APPENDIX A-1

Amended Order

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STATE OF CALIFORNIA
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
STATE WATER RESOURCES CONTROL BOARD

DIVISION OF WATER RIGHTS

In the Matter of Permit 12947A
(Application 12919A)

Sonoma County Water Agency

AMENDED ORDER APPROVING TEMPORARY URGENCY CHANGE (WITH MODIFICATIONS DATED MARCH 7, 2014)

SOURCE: East Fork Russian River

COUNTIES: Sonoma and Mendocino Counties

BY THE DEPUTY DIRECTOR FOR WATER RIGHTS:

1.0 SUBSTANCE OF TEMPORARY URGENCY CHANGE PETITION

On December 20, 2013, Sonoma County Water Agency (SCWA) filed a Temporary Urgency Change Petition (TUCP) with the State Water Resources Control Board (State Water Board), Division of Water Rights (Division) requesting approval of a change pursuant to California Water Code section 1435. Pursuant to Water Code section 1440 and in response to the Governor's Drought State of Emergency declaration, this order amends the order that was issued on December 31, 2013, which conditionally approved the TUCP. Revisions are shown using underline for additions and strikethrough for deletions.

The TUCP requests implementation of a hydrologic index based on Lake Mendocino storage values starting January 1, 2014 (proposed hydrologic index). The proposed hydrologic index is requested in lieu of the hydrologic index based on cumulative Lake Pillsbury inflow (current hydrologic index) to define the water supply conditions that determine which minimum instream flow requirements in Term 20 of Permit 12947A will apply to the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek). The proposed hydrologic index is as follows:

a. Dry water supply conditions will exist when storage in Lake Mendocino is less than:

40,000 acre-feet as of January 1
59,000 acre-feet as of February 1
68,000 acre-feet as of March 1
69,500 acre-feet as of March 16
71,000 acre-feet as of April 1
70,000 acre-feet as of April 16
69,000 acre-feet as of May 1
67,500 acre-feet as of May 16
65,000 acre-feet as of June 1

b. Critical water supply conditions exist when storage in Lake Mendocino is less than:

31,000 acre-feet as of January 1

36,000 acre-feet as of February 1
52,000 acre-feet as of March 1
53,000 acre-feet as of March 16
54,000 acre-feet as of April 1
53,000 acre-feet as of April 16
52,000 acre-feet as of May 1
51,000 acre-feet as of May 16
50,000 acre-feet as of June 1

c. Normal water supply conditions exist in the absence of defined dry or critical water supply conditions.

No changes to the current hydrologic index definitions as they apply to the lower Russian River (Russian River between its confluence with Dry Creek and the Pacific Ocean) or Dry Creek are requested.

The request is made to prevent significant depletions of storage in Lake Mendocino and potential elimination of water supplies for spring, summer, and fall of 2014. Such depletions in storage and reductions or eliminations of water supplies would cause serious impacts to human health and welfare and reduce water supplies needed for fishery protection and stable flows in the upper Russian River.

2.0 BACKGROUND

SCWA's TUCP involves Permit 12947A. Permit 12947A is for direct diversion of 92 cubic feet per second (cfs) from the East Fork Russian River and storage of 122,500 acre-feet per annum (afa) in Lake Mendocino from January 1 through December 31 of each year.

Following is the language contained in Term 20 of SCWA's Permit 12947A:

For the protection of fish and wildlife, and for the maintenance of recreation in the Russian River, permittee shall pass through or release from storage at Lake Mendocino sufficient water to maintain:

(A) A continuous streamflow in the East Fork Russian River from Coyote Dam to its confluence with the Russian River of 25 cfs at all times.

(B) The following minimum flows in the Russian River between the East Fork Russian River and Dry Creek:

(1) During normal water supply conditions when the combined water in storage, including dead storage, in Lake Pillsbury and Lake Mendocino on May 31 of any year exceeds 150,000 af or 90 percent of the estimated water supply storage capacity of the reservoirs, whichever is less:

From June 1 through August 31	185 cfs
From September 1 through March 31	150 cfs
From April 1 through May 31	185 cfs

(2) During normal water supply conditions and when the combined water in storage, including dead storage, in Lake Pillsbury and Lake Mendocino on May 31 of any year is between 150,000 af or 90 percent of the estimated water supply storage capacity of the reservoirs, whichever is less, and 130,000 af or 80 percent of the estimated water supply storage capacity of the reservoirs, whichever is less:

From June 1 through March 31	150 cfs
From April 1 through May 31	185 cfs

If from October 1 through December 31, storage in Lake Mendocino is less than 30,000 acre-feet	75 cfs

(3) During normal water supply conditions and when the combined water in storage, including dead storage, in Lake Pillsbury and Lake Mendocino on May 31 of any year is less than 130,000 af or 80 percent of the estimated water supply storage capacity of the reservoirs, whichever is less:

From June 1 through December 31	75 cfs
From January 1 through March 31	150 cfs
From April 1 through May 31	185 cfs

(4) During dry water supply conditions	75 cfs
(5) During critical water supply conditions	25 cfs

(C) The following minimum flows in the Russian River between its confluence with Dry Creek and the Pacific Ocean to the extent that such flows cannot be met by releases from storage at Lake Sonoma under Permit 16596 issued on Application 19351:

(1) During normal water supply conditions	125 cfs
(2) During dry water supply conditions	85 cfs
(3) During critical water supply conditions	35 cfs

For the purposes of the requirements in this term, the following definitions shall apply:

(1) Dry water supply conditions exist when cumulative inflow to Lake Pillsbury beginning on October 1 of each year is less than:

8,000 acre-feet as of January 1
39,200 acre-feet as of February 1
65,700 acre-feet as of March 1
114,500 acre-feet as of April 1
145,600 acre-feet as of May 1
160,000 acre-feet as of June 1

(2) Critical water supply conditions exist when cumulative inflow to Lake Pillsbury beginning on October 1 of each year is less than:

4,000 acre-feet as of January 1
20,000 acre-feet as of February 1
45,000 acre-feet as of March 1
50,000 acre-feet as of April 1
70,000 acre-feet as of May 1
75,000 acre-feet as of June 1

(3) Normal water supply conditions exist in the absence of defined dry or critical water supply conditions.

(4) The water supply condition designation for the months of July through December shall be the same as the designation for the previous June. Water supply conditions for January through June shall be predetermined monthly.

(5) Cumulative inflow to Lake Pillsbury is the calculated algebraic sum of releases from Lake Pillsbury, increases in storage in Lake Pillsbury, and evaporation from Lake Pillsbury.

(6) Estimated water supply storage space is the calculated reservoir volume below elevation 1,828.3 feet in Lake Pillsbury and below elevation 749.0 feet in Lake Mendocino. Both elevations refer to the National Geodetic Vertical Datum of 1929. The calculation shall use the most recent two reservoir volume surveys made by the U. S. Geological Survey, U. S. Army Corps of Engineers, or other responsible agency to determine the rate of sedimentation to be assumed from the date of the most recent reservoir volume survey.

SCWA submitted with the TUCP a document prepared by its staff titled, "Supplement to the December 2013 Temporary Urgency Change Petition," (Supplement) dated December 2013. The Supplement indicates that on December 18, 2013 the water supply storage level in Lake Mendocino was 28,457 af. This storage level was 42 percent of the available winter water supply pool and 26 percent of the summer water supply pool. The low storage level is the result of severely low rainfall in the region since January 1 ~~of this year~~, 2013.

According to the Supplement, without significant storm events between December 19 and December 31, 2013, Lake Mendocino storage ~~will~~ would decline to approximately 26,000 af by December 31, 2013 due to releases required to meet downstream water demands and minimum instream flow requirements on the Russian River. This estimated amount is significantly lower than the December 31 levels that occurred in 1977 and 2009.

SCWA is concerned that the current hydrologic index, identified in Decision 1610 and included in Permit 12947A, does not accurately reflect water supply conditions in the Russian River System and, if current weather patterns persist, could cause storage levels in Lake Mendocino to rapidly decline to unsafe levels. The cumulative inflow to Lake Pillsbury, as of December 18 was 4,010 af, which exceeds the January 1 threshold for *Dry* conditions in the current hydrologic index (identified in Decision 1610 and Term 20 of Permit 12947A). Accordingly, the current hydrologic index will require SCWA to maintain minimum instream flows in the upper Russian River beyond levels which Lake Mendocino storage could reliably and safely sustain.

Furthermore, on December 9, 2013, Pacific Gas & Electric (PG&E) filed an application for a flow variance for the Potter Valley Project (PVP) with the Federal Energy Regulatory Commission (FERC). PG&E requested the variance due to extremely low storage levels in Lake Pillsbury and concern that they could no longer meet minimum flow requirements while also ensuring the safe operation of PVP. On December 12, 2013, FERC approved PG&E's flow variance request. This variance diminishes the reliability of the Lake Pillsbury cumulative inflow index as an accurate metric under current conditions and additionally, has resulted in a substantial reduction in required minimum flows in the East Fork of the Russian River and correspondingly reduced inflow into Lake Mendocino. Consequently, Lake Mendocino storage levels have begun to drop at a higher rate.

As described above, in lieu of the current hydrologic index, SCWA proposes Lake Mendocino monthly storage thresholds be used to define the water supply conditions that determine which minimum instream flow requirements in Term 20 of Permit 12947A will apply to the upper Russian River. As described in the Supplement submitted by SCWA, the Lake Mendocino storage thresholds were developed using SCWA's Russian River System Model to approximately replicate the statistical occurrence of the water supply conditions under Decision 1610 from January through June, with an 86% occurrence of Normal conditions, an 11% occurrence of Dry conditions, and a 4% occurrence of Critical conditions.

As of December 18, 2013 the water supply storage level in Lake Sonoma was 170,091 af. This storage level is 69 percent of the available water conservation pool. This storage level is not significantly below normal for this time of year. In addition, the much larger water supply pool of Lake Sonoma provides multiple years of carry over storage. Consequently, no changes to the hydrologic index definitions as they apply to the lower

Russian River (Russian River between its confluence with Dry Creek and the Pacific Ocean) or Dry Creek are requested at this time.

3.0 COMPLIANCE WITH CALIFORNIA ENVIRONMENTAL QUALITY ACT

SCWA has determined that the requested temporary urgency change is statutorily and categorically exempt under the California Environmental Quality Act (CEQA). SCWA found that the change is consistent with the statutory exemption criteria for an emergency project as well as the Class 1, 7, and 8 categorical exemption criteria. The State Water Board has reviewed the information submitted by SCWA and has made its own independent finding that the temporary urgency change is statutorily and categorically exempt under CEQA for the following reasons:

- As of December 18, 2013, the storage level in Lake Mendocino was 42 percent of the available winter water supply pool and 26 percent of the summer water supply pool. Information provided by SCWA demonstrates that, without significant storm events before December 31, continued releases of water pursuant to the current hydrologic index in term 20 of Permit 12947A as it applies to the upper Russian River could cause storage levels in Lake Mendocino to rapidly decline to unsafe levels. Additionally, the rainfall has remained low through 2014 and on January 17, 2014, the Governor declared a drought State of Emergency. If storage in Lake Mendocino is depleted, there will be serious impacts to human health and welfare and water will not be available to protect aquatic life, including threatened and endangered species, in the upper Russian River. Approval of the TUCP is therefore necessary to prevent and mitigate loss of, or damage to, the environment, fishery resources, property, public health, and essential public services. Accordingly the project is statutorily exempt from CEQA because it is necessary to prevent or mitigate an emergency (Pub. Resources Code, § 21080, subd. (b)(4), Cal. Code Regs., tit. 14, § 15269, subd. (c).)

- The proposed action consists of the operation of existing facilities involving negligible or no expansion of use beyond that existing, and accordingly is categorically exempt from CEQA under a Class 1 exemption. (Cal. Code Regs., tit. 14, § 15301.) The proposed action will be within the existing minimum instream flows established by Decision 1610. The proposed action does not request and will not expand the water supply available to SCWA for consumptive purposes.

- The proposed action will assure the maintenance of a natural resource, i.e., the instream resources of the Russian River, by reserving water in Lake Mendocino to prevent harm to, and protect, habitat for listed Russian River salmonid fisheries, and accordingly is categorically exempt from CEQA pursuant to a Class 7 exemption. A Class 7 exemption "consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment." (Cal. Code Regs, tit. 14, § 15307.)

- A Class 8 exemption "consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment." (Cal. Code Regs., tit. 14, § 15308.) The proposed action will assure the maintenance of the environment, i.e., the instream environment of the Russian River, in the same way as stated for the Class 7 exemption.

4.0 PUBLIC NOTICE OF THE TEMPORARY URGENCY CHANGE PETITION

The State Water Board ~~will issue~~ issued and ~~deliver~~ delivered to SCWA ~~as soon as practicable,~~ a notice of the temporary urgency change order pursuant to Water Code section 1438(a~~).~~) on January 3, 2014. Pursuant to Water Code section 1438(b)(1), SCWA was required to publish the notice in a newspaper having a general circulation, and that is published within the counties where the points of diversion lie. SCWA published the notice on January 7, 2014, in the Ukiah Daily Journal and on January 8, 2014, in The Press Democrat. The State Water Board ~~will post~~ posted the notice of the temporary urgency change and the TUCP (and accompanying materials) on its website. The State Water Board also ~~will distribute~~ distributed

the notice through an electronic notification system. Pursuant to Water Code section 1438, the State Water Board may issue a temporary urgency change order in advance of the required notice. One objection was received during the objection period, which ended on February 3rd.

5.0 CRITERIA FOR APPROVING THE PROPOSED TEMPORARY URGENCY CHANGE

Water Code section 1435 provides that a permittee or licensee who has an urgent need to change the point of diversion, place of use, or purpose of use from that specified in the permit or license may petition for a conditional temporary change order. The State Water Board's regulations set forth the filing and other procedural requirements applicable to TUCPs. (Cal. Code Regs., tit. 23, §§ 805, 806.) The State Water Board's regulations also clarify that requests for changes to permits or licenses other than changes in point of diversion, place of use, or purpose of use may be filed, subject to the same filing and procedural requirements that apply to changes in point of diversion, place of use, or purpose of use. (*Id.*, § 791, subd. (e).)

Before approving a temporary urgency change, the State Water Board must make the following findings:

1. the permittee or licensee has an urgent need to make the proposed change;
2. the proposed change may be made without injury to any other lawful user of water;
3. the proposed change may be made without unreasonable effect upon fish, wildlife, or other instream beneficial uses; and
4. the proposed change is in the public interest.

(Wat. Code, § 1435, subd. (b)(1-4).)

5.1 Urgency of the Proposed Change

Under Water Code section 1435, subdivision (c), an "urgent need" means "the existence of circumstances from which the board may in its judgment conclude that the proposed temporary change is necessary to further the constitutional policy that the water resources of the state be put to beneficial use to the fullest extent of which they are capable and that waste of water be prevented . . . ." However, the State Water Board shall not find the need urgent if it concludes that the petitioner has failed to exercise due diligence in petitioning for a change pursuant to other appropriate provisions of the Water Code.

In this case, an urgent need exists for the proposed change in the hydrologic index for determining minimum instream flow requirements on the upper Russian River because, as described in the Supplement, cumulative inflow into Lake Pillsbury is no longer a good metric to determine water supply conditions in the Russian River system due to the extremely low storage levels in Lake Mendocino, the changes in PVP operations since 2004, and the recent FERC order authorizing reduced imports into the East Branch of the Russian River. Without the proposed changes, the current hydrologic index may require releases of water from Lake Mendocino at levels that would risk significant depletions of storage and potential elimination of water supplies for water users in Mendocino County and northern Sonoma County (above the confluence with Dry Creek) during the spring, summer and fall of 2014. Such depletions in storage and reductions or eliminations of water supplies would cause serious impacts to human health and welfare, and reduce water supplies needed for fishery protections and stable flows in the upper Russian River. Furthermore, on January 17, 2014, the Governor declared a State of Emergency due to current drought conditions.

5.2 No Injury to Any Other Lawful User of Water

Under this Order, SCWA will be required to maintain specific flows in the Russian River from its most upstream point of diversion to the river's confluence with the ocean. Therefore, because these minimum flows will be present, it is anticipated that all other lawful users of water will still be able to divert and use the amounts of water to which they are legally entitled during the period specified in this Order. Moreover, failure to implement the proposed hydrologic index could result in severe depletion of Lake Mendocino, which in turn could result in serious impacts to entitled users of water downstream of Lake Mendocino later in the year. Accordingly, granting this TUCP will not result in any injury to any other lawful user of water.

Pursuant to Water Code section 1439, the State Water Board shall supervise diversion and use of water under this temporary change order for the protection of all other lawful users of water and instream beneficial uses.

5.3 No Unreasonable Effect upon Fish, Wildlife, or Other Instream Beneficial Uses

Using Lake Mendocino storage thresholds to determine the water supply conditions that will be used to determine upper Russian River minimum instream flow requirements is likely to result in lower instream flows in the upper Russian River after January 1, 2014 than might otherwise occur under the current hydrologic index. It is possible that such reduced flows may impair some instream beneficial uses in the upper Russian River. However, any effects associated with such flow reductions would not be unreasonable, considering the potential catastrophic impacts to fish, wildlife and other instream beneficial uses that could occur with the current hydrologic index, if the current hydrologic index led to the draining of Lake Mendocino and the dewatering of the upper Russian River. SCWA has consulted with the California Department of Fish and Wildlife (CDFW), the National Marine Fisheries Services (NMFS), and the Regional Water Quality Control Board (Regional Board) regarding filing the TUCP and the effects of the proposed change. All three agencies support the petition and concur that storage thresholds in Lake Mendocino would most accurately reflect the water supply condition in the upper Russian River system. CDFW and NMFS also concurred that the flow reductions that might occur as a result of the proposed index are prudent measures to protect aquatic resources (in particular threatened Chinook salmon egg incubation) as they will support conservation of Lake Mendocino's water supply and avoid dewatering of the upper Russian River.

To inform the review and approval of the TUCP and the State Water Board's continuing supervision of the diversion and use of water under this temporary change order pursuant to Water Code section 1439, this order requires SCWA to report on consultations with CDFW, NMFS, and the Regional Board during periods of reduced flow (should they occur). In addition, to ensure beneficial use of water resources to the fullest extent possible and to prevent waste of water, SCWA is required to provide a weekly update to the Deputy Director regarding the current hydrologic conditions of the Russian River watershed. This information will assist the State Water Board in determining whether additional actions are necessary.

5.4 The Proposed Change is in the Public Interest

Approval of this TUCP will help conserve stored water in Lake Mendocino so that it can be released throughout 2014 to maintain instream flows for the benefit and protection of all uses of Russian River water, including the salmonid fisheries in the Russian River. It is in the public interest to preserve these water supplies for these beneficial uses under present hydrological conditions.

To further ensure preservation of Lake Mendocino water supplies in the public interest, SCWA was required, pursuant to a State Water Board order dated May 1, 2013, to prepare a long-term reliability evaluation of the Lake Mendocino water supply (Term 17). The evaluation requires coordination with the water users and land use planners in the upper Russian River from Lake Mendocino to the confluence of the Russian River with Dry Creek. The final evaluation report will include an analysis of potential impacts to reservoir storage from future potential changes in land use as well as climate change. The report is due to the State Water Board by December 31, 2014. Currently, SCWA is preparing the interim status report that is due on December 31, 2013. In addition and notwithstanding the fact that the TUCP does not request changes to the requirements for instream flows on the lower Russian River or Dry Creek, SCWA and its water contractors continue to implement water use efficiency programs that align with the California Urban Water Conservation Council's Best Management Practices (BMPs) and comply with SBx7-7 <u>and are pursuing a regional public information campaign to instruct the public for the need to cease irrigation during the winter months</u>. <u>According to SCWA, this campaign should provide a reduction in demands for the benefit of the region's water supply.</u> Imposing additional conservation requirements on SCWA and its water contractors is unnecessary at this time because SCWA's diversions during the effective period of the change will be supported primarily by water released from storage in Lake Sonoma. As described above, SCWA has requested no changes to the hydrologic index definitions as they apply to the lower Russian River or Dry Creek. Therefore, reducing SCWA's demand will not alleviate low storage conditions in Lake Mendocino.

In response to the Governor's Drought State of Emergency declaration, the Division has added two terms to encourage conservation measures. One term requires SCWA to immediately develop and implement a Drought Action Plan to further preserve water stored in Lake Mendocino and provide the Division with updates. The other term requires reporting on the ongoing conservation activities implemented by SCWA and its water contractors described above. These updates will further assist the State Water Board in determining whether additional actions in response to the drought are necessary.

6.0 CONCLUSIONS

The State Water Board has adequate information in its files to make the evaluation required by Water Code section 1435.

I conclude that, based on the available evidence:

1. The permittee has an urgent need to make the proposed change;

2. The petitioned change will not operate to the injury of any other lawful user of water;

3. The petitioned change will not have an unreasonable effect upon fish, wildlife, or other instream beneficial uses; and,

4. The petitioned change, with the modifications described above, is in the public interest.

ORDER

NOW, THEREFORE, IT IS ORDERED THAT: the Petition filed by Sonoma County Water Agency (SCWA) for a temporary urgency change in Permit 12947A is approved.

All existing terms and conditions of the subject permit remain in effect, except as temporarily amended by the following provision:

1. From the date of this Order until June 29, 2014, the minimum instream flow requirements for the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) will be established using a hydrologic index based on water storage in Lake Mendocino. The definitions included in term 20 of Permit 12947A shall be modified as follows as the definitions apply to the upper river:

    a. Dry water supply conditions will exist when storage in Lake Mendocino is less than:

        40,000 acre-feet as of January 1
        59,000 acre-feet as of February 1
        68,000 acre-feet as of March 1
        69,500 acre-feet as of March 16
        71,000 acre-feet as of April 1
        70,000 acre-feet as of April 16
        69,000 acre-feet as of May 1
        67,500 acre-feet as of May 16
        65,000 acre-feet as of June 1

    b. Critical water supply conditions exist when storage in Lake Mendocino is less than:

        31,000 acre-feet as of January 1
        36,000 acre-feet as of February 1

52,000 acre-feet as of March 1
53,000 acre-feet as of March 16
54,000 acre-feet as of April 1
53,000 acre-feet as of April 16
52,000 acre-feet as of May 1
51,000 acre-feet as of May 16
50,000 acre-feet as of June 1

c. Normal water supply conditions exist in the absence of defined dry or critical water supply conditions.

2. During time periods when the water supply conditions pursuant to the Lake Mendocino storage level index (term 1 of this order) result in lower minimum instream flows than would have been required pursuant to the Lake Pillsbury cumulative inflow index (term 20 of Permit 12947A) SCWA shall consult with NMFS and CDFW every two weeks regarding the need for applicable fisheries monitoring activities on the Upper Russian River or changes to this temporary urgency change order. Upon approval by the Deputy Director, any necessary revisions to the terms and conditions of this order based on consultations with NMFS and CDFW shall be made. SCWA shall submit a summary report of consultation details to the Deputy Director within one week of each consultation meeting.

3. SCWA shall continue ongoing monitoring in coordination with the United States Geological Survey (USGS) at five multi-parameter water quality sonde sites on the Russian River located at Hopland, Diggers Bend in Healdsburg, SCWA river diversion facility at Mirabel, Hacienda Bridge, and Johnson's Beach. Additionally, during time periods when the water supply conditions pursuant to the Lake Mendocino storage level index (term 1 of this order) result in lower minimum instream flows than would have been required pursuant to the Lake Pillsbury cumulative inflow index (term 20 of Permit 12947A) SCWA shall consult with the Regional Board. Upon approval by the Deputy Director, any necessary revisions to the terms and conditions of this order based on Regional Board consultation shall be made. SCWA shall submit a summary report of consultation details to the Deputy Director within one week of each consultation meeting.

4. SCWA shall report to the Deputy Director and the Regional Board on a weekly basis during Dry and Critical water supply periods and a monthly basis during Normal water supply periods regarding the current hydrologic condition of the Russian River system, including current Lake Mendocino reservoir level, the rate of decline for Lake Mendocino, a 16-day cumulative rainfall forecast, current inflow from Potter Valley, and a summary of the water quality data from the five water quality sonde sites.

5. This Order does not authorize any act that results in the taking of a candidate, threatened or endangered species, or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). If a "take" will result from any act authorized under this Order, the permittee shall obtain authorization for an incidental take permit prior to construction or operation of the project. Permittee shall be responsible for meeting all requirements of the applicable Endangered Species Act for the temporary urgency change authorized under this Order.

6. The State Water Board reserves jurisdiction to supervise the temporary urgency change under this Order, and to coordinate or modify terms and conditions, for the protection of vested rights, fish, wildlife, instream beneficial uses and the public interest as future conditions may warrant.

7. SCWA shall immediately notify the State Water Board if any significant change in storage conditions in Lake Mendocino occurs that warrants reconsideration of this Order.

8. To further preserve storage in Lake Mendocino and support the development of the long term reliability study of Lake Mendocino SCWA shall develop a drought action plan. At a minimum the plan shall include:

   a. A detailed schedule with planned completion dates for key events;
   b. A description of how diversions under Permits 12947A, 12949, 12950, and 16596 will not impact Lake Mendocino storage and a list of commitments to avoid impacts;
   c. An explanation of SCWA's authority or other ability to impose mandatory water conservation measures and identification of the persons and entities subject to that authority;
   d. Identification of Russian River water users who are not subject to SCWA's authority to impose mandatory water conservation measures; and
   e. Descriptions of coordination efforts with upper Russian River agricultural and municipal water users to determine water conservation goals (identified in percent reduction), implement immediate mandatory conservation measures, reduce water demand, identify other sources of water supply, and prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water from the upper Russian River.

   The plan shall be submitted to the Deputy Director for approval within 21 days of the date of this amended Order and SCWA shall immediately implement the plan upon submittal. SCWA shall provide monthly status updates, within 15 days of the end of each month, to the Deputy Director describing actions and efforts implemented and completed pursuant to the plan for the duration of this Order, and progress towards the identified water conservation goals.

9. SCWA shall provide a written update to the Deputy Director by October 31, 2014, regarding activities and programs being implemented by SCWA and its water contractors to assess and reduce water loss, promote increased water use efficiency and conservation, and improve regional water supply reliability. The written update shall include a report regarding the water budget for irrigation identifying the actual maximum applied water allowance (MAWA) achieved by each of SCWA's contractors during January through June 2014.

STATE WATER RESOURCES CONTROL BOARD

ORIGINAL SIGNED BY:

Barbara Evoy, Deputy Director
Division of Water Rights

Dated: MAR 7 2014

APPENDIX A-2

2014 TUCP Transmittal Package

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SONOMA COUNTY WATER AGENCY

CF/42-0.19-9 SWRCB ORDER APPROVING TEMPORARY URGENCY CHANGE IN PERMITS 12947A, 12949, 12950 & 16596 FOR 2014 (ID 5110)

August 13, 2014

Barbara Evoy, Deputy Director of Water Rights
State Water Resources Control Board
Division of Water Rights
P.O. Box 2000
Sacramento, CA 95812-2000

RE: Petition for Temporary Urgency Change—Permits 12947A, 12949, 12950, and 16596

Dear Ms. Evoy:

Enclosed is a Petition for Temporary Urgency Change to modify the methodology for determination of water supply conditions for the Russian River as established by Decision 1610 for Permits 12947A, 12949, 12950 and 16596. Accompanying the petition are the following:

1) Attachment 1, *Sonoma County Water Agency Temporary Urgency Change Petition*
2) Attachment 2, *Supplement to the August 2014 Temporary Urgency Change Petition*
3) *Environmental Information for Petitions*
4) Notice of Exemption
5) California Department of Fish and Wildlife Review Fee Payment
6) State Water Resources Control Board Petition Fee Payment

The petition is being submitted due to severely low storage levels in Lake Mendocino due to persistent drought conditions. The Sonoma County Water Agency requests that the Division of Water Rights act expeditiously to approve the requested changes to conserve critical storage in Lake Mendocino.

404 Aviation Boulevard - Santa Rosa, CA 95403-9019 • (707) 526-5370 - Fax (707) 544-6123 - www.sonomacountywater.org/

I look forward to working with the State Water Resources Control Board and Division of Water Rights staff on this important conservation effort.

Sincerely,

Grant Davis
General Manager

c: Katy Lee – State Water Resources Control Board
B. Coey, J. Fuller – National Marine Fisheries Service
E. Larson - CA Department of Fish & Wildlife
P. Jeane, D. Seymour, T. Schram, J. Martini Lamb, J. Jasperse – Sonoma County Water Agency
S. Shupe, C. O'Donnell – Sonoma County Counsel
A. Lilly – Bartkiewicz, Kronick & Shanahan

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Please indicate County where your project is located here:

Sonoma / Mendo.

MAIL FORM AND ATTACHMENTS TO:
State Water Resources Control Board
DIVISION OF WATER RIGHTS
P.O. Box 2000, Sacramento, CA 95812-2000
Tel: (916) 341-5300 Fax: (916) 341-5400
http://www.waterboards.ca.gov/waterrights

PETITION FOR CHANGE

Separate petitions are required for each water right. Mark all areas that apply to your proposed change(s). Incomplete forms may not be accepted. Location and area information must be provided on maps in accordance with established requirements. (Cal. Code Regs., tit. 23, § 715 et seq.) Provide attachments if necessary.

☐ **Point of Diversion** Wat. Code, § 1701
☐ **Point of Rediversion** Cal. Code Regs., tit. 23, § 791(e)
☐ **Place of Use** Wat. Code, § 1701
☐ **Purpose of Use** Wat. Code, § 1701

☐ **Distribution of Storage** Cal. Code Regs., tit. 23, § 791(e)
☒ **Temporary Urgency** Wat. Code, § 1435
☐ **Instream Flow Dedication** Wat. Code, § 1707
☐ **Waste Water** Wat. Code, § 1211

☐ **Split** Cal. Code Regs., tit. 23, § 836
☐ **Terms or Conditions** Cal. Code Regs., tit. 23, § 791(e)
☐ **Other**

Application 12919A Permit 12947A License Statement

I (we) hereby petition for change(s) noted above and described as follows:

Point of Diversion or Rediversion – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Present:

Proposed:

Place of Use – Identify area using Public Land Survey System descriptions to ¼-¼ level; for irrigation, list number of acres irrigated.

Present:

Proposed:

Purpose of Use

Present:

Proposed:

Split

Provide the names, addresses, and phone numbers for all proposed water right holders.

In addition, provide a separate sheet with a table describing how the water right will be split between the water right holders: for each party list amount by direct diversion and/or storage, season of diversion, maximum annual amount, maximum diversion to offstream storage, point(s) of diversion, place(s) of use, and purpose(s) of use. Maps showing the point(s) of diversion and place of use for each party should be provided.

Distribution of Storage

Present:

Proposed:

Temporary Urgency

This temporary urgency change will be effective from August 15, 2014 to February 10, 2015.

Include an attachment that describes the urgent need that is the basis of the temporary urgency change and whether the change will result in injury to any lawful user of water or have unreasonable effects on fish, wildlife or instream uses.

Instream Flow Dedication – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Upstream Location:

Downstream Location:

List the quantities dedicated to instream flow in either: ☐ cubic feet per second or ☐ gallons per day:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Will the dedicated flow be diverted for consumptive use at a downstream location? ○ Yes ○ No

If yes, provide the source name, location coordinates, and the quantities of flow that will be diverted from the stream.

Waste Water

If applicable, provide the reduction in amount of treated waste water discharged in cubic feet per second.

Will this change involve water provided by a water service contract which prohibits your exclusive right to this treated waste water? ○ Yes ○ No

Will any legal user of the treated waste water discharged be affected? ○ Yes ○ No

General Information – For all Petitions, provide the following information, if applicable to your proposed change(s).

Will any current Point of Diversion, Point of Storage, or Place of Use be abandoned? ○ Yes ◉ No

I (we) have access to the proposed point of diversion or control the proposed place of use by virtue of:

☐ ownership ☐ lease ☐ verbal agreement ☐ written agreement

If by lease or agreement, state name and address of person(s) from whom access has been obtained.

Give name and address of any person(s) taking water from the stream between the present point of diversion or rediversion and the proposed point of diversion or rediversion, as well as any other person(s) known to you who may be affected by the proposed change.

All Right Holders Must Sign This Form: I (we) declare under penalty of perjury that this change does not involve an increase in the amount of the appropriation or the season of diversion, and that the above is true and correct to the best of my (our) knowledge and belief. Dated 8-13-14 at Santa Rosa, CA.

Right Holder or Authorized Agent Signature

Right Holder or Authorized Agent Signature

NOTE: All petitions must be accompanied by:

(1) the form Environmental Information for Petitions, including required attachments, available at: http://www.waterboards.ca.gov/waterrights/publications_forms/forms/docs/pet_info.pdf

(2) Division of Water Rights fee, per the Water Rights Fee Schedule, available at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/fees/

(3) Department of Fish and Wildlife fee of $850 (Pub. Resources Code, § 10005)

Please indicate County where your project is located here:

Sonoma / Mendo.

MAIL FORM AND ATTACHMENTS TO:
State Water Resources Control Board
DIVISION OF WATER RIGHTS
P.O. Box 2000, Sacramento, CA 95812-2000
Tel: (916) 341-5300 Fax: (916) 341-5400
http://www.waterboards.ca.gov/waterrights

PETITION FOR CHANGE

Separate petitions are required for each water right. Mark all areas that apply to your proposed change(s). Incomplete forms may not be accepted. Location and area information must be provided on maps in accordance with established requirements. (Cal. Code Regs., tit. 23, § 715 et seq.) Provide attachments if necessary.

☐ **Point of Diversion** Wat. Code, § 1701
☐ **Point of Rediversion** Cal. Code Regs., tit. 23, § 791(e)
☐ **Place of Use** Wat. Code, § 1701
☐ **Purpose of Use** Wat. Code, § 1701

☐ **Distribution of Storage** Cal. Code Regs., tit. 23, § 791(e)
☒ **Temporary Urgency** Wat. Code, § 1435
☐ **Instream Flow Dedication** Wat. Code, § 1707
☐ **Waste Water** Wat. Code, § 1211

☐ **Split** Cal. Code Regs., tit. 23, § 836
☐ **Terms or Conditions** Cal. Code Regs., tit. 23, § 791(e)
☐ **Other**

Application 15736 Permit 12949 License Statement

I (we) hereby petition for change(s) noted above and described as follows:

Point of Diversion or Rediversion – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Present:

Proposed:

Place of Use – Identify area using Public Land Survey System descriptions to ¼-¼ level; for irrigation, list number of acres irrigated.

Present:

Proposed:

Purpose of Use

Present:

Proposed:

Split

Provide the names, addresses, and phone numbers for all proposed water right holders.

In addition, provide a separate sheet with a table describing how the water right will be split between the water right holders: for each party list amount by direct diversion and/or storage, season of diversion, maximum annual amount, maximum diversion to offstream storage, point(s) of diversion, place(s) of use, and purpose(s) of use. Maps showing the point(s) of diversion and place of use for each party should be provided.

Distribution of Storage

Present:

Proposed:

Temporary Urgency
This temporary urgency change will be effective from August 15, 2014 to February 10, 2015 .

Include an attachment that describes the urgent need that is the basis of the temporary urgency change and whether the change will result in injury to any lawful user of water or have unreasonable effects on fish, wildlife or instream uses.

Instream Flow Dedication – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Upstream Location:

Downstream Location:

List the quantities dedicated to instream flow in either: ☐ cubic feet per second or ☐ gallons per day:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Will the dedicated flow be diverted for consumptive use at a downstream location? ○ Yes ○ No
If yes, provide the source name, location coordinates, and the quantities of flow that will be diverted from the stream.

Waste Water
If applicable, provide the reduction in amount of treated waste water discharged in cubic feet per second.

Will this change involve water provided by a water service contract which prohibits your exclusive right to this treated waste water? ○ Yes ○ No

Will any legal user of the treated waste water discharged be affected? ○ Yes ○ No

General Information – For all Petitions, provide the following information, if applicable to your proposed change(s).

Will any current Point of Diversion, Point of Storage, or Place of Use be abandoned? ○ Yes ◉ No

I (we) have access to the proposed point of diversion or control the proposed place of use by virtue of:
☐ ownership ☐ lease ☐ verbal agreement ☐ written agreement

If by lease or agreement, state name and address of person(s) from whom access has been obtained.

Give name and address of any person(s) taking water from the stream between the present point of diversion or rediversion and the proposed point of diversion or rediversion, as well as any other person(s) known to you who may be affected by the proposed change.

All Water Right Holders Must Sign This Form: I (we) declare under penalty of perjury that this change does not involve an increase in the amount of the appropriation or the season of diversion, and that the above is true and correct to the best of my (our) knowledge and belief. Dated 8-13-14 at Santa Rosa, CA .

Water Right Holder or Authorized Agent Signature

Water Right Holder or Authorized Agent Signature

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Please indicate County where your project is located here:

Sonoma / Mendo.

MAIL FORM AND ATTACHMENTS TO:
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DIVISION OF WATER RIGHTS
P.O. Box 2000, Sacramento, CA 95812-2000
Tel: (916) 341-5300 Fax: (916) 341-5400
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PETITION FOR CHANGE

Separate petitions are required for each water right. Mark all areas that apply to your proposed change(s). Incomplete forms may not be accepted. Location and area information must be provided on maps in accordance with established requirements. (Cal. Code Regs., tit. 23, § 715 et seq.) Provide attachments if necessary.

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☐ **Point of Rediversion** Cal. Code Regs., tit. 23, § 791(e)
☐ **Place of Use** Wat. Code, § 1701
☐ **Purpose of Use** Wat. Code, § 1701

☐ **Distribution of Storage** Cal. Code Regs., tit. 23, § 791(e)
☒ **Temporary Urgency** Wat. Code, § 1435
☐ **Instream Flow Dedication** Wat. Code, § 1707
☐ **Waste Water** Wat. Code, § 1211

☐ **Split** Cal. Code Regs., tit. 23, § 836
☐ **Terms or Conditions** Cal. Code Regs., tit. 23, § 791(e)
☐ **Other**

Application 15737 Permit 12950 License Statement

I (we) hereby petition for change(s) noted above and described as follows:

Point of Diversion or Rediversion – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Present:

Proposed:

Place of Use – Identify area using Public Land Survey System descriptions to ¼-¼ level; for irrigation, list number of acres irrigated.

Present:

Proposed:

Purpose of Use

Present:

Proposed:

Split

Provide the names, addresses, and phone numbers for all proposed water right holders.

In addition, provide a separate sheet with a table describing how the water right will be split between the water right holders: for each party list amount by direct diversion and/or storage, season of diversion, maximum annual amount, maximum diversion to offstream storage, point(s) of diversion, place(s) of use, and purpose(s) of use. Maps showing the point(s) of diversion and place of use for each party should be provided.

Distribution of Storage

Present:

Proposed:

Temporary Urgency
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If applicable, provide the reduction in amount of treated waste water discharged in cubic feet per second.

Will this change involve water provided by a water service contract which prohibits your exclusive right to this treated waste water? ○ Yes ○ No

Will any legal user of the treated waste water discharged be affected? ○ Yes ○ No

General Information – For all Petitions, provide the following information, if applicable to your proposed change(s).

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If by lease or agreement, state name and address of person(s) from whom access has been obtained.

Give name and address of any person(s) taking water from the stream between the present point of diversion or rediversion and the proposed point of diversion or rediversion, as well as any other person(s) known to you who may be affected by the proposed change.

All Water Right Holders Must Sign This Form: I (we) declare under penalty of perjury that this change does not involve an increase in the amount of the appropriation or the season of diversion, and that the above is true and correct to the best of my (our) knowledge and belief. Dated 8-13-14 at Santa Rosa, CA .

Water Right Holder or Authorized Agent Signature

Water Right Holder or Authorized Agent Signature

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Please indicate County where your project is located here:

Sonoma / Mendo.

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☐ **Purpose of Use** Wat. Code, § 1701

☐ **Distribution of Storage** Cal. Code Regs., tit. 23, § 791(e)
☒ **Temporary Urgency** Wat. Code, § 1435
☐ **Instream Flow Dedication** Wat. Code, § 1707
☐ **Waste Water** Wat. Code, § 1211

☐ **Split** Cal. Code Regs., tit. 23, § 836
☐ **Terms or Conditions** Cal. Code Regs., tit. 23, § 791(e)
☐ **Other**

Application 19351 Permit 16596 License Statement

I (we) hereby petition for change(s) noted above and described as follows:

Point of Diversion or Rediversion – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Present:

Proposed:

Place of Use – Identify area using Public Land Survey System descriptions to ¼-¼ level; for irrigation, list number of acres irrigated.

Present:

Proposed:

Purpose of Use

Present:

Proposed:

Split

Provide the names, addresses, and phone numbers for all proposed water right holders.

In addition, provide a separate sheet with a table describing how the water right will be split between the water right holders: for each party list amount by direct diversion and/or storage, season of diversion, maximum annual amount, maximum diversion to offstream storage, point(s) of diversion, place(s) of use, and purpose(s) of use. Maps showing the point(s) of diversion and place of use for each party should be provided.

Distribution of Storage

Present:

Proposed:

Temporary Urgency

This temporary urgency change will be effective from August 15, 2014 to February 10, 2015 .

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Instream Flow Dedication – Provide source name and identify points using both Public Land Survey System descriptions to ¼-¼ level and California Coordinate System (NAD 83).

Upstream Location:

Downstream Location:

List the quantities dedicated to instream flow in either: ☐ cubic feet per second or ☐ gallons per day:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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If yes, provide the source name, location coordinates, and the quantities of flow that will be diverted from the stream.

Waste Water

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Will this change involve water provided by a water service contract which prohibits your exclusive right to this treated waste water? ○ Yes ○ No

Will any legal user of the treated waste water discharged be affected? ○ Yes ○ No

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If by lease or agreement, state name and address of person(s) from whom access has been obtained.

Give name and address of any person(s) taking water from the stream between the present point of diversion or rediversion and the proposed point of diversion or rediversion, as well as any other person(s) known to you who may be affected by the proposed change.

All Water Right Holders Must Sign This Form: I (we) declare under penalty of perjury that this change does not involve an increase in the amount of the appropriation or the season of diversion, and that the above is true and correct to the best of my (our) knowledge and belief. Dated 8-13-14 at Santa Rosa, CA .

Water Right Holder or Authorized Agent Signature

Water Right Holder or Authorized Agent Signature

NOTE: All petitions must be accompanied by:

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(2) applicable fees, per the Water Rights Fee Schedule, available at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/fees/

August 2014

Attachment 1 to Sonoma County Water Agency Temporary Urgency Change Petition

Background

As discussed in section 5.0 of the *Supplement to the August 2014 Temporary Urgency Change Petition*, under the normal operating protocols the Sonoma County Water Agency (Water Agency) releases water from storage in Lake Mendocino to support demands and to maintain minimum instream flows for the Upper Russian River down to its confluence with Dry Creek. Because of these operating protocols, mandatory reductions in diversions of water from the Upper Russian River would be complementary to the changes in minimum instream flow requirements that are requested in the Water Agency's Temporary Urgency Change Petition (TUCP). As shown in Figure 5 to that Supplement, 20 percent reductions in diversions from the Upper Russian River during August through October, compared to 2013 diversions during those months, would result in December 1 Lake Mendocino storage being approximately 5,000 acre-feet higher than the level that would occur without such reductions in diversions.

Mendocino District TUCP

For this reason, the Water Agency is coordinating the filing of its TUCP with the filing of a separate TUCP by the Mendocino County Russian River Flood Control and Water Conservation Improvement District (Mendocino District) for its water right Permit 12947B (Application 12919B). The Water Agency has asked that the Mendocino District's TUCP ask the State Water Board to add the following terms to Permit 12947B during the term of the order on the Mendocino District's TUCP:

1. **Provisions for Real Time Forecasts of Diversions.**

   District is currently implementing real time metering of customer diversions. Although the District currently does not have the ability to forecast all diversions by its customers in real time, the District shall work with its customers to develop a real-time forecasting plan that will assist SCWA in managing releases of water from Lake Mendocino storage to meet minimum instream flow requirements with as small of an operational buffer as possible while the SWRCB's orders on the District's and SCWA's TUCP's are in effect.

   To develop this plan, the District shall hold a meeting of all of its customers within 7 days after the date of the SWRCB's approval of the District's TUCP, and using the input from its customers that the District receives during this meeting, the District shall prepare a plan for providing real time one-day and three-day forward forecasts of its customers' diversions to SCWA. The goal of this plan shall be to provide these forecasts of all diversions from the Russian River or its underflow by District customers with at least three-fourths of the total amount of water that is subject to District contracts.

   The District shall file this plan with the SWRCB, and submit a copy of this plan to SCWA, within 14 days of the date of the SWRCB's approval of the District's TUCP. The District shall begin to

implement this plan immediately after the District files it with the SWRCB. The District shall continue to implement this plan while the SWRCB's order on the District's TUCP is in effect.

2. **Plan for Reductions in Diversions.**

District has currently imposed a mandatory 25% reduction in contract deliveries. While the majority of the District's customers have supplemental sources of supply, in 2014 the majority of those customers have had those supplies curtailed by the State Water Resources Control Board, so the 25% mandatory conservation has resulted in corresponding amounts of actual demand reduction. A chart depicting demand reductions achieved to date is attached as **Exhibit A**. **[Note: Exhibit A was included in the District's August 7, 2014 TUCP.]**

- District shall hold a meeting of its customers within 7 days after the date of the SWRCB's order approving the District's TUCP, and, during that meeting and through written correspondence, provide its customers with information about the drought emergency and the District's TUCP, and request sufficient reductions in its customers' diversions to achieve at least 20% reductions in their diversions (using the baseline defined in term U) while the SWRCB's order on the District's TUCP is in effect.
- District shall implement the requirements imposed by SWRCB Standard Permit Term U in accordance with a Water Demand Reduction Plan that the District will prepare and file with the Deputy Director for Water Rights within 14 days after the SWRCB's order approving the District's TUCP, for review and approval by the Deputy Director. The Plan shall be designed to ensure that all parties that beneficially use water diverted or stored under the District's water-right Permit 12947B will implement actions to meet reductions in all of their diversions of at least 20% of their baseline water demands (as defined in Term U)..

3. **Long-Term Drought Contingency Plan.**

- District shall develop a long-term drought contingency plan in cooperation with Sonoma County Water Agency. This plan will contain the following provisions: (a) protocols for real-time one-day and three-day advance forecasts of total diversions by all District customers under all bases of right, to facilitate SCWA's operations with releases of Lake Mendocino stored water with minimal operational buffers; (b) protocols for achieving reductions in the total diversions by each District contractor during future droughts; and (c) annual reporting to the SWRCB of the total monthly amounts water diverted by each District contractor***, with allocations of each of these amounts to water diverted under the customer's contract with the District and water diverted under the contractor's own rights*** (with the report for each year to be filed by June 30 of the following year). The District shall file this plan with the SWRCB within six months after the date of the SWRCB's order approving the District's TUCP. **[Note: The District's August 7, 2014 TUCP does not contain the language that appears in *bold italics* above. SCWA requests that the SWRCB's order on the District's TUCP include this language.]**

4. Standard Permit Term U.

The temporary change(s) authorized by this Order are not effective unless right holder is operating in accordance with a Water Demand Reduction Plan (Plan) satisfactory to the Deputy Director for Water Rights. The Plan shall be designed to ensure that all parties that beneficially use water diverted and/or stored under this right implement actions to meet a water demand reduction of a minimum of 20% of the baseline water demand. The Plan shall define baseline water demand as appropriate for the right holder's situation based on considerations such as

weather, economy, wholesale supplier allocations or other relevant information. For the purpose of compliance with this term, if the Plan does not define baseline water demand, it is assumed to be the average water demand for Use during 2013.

The Plan shall include, at a minimum, the following components:

1. All parties that beneficially use water diverted and/or stored under this right and/or parties otherwise subject to the temporary change(s) authorized by this Order;

2. Baseline water demand for all parties included in (1) above;

3. Existing actions and additional actions planned by each party included in (1) above to reduce water use in order to meet the water demand reduction required by this term, including a description of how such actions can be expected to meet the demand reduction. The Plan shall also identify additional actions to be implemented, in the event that the right holder does not attain the amount of water use demand reduction relative to baseline water demand.;

For right holders with municipal or domestic use: Additional actions to be considered include, at a minimum, those recommended in any applicable Governor's Drought Proclamation as applicable to the right holders operations, and determine if implementation of such action(s) may increase conservation of their water supply. If so, the right holder will either implement the recommendation(s) or provide documentation as to why such action is not reasonable for the right holders' situation. Actions to evaluate include, but are not limited to, 1) Avoid using water to clean sidewalks, driveways, parking lots and other hardscapes; 2) Turn off fountains and other decorative water features unless recycled or grey water is used for those water features, 3) Limit vehicle washing at home by patronizing local carwashes that use recycled water; 4) Limit outdoor watering of lawns and landscaping to no more than two times a week; 5) Recreational facilities, such as city parks and golf courses, and large institutional complexes, such as schools, business parks and campuses, should immediately implement water reduction plans to reduce the use of potable water for outdoor irrigation; 6) Commercial establishments such as hotel and restaurants should take steps to reduce water usage and increase public awareness of the drought through measures such as offering drinking water only upon request and providing customers with options to avoid daily washing of towels or sheets; 7) Professional sports facilities, such as basketball arenas, football, soccer, and baseball stadiums, and hockey rinks should reduce water usage and increase public awareness of the drought by reducing the use of potable water for outdoor irrigation and encouraging conservation by spectators.;

For right holders with irrigation use for commercial agriculture: Additional actions to be considered include, but are not limited to, those associated with on farm conservation, such as irrigation scheduling, tailwater recovery systems, and irrigation system improvements, and irrigation district system improvements, such as canal lining, canal structure improvements, and remote measurement, monitoring and control. Right holder shall determine if implementation of such action(s) may increase conservation of water supply. The right holder will either implement action(s) or provide documentation as to why such action is not reasonable for the right holders' situation.

4. For parties included in (1) above over which the right holder has the authority or other ability to impose the listed water demand reduction actions, a list of such parties and a description of such authority or other ability over each party;

5. For parties included in (1) above over which the right holder does not have the authority or other ability to impose the listed water demand reduction actions, a list of such parties, a description of the efforts of the right holder to coordinate with each of the listed parties to ensure that each party take appropriate action to reduce water demand, and a description of such actions for each party;

6. A detailed schedule with planned completion dates for key events. Right holder shall submit to the Deputy Director for Water Rights a written report within 15 days of the end of each month (monthly status update) that provides a summary of compliance with this term. The monthly status update shall, at a minimum, include a description of the right holder's actions to date to comply with the requirements of this term and the results of such actions, including but not limited to the amount of water demand reduction relative to baseline water demand. The data submitted for the amount of water demand reduction shall include both monthly and aggregate annual to date information and shall be compared to baseline water demand. When the monthly status update reflects that the right holder is not achieving the minimum water demand reduction of this term, the right holder shall also include additional actions the right holder has adopted and/or implemented to meet the demand reduction and identify the date when such additional actions will be fully implemented as part of the monthly status update.

Failure to achieve demand reduction may result in modification of this Order to limit the extent of the approved action, at the discretion of the Deputy Director for Water Rights.

State Water Board Order Directing Reductions in Diversions Under 10,000 af/yr Sonoma County Reservation

In its Order WR 74-30, the State Water Board added the following term to the Water Agency's water right Permit 12947A:

> Permittee (Permit 12947A) shall release water from storage as required to meet the demands of junior appropriators not to exceed 10,000 acre-feet per annum, in Russian River Valley in Sonoma County, except to the extent that retention of stored water is necessary to insure satisfaction of the minimum streamflows required by this permit.

(Order WR 74-30, p. 13, ¶ 18.) This term now is Term 23 of Permit 12947A.

Order WR 74-30 stated that rights to the beneficial use of Coyote Valley Dam Project water under this 10,000 af/yr Sonoma County reservation could be obtained by the water users filing with the State Water Board applications to appropriate water. (Order WR 74-30, p. 4, ¶ 4.) Many such water users have filed such applications, and the State Water Board has issued permits and licenses on these applications. Rights to divert and use water under this reservation therefore now are administered by the State Water Board, and the Water Agency has no authority to direct these water users to reduce their diversions.

Because of the hydrological conditions described in the Supplement to the Water Agency's TUCP, reductions in diversions under this reservation, as provided for in Term 23, now are necessary so that water may be retained in storage in Lake Mendocino to insure satisfaction of the minimum streamflow requirements in Permit 12947A. The Water Agency therefore requests

that the State Water Board consider taking actions to cause holders of water right permits and licenses that were issued under the 10,000 af/yr Sonoma County reservation to reduce their diversions by 20 percent (compared to 2013 diversions during the corresponding months) during the term of the State Water Board's order on the Water Agency's TUCP.

August 2014

Sonoma County Water Agency

Supplement to the August 2014 Temporary Urgency Change Petition

1.0 BACKGROUND

The Sonoma County Water Agency (Water Agency) controls and coordinates water supply releases from Lake Mendocino and Lake Sonoma to implement the minimum instream flow requirements in water rights Decision 1610, which the State Water Resources Control Board (State Water Board) adopted on April 17, 1986. Decision 1610 specifies minimum flow requirements for the Upper Russian River, Dry Creek and the Lower Russian River. These minimum flow requirements vary based on water supply conditions, which are also specified in Decision 1610. Term 20 of the Water Agency's water-right Permit 12947A (Application 12919A) contains the Decision 1610 requirements for the Upper Russian River and Lower Russian River. Term 17 of the Water Agency's water-right Permit 12949 (Application 15736) and term 17 of the Water Agency's water-right Permit 12950 (Application 15737) contain the Decision 1610 requirements for the Lower Russian River. Term 13 of the Water Agency's water-right Permit 16596 (Application 19351) contains the Decision 1610 requirements for Dry Creek and the Lower Russian River.

The Water Agency's operations are also subject to the Russian River Biological Opinion issued by the National Marine Fisheries Service on September 24, 2008.

1.1 <u>Minimum Flow Requirements</u>

Decision 1610 requires a minimum flow of 25 cubic feet per second (cfs) in the East Fork of the Russian River from Coyote Valley Dam to the confluence with the West Fork of the Russian River under all water supply conditions. From this point to Dry Creek, the Decision 1610 required minimum Russian River flows are 185 cfs from April through August and 150 cfs from September through March during *Normal* water supply conditions, 75 cfs during *Dry* conditions and 25 cfs during *Critical* conditions. Decision 1610 further specifies two variations of the *Normal* water supply condition, commonly known as *Dry Spring 1* and *Dry Spring 2*. These conditions provide for lower required minimum flows in the Upper Russian River during times when the combined storage in Lake Pillsbury (owned and operated by the Pacific Gas and

Electric Company) and Lake Mendocino on May 31 is unusually low. *Dry Spring 1* conditions exist if the combined storage in Lake Pillsbury and Lake Mendocino is less than 150,000 acre-feet on May 31. Under *Dry Spring 1* conditions, the required minimum flow in the Upper Russian River between the confluence of the East Fork and West Fork and Healdsburg is 150 cfs from June through March, with a reduction to 75 cfs during October through December if Lake Mendocino storage is less than 30,000 acre-feet during those months. *Dry Spring 2* conditions exist if the combined storage in Lake Pillsbury and Lake Mendocino is less than 130,000 acre-feet on May 31. Under *Dry Spring 2* conditions, the required minimum flows in the Upper Russian River are 75 cfs from June through December and 150 cfs from January through March.

From Dry Creek to the Pacific Ocean, the required minimum flows in the Lower Russian River are 125 cfs during *Normal* water supply conditions, 85 cfs during *Dry* conditions and 35 cfs during *Critical* conditions.

In Dry Creek below Warm Springs Dam, the required minimum flows are 75 cfs from January through April, 80 cfs from May through October and 105 cfs in November and December during *Normal* water supply conditions. During *Dry* and *Critical* conditions, these required minimum flows are 25 cfs from April through October and 75 cfs from November through March.

Figure 1 shows all of the required minimum instream flows specified in Decision 1610 by river reach, gaging stations used to monitor compliance, and criteria for the various water supply conditions.

1.2 Water Supply Conditions

There are three main water supply conditions that are defined in Decision 1610, which set the minimum instream flow requirements based on the hydrologic conditions for the Russian River system. These water supply conditions are determined based on criteria for the calculated cumulative inflow into Lake Pillsbury from October 1 to the first day of each month from January to June. Decision 1610 defines cumulative inflow for Lake Pillsbury as the algebraic sum of releases from Lake Pillsbury, change in storage and lake evaporation.

Dry water supply conditions exist when cumulative inflow to Lake Pillsbury from October 1 to the date specified below is less than:

- 8,000 acre-feet as of January 1;
- 39,200 acre-feet as of February 1;
- 65,700 acre-feet as of March 1;
- 114,500 acre-feet as of April 1;
- 145,600 acre-feet as of May 1; and
- 160,000 acre-feet as of June 1.

Critical water supply conditions exist when cumulative inflow to Lake Pillsbury from October 1 to the date specified below is less than:

- 4,000 acre-feet as of January 1:
- 20,000 acre-feet as of February 1;
- 45,000 acre-feet as of March 1;
- 50,000 acre-feet as of April 1;
- 70,000 acre-feet as of May 1; and
- 75,000 acre-feet as of June 1.

Normal water supply conditions exist whenever a *Dry* or *Critical* water supply condition is not present. As indicated above, Decision 1610 further specifies three variations of the *Normal* water supply condition based on the combined storage in Lake Pillsbury and Lake Mendocino on May 31. These three variations of the *Normal* water supply condition determine the required minimum instream flows for the Upper Russian River from the confluence of the East Fork and the West Fork to the Russian River's confluence with Dry Creek. This provision of Decision 1610 does not provide for any changes in the required minimum instream flows in Dry Creek or the Lower Russian River (the Russian River between its confluence with Dry Creek and the Pacific Ocean). A summary of the required minimum flows in the Russian River for *Normal*, *Normal — Dry Spring 1* and *Normal — Dry Spring 2* water supply conditions is provided here:

1. *Normal*: When the combined water in storage in Lake Pillsbury and Lake Mendocino on May 31 of any year exceeds 150,000 acre-feet or 90 percent of the estimated water supply storage capacity of the reservoirs, whichever is less:

From June 1 through August 31	185 cfs
From September 1 through March 31	150 cfs
From April 1 through May 31	185 cfs

2. *Normal-Dry Spring 1*: When the combined water in storage in Lake Pillsbury and Lake Mendocino on May 31 of any year is between 150,000 acre-feet or 90 percent of the estimated water supply storage capacity of the reservoirs, which ever is less, and 130,000 acre-feet or 80 percent or the estimated water supply storage capacity of the reservoirs, whichever is less:

From June 1 through March 31	150 cfs
From April 1 through May 31	185 cfs
If from October 1 through December 31, storage in Lake	

Mendocino is less than 30,000 acre-feet	75 cfs

3. *Normal-Dry Spring 2*: When the combined water in storage in Lake Pillsbury and Lake Mendocino on May 31 of any year is less than 130,000 acre-feet or 80 percent of the estimated water supply storage capacity of the reservoirs, which ever is less:

From June 1 through December 31	75 cfs
From January 1 through March 31	150 cfs
From April 1 through May 31	185 cfs

2.0 CURRENT WATER SUPPLY CONDITIONS

On December 18, 2013, the Water Agency filed a Temporary Urgency Change Petition (December 2013 TUCP) with the State Water Board, requesting changes to the minimum instream flow requirements in Permit 12947A (Application 12919A). The State Water Board Division of Water Rights issued an order approving the December 2013 TUCP on December 31, 2013 (Order). The December 2013 TUCP requested that the minimum instream flow requirements for the Upper Russian River be established using an index based on water storage in Lake Mendocino rather than using cumulative inflow into Lake Pillsbury (per Decision 1610) for 180 days, starting on January 1, 2014. The request was a result of the very dry hydrologic conditions in the watershed that had led to unseasonably low Lake Mendocino water supply levels. The approved changes in the Order resulted in preserving approximately 5,000 acre-feet of storage in Lake Mendocino. This was in addition to the approximately 8,000 acre-feet of Lake Mendocino storage that was preserved with the modifications to minimum instream flow requirements that were approved by the State Water Board in its order granting the TUCP the Water Agency filed in April 2013 to address the rapidly declining Lake Mendocino storage levels that were occurring then.

The December 2013 TUCP Order expired on June 29. The current minimum instream flow requirements for the Upper and Lower Russian River, which have been unchanged since June 1, are those for *Dry* conditions. Under these conditions, the required minimum instream flows are 75 cfs for the Upper Russian and 85 cfs for the Lower Russian. Unless the SWRCB issues an order changing these requirements, they will continue to be in effect through December 31.

2.1 Lake Mendocino

On August 12, 2014, the storage level in Lake Mendocino was 36,052 acre-feet. This storage level is 32 percent of the available summer water supply pool. Since its completion in 1958, this is the lowest level in Lake Mendocino on this date, except for August 12, 1977, when reservoir storage was 21,982 acre-feet. The current low storage level is the result of a severe drought that began in the region in January 2013.

Analyses recently prepared by Water Agency engineering staff indicate that, unless there are

significant storm events before November 1, Lake Mendocino storage is expected to decline to approximately 20,000 acre-feet by November 1. This decline will result from the releases of stored water that will be necessary to meet both downstream water demands on, and the current minimum instream flow requirement for, the Upper Russian River. The projected storage analysis was completed using the Water Agency's Russian River Water System Model with the following assumptions: (1) the current Upper Russian River minimum instream flow requirement of 75 cfs; (2) 2013 hydrology; (3) 2013 Upper Russian River observed reach losses; and (4) Potter Valley Project operations based on the 2004 amended license issued by the Federal Energy Regulatory Commission. Figure 2 shows the Lake Mendocino storage levels that have occurred so far during 2014 and the projected storage levels for the remainder of 2014 if minimum instream flow requirements are unchanged.

The extremely low projected storage level in Lake Mendocino could: (a) severely impact Russian River salmonid species that are listed as threatened species under the Federal Endangered Species Act (ESA), (b) create more serious water-supply impacts in Mendocino County and the Alexander Valley in Sonoma County, and (c) further harm Lake Mendocino and Russian River recreation.

2.2 Lake Sonoma

On August 12, 2014 the water supply storage level in Lake Sonoma was 159,781 acre-feet, which is 65 percent of the available water conservation pool. Lake Sonoma storage levels have not dropped to this low of a level since March 1991. Based on the analysis with the Water Agency's Russian River Water System Model, storage levels in Lake Sonoma are projected to decline to approximately 145,000 acre-feet by November 1, with the assumption of a recurrence of 2013 hydrology, which had no significant storm events before that date. While the Lake Sonoma storage levels are reaching a 25-year low, there is still a substantial water supply volume in Lake Sonoma. Consequently, the Water Agency does not believe that storage levels in Lake Sonoma are a significant concern at this time.

2.3 River System Operational Constraints

As further discussed in Section 3.0 below, along with requesting changes to minimum instream flow requirements for the Upper Russian River, the Water Agency is also requesting changes to the minimum instream flow requirements for the Lower Russian River. These changes are necessary because implementation of the lower minimum instream flow requirements that are being requested for the Upper Russian River, which are necessary to preserve Lake Mendocino storage, will result in the Upper Russian River providing significantly lower contributions of flows to meet minimum instream flow requirements for the Lower Russian River. Consequently, increased releases from Lake Sonoma into Dry Creek would be necessary to maintain present Decision 1610 minimum instream flow requirement (85 cfs) for the Lower Russian River. However, such increased releases into Dry Creek could result in the Water Agency's violating the Incidental Take Statement in the Russian River Biological Opinion issued by the National

Marine Fisheries Service (NMFS)[1]. The Incidental Take Statement restricts releases from Lake Sonoma into Dry Creek during June through October of each year because high Dry Creek flows during these months result in sub-optimal habitat conditions for juvenile salmonids.

Furthermore, NMFS concluded in the Biological Opinion that flows lower than those required by Decision 1610 for the Lower Russian River may improve opportunities in the Russian River estuary to maintain a freshwater lagoon, which is beneficial for the ESA-listed salmonids and their critical habitats. Consequently, lowering minimum instream flows on the Lower Russian River is consistent with the objectives of the Biological Opinion.

The window of opportunity for an SWRCB order on this petition to preserve stored water in Lake Mendocino through reductions in the minimum instream flow requirements is limited. Chinook salmon in-migration typically commences within a few weeks of November 1. When this salmon in-migration begins, SCWA will consult with NMFS and California Department of Fish and Wildlife to determine the increases in reservoir release rates that are appropriate to maintain a balance between trying to preserve prudent storage in Lake Mendocino and trying to optimize fish passage for fall Chinook migration and winter steelhead migration.

3.0 REQUESTED TEMPORARY URGENCY CHANGE TO PERMITS 12947A, 12949, 12950 AND 16596

To preserve the drought-limited water supply in Lake Mendocino and to avoid excessively high releases from Lake Sonoma down Dry Creek that could result in violations to the Incidental Take Statement in the Biological Opinion, the Water Agency is filing this TUCP, which requests that the State Water Board make the following changes to the Water Agency's permits for a period of 180 days from August 15, 2014 until February 10, 2015: (1) reduce the required minimum instream flow in the Russian River from the confluence of the East and West Forks to the river's confluence with Dry Creek from 75 cfs to 50 cfs; and (2) reduce required minimum instream flow in the Russian River from its confluence with Dry Creek to the Pacific Ocean from 85 cfs to 60 cfs. Figure 3 shows an analysis of the approximate flows by river reach for the Lower Russian River and Dry Creek that are occurring under the present Decision 1610 minimum instream flow requirements. Figure 4 shows the approximate flows that would occur under the proposed minimum instream flow requirements that are requested in this TUCP.

To allow the Water Agency to optimally manage flows in the Upper Russian River and Lower Russian River, the Water Agency is requesting that the TUCP minimum instream flow requirements be specified as 5-day running averages of the specified minimum average daily stream flows, with the conditions that instantaneous flows in the Upper Russian River are never less than 40 cfs and instantaneous flows in the Lower Russian River are never less than 50 cfs. These 5-day running average provisions will allow the Water Agency to reduce the operational

[1] Refer to the *Biological Opinion for Water Supply, Flood Control Operations and Channel Maintenance conducted by U.S. Army Corps of Engineers, the Sonoma County Water Agency and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River Watershed*, pp. 297-299 (NMFS, Sept. 24, 2008) for details on the incidental take statement and criteria.

buffers needed to manage these stream flows, thereby allowing the Water Agency to conserve more water in Lake Mendocino. Higher Lake Mendocino storage levels in the fall will benefit migrating Chinook salmon and improve carryover storage volumes to meet Upper Russian River demands into 2015 if dry conditions persist.

The TUCP requests that the term of the State Water Board's order on the TUCP extend into the initial months of the normal rainy season. Because the reductions in minimum instream flow requirements that are requested in this TUCP no longer will be necessary if Russian River watershed hydrological conditions improve substantially, the Water Agency requests that the State Water Board's order specify that the order will terminate when Lake Mendocino storage reaches the top of the water supply pool (68,400 acre-feet).

4.0 CRITERIA FOR APPROVING TEMPORARY URGENCY CHANGES TO PERMITS 12947A, 12949, 12950 AND 16596

As required by Water Code section 1435, subdivision (b), the Board must make the following findings before issuing a temporary change order:

1. The permittee or licensee has an urgent need to make the proposed change;
2. The proposed change may be made without injury to any other lawful user of water;
3. The proposed change may be made without unreasonable effect upon fish, wildlife, or other instream beneficial uses; and
4. The proposed change is in the public interest.

4.1 Urgency of the Proposed Change

Under Water Code section 1435, subdivision (c), an urgent need to make a proposed change exists when the State Water Board concludes that the proposed temporary change is necessary to further the constitutional policy that the water resources of the State be put to beneficial use to the fullest extent of which they are capable and that waste of water be prevented.

For this petition, an urgent need for the requested temporary changes exists because Lake Mendocino storage levels are declining, with projected levels reaching extremely low conditions that may prevent the Water Agency from continuing to make the reservoir releases that will be necessary to support the beneficial uses that rely on these releases during dry periods.

The Water Agency projects that water storage in Lake Mendocino could decline to 20,000 acre-feet by November 1, 2014 unless the requested temporary urgency changes are approved. If upcoming dry conditions persist and significant storm events are delayed or do not occur in Water Year 2015, then carryover storage in Lake Mendocino will be crucial for the continued protection of the Russian River salmonid fishery and water supply reliability. At a storage levels below 20,000 acre-feet, there would be greater risks that there would be insufficient water supplies to support: (a) survival of ESA-listed Russian River salmonid species, (b) agricultural and municipal uses that depend on the Russian River, and (c) river-based recreation. Without the proposed changes, the Water Agency would need to release additional stored water from

Lake Mendocino, which would result in greater depletion of stored water during the summer and potentially would jeopardize water supplies for Russian River water users in Mendocino County and northern Sonoma County (upstream of the confluence with Dry Creek) during the fall. This could cause serious impacts to human health and welfare and would reduce water supplies needed for fishery protection and stable flows in the Upper Russian River during the fall when the ESA-listed salmonid species are spawning and are most sensitive to flow and water temperatures.

An urgent need exists for the proposed changes on the Lower Russian River because the current instream flow requirements are above the target flows that are necessary to support the salmonid fisheries and, with the reductions in the Upper Russian River flows, would require increases in Lake Sonoma releases down Dry Creek that would be detrimental to its fisheries. These higher Dry Creek flows also could violate the Incidental Take Statement in the Biological Opinion. As discussed in Section 2.3, the Incidental Take Statement restricts releases from Lake Sonoma into Dry Creek during June through October of each year because high Dry Creek flows during these months result in sub-optimal habitat conditions for juvenile salmonids. Furthermore, NMFS concluded in the Biological Opinion that minimum instream flows lower than those required by Decision 1610 may result in lower flows into the estuary that will improve opportunities to maintain the freshwater lagoon there, which benefits the ESA-listed salmonids.

As discussed in Section 3.0, the Water Agency requests that the State Water Board's order on the TUCP specify that it will terminate when hydrological conditions improve substantially and, as a result, the urgency for the proposed changes no longer exists.

4.2 No Injury to Any Other Lawful User of Water

If this petition is granted, the Water Agency still will be required to maintain specific minimum flows in the Russian River. Because these minimum flows will be present in the Upper and Lower Russian River reaches, all other legal users of water still will be able to divert and use the amounts of water that they may legally divert and use. Accordingly, granting this petition will not result in any injury to any other lawful user of water.

4.3 No Unreasonable Effect upon Fish, Wildlife, or Other Instream Beneficial Uses

Approval of this petition will reduce flows in the mainstem Russian River, which will result in additional water being conserved in Lake Mendocino. This will improve carryover storage in Lake Mendocino if dry conditions persist into Water Year 2015, which will have benefits that exceed any possible deleterious effects of the reduced flows during the late summer and early fall of 2014. Conserved storage will allow enhanced management of Russian River flows in the fall for the benefit of salmon migration and spawning. While reduced flows in the Russian River during the late summer and early fall may impair some instream beneficial uses, principally recreation, these effects will not be unreasonable, considering the potential grave impacts to fisheries and water supply that could occur if the petition were not approved. If the requested reductions in Lower Russian River minimum flow requirements are not approved, then the

higher Lake Sonoma releases and higher Dry Creek flows that would be necessary to meet the Lower Russian River minimum instream flow requirements would have severely negative impacts to juvenile salmonid habitat in Dry Creek.

As discussed in Section 2.3, when salmon in-migration from the Pacific Ocean into the Russian River begins, the Water Agency will consult with NMFS and CDFW regarding the appropriate flow increases to avoid unreasonable effects on these in-migrating fish.

4.4 The Proposed Changes are in the Public Interest

Approval of this petition will help preserve stored water in Lake Mendocino, which may reach critically low levels if dry weather conditions persist into 2015. Among other uses, the conserved stored water in Lake Mendocino will support releases for listed salmonids present in the Russian River during the fall-Chinook salmon migration season and winter-steelhead migration season. It is in the public interest to preserve water supplies for these beneficial uses now, when hydrologic circumstances have resulted in severely reduced water supplies. The proposed changes in the Lower Russian River minimum instream flow requirements will support ecological values in Dry Creek by preventing the higher Dry Creek flows that would be necessary if the State Water Board were to approve only the requested changes in the Upper Russian River requirements. As discussed above, such higher Dry Creek flows would impair habitat conditions for juvenile salmonids.

The proposed changes also are in the public interest because: (a) as discussed in Section 2.3, when salmon in-migration from the Pacific Ocean into the Russian River begins, the Water Agency will consult with NMFS and CDFW regarding the appropriate flow increases to avoid unreasonable effects on these in-migrating fish; and (b) as discussed in Section 3.0, the Water Agnency requests that the State Water Board's order on the TUCP specify that it will terminate when hydrological conditions improve substantially and, as a result, the urgency for the proposed changes no longer exists.

5.0 RESERVOIR OPERATIONS AND DIVERSIONS FROM UPPER RUSSIAN RIVER

Under the Water Agency's normal operating protocols, the Water Agency releases water from storage in Lake Mendocino to support demands and to maintain minimum instream flows for the Upper Russian River down to its confluence with Dry Creek. The Water Agency does not normally make additional releases of water from storage in Lake Mendocino to meet instream flow requirements in or diversions from the Russian River downstream of its confluence with Dry Creek. Minimum instream flow requirements and diversions from the Lower Russian River downstream of its confluence with Dry Creek, which includes those made by the Water Agency, normally are maintained with releases of stored water from Lake Sonoma into Dry Creek. Because of these operating protocols, mandatory reductions in the Water Agency's diversions from the Lower Russian River would not provide any significant benefits to Lake Mendocino storage levels.

On the other hand, mandatory reductions in water diversions from the Upper Russian River would be complimentary to the requested changes in minimum instream flow requirements and would improve water supply conditions in Lake Mendocino. Figure 5 shows projected storage levels in Lake Mendocino under the following three scenarios: (1) no changes to the minimum instream flow requirements; (2) approval of the requested changes in instream flow requirements starting on August 15; and (3) approval of the requested changes in instream flow requirements and a 20 percent reduction in diversions from the Upper Russian River, compared to 2013 diversions.

As shown in Figure 5, a 20 percent reduction in Upper Russian River diversions would result in approximately an additional 5,000 acre-feet of Lake Mendocino storage on November 1, if 2014 hydrology is similar to 2013 hydrology. For these reasons, the Water Agency is coordinating its filing of this TUCP with the filing of a separate TUCP by the Mendocino County Russian River Flood Control and Water Conservation Improvement District, which will ask the State Water Board to direct the District to take various actions to reduce diversions of water from the Upper Russian River in Mendocino County and that will allow the Water Agency to manage Russian River flows more efficiently. The Water Agency also is requesting that the State Water Board order 20 percent reductions in diversions from the Russian River in Sonoma County under the 10,000 acre-foot per year reservation that was created by term 18 on page 13 of the State Water Board's Order WR 74-30. (This term now is term 23 of the Water Agency's water right Permit 12947A.) These actions are described in more detail in Attachment 1 to this TUCP.

6.0 WATER CONSERVATION ACTIVITIES BY THE WATER AGENCY AND ITS CONTRACTORS

As discussed above, the requested changes are not driven by the water storage levels in Lake Sonoma. Consequently, any reductions in diversions from the Lower Russian River by the Water Agency at its Wohler/Mirabel facilities would not result in any significant benefits to the water supply conditions in Lake Mendocino. Nevertheless, the Water Agency's water contractors are committed to eliminating unnecessary use of potable water for landscape irrigation and other waste during these drought conditions. The Water Agency and its water contractors continue to implement water use efficiency programs that align with the California Urban Water Conservation Council's Best Management Practices (BMPs) and comply with SB 7x-7. While these BMPs remain the baseline for the region, the establishment of the Sonoma-Marin Water Saving Partnership (Partnership) in December 2010 memorialized the region's commitment to long-term, year-round water use efficiencies. The Partnership removes one of the most significant barriers to implementing conservation programs, funding. Each Partner has committed to a sustained level of funding that is allocated specifically to implementing conservation programs.

The Partnership represents ten water utilities in the North Bay in Sonoma and Marin counties that have joined together to provide regional solutions for water use efficiency. The utilities (Partners) include: the Cities of Santa Rosa, Rohnert Park, Petaluma, Sonoma, Cotati; North Marin, Valley of the Moon and Marin Municipal Water Districts; the Town of Windsor and the

Sonoma County Water Agency. The Partnership was formed to identify and recommend water use efficiency projects and to maximize the cost-effectiveness of water use efficiency programs in our region.

Each Partner is continuously implementing water conservation programs to reduce overall regional water use. Over the last few years, in response to the drought, the Partnership has increased outreach, revised education programs and expanded the available conservation incentives.

At the onset of the drought in 2013, the Partnership doubled its annual public education campaign to encourage residents to voluntarily reduce water consumption. The Partnership launched the "20-Gallon Challenge" campaign to increase awareness of the water supply situation and as a call to action. The campaign featured a pledge to save 20 gallons per person per day. As an incentive to pledge, entries for monthly prize drawings for high-efficiency toilets and clothes washers, rainwater catchment and gray water systems, and custom water-wise landscape designs were provided. Pledges and contest entries were accepted from participants throughout the Russian River Watershed to encourage water users in both Upper Russian River and Lower Russian River areas to participate in the challenge.

In January 2014, in response to Governor Brown's emergency drought proclamation, the Partnership launched a regional multi-media effort throughout the North Bay region with a simple message: 'There's a drought on. Turn the water off.' The campaign has included: (1) outdoor water conservation tips that have been rotated in local and regional publications; and (2) advertisements on local radio stations and online media. Each advertisement spotlights a creative or humorous method for saving water. The campaign has been well received and is ongoing.

An additional effort by the Water Agency included sponsoring four drought town hall meetings in Sonoma County in April 2014 to educate the public about the drought and the need to conserve water. The meetings were held in Santa Rosa, Rohnert Park, Windsor and Petaluma. Water resource and conservation specialists attended these meetings to discuss the drought, water supply conditions and water conservation rebate programs. In addition, officials from the County's Permit and Resources Management Department and Office of Emergency Services attended each meeting to provide drought information relevant to rural residents and fire prevention.

The Water Agency also sponsored ten "Drought Drive-Up" locations on April 23 in coordination with the Partnership. Over 4,000 community members drove up to the ten locations to receive free drought tool kits, which included: (1) a water efficient faucet aerator; (2) toilet dye tab test; (3) shower timer; (4) shower bucket; (5) low-flow showerhead; and (6) conservation tip card. All participants in the "Drought Drive-Up" were also entered to win a free high-efficiency toilet or high-efficiency washing machine.

The Partnership's outreach efforts have improved water-use efficiencies in the region and the Water Agency remains committed to ensuring that our water supply is reliable. The Partners remain members in good standing with the California Urban Water Conservation Council (CUWCC) and implement the CUWCC's Best Management Practices (BMPs) for water conservation.

Furthermore, on July 15, 2014, the State Board adopted Resolution No. 2014-0038, which adopted emergency regulations for statewide urban water conservation. The new regulations require almost all of the Water Agency's primary water customers to implement their water shortage contingency plans to the level of mandatory restrictions on outdoor irrigation and submit monthly monitoring reports comparing monthly water production with the corresponding calendar month production from 2013. Table 1 below summarizes the dates that each of the Water Agency's Contractors (including Marin Municipal Water District) will be going to their City Councils or Board of Directors for approval to implement the State Board's emergency regulations for urban water conservation.

To promote water savings that extend beyond the Water Agency's service area, the Water Agency has spearheaded the Sonoma-Mendocino Immediate Drought Relief Project, a demand reduction program that includes many entities in the Upper Russian River, in areas that have lacked aggressive water conservation programs in the past, where opportunities exist to achieve significant water savings. The project offers immediate drought relief and long-term water savings to the following participating agencies: 12th District Agricultural Agency (Redwood Empire Fairgrounds), Airport-Larkfield-Wikiup Sanitation Zone, Belmont Terrace Mutual Water Company, City of Cloverdale, City of Healdsburg, City of Ukiah, County of Sonoma - Department of Transportation and Public Works, City of Fort Bragg, Geyserville Sanitation Zone, Mendocino County Russian River Flood Control and Water Conservation Improvement District, Occidental County Sanitation District, Redwood Valley County Water District, Russian River County Sanitation District, Sea Ranch Sanitation Zone, Sonoma County Water Agency, and Sweetwater Springs Water District. This project has the potential to increase regional water use efficiency and drought resilience in the region for years to come and is a response to the Governor's emergency drought declaration that set a 20 percent water demand reduction goal. This project will reduce demands for water from Lake Mendocino and local groundwater supplies.

The participating agencies have the option of offering one or both of the following water-saving programs to their customers:

1) High-Efficiency Fixture Direct-Install Program, which will retrofit up to two inefficient toilets per customer with new high-efficiency toilets. During the installation appointment, the Water Agency-hired plumber will also replace inefficient showerheads and aerators with free, water-efficient models and perform a leak check at the water meter. For commercial properties, in addition to toilets, inefficient urinals will be retrofitted with 0.125 gpf high-efficiency urinals; and

2) Cash for Grass Turf Rebate Program, which will offer a $0.50/sq. ft. rebate for converting high-water-use turf to low-water-use plant material (up to max of 500 sq. ft or $250 per customer).

The Water Agency has managed a Direct Install program in its service area for five years. The Water Agency has already established the needed program elements (agreements with local plumbers, billings procedures, etc.) that will be utilized for this new program.

Through this project, participating agencies will be set up to transition into self-managed ongoing conservation programs. The High-Efficiency Fixture Direct-Install Program reduces base demands addressing approximately 75% of the total indoor residential water use (showers: 20%, faucets: 18%, toilets: 20%, leaks: 18%) by improving fixture efficiency and identifying leaks. The Cash for Grass program addresses 50% of the total water use by homes and directly reduces peak water demands.

On June 2, 2014, the CA Department of Water Resources (DWR) released an expedited 2014 Integrated Regional Water Management Drought Grant Solicitation seeking projects that would provide immediate, measurable water savings. The Water Agency submitted a grant proposal for the Sonoma-Mendocino Immediate Drought Relief Project, which was selected as one of eleven projects by the North Coast Resource Partnership, which submitted the Water Agency's proposal on July 21, 2014 to DWR with a recommended funding of $1.05 million. The participating agencies and Water Agency have committed to provide $630,000 in local matching funds, raising the possible total funding to $1.68 million. The DWR anticipates approving grant awards for this program in October 2014.

For these reasons, the State Water Boards's order on the Water Agency's TUCP should not contain any additional terms regarding the water conservation activities of the Water Agency and its contractors.

7.0 CONCLUSION

The Water Agency is submitting this Temporary Urgency Change Petition to address the extremely dry conditions that have persisted in the Russian River watershed since January 2013. Because of these conditions and the uncertainties regarding regional precipitation over the next several months, the Water Agency requests that the State Water Board issue an order reducing the applicable minimum instream flow requirements for the Upper Russian River and Lower Russian River to preserve storage in Lake Mendocino and to prevent more-severe storage conditions from developing.

Figures

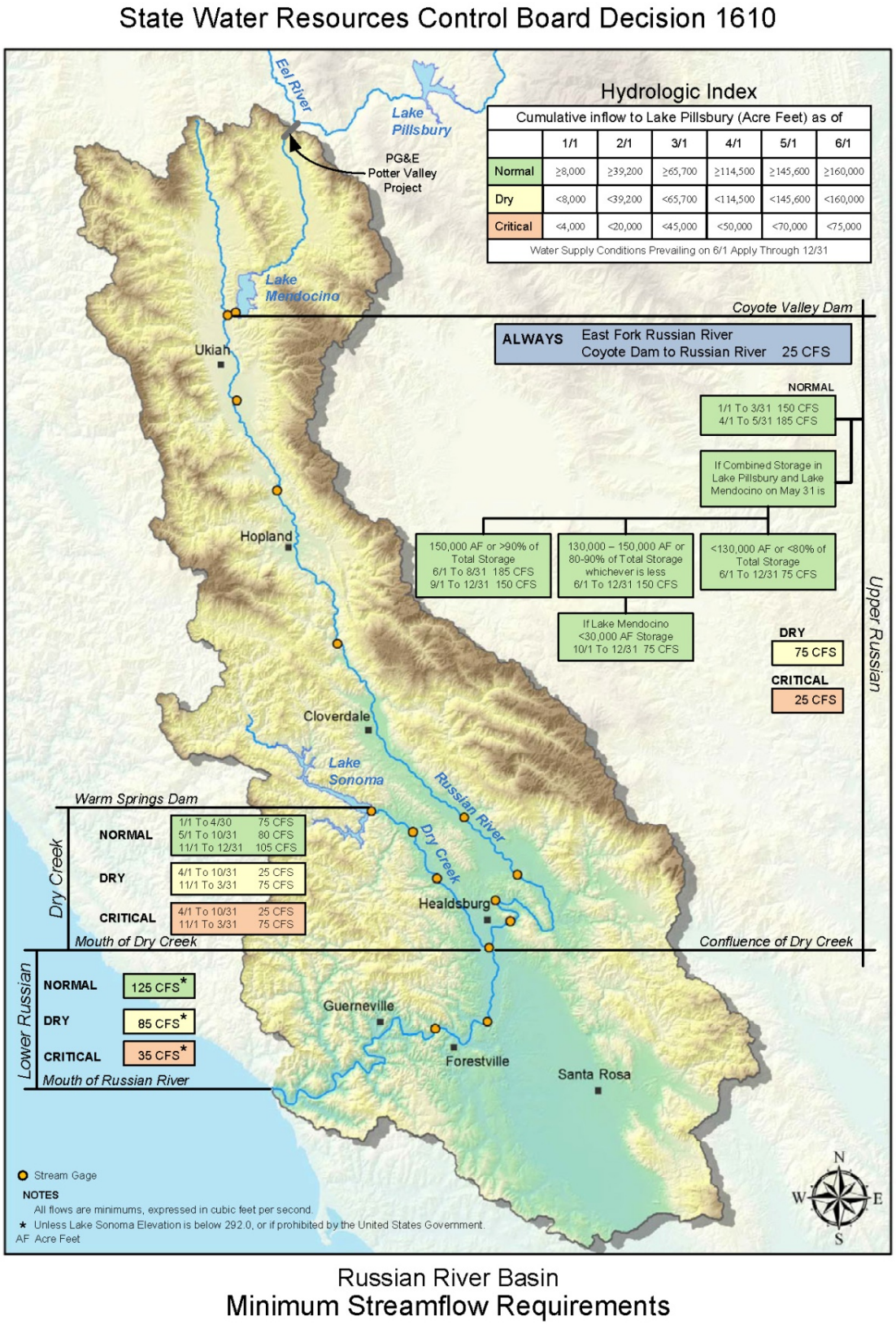


Figure 1 - Decision 1610 Minimum Stream Flow Requirements by Reach

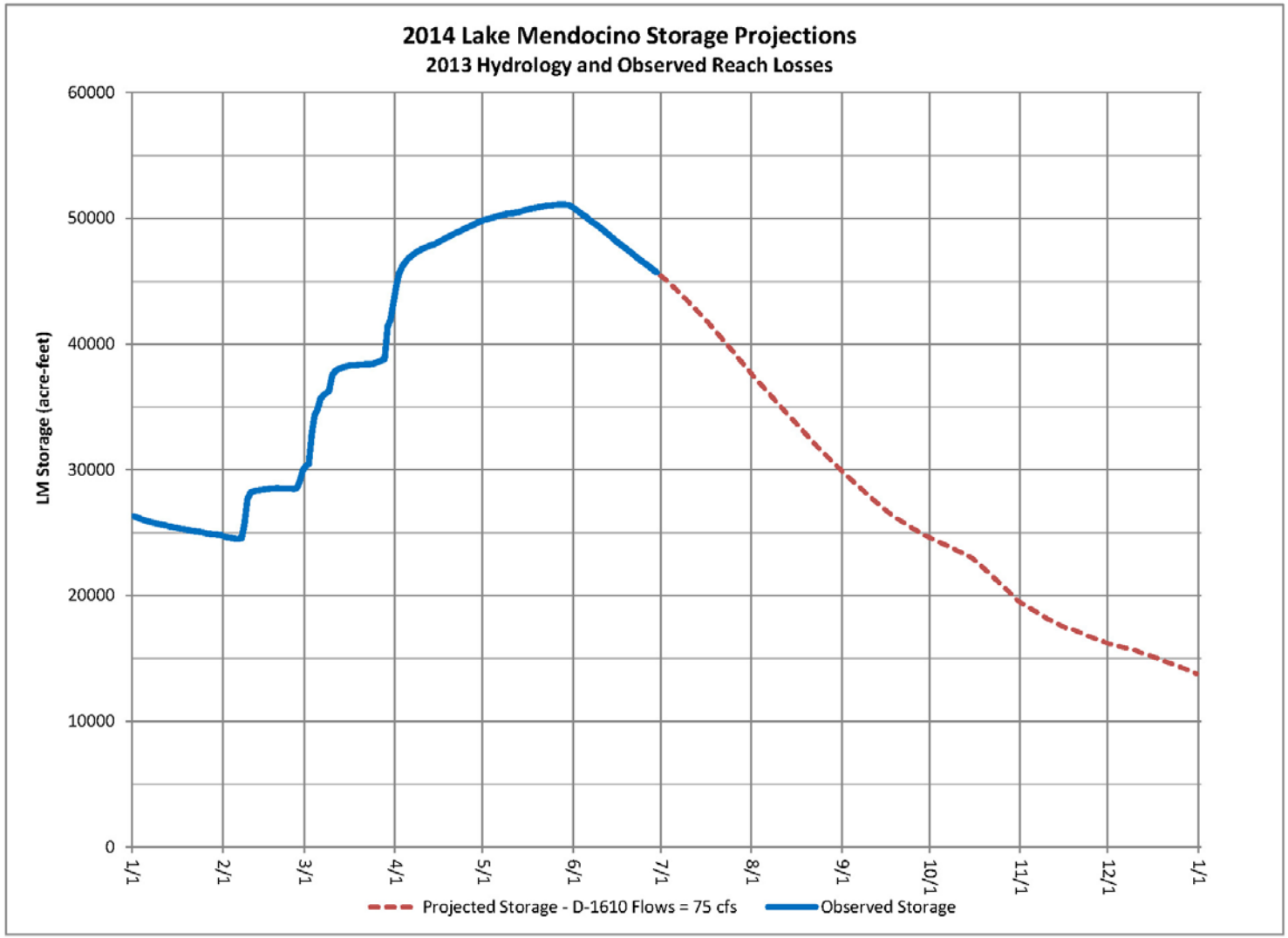


Figure 2 - Lake Mendocino 2014 Storage Projection

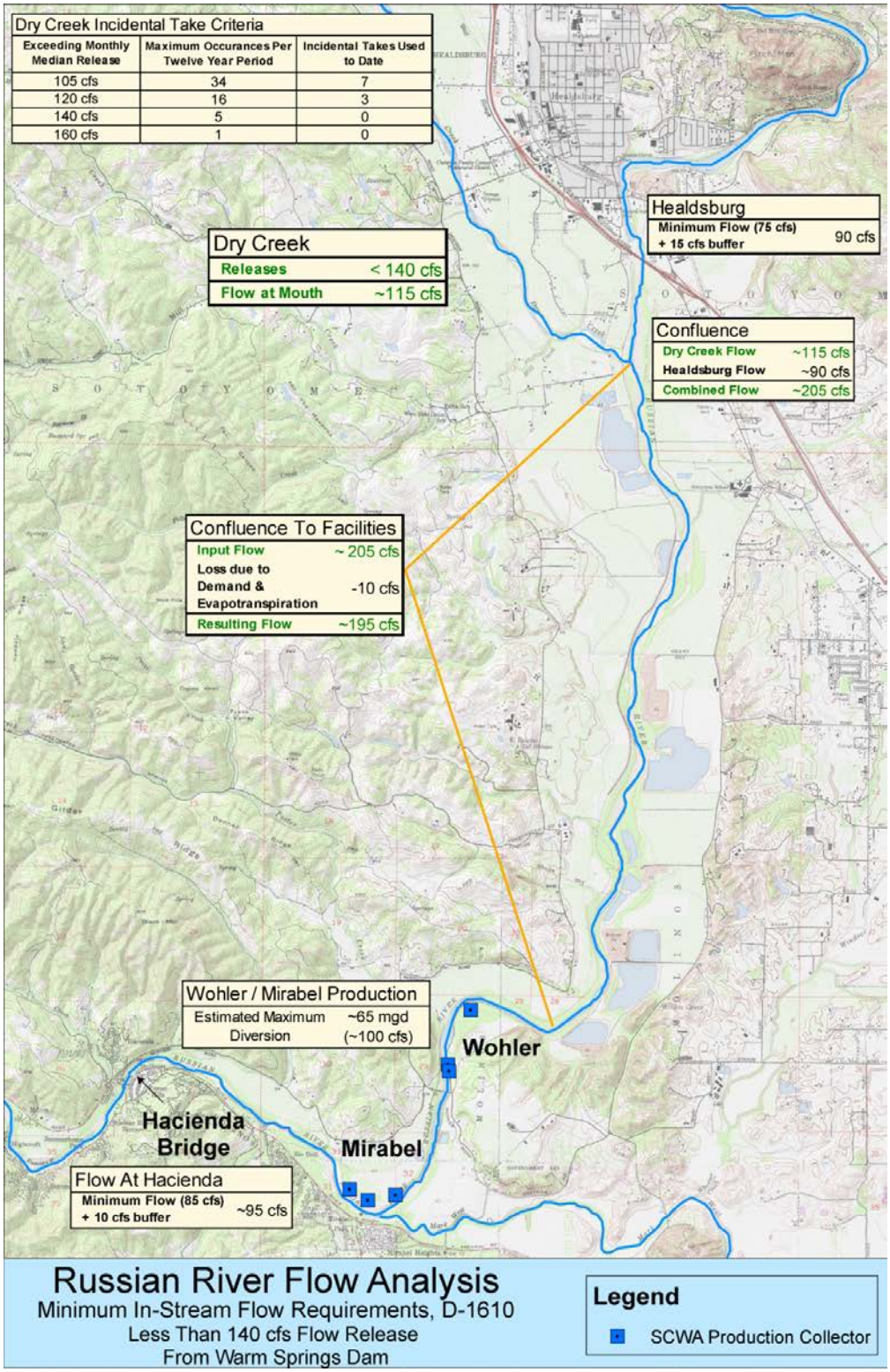


Figure 3 – Approximate Flows under Existing Minimum Instream Flow Requirements

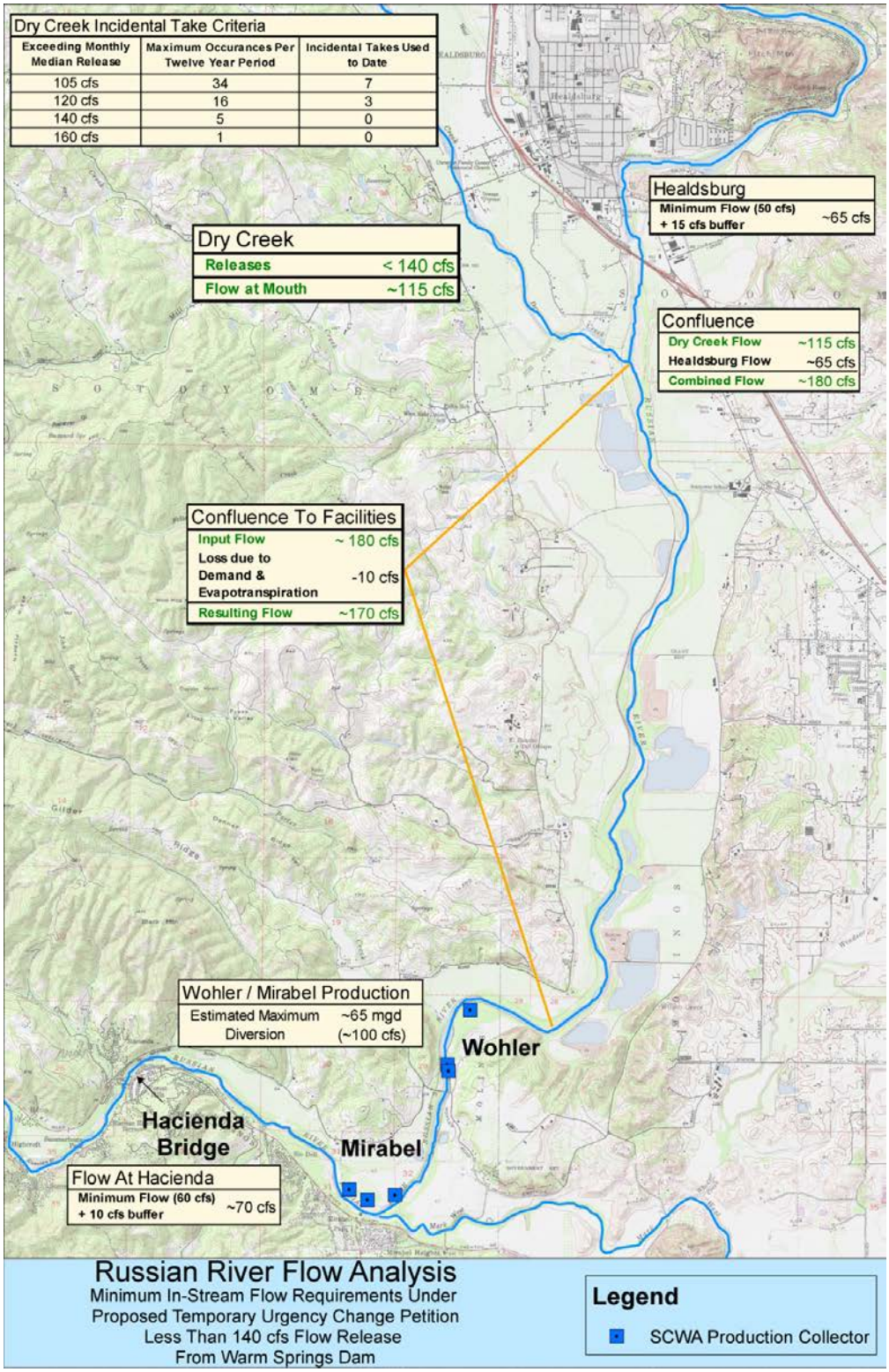
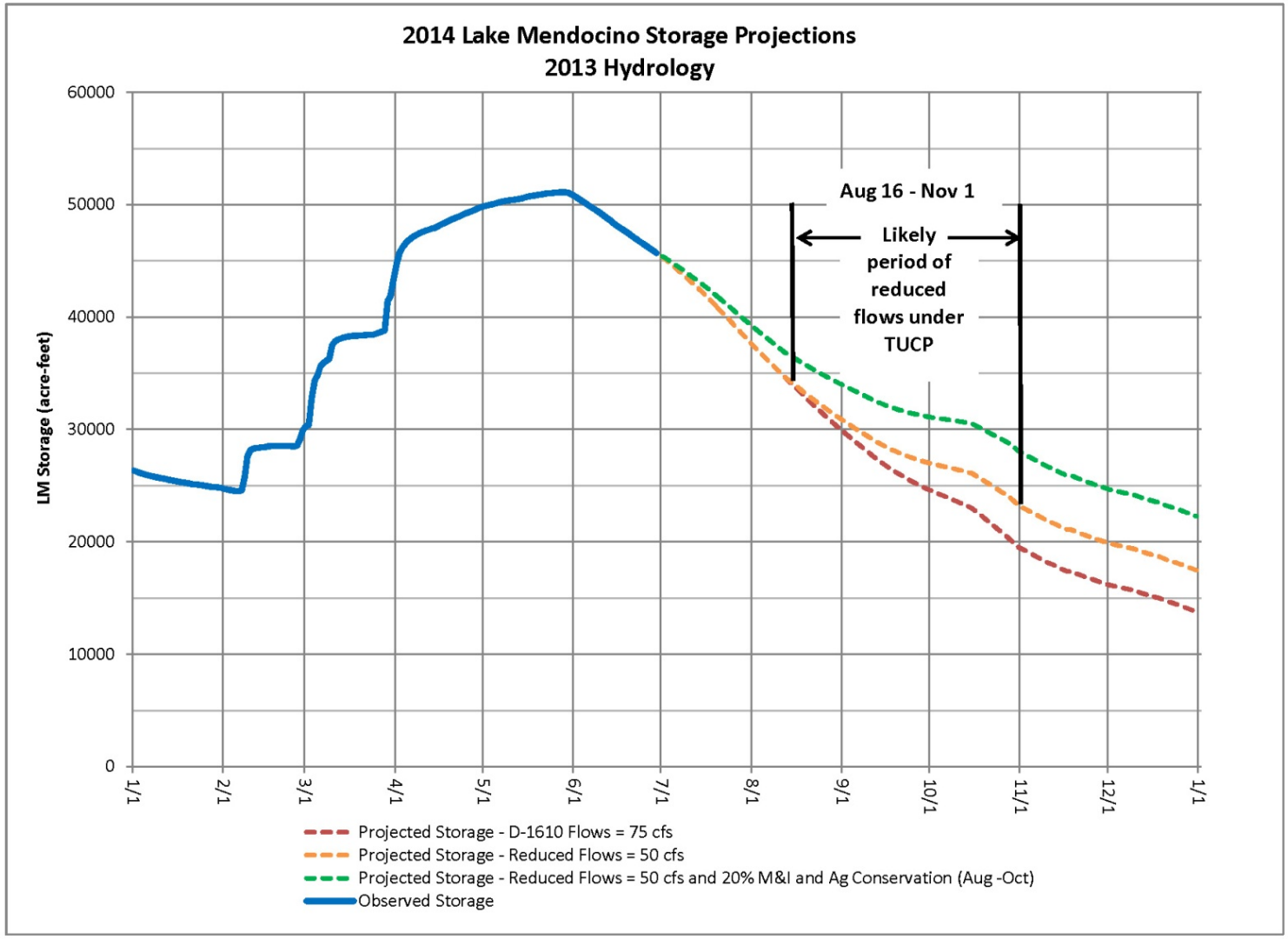


Figure 4 - Approximate Flows under Proposed Minimum Instream Flow Requirements



*November 1st (estimated date) to increase minimum instream flows to 75 cfs for migration of spawning Chinook salmon

Figure 5 - Lake Mendocino Storage Projections

Table

Contractor	Approval Date	Stage	Actions	Source
City of Cotati	8/12/2014	20% mandatory		Verbal update @ Ad hoc 7/28/14
Marin Municipal Water District	8/5/2014	unknown	Introduced on 8/5, back for approval on 8/19. • Irrigation is limited to the hours between 7pm and 9am • The use of a hose without a shut-off nozzle for the irrigation of new turf, washing of cars, boats and airplanes is prohibited 20% conservation requirement not explicitly stated	MMWD Board of Directors Meeting of August 5, 2014
North Marin Water District	8/5/2014	Stage 1	• Watering of any landscaping except from a handheld hose equipped with a shut off nozzle, container or drip irrigation. Overhead sprinkler system can be used if the customer can maintain a 20% reduction in water use compared to the same billing period in 2013. • Watering outside the hours of 7pm to 9am. • Unreasonable/excessive irrigation overspray and/or run-off onto pavement, down a gutter, ditch or other surface drain. • Washing down of exterior paved areas. • Failure to repair a controllable leak. • Refilling a swimming pool drained after July 1, 2014. • Washing of privately-owned motor vehicles, trailers, or boats except from a bucket with a quick rinse from a hose equipped with a shut off nozzle. • Continued enforcement of all additional water waste prohibitions listed in Regulation 15, section b.	NMWD Regular Meeting of August 5, 2014
City of Petaluma	9/8/2014	Unknown	Amend Water Waste Ordinance to address hardscape washing	Verbal update @ Ad hoc 7/28/14
City of Rohnert Park	8/26/2014	Unknown		Verbal update @ Ad hoc 7/28/14
City of Santa Rosa	8/5/2014	Stage 1 Mandatory Conservation	• 20% community-wide reduction in water use by focusing on eliminating water waste and reducing outdoor water use. • Prohibits water waste as defined by the Water Waste Ordinance, which is defined as breaks or leaks in the distribution system and runoff and overspray from irrigation. • Outdoor irrigation is limited to the hours between 8pm and 6am. • Prohibits washing down of hardscapes (unless required for public health and safety). • Prohibits the use of potable water for street washing. • Requires the use of shut-off hose nozzles on all garden and utility hoses. • Requires "Water-on-request" programs at restaurants.	Agenda Item #12.2 for City of Santa Rosa Council Meeting of August 5, 2014
City of Sonoma	8/18/2014	Stage 2 Mandatory Conservation	Stage 2 Mandatory Conservation prohibits: • Non-recirculating fountains (Section 864.4) • Washing vehicles, boats and trailers without a shutoff nozzle (Section 864.2) Water Waste Ordinance (SMC 13.10.060) already covers/prohibits the regulated issues of: • Washing of driveways and sidewalks (Section 864.3) • Runoff to adjacent properties or streets (Section 864.1)	Email to CAP Tue 8/5/2014 2:10 PM
Valley of the Moon Water District	8/5/2014	Stage 2 Mandatory Conservation	• Use of a garden or utility hose without a hose-end shut-off nozzle • Service of water in restaurants except upon request • Using potable water for street washing • Washing sidewalks, patios, driveways and other hardscapes unless for public health and safety • Recycled water must be used for construction dust control • Irrigation is limited to the hours between 8pm and 6am	VOMWD Board of Directors Meeting of August 5, 2014
Town of Windsor	8/6/2014	Stage 2 Mandatory Conservation	• Automated sprinkler irrigation must be properly controlled and performed in non-wasteful and efficient manner • Irrigation is limited to the hours between 7pm and 9am • The amount of water normally required to maintain a healthy landscape shall be reduced by 20 percent, based on landscape size, plant water requirement, and current weather as specified in section 12-3-835 of the Windsor Municipal Code.	Town of Windsor Council Meeting of August 6,2014

Table 1 – Water Agency Contractors' Strategies for Implementing Emergency Urban Water Conservation Regulations

State of California
State Water Resources Control Board
DIVISION OF WATER RIGHTS
P.O. Box 2000, Sacramento, CA 95812-2000
Tel: (916) 341-5300 Fax: (916) 341-5400
http://www.waterboards.ca.gov/waterrights

ENVIRONMENTAL INFORMATION FOR PETITIONS

This form is required for all petitions.

Before the State Water Resources Control Board (State Water Board) can approve a petition, the State Water Board must consider the information contained in an environmental document prepared in compliance with the California Environmental Quality Act (CEQA). This form is not a CEQA document. If a CEQA document has not yet been prepared, a determination must be made of who is responsible for its preparation. As the petitioner, you are responsible for all costs associated with the environmental evaluation and preparation of the required CEQA documents. Please answer the following questions to the best of your ability and submit any studies that have been conducted regarding the environmental evaluation of your project. If you need more space to completely answer the questions, please number and attach additional sheets.

DESCRIPTION OF PROPOSED CHANGES OR WORK REMAINING TO BE COMPLETED

For a petition for change, provide a description of the proposed changes to your project including, but not limited to, type of construction activity, structures existing or to be built, area to be graded or excavated, increase in water diversion and use (up to the amount authorized by the permit), changes in land use, and project operational changes, including changes in how the water will be used. For a petition for extension of time, provide a description of what work has been completed and what remains to be done. Include in your description any of the above elements that will occur during the requested extension period.

See Attachment 2 'Supplement to the August 2014 Temporary Urgency Change Petition'

Insert the attachment number here, if applicable: 2

Coordination with Regional Water Quality Control Board

For change petitions only, you must request consultation with the Regional Water Quality Control Board regarding the potential effects of your proposed change on water quality and other instream beneficial uses. (Cal. Code Regs., tit. 23, § 794.) In order to determine the appropriate office for consultation, see: http://www.waterboards.ca.gov/waterboards_map.shtml. Provide the date you submitted your request for consultation here, then provide the following information.

Date of Request: 8/5/2014

Will your project, during construction or operation, (1) generate waste or wastewater containing such things as sewage, industrial chemicals, metals, or agricultural chemicals, or (2) cause erosion, turbidity or sedimentation? ○ Yes ◉ No

Will a waste discharge permit be required for the project? ○ Yes ◉ No

If necessary, provide additional information below:

Consultation was held with Matt St. John, the Executive Director, of the North Coast Regional Water Quality Control Board regarding the filing of this petition on August 5, 2014. Mr. St. John was amenable to Water Agency proposal to provide weekly summary reports of water quality data and to convene meeting if water quality issues develop to establish a response plan.

Insert the attachment number here, if applicable: [ ]

Local Permits

For temporary transfers only, you must contact the board of supervisors for the county(ies) both for where you currently store or use water and where you propose to transfer the water. (Wat. Code § 1726.) Provide the date you submitted your request for consultation here.

Date of Contact: [ ]

For change petitions only, you should contact your local planning or public works department and provide the information below.

Person Contacted: [ ] Date of Contact: [ ]

Department: [ ] Phone Number: [ ]

County Zoning Designation: [ ]

Are any county permits required for your project? If yes, indicate type below. ○ Yes ◉ No

☐ Grading Permit ☐ Use Permit ☐ Watercourse ☐ Obstruction Permit

☐ Change of Zoning ☐ General Plan Change ☐ Other (explain below)

If applicable, have you obtained any of the permits listed above? If yes, provide copies. ○ Yes ○ No

If necessary, provide additional information below:

Insert the attachment number here, if applicable: [ ]

Federal and State Permits

Check any additional agencies that may require permits or other approvals for your project:

- [ ] Regional Water Quality Control Board
- [ ] Department of Fish and Game
- [ ] Dept of Water Resources, Division of Safety of Dams
- [ ] California Coastal Commission
- [ ] State Reclamation Board
- [ ] U.S. Army Corps of Engineers
- [ ] U.S. Forest Service
- [ ] Bureau of Land Management
- [ ] Federal Energy Regulatory Commission
- [ ] Natural Resources Conservation Service

Have you obtained any of the permits listed above? If yes, provide copies. ○ Yes ◉ No

For each agency from which a permit is required, provide the following information:

Agency	Permit Type	Person(s) Contacted	Contact Date	Phone Number

If necessary, provide additional information below:

Consultations with NOAA National Marine Fisheries Service (Robert Cooey, Josh Fuller) and CA Department of Fish & Wildlife (Eric Larson) on filing of this petition occurred on July 10, 2014.

Insert the attachment number here, if applicable: [ ]

Construction or Grading Activity

Does the project involve any construction or grading-related activity that has significantly altered or would significantly alter the bed, bank or riparian habitat of any stream or lake? ○ Yes ◉ No

If necessary, provide additional information below:

Insert the attachment number here, if applicable: [ ]

Archeology

Has an archeological report been prepared for this project? If yes, provide a copy. ○ Yes ◉ No

Will another public agency be preparing an archeological report? ○ Yes ◉ No

Do you know of any archeological or historic sites in the area? If yes, explain below. ○ Yes ◉ No

If necessary, provide additional information below:

Insert the attachment number here, if applicable: ☐

Photographs

For all petitions other than time extensions, attach complete sets of color photographs, clearly dated and labeled, showing the vegetation that exists at the following three locations:

- ☑ Along the stream channel immediately downstream from each point of diversion
- ☑ Along the stream channel immediately upstream from each point of diversion
- ☑ At the place where water subject to this water right will be used

Maps

For all petitions other than time extensions, attach maps labeled in accordance with the regulations showing all applicable features, both present and proposed, including but not limited to: point of diversion, point of rediversion, distribution of storage reservoirs, point of discharge of treated wastewater, place of use, and location of instream flow dedication reach. (Cal. Code Regs., tit. 23, §§ 715 et seq., 794.)

Pursuant to California Code of Regulations, title 23, section 794, petitions for change submitted without maps may not be accepted.

All Water Right Holders Must Sign This Form:
I (we) hereby certify that the statements I (we) have furnished above and in the attachments are complete to the best of my (our) ability and that the facts, statements, and information presented are true and correct to the best of my (our) knowledge. Dated 8-13-14 at Santa Rosa, CA.

Water Right Holder or Authorized Agent Signature

Water Right Holder or Authorized Agent Signature

NOTE:

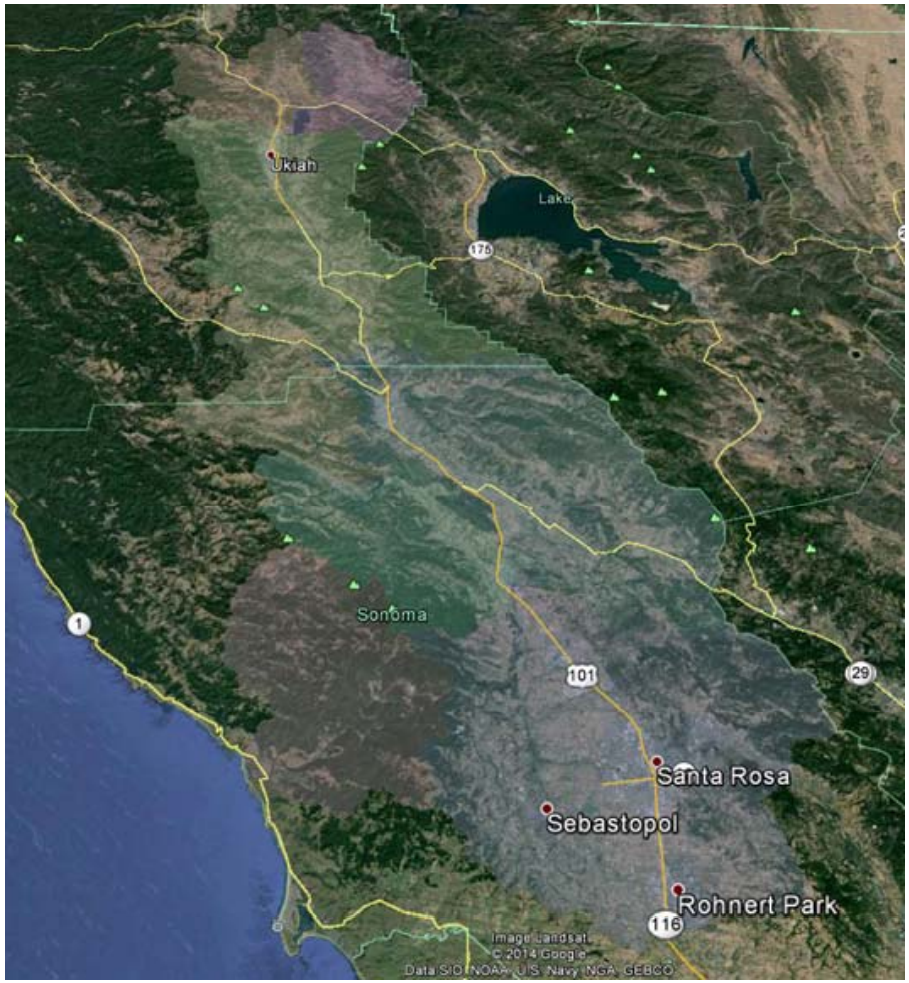
- **Petitions for Change may not be accepted unless you include proof that a copy of the petition was served on the Department of Fish and Game. (Cal. Code Regs., tit. 23, § 794.)**
- **Petitions for Temporary Transfer may not be accepted unless you include proof that a copy of the petition was served on the Department of Fish and Game and the board of supervisors for the county(ies) where you currently store or use water and the county(ies) where you propose to transfer the water. (Wat. Code § 1726.)**

Sonoma County Water Agency

Photographs in Vicinity of Main Diversion Facilities at Wohler and Mirabel Park

Russian River Between at Mirabel Park on July 25, 2014

Russian River Watershed



NOTICE OF EXEMPTION

To: X Office of Planning & Research
1400 Tenth Street
Sacramento, CA 95814

X County Clerk
County of Sonoma
Santa Rosa, CA 95401

X County Clerk
County of Mendocino
Ukiah, CA 95482

From: Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403

Project Title: Petition Requesting Approval of Temporary Urgency Changes in Water Right Permits 12947A,12949, 12950, and 16596 in Mendocino and Sonoma counties

Project Location-Specific: The proposed action would occur in Mendocino and Sonoma counties at Lake Mendocino and in the Upper Russian River from Coyote Valley Dam/Lake Mendocino to the confluence with Dry Creek, and in the Lower Russian River from the confluence with Dry Creek to the Pacific Ocean. Figure 1 shows the minimum instream flow requirements for the Russian River system. Communities and cities along the Russian River include Ukiah, Hopland, Cloverdale, Geyserville, Healdsburg, Forestville, Mirabel Park, Rio Nido, Guerneville, Monte Rio, Duncans Mills, and Jenner.

Project Location – City: N/A **Project Location – County:** Mendocino and Sonoma

Description of Nature, Purpose and Beneficiaries of Project: The Sonoma County Water Agency (Water Agency) controls and coordinates water supply releases from the Coyote Valley Dam and Warm Springs Dam projects in accordance with the provisions of water rights Decision 1610, which the State Water Resources Control Board (SWRCB) adopted on April 17, 1986. Decision 1610 specifies the minimum instream flow requirements for the Upper Russian River, Dry Creek and the Lower Russian River, which vary based on water supply conditions (Figure 1).

The Water Agency is filing a temporary urgency change petition requesting that the SWRCB make the following changes in the minimum instream flow requirements for the Russian River mainstem that are specified in Decision 1610 and the Water Agency's water right permits: (a) a minimum instream flow of 50 cubic feet per second (cfs) in the Upper Russian River from its confluence with the East Fork to its confluence with Dry Creek, and (b) a minimum instream flow of 60 cfs in the Lower Russian River downstream of its confluence with Dry Creek to the Pacific Ocean (Figure 2). These changes are 25 cfs reductions from the current *Dry* condition minimum instream flow requirements in the Upper and Lower Russian River under Decision 1610.

To allow the Water Agency to optimally manage flows in the Upper Russian River and Lower Russian River, the Water Agency is requesting that the TUCP minimum instream flow requirements be specified as 5-day running averages of the specified minimum average daily stream flows, with the conditions that instantaneous flows in the Upper Russian River are never less than 40 cfs and instantaneous flows in the Lower Russian River are never less than 50 cfs. This implementation of minimum instream flow requirements will allow the Water Agency to manage stream flows with a smaller operational buffer, thereby conserving water supply in Lake Mendocino. This will result in higher storage levels in the fall and early winter for increased releases for the migration and spawning of Chinook salmon and improving carryover storage for the following year.

Water supplies sufficient to support survival of listed Russian River salmonid fisheries, agricultural and municipal use, and recreation are at risk. Without the proposed changes, the Water Agency would be required to continue to release additional stored water from Lake Mendocino to meet Decision 1610 *Dry* condition minimum instream flow requirements, which would result in the significant depletion and potential elimination of water supplies in Lake Mendocino for water users in Mendocino County and northern Sonoma County (above the confluence with Dry Creek), which would cause serious impacts to human health and welfare, and which would reduce the water supplies needed for fishery protection and stable flows in the Upper Russian River during the fall when spawning state and federally listed fish species are sensitive to flow levels and water temperatures. Furthermore, if the upcoming Water Year 2015 is another dry year, carryover storage in Lake Mendocino will be crucial for the continued recovery of the Russian River salmonid fishery and for water supply reliability during 2015.

Water Agency staff estimate that the existing 75 cfs minimum flow in the Upper Russian River will result in a storage level of approximately 20,000 acre-feet in Lake Mendocino on November 1 if no significant storm events occur. Reducing Upper Russian River minimum flows from 75 cfs to 50 cfs would increase the estimated storage to approximately 24,000 acre-feet.

With the proposed changes in the Upper Russian River minimum flow requirements, the Water Agency would violate the Incidental Take Statement contained in the National Marine Fisheries Service's *Biological Opinion for Water Supply, Flood Control Operations and Channel Maintenance Conducted by U.S. Army Corps of Engineers, the Sonoma County Water Agency and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River Watershed* (Russian River Biological Opinion), at pages 297-299 (September 24, 2008), unless a corresponding reduction is made in the minimum flow requirements for the Lower Russian River. This is because, if there are lower flows in the Upper Russian River and no corresponding reductions in the minimum flow requirements for the Lower Russian River, then higher flows on Dry Creek would be required to meet the Decision 1610 minimum instream flow requirements for the Lower Russian River. To minimize the need for these high Dry Creek flows, the Water Agency is requesting, as a part of the temporary urgency change petition, that the required minimum instream flows for the Lower Russian River be reduced by the same amount (25 cfs) as the requested reduction in the Upper Russian River minimum flow requirements.

Name of Public Agency Approving Project: State Water Resources Control Board - Division of Water Rights

Name of Person or Agency Carrying Out Project: Sonoma County Water Agency

Exempt Status: (check one)

	Ministerial (Sec. 21080(b)(1); 15268)	
	Declared Emergency (Sec. 21080(b)(3); 15269(a))	
X	Emergency Project (Sec.21080 (b)(4); 15269(b)(c)):	Section 21080(b)(4): Specific actions necessary to prevent or mitigate an emergency
X	Categorical Exemption. State type and section number:	State CEQA Guidelines 15307: Actions by Regulatory Agencies for Protection of Natural Resources State CEQA Guidelines 15308: Actions by Regulatory Agencies for Protection of the Environment State CEQA Guidelines 15301(i): Existing Facilities
	Statutory Exemptions. State code number:	

Reasons why project is exempt: The proposed action is statutorily exempt under California Environmental Quality Act (CEQA) Statute 21080(b)(4) and categorically exempt from CEQA under the State CEQA Guidelines Sections 15307, 15308, and 15301(i).

A. Actions to Prevent or Mitigate an Emergency
California Public Resources Code, Division 13, Section 21080(b)(4) provides that specific actions necessary to prevent or mitigate an emergency are exempt from CEQA. The emergency conditions are demonstrated by current Lake Mendocino storage levels. As of August 12, 2014, the water supply storage level in Lake Mendocino was approximately 36,052 acre-feet. This storage level is 32 percent of the summer water supply pool. The current low storage level is the result of a severe drought that began in the region in January 2013. These emergency conditions also are demonstrated by Governor Brown's January 17, 2014, Proclamation of a State of Emergency and his April 25, 2014, Proclamation of a Continued State of Emergency.

Water Agency staff estimate that the existing 75 cfs minimum instream flow requirement for the Upper Russian River will result in a storage level of approximately 20,000 acre-feet in Lake Mendocino on November 1, if it remains in effect and no significant storm events occur before that date. Reducing the Upper Russian River minimum instream flow requirement from 75 cfs to 50 cfs would increase the estimated November 1 storage to approximately 24,000 acre-feet. Without the proposed changes, the Water Agency would be required to continue to release additional stored water from Lake Mendocino to meet Decision 1610 *Dry* condition minimum instream flow requirements, which would result in the significant depletion of water supplies for water users in Mendocino County and northern Sonoma County (above the confluence with Dry Creek), which would cause serious impacts to human health and welfare, and which would reduce the water supplies needed for fishery protection and stable flows in the Upper Russian River during the fall when spawning state and federally listed fish species are sensitive to flow levels and water temperatures. Furthermore, if the upcoming Water Year 2015 is another dry year, carryover storage in Lake Mendocino will be crucial for the continued recovery of the Russian River salmonid fishery and for water supply reliability during 2015.

B. Actions by Regulatory Agencies for Protection of Natural Resources and the Environment
CEQA Guidelines Sections 15307 and 15308 provide that actions taken by regulatory agencies to assure the maintenance, restoration or enhancement of a natural resource and the environment are categorically exempt. The proposed temporary urgency change to the Water Agency's water right Permits 12947A,12949, 12950, and 16596 would conserve water in Lake Mendocino to support beneficial uses downstream of Lake Mendocino, including habitat for listed Russian River salmonid fisheries, agricultural and municipal use, and recreation. The Russian River Biological Opinion found that high flows in Dry Creek (above 90 cfs) were harmful to listed salmon, and limited the extent to which the Water Agency could make releases from Lake Sonoma from July through October. Approval of the proposed temporary urgency change in the Lower Russian River is requested in order to avoid violation of the Incidental Take Statement contained in the Russian River Biological Opinion due to higher releases that would be required for Dry Creek to meet Decision 1610 minimum flow requirements in the Lower Russian River, if the Upper Russian River flows are reduced and the Lower Russian River minimum flow requirements are not reduced.

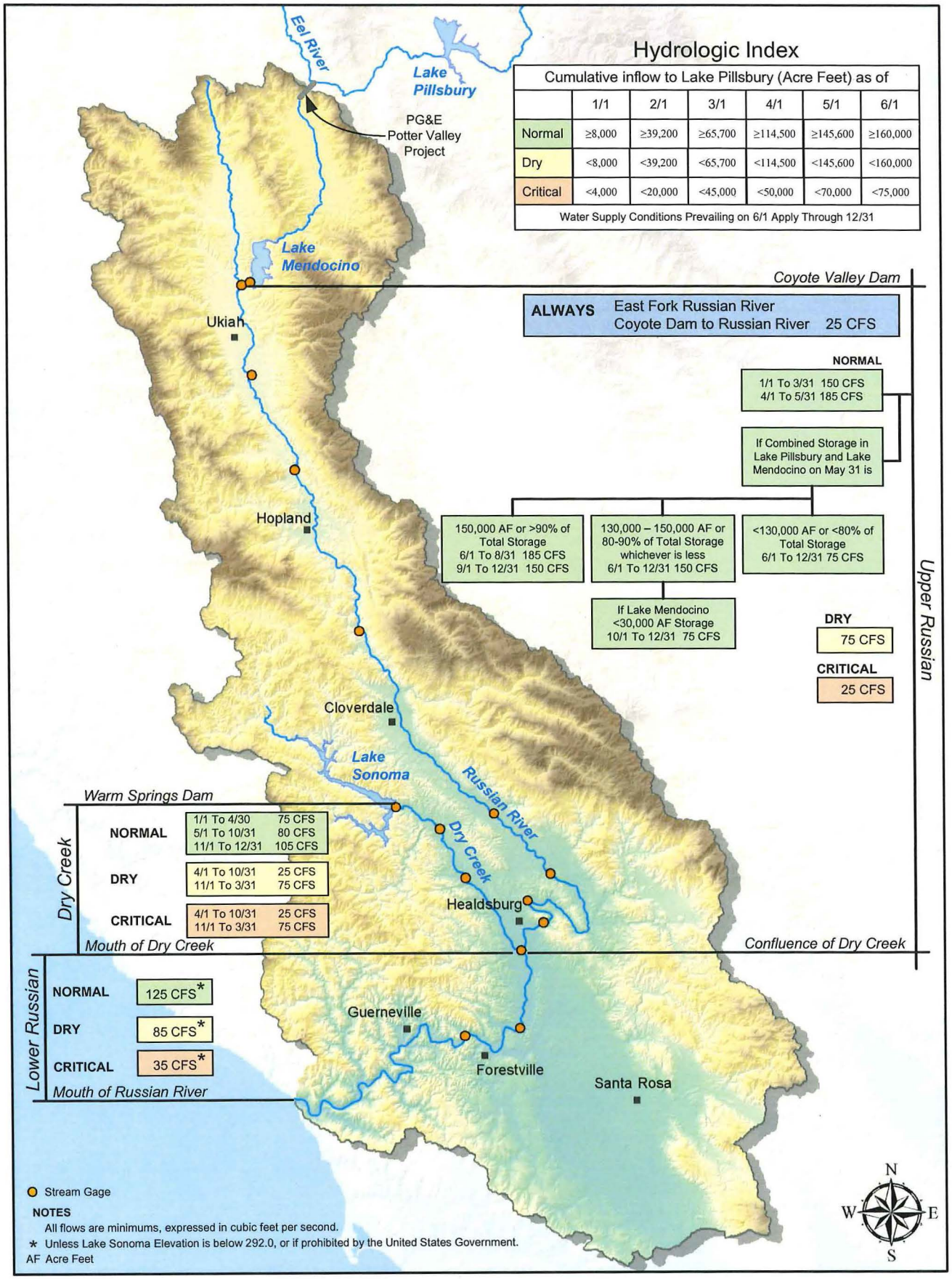
C. Existing Facilities
CEQA Guidelines Section 15301(i) provides, generally, that the operation of existing facilities involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination is categorically exempt from CEQA. The examples in subdivision (i) of Section 15301(i) specifically provide that the maintenance of streamflows to protect fish and wildlife resources is exempt. The Water Agency's request to change minimum instream flows would not expand the Water Agency's use or increase the water diversions available to the Water Agency for consumptive purposes. The proposed changes in minimum instream flows would still be within the existing minimum instream flows established by Decision 1610.

Lead Agency Contact Person: Jessica Martini-Lamb Area Code/Telephone: (707) 547-1903

Signature: _____ Date: 08/13/2014 Title: General Manager

X Lead Agency ___ Applicant Date Received for filing at OPR: _____

State Water Resources Control Board Decision 1610



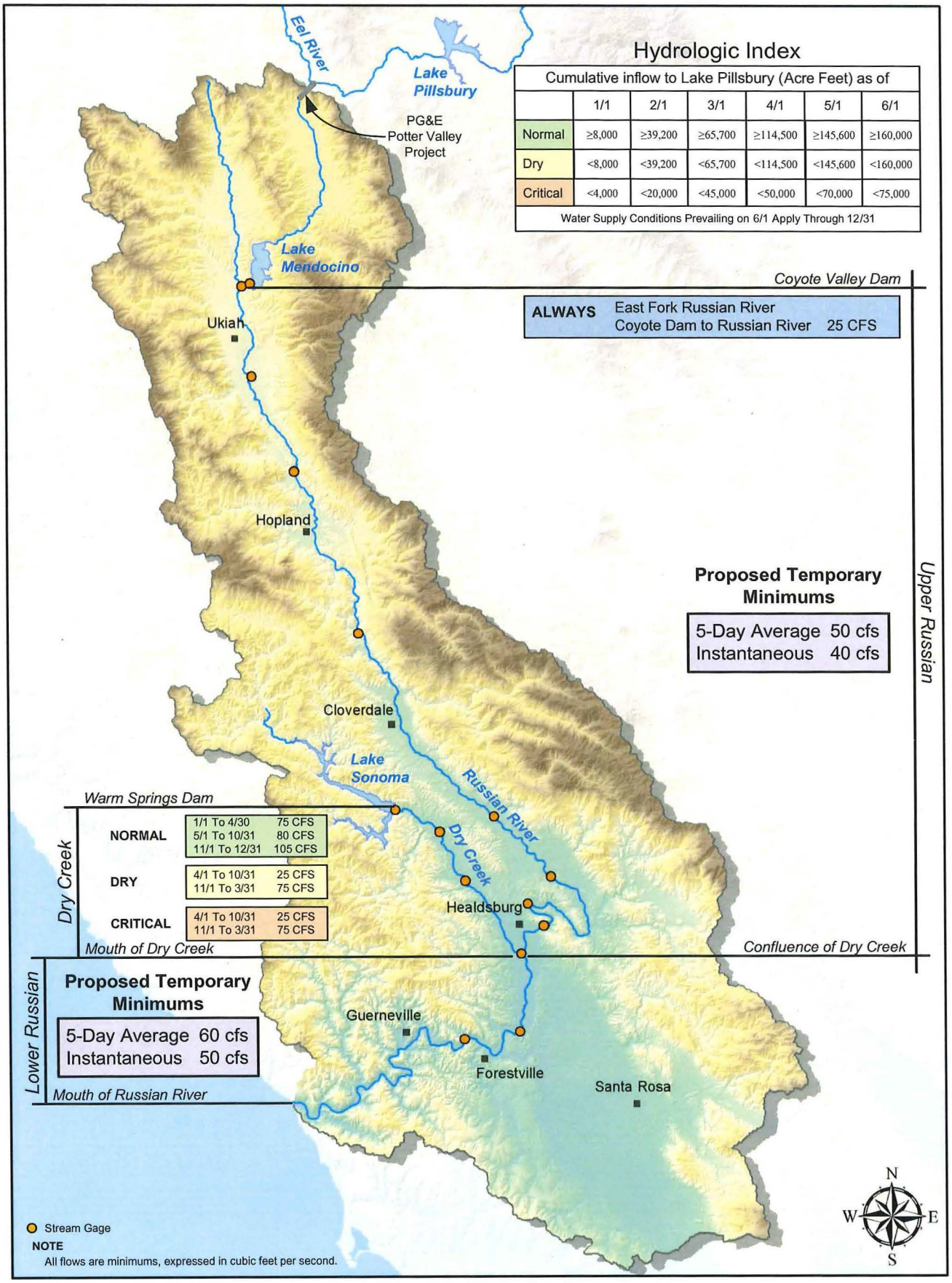
Hydrologic Index

Cumulative inflow to Lake Pillsbury (Acre Feet) as of	1/1	2/1	3/1	4/1	5/1	6/1
Normal	≥8,000	≥39,200	≥65,700	≥114,500	≥145,600	≥160,000
Dry	<8,000	<39,200	<65,700	<114,500	<145,600	<160,000
Critical	<4,000	<20,000	<45,000	<50,000	<70,000	<75,000

Water Supply Conditions Prevailing on 6/1 Apply Through 12/31

Russian River Basin
Minimum Instream Flow Requirements

August 2014 Temporary Urgency Change Petition



Hydrologic Index

Cumulative inflow to Lake Pillsbury (Acre Feet) as of						
	1/1	2/1	3/1	4/1	5/1	6/1
Normal	≥8,000	≥39,200	≥65,700	≥114,500	≥145,600	≥160,000
Dry	<8,000	<39,200	<65,700	<114,500	<145,600	<160,000
Critical	<4,000	<20,000	<45,000	<50,000	<70,000	<75,000
Water Supply Conditions Prevailing on 6/1 Apply Through 12/31						

ALWAYS East Fork Russian River
Coyote Dam to Russian River 25 CFS

Proposed Temporary Minimums

5-Day Average 50 cfs
Instantaneous 40 cfs

NORMAL	1/1 To 4/30	75 CFS
	5/1 To 10/31	80 CFS
	11/1 To 12/31	105 CFS
DRY	4/1 To 10/31	25 CFS
	11/1 To 3/31	75 CFS
CRITICAL	4/1 To 10/31	25 CFS
	11/1 To 3/31	75 CFS

Proposed Temporary Minimums

5-Day Average 60 cfs
Instantaneous 50 cfs

NOTE
All flows are minimums, expressed in cubic feet per second.

Russian River Basin

Proposed Minimum Instream Flow Requirements

August 15, 2014 to February 10, 2015

APPENDIX A-3

SWRCB Approval of 2014 TUCP

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CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

AUG 25 2014

In Reply Refer to:
EKH: A012919A et al.

Mr. Grant Davis
General Manager
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403-9019

Dear Mr. Davis:

ORDER APPROVING SONOMA COUNTY WATER AGENCY'S PETITION FOR TEMPORARY URGENCY CHANGE OF PERMITS 12947A, 12949, 12950, AND 16596 (APPLICATIONS 12919A, 15736, 15737, 19351)

The enclosed Order approves the petition for temporary urgency change in the subject permits. Please review the conditions of the Order and retain the Order with your permit.

If you have any questions, please contact Emily Hyland at (916) 341-5803 or by email at Emily.Hyland@waterboards.ca.gov. Written correspondence should be addressed as follows: State Water Resources Control Board, Division of Water Rights, Attn: Emily Hyland, P.O. Box 2000, Sacramento, CA 95812-2000.

Sincerely,

[redacted]

Amanda Montgomery, Manager
Permitting and Licensing Section
Division of Water Rights

Enclosure

cc: See next page.

AUG 2 5 2014

cc w/ enclosure:

North Coast Regional Water Quality Control Board
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403

National Marine Fisheries Service
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, CA 95404

California Department of Fish and Wildlife
Region 3: Bay Delta Region
7329 Silverado Trail
Napa, CA 94558

United States Geological Survey
California Water Science Center
6000 J Street, Placer Hall
Sacramento, CA 95819

ec w/ enclosure:

Mr. Don Seymour
Donald.Seymour@scwa.ca.gov

Ms. Pam Jeane
Pam.Jeane@scwa.ca.gov

Mr. Todd Schram
Todd.Schram@scwa.ca.gov

STATE OF CALIFORNIA
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
STATE WATER RESOURCES CONTROL BOARD

DIVISION OF WATER RIGHTS

In the Matter of Permits 12947A, 12949, 12950, and 16596
(Applications 12919A, 15736, 15737, 19351)

Sonoma County Water Agency

ORDER APPROVING TEMPORARY URGENCY CHANGE

SOURCE: Dry Creek and Russian River

COUNTIES: Sonoma and Mendocino Counties

BY THE DEPUTY DIRECTOR FOR WATER RIGHTS:

1.0 SUBSTANCE OF TEMPORARY URGENCY CHANGE PETITION

On August 14, 2014, Sonoma County Water Agency (SCWA) filed a Temporary Urgency Change Petition (TUCP) with the State Water Resources Control Board (State Water Board), Division of Water Rights (Division) requesting approval of a change to the subject permits pursuant to California Water Code section 1435. The TUCP requests the following temporary reductions to the Russian River instream flow requirements to address low storage conditions in Lake Mendocino:

(1) From August 15, 2014 through February 10, 2015, reduce instream flow requirements for the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) from 75 cubic feet per second (cfs) to 50 cfs.

(2) From August 15, 2014 through February 10, 2015, reduce instream flow requirements for the lower Russian River (downstream of its confluence with Dry Creek) from 85 cfs to 60 cfs.

The TUCP requests that compliance with these minimum instream flow requirements be measured based on a 5-day running average of average daily stream flow measurements, provided that instantaneous flows on the upper Russian River shall be no less than 40 cfs and on the lower Russian River shall be no less than 50 cfs. These 5-day running average provisions will allow SCWA to reduce the operational buffers needed to manage these stream flows, thereby allowing the SCWA to conserve more water in Lake Mendocino.

No changes to the instream flow requirements for Dry Creek are requested.

The request for the upper Russian River is intended to prevent significant depletion of storage in Lake Mendocino and potential elimination of water supplies for 2015. Such depletion in storage and reduction to or elimination of water supplies would cause serious impacts to human health and welfare and reduce water supplies needed for fishery protection and stable flows in the upper Russian River. The request for the lower Russian River is intended to protect fishery resources in Dry Creek.

2.0 BACKGROUND

2.1 Water Right Permits

SCWA's TUCP involves the following permits:

- Permit 12947A for direct diversion of 92 cubic feet per second (cfs) from the East Fork Russian River and storage of 122,500 acre-feet per annum (afa) in Lake Mendocino from January 1 through December 31 of each year.

- Permit 12949 for year-round direct diversion of 20 cfs from the Russian River at the Wohler and Mirabel Park Intakes near Forestville.

- Permit 12950 for direct diversion of 60 cfs from the Russian River at the Wohler and Mirabel Park Intakes from April 1 through September 30 of each year.

- Permit 16596 for year-round direct diversion of 180 cfs from the Russian River and storage of 245,000 afa in Lake Sonoma from October 1 of each year to May 1 of the succeeding year.

Term 20 of SCWA's Permit 12947A requires SCWA to pass through or release from storage at Lake Mendocino sufficient water to maintain specified instream flows for the protection of fish and wildlife, and for the maintenance of recreation in the Russian River. The flows vary depending on river reach and water supply conditions. The current minimum instream flow requirements are for dry water supply conditions. The requirements are 75 cfs for the upper Russian River (between the confluence of the East and West Forks of the Russian River and the confluence of the Russian River and Dry Creek) and 85 cfs for the lower Russian River (between its confluence with Dry Creek and the Pacific Ocean).

Term 17 of both Permit 12949 and Permit 12950 requires SCWA to allow sufficient water to bypass the points of diversion at the Wohler and Mirabel Park Intakes on the Russian River to maintain 85 cfs to the Pacific Ocean during dry water supply conditions.

Similarly, Term 13 of Permit 16596 requires SCWA to maintain 85 cfs in the lower Russian River during dry water supply conditions, unless the water level in Lake Sonoma is below elevation 292.0 feet with reference to the National Geodetic Vertical Datum of 1929, or unless prohibited by the United States Government. Permits 12947A, 12949, 12950, and 16596 use the same water-year classification definitions. The water year classifications (Normal, Dry or Critically Dry) were established in Decision 1610 and are based on cumulative inflow into Lake Pillsbury beginning October 1. Although Lake Mendocino storage is critically low, cumulative inflow into Lake Pillsbury during this water year has been of a sufficient volume such that under Decision 1610, 2014 is currently classified as a Dry year.

2.2 Information Concerning the Temporary Urgency Change Petition

A Supplement to the TUCP indicates that on August 12, 2014, the water supply storage level in Lake Mendocino was 36,052 acre-feet. This storage level was 32 percent of the available summer water supply pool. Since its completion in 1958, this is the lowest level in Lake Mendocino on this date, except for August 12, 1977, when reservoir storage was 21,982 acre-feet. The low storage level is the result of a severe drought that began in the region in January 2013.

According to the Supplement, using 2013 hydrology, Lake Mendocino storage is expected to decline to approximately 20,000 acre-feet by November 1, 2014, due to releases required to meet downstream water demands and minimum instream flow requirements on the Russian River. If dry conditions continue, storage levels could be as low as 14,000 acre-feet on January 1, 2015. The projected storage analysis was completed using SCWA's Russian River Water System Model with the following assumptions: (1) the current upper Russian River minimum instream flow requirement of 75 cfs; (2) 2013 hydrology; (3) 2013 upper

Russian River observed reach losses; and (4) Potter Valley Project operations based on the 2004 amended license issued by the Federal Energy Regulatory Commission. These extremely low projected storage levels and possible elimination of water supply in Lake Mendocino could cause serious impacts to human health and welfare, threatened Russian River fish species, and water-supply in Mendocino County and the Alexander Valley in Sonoma County, as well as harm Lake Mendocino and Russian River recreation. Therefore, SCWA proposes to reduce the instream flow requirements on the upper Russian River, which are maintained by reservoir releases, to preserve water in Lake Mendocino.

As of August 12, 2014, the water supply storage level in Lake Sonoma was 159,781 acre-feet. This storage level is 65 percent of the available water conservation pool. This storage level is the lowest seen since March 1991. However, the much larger water supply pool of Lake Sonoma provides multiple years of carry over storage. Consequently, SCWA has not requested any changes to the current minimum instream flow requirements for Dry Creek at this time.

SCWA is requesting changes to the minimum instream flow requirements on the lower Russian River, downstream of its confluence with Dry Creek to the Pacific Ocean. These changes are requested because the reduced minimum instream flows being requested on the upper Russian River will provide significantly less contribution to meet minimum instream flow requirements in the lower Russian River. Consequently, increased releases from Lake Sonoma into Dry Creek could be necessary to maintain Decision 1610 minimum instream flow requirements on the lower Russian River. However, increased releases into Dry Creek are limited by the Incidental Take Statement contained in the September 24, 2008, National Marine Fisheries Service (NMFS) Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, SCWA, and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River watershed (Biological Opinion). The Incidental Take Statement restricts releases from Lake Sonoma into Dry Creek because they can result in flows that are too high for optimal habitat for juvenile salmonids. Therefore, SCWA proposes to reduce the minimum instream flow requirements for the lower Russian River to protect fishery resources in Dry Creek.

3.0 COMPLIANCE WITH CALIFORNIA ENVIRONMENTAL QUALITY ACT

Ordinarily, the State Water Board must comply with any applicable requirements of the California Environmental Quality Act (CEQA) prior to issuance of any order approving a TUCP pursuant to Water Code section 1435. (See Cal. Code Regs., tit. 23, § 805.) However, on January 17, 2014 Governor Edmund G. Brown, Jr. declared a State of Emergency, due to drought conditions, which concluded that strict compliance with CEQA would "prevent, hinder, or delay the mitigation of the effects of the emergency." Accordingly, as authorized by Government Code section 8571, item 9 of the Governor's Proclamation suspends CEQA, and the regulations adopted pursuant to it, to the extent that CEQA would otherwise apply to specified actions necessary to mitigate the effects of the drought, including the actions described in item 8 of the Governor's Proclamation. Item 8 requires the State Water Board to consider modifying requirements for reservoir releases or diversion limitations that were established to implement a water quality control plan. The subject instream flow requirements implement the Water Quality Control Plan for the North Coast Region because they protect instream beneficial uses that are designated in the plan, including recreation, cold and warm freshwater habitat, and wildlife habitat. Accordingly, CEQA is suspended to the extent that it would otherwise apply to the TUCP and subsequent modifications thereto.

In addition, the changes requested in the TUCP are consistent with the following Statutory and Categorical CEQA exemptions for the following reasons:

1) As of August 12, 2014, the water supply storage level in Lake Mendocino was 32 percent of the available summer water supply pool. Information provided by SCWA demonstrates that continued releases of water pursuant to permit term requirements could cause storage levels in Lake Mendocino to decline to unsafe levels. If storage in Lake Mendocino is depleted there will be serious impacts to human health and welfare and water will not be available to protect aquatic life, including

threatened and endangered species in the Russian River. Approval of the TUCP is therefore necessary to prevent and mitigate loss of, or damage to, the environment, fishery resources, property, public health, and essential public services. Accordingly, the project is statutorily exempt from CEQA because it is necessary to prevent or mitigate an emergency. (Pub. Resources Code, § 21080, subd. (b)(4); Cal. Code Regs., tit. 14, § 15269, subd. (c).)

2) The proposed action consists of the operation of existing facilities involving negligible or no expansion of use beyond that existing, and accordingly is categorically exempt from CEQA under a Class 1 exemption. (Cal. Code Regs., tit. 14, § 15301.) The proposed action will be within the range of minimum instream flows established by Decision 1610. The proposed action does not request and will not expand the water supply available to SCWA for consumptive purposes.

3) A Class 7 exemption "consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment." (Cal. Code Regs, tit. 14, § 15307.) The proposed action on the upper Russian River will assure the maintenance of a natural resource, i.e., the instream resources of the Russian River, by reserving water in Lake Mendocino to prevent harm to, and protect habitat for listed Russian River salmonid fisheries. The proposed action on the lower Russian River will also assure the maintenance of a natural resource, i.e, the instream resources of Dry Creek, by avoiding impacts to salmonids consistent with the Incidental Take Statement. Accordingly, these changes are categorically exempt from CEQA pursuant to a Class 7 exemption.

4) A Class 8 exemption "consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment." (Cal. Code Regs., tit. 14, § 15308.) The proposed action will assure the maintenance of the environment, i.e., the instream environment of the Russian River, in the same way as stated for the Class 7 exemption.

4.0 PROCEDURAL REQUIREMENTS CONCERNING THE TEMPORARY URGENCY CHANGE PETITION

Pursuant to Water Code section 1438, the State Water Board may issue a temporary urgency change order in advance of the required notice. The State Water Board will issue and deliver to SCWA as soon as practicable, a notice of the temporary urgency change order pursuant to Water Code section 1438, subdivision (a). Pursuant to Water Code section 1438, subdivision (b)(1), SCWA is required to publish the notice in a newspaper having a general circulation, and that is published within the counties where the points of diversion lie. In addition, the State Water Board will post the notice of the temporary urgency change order on its website, along with the TUCP (and accompanying materials). The State Water Board also will distribute the notice through an electronic notification system.

Any interested person may file an objection to a temporary urgency change. (*Id.*, subd. (d).) The State Water Board must promptly consider and may hold a hearing on any objection. (*Id.*, subd. (e).) State Water Board Resolution 2012-0029 delegates to the Deputy Director for Water Rights the authority to act on a temporary urgency change petition if there are no objections to the petition. (Resolution 2012-0029, ¶ 4.4.1.)

The State Water Board exercises continuing supervision over temporary urgency change orders and may modify or revoke temporary urgency change orders at any time. (Wat. Code, §§ 1439, 1440.) Temporary urgency change orders expire automatically 180 days after issuance, unless they are revoked or an earlier expiration date is specified. (*Id.*, § 1440.)

5.0 CRITERIA FOR APPROVING THE PROPOSED TEMPORARY URGENCY CHANGE

Water Code section 1435 provides that a permittee or licensee who has an urgent need to change the point of diversion, place of use, or purpose of use from that specified in the permit or license may petition for a conditional temporary change order. The State Water Board's regulations set forth the filing and other procedural requirements applicable to TUCP's. (Cal. Code Regs., tit. 23, §§ 805, 806.) The State Water Board's regulations also clarify that requests for changes to permits or licenses other than changes in point of diversion, place of use, or purpose of use may be filed, subject to the same filing and procedural requirements that apply to changes in point of diversion, place of use, or purpose of use. (*Id.*, § 791, subd. (e).)

Before approving a temporary urgency change, the State Water Board must make the following findings:

1. the permittee or licensee has an urgent need to make the proposed change;
2. the proposed change may be made without injury to any other lawful user of water;
3. the proposed change may be made without unreasonable effect upon fish, wildlife, or other instream beneficial uses; and
4. the proposed change is in the public interest.

(Wat. Code, § 1435, subd. (b)(1-4).)

5.1 Urgency of the Proposed Change

Under Water Code section 1435, subdivision (c), an "urgent need" means "the existence of circumstances from which the board may in its judgment conclude that the proposed temporary change is necessary to further the constitutional policy that the water resources of the state be put to beneficial use to the fullest extent of which they are capable and that waste of water be prevented . . . ."

In this case, an urgent need exists for the proposed change in minimum instream flow requirements on the upper Russian River because, as described in the Supplement to the TUCP, Lake Mendocino reservoir levels are projected to reach extremely low conditions that may prevent SCWA from continuing to make the reservoir releases that are necessary to support the various beneficial uses that rely on these releases in the Russian River. If upcoming dry conditions persist and significant storm events are delayed or do not occur in Water Year 2015, then carryover storage in Lake Mendocino will be crucial for the continued protection of the Russian River salmonid fishery and water supply reliability. Specifically, at a storage level below 20,000 acre-feet, there would be greater risks that there would be insufficient water supplies to support: (a) survival of ESA-listed Russian River salmonid species, (b) agricultural and municipal uses that depend on the Russian River, and (c) river-based recreation. Without the proposed changes, the current minimum instream flow requirements would require releases of water from Lake Mendocino at levels that would risk significant depletion of storage and potential elimination of water supplies for water uses in Mendocino County and northern Sonoma County (above the confluence with Dry Creek). Such depletion in storage and reduction in or elimination of water supplies would cause serious impacts to human health and welfare, and reduce water supplies needed for fishery protection and stable flows in the upper Russian River.

An urgent need also exists for the proposed change in minimum instream flow requirements on the lower Russian River because reductions in the upper Russian River flows could require an increase in Lake Sonoma releases into Dry Creek to meet lower Russian River flow requirements. The 2008 NMFS Biological Opinion found that high Dry Creek flows from June through October result in sub-optimal habitat conditions for juvenile salmonids and issued an Incidental Take Statement restricting releases from Lake Sonoma to Dry Creek from June through October each year. Therefore, higher Dry Creek flows could be detrimental to the fisheries in Dry Creek and result in violations of the Incidental Take Statement. In addition, reductions in the lower Russian River minimum instream flow requirements will conserve storage in Lake Sonoma during drought conditions. Considering the severe drought conditions and the Governor's Emergency Drought Proclamation, conservation of water in Lake Sonoma is prudent.

5.2 No Injury to Any Other Lawful User of Water

Under this Order, SCWA will be required to maintain specific flows in the Russian River from its most upstream point of diversion to the river's confluence with the ocean. Therefore, because these minimum flows will be present, it is anticipated that all other lawful users of water will still be able to divert and use any water to which they may be legally entitled during the period specified in this Order. Accordingly, granting this TUCP will not result in any injury to any other lawful user of water. Pursuant to Water Code section 1439, the State Water Board will supervise diversion and use of water under this temporary change order for the protection of all other lawful users of water and instream beneficial uses.

5.3 No Unreasonable Effect upon Fish, Wildlife, or Other Instream Beneficial Uses

Although flows in the mainstem Russian River will be reduced upon approval of this TUCP, prevention of the depletion of storage in Lake Mendocino is crucial for instream beneficial uses, including threatened and endangered fish species. Reductions in the minimum instream flow requirements will improve carryover storage in Lake Mendocino, which will provide significant benefit to all instream beneficial uses if dry conditions persist into Water Year 2015. Specifically, conserved storage will allow enhanced management of Russian River flows in the fall, winter and next spring for the benefit of salmon migration, spawning, and rearing. It is possible that the reduced flows may impair some instream beneficial uses, principally recreation, in the Russian River. However, any effects associated with such flow reductions would not be unreasonable, considering the potential catastrophic impacts to fish, wildlife and other instream beneficial uses that could occur with the current release levels, if the current release levels result in the draining of Lake Mendocino and the dewatering of the upper Russian River

SCWA has consulted with the California Department of Fish and Wildlife (CDFW), NMFS, and the Regional Water Quality Control Board (Regional Board) regarding filing the TUCP and the effects of the proposed changes. All three agencies support the changes requested in the TUCP. The Regional Board has requested continuous water quality monitoring on the mainstem Russian River and at the Russian River Estuary and associated reporting, which will be required. CDFW and NMFS concurred that the proposed flow reductions are prudent measures to protect aquatic resources, such as Chinook, steelhead, and coho migration and spawning, as well as salmon egg incubation. CDFW and NMFS recognize that flow reductions will support conservation of Lake Mendocino's water supply and avoid dewatering of the upper Russian River. In light of the potential for the effective period of this Order to continue into migration seasons for threatened and endangered anadromous fish species, CDFW and NMFS have requested continuation of ongoing consultation and reporting efforts with SCWA to determine monitoring efforts and appropriate flows for fish passage. CDFW and NMFS also requested an additional pulse flow release requirement. However, current data regarding timing and need for a pulse flow is limited at this time. Furthermore, it is unclear whether a pulse flow is necessary to mitigate for the impacts of the changes sought by SCWA's TUCP. This Order may not be an appropriate vehicle to require SCWA to implement a pulse flow, but these issues should be discussed in the consultations with CDFW and NMFS. This order includes requirements for consultation on: 1) flow increases after November 1 to support successful migration and spawning of Chinook, steelhead, and coho salmon and 2) the need for and appropriate methodology for monitoring salmonid species and other native fish species in the Russian River. This Order also includes a term limiting ramping rates below Lake Mendocino to avoid fish stranding.

To inform the review and approval of the TUCP and the State Water Board's continuing supervision of the diversion and use of water under this temporary change order pursuant to Water Code section 1439, this Order requires SCWA to report on consultations with CDFW, NMFS, and the Regional Board. In addition, to ensure beneficial use of water resources to the fullest extent possible and to prevent waste of water, SCWA is required to provide a weekly update to the Deputy Director, CDFW, NMFS, and the Regional Board regarding the current hydrologic and environmental conditions of the Russian River (Term 11). This information will assist the State Water Board in determining whether additional actions are necessary.

5.4 The Proposed Change is in the Public Interest

The proposed changes in the upper Russian River minimum instream flow requirements will help conserve stored water in Lake Mendocino so that, in the event drought conditions persist, water can be released to maintain instream flows for the benefit and protection of all uses of Russian River water, including the salmonid fisheries in the Russian River. It is in the public interest to preserve these water supplies for these beneficial uses under present severe drought hydrologic conditions.

The proposed changes in the lower Russian River minimum instream flow requirements will support ecological values in Dry Creek by preventing higher Dry Creek flows that could be necessary if the State Water Board were to approve only the requested changes in the upper Russian River requirements. As discussed above, such higher Dry Creek flows would impair habitat conditions for juvenile salmonids and deplete storage in Lake Sonoma. It is in the public interest to minimize impacts to salmonids and conserve water supplies in Lake Sonoma during drought conditions. Reductions in diversions at SCWA's facilities can also serve to increase flows in the lower Russian River and prevent the need for higher Dry Creek flows. Accordingly, inclusion of a term requiring SCWA and its contractors to conserve water is in the public interest. Pursuant to Term 17, SCWA will be required to implement a Water Demand Reduction Plan to reduce water demand by a minimum of 20 percent relative to baseline (pre-drought) water demand. In addition, SCWA will continue to implement water use efficiency programs that align with the California Urban Water Conservation Council's Best Management Practices (BMPs) and comply with SBx7-7.

To further ensure preservation of Lake Mendocino water supplies in the public interest, SCWA has coordinated the filing of this TUCP with the filing of a separate TUCP by the Mendocino Russian River Flood Control and Water Conservation Improvement District (District). The District's TUCP requested the temporary incorporation of demand management terms into the District's permit (Permit 12947B), which authorizes storage in Lake Mendocino for use within Mendocino County. According to the Supplement to SCWA's TUCP, the District's TUCP should result in reduced diversions in the upper Russian River, which will further improve storage in Lake Mendocino and allow SCWA to manage Russian River flows more efficiently.

6.0 CONCLUSIONS

The State Water Board has adequate information in its files to make the evaluation required by Water Code section 1435.

I conclude that, based on the available evidence:

1. The permittee has an urgent need to make the proposed change;

2. The petitioned change will not operate to the injury of any other lawful user of water;

3. The petitioned change will not have an unreasonable effect upon fish, wildlife, or other instream beneficial uses; and,

4. The petitioned change, with the modifications described above, is in the public interest.

ORDER

NOW, THEREFORE, IT IS ORDERED THAT: the Petition filed by Sonoma County Water Agency (SCWA) for a temporary urgency change in Permits 12947A, 12949, 12950 and 16596 is approved and effective until 180 days from the date of this Order or Lake Mendocino storage reaches the top of the water supply pool (68,400 acre-feet), whichever is earlier.

All existing terms and conditions of the subject permit remain in effect, except as temporarily amended by the following provision:

1. The minimum instream flow requirements in the Russian River, as specified in Term 20 of Permit 12947A, Term 17 of Permits 12949 and 12950, and Term 13 of Permit 16596, shall be modified as follows:

    a. Minimum instream flow in the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) shall remain at or above 50 cubic feet per second (cfs).
    b. Minimum instream flow in the lower Russian River (from its confluence with Dry Creek to the Pacific Ocean) shall remain at or above 60 cubic feet per second (cfs).
    c. For purposes of compliance with this term, the minimum instream flow requirements shall be measured based on a 5-day running average of average daily stream flow measurements, provided that instantaneous flows on the upper Russian River shall be no less than 40 cfs and on the lower Russian River shall be no less than 50 cfs.

2. Beginning November 1 SCWA shall consult with the National Marine Fisheries Service (NMFS) and the California Department of Fish and Wildlife (CDFW) regarding increasing controlled instream flow, to allow successful migration and spawning of Chinook, steelhead, and coho, at the USGS gages at both Hopland (No.11462500) and Healdsburg (No. 11464000) to a level not to exceed 100 cfs and at the USGS Hacienda gage to a level not to exceed 135 cfs. Consultations shall occur every two weeks and SCWA shall submit a summary report of consultation details and any increases to the minimum flows to the Deputy Director within one week of each consultation meeting.

3. To protect against stranding of fish when releases from Lake Mendocino are reduced under this Order, flow in the East Fork Russian River immediately below Coyote Dam shall not be reduced by more than 25 cfs per hour. Ramping rates specified in this term may be revised upon consultation with NMFS and the CDFW. SCWA shall submit a summary report of consultation details to the Deputy Director within one week of each consultation meeting.

4. Within two weeks of the issuance of this Order, SCWA shall consult with NMFS and CDFW regarding the need for and appropriate methodology for monitoring salmonid species and other native fishes in the Russian River during the term of this Order. SCWA shall submit a summary report of consultation details and a description of any plans and methodologies for monitoring required by NMFS and CDFW to the Deputy Director within one week of the consultation.

5. SCWA shall monitor and record daily numbers of adult salmonids moving upstream past the life cycle monitoring station in Dry Creek (when operable) beginning no later than September 1, 2014, and continuing through the duration of the Order. SCWA shall include these numbers in the weekly reports required in Term 11.

6. SCWA shall report to NMFS and CDFW every two weeks or more frequently upon their request regarding the applicable fisheries monitoring activities specified in Terms 4 and 5 of this Order. Consistent with the Biological Opinion, SCWA shall consult with NMFS and CDFW regarding any necessary adaptations to the monitoring program including revisions to Terms 4 and 5. SCWA shall submit a summary report of consultation details to the Deputy Director within one week of each consultation meeting. Upon consultation with NMFS and CDFW, any necessary revisions to the terms and conditions of this order shall be made upon approval by the Deputy Director. Reporting of fisheries monitoring tasks described in Terms 4 and 5 shall be submitted to the Deputy Director by April 1, 2015 in accordance with NMFS and CDFW annual reporting requirements as more fully described in the Biological Opinion.

7. Monitoring shall be conducted to determine the water quality effects and the effects to availability of aquatic habitat for salmonids resulting from the approved temporary urgency change. Mainstem Russian River and estuary monitoring shall include continuous monitoring of temperature, dissolved oxygen (DO), pH, and specific conductance at multiple stations from Ukiah to Jenner.

   a. For the duration of this Order, monitoring on the mainstem Russian River shall occur at three, multi-parameter "permanent" water quality sondes on the Russian River at USGS stream gages located at Hopland, Diggers Bend near Healdsburg, and Hacienda Bridge. These three sondes are referred to as "permanent" as they are maintained as part of SCWA's early warning detection system in coordination with the United States Geological Survey (USGS) on its "Real-time Data for California" website. As of March 2014, the sonde at SCWA's river diversion facility (RDS) at Mirabel was removed due to several construction projects; therefore it will not be included in the 2014 monitoring effort. SCWA, in cooperation with the USGS, shall also operate three seasonal sondes with real-time telemetry at USGS gages at Cloverdale station (north of Cloverdale at Commisky Station Road), Jimtown (at the Alexander Valley Road bridge), and at Johnson's Beach (Guerneville). The sonde at the Cloverdale gage collects DO and temperature, the sonde at the Jimtown gage collects pH, temperature, DO, specific conductivity and turbidity, and the sonde at Johnson's Beach collects pH, temperature, DO, specific conductivity and turbidity. Data from these locations is available on the USGS "Real-time Data for California" website.

   b. Monitoring in the mainstem Russian River Estuary shall include nine stations in the lower, middle, and upper reaches of the Estuary, including tributaries and areas upstream from the Estuary that become inundated during lagoon conditions (maximum backwater area). Seven stations shall be located in the mainstem Estuary between the mouth of the river at Jenner and Monte Rio and two stations shall be located in the Willow and Austin creek tributaries, in areas that are subject to tidal and/or lagoon inundation. These sondes shall be removed when/if flows reach 1000 cfs and high flows are sustained.

      Sondes shall record hourly measurements of water temperature (Celsius), dissolved oxygen (milligrams per liter, mg/L), dissolved oxygen (percent saturation, % Sat), specific conductance (microsiemens), salinity (parts per thousand, ppt), and hydrogen ion (pH). All sondes shall be recalibrated following the manufacturer's manual and data downloaded every two weeks.

      Monitoring sites include:

      i. Russian River Mouth at Goat Rock State Beach (2 YSI 6600 Datasondes)
      ii. Russian River at Patty's Rock upstream from Penny Island (2 YSI 6600 Datasondes)
      iii. Willow Creek at the first bridge (1 YSI 6600 Datasonde)
      iv. Russian River at Sheephouse Creek downstream of Sheephouse Creek (1 or 2 YSI 6600 Datasondes)
      v. Russian River at Freezeout Creek downstream of Freezeout Creek (2 YSI 6600 Datasondes)
      vi. Russian River at Brown's Pool downstream of Austin Creek (1 YSI 6600 Datasonde)
      vii. Austin Creek downstream of the first steel bridge (1 YSI 6600 Datasonde)
      viii. Russian River at Patterson Point in Villa Grande (1 YSI 6600 Datasonde)
      ix. Russian River at Monte Rio downstream of Dutch Bill Creek (1 YSI 6600 Datasonde)

   c. Monitoring on the East Fork Russian River, shall occur at a seasonal sonde approximately 1/3 mile (0.33 mi) downstream from Lake Mendocino, and shall record hourly measurements

of water temperature, dissolved oxygen, specific conductance, pH, and turbidity. The monitoring site will be accessed by foot.

8. SCWA shall monitor bacteria, nutrients, and algae at five surface-water sites in the Russian River Estuary. All samples shall be analyzed for nutrients (e.g. nitrogen, ammonia, and phosphorus), chlorophyll a, standard bacterial indicators (Total coliforms, E. coli, and Enterococcus), total and dissolved organic carbon, total dissolved solids, and turbidity. Nutrient/Bacterial/Chlorophyll a monitoring sites include: Russian River at the Jenner Boat Ramp; Russian River at Casini Ranch below Austin Creek; Russian River at Patterson Point in Villa Grande; Russian River at Monte Rio below Dutch Bill Creek; and Russian River at Vacation Beach below summer dam.

   Additional focused sampling would occur under certain conditions and following specific river management and operational events, noted below, at the sites listed above:
   a. Removal of Johnson's Beach and/or Vacation Beach Dam – 3 samples within 10 days after dam removal
   b. Sandbar Closure at the river mouth – 3 samples within first 10 days (weekly thereafter)
   c. Sandbar Breach at the river mouth – 3 samples within 10 days after breach
   d. Lagoon Outlet Channel implementation – 3 samples within 10 days after implementation (weekly thereafter).

   Bacteroides bacteria sampling shall be conducted at the three surface-water sites in the maximum backwater area: Patterson Point, Monte Rio, and Vacation Beach. Sampling for human-host Bacteroides bacteria shall be conducted at public freshwater beaches during periods of potentially heavy contact recreational use (i.e. following Labor Day and Veteran's Day holiday) and during river mouth closure and lagoon outlet channel implementation when freshwater beaches may become inundated.

   Samples shall be collected weekly through the duration of the lagoon management period (May 1 - October 15). Measurements of water temperature, dissolved oxygen, specific conductance, pH, and turbidity shall be collected using a YSI 6600 datasonde and YSI 650MDS datalogger during water sample collection. The sonde will be calibrated before and after the collection of water samples.

   Sampling frequency shall increase to daily at freshwater beach sites, including Patterson Point, Monte Rio and Vacation Beach, if bacteria indicators exceed North Coast Regional Water Quality Control Board (Regional Board) operative standards during the weekly sampling effort and shall continue daily until measurements are below operational standards. Measurements for E. coli (235 MPN/100mL) shall be used for a comparison to operational standards. Bacteria indicators and sampling effort shall be included in the weekly reports required in Term 11.

   SCWA shall continue to collect Enterococcus samples and record and report the data, however, Enterococcus results will not be relied upon when coordinating with the Regional Board and Sonoma County DHS about potentially posting warning signs at freshwater beach sites or to discuss potential adaptive Estuary management actions including mechanical breaching of the sandbar to address potential threats to public health.

   At the conclusion of any focused grab sampling event, regular weekly sampling shall resume, as described above.

9. SCWA shall provide the summary data from the permanent water quality sondes required in Term 7a and nutrient/bacterial/algal sampling in Term 8 (as data becomes available) to the Deputy Director for the State Water Board and the Executive Director for the Regional Board in the weekly hydrologic status report required in Term 11. If any water quality issues of concern are observed from the continuous monitoring network, SCWA or the Regional Board can initiate consultation. SCWA shall submit a summary report of consultation details to the Deputy Director within one week of each consultation meeting. If no consultation is necessary; SCWA shall submit an explanation to the

Deputy Director within one week after the conclusion of the effective period of this Order. Upon consultation with the Regional Board, any necessary revisions to Terms 7 and 8 shall be made upon approval by the Deputy Director.

10. SCWA shall summarize all water quality data collected pursuant to Terms 7 and 8 during the term of this Order. The summary report shall include an evaluation of whether, and to what extent, the reduced flows authorized by the Order caused any impacts to water quality, including any water quality impacts affecting recreation or the availability of aquatic habitat for salmonids. The report shall be submitted to the Deputy Director by April 1, 2015.

11. SCWA shall report to the Deputy Director of Water Rights and the Executive Director of the North Coast Regional Board on a weekly basis regarding the current hydrologic condition of the Russian River system, including current Lake Mendocino reservoir level, the rate of decline for Lake Mendocino, a 16-day cumulative rainfall forecast, current inflow from Potter Valley, fish counts, and a summary of the available water quality data.

12. This Order does not authorize any act that results in the taking of a candidate, threatened or endangered species, or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). If a "take" will result from any act authorized under this Order, the permittee shall obtain authorization for an incidental take permit prior to construction or operation of the project. Permittee shall be responsible for meeting all requirements of the applicable Endangered Species Act for the temporary urgency change authorized under this Order.

13. The State Water Board reserves jurisdiction to supervise the temporary urgency change under this Order, and to coordinate or modify terms and conditions, for the protection of vested rights, fish, wildlife, instream beneficial uses and the public interest as future conditions may warrant.

14. SCWA shall immediately notify the State Water Board if Lake Mendocino storage reaches the top of the winter water supply pool (68,400 acre-feet).

15. SCWA shall immediately notify the State Water Board if any significant change in storage conditions in Lake Mendocino occurs that warrants reconsideration of this Order.

16. SCWA shall provide a written update to the Deputy Director by April 1, 2015, regarding activities and programs being implemented by SCWA and its water contractors to assess and reduce water loss, promote increased water use efficiency and conservation, and improve regional water supply reliability.

17. The temporary changes authorized by this Order are not effective unless SCWA is operating in accordance with a Water Demand Reduction Plan (Plan) satisfactory to the Deputy Director for Water Rights. The Plan shall be designed to ensure that all parties that beneficially use water diverted and/or stored under this right implement actions to meet a water demand reduction of a minimum of 20 percent of the baseline water demand. The Plan shall define baseline water demand as appropriate for SCWA's situation based on considerations such as weather, economy, wholesale supplier allocations or other relevant information. For the purpose of compliance with this term, if the Plan does not define baseline water demand, it is assumed to be the average water demand for the previous year (excluding drought years).

    The Plan shall include, at a minimum, the following components:

    1) All parties that beneficially use water diverted and/or stored under these rights and/or parties otherwise subject to the temporary change(s) authorized by this Order (excluding SCWA's surplus customers, whom are curtailed, and parties found on the De Minimus list provided by

SCWA on August 22, 2014, whose diversions amount to less than one percent of SCWA's total water distributed);

2) Baseline water demand for all parties included in (1) above;

3) Existing actions and additional actions planned by each party included in (1) above to reduce water use in order to meet the water demand reduction required by this term, including a description of how such actions can be expected to meet the demand reduction. The Plan shall also identify additional actions to be implemented, in the event that SCWA does not attain the amount of water use demand reduction relative to baseline water demand.

   Additional actions to be considered include, at a minimum, those recommended in any applicable Governor's Drought Proclamation as applicable to SCWA's operations, and determine if implementation of such action(s) may increase conservation of their water supply. If so, SCWA will either implement the recommendation(s) or provide documentation as to why such action is not reasonable for SCWA's situation. Actions to evaluate include, but are not limited to, 1) Avoid using water to clean sidewalks, driveways, parking lots and other hardscapes; 2) Turn off fountains and other decorative water features unless recycled or grey water is used for those water features, 3) Limit vehicle washing at home by patronizing local carwashes that use recycled water; 4) Limit outdoor watering of lawns and landscaping to no more than two times a week; 5) Recreational facilities, such as city parks and golf courses, and large institutional complexes, such as schools, business parks and campuses, should immediately implement water reduction plans to reduce the use of potable water for outdoor irrigation; 6) Commercial establishments such as hotel and restaurants should take steps to reduce water usage and increase public awareness of the drought through measures such as offering drinking water only upon request and providing customers with options to avoid daily washing of towels or sheets; 7) Professional sports facilities, such as basketball arenas, football, soccer, and baseball stadiums, and hockey rinks should reduce water usage and increase public awareness of the drought by reducing the use of potable water for outdoor irrigation and encouraging conservation by spectators.;

   Additional actions to be considered include, but are not limited to, those associated with on farm conservation, such as irrigation scheduling, tailwater recovery systems, and irrigation system improvements, and irrigation district system improvements, such as canal lining, canal structure improvements, and remote measurement, monitoring and control. SCWA shall determine if implementation of such action(s) may increase conservation of water supply. SCWA will either implement action(s) or provide documentation as to why such action is not reasonable for SCWA's situation;

4) For parties included in (1) above over which SCWA has the authority or other ability to impose the listed water demand reduction actions, a list of such parties and a description of such authority or other ability over each party;

5) For parties included in (1) above over which SCWA does not have the authority or other ability to impose the listed water demand reduction actions, a list of such parties, a description of the efforts of SCWA to coordinate with each of the listed parties to ensure that each party take appropriate action to reduce water demand, and a description of such actions for each party;

6) A detailed schedule with planned completion dates for key events.

SCWA shall submit to the Deputy Director for Water Rights a written report within 15 days of the end of each month (monthly status update) that provides a summary of compliance with this term. The monthly status update shall, at a minimum, include a description of SCWA's actions to date to comply with the requirements of this term and the results of such actions, including but not limited to the amount of water demand

reduction relative to baseline water demand. The data submitted for the amount of water demand reduction shall include both monthly and aggregate annual to date information and shall be compared to baseline water demand. When the monthly status update reflects that SCWA is not achieving the minimum water demand reduction of this term, SCWA shall also include additional actions SCWA has adopted and/or implemented to meet the demand reduction and identify the date when such additional actions will be fully implemented as part of the monthly status update.

Failure to achieve demand reduction may result in modification of this Order to limit the extent of the approved action, at the discretion of the Deputy Director for Water Rights.

(000000U2)

STATE WATER RESOURCES CONTROL BOARD

Barbara Evoy, Deputy Director
Division of Water Rights

Dated: AUG 25 2014

APPENDIX A-4

SWRCB Public Notice of 2014 TUCP

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NOTICE OF A TEMPORARY URGENCY CHANGE PETITION BY SONOMA COUNTY WATER AGENCY REGARDING PERMITS 12947A, 12949, 12950, AND 16596 (APPLICATIONS 12919A, 15736, 15737, 19351)

COUNTY: MENDOCINO, SONOMA

STREAM SYSTEM: RUSSIAN RIVER
PACIFIC OCEAN

The Sonoma County Water Agency (SCWA) has filed a temporary urgency change petition, pursuant to California Water Code section 1435, with the State Water Resources Control Board (State Water Board), Division of Water Rights (Division). Due to severe drought conditions, the petition requests to temporarily change the minimum instream flow requirements for the Russian River as listed below:

(1) Reduce the minimum instream flow requirements in the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) from 75 cubic feet per second (cfs) to 50 cfs.

(2) Reduce minimum instream flow requirements in the lower Russian River (from its confluence with Dry Creek to the Pacific Ocean) from 85 cfs to 60 cfs.

(3) For purposes of compliance, measure the minimum instream flow requirements based on a 5-day running average of average daily stream flow measurements, provided that instantaneous flows on the upper Russian River shall be no less than 40 cfs and on the lower Russian River shall be no less than 50 cfs.

On August 25, 2014, the Division issued an Order approving the temporary urgency change petition. More information regarding this Order, including the petition, is available at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/transfers_tu_notices/index.shtml

Pursuant to California Water Code section 1438(d), any interested person may file an objection to the temporary change. The procedure for addressing an objection is described in Water Code section 1438. **Objections filed in response to this notice should be submitted to the persons listed below and must be received by 4:30 p.m. on September 25, 2014.**

Send objections to both:

Emily Hyland
Permitting Section
Division of Water Rights
State Water Resources Control Board
P. O. Box 2000
Sacramento, CA 95812

Grant Davis
General Manager
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403-9019

For more information regarding this project, including procedures for filing objections, please contact Emily Hyland at (916) 341-5803 or Emily.Hyland@waterboards.ca.gov.

DATE OF NOTICE: August 26, 2014

APPENDIX A-5

Sonoma County Water Agency Term 16 & 17 Reports

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State Water Resources Control Board
Order 8/25/2014

Term 16 – Water Loss, Water Use Efficiency and Water Reliability

April 1, 2015

Prepared by

Sonoma County Water Agency
404 Aviation Blvd
Santa Rosa, CA 95403

1 Introduction

This report has been prepared by the Sonoma County Water Agency (Water Agency) to fulfill the requirements of Term 16 of the State Water Resources Control Board (State Board) Order dated August 25, 2014 (Order).

Term 16 of the Order directs the Water Agency to take the following actions:

> SCWA shall provide a written update to the Deputy Director by April 1, 2015, regarding activities and programs being implemented by SCWA and its water contractors to assess and reduce water loss, promote increasing water use efficiency and conservation, and improve regional water supply reliability.

2 Water Use Efficiency

In response to ongoing drought conditions, the Water Agency launched a conservation campaign, "There's a Drought On, Turn the Water Off." This first ever winter advertising campaign used humor to remind customers to conserve. Inspired by the Water Agency campaign, SaveOurWater.org launched a similar campaign using the same slogan.

The Water Agency also hosted a "Drought Drive-Up" event. This event, with 10 locations throughout Sonoma County, gave away free water saving kits of a free showerhead, bathroom and kitchen faucet aerators, dye tabs, a shower timer and a bucket for saving water while waiting for hot water. Over 5,100 kits were given away in one day.

In addition to the Drought Drive-Up event, the Water Agency was one of the hosts of the DIY Outdoor Drought Solutions event, an interactive water conservation focused event that attracted approximately 1,000 people. There, customers learned about how to sheet mulch, convert their sprinklers to drip irrigation, harvest rainwater and more.

Also in response to the severe drought conditions, the Water Agency applied for and was awarded a grant though the Department of Water Resources- North Coast Integrated Regional Water Management Plan. This grant provided $1.05m for a direct installation toilet and urinal program, as well as a turf removal rebate program for residents within the Russian River watershed, an area that has never had water conservation programs available previously.

The Water Agency also won the U.S. Environmental Protection Agency WaterSense Partner of the Year award for the Sonoma-Marin Saving Water Partnership work with the Qualified Water Efficient Landscaper (QWEL) program. QWEL is a national certification program, created in part by the Water Agency, developed to educate landscape professionals to the benefits of sound landscape design, management and irrigation practices.

2.1 Sonoma-Marin Saving Water Partnership Annual Report

The Cities of Santa Rosa, Rohnert Park, Sonoma, Cotati, Petaluma, Town of Windsor and North Marin, Marin Municipal and Valley of the Moon Water Districts and the Water Agency formed the Sonoma-Marin Saving Water Partnership in 2010. The purpose of the Sonoma-Marin Saving Water Partnership is to establish the financial obligation for the eight local water utilities, Marin Municipal Water District and Sonoma County Water Agency, identify and recommend implementation of water conservation projects and to maximize the cost-effective projects for the Partnership.

The Partners are committed to remain as members in good standing of the California Urban Water Conservation Council (CUWCC) and implement the Best Management Practices (BMPs) for water conservation. The Partners will implement or use best efforts to secure the implementation of any water conservation requirements and will publish an Annual Report to track progress. The Annual Report will track program implementation, highlight program milestones, and reinforce the importance of protecting and preserving water resources for future generations. The 2013/2014 Annual Report for the Partnership is attached in Appendix A.

3 Water Loss

Under the Water Agency's Condition Assessment Program, Pure Technologies (Pure) was contracted to conduct two pipeline inspections in 2014 using two different approaches. In January 2014, Pure provided detailed inspection of 1.2 miles of the Agency's 24-inch Oakmont Pipeline. The pipeline was taken off-line, dewatered, and inspected with a robotic crawler (PureRobotics platform) outfitted with a high-definition CCTV camera to assess mortar lining, LiDAR assembly for 3-dimensional pipe scans, and enhanced electromagnetics equipment to assess the condition of the steel cylinder and bar-wrapping of the bar-wrapped concrete cylinder pipe (AWWA 303). The results of the inspection identified small isolated areas that experienced mortar loss, but overall the inspected pipeline was found to be in very good condition with no signs of the pipe integrity being compromised. The enhanced electromagnetics analysis found no indications of corrosion of the pipe's steel cylinder or bar-wrapping.

In June 2014, Pure conducted an acoustic pipeline inspection of 6.8 miles in the southern portion of the Sonoma Aqueduct. The inspected section of pipeline was welded steel pipe of mainly 20-inch and 16-inch diameter. Pure inspected the pipeline with their SmartBall technology, an acoustic sensing device capable of detecting leaks and air pockets. The SmartBall was inserted in the pipeline while it remained in service traveling with the flow. The results of the acoustic data analysis identified two leaks over the 6.8 miles. The first leak was categorized as medium-sized (2-10 gpm) and was found during a follow-up site visit to be a delivery turnout valve that was not properly sealing. This 'leak' was not a water loss leak since water was flowing out to an Agency customer's (Valley of the Moon Water District) distribution system. The second identified leak was categorized as small (<2 gpm). Subsequent site visits were not able to detect a leak with a ground mic in the vicinity identified by the SmartBall. The final determination for this leak was that the elevated pipeline pressures during the inspection created a small joint leak that under normal pressures disappeared. While the analysis of the acoustic data did not pick up an additional leak because noise from a nearby throttling valve masked the signal, a leaking

check valve was discovered during the inspection planning process. A swing check valve located on the east end of the Verano Avenue bridge in Sonoma was discovered to have a bad seal and leaking at approximately 5 gpm. There was no recollection by Agency staff of any inspection of the check valve prior and therefore the leak may have been occurring for many years without detection. Temporary repairs have reduced the leak and the check valve has been scheduled for replacement.

4 Water Supply Reliability- Forecast-Informed Reservoir Operations

Forecast-Informed Reservoir Operations is a management strategy that uses data from watershed monitoring and modern weather and water forecasting to help water managers selectively retain or release water from reservoirs in a manner that reflects current and forecasted conditions. A workshop was held in August 2014, at University of California San Diego/Scripps Institution of Oceanography. Thirty-two representatives from multiple agencies met for three days to scope out an appraisal level FIRO study for Lake Mendocino. A work plan is now being drafted for release in 2015. The FIRO study is expected to occur over the next five years (depending on funding). Tangible outcomes from the full Lake Mendocino FIRO study will include identification, assessment and enhancement of the best science available to improve operations to maximize flood control, water supply and ecosystem benefits. The evaluation will identify realistic, short-term steps to provide more accurate and timely information about weather and watershed conditions. In addition to benefitting Lake Mendocino, the project has transferability potential throughout the western United States. Additional information on Improving Reliability for Droughts & Floods: Forecast-Informed Reservoir Operations is attached in Appendix B.

Appendix A

2013/2014 Annual Report for the Sonoma-Marin Saving Water Partnership

(begins on the following page)

SONOMA - MARIN
SAVING WATER
PARTNERSHIP

Annual Report

FY2013/2014

About the Partnership

The Sonoma-Marin Saving Water Partnership (Partnership) represents 10 water utilities in Sonoma and Marin counties that have joined together to provide regional solutions for water use efficiency.

The utilities include the Cities of Santa Rosa, Rohnert Park, Petaluma, Sonoma, Cotati; North Marin, Valley of the Moon and Marin Municipal Water Districts; Town of Windsor and Sonoma County Water Agency (Partners). Each of the Partners have water conservation programs that can assist customers in reducing their water use.

The Partnership was formed to identify and recommend implementation of water use efficiency projects, and maximize the cost-effectiveness of water use efficiency programs in our region.

The Partners are committed to remain members in good standing of the California Urban Water Conservation Council (CUWCC) and implement the Best Management Practices (BMPs) for water conservation.

Our Service Area

More than 600,000 residents in Sonoma and Marin counties rely on the water delivered from the Russian River by the Sonoma County Water Agency (Water Agency) to the nine cities and districts in the Partnership. Supplementing the water provided by the Water Agency are local supplies including recycled water, groundwater from underground aquifers and surface water reservoirs.

Recreation, agriculture and wildlife, including threatened and endangered steelhead and coho and Chinook salmon also rely on these same natural resources in order to thrive.

Realizing the importance of protecting and preserving water resources for future generations, the members of the Partnership have taken a proactive role in helping fund, maintain and implement an array of water supply, water use efficiency and fishery recovery programs.

There's a Drought On! Turn the Water Off!

This year the California drought took center stage and Governor Jerry Brown declared a State of Emergency on January 17, 2014. Our region experienced historically dry weather and low reservoir water storage levels. The Sonoma-Marin Water Saving Partnership implemented an unusual winter water conservation public outreach effort with a simple message: *"There's a Drought On. Turn the Water Off."* In addition, the Partnership joined together to create a one day "Drought Drive-Up" event at 10 different locations throughout the region and handed out over 5,000 drought tool kits to community members. The area retail water providers stepped up their water conservation efforts and the Partnership website was enhanced by adding a Water Savings Calculator tool, an online form for reporting water waste, and providing online access to water conservation tips.

The Partnership received a 2014 WaterSense "Partner of the Year" award from the U.S. Environmental Protection Agency as a professional certifying organization for promoting water efficient irrigation practices through implementation of the Qualified Water Efficient Landscaper Program (QWEL). QWEL educates landscape professionals and their customers on the benefits of sound landscape design, management and irrigation practices. The award was one of only nine issued by the EPA nationally.

The Partnership was formed in late 2010 and recognizes that establishing common regional water conservation projects may cost effectively conserve more water than would otherwise be conserved by individual agencies. This regional approach is based on meeting water conservation regulatory requirements by offering financial incentives to conserve and by educating water users about where drinking water comes from and how to use it most efficiently. The Partnership, through its many water efficiency programs, educational seminars and outreach campaigns, is working every day of the year to educate our communities about the importance of conserving water resources and curbing water-wasting behaviors.

Regional water use during Fiscal Year 2013/2014 remains down significantly from prior years as mandatory outdoor water use restriction were in effect. The Partnership continues to offer educational resources, programs and incentives to aid our communities in meeting water use efficiency requirements in the future as we work together in response to variable water year conditions and maintain supplies for beneficial use and instream needs.

Sincerely,

Dennis J. Rodoni, Chair
Water Advisory Committee
President
North Marin Water District

Susan Gorin, Chair
Sonoma County Water Agency
Supervisor, County of Sonoma

Partnership Achievements by the Numbers

5,355,996 gallons of water per year are being saved by local businesses through **sustained reduction** programs where rebates are provided for implementing process changes and equipment upgrades resulting in measurable water use efficiencies.

507,222 square feet of lawn were removed through **turf conversion** programs — enough to cover nearly nine professional football fields.

23,061 students in 823 different classrooms received curriculum materials provided by the **Water Education Program.**

10,496 students experienced "The Musical Watershed" performed by the **ZunZun** performing arts group in 37 shows at 25 different elementary schools.

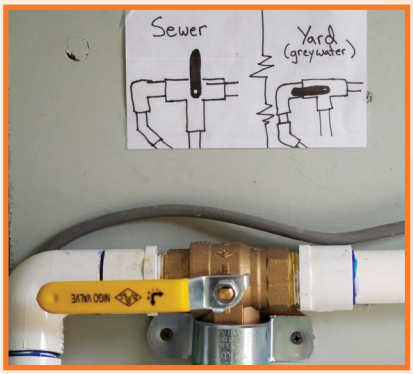
7,058 actions were inspired by the **Community Resilience Challenge.**

8,037 students received **direct instruction** by Water Education Program staff in the classroom, on technical tours and during field study sessions.

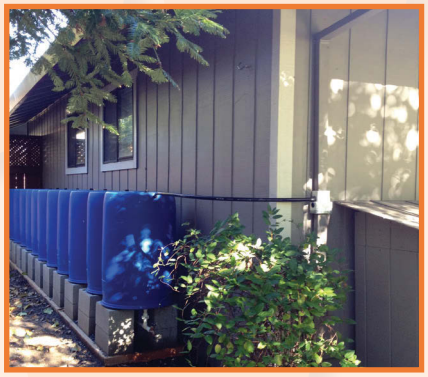
5,148 drought kits were distributed during the **Drought Drive-Up Event** held at 10 locations throughout Sonoma and Marin counties on April 23, 2014. The kits included showerheads, bath and kitchen faucet aerators, dye tabs, shower timer, and bucket for saving water while waiting for hot water.

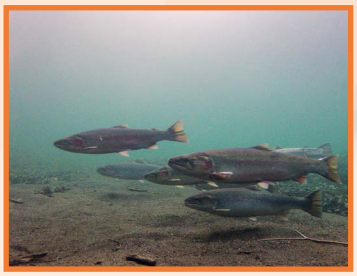
4,410 Water Smart Home evaluations were performed. These in-home water efficiency assessments are performed by trained technicians to find opportunities for improvements, identify leaks, and inform homeowners about their indoor and outdoor water use.

3,540 rebates were issued to **residents** for replacing their old, inefficient toilets with new, EPA WaterSense labeled **high-efficiency toilets** that flush at 1.28 gallons per flush or less.



Fiscal Year 2013/2014





2,379 high-efficiency clothes washer rebates were issued. These EPA EnergyStar rated clothes washers use 40 to 60% less water than older, top loading models and they save energy from heating less water and wringing out more water before the clothes go into the dryer.

2,284 students participated in the Field Study Program where the 5th grade students performed water related experiments along the banks of the Russian River and learned about the riparian ecosystem.

2,210 high school students learned about the water system and explored career opportunities in the field of water.

941 rebates were issued to **businesses** for installing **high-efficiency toilets and urinals.**

720 guests visited the nine gardens that participated in the Third Annual **Eco Friendly Garden Tour.**

356 parents volunteered to chaperone their child's class during their field study visit to the Water Agency's Russian River Field Study Site near Forestville. The parents participated along with the students allowing the **Field Study Program** to reach adults as well as children.

215 landscapes were upgraded through our rebate programs.

185 students graduated from the **Qualified Water Efficient Landscaper** (QWEL) and Spanish QWEL programs.

166 in-garden visits were conducted by the Master Gardeners through the **Garden Sense** program to educate customers on low water use landscapes.

151 businesses participated in our **water use survey** programs.

87 people attended **Rainwater Harvesting classes.**

47 videos were submitted for the high school video contest themed *"There's a Drought On! Turn the Water Off!"*

22 businesses were certified through the Sonoma County Green Business Program sponsored by the Water Agency.

11 permitted graywater systems were installed in homes to reuse water from bathroom sinks, showers, tubs and laundry for irrigating landscapes.

ANNUAL MULTI-MEDIA PUBLIC EDUCATION CAMPAIGN

Following the 20-Gallon Challenge Campaign, the Partnership launched a new campaign to continue to increase awareness of the dry weather and serious drought conditions. The Partnership implemented a new regional multi-media effort throughout the North Bay region with a simple message: **There's a drought. Turn the water off.** The campaign's goal is to educate the public about outdoor and indoor water conservation by promoting creative and humorous tips for saving water.

The Partnership also joined forces to hand out over 5,000 drought tool kits during a one day, 10 location event called the "Drought Drive-Up." Partnership staff and elected officials handed out tool kits that included toilet dye-tests, water efficient shower heads, spray nozzles, shower buckets and more. The community's response was overwhelming as many drive-up locations ran out of supplies before the end of the day.

Partnership Highlights

PROGRAM EXPENDTURES

Partners have pledged to fund water use efficiency programs. The baseline funding is established in the Memorandum of Understanding (MOU) and is based on historic water deliveries through the Water Agency's water transmission system, ensuring that programs will always be available to help residents use our water resources efficiently.

Minimum funding levels are presented in the orange bar in the table below along with Fiscal Year 13/14 expenditures.

For the Town of Windsor, additional required funding paid through a direct diversion water conservation sub-charge is not included with their MOU minimum. These additional funds are designated for the Town's water use efficiency programs and are included in their annual program expenditures.

The Water Agency's Water Use Efficiency Program is funded by the water contractors through the Water Conservation Sub-Charge as part of the Water Agency wholesale water rates. The amount of money deposited into the fund is calculated based on an estimate of the total costs for all regional Water Conservation Projects for each fiscal year.

The Sonoma-Marin Saving Water Partnership does not specify a minimum amount that should be utilized for regional programs.

Program Expenditures (in thousands of dollars)

	City of Cotati	Marin Municipal Water District	North Marin Water District	City of Petaluma	City of Rohnert Park	City of Santa Rosa	City of Sonoma	Valley of the Moon Water District	Town of Windsor	Sonoma County Water Agency	Regional Total
FY 13-14	$ 84	$1,947	$429	$660	$14	$1,127	$129	$245	$259	$1,630	$6,526
Minimum	$25	$177	$241	$242	$120	$557	$55	$72	$10	NA	$1,500

2014 TEMPORARY URGENCY CHANGE PETITION

As a result of the driest calendar year on record in Ukiah, the California State Water Resources Control Board (SWRCB) issued an order on December 31, 2013 that allowed the Sonoma County Water Agency to preserve Lake Mendocino's dwindling water storage in response to a Temporary Urgency Change Petition that was filed on December 20, 2013 by the Water Agency.

Beginning January 1, 2014 the order allowed lower minimum flows in the upper Russian River and more operational flexibility for water managers working to preserve every drop of water in Lake Mendocino. Due to the lack of rainfall in early 2014, the order was amended on March 7, 2014 adding terms to reduce water demand throughout the Russian River watershed. The reduced water releases saved over 15,000 acre- feet in Lake Mendocino; the equivalent of the reservoir's total storage in Fall 2014. The Water Agency worked closely with natural resource agencies to maintain river flows at levels supporting migrating endangered coho salmon and threatened Chinook salmon and steelhead.

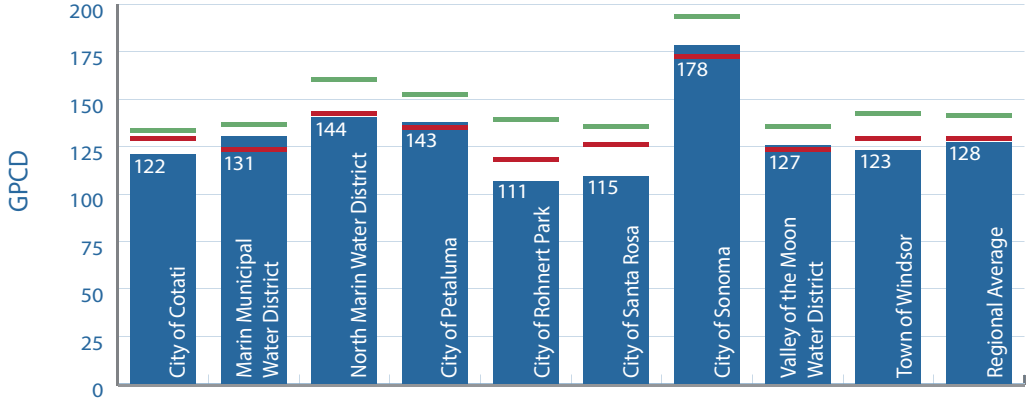
20 x 2020 GOALS

In 2009, SBx7-7 established a statewide goal, known as 20 x 2020, to reduce per capita water use 20% by the year 2020 with an interim goal of a 10% reduction by 2015. The chart below displays 2013 per capita water use in each Partner service area and the region as a whole. The 2015 and 2020 goals are indicated by the green and red lines, respectively.

While the chart shows that many Partners are currently meeting the 2020 targets, we recognize that water use efficiency must continue. Many factors can affect water use patterns as seen in recent years. The rebound in the economy is one key factor that has caused an increase in water use. The overall longterm trend shows water demands have dropped as a result of many factors including the California drought, economy, changes in weather conditions, and active water conservation programs.

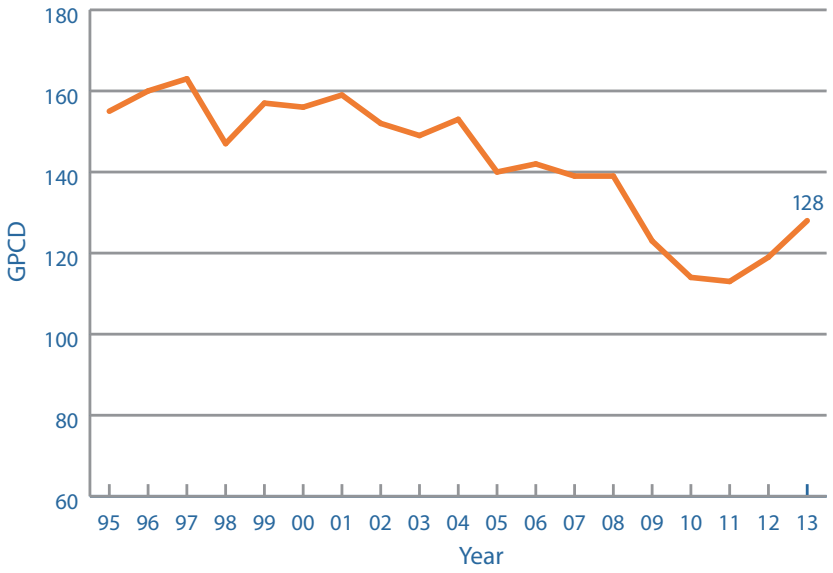
It is important to continue the work on water use efficiency to maintain the savings already achieved and make sure the region captures all the benefits of future water savings.

2013 Gallons per Capita per Day (GPCD) and 20 x 2020 Goals



	City of Cotati	Marin Municipal Water District	North Marin Water District	City of Petaluma	City of Rohnert Park	City of Santa Rosa	City of Sonoma	Valley of the Moon Water District	Town of Windsor	Regional Average
2015 Target	134	137	161	153	140	136	194	136	143	142
2020 Target	130	124	143	136	119	127	173	124	130	129

Regional Average GPCD Usage



PARTNERSHIP RECEIVES NATIONAL AWARD

The Partnership was recognized with a 2013 WaterSense Excellence Award from the U.S. Environmental Protection Agency (EPA) for promoting water efficient irrigation practices through implementation of the Qualified Water Efficient Landscaper (QWEL) program. The Partnership was honored for its groundbreaking regional approach towards cost-effective incentive and educational based water use efficiency programs.

From its early development through a collaborative effort between Partnership agencies (before the Partnership was formed) and the landscape industry, QWEL's mission has been to educate landscape professionals and their customers on the benefits of sound landscape design, management, and irrigation practices. Since the QWEL program became WaterSense labeled in 2007, QWEL has issued over 700 certifications and is offered by 10 organizations throughout the US.

SONOMA - MARIN SAVING WATER PARTNERSHIP

www.savingwaterpartnership.org

City of Cotati
(707) 665-3631
www.ci.cotati.ca.us

Marin Municipal Water District
(415) 945-1520
www.marinwater.org

City of Petaluma
(707) 778-4507
cityofpetaluma.net/wrcd

North Marin Water District
(415) 761-8933
www.nmwd.com

City of Rohnert Park
(707) 588-3300
www.rpcity.org

Sonoma County Water Agency
(707) 547-1933
www.sonomacountywater.org

City of Santa Rosa
(707) 543-3985
www.srcity.org/wue

Town of Windsor
(707) 838-1004
townofwindsor.com

City of Sonoma
(707) 933-2237
www.sonomacity.org

Valley of the Moon Water District
(707) 996-1037
www.vomwd.com

EPA WaterSense PARTNER

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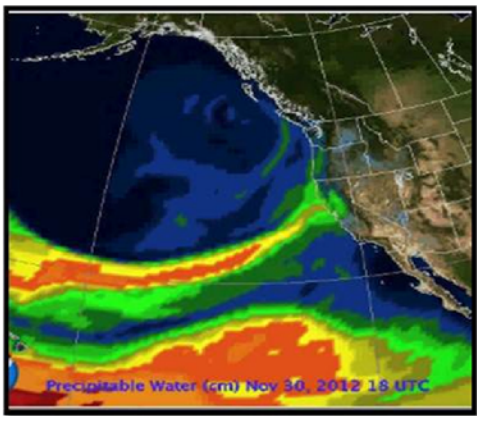
Appendix B

Improving Reliability for Droughts & Floods: Forecast-Informed Reservoir Operations (FIRO)

(begins on the following page)

IMPROVING RELIABILITY FOR DROUGHTS & FLOODS: FORECAST-INFORMED RESERVOIR OPERATIONS (FIRO)

PROJECT PARTNERS



BACKGROUND Lake Mendocino is located on the East Fork of the Russian River in Mendocino County, California. Created in 1958 by the Coyote Valley Dam, it provides flood control, water supply, recreation and stream flow regulation. The U.S. Army Corps of Engineers (Corps) owns and operates the dam in accordance with the Lake Mendocino Water Control Manual (1959, revised in 1986). Sonoma County Water Agency is the local partner that manages water stored in Lake Mendocino for water supply.

The Manual specifies elevations for an upper volume of reservoir storage that must be kept available for capturing storm runoff and reducing flood risk and a lower volume of storage that may be used for water supply. During a flood event, runoff is captured by the reservoir and released soon after to create storage space for another potential storm. The Manual is based on typical historical weather patterns– wet during the winter, dry otherwise.

THE PROBLEM

The Manual utilizes gross estimates of flood potential to establish reservoir storage and release requirements. It does not account for changing conditions in the watershed—for example, increased variation in dry and wet weather patterns and reductions to imported flows into the Lake that have occurred since 1986. Also, the Manual's reservoir operations procedures were developed decades ago, without the benefit of current science that more accurately predicts weather and streamflow.

Given reduced supplies, changed hydrologic conditions, and technological advances, some adjustments to the current reservoir operating procedures may be possible to optimize the goals of maintaining flood control while bolstering water supply reliability for downstream users and the environment (e.g., to support recovery of endangered and threatened fish). Modern observation and prediction technology could be used to reduce flood risk by supporting decisions of greater reservoir level drawdown in advance of storms. Or, such technology might be used to improve supply reliability by permitting more storm runoff to be retained for water supply while still preserving flood risk reduction objectives.

(over)

STEERING COMMITTEE MEMBERS

FIRO CO-CHAIRS

Jay Jasperse
Sonoma County Water Agency

F. Martin Ralph
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For example, following an atmospheric river-type storm in December 2012, water was released to create flood space according to the Manual, dropping reservoir levels by more than 35%. 2013 was the driest year on record, resulting in little inflow to refill the reservoir. By December 2013 lake levels were extremely low and remained low through 2014. Ideally, water from the December 2012 event could have been retained based on a longer-term precipitation forecasts, lessening the impact of drought.

THE POTENTIAL SOLUTION An interagency Steering Committee was formed to explore methods for better balancing flood control and water supply needs. The committee, consisting of state and federal agencies, the Center for Western Water and Weather Extremes (CW3E) at UC San Diego and Sonoma County Water Agency are working together on a viability study to determine if Forecast-Informed Reservoir Operations (FIRO) at Lake Mendocino can improve water supply, maintain flood risk reduction, and achieve additional ecosystem benefits. Recent studies show the potential for improved predictability of atmospheric rivers, which provide 50% of the region's precipitation and cause most of the Russian River's floods.

FIRO is a management strategy that uses data from watershed monitoring and modern weather and water forecasting to help water managers selectively retain or release water from reservoirs in a manner that reflects current and forecasted conditions. FIRO's utilization of modern technology can optimize the use of limited resources and represents a viable climate change adaptation strategy.

The goal of FIRO is to update standard flood control guidelines in order to improve water supply and environmental outcomes without diminishing flood risk reduction or dam safety. Examples of tangible benefits include:

Improve Supply Reliability for Downstream Uses - When storms cause moderate-to-high reservoir levels, normal operation is to release water to re-establish flood control space. With FIRO, some of that water could be retained for future supply as long as no major precipitation is predicted for several days and it can be demonstrated that the retained water can be released past downstream flood prone areas before the arrival of the next storm. This strategy will permit earlier supply capture in some years, improving summer season supply reliability for downstream water users and improving the timing and volume of releases to protect water quality and provide flows needed for recovery of fish populations.

Enhance Flood Risk Reduction - When a storm is predicted to cause flooding, normal operations call for release of reservoir water and drawdown of water levels. With FIRO, release decisions would consider weather observations and predictions, which, in some cases, would indicate greater drawdown for flood risk reduction so long as there is confidence that the amount of precipitation and runoff will restore reservoir levels for water supply after the storm.

PROJECT STATUS A workshop was held in August 2014, at University of California San Diego/Scripps Institution of Oceanography. Thirty-two representatives from multiple agencies met for three days to scope out an appraisal-level FIRO study. A work plan is now being drafted for release in early 2015. The FIRO study is expected to occur over the next five years (depending on funding).

Tangible outcomes from the full Lake Mendocino FIRO study will include identification, assessment and enhancement of the best science available to improve operations to maximize flood control, water supply and ecosystem benefits. The evaluation will identify realistic, short-term steps to provide more accurate and timely information about weather and watershed conditions. In addition to benefitting Lake Mendocino, the project has transferability potential throughout the western U.S.

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State Water Resources Control Board
Order Dated 08/25/2014

Provision 17 – Water Demand Reduction Plan and August Status Update

September 19, 2014

Prepared by

Sonoma County Water Agency

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1 Introduction

This Water Demand Reduction Plan (plan) has been prepared by the Sonoma County Water Agency (Water Agency) to fulfill the requirements of Provision 17 of the State Water Resources Control Board (State Board) Order dated August 25, 2014 (Order).

Provision 17 of the Order directs the Water Agency as follows:

> "17. The temporary changes authorized by this Order are not effective unless SCWA is operating in accordance with a Water Demand Reduction Plan (Plan) satisfactory to the Deputy Director for Water Rights. The Plan shall be designed to ensure that all parties that beneficially use water diverted and/or stored under this right implement actions to meet a water demand reduction of a minimum of 20 percent of the baseline water demand. The Plan shall define baseline water demand as appropriate for SCWA's situation based on considerations such as weather, economy, wholesale supplier allocations or other relevant information. For the purpose of compliance with this term, if the Plan does not define baseline water demand, it is assumed to be the average water demand for the previous year (excluding drought years).
>
> The Plan shall include, at a minimum, the following components:
>
> 1) All parties that beneficially use water diverted and/or stored under these rights and/or parties otherwise subject to the temporary change(s) authorized by this Order (excluding SCWA's surplus customers, whom are curtailed, and parties found on the De Minimus list provided by SCWA on August 22, 2014, whose diversions amount to less than one percent of SCWA's total water distributed);
>
> 2) Baseline water demand for all parties included in (1) above;
>
> 3) Existing actions and additional actions planned by each party included in (1) above to reduce water use in order to meet the water demand reduction required by this term, including a description of how such actions can be expected to meet the demand reduction. The Plan shall also identify additional actions to be implemented, in the event that SCWA does not attain the amount of water use demand reduction relative to baseline water demand.
>
> Additional actions to be considered include, at a minimum, those recommended in any applicable Governor's Drought Proclamation as applicable to SCWA's operations, and determine if implementation of such action(s) may increase conservation of their water supply. If so, SCWA will either implement the recommendation(s) or provide documentation as to why such action is not reasonable for SCWA's situation. Actions to evaluate include, but are not limited to,1) Avoid using water to clean sidewalks, driveways, parking lots and other hardscapes; 2) Turn off fountains and other decorative water features unless recycled or grey water is used for those water features, 3) Limit vehicle washing at home by patronizing local carwashes that use recycled water; 4) Limit outdoor watering of lawns and landscaping to no more than two times a week;5) Recreational facilities, such as city parks and golf courses, and large institutional complexes, such as schools, business parks and campuses, should immediately implement water reduction plans to reduce the use of potable water for outdoor irrigation; 6) Commercial establishments such as hotel and restaurants should take steps to reduce water usage and increase public awareness of the drought

through measures such as offering drinking water only upon request and providing customers with options to avoid daily washing of towels or sheets; 7) Professional sports facilities, such as basketball arenas, football, soccer, and baseball stadiums, and hockey rinks should reduce water usage and increase public awareness of the drought by reducing the use of potable water for outdoor irrigation and encouraging conservation by spectators.;

Additional actions to be considered include, but are not limited to, those associated with on farm conservation, such as irrigation scheduling, tailwater recovery systems, and irrigation system improvements, and irrigation district system improvements, such as canal lining, canal structure improvements, and remote measurement, monitoring and control. SCWA shall determine if implementation of such action(s) may increase conservation of water supply. SCWA will either implement action(s) or provide documentation as to why such action is not reasonable for SCWA's situation;

4) For parties included in (1) above over which SCWA has the authority or other ability to impose the listed water demand reduction actions, a list of such parties and a description of such authority or other ability over each party;

5) For parties included in (1) above over which SCWA does not have the authority or other ability to impose the listed water demand reduction actions, a list of such parties, a description of the efforts of SCWA to coordinate with each of the listed parties to ensure that each party take appropriate action to reduce water demand, and a description of such actions for each party;

6) A detailed schedule with planned completion dates for key events.

SCWA shall submit to the Deputy Director for Water Rights a written report within 15 days of the end of each month (monthly status update) that provides a summary of compliance with this term. The monthly status update shall, at a minimum, include a description of SCWA's actions to date to comply with the requirements of this term and the results of such actions, including but not limited to the amount of water demand reduction relative to baseline water demand. The data submitted for the amount of water demand reduction shall include both monthly and aggregate annual to date information and shall be compared to baseline water demand. When the monthly status update reflects that SCWA is not achieving the minimum water demand reduction of this term, SCWA shall also include additional actions SCWA has adopted and/or implemented to meet the demand reduction and identify the date when such additional actions will be fully implemented as part of the monthly status update."

2 Water Retailers included in Plan (Plan Component #1)

The individual water utilities (Water Retailers) that are subject to the temporary change authorized by the Order are listed below. The list excludes Water Agency's surplus customers, whom are curtailed, and parties found on the De Minimus list provided to the State Board on August 22, 2014, whose diversions amount to less than one percent of Water Agency's total water distributed.

1. City of Cotati
2. Forestville Water District
3. City of Healdsburg
4. California-American Water – Larkfield
5. Marin Municipal Water District
6. North Marin Water District
7. City of Petaluma
8. City of Rohnert Park
9. City of Santa Rosa
10. City of Sonoma
11. Town of Windsor Public Works
12. Valley of the Moon Water District

3 Baseline Water Demands (Plan Component #2)

The Order provides the following description for determining the baseline water demands:

> "The Plan shall define baseline water demand as appropriate for SCWA's situation based on considerations such as weather, economy, wholesale supplier allocations or other relevant information."

The Water Agency has determined that the SBx7-7 methodology for calculating the baseline water demands would be appropriate. According to California Water Code Section 10608.12(b)(1) 'Base daily per capita water use' is defined as the following:

> "The urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10-year period ending no earlier than December 31, 2004, and no later than December 31, 2010."

The Water Agency and Water Retailers have selected a continuous 10-year period ending in December 31, 2006 to be used to determine the baseline water demands for each Water Retailer. The 10-year period selected accounts for the economic downturn and severe weather patterns that the region has experienced. The baseline accounts for varying economic conditions and weather patterns that constitute generally normal conditions for the region. It is also consistent with determining per capita water use targets as required by the Urban Water Management Planning Act. The Water Retailers baseline gallons per capita per day (GPCD) water demand will vary month to month to allow an accurate comparison to the 2014 water demands. Below are the baselines that will be used during the term of the Order (August-February).

Water Retailer	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Cotati	224	210	172	113	93	100	103
Marin Municipal	197	183	157	115	104	96	100
North Marin	259	245	204	138	101	101	91
Petaluma	259	236	190	122	109	104	103
Rohnert Park	201	192	153	115	101	100	105
Santa Rosa	205	181	150	104	87	91	90
Sonoma	305	294	247	159	132	134	121
Valley of the Moon	206	193	162	112	97	97	93
Windsor	244	221	175	102	85	77	78
Forestville	292	264	214	124	104	104	99
Healdsburg	300	279	224	146	133	127	131
Cal-Am Larkfield	281	258	209	147	128	119	119
Regional Average	**248**	**230**	**188**	**125**	**106**	**104**	**103**

4 Existing Actions (Plan Component #3)

The Water Agency and the Water Retailers are committed to eliminating unnecessary use of potable water for landscape irrigation and other waste during these drought conditions. The Water Agency and its water contractors continue to implement water use efficiency programs that align with the California Urban Water Conservation Council's Best Management Practices (BMPs) and comply with SB 7x-7. While these BMPs remain the baseline for the region, the establishment of the Sonoma-Marin Water Saving Partnership (Partnership) in December 2010 memorialized the region's commitment to long-term, year-round water use efficiency. The Partnership removes one of the most significant barriers to implementing conservation programs, funding. Each Partner has committed to a sustained level of funding that is allocated specifically to implementing conservation programs.

The Partnership represents ten water utilities in the North Bay in Sonoma and Marin counties (Partners) that have joined together to provide regional solutions for water use efficiency. The Partners include: the Cities of Santa Rosa, Rohnert Park, Petaluma, Sonoma, and Cotati; North Marin, Valley of the Moon, and Marin Municipal Water Districts; the Town of Windsor, and the Water Agency. The Partnership was formed to identify and recommend water use efficiency projects and to maximize the cost-effectiveness of water use efficiency programs in our region.

Each Partner is continuously implementing water conservation programs to reduce overall regional water use. Over the last few years, in response to the drought, the Partnership has increased outreach, revised education programs and expanded the available conservation incentives.

At the onset of the drought in 2013, the Partnership doubled its annual public education campaign to encourage residents to voluntarily reduce water consumption. The Partnership launched the "20-Gallon Challenge" campaign to increase awareness of the water supply situation and as a call to action. The campaign featured a pledge to save 20 gallons per person per day. As an incentive to pledge, entries for

monthly prize drawings for high-efficiency toilets and clothes washers, rainwater catchment and gray water systems, and custom water-wise landscape designs were provided. Pledges and contest entries were accepted from participants throughout the Russian River Watershed to encourage water users in both Upper Russian River and Lower Russian River areas to participate in the challenge.

In January 2014, in response to Governor Brown's emergency drought proclamation, the Partnership launched a regional multi-media effort throughout the North Bay region with a simple message: "There's a drought on. Turn the water off." The campaign has included: (1) outdoor water conservation tips that have been rotated in local and regional publications; and (2) advertisements on local radio stations and online media. Each advertisement spotlights a creative or humorous method for saving water. The campaign has been well received and is ongoing.

An additional effort by the Water Agency included sponsoring four drought town hall meetings in Sonoma County in April 2014 to educate the public about the drought and the need to conserve water. The meetings were held in Santa Rosa, Rohnert Park, Windsor, and Petaluma. Water resource and conservation specialists attended these meetings to discuss the drought, water supply conditions and water conservation rebate programs. In addition, officials from the County of Sonoma's Permit and Resources Management Department and Office of Emergency Services attended each meeting to provide drought information relevant to rural residents and fire prevention.

The Water Agency also sponsored ten "Drought Drive-Up" locations on April 23, 2014, in coordination with the Partnership. Over 4,000 community members drove up to the ten locations to receive free drought tool kits, which included: (1) a water efficient faucet aerator; (2) toilet dye tab test; (3) shower timer; (4) shower bucket; (5) low-flow showerhead; and (6) conservation tip card. All participants in the "Drought Drive-Up" were also entered to win a free high-efficiency toilet or high-efficiency washing machine.

The Partnership's outreach efforts have improved water-use efficiency in the region and the Water Agency remains committed to ensuring that our water supply is reliable. The Partners remain in good standing with the California Urban Water Conservation Council (CUWCC) and implement the CUWCC's Best Management Practices (BMPs) for water conservation.

To promote water savings that extend beyond the Water Agency's service area, the Water Agency has spearheaded the Sonoma-Mendocino Immediate Drought Relief Project (SMIDR), a demand reduction program that includes many entities in the Upper Russian River, an area that has lacked aggressive water conservation programs in the past, where opportunities exist to achieve significant water savings. SMIDR offers immediate drought relief and long-term water savings to the following participating agencies: 12th District Agricultural Agency (Redwood Empire Fairgrounds), Airport-Larkfield-Wikiup Sanitation Zone, Belmont Terrace Mutual Water Company, City of Cloverdale, City of Healdsburg, City of Ukiah, County of Sonoma - Department of Transportation and Public Works, City of Fort Bragg, Geyserville Sanitation Zone, Mendocino County Russian River Flood Control and Water Conservation Improvement District, Occidental County Sanitation District, Redwood Valley County Water District, Russian River County Sanitation District, private well owners within the Russian River watershed, Sea Ranch Sanitation Zone and Sweetwater Springs Water District. SMIDR has the potential to increase regional water use efficiency and drought resilience in the region for years to come and is a response to the Governor's emergency drought declaration that set a 20 percent water demand reduction goal. SMIDR will reduce demands for water from Lake Mendocino and local groundwater supplies.

The participating agencies in SMIDR have the option of offering one or both of the following water-saving programs to their customers:

1. High-Efficiency Fixture Direct-Install Program, which will retrofit up to two inefficient toilets per customer with new high-efficiency toilets. During the installation appointment, the Water Agency-hired plumber will also replace inefficient showerheads and aerators with free, water-efficient models and perform a leak check at the water meter. For commercial properties, in addition to toilets, inefficient urinals will be retrofitted with 0.125 gpf high-efficiency urinals; and
2. Cash for Grass Turf Rebate Program, which will offer a $0.50/sq. ft. rebate for converting high-water-use turf to low-water-use plant material (up to max of 500 sq. ft or $250 per customer).

The Water Agency has managed a Direct Install program in its service area for five years. The Water Agency has already established the needed program elements (agreements with local plumbers, billings procedures, etc.) that will be utilized for SMIDR.

Through SMIDR, participating agencies will be set up to transition into self-managed ongoing conservation programs. The High-Efficiency Fixture Direct-Install Program reduces base demands addressing approximately 75% of the total indoor residential water use (showers: 20%, faucets: 18%, toilets: 20%, leaks: 18%) by improving fixture efficiency and identifying leaks. The Cash for Grass program addresses 50% of the total water use by homes and directly reduces peak water demands.

On June 2, 2014, the California Department of Water Resources (DWR) released an expedited 2014 Integrated Regional Water Management Drought Grant Solicitation seeking projects that would provide immediate, measurable water savings. The Water Agency submitted a grant proposal for SMIDR, which was selected as one of eleven projects by the North Coast Resource Partnership, which submitted the Water Agency's proposal on July 21, 2014 to DWR with a recommended funding of $1.05 million. The participating agencies in SMIDR and Water Agency have committed to provide $630,000 in local matching funds, raising the possible total funding to $1.68 million. The DWR anticipates approving grant awards for this program in October 2014. If the grant is not awarded, SMIDR will still continue at a scaled back level with local funding.

On-farm conservation programs are not applicable in the Water Agency and Water Retailers service area. Thus, on-farm irrigation scheduling, tailwater recovery systems, and irrigation system improvements are not included in our water use efficiency programs. The Water Agency does not operate an irrigation district system. Canal lining, canal structure improvements, and remote measurement, monitoring and control are not applicable to our system.

On July 15, 2014, the State Board adopted Resolution No. 2014-0038, which adopted emergency regulations for statewide urban water conservation. The new regulations require almost all of the Water Agency's primary water customers to implement water shortage contingency plans to the level of mandatory restrictions on outdoor irrigation and submit monthly monitoring reports comparing monthly water production with the corresponding calendar month production from 2013.

Each of the Water Retailers have taken local action to reduce water use and comply with the State Emergency Water Conservation Regulations effective July 29, 2014. Appendix of Resolutions contains copies of formal action taken by each Water Retailer's City Councils or Board of Directors for approval of implementing the State Board's emergency regulations for urban water conservation. The following is a summary of the actions taken by each of the Water Retailers included in the Plan.

4.1 City of Cotati

Activities in response to the drought to date:

- Phase 2 of the water shortage contingency plan was adopted on August 12, 2014.

- Voluntary 20% water use resolution, February 25, 2014.
- Mandatory outdoor water use restrictions resolution, instituting Stage 2 of water conservation shortage plan.
- Direct mail out to all dedicated irrigation accounts informing them of the mandatory reductions.
- WaterSmart mailers every 2 months to all residential customers, giving them actual water use comparisons with similar households or prior year usage, and recommending water conservation measures tailored to the customers usage profile, and past conservation actions.
- Farmer's Market water conservation information and fixture giveaways.
- Increased water conservation surveys, direct install toilets, turf rebates, and washer rebates.
- City of Cotati (Cotati) staff are looking for overwatering to notify residents of water waste.
- Cotati Staff are developing a new water conservation door hanger.

The Cotati City Council authorized a project to upgrade all older meters to more accurate ultrasonic meters, and add an AMI network to collect all reads which will begin this winter. The system will enable real-time notification of Cotati and customers of customer-side leaks, notify Cotati of leaks on the distribution system, and allow for a precise accounting of unmetered water to address any systemic issues.

4.2 Forestville Water District

On August 12, 2014 Forestville Water District (FWD) adopted a Resolution enacting Phase II- Mandatory conservation. The Resolution requires mandatory conservation including the following prohibitions:

- Irrigation of outdoor landscaping that results in excess runoff.
- Washing down of sidewalks, driveways or other hardscapes.
- Operation of decorative fountains or other features that do not recirculate the water.
- Washing of vehicles without an automatic shutoff device on the hose.
- Irrigation of outdoor landscaping more than 2 times per week.

FWD has been utilizing social media to educate its customers on the conservation requirements.

4.3 City of Healdsburg

City of Healdsburg (Healdsburg) began taking actions to address the drought in June 2013 through the implementation of Stage 1 Voluntary Water Conservation Measures requesting a 10% reduction in water use. These measures were in place until January 2014 when Healdsburg moved to more aggressive Stage 2 Mandatory Water Conservation Measures, requiring 20% reduction in water use.

Outreach and education is a key component to meeting the mandatory restrictions. To ensure customers had the tools to reduce water use Healdsburg launched the Water Conservation Rebate Program in March 2014. A Graywater Conversion 101 course was offered on July 17, 2014 for residents to learn how to safely use graywater for irrigation. Outreach continues through bill insert notifications, and education has been increased through enforcement actions, such as code enforcement letters sent to customers violating stage 2 requirements. Healdsburg has launched of the Direct-Install Toilet Replacement Program and the Turf Rebate Program through SMIDR.

In April 2014, Healdsburg received approval to utilize recycled water for construction purposes and on May 5, 2014 Healdsburg was able to begin using recycled water for agricultural irrigation.

Below are the conservation measures that are currently in place within Healdsburg service area.

- Apply outdoor irrigation water only during the evening and early morning hours to reduce evaporation losses (8:00 pm to 7:00 am).
- For property with an even numbered address, irrigate outdoors only on even days of the month.
- For property with an odd numbered address, irrigate outdoors only on odd days of the month.
- Stop the washing of sidewalks, walkways, driveways, parking lots and other hard-surfaced areas by direct hosing, except as may be necessary to prevent or eliminate materials that present a danger to public health and safety.
- Correct and repair the escape of water through breaks or leaks within the customer's plumbing or private distribution system. It shall be presumed that a period of seventy-two (72) hours after the customer discovers such a break or leak, or receives notice from Healdsburg, is a reasonable time within which to correct such break or leak or, at a minimum, to stop the flow of water from such break or leak.
- For irrigation valves controlling water applied to lawns, vary the minutes of run-time consistent with fluctuations in weather. Reduce minutes of run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed.
- Utilize water conservation incentives, as available, to replace inefficient plumbing fixtures and appliances with water efficient models.
- Utilize City information regarding using water efficiently, reading water meters, repairing ordinary leaks, and water efficient landscapes.
- Stop noncommercial washing of privately owned motor vehicles, trailers and/or boats except when utilizing a bucket and a hose equipped with an automatic shut-off.
- Prohibited: Any use of water from a fire hydrant, except for fighting fires, line flushing required by regulatory agencies or essential construction needs.
- Healdsburg will not accept or approve building permits for new swimming pools unless the owner agrees to obtain pool water from a source other than Healdsburg's potable water system.
- Prohibited: Use of potable water for dust control, compaction, and other construction purposes, except recycled water as allowed by the Regional Water Quality Control Board, for dust control and compaction at construction sites.
- Water use by a vehicle washing facility is limited to 80% of the water used by the facility from the corresponding billing period in the prior year, unless such washing facility treats and recycles wash water in which case this provision shall not apply.
- Water use for any non-residential use is limited to 80% of the water used by the customer during the corresponding billing period in the prior year.

4.4 California-American Water – Larkfield

California-American Water (Cal-Am) implemented its Rule 14.1 voluntary water conservation plan in March 2014. Cal-Am has focused on education over enforcement, visiting customers engaged in water

wasting activities and helping them prevent wasteful use. Cal-Am has also continued to promote conservation with four direct mail pieces, bill text messages and customer outreach at five local events and meetings in and near the service area this year.

California-American Water offers Water Use Surveys, free devices including showerheads and hose nozzles, and rebates for toilets, clothes washers, turf removal, irrigation equipment and more.

4.5 Marin Municipal Water District

Marin Municipal Water District (MMWD) serves a population of approximately 185,000 located within the unincorporated areas of Marin County and the cities of San Rafael, Mill Valley, Fairfax, San Anselmo, Ross, Larkspur, Corte Madera, Tiburon, Belvedere and Sausalito. MMWD's water supply sources are comprised of a reservoir system, imported water from the Sonoma County Water Agency and recycled water.

In November 2013, MMWD began making preparations should the dry conditions extend into a third consecutive year. The following timeline describes actions taken by MMWD:

- December 17, 2013: MMWD Board of Directors adopted Resolution No. 8244 directing the General Manager to take specific actions in response to the dry weather conditions, including jump starting our conservation rebate program, which had been temporarily suspended during the economic challenges of the prior years (all of MMWD's other water conservation programs continued unabated). The Board also formed a Drought Resiliency Task Force.
- January 11, 2014: Calendar year 2013 rainfall totaled 11 inches, which was the lowest calendar year rainfall in MMWD's recorded history. As the dry conditions persisted into January 2014, MMWD began utilizing Phoenix Lake, one of our reserve reservoirs, which is only used during periods of very dry weather. MMWD also suspended its water quality flushing program to conserve water, and boosted resources dedicated to our leak repair program. On January 11th, MMWD published an opinion/editorial in the Marin IJ about the drought and urged our customers to save water.
- January 15, 2014: Issued news release regarding District's decision to begin pumping water from Phoenix Lake.
- January 21, 2014: MMWD's Board of Directors adopted Resolution No. 8251, which called for our customers to voluntarily reduce water usage by 25 percent and activated Phase 1 of MMWD's water shortage contingency plan.
- January 22, 2014: issued news release regarding Board's call for 25 percent voluntary reduction in water use.
- January 26, 2014: MMWD began running weekly ads in the Marin IJ updating our customers on reservoir levels and the drought.
- January 28, 2014: MMWD's General Manager led a presentation to the Marin County Board of Supervisors on the drought and water supply in Marin County.

MMWD's water shortage contingency plan calls for a 25 percent mandatory reduction in water usage if reservoir storage is projected to be below 40,000 acre-feet on April 1st. District modeling indicated this level could be reached by mid-March if the lack of rainfall continued. MMWD immediately began preparing to implement a 25 percent mandatory rationing program. Other actions conducted by MMWD at this time included:

- February 5, 2014: drought presentation to Fairfax City Council.
- February 7, 2014: drought meeting with Congressman Jared Huffman.
- February 10, 2014: drought presentation to San Geronimo Valley Planning Group.
- February 11, 2014: drought presentation to San Anselmo Town Council.
- February 12, 2014: mailed 90,000+ copies of Drought Watch newsletter to District customers and property owners.
- February 13, 2014: drought meeting with Assembly member Marc Levine.
- February 13, 2014: drought presentation to Ross Town Council.
- February 14, 2014: participated in ACWA's statewide Drought Action Group meeting.
- February, 2014: started up recycled water system (system usually doesn't start-up until April 1 each year).
- February, 2014: began making preparations to utilize Soulajule Reservoir, another of MMWD's reserve reservoirs, which is only used during extremely dry conditions.

A five day storm in early February brought nearly 15-inches of rain to MMWD's Lagunitas Creek watershed. Total storage on February 17th was over 53,000 acre-feet. MMWD was no longer in danger of being below 40,000 acre-feet of total storage on April 1, which would have triggered a mandatory 25 percent reduction in water usage by customers.

Even though the February storms substantially improved MMWD's water storage conditions, MMWD storage levels were still below normal. Therefore MMWD continued to urge customers to reduce water usage through newsletters, media ads, MMWD's web page and at community meetings.

- February 21, 2014: conducted meeting of MMWD's Drought Resiliency Task Force.
- March 7, 2014: drought presentation to Lagunitas Creek Watershed Technical Advisory Committee.
- March 13, 2014: drought presentation at Impact Marin Conference on Water Supply and the Drought.
- March 13, 2014: drought presentation to San Francisco Planning and Urban Renewal Association (SPUR).
- March 19, 2014: drought presentation to Larkspur City Council.
- March 22, 2014: published opinion/editorial on the drought in the Marin IJ.
- March 26, 2014: issued news release regarding MMWD providing "Drinking Water Upon Request" table tents for restaurants.
- April 3, 2014: drought presentation to Oak Manor Homeowner's Association.
- April 10, 2014: conducted meeting of MMWD's Drought Resiliency Task Force.
- April 16, 2014: drought presentation to Tiburon Town Council.
- May 2, 2014: drought presentation at Marin Economic Forum.
- May 22, 2104: District launched "Water Saving Heroes" conservation recognition program.

- July 9, 2014: District launched a new conservation pilot program in partnership with WaterSmart Software involving 5,000 District customers.

In addition to these actions, MMWD has been issuing drought updates on a monthly basis through e-newsletter and bill inserts, providing water saving tips through blog posts, and placing ads through social media such as Facebook and Twitter. MMWD has also been actively participating in the regional Sonoma-Marin Saving Water Partnership.

4.6 North Marin Water District

On April 1, 2014, North Marin Water District (NMWD) declared a water shortage emergency, enacted Stage 1 of the Novato Water Shortage Contingency Plan and adopted Emergency Water Conservation Ordinance No. 28 which prohibits waste and non-essential use of water and establishes a community wide 20% reduction target for water use compared to the corresponding billing period in 2013. On August 5, 2014, NMWD adopted Resolution 14-18 in response to the State Board's Emergency Water Conservation Regulations to enact mandatory restrictions on outdoor irrigation pursuant to Stage 2 of the Novato Water Shortage Contingency Plan. Effective August 6th, Resolution 14-18 prohibits outdoor spray irrigation (for both residential and non-residential customers) except if the customer maintains a 20% reduction when compared to the corresponding billing period in 2013, and mandates night-time watering (7pm to 9am).

4.7 City of Petaluma

On September 8, 2014 the City of Petaluma (Petaluma) adopted a resolution that contains the following mandatory restrictions to outdoor irrigation and potable water use:

1. No irrigation of ornamental landscapes or turf with potable water between the hours of 8:00 a.m. and 7:00 p.m.
2. Hose-end shut off nozzles required on all garden and utility hoses to include washing cars, boats, and trailers.
3. No application of potable water for washing down pavement by direct hosing without a shutoff nozzle, except for health and safety including sanitation. Use of low flow pressure washers is encouraged.
4. No runoff or overspray caused by outdoor irrigation.
5. No water used for non-recycling water features such as fountains.
6. Irrigation accounts cannot exceed allocated water budgets by more than 20%.

To remain consistent with the action taken by the SWRCB, the proposed resolution to re-implement Stage 1 of Petaluma's Water Shortage Contingency Plan would end (i.e. "sunset") on April 25, 2015 unless Emergency Regulations are extended or ended earlier by the SWRCB.

Petaluma staff has conducted the following outreach:

1. Direct Mailings: three post cards sent to all customers beginning March 2014. Additional post cards will be sent regularly throughout the drought period.
2. Message at this year's Sonoma-Marin fair display focused on the drought.
3. Monthly Argus Courier newspaper ads began running in March 2014 and have continued.
4. Argus Courier newspaper ads increased to weekly as of September 2014.

5. "Before the Movie" ads began running March 2014 and will continue.
6. Four public workshops have been conducted since March 2014 – each workshop attendee was provided drought information and given ways to conserve water – approximately 230 attendees attended the workshops.
7. Social media posts have included drought related messages – this effort will increase to every Thursday effective immediately.
8. Signs at Petaluma parks being installed say "Please Tolerate our Thirsty Lawns During This Period of Drought".
9. A drought banner will be displayed at D St., Kentucky St. and McDowell Shopping Center when space is available.

Petaluma staff will exercise progressive enforcement of the mandatory irrigation restriction in accordance with the 2008 resolution addressing administrative citation for violation of the PMC; and PMC 15.16.100, Enforcement and Fees, as follows:

1. Personal contact: Education and technical support provided. If no one is home, a door hanger indicating the nature of the violation is provided. Customer is given 72 hours or less as appropriate to mitigate violation.
2. If personal contact is not successful: Provide written notice of the violation including date when correction must be complete. Copy of notice is sent by certified mail.
3. First violation under administrative penalty resolution: If correction not made in accordance with written notice, apply fine of $100.
4. Second violation within 36 months under administrative penalty resolution: If correction not made or recurrence of violation a fine of $500.
5. Third violation within 36 months under administrative penalty resolution: Fine of $1,000.
6. In addition to issuing a notice of violations, if appropriate: Shut off water service until verification of correction is made. Cost of shut off and turn on is an additional $60.

4.8 City of Rohnert Park

On February 11, 2014, the City of Rohnert Park (Rohnert Park) adopted a resolution calling for voluntary 20% reduction in water use. On August 26, 2014, Rohnert Park adopted an interim urgency ordinance that:

1. Imposed prohibitions against washing hardscapes; washing cars without a shutoff nozzle; irrigation runoff; and non-recycling decorative water features.
2. Implemented the provisions of Stage 2 of our Water Shortage Emergency Plan that make outdoor irrigation restrictions mandatory including:
    i. Restricting residential irrigation use to between the hours of 6 p.m. and 8 a.m.
    ii. Restricting potable water use through a dedicated irrigation meter to the hours of 6 p.m. and 8 a.m. and to an amount no greater than eighty percent (80%) of historical net evapotranspiration-based demand for the square footage of the irrigated area.
    iii. Requiring customer inspections of all irrigation systems, repairing of leaks, and adjustment of spray heads to provide optimum coverage and eliminate avoidable over-spray.

iv. Requiring that when irrigation control values are used, sprinkler system run times vary consistent with fluctuations in weather.
v. Requiring reduced run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed.

3. Encouraged ongoing voluntary efforts to Rohnert Park's conservation incentive, rebate and giveaway programs and Rohnert Park's information regarding water efficient landscapes.

To help with implementing the ordinance Rohnert Park also undertook some work on our website to make conservation information more easily accessible and the Partnership's "There's A Drought On. Turn Your Water Off." signs were placed around town. At the direction of the Rohnert Park Water Issues Subcommittee, staff is currently working on a proposal for a cash-for-grass program for consideration by City Council.

4.9 City of Santa Rosa

In February 2014, the City of Santa Rosa (Santa Rosa) adopted a resolution asking for a voluntary 20% community-wide reduction in water use by focusing on eliminating water waste and improving water use efficiency. To inform water utility customers, Santa Rosa sent a letter to each of our approximately 52,000 accounts regarding the resolution and providing information on the requirements should Santa Rosa need to adopt a stage of the Urban Water Shortage Contingency Plan (Shortage Plan) in future months. Santa Rosa participated in the regional "There's A Drought On. Turn Your Water Off." media campaign, sent out utility bill inserts, provided information through its website and social media, provided weekly drought updates to local officials and to the public at City Council meetings, and provided education to all City employees. In addition, Santa Rosa provided information and giveaways at community events, including Earth Day, downtown markets, the Drought Drive-Up and held a Drought Town Hall meeting. As a result of the voluntary conservation efforts, water demand during the months of March - July was reduced by 16% compared to same time last year.

On August 5, 2014, in response to State Emergency Drought Regulations, Santa Rosa of Santa Rosa adopted Stage 1 – Mandatory of the Shortage Plan. Stage 1 – Mandatory requires the following:

- 20% community-wide reduction in water use;
- Compliance with Santa Rosa's water waste ordinance which prohibits runoff from irrigated areas and prohibits property side breaks and leaks;
- Irrigation can only occur between the hours of 8 PM through 6 AM;
- Prohibits washing down hardscapes unless required for public health and safety;
- Prohibits using potable water for street washing;
- Requires shut-off hose nozzles for all garden and utility hoses; and
- Requires "Water-on-request" at all restaurants.

Santa Rosa has implemented weekly water watch patrols and also provides options for the community to report water waste and Stage 1 – Mandatory violations through its website, hotline and MySantaRosa app. Santa Rosa has hired additional staff to assist with implementing the water waste program. Water Use Efficiency staff and City field crews have been trained and can door tag any home or business for a violation. Santa Rosa has a progressive enforcement program that starts with information and education and can ultimately lead to turning off the customer's water service.

Santa Rosa is providing information to the community through utility bill inserts, utility bill face messages, utility bill envelopes, social media, dedicated website, video on local cable channels, radio and newspaper ads. Weekly drought updates to our local officials and to the public at City Council meetings and employee education is on-going. Santa Rosa provided information and giveaways at the Sonoma County Fair and held a DIY Outdoor Drought Solutions event providing information and hands-on learning opportunities for reducing outdoor water use.

In addition to the numerous water use efficiency rebate and incentive programs, Santa Rosa is launching a new Water Smart Campaign, focusing on reducing outdoor water use. The Water Smart Campaign includes yard signs and weekly watering recommendations. Santa Rosa has updated its rebate amount for turf removal from $0.50 per square foot to $1.00 per square foot, is introducing a new recirculating hot water pump rebate and launching a new high efficiency fixture direct install program. City staff anticipates that the renewed outreach and additional programs will achieve a 20% reduction in water use compared to same time last year. Water demand during August 2014 was reduced by 17% compared to August 2013.

4.10 City of Sonoma

The City of Sonoma (Sonoma) has taken the following in addition to the Partnership activities listed above:

1. Implemented Stage 2 Mandatory Conservation on 8/18/14, limiting outdoor turf irrigation to 2 days per week, and complying with all other State Emergency Conservation Regulations.
2. Suspended the use of hydrant meters on 2/3/14 to draw water from Sonoma fire hydrants, except for fire emergency use.
3. Deferred hydrant flushing maintenance and requests for hydrant flow testing.
4. Doubled efforts and expenditures on leak detection, including capital projects to replace old polybutylene water service lines.
5. Implemented Sonoma-specific “Before the Movie” advertising to promote water conservation rebates.
6. Switched to monthly water billing to keep Sonoma customers better apprised of water usage and potential private plumbing leaks.
7. Distributed “ask for water” placards in some restaurants.
8. Mailed letters to all Landscape Contractors working in Sonoma, advising them of Stage 2 water restrictions.
9. Provided a 1-page insert into the local Index-Tribune newspaper listing Stage 2 water restrictions.

4.11 Town of Windsor Public Works

On February 19, 2014 the Windsor Town Council declared a Stage 1 Water Shortage Emergency, asking for a voluntary 20% reduction in 2014 water use as compared to 2013. Subsequently, on August 6, 2014, Council declared a Stage 2 Water Shortage Emergency, making the 20% reduction mandatory. Below is a list of the measures and prohibitions being implemented to meet the reduction goal:

Measures:

1. Inspect all irrigation systems, repair leaks, and adjust spray heads to provide optimum coverage and eliminate avoidable over-spray.
2. For irrigation valves controlling water applied to turf grass, vary the minutes of run-time consistent with fluctuations in weather.
3. Reduce minutes of run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed.
4. Become informed about and strictly adhere to the Town's Water Waste Prohibitions listed in Section 12-3-825 of the Windsor Municipal Code.
5. Utilize water conservation incentive, rebate and giveaway programs to replace water guzzling plumbing fixtures and appliances with water efficient models.
6. Take advantage of the free information available from the Town on how to use water efficiently, read a water meter, repair ordinary leaks, and how to apply water efficiently to the landscape.

Prohibitions:

1. Washing of sidewalks, walkways, driveways, parking lots and other hard-surfaced areas by direct hosing.
2. Escape of water through breaks or leaks within the customer's plumbing or private distribution system for any substantial period of time within which such break or leak should reasonably have been discovered and corrected. It shall be presumed that a period of seventy two (72) hours after the customer discovers such a break or leak or receives notice from the Town, is a reasonable time within which to correct such break or leak or, as a minimum, to stop the flow of water from such break or leak.
3. Irrigation in a manner or to an extent which allows excessive runoff of water or unreasonable over-spray of the areas being watered. Every customer is deemed to have his or her water system under control at all times, to know the manner and extent of his or her water use and any run off, and to employ available alternatives to apply irrigation water in a reasonably efficient manner.
4. Water for non-recycling decorative water fountains.
5. Water for single pass evaporative cooling systems for air conditioning in all connections installed after July 18, 2007 unless required for health or safety reasons.
6. Water for new non-recirculating conveyor car wash systems.
7. Water for new non-recirculating industrial clothes wash systems.
8. Initial filling of any swimming pool for which approval of a construction permit issued by the Town was made after the date on which the water shortage emergency condition was declared to exist, and refilling a swimming pool that was drained after the emergency condition has been declared.
9. Non-commercial washing of motor vehicles, trailers and boats except from a bucket with use of a hose equipped with a shutoff nozzle for a quick rinse.
10. Watering of new turf grass or replacement turf grass.

11. Service of drinking water at any restaurant, cafe, cafeteria or other public place where food is sold, served or offered for sale, unless expressly requested by a patron.

Use of Sprinklers is Conditional:

1. Automated sprinkler irrigation must be properly controlled and performed in a non-wasteful and efficient manner between the nighttime hours of 7:00 p.m. and 9:00 a.m. of the next day.
2. The amount of water normally required to maintain a healthy landscape shall be reduced by 20 percent, based on landscape size, plant water requirement, and current weather as specified in section 12-3-835 of the Windsor Municipal Code.

4.12 Valley of the Moon Water District

Valley of the Moon Water District has a long standing commitment to conservation and is evidenced by the fact that in 2013 VOMWD was already meeting its 20% by 2020 goal (SBx7-7). However, as the third year of the drought gripped the State and its water resources VOMWD saw the need to redouble its efforts. On March 4, 2014 VOMWD adopted a Resolution supporting the Governor's voluntary call for 20% conservation statewide. At that time VOMWD took the following actions:

- Created a Facebook page for drought updates for our customers.
- Ran bill face messages regarding drought and water supply conditions.
- Participated in a Sonoma Valley water forum.
- Created speaking engagements with Kiwanis club and a monthly spot on a Sonoma radio station.
- Developed and prop 218 noticed drought water shortage charges.
- Updated Water Shortage Contingency Plan stages and allocations.
- Developed list of possible local emergency supply options.
- Field crews increased hanging water waste tags.
- Deferred full distribution system flushing, only flushing critical areas or as needed.
- Office staff calls all customers that have high bills.
- Created a SMART Controller rebate program.
- Initiated AMI meter project to allow customers to have access to daily water use records.
- Performed ultra-sonic leak detection on entire distribution system.

Additionally on August 5, 2014, in response to the State Water Resources Control Board's Emergency Conservation Regulations, VOMWD adopted a Resolution declaring Stage 2 Mandatory Conservation at a 20% level. This Resolution resulted in the following:

a) Water on request at restaurants.

b) No washing of hardscapes.

c) No runoff.

d) Known leaks must be fixed.

e) Hose-end nozzle required.

f) Recycled water must be used for construction dust control.

g) Irrigation is limited to the hours of 8pm to 6am.

To further support the 20% goal VOMWD has performed the following since the August Resolution declaring a Stage 2 shortage:

- Delivered "water on request" cards to all restaurants.
- Initiated Water Shortage Charges (+10% on tier 2, +25% on tier 3).
- Trained staff on indoor and outdoor water conservation.

5 Additional Actions (Plan Component #3)

Each month the State Board will receive a status update detailing the amount of water demand reduction relative to baseline water demand that has been achieved by the Water Retailers. The Water Agency and the Water Retailers will continue to actively monitor the water demand reductions to determine what, if any, additional actions are needed. Below are the potential actions that will be considered by the Water Retailers if it is deemed that additional actions are necessary.

5.1 City of Cotati

If Cotati doesn't achieve 20% conservation, Cotati can implement specific measures, including the advanced metering project, increase public information outreach, and ultimately implement Stage 3 of the water conservation contingency plan.

5.2 Forestville County Water District

The FWD currently has an ordinance that covers water shortage emergencies. The Resolution that was adopted at last month's Board meeting modified phase II of that ordinance to align with the State's recommendations. If the drought continues, there are several other prohibitions that can be implemented both from phase II and phase III of this ordinance. The following is a partial list of the remaining prohibitions: Phase II: Hydrant use restricted to firefighting purposes only, no potable water irrigation for public or private areas, no washing of cars, trucks, airplanes or other vehicles, no filling or refilling of pools. Phase III: Daily usage allotment of 50 gallons per day per person, Non-residential users restricted to 50% of usage of historical averages, no irrigation of any kind (includes hand watering), no new service connections.

5.3 City of Healdsburg

If additional measure were required Healdsburg would consider Stage 3 Mandatory Water Conservation Measures (40% reduction). Stage 3 would include the following prohibitions, in addition to the currently adopted Stage 1 and Stage 2 restrictions:

1. Prohibited: Irrigation of any lawn (residential, commercial, or industrial) with water at any time of the day or night.
2. Prohibited: Planting of new landscaping except for designated drought resistant landscaping prescribed by the City Manager or designated representative.

3. Prohibited: All day and night-time irrigation sprinkling unless only a hand held nozzle is used. This prohibition shall not apply to drip irrigation systems established for perennial plants and trees using manual or automatic time-controlled water application.
4. Prohibited: Planting of new annual plants, vegetables, flowers, or vines.

5.4 California-American Water - Larkfield

California-American Water is implementing its schedule 14.1 stage 1 mandatory rationing requiring a 20 percent reduction in water use and hiring additional conservation staff. Additional stages of mandatory rationing may be implemented with CPUC approval, if necessary.

5.5 Marin Municipal Water District

MMWD staff will continue to monitor water use and may take further action if the goal is not met.

5.6 North Marin Water District

If the goal is not met, NMWD may enact further mandatory requirements as specified in the Water Shortage Contingency Plan.

5.7 City of Petaluma

If the goal is not met, Petaluma may enact further mandatory requirements as specified in the Water Shortage Contingency Plan.

5.8 City of Rohnert Park

If additional conservation is needed the City will consider:

1. Implementation of Stage 2 of the Water Shortage Emergency Plan which goes beyond outdoor irrigation restrictions.
2. Implement Stages 3 and 4 of the Water Shortage Emergency Plan.

5.9 City of Santa Rosa

Santa Rosa staff will continue to monitor water use and will increase outreach and water watch patrols as needed should the 20% reduction in water use not be attained.

5.10 City of Sonoma

If additional conservation is needed Sonoma will consider:

1. Implementing daily water patrols to stringently enforce outdoor irrigation restrictions and identify leaks.
2. Dedicating staff time to investigate high use water accounts.
3. Imposing administrative fines and flow restriction devices on customers with repeat violations.
4. Imposing conservation rate tiers for commercial and multi-family water accounts.
5. Steepening the conservation rate tiers for single family residential water accounts.

5.11 Town of Windsor Public Works

Windsor staff will continue to monitor water use carefully. In the event further action is necessary, additional irrigation restrictions or other water conservation measures, including those contained in

Windsor's adopted Water Shortage Contingency Plan, may be implemented by resolution of Town Council.

5.12 Valley of the Moon Water District

Should water supply conditions change then VOMWD would rely on the adopted Water Shortage Contingency Plan.

6 Water Agency Authority (Plan Components #4 & #5)

The Water Agency's water supply agreements provide a limited authority to impose water demand reduction actions. The Water Agency's water supply agreements require that any water conservation terms imposed on the Water Agency to be passed through to the water retailers, but the Water Agency does not have the ability to impose conservation measures directly on end-use customers. The following Water Retailers have water supply agreements with the Water Agency and are subject to any regulations imposed on the Water Agency by the State Board under the Water Agency's water right permits:

1. City of Cotati
2. Forestville Water District
3. City of Healdsburg
4. California-American Water - Larkfield
5. North Marin Water District
6. City of Petaluma
7. City of Rohnert Park
8. City of Santa Rosa
9. City of Sonoma
10. Town of Windsor Public Works
11. Valley of the Moon Water District

MMWD is not contractually required to automatically implement conservation measures imposed on the Water Agency by the State Board. However, MMWD is required to follow all State laws relating to conservation, and is subject to curtailment provisions in its water supply agreement with the Water Agency during times of shortage.

7 Schedule (Plan Component #6)

Sonoma-Mendocino Immediate Drought Relief Project Schedule

Turf Rebate	**Date Complete**
Develop program criteria	7/3/14
Develop training for project proponents 7/3	7/3/14
Develop tracking/monitoring database	7/10/14
Train project proponents for project implementation	7/23/14
Project proponents to begin outreach to residential/commercial customers	7/24/14
Develop outreach materials	8/1/14
Project Start: Notify secondary project proponents of project start date	8/1/14

High Efficiency Fixture Direct Installation	**Date Complete**
Develop program criteria	7/10/14
Solicit and contract plumbers to conduct installation	7/17/14 (ongoing)
Develop tracking/monitoring database	7/24/14
Develop website for eligibility verification and participant registration	8/29/14
Project proponents to begin outreach to residential/commercial customers	9/2/14
Online registration opens	9/2/14
Train plumbers on program implementation and invoicing	9/30/14 (ongoing)
Installations begin	10/15/14
Project end date	7/31/16

Attachment A: August Status Update

1 Introduction

Provision 17 of the Order directs the Water Agency as follows:

> "SCWA shall submit to the Deputy Director for Water Rights a written report within 15 days of the end of each month (monthly status update) that provides a summary of compliance with this term. The monthly status update shall, at a minimum, include a description of SCWA's actions to date to comply with the requirements of this term and the results of such actions, including but not limited to the amount of water demand reduction relative to baseline water demand. The data submitted for the amount of water demand reduction shall include both monthly and aggregate annual to date information and shall be compared to baseline water demand. When the monthly status update reflects that SCWA is not achieving the minimum water demand reduction of this term, SCWA shall also include additional actions SCWA has adopted and/or implemented to meet the demand reduction and identify the date when such additional actions will be fully implemented as part of the monthly status update."

2 Water Demand Reduction

Overall water demand of the Water Retailers is down for the month of August compared to the baseline. The table below provides a comparison of the August baseline and the August 2014 production.

Water Retailer	GPCD Aug	GPCD Benchmark	GPCD Relative to Benchmark
Cotati	112	224	-50%
Marin Municipal	144	197	-27%
North Marin	158	259	-39%
Petaluma	151	259	-42%
Rohnert Park	111	201	-45%
Santa Rosa	110	205	-46%
Sonoma	177	305	-42%
Valley of the Moon	129	206	-38%
Windsor	139	244	-43%
Forestville	166	292	-43%
Healdsburg	192	300	-36%
Cal-Am Larkfield	145	281	-48%
Regional Average	**145**	**248**	**-42%**

3 Actions

The Water Agency and the Water Retailers are committed to ensuring that current water supply conditions are a top priority in the community. At a minimum, the Water Retailers provide a Water Supply Condition Update monthly at the respective governing board meetings. Below are some of the actions taken locally in August 2014.

3.1 Water Agency

Each month the Water Agency contractors meet as a Technical Advisory Committee to discuss water supply issues and provide project updates. On August 4 the TAC met and discussed the following item "Report on SWRCB Emergency Regulation for Statewide Urban Water Conservation/Sonoma Marin Saving Water Partnership/Water Contractor Water Conservation Activity."

On August 18, the Water Agency hosted a meeting in Cloverdale, California with upper

Russian River municipal water managers to discuss Lake Mendocino water supply, implementation of water conservation programs and ongoing coordination. Attendees included representatives from Cloverdale, Healdsburg and various other upper river water managers.

The Water Agency Board of Directors approved the Sonoma-Mendocino Immediate Drought Relief Project on August 19, 2014.

The Partnership's "There's a Drought On. Turn the Water Off." campaign continued to have a significant presence in the community. Below is a summary of the outreach conducted for the month of August, Appendix A-1 contains the entire list.

- 29 English print ads in 18 local publications
- 3 Spanish print ads in 3 local publications
- (63) 60 second commercials played on 5 local English radio stations
- (47) 60 second commercials played on 3 local Spanish radio stations
- 3 radio English billboards
- 48 English radio web ads
- 3 radio Spanish billboards
- (5) 22"x 28" DIY Outdoor Drought Solutions event signs
- DIY Outdoor Drought Solutions event space

3.2 City of Cotati

On August 12, 2014, Cotati adopted Phase 2 of the water shortage contingency plan.

3.3 Forestville Water District

On August 12, 2014 FWD adopted a Resolution enacting Phase II- Mandatory conservation.

3.4 Marin Municipal Water District

August 19, 2014: MMWD Board of Directors adopted Ordinance No. 427 amending MMWD's water waste prohibition code pursuant to State Water Code Section 375. This action added further mandatory restrictions to MMWD's water waste prohibition code, including prohibiting the following actions: landscape irrigation between 9:00 am and 7:00 pm and the use of a garden hose without a shutoff

nozzle. The other requirements included in the State's action were already included in MMWD's water waste prohibition code.

3.5 North Marin Water District

Effective August 6, 2014, NMWD prohibited outdoor spray irrigation (for both residential and non-residential customers) except if the customer maintains a 20% reduction when compared to the corresponding billing period in 2013, and mandates night-time watering (7pm to 9am).

3.6 City of Rohnert Park

On August 26, 2014, Rohnert Park adopted an interim urgency ordinance that: 1)Imposed prohibitions against washing hardscapes; washing cars without a shutoff nozzle; irrigation runoff; and non-recycling decorative water features and 2) Implemented the provisions of Stage 2 of Rohnert Park's Water Shortage Emergency Plan that makes outdoor irrigation restrictions mandatory.

3.7 City of Santa Rosa

On August 5, 2014, in response to State Emergency Drought Regulations, Santa Rosa adopted Stage 1 – Mandatory of its Shortage Plan. On August 23, 2014 Santa Rosa, along with the Water Agency and the Partnership, hosted a free DIY Outdoor Drought Solutions event. The goal of the event was to give residents a range of interactive, hands-on activities that demonstrate the skills and build confidence to implement drought-busting solutions to help gardens not just survive the dry months, but actually thrive. The event was attended by over 800 residents who engaged in activities including: sheet mulching, programming smart controllers, converting spray to drip irrigation, choosing drought-tolerant and native plants, installing a graywater system, harvesting rainwater, and planting a water-wise garden.

3.8 City of Sonoma

Sonoma implemented Stage 2 Mandatory Conservation on August 18, 2014, limiting outdoor turf irrigation to 2 days per week along with all the other requirements as described in the state Emergency regulations.

3.9 Town of Windsor Public Works

On August 6, 2014, Windsor's Town Council declared a Stage 2 Water Shortage Emergency, making the 20 percent reduction mandatory. Windsor's declaration and Resolution also contains all the requirements, as described in the state Emergency regulations, with respect to prohibiting outdoor water waste.

3.10 Valley of the Moon Water District

On August 5, 2014, VOMWD adopted a Resolution declaring Stage 2 Mandatory Conservation at a 20% level. This Resolution resulted in specific actions to ensure water is used efficiently. To further support the 20% goal VOMWD has performed the following since the August Resolution declaring a Stage 2 shortage:

- Delivered water on request cards to all restaurants.
- Initiated Water Shortage Charges (+10% on tier 2, +25% on tier 3).
- Trained staff on indoor and outdoor water conservation.

Appendix A-1

English Print

Press Democrat – (6) print ads and 200,000 impressions on pressdemocrat.com

Sonoma IT – 2 ads

Argus – 2 ads

Farm Bureau News

Marin IJ

Novato Advance

San Rafael News Pointer

Ross Valley Reporter

Twin Cities Times

Mill Valley Herald

Sausalito Marin Scope

Healdsburg Tribune – 2 ads

Sonoma West - 2 ads

The Windsor Times - 2 ads

Ukiah Daily Journal - 2 ads

Sonoma County Gazette

Sonoma Sun

Russian River Times

Spanish Print

Al Punto - Ukiah

El Superior – Sonoma County

Impulso – Sonoma County

English Radio

KZST – 1 week of (17) 60 second commercials

Krush – 2 week of (10) 60 second commercials and 3 billboards

Mix – 1 week of (12) 60 second ads and (16) web ads

KSRO – 1 week of (12) 60 second ads and (16) web ads

HOT – 1 week of (12) 60 second ads and (16) web ads

Spanish Radio

La Mejor – 2 weeks 0f (14) 60 second commercials

Radio Lazer – 1 week of (23) 60 second commercials

Exitos – 2 weeks of (10) 60 second commercials and 3 billboards

Events

DIY event space and (5) 22x28” signs

Appendix of Resolutions

RESOLUTION NO. 2014-062

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF COTATI INSTITUTING STAGE TWO OF THE COTATI WATER SHORTAGE CONTINGENCY PLAN AND OUTDOOR IRRIGATION RESTRICTIONS IN COMPLIANCE WITH THE STATE OF CALIFORNIA'S EMERGENCY DROUGHT REGULATIONS

WHEREAS, the Restructured Agreement for Water Supply (RA), executed on June 23, 2006, by and between the Sonoma County Water Agency (SCWA), the Cities of Cotati, Petaluma, Rohnert Park, Santa Rosa, Sonoma and Forestville, the North Marin and Valley of the Moon Water Districts and the Town of Windsor, collectively known as the Water Contractors, creates the Water Advisory Committee (WAC) and Technical Advisory Committee (TAC); and

WHEREAS, the City of Cotati along with SCWA, Marin Municipal Water District, and the other Water Contractors are members of the Sonoma-Marin Saving Water Partnership (Partnership), which have joined together to provide a regional approach to water use efficiency; and

WHEREAS, the Partnership members have embarked on a regional water use efficiency media campaign titled: "There's a Drought on. Turn the Water Off" designed to increase awareness and reduce water use; and

WHEREAS, the City of Cotati provides a comprehensive water efficiency program to assist its customers in reducing their water use and water bills; and

WHEREAS, the historical dry conditions have resulted in historically low levels in Lake Sonoma and the second lowest level on record for Lake Mendocino; and

WHEREAS, on February 25, 2014 the City adopted a call for 20% voluntary water conservation in response to the Governor's drought declaration; and

WHEREAS, on July 15, 2014, the State adopted emergency regulations requiring mandatory reductions in water use statewide.

WHEREAS, the City has a Water Shortage Contingency Plan, codified in section 13.30.070 of the Cotati Municipal Code.

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Cotati hereby:

1. Institutes mandatory Stage 2 Water Shortage Contingency Plan as modified herein, to focus on reducing outdoor water usage, including:
    a. Apply irrigation water only between 7 pm and 7 am to reduce evaporation losses; and
    b. Inspect all irrigation systems, repair leaks, and adjust spray heads to provide optimum coverage and eliminate avoidable over-spray; and
    c. Vary the minutes of run-time consistent with fluctuations in weather and landscape requirements; and

d. Adjust each irrigation cycle length so that water does not run off to gutters and ditches before the irrigation cycle is completed; and
e. Any lawn, garden, landscaped area, tree, shrub or other plant must be irrigated with a handheld hose with an automatic shut-off nozzle, water container or drip irrigation system; and
f. Overhead (spray) irrigation can only be used if water use is reduced by 20%, on an overall average, from the same billing period in 2013; and
g. Elminate non-essential uses of water, including the following:
    i. Refilling or initial filling of a swimming pool, and
    ii. Noncommercial washing of privately owned motor vehicles, trailers and boats except from a bucket and a hose equipped with a shutoff nozzle may be used to rinse the vehicle, and
    iii. Any use of water from a fire hydrant except for fighting fires or essential construction needs, and
    iv. Use of potable water for dust control at construction sites;

2. Encourages customers to participate in free home water surveys to assist with proper set up and timing of irrigation systems.
3. Determines that at this time, the preferred approach is to educate customers and use existing outreach mechanisms and ordinances to reduce water demand, rather than using the fining authority promulgated under the State Emergency Regulations.

IT IS HEREBY CERTIFIED that the foregoing resolution was duly adopted at a regular meeting of the City Council of the City of Cotati held on the 12th day of August, 2014 by the following vote, to wit:

DELL'OSSO	Yes
SKILLMAN	Yes
HARVEY	Yes
LANDMAN	Yes
MOORE	Yes

Approved: _____
John A. Dell'Osso, Mayor

Attest: _____
Tamara Taylor, CMC
Deputy City Clerk

Approved as to form:

_____
Robin Donoghue, City Attorney

Resolution No. 2014-062
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FORESTVILLE WATER DISTRICT
P.O. Box 261
Forestville, California 95436-0261
Phone (707) 887-1551 Fax (707) 887-1552
fwd@sonic.net

RESOLUTION NO. 357
Adopted by the Forestville Water District Board of Directors
August 12, 2014
FINDING THE EXISTENCE OF A DROUGHT EMERGENCYAND ENACTING OF MANDATORY WATER RESTRICTIONS

WHEREAS, California Water Code section 71642 authorizes the governing body of a ~~municipal~~ Water District to find the existence or threat of a drought emergency or other threatened or existing water shortage, and that finding is prima facie evidence of the fact or matter so found, and such fact or matter shall be presumed to continue unchanged unless and until a contrary finding is made by the board by resolution or ordinance; and

WHEREAS, pursuant to Water Code section 71640, the District may restrict the use of district water during the drought emergency or other water shortage condition and may prohibit the wastage of district water or the use of district water during such periods for any purpose other than household uses or other restricted uses as the District determines to be necessary; and

WHEREAS, on January 17, 2014, the Governor of the State of California proclaimed a state of emergency in the State of California due to drought conditions in the state; and

WHEREAS, the Governor's proclamation acknowledged the State of California is experiencing extremely dry conditions that have persisted since 2012; and

WHEREAS, the Governor's proclamation also noted the snowpack in California's mountains is approximately 20 percent of the normal average for this date; and

WHEREAS, the Governor's proclamation called upon local urban water suppliers and municipalities, voluntarily, to implement any local water shortage contingency plans immediately in order to avoid or forestall outright restrictions that could become necessary later in the drought season; and

WHEREAS, on January 17, 2014, the California State Water Resources Control Board notified all water rights holders in California that, in the coming months, if dry weather conditions persist, the State Water Board will notify water rights holders in critically dry watersheds of the requirement to limit or stop diversions of water under their water right, based upon the priority of their right; and

WHEREAS, On July 28, 2014, The California State Water Resources Control Board approved an emergency regulation to ensure water agencies, their customers and state residents increase water conservation in urban settings or face possible fines or other enforcement.

WHEREAS, pursuant to the previously adopted Ordinance #16 of the Forestville Water District, and amended by Ordinance #18 the Board is enacting Phase II-Mandatory Conservation.

Page 2 of 2

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Forestville Water District, as follows:

1. Pursuant to Water Code section 71642, and for the reasons set forth herein, the Board finds the existence of a drought emergency or other water shortage condition; and

2. The Board hereby requires mandatory water conservation including: Irrigation of outdoor landscaping that results in excess runoff; washing down of sidewalks, driveways or other hardscapes; operation of a decorative fountain or other water feature that does not recirculate water, washing of vehicles without a shutoff device on the hose; and that no outdoor landscaping that uses potable water be irrigated more than two (2) times per week: and

3. Violation of the requirements of this resolution shall constitute a misdemeanor, subject to the following penalties:
   a. Each violation of this resolution may be prosecuted as a misdemeanor punishable by imprisonment in the county jail for not more than thirty (30) days or by a fine not exceeding $600, or by both as provided in Water Code section 71644.
   b. Each day that a violation occurs is a separate offense.
   c. Administrative penalties may be levied for each violation of a provision of this resolution in accordance with Water Code section 71590.

4. This emergency water shortage condition shall be presumed to continue unchanged unless and until a contrary finding is made by the Board by resolution or ordinance; and

5. The District requests that federal and state agencies provide financial and other assistance to residents, water suppliers, water rights holders, ranchers, farmers, business owners and any local governments who are harmed by the drought emergency in its territorial limits to help them mitigate the effects of the persistent drought conditions.

Passed and adopted this 12th day of August 2014, by the following vote:

AYES: 4 NOES: 0 ABSTAIN: 0 ABSENT: 1

(Directors: Bandettini, Benyo, Harris, Reha and Jones)

FORESTVILLE WATER DISTRICT: Steve P. Bandettini

By: Vice-Chair of the Board (Steve Bandettini)

ATTEST: Judy D. Evans

Clerk, Judy D. Evans

M/MF/je: File Name – Resolution #357 (adopted 8-12-14)

CITY OF HEALDSBURG

RESOLUTION NO. 8- 2014

A RESOLUTION OF THE CITY COUNCIL DECLARING A WATER SHORTAGE EMERGENCY AND AUTHORIZING AND DIRECTING STAFF TO TAKE THE NECESSARY ACTION TO IMPLEMENT STAGE 2 MANDATORY WATER CONSERVATION MEASURES AS CONTAINED IN THE HEALDSBURG MUNICIPAL CODE

WHEREAS, on May 1, 2013 the State Water Resources Control Board (SWRCB) adopted an urgency order approving temporary urgency changes to minimum in-stream flows in the Russian River at the request of the Sonoma County Water Agency; and

WHEREAS on December 31, 2013 the SWRCB further restricted the flows of the Russian River to preserve storage levels of Lake Mendocino; and

WHEREAS, the reduction in minimum in-stream flows authorized by the SWRCB will affect the City's ability to provide water to its residents and businesses; and

WHEREAS, it is in the best interest of all parties that rely on the Russian River for their water supply to work together for water conservation during declared water shortage years; and

WHEREAS, based on the orders of the SWRCB and water supply and delivery projections, staff has determined an overall system-wide reduction of 20 percent is necessary and therefore it is appropriate for the City Council of the City of Healdsburg to consider formal measure for water conservation within the corporate limits of Healdsburg; and

WHEREAS, on January 21, 2014 the City Council of the City of Healdsburg received the report from the Public Works Department recommending that Stage 2 water conservation measures should be implemented.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Healdsburg hereby declares that there is a water shortage due to lack of annual rainfall within the Russian River watershed and it is necessary to implement water conservation measures; and

BE IT FURTHER RESOLVED that staff is authorized and directed to take the necessary steps to implement Stage 2 mandatory water conservation measures as contained in the Healdsburg Municipal Code to achieve a twenty percent reduction in water consumption over last year and appoints the City Manager or designee to work with the Sonoma County Water Agency on the preparation of any reports required under the urgency order adopted by the SWRCB.

PASSED, APPROVED AND ADOPTED this 21st day of January 2014 by the following vote:

AYES:	Councilmembers: (5)	Chambers, Jones, McCaffery, Plass and Mayor Wood
NOES:	Councilmembers: (0)	None
ABSENT:	Councilmembers: (0)	None
ABSTAINING:	Councilmembers: (0)	None

SO ORDERED: ATTEST:

James D. Wood, Mayor

Maria Curiel, City Clerk

MARIN MUNICIPAL WATER DISTRICT

ORDINANCE NO. 427

AN ORDINANCE AMENDING TITLE 13 OF THE MARIN MUNICIPAL WATER DISTRICT CODE ADDING ANOTHER ELEMENT OF THE DISTRICT'S WATER CONSERVATION PROGRAM PURSUANT TO WATER CODE SECTION 375 BY ADDING SECTIONS 13.02.02(1) (G) & (F) AND (4) to TITLE 13, CHAPTER 13.02 SECTION 13.02.020 ENTITLED "WATER WASTE PROHIBITIONS," OF THE DISTRICT CODE

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF THE MARIN MUNICIPAL WATER DISTRICT AS FOLLOWS:

SECTION 1. Purpose: The purpose of this ordinance is to adopt another element of the District's water conservation program pursuant to Water Code Section 375. This element addresses outdoor water use. Conservation within the District's service area continues to be necessary, as on April 25, 2014 Governor Brown issued an executive order (Governor's Proclamation No. 1-17-2014) to strengthen the state's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water and reduce their consumption by 20 percent. On July 15, 2014 the California State Water Resources Control Board via Resolution No. 2014-0038 adopted California Code of Regulations Title 23 Sections 863, 864 and 865 which impose certain obligations on urban water suppliers. The Board of Directors views this conservation program as a fundamental and necessary step in its on-going efforts to reduce overall water use District-wide and comply with those state regulations.

SECTION 2. Amendments: Section 13.02.020 (1) (F) and 1(G) and Section 13.02.020 (4) are added to Section 13.02.020 entitled "Water Waste Prohibitions" to read as follows:

13.020.02 Water waste prohibitions.

(1) Prohibited Nonessential uses Applicable to All Consumers. It is unlawful for any person, firm, partnership, association, corporation or political entity to use water from the district for the following nonessential uses:

(F) Using a garden hose without a shut-off nozzle.

(G) Landscape irrigation between the hours of 9:00 a.m. and 7:00 p.m.

(4) Exemption from daytime water prohibition: Notwithstanding anything contained in this Title 13, testing and repairing irrigation systems for the purpose of eliminating water waste is permitted during the hours of 9:00am and 7:00pm.

SECTION 3. Findings of Necessity: The Board of Directors, after considering all of the information and testimony presented at its August 19, 2014 meeting finds as follows:

A. Water is a finite and precious resource.

B. On January 17, 2014 Governor Jerry Brown proclaimed a state of emergency to exist in the State of California due to current drought conditions and asked all Californians to reduce their water usage by 20 percent.

C. The Governor's Proclamation of a State of Emergency highlighted the fact that "...extremely dry conditions have persisted since 2012 and may continue beyond this year and more regularly into the future, based on scientific projections regarding the impact of climate change on California's snowpack."

D. On April 25, 2014 Governor Brown issued an executive order (Governor's Proclamation No. 1-17-2014) to strengthen the state's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water.

E. That executive order recognized that the magnitude of the severe drought conditions continues to present threats beyond the control of the services, personnel, equipment and facilities of any single local government and requires the combined forces of a mutual aid region or regions to combat and found that under Government Code Section 8558(b) conditions of extreme peril to the safety of persons and property continue to exist in California due to water shortage and drought conditions with which local authority is unable to cope.

F. On July 15, 2014 the State Water Resources Control Board adopted California Code of Regulations Title 23, Section 863, 864 and 865 which require urban water suppliers to implement certain drought emergency water conservation measures.

G. Section 864 of the emergency regulations prohibits several outdoor activities in promotion of water conservation. The District's existing normal year water conservation/landscape ordinance, District Code Title 13 Sections 13.02.020 and 13.02.021, includes three of the four prohibited activities contained in emergency regulation Section 864.

H. The amendments to District Code Section 13.02.020 contained herein are intended to bring the District's normal year water conservation/landscape ordinance into compliance with the emergency drought regulations and limit outdoor watering during certain times of the day to preserve the water supply.

SECTION 4. Environmental Determination: This project has been reviewed for compliance with the California Environmental Quality Act and qualifies for an exemption under the General Rule section 15061(b)(3) because it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment.

SECTION 5. Severability: If any section, subsection, sentence, clause, phrase, portion or part of this ordinance is for any reason held to be invalid or unconstitutional by any court of competent jurisdiction, such section shall not affect the validity of the remaining portions of this code. The Board of Directors hereby declares that it would have adopted this ordinance and each section, subsection, sentence, clause, phrase, part or portion thereof, irrespective of the fact that any one or more sections subsections, clauses, phrases, parts or portions be declared invalid or unconstitutional.

SECTION 6. Effective Date: This ordinance shall be effective on the day of its adoption.

Ordinance No. 427

PASSED AND ADOPTED this 19th day of August, 2014, by the following vote of the Board:

AYES: Directors Crosse, Gibson, Koehler, Quintero and Russell

NOES: None

ABSENT: None

President, Board of Directors

ATTEST:

Secretary, Board of Directors

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RESOLUTION 14-18

RESOLUTION OF THE BOARD OF DIRECTORS OF THE NORTH MARIN WATER DISTRICT IMPLEMENTING THE STATE WATER RESOURCES CONTROL BOARD'S MANDATE ON URBAN WATER SUPPLIERS TO ACTIVATE THOSE PORTIONS OF THEIR WATER SHORTAGE CONTINGENCY PLANS RELATED TO MANDATORY RESTRICTIONS ON OUTDOOR WATER USE.

WHEREAS, pursuant to California Water Code Section 102, all water in the state is the property of the people of the state; and

WHEREAS, the State Resources Control Board (State Board) is the agency tasked with issuing and monitoring permits to urban water suppliers and others to appropriate water statewide and determining the amount, purpose, place and beneficial use of that water. The North Marin Water District (District) is the beneficiary of multiple State Board permits which authorize the appropriation of waters of the state; and

WHEREAS, Water Code Section 10617 defines "urban water supplier" as a supplier for municipal purposes that serves 3,000 customers or more than 3,000 acre feet annually. Pursuant to Section 10617, the District is an urban water supplier; and

WHEREAS, on July 15, 2014, the State Board adopted Article 22.5 entitled "Drought Emergency Water Conservation Regulations" (California Code of Regulations, Title 23, sections 863, 864, and 865) which makes drought related findings and imposes mandatory requirements on urban water suppliers state-wide; and

WHEREAS, Section 863 of Article 22.5 made the following factual findings related to the current state of drought in California and the Governor's proclamations of emergency related thereto:

1. On January 17, 2014, the Governor proclaimed a state of emergency under the California Emergency Services Act (Act) based on drought conditions;

2. On April 25, 2014, the Governor issued a proclamation of continued state of emergency under the Act based on continued drought conditions existing statewide;

3. The drought conditions forming the base of the Governor's proclamations still exist;

4. The present year is critically dry and has been immediately preceded by two or more consecutive below normal, dry, or critically dry years; and

5. The drought conditions will likely continue for the foreseeable future and additional action by both the State Water Resources Control Board and local water suppliers will likely be necessary to further promote conservation.

WHEREAS, Section 864 of Article 22.5 promotes conservation by prohibiting the following outdoor activities, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency;

1. The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;

2. The use of a hose that dispensed potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;

3. The application of potable water to driveways and sidewalks;

4. The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculation system.

WHEREAS, Section 865 of Article 22.5 requires urban water suppliers state-wide to:

1. Implement all requirements and actions of the stage of its water shortage contingency plan that imposes mandatory restrictions on outdoor irrigation of ornamental landscapes or turf with potable water;

2. Prepare and submit to the State Board by the 15th of each month a monitoring report that includes the amount of potable water produced, including potable water provided by a wholesaler, in the preceding calendar month compared to the amount produced in the same calendar month in 2013 and estimate the gallons of water per person per day used by the residential customers it serves.

NOW, THEREFORE, THE BOARD OF DIRECTORS RESOLVES AS FOLLOWS:

1. The District's existing Regulation 15, section b. (Water Conservation) and Emergency Water Conservation Ordinance No. 28, enacted on April 1, 2014, contain prohibitions on those uses contained in Section 864 of Article 22.5, and remains in effect.

2. The following use (s) is declared to be non-essential and is prohibited:

    a. Watering of any lawn, garden landscaped area, tree, shrub or other plant except from a handheld hose equipped with an automatic shut-off nozzle, container or drip irrigation system. Overhead sprinkler irrigation can be used if customer maintains an overall 20% reduction in water use compared to the corresponding billing period in 2013 (Customers using less than 300 gallons per day are permitted to water their landscapes without the required 20% reduction), and properly operates the irrigation system in a non-wasteful manner between the hours of 7:00 p.m. and 9:00 a.m. the next day. If overhead sprinkler water is used in a wasteful manner, the General Manager may prohibit sprinkling by that customer.

3. In response to the mandate in Section 865 in Article 22.5, the Board directs staff to implement those water conservation measures governing restrictions on outdoor water use descried above. In addition, the Board leaves in full force and effect

Regulation 15 Section b., and Emergency Water Conservation Ordinance No. 28. These will ensure continued water conservation on compliance with the mandate contained in Article 22.5. Enforcement will be in accordance with existing provisions of Regulation 15, Section b., and Emergency Water Conservation Ordinance No. 28.

4. The Board directs staff to comply with the reporting requirements noted in Section 865 or Article 22.5.

5. The provisions of this Resolution shall remain in effect as long as Article 22.5 remains in effect.

* * * * *

I hereby certify that the foregoing is a true and complete copy of a resolution duly and regularly adopted by the Board of Directors of NORTH MARIN WATER DISTRICT at a regular meeting of said Board held on the fifth of August 2014, by the following vote:

AYES:	Director Baker, Fraites, Petterle, Rodoni, Schoonover
NOES:	None
ABSENT:	None
ABSTAINED:	None

Katie Young, District Secretary
North Marin Water District

(SEAL)

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Agenda Item #5.A

DATE: **September 8, 2014**

TO: Honorable Mayor and Members of the City Council through City Manager

FROM: Dan St. John, F.ASCE – Director, Public Works and Utilities
Leah Walker – Environmental Services Manager

SUBJECT: Resolution Authorizing the City Manager to Implement the City's Water Shortage Contingency Plan, Stage 1 as Amended, as Mandated by the State Water Resources Control Board within the Area Served by the City of Petaluma Public Water System and Repeal and Replace Resolution No. 2014-045

RECOMMENDATION

It is recommended that the City Council Approve a Resolution to Implement of the City's Water Shortage Contingency Plan, Stage 1 as Amended herein, as Mandated by the State Water Resources Control Board (SWRCB) within the Area served by the City of Petaluma Public Water System and Repeal and Replace Resolution No. 2014-045.

BACKGROUND

On January 17, 2014, Governor Brown declared a drought state of emergency. On February 3, 2014 the Water Advisory Committee (WAC) of the Sonoma County Water Agency (SCWA) adopted a resolution supporting Governor Brown's drought proclamation. The City of Petaluma, on March 3, 2014, adopted Resolution No 2014-045 "Declaring a Water Shortage Emergency and Implementation of Stage 1 of the City's Water Shortage Contingency Plan". Stage 1 customer mandates include: hose-end shut-off nozzles required on all garden and utility hoses; water served in restaurants on request only; and pavement wash down only allowed for health and safety purposes. These mandates were in addition to municipal code requirements. Chapter 15.17 prohibits use of potable water for washing hard surfaces by direct hosing without a shut-off nozzle, except for health and safety reasons, for irrigation that results in runoff or over-spray, for washing cars without a shutoff nozzle and for use in water features without recirculation.

On April 25, 2014 the Governor signed an Executive Order calling on the State to redouble drought actions. Among other things, the Executive Order provides that: "The Water Board shall direct urban water suppliers that are not already implementing drought response plans to limit outdoor irrigation and other wasteful water practices such as those identified in this Executive

Agenda Review:

City Attorney_____ Finance Director_____ City Manager_____ 1
1

Order. The Water Board was directed to adopt emergency regulations as it deems necessary, pursuant to Water Code section 1058.5, to implement the Governor's directive."

Water Code section 1058.5 grants the SWRCB the authority to adopt emergency regulations in certain drought years in order to: "prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion, of water, to promote water recycling or water conservation, to require curtailment of diversions when water is not available under the diverter's priority of right, or in furtherance of any of the foregoing, to require reporting of diversion or use or the preparation of monitoring reports."

On May 23, 2014 the SWRCB surveyed more than 400 urban water suppliers to ascertain the degree and effectiveness of their urban water conservation actions. The State Water Board held a board meeting on June 17, 2014, which was attended by the City Water Conservation Coordinator, to receive an update on the survey results and descriptions of urban water conservation efforts being carried out by urban water suppliers. The survey indicated that water conservation efforts state-wide had not produced the reductions targeted in the Governor's January declaration.

On July 15, 2014, the SWRCB adopted a resolution enacting emergency regulations adding Article 22.5, Section 863, 864 and 865, to Title 23 of the California Code of Regulations. Key provisions of the proposed emergency regulations prohibit certain outdoor water use practices and require urban water suppliers to implement "the stage of its water shortage contingency plan that imposes mandatory restrictions on outdoor irrigation of ornamental landscapes or turf with potable water." In addition, water suppliers with 3,000 or more service connections must provide monthly data on water production.

The regulations specifically prohibit the following activities except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency:

- The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;
- The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;
- The application of potable water to driveways and sidewalks; and
- The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.

The regulations also specify that the taking of any action prohibited in the regulations, in addition to any other applicable civil or criminal penalties, is an infraction punishable by the State, by a fine of up to five hundred dollars ($500) for each day in which the violation occurs by the State. While the City is not required by the SWRCB action to adopt a similar fine structure, on November 17, 2008, Council adopted a resolution updating the schedule of penalties for administrative citations for violation of the Petaluma Municipal Code (PMC) that sets penalties for first, second and third violations at $100, $500, and $1000, respectively.

The City Council adopted the Water Shortage Contingency Plan (WSCP) in 2011 with the Urban Water Management Plan. The WSCP outlines four progressive stages to achieve water demand reductions during a water supply shortage. Stage 1 was previously adopted by City Council Resolution on March 3, 2014 calling for a community-wide effort to achieve 20% reduction in water use.

DISCUSSION

The purpose of the recommended Council action is to assure compliance with the SWRCB's recent Emergency Regulations. While staff believes that the Council's action in March with the initial adoption of Stage 1 complies with the "letter of the law", the proposed action adds important tools, time of day water restrictions, to the water conservation effort; and also sets an end date to coincide with the SWRCB action.

The City and our "principle contractor" partners with the SCWA have achieved better conservation results than seen elsewhere in California. Since adoption of Stage 1 in March in response to the Governor's emergency declaration in January the City has recorded a year over year reduction of 14.6% with monthly results of total rates purchased from SCWA plus pumped from City wells as follows:

March 2014	April 2014	May 2014	June 2014	July 2014
-13%	-20%	-19%	-6%	-15%

While these results fall short of our 20% goal, they represent a significant effort by our community to meet the drought challenge especially considering that many of our citizens had already taken critical steps to reduce water usage through the first two years of the current three year drought. Petaluma and its SCWA partners are facing "demand hardening" where the next increment of conservation becomes increasingly difficult.

On July 15, 2014, the San Jose Mercury News reported the results of the SWRCB survey of water purveyors' that compared the three year average of May water demands from 2011 thru 2013 to May 2014 demands. The statewide average reduction was in fact a 1% increase while the Bay Area and North Coast regions reported decreases of 5% and 12%, respectively. In contrast, the City's May 2011 to 2013 average compared to May 2014 decreased 7%.

Nevertheless, given the severity of the drought, the City should increase its efforts, such as implementing time of day irrigation restrictions and encouraging higher vigilance by staff and citizens to achieve further reductions in water demand. In addition, staff has established maximum limits to water haulers that fill trucks and trailers with potable water for use on construction sites and other purposes to incentivize conservation. These limits are based on historic needs and are intended to prevent the increase in usage by certain commercial haulers. With adoption of the proposed resolution, the following mandatory restrictions to outdoor irrigation and potable water use will be in place:

1. No irrigation of ornamental landscapes or turf with potable water between the hours of 8:00 a.m. and 7:00 p.m.
2. Hose-end shut off nozzles required on all garden and utility hoses to include washing cars, boats, and trailers.
3. No application of potable water for washing down pavement by direct hosing without a shutoff nozzle, except for health and safety including sanitation. Use of low flow pressure washers is encouraged.
4. No runoff or overspray caused by outdoor irrigation.
5. No water used for non-recycling water features such as fountains.
6. Irrigation accounts cannot exceed allocated water budgets by more than twenty percent.
7. To remain consistent with the action taken by the SWRCB, the proposed resolution to re-implement Stage 1 of the City's Water Shortage Contingency Plan would end (i.e. "sunset") on April 25, 2015 unless Emergency Regulations are extended or ended earlier by the SWRCB.

Items 2, 3, 4 and 5 are substantially the same requirements adopted by the State in the Emergency Regulations. Item 1 sets further limits on outdoor irrigation as promoted by the SWRCB. The City is proposing to go further than mandated by the State to set additional requirements and increase awareness of the severity of the drought. This will increase the likelihood that the City will achieve a 20% reduction in water demands.

Staff is stepping up a public information campaign in the following areas:

1. Circulating educational materials as bill inserts.
2. Providing technical support to customers.
3. Staffing information booths at fairs and other public venues.
4. Increased use of media with news releases.
5. Seek voluntary reporting of potential water wasting from the public.
6. Enlist all City departments to report observed potential water wasting to the Water Conservation Hotline and email portals.
7. Expand water conservation staff: a full-time Environmental Services Technician was upgraded from part-time technician on July 1 to allow greater focus on water conservation.
8. Initiate early morning monitoring to identify properties with irrigation water runoff.
9. Set specific water conservation goals for City's LAD landscape contractors and irrigation accounts.
10. Continued participation with the Sonoma Marin Water Saving Partnership including: "There's a Drought On, Turn the Tap Off" campaign featuring print, radio, movie ads; public events at fair, workshops, and Town Hall meetings; and drought drive up events.

Specifically, staff has conducted the following outreach:

1. Direct Mailings: 3 post cards sent to all customers beginning March 2014. Additional post cards will be sent regularly throughout the drought period.
2. Message at this year's Sonoma-Marin fair display focused on the drought.
3. Monthly Argus ads began running in March 2014 and have continued.
4. Argus ads will increase to weekly beginning Sept 2014.
5. "Before the Movie" ads began running March 2014 and will continue.

6. Four public workshops have been conducted since March 2014 – each workshop attendee was provided drought information and given ways to conserve water – approximately 230 attendees attended at the workshops.
7. Social media posts have included drought related messages – this effort will increase to every Thursday effective immediately.
8. Signs at City parks being installed say "Please Tolerate our Thirsty Lawns During This Period of Drought".
9. A drought banner will be displayed at D St., Kentucky St. and McDowell Shopping Center when space is available.

Staff will exercise progressive enforcement of the mandatory irrigation restriction in accordance with the 2008 resolution addressing administrative citation for violation of the PMC; and PMC 15.16.100, Enforcement and Fees, as follows:

1. Personal contact: Education and technical support provided. If no one is home, a door hanger indicating the nature of the violation is provided. Customer is given 72 hours or less as appropriate to mitigate violation.
2. If personal contact is not successful: Provide written notice of the violation including date when correction must be complete. Copy of notice is sent by certified mail.
3. First violation under administrative penalty resolution: If correction not made in accordance with written notice, apply fine of $100.
4. Second violation within 36 months under administrative penalty resolution: If correction not made or recurrence of violation a fine of $500.
5. Third violation within 36 months under administrative penalty resolution: Fine of $1,000.
6. In addition to issuing a notice of violations, if appropriate: Shut off water service until verification of correction is made. Cost of shut off and turn on is an additional $60.

Note that the City's administrative fines are more onerous that those adopted by the SWRCB in the Emergency Regulations.

The proposed action will meet Council Goal: "Plan for the future".

FINANCIAL IMPACTS

The financial impacts of implementing the Stage 1 plan, as amended include:

1. Reduction of revenue from commodity charges: For the four month period ending July 31, 2014, revenue was down 7.4 percent, a reduction of $328,440 over same period last year. As a partial offset, the cost of purchasing water from SCWA decreased about $285,000 during the same period. The net effect is approximately $10,600 per month net of income to the Water Enterprise.
2. Increase resources: Implementation of Stage 1 as amended will require additional administrative and environmental service technician time to deal with increased vigilance related to higher demand for house calls, more water waste monitoring, additional mailers to irrigation customers, and enforcement. While plans are still developing, staff expects

to spend an additional $40,000 for temporary labor, advertising, and consulting services through the end of Stage 1, as amended, declaration.

The net fiscal impact of the proposed action is being calculated and appears to be within the budget for the water conservation cost center of the water enterprise fund.

ATTACHMENTS

1. Resolution
2. State Water Resources Control Board (SWRCB) July 15, 2014 Resolution and Emergency Regulations

Attachment 1

RESOLUTION AUTHORIZING THE CITY MANAGER TO IMPLEMENT THE CITY'S WATER SHORTAGE CONTINGENCY PLAN, STAGE 1 AS AMENDED, AS MANDATED BY THE STATE WATER RESOURCES CONTROL BOARD WITHIN THE AREA SERVED BY THE CITY OF PETALUMA PUBLIC WATER SYSTEM AND REPEAL AND REPLACE RESOLUTION NO. 2014-045

WHEREAS, the City of Petaluma is a City empowered to provide water service within certain boundaries; and

WHEREAS, calendar year 2013 was the lowest rainfall year on record in 120 years; and

WHEREAS, due to this water supply shortage, a water shortage emergency exists and a reduction in demand is required to ensure adequate supply in 2014 and beyond; and

WHEREAS, on January 17, 2014 Gov. Edmund G. Brown, Jr. declared a drought state of emergency and directed state and local officials to take all necessary actions to conserve water; and

WHEREAS, the Restructured Agreement for Water Supply, executed on June 23, 2006, by and between the Sonoma County Water Agency (SCWA), the Cities of Cotati, Petaluma, Rohnert Park, Santa Rosa, and Sonoma, the North Marin and Valley of the Moon Water Districts and the Town of Windsor, collectively known as the Water Contractors, created the Water Advisory Committee and Technical Advisory Committee; and

WHEREAS, the Water Contractors, along with SCWA and Marin Municipal Water District, are members of the Sonoma-Marin Saving Water Partnership, through which these members have joined together to provide a regional approach to water use efficiency; and

WHEREAS, on February 3, 2014, the Water Advisory Committee of the SCWA approved a Resolution supporting the Sonoma Marin Saving Water Partnership Efforts and Governor Jerry Brown's Emergency Drought Declaration that includes seeking 20% voluntary conservation and recommended that all principal SCWA contractors follow suit with their respective governing boards; and

WHEREAS, on March 3, 2014, the City Council adopted Resolution No 2014-045 "Declaring a Water Shortage Emergency and Implementation of Stage 1 of the City's Water Shortage Contingency Plan"; and

WHEREAS, on April 25, 2014, Governor Edmund G. Brown Jr. issued an executive order to strengthen the state's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water. The executive order finds that the continuous severe drought conditions present urgent challenges across the state including water shortages in communities and for agricultural production, increased wildfires, degraded habitat for fish and wildlife, threat of saltwater contamination, and additional water scarcity if drought conditions continue into 2015. The National Integrated Drought Information System reported that nearly 80% of the state was reported to be under "extreme" drought conditions at the end of June; and

WHEREAS, On July 15, 2014 the State Water Resources Control Board (SWRCB) adopted Resolution No. 2014-0038 enacting Article 22.5, Sections 863, 864 and 865 to Title 23 of the California Code of Regulations, emergency regulations for mandatory statewide urban water conservation that sets certain requirements for urban water suppliers to meet; and

WHEREAS, the City of Petaluma has satisfied the mandates of SWRCB Resolution No. 2014-0038 through its Water Conservation Ordinance that prohibits water waste for all water use classifications and implementation of Stage 1 of the City's Water Shortage Contingency Plan, which establishes a 20% reduction target in water use by all customers served by the City's potable water distribution system; and

WHEREAS, the City of Petaluma has adopted a resolution updating the schedule of penalties for administrative citations for violations of the Petaluma Municipal Code including violation of the Water Conservation Ordinance; and

WHEREAS, the City of Petaluma has the authority and responsibility to adopt water demand reduction measures within its area of service; and

NOW, THEREFORE, BE IT RESOLVED that the City Council declares that under the current water shortage conditions, a water shortage emergency continues to exist and in order to satisfy the water conservation goal of SWRCB Resolution No. 2014-0038 and Sections 863, 864 and 865 to Title 23 of the California Code of Regulations, all requirements and actions of Stage 1 of the City's Water Shortage Contingency Plan will be immediately re-implemented as amended as follows:

1. Resolution No. 2014-045 is hereby repealed and replaced with this Resolution.
2. Under the current water shortage conditions, a water shortage emergency exists and Stage 1 of the City's Water Shortage Contingency Plan shall be implemented immediately, with the following amendments:
    a. Stage 1 shall establish a water demand reduction goal of 20 percent; and
    b. Stage 1 shall include a mandate to limit irrigation to the hours of 7:00 p.m. to 8:00 a.m. for all customers.
    c. Stage 1, as amended, shall remain in effect until the SWRCB determines that the Emergency Regulations are no longer necessary due to changed conditions or unless it renews the regulations due to continued drought. In the absence of this, the Stage 1, as amended, declaration ends on April 25, 2015.

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Attachment 2

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2014-0038

TO ADOPT AN EMERGENCY REGULATION
FOR STATEWIDE URBAN WATER CONSERVATION

WHEREAS:

1. On April 25, 2014, Governor Edmund G. Brown Jr. issued an executive order to strengthen the state's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water. The executive order finds that the continuous severe drought conditions present urgent challenges across the state including water shortages in communities and for agricultural production, increased wildfires, degraded habitat for fish and wildlife, threat of saltwater contamination, and additional water scarcity if drought conditions continue into 2015. The National Integrated Drought Information System reported that nearly 80% of the state was reported to be under "extreme" drought conditions at the end of June;

2. The executive order refers to the Governor's Proclamation No. 1-17-2014, issued on January 17, 2014, declaring a State of Emergency to exist in California due to severe drought conditions. The January Proclamation notes that the state is experiencing record dry conditions, with 2014 projected to become the driest year on record. Since January, state water officials indicate that reservoirs, rainfall totals and the snowpack remain critically low. This follows two other dry or below average years, leaving reservoir storage at alarmingly low levels. The January Proclamation highlights the State's dry conditions, lack of precipitation and the resulting effects on drinking water supplies, the cultivation of crops, and the survival of animals and plants that rely on California's rivers and streams. The January Proclamation also calls on all Californians to reduce their water usage by 20 percent;

3. There is no guarantee that winter precipitation will alleviate the drought conditions that the executive orders address, which will lead to even more severe impacts across the state if the drought wears on;

4. Water Code section 1058.5 grants the State Water Board the authority to adopt emergency regulations in certain drought years in order to: "prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion, of water, to promote water recycling or water conservation, to require curtailment of diversions when water is not available under the diverter's priority of right, or in furtherance of any of the foregoing, to require reporting of diversion or use or the preparation of monitoring reports";

5. Over 400,000 acres of farmland are expected to be fallowed, thousands of people may be out of work, communities risk running out of drinking water, and fish and wildlife will suffer.

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6. Many Californians have taken bold steps over the years and in this year to reduce water use; nevertheless, the dire nature of the current drought requires additional conservation actions from residents and businesses. Some severely affected communities have implemented water rationing, limiting water use in some cases to only 50 gallons per person per day, foregoing showers, laundry, toilet flushing, and all outdoor watering.

7. Water conservation is the easiest, most efficient and most cost effective way to quickly reduce water demand and extend supplies into the next year, providing flexibility for all California communities. Water saved this summer is water available next year, giving water suppliers the flexibility to manage their systems efficiently. The more water that is conserved now, the less likely it is that a community will experience such dire circumstances that water rationing is required ;

8. Most Californians use more water outdoors than indoors. In many areas, 50 percent or more of daily water use is for lawns and outdoor landscaping. Outdoor water use is generally discretionary, and many irrigated landscapes would not suffer greatly from receiving a decreased amount of water;

9. Public information and awareness is critical to achieving conservation goals and the Save Our Water campaign, run jointly by the Department of Water Resources (DWR) and the Association of California Water Agencies, is an excellent resource for conservation information and messaging that is integral to effective drought response (http://saveourwater.com).

10. Enforcement against water waste is a key tool in conservation programs. When conservation becomes a social norm in a community, the need for enforcement is reduced or eliminated;

11. The emergency regulations set a minimum standard requiring only modest lifestyle changes across the state. Many communities are already doing more and have been for years. They should be commended, but can and should do more. Others are not yet doing so and should at least do this, but should do much more given the severity of the drought;

12. On July 8, 2014, the State Water Board issued public notice that the State Water Board would consider the adoption of the regulation at the Board's regularly-scheduled July 15, 2014 public meeting, in accordance with applicable State laws and regulations. The State Water Board also distributed for public review and comment a Finding of Emergency that complies with State laws and regulations;

13. On April 25, 2014, the Governor suspended the California Environmental Quality Act's application to the State Water Board's adoption of emergency regulations pursuant to Water Code section 1058.5 to prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water, to promote water recycling or water conservation;

14. As discussed above, the State Water Board is adopting the emergency regulation because of emergency drought conditions, the need for prompt action, and current limitations in the existing enforcement process;

15. Disadvantaged communities may require assistance in increasing water conservation and state agencies should look for opportunities to provide assistance in promoting water conservation;

16. Nothing in the regulations or in the enforcement provisions of the regulations, preclude a local agency from exercising its authority to adopt more stringent conservation measures. Moreover, the Water Code does not impose a mandatory penalty for violations of the regulations adopted by this resolution and local agencies retain their enforcement discretion in enforcing the regulations, to the extent authorized, and may develop their own progressive enforcement practices to encourage conservation.

THEREFORE BE IT RESOLVED THAT:

1. The State Water Board adopts California Code of Regulations, title 23, sections 863, 864, and 865, as appended to this resolution as an emergency regulation;

2. The State Water Board staff will submit the regulation to the Office of Administrative Law (OAL) for final approval;

3. If, during the approval process, State Water Board staff, the State Water Board, or OAL determines that minor corrections to the language of the regulation or supporting documentation are needed for clarity or consistency, the State Water Board Executive Director or designee may make such changes;

4. These regulations shall remain in effect for 270 days after filing with the Secretary of State unless the State Water Board determines that it is no longer necessary due to changed conditions, or unless the State Water Board renews the regulations due to continued drought conditions as described in Water Code section 1058.5;

5. The State Water Board directs staff to provide the Board with monthly updates on the implementation of the emergency regulations and their effect;

6. Directs State Water Board staff to condition funding upon compliance with the emergency regulations, to the extent feasible;

7. Directs State Water Board staff to work with the Department of Water Resources and the Save Our Water campaign to disseminate information regarding the emergency regulations; and

8. Directs State Water Board staff in developing an electronic reporting portal to include data fields so that local agencies may provide monthly reporting data on (i) conservation-related implementation measures or enforcement actions taken by the local agency and (ii) substitution during the drought of potable water with recycled water to extend water supplies.

THEREFORE BE IT FURTHER RESOLVED THAT:

9. The State Water Board commends water suppliers that have increased conservation messaging and adopted innovative strategies to enhance customer awareness of water use, such as applications that let customers compare their water use to water use by others; reduce system losses, such as fixing system leaks which can deplete supplies by 10 percent or more; and establish incentives to reduce demand, such as tiered or drought rate structures. The State Water Board also commends all Californians that have already been working to maximize their conservation efforts, both at home and at work;

10. The State Water Board calls upon water suppliers to take the following actions:

Educate customers and employees

- Retail water suppliers should provide notice of the regulations in English and Spanish in one or more of the following ways: newspaper advertisements, bill inserts, website homepage, social media, notices in public libraries;
- Wholesale suppliers should include reference to the regulations in their customer communications;
- All water suppliers should train personnel on the regulations;
- All water suppliers should provide signage where recycled or reclaimed water is being used for activities that the emergency regulations prohibit with the use of potable water, such as operation of fountains and other water features;
- All water suppliers should redouble their efforts to disseminate information regarding opportunities and incentives to upgrade indoor fixtures and appliances;
- All water suppliers should use education and the tools available through the Save Our Water website (http://saveourwater.com); and
- All water suppliers should educate and prepare their boards and councils on the drought response actions contained in the emergency regulations and in this resolution, and to make sure that drought response items are placed on agendas as early as possible;

Increasing local supplies

- All water suppliers should accelerate the completion of projects that will conserve potable water by making use of non-potable supplies, such as recycled water, "greywater," and stormwater collection projects;
- All water suppliers should improve their leak reporting and response programs and request that police and fire departments and other local government personnel report leaks and water waste that they encounter during their routine duties/patrols;
- Smaller water suppliers – those with fewer than 3,000 service connections – should take proactive steps to secure their communities' water supplies and educate their customers about water conservation and the status of their supply reserves;
- All water suppliers should conduct water loss audits and make leak detection and repair a top priority for the duration of the drought; and
- All urban water suppliers should evaluate their rate structures and begin to implement needed changes as part of planning for another dry year. Information and assistance on setting and implementing drought rates is available from the Alliance for Water Efficiency. (http://www.allianceforwaterefficiency.org/).

11. The State Water Board calls on all Californians to take the following additional actions:
    - Further reduce water demand, whether by using less water in daily routines indoors and out, retrofitting appliances and installing greywater and rainwater catchment systems; and
    - Check residential and business water bills to see if there are high charges that may indicate a leak and to fix the leak, if they are able, or contact their local water utility if they need assistance.

12. The State Water Board encourages its staff, the Department of Water Resources, the Public Utilities Commission, urban water suppliers, and other local agencies to look for opportunities to encourage and promote new technologies that reduce water usage, including through timely access to water usage information and behavioral response.

13. The State Water Board encourages all state and local agencies to look for additional opportunities to minimize potable water use in outdoor spaces.

14. The State Water Board encourages investor-owned utilities to expeditiously submit applications for implementation of the regulations to the California Public Utilities Commission.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on July 15, 2014.

AYE:	Chair Felicia Marcus Vice Chair Frances Spivy-Weber Board Member Steven Moore Board Member Dorene D'Adamo
NAY:	None
ABSENT:	Board Member Tam M. Doduc
ABSTAIN:	None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board

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PROPOSED TEXT OF EMERGENCY REGULATIONS

Article 22.5. Drought Emergency Water Conservation

Sec. 863 Findings of Drought Emergency

(a) The State Water Resources Control Board finds as follows:

(1) On January 17, 2014, the Governor issued a proclamation of a state of emergency under the California Emergency Services Act based on drought conditions;

(2) On April 25, 2014, the Governor issued a proclamation of a continued state of emergency under the California Emergency Services Act based on continued drought conditions;

(3) The drought conditions that formed the basis of the Governor's emergency proclamations continue to exist;

(4) The present year is critically dry and has been immediately preceded by two or more consecutive below normal, dry, or critically dry years; and

(5) The drought conditions will likely continue for the foreseeable future and additional action by both the State Water Resources Control Board and local water suppliers will likely be necessary to further promote conservation.

Authority: Wat. Code, § 1058.5.
References: Wat. Code, §§ 102, 104, 105.

Sec. 864 Prohibited Activities in Promotion of Water Conservation

(a) To promote water conservation, each of the following actions is prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency:

(1) The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;

(2) The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;

(3) The application of potable water to driveways and sidewalks; and

(4) The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.

(b) The taking of any action prohibited in subdivision (a) of this section, in addition to any other applicable civil or criminal penalties, is an infraction, punishable by a fine of up to five hundred dollars ($500) for each day in which the violation occurs.

Authority: Wat. Code, § 1058.5.
References: Wat. Code, §§ 102, 104, 105.

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PROPOSED TEXT OF EMERGENCY REGULATIONS

Sec. 865 Mandatory Actions by Water Suppliers

(a) The term "urban water supplier," when used in this section, refers to a supplier that meets the definition set forth in Water Code section 10617, except it does not refer to suppliers when they are functioning solely in a wholesale capacity, but does apply to suppliers when they are functioning in a retail capacity.

(b)(1) To promote water conservation, each urban water supplier shall implement all requirements and actions of the stage of its water shortage contingency plan that imposes mandatory restrictions on outdoor irrigation of ornamental landscapes or turf with potable water.

(2) As an alternative to subdivision (b)(1), an urban water supplier may submit a request to the Executive Director for approval of an alternate plan that includes allocation-based rate structures that satisfies the requirements of chapter 3.4 (commencing with section 370) of division 1 of the Water Code, and the Executive Director may approve such an alternate plan upon determining that the rate structure, in conjunction with other measures, achieves a level of conservation that would be superior to that achieved by implementing limitations on outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves to no more than two days per week.

(c) To promote water conservation, each urban water supplier that does not have a water shortage contingency plan or has been notified by the Department of Water Resources that its water shortage contingency plan does not meet the requirements of Water Code section 10632 shall, within thirty (30) days, limit outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves to no more than two days per week or shall implement another mandatory conservation measure or measures intended to achieve a comparable reduction in water consumption by the persons it serves relative to the amount consumed in 2013.

(d) In furtherance of the promotion of water conservation each urban water supplier shall prepare and submit to the State Water Resources Control Board by the 15th of each month a monitoring report on forms provided by the Board. The monitoring report shall include the amount of potable water the urban water supplier produced, including water provided by a wholesaler, in the preceding calendar month and shall compare that amount to the amount produced in the same calendar month in 2013. Beginning October 15, 2014, the monitoring report shall also estimate the gallons of water per person per day used by the residential customers it serves. In its initial monitoring report, each urban water supplier shall state the number of persons it serves.

(e) To promote water conservation, each distributor of a public water supply, as defined in Water Code section 350, that is not an urban water supplier shall, within thirty (30) days, take one or more of the following actions:

(1) Limit outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves to no more than two days per week; or

(2) Implement another mandatory conservation measure or measures intended to achieve a comparable reduction in water consumption by the persons it serves relative to the amount consumed in 2013.

Authority: Wat. Code, § 1058.5.
References: Wat. Code, §§ 102, 104, 105; 350; 10617; 10632.

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11. The State Water Board calls on all Californians to take the following additional actions:
    - Further reduce water demand, whether by using less water in daily routines indoors and out, retrofitting appliances and installing greywater and rainwater catchment systems; and
    - Check residential and business water bills to see if there are high charges that may indicate a leak and to fix the leak, if they are able, or contact their local water utility if they need assistance.

12. The State Water Board encourages its staff, the Department of Water Resources, the Public Utilities Commission, urban water suppliers, and other local agencies to look for opportunities to encourage and promote new technologies that reduce water usage, including through timely access to water usage information and behavioral response.

13. The State Water Board encourages all state and local agencies to look for additional opportunities to minimize potable water use in outdoor spaces.

14. The State Water Board encourages investor-owned utilities to expeditiously submit applications for implementation of the regulations to the California Public Utilities Commission.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on July 15, 2014.

AYE:	Chair Felicia Marcus Vice Chair Frances Spivy-Weber Board Member Steven Moore Board Member Dorene D'Adamo
NAY:	None
ABSENT:	Board Member Tam M. Doduc
ABSTAIN:	None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board

5

PROPOSED TEXT OF EMERGENCY REGULATIONS

Article 22.5. Drought Emergency Water Conservation

Sec. 863 Findings of Drought Emergency

(a) The State Water Resources Control Board finds as follows:

(1) On January 17, 2014, the Governor issued a proclamation of a state of emergency under the California Emergency Services Act based on drought conditions;

(2) On April 25, 2014, the Governor issued a proclamation of a continued state of emergency under the California Emergency Services Act based on continued drought conditions;

(3) The drought conditions that formed the basis of the Governor's emergency proclamations continue to exist;

(4) The present year is critically dry and has been immediately preceded by two or more consecutive below normal, dry, or critically dry years; and

(5) The drought conditions will likely continue for the foreseeable future and additional action by both the State Water Resources Control Board and local water suppliers will likely be necessary to further promote conservation.

Authority: Wat. Code, § 1058.5.
References: Wat. Code, §§ 102, 104, 105.

Sec. 864 Prohibited Activities in Promotion of Water Conservation

(a) To promote water conservation, each of the following actions is prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency:

(1) The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;

(2) The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;

(3) The application of potable water to driveways and sidewalks; and

(4) The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.

(b) The taking of any action prohibited in subdivision (a) of this section, in addition to any other applicable civil or criminal penalties, is an infraction, punishable by a fine of up to five hundred dollars ($500) for each day in which the violation occurs.

Authority: Wat. Code, § 1058.5.
References: Wat. Code, §§ 102, 104, 105.

PROPOSED TEXT OF EMERGENCY REGULATIONS

Sec. 865 Mandatory Actions by Water Suppliers

(a) The term "urban water supplier," when used in this section, refers to a supplier that meets the definition set forth in Water Code section 10617, except it does not refer to suppliers when they are functioning solely in a wholesale capacity, but does apply to suppliers when they are functioning in a retail capacity.

(b)(1) To promote water conservation, each urban water supplier shall implement all requirements and actions of the stage of its water shortage contingency plan that imposes mandatory restrictions on outdoor irrigation of ornamental landscapes or turf with potable water.

(2) As an alternative to subdivision (b)(1), an urban water supplier may submit a request to the Executive Director for approval of an alternate plan that includes allocation-based rate structures that satisfies the requirements of chapter 3.4 (commencing with section 370) of division 1 of the Water Code, and the Executive Director may approve such an alternate plan upon determining that the rate structure, in conjunction with other measures, achieves a level of conservation that would be superior to that achieved by implementing limitations on outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves to no more than two days per week.

(c) To promote water conservation, each urban water supplier that does not have a water shortage contingency plan or has been notified by the Department of Water Resources that its water shortage contingency plan does not meet the requirements of Water Code section 10632 shall, within thirty (30) days, limit outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves to no more than two days per week or shall implement another mandatory conservation measure or measures intended to achieve a comparable reduction in water consumption by the persons it serves relative to the amount consumed in 2013.

(d) In furtherance of the promotion of water conservation each urban water supplier shall prepare and submit to the State Water Resources Control Board by the 15th of each month a monitoring report on forms provided by the Board. The monitoring report shall include the amount of potable water the urban water supplier produced, including water provided by a wholesaler, in the preceding calendar month and shall compare that amount to the amount produced in the same calendar month in 2013. Beginning October 15, 2014, the monitoring report shall also estimate the gallons of water per person per day used by the residential customers it serves. In its initial monitoring report, each urban water supplier shall state the number of persons it serves.

(e) To promote water conservation, each distributor of a public water supply, as defined in Water Code section 350, that is not an urban water supplier shall, within thirty (30) days, take one or more of the following actions:

(1) Limit outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves to no more than two days per week; or

(2) Implement another mandatory conservation measure or measures intended to achieve a comparable reduction in water consumption by the persons it serves relative to the amount consumed in 2013.

Authority: Wat. Code, § 1058.5.
References: Wat. Code, §§ 102, 104, 105; 350; 10617; 10632.

ORDINANCE SUMMARY

SUMMARY OF ORDINANCE NO. 880 OF THE CITY OF ROHNERT PARK, CALIFORNIA, APPROVING AN INTERIM URGENCY ORDINANCE OF THE CITY COUNCIL OF THE CITY OF ROHNERT PARK, CALIFORNIA, AS AN URBAN WATER SUPPLIER, PROHIBITING CERTAIN ACTIVITIES THAT WASTE WATER AND IMPLEMENTING MANDATORY RESTRICTIONS ON OUTDOOR IRRIGATION TO PROMOTE WATER CONSERVATION AND TO BECOME EFFECTIVE IMMEDIATELY

Pursuant to Government Code Section 36933(c), the following constitutes a summary of Ordinance No. 880 scheduled for consideration and adoption by the Rohnert Park City Council on August 26, 2014, at its meeting to be held in the City Council Chambers, 130 Avram Avenue., Rohnert Park, California.

The purpose of Ordinance No. 880 is to comply with the State Water Resources Control Board's Emergency Regulation for Statewide Water Conservation. The Ordinance regulates water use by:

- Imposing the prohibitions included in the state's emergency regulation including:
  - washing hardscapes
  - washing cars without a shutoff nozzle
  - irrigation runoff
  - decorative water features
- Restricting outdoor water use in accordance with the state's emergency regulation by:
  - Restricting residential irrigation use to between the hours of six pm and eight am (6 pm and 8 am)
  - Restricting potable water use through a dedicated irrigation meter to the hours of six p.m. and eight a.m. (6 pm and 8 am) and to an amount no greater than eighty percent (80%) of historical net evapotranspiration-based demand for the square footage of the irrigated area
  - Requiring inspections of all irrigation systems, repairing of leaks, and adjustment of spray heads to provide optimum coverage and eliminate avoidable over-spray
  - Requiring that when irrigation control values are used, sprinkler system run times vary consistent with fluctuations in weather
  - Requiring reduced run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed
- Encouraging voluntary efforts to:
  - Limit irrigation use to no more than two days per week
  - Utilize water conservation incentive, rebate and giveaway programs to replace plumbing fixtures and appliances with more water efficient models
  - Utilize city information regarding water efficient landscapes

The Interim Urgency Ordinance will utilize the enforcement procedures outlined in Municipal Code Section 13.66 including: personal contact with the customer; written notice to the customer and options to install water restricting device or terminate service after notice and hearing. The

Interim Urgency Ordinance provides the City Council with the ability to set a water waste fee by resolution. No fee is proposed at this time.

A certified copy of the full text of the Ordinance is posted and available for review in the City Clerk's Office at 130 Avram Avenue, Rohnert Park, California.

This ordinance shall be in full force and effective immediately upon its adoption, and shall be published and posted as required by law.

Dated: August 13, 2014
Published: August 15, 2014

JoAnne M. Buergler
City Clerk

ITEM NO. 8

Mission Statement
"We Care for Our Residents by Working Together to Build a Better Community for Today and Tomorrow."

CITY OF ROHNERT PARK
CITY COUNCIL AGENDA REPORT

Meeting Date:	August 26, 2014
Department:	Development Services
Submitted By:	Marilyn Ponton, Interim Director of Development Services
Prepared By:	Mary Grace Pawson PE, City Engineer
Agenda Title:	Approve an Interim Urgency Ordinance of the City Council of the City of Rohnert Park, California, as an Urban Water Supplier, Prohibiting Certain Activities that Waste Water and Implementing Mandatory Restrictions on Outdoor Irrigation to Promote Water Conservation and to become Effective Immediately and Make CEQA Exemption Findings

RECOMMENDED ACTION: Approve an Interim Urgency Ordinance of the City Council of the City of Rohnert Park, California, as an Urban Water Supplier, Prohibiting Certain Activities that Waste Water and Implementing Mandatory Restrictions on Outdoor Irrigation to Promote Water Conservation and to become Effective Immediately

BACKGROUND:
California is experiencing a serious drought with rainfall for 2013 being recorded as the lowest on record in 120 years; consequently, a statewide drought emergency was declared by Governor Brown on January 17, 2014. On February 11, 2014, and in response to the Governor's declaration, the City Council approved Resolution 2014-12 encouraging its residents to reduce water use by twenty percent. To assist in meeting this goal, the City participates in the Sonoma Marin Water Saving Partnership (Partnership) which includes the cities of Cotati, Petaluma, Rohnert Park, Santa Rosa and Sonoma, the Town of Windsor and the Marin Municipal, North Marin and Valley of the Moon Water Districts. The members of the Partnership report regularly on per capita water use and the City is currently achieving the lowest per capita use of all the partners (see Exhibit A - Sonoma Marin Water Saving Partnership Per Capita Water Use Report).

On Tuesday, July 15, in response to the continuing severity of the drought, the State Water Resources Control Board (State Water Board) approved Resolution No. 2014-0032, which includes new California Code of Regulations Title 23, Sections 863, 864 and 865, an emergency regulation to ensure urban water suppliers, their customers and state residents increase water conservation in urban settings or face possible fines or other enforcement (see Exhibit B – State Water Board Emergency Regulation). The State Water Board Emergency Regulation became effective August 1, 2014, will be in effect for 270 days, unless extended, and is intended to reduce outdoor urban water use and mandates minimum actions to conserve water supplies both for this year and into 2015. Urban water suppliers, like the City, must comply with this requirement within 30 days of the Emergency Regulation's effective date of August 1, 2014.

ITEM NO. 8

The Emergency Regulation includes both prohibitions and restrictions on outdoor water use. The "prohibitions" (Section 864(a) (1)-(4)) include:

- washing down driveways and sidewalks;
- watering of outdoor landscapes that causes excess runoff;
- using a hose to wash a motor vehicle, unless the hose is fitted with a shut-off nozzle; and
- using potable water in a fountain or decorative water feature, unless the water is recirculated.

The Emergency Regulation makes an exception for health and safety circumstances.

The "restrictions" (Section 865(b) (1)) include a requirement that urban water suppliers, such as Rohnert Park, "implement all requirements and actions of the stage of its water shortage contingency plan that imposes mandatory restrictions on outdoor irrigation…"

The Emergency Regulation also provides a process that would allow local agencies to ask the courts to fine water users up to $500 a day for failure to implement conservation requirements. This new authority is in addition to any existing authorities and processes that local agencies have already developed.

Finally, the Emergency Regulation requires water suppliers to report water use on a monthly basis to track progress towards reducing use by twenty percent from 2013 levels.

The State Water Board could initiate enforcement actions against water suppliers that do not comply with the new regulation. Failure to comply with a State Water Board enforcement order could result in penalties up to $10,000 a day for the City.

ANALYSIS:

The City of Rohnert Park is an urban water supplier as defined in Water Code Section 10617 and is subject to the State Water Board's emergency regulation. Because it is an urban water supplier, the City has adopted prohibitions against water waste (Municipal Code Section 13.62).

The City has also adopted a Water Shortage Emergency Plan (Municipal Code Section 13.66), which was submitted as the "water shortage contingency plan" in the City's 2010 Urban Water Management Plan. The California Department of Water Resources has approved the City's Water Shortage Emergency Plan as its "water shortage contingency plan". The City has existing enforcement processes codified in both Section 13.62 and 13.66 of the Municipal Code. These enforcement processes are similar, but not identical, and generally emphasize customer education with options to impose a water waste fee, install a flow restricting device or terminate service. Both sections of the Municipal Code allow the City Council to establish a water waste fee by resolution, which has not been done.

The Municipal Code has evolved over time, in response to changes in state law. While the Water Shortage Emergency Plan (Municipal Code Section 13.66) has been approved by the Department of Water Resources as part of the City's Urban Water Management Plan, the prohibitions and restrictions outlined in the Municipal Code do not align exactly with the state's emergency regulation.

ITEM NO. 8

There is need for some flexibility in selecting the exact strategy to be used to respond to a particular water shortage situation. The action by the State Water Resources Board imposes requirements on the City to initiate measures, specifically, elements of its "water shortage contingency plan", which normally would only be triggered after certain milestones have been met, such as a system-wide shortage of water (declared by the wholesaler) followed by a City Council declaration of local water shortage emergency. Here, while both the City and its wholesale supplier have actively encouraged voluntary conservation by customers, neither the City nor its wholesale supplier has declared a local water shortage emergency. To comply with the State Water Board's emergency regulations and maintain the Council's discretion to craft water measures that are responsive to local conditions, staff recommends that the Council to adopt an Interim Urgency Ordinance that augments our current Municipal Code with a set of prohibitions and restrictions that are tailored to comply with the specific requirements of the State Water Board's Emergency Regulation and that are enforced uniformly. The ordinance is crafted as an urgency ordinance so that it will become effective immediately (as opposed to traditional ordinances which are effective 30 days after second reading) consistent with the Governor's declaration of the state of emergency and the directive of the State Water Board. It is crafted as an interim ordinance because it is designed to be in place only for so long as the Emergency Regulations are in effect, which is currently 270 days, although that period may be extended by the State Water Board.

Specifically this Interim Urgency Ordinance will:

- Impose the prohibitions included in the state's emergency regulation including:
  - washing hardscapes,
  - washing cars without a shutoff nozzle
  - irrigation runoff
  - decorative water features
- Restrict outdoor water use by implementing the provisions of Stage II of our Water Shortage Emergency Plan that make outdoor irrigation restrictions mandatory:
  - Restricting residential irrigation use to between the hours of six p.m. and eight a.m.
  - Restricting potable water use through a dedicated irrigation meter to the hours of six p.m. and eight a.m. and to an amount no greater than eighty percent (80%) of historical net evapotranspiration-based demand for the square footage of the irrigated area
  - Requiring customer inspections of all irrigation systems, repairing of leaks, and adjustment of spray heads to provide optimum coverage and eliminate avoidable over-spray
  - Requiring that when irrigation control values are used, sprinkler system run times vary consistent with fluctuations in weather
  - Requiring reduced run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed
- Encouraging voluntary efforts to:
  - Utilize water conservation incentive, rebate and giveaway programs to replace plumbing fixtures and appliances with more water efficient models
  - Utilize city information regarding water efficient landscapes

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ITEM NO. 8

The Interim Urgency Ordinance will utilize the enforcement procedures outlined in Municipal Code Section 13.66 including:

- Personal contact
- Written notice
- Options to install water restricting device or terminate service after notice and hearing

The Interim Urgency Ordinance treats violations as infractions, under Section 1.24 of the Municipal Code, which can be subject to abatement under the same Section. Council will retain the ability to set a water waste fee by resolution. Staff is not proposing to set a fee at this time.

Staff has been coordinating with the members of the Sonoma Marin Water Saving Partnership both in order to leverage our existing regional partnership to encourage conservation and to understand how these agencies are implementing the emergency regulation. Of the eight members of the Partnership, two are proposing to declare a "stage" of their existing water shortage emergency plan and the others are proposing some form of resolution or ordinance to make their action consistent with the emergency regulation.

The Council's Water Issues Subcommittee (the Subcommittee) met on August 6, 2014, and reviewed the State Water Board's Emergency Regulation and the proposed staff recommendation. The Subcommittee also considered activities to enhance community education and enforcement of the prohibitions and restrictions included in the proposed interim emergency ordinance.

The recommended action will have a fiscal impact for two reasons. First, by adopting the proposed emergency ordinance, the City will be enforcing mechanisms of its Water Shortage Emergency Plan designed to reduce water use by twenty percent, which also reduces water sales revenue. This reduction in revenue is somewhat balanced by the fact that the City may experience lower costs associated with water purchases or groundwater pumping. Secondly, the City's efforts associated with enforcing the mandatory restrictions and reporting to the state will increase costs. Using enhanced communication between existing staff, particularly field staff that have opportunity to see water waste in their day-to-day work, will help minimize these additional costs. The effect of these cost increases is expected to be relatively short-lived because the Emergency Regulations are only in place for 270 days, unless extended by the State Water Board. In anticipation of future drought emergencies, staff is currently working on a water rate study that will include, among other things, an analysis of "drought rates". These special rates, which come into effect only when water use is restricted, could help the City manage the fiscal impacts of water shortage emergencies in the future.

This ordinance is not subject to the California Environmental Quality Act (CEQA) for two reasons. The statutory exemption set forth in Section 15269(c) (specific actions necessary to prevent or mitigate an emergency) of the CEQA Guidelines, California Code of Regulations, Title 14, Chapter 3, applies because this ordinance is a direct response to the State's Emergency Regulation. The categorical exemption set forth in Section 15307 (actions by regulatory agencies for protection of natural resources) also applies because the State Water Resources Control Board has mandated that Rohnert Park, as an urban water supplier, protect and conserve the natural resource of water during the severe drought.

ITEM NO. 8

OPTIONS CONSIDERED:

1. Adopt an interim urgency ordinance that clearly prohibits water waste and restricts outdoor water use, consistent with the State Water Board's Emergency Regulation (recommended action)
2. Adopt a resolution declaring Stage 2 of the City's Water Shortage Emergency Plan. This option is not recommended at this time as it does not reflect local conditions and would not be tailored to the requirements of the Emergency Regulation.

FISCAL IMPACT/FUNDING SOURCE:

The recommended action will be funded through the water fund. As noted above, the fiscal impact is expected by relatively short-lived because the Emergency Regulations are in force for 270 days.

Department Head Approval Date: **8/11/14**

City Manager Approval Date: **8/13/14**

City Attorney Approval Date: **8/11/14**

Attachments *(list in packet assembly order):*

1. Interim Urgency Ordinance of the City Council of the City of Rohnert Park, California, as an Urban Water Supplier, Prohibiting Certain Activities that Waste Water and Implementing Mandatory Restrictions on Outdoor Irrigation to Promote Water Conservation and to become Effective Immediately
2. Exhibit A – Sonoma Marin Water Saving Partnership Per Capita Water Use Report
3. Exhibit B – State Water Board Emergency Regulation
4. Ordinance Summary

ORDINANCE NO. 880

AN INTERIM URGENCY ORDINANCE OF THE CITY COUNCIL OF THE CITY OF ROHNERT PARK, CALIFORNIA, AS AN URBAN WATER SUPPLIER, PROHIBITING CERTAIN ACTIVITIES THAT WASTE WATER AND IMPLEMENTING MANDATORY RESTRICTIONS ON OUTDOOR IRRIGATION TO PROMOTE WATER CONSERVATION, TO BECOME EFFECTIVE IMMEDIATELY

THE CITY COUNCIL OF THE CITY OF ROHNERT PARK HEREBY ORDAINS AS FOLLOWS:

SECTION 1. Authority. This Ordinance is adopted pursuant to the provisions set forth in Government Code Section 36937(b) and pursuant to other applicable law.

SECTION 2. Findings.

A. On January 17, 2014 Governor Brown issued Governor's Proclamation No. 1-17-2014 declaring a State of Emergency to exist in California due to severe drought conditions.

B. February 11, 2014, and in support of the Governor's Proclamation, the City adopted its Resolution Number 2014-12 calling for a voluntary 20% reduction in water use.

C. On April 25, 2014, Governor Brown issued an executive order to strengthen the state's ability to manage water and habitat effectively in a drought.

D. On July 15, 2014, the State Water Resources Control Board approved its Resolution No. 2014-0032 To Adopt an Emergency Regulation for Statewide Water Conservation and this emergency regulation includes new California Code of Regulations Title 23, Section 863, 864 and 865 (hereinafter "Emergency Regulation"). These Regulations became effective as of August 1, 2014.

E. The Emergency Regulation prohibits each of the following actions, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency:
   - The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;
   - The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;
   - The application of potable water to driveways and sidewalks; and
   - The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.

F. The Emergency Regulation requires that each urban water supplier within 30 days to either implement all requirements and actions of the stage of their Water Shortage Contingency Plan that impose mandatory restrictions on outdoor irrigation of ornamental landscapes or turf with potable water or request approval from the State Water Resources Control Board of an alternate plan that achieves a specified level of conservation.

G. The Emergency Regulation requires that urban water supplier shall prepare and submit to the State Water Resources Control Board by the 15th of each month a monitoring report on forms provided by the Board that includes the amount of potable water the urban water supplier produced, including water provided by a wholesaler, in the preceding calendar month and shall compare that amount to the amount produced in the same calendar month in 2013. Beginning October 15, 2014, the monitoring report shall also estimate the gallons of water per person per day used by the residential customers it serves.

H. The Emergency Regulation is in effect for 270 days, beginning on or about August 1, 2014, and may be extended by the State Water Resources Control Board.

I. The City of Rohnert Park (City) is an urban water supplier, as that term is defined in Water Code Section 10617.

J. The City's Water Waste Regulations (Municipal Code Section 13.62) and Water Shortage Emergency Plan (Municipal Code Section 13.66) contain prohibitions and mandatory restrictions to reduce water waste and control outdoor water use.

K. By adopting this ordinance, the City will both implement the Emergency Regulation and provide clarity to its customers on prohibitions and restrictions that are in effect.

L. In light of the declaration of a State of Emergency by the Governor and the obligation to implement the Emergency Regulations in a short timeframe, the City considered the adoption of this interim urgency ordinance in accordance with Government Code § 36937 at a duly noticed public meeting on August 26, 2014, at which time it received and considered testimony from members of the public.

M. Pursuant to Article XI, Section 7 of the California Constitution, the City may make and enforce all regulations and ordinances using its police powers.

SECTION 3. <u>IMPOSITION OF INTERM URGENCY ORDINANCE.</u>

In accordance with the authority granted the City under Government Code section 36937(b), and pursuant to the findings stated herein, the City Council: (1) hereby finds that there exists a current and immediate threat to the public health, safety, and welfare requiring immediate implementation of the Emergency Regulations to promote water conservation during the drought, (2) further finds that this ordinance is necessary for the immediate preservation of the public peace, health, and safety, and (3) hereby declares and imposes the prohibitions on wasting water and restrictions on water use as set forth below.

2

The City Council of the City of Rohnert Park hereby ordains as follows:

1. To promote water conservation, each of the following actions shall be prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency:

A. The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;

B. The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;

C. The application of potable water to driveways and sidewalks; and

D. The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.

In addition, the prohibition against nonessential uses of water outlined in Chapter 13.62.030 of the Municipal Code remain in effect, except to the extent that those provisions conflict with the prohibitions described above. In the event of a conflict, the prohibitions described above shall govern.

2. To promote conservation, all potable water customers of the city shall comply with the following mandatory restrictions:

A. Restrict residential irrigation use to between the hours of six p.m. and eight a.m.
B. Restrict potable water use through a dedicated irrigation meter to the hours of six p.m. and eight a.m. and to an amount no greater than eighty percent (80%) of historical net evapotranspiration-based demand for the square footage of the irrigated area.
C. Inspect all irrigation systems, repair leaks, and adjust spray heads to provide optimum coverage and eliminate avoidable over-spray.
D. When irrigation control values are used, vary the sprinkler system run times consistent with fluctuations in weather.
E. Reduce minutes of run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed.

3. To promote conservation, all potable water customers of the city are requested to undertake the following voluntary activities:

A. Utilize water conservation incentive, rebate and giveaway programs to replace plumbing fixtures and appliances with more water efficient models.
B. Utilize city information regarding water efficient landscapes.

4. Any customer of the city may make written application for an exception to this Ordinance. Said application shall describe in detail why applicant believes an exception

is justified. The application shall be processed in accordance with the Section 13.66.060 of the Municipal Code.

5. The violation of each provision of this Ordinance, and each separate violation thereof, shall be deemed a separate offense, and shall be enforced as an infraction in accordance with Chapter 1.24 of the Municipal Code. When undertaking enforcement, the city may take any or all of the actions necessary and proper to ensure compliance, including but not limited to imposing any or all of the fees and charges described in Section 13.66.070 of the Municipal Code. When undertaking enforcement, the city shall comply with the notice and hearing process described in Section 13.66.080 of the Municipal Code.

6. As a remedy, the violation of any provision of this Ordinance by any person who has received more than one written warning to refrain from the same or any other violation under this Ordinance, in one calendar year, shall be deemed and is declared to be a public nuisance and may be subject to abatement in accordance with Chapter 1.24 of the Municipal Code.

7. As an additional remedy and in accordance with the Emergency Regulation, the taking of any prohibited action, in addition to any other applicable civil or criminal penalties, is an infraction, punishable by a fine of up to five hundred dollars ($500) for each day in which the violation occurs.

SECTION 9. Environmental Review.
The City Council finds that this ordinance is not subject to the California Environmental Quality Act (CEQA) pursuant to the statutory exemption set forth in Section 15269(c) (specific actions necessary to prevent or mitigate an emergency) of the CEQA Guidelines, California Code of Regulations, Title 14, Chapter 3, because this ordinance is a direct response to the State's Emergency Regulation, and pursuant to the categorical exemption set forth in Section 15307 (actions by regulatory agencies for protection of natural resources) because the State Water Resources Control Board has mandated that Rohnert Park, as an urban water supplier, protect and conserve the natural resource of water during the severe drought.

SECTION 10. Severability. If any section, subsection, sentence, clause, or phrase of this ordinance is for any reason held to be invalid or unconstitutional by a decision of any court of competent jurisdiction, such decision will not affect the validity of the remaining portions of this ordinance. The City Council hereby declares that it would have passed this ordinance and each and every section, subsection, sentence, clause, or phrase not declared invalid or unconstitutional without regard to whether any portion of the ordinance would be subsequently declared invalid or unconstitutional.

SECTION 11. Effective Date and Duration. This ordinance is an urgency ordinance enacted under California Government Code sections 36934 and 36937(b). This urgency ordinance is effective upon adoption by a four-fifths (4/5) vote of the City Council. This Ordinance shall remain in full force and effect for a period of two hundred and seventy (270) days from the date of adoption, at which time it will automatically expire, unless it is earlier repealed by the enactment of a new regulatory scheme or extended by the City Council in accordance with applicable law.

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SECTION 12. Publication. The City Clerk is directed to cause this ordinance to be published in the manner required by law.

This ordinance was introduced and duly adopted by the City Council of the City of Rohnert Park at the regular meeting held this 26th day of August, 2014 by a four-fifths vote of the City Council as follows:

AYES:
NOES:
ABSENT:
ABSTAIN:

CITY OF ROHNERT PARK

_____
Joseph T. Callinan, Mayor

ATTEST:

_____
JoAnne M. Buergler
City Clerk

APPROVED AS TO FORM:

_____
Michelle M. Kenyon
City Attorney

5

Exhibit "A"

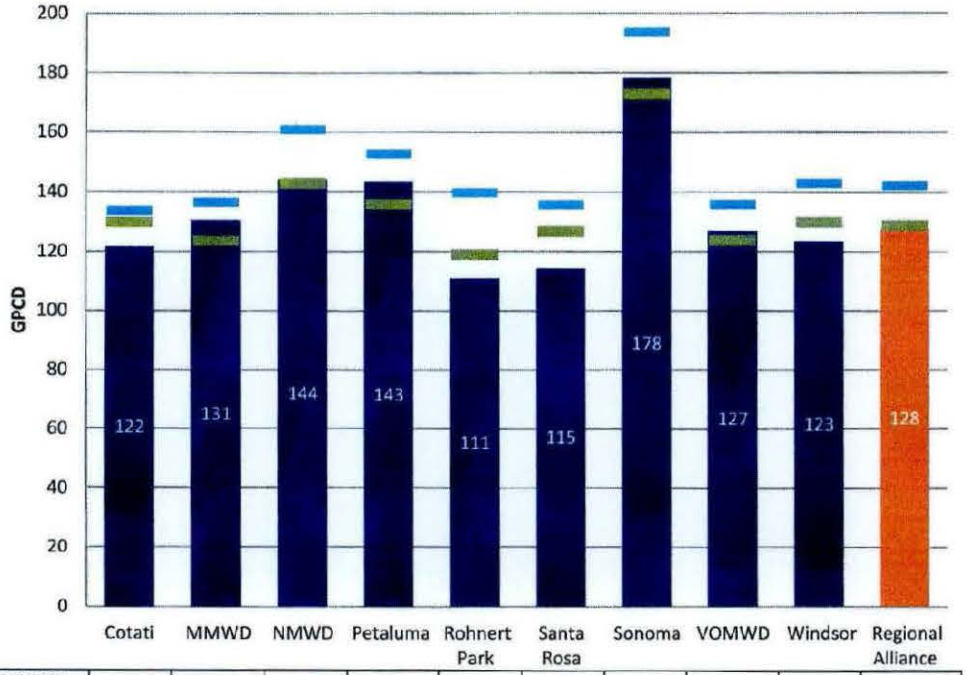
MEMORANDUM

To: Chris DeGabriele, Technical Advisory Committee Chair **May 1, 2014**
From: Carrie Pollard, Principal Program Specialist, Water Agency
Subject: UPDATED 2013 Gallon per Capita per Day (GPCD)

On May 18, 2011 DWR was notified that a regional alliance has been formed between and among the cities of Santa Rosa, Rohnert Park, Sonoma, Cotati, Petaluma, Town of Windsor and North Marin, Marin Municipal and Valley of the Moon Water Districts to comply with SBx7-7, the Water Conservation Act of 2009. The regional alliance was formed pursuant to the Department of Water Resources Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use because the parties receive water from a common water wholesale supplier, the Sonoma County Water Agency.

The Sonoma-Marin Saving Water Partnership established a regional commitment to work collaboratively on the implementation of appropriate water use efficiency programs. The Partnership is the mechanism used for tracking each water contractor's individual progress towards SBx7-7 compliance and to track the regional status on an annual basis.

The graph and table below show the reported 2013 GPCD, the 2015 Target and the 2020 Target for each water contractor and the region as whole.



	Cotati	MMWD	NMWD	Petaluma	Rohnert Park	Santa Rosa	Sonoma	VOMWD	Windsor	Regional Alliance
2013 GPCD	122	131	144	143	111	115	178	127	123	128
2015 Target	134	137	161	153	140	136	194	136	143	142
2020 Target	130	124	143	136	119	127	173	124	130	129

Exhibit "B"

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2014-0038

TO ADOPT AN EMERGENCY REGULATION
FOR STATEWIDE URBAN WATER CONSERVATION

WHEREAS:

1. On April 25, 2014, Governor Edmund G. Brown Jr. issued an executive order to strengthen the state's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water. The executive order finds that the continuous severe drought conditions present urgent challenges across the state including water shortages in communities and for agricultural production, increased wildfires, degraded habitat for fish and wildlife, threat of saltwater contamination, and additional water scarcity if drought conditions continue into 2015. The National Integrated Drought Information System reported that nearly 80% of the state was reported to be under "extreme" drought conditions at the end of June;

2. The executive order refers to the Governor's Proclamation No. 1-17-2014, issued on January 17, 2014, declaring a State of Emergency to exist in California due to severe drought conditions. The January Proclamation notes that the state is experiencing record dry conditions, with 2014 projected to become the driest year on record. Since January, state water officials indicate that reservoirs, rainfall totals and the snowpack remain critically low. This follows two other dry or below average years, leaving reservoir storage at alarmingly low levels. The January Proclamation highlights the State's dry conditions, lack of precipitation and the resulting effects on drinking water supplies, the cultivation of crops, and the survival of animals and plants that rely on California's rivers and streams. The January Proclamation also calls on all Californians to reduce their water usage by 20 percent;

3. There is no guarantee that winter precipitation will alleviate the drought conditions that the executive orders address, which will lead to even more severe impacts across the state if the drought wears on;

4. Water Code section 1058.5 grants the State Water Board the authority to adopt emergency regulations in certain drought years in order to: "prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion, of water, to promote water recycling or water conservation, to require curtailment of diversions when water is not available under the diverter's priority of right, or in furtherance of any of the foregoing, to require reporting of diversion or use or the preparation of monitoring reports";

5. Over 400,000 acres of farmland are expected to be fallowed, thousands of people may be out of work, communities risk running out of drinking water, and fish and wildlife will suffer.

6. Many Californians have taken bold steps over the years and in this year to reduce water use; nevertheless, the dire nature of the current drought requires additional conservation actions from residents and businesses. Some severely affected communities have implemented water rationing, limiting water use in some cases to only 50 gallons per person per day, foregoing showers, laundry, toilet flushing, and all outdoor watering.

7. Water conservation is the easiest, most efficient and most cost effective way to quickly reduce water demand and extend supplies into the next year, providing flexibility for all California communities. Water saved this summer is water available next year, giving water suppliers the flexibility to manage their systems efficiently. The more water that is conserved now, the less likely it is that a community will experience such dire circumstances that water rationing is required ;

8. Most Californians use more water outdoors than indoors. In many areas, 50 percent or more of daily water use is for lawns and outdoor landscaping. Outdoor water use is generally discretionary, and many irrigated landscapes would not suffer greatly from receiving a decreased amount of water;

9. Public information and awareness is critical to achieving conservation goals and the Save Our Water campaign, run jointly by the Department of Water Resources (DWR) and the Association of California Water Agencies, is an excellent resource for conservation information and messaging that is integral to effective drought response (http://saveourwater.com).

10. Enforcement against water waste is a key tool in conservation programs. When conservation becomes a social norm in a community, the need for enforcement is reduced or eliminated;

11. The emergency regulations set a minimum standard requiring only modest lifestyle changes across the state. Many communities are already doing more and have been for years. They should be commended, but can and should do more. Others are not yet doing so and should at least do this, but should do much more given the severity of the drought;

12. On July 8, 2014, the State Water Board issued public notice that the State Water Board would consider the adoption of the regulation at the Board's regularly-scheduled July 15, 2014 public meeting, in accordance with applicable State laws and regulations. The State Water Board also distributed for public review and comment a Finding of Emergency that complies with State laws and regulations;

13. On April 25, 2014, the Governor suspended the California Environmental Quality Act's application to the State Water Board's adoption of emergency regulations pursuant to Water Code section 1058.5 to prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water, to promote water recycling or water conservation;

14. As discussed above, the State Water Board is adopting the emergency regulation because of emergency drought conditions, the need for prompt action, and current limitations in the existing enforcement process;

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15. Disadvantaged communities may require assistance in increasing water conservation and state agencies should look for opportunities to provide assistance in promoting water conservation;

16. Nothing in the regulations or in the enforcement provisions of the regulations, preclude a local agency from exercising its authority to adopt more stringent conservation measures. Moreover, the Water Code does not impose a mandatory penalty for violations of the regulations adopted by this resolution and local agencies retain their enforcement discretion in enforcing the regulations, to the extent authorized, and may develop their own progressive enforcement practices to encourage conservation.

THEREFORE BE IT RESOLVED THAT:

1. The State Water Board adopts California Code of Regulations, title 23, sections 863, 864, and 865, as appended to this resolution as an emergency regulation;

2. The State Water Board staff will submit the regulation to the Office of Administrative Law (OAL) for final approval;

3. If, during the approval process, State Water Board staff, the State Water Board, or OAL determines that minor corrections to the language of the regulation or supporting documentation are needed for clarity or consistency, the State Water Board Executive Director or designee may make such changes;

4. These regulations shall remain in effect for 270 days after filing with the Secretary of State unless the State Water Board determines that it is no longer necessary due to changed conditions, or unless the State Water Board renews the regulations due to continued drought conditions as described in Water Code section 1058.5;

5. The State Water Board directs staff to provide the Board with monthly updates on the implementation of the emergency regulations and their effect;

6. Directs State Water Board staff to condition funding upon compliance with the emergency regulations, to the extent feasible;

7. Directs State Water Board staff to work with the Department of Water Resources and the Save Our Water campaign to disseminate information regarding the emergency regulations; and

8. Directs State Water Board staff in developing an electronic reporting portal to include data fields so that local agencies may provide monthly reporting data on (i) conservation-related implementation measures or enforcement actions taken by the local agency and (ii) substitution during the drought of potable water with recycled water to extend water supplies.

THEREFORE BE IT FURTHER RESOLVED THAT:

9. The State Water Board commends water suppliers that have increased conservation messaging and adopted innovative strategies to enhance customer awareness of water use, such as applications that let customers compare their water use to water use by others; reduce system losses, such as fixing system leaks which can deplete supplies by 10 percent or more; and establish incentives to reduce demand, such as tiered or drought rate structures. The State Water Board also commends all Californians that have already been working to maximize their conservation efforts, both at home and at work;

10. The State Water Board calls upon water suppliers to take the following actions:

Educate customers and employees

- Retail water suppliers should provide notice of the regulations in English and Spanish in one or more of the following ways: newspaper advertisements, bill inserts, website homepage, social media, notices in public libraries;
- Wholesale suppliers should include reference to the regulations in their customer communications;
- All water suppliers should train personnel on the regulations;
- All water suppliers should provide signage where recycled or reclaimed water is being used for activities that the emergency regulations prohibit with the use of potable water, such as operation of fountains and other water features;
- All water suppliers should redouble their efforts to disseminate information regarding opportunities and incentives to upgrade indoor fixtures and appliances;
- All water suppliers should use education and the tools available through the Save Our Water website (http://saveourwater.com); and
- All water suppliers should educate and prepare their boards and councils on the drought response actions contained in the emergency regulations and in this resolution, and to make sure that drought response items are placed on agendas as early as possible;

Increasing local supplies

- All water suppliers should accelerate the completion of projects that will conserve potable water by making use of non-potable supplies, such as recycled water, "greywater," and stormwater collection projects;
- All water suppliers should improve their leak reporting and response programs and request that police and fire departments and other local government personnel report leaks and water waste that they encounter during their routine duties/patrols;
- Smaller water suppliers – those with fewer than 3,000 service connections – should take proactive steps to secure their communities' water supplies and educate their customers about water conservation and the status of their supply reserves;
- All water suppliers should conduct water loss audits and make leak detection and repair a top priority for the duration of the drought; and
- All urban water suppliers should evaluate their rate structures and begin to implement needed changes as part of planning for another dry year. Information and assistance on setting and implementing drought rates is available from the Alliance for Water Efficiency. (http://www.allianceforwaterefficiency.org/).

4

RESOLUTION NO. 28536

RESOLUTION OF THE COUNCIL OF THE CITY OF SANTA ROSA ADOPTING STAGE 1 – MANDATORY OF THE CITY'S URBAN WATER SHORTAGE CONTINGENCY PLAN REQUIRING CUSTOMERS TO REDUCE COMMUNITY-WIDE WATER USE BY 20% AND AUTHORIZING UTILIZATION OF THE UTILITY'S CATASTROPHIC RESERVE

WHEREAS, the City of Santa Rosa is a City empowered to provide water service within certain boundaries; and

WHEREAS, California is continuing to experience extremely dry conditions and the Governor of the State of California, on January 17, 2014, declared a state-wide drought emergency and requested Californians to voluntarily reduce water use by 20%; and

WHEREAS, on February 11, 2014, the Council of the City of Santa Rosa adopted Resolution No. 28427 requesting Santa Rosa customers reduce water use by 20% community-wide through voluntary conservation; and

WHEREAS, on April 25, 2014, the Governor of the State of California issued an Executive Order directing local water suppliers to redouble efforts to implement water conservation activities; and

WHEREAS, Santa Rosa customers have reduced water use by approximately 16% during the months of March through June 2014 in comparison to the same time in 2013; and

WHEREAS, on July 15, 2014, the State Water Resources Control Board adopted Drought Emergency Water Conservation Regulations (Emergency Regulations) prohibiting certain water using activities and requiring urban water suppliers to implement their Urban Water Shortage Contingency Plans to a level that imposes mandatory restrictions on outdoor irrigation with potable water; and

WHEREAS, the City of Santa Rosa has the authority and responsibility to adopt and had adopted water conservation measures within its area of service; and

WHEREAS, the City of Santa Rosa has the authority to employ the Catastrophic Reserve during implementation of the City's Urban Water Shortage Contingency Plan; and

WHEREAS, in order to comply with the State Water Resources Control Board Emergency Regulations, the Utilities Department is recommending implementation of Stage 1 – Mandatory of the City's Urban Water Shortage Contingency Plan; and

WHEREAS, on July 24, 2014, the Board of Public Utilities recommended that the Council of the City of Santa Rosa, by resolution, adopt Stage 1 – Mandatory of the City's Urban Water Shortage Contingency Plan, directing staff to implement the water conservation program

as defined by Stage 1 – Mandatory to realize community-wide water use reduction of 20%, and authorizing staff to utilize the Utility's Catastrophic Reserve, if necessary.

NOW, THEREFORE, BE IT RESOLVED that the Council of the City of Santa Rosa adopts Stage 1 – Mandatory of the City's Urban Water Shortage Contingency Plan and directs staff to implement the water conservation program as defined by Stage 1 – Mandatory to realize community-wide water use reduction of 20%.

BE IT FURTHER RESOLVED that the Council of the City of Santa Rosa authorizes staff to utilize the Utility's Catastrophic Reserve, if necessary.

IN COUNCIL DULY PASSED this 5th day of August, 2014.

AYES: (5) Mayor Bartley, Vice Mayor Swinth, Council Members Carlstrom, Olivares, Ours

NOES: (0)

ABSENT: (2) Council Members Combs, Wysocky

ABSTAIN: (0)

ATTEST: _____ APPROVED: _____
City Clerk Mayor

APPROVED AS TO FORM:

_____
City Attorney

Reso. No. 28536
Page 2 of 2

CITY OF SONOMA

RESOLUTION 42 - 2014

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SONOMA DECLARING A MANDATORY STAGE 2 WATER SHORTAGE ALERT

WHEREAS, pursuant to California Water Code Section 102, all water in the state is the property of the people of the state; and

WHEREAS, the State Resources Control Board (State Board) is the agency tasked with issuing and monitoring permits to urban water suppliers and others to appropriate water statewide and determining the amount, purpose, place and beneficial use of that water. The City of Sonoma is the beneficiary of multiple State Board permits which authorize the appropriation of waters of the state; and

WHEREAS, Water Code Section 10617 defines "urban water supplier" as a supplier for municipal purposes that serves 3,000 customers or more than 3,000 acre feet annually. Pursuant to Section 10617, the City is an urban water supplier; and

WHEREAS, California is continuing to experience extremely dry conditions and the Governor of the State of California, on January 17, 2014, declared a state-wide drought emergency and requested Californians to voluntarily reduce water use by 20%; and

WHEREAS, on February 3, 2014, the Council of the City of Sonoma adopted Resolution 07-2014 requesting Sonoma customers reduce water use by 15% community-wide through voluntary conservation; and

WHEREAS, on April 25, 2014, the Governor of the State of California issued an Executive Order directing local water suppliers to redouble efforts to implement water conservation activities; and

WHEREAS, Sonoma customers have reduced water use by approximately 16% during the months of April through July 2014 in comparison to the same time in 2013; and

WHEREAS, on July 15, 2014, the State Water Resources Control Board adopted Drought Emergency Water Conservation Regulations (Emergency Regulations) prohibiting certain water using activities and requiring urban water suppliers to implement their Urban Water Shortage Contingency Plans to a level that imposes mandatory restrictions on outdoor irrigation with potable water; and

WHEREAS, the City of Sonoma has the authority and responsibility to adopt and had adopted water conservation measures within its area of service; and

WHEREAS, in order to comply with the State Water Resources Control Board Emergency Regulations, the City staff is recommending implementation of a Mandatory Stage 2 Water Conservation Alert, which imposes mandatory restrictions on outdoor irrigation with potable water; and

WHEREAS, the City Council has determined that it is necessary to be proactive and responsible in the management of the City's water supply.

NOW. THEREFORE, BE IT RESOLVED that the City Council of the City of Sonoma hereby declares a mandatory Stage 2 water shortage alert, in accordance with Sonoma Municipal Code 13.10.070.

BE IT FURTHER RESOLVED that until such time as the City Council determines that the condition for conservation no longer exists, all potable water customers of the City of Sonoma shall adhere to the following restrictions on non-essential water use:

1. Refilling or initial filling of a swimming pool shall be prohibited;
2. Use of water for nonrecirculating ornamental fountains by commercial customers shall be prohibited;
3. Noncommercial washing of privately owned motor vehicles, trailers, and boats except from a bucket and a hose equipped with a shutoff nozzle shall be prohibited;
4. Any use of water from a fire hydrant except for fighting fires shall be prohibited. Use for essential construction needs may be permitted by the director upon submittal of a permit application for construction water;
5. Use of potable water for dust control at construction sites shall be prohibited;
6. Residential and commercial turf irrigation shall be prohibited except on Mondays and Thursdays from 7:00pm to 7:00am. An exception to this prohibition shall apply to the Sonoma Plaza Park turf and athletic fields to the degree to ensure the safety of athletes.

PASSED, APPROVED AND ADOPTED this 18th day of August 2014 by the following vote:

AYES: Barbose, Cook, Rouse, Brown, Gallian
NOES: None
ABSENT: None

Tom Rouse, Mayor

ATTEST:

Gay Johann
Assistant City Manager/City Clerk

RESOLUTION NO. 3118-14

RESOLUTION OF THE TOWN COUNCIL OF THE TOWN OF WINDSOR TERMINATING STAGE 1 WATER SHORTAGE EMERGENCY AND DECLARING A STAGE 2 WATER SHORTAGE EMERGENCY AND DIRECTING IMPLEMENTATION OF MANDATORY WATER RESTRICTIONS

WHEREAS, the Town of Windsor is a retail water purveyor and a Sonoma County Water Agency Water Contractor; and

WHEREAS, calendar year 2013 was the lowest rainfall year on record in 120 years; and

WHEREAS, the historical dry conditions have resulted in severely low storage levels in Lake Mendocino, requiring a Temporary Urgency Change order issued by the State Water Resources Control Board earlier this year enabling lower in stream releases to the Russian River and preserving lake storage; and

WHEREAS, on January 17, 2014, Governor Brown declared a statewide drought in California and called for a 20 percent voluntary reduction in water use; and

WHEREAS, on February 3, 2014, the Water Advisory Committee for the Restructured Water Supply Agreement for the Russian River project adopted a resolution that encourages residents to increase water use efficiency and urged water customers to heed the Governor's declaration to reduce water use by 20%; and

WHEREAS, on February 19, 2014, the Town Council adopted Resolution 3057-14 in support of the call voluntarily to reduce water use by 20%; and

WHEREAS, on July 15, 2014 the State Water Resources Control Board (State) adopted emergency regulations for mandatory outdoor water restrictions due to the ongoing drought emergency;

WHEREAS, a duly noticed public hearing was held on August 6, 2014, at which time public comment was heard and considered.

NOW, THEREFORE, BE IT RESOLVED that the Town Council of the Town of Windsor hereby terminates the existing Stage 1 water shortage emergency condition; finds, determines and declares that a Stage 2 water shortage emergency condition exists, with an overall mandatory rationing requirement of 20 percent; and declares certain water uses to be non-essential and declares suspension of new connections, all as specified in Section 12-3-800 *et.seq.* of the Code.

BE IT FURTHER RESOLVED that all customers are subject to the Stage 2 water shortage emergency measures and prohibitions listed in Exhibit "A."

BE IT FURTHER RESOLVED that Town staff is directed to do what is necessary and appropriate to implement the Stage 2 water shortage emergency through education and outreach, by monitoring customer water use and encouraging customers to increase water use efficiency measures, by inspection of outdoor water waste prohibitions and mandatory restrictions, and by enforcement thereof.

PASSED, APPROVED AND ADOPTED this 6th day of August 2014 by the following vote:

AYES:	**COUNCILMEMBERS FUDGE, GOBLE, SALMON AND MAYOR OKREPKIE**
NOES:	**VICE MAYOR ALLEN**
ABSTAIN:	**NONE**
ABSENT:	**NONE**

BRUCE OKREPKIE, MAYOR

ATTEST:

MARIA DE LA O, TOWN CLERK

Attachment:
Exhibit "A"

Exhibit "A"
Stage 2 Water Shortage Emergency Measures and Prohibitions

Measures:

1. Inspect all irrigation systems, repair leaks, and adjust spray heads to provide optimum coverage and eliminate avoidable over-spray;
2. For irrigation valves controlling water applied to turf grass, vary the minutes of run-time consistent with fluctuations in weather;
3. Reduce minutes of run-time for each irrigation cycle if water begins to run-off to gutters and ditches before the irrigation cycle is completed;
4. Become informed about and strictly adhere to the Town's Water Waste Prohibitions listed in Section 12-3-825 of the Windsor Municipal Code;
5. Utilize water conservation incentive, rebate and giveaway programs to replace water guzzling plumbing fixtures and appliances with water efficient models.
6. Take advantage of the free information available from the Town on how to use water efficiently, read a water meter, repair ordinary leaks, and how to apply water efficiently to the landscape;

Prohibitions:

a. Washing of sidewalks, walkways, driveways, parking lots and other hard-surfaced areas by direct hosing.
b. Escape of water through breaks or leaks within the customer's plumbing or private distribution system for any substantial period of time within which such break or leak should reasonably have been discovered and corrected. It shall be presumed that a period of seventy two (72) hours after the customer discovers such a break or leak or receives notice from the Town, is a reasonable time within which to correct such break or leak or, as a minimum, to stop the flow of water from such break or leak.
c. Irrigation in a manner or to an extent which allows excessive runoff of water or unreasonable over-spray of the areas being watered. Every customer is deemed to have his water system under control at all times, to know the manner and extent of his water use and any run off, and to employ available alternatives to apply irrigation water in a reasonably efficient manner.
d. Water for non-recycling decorative water fountains.
e. Water for single pass evaporative cooling systems for air conditioning in all connections installed after July 18, 2007 unless required for health or safety reasons.
f. Water for new non-recirculating conveyor car wash systems.
g. Water for new non-recirculating industrial clothes wash systems.
h. Initial filling of any swimming pool for which approval of a construction permit issued by the Town was made after the date on which the water shortage emergency condition was declared to exist, and refilling a swimming pool that was drained after the emergency condition has been declared.
i. Non-commercial washing of motor vehicles, trailers and boats except from a bucket with use of a hose equipped with a shutoff nozzle for a quick rinse.
j. Watering of new turf grass or replacement turf grass.
k. Service of drinking water at any restaurant, cafe, cafeteria or other public place where food is sold, served or offered for sale, unless expressly requested by a patron.

Use of Sprinklers is Conditional:

a. Automated sprinkler irrigation must be properly controlled and performed in a non-wasteful and efficient manner between the nighttime hours of 7:00 p.m. and 9:00 a.m. of the next day.
b. The amount of water normally required to maintain a healthy landscape shall be reduced by 20 percent, based on landscape size, plant water requirement, and current weather as specified in section 12-3-835 of the Windsor Municipal Code.

RESOLUTION NO. 140801

RESOLUTION OF THE BOARD OF DIRECTORS OF VALLEY OF THE MOON WATER DISTRICT DECLARING MANDATORY CONSERVATION IN RESPONSE TO THE STATE WATER RESOURCES CONTROL BOARD EMERGENCY CONSERVATION REGULATIONS AND ADOPTING WATER SHORTAGE CHARGES

WHEREAS, the Valley of the Moon Water District is a County Water District, duly organized and existing under the provisions of the County Water District Law (California Water Code section 30000 *et seq.*), and is empowered to provide water service to customers within certain boundaries; and

WHEREAS, the State of California is in a drought caused by two years of below average rainfall followed by this past year of significantly below average rainfall; and

WHEREAS, on January 17, 2014 Governor Brown declared a statewide drought in California and called for a 20% voluntary reduction in water use; and

WHEREAS, on March 4, 2014 the District adopted a resolution that encourages residents to increase water use efficiency by fixing leaks and eliminating unnecessary outdoor irrigation to help protect and preserve reliable drinking water supplies stored in Lake Mendocino and Lake Sonoma; and urge water customers to heed the Governor's declaration and SCWA's General Manager's request to voluntarily reduce water use by 20%; and

WHEREAS, due to insufficient statewide conservation and a potentially dry 2015 the State Water Resources Control Board adopted resolution number 2014-0038 adopting California Code of Regulations title 23, sections 863, 864 and 865 that requires each urban water supplier to implement all requirements and actions of the stage of its water shortage contingency plan that imposes mandatory restriction on outdoor irrigation of ornamental landscapes or turf with potable water; and

WHEREAS, pursuant to the provisions of Water Code section 375 *et seq.* and 10632, the District has the authority and responsibility to adopt water demand reduction measures within its area of service during the existence of a water shortage.

NOW, THEREFORE, IT IS RESOLVED that the Board of Directors finds and determines that the State Water Resources Control Board Emergency Conservation Regulations require the District to declare a Stage 2 water shortage at a 20% level.

BE IT FURTHER RESOLVED, that the Board of Directors hereby establishes the Water Shortage Charges as defined in the District's 2014 Urban Water Shortage Contingency Plan.

BE IT FURTHER RESOLVED, that the Board of Directors finds and determines that the water shortage declaration are in the public interest, serve a public purpose, and will promote the health, welfare, and safety of the people who reside within the District.

BE IT FURTHER RESOLVED, that this resolution shall become effective immediately with Water Shortage Charges starting for water bills issued after August 31, 2014 and will automatically expire April 30, 2015.

BE IT FURTHER RESOLVED, that the General Manager is hereby authorized and directed to take such steps as he shall deem necessary to implement Stage 2 and shall report back to the Board and make such recommendations for further actions of this Board as may be necessary due to additional State Water Resources Control Board Actions or actual water supply conditions.

THIS RESOLUTION PASSED AND ADOPTED THIS 5th DAY OF AUGUST, 2014, by the following votes:

Director Heneveld Aye

Director Foreman Aye

Director Kenny Aye

Director Peddicord Absent

Director Prushko Aye

By _____
President

By Shari Walk
Deputy Secretary

AYES 4 NOES 0 ABSENT 1 ABSTAIN 0

I HEREBY CERTIFY that the foregoing Resolution was duly adopted at a regular meeting of the board of Directors of Valley of the Moon Water District, held on the 5th day of August, 2014, of which meeting all Directors were duly notified and at which meeting a quorum was present at all times and acting.

By Shari Walk
Deputy Secretary

APPENDIX A-6

Sonoma County Water Agency Water Quality Summary Report 2014 TUCP

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Russian River Water Quality Summary for the 2014 Temporary Urgency Change

SONOMA COUNTY WATER AGENCY

March 2015

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1.0 Introduction

On August 14, 2014, the Sonoma County Water Agency (Water Agency) filed a Temporary Urgency Change Petition (TUCP) with the State Water Resources Control Board (SWRCB) to temporarily reduce minimum instream flows in the Russian River to address low storage conditions in Lake Mendocino.

In summary, the Water Agency requested that the SWRCB make the following temporary changes to the Decision 1610 (D1610) instream flow requirements:

(1) From August 15, 2014, through February 10, 2015, reduce instream flow requirements for the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) from 75 cubic feet per second (cfs) to 50 cfs.

(2) From August 15, 2014, through February 10, 2015, reduce instream flow requirements for the lower Russian River (downstream of its confluence with Dry Creek) from 85 cfs to 60 cfs.

The TUCP also requested that compliance with these minimum instream flow requirements be measured based on a 5-day running average of average daily stream flow measurements, provided that instantaneous flows on the upper Russian River shall be no less than 40 cfs and on the lower Russian River shall be no less than 50 cfs. These 5-day running average provisions will allow the Water Agency to reduce the operational buffers needed to manage these stream flows, thereby allowing the Water Agency to conserve more water in Lake Mendocino.

The SWRCB issued an Order (Order) approving the Water Agency's TUCP on August 25, 2014. The Order was effective until 180 days from the date of the Order (February 20, 2015) or Lake Mendocino storage reached the top of the water supply pool (68,400 acre-feet), whichever was earlier. The Order included several terms and conditions, including requirements for monitoring water quality to assess possible effects from the TUCP on the availability of aquatic habitat for salmonids or recreation (Terms 7 and 8). Data collected under Terms 7a and 8 were provided in weekly Hydrologic Status Reports as they became available. This report provides and summarizes all data collected during the 2014 water quality monitoring program as required by Term 10 of the Order.

2.0 2013 Russian River Flow Summary

As described in the Order, the Water Agency requested temporary changes to D1610 instream flow requirements for dry water supply conditions, including reductions from 75 cfs to 50 cfs in the upper Russian River (from its confluence with the East Fork of the Russian River to its confluence with Dry Creek) and from 85 cfs to 60 cfs in the lower Russian River (downstream of its confluence with Dry Creek). The purpose of the 2014 Temporary Urgency Change (TUC) was to address low storage conditions in Lake Mendocino.

Through a prior TUCP that was approved by the State Board on December 31, 2013 and in effect through June 29, 2014, the Water Agency requested a change in the hydrologic index used to define D1610 water supply conditions. The modification involved relying on storage in Lake Mendocino instead of cumulative Lake Pillsbury inflow to determine D1610 minimum instream flow requirements in the upper Russian River. While the prior TUCP was in effect, low storage levels in Lake Mendocino resulted

in water supply conditions being defined as a Dry Spring under D1610, thereby allowing flows to be decreased from 185 cfs to 75 cfs in the upper Russian River. Concurrently, low inflow into Lake Pillsbury resulted in dry water supply conditions in the lower Russian River, thereby allowing flows to be decreased from 125 cfs to 85 cfs below the confluence with Dry Creek. In 2014, water storage in Lake Mendocino was below conditions experienced in 2009 and remained below conditions observed in 2009 and 2013 for the entire season until early December storms increased storage to over 56,000 acre-feet by 31 December (Figure 2-1). Lake Mendocino storage continued to increase through January and was approximately 68,092 acre-feet by 20 February 2015, the date the Order expired.

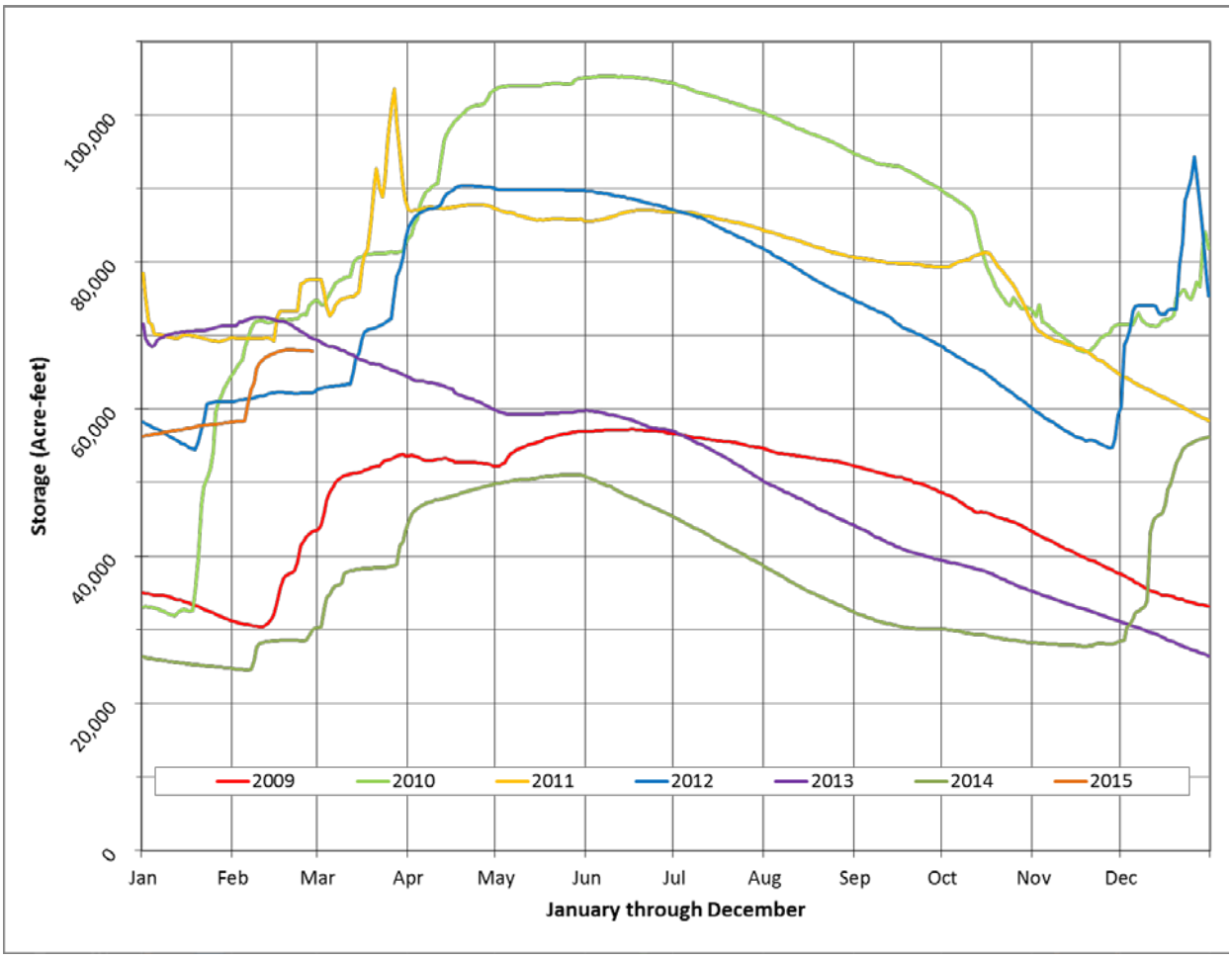

Figure 2-1. Lake Mendocino water storage levels, in acre-feet, from 2009 to early 2015.

The reduced Coyote Valley Dam releases authorized by the Order allowed flows to drop below D1610 dry water supply condition minimum flows in most sections of the Russian River. However, a moderate demand season allowed stable releases from Lake Mendocino. Figure 2-2 shows 2014 and early 2015 average daily flows.

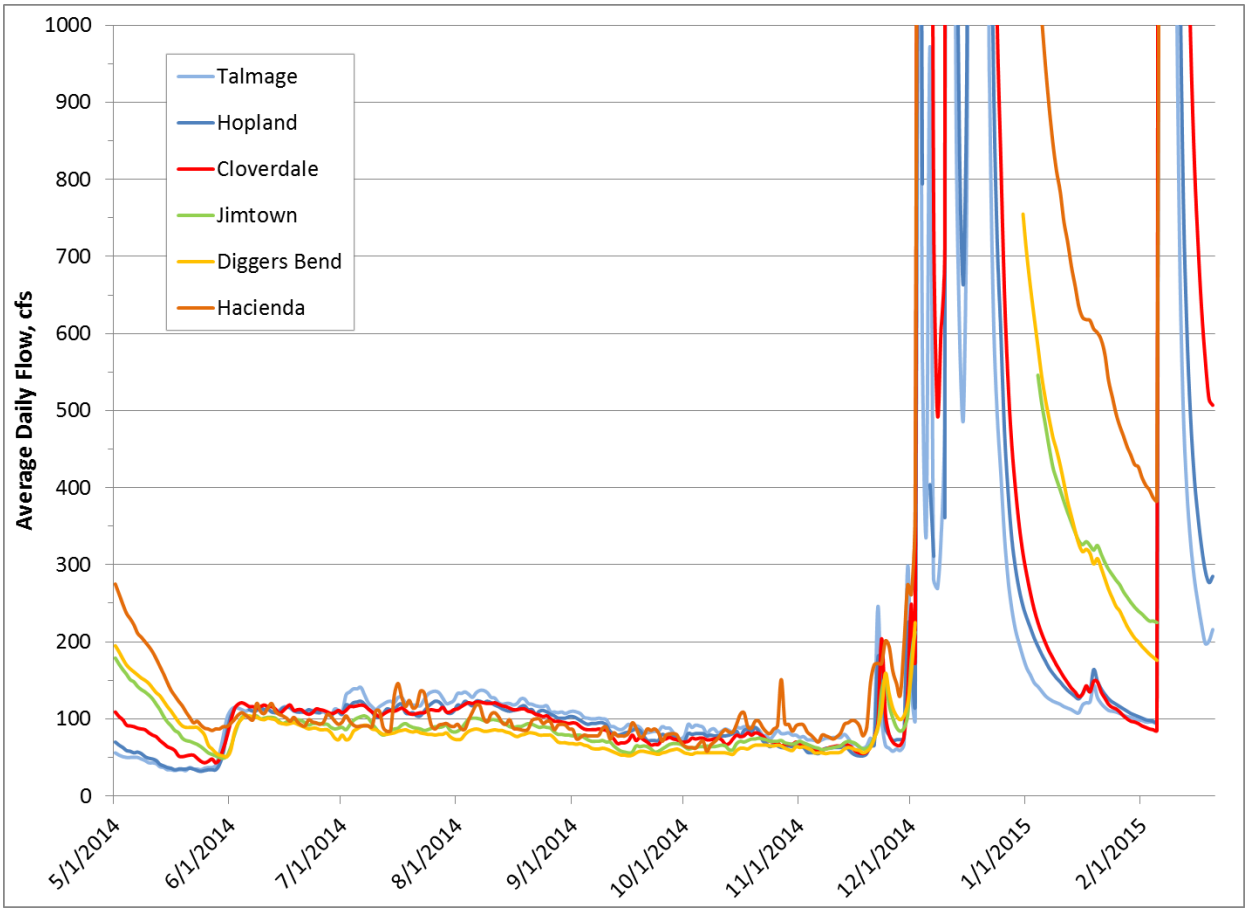

Figure 2-2. 2014 and early 2015 average daily flows in the Russian River as measured at U.S. Geological Survey (USGS) gages in cubic feet per second (cfs).

While the Order was in effect, upper Russian River flows did not drop below the 50 cfs five-day running average TUC flow or the instantaneous flow of 40 cfs authorized by the Order. Flows in the upper Russian River at Hopland were below 75 cfs periodically in late September and again in late October and November. Flows at Digger's Bend dropped to less than 75 cfs from August 28 to November 21, but did not drop below the five-day running average of 50 cfs or the instantaneous minimum flow of 40 cfs throughout the Order (Figure 2-3).

Flows in the lower Russian River at Hacienda (downstream of the confluence with Dry Creek) dropped below the TUC five-day running average of 60 cfs one day on October 7, but remained higher than the TUC instantaneous minimum flow of 50 cfs throughout the Order (Figure 2-4).

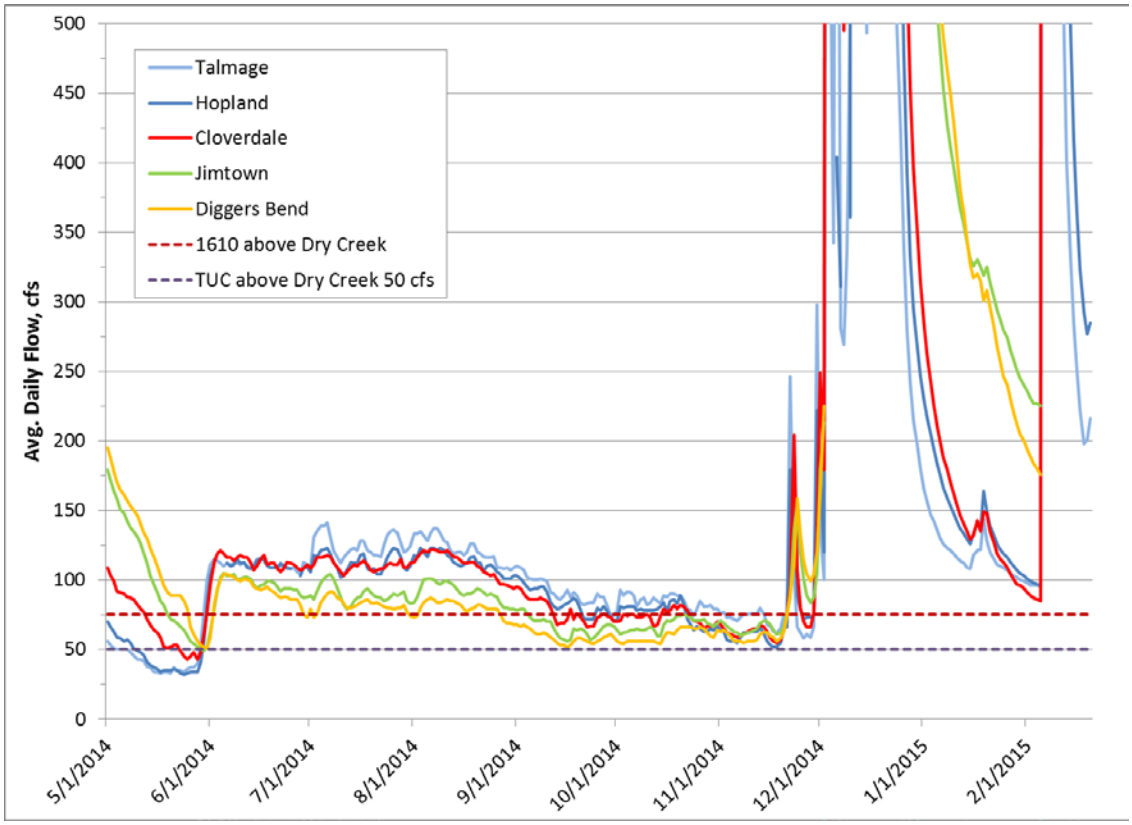

Figure 2-3. 2014 and early 2015 average daily flows in the Russian River as measured at USGS gages above the Dry Creek confluence in cubic feet per second.

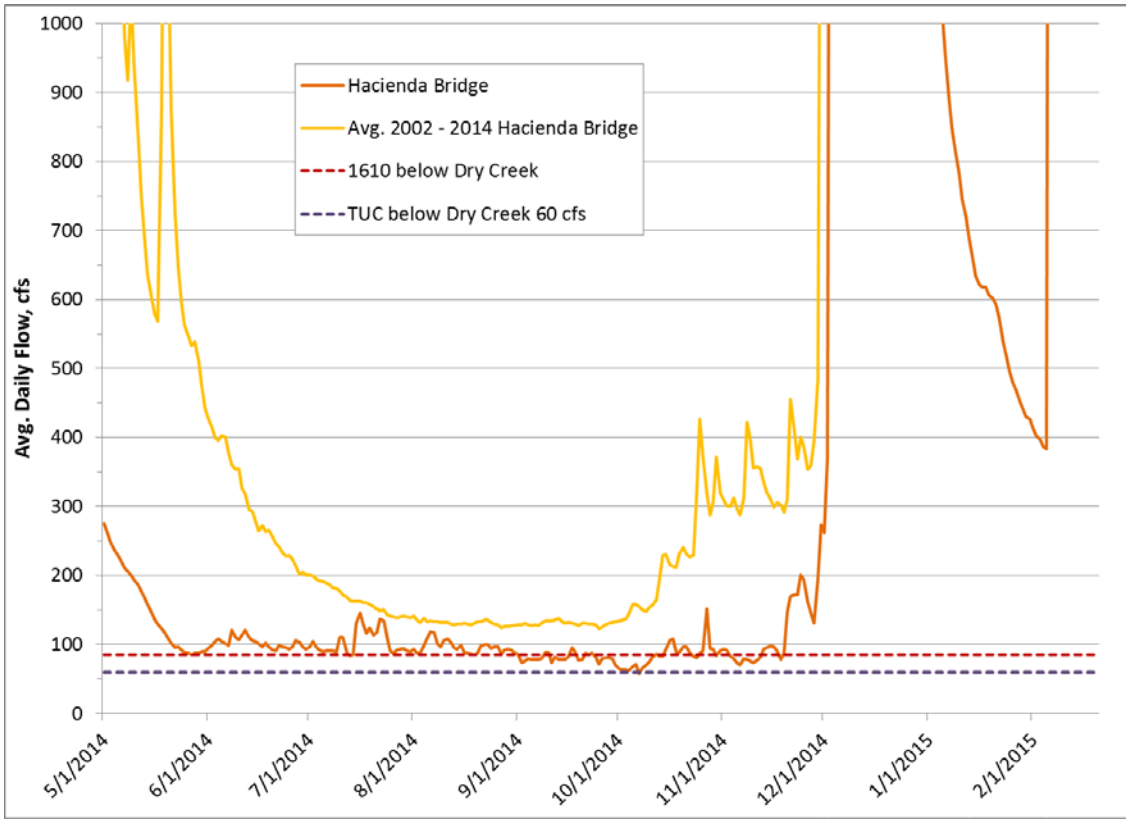

Figure 2-4. 2014 and early 2015 average daily flows in the Russian River as measured at USGS gages below the Dry Creek confluence in cubic feet per second.

3.0 Water Quality Monitoring

Water quality data was collected to monitor TUC flows for potential effects to recreation and available aquatic habitat for salmonids. The data will also be used to supplement existing data to provide a more complete basis for analyzing spatial and temporal water quality trends due to Biological Opinion-stipulated changes in river flow and estuary management. The resulting data will help provide information to evaluate potential changes to water quality and availability of habitat for aquatic resources resulting from the proposed permanent changes to D1610 minimum instream flows that are mandated by the Biological Opinion. A complete evaluation of the water quality data is being conducted as part of the California Environmental Quality Act (CEQA) analysis associated with proposed permanent changes to D1610.

3.1 Seasonal Mainstem Bacterial Sampling (Beach Sampling)

The Sonoma County Department of Health Services (DHS) conducts seasonal bacteriological sampling to monitor levels of pathogens at nine (9) Russian River beaches with recreational activities involving the greatest body contact. Results are used by the Sonoma County DHS to determine whether or not bacteria levels fall within State guidelines. The 2014 Sonoma County DHS seasonal beach sampling locations consisted of: Cloverdale River Park; Camp Rose Beach; Healdsburg Veterans Memorial Beach; Steelhead Beach; Forestville Access Beach; Sunset Beach; Johnson's Beach; Monte Rio Beach; and Patterson Point. Bacteriological samples were collected weekly beginning May 27 and continued until September 2. The samples were analyzed using the Colilert quantitray MPN method for total coliform and *E. coli*. Results from the sampling program are reported by the Sonoma County DHS at their website and on the Sonoma County DHS Beach Sampling Hotline. The 2014 seasonal results are shown in Table 3-1 and in Figures 3-1 and 3-2.

The California Department of Public Health (CDPH) developed the "Draft Guidance for Fresh Water Beaches," which describes bacteria levels that, if exceeded, may require posted warning signs in order to protect public health (CDPH 2011). The CDPH draft guideline for single sample maximum concentrations is: 10,000 most probable numbers (MPN) per 100 milliliters (ml) for total coliform, 235 MPN per 100 ml for *E. coli*, and 61 MPN per 100 ml for Enterococcus. In 2012, the United States Environmental Protection Agency (EPA) issued Clean Water Act (CWA) §304(a) Recreational Water Quality Criteria (RWQC) for States (EPA 2012). The RWQC recommends using two criteria for assessing water quality relating to fecal indicator bacteria: the geometric mean (GM) of the dataset, and changing the single sample maximum (SSM) to a Statistical Threshold Value (STV) representing the 75th percentile of an acceptable water-quality distribution. However, the EPA recommends using STV values as SSM values for potential recreational beach posting and those values are provided in this report for comparative purposes. Exceedances of the STV values are highlighted in Table 3-1. It must be emphasized that these are draft guidelines and criteria, not adopted standards, and are therefore both subject to change (if it is determined that the guidelines and/or criteria are not accurate indicators) and are not currently enforceable. In addition, these draft guidelines and criteria were established for and are only applicable to fresh water beaches. Currently, there are no numeric guidelines or criteria that have been developed for estuarine areas.

Table 3-1. Russian River Seasonal Recreational Beach Bacteria Sampling Results collected by the Sonoma County Department of Health Services in 2014. Highlighted values indicate those values exceeding the California Department of Public Health Draft Guidance for Fresh Water Beaches (CDPH 2011).

Date	Cloverdale River Park		Camp Rose Beach		Healdsburg Veterans		Steelhead Beach		Forestville Access Beach		Sunset Beach		Johnson's Beach		Monte Rio Beach		Patterson Point	
	TC	EC	TC	EC	TC	EC	TC	EC	TC	EC	TC	EC	TC	EC	TC	EC	TC	EC
5/27/2014	**24196**	20	2613	30	1723	63	1439	10	2382	10	2755	<10	2359	20	2902	20	1785	10
5/29/2014	**24196**	10																
6/3/2014	4376	61	2382	85	1565	63	1396	63	1785	41	1616	10	1354	<10	1597	<10	749	10
6/10/2014	9804	30	4352	10	1616	20	1396	20	2481	20	2755	10	1850	30	2909	10	905	10
6/17/2014	4106	20	2359	41	2359	41	1112	10	1236	41	2014	<10	1723	63	813	20	1081	<10
6/24/2014	8164	120	3076	<10	1616	63	1396	31	1842	10	2098	<10	2098	85	565	<10	1664	20
7/1/2014	9208	10	4352	31	2755	75	2143	10	2143	10	2755	<10	2187	52	10	20	1607	<10
7/8/2014	6131	31	2613	31	3448	52	1119	10	2014	10	2909	20	2142	<10	2613	63	2224	20
7/15/2014	**10462**	<10	2613	30	2098	52	1439	31	1565	10	1624	31	2909	31	1274	20	3873	10
7/16/2014	3076	20																
7/22/2014	6131	20	3255	20	3130	52	4106	41	2755	<10	1314	<10	1401	41	1296	10	480	<10
7/29/2014	9804	<10	5794	31	2359	31	1309	10	1259	<10	1793	10	908	10	1658	30	727	31
8/5/2014	7270	10	6867	10	3076	52	2247	31	1658	63	1421	10	1317	10	987	10	1497	20
8/12/2014	9804	30	4884	31	2613	63	1607	20	1597	<10	1137	41	1664	<10	1333	<10	1782	20
8/19/2014	6867	10	2613	31	2014	63	1274	10	1317	20	1515	31	1112	<10	839	41	908	10
8/26/2014	6488	31	2255	10	2247	76	1354	41	1081	73	1153	20	1664	<10	556	41	664	20
9/2/2014	8164	31	2909	10	2909	20	1081	31	1783	41	1515	31	933	<10	1014	10	1145	30

Recommended EPA Recreational Water Quality Criteria - Statistical Threshold Values (STV):
(Beach posting is recommended when indicator organisms exceed the STV) - Indicated by red text
Total Coliforms (STV): 10,000 per 100ml
E. coli (STV): 235 per 100 ml

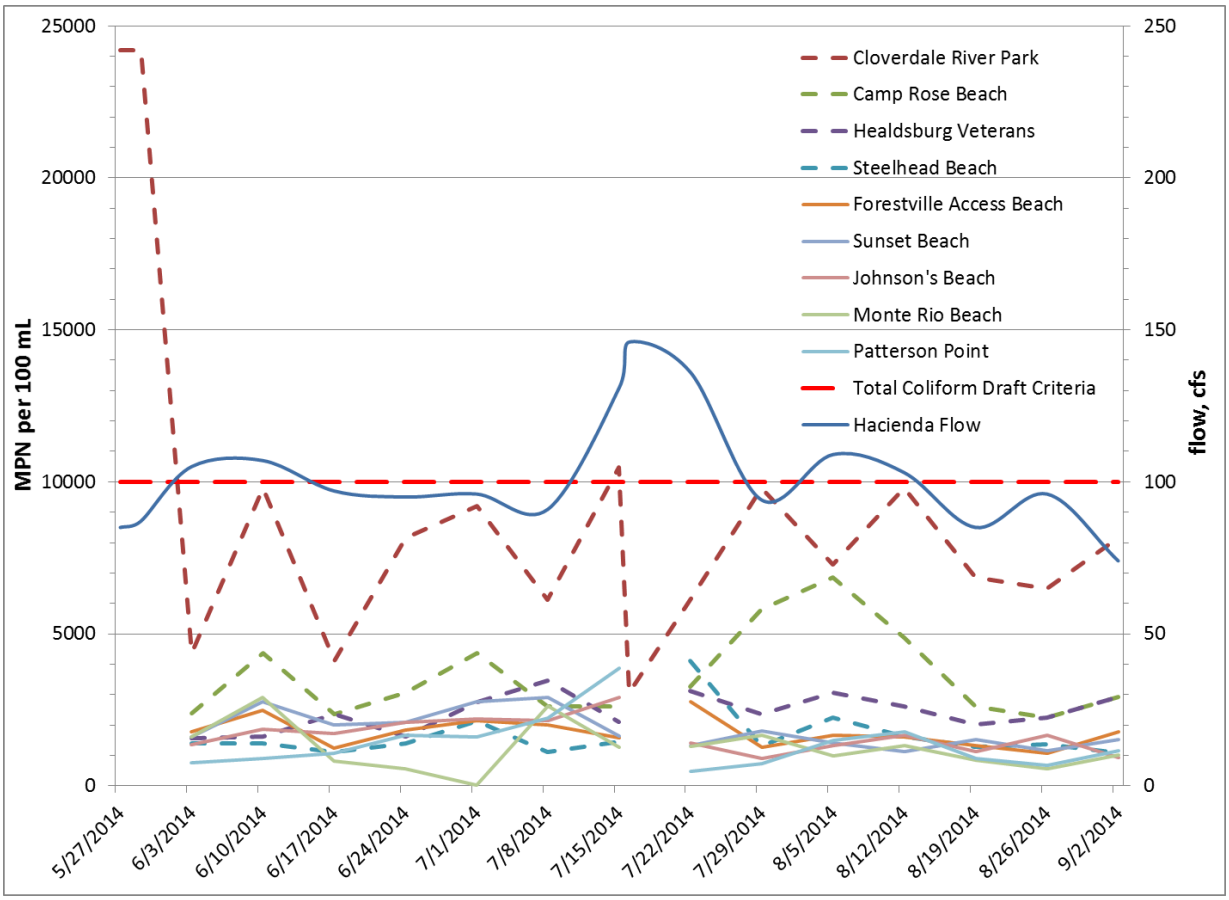

Figure 3-1. Russian River Beach Recreational Beach Bacteria Sample Results for Total Coliform in 2014.

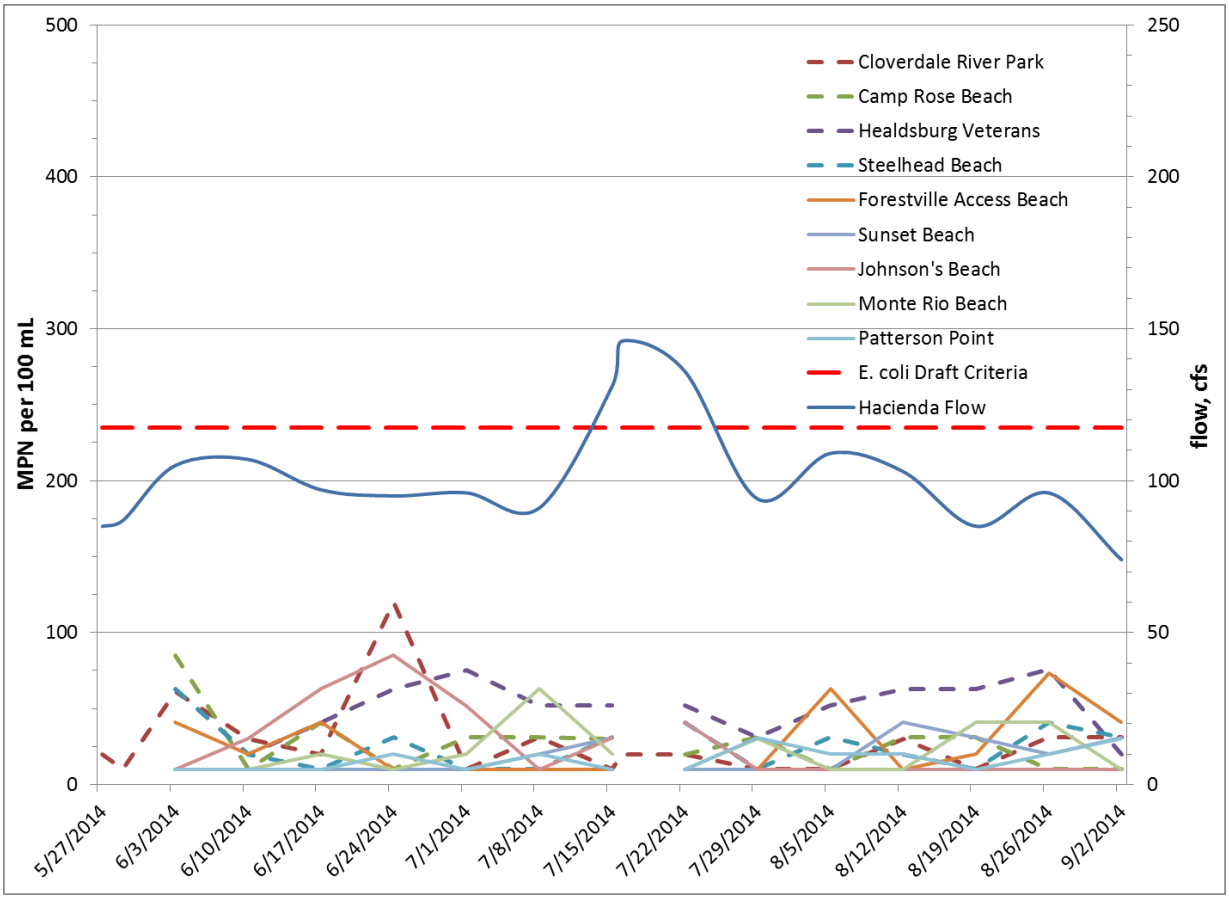

Figure 3-2. Russian River Recreational Beach Bacteria Sample Results for E. coli in 2014.

3.2 Water Agency Estuary Water Quality Sampling and Monitoring

Flows in the lower Russian River at Hacienda (downstream of the confluence with Dry Creek) continued to be affected by drought conditions during the term of the Order in late-2014 and dropped below the TUC five-day running average of 60 cfs one day on October 7, but remained higher than TUC instantaneous minimum flow of 50 cfs. Long-term water quality monitoring and grab sampling was conducted in the lower, middle, and upper reaches of the Russian River Estuary and the upper extent of inundation and backwatering during lagoon formation, between the mouth of the river at Jenner and Vacation Beach, including in two tributaries.

Water Agency staff conducted weekly grab sampling from May 15 to October 21 at five stations in the mainstem of the lower river including: Jenner; Casini Ranch; Patterson Point, Monte Rio, and Vacation Beach (Figure 3-3). All samples were analyzed for nutrients, *chlorophyll a*, standard bacterial indicators (Total coliforms, *E. coli*, and *Enterococcus*), total and dissolved organic carbon, total dissolved solids, and turbidity. Additional sampling was conducted for *Bacteroides* bacteria at the 3 surface-water sites that occur in the maximum backwater area including Patterson Point, Monte Rio, and Vacation Beach. The Water Agency submitted samples to the Sonoma County DHS Public Health Division Lab in Santa Rosa for bacteria analysis. *E. coli* and total coliform were analyzed using the Colilert method and Enterococcus was analyzed using the Enterolert method. Samples for all other constituents were submitted to Alpha Labs in Ukiah for analysis.

Samples were not analyzed specifically for total coliforms, but concentrations are determined as part of the analytical process for determining *E. coli* concentrations and the results are included in the lab report. As such, it should be noted that the dilution rates that are utilized to accurately quantify *E. coli* concentrations for comparison to the draft guidelines do not allow for the quantification of total coliform concentrations at a high enough level to compare with the draft guidelines and are instead reported as greater than 2419.6 MPN (>2419.6). However, some samples were collected during the middle of the monitoring season for diluted and undiluted analysis of *E. coli* and total coliforms for comparative purposes and the results are included in the Tables 3-2 through 3-6. The decision to focus on *E. coli* for the analysis of potential water quality impacts and not total coliform concentrations was done in coordination and consultation with North Coast Regional Water Quality Control Board (NCRWQCB) staff.

Staff at the NCRWQCB also indicated that *Enterococcus* is not currently being utilized as a fecal indicator bacteria due to uncertainty in the validity of the lab analysis to produce accurate results, as well as evidence that *Enterococcus* colonies can be persistent in the water column and therefore its presence at a given site may not always be associated with a fecal source. However, Water Agency staff will continue to collect *Enterococcus* samples and record and report the data. NCRWQCB staff also indicated during the 2014 monitoring season that they were uncertain of the validity of the laboratory analysis for *Bacteroides* and would not be conducting lab analysis of the samples until the question of validity had been resolved. Water Agency staff continued to collect surface-water samples to test for *Bacteroides*, however the samples have not been analyzed to date and remain stored at the County DHS lab. As a result, there are no *Bacteroides* data to report.

Water Agency staff continued to collect long-term monitoring data to: establish baseline information on water quality in the Estuary and assess the availability of aquatic habitat in the Estuary; gain a better understanding of the longitudinal and vertical water quality profile during the ebb and flow of the tide; and track changes to the water quality profile that may occur during periods of low flow conditions, barrier beach closure, lagoon outlet channel implementation, and reopening. Long-term monitoring datasondes were deployed at nine stations in the Russian River estuary, including two tributary stations during the 2014 monitoring season (Figure 3-3).

Saline water is denser than freshwater and a salinity “wedge” forms as freshwater outflow passes over the denser tidal inflow. During the lagoon management period (May 15 to October 15), the lower and middle reaches of the Estuary up to Sheephouse Creek are predominantly saline environments with a thin freshwater layer that flows over the denser saltwater. The upper reach of the Estuary transitions to a predominantly freshwater environment, which is periodically underlain by a denser, saltwater layer that migrates upstream to Duncans Mills during low flow conditions and barrier beach closure. Additionally, river flows, tides, topography, and wind action affect the amount of mixing of the water column at various longitudinal and vertical positions within the Estuary.

The Water Agency submits an annual report to the National Marine Fisheries Service and California Department of Fish and Wildlife documenting the status updates of the Water Agency’s efforts in implementing the Biological Opinion. The water quality monitoring data for 2014 is currently being compiled and will be discussed in the “Russian River Biological Opinion Status and Data Report Year 2014-15” due to be released in June 2015. The annual report will be available on the Water Agency’s

website: http://www.scwa.ca.gov/bo-annual-report/. This data will also be evaluated as part of the CEQA requirements associated with proposed permanent changes to minimum flows under D1610.

The grab sample sites are shown in Figure 3-3, and the results are summarized in Tables 3-2 through 3-11 and Figures 3-4 and 3-5. Highlighted values indicate those values exceeding California Department of Public Health Draft Guidance for Fresh Water Beaches for Indicator Bacteria (CDPH 2011), EPA Recreational Water Quality Criteria (EPA 2012), and EPA recommended criteria for Nutrients, Chlorophyll a, and Turbidity in Rivers and Streams in Aggregate Ecoregion III (EPA 2000). However, it must be emphasized that the draft CDPH guidelines and EPA criteria are not adopted standards, and are therefore both subject to change (if it is determined that the guidelines or criteria are not accurate indicators) and are not currently enforceable. In addition, these draft guidelines and criteria were established for and are only applicable to fresh water beaches and freshwater portions of the estuary. Currently, there are no numeric guidelines or criteria that have been established specifically for estuaries.

Based upon the recommended RWQC for fresh water beaches, *Enterococcus* exceedances varied throughout the term of the Order with several exceedances being observed at Jenner. The exceedances at Jenner occurred throughout the monitoring season and under a variety of flows ranging from 70 cfs to 130 cfs. Several exceedances of the Enterococcus RWQC were also observed in the latter half of the season at all of the other stations, with flows varying from 60 cfs to 114 cfs. External factors likely had an effect on increasing *Enterococcus* concentrations including the removal of two summer dams in Guerneville at the end of September during a period of extended estuary closure that occurred from mid-September through October. There were also several exceedances of the RWQC for *E. coli* at the Monte Rio site following summer dam removal. None of the other stations had any exceedances of the RWQC for *E. coli* during the term of the Order. However, Jenner did have one exceedance of the *E. coli* RWQC that occurred before the term of the Order on July 15 when flows were approximately 134 cfs (Table 3-6). Interestingly, two samples were collected at the Jenner site for *E. coli* that day, one was analyzed undiluted and the other was diluted 1:10. The undiluted sample had a concentration of 579 MPN, whereas the diluted sample had a concentration of 20 MPN.

All five stations predominantly exceeded the EPA criteria for Total Phosphorous before and during the term of the Order and under flows that ranged from 60 cfs to 147 cfs, continuing a trend of consistent exceedances observed in previous years. Total Nitrogen was exceeded periodically at all stations before and during the term of the Order under flows that ranged from 60 cfs to 147 cfs. Occasional exceedances of the Turbidity EPA criteria occurred before and during the term of the Order at all stations under flows that ranged from 60 cfs to 134 cfs. Most exceedances were slightly higher than the criteria, except for samples collected on October 7. Jenner had a turbidity value of 5,100 NTU, whereas the other four stations had values in the 230 to 250 NTU range, compared to the EPA criteria of 2.34 NTU. Algal (chlorophyll *a*) results exceeded the criteria at Vacation Beach Monte Rio before the term of the Order in May and July when flows ranged from 85 cfs to 147 cfs, but not while the Order was in effect. Algal results also exceeded the criteria at Patterson Point and Casini Ranch in May and July, and again at the end of September and October following summer dam removal while the estuary was closed. Jenner had several algal exceedances throughout the season at flows ranging from 60 cfs to 132 cfs. See Tables 3-7 through 3-11.

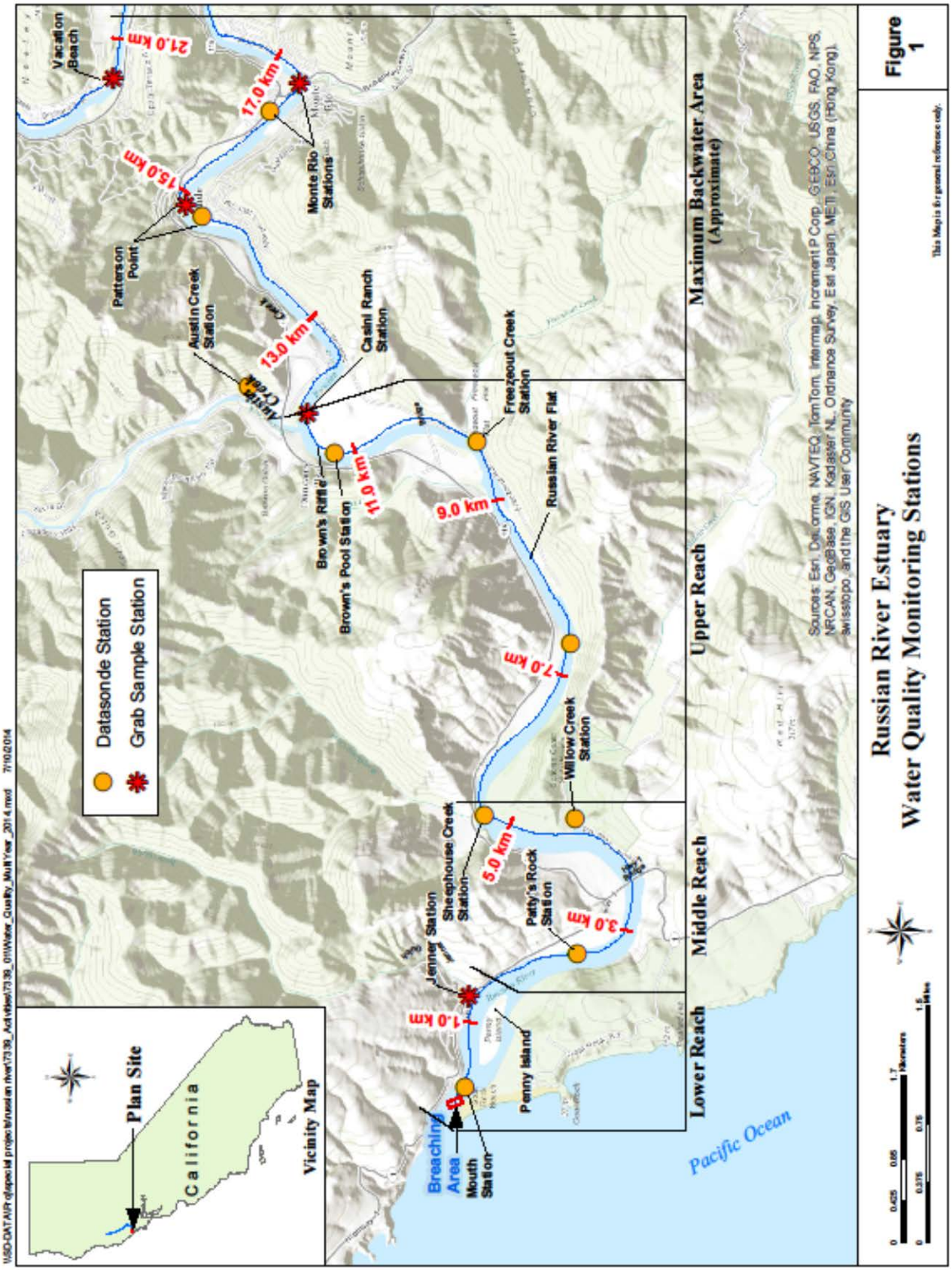

Figure 3-3. 2014 Russian River Estuary water quality monitoring stations sampled by the Sonoma County Water Agency.

Table 3-2. 2014 Vacation Beach bacteria concentrations for samples collected by the Sonoma County Water Agency. This site experiences freshwater conditions.

Vacation Beach	Time	Temperature	pH	Total Coliforms (Colilert)	Total Coliforms Diluted 1:10 (Colilert)	E. coli (Colilert)	E. coli Diluted 1:10 (Colilert)	Enterococcus (Enterolert)	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				20		20		2	Flow Rate****
Date		°C		MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	(cfs)
5/15/2014	11:10:00	21.5	8.4	1413.6	----	9.7	----	8.5	147
5/20/2014	11:10:00	20.7	8.3	1986.3	----	8.4	----	9.7	109
5/27/2014	11:30:00	22.9	8.2	>2419.6	----	17.3	----	5.2	85
6/3/2014	11:30:00	21.1	8.0	>2419.6	----	16.0	----	26.6	105
6/10/2014	12:20:00	23.6	8.6	>2419.6	3143	15.6	20	6.3	106
6/17/2014	10:00:00	21.6	8.3	2419.6	1785	32.7	20	32.7	96
6/24/2014	10:50:00	23.9	8.3	>2419.6	2382	19.9	31	47.3	94
7/1/2014	10:40:00	24.9	8.1	1553.1	2187	22.6	<10	49.6	100
7/8/2014	11:50:00	24.3	8.0	2419.6	2613	13.5	<10	28.1	95
7/15/2014	10:40:00	24.1	8.1	1732.9	2909	14.5	10	28.1	134
7/22/2014	11:10:00	22.1	8.1	1413.6	1616	4.1	<10	17.7	132
7/29/2014	11:00:00	24.6	8.1	960.6	1872	14.8	41	28.5	96
8/5/2014	11:00:00	22.6	8.1	1732.9	1565	12.2	31	12.1	111
8/12/2014	11:50:00	22.6	8.1	----	1616	----	<10	7.3	105
8/19/2014	12:10:00	23.0	8.1	----	1732	----	<10	9.7	87
8/26/2014	12:40:00	22.1	8.0	----	1236	----	41	75	93
9/2/2014	12:30:00	22.4	8.1	----	2046	----	10	41	70
9/9/2014	12:20:00	21.1	8.1	1553.1	----	5.2	----	3.1	81
9/16/2014	11:20:00	21.5	8.0	1986.3	----	33.1	----	4.1	84
9/23/2014	12:20:00	21.7	7.9	1986.3	----	12.1	----	47.3	89
9/25/2014	12:50:00	21.8	7.9	1413.6	----	18.7	----	18.3	73
9/30/2014	10:50:00	19.6	7.8	1299.7	----	70.3	----	**214.3**	73
10/2/2014	11:30:00	19.3	7.7	1413.6	----	52.1	----	44.1	64
10/7/2014	11:00:00	19.0	7.9	601.5	----	18.1	----	**63.1**	60
10/9/2014	10:50:00	18.3	7.9	1119.9	----	32.8	----	46.7	75
10/14/2014	11:10:00	17.9	7.8	472.1	----	50.4	----	**91.1**	86
10/21/2014	11:20:00	17.5	7.9	770.1	----	63.1	----	**76.7**	101

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** United States Geological Survey (USGS) Continuous-Record Gaging Station

*** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Recreational Water Quality Criteria - Statistical Threshold Value (STV) and Geomteric Mean (GM)

(Beach posting is recommended when indicator organisms exceed the STV) - Indicated by red text

E. coli (STV): 235 per 100 ml — Enterococcus (STV): 61 per 100 ml

E. coli (GM): 126 per 100mL — Enterococcus (GM): 33 per 100 mL

Table 3-3. 2014 Monte Rio bacteria concentrations for samples collected by the Sonoma County Water Agency. This site experiences freshwater conditions.

Monte Rio	Time	Temperature	pH	Total Coliforms (Colilert)	Total Coliforms Diluted 1:10 (Colilert)	E. coli (Colilert)	E. coli Diluted 1:10 (Colilert)	Enterococcus (Enterolert)	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				20		20		2	Flow Rate****
Date		°C		MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	(cfs)
5/15/2014	10:50:00	21.6	8.3	1553.1	----	11.8	----	11.0	147
5/20/2014	11:00:00	21.3	8.3	>2419.6	----	12.2	----	11.0	109
5/27/2014	11:10:00	23.2	8.1	>2419.6	----	7.5	----	2.0	85
6/3/2014	11:10:00	21.6	8.1	2419.6	----	7.5	----	6.3	105
6/10/2014	12:00:00	24.4	8.7	2419.6	1515	18.7	10	4.1	106
6/17/2014	9:40:00	21.9	8.5	1732.9	1985	7.4	10	18.7	96
6/24/2014	10:30:00	23.3	8.2	1553.1	1187	14.5	31	44.8	94
7/1/2014	10:20:00	24.4	8.0	>2419.6	1956	21.6	10	24.7	100
7/8/2014	11:30:00	24.1	8.0	2419.6	1935	14.5	10	6.3	95
7/15/2014	10:30:00	24.0	8.0	2419.6	1989	4.1	<10	7.3	134
7/22/2014	10:50:00	22.3	8.1	2419.6	1500	4.1	20	23.8	132
7/29/2014	10:40:00	24.0	8.1	1732.9	1376	3.1	20	9.5	96
8/5/2014	10:50:00	22.5	8.1	1553.1	1597	12	10	9.3	111
8/12/2014	11:30:00	22.6	8.2	----	1076	----	31	6.3	105
8/19/2014	12:00:00	22.8	8.2	----	794	----	20	6.2	87
8/26/2014	12:20:00	22.1	8.1	----	1334	----	20	**105**	93
9/2/2014	12:20:00	23.2	8.0	----	1989	----	10	**156**	70
9/9/2014	12:00:00	21.0	8.0	1119.9	----	14.8	----	25.9	81
9/16/2014	11:10:00	20.9	8.0	920.8	----	5.1	----	4.1	84
9/23/2014	12:00:00	21.5	7.9	648.8	----	29.5	----	5.2	89
9/25/2014	12:30:00	21.7	7.9	2419.6	----	**365.4**	----	**248.9**	73
9/29/2014	11:40:00	----	----	>2419.6	----	162.4	----	**344.8**	84
9/30/2014	10:30:00	20.2	7.9	1732.9	----	187.2	----	**150.0**	73
10/2/2014	11:20:00	19.5	7.8	>2419.6	----	133.4	----	**191.8**	64
10/7/2014	10:40:00	19.0	7.9	1986.3	----	117.8	----	**139.1**	60
10/9/2014	10:30:00	18.9	8.0	>2419.6	----	**410.6**	----	**435.2**	75
10/13/2014	12:10:00	18.8	7.8	>2419.6	----	**1299.7**	----	**920.8**	85
10/14/2014	10:50:00	18.5	7.9	>2419.6	----	**686.7**	----	**1119.9**	86
10/16/2014	12:20:00	18.0	7.8	>2419.6	----	**>2419.6**	----	**1986.3**	107
10/17/2014	10:30:00	17.6	7.7	>2419.6	----	**2419.6**	----	**>2419.6**	114
10/21/2014	11:00:00	18.0	7.8	1299.7	----	**248.1**	----	**435.2**	101

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** United States Geological Survey (USGS) Continuous-Record Gaging Station

*** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Recreational Water Quality Criteria - Statistical Threshold Value (STV) and Geomteric Mean (GM)

(Beach posting is recommended when indicator organisms exceed the STV) - Indicated by red text

E. coli (STV): 235 per 100 ml — Enterococcus (STV): 61 per 100 ml

E. coli (GM): 126 per 100mL — Enterococcus (GM): 33 per 100 mL

Table 3-4. 2014 Patterson Point bacteria concentrations for samples collected by the Sonoma County Water Agency. This site experiences freshwater conditions.

Patterson Point	Time	Temperature	pH	Total Coliforms (Colilert)	Total Coliforms Diluted 1:10 (Colilert)	E. coli (Colilert)	E. coli Diluted 1:10 (Colilert)	Enterococcus (Enterolert)	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				20		20		2	Flow Rate****
Date		°C		MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	(cfs)
5/15/2014	10:30:00	21.3	8.3	1553.1	----	7.5	----	2.0	147
5/20/2014	10:30:00	21.6	8.2	1732.9	----	4.1	----	3.1	109
5/27/2014	10:40:00	22.7	8.0	>2419.6	----	4.1	----	6.3	85
6/3/2014	10:50:00	21.5	8.0	1203.3	----	8.6	----	10.6	105
6/10/2014	11:30:00	24.2	8.6	2419.6	1850	39.3	52	22.1	106
6/17/2014	9:20:00	21.9	8.5	1732.9	1872	4.1	<10	29.9	96
6/24/2014	10:10:00	24.0	8.2	>2419.6	1553	16.1	<10	**66.8**	94
7/1/2014	10:00:00	24.1	7.9	>2419.6	4611	12.1	<10	55.6	100
7/8/2014	11:00:00	23.4	7.8	1986.3	2595	13.4	20	7.2	95
7/15/2014	10:10:00	23.6	7.9	1986.3	2247	8.6	10	19.3	134
7/22/2014	10:30:00	22.1	8.1	1686.3	3255	11.0	31	14.6	132
7/29/2014	10:20:00	23.8	7.9	2419.6	4352	3.1	10	8.5	96
8/5/2014	10:30:00	22.1	8.1	2419.6	3448	11.8	<10	11.0	111
8/12/2014	11:10:00	22.2	8.1	----	1842	----	10	17.3	105
8/19/2014	11:40:00	22.3	8.2	----	2909	----	10	5.2	87
8/26/2014	11:50:00	21.9	7.9	----	1670	----	31	**121.0**	93
9/2/2014	11:50:00	22.5	7.9	----	2282	----	10	**529**	70
9/9/2014	11:40:00	20.6	7.9	1046.2	----	17.3	----	10.9	81
9/16/2014	10:50:00	20.9	7.9	1413.6	----	43.5	----	8.5	84
9/23/2014	11:30:00	21.9	7.9	1203.3	----	42.8	----	**71.2**	89
9/25/2014	12:20:00	22.0	7.9	>2419.6	----	116.9	----	**62.7**	73
9/30/2014	10:10:00	20.1	7.9	1732.9	----	58.3	----	**143.9**	73
10/2/2014	11:00:00	19.8	7.8	1553.1	----	71.4	----	**116.9**	64
10/7/2014	10:20:00	18.7	7.9	1203.3	----	103.9	----	**95.9**	60
10/9/2014	10:10:00	18.6	8.0	648.8	----	19.9	----	48.7	75
10/14/2014	10:30:00	18.6	7.9	>2419.6	----	70.3	----	**114.5**	86
10/21/2014	10:50:00	17.8	7.8	866.4	----	29.2	----	**86.0**	101

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** United States Geological Survey (USGS) Continuous-Record Gaging Station

*** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Recreational Water Quality Criteria - Statistical Threshold Value (STV) and Geomteric Mean (GM)

(Beach posting is recommended when indicator organisms exceed the STV) - Indicated by red text

E. coli (STV): 235 per 100 ml — Enterococcus (STV): 61 per 100 ml

E. coli (GM): 126 per 100mL — Enterococcus (GM): 33 per 100 mL

Table 3-5. 2014 Casini Ranch bacteria concentrations for samples collected by the Sonoma County Water Agency. This site may experience estuarine conditions.

Casini Ranch	Time	Temperature	pH	Total Coliforms (Colilert)	Total Coliforms Diluted 1:10 (Colilert)	E. coli (Colilert)	E. coli Diluted 1:10 (Colilert)	Enterococcus (Enterolert)	USGS 11467000 RR near Guerneville (Hacienda)**
MDL*				20		20		2	Flow Rate***
Date		°C		MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	(cfs)
5/15/2014	10:00:00	22.5	8.4	1553.1	----	21.8	----	13.2	147
5/20/2014	10:10:00	22.0	8.4	1732.9	----	2.0	----	6.3	109
5/27/2014	10:10:00	22.3	8.2	>2419.6	----	6.3	----	5.2	85
6/3/2014	10:30:00	21.1	8.1	1553.1	----	4.1	----	2.0	105
6/10/2014	11:10:00	22.6	8.9	>2419.6	2909	9.8	20	3.0	106
6/17/2014	9:00:00	20.6	8.9	>2419.6	2143	5.1	<10	6.2	96
6/24/2014	9:50:00	23.4	8.4	>2419.6	1918	6.3	10	17.7	94
7/1/2014	9:40:00	22.4	8.2	>2419.6	2909	<1.0	<10	13.2	100
7/8/2014	10:40:00	22.8	8.0	1732.9	1401	4.1	<10	5.2	95
7/15/2014	9:50:00	24.1	8.2	1413.6	1500	5.1	10	11.8	134
7/22/2014	10:10:00	23.0	8.4	1203.3	1956	3.0	10	4.1	132
7/29/2014	10:00:00	24.1	8.4	1203.3	1396	4.1	<10	5.2	96
8/5/2014	10:10:00	21.3	8.2	1986.3	1291	3.1	10	3.0	111
8/12/2014	10:50:00	21.45	8.19	----	933	----	<10	14.6	105
8/19/2014	11:20:00	22.1	8.6	----	959	----	10	2.0	87
8/26/2014	11:20:00	21.9	8.1	----	932	----	20	41.0	93
9/2/2014	11:20:00	22.6	8.1	----	1076	----	<10	20	70
9/9/2014	11:00:00	20.6	8.1	488.4	----	7.4	----	10.9	81
9/16/2014	10:30:00	21.1	8.2	686.7	----	3.1	----	1.0	84
9/23/2014	11:00:00	21.5	8.0	2419.6	----	224.7	----	**980.4**	89
9/25/2014	11:50:00	22.9	8.0	2419.6	----	98.7	----	**260.3**	73
9/30/2014	9:50:00	20.3	8.0	1732.9	----	142.1	----	**218.7**	73
10/2/2014	10:40:00	20.4	8.0	>2419.6	----	98.8	----	**218.7**	64
10/7/2014	10:00:00	19.4	8.0	2419.6	----	108.1	----	**222.4**	60
10/9/2014	9:50:00	18.5	8.1	1553.1	----	44.1	----	**66.3**	75
10/14/2014	10:10:00	18.6	8.1	>2419.6	----	50.4	----	**344.8**	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** United States Geological Survey (USGS) Continuous-Record Gaging Station

*** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Recreational Water Quality Criteria - Statistical Threshold Value (STV) and Geomteric Mean (GM)

(Beach posting is recommended when indicator organisms exceed the STV) - Indicated by red text

E. coli (STV): 235 per 100 ml — Enterococcus (STV): 61 per 100 ml

E. coli (GM): 126 per 100mL — Enterococcus (GM): 33 per 100 mL

Table 3-6. 2014 Jenner bacteria concentrations for samples collected by the Sonoma County Water Agency. Estuarine conditions exist at this site.

Jenner Boat Ramp	Time	Temperature	pH	Total Coliforms (Colilert)	Total Coliforms Diluted 1:10 (Colilert)	E. coli (Colilert)	E. coli Diluted 1:10 (Colilert)	Enterococcus (Enterolert)	USGS 11467000 RR near Guerneville (Hacienda)**
MDL*				20		20		2	Flow Rate***
Unit of Measure		°C		MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	MPN/100mL	(cfs)
5/15/2014	9:40:00	18.4	8.4	>2419.6	----	16.8	----	15	147
5/20/2014	9:40:00	16.9	8.3	>2419.6	----	4.1	----	8.6	109
5/27/2014	9:40:00	18.9	8.1	>2419.6	----	1.0	----	1.0	85
6/3/2014	10:00:00	16.2	8.0	>2419.6	----	3.0	----	3.1	105
6/10/2014	9:40:00	19.0	8.6	>2419.6	6131	74.9	85	**195.6**	106
6/17/2014	8:40:00	15.6	8.2	2419.6	7270	5.2	<10	33.7	96
6/24/2014	9:20:00	18.2	8.1	>2419.6	**24196**	81.3	<10	**145.5**	94
7/1/2014	9:20:00	17.5	8.2	>2419.6	4884	222.4	120	**344.1**	100
7/8/2014	10:20:00	19.0	8.1	>2419.7	**14136**	22.3	10	22.6	95
7/15/2014	9:30:00	18.2	7.9	>2419.6	**10462**	**579.4**	20	**435.2**	134
7/22/2014	9:50:00	19.7	7.9	>2419.6	**10462**	28.8	10	**613.1**	132
7/29/2014	9:40:00	20.4	8.0	>2419.6	**>24196**	15.9	<10	**2419.6**	96
8/5/2014	9:50:00	17.8	7.9	>2419.6	**14136**	152.5	41	**103.4**	111
8/12/2014	10:30:00	19.0	7.9	----	**14136**	----	41	**231.0**	105
8/19/2014	10:50:00	18.9	8.0	----	7270	----	10	**79.8**	87
8/26/2014	11:00:00	19.5	8.0	----	3873	----	<10	**2046.0**	93
9/2/2014	11:00:00	19.1	8.1	----	**10462**	----	<10	**289**	70
9/9/2014	10:40:00	18.2	8.1	>2419.6	----	30.2	----	**248.1**	81
9/16/2014	10:10:00	18.0	8.1	>2419.6	----	17.3	----	**172.2**	84
9/23/2014	10:40:00	19.2	8.4	>2419.6	----	59.5	----	**365.4**	89
9/25/2014	11:30:00	19.5	8.3	>2419.6	----	87.5	----	18.7	73
9/30/2014	9:20:00	18.2	8.2	>2419.6	----	151.5	----	**204.6**	73
10/2/2014	10:10:00	18.3	8.3	1732.9	----	16.8	----	45.9	64
10/7/2014	9:40:00	18.1	8.2	2419.6	----	8.5	----	60.2	60
10/9/2014	9:30:00	17.8	8.0	>2419.6	----	23.5	----	32.7	75
10/14/2014	9:50:00	18.0	8.0	>2419.6	----	51.9	----	**435.2**	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** United States Geological Survey (USGS) Continuous-Record Gaging Station

*** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Recreational Water Quality Criteria - Statistical Threshold Value (STV) and Geomteric Mean (GM)

(Beach posting is recommended when indicator organisms exceed the STV) - Indicated by red text

E. coli (STV): 235 per 100 ml — Enterococcus (STV): 61 per 100 ml

E. coli (GM): 126 per 100mL — Enterococcus (GM): 33 per 100 mL

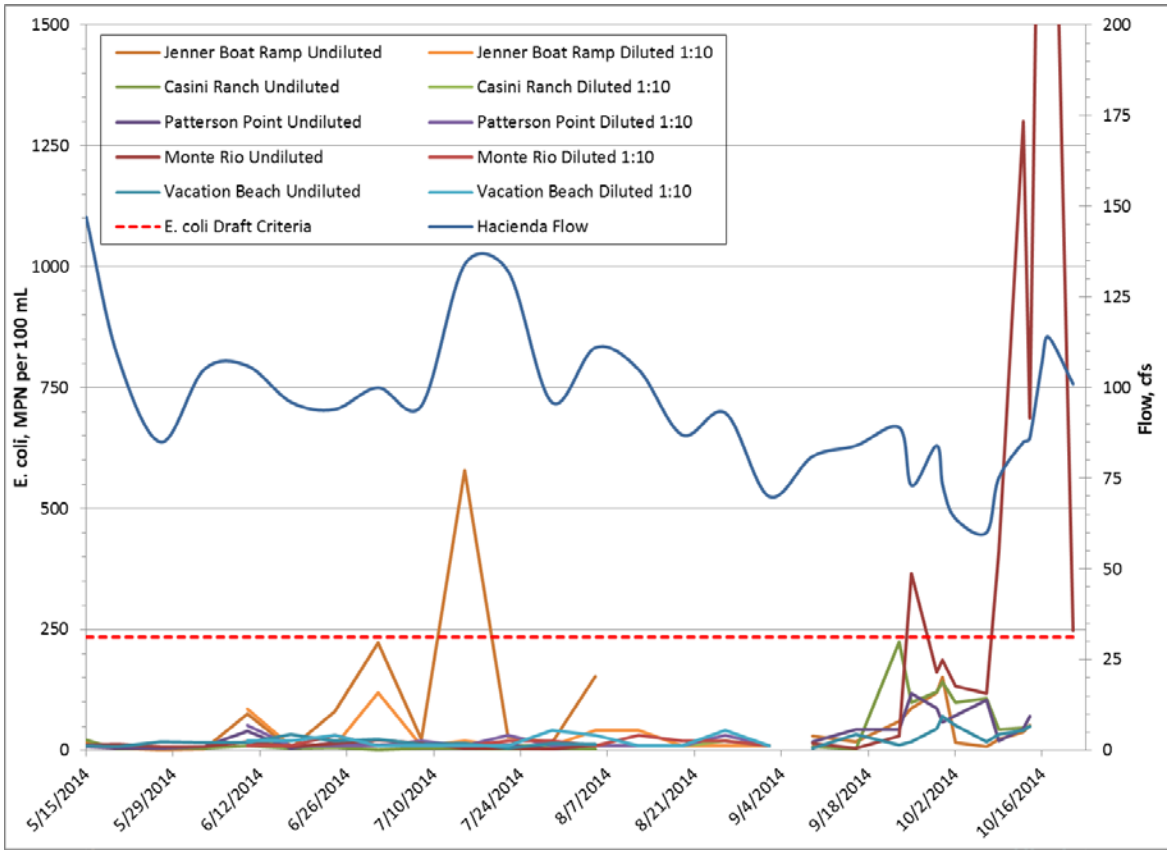

Figure 3-4. E. coli results on for the Russian River from Vacation Beach to Jenner in 2014.

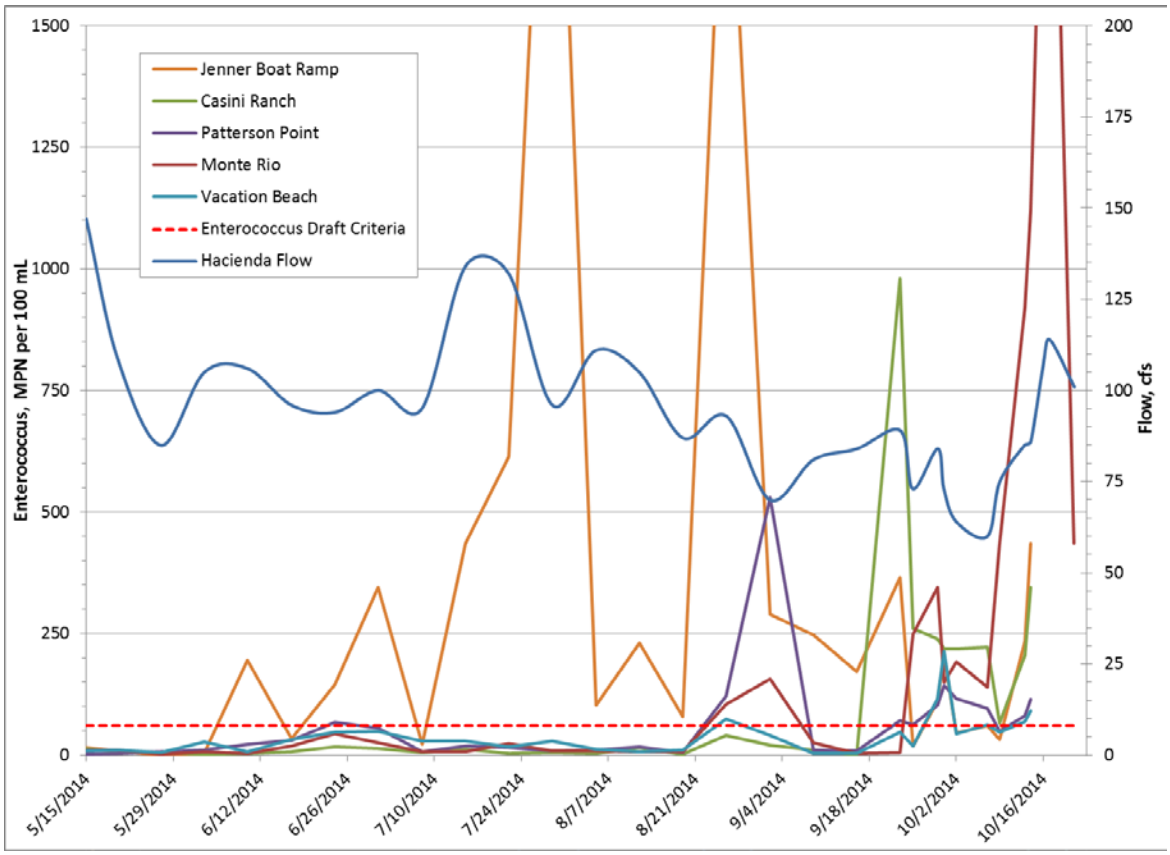

Figure 3-5. Enterococcus results for the Russian River from Vacation Beach to Jenner in 2014.

Table 3-7. 2014 Vacation Beach nutrient grab sample results. This site experiences freshwater conditions.

Vacation Beach	Time	Temperature	pH	Total Organic Nitrogen	Ammonia as N	Ammonia as N Unionized	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen	Total Nitrogen**	Phosphorus, Total	Total Orthophosphate	Dissolved Organic Carbon	Total Organic Carbon	Total Dissolved Solids	Turbidity	Chlorophyll-a	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				0.200	0.10	0.00010	0.030	0.030	0.10		0.020	0.020	0.0400	0.0400	4.2	0.020	0.000050	Flow Rate****
Date		°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	(cfs)
5/15/2014	11:10	21.5	8.4	ND	0.07	0.0066	0.11	ND	0.21	0.32	**0.046**	0.094	1.54	1.83	180	1.8	**0.0026**	147
5/20/2014	11:10	20.7	8.3	ND	0.070	0.0055	0.11	ND	0.24	0.36	**0.056**	0.12	1.67	2.12	180	**2.9**	**0.0026**	109
5/27/2014	11:30	22.9	8.2	ND	0.070	ND	0.13	ND	0.21	0.34	**0.041**	0.11	1.72	1.96	170	2.2	**0.0034**	85
6/3/2014	11:30	21.1	8.0	0.35	ND	ND	0.13	ND	0.35	**0.48**	**0.059**	0.078	1.56	1.82	150	1.8	0.0017	105
6/10/2014	12:20	23.6	8.6	ND	0.070	0.012	0.12	ND	ND	0.26	**0.041**	0.11	1.57	2.14	190	1.7	0.00037	106
6/17/2014	10:00	21.6	8.3	ND	ND	ND	ND	ND	ND	ND	**0.039**	0.091	1.82	1.93	160	**2.4**	0.00063	96
6/24/2014	10:50	23.9	8.3	0.24	ND	ND	ND	ND	0.24	0.24	**0.041**	0.087	1.58	1.77	150	2.0	0.0017	94
7/1/2014	10:40	24.9	8.1	ND	ND	ND	0.12	ND	ND	0.26	**0.035**	0.084	1.59	1.92	140	**2.6**	**0.0021**	100
7/8/2014	11:50	24.3	8.0	0.38	ND	ND	ND	ND	0.38	**0.38**	**0.036**	0.075	1.83	2.18	150	2.3	**0.0024**	95
7/15/2014	10:40	24.1	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.035**	0.071	1.68	1.88	140	2.3	**0.0026**	134
7/22/2014	11:10	22.1	8.1	ND	ND	ND	ND	ND	ND	0.07	**0.025**	0.075	1.51	1.75	160	2.0	0.0016	132
7/29/2014	11:00	24.6	8.1	0.35	ND	ND	ND	ND	0.35	0.35	**0.033**	0.071	1.65	2.09	220	1.6	0.0014	96
8/5/2014	11:00	22.6	8.1	0.21	ND	ND	0.12	ND	0.21	0.33	**0.034**	0.065	0.78	0.94	140	1.5	0.0016	111
8/12/2014	11:50	22.6	8.1	ND	ND	0.0034	0.12	ND	ND	0.23	**0.033**	0.064	1.72	2.07	150	2.2	0.0010	105
8/19/2014	12:10	23.0	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.027**	0.072	1.70	2.09	130	0.96	0.00089	87
8/26/2014	12:40	22.1	8.0	ND	ND	ND	0.13	ND	ND	0.27	**0.027**	0.075	1.64	2.02	140	1.5	0.00069	93
9/2/2014	12:30	22.4	8.1	ND	ND	ND	0.15	ND	ND	0.29	**0.030**	0.052	1.81	2.11	140	1.4	0.00089	70
9/9/2014	12:20	21.1	8.1	0.21	ND	ND	ND	ND	0.21	0.21	**0.026**	0.058	1.53	1.84	130	1.1	0.00084	81
9/16/2014	11:20	21.5	8.0	0.28	ND	ND	ND	ND	0.28	0.28	**0.025**	0.082	1.65	1.95	130	1.2	0.0011	84
9/23/2014	12:20	21.7	7.9	ND	ND	ND	ND	ND	ND	ND	**0.025**	0.068	1.82	2.12	120	1.7	0.0015	89
9/25/2014	12:50	21.8	7.9	0.24	ND	ND	ND	ND	0.24	0.24	**0.031**	0.065	1.56	1.91	130	**2.4**	0.00098	73
9/30/2014	10:50	19.6	7.8	0.21	ND	ND	ND	ND	0.21	0.21	**0.036**	0.094	1.65	2.06	160	0.96	0.0013	73
10/2/2014	11:30	19.3	7.7	ND	ND	ND	0.16	ND	ND	0.18	**0.048**	0.10	1.51	1.95	150	**3.0**	0.00027	64
10/7/2014	11:00	19.0	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.032**	0.08	1.50	1.88	140	**230**	0.00081	60
10/9/2014	10:50	18.3	7.9	ND	ND	0.0009	0.17	ND	ND	0.17	**0.025**	0.06	1.46	1.80	150	1.8	0.00095	75
10/14/2014	11:10	17.9	7.8	ND	ND	ND	ND	ND	ND	0.18	**0.029**	0.085	1.40	1.83	150	2.1	0.00094	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** Total nitrogen is calculated through the summation of the different components of total nitrogen: organic and ammoniacal nitrogen (together referred to as Total Kjeldahl Nitrogen or TKN) and nitrate/nitrite nitrogen.

*** United States Geological Survey (USGS) Continuous-Record Gaging Station

**** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Criteria based on Aggregate Ecoregion III

Total Phosporus: 0.02188 mg/L (21.88 ug/L) ≈ 0.022 mg/L

Chlorophyll *a*: 0.00178 mg/L (1.78 ug/L) ≈ 0.0018 mg/L

Total Nitrogen: 0.38 mg/L

Turbidity: 2.34 FTU/NTU

Table 3-8. 2014 Monte Rio nutrient grab sample results. This site experiences freshwater conditions.

Monte Rio	Time	Temperature	pH	Total Organic Nitrogen	Ammonia as N	Ammonia as N Unionized	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen	Total Nitrogen**	Phosphorus, Total	Total Orthophosphate	Dissolved Organic Carbon	Total Organic Carbon	Total Dissolved Solids	Turbidity	Chlorophyll-a	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				0.200	0.10	0.00010	0.030	0.030	0.10		0.020	0.020	0.0400	0.0400	4.2	0.020	0.000050	Flow Rate****
Date		°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	(cfs)
5/15/2014	10:50	21.6	8.3	ND	0.21	0.016	0.12	ND	ND	0.29	**0.048**	0.11	1.49	1.91	180	1.9	**0.0018**	147
5/20/2014	11:00	21.3	8.3	ND	0.070	0.0053	0.12	ND	0.21	0.33	**0.060**	0.12	1.63	2.13	180	**2.7**	**0.0027**	109
5/27/2014	11:10	23.2	8.1	ND	0.070	0.0039	0.13	ND	ND	0.31	**0.057**	0.13	1.68	1.94	170	**3.1**	**0.0037**	85
6/3/2014	11:10	21.6	8.1	ND	ND	ND	0.12	ND	ND	0.30	**0.099**	0.094	1.52	1.85	160	2.1	0.0017	105
6/10/2014	12:00	24.4	8.7	ND	0.070	0.014	ND	ND	ND	0.14	**0.040**	0.1	1.58	2.14	160	1.8	0.00055	106
6/17/2014	9:40	21.9	8.5	ND	ND	ND	ND	ND	ND	0.18	**0.041**	0.11	1.58	1.98	150	1.7	0.00073	96
6/24/2014	10:30	23.3	8.2	ND	ND	ND	ND	ND	ND	0.10	**0.045**	0.12	1.61	1.82	140	1.8	0.0010	94
7/1/2014	10:20	24.4	8.0	ND	ND	ND	ND	ND	ND	0.18	**0.050**	0.13	1.53	1.95	150	**3.1**	**0.0023**	100
7/8/2014	11:30	24.1	8.0	ND	ND	ND	ND	ND	ND	0.14	**0.045**	0.087	1.79	2.25	140	**2.6**	**0.0020**	95
7/15/2014	10:30	24.0	8.0	ND	ND	ND	ND	ND	ND	0.14	**0.044**	0.083	1.77	1.77	150	2.2	**0.0020**	134
7/22/2014	10:50	22.3	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.028**	0.091	1.42	1.28	160	2.2	0.0016	132
7/29/2014	10:40	24.0	8.1	0.21	ND	ND	ND	ND	0.21	0.21	**0.035**	0.098	1.57	2.08	180	1.9	0.0013	96
8/5/2014	10:50	22.5	8.1	ND	ND	ND	0.12	ND	ND	0.30	**0.034**	0.073	0.76	0.81	140	1.6	0.0011	111
8/12/2014	11:30	22.6	8.2	0.21	ND	ND	ND	ND	0.21	0.21	**0.028**	0.068	1.74	2.23	150	1.0	0.00089	105
8/19/2014	12:00	22.8	8.2	ND	ND	ND	ND	ND	ND	0.14	**0.036**	0.072	1.80	2.11	130	1.2	0.00099	87
8/26/2014	12:20	22.1	8.1	0.24	ND	ND	ND	ND	0.24	0.24	**0.027**	0.059	1.63	2.03	140	1.2	0.0011	93
9/2/2014	12:20	23.2	8.0	0.38	ND	ND	0.15	ND	0.38	**0.53**	**0.028**	0.055	1.76	2.11	130	1.4	0.00067	70
9/9/2014	12:00	21.0	8.0	ND	ND	ND	ND	ND	ND	0.14	**0.030**	0.061	1.56	1.86	130	0.82	0.00084	81
9/16/2014	11:10	20.9	8.0	0.52	ND	ND	ND	ND	0.52	**0.52**	**0.025**	0.07	1.58	1.95	140	**2.5**	0.00082	84
9/23/2014	12:00	21.5	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.028**	0.08	1.66	2.11	130	0.95	0.00076	89
9/25/2014	12:30	21.7	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.027**	0.077	1.66	2.07	130	1.1	0.0011	73
9/30/2014	10:30	20.2	7.9	ND	ND	ND	ND	ND	ND	0.10	**0.025**	0.067	1.60	2.07	130	1.3	0.00081	73
10/2/2014	11:20	19.5	7.8	0.24	ND	ND	0.17	ND	0.24	0.25	**0.037**	0.087	1.73	2.13	170	1.3	0.00027	64
10/7/2014	10:40	19.0	7.9	0.21	ND	ND	0.17	ND	0.21	**0.38**	**0.046**	0.1	1.65	2.09	150	**250**	0.0011	60
10/9/2014	10:30	18.9	8.0	ND	ND	ND	0.16	ND	ND	0.16	**0.034**	0.083	1.63	1.99	150	1.1	0.00068	75
10/14/2014	10:50	18.5	7.9	ND	ND	ND	0.17	ND	ND	0.34	**0.034**	0.085	1.49	1.96	140	1.0	0.00082	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** Total nitrogen is calculated through the summation of the different components of total nitrogen: organic and ammoniacal nitrogen (together referred to as Total Kjeldahl Nitrogen or TKN) and nitrate/nitrite nitrogen.

*** United States Geological Survey (USGS) Continuous-Record Gaging Station

**** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Criteria based on Aggregate Ecoregion III

Total Phosporus: 0.02188 mg/L (21.88 ug/L) ≈ 0.022 mg/L

Chlorophyll *a*: 0.00178 mg/L (1.78 ug/L) ≈ 0.0018 mg/L

Total Nitrogen: 0.38 mg/L

Turbidity: 2.34 FTU/NTU

Table 3-9. 2014 Patterson Point nutrient grab sample results. This site experiences freshwater conditions.

Patterson Point	Time	Temperature	pH	Total Organic Nitrogen	Ammonia as N	Ammonia as N Unionized	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen	Total Nitrogen**	Phosphorus, Total	Total Orthophosphate	Dissolved Organic Carbon	Total Organic Carbon	Total Dissolved Solids	Turbidity	Chlorophyll-a	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				0.200	0.10	0.00010	0.030	0.030	0.10		0.020	0.020	0.0400	0.0400	4.2	0.020	0.000050	Flow Rate****
Date		°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	(cfs)
5/15/2014	10:30	21.3	8.3	ND	0.21	0.016	0.13	ND	0.32	**0.44**	**0.051**	0.11	1.49	1.87	180	1.9	**0.0018**	147
5/20/2014	10:30	21.6	8.2	ND	0.070	0.0044	0.11	ND	0.21	0.32	**0.055**	0.13	1.64	2.17	190	**2.8**	**0.0024**	109
5/27/2014	10:40	22.7	8.0	ND	0.070	0.003	0.13	ND	0.24	**0.38**	**0.063**	0.15	1.76	1.96	180	**2.4**	**0.0043**	85
6/3/2014	10:50	21.5	8.0	0.24	ND	ND	0.12	ND	0.24	0.37	**0.081**	0.98	1.51	1.87	160	2.2	**0.0021**	105
6/10/2014	11:30	24.2	8.6	0.21	ND	ND	ND	ND	0.21	0.21	**0.034**	0.097	1.32	2.29	170	1.9	0.00092	106
6/17/2014	9:20	21.9	8.5	ND	ND	ND	ND	ND	ND	0.14	**0.046**	0.12	1.62	2.05	170	**3.0**	ND	96
6/24/2014	10:10	24.0	8.2	0.32	ND	ND	ND	ND	0.32	0.32	**0.054**	0.12	1.60	1.94	150	**3.0**	0.001	94
7/1/2014	10:00	24.1	7.9	0.21	ND	ND	0.13	ND	0.21	0.34	**0.054**	0.12	1.54	1.97	160	2.2	0.0013	100
7/8/2014	11:00	23.4	7.8	0.32	ND	ND	0.12	ND	0.32	**0.44**	**0.050**	0.11	1.81	2.18	140	**4.6**	**0.0018**	95
7/15/2014	10:10	23.6	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.044**	0.087	1.34	1.65	150	**2.7**	**0.002**	134
7/22/2014	10:30	22.1	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.030**	0.091	1.55	1.84	150	**2.4**	**0.0022**	132
7/29/2014	10:20	23.8	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.042**	0.094	1.56	2.05	160	**2.8**	0.00096	96
8/5/2014	10:30	22.1	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.041**	0.085	1.34	1.40	140	2.0	0.0011	111
8/12/2014	11:10	22.2	8.1	ND	ND	0.0017	ND	ND	ND	0.18	**0.032**	0.095	1.71	2.10	150	**2.7**	0.00067	105
8/19/2014	11:40	22.3	8.2	0.31	ND	ND	0.12	ND	0.31	**0.43**	**0.049**	0.087	1.75	2.11	130	2.2	0.00079	87
8/26/2014	11:50	21.9	7.9	0.21	ND	ND	0.12	ND	0.21	0.33	**0.029**	0.075	1.60	2.04	140	2.0	0.00059	93
9/2/2014	11:50	22.5	7.9	0.24	ND	ND	0.15	ND	0.24	**0.39**	**0.036**	0.09	1.78	2.19	140	**2.4**	0.0011	70
9/9/2014	11:40	20.6	7.9	ND	ND	ND	ND	ND	ND	0.10	**0.030**	0.065	1.49	1.86	140	0.9	0.00074	81
9/16/2014	10:50	20.9	7.9	0.42	ND	ND	ND	ND	0.42	**0.42**	**0.028**	0.074	1.56	1.95	140	1.5	0.00062	84
9/23/2014	11:30	21.9	7.9	ND	ND	ND	ND	ND	ND	0.14	**0.028**	0.072	1.72	2.15	130	1.0	0.00065	89
9/25/2014	12:20	22.0	7.9	0.21	ND	ND	ND	ND	0.21	0.21	**0.031**	0.069	1.67	2.00	130	1.0	0.0016	73
9/30/2014	10:10	20.1	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.031**	0.071	1.65	2.06	120	0.86	**0.0021**	73
10/2/2014	11:00	19.8	7.8	ND	ND	ND	ND	ND	ND	0.18	**0.036**	0.075	1.58	2.03	99	1.0	0.00095	64
10/7/2014	10:20	18.7	7.9	ND	ND	ND	ND	ND	ND	0.18	**0.043**	0.10	1.95	2.15	160	**250**	**0.0026**	60
10/9/2014	10:10	18.6	8.0	ND	ND	ND	ND	ND	ND	ND	**0.037**	0.099	1.68	2.10	150	1.2	**0.0018**	75
10/14/2014	10:30	18.6	7.9	0.24	ND	ND	ND	ND	0.24	0.24	**0.034**	0.089	1.59	1.97	140	0.68	**0.0018**	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** Total nitrogen is calculated through the summation of the different components of total nitrogen: organic and ammoniacal nitrogen (together referred to as Total Kjeldahl Nitrogen or TKN) and nitrate/nitrite nitrogen.

*** United States Geological Survey (USGS) Continuous-Record Gaging Station

**** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Criteria based on Aggregate Ecoregion III

Total Phosporus: 0.02188 mg/L (21.88 ug/L) ≈ 0.022 mg/L

Chlorophyll *a*: 0.00178 mg/L (1.78 ug/L) ≈ 0.0018 mg/L

Total Nitrogen: 0.38 mg/L

Turbidity: 2.34 FTU/NTU

Table 3-10. 2014 Casini Ranch nutrient grab sample results. This site may experience estuarine conditions.

Casini Ranch	Time	Temperature	pH	Total Organic Nitrogen	Ammonia as N	Ammonia as N Unionized	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen	Total Nitrogen**	Phosphorus, Total	Total Orthophosphate	Dissolved Organic Carbon	Total Organic Carbon	Total Dissolved Solids	Turbidity	Chlorophyll-a	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				0.200	0.10	0.00010	0.030	0.030	0.10		0.020	0.020	0.0400	0.0400	4.2	0.020	0.000050	Flow Rate****
Date		°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	(cfs)
5/15/2014	10:00	22.5	8.4	ND	0.07	0.0071	0.12	ND	ND	0.30	**0.058**	0.12	1.78	1.88	190	2.0	0.0011	147
5/20/2014	10:10	22.0	8.4	ND	0.07	0.0068	0.11	ND	ND	0.28	**0.056**	0.12	1.54	2.02	180	**2.5**	**0.002**	109
5/27/2014	10:10	22.3	8.2	0.21	ND	ND	0.13	ND	0.21	0.34	**0.064**	0.14	1.63	2.03	190	2.3	**0.0031**	85
6/3/2014	10:30	21.1	8.1	0.24	ND	ND	0.12	ND	0.24	0.37	**0.081**	0.12	1.61	1.92	160	2.0	0.0014	105
6/10/2014	11:10	22.6	8.9	ND	ND	ND	0.12	ND	ND	0.30	**0.044**	0.11	2.03	1.55	170	1.6	ND	106
6/17/2014	9:00	20.6	8.9	ND	ND	ND	ND	ND	ND	0.14	**0.047**	0.12	1.72	2.11	160	1.0	0.00021	96
6/24/2014	9:50	23.4	8.4	ND	ND	ND	ND	ND	ND	0.18	**0.057**	0.13	2.04	2.36	150	**3.6**	0.0015	94
7/1/2014	9:40	22.4	8.2	0.28	ND	ND	0.12	ND	0.28	**0.40**	**0.058**	0.14	1.61	2.05	150	1.4	0.0014	100
7/8/2014	10:40	22.8	8.0	ND	0.21	0.0097	0.12	ND	0.32	**0.44**	**0.055**	0.11	1.88	2.50	140	1.8	**0.0026**	95
7/15/2014	9:50	24.1	8.2	ND	ND	ND	ND	ND	ND	0.14	**0.050**	0.10	1.77	2.40	140	1.1	0.0013	134
7/22/2014	10:10	23.0	8.4	ND	ND	ND	0.12	ND	ND	0.30	**0.030**	0.091	1.61	1.60	160	1.1	**0.0020**	132
7/29/2014	10:00	24.1	8.4	0.21	ND	ND	ND	ND	0.21	0.21	**0.039**	0.11	1.70	2.24	160	1.4	0.00087	96
8/5/2014	10:10	21.3	8.2	ND	ND	ND	ND	ND	ND	0.18	**0.073**	0.096	1.47	2.03	140	1.3	0.0012	111
8/12/2014	10:50	21.5	8.2	ND	ND	ND	0.13	ND	ND	0.30	**0.032**	0.079	1.69	2.14	140	1.2	0.00067	105
8/19/2014	11:20	22.1	8.6	0.21	ND	ND	ND	ND	0.21	0.21	**0.036**	0.076	1.78	2.20	140	0.81	0.0012	87
8/26/2014	11:20	21.9	8.1	0.24	ND	ND	0.12	ND	0.24	0.37	**0.029**	0.071	1.72	2.15	150	1.5	0.00089	93
9/2/2014	11:20	22.6	8.1	ND	ND	ND	0.15	ND	ND	0.29	**0.030**	0.071	1.84	2.35	140	1.5	0.0010	70
9/9/2014	11:00	20.6	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.032**	0.065	1.55	1.95	150	0.64	0.00074	81
9/16/2014	10:30	21.1	8.2	0.24	ND	ND	ND	ND	0.24	0.24	**0.088**	0.07	1.72	2.06	140	0.82	0.00072	84
9/23/2014	11:00	21.5	8.0	ND	ND	ND	0.17	ND	ND	0.31	**0.032**	0.076	1.81	2.34	120	1.4	0.00076	89
9/25/2014	11:50	22.9	8.0	0.21	ND	ND	ND	ND	0.21	0.21	**0.038**	0.096	1.70	2.11	120	0.64	0.0015	73
9/30/2014	9:50	20.3	8.0	ND	ND	ND	ND	ND	ND	0.14	**0.027**	0.078	1.78	2.25	120	0.79	**0.0019**	73
10/2/2014	10:40	20.4	8.0	ND	ND	0.0013	ND	ND	0.21	0.21	**0.030**	0.067	1.62	2.13	140	0.94	0.00068	64
10/7/2014	10:00	19.4	8.0	0.24	ND	ND	0.17	ND	0.24	**0.42**	**0.049**	0.096	1.95	2.39	160	**250**	**0.0022**	60
10/9/2014	9:50	18.5	8.1	ND	ND	ND	0.17	ND	ND	0.17	**0.042**	0.10	1.92	2.32	160	1.0	**0.0019**	75
10/14/2014	10:10	18.6	8.1	0.28	ND	ND	0.17	ND	0.28	**0.45**	**0.038**	0.093	1.74	2.13	140	0.84	**0.0020**	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** Total nitrogen is calculated through the summation of the different components of total nitrogen: organic and ammoniacal nitrogen (together referred to as Total Kjeldahl Nitrogen or TKN) and nitrate/nitrite nitrogen.

*** United States Geological Survey (USGS) Continuous-Record Gaging Station

**** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Criteria based on Aggregate Ecoregion III

Total Phosporus: 0.02188 mg/L (21.88 ug/L) ≈ 0.022 mg/L

Chlorophyll *a*: 0.00178 mg/L (1.78 ug/L) ≈ 0.0018 mg/L

Total Nitrogen: 0.38 mg/L

Turbidity: 2.34 FTU/NTU

Table 3-11. 2014 Jenner Boat Ramp nutrient grab sample results. Estuarine conditions exist at this site.

Jenner Boat Ramp	Time	Temperature	pH	Total Organic Nitrogen	Ammonia as N	Ammonia as N Unionized	Nitrate as N	Nitrite as N	Total Kjeldahl Nitrogen	Total Nitrogen**	Phosphorus, Total	Total Orthophosphate	Dissolved Organic Carbon	Total Organic Carbon	Total Dissolved Solids	Turbidity	Chlorophyll-a	USGS 11467000 RR near Guerneville (Hacienda)***
MDL*				0.200	0.10	0.00010	0.030	0.030	0.10		0.020	0.020	0.0400	0.0400	4.2	0.020	0.000050	Flow Rate****
Date		°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	(cfs)
5/15/2014	9:40	18.4	8.4	ND	0.21	0.013	2.0	ND	0.24	**2.20**	**0.055**	0.13	1.22	1.13	10000	2.2	0.00068	147
5/20/2014	9:40	16.9	8.3	ND	0.070	0.0032	ND	ND	0.24	0.24	**0.056**	0.12	1.06	1.28	11000	**2.4**	0.0011	109
5/27/2014	9:40	18.9	8.1	0.28	0.070	0.0024	ND	ND	0.35	0.35	**0.067**	0.12	1.46	1.51	9700	**2.6**	**0.0079**	85
6/3/2014	10:00	16.2	8.0	0.21	ND	ND	ND	ND	0.21	0.21	**0.067**	0.13	1.09	1.07	11000	**2.7**	**0.0056**	105
6/10/2014	9:40	19.0	8.6	ND	0.10	0.011	ND	ND	0.24	0.24	**0.035**	0.13	1.20	1.03	10000	**2.5**	0.00074	106
6/17/2014	8:40	15.6	8.2	ND	ND	ND	ND	ND	ND	0.10	**0.051**	0.13	0.80	0.94	19000	**2.7**	0.00031	96
6/24/2014	9:20	18.2	8.1	0.49	ND	ND	ND	ND	0.49	**0.49**	**0.110**	0.17	1.19	1.05	16000	**20**	**0.019**	94
7/1/2014	9:20	17.5	8.2	0.21	ND	ND	ND	ND	0.21	0.21	**0.047**	0.088	1.13	0.97	15000	**2.4**	0.0014	100
7/8/2014	10:20	19.0	8.1	0.56	ND	ND	ND	ND	0.56	**0.56**	**0.053**	0.11	1.51	1.45	10000	**5.9**	**0.0019**	95
7/15/2014	9:30	18.2	7.9	0.21	ND	ND	ND	ND	0.21	0.21	**0.055**	0.11	0.46	0.46	600	1.9	0.00093	134
7/22/2014	9:50	19.7	7.9	0.35	ND	ND	ND	ND	0.35	0.35	**0.044**	0.083	1.16	1.01	13000	1.7	**0.0051**	132
7/29/2014	9:40	20.4	8.0	0.32	ND	ND	ND	ND	0.32	0.32	**0.043**	0.086	1.23	1.24	14000	2.1	0.0011	96
8/5/2014	9:50	17.8	7.9	0.28	ND	ND	ND	ND	0.28	0.28	**0.044**	0.085	0.82	0.95	13000	1.5	0.0011	111
8/12/2014	10:30	19.0	7.9	0.24	ND	ND	ND	ND	0.24	0.24	**0.051**	0.10	1.21	1.14	16000	**4.8**	**0.0062**	105
8/19/2014	10:50	18.9	8.0	0.32	ND	ND	ND	ND	0.32	0.32	**0.032**	0.072	1.23	1.16	15000	1.9	0.0012	87
8/26/2014	11:00	19.5	8.0	0.32	ND	ND	ND	ND	0.32	0.32	**0.043**	0.075	1.10	1.04	16000	**3.4**	0.00099	93
9/2/2014	11:00	19.1	8.1	0.28	ND	ND	ND	ND	0.28	0.28	**0.042**	0.059	1.48	1.64	9900	**2.4**	**0.0034**	70
9/9/2014	10:40	18.2	8.1	0.21	ND	ND	ND	ND	0.21	0.21	**0.030**	0.061	1.06	1.03	18000	1.2	0.0012	81
9/16/2014	10:10	18.0	8.1	ND	ND	ND	ND	ND	ND	0.18	**0.029**	0.066	1.01	1.03	16000	1.2	0.00062	84
9/23/2014	10:40	19.2	8.4	ND	ND	ND	ND	ND	ND	0.18	**0.028**	0.044	2.06	2.25	4900	1.6	**0.0027**	89
9/25/2014	11:30	19.5	8.3	0.21	ND	ND	ND	ND	0.21	0.21	**0.033**	0.049	2.18	2.19	3400	0.98	**0.002**	73
9/30/2014	9:20	18.2	8.2	0.24	ND	ND	ND	ND	0.24	0.24	**0.025**	0.055	2.70	2.55	3000	1.2	**0.0037**	73
10/2/2014	10:10	18.3	8.3	0.32	ND	ND	ND	ND	0.32	0.33	**0.030**	0.044	2.33	2.43	4000	1.4	**0.0023**	64
10/7/2014	9:40	18.1	8.2	0.21	ND	0.0014	ND	ND	0.24	0.24	**0.028**	0.044	2.59	2.80	2800	**5100**	**0.0019**	60
10/9/2014	9:30	17.8	8.0	0.28	ND	ND	ND	ND	0.28	0.28	**0.033**	0.06	2.60	2.97	2800	1.1	0.0014	75
10/14/2014	9:50	18.0	8.0	0.32	ND	ND	ND	ND	0.32	0.32	**0.039**	0.061	2.70	2.77	2600	1.1	**0.0034**	86

* Method Detection Limit - limits can vary for individual samples depending on matrix interference and dilution factors, all results are preliminary and subject to final revision.

** Total nitrogen is calculated through the summation of the different components of total nitrogen: organic and ammoniacal nitrogen (together referred to as Total Kjeldahl Nitrogen or TKN) and nitrate/nitrite nitrogen.

*** United States Geological Survey (USGS) Continuous-Record Gaging Station

**** Flow rates are preliminary and subject to final revision by USGS.

Recommended EPA Criteria based on Aggregate Ecoregion III

Total Phosporus: 0.02188 mg/L (21.88 ug/L) ≈ 0.022 mg/L

Chlorophyll *a*: 0.00178 mg/L (1.78 ug/L) ≈ 0.0018 mg/L

Total Nitrogen: 0.38 mg/L

Turbidity: 2.34 FTU/NTU

4.0 Additional Monitoring

4.1 Permanent Datasondes

In coordination with the USGS the Water Agency maintains three, multi-parameter water quality sondes on the Russian River located at Russian River near Hopland, Russian River at Diggers Bend near Healdsburg, and Russian River near Guerneville (aka Hacienda Bridge), . These three sondes are referred to as "permanent" because the Water Agency maintains them as part of its early warning detection system for use year-round. The sondes take real time readings of water pH, temperature, dissolved oxygen content (DO), specific conductivity, turbidity, and depth, every 15 minutes.

In addition to the permanent sondes, the Water Agency, in cooperation with the USGS, installed three seasonal sondes with real-time telemetry at the USGS river gage station at Russian River near Cloverdale (north of Cloverdale at Comminsky Station Road), at the gage station at Russian River at Jimtown (Alexander Valley Road Bridge), and at Johnson's Beach in Guerneville. The two seasonal sondes at Cloverdale and Jimtown are included by the USGS on its "Real-time Data for California" website.

The data collected by the sondes described above are evaluated in Section 4.2 in response to the SWRCB request to evaluate whether and to what extent the reduced flows authorized by the Order caused any impacts to water quality or availability of aquatic habitat for salmonids. In addition, the 2014 data will help provide information to evaluate potential changes to water quality and availability of habitat for aquatic resources resulting from the proposed permanent changes to D1610 minimum instream flows that are mandated by the Biological Opinion. A complete evaluation of the water quality data is being conducted as part of the California Environmental Quality Act (CEQA) analysis associated with proposed permanent changes to D1610.

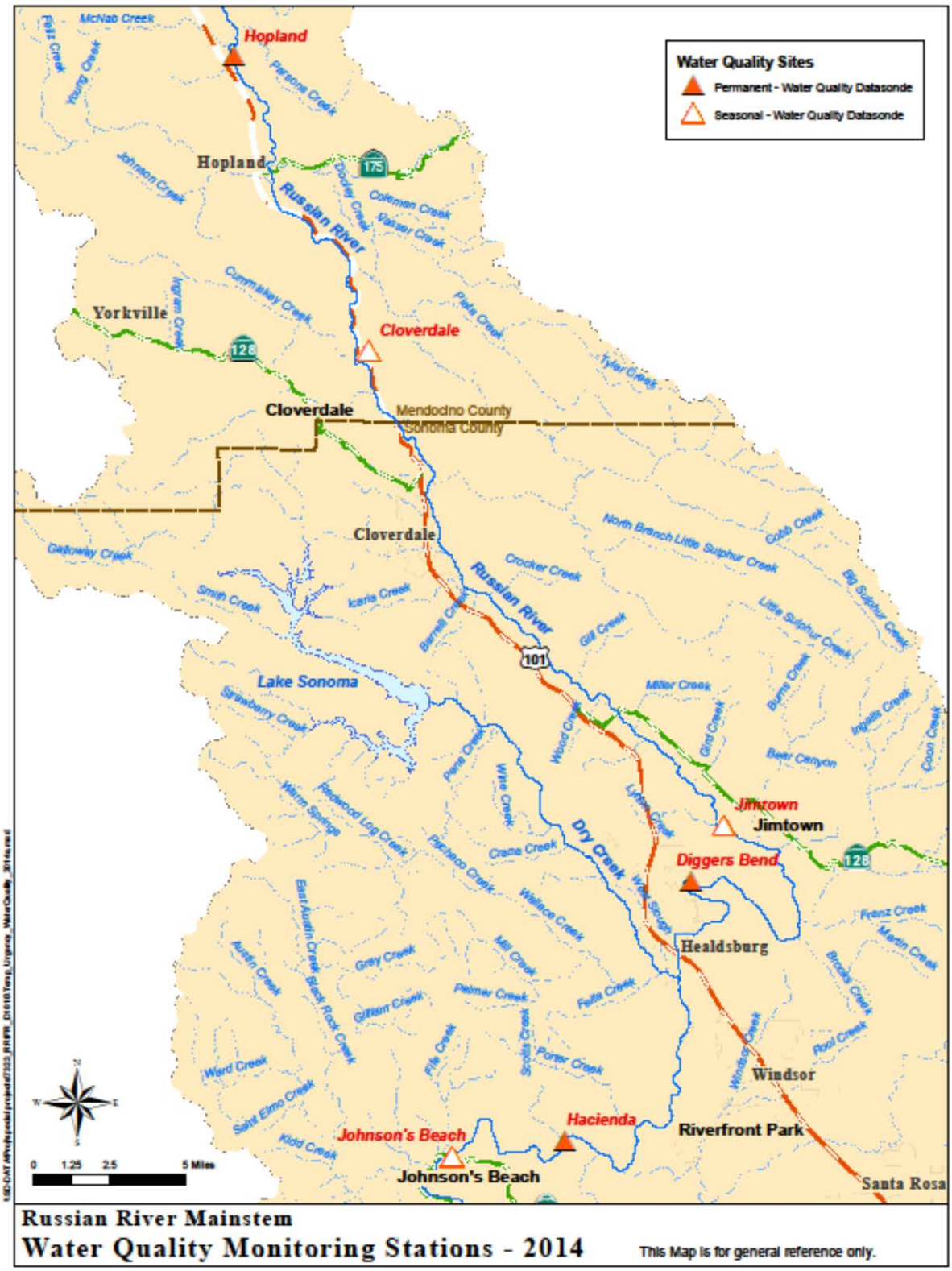

Figure 4-6. 2014 Russian River mainstem water quality monitoring stations sampled by the Sonoma County Water Agency.

4.2 Aquatic Habitat for Salmonids

4.2.1 Introduction

The State Water Resource Control Board (SWRCB) tasked the Water Agency with both fisheries and water quality monitoring and reporting requirements. These tasks included consulting with the National Marine Fisheries Service (NMFS) and the California Department of Fish and Wildlife (CDFW) to develop methodology to monitor freshwater fish in the Russian River and implement the resulting plan. In addition to these tasks the SWRCB required the Water Agency to collect adult fish counts at Dry Creek and report these counts on a weekly and annual basis to NMFS, CDFW, and the SWRCB. Furthermore, The SWRCB tasked the Water Agency with evaluating impacts associated with reductions in minimum instream flows authorized by the Order to water quality and the availability of aquatic habitat for salmonids in the Russian River.

4.2.2 Russian River Salmonid Life Stages

Salmonids in the Russian River can be affected by flow, temperature, and dissolved oxygen (DO) changes at multiple life stages. The Russian River supports three species of salmonids, coho salmon, steelhead, and Chinook salmon. These species follow a similar life history where adults migrate from the ocean to the river and move upstream to spawn in the fall and winter. Females dig nests called redds in the stream substrate on riffles and pool tail crests. As eggs are deposited into the nest they are fertilized by males. The eggs are covered with gravel by the female and the eggs remain in the nest for 8-10 weeks before hatching. After hatching, the larval fish remain in the gravel for another 4-10 weeks before emerging. After emerging from the gravel these young salmonids are identified first as fry and then later as parr once they have undergone some freshwater growth. Parr rear for a few months (Chinook) to 2 years (steelhead) in freshwater before undergoing a physiological change identified as smoltification. At this stage, fish are identified as smolts, and are physiologically able to adapt to living in saltwater, and are ready for ocean entry (Quinn 2005). In the Russian River smolts move downstream to the ocean in the spring (Chase et al. 2005 and 2007, Obedzinski et al. 2006). Salmonids spend 1 to 4 years at sea before returning to the river to spawn as adults (Moyle 2002). Because all life stages of all three species of Russian River salmonids spend a period of time in the Russian River watershed, they must cope with the freshwater conditions they encounter including flow, temperature, and DO. While all three species follow a similar life history, each species tends to spawn and rear in different locations and are present in the Russian River watershed at slightly different times. These subtle but important differences may expose each species to a different set of freshwater conditions.

Coho Timing and Distribution

Wild coho have become scarce in the Russian River and monitoring data relies mainly on fish released from the hatchery as part of the Russian River Coho Salmon Captive Broodstock Program (RRCSCBP). Data collected on the Water Agency's Mirabel inflatable dam video camera system in 2011 through 2013 indicate that the adult coho salmon run may start in late October and continue through at least January (SCWA unpublished data). Spawning and rearing occurs in the tributaries to the Russian River (NMFS 2008). Downstream migrant trapping in tributaries of the Russian River indicate that the coho smolt out-migration starts before April and continues through mid-June (Obedzinski et al. 2006). Coho salmon have been detected as late as mid-July in the mainstem Russian River downstream migrant traps

operated by the Water Agency (Martini-Lamb and Manning 2011). For coho, only the temperature and DO data relating to the adult life stage will be analyzed for this report as this is the life stage likely to be present in the Russian River during the time period governed by the Order (August 25, 2014 through February 20, 2015).

Steelhead Timing and Distribution

Based on video monitoring at the Water Agency's Mirabel inflatable dam and returns to the Warm Springs Hatchery, adult steelhead return to the Russian River later than Chinook. Deflation of the inflatable dam and removal of the underwater video camera system preclude a precise measure of adult return timing or numbers; however, continuous video monitoring at the inflatable dam during late fall through spring in 2006-2007, timing of returns to the hatchery, and data gathered from steelhead angler report cards (SCWA unpublished data, Jackson 2007) suggests that although very few adult steelhead may return as early September in some years, the vast majority of returns occur between January and April. Additionally, during coho spawner surveys conducted by the University of California Cooperative Extension (UCCE), steelhead have been observed spawning in tributaries of the Russian River in January, but more often in February and March (Obedzinski 2012).

Many steelhead spawn and rear in the tributaries of the Russian River while some steelhead rear in the upper mainstem Russian River (NMFS 2008, Cook 2003). Cook (2003) found that summer rearing steelhead in the main stem of the Russian River were distributed in the highest concentrations between Hopland and Cloverdale (Canyon Reach). Steelhead were also found in relatively high numbers (when compared to habitats downstream of Cloverdale) in the section of river between the Coyote Valley Dam and Hopland. The Canyon Reach is the highest gradient section of the mainstem Russian River and contains fast water habitats that include riffles and cascades (Cook 2003). Both the Canyon and Ukiah reaches generally have cooler water temperatures when compared to other mainstem reaches.

The steelhead smolt migration in the Russian River begins at least as early as March and continues through June, peaking between mid-March and mid-May (Martini-Lamb and Manning 2011). For Russian River steelhead, adult migratory and parr (rearing) life stages are present in the mainstem during the time period covered by the Order. Therefore only the temperature and DO data relating to the adult life stage and juvenile rearing will be analyzed for this report.

Chinook Timing and Distribution

Based on video monitoring at the Water Agency's Mirabel inflatable dam, adult Chinook are typically observed in the Russian River before coho and steelhead. Chinook enter the Russian River as early as September, but are typically not present in high numbers until mid-October. Generally the Chinook run peaks between mid-October and mid-November and is over in late December (Chase et al. 2005 and 2007, Martini-Lamb and Manning 2011). Chinook are mainstem spawners and deposit their eggs into the stream bed of the mainstem Russian River and in Dry Creek during the fall (Chase et al. 2005 and 2007, Cook 2003, Martini-Lamb and Manning 2011). Chinook offspring rear for approximately two to four months before out-migrating to sea in the spring. Based on downstream migrant trapping data Chinook smolts are present as early as march and the majority of the Chinook smolt out-migration appears to be complete by mid to late June (Chase et al. 2005 and 2007, Martini-Lamb and Manning 2011). The adult migratory life stage is present in the mainstem of the Russian River during the time period covered by the Order. Therefore, only the temperature and DO data relating to the adult life

stage will be analyzed for this report as this is the life stage likely to be present in the Russian River during the time period governed by the Order.

4.2.3 Methods

The Water Agency uses, underwater video, and dual frequency identification sonar (DIDSON), and water quality data collected in the Russian River and Dry Creek to summarize Russian River water quality conditions when salmonids where present. The Water Agency operates underwater video cameras and DIDSON to enumerate adult salmonids. USGS stream gages were used to provide water quality data in the mainstem Russian River.

Typically the Water Agency operates an underwater video camera system at Mirabel to estimate the number of adult Chinook that return to the Russian River. However, a large construction project to improve fish passage at Mirabel in 2014 precluded us from operating an underwater camera system at this site. Instead the Water Agency relied on adult counts from a DIDSON paired with an underwater video camera at Dry Creek (a tributary to the Russian River near Healdsburg). The DIDSON collects sonar images of fish as they pass the sample site. This allows us to count fish that would be too distant for an underwater camera to collect images of fish during periods of high turbidity when an underwater camera would be ineffective. The resolution of DIDSON often precludes the accurate identification of species. When conditions permitted we operated an underwater video camera at this site in combination with the DIDSON in order to determine the species composition of fish passing the Dry Creek site. This allowed us to prorate DIDSON counts at Dry Creek. In addition to operating a DIDSON at Dry Creek the Water Agency experimented with an underwater video camera in a fish ladder at Memorial Beach near Healdsburg. This site is located on the mainstem Russian River upstream of Dry Creek. Data from these monitoring site were used to determine when adult salmonids were present in the Russian River during 2014-15.

Physical habitat conditions (flow, water temperature, and DO) were collected at multiple sites in the Russian River. USGS stream gages located on the Russian River at Hacienda, Diggers Bend, Jimtown, and Hopland provided flow, water temperature, and DO data. These water quality conditions were compared to findings in the literature and were used to construct temperature and DO criteria for Russian River salmonids (Table 4-1).

Adult salmonid counts are used to relate water quality conditions to the timing and magnitude of the adult salmonid run. We compared adult counts from counting stations with water quality information only where fish would either pass through a water quality station before or after being detected at a particular counting station. For instance since Hacienda is downstream of both Dry Creek and Healdsburg all adult salmonids observed at these sites must first pass through the Hacienda water quality station. Therefore displaying Dry Creek and Healdsburg adult salmonid counts with Hacienda water quality conditions allows us to relate the timing and magnitude of the adult salmonid run to water quality conditions they likely experienced at Hacienda. Fish counted at Dry Creek are destined to spawn in Dry Creek and will not experience the conditions at water quality stations in the mainstem Russian River upstream of Dry Creek (Diggers Bend, Jimtown, and Hopland). Adult salmonids passing Healdsburg are destined to spawn in the upper mainstem Russian River and may swim past Diggers Bend, Jimtown, and Hopland stations on their way to spawning grounds. Therefore we relate only Healdsburg adult salmonid counts to water quality collected at the Diggers Bend, Jimtown, and Hopland stations.

Because the Majority of steelhead rearing habitat in the mainstem Russian River occurs upstream of Hopland this report presents the water quality data from the USGS Hopland gaging station when discussing juvenile steelhead.

Table 4-1. Temperature and dissolved oxygen thresholds used for ranking observed estuarine water quality for rearing salmonids in 2010. Temperature thresholds are based on Sullivan et al. (2000) and NCRWQCB (2000).The Order only applies to the Mainstem Russian River and not its tributaries.

Quality	Maximum weekly average temperature (˚C)	Dissolved oxygen (mg/l)
Excellent	13-17	7-12
Good	17-19	5-7
Poor	19-24	3-5
Very poor	>24	<3

4.2.4 Results

Flow

Flow in the Russian River was generally controlled by reservoir releases from the beginning of the Order on August 24, 2014 to the first major storm event on November 20, 2014. Flows in the Russian River were mainly the result of natural runoff starting with the storm on November 20 through the end of the Order on February 20, 2015. Flow generally remained slightly below 100 cfs at Hacienda during the beginning of the order. From August 25, 2014 to late November flow in the Russian River at Hacienda ranged from approximately 60 cfs to approximately 150 cfs. A major storm event in early December elevated stream flows at Hacienda to 40,500 cfs (instantaneous maximum) on December 12, 2014 and a second major storm event in early February elevated stream flows to 25,000 cfs (instantaneous maximum) on February 7, 2015. These two storm events required us to remove our monitoring equipment from the stream. On December 3, 2014 we removed the underwater video cameras from Dry Creek and the Russian River. On December 11, we removed the DIDSON from Dry Creek. We reinstalled the DIDSON on December 29, 2014, but elevated turbidity precluded us from reinstalling either of the underwater video camera systems. We were not able to operate the DIDSON from February 6, 2015 through February 18, 2015 due to another storm event (Figure 4-1). This report only summarizes data through February 1, 2015.

Adult salmonids including Chinook were observed migrating past the adult counting stations at Dry Creek and on the mainstem Russian River at Healdsburg during the order. Adult salmonids were frequently observed at these monitoring sites in November when stream flow was still controlled by reservoir releases. Prior to late October, few salmonids were observed but this is mainly attributed to the mouth of the Russian River being closed from September 17, 2014 to October 22, 2014. Prior to the breach that occurred on October 23, 2014 only 3 salmonids had been observed at the counting stations operated by the Water Agency. The river mouth closed again on October 24, 2014 and remained closed

for 25 days. During this time, a total of 321 adult salmonids were observed at the counting station. The first of these fish were observed at the counting stations the day following the breach. This suggests that flow was adequate for adult salmonid passage from the mouth of the river upstream to at least the location of the adult counting station – a distance of approximately 50 river km. During this time period (October 23, 2014 through November 22, 2014) flow in the river was mainly controlled by reservoir releases (Figure 4-2).

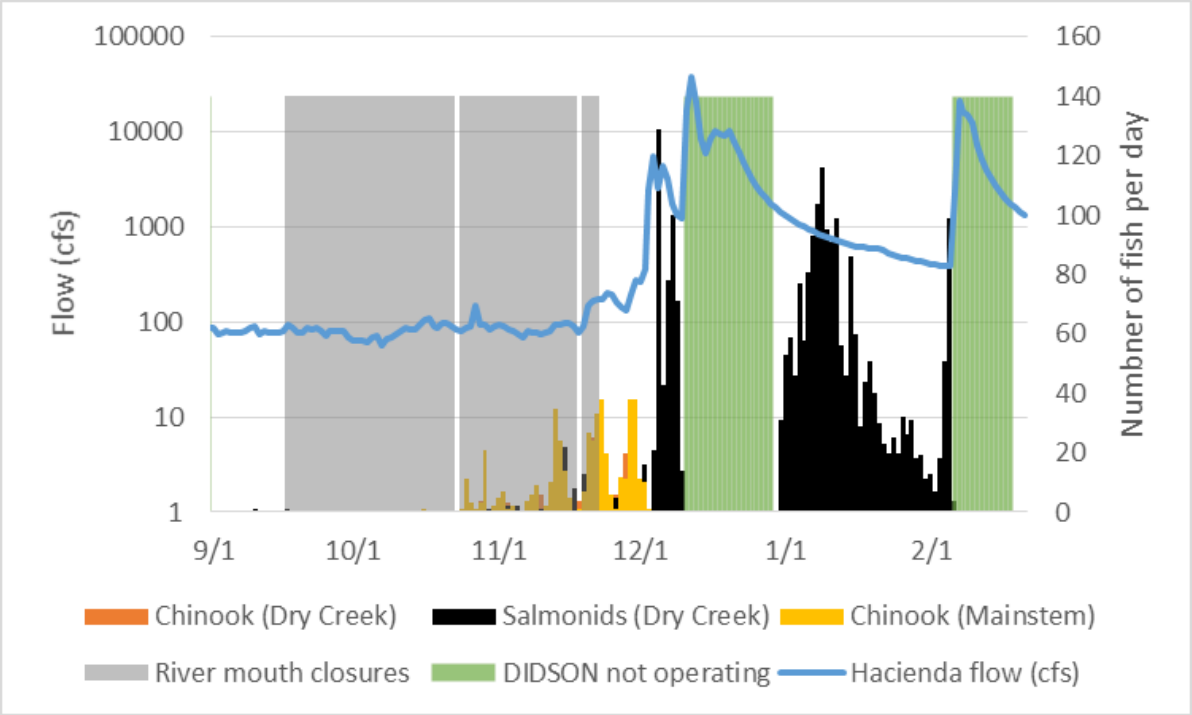

Figure 4-2. Flow in the Russian River gaged at the USGS Hacienda stream gage for the period of the Order shown with the period of time that the mouth of the Russian River was closed due to the formation of a sand bar. Also shown are adult Chinook counts from video collected at Healdsburg on the mainstem Russian River and adult Chinook and salmonid counts from video and DIDSON collected on Dry Creek and the period of time that the DIDSON was not operating.

Temperature

Temperature was relatively warm for salmonids during the beginning of the order, but salmonids were not present until later in the order when temperature was generally good to excellent. At Hacienda average daily water temperature ranged from a high of 22.5 °C to a low of 9.1 °C during the period of the order. Few salmonids were observed in the Russian River prior to October 23, 2014. During the period of time following the beach on October 23 to the end of the Order the average daily water temperature at Hacienda ranged from a high of 17.6 °C to a low of 9.1 °C (Figure 4-3). This temperature range is considered good to excellent for salmonids based on Sullivan et al. (2000) and NCRWQCB (2000).

At Diggers Bend near Healdsburg, water temperature was relatively warm for salmonids in the early part of the order but was generally favorable for salmonids for the remainder of the Order. Average daily water temperature at the USGS Diggers Bend stream gage ranged from a maximum of 24.9 °C to a minimum of 9.1 °C during the Order. Few salmonids were present prior to breaching the mouth of the Russian River on October 23, 2014. For the time period following this breach to the end of the Order,

the average daily water temperature at Diggers Bend ranged from a maximum of 18.8 °C to a minimum of 9.1 °C (Figure 4-4). According to the literature, this temperature range is good to excellent for salmonids Sullivan et al. (2000) and NCRWQCB (2000).

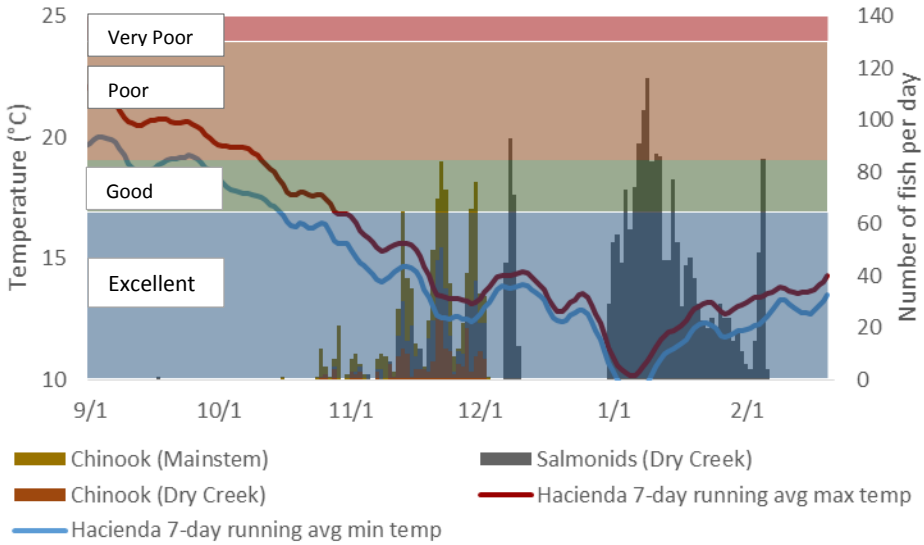

Figure 4-3. The 7-day running average of the minimum and maximum water temperatures collected at Hacienda shown with the Chinook counts from the mainstem Russian River and Chinook and salmonid counts from Dry Creek. Also shown are the excellent, good, poor, and very poor water temperature thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

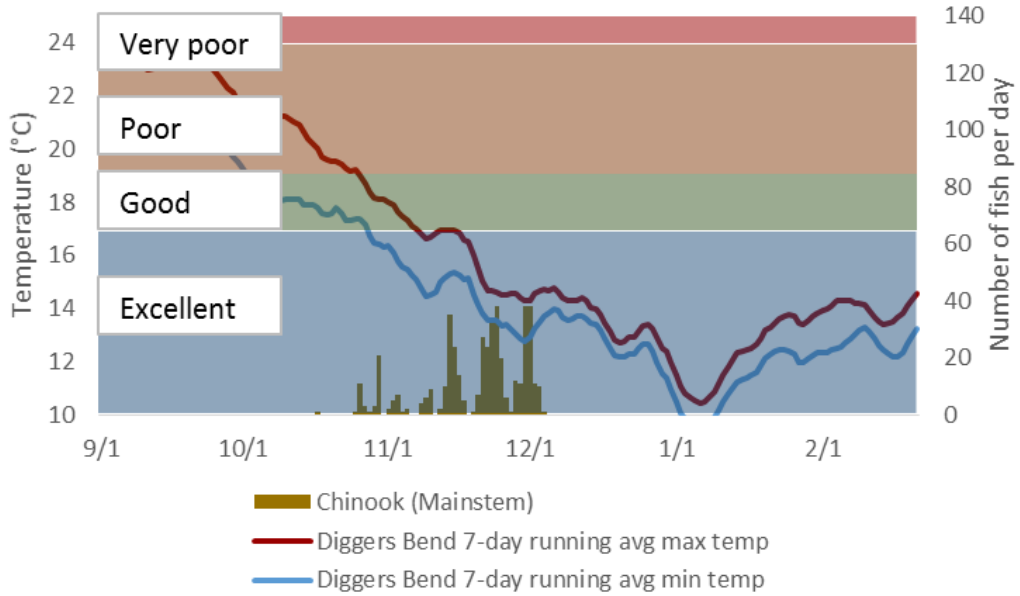

Figure 4-4. The 7-day running average of the minimum and maximum water temperatures collected at Diggers Bend shown with the Chinook counts from the mainstem Russian River. Also shown are the excellent, good, poor, and very poor water temperature thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

Water temperature collected at the USGS gage near Jimtown only exists for the early part of the record and ranges from poor to excellent conditions for salmonids. During the period of time that water temperature was recorded for Jimtown (October 1, 2014 to October 31, 2014) average daily water

temperatures ranged from a maximum of 21.8 °C to 15.7 °C (Figure 4-5). It is worth noting that data from this gage is missing for most of the time period when adult salmonids were present in the Russian and based on nearby gages, water temperatures were likely favorable for salmonids during this time period.

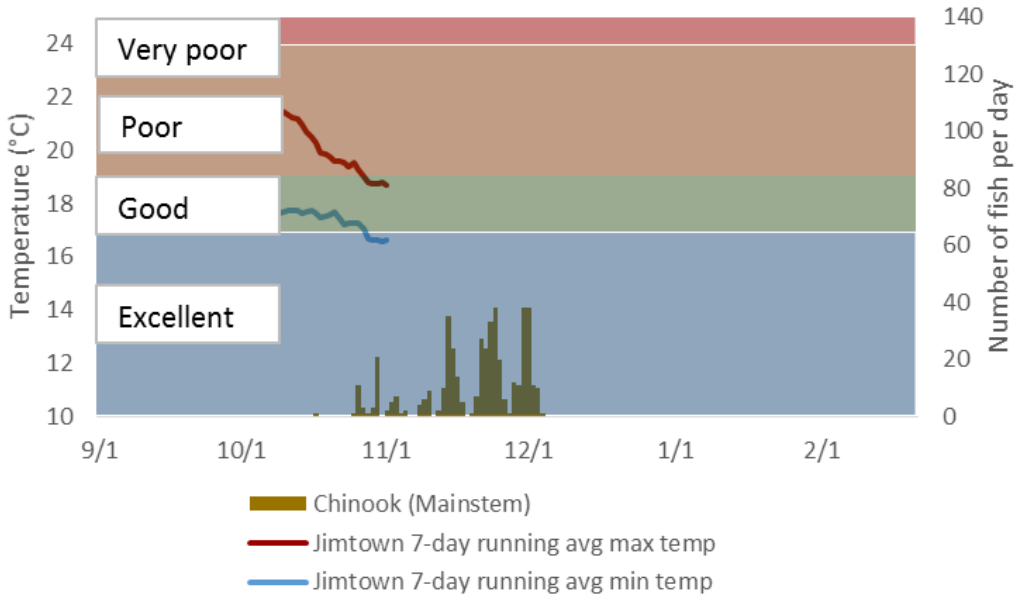

Figure 4-5. The 7-day running average of the minimum and maximum water temperatures collected at the USGS gage near Jimtown shown with the Chinook counts from the mainstem Russian River. Also shown are the excellent, good, poor, and very poor water temperature thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

At Hopland water temperatures conditions for salmonids ranged from poor to excellent during the period of the order. The majority of the time water temperatures at Hopland ranged from good to excellent with the poor conditions only occurring in the early portion of the Order. The average daily water temperature at Hopland ranged from 22.6 °C to 8.3 °C during the order. Few adult salmonids were present in the Russian River prior to breaching the mouth of the Russian River on October 23, 2014. For the time period following this breach to the end of the Order the average daily water temperature at Diggers Bend ranged from a maximum of 18.8 °C to a minimum of 9.1 °C (Figure 4-6). Cold water released from the bottom of Lake Mendocino typically makes the section of river between Cloverdale and Lake Mendocino favorable for juvenile salmonids throughout the summer. However these conditions did not likely persists throughout the summer as storage in Lake Mendocino was unusually low due to drought conditions and the cold water pool in Lake Mendocino was likely depleted during the summer (Figure 2-1).

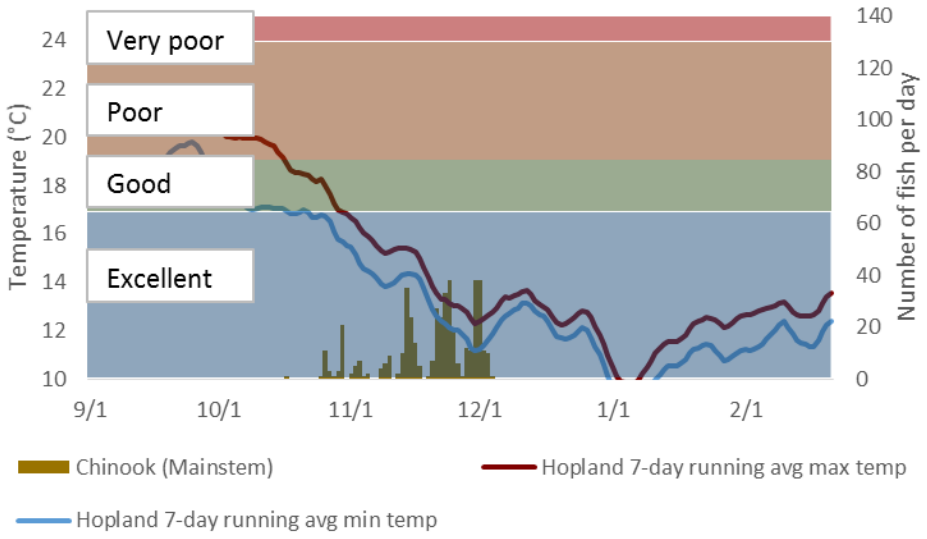

Figure 4-6. The 7-day running average of the minimum and maximum water temperatures collected at the USGS gage near Hopland shown with the Chinook counts from the mainstem Russian River. Also shown are the excellent, good, poor, and very poor water temperature thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

Dissolved Oxygen

Dissolved oxygen was generally favorable for salmonids in the Russian River through the Order. At Hacienda, the average daily dissolved oxygen ranged from a 7.6 mg/L to 12.2 mg/L (Figure 4-7). Dissolved oxygen levels in this range are considered excellent for salmonids based on Sullivan et al. (2000) and NCRWQCB (2000).

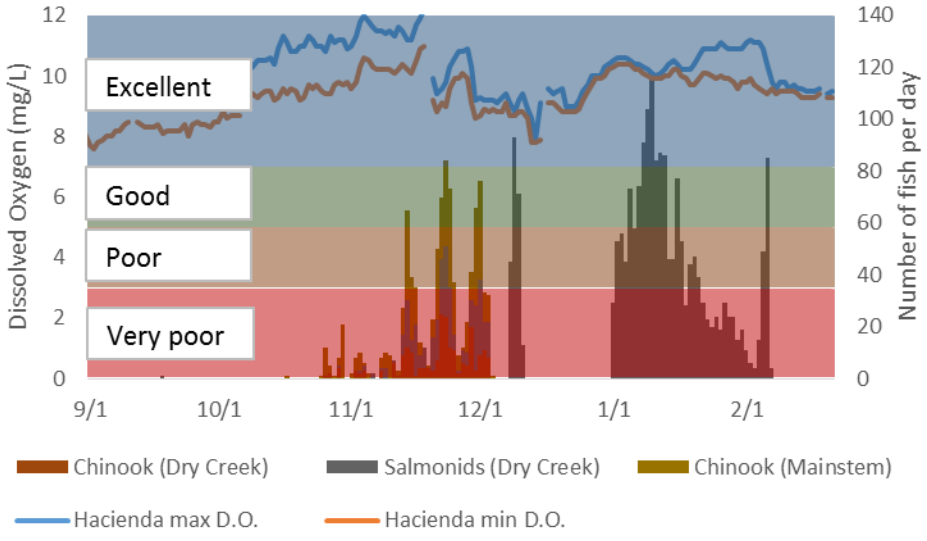

Figure 4-7. The 7-day running average of the minimum and maximum dissolved oxygen collected at Hacienda shown with the Chinook counts from the mainstem Russian River and Chinook and salmonid counts from Dry Creek. Also shown are the excellent, good, poor, and very poor dissolved oxygen thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

Dissolved oxygen levels at Diggers Bend were favorable for salmonids throughout the Order. Dissolved oxygen levels at the USGS stream gage at Diggers Bend ranged from 6.1 mg/L to 12.4 mg/L (Figure 4-8).

Dissolved oxygen levels in this range are considered good to excellent based on Sullivan et al. (2000) and NCRWQCB (2000).

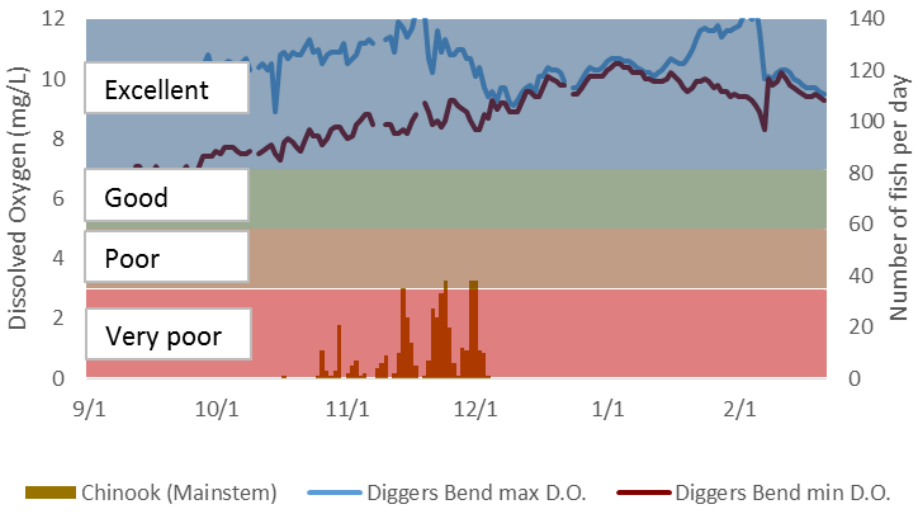

Figure 4-8. The 7-day running average of the minimum and maximum dissolved oxygen collected at the USGS stream gage near Diggers Bend shown with the Chinook counts from the mainstem Russian River. Also shown are the excellent, good, poor, and very poor dissolved oxygen thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

The period of record at the USGS stream gage at Jimtown only extends for a portion of the Order, but dissolved oxygen levels were favorable for salmonids. At Jimtown the average daily dissolved oxygen ranged from a 6.2 mg/L to 12.2 mg/L during the period of the order and when salmonids were present in the Russian River (Figure 4-9). Dissolved oxygen levels in this range are considered good to excellent for salmonids based on Sullivan et al. (2000) and NCRWQCB (2000).

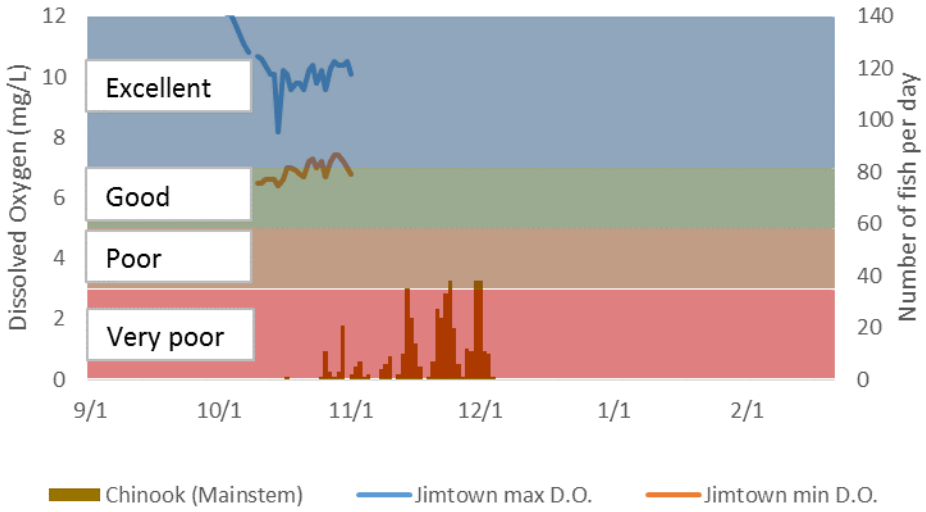

Figure 4-9. The 7-day running average of the minimum and maximum dissolved oxygen collected at the USGS stream gage near Jimtown shown with the Chinook counts from the mainstem Russian River. Also show are the excellent, good, poor, and very poor dissolved oxygen thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

Dissolved oxygen levels at Hopland where favorable for salmonids throughout the Order. Dissolved oxygen levels at the USGS stream gage at Hopland ranged from 7.3 mg/L to 11.8 mg/L (Figure 4-10). Dissolved oxygen levels in this range are considered excellent based on Sullivan et al. (2000) and NCRWQCB (2000).

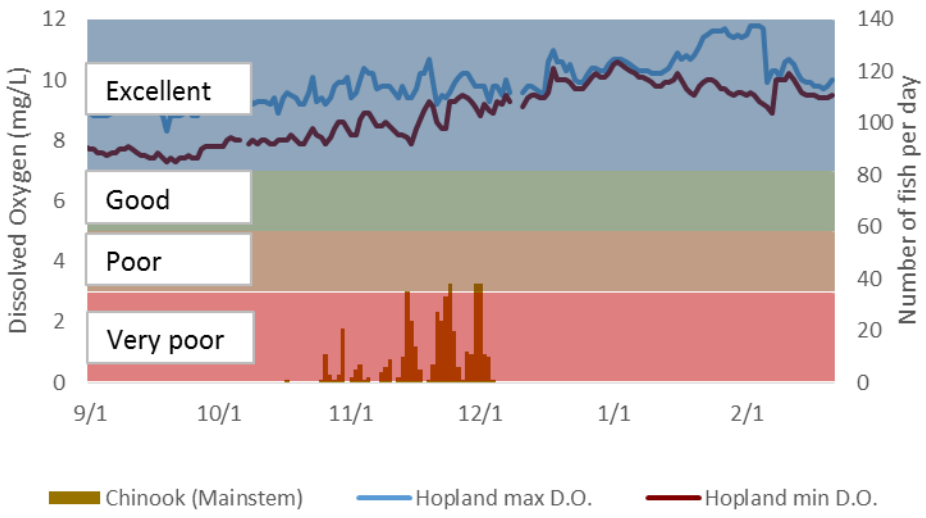

Figure 4-10. The 7-day running average of the minimum and maximum dissolved oxygen collected at the USGS stream gage near Hopland shown with the Chinook counts from the mainstem Russian River. Also show are the excellent, good, poor, and very poor dissolved oxygen thresholds based on Sullivan et al. (2000) and NCRWQCB (2000). See Table 4-1 for a description of water quality zones.

4.2.5 Summary

Flow in the Russian River was generally sufficient to allow for Chinook passage during the Order. The Chinook run in 2014 occurred later in the year relative to other years due to a sand bar forming at the mouth of the Russian River during most of the fall. Once Chinook had access to the river they were observed the following day at the adult counting stations located approximant 50 river km upstream of the river mouth. Chinook were observed at these counting stations for a 26 day period when the flow was controlled by reservoir releases. This suggest that flow was sufficient to allow for Chinook passage during the Order.

Water quality conditions in the Russian River were generally favorable for salmonids during the Order and particularly in the later portion of the order when adult salmonids were present in the river. Water temperatures were often poor during the beginning of the order, this likely affected juvenile steelhead that often rear in the section of the Russian River between Cloverdale and Lake Mendocino. Normally Lake Mendocino releases make this section of river relatively cool in the summer, however during the summer and early fall 2014 upper river water temperatures were warm due to low lake levels. It is important to note that steelhead rear in many of the tributaries to the Russian River and these fish would not be affected by the conditions in the upper Russian River. During the period of time that adult salmonids were observed at the counting stations water temperature was generally good to excellent. Dissolved oxygen was good to excellent for salmonids at the Hacienda, Diggers Bend, Jimtown, and Hopland USGS stream gages.

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APPENDIX B-1

2014 Outlet Channel Management Plan

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RUSSIAN RIVER ESTUARY OUTLET CHANNEL
ADAPTIVE MANAGEMENT PLAN
2014

Prepared for

Sonoma County Water Agency

Prepared by

ESA PWA

with

Bodega Marine Laboratory, University of California at Davis

May 15, 2014

ESA PWA REF. # DW01958

Services provided pursuant to this Agreement are intended solely for the use and benefit of the Sonoma County Water Agency.

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1. INTRODUCTION

Sonoma County Water Agency (the Agency) is required to develop a management plan for the Russian River Estuary mouth in response to a 2008 Biological Opinion (BO) from the National Marine Fisheries Service (NMFS) designed to improve salmonid rearing habitat in the estuary (NMFS, 2008). Prior to the BO, the existing Russian River Estuary management plan focused on artificial breaching to prevent flooding. The Agency retained ESA PWA[1] to assist in developing the revised plan to address the objectives of the BO.

The BO stipulates several phases of outlet channel management over fifteen years with additional management options specified for each phase. The phases are part of an adaptive process for management actions to enhance salmonid habitat. If earlier phases are successful in meeting the performance criteria, subsequent phases will not be needed. The existing plan was first developed in 2009 to address the Phase 1 objectives in the BO and then updated in 2010, 2011, 2012, and 2013. This document, the management plan for 2014, is largely based on the plan drafted in 2013. The changes between the 2013 and 2014 plan include: documented 2013 inlet conditions (Attachment H), and updated permitting requirements (Sections 3.2 and Attachment C).

Because of permitting issues, the outlet channel was not implemented in 2009. In 2010, the outlet channel naturally established itself for about one a week at the end of June, and was then closed by ocean waves. After this closure, the Agency mechanically re-created the outlet channel. However, waves closed the outlet channel less than a day after implementation. Before the outlet channel could be re-established by the Agency, the lagoon breached, returning the estuary to tidal conditions for the remainder of the summer. Additional closures occurred in September and October, but large wave conditions and imminent flooding prevented efforts to create an outlet channel. In 2011, the inlet never closed long enough to warrant management action. Wave events caused a series of closures between the end of September and into November. However, the closures lasted a week or less, ending when rising lagoon water levels overtopped the beach berm and naturally scoured a new tidal channel. 2013 was similar to 2011 and 2012, with early summer and early fall closures ending when overtopping naturally scoured a new channel.

The approach of the 2014 plan is to meet the objective of the Reasonable and Prudent Alternative (RPA), Alterations to Estuary Management, to the greatest extent feasible while staying within the constraints of existing regulatory permits and minimizing the impact to aesthetic, biological, and recreational resources of the site. It is recognized that the measures developed in the 2014 management plan, when implemented, may not fully meet the objective established by the RPA. The concept of this approach was developed in coordination with NMFS, California Department of Fish and Wildlife (CDFW)[2], and California State Parks (CSP). This draft plan was provided to these agencies and discussed at a meeting on March 11, 2014 that included representatives from NMFS and CDFW, as well as the Sonoma County Water Agency, Bodeg Marine Laboratory, the U.S. Army

[1] Previously Philip Williams & Associates
[2] CDFW's CESA tracking number is 2080-2009-016-03 and 1600 Notification number is III-1176-96

Corps of Engineers, the Regional Water Quality Control Board, and ESA PWA. Comments on the draft plan from these representatives will inform the revision of the draft plan to create the final plan.

The goal of the management plan is to reduce marine influence on the Russian River Estuary (Figure 1) during the management period, May 15th to October 15th. The management actions are intended to limit tidal exchange between the ocean and the estuary. Instead of the existing tidal estuary, the BO proposes a perched lagoon with water levels above tidal elevations. With tidal inflows limited, river inflow to the lagoon may enhance the extent of freshwater habitat for the benefit of juvenile salmonid rearing. Maintaining the lagoon water levels in a perched state that is also below flood stage requires an outlet channel to convey water from the estuary to the ocean over the beach berm.

The outlet channel adaptive management plan is organized as follows. Conclusions and recommendations of this plan are described in Section 2. Sections 3-6 describe the planning and analysis steps: (1) defining project performance criteria (Section 3), (2) developing a conceptual model of relevant physical processes (Section 4), and (3) conducting technical analysis to quantify target outlet channel conditions (Sections 5 and 6). The resulting operations and management plan derived from these planning steps is also documented in this report (Section 7). The adaptive management strategy will continue by actual implementation of this plan, then monitoring and evaluating the outlet channel response to refine the plan for subsequent years.

2. CONCLUSIONS AND RECOMMENDATIONS

Conclusions about the physical processes affecting outlet channel behavior and recommendations for 2014 management are summarized below.

2.1 CONCLUSIONS: PHYSICAL PROCESSES AFFECTING OUTLET CHANNEL BEHAVIOR

1. The location of the outlet channel, at the interface of the Russian River estuary and the surf zone of the Pacific Ocean, is a dynamic system influenced by river discharge, ocean waves, and sand transport. As such, the outlet channel will be subject to variable forcing at hourly, tidal, and monthly timescales. In order for the outlet channel mouth to preserve its function in this active transport zone, the net sediment transport must be small, even though the gross sediment transport is large. To sustainably meet its performance criteria, the outlet channel must be resilient in the face of this variable forcing. This resiliency is difficult to predict.
2. Under current management of the Russian River watershed and estuary, there has been one documented occurrence of target outlet channel conditions occurring during the proposed management season of May 15 to October 15 for the fifteen year period of record (1999 to 2013). Outlet channel conditions occurred in June 2010 and persisted for about one week before closing. More typically, as a result of natural processes and existing artificial breaching practice, the connection between the estuary and the ocean has been observed in one of two states: bi-directional tidal exchange (88% of the time during the 1999-2008 management periods) or fully closed with no exchange (12% of the time).
3. Conditions similar to target outlet channel performance criteria were observed outside the management period five times between 1999 and 2013. These events appeared to be extended transitions to fully tidal conditions rather than stable conditions. Estuary water levels steadily declined throughout all events and the estuary typically returned to tidal exchange within 48 hours.
4. To meet the performance criteria, the outlet channel geometry must simultaneously meet two key constraints: convey sufficient discharge from the estuary to the ocean to preserve constant water levels in the estuary and preserve channel function by avoiding closure or breaching. These two constraints can be in conflict, since both conveyance capacity to preserve estuary water levels and the potential for breaching increase with flow rates but closure is more likely for lower flow rates.
5. The target outlet channel is subject to two failure modes: (1) closure caused by deposition, leading to estuary water levels to rise and possibly cause flooding, and (2) breaching caused by scour, leading to tidal exchange and marine conditions in the estuary. Of the two failure modes, breaching is more detrimental to NMFS's goal of reducing or eliminating exposure of the estuary to tidal water levels and saline inflow. Once breaching occurs, the estuary may persist in a breached state for weeks or months before the target outlet channel can re-form. The immediate impact of closure is only increasing estuary water levels, which allows time for management action to prevent habitat loss.

6. Based on engineering calculations, the channel bed slope must be essentially flat (slope on the order of 0.0001) and water depths less than 2 ft, preferably 0.5 to 1 ft, to reduce the likelihood of channel scour at likely May to October flows.
7. Based on the results of hydrologic modeling, it may be difficult to convey sufficient discharge to maintain estuary water levels while simultaneously keeping the bed shear stress in the outlet channel below the threshold for scour. Even with the anticipated reduced 2014 instream flows, the predicted local bed shear stress during the management period is almost always greater than the critical bed shear stress threshold for erosion.
8. Discharge conditions are a significant source of hydraulic uncertainty for assessing the outlet channel. Discharge measurements are made at the USGS Guerneville gaging station[3], 21 miles upstream from the Russian River's mouth, and changes in flow (losses/gains) are known to occur between the Guerneville station and the mouth. A water balance model for the estuary indicates that net losses between the Guerneville gaging station and the mouth vary from 10% to 53% and average 37%. Limited USGS and Agency discharge measurements at other locations suggest that most losses occur in the lower 6 miles of the river; perhaps in large part due to seepage through the beach berm.

2.2 RECOMMENDATIONS: 2014 MANAGEMENT ACTIONS

1. Two channel configurations will be initially considered for implementation.
    - a wide and short channel that seeks to minimize scour potential; or
    - a narrow and long channel aligned to the north that seeks minimize closure potential.

    The channel selected for implementation will be based on site conditions at the time of closure and discussion with the resource agency management team. Monitoring of the outlet channel and estuary response will be used to inform adaptive management during the management period.
2. Initial management actions may be more frequent, and include maintenance actions that are corrections to the existing channel configuration. Based on experience from these initial efforts, larger and less frequent actions may be undertaken.
3. Once the estuary closes, implement the channel so that when reconnecting the channel, the estuary water levels are no more than 0.5 to 1 ft above the constructed channel bed elevation. This approach reduces the potential for scour.
4. Channel excavation activities should be completed (i.e. the temporary sand barrier removed) coincident with high tides in the ocean. This will reduce the scour potential associated with the initial outflow at the time of breaching.
5. A communication protocol will provide guidance between the Agency and identified points of contact representing key resource management agencies in the estuary.
6. Because of uncertainty about the system and its response to outlet channel management, the adaptive management approach specified in the BO and being pursued by the Agency is

[3] Located just downstream of Hacienda Bridge, USGS station ID 11467000.

critical. A year-end evaluation to assess actual channel performance and revised management for subsequent years is also recommended.

3. PERFORMANCE CRITERIA

The principal estuarine habitat goal stipulated in the Reasonable and Prudent Alternative (RPA), Alterations to Estuary Management, in the BO is to reduce marine influence in the estuary from May 15 to October 15. According to the BO, marine influence includes tidal water level oscillations and saline water. NMFS believes that marine conditions diminish habitat quality for salmonid rearing by reducing the habitat extent, elevating salinity above optimal levels for salmonid juveniles and their invertebrate prey, and flushing juveniles into the ocean.

The performance criteria for outlet channel management are intended to assist in meeting the estuarine habitat objective of the RPA specified in the BO. This section presents performance criteria for Phase 1 of outlet channel management, and minor modifications to these criteria for 2014 management.

Performance criteria for water quality and ecological values in the lagoon are addressed separately and are not included in this document. The Water Agency's water quality monitoring plan is described in Sonoma County Water Agency (2013a), with the monitoring results described in Sonoma County Water Agency (2013b).

3.1 PHASE 1

Phase 1 of outlet channel management has the following performance criteria for the May 15 to October 15 management period:

1. **Estuary water levels**. The estuary water level management target is "[a]n average daily water surface elevation of at least 7 feet [NGVD] from May 15 to October 15" (BO, p. 249). Higher estuary water levels, but not exceeding flood stage of 9 ft NGVD, would be preferred by NMFS. However, water levels greater than 4 ft NGVD are expected to accompany reduced marine influence and would be likely to improve habitat.
2. **Sand channel**. The outlet channel will be a temporary feature, created only by excavating and placing beach sand. No new structures or mechanical devices, temporary or permanent, will be a part of the outlet channel implementation.
3. **Minimize artificial breaching**. Though the overall goal is to create a freshwater estuary, and therefore avoid artificial breaching, in light of natural variability of river discharge and nearshore wave conditions, several years of experience managing the estuary may be required to develop operational procedures which minimize the need for artificial breaching. As such, NMFS estimates "that SCWA will need to artificially breach the lagoon using methods that do not create a perched lagoon twice per year between May 15 and October 15 during the first three years covered by this opinion, and once per year between May 15 and October 15 during years 4-15 covered by this opinion" (BO, p. 302).
4. **Economic feasibility**. Operations and maintenance requirements will not place undue burden on the Agency in terms of cost, particularly as it relates to frequency or duration of maintenance activities.

5. **Public Safety**. The outlet channel management plan will not diminish public safety as it pertains to floodplain property owners, visitors and employees of the State Beach, and the Agency maintenance staff.

To meet the criterion for estuary water level (#1 above), the estuary will function as a perched lagoon with "water surface elevation above mean high tide … where freshwater flows out to the ocean over the sandbar at the lagoon's mouth" (BO, p. 92). This implies uni-directional flow in the outlet channel, from the estuary to the ocean, to minimize marine influence, and minimal sediment transport within the outlet channel to prevent the channel bed from scouring and transforming into a tidal channel.

NMFS (2008) introduced the terminology 'natural' to describe breaches that occur without human intervention and 'artificial' to describe breaches that are the result of human sand excavation. This terminology was used in the management plan through 2013. However, inlet and beach observations in 2012 (Attachment G) and 2013 (Attachment H), suggest that the jetty, a human intervention, may indirectly facilitate breaching. The jetty appears to encourage some breaches sooner than natural conditions because the jetty shelters a portion of the beach immediately to its north, limiting sand deposition and resulting in a low point in the beach berm. In 2012 and 2013, this low point was often the location where rising lagoon water levels scoured a new inlet. Therefore, starting with the 2014 plan, the term 'self-breach' is used to describe breaches caused by the estuary's own rising water levels. This term is used to include all breaches of this type, since the extent of the jetty's influence has not been fully determined. 'Artificial' breach continues to refer to instances involving human excavation, covering both authorized Water Agency contractors with mechanical equipment or unauthorized members of the public with hand tools.

Note that each time the lagoon breaches, NMFS believes the lagoon is subject to undesirable water quality conditions not just during the breached period, but also for some period of time following the subsequent closure. "NMFS anticipates 3-4 weeks of adverse water quality conditions after the sandbar closes at the mouth of the estuary" (BO p. 302). Thus the management plan seeks to minimize self, as well as artificial breaching events.

The BO requires the Agency to petition the State Water Resources Control Board (SWRCB) to change minimum instream flow requirements to improve rearing habitat for steelhead. Permanent changes in instream flow requirements will take years to accomplish, therefore, the BO also requires the Agency to petition the SWRCB to change minimum instream flow requirements on an interim (temporary) basis to facilitate management of the Estuary as a summer lagoon. The management plan anticipates an interim reduction in instream minimum flow requirements between the Dry Creek confluence and the mouth starting in 2010. Minimum flows would be reduced from current SWRCB Water Right Decision 1610 levels of 125 ft^3/s to 80-85 ft^3/s [4]. The expected reduction in

[4] The proposed instream flow requirement is 70 ft^3/s, but "SCWA maintains a 10 to 15 ft^3/s buffer to avoid non-compliance of the minimum standard" (BO, p. 245).

minimum instream flow will provide more favorable conditions for outlet channel management by reducing the potential for scour-induced breaching.

For channel location, the BO suggests the use of "a lagoon outlet channel cut diagonally to the northwest. … Alternative methods may include … use of a channel cut to the south if prolonged south west swells occur" (BO p. 250).

3.2 2014 MODIFICATIONS

As discussed above (Section 1), the approach of the 2014 plan is to meet the objective of the RPA to the greatest extent feasible while staying within the constraints of existing regulatory permits. It is recognized that the measures developed in the 2014 management plan, when implemented, may not fully meet the objective established by the RPA as summarized in Section 3.1 above. The concept of this approach was developed in coordination with NMFS, CDFG, and CSP.

Because of the estuary's coastal location and hydrologic significance, the Agency must manage the estuary's mouth in accordance with multiple land use permits from various state and federal agencies. A table summarizing all these permits is provided in Attachment C. Key aspects of these permits which directly affect 2014 outlet channel management include:

- Excavation is limited to 2,000 cubic yards of sand per event to create a channel 25 to 100 ft wide. The channel width range is consistent with historic widths observed within the management covered by existing permits (Behrens, 2008).
- Management actions are permitted only on Monday-Thursday to minimize interference with public use.
- Management actions cannot be longer than two consecutive days (unless flooding is threatened).
- Access is constrained during marine mammal pupping season (March 15 – June 30) to reduce incidental harassment of habor seals, sea lions, and elephant seals.

Artificial breaching may be required during 2014. With this management plan, the Agency seeks to minimize or avoid such breaches during the management period, but recognizes that they may be needed to avoid flooding of adjacent properties.

4. CONCEPTUAL MODEL

The conceptual model of the outlet channel articulates the project's working assumptions about process linkages between channel features, external conditions (e.g. river flow and ocean processes), and channel performance. These working assumptions are uncertain, and may not capture all relevant processes. However, by making these assumptions explicit, they can be documented, discussed, and tested, all of which are necessary steps in the adaptive management process. Observations of the actual outlet channel response will then enable refinement of the conceptual model. In addition, because the conceptual model is expressed in a relatively non-technical manner, it provides an avenue for public outreach and education about the outlet channel. The conceptual model is not a hydrodynamic, sediment transport model but rather uses empirical observations and geomorphic interpretations to identify likely responses to key forcing parameters, given antecedent conditions and management actions.

Development of a conceptual model for the outlet channel focuses on the essential physical processes and linkages, as well as the management parameters of the channel. Although this approach leaves out some processes which may slightly alter the channel's performance, it prevents the conceptual model from becoming so complex that it becomes unwieldy. In addition to limiting the conceptual model's scope to only the essential processes, the model also excludes impacts of the outlet channel on water quality and ecological aspects of the estuary. To further enhance model clarity, the conceptual model is presented graphically with a schematic that reflects the layout of the physical system. One caveat to simplification is that the static, schematic diagrams clearly do not encapsulate the full complexity of this dynamic system.

The conceptual model first describes target conditions for the outlet channel, in accordance with the performance criteria in Section 3. Then the model identifies the morphological processes which may lead to the two failure modes for the outlet channel: closure and breaching. Closure refers to sand transport induced by ocean waves that deposits sufficient volume of sand in the outlet channel mouth that it blocks the outlet channel. Closure prevents discharge through the outlet channel, leading to increasing estuary water levels and the threat of flooding. Breaching refers to the flows enlarging the outlet channel to the point that it becomes a tidal inlet subject to bi-directional flow. It is important to note that these "failure modes" are conditions associated with natural tidal inlets and river mouths, but are considered problems at the Russian River Mouth because modified forcing parameters have affected the timing and frequency such that native species may be adversely affected (see the BO), as well as conflicts with other man-made constraints. One of the key questions in this management plan is whether the inherently dynamic system can be "trained" to drain gradually without breaching and then closing repeatedly.

There are additional aspects of the site which may impact the outlet channel, but whose impacts are thought to be secondary or not well defined. Therefore, they are not included in the conceptual model at this time. If implementation of the outlet channel suggests these aspects are important, they will be incorporated into a revised conceptual model. These aspects include large rocks and/or bed rock within the beach berm, jetty impacts on seepage, and decadal changes to beach width.

Specifically, the jetty at the river mouth and the fill across the tombolo to the south of the site may have affected littoral processes and mouth dynamics, but are not addressed in this study.

This conceptual model is based on existing literature, knowledge of similar estuaries, professional judgment, and ongoing discussion with the Agency, NMFS, CDFW, and CSP. New data and experience adaptively managing the outlet channel will be used to revise the conceptual model in subsequent management plans.

4.1 TARGET OUTLET CHANNEL CONDITIONS

The conceptual model for target outlet conditions is shown in Figure 2. Ideally, the outlet channel conveys water from the estuary to the ocean so that estuary can be maintained in a non-tidal state during the management period. A key performance criterion of this non-tidal state is that the water levels in the estuary (h_l) fall within the range of 4 to 9 ft NGVD, with elevations above 7 ft NGVD preferred. The estuary water level will not be managed directly, e.g. by pumping. Instead, it will be managed indirectly by management actions dictated by the BO, the operation and maintenance of the outlet channel and the reduction of instream flow requirement.

The estuary water level is determined by the balance between inflowing river discharge (Q_r) and three outflows: outlet channel discharge (Q_c), evaporation (Q_e), and seepage through beach berm (Q_s). For estuary water levels to remain within the target range, the inflow and outflows must sum to zero when averaged over a period of several days. As indicated by the width of the arrows depicting these flows in Figure 2, the river inflow, seepage and the outlet channel discharge are the three largest flows; evaporation is a minor factor in the water balance. As such, the sum of the seepage and outlet channel discharge capacity needs to nearly match the river discharge. If the combined outflows are too low, the estuary water level will rise to flood stage and artificial breaching will be necessary. If the outlet channel discharge is too high, the channel will scour and deepen, allowing tidal flows to enter through the channel. The outlet channel discharge is determined in part by its width, bed elevation, slope, and planform alignment. These parameters can be managed to a certain degree, but are likely to evolve in response to the natural variability of the discharge and wave forcing, and the effects of tide range. Seepage is determined by the beach berm's permeability, the water level difference between the estuary and the ocean, and the ambient conditions of the regional water table (Largier and Behrens, 2010). Presently, only the water level difference is subject to management influence. In the future, modification of the jetty to increase the beach berm's hydraulic conductivity will be studied (NMFS, 2008). The river inflow is another management parameter, however, since its value is determined as part of a separate water supply determination and permitting process, its manipulation is not considered here.

Although sediment transport will be minimal within the outlet channel under target conditions, the channel's mouth will perpetually be an active transport zone. This portion of the channel, at its interface with the ocean, will be an active transport zone for two reasons. First, it lies within the surf zone and breaking waves move up and down its face in response to the tides and variations in wave

direction, magnitude, and period. Second, this wave action creates a slope on the order of 10:1, which is sufficiently steep that flows of nearly any magnitude from the outlet channel will accelerate to above the scour velocity threshold. In order for the outlet channel to persist with this active transport zone at its mouth, this zone will have to experience minimal net sediment transport. In other words, tidal fluctuations in water level and variability in wave intensity will cause the locations of scour and deposition to shift at hourly timescales, but averaging across several tidal cycles, any sand lost by scour will be balanced by an equivalent amount of deposition. This active transport zone also plays a significant role in lateral migration of the existing channel mouth. This process is discussed in Section 4.4 on planform alignment.

Preserving these target conditions, particularly the discharge conveyance capacity, requires that the outlet channel maintain its cross-sectional flow area. This flow area can decrease or increase, leading to the two failure modes of the outlet channel: closure and breaching. These two failure modes are discussed in the sections below.

4.2 CHANNEL FAILURE: CLOSURE

The processes which lead to outlet channel closure are likely to originate from elevated total water levels in the ocean (z_{wave}), as shown on the right side of Figure 3. Elevated ocean water levels will move the active transport zone into the outlet channel, increasing deposition at elevations above that of the outlet channel's bed, z_{out}. Once deposition rates exceed any capacity of the outlet channel discharge to scour sediment, a berm will build at the mouth of the outlet channel, causing it to close. This process is thought to occur over one to several high tides, corresponding to one to several days. During the management season, total ocean water level is the combination of two ocean processes, the tides and ocean waves. As offshore waves interact with the coastline and nearshore, they are transformed such that the significant elevation on the beach is a function of the wave direction, magnitude, period and runup. While the tides fluctuate with a predictable schedule, ocean waves vary according to the unpredictable weather and wind patterns over the ocean. Therefore, the total water level can be best characterized as frequency distribution that is based on observed tide and wave data.

If the outlet channel closes and flow through the channel stops, the estuary water level will increase since the continuing river inflow cannot be exported through evaporation and seepage alone. Although seepage rates are likely to increase as a result of increasing water levels, it is assumed that seepage rates will remain below river inflow. As the water level rises, it will again overflow the beach berm when it reaches the minimum elevation of the berm crest. Early in the management season, the flow may overtop the berm below flood stage of 9 ft NGVD. However, as the berm crest elevation rises over the course of the management period, the water levels can rise above flood stage. If more moderate management actions do not stop this rising water level, a full artificial breach, as is currently practiced, will be necessary to prevent flooding.

4.3 CHANNEL FAILURE: BREACHING

The breach failure considered as part of the conceptual model and shown in Figure 4 is breaching that occurs when the outlet channel is operating according to the target conditions described above. Breaching is likely to result from two processes, high discharge which scours the channel bed or seepage-induced bed mobilization. Self or artificial breaching after a closure event are not discussed in this section because it is assumed that management actions would be enacted to return the outlet channel to target conditions prior to either of these breach mechanisms occurring. Additionally, breaching by wave overtopping or strong river discharge are not considered because these processes are associated with winter storm events, which are rare during the management period.

Because the outlet channel is an unconsolidated bed composed of relatively small particles, it is susceptible to scour by the discharge flowing through the outlet channel. Sand scoured from the channel will be lost to the ocean and there is not a significant upstream source to replace scoured sand. Extensive scour will enlarge the channel to the point of breaching and tidal inflows. To prevent scour, flow conditions within the outlet channel (u_c) must be below the threshold for scouring sand (u_{crit}). This threshold is a function of the sand grain size, which has been observed to be coarse sand, narrowly distributed around 1 mm at the Russian River mouth (EDS, 2009a). Further north on the beach, large rocks imbedded in the beach berm may provide grade control and limit scour. Whether the flow velocity is below the threshold depends on the type of bed material and hydraulic conveyance through the management parameters of the outlet channel's width, length, and bed slope.

As noted in the description of target channel conditions, the beach face slope is set by wave action in the surf zone and is sufficiently steep that flow velocity exceeds threshold for sand movement for all expected discharge rates. Under target conditions, the sand scoured by this process will be replaced by wave action on high tides, yielding no net change in the channel mouth morphology. However, if the scour is larger than deposition on the beach face, the active scour zone may move landward, into the outlet channel. This upstream movement is similar to nick point migration or head-cutting observed in streams and rivers. It is also the process observed by the Agency's maintenance staff when the beach berm is artificially breached under current practice. The breaching typically happens very quickly, before wave-induced sand transport can close off the breach in subsequent higher tides.

A second possible mechanism of breaching is seepage-induced sand mobilization, represented in Figure 4 as an arrow associated with Q_s. If seepage rates are sufficiently large, the movement of water through the sand can mobilize sand particles where the seepage flow daylights at the ground surface. Piping of groundwater along preferred pathways, which may exist within or adjacent to the jetty, might encourage this process by increasing flow rates through portions of the beach. Although seepage failure has not been observed at the Russian River estuary, it has been observed at other estuaries including Crissy Field (Battalio et al 2006) and others (Kraus et al 2002). Seepage failure may simultaneously accompany other breach mechanisms and hence be difficult to identify on its

own. Or, seepage failure may require a larger head difference between the estuary and the ocean than what occurs at the Russian River mouth because of artificial breaching to prevent flooding.

In contrast to closure which can be managed with further intervention, breaching can immediately and negatively impact NMFS's habitat objectives by allowing the marine influences of tidal water levels and saline water to enter the estuary. For this reason, breaching is more detrimental to NMFS's habitat goals than closure.

4.4 PLANFORM ALIGNMENT

Because of the presence of hard barriers in the form of the southern jetty and the northern cliffs, the outlet channel is expected to occupy an alignment within the same region that the current tidal inlet occupies, as show in Figure 1. At this initial stage in the adaptive management process, the conceptual model for the outlet channel's planform alignment is indeterminate as to a target alignment most likely to facilitate outlet channel sustainability. Therefore, observations and interpretations of the existing channel are presented in this section to provide an indication of factors acting on the proposed outlet channel. Once the outlet channel is implemented and monitored, a more definitive conceptual model for target alignment will be developed.

The exiting channel's initial alignment after a closure is typically straight and set by one of three factors, depending on the breaching mechanisms. When breached by high river discharge, the channel aligns itself to the northwest, primarily in response to the direction of the river flow during these events. When the channel self breaches at water levels below flood stage, it will overflow the berm at the minimum elevation in the berm crest. For example, in April 2009, this low point was toward the north since this was where the antecedent inlet had lowered the berm crest elevation. The Agency has attempted artificial breaching in several locations; under current practice, the initial alignment is perpendicular to the beach and just to the north of the large rock ("Haystack Rock") at the northwest corner of the estuary (Agency staff, personal communication).

Once breached, the existing channel typically changes alignment because the mouth migrates laterally in response to wave and littoral transport processes (Behrens et al., 2009). Lateral migration by the mouth while the upstream channel lags behind creates a sinuous channel. The direction and magnitude of wave energy and the resultant littoral sand transport are thought to determine the migration direction and extent. For the case of a tidal inlet, the mouth typically moves in the direction of the littoral transport (Dean and Dalrymple, 2002). However, several mechanisms have been identified that enable an inlet to move updrift, opposite to the direction of the littoral transport. Aubrey and Speer (1984) demonstrate that sand bars associated with the inlet's ebb tide delta can attach to the downdrift beach, displacing the inlet in the updrift direction. Pranzini (2001) documents a mechanism whereby riverine sediments discharged to a prograding delta preferentially deposit on the downdrift side side, which translate and rotate the inlet mouth towards incoming wave energy. Aubrey and Speer (1984) also propose that flow patterns created by inlet channel bends can create erosion on the outside of the bend and deposition on the inside, much like the development of

river meanders, with a net result of the inlet migrating updrift. Mechanisms similar to these may explain observations by NMFS that suggest that the direction of migration of the outlet channel may be against the direction of littoral transport (J. McKeon, personal communication).

Observations by Behrens et al. (2009) show that the existing tidal mouth typically moves both northward and southward during the management period. Their analysis correlates large changes in mouth location with rapid changes in significant wave height, indicating that the wave processes control the migration process. The bi-directional migration of the mouth suggests that wave energy also changes directions. This is further supported by the resulting shape of the channel, which can develop multiple channel bends in response to the mouth reversing directions. The temporal and spatial distribution of wave energy along the mouth is not well documented since wave observations have only been made offshore and estimates of how the offshore waves are transformed by local bathymetry have not been verified. Studies using trace elements and sand budgets along this stretch of coast indicate reversing directions of littoral transport because of varying periods of convergence and divergence of wave energy (DeGraca, 1976). The predominant direction may be sensitive to the relative contributions of northwest wind waves versus southerly swell. For instance, Behrens et al. (2009) show that mouth migration patterns are significantly different during El Niño years with the channel remaining in at the northern end of its range for the entire summer. They speculate that the decrease in northerly wind waves during El Niño events may explain this phenomenon. Another potential cause for this pattern is the more southerly approach angle of incident swell waves during El Nino years, as suggested by Allen and Komar (2006).

An additional factor which may affect the mouth location is the landward migration of the offshore bar. This bar, which is created by sand eroded off the beach during winter storms, moves landward with the low steepness summer waves. If this bar, which runs parallel to the shore, moves sufficiently close to the channel mouth, it may force the mouth to either side.

5. EMPIRICAL ASSESSMENT OF HISTORIC INLET CONDITIONS

The Russian River inlet is highly variable in form, position, and capacity for tidal conveyance. Analyses of field data and an extensive photographic record of daily conditions show that this variability is largely influenced by tides as well as seasonal changes in wave and river conditions (Rice, 1974; Behrens, 2008). Management actions also influence the timing and duration of closure events (Goodwin and Cuffe, 1994).

When the estuary is open to the ocean, the inlet can take one of the following forms:

- A river-dominated channel with minimal influence from tides and waves. This occurs during short-lived river flood events between December and April.
- A channel controlled by a mix of river flow, tides, and wave action. This is the most common inlet state, with waves tending to deposit sand in the inlet and estuary-to-ocean flows due to tide and river being active in removing sand from the inlet. Estuary tidal range is a fraction of the ocean tidal range, ranging from zero to over 70%, varying in response to sediment infilling and scouring of the inlet channel. Here we give special attention to "marginally tidal inlets", where tidal conveyance is less than 10%.
- A one-way overflow channel with water draining from a perched estuary, i.e., the sand barrier is built across the mouth of the estuary, but the estuary water level is high enough to overflow. Waves have limited control over such an "overflow inlet", and tidal influence is nonexistent. River flow rate controls estuary water level and overflow volume, which determines the susceptibility to breaching.

This section provides an overview of inlet states observed during the years 1999 to 2008, the time period for which the photographic record has been analyzed in detail. The analysis emphasizes the dates corresponding to the proposed management period of May 15 to October 15. The purpose of this assessment is to use existing data to identify relationships between forcing due to river, tides and waves and the response of the estuary mouth ("inlet") – and to explore the frequency of the latter two conditions described above.

5.1 FREQUENCY AND FATE OF RUSSIAN RIVER INLET STATES

The possible occurrence of an "overflow" channel at the mouth of the Russian River estuary was investigated by comparing water level records from the Jenner gage with tidal data from the NOAA Point Reyes station. The focus was to analyze events when the inlet was open for at least 24 hours with water levels remaining above tidal influence and slowly varying. Attention was also given to events when the inlet allowed minimal amounts of tidal interaction. Dates for which the inlet was at least partially open were disaggregated into a series of categories based on the ratio of the estuary tide range observed at the Jenner gage to ocean tide range (defined here as "tidal conveyance") – see Table 1. Estuary tide is driven by ocean tide, but estuary tide range is reduced either due to the elevation of the channel base that precludes complete draining of the estuary to low tide levels or due to the channel size being too small for enough water to be transported between estuary and

ocean. The estuary-ocean tidal ratio is thus an indicator of mouth state, with smaller values representing an increasingly choked mouth (near to closure or overflow state).

Table 1 Frequency of observed inlet states from May 15 to October 15 for years 1999-2008.

Inlet state		Number of days observed	Proportion of period
Tidal conveyance[1]	0-5%	10	0.8%
	6-10%	4	0.3%
	10-29%	82	5.4%
	30-49%	315	20.9%
	50-69%	590	39.2%
	≥ 70%	142	9.4%
Full inlet closure		161	10.7%
Overflow channel, stable or decreasing water level(≥ 24 hours)		0	0.0%
Device error		199	13.2%

[1]Defined as the ratio of estuary tide range to ocean tide range.

The 161 days when the estuary was closed consisted of 26 separate closure events. Of these, 19 were artificially breached and the remaining 7 were self breaches. Although the low number of self breach events prevents any statistically significant comparisons with river or wave data, it is worth noting that flows over 400 ft^3/s resulted in self breaches within 1-2 days of closure. Including all closures, there was a correlation between Guerneville flow and closure duration, with lower flows leading to longer closure periods.

During the years 1999-2008, there were no instances of overflow conditions during the proposed management period, but there were five relevant events that occurred just outside of the management period. All events had decreasing water levels, reflecting down-cutting of the barrier, although the rate of down-cutting was slow enough to prevent tidal interaction for at least 24 hours. Two of these events occurred during October, one in November, and two in May. Three of the events were associated with closure events and most lasted for less than 48 hours. An exception was a five-day event that occurred 6-11 May 2008. In this case, the inlet was breached artificially, and the Agency immediately noted that the channel had become elongated, beginning near "Haystack Rock", nearly 450 feet north of the jetty, and terminating at the jetty. This is uncommon, as post-breach channels are almost always short and wide (Behrens, 2008). The sudden elongation of the channel is likely associated with onshore bar migration.

During tidal periods, tidal conveyance was less than 10% on only 14 days during the management period from 1999-2008. These states were generally a precursor to closure events – all dates for which tidal conveyance was below 10% resulted in closure and the muted tidal state typically lasted for only one or two days. They were most commonly observed during short periods when an artificial breach failed to keep the inlet open for more than 1 or 2 days, or during periods of low flow

when the inlet was narrow and elongated. Note that there is a diminishing propensity for the inlet to be in a muted tidal state when it is close less than 30% of the full tide range. This indicates that being in between fully open or fully closed is not a condition supported by natural processes at this site.

5.2 WAVE AND RIVER CHARACTERISTICS

Wind waves and river outflow characteristics strongly influence the behavior of the inlet. These forcings exhibit seasonal patterns and other trends that correlate with different inlet states. Details of these relationships are presented below.

5.2.1 Seasonal patterns

Wave data were obtained from the CDIP Point Reyes buoy and a transformation matrix accounting for shoaling and refraction (e.g. http://cdip.ucsd.edu/) was used to transfer deepwater conditions to conditions at a location at 10-meter depth near the inlet. This method provides a first-order estimate of nearshore wave conditions that is necessary as there is a significant difference between deepwater/offshore waves and those nearshore. Wave energy is greatest in winter, declining through spring, to a minimum in July-August. However, late spring storms and/or early fall storms can occasionally produce waves exceeding 10 feet in the vicinity of the inlet during the management period. As discussed in Rice (1974) and Behrens et al. (2009), predominant swell waves from the northwest are often the cause of prolonged inlet migration or closure during late spring.

Data on river flow at Guerneville[5] show a rapid decline from a maximum at the beginning of the management period (mid-May) to a minimum in August (Table 2). Flows in July through September are low, between 80 and 225 ft^3/s for the years 1999 to 2008.

5.2.2 Conditions during different inlet states

Wave and flow conditions were compared with specific inlet states, as shown in Table 2.

Marginally tidal inlet: There is a relation between tidal conveyance and nearshore waves (H_s is significant wave height). Marginal tidal conveyance (< 10%) occurs during larger waves (H_s of 2.5 to 3.25 feet), consistent with the idea that these are transitory states associated with inlet closure and one needs waves big enough to overcome tidal (plus river) flows. These wave conditions may be lower during periods of weaker river flow. Further, if this marginally tidal mouth condition persisted, it could do so for any weaker wave conditions (which would not close the mouth).

Closed inlet: Estuary water level increase during closure events was analyzed to understand how close these conditions were to a steady-state overflow scenario. In all cases, water levels rose at rates of 0.1 ft/day or faster (Table 2). However, accounting for estuary area, the slower water level rise suggests that it may be possible to achieve a steady state with limited flow over the berm if river

[5] USGS gaging station located just downstream of Hacienda Bridge, station ID 11467000.

flows are of order 100 ft^3/s or weaker. Flows marginally over 100 ft^3/s may be possible, depending on the limit on overflow rate without eroding the sand barrier.

Overflow inlet: All of the five observed overflow events had flows higher than 100 ft^3/s, but only one persisted for more than a couple of days. Further, all of these events exhibited unusual conditions. The October 1999, November 1999 and first May 2008 event occurred during a sequence in which high waves began to induce closure, but a sudden increase in river flow prevented full closure and eroded the channel down to its original state. It appears that overflow conditions only occurred because the initial transition towards closure allowed estuary water levels to temporarily exceed high tide levels. The event in October 2006 occurred after a self breach of a four-day closure, so the lower flows observed in this case are expected. Finally, the most persistent event in May 2008 was associated with an unusually long channel, which is important in that frictional losses may have encouraged the prolonged high water elevation in the estuary. As noted above, this event was likely due to seasonal onshore bar migration.

Table 2 Comparison of average wave and average river conditions for various ranges of tidal conveyance and water level increase in the estuary. Overflow conditions are analyzed for five events observed outside of the proposed management period.

Inlet state		Guerneville flow, ft^3/s	Nearshore H_s, ft
Open inlet with given tidal conveyance:	<10%	323	3.2
	10-29%	261	2.5
	30-49%	219	2.1
	50-69%	276	2.0
	≥70%	328	1.8
Closed inlet; estuary stage rising at given rates:	0.1-0.29 ft/day	146	2.7
	0.3-0.49 ft/day	175	2.6
	0.5-0.7 ft/day	185	3.4
	≥0.7 ft/day	211	4.1
Overflow channel (outside management period)	Oct 28, 1999	291	15.7
	Nov 4-5, 1999	247	5.9
	Oct 26, 2006	155	2.2
	May 1-2, 2008	323	6.6
	May 6-11, 2008	283	1.3

5.2.3 Analysis of wave runup

The mouth of the estuary is typically closed by waves depositing sediment in the inlet channel during slack high tides, but waves can only do so if wave runup can reach the height of the inlet channel base. Thus, wave runup exceedance curves were generated for each of the management months to assess the likelihood of the (overflow) channel being closed by wave action. De-shoaled deepwater equivalent wave heights were combined with daily higher-high tide water levels to estimate runup height following Stockdon et al. (2006), and assuming a constant beach-face slope.

The height exceeded by 2% of the waves under given monthly wave conditions is shown in Figure 5. Runup is highest in October, with heights of 11ft being exceeded on 1 in 10 days. For May, June and September, runup exceeds 10ft on 1 in 10 days, and this drops to 9ft for July and August. This is consistent with the seasonal cycle of large swell events, due to winter storms in the north Pacific, which may occur in October, and occasional swell events due to storms in the tropical or south Pacific during summer. The locally generated waves due to northerly winds in summer are of shorter period and lower height. These data suggest that wave-induced closure of an overflow channel will be a greater concern at the beginning and end of the May-October management period.

5.3 CHANNEL PLANFORM GEOMETRY

Inlet morphological behavior has been studied by Behrens (2008) for the years 1999-2008 through an analysis of inlet width, length and position estimates derived from photographic records. Data collection methods and error estimates are described in Behrens et al (2009). Inlet planform geometry and closure risk are summarized for different mouth states (Table 3).

Table 3 Inlet planform geometry for overflow conditions and various ranges of tidal muting (May 15 to October 15, 1999-2006). Overflow conditions are analyzed despite the fact that they occurred outside of this timeframe.

Inlet state		Inlet width[1], ft	Inlet length[1], ft	Most common configuration	Closure risk[2]
Open inlet with given tidal conveyance:	<10%	25 ± 1.8	530 ± 37.1	≥2 channel bends	81.3%
	10-29%	51 ± 3.6	358 ± 25.1	1-2 channel bends	35.3%
	30-49%	71 ± 5.0	282 ± 19.7	1 channel bend	28.6%
	50-69%	86 ± 6.0	236 ± 16.5	1 channel bend	13.7%
	≥ 70%	92 ± 6.4	221 ± 15.5	Straight	3.5%
Overflow channel (outside management period)	Oct 28, 1999	60 ± 4.2	140 ± 9.8	Straight	--
	Nov 4-5, 1999	20 ± 1.4	360 ± 25.2	Deflected by jetty	--
	Oct 26, 2006	25 ± 1.8	110 ± 7.7	Straight	--
	May 1-2, 2008	65 ± 4.6	100 ± 7.0	Straight	--
	May 6-11, 2008	20 ± 1.4	480 ± 33.6	Deflected by jetty	--

[1] Ranges are based on error estimates from Behrens *et al* (2009).
[2] Defined as the number of observations that were followed by closure within two weeks, divided by the total number of observations.

The data for overflow channel geometry indicate that the limited number of overflow events exhibited a range of shapes. The geometry of the only persistent case (6-11 May 2008) suggests that frictional loss plays an important role in attenuating channel velocity and the resulting downcutting.

However, there is a tradeoff for the frictional losses associated with sinuous channels. For a marginally tidal inlet the channel is long and narrow, with a couple of bends – and there is a very high risk of closure. There is no apparent relation between inlet position (not shown in this table) and tidal conveyance. However, marginally tidal inlets and overflow inlets were observed only at

the northern or southern extreme of the inlet's migration range. Inlet width and length are known to vary in concert with river flow during the wetter months of the year and with tidal range during the drier months (Behrens et al., 2009). In general, low-flow conditions (low tides or river flow) appear to encourage inlet elongation and narrowing. Inlet width, length, and the number of channel bends all influence the tidal signal by determining frictional losses in the channel.

5.4 NOTES ON OTHER ESTUARIES

Overflow inlets have been observed in numerous estuaries along the coasts of California, Oregon, Chile and South Africa (and probably other areas with comparable climate and topography) (personal communication, John Largier). These are unpublished observations. Specifically, an overflow inlet is typically observed to persist for 1 to 3 months each year at the mouth of Salmon Creek (10 miles south of the Russian River) and at the mouth of the Gualala River, discussed below. Further, small central coast estuaries exhibit overflow states during spring and summer, e.g., Scott Creek and Waddell Creek. Systems photographed along the Chilean, South African and Oregon coasts are of similar size in terms of river flow and lagoon area. The absence of observations of overflow conditions in larger estuaries, similar to the size of the Russian River, suggests that there is a limit to the flow energy that can be accommodated by flow over a sand barrier of finite width (and thus high slope).

5.4.1 Gualala River

The mouth of the Gualala River is located 31 miles northwest of Jenner. Both its tidal prism and annual river flow are significantly lower than those of the Russian River. Despite this, the sites have several similarities, most notably their similarly sized beaches bordered by headlands. During a typical year, the inlet is closed for the entire summer and is opened by the first major storm of the winter (ECORP, 2005). The inlet requires consistent rainfall to remain open, and it is common for closures to occur within several weeks after each major storm event. As rainfall decreases during the spring, the inlet undergoes repeated cycles involving a closure event, a period of gradual estuary stage increase leading to a natural breach, and finally, several days to several weeks of minimal tidal conveyance and/or overflow conditions culminating in a new closure event. These cycles appear to continue until evaporative and seepage losses counterbalance inflows into the estuary, preventing the stage increase required to cause a natural breach event.

5.4.2 Carmel River

California State Parks adaptively manages the beach berm which creates a lagoon at the mouth of the Carmel River (CA Dept. of Parks and Recreation, 2008). The goal of this management is similar to the goal stated in the Russian River BO (NMFS, 2008): to enhance the freshwater salmonid rearing habitat during summer months. Sometime in April, May, or June, once the Carmel River discharge into the estuary drops below 20-25 ft^3/s, bulldozers are used to increase the height of the beach berm. This elevated berm blocks ocean tides and saline water from entering the estuary, thereby creating a perched lagoon. When forming the elevated beach berm, an outlet channel is also created so that if lagoon water levels exceed 10 feet NGVD, the outlet channel will drain water from the lagoon into the ocean. The outlet channel only conveys water if the discharge to the lagoon does not taper off

from 25-20 ft^3/s to 10 ft^3/s as rapidly as expected. Once river discharge falls below approximately 10 ft^3/s, evaporation and seepage export enough water from the lagoon that lagoon water levels no longer increase.

The Carmel Lagoon outlet channel differs from the proposed Russian River outlet channel with respect to several key features, as summarized in Table 4. Overall, the Russian River outlet channel is likely to be more difficult to manage than the Carmel River outlet channel because of its higher required conveyance, longer operational period, and lack of natural grade control.

Table 4 Comparison between Russian River and Carmel River outlet channel features

Outlet channel feature	**Russian River**	**Carmel River**
Conveyance capacity	50 ft^3/s	10 ft^3/s
Operational period	5 months (May-Oct)	1 month
Grade control	none	natural rock outcrops

6. CHANNEL CONFIGURATION ANALYSIS

As discussed in the conceptual model for target conditions, the outlet channel geometry must simultaneously meet two key constraints: convey sufficient discharge from the estuary to the ocean to preserve constant water levels in the estuary and preserve channel function by avoiding closure or breaching. Note that these two constraints can be in conflict since both conveyance capacity and the potential for breaching increase with flow rates but closure is more likely for lower flow rates. The technical analyses described in this section inform the range of target channel conditions by quantifying the relationship between outlet channel dimensions, bed scour potential, and hydraulic conditions. The ocean-driven processes associated with closure, the wave runup elevation and planform alignment, are discussed above in Section 5. Preventing breaching, a necessary condition for reducing marine influence on the estuary is the focus of this section.

Since the outlet channel will be located within a bed of unconsolidated beach sand, a key management objective is creating a channel which can sustain its cross section geometry instead of scouring. Breaching can occur if the discharge through the outlet channel is sufficiently forceful to scour the channel bed. To reduce the possibility of scour, threshold design principles (NRCS, 2007) are used to examine channel configurations most likely to avoid scour while meeting the other constraints of the system.

Channel design using a threshold methodology consists of the following steps:

- *Estimate the critical shear stress threshold.* This is a function of the site's bed particle composition, which can be characterized by grain size.
- *Predict hydraulic conditions for the proposed channel.* Use engineering calculations of steady flow and a one-dimensional hydraulic model of time-varying flow to estimate the velocity and shear stress for a proposed set of channel geometry, flow, and bed roughness.
- *Compare threshold and predicted bed shear stress.* The estimates from the two previous steps are compared with a factor of safety to account for variations in hydraulic conditions about the mean and uncertainty in parameter estimation.
- *Sensitivity analysis and uncertainty.* Evaluate the sensitivity of threshold and predicted bed shear stress to input parameters as well as the factors contributing to overall uncertainty.

6.1 CRITICAL SHEAR STRESS

The critical shear stress is defined as the applied bed shear stress at which sediment motion occurs. The critical threshold represents a balance between the force exerted by the flow on the bed and the resisting gravitational force of individual sediment particles. Flows above the critical shear stress will transport sediment while flows below the critical shear stress will result in no motion. The critical shear stress is dependent on characteristics of the sediment such as sediment density and particle size.

Sediment samples at the Russian River mouth were collected in March 2009 to inform the assessment of critical shear stress within the outlet channel. Ten sediment samples taken along the proposed outlet channel alignment were analyzed to determine the characteristic grain size distribution. On average, 78% of the sediment had a grain diameter between 0.6-2.0 mm (coarse sand), 18% was greater than 2.0 mm (granular), and 4% was between 0.2-0.6 mm (medium sand) (EDS, 2009a). Visual observations of grain size by ESA PWA near the mouth indicated a typical diameter between 0.8-1.25 mm (coarse sand).

Based on this assessment of typical beach grain size, ESA PWA estimated the critical shear stress using methods outlined in Soulsby (1997) and Fischenich (2001). For the typical range of observed grain size from 0.8-1.25 mm, a critical shear stress of 0.4-0.7 Pa (0.008-0.015 lb/ft^2) was determined for sand particles in the vicinity of the proposed outlet channel (Attachment A-1).

6.2 PREDICTED HYDRAULIC CONDITIONS

6.2.1 Steady mean flow conditions

ESA PWA conducted a preliminary assessment of outlet channel hydraulics under steady typical summer flow conditions as a screening tool to characterize the range of possible channel geometry parameters (bed elevation, channel slope, width, and length). Simple hydraulic equations for open channel flow were used to estimate the in-channel velocity and bed shear stress.

ESA PWA evaluated different combinations of river discharge, bed roughness, channel slope, and flow depth to evaluate channel performance. For a given discharge the hydraulic equations can be solved to determine the values of slope, width, and depth that satisfy the critical shear stress threshold for sediment motion. Once one of these three parameters is selected, the other two are fixed to meet a given shear stress threshold (NRCS, 2007). Multiple combinations of channel slope and width are capable of conveying the design flow at or below the critical shear stress threshold.

Figure 6 shows an example slope-versus-width stability curve for the outlet channel design. A stability curve is a tool used by designers to evaluate channel stability under a range of feasible slope-width combinations. Any combination of slope and width that falls on the stability curve will be stable for the prescribed discharge. Combinations of width and slope that plot above the stability curve will result in erosion and scour of the channel. Combinations of width and slope that plot on or below the stability curve will be stable (or depositional). For a given width, the depth of flow can be determined from the corresponding depth-width curve (Figure 6). For example, a 100-ft wide channel discharging 70 ft^3/s will be stable for channel slopes less than approximately 0.000125 and will flow at a depth of approximately 11 inches. The stability curve shows that as slope increases, channel width must also increase to keep channel velocities below the critical threshold for transport. Channel width and depth are inversely related for points on the stability curve, resulting in either a narrow channel with relatively deep flow or a wide channel with relatively shallow flow.

6.2.2 Calculation of estuary inflows

ESA PWA developed and calibrated a water balance model based on observed lagoon water levels at Jenner, CA. The purpose of the water balance model is to estimate the reduction in river discharge that occurs over the 21 river miles between Guerneville, a USGS continuous discharge gaging station, and the mouth of the estuary. The losses in discharge are attributed primarily to seepage through the beach berm (Largier and Behrens, 2010), with diversions, interaction with the adjacent aquifer, and groundwater pumping as possible contributing factors. No direct observations of these loss terms is available. The reduction factor serves as the calibration variable for the water balance model. For all cases, predicted estuary water levels during closure periods do not match observations unless lagoon inflows are reduced relative to the Guerneville discharge.

Model Setup

During a closure event, the rate of water level increase is a direct function of the net flows into and out of the lagoon (Goodwin and Cuffe 1993):

$$\frac{\Delta V}{\Delta t} = A\frac{\Delta h}{\Delta t} = \alpha Q_R - Ai_{evap} - Q_s$$

where:

$\triangle V$	=	lagoon inflow during closure (ft^3)
$\triangle t$	=	duration of closure (days)
A	=	surface area of the lagoon (ft^2)
$\triangle h$	=	change in water level in the lagoon (ft)
Q_R	=	river discharge at Guerneville (ft^3/day)
α	=	discharge reduction factor for groundwater losses
i_{evap}	=	rate of evaporation from the lagoon (ft/day)
Q_S	=	rate of seepage loss through the barrier beach (ft^3/day)

All terms in the water balance equation can be measured or approximated to allow calculation of α, the discharge reduction factor, for each closure event. The components and data sources of the water balance model are described below:

- Estuary water level and inlet state ($\triangle h$) – Jenner water level time series, (SCWA, 2000-2007). The inlet was assumed to be closed (no flow) during the calibration, based on periods when the estuary water levels were non-tidal and increasing estuary water levels.
- Guerneville discharge (Q_R) – USGS gaging station 11467000 (Russian River near Guerneville, CA at Hacienda Bridge) (http://waterdata.usgs.gov).
- Evaporation (i_{evap}) – estimated based on climatological evaporation rates for CIMIS evapo-transpiration reference Zone 1 (California coast) (*www.cimis.water.ca.gov*, Attachment A-3).
- Berm seepage (Q_S) – estimated using Darcy's Law based on water level difference between lagoon and ocean (Attachment A-4).
- Lagoon stage-storage curve (A) – determined from 2009 sidescan survey and LiDAR digital elevation model (EDS 2009b).

The volume of water entering the closed lagoon as a result of waves overtopping the beach berm is not included in the water balance model. Two lines of reasoning provide the basis for this exclusion. First, wave conditions during the May through October management period are generally associated with beach berm building, not with extensive overtopping and berm erosion more prevalent during winter storm events. The wave runup analysis in Section 5.2.3 confirms that runup elevations sufficient to overtop the berm are infrequent. Second, the observed water levels used in the water balance model exhibited nearly constant rates of increase, typically over two days or more. Short periods of rapidly changing water levels indicative of overtopping were not used in the water balance analysis.

Model Calibration

The observed rate of water level increase ($\triangle h/\triangle t$) in the lagoon during 18 closure events was calculated from the Jenner gage data. Rates of water level increase ranged from 0.4 ft/day to 3 ft/day and averaged 1 ft/day. The required inflow ($\triangle V/\triangle t$) to yield the observed rates was calculated based on an assumed lagoon surface area (A) at closure of approximately 400 acres. From the observed average discharge at Guerneville (Q_R) over each closure period, a discharge reduction factor, α, was calculated for estuary inflow during each of the closure events. The percent reduction ranged from 10% to 53% and averaged 37% (Attachment A-5). The largest reductions in discharge typically occurred in summer and were less in the spring and fall.

The reduction factors were averaged over each month from May-October to approximate a seasonal trend. The resulting calibration curve (Attachment A-5) was used to reduce the anticipated Guerneville discharge in the unsteady hydraulic modeling discussed in Section 6.2.3 to predict downstream flow rates into the lagoon based on upstream discharge measurements.

Comparison with Discharge Measurements

A limited set of USGS and Agency discharge measurements provides estimates of river flow at other locations besides the continuous discharge measurements at Guerneville. These discharge measurements, collected at four stations[6] in the 14 miles below Guerneville, typically fall within 10% of the Guerneville average daily discharge. For example, Behrens and Largier (2010) found that the longest record, collected by the Agency in 2009 at Vacation Beach, agreed to within 10 ft^3/s of the discharge measurements made at the permanent USGS Guerneville gage. These relatively low losses suggest that the losses calculated to complete the estuary water balance occur downstream of these discharge measurements, in the lower 6 miles of the river. Since the results of the water balance are used to estimate estuary inflow in the unsteady hydraulic model (see Section 6.2.3 below) and have a significant level of uncertainty, the estuary inflow values in the unsteady hydraulic model may not represent actual estuary inflow. Presently, the existing data are insufficient to fully characterize the losses between the discharge measurements and lagoon water levels. Higher

[6] Data available from USGS National Water Information System (http://waterdata.usgs.gov/nwis), Russian River station names (site number): Duncan Mills (11467210), Monte Rio (382757123003801), Vacation Beach (11467006), and Rio Nido (383012122574501).

rates of seepage through the beach berm are one possible explanation. Largier and Behrens (2010) estimate seepage rates to average 60 ft^3/s for all closure data. Their seepage estimates vary from approximately 30 ft^3/s when the estuary is closed and its water level exceeds the ocean water level by 2-3 ft to more than 70 ft^3/s when the water level difference exceeds 5 ft. Substantial uncertainty about the seepage rate, on the order of ±20 ft^3/s, remains; therefore monitoring to resolve this discrepancy is recommended in Section 7.7. The implications of alternative lagoon inflows are discussed in the model sensitivity analysis and outlet channel management sections of this report.

6.2.3 Hydraulic modeling of unsteady mean flow conditions

Using the calibrated water balance model results described in Section 6.2.2, ESA PWA developed a hydraulic model to evaluate the performance of the outlet channel for various hydrologic scenarios. This modeling is a refinement of the steady mean flow calculations described in Section 6.2.1 because it quantifies estuary discharge, explicit channel geometry, and temporal changes in hydraulic parameters. Sources and sinks accounted for in the model include river discharge, groundwater losses, berm seepage, evaporation, and outlet channel discharge (described in more detail in Section 6.2.2 and Figure 7). Flow in the outlet channel is represented by one-dimensional channel hydraulics as a function of estuarine water levels, channel dimensions, channel slope, and bed roughness. Tidally-varying ocean water levels are included in the model, but since these water levels stay below the channel's bed elevation, they do not influence flow in the channel. Initial channel dimensions were based on the results of the preliminary analysis described in Section 6.2.1. Model channel geometry was revised iteratively based on subsequent hydraulic analyses and discussions with the Agency and NMFS. Channel geometry is fixed throughout the simulation, even though the channel may be subject to scour and its mouth lies in the active transport zone created by ocean waves (Section 4). This assumption has been made because currently available data and models cannot adequately characterize the active transport zone. The management implications of this assumption are discussed in Section 7. The model simulates estuary water levels and outlet channel flow for the period spanning proposed outlet channel operations, from May 15 to October 15.

Discharge Boundary Condition

ESA PWA analyzed historic discharge data at Guerneville to select a "typical" water year for the hydraulic model boundary condition. A time series of monthly discharge was obtained from USGS for the time period from 1970 to 2008 and compared to the median monthly discharge for the duration of record to select a typical water year. For each month, the difference between the month's discharge and the median monthly discharge was computed. The sum of the differences (for May-Oct only) was used to rank each year relative to median conditions. Based on this ranking, the 2000 water year was selected as the most typical year (Attachment A-6).

The year 2000 discharge time series was used to generate a synthetic discharge time series to approximate anticipated reduced instream flow conditions. A measured time series is preferable to using the median daily discharge because it retains some of the short-term variability in the observed flow rates. A synthetic discharge time series for anticipated flow conditions was derived from the typical discharge time series by scaling the Guerneville discharge to an average summertime flow of

120 ft^3/s. This reduction to 67% of observed 2000 discharge is based on the anticipated reduced instream flow requirements (Section 3.1) versus historic instream flows. When flows are adjusted to average 120 ft^3/s from July to October, short-term variability ranges from about 85-150 ft^3/s. The resulting discharge time series at Guerneville is shown in Figure 7a for the simulation period.

The anticipated discharge time series at Guerneville was further reduced using the calibration curve developed in Section 6.2.2 to account for downstream losses between the gaging station and the lagoon. The resulting estuary inflow time series is shown in Figure 7a. Anticipated inflows to the lagoon vary from approximately 45-90 ft^3/s and average approximately 55 ft^3/s during the summer months. Once seepage and evaporation losses are subtracted from the lagoon inflow, modeled baseline flows in the outlet channel are 45-85 ft^3/s and average 50 ft^3/s.

Model Setup

The configuration for the unsteady HEC-RAS hydraulic model is very similar to the water balance model described in Section 6.2.2. The unsteady model includes the lagoon, outlet channel, and beach face, and simulations span the duration of the operational period, from May 15-October 15. The outlet channel was parameterized as a prismatic rectangular channel with a width of 100 ft and length of 300 ft. Bed roughness (Manning's n) was set to 0.02. The channel bed was set at 5 ft NGVD and transitions to a 1V:70H slope on the beach face. The actual beach face slope is believed to be closer to 1V:10H; however, a milder slope was required for model stability. Sensitivity runs with a steeper beach face slope indicated negligible influence on velocities in the upstream portion of the outlet channel. Time-varying seepage and evaporation losses from the lagoon were estimated from Darcy's Law and CIMIS climate statistics for coastal areas, as described in Section 6.2.2. The time series of these losses used as model input are shown in Figure 7b. Because these combined losses are less than 10% of the lagoon inflow, the modeled lagoon outflow through the outlet channel is similar to the lagoon inflow (Figure 7a). A downstream water level boundary condition was prescribed for the ocean; however, since the outlet channel bed elevation is above the limit of tidal influence (approximately 4.5 ft NGVD), there was no impact on outlet channel hydraulics.

Results

Model runs were conducted for the operational period from May 15-October 15 for the proposed outlet channel geometry described above. Time series of lagoon water level, channel velocity, and bed shear stress were extracted to evaluate channel performance. Bed shear stress and lagoon water level results for the hydraulic modeling are shown in Figure 8a and Figure 8b, respectively. The bed shear stress values shown in Figure 8a are mean model predictions times 1.5 to account for transverse variations in bed shear stress not captured by the one-dimensional model (Fischenich, 2001).

The results for the proposed channel geometry and the anticipated reduced instream hydrology are shown as the "Baseline" curve. The expected range of critical shear stress (0.4-0.7 Pa) is shown in Figure 8a for reference. After the initial higher flow period during the spring and early summer, both shear stress and lagoon water level are relatively constant throughout the summer and fall (July-October). Bed shear stresses fluctuate during this period, but are always above the critical shear

stress, indicating likely sediment motion and scouring of the channel. Lagoon water levels (Figure 8b) are relatively constant around 5.6 ft NGVD, resulting in a typical flow depth of approximately 0.6 ft in the channel. Channel velocities average 1.1 ft/s and range between 1.0-1.3 ft/s.

6.3 SENSITIVITY ANALYSIS AND UNCERTAINTY

ESA PWA conducted sensitivity and uncertainty model runs for important variables and parameters to assess their impact on channel performance. The testing focused on conditions that may encourage a stable channel by reducing predicted bed shear stress below the critical shear stress. Parameters tested were reduced outlet channel flow and critical shear stress.

Reduced Outlet Channel Flow

Anticipated flows in the outlet channel are somewhat uncertain because the losses between upstream observed discharges and the outlet channel are not well characterized, as described in Section 6.2.2. The baseline simulation presented in Section 6.2.3 used a calibrated seasonally-varying coefficient to reduce flow rates into the lagoon. Once seepage and evaporation losses are subtracted from the lagoon inflow, modeled baseline flows in the outlet channel are 45-85 ft^3/s. To test channel performance under conditions with further flow reductions (due to higher losses, groundwater recharge, diversions, or berm seepage), a sensitivity run was conducted with outlet channel flows reduced to 25-45 ft^3/s, approximately 45% less than baseline conditions.

Critical Shear Stress

Uncertainty in the critical shear stress for beach sand at the Russian River mouth is primarily due to the fact that the beach is comprised of a distribution of particles of varying diameter (see Section 6.1), as opposed to a uniform grain size. Grain size analyses indicate a narrow distribution of approximately 0.8-1.25 mm diameter sand, for which the critical shear stress ranges from 0.4-0.7 Pa. The critical shear stress for the typical grain size of 1 mm is 0.5 Pa.

Results

The results of the reduced outlet channel flow sensitivity model run are shown in Figure 8a for bed shear stress and Figure 8b for lagoon water level. The 45% reduction in outlet channel flow resulted in reduced bed shear stress and water level. Average water levels and channel depth decreased by approximately 0.1 ft relative to the baseline simulation. Average bed shear stress decreased by approximately 30% to an average value of 0.58 Pa for the summer months. The range of critical shear stress, 0.4-0.7 Pa, is shown in Figure 8a as a blue band. While the predicted bed shear stress for baseline conditions almost always exceeds this range, the predicted bed shear stress for reduced outlet channel flow falls within the range of critical shear stress.

The results of the sensitivity simulations suggest that while the baseline conditions are likely to cause scour, variability in outlet channel flow and critical shear stress could result in a marginally stable channel. If necessary, a wider channel could be excavated (or could develop naturally) to reduce bed shear stress below the critical threshold. This model was not used to predict sediment transport and therefore the modeled channel geometry was held fixed. Under target conditions,

active transport is expected at the channel mouth (Figure 2). In order for the outlet channel to persist, scour caused by the outlet channel flow accelerating down the beach face at low tides needs to be balanced by sediment deposition generated by wave action at high tides. However, if the active transport zone moves upstream into the outlet channel, the channel is likely to breach and return to tidal conditions, as shown in Figure 4.

7. PROPOSED OUTLET CHANNEL ADAPTIVE MANAGEMENT FOR 2014

This section describes the 2014 recommended channel management practices related to the BO requirements. Existing management practices for public safety, operator safety, operational responsibility, and other practices not related to meeting the BO objectives are not discussed here. These existing practices are documented in the Standard Operational Procedures: Russian River Mouth Opening (SCWA, 2002).

The outlet channel management described in this section is based on the performance criteria, conceptual model and technical analysis described in the preceding sections, as well as extensive discussion between the Agency, the resource management agencies, and ESA PWA. In addition, implementation efforts provided practical experience for adapting the plan. An account of the 2010 implementation is provided in Attachment E and an account of physical conditions is provided for 2011 (Attachment F), 2012 (Attachment G), and 2013 (Attachment H). Some uncertainty remains about the exact outlet channel configuration that may best achieve the target performance criteria. This uncertainty arises from the dynamic natural setting for the outlet channel and from the unquantified tradeoffs between channel specifications which may benefit one performance criterion while impairing another criterion. For example, to reduce the likelihood of closure, it may be beneficial to locate the mouth of the channel further north where the coastline's aspect is more sheltered from waves from the north. However, extending the channel's length to the northern location may necessitate narrowing its width to keep excavation within currently-permitted volumes. A narrower channel increases the likelihood of scour-induced breaching. The relative importance of these factors is not known, precluding an exact determination of optimal channel configuration. In addition to these uncertainties, actual conditions at the time of closure, such as beach berm topography, may inform the selected configuration.

The assessment of the outlet channel conducted to date suggests two possible configuration options:

- a wide and short channel that seeks to minimize scour potential; or
- a narrow and long channel aligned to the north that seeks minimize closure potential.

The rationale supporting each of these configurations is described in more detail in Section 7.3 and Attachment D below. The configuration that is selected at the time of closure will be documented to the resource management team in accordance with the communication protocol described in Section 9. Performance of implemented configurations will be monitored and documented to test the conceptual model which guides management and to suggest adaptive changes to future management actions, including some combination of these two configurations.

The strategy for outlet channel management is an adaptive and incremental approach. This strategy favors smaller, more frequent modifications over larger, less frequent, modification with less certain outcome. Once experience is gained from implementing the channel and observing its response, it may be possible to make larger changes during each incremental modification. These larger changes will decrease the duration and frequency of management activity, thereby reducing the disturbance impact over time. Management practices will be incrementally modified over the course of the

management period (May 15th to October 15th) in effort to improve performance in meeting the goals of the BO.

The approach may be constrained by an excavation volume limit of 2,000 yd^3 and antecedent beach berm topography prior to implementation. This approach will be implemented to the extent feasible while still staying within the constraints of existing land use permits.

To provide context for the proposed management plan, the first section below describes previous breaching practices for the inlet. Subsequent sections describe the target channel initiation, location, dimensions and supporting operations details. A hypothetical implementation scenario for the outlet channel, based on actual beach berm and ocean conditions observed at the estuary from June 30 to July 6, 2009, is provided in Attachment B.

7.1 PREVIOUS BREACHING PRACTICES

Breaching has historically been performed in accordance with the *Russian River Estuary Study 1992-1993* (PWA, 1993) in effort to minimize flooding of low lying shoreline properties in the Estuary. The beach berm was artificially breached by the Agency when the water surface elevation in the estuary is between 4.5 and 7.0 feet as read at the Jenner gage. Breaching was performed by creating a deep cut in the closed beach berm approximately 100 feet long by 25 feet wide and 6 feet deep by moving up to 1,000 yd^3 of sand. Based on experience and beach topography at the time of the breach, the planform alignment of the breach was selected to maximize the success of the breaches. Breaching activities were typically conducted on outgoing tides to maximize the elevation head difference between the estuary water surface and the ocean. After the last portion of the beach berm was removed, water would begin flowing out the channel at high velocities, scouring and enlarging the channel to widths of 50 to 100 feet. As the channel evolved and meandered, it reached lengths in excess of 400 ft. After breaching, the estuary would be subject to saline water inflow throughout incoming tides.

7.2 INITIATION OF EXCAVATION

Initial channel excavation will be performed when the outlet channel first closes following May 15th, the beginning of the management period. Closure is often preceded by a lengthening and narrowing of the outlet channel, muting of the estuary tide range, and/or an increase in mean tide level within the estuary. The Agency will monitor the estuary for these conditions and initiate planning for a management action when they are observed.

Throughout the management period, the Agency's permits with CSP and the California Coastal Commission dictate that management operations cannot occur on Friday, Saturday, Sunday or a holiday because these days coincide with high public use[7]. The incidental harassment authorization stipulates that management actions cannot occur for more than two consecutive days unless flooding

[7] Exceptions can be made in the event of emergency conditions. See Attachment C for more details.

is threatening. During the marine mammal pupping season (March 15th to June 30th), the initiation of Agency operations is further constrained. Outlet channel management activity must be delayed if a pup less than one week old is on the beach along site access pathways and there must be a week-long break between management actions. More details on timing restrictions are provided in Attachment C.

Should the outlet channel close in the weeks immediately preceding the management period, the Agency, in consultation with NMFS, CDFW, and CSP, may initiate excavation to increase the likelihood of entering the management period with the target channel configuration in place.

The constructed outlet channel may also close during the management season, such as following a large wave event. In such circumstances, it will be necessary to perform maintenance on the outlet channel, to re-connect the channel to the ocean before the lagoon water level rises too high above the new (higher) beach berm elevation.

7.3 CHANNEL LOCATION/PLANFORM ALIGNMENT

Two possible channel configurations within the extent of the existing alignment (Figure 1) may be pursued in 2014 since the location that may best achieve the performance criteria is not certain. Alternative channel alignments may be implemented to test the relationship of mouth location on channel stability.

7.3.1 Wide and short channel alignment

Preference for a wide and short outlet channel assumes that channel failure by scour-induced breaching (Section 4.3) is the controlling failure mode to avoid in selecting the channel's configuration. This assumption is based on the consequences of breaching, which returns the estuary to tidal habitat conditions that will persist until a large wave event occurs to renew the closure. Since these closure events are relatively infrequent during the management period (between 1999 and 2008, there were an average of 2.6 closures per management period), the next opportunity for creating freshwater habitat may be months away. In comparison, if the channel fails by closing, which may be more likely for the wide/short channel because of its mouth's location, another management action can be taken to re-open the outlet channel while preserving the freshwater condition of the lagoon. To reduce the possibility of scour-induced breaching, the hydraulic calculations and modeling in the channel configuration analysis indicates that the excavated channel should be as wide as possible. Under existing permits, the maximum width is 100 ft. The hydraulic modeling indicates that even a width of 100 ft is likely to scour; a narrower channel will further increase bed shear stress and the potential for scour. Once this width is selected, the channel length may need to be constrained to stay within the 2,000 yd^3 limit on excavation volume. The actual dimensions of the wide/short configuration will depend on the beach berm topography at the time of management action.

For a given lagoon water surface elevation, the wide/short configuration will have a higher average bed slope than the longer channel because of the channel's shorter length. The wide/short approach

attempts to mitigate this by splitting the outlet channel into two reaches with varying steepness, as shown in Figure 2. Across the beach berm, a flat slope is recommended to reduce the contribution of bed slope to flow velocity, thereby minimizing the potential for scour. The entire drop in elevation between the lagoon water level and ocean water level is initially located at the end of the outlet channel, in the active transport zone. In the active transport zone, scour caused by the outlet channel flow accelerating down the beach face at low tides may be balanced by sediment deposition generated by wave action at high tide. As indicated by modeling (Section 6.2.3), it is likely to be difficult to avoid scour even in the portion of the channel with a flat bed because the lagoon water level will set up to create the water surface slope necessary to convey the discharge that maintains constant lagoon water levels. So even if the bed slope is zero, the total energy slope (the combination of bed slope and water surface slope) is likely to generate scouring flow.

Failure by breaching may not be the controlling mechanism if the actual flows conveyed in the outlet channel are less than anticipated or if the channel develops an armored layer of larger particles. As discussed in Section 6.2.2, direct observations of the flow that the outlet channel must convey are not available and have been inferred from upstream discharge observations and lagoon water levels during closure events. The anticipated outlet channel conveyance rates average 50 ft^3/s and range between 45-85 ft^3/s. If actual flow rates are less due to losses elsewhere (e.g. berm seepage), the outlet channel will be less likely to scour. For example, the sensitivity analysis scenario with reduced flow rates between 25-45 ft^3/s exhibited conditions less likely to scour (Section 6.3). Channel armoring is the process by which the smaller sand particles are eroded, leaving behind larger particles that have a higher critical shear stress for erosion. Because of the uniformity of particle sizes observed on the beach berm (EDS, 2009a), armoring is thought to be unlikely within the range of target elevations for the outlet channel. Larger particles have been observed in the channel, but only when its elevation is lower and within the tidal regime.

The wide/short approach will be to construct the channel in the same general location and alignment as the preexisting channel (i.e., the location just prior to closure). When pursuing this approach, excavation will simply widen and connect the channel in place. As the channel migrates during the management season, the location of new excavation may follow this migration.

7.3.2 Narrow and long channel alignment

The narrow/long approach to channel design assumes that wave-induced closure (Section 4.2) is the controlling failure mode to avoid in selecting the channel's configuration. By excavating a longer channel that stretches to the northwest, the channel's mouth can be situated in an area that may be exposed to less wave energy. Because of its aspect, the area to the north is more sheltered from waves originating from the north. When large waves originate from the south, the channel will be oriented perpendicular to the incident wave direction, which may enhance the channel's capacity to transport sand that is washed into the channel's mouth by waves (Attachment D). Observations of lateral mouth migration in both directions (Behrens et al. 2009) suggest that waves from both north and south directions play a role in mouth dynamics. Additionally, the narrow/long alignment provides flexibility to locate the channel mouth at a location with a flatter beach face slope, which may reduce net scour (Attachment D). The narrow/long approach is supported by observations of

outlet channels that form at some other California river mouths (Attachment D). However, many of these other river mouths drain smaller watersheds that have lower flow rates into the lagoon, and therefore are less likely to breach. Also, these lagoons may not be constrained by the risk of flooding to adjacent property. Without a flood risk, lagoon water levels can rise higher and possibly drive more seepage through the beach berm rather than through the outlet channel. Finally, a longer channel will reduce the average bed slope, which is hypothesized to reduce scour. However, as discussed for the wide/short channel, it is the total energy slope (the combination of bed slope and water surface slope), which drives flow through the channel. Hydraulic analysis indicates that even if there is no slope to the outlet channel (i.e. it is flat), the water level in the lagoon will increase to create the water surface slope required to maintain the outlet channel's discharge. For the anticipated discharge, the corresponding bed shear stress is predicted to cause scour (Section 6.2.3).

The narrow/long approach will angle the channel to the northwest with an approximate aspect of 30-40 degrees with respect to the beach. This angled alignment tests possible advantages of site features such as areas of reduced wave energy and rocks imbedded in the beach.

7.4 TARGET CHANNEL DIMENSIONS

Prior to excavation the proposed outlet channel will be designed by Agency survey staff using computer-aided design (CAD) software. This design will then be used either to manually stake target channel dimensions or to automatically guide the excavation equipment via a GPS-based equipment controls. This operation protocol will ensure that the channel is excavated to the intended design.

7.4.1 Excavation Volume

The quantity of sand moved will depend on antecedent beach topography. To stay consistent with current permits, the excavated volume will not exceed 2,000 yd^3. Once either the wide/short or narrow/long planform alignment is selected, the limit on excavation volume will largely set channel dimensions. If a wide channel alignment is selected, the channel length will be limited so the total excavated volume remains below the limit. Similarly, if a long channel alignment is selected, the channel width will be limited so the total excavated volume remains below the limit. The actual dimensions at the time of implementation will depend on the beach berm topography at the time of implementation. Monthly surveys of the outlet channel, supplemented by spot checks at the time of management actions, will provide necessary information about beach berm topography.

Any sand excavated from the channel will be placed on the adjacent beach and graded to depths of approximately 1-2 ft higher than the existing grade. The placed sand will be distributed in such a way as to minimize changes to beach topography. If the time available for excavation is limited by uncontrollable factors such as tides, waves, seal use, or days when operations are forbidden, sand placed on the north side of the channel may be left in piles up to 3 ft high and not blended into the existing beach topography. The piles may need to remain un-graded on the north side because equipment access to this side is more difficult and may slow down operations. Once the outlet

channel is in place, the north side is also less accessible, reducing the impact of any remaining sand piles on public use.

7.4.2 Bed Elevation

The bed will be excavated 0.5 to 1 foot below the lagoon water level along its entire length, to achieve target channel depths (discussed below) upon initiation of flow. Channel bed elevations are expected to be in the range of 3 to 7 ft NGVD, with corresponding lagoon water levels of 4 to 8 ft, using a typical flow depth of one foot. At the start of the management season, lagoon water levels and the channel bed may be on the lower of this elevation range, since the system will have recently transitioned from intertidal to closed and the beach berm may not yet have built up. As the management season progresses, sand is expected to move onto the beach berm, raising the viable bed elevation for the outlet channel. As the beach berm builds higher, it will support higher lagoon water levels while maintaining channel depth within the target range. The upper end of the bed elevation is governed by the flood stage elevation (9 ft NGVD) minus the anticipated water depth and a factor of safety to buffer against flooding. Frequent maintenance will likely be required early in the management season to maintain an open outlet channel as the beach berm elevation builds. Eventually, the outlet channel may be above the typical wave runup elevation, the elevation at which waves may induce channel closure, and close less frequently.

The bed elevation is a key determinant of lagoon water levels and influences the stability of the outlet channel. Higher bed elevations have the advantage of better meeting the BO's performance criteria of higher lagoon water levels. Higher lagoon water levels would increase seepage through the beach berm, potentially reducing conveyance requirements and the possibility of scour in the outlet channel. A higher outlet channel is also less likely to be closed by waves. On the other hand, lower bed elevations reduce the potential energy which may cause outlet channel scour, provide a greater buffer before flood stage, and may reduce the release of oxygen-depleting organic matter from inundated upstream marshes. Developing a better feel the optimal bed elevation is one objective of the adaptive management plan.

The Phase 1 performance criteria are to develop an outlet channel that supports a stable, perched lagoon with water surface elevations at approximately 7 ft NGVD for several months (Section 3.1). Stable conditions imply that river inflow into the lagoon would be approximately the same as the sum of outflow through the outlet channel and seepage through the beach berm. Stable conditions also imply that net sand deposition or erosion does not impair the outlet channel's function. However, this goal may not be achievable in 2014 because additional constraints in place during this year call for modified performance criteria.

The bed slope should be nearly flat within the outlet channel to minimize the likelihood of scouring the bed. This may be difficult to maintain. In particular, incision within the "flat" channel bottom may occur.

7.4.3 Depth

The target range of water depths, 0.5-2 ft, is constrained on the upper end by the maximum depth at which the channel is likely to be stable (not scour). Larger depths would be associated with a narrower channel. The lower end of the range is constrained by the width; shallower depths would require impractically large channel widths to provide sufficient cross-sectional area to convey flow. Shallower water depths represent a greater factor of safety with regard to preventing bed scour since bed friction retards flow speed more strongly for shallower depths. Prior to implementation the predicted rate of water elevation rise within the estuary will need to be considered to determine the bed elevation to achieve the flow depths desired at the completion of the channel excavation.

7.4.4 Width

The width of the channel is estimated to vary within 25-100 ft for consistency with the existing management permits. For the wide/short configuration, the channel bottom would be excavated to a width of 100 ft, the permitted maximum, to reduce the potential for scour. For the narrow/long configuration, the channel bottom width will be approximately 30 ft to achieve the desired channel length and slope while still staying within the 2,000 yd^3 excavation volume limit.

7.4.5 Length

The channel length is estimated to vary within 100-800 ft, consistent with historic channel lengths observed within the management period (Behrens, 2008). Length will be a function of the channel's planform alignment while also balancing with other channel dimensions in order to keep excavation volumes less than 2,000 yd^3. The wide/short configuration would result in channel lengths between 100-400 ft while the narrow/long configuration would result in channel lengths approaching the maximum of 800 ft.

7.5 EXCAVATION TIMING RELATIVE TO THE TIDAL CYCLE

Under the proposed management plan, channel modifications will be initiated during low tide so that after several hours of work, the channel will be completed near high tide. As per existing practices, a temporary barrier will be left between the ocean and lagoon during excavation. When the last material is excavated, then the temporary barrier will be removed at or near high tide. This will minimize the difference in water levels between the estuary and ocean, reducing the potential for the re-connected channel to scour into a fully tidal inlet.

7.6 EXCAVATION FREQUENCY

Creating and maintaining the outlet channel will probably employ one or two pieces of heavy machinery (e.g. excavator or bulldozer) to move sand on the beach. At the start of the management period (late spring or early summer), when configuring the outlet channel for the first time that year, conditions may require operating machinery for up to two consecutive days (as allowed under the marine mammal incidental harassment permit). The precise number of excavations would depend on uncontrollable variables such as seasonal ocean wave conditions (e.g. wave heights and lengths), river inflows, and the success of previous excavations (e.g. the success of selected channel widths

and meander patterns) in forming an outlet channel that effectively maintains lagoon water surface elevations. As technical staff and maintenance crews gain more experience with implementing the outlet channel and observing its response, maintenance during the remainder of the management season is anticipated to be less frequent.

In consideration of the natural beach environment and public access, effort will be made to minimize the amount and frequency of mechanical intervention. Outlet channel management activities cannot last for more than two consecutive days. During the marine mammal pupping season (March 15th to June 30th), the duration and frequency of Agency operations is constrained by restrictions on incidental harassment. Seven days must pass between management events. More details on duration and frequency restrictions are provided in Attachment C.

7.7 UNCERTAINTY AND LIMITATIONS

The proposed operations are based on the analyses documented in this report, input from resource agency staff, and on our professional judgment. Uncertainties about the actual estuary inflow, berm seepage, and outlet channel performance remain. As described in Section 6.2.2, the two methods for estimating estuary inflow, the water balance model and limited discharge measurements, predict disparate estuary inflows. Estuary inflow will fluctuate over the management period and may be greater than the modeled inflow. The seepage through the beach berm is based only on inferred, not observed, estimates of hydraulic conductivity. The outlet channel, particularly its downstream end, will be located in a highly dynamic environment that is influenced by changing river flow, tidal water levels and waves. Since the outlet channel will not include any hard structures, all of these sources of hydrologic forces can readily alter the channel's configuration, which may make it difficult to achieve and maintain the channel's successful function. Modifications of the proposed plan in response to actual conditions will be discussed with the resource agency management team and documented according to the communication protocol described in Section 9. Any modifications will be consistent with existing permit requirements.

Adaptive management once the channel is implemented will further enhance management practice. Actual feasibility with regards to the full range of dynamic conditions has not been determined. Risks associated with outlet channel failure have not been quantified. In addition to the channel's performance criteria, there are also water quality and ecological performance criteria for the perched lagoon. These additional criteria have not been evaluated as part of the outlet channel management plan.

8. MONITORING AND ADAPTIVE MANAGEMENT

Monitoring of the outlet channel should be implemented to facilitate an understanding of the channel's behavior and guide adaptive changes to this initial management plan. Adaptive management changes may be made over the course of the management season, in response to natural processes, outlet channel conditions, and/or outlet channel response. In addition, a more comprehensive review at the end of the management season will employ the monitoring data to recommend management revisions for the following year.

Because relatively few closure events occur per year and each one experiences different river and ocean conditions, a comprehensive monitoring plan is recommended to support adaptive management. The monitoring would quantify changes in the beach and channel elevation, lengths, and widths, as well as flow velocities and observations of the bed structure (to identify bed forms and depth-dependent grain size distribution indicative of armoring) in the channel. If feasible, the required monthly beach topography surveys should be scheduled just in advance of potential closure situations (neap tides, low discharge, and/or large wave events). Staff safety, staff availability, pinniped constraints, and/or rapidly changing physical conditions may preclude optimal scheduling of beach topographic surveys. Because monitoring requires human presence on beach, potentially disturbing the seal population, the monitoring frequency represents a balance between management of the outlet channel and minimizing disruption of wildlife.

A list of recommended monitoring tasks for 2014 is provided below in Table 5.

Table 5 Monitoring tasks associated with outlet channel management

Task	Description	Field Activities	Frequency
Recommended			
Operations log	Record of outlet channel management actions and ambient conditions.	Operations staff to generate written record of operations (excavation method, extent, and location) and ambient conditions (weather, ocean state, estuary water level)	Daily to monthly (Depends on operational activity)
Outlet channel location and state	An automated video or still camera station to capture the outlet channel's location and state.	Field staff to install and service a camera, power supply, and possibly communication system on hillside adjacent to estuary.	Hourly imaging (automated); Weekly servicing
Outlet channel discharge measurements	Collected within the outlet channel to verify the channel's conveyance.	Field staff to complete cross sectional flow velocity surveys using flow meter attached to a wading rod with electronic data logger.	Monthly
Outlet channel bed structure	Observe the bed for bed forms and depth-dependent grain size distribution indicative of armoring. Sediment sampler used.	Field staff to collect sediment sample from the surface of the channel bed.	Monthly
Outlet channel topography	Collect outlet channel elevation and width	Field staff to survey outlet channel features using a total station and prism mounted on a survey rod.	Monthly
Beach topography	Collect beach elevation	Field staff operating rod and staff on beach.	Monthly
Estuary flow dynamics	Integrate cross sectional velocity data in estuary at various locations from mouth to Duncans Mills.	A boat with field staff, collecting cross sectional data from mouth to Duncans Mills.	Weekly

9. COMMUNICATION PROTOCOL

A communication protocol will provide guidance between the Agency and identified points of contact representing key resource management groups in the estuary for the implementation of the Outlet Channel Management Plan during the management period (May 15 – October 15). Primary and alternative points of contact have been identified for each of the key resource management groups. These parties, which together are hereafter referred to as the "Team", include: Sonoma County Water Agency, NOAA National Marine Fisheries Service, California Department of Fish and Wildlife, and California State Parks. A list of contacts for these groups is shown in Table 6.

Table 6 Russian River Estuary Management Team

Contact	Level	Organization	Phone Number	E-mail
Jessica Martini Lamb	Primary	Sonoma County Water Agency	707-547-1903 (w) 707-322-8177 (m)	jessica.martini.lamb@scwa.ca.gov
Chris Delaney	Secondary	Sonoma County Water Agency	707-547-1946 (w) 707-975-5606 (m)	cdelaney@scwa.ca.gov
Gary Tourady	Primary	Agency Operator Sonoma County Water Agency	707-547-1065 (w) 707-975-6285 (m)	garywt@scwa.ca.gov
Jon Niehaus	Secondary	Agency Operator Sonoma County Water Agency	707-521-1845 (w) 707-975-3999 (m)	jon@scwa.ca.gov
Robert Coey	Primary	National Marine Fisheries Service	707-575-6090 (w)	Bob.Coey@noaa.gov
John McKeon	Secondary	National Marine Fisheries Service	707-575-6069 (w)	john.mckeon@noaa.gov
Rick Rogers	Secondary	National Marine Fisheries Service	707-578-8552 (w)	rick.rogers@noaa.gov
Adam McKannay	Primary	CA Dept. of Fish and Wildlife	707-944-5534 (w)	amckannay@dfg.ca.gov
Eric Larson	Secondary	CA Dept. of Fish and Wildlife	707-944-5528 (w)	elarson@dfg.ca.gov
Brendan O'Neil	Primary	California State Parks	707-865-3129 (w)	BONEIL@parks.ca.gov
Damien Jones	Secondary	California State Parks	707-875-3907 (w)	dajone@parks.ca.gov

9.1 IMPLEMENTATION OF OUTLET CHANNEL MANAGEMENT ACTIVITIES

A minimum of 24 hours of notice shall be provided to the Team by the Agency in advance of the excavation and maintenance of the outlet channel. Notice shall be submitted by e-mail (see Attachment B.1 for sample) with a general description of the proposed action to be pursued and will typically include:

- Proposed date and time of implementation;
- Design schematic of proposed channel which shall include:
    - Approximate antecedent beach berm height and width;
    - Proposed location and alignment of outlet channel;
    - Approximate outlet channel dimensions including bed elevation, channel depth, width, length, slope and aspect with respect to beach face
    - Predicted estuary water surface elevation at the time of implementation;
- Current river discharge at USGS Guerneville gage (website: http://waterdata.usgs.gov/nwis/uv?cb_00060=on&cb_00065=on&format=gif_stats&period=21&site_no=11467000)
- Predicted 24 hour precipitation as estimated by the NOAA National Weather Service for Bodega Bay (website: http://forecast.weather.gov/MapClick.php?CityName=Bodega+Bay&state=CA&site=MTR&textField1=38.3333&textField2=-123.047&e=0&FcstType=graphical;
- Predicted deep water swell height, period, and direction at San Francisco as estimated by CDIP (website: http://cdip.ucsd.edu/?nav=recent&sub=forecast&units=metric&tz=UTC&pub=public)
- For maintenance actions a general description of maintenance to be performed;
- Presence of seal pups; and
- Equipment to be used for implementation.

Team members shall provide any comments or suggestions to the approach in writing within 12 hours of the proposed implementation time. If Agency does not receive any comments before this time it is assumed that there are no comments to the proposed action. Comments and recommendations will be recorded for consideration on that management action or future management actions, and the Agency will do its best to respond to comments prior to implementation.

9.2 COMPLETION OF OUTLET CHANNEL MANAGEMENT ACTIVITIES

Within 36 hours of completion of outlet channel excavation or maintenance activities the Agency shall provide the Team a summary of work performed. This summary will be submitted by e-mail and will typically include:

- Date, time and period of implementation;
- Estuary water surface elevation at the time of completion;
- River discharge at USGS Guerneville gage at time of completion
- Deep water swell at CDIP Pt. Reyes buoy at time of completion
- Approximate location of the centerline of the channel mouth in distance along beach berm north of the jetty;

- Approximate orientation of channel along the beach berm;
- Approximate dimensions and orientation of the excavated channel;
- Approximate water depth in the excavated channel;
- For maintenance actions, a general description of maintenance performed;
- Equipment used during implementation;
- Presence of seal pups; and
- Photos documenting work completed.

9.3 OVERRIDING CONDITIONS

Certain conditions such as declines in water quality or imminent flooding to properties and structures in the estuary could drastically change the course of management outlined in this plan and may force the Agency to breach the estuary. The Agency shall stay in close contact with the Team on the development of any conditions which could affect the overall course of management. However, rapidly changing conditions may limit the notification lead time given to the Team in advance of management actions to alleviate flooding or water quality concerns.

9.3.1 Flooding

Based on past management experience in the estuary, the Agency has found that if the estuary is in a closed condition, medium to large storm events can produce very rapid rises in estuary water levels. These storm events are frequently accompanied by large ocean swells which can close the estuary if outflows through the channel are not high enough to counteract the wave forces produced from the large swells. Management to avoid flooding is complicated by safety concerns; the Agency is unable to operate equipment required for channel management activities if ocean swells are too large. In the past the Agency has typically breached the estuary in anticipation of a large storm in order to prevent flooding.

The high water surface elevations pursued under this plan will diminish the storage capacity of the estuary to handle high inflows. Also, based on past management experience, the Agency believes that the outlet channel as described in this plan will be especially susceptible to closure from large swell events. In an effort to avoid flooding of properties in the estuary during the outlet channel management period, the Agency will consult with the Team regarding the possibility of breaching the estuary in anticipation of a large storm event.

9.3.2 Decline in Water Quality

Declines in water quality could have impacts to salmonids rearing in the estuary, other species which reside in the estuary and the public. Potential water quality concerns include, but are not limited to:

- Dissolved oxygen conditions becoming dangerously low to fish and other species;
- Elevated salinity levels in domestic water wells; and
- Elevated bacterial levels.

The Agency will stay in contact with the Team regarding water quality conditions during the management period. Should conditions get to the point that they are potentially dangerous to salmonids, other species, or the public, the Agency shall consult with the Team on potentially changing the course of management. In cases of high bacterial levels, the Agency will additionally consult with North Coast Regional Water Quality Control Board and the Sonoma County Department of Public Health on potential management actions.

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11. LIST OF PREPARERS

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12. FIGURES

Source: Sonoma County Orthophotography (April-May, 2000)

0 120 240 480 Feet

figure 1

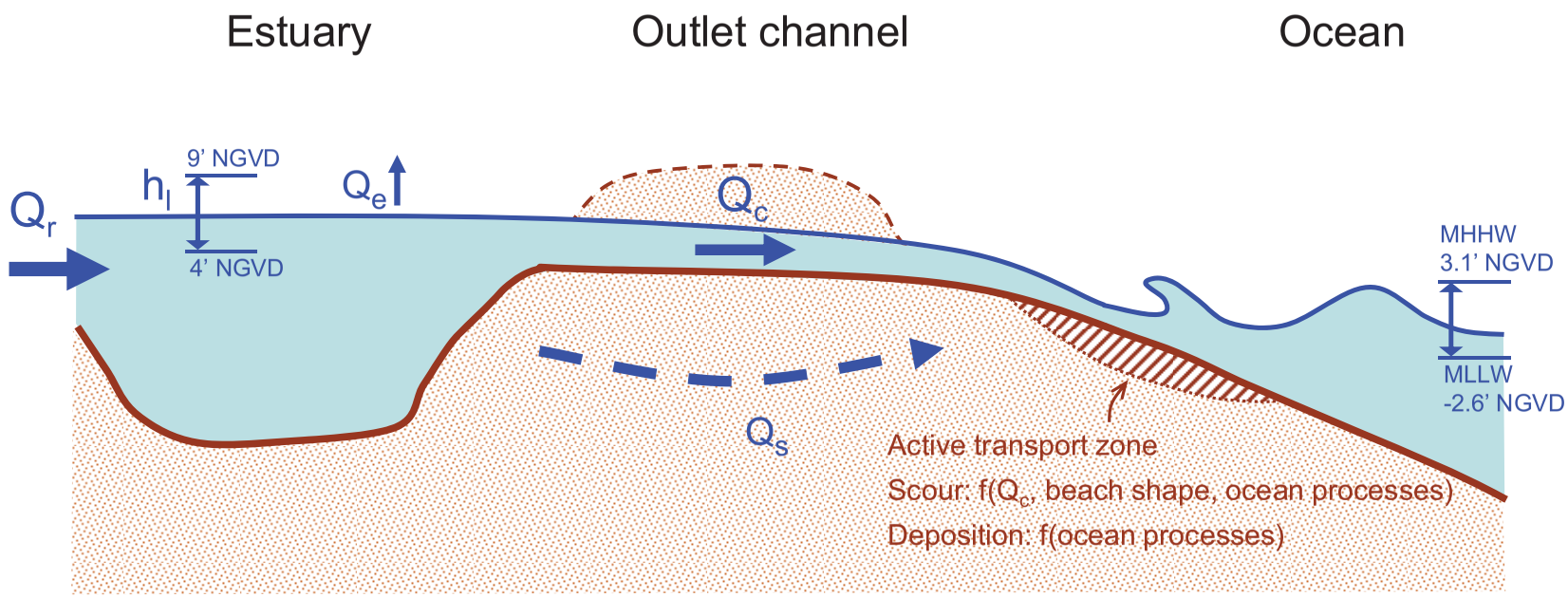
Russian River Estuary Outlet Channel Management Plan

Russian River Estuary Site Location

PWA Ref# - 1958.02

PWA

G:\1958.01_Russian_River\Projects



Parameters

h_l=lagoon water level

Q_r=river discharge

Q_c=outlet channel discharge

Q_s=seepage discharge

Q_e=evaporation from lagoon

Processes

- $Q_r = Q_c + Q_e + Q_s$ (averaged over days)
- No sediment transport within outlet channel
- Active sediment transport outside outlet channel

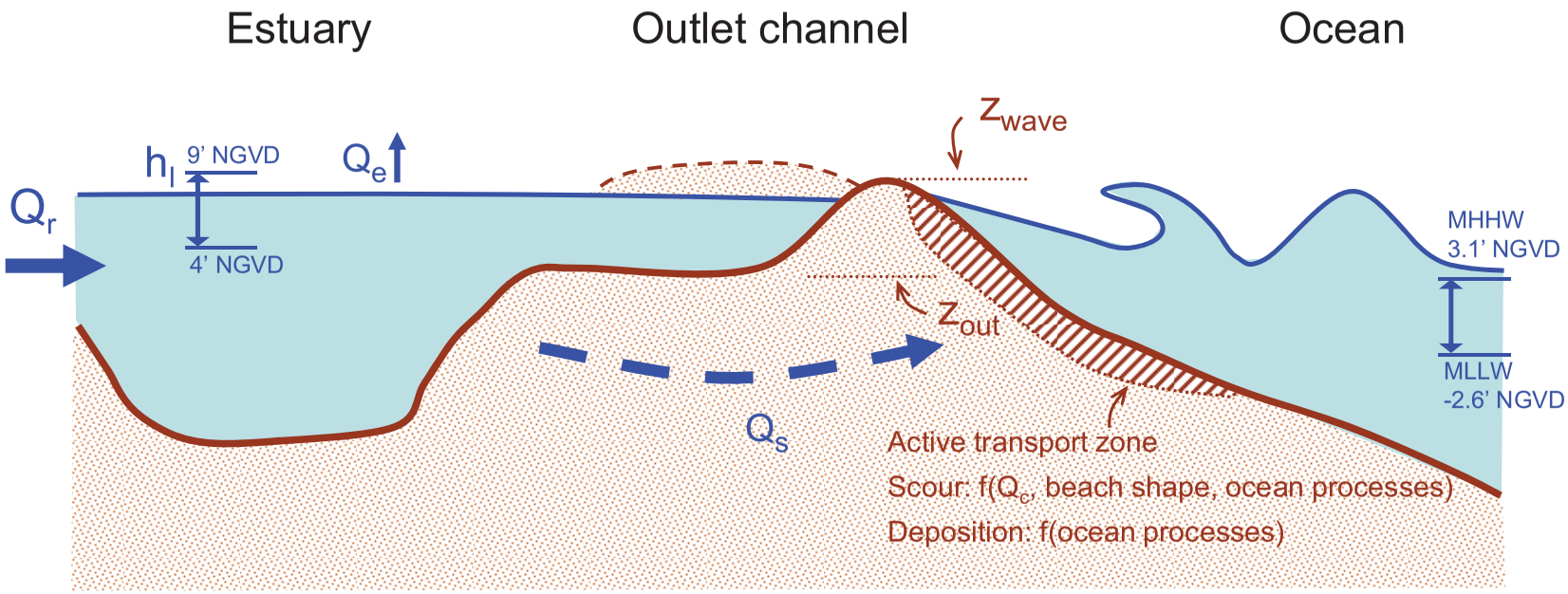
figure **2**

Russian River Estuary Outlet Channel Management Plan

Conceptual model – Target conditions

PWA Ref# 1958.01

PWA



Parameters

z_{out}=target channel bed elevation

z_{wave}=wave runup elevation; f(wave conditions, ocean water level, channel location)

Processes

- $z_{wave} \geq z_{out}$
- wave-induced sediment transport closes outlet channel
- $Q_c \rightarrow 0$
- h_l increasing

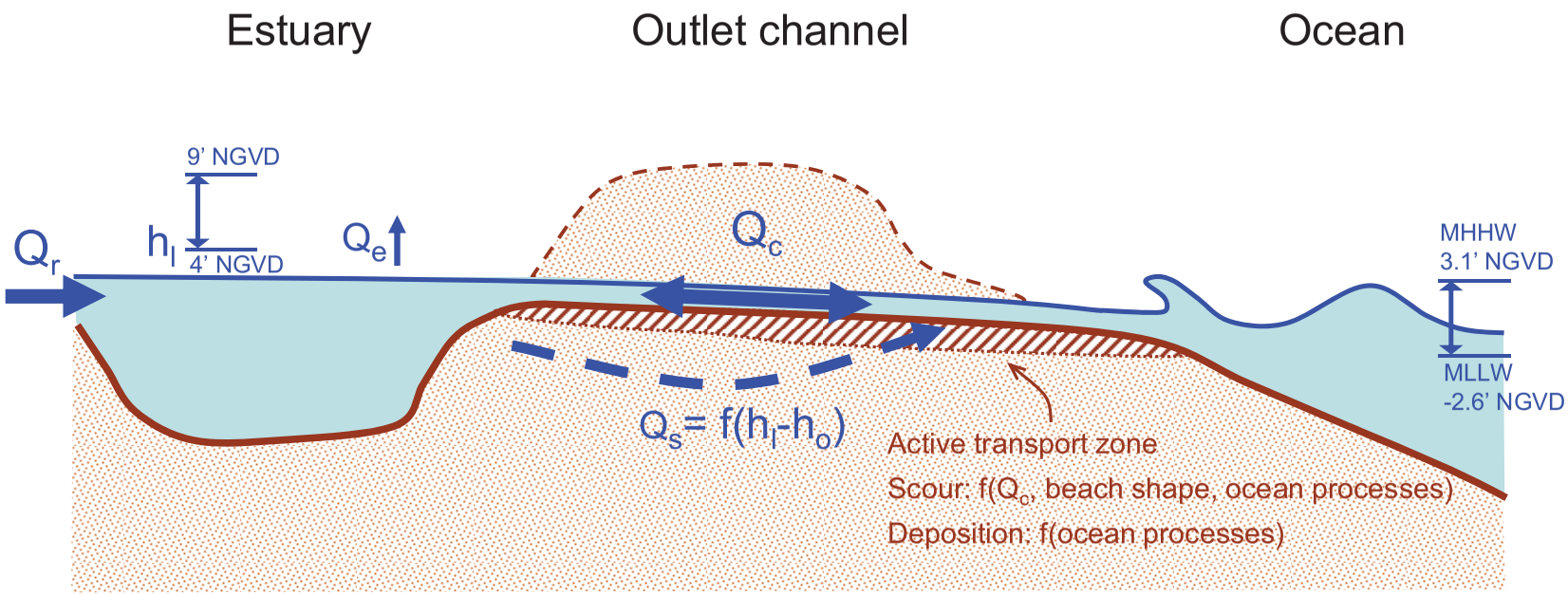
figure **3**

Russian River Estuary Outlet Channel Management Plan

Conceptual model – Closure

PWA Ref# 1958.01

PWA



Parameters

u_c= f(channel slope, length, and width; Q_r; ocean water level)
(can be managed to greater or lesser degree)

u_{crit} is f(grain size)

Processes

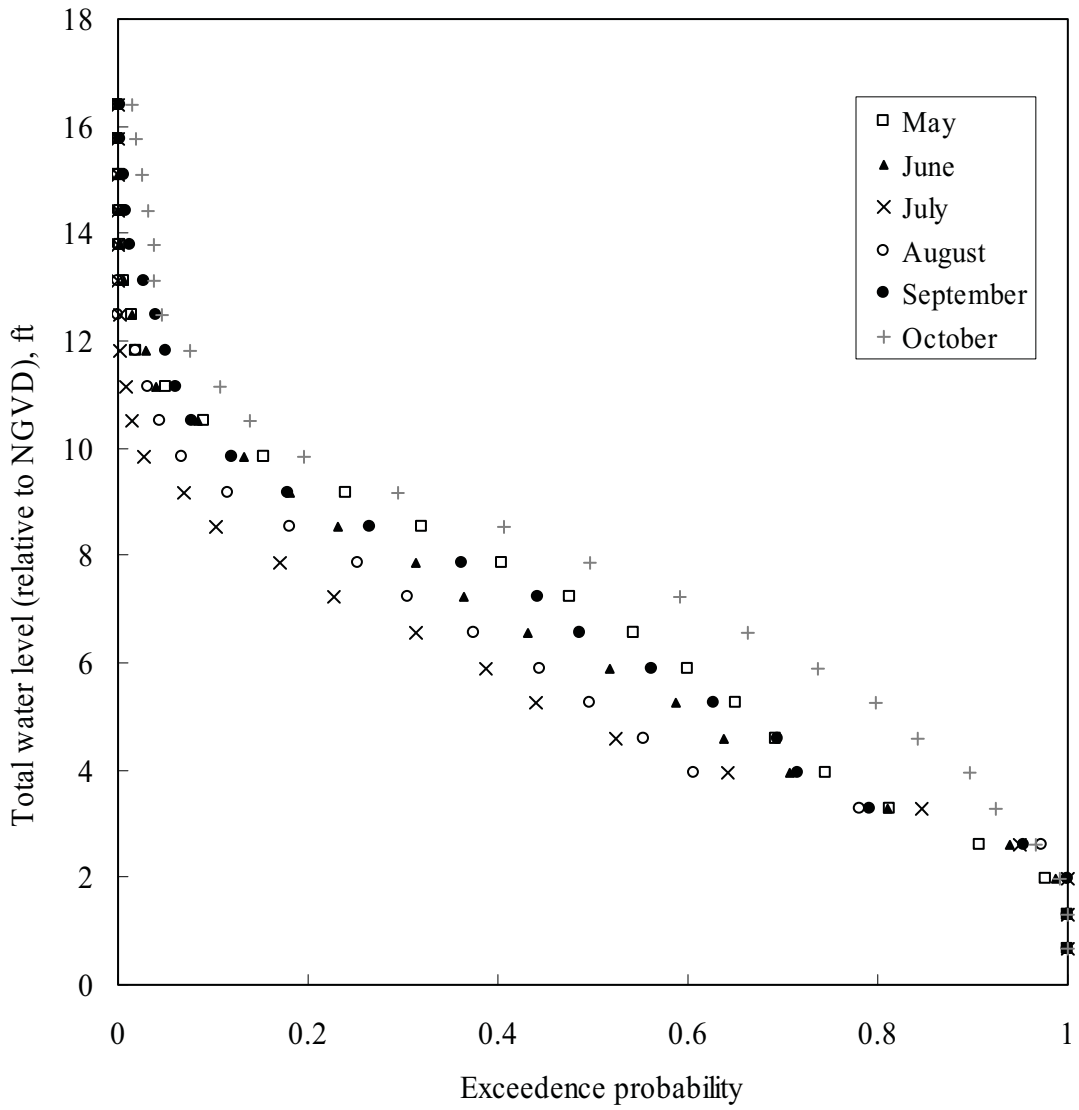
- $u_c > u_{crit}$; high velocities scour channel
- Q_s increases; high seepage creates groundwater piping and erosion
- sediment transport within outlet channel

figure 4
Russian River Estuary Outlet Channel Management Plan

Conceptual model – Breaching

PWA Ref# 1958.01

PWA



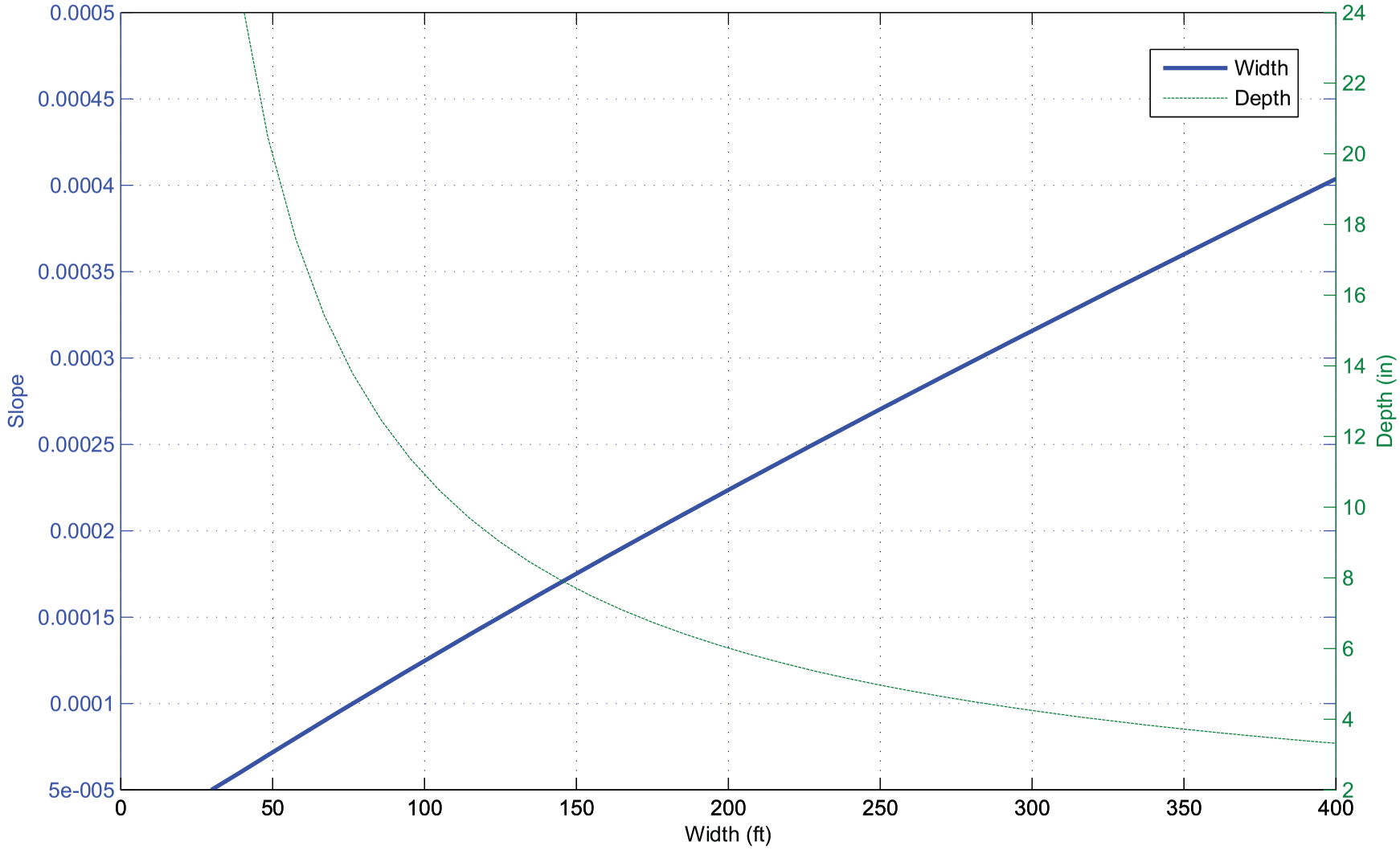
Source: D. Behrens (unpublished). Wave data from CDIP Point Reyes buoy.
Note: Total water level calculated as sum of daily higher high tide and wave runup elevation. Wave runup calculated from Stockdon et al (2006) using estimated de-shoaled deepwater equivalent wave heights.

figure **5**
Russian River Outlet Channel Management Plan

Total Water Level Exceedance, May-Oct

PWA Ref# 1958.01

PWA



Source: Stability curve for local bed shear stress of 0.5 Pa, flowrate of 70 cfs, and Manning's roughness of 0.02.

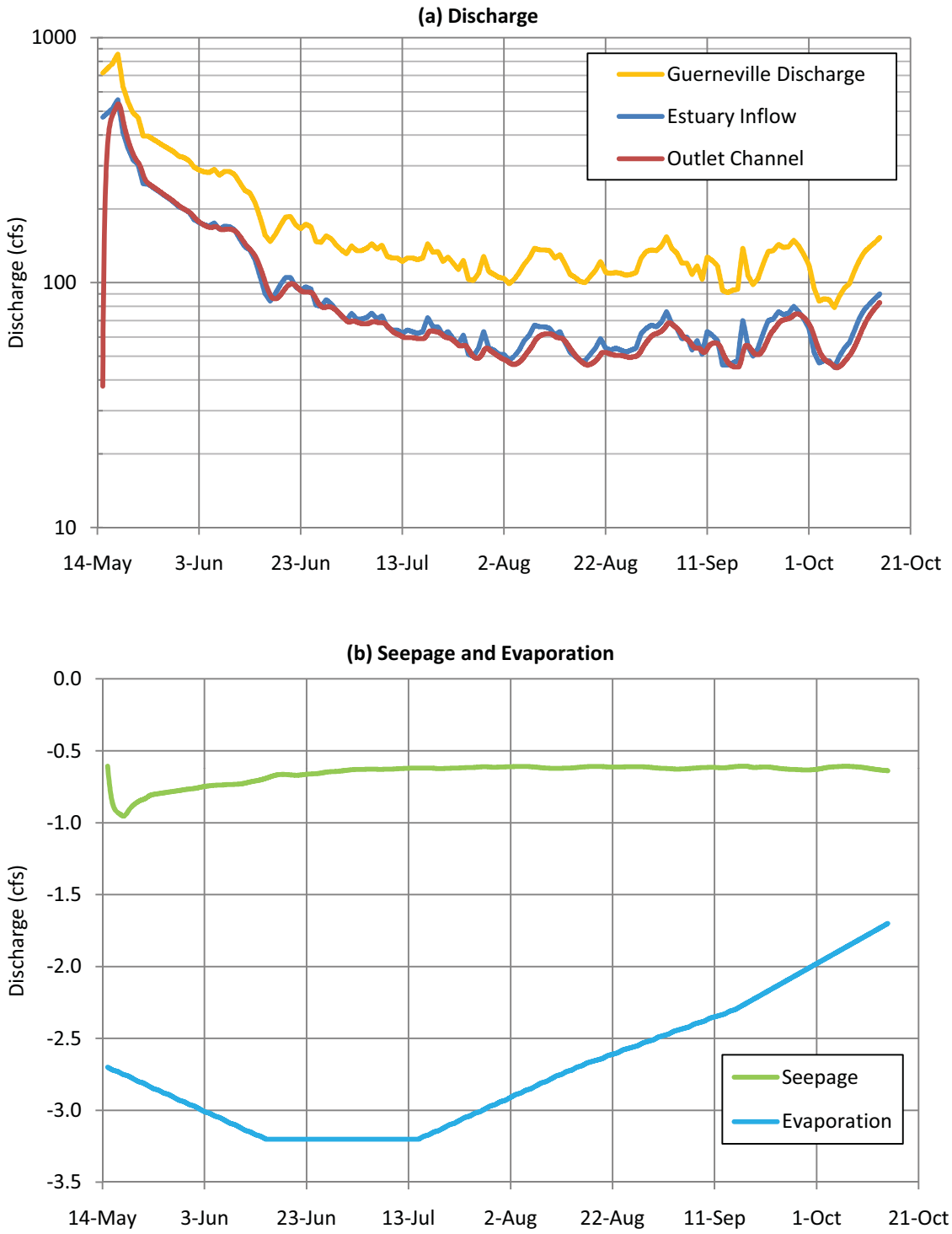
Figure 6
Russian River Estuary Outlet Channel Management Plan

Slope vs. Width Stability Plot

PWA Ref# 1958.01

PWA

j:\1958.01RREAMPOutletChannel\Task 4 Prelim geometry\matlab\solve_geometry.m



Source: 2010 anticipated discharge at Guerneville and into lagoon calculated by scaling observed 2000 discharge at USGS gage #11467000 (Russian River near Guerneville, CA). Evaporation rates calculated from monthly climatological rates for CIMIS evapotranspiration zone 1 (California coast).

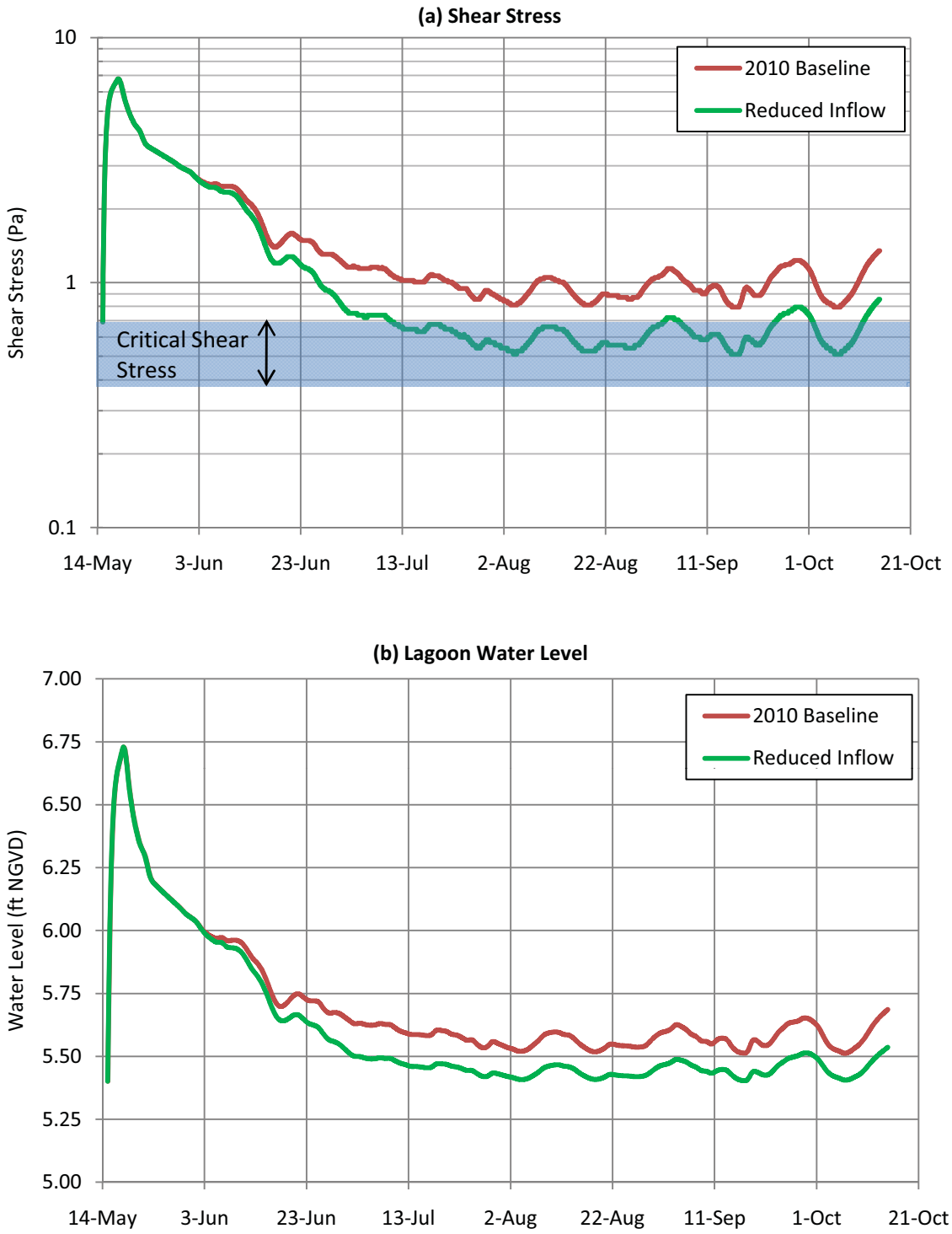
figure 7

Russian River Estuary Outlet Channel Management Plan

Hydraulic Model Discharge - 2010 Anticipated Hydrology

PWA Ref#: 1958.01

PWA



Notes: Baseline channel geometry: width=100 ft, length=300 ft, bed=5 ft NGVD, n = 0.02.
Source: HEC-RAS hydraulic model results for outlet channel.

figure **8**

Russian River Estuary Outlet Channel Management Plan

Hydraulic Model Results - 2010 Anticipated Hydrology

PWA Ref#: 1958.01

PWA

ATTACHMENT A: SUPPORTING WORKSHEETS FOR CHANNEL CONFIGURATION ANALYSIS

Worksheets

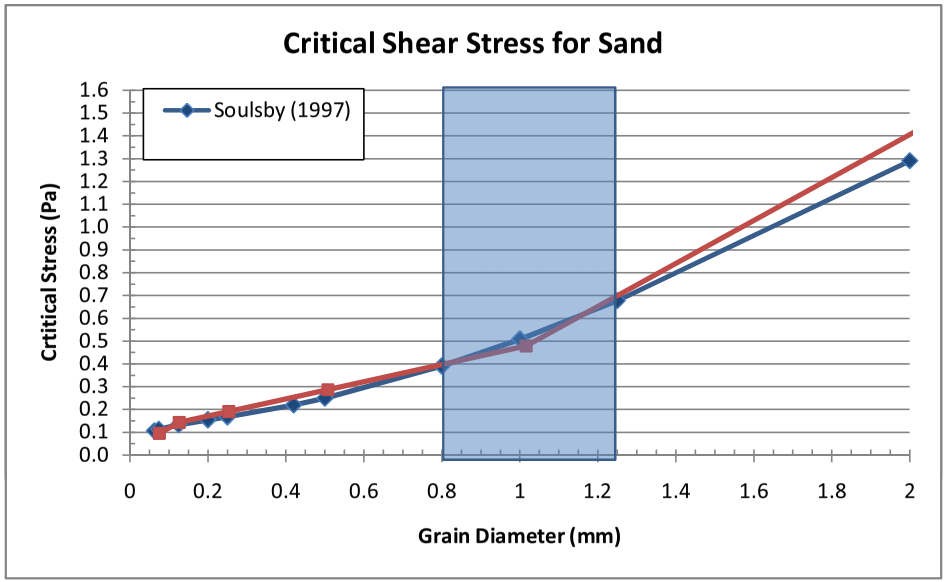
A-1. Critical shear stress for incipient motion of sane particles
A-2. Manning's n
A-3. Evaporation
A-4. Berm seepage
A-5. Mouth closure
A-6. Russian River discharge

A-1. Critical shear stress for incipient motion of sand particles

1958.01 Russian River Estuary Outlet Channel
J. Vandever (PWA)
4/1/2009

Variables		
p	1000	kg/m^3
g	9.81	m/s^2
s	2.65	(quartz)
v	1.0E-06	m^2/s

D (mm)	D*	Theta_crit	tau_crit (Pa)	Grain Size
0.0625	1.58	0.105	0.11	Very Fine Sand
0.074	1.87	0.094	0.11	
0.125	3.16	0.066	0.13	Fine Sand
0.20	5.06	0.048	0.15	
0.25	6.32	0.041	0.17	Medium Sand
0.42	10.62	0.032	0.22	
0.5	12.65	0.031	0.25	Coarse Sand
0.8	20.24	0.030	0.39	
1.0	25.30	0.031	0.51	Very Coarse Sand
1.25	31.62	0.033	0.68	
2.0	50.59	0.040	1.29	Granular



Notes: units Pa = N/m^2, assumes density of freshwater, quartz grained sand
Method based on Soulsby (1997) Dynamics of Marine Sand:

$$D_* = \left[\frac{g(s-1)}{\nu^2}\right]^{1/3} D$$

$$\theta_c = \frac{0.3}{1+1.2D_*} + 0.055\left[1-\exp\left(-0.020D_*\right)\right]$$

$$\tau_c = \rho(s-1)gd\theta_c$$

Note: does not account for gravitational effects on sloping bed

A-2. Manning's n worksheet

1958.01 Russian River Estuary Outlet Channel
J. Vandever (PWA)
4/1/2009

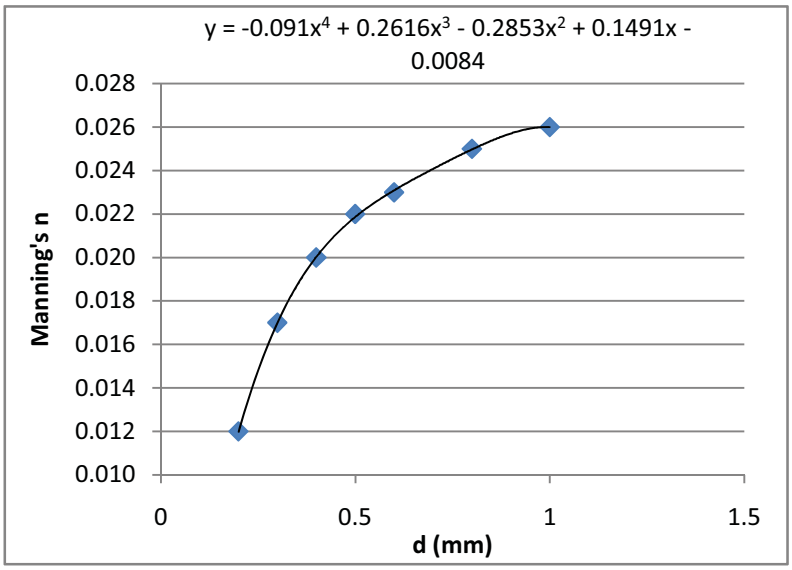
d_{50}	1	mm	0.003281 ft
D	0.84	ft	
Rh	0.83	ft	
S	0.00008	ft/ft	

Equation	n	Notes
Strickler (1923)*	0.018	*valid d range unknown
Limerinos (1970)*	0.021	
Bray (1979)*	0.017	
Bruschin (1985)*	0.018	
Julien (2002)*	0.024	
USGS (WSP2339)	0.026	for 0.2<d<1.0 mm
Average	**0.021**	
Average w/o USGS	**0.020**	

USGS

d (mm)	n
0.2	0.012
0.3	0.017
0.4	0.020
0.5	0.022
0.6	0.023
0.8	0.025
1.0	0.026
2.0	0.035

Polynomial fit to USGS data (d=2.0 mm not included):



A-3. Evaporation Worksheet

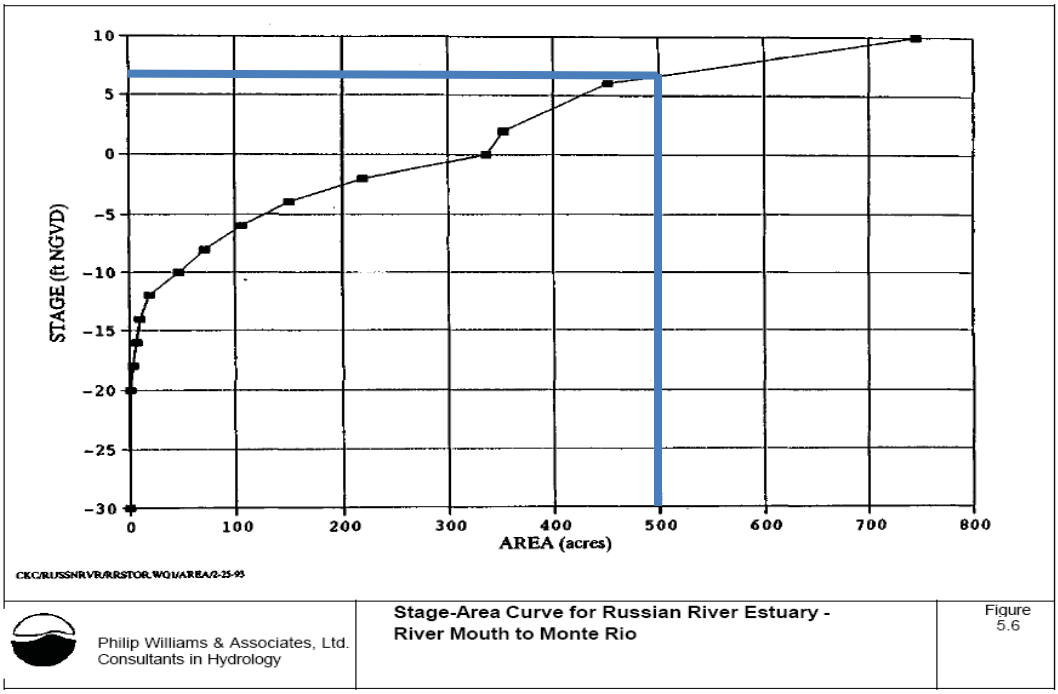
1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
15-Apr-09

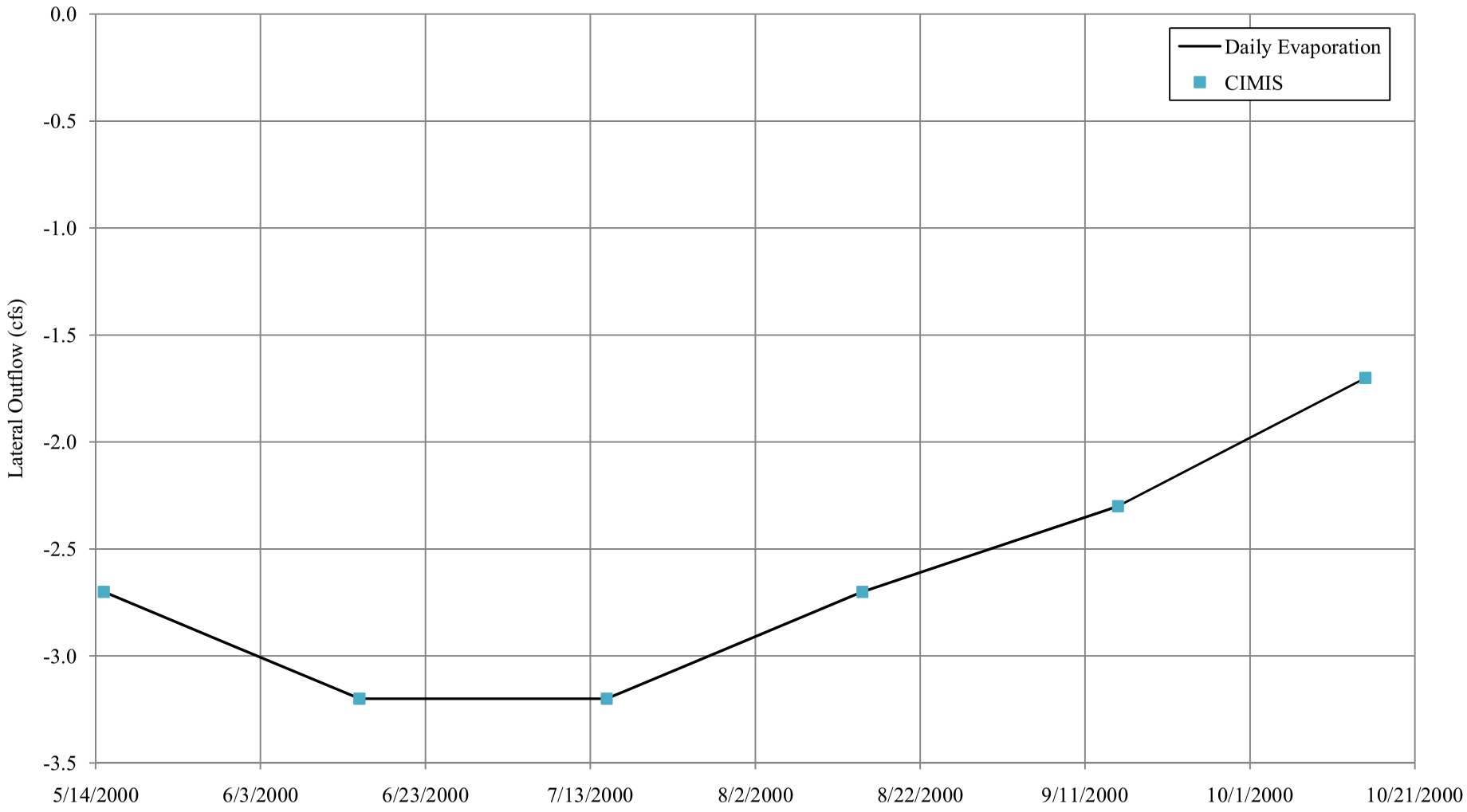
CIMIS Reference Evapotranspiration (Eto) Zones
http://www.cimis.water.ca.gov/cimis/images/etomap.jpg

Russian River Estuary is located on California coast in Zone 1
(Coastal plains and heavy fog. Lowest Eto in California, characterized by dense fog)

	in/month	days	in/day	mm/day	cfs
Jan	0.93	31	0.03	0.76	0.6
Feb	1.40	28	0.05	1.27	1.1
Mar	2.48	31	0.08	2.03	1.7
Apr	3.30	30	0.11	2.79	2.3
May	4.03	31	0.13	3.30	2.7
Jun	4.50	30	0.15	3.81	3.2
Jul	4.65	31	0.15	3.81	3.2
Aug	4.03	31	0.13	3.30	2.7
Sep	3.30	30	0.11	2.79	2.3
Oct	2.48	31	0.08	2.03	1.7
Nov	1.20	30	0.04	1.02	0.8
Dec	0.62	31	0.02	0.51	0.4

RRE Surface Area 500 acres
21,780,000 sq ft





Notes: Daily evaporation rates for Russian River lagoon interpolated from CIMIS average monthly evapotranspiration statistics for Zone 1 (Coastal plains and heavy fog). Calculations assume lagoon surface area of 500 acres.

*Appendix **A-3***

Russian River Estuary Outlet Channel Management Plan

HEC-RAS model evaporation boundary condition

PWA Ref #: 1958.01

PWA

A-4. Berm Seepage and Hydraulic Conductivity

1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
16-Apr-09

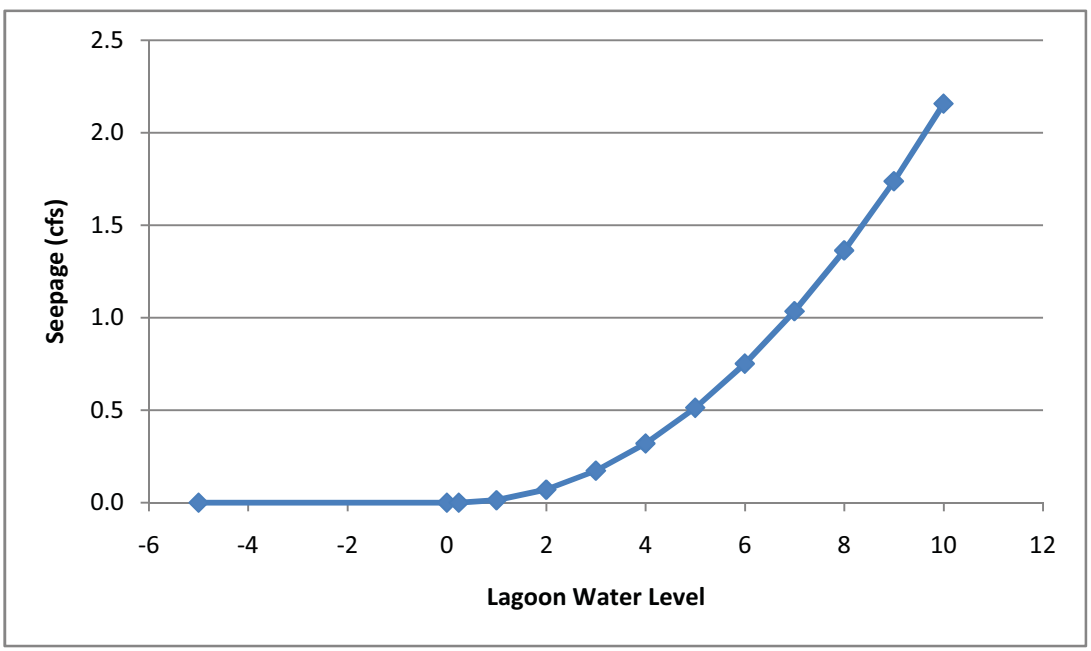
HEC-RAS Diversion Rating Curve

Lagoon WL (ft)	dh (ft)	q (cfs)	
-5	0	0.00	
0	0	0.00	
0.24	0	0.00	(MTL)
1	0.76	0.01	
2	1.76	0.07	
3	2.76	0.17	
4	3.76	0.32	
5	4.76	0.51	
6	5.76	0.75	
7	6.76	1.03	
8	7.76	1.36	
9	8.76	1.74	
10	9.76	2.16	(Flood Stage)
11	10.76	2.62	
12	11.76	3.13	

Darcy's Law

$$q = k\frac{\Delta h}{W}A = k\frac{\Delta h}{W}(\Delta h \cdot L)$$

W	250	ft
L	2500	ft
z_ocean	0.24	ft NGVD (MTL)
k	0.0023	ft/s



A-4. Berm Seepage and Hydraulic Conductivity

1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
7-Apr-09

Bouwer, H. 1978. Groundwater Hydrology. McGraw-Hill, Inc. 480 p.

	Hydraulic Conductivity (m/day)		Hydraulic Conductivity (cm/s)		
	Low	**High**	**Low**	**High**	**Mid**
Fine Sand	1	5	0.001	0.006	0.003
Medium Sand	5	20	0.006	0.023	0.014
Coarse Sand	20	100	0.023	0.116	0.069
Gravel	100	1000	0.116	1.157	0.637
Sand and Gravel	5	100	0.006	0.116	0.061

A-5. Mouth Closure Calibration Worksheet

1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
17-Apr-09

Russian River mouth closure calibrations - HEC-RAS model Years Examined: 2000, 2001, 2003, 2004, 2005, 2007

Accounts for losses between Hacienda Bridge (Guerneville, CA) and the lagoon and the interaction with the aquifer adjacent to the estuary.

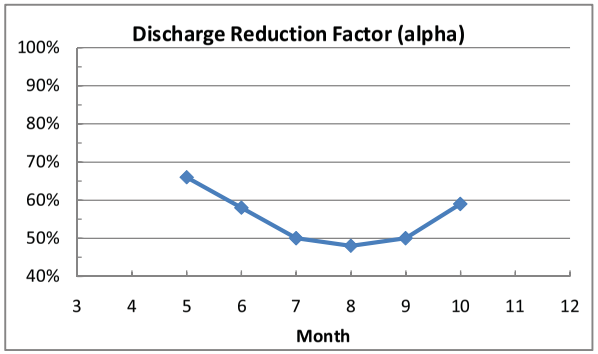
No detailed information available for the aquifer groundwater elevations or extraction rates by wells. The loss term is a calibrated variable in the model.

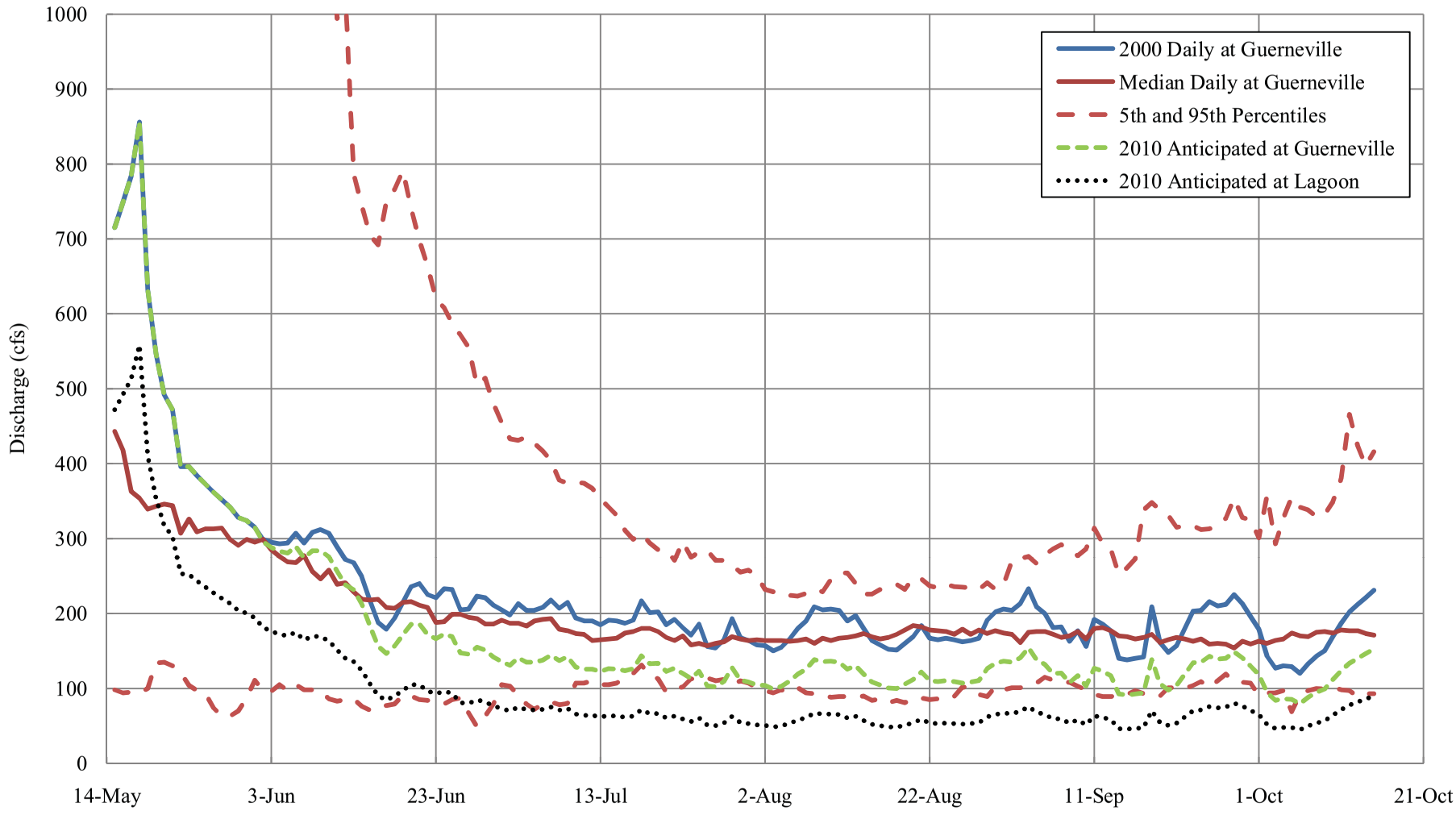
Lagoon Surface Area	400	ac
	17,424,000	sq ft
Evaporation and Seepage Losses	4	cfs

Calibration	Date		Water Level (ft NGVD)		dh	dt	dh/dt (ft/day)	dV/dt (cfs)	USGS Discharge (cfs)	% Reduction	alpha
Closure Event ID	Start	End	Start	End							
06May2000	5/6/2000 18:00	5/9/2000 6:00	3.10	8.40	5.30	2.50	2.12	432	580	26%	74%
24May2000	5/24/2000 8:00	5/25/2000 18:00	3.84	5.76	1.92	1.42	1.36	278	385	28%	72%
16June2000	6/16/2000 13:00	6/21/2000 6:00	4.79	6.90	2.11	4.71	0.45	94	200	53%	47%
25Aug2000	8/25/2000 0:00	9/5/2000 8:00	2.56	7.62	5.06	11.33	0.45	94	195	52%	48%
03Oct2000	10/3/2000 0:00	10/11/2000 12:00	2.85	6.53	3.68	8.50	0.43	91	140	35%	65%
15May2001	5/15/2001 23:00	5/21/2001 21:00	2.14	5.51	3.37	5.92	0.57	119	200	41%	59%
07Apr2007	4/7/2007 13:00	4/11/2007 0:00	1.17	7.68	6.51	3.46	1.88	384	480	20%	80%
13Apr2007	4/13/2007 21:30	4/17/2007 14:30	1.97	7.68	5.71	3.71	1.54	315	465	32%	68%
24Apr2007	4/24/2007 17:00	4/26/2007 14:00	1.51	7.57	6.06	1.88	3.23	656	725	10%	90%
13Oct2007	10/13/2007 2:30	10/22/2007 11:30	2.51	9.15	6.64	9.38	0.71	147	255	42%	58%
9June2003	6/9/2003 17:30	6/12/2003 1:00	2.77	6.47	3.70	2.31	1.60	322	475	32%	68%
9Oct2003	10/9/2003 23:11	10/14/2003 20:40	4.00	6.21	2.21	4.90	0.45	91	170	46%	54%
05Nov2004	11/5/2004 11:00	11/12/2004 4:00	2.40	8.93	6.53	6.71	0.97	196	300	35%	65%
26July2004	7/26/2004 15:41	8/5/2004 0:00	2.27	5.90	3.63	9.35	0.39	78	140	44%	56%
2May2004	5/2/2004 15:40	5/6/2004 19:35	3.44	8.39	4.95	4.16	1.19	240	420	43%	57%
16Apr2004	4/16/2004 9:09	4/18/2004 7:40	4.78	7.98	3.20	1.94	1.65	333	570	42%	58%
3Oct2005	10/3/2005 23:00	10/17/2005 6:30	2.40	8.30	5.90	13.31	0.44	89	170	47%	53%
17Sep2005	9/17/2005 2:00	9/21/2005 13:30	3.37	5.69	2.31	4.48	0.52	104	175	40%	60%

Note: Start and end times represent times used for water level calibration and do not correspond to exact timing of closures and breaches.

Month	Month	% Loss	N	HEC-RAS Multiplier
April	4	26%	4	
May	5	34%	4	66%
June	6	42%	2	58%
July	7	44%	1	50%
Aug	8	52%	1	48%
Sep	9	40%	1	50%
Oct	10	43%	4	59%
Nov	11	35%	1	
			18	





Notes: Median daily discharge calculated from 1970-2008.
Source: USGS gage 11467000 (Russian River near Guerneville, CA). 2010 anticipated discharge at Guerneville calculated from 2000 discharge by scaling factor to obtain typical summertime flowrates of 120 cfs. 2010 anticipated lagoon inflow calculated based on calibrated seasonal losses from Guerneville to lagoon.

Appendix A-6

Russian River Estuary Outlet Channel Management Plan

Daily Russian River Discharge

PWA Ref #: 1958.01

PWA

J:\1958.01RREAMPOutletChannel\Task 5 Hydrologic modeling\Data\Streamflow\USGS_11467000_WaterYear_2000.xls

Attachment B. Hypothetical Implementation Scenario

The following hypothetical implementation scenario is presented to demonstrate how the outlet channel management plan may be implemented. The scenario is based on actual beach berm and ocean conditions observed at the estuary from June 30 to July 6, 2009.

This scenario is purely hypothetical and demonstrates how the adaptive management plan may be implemented based on historical conditions observed in 2009. Actual implementation of the plan may vary in terms of channel geometry, channel location and time required for implementation. The beach environment at the project site is highly dynamic so actual implementation of the plan will be evaluated on a case-by-case basis.

Wednesday, June 30th

Agency personnel have been tracking riverine and ocean conditions on a daily basis during the outlet channel management period. Several days ago, they identified a forecasted ocean swell event with the potential to close the estuary. When it arrives, this medium-sized (2-4 ft.) ocean swell, angled from the southwest, pushes sand into the tidal inlet cutting flow from the estuary to the ocean. Stage in the estuary at the time of closure is approximately 3.5 ft NGVD. Based on river discharge and the time of year, Agency personnel estimate that the estuary water level's rate of rise will be 0.5 ft/day.

Thursday, July 1st

Agency personnel visit the site to assess sandbar conditions. The outlet at the time of closure is just south of Haystack Rock, approximately 550 ft northwest of the jetty, with an alignment roughly perpendicular to the beach face. The preexisting channel slope is steep and would, therefore, be susceptible to scour and wave run-up. Agency decides that this is not the preferable alignment for the outlet channel. In effort to create a channel which has shallower gradient and less susceptible to ocean conditions, it is decided that the channel will be more ideally located to the north of Haystack Rock angled to the northwest. Agency staff collects measurements and limited survey data (e.g. elevation at low point of the berm) in the area to develop a design for the outlet channel.

[Note: If closure had occurred during the pupping season (March 15 – June 30), the site assessment would have included a survey for the presence of seal pups.]

Agency staff returns to their offices to develop a plan and design for the implementation of the outlet channel. Changes between the most recent monthly topographic data and current conditions are assessed using the time-lapse photography and today's survey data. If indicated, today's survey data and judgment may be used to revise the topographic data.

Stage in the estuary is now approximately 4.0 ft. NGVD. Observations from the Jenner gage are used to confirm the previously estimated rate of water surface rise of 0.5 ft/day. Based on current stage and this rate of water surface rise, implementation of the outlet channel is scheduled for Monday and Tuesday, July 5th and 6th so that stage in the estuary will be approximately 6.5 ft. NGVD after the outlet channel is completed.

A design is prepared using the best available topographic data. The outlet channel will be approximately 30 ft wide with 4:1 side slopes, 350 ft long to the mean high tide line, a channel bottom elevation at the inlet of approximately 6 ft NGVD, and a channel design flow depth at time implementation of approximately 0.5 ft. Channel will be aligned to the northwest with an approximate aspect of 35° with respect to the beach face. Estimated material to be excavated is approximated and confirmed to be less than 1,000 yd^3.

Agency staff prepares e-mail to management team to notify them of intention and schedule to construct the outlet channel, provide information regarding current conditions, and provide team with a design schematic according to the Communication Protocol procedure documented in Section 7.8.1 of the management plan. Please see Attachments B.1 and B.2 for an example of e-mail transmittal with attached design schematic. Agency biologists coordinate with Stewards of the Coast and Redwoods to schedule volunteers to assist with pre-, day of, and day after outlet channel creation pinniped monitoring.

Friday, July 2nd

Agency staff receives comments from management team on proposed approach. Time allowing, Agency responds, modifies the proposed approach as needed, and decides on the final approach.

Agency staff reviews rate of water surface rise in the lagoon to confirm that flooding is not expected before proposed management action.

Monday and Tuesday, July 5th and 6th

Agency maintenance crews arrive at the Goat Rock State Beach parking lot early in the morning to prepare for implementation. Agency biologist arrives to begin pinniped monitoring at least one hour prior to crews and coordinates with maintenance crew leader. Agency surveyors stake out designed channel and make corrections to alignment and channel geometry to account for potential changes in beach berm topography since last topographic survey. Outlet channel excavation is carried out according to Section 7.5 of the management plan and according to the plan submitted to the management team. Implementation is also conducted in accordance with the Agency's IHA for harbor seals, northern elephant seals and California sea lions which may be present at the site during excavation activities. Photos are taken to document all implementation activities, and following completion of the outlet channel Agency staff collects measurements of completed channel geometry, flow depth and location.

Wednesday, July 7th

Agency staff sends e-mail to management team to provide documentation of the completion of the outlet channel according to the Communication Protocol procedure documented in Section 7.8.2 of the management plan. Please see Attachment B.3 for an example of e-mail transmittal.

After implementation of the channel, the Agency will monitor performance of the outlet channel according to the monitoring program described in Section 7.7 of the management plan.

Attachment B.1: Sample Proposed Outlet Channel Implementation Email

Date: 7/1/10

Hello Outlet Channel Management Team -

The Russian River Estuary closed on 6/30/10. The Sonoma County Water Agency plans to implement an outlet channel beginning at 7 am on July 5th and potentially extending to the afternoon of July 6th. Details of the proposed outlet channel are the following:

- Channel Width: 30 ft.
- Channel Length: 350 ft.
- Channel Bottom Elevation: 6 ft NGVD
- Design Flow Depth: 0.5 ft
- Location of Channel Inlet Centerline: 970 ft northwest of jetty
- Channel Alignment Aspect: 35 deg. with respect to beach face
- Estimated Estuary WSEL at Time of Completion: 6.5 ft
- Existing Beach Berm Crest Elevation: 10 ft NGVD
- Existing Beach Berm Width: 300 ft
- Excavation Equipment: 1 Excavator, 1 Bulldozer

Attached is a design drawing developed using the most recent topographical survey (6/30/10). Due to the highly dynamic nature of conditions at the site, actual topography at the time of implementation may vary. Implementation of the channel may differ from design in order to account for changed topography.

Current and predicted conditions at the site are the following:

- **River and Estuary:**
  - Russian River near Guerneville Flow (USGS 11467000): 120 cfs
  - Predicted 72 hour precipitation: 0 in.
- **Ocean:**
  - Approximate rate of estuary water surface rise: 0.5 ft/day
  - Current Swell Height and Direction: 5.8 ft @ 10 sec. @ 320 deg.
  - 7/5/10 Predicted Mean Swell Height and Direction: 2.5 ft @ 15 sec. @ 200 deg.

No seal pups were observed on the beach.

For updates on conditions please visit the following URL:

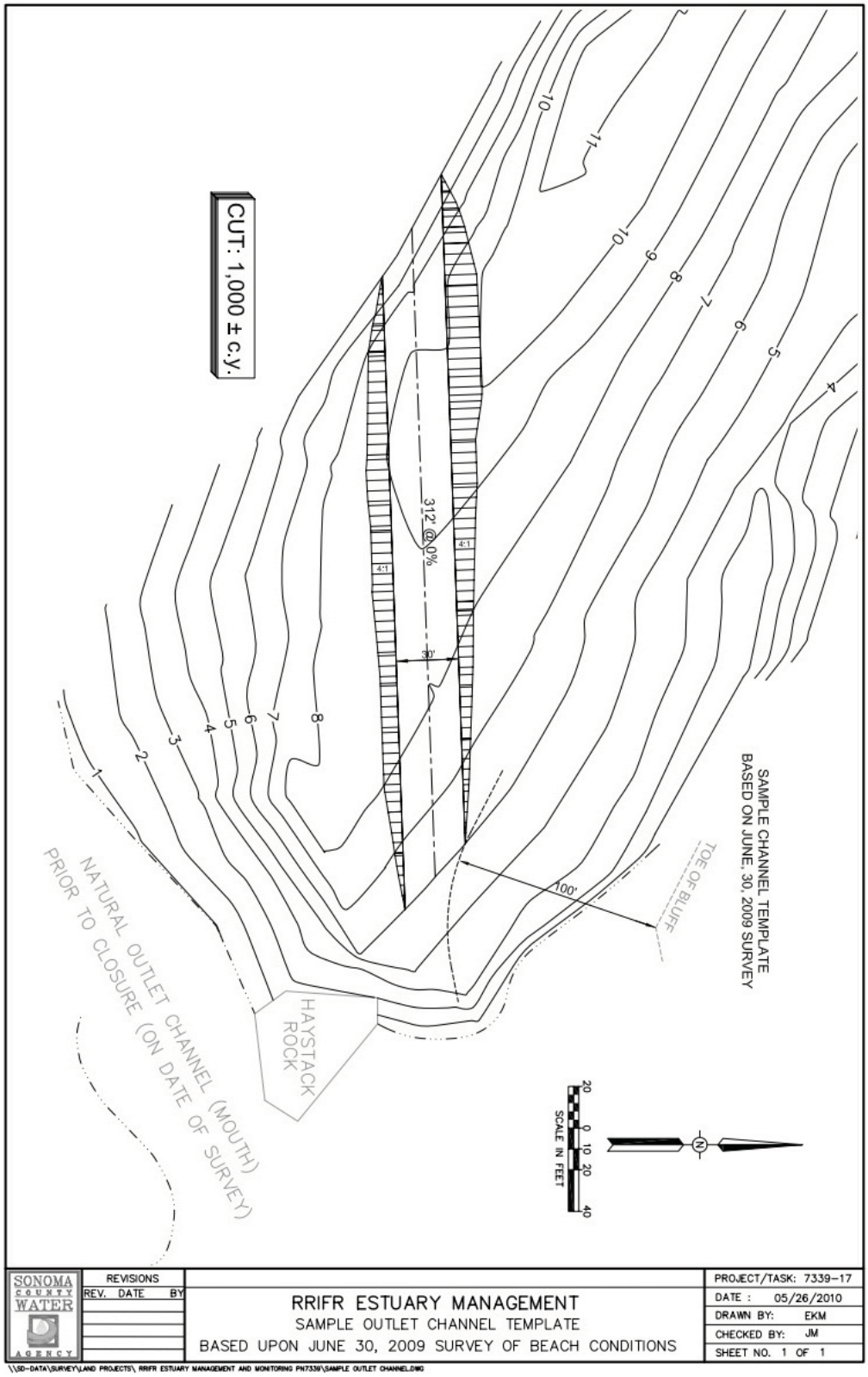
http://www.bml.ucdavis.edu/boon/russianriver

If you have any comments to the proposed implementation plan please provide comments no later than 7/2/10, 5 pm. Should you have any questions or concerns please contact me or Jessica Martini-Lamb at jessicam@scwa.ca.gov, 707-547-1903 (office), 707-322-8177 (mobile).

Sincerely,

Chris Delaney, P.E.
Agency Engineer
Sonoma County Water Agency
707-547-1946 (office)
707-975-5606 (mobile)

Attachment B.2: Sample Proposed Outlet Channel Design Schematic



Attachment B.3: Sample Proposed Outlet Channel Implementation Email

Date: 7/8/10

Hello Outlet Channel Management Team -

The Russian River Estuary closed on 6/30/10. The Sonoma County Water Agency implemented an outlet channel beginning at 7 am on July 5th and extending to the afternoon of July 6th. Details of the implemented outlet channel are the following:

- Channel Width: 30 ft.
- Channel Length: 350 ft.
- Channel Bottom Elevation: 6 ft NGVD
- Flow Depth: 0.7 ft
- Location of Channel Inlet Centerline: 970 ft northwest of jetty
- Channel Alignment Aspect: 35 deg. with respect to beach face
- Estuary WSEL at Time of Completion: 6.7 ft
- Existing Beach Berm Crest Elevation: 10.2 ft NGVD
- Existing Beach Berm Width: 300 ft
- Excavation Equipment: 1 Excavator, 1 Bulldozer

Attached are photographs of the beach before, during, and after the outlet channel implementation.

Current and predicted conditions at the site are the following:

- **River and Estuary:**
  - Russian River near Guerneville Flow (USGS 11467000): 115 cfs
  - Predicted 72 hour precipitation: 0 in.
- **Ocean:**
  - Current Swell Height and Direction: 2.7 ft @ 14 sec. @ 200 deg.
  - 7/10/10 Predicted Mean Swell Height and Direction: 2.4 ft @ 12 sec. @ 200 deg.

No seal pups were observed on the beach.

For updates on conditions please visit the following URL:

http://www.bml.ucdavis.edu/boon/russianriver

If you have any comments on the implemented channel, please provide comments no later than 7/12/10, 5 pm. Should you have any questions or concerns please contact me or Jessica Martini-Lamb at jessicam@scwa.ca.gov, 707-547-1903 (office), 707-322-8177 (mobile).

Sincerely,

Chris Delaney, P.E.
Agency Engineer
Sonoma County Water Agency
707-547-1946 (office)
707-975-5606 (mobile)

Attachment C. Summary of Land Use Permits (Revised May 15, 2014)

List of Valid Permits and Agreements for the Russian River Estuary Management Project

Agency	Permit No.	Expiration
California Department of Fish and Wildlife	Lake and Streambed Alteration Agreement (1600-2010-0380-R3)	December 31, 2015
California Regional Water Quality Control Board, North Coast Region	Section 401 Water Certification (1B10122WNSO)	May 14, 2019
California Coastal Commission	Coastal Development Permit 2-12-004	August 15, 2016
California State Lands Commission	General Lease, Public Agency Use (PRC 7918.9)	May 15, 2015
California Department of Parks and Recreation	Temporary Use Permit	December 31, 2014
California Department of Parks and Recreation	Collections Permit	February 26, 2015
US Army Corps of Engineers, San Francisco District	Section 404 & Section 10, Individual Permit (2004-285610N)	December 31, 2023
US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service	Incidental Harassment Authorization	April 20, 2015

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife Lake and Streambed Alteration Agreement (III-1176-96) - November 6, 1996 Agreement Renewal – November 14, 2001 Agreement Extension – October 17, 2002 Agreement Renewal – November 13, 2003 Agreement Renewal – September 30, 2005 Agreement Extension – December 7, 2009 Agreement Amendment – December 13, 2009 Lake and Streambed Alteration Agreement (1600-2010-0380-R3) - September 8, 2011 Expiration - December 31, 2015	**1. Administrative Measures** Permittee shall meet each administrative requirement described below. 1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to DFG personnel, or personnel from another state, federal, or local agency upon request. 1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors. 1.3 Notification of Conflicting Provisions. Permittee shall notify DFG if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, DFG shall contact Permittee to resolve any conflict. 1.4 Project Site Entry. Permittee agrees that DFG personnel may enter the project site at any time to verify compliance with the Agreement. 1.5 Work Period Extension. If the Permittee needs more time to complete the authorized activity, the work period may be extended on a day-to-day basis by contacting the DFG representative found within the Contact Information section of this Agreement.	May 1: Adaptive Management Annual Report

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife (continued)	1.6 To the extent that any provisions of this Agreement provide for activities that require the Permittee to traverse another owner's property, such provisions are agreed to with the understanding that the Permittee possesses the legal right to so traverse. In the absence of such right, any such provision is void. 1.7 If, in the opinion of the DFG, conditions arise, or change, in such a manner as to be considered deleterious to the stream or wildlife, operations shall cease until corrective measures approved by the DFG are taken. **2. Avoidance and Minimization Measures** To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below. 2.1 In each year that this Agreement is in effect, the Permittee shall provide DFG with an annual lagoon outlet channel adaptive management plan by April 15. 2.2 No excavation of the lagoon outlet channel may occur until DFG has reviewed and approved the annual lagoon outlet channel adaptive management plan. DFG shall provide written comments or approval by May 15 of each year this agreement is in effect. 2.3 The project site has been identified as an area that is potentially inhabited by steelhead trout (Federal Threatened), chinook salmon (Federal Threatened), coho salmon (Federal and State Endangered) and green sturgeon (Federal Threatened). This agreement does not authorize the take, or incidental take of any State or Federal listed threatened or endangered listed species. The Permittee is required, as prescribed in the state or federal endangered species acts, to consult with the appropriate agency prior to commencement of the project. Any unauthorized take of such listed species may result in prosecution. 2.4 To avoid impacts on aquatic and terrestrial species within the immediate work area, prior to implementation of an outlet channel, a qualified biologist will conduct a preconstruction survey to ensure no special-status species are occupying the site. If special-status species are observed within the project site or immediate surroundings, these areas will be avoided until the animal(s) has (have) vacated the area, and/or the animal(s) have been relocated out of the project area by a qualified biologist, upon approval by the regulatory agencies. In addition, the site will be surveyed	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife (continued)	periodically during construction to ensure that no special-status species are being impacted by construction activities. 2.5 The project biologist will conduct a preconstruction training session for construction crew members. The training will include a discussion of sensitive biological resources within the project area and the potential presence of special-status species, special-status species' habitats, protection measures to ensure species are not impacted by project activities and project boundaries. 2.6 Any material, which could be hazardous to aquatic life and enters a stream or lake (i.e., a piece of equipment tipping-over in a stream and dumping oil, fuel or hydraulic fluid), shall be removed immediately and the DFG shall be notified within 24 hours. 2.7 Any hazardous or toxic materials that could be deleterious to aquatic life that could be washed into State waters or its tributaries shall be contained in water tight container or removed from the project site. 2.8 The Permittee/contractor shall not dump any litter or construction debris within the riparian/stream zone. All such debris and waste shall be picked up daily and disposed of at an appropriate site. 2.9 Refueling of construction equipment and vehicles may not occur within 300 feet of any water body, or anywhere that spilled fuel could drain to a water body. Tarps or a similar material shall be placed underneath the construction equipment and vehicles, when refueling, to capture incidental spillage of fuels. 2.10 Any equipment or vehicles driven and/or operated within or adjacent to the stream/lake shall be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life, wildlife, or riparian habitat. 2.11 Any equipment or vehicles driven and/or operated within or adjacent to the stream/lake shall be cleaned of all external oil, grease, and materials that, if introduced to water, could be deleterious to aquatic life, wildlife or riparian habitat.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife (continued)	**3. Reporting Measures** Permittee shall meet each reporting requirement described below. 3.1 The Permittee shall notify DFG a minimum of 24 hours in advance of implementing the outlet channel management plan during the lagoon management period (May 15 to October 15). All communications shall be made in the method prescribed within the communication protocol section of the DFG approved annual lagoon outlet channel adaptive management plan. 3.2 The Permittee shall submit an annual report detailing that year's outlet channel management activities. This report may be submitted as a section of the annual lagoon outlet channel adaptive management plan required by May 1 of each year this agreement is in effect.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region Section 401 Water Certification (1B04001WNSO) - May 6, 2004 Amendment Extension – October 14, 2009 Amendment Extension – January 20, 2011 Amendment Extension – January 5, 2012 Amendment Extension – December 11, 2012 Amendment Extension – December 16, 2013 Expiration - December 31, 2014 Section 401 Water Certification (WDID 1B10122WNSO) - May 14, 2014 Expiration – May 14, 2019	**All conditions of this order apply to the applicant (and all their employees) and all contractors (and their employees), sub-contractors (and their employees), and any other entity or agency that performs activities or work on the project as related to this water quality certification.** 1. If monitoring results identify potentially dangerous water quality conditions, the applicant will promptly consult with Regional Water Board staff in addition to staff from other agencies identified in the application, including the National Marine Fisheries Service, the California Department of Fish and Wildlife, and California State Parks, with the intent of examining possible resolution through management action. Potentially dangerous conditions may include, but are not limited to, high bacterial levels, the presence of cyanobacteria, or other conditions that could affect human health. 2. The mitigation measures detailed in the Environmental Impact Report (SCH 2010052024) are hereby incorporated by reference and are conditions of approval of this certification. Notwithstanding any more specific conditions in this certification, the applicant shall comply with all mitigation measures identified in the Environmental Impact Report that are within the Regional Water Board's jurisdiction. 3. The annual fee amount for this Clean Water Act Section 401 Water Quality Certification shall be in accordance with the current dredge and fill fee schedule, per Division 3, Chapter 9, Article 1, section 2200(a)(3) of title 23 of the California Code of Regulations, based on the maximum dredge amount of 49,000 cubic yards proposed for the first year, and each year following. This fee shall be submitted prior to authorization of that year's management period and shall be approved by amendment to this Order by signature of the Executive Officer. The fee payment shall indicate the WDID number, and which season it is for. If the entire proposed beach dredging work for that year is not completed during that management season, the fee for the remaining amount of beach dredging for that year shall be applicable to the remaining management season(s), until the remaining amount of the fee is exhausted. In the case the remaining amount of the fee is exhausted within the five year term of this Order, the appropriate fee amount shall be paid at that point to be based on the actual volume of beach dredging performed, and/or proposed to be performed. There shall be no fee refunded to the Applicant if at the expiration of this Order there is any unapplied fee. 4. A draft water quality monitoring plan was submitted on December 23, 2013, which includes datasonde deployment, nutrient/bacterial/algal sampling, and sediment chemistry and benthic community indices. Regional Water Board staff issued a letter to SCWA on April 1, 2014, detailing the Regional Water Board's requirements for a water quality monitoring plan. A final water quality monitoring and reporting plan (WQMRP) must be submitted to the Regional Water Board by July 15, 2014, for approval by the Executive Officer. The WQMRP must include the following: a. Datasonde deployment – Since the size of estuary pool will increase at times under the new estuary management, it is expected that there will be an increase in shallow over-bank habitat along the new shoreline. Diel water temperature, dissolved oxygen, and pH levels in these expanded littoral regions should be evaluated for impacts to the COLD beneficial use during target water surface elevations. Sampling will	March 31: Draft Annual Adaptive Management Plan

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region (continued)	consist of vertical profiles in shallow water areas to characterize lagoon backwater areas. b. Stage measurements – The river reach near Monte Rio is expected to be affected by the backwater effects under the new estuary management. An additional water level measurement station should be placed in this river reach to evaluate when backwater effect on water quality conditions at stations sampled in the reach. c. Bacteria Sampling i. Duncans Mills and Bridgehaven stations should be replaced with public beach access locations at Patterson Point Preserve and Vacation Beach. ii. The monitoring plan should specify that the USEPA (2012) Beach Action Value for *E .coli* bacteria concentration (i.e., 235 MPN/100mL) will be used to determine if sampling should proceed the next day. iii. Water samples should be diluted when higher concentrations of bacteria are expected so that the results are not censored. iv. Assessment of the human-host *Bacteroides* bacteria levels should also be conducted to determine if the new estuary management increases a threat to public health from human sources. Quantifiable levels of human-host *Bacteroides* bacteria indicate recently deposited human waste. The assessment should be conducted at the public recreation beaches (i.e., Monte Rio, Patterson Point Preserve, and Vacation Beach) during the lagoon management period when the estuary is closed and the beaches are inundated. The Sonoma County Public Health Laboratory (as well as other labs) has the capability to quantify human-host *Bacteroides* bacteria that indicate recently deposited human waste. d. Algal sampling – Since the size of estuary pool will increase at times under the new estuary management, it is expected that there will be an increase in shallow over-bank habitat along the new shoreline. The larger areas of shallow habitat will provide additional habitat substrate for periphytic algal mats. The spatial extent of these algal mats and the resulting impact under the new estuary management should be evaluated. In addition, an evaluation of possible cyanobacteria within the periphytic algal mats should be conducted, and if found, the possibility of cyanotoxins should be evaluated. e. A Quality Assurance Project Plan (QAPP) needs to be submitted with the final WQMRP (i.e., EPA/240/B-01/003). 5. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Water Code section 13330 and title 23, California Code of Regulations, section 3867. 6. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to title 23, California Code of Regulations, section 3855, subdivision (b) and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region (continued)	7. The validity of this certification is conditioned upon total payment of any fee required under title 23, California Code of Regulations, section 3833, and owed by the applicant. 8. Regional Water Board staff shall be notified in writing at least five working days, when conditions allow, prior to the commencement of ground disturbing activities, or as soon as possible prior to or upon initiating ground disturbing activities, with details regarding the construction schedule, in order to allow staff to be present onsite during construction, and to answer any public inquiries that may arise regarding the project. 9. No debris, soil, silt, sand, bar, slash, sawdust, cement or concrete washings, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, other than that authorized by this Order, shall be allowed to enter into or be placed where it may be washed by rainfall into waters of the state. When operations are completed, any excess material or debris shall be removed from the work area. 10. All activities and best management practices (BMPs) shall be implemented according to the submitted application and the conditions in this certification. BMPs for erosion, sediment, and turbidity control shall be implemented and in place at commencement of, during, and after any ground clearing activities or any other project activities that could result in erosion or sediment discharges to surface water. 11. In accordance with state and federal laws and regulations, the applicant is liable and responsible for the proper disposal for project-generated waste. When handling, transporting, and disposing of project-generated waste, the applicant and their contractors shall comply with all applicable state and federal laws and regulations. When disposing of project-generated waste offsite, the applicant and its contractors shall: a. Make appropriate arrangements to dispose of the material, including, but not limited to, property owner agreements, permits, licenses, and environmental clearances; b. Obtain satisfactory evidence that the work in 11.a has been completed; and c. Obtain a dated, signed manifest from the disposal site owner, or authorized representative, that identifies the type and quantity of disposed waste. 12. The applicant shall prioritize the use of wildlife-friendly, biodegradable (not photo- degradable) erosion control products wherever feasible. The applicant shall not use or allow the use of erosion control products that contain synthetic materials within waters of the United States or waters of the state at any time. The applicant shall not use or allow the use of erosion control products that contain synthetic netting for permanent erosion control (i.e. erosion control materials to be left in place for two years or more after the completion date of the project). If the applicant finds that erosion control netting or products	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region (continued)	have entrapped or harmed wildlife, personnel shall remove the netting or product and replace it with wildlife-friendly biodegradable products. The applicant shall request approval from the Regional Water Board if an exception from this requirement is needed for a specific location. 13. Disturbance or removal of existing vegetation shall not exceed the minimum necessary to complete the project. 14. If, at any time, an unauthorized discharge to surface water (including wetlands, lakes, rivers, or streams) occurs, or any water quality problem arises, the associated project activities shall cease immediately until adequate BMPs are implemented including stopping work. The Regional Water Board shall be notified promptly and in no case more than 24 hours after the unauthorized discharge or water quality problem arises. 15. Fueling, lubrication, maintenance, storage, and staging of vehicles and equipment shall not result in a discharge or threatened discharge to any waters of the state including dry portions of the shoreline. At no time shall the applicant or its contractors allow use of any vehicle or equipment that leaks any substance that may impact water quality. 16. Prior to implementing any change to the project that may have a significant or material effect on the findings, conclusions, or conditions of this Order, the applicant shall obtain the written approval of the Regional Water Board executive officer. If the Regional Water Board is not notified of a significant alteration to the project, it will be considered a violation of this Order, and the applicant may be subject to Regional Water Board enforcement actions. 17. The Regional Water Board may add to or modify the conditions of this Order, as appropriate, to implement any new or revised water quality standards and implementation plans adopted and approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act. 18. The applicant shall provide Regional Water Board staff access to the project site to document compliance with this certification. 19. In the event of any violation or threatened violation of the conditions of this Order, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under applicable state or federal law. For the purposes of section 401 (d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties, process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this Order. In response to a suspected violation of any condition of this certification, the State Water Board may require the holder of any federal permit or license subject to this Order to furnish, under penalty of perjury, any technical or monitoring reports the State Water Board deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In response to any violation of the conditions of this Order, the Regional Water	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region (continued)	Board may add to or modify the conditions of this Order as appropriate to ensure compliance. 20. The applicant shall provide a copy of this Order and State Water Board Order 2003- 0017-DWQ to any contractor(s), subcontractor(s), and utility company(ies) conducting work on the project, and shall require that copies remain in their possession at the work site. The applicant shall be responsible for ensuring that all work conducted by its contractor(s), subcontractor(s), and utility companies is performed in accordance with the information provided by the applicant to the Regional Water Board. 21. In the event of any change in control of ownership of land presently owned or controlled by the Applicant, the Applicant shall notify the successor-in-interest of the existence of this Order by letter and shall forward a copy of the letter to the Regional Water Board at the above address. To discharge dredged or fill material under this Order, the successor-in-interest must send to the Regional Water Board Executive Officer a written request for transfer of the Order. The request must contain the requesting entity's full legal name, the state of incorporation if a corporation, and the address and telephone number of the person(s) responsible for contact with the Regional Water Board. The request must also describe any changes to the Project proposed by the successor- in-interest or confirm that the successor-in-interest intends to implement the Project as described in this Order. Except as may be modified by any preceding conditions, all certification actions are contingent on: a) the discharge being limited to and all proposed mitigation being completed in strict compliance with the Applicant's Project description, and b) compliance with all applicable requirements of the Water Quality Control Plan for the North Coast Region (Basin Plan). 22. Except as may be modified by any preceding conditions, all certification actions are contingent on a) the discharge being limited to and all proposed mitigation being completed in strict compliance with the applicant's project description, and b) compliance with all applicable requirements of the Water Quality Control Plan for the North Coast Region (Basin Plan). 23. The authorization of this certification for any dredge and fill activities expires on May 14, 2019. Conditions and monitoring requirements outlined in this Order are not subject to the expiration date outlined above, and remain in full effect and are enforceable.	

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Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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California Coastal Commission Coastal Development Permit (CDP 2-01-033) – May 15, 2002 Amend. Extension (2-01-033-1A) – June 14, 2010 Monthly Extensions (January - June 2011) Emergency CDP (2-12-002-G) –January 9, 2012 New CDP Application Submitted – January 23, 2012 Application deemed complete – July 9, 2012 Emergency CDP (2-13-005-G) –February 21, 2013 Emergency CDP (2-13-005-G) –February 21, 2013 Emergency CDP (G-2-13-0221) –October 15, 2013 CDP (2-12-004) February 26, 2014 Expiration-August 15, 2016	**SPECIAL CONDITIONS:** This permit is granted subject to the following special conditions: 1. **Approved Project.** Subject to these standard and special conditions (including modifications to the project, mitigation measures, and/or the project plans required by them), this CDP authorizes implementation of the Russian River Estuary Management Project and related jetty study, including 1) a new program that would implement a lagoon outlet channel during the lagoon management season, from May 15th to October 15th, 2) sand bar breaching from October 16th to May 14th and necessary from May 15th to October 15th to minimize flooding, and 3) a geotechnical evaluation of a relic jetty at the river mouth, all as more specifically described in the proposed project materials (see Appendices A and B and Exhibits 2, 3, and 7). 2. **Construction Plan.** PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit two copies of a Construction Plan (the Plan) to the Executive Director for review and written approval. The Plan shall, at a minimum, include the following: a. **Construction Areas.** The Construction Plan shall identify the specific location of all construction areas, all staging areas, and all construction access corridors in site plan view. All such areas within which construction activities and/or staging are to take place shall be	August 15: Annual Report for CDP (2-12-004)

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California Coastal Commission (continued)	minimized to the maximum extent feasible in order to have the least impact on public access and adjacent biological resources as well as to maintain best management practices (BMPs) to protect coastal dune and marine resources on-site and in the surrounding area, including by using offsite areas for staging and storing construction equipment and materials, as feasible. In addition, all construction areas shall avoid sensitive dune plant species, including Tidestrom's lupine, as required in subsection (c), below. The placement of the piezometers shall occur no closer than fifty feet from the sensitive dune plant habitat (as outlined in Exhibit 3 – Jetty Study Location, Detail, and Photos). Construction (including but not limited to construction activities, and materials and/or equipment storage) is prohibited outside of the defined construction, staging, and storage areas. b. **Construction Methods and Timing.** The plan shall specify the construction methods to be used, including all methods to be used to keep the construction areas separated from sensitive coastal dune and marine resources and public recreational use areas (including using unobtrusive fencing (or equivalent measures) to delineate construction areas). All work shall take place during daylight hours and all lighting of the beach, river, and dune habitat is prohibited. c. **Dune Plants Avoidance.** The plan shall include methods to avoid impacts to sensitive dune plant species, including Tidestrom's lupine. All sensitive species shall be avoided during construction, including through locating the defined construction areas required in subsection (a) away from such species (as generally depicted on Exhibit 3 – Jetty Study Location, Detail, and Photos). Furthermore, the sensitive dune plant habitat shall be fenced off during the two weeks wherein the instruments are being placed and the seismic work is occurring. For the duration of the project, markers identifying the boundaries of the sensitive dune plant habitat shall remain in place. A monitor shall be on site during instrument placement, testing, and removal to ensure that project activities occur within the defined construction, staging, and storage areas and outside of the sensitive dune plant habitat. d. **Best Management Practices.** The plan shall clearly identify all BMPs to be implemented during construction and their location. Contractors shall ensure that work crews are carefully briefed on the importance of observing the appropriate precautions and reporting and cleanup of accidental spills. Construction contracts shall contain appropriate penalty provisions, sufficient to offset the cost of retrieving or cleaning up improperly contained foreign materials. e. **Construction and Instrument Noise Level Restrictions.** Noise generated by any instrument driving or hammer strike activities shall be minimized to the maximum extent practicable. Underwater noise shall not exceed an accumulated 187 dB SEL as measured 10 meters from the source. At no time shall peak dB SEL rise above 206 at 10 meters from the source. Furthermore, the Applicants shall limit activities at the site that involve the use of heavy equipment to between local sunrise to local sunset. f. **Construction Site Documents.** The plan shall provide that copies of the signed CDP and the approved Construction Plan be maintained in a conspicuous location at the construction job site	

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California Coastal Commission (continued)	at all times, and that such copies are available for public review on request. All persons involved with the construction shall be briefed on the content and meaning of the coastal development permit and the approved Construction Plan, and the public review requirements applicable to them, prior to commencement of construction. g. **Construction Coordinator.** The plan shall provide that a construction coordinator be designated to be contacted during construction should questions arise regarding the construction (in case of both regular inquiries and emergencies), and that their contact information (i.e., address, phone numbers, etc.) including, at a minimum, a telephone number that will be made available 24 hours a day for the duration of construction, is conspicuously posted at the job site where such contact information is readily visible from public viewing areas, along with indication that the construction coordinator should be contacted in the case of questions regarding the construction (in case of both regular inquiries and emergencies). The construction coordinator shall record the name, phone number, and nature of all complaints received regarding the construction, and shall investigate complaints and take remedial action, if necessary, within 24 hours of receipt of the complaint or inquiry. In addition, all construction personnel shall be trained in proper material handling, cleanup, and disposal procedures. h. **Notification.** The Permittee shall notify planning staff of the Coastal Commission's North Central Coast District Office at least three working days in advance of commencement of construction, and immediately upon completion of construction. i. **Property Owner Consent.** The plan shall be submitted with evidence indicating that the owners of any properties on which construction activities are to take place, including properties to be crossed in accessing the site, consent to such use of their properties. Minor adjustments to the above construction requirements may be allowed by the Executive Director in the approved Construction Plan if such adjustments: (1) are deemed reasonable and necessary; and (2) do not adversely impact coastal resources. All requirements above and all requirements of the approved Construction Plan shall be enforceable components of this CDP. The Permittee shall undertake construction in accordance with the approved Construction Plan. 3. **Mitigation Monitoring Plan.** The project shall be conducted in compliance with the requirements of the Mitigation Monitoring Plan, dated August 17, 2011 (see Appendix B), except where the terms and conditions of this CDP require actions more protective of coastal resources. 4. **Marin e Mammal Avoidance and Monitoring.** To the maximum extent feasible, all work shall avoid the river mouth area where seal haul out is typically located (see Exhibit 4 – Pinniped Haul Outs). In addition, all work shall be conducted consistent with the NMFS and NOAA-approved seal haul out plan described in the Incidental Harassment Authorization (April 2013) (IHA) and any updates to this IHA. Project activities shall comply with all mitigation, monitoring and reporting requirements contained in the IHA, including the following requirements as outlined in the IHA:	

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California Coastal Commission (continued)	a. **Avoid Sudden Flushes.** Permittee crews shall cautiously approach the haul-out ahead of heavy equipment to minimize the potential for sudden flushes, which may result in a stampede. Crews on foot shall make an effort to be seen by seals from a distance, if possible, rather than appearing suddenly at the top of the sand bar, again preventing sudden flushes. Boats operating near river haul-outs during monitoring shall be kept within posted speed limits and driven as far from the haul-outs as safely possible to minimize flushing seals. b. **Avoid Haul-Out.** Permittee crews shall avoid walking or driving equipment through the seal haul-out. Physical and biological monitoring at the haul-out location shall not be occur if a pup less than one-week old is present at the monitoring site or on a path to the site. c. **Monitoring From Bluff.** During breaching events, all monitoring shall be conducted from the overlook on the bluff along Highway 1 adjacent to the haul-out in order to minimize potential for harassment. d. **Disturbance Recovery.** The Permittee shall maintain a one-week no-work period between water level management events (unless flooding is an immediate threat) to allow for an adequate disturbance recovery period. During the no-work period, equipment must be removed from the beach. e. **Equipment BMPs.** All equipment shall be driven slowly on the beach and care shall be taken to minimize the number of shutdowns and start-ups when equipment is on the beach. All work shall be completed as efficiently as possible, with the smallest amount of heavy equipment possible, to minimize disturbance of seals at the haul-out. f. **Haul-out Maintained.** The Permittee shall conduct seal counts at the Jenner seal haul-out and at nearby coastal and river haul-outs in accordance with methods described in the Russian River Management Activities Pinniped Monitoring Plan (Pinniped Monitoring Plan), dated September 9, 2009, or as updated by requirements of NMFS under the Marine Mammal Protection Act (MMPA). If monitoring during the lagoon management period indicates decreases in overall use at the Jenner haul-out are correlated with increases in use at the three closest haul-outs, then the Permittee shall consult with the Executive Director, NMFS and CDFW to modify the Estuary Management Plan activities such that the haul-out site is maintained. Proposed alterations to the approved Estuary Management Plan shall be reported to the Executive Director. No alterations to the approved Estuary Management Plan shall occur without an approved amendment to this CDP, unless the Executive Director determines that no amendment is legally required. 5. **Public Acc ess Management Plan.** PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit two copies of a public access management plan (Public Access Plan) to the Executive Director for review and approval. The Public Access Plan shall clearly describe the manner in which public access at the project site is to be protected, with the objective of avoiding any adverse impacts to public access at Goat Rock, Sonoma Coast State Beach. The Public Access Plan shall be consistent with all other terms and conditions of this CDP, and shall at a minimum include the following:	

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Agency / Permit / Expiration	Special Conditions	Report Due Date
California Coastal Commission (continued)	**a. No Disruption of Public Access.** Development under this CDP that blocks access to the beach at the project site shall be prohibited. Temporary signs shall warn the public of construction while construction activities are underway. Signs shall direct the public to safe access routes during construction activities. Signs shall not discourage public access. Signs shall notify beach users of channel conditions, potential for safety hazards from beach erosion or hydrologic action, and emergency contact information. Signs shall be posted and maintained at key locations, such as the parking lot at Goat Rock State Beach Parking lot, the unofficial beach access trail located on the north side of the beach off Highway 1, and 100 feet on either side of the outlet channel. **b. Peak Public Access Times Avoided.** Project activities shall occur Monday through Thursday only, to avoid impacts to park visitors during peak visitation times (Friday through Sunday). All requirements above and all requirements of the approved Public Access Plan shall be enforceable components of this CDP. The Permittee shall undertake development in accordance with the approved Public Access Plan, which shall govern all general public access to the site pursuant to this CDP. **6. Monitoring Plan.** PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit two copies of a Flood Analysis, Habitat and Water Quality Monitoring Plan (Monitoring Plan) to the Executive Director for review and approval. The Flood Analysis portion of the Monitoring Plan shall identify avoidance and mitigation measures as detailed in Special Condition 6(a). The Habitat Monitoring portion of the Monitoring Plan shall cover all approved project activities, and shall evaluate project effectiveness and alternatives as detailed in Special Condition 6(b). The Water Quality Monitoring portion of the Monitoring Plan shall direct management actions in response to water quality conditions and as detailed in Special Condition 6(c). The primary objective of the Monitoring Plan shall be to ensure that approved project activities protect and enhance project area habitats while also protecting development from flooding and enhancing water quality, and shall be measured against a clearly defined project baseline, which shall be provided in the Monitoring Plan. The Monitoring Plan shall be based upon an adaptation framework where lessons learned from approved project activities and monitoring are applied through adaptive changes designed to better achieve the primary objective over the course of this authorization. The Monitoring Plan shall include all monitoring components of the BO and the FEIR for the project, and shall include, at minimum, the following: **a. Flood Analysis.** The Permittee shall continue to coordinate with NMFS and work with property owners affected by flooding to identify measures that would, if necessary, substantially minimize or avoid any damages to existing structures that would occur as a result of increasing water elevations in the lagoon pursuant to the approved project. As appropriate and indicated in the BO, the Permittee shall continue to survey properties within the estuary's maximum water elevation in greater detail to more accurately and precisely determine the elevation of the structures potentially at risk; this information shall be kept on record by the Permittee and a copy shall be provided to each of the property owners. A detailed account of individual properties and development of these properties for each foot of estuary water surface elevations shall be	

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Coastal Commission (continued)	provided. The range of options available to protect affected developments, other than breaching or controlling water levels in the estuary, including relocating, elevating, or reinforcing structures, shall be provided. At a minimum, and evaluation of the effects of flood levels at 4.5, 7, and 9 feet shall be so evaluated. b. **Habitat Monitoring.** Monitoring shall be conducted consistent with the BO to provide information on (1) the ways in which the project results in benefits to juvenile steelhead and/or adverse impacts to other salmonids, (2) whether a controlled outlet program can achieve optimal lagoon elevations, and (3) whether habitat improvements would result if no breaching occurred, water levels were allowed to be higher than current management, a larger estuary was formed, and low-lying development within the historic estuary footprint were flooded. A geotechnical study shall be conducted prior to December 31, 2014 to contribute to a determination as to what modifications to/removal of the jetty infrastructure would optimize seepage through the sand barrier and allow estuary levels to rise to a maximum elevation without the sand bar manipulation. An evaluation of the need for additional monitoring wells and frequency of water level data needed to adequately characterize seepage through the sand bar and jetty shall be conducted at the commencement of the geotechnical work so that reliable information is assured to be included in the study. c. **Water Quality Monitoring.** The water quality monitoring data collected for the 2008 BO, the Temporary Urgency Change Petition's surface water sampling program, and the Stipulated Judgment's sediment sampling requirement shall be integrated under the direction of an independent water quality professional. These data collection programs shall be linked and coordinated so that they provide a cohesive and useful data set that can be used to evaluate the low velocity lagoon outlet channel and whether or not it is successful in sustaining raised water elevations and improved water quality conditions in the estuary. At a minimum, the Plan shall specify the water quality analyses, sampling locations, sampling frequency, quality control and data reporting that will be used to assess water quality impacts of implementing the Russian River Estuary Management Program Adaptive Management Plan. In addition, the Water Quality Monitoring Plan shall include sampling for the following constituents, at a minimum, temperature, salinity, pH, nutrients, chlorophyll, and bacteria indicators used to assess human health impacts consistent with the most up-to date methods and standards required by the North Coast Regional Water Quality Control Board (NCRWQCB). Monitoring shall occur weekly during the Lagoon Management Period at the locations that are currently included in the Russian River Water Quality Summary for the Sonoma County Water Agency 2012 Temporary Urgency Change. Finally, the Plan shall include a contingency to increase sampling frequency to daily if the bacteria indicators exceed the operative standards required by the NCRWQCB and monitoring shall continue daily until measurements are below the operative standards. If the operative standards are exceeded, the Permittee will immediately inform the NCRWQCB and Sonoma County Public Health and seek direction on whether warning signs should be posted at the affected beaches regarding a potential health threat and consult with NCRWQCB and Sonoma County Public Health to determine if mechanical breaching is a recommended action to reduce the threat to public health.	

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California Coastal Commission (continued)	d. **Monitoring Reports.** The Monitoring Plan shall provide for submission of annual reports of monitoring results to the Executive Director for review and approval for as long as activities are authorized by this CDP, with the first annual monitoring report due on August 15, 2014, and subsequent reports due on August 15th of each year thereafter. Each monitoring report shall be cumulative and shall summarize all previous results. Each report shall clearly document conditions in the project area related to project implementation, including in narrative (with supporting monitoring data) and through photographs taken from the same fixed points in the same directions each year, all commencing from the project baseline. Each report shall include a performance evaluation section where information and results from the monitoring program are used to evaluate the effect of project implementation with respect to flooding, habitat, and water quality impacts, both beneficial and detrimental. To allow for an adaptive approach, each report shall also include a recommendations section to address changes that may be necessary in light of monitoring results and/or other information, including with respect to more current data and/or species information related to the habitat areas in question, if any. Actions necessary to implement the recommendations shall be implemented within 30 days of Executive Director approval of each Monitoring Report, unless the Executive Director identifies a different time frame for implementation. Minor adjustments to the above monitoring requirements may be allowed by the Executive Director in the approved Monitoring Plan if such adjustments: (1) are deemed reasonable and necessary; and (2) do not adversely impact coastal resources. All requirements above and all requirements of the approved Monitoring Plan shall be enforceable components of this CDP. The Permittee shall undertake development in accordance with the approved Monitoring Plan. 7. **Assumption of Risk.** By acceptance of this CDP, the Permittee acknowledges and agrees, on behalf of itself and all successors and assigns: a. **Coastal Hazards.** That the site is subject to coastal hazards including but not limited to episodic and long-term shoreline retreat and coastal erosion, high seas, ocean waves, storms, tsunami, tidal scour, coastal flooding, and the interaction of same; b. **Assume Risks.** To assume the risks to the Permittee and the property that is the subject of this permit of injury and damage from the above-identified coastal hazards in connection with this permitted development; c. **Waive Liability.** To unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from the above-identified hazards; d. **Indemnification.** To indemnify and hold harmless the Coastal Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such	

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California Coastal Commission (continued)	claims), expenses, and amounts paid in settlement arising from any injury or damage due to the above-identified coastal hazards. 8. **Sand Bar Breaching L imitation**. Except under conditions requiring immediate action to prevent or mitigate loss or damage to life, health, property, or essential public services, the sand bar breaching activities authorized by the CDP shall not be initiated on or within 36 hours prior to any weekend or State holiday. 9. **CD P Term**. Development authorized by this CDP is valid for three (3) years from the date of Commission approval (until August 15, 2016). One request for an additional three-year period of development authorization may be accepted, reviewed and approved by the Executive Director for a maximum total of six (6) years of development authorization, provided the request would not alter the project description and/or require modifications of conditions due to new information or other changed circumstances. The request for an additional three-year period of development authorization shall be made at least 120 days prior to August 15, 2016. If the request for an additional three-year authorization period would alter the project description and/or require modifications of conditions due to new information or other changed circumstances, an amendment to this CDP shall be necessary to authorize development beyond August 15, 2016. If the Permittee submits a request/application to continue estuary management (including breaching and other activities intended to control water elevations) beyond August 15, 2016, such request/application shall be accompanied by a project alternatives analysis that, at minimum, provides a survey of potential flooding risks to properties within the estuary up to a water elevation of 14 feet, or the maximum water elevation known to occur, whichever is higher, to precisely determine the elevation of the structures potentially at risk. In addition, the analysis shall include an evaluation of the range of options available to protect against identified flooding risks, other than breaching or controlling water levels in the estuary, including relocating, elevating, or reinforcing structures. Such analysis shall also include an evaluation of the range of options available to modify or remove the jetty to reduce or eliminate the need for breaching. 10. **Other Agency Approval**. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit to the Executive Director written evidence that all necessary permits, permissions, approvals, and/or authorizations for the approved project have been granted by Sonoma County, the North Coast Regional Water Quality Control Board, California State Lands Commission, California Department of Parks and Recreation, California Department of Fish and Wildlife, National Marine Fisheries Service, U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service or that no such permits or approvals are necessary. Any changes to the approved project required by these agencies shall be reported to the Executive Director. No changes to the approved project shall occur without a Commission amendment to this CDP unless the Executive Director determines that no amendment is necessary. 11. **Liability for Costs and Attorneys' Fees.** By acceptance of this CDP, the Applicant/Permittee agrees to reimburse the Coastal Commission in full for all Coastal Commission costs and attorneys'	

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California Coastal Commission (continued)	fees (including (1) those charged by the Office of the Attorney General, and (2) any court costs and attorneys' fees that the Coastal Commission may be required by a court to pay) that the Coastal Commission incurs in connection with the defense of any action brought by a party other than the Applicant/Permittee against the Coastal Commission, its officers, employees, agents, successors and assigns challenging the approval or issuance of this CDP. The Coastal Commission retains complete authority to conduct and direct the defense of any such action against the Coastal Commission.	

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US Army Corps of Engineers, San Francisco District Section 404 & Section 10, Individual Permit (285610N) - July 22, 2005 Permit Modification - October 5, 2009 Time Extension January 5, 2011 Time Extension December 8, 2011 Time Extension December 10, 2012 Time Extension December 10, 2013 Section 404 & Section 10, Individual Permit (2004- 285610N) – April 1, 2014 Expiration - December 31, 2023	SPECIAL CONDITIONS: 12. To remain exempt from the prohibitions of Section 9 of the Endangered Species Act, the non-discretionary Terms and Conditions for incidental take of federally-listed Species shall be fully implemented as stipulated in the Biological Opinion entitled, *"Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Conh·ol and Water Conservation Improvement District in the Russian River Watershed,"* also known as the Russian River Biological Opinion, (NMFS File No. 151422SWR2000SRI50) dated September 24, 2008. Project authorization under this permit is conditional upon compliance with the mandatory terms and conditions associated with incidental take. Failure to comply with the terms and conditions for incidental take, where a take of a federally-listed species occurs, would constitute an unauthorized take and non-compliance with the authorization for your project. The NMFS is, however, the authoritative federal agency for determining compliance with the incidental take statement and for initiating appropriate enforcement actions or penalties under the Endangered Species Act. 13. SCWA shall provide USACE a copy of the approved Estuary Monitoring Plan and all subsequent Annual Monitoring Reports required by the Biological Opinion. 14. Unless otherwise approved, authorized discharges of dredged material on the sandbar below the high tide line shall consist only of the native sand excavated from the pilot channel. 15. SCWA shall provide USACE a Breaching Activities Report by 31 March for each year of the ten-year permit authorization period. Each Breaching Activities Report shall present a tabulation of the breaching events that occurred during the preceding year, including the approximate estuary closure date, the approximate number of estuary closure days occurring before the breach event, the breaching event date, and the recorded estuary water level of the breaching event date. 5. The current Coastal Development Permit (CDP 2-12-004) issued by the California Coastal Commission expires on 15 August 2016. The current Section 401 water quality certification (WDID No. IB04001WNSO) issued by the Regional Water Quality Control Board expires on 31 December 2015. SCWA shall obtain requisite time extensions for the Coastal Development Permit and water quality certification prior to the commencement of any work to be performed during the remainder of the ten-year Department of the Army permit authorization period. SCWA shall provide USACE a copy of all requisite time extensions to ensure continuing project conformance with State coastal zone and water quality standards.	March 31: Annual Breaching Report

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California Environmental Quality Act Environmental Impact Report (EIR) Notice of Preparation – May 10, 2010 Notice of Completion – December 15, 2010 Notice of Determination – August 16, 2011	See EIR for Mitigation Measures.	None

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California State Lands Commission General Lease, Public Agency Use (PRC 7918.1 R 08103) – June 29, 2004 Lagoon Outlet Channel Authorization – October 13, 2009 (Expiration - December 31, 2010) Monthly Extensions - January 1 to December 31, 2011 General Lease, Public Agency Use (PRC 7918.9) – January 1, 2012 Expiration – May 15, 2015	1. Lessee certified an Environmental Impact Report on August 16, 2011 for the proposed activities authorized in this Lease. Lessee acknowledges that, on September 14, 2011, a lawsuit was filed by the Russian River Watershed Protection Committee against Lessee in the Superior Court of the County of Sonoma alleging that the EIR is inadequate under the California Environmental Quality Act and certification of the EIR be vacated (Case SCV-250347). Notwithstanding any other provisions of this Lease, Lessee further acknowledges that, if certification of the EIR is vacated, the lease shall terminate within 30 days after the EIR is ruled in invalid. 2. Lessee shall comply with all mitigation measures contained in the Mitigation Monitoring Program prepared and adopted by the Sonoma County Water Agency on August 16, 2011. 3. Lessee acknowledges that the land described in Exhibit A of this Lease is subject to the Public Trust and is presently available to members of the public for recreation, waterborne commerce, navigation, fisheries, open space, or other recognized Public Trust uses and that Lessee's proposed construction activities and use of the Lease Premises shall not interfere or limit the Public Trust rights of the public. At least 24 hours prior to and during the breaching activities, Lessee will contact the California Department of Parks and Recreation lifeguards and post signs and barriers to minimize potential hazards to the public. 4. Prior to the start of the initial freshwater lagoon construction on the Lease Premises, Lessee shall submit to Lessor copies of all permits and authorizations from agencies having jurisdiction over the construction of the authorized activities on the Lease Premises. Lessee shall maintain all regulatory permits and authorization required during the term of the lease. 5. All breaching activities shall be carried out in accordance with all applicable safety regulations, permits, and conditions of all other agencies. 6. During the term of the lease, Lessee shall provide Lessor with an annual report on frequency and timing of outlet channel construction and maintenance and breaching occurrences completed each calendar year, including number of days of closure of Goat Rock State Beach. The report should include narrative descriptions and evaluations of outlet channel and breaching events, including any adaptive management changes implemented. 7. Lessee shall submit to Lessor copies of the following: a. Adaptive estuarine water level and barrier beach management plans (as described in 2.1.1 of the Russian River Biological Opinion) after approval by the National Marine Fisheries (NMFS), the California Department of Fish and Game, and the U.S. Army Corps of Engineers.	No Date: Annual Water Quality Data Summary Reports; Annual Report for Russian River Estuary Management Activities Monitoring Plan

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California State Lands Commission (continued)	b. Annual water quality data summary reports (as described in 2.2, Monitoring Estuarine Water Quality: Reporting and Review, of the Biological Opinion). c. Annual report, as specified in the "Russian River Estuary Management Activities Pinniped Monitoring Plan" and distributed to NMFS, the California Department of Parks and Recreation, and the Stewards of the Coasts and Redwoods, on pinnipeds' reaction to the proposed activities authorized in this Lease. 8. All personal property, tools, or equipment taken onto or placed upon the Lease Premises shall remain the property of the Lessee or its contractors. Such personal property shall be promptly removed by the Lessee, at its sole risk and expense upon the completion of the project. Lessor does not accept any responsibility for any damage, including damages to any personal property, including any equipment, tools, or machinery on the Lease Premises 9. No refueling, repairs, or maintenance of vehicles or equipment will take place on the Lease Premises. 10. Lessee shall maintain a logbook on all work vessels during work within the Lease Premises utilized in operations conducted under this Lease to keep track of all debris created by objects of any kind that may fall into the water. The logbook should include the type of debris, date, time and location to facilitate identification and location of debris for recovery and site clearance verification. All debris shall be promptly removed from the Lease Premises. 11. Any equipment to be used on the Lease Premises is limited to that which is directly required to perform the authorized use and does not include any equipment that may cause damage to the Lease Premises.	

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California State Lands Commission (continued)	12. Lessee acknowledges and agrees: a. The site may be subject to hazards from natural geophysical phenomena including, but not limited to waves, storm waves, tsunamis, earthquakes, flooding and erosion. b. To assume the risks to the Lessee and to the property that is the subject of any Coastal Development Permit (CDP) that is issued to Lessee for development on the leased property, of injury and damage from such hazards in connection with the permitted development and use. c. To unconditionally waive any claim or damage or liability against the State of California, its agencies, officers, agents, and employees for injury or damage from such hazards. d. To indemnify, hold harmless and, at the option of Lessor, defend the State of California, its agencies, officers, agents, and employees, against and for any and all liability, claims, demands, damages, injuries, or costs of any kind and from any cause (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement arising from any alleged or actual injury, damage or claim due to site hazards or connected in any way with respect to the approval of any CDP that is issued to Lessee involving this property or issuance of this Lease, any new lease, renewal, amendment, or assignment by Lessor.	

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California State Lands Commission (continued)	13. Lessor shall have the right to enter upon the property at reasonable times in order to monitor Lessee's compliance with and otherwise enforce the terms of the Lease. 14. Paragraph 9 contained within Section 3 is hereby deleted from this Lease. In the event of any conflict between the provisions of Section 2 and Section 3 of this Lease, the provisions of Section 2 shall prevail.	
California Department of Parks and Recreation Temporary Use Permit – December 30, 2003 Permit Extension – September 14, 2009 Permit Extension – December 28, 2009 Expiration – June 30, 2010 Temporary Use Permit – May 15, 2011 Time Extension – February 20, 2013 Time Extension – December 18, 2013 Expiration – December 31, 2014	**Now therefore**, the State by this Permit hereby grants to the Permittee permission to enter upon State's property, conditioned upon the agreement of the Parties that this Permit does not create or vest in Permittee any interest in the real property herein described or depicted, that the Permit is revocable and non-transferable, and that the Permit is further subject to the following terms and conditions: 1. **Project Description:** By this Permit, the State hereby grants to the Permittee permission to enter onto those lands depicted and described on Exhibit "A", Russian River Estuary Management Activities, and Exhibit "B", Russian River Estuary Outlet Channel: Excavation Cut and Fill Locations, attached hereto and herein incorporated by this reference, solely for the purpose of flood control and environmental monitoring. 2. **Permit Subject to Laws and Regulatory Agency Permits:** This Permit is expressly conditioned upon Permittee's obtaining any and all regulatory permits or approvals required by the relevant regulatory agencies for the Project and Permittee's use of the Property, and upon Permittee's compliance with all applicable municipal, state and federal laws, rules and regulations, including all State Park regulations. Prior to commencement of any work, Permittee shall obtain all such legally required permits or approvals and submit to the State full and complete copies of all permits and approvals, including documentation related to or referenced in such permits and approvals, along with the corresponding agency contact and telephone numbers, and related California Environmental Quality Act (CEQA) and/or National Environmental Policy Act (NEPA) documentation as applicable. 3. **Term of Permit:** This Permit shall only be for the period beginning on 11/15/2011, and ending on 12/31/2012, or as may be reasonably extended by written mutual agreement of the Parties. 4. **Consideration:** Permittee agrees to pay State the sum of One thousand five hundred and No/100 Dollars ($1,500.00) as consideration for the rights granted by this Permit. Payment is due upon execution of this Permit. 5. **Permit Subject to Existing Claims:** This Permit is subject to existing contracts, permits, licenses, encumbrances and claims which may affect the Property.	No Reporting Required for TUP

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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California Department of Parks and Recreation (continued)	**6. Waiver of Claims and Indemnity:** Permittee waives all claims against State, its officers, age and/or employees, for loss, injury, death or damage caused by, arising out of, or in any way connected with the condition or use of the Property, the issuance, exercise, use or implement of this Permit, and/or the rights herein granted. Permittee further agrees to protect, save, hol harmless, indemnify and defend State, its officers, agents and/or employees from any and al damage, claims, demands, costs and liability which may be suffered or incurred by State, its agents and/or employees from any cause whatsoever, arising out of, or in any way connecte this Permit, exercise by Permittee of the rights herein granted, Permittee's use of the Propert and/or the Project for which this Permit is granted, except those arising out of the sole active negligence or willful misconduct of State. Permittee will further cause such indemnification a waiver of claims in favor of State to be inserted in each contract that Permittee executes for t provision of services in connection with the Project for which this Permit is granted. **7. Contractors:** Permittee shall incorporate the terms, conditions and requirements contained when contracting out all or any portion of the work permitted hereunder. Permittee shall be responsible for ensuring contractor/subcontractor compliance with the terms and conditions contained herein. Failure of Permittee's contractors to abide by State's terms and conditions constitute default by Permittee (see Paragraph 20) allowing State to terminate this Permit an all legal remedies. **8. Insurance Requirements:** As a condition of this Permit and in connection with Permittee's indemnification and waiver of claims contained herein, Permittee shall maintain, and cause it contractors to maintain, a policy or policies of insurance as follows: Permittee shall maintain motor vehicle liability with limits of not less than $1,000,000 per a Such insurance shall cover liability arising out of a motor vehicle, including all owned, hire non-owned motor vehicles. Permittee shall maintain statutory Workers' Compensation and employer's liability insuran coverage in the amount of $1,000,000/employee/disease/each accident, for all its employ will be engaged in the performance of work on the Property, including special extensions applicable. Said policy shall include a waiver of subrogation in favor of State. If the Perm an individual or sole proprietor who is not required by law to have Workers' Compensatior insurance, Permittee shall provide State with a written confirmation that Permittee is not r to be, and has elected not to be, covered by Workers' Compensation. Permittee shall procure commercial general liability insurance at least as broad as the mo commonly available ISO policy form CG 0001 premises operations, products/completed operations, personal/advertising injury and contractual liability with limits not less than $1, per occurrence and $2,000,000 general aggregate. Said policy shall apply separately to insured against whom any claim is made or suit is brought subject to the Permittee limits liability.	

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California Department of Parks and Recreation (continued)	Each policy of insurance required by this provision shall: (a) be in a form, and written by an insurer, reasonably acceptable to State; (b) be maintained at Permittee's sole expense; and (c) require at least thirty (30) days written notice to State prior to any cancellation, non-renewal or material modification of insurance coverage. Insurance companies issuing such policies shall have a rating classification of "A-" or better and financial size category ratings of "VII" or better according to the latest edition of the A.M. Best Key Rating Guide. All Insurance companies issuing such policies shall be licensed to do business in the State of California. Such policies shall contain an endorsement naming the CALIFORNIA DEPARTMENT OF PARKS AND RECREATION as an additional insured at no cost to State. Permittee shall provide to State evidence that the insurance required to be carried by this Permit, including any endorsement affecting the additional insured status, is in full force and effect and that premiums therefore have been paid. Such evidence shall, at State's discretion, be in either the form of an ACORD Form (Certificate of Insurance) or DPR Form 169A (Certificate of Insurance for Concession Contracts/Special Events), or a certified copy of the original policy, including all endorsements. Permittee is responsible for any deductible or self-insured retention contained within the insurance program. Should Permittee fail to keep the specified insurance in effect at all times, Permittee shall be considered to be in default of this Permit, and State may, in addition to any other remedies it has, terminate this Permit.	

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California Department of Parks and Recreation (continued)	Permittee shall require and ensure that all contractors and subcontractors have adequate insurance meeting the coverage requirements in this provision. Any insurance required to be carried shall be primary and not excess to any other insurance carried by State. Coverage shall be in force for the complete term of this Permit, including any extension thereof, and for all work being done for which this Permit is required. 9. **Reservation of Rights:** State reserves the right to use the Property in any manner, provided such use does not unreasonably interfere with Permittee's rights herein. 10. **Access Limits and Conditions:** Access to the Property shall be limited to the access designated by State and is illustrated in Figure 2 of Exhibit "A" and as described below. The barrier beach would be accessed from the paved parking lot at Goat Rock State Beach, located at the end of Goat Rock Road off of Highway 1. Equipment would be off-loaded in the parking lot and driven north onto the beach via an existing access point within the parking lot. Additional detail is provided in the attached Russian River Estuary Management Activities. 11. **Notice of Work:** Any required notices to State shall be sent to the State authorities in charge of Sonoma Coast State Park named below. At least 24 hours prior to any entry upon the Property for any of the purposes hereinabove set forth, Permittee shall provide the State contact[s] named below with written notice of Permittee's intent to enter the Property. **STATE:** Contact: Brendan O'Neil Address: 25381 Steelhead Blvd. Duncans Mills, CA 95430 Tel: 707/865-2391 Fax: 707/865-2046 **PERMITTEE:** Contact: Jessica Martini-Lamb Address: 404 Aviation Blvd. Santa Rosa, CA 95403 Tel: 707/547-1903 Fax: 707/524-3782 12. **Limits of Work:** In no event shall this Permit authorize work in excess or contrary to the terms and conditions of any regulatory agency permit or approval. Under no circumstances, whether or not authorized by any regulatory agency, other permit or any person or entity other than State, shall work exceed that which is authorized by this Permit as described in the Exhibit B, Russian River Estuary Management Activities. 13. **Public Safety:** Permittee is responsible for public safety during and after the breaching operation until such time that water velocities and standing waves recede, the sandbar banks stabilize and cease to erode, cave and wash away and heavy equipment has been removed from State Park property. In the interest of public and Park visitor safety STATE reserves the right to require PERMITTEE to provide Peace Officers and/or Lifeguards, at no cost to STATE, to monitor and close the beach to the public for a distance of 750' on each side of the breach as recommended in the Russian River Estuary Study. In the interest of public safety, the preferred days for sandbar breaching are from Monday to Thursday (excluding holidays) when Park visitation is usually at a minimum. In the event of emergency situations, breaching may proceed immediately after notifying the State Park District Superintendent or their designee. 14. **Compliance with Monitoring and Mitigation Measures:** Resource monitoring and mitigation measures identified within the Russian River Estuary Management Project Final Environmental Impact Report, NMFS Biological Opinion, DFG Lake and Streambed Alteration Agreement, Regional Water Quality Control Board Section 401 Water Certification, California Coastal Commission Coastal Development Permit, US Army Corps of Engineers Section 404 and Section 10 Permit, and State Lands Commission General Lease shall be completed in accordance with and to the satisfaction of the District Superintendent or designee. Permittee's activities conducted under this Permit shall comply with all State and Federal environmental laws, including, but not limited to, the Endangered Species Act, CEQA, and Section 5024 of the Public Resources Code. Any of Permittee's archaeological consultants working within the boundaries of the Property shall obtain a permit from the California State Parks Archaeology, History & Museums Division prior to commencing any archaeological or cultural investigations of the Property.	

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California Department of Parks and Recreation (continued)	Permittee shall immediately advise State's contact person if any new site conditions are found during the course of permitted work. State will advise Permittee if any new historical resources (including archaeological sites), special status species, threatened/endangered species protocols, or other resource issues are identified within the Project site. Permittee shall abide by District Superintendent or designee's instructions to protect the resource(s) during the permitted work or risk revocation of the Permit. Permittee shall make all excavation activities on the Property available to the State Archaeologist for observation and monitoring. During excavation, the State archaeological monitor may observe and report to the State on all excavation activities. State archaeological monitor shall be empowered to stop any construction activities as necessary to protect significant cultural resources from being disturbed. In the event that previously unknown cultural resources, including, but not limited to, dark soil containing shell, bone, flaked stone, groundstone, or deposits of historic trash are encountered during Project construction by anyone, work will be suspended at that specific location, and the Permittee's work will be redirected to other tasks, until after a State-qualified archaeologist has evaluated the find and implemented appropriate treatment measures and disposition of artifacts, as appropriate, in compliance with all applicable laws and department resource directives. If human remains are discovered during the Project, work will be immediately suspended at that specific location and the District Superintendent or designee shall be notified by Permittee. The specific protocol, guidelines and channels of communication outlined by the California Native American Heritage Commission (NAHC), and/or contained in Health and Safety Code Section 7050.5 and Public Resources Code Sections 5097.9 et seq., will be followed. Those statutes will guide the potential Native American involvement in the event of discovery of human remains. Permittee shall provide a written work schedule to State so that the State archaeological monitor can arrange to be on site on the necessary days. Permittee shall provide reasonable advance notice of and invite the District Superintendent or designee to any preconstruction meetings with the prime contractor or subcontractors. 15. **Restoration of Property:** Permittee shall complete the restoration, repair, and revegetation of the Property in consultation with, and to the satisfaction of the State Environmental Scientist should any damage result from permitted activities. Restoration, repair and/or revegetation is required within 30 days after damage or as determined by the State Environmental Scientist. This obligation shall survive the expiration or termination of this Permit. 16. **Right to Halt Work:** The State reserves the right to halt work and demand mitigation measures at any time, with or without prior notice to Permittee, in the event the State determines that any provision contained herein has been violated, or in the event that cessation of work is necessary to prevent, avoid, mitigate or remediate any threat to the health and safety of the public or state park personnel, or to the natural or cultural resources of the state park. 17. **Use Restrictions:** The use of the Property by Permittee, including its guests, invitees, employees, contractors and agents, shall be restricted to the daytime hours between sunrise and sunset on a day-by-day basis, unless otherwise approved in advance in writing by State. No person shall use or occupy the Property overnight. Activities on the Property shall be conducted only in a manner which will not interfere with the orderly operation of the state park. Permittee shall not engage in any disorderly conduct and shall not maintain, possess, store or allow any contraband on the Property. Contraband includes, but is not limited to: any illegal alcoholic beverages, drugs, firearms, explosives and weapons. Permittee shall not use or allow the Property to be used, either in whole or in part, for any purpose other than as set forth in this Permit, without the prior written consent of the State. 18. **State's Right to Enter:** At all times during the term of this Permit and any extension thereof, there shall be and is hereby expressly reserved to State and to any of its agencies, contractors, agents, employees, representatives, invitees or licensees, the right at any and all times, and any and all places, to temporarily enter upon said Property to survey, inspect, or perform any other lawful State purposes. Permittee shall not interfere with State's right to enter. 19. **Protection of Property:** Permittee shall protect the Property, including all improvements and all natural and cultural features thereon, including cultural and natural resources, at all times at Permittee's sole cost and expense, and Permittee shall strictly adhere to the following restrictions:	

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California Department of Parks and Recreation (continued)	(a) Permittee shall not place or dump garbage, trash or refuse anywhere upon or within the Property, except in self-contained trash receptacles that are maintained to State's satisfaction by Permittee. (b) Permittee shall not commit or create, or suffer to be committed or created, any waste, hazardous condition or nuisance in, on, under, above or adjacent to the Property. (c) Permittee shall not cut, prune or remove any vegetation upon the Property, except as identified in the Project description and herein permitted or subsequently approved in writing by the District Superintendent. (d) Permittee shall not disturb, move or remove any rocks or boulders upon the Property, except as identified in the Project description and herein permitted or subsequently approved in writing by the District Superintendent. (e) Permittee shall not grade or regrade, or alter in any way, the ground surface of the Property, except as herein permitted, or subsequently approved in writing by the District Superintendent. (f) Permittee shall not bait, poison, trap, hunt, pursue, catch, kill or engage in any other activity which results in the taking, maiming or injury of wildlife upon the Property, except as identified in the Project description and herein permitted or subsequently approved in writing by the District Superintendent. (g) Permittee shall not use, create, store, possess or dispose of hazardous substances (as defined in the California Hazardous Substances Act) on the Property except as herein permitted, or subsequently approved in writing by the District Superintendent. (h) Permittee shall exercise due diligence to protect the Property against damage or destruction by fire, vandalism and any other causes. 20. **Default:** In the event of a default or breach by Permittee of any of the terms or conditions set forth in this Permit, State may at any time thereafter, without limiting State in the exercise of any right of remedy at law or in equity which State may have by reason of such default or breach: (a) Maintain this Permit in full force and effect and recover the consideration, if any, and other monetary charges as they become due, without terminating Permittee's right to use of the Property, regardless of whether Permittee has abandoned the Property; or (b) Immediately terminate this Permit upon giving written notice to Permittee, whereupon Permittee shall immediately surrender possession of the Property to State and remove all of Permittee's equipment and other personal property from the Property. In such event, State shall be entitled to recover from Permittee all damages incurred or suffered by State by reason of Permittee's default, including, but not limited to, the following: (i) any amount necessary to compensate State for all the detriment proximately caused by Permittee's failure to perform its obligations under this Permit, including, but not limited to, compensation for the cost of restoration, repair and revegetation of the Property, which shall be done at State's sole discretion and compensation for the detriment which in the ordinary course of events would be likely to result from the default; plus (ii) at State's election, such other amounts in addition to or in lieu of the foregoing as may be permitted from time to time by applicable law. 21. **State's Right to Cure Permittee's Default:** At any time after Permittee is in default or in material breach of this Permit, State may, but shall not be required to, cure such default or breach at Permittee's cost. If State at any time, by reason of such default or breach, pays any sum or does any act that requires the payment of any sum, the sum paid by State shall be due immediately from Permittee to State at the time the sum is paid. The sum due from Permittee to State shall bear the maximum interest allowed by California law from the date the sum was paid by State until the date on which Permittee reimburses State. 22. **Revocation of Permit:** The State shall have the absolute right to revoke this Permit for any reason upon ten (10) days written notice to Permittee. Written notice to Permittee may be accomplished by electronic or facsimile transmission, and the notice period set forth in this paragraph shall begin on the date of the electronic or facsimile transmission, or, if sent by mail, on the date of delivery. If Permittee is in breach of the Permit or owes money to the State pursuant to this Permit, any prepaid monies paid by Permittee to State shall be held and applied by the State as an offset toward	

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California Department of Parks and Recreation (continued)	damages and/or amounts owed. Nothing stated herein shall limit the State's exercise of its legal and equitable remedies. 23. **Recovery of Legal Fees:** In any action brought to enforce or interpret any provisions of this Permit or to restrain the breach of any agreement contained herein, or for the recovery of possession of the Property, or to protect any rights given to the State against Permittee, and in any actions or proceedings under Title 11 of the United States Code, if the State shall prevail in such action on trial or appeal, the Permittee shall pay to the State such amount in attorney's fees in said action as the court shall determine to be reasonable, which shall be fixed by the court as part of the costs of said action. 24. **Voluntary Execution and Independence of Counsel:** By their respective signatures below, each Party hereto affirms that they have read and understood this Permit and have received independent counsel and advice from their attorneys with respect to the advisability of executing this Permit. 25. **Reliance on Investigations:** Permittee declares that it has made such investigation of the facts pertaining to this Permit, the Property and all the matters pertaining thereto as it deems necessary, and on that basis accepts the terms and conditions contained in this Permit. Permittee acknowledges that State has made, and makes, no representations or warranties as to the condition of the Property, and Permittee expressly agrees to accept the Property in its as-is condition for use as herein permitted. 26. **Entire Agreement:** The Parties further declare and represent that no inducement, promise or agreement not herein expressed has been made to them and this Permit contains the entire agreement of the Parties, and that the terms of this agreement are contractual and not a mere recital. 27. **Warranty of Authority:** The undersigned represents that they have the authority to, and do, bind the person or entity on whose behalf and for whom they are signing this Permit and the attendant documents provided for herein, and this Permit and said additional documents are, accordingly, binding on said person or entity. 28. **Assignment:** This Permit shall not be assigned, mortgaged, hypothecated, or transferred by Permittee, whether voluntarily or involuntarily or by operation of law, nor shall Permittee let, sublet or grant any license or permit with respect to the use and occupancy of the Property or any portion thereof, without the prior written consent of State. 29. **Choice of Law:** This Permit will be governed and construed by the laws of the State of California.	

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California Department of Parks and Recreation (continued) Collections Permit – September 1, 2012 Collections Permit renewal – February 26, 2014 Expiration – February 26, 2015	PERMIT CONDITIONS: COORDINATE STUDY WITH STATE PARK STAFF. CONTACT ON PRIOR TO IMPLEMENTATION. SONOMA COAST LIFEGAURD SUPERVISOR; TIM MURPHY (TIM.MURPHY@PARKS SONOMA COAST RANGER SUPERVISOR; DAMIEN JONES (DAMIEN.JONES@PARK RUSSIAN RIVER SR. ENV. SCIENTIST; BRENDAN O'NEIL (BRENDAN.O'NEIL@PARK	No Reporting Required for Collectors Permit

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Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Incidental Harassment Authorization (IHA) - April 21, 2011 IHA (renewal) - April 21, 2012 IHA (renewal) - April 21, 2013 IHA (renewal) - April 21, 2014 Expiration – April 20, 2015	1. This Incidental Harassment Authorization (IHA) is valid from April 21 , 2014 through April20, 2015. 2. This IHA is valid only for activities associated with estuary management activities in the Russian River, Sonoma County, California, including: (a) Lagoon outlet channel management; (b) Artificial breaching of barrier beach; (c) Geophysical surveys and other work associated with a jetty study; and (d) Physical and biological monitoring of the beach and estuary as required. 3. General Conditions (a) A copy of this IHA must be in the possession of SCW A, its designees, and work crew personnel operating under the authority of this IHA. (b) SCWA is hereby authorized to incidentally take, by Level B harassment only, 3,880 harbor seals *(Phoca vitulina richardii),* 42 California sea lions *(Zalophus californianus californianus),* and 42 northern elephant seals *(Mirounga angustirostris).* (c) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in condition 3(b) of the IHA or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA. (d) If SCWA observes a pup that may be abandoned, it shall contact the National Marine Fisheries Service (NMFS) West Coast Regional Stranding Coordinator immediately (562-980-3230; Justin.Viezbicke@noaa.gov) and also report the incident to NMFS Office of Protected Resources (301-427-8425; Benjamin.Laws@noaa.gov) within 48 hours. Observers shall not approach or move the pup. 4. Mitigation Measures In order to ensure the least practicable impact on the species listed in condition 3(b), the holder of this IHA is required to implement the following mitigation measures:	January 20, 2015: Marine Mammal Monitoring Results Report

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Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (continued)	(a) SCWA crews shall cautiously approach the haul-out ahead of heavy equipment to minimize the potential for sudden flushes, which may result in a stampede – a particular concern during pupping season. (b) SCWA staff shall avoid walking or driving equipment through the seal haul-out. (c) Crews on foot shall make an effort to be seen by seals from a distance, if possible, rather than appearing suddenly at the top of the sandbar, again preventing sudden flushes. (d) During breaching events, all monitoring shall be conducted from the overlook on the bluff along Highway 1 adjacent to the haul-out in order to minimize potential for harassment. (e) A water level management event may not occur for more than two consecutive days unless flooding threats cannot be controlled. (f) Equipment shall be driven slowly on the beach and care will be taken to minimize the number of shut-downs and start-ups when the equipment is on the beach. (g) All work shall be completed as efficiently as possible, with the smallest amount of heavy equipment possible, to minimize disturbance of seals at the haul-out. (h) Boats operating near river haul-outs during monitoring shall be kept within posted speed limits and driven as far from the haul-outs as safely possible to minimize flushing seals. In addition, SCWA shall implement the following mitigation measures during pupping season (March 15-June 30): (i) SCWA shall maintain a one week no-work period between water level management events (unless flooding is an immediate threat) to allow for an adequate disturbance recovery period. During the no-work period, equipment must be removed from the beach. G) If a pup less than one week old is on the beach where heavy machinery will be used or on the path used to access the work location, the management action shall be delayed until the pup has left the site or the latest day possible to prevent flooding while still maintaining suitable fish rearing habitat. In the event that a pup remains present on the beach in the presence of flood risk, SCWA shall consult with NMFS and CDFG to determine the appropriate course of action. SCWA shall coordinate with the locally established seal monitoring program (Stewards of the Coast and Redwoods) to determine if pups less than one week old are on the beach prior to a breaching event. (k) Physical and biological monitoring shall not be conducted if a pup less than one week old is present at the monitoring site or on a path to the site. (1) No jetty study activities shall occur in the vicinity of the harbor seal haul-out during the pupping season.	

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	5. Monitoring The holder of this IHA is required to conduct baseline monitoring and shall conduct additional monitoring as required during estuary management activities. Monitoring and reporting shall be conducted in accordance with the approved Pinniped Monitoring Plan. (a) Baseline monitoring shall be conducted twice-monthly for the term of the IHA. These censuses shall begin at dawn and continue for eight hours, weather permitting; the census days shall be chosen to ensure that monitoring encompasses a low and high tide each in the morning and afternoon. All seals hauled out on the beach shall be counted every 30 minutes from the overlook on the bluff along Highway 1 adjacent to the haul-out using high-powered spotting scopes. Observers shall indicate where groups of seals are hauled out on the sandbar and provide a total count for each group. If possible, adults and pups shall be counted separately. (b) In addition, peripheral haul-outs shall be visited for 1 0-rninute counts twice during each baseline monitoring day. (c) During estuary management events, monitoring shall occur on all days that activity is occurring using the same protocols as described for baseline monitoring, with the difference that monitoring shall begin at least one hour prior to the crew and equipment accessing the beach work area and continue through the duration of the event, until at least one hour after the crew and equipment leave the beach. In addition, a one-day pre-event survey of the area shall be made within one to three days of the event and a one-day post-event survey shall be made after the event, weather permitting. (d) Monitoring of peripheral haul-outs shall occur concurrently with event monitoring, when possible. (e) For all monitoring, the following information shall be recorded in 30-minute intervals: i. Pinniped counts by species; ii. Behavior; iii. Time, source and duration of any disturbance, with takes incidental to SCWA actions recorded only for responses involving movement away from the disturbance or responses of greater intensity (e.g., not for alerts); iv. Estimated distances between source of disturbance and pinnipeds; v. Weather conditions (e.g., temperature, percent cloud cover, and wind speed); and vi. Tide levels and estuary water surface elevation. (f) All monitoring during pupping season shall include records of any neonate pup observations. SCWA shall coordinate with the Stewards' monitoring program to determine if pups less than one week old are on the beach prior to a water level management event.	

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	6. Reporting The holder of this IHA is required to: (a) Submit a report on all activities and marine mammal monitoring results to the Office of Protected Resources, NMFS, and the West Coast Regional Administrator, NMFS, 90 days prior to the expiration of the IHA if a renewal is sought, or within 90 days of the expiration of the permit otherwise. This report must contain the following information: i. The number of seals taken, by species and age class (if possible); ii. Behavior prior to and during water level management events; iii. Start and end time of activity; iv. Estimated distances between source and seals when disturbance occurs; v. Weather conditions (e.g., temperature, wind, etc.); vi. Haul-out reoccupation time of any seals based on post-activity monitoring; vii. Tide levels and estuary water surface elevation; viii. Seal census from bi-monthly and nearby haul-out monitoring; and ix. Specific conclusions that may be drawn from the data in relation to the four questions of interest in SCWA's Pinniped Monitoring Plan, if possible. (b) Reporting injured or dead marine mammals: i. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as an injury (Level A harassment), serious injury, or mortality, SCWA shall immediately cease the specified activities and report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS. The report must include the following information: A. Time and date of the incident; B. Description of the incident; C. Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility); D. Description of all marine mammal observations in the 24 hours preceding the incident; E. Species identification or description of the animal(s) involved; F. Fate of the animal(s); and G. Photographs or video footage of the animal(s).	

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Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
	Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with SCW A to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMP A compliance. SCWA may not resume their activities until notified by NMFS. ii. In the event that SCWA discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), SCWA shall immediately report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS. The report must include the same information identified in 6(b)(i) of this IHA. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with SCWA to determine whether additional mitigation measures or modifications to the activities are appropriate. iii. In the event that SCWA discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), SCW A shall report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. SCWA shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. IV. Pursuant to sections 6(b)(ii-iii), SCWA may use discretion in determining what injuries (i.e., nature and severity) are appropriate for reporting. At minimum, SCWA must report those injuries considered to be serious (i.e., will likely result in death) or that are likely caused by human interaction (e.g., entanglement, gunshot). Also pursuant to sections 6(b)(ii-iii), SCWA may use discretion in determining the appropriate vantage point for obtaining photographs of injured/dead marine mammals. 7. Validity of this IHA is contingent upon compliance with all applicable statutes and permits, including NMFS' 2008 Biological Opinion for water management in the Russian River watershed. This IHA may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if the authorized taking is having a more than a negligible impact on the species or stock of affected marine mammals.	

Attachment D. Russian River Barrier Beach and Estuary Water Surface Level Adaptive Management in Concert with Physical Processes

(from National Marine Fisheries Service)

Russian River Barrier Beach and Estuary Water Surface Level Adaptive Management in Concert with Physical Processes

John McKeon, National Marine Fisheries Service

To comply with NMFS' BO for adaptive management of the RR estuary, i.e., to manage the beach with the goal of conserving beach sand to allow formation of a stable low-flow season elevated outlet-channel and creating a brackish /freshwater lagoon with marine influence minimized, the Sonoma County Water Agency (SCWA) will need to balance multiple natural physical processes when carrying out flood control activities. The two primary processes to balance are: wave and longshore transport of sand into the channel, dependent on wave direction, height and steepness; and outlet channel river-flow scour determined by slope, depth and roughness. The amount of sand transported by either force is dependent on sand supply. As the channel is likely to be of sand only, the vertical elevation-controls of the outlet channel will be the sum of sand transport out of the channel at low tide by the river outflow, versus transport of sand into the channel on the incoming high tide by wave action and longshore current. As the tide lowers and rises, one of these two physical forces will predominate. Balancing the two transport mechanism rates over a 24 hr tidal cycle will be key to maintaining an over-all stable vertical outlet channel elevation and stable estuary water levels minimally influenced by tidal fluctuation. The wave-face between the low tide line and the top of the wave-face crest (height determined by wave height at high tide) will be the key area of scour and accretion during the cycle.

Calculation of scour in open flume channels is a well studied subject, with critical shear stress of when sediments are mobilized on the channel bottom a function of grain size, water velocity and depth. Velocity is determined by roughness and slope. Channel dimension, slope and roughness can be calculated for predicted flow ranges to minimize sheer stress, bed mobilization, scour, and incision of the channel. However, slope across the wave face will be determined by the beach profile where the river outflow meets the ocean. This is the likely point at which channel headcutting would begin, resulting in significant lowering of the outlet channel elevation and estuary water surface elevation (WSE). Because SCWA cannot influence the slope of the wave face beach profile, strategies to minimize scour potential are limited to: 1) choose a river channel outlet location across the wave face where the beach profile has the least slope between the low tide line and wave-face crest height, and 2) minimize depth with increased channel width across the crest of the wave face. This will both limit scour on the outgoing tide, and increase wave transport of sand into the mouth with a greater length of wave break pushing sand into the channel on high tides. Also, to limit propagation of any headcutting precipitated at low tide, the velocity in the channel above the wave face can be decreased with increased roughness and length, or the depth (and scour potential) decreased by increasing the outlet channel width. The beach size and configuration at the time of closure, and the jetty, will constrain, and in part determine, these three channel characteristics.

However, if flood threats and subsequent breaching actions are to be avoided, minimization of scour in the channel and across the wave face needs to be balanced against the ability of channel outflow to remove the predictable transport of sand into the channel by wave and longshore transport, both of which significantly increase during a beach building event and result in a channel closure event.

Transport of sand by waves on to a beach (and into the outlet channel) occurs when wave height compared to wave length reaches a critical point, which is called critical steepness, expressed as Critical H/L. JW Johnson determined critical steepness in the laboratory as = 0.03; waves with a lower H/L value moved sand offshore, those with a higher value moved sand onshore[2]. Wave length is directly proportional to wave period. Using the acceleration rate of gravity, 32/ft/sec/sec= g; and pi for rough approximation of wave form as sinusoidal, L = g/2pi* T^2 or $5.12T^2$ (*e.g.,* 13 ft waves, 9 second period; 9 squared*5.12= 414.72; 13/414.72= 0.0314, steep enough to accrete, or 9 ft waves, 7 second period; 7 squared*5.12= 250.88; 9/250.88= 0.0359).

Because of the coastal aspect of the RR beach and the presence of headlands to the north and south, wave direction is important in determining the height of waves which reach the beach. Wave direction and size also determine the strength of the longshore current, and thus the rate of channel infilling on an incoming tide. The larger the waves, and greater the angle of wave incidence away from perpendicular to the beach, the stronger the longshore current and amount of sand transport.

The incidence of the outlet channel to the wave-face crest will be critical in limiting channel infilling by wave action during a beach building event. When a beach building/closure event is occurring, at high tide waves will be delivering and depositing sand up and over the wave face crest into the mouth of the channel at a rate much greater than the ability of the relatively low flow of the channel to transport sand in opposition to the direction of wave transport. However, a channel behind the wave-face crest and close to perpendicular to the wave direction will be more capable of transporting the sand washed into it by wave action, as flow from the wave will be entrained in the flow of the outlet channel, with the added flow increasing the transport power of the outlet channel. Thus, by orienting the outlet channel near to perpendicular to wave run-up direction, the out-flow channel will be better at limiting or preventing accretion of sand in the channel mouth by successive waves than if the channel is parallel to the wave run-up direction. Strategies for minimizing accretion of sand in the lagoon outlet channel mouth during a beach building event, and limiting likelihood of outlet channel closure events will be: 1) choose a river channel outlet location where the beach profile has the least slope between the low tide line and wave-face crest height, as less slope will mean a greater distance for waves to expend their energy before topping the wave crest, and/or the lower wave-face crest would signify an area of reduced wave size and transport capacity; 2) align the channel from the lagoon outlet, and behind the wave-face crest, to be as near to perpendicular as possible to wave run-up direction in order to minimize sand accretion at the channel mouth during high tide.; 3) insure there is sufficient slope from the lagoon WSE to the point the channel crosses the wave-face crest sufficient to maintain flow across the wave-face crest when waves push the crest above the high tide line (~ 3.3 ft NGVD with a 6 foot high tide). This means planning for the outlet channel invert to be above the lowest point of the wave-face crest height.

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[2] Willard Bascom. 1980. *Waves and Beaches.* Anchor Books Edition. ISBN: 0-385-14844-5

Channel Planform and Slope

In addition to the above described means to balance scour and accretion in the channel mouth and across the wave face, the channel planform will be dictated by beach topography. The entire beach topography above the tide lines is determined by waves and longshore current that will continue to sculpt the beach once the outlet channel has been established. To avoid repetitive heavy equipment excursions on to the beach to reform the outlet channel, the beach topography should dictate both the channel planform and slope of the outlet channel. To determine the most natural channel planform and slope, *i.e.*, the planform location and slope that will most likely be maintained by wave and tidal action subsequent to formation of an outlet channel by SCWA, a detailed topographic survey of the beach will need to be prepared post lagoon-closure, and prior to beach and estuary WSE management actions.

Natural Analogues

When waves reach critical steepness and sand accretion occurs on the beach, the underwater sand bar just outside the wave break is moved onshore with the incoming tide. The beach increases in both width and height, which results in a lengthening of the outlet channel as it has a greater width of beach to cross, and behind the wave-face crest, flows longitudinally along the beach to the lowest point of the crest. The increased length of the channel results in more resiliency to scour and incision during low tide and allows for stabilized lagoon WSE, with tidal influence becoming muted. Lacking subsequent beach building events, the channels may scour back down below the high tide level within weeks, reintroducing tidal influence to the lagoon WSE. However, with continued or subsequent beach building events, the channel continues to elevate and lengthen, and with river inflows declining in spring/summer, the channel loses its ability to incise, and a closed of perched lagoon WSE eventually results.

A short duration event of critically steep waves and beach building occurred along the California Coast the week of May 27th to June 3, 2010. Attached are photos of these river mouth beaches and the channels that resulted from that short duration beach building event. A WSE stage monitor in the Carmel lagoon recorded the effect on lagoon WSE, in which subsequent to the event and the lengthening of the channel, the WSE of the lagoon was maintained above the high tide level and tidal influence became muted. Photos included are of Carmel, San Lorenzo, Scott, Waddell, Pamponio and Navarro river beaches. A plot of the Carmel lagoon WSE for June 2010 can be viewed at
http://www.mpwmd.dst.ca.us/wrd/lagoon/webplots/2010/2010webplots.htm

CARMEL, 6/9/2010

San Lorenzo, 6/10/2010

Scott Creek, 6/10/2010

Waddell, 6/10/2010

Pamponio, 6/10/2010

Navarro, 6/6/2010

Navarro, 6/6/2010

Navarro, 6/6/2010 (high tide-/Lagoon WSE ~ 6-7 feet NGVD estimated)

Navarro, 6/6/2010

Attachment E. Implementation of the 2010 Outlet Channel Adaptive Management Plan

At the direction of NMFS, Sonoma County Water Agency (the Agency) has been tasked with creating an outlet channel intended to improve salmonid habitat in the Russian River Estuary while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised in 2010. Because of permit constraints, the Agency was only able to implement the plan beginning in 2010. This attachment documents the management actions in response to inlet closures that occurred during the 2010 lagoon management period.

During the management period, May 15th to October 15th, Agency staff regularly monitored current and forecast estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate inlet closure. For the first month and a half, river discharge was somewhat larger than historic daily median conditions due to a wetter-than-average spring, but then receded to nearly replicate historic median flow rates. Average monthly wave energy in 2010 was similar to historic averages for most of the management period and higher for June and October. Two periods of inlet closure occurred (Figure 1), leading the Agency to begin planning for management action to create an outlet channel, in accordance with the plan's communication protocol:

- Starting in late June 2010, physical conditions at the mouth of the Russian River Estuary naturally established an outlet channel that persisted for a week before wave action completely closed the lagoon. In response to this closure, the Agency attempted to create an outlet channel for the first time. This management action briefly re-established outlet channel conditions, but within a half day, wave action re-closed the outlet channel. Before the next scheduled management action could take place, the lagoon breached, returning the estuary to tidal conditions.
- The estuary closed twice more in the management period, during the third week of September and again at the start of October. Although action to create an outlet channel was initially considered after the September closure, an extended period of large waves limited beach access due to safety concerns. As a result, water levels continued to rise, heightening flood risk. Therefore, in consultation with the resource agency management team, the Agency decided to implement full breaching. Two attempts were required for each closure before the lagoon was successfully breached.

The next section of this attachment reviews the process for leading up to and during the July outlet channel implementation. In the following section, the September and October closures are assessed. Although the September and October closures did not result in creation of an outlet channel, the planning process and physical processes are relevant to adaptive management. The last section summarizes lessons learned from the 2010 management period to consider in subsequent years.

JUNE-JULY 2010 OUTLET CHANNEL EVOLUTION

In the second half of June, an outlet channel and perched lagoon were naturally established at the mouth of the Russian River. For about one week, this channel conveyed enough water to the ocean to sustain 4.5 to 5 ft NGVD water levels in the lagoon. Once waves closed the outlet channel and lagoon water levels began to rise, the Agency implemented a management action to create an outlet channel. In the face of strong waves, this outlet quickly closed. Several days later, the lagoon was breached and tidal conditions returned until September. Details of this channel evolution are provided below.

NATURALLY ESTABLISHED OUTLET CHANNEL

Outlet channel conditions (defined as a nearly steady lagoon water levels above ocean water levels and maintained by uni-directional outflow in a channel passing through the beach berm) naturally established over a week-long period in late June. The physical conditions associated with this evolution are described below.

Water level

Water levels in the lagoon, as observed at the Jenner gage, exhibited a muted tide range, indicative of partial closure, starting on June 20th as shown in Figure 2a. The tide range gradually decreased from about 1.5 ft until tidal variations ceased early on the morning of June 27th. Lagoon water levels then increased over the next day to just over 4 ft NGVD. Water levels were then fairly constant at about 4 ft NGVD for three days. On June 30th, the water levels started to decline, probably due to the drop in upstream riverine discharge as compared to higher outlet channel discharge. Water levels declined to a minimum of 3 ft NGVD before the channel closed on July 4th.

Ocean waves and tides

Significant wave height at CDIP's Point Reyes buoy increased above 2 m starting on June 24th as shown in Figure 2b. About the time that tidal influence disappeared from lagoon water levels on June 27th, the significant wave height exceeded 3 m and stayed above 3 m until July 1st. Peak wave period during this time period was approximately 8 seconds and the peak direction was from the northwest. Figure 3 illustrates the wave direction, period, and magnitude from June 16th through July 14th. Astronomic tides were declining from peak spring levels, with the higher high water on June 27th of just over 3 ft NGVD as shown in Figure 2c.

Riverine discharge

Riverine discharge in late June was higher than to median conditions because of late season precipitation and full reservoirs. Figure 2d illustrates how flow dropped rapidly from 325 ft^3/s on June 27th to 225 ft^3/s on June 30th. Flow then continued to drop more slowly at a rate of less than 5 ft^3/s per day for the next two weeks.

Planform alignment

At the time of closure, the channel exited the northwest corner of the lagoon and ran along the foot of the bluff, landward of the berm crest, for approximately 550 ft. The channel then crossed the berm and exiting to the ocean. This alignment was similar to the alignment observed during 1998, an El Nino year (personal communication, C. Delaney). Several days before the closure, the channel was observed further south than its alignment along the bluff once the outlet channel established. Unfortunately, the Agency's automated camera did not collect pictures between June 23-29 due to a power failure, precluding a more detailed analysis of the channel's planform evolution in the days preceding the establishment of the outlet channel.

Beach and channel topography

The beach berm north of the outlet channel and the downstream end of the channel was surveyed by Agency staff on July 1st (Figure 4). The presence of seals on the beach to the south of the channel prevented additional survey data from being collected. On both sides of the channel's mouth, sand had deposited such the intertidal beach protruded approximately 50 feet into the ocean as compared to the beach alignment further south (Figure 4 and Figure 5a). Just north of the outlet channel, the beach face that had been covered by wave runup during the previous high tide extended up to 8 ft NGVD. Then the beach profile stepped up to a bench with elevations above 10 ft NGVD. South of the channel, the berm crest elevation was estimated to approximately 7 ft NGVD, but was not measured directly. The outlet channel was approximately 60 ft wide, with its bed elevation at 0-1 ft NGVD for last one hundred feet before it entered the ocean. The channel flowed around numerous large boulders along much of its length. These boulders may have served as natural grade control inhibiting erosion.

Channel discharge

On June 30th, the Agency collected water depths and point velocities in the outlet channel, which was approximately 60 ft wide. Water in the outlet channel flowed at depths up to 2.7 ft and velocities of at least 5.4 ft^2/s. These velocities are in excess of permissible scour criteria for beach sands, but not sufficient to scour the larger boulders found in the outlet channel (Fischenich, 2001). Integrated water depth and point velocity measurements yielded an estimate the channel's discharge of 297 ft^3/s (SCWA unpublished observations). As shown in Figure 2d, this discharge magnitude was observed upstream at Guerneville approximately two days earlier and was larger than the concurrent Guerneville discharge. This is consistent with the dropping water levels in the lagoon (Figure 2a) and tributary inflows downstream of Guerneville.

WAVE-INDUCED OUTLET CHANNEL CLOSURE

After the week of sustained outlet channel conditions, the wave energy briefly relaxed on July 2nd, and then returned to significant wave heights from the northwest exceeding 3.5 m starting on July 3rd (Figure 2b). This increase in wave height was accompanied by an increase in northwest swell wave period to approximately 10 seconds. This increase in wave energy provided enough landward sand transport to close the outlet channel. Riverine discharge had recently declined,

reducing the channel's ability to clear sand and remain open. This closure occurred during a neap tide, when higher high water levels just barely exceeded 2 ft NGVD.

Changes to the wave climate continued for the next several days, with the peak direction shifting to the south and the wave period lengthening to nearly 14 seconds (Figure 3). Significant wave height dropped to less than 1.5 m. This long-period, low-steepness swell is likely to have built the beach berm with onshore sand transport. This likely onshore transport changed the beach topography changed in two ways. The protruding sand deposits at the channel's mouth noticeably diminished in size between July 4th and July 5th, and were essentially gone by July 6th. In addition, the onshore transport probably built the berm crest elevation from the estimated berm crest elevation of 7 ft NGVD on July 1st (C. Delaney) and July 4th (J. Largier) to an elevation of 8.5 ft NGVD as surveyed on July 8th.

Once the outlet channel closed, lagoon water levels began to rise at a rate of approximately 0.5 ft/day. The channel closure and rising water levels initiated the Agency's outlet channel management plan.

MANAGEMENT ACTION

Management action to create an outlet channel was scheduled for July 8th in consultation with the resource management team. The action was scheduled for July 8th because it was a Thursday, the last day that action could be taken before the State Parks permit restrictions on Friday-Sunday operations went into effect. Given the observed rate of lagoon water level rise of 0.5 ft/day, waiting until the following Monday was deemed to be too risky in terms of flood hazard and channel scour. To provide operational flexibility in response to site conditions, two different management options were proposed during planning. Figure 4 shows the alignment of these options, both 30 ft wide, as laid on the topographic surface collected on July 1st. This schematic design was used to discuss management plans with the resource agencies, to estimate volumes of excavated material, and to guide operations staff. Option A, the preferred option, followed the northwest alignment of the natural outlet channel prior closure. In the event that beach surveys indicated a low point in the berm further south or if access to the Option A location was restricted by waves, Option B was proposed just north of Haystack Rock.

Based an assessment of site conditions early on the morning of July 8th, Option A was selected for implementation. Excavation began at approximately 7am on July 8th with a bulldozer and backhoe excavator. The lagoon water level at the time work began was 5.9 ft NGVD.

The excavated portion of the managed channel followed the alignment of the southern half of the naturally established outlet channel, as shown in Figure 5b. This alignment allowed the excavation equipment to avoid rocks embedded in the berm. The backhoe removed sand from the landward portion of the berm, adjacent to a large rock. The bulldozer pushed sand towards the ocean to form the lower portion of the channel. A small berm was preserved between the two pieces of equipment to prevent lagoon outflow before the channel was complete. After

approximately two hours of work, wave runup associated with the rising tide started to enter the channel's mouth. Therefore, the middle berm was removed with the excavator at approximately 9:30am, completing the channel.

At the time of completion, the outlet channel was approximately 30 ft wide and had an invert of approximately 4.5 ft NGVD. Water flowed in the channel at a depth of approximately 0.5 ft. Flow was typically uniformly seaward in the upstream portion of the newly excavated channel. However, in the downstream portion, wave runup periodically overwhelmed the outflow, causing the flow to switch direction to landward. The transition between the existing channel and the newly excavated portion created a hydraulic control across which water transitioned from subcritical to supercritical, thereby explaining the channel's lower water level as compared to the lagoon. Bed erosion was observed starting from this transition region and into the new portion.

During the period when the outlet channel was open, water levels in the lagoon continued to increase at a similar rate to the rate before the management action. This constant rate of water level increase indicates that flow in the outlet channel was relatively small compared to riverine inflow to the lagoon.

OUTLET CHANNEL CLOSURE

As ocean tides increased water levels throughout July 8th, the wave runup from the south swell advanced up and over the beach face, as evidenced by the absence of equipment tracks on the beach in July 9th photographs. By the evening of July 8th, this advancing wave runup transported enough sand into the outlet channel that the channel once again closed. Higher high water on the evening of July 8th was above 3 ft NGVD, as tidal conditions were building towards large spring tides.

After reviewing lagoon and beach conditions on July 9th, the Agency scheduled follow-up management for Monday, July 12th, the first day which they were allowed to operate on the beach under their State Parks permit.

BREACHING TO TIDAL CONDITIONS

Lagoon water levels continued to rise at a rate of approximately 0.5 ft/day in the days following closure. On the evening of July 11th, the lagoon breached in the vicinity of Haystack Rock. The lagoon water level at the time of the breach was 7 ft NGVD, which is approximately 1.5 ft below the berm crest elevation surveyed on July 8th. This difference suggests that the breach may have been caused by seepage through the berm. Just before the breach, the water's edge extending towards the breach site, indicating that breach occurred at the low point in the beach berm's crest elevation.

Because the estuary returned to tidal conditions on July 11th, the management action planned for July 12th was cancelled. Tidal conditions persisted in the estuary until September.

SEPTEMBER-OCTOBER 2010 CLOSURES AND MANAGEMENT

In the end of August, coincident with neap tides and increased wave heights, the estuary water levels became muted, diminishing to a tide range of less than one foot (Figure 6a). Shortly afterwards, starting on September 4th, wave energy increased considerably from the northwest (Figure 7b) to sustained wave heights exceeding 3 m and peaking above 4 m (Figure 6b). This combination of muted tides followed by large waves, would seem to have been ideal conditions to prompt closure. However, the inlet stayed open throughout this high wave period. Several factors probably contributed to the inlet's persistent opening. Although large in height, the waves' period was relatively short (below 12 seconds) and from the northwest. Because of the beach faces the southwest, it may be partially sheltered from waves out of the northwest. The tides were transitioning from neap to spring, so the increasing tidal prism would have contributed to scouring the inlet's channel. Wave overtopping also may have contributed to maintaining inlet by adding water to the estuary that then flowed out the inlet, scouring the channel.

After the muted tides in early September, full tide range returned to the lagoon, probably assisted by the arrival of larger spring tides. Around September 18th, during the month's second neap tide, another wave event was observed with significant wave height less than 2 m, nearly half the magnitude of the early September event (Figure 6b). However, the wave period was longer, 16-18 seconds instead of 8-10 seconds, and waves were from the south instead of the northwest. These conditions closed the estuary on September 21st.

After the inlet closed on September 21st, planning to establish an outlet channel began. Based on the most recent beach topography, the projected rate of lagoon water level increase, tides, and wave forecasts, September 28th, was selected for an attempt at creating an outlet channel. Two options for the channel were proposed, one extending to the northwest from the edge of the lagoon, and one just south of Haystack Rock where the inlet had been just before closure. Lagoon water levels were above 6 ft NGVD by the 28th, as anticipated, in part due to wave overwash. Although water levels were rising, runup from large waves made beach access unsafe and operations were postponed to September 29th. Unsafe wave conditions persisted on the 29th, again preventing beach access. Since wave forecasts predicted only a brief lull on the next day before large waves returned and weekend access restrictions loomed, the Agency, in consultation with the resource agency management team, decided on the evening of Wednesday, September 29th, to switch from attempting to create an outlet channel to attempting a full breach.

Wave and tide conditions on the morning of September 30th allowed for beach access and a full breach was implemented. However, waves carried on the rising tide re-closed the inlet that afternoon and lagoon water levels continued to rise. A second attempt at breaching the afternoon of the 30th was cancelled because of unsafe wave conditions on the beach. Because of the impending flood risk (9 ft water levels were projected by Sunday, October 3rd), the Agency sought and received permission from State Parks to access the beach Friday, October 1st. The

breach on October 1st was successful, helped by extensive scour coinciding with tides dropping to lower low water during the night. Estuary water levels dropped to 1 ft NGVD on October 2nd.

After a brief lull, wave conditions once again intensified and the inlet closed again on October 4th. Although still within the management period, the proximity to the end of the management season, as well as continuing forecasts for high waves, led the Agency to propose and receive permission from the resource agency management team for a full breach. Breaching was attempted on October 11th, when lagoon water levels had exceeded 7 ft NGVD. This attempt failed as waves pushed sand into the breach before it could enlarge and lower lagoon water levels. A second breach attempt was made on the afternoon of October 12th, successfully creating a sustained breach that lowered estuary water levels to tidal conditions. A third closure occurred on October 21st and self breached on October 24th, partly in response to high river discharge. Although this third event was outside the outlet channel management period, it was indicative of the extended period of large waves during September and October 2010.

LESSONS LEARNED AND RECOMMENDATIONS

Based on observations of the estuary, associated physical processes, and the July 8th outlet channel management action, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- All four closures discussed above occurred coincident with noticeable wave energy associated with periods greater than 12 seconds. In fact, a long period, but relatively low wave height (less than 2m) event closed the inlet in the third week of September even though a larger wave height, but shorter period wave event two weeks earlier did not close the inlet. In all but one case, the long period waves which caused closure originated from the south or west.
- When wave runup started to progress into the outlet channel and force operations to end, it was decided to favor a deeper outlet channel over a wider outlet channel. Channel depth was sought to facilitate more discharge from the lagoon to counter incoming waves. We recommend continuing to observe channel/ocean dynamics in subsequent outlet channels to inform tradeoff decisions of this nature.

FEASIBILITY

- In hindsight, a better opportunity for establishing an outlet channel in July may have been July 10th or the morning of July 11th, when the long-period south swell had subsided but before the breach occurred. However, based on available information (wave forecasts and no knowledge of the breach) the management action was enacted earlier, on July 8th, because the following days were Friday through Sunday when State Parks restricts beach access. Future outlet channel management opportunities are likely to face similarly constrained time windows: too soon after closure, the wave conditions which caused closure may prevent safe beach access and lagoon water levels will be less than the BO

targets; too late after closure and water levels may cause flooding or overtopping the beach berm. In addition to the State Parks weekend access constraints, operations are constrained by IHA rules, particularly before June 15th when pupping season ends.

- If the rocks embedded in the beach are essential for stabilizing against failure by scour, then the elevation of the rocks will largely determine the outlet channel bed elevation and lagoon water level. During the naturally established outlet channel which occurred from June 27th through July 3rd, the channel's bed elevation just before the beach face was 0-1 ft NGVD (July 1st Agency survey) and the lagoon water level was between 4.5 and 5 ft NGVD. Under these conditions, the outlet channel was able to convey approximately 300 ft^3/s.
- If an outlet channel had been in place at the start of the September-October large wave period, it quite likely would have closed since waves frequently overtopped the beach berm and even some full breaches were quickly closed. If the lagoon water level was close to or at the BO target 7 ft NGVD when the closure occurred and beach access was limited by wave conditions for multiple days, e.g. the five day period from September 26th to September 30th, the lagoon would likely have reached flood stage.
- Management actions attempting full breaching, which aim to convert the inlet between two of its stable modes (breached and closed) and which are informed by decades of management experience, still fail quite regularly. For example, in 2010, two of four breach attempts were unsuccessful and historically, one out of every three attempts have been unsuccessful (Behrens et al., in prep). We anticipate that the failure rate of efforts to create an outlet channel, a less common and less stable transitional state, to be at least as frequent, if not more frequent, than the failure rate for full breaches.

COMMUNICATION

- Continue the practice of developing and communicating a backup plan for the outlet channel management action in the event that surf conditions were unsafe at the preferred channel location. Communicating this backup plan ahead of time allowed time for discussion among the resource management team, reducing the potential for last minute disagreement if this option had to be enacted.
- Agency, NMFS, and ESA PWA staff consulted as to the specifics of the outlet channel implementation immediately before and during the excavation. This discussion was necessary because of uncertainty about the actual beach topography, the excavation progress relative to the tides, and the overall development of outlet channel strategy for this initial implementation. It enabled real-time adaptation to on-site constraints. For instance, the excavation's location was shifted slightly south of the prior channel's location to avoid large rocks known to be hidden within the berm. After following this alignment beyond the rocks, the excavation was guided northward so that the mouth of the outlet channel would be as close as possible to the prior location.
- After each management action, we suggest asking State Parks staff if operations had gone in accordance with their expectations with regard to parking lot use, public safety, sand placement, etc.

STAFFING

- The Agency's engineer on site had broad knowledge of the project objectives and operational constraints, enabling him to engage in discussion with the other on-site personnel (particularly the NMFS representative), observe physical conditions, and make real-time decisions about the outlet channel configuration. This presence and decision-making authority was essential since the management action was only defined ahead of time as a strategy, not construction-grade drawings.
- Develop capacity of other Agency staff to manage outlet channel operation so availability of informed decision-makers does not hinder management operations.
- Although equipment operators were new to the site, they adeptly executed outlet channel design as directed by Agency staff. Encourage the contractor to provide staff familiar with the project whenever possible.

EQUIPMENT AND OPERATIONS

- The backhoe excavator was more adept at operations adjacent to rock, the bulldozer was faster for areas with open sand. Particularly if operations occur over two days, consider choice of equipment. For example, on the first day, choose two bulldozers for speed in excavating a larger channel and replace one bulldozer with an excavator on the second day for more precise operations.
- Tides, daylight, and permits all restrict the time available for operations. To maximize time available for implementing management actions, consider the following procedures:
    - When possible, have key resource management team members discuss the operations plan ahead of time, ideally on-site the day before, or by phone if on-site is not practical.
    - Clarify staging procedure between equipment operators and engineering staff to reduce waiting
    - Consider the use of lights to enable equipment to operate under low-light conditions.
- Because rocks limit the outlet channel's alignment; having survey staff on-hand to stake locations of rocks covered by the sand was useful. Agency surveys should continue to monitor rock locations during monthly surveys.
- Equipment operators demonstrated good coordination between the pieces of equipment, with neither piece idle for an extended period. The two pieces smoothly switched the two primary tasks of channel excavation and feathering excavated material onto the beach face.
- Sand cleared from the outlet channel was left as a temporary berm at the mouth of the outlet channel to impede wave runup into the outlet channel. This berm was re-shaped just before finishing to open the outlet channel while still providing some protection from south swell.

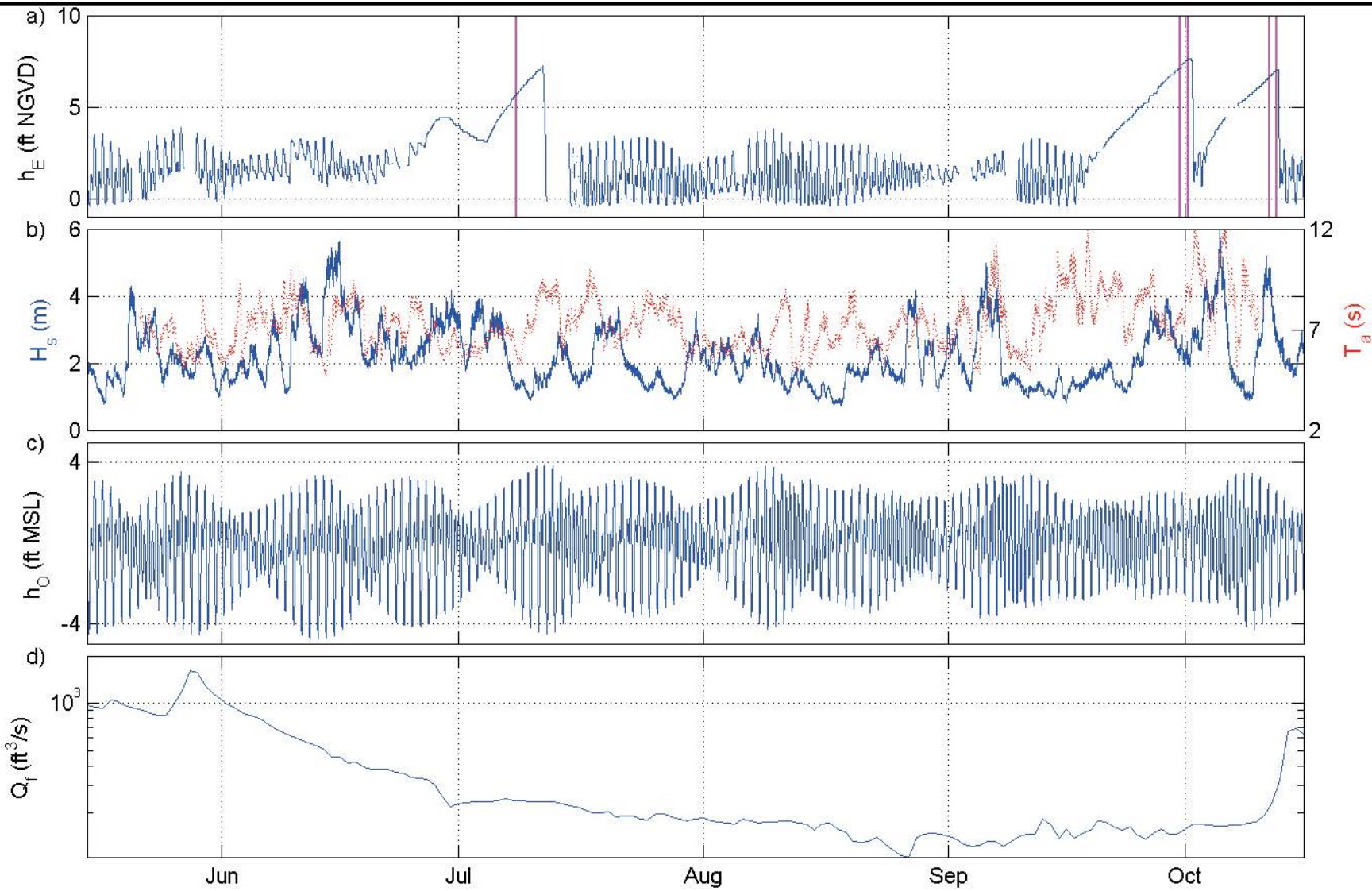
MONITORING

- Because the IHA limits the days available to place people on the beach to collect data, use the full two days allotted for outlet channel creation to collect additional data. For instance, consider having the survey team return at 12-hr intervals to take photographs and survey channel bathymetry and discharge.
- Consider an alternate automated camera placement to capture the northern portion of the beach.

REFERENCES

Behrens, D.K., F. A. Bombardelli, J. L. Largier, and E. Twohy. in preparation. Natural and human influences on tidal inlet closure in small bar-built estuaries

Fischenich, C. 2001. Stability thresholds for stream restoration materials. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-29). U.S. Army Engineer Research and Development Center, Vicksburg, MS.



Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)
d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 1
Russian River Estuary Outlet Channel Management Plan

Estuary and Ocean Conditions, May 15 - October 15 2010

PWA Ref# 1958.01

ESA PWA

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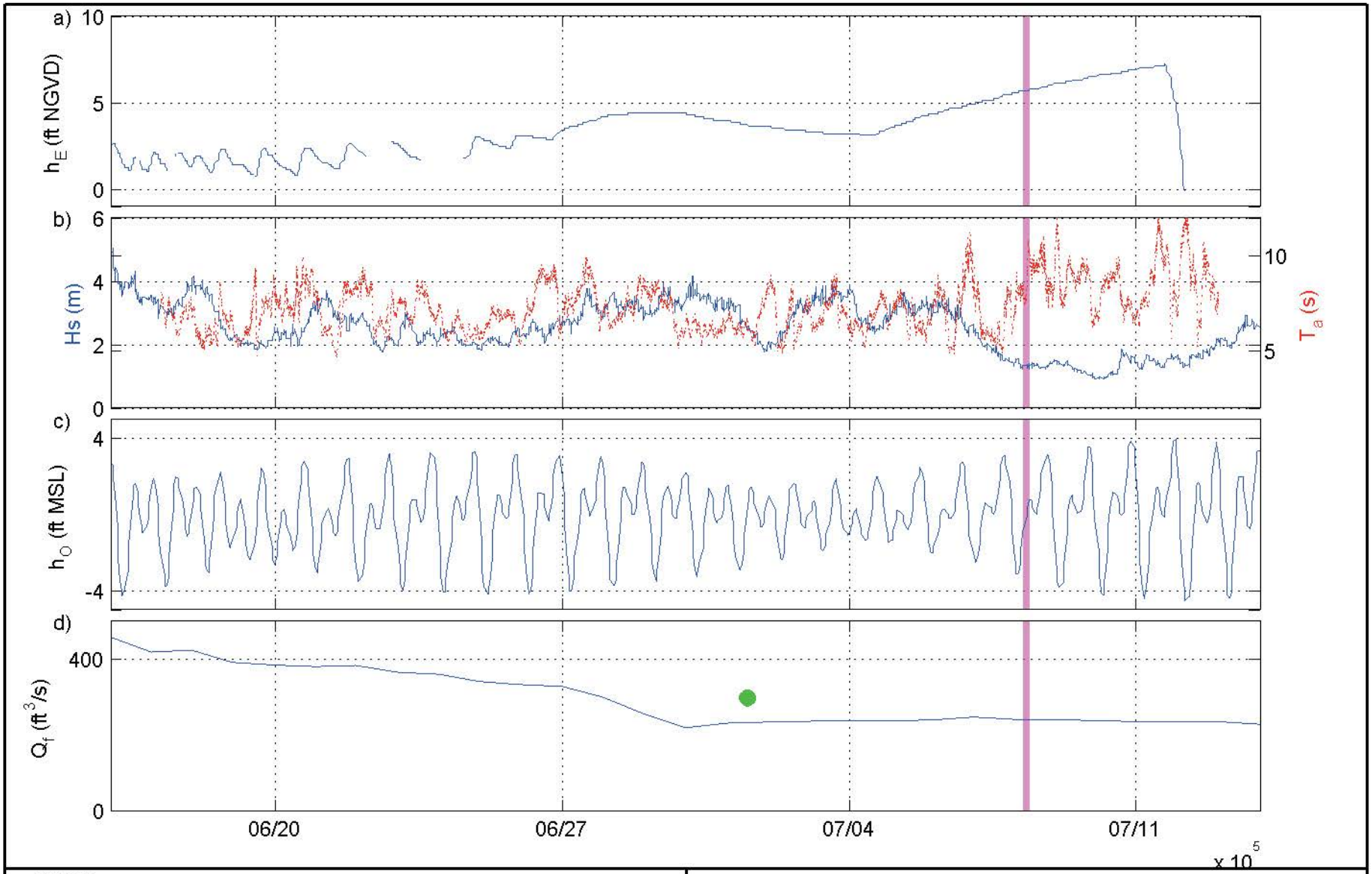

Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)
d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 2

Russian River Estuary Outlet Channel Management Plan

Estuary and Ocean Conditions, June - July 2010

PWA Ref# 1958.01

ESA PWA

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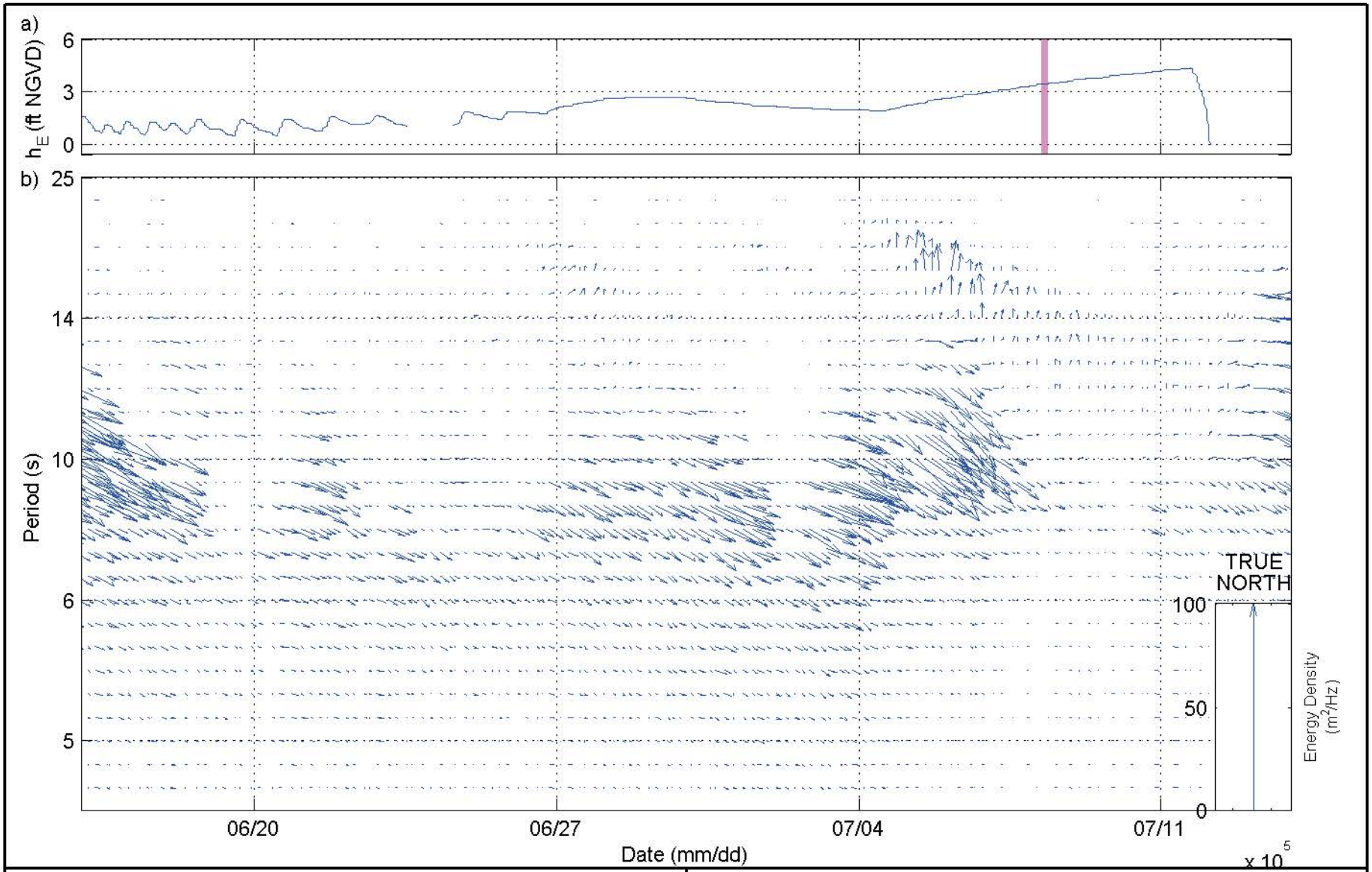

Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action

b) Wave magnitude and direction (CDIP, Pt. Reyes, #029)

Figure 3

Russian River Estuary Outlet Channel Management Plan

Estuary Water Level and Wave Energy/Direction Spectrum
JUNE-JULY 2010

PWA Ref# 1958.01

ESA PWA

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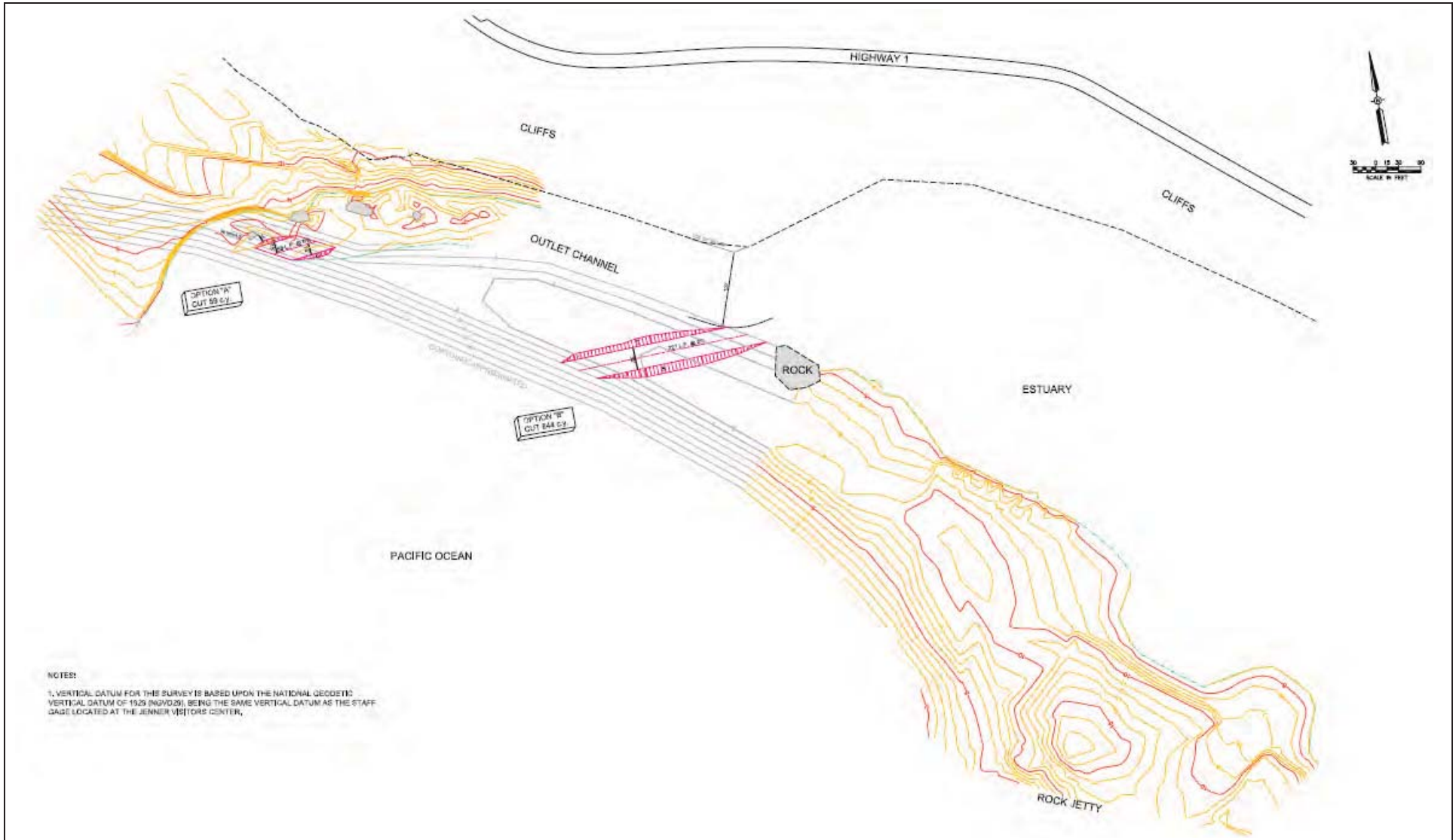


Source: SCWA

figure ***4***

Russian River Outlet Channel Adaptive Management Plan

Beach Topography and Management Options, June 2010

PWA Ref# 1958.01

ESA PWA

a)

b)

Source: C. Delaney, SCWA

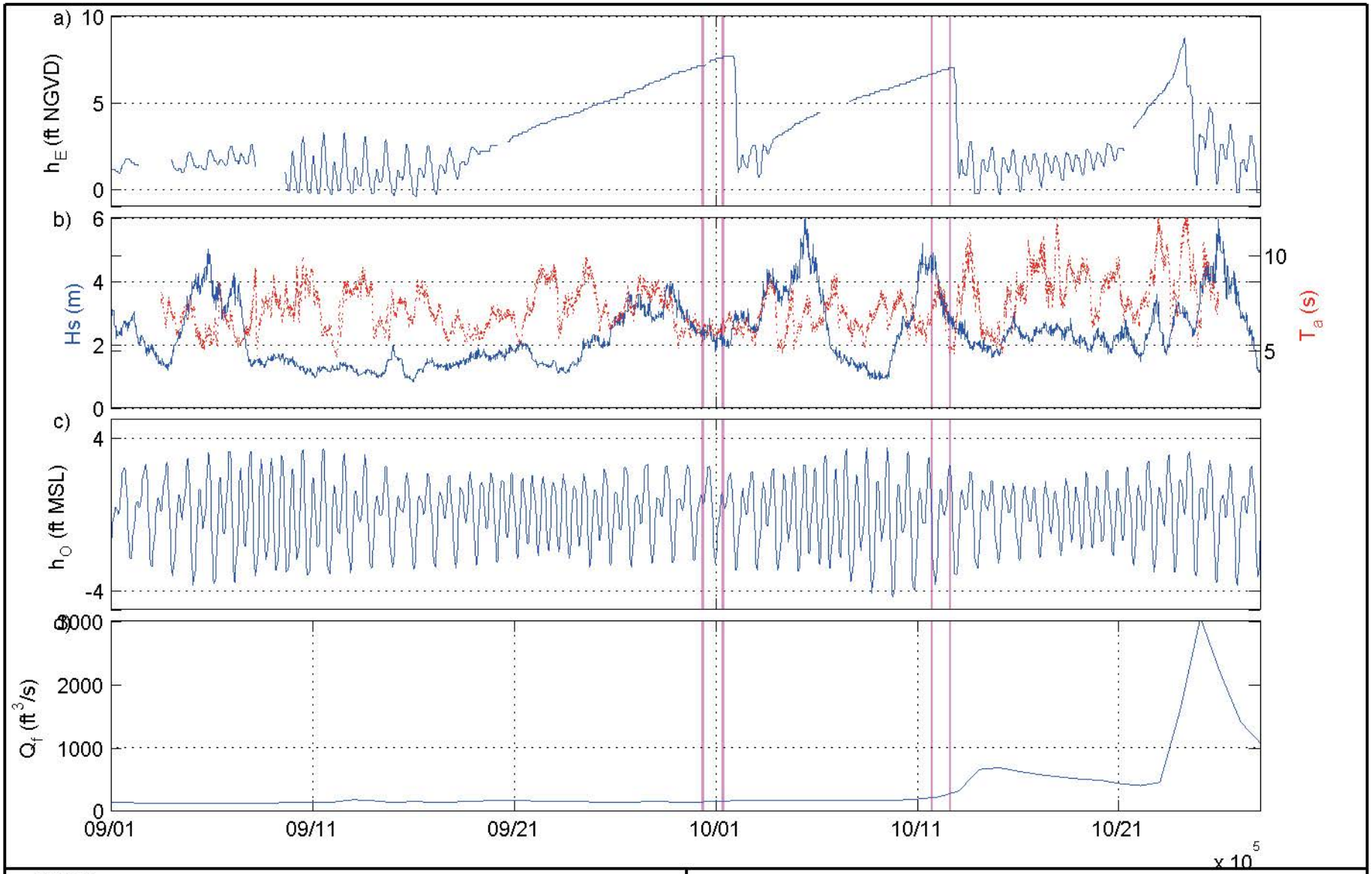
figure 5

Russian River Outlet Channel Adaptive Management Plan

Natural and Managed Outlet Channels

PWA Ref# 1958.01

ESA PWA



Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)
d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 6

Russian River Estuary Outlet Channel Management Plan

Estuary and Ocean Conditions, September - October 2010

PWA Ref# 1958.01

ESA PWA

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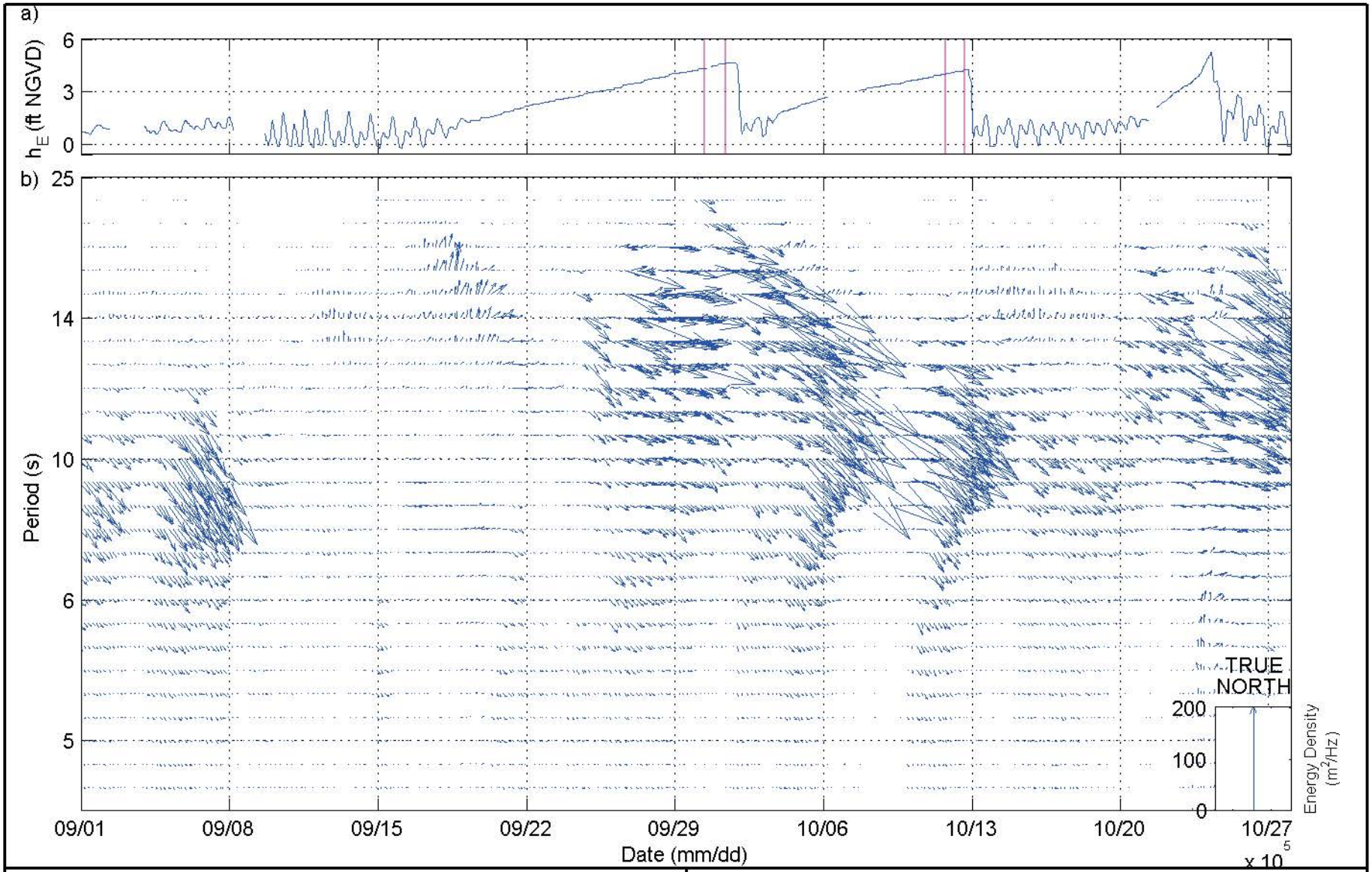

Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action

b) Wave magnitude and direction (CDIP, Pt. Reyes, #029)

Figure 7

Russian River Estuary Outlet Channel Management Plan

Estuary Water Level and Wave Energy/Direction Spectrum
September-October 2010

PWA Ref# 1958.01

ESA PWA

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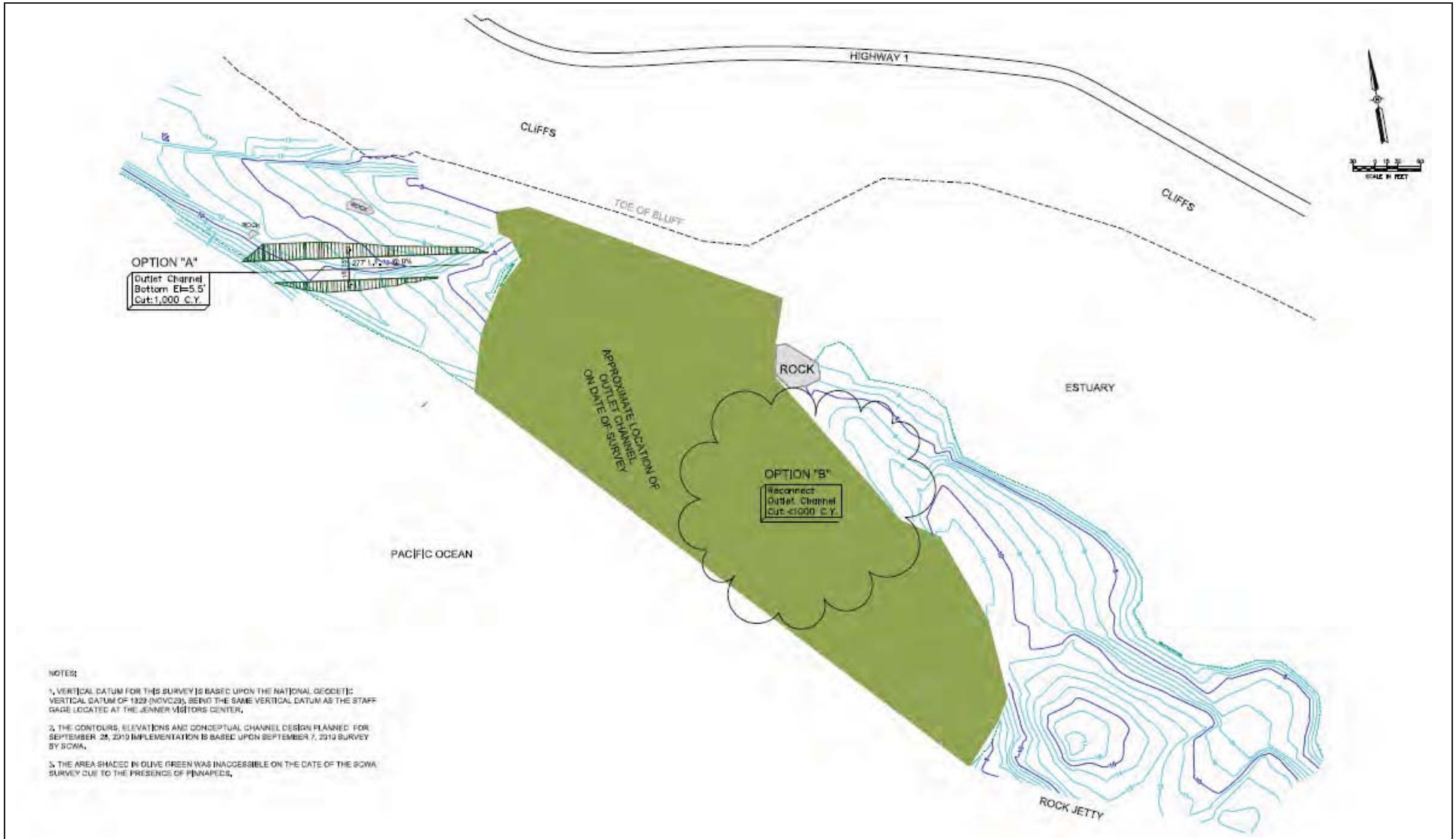

Source: SCWA

figure 8

Russian River Outlet Channel Adaptive Management Plan

Beach Topography and Management Options, September 2010

PWA Ref# 1958.01

ESA PWA

K:\projects\1958.01RREAMPOutletChannel\Task 8 Year 1 eval & 2011 plan\Year 1 eval memo\figs\FigX BeachTopoSept.doc

Attachment F. Physical Processes During the 2011 Management Period

As required by the Russian River Biological Opinion, Sonoma County Water Agency (Water Agency) has been tasked with managing a summer lagoon intended to improve salmonid habitat in the Russian River Estuary by creating an outlet channel while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised in 2010 and 2011. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2011, but no opportunities for management action occurred during the management period.

During the 2011 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. High river discharge in the first two months of the management period followed by the typical low wave energy conditions during the summer contributed to the inlet staying open for the first four months of the management period. Starting in late September, the inlet went through a succession of perched lagoon conditions and self breaches, during which the Water Agency closely monitored estuary conditions and considered management options. The perched episodes were short-lived, lasting no more than a week, and included a small outlet channel flowing along and sometimes through gaps in the jetty. The perched episodes ended when lagoon water levels increased, overtopped the beach berm, and scoured a new tidal channel. Since the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency did not take any management actions to encourage formation of an outlet channel.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2011 outlet channel management period examined water levels, ocean wave conditions, ocean water levels, riverine discharge, beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, DFG, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Gage failed near the end of July, and was replaced by early September.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk. (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel that formed in fall 2010. When discussing this parameter, both states are referred to as a 'closure'.) The inlet stability parameter presented by Behrens et al. (in publication) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The former is estimated from wave measurements and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (in publication) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

FALL PERCHED EPISODES AND SELF BREACHES

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. Prior to September, no inlet closures occurred, so lagoon water levels fluctuated in concert with ocean tides (Figure 1a). As shown in Figure 1d, discharge remained high for the first two months of the management period as a result of a wet spring, including precipitation in the start of June. River discharge did not drop below 400 ft^3/s until after June 15th and below 200 ft^3/s until after July 15th. This elevated discharge probably reduced the likelihood of inlet closure during the first two months of the management season even though some sizeable wave events occurred during these months (Figure 1b). In late July and particularly in August, wave energy was at the annual minimum, so tidal exchange was sufficient to maintain an open inlet. As typically occurs on the California

coast, wave energy increased starting in September, which eventually caused the estuary to perch six times, starting in late September and into November.

All six inlet perched lagoon episodes in fall 2011 lasted a week or less, ending when the estuary water levels reached 4-5 ft NGVD, overtopped the beach berm, and scoured a new tidal channel. Conditions during the perched lagoon episodes (September 22-29, October 3-8, October 10-14, November 3-8, November 10-12, and November 17-20) are shown in Figure 2. Although the management period ends on October 15th, conditions up through the end of November were reviewed since they were consistent with the inlet behavior that started in late September. Six instances of perched lagoon conditions are slightly higher than the average number of closures, 4.6, in September through November (ESA, 2011). However, a series of repeated perched episodes and self breaching is not common; since 1996, this pattern has only been observed only one other time, in 2006.

Consistent with the existing conceptual model described in Section 4 of the Management Plan, perched lagoon conditions typically occurred when both wave energy increased and tidal exchange decreased. All perched episodes occurred when the mean wave period was greater than 10 seconds and five perched episodes occurred when significant wave heights were greater than 12 ft. The October 10th episode coincided with wave heights of only 8 ft, but since these waves had long, 16-second periods and originated from the southwest, they still conveyed significant wave energy to the beach. Five of the 2011 episodes occurred during neap tides when the tide range was reduced to less than 5 ft (Figure 2c). When the tide range is less, tidal scour in the inlet is also less, making the inlet more susceptible to infill with sand. Only the November 10-12 episode occurred when the oceanic tide range was greater than 6 ft. All but the first episode occurred with riverine discharge elevated above 250 ft^3/s and the three November episodes occurred when riverine discharge was approximately 400 ft^3/s.

PERCHED LAGOON AND NATURAL BREACH DYNAMICS

As an example of a perched lagoon-breach cycle, Figure 3 shows a sequence of photos of the inlet before, during, and after the October 3-8 episode. As was the case for almost all of the management period, the inlet was located next to the jetty. Shortly before the episode, on September 30 (Figure 3a), the inlet had narrowed in width to approximately 30 feet.

The estuarine water level became muted starting on October 3 with the arrival of some larger, longer-period waves (Figure 2a and b). By October 5, a tidal signal was absent from the estuary and water levels began to rise. The inlet transformed into a small outlet channel running immediately adjacent to and among the rocks at the toe of the jetty (Figure 3b; Figure 4a). The outlet channel was narrow, with a width of approximately ten feet. When the channel reached the portion of the jetty which had been damaged, the channel turned south and flowed through the gap in the jetty (Figure 4b).

The jetty and rocks which had been a part of the jetty may have stabilized the outlet channel, both in sheltering the outlet channel from waves and by providing bank and bed stabilization that minimized channel scour. Sheltering by the jetty probably reduced berm build-up at the inlet's

location, leaving a low point in the beach berm that was the site for subsequent overtopping and self breaching. This small outlet channel, present from the start of the episode, contrasts with other historic closures that were more extensive. For these extensive closures, almost the entire inlet was filled with sand, with only a small indentation on the backside of the berm providing any indication of the inlet's prior location, and no outlet channel was present. All the 2011 episodes were less extensive, which left the beach berm more susceptible to self breaching.

Self breaching probably occurred when the estuary water level had risen sufficiently high that it overtopped the beach berm in the vicinity of the outlet channel. This overtopping increased the flow rate through the outlet channel and, in spite of any bank stabilization provided by the jetty and associated rocks, the increased flow rate scoured sand from the channel bed and banks. The enlarged channel was then sufficiently deep to allow tides and salt water to return to the estuary. Shortly after self breaching, the tidal channel was approximately 50 feet wide (Figure 3c), wider than it had been in the days preceding the episode. This channel enlargement is consistent with the self breaching mechanism as the higher flow, induced by the elevated estuary water levels during episode, scoured the channel.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2011 according to the method described in Behrens et al. (in publication). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 50 percent before each 2011 event (Figure 2a). Some 2011 episodes occurred quickly, transitioning from fully tidal to perched lagoon within a day, so the risk time series did not provide much forewarning in these cases. However the risk was elevated more than two days before the episodes on September 22, November 3, and November 17.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent is often limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which prohibits the survey crew from disturbing the marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at 1 ft intervals. The survey elevations are reported in the NGVD29 vertical datum, the working datum for estuary monitoring and management.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September) and 2011 (May to October) surveys. The locations of five

transects selected for analysis are shown in Figure 5. The locations include two transects backed by cliff (Figure 6 and Figure 7), two transects which extend into the estuary (Figure 8 and Figure 9), and a transect just north of the jetty (Figure 10).

This review focuses on the 2011 surveys when the surveys captured a clearer picture of beach evolution. However, the 2010 surveys are included in the transect plots for context. In general the crest elevations in 2010 were lower than 2011. The cause of the lower crest elevations is not known, but may the result of inter-annual variations in wave energy and littoral sediment supply. In addition, the inlet exhibited greater variation in its location in 2010, extending far to the north in July before moving south later by August. As the inlet opened and closed or changed location, it resulted in large changes in beach topography. For example, at Transect 4, the inlet's closure in early July 2010 is readily apparent as substantial increase in the berm's size between the 7/1/2010 and 7/8/2010 transect (Figure 6). The inlet's migration south is evident at Transect 3 (Figure 7) when the crest elevation drops from its 7/8/2010 profile to less than 4 ft NGVD on 8/3/2010. The inlet migration and gaps in the survey data yield little information for evaluating crest elevation evolution at most transects. However, there is sufficient data at Transect 4 to show a trend of increasing crest elevation during summer 2010.

The crest elevations of Transects 2, 3, and 4 steadily increased over the 2011 management period. This trend is consistent with seasonal patterns on many California beaches. After some initial increase from May to June, when wave energy was at the annual minimum in July and August, transect changes were minimal. Then berm building accelerated in the fall with the concurrent increase in wave energy (Figure 1), as indicated by the change between the August 15th survey and the September 19th survey. The largest change occurred between the September and October surveys, the period that also experienced the largest wave energy. Over the course of the management period, the crest moved landward at Transect 3 and Transect 4, with the exception of the October survey, when the crest moved seaward at Transect 3. This landward movement is opposite to the typical crest movement at other California beaches (Weigel, 1992) and may be indicative of additional processes affecting these transects, such as supply-limited alongshore transport. At Transects 1 and 2, the crest moved seaward as it built upwards, consistent with typical summer-time response.

Transect 0, which is located just north of and parallel to the jetty, had noticeably different elevations and evolution than the other transects. Compared to the other transects, crest elevations were highest at this transect for both 2010 and 2011. In addition, Transect 0 did not evolve during the management periods, as was observed at the other transects. The only significant change occurred during the winter between the 2010 and 2011 management periods. These two characteristics, the higher crest and lack of management period variability, suggest that the jetty shelters this portion of the beach from small to moderate waves that occur during the management period. Only the larger waves associated with winter storms may be sufficient to re-shape the beach berm near the jetty.

The changes to the beach berm at Transect 1 were intermediate between the monthly changes that occurred to the north (Transects 2-4) and the negligible change in berm elevation adjacent to the

jetty (Transect 0). Crest elevations at Transect 1 only increased between the September and October survey, the portion of the management period with the strongest wave energy. This suggests that the jetty may alter wave conditions over some distance from its location: Transect 1 is approximately 200 ft north of the jetty and outside of the area occupied by the inlet during most of the 2011 management period.

LESSONS LEARNED AND RECOMMENDATIONS

Based on observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- Elevated discharge in the late spring and early summer (greater than 400 ft^3/s until June 15th; greater than 200 ft^3/s until July 15th) reduced the likelihood for inlet closure at that time. However, multiple perched lagoon episodes occurred in the fall when riverine discharged exceeded 250 ft^3/s. This is consistent with Behrens et al. (in publication) that although discharge affects probability of closure, the threshold that prevents closure is likely in excess of 2,000 ft^3/s. A likely contributing factor to the fall perched episodes was the higher wave energy.
- The inlet moved south early in the management period, reaching the jetty in late May or early June, and remained there throughout the 2011 management period and the following winter. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- During the management period, steady growth of the beach berm was observed north of the jetty, consistent with typical beach berm building that occurs during the summer. However, the rate of berm growth appeared to decrease approximately 200 ft north of the jetty and was negligible immediately adjacent to the jetty.
- Although autumn wave events were large enough to create perched lagoon conditions, the beach berm remained at low elevations, approximately 5 ft NGVD. The inlet then self breached when rising estuary water levels overtopped the berm at this low point and scoured a new tidal channel.

OUTLET CHANNEL FEASIBILITY

- The jetty may shelter the inlet, making closure less likely and also limiting berm growth, which then maintains a low point for self breaching. When the lagoon self breaches, management actions cannot be implemented.
- Even if the inlet being near the jetty hinders formation of sustained lagoon and outlet channel conditions, management opportunities for re-locating the outlet channel are limited and constrained. At a minimum, creating an outlet channel further north from the jetty requires a full natural closure, absence of a low point in the beach berm near the jetty, and equipment access to the area north of the jetty.
- A small outlet channel formed during the fall perched lagoon episodes. However, it did not convey enough discharge to prevent lagoon water levels from rising at 0.8 ft/day.

- The outlet channel that formed during the perched lagoon episodes flowed along the jetty and among the disaggregated rock at the damaged end of the jetty. This rock from the jetty may have provided channel stabilization for the outlet channel, increasing the channel's resilience to scour.
- Once outlet channel discharge increased due to rising lagoon water levels, the discharge scoured a new channel, breaching the estuary to the tides. This behavior highlights the susceptibility of a sand bed outlet channel to scour, limiting conveyance capacity.
- The mere occurrence of a perched lagoon is not sufficient to provide an opportunity for outlet channel management; other factors may not permit management action. This point is highlighted by both the 2011 self breachings and the early fall closures in 2010, when continuing ocean swell precluded outlet channel management action. Over the first two years of effort to implement the outlet channel adaptive management plan, only one closure (July 2010), has been suited for outlet channel management action.

OPERATIONS

- When equipment operators visited the beach to plan a possible management action, they noted that the channel had incised a steep bank in the berm adjacent to the jetty (Figure 11), which would have made equipment access to any areas north of the jetty infeasible.

COMMUNICATIONS

- Although the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency began planning management actions as soon as the episodes occurred. Planning included heightened observations of inlet conditions by Water Agency staff, email updates to inform the resource management group, and pre-implementation meetings at the project site to refine plans for management action.

MONITORING

- The Water Agency's upgrades to monitoring the estuary (water levels and photographs available in real-time via the Internet) enhance both management planning and the ability to observe inlet processes.

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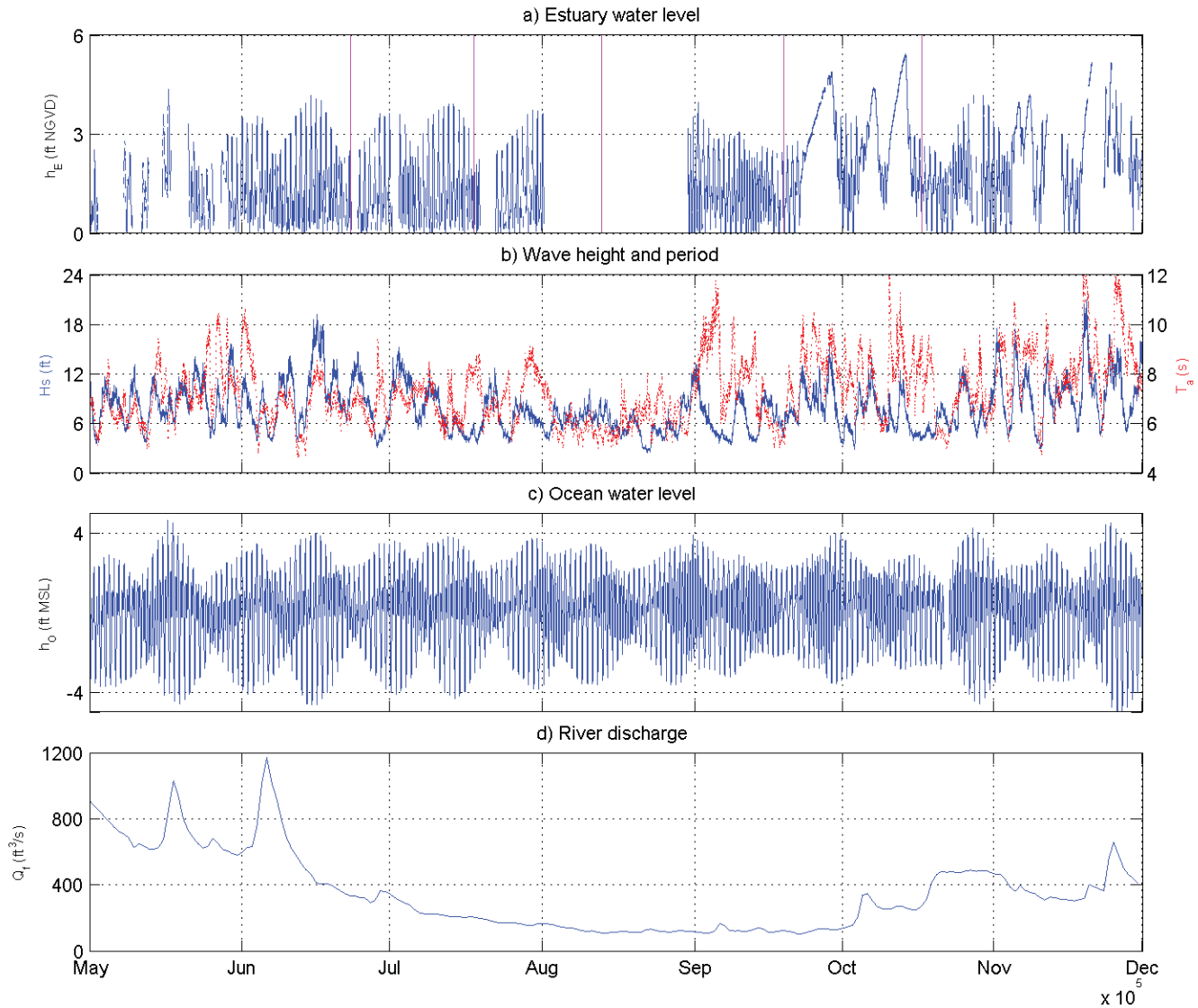


SOURCE:

a) h_E=estuary water level (SCWA); pink bar = beach survey

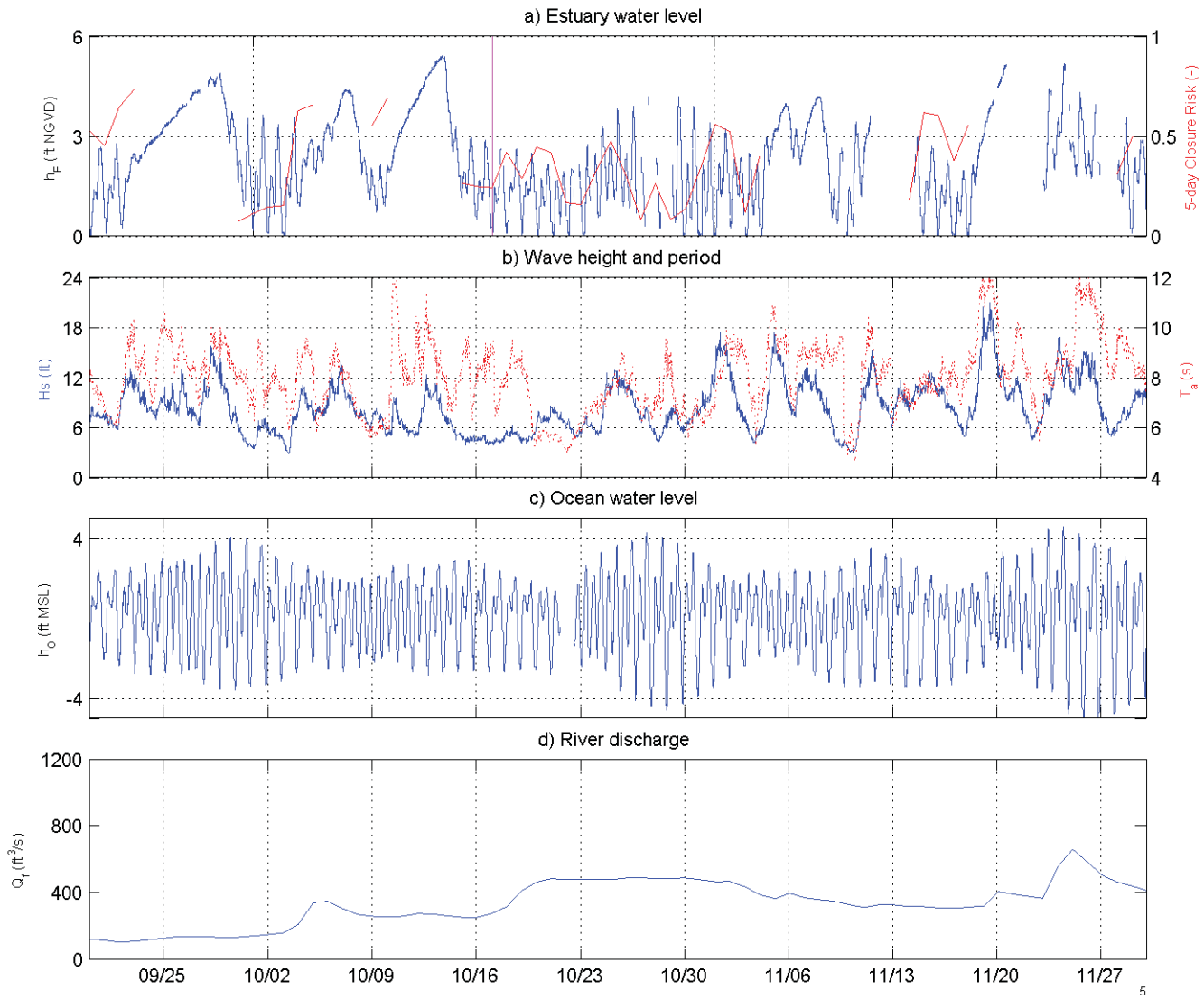
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)

c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)

d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 1

Estuary, Ocean, and River Conditions
May - November 2011



SOURCE:

a) h_E=estuary water level (SCWA); pink bar = beach survey

b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)

c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)

d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 2

Estuary, Ocean, and River Conditions
September - November 2011

a)

b)

c)

SOURCE: Bodega Marine Lab

Figure 3

Inlet State, September 30, October 6, and October 9, 2011

a)

b)

SOURCE: Sonoma County Water Agency

Figure 4

Outlet Channel Along and Through Jetty, September 26, 2011

Source: Sonoma County Water Agency survey data

N

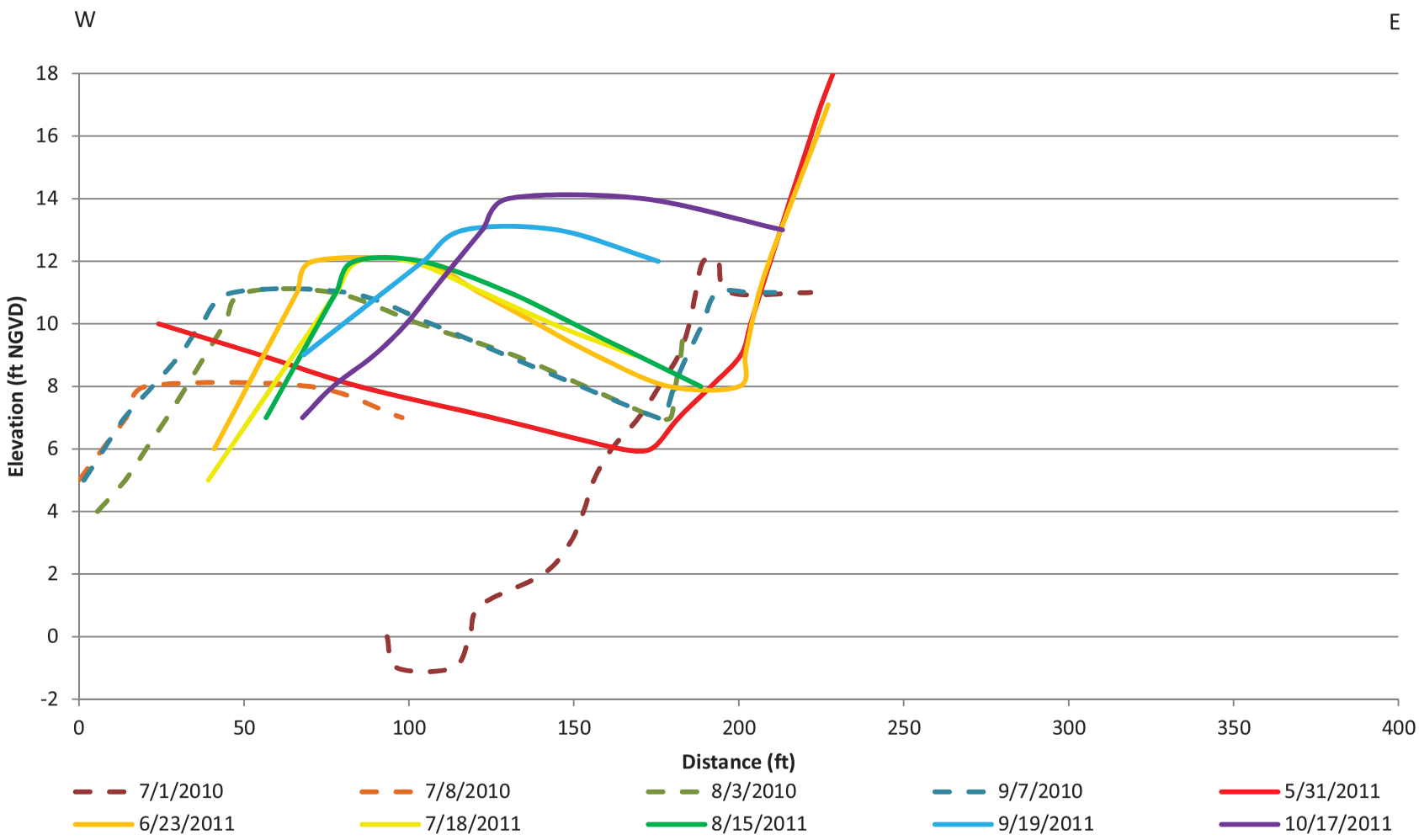
figure 5
Russian River Outlet
Channel Management Plan

Beach Topography Transect Locations

ESA PWA Ref# - DW01958

ESA PWA

Beach_topo.mxd



Source: Sonoma County Water Agency survey data

figure **6**

Russian River Outlet Channel Management Plan

Beach Transect 4

ESA PWA Ref #: DW01958

ESA PWA

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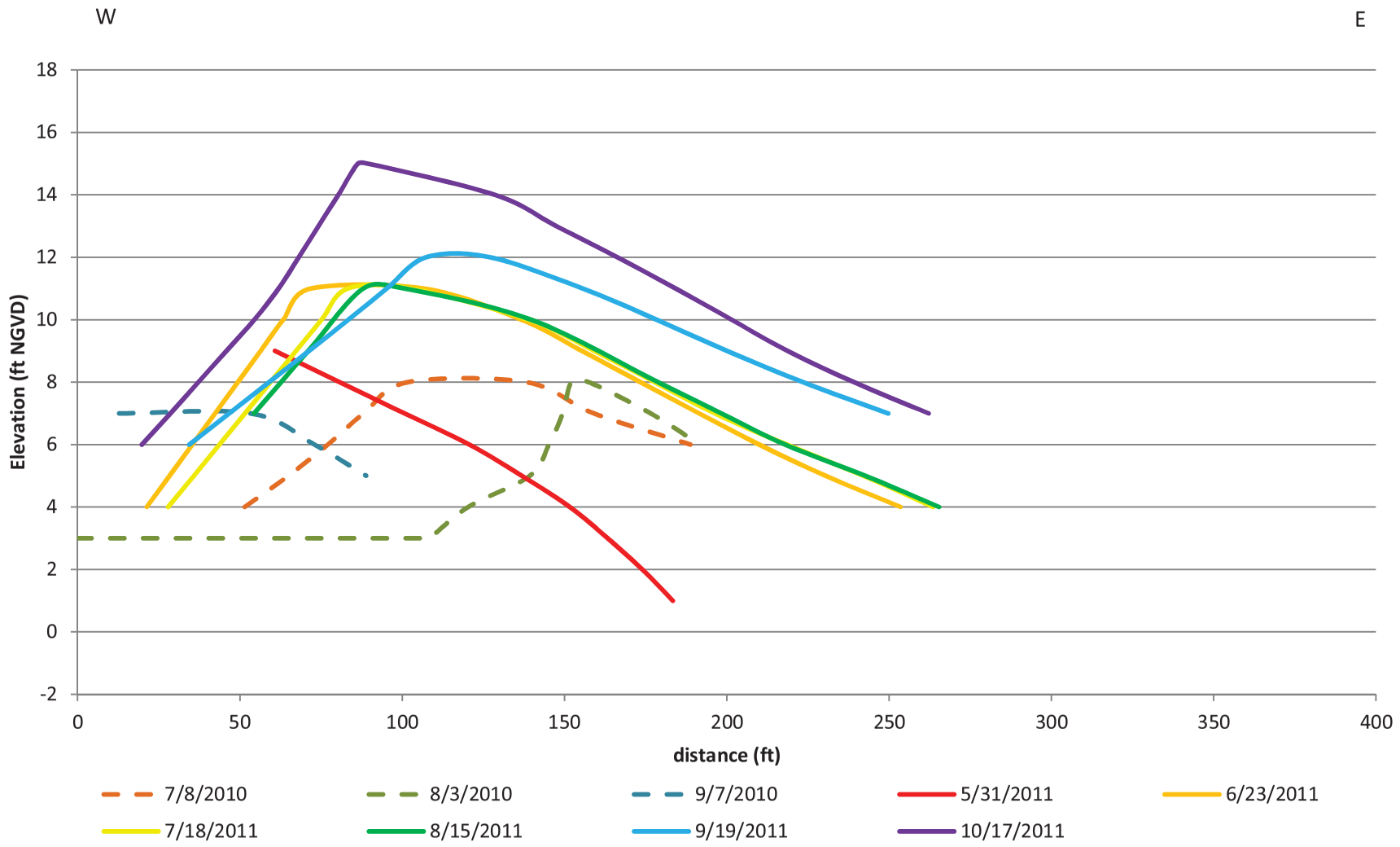


Source: Sonoma County Water Agency survey data

figure 7

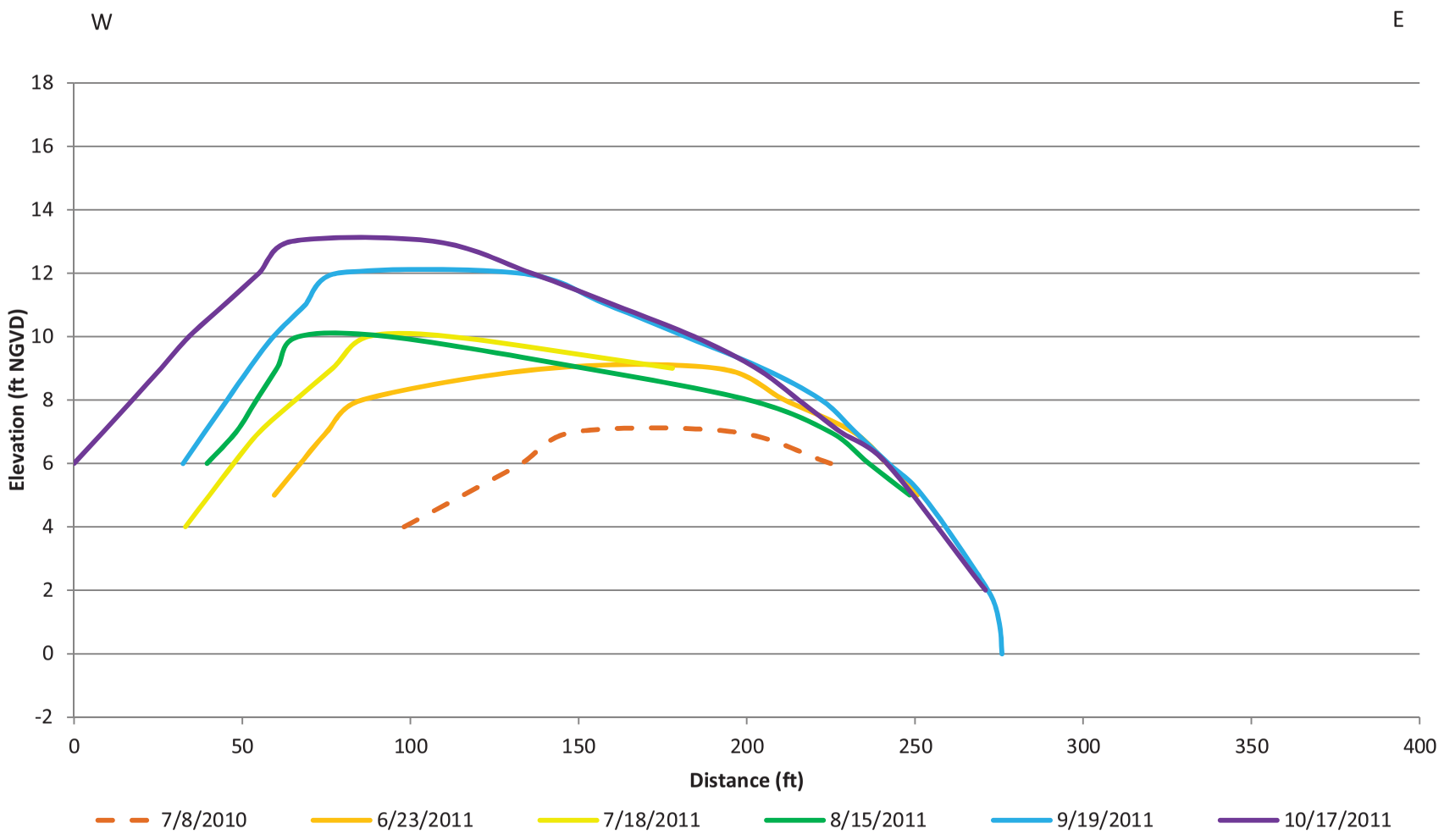
Russian River Outlet Channel Management Plan

Beach Transect 3

ESA PWA Ref #: DW01958

ESA PWA

Bathy_transects.xlsx / Transect3



Source: Sonoma County Water Agency survey data

figure **8**

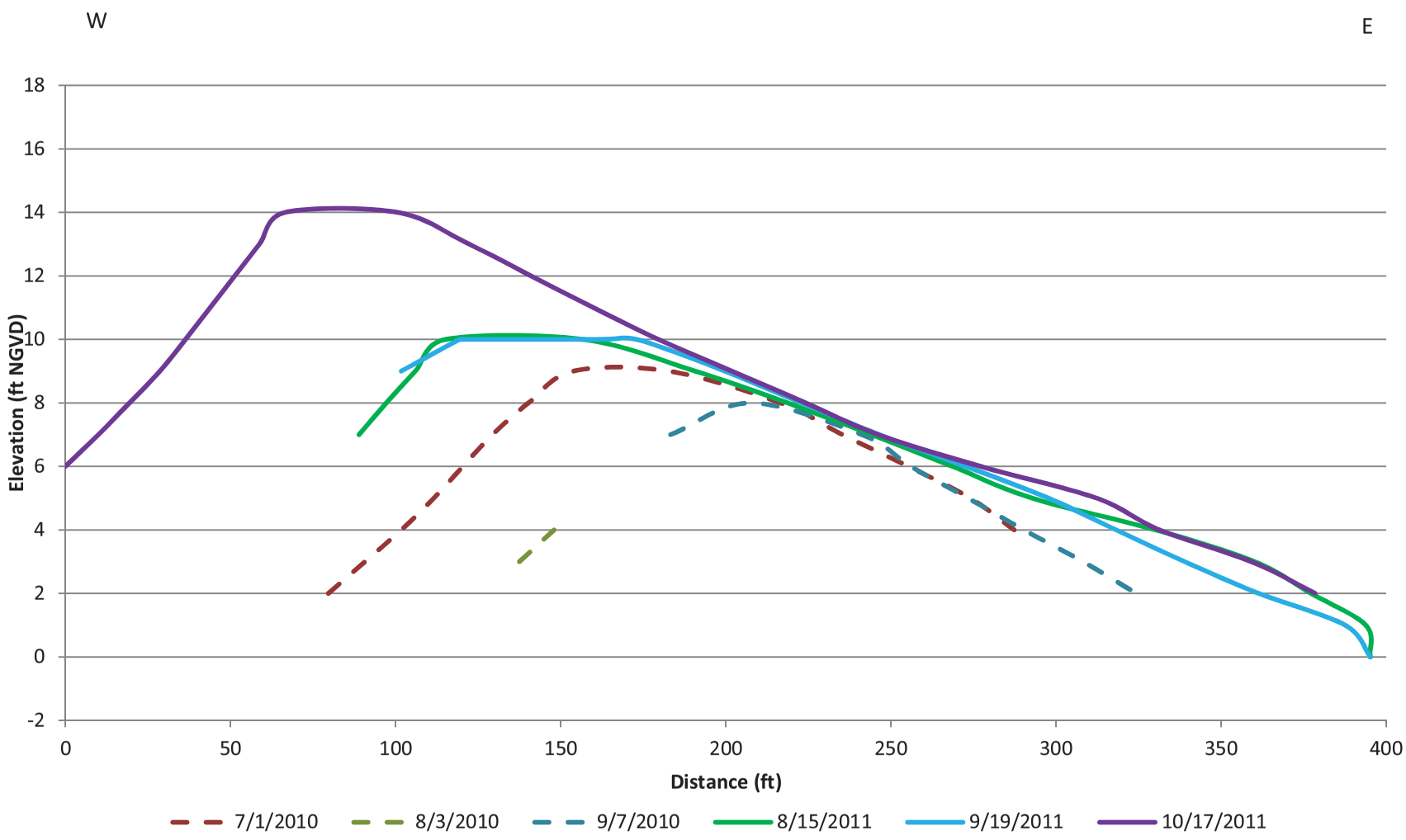
Russian River Outlet Channel Management Plan

Beach Transect 2

ESA PWA Ref #: DW01958

ESA PWA

Bathy_transects.xlsx / Transect2



Source: Sonoma County Water Agency survey data

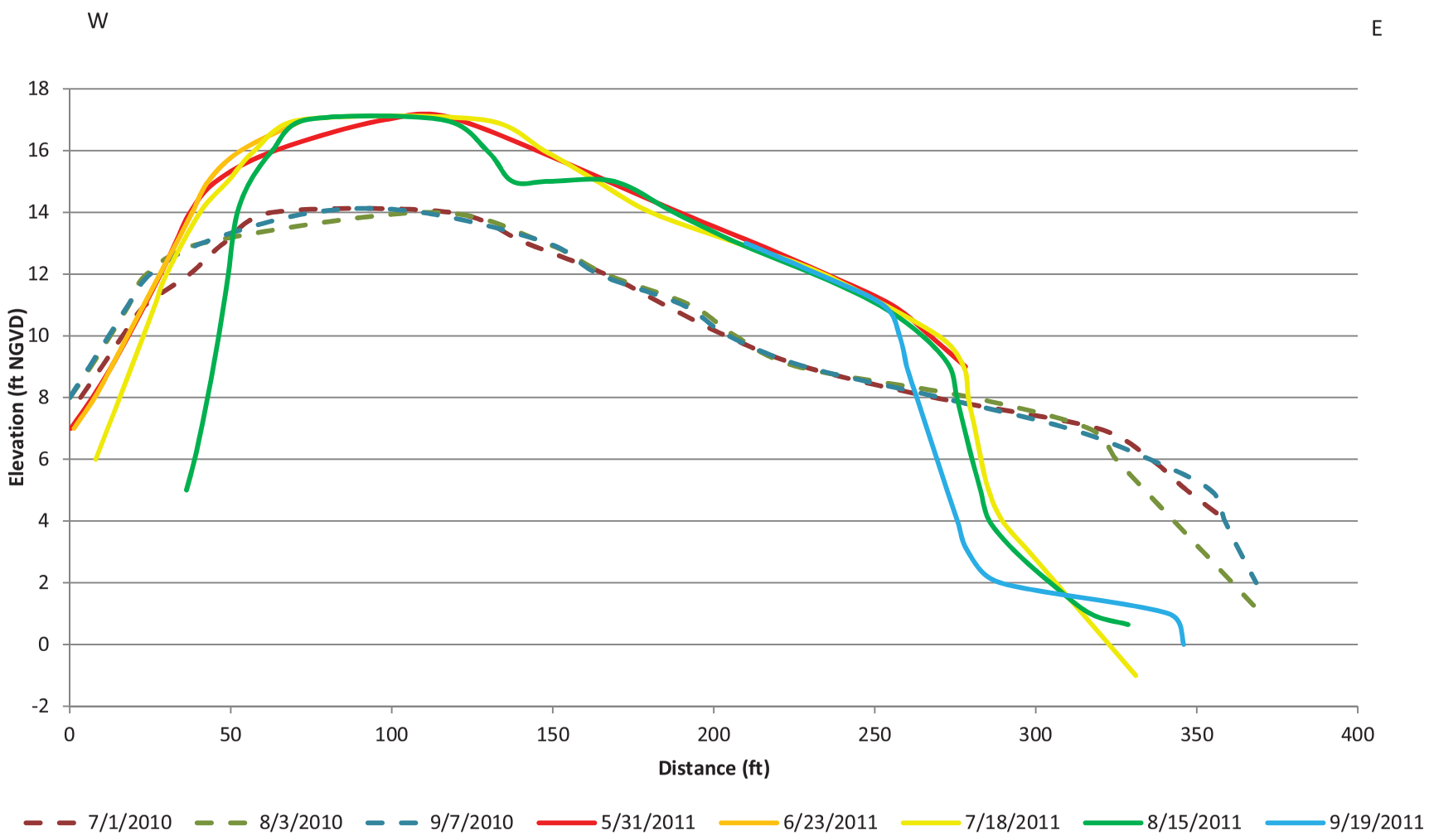
figure **9**

Russian River Outlet Channel Management Plan

Beach Transect 1

ESA PWA Ref #: DW01958

ESA PWA



Source: Sonoma County Water Agency survey data

figure ***10***

Russian River Outlet Channel Management Plan

Beach Transect 0

ESA PWA Ref #: DW01958

ESA PWA

Bathy_transects.xlsx / Transect0

SOURCE: Sonoma County Water Agency

Figure 11

Steep Berm Limiting Beach Access, September 26, 2011

Attachment G. Physical Processes During the 2012 Management Period

As required by the Russian River Biological Opinion, Sonoma County Water Agency (Water Agency) has been tasked with managing a summer lagoon intended to improve salmonid habitat in the Russian River Estuary by creating an outlet channel while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised annually in 2010-2013. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2012, but no opportunities for management action occurred during the management period.

During the 2012 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. Although the inlet experienced several closures, none resulted in water levels above 5.5 ft NGVD prior to self-breaching. For much of June and July, the inlet was either closed or only allowing heavily muted tides (tide range < 1 ft), but the lagoon water surface never surpassed 5 ft NGVD. During this time, each closure ended when lagoon water levels increased, overtopped the beach berm, and scoured a new tidal channel. Since these episodes did not evolve to the point that management action was warranted, the Water Agency did not take any management actions to encourage formation of an outlet channel. For the remainder of July, all of August, and the first half of September, the estuary was fully tidal. Then the inlet closed twice between September 20th and October 10th. Both closures were short-lived, lasting less than one week, and again the inlet self-breached, precluding any Water Agency management action. The highest lagoon water level of the 2012 management period, 5.25 ft NGVD, occurred at the end of the October closure.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2012 outlet channel management period examined water levels, ocean wave conditions, ocean water levels, riverine discharge, beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, DFG, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Data transmission failure due to cellular network issues occurred for several 1-5 day periods throughout the management period.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk (Behrens et al., 2013). (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel. When discussing this parameter, both states are referred to as a 'closure' in that tides are prevented from propagating into the estuary.) The inlet stability parameter presented by Behrens et al. (2013) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The wave-driven import is assessed using nearshore wave estimates derived from a transformation matrix and offshore buoy data (ESA PWA 2012) and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (2013) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

SUMMER AND FALL CLOSURES AND SELF-BREACHES

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. The lagoon water level time series (Figure 1a) summarizes the observed muted conditions in early summer and short-lived closure events that occurred at the end of the management period. As shown in Figure 1d, discharge remained high for the first two months of the management period. River discharge did not drop below 200 ft^3/s until after June 10th, at which time the estuary had already begun its muted tidal phase, leading up to four short-lived closures. This elevated discharge probably reduced the likelihood of inlet closure during the first 30-40 days of the management period (Figure 1d), despite the occurrence of energetic wave conditions in May (Figure 1b). Wave

energy reached a minimum in August and early September, but was weaker throughout the 2012 management period than in 2011. The hourly significant wave height was less than 8 ft for the majority of this period.

The conditions leading to inlet closure were consistent with the existing conceptual model described in Section 4 of the Management Plan. All closure events coincided with either moderately high waves (H_s > 6 ft) having periods greater than 10 s, or with neap oceanic tide ranges of less than approximately 5 ft. Moderately high waves coincided with the closure events in June, July, September and October. The first closure observed in June and both July closures coincided with neap tide conditions, although long-period swells occurred prior to the former of the two. Closure events that occurred in June and July are examined in more detail in Figure 2, while Figure 3 summarizes conditions that occurred later in September-November.

All closure events occurred with the inlet located adjacent to the jetty. This positioning may have prevented perched conditions from arising by shielding this area of the beach from the wave-driven sediment deposition that caused closure, preventing the beach from accreting to a sufficient height to allow the desired outlet channel elevations from being attained. The low point in the beach berm that was subsequently overtopped and self-breached also persisted immediately adjacent to the jetty.

PERCHED LAGOON AND SELF-BREACH DYNAMICS

During the June and July closures (Figure 2), as well as the late September closure (Figure 3), the lagoon water level only increased at approximately 0.3 ft/day. This slower increase probably occurred because a small outlet channel that flowed over the beach berm and through a gap in the jetty partially balanced inflowing river discharge.

As an example of one of the several inlet closure events that resulted in self-breaching prior to target outlet channel elevations, Figure 4 shows a sequence of photos of the inlet before, during, and after an episode from October 8-15. As was the case for all of the management period, the inlet was located next to the jetty. Prior to closure, the inlet had allowed only muted tides, resulting from a partial breach on October 2nd that did not restore full tidal action. Neap oceanic tides compounded this, and 7-ft high nearshore waves having a dominant period above 20 seconds closed the inlet on October 8th (Figure 3b,c).

After the onset of closure, the estuary water levels began to rise. For the first two days of closure, the water level increased at approximately 0.5 ft/day from 3 to 4 ft NGVD, but this decreased to less than 0.3 ft/day afterwards (lagoon stage above 4 ft NGVD). Waves deposited sediment adjacent to the gap in the jetty structure, blocking outflows from the lagoon that had occurred in prior closures (Figure 4b). This partially-formed barrier berm was overtopped when the lagoon reached approximately 5.25 ft on October 15th (Figure 4c). The outlet channel was narrow, with a width of less than ten feet. This overtopping event coincided with a spring phase of the oceanic tides, which generated a large head difference between the estuary and ocean waters. This head difference presumably contributed to channel flow velocities exceeding the threshold for scouring the beach sand, since the spring lower-low tide on October 16th resulted in the small channel

eroding the barrier and creating a new inlet (Figure 4d). After the initial breach, the increased flow rate scoured sand from the channel bed and banks, and the channel increased to more than 20 feet in width (Figure 4d).

The jetty and rocks which had been a part of the jetty appeared to have a significant influence on the geomorphic evolution of the channel. At times, the jetty elements may have stabilized the outlet channel, both in sheltering the outlet channel from waves and by providing bank and bed stabilization that minimized channel scour. Wave sheltering by the jetty probably reduced berm build-up at the inlet's location, leaving a low point in the beach berm that was the site for subsequent overtopping and self-breaching. Of the six closure events that occurred within the management period, all experienced a similar breaching pattern, self-scouring a tidal inlet before estuary water levels reached 5.5 ft NGVD. This was also true of the two closure events which occurred in November, following the management period (Figure 3). At times, the outlet channel flowed through notch in the jetty (Figure 5), such that the rocks probably provided stabilization that prevented bed scour. The jetty also halted lateral scour to the south. However, once lateral scour is halted, the channel may then maintain its cross-sectional area by scouring downward where it runs parallel to the jetty.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2012 according to the method described in Behrens et al. (2013). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 50 percent before each 2012 event (Figure 1e, Figure 2e, and Figure 3e). The closure event initiated on July 1st occurred quickly, transitioning from fully tidal to fully closed within a day, so the risk time series did not provide much forewarning in this case. This was also true of two closure events occurring outside of the management period, in November 2012. However, for all other events observed from June to November, the predicted probability of closure exceeded 50% 2-5 days in advance of each closure. There were no instances during the management period when the predicted probability of closure exceeded 50% and a closure did not occur within 5 days.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent can be limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which sets guidelines for the survey crew's disturbance to marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at

1 ft intervals. The survey elevations are reported in the NGVD29 vertical datum, the working datum for estuary monitoring and management.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September), 2011 (May to October), and 2012 (May to October) surveys. Surveys from November 2011 to May 2012 were also compared, to assess winter-time changes of beach shape. Survey transects from the 2011 analysis were reused (Figure 6), and include two transects backed by cliff (Figure 7 and Figure 8), one transect which extends into the estuary (Figure 9), and two transects just north of the jetty (Figure 10).

This review focuses on the 2012 surveys, although the 2010 and 2011 surveys are included for context. Compared with both 2010 and 2011, the 2012 topographic data indicate that the beach berm was less variable in shape than in previous years. This is especially true of the northern two transects (Figures 7 and 8), and to a lesser extent at Transect 2 (Figure 9). Because of inlet and seal haulout locations, topographic data were not collected in the vicinity of Transect 1 in 2012, so this is not included in the analysis. Adjacent to the jetty groin, Transect 0 showed little monthly change in topography, but extensive inter-annual variability.

During the management period in 2012, the beach berm along transects 2, 3, and 4 showed little variability, changing by less than two feet. The profile along Transect 2 (Figure 9) showed a slight aggradation trend over the course of the management period, but at Transects 3 and 4, the change in shape fluctuated only slightly (Figures 7 and 8). In contrast, between May 2011 and October 2011, the beach berm at these transects built in size by more than 6 feet. The difference in monthly variability at the northern transects between the 2011 and 2012 management periods can likely be tied to the difference in the extent of inlet migration. In 2011, the inlet migrated north of Haystack Rock during the winter, and returned to the jetty in late spring or early summer. This migration resulted in a lower beach profile at all transects. Over the course of the management period, the beach gradually built up to a typical summer profile. Even during the peak winter and spring flows of 2012, the inlet never migrated north of Haystack Rock, leaving a largely-intact beach berm north of Haystack Rock and a lower terrace between Haystack Rock and the jetty groin. Since these northern transects started at a much higher elevation at the start of the management period, the vertical growth of the beach profiles at these locations were several feet less than during the previous year in the same locations.

Transect 0, which is located just north of and parallel to the jetty, had noticeably different elevations and evolution than the other transects during the 2012 management period. Compared to the other transects, crest elevations were highest at this transect for both 2010 and 2011. This was not the case in 2012, when the northernmost two transects were the highest. The crest elevation at Transect 0 did not evolve during the management periods in 2010 and 2011, but was observed to erode between August and October in 2012. Images from the BML stationary camera indicate that this was the result of the inlet shifting from a sinuous alignment (resulting from southward migration) to a straight alignment running nearly parallel to the jetty. The only significant changes occurred during the winter between each of the management periods. The lack of management period variability of this region suggests that the jetty shelters this portion of

the beach from small to moderate waves that occur during the management period. Only the larger waves associated with winter storms may be sufficient to re-shape the beach berm near the jetty.

Water Agency surveys taken during the months preceding the 2012 management period (November 2011 to April 2012, Figure 11) show more variability in beach berm height and width than was observed for the 2012 management period (Figure 9). The highest beach crests observed during the 12-month period from November 2011 to October 2012 occurred in November and December 2011, peaking between 14 and 15 ft NAVD88 at Transect 2 (Figure 11). This is consistent with the combination of high-energy, long-period swell waves and generally low fluvial flows during the late fall. By the February 2012 survey, erosion significantly reduced the beach crest elevation. This erosion is likely due to fluvial flows through the inlet at Transect 2. Farther north, at Transect 3, there was less influence from the inlet, and there appeared to be less erosion during winter 2011-12 (Figure 12). The berm crest was highest in late spring (March and May profiles) and in November 2012, peaking between 16 and 17 ft NAVD88. The difference between the evolution of Transects 2 and 3 may be a result of the inlet's lack of migration in 2012, or possibly a difference in the amount of wave exposure between locations.

Water Agency surveys were also used to assess the beach width at Transect 3. We focus on Transect 3, because the influence of the inlet caused the beach to be consistently lower at other transects, sometimes as low as the intertidal zone, where survey data were not consistently collected. The Transect 3 beach width was as the horizontal distance between a particular elevation on the ocean and estuary sides of the beach face, respectively. From November 2011 to June 2012, the beach width at the 12 ft NAVD88 elevation varied from 110 to 145 feet, showing signs of both narrowing and widening during the winter and spring (Figure 13). From June to August 2012, the beach width grew steadily from about 110 ft to 145 ft and appeared to remain at this width though November 2012. At an elevation of 14 ft NAVD88, the width followed the same pattern, but had larger fluctuations, varying from roughly 30 to 110 ft and grew steadily from June 2012 onward. These observations underscore the typical pattern of beach building in summer, but also indicate that waves in winter can build the beach between destructive events.

LESSONS LEARNED AND RECOMMENDATIONS

Based on observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- Elevated discharge in the late spring (greater than 200 ft^3/s until June 10th) may have reduced the likelihood for inlet closure in May, although the wave climate at this time was also significantly weaker than during the previous year.
- Several short-lived closure events occurred, but waves never built up the minimum crest height (the limiting height for closure) beyond 5.5 ft NGVD, and all events ended with

self-breaches below this elevation. This prevented management actions from being taken during the 2012 season.

- The inlet never migrated north of Haystack Rock during peak winter floods, and returned to the jetty in early spring, much earlier than in most years. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- During the management period, most of the beach north of Haystack Rock underwent little topographic change. A transect adjacent to Haystack Rock aggraded slightly, consistent with typical beach berm building that occurs during the summer. Adjacent to the jetty, the berm did not aggrade, but rather remained largely unchanged for most of the season and then later eroded between August and October as a result of a shift in the inlet alignment.
- The wave climate remained weak throughout much of the summer and fall, which may have stunted the growth of the beach crest in the vicinity of the jetty (the location of the inlet throughout the 2012 season), preventing lagoon water levels from reaching levels conducive of the planned outlet channel.
- When an outlet channel is present, oceanic tide conditions can encourage scouring and formation of a new tidal inlet. During the spring phase of the tide, the lower-low tide creates a large head difference between the lagoon and ocean, likely increasing the flow velocity in the channel.

OUTLET CHANNEL FEASIBILITY

- The jetty may shelter the inlet, making closure less likely and also limiting berm growth, which then maintains a low point for self-breaching. When the inlet is in a fully or muted tidal condition, options for management become considerably more difficult to implement.
- An outlet channel that was intermittently observed during the 2012 closures conveyed a portion of the inflowing river discharge, slowing the rise in lagoon water levels to approximately 0.3 ft/day. This channel flowed through a gap in the jetty, whose large rocks likely provided some degree of channel stabilization against scour. However, this condition changed with lagoon levels, as described below.
- Once outlet channel discharge increased due to rising lagoon water levels or low oceanic tides, the discharge scoured a new channel, breaching the estuary to the tides. This behavior highlights the susceptibility of a sand bed outlet channel to scour, limiting conveyance capacity.
- Even if the inlet being near the jetty hinders formation of sustained lagoon and outlet channel conditions, management opportunities for re-locating the outlet channel are limited and constrained. At a minimum, creating an outlet channel further north from the jetty requires a full natural closure, absence of a low point in the beach berm near the jetty, and equipment access to the area north of the jetty.
- Over the first three years of effort to implement the outlet channel adaptive management plan, only one closure (July 2010), has been suited for outlet channel management action.

COMMUNICATIONS

- Although the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency began planning management actions as soon as the

episodes occurred. Planning included heightened observations of inlet conditions by Water Agency staff, email updates to inform the resource management group, and pre-implementation meetings at the project site to refine plans for management action.

MONITORING

- The Agency's month survey methods should be modified to collect specified contours, such as the beach berm ridge line, wetted edge (beach side), and water edge (estuary side).

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Behrens, D., Bombardelli, F., Largier, J. and E. Twohy. 2009. Characterization of time and spatial scales of a migrating rivermouth. Geophysical Research Letters. Vol. 36, L09402, doi:10.1029/2008GL037025.

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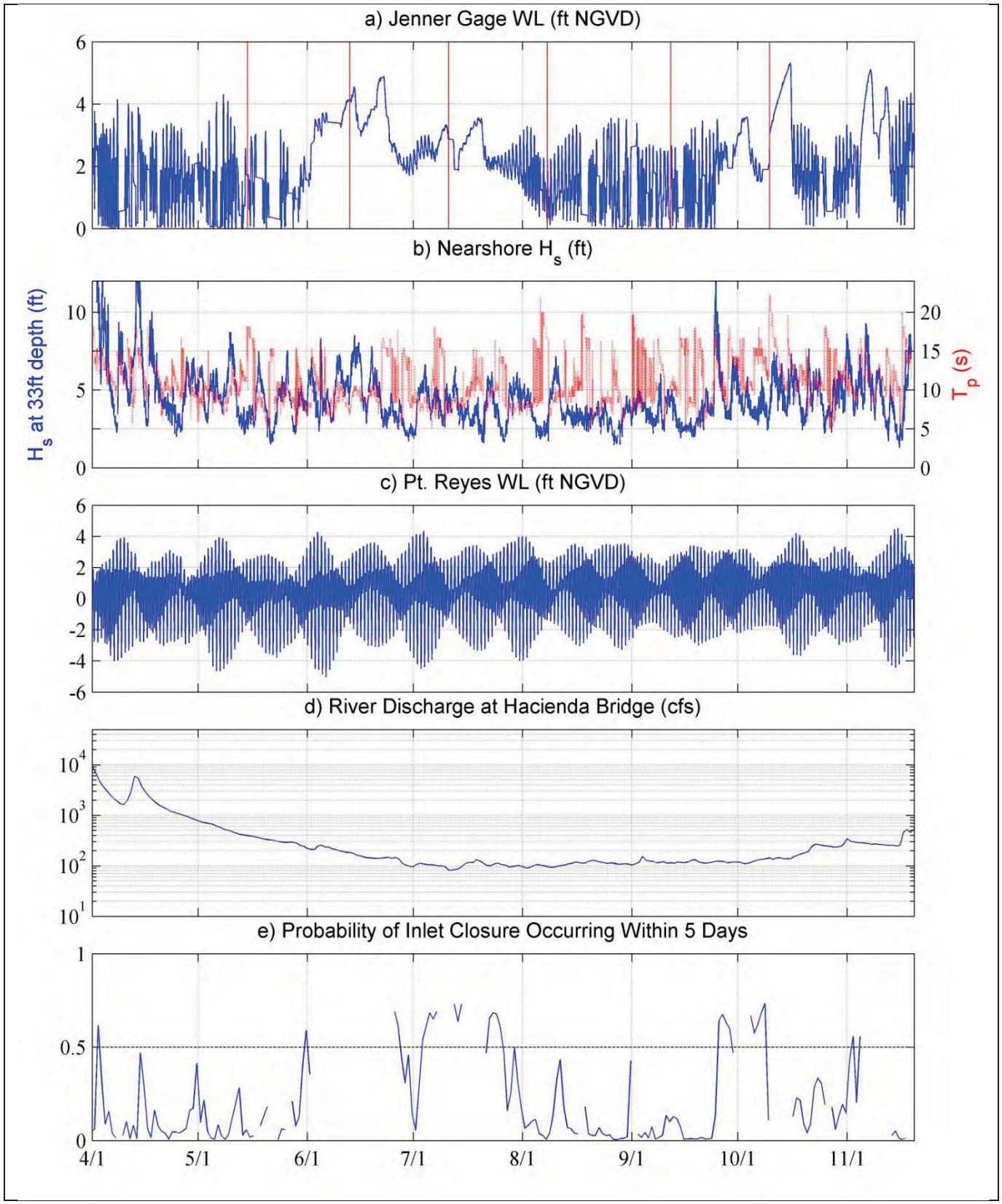
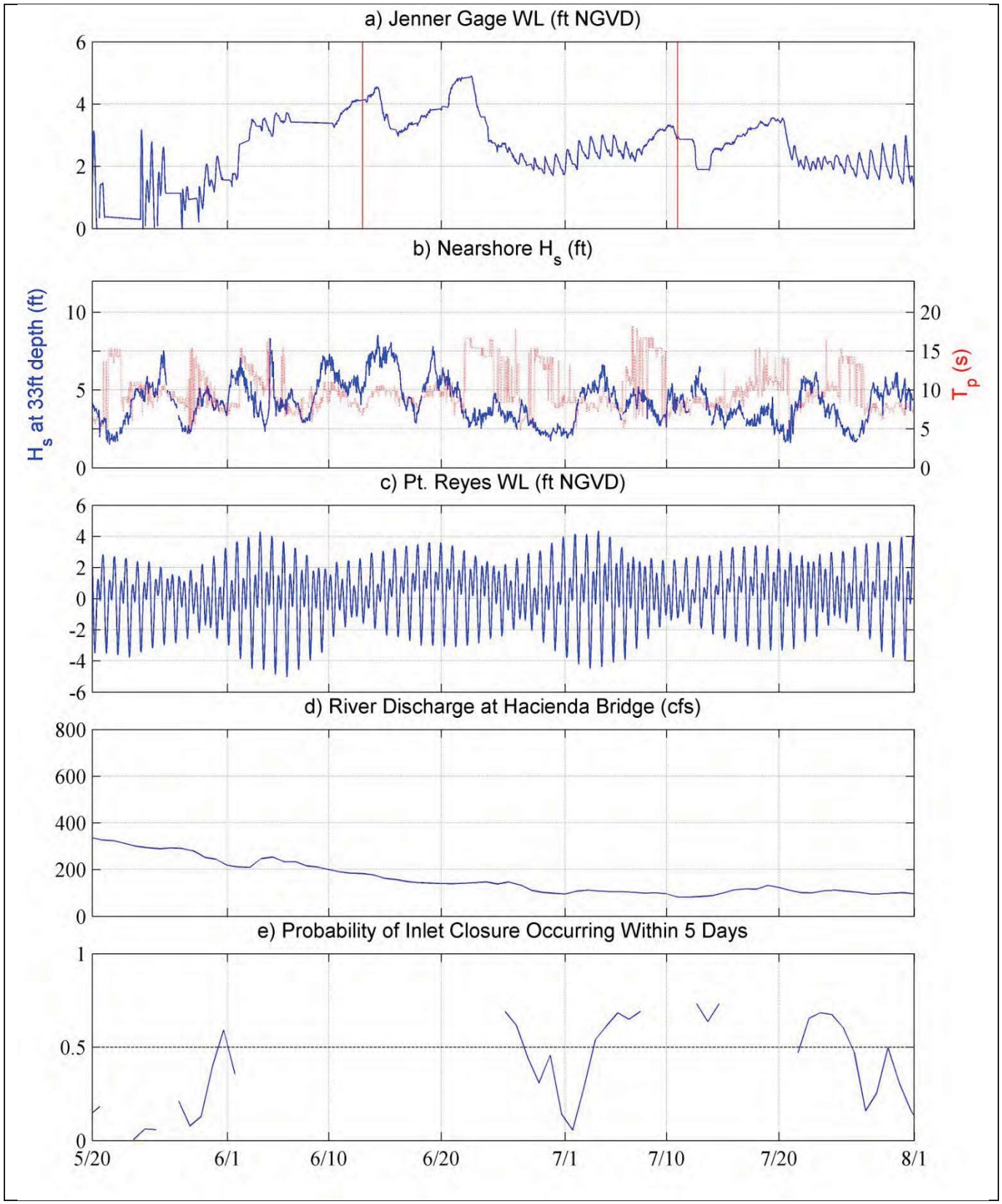


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 1

Estuary, Ocean, and River Conditions Compared with Closure Probability: September – November 2012

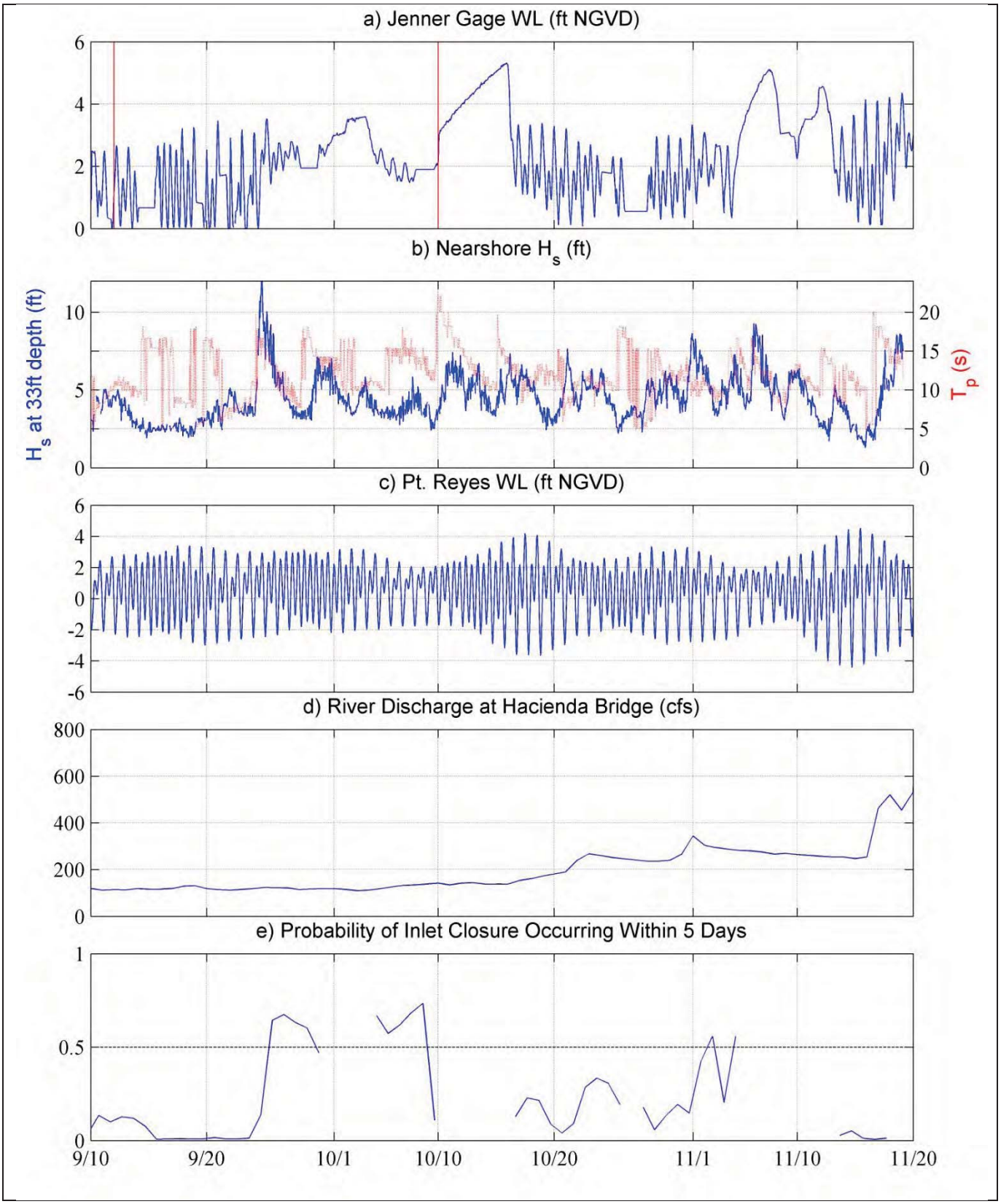


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; T_p=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 2

Estuary, Ocean, and River Conditions Compared with Closure Probability: May 20 – August 1, 2012

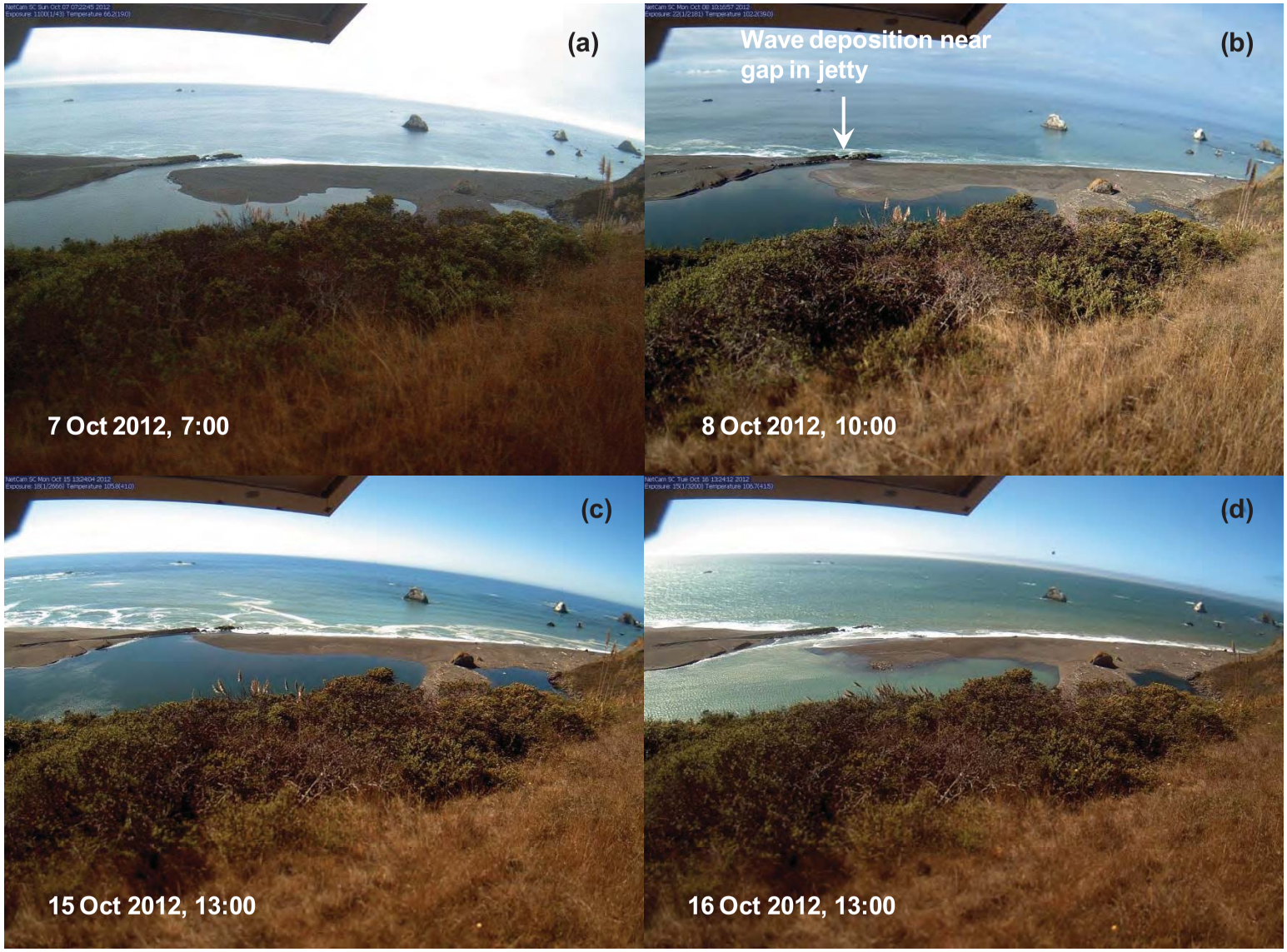


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; T_p=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 3

Estuary, Ocean, and River Conditions Compared with Closure Probability: September 10 – November 20, 2012



SOURCE: Russian River stationary observation camera (BML)

Figure 4

Inlet Closure and Self-Breach in October 2012

Source: Sonoma County Water Agency

figure 5
Project Name

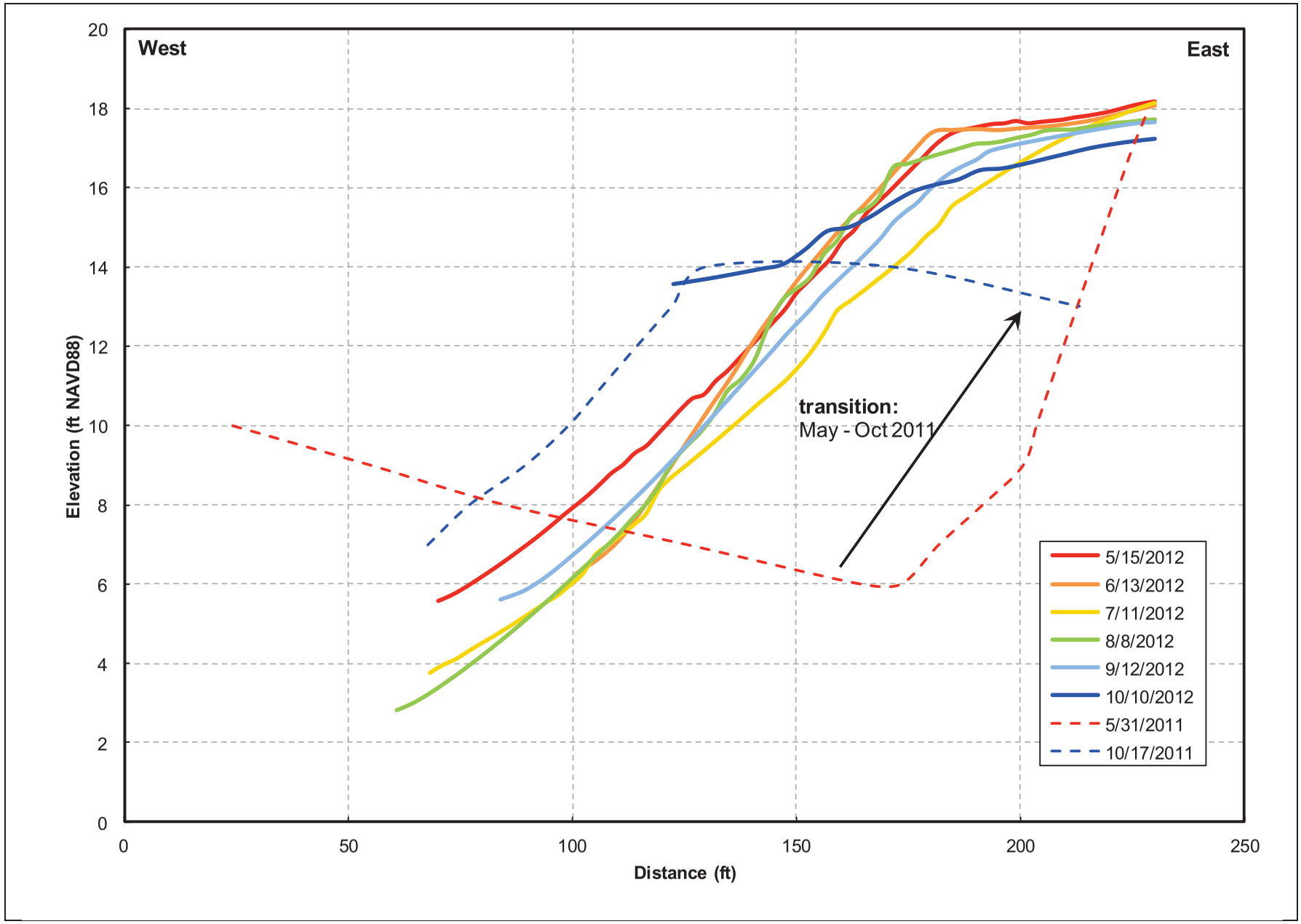
Outlet Channel Flow Through Jetty Notch

ESA PWA Ref# DW01958.02

ESA PWA

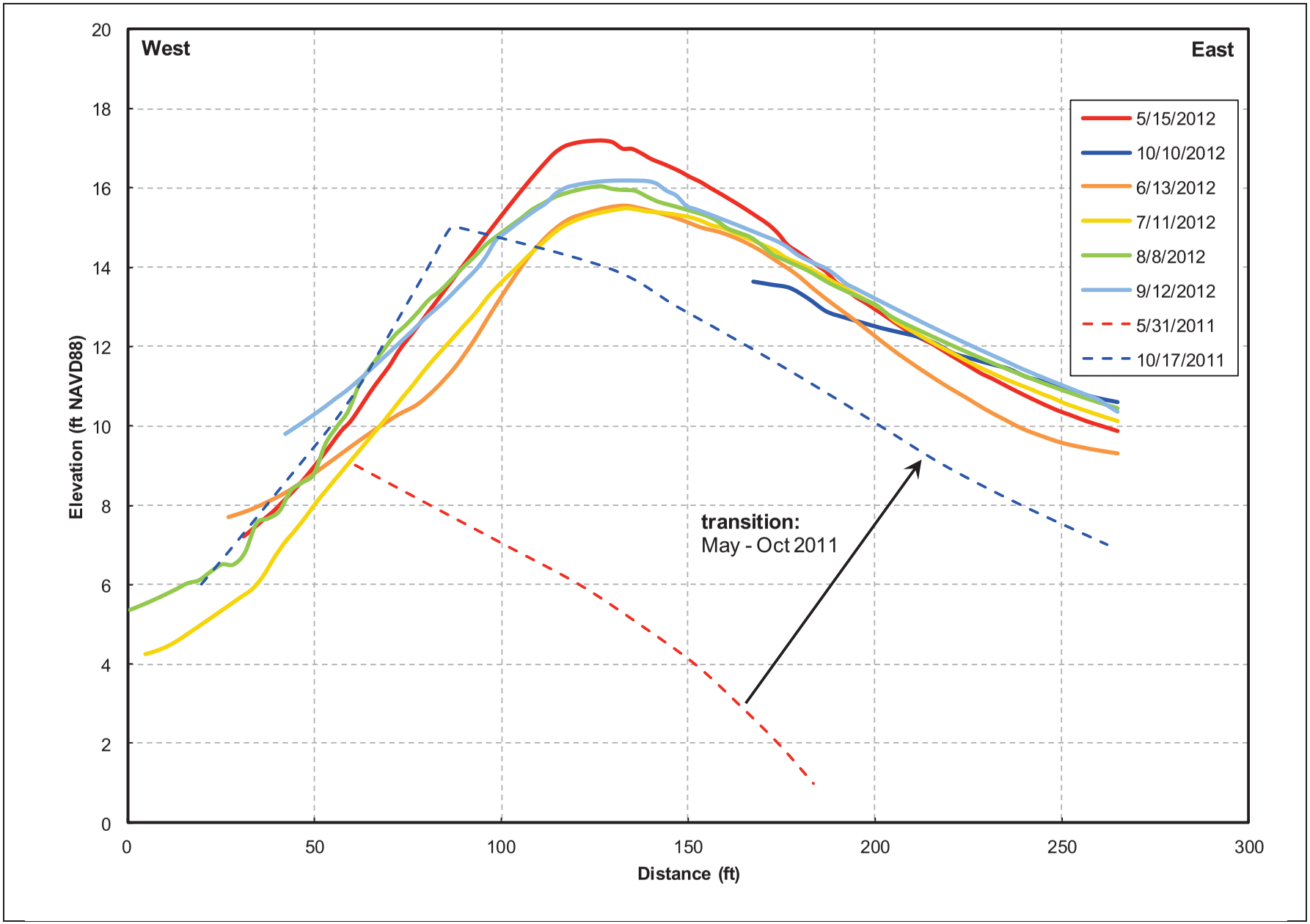
SOURCE: image from USDA NAIP

Figure 6
Beach Transect Locations



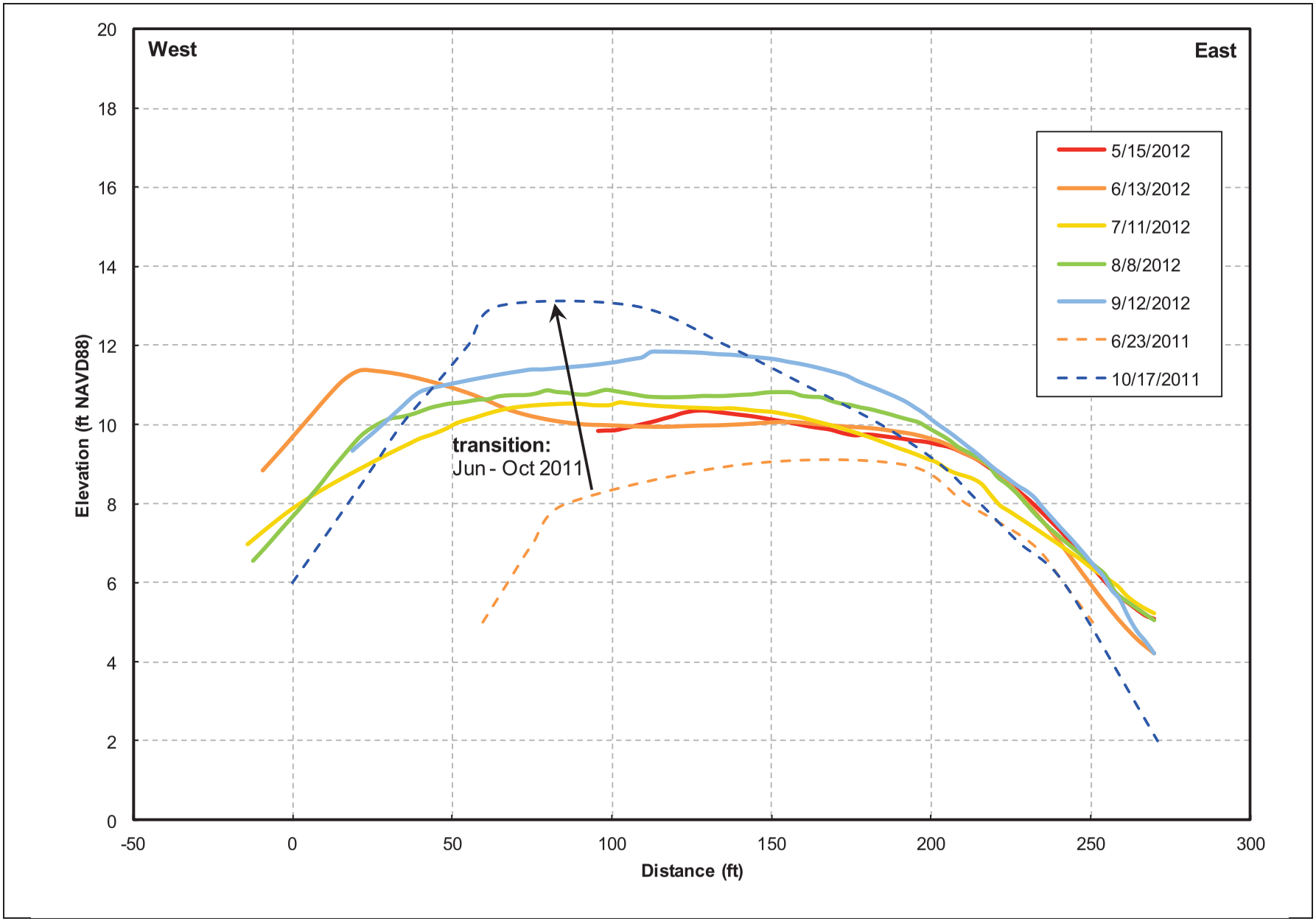
SOURCE: SCWA survey data

Figure 7
Beach Transect 4



SOURCE: SCWA survey data

Figure 8
Beach Transect 3

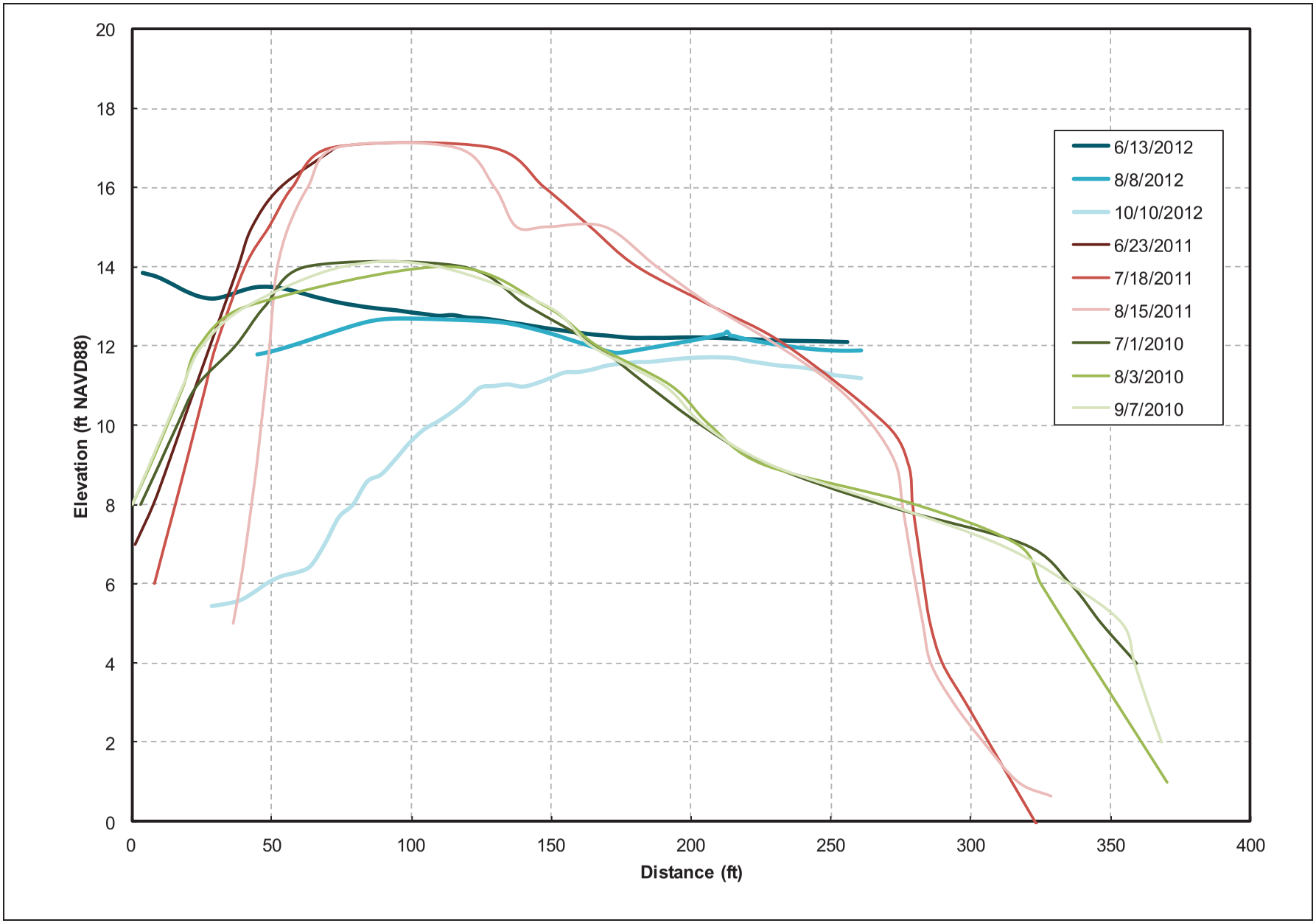


SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 9

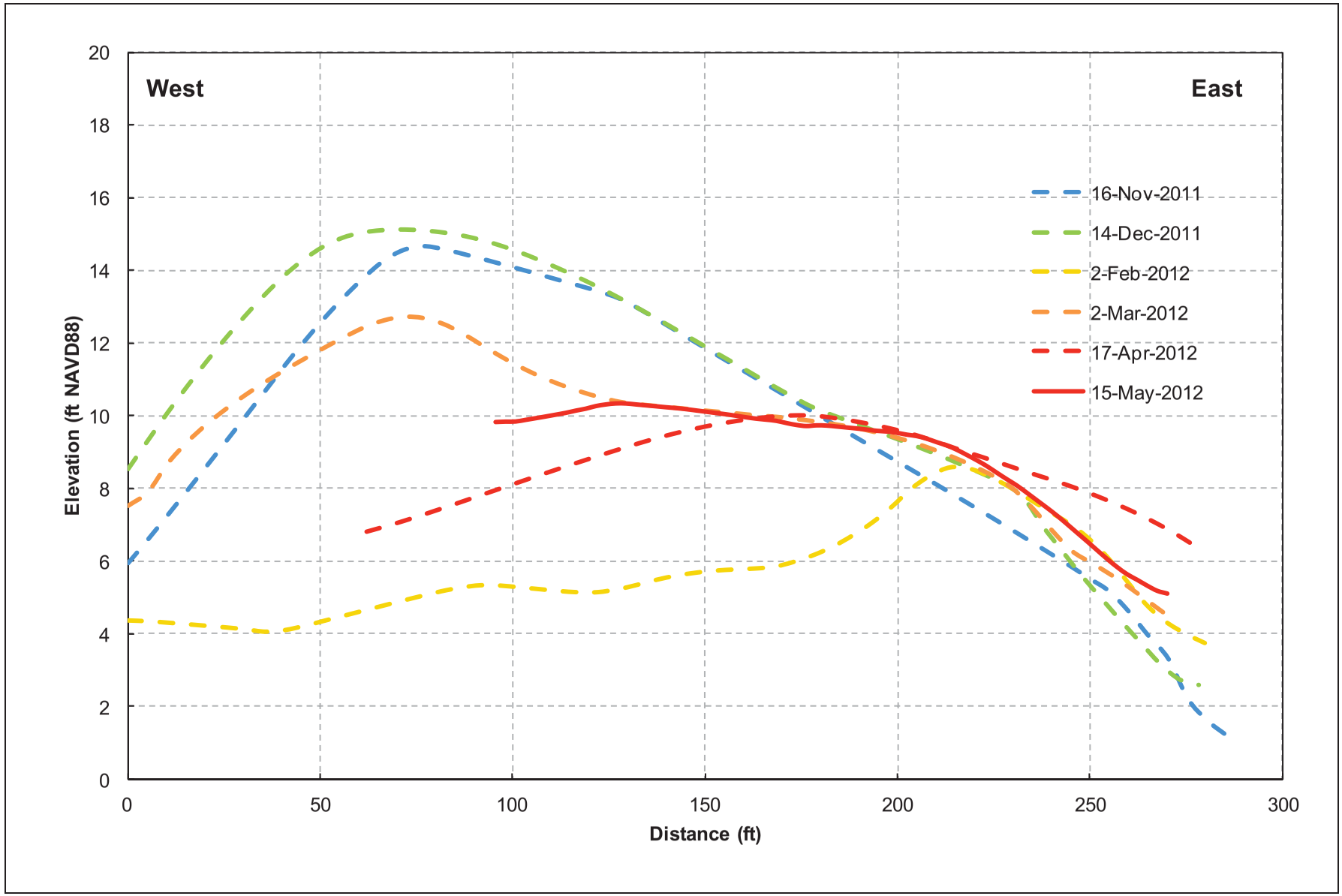
Beach Transect 2



SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

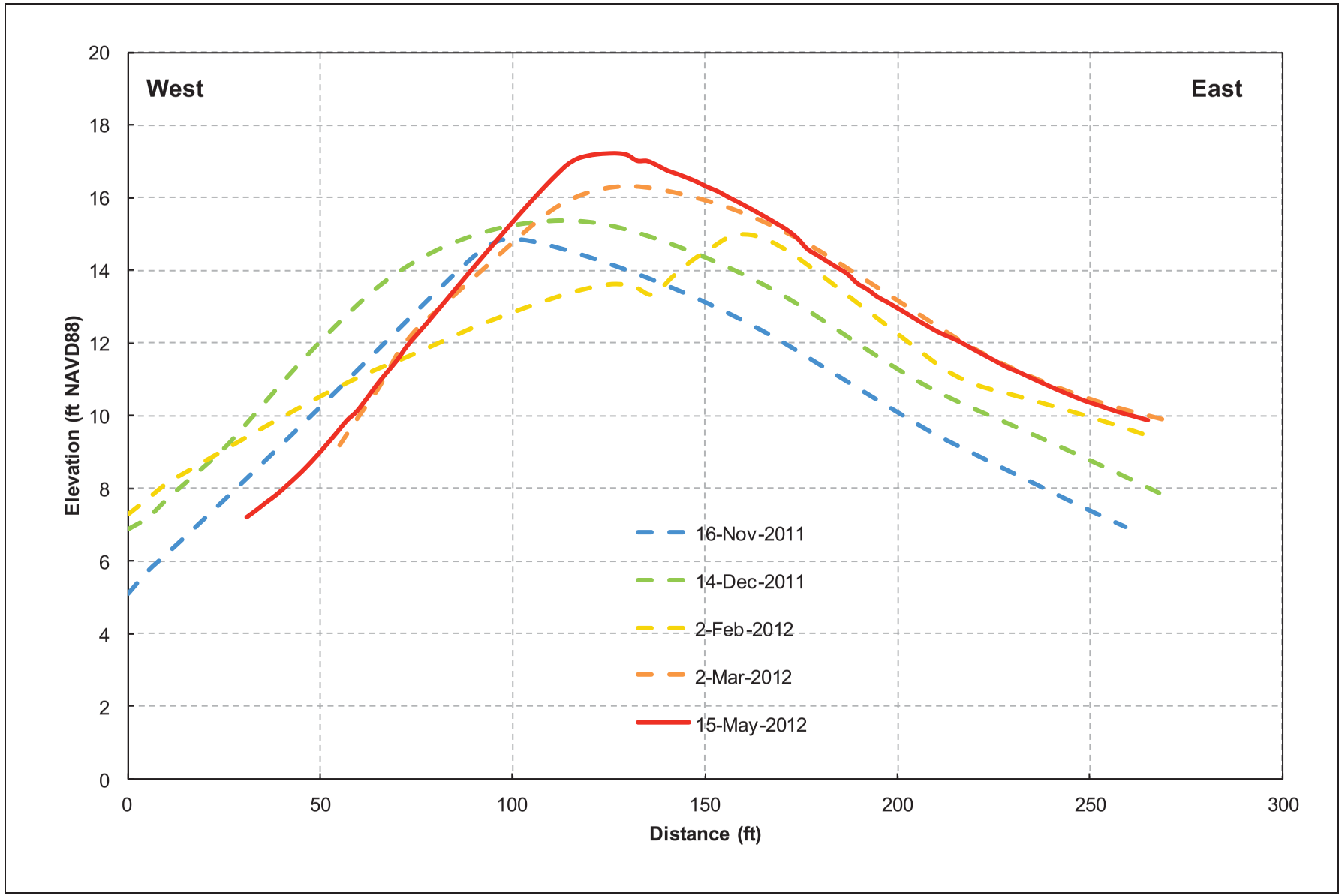
Figure 10
Beach Transect 0



SOURCE: SCWA survey data

Figure 11

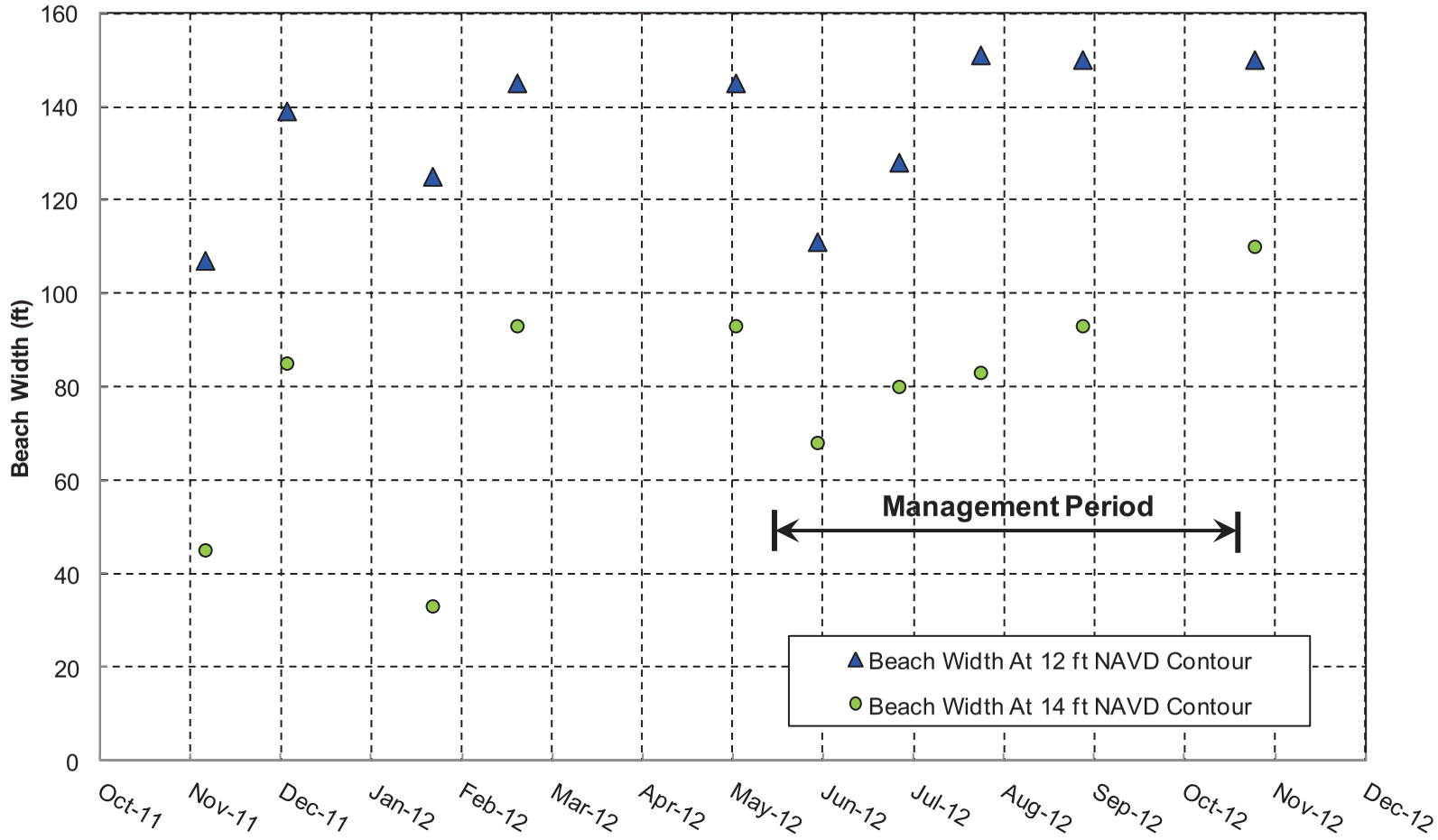
Nov 2011 to May 2012 topographic change at Beach Transect 2



SOURCE: SCWA survey data

Figure 12

Nov 2011 to May 2012 topographic change at Beach Transect 3



SOURCE: SCWA survey data

Figure 13

Beach Width at Beach Transect 3.

Attachment H. Physical Processes During the 2013 Management Period

As required by the Russian River Biological Opinion, the Sonoma County Water Agency (Water Agency) has been tasked with managing a summer lagoon intended to improve salmonid habitat in the Russian River Estuary by creating an outlet channel while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised annually from 2010 to 2014. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2013, but no opportunities for management action occurred during the management period.

During the 2013 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. Although the inlet experienced several closures, an outlet channel was not implemented. The inlet was closed for the majority of the first two months of the management period as a result of two closure events. During this time, each closure ended when lagoon water levels increased, overtopped the beach berm, and scoured a new tidal channel. The first event self-breached in early June before water levels reached 7 ft NGVD, while the second event resulted in lagoon stage above 7 ft NGVD but self-breached in early July before an outlet channel could be implemented. The estuary remained fully tidal until it closed again in late September. This September-October event was ended with a manual breach on the last day of the management period to provide a pathway for migrating salmonids and to reduce water levels in advance of potential fall precipitation.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2013 outlet channel management period examined water levels, ocean wave conditions, ocean water levels, riverine discharge, beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, CDFW, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Data transmission failure due to cellular network issues occurred for several periods throughout the management period.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk (Behrens et al., 2013). (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel. When discussing this parameter, both states are referred to as a 'closure' in that tides are prevented from propagating into the estuary.) The inlet stability parameter presented by Behrens et al. (2013) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The wave-driven import is assessed using nearshore wave estimates derived from a transformation matrix and offshore buoy data (ESA PWA, 2012) and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (2013) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

SUMMER AND FALL CLOSURES AND SELF-BREACHES

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. The lagoon water level time series (Figure 1a) summarizes the closure events at the beginning of the management period, as well as the subsequent tidal conditions and later closure events in fall. As shown in Figure 1d, discharge was low for most of the management period, dropping below 100 ft^3/s at the onset of June and not rising back significantly 100 ft^3/s until September, with the exception of a short rise in response to a late June rainfall. Flows as low as 85 ft^3/s during the closure in mid-June allowed

the lagoon stage to remain steady at approximately 5 ft NGVD for over a week. Immediately following this steady period, a late-season rainstorm briefly increased flows into the lagoon to more than 200 ft^3/s, causing the lagoon stage to approach 8 ft NGVD and eventually self-breach. As in prior years, wave energy in the subsequent months of July-September was minimal (Figure 1b). The hourly significant wave height only consistently surpassed 8 ft in late September, a likely cause of the last closure event of the management period.

The conditions leading to inlet closure were consistent with the existing conceptual model described in Section 4 of the Management Plan. All closure events coincided with either moderately high waves (H_s > 6 ft) having periods greater than 10 s, or with neap oceanic tide ranges of less than approximately 5 ft. Moderately high waves coincided with the closure events in May, June, and October. All closure events also occurred during or shortly after neap tidal periods. Closure events that occurred in May and June are examined in more detail in Figure 2.

All closure events occurred with the inlet located adjacent to the jetty. In 2012, this positioning may have prevented perched conditions from arising by shielding this area of the beach from the wave-driven sediment deposition that caused closure, preventing the beach from accreting to a sufficient height to allow the desired outlet channel elevations from being attained. This appeared to be the case for the first closure event of the 2013 management season (Figure 2), which self-breached on June 3rd at a stage of roughly 6.5 ft NGVD. The low point in the beach berm that was subsequently overtopped and self-breached also persisted immediately adjacent to the jetty. However, the same late-June rain storm that increased lagoon stage during the subsequent closure event also coincided with several days of long period swell waves (Hs ~ 5 ft, Tp ~ 15 s) that built up the beach in this location, allowing the lagoon stage to rise to almost 8 ft NGVD (Figure 2) before self-breaching in early July. Closure events that occurred later in fall (Figure 3) were breached at or below a lagoon stage of 8 ft NGVD.

CLOSURE AND SELF-BREACH DYNAMICS

Of the three closure events that occurred within the management period, the second closure event (lasting approximately from June 7th until July 4th) provided the best opportunity for outlet channel implementation. This event also indicated that water levels and closures can be persistent if flows drop below a minimum level.

To better illustrate both the lagoon stage and beach morphology during this time, Figure 4 shows a sequence of photos of the inlet before and during this closure event. As was the case for all of the management period, the inlet was located next to the jetty. Five days prior to closure, on June 3rd, the barrier beach self-breached. Since this self-breach occurred during a period of neap oceanic tides, tidal scour probably enlarged the inlet at a reduced rate, leaving it more susceptible to closure. Figure 4a depicts the inlet when it was located next to the jetty several days before closure, indicating a width of less than roughly 40 ft. Nearshore waves having significant heights of 6-7 ft and periods of 9-12 seconds coincided with closure (Figure 2b, Figure 4b), and subsequently raised the berm near the jetty (Figure 4c). As discussed later, these waves built the berm higher next to the jetty than in previous years, which allowed the closure event to persist.

During the first week of closure, inflows (Figure 2d) were measured at 100 – 115 ft^3/s, and the increase in stage was roughly 0.2 – 0.4 ft/day. As inflows dropped to 80 - 100 ft^3/s over the next several weeks, the water level increase slowed until the lagoon reached a balance between inflows and the combined losses from beach seepage and evaporation (Figure 2a). Summer dams constructed during this time downstream of the Hacienda Bridge gage further reduced inflows to the estuary. This markedly slower water level increase is evidenced by the lack of movement of the water line (emphasized with red dashed line) over the twelve days between Figure 4c and Figure 4d. Rainstorm-derived inflows and possible wave overwash from June 25th -27th caused the water level to rise at roughly 0.4 ft/day. From June 28th until the self-breach event on July 3rd, the water level increase slowed to less than 0.2ft/day. The low point of the beach (where breaching typically occurs) was at the jetty (Figure 4e).

Unlike the 2012 management period, no natural outlet channels were formed near the jetty in 2013. However, as with 2012 and other previous years, the lowest portion of the beach was consistently located at the jetty. This persistent low portion is probably caused by wave sheltering by the jetty, which may have reduced berm build-up at the inlet's location, leaving a low point in the beach berm that was the site for subsequent overtopping and self-breaching.

The first event (lasting from May 23rd until June 3rd) and last event (lasting from September 24th until October 15th) of the 2013 management period were also unsuitable for implementing an outlet channel. The first event self-breached before the lagoon stage reached the 7 ft NGVD target stage. The second event just reached the target elevation at the end of the management period. Then, on the last day of the management period, the Water Agency artificially breached the beach to provide a pathway for migrating salmonids and to reduce water levels in advance of potential fall precipitation.

Four more closures occurred after the end of the management period in October–December 2013 (Figure 3). These events coincided with typical late-fall energetic swell waves, and each persisted for over a week, since inflows remained lower than 300 ft^3/s through the end of December. In consultation with the resource agencies, the Water Agency conducted its October and November artificial breaches to the north of Haystack Rock. The intent of this alignment was to discourage the inlet from re-establishing next to the jetty. However, after the inlet closed twice north of Haystack Rock, the December artificial breach was implemented closer to the jetty. This December breach location was selected to encourage the inlet to stay open longer for migrating salmonids and to ensure that the breaching stayed within the Water Agency's permitted excavation limits of 1,000 yd^3.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2013 according to the method described in Behrens et al. (2013). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean

forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 70 percent before each 2013 event (Figure 1e, Figure 2e, and Figure 3e). Data gaps in the Jenner gage record prevented closure risk predictions prior to the first closure event. Otherwise, the predicted probability of closure exceeded 70% 2-5 days in advance of each closure. In previous years, a prediction threshold of 50% was used, but there were several instances exceeding 50% in April and July of 2013 that did not result in closures.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent can be limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which sets guidelines for the survey crew's approach to marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at 1 ft intervals, as well as profiles along the beach berm crest, the ocean wetted edge, and the estuary water line. The survey elevations are reported in the NGVD29 vertical datum.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September), 2011 (May to October), 2012 (May to October), and 2013 (May to October) surveys. Survey transects from the 2012 analysis were reused (Figure 5), and include two transects backed by cliff (Figure 6 and Figure 7), two transects which extend into the estuary (Figure 8 and Figure 9), and two variations on a transect just north of the jetty (Figure 9).

This review focuses on the 2013 surveys, although the 2011 surveys are included for context. The 2013 topographic data were similar to those of 2012, when little morphologic change occurred throughout the management season. In contrast, surveys taken in 2010 and 2011 indicated that beach erosion and accretion occurred during the management period. The erosion was associated with inlet migration and subsequent accretion of the beach was associated with long-period swell waves. During the 2012 and 2013 management seasons, the inlet remained at the jetty and did not migrate north. Adjacent to the jetty groin, Transect 0 showed little monthly change in topography, but extensive inter-annual variability (Figure 10).

During the management period in 2013, the beach berm along Transects 1- 4 showed little variability, changing by less than one foot. This was particularly true during the months of May – September at Transects 1-2 (Figures 8-9) and Transect 4 (Figure 6). At each of these profiles, the change in beach profile from September to October was greater than for the rest of the management season. The only transect to experience more than one foot of change in elevation was Transect 3 (Figure 7), whose crest aggraded by 1.5 feet between the May 30th and June 13th surveys. The difference in monthly variability at each transect between 2013 and prior years can likely be tied to the difference in the extent of inlet migration. As an example, in 2011, the inlet

migrated north of Haystack Rock during the winter, and returned to the jetty in late spring or early summer. This migration resulted in a lower beach profile at all transects. Then, over the course of the management period, the beach gradually built up to a typical summer profile. In contrast, the inlet never migrated north of Haystack Rock in 2013, even during peak winter and spring flows. As in 2012, this left the beach berm largely intact north of Haystack Rock and a lower terrace between Haystack Rock and the jetty groin. Since these northern transects started at a much higher elevation at the start of the management period, the vertical growth of the beach profiles at these locations were several feet less than during 2011 in the same locations.

Transect 0, which is located just north of and parallel to the jetty, was slightly lower than the other transects measured during the 2013 management period. Its crest was measured at roughly 15 ft NGVD both at the beginning and end of the management period, compared with crest elevations of 15-17 ft NGVD measured at the other transects. Figure 10 shows that this location is typically stable throughout the management period but varies from year to year, likely as a result of inlet migration, flood erosion, and berm building by winter waves. Compared with prior years, the berm at this location is lower than in 2011, but higher than in 2010 and 2012. As we have noted during previous reports, the lack of management period variability of this region suggests that the jetty shelters this portion of the beach from small to moderate waves that occur during the management period. Only the larger waves associated with winter storms may be sufficient to re-shape the beach berm near the jetty.

Beach berm crest profiles were collected by the Water Agency for the first time in 2013. These data make it possible to discern important changes in beach shape along the length of the berm from the northern beach access point to the jetty. Along-beach trends in crest elevation generally indicate along-beach trends in wave energy and the influence of inlet migration and breaching.

Figure 11 shows that the same minimal change in crest elevation was apparent throughout the length of the beach north of Transect 1. Although the crest elevation changed by as much as 2 ft in some areas, there was a distinct pattern in the along-shore crest height that remained roughly the same throughout the management period. The beach crest was lowest south of Transect 1, where the inlet resided. At Transects 1 and 2, a set of ridges remained in place with peak elevations at 17-18 ft NGVD, while the crest was generally lower (14-17 ft NGVD) and had less of a consistent shape north of Transect 2. Wave runup generally has less influence for higher beach profiles, since it becomes less likely that a given wave will overtop the crest. The higher variability north of Transect 2 is probably a reflection of the fact that the beach was lower in this area, and was more susceptible to change from the limited summer and fall waves.

Changes to the beach shape were much larger after the end of the 2013 management period, as shown in Figure 12. This is probably attributable to greater wave energy and relocation of the inlet. Wave energy increased dramatically in November and December, both in height and period. Although changes to the crest height were still minor during these months, by January 16th 2014, the crest had been built as high as 19-20 ft NGVD north of Transect 4. At Transects 1 and 2, the crest ridges shifted in the along-beach direction, but the peak heights remained similar to August.

Manual breaching of the inlet north of Haystack Rock on October allowed the inlet to carve a 400-500 wide swath within the beach, centered roughly at Transect 3. The inlet then closed again and later breached at the jetty. By December 12th, waves had rebuilt the crest to a height of 10-12 feet within the swath. By January 1, 2014, this segment of the beach that the inlet had occupied in October and November was indistinguishable from the rest of the beach crest profile.

BEACH WIDTH

To provide additional information about the beach morphology, ESA PWA assessed the beach width using the Water Agency survey data. Figure 13 shows the evolution of the beach width at Transect 3 during both the 2012 and 2013 management periods. During winter months, the beach was often eroded at Transect 3 to the point that the beach crest was below 12 ft NGVD, so that the width was effectively zero. Apart from this seasonal erosion, there was no marked trend in the beach width. In 2013, the width at 12 ft NGVD varied between 80 and 120 ft, and was generally less than 65 ft wide at the 14 ft NGVD contour. This was smaller than in 2012, when it varied from 110-150 ft NGVD at the 12 ft contour and was less than 110 ft at the 14 ft contour. This interannual difference may be attributable to differences in fall-spring wave energy (and thus beach building), or possibly to differences in inlet position.

LESSONS LEARNED AND RECOMMENDATIONS

Based on 2013 observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- The beach north of the inlet saw little change from the 16-18 ft NGVD elevations established in 2012. Near the jetty, the berm was lowered by inlet migration while undergoing beach building.
- The influence of inlet breaching or migration north of the jetty can lead to erosion of a wide swath of beach, several times larger than the width of the channel. An erosion swath of 400-500 was observed following the Agency breach on October 15th.
- Similar to the winter of 2011-12, the inlet never migrated north of Haystack Rock during winter 2012-13, and returned to the jetty in early spring, much earlier than in most years. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- Peak annual river discharge has remained below 40,000 ft^3/s for 8 consecutive years, a streak unmatched in the 70-year flow record. This may have a connection to the recent lack of inlet migration to the north.
- The beach width in 2013 at Transect 3 (near Haystack Rock) was smaller than in 2012. The interannual decline was larger than changes to beach width at this location within the 2013 management season alone. This may suggest that beach width is more closely tied to seasonal changes in inlet behavior and offshore waves than to shorter-term changes.

OUTLET CHANNEL FEASIBILITY

- The jetty may shelter the inlet, making closure less likely and also limiting berm growth, which then maintains a low point for self-breaching. When the inlet is in a fully or muted tidal condition, options for management become considerably more difficult to implement.
- Late June closure included a 10-day period when lagoon water levels were nearly constant at approximately 5 ft NGVD because low flows measured at Hacienda Bridge (80-100 ft^3/s) and construction of summer dams reduced flows into the estuary to the point that they were balanced by seepage. An unusual early summer rain then boosted discharge to more than 200 ft^3/s, causing self-breach at approximately 8 ft NGVD.
- Once lagoon water levels reach the low point of the beach crest elevation, the lagoon self-breached. This behavior highlights the susceptibility of a sand bed outlet channel to scour, limiting conveyance capacity.
- Post-management period, the Water Agency breached the inlet north of Haystack Rock. This alignment was not continued because repeated closure threatened Chinook migration and the enlarged beach berm restricted breaching to within the permitted excavation volume.

- Over the first three years of effort to implement the outlet channel adaptive management plan, only one closure (July 2010), has been suited for outlet channel management action.

COMMUNICATIONSAND PROTOCOLS

- Since full set of permits was not in effect, the Water Agency was required to seek authorization for each breaching event, which occasionally caused delayed operations.
- Although the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency began planning management actions as soon as the episodes occurred. Planning included heightened observations of inlet conditions by Water Agency staff, email updates to inform the resource management group, and pre-implementation meetings at the project site to refine plans for management action.

MONITORING

- The Water Agency's monthly survey methods were modified to collect specified profiles, such as the beach berm ridge line, wetted edge (beach side), and water edge (estuary side).

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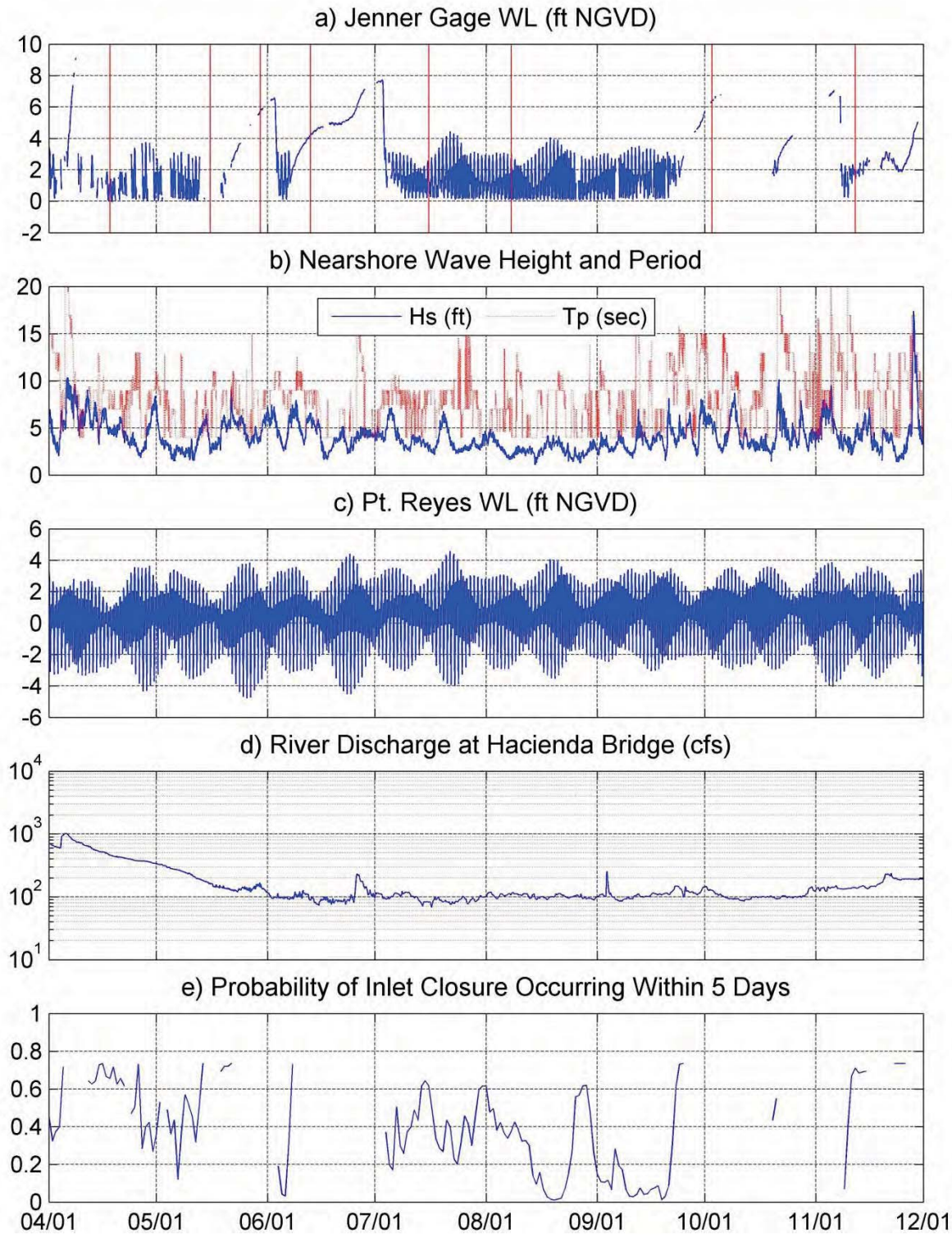
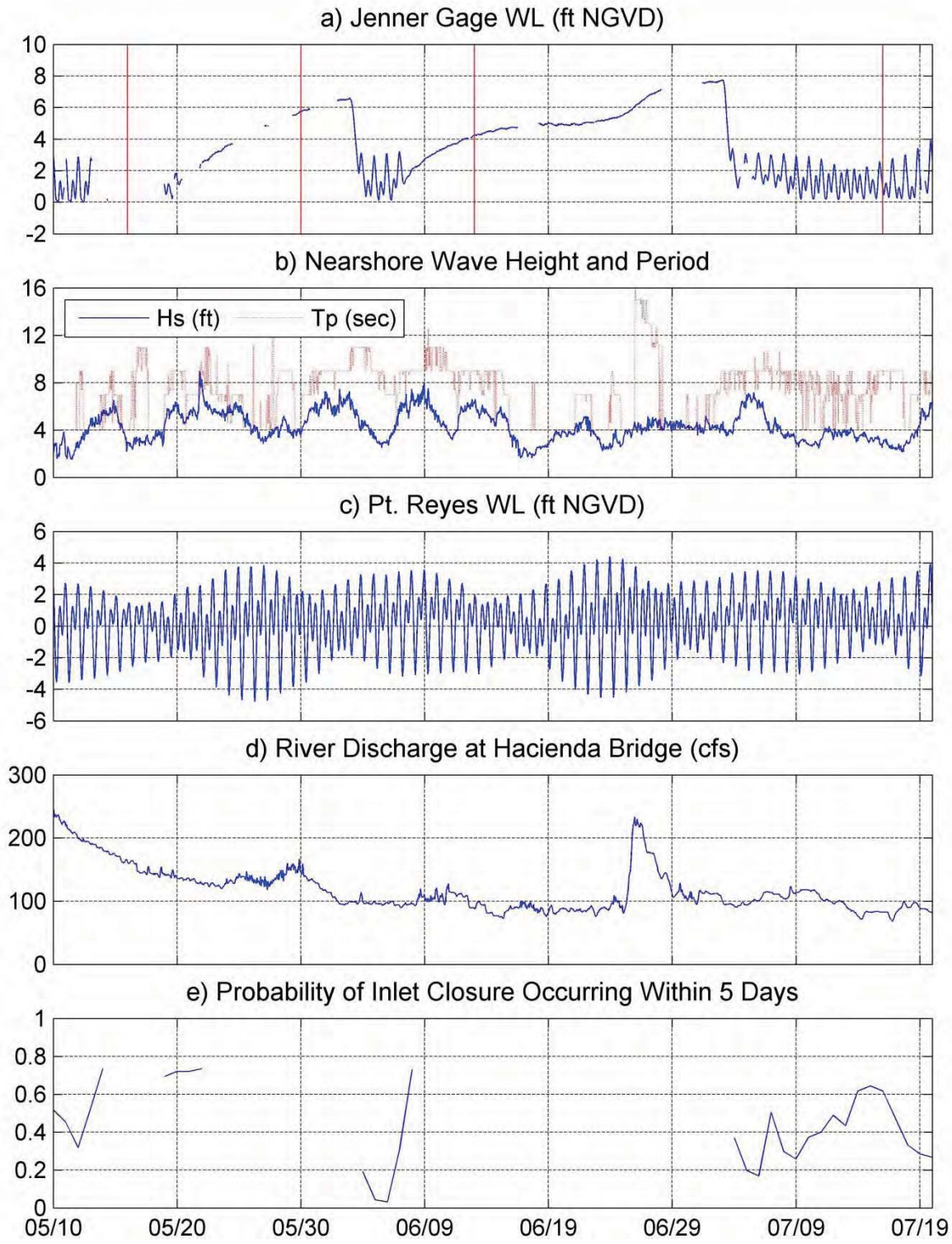


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 1

Estuary, Ocean, and River Conditions Compared with Closure Probability: April – November 2013

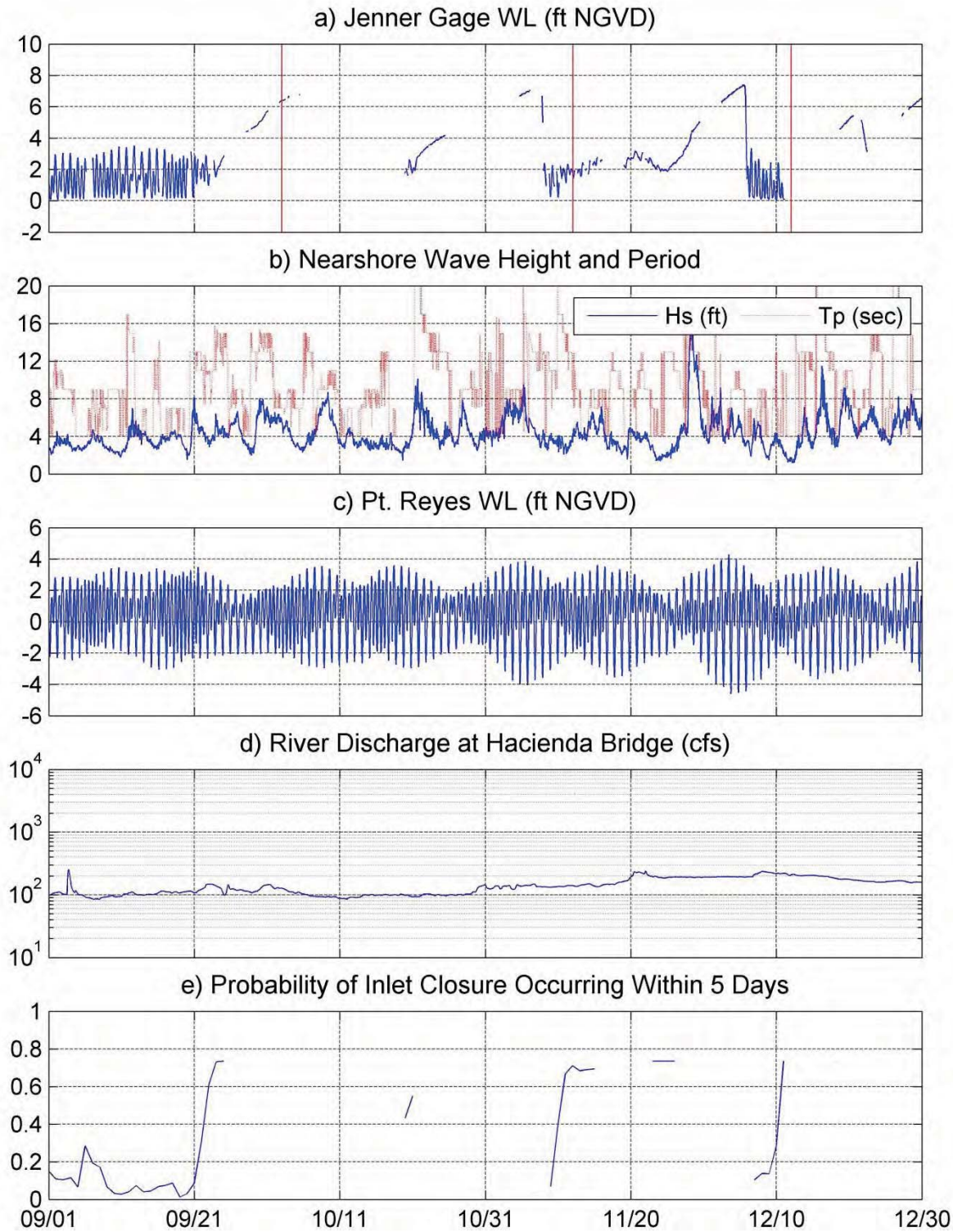


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 2

Estuary, Ocean, and River Conditions Compared with Closure Probability: May – July 2013



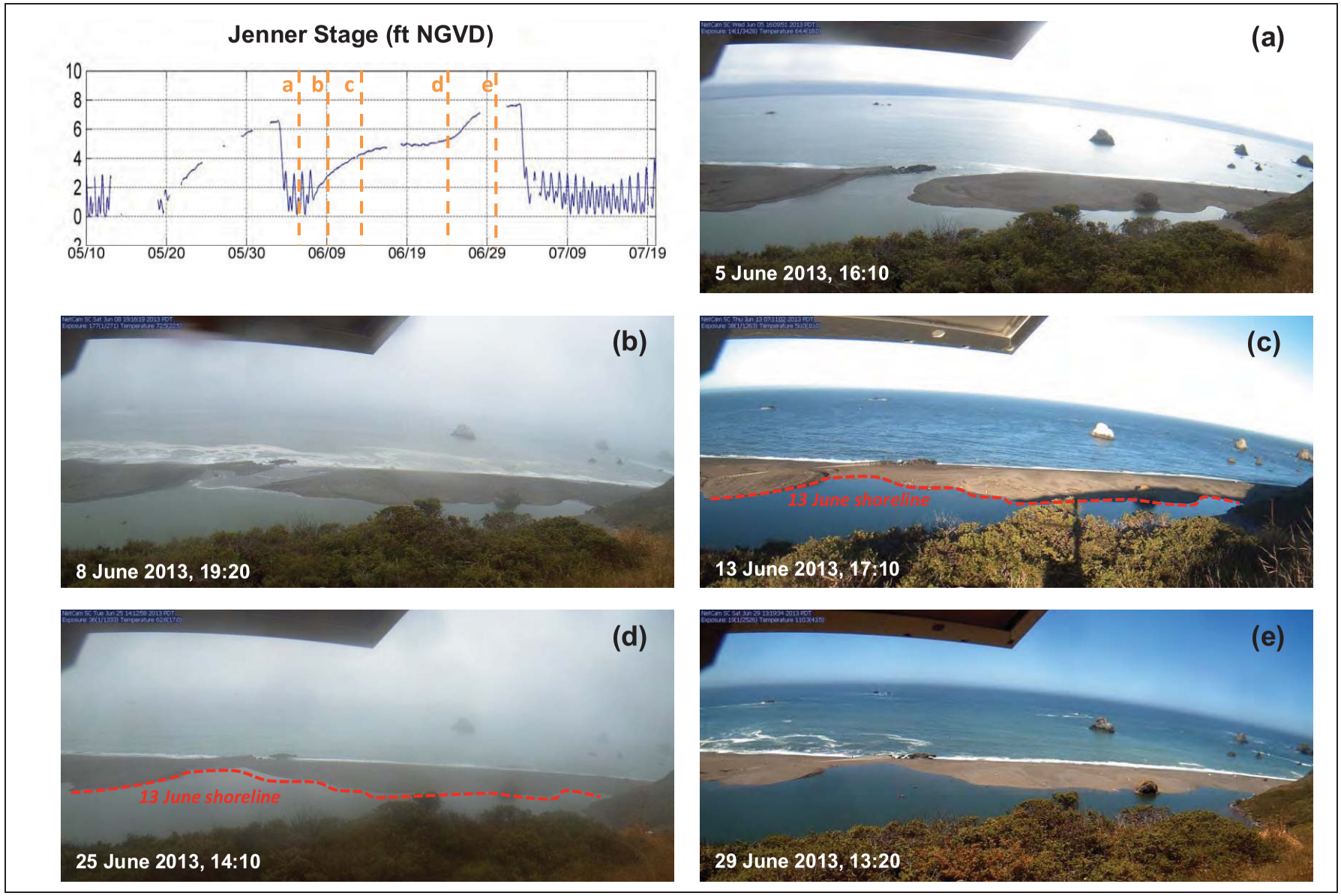
Russian River Estuary Outlet Channel Management Plan . DW01958

SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 3

Estuary, Ocean, and River Conditions Compared with Closure Probability: September – December 2013



SOURCE: Russian River stationary observation camera (BML)

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 4

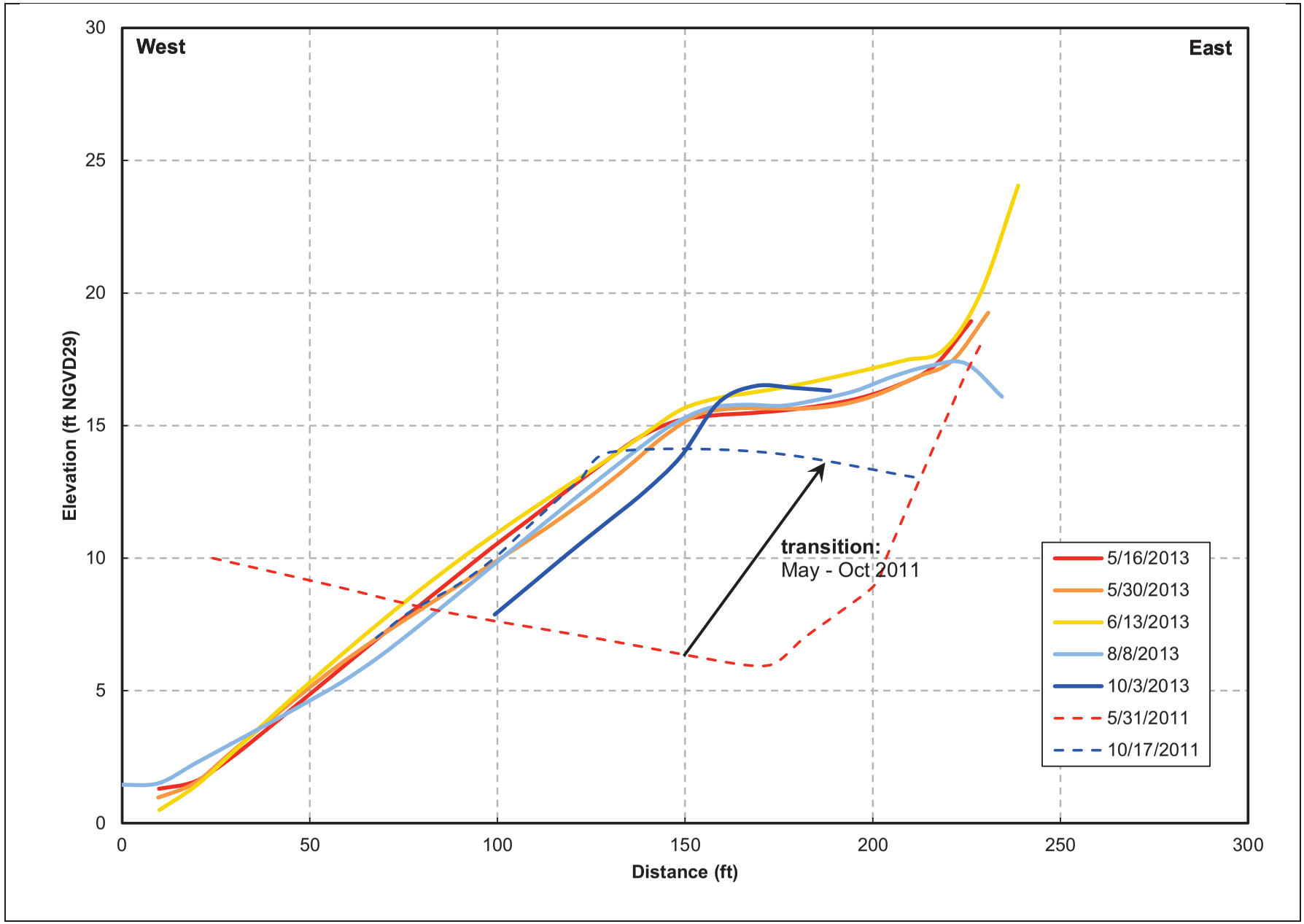
Inlet Closure Event in June-July 2013

SOURCE: image from USDA NAIP

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 5

Beach Transect Locations

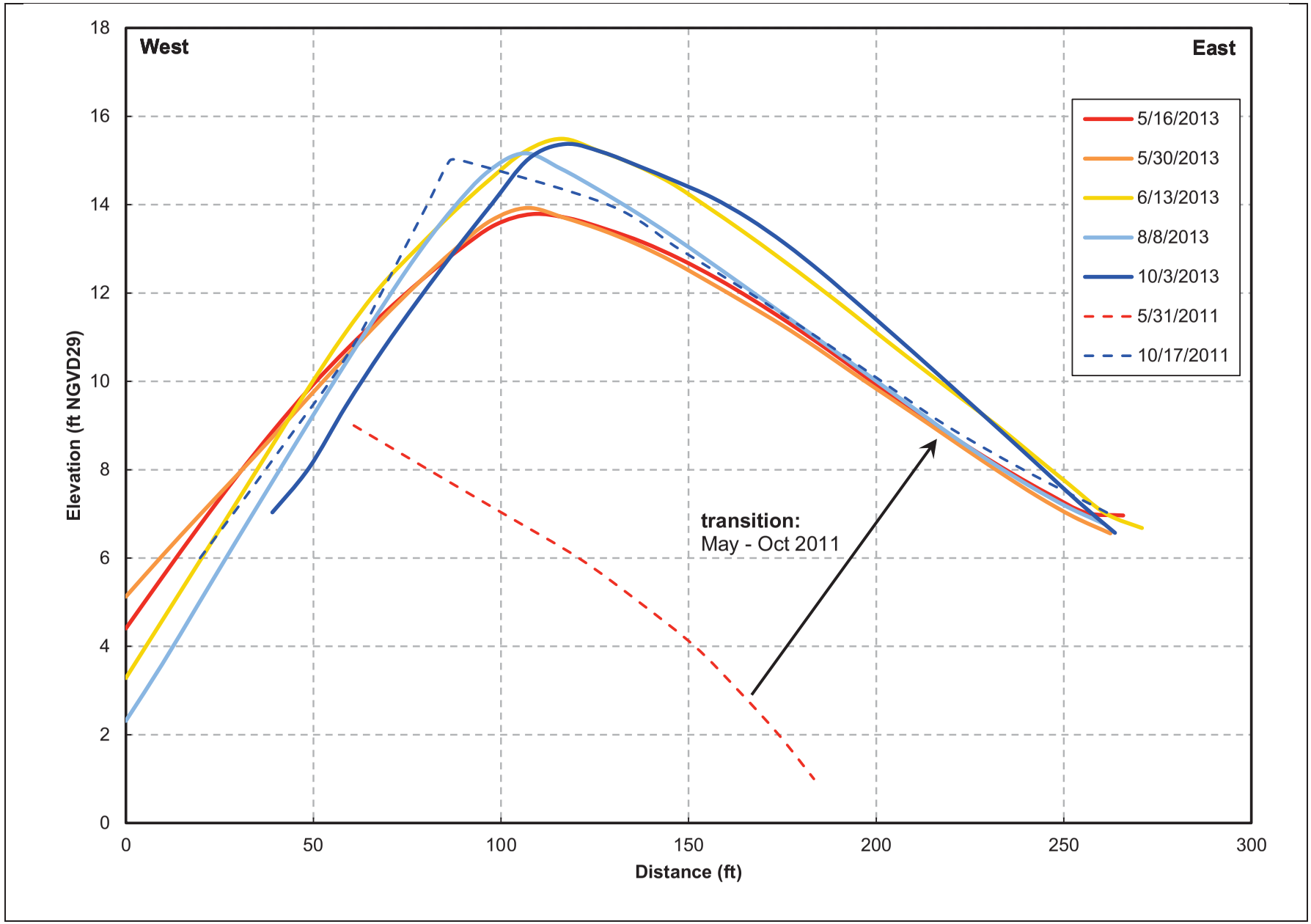


SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

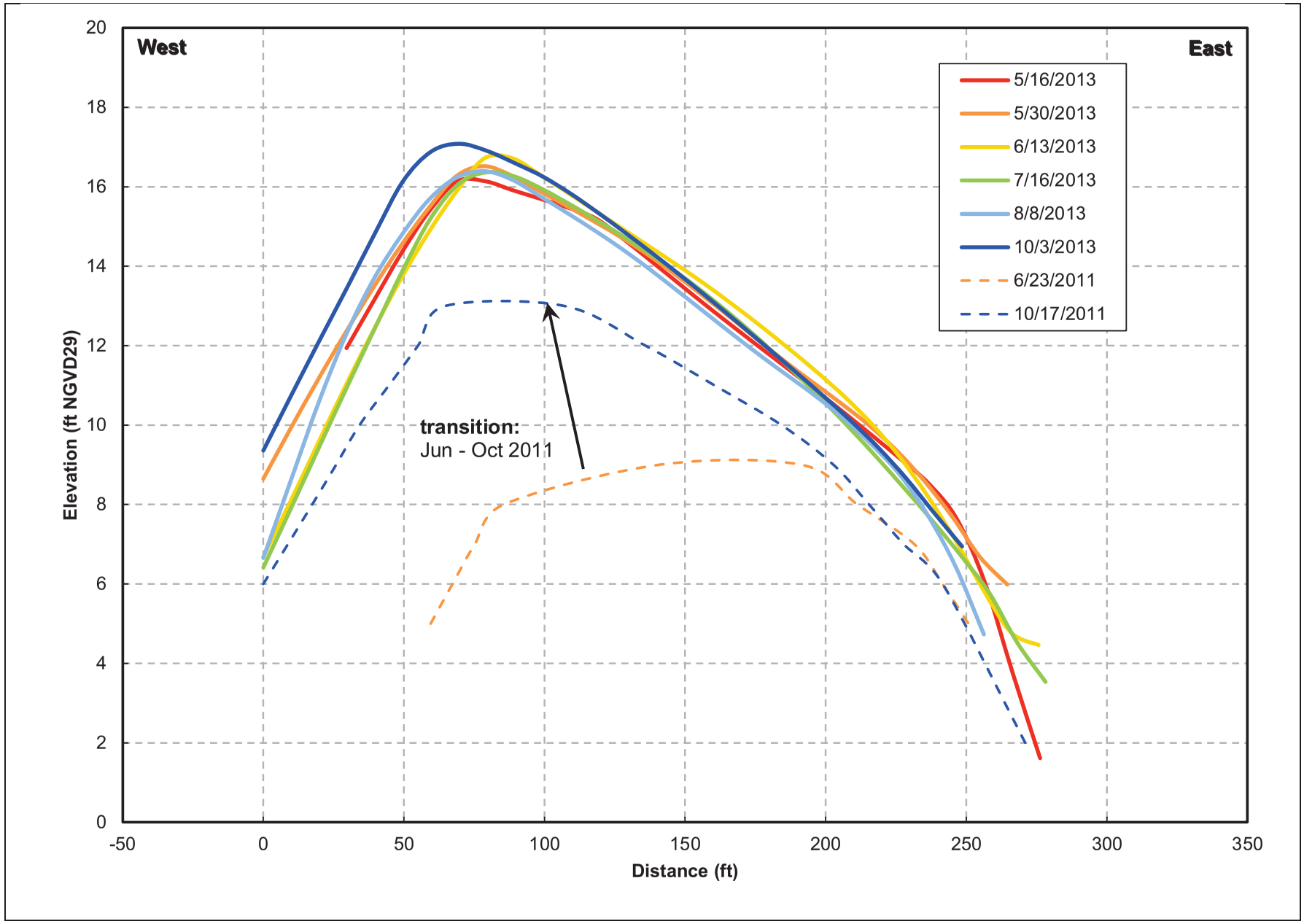
Figure 6

Beach Transect #4



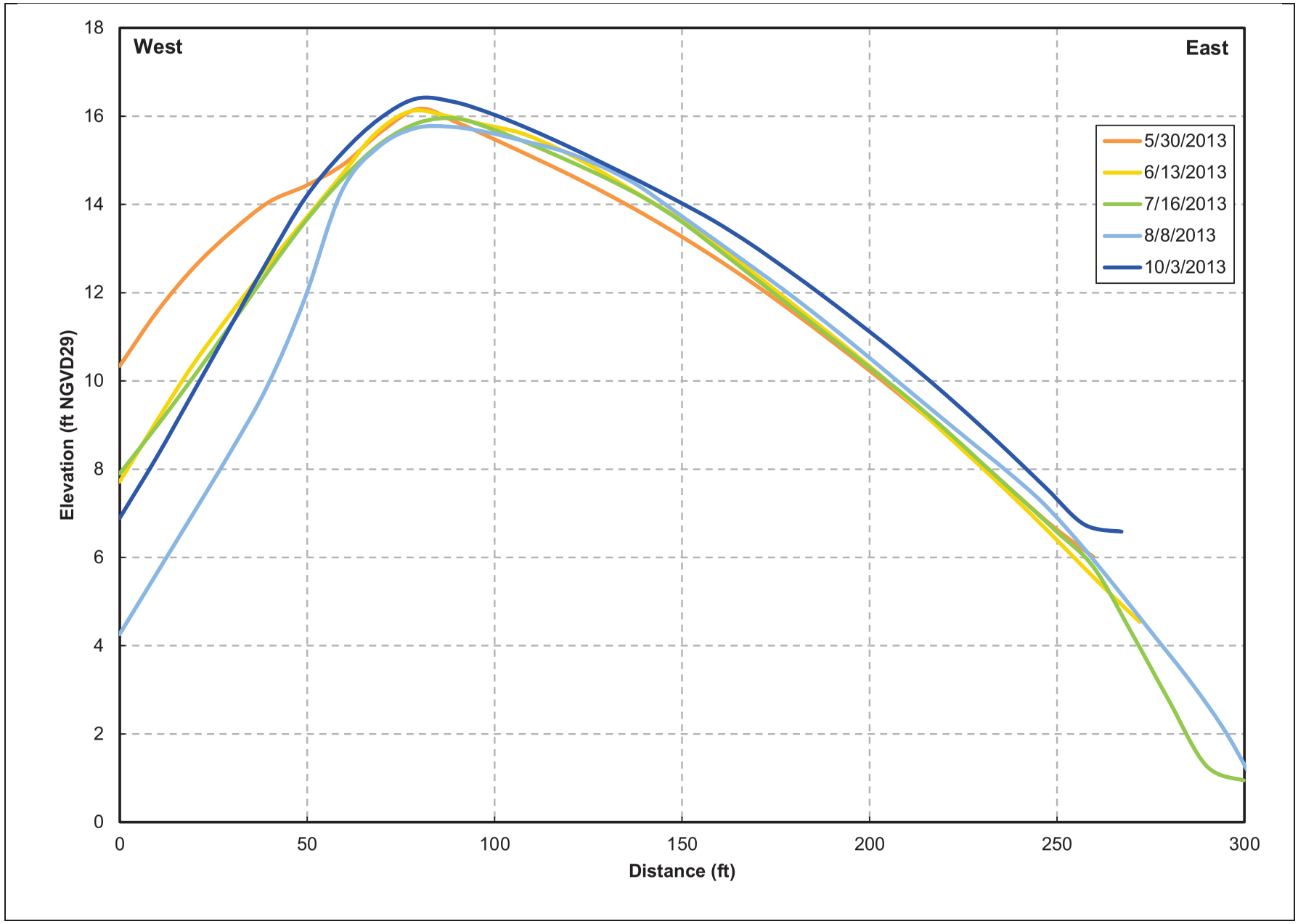
SOURCE: Russian River stationary observation camera (BML)

Figure 7
Beach Transect #3



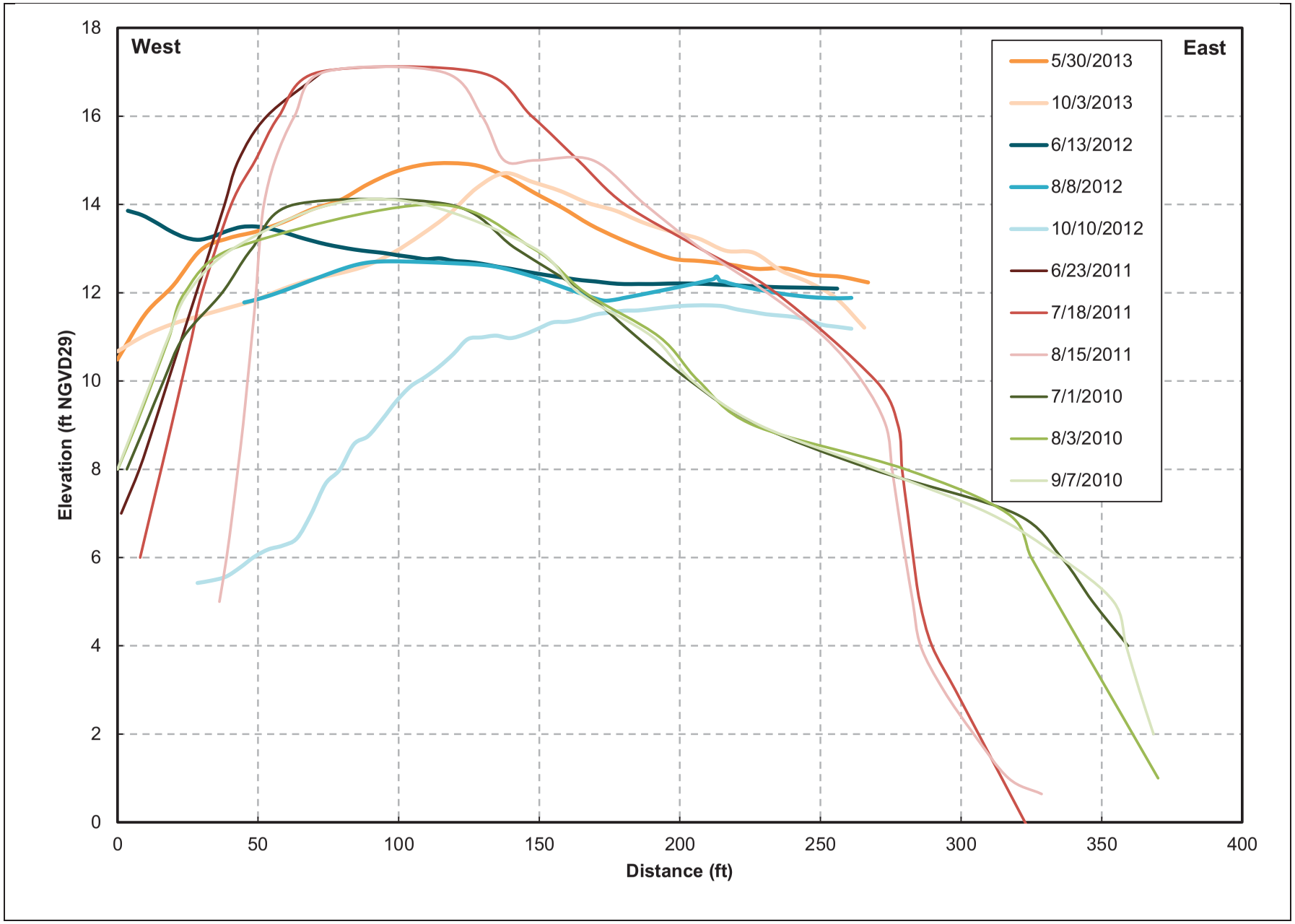
SOURCE: Russian River stationary observation camera (BML)

Figure 8
Beach Transect #2



SOURCE: Russian River stationary observation camera (BML)

Figure 9
Beach Transect #1

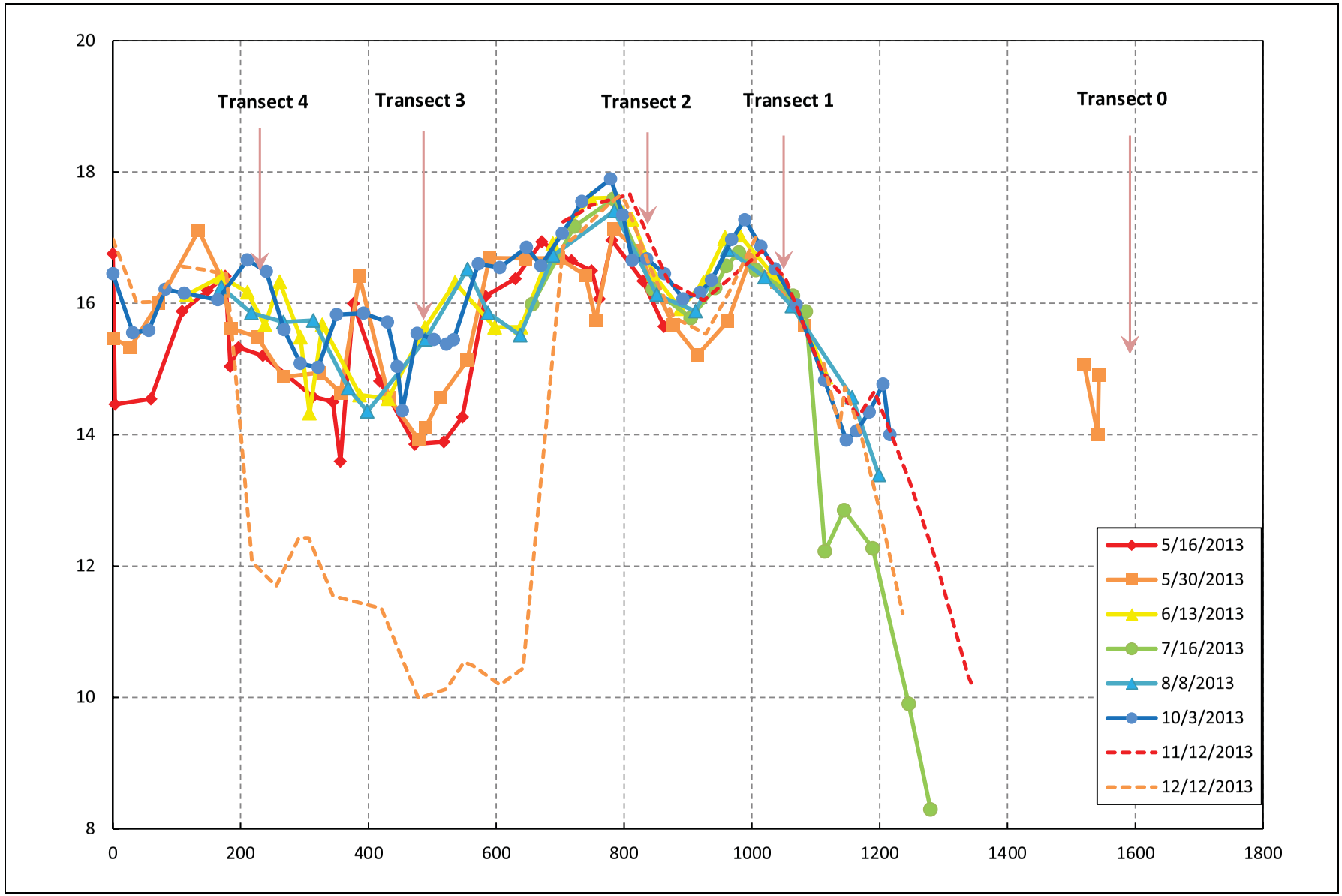


SOURCE: Russian River stationary observation camera (BML)

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 10

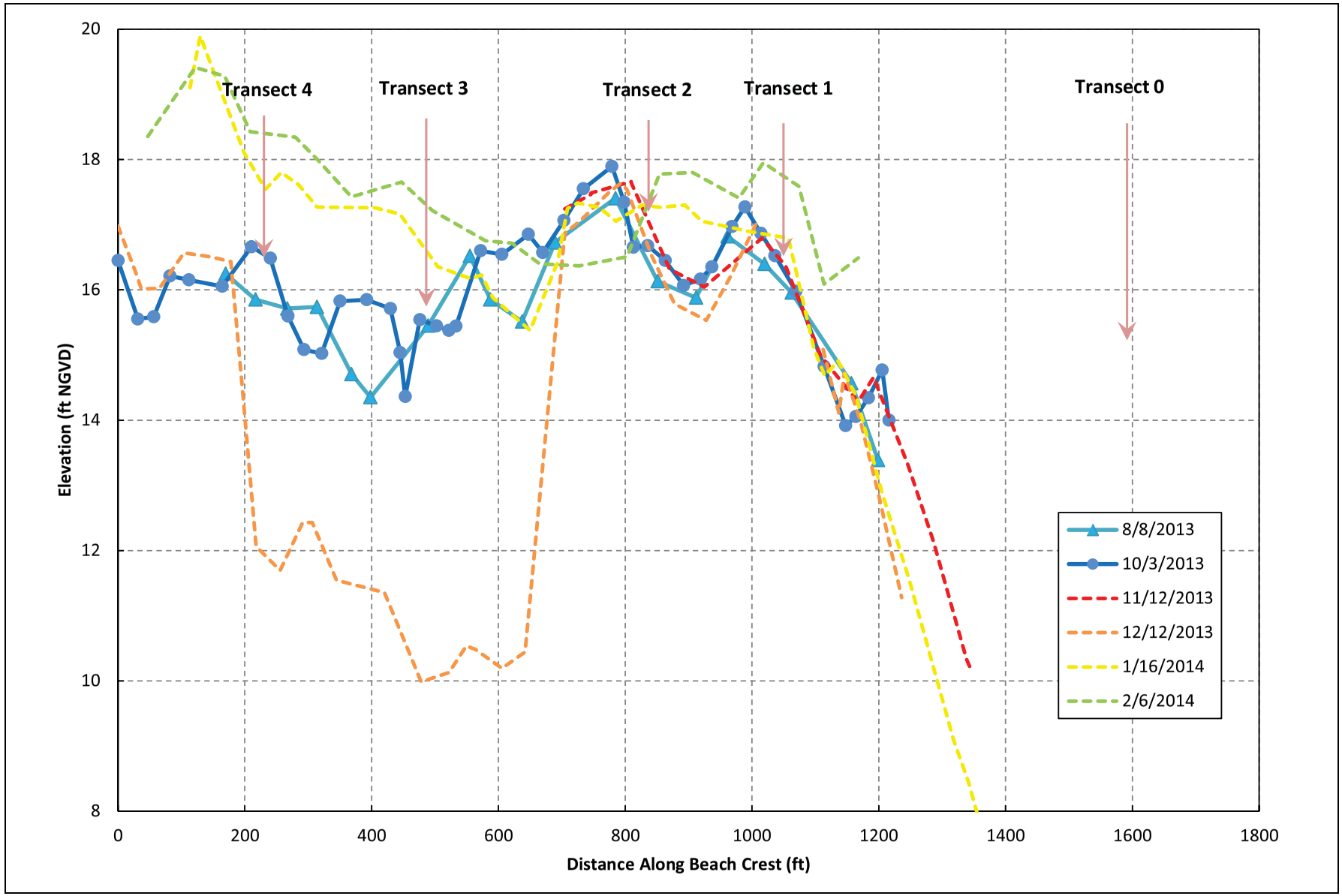
Beach Transect #0



SOURCE: SCWA survey data

Figure 11

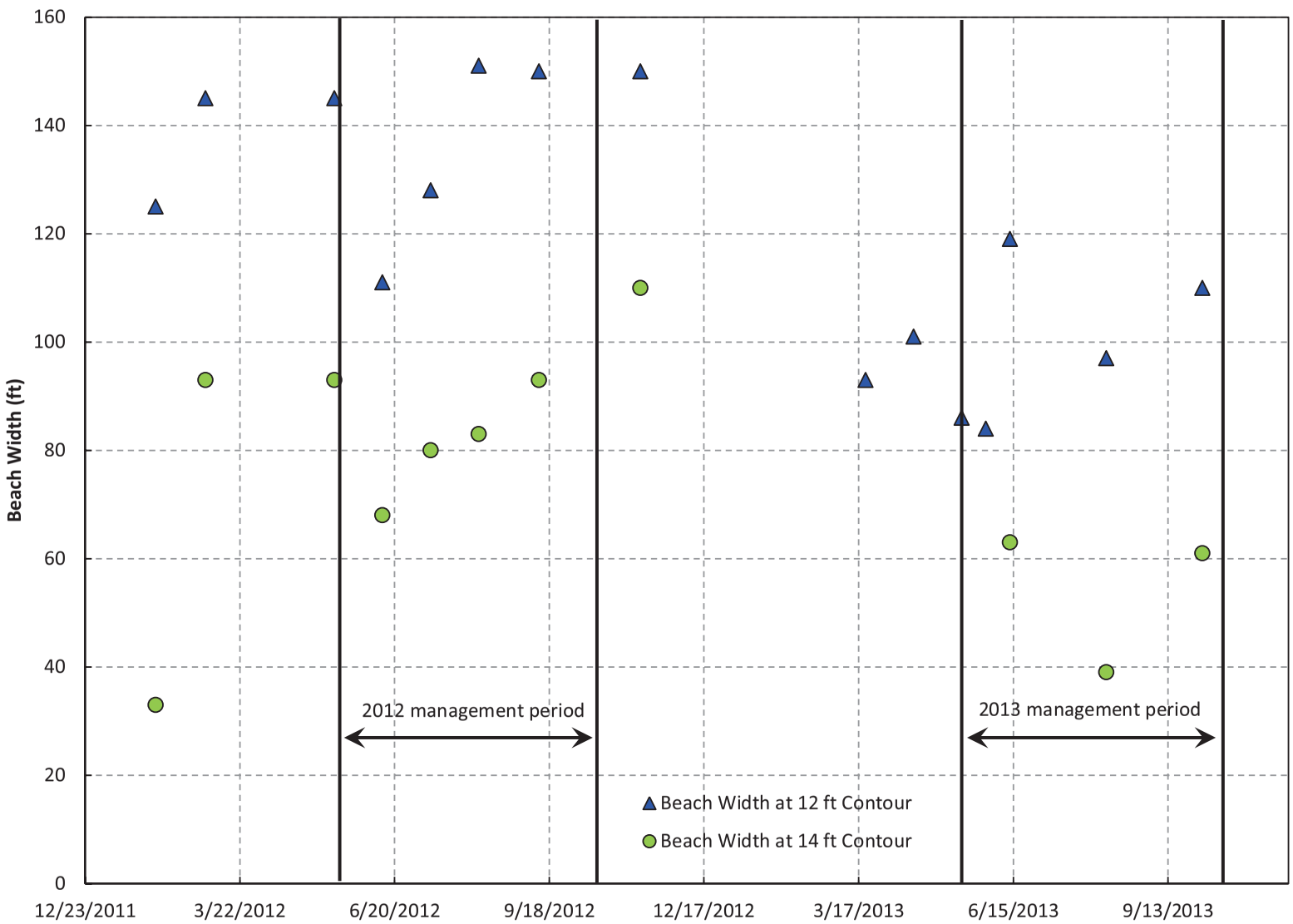
Beach Crest Profiles During the 2013 Management Period.



SOURCE: SCWA survey data

Figure 12

Beach Crest Profiles From August 2013 to February 2014.



SOURCE: SCWA survey data

Figure 13

Beach Width During 2012 and 2013 Management Periods.

APPENDIX B-2

Beach Topos

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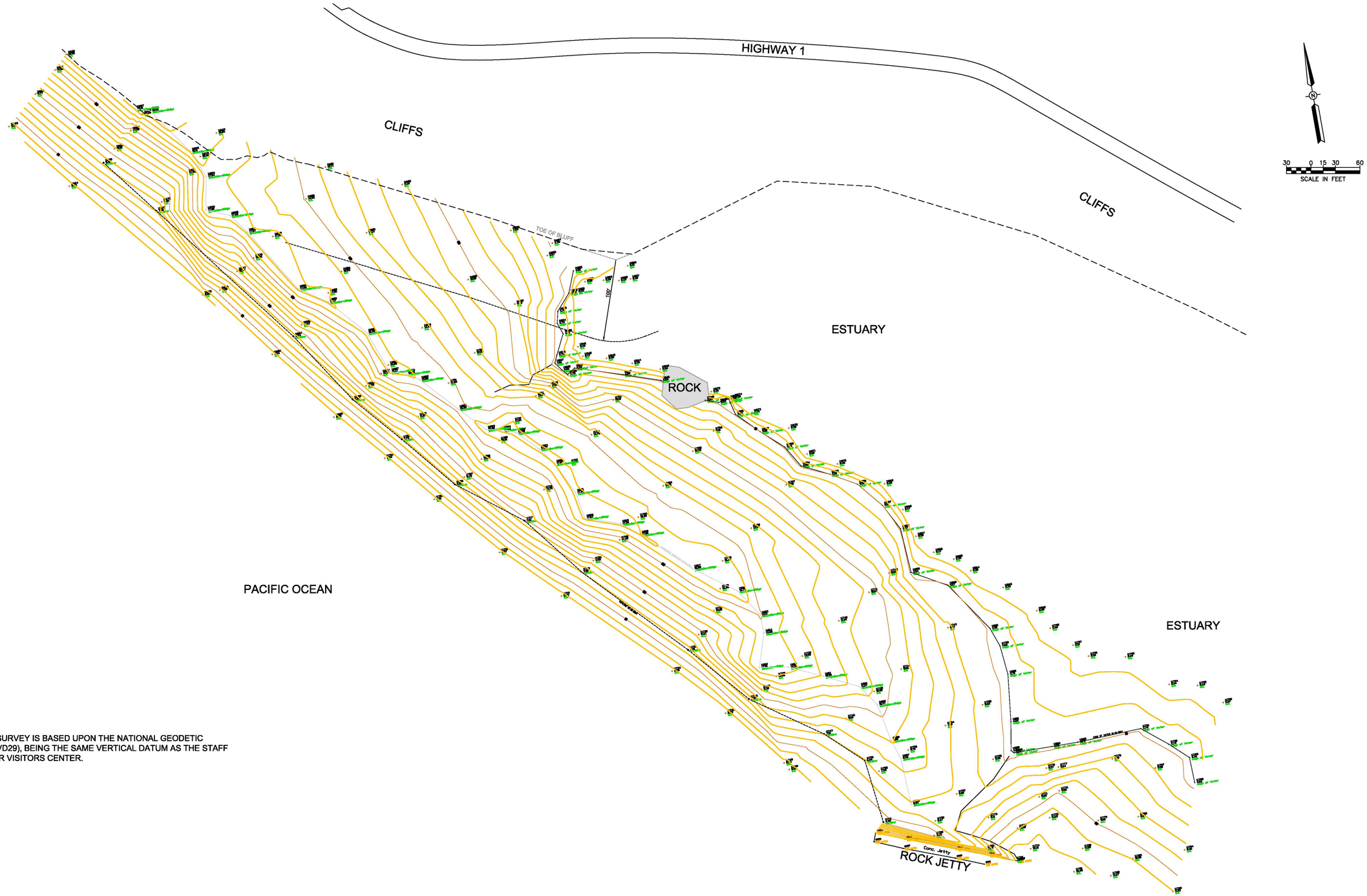

NOTES:

1. VERTICAL DATUM FOR THIS SURVEY IS BASED UPON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29), BEING THE SAME VERTICAL DATUM AS THE STAFF GAGE LOCATED AT THE JENNER VISITORS CENTER.

NO.	DATE		BY

SONOMA COUNTY WATER AGENCY

SCALE: AS NOTED
DATE : AS NOTED
DRAWN : EKM
CHECKED : JRM

APPROVED DEPUTY CHIEF ENGR:
SUBMITTED
DESIGNED

RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

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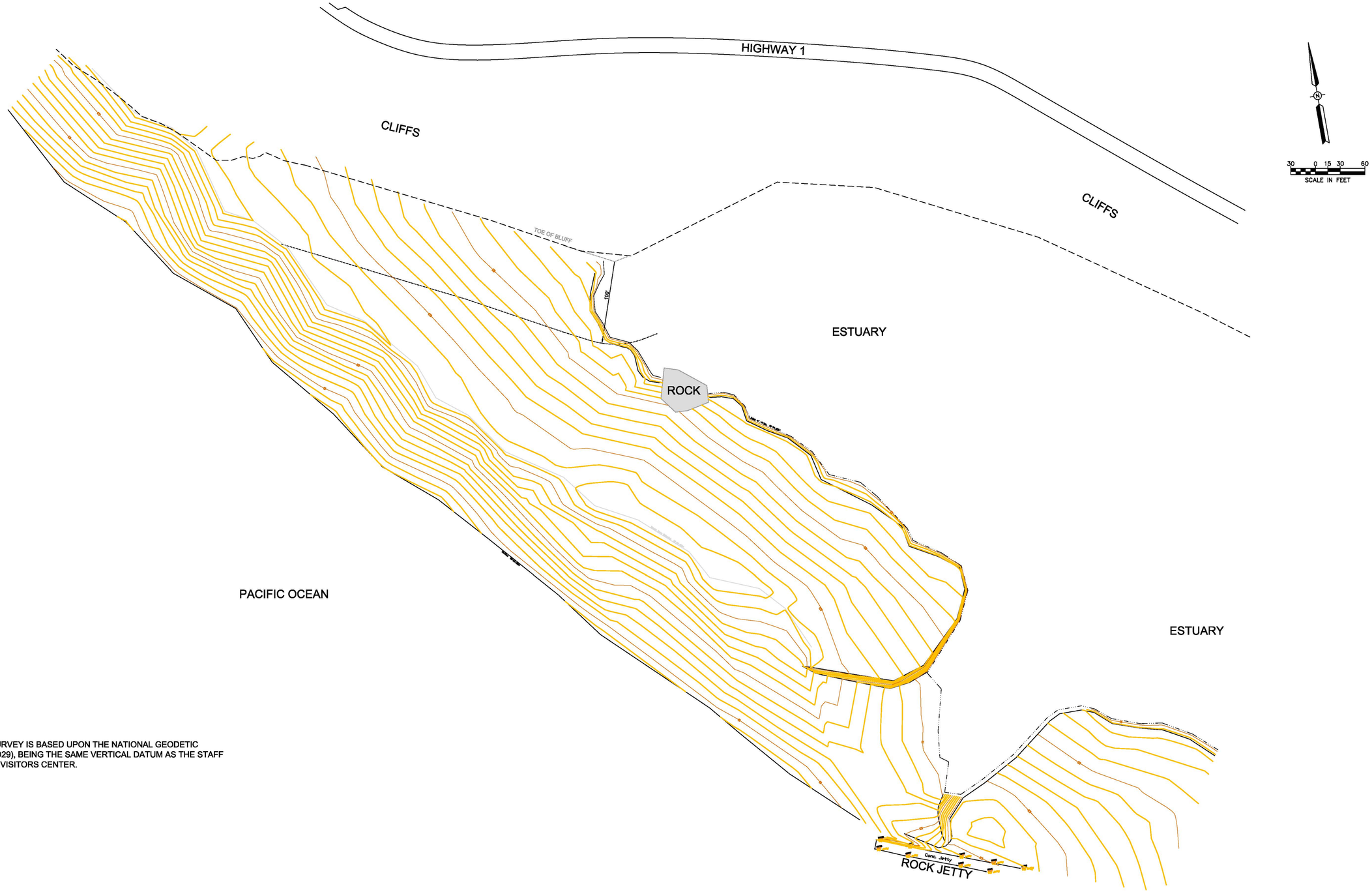

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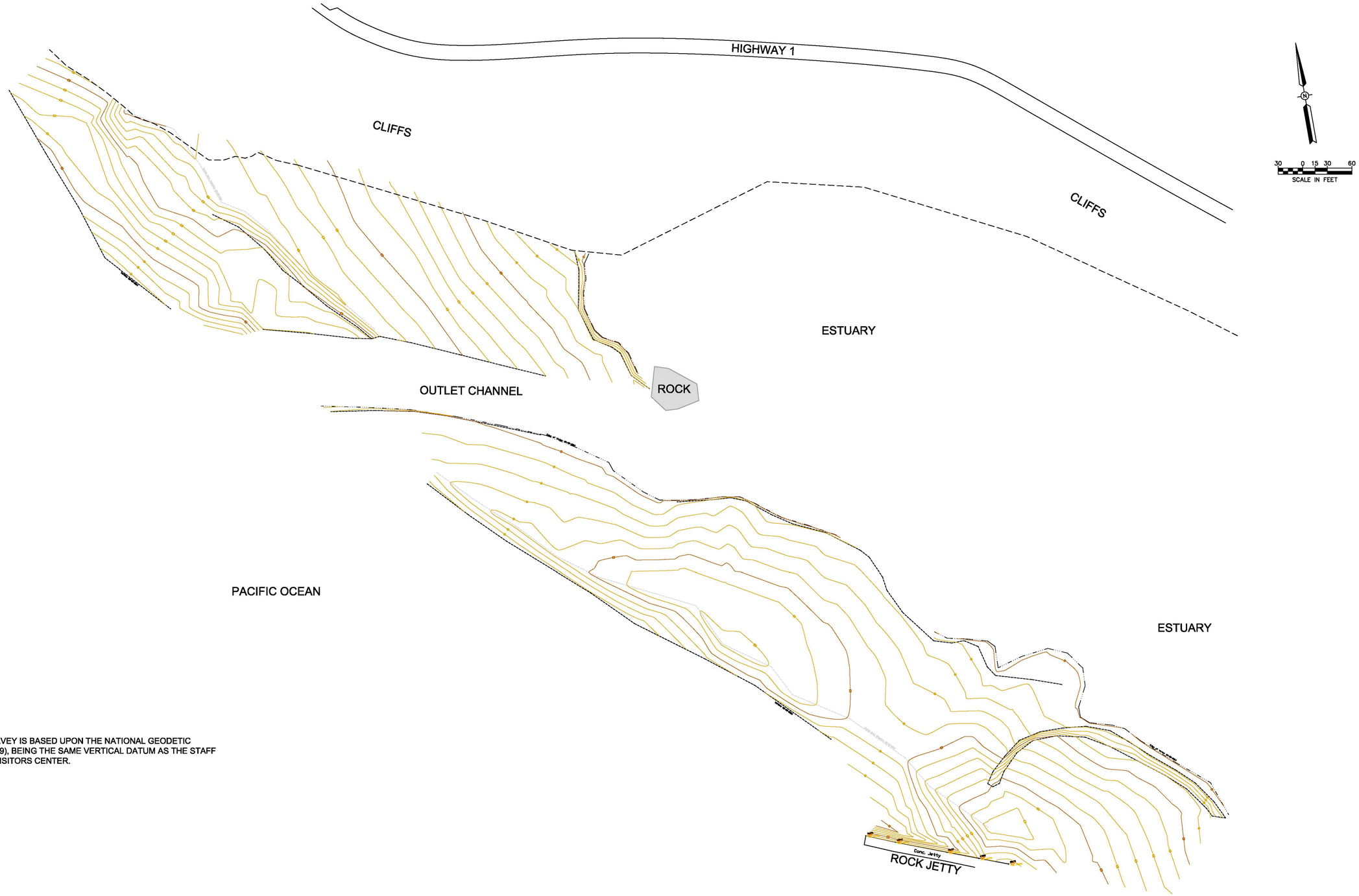

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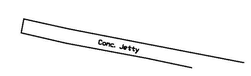

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM
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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

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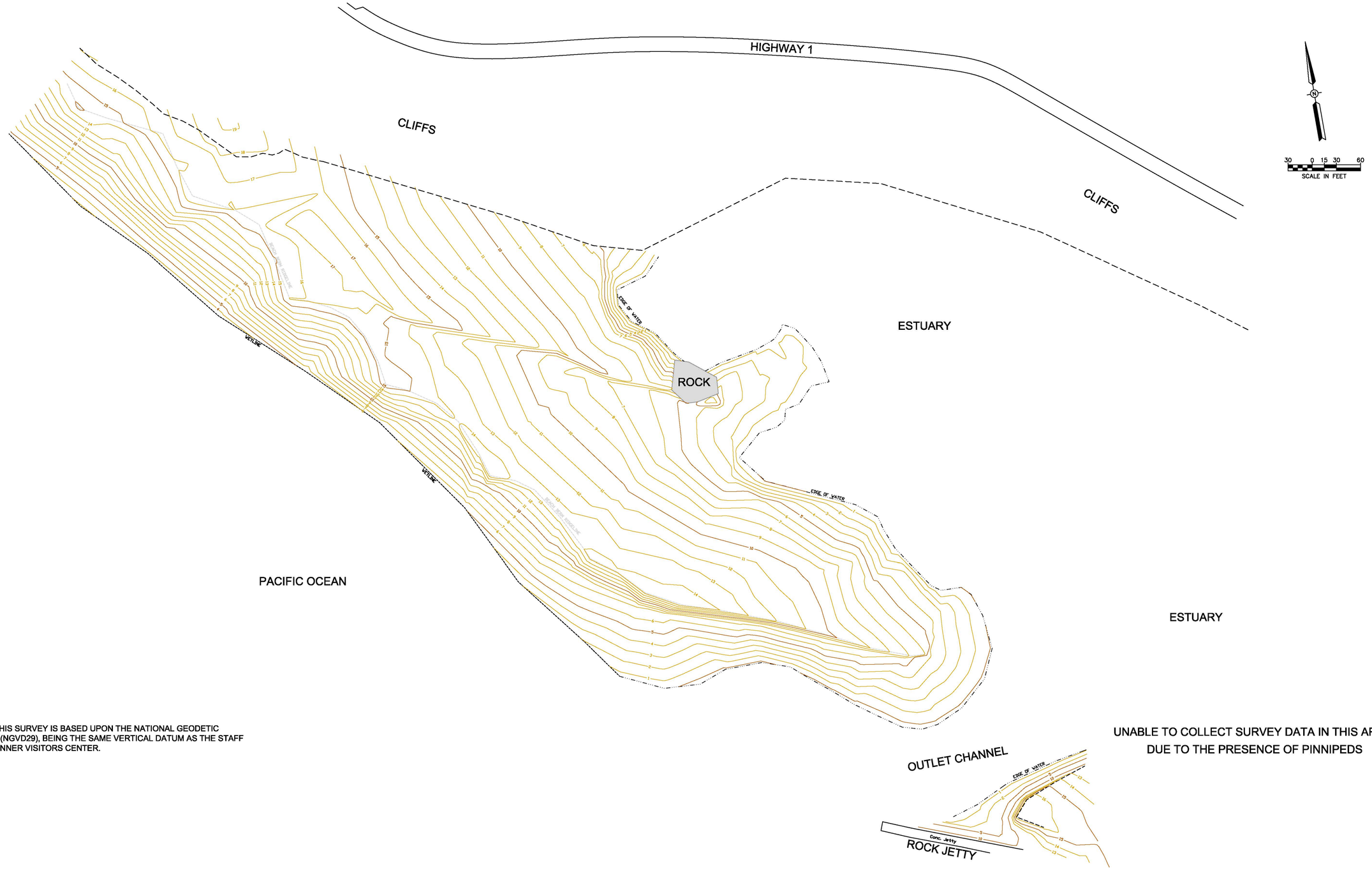

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

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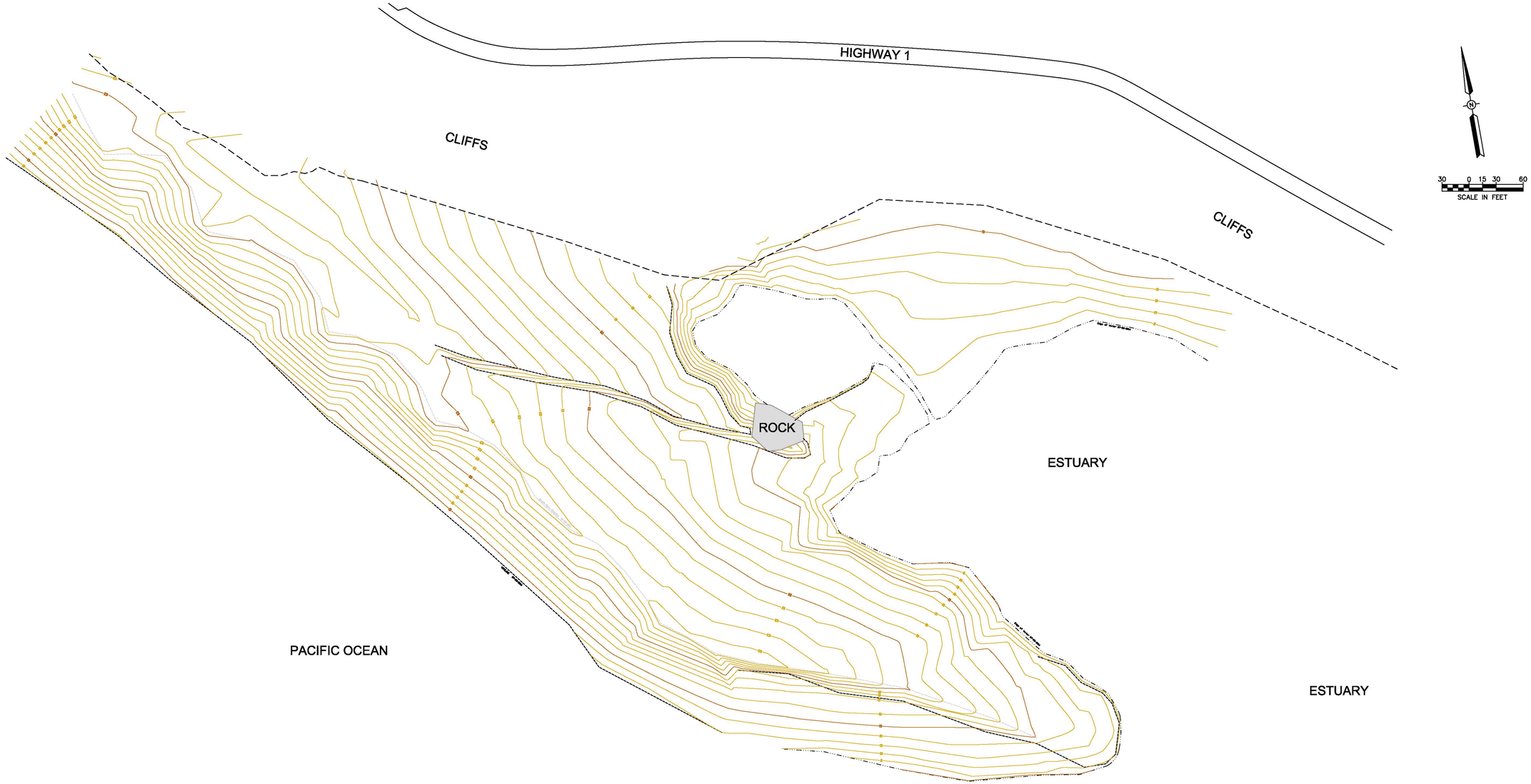

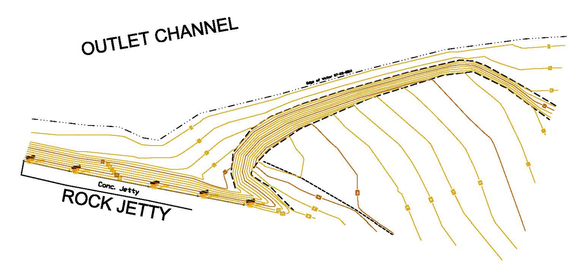

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

MONTHLY SURVEY OF BEACH TOPOGRAPHY AND OUTLET CHANNEL: July 3, 2014

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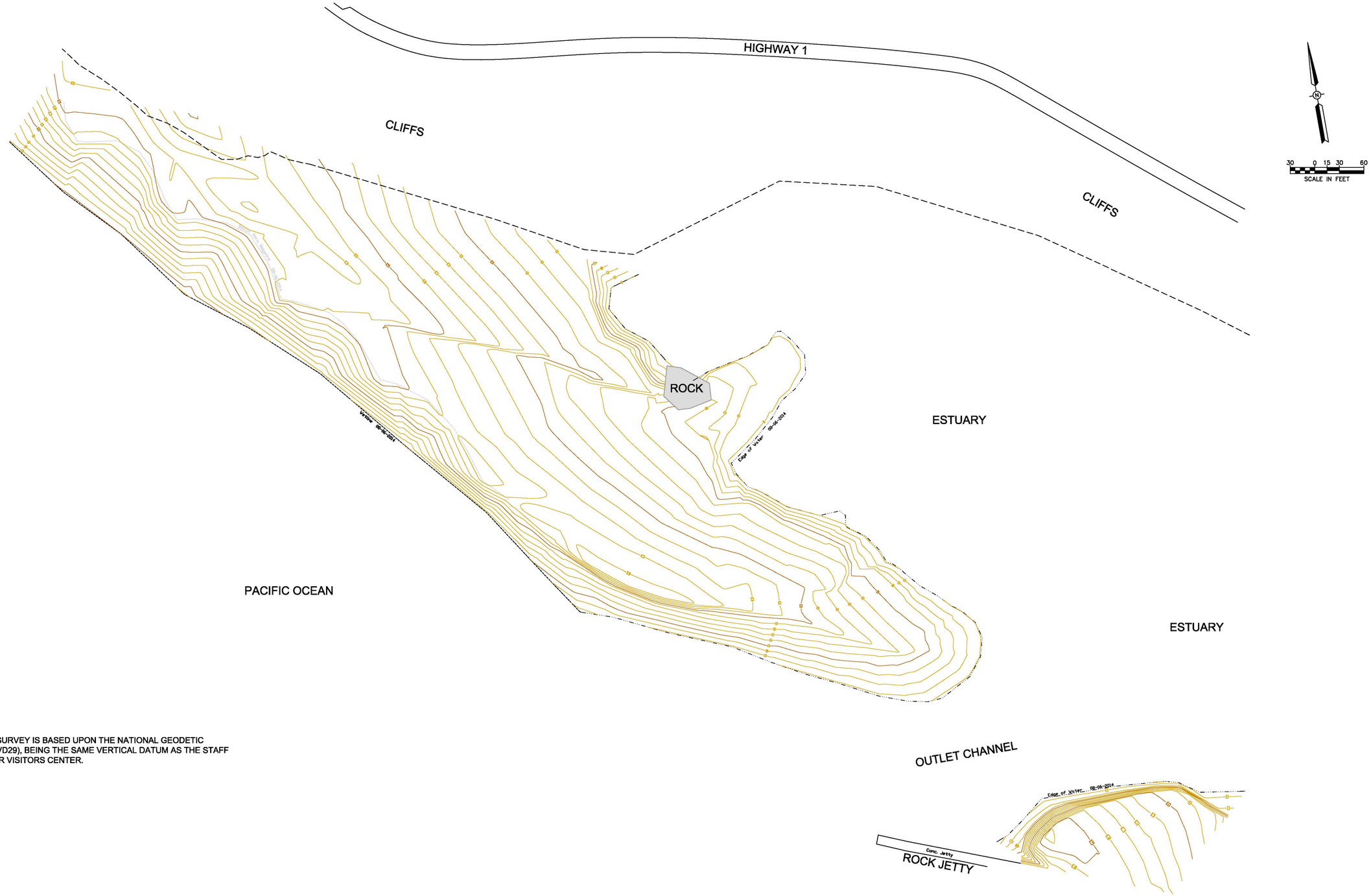

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

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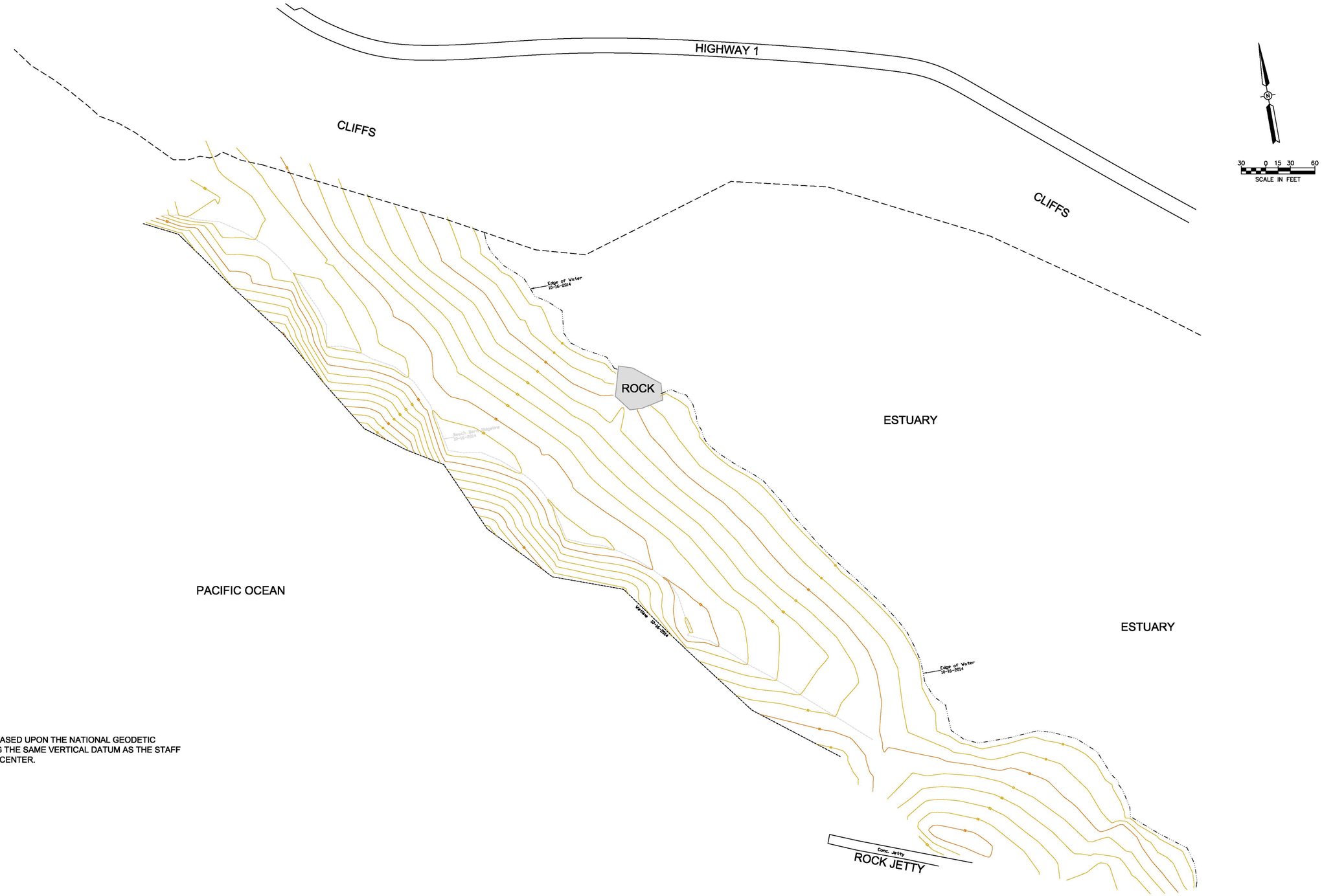

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

MONTHLY SURVEY OF BEACH TOPOGRAPHY AND OUTLET CHANNEL: Oct. 16, 2014

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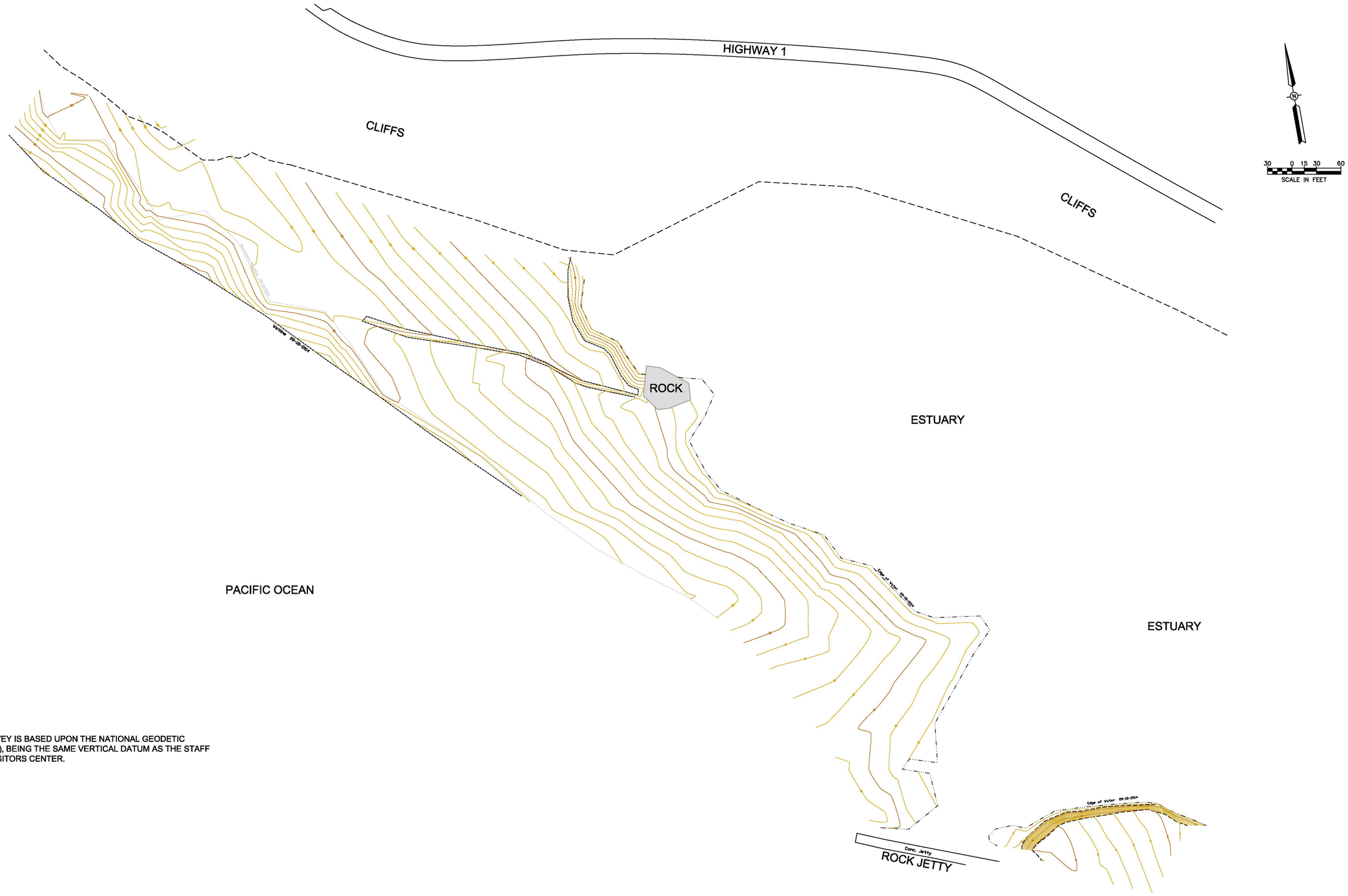

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

MONTHLY SURVEY OF BEACH TOPOGRAPHY AND OUTLET CHANNEL: Sept. 18, 2014

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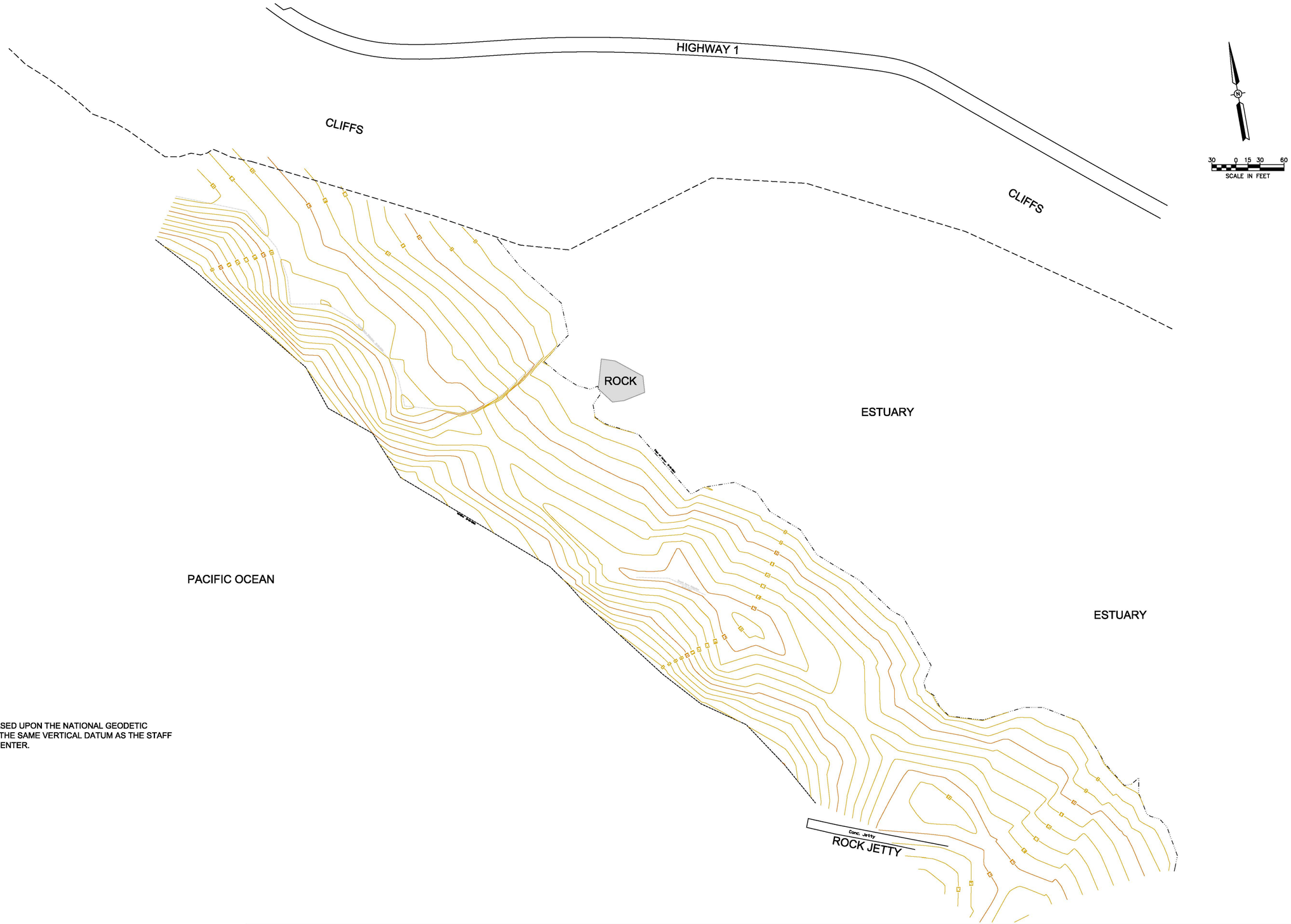

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RUSSIAN RIVER INSTREAM FLOW RESTORATION (RRIFR) PROGRAM

MONTHLY SURVEY OF BEACH TOPOGRAPHY AND OUTLET CHANNEL: Nov. 26, 2014

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APPENDIX B-3

2015 Outlet Channel Management Plan

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RUSSIAN RIVER ESTUARY OUTLET CHANNEL ADAPTIVE MANAGEMENT PLAN 2015

Prepared for

Sonoma County Water Agency

Prepared by

ESA

with

Bodega Marine Laboratory, University of California at Davis

May 15, 2015

ESA REF. # DW01958

Services provided pursuant to this Agreement are intended solely for the use and benefit of the Sonoma County Water Agency.

No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided pursuant to this agreement without the express written consent of ESA, 550 Kearny Street, Suite 800, San Francisco, CA 94108.

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1. INTRODUCTION

Sonoma County Water Agency (the Agency) is required to develop a management plan for the Russian River Estuary mouth in response to a 2008 Biological Opinion (BO) from the National Marine Fisheries Service (NMFS) designed to improve salmonid rearing habitat in the estuary (NMFS, 2008). Prior to the BO, the existing Russian River Estuary management plan focused on artificial breaching to prevent flooding. The Agency retained ESA PWA[1] to assist in developing the revised plan to address the objectives of the BO.

The BO stipulates several phases of outlet channel management over fifteen years with additional management options specified for each phase. The phases are part of an adaptive process for management actions to enhance salmonid habitat. If earlier phases are successful in meeting the performance criteria, subsequent phases will not be needed. The existing plan was first developed in 2009 to address the Phase 1 objectives in the BO and then updated in 2010, 2011, 2012, and 2013. This document, the management plan for 2015, is largely based on the plan drafted in 2014. The changes between the 2014 and 2015 plan include: documented 2014 inlet conditions (Attachment I), and updated permitting requirements (Sections 3.2 and Attachment C).

Because of permitting issues, the outlet channel was not implemented in 2009. In 2010, the outlet channel naturally established itself for about one a week at the end of June, and was then closed by ocean waves. After this closure, the Agency mechanically re-created the outlet channel. However, waves closed the outlet channel less than a day after implementation. Before the outlet channel could be re-established by the Agency, the lagoon breached, returning the estuary to tidal conditions for the remainder of the summer. Additional closures occurred in September and October, but large wave conditions and imminent flooding prevented efforts to create an outlet channel. In 2011, the inlet never closed long enough to warrant management action. Wave events caused a series of closures between the end of September and into November. However, the closures lasted a week or less, ending when rising lagoon water levels overtopped the beach berm and naturally scoured a new tidal channel. 2013 was similar to 2011 and 2012, with early summer and early fall closures ending when overtopping naturally scoured a new channel. In 2014, minimum instream flows on the Russian River were lowered due to drought conditions. So when the inlet closed in September and October, these lower inflows slowed the rate of lagoon water level rise, enabling two back-to-back closures. The September closure lasted more than a month and the October closure lasted about three weeks. These closures persisted beyond the lagoon management period, and were artificially breached.

The approach of the 2015 plan is to meet the objective of the Reasonable and Prudent Alternative (RPA), Alterations to Estuary Management, to the greatest extent feasible while staying within the constraints of existing regulatory permits and minimizing the impact to aesthetic, biological, and recreational resources of the site. It is recognized that the measures developed in the 2015 management plan, when implemented, may not fully meet the objective established by the RPA.

[1] Previously Philip Williams & Associates

The concept of this approach was developed in coordination with NMFS, California Department of Fish and Wildlife (CDFW)[2], and California State Parks (CSP). This draft plan was provided to these agencies and discussed at a meeting on April 9, 2015 that included representatives from NMFS and CDFW, as well as the Sonoma County Water Agency, Bodega Marine Laboratory, the U.S. Army Corps of Engineers, the North Coast Regional Water Quality Control Board, and ESA PWA. Comments on the draft plan from these representatives will inform the revision of the draft plan to create the final plan.

The goal of the management plan is to reduce marine influence on the Russian River Estuary (Figure 1) during the management period, May 15th to October 15th. The management actions are intended to limit tidal exchange between the ocean and the estuary. Instead of the existing tidal estuary, the BO proposes a perched lagoon with water levels above tidal elevations. With tidal inflows limited, river inflow to the lagoon may enhance the extent of freshwater habitat for the benefit of juvenile salmonid rearing. Maintaining the lagoon water levels in a perched state that is also below flood stage requires an outlet channel to convey water from the estuary to the ocean over the beach berm.

The outlet channel adaptive management plan is organized as follows. Conclusions and recommendations of this plan are described in Section 2. Sections 3-6 describe the planning and analysis steps: (1) defining project performance criteria (Section 3), (2) developing a conceptual model of relevant physical processes (Section 4), and (3) conducting technical analysis to quantify target outlet channel conditions (Sections 5 and 6). The resulting operations and management plan derived from these planning steps is also documented in this report (Section 7). The adaptive management strategy will continue by actual implementation of this plan, then monitoring and evaluating the outlet channel response to refine the plan for subsequent years.

[2] CDFW's CESA tracking number is 2080-2009-016-03 and 1600 Notification number is III-1176-96

2. CONCLUSIONS AND RECOMMENDATIONS

Conclusions about the physical processes affecting outlet channel behavior and recommendations for 2015 management are summarized below.

2.1 CONCLUSIONS: PHYSICAL PROCESSES AFFECTING OUTLET CHANNEL BEHAVIOR

1. The location of the outlet channel, at the interface of the Russian River estuary and the surf zone of the Pacific Ocean, is a dynamic system influenced by river discharge, ocean waves, and sand transport. As such, the outlet channel will be subject to variable forcing at hourly, tidal, and monthly timescales. In order for the outlet channel mouth to preserve its function in this active transport zone, the net sediment transport must be small, even though the gross sediment transport is large. To sustainably meet its performance criteria, the outlet channel must be resilient in the face of this variable forcing. This resiliency is difficult to predict.
2. Under current management of the Russian River watershed and estuary, there has been one documented occurrence of target outlet channel conditions occurring during the proposed management season of May 15 to October 15 for the fifteen year period of record (1999 to 2014). Outlet channel conditions occurred in June 2010 and persisted for about one week before closing. More typically, as a result of natural processes and existing artificial breaching practice, the connection between the estuary and the ocean has been observed in one of two states: bi-directional tidal exchange (88% of the time during the 1999-2008 management periods) or fully closed with no exchange (12% of the time).
3. Conditions similar to target outlet channel performance criteria were observed outside the management period five times between 1999 and 2013. These events appeared to be extended transitions to fully tidal conditions rather than stable conditions. Estuary water levels steadily declined throughout all events and the estuary typically returned to tidal exchange within 48 hours.
4. To meet the performance criteria, the outlet channel geometry must simultaneously meet two key constraints: convey sufficient discharge from the estuary to the ocean to preserve constant water levels in the estuary and preserve channel function by avoiding closure or breaching. These two constraints can be in conflict, since both conveyance capacity to preserve estuary water levels and the potential for breaching increase with flow rates but closure is more likely for lower flow rates.
5. The target outlet channel is subject to two failure modes: (1) closure caused by deposition, leading to estuary water levels to rise and possibly cause flooding, and (2) breaching caused by scour, leading to tidal exchange and marine conditions in the estuary. Of the two failure modes, breaching is more detrimental to NMFS's goal of reducing or eliminating exposure of the estuary to tidal water levels and saline inflow. Once breaching occurs, the estuary may persist in a breached state for weeks or months before the target outlet channel can re-form. The immediate impact of closure is only increasing estuary water levels, which allows time for management action to prevent habitat loss.

6. Based on engineering calculations, the channel bed slope must be essentially flat (slope on the order of 0.0001) and water depths less than 2 ft, preferably 0.5 to 1 ft, to reduce the likelihood of channel scour at likely May to October flows.
7. Based on the results of hydrologic modeling, it may be difficult to convey sufficient discharge to maintain estuary water levels while simultaneously keeping the bed shear stress in the outlet channel below the threshold for scour. Even with dry-year reductions to instream flows, the predicted local bed shear stress during the management period is almost always greater than the critical bed shear stress threshold for erosion.
8. Discharge conditions are a significant source of hydraulic uncertainty for assessing the outlet channel. Discharge measurements are made at the USGS Guerneville gaging station[3], 21 miles upstream from the Russian River's mouth, and changes in flow (losses/gains) are known to occur between the Guerneville station and the mouth. A water balance model for the estuary indicates that net losses between the Guerneville gaging station and the mouth vary from 10% to 53% and average 37%. Limited USGS and Agency discharge measurements at other locations suggest that most losses occur in the lower 6 miles of the river; perhaps in large part due to seepage through the beach berm.

2.2 RECOMMENDATIONS: 2015 MANAGEMENT ACTIONS

1. Two channel configurations will be initially considered for implementation.
    - a wide and short channel that seeks to minimize scour potential; or
    - a narrow and long channel aligned to the north that seeks minimize closure potential.

    The channel selected for implementation will be based on site conditions at the time of closure and discussion with the resource agency management team. Monitoring of the outlet channel and estuary response will be used to inform adaptive management during the management period.
2. Initial management actions may be more frequent, and include maintenance actions that are corrections to the existing channel configuration. Based on experience from these initial efforts, larger and less frequent actions may be undertaken.
3. Once the estuary closes, implement the channel so that when reconnecting the channel, the estuary water levels are no more than 0.5 to 1 ft above the constructed channel bed elevation. This approach reduces the potential for scour.
4. Channel excavation activities should be completed (i.e. the temporary sand barrier removed) coincident with high tides in the ocean. This will reduce the scour potential associated with the initial outflow at the time of breaching.
5. A communication protocol will provide guidance between the Agency and identified points of contact representing key resource management agencies in the estuary.
6. Because of uncertainty about the system and its response to outlet channel management, the adaptive management approach specified in the BO and being pursued by the Agency is

[3] Located just downstream of Hacienda Bridge, USGS station ID 11467000.

critical. A year-end evaluation to assess actual channel performance and revised management for subsequent years is also recommended.

3. PERFORMANCE CRITERIA

The principal estuarine habitat goal stipulated in the Reasonable and Prudent Alternative (RPA), Alterations to Estuary Management, in the BO is to reduce marine influence in the estuary from May 15 to October 15. According to the BO, marine influence includes tidal water level oscillations and saline water. NMFS believes that marine conditions diminish habitat quality for salmonid rearing by reducing the habitat extent, elevating salinity above optimal levels for salmonid juveniles and their invertebrate prey, and flushing juveniles into the ocean.

The performance criteria for outlet channel management are intended to assist in meeting the estuarine habitat objective of the RPA specified in the BO. This section presents performance criteria for Phase 1 of outlet channel management, and minor modifications to these criteria for 2015 management.

Performance criteria for water quality and ecological values in the lagoon are addressed separately and are not included in this document. The Water Agency's water quality monitoring plan is described in Sonoma County Water Agency (2013a), with the monitoring results described in Sonoma County Water Agency (2013b).

3.1 PHASE 1

Phase 1 of outlet channel management has the following performance criteria for the May 15 to October 15 management period:

1. **Estuary water levels**. The estuary water level management target is "[a]n average daily water surface elevation of at least 7 feet [NGVD] from May 15 to October 15" (BO, p. 249). Higher estuary water levels, but not exceeding flood stage of 9 ft NGVD, would be preferred by NMFS. However, water levels greater than 4 ft NGVD are expected to accompany reduced marine influence and would be likely to improve habitat.
2. **Sand channel**. The outlet channel will be a temporary feature, created only by excavating and placing beach sand. No new structures or mechanical devices, temporary or permanent, will be a part of the outlet channel implementation.
3. **Minimize artificial breaching**. Though the overall goal is to create a freshwater estuary, and therefore avoid artificial breaching, in light of natural variability of river discharge and nearshore wave conditions, several years of experience managing the estuary may be required to develop operational procedures which minimize the need for artificial breaching. As such, NMFS estimates "that SCWA will need to artificially breach the lagoon using methods that do not create a perched lagoon twice per year between May 15 and October 15 during the first three years covered by this opinion, and once per year between May 15 and October 15 during years 4-15 covered by this opinion" (BO, p. 302).
4. **Economic feasibility**. Operations and maintenance requirements will not place undue burden on the Agency in terms of cost, particularly as it relates to frequency or duration of maintenance activities.

5. **Public Safety**. The outlet channel management plan will not diminish public safety as it pertains to floodplain property owners, visitors and employees of the State Beach, and the Agency maintenance staff.

To meet the criterion for estuary water level (#1 above), the estuary will function as a perched lagoon with "water surface elevation above mean high tide … where freshwater flows out to the ocean over the sandbar at the lagoon's mouth" (BO, p. 92). This implies uni-directional flow in the outlet channel, from the estuary to the ocean, to minimize marine influence, and minimal sediment transport within the outlet channel to prevent the channel bed from scouring and transforming into a tidal channel.

NMFS (2008) introduced the terminology 'natural' to describe breaches that occur without human intervention and 'artificial' to describe breaches that are the result of human sand excavation. This terminology was used in the management plan through 2013. However, inlet and beach observations in 2012 (Attachment G), 2013 (Attachment H), and 2014 (Attachment I) suggest that the jetty, a human intervention, may indirectly facilitate breaching. The jetty appears to encourage some breaches sooner than natural conditions because the jetty shelters a portion of the beach immediately to its north, limiting sand deposition and resulting in a low point in the beach berm. In 2012- 2014, this low point was often the location where rising lagoon water levels scoured a new inlet. Therefore, starting with the 2014 plan, the term 'self-breach' is used to describe breaches caused by the estuary's own rising water levels. This term is used to include all breaches of this type, since the extent of the jetty's influence has not been fully determined. 'Artificial' breach continues to refer to instances involving human excavation, covering both authorized Water Agency contractors with mechanical equipment or unauthorized members of the public with hand tools.

Note that each time the lagoon breaches, NMFS believes the lagoon is subject to undesirable water quality conditions not just during the breached period, but also for some period of time following the subsequent closure. "NMFS anticipates 3-4 weeks of adverse water quality conditions after the sandbar closes at the mouth of the estuary" (BO p. 302). Thus the management plan seeks to minimize self, as well as artificial breaching events.

The BO requires the Agency to petition the State Water Resources Control Board (SWRCB) to change minimum instream flow requirements to improve rearing habitat for steelhead. Permanent changes in instream flow requirements will take years to accomplish, therefore, the BO also requires the Agency to petition the SWRCB to change minimum instream flow requirements on an interim (temporary) basis to facilitate management of the Estuary as a summer lagoon. The management plan anticipates an interim reduction in instream minimum flow requirements between the Dry Creek confluence and the mouth starting in 2010. Minimum flows would be reduced from current SWRCB Water Right Decision 1610 levels of 125 ft^3/s to 80-85 ft^3/s [4]. The expected reduction in

[4] The proposed instream flow requirement is 70 ft^3/s, but "SCWA maintains a 10 to 15 ft^3/s buffer to avoid non-compliance of the minimum standard" (BO, p. 245).

minimum instream flow will provide more favorable conditions for outlet channel management by reducing the potential for scour-induced breaching.

For channel location, the BO suggests the use of "a lagoon outlet channel cut diagonally to the northwest. … Alternative methods may include … use of a channel cut to the south if prolonged south west swells occur" (BO p. 250).

3.2 2015 MODIFICATIONS

As discussed above (Section 1), the approach of the 2015 plan is to meet the objective of the RPA to the greatest extent feasible while staying within the constraints of existing regulatory permits. It is recognized that the measures developed in the 2015 management plan, when implemented, may not fully meet the objective established by the RPA as summarized in Section 3.1 above. The concept of this approach was developed in coordination with NMFS, CDFG, and CSP.

Because of the estuary's coastal location and hydrologic significance, the Agency must manage the estuary's mouth in accordance with multiple land use permits from various state and federal agencies. A table summarizing all these permits is provided in Attachment C. Key aspects of these permits which directly affect 2015 outlet channel management include:

- Excavation is limited to 2,000 cubic yards of sand per event to create a channel 25 to 100 ft wide. The channel width range is consistent with historic widths observed within the management covered by existing permits (Behrens, 2008).
- Management actions are permitted only on Monday-Thursday to minimize interference with public use.
- Management actions cannot be longer than two consecutive days (unless flooding is threatened).
- Access is constrained during marine mammal pupping season (March 15 – June 30) to reduce incidental harassment of harbor seals, sea lions, and elephant seals.

Artificial breaching may be required during 2015. With this management plan, the Agency seeks to minimize or avoid such breaches during the management period, but recognizes that they may be needed to avoid flooding of adjacent properties.

4. CONCEPTUAL MODEL

The conceptual model of the outlet channel articulates the project's working assumptions about process linkages between channel features, external conditions (e.g. river flow and ocean processes), and channel performance. These working assumptions are uncertain, and may not capture all relevant processes. However, by making these assumptions explicit, they can be documented, discussed, and tested, all of which are necessary steps in the adaptive management process. Observations of the actual outlet channel response will then enable refinement of the conceptual model. In addition, because the conceptual model is expressed in a relatively non-technical manner, it provides an avenue for public outreach and education about the outlet channel. The conceptual model is not a hydrodynamic, sediment transport model but rather uses empirical observations and geomorphic interpretations to identify likely responses to key forcing parameters, given antecedent conditions and management actions.

Development of a conceptual model for the outlet channel focuses on the essential physical processes and linkages, as well as the management parameters of the channel. Although this approach leaves out some processes which may slightly alter the channel's performance, it prevents the conceptual model from becoming so complex that it becomes unwieldy. In addition to limiting the conceptual model's scope to only the essential processes, the model also excludes impacts of the outlet channel on water quality and ecological aspects of the estuary. To further enhance model clarity, the conceptual model is presented graphically with a schematic that reflects the layout of the physical system. One caveat to simplification is that the static, schematic diagrams clearly do not encapsulate the full complexity of this dynamic system.

The conceptual model first describes target conditions for the outlet channel, in accordance with the performance criteria in Section 3. Then the model identifies the morphological processes which may lead to the two failure modes for the outlet channel: closure and breaching. Closure refers to sand transport induced by ocean waves that deposits sufficient volume of sand in the outlet channel mouth that it blocks the outlet channel. Closure prevents discharge through the outlet channel, leading to increasing estuary water levels and the threat of flooding. Breaching refers to the flows enlarging the outlet channel to the point that it becomes a tidal inlet subject to bi-directional flow. It is important to note that these "failure modes" are conditions associated with natural tidal inlets and river mouths, but are considered problems at the Russian River Mouth because modified forcing parameters have affected the timing and frequency such that native species may be adversely affected (see the BO), as well as conflicts with other man-made constraints. One of the key questions in this management plan is whether the inherently dynamic system can be "trained" to drain gradually without breaching and then closing repeatedly.

There are additional aspects of the site which may impact the outlet channel, but whose impacts are thought to be secondary or not well defined. Therefore, they are not included in the conceptual model at this time. If implementation of the outlet channel suggests these aspects are important, they will be incorporated into a revised conceptual model. These aspects include large rocks and/or bed rock within the beach berm, jetty impacts on seepage, and decadal changes to beach width.

Specifically, the jetty at the river mouth and the fill across the tombolo to the south of the site may have affected littoral processes and mouth dynamics, but are not addressed in this study.

This conceptual model is based on existing literature, knowledge of similar estuaries, professional judgment, and ongoing discussion with the Agency, NMFS, CDFW, and CSP. New data and experience adaptively managing the outlet channel will be used to revise the conceptual model in subsequent management plans.

4.1 TARGET OUTLET CHANNEL CONDITIONS

The conceptual model for target outlet conditions is shown in Figure 2. Ideally, the outlet channel conveys water from the estuary to the ocean so that estuary can be maintained in a non-tidal state during the management period. A key performance criterion of this non-tidal state is that the water levels in the estuary (h_l) fall within the range of 4 to 9 ft NGVD, with elevations above 7 ft NGVD preferred. The estuary water level will not be managed directly, e.g. by pumping. Instead, it will be managed indirectly by management actions dictated by the BO, the operation and maintenance of the outlet channel and the reduction of instream flow requirement.

The estuary water level is determined by the balance between inflowing river discharge (Q_r) and three outflows: outlet channel discharge (Q_c), evaporation (Q_e), and seepage through beach berm (Q_s). For estuary water levels to remain within the target range, the inflow and outflows must sum to zero when averaged over a period of several days. As indicated by the width of the arrows depicting these flows in Figure 2, the river inflow, seepage and the outlet channel discharge are the three largest flows; evaporation is a minor factor in the water balance. As such, the sum of the seepage and outlet channel discharge capacity needs to nearly match the river discharge. If the combined outflows are too low, the estuary water level will rise to flood stage and artificial breaching will be necessary. If the outlet channel discharge is too high, the channel will scour and deepen, allowing tidal flows to enter through the channel. The outlet channel discharge is determined in part by its width, bed elevation, slope, and planform alignment. These parameters can be managed to a certain degree, but are likely to evolve in response to the natural variability of the discharge and wave forcing, and the effects of tide range. Seepage is determined by the beach berm's permeability, the water level difference between the estuary and the ocean, and the ambient conditions of the regional water table (Largier and Behrens, 2010). Presently, only the water level difference is subject to management influence. In the future, modification of the jetty to increase the beach berm's hydraulic conductivity will be studied (NMFS, 2008). The river inflow is another management parameter, however, since its value is determined as part of a separate water supply determination and permitting process, its manipulation is not considered here.

Although sediment transport will be minimal within the outlet channel under target conditions, the channel's mouth will perpetually be an active transport zone. This portion of the channel, at its interface with the ocean, will be an active transport zone for two reasons. First, it lies within the surf zone and breaking waves move up and down its face in response to the tides and variations in wave

direction, magnitude, and period. Second, this wave action creates a slope on the order of 10:1, which is sufficiently steep that flows of nearly any magnitude from the outlet channel will accelerate to above the scour velocity threshold. In order for the outlet channel to persist with this active transport zone at its mouth, this zone will have to experience minimal net sediment transport. In other words, tidal fluctuations in water level and variability in wave intensity will cause the locations of scour and deposition to shift at hourly timescales, but averaging across several tidal cycles, any sand lost by scour will be balanced by an equivalent amount of deposition. This active transport zone also plays a significant role in lateral migration of the existing channel mouth. This process is discussed in Section 4.4 on planform alignment.

Preserving these target conditions, particularly the discharge conveyance capacity, requires that the outlet channel maintain its cross-sectional flow area. This flow area can decrease or increase, leading to the two failure modes of the outlet channel: closure and breaching. These two failure modes are discussed in the sections below.

4.2 CHANNEL FAILURE: CLOSURE

The processes which lead to outlet channel closure are likely to originate from elevated total water levels in the ocean (z_{wave}), as shown on the right side of Figure 3. Elevated ocean water levels will move the active transport zone into the outlet channel, increasing deposition at elevations above that of the outlet channel's bed, z_{out}. Once deposition rates exceed any capacity of the outlet channel discharge to scour sediment, a berm will build at the mouth of the outlet channel, causing it to close. This process is thought to occur over one to several high tides, corresponding to one to several days. During the management season, total ocean water level is the combination of two ocean processes, the tides and ocean waves. As offshore waves interact with the coastline and nearshore, they are transformed such that the significant elevation on the beach is a function of the wave direction, magnitude, period and runup. While the tides fluctuate with a predictable schedule, ocean waves vary according to the unpredictable weather and wind patterns over the ocean. Therefore, the total water level can be best characterized as frequency distribution that is based on observed tide and wave data.

If the outlet channel closes and flow through the channel stops, the estuary water level will increase since the continuing river inflow cannot be exported through evaporation and seepage alone. Although seepage rates are likely to increase as a result of increasing water levels, it is assumed that seepage rates will remain below river inflow. As the water level rises, it will again overflow the beach berm when it reaches the minimum elevation of the berm crest. Early in the management season, the flow may overtop the berm below flood stage of 9 ft NGVD. However, as the berm crest elevation rises over the course of the management period, the water levels can rise above flood stage. If more moderate management actions do not stop this rising water level, a full artificial breach, as is currently practiced, will be necessary to prevent flooding.

4.3 CHANNEL FAILURE: BREACHING

The breach failure considered as part of the conceptual model and shown in Figure 4 is breaching that occurs when the outlet channel is operating according to the target conditions described above. Breaching is likely to result from two processes, high discharge which scours the channel bed or seepage-induced bed mobilization. Self or artificial breaching after a closure event are not discussed in this section because it is assumed that management actions would be enacted to return the outlet channel to target conditions prior to either of these breach mechanisms occurring. Additionally, breaching by wave overtopping or strong river discharge are not considered because these processes are associated with winter storm events, which are rare during the management period.

Because the outlet channel is an unconsolidated bed composed of relatively small particles, it is susceptible to scour by the discharge flowing through the outlet channel. Sand scoured from the channel will be lost to the ocean and there is not a significant upstream source to replace scoured sand. Extensive scour will enlarge the channel to the point of breaching and tidal inflows. To prevent scour, flow conditions within the outlet channel (u_c) must be below the threshold for scouring sand (u_{crit}). This threshold is a function of the sand grain size, which has been observed to be coarse sand, narrowly distributed around 1 mm at the Russian River mouth (EDS, 2009a). Further north on the beach, large rocks imbedded in the beach berm may provide grade control and limit scour. Whether the flow velocity is below the threshold depends on the type of bed material and hydraulic conveyance through the management parameters of the outlet channel's width, length, and bed slope.

As noted in the description of target channel conditions, the beach face slope is set by wave action in the surf zone and is sufficiently steep that flow velocity exceeds threshold for sand movement for all expected discharge rates. Under target conditions, the sand scoured by this process will be replaced by wave action on high tides, yielding no net change in the channel mouth morphology. However, if the scour is larger than deposition on the beach face, the active scour zone may move landward, into the outlet channel. This upstream movement is similar to nick point migration or head-cutting observed in streams and rivers. It is also the process observed by the Agency's maintenance staff when the beach berm is artificially breached under current practice. The breaching typically happens very quickly, before wave-induced sand transport can close off the breach in subsequent higher tides.

A second possible mechanism of breaching is seepage-induced sand mobilization, represented in Figure 4 as an arrow associated with Q_s. If seepage rates are sufficiently large, the movement of water through the sand can mobilize sand particles where the seepage flow daylights at the ground surface. Piping of groundwater along preferred pathways, which may exist within or adjacent to the jetty, might encourage this process by increasing flow rates through portions of the beach. Although seepage failure has not been observed at the Russian River estuary, it has been observed at other estuaries including Crissy Field (Battalio et al 2006) and others (Kraus et al 2002). Seepage failure may simultaneously accompany other breach mechanisms and hence be difficult to identify on its

own. Or, seepage failure may require a larger head difference between the estuary and the ocean than what occurs at the Russian River mouth because of artificial breaching to prevent flooding.

In contrast to closure which can be managed with further intervention, breaching can immediately and negatively impact NMFS's habitat objectives by allowing the marine influences of tidal water levels and saline water to enter the estuary. For this reason, breaching is more detrimental to NMFS's habitat goals than closure.

4.4 PLANFORM ALIGNMENT

Because of the presence of hard barriers in the form of the southern jetty and the northern cliffs, the outlet channel is expected to occupy an alignment within the same region that the current tidal inlet occupies, as show in Figure 1. At this initial stage in the adaptive management process, the conceptual model for the outlet channel's planform alignment is indeterminate as to a target alignment most likely to facilitate outlet channel sustainability. Therefore, observations and interpretations of the existing channel are presented in this section to provide an indication of factors acting on the proposed outlet channel. Once the outlet channel is implemented and monitored, a more definitive conceptual model for target alignment will be developed.

The exiting channel's initial alignment after a closure is typically straight and set by one of three factors, depending on the breaching mechanisms. When breached by high river discharge, the channel aligns itself to the northwest, primarily in response to the direction of the river flow during these events. When the channel self breaches at water levels below flood stage, it will overflow the berm at the minimum elevation in the berm crest. For example, in April 2009, this low point was toward the north since this was where the antecedent inlet had lowered the berm crest elevation. The Agency has attempted artificial breaching in several locations; under current practice, the initial alignment is perpendicular to the beach and just to the north of the large rock ("Haystack Rock") at the northwest corner of the estuary (Agency staff, personal communication).

Once breached, the existing channel typically changes alignment because the mouth migrates laterally in response to wave and littoral transport processes (Behrens et al., 2009). Lateral migration by the mouth while the upstream channel lags behind creates a sinuous channel. The direction and magnitude of wave energy and the resultant littoral sand transport are thought to determine the migration direction and extent. For the case of a tidal inlet, the mouth typically moves in the direction of the littoral transport (Dean and Dalrymple, 2002). However, several mechanisms have been identified that enable an inlet to move updrift, opposite to the direction of the littoral transport. Aubrey and Speer (1984) demonstrate that sand bars associated with the inlet's ebb tide delta can attach to the downdrift beach, displacing the inlet in the updrift direction. Pranzini (2001) documents a mechanism whereby riverine sediments discharged to a prograding delta preferentially deposit on the downdrift side side, which translate and rotate the inlet mouth towards incoming wave energy. Aubrey and Speer (1984) also propose that flow patterns created by inlet channel bends can create erosion on the outside of the bend and deposition on the inside, much like the development of

river meanders, with a net result of the inlet migrating updrift. Mechanisms similar to these may explain observations by NMFS that suggest that the direction of migration of the outlet channel may be against the direction of littoral transport (J. McKeon, personal communication).

Observations by Behrens et al. (2009) show that the existing tidal mouth typically moves both northward and southward during the management period. Their analysis correlates large changes in mouth location with rapid changes in significant wave height, indicating that the wave processes control the migration process. The bi-directional migration of the mouth suggests that wave energy also changes directions. This is further supported by the resulting shape of the channel, which can develop multiple channel bends in response to the mouth reversing directions. The temporal and spatial distribution of wave energy along the mouth is not well documented since wave observations have only been made offshore and estimates of how the offshore waves are transformed by local bathymetry have not been verified. Studies using trace elements and sand budgets along this stretch of coast indicate reversing directions of littoral transport because of varying periods of convergence and divergence of wave energy (DeGraca, 1976). The predominant direction may be sensitive to the relative contributions of northwest wind waves versus southerly swell. For instance, Behrens et al. (2009) show that mouth migration patterns are significantly different during El Niño years with the channel remaining in at the northern end of its range for the entire summer. They speculate that the decrease in northerly wind waves during El Niño events may explain this phenomenon. Another potential cause for this pattern is the more southerly approach angle of incident swell waves during El Nino years, as suggested by Allen and Komar (2006).

An additional factor which may affect the mouth location is the landward migration of the offshore bar. This bar, which is created by sand eroded off the beach during winter storms, moves landward with the low steepness summer waves. If this bar, which runs parallel to the shore, moves sufficiently close to the channel mouth, it may force the mouth to either side.

5. EMPIRICAL ASSESSMENT OF HISTORIC INLET CONDITIONS

The Russian River inlet is highly variable in form, position, and capacity for tidal conveyance. Analyses of field data and an extensive photographic record of daily conditions show that this variability is largely influenced by tides as well as seasonal changes in wave and river conditions (Rice, 1974; Behrens, 2008). Management actions also influence the timing and duration of closure events (Goodwin and Cuffe, 1994).

When the estuary is open to the ocean, the inlet can take one of the following forms:

- A river-dominated channel with minimal influence from tides and waves. This occurs during short-lived river flood events between December and April.
- A channel controlled by a mix of river flow, tides, and wave action. This is the most common inlet state, with waves tending to deposit sand in the inlet and estuary-to-ocean flows due to tide and river being active in removing sand from the inlet. Estuary tidal range is a fraction of the ocean tidal range, ranging from zero to over 70%, varying in response to sediment infilling and scouring of the inlet channel. Here we give special attention to "marginally tidal inlets", where tidal conveyance is less than 10%.
- A one-way overflow channel with water draining from a perched estuary, i.e., the sand barrier is built across the mouth of the estuary, but the estuary water level is high enough to overflow. Waves have limited control over such an "overflow inlet", and tidal influence is nonexistent. River flow rate controls estuary water level and overflow volume, which determines the susceptibility to breaching.

This section provides an overview of inlet states observed during the years 1999 to 2008, the time period for which the photographic record has been analyzed in detail. The analysis emphasizes the dates corresponding to the proposed management period of May 15 to October 15. The purpose of this assessment is to use existing data to identify relationships between forcing due to river, tides and waves and the response of the estuary mouth ("inlet") – and to explore the frequency of the latter two conditions described above.

5.1 FREQUENCY AND FATE OF RUSSIAN RIVER INLET STATES

The possible occurrence of an "overflow" channel at the mouth of the Russian River estuary was investigated by comparing water level records from the Jenner gage with tidal data from the NOAA Point Reyes station. The focus was to analyze events when the inlet was open for at least 24 hours with water levels remaining above tidal influence and slowly varying. Attention was also given to events when the inlet allowed minimal amounts of tidal interaction. Dates for which the inlet was at least partially open were disaggregated into a series of categories based on the ratio of the estuary tide range observed at the Jenner gage to ocean tide range (defined here as "tidal conveyance") – see Table 1. Estuary tide is driven by ocean tide, but estuary tide range is reduced either due to the elevation of the channel base that precludes complete draining of the estuary to low tide levels or due to the channel size being too small for enough water to be transported between estuary and

ocean. The estuary-ocean tidal ratio is thus an indicator of mouth state, with smaller values representing an increasingly choked mouth (near to closure or overflow state).

Table 1 Frequency of observed inlet states from May 15 to October 15 for years 1999-2008.

Inlet state		Number of days observed	Proportion of period
Tidal conveyance[1]	0-5%	10	0.8%
	6-10%	4	0.3%
	10-29%	82	5.4%
	30-49%	315	20.9%
	50-69%	590	39.2%
	≥ 70%	142	9.4%
Full inlet closure		161	10.7%
Overflow channel, stable or decreasing water level(≥ 24 hours)		0	0.0%
Device error		199	13.2%

[1]Defined as the ratio of estuary tide range to ocean tide range.

The 161 days when the estuary was closed consisted of 26 separate closure events. Of these, 19 were artificially breached and the remaining 7 were self breaches. Although the low number of self breach events prevents any statistically significant comparisons with river or wave data, it is worth noting that flows over 400 ft^3/s resulted in self breaches within 1-2 days of closure. Including all closures, there was a correlation between Guerneville flow and closure duration, with lower flows leading to longer closure periods.

During the years 1999-2008, there were no instances of overflow conditions during the proposed management period, but there were five relevant events that occurred just outside of the management period. All events had decreasing water levels, reflecting down-cutting of the barrier, although the rate of down-cutting was slow enough to prevent tidal interaction for at least 24 hours. Two of these events occurred during October, one in November, and two in May. Three of the events were associated with closure events and most lasted for less than 48 hours. An exception was a five-day event that occurred 6-11 May 2008. In this case, the inlet was breached artificially, and the Agency immediately noted that the channel had become elongated, beginning near "Haystack Rock", nearly 450 feet north of the jetty, and terminating at the jetty. This is uncommon, as post-breach channels are almost always short and wide (Behrens, 2008). The sudden elongation of the channel is likely associated with onshore bar migration.

During tidal periods, tidal conveyance was less than 10% on only 14 days during the management period from 1999-2008. These states were generally a precursor to closure events – all dates for which tidal conveyance was below 10% resulted in closure and the muted tidal state typically lasted for only one or two days. They were most commonly observed during short periods when an artificial breach failed to keep the inlet open for more than 1 or 2 days, or during periods of low flow

when the inlet was narrow and elongated. Note that there is a diminishing propensity for the inlet to be in a muted tidal state when it is close less than 30% of the full tide range. This indicates that being in between fully open or fully closed is not a condition supported by natural processes at this site.

5.2 WAVE AND RIVER CHARACTERISTICS

Wind waves and river outflow characteristics strongly influence the behavior of the inlet. These forcings exhibit seasonal patterns and other trends that correlate with different inlet states. Details of these relationships are presented below.

5.2.1 Seasonal patterns

Wave data were obtained from the CDIP Point Reyes buoy and a transformation matrix accounting for shoaling and refraction (e.g. http://cdip.ucsd.edu/) was used to transfer deepwater conditions to conditions at a location at 10-meter depth near the inlet. This method provides a first-order estimate of nearshore wave conditions that is necessary as there is a significant difference between deepwater/offshore waves and those nearshore. Wave energy is greatest in winter, declining through spring, to a minimum in July-August. However, late spring storms and/or early fall storms can occasionally produce waves exceeding 10 feet in the vicinity of the inlet during the management period. As discussed in Rice (1974) and Behrens et al. (2009), predominant swell waves from the northwest are often the cause of prolonged inlet migration or closure during late spring.

Data on river flow at Guerneville[5] show a rapid decline from a maximum at the beginning of the management period (mid-May) to a minimum in August (Table 2). Flows in July through September are low, between 80 and 225 ft^3/s for the years 1999 to 2008.

5.2.2 Conditions during different inlet states

Wave and flow conditions were compared with specific inlet states, as shown in Table 2.

Marginally tidal inlet: There is a relation between tidal conveyance and nearshore waves (H_s is significant wave height). Marginal tidal conveyance (< 10%) occurs during larger waves (H_s of 2.5 to 3.25 feet), consistent with the idea that these are transitory states associated with inlet closure and one needs waves big enough to overcome tidal (plus river) flows. These wave conditions may be lower during periods of weaker river flow. Further, if this marginally tidal mouth condition persisted, it could do so for any weaker wave conditions (which would not close the mouth).

Closed inlet: Estuary water level increase during closure events was analyzed to understand how close these conditions were to a steady-state overflow scenario. In all cases, water levels rose at rates of 0.1 ft/day or faster (Table 2). However, accounting for estuary area, the slower water level rise suggests that it may be possible to achieve a steady state with limited flow over the berm if river

[5] USGS gaging station located just downstream of Hacienda Bridge, station ID 11467000.

flows are of order 100 ft^3/s or weaker. Flows marginally over 100 ft^3/s may be possible, depending on the limit on overflow rate without eroding the sand barrier.

Overflow inlet: All of the five observed overflow events had flows higher than 100 ft^3/s, but only one persisted for more than a couple of days. Further, all of these events exhibited unusual conditions. The October 1999, November 1999 and first May 2008 event occurred during a sequence in which high waves began to induce closure, but a sudden increase in river flow prevented full closure and eroded the channel down to its original state. It appears that overflow conditions only occurred because the initial transition towards closure allowed estuary water levels to temporarily exceed high tide levels. The event in October 2006 occurred after a self breach of a four-day closure, so the lower flows observed in this case are expected. Finally, the most persistent event in May 2008 was associated with an unusually long channel, which is important in that frictional losses may have encouraged the prolonged high water elevation in the estuary. As noted above, this event was likely due to seasonal onshore bar migration.

Table 2 Comparison of average wave and average river conditions for various ranges of tidal conveyance and water level increase in the estuary. Overflow conditions are analyzed for five events observed outside of the proposed management period.

Inlet state		Guerneville flow, ft^3/s	Nearshore H_s, ft
Open inlet with given tidal conveyance:	<10%	323	3.2
	10-29%	261	2.5
	30-49%	219	2.1
	50-69%	276	2.0
	≥70%	328	1.8
Closed inlet; estuary stage rising at given rates:	0.1-0.29 ft/day	146	2.7
	0.3-0.49 ft/day	175	2.6
	0.5-0.7 ft/day	185	3.4
	≥0.7 ft/day	211	4.1
Overflow channel (outside management period)	Oct 28, 1999	291	15.7
	Nov 4-5, 1999	247	5.9
	Oct 26, 2006	155	2.2
	May 1-2, 2008	323	6.6
	May 6-11, 2008	283	1.3

5.2.3 Analysis of wave runup

The mouth of the estuary is typically closed by waves depositing sediment in the inlet channel during slack high tides, but waves can only do so if wave runup can reach the height of the inlet channel base. Thus, wave runup exceedance curves were generated for each of the management months to assess the likelihood of the (overflow) channel being closed by wave action. De-shoaled deepwater equivalent wave heights were combined with daily higher-high tide water levels to estimate runup height following Stockdon et al. (2006), and assuming a constant beach-face slope.

The height exceeded by 2% of the waves under given monthly wave conditions is shown in Figure 5. Runup is highest in October, with heights of 11ft being exceeded on 1 in 10 days. For May, June and September, runup exceeds 10ft on 1 in 10 days, and this drops to 9ft for July and August. This is consistent with the seasonal cycle of large swell events, due to winter storms in the north Pacific, which may occur in October, and occasional swell events due to storms in the tropical or south Pacific during summer. The locally generated waves due to northerly winds in summer are of shorter period and lower height. These data suggest that wave-induced closure of an overflow channel will be a greater concern at the beginning and end of the May-October management period.

5.3 CHANNEL PLANFORM GEOMETRY

Inlet morphological behavior has been studied by Behrens (2008) for the years 1999-2008 through an analysis of inlet width, length and position estimates derived from photographic records. Data collection methods and error estimates are described in Behrens et al (2009). Inlet planform geometry and closure risk are summarized for different mouth states (Table 3).

Table 3 Inlet planform geometry for overflow conditions and various ranges of tidal muting (May 15 to October 15, 1999-2006). Overflow conditions are analyzed despite the fact that they occurred outside of this timeframe.

Inlet state		Inlet width[1], ft	Inlet length[1], ft	Most common configuration	Closure risk[2]
Open inlet with given tidal conveyance:	<10%	25 ± 1.8	530 ± 37.1	≥2 channel bends	81.3%
	10-29%	51 ± 3.6	358 ± 25.1	1-2 channel bends	35.3%
	30-49%	71 ± 5.0	282 ± 19.7	1 channel bend	28.6%
	50-69%	86 ± 6.0	236 ± 16.5	1 channel bend	13.7%
	≥ 70%	92 ± 6.4	221 ± 15.5	Straight	3.5%
Overflow channel (outside management period)	Oct 28, 1999	60 ± 4.2	140 ± 9.8	Straight	--
	Nov 4-5, 1999	20 ± 1.4	360 ± 25.2	Deflected by jetty	--
	Oct 26, 2006	25 ± 1.8	110 ± 7.7	Straight	--
	May 1-2, 2008	65 ± 4.6	100 ± 7.0	Straight	--
	May 6-11, 2008	20 ± 1.4	480 ± 33.6	Deflected by jetty	--

[1] Ranges are based on error estimates from Behrens *et al* (2009).
[2] Defined as the number of observations that were followed by closure within two weeks, divided by the total number of observations.

The data for overflow channel geometry indicate that the limited number of overflow events exhibited a range of shapes. The geometry of the only persistent case (6-11 May 2008) suggests that frictional loss plays an important role in attenuating channel velocity and the resulting downcutting.

However, there is a tradeoff for the frictional losses associated with sinuous channels. For a marginally tidal inlet the channel is long and narrow, with a couple of bends – and there is a very high risk of closure. There is no apparent relation between inlet position (not shown in this table) and tidal conveyance. However, marginally tidal inlets and overflow inlets were observed only at

the northern or southern extreme of the inlet's migration range. Inlet width and length are known to vary in concert with river flow during the wetter months of the year and with tidal range during the drier months (Behrens et al., 2009). In general, low-flow conditions (low tides or river flow) appear to encourage inlet elongation and narrowing. Inlet width, length, and the number of channel bends all influence the tidal signal by determining frictional losses in the channel.

5.4 NOTES ON OTHER ESTUARIES

Overflow inlets have been observed in numerous estuaries along the coasts of California, Oregon, Chile and South Africa (and probably other areas with comparable climate and topography) (personal communication, John Largier). These are unpublished observations. Specifically, an overflow inlet is typically observed to persist for 1 to 3 months each year at the mouth of Salmon Creek (10 miles south of the Russian River) and at the mouth of the Gualala River, discussed below. Further, small central coast estuaries exhibit overflow states during spring and summer, e.g., Scott Creek and Waddell Creek. Systems photographed along the Chilean, South African and Oregon coasts are of similar size in terms of river flow and lagoon area. The absence of observations of overflow conditions in larger estuaries, similar to the size of the Russian River, suggests that there is a limit to the flow energy that can be accommodated by flow over a sand barrier of finite width (and thus high slope).

5.4.1 Gualala River

The mouth of the Gualala River is located 31 miles northwest of Jenner. Both its tidal prism and annual river flow are significantly lower than those of the Russian River. Despite this, the sites have several similarities, most notably their similarly sized beaches bordered by headlands. During a typical year, the inlet is closed for the entire summer and is opened by the first major storm of the winter (ECORP, 2005). The inlet requires consistent rainfall to remain open, and it is common for closures to occur within several weeks after each major storm event. As rainfall decreases during the spring, the inlet undergoes repeated cycles involving a closure event, a period of gradual estuary stage increase leading to a natural breach, and finally, several days to several weeks of minimal tidal conveyance and/or overflow conditions culminating in a new closure event. These cycles appear to continue until evaporative and seepage losses counterbalance inflows into the estuary, preventing the stage increase required to cause a natural breach event.

5.4.2 Carmel River

California State Parks adaptively manages the beach berm which creates a lagoon at the mouth of the Carmel River (CA Dept. of Parks and Recreation, 2008). The goal of this management is similar to the goal stated in the Russian River BO (NMFS, 2008): to enhance the freshwater salmonid rearing habitat during summer months. Sometime in April, May, or June, once the Carmel River discharge into the estuary drops below 20-25 ft^3/s, bulldozers are used to increase the height of the beach berm. This elevated berm blocks ocean tides and saline water from entering the estuary, thereby creating a perched lagoon. When forming the elevated beach berm, an outlet channel is also created so that if lagoon water levels exceed 10 feet NGVD, the outlet channel will drain water from the lagoon into the ocean. The outlet channel only conveys water if the discharge to the lagoon does not taper off

from 25-20 ft^3/s to 10 ft^3/s as rapidly as expected. Once river discharge falls below approximately 10 ft^3/s, evaporation and seepage export enough water from the lagoon that lagoon water levels no longer increase.

The Carmel Lagoon outlet channel differs from the proposed Russian River outlet channel with respect to several key features, as summarized in Table 4. Overall, the Russian River outlet channel is likely to be more difficult to manage than the Carmel River outlet channel because of its higher required conveyance, longer operational period, and lack of natural grade control.

Table 4 Comparison between Russian River and Carmel River outlet channel features

Outlet channel feature	**Russian River**	**Carmel River**
Conveyance capacity	50 ft^3/s	10 ft^3/s
Operational period	5 months (May-Oct)	1 month
Grade control	none	natural rock outcrops

6. CHANNEL CONFIGURATION ANALYSIS

As discussed in the conceptual model for target conditions, the outlet channel geometry must simultaneously meet two key constraints: convey sufficient discharge from the estuary to the ocean to preserve constant water levels in the estuary and preserve channel function by avoiding closure or breaching. Note that these two constraints can be in conflict since both conveyance capacity and the potential for breaching increase with flow rates but closure is more likely for lower flow rates. The technical analyses described in this section inform the range of target channel conditions by quantifying the relationship between outlet channel dimensions, bed scour potential, and hydraulic conditions. The ocean-driven processes associated with closure, the wave runup elevation and planform alignment, are discussed above in Section 5. Preventing breaching, a necessary condition for reducing marine influence on the estuary is the focus of this section.

Since the outlet channel will be located within a bed of unconsolidated beach sand, a key management objective is creating a channel which can sustain its cross section geometry instead of scouring. Breaching can occur if the discharge through the outlet channel is sufficiently forceful to scour the channel bed. To reduce the possibility of scour, threshold design principles (NRCS, 2007) are used to examine channel configurations most likely to avoid scour while meeting the other constraints of the system.

Channel design using a threshold methodology consists of the following steps:

- *Estimate the critical shear stress threshold.* This is a function of the site's bed particle composition, which can be characterized by grain size.
- *Predict hydraulic conditions for the proposed channel.* Use engineering calculations of steady flow and a one-dimensional hydraulic model of time-varying flow to estimate the velocity and shear stress for a proposed set of channel geometry, flow, and bed roughness.
- *Compare threshold and predicted bed shear stress.* The estimates from the two previous steps are compared with a factor of safety to account for variations in hydraulic conditions about the mean and uncertainty in parameter estimation.
- *Sensitivity analysis and uncertainty.* Evaluate the sensitivity of threshold and predicted bed shear stress to input parameters as well as the factors contributing to overall uncertainty.

6.1 CRITICAL SHEAR STRESS

The critical shear stress is defined as the applied bed shear stress at which sediment motion occurs. The critical threshold represents a balance between the force exerted by the flow on the bed and the resisting gravitational force of individual sediment particles. Flows above the critical shear stress will transport sediment while flows below the critical shear stress will result in no motion. The critical shear stress is dependent on characteristics of the sediment such as sediment density and particle size.

Sediment samples at the Russian River mouth were collected in March 2009 to inform the assessment of critical shear stress within the outlet channel. Ten sediment samples taken along the proposed outlet channel alignment were analyzed to determine the characteristic grain size distribution. On average, 78% of the sediment had a grain diameter between 0.6-2.0 mm (coarse sand), 18% was greater than 2.0 mm (granular), and 4% was between 0.2-0.6 mm (medium sand) (EDS, 2009a). Visual observations of grain size by ESA PWA near the mouth indicated a typical diameter between 0.8-1.25 mm (coarse sand).

Based on this assessment of typical beach grain size, ESA PWA estimated the critical shear stress using methods outlined in Soulsby (1997) and Fischenich (2001). For the typical range of observed grain size from 0.8-1.25 mm, a critical shear stress of 0.4-0.7 Pa (0.008-0.015 lb/ft^2) was determined for sand particles in the vicinity of the proposed outlet channel (Attachment A-1).

6.2 PREDICTED HYDRAULIC CONDITIONS

6.2.1 Steady mean flow conditions

ESA PWA conducted a preliminary assessment of outlet channel hydraulics under steady typical summer flow conditions as a screening tool to characterize the range of possible channel geometry parameters (bed elevation, channel slope, width, and length). Simple hydraulic equations for open channel flow were used to estimate the in-channel velocity and bed shear stress.

ESA PWA evaluated different combinations of river discharge, bed roughness, channel slope, and flow depth to evaluate channel performance. For a given discharge the hydraulic equations can be solved to determine the values of slope, width, and depth that satisfy the critical shear stress threshold for sediment motion. Once one of these three parameters is selected, the other two are fixed to meet a given shear stress threshold (NRCS, 2007). Multiple combinations of channel slope and width are capable of conveying the design flow at or below the critical shear stress threshold.

Figure 6 shows an example slope-versus-width stability curve for the outlet channel design. A stability curve is a tool used by designers to evaluate channel stability under a range of feasible slope-width combinations. Any combination of slope and width that falls on the stability curve will be stable for the prescribed discharge. Combinations of width and slope that plot above the stability curve will result in erosion and scour of the channel. Combinations of width and slope that plot on or below the stability curve will be stable (or depositional). For a given width, the depth of flow can be determined from the corresponding depth-width curve (Figure 6). For example, a 100-ft wide channel discharging 70 ft^3/s will be stable for channel slopes less than approximately 0.000125 and will flow at a depth of approximately 11 inches. The stability curve shows that as slope increases, channel width must also increase to keep channel velocities below the critical threshold for transport. Channel width and depth are inversely related for points on the stability curve, resulting in either a narrow channel with relatively deep flow or a wide channel with relatively shallow flow.

6.2.2 Calculation of estuary inflows

ESA PWA developed and calibrated a water balance model based on observed lagoon water levels at Jenner, CA. The purpose of the water balance model is to estimate the reduction in river discharge that occurs over the 21 river miles between Guerneville, a USGS continuous discharge gaging station, and the mouth of the estuary. The losses in discharge are attributed primarily to seepage through the beach berm (Largier and Behrens, 2010), with diversions, interaction with the adjacent aquifer, and groundwater pumping as possible contributing factors. No direct observations of these loss terms is available. The reduction factor serves as the calibration variable for the water balance model. For all cases, predicted estuary water levels during closure periods do not match observations unless lagoon inflows are reduced relative to the Guerneville discharge.

Model Setup

During a closure event, the rate of water level increase is a direct function of the net flows into and out of the lagoon (Goodwin and Cuffe 1993):

$$\frac{\Delta V}{\Delta t} = A\frac{\Delta h}{\Delta t} = \alpha Q_R - Ai_{evap} - Q_s$$

where:

$\triangle V$	=	lagoon inflow during closure (ft^3)
$\triangle t$	=	duration of closure (days)
A	=	surface area of the lagoon (ft^2)
$\triangle h$	=	change in water level in the lagoon (ft)
Q_R	=	river discharge at Guerneville (ft^3/day)
α	=	discharge reduction factor for groundwater losses
i_{evap}	=	rate of evaporation from the lagoon (ft/day)
Q_S	=	rate of seepage loss through the barrier beach (ft^3/day)

All terms in the water balance equation can be measured or approximated to allow calculation of α, the discharge reduction factor, for each closure event. The components and data sources of the water balance model are described below:

- Estuary water level and inlet state ($\triangle h$) – Jenner water level time series, (SCWA, 2000-2007). The inlet was assumed to be closed (no flow) during the calibration, based on periods when the estuary water levels were non-tidal and increasing estuary water levels.
- Guerneville discharge (Q_R) – USGS gaging station 11467000 (Russian River near Guerneville, CA at Hacienda Bridge) (http://waterdata.usgs.gov).
- Evaporation (i_{evap}) – estimated based on climatological evaporation rates for CIMIS evapo-transpiration reference Zone 1 (California coast) (*www.cimis.water.ca.gov*, Attachment A-3).
- Berm seepage (Q_S) – estimated using Darcy's Law based on water level difference between lagoon and ocean (Attachment A-4).
- Lagoon stage-storage curve (A) – determined from 2009 sidescan survey and LiDAR digital elevation model (EDS 2009b).

The volume of water entering the closed lagoon as a result of waves overtopping the beach berm is not included in the water balance model. Two lines of reasoning provide the basis for this exclusion. First, wave conditions during the May through October management period are generally associated with beach berm building, not with extensive overtopping and berm erosion more prevalent during winter storm events. The wave runup analysis in Section 5.2.3 confirms that runup elevations sufficient to overtop the berm are infrequent. Second, the observed water levels used in the water balance model exhibited nearly constant rates of increase, typically over two days or more. Short periods of rapidly changing water levels indicative of overtopping were not used in the water balance analysis.

Model Calibration

The observed rate of water level increase ($\triangle h/\triangle t$) in the lagoon during 18 closure events was calculated from the Jenner gage data. Rates of water level increase ranged from 0.4 ft/day to 3 ft/day and averaged 1 ft/day. The required inflow ($\triangle V/\triangle t$) to yield the observed rates was calculated based on an assumed lagoon surface area (A) at closure of approximately 400 acres. From the observed average discharge at Guerneville (Q_R) over each closure period, a discharge reduction factor, α, was calculated for estuary inflow during each of the closure events. The percent reduction ranged from 10% to 53% and averaged 37% (Attachment A-5). The largest reductions in discharge typically occurred in summer and were less in the spring and fall.

The reduction factors were averaged over each month from May-October to approximate a seasonal trend. The resulting calibration curve (Attachment A-5) was used to reduce the anticipated Guerneville discharge in the unsteady hydraulic modeling discussed in Section 6.2.3 to predict downstream flow rates into the lagoon based on upstream discharge measurements.

Comparison with Discharge Measurements

A limited set of USGS and Agency discharge measurements provides estimates of river flow at other locations besides the continuous discharge measurements at Guerneville. These discharge measurements, collected at four stations[6] in the 14 miles below Guerneville, typically fall within 10% of the Guerneville average daily discharge. For example, Behrens and Largier (2010) found that the longest record, collected by the Agency in 2009 at Vacation Beach, agreed to within 10 ft^3/s of the discharge measurements made at the permanent USGS Guerneville gage. These relatively low losses suggest that the losses calculated to complete the estuary water balance occur downstream of these discharge measurements, in the lower 6 miles of the river. Since the results of the water balance are used to estimate estuary inflow in the unsteady hydraulic model (see Section 6.2.3 below) and have a significant level of uncertainty, the estuary inflow values in the unsteady hydraulic model may not represent actual estuary inflow. Presently, the existing data are insufficient to fully characterize the losses between the discharge measurements and lagoon water levels. Higher

[6] Data available from USGS National Water Information System (http://waterdata.usgs.gov/nwis), Russian River station names (site number): Duncan Mills (11467210), Monte Rio (382757123003801), Vacation Beach (11467006), and Rio Nido (383012122574501).

rates of seepage through the beach berm are one possible explanation. Largier and Behrens (2010) estimate seepage rates to average 60 ft^3/s for all closure data. Their seepage estimates vary from approximately 30 ft^3/s when the estuary is closed and its water level exceeds the ocean water level by 2-3 ft to more than 70 ft^3/s when the water level difference exceeds 5 ft. Substantial uncertainty about the seepage rate, on the order of ±20 ft^3/s, remains; therefore monitoring to resolve this discrepancy is recommended in Section 7.7. The implications of alternative lagoon inflows are discussed in the model sensitivity analysis and outlet channel management sections of this report.

6.2.3 Hydraulic modeling of unsteady mean flow conditions

Using the calibrated water balance model results described in Section 6.2.2, ESA PWA developed a hydraulic model to evaluate the performance of the outlet channel for various hydrologic scenarios. This modeling is a refinement of the steady mean flow calculations described in Section 6.2.1 because it quantifies estuary discharge, explicit channel geometry, and temporal changes in hydraulic parameters. Sources and sinks accounted for in the model include river discharge, groundwater losses, berm seepage, evaporation, and outlet channel discharge (described in more detail in Section 6.2.2 and Figure 7). Flow in the outlet channel is represented by one-dimensional channel hydraulics as a function of estuarine water levels, channel dimensions, channel slope, and bed roughness. Tidally-varying ocean water levels are included in the model, but since these water levels stay below the channel's bed elevation, they do not influence flow in the channel. Initial channel dimensions were based on the results of the preliminary analysis described in Section 6.2.1. Model channel geometry was revised iteratively based on subsequent hydraulic analyses and discussions with the Agency and NMFS. Channel geometry is fixed throughout the simulation, even though the channel may be subject to scour and its mouth lies in the active transport zone created by ocean waves (Section 4). This assumption has been made because currently available data and models cannot adequately characterize the active transport zone. The management implications of this assumption are discussed in Section 7. The model simulates estuary water levels and outlet channel flow for the period spanning proposed outlet channel operations, from May 15 to October 15.

Discharge Boundary Condition

ESA PWA analyzed historic discharge data at Guerneville to select a "typical" water year for the hydraulic model boundary condition. A time series of monthly discharge was obtained from USGS for the time period from 1970 to 2008 and compared to the median monthly discharge for the duration of record to select a typical water year. For each month, the difference between the month's discharge and the median monthly discharge was computed. The sum of the differences (for May-Oct only) was used to rank each year relative to median conditions. Based on this ranking, the 2000 water year was selected as the most typical year (Attachment A-6).

The year 2000 discharge time series was used to generate a synthetic discharge time series to approximate anticipated reduced instream flow conditions. A measured time series is preferable to using the median daily discharge because it retains some of the short-term variability in the observed flow rates. A synthetic discharge time series for anticipated flow conditions was derived from the typical discharge time series by scaling the Guerneville discharge to an average summertime flow of

120 ft^3/s. This reduction to 67% of observed 2000 discharge is based on the anticipated reduced instream flow requirements (Section 3.1) versus historic instream flows. When flows are adjusted to average 120 ft^3/s from July to October, short-term variability ranges from about 85-150 ft^3/s. The resulting discharge time series at Guerneville is shown in Figure 7a for the simulation period.

The anticipated discharge time series at Guerneville was further reduced using the calibration curve developed in Section 6.2.2 to account for downstream losses between the gaging station and the lagoon. The resulting estuary inflow time series is shown in Figure 7a. Anticipated inflows to the lagoon vary from approximately 45-90 ft^3/s and average approximately 55 ft^3/s during the summer months. Once seepage and evaporation losses are subtracted from the lagoon inflow, modeled baseline flows in the outlet channel are 45-85 ft^3/s and average 50 ft^3/s.

Model Setup

The configuration for the unsteady HEC-RAS hydraulic model is very similar to the water balance model described in Section 6.2.2. The unsteady model includes the lagoon, outlet channel, and beach face, and simulations span the duration of the operational period, from May 15-October 15. The outlet channel was parameterized as a prismatic rectangular channel with a width of 100 ft and length of 300 ft. Bed roughness (Manning's n) was set to 0.02. The channel bed was set at 5 ft NGVD and transitions to a 1V:70H slope on the beach face. The actual beach face slope is believed to be closer to 1V:10H; however, a milder slope was required for model stability. Sensitivity runs with a steeper beach face slope indicated negligible influence on velocities in the upstream portion of the outlet channel. Time-varying seepage and evaporation losses from the lagoon were estimated from Darcy's Law and CIMIS climate statistics for coastal areas, as described in Section 6.2.2. The time series of these losses used as model input are shown in Figure 7b. Because these combined losses are less than 10% of the lagoon inflow, the modeled lagoon outflow through the outlet channel is similar to the lagoon inflow (Figure 7a). A downstream water level boundary condition was prescribed for the ocean; however, since the outlet channel bed elevation is above the limit of tidal influence (approximately 4.5 ft NGVD), there was no impact on outlet channel hydraulics.

Results

Model runs were conducted for the operational period from May 15-October 15 for the proposed outlet channel geometry described above. Time series of lagoon water level, channel velocity, and bed shear stress were extracted to evaluate channel performance. Bed shear stress and lagoon water level results for the hydraulic modeling are shown in Figure 8a and Figure 8b, respectively. The bed shear stress values shown in Figure 8a are mean model predictions times 1.5 to account for transverse variations in bed shear stress not captured by the one-dimensional model (Fischenich, 2001).

The results for the proposed channel geometry and the anticipated reduced instream hydrology are shown as the "Baseline" curve. The expected range of critical shear stress (0.4-0.7 Pa) is shown in Figure 8a for reference. After the initial higher flow period during the spring and early summer, both shear stress and lagoon water level are relatively constant throughout the summer and fall (July-October). Bed shear stresses fluctuate during this period, but are always above the critical shear

stress, indicating likely sediment motion and scouring of the channel. Lagoon water levels (Figure 8b) are relatively constant around 5.6 ft NGVD, resulting in a typical flow depth of approximately 0.6 ft in the channel. Channel velocities average 1.1 ft/s and range between 1.0-1.3 ft/s.

6.3 SENSITIVITY ANALYSIS AND UNCERTAINTY

ESA PWA conducted sensitivity and uncertainty model runs for important variables and parameters to assess their impact on channel performance. The testing focused on conditions that may encourage a stable channel by reducing predicted bed shear stress below the critical shear stress. Parameters tested were reduced outlet channel flow and critical shear stress.

Reduced Outlet Channel Flow

Anticipated flows in the outlet channel are somewhat uncertain because the losses between upstream observed discharges and the outlet channel are not well characterized, as described in Section 6.2.2. The baseline simulation presented in Section 6.2.3 used a calibrated seasonally-varying coefficient to reduce flow rates into the lagoon. Once seepage and evaporation losses are subtracted from the lagoon inflow, modeled baseline flows in the outlet channel are 45-85 ft^3/s. To test channel performance under conditions with further flow reductions (due to higher losses, groundwater recharge, diversions, or berm seepage), a sensitivity run was conducted with outlet channel flows reduced to 25-45 ft^3/s, approximately 45% less than baseline conditions.

Critical Shear Stress

Uncertainty in the critical shear stress for beach sand at the Russian River mouth is primarily due to the fact that the beach is comprised of a distribution of particles of varying diameter (see Section 6.1), as opposed to a uniform grain size. Grain size analyses indicate a narrow distribution of approximately 0.8-1.25 mm diameter sand, for which the critical shear stress ranges from 0.4-0.7 Pa. The critical shear stress for the typical grain size of 1 mm is 0.5 Pa.

Results

The results of the reduced outlet channel flow sensitivity model run are shown in Figure 8a for bed shear stress and Figure 8b for lagoon water level. The 45% reduction in outlet channel flow resulted in reduced bed shear stress and water level. Average water levels and channel depth decreased by approximately 0.1 ft relative to the baseline simulation. Average bed shear stress decreased by approximately 30% to an average value of 0.58 Pa for the summer months. The range of critical shear stress, 0.4-0.7 Pa, is shown in Figure 8a as a blue band. While the predicted bed shear stress for baseline conditions almost always exceeds this range, the predicted bed shear stress for reduced outlet channel flow falls within the range of critical shear stress.

The results of the sensitivity simulations suggest that while the baseline conditions are likely to cause scour, variability in outlet channel flow and critical shear stress could result in a marginally stable channel. If necessary, a wider channel could be excavated (or could develop naturally) to reduce bed shear stress below the critical threshold. This model was not used to predict sediment transport and therefore the modeled channel geometry was held fixed. Under target conditions,

active transport is expected at the channel mouth (Figure 2). In order for the outlet channel to persist, scour caused by the outlet channel flow accelerating down the beach face at low tides needs to be balanced by sediment deposition generated by wave action at high tides. However, if the active transport zone moves upstream into the outlet channel, the channel is likely to breach and return to tidal conditions, as shown in Figure 4.

7. PROPOSED OUTLET CHANNEL ADAPTIVE MANAGEMENT FOR 2015

This section describes the 2015 recommended channel management practices related to the BO requirements. Existing management practices for public safety, operator safety, operational responsibility, and other practices not related to meeting the BO objectives are not discussed here. These existing practices are documented in the Standard Operational Procedures: Russian River Mouth Opening (SCWA, 2002).

The outlet channel management described in this section is based on the performance criteria, conceptual model and technical analysis described in the preceding sections, as well as extensive discussion between the Agency, the resource management agencies, and ESA PWA. In addition, implementation efforts provided practical experience for adapting the plan. An account of the 2010 implementation is provided in Attachment E and an account of physical conditions is provided for 2011 (Attachment F), 2012 (Attachment G), 2013 (Attachment H), and 2014 (Attachment I). Some uncertainty remains about the exact outlet channel configuration that may best achieve the target performance criteria. This uncertainty arises from the dynamic natural setting for the outlet channel and from the unquantified tradeoffs between channel specifications which may benefit one performance criterion while impairing another criterion. For example, to reduce the likelihood of closure, it may be beneficial to locate the mouth of the channel further north where the coastline's aspect is more sheltered from waves from the north. However, extending the channel's length to the northern location may necessitate narrowing its width to keep excavation within currently-permitted volumes. A narrower channel increases the likelihood of scour-induced breaching. The relative importance of these factors is not known, precluding an exact determination of optimal channel configuration. In addition to these uncertainties, actual conditions at the time of closure, such as beach berm topography, may inform the selected configuration.

The assessment of the outlet channel conducted to date suggests two possible configuration options:

- a wide and short channel that seeks to minimize scour potential; or
- a narrow and long channel aligned to the north that seeks minimize closure potential.

The rationale supporting each of these configurations is described in more detail in Section 7.3 and Attachment D below. The configuration that is selected at the time of closure will be documented to the resource management team in accordance with the communication protocol described in Section 9. Performance of implemented configurations will be monitored and documented to test the conceptual model which guides management and to suggest adaptive changes to future management actions, including some combination of these two configurations.

The strategy for outlet channel management is an adaptive and incremental approach. This strategy favors smaller, more frequent modifications over larger, less frequent, modification with less certain outcome. Once experience is gained from implementing the channel and observing its response, it may be possible to make larger changes during each incremental modification. These larger changes will decrease the duration and frequency of management activity, thereby reducing the disturbance impact over time. Management practices will be incrementally modified over the course of the

management period (May 15th to October 15th) in effort to improve performance in meeting the goals of the BO.

The approach may be constrained by an excavation volume limit of 2,000 yd^3 and antecedent beach berm topography prior to implementation. This approach will be implemented to the extent feasible while still staying within the constraints of existing land use permits.

To provide context for the proposed management plan, the first section below describes previous breaching practices for the inlet. Subsequent sections describe the target channel initiation, location, dimensions and supporting operations details. A hypothetical implementation scenario for the outlet channel, based on actual beach berm and ocean conditions observed at the estuary from June 30 to July 6, 2009, is provided in Attachment B.

7.1 PREVIOUS BREACHING PRACTICES

Breaching has historically been performed in accordance with the *Russian River Estuary Study 1992-1993* (PWA, 1993) in effort to minimize flooding of low lying shoreline properties in the Estuary. The beach berm was artificially breached by the Agency when the water surface elevation in the estuary is between 4.5 and 7.0 feet as read at the Jenner gage. Breaching was performed by creating a deep cut in the closed beach berm approximately 100 feet long by 25 feet wide and 6 feet deep by moving up to 1,000 yd^3 of sand. Based on experience and beach topography at the time of the breach, the planform alignment of the breach was selected to maximize the success of the breaches. Breaching activities were typically conducted on outgoing tides to maximize the elevation head difference between the estuary water surface and the ocean. After the last portion of the beach berm was removed, water would begin flowing out the channel at high velocities, scouring and enlarging the channel to widths of 50 to 100 feet. As the channel evolved and meandered, it reached lengths in excess of 400 ft. After breaching, the estuary would be subject to saline water inflow throughout incoming tides.

7.2 INITIATION OF EXCAVATION

Initial channel excavation will be performed when the outlet channel first closes following May 15th, the beginning of the management period. Closure is often preceded by a lengthening and narrowing of the outlet channel, muting of the estuary tide range, and/or an increase in mean tide level within the estuary. The Agency will monitor the estuary for these conditions and initiate planning for a management action when they are observed.

Throughout the management period, the Agency's permits with CSP and the California Coastal Commission dictate that management operations cannot occur on Friday, Saturday, Sunday or a holiday because these days coincide with high public use[7]. The incidental harassment authorization stipulates that management actions cannot occur for more than two consecutive days unless flooding

[7] Exceptions can be made in the event of emergency conditions. See Attachment C for more details.

is threatening. During the marine mammal pupping season (March 15th to June 30th), the initiation of Agency operations is further constrained. Outlet channel management activity must be delayed if a pup less than one week old is on the beach along site access pathways and there must be a week-long break between management actions. More details on timing restrictions are provided in Attachment C.

Should the outlet channel close in the weeks immediately preceding the management period, the Agency, in consultation with NMFS, CDFW, and CSP, may initiate excavation to increase the likelihood of entering the management period with the target channel configuration in place.

The constructed outlet channel may also close during the management season, such as following a large wave event. In such circumstances, it will be necessary to perform maintenance on the outlet channel, to re-connect the channel to the ocean before the lagoon water level rises too high above the new (higher) beach berm elevation.

7.3 CHANNEL LOCATION/PLANFORM ALIGNMENT

Two possible channel configurations within the extent of the existing alignment (Figure 1) may be pursued in 2015 since the location that may best achieve the performance criteria is not certain. Alternative channel alignments may be implemented to test the relationship of mouth location on channel stability.

7.3.1 Wide and short channel alignment

Preference for a wide and short outlet channel assumes that channel failure by scour-induced breaching (Section 4.3) is the controlling failure mode to avoid in selecting the channel's configuration. This assumption is based on the consequences of breaching, which returns the estuary to tidal habitat conditions that will persist until a large wave event occurs to renew the closure. Since these closure events are relatively infrequent during the management period (between 1999 and 2008, there were an average of 2.6 closures per management period), the next opportunity for creating freshwater habitat may be months away. In comparison, if the channel fails by closing, which may be more likely for the wide/short channel because of its mouth's location, another management action can be taken to re-open the outlet channel while preserving the freshwater condition of the lagoon. To reduce the possibility of scour-induced breaching, the hydraulic calculations and modeling in the channel configuration analysis indicates that the excavated channel should be as wide as possible. Under existing permits, the maximum width is 100 ft. The hydraulic modeling indicates that even a width of 100 ft is likely to scour; a narrower channel will further increase bed shear stress and the potential for scour. Once this width is selected, the channel length may need to be constrained to stay within the 2,000 yd^3 limit on excavation volume. The actual dimensions of the wide/short configuration will depend on the beach berm topography at the time of management action.

For a given lagoon water surface elevation, the wide/short configuration will have a higher average bed slope than the longer channel because of the channel's shorter length. The wide/short approach

attempts to mitigate this by splitting the outlet channel into two reaches with varying steepness, as shown in Figure 2. Across the beach berm, a flat slope is recommended to reduce the contribution of bed slope to flow velocity, thereby minimizing the potential for scour. The entire drop in elevation between the lagoon water level and ocean water level is initially located at the end of the outlet channel, in the active transport zone. In the active transport zone, scour caused by the outlet channel flow accelerating down the beach face at low tides may be balanced by sediment deposition generated by wave action at high tide. As indicated by modeling (Section 6.2.3), it is likely to be difficult to avoid scour even in the portion of the channel with a flat bed because the lagoon water level will set up to create the water surface slope necessary to convey the discharge that maintains constant lagoon water levels. So even if the bed slope is zero, the total energy slope (the combination of bed slope and water surface slope) is likely to generate scouring flow.

Failure by breaching may not be the controlling mechanism if the actual flows conveyed in the outlet channel are less than anticipated or if the channel develops an armored layer of larger particles. As discussed in Section 6.2.2, direct observations of the flow that the outlet channel must convey are not available and have been inferred from upstream discharge observations and lagoon water levels during closure events. The anticipated outlet channel conveyance rates average 50 ft^3/s and range between 45-85 ft^3/s. If actual flow rates are less due to losses elsewhere (e.g. berm seepage), the outlet channel will be less likely to scour. For example, the sensitivity analysis scenario with reduced flow rates between 25-45 ft^3/s exhibited conditions less likely to scour (Section 6.3). Channel armoring is the process by which the smaller sand particles are eroded, leaving behind larger particles that have a higher critical shear stress for erosion. Because of the uniformity of particle sizes observed on the beach berm (EDS, 2009a), armoring is thought to be unlikely within the range of target elevations for the outlet channel. Larger particles have been observed in the channel, but only when its elevation is lower and within the tidal regime.

The wide/short approach will be to construct the channel in the same general location and alignment as the preexisting channel (i.e., the location just prior to closure). When pursuing this approach, excavation will simply widen and connect the channel in place. As the channel migrates during the management season, the location of new excavation may follow this migration.

7.3.2 Narrow and long channel alignment

The narrow/long approach to channel design assumes that wave-induced closure (Section 4.2) is the controlling failure mode to avoid in selecting the channel's configuration. By excavating a longer channel that stretches to the northwest, the channel's mouth can be situated in an area that may be exposed to less wave energy. Because of its aspect, the area to the north is more sheltered from waves originating from the north. When large waves originate from the south, the channel will be oriented perpendicular to the incident wave direction, which may enhance the channel's capacity to transport sand that is washed into the channel's mouth by waves (Attachment D). Observations of lateral mouth migration in both directions (Behrens et al. 2009) suggest that waves from both north and south directions play a role in mouth dynamics. Additionally, the narrow/long alignment provides flexibility to locate the channel mouth at a location with a flatter beach face slope, which may reduce net scour (Attachment D). The narrow/long approach is supported by observations of

outlet channels that form at some other California river mouths (Attachment D). However, many of these other river mouths drain smaller watersheds that have lower flow rates into the lagoon, and therefore are less likely to breach. Also, these lagoons may not be constrained by the risk of flooding to adjacent property. Without a flood risk, lagoon water levels can rise higher and possibly drive more seepage through the beach berm rather than through the outlet channel. Finally, a longer channel will reduce the average bed slope, which is hypothesized to reduce scour. However, as discussed for the wide/short channel, it is the total energy slope (the combination of bed slope and water surface slope), which drives flow through the channel. Hydraulic analysis indicates that even if there is no slope to the outlet channel (i.e. it is flat), the water level in the lagoon will increase to create the water surface slope required to maintain the outlet channel's discharge. For the anticipated discharge, the corresponding bed shear stress is predicted to cause scour (Section 6.2.3).

The narrow/long approach will angle the channel to the northwest with an approximate aspect of 30-40 degrees with respect to the beach. This angled alignment tests possible advantages of site features such as areas of reduced wave energy and rocks imbedded in the beach.

7.4 TARGET CHANNEL DIMENSIONS

Prior to excavation the proposed outlet channel will be designed by Agency survey staff using computer-aided design (CAD) software. This design will then be used either to manually stake target channel dimensions or to automatically guide the excavation equipment via a GPS-based equipment controls. This operation protocol will ensure that the channel is excavated to the intended design.

7.4.1 Excavation Volume

The quantity of sand moved will depend on antecedent beach topography. To stay consistent with current permits, the excavated volume will not exceed 2,000 yd^3. Once either the wide/short or narrow/long planform alignment is selected, the limit on excavation volume will largely set channel dimensions. If a wide channel alignment is selected, the channel length will be limited so the total excavated volume remains below the limit. Similarly, if a long channel alignment is selected, the channel width will be limited so the total excavated volume remains below the limit. The actual dimensions at the time of implementation will depend on the beach berm topography at the time of implementation. Monthly surveys of the outlet channel, supplemented by spot checks at the time of management actions, will provide necessary information about beach berm topography.

Any sand excavated from the channel will be placed on the adjacent beach and graded to depths of approximately 1-2 ft higher than the existing grade. The placed sand will be distributed in such a way as to minimize changes to beach topography. If the time available for excavation is limited by uncontrollable factors such as tides, waves, seal use, or days when operations are forbidden, sand placed on the north side of the channel may be left in piles up to 3 ft high and not blended into the existing beach topography. The piles may need to remain un-graded on the north side because equipment access to this side is more difficult and may slow down operations. Once the outlet

channel is in place, the north side is also less accessible, reducing the impact of any remaining sand piles on public use.

7.4.2 Bed Elevation

The bed will be excavated 0.5 to 1 foot below the lagoon water level along its entire length, to achieve target channel depths (discussed below) upon initiation of flow. Channel bed elevations are expected to be in the range of 3 to 7 ft NGVD, with corresponding lagoon water levels of 4 to 8 ft, using a typical flow depth of one foot. At the start of the management season, lagoon water levels and the channel bed may be on the lower of this elevation range, since the system will have recently transitioned from intertidal to closed and the beach berm may not yet have built up. As the management season progresses, sand is expected to move onto the beach berm, raising the viable bed elevation for the outlet channel. As the beach berm builds higher, it will support higher lagoon water levels while maintaining channel depth within the target range. The upper end of the bed elevation is governed by the flood stage elevation (9 ft NGVD) minus the anticipated water depth and a factor of safety to buffer against flooding. Frequent maintenance will likely be required early in the management season to maintain an open outlet channel as the beach berm elevation builds. Eventually, the outlet channel may be above the typical wave runup elevation, the elevation at which waves may induce channel closure, and close less frequently.

The bed elevation is a key determinant of lagoon water levels and influences the stability of the outlet channel. Higher bed elevations have the advantage of better meeting the BO's performance criteria of higher lagoon water levels. Higher lagoon water levels would increase seepage through the beach berm, potentially reducing conveyance requirements and the possibility of scour in the outlet channel. A higher outlet channel is also less likely to be closed by waves. On the other hand, lower bed elevations reduce the potential energy which may cause outlet channel scour, provide a greater buffer before flood stage, and may reduce the release of oxygen-depleting organic matter from inundated upstream marshes. Developing a better feel the optimal bed elevation is one objective of the adaptive management plan.

The Phase 1 performance criteria are to develop an outlet channel that supports a stable, perched lagoon with water surface elevations at approximately 7 ft NGVD for several months (Section 3.1). Stable conditions imply that river inflow into the lagoon would be approximately the same as the sum of outflow through the outlet channel and seepage through the beach berm. Stable conditions also imply that net sand deposition or erosion does not impair the outlet channel's function. However, this goal may not be achievable in 2015 because additional constraints in place during this year call for modified performance criteria.

The bed slope should be nearly flat within the outlet channel to minimize the likelihood of scouring the bed. This may be difficult to maintain. In particular, incision within the "flat" channel bottom may occur.

7.4.3 Depth

The target range of water depths, 0.5-2 ft, is constrained on the upper end by the maximum depth at which the channel is likely to be stable (not scour). Larger depths would be associated with a narrower channel. The lower end of the range is constrained by the width; shallower depths would require impractically large channel widths to provide sufficient cross-sectional area to convey flow. Shallower water depths represent a greater factor of safety with regard to preventing bed scour since bed friction retards flow speed more strongly for shallower depths. Prior to implementation the predicted rate of water elevation rise within the estuary will need to be considered to determine the bed elevation to achieve the flow depths desired at the completion of the channel excavation.

7.4.4 Width

The width of the channel is estimated to vary within 25-100 ft for consistency with the existing management permits. For the wide/short configuration, the channel bottom would be excavated to a width of 100 ft, the permitted maximum, to reduce the potential for scour. For the narrow/long configuration, the channel bottom width will be approximately 30 ft to achieve the desired channel length and slope while still staying within the 2,000 yd^3 excavation volume limit.

7.4.5 Length

The channel length is estimated to vary within 100-800 ft, consistent with historic channel lengths observed within the management period (Behrens, 2008). Length will be a function of the channel's planform alignment while also balancing with other channel dimensions in order to keep excavation volumes less than 2,000 yd^3. The wide/short configuration would result in channel lengths between 100-400 ft while the narrow/long configuration would result in channel lengths approaching the maximum of 800 ft.

7.5 EXCAVATION TIMING RELATIVE TO THE TIDAL CYCLE

Under the proposed management plan, channel modifications will be initiated during low tide so that after several hours of work, the channel will be completed near high tide. As per existing practices, a temporary barrier will be left between the ocean and lagoon during excavation. When the last material is excavated, then the temporary barrier will be removed at or near high tide. This will minimize the difference in water levels between the estuary and ocean, reducing the potential for the re-connected channel to scour into a fully tidal inlet.

7.6 EXCAVATION FREQUENCY

Creating and maintaining the outlet channel will probably employ one or two pieces of heavy machinery (e.g. excavator or bulldozer) to move sand on the beach. At the start of the management period (late spring or early summer), when configuring the outlet channel for the first time that year, conditions may require operating machinery for up to two consecutive days (as allowed under the marine mammal incidental harassment permit). The precise number of excavations would depend on uncontrollable variables such as seasonal ocean wave conditions (e.g. wave heights and lengths), river inflows, and the success of previous excavations (e.g. the success of selected channel widths

and meander patterns) in forming an outlet channel that effectively maintains lagoon water surface elevations. As technical staff and maintenance crews gain more experience with implementing the outlet channel and observing its response, maintenance during the remainder of the management season is anticipated to be less frequent.

In consideration of the natural beach environment and public access, effort will be made to minimize the amount and frequency of mechanical intervention. Outlet channel management activities cannot last for more than two consecutive days. During the marine mammal pupping season (March 15th to June 30th), the duration and frequency of Agency operations is constrained by restrictions on incidental harassment. Seven days must pass between management events. More details on duration and frequency restrictions are provided in Attachment C.

7.7 UNCERTAINTY AND LIMITATIONS

The proposed operations are based on the analyses documented in this report, input from resource agency staff, and on our professional judgment. Uncertainties about the actual estuary inflow, berm seepage, and outlet channel performance remain. As described in Section 6.2.2, the two methods for estimating estuary inflow, the water balance model and limited discharge measurements, predict disparate estuary inflows. Estuary inflow will fluctuate over the management period and may be greater than the modeled inflow. The seepage through the beach berm is based only on inferred, not observed, estimates of hydraulic conductivity. The outlet channel, particularly its downstream end, will be located in a highly dynamic environment that is influenced by changing river flow, tidal water levels and waves. Since the outlet channel will not include any hard structures, all of these sources of hydrologic forces can readily alter the channel's configuration, which may make it difficult to achieve and maintain the channel's successful function. Modifications of the proposed plan in response to actual conditions will be discussed with the resource agency management team and documented according to the communication protocol described in Section 9. Any modifications will be consistent with existing permit requirements.

Adaptive management once the channel is implemented will further enhance management practice. Actual feasibility with regards to the full range of dynamic conditions has not been determined. Risks associated with outlet channel failure have not been quantified. In addition to the channel's performance criteria, there are also water quality and ecological performance criteria for the perched lagoon. These additional criteria have not been evaluated as part of the outlet channel management plan.

8. MONITORING AND ADAPTIVE MANAGEMENT

Monitoring of the outlet channel should be implemented to facilitate an understanding of the channel's behavior and guide adaptive changes to this initial management plan. Adaptive management changes may be made over the course of the management season, in response to natural processes, outlet channel conditions, and/or outlet channel response. In addition, a more comprehensive review at the end of the management season will employ the monitoring data to recommend management revisions for the following year.

Because relatively few closure events occur per year and each one experiences different river and ocean conditions, a comprehensive monitoring plan is recommended to support adaptive management. The monitoring would quantify changes in the beach and channel elevation, lengths, and widths, as well as flow velocities and observations of the bed structure (to identify bed forms and depth-dependent grain size distribution indicative of armoring) in the channel. If feasible, the required monthly beach topography surveys should be scheduled just in advance of potential closure situations (neap tides, low discharge, and/or large wave events). Staff safety, staff availability, pinniped constraints, and/or rapidly changing physical conditions may preclude optimal scheduling of beach topographic surveys. Because monitoring requires human presence on beach, potentially disturbing the seal population, the monitoring frequency represents a balance between management of the outlet channel and minimizing disruption of wildlife.

A list of recommended monitoring tasks for 2015 is provided below in Table 5.

Table 5 Monitoring tasks associated with outlet channel management

Task	Description	Field Activities	Frequency
Recommended			
Operations log	Record of outlet channel management actions and ambient conditions.	Operations staff to generate written record of operations (excavation method, extent, and location) and ambient conditions (weather, ocean state, estuary water level)	Daily to monthly (Depends on operational activity)
Outlet channel location and state	An automated video or still camera station to capture the outlet channel's location and state.	Field staff to install and service a camera, power supply, and possibly communication system on hillside adjacent to estuary.	Hourly imaging (automated); Weekly servicing
Outlet channel discharge measurements	Collected within the outlet channel to verify the channel's conveyance.	Field staff to complete cross sectional flow velocity surveys using flow meter attached to a wading rod with electronic data logger.	Monthly
Outlet channel bed structure	Observe the bed for bed forms and depth-dependent grain size distribution indicative of armoring. Sediment sampler used.	Field staff to collect sediment sample from the surface of the channel bed.	Monthly
Outlet channel topography	Collect outlet channel elevation and width	Field staff to survey outlet channel features using a total station and prism mounted on a survey rod.	Monthly
Beach topography	Collect beach elevation	Field staff operating rod and staff on beach.	Monthly
Estuary flow dynamics	Integrate cross sectional velocity data in estuary at various locations from mouth to Duncans Mills.	A boat with field staff, collecting cross sectional data from mouth to Duncans Mills.	Weekly

9. COMMUNICATION PROTOCOL

A communication protocol will provide guidance between the Agency and identified points of contact representing key resource management groups in the estuary for the implementation of the Outlet Channel Management Plan during the management period (May 15 – October 15). Primary and alternative points of contact have been identified for each of the key resource management groups. These parties, which together are hereafter referred to as the "Team", include: Sonoma County Water Agency, NOAA National Marine Fisheries Service, California Department of Fish and Wildlife, and California State Parks. A list of contacts for these groups is shown in Table 6.

Table 6 Russian River Estuary Management Team

Contact	Level	Organization	Phone Number	E-mail
Jessica Martini Lamb	Primary	Sonoma County Water Agency	707-547-1903 (w) 707-322-8177 (m)	jessica.martini.lamb@scwa.ca.gov
Chris Delaney	Secondary	Sonoma County Water Agency	707-547-1946 (w) 707-975-5606 (m)	cdelaney@scwa.ca.gov
Gary Tourady	Primary	Agency Operator Sonoma County Water Agency	707-547-1065 (w) 707-975-6285 (m)	garywt@scwa.ca.gov
Jon Niehaus	Secondary	Agency Operator Sonoma County Water Agency	707-521-1845 (w) 707-975-3999 (m)	jon@scwa.ca.gov
Robert Coey	Primary	National Marine Fisheries Service	707-575-6090 (w)	Bob.Coey@noaa.gov
John McKeon	Secondary	National Marine Fisheries Service	707-575-6069 (w)	john.mckeon@noaa.gov
Rick Rogers	Secondary	National Marine Fisheries Service	707-578-8552 (w)	rick.rogers@noaa.gov
Tim Dodson	Primary	CA Dept. of Fish and Wildlife	707-944-5513 (w)	timothy.dodson@wildlife.ca.gov
Eric Larson	Secondary	CA Dept. of Fish and Wildlife	707-944-5528 (w)	eric.larson@wildlife.ca.gov
Brendan O'Neil	Primary	California State Parks	707-865-3129 (w)	BONEIL@parks.ca.gov
Damien Jones	Secondary	California State Parks	707-875-3907 (w)	dajone@parks.ca.gov

9.1 IMPLEMENTATION OF OUTLET CHANNEL MANAGEMENT ACTIVITIES

A minimum of 24 hours of notice shall be provided to the Team by the Agency in advance of the excavation and maintenance of the outlet channel. Notice shall be submitted by e-mail (see Attachment B.1 for sample) with a general description of the proposed action to be pursued and will typically include:

- Proposed date and time of implementation;
- Design schematic of proposed channel which shall include:
    - Approximate antecedent beach berm height and width;
    - Proposed location and alignment of outlet channel;
    - Approximate outlet channel dimensions including bed elevation, channel depth, width, length, slope and aspect with respect to beach face
    - Predicted estuary water surface elevation at the time of implementation;
- Current river discharge at USGS Guerneville gage (website: http://waterdata.usgs.gov/nwis/uv?cb_00060=on&cb_00065=on&format=gif_stats&period=21&site_no=11467000)
- Predicted 24 hour precipitation as estimated by the NOAA National Weather Service for Bodega Bay (website: http://forecast.weather.gov/MapClick.php?CityName=Bodega+Bay&state=CA&site=MTR&textField1=38.3333&textField2=-123.047&e=0&FcstType=graphical;
- Predicted deep water swell height, period, and direction at San Francisco as estimated by CDIP (website: http://cdip.ucsd.edu/?nav=recent&sub=forecast&units=metric&tz=UTC&pub=public)
- For maintenance actions a general description of maintenance to be performed;
- Presence of seal pups; and
- Equipment to be used for implementation.

Team members shall provide any comments or suggestions to the approach in writing within 12 hours of the proposed implementation time. If Agency does not receive any comments before this time it is assumed that there are no comments to the proposed action. Comments and recommendations will be recorded for consideration on that management action or future management actions, and the Agency will do its best to respond to comments prior to implementation.

9.2 COMPLETION OF OUTLET CHANNEL MANAGEMENT ACTIVITIES

Within 36 hours of completion of outlet channel excavation or maintenance activities the Agency shall provide the Team a summary of work performed. This summary will be submitted by e-mail and will typically include:

- Date, time and period of implementation;
- Estuary water surface elevation at the time of completion;
- River discharge at USGS Guerneville gage at time of completion
- Deep water swell at CDIP Pt. Reyes buoy at time of completion

- Approximate location of the centerline of the channel mouth in distance along beach berm north of the jetty;
- Approximate orientation of channel along the beach berm;
- Approximate dimensions and orientation of the excavated channel;
- Approximate water depth in the excavated channel;
- For maintenance actions, a general description of maintenance performed;
- Equipment used during implementation;
- Presence of seal pups; and
- Photos documenting work completed.

9.3 OVERRIDING CONDITIONS

Certain conditions such as declines in water quality or imminent flooding to properties and structures in the estuary could drastically change the course of management outlined in this plan and may force the Agency to breach the estuary. The Agency shall stay in close contact with the Team on the development of any conditions which could affect the overall course of management. However, rapidly changing conditions may limit the notification lead time given to the Team in advance of management actions to alleviate flooding or water quality concerns.

9.3.1 Flooding

Based on past management experience in the estuary, the Agency has found that if the estuary is in a closed condition, medium to large storm events can produce very rapid rises in estuary water levels. These storm events are frequently accompanied by large ocean swells which can close the estuary if outflows through the channel are not high enough to counteract the wave forces produced from the large swells. Management to avoid flooding is complicated by safety concerns; the Agency is unable to operate equipment required for channel management activities if ocean swells are too large. In the past the Agency has typically breached the estuary in anticipation of a large storm in order to prevent flooding.

The high water surface elevations pursued under this plan will diminish the storage capacity of the estuary to handle high inflows. Also, based on past management experience, the Agency believes that the outlet channel as described in this plan will be especially susceptible to closure from large swell events. In an effort to avoid flooding of properties in the estuary during the outlet channel management period, the Agency will consult with the Team regarding the possibility of breaching the estuary in anticipation of a large storm event.

9.3.2 Decline in Water Quality

Declines in water quality could have impacts to salmonids rearing in the estuary, other species which reside in the estuary and the public. Potential water quality concerns include, but are not limited to:

- Dissolved oxygen conditions becoming dangerously low to fish and other species;
- Elevated salinity levels in domestic water wells; and
- Elevated bacterial levels.

The Agency will stay in contact with the Team regarding water quality conditions during the management period. Should conditions get to the point that they are potentially dangerous to salmonids, other species, or the public, the Agency shall consult with the Team on potentially changing the course of management. In cases of high bacterial levels, the Agency will additionally consult with North Coast Regional Water Quality Control Board and the Sonoma County Department of Public Health on potential management actions.

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12. FIGURES

Source: Sonoma County Orthophotography (April-May, 2000)

0 120 240 480 Feet

figure 1

Russian River Estuary Outlet Channel Management Plan

Russian River Estuary Site Location

PWA Ref# - 1958.02

PWA

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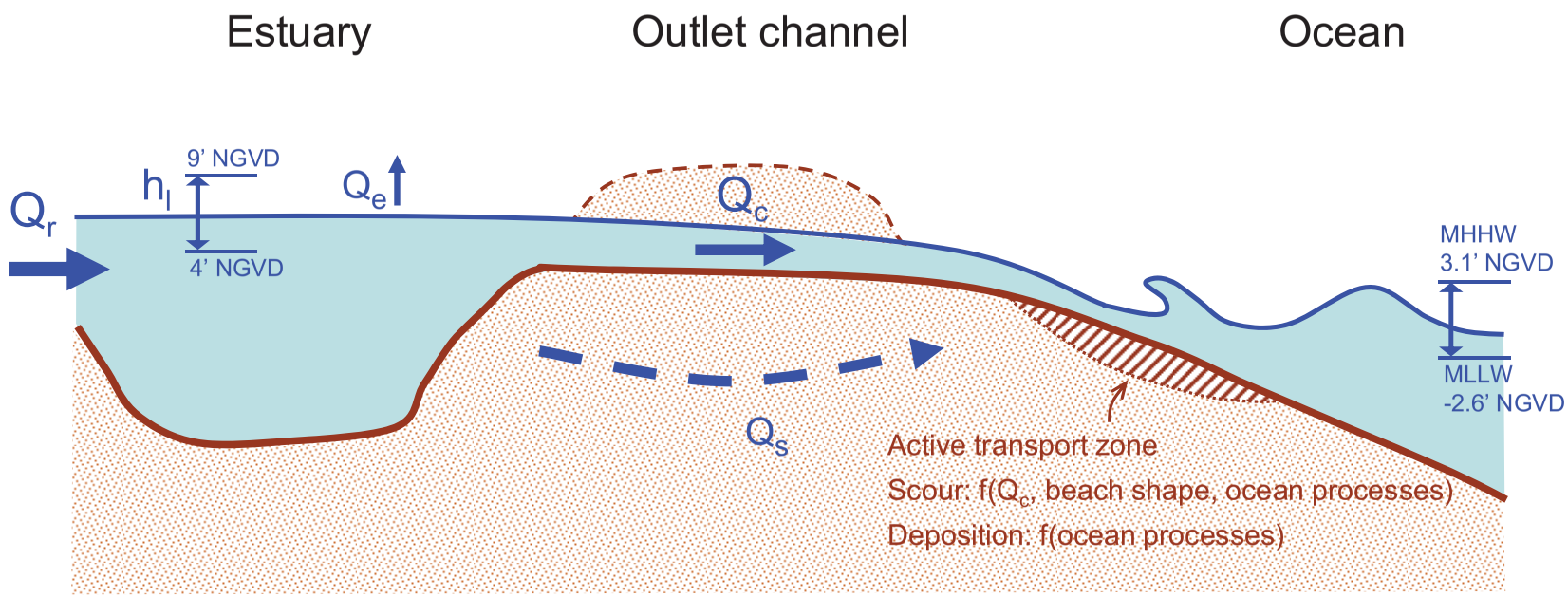


Parameters

h_l=lagoon water level
Q_r=river discharge
Q_c=outlet channel discharge
Q_s=seepage discharge
Q_e=evaporation from lagoon

Processes

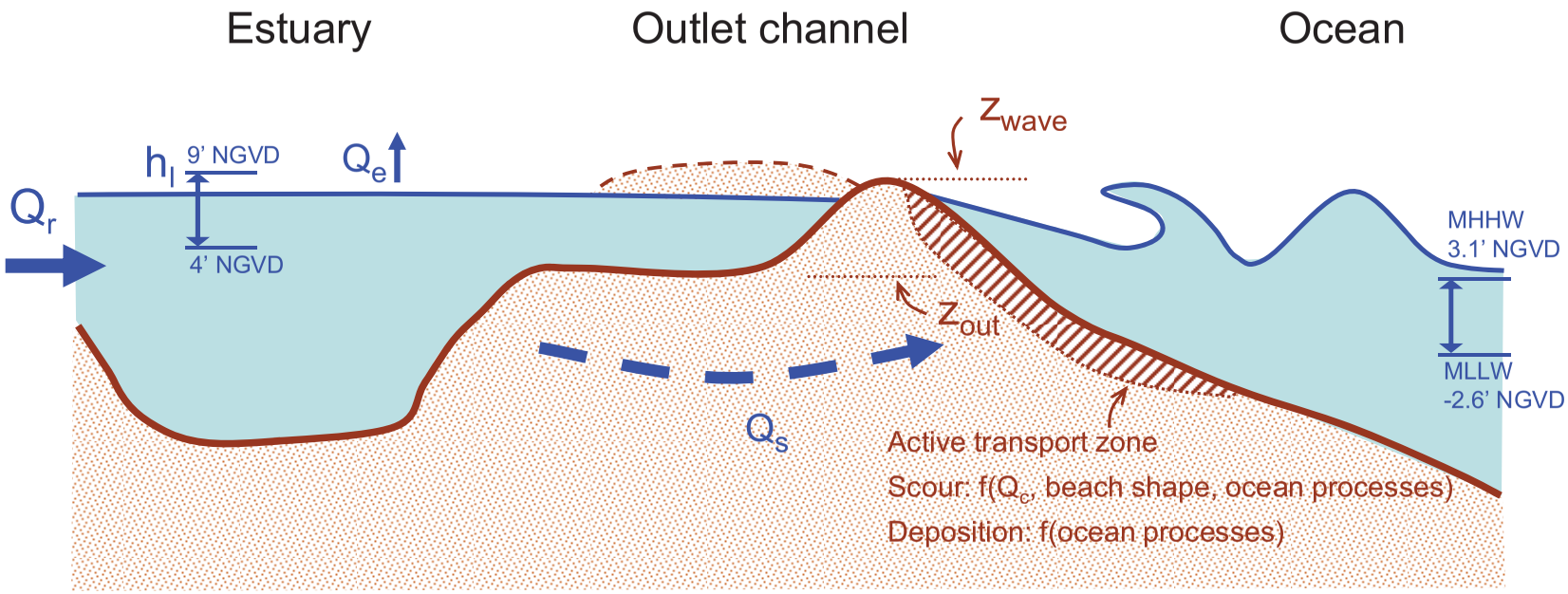
- $Q_r = Q_c + Q_e + Q_s$ (averaged over days)
- No sediment transport within outlet channel
- Active sediment transport outside outlet channel

figure **2**
Russian River Estuary Outlet Channel Management Plan

Conceptual model – Target conditions

PWA Ref# 1958.01

PWA



Parameters

z_{out}=target channel bed elevation

z_{wave}=wave runup elevation; f(wave conditions, ocean water level, channel location)

Processes

- $z_{wave} \geq z_{out}$
- wave-induced sediment transport closes outlet channel
- $Q_c \rightarrow 0$
- h_l increasing

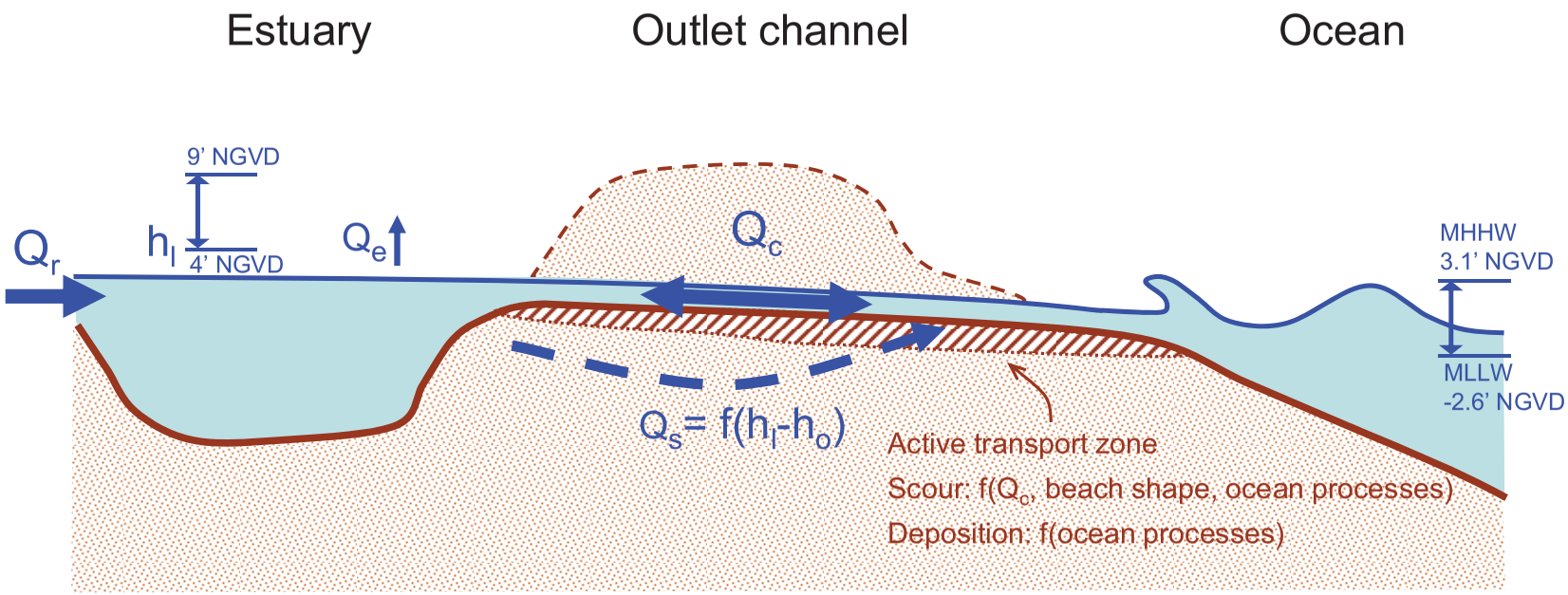
figure ***3***

Russian River Estuary Outlet Channel Management Plan

Conceptual model – Closure

PWA Ref# 1958.01

PWA



Parameters

u_c= f(channel slope, length, and width; Q_r; ocean water level)
(can be managed to greater or lesser degree)

u_{crit} is f(grain size)

Processes

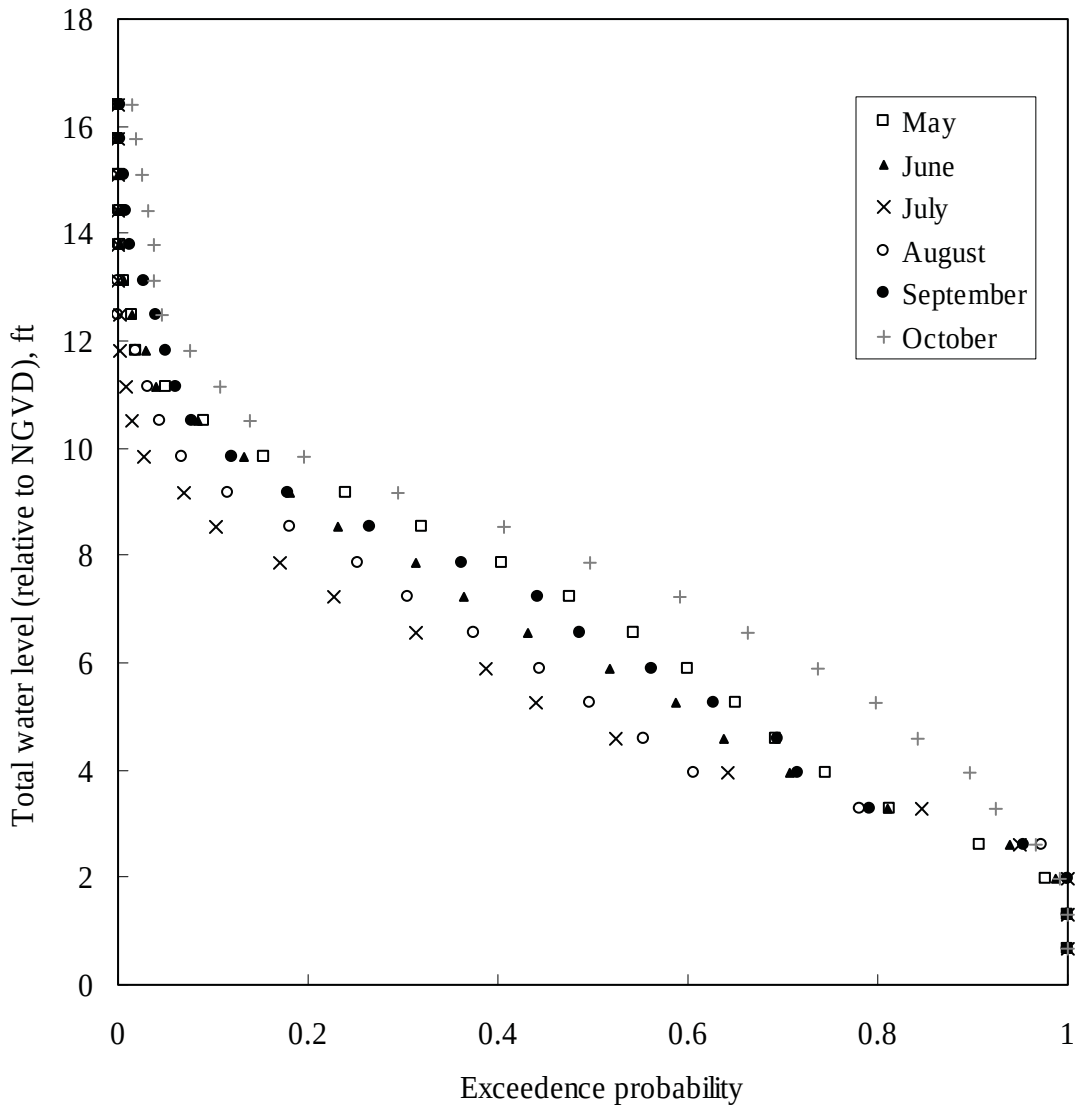
- $u_c > u_{crit}$; high velocities scour channel
- Q_s increases; high seepage creates groundwater piping and erosion
- sediment transport within outlet channel

figure **4**
Russian River Estuary Outlet Channel Management Plan

Conceptual model – Breaching

PWA Ref# 1958.01

PWA



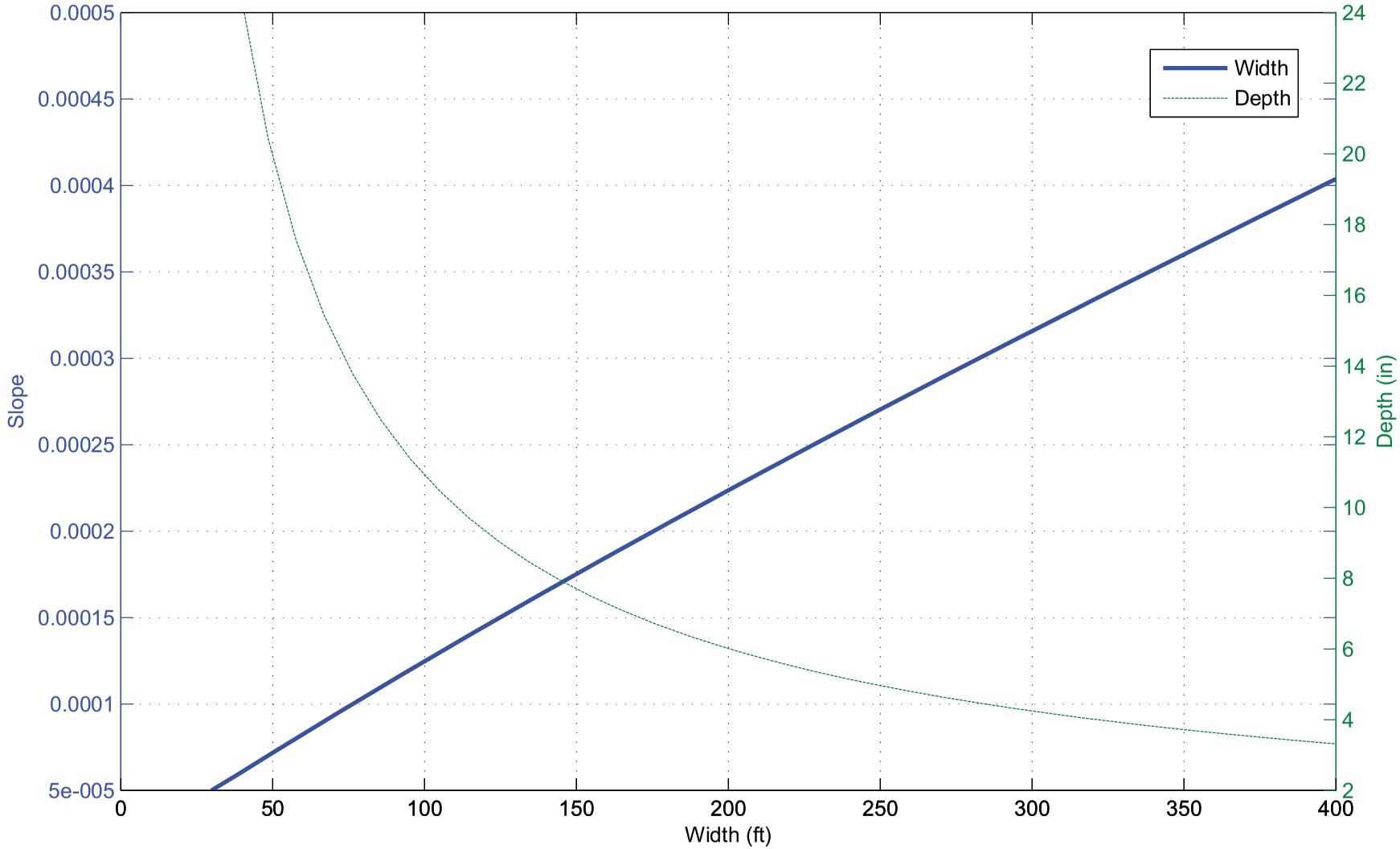
Source: D. Behrens (unpublished). Wave data from CDIP Point Reyes buoy.
Note: Total water level calculated as sum of daily higher high tide and wave runup elevation. Wave runup calculated from Stockdon et al (2006) using estimated de-shoaled deepwater equivalent wave heights.

figure **5**
Russian River Outlet Channel Management Plan

Total Water Level Exceedance, May-Oct

PWA Ref# 1958.01

PWA



Source: Stability curve for local bed shear stress of 0.5 Pa, flowrate of 70 cfs, and Manning's roughness of 0.02.

Figure 6
Russian River Estuary Outlet Channel Management Plan

Slope vs. Width Stability Plot

PWA Ref# 1958.01

PWA

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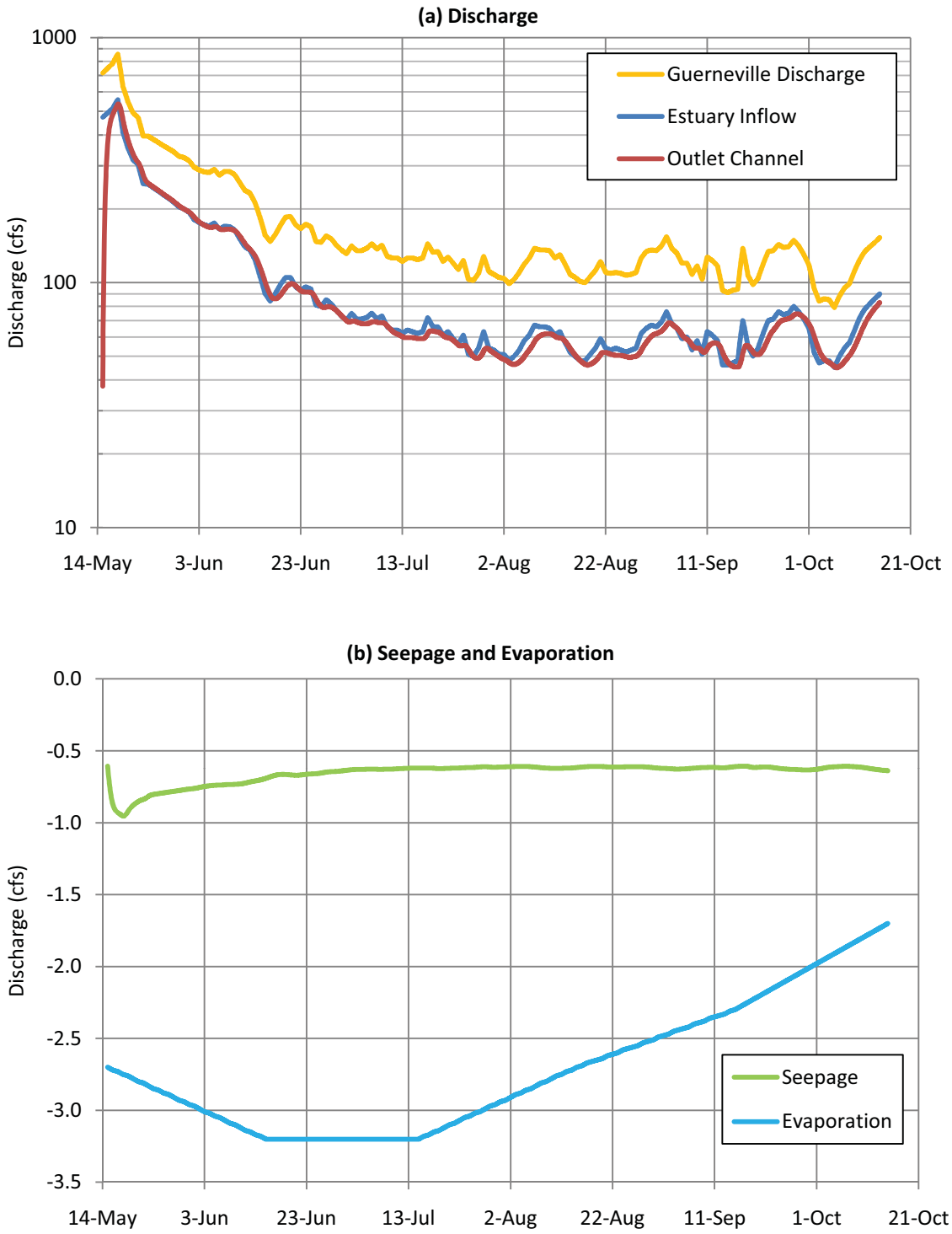


Source: 2010 anticipated discharge at Guerneville and into lagoon calculated by scaling observed 2000 discharge at USGS gage #11467000 (Russian River near Guerneville, CA). Evaporation rates calculated from monthly climatological rates for CIMIS evapotranspiration zone 1 (California coast).

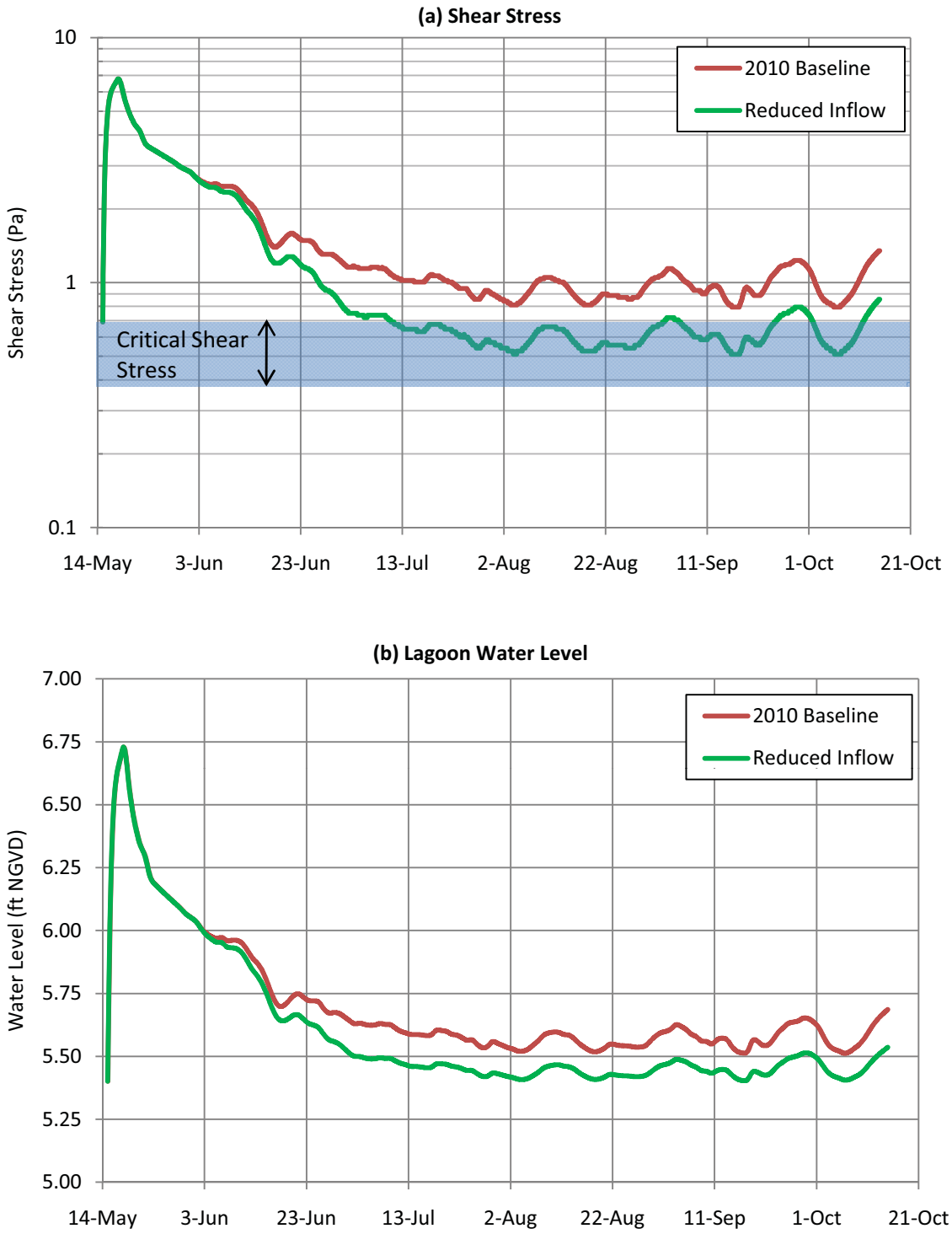
figure 7

Russian River Estuary Outlet Channel Management Plan

Hydraulic Model Discharge - 2010 Anticipated Hydrology

PWA Ref#: 1958.01

PWA



Notes: Baseline channel geometry: width=100 ft, length=300 ft, bed=5 ft NGVD, n = 0.02.
Source: HEC-RAS hydraulic model results for outlet channel.

figure **8**

Russian River Estuary Outlet Channel Management Plan

Hydraulic Model Results - 2010 Anticipated Hydrology

PWA Ref#: 1958.01

PWA

ATTACHMENT A: SUPPORTING WORKSHEETS FOR CHANNEL CONFIGURATION ANALYSIS

Worksheets

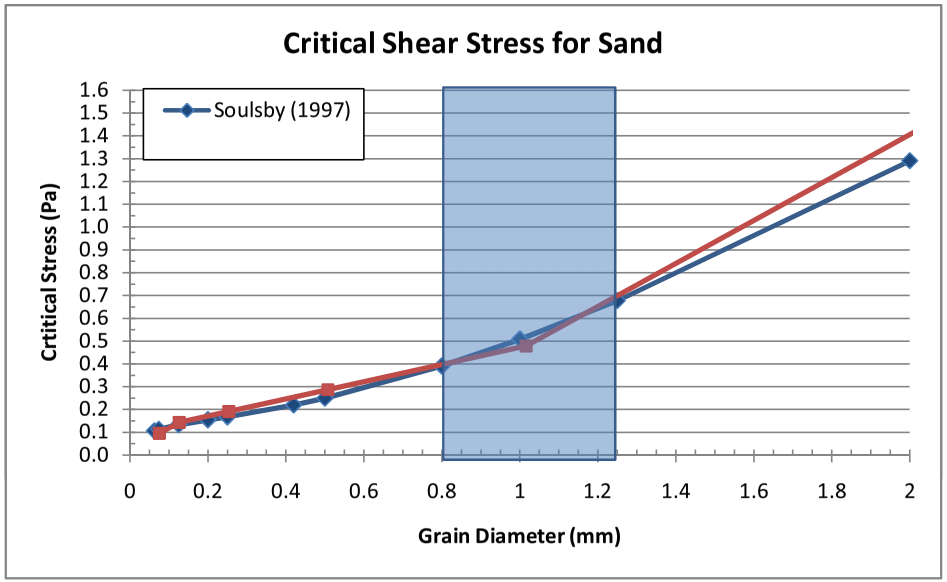
A-1. Critical shear stress for incipient motion of sane particles
A-2. Manning's n
A-3. Evaporation
A-4. Berm seepage
A-5. Mouth closure
A-6. Russian River discharge

A-1. Critical shear stress for incipient motion of sand particles

1958.01 Russian River Estuary Outlet Channel
J. Vandever (PWA)
4/1/2009

Variables		
p	1000	kg/m^3
g	9.81	m/s^2
s	2.65	(quartz)
v	1.0E-06	m^2/s

D (mm)	D*	Theta_crit	tau_crit (Pa)	Grain Size
0.0625	1.58	0.105	0.11	Very Fine Sand
0.074	1.87	0.094	0.11	
0.125	3.16	0.066	0.13	Fine Sand
0.20	5.06	0.048	0.15	
0.25	6.32	0.041	0.17	Medium Sand
0.42	10.62	0.032	0.22	
0.5	12.65	0.031	0.25	Coarse Sand
0.8	20.24	0.030	0.39	
1.0	25.30	0.031	0.51	Very Coarse Sand
1.25	31.62	0.033	0.68	
2.0	50.59	0.040	1.29	Granular



Notes: units Pa = N/m^2, assumes density of freshwater, quartz grained sand
Method based on Soulsby (1997) Dynamics of Marine Sand:

$$D_* = \left[\frac{g(s-1)}{\nu^2}\right]^{1/3} D$$

$$\theta_c = \frac{0.3}{1+1.2D_*} + 0.055\left[1-\exp\left(-0.020D_*\right)\right]$$

$$\tau_c = \rho(s-1)gd\theta_c$$

Note: does not account for gravitational effects on sloping bed

A-2. Manning's n worksheet

1958.01 Russian River Estuary Outlet Channel
J. Vandever (PWA)
4/1/2009

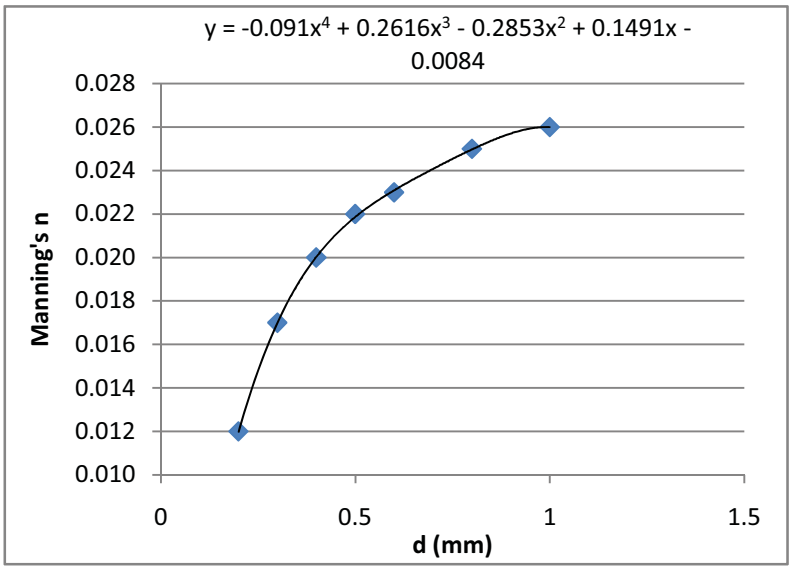
d_{50}	1	mm	0.003281 ft
D	0.84	ft	
Rh	0.83	ft	
S	0.00008	ft/ft	

Equation	n	Notes
Strickler (1923)*	0.018	*valid d range unknown
Limerinos (1970)*	0.021	
Bray (1979)*	0.017	
Bruschin (1985)*	0.018	
Julien (2002)*	0.024	
USGS (WSP2339)	0.026	for 0.2<d<1.0 mm
Average	**0.021**	
Average w/o USGS	**0.020**	

USGS

d (mm)	n
0.2	0.012
0.3	0.017
0.4	0.020
0.5	0.022
0.6	0.023
0.8	0.025
1.0	0.026
2.0	0.035

Polynomial fit to USGS data (d=2.0 mm not included):



A-3. Evaporation Worksheet

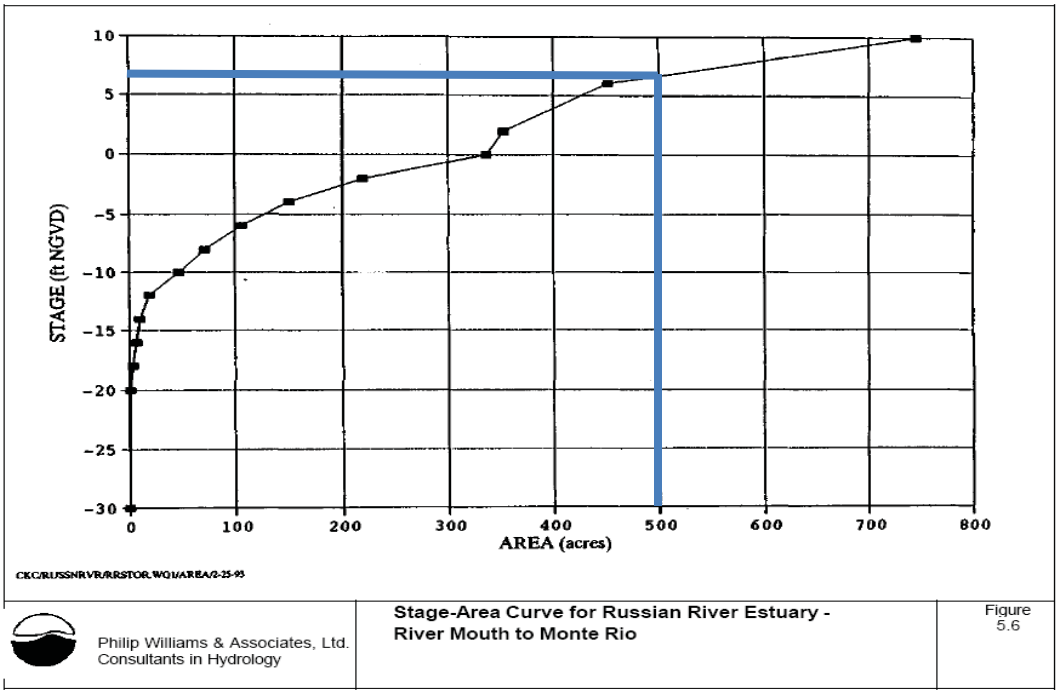
1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
15-Apr-09

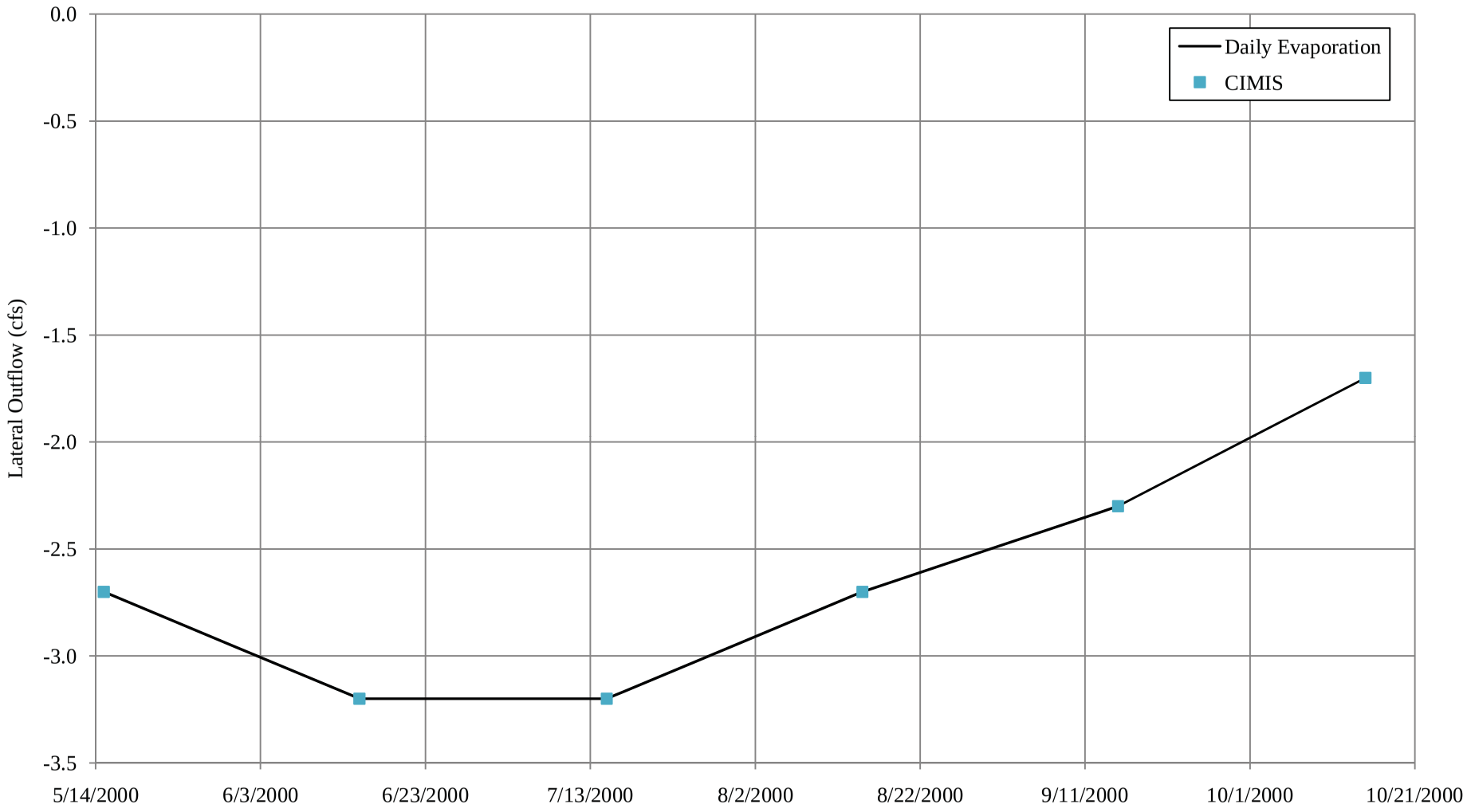
CIMIS Reference Evapotranspiration (Eto) Zones
http://www.cimis.water.ca.gov/cimis/images/etomap.jpg

Russian River Estuary is located on California coast in Zone 1
(Coastal plains and heavy fog. Lowest Eto in California, characterized by dense fog)

	in/month	days	in/day	mm/day	cfs
Jan	0.93	31	0.03	0.76	0.6
Feb	1.40	28	0.05	1.27	1.1
Mar	2.48	31	0.08	2.03	1.7
Apr	3.30	30	0.11	2.79	2.3
May	4.03	31	0.13	3.30	2.7
Jun	4.50	30	0.15	3.81	3.2
Jul	4.65	31	0.15	3.81	3.2
Aug	4.03	31	0.13	3.30	2.7
Sep	3.30	30	0.11	2.79	2.3
Oct	2.48	31	0.08	2.03	1.7
Nov	1.20	30	0.04	1.02	0.8
Dec	0.62	31	0.02	0.51	0.4

RRE Surface Area 500 acres
21,780,000 sq ft





Notes: Daily evaporation rates for Russian River lagoon interpolated from CIMIS average monthly evapotranspiration statistics for Zone 1 (Coastal plains and heavy fog). Calculations assume lagoon surface area of 500 acres.

Appendix ***A-3***

Russian River Estuary Outlet Channel Management Plan

HEC-RAS model evaporation boundary condition

PWA Ref #: 1958.01

PWA

A-4. Berm Seepage and Hydraulic Conductivity

1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
16-Apr-09

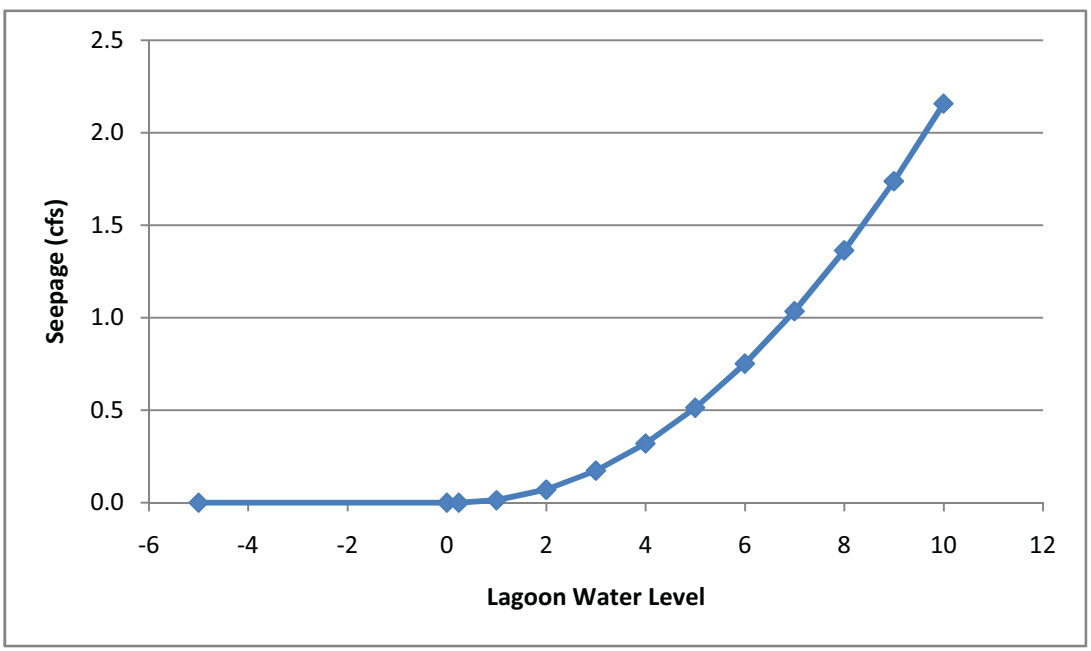
HEC-RAS Diversion Rating Curve

Lagoon WL (ft)	dh (ft)	q (cfs)	
-5	0	0.00	
0	0	0.00	
0.24	0	0.00	(MTL)
1	0.76	0.01	
2	1.76	0.07	
3	2.76	0.17	
4	3.76	0.32	
5	4.76	0.51	
6	5.76	0.75	
7	6.76	1.03	
8	7.76	1.36	
9	8.76	1.74	
10	9.76	2.16	(Flood Stage)
11	10.76	2.62	
12	11.76	3.13	

Darcy's Law

$$q = k\frac{\Delta h}{W}A = k\frac{\Delta h}{W}(\Delta h \cdot L)$$

W	250	ft
L	2500	ft
z_ocean	0.24	ft NGVD (MTL)
k	0.0023	ft/s



A-4. Berm Seepage and Hydraulic Conductivity

1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
7-Apr-09

Bouwer, H. 1978. Groundwater Hydrology. McGraw-Hill, Inc. 480 p.

	Hydraulic Conductivity (m/day)		Hydraulic Conductivity (cm/s)		
	Low	**High**	**Low**	**High**	**Mid**
Fine Sand	1	5	0.001	0.006	0.003
Medium Sand	5	20	0.006	0.023	0.014
Coarse Sand	20	100	0.023	0.116	0.069
Gravel	100	1000	0.116	1.157	0.637
Sand and Gravel	5	100	0.006	0.116	0.061

A-5. Mouth Closure Calibration Worksheet

1958.01 Russian River Estuary Outlet Canal
J. Vandever (PWA)
17-Apr-09

Russian River mouth closure calibrations - HEC-RAS model Years Examined: 2000, 2001, 2003, 2004, 2005, 2007

Accounts for losses between Hacienda Bridge (Guerneville, CA) and the lagoon and the interaction with the aquifer adjacent to the estuary.

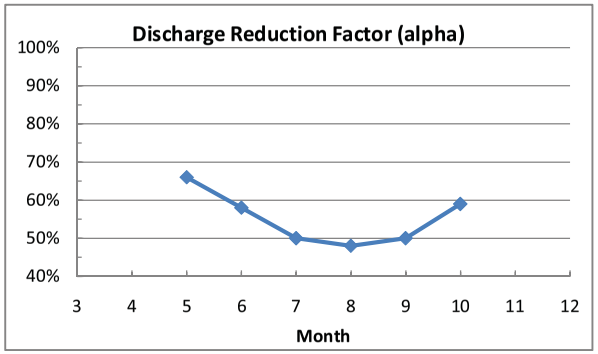
No detailed information available for the aquifer groundwater elevations or extraction rates by wells. The loss term is a calibrated variable in the model.

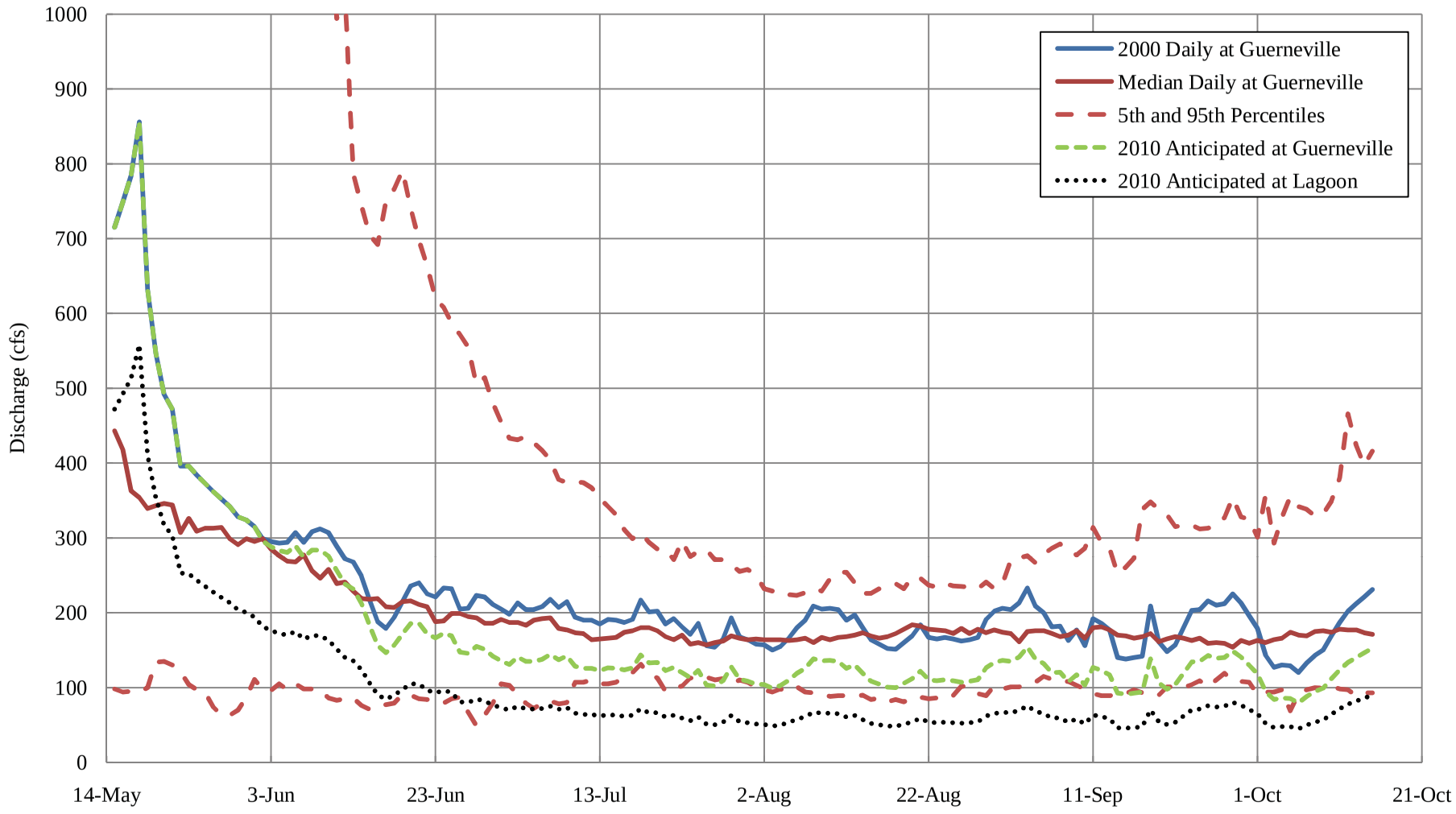
Lagoon Surface Area	400	ac
	17,424,000	sq ft
Evaporation and Seepage Losses	4	cfs

Calibration	Date		Water Level (ft NGVD)		dh	dt	dh/dt (ft/day)	dV/dt (cfs)	USGS Discharge (cfs)	% Reduction	alpha
Closure Event ID	Start	End	Start	End							
06May2000	5/6/2000 18:00	5/9/2000 6:00	3.10	8.40	5.30	2.50	2.12	432	580	26%	74%
24May2000	5/24/2000 8:00	5/25/2000 18:00	3.84	5.76	1.92	1.42	1.36	278	385	28%	72%
16June2000	6/16/2000 13:00	6/21/2000 6:00	4.79	6.90	2.11	4.71	0.45	94	200	53%	47%
25Aug2000	8/25/2000 0:00	9/5/2000 8:00	2.56	7.62	5.06	11.33	0.45	94	195	52%	48%
03Oct2000	10/3/2000 0:00	10/11/2000 12:00	2.85	6.53	3.68	8.50	0.43	91	140	35%	65%
15May2001	5/15/2001 23:00	5/21/2001 21:00	2.14	5.51	3.37	5.92	0.57	119	200	41%	59%
07Apr2007	4/7/2007 13:00	4/11/2007 0:00	1.17	7.68	6.51	3.46	1.88	384	480	20%	80%
13Apr2007	4/13/2007 21:30	4/17/2007 14:30	1.97	7.68	5.71	3.71	1.54	315	465	32%	68%
24Apr2007	4/24/2007 17:00	4/26/2007 14:00	1.51	7.57	6.06	1.88	3.23	656	725	10%	90%
13Oct2007	10/13/2007 2:30	10/22/2007 11:30	2.51	9.15	6.64	9.38	0.71	147	255	42%	58%
9June2003	6/9/2003 17:30	6/12/2003 1:00	2.77	6.47	3.70	2.31	1.60	322	475	32%	68%
9Oct2003	10/9/2003 23:11	10/14/2003 20:40	4.00	6.21	2.21	4.90	0.45	91	170	46%	54%
05Nov2004	11/5/2004 11:00	11/12/2004 4:00	2.40	8.93	6.53	6.71	0.97	196	300	35%	65%
26July2004	7/26/2004 15:41	8/5/2004 0:00	2.27	5.90	3.63	9.35	0.39	78	140	44%	56%
2May2004	5/2/2004 15:40	5/6/2004 19:35	3.44	8.39	4.95	4.16	1.19	240	420	43%	57%
16Apr2004	4/16/2004 9:09	4/18/2004 7:40	4.78	7.98	3.20	1.94	1.65	333	570	42%	58%
3Oct2005	10/3/2005 23:00	10/17/2005 6:30	2.40	8.30	5.90	13.31	0.44	89	170	47%	53%
17Sep2005	9/17/2005 2:00	9/21/2005 13:30	3.37	5.69	2.31	4.48	0.52	104	175	40%	60%

Note: Start and end times represent times used for water level calibration and do not correspond to exact timing of closures and breaches.

Month	Month	% Loss	N	HEC-RAS Multiplier
April	4	26%	4	
May	5	34%	4	66%
June	6	42%	2	58%
July	7	44%	1	50%
Aug	8	52%	1	48%
Sep	9	40%	1	50%
Oct	10	43%	4	59%
Nov	11	35%	1	
			18	





Notes: Median daily discharge calculated from 1970-2008.
Source: USGS gage 11467000 (Russian River near Guerneville, CA). 2010 anticipated discharge at Guerneville calculated from 2000 discharge by scaling factor to obtain typical summertime flowrates of 120 cfs. 2010 anticipated lagoon inflow calculated based on calibrated seasonal losses from Guerneville to lagoon.

Appendix A-6

Russian River Estuary Outlet Channel Management Plan

Daily Russian River Discharge

PWA Ref #: 1958.01

PWA

J:\1958.01RREAMPOutletChannel\Task 5 Hydrologic modeling\Data\Streamflow\USGS_11467000_WaterYear_2000.xls

Attachment B. Hypothetical Implementation Scenario

The following hypothetical implementation scenario is presented to demonstrate how the outlet channel management plan may be implemented. The scenario is based on actual beach berm and ocean conditions observed at the estuary from June 30 to July 6, 2009.

This scenario is purely hypothetical and demonstrates how the adaptive management plan may be implemented based on historical conditions observed in 2009. Actual implementation of the plan may vary in terms of channel geometry, channel location and time required for implementation. The beach environment at the project site is highly dynamic so actual implementation of the plan will be evaluated on a case-by-case basis.

Wednesday, June 30th

Agency personnel have been tracking riverine and ocean conditions on a daily basis during the outlet channel management period. Several days ago, they identified a forecasted ocean swell event with the potential to close the estuary. When it arrives, this medium-sized (2-4 ft.) ocean swell, angled from the southwest, pushes sand into the tidal inlet cutting flow from the estuary to the ocean. Stage in the estuary at the time of closure is approximately 3.5 ft NGVD. Based on river discharge and the time of year, Agency personnel estimate that the estuary water level's rate of rise will be 0.5 ft/day.

Thursday, July 1st

Agency personnel visit the site to assess sandbar conditions. The outlet at the time of closure is just south of Haystack Rock, approximately 550 ft northwest of the jetty, with an alignment roughly perpendicular to the beach face. The preexisting channel slope is steep and would, therefore, be susceptible to scour and wave run-up. Agency decides that this is not the preferable alignment for the outlet channel. In effort to create a channel which has shallower gradient and less susceptible to ocean conditions, it is decided that the channel will be more ideally located to the north of Haystack Rock angled to the northwest. Agency staff collects measurements and limited survey data (e.g. elevation at low point of the berm) in the area to develop a design for the outlet channel.

[Note: If closure had occurred during the pupping season (March 15 – June 30), the site assessment would have included a survey for the presence of seal pups.]

Agency staff returns to their offices to develop a plan and design for the implementation of the outlet channel. Changes between the most recent monthly topographic data and current conditions are assessed using the time-lapse photography and today's survey data. If indicated, today's survey data and judgment may be used to revise the topographic data.

Stage in the estuary is now approximately 4.0 ft. NGVD. Observations from the Jenner gage are used to confirm the previously estimated rate of water surface rise of 0.5 ft/day. Based on current stage and this rate of water surface rise, implementation of the outlet channel is scheduled for Monday and Tuesday, July 5th and 6th so that stage in the estuary will be approximately 6.5 ft. NGVD after the outlet channel is completed.

A design is prepared using the best available topographic data. The outlet channel will be approximately 30 ft wide with 4:1 side slopes, 350 ft long to the mean high tide line, a channel bottom elevation at the inlet of approximately 6 ft NGVD, and a channel design flow depth at time implementation of approximately 0.5 ft. Channel will be aligned to the northwest with an approximate aspect of 35° with respect to the beach face. Estimated material to be excavated is approximated and confirmed to be less than 1,000 yd^3.

Agency staff prepares e-mail to management team to notify them of intention and schedule to construct the outlet channel, provide information regarding current conditions, and provide team with a design schematic according to the Communication Protocol procedure documented in Section 7.8.1 of the management plan. Please see Attachments B.1 and B.2 for an example of e-mail transmittal with attached design schematic. Agency biologists coordinate with Stewards of the Coast and Redwoods to schedule volunteers to assist with pre-, day of, and day after outlet channel creation pinniped monitoring.

Friday, July 2nd

Agency staff receives comments from management team on proposed approach. Time allowing, Agency responds, modifies the proposed approach as needed, and decides on the final approach.

Agency staff reviews rate of water surface rise in the lagoon to confirm that flooding is not expected before proposed management action.

Monday and Tuesday, July 5th and 6th

Agency maintenance crews arrive at the Goat Rock State Beach parking lot early in the morning to prepare for implementation. Agency biologist arrives to begin pinniped monitoring at least one hour prior to crews and coordinates with maintenance crew leader. Agency surveyors stake out designed channel and make corrections to alignment and channel geometry to account for potential changes in beach berm topography since last topographic survey. Outlet channel excavation is carried out according to Section 7.5 of the management plan and according to the plan submitted to the management team. Implementation is also conducted in accordance with the Agency's IHA for harbor seals, northern elephant seals and California sea lions which may be present at the site during excavation activities. Photos are taken to document all implementation activities, and following completion of the outlet channel Agency staff collects measurements of completed channel geometry, flow depth and location.

Wednesday, July 7th

Agency staff sends e-mail to management team to provide documentation of the completion of the outlet channel according to the Communication Protocol procedure documented in Section 7.8.2 of the management plan. Please see Attachment B.3 for an example of e-mail transmittal.

After implementation of the channel, the Agency will monitor performance of the outlet channel according to the monitoring program described in Section 7.7 of the management plan.

Attachment B.1: Sample Proposed Outlet Channel Implementation Email

Date: 7/1/10

Hello Outlet Channel Management Team -

The Russian River Estuary closed on 6/30/10. The Sonoma County Water Agency plans to implement an outlet channel beginning at 7 am on July 5th and potentially extending to the afternoon of July 6th. Details of the proposed outlet channel are the following:

- Channel Width: 30 ft.
- Channel Length: 350 ft.
- Channel Bottom Elevation: 6 ft NGVD
- Design Flow Depth: 0.5 ft
- Location of Channel Inlet Centerline: 970 ft northwest of jetty
- Channel Alignment Aspect: 35 deg. with respect to beach face
- Estimated Estuary WSEL at Time of Completion: 6.5 ft
- Existing Beach Berm Crest Elevation: 10 ft NGVD
- Existing Beach Berm Width: 300 ft
- Excavation Equipment: 1 Excavator, 1 Bulldozer

Attached is a design drawing developed using the most recent topographical survey (6/30/10). Due to the highly dynamic nature of conditions at the site, actual topography at the time of implementation may vary. Implementation of the channel may differ from design in order to account for changed topography.

Current and predicted conditions at the site are the following:

- **River and Estuary:**
  - Russian River near Guerneville Flow (USGS 11467000): 120 cfs
  - Predicted 72 hour precipitation: 0 in.
- **Ocean:**
  - Approximate rate of estuary water surface rise: 0.5 ft/day
  - Current Swell Height and Direction: 5.8 ft @ 10 sec. @ 320 deg.
  - 7/5/10 Predicted Mean Swell Height and Direction: 2.5 ft @ 15 sec. @ 200 deg.

No seal pups were observed on the beach.

For updates on conditions please visit the following URL:

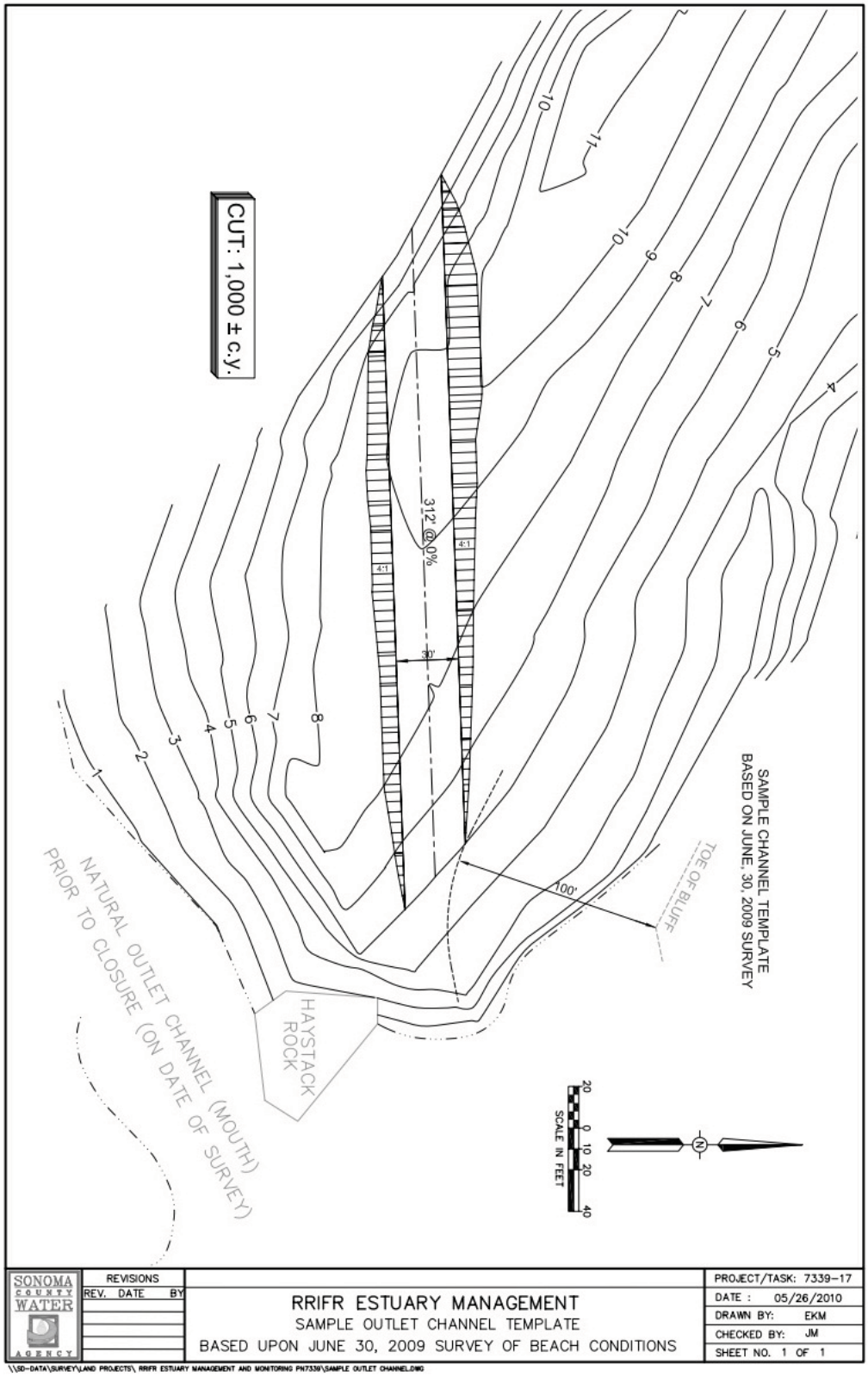
http://www.bml.ucdavis.edu/boon/russianriver

If you have any comments to the proposed implementation plan please provide comments no later than 7/2/10, 5 pm. Should you have any questions or concerns please contact me or Jessica Martini-Lamb at jessicam@scwa.ca.gov, 707-547-1903 (office), 707-322-8177 (mobile).

Sincerely,

Chris Delaney, P.E.
Agency Engineer
Sonoma County Water Agency
707-547-1946 (office)
707-975-5606 (mobile)

Attachment B.2: Sample Proposed Outlet Channel Design Schematic



Attachment B.3: Sample Proposed Outlet Channel Implementation Email

Date: 7/8/10

Hello Outlet Channel Management Team -

The Russian River Estuary closed on 6/30/10. The Sonoma County Water Agency implemented an outlet channel beginning at 7 am on July 5th and extending to the afternoon of July 6th. Details of the implemented outlet channel are the following:

- Channel Width: 30 ft.
- Channel Length: 350 ft.
- Channel Bottom Elevation: 6 ft NGVD
- Flow Depth: 0.7 ft
- Location of Channel Inlet Centerline: 970 ft northwest of jetty
- Channel Alignment Aspect: 35 deg. with respect to beach face
- Estuary WSEL at Time of Completion: 6.7 ft
- Existing Beach Berm Crest Elevation: 10.2 ft NGVD
- Existing Beach Berm Width: 300 ft
- Excavation Equipment: 1 Excavator, 1 Bulldozer

Attached are photographs of the beach before, during, and after the outlet channel implementation.

Current and predicted conditions at the site are the following:

- **River and Estuary:**
  - Russian River near Guerneville Flow (USGS 11467000): 115 cfs
  - Predicted 72 hour precipitation: 0 in.
- **Ocean:**
  - Current Swell Height and Direction: 2.7 ft @ 14 sec. @ 200 deg.
  - 7/10/10 Predicted Mean Swell Height and Direction: 2.4 ft @ 12 sec. @ 200 deg.

No seal pups were observed on the beach.

For updates on conditions please visit the following URL:

http://www.bml.ucdavis.edu/boon/russianriver

If you have any comments on the implemented channel, please provide comments no later than 7/12/10, 5 pm. Should you have any questions or concerns please contact me or Jessica Martini-Lamb at jessicam@scwa.ca.gov, 707-547-1903 (office), 707-322-8177 (mobile).

Sincerely,

Chris Delaney, P.E.
Agency Engineer
Sonoma County Water Agency
707-547-1946 (office)
707-975-5606 (mobile)

Attachment C. Summary of Land Use Permits
(Revised March 23, 2015)

List of Valid Permits and Agreements for the Russian River Estuary Management Project

Page	Agency	Permit No.	Expiration
C-1	California Department of Fish and Wildlife	Lake and Streambed Alteration Agreement (1600-2010-0380-R3)	December 31, 2015
C-6	California Regional Water Quality Control Board, North Coast Region	Section 401 Water Certification (1B10122WNSO)	May 14, 2019
C-11	California Coastal Commission	Coastal Development Permit 2-12-004	August 15, 2016
C-20	US Army Corps of Engineers, San Francisco District	Section 404 & Section 10, Individual Permit (2004- 285610N)	December 31, 2023
C-21	California Environmental Quality Act		None
C-21	California State Lands Commission	General Lease, Public Agency Use (PRC 7918.9)	December 31, 2023
C-24	California Department of Parks and Recreation	Temporary Use Permit	December 31, 2015
C-31	California Department of Parks and Recreation	Collections Permit	February 26, 2015
C-33	US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service	Incidental Harassment Authorization	April 20, 2015

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife Lake and Streambed Alteration Agreement (III-1176-96) - November 6, 1996 Agreement Renewal – November 14, 2001 Agreement Extension – October 17, 2002 Agreement Renewal – November 13, 2003 Agreement Renewal – September 30, 2005 Agreement Extension – December 7, 2009 Agreement Amendment – December 13, 2009 Lake and Streambed Alteration Agreement (1600-2010-0380-R3) - September 8, 2011 Expiration - December 31, 2015	**1. Administrative Measures** Permittee shall meet each administrative requirement described below. 1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to DFG personnel, or personnel from another state, federal, or local agency upon request. 1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors. 1.3 Notification of Conflicting Provisions. Permittee shall notify DFG if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, DFG shall contact Permittee to resolve any conflict. 1.4 Project Site Entry. Permittee agrees that DFG personnel may enter the project site at any time to verify compliance with the Agreement. 1.5 Work Period Extension. If the Permittee needs more time to complete the authorized activity, the work period may be extended on a day-to-day basis by contacting the DFG representative found within the Contact Information section of this Agreement.	May 1: Adaptive Management Annual Report

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife (continued)	1.6 To the extent that any provisions of this Agreement provide for activities that require the Permittee to traverse another owner's property, such provisions are agreed to with the understanding that the Permittee possesses the legal right to so traverse. In the absence of such right, any such provision is void. 1.7 If, in the opinion of the DFG, conditions arise, or change, in such a manner as to be considered deleterious to the stream or wildlife, operations shall cease until corrective measures approved by the DFG are taken. **2. Avoidance and Minimization Measures** To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below. 2.1 In each year that this Agreement is in effect, the Permittee shall provide DFG with an annual lagoon outlet channel adaptive management plan by April 15. 2.2 No excavation of the lagoon outlet channel may occur until DFG has reviewed and approved the annual lagoon outlet channel adaptive management plan. DFG shall provide written comments or approval by May 15 of each year this agreement is in effect. 2.3 The project site has been identified as an area that is potentially inhabited by steelhead trout (Federal Threatened), chinook salmon (Federal Threatened), coho salmon (Federal and State Endangered) and green sturgeon (Federal Threatened). This agreement does not authorize the take, or incidental take of any State or Federal listed threatened or endangered listed species. The Permittee is required, as prescribed in the state or federal endangered species acts, to consult with the appropriate agency prior to commencement of the project. Any unauthorized take of such listed species may result in prosecution. 2.4 To avoid impacts on aquatic and terrestrial species within the immediate work area, prior to implementation of an outlet channel, a qualified biologist will conduct a preconstruction survey to ensure no special-status species are occupying the site. If special-status species are observed within the project site or immediate surroundings, these areas will be avoided until the animal(s) has (have) vacated the area, and/or the animal(s) have been relocated out of the project area by a qualified biologist, upon approval by the regulatory agencies. In addition, the site will be surveyed	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife (continued)	periodically during construction to ensure that no special-status species are being impacted by construction activities. 2.5 The project biologist will conduct a preconstruction training session for construction crew members. The training will include a discussion of sensitive biological resources within the project area and the potential presence of special-status species, special-status species' habitats, protection measures to ensure species are not impacted by project activities and project boundaries. 2.6 Any material, which could be hazardous to aquatic life and enters a stream or lake (i.e., a piece of equipment tipping-over in a stream and dumping oil, fuel or hydraulic fluid), shall be removed immediately and the DFG shall be notified within 24 hours. 2.7 Any hazardous or toxic materials that could be deleterious to aquatic life that could be washed into State waters or its tributaries shall be contained in water tight container or removed from the project site. 2.8 The Permittee/contractor shall not dump any litter or construction debris within the riparian/stream zone. All such debris and waste shall be picked up daily and disposed of at an appropriate site. 2.9 Refueling of construction equipment and vehicles may not occur within 300 feet of any water body, or anywhere that spilled fuel could drain to a water body. Tarps or a similar material shall be placed underneath the construction equipment and vehicles, when refueling, to capture incidental spillage of fuels. 2.10 Any equipment or vehicles driven and/or operated within or adjacent to the stream/lake shall be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life, wildlife, or riparian habitat. 2.11 Any equipment or vehicles driven and/or operated within or adjacent to the stream/lake shall be cleaned of all external oil, grease, and materials that, if introduced to water, could be deleterious to aquatic life, wildlife or riparian habitat.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Fish and Wildlife (continued)	**3. Reporting Measures** Permittee shall meet each reporting requirement described below. 3.1 The Permittee shall notify DFG a minimum of 24 hours in advance of implementing the outlet channel management plan during the lagoon management period (May 15 to October 15). All communications shall be made in the method prescribed within the communication protocol section of the DFG approved annual lagoon outlet channel adaptive management plan. 3.2 The Permittee shall submit an annual report detailing that year's outlet channel management activities. This report may be submitted as a section of the annual lagoon outlet channel adaptive management plan required by May 1 of each year this agreement is in effect.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region Section 401 Water Certification (1B04001WNSO) - May 6, 2004 Amendment Extension – October 14, 2009 Amendment Extension – January 20, 2011 Amendment Extension – January 5, 2012 Amendment Extension – December 11, 2012 Amendment Extension – December 16, 2013 Expiration - December 31, 2014 Section 401 Water Certification (WDID 1B10122WNSO) - May 14, 2014 Expiration – May 14, 2019	**All conditions of this order apply to the applicant (and all their employees) and all contractors (and their employees), sub-contractors (and their employees), and any other entity or agency that performs activities or work on the project as related to this water quality certification.** 1. If monitoring results identify potentially dangerous water quality conditions, the applicant will promptly consult with Regional Water Board staff in addition to staff from other agencies identified in the application, including the National Marine Fisheries Service, the California Department of Fish and Wildlife, and California State Parks, with the intent of examining possible resolution through management action. Potentially dangerous conditions may include, but are not limited to, high bacterial levels, the presence of cyanobacteria, or other conditions that could affect human health. 2. The mitigation measures detailed in the Environmental Impact Report (SCH 2010052024) are hereby incorporated by reference and are conditions of approval of this certification. Notwithstanding any more specific conditions in this certification, the applicant shall comply with all mitigation measures identified in the Environmental Impact Report that are within the Regional Water Board's jurisdiction. 3. The annual fee amount for this Clean Water Act Section 401 Water Quality Certification shall be in accordance with the current dredge and fill fee schedule, per Division 3, Chapter 9, Article 1, section 2200(a)(3) of title 23 of the California Code of Regulations, based on the maximum dredge amount of 49,000 cubic yards proposed for the first year, and each year following. This fee shall be submitted prior to authorization of that year's management period and shall be approved by amendment to this Order by signature of the Executive Officer. The fee payment shall indicate the WDID number, and which season it is for. If the entire proposed beach dredging work for that year is not completed during that management season, the fee for the remaining amount of beach dredging for that year shall be applicable to the remaining management season(s), until the remaining amount of the fee is exhausted. In the case the remaining amount of the fee is exhausted within the five year term of this Order, the appropriate fee amount shall be paid at that point to be based on the actual volume of beach dredging performed, and/or proposed to be performed. There shall be no fee refunded to the Applicant if at the expiration of this Order there is any unapplied fee. 4. A draft water quality monitoring plan was submitted on December 23, 2013, which includes datasonde deployment, nutrient/bacterial/algal sampling, and sediment chemistry and benthic community indices. Regional Water Board staff issued a letter to SCWA on April 1, 2014, detailing the Regional Water Board's requirements for a water quality monitoring plan. A final water quality monitoring and reporting plan (WQMRP) must be submitted to the Regional Water Board by July 15, 2014, for approval by the Executive Officer. The WQMRP must include the following: a. Datasonde deployment – Since the size of estuary pool will increase at times under the new estuary management, it is expected that there will be an increase in shallow over-bank habitat along the new shoreline. Diel water temperature, dissolved oxygen, and pH levels in these expanded littoral regions should be evaluated for impacts to the COLD beneficial use during target water surface elevations. Sampling will	March 31: Draft Annual Adaptive Management Plan

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region (continued)	consist of vertical profiles in shallow water areas to characterize lagoon backwater areas. b. Stage measurements – The river reach near Monte Rio is expected to be affected by the backwater effects under the new estuary management. An additional water level measurement station should be placed in this river reach to evaluate when backwater effect on water quality conditions at stations sampled in the reach. c. Bacteria Sampling i. Duncans Mills and Bridgehaven stations should be replaced with public beach access locations at Patterson Point Preserve and Vacation Beach. ii. The monitoring plan should specify that the USEPA (2012) Beach Action Value for *E .coli* bacteria concentration (i.e., 235 MPN/100mL) will be used to determine if sampling should proceed the next day. iii. Water samples should be diluted when higher concentrations of bacteria are expected so that the results are not censored. iv. Assessment of the human-host *Bacteroides* bacteria levels should also be conducted to determine if the new estuary management increases a threat to public health from human sources. Quantifiable levels of human-host *Bacteroides* bacteria indicate recently deposited human waste. The assessment should be conducted at the public recreation beaches (i.e., Monte Rio, Patterson Point Preserve, and Vacation Beach) during the lagoon management period when the estuary is closed and the beaches are inundated. The Sonoma County Public Health Laboratory (as well as other labs) has the capability to quantify human-host *Bacteroides* bacteria that indicate recently deposited human waste. d. Algal sampling – Since the size of estuary pool will increase at times under the new estuary management, it is expected that there will be an increase in shallow over-bank habitat along the new shoreline. The larger areas of shallow habitat will provide additional habitat substrate for periphytic algal mats. The spatial extent of these algal mats and the resulting impact under the new estuary management should be evaluated. In addition, an evaluation of possible cyanobacteria within the periphytic algal mats should be conducted, and if found, the possibility of cyanotoxins should be evaluated. e. A Quality Assurance Project Plan (QAPP) needs to be submitted with the final WQMRP (i.e., EPA/240/B-01/003). 5. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Water Code section 13330 and title 23, California Code of Regulations, section 3867. 6. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to title 23, California Code of Regulations, section 3855, subdivision (b) and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Regional Water Quality Control Board, North Coast Region (continued)	7. The validity of this certification is conditioned upon total payment of any fee required under title 23, California Code of Regulations, section 3833, and owed by the applicant. 8. Regional Water Board staff shall be notified in writing at least five working days, when conditions allow, prior to the commencement of ground disturbing activities, or as soon as possible prior to or upon initiating ground disturbing activities, with details regarding the construction schedule, in order to allow staff to be present onsite during construction, and to answer any public inquiries that may arise regarding the project. 9. No debris, soil, silt, sand, bar, slash, sawdust, cement or concrete washings, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, other than that authorized by this Order, shall be allowed to enter into or be placed where it may be washed by rainfall into waters of the state. When operations are completed, any excess material or debris shall be removed from the work area. 10. All activities and best management practices (BMPs) shall be implemented according to the submitted application and the conditions in this certification. BMPs for erosion, sediment, and turbidity control shall be implemented and in place at commencement of, during, and after any ground clearing activities or any other project activities that could result in erosion or sediment discharges to surface water. 11. In accordance with state and federal laws and regulations, the applicant is liable and responsible for the proper disposal for project-generated waste. When handling, transporting, and disposing of project-generated waste, the applicant and their contractors shall comply with all applicable state and federal laws and regulations. When disposing of project-generated waste offsite, the applicant and its contractors shall: a. Make appropriate arrangements to dispose of the material, including, but not limited to, property owner agreements, permits, licenses, and environmental clearances; b. Obtain satisfactory evidence that the work in 11.a has been completed; and c. Obtain a dated, signed manifest from the disposal site owner, or authorized representative, that identifies the type and quantity of disposed waste. 12. The applicant shall prioritize the use of wildlife-friendly, biodegradable (not photo- degradable) erosion control products wherever feasible. The applicant shall not use or allow the use of erosion control products that contain synthetic materials within waters of the United States or waters of the state at any time. The applicant shall not use or allow the use of erosion control products that contain synthetic netting for permanent erosion control (i.e. erosion control materials to be left in place for two years or more after the completion date of the project). If the applicant finds that erosion control netting or products	

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Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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California Regional Water Quality Control Board, North Coast Region (continued)	have entrapped or harmed wildlife, personnel shall remove the netting or product and replace it with wildlife-friendly biodegradable products. The applicant shall request approval from the Regional Water Board if an exception from this requirement is needed for a specific location. 13. Disturbance or removal of existing vegetation shall not exceed the minimum necessary to complete the project. 14. If, at any time, an unauthorized discharge to surface water (including wetlands, lakes, rivers, or streams) occurs, or any water quality problem arises, the associated project activities shall cease immediately until adequate BMPs are implemented including stopping work. The Regional Water Board shall be notified promptly and in no case more than 24 hours after the unauthorized discharge or water quality problem arises. 15. Fueling, lubrication, maintenance, storage, and staging of vehicles and equipment shall not result in a discharge or threatened discharge to any waters of the state including dry portions of the shoreline. At no time shall the applicant or its contractors allow use of any vehicle or equipment that leaks any substance that may impact water quality. 16. Prior to implementing any change to the project that may have a significant or material effect on the findings, conclusions, or conditions of this Order, the applicant shall obtain the written approval of the Regional Water Board executive officer. If the Regional Water Board is not notified of a significant alteration to the project, it will be considered a violation of this Order, and the applicant may be subject to Regional Water Board enforcement actions. 17. The Regional Water Board may add to or modify the conditions of this Order, as appropriate, to implement any new or revised water quality standards and implementation plans adopted and approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act. 18. The applicant shall provide Regional Water Board staff access to the project site to document compliance with this certification. 19. In the event of any violation or threatened violation of the conditions of this Order, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under applicable state or federal law. For the purposes of section 401 (d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties, process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this Order. In response to a suspected violation of any condition of this certification, the State Water Board may require the holder of any federal permit or license subject to this Order to furnish, under penalty of perjury, any technical or monitoring reports the State Water Board deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In response to any violation of the conditions of this Order, the Regional Water	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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California Regional Water Quality Control Board, North Coast Region (continued)	Board may add to or modify the conditions of this Order as appropriate to ensure compliance. 20. The applicant shall provide a copy of this Order and State Water Board Order 2003- 0017-DWQ to any contractor(s), subcontractor(s), and utility company(ies) conducting work on the project, and shall require that copies remain in their possession at the work site. The applicant shall be responsible for ensuring that all work conducted by its contractor(s), subcontractor(s), and utility companies is performed in accordance with the information provided by the applicant to the Regional Water Board. 21. In the event of any change in control of ownership of land presently owned or controlled by the Applicant, the Applicant shall notify the successor-in-interest of the existence of this Order by letter and shall forward a copy of the letter to the Regional Water Board at the above address. To discharge dredged or fill material under this Order, the successor-in-interest must send to the Regional Water Board Executive Officer a written request for transfer of the Order. The request must contain the requesting entity's full legal name, the state of incorporation if a corporation, and the address and telephone number of the person(s) responsible for contact with the Regional Water Board. The request must also describe any changes to the Project proposed by the successor- in-interest or confirm that the successor-in-interest intends to implement the Project as described in this Order. Except as may be modified by any preceding conditions, all certification actions are contingent on: a) the discharge being limited to and all proposed mitigation being completed in strict compliance with the Applicant's Project description, and b) compliance with all applicable requirements of the Water Quality Control Plan for the North Coast Region (Basin Plan). 22. Except as may be modified by any preceding conditions, all certification actions are contingent on a) the discharge being limited to and all proposed mitigation being completed in strict compliance with the applicant's project description, and b) compliance with all applicable requirements of the Water Quality Control Plan for the North Coast Region (Basin Plan). 23. The authorization of this certification for any dredge and fill activities expires on May 14, 2019. Conditions and monitoring requirements outlined in this Order are not subject to the expiration date outlined above, and remain in full effect and are enforceable.	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Coastal Commission Coastal Development Permit (CDP 2-01-033) – May 15, 2002 Amend. Extension (2-01-033-1A) – June 14, 2010 Monthly Extensions (January - June 2011) Emergency CDP (2-12-002-G) –January 9, 2012 New CDP Application Submitted – January 23, 2012 Application deemed complete – July 9, 2012 Emergency CDP (2-13-005-G) –February 21, 2013 Emergency CDP (2-13-005-G) –February 21, 2013 Emergency CDP (G-2-13-0221) –October 15, 2013 CDP (2-12-004) February 26, 2014 Expiration-August 15, 2016	**SPECIAL CONDITIONS:** This permit is granted subject to the following special conditions: 1. **Approved Project.** Subject to these standard and special conditions (including modifications to the project, mitigation measures, and/or the project plans required by them), this CDP authorizes implementation of the Russian River Estuary Management Project and related jetty study, including 1) a new program that would implement a lagoon outlet channel during the lagoon management season, from May 15th to October 15th, 2) sand bar breaching from October 16th to May 14th and necessary from May 15th to October 15th to minimize flooding, and 3) a geotechnical evaluation of a relic jetty at the river mouth, all as more specifically described in the proposed project materials (see Appendices A and B and Exhibits 2, 3, and 7). 2. **Construction Plan.** PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit two copies of a Construction Plan (the Plan) to the Executive Director for review and written approval. The Plan shall, at a minimum, include the following: a. **Construction Areas.** The Construction Plan shall identify the specific location of all construction areas, all staging areas, and all construction access corridors in site plan view. All such areas within which construction activities and/or staging are to take place shall be	August 15: Annual Report for CDP (2-12-004)

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Coastal Commission (continued)	minimized to the maximum extent feasible in order to have the least impact on public access and adjacent biological resources as well as to maintain best management practices (BMPs) to protect coastal dune and marine resources on-site and in the surrounding area, including by using offsite areas for staging and storing construction equipment and materials, as feasible. In addition, all construction areas shall avoid sensitive dune plant species, including Tidestrom's lupine, as required in subsection (c), below. The placement of the piezometers shall occur no closer than fifty feet from the sensitive dune plant habitat (as outlined in Exhibit 3 – Jetty Study Location, Detail, and Photos). Construction (including but not limited to construction activities, and materials and/or equipment storage) is prohibited outside of the defined construction, staging, and storage areas. **b. Construction Methods and Timing.** The plan shall specify the construction methods to be used, including all methods to be used to keep the construction areas separated from sensitive coastal dune and marine resources and public recreational use areas (including using unobtrusive fencing (or equivalent measures) to delineate construction areas). All work shall take place during daylight hours and all lighting of the beach, river, and dune habitat is prohibited. **c. Dune Plants Avoidance.** The plan shall include methods to avoid impacts to sensitive dune plant species, including Tidestrom's lupine. All sensitive species shall be avoided during construction, including through locating the defined construction areas required in subsection (a) away from such species (as generally depicted on Exhibit 3 – Jetty Study Location, Detail, and Photos). Furthermore, the sensitive dune plant habitat shall be fenced off during the two weeks wherein the instruments are being placed and the seismic work is occurring. For the duration of the project, markers identifying the boundaries of the sensitive dune plant habitat shall remain in place. A monitor shall be on site during instrument placement, testing, and removal to ensure that project activities occur within the defined construction, staging, and storage areas and outside of the sensitive dune plant habitat. **d. Best Management Practices.** The plan shall clearly identify all BMPs to be implemented during construction and their location. Contractors shall ensure that work crews are carefully briefed on the importance of observing the appropriate precautions and reporting and cleanup of accidental spills. Construction contracts shall contain appropriate penalty provisions, sufficient to offset the cost of retrieving or cleaning up improperly contained foreign materials. **e. Construction and Instrument Noise Level Restrictions.** Noise generated by any instrument driving or hammer strike activities shall be minimized to the maximum extent practicable. Underwater noise shall not exceed an accumulated 187 dB SEL as measured 10 meters from the source. At no time shall peak dB SEL rise above 206 at 10 meters from the source. Furthermore, the Applicants shall limit activities at the site that involve the use of heavy equipment to between local sunrise to local sunset. **f. Construction Site Documents.** The plan shall provide that copies of the signed CDP and the approved Construction Plan be maintained in a conspicuous location at the construction job site	

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Coastal Commission (continued)	at all times, and that such copies are available for public review on request. All persons involved with the construction shall be briefed on the content and meaning of the coastal development permit and the approved Construction Plan, and the public review requirements applicable to them, prior to commencement of construction. g. **Construction Coordinator.** The plan shall provide that a construction coordinator be designated to be contacted during construction should questions arise regarding the construction (in case of both regular inquiries and emergencies), and that their contact information (i.e., address, phone numbers, etc.) including, at a minimum, a telephone number that will be made available 24 hours a day for the duration of construction, is conspicuously posted at the job site where such contact information is readily visible from public viewing areas, along with indication that the construction coordinator should be contacted in the case of questions regarding the construction (in case of both regular inquiries and emergencies). The construction coordinator shall record the name, phone number, and nature of all complaints received regarding the construction, and shall investigate complaints and take remedial action, if necessary, within 24 hours of receipt of the complaint or inquiry. In addition, all construction personnel shall be trained in proper material handling, cleanup, and disposal procedures. h. **Notification.** The Permittee shall notify planning staff of the Coastal Commission's North Central Coast District Office at least three working days in advance of commencement of construction, and immediately upon completion of construction. i. **Property Owner Consent.** The plan shall be submitted with evidence indicating that the owners of any properties on which construction activities are to take place, including properties to be crossed in accessing the site, consent to such use of their properties. Minor adjustments to the above construction requirements may be allowed by the Executive Director in the approved Construction Plan if such adjustments: (1) are deemed reasonable and necessary; and (2) do not adversely impact coastal resources. All requirements above and all requirements of the approved Construction Plan shall be enforceable components of this CDP. The Permittee shall undertake construction in accordance with the approved Construction Plan. 3. **Mitigation Monitoring Plan.** The project shall be conducted in compliance with the requirements of the Mitigation Monitoring Plan, dated August 17, 2011 (see Appendix B), except where the terms and conditions of this CDP require actions more protective of coastal resources. 4. **Marin e Mammal Avoidance and Monitoring.** To the maximum extent feasible, all work shall avoid the river mouth area where seal haul out is typically located (see Exhibit 4 – Pinniped Haul Outs). In addition, all work shall be conducted consistent with the NMFS and NOAA-approved seal haul out plan described in the Incidental Harassment Authorization (April 2013) (IHA) and any updates to this IHA. Project activities shall comply with all mitigation, monitoring and reporting requirements contained in the IHA, including the following requirements as outlined in the IHA:	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

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California Coastal Commission (continued)	**a. Avoid Sudden Flushes.** Permittee crews shall cautiously approach the haul-out ahead of heavy equipment to minimize the potential for sudden flushes, which may result in a stampede. Crews on foot shall make an effort to be seen by seals from a distance, if possible, rather than appearing suddenly at the top of the sand bar, again preventing sudden flushes. Boats operating near river haul-outs during monitoring shall be kept within posted speed limits and driven as far from the haul-outs as safely possible to minimize flushing seals. **b. Avoid Haul-Out.** Permittee crews shall avoid walking or driving equipment through the seal haul-out. Physical and biological monitoring at the haul-out location shall not be occur if a pup less than one-week old is present at the monitoring site or on a path to the site. **c. Monitoring From Bluff.** During breaching events, all monitoring shall be conducted from the overlook on the bluff along Highway 1 adjacent to the haul-out in order to minimize potential for harassment. **d. Disturbance Recovery.** The Permittee shall maintain a one-week no-work period between water level management events (unless flooding is an immediate threat) to allow for an adequate disturbance recovery period. During the no-work period, equipment must be removed from the beach. **e. Equipment BMPs.** All equipment shall be driven slowly on the beach and care shall be taken to minimize the number of shutdowns and start-ups when equipment is on the beach. All work shall be completed as efficiently as possible, with the smallest amount of heavy equipment possible, to minimize disturbance of seals at the haul-out. **f. Haul-out Maintained.** The Permittee shall conduct seal counts at the Jenner seal haul-out and at nearby coastal and river haul-outs in accordance with methods described in the Russian River Management Activities Pinniped Monitoring Plan (Pinniped Monitoring Plan), dated September 9, 2009, or as updated by requirements of NMFS under the Marine Mammal Protection Act (MMPA). If monitoring during the lagoon management period indicates decreases in overall use at the Jenner haul-out are correlated with increases in use at the three closest haul-outs, then the Permittee shall consult with the Executive Director, NMFS and CDFW to modify the Estuary Management Plan activities such that the haul-out site is maintained. Proposed alterations to the approved Estuary Management Plan shall be reported to the Executive Director. No alterations to the approved Estuary Management Plan shall occur without an approved amendment to this CDP, unless the Executive Director determines that no amendment is legally required. **5. Public Acc ess Management Plan.** PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit two copies of a public access management plan (Public Access Plan) to the Executive Director for review and approval. The Public Access Plan shall clearly describe the manner in which public access at the project site is to be protected, with the objective of avoiding any adverse impacts to public access at Goat Rock, Sonoma Coast State Beach. The Public Access Plan shall be consistent with all other terms and conditions of this CDP, and shall at a minimum include the following:	

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California Coastal Commission (continued)	**a. No Disruption of Public Access.** Development under this CDP that blocks access to the beach at the project site shall be prohibited. Temporary signs shall warn the public of construction while construction activities are underway. Signs shall direct the public to safe access routes during construction activities. Signs shall not discourage public access. Signs shall notify beach users of channel conditions, potential for safety hazards from beach erosion or hydrologic action, and emergency contact information. Signs shall be posted and maintained at key locations, such as the parking lot at Goat Rock State Beach Parking lot, the unofficial beach access trail located on the north side of the beach off Highway 1, and 100 feet on either side of the outlet channel. **b. Peak Public Access Times Avoided.** Project activities shall occur Monday through Thursday only, to avoid impacts to park visitors during peak visitation times (Friday through Sunday). All requirements above and all requirements of the approved Public Access Plan shall be enforceable components of this CDP. The Permittee shall undertake development in accordance with the approved Public Access Plan, which shall govern all general public access to the site pursuant to this CDP. **6. Monitoring Plan.** PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit two copies of a Flood Analysis, Habitat and Water Quality Monitoring Plan (Monitoring Plan) to the Executive Director for review and approval. The Flood Analysis portion of the Monitoring Plan shall identify avoidance and mitigation measures as detailed in Special Condition 6(a). The Habitat Monitoring portion of the Monitoring Plan shall cover all approved project activities, and shall evaluate project effectiveness and alternatives as detailed in Special Condition 6(b). The Water Quality Monitoring portion of the Monitoring Plan shall direct management actions in response to water quality conditions and as detailed in Special Condition 6(c). The primary objective of the Monitoring Plan shall be to ensure that approved project activities protect and enhance project area habitats while also protecting development from flooding and enhancing water quality, and shall be measured against a clearly defined project baseline, which shall be provided in the Monitoring Plan. The Monitoring Plan shall be based upon an adaptation framework where lessons learned from approved project activities and monitoring are applied through adaptive changes designed to better achieve the primary objective over the course of this authorization. The Monitoring Plan shall include all monitoring components of the BO and the FEIR for the project, and shall include, at minimum, the following: **a. Flood Analysis.** The Permittee shall continue to coordinate with NMFS and work with property owners affected by flooding to identify measures that would, if necessary, substantially minimize or avoid any damages to existing structures that would occur as a result of increasing water elevations in the lagoon pursuant to the approved project. As appropriate and indicated in the BO, the Permittee shall continue to survey properties within the estuary's maximum water elevation in greater detail to more accurately and precisely determine the elevation of the structures potentially at risk; this information shall be kept on record by the Permittee and a copy shall be provided to each of the property owners. A detailed account of individual properties and development of these properties for each foot of estuary water surface elevations shall be	

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California Coastal Commission (continued)	provided. The range of options available to protect affected developments, other than breaching or controlling water levels in the estuary, including relocating, elevating, or reinforcing structures, shall be provided. At a minimum, and evaluation of the effects of flood levels at 4.5, 7, and 9 feet shall be so evaluated. **b. Habitat Monitoring.** Monitoring shall be conducted consistent with the BO to provide information on (1) the ways in which the project results in benefits to juvenile steelhead and/or adverse impacts to other salmonids, (2) whether a controlled outlet program can achieve optimal lagoon elevations, and (3) whether habitat improvements would result if no breaching occurred, water levels were allowed to be higher than current management, a larger estuary was formed, and low-lying development within the historic estuary footprint were flooded. A geotechnical study shall be conducted prior to December 31, 2014 to contribute to a determination as to what modifications to/removal of the jetty infrastructure would optimize seepage through the sand barrier and allow estuary levels to rise to a maximum elevation without the sand bar manipulation. An evaluation of the need for additional monitoring wells and frequency of water level data needed to adequately characterize seepage through the sand bar and jetty shall be conducted at the commencement of the geotechnical work so that reliable information is assured to be included in the study. **c. Water Quality Monitoring.** The water quality monitoring data collected for the 2008 BO, the Temporary Urgency Change Petition's surface water sampling program, and the Stipulated Judgment's sediment sampling requirement shall be integrated under the direction of an independent water quality professional. These data collection programs shall be linked and coordinated so that they provide a cohesive and useful data set that can be used to evaluate the low velocity lagoon outlet channel and whether or not it is successful in sustaining raised water elevations and improved water quality conditions in the estuary. At a minimum, the Plan shall specify the water quality analyses, sampling locations, sampling frequency, quality control and data reporting that will be used to assess water quality impacts of implementing the Russian River Estuary Management Program Adaptive Management Plan. In addition, the Water Quality Monitoring Plan shall include sampling for the following constituents, at a minimum, temperature, salinity, pH, nutrients, chlorophyll, and bacteria indicators used to assess human health impacts consistent with the most up-to date methods and standards required by the North Coast Regional Water Quality Control Board (NCRWQCB). Monitoring shall occur weekly during the Lagoon Management Period at the locations that are currently included in the Russian River Water Quality Summary for the Sonoma County Water Agency 2012 Temporary Urgency Change. Finally, the Plan shall include a contingency to increase sampling frequency to daily if the bacteria indicators exceed the operative standards required by the NCRWQCB and monitoring shall continue daily until measurements are below the operative standards. If the operative standards are exceeded, the Permittee will immediately inform the NCRWQCB and Sonoma County Public Health and seek direction on whether warning signs should be posted at the affected beaches regarding a potential health threat and consult with NCRWQCB and Sonoma County Public Health to determine if mechanical breaching is a recommended action to reduce the threat to public health.	

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California Coastal Commission (continued)	**d. Monitoring Reports.** The Monitoring Plan shall provide for submission of annual reports of monitoring results to the Executive Director for review and approval for as long as activities are authorized by this CDP, with the first annual monitoring report due on August 15, 2014, and subsequent reports due on August 15th of each year thereafter. Each monitoring report shall be cumulative and shall summarize all previous results. Each report shall clearly document conditions in the project area related to project implementation, including in narrative (with supporting monitoring data) and through photographs taken from the same fixed points in the same directions each year, all commencing from the project baseline. Each report shall include a performance evaluation section where information and results from the monitoring program are used to evaluate the effect of project implementation with respect to flooding, habitat, and water quality impacts, both beneficial and detrimental. To allow for an adaptive approach, each report shall also include a recommendations section to address changes that may be necessary in light of monitoring results and/or other information, including with respect to more current data and/or species information related to the habitat areas in question, if any. Actions necessary to implement the recommendations shall be implemented within 30 days of Executive Director approval of each Monitoring Report, unless the Executive Director identifies a different time frame for implementation. Minor adjustments to the above monitoring requirements may be allowed by the Executive Director in the approved Monitoring Plan if such adjustments: (1) are deemed reasonable and necessary; and (2) do not adversely impact coastal resources. All requirements above and all requirements of the approved Monitoring Plan shall be enforceable components of this CDP. The Permittee shall undertake development in accordance with the approved Monitoring Plan. **7. Assumption of Risk.** By acceptance of this CDP, the Permittee acknowledges and agrees, on behalf of itself and all successors and assigns: a. **Coastal Hazards.** That the site is subject to coastal hazards including but not limited to episodic and long-term shoreline retreat and coastal erosion, high seas, ocean waves, storms, tsunami, tidal scour, coastal flooding, and the interaction of same; b. **Assume Risks.** To assume the risks to the Permittee and the property that is the subject of this permit of injury and damage from the above-identified coastal hazards in connection with this permitted development; c. **Waive Liability.** To unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from the above-identified hazards; d. **Indemnification.** To indemnify and hold harmless the Coastal Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such	

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California Coastal Commission (continued)	claims), expenses, and amounts paid in settlement arising from any injury or damage due to the above-identified coastal hazards. 8. **Sand Bar Breaching L imitation**. Except under conditions requiring immediate action to prevent or mitigate loss or damage to life, health, property, or essential public services, the sand bar breaching activities authorized by the CDP shall not be initiated on or within 36 hours prior to any weekend or State holiday. 9. **CD P Term**. Development authorized by this CDP is valid for three (3) years from the date of Commission approval (until August 15, 2016). One request for an additional three-year period of development authorization may be accepted, reviewed and approved by the Executive Director for a maximum total of six (6) years of development authorization, provided the request would not alter the project description and/or require modifications of conditions due to new information or other changed circumstances. The request for an additional three-year period of development authorization shall be made at least 120 days prior to August 15, 2016. If the request for an additional three-year authorization period would alter the project description and/or require modifications of conditions due to new information or other changed circumstances, an amendment to this CDP shall be necessary to authorize development beyond August 15, 2016. If the Permittee submits a request/application to continue estuary management (including breaching and other activities intended to control water elevations) beyond August 15, 2016, such request/application shall be accompanied by a project alternatives analysis that, at minimum, provides a survey of potential flooding risks to properties within the estuary up to a water elevation of 14 feet, or the maximum water elevation known to occur, whichever is higher, to precisely determine the elevation of the structures potentially at risk. In addition, the analysis shall include an evaluation of the range of options available to protect against identified flooding risks, other than breaching or controlling water levels in the estuary, including relocating, elevating, or reinforcing structures. Such analysis shall also include an evaluation of the range of options available to modify or remove the jetty to reduce or eliminate the need for breaching. 10. **Other Agency Approval**. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit to the Executive Director written evidence that all necessary permits, permissions, approvals, and/or authorizations for the approved project have been granted by Sonoma County, the North Coast Regional Water Quality Control Board, California State Lands Commission, California Department of Parks and Recreation, California Department of Fish and Wildlife, National Marine Fisheries Service, U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service or that no such permits or approvals are necessary. Any changes to the approved project required by these agencies shall be reported to the Executive Director. No changes to the approved project shall occur without a Commission amendment to this CDP unless the Executive Director determines that no amendment is necessary. 11. **Liability for Costs and Attorneys' Fees.** By acceptance of this CDP, the Applicant/Permittee agrees to reimburse the Coastal Commission in full for all Coastal Commission costs and attorneys'	

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California Coastal Commission (continued)	fees (including (1) those charged by the Office of the Attorney General, and (2) any court costs and attorneys' fees that the Coastal Commission may be required by a court to pay) that the Coastal Commission incurs in connection with the defense of any action brought by a party other than the Applicant/Permittee against the Coastal Commission, its officers, employees, agents, successors and assigns challenging the approval or issuance of this CDP. The Coastal Commission retains complete authority to conduct and direct the defense of any such action against the Coastal Commission.	

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US Army Corps of Engineers, San Francisco District Section 404 & Section 10, Individual Permit (285610N) - July 22, 2005 Permit Modification - October 5, 2009 Time Extension January 5, 2011 Time Extension December 8, 2011 Time Extension December 10, 2012 Time Extension December 10, 2013 Section 404 & Section 10, Individual Permit (2004- 285610N) – April 1, 2014 Expiration - December 31, 2023	SPECIAL CONDITIONS: 12. To remain exempt from the prohibitions of Section 9 of the Endangered Species Act, the non-discretionary Terms and Conditions for incidental take of federally-listed Species shall be fully implemented as stipulated in the Biological Opinion entitled, *"Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Conh·ol and Water Conservation Improvement District in the Russian River Watershed,"* also known as the Russian River Biological Opinion, (NMFS File No. 151422SWR2000SRl50) dated September 24, 2008. Project authorization under this permit is conditional upon compliance with the mandatory terms and conditions associated with incidental take. Failure to comply with the terms and conditions for incidental take, where a take of a federally-listed species occurs, would constitute an unauthorized take and non-compliance with the authorization for your project. The NMFS is, however, the authoritative federal agency for determining compliance with the incidental take statement and for initiating appropriate enforcement actions or penalties under the Endangered Species Act. 13. SCWA shall provide USACE a copy of the approved Estuary Monitoring Plan and all subsequent Annual Monitoring Reports required by the Biological Opinion. 14. Unless otherwise approved, authorized discharges of dredged material on the sandbar below the high tide line shall consist only of the native sand excavated from the pilot channel. 15. SCWA shall provide USACE a Breaching Activities Report by 31 March for each year of the ten-year permit authorization period. Each Breaching Activities Report shall present a tabulation of the breaching events that occurred during the preceding year, including the approximate estuary closure date, the approximate number of estuary closure days occurring before the breach event, the breaching event date, and the recorded estuary water level of the breaching event date. 5. The current Coastal Development Permit (CDP 2-12-004) issued by the California Coastal Commission expires on 15 August 2016. The current Section 401 water quality certification (WDID No. IB04001WNSO) issued by the Regional Water Quality Control Board expires on 31 December 2015. SCWA shall obtain requisite time extensions for the Coastal Development Permit and water quality certification prior to the commencement of any work to be performed during the remainder of the ten-year Department of the Army permit authorization period. SCWA shall provide USACE a copy of all requisite time extensions to ensure continuing project conformance with State coastal zone and water quality standards.	March 31: Annual Breaching Report

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California Environmental Quality Act Environmental Impact Report (EIR) Notice of Preparation – May 10, 2010 Notice of Completion – December 15, 2010 Notice of Determination – August 16, 2011	See EIR for Mitigation Measures.	None
California State Lands Commission General Lease, Public Agency Use (PRC 7918.1 R 08103) – June 29, 2004 Lagoon Outlet Channel Authorization – October 13, 2009 (Expiration - December 31, 2010) Monthly Extensions - January 1 to December 31, 2011 General Lease, Public Agency Use (PRC 7918.9) – January 1, 2012	**SECTION 2** **SPECIAL PROVISIONS** **BEFORE THE EXECUTION OF THIS LEASE, ITS PROVISIONS ARE AMENDED, REVISED OR SUPPLEMENTED AS FOLLOWS:** 1. Lessee agrees to be bound by and fully carry out, implement, and comply with all mitigation measures and reporting obligations identified as Lessee's, or Responsible Party's responsibility as set forth in the Mitigation Monitoring Program (MMP) attached hereto as Exhibit C and by this reference made a part of this Lease, or as modified by Lessor as permitted by law. 2. Lessee acknowledges that the land described in Exhibit A of this Lease is subject to the Public Trust and is presently available to members of the public for recreation, waterborne commerce, navigation, fisheries, open space, or other recognized Public Trust uses and that Lessee's proposed construction activities and use of the Lease Premises shall not interfere or limit the Public Trust rights of the public. At least 24 hours prior to and during the breaching activities, Lessee will contact the California Department of Parks and Recreation lifeguards and post signs and barriers to minimize potential hazards to the public. 3. Prior to the start of the initial freshwater lagoon construction on the Lease Premises, Lessee shall submit to Lessor copies of all permits and authorizations from agencies having jurisdiction over the construction of the authorized activities on the Lease Premises. Lessee shall maintain all regulatory permits and authorization required during the term of the lease.	No Date: Annual Water Quality Data Summary Reports; Annual Report for Russian River Estuary Management Activities Monitoring Plan

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California State Lands Commission (continued) Renewed General Lease, Public Agency Use (PRC 7918.9) – Approved by Commission on February 20, 2015 Expiration – December 31, 2023	4. All breaching activities shall be carried out in accordance with all applicable safety regulations, permits, and conditions of all other agencies. 5. During the term of the lease, Lessee shall provide Lessor with an annual report on frequency and timing of outlet channel construction and maintenance and breaching occurrences completed each calendar year, including number of days of closure of Goat Rock State Beach. The report should include narrative descriptions and evaluations of outlet channel and breaching events, including any adaptive management changes implemented. 6. Lessee shall submit to Lessor copies of the following: a. Adaptive estuarine water level and barrier beach management plans (as described in 2.1.1 of the Russian River Biological Opinion) after approval by the National Marine Fisheries (NMFS), the California Department of Fish and Wildlife, and the U.S. Army Corps of Engineers. b. Annual water quality data summary reports (as described in 2.2, Monitoring Estuarine Water Quality: Reporting and Review, of the Biological Opinion). c. Annual report, as specified in the "Russian River Estuary Management Activities Pinniped Monitoring Plan" and distributed to NMFS, the California Department of Parks and Recreation, and the Stewards of the Coasts and Redwoods, on pinnipeds' reaction to the proposed activities authorized in this Lease. 7. All personal property, tools, or equipment taken onto or placed upon the Lease Premises shall remain the property of the Lessee or its contractors. Such personal property shall be promptly removed by the Lessee, at its sole risk and expense upon the completion of the project. Lessor does not accept any responsibility for any damage, including damages to any personal property, including any equipment, tools, or machinery on the Lease Premises	

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California State Lands Commission (continued)	8. No refueling, repairs, or maintenance of vehicles or equipment will take place on the Lease Premises. 9. Lessee shall maintain a logbook on all work vessels during work within the Lease Premises utilized in operations conducted under this Lease to keep track of all debris created by objects of any kind that may fall into the water. The logbook should include the type of debris, date, time and location to facilitate identification and location of debris for recovery and site clearance verification. All debris shall be promptly removed from the Lease Premises. 10. Any equipment to be used on the Lease Premises is limited to that which is directly required to perform the authorized use and does not include any equipment that may cause damage to the Lease Premises. 11. Lessee acknowledges and agrees: a. The site may be subject to hazards from natural geophysical phenomena including, but not limited to waves, storm waves, tsunamis, earthquakes, flooding and erosion. b. To assume the risks to the Lessee and to the property that is the subject of any Coastal Development Permit (CDP) that is issued to Lessee for development on the leased property, of injury and damage from such hazards in connection with the permitted development and use. c. To unconditionally waive any claim or damage or liability against the State of California, its agencies, officers, agents, and employees for injury or damage from such hazards. d. To indemnify, hold harmless and, at the option of Lessor, defend the State of California, its agencies, officers, agents, and employees, against and for any and all liability, claims, demands, damages, injuries, or costs of any kind and from any cause (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement arising from any alleged or actual injury, damage or claim due to site hazards or connected in any way with respect to the approval of any CDP that is issued to Lessee involving this property or issuance of this Lease, any new lease, renewal, amendment, or assignment by Lessor. 12. Lessor shall have the right to enter upon the property at reasonable times in order to monitor Lessee's compliance with and otherwise enforce the terms of the Lease. 13. Paragraph 10, Surety Bond, contained within Section 3 is hereby deleted from this Lease.	

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California Department of Parks and Recreation Temporary Use Permit – December 30, 2003 Permit Extension – September 14, 2009 Permit Extension – December 28, 2009 Expiration – June 30, 2010 Temporary Use Permit – May 15, 2011 Time Extension – February 20, 2013 Time Extension – December 18, 2013 Time Extension – February 2, 2015	**Now therefore**, the State by this Permit hereby grants to the Permittee permission to enter upon State's property, conditioned upon the agreement of the Parties that this Permit does not create or vest in Permittee any interest in the real property herein described or depicted, that the Permit is revocable and non-transferable, and that the Permit is further subject to the following terms and conditions: 1. **Project Description:** By this Permit, the State hereby grants to the Permittee permission to enter onto those lands depicted and described on Exhibit "A", Russian River Estuary Management Activities, and Exhibit "B", Russian River Estuary Outlet Channel: Excavation Cut and Fill Locations, attached hereto and herein incorporated by this reference, solely for the purpose of flood control and environmental monitoring. 2. **Permit Subject to Laws and Regulatory Agency Permits:** This Permit is expressly conditioned upon Permittee's obtaining any and all regulatory permits or approvals required by the relevant regulatory agencies for the Project and Permittee's use of the Property, and upon Permittee's compliance with all applicable municipal, state and federal laws, rules and regulations, including all State Park regulations. Prior to commencement of any work, Permittee shall obtain all such legally required permits or approvals and submit to the State full and complete copies of all permits and approvals, including documentation related to or referenced in such permits and approvals, along with the corresponding agency contact and telephone numbers, and related California Environmental Quality Act (CEQA) and/or National Environmental Policy Act (NEPA) documentation as applicable. 3. **Term of Permit:** This Permit shall only be for the period beginning on 11/15/2011, and ending on 12/31/2012, or as may be reasonably extended by written mutual agreement of the Parties. 4. **Consideration:** Permittee agrees to pay State the sum of One thousand five hundred and No/100 Dollars ($1,500.00) as consideration for the rights granted by this Permit. Payment is due upon execution of this Permit. 5. **Permit Subject to Existing Claims:** This Permit is subject to existing contracts, permits, licenses, encumbrances and claims which may affect the Property.	No Reporting Required for TUP

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California Department of Parks and Recreation (continued) Expiration – December 31, 2015	**6. Waiver of Claims and Indemnity:** Permittee waives all claims against State, its officers, age and/or employees, for loss, injury, death or damage caused by, arising out of, or in any way connected with the condition or use of the Property, the issuance, exercise, use or implement of this Permit, and/or the rights herein granted. Permittee further agrees to protect, save, hol harmless, indemnify and defend State, its officers, agents and/or employees from any and al damage, claims, demands, costs and liability which may be suffered or incurred by State, its agents and/or employees from any cause whatsoever, arising out of, or in any way connecte this Permit, exercise by Permittee of the rights herein granted, Permittee's use of the Propert and/or the Project for which this Permit is granted, except those arising out of the sole active negligence or willful misconduct of State. Permittee will further cause such indemnification a waiver of claims in favor of State to be inserted in each contract that Permittee executes for t provision of services in connection with the Project for which this Permit is granted. **7. Contractors:** Permittee shall incorporate the terms, conditions and requirements contained when contracting out all or any portion of the work permitted hereunder. Permittee shall be responsible for ensuring contractor/subcontractor compliance with the terms and conditions contained herein. Failure of Permittee's contractors to abide by State's terms and conditions constitute default by Permittee (see Paragraph 20) allowing State to terminate this Permit an all legal remedies. **8. Insurance Requirements:** As a condition of this Permit and in connection with Permittee's indemnification and waiver of claims contained herein, Permittee shall maintain, and cause it contractors to maintain, a policy or policies of insurance as follows: Permittee shall maintain motor vehicle liability with limits of not less than $1,000,000 per a Such insurance shall cover liability arising out of a motor vehicle, including all owned, hire non-owned motor vehicles. Permittee shall maintain statutory Workers' Compensation and employer's liability insuran coverage in the amount of $1,000,000/employee/disease/each accident, for all its employ will be engaged in the performance of work on the Property, including special extensions applicable. Said policy shall include a waiver of subrogation in favor of State. If the Perm an individual or sole proprietor who is not required by law to have Workers' Compensatior insurance, Permittee shall provide State with a written confirmation that Permittee is not r to be, and has elected not to be, covered by Workers' Compensation. Permittee shall procure commercial general liability insurance at least as broad as the mo commonly available ISO policy form CG 0001 premises operations, products/completed operations, personal/advertising injury and contractual liability with limits not less than $1, per occurrence and $2,000,000 general aggregate. Said policy shall apply separately to insured against whom any claim is made or suit is brought subject to the Permittee limits liability.	

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California Department of Parks and Recreation (continued)	Each policy of insurance required by this provision shall: (a) be in a form, and written by an insurer, reasonably acceptable to State; (b) be maintained at Permittee's sole expense; and (c) require at least thirty (30) days written notice to State prior to any cancellation, non-renewal or material modification of insurance coverage. Insurance companies issuing such policies shall have a rating classification of "A-" or better and financial size category ratings of "VII" or better according to the latest edition of the A.M. Best Key Rating Guide. All Insurance companies issuing such policies shall be licensed to do business in the State of California. Such policies shall contain an endorsement naming the CALIFORNIA DEPARTMENT OF PARKS AND RECREATION as an additional insured at no cost to State. Permittee shall provide to State evidence that the insurance required to be carried by this Permit, including any endorsement affecting the additional insured status, is in full force and effect and that premiums therefore have been paid. Such evidence shall, at State's discretion, be in either the form of an ACORD Form (Certificate of Insurance) or DPR Form 169A (Certificate of Insurance for Concession Contracts/Special Events), or a certified copy of the original policy, including all endorsements. Permittee is responsible for any deductible or self-insured retention contained within the insurance program. Should Permittee fail to keep the specified insurance in effect at all times, Permittee shall be considered to be in default of this Permit, and State may, in addition to any other remedies it has, terminate this Permit.	

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California Department of Parks and Recreation (continued)	Permittee shall require and ensure that all contractors and subcontractors have adequate insurance meeting the coverage requirements in this provision. Any insurance required to be carried shall be primary and not excess to any other insurance carried by State. Coverage shall be in force for the complete term of this Permit, including any extension thereof, and for all work being done for which this Permit is required. **9. Reservation of Rights:** State reserves the right to use the Property in any manner, provided such use does not unreasonably interfere with Permittee's rights herein. **10. Access Limits and Conditions:** Access to the Property shall be limited to the access designated by State and is illustrated in Figure 2 of Exhibit "A" and as described below. The barrier beach would be accessed from the paved parking lot at Goat Rock State Beach, located at the end of Goat Rock Road off of Highway 1. Equipment would be off-loaded in the parking lot and driven north onto the beach via an existing access point within the parking lot. Additional detail is provided in the attached Russian River Estuary Management Activities. **11. Notice of Work:** Any required notices to State shall be sent to the State authorities in charge of Sonoma Coast State Park named below. At least 24 hours prior to any entry upon the Property for any of the purposes hereinabove set forth, Permittee shall provide the State contact[s] named below with written notice of Permittee's intent to enter the Property. **STATE:** Contact: Brendan O'Neil Address: 25381 Steelhead Blvd. Duncans Mills, CA 95430 Tel: 707/865-2391 Fax: 707/865-2046 **PERMITTEE:** Contact: Jessica Martini-Lamb Address: 404 Aviation Blvd. Santa Rosa, CA 95403 Tel: 707/547-1903 Fax: 707/524-3782 **12. Limits of Work:** In no event shall this Permit authorize work in excess or contrary to the terms and conditions of any regulatory agency permit or approval. Under no circumstances, whether or not authorized by any regulatory agency, other permit or any person or entity other than State, shall work exceed that which is authorized by this Permit as described in the Exhibit B, Russian River Estuary Management Activities. **13. Public Safety:** Permittee is responsible for public safety during and after the breaching operation until such time that water velocities and standing waves recede, the sandbar banks stabilize and cease to erode, cave and wash away and heavy equipment has been removed from State Park property. In the interest of public and Park visitor safety STATE reserves the right to require PERMITTEE to provide Peace Officers and/or Lifeguards, at no cost to STATE, to monitor and close the beach to the public for a distance of 750' on each side of the breach as recommended in the Russian River Estuary Study. In the interest of public safety, the preferred days for sandbar breaching are from Monday to Thursday (excluding holidays) when Park visitation is usually at a minimum. In the event of emergency situations, breaching may proceed immediately after notifying the State Park District Superintendent or their designee. **14. Compliance with Monitoring and Mitigation Measures:** Resource monitoring and mitigation measures identified within the Russian River Estuary Management Project Final Environmental Impact Report, NMFS Biological Opinion, DFG Lake and Streambed Alteration Agreement, Regional Water Quality Control Board Section 401 Water Certification, California Coastal Commission Coastal Development Permit, US Army Corps of Engineers Section 404 and Section 10 Permit, and State Lands Commission General Lease shall be completed in accordance with and to the satisfaction of the District Superintendent or designee. Permittee's activities conducted under this Permit shall comply with all State and Federal environmental laws, including, but not limited to, the Endangered Species Act, CEQA, and Section 5024 of the Public Resources Code. Any of Permittee's archaeological consultants working within the boundaries of the Property shall obtain a permit from the California State Parks Archaeology, History & Museums Division prior to commencing any archaeological or cultural investigations of the Property.	

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California Department of Parks and Recreation (continued)	Permittee shall immediately advise State's contact person if any new site conditions are found during the course of permitted work. State will advise Permittee if any new historical resources (including archaeological sites), special status species, threatened/endangered species protocols, or other resource issues are identified within the Project site. Permittee shall abide by District Superintendent or designee's instructions to protect the resource(s) during the permitted work or risk revocation of the Permit. Permittee shall make all excavation activities on the Property available to the State Archaeologist for observation and monitoring. During excavation, the State archaeological monitor may observe and report to the State on all excavation activities. State archaeological monitor shall be empowered to stop any construction activities as necessary to protect significant cultural resources from being disturbed. In the event that previously unknown cultural resources, including, but not limited to, dark soil containing shell, bone, flaked stone, groundstone, or deposits of historic trash are encountered during Project construction by anyone, work will be suspended at that specific location, and the Permittee's work will be redirected to other tasks, until after a State-qualified archaeologist has evaluated the find and implemented appropriate treatment measures and disposition of artifacts, as appropriate, in compliance with all applicable laws and department resource directives. If human remains are discovered during the Project, work will be immediately suspended at that specific location and the District Superintendent or designee shall be notified by Permittee. The specific protocol, guidelines and channels of communication outlined by the California Native American Heritage Commission (NAHC), and/or contained in Health and Safety Code Section 7050.5 and Public Resources Code Sections 5097.9 et seq., will be followed. Those statutes will guide the potential Native American involvement in the event of discovery of human remains. Permittee shall provide a written work schedule to State so that the State archaeological monitor can arrange to be on site on the necessary days. Permittee shall provide reasonable advance notice of and invite the District Superintendent or designee to any preconstruction meetings with the prime contractor or subcontractors. 15. **Restoration of Property:** Permittee shall complete the restoration, repair, and revegetation of the Property in consultation with, and to the satisfaction of the State Environmental Scientist should any damage result from permitted activities. Restoration, repair and/or revegetation is required within 30 days after damage or as determined by the State Environmental Scientist. This obligation shall survive the expiration or termination of this Permit. 16. **Right to Halt Work:** The State reserves the right to halt work and demand mitigation measures at any time, with or without prior notice to Permittee, in the event the State determines that any provision contained herein has been violated, or in the event that cessation of work is necessary to prevent, avoid, mitigate or remediate any threat to the health and safety of the public or state park personnel, or to the natural or cultural resources of the state park. 17. **Use Restrictions:** The use of the Property by Permittee, including its guests, invitees, employees, contractors and agents, shall be restricted to the daytime hours between sunrise and sunset on a day-by-day basis, unless otherwise approved in advance in writing by State. No person shall use or occupy the Property overnight. Activities on the Property shall be conducted only in a manner which will not interfere with the orderly operation of the state park. Permittee shall not engage in any disorderly conduct and shall not maintain, possess, store or allow any contraband on the Property. Contraband includes, but is not limited to: any illegal alcoholic beverages, drugs, firearms, explosives and weapons. Permittee shall not use or allow the Property to be used, either in whole or in part, for any purpose other than as set forth in this Permit, without the prior written consent of the State. 18. **State's Right to Enter:** At all times during the term of this Permit and any extension thereof, there shall be and is hereby expressly reserved to State and to any of its agencies, contractors, agents, employees, representatives, invitees or licensees, the right at any and all times, and any and all places, to temporarily enter upon said Property to survey, inspect, or perform any other lawful State purposes. Permittee shall not interfere with State's right to enter. 19. **Protection of Property:** Permittee shall protect the Property, including all improvements and all natural and cultural features thereon, including cultural and natural resources, at all times at Permittee's sole cost and expense, and Permittee shall strictly adhere to the following restrictions:	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Parks and Recreation (continued)	(a) Permittee shall not place or dump garbage, trash or refuse anywhere upon or within the Property, except in self-contained trash receptacles that are maintained to State's satisfaction by Permittee. (b) Permittee shall not commit or create, or suffer to be committed or created, any waste, hazardous condition or nuisance in, on, under, above or adjacent to the Property. (c) Permittee shall not cut, prune or remove any vegetation upon the Property, except as identified in the Project description and herein permitted or subsequently approved in writing by the District Superintendent. (d) Permittee shall not disturb, move or remove any rocks or boulders upon the Property, except as identified in the Project description and herein permitted or subsequently approved in writing by the District Superintendent. (e) Permittee shall not grade or regrade, or alter in any way, the ground surface of the Property, except as herein permitted, or subsequently approved in writing by the District Superintendent. (f) Permittee shall not bait, poison, trap, hunt, pursue, catch, kill or engage in any other activity which results in the taking, maiming or injury of wildlife upon the Property, except as identified in the Project description and herein permitted or subsequently approved in writing by the District Superintendent. (g) Permittee shall not use, create, store, possess or dispose of hazardous substances (as defined in the California Hazardous Substances Act) on the Property except as herein permitted, or subsequently approved in writing by the District Superintendent. (h) Permittee shall exercise due diligence to protect the Property against damage or destruction by fire, vandalism and any other causes. 20. **Default:** In the event of a default or breach by Permittee of any of the terms or conditions set forth in this Permit, State may at any time thereafter, without limiting State in the exercise of any right of remedy at law or in equity which State may have by reason of such default or breach: (a) Maintain this Permit in full force and effect and recover the consideration, if any, and other monetary charges as they become due, without terminating Permittee's right to use of the Property, regardless of whether Permittee has abandoned the Property; or (b) Immediately terminate this Permit upon giving written notice to Permittee, whereupon Permittee shall immediately surrender possession of the Property to State and remove all of Permittee's equipment and other personal property from the Property. In such event, State shall be entitled to recover from Permittee all damages incurred or suffered by State by reason of Permittee's default, including, but not limited to, the following: (i) any amount necessary to compensate State for all the detriment proximately caused by Permittee's failure to perform its obligations under this Permit, including, but not limited to, compensation for the cost of restoration, repair and revegetation of the Property, which shall be done at State's sole discretion and compensation for the detriment which in the ordinary course of events would be likely to result from the default; plus (ii) at State's election, such other amounts in addition to or in lieu of the foregoing as may be permitted from time to time by applicable law. 21. **State's Right to Cure Permittee's Default:** At any time after Permittee is in default or in material breach of this Permit, State may, but shall not be required to, cure such default or breach at Permittee's cost. If State at any time, by reason of such default or breach, pays any sum or does any act that requires the payment of any sum, the sum paid by State shall be due immediately from Permittee to State at the time the sum is paid. The sum due from Permittee to State shall bear the maximum interest allowed by California law from the date the sum was paid by State until the date on which Permittee reimburses State. 22. **Revocation of Permit:** The State shall have the absolute right to revoke this Permit for any reason upon ten (10) days written notice to Permittee. Written notice to Permittee may be accomplished by electronic or facsimile transmission, and the notice period set forth in this paragraph shall begin on the date of the electronic or facsimile transmission, or, if sent by mail, on the date of delivery. If Permittee is in breach of the Permit or owes money to the State pursuant to this Permit, any prepaid monies paid by Permittee to State shall be held and applied by the State as an offset toward	

Sonoma County Water Agency
Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Parks and Recreation (continued)	damages and/or amounts owed. Nothing stated herein shall limit the State's exercise of its legal and equitable remedies. 23. **Recovery of Legal Fees:** In any action brought to enforce or interpret any provisions of this Permit or to restrain the breach of any agreement contained herein, or for the recovery of possession of the Property, or to protect any rights given to the State against Permittee, and in any actions or proceedings under Title 11 of the United States Code, if the State shall prevail in such action on trial or appeal, the Permittee shall pay to the State such amount in attorney's fees in said action as the court shall determine to be reasonable, which shall be fixed by the court as part of the costs of said action. 24. **Voluntary Execution and Independence of Counsel:** By their respective signatures below, each Party hereto affirms that they have read and understood this Permit and have received independent counsel and advice from their attorneys with respect to the advisability of executing this Permit. 25. **Reliance on Investigations:** Permittee declares that it has made such investigation of the facts pertaining to this Permit, the Property and all the matters pertaining thereto as it deems necessary, and on that basis accepts the terms and conditions contained in this Permit. Permittee acknowledges that State has made, and makes, no representations or warranties as to the condition of the Property, and Permittee expressly agrees to accept the Property in its as-is condition for use as herein permitted. 26. **Entire Agreement:** The Parties further declare and represent that no inducement, promise or agreement not herein expressed has been made to them and this Permit contains the entire agreement of the Parties, and that the terms of this agreement are contractual and not a mere recital. 27. **Warranty of Authority:** The undersigned represents that they have the authority to, and do, bind the person or entity on whose behalf and for whom they are signing this Permit and the attendant documents provided for herein, and this Permit and said additional documents are, accordingly, binding on said person or entity. 28. **Assignment:** This Permit shall not be assigned, mortgaged, hypothecated, or transferred by Permittee, whether voluntarily or involuntarily or by operation of law, nor shall Permittee let, sublet or grant any license or permit with respect to the use and occupancy of the Property or any portion thereof, without the prior written consent of State. 29. **Choice of Law:** This Permit will be governed and construed by the laws of the State of California.	

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Agency / Permit / Expiration	Special Conditions	Report Due Date
California Department of Parks and Recreation (continued) Collections Permit – September 1, 2012 Collections Permit renewal – February 26, 2014 Expiration – February 26, 2015	PERMIT CONDITIONS: COORDINATE STUDY WITH STATE PARK STAFF. CONTACT ONE WEEK PRIOR TO IMPLEMENTATION. SONOMA COAST LIFEGAURD SUPERVISOR; TIM MURPHY (TIM.MURPHY@PARKS.CA.GOV) SONOMA COAST RANGER SUPERVISOR; DAMIEN JONES (DAMIEN.JONES@PARKS.CA.GOV) RUSSIAN RIVER SR. ENV. SCIENTIST; BRENDAN O'NEIL (BRENDAN.O'NEIL@PARKS.CA.GOV)	No Reporting Required for Collectors Permit

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Summary of Special Conditions of Permits for Russian River Estuary Management Activities

Agency / Permit / Expiration	Special Conditions	Report Due Date
US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Incidental Harassment Authorization (IHA) - April 21, 2011 IHA (renewal) - April 21, 2012 IHA (renewal) - April 21, 2013 IHA (renewal) - April 21, 2014 Expiration – April 20, 2015	1. This Incidental Harassment Authorization (IHA) is valid from April 21 , 2014 through April20, 2015. 2. This IHA is valid only for activities associated with estuary management activities in the Russian River, Sonoma County, California, including: (a) Lagoon outlet channel management; (b) Artificial breaching of barrier beach; (c) Geophysical surveys and other work associated with a jetty study; and (d) Physical and biological monitoring of the beach and estuary as required. 3. General Conditions (a) A copy of this IHA must be in the possession of SCW A, its designees, and work crew personnel operating under the authority of this IHA. (b) SCWA is hereby authorized to incidentally take, by Level B harassment only, 3,880 harbor seals *(Phoca vitulina richardii),* 42 California sea lions *(Zalophus californianus californianus),* and 42 northern elephant seals *(Mirounga angustirostris).* (c) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in condition 3(b) of the IHA or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA. (d) If SCWA observes a pup that may be abandoned, it shall contact the National Marine Fisheries Service (NMFS) West Coast Regional Stranding Coordinator immediately (562-980-3230; Justin.Viezbicke@noaa.gov) and also report the incident to NMFS Office of Protected Resources (301-427-8425; Benjamin.Laws@noaa.gov) within 48 hours. Observers shall not approach or move the pup. 4. Mitigation Measures In order to ensure the least practicable impact on the species listed in condition 3(b), the holder of this IHA is required to implement the following mitigation measures:	January 20, 2015: Marine Mammal Monitoring Results Report

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Agency / Permit / Expiration	Special Conditions	Report Due Date
US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (continued)	(a) SCWA crews shall cautiously approach the haul-out ahead of heavy equipment to minimize the potential for sudden flushes, which may result in a stampede – a particular concern during pupping season. (b) SCWA staff shall avoid walking or driving equipment through the seal haul-out. (c) Crews on foot shall make an effort to be seen by seals from a distance, if possible, rather than appearing suddenly at the top of the sandbar, again preventing sudden flushes. (d) During breaching events, all monitoring shall be conducted from the overlook on the bluff along Highway 1 adjacent to the haul-out in order to minimize potential for harassment. (e) A water level management event may not occur for more than two consecutive days unless flooding threats cannot be controlled. (f) Equipment shall be driven slowly on the beach and care will be taken to minimize the number of shut-downs and start-ups when the equipment is on the beach. (g) All work shall be completed as efficiently as possible, with the smallest amount of heavy equipment possible, to minimize disturbance of seals at the haul-out. (h) Boats operating near river haul-outs during monitoring shall be kept within posted speed limits and driven as far from the haul-outs as safely possible to minimize flushing seals. In addition, SCWA shall implement the following mitigation measures during pupping season (March 15-June 30): (i) SCWA shall maintain a one week no-work period between water level management events (unless flooding is an immediate threat) to allow for an adequate disturbance recovery period. During the no-work period, equipment must be removed from the beach. G) If a pup less than one week old is on the beach where heavy machinery will be used or on the path used to access the work location, the management action shall be delayed until the pup has left the site or the latest day possible to prevent flooding while still maintaining suitable fish rearing habitat. In the event that a pup remains present on the beach in the presence of flood risk, SCWA shall consult with NMFS and CDFG to determine the appropriate course of action. SCWA shall coordinate with the locally established seal monitoring program (Stewards of the Coast and Redwoods) to determine if pups less than one week old are on the beach prior to a breaching event. (k) Physical and biological monitoring shall not be conducted if a pup less than one week old is present at the monitoring site or on a path to the site. (1) No jetty study activities shall occur in the vicinity of the harbor seal haul-out during the pupping season.	

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Agency / Permit / Expiration	Special Conditions	Report Due Date
	5. Monitoring The holder of this IHA is required to conduct baseline monitoring and shall conduct additional monitoring as required during estuary management activities. Monitoring and reporting shall be conducted in accordance with the approved Pinniped Monitoring Plan. (a) Baseline monitoring shall be conducted twice-monthly for the term of the IHA. These censuses shall begin at dawn and continue for eight hours, weather permitting; the census days shall be chosen to ensure that monitoring encompasses a low and high tide each in the morning and afternoon. All seals hauled out on the beach shall be counted every 30 minutes from the overlook on the bluff along Highway 1 adjacent to the haul-out using high-powered spotting scopes. Observers shall indicate where groups of seals are hauled out on the sandbar and provide a total count for each group. If possible, adults and pups shall be counted separately. (b) In addition, peripheral haul-outs shall be visited for 1 0-rninute counts twice during each baseline monitoring day. (c) During estuary management events, monitoring shall occur on all days that activity is occurring using the same protocols as described for baseline monitoring, with the difference that monitoring shall begin at least one hour prior to the crew and equipment accessing the beach work area and continue through the duration of the event, until at least one hour after the crew and equipment leave the beach. In addition, a one-day pre-event survey of the area shall be made within one to three days of the event and a one-day post-event survey shall be made after the event, weather permitting. (d) Monitoring of peripheral haul-outs shall occur concurrently with event monitoring, when possible. (e) For all monitoring, the following information shall be recorded in 30-minute intervals: i. Pinniped counts by species; ii. Behavior; iii. Time, source and duration of any disturbance, with takes incidental to SCWA actions recorded only for responses involving movement away from the disturbance or responses of greater intensity (e.g., not for alerts); iv. Estimated distances between source of disturbance and pinnipeds; v. Weather conditions (e.g., temperature, percent cloud cover, and wind speed); and vi. Tide levels and estuary water surface elevation. (f) All monitoring during pupping season shall include records of any neonate pup observations. SCWA shall coordinate with the Stewards' monitoring program to determine if pups less than one week old are on the beach prior to a water level management event.	

Agency / Permit / Expiration	Special Conditions	Report Due Date
	6. Reporting The holder of this IHA is required to: (a) Submit a report on all activities and marine mammal monitoring results to the Office of Protected Resources, NMFS, and the West Coast Regional Administrator, NMFS, 90 days prior to the expiration of the IHA if a renewal is sought, or within 90 days of the expiration of the permit otherwise. This report must contain the following information: i. The number of seals taken, by species and age class (if possible); ii. Behavior prior to and during water level management events; iii. Start and end time of activity; iv. Estimated distances between source and seals when disturbance occurs; v. Weather conditions (e.g., temperature, wind, etc.); vi. Haul-out reoccupation time of any seals based on post-activity monitoring; vii. Tide levels and estuary water surface elevation; viii. Seal census from bi-monthly and nearby haul-out monitoring; and ix. Specific conclusions that may be drawn from the data in relation to the four questions of interest in SCWA's Pinniped Monitoring Plan, if possible. (b) Reporting injured or dead marine mammals: i. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as an injury (Level A harassment), serious injury, or mortality, SCWA shall immediately cease the specified activities and report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS. The report must include the following information: A. Time and date of the incident; B. Description of the incident; C. Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility); D. Description of all marine mammal observations in the 24 hours preceding the incident; E. Species identification or description of the animal(s) involved; F. Fate of the animal(s); and G. Photographs or video footage of the animal(s).	

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	Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with SCW A to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMP A compliance. SCWA may not resume their activities until notified by NMFS. ii. In the event that SCWA discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), SCWA shall immediately report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS. The report must include the same information identified in 6(b)(i) of this IHA. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with SCWA to determine whether additional mitigation measures or modifications to the activities are appropriate. iii. In the event that SCWA discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), SCW A shall report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. SCWA shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. IV. Pursuant to sections 6(b)(ii-iii), SCWA may use discretion in determining what injuries (i.e., nature and severity) are appropriate for reporting. At minimum, SCWA must report those injuries considered to be serious (i.e., will likely result in death) or that are likely caused by human interaction (e.g., entanglement, gunshot). Also pursuant to sections 6(b)(ii-iii), SCWA may use discretion in determining the appropriate vantage point for obtaining photographs of injured/dead marine mammals. 7. Validity of this IHA is contingent upon compliance with all applicable statutes and permits, including NMFS' 2008 Biological Opinion for water management in the Russian River watershed. This IHA may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if the authorized taking is having a more than a negligible impact on the species or stock of affected marine mammals.	

Attachment D. Russian River Barrier Beach and Estuary Water Surface Level Adaptive Management in Concert with Physical Processes

(from National Marine Fisheries Service)

Russian River Barrier Beach and Estuary Water Surface Level Adaptive Management in Concert with Physical Processes

John McKeon, National Marine Fisheries Service

To comply with NMFS' BO for adaptive management of the RR estuary, i.e., to manage the beach with the goal of conserving beach sand to allow formation of a stable low-flow season elevated outlet-channel and creating a brackish /freshwater lagoon with marine influence minimized, the Sonoma County Water Agency (SCWA) will need to balance multiple natural physical processes when carrying out flood control activities. The two primary processes to balance are: wave and longshore transport of sand into the channel, dependent on wave direction, height and steepness; and outlet channel river-flow scour determined by slope, depth and roughness. The amount of sand transported by either force is dependent on sand supply. As the channel is likely to be of sand only, the vertical elevation-controls of the outlet channel will be the sum of sand transport out of the channel at low tide by the river outflow, versus transport of sand into the channel on the incoming high tide by wave action and longshore current. As the tide lowers and rises, one of these two physical forces will predominate. Balancing the two transport mechanism rates over a 24 hr tidal cycle will be key to maintaining an over-all stable vertical outlet channel elevation and stable estuary water levels minimally influenced by tidal fluctuation. The wave-face between the low tide line and the top of the wave-face crest (height determined by wave height at high tide) will be the key area of scour and accretion during the cycle.

Calculation of scour in open flume channels is a well studied subject, with critical shear stress of when sediments are mobilized on the channel bottom a function of grain size, water velocity and depth. Velocity is determined by roughness and slope. Channel dimension, slope and roughness can be calculated for predicted flow ranges to minimize sheer stress, bed mobilization, scour, and incision of the channel. However, slope across the wave face will be determined by the beach profile where the river outflow meets the ocean. This is the likely point at which channel headcutting would begin, resulting in significant lowering of the outlet channel elevation and estuary water surface elevation (WSE). Because SCWA cannot influence the slope of the wave face beach profile, strategies to minimize scour potential are limited to: 1) choose a river channel outlet location across the wave face where the beach profile has the least slope between the low tide line and wave-face crest height, and 2) minimize depth with increased channel width across the crest of the wave face. This will both limit scour on the outgoing tide, and increase wave transport of sand into the mouth with a greater length of wave break pushing sand into the channel on high tides. Also, to limit propagation of any headcutting precipitated at low tide, the velocity in the channel above the wave face can be decreased with increased roughness and length, or the depth (and scour potential) decreased by increasing the outlet channel width. The beach size and configuration at the time of closure, and the jetty, will constrain, and in part determine, these three channel characteristics.

However, if flood threats and subsequent breaching actions are to be avoided, minimization of scour in the channel and across the wave face needs to be balanced against the ability of channel outflow to remove the predictable transport of sand into the channel by wave and longshore transport, both of which significantly increase during a beach building event and result in a channel closure event.

Transport of sand by waves on to a beach (and into the outlet channel) occurs when wave height compared to wave length reaches a critical point, which is called critical steepness, expressed as Critical H/L. JW Johnson determined critical steepness in the laboratory as = 0.03; waves with a lower H/L value moved sand offshore, those with a higher value moved sand onshore[2]. Wave length is directly proportional to wave period. Using the acceleration rate of gravity, 32/ft/sec/sec= g; and pi for rough approximation of wave form as sinusoidal, L = g/2pi* T^2 or $5.12T^2$ (*e.g.*, 13 ft waves, 9 second period; 9 squared*5.12= 414.72; 13/414.72= 0.0314, steep enough to accrete, or 9 ft waves, 7 second period; 7 squared*5.12= 250.88; 9/250.88= 0.0359).

Because of the coastal aspect of the RR beach and the presence of headlands to the north and south, wave direction is important in determining the height of waves which reach the beach. Wave direction and size also determine the strength of the longshore current, and thus the rate of channel infilling on an incoming tide. The larger the waves, and greater the angle of wave incidence away from perpendicular to the beach, the stronger the longshore current and amount of sand transport.

The incidence of the outlet channel to the wave-face crest will be critical in limiting channel infilling by wave action during a beach building event. When a beach building/closure event is occurring, at high tide waves will be delivering and depositing sand up and over the wave face crest into the mouth of the channel at a rate much greater than the ability of the relatively low flow of the channel to transport sand in opposition to the direction of wave transport. However, a channel behind the wave-face crest and close to perpendicular to the wave direction will be more capable of transporting the sand washed into it by wave action, as flow from the wave will be entrained in the flow of the outlet channel, with the added flow increasing the transport power of the outlet channel. Thus, by orienting the outlet channel near to perpendicular to wave run-up direction, the out-flow channel will be better at limiting or preventing accretion of sand in the channel mouth by successive waves than if the channel is parallel to the wave run-up direction. Strategies for minimizing accretion of sand in the lagoon outlet channel mouth during a beach building event, and limiting likelihood of outlet channel closure events will be: 1) choose a river channel outlet location where the beach profile has the least slope between the low tide line and wave-face crest height, as less slope will mean a greater distance for waves to expend their energy before topping the wave crest, and/or the lower wave-face crest would signify an area of reduced wave size and transport capacity; 2) align the channel from the lagoon outlet, and behind the wave-face crest, to be as near to perpendicular as possible to wave run-up direction in order to minimize sand accretion at the channel mouth during high tide.; 3) insure there is sufficient slope from the lagoon WSE to the point the channel crosses the wave-face crest sufficient to maintain flow across the wave-face crest when waves push the crest above the high tide line (~ 3.3 ft NGVD with a 6 foot high tide). This means planning for the outlet channel invert to be above the lowest point of the wave-face crest height.

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[2] Willard Bascom. 1980. *Waves and Beaches.* Anchor Books Edition. ISBN: 0-385-14844-5

Channel Planform and Slope

In addition to the above described means to balance scour and accretion in the channel mouth and across the wave face, the channel planform will be dictated by beach topography. The entire beach topography above the tide lines is determined by waves and longshore current that will continue to sculpt the beach once the outlet channel has been established. To avoid repetitive heavy equipment excursions on to the beach to reform the outlet channel, the beach topography should dictate both the channel planform and slope of the outlet channel. To determine the most natural channel planform and slope, *i.e.*, the planform location and slope that will most likely be maintained by wave and tidal action subsequent to formation of an outlet channel by SCWA, a detailed topographic survey of the beach will need to be prepared post lagoon-closure, and prior to beach and estuary WSE management actions.

Natural Analogues

When waves reach critical steepness and sand accretion occurs on the beach, the underwater sand bar just outside the wave break is moved onshore with the incoming tide. The beach increases in both width and height, which results in a lengthening of the outlet channel as it has a greater width of beach to cross, and behind the wave-face crest, flows longitudinally along the beach to the lowest point of the crest. The increased length of the channel results in more resiliency to scour and incision during low tide and allows for stabilized lagoon WSE, with tidal influence becoming muted. Lacking subsequent beach building events, the channels may scour back down below the high tide level within weeks, reintroducing tidal influence to the lagoon WSE. However, with continued or subsequent beach building events, the channel continues to elevate and lengthen, and with river inflows declining in spring/summer, the channel loses its ability to incise, and a closed of perched lagoon WSE eventually results.

A short duration event of critically steep waves and beach building occurred along the California Coast the week of May 27th to June 3, 2010. Attached are photos of these river mouth beaches and the channels that resulted from that short duration beach building event. A WSE stage monitor in the Carmel lagoon recorded the effect on lagoon WSE, in which subsequent to the event and the lengthening of the channel, the WSE of the lagoon was maintained above the high tide level and tidal influence became muted. Photos included are of Carmel, San Lorenzo, Scott, Waddell, Pamponio and Navarro river beaches. A plot of the Carmel lagoon WSE for June 2010 can be viewed at
http://www.mpwmd.dst.ca.us/wrd/lagoon/webplots/2010/2010webplots.htm

CARMEL, 6/9/2010

San Lorenzo, 6/10/2010

Scott Creek, 6/10/2010

Waddell, 6/10/2010

Pamponio, 6/10/2010

Navarro, 6/6/2010

Navarro, 6/6/2010

Navarro, 6/6/2010 (high tide-/Lagoon WSE ~ 6-7 feet NGVD estimated)

Navarro, 6/6/2010

Attachment E. Implementation of the 2010 Outlet Channel Adaptive Management Plan

At the direction of NMFS, Sonoma County Water Agency (the Agency) has been tasked with creating an outlet channel intended to improve salmonid habitat in the Russian River Estuary while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised in 2010. Because of permit constraints, the Agency was only able to implement the plan beginning in 2010. This attachment documents the management actions in response to inlet closures that occurred during the 2010 lagoon management period.

During the management period, May 15th to October 15th, Agency staff regularly monitored current and forecast estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate inlet closure. For the first month and a half, river discharge was somewhat larger than historic daily median conditions due to a wetter-than-average spring, but then receded to nearly replicate historic median flow rates. Average monthly wave energy in 2010 was similar to historic averages for most of the management period and higher for June and October. Two periods of inlet closure occurred (Figure 1), leading the Agency to begin planning for management action to create an outlet channel, in accordance with the plan's communication protocol:

- Starting in late June 2010, physical conditions at the mouth of the Russian River Estuary naturally established an outlet channel that persisted for a week before wave action completely closed the lagoon. In response to this closure, the Agency attempted to create an outlet channel for the first time. This management action briefly re-established outlet channel conditions, but within a half day, wave action re-closed the outlet channel. Before the next scheduled management action could take place, the lagoon breached, returning the estuary to tidal conditions.
- The estuary closed twice more in the management period, during the third week of September and again at the start of October. Although action to create an outlet channel was initially considered after the September closure, an extended period of large waves limited beach access due to safety concerns. As a result, water levels continued to rise, heightening flood risk. Therefore, in consultation with the resource agency management team, the Agency decided to implement full breaching. Two attempts were required for each closure before the lagoon was successfully breached.

The next section of this attachment reviews the process for leading up to and during the July outlet channel implementation. In the following section, the September and October closures are assessed. Although the September and October closures did not result in creation of an outlet channel, the planning process and physical processes are relevant to adaptive management. The last section summarizes lessons learned from the 2010 management period to consider in subsequent years.

JUNE-JULY 2010 OUTLET CHANNEL EVOLUTION

In the second half of June, an outlet channel and perched lagoon were naturally established at the mouth of the Russian River. For about one week, this channel conveyed enough water to the ocean to sustain 4.5 to 5 ft NGVD water levels in the lagoon. Once waves closed the outlet channel and lagoon water levels began to rise, the Agency implemented a management action to create an outlet channel. In the face of strong waves, this outlet quickly closed. Several days later, the lagoon was breached and tidal conditions returned until September. Details of this channel evolution are provided below.

NATURALLY ESTABLISHED OUTLET CHANNEL

Outlet channel conditions (defined as a nearly steady lagoon water levels above ocean water levels and maintained by uni-directional outflow in a channel passing through the beach berm) naturally established over a week-long period in late June. The physical conditions associated with this evolution are described below.

Water level

Water levels in the lagoon, as observed at the Jenner gage, exhibited a muted tide range, indicative of partial closure, starting on June 20th as shown in Figure 2a. The tide range gradually decreased from about 1.5 ft until tidal variations ceased early on the morning of June 27th. Lagoon water levels then increased over the next day to just over 4 ft NGVD. Water levels were then fairly constant at about 4 ft NGVD for three days. On June 30th, the water levels started to decline, probably due to the drop in upstream riverine discharge as compared to higher outlet channel discharge. Water levels declined to a minimum of 3 ft NGVD before the channel closed on July 4th.

Ocean waves and tides

Significant wave height at CDIP's Point Reyes buoy increased above 2 m starting on June 24th as shown in Figure 2b. About the time that tidal influence disappeared from lagoon water levels on June 27th, the significant wave height exceeded 3 m and stayed above 3 m until July 1st. Peak wave period during this time period was approximately 8 seconds and the peak direction was from the northwest. Figure 3 illustrates the wave direction, period, and magnitude from June 16th through July 14th. Astronomic tides were declining from peak spring levels, with the higher high water on June 27th of just over 3 ft NGVD as shown in Figure 2c.

Riverine discharge

Riverine discharge in late June was higher than to median conditions because of late season precipitation and full reservoirs. Figure 2d illustrates how flow dropped rapidly from 325 ft^3/s on June 27th to 225 ft^3/s on June 30th. Flow then continued to drop more slowly at a rate of less than 5 ft^3/s per day for the next two weeks.

Planform alignment

At the time of closure, the channel exited the northwest corner of the lagoon and ran along the foot of the bluff, landward of the berm crest, for approximately 550 ft. The channel then crossed the berm and exiting to the ocean. This alignment was similar to the alignment observed during 1998, an El Nino year (personal communication, C. Delaney). Several days before the closure, the channel was observed further south than its alignment along the bluff once the outlet channel established. Unfortunately, the Agency's automated camera did not collect pictures between June 23-29 due to a power failure, precluding a more detailed analysis of the channel's planform evolution in the days preceding the establishment of the outlet channel.

Beach and channel topography

The beach berm north of the outlet channel and the downstream end of the channel was surveyed by Agency staff on July 1st (Figure 4). The presence of seals on the beach to the south of the channel prevented additional survey data from being collected. On both sides of the channel's mouth, sand had deposited such the intertidal beach protruded approximately 50 feet into the ocean as compared to the beach alignment further south (Figure 4 and Figure 5a). Just north of the outlet channel, the beach face that had been covered by wave runup during the previous high tide extended up to 8 ft NGVD. Then the beach profile stepped up to a bench with elevations above 10 ft NGVD. South of the channel, the berm crest elevation was estimated to approximately 7 ft NGVD, but was not measured directly. The outlet channel was approximately 60 ft wide, with its bed elevation at 0-1 ft NGVD for last one hundred feet before it entered the ocean. The channel flowed around numerous large boulders along much of its length. These boulders may have served as natural grade control inhibiting erosion.

Channel discharge

On June 30th, the Agency collected water depths and point velocities in the outlet channel, which was approximately 60 ft wide. Water in the outlet channel flowed at depths up to 2.7 ft and velocities of at least 5.4 ft^2/s. These velocities are in excess of permissible scour criteria for beach sands, but not sufficient to scour the larger boulders found in the outlet channel (Fischenich, 2001). Integrated water depth and point velocity measurements yielded an estimate the channel's discharge of 297 ft^3/s (SCWA unpublished observations). As shown in Figure 2d, this discharge magnitude was observed upstream at Guerneville approximately two days earlier and was larger than the concurrent Guerneville discharge. This is consistent with the dropping water levels in the lagoon (Figure 2a) and tributary inflows downstream of Guerneville.

WAVE-INDUCED OUTLET CHANNEL CLOSURE

After the week of sustained outlet channel conditions, the wave energy briefly relaxed on July 2nd, and then returned to significant wave heights from the northwest exceeding 3.5 m starting on July 3rd (Figure 2b). This increase in wave height was accompanied by an increase in northwest swell wave period to approximately 10 seconds. This increase in wave energy provided enough landward sand transport to close the outlet channel. Riverine discharge had recently declined,

reducing the channel's ability to clear sand and remain open. This closure occurred during a neap tide, when higher high water levels just barely exceeded 2 ft NGVD.

Changes to the wave climate continued for the next several days, with the peak direction shifting to the south and the wave period lengthening to nearly 14 seconds (Figure 3). Significant wave height dropped to less than 1.5 m. This long-period, low-steepness swell is likely to have built the beach berm with onshore sand transport. This likely onshore transport changed the beach topography changed in two ways. The protruding sand deposits at the channel's mouth noticeably diminished in size between July 4th and July 5th, and were essentially gone by July 6th. In addition, the onshore transport probably built the berm crest elevation from the estimated berm crest elevation of 7 ft NGVD on July 1st (C. Delaney) and July 4th (J. Largier) to an elevation of 8.5 ft NGVD as surveyed on July 8th.

Once the outlet channel closed, lagoon water levels began to rise at a rate of approximately 0.5 ft/day. The channel closure and rising water levels initiated the Agency's outlet channel management plan.

MANAGEMENT ACTION

Management action to create an outlet channel was scheduled for July 8th in consultation with the resource management team. The action was scheduled for July 8th because it was a Thursday, the last day that action could be taken before the State Parks permit restrictions on Friday-Sunday operations went into effect. Given the observed rate of lagoon water level rise of 0.5 ft/day, waiting until the following Monday was deemed to be too risky in terms of flood hazard and channel scour. To provide operational flexibility in response to site conditions, two different management options were proposed during planning. Figure 4 shows the alignment of these options, both 30 ft wide, as laid on the topographic surface collected on July 1st. This schematic design was used to discuss management plans with the resource agencies, to estimate volumes of excavated material, and to guide operations staff. Option A, the preferred option, followed the northwest alignment of the natural outlet channel prior closure. In the event that beach surveys indicated a low point in the berm further south or if access to the Option A location was restricted by waves, Option B was proposed just north of Haystack Rock.

Based an assessment of site conditions early on the morning of July 8th, Option A was selected for implementation. Excavation began at approximately 7am on July 8th with a bulldozer and backhoe excavator. The lagoon water level at the time work began was 5.9 ft NGVD.

The excavated portion of the managed channel followed the alignment of the southern half of the naturally established outlet channel, as shown in Figure 5b. This alignment allowed the excavation equipment to avoid rocks embedded in the berm. The backhoe removed sand from the landward portion of the berm, adjacent to a large rock. The bulldozer pushed sand towards the ocean to form the lower portion of the channel. A small berm was preserved between the two pieces of equipment to prevent lagoon outflow before the channel was complete. After

approximately two hours of work, wave runup associated with the rising tide started to enter the channel's mouth. Therefore, the middle berm was removed with the excavator at approximately 9:30am, completing the channel.

At the time of completion, the outlet channel was approximately 30 ft wide and had an invert of approximately 4.5 ft NGVD. Water flowed in the channel at a depth of approximately 0.5 ft. Flow was typically uniformly seaward in the upstream portion of the newly excavated channel. However, in the downstream portion, wave runup periodically overwhelmed the outflow, causing the flow to switch direction to landward. The transition between the existing channel and the newly excavated portion created a hydraulic control across which water transitioned from subcritical to supercritical, thereby explaining the channel's lower water level as compared to the lagoon. Bed erosion was observed starting from this transition region and into the new portion.

During the period when the outlet channel was open, water levels in the lagoon continued to increase at a similar rate to the rate before the management action. This constant rate of water level increase indicates that flow in the outlet channel was relatively small compared to riverine inflow to the lagoon.

OUTLET CHANNEL CLOSURE

As ocean tides increased water levels throughout July 8th, the wave runup from the south swell advanced up and over the beach face, as evidenced by the absence of equipment tracks on the beach in July 9th photographs. By the evening of July 8th, this advancing wave runup transported enough sand into the outlet channel that the channel once again closed. Higher high water on the evening of July 8th was above 3 ft NGVD, as tidal conditions were building towards large spring tides.

After reviewing lagoon and beach conditions on July 9th, the Agency scheduled follow-up management for Monday, July 12th, the first day which they were allowed to operate on the beach under their State Parks permit.

BREACHING TO TIDAL CONDITIONS

Lagoon water levels continued to rise at a rate of approximately 0.5 ft/day in the days following closure. On the evening of July 11th, the lagoon breached in the vicinity of Haystack Rock. The lagoon water level at the time of the breach was 7 ft NGVD, which is approximately 1.5 ft below the berm crest elevation surveyed on July 8th. This difference suggests that the breach may have been caused by seepage through the berm. Just before the breach, the water's edge extending towards the breach site, indicating that breach occurred at the low point in the beach berm's crest elevation.

Because the estuary returned to tidal conditions on July 11th, the management action planned for July 12th was cancelled. Tidal conditions persisted in the estuary until September.

SEPTEMBER-OCTOBER 2010 CLOSURES AND MANAGEMENT

In the end of August, coincident with neap tides and increased wave heights, the estuary water levels became muted, diminishing to a tide range of less than one foot (Figure 6a). Shortly afterwards, starting on September 4th, wave energy increased considerably from the northwest (Figure 7b) to sustained wave heights exceeding 3 m and peaking above 4 m (Figure 6b). This combination of muted tides followed by large waves, would seem to have been ideal conditions to prompt closure. However, the inlet stayed open throughout this high wave period. Several factors probably contributed to the inlet's persistent opening. Although large in height, the waves' period was relatively short (below 12 seconds) and from the northwest. Because of the beach faces the southwest, it may be partially sheltered from waves out of the northwest. The tides were transitioning from neap to spring, so the increasing tidal prism would have contributed to scouring the inlet's channel. Wave overtopping also may have contributed to maintaining inlet by adding water to the estuary that then flowed out the inlet, scouring the channel.

After the muted tides in early September, full tide range returned to the lagoon, probably assisted by the arrival of larger spring tides. Around September 18th, during the month's second neap tide, another wave event was observed with significant wave height less than 2 m, nearly half the magnitude of the early September event (Figure 6b). However, the wave period was longer, 16-18 seconds instead of 8-10 seconds, and waves were from the south instead of the northwest. These conditions closed the estuary on September 21st.

After the inlet closed on September 21st, planning to establish an outlet channel began. Based on the most recent beach topography, the projected rate of lagoon water level increase, tides, and wave forecasts, September 28th, was selected for an attempt at creating an outlet channel. Two options for the channel were proposed, one extending to the northwest from the edge of the lagoon, and one just south of Haystack Rock where the inlet had been just before closure. Lagoon water levels were above 6 ft NGVD by the 28th, as anticipated, in part due to wave overwash. Although water levels were rising, runup from large waves made beach access unsafe and operations were postponed to September 29th. Unsafe wave conditions persisted on the 29th, again preventing beach access. Since wave forecasts predicted only a brief lull on the next day before large waves returned and weekend access restrictions loomed, the Agency, in consultation with the resource agency management team, decided on the evening of Wednesday, September 29th, to switch from attempting to create an outlet channel to attempting a full breach.

Wave and tide conditions on the morning of September 30th allowed for beach access and a full breach was implemented. However, waves carried on the rising tide re-closed the inlet that afternoon and lagoon water levels continued to rise. A second attempt at breaching the afternoon of the 30th was cancelled because of unsafe wave conditions on the beach. Because of the impending flood risk (9 ft water levels were projected by Sunday, October 3rd), the Agency sought and received permission from State Parks to access the beach Friday, October 1st. The

breach on October 1st was successful, helped by extensive scour coinciding with tides dropping to lower low water during the night. Estuary water levels dropped to 1 ft NGVD on October 2nd.

After a brief lull, wave conditions once again intensified and the inlet closed again on October 4th. Although still within the management period, the proximity to the end of the management season, as well as continuing forecasts for high waves, led the Agency to propose and receive permission from the resource agency management team for a full breach. Breaching was attempted on October 11th, when lagoon water levels had exceeded 7 ft NGVD. This attempt failed as waves pushed sand into the breach before it could enlarge and lower lagoon water levels. A second breach attempt was made on the afternoon of October 12th, successfully creating a sustained breach that lowered estuary water levels to tidal conditions. A third closure occurred on October 21st and self breached on October 24th, partly in response to high river discharge. Although this third event was outside the outlet channel management period, it was indicative of the extended period of large waves during September and October 2010.

LESSONS LEARNED AND RECOMMENDATIONS

Based on observations of the estuary, associated physical processes, and the July 8th outlet channel management action, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- All four closures discussed above occurred coincident with noticeable wave energy associated with periods greater than 12 seconds. In fact, a long period, but relatively low wave height (less than 2m) event closed the inlet in the third week of September even though a larger wave height, but shorter period wave event two weeks earlier did not close the inlet. In all but one case, the long period waves which caused closure originated from the south or west.
- When wave runup started to progress into the outlet channel and force operations to end, it was decided to favor a deeper outlet channel over a wider outlet channel. Channel depth was sought to facilitate more discharge from the lagoon to counter incoming waves. We recommend continuing to observe channel/ocean dynamics in subsequent outlet channels to inform tradeoff decisions of this nature.

FEASIBILITY

- In hindsight, a better opportunity for establishing an outlet channel in July may have been July 10th or the morning of July 11th, when the long-period south swell had subsided but before the breach occurred. However, based on available information (wave forecasts and no knowledge of the breach) the management action was enacted earlier, on July 8th, because the following days were Friday through Sunday when State Parks restricts beach access. Future outlet channel management opportunities are likely to face similarly constrained time windows: too soon after closure, the wave conditions which caused closure may prevent safe beach access and lagoon water levels will be less than the BO

targets; too late after closure and water levels may cause flooding or overtopping the beach berm. In addition to the State Parks weekend access constraints, operations are constrained by IHA rules, particularly before June 15th when pupping season ends.

- If the rocks embedded in the beach are essential for stabilizing against failure by scour, then the elevation of the rocks will largely determine the outlet channel bed elevation and lagoon water level. During the naturally established outlet channel which occurred from June 27th through July 3rd, the channel's bed elevation just before the beach face was 0-1 ft NGVD (July 1st Agency survey) and the lagoon water level was between 4.5 and 5 ft NGVD. Under these conditions, the outlet channel was able to convey approximately 300 ft^3/s.
- If an outlet channel had been in place at the start of the September-October large wave period, it quite likely would have closed since waves frequently overtopped the beach berm and even some full breaches were quickly closed. If the lagoon water level was close to or at the BO target 7 ft NGVD when the closure occurred and beach access was limited by wave conditions for multiple days, e.g. the five day period from September 26th to September 30th, the lagoon would likely have reached flood stage.
- Management actions attempting full breaching, which aim to convert the inlet between two of its stable modes (breached and closed) and which are informed by decades of management experience, still fail quite regularly. For example, in 2010, two of four breach attempts were unsuccessful and historically, one out of every three attempts have been unsuccessful (Behrens et al., in prep). We anticipate that the failure rate of efforts to create an outlet channel, a less common and less stable transitional state, to be at least as frequent, if not more frequent, than the failure rate for full breaches.

COMMUNICATION

- Continue the practice of developing and communicating a backup plan for the outlet channel management action in the event that surf conditions were unsafe at the preferred channel location. Communicating this backup plan ahead of time allowed time for discussion among the resource management team, reducing the potential for last minute disagreement if this option had to be enacted.
- Agency, NMFS, and ESA PWA staff consulted as to the specifics of the outlet channel implementation immediately before and during the excavation. This discussion was necessary because of uncertainty about the actual beach topography, the excavation progress relative to the tides, and the overall development of outlet channel strategy for this initial implementation. It enabled real-time adaptation to on-site constraints. For instance, the excavation's location was shifted slightly south of the prior channel's location to avoid large rocks known to be hidden within the berm. After following this alignment beyond the rocks, the excavation was guided northward so that the mouth of the outlet channel would be as close as possible to the prior location.
- After each management action, we suggest asking State Parks staff if operations had gone in accordance with their expectations with regard to parking lot use, public safety, sand placement, etc.

STAFFING

- The Agency's engineer on site had broad knowledge of the project objectives and operational constraints, enabling him to engage in discussion with the other on-site personnel (particularly the NMFS representative), observe physical conditions, and make real-time decisions about the outlet channel configuration. This presence and decision-making authority was essential since the management action was only defined ahead of time as a strategy, not construction-grade drawings.
- Develop capacity of other Agency staff to manage outlet channel operation so availability of informed decision-makers does not hinder management operations.
- Although equipment operators were new to the site, they adeptly executed outlet channel design as directed by Agency staff. Encourage the contractor to provide staff familiar with the project whenever possible.

EQUIPMENT AND OPERATIONS

- The backhoe excavator was more adept at operations adjacent to rock, the bulldozer was faster for areas with open sand. Particularly if operations occur over two days, consider choice of equipment. For example, on the first day, choose two bulldozers for speed in excavating a larger channel and replace one bulldozer with an excavator on the second day for more precise operations.
- Tides, daylight, and permits all restrict the time available for operations. To maximize time available for implementing management actions, consider the following procedures:
    - When possible, have key resource management team members discuss the operations plan ahead of time, ideally on-site the day before, or by phone if on-site is not practical.
    - Clarify staging procedure between equipment operators and engineering staff to reduce waiting
    - Consider the use of lights to enable equipment to operate under low-light conditions.
- Because rocks limit the outlet channel's alignment; having survey staff on-hand to stake locations of rocks covered by the sand was useful. Agency surveys should continue to monitor rock locations during monthly surveys.
- Equipment operators demonstrated good coordination between the pieces of equipment, with neither piece idle for an extended period. The two pieces smoothly switched the two primary tasks of channel excavation and feathering excavated material onto the beach face.
- Sand cleared from the outlet channel was left as a temporary berm at the mouth of the outlet channel to impede wave runup into the outlet channel. This berm was re-shaped just before finishing to open the outlet channel while still providing some protection from south swell.

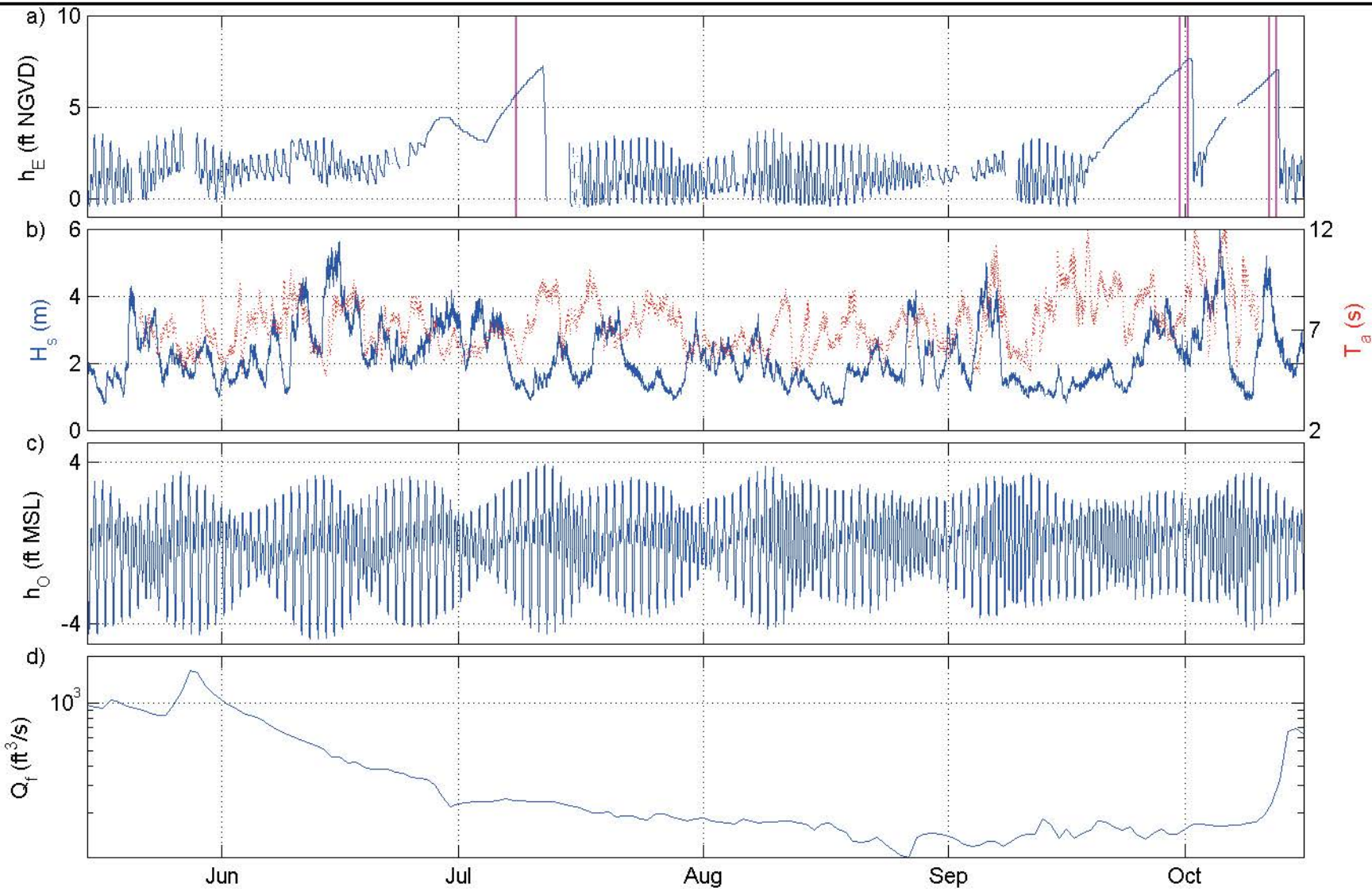
MONITORING

- Because the IHA limits the days available to place people on the beach to collect data, use the full two days allotted for outlet channel creation to collect additional data. For instance, consider having the survey team return at 12-hr intervals to take photographs and survey channel bathymetry and discharge.
- Consider an alternate automated camera placement to capture the northern portion of the beach.

REFERENCES

Behrens, D.K., F. A. Bombardelli, J. L. Largier, and E. Twohy. in preparation. Natural and human influences on tidal inlet closure in small bar-built estuaries

Fischenich, C. 2001. Stability thresholds for stream restoration materials. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-29). U.S. Army Engineer Research and Development Center, Vicksburg, MS.



Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)
d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 1
Russian River Estuary Outlet Channel Management Plan

Estuary and Ocean Conditions, May 15 - October 15 2010

PWA Ref# 1958.01

ESA PWA

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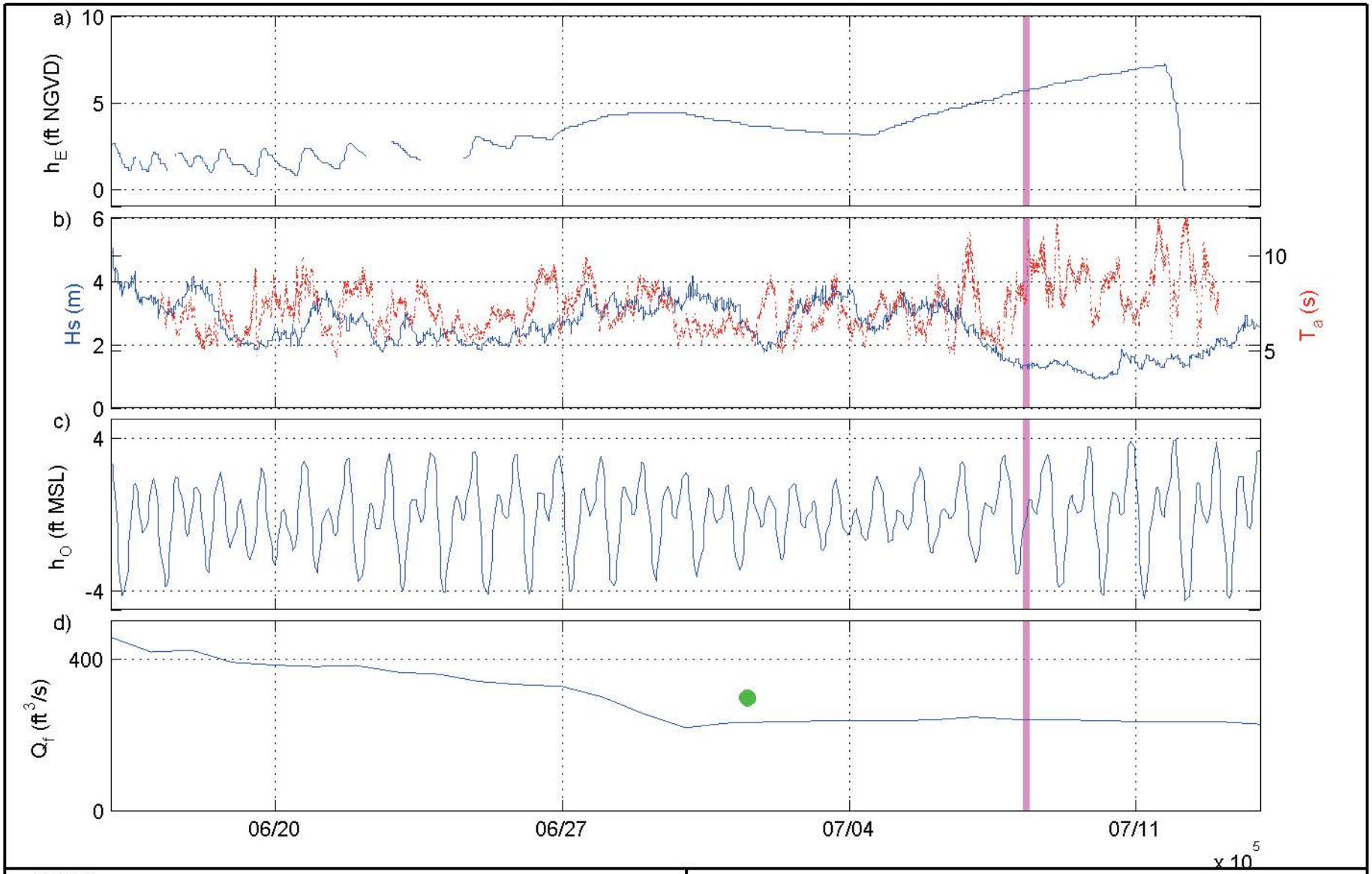

Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)
d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 2

Russian River Estuary Outlet Channel Management Plan

Estuary and Ocean Conditions, June - July 2010

PWA Ref# 1958.01

ESA PWA

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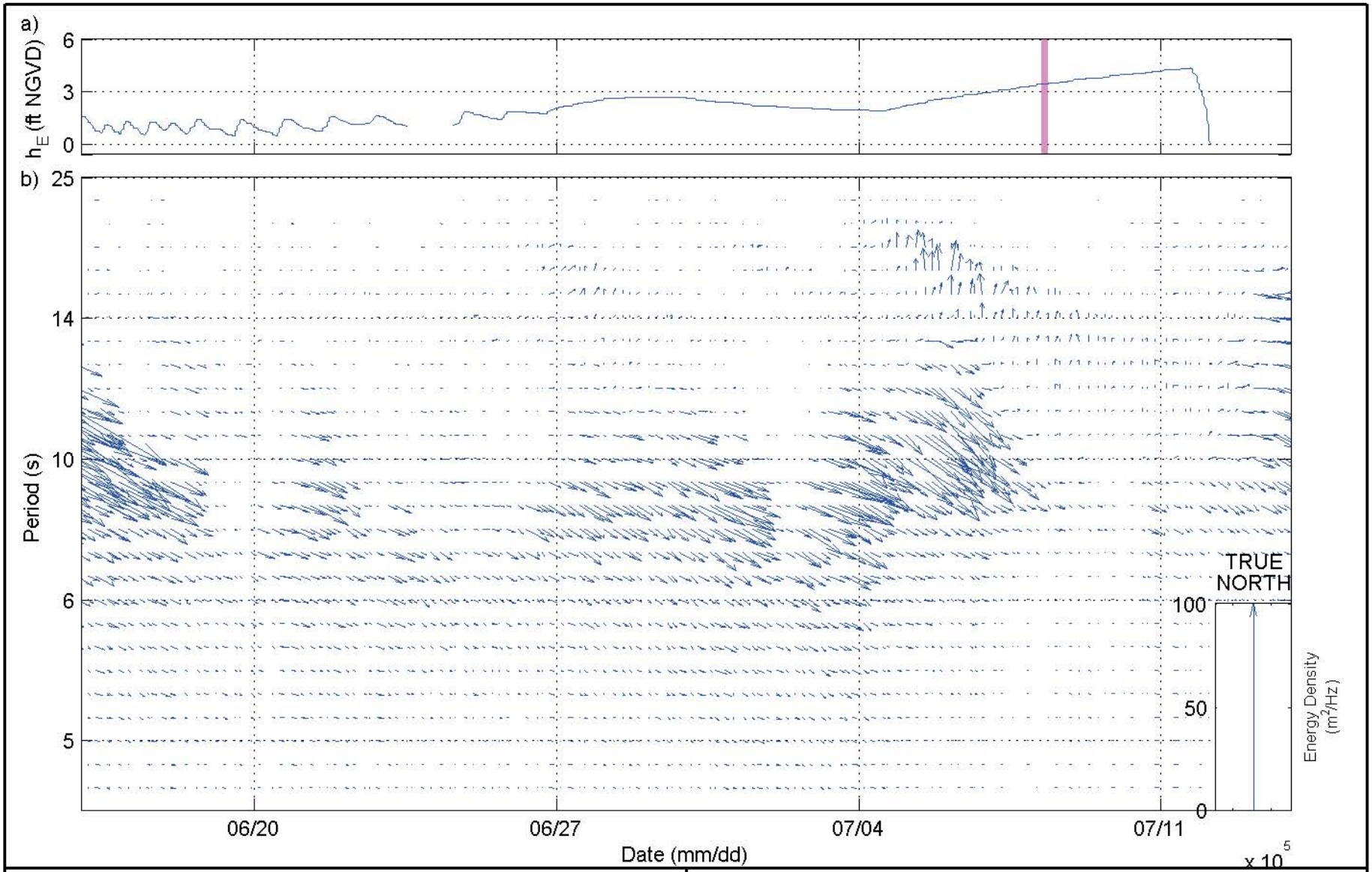

Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action

b) Wave magnitude and direction (CDIP, Pt. Reyes, #029)

Figure 3

Russian River Estuary Outlet Channel Management Plan

Estuary Water Level and Wave Energy/Direction Spectrum
JUNE-JULY 2010

PWA Ref# 1958.01

ESA PWA

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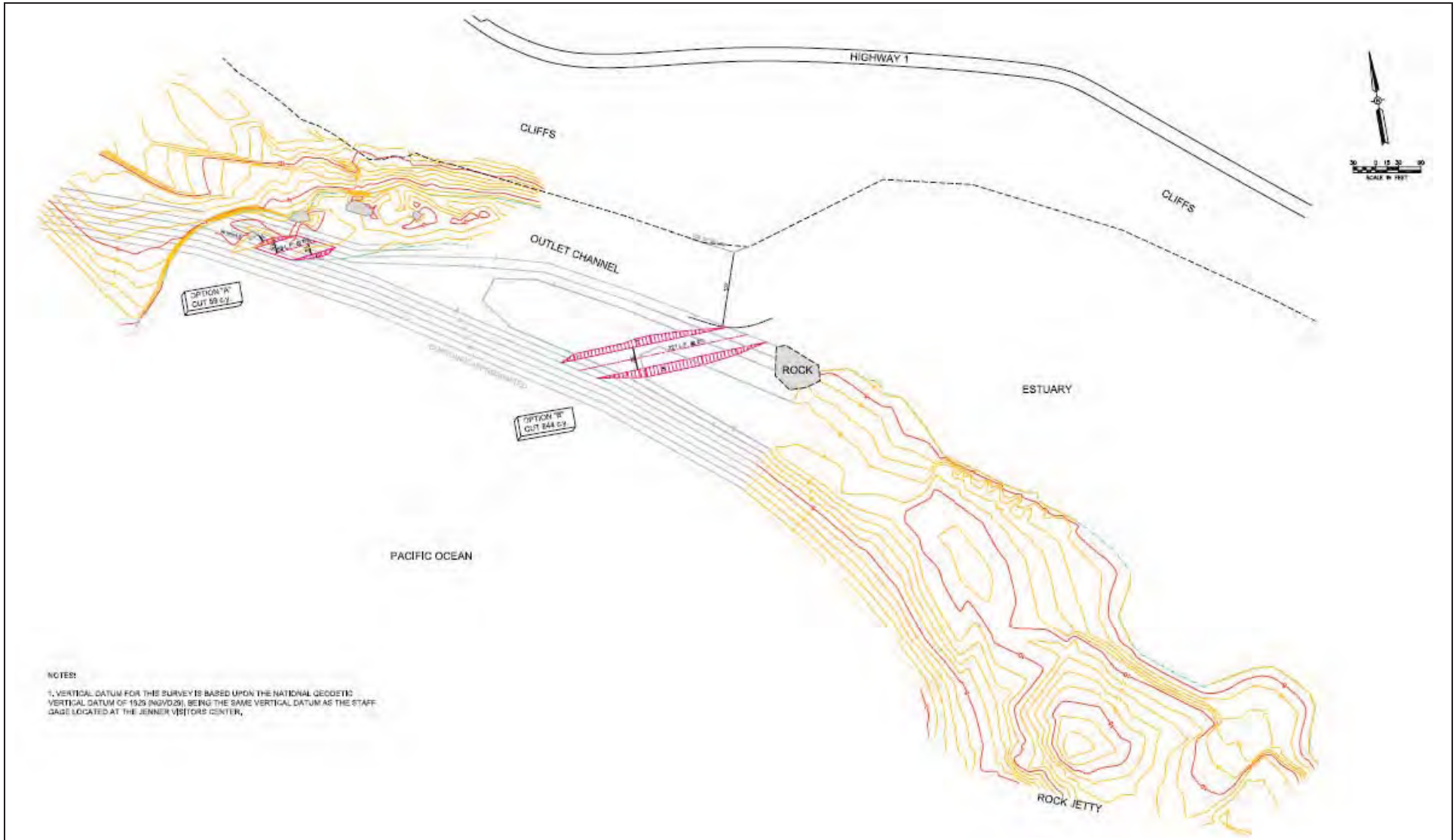


Source: SCWA

figure ***4***

Russian River Outlet Channel Adaptive Management Plan

Beach Topography and Management Options, June 2010

PWA Ref# 1958.01

ESA PWA

K:\projects\1958.01RREAMPOutletChannel\Task 8 Year 1 eval & 2011 plan\Year 1 eval memo\figs\FigX BeachTopoJune.doc

a)

b)

Source: C. Delaney, SCWA

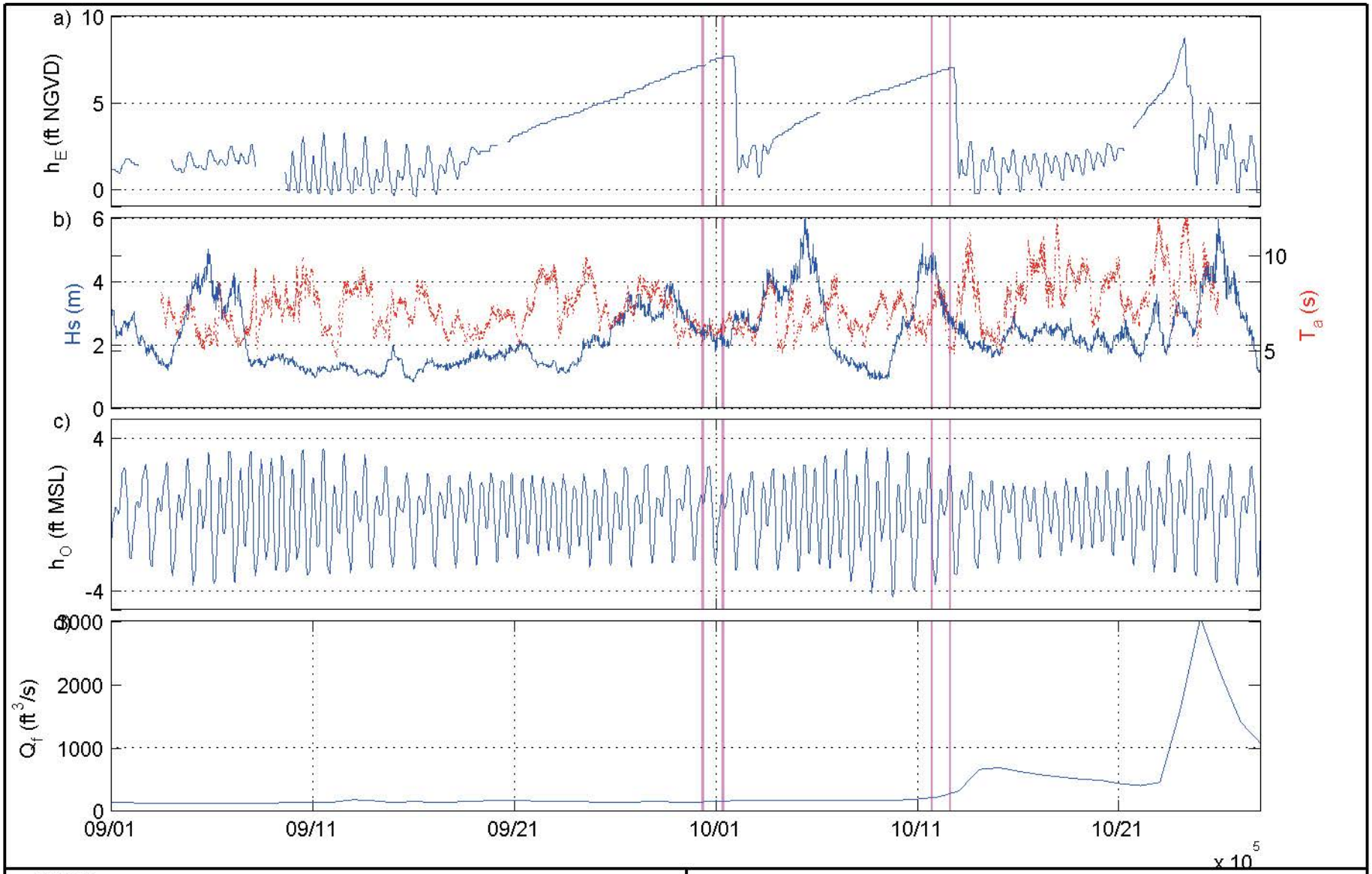
figure 5

Russian River Outlet Channel Adaptive Management Plan

Natural and Managed Outlet Channels

PWA Ref# 1958.01

ESA PWA



Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action
b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)
d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 6

Russian River Estuary Outlet Channel Management Plan

Estuary and Ocean Conditions, September - October 2010

PWA Ref# 1958.01

ESA PWA

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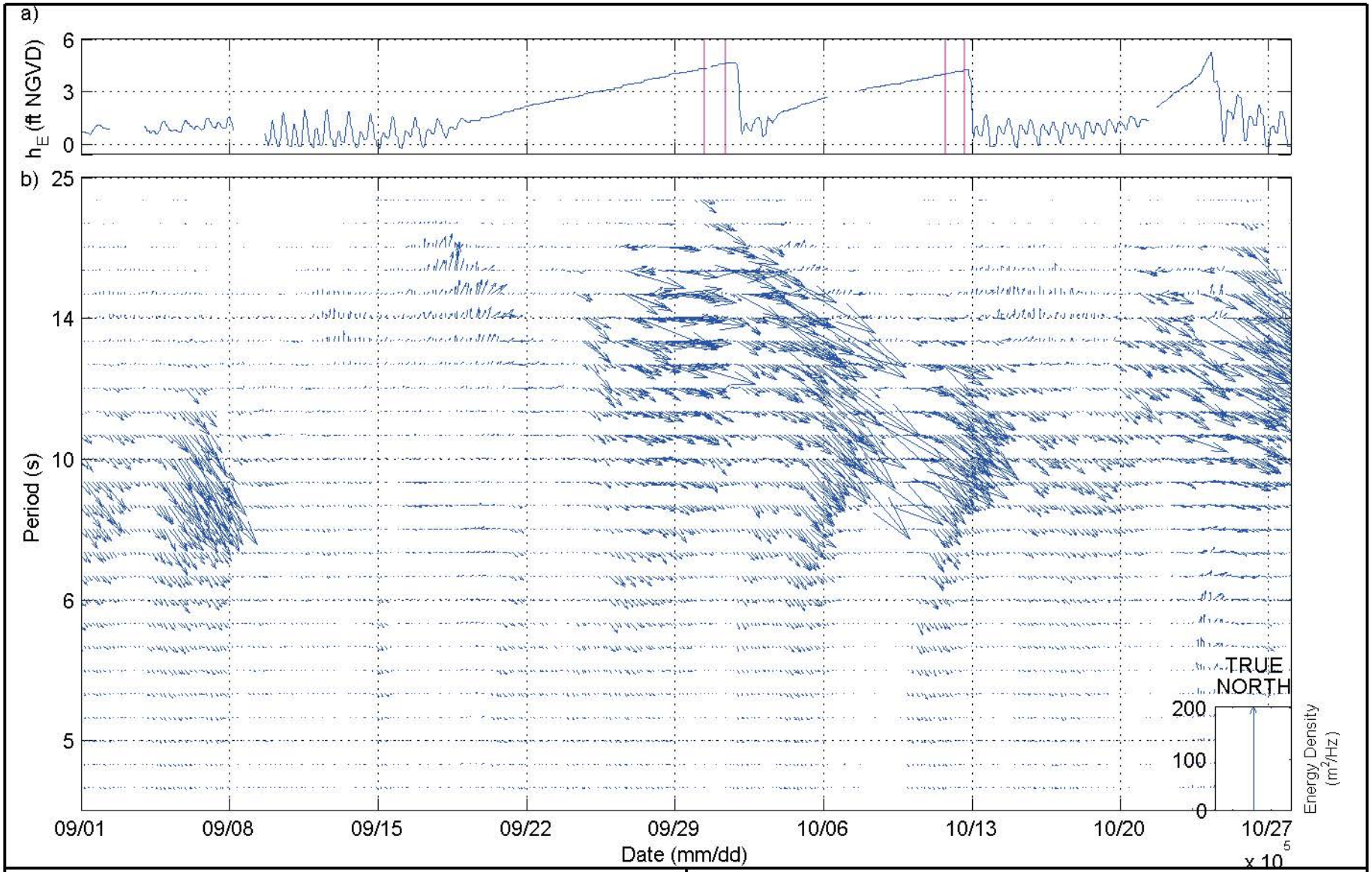


Sources:

a) h_E=estuary water level (SCWA); pink bar = mmgt action

b) Wave magnitude and direction (CDIP, Pt. Reyes, #029)

Figure 7

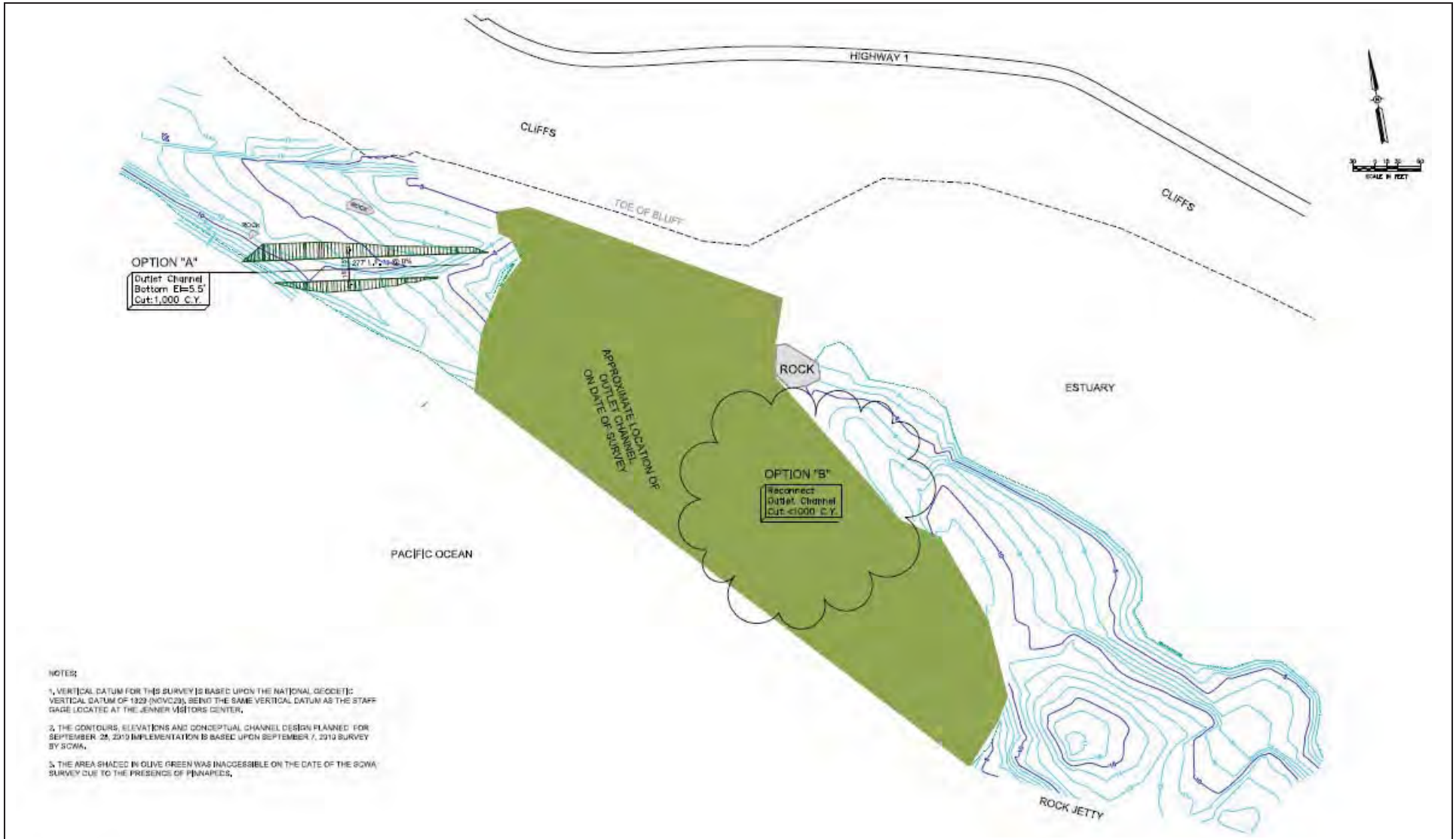
Russian River Estuary Outlet Channel Management Plan

Estuary Water Level and Wave Energy/Direction Spectrum
September-October 2010

PWA Ref# 1958.01

ESA PWA

K:\projects\1958.01RREAMPOutletChannel\Task 8 Year 1 eval & 2011 plan\Year 1 eval memo\mfiles\featherfigure.m



Source: SCWA

figure 8

Russian River Outlet Channel Adaptive Management Plan

Beach Topography and Management Options, September 2010

PWA Ref# 1958.01

ESA PWA

K:\projects\1958.01RREAMPOutletChannel\Task 8 Year 1 eval & 2011 plan\Year 1 eval memo\figs\FigX BeachTopoSept.doc

Attachment F. Physical Processes During the 2011 Management Period

As required by the Russian River Biological Opinion, Sonoma County Water Agency (Water Agency) has been tasked with managing a summer lagoon intended to improve salmonid habitat in the Russian River Estuary by creating an outlet channel while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised in 2010 and 2011. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2011, but no opportunities for management action occurred during the management period.

During the 2011 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. High river discharge in the first two months of the management period followed by the typical low wave energy conditions during the summer contributed to the inlet staying open for the first four months of the management period. Starting in late September, the inlet went through a succession of perched lagoon conditions and self breaches, during which the Water Agency closely monitored estuary conditions and considered management options. The perched episodes were short-lived, lasting no more than a week, and included a small outlet channel flowing along and sometimes through gaps in the jetty. The perched episodes ended when lagoon water levels increased, overtopped the beach berm, and scoured a new tidal channel. Since the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency did not take any management actions to encourage formation of an outlet channel.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2011 outlet channel management period examined water levels, ocean wave conditions, ocean water levels, riverine discharge, beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, DFG, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Gage failed near the end of July, and was replaced by early September.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk. (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel that formed in fall 2010. When discussing this parameter, both states are referred to as a 'closure'.) The inlet stability parameter presented by Behrens et al. (in publication) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The former is estimated from wave measurements and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (in publication) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

FALL PERCHED EPISODES AND SELF BREACHES

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. Prior to September, no inlet closures occurred, so lagoon water levels fluctuated in concert with ocean tides (Figure 1a). As shown in Figure 1d, discharge remained high for the first two months of the management period as a result of a wet spring, including precipitation in the start of June. River discharge did not drop below 400 ft^3/s until after June 15th and below 200 ft^3/s until after July 15th. This elevated discharge probably reduced the likelihood of inlet closure during the first two months of the management season even though some sizeable wave events occurred during these months (Figure 1b). In late July and particularly in August, wave energy was at the annual minimum, so tidal exchange was sufficient to maintain an open inlet. As typically occurs on the California

coast, wave energy increased starting in September, which eventually caused the estuary to perch six times, starting in late September and into November.

All six inlet perched lagoon episodes in fall 2011 lasted a week or less, ending when the estuary water levels reached 4-5 ft NGVD, overtopped the beach berm, and scoured a new tidal channel. Conditions during the perched lagoon episodes (September 22-29, October 3-8, October 10-14, November 3-8, November 10-12, and November 17-20) are shown in Figure 2. Although the management period ends on October 15th, conditions up through the end of November were reviewed since they were consistent with the inlet behavior that started in late September. Six instances of perched lagoon conditions are slightly higher than the average number of closures, 4.6, in September through November (ESA, 2011). However, a series of repeated perched episodes and self breaching is not common; since 1996, this pattern has only been observed only one other time, in 2006.

Consistent with the existing conceptual model described in Section 4 of the Management Plan, perched lagoon conditions typically occurred when both wave energy increased and tidal exchange decreased. All perched episodes occurred when the mean wave period was greater than 10 seconds and five perched episodes occurred when significant wave heights were greater than 12 ft. The October 10th episode coincided with wave heights of only 8 ft, but since these waves had long, 16-second periods and originated from the southwest, they still conveyed significant wave energy to the beach. Five of the 2011 episodes occurred during neap tides when the tide range was reduced to less than 5 ft (Figure 2c). When the tide range is less, tidal scour in the inlet is also less, making the inlet more susceptible to infill with sand. Only the November 10-12 episode occurred when the oceanic tide range was greater than 6 ft. All but the first episode occurred with riverine discharge elevated above 250 ft^3/s and the three November episodes occurred when riverine discharge was approximately 400 ft^3/s.

PERCHED LAGOON AND NATURAL BREACH DYNAMICS

As an example of a perched lagoon-breach cycle, Figure 3 shows a sequence of photos of the inlet before, during, and after the October 3-8 episode. As was the case for almost all of the management period, the inlet was located next to the jetty. Shortly before the episode, on September 30 (Figure 3a), the inlet had narrowed in width to approximately 30 feet.

The estuarine water level became muted starting on October 3 with the arrival of some larger, longer-period waves (Figure 2a and b). By October 5, a tidal signal was absent from the estuary and water levels began to rise. The inlet transformed into a small outlet channel running immediately adjacent to and among the rocks at the toe of the jetty (Figure 3b; Figure 4a). The outlet channel was narrow, with a width of approximately ten feet. When the channel reached the portion of the jetty which had been damaged, the channel turned south and flowed through the gap in the jetty (Figure 4b).

The jetty and rocks which had been a part of the jetty may have stabilized the outlet channel, both in sheltering the outlet channel from waves and by providing bank and bed stabilization that minimized channel scour. Sheltering by the jetty probably reduced berm build-up at the inlet's

location, leaving a low point in the beach berm that was the site for subsequent overtopping and self breaching. This small outlet channel, present from the start of the episode, contrasts with other historic closures that were more extensive. For these extensive closures, almost the entire inlet was filled with sand, with only a small indentation on the backside of the berm providing any indication of the inlet's prior location, and no outlet channel was present. All the 2011 episodes were less extensive, which left the beach berm more susceptible to self breaching.

Self breaching probably occurred when the estuary water level had risen sufficiently high that it overtopped the beach berm in the vicinity of the outlet channel. This overtopping increased the flow rate through the outlet channel and, in spite of any bank stabilization provided by the jetty and associated rocks, the increased flow rate scoured sand from the channel bed and banks. The enlarged channel was then sufficiently deep to allow tides and salt water to return to the estuary. Shortly after self breaching, the tidal channel was approximately 50 feet wide (Figure 3c), wider than it had been in the days preceding the episode. This channel enlargement is consistent with the self breaching mechanism as the higher flow, induced by the elevated estuary water levels during episode, scoured the channel.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2011 according to the method described in Behrens et al. (in publication). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 50 percent before each 2011 event (Figure 2a). Some 2011 episodes occurred quickly, transitioning from fully tidal to perched lagoon within a day, so the risk time series did not provide much forewarning in these cases. However the risk was elevated more than two days before the episodes on September 22, November 3, and November 17.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent is often limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which prohibits the survey crew from disturbing the marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at 1 ft intervals. The survey elevations are reported in the NGVD29 vertical datum, the working datum for estuary monitoring and management.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September) and 2011 (May to October) surveys. The locations of five

transects selected for analysis are shown in Figure 5. The locations include two transects backed by cliff (Figure 6 and Figure 7), two transects which extend into the estuary (Figure 8 and Figure 9), and a transect just north of the jetty (Figure 10).

This review focuses on the 2011 surveys when the surveys captured a clearer picture of beach evolution. However, the 2010 surveys are included in the transect plots for context. In general the crest elevations in 2010 were lower than 2011. The cause of the lower crest elevations is not known, but may the result of inter-annual variations in wave energy and littoral sediment supply. In addition, the inlet exhibited greater variation in its location in 2010, extending far to the north in July before moving south later by August. As the inlet opened and closed or changed location, it resulted in large changes in beach topography. For example, at Transect 4, the inlet's closure in early July 2010 is readily apparent as substantial increase in the berm's size between the 7/1/2010 and 7/8/2010 transect (Figure 6). The inlet's migration south is evident at Transect 3 (Figure 7) when the crest elevation drops from its 7/8/2010 profile to less than 4 ft NGVD on 8/3/2010. The inlet migration and gaps in the survey data yield little information for evaluating crest elevation evolution at most transects. However, there is sufficient data at Transect 4 to show a trend of increasing crest elevation during summer 2010.

The crest elevations of Transects 2, 3, and 4 steadily increased over the 2011 management period. This trend is consistent with seasonal patterns on many California beaches. After some initial increase from May to June, when wave energy was at the annual minimum in July and August, transect changes were minimal. Then berm building accelerated in the fall with the concurrent increase in wave energy (Figure 1), as indicated by the change between the August 15th survey and the September 19th survey. The largest change occurred between the September and October surveys, the period that also experienced the largest wave energy. Over the course of the management period, the crest moved landward at Transect 3 and Transect 4, with the exception of the October survey, when the crest moved seaward at Transect 3. This landward movement is opposite to the typical crest movement at other California beaches (Weigel, 1992) and may be indicative of additional processes affecting these transects, such as supply-limited alongshore transport. At Transects 1 and 2, the crest moved seaward as it built upwards, consistent with typical summer-time response.

Transect 0, which is located just north of and parallel to the jetty, had noticeably different elevations and evolution than the other transects. Compared to the other transects, crest elevations were highest at this transect for both 2010 and 2011. In addition, Transect 0 did not evolve during the management periods, as was observed at the other transects. The only significant change occurred during the winter between the 2010 and 2011 management periods. These two characteristics, the higher crest and lack of management period variability, suggest that the jetty shelters this portion of the beach from small to moderate waves that occur during the management period. Only the larger waves associated with winter storms may be sufficient to re-shape the beach berm near the jetty.

The changes to the beach berm at Transect 1 were intermediate between the monthly changes that occurred to the north (Transects 2-4) and the negligible change in berm elevation adjacent to the

jetty (Transect 0). Crest elevations at Transect 1 only increased between the September and October survey, the portion of the management period with the strongest wave energy. This suggests that the jetty may alter wave conditions over some distance from its location: Transect 1 is approximately 200 ft north of the jetty and outside of the area occupied by the inlet during most of the 2011 management period.

LESSONS LEARNED AND RECOMMENDATIONS

Based on observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- Elevated discharge in the late spring and early summer (greater than 400 ft^3/s until June 15th; greater than 200 ft^3/s until July 15th) reduced the likelihood for inlet closure at that time. However, multiple perched lagoon episodes occurred in the fall when riverine discharged exceeded 250 ft^3/s. This is consistent with Behrens et al. (in publication) that although discharge affects probability of closure, the threshold that prevents closure is likely in excess of 2,000 ft^3/s. A likely contributing factor to the fall perched episodes was the higher wave energy.
- The inlet moved south early in the management period, reaching the jetty in late May or early June, and remained there throughout the 2011 management period and the following winter. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- During the management period, steady growth of the beach berm was observed north of the jetty, consistent with typical beach berm building that occurs during the summer. However, the rate of berm growth appeared to decrease approximately 200 ft north of the jetty and was negligible immediately adjacent to the jetty.
- Although autumn wave events were large enough to create perched lagoon conditions, the beach berm remained at low elevations, approximately 5 ft NGVD. The inlet then self breached when rising estuary water levels overtopped the berm at this low point and scoured a new tidal channel.

OUTLET CHANNEL FEASIBILITY

- The jetty may shelter the inlet, making closure less likely and also limiting berm growth, which then maintains a low point for self breaching. When the lagoon self breaches, management actions cannot be implemented.
- Even if the inlet being near the jetty hinders formation of sustained lagoon and outlet channel conditions, management opportunities for re-locating the outlet channel are limited and constrained. At a minimum, creating an outlet channel further north from the jetty requires a full natural closure, absence of a low point in the beach berm near the jetty, and equipment access to the area north of the jetty.
- A small outlet channel formed during the fall perched lagoon episodes. However, it did not convey enough discharge to prevent lagoon water levels from rising at 0.8 ft/day.

- The outlet channel that formed during the perched lagoon episodes flowed along the jetty and among the disaggregated rock at the damaged end of the jetty. This rock from the jetty may have provided channel stabilization for the outlet channel, increasing the channel's resilience to scour.
- Once outlet channel discharge increased due to rising lagoon water levels, the discharge scoured a new channel, breaching the estuary to the tides. This behavior highlights the susceptibility of a sand bed outlet channel to scour, limiting conveyance capacity.
- The mere occurrence of a perched lagoon is not sufficient to provide an opportunity for outlet channel management; other factors may not permit management action. This point is highlighted by both the 2011 self breachings and the early fall closures in 2010, when continuing ocean swell precluded outlet channel management action. Over the first two years of effort to implement the outlet channel adaptive management plan, only one closure (July 2010), has been suited for outlet channel management action.

OPERATIONS

- When equipment operators visited the beach to plan a possible management action, they noted that the channel had incised a steep bank in the berm adjacent to the jetty (Figure 11), which would have made equipment access to any areas north of the jetty infeasible.

COMMUNICATIONS

- Although the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency began planning management actions as soon as the episodes occurred. Planning included heightened observations of inlet conditions by Water Agency staff, email updates to inform the resource management group, and pre-implementation meetings at the project site to refine plans for management action.

MONITORING

- The Water Agency's upgrades to monitoring the estuary (water levels and photographs available in real-time via the Internet) enhance both management planning and the ability to observe inlet processes.

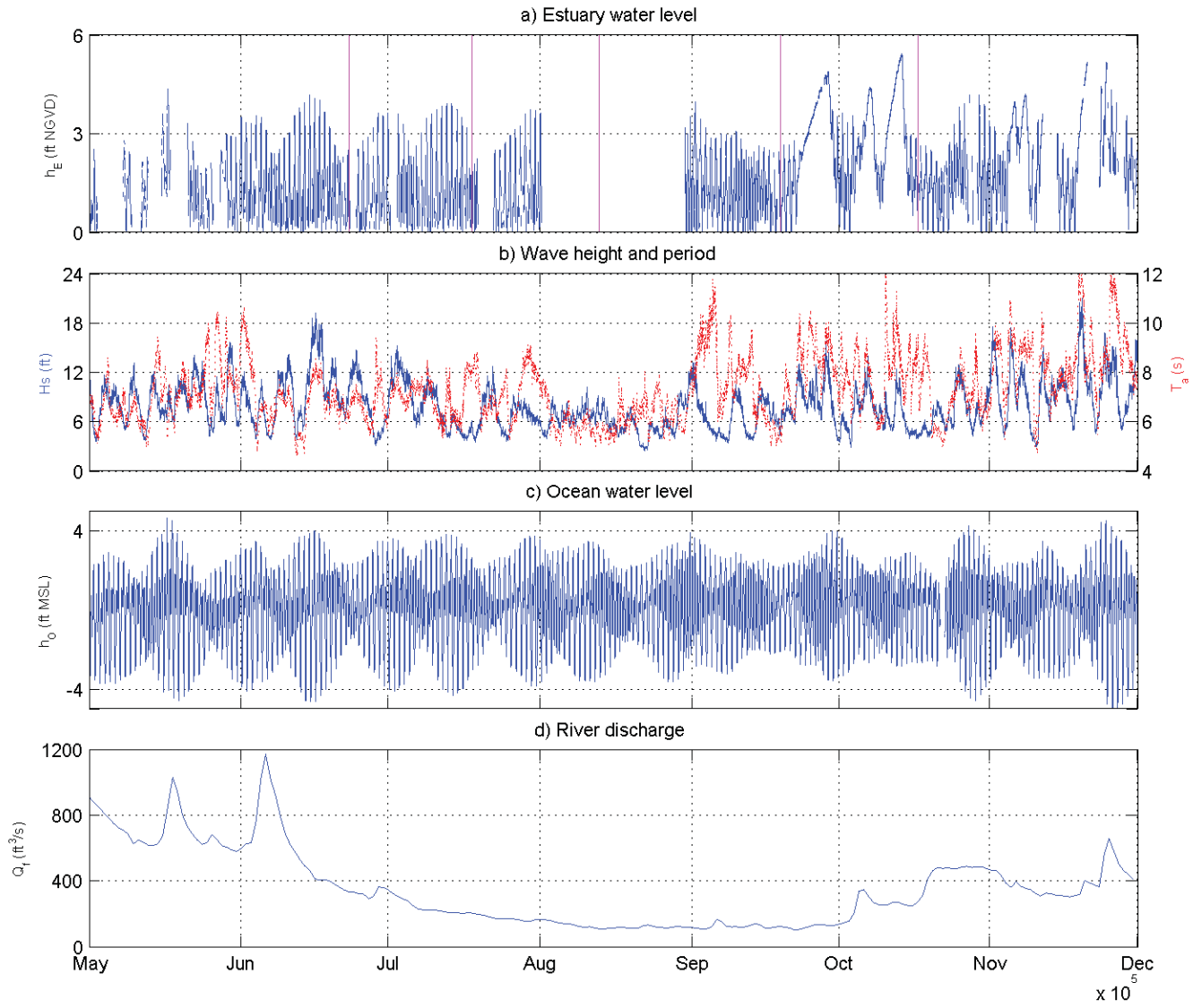
REFERENCES

Behrens, D., Bombardelli, F., Largier, J. and E. Twohy. 2009. Characterization of time and spatial scales of a migrating rivermouth. Geophysical Research Letters. Vol. 36, L09402, doi:10.1029/2008GL037025.

Behrens, D., Bombardelli, F., Largier, J. and Twohy, E. In publication. Episodic closure of the tidal inlet at the mouth of the Russian River – a small bar-built estuary in California. Geomorphology.

ESA. 2011. Russian River Estuary Management Project Environmental Impact Report. Prepared for Sonoma County Water Agency.

Weigel, R. 1992. Oceanographical Engineering.



SOURCE:

a) h_E=estuary water level (SCWA); pink bar = beach survey

b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)

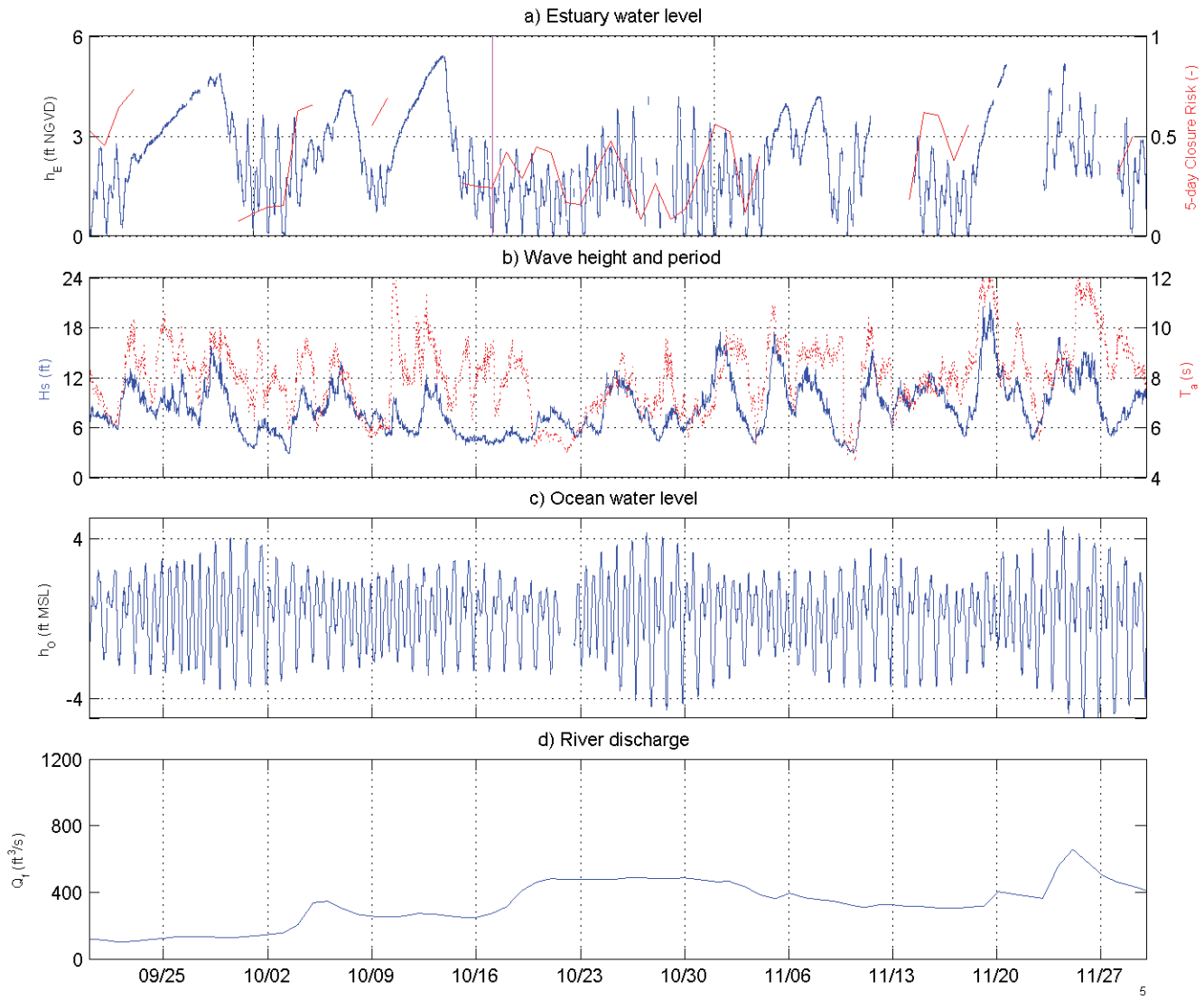
c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)

d) Q_f=river discharge (USGS, Guerneville #11467000)

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 1

Estuary, Ocean, and River Conditions
May - November 2011



SOURCE:

a) h_E=estuary water level (SCWA); pink bar = beach survey

b) H_s=sig. wave height; T_a=avg. wave period (CDIP, Pt. Reyes, #029)

c) h_O=ocean water level (NOAA, Pt. Reyes #9415020)

d) Q_f=river discharge (USGS, Guerneville #11467000)

Figure 2

Estuary, Ocean, and River Conditions
September - November 2011

a)

b)

c)

SOURCE: Bodega Marine Lab

Figure 3

Inlet State, September 30, October 6, and October 9, 2011

a)

b)

SOURCE: Sonoma County Water Agency

Figure 4

Outlet Channel Along and Through Jetty, September 26, 2011

Source: Sonoma County Water Agency survey data

N

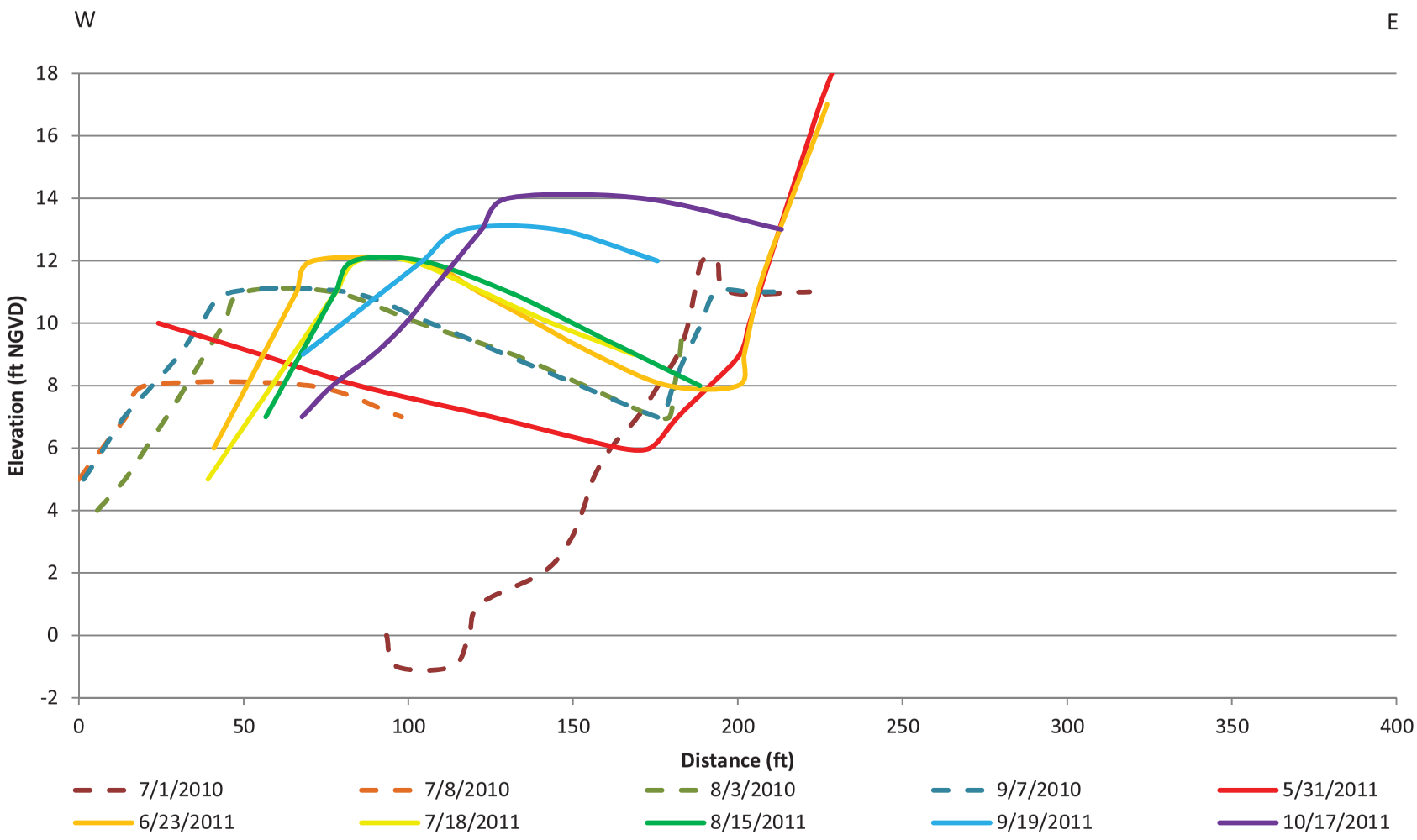
figure 5
Russian River Outlet
Channel Management Plan

Beach Topography Transect Locations

ESA PWA Ref# - DW01958

ESA PWA

Beach_topo.mxd



Source: Sonoma County Water Agency survey data

figure **6**

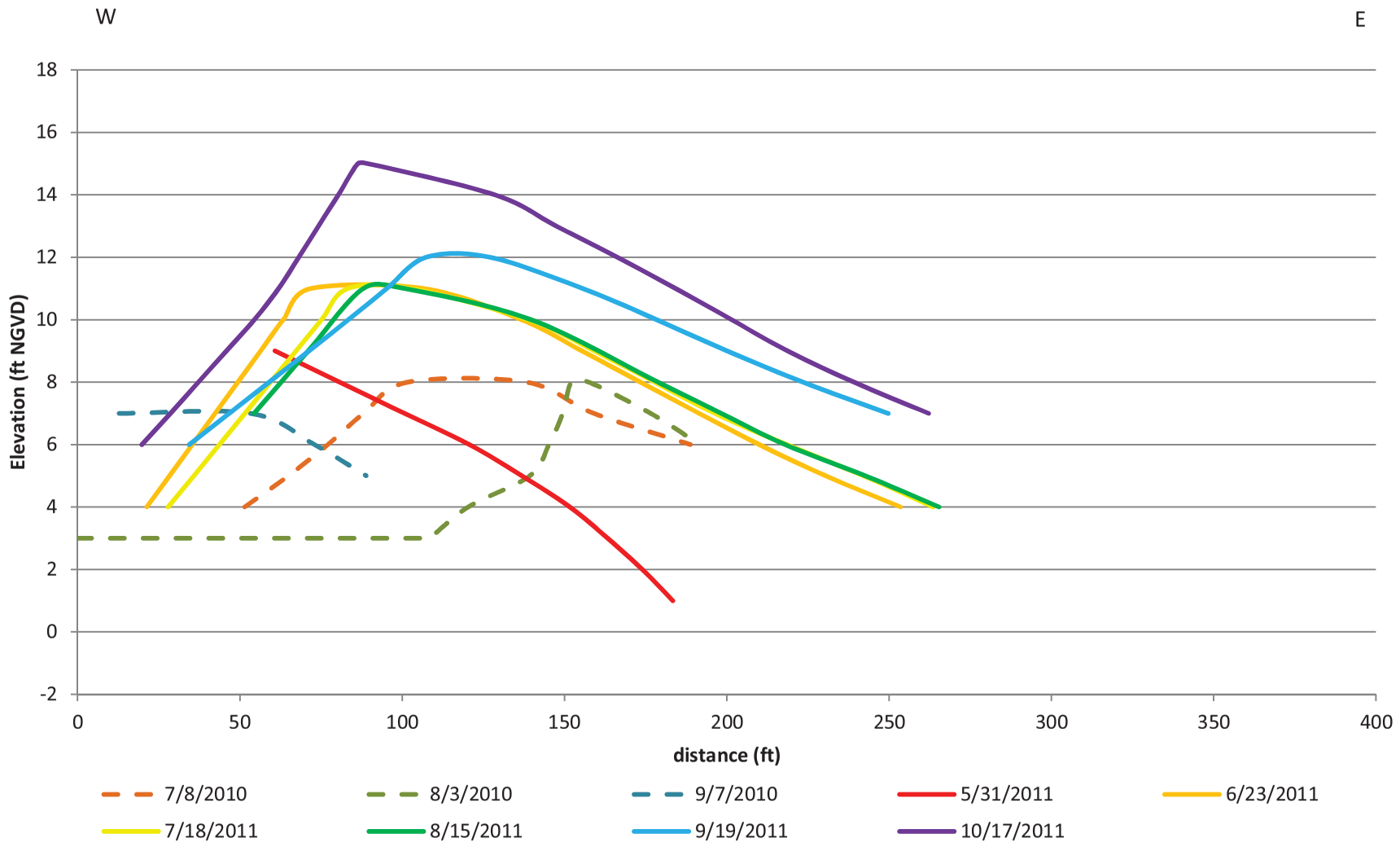
Russian River Outlet Channel Management Plan

Beach Transect 4

ESA PWA Ref #: DW01958

ESA PWA

Bathy_transects.xlsx / Transect4



Source: Sonoma County Water Agency survey data

figure 7

Russian River Outlet Channel Management Plan

Beach Transect 3

ESA PWA Ref #: DW01958

ESA PWA

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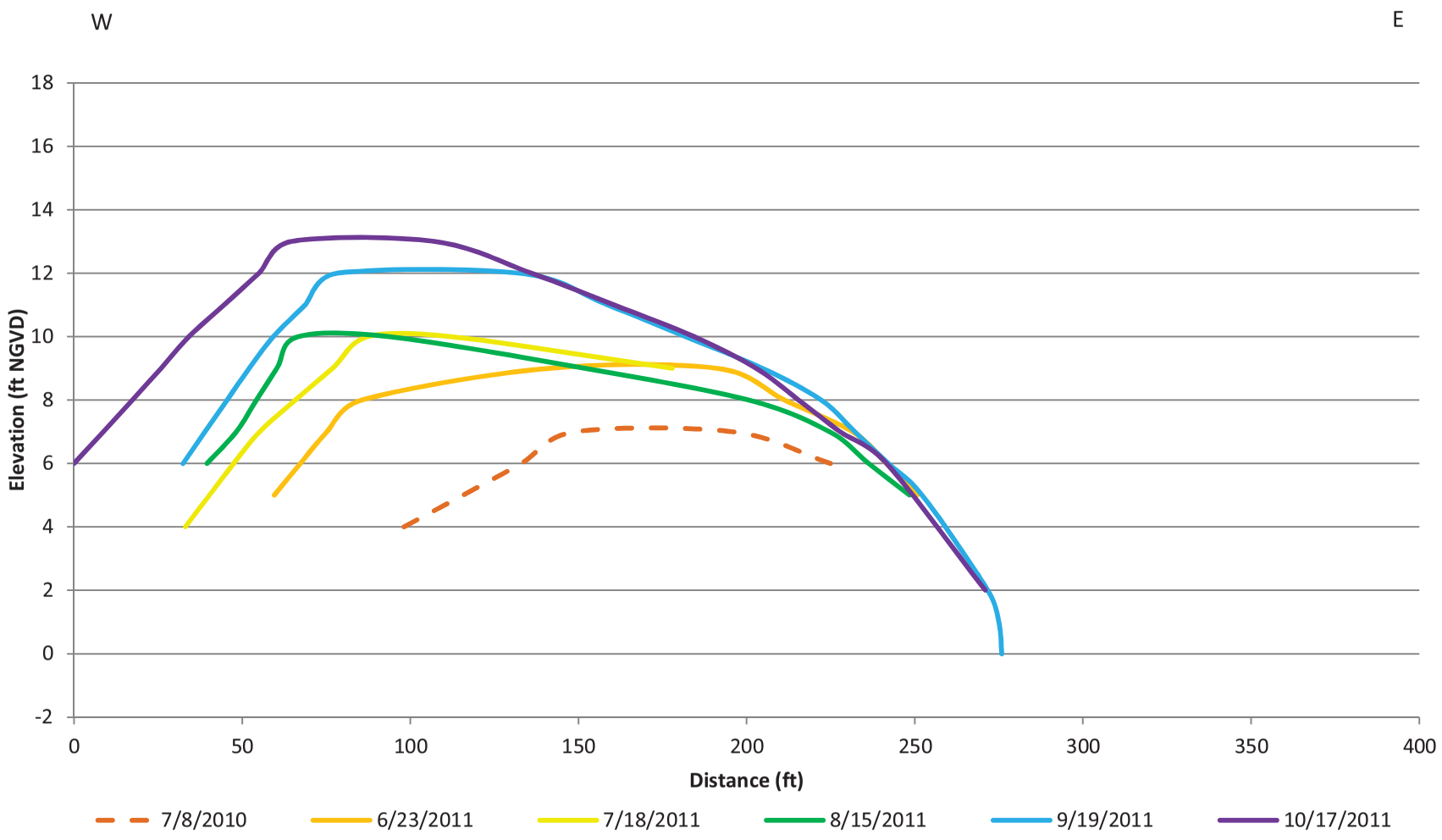

Source: Sonoma County Water Agency survey data

figure ***8***

Russian River Outlet Channel Management Plan

Beach Transect 2

ESA PWA Ref #: DW01958

ESA PWA

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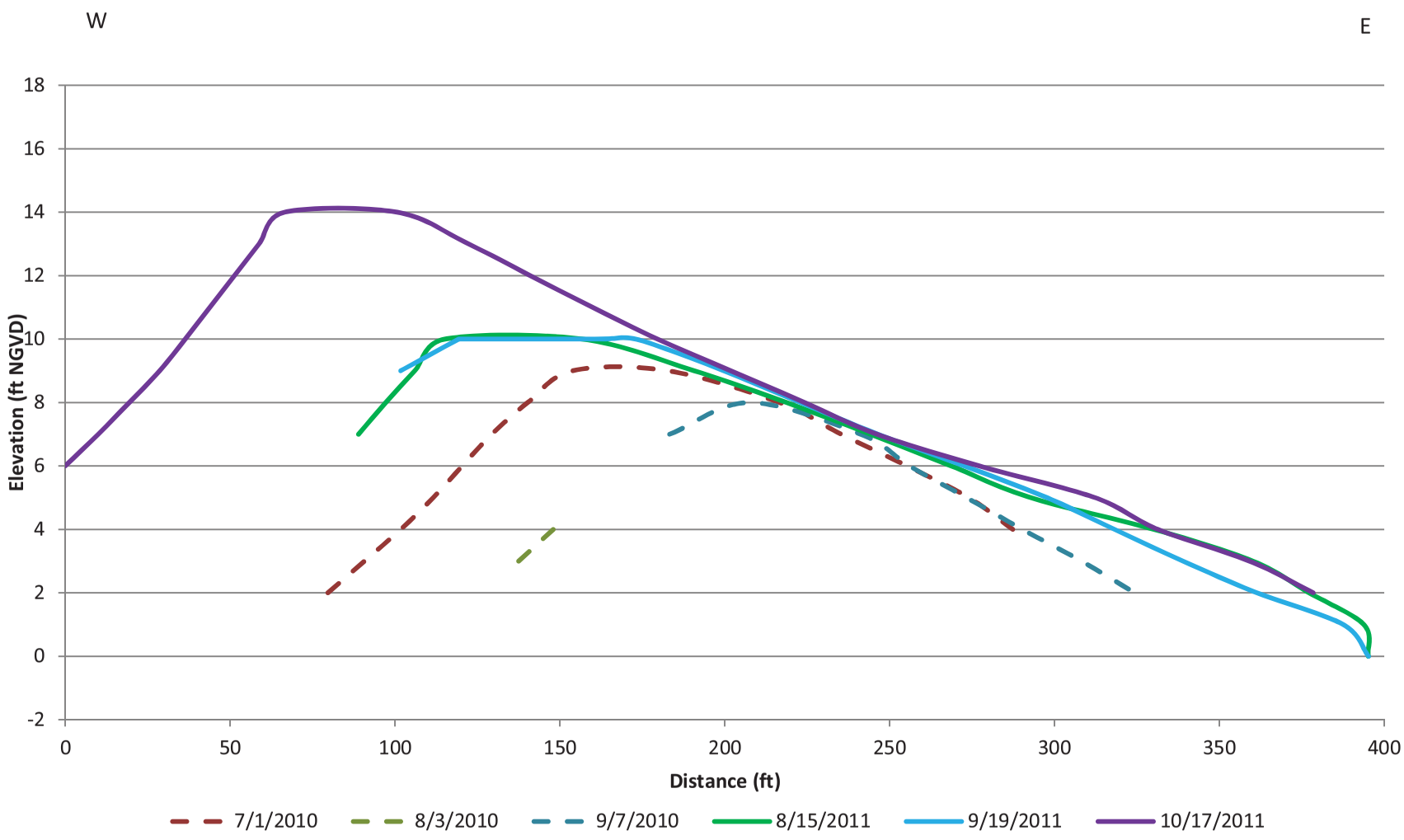


Source: Sonoma County Water Agency survey data

figure **9**

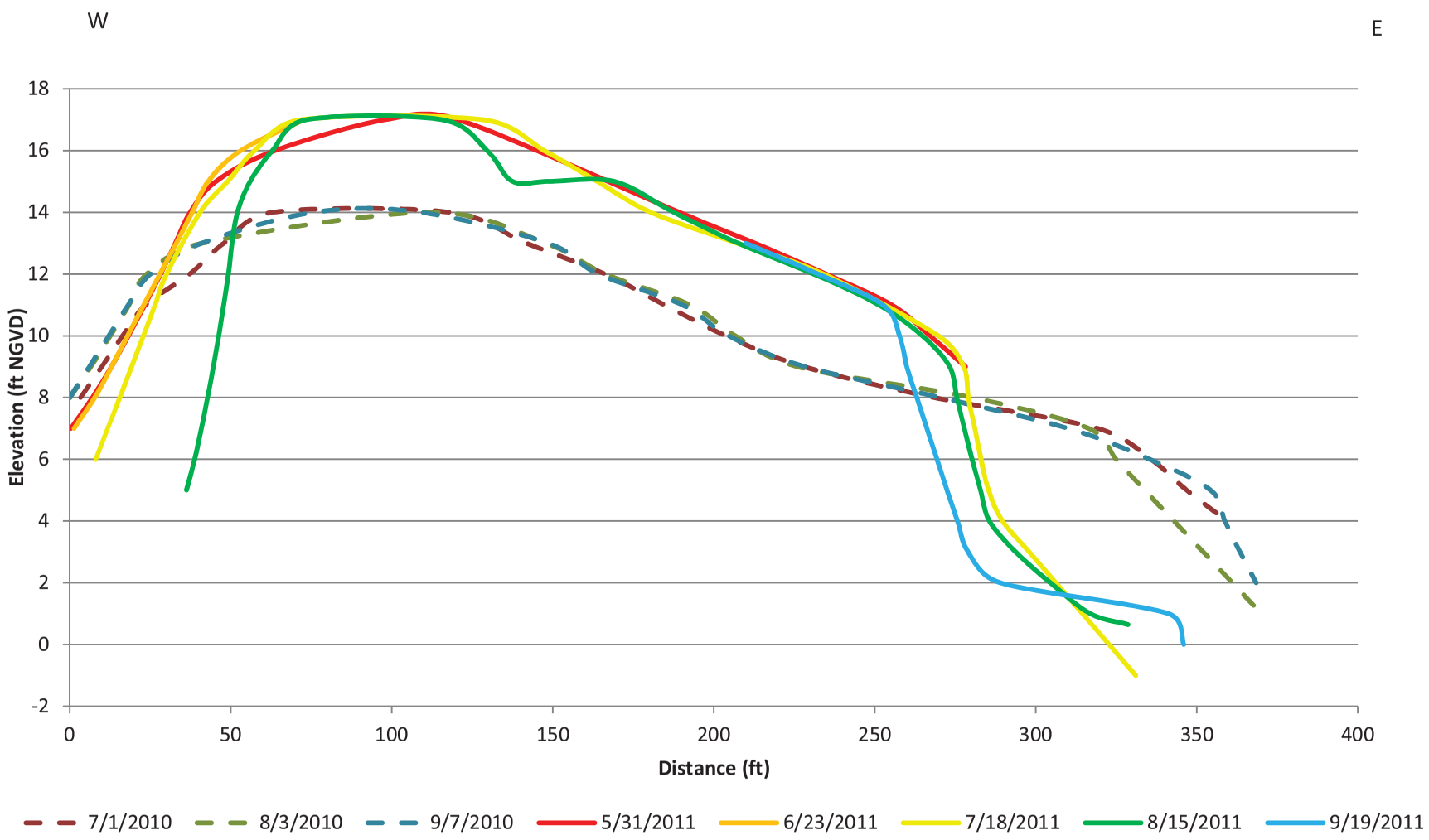
Russian River Outlet Channel Management Plan

Beach Transect 1

ESA PWA Ref #: DW01958

ESA PWA

Bathy_transects.xlsx / Transect1



Source: Sonoma County Water Agency survey data

figure ***10***

Russian River Outlet Channel Management Plan

Beach Transect 0

ESA PWA Ref #: DW01958

ESA PWA

Bathy_transects.xlsx / Transect0

SOURCE: Sonoma County Water Agency

Figure 11

Steep Berm Limiting Beach Access, September 26, 2011

Attachment G. Physical Processes During the 2012 Management Period

As required by the Russian River Biological Opinion, Sonoma County Water Agency (Water Agency) has been tasked with managing a summer lagoon intended to improve salmonid habitat in the Russian River Estuary by creating an outlet channel while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised annually in 2010-2013. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2012, but no opportunities for management action occurred during the management period.

During the 2012 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. Although the inlet experienced several closures, none resulted in water levels above 5.5 ft NGVD prior to self-breaching. For much of June and July, the inlet was either closed or only allowing heavily muted tides (tide range < 1 ft), but the lagoon water surface never surpassed 5 ft NGVD. During this time, each closure ended when lagoon water levels increased, overtopped the beach berm, and scoured a new tidal channel. Since these episodes did not evolve to the point that management action was warranted, the Water Agency did not take any management actions to encourage formation of an outlet channel. For the remainder of July, all of August, and the first half of September, the estuary was fully tidal. Then the inlet closed twice between September 20th and October 10th. Both closures were short-lived, lasting less than one week, and again the inlet self-breached, precluding any Water Agency management action. The highest lagoon water level of the 2012 management period, 5.25 ft NGVD, occurred at the end of the October closure.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2012 outlet channel management period examined water levels, ocean wave conditions, ocean water levels, riverine discharge, beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, DFG, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Data transmission failure due to cellular network issues occurred for several 1-5 day periods throughout the management period.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk (Behrens et al., 2013). (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel. When discussing this parameter, both states are referred to as a 'closure' in that tides are prevented from propagating into the estuary.) The inlet stability parameter presented by Behrens et al. (2013) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The wave-driven import is assessed using nearshore wave estimates derived from a transformation matrix and offshore buoy data (ESA PWA 2012) and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (2013) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

SUMMER AND FALL CLOSURES AND SELF-BREACHES

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. The lagoon water level time series (Figure 1a) summarizes the observed muted conditions in early summer and short-lived closure events that occurred at the end of the management period. As shown in Figure 1d, discharge remained high for the first two months of the management period. River discharge did not drop below 200 ft^3/s until after June 10th, at which time the estuary had already begun its muted tidal phase, leading up to four short-lived closures. This elevated discharge probably reduced the likelihood of inlet closure during the first 30-40 days of the management period (Figure 1d), despite the occurrence of energetic wave conditions in May (Figure 1b). Wave

energy reached a minimum in August and early September, but was weaker throughout the 2012 management period than in 2011. The hourly significant wave height was less than 8 ft for the majority of this period.

The conditions leading to inlet closure were consistent with the existing conceptual model described in Section 4 of the Management Plan. All closure events coincided with either moderately high waves (H_s > 6 ft) having periods greater than 10 s, or with neap oceanic tide ranges of less than approximately 5 ft. Moderately high waves coincided with the closure events in June, July, September and October. The first closure observed in June and both July closures coincided with neap tide conditions, although long-period swells occurred prior to the former of the two. Closure events that occurred in June and July are examined in more detail in Figure 2, while Figure 3 summarizes conditions that occurred later in September-November.

All closure events occurred with the inlet located adjacent to the jetty. This positioning may have prevented perched conditions from arising by shielding this area of the beach from the wave-driven sediment deposition that caused closure, preventing the beach from accreting to a sufficient height to allow the desired outlet channel elevations from being attained. The low point in the beach berm that was subsequently overtopped and self-breached also persisted immediately adjacent to the jetty.

PERCHED LAGOON AND SELF-BREACH DYNAMICS

During the June and July closures (Figure 2), as well as the late September closure (Figure 3), the lagoon water level only increased at approximately 0.3 ft/day. This slower increase probably occurred because a small outlet channel that flowed over the beach berm and through a gap in the jetty partially balanced inflowing river discharge.

As an example of one of the several inlet closure events that resulted in self-breaching prior to target outlet channel elevations, Figure 4 shows a sequence of photos of the inlet before, during, and after an episode from October 8-15. As was the case for all of the management period, the inlet was located next to the jetty. Prior to closure, the inlet had allowed only muted tides, resulting from a partial breach on October 2nd that did not restore full tidal action. Neap oceanic tides compounded this, and 7-ft high nearshore waves having a dominant period above 20 seconds closed the inlet on October 8th (Figure 3b,c).

After the onset of closure, the estuary water levels began to rise. For the first two days of closure, the water level increased at approximately 0.5 ft/day from 3 to 4 ft NGVD, but this decreased to less than 0.3 ft/day afterwards (lagoon stage above 4 ft NGVD). Waves deposited sediment adjacent to the gap in the jetty structure, blocking outflows from the lagoon that had occurred in prior closures (Figure 4b). This partially-formed barrier berm was overtopped when the lagoon reached approximately 5.25 ft on October 15th (Figure 4c). The outlet channel was narrow, with a width of less than ten feet. This overtopping event coincided with a spring phase of the oceanic tides, which generated a large head difference between the estuary and ocean waters. This head difference presumably contributed to channel flow velocities exceeding the threshold for scouring the beach sand, since the spring lower-low tide on October 16th resulted in the small channel

eroding the barrier and creating a new inlet (Figure 4d). After the initial breach, the increased flow rate scoured sand from the channel bed and banks, and the channel increased to more than 20 feet in width (Figure 4d).

The jetty and rocks which had been a part of the jetty appeared to have a significant influence on the geomorphic evolution of the channel. At times, the jetty elements may have stabilized the outlet channel, both in sheltering the outlet channel from waves and by providing bank and bed stabilization that minimized channel scour. Wave sheltering by the jetty probably reduced berm build-up at the inlet's location, leaving a low point in the beach berm that was the site for subsequent overtopping and self-breaching. Of the six closure events that occurred within the management period, all experienced a similar breaching pattern, self-scouring a tidal inlet before estuary water levels reached 5.5 ft NGVD. This was also true of the two closure events which occurred in November, following the management period (Figure 3). At times, the outlet channel flowed through notch in the jetty (Figure 5), such that the rocks probably provided stabilization that prevented bed scour. The jetty also halted lateral scour to the south. However, once lateral scour is halted, the channel may then maintain its cross-sectional area by scouring downward where it runs parallel to the jetty.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2012 according to the method described in Behrens et al. (2013). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 50 percent before each 2012 event (Figure 1e, Figure 2e, and Figure 3e). The closure event initiated on July 1st occurred quickly, transitioning from fully tidal to fully closed within a day, so the risk time series did not provide much forewarning in this case. This was also true of two closure events occurring outside of the management period, in November 2012. However, for all other events observed from June to November, the predicted probability of closure exceeded 50% 2-5 days in advance of each closure. There were no instances during the management period when the predicted probability of closure exceeded 50% and a closure did not occur within 5 days.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent can be limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which sets guidelines for the survey crew's disturbance to marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at

1 ft intervals. The survey elevations are reported in the NGVD29 vertical datum, the working datum for estuary monitoring and management.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September), 2011 (May to October), and 2012 (May to October) surveys. Surveys from November 2011 to May 2012 were also compared, to assess winter-time changes of beach shape. Survey transects from the 2011 analysis were reused (Figure 6), and include two transects backed by cliff (Figure 7 and Figure 8), one transect which extends into the estuary (Figure 9), and two transects just north of the jetty (Figure 10).

This review focuses on the 2012 surveys, although the 2010 and 2011 surveys are included for context. Compared with both 2010 and 2011, the 2012 topographic data indicate that the beach berm was less variable in shape than in previous years. This is especially true of the northern two transects (Figures 7 and 8), and to a lesser extent at Transect 2 (Figure 9). Because of inlet and seal haulout locations, topographic data were not collected in the vicinity of Transect 1 in 2012, so this is not included in the analysis. Adjacent to the jetty groin, Transect 0 showed little monthly change in topography, but extensive inter-annual variability.

During the management period in 2012, the beach berm along transects 2, 3, and 4 showed little variability, changing by less than two feet. The profile along Transect 2 (Figure 9) showed a slight aggradation trend over the course of the management period, but at Transects 3 and 4, the change in shape fluctuated only slightly (Figures 7 and 8). In contrast, between May 2011 and October 2011, the beach berm at these transects built in size by more than 6 feet. The difference in monthly variability at the northern transects between the 2011 and 2012 management periods can likely be tied to the difference in the extent of inlet migration. In 2011, the inlet migrated north of Haystack Rock during the winter, and returned to the jetty in late spring or early summer. This migration resulted in a lower beach profile at all transects. Over the course of the management period, the beach gradually built up to a typical summer profile. Even during the peak winter and spring flows of 2012, the inlet never migrated north of Haystack Rock, leaving a largely-intact beach berm north of Haystack Rock and a lower terrace between Haystack Rock and the jetty groin. Since these northern transects started at a much higher elevation at the start of the management period, the vertical growth of the beach profiles at these locations were several feet less than during the previous year in the same locations.

Transect 0, which is located just north of and parallel to the jetty, had noticeably different elevations and evolution than the other transects during the 2012 management period. Compared to the other transects, crest elevations were highest at this transect for both 2010 and 2011. This was not the case in 2012, when the northernmost two transects were the highest. The crest elevation at Transect 0 did not evolve during the management periods in 2010 and 2011, but was observed to erode between August and October in 2012. Images from the BML stationary camera indicate that this was the result of the inlet shifting from a sinuous alignment (resulting from southward migration) to a straight alignment running nearly parallel to the jetty. The only significant changes occurred during the winter between each of the management periods. The lack of management period variability of this region suggests that the jetty shelters this portion of

the beach from small to moderate waves that occur during the management period. Only the larger waves associated with winter storms may be sufficient to re-shape the beach berm near the jetty.

Water Agency surveys taken during the months preceding the 2012 management period (November 2011 to April 2012, Figure 11) show more variability in beach berm height and width than was observed for the 2012 management period (Figure 9). The highest beach crests observed during the 12-month period from November 2011 to October 2012 occurred in November and December 2011, peaking between 14 and 15 ft NAVD88 at Transect 2 (Figure 11). This is consistent with the combination of high-energy, long-period swell waves and generally low fluvial flows during the late fall. By the February 2012 survey, erosion significantly reduced the beach crest elevation. This erosion is likely due to fluvial flows through the inlet at Transect 2. Farther north, at Transect 3, there was less influence from the inlet, and there appeared to be less erosion during winter 2011-12 (Figure 12). The berm crest was highest in late spring (March and May profiles) and in November 2012, peaking between 16 and 17 ft NAVD88. The difference between the evolution of Transects 2 and 3 may be a result of the inlet's lack of migration in 2012, or possibly a difference in the amount of wave exposure between locations.

Water Agency surveys were also used to assess the beach width at Transect 3. We focus on Transect 3, because the influence of the inlet caused the beach to be consistently lower at other transects, sometimes as low as the intertidal zone, where survey data were not consistently collected. The Transect 3 beach width was as the horizontal distance between a particular elevation on the ocean and estuary sides of the beach face, respectively. From November 2011 to June 2012, the beach width at the 12 ft NAVD88 elevation varied from 110 to 145 feet, showing signs of both narrowing and widening during the winter and spring (Figure 13). From June to August 2012, the beach width grew steadily from about 110 ft to 145 ft and appeared to remain at this width though November 2012. At an elevation of 14 ft NAVD88, the width followed the same pattern, but had larger fluctuations, varying from roughly 30 to 110 ft and grew steadily from June 2012 onward. These observations underscore the typical pattern of beach building in summer, but also indicate that waves in winter can build the beach between destructive events.

LESSONS LEARNED AND RECOMMENDATIONS

Based on observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- Elevated discharge in the late spring (greater than 200 ft^3/s until June 10th) may have reduced the likelihood for inlet closure in May, although the wave climate at this time was also significantly weaker than during the previous year.
- Several short-lived closure events occurred, but waves never built up the minimum crest height (the limiting height for closure) beyond 5.5 ft NGVD, and all events ended with

self-breaches below this elevation. This prevented management actions from being taken during the 2012 season.

- The inlet never migrated north of Haystack Rock during peak winter floods, and returned to the jetty in early spring, much earlier than in most years. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- During the management period, most of the beach north of Haystack Rock underwent little topographic change. A transect adjacent to Haystack Rock aggraded slightly, consistent with typical beach berm building that occurs during the summer. Adjacent to the jetty, the berm did not aggrade, but rather remained largely unchanged for most of the season and then later eroded between August and October as a result of a shift in the inlet alignment.
- The wave climate remained weak throughout much of the summer and fall, which may have stunted the growth of the beach crest in the vicinity of the jetty (the location of the inlet throughout the 2012 season), preventing lagoon water levels from reaching levels conducive of the planned outlet channel.
- When an outlet channel is present, oceanic tide conditions can encourage scouring and formation of a new tidal inlet. During the spring phase of the tide, the lower-low tide creates a large head difference between the lagoon and ocean, likely increasing the flow velocity in the channel.

OUTLET CHANNEL FEASIBILITY

- The jetty may shelter the inlet, making closure less likely and also limiting berm growth, which then maintains a low point for self-breaching. When the inlet is in a fully or muted tidal condition, options for management become considerably more difficult to implement.
- An outlet channel that was intermittently observed during the 2012 closures conveyed a portion of the inflowing river discharge, slowing the rise in lagoon water levels to approximately 0.3 ft/day. This channel flowed through a gap in the jetty, whose large rocks likely provided some degree of channel stabilization against scour. However, this condition changed with lagoon levels, as described below.
- Once outlet channel discharge increased due to rising lagoon water levels or low oceanic tides, the discharge scoured a new channel, breaching the estuary to the tides. This behavior highlights the susceptibility of a sand bed outlet channel to scour, limiting conveyance capacity.
- Even if the inlet being near the jetty hinders formation of sustained lagoon and outlet channel conditions, management opportunities for re-locating the outlet channel are limited and constrained. At a minimum, creating an outlet channel further north from the jetty requires a full natural closure, absence of a low point in the beach berm near the jetty, and equipment access to the area north of the jetty.
- Over the first three years of effort to implement the outlet channel adaptive management plan, only one closure (July 2010), has been suited for outlet channel management action.

COMMUNICATIONS

- Although the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency began planning management actions as soon as the

episodes occurred. Planning included heightened observations of inlet conditions by Water Agency staff, email updates to inform the resource management group, and pre-implementation meetings at the project site to refine plans for management action.

MONITORING

- The Agency's month survey methods should be modified to collect specified contours, such as the beach berm ridge line, wetted edge (beach side), and water edge (estuary side).

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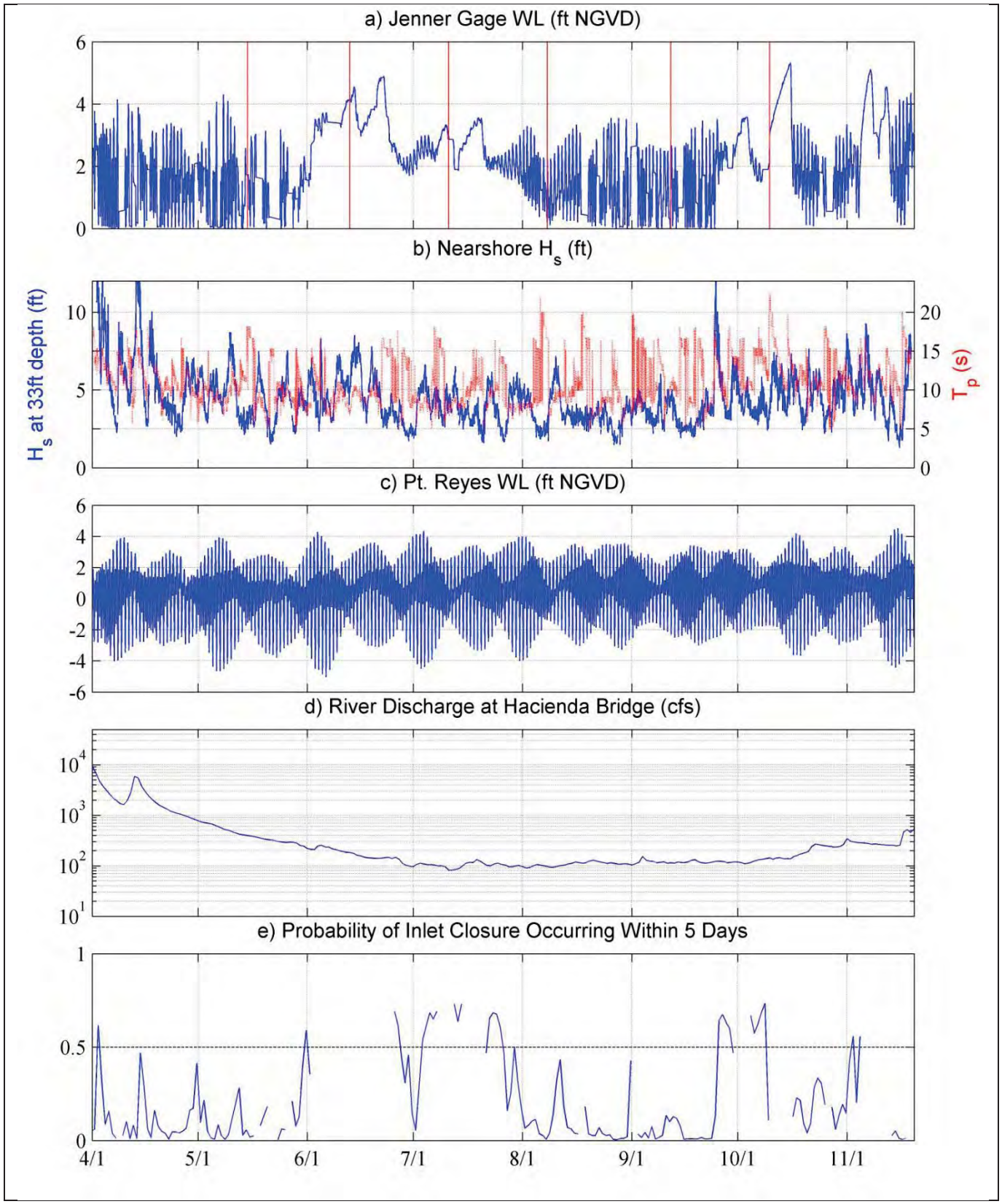
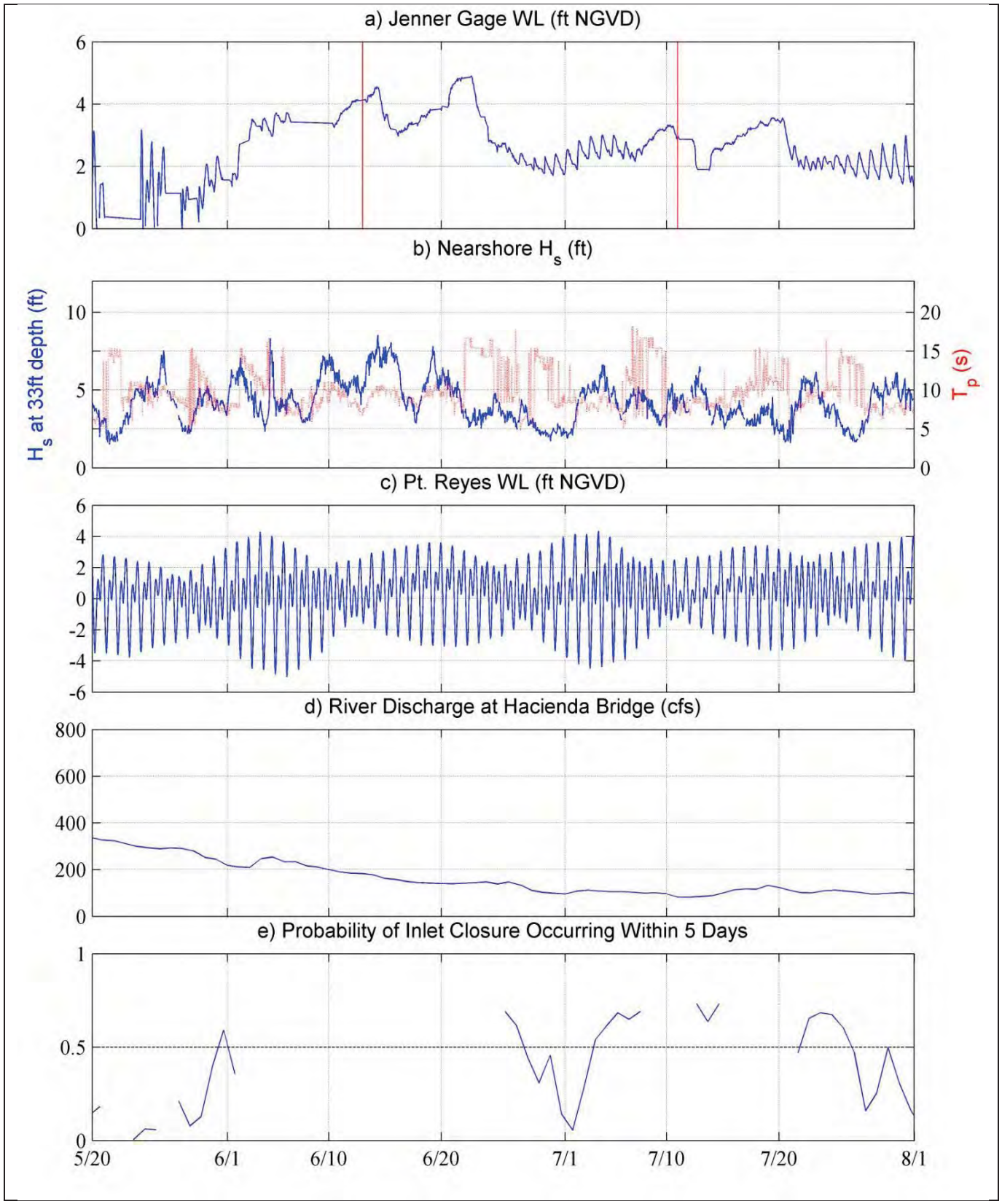


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 1

Estuary, Ocean, and River Conditions Compared with Closure Probability: September – November 2012

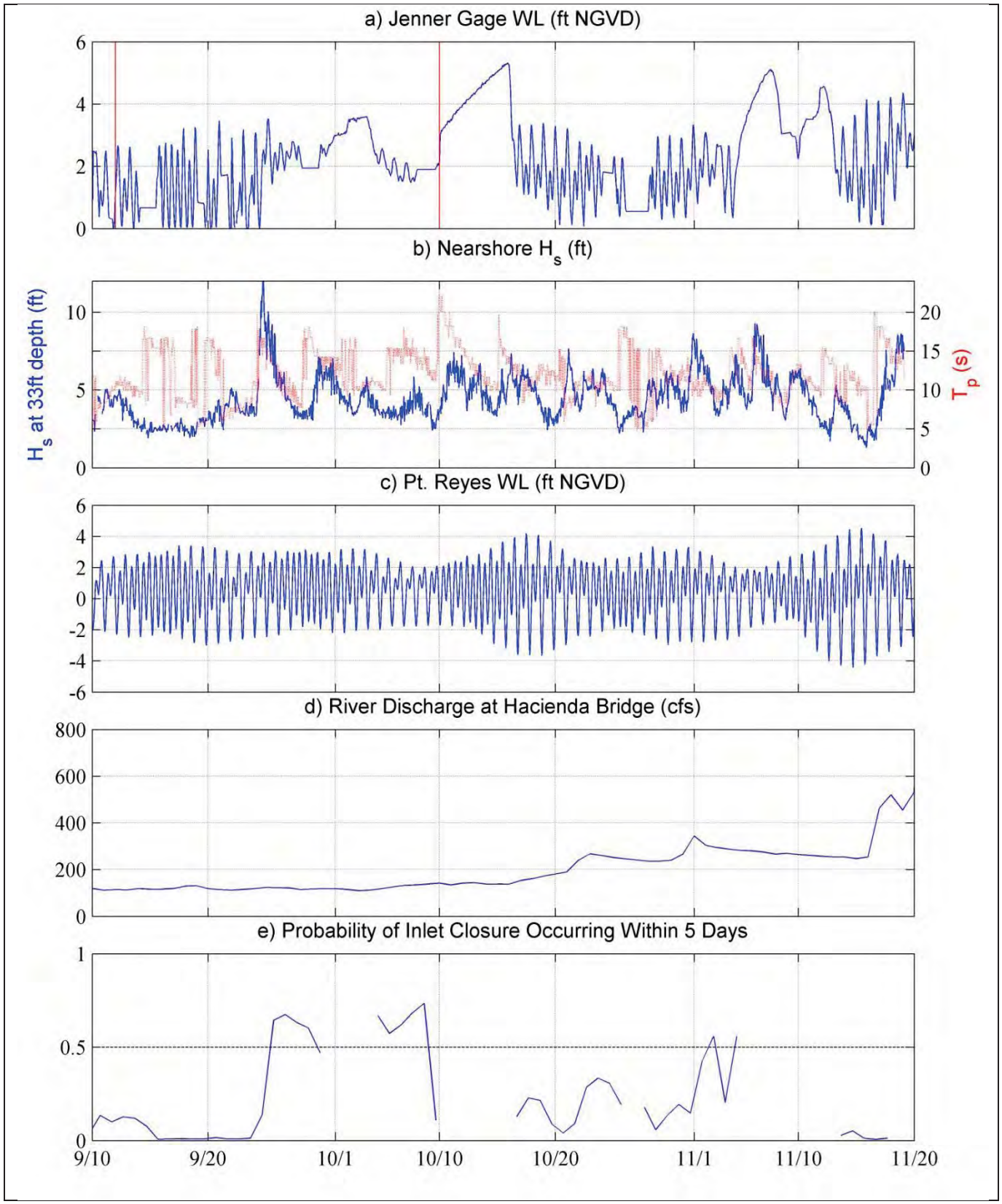


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; T_p=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 2

Estuary, Ocean, and River Conditions Compared with Closure Probability: May 20 – August 1, 2012

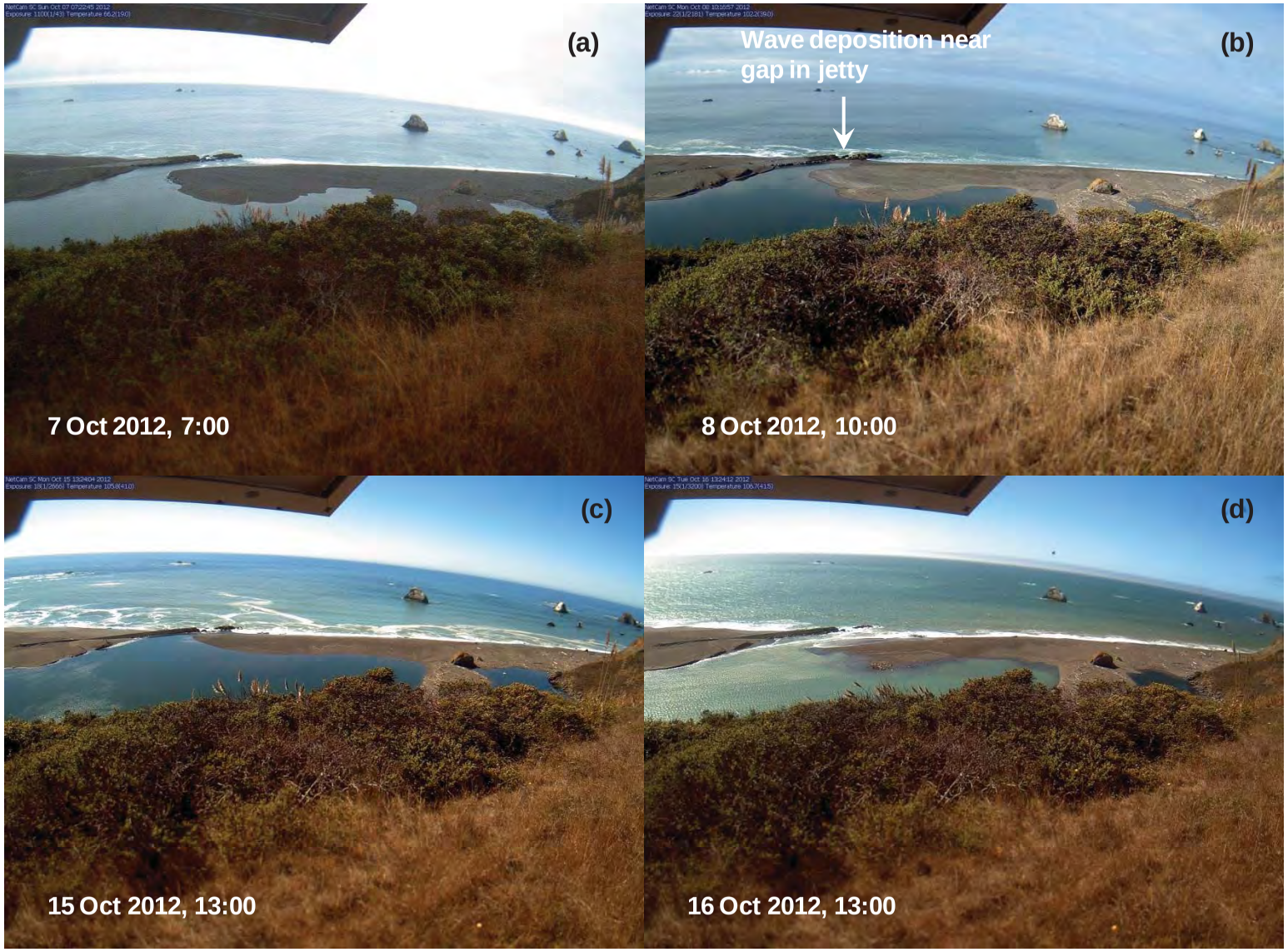


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; T_p=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 3

Estuary, Ocean, and River Conditions Compared with Closure Probability: September 10 – November 20, 2012



SOURCE: Russian River stationary observation camera (BML)

Figure 4

Inlet Closure and Self-Breach in October 2012

Source: Sonoma County Water Agency

figure 5
Project Name

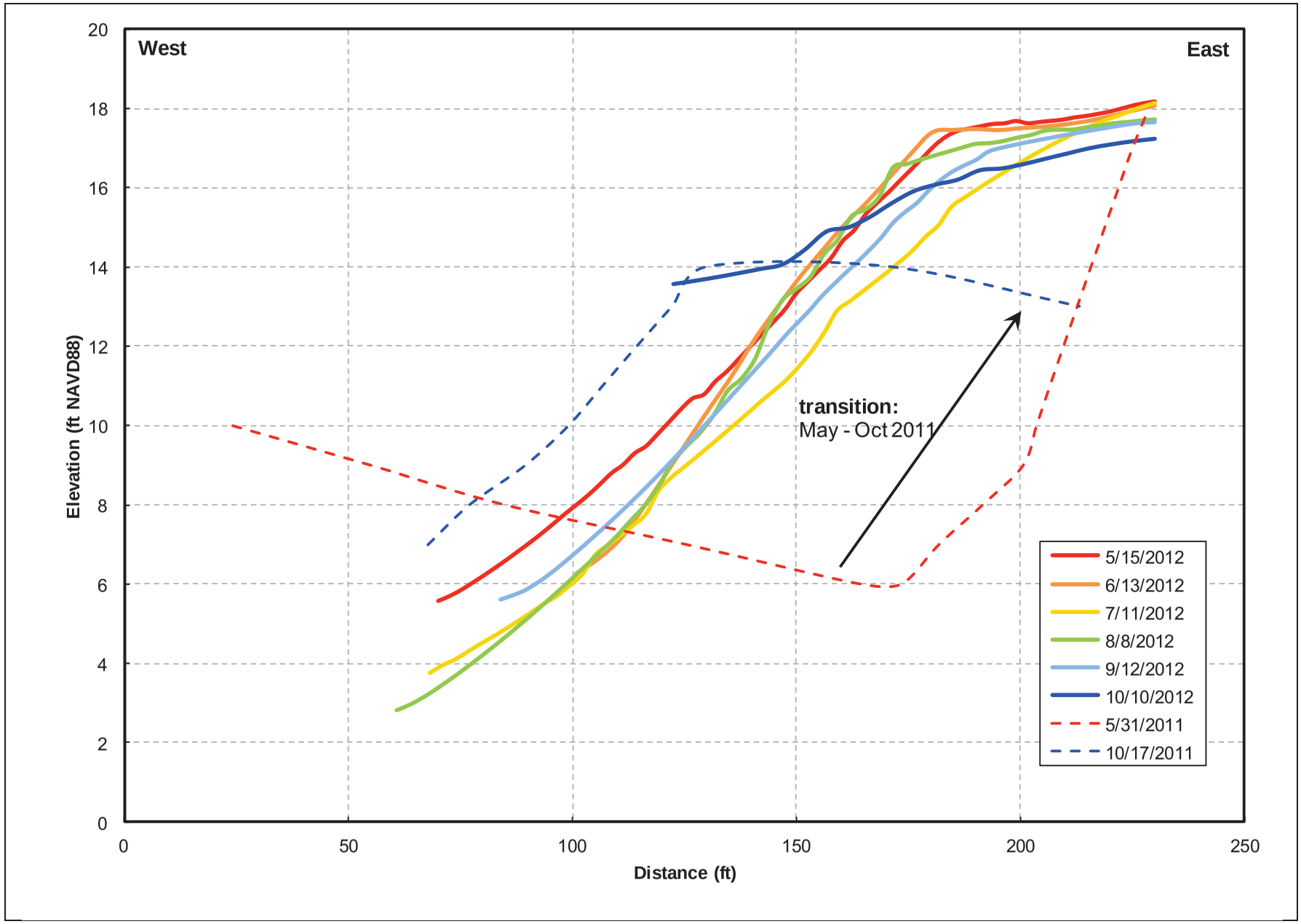
Outlet Channel Flow Through Jetty Notch

ESA PWA Ref# DW01958.02

ESA PWA

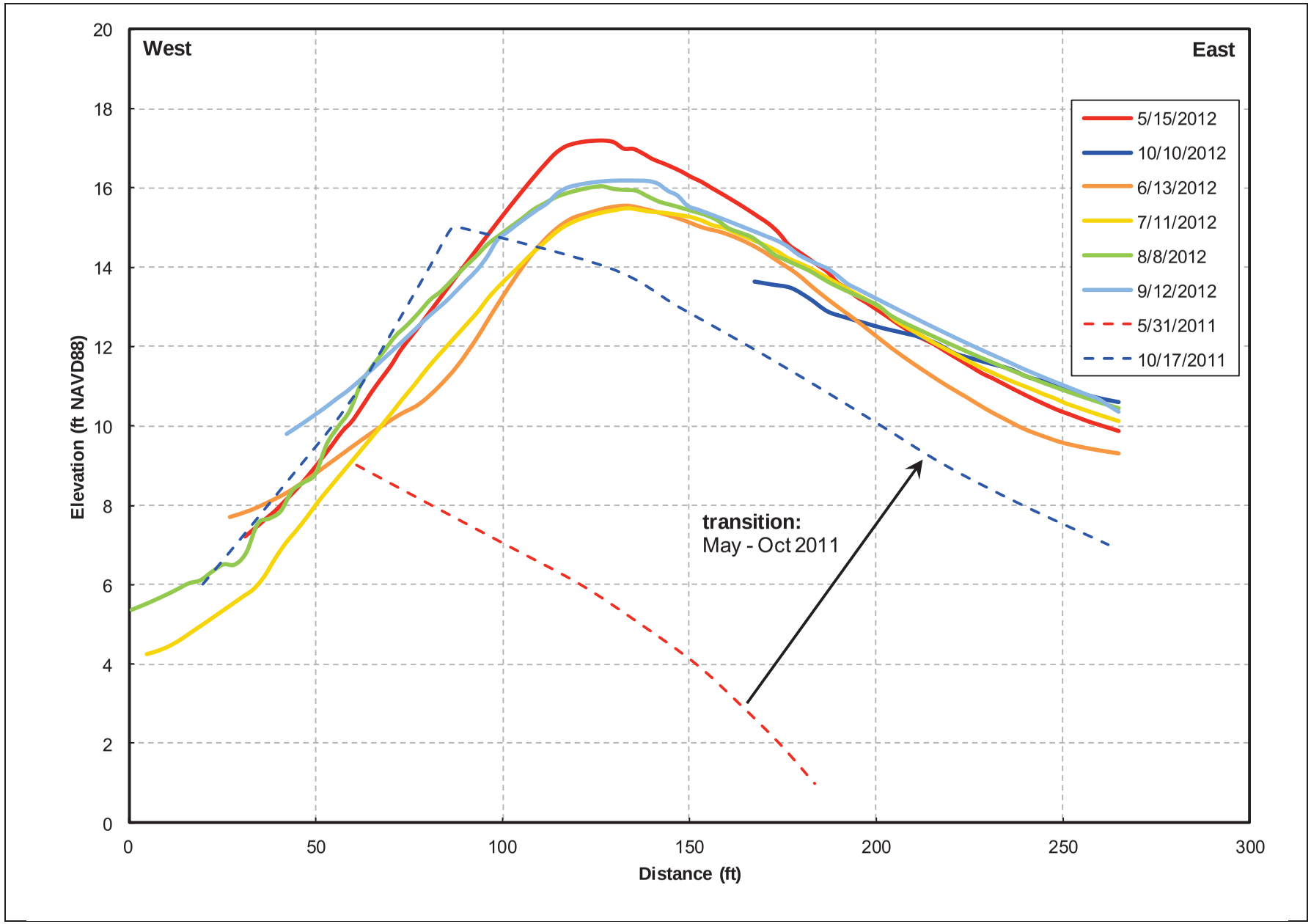
SOURCE: image from USDA NAIP

Figure 6
Beach Transect Locations



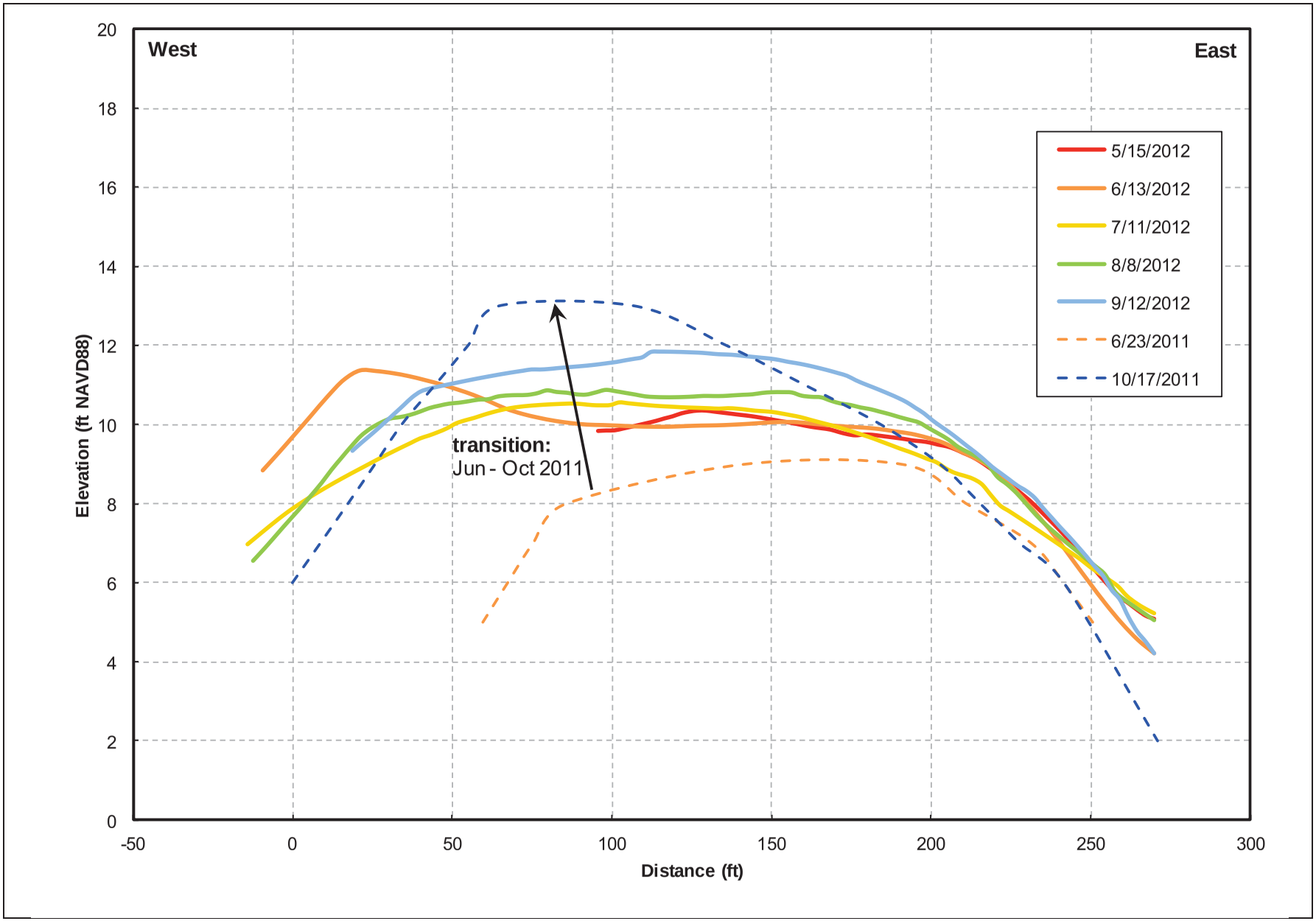
SOURCE: SCWA survey data

Figure 7
Beach Transect 4



SOURCE: SCWA survey data

Figure 8
Beach Transect 3

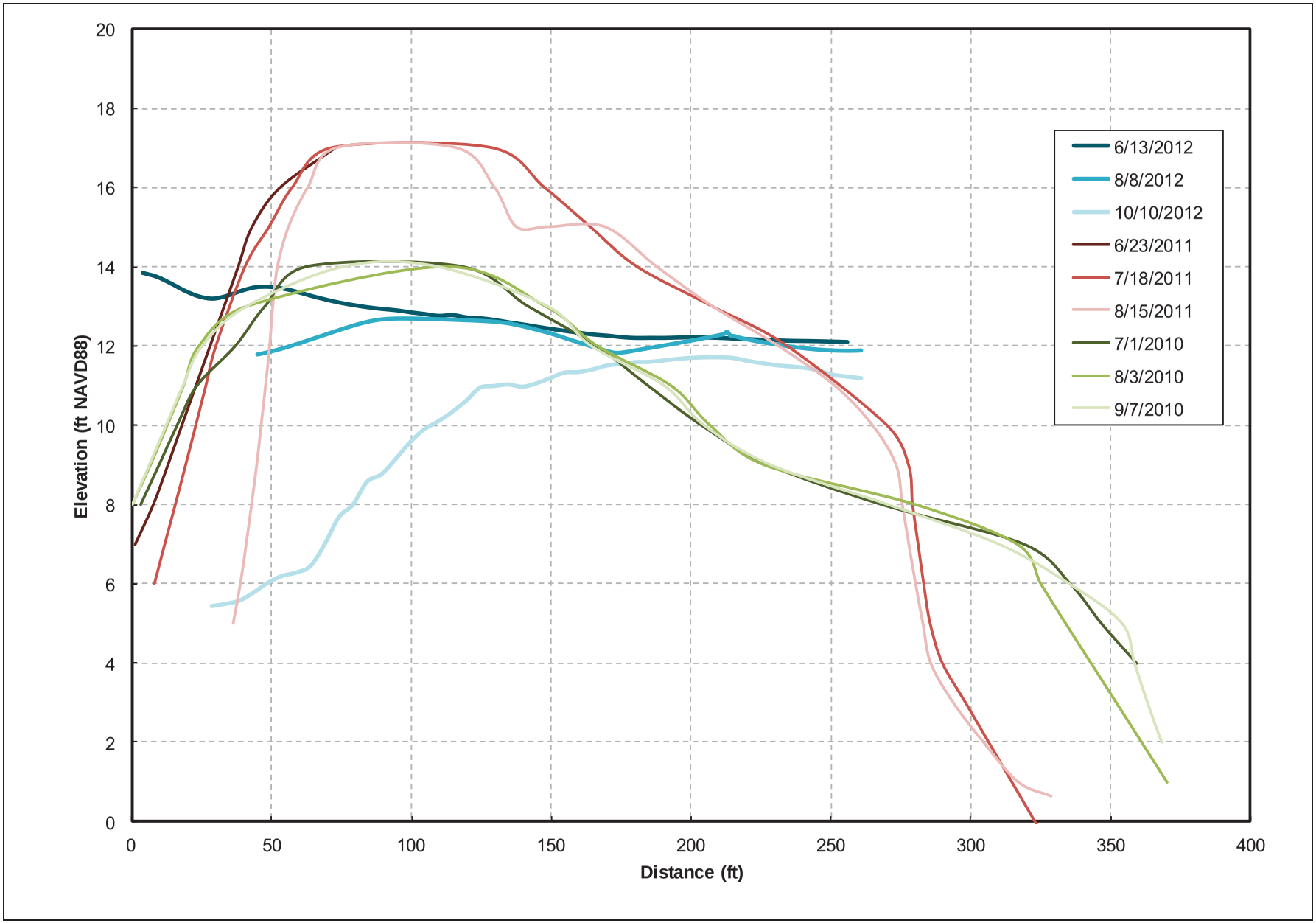


SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 9

Beach Transect 2

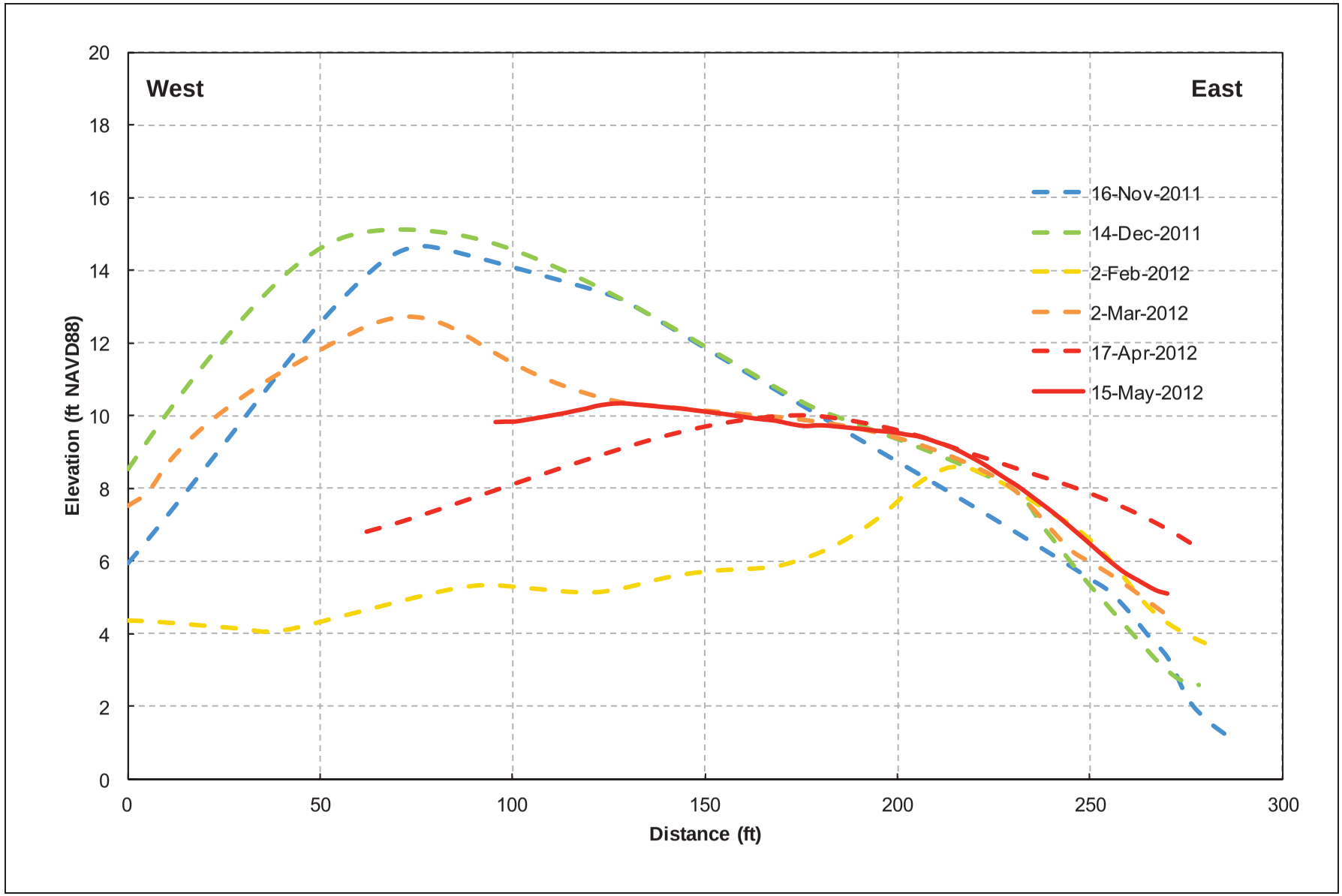


SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 10

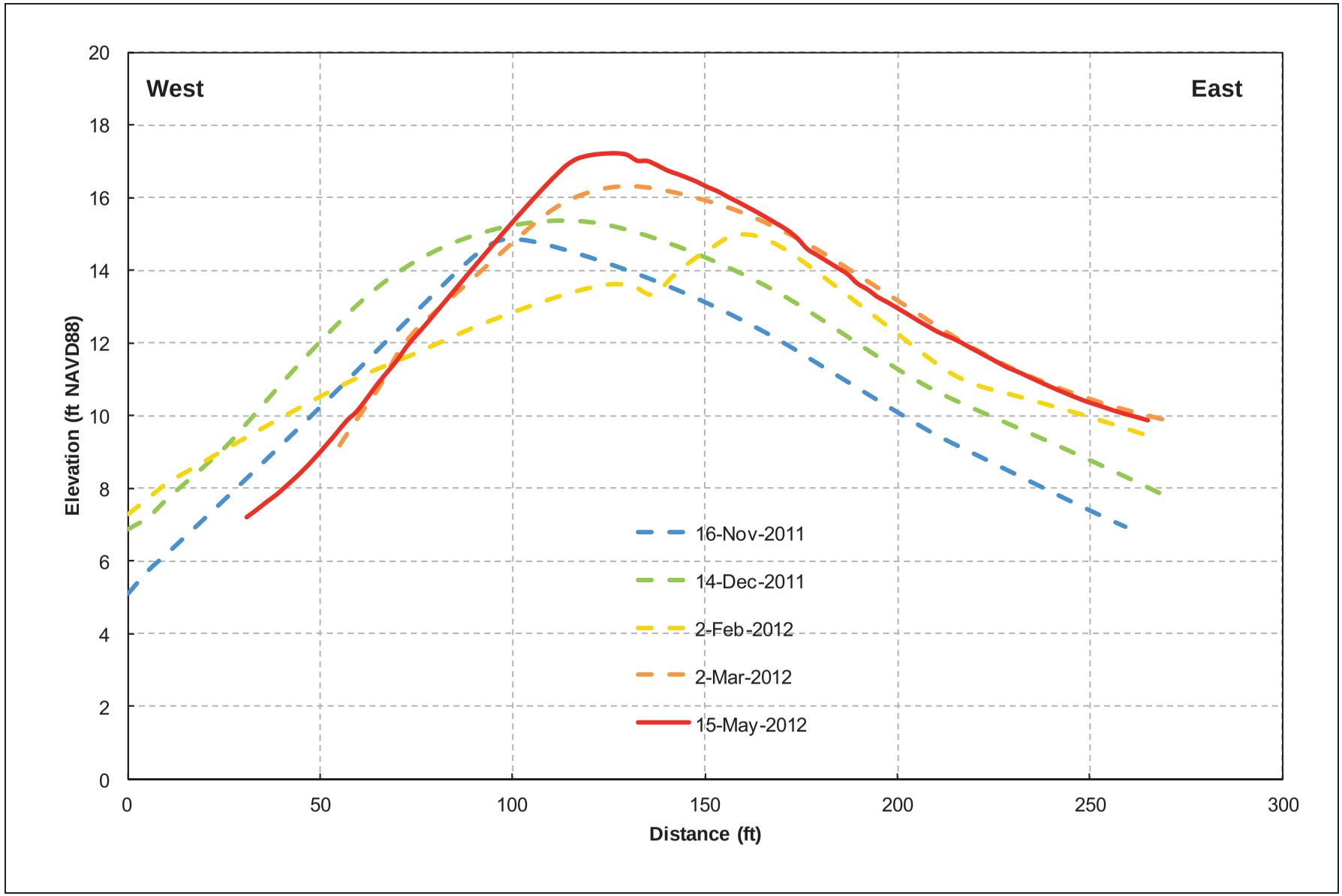
Beach Transect 0



SOURCE: SCWA survey data

Figure 11

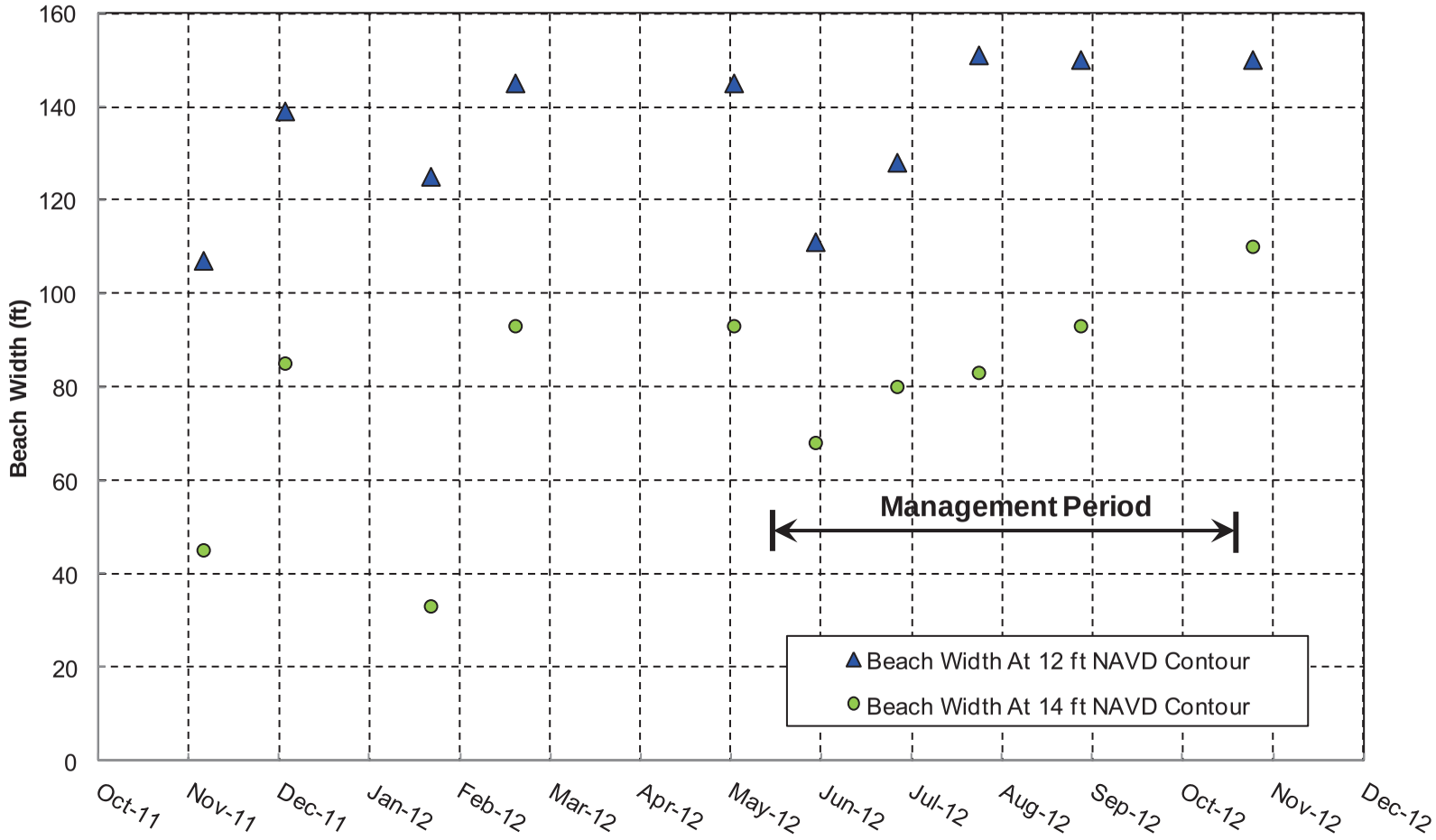
Nov 2011 to May 2012 topographic change at Beach Transect 2



SOURCE: SCWA survey data

Figure 12

Nov 2011 to May 2012 topographic change at Beach Transect 3



SOURCE: SCWA survey data

Figure 13

Beach Width at Beach Transect 3.

Attachment H. Physical Processes During the 2013 Management Period

As required by the Russian River Biological Opinion, the Sonoma County Water Agency (Water Agency) has been tasked with managing a summer lagoon intended to improve salmonid habitat in the Russian River Estuary by creating an outlet channel while maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised annually from 2010 to 2014. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2013, but no opportunities for management action occurred during the management period.

During the 2013 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. Although the inlet experienced several closures, an outlet channel was not implemented. The inlet was closed for the majority of the first two months of the management period as a result of two closure events. During this time, each closure ended when lagoon water levels increased, overtopped the beach berm, and scoured a new tidal channel. The first event self-breached in early June before water levels reached 7 ft NGVD, while the second event resulted in lagoon stage above 7 ft NGVD but self-breached in early July before an outlet channel could be implemented. The estuary remained fully tidal until it closed again in late September. This September-October event was ended with a manual breach on the last day of the management period to provide a pathway for migrating salmonids and to reduce water levels in advance of potential fall precipitation.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2013 outlet channel management period examined water levels, ocean wave conditions, ocean water levels, riverine discharge, beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, CDFW, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Data transmission failure due to cellular network issues occurred for several periods throughout the management period.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk (Behrens et al., 2013). (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel. When discussing this parameter, both states are referred to as a 'closure' in that tides are prevented from propagating into the estuary.) The inlet stability parameter presented by Behrens et al. (2013) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The wave-driven import is assessed using nearshore wave estimates derived from a transformation matrix and offshore buoy data (ESA PWA, 2012) and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (2013) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

SUMMER AND FALL CLOSURES AND SELF-BREACHES

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. The lagoon water level time series (Figure 1a) summarizes the closure events at the beginning of the management period, as well as the subsequent tidal conditions and later closure events in fall. As shown in Figure 1d, discharge was low for most of the management period, dropping below 100 ft^3/s at the onset of June and not rising back significantly 100 ft^3/s until September, with the exception of a short rise in response to a late June rainfall. Flows as low as 85 ft^3/s during the closure in mid-June allowed

the lagoon stage to remain steady at approximately 5 ft NGVD for over a week. Immediately following this steady period, a late-season rainstorm briefly increased flows into the lagoon to more than 200 ft^3/s, causing the lagoon stage to approach 8 ft NGVD and eventually self-breach. As in prior years, wave energy in the subsequent months of July-September was minimal (Figure 1b). The hourly significant wave height only consistently surpassed 8 ft in late September, a likely cause of the last closure event of the management period.

The conditions leading to inlet closure were consistent with the existing conceptual model described in Section 4 of the Management Plan. All closure events coincided with either moderately high waves (H_s > 6 ft) having periods greater than 10 s, or with neap oceanic tide ranges of less than approximately 5 ft. Moderately high waves coincided with the closure events in May, June, and October. All closure events also occurred during or shortly after neap tidal periods. Closure events that occurred in May and June are examined in more detail in Figure 2.

All closure events occurred with the inlet located adjacent to the jetty. In 2012, this positioning may have prevented perched conditions from arising by shielding this area of the beach from the wave-driven sediment deposition that caused closure, preventing the beach from accreting to a sufficient height to allow the desired outlet channel elevations from being attained. This appeared to be the case for the first closure event of the 2013 management season (Figure 2), which self-breached on June 3rd at a stage of roughly 6.5 ft NGVD. The low point in the beach berm that was subsequently overtopped and self-breached also persisted immediately adjacent to the jetty. However, the same late-June rain storm that increased lagoon stage during the subsequent closure event also coincided with several days of long period swell waves (Hs ~ 5 ft, Tp ~ 15 s) that built up the beach in this location, allowing the lagoon stage to rise to almost 8 ft NGVD (Figure 2) before self-breaching in early July. Closure events that occurred later in fall (Figure 3) were breached at or below a lagoon stage of 8 ft NGVD.

CLOSURE AND SELF-BREACH DYNAMICS

Of the three closure events that occurred within the management period, the second closure event (lasting approximately from June 7th until July 4th) provided the best opportunity for outlet channel implementation. This event also indicated that water levels and closures can be persistent if flows drop below a minimum level.

To better illustrate both the lagoon stage and beach morphology during this time, Figure 4 shows a sequence of photos of the inlet before and during this closure event. As was the case for all of the management period, the inlet was located next to the jetty. Five days prior to closure, on June 3rd, the barrier beach self-breached. Since this self-breach occurred during a period of neap oceanic tides, tidal scour probably enlarged the inlet at a reduced rate, leaving it more susceptible to closure. Figure 4a depicts the inlet when it was located next to the jetty several days before closure, indicating a width of less than roughly 40 ft. Nearshore waves having significant heights of 6-7 ft and periods of 9-12 seconds coincided with closure (Figure 2b, Figure 4b), and subsequently raised the berm near the jetty (Figure 4c). As discussed later, these waves built the berm higher next to the jetty than in previous years, which allowed the closure event to persist.

During the first week of closure, inflows (Figure 2d) were measured at 100 – 115 ft^3/s, and the increase in stage was roughly 0.2 – 0.4 ft/day. As inflows dropped to 80 - 100 ft^3/s over the next several weeks, the water level increase slowed until the lagoon reached a balance between inflows and the combined losses from beach seepage and evaporation (Figure 2a). Summer dams constructed during this time downstream of the Hacienda Bridge gage further reduced inflows to the estuary. This markedly slower water level increase is evidenced by the lack of movement of the water line (emphasized with red dashed line) over the twelve days between Figure 4c and Figure 4d. Rainstorm-derived inflows and possible wave overwash from June 25th -27th caused the water level to rise at roughly 0.4 ft/day. From June 28th until the self-breach event on July 3rd, the water level increase slowed to less than 0.2ft/day. The low point of the beach (where breaching typically occurs) was at the jetty (Figure 4e).

Unlike the 2012 management period, no natural outlet channels were formed near the jetty in 2013. However, as with 2012 and other previous years, the lowest portion of the beach was consistently located at the jetty. This persistent low portion is probably caused by wave sheltering by the jetty, which may have reduced berm build-up at the inlet's location, leaving a low point in the beach berm that was the site for subsequent overtopping and self-breaching.

The first event (lasting from May 23rd until June 3rd) and last event (lasting from September 24th until October 15th) of the 2013 management period were also unsuitable for implementing an outlet channel. The first event self-breached before the lagoon stage reached the 7 ft NGVD target stage. The second event just reached the target elevation at the end of the management period. Then, on the last day of the management period, the Water Agency artificially breached the beach to provide a pathway for migrating salmonids and to reduce water levels in advance of potential fall precipitation.

Four more closures occurred after the end of the management period in October–December 2013 (Figure 3). These events coincided with typical late-fall energetic swell waves, and each persisted for over a week, since inflows remained lower than 300 ft^3/s through the end of December. In consultation with the resource agencies, the Water Agency conducted its October and November artificial breaches to the north of Haystack Rock. The intent of this alignment was to discourage the inlet from re-establishing next to the jetty. However, after the inlet closed twice north of Haystack Rock, the December artificial breach was implemented closer to the jetty. This December breach location was selected to encourage the inlet to stay open longer for migrating salmonids and to ensure that the breaching stayed within the Water Agency's permitted excavation limits of 1,000 yd^3.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2013 according to the method described in Behrens et al. (2013). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean

forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 70 percent before each 2013 event (Figure 1e, Figure 2e, and Figure 3e). Data gaps in the Jenner gage record prevented closure risk predictions prior to the first closure event. Otherwise, the predicted probability of closure exceeded 70% 2-5 days in advance of each closure. In previous years, a prediction threshold of 50% was used, but there were several instances exceeding 50% in April and July of 2013 that did not result in closures.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent can be limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which sets guidelines for the survey crew's approach to marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at 1 ft intervals, as well as profiles along the beach berm crest, the ocean wetted edge, and the estuary water line. The survey elevations are reported in the NGVD29 vertical datum.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September), 2011 (May to October), 2012 (May to October), and 2013 (May to October) surveys. Survey transects from the 2012 analysis were reused (Figure 5), and include two transects backed by cliff (Figure 6 and Figure 7), two transects which extend into the estuary (Figure 8 and Figure 9), and two variations on a transect just north of the jetty (Figure 9).

This review focuses on the 2013 surveys, although the 2011 surveys are included for context. The 2013 topographic data were similar to those of 2012, when little morphologic change occurred throughout the management season. In contrast, surveys taken in 2010 and 2011 indicated that beach erosion and accretion occurred during the management period. The erosion was associated with inlet migration and subsequent accretion of the beach was associated with long-period swell waves. During the 2012 and 2013 management seasons, the inlet remained at the jetty and did not migrate north. Adjacent to the jetty groin, Transect 0 showed little monthly change in topography, but extensive inter-annual variability (Figure 10).

During the management period in 2013, the beach berm along Transects 1- 4 showed little variability, changing by less than one foot. This was particularly true during the months of May – September at Transects 1-2 (Figures 8-9) and Transect 4 (Figure 6). At each of these profiles, the change in beach profile from September to October was greater than for the rest of the management season. The only transect to experience more than one foot of change in elevation was Transect 3 (Figure 7), whose crest aggraded by 1.5 feet between the May 30th and June 13th surveys. The difference in monthly variability at each transect between 2013 and prior years can likely be tied to the difference in the extent of inlet migration. As an example, in 2011, the inlet

migrated north of Haystack Rock during the winter, and returned to the jetty in late spring or early summer. This migration resulted in a lower beach profile at all transects. Then, over the course of the management period, the beach gradually built up to a typical summer profile. In contrast, the inlet never migrated north of Haystack Rock in 2013, even during peak winter and spring flows. As in 2012, this left the beach berm largely intact north of Haystack Rock and a lower terrace between Haystack Rock and the jetty groin. Since these northern transects started at a much higher elevation at the start of the management period, the vertical growth of the beach profiles at these locations were several feet less than during 2011 in the same locations.

Transect 0, which is located just north of and parallel to the jetty, was slightly lower than the other transects measured during the 2013 management period. Its crest was measured at roughly 15 ft NGVD both at the beginning and end of the management period, compared with crest elevations of 15-17 ft NGVD measured at the other transects. Figure 10 shows that this location is typically stable throughout the management period but varies from year to year, likely as a result of inlet migration, flood erosion, and berm building by winter waves. Compared with prior years, the berm at this location is lower than in 2011, but higher than in 2010 and 2012. As we have noted during previous reports, the lack of management period variability of this region suggests that the jetty shelters this portion of the beach from small to moderate waves that occur during the management period. Only the larger waves associated with winter storms may be sufficient to re-shape the beach berm near the jetty.

Beach berm crest profiles were collected by the Water Agency for the first time in 2013. These data make it possible to discern important changes in beach shape along the length of the berm from the northern beach access point to the jetty. Along-beach trends in crest elevation generally indicate along-beach trends in wave energy and the influence of inlet migration and breaching.

Figure 11 shows that the same minimal change in crest elevation was apparent throughout the length of the beach north of Transect 1. Although the crest elevation changed by as much as 2 ft in some areas, there was a distinct pattern in the along-shore crest height that remained roughly the same throughout the management period. The beach crest was lowest south of Transect 1, where the inlet resided. At Transects 1 and 2, a set of ridges remained in place with peak elevations at 17-18 ft NGVD, while the crest was generally lower (14-17 ft NGVD) and had less of a consistent shape north of Transect 2. Wave runup generally has less influence for higher beach profiles, since it becomes less likely that a given wave will overtop the crest. The higher variability north of Transect 2 is probably a reflection of the fact that the beach was lower in this area, and was more susceptible to change from the limited summer and fall waves.

Changes to the beach shape were much larger after the end of the 2013 management period, as shown in Figure 12. This is probably attributable to greater wave energy and relocation of the inlet. Wave energy increased dramatically in November and December, both in height and period. Although changes to the crest height were still minor during these months, by January 16th 2014, the crest had been built as high as 19-20 ft NGVD north of Transect 4. At Transects 1 and 2, the crest ridges shifted in the along-beach direction, but the peak heights remained similar to August.

Manual breaching of the inlet north of Haystack Rock on October allowed the inlet to carve a 400-500 wide swath within the beach, centered roughly at Transect 3. The inlet then closed again and later breached at the jetty. By December 12th, waves had rebuilt the crest to a height of 10-12 feet within the swath. By January 1, 2014, this segment of the beach that the inlet had occupied in October and November was indistinguishable from the rest of the beach crest profile.

BEACH WIDTH

To provide additional information about the beach morphology, ESA PWA assessed the beach width using the Water Agency survey data. Figure 13 shows the evolution of the beach width at Transect 3 during both the 2012 and 2013 management periods. During winter months, the beach was often eroded at Transect 3 to the point that the beach crest was below 12 ft NGVD, so that the width was effectively zero. Apart from this seasonal erosion, there was no marked trend in the beach width. In 2013, the width at 12 ft NGVD varied between 80 and 120 ft, and was generally less than 65 ft wide at the 14 ft NGVD contour. This was smaller than in 2012, when it varied from 110-150 ft NGVD at the 12 ft contour and was less than 110 ft at the 14 ft contour. This interannual difference may be attributable to differences in fall-spring wave energy (and thus beach building), or possibly to differences in inlet position.

LESSONS LEARNED AND RECOMMENDATIONS

Based on 2013 observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- The beach north of the inlet saw little change from the 16-18 ft NGVD elevations established in 2012. Near the jetty, the berm was lowered by inlet migration while undergoing beach building.
- The influence of inlet breaching or migration north of the jetty can lead to erosion of a wide swath of beach, several times larger than the width of the channel. An erosion swath of 400-500 was observed following the Agency breach on October 15th.
- Similar to the winter of 2011-12, the inlet never migrated north of Haystack Rock during winter 2012-13, and returned to the jetty in early spring, much earlier than in most years. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- Peak annual river discharge has remained below 40,000 ft^3/s for 8 consecutive years, a streak unmatched in the 70-year flow record. This may have a connection to the recent lack of inlet migration to the north.
- The beach width in 2013 at Transect 3 (near Haystack Rock) was smaller than in 2012. The interannual decline was larger than changes to beach width at this location within the 2013 management season alone. This may suggest that beach width is more closely tied to seasonal changes in inlet behavior and offshore waves than to shorter-term changes.

OUTLET CHANNEL FEASIBILITY

- The jetty may shelter the inlet, making closure less likely and also limiting berm growth, which then maintains a low point for self-breaching. When the inlet is in a fully or muted tidal condition, options for management become considerably more difficult to implement.
- Late June closure included a 10-day period when lagoon water levels were nearly constant at approximately 5 ft NGVD because low flows measured at Hacienda Bridge (80-100 ft^3/s) and construction of summer dams reduced flows into the estuary to the point that they were balanced by seepage. An unusual early summer rain then boosted discharge to more than 200 ft^3/s, causing self-breach at approximately 8 ft NGVD.
- Once lagoon water levels reach the low point of the beach crest elevation, the lagoon self-breached. This behavior highlights the susceptibility of a sand bed outlet channel to scour, limiting conveyance capacity.
- Post-management period, the Water Agency breached the inlet north of Haystack Rock. This alignment was not continued because repeated closure threatened Chinook migration and the enlarged beach berm restricted breaching to within the permitted excavation volume.

- Over the first three years of effort to implement the outlet channel adaptive management plan, only one closure (July 2010), has been suited for outlet channel management action.

COMMUNICATIONSAND PROTOCOLS

- Since full set of permits was not in effect, the Water Agency was required to seek authorization for each breaching event, which occasionally caused delayed operations.
- Although the perched lagoon episodes did not evolve to the point that management action was warranted, the Water Agency began planning management actions as soon as the episodes occurred. Planning included heightened observations of inlet conditions by Water Agency staff, email updates to inform the resource management group, and pre-implementation meetings at the project site to refine plans for management action.

MONITORING

- The Water Agency's monthly survey methods were modified to collect specified profiles, such as the beach berm ridge line, wetted edge (beach side), and water edge (estuary side).

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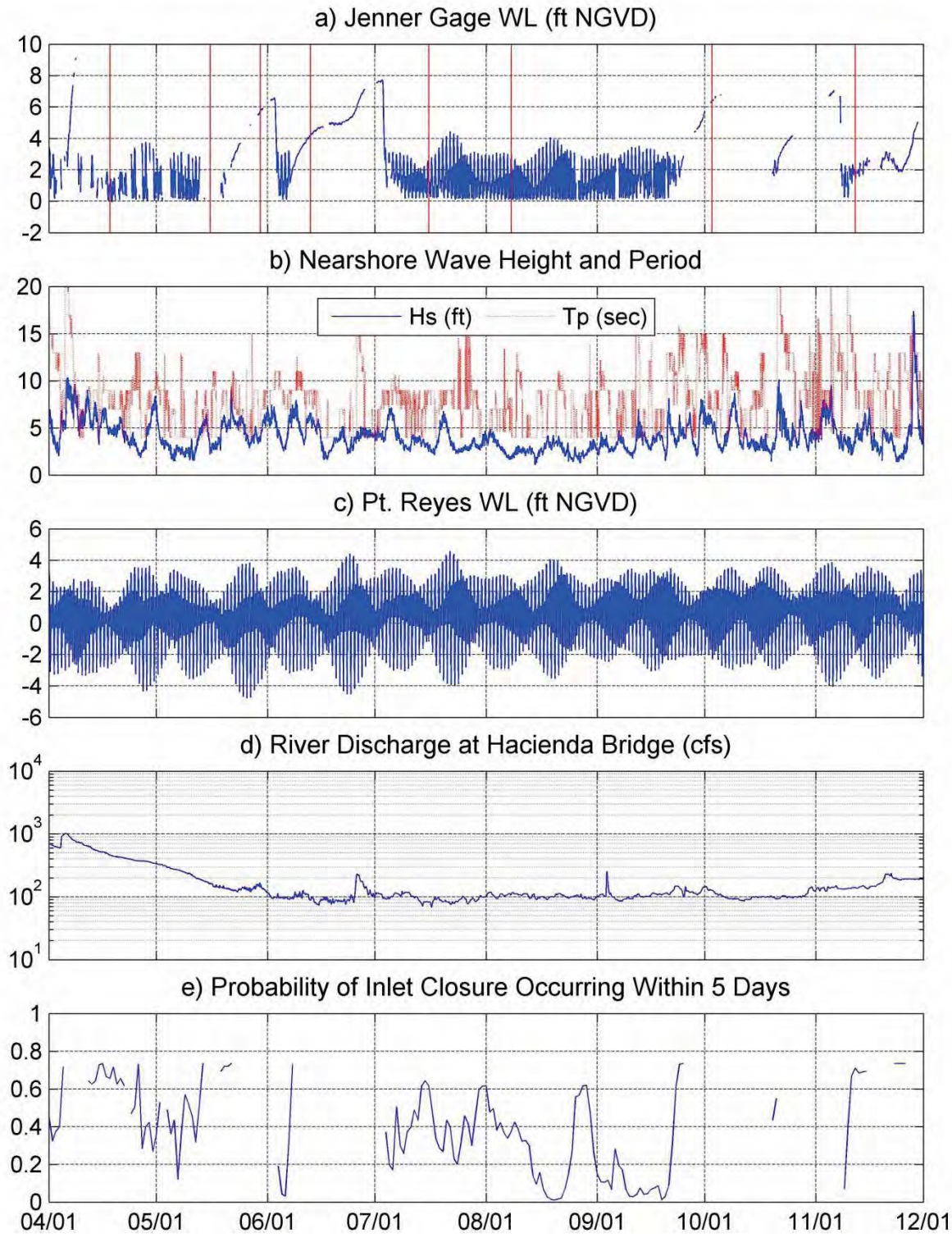
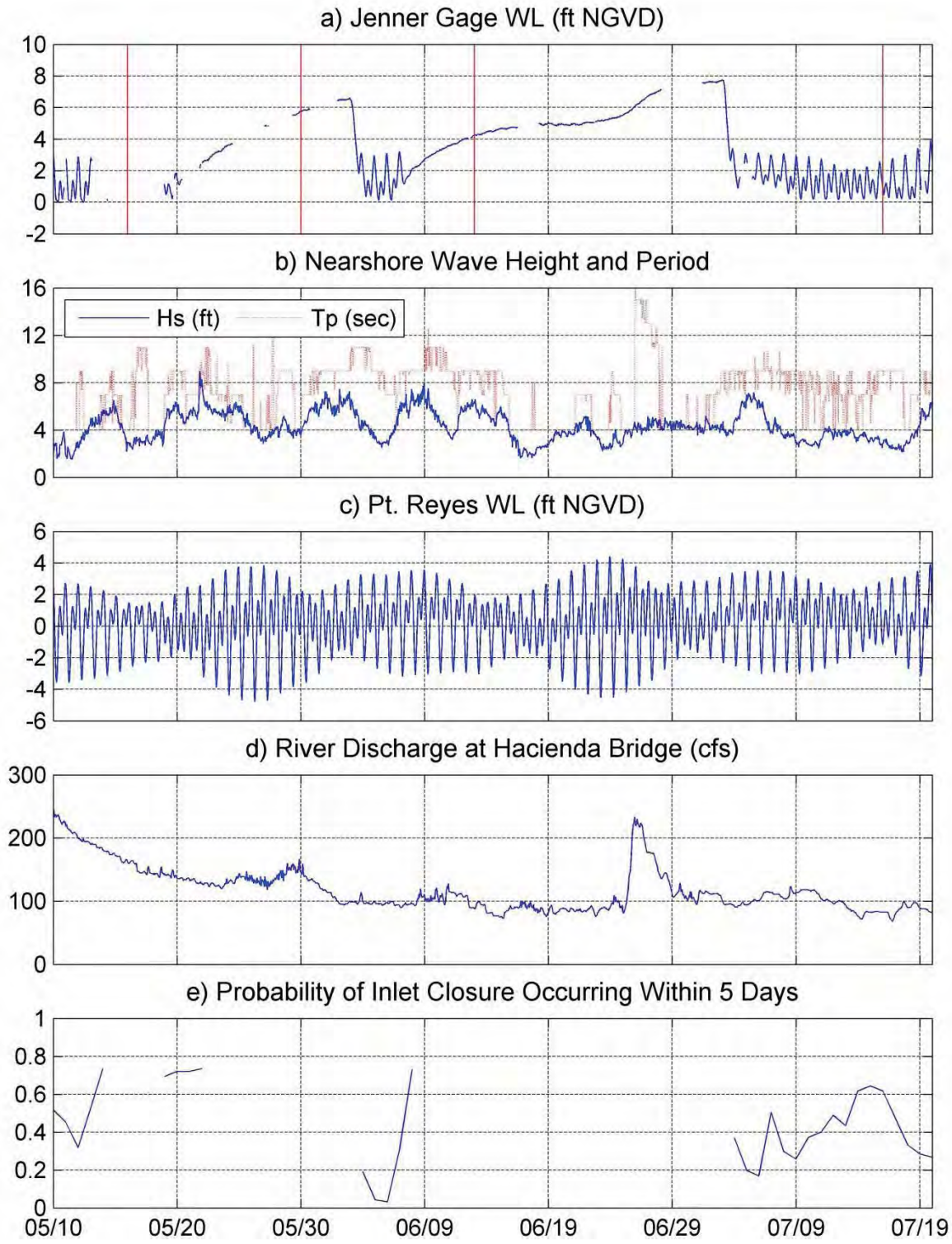


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 1

Estuary, Ocean, and River Conditions Compared with Closure Probability: April – November 2013

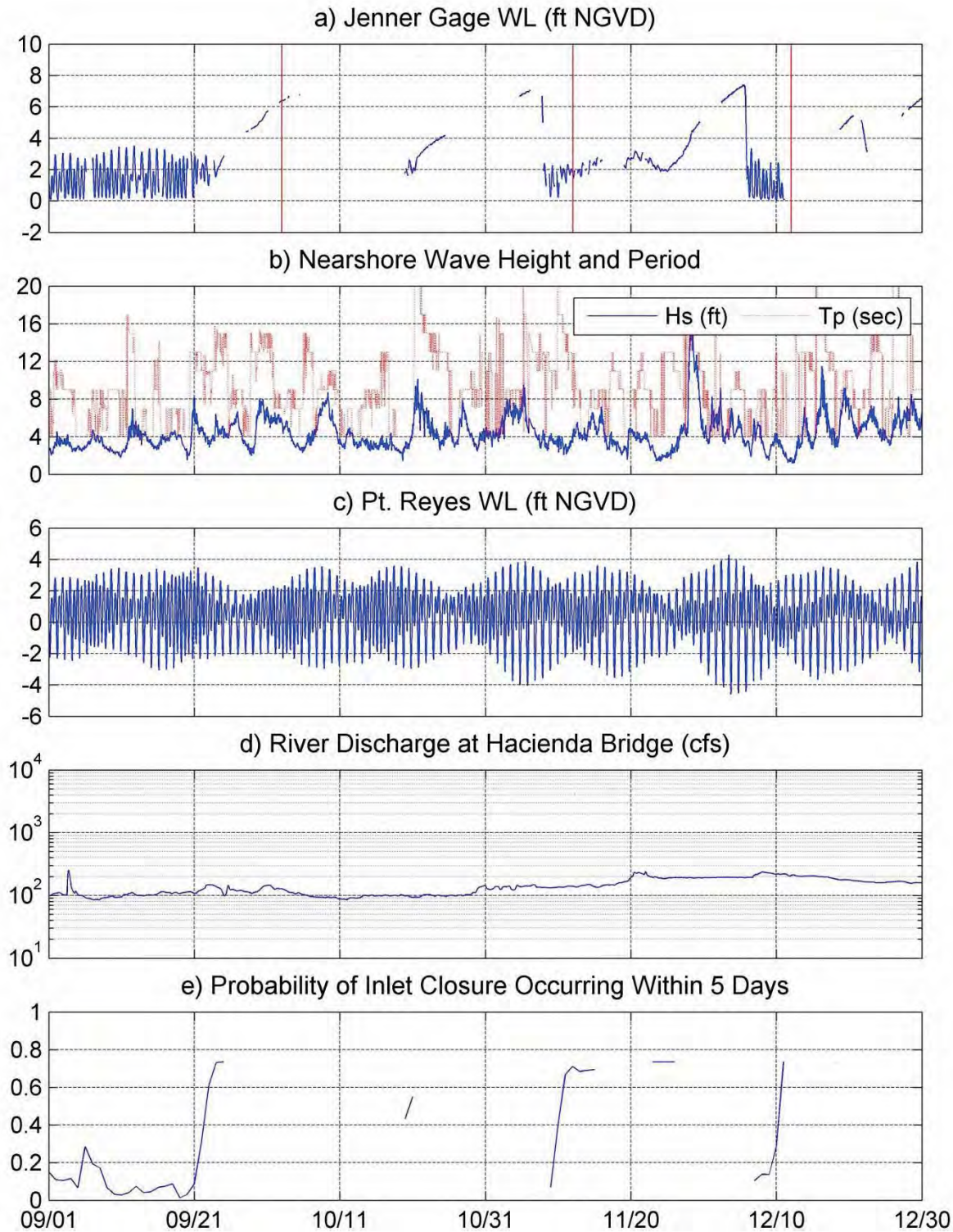


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 2

Estuary, Ocean, and River Conditions Compared with Closure Probability: May – July 2013

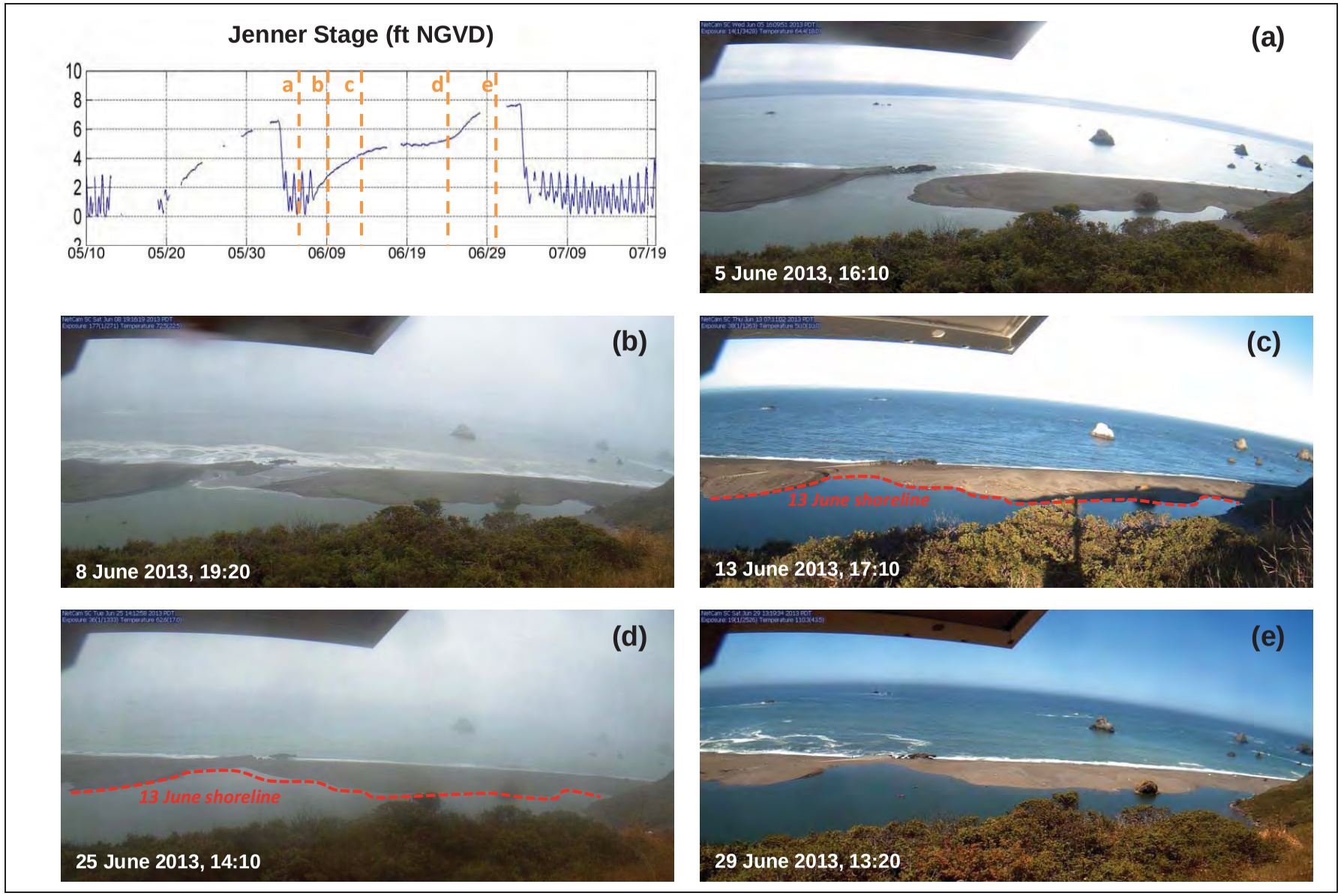


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 3

Estuary, Ocean, and River Conditions Compared with Closure Probability: September – December 2013



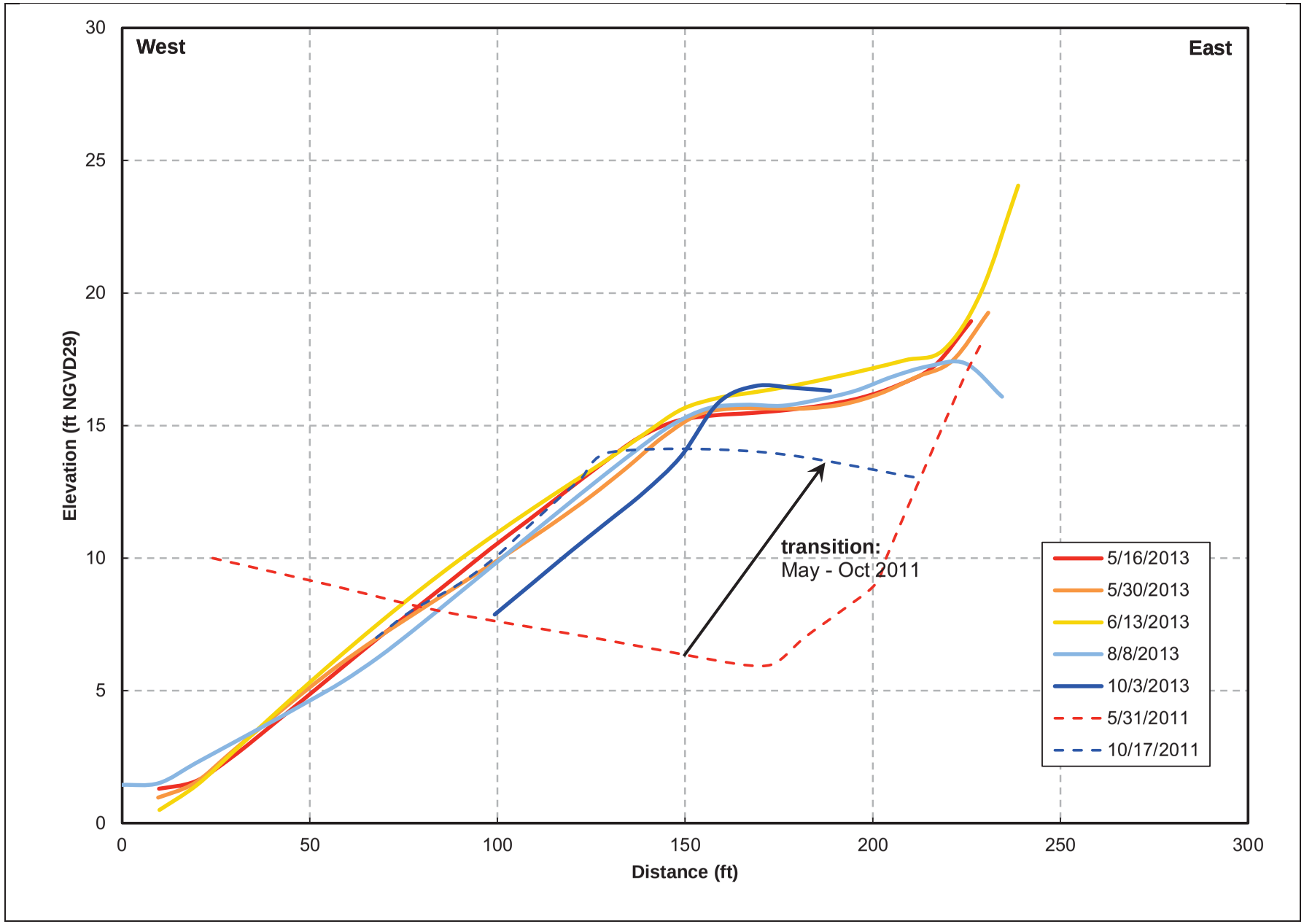
SOURCE: Russian River stationary observation camera (BML)

Figure 4

Inlet Closure Event in June-July 2013

SOURCE: image from USDA NAIP

Figure 5
Beach Transect Locations

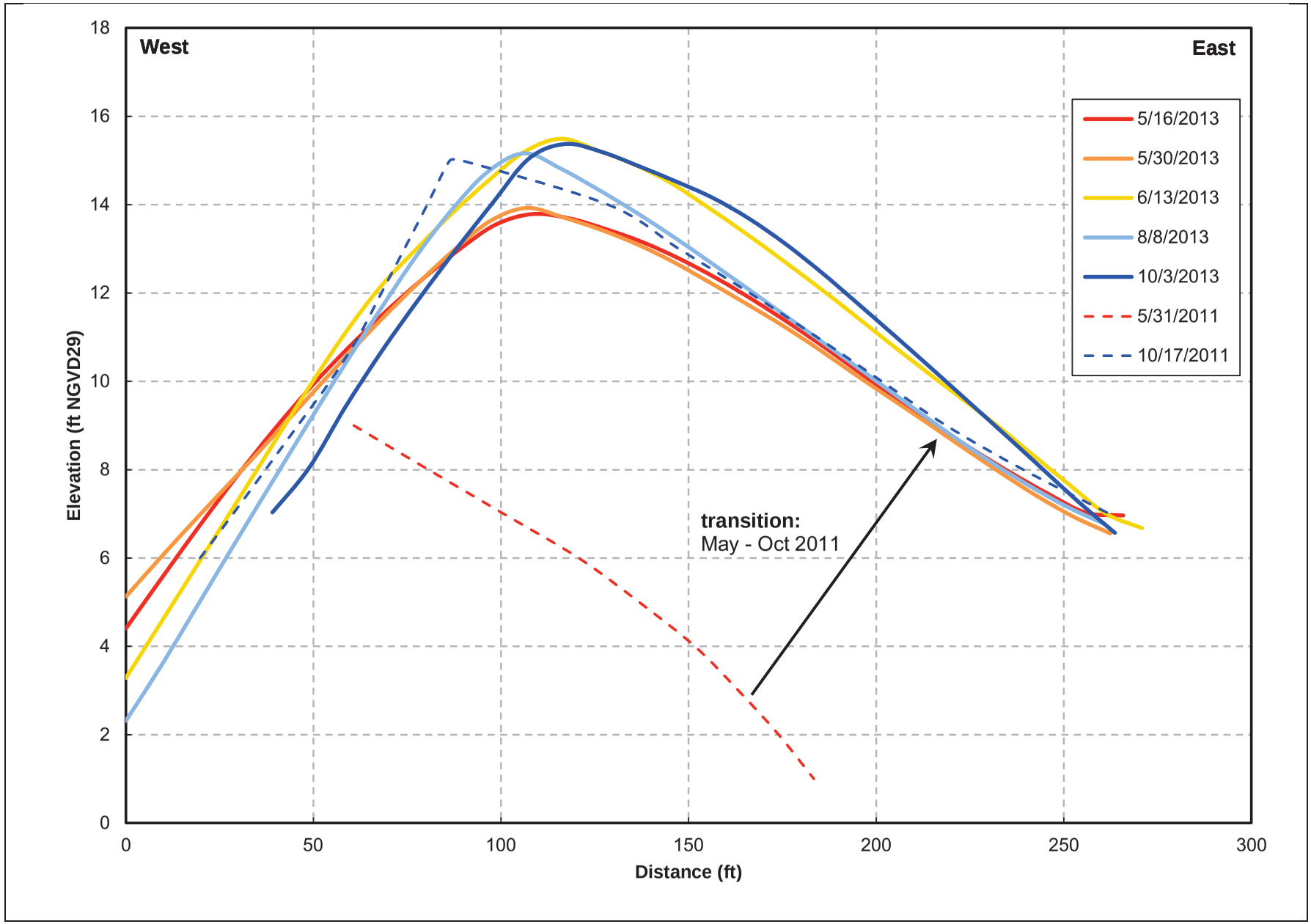


SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

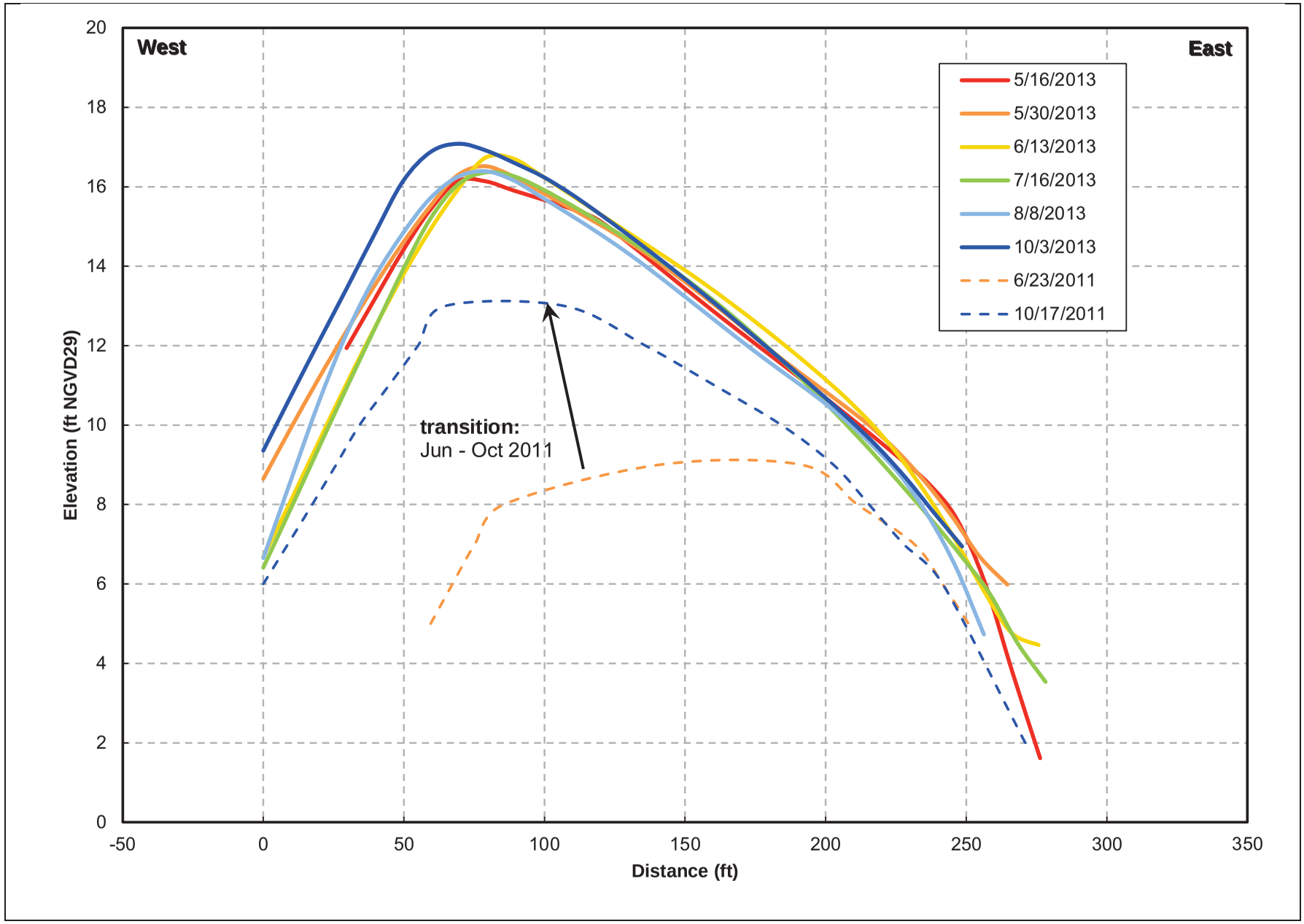
Figure 6

Beach Transect #4



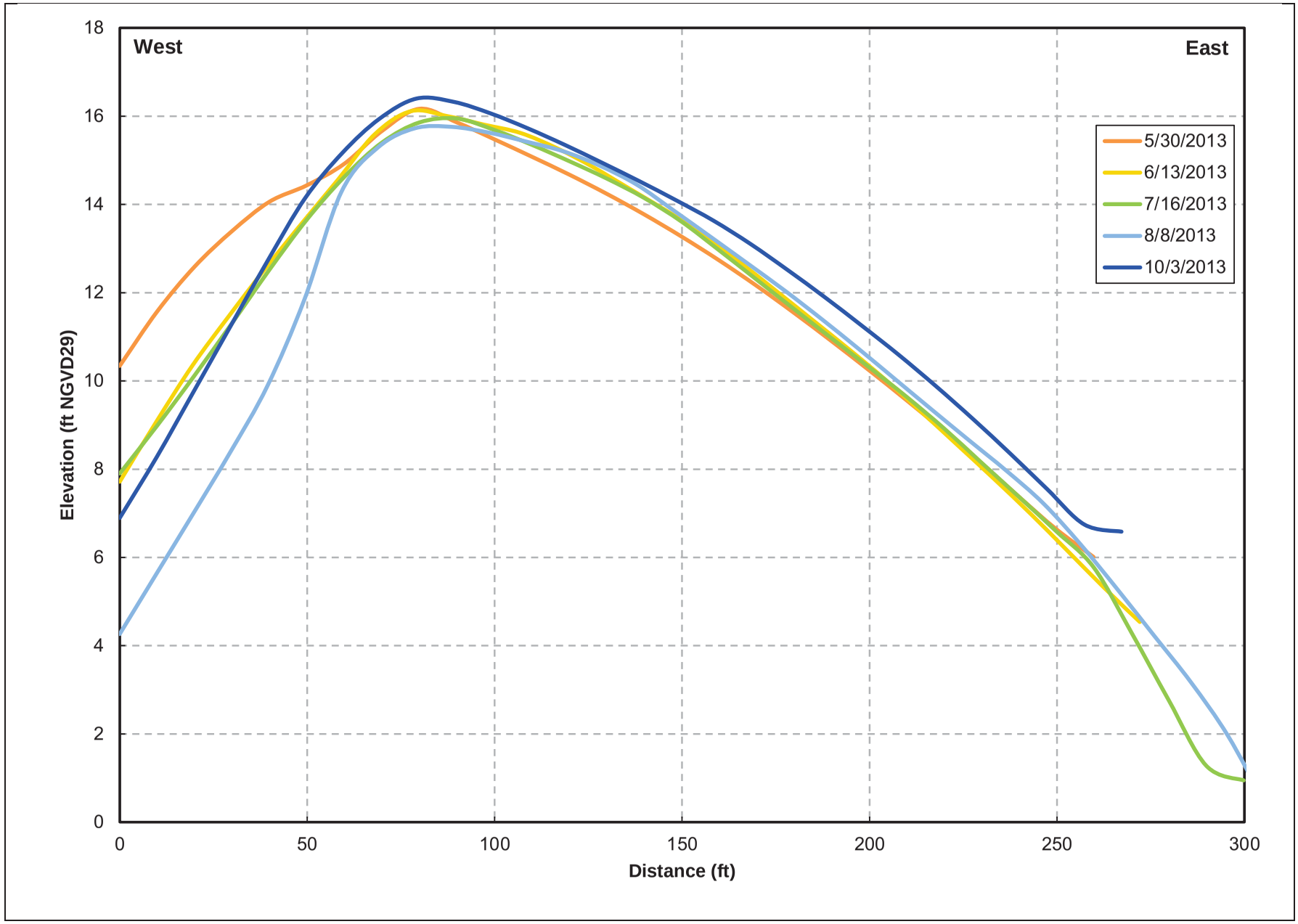
SOURCE: Russian River stationary observation camera (BML)

Figure 7
Beach Transect #3



SOURCE: Russian River stationary observation camera (BML)

Figure 8
Beach Transect #2

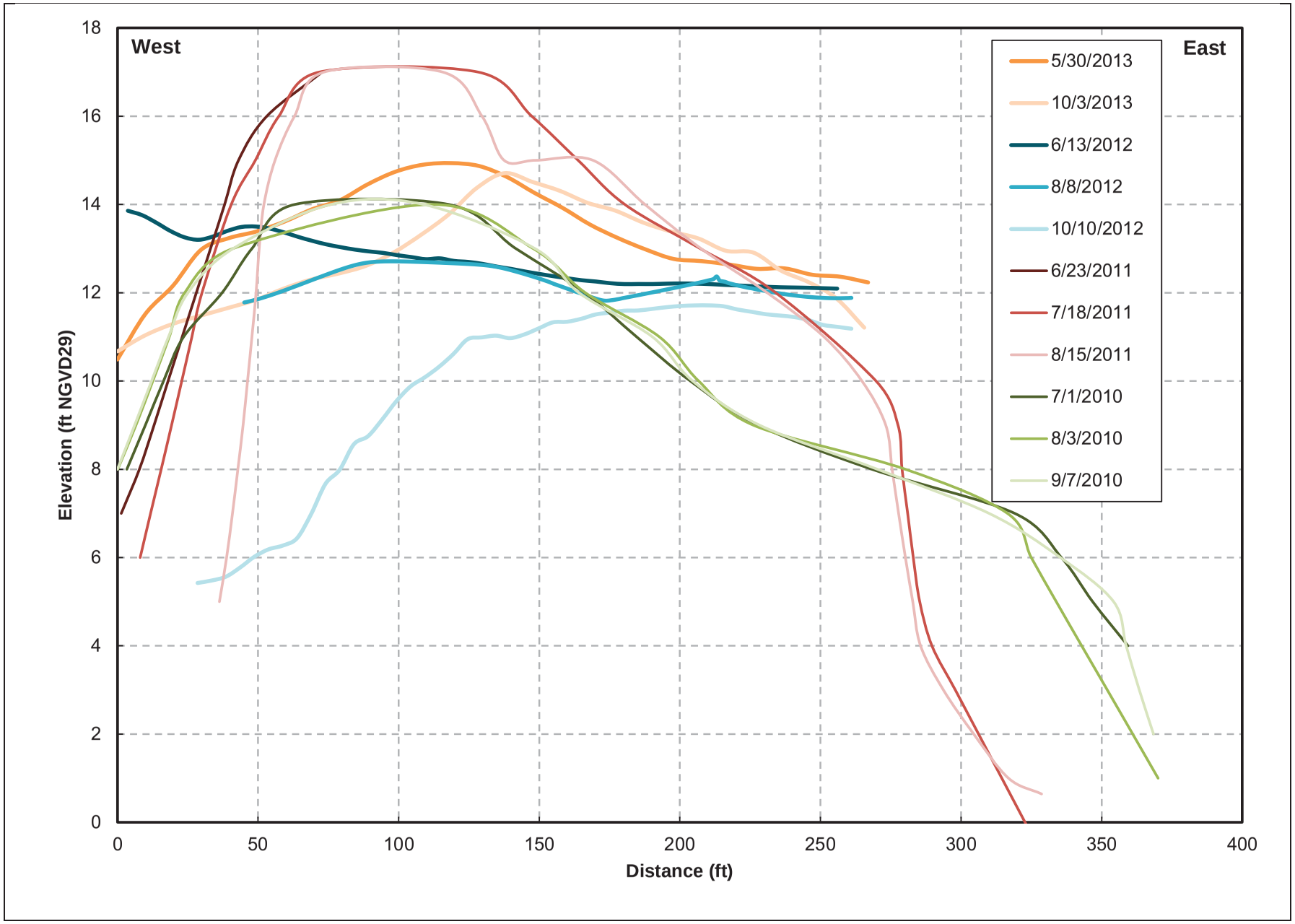


SOURCE: Russian River stationary observation camera (BML)

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 9

Beach Transect #1

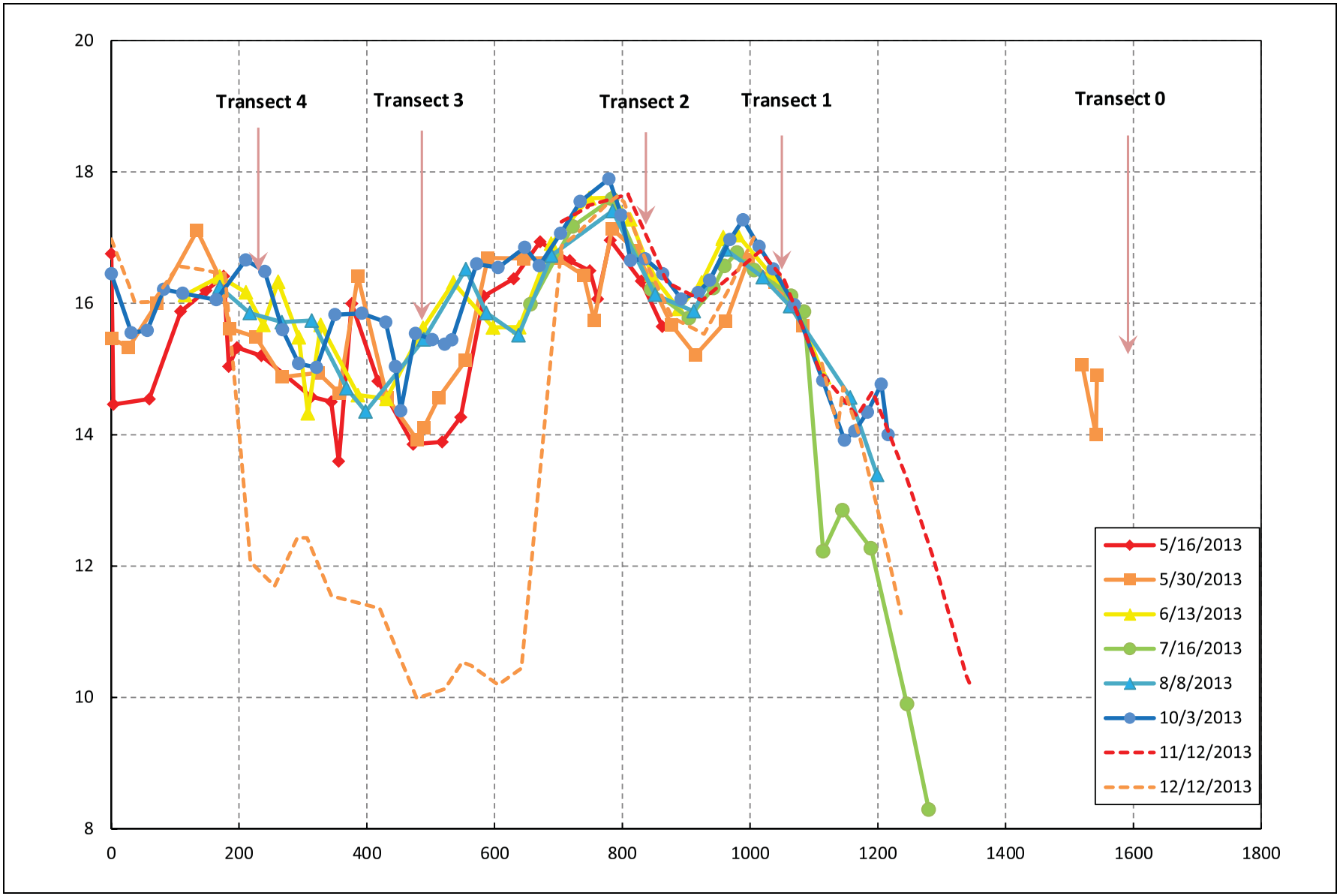


SOURCE: Russian River stationary observation camera (BML)

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 10

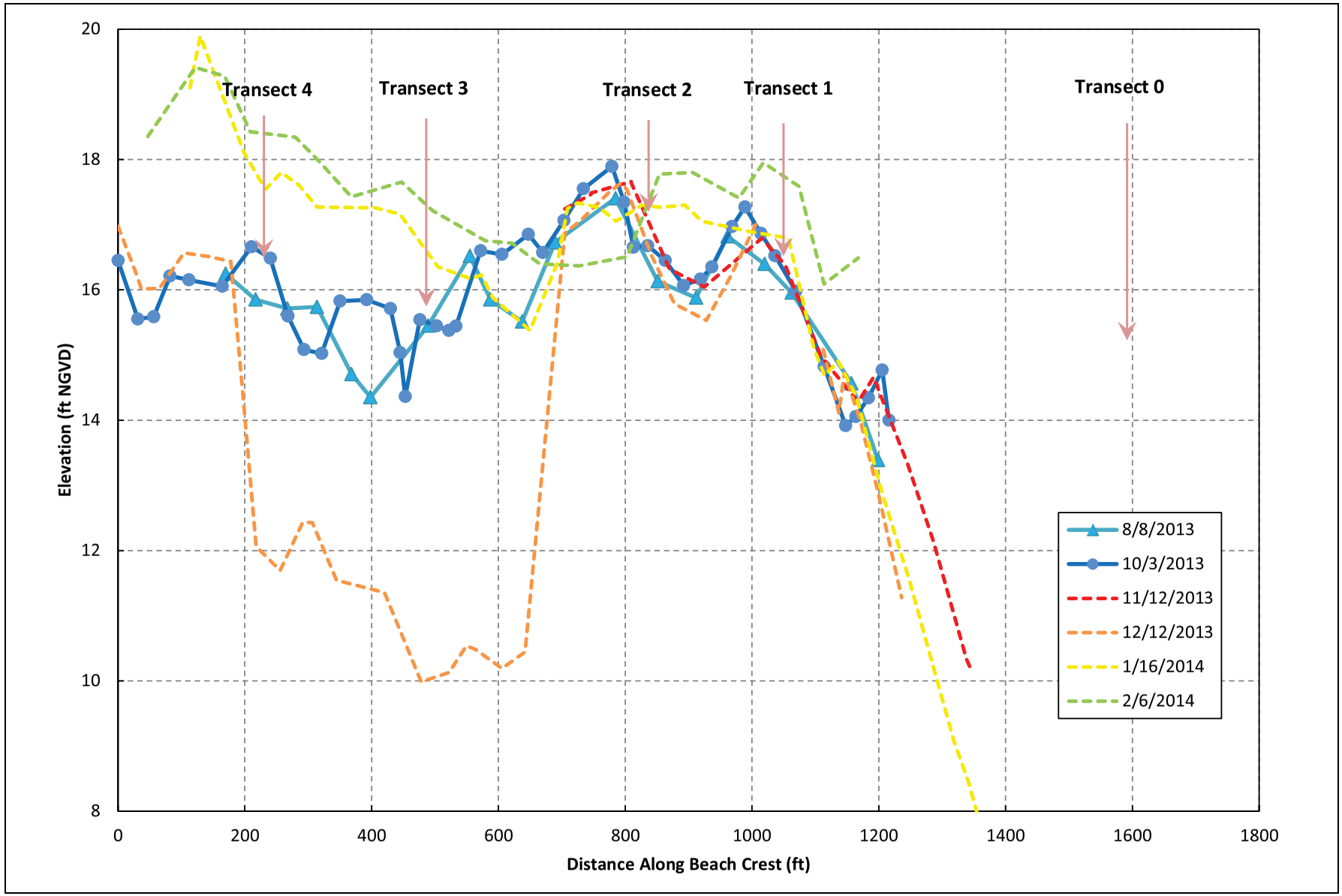
Beach Transect #0



SOURCE: SCWA survey data

Figure 11

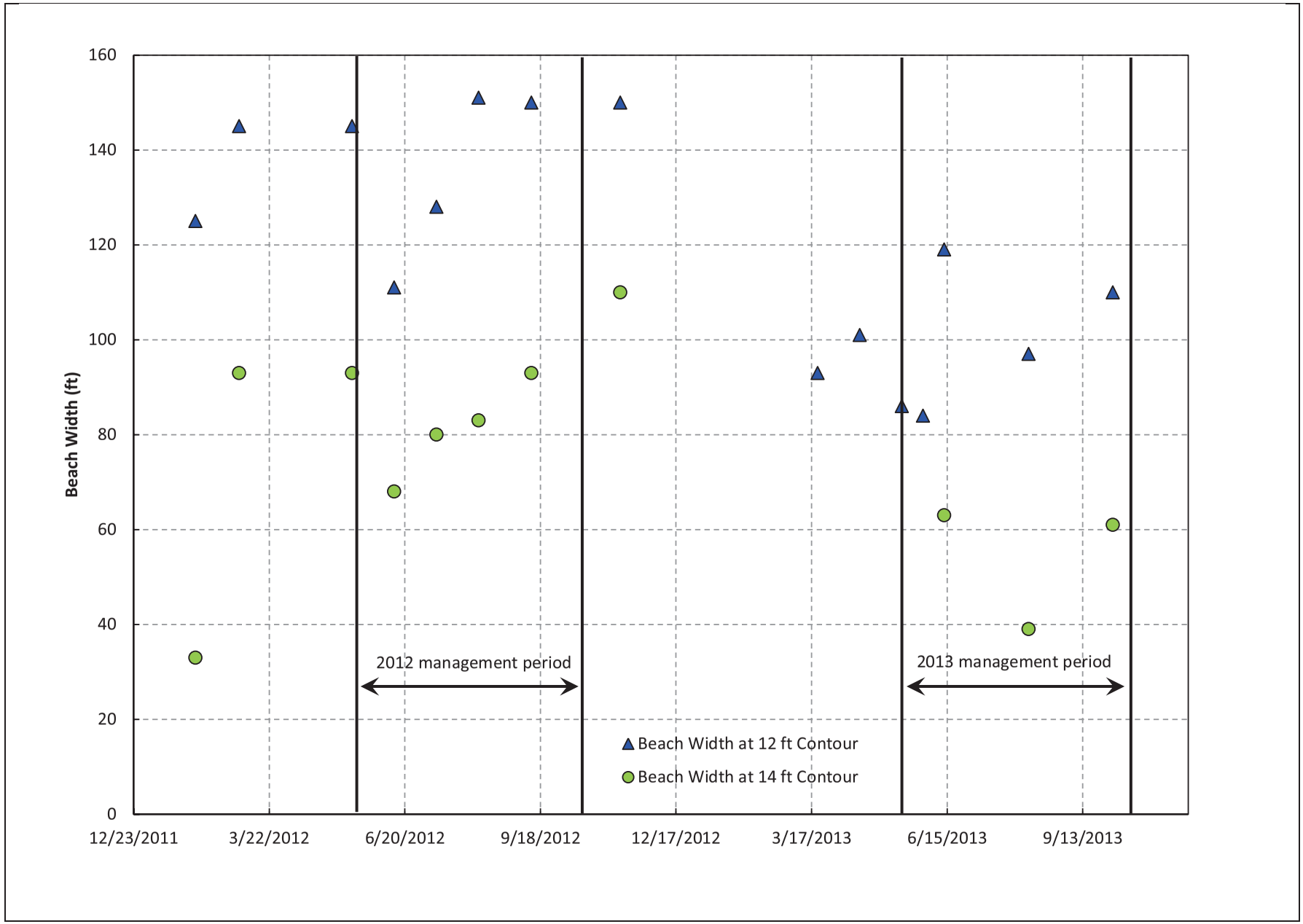
Beach Crest Profiles During the 2013 Management Period.



SOURCE: SCWA survey data

Figure 12

Beach Crest Profiles From August 2013 to February 2014.



SOURCE: SCWA survey data

Figure 13

Beach Width During 2012 and 2013 Management Periods.

Attachment I. Physical Processes During the 2014 Management Period

As required by the Russian River Biological Opinion, the Sonoma County Water Agency (Water Agency) has been tasked with managing the Russian River Estuary to facilitate summer lagoon conditions to improve salmonid habitat. The goal is to meet this need by creating an outlet channel while also maintaining the current level of flood protection for properties adjacent to the estuary (NMFS, 2008). The adaptive management plan, described in the main body of this report, was developed by the Water Agency with assistance from ESA PWA and the resource agency management team in 2009 and revised annually from 2010 to 2015. Because of permit constraints, the Water Agency was only able to implement the plan beginning in 2010. The revised plan was in effect for 2014, but no opportunities for management action occurred during the management period.

During the 2014 management period, May 15th to October 15th, Water Agency staff regularly monitored current and forecasted estuary water levels, inlet state, river discharge, tides, and wave conditions to anticipate changes to the inlet's state. Although several short-lived closure events occurred throughout late April and early May, the first four months of the management period experienced only tidal conditions. An extended closure event began on September 17th. Because of reduced inflows, the lagoon's stage rose slowly and did not reach an appropriate level for enacting the outlet channel until the end of the management period. Except for a few days immediately after artificial breaches, the lagoon remained closed from late September through late November.

Even though no management actions were implemented to inform the adaptive management process, the physical conditions and inlet response during the management period are reviewed in this attachment to contribute to site understanding and to inform future management actions.

METHODOLOGY

This review of the 2014 outlet channel management period examines water levels, ocean wave conditions, ocean water levels, riverine discharge, and beach topography, as well as inlet size and location. The sources for these parameters are listed in Table 1. These data were supplemented with personal observations and discussion with staff from the Water Agency, NMFS, CDFW, and the Bodega Marine Laboratory.

Table 1. Data Sources

Parameter	Source
Estuary water level (h_E)	Water Agency Jenner gage*
Wave height (H_s), period (T_a), and direction	CDIP Point Reyes buoy #029
Ocean water level (h_O)	NOAA Point Reyes #9415020
Russian River discharge (Q_f)	USGS Guerneville #11467000
Beach topography, ft NGVD	Water Agency monthly surveys
Inlet size and location	Water Agency and Bodega Marine Laboratory autonomous cameras

*Data transmission failure due to cellular network issues occurred for several periods throughout the management period.

INLET STABILITY PARAMETER AND CLOSURE RISK PROBABILITY

In addition to considering individual parameters, researchers at the Bodega Marine Laboratory have developed a combined parameter to evaluate the stability of the inlet's state, with the aim of predicting closure risk (Behrens et al., 2013). (Note that the inlet stability parameter does not differentiate between full closure and the perched conditions with a small outlet channel. When discussing this parameter, both states are referred to as a 'closure' in that tides are prevented from propagating into the estuary.) The inlet stability parameter presented by Behrens et al. (2013) quantifies the risk of inlet closure based on a sediment balance in the inlet. It considers the daily balance between wave-driven sediment import to the inlet and sediment export driven by tidal fluctuations. The wave-driven import is assessed using nearshore wave estimates derived from a transformation matrix and offshore buoy data (ESA PWA, 2012) and the latter is estimated from tide gage data within the estuary and a stage-storage relation derived from the available bathymetry. Using daily-average values of the stability parameter within the period 1999-2008, Behrens et al. (2013) showed that high-percentile values of the parameter are closely linked to the risk of the inlet closing within five days. As the percentile of the stability parameter increases, the risk of inlet closure within five days increases exponentially, from risks of roughly five percent when the parameter is at the 50th percentile to a risk of 80 percent when it is measured at the 99th percentile.

SUMMER AND FALL CONDITIONS

Time series of estuary water levels, as well as the key forcing factors (waves, tides, and riverine discharge), are shown in Figure 1 for the entire management period. The lagoon water level time series (Figure 1a) summarizes the closure events at the beginning of the management period, as well as the subsequent tidal conditions and later closure events in fall. As shown in Figure 1d, discharge was low for most of the management period, dropping from 7,000 ft^3/s on April 2nd to below 100 ft^3/s on May 21st. In mid-July, flows briefly reached 200 ft^3/s and remained above 100 ft^3/s for about a week. Afterwards, flows slowly declined until they reached a minimum of 55 ft^3/s on October 7th. As in prior years, wave energy was minimal in much of the management period. A late season swell event (H_s > 8 ft, T_p > 14s) occurred in late June, and may have led to the

subsequent week of muted tides in the lagoon, but did not lead to full inlet closure. A gap in Pt Reyes wave buoy data for the dominant period (T_p) for parts of September and October prevented nearshore transformation of waves during this time. At the end of the management season, high wave events overtopped the beach berm, delivering enough water to the lagoon to increase the daily rises in lagoon stage to 0.4-0.8 ft during the late-season closure event. Overtopping is visible in photographs taken by the river mouth overlook camera. These large waves also prevented breaching equipment from accessing the beach.

The conditions leading to inlet closure were consistent with the existing conceptual model described in Section 4 of the Management Plan. All closure events coincided with either moderately high waves (H_s > 6 ft) having periods greater than 10 s, or with neap oceanic tide ranges of less than approximately 5 ft, with the exception of the September closure event, when nearshore waves could not be estimated. Moderately high waves coincided with the closure events in April and May. The September closure event occurred during a neap tide. The artificial breach events that occurred on October 22nd and November 17th were coincident with neap tides and large to moderate waves, and were followed by closure within less than one day. The artificial breach event on November 26th happened during a spring tide, and was not followed by closure. The persistent closure conditions from September through November are examined in more detail in Figure 2.

As in 2012 and 2013, all closure events occurred when the inlet was adjacent to the jetty. In former years, this positioning may have prevented perched conditions from arising by shielding this area of the beach from the wave-driven sediment deposition that caused closure, preventing the beach from accreting to a sufficient height to allow the desired outlet channel elevations from being attained. This may have been the case for the September closure event in 2014 as well. Wave overwash in mid-October did appear to provide enough volume to raise the lagoon stage to a level requiring artificial breaching, but the same wave overwash also made work on the beach impossible, and occurred too late in the management season for a channel to be created.

LATE-SEASON CLOSURE EVENT

The only event that would have provided an opportunity for implementing the outlet channel occurred on September 17th. Inflows generally were below 100 ft^3/s throughout the event, allowing the stage to remain lower than 7 ft NGVD for almost a month of closure. The largest increases in stage happened on September 25th and October 12th due to wave overwash. The overwash raised the stage by about three quarters of a foot. Otherwise the weak inflows allowed the stage to rise at a very slow pace; the stage increased from roughly 5.0 ft NGVD on September 26th to approximately 6.8 ft NGVD on October 11th, and average increase of about 0.1 feet per day. Flows during this time were less than 85 ft^3/s and dipped to as low as 55 ft^3/s.

To better illustrate both the lagoon stage and beach morphology during this time, Figure 3 shows a sequence of photos of the inlet before and during this closure event. As was the case for all of the management period, the inlet was located next to the jetty. Figure 3a depicts the inlet when it was located next to the jetty several days before closure, indicating a width of less than roughly

40 ft. Nearshore waves could not be estimated for the week of closure, but are likely to have played a role, since waves generally begin to increase in energy in September. Neap tide conditions were present during the week of closure, with the oceanic tide range measured at approximately 4 feet (Figure 2c). Figure 3d shows extensive wave overwash surging over the beach berm and into the lagoon.

Unlike the 2012 management period, no natural outlet channels were formed near the jetty in 2014. However, as with 2012 and other previous years, the lowest portion of the beach was consistently located at the jetty. This persistent low portion is probably caused by wave sheltering by the jetty, which may have reduced berm build-up at the inlet's location, leaving a low point in the beach berm that was the site for subsequent overtopping and natural breaching.

CLOSURE RISK PROBABILITY

The 5-day closure risk probability, a derivative of the inlet stability parameter described above, was hindcast for 2014 according to the method described in Behrens et al. (2013). This hindcast provides an indication of the utility of the stability parameter as a prediction tool for monitoring inlet conditions and planning management action. This parameter integrates wave and ocean forcing conditions, as well as estuary water levels, to provide greater predictive skill than just waves or ocean tides on their own. The stability parameter combines these factors, and the corresponding five-day closure risk time series exceeded 50 percent before most 2014 events (Figure 1e). The gap in nearshore wave estimates in September was filled with offshore wave heights and periods, which are a poorer estimate of nearshore conditions. Since at least one day of tidal conditions are needed to predict closure, many of the closure events could not be predicted, since they occurred less than one day after breaching. Otherwise, the predicted probability of closure exceeded 50% 2-5 days in advance of most other closures.

TOPOGRAPHIC CHANGE

The Water Agency has conducted monthly surveys of Goat Rock State Beach that cover a region starting from the jetty and extending approximately 1,500 feet to the north. Typically, the surveys do not include bathymetry within the inlet because flow conditions in the inlet prevent safe access. Also, the survey extent can be limited by the Water Agency's compliance with its marine mammal incidental harassment authorization, which sets guidelines for the survey crew's approach to marine mammals hauled out on the beach. Water Agency survey staff collected spot elevations using RTK-GPS and then assembled these elevations into a set of contour lines at 1 ft intervals, as well as profiles along the beach berm crest, the ocean wetted edge, and the estuary water line. The survey elevations are reported in the NGVD29 vertical datum.

To characterize beach berm topographic conditions, ESA PWA assessed data from the Water Agency's 2010 (July to September), 2011 (May to October), 2012 (May to October), 2013 (May to October), and 2014 (May to October) surveys. Profiles include two transects backed by cliff (Figure 5 and Figure 6), two transects which extend into the estuary (Figure 7 and Figure 8), and two variations on a transect just north of the jetty (Figure 9 and Figure 10).

This review focuses on the 2014 surveys, although the 2011 surveys are included for context in some figures. The 2014 topographic data were similar to those of 2012 and 2013 in that the northernmost profiles underwent little morphologic change during the management season. However, in 2014 the southernmost profiles underwent more morphologic change than in those years, similar to the results from the 2010 and 2011 management seasons.

At profiles 3 and 4, the beach is backed by cliff, and undergoes morphologic changes when the inlet migrates north during floods and returns south to the jetty in spring or summer. In 2010 and 2011, migration in this area led to a sequence of erosion and accretion at these sites during the management period. The erosion seen in those years was associated with inlet migration and subsequent accretion of the beach was associated with long-period swell waves. During the 2012-2014 management seasons, the inlet remained at the jetty and did not migrate north, leading to an especially stable profile at Profile 4 (Figure 5). Profile 3 was also stable, but steepening in October led to changes in elevation on the order of 1-2 feet at the crest and along the beach face (Figure 6).

Compared with 2012 and 2013, Profiles 1 and 2 were much more variable. At Transect 2 (nearest to Haystack Rock), the beach profile was stable from May through August, and then grew vertically and moved landward in September (Figure 7). The largest change was between the September and October surveys, when the crest grew by roughly 2 feet. This type of seasonal growth is apparent in previous years, and is expected as wave energy increases seasonally. While Transect 1 underwent similar changes, it was more strongly influenced by proximity to the inlet throughout the summer. It was lowest in July and August, when the inlet was fully tidal. It extended seaward along the beach face from August to September and added an additional 1-2 feet vertically throughout the entire profile between September and October, reflecting the closure event.

Transect 0, which is located parallel to the jetty, was slightly higher than transect 1 in 2014, and showed a large shift in morphology at the end of summer (Figure 9). In previous years, it was more typical to see limited change throughout the management season at this transect, but large interannual variability (Figure 10). In 2014, it was mostly stable until August, and then grew seaward by over 50 feet between August and September. Its crest remained at roughly 14.5-15.0 ft NGVD despite this shift. This seaward growth is likely related to an abundance of northwesterly swell (Figure 2) that arrived during this month. Further growth between September and October was probably made possible by the combined waves and extended closure event.

Beach berm crest profiles were collected by the Water Agency for the first time in 2013 and collected again in 2014. These data make it possible to discern important changes in beach shape along the length of the berm from the northern beach access point to the jetty. Along-beach trends in crest elevation generally indicate along-beach trends in wave energy and the influence of inlet migration and breaching.

Figure 11 shows that through September, the change in crest elevation was minimal throughout the length of the beach north of Transect 1. By October, the crest elevation increased by as much as 3 ft in some areas. The beach crest was lowest south of Transect 1, where the inlet resided. At Transects 1-4, the crest profile shape remained essentially the same from May to September, with the dominant ridge pattern not shifting laterally. The along-crest ridge pattern also shifted laterally, with the new peak (18.0 ft NGVD) located along Transect 3. The beach was highest between Transects 3 and 4, peaking at 16-18 ft NGVD and minimum of 12.5-14.0 ft NGVD, north of Transect 4.

BEACH WIDTH

To provide additional information about the beach morphology, ESA PWA assessed the beach width using the Water Agency survey data. Figure 12 shows the evolution of the beach width at Transect 3 during the 2012-2014 management periods. In previous years during winter months, the beach was often eroded at Transect 3 to the point that the beach crest was below 12 ft NGVD, so that the width was effectively zero. In 2012 and 2013, apart from this seasonal erosion, there was no marked trend in the beach width. In 2014, the beach was wider than the previous two years, with peak width at the beginning of the management season (Figure 12). The width steadily decreased from 198 at 12 ft NGVD and 130 at 14 ft NGVD in May to 170 and 111 ft NGVD, respectively, in October. The shift appeared to be a result of beach face steepening, a typical summer process.

JENNER STAGE EXCEEDANCE

The Biological Opinion (NMFS, 2008) sets a target for estuary water levels “a daily minimum water surface elevation of 3.2 feet [NGVD] during 70% of the year.” To facilitate this target, the Biological Opion notes “Absent river flood flows and historic mechanical breaching practices, NMFS expects cross shore transport of sand by wave action will be sufficient to maintain the bar at this elevation.”

In 2014, the daily minimum water surface elevation exceed 3.2 ft NGVD roughly 33% of the year (Figure 13). For comparison, Figure 13 also includes hourly lagoon stage (exceeded 3.2 ft NGVD for roughly 46% of the year) and hourly Point Reyes stage (exceeded 3.2 ft NGVD for roughly 4% of the year). Data gaps at the Jenner Gage influence the exceedance curve, but BML camera photographs suggest an open mouth during most of the periods when stage data were missing, so the exceedance curves for the estuary are likely biased high, meaning that stage exceeded 3.2 ft NGVD for less of the year. This low amount of perched conditions results from the inlet maintaining open conditions throughout the summer of 2014. As with several of the years since 2010, lack of closure in June or July led to prolonged open conditions, as July and August waves were too small to cause closure. As explained in previous annual updates, if the inlet does not close in late spring, it is likely that open-inlet conditions will persist as a result of the seasonally weak waves. Since no closures occurred in late spring in 2014, an outlet channel could not be made, which would have presumably had the intended effect of causing prolonged perched conditions.

LESSONS LEARNED AND RECOMMENDATIONS

Based on 2014 observations of the estuary, associated physical processes, and the Water Agency's planning for outlet channel management, we note the following lessons about implementing the outlet channel management plan.

CONCEPTUAL MODEL

- The beach north of the inlet saw little change from the 16-18 ft NGVD elevations established in 2013. Near the jetty, the berm was lowered by inlet migration while undergoing beach building.
- Similar to the winters of 2011-12 and 2012-2013, the inlet never migrated north of Haystack Rock during winter 2013-14, and returned to the jetty in early spring, much earlier than in most years. This inlet alignment is not common, but has been observed in past years (Behrens et al., 2009).
- Peak annual river discharge has remained below 40,000 ft^3/s for 9 consecutive years, a streak unmatched in the 70-year flow record. This may have a connection to the recent lack of inlet migration to the north.
- The beach width in 2014 at Transect 3 (near Haystack Rock) was larger than in 2013. This may suggest that beach width is closely tied to inlet migration – the lack of migration north of Haystack Rock for several years has allowed the beach to grow at this end of the littoral cell.

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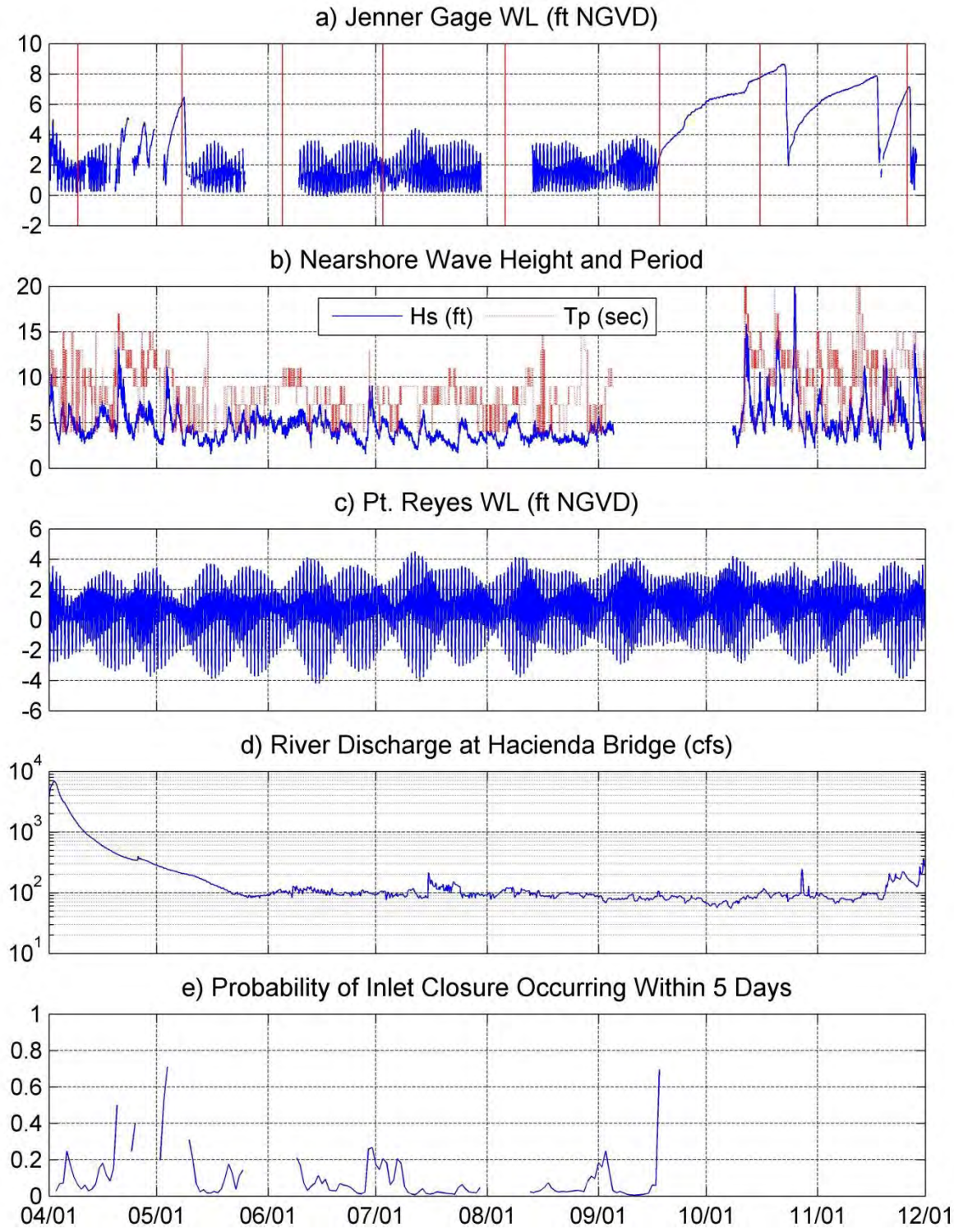
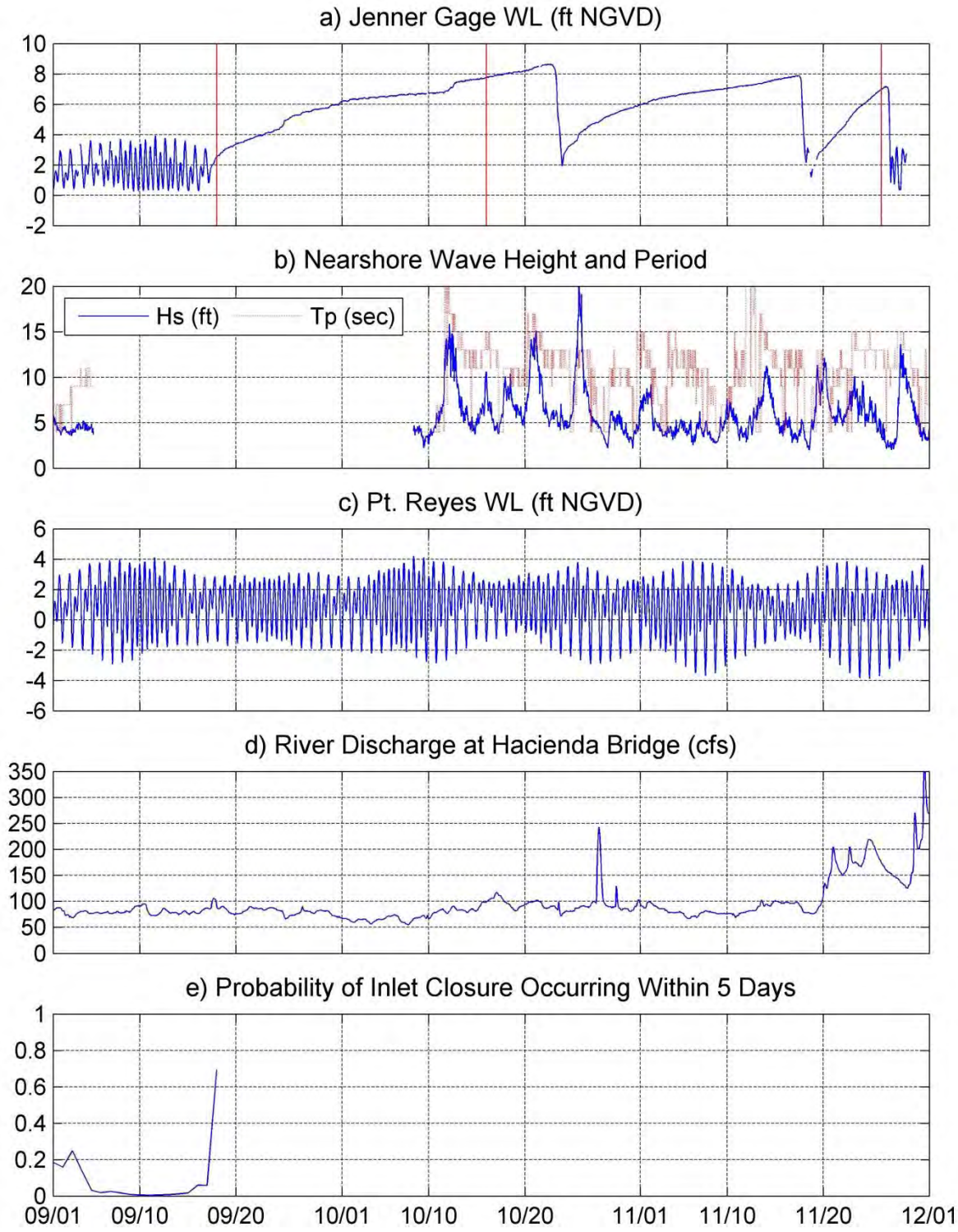


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 1

Estuary, Ocean, and River Conditions Compared with Closure Probability: April – November 2014

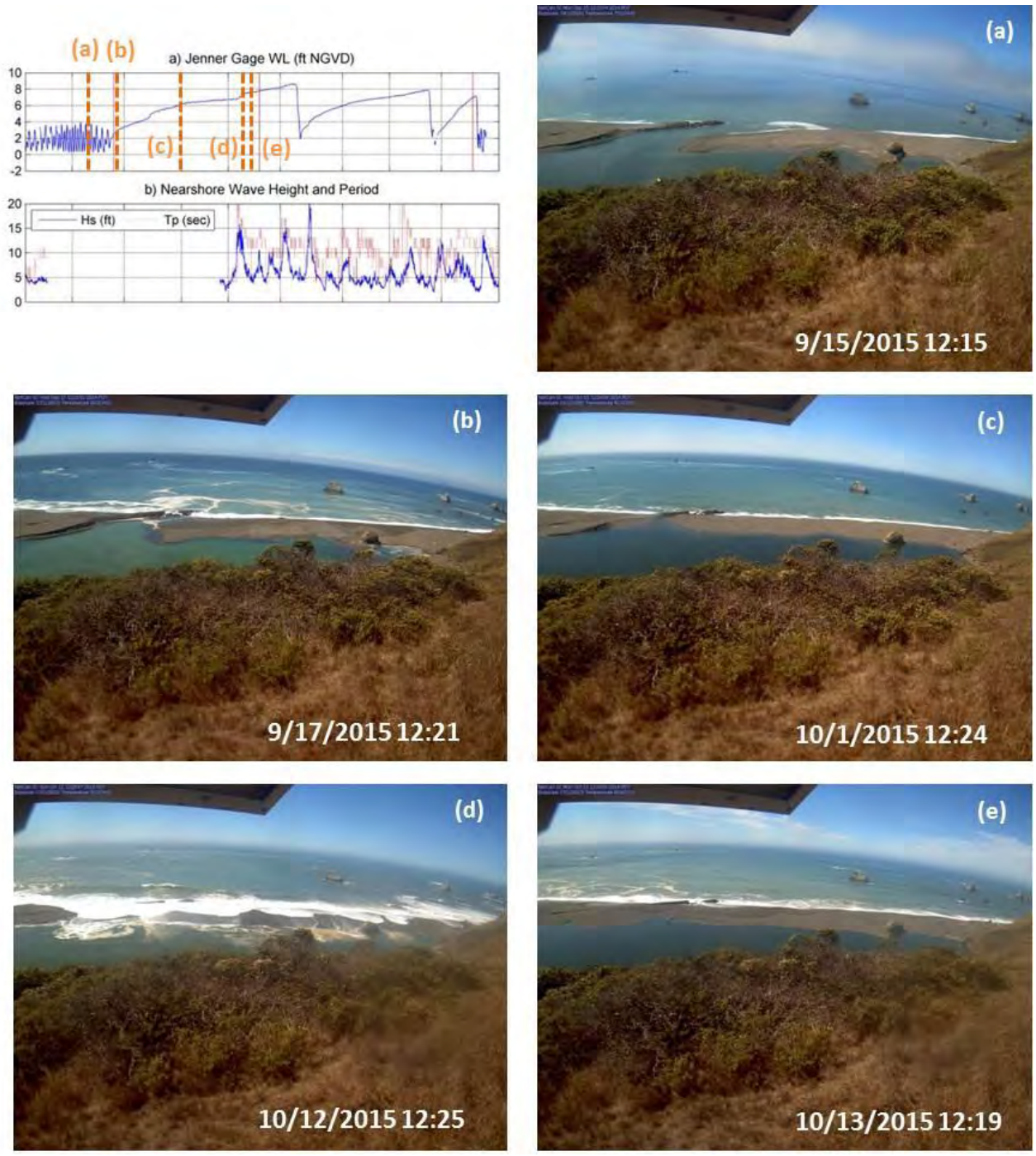


SOURCE:

a) Jenner gage water level provided by SCWA; red bar = beach survey
b) H_s = sig. wave height; Tp=peak wave period (CDIP, Pt. Reyes, #029)
c) Ocean water level provided by NOAA (Pt. Reyes #9415020)
d) River discharge provided by USGS (Guerneville #11467000)
e) Five-day closure probability provided after Behrens et al. (2013)

Figure 2

Estuary, Ocean, and River Conditions Compared with Closure Probability: September – November 2014



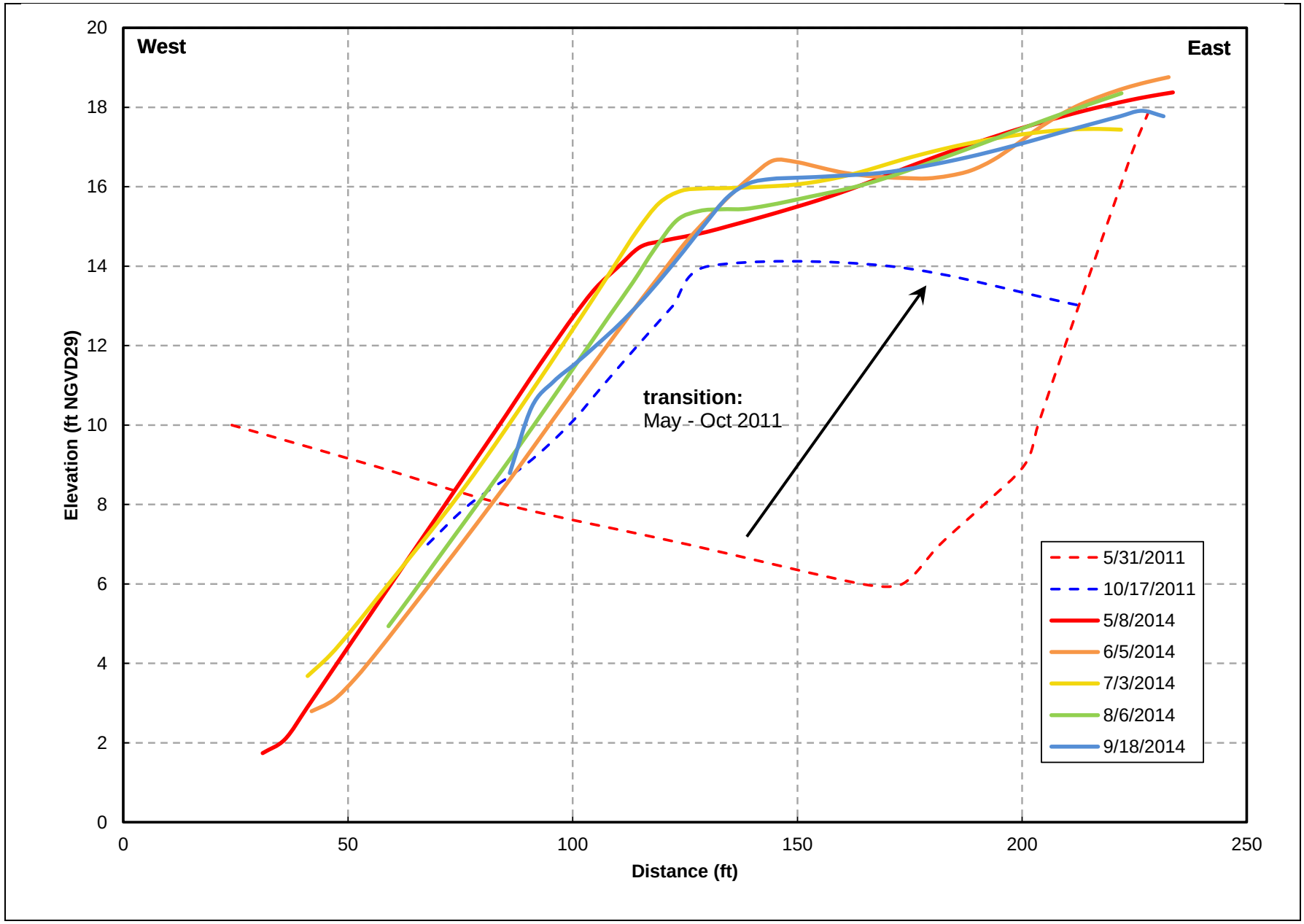
SOURCE: SCWA camera

Figure 3

Russian River camera photographs showing some of the key morphologic influences during the September-October 2014 closure event.

SOURCE: image from USDA NAIP

Figure 4
Beach Transect Locations

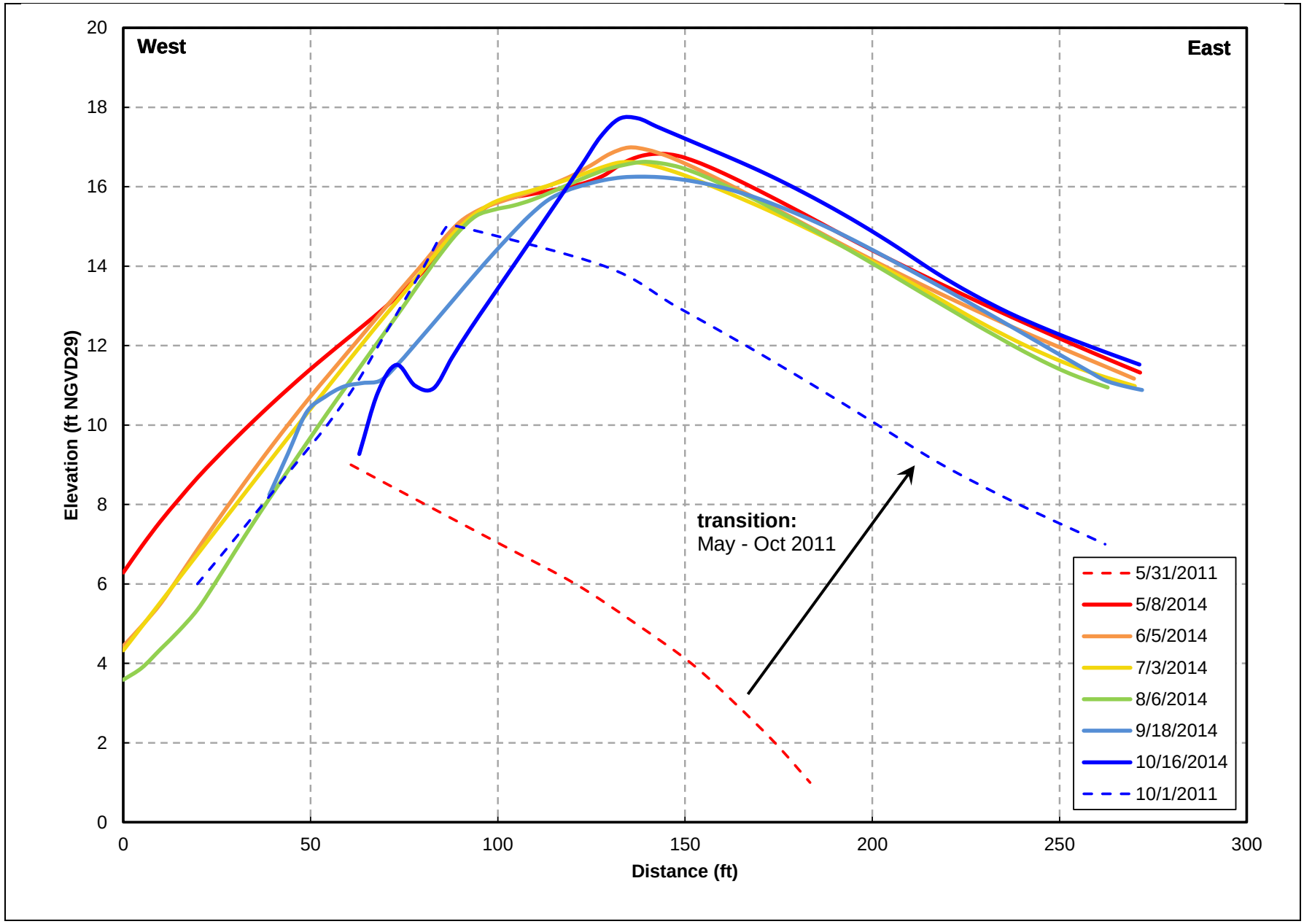


SOURCE: SCWA survey data

Russian River Estuary Outlet Channel Management Plan . DW01958

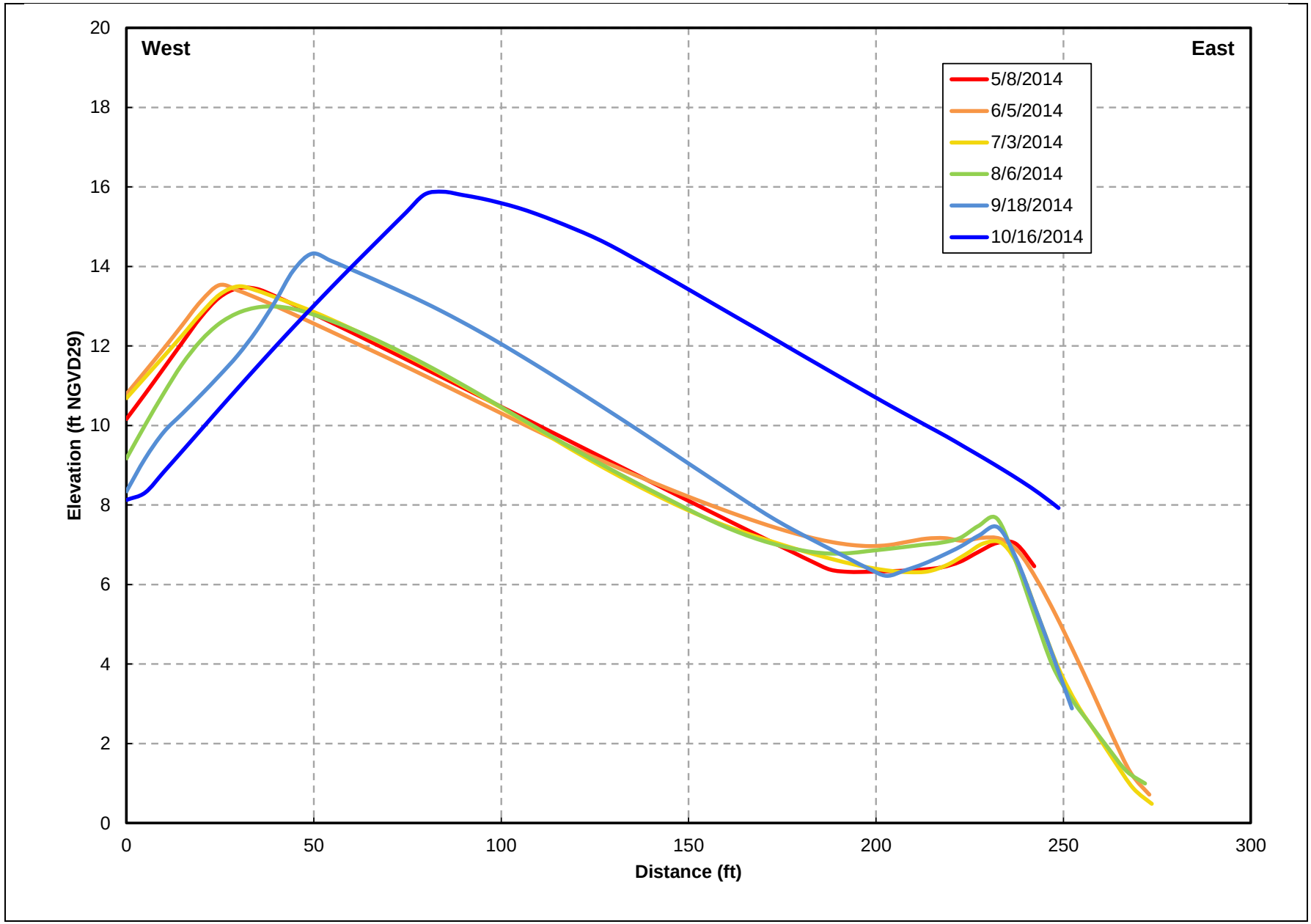
Figure 5

Beach Transect #4



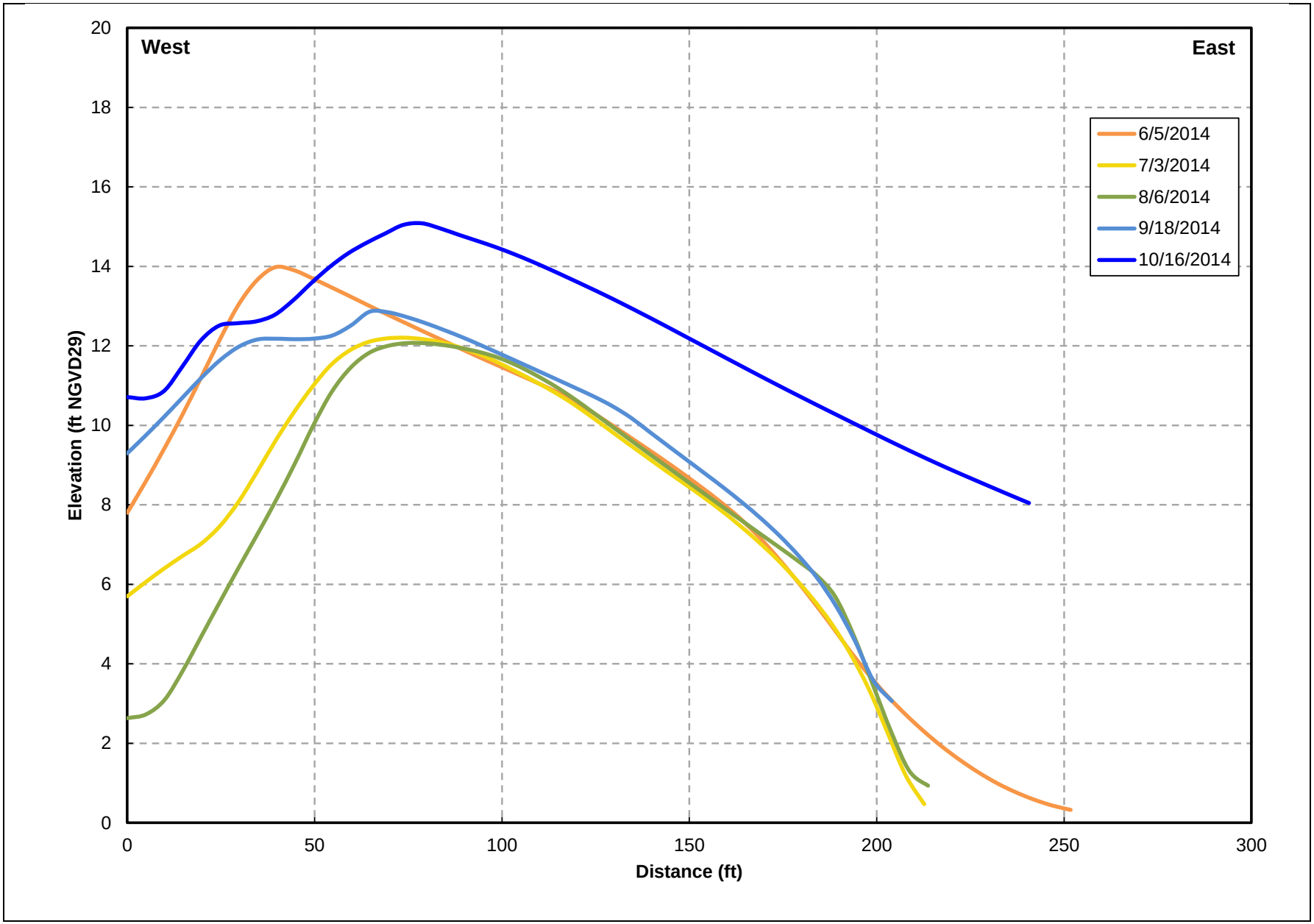
SOURCE: SCWA survey data

Figure 6
Beach Transect #3



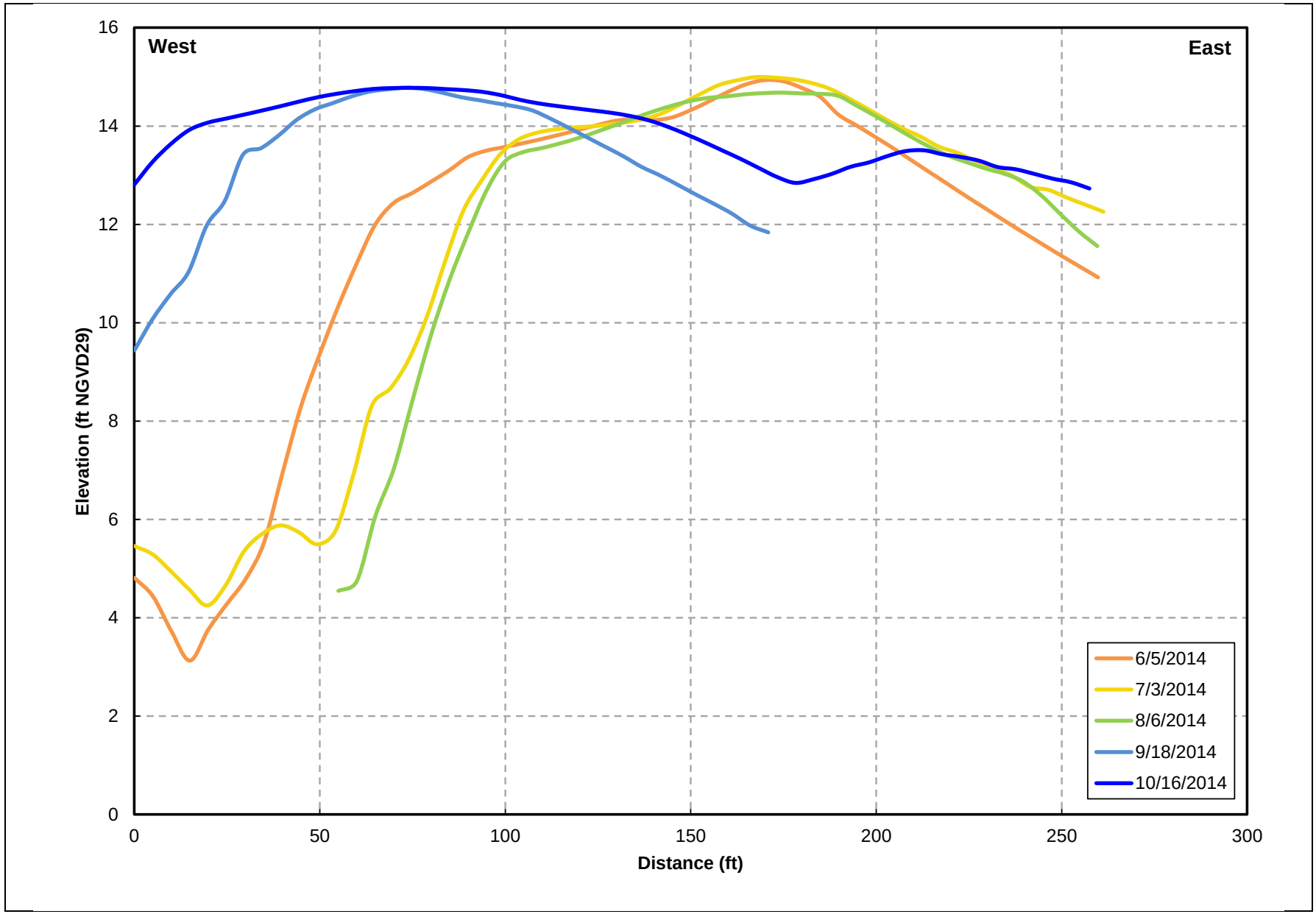
SOURCE: SCWA survey data

Figure 7
Beach Transect #2



SOURCE: SCWA survey data

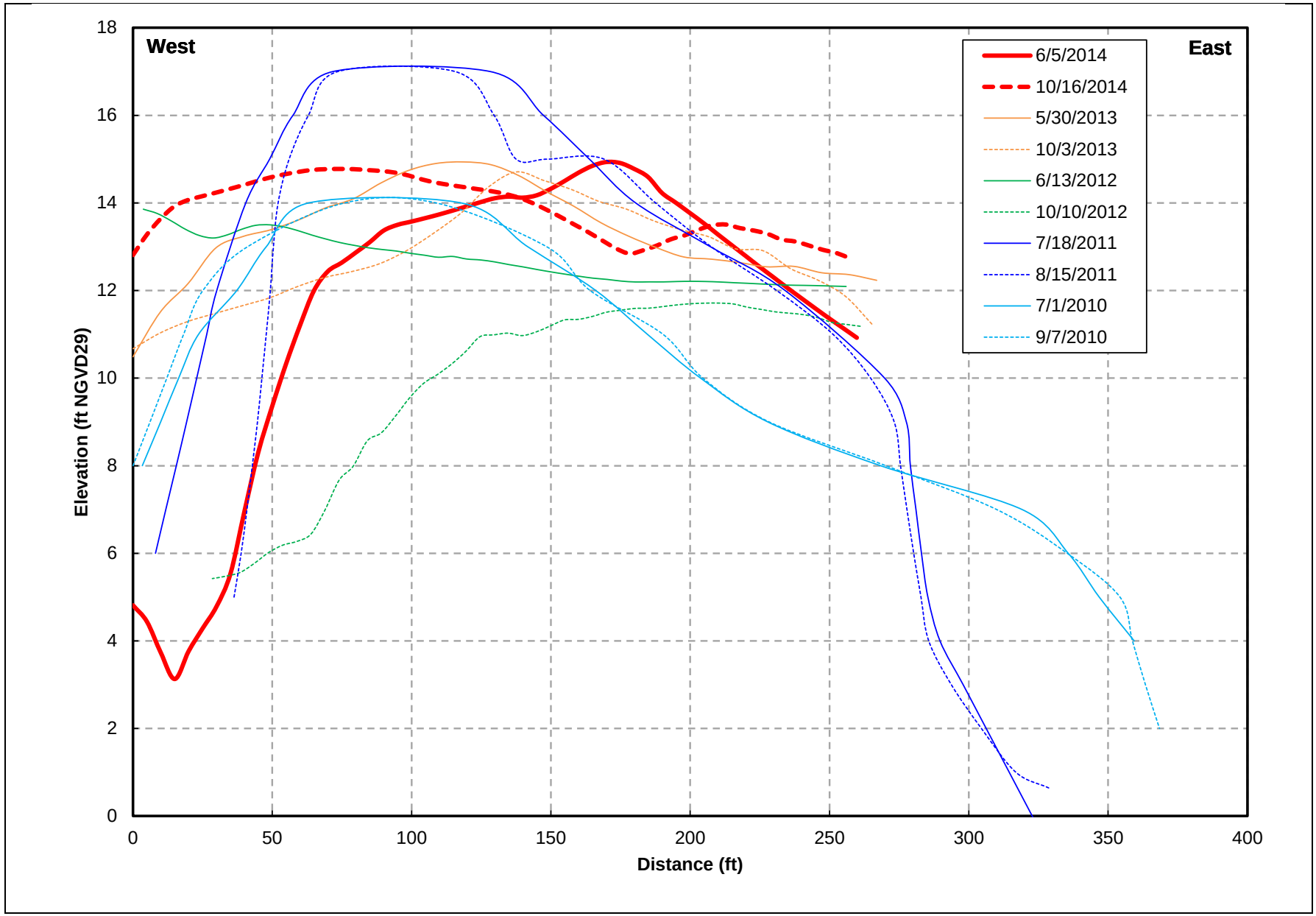
Figure 8
Beach Transect #1



SOURCE: SCWA survey data

Figure 9

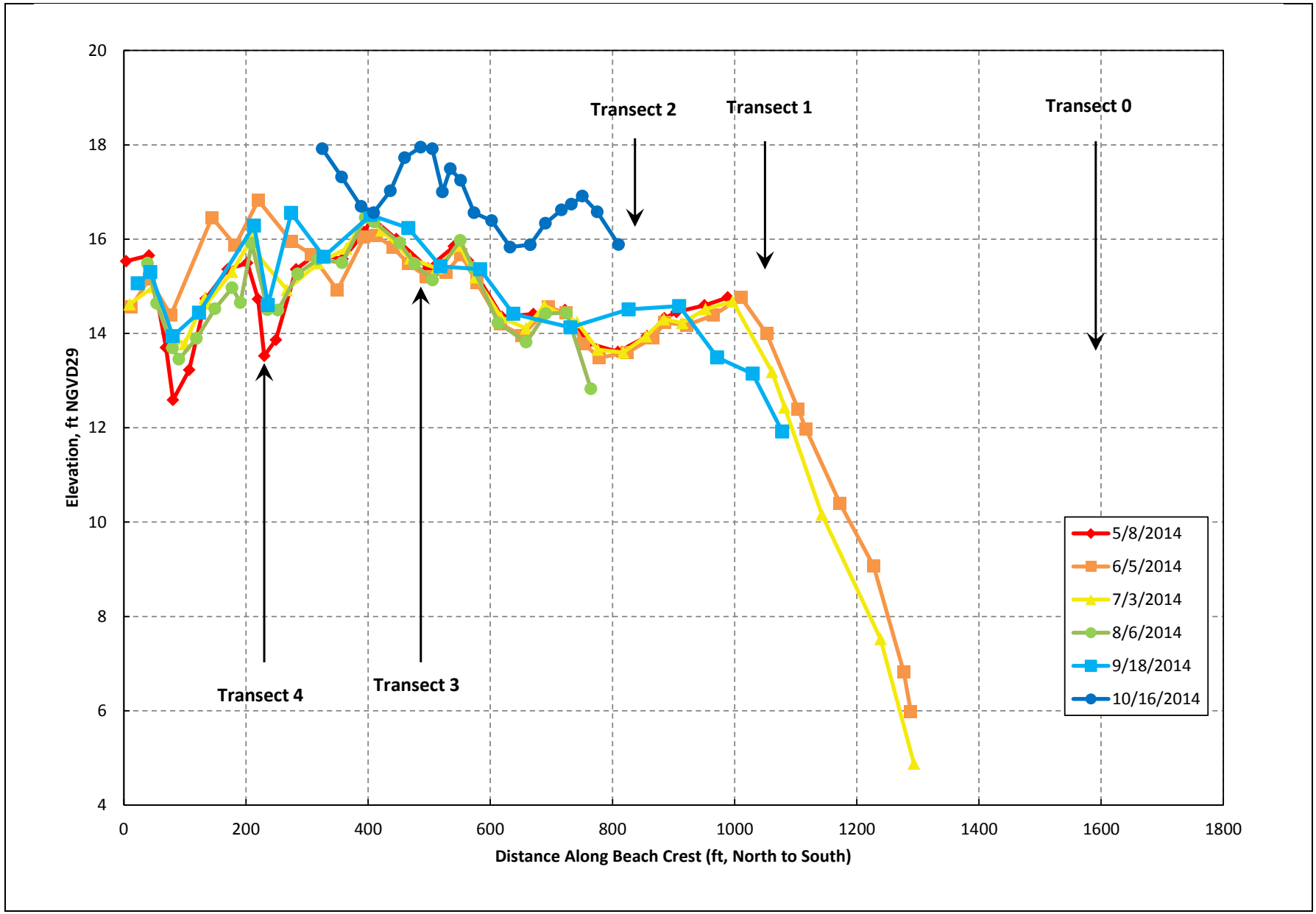
Beach Transect #0 from 2014 management period.



SOURCE: SCWA survey data

Figure 10

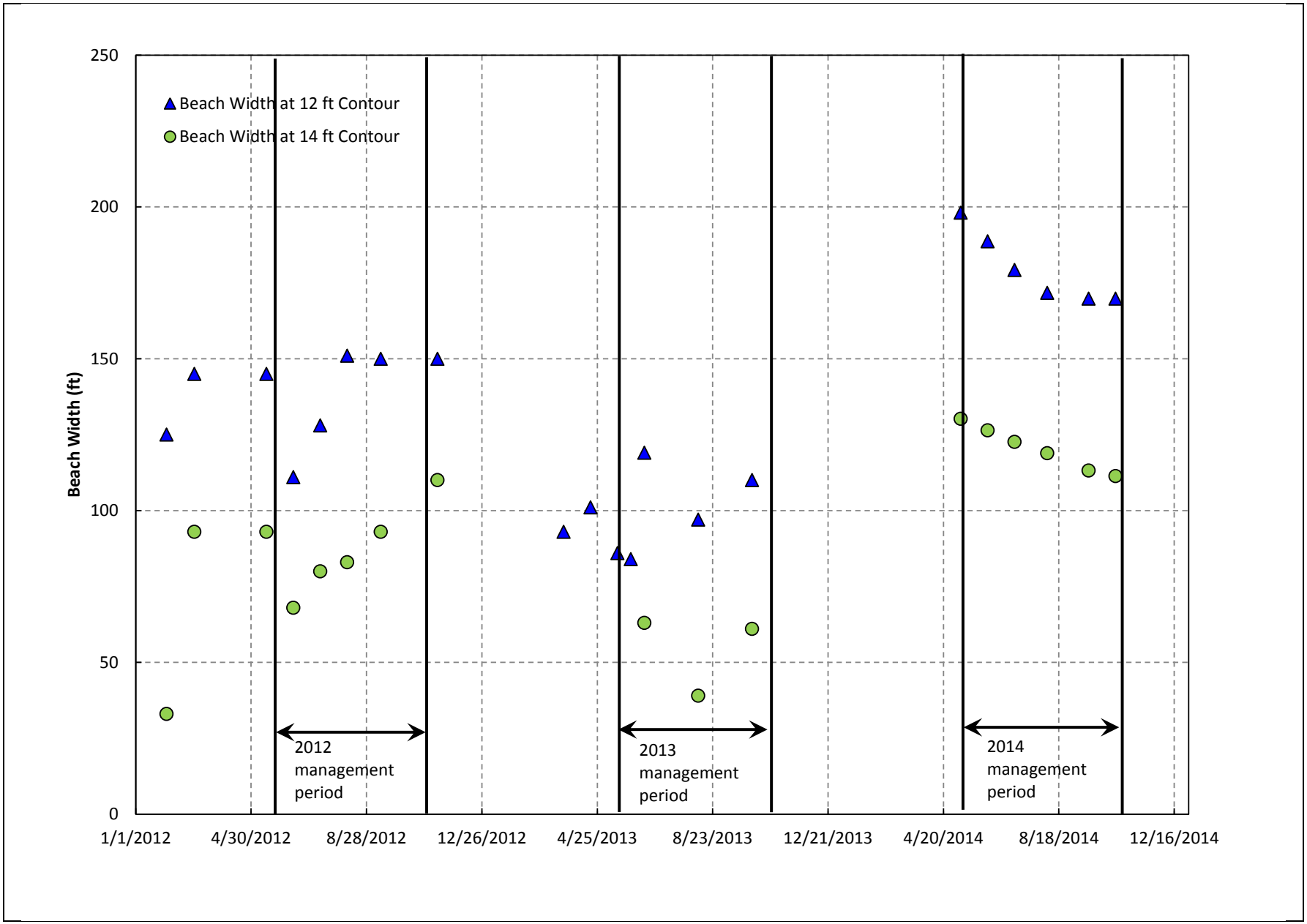
Beach Transect #0 from 2010-2014 management periods.



SOURCE: SCWA survey data

Figure 11

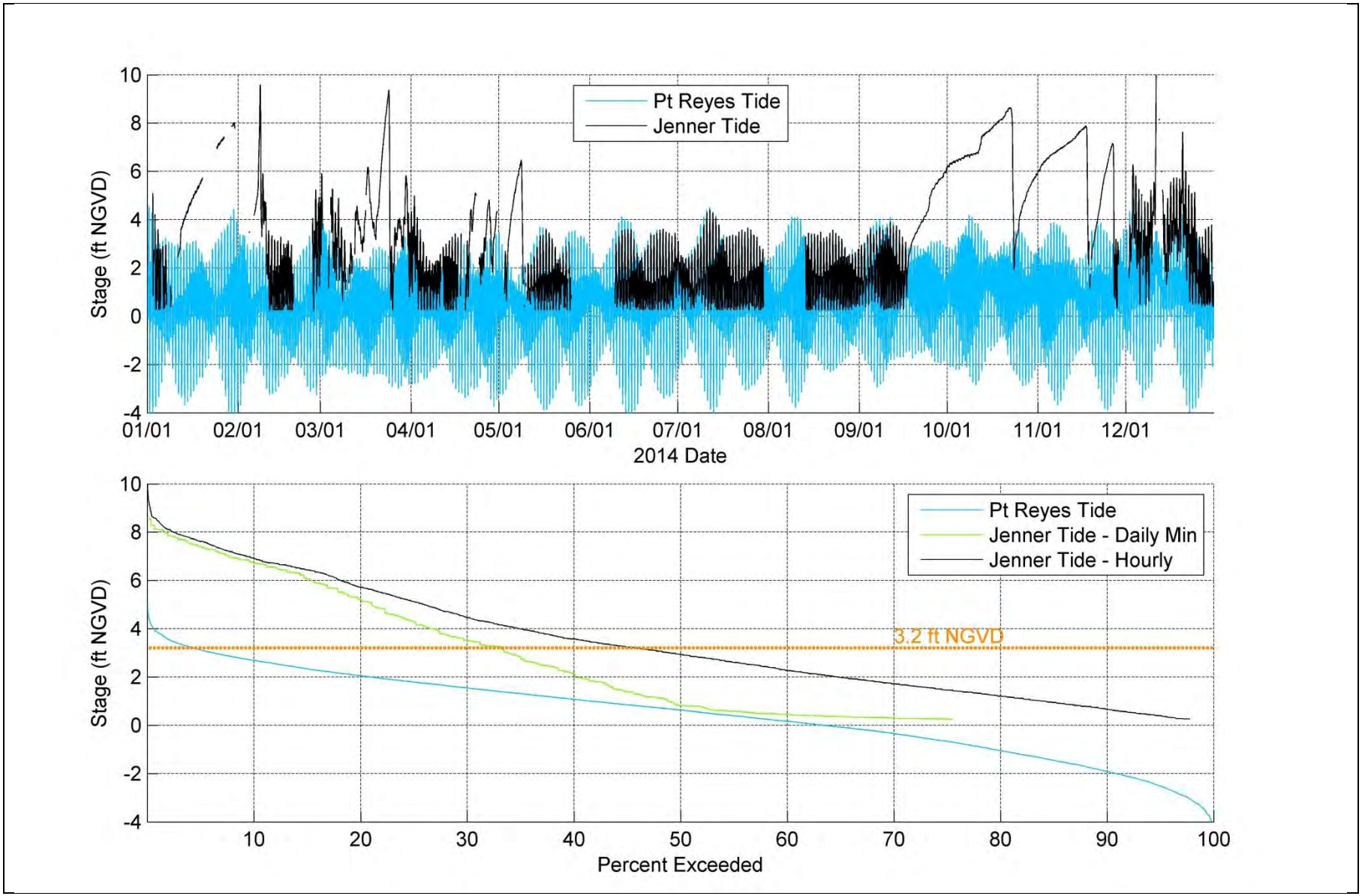
Beach Crest Profiles During the 2014 Management Period.



SOURCE: SCWA survey data

Figure 12

Beach Width During 2012-2014 Management Periods.



SOURCE: SCWA Jenner Gage and NOAA Pt Reyes tide data

Russian River Estuary Outlet Channel Management Plan . DW01958

Figure 13

Russian River Estuary stage exceedance for 2014.

APPENDIX B-4

Pinniped Monitoring Report 2014

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Russian River Estuary Management Project

Marine Mammal Protection Act Incidental Harassment Authorization
Report of Activities and Monitoring Results – January 1 to December 31, 2014

Prepared for
Office of Protected Resources and
Southwest Regional Administrator
National Marine Fisheries Service

Prepared by
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Jessica Martini-Lamb
Sonoma County Water Agency

January 2015

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Appendix A. Summary of pinniped monitoring activities at the Jenner haul-out (Goat Rock State Beach, Sonoma County) conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from January – December 2014 for the Russian River Estuary Management Project, including summary of pinniped abundance and Estuary water level.

EXECUTIVE SUMMARY

The purpose of this report of activities and monitoring results is to comply with the requirements of the Incidental Harassment Authorization (IHA) issued pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C 1361 et seq.) to take small numbers of marine mammals, by Level B harassment, incidental to the Sonoma County Water Agency's (Water Agency) Russian River Estuary Water Level Management Activities (April 21, 2014, NMFS IHA).

The Water Agency applied in 2009 to the National Marine Fisheries Service (NMFS) Office of Protected Resources for an IHA under the Marine Mammal Protection Act (MMPA) for activities associated with water level management activities in the Russian River Estuary (Estuary). NMFS issued an original IHA to the Water Agency on March 30, 2010 and subsequently on April 20, 2011, April 17, 2012, April 16, 2013, and April 21, 2014. This report provides the results of all monitoring of baseline conditions, water level management activities, and activities related to the Jetty Study Plan (ESA PWA 2011) for the 2014 calendar year, and additional summary information for all related activities.

The Estuary may close throughout the year as a result of a barrier beach forming across the mouth of the Russian River. Closures result in formation of a lagoon behind the barrier beach and, as water surface levels rise in the Estuary, flooding may occur. The Water Agency's artificial breaching activities are conducted in accordance with the Russian River Estuary Management Plan recommended in the Heckel (1994) study. The purpose of artificially breaching the barrier beach is to alleviate potential flooding of low-lying properties along the Estuary. The Water Agency and the U.S. Army Corps of Engineers (Corps) consulted with the NMFS under Section 7 of the Endangered Species Act (ESA) regarding the potential effects of their operations and maintenance activities, including the Water Agency's estuary management program, on federally-listed steelhead (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*), and Chinook salmon (*O. tshawytscha*). As a result of this consultation, the NMFS issued the Russian River Biological Opinion (NMFS 2008) finding that artificially elevated inflows to the Russian River estuary during the low flow season (May through October) and historic artificial breaching practices have significant adverse effects on the Russian River's estuarine rearing habitat primarily for steelhead. The historic method of artificial sandbar breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the Estuary's water quality and freshwater depths.

The Biological Opinion (NMFS 2008) concludes that the combination of high inflows and breaching practices impact rearing habitat because they interfere with natural processes that cause a freshwater lagoon to form behind the barrier beach. Fresh or brackish water lagoons at the mouths of many streams in central and southern California often provide depths and water quality that are highly favorable to the survival of rearing salmon and steelhead.

The Biological Opinion's Reasonable and Prudent Alternative (RPA) 2 (NMFS 2008) requires the Water Agency to collaborate with NMFS and to modify estuary water level management in order to reduce marine influence (high salinity and tidal inflow) and promote a higher water surface elevation in the estuary (formation of a fresh or brackish lagoon) for purposes of enhancing the quality of rearing habitat for juvenile (age 0+ and 1+) steelhead from May 15 to October 15 (the lagoon management period). A program of potential, incremental steps are prescribed to accomplish this, including adaptive management of a lagoon outlet channel on the barrier beach.

The Biological Opinion also requires the Water Agency to study the potential influences of an existing jetty at the mouth of the Russian River on water surface elevations in the Estuary. In accordance with the Biological Opinion's RPA 2 the Water Agency commissioned a study plan to analyze the effects and role of the existing, remnant Goat Rock State Beach jetty on beach permeability, seasonal sand storage and transport, seasonal flood risk, and seasonal water surface elevations in the Russian River estuary (ESA PWA 2011). Implementation of this study plan began in 2014 and included the installation and maintenance of monitoring wells and geophysical surveys.

Harbor seals (*Phoca vitulina richardsi*) regularly haul out at the mouth of the Russian River (Jenner haul-out). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haul-out. There are also several known river haul-outs at logs and rock piles in the Russian River Estuary. The Water Agency applied for an IHA under the MMPA for activities associated with Russian River Estuary management activities, which occur in the vicinity of these haul-outs, including:

- excavation and maintenance of a lagoon outlet channel that would facilitate management of a summer lagoon to improve rearing habitat for listed steelhead as required by the Russian River Biological Opinion (NMFS 2008);
- artificially breaching the barrier beach to minimize the potential for flooding of low-lying properties along the Estuary;
- biological and geophysical monitoring activities associated with the management actions described above;
- construction and maintenance of monitoring wells on the barrier beach south of the jetty; and
- geophysical surveys conducted at the barrier beach.

Pinniped monitoring was performed in accordance with the requirements of the NMFS IHA issued April 21, 2014, and the Russian River Estuary Management Activities Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011).

In an attempt to understand possible relationships between use of the Jenner haul-out and nearby coastal and river (peripheral) haul-outs, several other haul-outs on the coast and in the Russian River Estuary were monitored. These haul-outs include North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny Logs, Paddy's Rock, and Chalanchawi in the Russian River Estuary.

Baseline monitoring was performed to gather additional information about the population of harbor seals utilizing the Jenner haul-out including population trends, patterns in seasonal abundance and the influence of barrier beach condition on harbor seal abundance. Pinniped monitoring was also conducted in relation to Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Each of the peripheral haul-outs was monitored concurrent with Jenner baseline monitoring and monitoring of water level management activities. Estuary management monitoring occurred during the Water Agency's monthly topographic surveys of the barrier beach, Jetty Study investigations, and biological and physical monitoring of the Estuary. The purpose of Estuary management monitoring is to record any pinniped disturbances during the above activities.

A barrier beach was formed eleven times during 2014, but only during six of these closure events did the Water Agency artificially breach the sand bar. The Russian River mouth was closed to the ocean for a

total of 110 days (or 30%) in 2014, mostly during the fall months. Pinniped monitoring occurred no more than 3 days before, the day of, and the day after each water level management activity.

The Water Agency's Estuary biological and physical monitoring activities are included in the NMFS IHA. The Water Agency surveys the sandbar (or barrier beach) monthly to collect a topographic map of the beach, as required by the Russian River Biological Opinion. A monitor is present during these surveys to record any disturbances of the Jenner haul-out during the survey. In 2014 the Water Agency implemented the Jetty Study Plan (ESA PWA 2011) and a pinniped monitor was present to record any disturbances of the Jenner haul-out, similar to the monthly topographic surveys. Additionally, Water Agency field staff conducting biological and physical monitoring in the Estuary recorded any pinnipeds they encountered hauled out and any disturbance to pinnipeds associated with their activities.

The Russian River Estuary Management and Monitoring Activities in 2014 resulted in incidental harassment (Level B harassment) of 2,121 harbor seals and two northern elephant seals, well under the total allowed by NMFS IHA. The Russian River Estuary Management activities in 2013, 2012, 2011 and 2010 resulted in incidental harassment (Level B harassment) of 1,351, 208, 42 and 290 harbor seals, respectively.

INTRODUCTION

The purpose of this report of activities and monitoring results is to comply with the requirements of the Incidental Harassment Authorization (IHA) issued pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C 1361 et seq.) to take small numbers of marine mammals, by Level B harassment, incidental to the Sonoma County Water Agency's (Water Agency) Russian River Estuary Water Level Management Activities (April 21, 2014, NMFS IHA).

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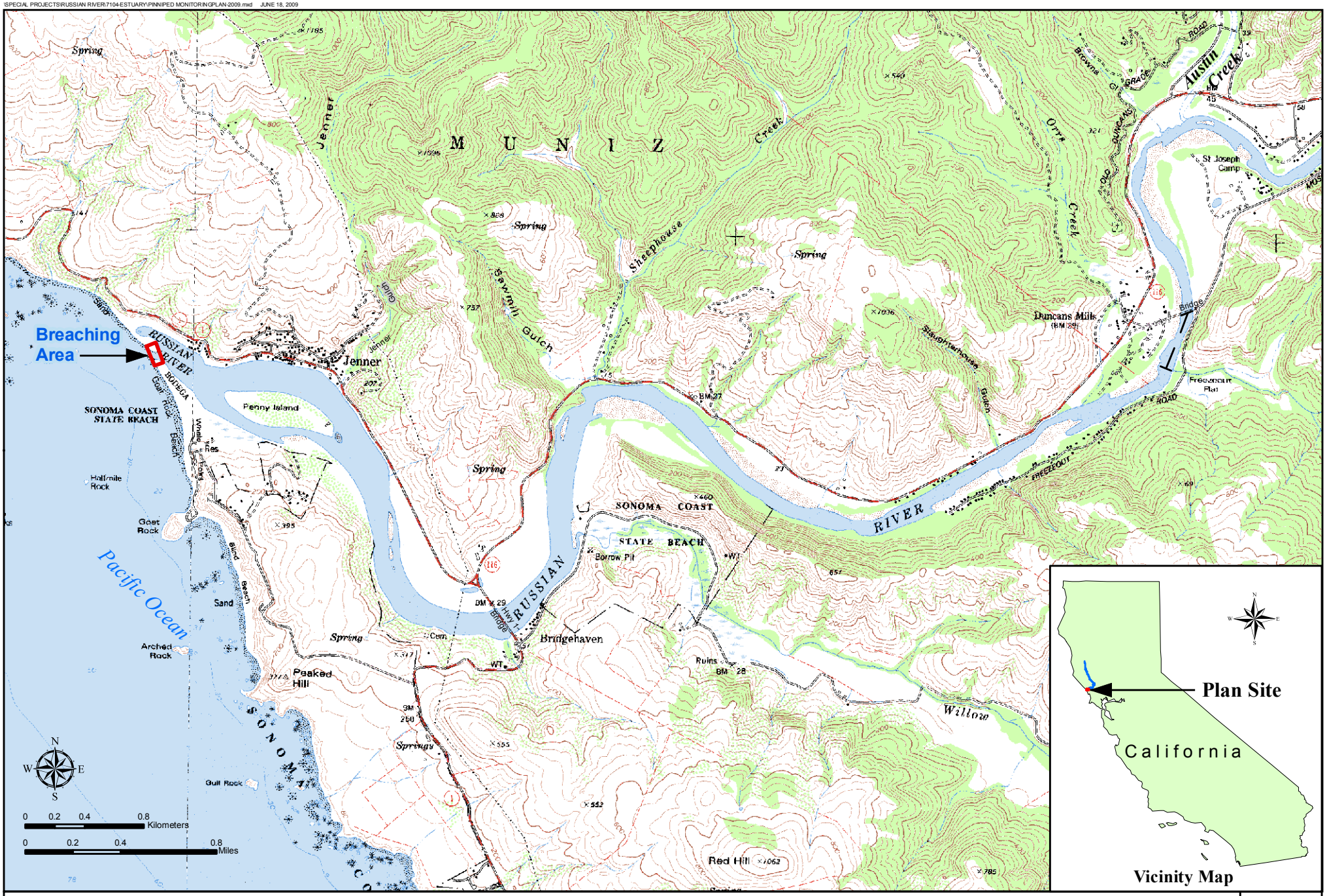
BACKGROUND

The Russian River Estuary (Estuary) is located about 97 kilometers (km; 60 miles) northwest of San Francisco in Jenner, Sonoma County, California (Figure 1). The Russian River watershed encompasses 3,847 square kilometers (km) (1,485 square miles) in Sonoma, Mendocino, and Lake Counties. The Estuary extends from the mouth of the Russian River upstream approximately 10 to 11 km (6 to 7 miles) between Austin Creek and the community of Duncans Mills (Heckel 1994).

The Estuary may close throughout the year as a result of a barrier beach forming across the mouth of the Russian River. The mouth is located at Goat Rock State Beach (California Department of Parks and Recreation). Closures result in formation of a lagoon behind the barrier beach and, as water surface levels rise in the Estuary, flooding may occur. Natural breaching events occur when Estuary water surface levels exceed the capability of the barrier beach to impound water, causing localized erosion of the barrier beach and creation of a tidal channel that reconnects the Russian River to the Pacific Ocean.

The barrier beach has also been artificially breached for decades; first by local citizens, then the County of Sonoma Public Works Department, and, since 1995, by the Water Agency. The Water Agency's artificial breaching activities are conducted in accordance with the Russian River Estuary Management Plan recommended in the Heckel (1994) study. The purpose of artificially breaching the barrier beach is to alleviate potential flooding of low-lying properties along the Estuary.



RRIFR
Russian River Instream Flow and Restoration

Russian River Estuary

This Map is for general reference only.

Figure 1

Biological Opinion and the Estuary

The Water Agency and the U.S. Army Corps of Engineers (Corps) consulted with the NMFS under Section 7 of the Endangered Species Act (ESA) regarding the potential effects of their operations and maintenance activities, including the Water Agency's Estuary Management Program, on federally-listed steelhead (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*), and Chinook salmon (*O. tshawytscha*). As a result of this consultation, the NMFS issued the Russian River Biological Opinion (NMFS 2008) finding that artificially elevated inflows to the Russian River Estuary during the low flow season (May through October) and historical artificial breaching practices have significant adverse effects on the Russian River's estuarine rearing habitat primarily for steelhead. The historical method of artificial sandbar breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the Estuary's water quality and freshwater depths.

The historical artificial breaching practices create a tidal marine environment with shallow freshwater depths and high salinity. Salinity stratification contributes to low dissolved oxygen at the bottom in some areas. The Biological Opinion (NMFS 2008) concluded that the combination of high inflows and breaching practices impacted rearing habitat by interfering with natural processes that form a freshwater lagoon behind the barrier beach. Fresh or brackish water lagoons at the mouths of many streams in central and southern California often provide depths and water quality that are highly favorable to the survival of rearing salmon and steelhead.

The Biological Opinion's Reasonable and Prudent Alternative (RPA) 2 (NMFS 2008) requires the Water Agency to collaborate with NMFS to modify Estuary water level management to reduce marine influence on the Estuary (tidal inflow and high salinity) and to promote a higher water surface elevation in the Estuary to form a fresh or brackish lagoon to enhance rearing habitat for juvenile (age 0+ and 1+) steelhead from May 15 to October 15 (the lagoon management period). The Biological Opinion outlines a program of potential, incremental steps to accomplish this, including adaptive management of a lagoon outlet channel on the barrier beach.

In accordance with the Biological Opinion's RPA 2 the Water Agency commissioned a study plan to analyze the effects and role of the existing, remnant Goat Rock State Beach jetty on beach permeability, seasonal sand storage and transport, seasonal flood risk, and seasonal water surface elevations in the Russian River Estuary (ESA PWA 2011). Implementation of this study plan began in March 2014 and included the installation and maintenance of monitoring wells and geophysical surveys.

Harbor seals (*Phoca vitulina richardsi*) regularly haul out at the mouth of the Russian River (Jenner haul-out) (Figure 2). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haul-out. There are also several known river haul-outs at logs and rock piles in the Russian River Estuary (Figure 2). The Water Agency applied for an IHA under the MMPA for activities associated with Russian River estuary management activities, including:

- excavation and maintenance of a lagoon outlet channel that would facilitate management of a summer lagoon to improve rearing habitat for listed steelhead as required by the Russian River Biological Opinion (NMFS 2008);
- artificially breaching the barrier beach to minimize the potential for flooding of low-lying properties along the Estuary;
- biological and geophysical monitoring activities associated with the management actions described above;

- construction and maintenance of monitoring wells on the barrier beach south of the jetty; and
- geophysical surveys conducted at the barrier beach.

The purpose of the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011) is to detect the response of pinnipeds to Estuary management activities at the Russian River Estuary. Specifically, the following questions are of interest:

1. Under what conditions do pinnipeds haul out at the Russian River Estuary mouth at Jenner?

2. How do seals at the Jenner haul-out respond to activities associated with the construction and maintenance of the lagoon outlet channel and artificial breaching activities?

3. Does the number of seals at the Jenner haul-out significantly differ from historic averages with formation of a summer (May 15th to October 15th) lagoon in the Russian River Estuary?

4. Are seals at the Jenner haul-out displaced to nearby river and coastal haul-outs when the mouth remains closed in the summer?

METHODS

Monitoring was performed in accordance with the requirements of NMFS IHA issued April 21, 2014, and the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011).

Water Agency biologists and Stewards of the Coast and Redwoods (Stewards) volunteers and staff monitored pinnipeds at the Jenner and peripheral haul-outs. The Stewards and Water Agency provide annual training for all volunteers; trainings occurred on March 10, 2010, January 10, 2011, February 14, 2012, February 14, 2013 and February 11, 2014. Water Agency biologists participating in the monitoring program also attended the training session. The training agenda covered:

- the Marine Mammal Protection Act;
- anticipated IHA monitoring requirements;
- the Russian River Estuary Management Activities Pinniped Monitoring Plan and monitoring methods therein, including completion of data sheets;
- field identification of pinnipeds of the California coast, including harbor seals, California sea lions, Steller sea lions, northern elephant seals, northern fur seals and Guadalupe fur seals;
- field identification of neonates (pups less than 1 week old);
- care and use of field equipment (e.g. cameras, spotting scopes, binoculars); and
- field visits to each haul-out monitoring location.

SPECIAL PROJECTS/RUSSIAN RIVER/7104-ESTUARY/HARBOR SEAL-2009-JENNER FEBRUARY 10,2011

Pinniped Haulouts at the Russian River Estuary and Surrounds

Figure 2

Twice monthly baseline monitoring of the Jenner haul-out was shared by Water Agency biologists and trained Stewards volunteers (each group monitored once a month), with volunteers monitoring the peripheral haul-outs for all baseline monitoring. Monitoring of water level management activities (lagoon outlet channel and artificial breaching) at the Jenner haul-out was also shared, but Water Agency biologists monitored artificial breaching activities on the day of the event (no lagoon outlet channel activities occurred in 2014). Pre- breaching and post-breaching monitoring was shared by the organizations depending on the availability of volunteers and Water Agency staff. Water Agency biologists also monitored pinnipeds during monthly topographic surveys of the beach, Jetty Study investigations, and biological and physical monitoring of the Estuary.

Baseline

Baseline monitoring was performed to gather information about the population of harbor seals utilizing the Jenner haul-out including population trends, patterns in seasonal abundance and the influence of barrier beach condition on harbor seal abundance. Baseline monitoring of the peripheral haul-outs was completed concurrently with the monitoring of the Jenner haul-out. Baseline counts were scheduled for two days out of each month with the intention of capturing a low and high tide each in the morning and afternoon. Weather conditions were recorded at the beginning of each census. These included temperature, visibility, ocean conditions (Beaufort scale) and wind speed. Tide levels and Estuary water surface elevations were correlated to each monitoring day.

Jenner Haul-out Use

Pinnipeds at the Jenner and peripheral haul-outs were surveyed twice monthly. This census began at local dawn and continued for 8 hours. At Jenner, all pinnipeds hauled out on the beach were counted every 30 minutes from the overlook on the bluff along Highway 1 adjacent to the haul-out using binoculars or a high-powered spotting scope. Depending on time of year and how the sandbar is formed, harbor seals may haul out in multiple groups at the Jenner haul-out. At each 30-minute count, the observer would indicate where groups of seals are hauled out on the sandbar (e.g. Site A, Site B mapped on datasheet) and provide a total count for each group.

Pupping Season

Adults and pups were counted separately through June, after which it became difficult to differentiate between age classes. All neonates were also recorded and were identified using one or more of the following characteristics: less than 1 week old, less than 15 kg, thin for their body length, an umbilicus or natal pelage present, wrinkled skin, or awkward or “jerky” movement. If any potentially abandoned pup was observed during monitoring, the Water Agency would contact the NMFS stranding response network (Marine Mammal Center in Sausalito, CA) immediately and report the incident to NMFS’ Southwest Regional Office and NMFS Headquarters within 48 hours. Monitors were instructed not to approach or move the pup. Monitors used the following potential indications that a pup may be abandoned: no observed contacts with adult seals, no movement of the pup, and the pup’s attempts to nurse were rebuffed.

Peripheral Haul-out Use

To understand possible relationships between use of the Jenner haul-out and nearby coastal and river (peripheral) haul-outs, monitoring occurred at several other haul-outs on the coast and in the Russian River Estuary (Figure 2). These haul-outs include North Jenner and Odin Cove to the north; Pocked Rock, Kabemali, and Rock Point to the south; Penny Logs, Paddy’s Rock, and Chalanchawi in the Russian River Estuary. These are known harbor seal haul-outs that have been monitored by Joe Mortenson for over 25

years. The peripheral haul-outs were visited for 10 minute counts four times during each baseline monitoring day. All pinnipeds hauled out during the 10 minutes were counted from the same vantage points at each haul-out using a high-powered spotting scope or binoculars.

Disturbance of Seals

In addition to the census data, disturbances of the haul-outs were recorded. The methods for recording disturbances followed those in Mortenson (1996). Disturbances were recorded on a three-point scale that represents an increasing seal response to the disturbance (Table 1). The time, source, and duration of the disturbance, as well as an estimated distance between the source and haul-out, were recorded.

Table 1. Levels of pinniped response to disturbance used for Russian River Estuary Management Project pinniped monitoring. For permitting purposes a "take" or Level B harassment would include only moving or flight responses.

Level	Type of Response	Definition
1	Alert	Seal head orientation in response to disturbance. This may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, or changing from a lying to a sitting position.
2	Moving	Movements away from the source of disturbance, ranging from short withdrawals over short distances to hurried retreats many meters in length.
3	Flight	All retreats (flushes) to the water, another group of seals, or over the beach.
SOURCE: Mortenson, J. 1996. Human interference with harbor seals at Jenner, California, 1994-1995. Prepared for Stewards of Slavianka and Sonoma Coast State Beaches, Russian River/Mendocino Park District. July 11, 1996.		

Water Level Management Activities

Pinniped haul-outs were monitored during Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Peripheral haul-outs were monitored concurrently with the Jenner haul-out during water level management activities. This provided an opportunity to investigate possible correlation between water level management activities and number of seals using these nearby haul-outs. Since the movements of individual seals are not tracked, the number of seals displaced from the Jenner haul-out to the peripheral haul-outs cannot be quantified; however, potential trends may be observed.

The monitoring methods for water level management activities followed a deliberate pattern. To begin, a one-day, pre-event survey was made within 1 to 3 days prior to all water level management events. On the day of the management event, pinniped monitoring began at least one hour prior to the crew and equipment accessing the beach work area and continued during the duration of the event until at least one hour after the crew and equipment left the beach. Monitoring continued on the day following each water level management event to document the number of seals utilizing the haul-outs. Methods followed the census and disturbance monitoring protocols described in the "Baseline" section above.

Prior to each breaching or lagoon outlet channel implementation, the Water Agency monitor participated in the onsite tailgate safety meeting to discuss the location(s) of pinnipeds at the Jenner haul-out that day and methods of avoiding and minimizing disturbances to the haul-out as outlined in NMFS IHA.

Biological and Physical Monitoring

The NMFS IHA also provides incidental take for Level B harassment of pinnipeds that may result from monitoring of biological resources and physical processes in the Estuary. Water Agency field staff record the presence of pinnipeds hauled out in the Estuary in the vicinity of their activities and record any resulting disturbances. The Russian River Biological Opinion also requires monthly topographic surveys of the sandbar at the mouth of the Russian River. A Water Agency biologist was present during topographic surveys to provide guidance to the survey crews on minimizing disturbance of the haul-out and to observe pinniped response to the survey work in the vicinity of the Jenner haul-out. Beginning on May 30, 2013, the methods for conducting the monthly topographic surveys of the barrier beach changed. Due to the frequent and prolonged river mouth closures there was an increased need to gather complete information about the topography and berm crest elevation of the beach to best inform water level management activities. This necessitated the survey crew to access the entire beach, including any area where seals were hauled out. Provided that no neonates or nursing pups were on the haul-out, the survey crew approached the haul-out slowly on foot and allowed for the seals to gradually vacate the beach before the survey proceeded. A pinniped monitor was present for all of these surveys and carefully documented the seals' response and total number of animals disturbed.

RESULTS AND DISCUSSION

The NMFS IHA (April 21, 2014) requires the following information be provided in this report:

(a) the number of seals taken, by species and age class (if possible)
(b) behavior prior to and during water level management events
(c) start and end time of activity
(d) estimated distances between source and seals when disturbance occurs
(e) weather conditions (e.g., temperature, wind, etc.)
(f) haul-out reoccupation time of any seals based on post activity monitoring
(g) tide levels and estuary water surface elevation
(h) seal census from bi-monthly and nearby haul-out monitoring
(i) specific conclusions that may be drawn from the data in relation to the four questions of interest in SCWA's Pinniped Monitoring Plan, if possible

Estuary water surface elevations are recorded at the Jenner gauge (operated by the Water Agency), located at the State Parks visitor center in the town of Jenner. Appendix A includes the Estuary water surface elevations associated with pinniped monitoring in 2014, including baseline, water level management events and Estuary management investigations.

Baseline

In 2014 a total of 23 baseline surveys, 11 monthly beach topographic surveys, 6 breaching surveys, 6 pre-breaching, 6 post-breaching and 10 jetty study surveys were conducted (Appendix A). Three of the total baseline surveys also functioned as pre-breaching surveys and one baseline survey also functioned as a post-breaching survey. Additionally one of the topographic surveys was conducted during a breaching event. December's beach topographic survey was cancelled due to dangerous, high wave conditions.

Jenner Haul-out Use

Peak seal abundance, as measured by the single greatest count of harbor seals at the Jenner haul-out, was on March 6 (424 seals). However, using the average number of seals hauled out as a measure of abundance, seal abundance at Jenner was greatest in July (mean = 266 ± 2.1 s.e., n = 33) (Figure 3). Seal

abundance was significantly greater in July and March compared to all other months except February (Unequal N HSD multiple comparisons test, $p < 0.001$). The July peak in abundance occurred during the summer molting period, while the March peak in abundance occurred prior to the start of pupping. Similar to previous years, seal abundance declined in the fall, and was particularly low in October and November (significantly lower than all other months except September; Unequal N HSD multiple comparisons test, $p < 0.001$) (Figure 3). The reduction in seal abundance during the fall months, while not atypical, may have been more severe for 2014 due to the long periods of barrier beach closures during those months. The barrier beach was closed 36 consecutive days beginning on September 17th and another 24 consecutive days beginning October 24th. When compared to previous years combined, there were significantly more seals at the Jenner haul-out in February, March and December, and significantly fewer seals in November of 2014 (Unequal N HSD multiple comparisons test, $p < 0.05$) (Figure 3).

While it is not possible to separate the effect of river mouth condition (closed versus open) from time of year, fewer seals are present during closed conditions (mean = 46.9 ± 1.74 s.e., n =713) compared to open conditions (mean = 134.6 ± 1.89 s.e., n=2,179; ANOVA $p<0.001$) (Figure 4). However, the overall trend was an increase in seal abundance compared to earlier years.

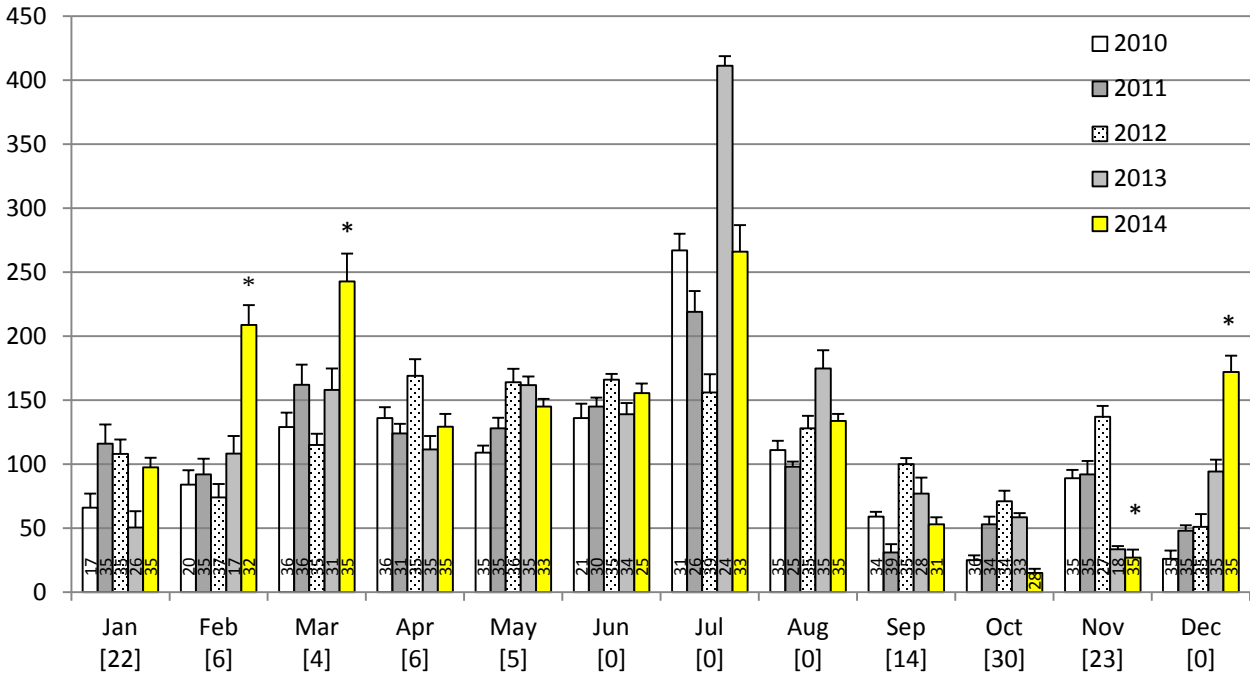


Figure 3. The average number of harbor seals hauled out at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) as counted during baseline surveys for each year (January 2010 – December 2014) categorized by month. Error bars represent standard error and sample size used to calculate means are presented inside the bars. Numbers in brackets indicate the number of days the river mouth was closed in 2014. Asterisk above indicate 2014 monthly average seals counts that varied significantly from the previous years combined monthly average (Unequal N HSD multiple comparisons test, $p < 0.05$).

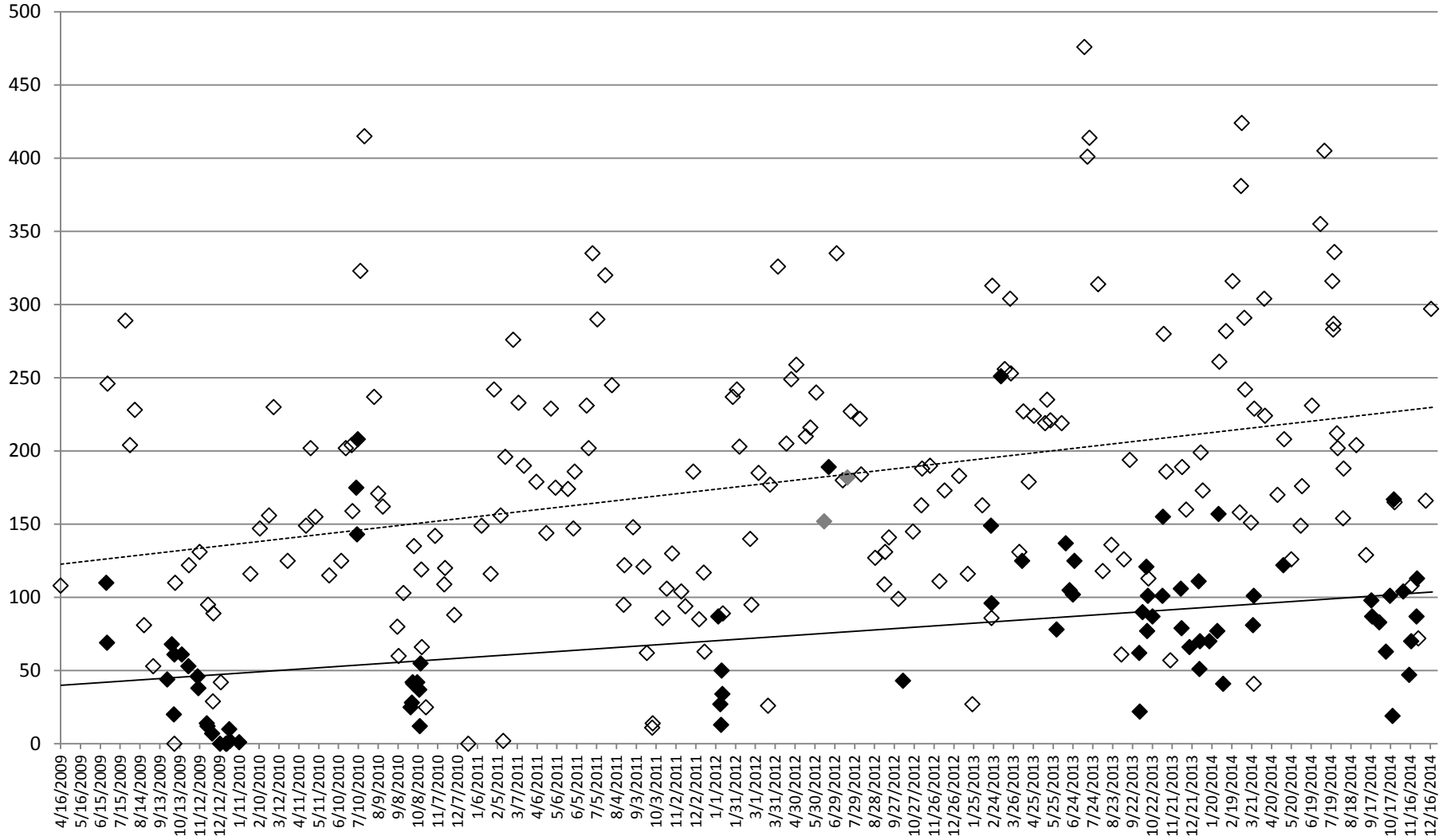


Figure 4. Maximum number of harbor seals counted during all pinniped surveys at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) since surveys began in 2009. Open diamonds represent counts in mouth open conditions, black filled diamonds represent counts during mouth closed conditions and grey diamonds represent counts during naturally perched conditions. Dashed line represents linear trend for harbor seal counts in mouth open conditions and solid line represents linear trend for harbor seal counts in mouth closed conditions.

Pupping Season

Pups have been observed at the Jenner haul-out as early as March (SCWA 2012, 2013). In 2014 the first pups were observed on April 9, with the latest observation of pups occurring on June 5 (the last neonate was observed on May 9). In 2013 the first pups were observed on April 18, with the latest observation of pups occurring on May 30, 2013 (SCWA 2014). Pups are counted during surveys through June, after which time it becomes difficult to distinguish pups from sub-adult seals. No distressed or abandoned pups were reported by Water Agency or Stewards monitors in 2014.

Pup production at the Jenner haul-out was 23.2% of adult seals as calculated from the peak pup count recorded on April 29 and the number of adult harbor seals present at the same time. Pup production decreased slightly since last year when 28.8% of adult seals was reported. However, the average number of pups observed (when pups were present) during April and May was up slightly for 2014: 13.9 pups compared to 12.9 pups in 2013.

Peripheral Haul-out Use

In addition to monitoring harbor seal abundance at the Jenner haul-out, eight coastal and Estuary haul-outs were monitored. Similar to previous years, most of these peripheral haul-outs had very low seal abundance with three sites averaging less than one seal (North Jenner = 0.3, Penny Logs = 0.1, Paddy's Rock = 0) and three sites averaging less than 4 seals (Odin Cove = 3.3, Chalanchawi = 1.2 and Pocked Rock = 3.7), as observed during baseline surveys. The two southernmost coastal haul-outs included in our monitoring surveys, Kabemali and Rock Point, had the highest abundance of seals with a baseline average of 6.0 and 7.6 respectively. Seasonal increases in seal abundance were most apparent at the Pocked Rock, Kabemali, and Rock Point haul-outs, where seal abundance peaked during June and July for Rock Point and Pocked Rock; May and June for Kabemali) (Table 2).

Table 2. The average number of harbor seals by month hauled out at peripheral sites as observed during all monitoring surveys conducted in 2014.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Jenner	0.1	0.0	3.1	0.0	4.0	0.0	0.0	0.4	0.0	0.0	1.8	0.0
Odin Cove	3.0	4.3	5.9	0.0	6.0	3.0	7.3	6.3	4.6	1.5	4.5	0.0
Penny Logs	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.5	0.1	0
Paddy's Rock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chalanchawi	0.7	2.0	0.5	0.9	2.5	2.5	1.9	2.6	0.0	0.1	0.6	0.7
Pocked Rock	1.3	4.3	3.4	2.8	4.3	**7.8**	**7.8**	2.4	2.3	2.4	2.3	2.7
Kabemali	5.8	2.0	4.6	6.1	**16.2**	**22.5**	3.3	5.6	2.1	1.4	6.8	0.0
Rock Point	8.3	1.6	3.7	8.0	8.5	**13.8**	**25.1**	6.4	8.9	3.4	8.4	0.0

Disturbance of Seals

An effort was made to compare the level of disturbance between baseline surveys and surveys when Water Agency personnel are working in the vicinity of the Jenner haul-out. Disturbance sources were separated into 9 categories: aircraft, bird, dog, kayak, multiple, other boat, people, unknown and vehicle. Seals were considered to be disturbed if they moved on or flushed from the haul-out. Given that seal abundance on the haul-out is lower during closed (including naturally perched) conditions we also compare level of disturbance by river mouth condition.

Figure 5 illustrates the proportion of baseline surveys when harbor seals were disturbed at the Jenner haul-out, categorized by disturbance source. Harbor seals were most frequently disturbed by people on foot (54% of surveys), with an increase in disturbances during mouth closed conditions (69% of surveys). People in kayaks were the next most frequent source of disturbance (29% of surveys). The proportion of baseline surveys when seals were disturbed by people, on foot or in kayaks, was greater for days when the river mouth was closed (Figure 5).

To compare the relative level of disturbance associated with Water Agency personnel working near the Jenner haul-out to days when no Water Agency activities are conducted (*i.e.,* baseline surveys) Figure 6 illustrates disturbances observed during beach topographic surveys, jetty study activities, breaching, and lagoon outlet channel implementation. As expected the proportion of surveys where seals were disturbed by people increased for days when Water Agency personnel were working in the area of the Jenner haul-out (an increase of 30%).

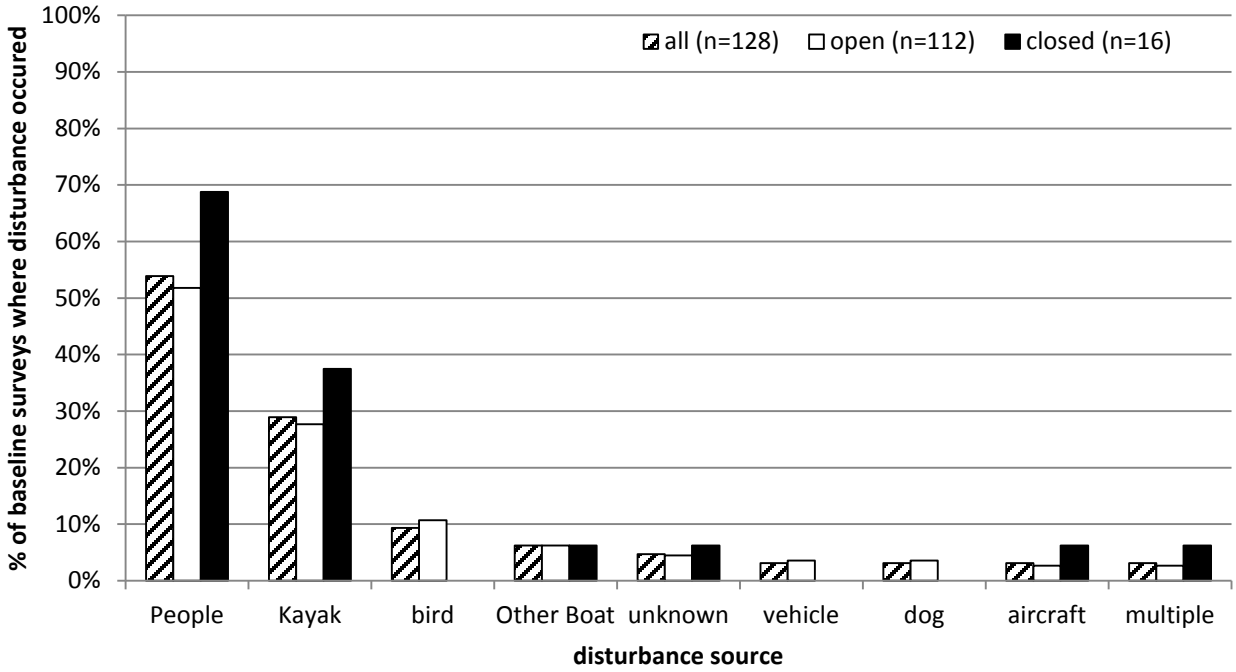


Figure 5. The proportion of baseline surveys where harbor seals were disturbed (moved or flushed) at the Jenner haul-out, described for each disturbance source. Data includes all baseline surveys since surveys began in 2009. Data is presented for baseline surveys during mouth open (n=112) and mouth closed (n=16) conditions, where closed includes naturally perched conditions.

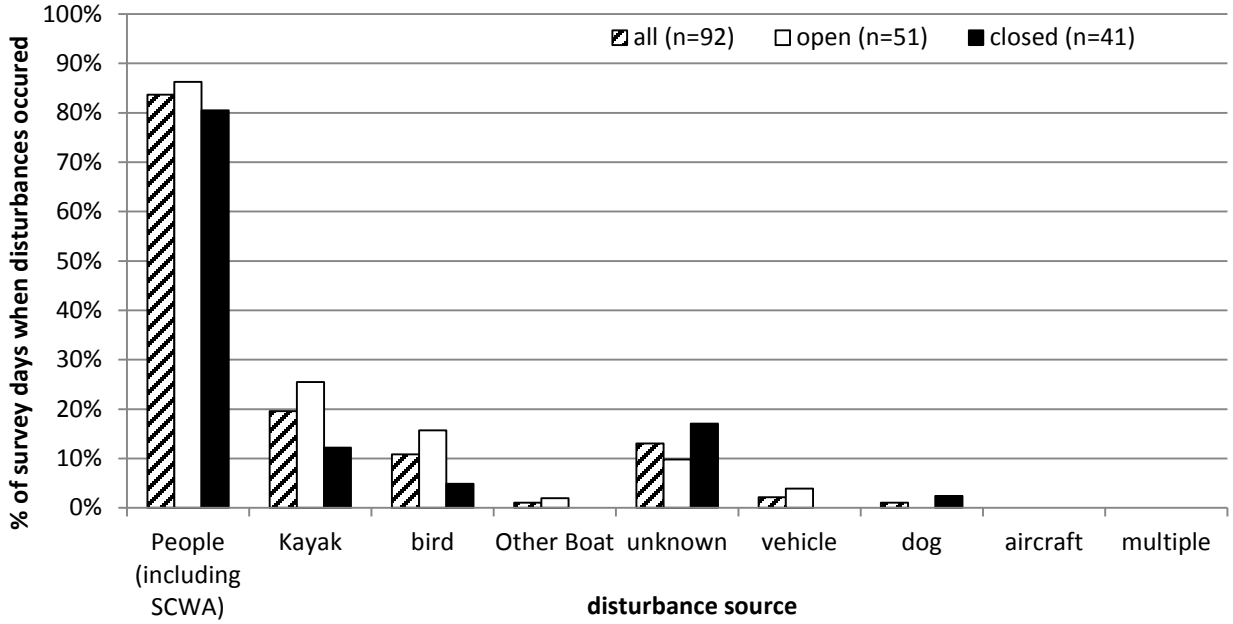


Figure 6. The proportion of surveys during Water Agency activities where harbor seals were disturbed (moved or flushed) at the Jenner haul-out, described for each disturbance source. Data includes all breaching, lagoon outlet channel implementation, beach topographic and jetty study surveys since surveys began in 2009. Data is presented for surveys during mouth open (n=51) and mouth closed (n=41) conditions, where mouth closed conditions include a period of time in 2012 when the barrier beach had formed, but water outflow occurred at the jetty structure. Disturbance source "people" includes Water Agency personnel and/or equipment in the vicinity of the Jenner haul-out.

Water Level Management Activities

A barrier beach formed eleven times during 2014 (Table 3), and the Water Agency artificially breached the sand bar during six of these closures. The Russian River outlet was closed to the ocean for a total of 110 days (or 30%) in 2014, with 29 (or 26%) of these days occurring during the Lagoon Management Period. This is similar to the previous year where the outlet was closed for 104 days, however in 2013 54% of outlet closures occurred during the Lagoon Management Period.

On December 16, 2013, the barrier beach formed, closing the river mouth until December 21st when the water impounded behind the barrier beach and wave over wash at the jetty eroded away enough sand for an outlet channel to form. By the December 23, a barrier beach again closed the river mouth until it was mechanically breached by the Water Agency on January 2, 2014. Breaching activities began at 10:11 and were completed at 11:52. The water level in the Estuary reached 7.37 ft NGVD on the day of breaching. Just prior to breaching harbor seals were hauled out on the ocean side of the barrier beach north of the jetty structure. The maximum number of seals observed hauled out on January 2nd was 62 at 09:25. On January 3rd there were 111 harbor seals hauled out at 07:00.

On January 11, 2014, the river mouth closed and remained closed until it was mechanically breached by the Water Agency on January 30th at 15:14. The peak water level in the Estuary was 8.03 ft NGVD as read from the Jenner gauge at 14:22 on January 30th. Prior to the start of breaching activities there were 157 harbor seals hauled out on the estuary side of the barrier beach. At the end of the day 30 seals remained on the estuary side of the beach. Water Agency staff was on the beach for a total of four hours during this event.

On February 3rd the river mouth closed again. After a period of rain, with a three-day total of 4.49 inches from February 6 – 8 [1], the barrier beach was overtopped from the Estuary and self-breached on February 8th. The river mouth remained open until March 20th. During this period the river mouth migrated north along the beach away from the jetty structure. By the time the mouth closed in March the river mouth was a narrow and shallow channel opening at the north end of Goat Rock State Beach. Again the river mouth closed and the barrier beach remained until it was mechanically breached by the Water Agency on March 24th at 09:14, after only 40 minutes of breaching activity. The peak water level during this closure reached 9.42 ft NGVD at the Jenner gauge. Just before breaching activities began there were 101 harbor seals hauled out on the estuary side of the barrier beach. Following the breaching there were 40 seals hauled out on the beach at 13:30.

During April and May the river mouth closed and opened due to the natural combined actions of ocean waves and river flow a total of four times. The length of time the barrier beach remained was short, from 1 to 4 days (Table 3).

On September 17th the river mouth closed and remained closed for 36 consecutive days until the Water Agency breached the barrier beach on October 22nd at 14:24. Breaching activities began at 11:11 and Water Agency staff was on the beach for three hours and 45 minutes during this event. Water levels in the Estuary reached 8.68 ft NGVD on the morning of October 22nd. Prior to breaching activities there was a large group of harbor seals (137) hauled out on the ocean side and a smaller group (30) hauled out on the estuary side of the barrier beach. By the end of the day there were no seals on the beach, but by 07:30 the following day there were 109 seals on the beach in the area of the new cut.

Due to continued large swells the barrier beach formed again on October 24th. The barrier beach remained closed for another 23 days until it was breached by the Water Agency on November 17th at 12:51. Breaching activities began at 09:30 and Water Agency staff was on the beach for four hours during this event. Water levels in the Estuary reached 7.92 ft NGVD on the morning of November 17th. Prior to breaching activities there were 69 seals hauled out on the ocean side of the barrier beach. No seals were on the beach at the end of the day, but by 07:44 the following day there were 72 seals hauled out just south of the new cut on the estuary side of the beach.

Again, the river mouth closed shortly after breaching and remained closed for 8 days until it was breached by the Water Agency on November 26th at 12:00. Breaching activities began at 09:24 and Water Agency staff was on the beach for three hours and ten minutes during this event. Peak water level in the Estuary was 7.16 ft NGVD recorded on the morning of November 26th. Prior to breaching activities there were 113 seals hauled out on the ocean side of the barrier beach. A small group of seals remained on the ocean side of the beach throughout excavation activities and 15 seals remained at the end of the day (15:07). A maximum count of 72 seals was recorded on November 28; post-breaching monitoring was delayed by one day due to the Thanksgiving Day holiday.

Harbor seal response to excavation activities was similar for all breaching events, and similar to those observed in previous years. Seals that are hauled out first alert to the sound of the excavator being off-loaded in the Goat Rock State Beach parking lot (greater than 1,500 feet south of the haul-out). Seals will then move on the beach or flush into the water as the Water Agency safety crew approaches on

[1] Data provided by the University of California, Davis, Bodega Marine Laboratory. Rain total data retrieved from the BML data set at http://bml.ucdavis.edu/boon/data_rain_fall.html.

foot. People on foot typically come within 200-100 feet of the haul-out before seals are disturbed. Once on the beach the noise and motion of the excavator will disturb seals at greater distances, between 800 and 200 feet. Seals will remain on the beach in small numbers if the excavation activity is far enough away from their initial haul-out location. The estimated take by incidental harassment (Level B), as defined by the Marine Mammal Protection Act, of harbor seals during artificial breaching activities in 2014 was 665 harbor seals (497 flushed and 168 moved). Disturbance information for each event is provided in Table 4.

Table 3. Summary of conditions during river mouth closures occurring in 2014 at the Russian River mouth (Goat Rock State Beach). Peak water level during the event was measured at the gauge located at the Sonoma Coast State Park Visitors Center in Jenner, Ca.

Dates barrier beach closed	Peak Jenner gauge height (ft NGVD)	Date mouth opened	Method of breaching
December 23 – January 2	7.37[a]	January 2	Artificial
January 11 – 30	8.03	January 30	Artificial
February 3-8	9.68	February 8	Self
March 20 – 24	9.42	March 24	Artificial
April 22	5.20	April 23	Self
April 26 – 27	4.86	April 27	Self
April 29 – 30	4.44[b]	May 1	Self
May 4 – 8	6.51	May 8	Self
September 17 – October 22	8.68	October 22	Artificial
October 24 – November 17	7.92	November 17	Artificial
November 19 - 26	7.16	November 26	Artificial

[a] *Gauge data not available from December 22, 2013, 12:00 to December 27, 2013, 04:44 or December 31, 2013, 16:58 to January 2, 2013, 18:16. Peak gauge height given is from January 2, 2014 as read at the staff gauge at the California State Parks Jenner Visitors Center.*

[b] *Gauge data not available from April 30, 2014, 09:34 to May 2, 2014, 19:34. Peak gauge height given is from April 30, 2014, 09:20.*

In order to evaluate whether or not beach management activities cause harbor seals to leave the Jenner haul-out for near-by peripheral sites we compared average seal abundance for each peripheral site before, during and after breaching activities for 2014 (Figure 7). Very few seals were observed at the estuary haul-out sites, regardless of timing. All of the coastal haul-outs monitored exhibited an increase in seal abundance during breaching surveys compared with pre-breaching and post-breaching surveys. However the only significant differences were for Odin Cove and Rock Point where there were more seals observed during breaching surveys compared to both pre- and post- breaching surveys (Unequal N HSD multiple comparisons, $p < 0.001$) (Figure 7).

Due to the small sample sizes used for comparisons of seal abundance during water level management activities for 2014 only, a similar comparison of seal abundance at the peripheral haul-outs was made for 2010-2014 observations combined. Results for the estuarine sites were similar when compared to those for 2014 observations only, with very few seals observed (Figure 8). The most notable difference for the coastal haul-out sites was that at North Jenner there were more seals observed during pre-breaching, rather than breaching surveys (Figure 8). The only significant differences in the number of seals observed during water level management monitoring were found at Rock Point and Odin Cove. At Odin Cove there were more seals during breaching surveys (mean = 5.9 ± 0.98 s.e., n = 55) compared to pre-breaching surveys (mean = 2.2 ± 0.56 s.e., n = 58) (Unequal N HSD multiple comparisons test, $p < 0.05$). Similarly, at Rock Point there were more seals were observed during breaching surveys (mean = 9.5 ± 1.40 s.e., n = 55) compared to pre-breaching surveys (mean = 3.6 ± 0.83 s.e., n = 53) (Unequal N HSD $p < 0.001$) (Figure 8). For data from 2010 – 2014 there was no significant difference in the number of seals at any peripheral site during mouth open vs closed conditions (Unequal N HSD multiple comparisons test, $p > 0.50$) (Figure 8).

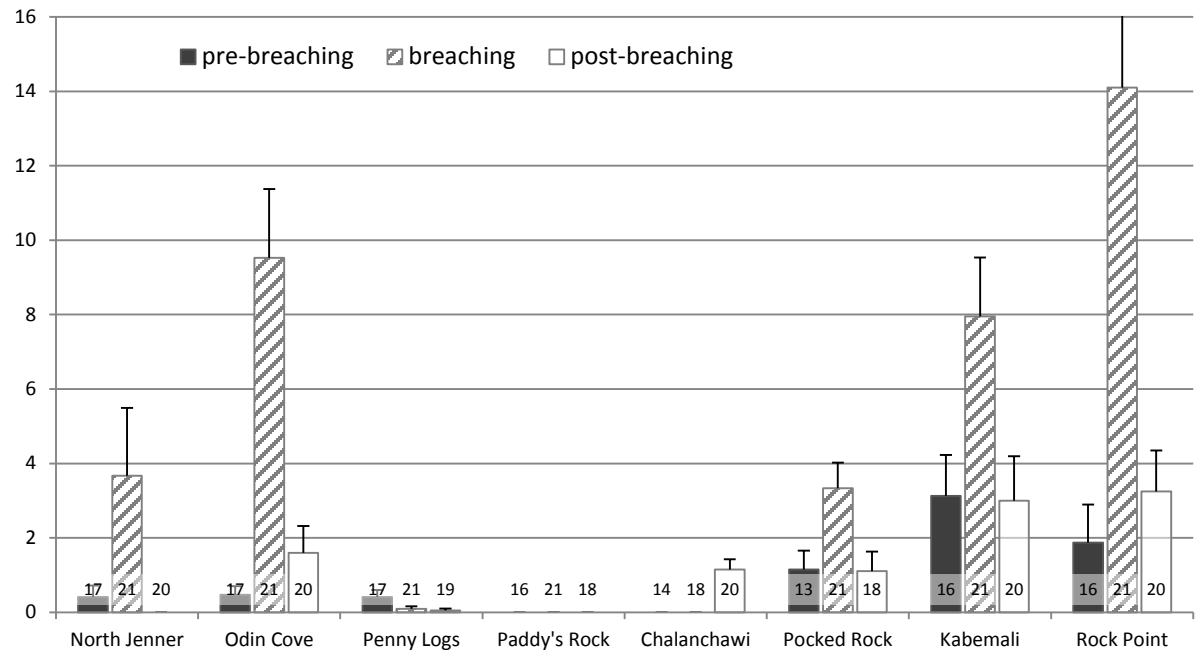


Figure 7. Average seal abundance at peripheral haul-outs as observed during pre-breaching, breaching and post-breaching surveys during 2014. Error bars represent standard error and sample size used to calculate means are presented inside the bars.

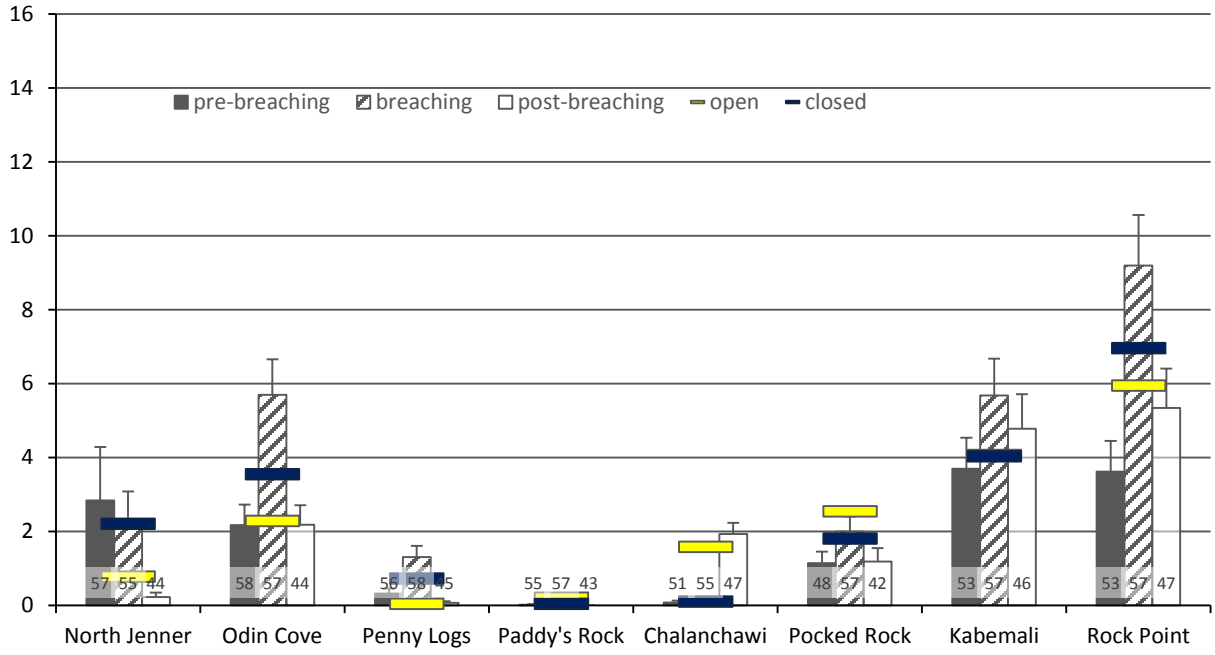


Figure 8. Average seal abundance at peripheral haul-outs as observed during pre-breaching, breaching and post-breaching surveys during 2010-2014 combined. Colored bars represent the average seal abundance during mouth open (yellow) and closed (blue) conditions for all surveys during 2010-2014. Error bars represent standard error and sample size used to calculate means are presented inside the bars.

Biological and Physical Monitoring

The NMFS IHA (2014) provides incidental take for Level B harassment of pinnipeds that may result from monitoring of biological resources and physical processes in the Russian River Estuary. The number of incidental takes in 2014 was calculated based on the number of animals that responded to activities by either moving on their haul-out or flushing from their haul-out. Alerts were also recorded by monitors, but are not included in the number of incidental takes reported. Most often at haul-out sites within the Estuary (excluding the Jenner haul-out on Goat Rock State Beach, Figure 2) seals either had no reaction or raised their heads in alert as a boat passed. The most seals hauled out in the Estuary as observed by Water Agency field staff were six at Chalanchawi (middle reach), while the most seals observed in the lower reach was one at Penny Logs. Other disturbances resulting from monitoring of the biological resources and physical processes in the Estuary occurred at the Jenner haul-out. Only one of 14 fisheries seining and none of the 24 water quality monitoring events or 61 acoustic telemetry surveys conducted in the Estuary resulted in a disturbance to harbor seals (Table 4).

The Russian River Biological Opinion requires monthly topographic surveys of the barrier beach at the mouth of the Russian River. A Water Agency biologist was present during topographic surveys to monitor the seal response to the survey crew. With the exception of the harbor seal pupping season, when survey personnel will avoid the haul-out when neonates are present, between 53% and 100% of seals were flushed from their haul-out during the monthly mapping activities (Table 4).

Table 4. Number of pinnipeds disturbed as a result of Russian River Estuary Management and Monitoring Activities for 2014, resulting in incidental take by harassment. Disturbances reported are pinnipeds moving on or flushing from their haul-out, number of disturbed seals that flushed from their haul-out is denoted by (#).

Date	Event Type	Estimated Disturbance			
		Species	Age Class	Number	Max % total seals flushed[a]
2-Jan	breaching	harbor seal	adult	80(65)	93%
16-Jan	topo survey	harbor seal	adult	54(34)	71%
30-Jan	breaching	harbor seal	adult	163(137)	83%
6-Feb	topo survey	harbor seal	adult	35(29)	54%
20-Feb	baseline[b]	harbor seal	adult	12(10)	5%
5-Mar	jetty study	harbor seal	adult	53(26)	7%
20-Mar	topo survey	harbor seal	adult	172(172)	100%
23-Mar	pre-breaching[c]	harbor seal	adult	2(1)	1%
24-Mar	breaching	harbor seal	adult	110(84)	69%
9-Apr	topo survey	harbor seal	adult	10(3)	1%
29-May	fish seining	harbor seal	adult	12(6)	26%
5-Jun	topo survey	harbor seal	adult	142(139)	77%
			pup	5(5)	
3-Jul	topo survey	harbor seal	adult	228(228)	53%
22-Jul	jetty study	harbor seal	adult	186(186)	60%
		elephant seal	juvenile	1(1)	100%[d]
29-Jul	jetty study	harbor seal	adult	33(18)	9%
6-Aug	topo survey	harbor seal	adult	169(163)	84%
		elephant seal	juvenile	1(0)	0%[d]
18-Sep	topo survey	harbor seal	adult	165(119)	100%
30-Sep	jetty study	harbor seal	adult	3(0)	0%
16-Oct	topo survey	harbor seal	adult	129(92)	100%
22-Oct	breaching	harbor seal	adult	47(28)	100%
14-Nov	pre-breaching[c]	harbor seal	adult	46(46)	100%
17-Nov	breaching	harbor seal	adult	103(69)	100%
26-Nov	breaching	harbor seal	adult	162(114)	81%
	2014 total	**harbor seal**	**adult**	**2,116(1,769)**	
			pup	**5(5)**	
		elephant seal	**juvenile**	**2(1)**	

[a] *Due to the fact that multiple disturbance episodes are represented by the total number of seals disturbed for a given day, the number reported for the percent of seals on the haul out that were flushed is the maximum value recorded for that day.*
[b] *Disturbance was caused by Water Agency conducting annual plant survey on beach dunes south of jetty structure on Goat Rock State Beach.*
[c] *Disturbance was caused by Water Agency personnel posting warning signs on beach, prior to breaching activities.*
[d] *Percentage of seals flushed is for total number of elephant seals present on the beach.*

CONCLUSIONS

The water level management activities and biological and physical monitoring activities conducted by the Water Agency resulted in incidental harassment (Level B harassment) of 2,116 harbor seals and 2 juvenile elephant seals in 2014, well under the total allowed by NMFS IHA.

The purpose of the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011) is to detect the response of pinnipeds to Estuary management activities at the Russian River Estuary. Specifically, the following questions are of interest:

1. Under what conditions do pinnipeds haul out at the Russian River Estuary mouth at Jenner?

2. How do seals at the Jenner haul-out respond to activities associated with the construction and maintenance of the lagoon outlet channel and artificial breaching activities?

3. Does the number of seals at the Jenner haul-out significantly differ from historic averages with formation of a summer (May 15th to October 15th) lagoon in the Russian River Estuary?

4. Are seals at the Jenner haul-out displaced to nearby river and coastal haul-outs when the mouth remains closed in the summer?

Harbor seals are found at the mouth of the Russian River (Jenner haul-out) throughout the year. They are observed on the beach throughout the tidal cycle and at any time of day. Our baseline pinniped monitoring concluded that tidal state and time of day influenced harbor seal abundance at the Jenner haul-out, with seals less abundant in the early morning and at high tide (SCWA 2012). Harbor seals were most abundant on the Jenner haul-out in July during their annual molt (SCWA 2012), with these same trends being observed in subsequent years (SCWA 2013, 2014). Seasonal variation in the abundance of harbor seals at their haul-out locations is commonly observed throughout their range (Allen et al. 1989, Stewart and Yochem 1994, Gemmer 2002). The variation in their abundance can mostly be explained by changes in their biological and physiological requirements throughout the year. Peak seal abundance occurring in July during their molting season is likely a result of seals spending more time on land in order to help facilitate the molting process. This annual peak is typically followed by a decline in seal abundance which is likely a result of individual seals decreasing the amount of time on the haul-out post-molt to spend more time foraging and also coincides with the time that young seals may temporarily disperse from their natal haul-out (Stewart and Yochem, 1994, Thompson et al. 1994, Small et al. 2005). Most notable for 2014 was the increase in the number of seals observed during February, March and December. While it is difficult to speculate the reasons for these increases after just one year, it could be that it is a result of an overall increase in the number of harbor seals utilizing the Jenner haul-out as a resting area. We do not have the ability to determine if these increases are due to an increase in immigration to or a decrease in emigration from the haul-out.

The Jenner haul-out is a harbor seal rookery and we have attempted to standardize a measure of pup counts so that comparisons can be made across years. However, our ability to accurately measure natality (*i.e.,* proportion of births to the number of mature females) is limited by the fact that harbor seals are not sexually dimorphic so the number of adult females on the beach cannot be easily determined. Harbor seal pups are very precocial and are able to swim just after birth, so counts of pups on the beach does not accurately reflect the total number of births.

Harbor seals will use the beach when there is an open channel or when a barrier beach has formed, however, the number of seals at Jenner was influenced by river mouth condition. Daily average seal abundance was lower during closed conditions compared to open conditions. This effect is also closely related to time of year, since most closures occur during the fall and winter, when seal abundance is low. While earlier results suggested there may have been a relationship between the level of disturbance and river mouth condition (SCWA 2013, 2014), we did not find evidence that there was a significant increase in the number of people near the haul-out or the number of disturbance events during mouth closed conditions.

The response of harbor seals at the Jenner haul-out to water level management activities in 2014 (Question 2 above) was similar to the responses observed in previous years of monitoring (Merritt Smith Consulting 1997, 1998, 1999, 2000; Sonoma County Water Agency and Merritt Smith Consulting 2001; SCWA 2011, 2012, 2013 and 2014). Harbor seals alerted to the sound of equipment on the beach and left the haul-out as the crew and equipment approached closer on the beach. When breaching activities were conducted south of the haul-out location seals often remained on the beach during all or some of the breaching activity. This indicates that seals are less disturbed by activities when equipment and crew do not pass directly past their haul-out.

Since the beginning of the modified estuary water level management procedures as a result of the NMFS 2008 Biological Opinion a lagoon outlet channel has only been implemented once (July 2010). While the Water Agency has not had further opportunity to implement and sustain an outlet channel, observations when a barrier beach has formed during the lagoon management period provide information as to how harbor seals respond when aquatic access between the estuary and the ocean is limited (Question 3 above). A barrier beach has formed during the lagoon management period thirteen times, the longest incidence lasting 29 days, with an average duration of ten days. While seal abundance was lower during closed conditions, overall there continues to be a slight increasing trend in seal abundance. These results indicate that while seal abundance may exhibit a short term decline during closed conditions it has not inhibited seals from using the Jenner haul-out during any period of the year. We conclude that the effect of barrier beach condition on seal abundance represents only a short term response, and is not an indication that seals are less likely to choose Jenner as a haul-out overall. We do not yet know how seals would respond to a maintained lagoon outlet channel.

As stated above we are unable to draw conclusions about the response of harbor seals to the implementation and maintenance of summer lagoon as outlined in the NMFS 2008 Biological Opinion. Results to date indicate that the peripheral haul-outs located in the Estuary are little used by seals, and even though access is limited by rising water level in the Estuary there is no effect of mouth condition on seal abundance at these sites. The coastal sites are regularly used by harbor seals, albeit in low numbers. Again, we found no effect of mouth condition in the abundance of seals at these peripheral haul-outs.

Harbor seals are generalists in many ways: including diet, resting locations and activity patterns. They are able to find refuge on sandy beaches, tidal mud flats and rocky shores (Allen et al. 1989, Gemmer 2002, Small et el. 2005). Seals exploit a wide range of locally abundant prey (Gemmer 2002, Hanson 1993, Tollit et al. 1997): they may forage during the day and come ashore at night, or forage at night and come ashore during the day, or even spend multiple days at sea (Small et al. 2005, Suryan and Harvey 1998, Yochem et al. 1987). Given that harbor seals exhibit this range of behaviors our ability to understand temporal changes in seal behavior and population abundance is limited by the use of periodic count data.

ACKNOWLEDGEMENTS

Much appreciation is extended to the Stewards of the Coast and Redwoods staff and volunteers for their hard work and commitment to gathering data on the pinnipeds and haul-outs in and around the Russian River estuary. M. Luna, J. Mortenson, A. Cresswell and David Berman provided the training and support that made the monitoring effort possible. Special thanks to the volunteers that provided their time and keen observations to monitoring pinnipeds: B. Bambrick, D. Barth, J. Cross, E. Davis, C. Else, C. Farnes, L. Fisher, C. Martin, K. O'Conner, A. Southwick and G. Walker.

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Appendix A. Summary of pinniped monitoring activities at the Jenner haul-out (Goat Rock State Beach, Sonoma County) conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from January – December 2014 for the Russian River Estuary Management Project, including summary of pinniped abundance and Estuary water level.

			HASE adult			HASE neonates			HASE pups					
date	**Activity**	**Estuary water level**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**n**	**CASL present**	**NES present**
1/1/2014	Pre-breaching	--	51	50.5	1.01							2		
1/2/2014	Breaching	5.11	70	29.6	6.56							14		
1/3/2014	Post-breaching	1.65	199	165.4	5.46							17		
1/6/2014	Baseline	1.11	173	127.1	9.47							18		
1/16/2014	Topo survey	4.91	70	40.8	7.33							8		
1/28/2014	Baseline/pre-breaching	--	77	66.5	3.69							17		
1/30/2014	Breaching	7.99	157	57.9	13.04							16		
1/31/2014	Post-breaching	--	261	192.8	13.93							18		
2/6/2014	Topo survey	4.38	41	21.6	5.33							7		
2/10/2014	Baseline	3.20	282	209.9	19.28							15		
2/20/2014	Baseline	--	316	207.7	24.49							17	Y	
3/3/2014	Jetty study	2.21	158	158.0								1		
3/5/2014	Jetty study	3.12	381	215.7	26.59							21		
3/6/2014	Baseline	2.92	424	352.1	12.37							18		
3/10/2014	Jetty study	1.94	291	203.2	24.54							16		
3/11/2014	Jetty study	2.32	242	147.1	22.95							16		
3/20/2014	Topo survey	4.20	151	113.0	9.07							13		
3/23/2014	Pre-breaching	8.44	81	71.2	2.20							13		
3/24/2014	Breaching	9.38	101	53.1	6.59							15		
3/25/2014	Baseline/post-breaching	1.41	229	126.9	17.17							17		
4/9/2014	Topo survey	1.37	302	200.5	25.24	2	1.1	0.28	1	0.1	0.09	11		

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			HASE adult			HASE neonates			HASE pups					
date	**activity**	**estuary water level**	**Max**	**mean**	**s.e.**	**Max**	**mean**	**s.e.**	**Max**	**mean**	**s.e.**	**n**	**CASL present**	**NES present**
4/10/2014	baseline	1.52	223	137.6	18.42	1	0.2	0.09	2	0.2	0.13	18		
4/29/2014	baseline	3.43	138	98.4	5.80	7	2.5	0.38	27	19.1	1.45	17		
5/8/2014	topo survey	5.79	105	88.6	3.62	3	2.4	0.18	20	15.6	0.78	8		
5/9/2014	baseline	1.88	197	164.8	5.89	2	0.4	0.18	16	10.6	0.53	16		
5/20/2014	baseline	1.39	110	99.6	2.04	0	0.0		25	16.3	1.01	17		
6/3/2014	baseline	--	141	124.4	2.78	0	0.0		9	7.6	0.22	16		
6/5/2014	topo survey	--	168	139.3	11.09	0	0.0		8	6.1	0.58	11		
6/20/2014	baseline	1.05	231	197.4	9.68	0	0.0		0	0		9		
7/3/2014	topo survey	1.48	355	293.3	15.44							8		
7/9/2014	baseline	1.72	405	373.5	4.16							17		
7/21/2014	Jetty study	1.30	316	286.3	5.94							15		Y
7/22/2014	Jetty study	1.31	283	190.4	18.15							8		Y
7/23/2014	Jetty study	1.30	287	218.8	15.37							13		
7/24/2014	Jetty study	1.29	336	264.2	9.99							12		Y
7/28/2014	baseline	1.19	212	151.8	13.86							16		
7/29/2014	Jetty study	1.22	202	190.5	2.31							11		
8/6/2014	topo survey	--	154	93.7	13.06							13		Y
8/7/2014	baseline	--	188	148.4	6.80							17		
8/26/2014	baseline	1.42	204	119.8	7.80							18		
9/10/2014	baseline	1.73	129	52.8	8.40							17		
9/18/2014	topo survey	2.81	98	68.1	5.87							10		
9/19/2014	baseline	3.22	87	53.4	6.82							14		
9/30/2014	Jetty study	3.01	83	12.6	6.34							17		
10/10/2014	baseline	6.73	63	22.1	7.60							11		

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			HASE adult			HASE neonates			HASE pups					
date	**activity**	**estuary water level**	**Max**	**mean**	**s.e.**	**Max**	**mean**	**s.e.**	**Max**	**mean**	**s.e.**	**n**	**CASL present**	**NES present**
10/16/2014	topo survey	7.83	101	45.0	16.39							9		
10/20/2014	Baseline/pre-breaching	8.29	19	10.4	1.56							17		
10/22/2014	Breaching	8.60	167	29.4	14.49							15		
10/23/2014	Post-breaching	4.99	165	134.6	3.64							17		
11/5/2014	Baseline	6.68	104	26.9	9.85							17		
11/14/2014	Pre-breaching	7.54	47	35.4	1.94							18		
11/17/2014	Breaching	7.88	70	18.1	7.94							15		
11/18/2014	Post-breaching	2.36	108	85.8	3.83							17		
11/25/2014	Baseline/pre-breaching	6.74	87	27.4	8.49							18		
11/26/2014	Breaching/ topo survey	7.16	113	34.0	9.86							15		
11/28/2014	Post-breaching	2.31	72	26.8	6.68							17		
12/9/2014	Baseline	3.53	166	119.4	6.90							18		
12/17/2014	Baseline	4.03	297	228.4	17.03							17		

[a] *For breaching events Estuary water level from time of breaching*

[b] *For all other events Estuary water level is average height for the day*

[c] *Only counts for sea lions on land, does not include sea lions observed in the water*

[d] *No water level management occurred during closure, barrier beach breached naturally*

[e] *Remote link to Jenner river gauge not working, data was recorded from gauge at beginning of pinniped monitoring*

[f] *Some data is missing for the day, including at time of breach, data reported is average of gauge height available for the day*

-- missing data

APPENDIX B-5

Grab Samples Water Quality Conditions 2014

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Station	Date	Temperature	Specific Conductance	Oxygen % sat	Oxygen mg/L	pH
Jenner	5/15/2014	18.37	14,850	94.0	8.41	8.22
Casini Ranch	5/15/2014	22.47	230	94.4	8.16	8.44
Patterson Point	5/15/2014	21.34	152	87.5	7.75	8.31
Monte Rio	5/15/2014	21.64	302	89.0	7.83	8.33
Vacation Beach	5/15/2014	21.53	290	94.5	8.33	8.43
Jenner	5/20/2014	16.94	19,400	76.2	6.87	8.29
Casini Ranch	5/20/2014	21.98	303	96.6	8.44	8.38
Patterson Point	5/20/2014	21.55	297	90.1	7.94	8.18
Monte Rio	5/20/2014	21.27	262	97.8	8.66	8.30
Vacation Beach	5/20/2014	20.69	296	100.9	9.04	8.34
Jenner	5/27/2014	18.85	13,685	77.2	6.87	8.07
Casini Ranch	5/27/2014	22.31	189	135.2	11.74	8.21
Patterson Point	5/27/2014	22.71	235	160.6	13.94	8.01
Monte Rio	5/27/2014	23.15	283	210.3	17.96	8.08
Vacation Beach	5/27/2014	22.85	284	210.1	18.06	8.21
Jenner	6/3/2014	16.21	14,847	107.1	9.99	8.02
Casini Ranch	6/3/2014	21.13	142	94.9	8.43	8.09
Patterson Point	6/3/2014	21.48	259	88.0	7.75	7.96
Monte Rio	6/3/2014	21.59	250	99.4	8.75	8.07
Vacation Beach	6/3/2014	21.14	159	101.9	9.06	8.04
Jenner	6/10/2014	19.03	17,236	111.4	9.73	8.63
Casini Ranch	6/10/2014	22.59	192	101.2	8.74	8.88
Patterson Point	6/10/2014	24.16	112	99.0	8.30	8.61
Monte Rio	6/10/2014	24.44	281	107.4	8.96	8.69
Vacation Beach	6/10/2014	23.56	247	108.3	9.19	8.62
Jenner	6/17/2014	15.59	29,150	95.3	8.48	8.21
Casini Ranch	6/17/2014	20.60	272	100.9	9.06	8.85
Patterson Point	6/17/2014	21.92	227	97.3	8.51	8.50
Monte Rio	6/17/2014	21.91	263	100.7	8.82	8.45
Vacation Beach	6/17/2014	21.56	259	96.0	8.46	8.31
Jenner	6/24/2014	18.24	17,030	110.4	9.80	8.10
Casini Ranch	6/24/2014	23.40	230	98.4	8.38	8.41
Patterson Point	6/24/2014	23.95	165	90.5	7.60	8.23
Monte Rio	6/24/2014	23.27	263	95.8	8.16	8.18
Vacation Beach	6/24/2014	23.90	242	100.4	8.45	8.31
Jenner	7/1/2014	17.48	20,823	114.1	10.13	8.16
Casini Ranch	7/1/2014	22.42	253	74.1	6.39	8.19
Patterson Point	7/1/2014	24.09	247	74.9	6.29	7.85
Monte Rio	7/1/2014	24.43	254	92.8	7.75	7.95
Vacation Beach	7/1/2014	24.88	217	98.1	8.12	8.09
Jenner	7/8/2014	19.04	17,515	114.7	10.00	8.14
Casini Ranch	7/8/2014	22.78	210	85.3	7.34	8.02
Patterson Point	7/8/2014	23.42	242	79.5	6.76	7.81

Monte Rio	7/8/2014	24.13	210	96.2	8.08	7.96
Vacation Beach	7/8/2014	24.28	206	99.0	8.29	8.01
Jenner	7/15/2014	18.17	32,975	95.5	7.98	7.85
Casini Ranch	7/15/2014	24.08	257	93.4	7.85	8.15
Patterson Point	7/15/2014	23.57	182	84.7	7.18	7.86
Monte Rio	7/15/2014	23.96	247	100.2	8.44	8.00
Vacation Beach	7/15/2014	24.14	159	101.7	8.53	8.07
Jenner	7/22/2014	19.66	27,042	103.3	8.55	7.90
Casini Ranch	7/22/2014	23.00	250	97.8	8.36	8.35
Patterson Point	7/22/2014	22.12	224	93.4	8.14	8.07
Monte Rio	7/22/2014	22.28	246	103.2	8.97	8.12
Vacation Beach	7/22/2014	22.12	245	100.4	8.74	8.14
Jenner	7/29/2014	20.39	22,810	100.0	8.30	8.00
Casini Ranch	7/29/2014	24.05	246	102.0	8.56	8.35
Patterson Point	7/29/2014	23.75	237	86.7	7.30	7.90
Monte Rio	7/29/2014	24.04	196	102.7	8.63	8.07
Vacation Beach	7/29/2014	24.55	140	99.6	8.31	8.06
Jenner	8/5/2014	17.81	22,441	93.3	8.18	7.87
Casini Ranch	8/5/2014	21.26	197	93.0	8.24	8.22
Patterson Point	8/5/2014	22.13	235	88.4	7.68	8.05
Monte Rio	8/5/2014	22.46	246	99.7	8.64	8.10
Vacation Beach	8/5/2014	22.64	240	95.9	8.27	8.05
Jenner	8/12/2014	18.95	13,868	104.9	9.28	7.86
Casini Ranch	8/12/2014	21.45	241	89.8	7.90	8.19
Patterson Point	8/12/2014	22.17	237	94.6	8.24	8.07
Monte Rio	8/12/2014	22.61	235	103.0	8.90	8.15
Vacation Beach	8/12/2014	22.63	201	98.1	8.47	8.05
Jenner	8/19/2014	18.87	17,248	98.0	8.56	8.02
Casini Ranch	8/19/2014	22.13	216	103.5	9.03	8.60
Patterson Point	8/19/2014	22.28	236	88.3	7.64	8.16
Monte Rio	8/19/2014	22.84	232	107.5	9.25	8.21
Vacation Beach	8/19/2014	22.96	231	99.2	8.51	8.12
Jenner	8/26/2014	19.48	25,430	94.7	7.94	7.95
Casini Ranch	8/26/2014	21.92	234	95.4	8.34	8.11
Patterson Point	8/26/2014	21.94	154	92	8.06	7.94
Monte Rio	8/26/2014	22.10	234	106.9	9.32	8.08
Vacation Beach	8/26/2014	22.13	203	100.9	8.79	8.04
Jenner	9/2/2014	19.05	15,902	106.1	9.30	8.22
Casini Ranch	9/2/2014	22.63	192	98.4	8.51	8.14
Patterson Point	9/2/2014	22.54	235	91.4	7.82	7.86
Monte Rio	9/2/2014	23.20	227	103.3	8.81	8.04
Vacation Beach	9/2/2014	23.43	232	103.3	8.79	8.12
Jenner	9/9/2014	18.18	28,056	97.2	8.27	8.12
Casini Ranch	9/9/2014	20.56	226	98.3	8.83	8.14
Patterson Point	9/9/2014	20.61	230	90.4	8.13	7.92
Monte Rio	9/9/2014	20.96	233	101	9.02	8.01
Vacation Beach	9/9/2014	21.14	236	101.3	9.00	8.06

Jenner	9/16/2014	17.98	26,026	96.8	8.34	8.09
Casini Ranch	9/16/2014	21.10	239	100.8	8.97	8.15
Patterson Point	9/16/2014	20.91	233	92.2	8.23	7.93
Monte Rio	9/16/2014	20.92	230	97.8	8.72	7.95
Vacation Beach	9/16/2014	21.54	226	100.8	8.89	8.03
Jenner	9/23/2014	19.15	8,874	100.2	9.00	8.36
Casini Ranch	9/23/2014	21.50	234	95.4	8.42	8.01
Patterson Point	9/23/2014	21.90	226	98.4	8.62	7.94
Monte Rio	9/23/2014	21.50	218	99.3	8.76	7.90
Vacation Beach	9/23/2014	21.72	224	99.5	8.74	7.94
Jenner	9/25/2014	19.51	6,307	99.2	8.92	8.29
Casini Ranch	9/25/2014	22.87	226	101.9	8.76	7.99
Patterson Point	9/25/2014	21.97	225	96.1	8.39	7.89
Monte Rio	9/25/2014	21.71	225	99.9	8.78	7.87
Vacation Beach	9/25/2014	21.75	231	98.1	8.61	7.88
Jenner	9/30/2014	18.15	5,712	97.4	9.01	8.22
Casini Ranch	9/30/2014	20.29	262	92.9	8.39	7.95
Patterson Point	9/30/2014	20.13	238	94.1	8.53	7.88
Monte Rio	9/30/2014	20.23	238	95.6	8.64	7.86
Vacation Beach	9/30/2014	19.64	253	99.4	8.73 (est.)	7.79
Jenner	10/2/2014	18.26	7,585	100.3	9.23	8.29
Casini Ranch	10/2/2014	20.41	247	98.2	8.85	8.01
Patterson Point	10/2/2014	19.81	246	91.1	8.30	7.82
Monte Rio	10/2/2014	19.52	259	88.1	8.09	7.82
Vacation Beach	10/2/2014	19.25	271	88.2	8.13	7.67
Jenner	10/7/2014	18.05	5,326	96.8	8.99	8.15
Casini Ranch	10/7/2014	19.36	265	95.7	8.80	8.01
Patterson Point	10/7/2014	18.74	266	92.3	8.59	7.91
Monte Rio	10/7/2014	18.97	264	94.6	8.76	7.88
Vacation Beach	10/7/2014	19.03	248	98.9	9.15	7.93
Jenner	10/9/2014	17.80	5,138	95.4	8.92	8.01
Casini Ranch	10/9/2014	18.47	270	97.4	9.11	8.08
Patterson Point	10/9/2014	18.57	262	93.5	8.72	7.98
Monte Rio	10/9/2014	18.94	253	97.5	9.04	7.97
Vacation Beach	10/9/2014	18.32	244	99.0	9.20	7.94
Monte Rio	10/13/2014	18.80	245	93.4	8.71	7.84
Jenner	10/14/2014	18.02	4,693	92.4	8.61	7.98
Casini Ranch	10/14/2014	18.59	268	94.3	8.81	8.09
Patterson Point	10/14/2014	18.61	244	89.9	8.40	7.90
Monte Rio	10/14/2014	18.48	243	88.1	8.25	7.85
Vacation Beach	10/14/2014	17.92	236	90.3	8.56	7.84
Monte Rio	10/16/2014	18.04	239	85.8	8.12	7.80
Monte Rio	10/17/2014	17.60	236	85.4	8.14	7.73
Patterson Point	10/21/2014	17.77	235	83.5	7.92	7.82
Monte Rio	10/21/2014	18.01	238	87.7	8.28	7.82
Vacation Beach	10/21/2014	17.47	244	97.5	9.32	7.94

* The Jenner and Monte Rio staff gauges used to measure water surface levels correspond to within a couple of i
Base WSL during open estuary dry season flows at Monte Rio is 4 feet.

Turbidity	Estuary Condition	Monte Rio Water Surface Level (ft.) during Estuary closure*	
2.6	Open		
2.4	Open		
1.4	Open		
2.2	Open		
2.2	Open		
1.8	Open		
1.5	Open		
1.5	Open		
2.2	Open		
2.7	Open		
4.0	Open		
1.3	Open		
2.2	Open		
1.9	Open		
1.8	Open		
1.8	Open		
1.8	Open		
1.5	Open		
1.5	Open		
1.1	Open		
1.0	Open		
-0.7	Open		
1.5	Open		
-0.6	Open		
-0.4	Open		
2.3	Open		
0.4	Open		
1.7	Open		
0.8	Open		
2.1	Open		Installing JB Dam/VB Dam/Bridge
40.5	Open		
1.1	Open		
0.5	Open		
0.6	Open		
0.8	Open		
2.0	Open		
	Open		
	Open		
	Open		
	Open		
8.6	Open		
0.3	Open		
1.9	Open		

0.7	Open
0.5	Open
0.9	Open
0.3	Open
1.4	Open
0.7	Open
1.2	Open
2.7	Open
4.3	Open
4.2	Open
2.9	Open
2.5	Open
2.0	Open
1.0	Open
3.2	Open
1.1	Open
1.0	Open
0.3	Open
0.1	Open
1.9	Open
1.2	Open
1.0	Open
1.4	Open
0.6	Open
0.9	Open
0.7	Open
1.4	Open
2.5	Open
4.2	Open
3.3	Open
1.0	Open
1.7	Open
1.1	Open
0.9	Open
1.5	Open
1.0	Open
1.2	Open
1.5	Open
1.5	Open
2.0	Open
1.3	Open
1.1	Open
1.7	Open
1.0	Open
1.6	Open
0.9	Open
1.0	Open

1.3	Open		
0.5	Open		
0.8	Open		
0.6	Open		
0.8	Open		
2.2	Closed		
0.9	Closed		
0.9	Closed		
0.8	Closed	4.0	
1.6	Closed		
0.6	Closed		
0.9	Closed		
1.0	Closed		
0.7	Closed	5.0	
1.9	Closed		JB/VB Summer Dam removal
0.7	Closed		
0.1	Closed		
0.2	Closed		
0.6	Closed	6.0	
-0.7	Closed		
0.6	Closed		
0.1	Closed		
2.3	Closed		
0.8	Closed	6.5	
2.8	Closed		
0.7	Closed		
0.7	Closed		
1.3	Closed		
0.8	Closed	6.7	
2.2	Closed		
1.0	Closed		
2.2	Closed		
2.9	Closed		
0.8	Closed	6.7	
2.0	Closed		
0.8	Closed	7.5	
1.5	Closed		
0.1	Closed		
0.3	Closed		
0.4	Closed	7.6	
1.6	Closed		
0.5	Closed	7.8	
1.3	Closed	8.0	
0.5	Closed		
0.5	Closed	8.5	
2.0	Closed		

nches.

APPENDIX B-6

Hydroacoustic Telemetry 2014

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Appendix B-6. Hydroacoustic telemetry tag deployment in 2014. Life stages: P = parr; s = smolt.

TagID	CaptureSite	ReleaseSite	Date	LifeStage	FL (mm)	Wt (g)
5700	JennerGulch	JennerGulch	5/29/2014	P	116	18.1
2500	JennerGulch	JennerGulch	5/29/2014	P	151	41.8
4400	JennerGulch	JennerGulch	5/29/2014	p	117	19.2
2600	JennerGulch	JennerGulch	5/29/2014	P	141	36.9
5600	JennerGulch	JennerGulch	5/29/2014	p	139	30.5
800	BridgeHaven	BridgeHaven	6/2/2014	P	102	13.2
5100	BridgeHaven	BridgeHaven	6/2/2014	p	144	37.5
1700	BridgeHaven	BridgeHaven	6/2/2014	P	124	25
700	BrownsPool	BrownsPool	6/4/2014	p	141	33.5
1800	BrownsPool	BrownsPool	6/4/2014	P	155	44.7
4300	BrownsPool	BrownsPool	6/4/2014	p	132	27.9
3000	BrownsPool	BrownsPool	6/4/2014	P	141	40.5
5900	AustinCreek	AustinCreek	6/6/2014	p	112	14.9
900	BrownsPool	BrownsPool	6/9/2014	P	149	39.5
3400	BrownsPool	BrownsPool	6/9/2014	p	142	34.5
4600	BrownsPool	BrownsPool	6/9/2014	p	110	16.6
2700	BrownsPool	BrownsPool	6/9/2014	p	138	32.5
4500	JennerGulch	JennerGulch	6/9/2014	p	139	33.6
3300	JennerGulch	JennerGulch	6/16/2014	p	99	11.4
2300	JennerGulch	JennerGulch	6/16/2014	p	137	29.3
2400	JennerGulch	JennerGulch	6/16/2014	p	166	57.1
1600	JennerGulch	JennerGulch	6/26/2014	p	97	10.7
3600	JennerGulch	JennerGulch	6/26/2014	p	111	15.1
4000	JennerGulch	JennerGulch	6/26/2014	p	178	61.4
1000	JennerGulch	JennerGulch	6/26/2014	p	100	11.5
2800	MoscowBridge	MoscowBridge	6/23/2014	p	99	11
3500	MoscowBridge	MoscowBridge	6/23/2014	p	123	20.7
3200	Cassini	Cassini	6/23/2014	p	97	10.7
5000	BridgeHaven	BridgeHaven	7/8/2014	p	106	15.6
2200	JennerGulch	JennerGulch	7/8/2014	p	99	10.8
1200	JennerGulch	JennerGulch	7/9/2014	p	101	12.3
1400	JennerGulch	JennerGulch	7/9/2014	p	101	11.2
1300	JennerGulch	JennerGulch	7/9/2014	s	209	116.8
4900	FreezeOut	FreezeOut	7/9/2014	s	183	65.6
3900	JennerGulch	BridgeHaven	8/25/2014	s	140	35.2
3100	JennerGulch	BridgeHaven	8/25/2014	s	142	34.9
4200	JennerGulch	BridgeHaven	8/25/2014	p	149	44.5
1900	JennerGulch	BridgeHaven	8/25/2014	p	144	37.2
5800	JennerGulch	BridgeHaven	8/25/2014	s	140	37.2
4800	JennerGulch	BridgeHaven	8/25/2014	p	146	36.2
3700	JennerGulch	BridgeHaven	8/25/2014	p	121	22
2100	JennerGulch	BridgeHaven	8/25/2014	p	124	23.5
1100	JennerGulch	Sheephouse	9/11/2014	s	139	30
2000	Willow	Sheephouse	9/11/2014	s	134	29

APPENDIX C

Russian River Biological Opinion Dry Creek Habitat Enhancements Mile 1 Implementation Monitoring Report Year 2012-2014

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Russian River Biological Opinion

Dry Creek Habitat Enhancements

Mile 1 Implementation Monitoring Report

Year 2012-2014

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DRY CREEK REACH 15 AS-BUILT RECORD DRAWINGS

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APPENDIX D

IMPLEMENTATION MONITORING FORMS

Dry Creek Habitat Enhancement, Mile 1 Implementation Monitoring

Dry Creek Habitat Enhancement

The Biological Opinion contains an explicit timeline that prescribes a series of projects to improve summer and winter rearing habitat for juvenile coho salmon and steelhead in Dry Creek. During the initial three years of implementation, 2008 to 2011, the Water Agency is charged with improving fish passage and habitat in selected tributaries to Dry Creek and the lower Russian River.

In 2012, the Water Agency began construction of the first phase of the Dry Creek Habitat Enhancement Demonstration Project. A second phase of the Dry Creek Habitat Enhancement Demonstration Project was constructed in 2013 with a third and final phase scheduled for construction in 2014. The Dry Creek Habitat Enhancement Demonstration Project consists of a variety of habitat enhancement projects along a section of Dry Creek a little over one mile in length in the area centered around Lambert Bridge. Concurrently, the U.S. Army Corps of Engineers completed construction in 2013 of a habitat enhancement project on U.S. Army Corps of Engineers owned property just below Warm Springs Dam (Reach 15 area).

Habitat Enhancement Feasibility Study

The Water Agency regulates summer releases from Warms Springs Dam along a 14 mile reach of Dry Creek from Lake Sonoma to the Russian River. This abundant, cool, high quality water has tremendous potential to enhance the Russian River's coho and steelhead population but it flows too swiftly to provide maximum habitat benefit. By modifying habitat conditions to create refugia from high water velocities along 6 miles of Dry Creek, the National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (DFW) assert that water supply releases can continue at current discharge levels of approximately 100 cubic feet per second (cfs) and potentially historic discharge levels up to 175 cfs.

To plan large scale enhancement of the Dry Creek channel, the Water Agency retained Inter-Fluve, Inc. to conduct extensive field surveys and produce a series of reports detailing habitat enhancement opportunities along Dry Creek. Interfluve's work was conducted in three phases: 1) inventory and assessment of current conditions; 2) feasibility assessment of habitat improvement approaches; and 3) conceptual design of habitat approaches deemed feasible. All three reports have been completed and can be viewed at http://www.scwa.ca.gov/drycreek/.

During 2011, Interfluve developed the Dry Creek Fish Habitat Enhancement Conceptual Design Report. The final report was released to the public in July 2012 and identifies 26 sub reaches along Dry Creek as potential areas for construction of low velocity habitat with depth and cover characteristics conducive to rearing juvenile coho salmon and

steelhead. The opportunities identified in the report are distributed throughout the 14 mile length of Dry Creek. However, different reaches of Dry Creek present unique geomorphic and hydrologic constraints and Interfluve divided the stream into upper, middle, and lower segments. In the upper segment (mile 11 to 13.7), the influence of Warm Springs Dam on streamflow, substrate, and channel dimensions is most pronounced. The stability of this reach provides opportunities for long lasting "constructed" habitat features such as side channels, backwaters, and log structures. In the lower segment between Westside Road Bridge and the confluence with the Russian River (mile 0 to 3), conditions are amenable to constructing projects designed to let natural river processes develop habitat over time. The middle segment between Pena Creek and Westside Road (mile 3 to 11), has opportunities for both constructed habitat and river process based approaches.

The Conceptual Design report includes a description of current habitat conditions, modeled inundations at high flow, maps and graphics depicted proposed summer and winter habitat features (Figure 1), and a preliminary cost estimate for each of the 26 enhancement sub reaches along Dry Creek. All of the sub reaches are ranked according to the potential quantity of summer and winter coho rearing habitat they provide (Table 1). This ranking does not, however, include implementation considerations such as relative cost, landowner willingness and accessibility, and continuity or predicted longevity of constructed features. Figure 2 illustrates the two step process that will be employed to select enhancement reaches on Dry Creek.

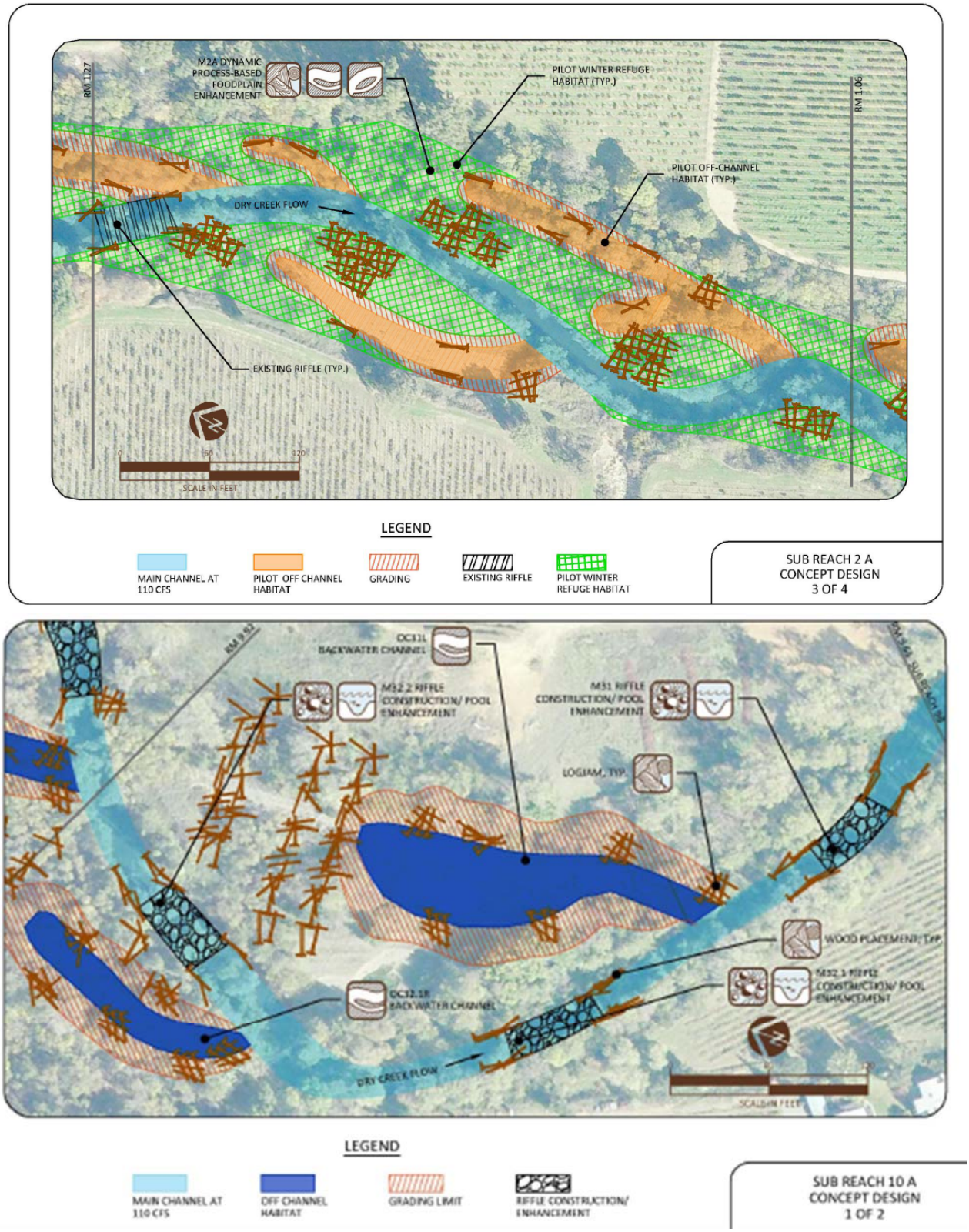


Figure 1. Examples of habitat enhancement conceptual designs for two Dry Creek subreaches. The top panel, Reach 10A, illustrates proposed summer habitat enhancements using a static "constructed" habitat approach. Reach 2A, lower panel, is close the confluence of Dry Creek and the mainstem Russian River. In

this highly dynamic environment, a "process" based approach that creates pilot habitat features the stream can adjust over time is proposed.

Table 1. Ranking of enhancement subreaches in Dry Creek organized by Upper, Middle, and Lower segments.

Segment	Ranking Tier	(Sub) Reach	Coho Potential Coho Rearing Habitat Score	Winter Refuge & Rearing Habitat Score	Total Potential Habitat Score	Predicted Continuity Score
Upper	Tier I	14a	High	Medium	High	High
		13b	Medium	Medium	Medium	High
		15	Medium	Low	Low	High
		14b	Medium	Low	Low	High
	Tier II	12b	Low	High	Medium	High
		13a	Low	Low	Low	High
		12a	Low	Low	Low	High
Middle	Tier I	8b	High	Medium	High	Medium
		4a	High	Low	High	High
		5a	High	Low	High	Medium
		4b	High	Low	Medium	Medium
		8a	Medium	High	High	High
		5b	Medium	Medium	High	Medium
		10a	Medium	Low	Medium	High
		10b	Medium	Low	Medium	Medium
		4c	Medium	Low	Low	High
	Tier II	6	Low	High	High	Medium
		11	Low	Medium	High	Medium
		9b	Low	Medium	Low	Medium
		9a	Low	Low	Low	Medium
Lower	Tier I	2b	High	High	High	Low
		2a	High	High	High	Low
		1	High	High	High	Low
	Tier II	3b	Medium	Low	Medium	Medium
		3a	Medium	Low	Medium	Medium

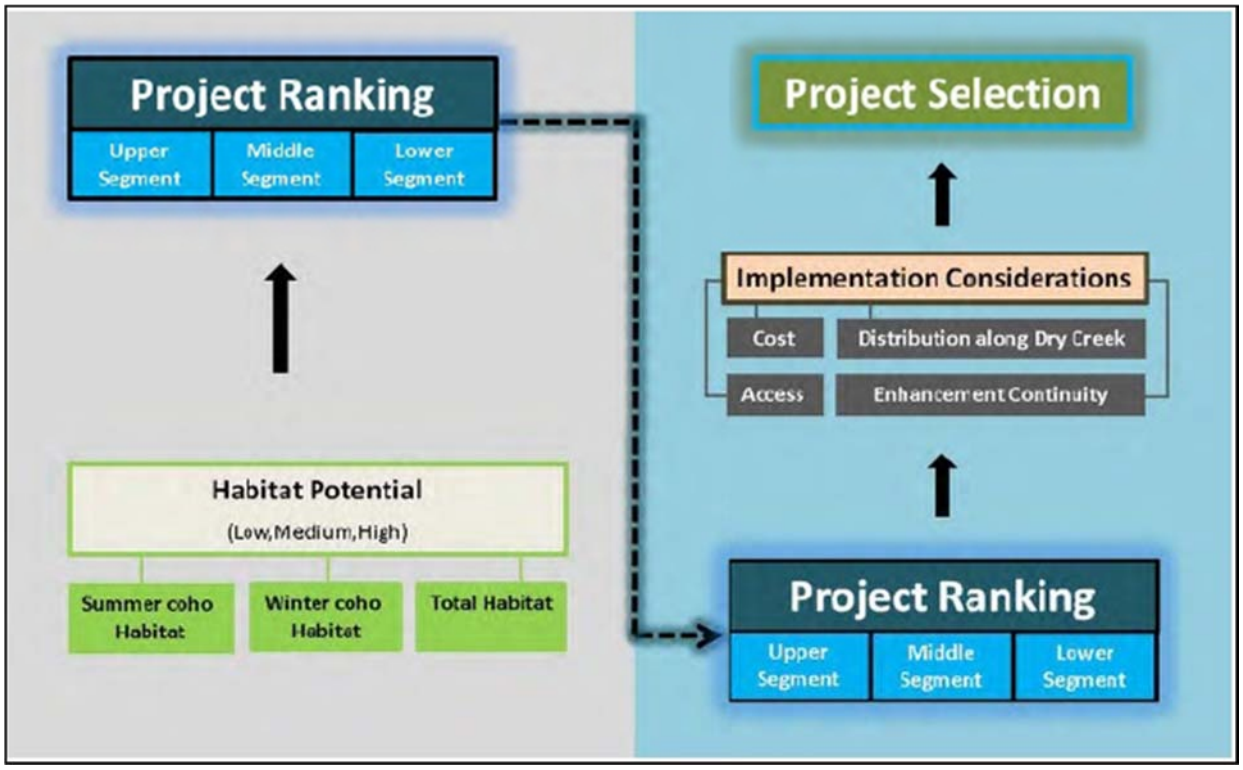


Figure 2. Conceptual depiction of habitat project prioritization approach. The left side of the figure represents the first phase of the prioritization process which includes ranking of the enhancement subreaches based solely on their inherent potential for habitat enhancement. The second phase, project selection, includes implementation considerations such as access, distribution, and cost.

Demonstration Project (Mile 1)

The Water Agency must engage a diverse group of stakeholders to implement the Biological Opinion. Dry Creek is held almost entirely in private ownership and Water Agency staff must work in concert with landowners of more than 170 parcels to study, plan, and construct habitat enhancements. The Biological Opinion's 5 year timeline prior to construction of the first mile of habitat enhancement acknowledges this challenge and the depth of study, planning, and environmental compliance required for implementation. A forward looking group of property owners along a one mile stretch of the stream near Lambert Bridge, in the middle of Dry Creek Valley, approached the Water Agency with the opportunity to advance the schedule and demonstrate habitat enhancement techniques in their reach of the stream (Figure 3). The Water Agency has welcomed this opportunity, and has worked to implement the Dry Creek Habitat Enhancement Demonstration Project. The U.S. Army Corps of Engineers has implemented a similar habitat enhancement on a 0.3 mile reach (Reach 15) of Dry Creek immediately below Warms Springs Dam (Figure 3).

The Demonstration Project has four goals and objectives:

1. Maximize the general ecological lift to the reach to the extent practicable within the current geomorphic and hydraulic function of the stream,
2. Increase the availability of high quality summer rearing and winter refugia habitat for salmonids (specifically coho and steelhead), given the current physical function of the system,
3. Stabilize areas of problem erosion using techniques that also enhance habitat conditions for fish, and
4. Demonstrate enhancement techniques that may be utilized elsewhere in Dry Creek in order to meet the habitat requirements of the Biological Opinion.

In close consultation with NMFS and DFW, InterFluve advanced the Demonstration Project engineering design to the 90 percent complete phase in 2011. A CEQA Initial Study and Mitigated Negative Declaration for the project was approved by the Agency's Board of directors on November 15, 2011. In September 2012, the first phase of the Demonstration Project was constructed by BioEngineering Associates at the Quivira Winery site just downstream of the confluence of Grape Creek and Dry Creek. This project included the construction of a backwater channel for winter refuge habitat, placement of large wood structures, and removal of invasive plant species.

In 2013, work on the Demonstration Project continued downstream of Lambert Bridge at the Dry Creek Vineyard and Amista Winery sites. The Water Agency's contractor, Hanford ARC, constructed a large backwater pond for summer and winter habitat, installed boulder clusters and log jams, and implemented a bank stabilization treatment to prevent erosion and enhance habitat.

In 2014, Hanford ARC continued with the third and final phase of construction of the Demonstration Project. In 2014, Hanford ARC worked both upstream and downstream of Lambert Bridge on additional backwater ponds and channels, log jams, riffles, and bank stabilization treatments. Hanford ARC completed construction of the Demonstration Project components in November of 2014.

Together, the Water Agency's Demonstration Project and the Corps of Engineer's Reach 15 project provide slightly more than one mile of improved habitat at a total cost of $9 million to $10 million. Effectiveness and validation monitoring data is being gathered and will be reported in future reports.

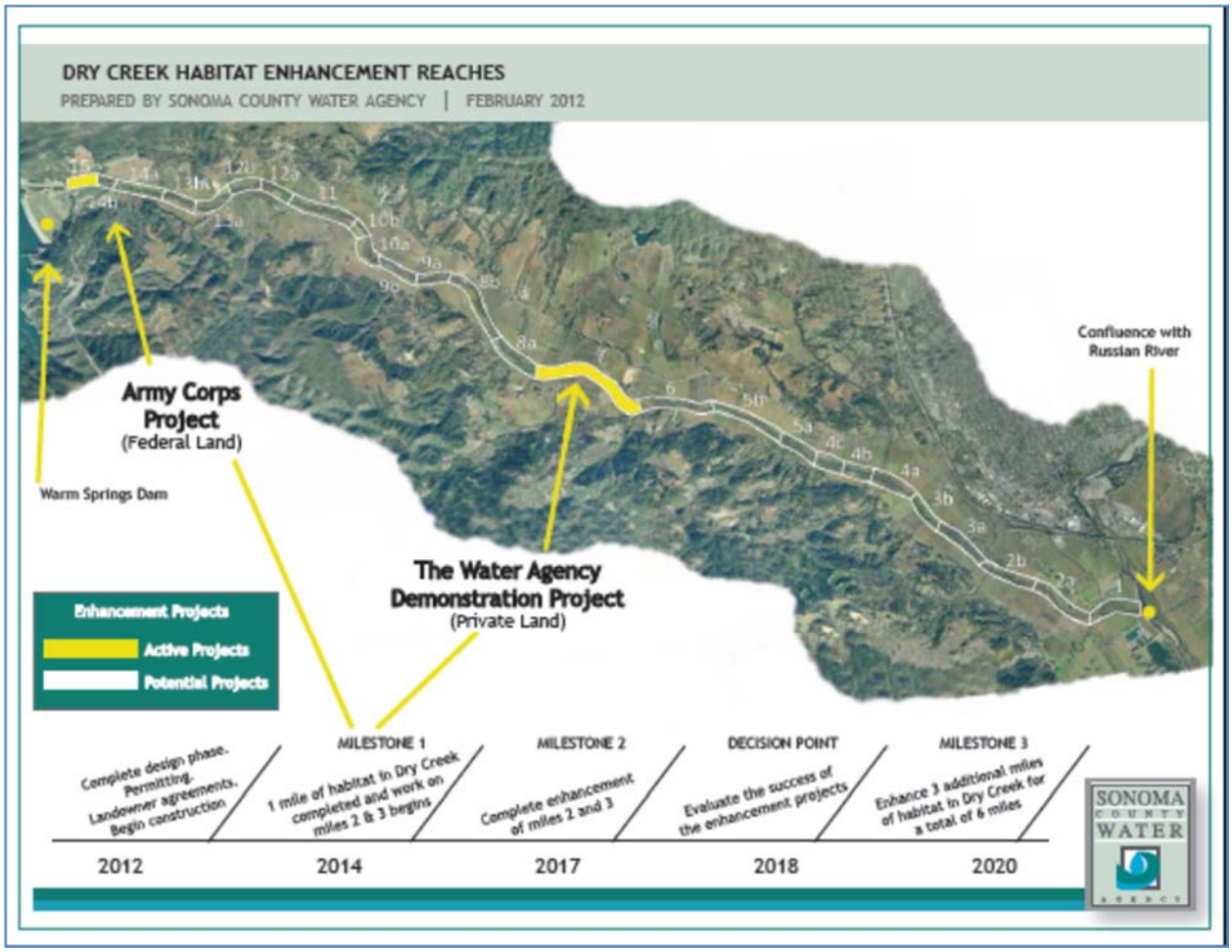


Figure 3. The location of Water Agency and Army Corps of Engineers Dry Creek habitat enhancement projects to meet Biological opinion milestones.

Adaptive Management Plan

A question raised by the Biological Opinion is whether Dry Creek habitat enhancements will have the desired benefits. This question is important both for receiving credit toward the total amount of habitat enhancements set forth in the Biological Opinion (six miles) and for assessing the relative effectiveness of various habitat enhancements options. For the latter reason, the Biological Opinion states that “an adaptive management, monitoring and evaluation plan” will be developed that identifies “project goals, objectives and success criteria”. ESSA Technologies Ltd. (an independent consulting firm from Vancouver Canada) facilitated the collaborative development of an adaptive management plan (AMP) for Dry Creek in an iterative process of meetings, discussions and document revision.

The goal of the Dry Creek AMP is to serve as a guide for monitoring juvenile coho and steelhead populations and the habitats they live in over multiple years to detect change

resulting from habitat enhancement. A series of multi-agency workshops were convened to address the following objectives:

1. Identify performance measures;

2. Develop success criteria for each performance measure;

3. Select approaches for evaluating performance measures relative to success criteria;

4. Agree on a set of decision rules for determining credit toward the total amount of habitat enhancement.

Evaluation of performance measures will be based on the results of **implementation** monitoring, **effectiveness** (habitat) monitoring, and **validation** (fish) monitoring. This report represents the implementation monitoring results for the first mile of completed habitat enhancement efforts in Dry Creek.

For each type of monitoring, quantitative data for performance measures will be gathered using specific data collection protocols. These quantitative data will then be used to qualitatively rate whether the habitat enhancement was implemented correctly, whether it is having the desired effect on physical habitat conditions and whether juvenile coho and steelhead are benefiting from the work.

Implementation monitoring is “monitoring to determine if the habitat enhancement was done according to the approved design” (NMFS Russian River Biological Opinion 2008, pg. 266). In other words, did the contractor/builder do what they said they were going to do? Implementation monitoring will occur immediately post-construction and will serve as a check-in point to determine if all the essential elements were placed according to the design as approved by NMFS/CDFW. Based on the results of post-construction implementation monitoring, the Water Agency’s, USACE’s or other engineering techniques and approaches will be re-visited as deemed necessary.

Effectiveness monitoring is “monitoring to determine whether habitat enhancement is having the intended effect on physical habitat quality” (NMFS Russian River Biological Opinion 2008, pg. 266). This definition implies that protocols should facilitate a detailed comparison between baseline habitat quantity and quality data collected prior to any enhancement actions (pre-enhancement monitoring) and the habitat amounts/condition as measured over time after each implementation phase (post-enhancement monitoring). For example, pre-enhancement monitoring will occur prior to each enhancement phase, and post-enhancement monitoring will occur after the first geomorphically-effective flow (i.e., flow that deposits substantial sediment on the flood plain), or within 3 years following each enhancement phase, and then at minimum every

3 years until 2023, to assess the long term sustainability of all implemented habitat enhancement actions

Validation monitoring is “monitoring to determine whether habitat enhancement work is achieving the intended objective (i.e., creating habitat that is inhabited by listed salmonids and appreciably improves the production and survival of rearing steelhead and coho salmon in Dry Creek”; NMFS Russian River Biological Opinion 2008, pg. 266). Establishing the temporal component for validation monitoring (i.e., when should validation monitoring start and for how long) is challenging because of the inherent time lag between the physical habitat response and the expected biological response.

In addition to monitoring the habitat efforts over time (temporal scale), there is also a spatial scale at which data to evaluate habitat efforts are collected at the implementation, effectiveness, and validation monitoring stages. This spatial scale includes four progressively broader scales: feature, site, enhancement reach, project reach.

> **Features:** Individually engineered elements (e.g., large woody debris accumulation, riffle, pool, side channel, alcove, boulder cluster, etc.) that will individually or in composite make up a habitat enhancement site (see definition for Site below). Features can in some cases represent complete habitat units (see definition for Habitat Unit below), while in other cases they represent only structural components within a habitat unit (e.g., large wood placement).
>
> **Site:** One or more engineered habitat features (see definition for Features above) that have been designed to work in combination to enhance a stream reach.
>
> **Enhancement reach:** A specified collection of enhancement sites (see definition for site below) that are implemented in close proximity to one another.
>
> **Project reach:** A specified collection of enhancement reaches (see definition for Enhancement Reach above)

An important initial step prior to the commencement of post-construction effectiveness monitoring within a given enhancement reach will be an agreed-on definition of what constitutes a feature and a site within that reach. For features that will be enhanced (e.g., existing pools, placement of boulder clusters) this step could occur prior to the commencement of construction so that the degree of improvement in meeting target habitat conditions can be assessed for a given site. However, in cases where no habitat currently exists (e.g., construction of new off-channel habitat) features and sites will be defined immediately following construction (i.e., during implementation monitoring).

The focus of implementation monitoring is simply to determine whether actions have/have not been undertaken as intended/planned. As a matter of course, NMFS/CDFW will approve the construction plans for each phase of project construction. This approval is based on several factors including whether habitat enhancement in selected reaches is being designed in such a way to maximize the benefit to juvenile salmonids given the geomorphic opportunities and other constraints in the immediate vicinity of the enhancement reach.

The implementation monitoring design can be envisioned as a way to ensure that each feature has been constructed when, where and how intended and without any structural changes or omissions that would compromise integrity. Monitoring protocols and associated implementation monitoring checklists identified in the AMP provide a useful, consistent template that will be used for describing/documenting the implementation status of engineered enhancements in Dry Creek reaches. There is a separate checklist with respect to the three relative locations within the stream channel where habitat enhancement is being contemplated: 1) instream, 2) off-channel, 3) channel reconstruction and bank stabilization. Enhanced features will be assessed using one of these implementation checklists. Suites of feature-level assessments will then be rolled-up into a final composite site rating that will be used to determine whether enhancements at a particular site are considered successful or whether further remediation will be necessary. The final overall qualitative site-scale rollup assessments of habitat enhancement implementation (i.e., excellent, good, fair, poor, fail) will be undertaken by a Joint Monitoring Team consisting of representatives from NMFS, CDFW and either the Water Agency or USACE (or both as appropriate). In the event that implementation was insufficient, remedial action may be recommended by the Joint Monitoring Team.

Summary of implementation monitoring steps:

- Every attempt will be made to implement habitat enhancement measures in a manner that is consistent with designs approved by NMFS and CDFW.

- Upon completion of implementation, a Joint Monitoring Team consisting of representatives from NMFS, CDFW and either the Water Agency or USACE (as appropriate) will conduct a walk-through of newly-implemented enhancement reaches in order to evaluate whether the features were implemented according to the approved designs. The outcome of this step will be a site-scale rollup (see Figure 8a and Table 2).

- Modifications to the approved designs will be documented and determination made as to whether modifications were beneficial to performance or otherwise

• If implementation did not sufficiently follow the approved design, the Joint Monitoring Team will recommend what adjustments (if any) should be made.

Dry Creek Mile 1 Habitat Enhancement Project Designs

The first mile of Dry Creek habitat enhancement projects have been completed over a three-year period and under three separate construction contracts:

U.S. Army Corps of Engineers' **Reach 15 Fish Habitat Enhancement Project**. Constructed in 2013 by Contractor Services Group.

Sonoma County Water Agency's **Dry Creek Habitat Enhancement Demonstration Project, Phase 1**. Constructed in 2012 by Bioengineering Associates.

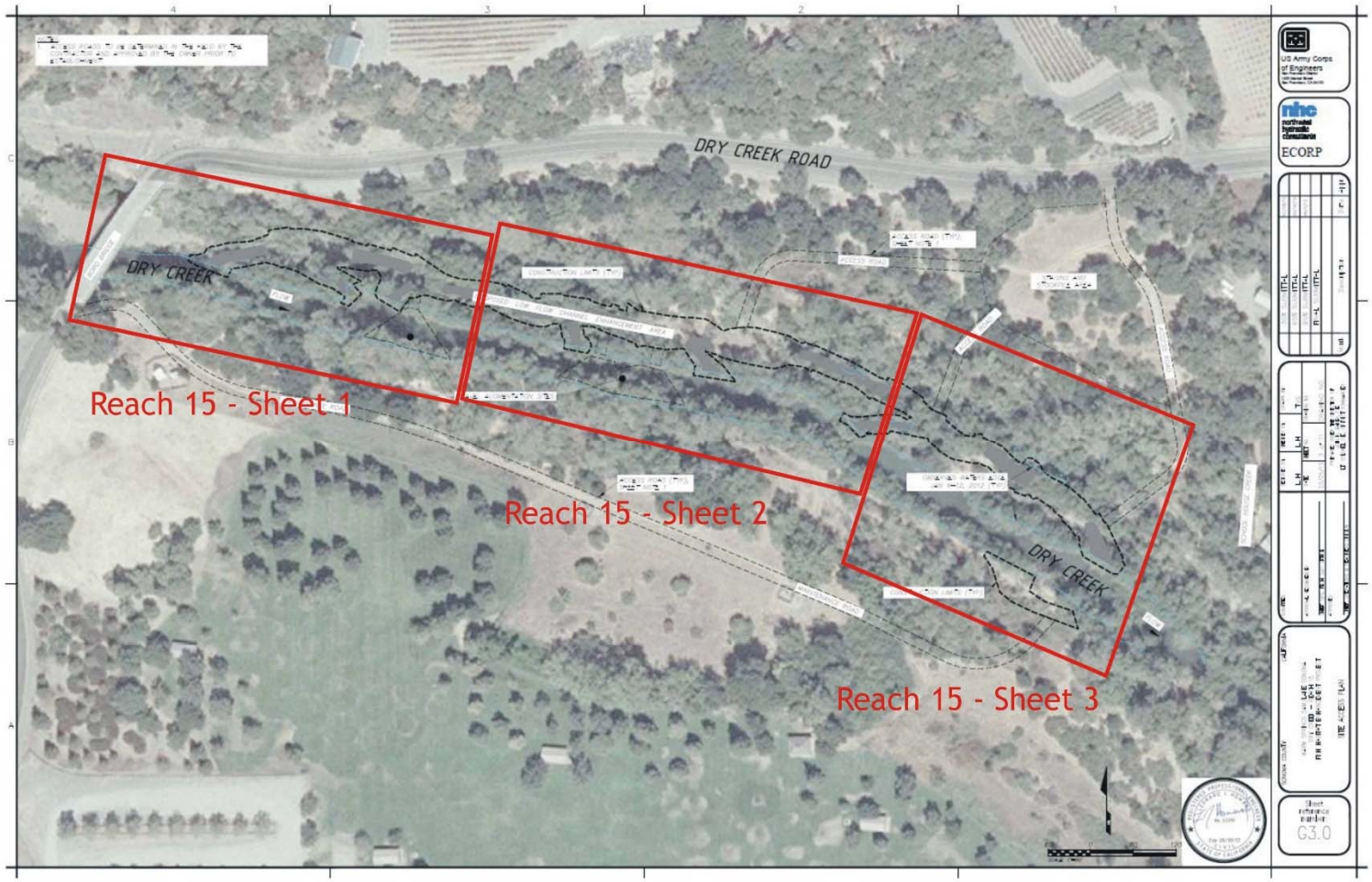
Sonoma County Water Agency's **Dry Creek Habitat Enhancement Demonstration Project, Phase 2**. Constructed in 2013 and 2014 by Hanford ARC.

The final design construction drawings for these projects are included in Appendices A, B, and C of this report.

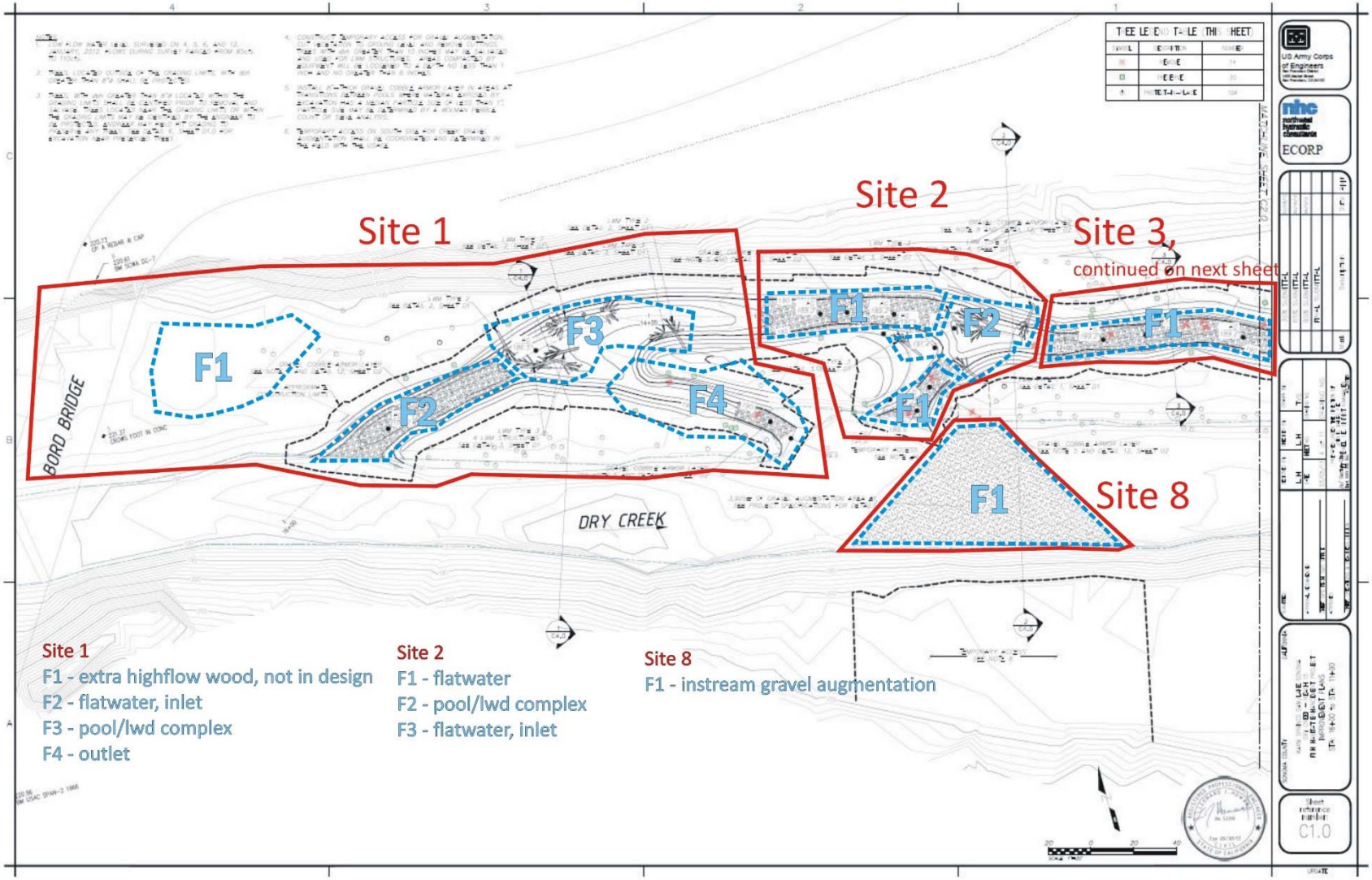
Dry Creek Mile 1 Habitat Enhancement Implementation Key Figures

As noted above, an important initial step prior to the commencement of post-construction effectiveness monitoring within a given enhancement reach will be an agreed-on definition of what constitutes a feature and a site within that reach. The following figures show the identified features and sites within both the U.S. Army Corps of Engineers' Reach 15 project and the Water Agency's Demonstration Project.

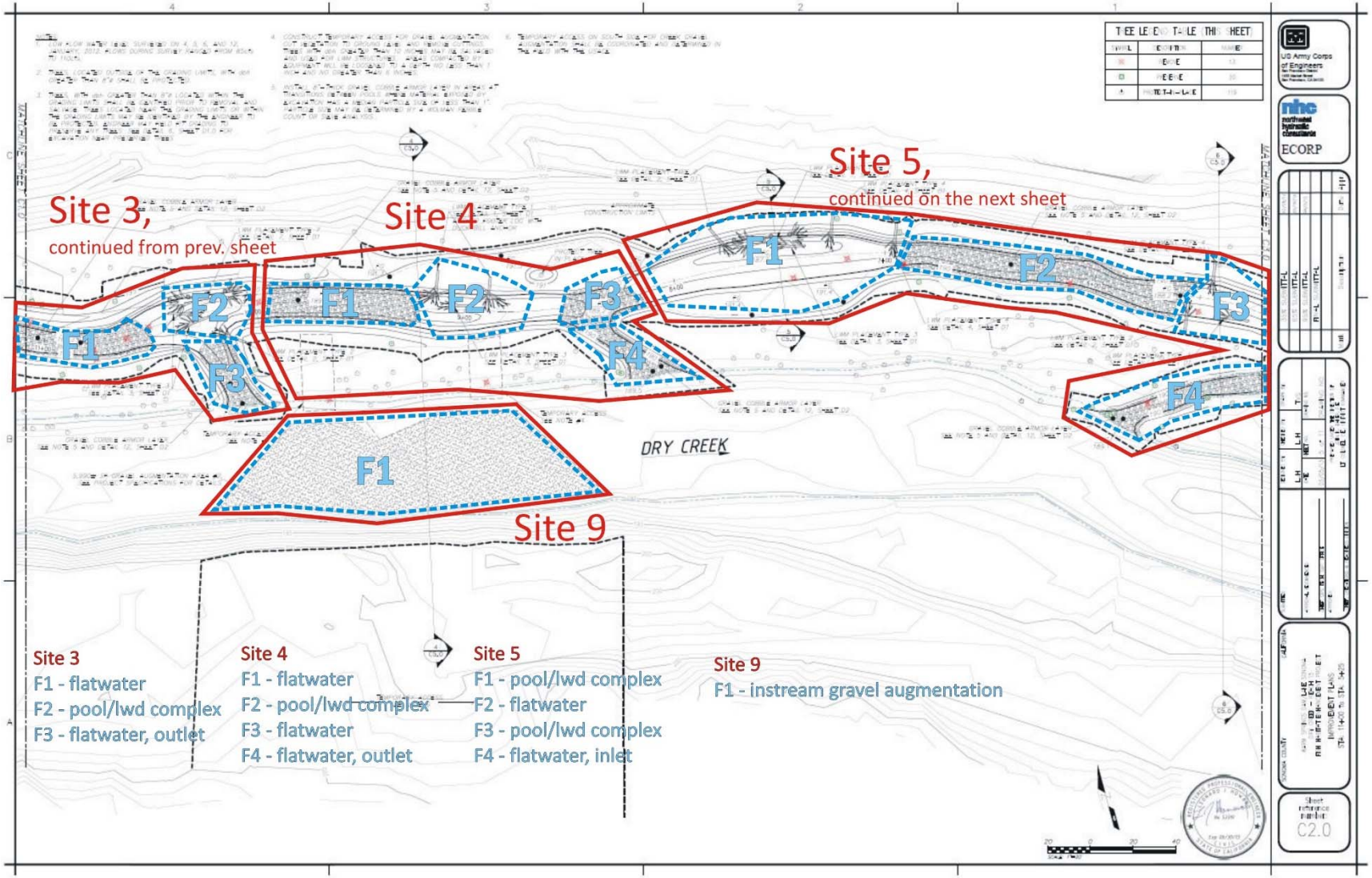
U.S. Army Corps of Engineers Dry Creek – Reach 15 Fish Habitat Enhancement Project



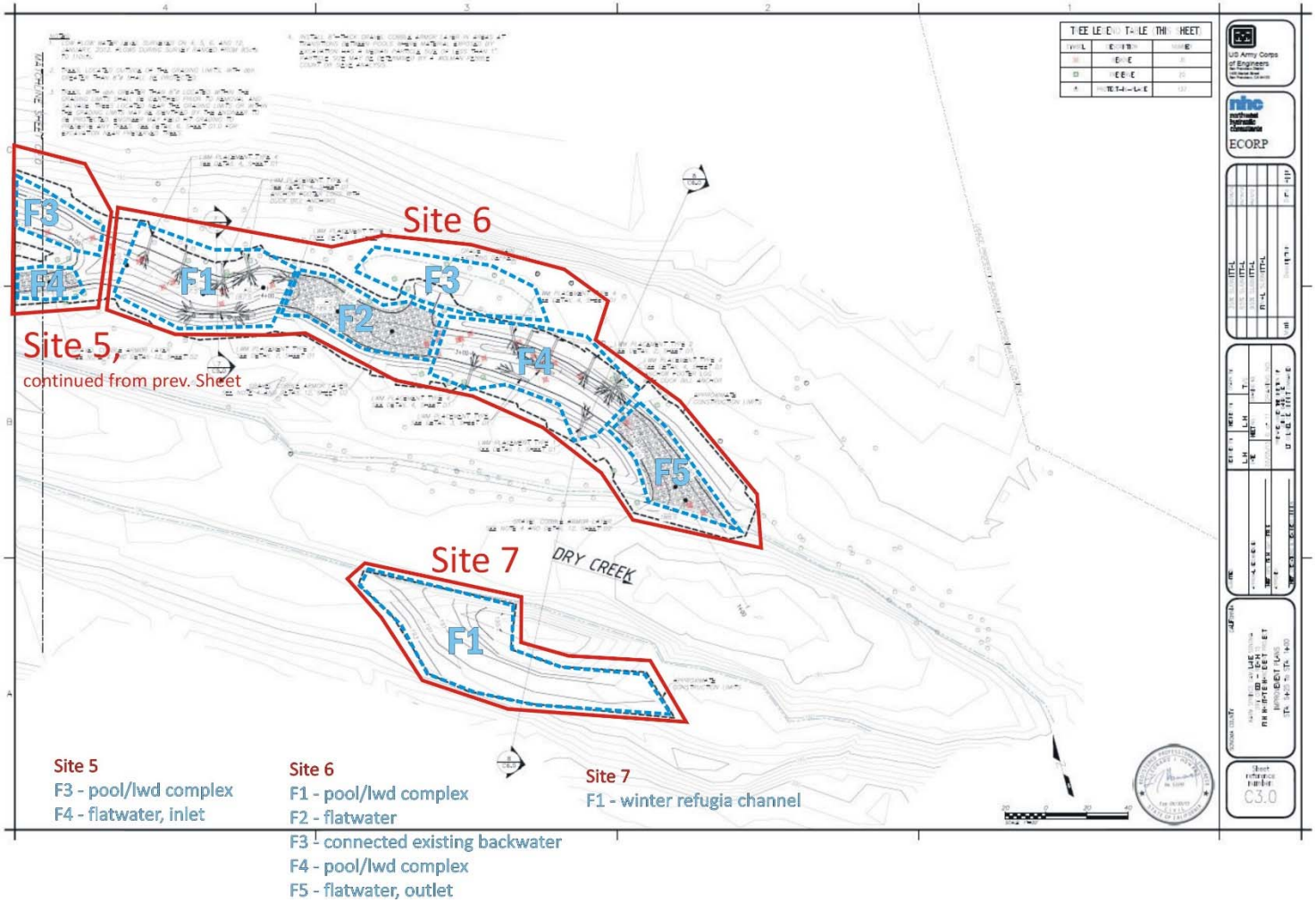
U.S. Army Corps of Engineers Dry Creek – Reach 15 Fish Habitat Enhancement Project – Overview. Total linear distance along channel length is 1,600 feet (0.3 mile).



Reach 15 - Sheet 1 Site Key

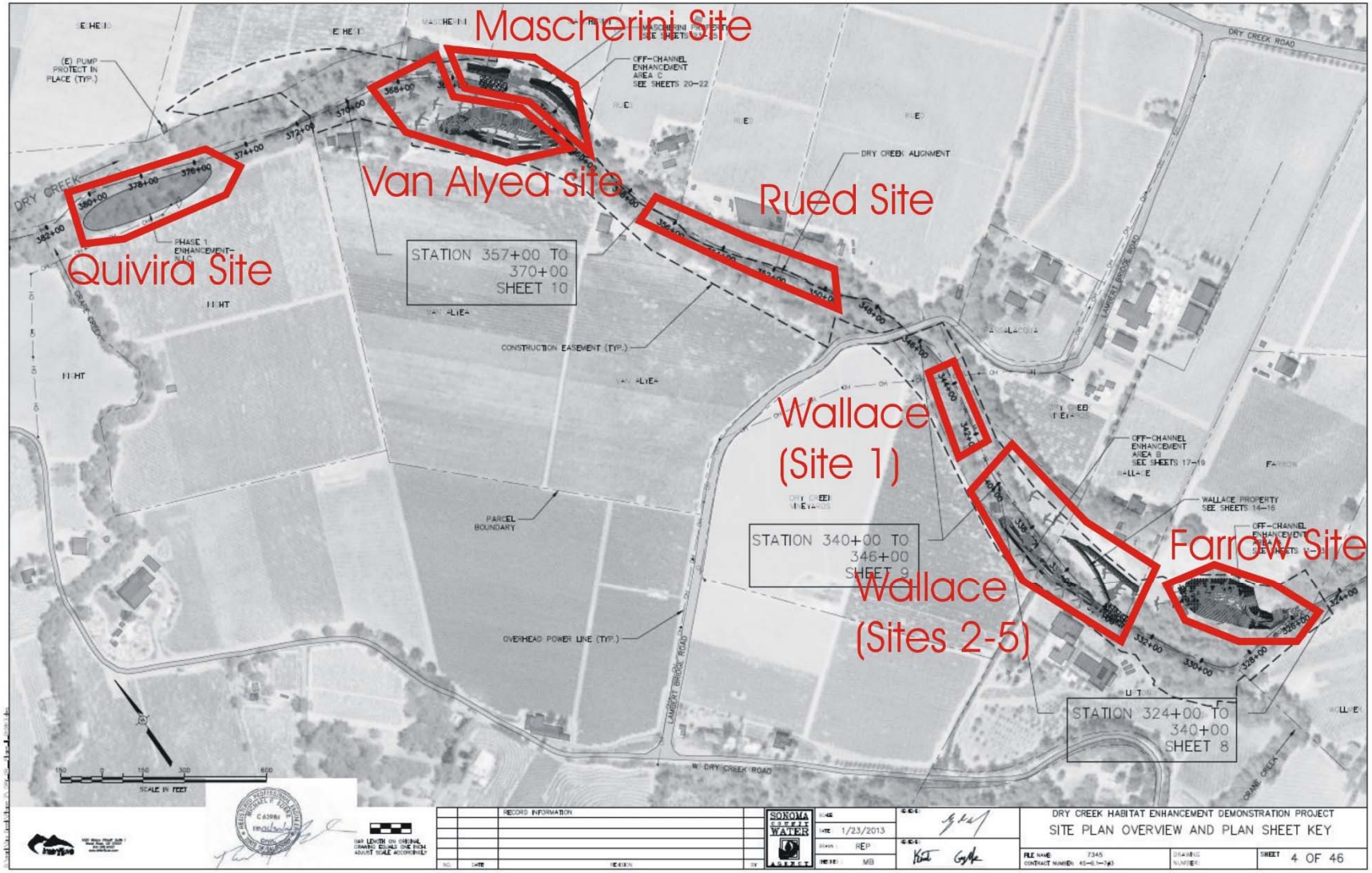


Reach 15 - Sheet 2 Site Key

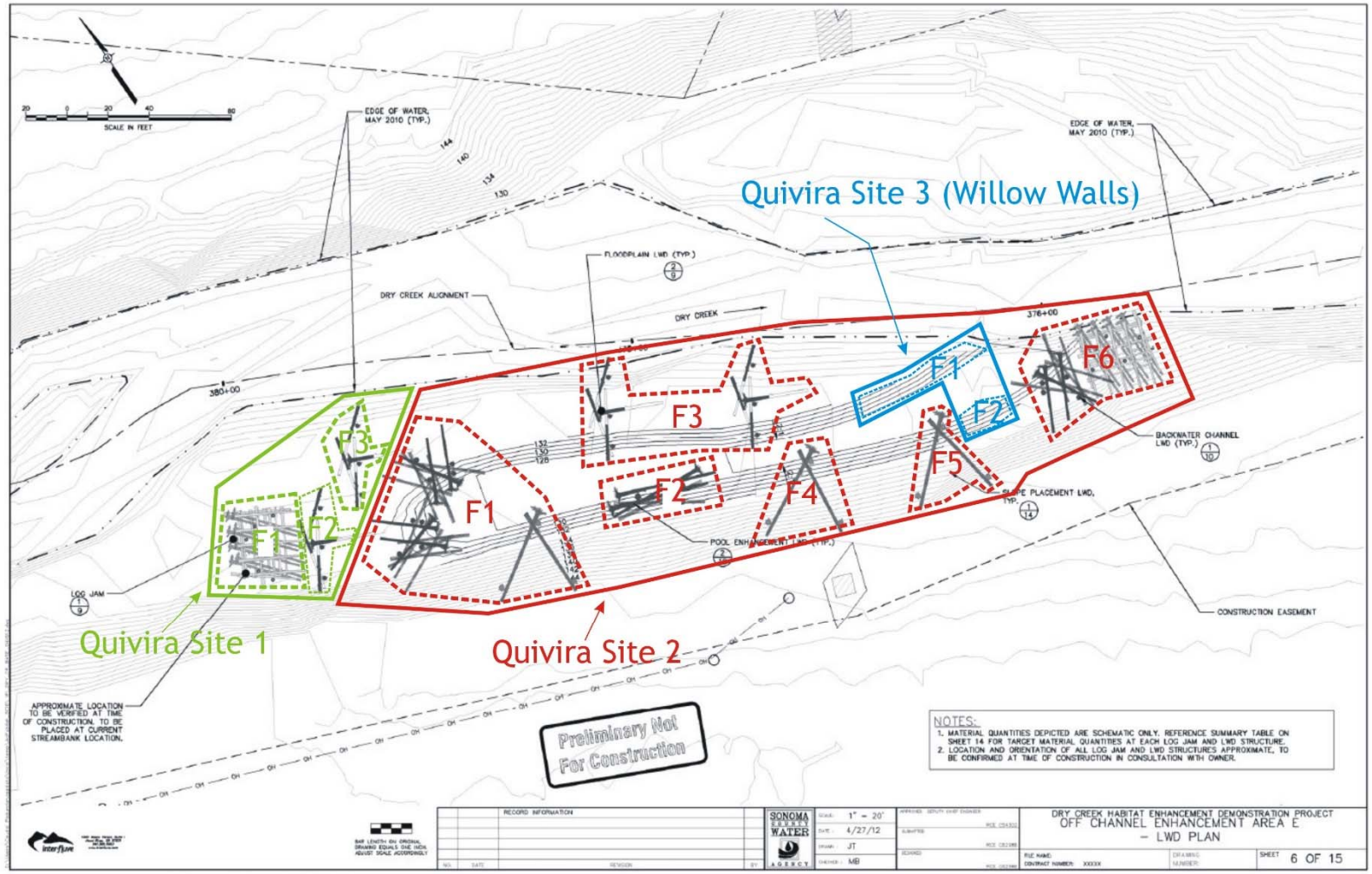


Reach 15 - Sheet 3 Site Key

Water Agency's Dry Creek Habitat Enhancement Demonstration Project



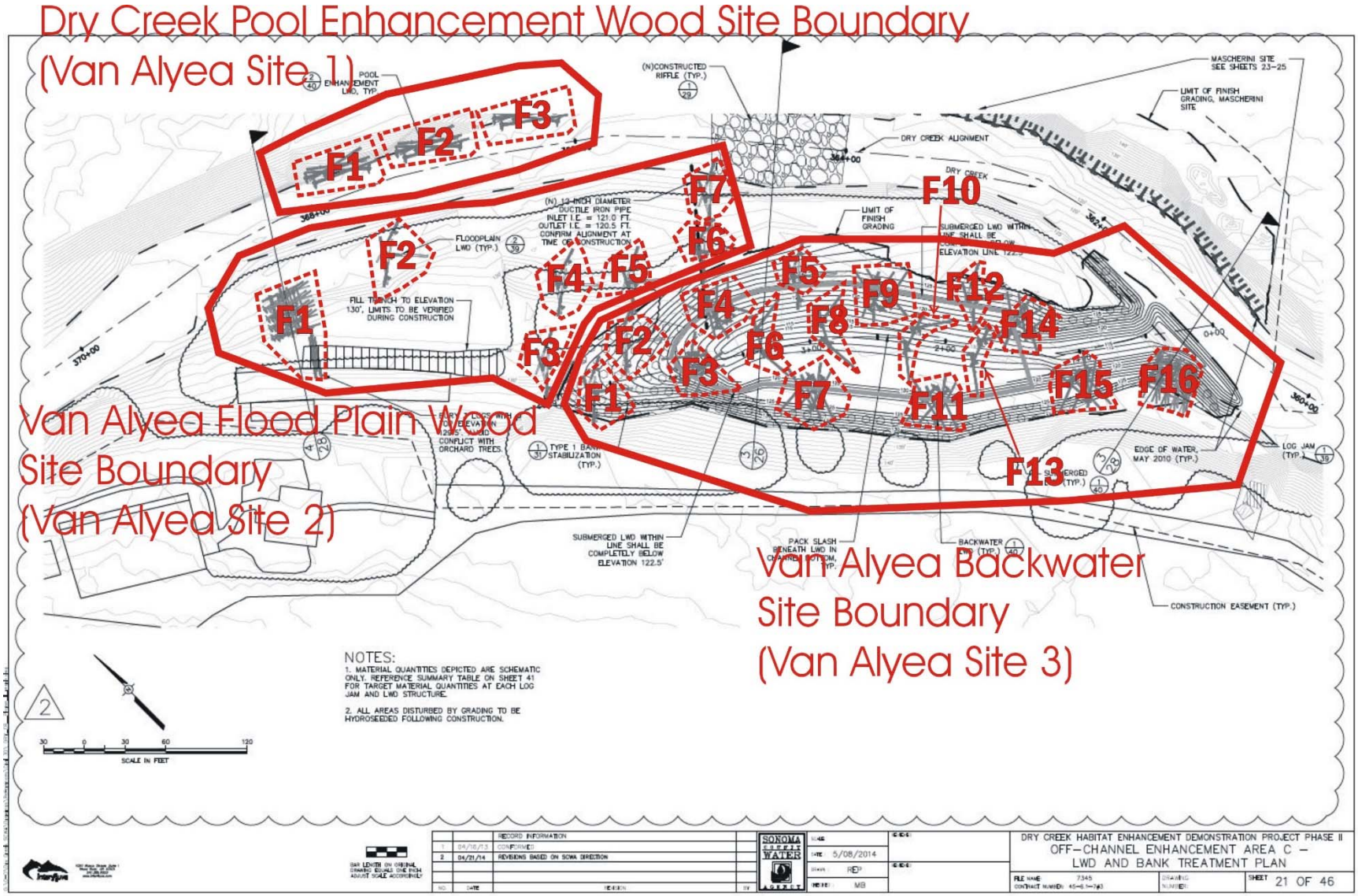
Water Agency Demonstration Reach Overview. Total linear distance along channel length is 5,600 feet (1.06 mile).



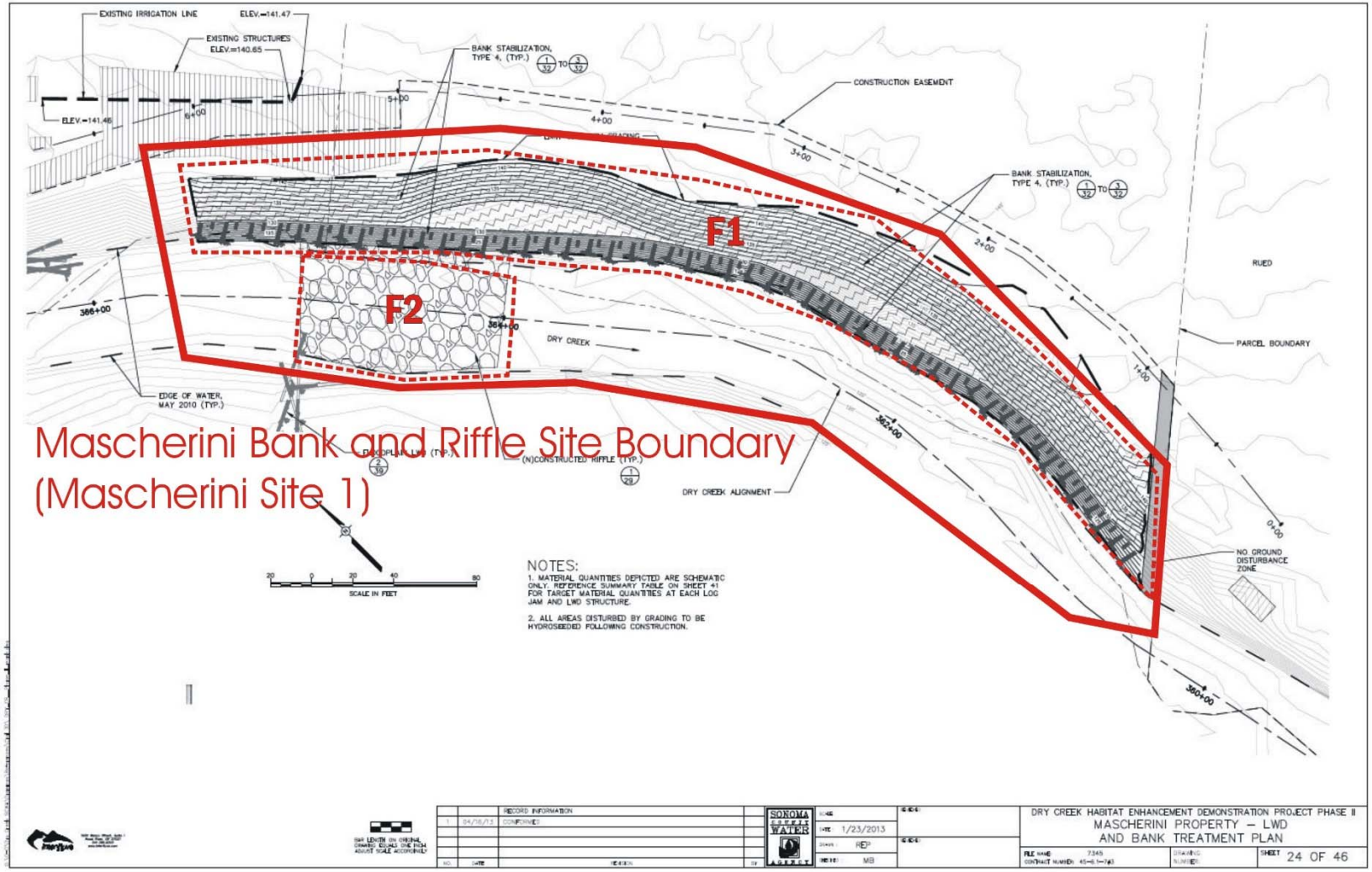
Site Boundary

Feature Boundary Within Each Site

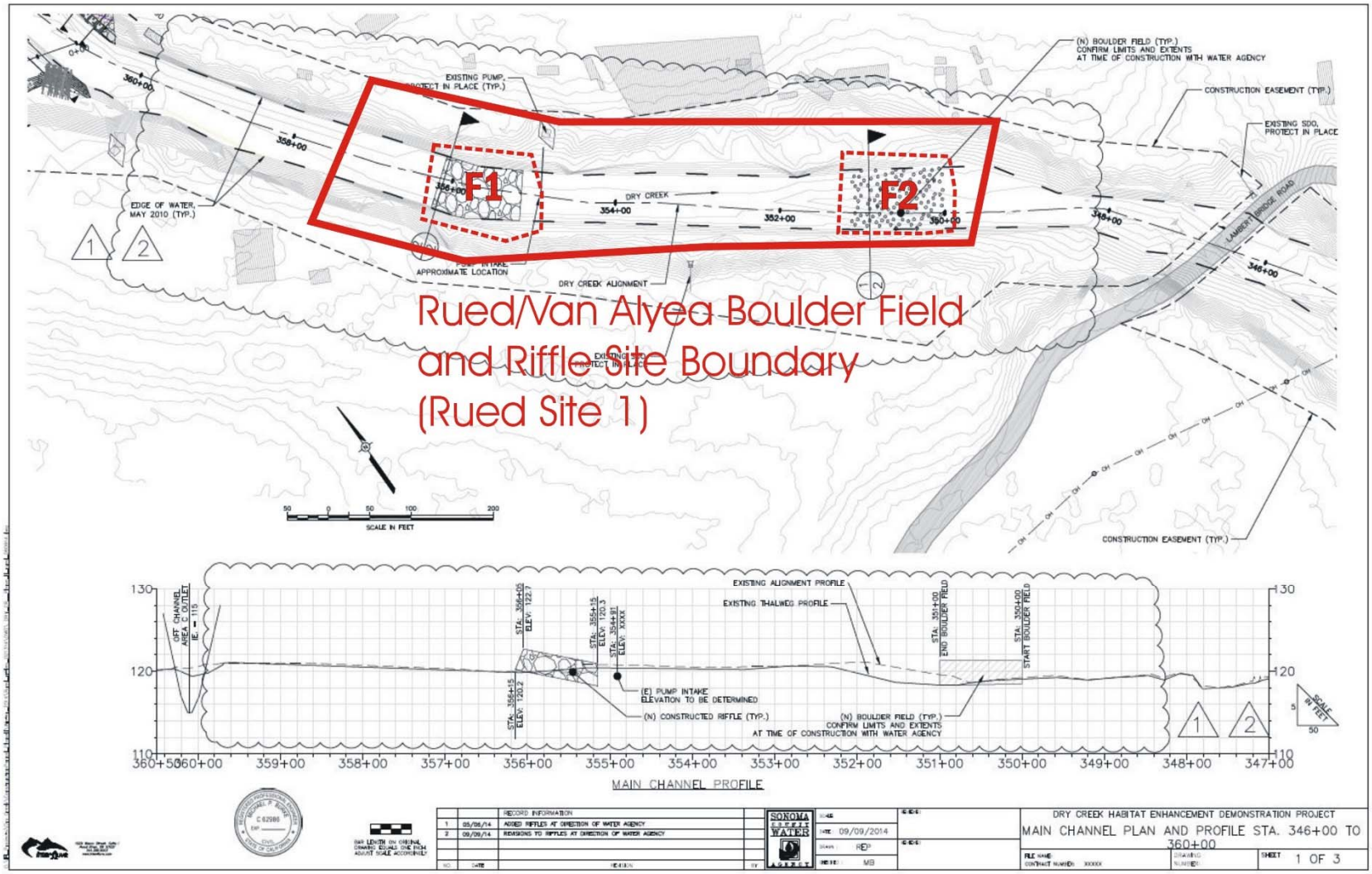
Water Agency Demonstration Reach - Quivira Site Key



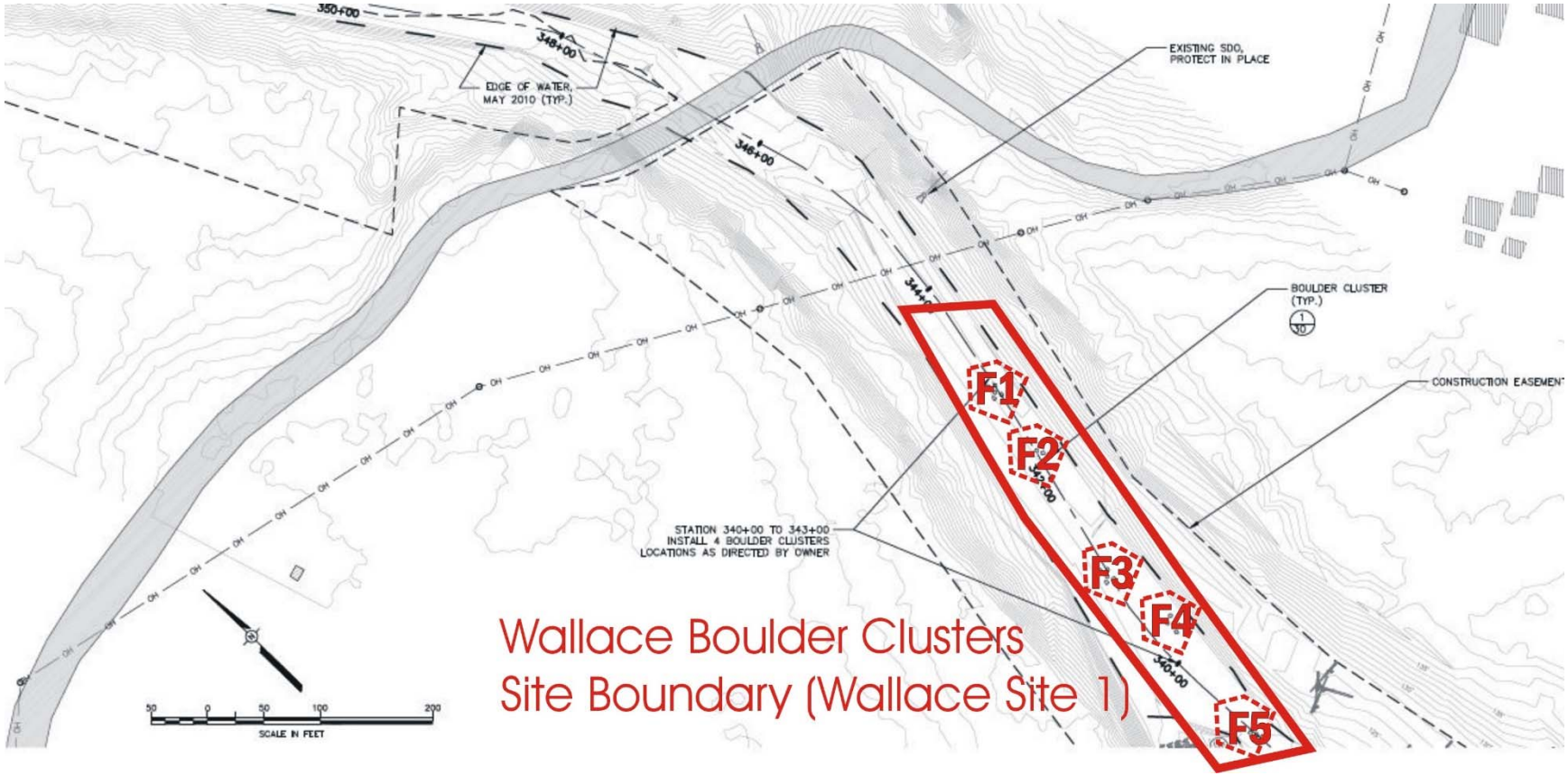
Water Agency Demonstration Reach – Van Alyea Site Key



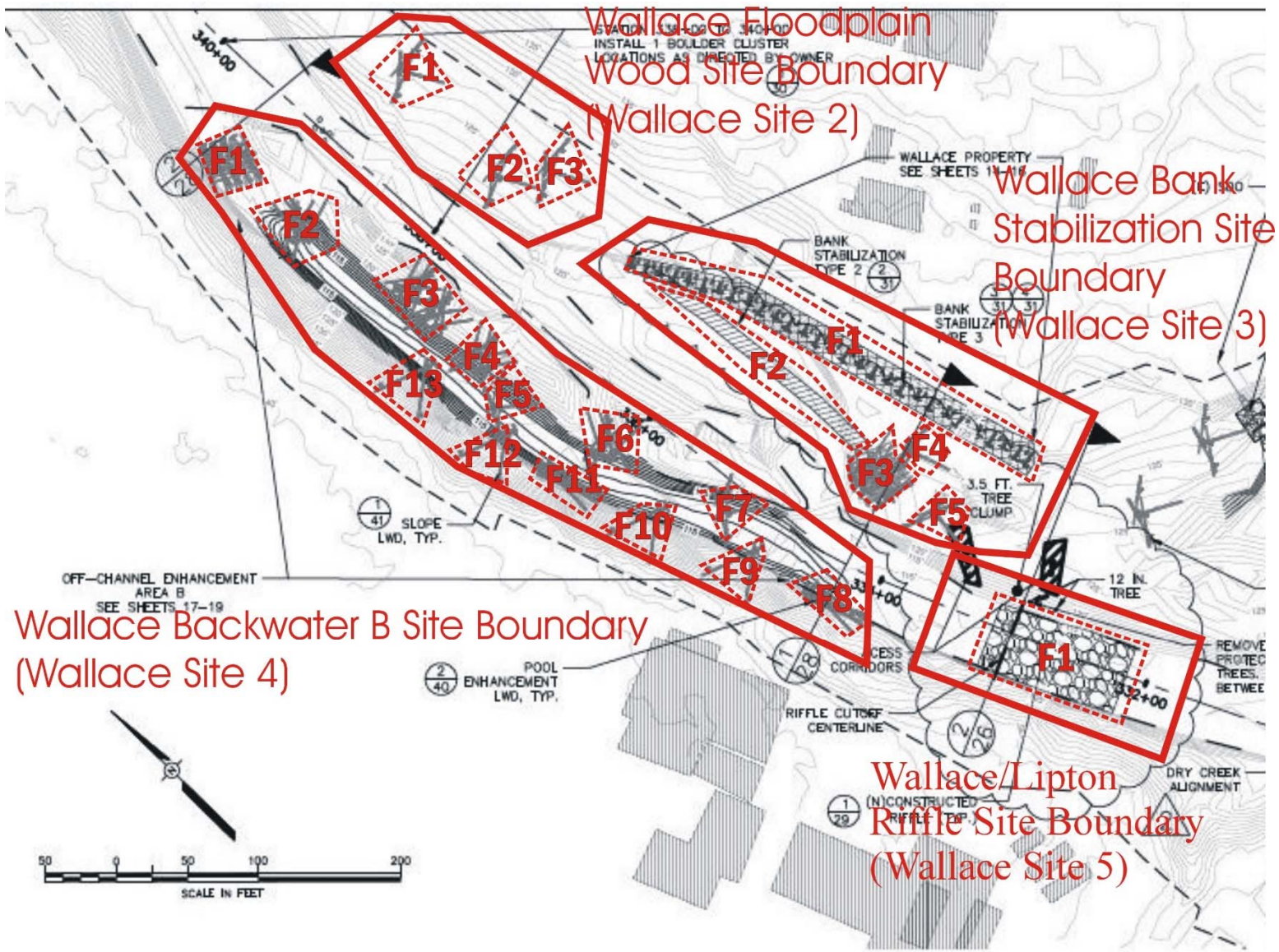
Water Agency Demonstration Reach – Mascherini Site Key



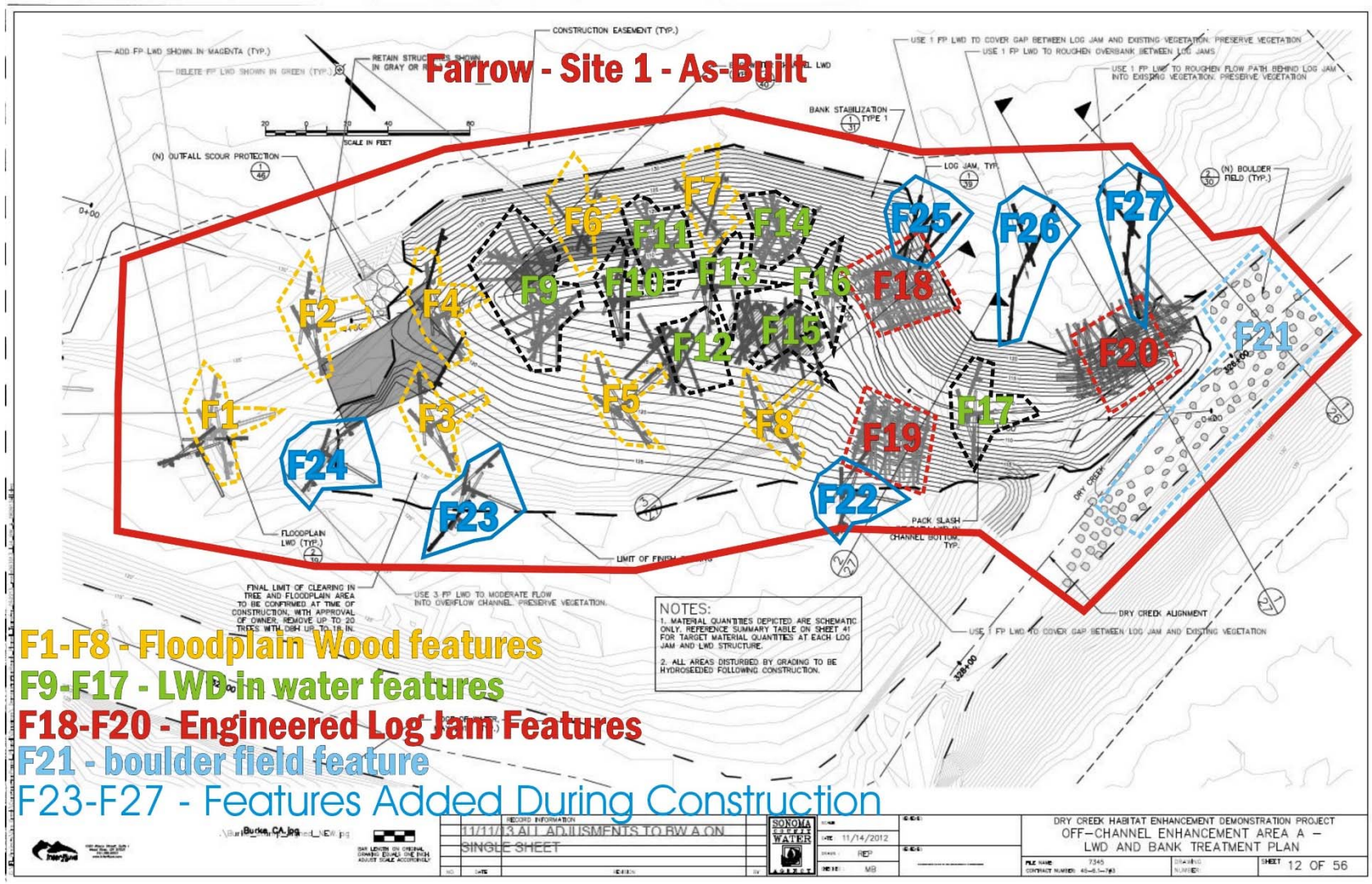
Water Agency Demonstration Reach – Rued Site Key



Water Agency Demonstration Reach – Wallace Site 1 Key



Water Agency Demonstration Reach – Wallace Sites 2-5 Key



Water Agency Demonstration Reach – Farrow Site Key

Summary of Changes from Final Design in Construction

Construction of large-scale habitat projects often include changes from the final design. Some of these changes can occur as a result of necessary adjustments due to changed or unknown site conditions, new opportunities at the site that allow for a modified design, or landowner concerns. The as-built record construction drawings for these projects are included in Appendices D, E, and F of this report. These as-built drawings document the differences between the final design drawings and what was actually constructed. A summary of the major changes is provided below.

Corps of Engineers' Reach 15 Project

- Alteration to one type of large wood structure (Type 7). The construction designs shows four embedded logs, one footer log, and two parallel rootwad logs with anchor ballast boulders. The as-built structure constructed was modified to consist of two parallel rootwad logs anchored to submerged ballast boulders. There are a total of three Type 7 large wood structures within Reach 15 (Site 1, within Feature 3; Site 5, within Feature 1; and Site 6, within Feature 1).
- Anchoring to live trees was eliminated during construction. Submerged ballast boulders was substituted as the anchoring method.
- Floodplain wood was added to the project design at the upstream end of the project between the inlet of the side channel and Bord Bridge (Site 1, Feature F1).

Water Agency's Demonstration Project

Quivira Sites

- Engineered logjam at upstream end of site (Quivira Site 1, Feature F1). Bedrock was encountered which prevented the installation of vertical snags as originally designed. The vertical snags were oriented at an angle and additional ballast boulder rock was added.
- Minor slope and excavation adjustment at upstream end of backwater channel to preserve existing live trees. Large wood structure on bank was also moved upstream approximately 20 feet towards the larger log structures at the top end of the backwater channel (Quivira Site 2, Feature 1).
- Floodplain structures making up Quivira Site 2, Feature 3, were combined and moved to bank channel. Two additional flood plain structures were also added in this area.
- Large wood structures (Quivira Site 2, Features F4 and F5) were both moved upstream approximately 20 feet.

- Willow mattress and woven willow wall were added during construction to the project design for additional bank erosion control (Quivira Site 3, Features F1 and F2).

Van Alyea Sites

- Throughout the site, above-ground/water portion of vertical snags and wood structures were eliminated due to landowner's aesthetic concerns (particularly at all features within Van Alyea Site 3).
- Additional wood was added to engineered log jam to span a flow path between the log jam location and the existing riparian vegetation (Van Alyea Site 2, Feature 1). Floodplain wood structure at this feature was also buried because of aesthetic concerns.
- Floodplain wood structure (Van Alyea Site 2, Feature F7) was eliminated because existing riparian vegetation that provided same function at location was preserved.
- Location of pipe connecting Dry Creek with upstream end of Van Alyea backwater was relocated to preserve existing vegetation.

Mascherini Sites

- Bank stabilization feature (Mascherini Site 1, Feature F1) was re-designed during construction to eliminate a portion of the existing bank originally expected to be preserved between two sections of bank stabilization work. Due to constructability concerns as well as concerns that the preservation of an existing section would increase the risk of failure of the adjacent stabilized sections, the entire bank within this feature was included in the stabilization work.
- The length of the constructed riffle (Mascherini Site 1, Feature F2) was extended approximately 15 feet upstream to avoid removal of existing riparian vegetation.

Rued Site

- Due to lack of right-of-way from the landowner, no features within this site were included as part of the final construction design plans. Midway during construction, the Water Agency was able to secure the necessary right-of-way to include this site and a constructed riffle and a boulder field were added to the project (Rued Site 1, Features F1 and F2).

Wallace Sites

- Boulder cluster sites were shown as typical locations on the construction drawings. During construction, the design engineer field located appropriate locations for the boulder placement. One cluster (Wallace Site 1, Feature F2)

was omitted, and boulder numbers were doubled at two other cluster locations (Wallace Site 1, Features F4 and F5).

- Floodplain wood structure locations field adjusted (Wallace Site 2, Features F1, F2, and F3).
- Engineered log jam was increased in size and field fit at site location (Wallace Site 3, Feature F3. Flood plain wood features were also adjusted as a result at this site (two floodplain wood structures were combined into one (Feature F4) and one was moved to new location (Feature F5).
- Engineered log jam (Wallace Site 4, Feature F1 was increased in size by 2 footer logs and 2 rootwad logs to block flowpath between structure and existing riparian vegetation.
- Low-flow surface connections with Dry Creek were added at two log structure locations along the Wallace backwater channel to enhance freshwater input into the backwater channel (Wallace Site 4, Features F3 and F6).
- The large wood structure at the backwater outlet (Wallace Site 4, Feature F8) was moved approximately 20 feet upstream.
- Constructed riffle (Wallace Site 5, Feature F1) was moved approximately 100 feet downstream to avoid existing riparian vegetation.

Farrow Site

- Field adjustments to floodplain wood structures. Orientation of Feature F1 was rotated.
- Additional floodplain wood structures were added (two structures adjacent to Feature F3, one structure adjacent to feature F19, and three buried wood structures in an upper terrace area above features F18 and F20).
- An in-water wood feature was expanded and converted into an island feature within the backwater (feature F15).
- The boulder field was increased in size during construction (feature F21).

Site and Feature Photos

U.S. Army Corps of Engineers Dry Creek – Reach 15 Fish Habitat Enhancement Project

Photo 1. Site 4, Features F1 and F2. July 22, 2013. Under construction.

Photo 2. Site 1, Feature F1. August 15, 2013.

Photo 3. Site 1, Feature F2 in foreground and Feature F3 beyond. August 15, 2013.

Photo 4. Site 1, Features F3 and F4 in foreground and Site 2, Features F1 and F2 beyond. August 15, 2013.

Photo 5. Site 2, Features F1, F2, and F3. August 15, 2013.

Photo 6. Site 3, Feature F1. August 15, 2013.

Photo 7. Site 5, Feature F1. August 15, 2013.

Photo 8. Site 5, Feature F1. August 15, 2013.

Photo 9. Site 6, Feature F1. August 15, 2013.

Photo 10. Site 6, Features F2, F3, and F4. August 15, 2013.

Photo 11. Site 6, Feature F4. October 25, 2013.

Photo 12. Site 7, Feature F1. October 25, 2013.

Photo 13. Site 7, Feature F1. October 25, 2013.

Water Agency's Dry Creek Habitat Enhancement Demonstration Project

Photo 14. Quivira Site 2, Feature F6 and Site 3, Feature F1 and F2. Constructed in 2012.

Photo 15. Quivira Site 1, Feature F1. October 4, 2012.

Photo 16. Quivira Site 1, Feature F2 and F3 under construction. September 24, 2012.

Photo 17. Quivira Site 2, Feature F1. October 4, 2012.

Photo 18. Quivira Site 2, Feature F2. October 4, 2012.

Photo 19. Quivira Site 3, Feature F3. October 24, 2012.

Photo 20. Quivira Site 2, Feature F4 and F5. October 8, 2012.

Photo 21. Quivira Site 2, Feature F6. October 8, 2012.

Photo 22. Quivira Site 2, Feature F6 and Site 3, Feature F1 and F2. October 24, 2012.

Photo 23. Van Alyea Site 1, Feature F2 and F3. October 2, 2014.

Photo 24. Van Alyea Site 2, Feature F1. November 6, 2014.

Photo 25. Van Alyea Site 2, Feature F2. November 6, 2014.

Photo 26. Van Alyea Site 2, Feature F4. November 13, 2014.

Photo 27. Van Alyea Site 3, Feature F4. November 6, 2014.

Photo 28. Van Alyea Site 3, Feature F11 in foreground. Feature F12 and F14 visible on far side bank of pond. Features F10 and F13 visible in water in middle of pond. November 17, 2014.

Photo 29. Van Alyea Site 3, Feature F16 on left. November 17, 2014.

Photo 30. Van Alyea Site 3 on left, Mascherini Site 1, Feature F1 on right. November 17, 2014.

Photo 31. Mascherini Site 1, Feature F1. November 17, 2014.

Photo 32. Mascherini Site 1, Feature F2. November 17, 2014.

Photo 33. Rued Site 1, Feature F1. November 20, 2014.

Photo 34. Rued Site 1, Feature F2. October 13, 2014.

Photo 35. Wallace Site 1, Feature F5. July 22, 2013.

Photo 36. Wallace Site 2, Feature F2. August 25, 2014.

Photo 37. Wallace Site 2, Feature F1. During high-flow event. December 11, 2014.

Photo 38. Wallace Site 3, Features F1, F2, and F3. October 21, 2013.

Photo 39. Wallace Site 3, Feature F4. October 17, 2013.

Photo 40. Wallace Site 4, Feature F1. December 4, 2014.

Photo 41. Wallace Site 4, Features F1 and F2 in background, and F3 in middle of photo. Two logs in foreground not yet installed. August 5, 2014.

Photo 42. Wallace Site 4, Features F2 in foreground. Features F3 and F13 in background. September 11, 2014.

Photo 43. Wallace Site 4, Features F6 in foreground. December 4, 2014.

Photo 44. Wallace Site 4, Features F7 in foreground. Features F10 and F11 in background on bank. December 4, 2014.

Photo 45. Wallace Site 4, Feature F8. August 6, 2014.

Photo 46. Wallace Site 5, Feature F1. August 4, 2014.

Photo 47. Farrow Site 1, new floodplain wood structure adjacent to Feature F3. September 24, 2013.

Photo 48. Farrow Site 1. October 17, 2013.

Photo 49. Farrow Site 1, Features F17 and F20. October 17, 2013.

Photo 50. Farrow Site 1, Feature F21. July 22, 2013.

Implementation Monitoring Forms

As noted above, an important initial step prior to the commencement of post-construction effectiveness monitoring within a given enhancement reach is to document and identify the sites and features actually constructed. The following tables provides the overall feature implementation rating (Excellent, Good, Fair, Poor, Fail) as well as the form type completed for each of the features identified for each site. The completed implementation monitoring forms are included as Appendix G.

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Corps Reach 15	1	F1	Offchannel Habitat Enhancement	Good	
Corps Reach 15	1	F2	Offchannel Habitat Enhancement	Good	
Corps Reach 15	1	F3	Offchannel Habitat Enhancement	Good	
Corps Reach 15	1	F4	Offchannel Habitat Enhancement	Good	
Corps Reach 15	2	F1	Offchannel Habitat Enhancement	Good	
Corps Reach 15	2	F2	Offchannel Habitat Enhancement	Excellent	
Corps Reach 15	2	F3	Offchannel Habitat Enhancement	Good	
Corps Reach 15	3	F1	Offchannel Habitat Enhancement	Good	
Corps Reach 15	3	F2	Offchannel Habitat Enhancement	Good	
Corps Reach 15	3	F3	Offchannel Habitat Enhancement	Fair	
Corps Reach 15	4	F1	Offchannel Habitat Enhancement	Good	
Corps Reach 15	4	F2	Offchannel Habitat Enhancement	Excellent	
Corps Reach 15	4	F3	Offchannel Habitat Enhancement	Good	
Corps Reach 15	4	F4	Offchannel Habitat Enhancement	Good	
Corps Reach 15	5	F1	Offchannel Habitat Enhancement	Good	
Corps Reach 15	5	F2	Offchannel Habitat Enhancement	Good	
Corps Reach 15	5	F3	Offchannel Habitat Enhancement	Fair	
Corps Reach 15	5	F4	Offchannel Habitat Enhancement	Good	
Corps Reach 15	6	F1	Offchannel Habitat Enhancement	Fair	
Corps Reach 15	6	F2	Offchannel Habitat Enhancement	Good	
Corps Reach 15	6	F3	Offchannel Habitat Enhancement	Excellent	
Corps Reach 15	6	F4	Offchannel Habitat Enhancement	Fair	
Corps Reach 15	6	F5	Offchannel Habitat Enhancement	Good	
Corps Reach 15	7	F1	Offchannel Habitat Enhancement	Good	
Corps Reach 15	8	F1	Instream Habitat Enhancment	Good	
Corps Reach 15	9	F1	Instream Habitat Enhancment	Good	

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Quivira	1	F1	Offchannel Habitat Enhancement	Excellent	
Quivira	1	F2	Offchannel Habitat Enhancement	Excellent	
Quivira	1	F3	Offchannel Habitat Enhancement	Excellent	
Quivira	2	F1	Offchannel Habitat Enhancement	Excellent	
Quivira	2	F2	Offchannel Habitat Enhancement	Excellent	
Quivira	2	F3	Offchannel Habitat Enhancement	Excellent	
Quivira	2	F4	Offchannel Habitat Enhancement	Excellent	
Quivira	2	F5	Offchannel Habitat Enhancement	Excellent	
Quivira	2	F6	Offchannel Habitat Enhancement	Excellent	
Quivira	3	F1	Channel Reconstruction and Bank Stabilization	Good	
Quivira	3	F2	Channel Reconstruction and Bank Stabilization	Excellent	

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Van Alyea	1	F1	Instream Habitat Enhancment	Excellent	
Van Alyea	1	F2	Instream Habitat Enhancment	Excellent	
Van Alyea	1	F3	Instream Habitat Enhancment	Excellent	
Van Alyea	2	F1	Offchannel Habitat Enhancement	Excellent	
Van Alyea	2	F2	Offchannel Habitat Enhancement	Excellent	
Van Alyea	2	F3	Offchannel Habitat Enhancement	Excellent	
Van Alyea	2	F4	Offchannel Habitat Enhancement	Excellent	
Van Alyea	2	F5	Offchannel Habitat Enhancement	Excellent	
Van Alyea	2	F6	Offchannel Habitat Enhancement	Excellent	
Van Alyea	2	F7	Offchannel Habitat Enhancement	Not Constructed	
Van Alyea	3	F1	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F2	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F3	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F4	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F5	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F6	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F7	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F8	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F9	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F10	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F11	Offchannel Habitat Enhancement	Good	
Van Alyea	3	F12	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F13	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F14	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F15	Offchannel Habitat Enhancement	Excellent	
Van Alyea	3	F16	Instream Habitat Enhancment	Excellent	

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Mascherini	1	F1	Channel Reconstruction and Bank Stabilization	Excellent	
Mascherini	1	F2	Instream Habitat Enhancment	Excellent	

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Rued	1	F1	Instream Habitat Enhancment	Excellent	
Rued	1	F2	Instream Habitat Enhancment	Excellent	

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Wallace	1	F1	Instream Habitat Enhancment	Good	
Wallace	1	F2	Instream Habitat Enhancment	Not Constructed	
Wallace	1	F3	Instream Habitat Enhancment	Good	
Wallace	1	F4	Instream Habitat Enhancment	Good	
Wallace	1	F5	Instream Habitat Enhancment	Good	
Wallace	2	F1	Offchannel Habitat Enhancement	Excellent	
Wallace	2	F2	Offchannel Habitat Enhancement	Excellent	
Wallace	2	F3	Offchannel Habitat Enhancement	Excellent	
Wallace	3	F1	Channel Reconstruction and Bank Stabilization	Good	
Wallace	3	F2	Channel Reconstruction and Bank Stabilization	Excellent	
Wallace	3	F3	Channel Reconstruction and Bank Stabilization	Good	
Wallace	3	F4	Offchannel Habitat Enhancement	Excellent	
Wallace	3	F5	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F1	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F2	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F3	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F4	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F5	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F6	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F7	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F8	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F9	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F10	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F11	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F12	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F13	Offchannel Habitat Enhancement	Excellent	
Wallace	4	F14	Offchannel Habitat Enhancement	Excellent	
Wallace	5	F1	Instream Habitat Enhancment	Excellent	

Site Name	Site ID Number	Feature Number	Form Type	Overall Feature Implementation Rating	Overall Site Implementation Rating
Farrow	1	F1	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F2	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F3	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F4	Offchannel Habitat Enhancement	Good	
Farrow	1	F5	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F6	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F7	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F8	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F9	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F10	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F11	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F12	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F13	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F14	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F15	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F16	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F17	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F18	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F19	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F20	Offchannel Habitat Enhancement	Good	
Farrow	1	F21	Instream Habitat Enhancment	Good	
Farrow	1	F22	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F23	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F24	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F25	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F26	Offchannel Habitat Enhancement	Excellent	
Farrow	1	F27	Offchannel Habitat Enhancement	Excellent	

Appendix A

U.S. Army Corps of Engineers

Dry Creek Reach 15 As-Built Record Drawings

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read instructions on the reverse side prior to initiating this form)

DATE: 01/13/2014

TRANSMITTAL NO.: 01 33 00-2

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS

(This section will be initiated by the contractor)

TO: North Bay Resident Office
2100 Bridgeway
Sausalito, CA 94965

FROM: Contractor Services Group, Inc.
3960 Industrial Blvd. Suite 500
West Sacramento, CA 95691

CONTRACT NO.: W912P7-11-C-0017 NA

CHECK ONE:
[X] THIS IS A NEW TRANSMITTAL
[ ] THIS IS A RESUBMITTAL OF TRANSMITTAL _____

SPECIFICATION SEC. NO. (Cover only one section with each transmittal): 01 33 00

PROJECT TITLE AND LOCATION: 01-Main Register
FY12 Dry Creek Fish Enhancement Sonoma County

CHECK ONE: THIS TRANSMITTAL IS FOR [X] FIO [ ] GA [ ] DA [ ] CR

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED (Type size, model number/etc.) b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT SPEC. PARA. NO. e.	CONTRACT REFERENCE DOCUMENT DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION (See Instruction No. 6) h.	FOR CE USE CODE i.
1.1	As-Built Drawings	AS-BUILTS	2			A	N	
	Contractor Services Group (CSG)							
	__X___ Approved							
	_____ Approved with corrections noted on							
	submittal data and/or attached sheet(s)							
	Signature: Trevor Stotka_____							
	Title: Assistant CQC Manager_____							
	Date: 1-13-14_____							

REMARKS

Enclosed is one (1) revised copy of the Dry Creek As-Built Drawings submitted by Contractor Services Group, Inc. on January 13, 2014.

I certify that the above submitted items have been reviewed in detail and are correct and in the strict conformance with the contract drawings and specifications except as otherwise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by item No.)

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY

DATE

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

US Army Corps of Engineers
San Francisco District

DRY CREEK - REACH 15 FISH HABITAT ENHANCEMENT PROJECT (AS-BUILT)

GEYSERVILLE, SONOMA COUNTY, CALIFORNIA

CONTRACT NO: W912P7-11-C-0017

FY: 03/2013

CONTRACTOR SERVICES GROUP INC.
Home Office: P.O. Box 1505 • West Sacramento, CA 95691
Oregon: 147 North Central Ave #201, Medford, OR 94501
Texas: 1517 Centre Place Dr. #350, Denton, TX 76205
Main Phone: (916) 371-7303 • Fax: (866) 366-6646

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS
Inland Empire: 215 North 5th Street, Redlands, CA 92374, Ph: (909) 307-0046
Northern California: 2525 Warren Drive, Rocklin, CA 95677, Ph: (916) 782-9100
San Diego Region: 3914 Murphy Canyon Rd. Suite A232, San Diego, CA 92123, Ph: (858) 279-4040
Bay Area: 1488 Harrison Street, Suite 303, San Fransisco, CA 94103, Ph: (415) 553-4101
Orange County: 1801 Park Court Place, Building B, Ste 103, Santa Ana, CA 92701, Ph: (714) 648-0630

nhc northwest hydraulic consultants
3950 industrial blvd, suite 100C
west sacramento, california 95691
(916) 371-7400 fax: (916) 371-7475
www.nhcweb.com

Cascade STREAM SOLUTIONS

US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

nhc northwest hydraulic consultants

ECORP

Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/18/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	01/13/14	

DESIGNED BY: LJH | CHECKED BY: LJH | DRAWN BY: TVS
DATE: 01/13/14 | SHEET NO. 1 of 11 | DRAWING NO. DRAWING NO.

SUBMITTED:
APPROVAL RECOMMENDED
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

PREPARED UNDER THE DIRECTION OF
JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SONOMA COUNTY CALIFORNIA
DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT
TITLE SHEET

Sheet reference number: G1.0

GENERAL NOTES:

1. CONTRACTOR SERVICES GROUP INC IS REFERRED TO AS "CONTRACTOR", NORTHWEST HYDRAULIC CONSULTANTS INC IS REFERRED TO AS 'ENGINEER' AND THE UNITED STATES ARMY CORPS OF ENGINEERS (USACE) IS REFERRED TO AS 'OWNER'.

2. ALL WORK SHALL BE IN CONFORMANCE WITH THE STANDARDS, SPECIFICATIONS, AND ORDINANCES OF USACE.

3. THE CONTRACTOR SHALL CONTACT THE ENGINEER AS NECESSARY TO CLARIFY ANY IMPROVEMENT THAT THE CONTRACTOR BELIEVES THERE IS NOT SUFFICIENT DETAIL OF ON THE DRAWINGS TO CONSTRUCT. IF DISCREPANCIES BETWEEN THE DRAWINGS, SPECIFICATIONS, THESE NOTES, OR FIELD CONDITIONS OCCUR, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO PROCEEDING WITH WORK. CHANGES MADE WITHOUT PRIOR APPROVAL OF THE OWNER AND ENGINEER SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. SPECIFIED DIMENSIONS ON THE DRAWINGS SHALL TAKE PRECEDENCE OVER SCALED DIMENSIONS.

4. THE SITE TOPOGRAPHY IS BASED ON RECENT SURVEY DATA PERFORMED BY ENGINEER. ANY DIFFERENCES IN TOPOGRAPHY SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE PROCEEDING.

5. THE CONTRACTOR SHALL MAINTAIN A SET OF RED LINE OR RECORD DRAWINGS DURING CONSTRUCTION AND SHALL SUBMIT A SET OF REPRODUCIBLE "AS-BUILT" DRAWINGS TO THE ENGINEER AND THE OWNER AFTER COMPLETION OF THE WORK.

6. ALL SIEVE ANALYSIS NECESSARY FOR GRAVEL AUGMENTATION SHALL BE ARRANGED AND PAID FOR BY THE CONTRACTOR.

7. THE OWNER SHALL BE RESPONSIBLE FOR ALL PERMITS REQUIRED FOR THIS WORK.

8. CONTRACTOR SHALL POST ON THE PROJECT SITE, EMERGENCY TELEPHONE NUMBERS FOR AMBULANCE, POLICE AND FIRE DEPARTMENTS.

9. WOODY MATERIAL SHALL BE SALVAGED ONSITE AND SUPPLEMENTED WITH MATERIAL PROVIDED BY USACE AND THE CONTRACTOR. ROCK BOULDERS SHALL BE PROVIDED BY THE USACE AND THE CONTRACTOR.

10. THE CONTRACTOR SHALL PROTECT EXISTING ADJACENT STRUCTURES, ROADS AND UTILITIES FROM DAMAGE. ANY DAMAGE CAUSED BY THE CONTRACTOR SHALL BE REPAIRED OR REPLACED AT NO ADDITIONAL COST TO THE OWNER. BARRICADES, SIGNS, LIGHTS, ETC., REQUIRED FOR THE PROTECTION OF PERSONNEL, PROPERTY AND MATERIAL SHALL BE PROVIDED FOR AND MAINTAINED DURING CONSTRUCTION BY THE CONTRACTOR, AND SHALL CONFORM TO ALL GOVERNING CODES, ORDINANCES AND REGULATIONS.

11. THE CONTRACTOR SHALL MAINTAIN GOOD HOUSEKEEPING PRACTICES AT THE JOB SITE. ALL BUILDING MATERIAL AND DEBRIS ARE TO BE KEPT WITHIN WORK OR STAGING AREAS AT ALL TIMES. EXCESS BUILDING MATERIALS AND DEBRIS SHALL BE REMOVED PROMPTLY FROM THE JOB SITE AND DISPOSED OF AT AN APPROPRIATE DUMPSITE. ALL TOUCH UP WORK SHALL BE COMPLETED. ALL COMPLETED WORK SHALL BE PROTECTED AT ALL TIMES AGAINST SUBSEQUENT DAMAGE, UNTIL FINAL ACCEPTANCE BY THE OWNER.

12. CONTRACTOR IS RESPONSIBLE FOR PRESERVATION AND/OR PERPETUATION OF ALL EXISTING MONUMENTS WHICH CONTROL SUBDIVISIONS, TRACTS, BOUNDARIES, STREETS, HIGHWAYS, OR OTHER RIGHT-OF-WAY, EASEMENTS, OR SURVEY CONTROLS WHICH WILL BE DISTURBED OR REMOVED DUE TO CONTRACTOR'S WORK.

WORK SCHEDULE NOTES:

1. CONTRACTOR SHALL SCHEDULE WORK BETWEEN APRIL 15 AND OCTOBER 15.

2. CONTRACTOR SHALL SCHEDULE IN STREAM WORK BETWEEN APRIL 15 AND OCTOBER 15.

3. WORKING HOURS FOR THE CONTRACTOR WILL BE BETWEEN THE HOURS OF 7:00 AND 17:00 MONDAY THROUGH FRIDAY. IF THE CONTRACTOR DESIRES TO WORK DURING PERIODS OTHER THAN THESE, HE/SHE MUST OBTAIN APPROVAL FROM THE OWNER THREE DAYS IN ADVANCE.

EROSION AND SEDIMENT CONTROL NOTES:

1. INSTALLATION AND MAINTENANCE OF EROSION CONTROL MEASURES ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PREVENTION OF SIGNIFICANT EROSION AND SILTATION ENTERING DRY CREEK, NATURAL DRAINAGE COURSES AND/OR INTRUDING UPON ADJACENT ROADWAYS AND PROPERTIES. WINTERIZATION AND EROSION CONTROL SHOWN ON THESE PLANS IS INTENDED AS A GUIDE. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS DETERMINED IN THE FIELD AND APPROVED BY THE ENGINEER. THIS RESPONSIBILITY SHALL APPLY THROUGHOUT THE COURSE OF CONSTRUCTION AND UNTIL ALL DISTURBED AREAS HAVE BECOME STABILIZED AND SHALL NOT BE LIMITED TO WET WEATHER PERIODS.

2. ALL PERMITS REQUIRED FOR EROSION AND SEDIMENT CONTROL WILL BE PROVIDED BY THE OWNER.

3. CONTRACTOR SHALL INSTALL AND MAINTAIN EROSION CONTROL BEST MANAGEMENT PRACTICES (BMPS) DURING THE CONSTRUCTION PERIODS.

4. WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES PAVED AREAS OR ACCESS ROADS, STABILIZED CONSTRUCTION ACCESS SHALL BE CONSTRUCTED AND MAINTAINED UNTIL THE COMPLETION OF CONSTRUCTION. DRY CREEK ROAD SHALL BE MAINTAINED FREE OF DEBRIS AND SEDIMENT THROUGHOUT THE COURSE OF THE PROJECT.

5. AREAS SHOWN ON THE PLANS AND DISTURBED DURING CONSTRUCTION, BY GRADING, TRENCHING, OR OTHER ACTIVITIES, SHALL BE HYDROSEEDED. SEE VEGETATION MANAGEMENT PLAN FOR DETAILED DESCRIPTION OF PLANTING LOCATIONS, PLANT SPECIES, AND HYDROSEED SPECIFICATIONS.

6. DUST SHALL BE CONTROLLED AT THE SITE THROUGH THE USE OF WATER AND CONTROLLING TRAFFIC SPEED. WATER HOOKUP AND SUPPLY SHALL BE PROVIDED BY OWNER. OTHER COSTS ASSOCIATED WITH DUST CONTROL SHALL BE BORNE BY THE CONTRACTOR. THE STANDARD FOR DUST SUPPRESSION SHALL BE NO VISIBLE DUST LEAVING THE PROJECT BOUNDARY. THIS JUDGMENT WILL SOLELY BE THE ENGINEER'S OR OWNER'S AND HE/SHE WILL HAVE THE ABILITY TO STOP WORK.

7. SEASONAL WETLANDS ARE LOCATED IN THE PROJECT VICINITY. THE USACE SHALL PROVIDE WETLAND BOUNDARIES DESIGNATING SEASONAL WETLAND WITHIN THE PROJECT AREA. THE CONTRACTOR SHALL AVOID DISTURBANCE TO THE AREAS DURING CONSTRUCTION BY ENSURING VEHICLES, EQUIPMENT AND PERSONNEL DO NOT ENTER AREAS THAT HAVE THE POTENTIAL TO BE OCCUPIED BY ENDANGERED SPECIES OR THEIR HABITAT.

UTILITY NOTES:

1. CONTRACTOR MUST NOTIFY USA (800) 227-2600 A MINIMUM OF 48 HOURS PRIOR TO COMMENCING EARTHWORK.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND PROTECTION OF ALL EXISTING UTILITIES AND STRUCTURES SHOWN ON THE DRAWINGS AND THOSE NOT SHOWN ON THE DRAWINGS, BUT MADE KNOWN TO HIM/HER.

3. UNKNOWN SUBSURFACE STRUCTURES AND UTILITIES ENCOUNTERED DURING THE WORK SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY AND WORK SHALL NOT PROCEED IN THESE AREAS WITHOUT THE ENGINEERS APPROVAL.

EARTHWORK NOTES:

1. THE CONTRACTOR SHALL HAUL STRIPPING AND EXCESS EXCAVATED MATERIAL TO THE USACE STORAGE AREA, ALSO KNOWN AS THE "BONEYARD".

2. ONCE EARTHWORK IS COMPLETE, ALL DISTURBED SOILS SHALL BE HYDROSEEDED. SEE EROSION AND SEDIMENT CONTROL NOTES 3 AND 5.

3. THE CONTRACTOR SHALL ARRANGE FOR AND PAY FOR ALL SURVEY SERVICES NECESSARY TO ASSURE GRADING COMPLIANCE WITH THE DESIGN DOCUMENTS.

4. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL STOCKPILE, GRADED AND EXCAVATED AREAS FROM EROSION.

5. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN WRITING IMMEDIATELY OF ANY DIFFERENCES IN TOPOGRAPHY FROM THAT SHOWN ON THE DRAWING WHICH MAY REQUIRE SIGNIFICANT CHANGES IN DESIGN SUCH AS CHANNEL WIDTH AND BANK SLOPE.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SURVEY AND STAKING FOR ALL GRADING WORK. ALL CONSTRUCTION CONTROL SHALL BE SETUP BY A LICENSED LAND SURVEYOR, AS WELL AS THE VERIFICATION OF AS-BUILT DRAWINGS, AND PAID FOR BY THE CONTRACTOR.

7. CONSTRUCTED CHANNEL SHALL BE COMPACTED BY TRACK WALKING CHANNEL BOTTOM AND SIDE SLOPES. IN AREAS WHERE SLOPES ARE TOO STEEP TO TRACK WALK, CONTRACTOR SHALL COMPACT SOIL USING EQUIPMENT BUCKET OR OTHER APPROVED METHODS.

CONTROL POINTS NOTES:

1. TABLE 1 PROVIDES THE NORTHING, EASTING, AND ELEVATION AND DESCRIPTION OF PROJECT CONTROL POINTS. THE SPATIAL DATUM OF THE CONTROL POINTS IS IN NAD83 CALIFORNIA STATE PLANE ZONE 2. THE VERTICAL DATUM OF CONTROL POINT IS NAVD88.

CONTROL POINTS

POINT #	NORTHING, FT	EASTING, FT	ELEV, FT	DESCRIPTION
1	2025686.70	6276733.25	220.7	CP A REBAR & CAP
2	2025445.28	6276632.07	221.0	BM USAC SPAN-2 1966
8	2025668.20	6276733.14	220.6	BM SCWA DC-7
41	2025533.12	6277976.63	204.7	CP B REBAR & CAP
73	2025394.13	6276595.89	220.1	BM USAC RU2-18
94	2001308.73	6295880.37	142.7	BM SCWA DC4 GPS

TREES TO REMOVE:

PT	EASTING	NORTHING
20	6277838	2025345
26	6277817	2025353
91	6278086	2025142
100	6278067	2025190
107	6278008	2025238
108	6278004	2025252
109	6277998	2025250
110	6277999	2025250
111	6277990	2025256
112	6277989	2025253
113	6277987	2025246
129	6277917	2025300
133	6277890	2025297
134	6277893	2025303
137	6277870	2025313
138	6277865	2025312
139	6277859	2025328
140	6277857	2025328
141	6277846	2025338
164	6277755	2025335
174	6277609	2025435
177	6277437	2025473
181	6277311	2025491
182	6277299	2025488
184	6277283	2025483
185	6277283	2025487
191	6277231	2025513
192	6277231	2025516
195	6277187	2025521
226	6277101	2025523
228	6277064	2025561
235	6276991	2025546
237	6276981	2025553
288	6277384	2025436
305	6277457	2025425
325	6277258	2025507
327	6277222	2025517
330	6277151	2025526
363	6277086	2025510
368	6277117	2025499
369	6277115	2025503
391	6277018	2025528
493	6278092	2025137
495	6278074	2025156
499	6277983	2025252
521	6278038	2025232
522	6278051	2025217
523	6278041	2025227
524	6278032	2025227
525	6278039	2025232
526	6278034	2025220
528	6278034	2025229
529	6278032	2025233
532	6278026	2025241
1018	6277789	2025370
1022	6277734	2025399
1025	6277660	2025427
1027	6277661	2025428
1029	6277636	2025437
1035	6277364	2025489

TREES TO PRESERVE:

PT	EASTING	NORTHING
24	6277827	2025319
40	6277732	2025392
53	6277636	2025457
59	6277389	2025495
70	6277299	2025507
93	6278062	2025150
99	6278070	2025209
105	6278084	2025194
106	6278005	2025229
115	6277995	2025266
116	6277981	2025281
117	6277976	2025275
118	6277976	2025287
119	6277961	2025280
125	6277948	2025293
130	6277976	2025239
131	6277988	2025231
132	6277995	2025229
135	6277897	2025312
148	6277817	2025318
149	6277823	2025319
150	6277793	2025325
152	6277758	2025322
158	6277720	2025341
161	6277735	2025335
163	6277738	2025335
178	6277419	2025454
179	6277323	2025473
183	6277302	2025473
186	6277266	2025480
194	6277221	2025503
196	6277174	2025512
198	6277157	2025542
202	6277182	2025535
208	6277180	2025532
218	6277213	2025532
225	6277107	2025513
229	6277055	2025555
233	6277006	2025524
234	6277002	2025527
236	6276993	2025553
238	6276982	2025557
240	6276915	2025599
250	6276862	2025587
286	6277354	2025459
313	6277520	2025412
315	6277518	2025413
322	6277261	2025517
323	6277265	2025514
337	6276962	2025544
338	6276886	2025587
362	6277061	2025517
364	6277067	2025520
390	6277004	2025525
392	6277009	2025520
496	6278062	2025150
497	6278066	2025212
502	6277783	2025330
503	6277729	2025340
540	6278002	2025287
1004	6277910	2025314
1006	6277880	2025322
1012	6277843	2025351
1014	6277824	2025338
1015	6277818	2025339
1019	6277760	2025342
1026	6277663	2025443
1028	6277666	2025418
1047	6278055	2025168

TREES TO PROTECT-IN-PLACE:

PT	EASTING	NORTHING
28	6277790	2025347
30	6277791	2025396
36	6277755	2025374
38	6277741	2025414
46	6277689	2025439
48	6277660	2025451
55	6277495	2025467
66	6277311	2025517
71	6277258	2025527
96	6278080	2025213
97	6278087	2025200
98	6278089	2025197
104	6278089	2025193
127	6277920	2025313
128	6277930	2025307
136	6277867	2025335
144	6277869	2025284
146	6277832	2025310
151	6277762	2025312
159	6277721	2025349
160	6277725	2025335
180	6277317	2025469
199	6277160	2025547
204	6277192	2025536
207	6277175	2025540
216	6277195	2025536
217	6277206	2025538
222	6277123	2025568
227	6277063	2025525
231	6277022	2025541
232	6277016	2025554
283	6277327	2025451
284	6277345	2025441
285	6277360	2025441
287	6277370	2025442
312	6277502	2025428
316	6277555	2025399
317	6277589	2025415
318	6277566	2025401
331	6277192	2025536
335	6277063	2025525
365	6277106	2025507
366	6277102	2025499
367	6277102	2025503
386	6277019	2025515
387	6277065	2025511
388	6277018	2025507
411	6276847	2025548
412	6276866	2025553
448	6278051	2025163
481	6277889	2025319
483	6277372	2025504
484	6277372	2025504
485	6277372	2025504
486	6277372	2025504
500	6277920	2025313
514	6278115	2025128
520	6278052	2025232
527	6278045	2025240
531	6278026	2025250
1002	6277909	2025322
1003	6277915	2025315
1007	6277889	2025319
1009	6277884	2025327
1011	6277879	2025331
1013	6277842	2025358
1016	6277802	2025349
1017	6277804	2025389
1021	6277748	2025379
1024	6277700	2025401
1031	6277455	2025494
1033	6277390	2025502
1034	6277372	2025504
1038	6277328	2025518

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

nhc northwest hydraulic consultants

ECORP

Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/18/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	09/13/14	

DESIGNED BY: LJH
CHECKED BY: LJH
DRAWN BY: TVS
DATE: 03/05/13
SHEET NO. 2 of 11
DRAWING NO.
DRAWING NO.

PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SUBMITTED:

APPROVAL RECOMMENDED:
CHIEF, OPS. TECH. SUP. OFFICE

APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

CALIFORNIA
SONOMA COUNTY
DRY CREEK - REACH 15
FISH HABITAT ENHANCEMENT PROJECT

NOTES, ABREVIATIONS, & LEGEND

Sheet reference number:
G2.0

NOTES:
1. ACCESS ROADS TO BE DETERMINED IN THE FIELD BY THE CONTRACTOR AND APPROVED BY THE OWNER PRIOR TO ESTABLISHMENT.

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

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San Francisco District
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San Francisco, CA 94103

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	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/16/12	
	95% SUBMITTAL	08/31/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	07/15/14	

DESIGNED BY: LJH
CHECKED BY: LJH
DRAWN BY: TVS
DATE: 03/05/13
SHEET NO. 3 of 11
DRAWING NO.

SUBMITTED:
APPROVAL RECOMMENDED
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SONOMA COUNTY CALIFORNIA

DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT

SITE ACCESS PLAN

Sheet reference number:
G3.0

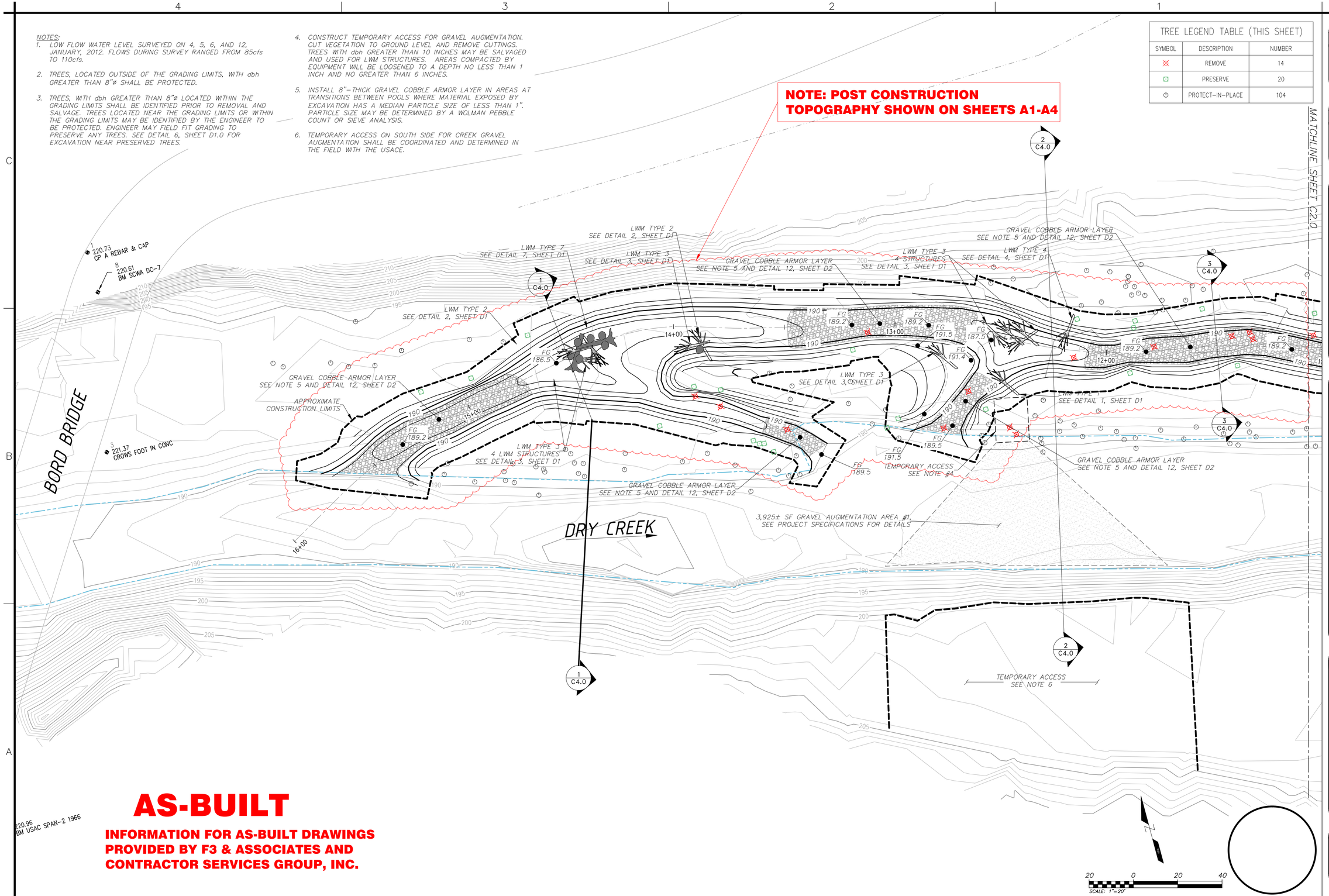
NOTES:

1. LOW FLOW WATER LEVEL SURVEYED ON 4, 5, 6, AND 12, JANUARY, 2012. FLOWS DURING SURVEY RANGED FROM 85cfs TO 110cfs.
2. TREES, LOCATED OUTSIDE OF THE GRADING LIMITS, WITH dbh GREATER THAN 8"ø SHALL BE PROTECTED.
3. TREES, WITH dbh GREATER THAN 8"ø LOCATED WITHIN THE GRADING LIMITS SHALL BE IDENTIFIED PRIOR TO REMOVAL AND SALVAGE. TREES LOCATED NEAR THE GRADING LIMITS OR WITHIN THE GRADING LIMITS MAY BE IDENTIFIED BY THE ENGINEER TO BE PROTECTED. ENGINEER MAY FIELD FIT GRADING TO PRESERVE ANY TREES. SEE DETAIL 6, SHEET D1.0 FOR EXCAVATION NEAR PRESERVED TREES.
4. CONSTRUCT TEMPORARY ACCESS FOR GRAVEL AUGMENTATION. CUT VEGETATION TO GROUND LEVEL AND REMOVE CUTTINGS. TREES WITH dbh GREATER THAN 10 INCHES MAY BE SALVAGED AND USED FOR LWM STRUCTURES. AREAS COMPACTED BY EQUIPMENT WILL BE LOOSENED TO A DEPTH NO LESS THAN 1 INCH AND NO GREATER THAN 6 INCHES.
5. INSTALL 8"–THICK GRAVEL COBBLE ARMOR LAYER IN AREAS AT TRANSITIONS BETWEEN POOLS WHERE MATERIAL EXPOSED BY EXCAVATION HAS A MEDIAN PARTICLE SIZE OF LESS THAN 1". PARTICLE SIZE MAY BE DETERMINED BY A WOLMAN PEBBLE COUNT OR SIEVE ANALYSIS.
6. TEMPORARY ACCESS ON SOUTH SIDE FOR CREEK GRAVEL AUGMENTATION SHALL BE COORDINATED AND DETERMINED IN THE FIELD WITH THE USACE.

NOTE: POST CONSTRUCTION TOPOGRAPHY SHOWN ON SHEETS A1-A4

TREE LEGEND TABLE (THIS SHEET)

SYMBOL	DESCRIPTION	NUMBER
⊠	REMOVE	14
□	PRESERVE	20
⊙	PROTECT–IN–PLACE	104



AS-BUILT

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San Francisco District
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Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/18/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS–BUILT SUBMITTAL	07/13/14	

DESIGNED BY: LJH
DATE: 03/05/13
SHEET NO. 4 of 11
CHECKED BY: LJH
DRAWN BY: TVS
DRAWING NO.
DRAWING NO. AS NOTED

PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
/s/ Section Chief, COL. CORNELL, C.E., DISTRICT COMMANDER
Chief, xxxx Sec. xx

SUBMITTED:
APPROVAL RECOMMENDED
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

CALIFORNIA
SONOMA COUNTY
DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT
IMPROVEMENT PLANS
STA: 16+00 to STA: 11+00

Sheet reference number: C1.0

UPDATE

NOTES:

1. LOW FLOW WATER LEVEL SURVEYED ON 4, 5, 6, AND 12, JANUARY, 2012. FLOWS DURING SURVEY RANGED FROM 85cfs TO 110cfs.
2. TREES, LOCATED OUTSIDE OF THE GRADING LIMITS, WITH dbh GREATER THAN 8"ø SHALL BE PROTECTED.
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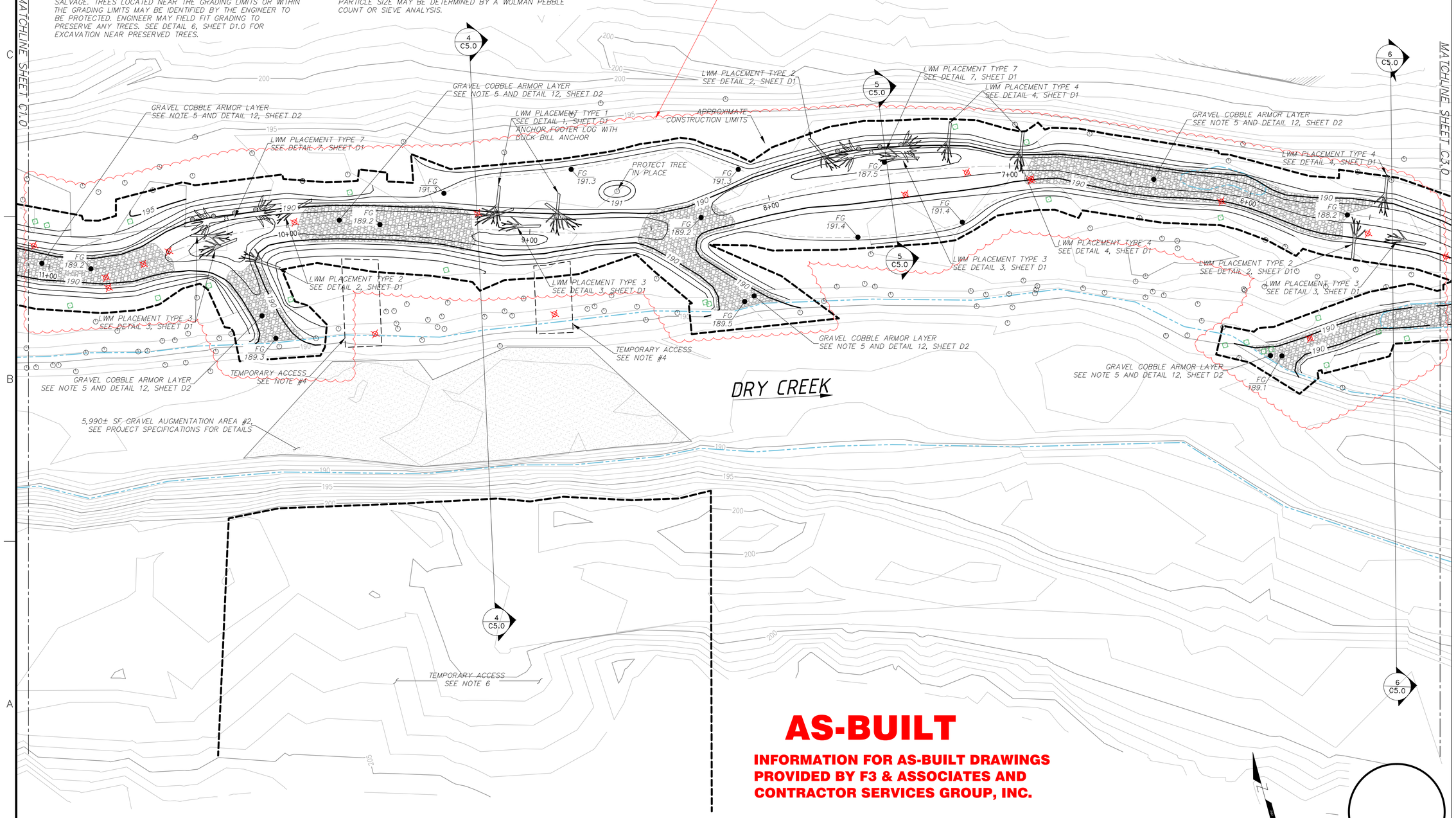
NOTE: POST CONSTRUCTION TOPOGRAPHY SHOWN ON SHEETS A1-A4

TREE LEGEND TABLE (THIS SHEET)

SYMBOL	DESCRIPTION	NUMBER
⊠	REMOVE	13
□	PRESERVE	20
⊙	PROTECT-IN-PLACE	119



AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

US Army Corps of Engineers
San Francisco District
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Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/18/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	07/13/14	

DESIGNED BY: LJH
DATE: 03/05/13
SHEET NO. 5 of 11
CHECKED BY: LJH
DRAWN BY: TVS
DRAWING NO.
DRAWING NO.

PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

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APPROVAL RECOMMENDED
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APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

SONOMA COUNTY CALIFORNIA

DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT

IMPROVEMENT PLANS
STA: 11+00 to STA: 5+25

Sheet reference number:
C2.0

NOTES:

1. LOW FLOW WATER LEVEL SURVEYED ON 4, 5, 6, AND 12, JANUARY, 2012. FLOWS DURING SURVEY RANGED FROM 85cfs TO 110cfs.
2. TREES, LOCATED OUTSIDE OF THE GRADING LIMITS, WITH dbh GREATER THAN 8"ø SHALL BE PROTECTED.
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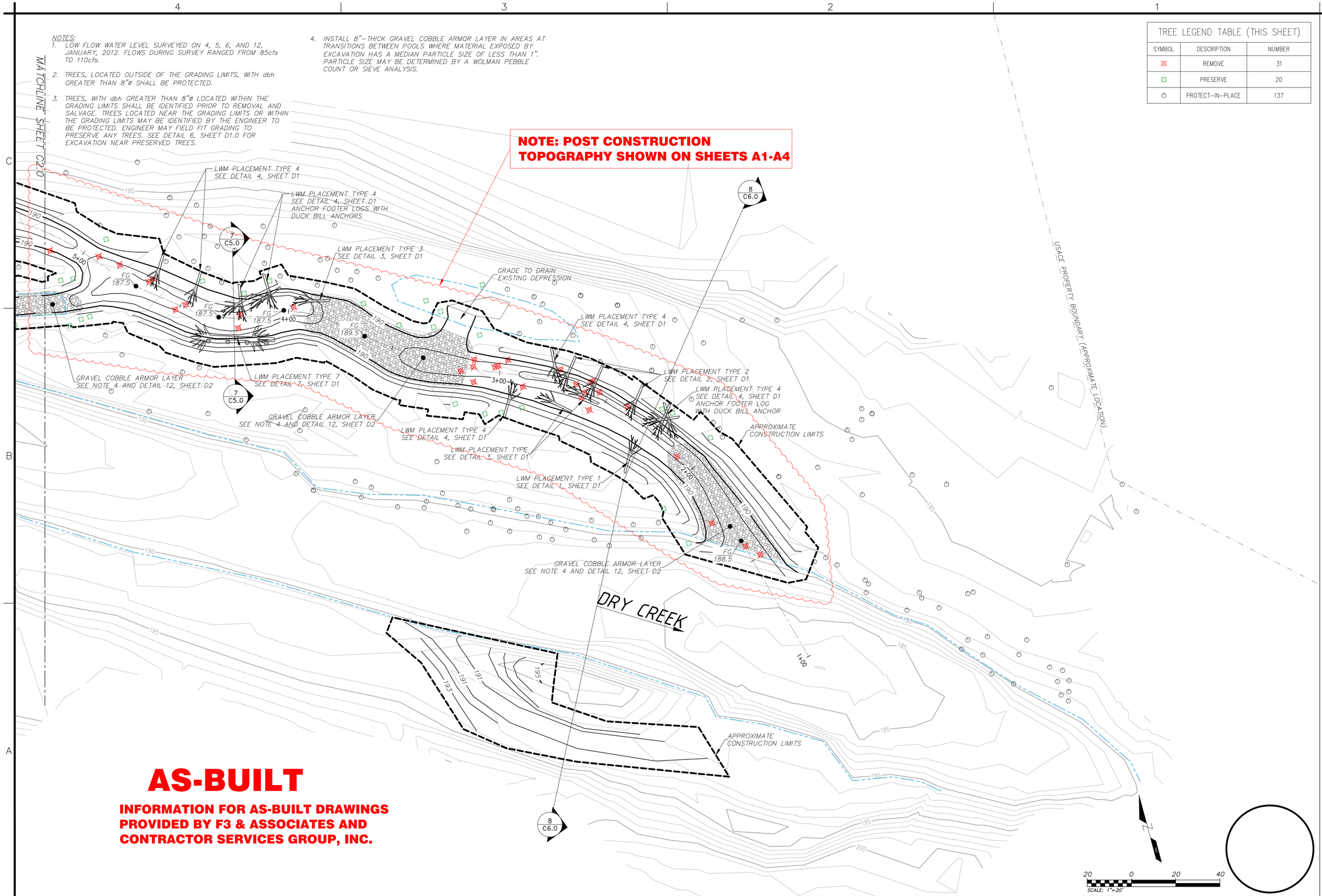
TREE LEGEND TABLE (THIS SHEET)

SYMBOL	DESCRIPTION	NUMBER
⊠	REMOVE	31
□	PRESERVE	20
⊙	PROTECT-IN-PLACE	137



AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

US Army Corps of Engineers
San Francisco District
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Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/16/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	07/13/14	

DESIGNED BY: LJH
CHECKED BY: LJH
DRAWN BY: TVS
DATE: 03/05/13
SHEET NO. 6 of 11
DRAWING NO.

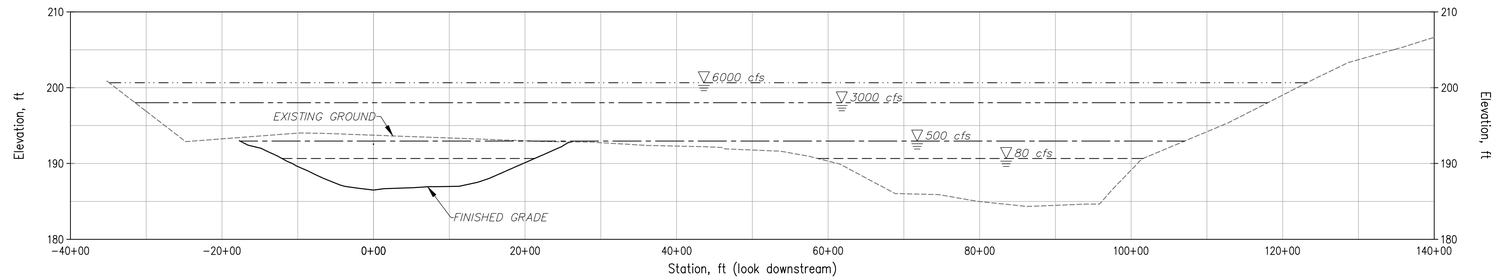
PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SUBMITTED:
APPROVAL RECOMMENDED:
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

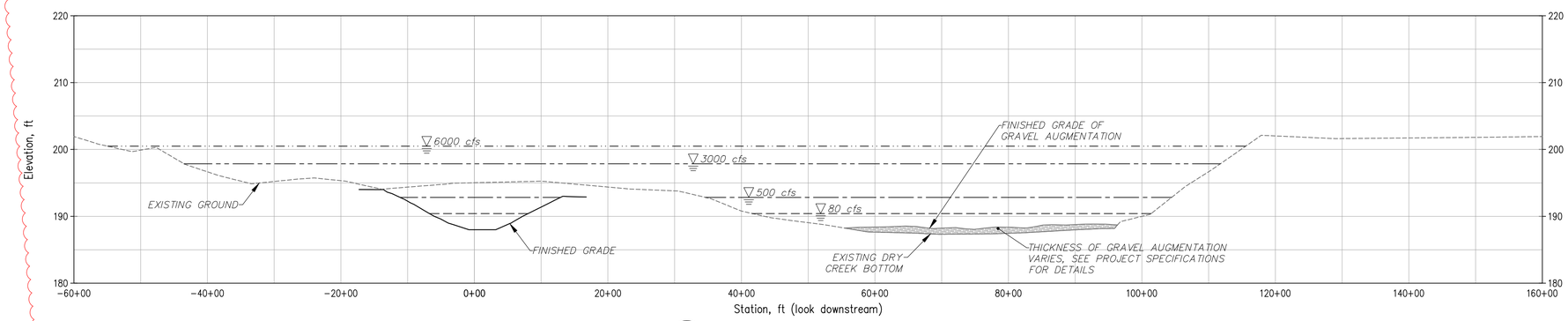
CALIFORNIA
SONOMA COUNTY
DRY CREEK - REACH 15
FISH HABITAT ENHANCEMENT PROJECT
IMPROVEMENT PLANS
STA: 5+25 to STA: 1+00

Sheet reference number:
C3.0

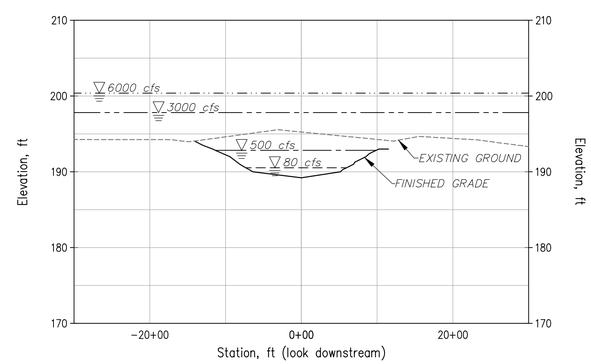
NOTE:
1. SIDE SLOPE VARIES.



1 TYPICAL SECTION @ STA: 14+50
H:1"=10' V:1"=10'



2 TYPICAL SECTION @ GRAVEL AUGMENTATION AREA #1
H:1"=10' V:1"=10'



3 TYPICAL SECTION @ STA: 11+50
H:1"=10' V:1"=10'

NOTE: POST CONSTRUCTION TOPOGRAPHY SHOWN ON SHEETS A1-A4

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

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San Francisco District
1455 Market Street
San Francisco, CA 94103

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ECORP

Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/16/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	01/13/14	

DESIGNED BY: LJH
DATE: 03/05/13
CHECKED BY: LJH
SHEET NO. 7 of 11
DRAWN BY: TVS
DRAWING NO.
DRAWING NO.

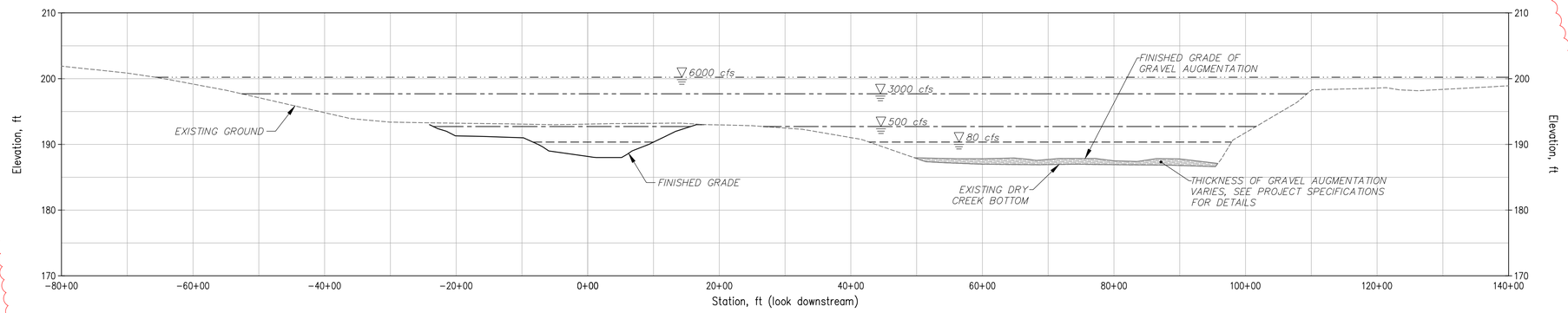
PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SUBMITTED:
APPROVAL RECOMMENDED:
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

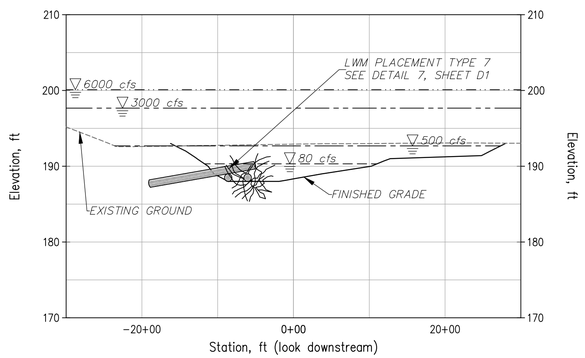
CALIFORNIA
SONOMA COUNTY
DRY CREEK - REACH 15
FISH HABITAT ENHANCEMENT PROJECT
TYPICAL SECTIONS

Sheet reference number:
C4.0

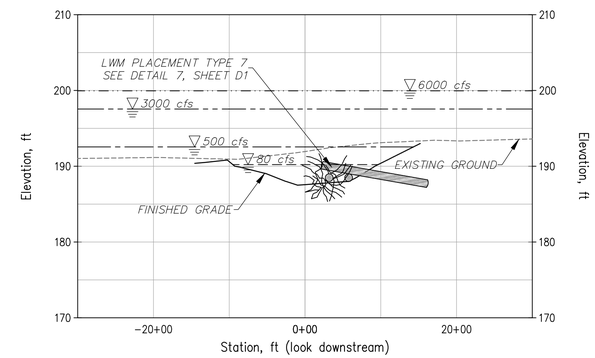
NOTE:
1. SIDE SLOPE VARIES.



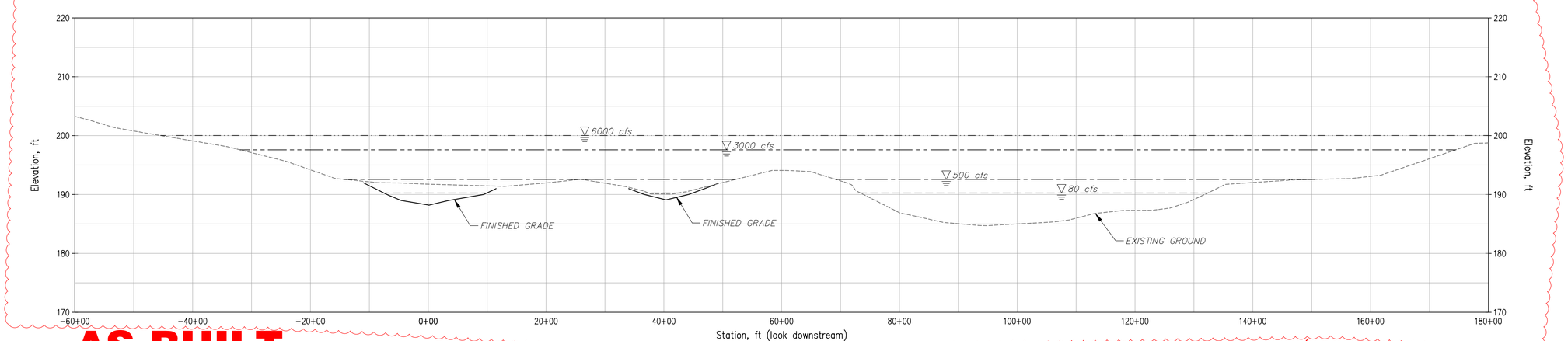
4 TYPICAL SECTION @ GRAVEL AUGMENTATION AREA #2
H:1"=10' V:1"=10'



5 TYPICAL SECTION @ STA: 7+50
H:1"=10' V:1"=10'



7 TYPICAL SECTION @ STA: 4+25
H:1"=10' V:1"=10'



6 TYPICAL SECTION @ STA: 5+25
H:1"=10' V:1"=10'

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

NOTE: POST CONSTRUCTION TOPOGRAPHY SHOWN ON SHEETS A1-A4

US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

nhc northwest hydraulic consultants

ECORP

Mark	Description	Date	Appr
	35% SUBMITTAL	02/28/12	
	65% SUBMITTAL	05/18/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	01/13/14	

DESIGNED BY: LJH
CHECKED BY: LJH
DRAWN BY: TVS
DATE: 03/05/13
SHEET NO. 8 of 11
DRAWING NO.

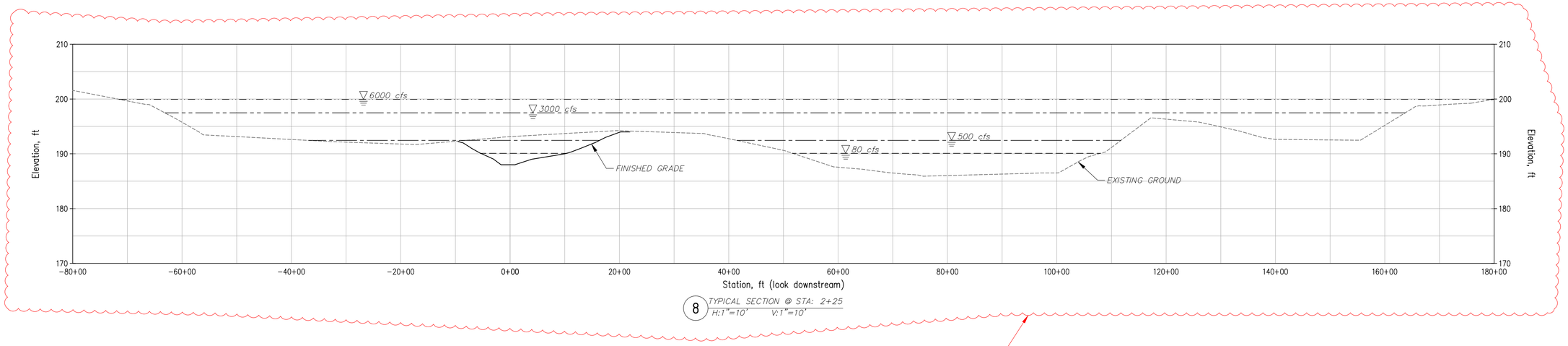
PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

SUBMITTED:
APPROVAL RECOMMENDED
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

CALIFORNIA
SONOMA COUNTY
DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT
TYPICAL SECTIONS

Sheet reference number:
C5.0

NOTE:
1. SIDE SLOPE VARIES.



8 TYPICAL SECTION @ STA: 2+25
H:1"=10' V:1"=10'

NOTE: POST CONSTRUCTION TOPOGRAPHY SHOWN ON SHEETS A1-A4

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

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ECORP

Mark	Description	Date	Appr
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	65% SUBMITTAL	05/16/12	
	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL	01/13/14	

DESIGNED BY: LJH
DATE: 03/05/13
CHECKED BY: LJH
SHEET NO. 9 of 11
DRAWN BY: TVS
DRAWING NO.
DRAWING NO.

PREPARED UNDER THE DIRECTION OF
JOHN K. BAKER, P.E.
LT. COLONEL, C.E., DISTRICT COMMANDER

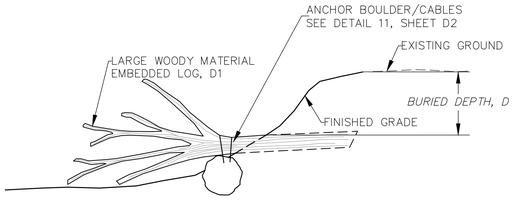
SUBMITTED:
APPROVAL RECOMMENDED:
CHIEF, OPS. TECH. SUP. OFFICE
APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

SONOMA COUNTY CALIFORNIA

DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT

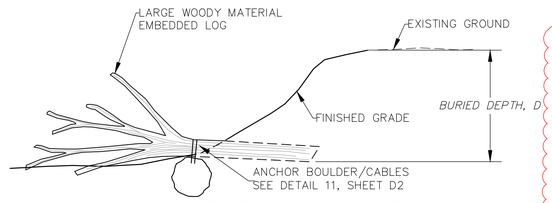
TYPICAL SECTIONS

Sheet reference number:
C6.0

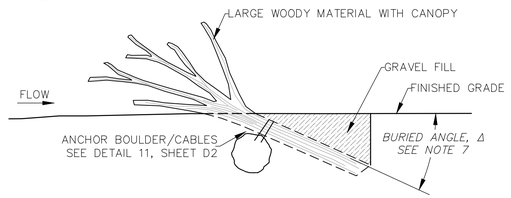


1 LWM PLACEMENT - TYPE 1
Not to Scale

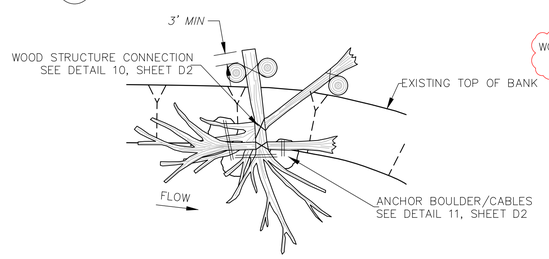
TABLE 1. TYPE 1 LWM PLACEMENT BALLAST WEIGHT			
BURIED DEPTH, D	EMBEDDED LWM LOG DIAMETER, D1	FOOTER LOG DIAMETER, D2	BALLAST WEIGHT NEEDED
(FT)	(IN)	(IN)	(LB)
3	15	8	1610
	12	8	670
	≤8	NO BALLAST NEEDED	
4	18	18	2550
		15	2350
		12	2150
		8	1880
	15	18	1500
		15	1330
		12	1170
		8	940
	12	15	450
		12	310
		8	0
	≤8	NO BALLAST NEEDED	
5	18	18	1750
		15	1540
		12	1340
		8	1080
	15	18	830
		15	660
		12	500
		8	0
	≤12	NO BALLAST NEEDED	
6	18	18	940
		15	740
		12	540
		8	0
	≤15	NO BALLAST NEEDED	
≥7	NO BALLAST NEEDED		



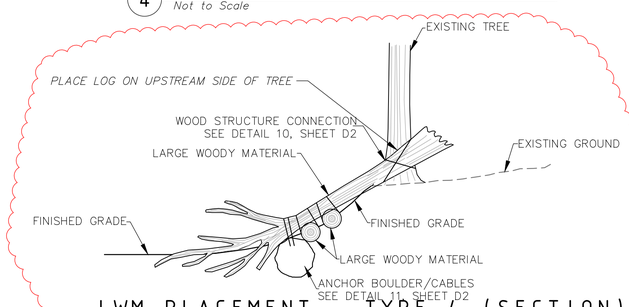
2 LWM PLACEMENT - TYPE 2
Not to Scale



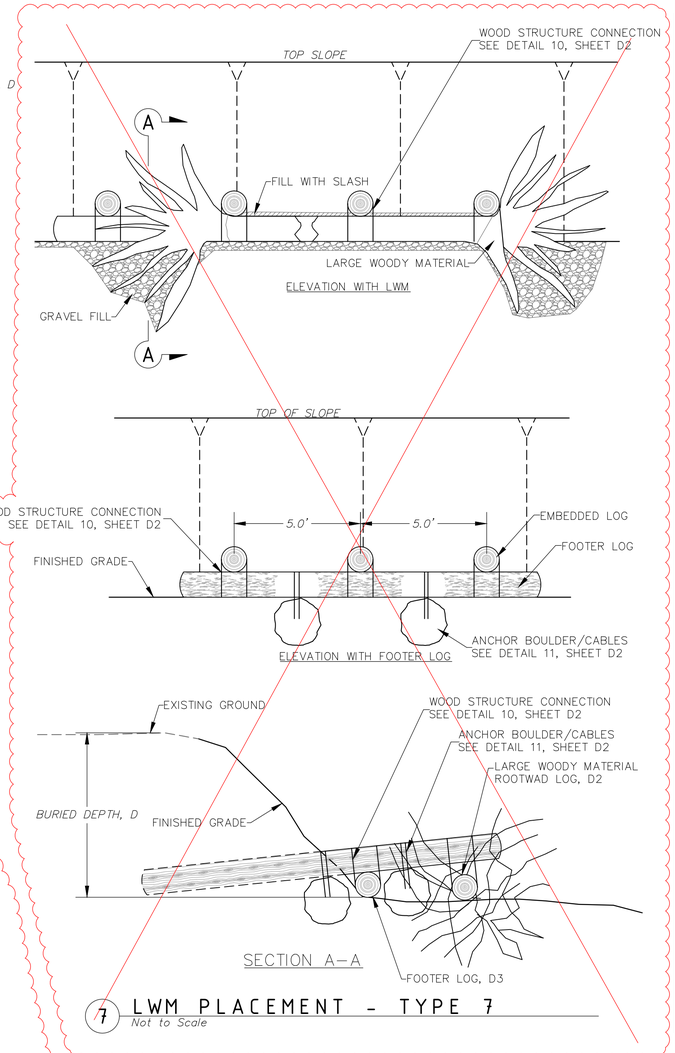
3 LWM PLACEMENT - TYPE 3
Not to Scale



4 LWM PLACEMENT - TYPE 4
Not to Scale



LWM PLACEMENT - TYPE 4 (SECTION)
Not to Scale



7 LWM PLACEMENT - TYPE 7
Not to Scale

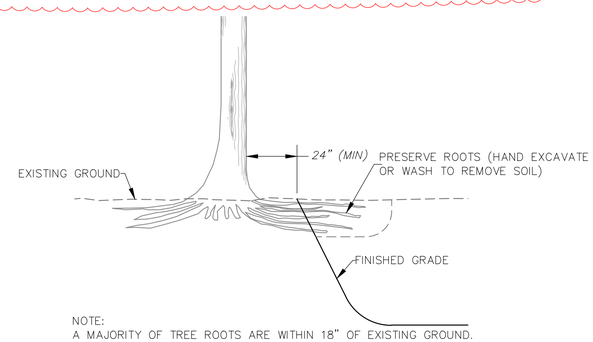
TABLE 2. TYPE 7 LWM PLACEMENT BALLAST WEIGHT				
BURIED DEPTH, D	ANCHOR LOG DIAMETER X4, D1	ROOTWAD LOG DIAMETER X2, D2	FOOTER LOG DIAMETER X2, D3	BALLAST WEIGHT NEEDED
(FT)	(IN)	(IN)	(IN)	(LB)
3	12	12	12	2690
			8	950
	8	12	8	1370
		8	8	0
4	18	18	18	7620
			15	5430
			12	3650
		15	18	5970
			15	3790
			12	2000
		12	18	4610
			15	2430
			12	640
	15	18	15	4930
			12	3140
		15	15	3280
			12	1500
		12	15	1920
			12	0
	12	18	12	3550
		15	12	1910
		12	12	550
			8	0
	≤8	NO BALLAST NEEDED		
5	18	18	18	4400
			15	2220
			12	430
		15	18	2750
			15	570
			12	0
		12	18	1390
			15	0
			12	0
	15	18	15	2250
			12	460
		15	15	600
			12	0
		12	15	0
			12	0
	12	18	12	1410
		15	12	0
		12	12	0
			8	0
	≤8	NO BALLAST NEEDED		
6	18	18	18	1180
			≤18	0
	≤18	NO BALLAST NEEDED		
≥7	NO BALLAST NEEDED			

NOTES:
1. MAXIMUM FOOTER LOG DIMENSION IS 18 FEET IN LENGTH AND 18–IINCH IN DIAMETER.
2. ALL LWM EMBEDDED LOG MUST BE LESS THAN 20 FEET LONG. A MINIMUM OF 50% OF LOG SHALL BE EMBEDDED UNDER FINISH GRADE BANK.
3. ALL LWM STRUCTURE SHALL HAVE A MINIMUM OF 1 FOOT SOIL COVER OVER THE TOP LOG.
4. FOOTER LOG DIAMETER MUST BE LESS THAN OR EQUAL TO ANCHOR LOG DIAMETER FOR TYPE 7 LWM PLACEMENT.
5. THE CONTRACTOR SHALL LOOKUP MINIMUM REQUIRED BALLAST WEIGHT FOR TYPE 1 AND TYPE 7 LWM PLACEMENT BASED ON LOG DIMENSION AND QUANTITY. TABLE 3 SHALL BE USED TO ESTIMATE THE QUANTITY AND SIZE OF BOULDERS REQUIRED TO PROVIDE THE MINIMUM REQUIRED BALLAST WEIGHT.
6. TYPE 2 LWM PLACEMENT DOES NOT REQUIRE ADDITIONAL BALLAST WEIGHT WITH 1 FOOT MINIMUM SOIL COVER.
7. TYPE 3 LWM PLACEMENT DOES NOT REQUIRE ADDITIONAL BALLAST WEIGHT WITH BURIED ANGLE OF 15 DEGREE TO 30 DEGREE.

TABLE 3. BALLAST BOULDER SUBMERGED WEIGHT	
SUBMERGED WEIGHT	BOULDER DIAMETER
(LB)	(FT)
2517	3.8
2140	3.6
1803	3.4
1503	3.2
1238	3.0
1007	2.8
806	2.6
634	2.4
488	2.2
367	2.0

NOTE: LIVE TREE CONNECTIONS HAVE BEEN ELIMINATED. LWM STRUCTURES ARE ANCHORED TO SUBMERGED BALLAST BOULDERS PER DESIGN WEIGHT OF TABLE 3.

NOTE: TYPE 7 LWM STRUCTURES INSTALLED AS TWO (2) PARALLEL ROOTWAD LOGS ANCHORED TO SUBMERGED BALLAST BOULDERS PER DESIGN WEIGHT OF TABLE 3



NOTE:
A MAJORITY OF TREE ROOTS ARE WITHIN 18" OF EXISTING GROUND.

6 TREE PRESERVATION BANK EXCAVATION
Not to Scale

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	95% SUBMITTAL	08/3/12	
	FINAL SUBMITTAL		

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DRAWING NO.
CHECKED BY: LJH
DESIGNED BY: LJH
SHEET NO. 10 of 11
DATE: 03/05/13
DRAWING NO.

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SUBMITTED:
APPROVAL RECOMMENDED: CHIEF, OPS. TECH. SUP. OFFICE
APPROVED: CHIEF, OPERATIONS & READINESS DIVISION

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SONOMA COUNTY
DRY CREEK – REACH 15
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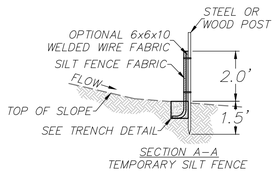
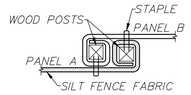
DETAILS SHEET

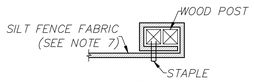
Sheet reference number:
D1.0



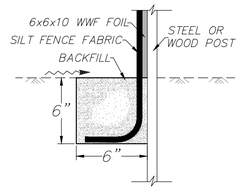
SECTION A–A
TEMPORARY SILT FENCE



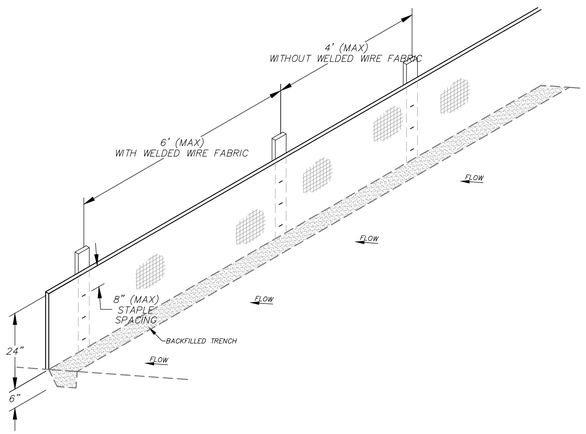
PLAN
POST AT JOINTS



PLAN
END POST DETAIL

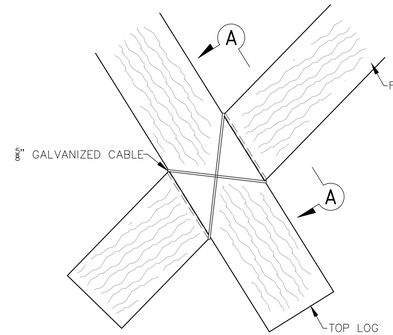


SECTION
TRENCH DETAIL

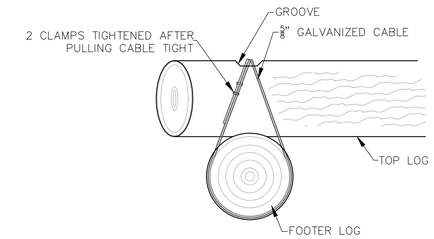


NOTES:
1. SILT FENCE FABRIC SHALL BE WOVEN POLYPROPYLENE WITH A MINIMUM GRAB BREAKING LOAD (ASTM D4632) OF 120 LB.
2. A MINIMUM OF 4 STAPLES ARE REQUIRED PER POST.
3. SILT FENCE SHALL BE INSTALLED ALONG CREEK EDGE IN AREAS WHERE CONTRACTOR IS WORKING WITHIN 15' OF CREEK UNLESS OTHERWISE SPECIFIED BY USACE.
4. THE INSTALLATION CONFIGURATION SHALL PREVENT RUNOFF FROM LEAVING THE SITE OR ENTERING A WATERCOURSE WITHOUT PASSING THROUGH A SILT FENCE.
5. THE MAXIMUM LENGTH OF SLOPE DRAINING TO THE SILT FENCE SHALL BE 100 FEET FOR SLOPES 10% OR GREATER AND 200 FEET FOR SLOPES FLATTER THAN 10%.
6. DOUBLED POSTS AT JOINTS AND SHALL BE SECURED TO EACH OTHER.
7. WELDED WIRE FABRIC SHALL BE 6x6x10 MINIMUM (6"x6" OPENINGS WITH 10 GAGE WIRE)

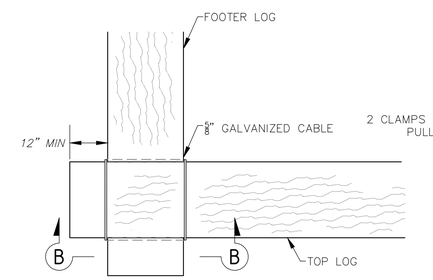
9 SILT FENCE
NOT TO SCALE



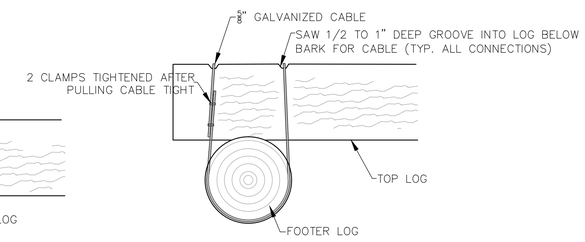
ANGULAR CONNECTION
SCALE: 1"=2'



A SECTION
Scale 1"=2'

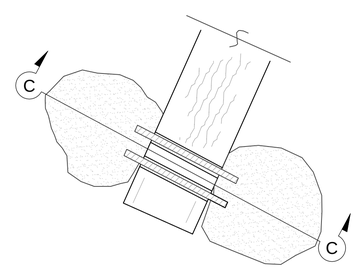


PERPENDICULAR CONNECTION
SCALE: 1"=2'

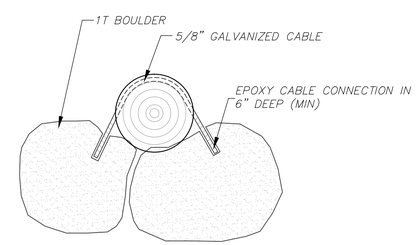


B SECTION
Scale 1"=2'

10 WOOD STRUCTURE CONNECTIONS
SCALE: 1"=2'

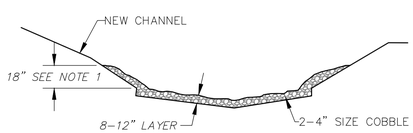


11 BOULDER ANCHOR
SCALE: 1"=2'



C SECTION
SCALE: 1"=2'

NOTES FOR BOULDER ANCHOR:
1. EACH BOULDER ANCHOR CONSISTS OF TWO BOULDERS AND TWO CABLES.
2. PRE–ASSEMBLED ANCHOR SHALL BE INSTALLED BY EXCAVATING SUFFICIENT SPACE BELOW THE LOG STRUCTURE TO ALLOW THE BOULDER ANCHOR TO BE DRAPED OVER THE LOG AND HANG ON IT TO TENSION CABLES.
3. ANCHORS ASSEMBLED IN PLACE SHALL BE ALLOWED TO CURE AND THEN REPOSITIONED TO PLACE TENSION ON CABLES AND WEIGHT ON LOG.
4. SEE TABLE 3, SHEET D10 FOR INFORMATION BOULDER SELECTION.



12 GRAVEL COBBLE ARMOR
NOT TO SCALE

GRAVEL COBBLE ARMOR NOTE:
1. INSTALL GRAVEL COBBLE ARMOR LAYER FROM SLOPE TOE TO A HEIGHT OF 18" UP SITE SLOPE.

AS-BUILT

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BOULDERS	PERCENTAGE LARGER THAN SIZE, FT* (WT)						
TYPE	1.8 (0.25T)	2.3 (0.5T)	2.9 (1T)	3.3 (1.5T)	3.6 (2T)	4.6 (4T)
ANCHOR			100	0–50	0–10	

*SIZES IN FEET ARE COMPUTED EQUIVALENT SPHERE DIAMETER FOR A SPECIFIC GRAVITY OF 2.6. BOULDERS MUST MEET WT REQUIREMENTS.

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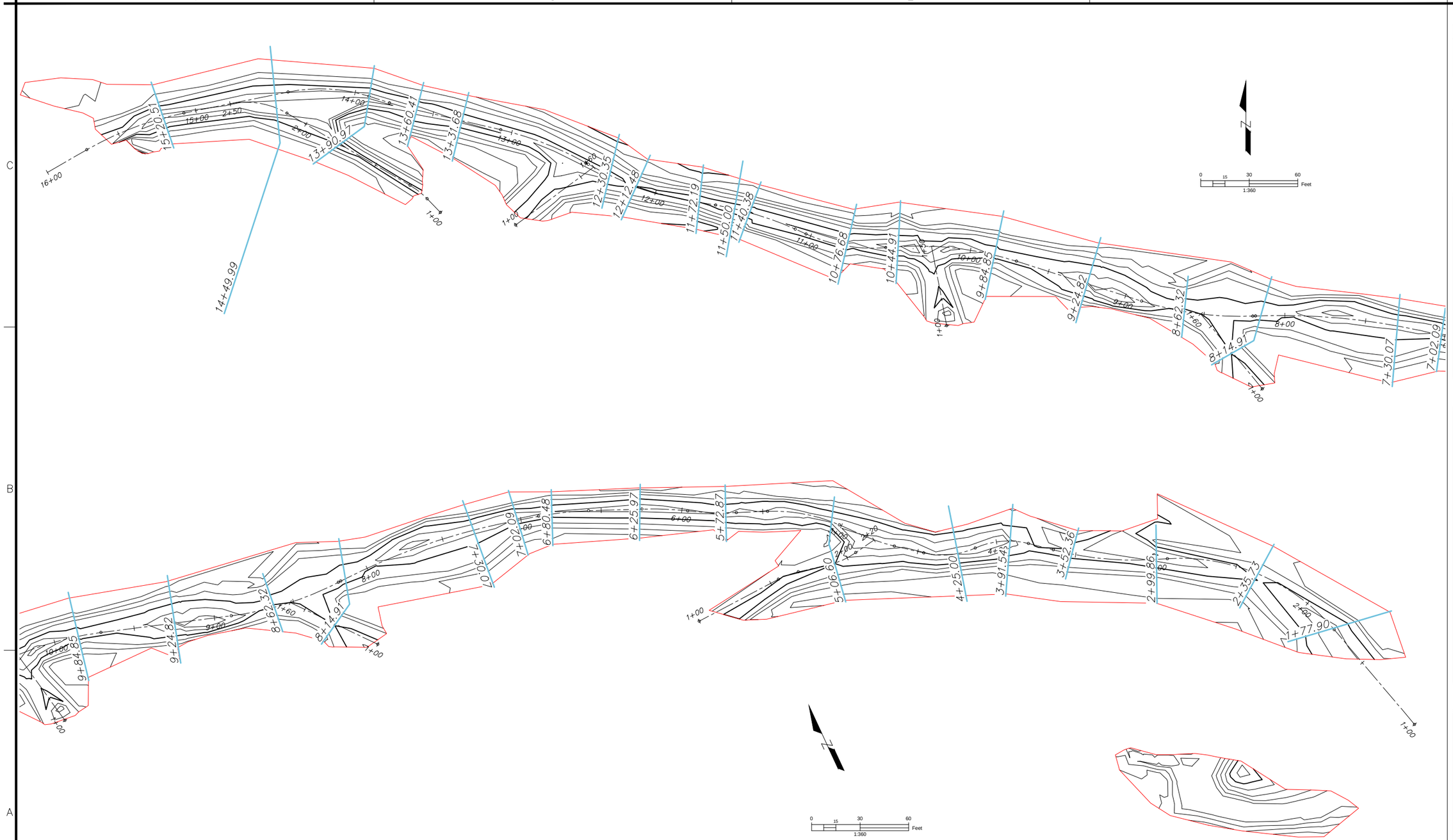

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SONOMA COUNTY CALIFORNIA

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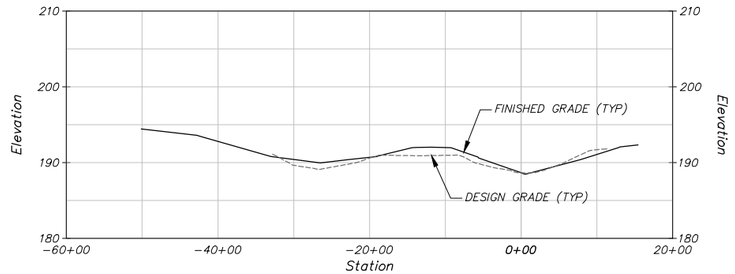
AS-BUILT TOPOGRAPHY

Sheet reference number:
A1.0

STA. 5+06.60



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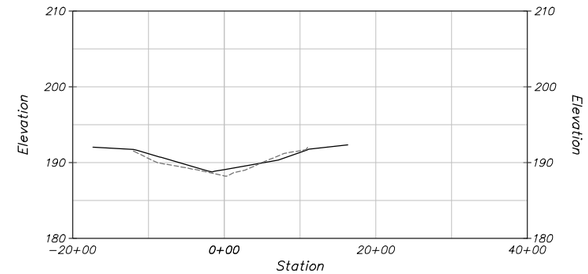

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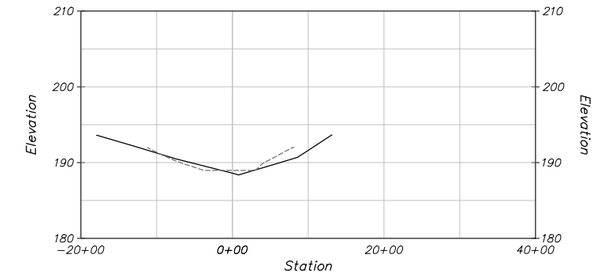

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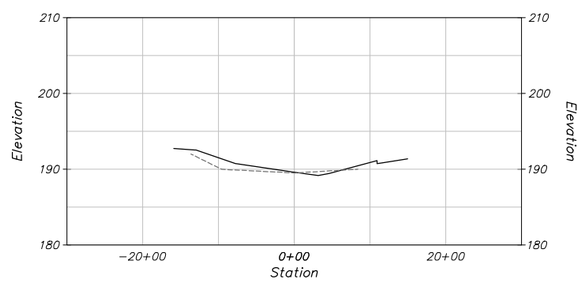

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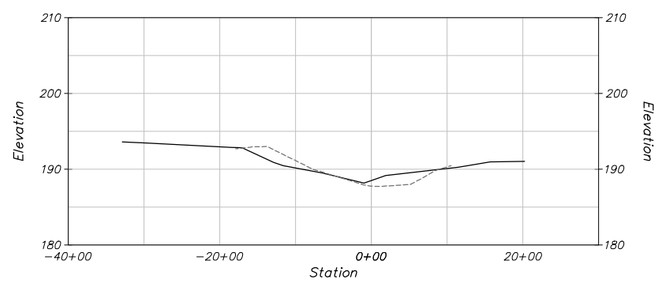
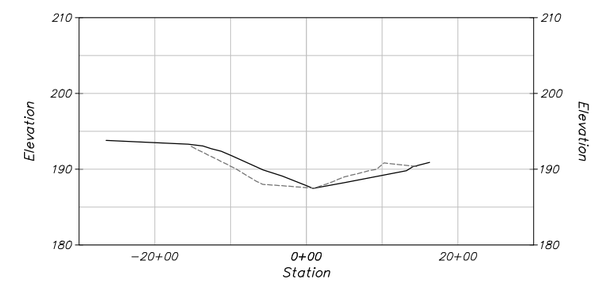


STA. 4+25.00



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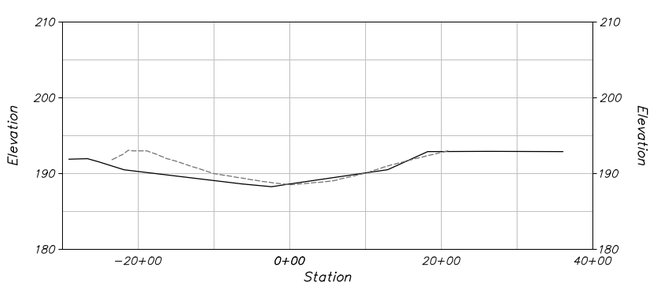

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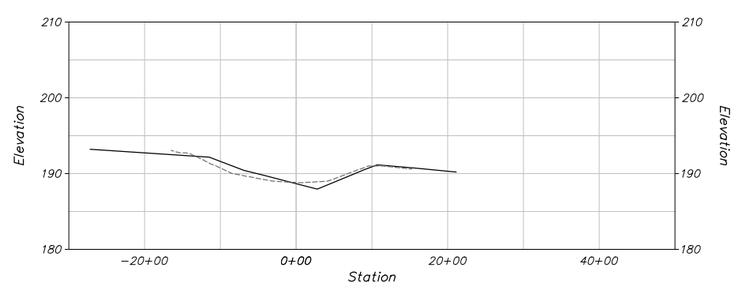

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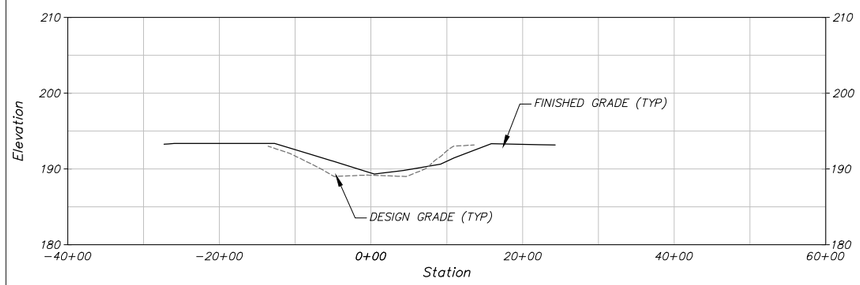
AS-BUILT SECTIONS

Sheet reference number:
A2.0

STA. 9+84.85



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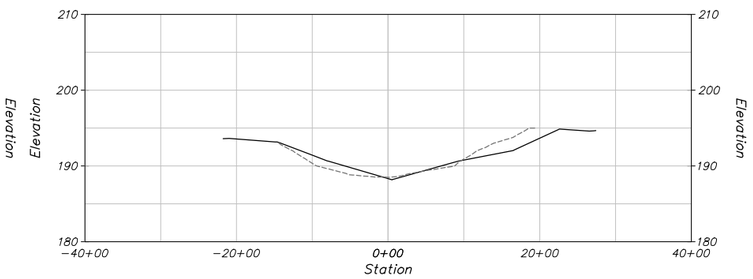

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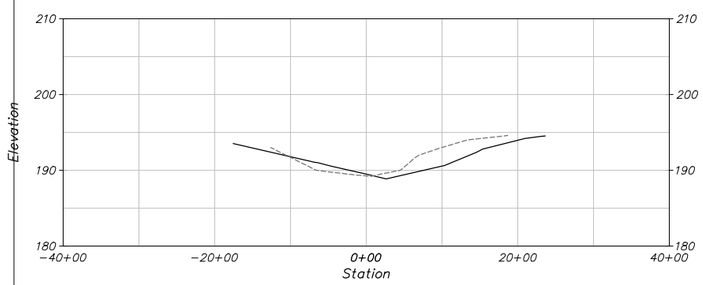

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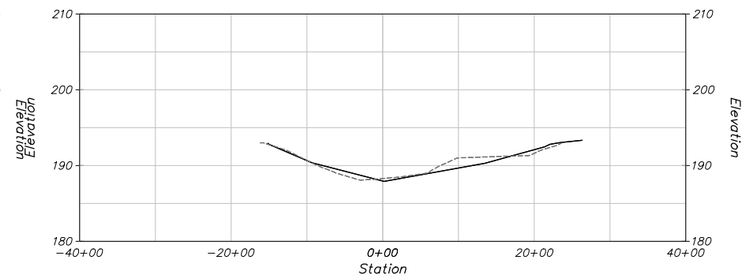

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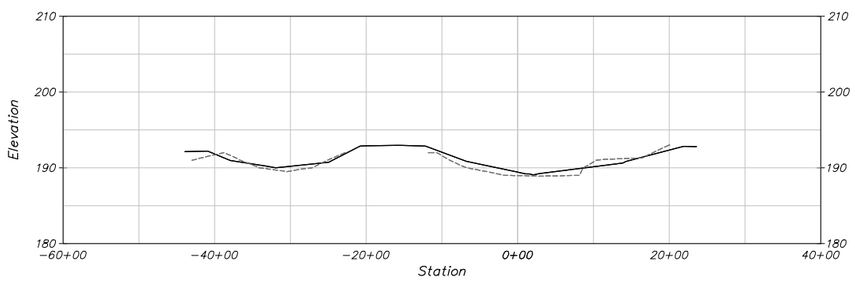

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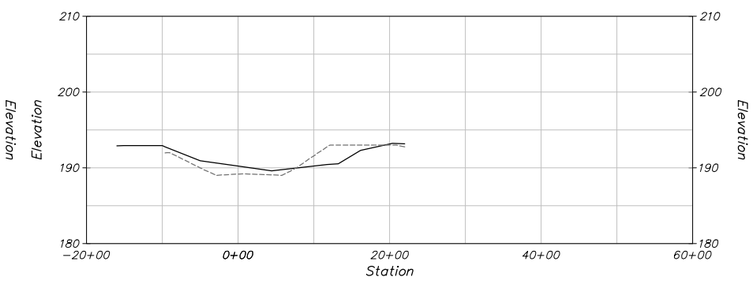

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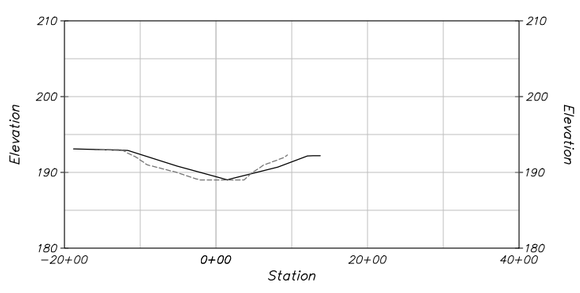

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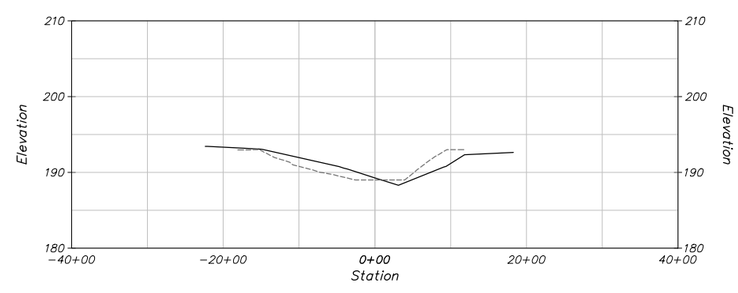

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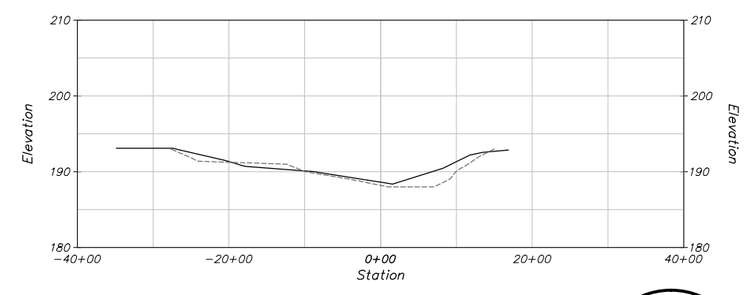

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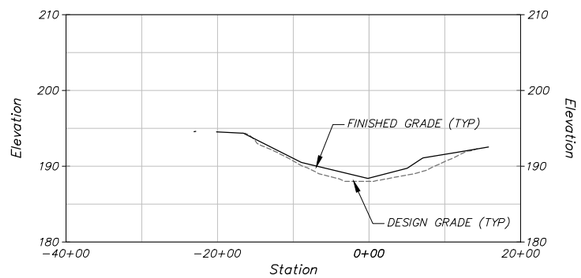
AS-BUILT SECTIONS

Sheet reference number:
A3.0

STA. 13+60.41



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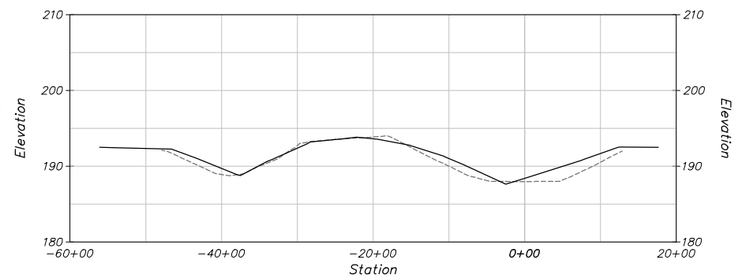
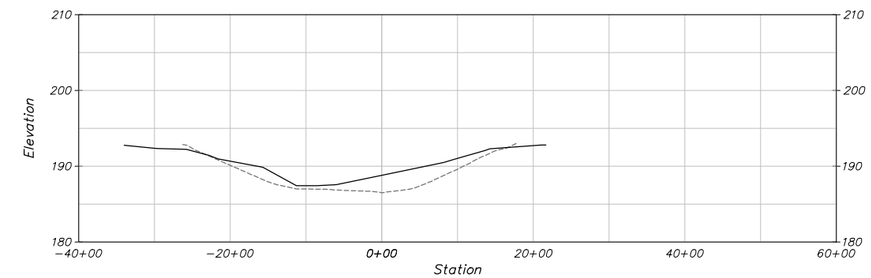


STA. 14+49.99



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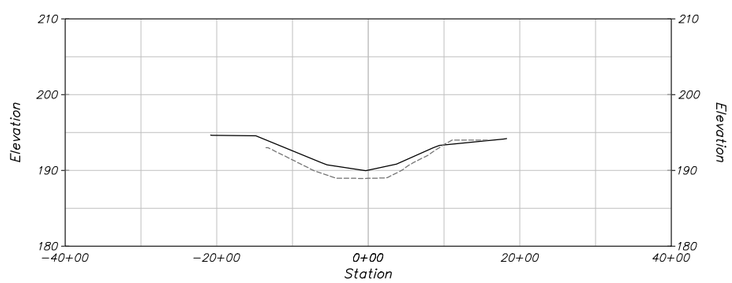

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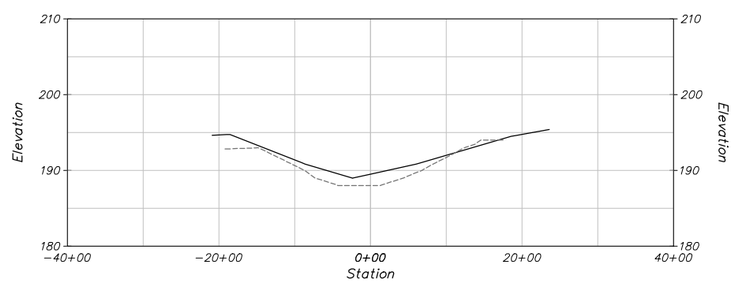
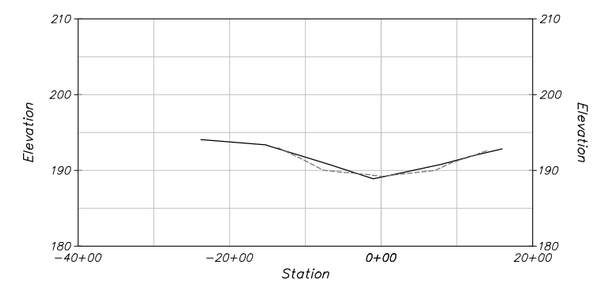
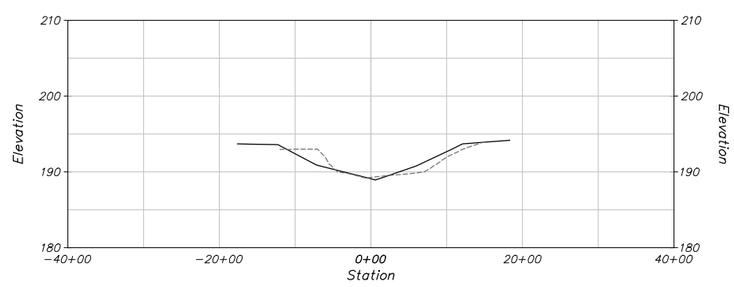


STA. 13+31.68



STA. 11+40.38



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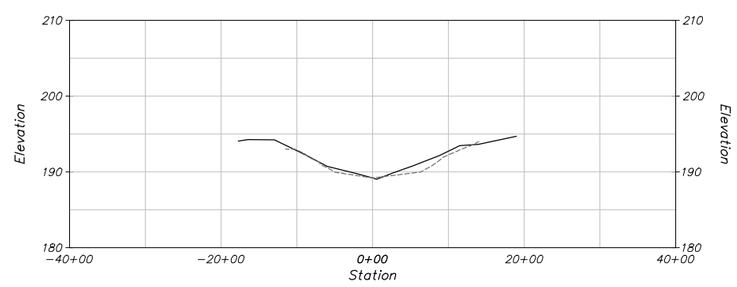
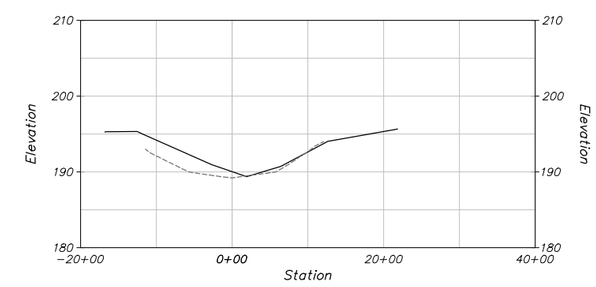


STA. 11+72.19



AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

northwest hydraulic consultants

ECORP

Mark	Description	Date	Appr
	35% SUBMITTAL		
	65% SUBMITTAL		
	95% SUBMITTAL		
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL		

DESIGNED BY: LJH
DATE: 03/05/13
CHECKED BY: LJH
SHEET NO.
DRAWN BY: TVS
DRAWING NO.
DRAWING NO.

PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E. LT. COLONEL, C.E., DISTRICT COMMANDER

SUBMITTED:
APPROVAL RECOMMENDED: CHIEF, OPS. TECH. SUP. OFFICE
APPROVED: CHIF, OPERATIONS & READINESS DIVISION

SONOMA COUNTY CALIFORNIA

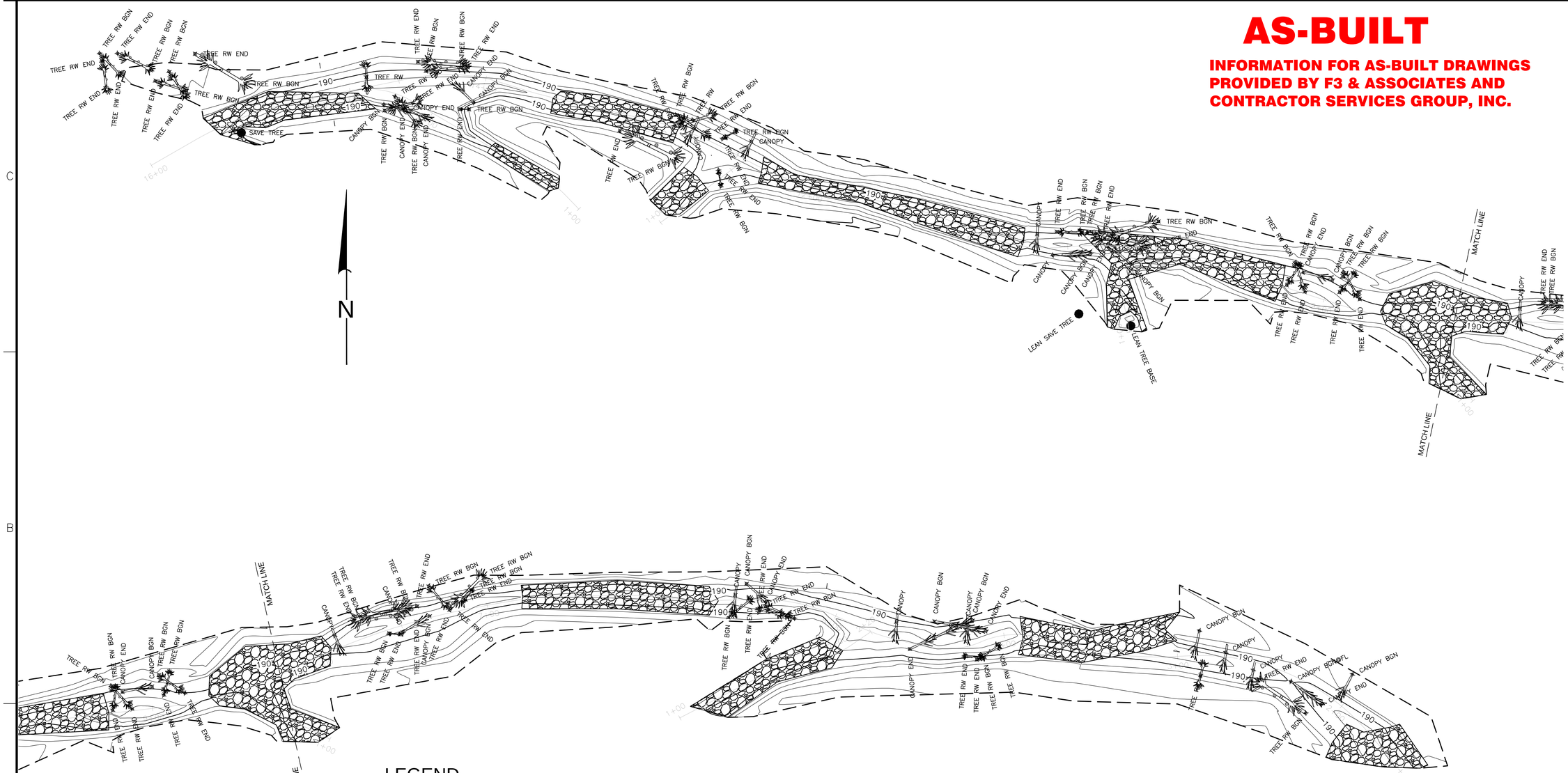
DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT

AS-BUILT SECTIONS

Sheet reference number: A4.0

AS-BUILT

INFORMATION FOR AS-BUILT DRAWINGS PROVIDED BY F3 & ASSOCIATES AND CONTRACTOR SERVICES GROUP, INC.

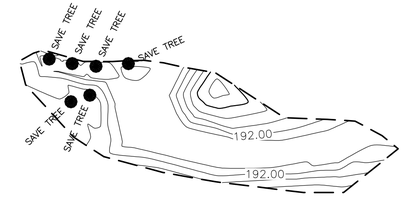


LEGEND

- ROOT WAD TREE
- CANOPY TREE
- SAVED TREE
- MAJOR CONTOUR–5' INTERVAL
- MINOR CONTOUR–1' INTERVAL
- TOPO SHOT ON ROOT WAD TREE/ CANOPY TREE. SEE NOTE.
- TOPO LIMITS
- COBBLE STONE AREA

NOTE:
Per request trees running perpendicular to creek were shot only once in the middle. Trees running parallel to creek were shot at beginning and end.

Point Descriptions:
TREE RW= root wad tree
CANOPY= canopy tree
SAVE TREE= trees chosen to save in place



US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103

nhc northwest hydraulic consultants

ECORP

Mark	Description	Date	Appr.
	35% SUBMITTAL		
	65% SUBMITTAL		
	95% SUBMITTAL		
	FINAL SUBMITTAL		
	AS-BUILT SUBMITTAL		

DESIGNED BY: LJH | CHECKED BY: LJH | DRAWN BY: TVS
DATE: 03/05/13 | SHEET NO. | DRAWING NO. | DRAWING NO.

PREPARED UNDER THE DIRECTION OF JOHN K. BAKER, P.E. Section Chief, C.E., DISTRICT COMMANDER

/s/

SUBMITTED:
APPROVAL RECOMMENDED
CHIEF, OPS. TECH. SUP. OFFICE

APPROVED:
CHIEF, OPERATIONS & READINESS DIVISION

SONOMA COUNTY CALIFORNIA

DRY CREEK – REACH 15
FISH HABITAT ENHANCEMENT PROJECT
IMPROVEMENT PLANS
FEATURE LOCATION PLAN

Sheet reference number:
A5.0

UPDATE

Appendix B

Sonoma County Water Agency

Dry Creek Habitat Enhancement Demonstration Project Phase I As-Built Record Drawings

(Quivira Site)

PN 7345-A1

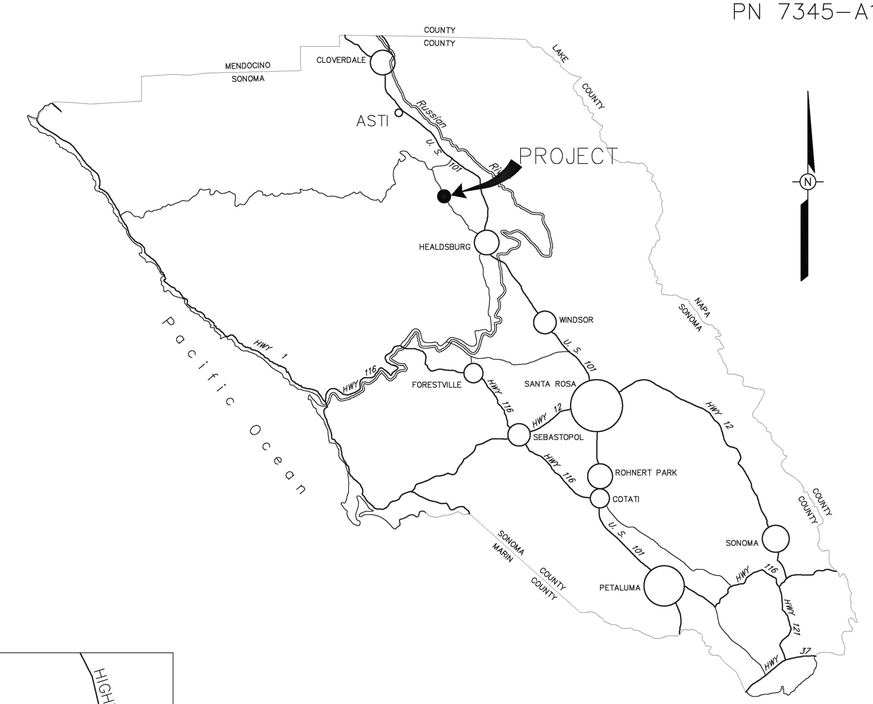
SONOMA COUNTY WATER AGENCY

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE I

CONTRACT # 45-6.1-7 #2

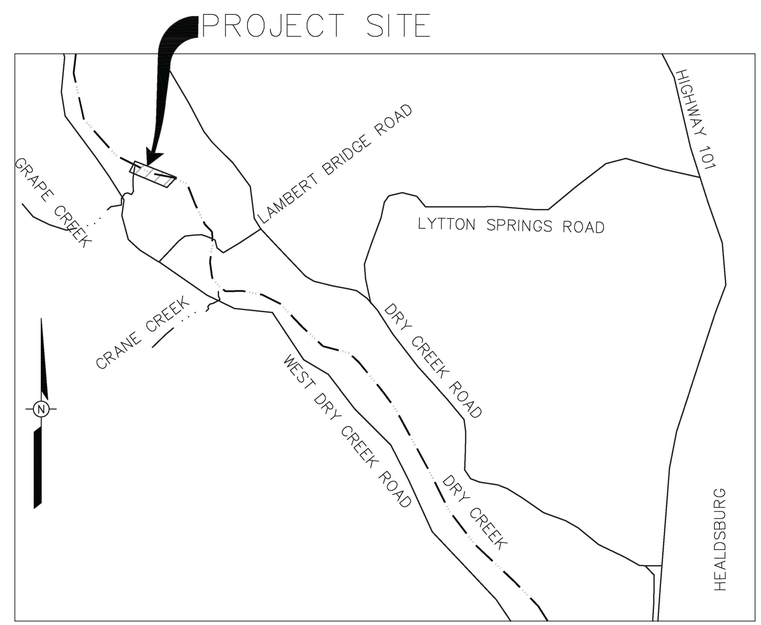
MAY 18, 2012

SHEET NO.	DRAWING NO.	TITLE
1.		LOCATION MAP AND SHEET INDEX
2.		GENERAL NOTES AND LEGEND
3.		EXISTING CONDITIONS AND CONSTRUCTION ACCESS
4.		MAIN CHANNEL PLAN AND PROFILE STA 370+00 TO 383+00
5.		OFF CHANNEL ENHANCEMENT AREA E – GRADING PLAN
6.		OFF CHANNEL ENHANCEMENT AREA E – LWD PLAN
6A.	R	FIELD SKETCHES – LOG JAM STA: 380+00 (APPENDIX A) AND MODIFIED FLOODPLAIN STA: 378+00 (APPENDIX B)
7.		OFF CHANNEL ENHANCEMENT AREA E – GRADING CROSS-SECTIONS
8.		TYPICAL SECTIONS – LOG JAMS STA: 375+60 TO 380+27
9.		LWD DETAILS – LOG JAM AND FLOODPLAIN LWD
10.		LWD DETAILS – BACKWATER CHANNEL AND POOL ENHANCEMENT
11.		LOG JAM DETAILS – TYPICAL SEQUENCE
11A.	R	LOG JAM DETAILS – LOG JAM STA: 380+00
12.		FLOODPLAIN AND POOL ENHANCEMENT LWD DETAILS – TYPICAL SEQUENCES
13.		BACKWATER LWD DETAILS – TYPICAL SEQUENCE
14.		SLOPE PLACEMENT LWD DETAILS AND LOG JAM AND LWD SUMMARY TABLE
15.		LWD DETAILS – CABLING AND BALLASTING



LOCATION MAP

NOT TO SCALE



VICINITY MAP

NOT TO SCALE

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

LOCATION MAP AND SHEET INDEX

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 1 OF 15

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COORDINATION CHECK	ORIG REL	DATE	CIVIL	ELECT	MECH	TECH WR	INSPECTION	OPERATIONS	SURVEY
MICROFILM DATE	REV								

\\sd-data\Proj\special projects\7345 RBIFP Demo Project\7345 Record Dwgs\ DRY CR Phase I R.dwg

PLAN LEGEND

- EXISTING CONTOURS (1 FT.)
- PROPOSED CONTOURS (1 FT.)
- EDGE OF WATER, MAY 2010 (TYP.)
- PROPOSED ACCESS CORRIDOR
- CONSTRUCTION EASEMENT (TYP.)
- OH — OH — OVERHEAD POWER LINE
- 233+00 — DRY CREEK ALIGNMENT
- PARCEL BOUNDARY
- SILT FENCE
- POWER POLE
- INGRESS/EGRESS
- STORM DRAIN OUTFALL (SDO)
- (E) PUMP
- LARGE WOODY DEBRIS (LWD)
- LOG JAM
- EXISTING STRUCTURES
- STAGING AREA
- EXISTING ROAD

ABBREVIATIONS

LWD	LARGE WOODY DEBRIS
STA	STATION
(TYP)	TYPICAL
(N)	NEW
(E)	EXISTING
SDO	STORM DRAIN OUTFALL
HDPE	HIGH DENSITY POLYETHYLENE
NTS	NOT TO SCALE
O.C.	ON CENTER
OHW	ORDINARY HIGH WATER
FES	FABRIC ENCAPSULATED SOIL LIFT
OH	OVERHEAD
PDSCS	PUMP DISCHARGE SEDIMENT CONTROL SYSTEM
I.E.	INVERT ELEVATION
D.B.H.	DIAMETER BREAST HEIGHT
EG	EXISTING GRADE

TYPICAL SECTION AND DETAIL LETTERING SYSTEM

SECTIONS AND DETAILS CUT ON SHEET NO. 12 TO BE FOUND ON SHEET NO. 15: A/15 — SECTION OR DETAIL LETTER; SHEET ON WHICH IT APPEARS

ON SHEET NO. 15 THIS SECTION IS SHOWN AS: SECTION A/12 — SECTION OR DETAIL LETTER; SHEET FROM WHICH SECTION WAS CUT

SECTIONS AND DETAILS TO BE FOUND ON SAME SHEET AS CUT: A/—

TYPICAL SECTION IMPROVEMENTS — X/X

TYPICAL SECTION–PROJECT GRADING SECTIONS FOUND ON SHEET 7 — STA: XX+XX

GENERAL NOTES

1. UNITS — FEET
2. HORIZONTAL DATUM — CALIFORNIA STATE PLANE COORDINATES (NAD83) ZONE 2, US SURVEY FEET
3. VERTICAL DATUM : — NORTH AMERICAN VERTICAL DATUM (NAVD), 1988 US SURVEY FEET.
4. PROJECT BENCHMARKS:

PT	NORTHING	EASTING	ELEVATION	DESCRIPSTION
DC–03	2001363.832	6296702.537	146.48	2" DIA. BRASS DISK
DC–04	2001308.733	6295880.366	142.712	2" DIA. BRASS DISK

5. STATIONING : ALL STATIONING REPRESENTS HORIZONTAL MEASUREMENT AT ALIGNMENT OF CONSTRUCTION.
6. ORIENTATION : RIGHT AND LEFT DIRECTIONS ARE FROM CENTERLINE LOOKING DOWNSTREAM.
7. UTILITIES : THE OWNER, TO THE BEST OF ITS ABILITY, HAS DELINEATED ON THE DRAWINGS ALL UTILITY INSTALLATIONS TO BE ENCOUNTERED WITHIN THE LIMITS OF WORK. SUCH INFORMATION IS BASED UPON INFORMATION FURNISHED TO THE AGENCY BY THE UTILITY OWNERS, AND THE OWNER DOES NOT EITHER EXPRESSLY OR BY IMPLICATION GUARANTEE THAT UTILITY INSTALLATIONS WILL BE FOUND AT THE LOCATIONS OR DEPTHS INDICATED. THE OWNER ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE INFORMATION SHOWN OR THE INADVERTENT OMISSION OF ANY SUCH INFORMATION.
8. PARCEL DATA : OBTAINED FROM SONOMA COUNTY WATER AGENCY ON FEBRUARY 16, 2012.
9. TOPOGRAPHY : BASED ON LIDAR MAPPING COLLECTED NOVEMBER 2008 BY PICTOMETRY, INC. SUPPLEMENTED WITH GROUND SURVEY BY INTER–FLUVE, INC. COLLECTED MAY 2010

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP. 6/30/12 CIVIL STATE OF CALIFORNIA

inter·fluve 1020 Wasco Street, Suite I Hood River, OR 97031 541.386.9003 www.interfluve.com

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
GENERAL NOTES AND LEGEND

FILE NAME:
CONTRACT NUMBER: 45–6.1–7 #2
DRAWING NUMBER:
SHEET 2 OF 15

COORDINATION CHECK: ORIG REL | DATE | CIVIL | ELECT | MECH | TECH WR | INSPECTION | OPERATIONS | SURVEY
REV
MICROFILM DATE

\\sd-data\Proj\special projects\7345 RRIFR Demo Project\7345 Record Dwgs\ DRY CR Phase I R.dwg

SEGESIO
SEGESIO
MASCHERINI
MASCHERINI
RUED
RUED
RUED
DRY CREEK ROAD
DRY CREEK
KIGHT
PROJECT AREA, TYP.
CONSTRUCTION EASMENT, TYP.
VAN ALYEA
PASSALACQUA
GRAPE CREEK
CONSTRUCTION ACCESS
DRY CREEK VINEYARDS
WALLACE
DRY CREEK VINEYARDS
FARROW
LIPTON
PARCEL BOUNDARY TYP.
W. DRY CREEK ROAD

150 0 150 300 200
SCALE IN FEET

NOTES:
1. LOCATION OF ACCESS RAMP TO PROJECT AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

REGISTERED PROFESSIONAL ENGINEER
MICHAEL P. BURKE
C 62986
EXP. 6/30/12
CIVIL
STATE OF CALIFORNIA

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BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

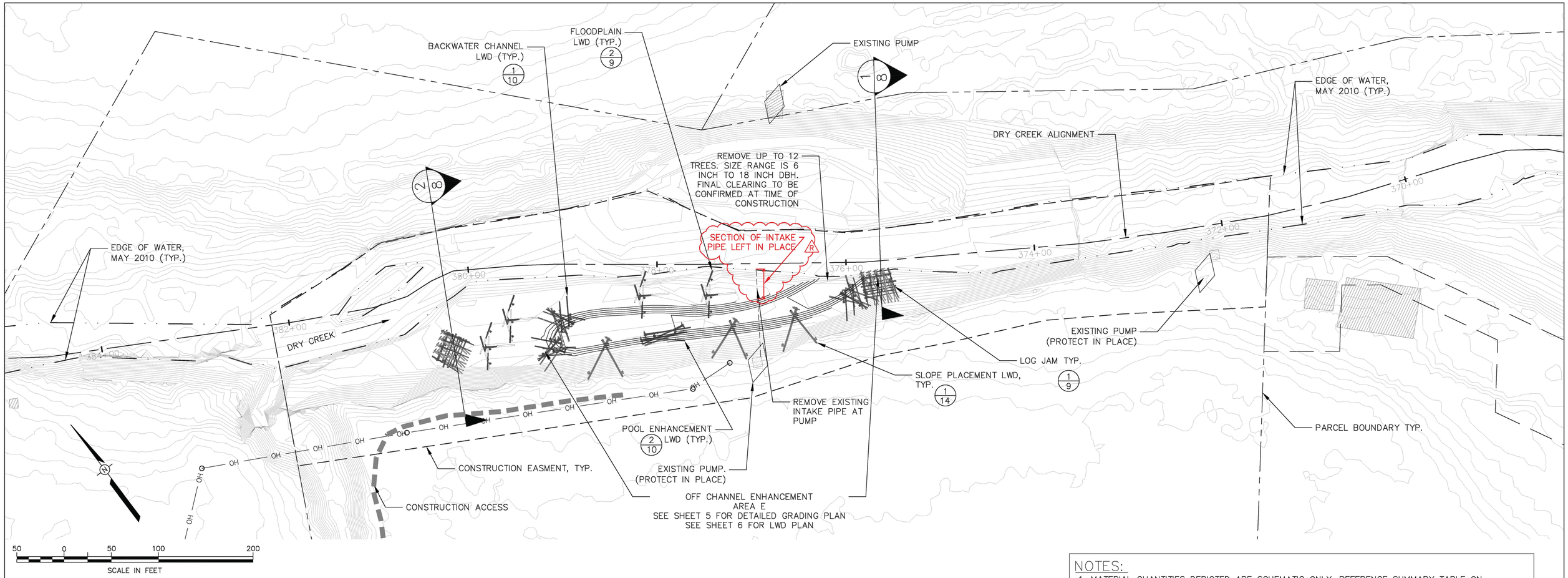
SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB,RP,BN,MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
EXISTING CONDITIONS AND CONSTRUCTION ACCESS

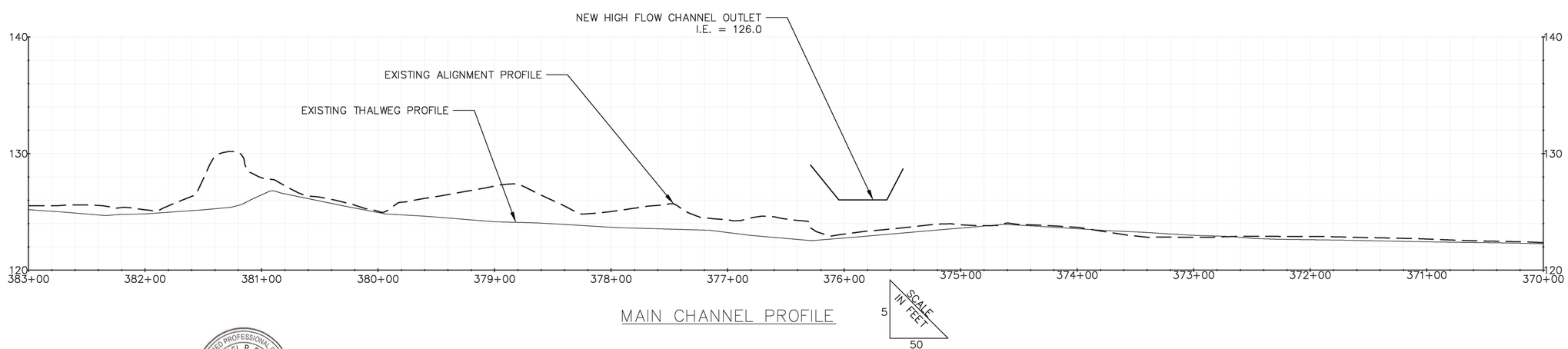
FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 3 OF 15

\\sd-data\Proj\special projects\7345 RRIFR Demo Project\7345 Record Dwgs\ DRY CR Phase I R.dwg



NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. LOCATION OF ACCESS RAMP TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.



MAIN CHANNEL PROFILE

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: Signature
CHRIS ANDERSON
Print Name
Date: 12/18/12

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CIVIL
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH, ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
MAIN CHANNEL PLAN AND PROFILE
STA. 370+00 TO 383+00

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 4 OF 15

\\srf-data\Proj\special projects\7345 RRFR Demo Project\7345 Record Dwgs\DRY CR Plans R.dwg

PARCEL BOUNDARY TYP.

20 0 20 40 80
SCALE IN FEET

CONSTRUCTION EASEMENT

EDGE OF WATER, MAY 2010 (TYP.)

REMOVE UP TO 12 TREES. SIZE RANGE IS 6 INCH TO 18 INCH DBH. FINAL CLEARING TO BE CONFIRMED AT TIME OF CONSTRUCTION

DRY CREEK ALIGNMENT

DRY CREEK

SECTION OF INTAKE PIPE LEFT IN PLACE

EXCAVATION AND SLOPE CHANGED TO PRESERVE LIVE TREE

STA:5+13
STA:3+70
STA:3+22
STA:2+66
STA:1+70
STA:1+18
STA:0+88
STA:0+10

380+00
378+00
376+00

REMOVE EXISTING INTAKE PIPE AT PUMP

CONSTRUCTION EASEMENT

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

NOTES:
ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED.

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C 62986
EXP 6/30/12
CIVIL
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

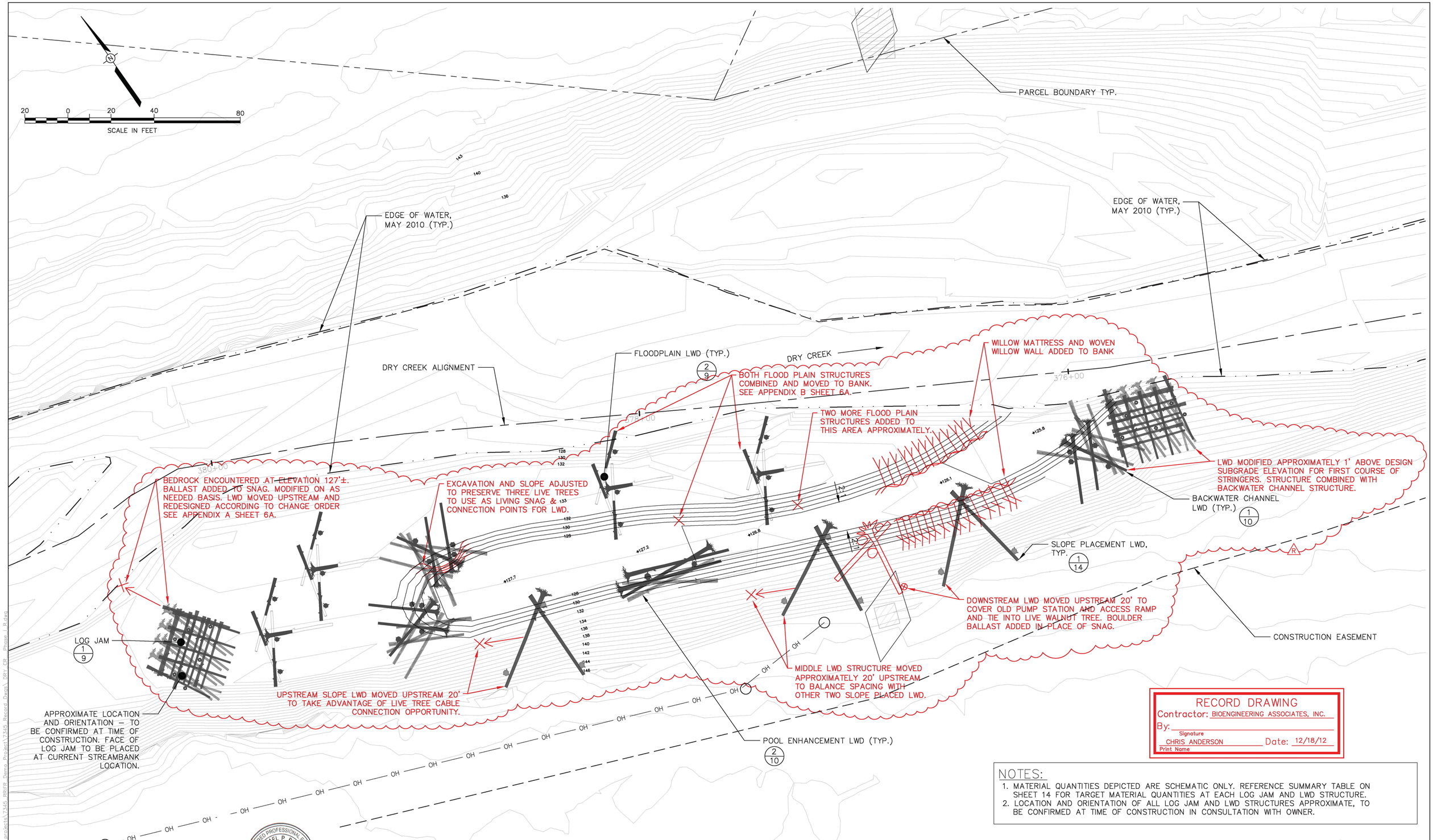
SONOMA COUNTY WATER AGENCY

SCALE: 1" = 20'
DATE: 5/18/12
DRAWN: JT
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
OFF CHANNEL ENHANCEMENT
AREA E – GRADING PLAN

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 5 OF 15



RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Print Name Date: 12/18/12

NOTES:
1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. LOCATION AND ORIENTATION OF ALL LOG JAM AND LWD STRUCTURES APPROXIMATE, TO BE CONFIRMED AT TIME OF CONSTRUCTION IN CONSULTATION WITH OWNER.

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REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP. 6/30/12 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

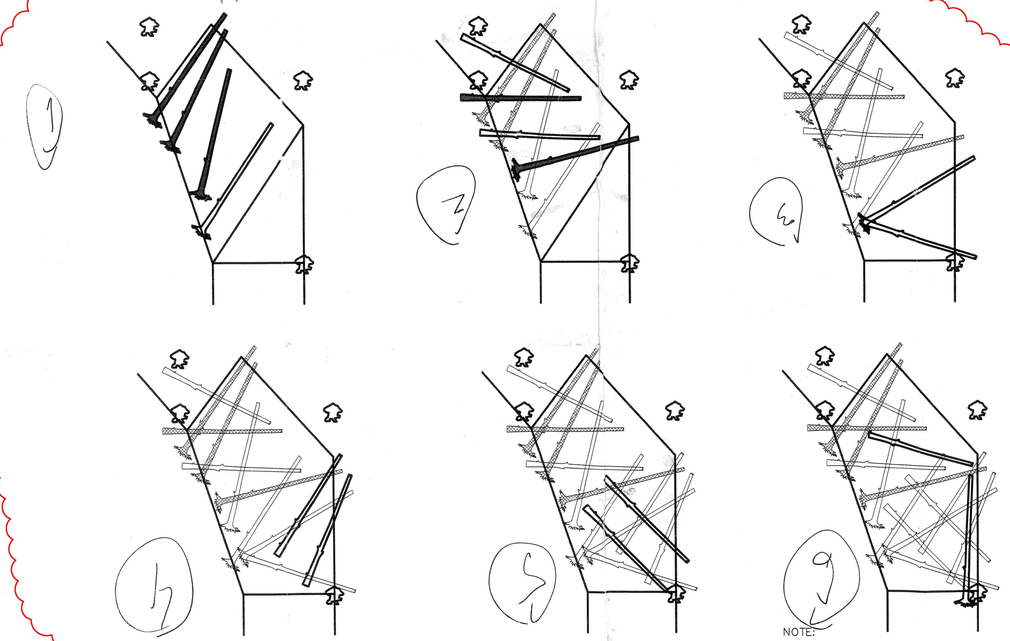
SCALE: 1" = 20'
DATE: 5/18/12
DRAWN: JT
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
OFF CHANNEL ENHANCEMENT AREA E – LWD PLAN

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 6 OF 15

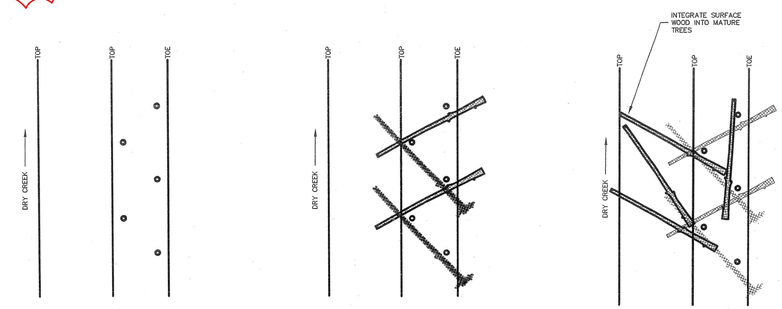
Appendix A



1 FIELD SKETCH
LOG JAM AT 380+00
NTS

NOTE:
INSTALL SNAGS OPPORTUNISTICALLY
SUBTLE LOW THROUGH CENTRAL PORTION OF LOG JAM

APPENDIX A



1 FIELD SKETCH
MODIFIED FLOODPLAIN LWD AT STA. ~~2+00~~ 378+00
NTS

NOTE:
20 BOULDERS TO BE INSTALLED

APPENDIX B

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____
Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

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Hood River, OR 97031
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MICHAEL P. BURKE
C 62986
EXP 6/30/12
CIVIL
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

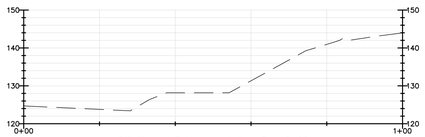
SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

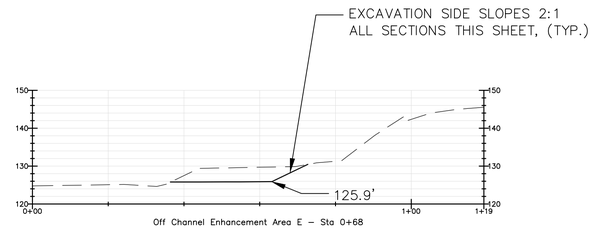
REVIEWED
REVIEWED

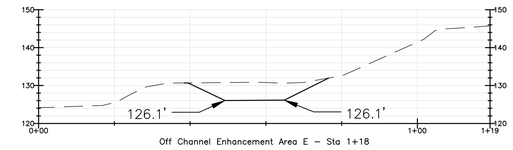
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
FIELD SKETCHES–LOG JAM STA: 380+00 (APPENDIX A)
AND MODIFIED FLOODPLAIN STA: 378+00 (APPENDIX B)

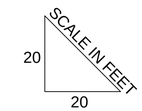
FILE NAME:
CONTRACT NUMBER: 45–6.1–7 #2
DRAWING NUMBER:
SHEET 6A OF 15

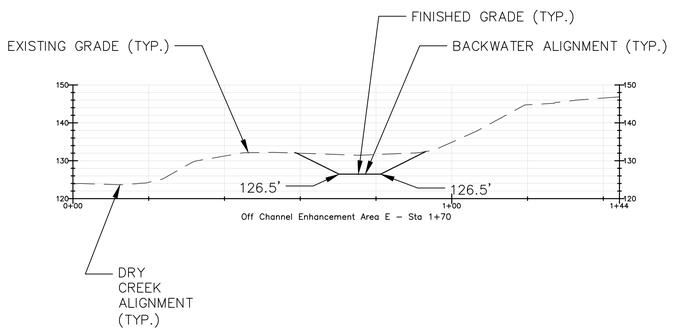
\\sf-data\Proj\special projects\7345 BBWTB Demo Project\7345 Record Dwgs\ DRY CR Phase I R.dwg

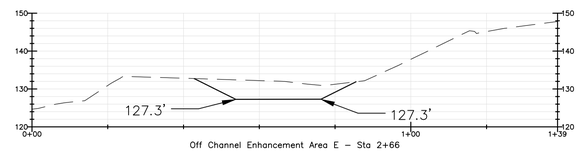


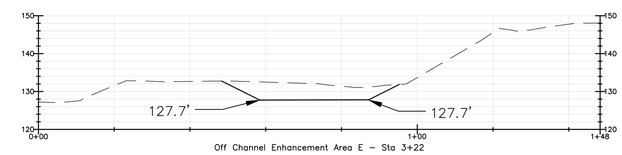


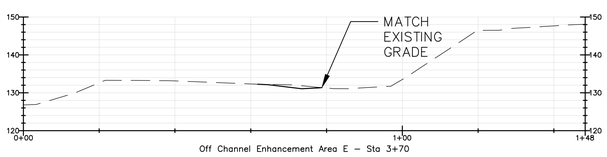


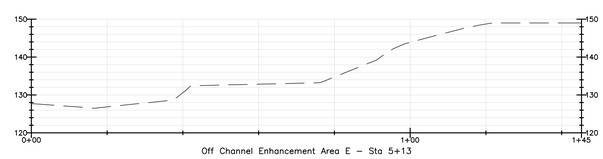












RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____
Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

inter-fluve
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

REGISTERED PROFESSIONAL ENGINEER
MICHAEL P. BURKE
C 62986
EXP 6/30/12
CIVIL
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE: 1" = 30'
DATE: 5/18/12
DRAWN: JT
CHECKED: MB

REVIEWED
REVIEWED

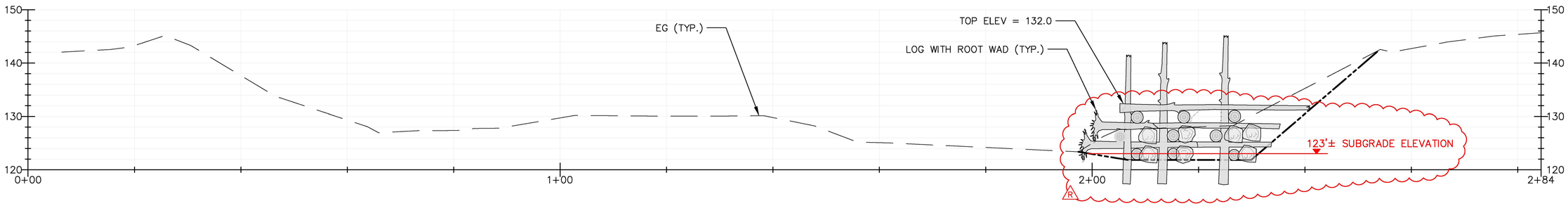
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
OFF CHANNEL ENHANCEMENT AREA E
– GRADING CROSS-SECTIONS

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 7 OF 15

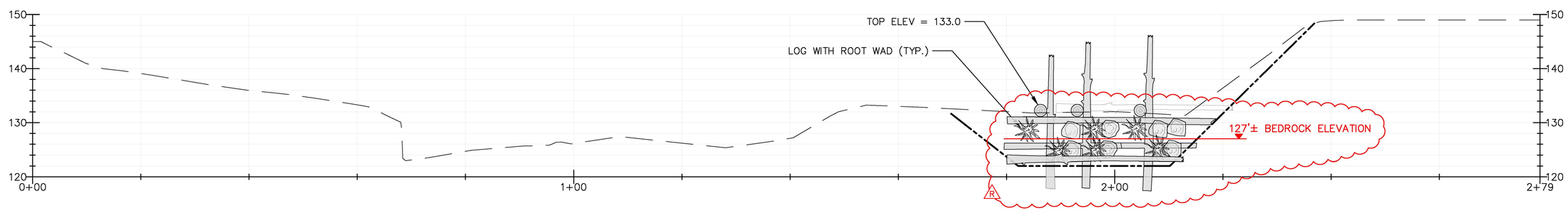
\\sd-data\Proj\special projects\7345_RBIFR_Demo_Project\7345_Record_Dwgs_DRY_CR__Phase_I_R.dwg

NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.



1/4 TYPICAL SECTION
LOG JAM STA: 375+60
NTS



2/4 TYPICAL SECTION
LOG JAM STA: 380+27
NTS

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

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Hood River, OR 97031
541.386.9003
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REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

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		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE: 1" = 30'
DATE: 5/18/12
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CHECKED: MB

REVIEWED
REVIEWED

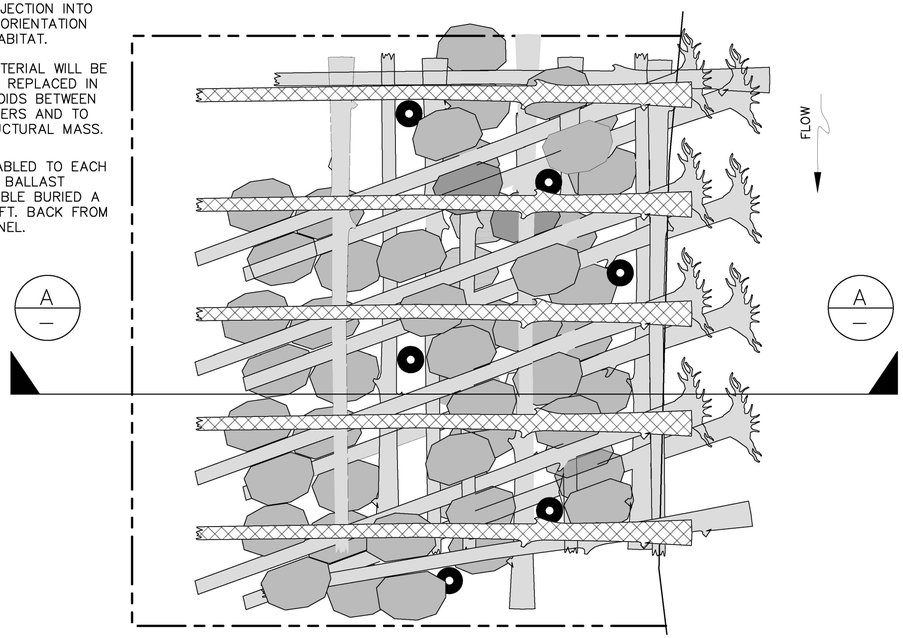
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
TYPICAL SECTIONS – LOG JAMS
STA. 375+60 TO 380+27

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 8 OF 15

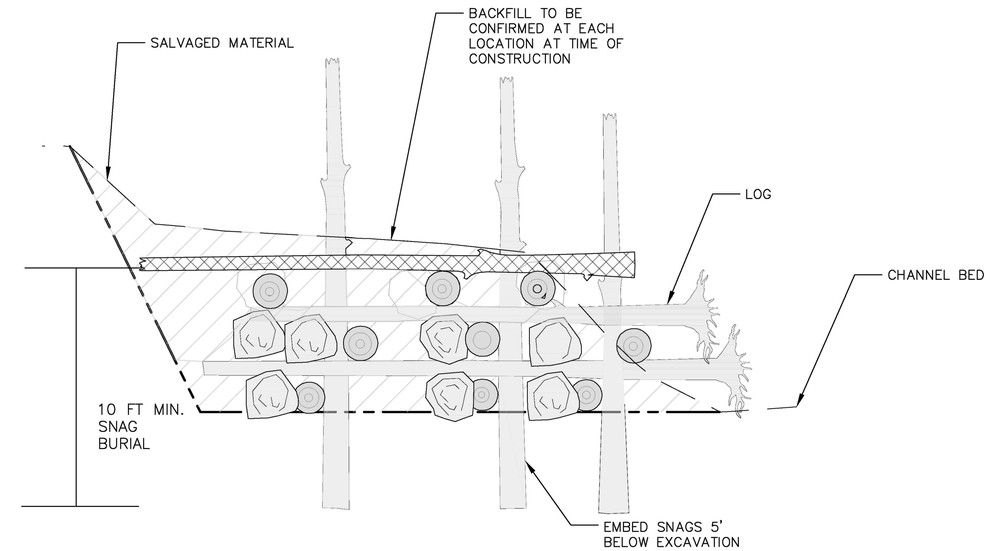
\\sdc-data\Proj\special projects\7345 RBIFB Demo Project\7345 Record Dwgs\ DRY CR Phase I R.dwg

LOG JAM SPECIFIC NOTES:

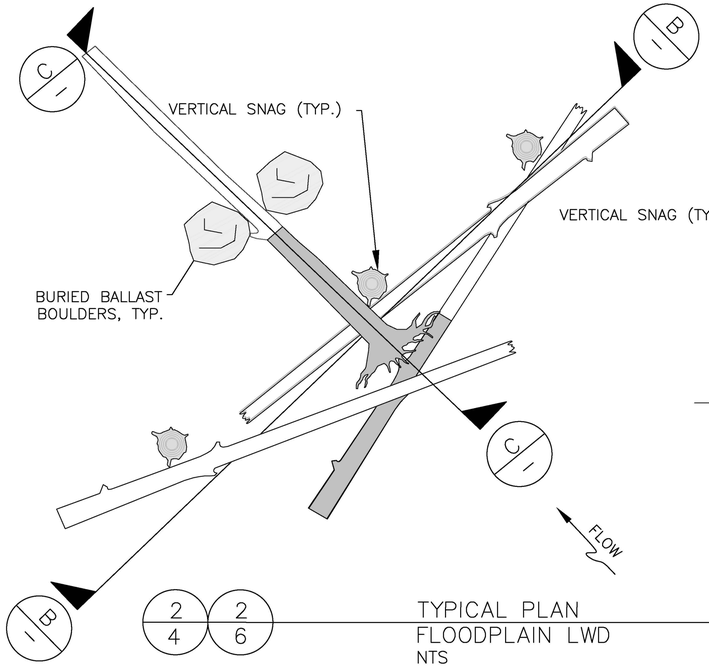
1. VARY LWD PROJECTION INTO CHANNEL AND ORIENTATION TO OPTIMIZE HABITAT.
2. EXCAVATED MATERIAL WILL BE SALVAGED AND REPLACED IN JAM TO FILL VOIDS BETWEEN STACKED MEMBERS AND TO INCREASE STRUCTURAL MASS.
3. LOGS TO BE CABLED TO EACH OTHER AND TO BALLAST BOULDERS. CABLE BURIED A MINIMUM OF 6 FT. BACK FROM EDGE OF CHANNEL.



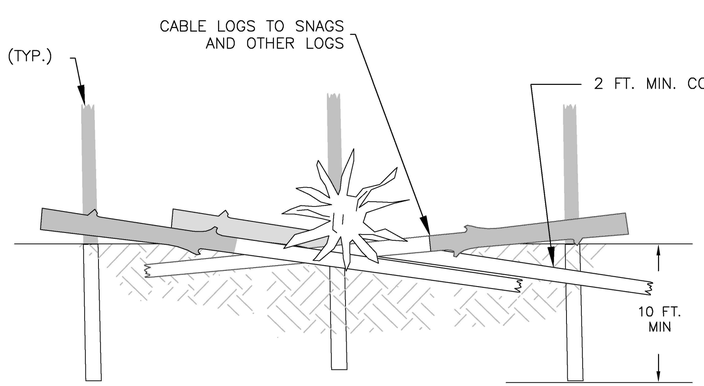
1/4 1/6 TYPICAL PLAN DETAIL
LOG JAM
NTS



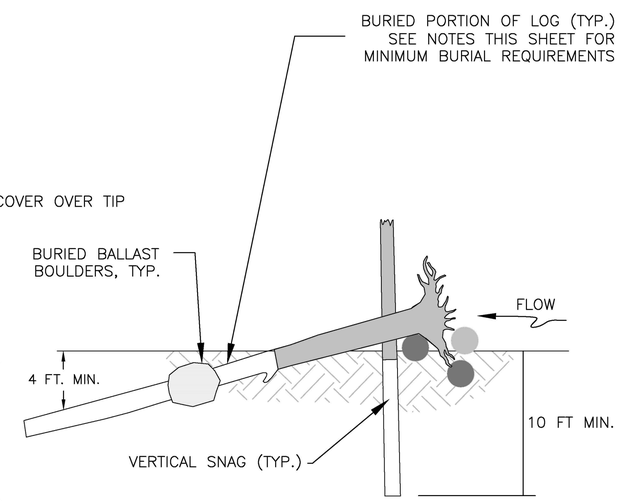
A/– TYPICAL SECTION
LOG JAM



2/4 2/6 TYPICAL PLAN
FLOODPLAIN LWD
NTS



B/– TYPICAL ELEVATION VIEW
FLOODPLAIN LWD
NTS



C/– TYPICAL SECTION
FLOODPLAIN LWD
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
3. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
4. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO EXISTING TREES OR BOULDERS, OR OTHER METHODS.

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

inter fluve
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

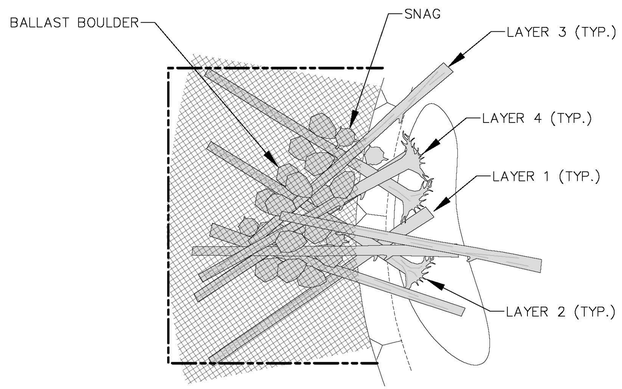
SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

REVIEWED
REVIEWED

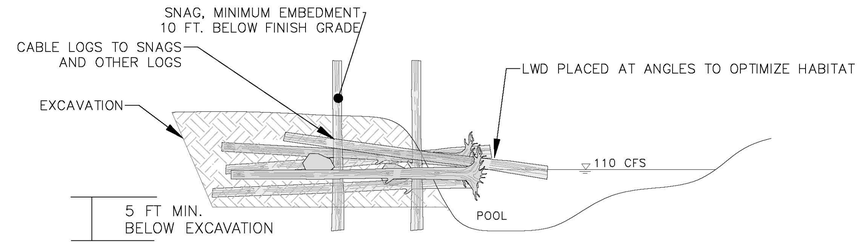
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
LWD DETAILS – LOG JAM AND FLOODPLAIN LWD

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 9 OF 15

\\ad5-data\Dry\spacial projects\3345 RRIP Demo Project\3345 Record Dwgs\DRY CDF Phase I R.dwg



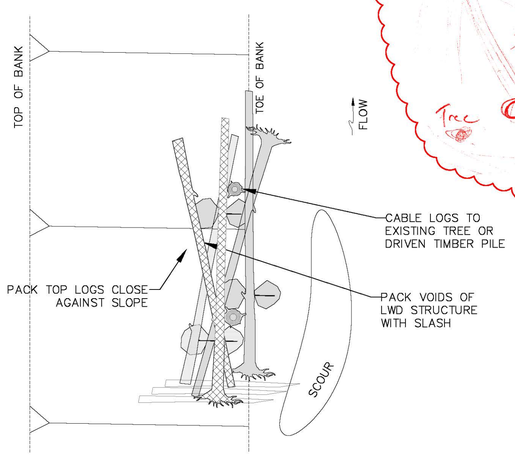
1/4 1/6 TYPICAL PLAN DETAIL
BACKWATER CHANNEL LWD
NTS

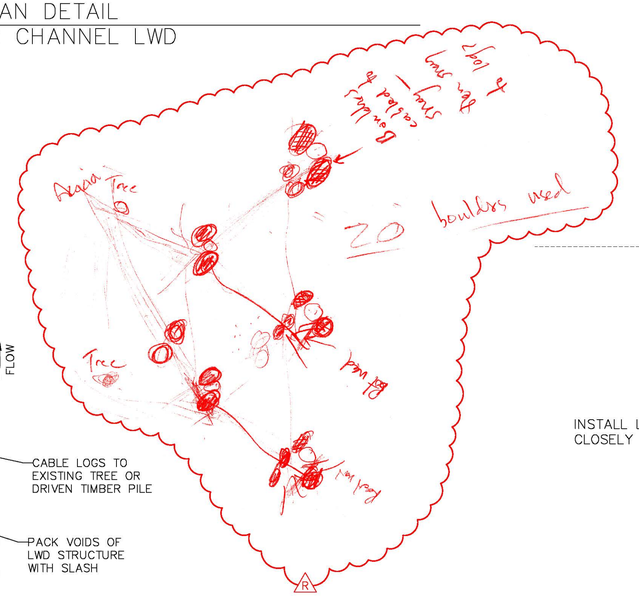


A/_ TYPICAL SECTION
BACKWATER CHANNEL LWD
NTS

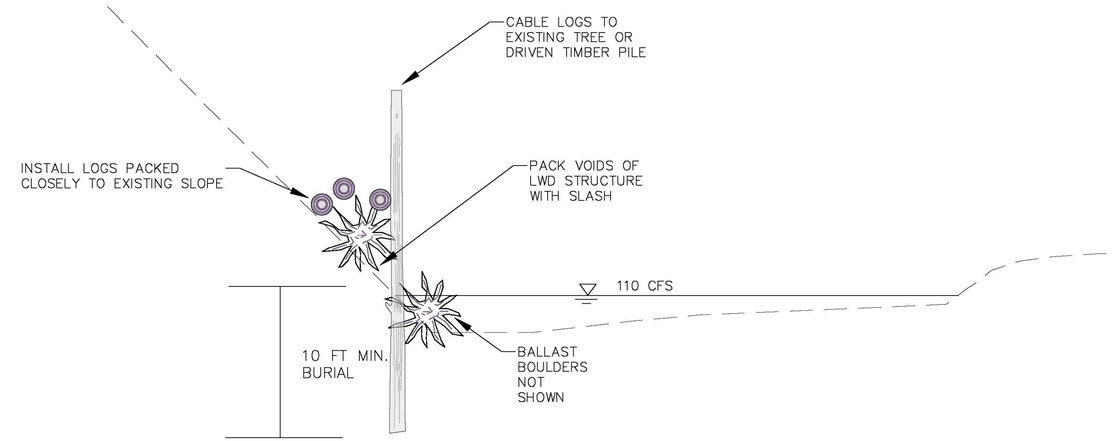
GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
3. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
4. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO EXISTING TREES OR BOULDERS, OR OTHER METHODS.





2/4 2/6 TYPICAL PLAN DETAIL
POOL ENHANCEMENT LWD
NTS



B/_ TYPICAL SECTION
POOL ENHANCEMENT LWD
NTS

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

REGISTERED PROFESSIONAL ENGINEER MICHAEL P BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH; ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE: 1" = 100'
DATE: 5/18/12
DRAWN: JT
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
LWD DETAILS – BACKWATER CHANNEL AND POOL ENHANCEMENT

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 10 OF 15

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541.386.9003
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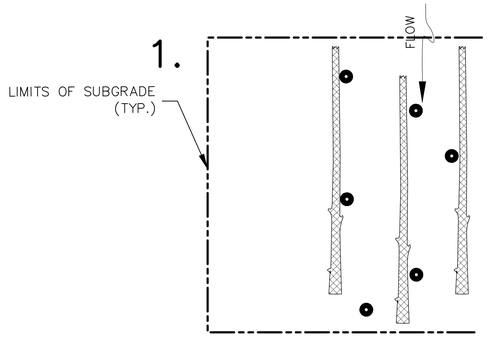
\\sd-data\Proj\special projects\Y2345 RRFP Demo Project\Y2345 Record Dwgs\ DRY CR Phase 1 R.dwg

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LOG JAM CONSTRUCTION.
3. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
4. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
5. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO EXISTING TREES OR BOULDERS, OR OTHER METHODS.
6. FOR CONNECTION DETAILS SEE SHEET 15.

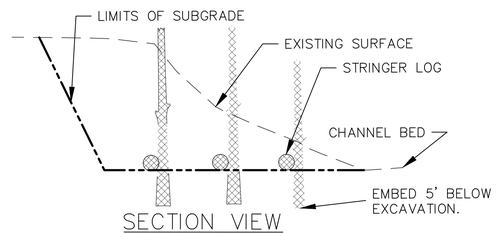
1.



PLAN VIEW
NTS

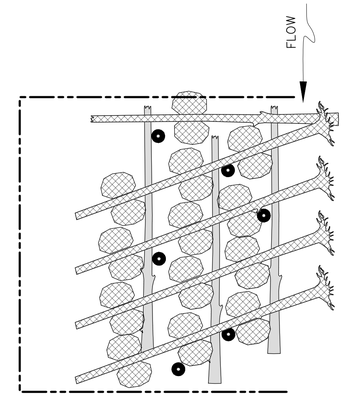
TYPICAL LAYER ONE SEQUENCING

1. PREPARE SITE
2. EXCAVATE TO SUBGRADE.
3. INSTALL LAYER ONE STRINGER LOGS.
4. INSTALL VERTICAL SNAG



SECTION VIEW
NTS

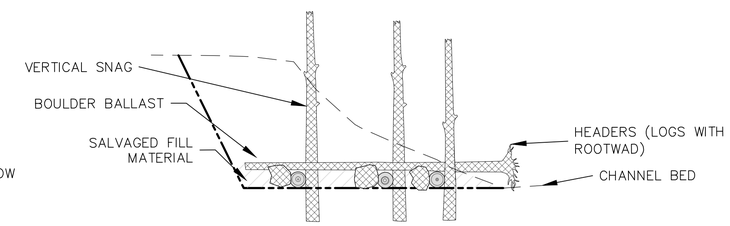
2.



PLAN VIEW
NTS

TYPICAL LAYER TWO SEQUENCING

1. INSTALL LAYER TWO HEADERS (LOGS WITH ROOTWADS).
2. PLACE BOULDERS FOR BALLASTING. BOULDER BALLAST TO BE PLACED AS APPROVED BY OWNER.
3. ANCHOR LAYER TWO HEADERS AND LAYER ONE STRINGERS TO BOULDER BALLAST WHERE CONNECTIONS ARE AVAILABLE . MINIMUM TWO CONNECTIONS PER STRINGER OR HEADER LOGS.
4. BACKFILL AND COMPACT WITH SALVAGED FILL MATERIAL TO TOP OF LAYER TWO.



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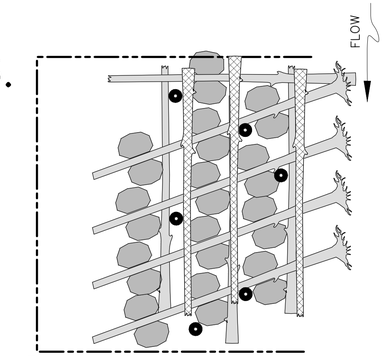
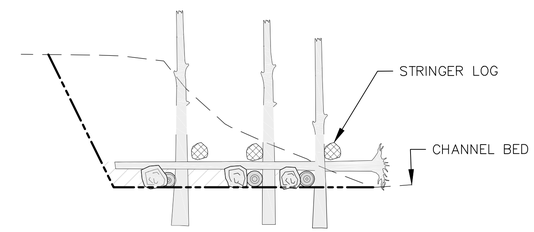


PLAN VIEW
NTS

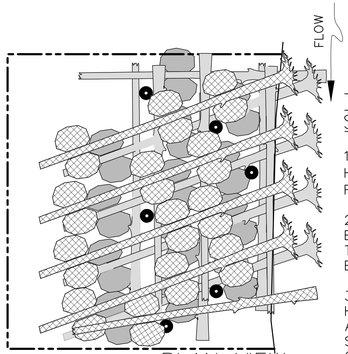
TYPICAL LAYER THREE SEQUENCING

1. INSTALL LAYER THREE STRINGER LOGS.
2. ANCHOR LAYER THREE STRINGER LOGS TO LOGS AND BOULDERS WHERE CONNECTIONS ARE AVAILABLE. MINIMUM TWO CONNECTIONS PER STRINGER AND HEADER LOGS.



SECTION VIEW
NTS

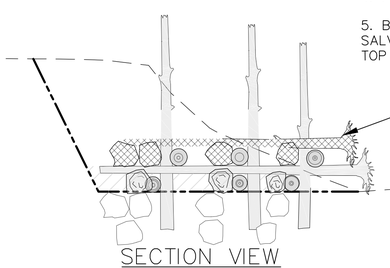
4.



PLAN VIEW
NTS

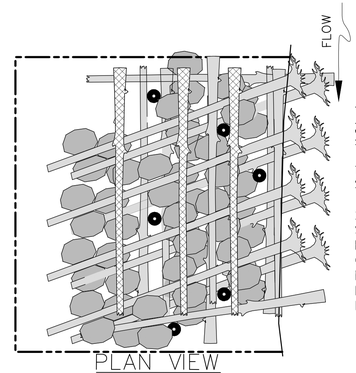
TYPICAL LAYER FOUR SEQUENCING

1. INSTALL LAYER FOUR HEADERS (LOGS WITH ROOTWADS).
2. PLACE BOULDERS FOR BALLASTING. BOULDER BALLAST TO BE PLACED AS APPROVED BY OWNER.
3. ANCHOR LAYER FOUR HEADERS TO BOULDER BALLAST AND LOGS WHERE CONNECTIONS S ARE AVAILABLE. MINIMUM TWO CONNECTIONS PER STRINGER OR HEADER LOGS.
4. PACK SLASH INTO VOIDS
5. BACKFILL AND COMPACT WITH SALVAGED FILL MATERIAL TO TOP OF LAYER FOUR.



SECTION VIEW

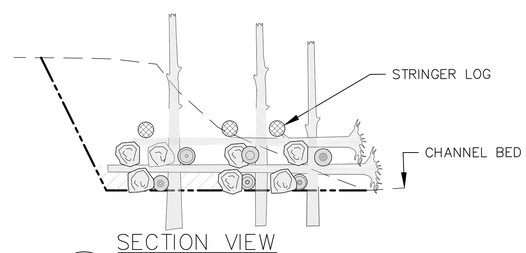
5.



PLAN VIEW
NTS

TYPICAL LAYER FIVE SEQUENCING

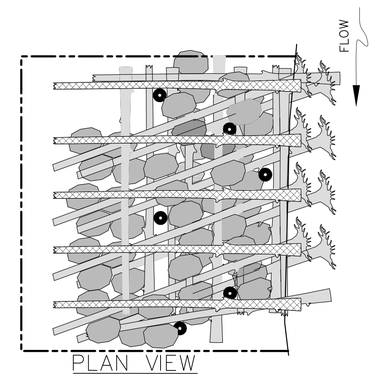
1. INSTALL LAYER FIVE STRINGER LOGS.
2. ANCHOR LAYER FIVE STRINGER LOGS TO LOGS AND BOULDERS WHERE CONNECTIONS ARE AVAILABLE. MINIMUM TWO CONNECTIONS PER STRINGER AND HEADER LOGS.



SECTION VIEW

1 — TYPICAL SEQUENCE LOG JAM
NTS

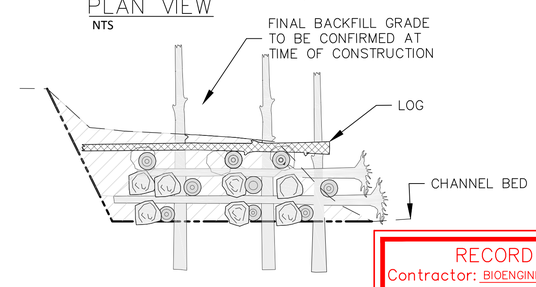
6.



PLAN VIEW
NTS

TYPICAL LAYER SIX SEQUENCING

1. INSTALL LAYER SIX HEADERS.
2. ANCHOR LAYER SIX HEADERS TO BOULDER BALLAST AND LOGS WHERE CONNECTIONS ARE AVAILABLE. MINIMUM TWO CONNECTIONS PER STRINGER OR HEADER LOGS.
3. BACKFILL AND COMPACT WITH SALVAGED FILL MATERIAL TO FINISHED GRADE.



SECTION VIEW

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
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REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
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R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 5/18/12
DRAWN: JT
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
LOG JAM DETAILS – TYPICAL SEQUENCE

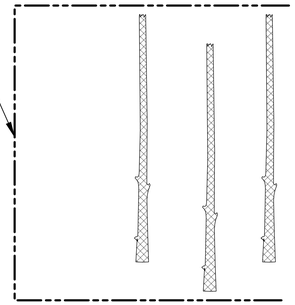
FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 11 OF 15

\\sd-data\Proj\special projects\7345_RRFR_Demo_Project\7345_Record_Dwgs_DRY_CR__Phase_I_R.dwg

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LOG JAM CONSTRUCTION.
3. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
4. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
5. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO EXISTING TREES OR BOULDERS, OR OTHER METHODS.
6. FOR CONNECTION DETAILS SEE SHEET 15.

1.

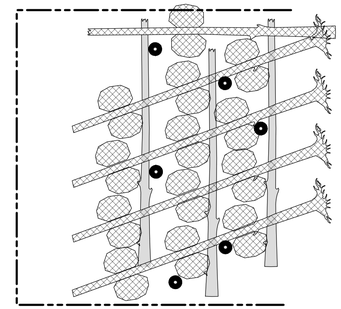


PLAN VIEW
NTS

TYPICAL LAYER ONE SEQUENCING

1. PREPARE SITE
2. EXCAVATE TO SUBGRADE.
3. INSTALL LAYER ONE STRINGER LOGS.

2.

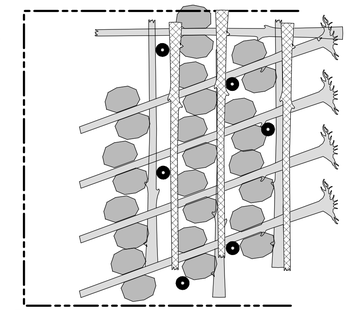


PLAN VIEW
NTS

TYPICAL LAYER TWO SEQUENCING

1. INSTALL LAYER TWO HEADERS (LOGS WITH ROOTWADS).
2. PLACE BOULDERS FOR BALLASTING. BOULDER BALLAST TO BE PLACED AS APPROVED BY OWNER.
3. ANCHOR LAYER TWO HEADERS AND LAYER ONE STRINGERS TO BOULDER BALLAST WHERE CONNECTIONS ARE AVAILABLE . MINIMUM TWO CONNECTIONS PER STRINGER OR HEADER LOGS.
4. BACKFILL AND COMPACT WITH SALVAGED FILL MATERIAL TO TOP OF LAYER TWO.

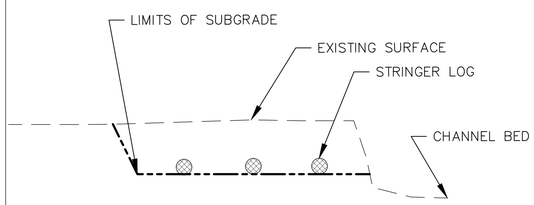
3.



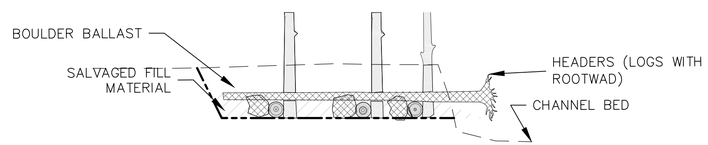
PLAN VIEW
NTS

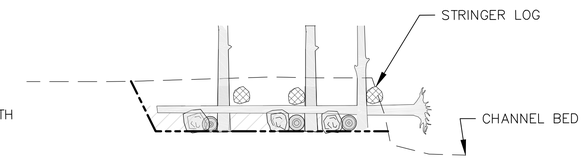
TYPICAL LAYER THREE SEQUENCING

1. INSTALL LAYER THREE STRINGER LOGS.
2. ANCHOR LAYER THREE STRINGER LOGS TO LOGS AND BOULDERS WHERE CONNECTIONS ARE AVAILABLE. MINIMUM TWO CONNECTIONS PER STRINGER AND HEADER LOGS.
4. INSTALL VERTICAL SNAG



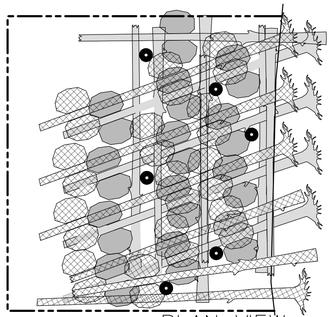
SECTION VIEW
NTS





SECTION VIEW
NTS

4.

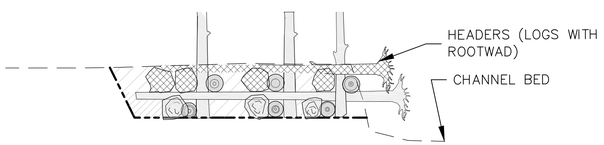


PLAN VIEW
NTS

TYPICAL LAYER FOUR SEQUENCING

1. INSTALL LAYER FOUR HEADERS (LOGS WITH ROOTWADS).
2. PLACE BOULDERS FOR BALLASTING. BOULDER BALLAST TO BE PLACED AS APPROVED BY OWNER.
3. ANCHOR LAYER FOUR HEADERS TO BOULDER BALLAST AND LOGS WHERE CONNECTIONS S ARE AVAILABLE. MINIMUM TWO CONNECTIONS PER STRINGER OR HEADER LOGS.
4. PACK SLASH INTO VOIDS
5. BACKFILL AND COMPACT WITH SALVAGED FILL MATERIAL TO TOP OF LAYER FOUR.

FLOW



SECTION VIEW

1 TYPICAL SEQUENCE
LOG JAM
NTS

R

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

interfluve
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

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NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	09/11/12	REVISE DETAIL FOR BEDROCK AT LOG JAM AT 380+00	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

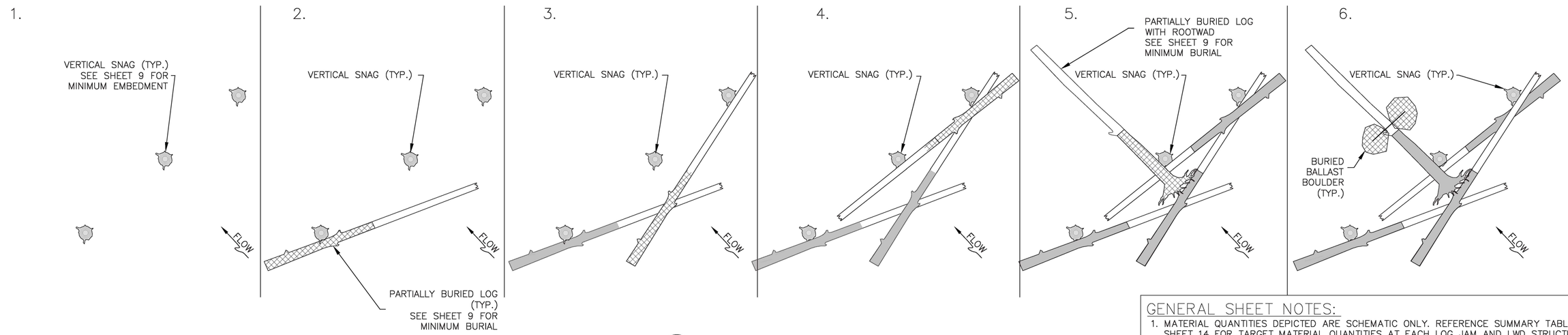
SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

APPROVED DEPUTY CHIEF ENGINEER RCE C54302
SUBMITTED RCE C62986
DESIGNED RCE C62986

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
LOG JAM DETAILS – JOG JAM STA: 380+00

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 11A OF 15

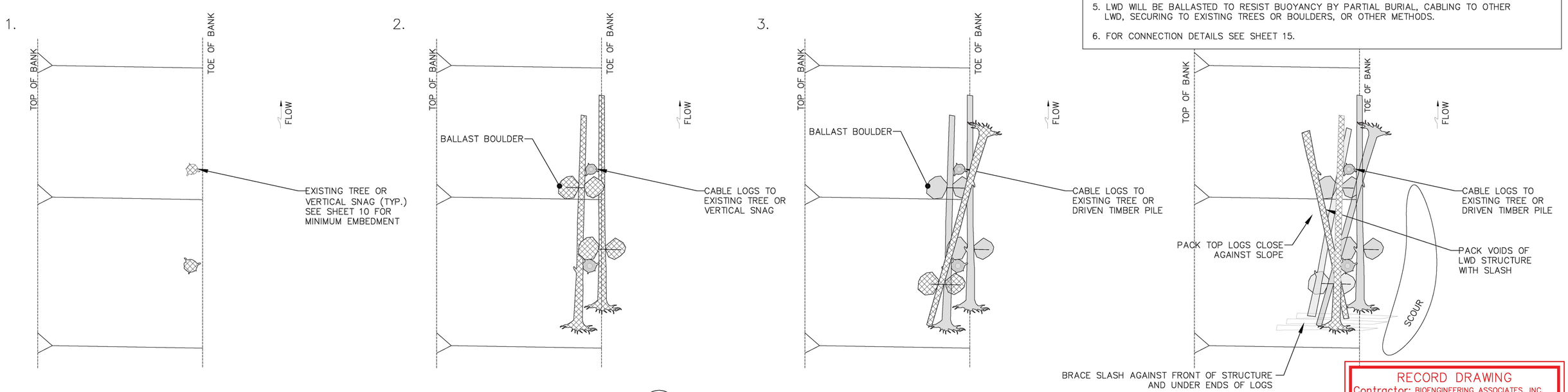
\\sd-data\Pro\special projects\7345_RRIFR_Demo_Project\7345_Record_Dwgs_DryCreek_Phase1_RevisedSheet11_R.dwg



1 TYPICAL SEQUENCE
FLOODPLAIN LWD

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LWD CONSTRUCTION.
3. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
4. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
5. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO EXISTING TREES OR BOULDERS, OR OTHER METHODS.
6. FOR CONNECTION DETAILS SEE SHEET 15.



2 TYPICAL SEQUENCE
POOL ENHANCEMENT LWD

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

interfluve
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

REGISTERED PROFESSIONAL ENGINEER
MICHAEL P BURKE
C 62986
EXP 6/30/12
CIVIL
STATE OF CALIFORNIA

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NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

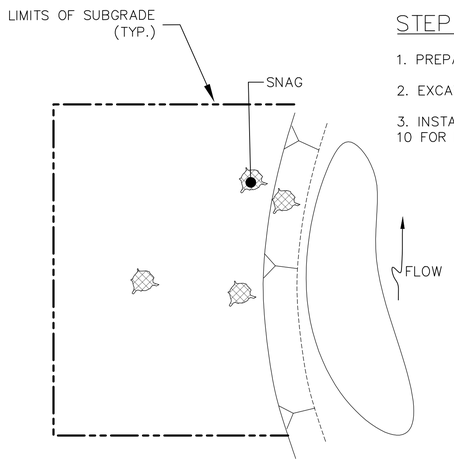
SONOMA COUNTY WATER AGENCY

SCALE:
DATE : 5/18/12
DRAWN : JT
CHECKED : MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
FLOODPLAIN AND POOL ENHANCEMENT LWD
DETAILS TYPICAL SEQUENCES

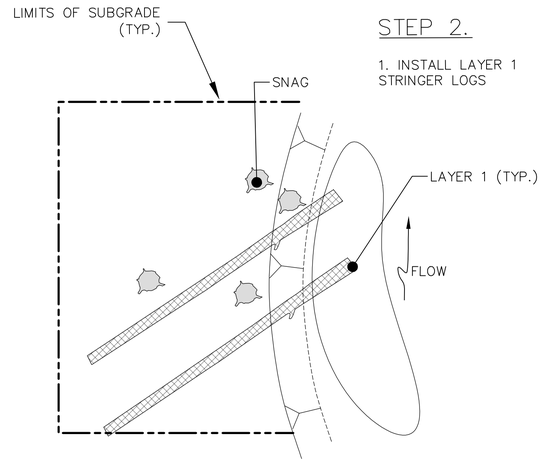
FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 12 OF 15



STEP 1.

1. PREPARE SITE
2. EXCAVATE TO SUBGRADE.
3. INSTALL SNAGS. SEE SHEET 10 FOR MINIMUM EMBEDMENT

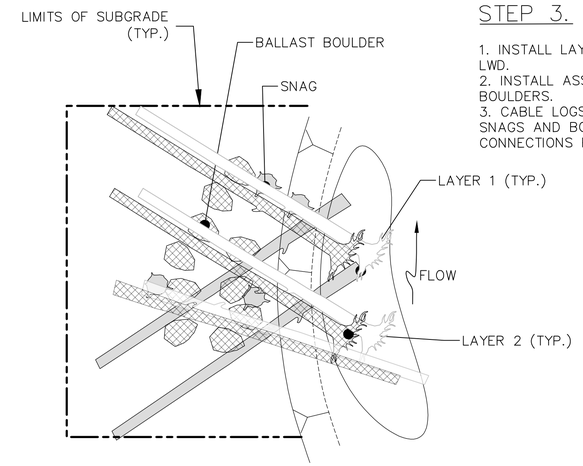
PLAN VIEW
NTS



STEP 2.

1. INSTALL LAYER 1 STRINGER LOGS

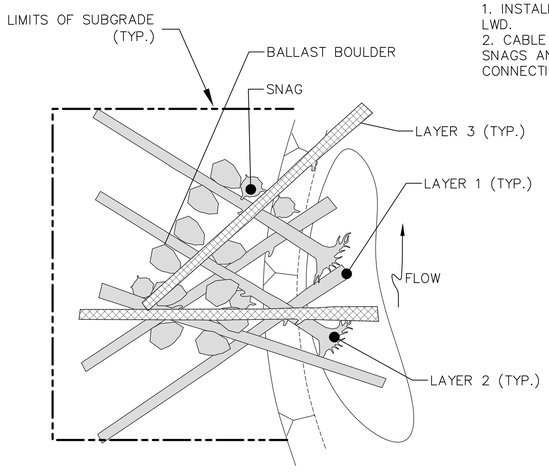
PLAN VIEW
NTS



STEP 3.

1. INSTALL LAYER 2 LWD.
2. INSTALL ASSOCIATED BOULDERS.
3. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LOG.

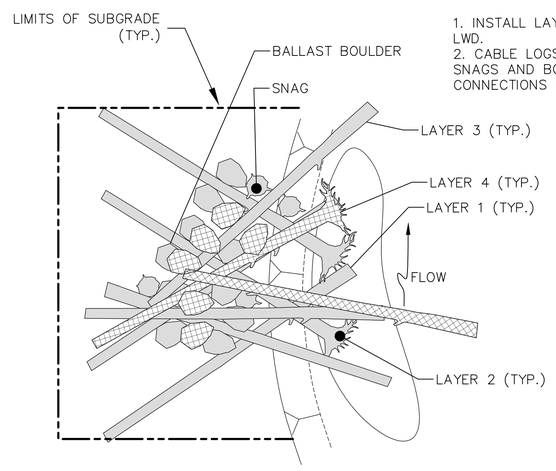
PLAN VIEW
NTS



STEP 4.

1. INSTALL LAYER 3 LWD.
2. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LWD.

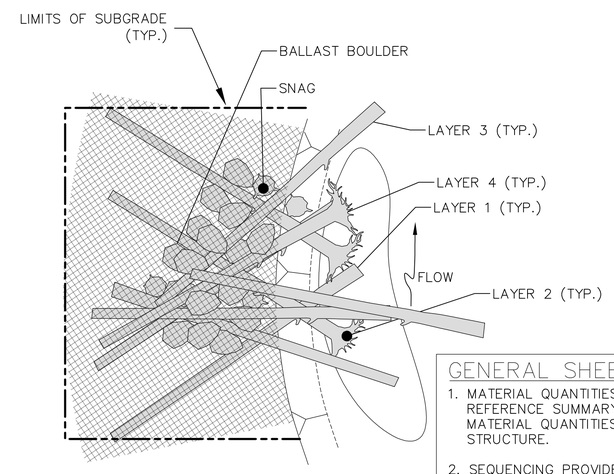
PLAN VIEW
NTS



STEP 5.

1. INSTALL LAYER 3 LWD.
2. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LWD.

PLAN VIEW
NTS



STEP 6.

1. BACKFILL

PLAN VIEW
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LWD CONSTRUCTION.
3. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
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6. FOR CONNECTION DETAILS SEE SHEET 15.

1 TYPICAL SEQUENCE
BACKWATER LWD
NTS

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

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1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

REGISTERED PROFESSIONAL ENGINEER MICHAEL P BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

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NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE : 5/18/12
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CHECKED : MB

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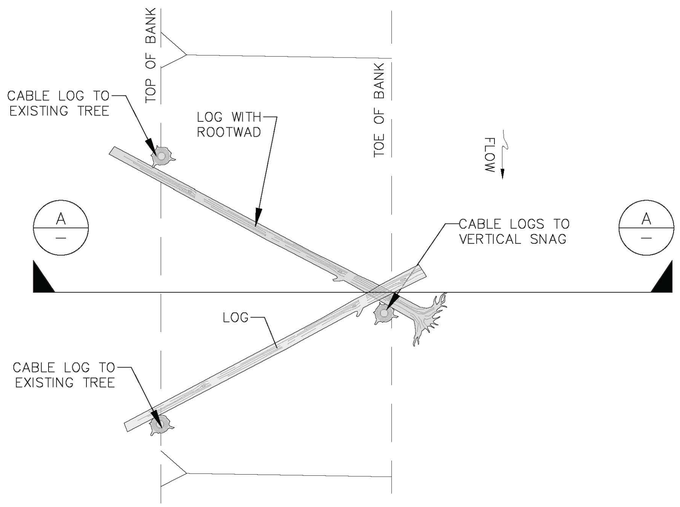
REVIEWED

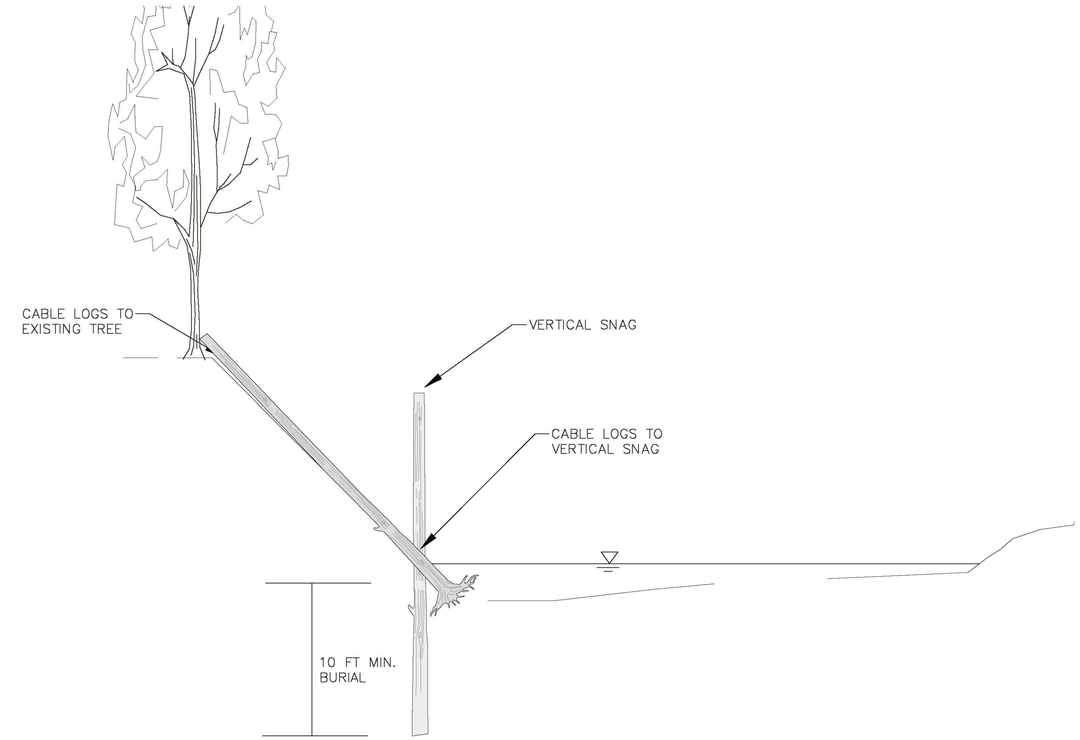
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
BACKWATER LWD DETAILS
TYPICAL SEQUENCE

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 13 OF 15

\\sd-data\Proj\special projects\7345_RRFR_Demo_Project\7345_Record_Dwgs\DRY_CR__Phase_I_R.dwg



1/4 1/6 TYPICAL PLAN DETAIL
SLOPE PLACEMENT LWD



A/– TYPICAL SECTION
SLOPE PLACEMENT LWD

STATION	TYPE*	NUMBER OF STRUCTURES (EA)	LOGS (EA)	LOGS WITH ROOTWADS (EA)	SNAGS (EA)	CABLE ATTACHMENTS (EA)	BALLAST BOULDERS (EA)
375+60** +BW#3	LJ	1	~~10~~ 19	~~5~~ 8	~~4~~ 5	~~30~~ 61 (28 L-L, 33 B-L-B)	~~32~~ 66
380+00***	LJ	1	~~16~~ 5	8	~~6~~ 5	~~48~~ 49 (11 L-L, 38 B-L-B)	~~52~~ 76
–	BW	3	~~18~~ 16	~~9~~ 6	~~12~~ 5	~~54~~ 36.5 (18 L-L, 18.5 B-L-B)	~~54~~ 37
–	P	1	2	3	2	10 (4 L-L, 6 B-L-B)	~~10~~ 12
–	FP	~~4~~ 6	~~12~~ 15	4	~~12~~ 10	~~20~~ 44.5 (19 L-L, 25.5 B-L-B)	~~16~~ 51
–	SL	3	3	3	~~3~~ 1	~~12~~ 8 (4 L-L, 4 B-L-B)	~~1~~ 8
TOTAL			~~61~~ 60	32	~~39~~ 28	~~174~~ 209	~~164~~ 250

* LJ: LOG JAM
BW: BACKWATER LWD
FP: FLOODPLAIN LWD
P: POOL ENHANCEMENT LWD
SL: SLOPE PLACEMENT LWD

** TREATMENT LENGTH 25 FT. MEASURED PARALLEL TO LOG JAM FACE
– SEE SHEET 6 FOR ORIENTATION

*** TREATMENT LENGTH 40 FT. MEASURED PARALLEL TO LOG JAM FACE
– SEE SHEET 6 FOR ORIENTATION

2/– SUMMARY TABLE
LOG JAM AND LWD

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 14 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LWD CONSTRUCTION.
3. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
4. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
5. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO EXISTING TREES OR BOULDERS, OR OTHER METHODS.
6. FOR CONNECTION DETAILS SEE SHEET 15.

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

interfluve
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
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REGISTERED PROFESSIONAL ENGINEER MICHAEL P BURKE C 62986 EXP 6/30/12 CIVIL STATE OF CALIFORNIA

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NO.	DATE	REVISION	BY
		RECORD INFORMATION	
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SONOMA COUNTY WATER AGENCY

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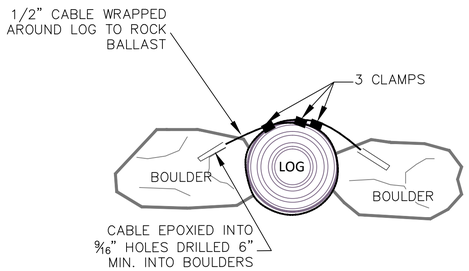
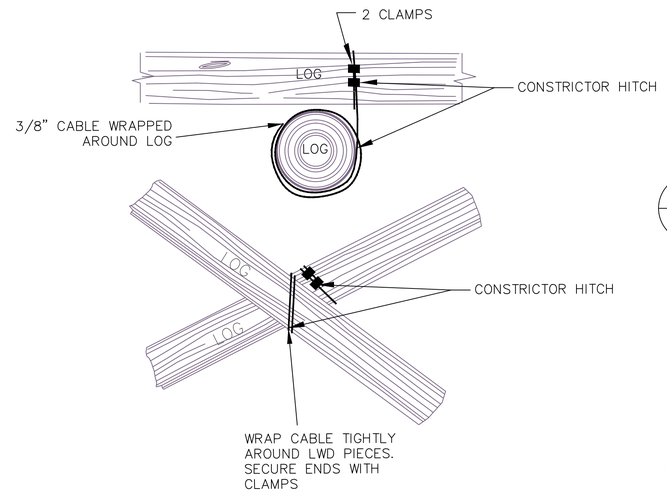
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
SLOPE PLACEMENT LWD DETAILS AND LOG JAM AND LWD SUMMARY TABLE

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 14 OF 15

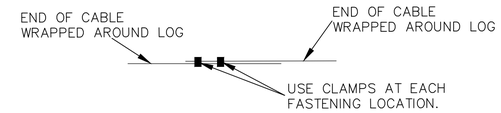
\\sd-data\Proj\special projects\Y2345_RBFTP_Demo_Project\Y2345_Record_Dwgs_DRY_CR_Phase_I_R.dwg



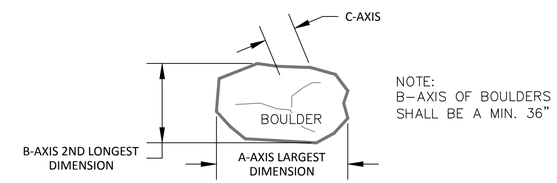
1 TYPICAL DETAIL
LOG CABLED TO BOULDERS
NTS



2 TYPICAL DETAIL
LOG CABLED TO LOG
NTS



4 TYPICAL DETAIL
CABLE SPLICE
NTS



3 TYPICAL DETAIL
BALLAST BOULDER
NTS

GENERAL NOTES

1. FINAL POSITIONING OF THE ANCHORED LOG STRUCTURES SHALL BE IN THE APPROXIMATE LOCATION AS SHOWN ON THE PLANS AND AS APPROVED BY THE BY THE OWNER. CABLING SITES AS APPROVED BY OWNER.
2. ANCHORED LOG STRUCTURES SHALL BE SECURED AS SHOWN. NO GAPS SHALL EXIST BETWEEN BOULDER AND CABLED LWD. NO SLACK SHALL EXIST IN CABLE FOLLOWING EPOXY SET. CABLE SHALL BOTTOM IN DRILLED EPOXY HOLE PER MANUFACTURER'S RECOMENDATION WITH NO SLACK.
3. DRILL HOLES IN SOLID ROCK AND AVOID ANY CRACKS OR FRACTURES. HOLES SHALL BE 9/16 INCH IN DIAMETER, DRILLED 6 INCHES, MINIMUM, INTO ROCK. PREPARE DRILL HOLES PER MANUFACTURER RECOMMENDATIONS FOR EPOXY INSTALLATION.
4. CABLE SHALL BE WRAPPED ONCE AROUND LOG BEFORE ENDS ARE INSERTED INTO THE DRILLED HOLES FILLED WITH EPOXY. SEE DETAIL. WIPE CABLE WITH CLEAN RAG SOAKED IN ACETONE TO REMOVE OILS AND GREASES PRIOR TO INSERTION INTO EPOXY FILLED HOLE. FILL DRILL HOLES ENOUGH TO ENSURE COMPLETE COVERAGE WITH EPOXY. INSERT CABLE INTO HOLE SO THAT END OF CABLE HITS THE BOTTOM OF THE HOLE. EXCESS EPOXY SHOULD COME OUT OF THE TOP OF THE HOLE AS CABLE IS SEATED IN DRILL HOLE. TEST STRENGTH OF BOND BY PICKING UP LOG AFTER MINIMUM CURE TIME RECOMMENDED BY THE EPOXY MANUFACTURER. IF BOND FAILS, REPLACE WITH A NEW HOLE AND CUT THE CONTAMINATED END OFF OF THE CABLE.
5. MINIMUM 2 CLAMPS PER CONNECTION. CLAMPS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION, SPACING AND DIAMETER FOR THE SIZE AND LOAD RATING OF THE CABLE BEING USED.

RECORD DRAWING
Contractor: BIOENGINEERING ASSOCIATES, INC.
By: _____ Signature
CHRIS ANDERSON Date: 12/18/12
Print Name

interfluve
1020 Wasco Street, Suite I
Hood River, OR 97031
541.386.9003
www.interfluve.com

REGISTERED PROFESSIONAL ENGINEER
MICHAEL P. BURKE
C 62986
EXP 6/30/12
CIVIL
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
R	12/18/12	RECORD DRAWING	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE : 5/18/12
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CHECKED : MB

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REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
LWD DETAILS – CABLING AND BALLASTING

FILE NAME:
CONTRACT NUMBER: 45-6.1-7 #2
DRAWING NUMBER:
SHEET 15 OF 15

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Appendix C

Sonoma County Water Agency

Dry Creek Habitat Enhancement Demonstration Project Phase II As-Built Record Drawings

(Van Alyea, Mascherini, Rued, Wallace, and Farrow Sites)

Dry Creek Habitat Enhancement Demonstrat

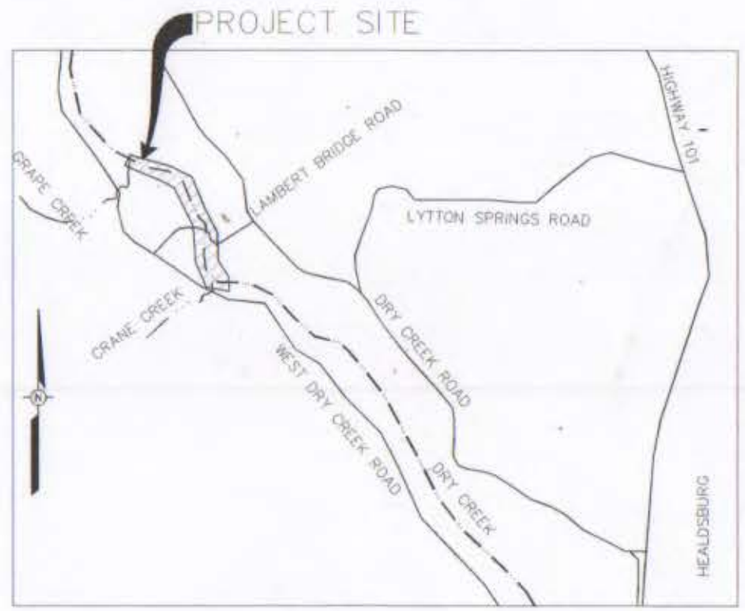
2014

SONOMA COUNTY WATER AGENCY
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

Final

SHEET NO.	TITLE
1	LOCATION MAP AND INDEX TO DRAWINGS
2	GENERAL NOTES AND LEGEND
3	EXISTING CONDITIONS
4	SITE PLAN OVERVIEW AND PLAN SHEET KEY
5	ACCESS AND STAGING OVERVIEW
6	ACCESS AND STAGING PLAN – UPPER HALF
7	ACCESS AND STAGING PLAN – LOWER HALF
8	MAIN CHANNEL PLAN AND PROFILE – STA. 324+00 TO 340+00
9	MAIN CHANNEL PLAN AND PROFILE – STA. 340+00 TO 346+00
10	MAIN CHANNEL PLAN AND PROFILE – STA. 357+00 TO 370+00
11	OFF-CHANNEL ENHANCEMENT AREA A – GRADING PLAN
12	OFF-CHANNEL ENHANCEMENT AREA A – LWD AND BANK TREATMENT PLAN
13	OFF-CHANNEL ENHANCEMENT AREA A – GRADING CROSS SECTIONS
14	WALLACE PROPERTY – GRADING PLAN
15	WALLACE PROPERTY – LWD AND BANK TREATMENT PLAN
16	WALLACE PROPERTY – GRADING CROSS SECTIONS
17	OFF-CHANNEL ENHANCEMENT AREA B – GRADING PLAN
18	OFF-CHANNEL ENHANCEMENT AREA B – LWD AND BANK TREATMENT PLAN
19	OFF-CHANNEL ENHANCEMENT AREA B – GRADING CROSS SECTIONS
20	OFF-CHANNEL ENHANCEMENT AREA C – GRADING PLAN
21	OFF-CHANNEL ENHANCEMENT AREA C – LWD AND BANK TREATMENT PLAN
22	OFF-CHANNEL ENHANCEMENT AREA C – GRADING CROSS SECTIONS
23	MASCHERINI PROPERTY – GRADING PLAN
24	MASCHERINI PROPERTY – LWD AND BANK TREATMENT PLAN
25	MASCHERINI PROPERTY – GRADING CROSS SECTIONS
26	SECTIONS – BOULDER FIELD AND RIFFLES
27	SECTIONS – LOG JAMS (1 OF 2)
28	SECTIONS – LOG JAMS (2 OF 2)
29	TYPICAL DETAILS – RIFFLES
30	TYPICAL DETAILS – BOULDER CLUSTER AND BOULDER FIELD
31	TYPICAL DETAILS – TYPE 1-3 BANK
32	TYPICAL DETAILS – TYPE 4 BANK (1 OF 4)
33	TYPICAL DETAILS – TYPE 4 BANK (2 OF 4)
34	TYPICAL DETAILS – TYPE 4 BANK (3 OF 4)
35	TYPICAL DETAILS – TYPE 4 BANK (4 OF 4)
36	TYPICAL DETAILS – FABRIC INSTALLATION
37	TYPICAL DETAILS – FES LIFT (1 OF 2)
38	TYPICAL DETAILS – FES LIFT (2 OF 2)
39	LWD DETAILS – LOG JAM AND FLOODPLAIN LWD
40	LWD DETAILS – BACKWATER CHANNEL AND POOL ENHANCEMENT
41	LWD DETAILS – SLOPE LWD AND LWD SUMMARY TABLE
42	TYPICAL SEQUENCE DETAILS – LOG JAM
43	TYPICAL SEQUENCE DETAILS – FLOODPLAIN AND POOL ENHANCEMENT LWD
44	TYPICAL SEQUENCE DETAILS – BACKWATER LWD
45	TYPICAL DETAILS – LWD CABLING AND BALLASTING
46	DETAILS – SDO SCOUR PROTECTION

LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

PROJECT RECORD DRAWING

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LOCATION MAP AND INDEX TO DRAWINGS

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-7p3
DRAWING NUMBER:
SHEET 1 OF 46

interflow

MICROFILM DATE
COORDINATION CHECK
ORIG. REL.
REV.
DATE
CIVIL
ELECT
MECH
TECH. MB
INSPECTION
DRAFTING
SURVEY

PLAN LEGEND

- EXISTING GRADE (EG)
- EXISTING CONTOURS (1 FT.)
- PROPOSED CONTOURS (1 FT.)
- EDGE OF WATER, MAY 2010 (TYP.)
- ACCESS CORRIDOR
- CONSTRUCTION EASEMENT (TYP.)
- OH — OH — OVERHEAD POWER LINE
- 233+00 DRY CREEK ALIGNMENT
- PARCEL BOUNDARY
- SILT FENCE
- x126.0 SPOT ELEVATION, FINISH GRADE
- POWER POLE
- INGRESS/EGRESS
- STORM DRAIN OUTFALL (SDO)
- (E) PUMP
- TEMPORARY DEWATERING WELL
- LARGE WOODY DEBRIS (LWD)
- LOG JAM
- POOL LWD
- SLOPE LWD
- SLASH
- BACKWATER CHANNEL LWD
- FLOODPLAIN LWD
- EXISTING STRUCTURES
- STAGING AREA
- EXISTING ROAD
- CONSTRUCTED RIFFLE
- BOULDER FIELD
- BOULDER CLUSTER
- WATER SURFACE ELEVATION
- SLOPE BREAK
- SUBGRADE EXCAVATION
- LIMIT OF FINSH GRADE
- TYPE 1 BANK STABILIZATION
- TYPE 2 BANK STABILIZATION
- TYPE 3 BANK STABILIZATION
- TYPE 4 BANK STABILIZATION
- COMPACTED SELECT SOIL
- COMPACTED SELECT FILL
- BACKFILL NATIVE SUBSTRATE

ABBREVIATIONS

CFS	CUBIC FEET PER SECOND	N.I.C.	NOT IN CONTRACT
CMP	CORRUGATED METAL PIPE	NTS	NOT TO SCALE
D.B.H.	DIAMETER BREAST HEIGHT	O.C.	ON CENTER
EG	EXISTING GRADE	OH	OVERHEAD
(E)	EXISTING	OHW	ORDINARY HIGH WATER
FES	FABRIC ENCAPSULATED SOIL LIFT	PDSCS	PUMP DISCHARGE SEDIMENT CONTROL SYSTEM
FG	FINISHED GRADE	SDO	STORM DRAIN OUTFALL
HDPE	HIGH DENSITY POLYETHYLENE	STA	STATION
I.E.	INVERT ELEVATION	(TYP)	TYPICAL
LWD	LARGE WOODY DEBRIS		
(N)	NEW		

TYPICAL SECTION AND DETAIL LETTERING SYSTEM

SECTIONS AND DETAILS CUT ON SHEET NO. 12 TO BE FOUND ON SHEET NO. 15: (A / 15) — SECTION OR DETAIL LETTER; SHEET ON WHICH IT APPEARS

ON SHEET NO. 15 THIS SECTION IS SHOWN AS: SECTION (A / 12) — SECTION OR DETAIL LETTER; SHEET FROM WHICH SECTION WAS CUT

SECTIONS AND DETAILS TO BE FOUND ON SAME SHEET AS CUT: (A / —)

TYPICAL SECTION IMPROVEMENTS (X / X)

TYPICAL SECTION–PROJECT GRADING — STA: XX+XX

GENERAL NOTES

1. UNITS: FEET
2. HORIZONTAL DATUM: CALIFORNIA STATE PLANE COORDINATES (NAD83) ZONE 2, US SURVEY FEET
3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD), 1988 US SURVEY FEET.
4. PROJECT BENCHMARKS:

PT	NORTHING	EASTING	ELEVATION	DESCRIPTIONS
DC-03	2001363.832	6296702.537	146.48	2 IN. DIA. BRASS DISK
DC-04	2001308.733	6295880.366	142.712	2 IN. DIA. BRASS DISK

5. STATIONING: ALL STATIONING REPRESENTS HORIZONTAL MEASUREMENT AT ALIGNMENT OF CONSTRUCTION.
6. ORIENTATION: RIGHT AND LEFT DIRECTIONS ARE FROM CENTERLINE LOOKING DOWNSTREAM.
7. UTILITIES: THE OWNER, TO THE BEST OF ITS ABILITY, HAS DELINEATED ON THE DRAWINGS ALL UTILITY INSTALLATIONS TO BE ENCOUNTERED WITHIN THE LIMITS OF WORK. SUCH INFORMATION IS BASED UPON INFORMATION FURNISHED TO OWNER BY THE UTILITY OWNERS, AND THE OWNER DOES NOT EITHER EXPRESSLY OR BY IMPLICATION GUARANTEE THAT UTILITY INSTALLATIONS WILL BE FOUND AT THE LOCATIONS OR DEPTHS INDICATED. THE OWNER ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE INFORMATION SHOWN OR THE INADVERTENT OMISSION OF ANY SUCH INFORMATION.
8. PARCEL DATA: OBTAINED FROM OWNER ON FEBRUARY 16, 2012.
9. TOPOGRAPHY: BASED ON LIDAR MAPPING COLLECTED NOVEMBER 2008 BY PICTOMETRY, INC. SUPPLEMENTED WITH GROUND SURVEY BY INTER-FLUVE, INC. COLLECTED MAY 2010 AND OWNER SEPTEMBER 2012.

PROJECT RECORD DRAWING

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

GENERAL NOTES AND LEGEND

FILE NAME: 7345
CONTRACT NUMBER: 45-61-743
DRAWING NUMBER:
SHEET 2 OF 46

MICROFILM DATE | COORDINATION CHECK | ORIG. REL. | REV | DATE | CIVIL | ELECT | MECH | TECH | WR | INSPECTION | OPERATIONS | SURVEY

SEGHESIO
SEGHESIO
MASCHERINI
MASCHERINI
RUED
RUED
RUED
DRY CREEK ROAD
(E) PUMP
(E) PUMP
(E) PUMP
(E) PUMP
DRY CREEK ALIGNMENT
LAMBERT BRIDGE
(E) SDO
(E) SDO
(E) SDO
(E) SDO
DRY CREEK
PHASE 1 ENHANCEMENT – N.I.C.
KIGHT
KIGHT
GRANT CREEK
VAN ALYEA
VAN ALYEA
PASSALACQUA
LAMBERT BRIDGE ROAD
DRY CREEK VINEYARDS
DRY CREEK VINEYARDS
WALLACE
FARROW
PARCEL BOUNDARY
OVERHEAD POWER LINE (TYP.)
LAMBERT BRIDGE ROAD
UPTON
WOLLMER
GRANT CREEK
W. DRY CREEK ROAD
SCALE IN FEET

PROJECT RECORD DRAWING

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

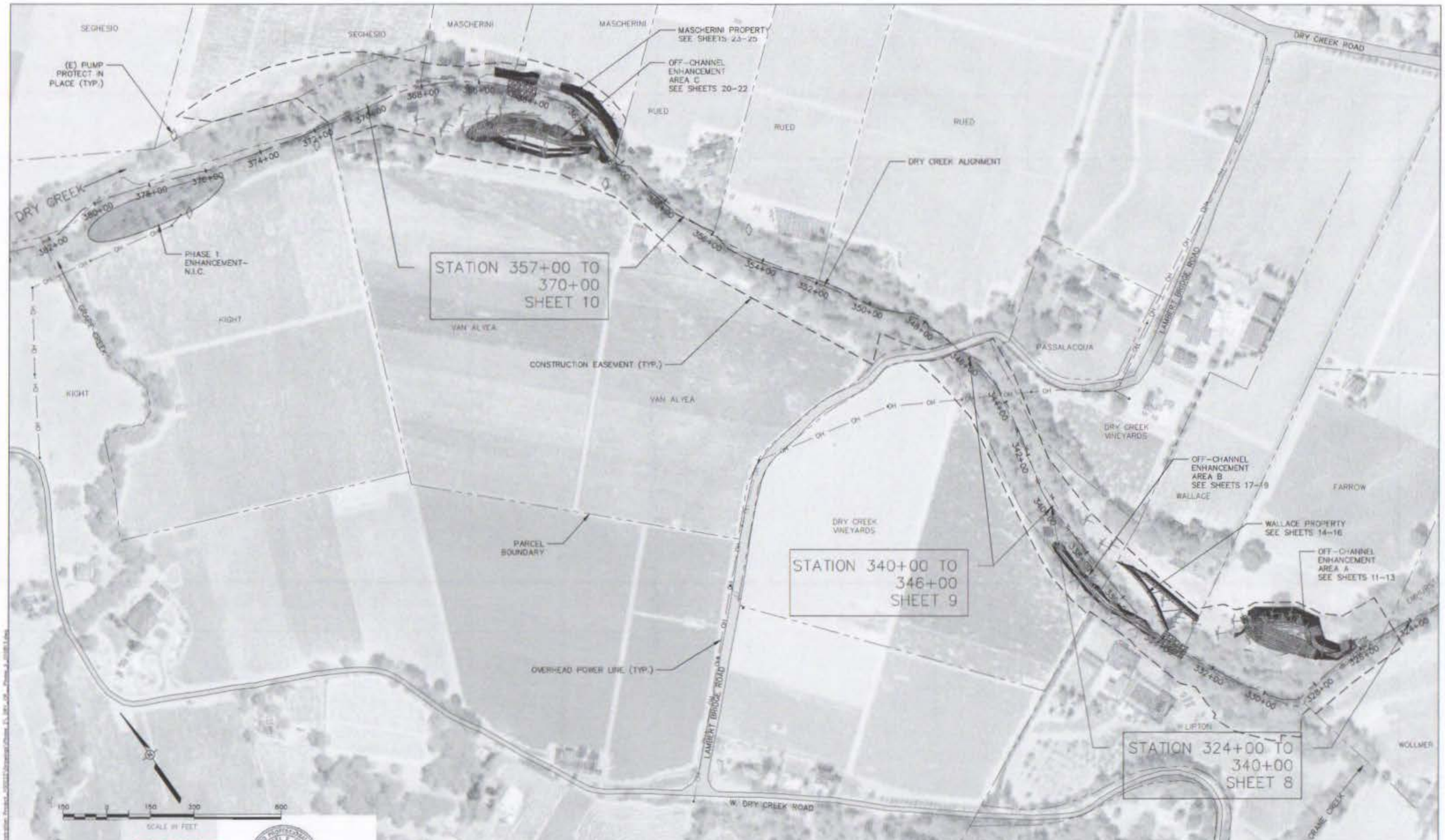
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

EXISTING CONDITIONS

FILE NAME: 7345
CONTRACT NUMBER: 45-61-763

DRAWING NUMBER:

SHEET 3 OF 46



PROJECT
RECORD
DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

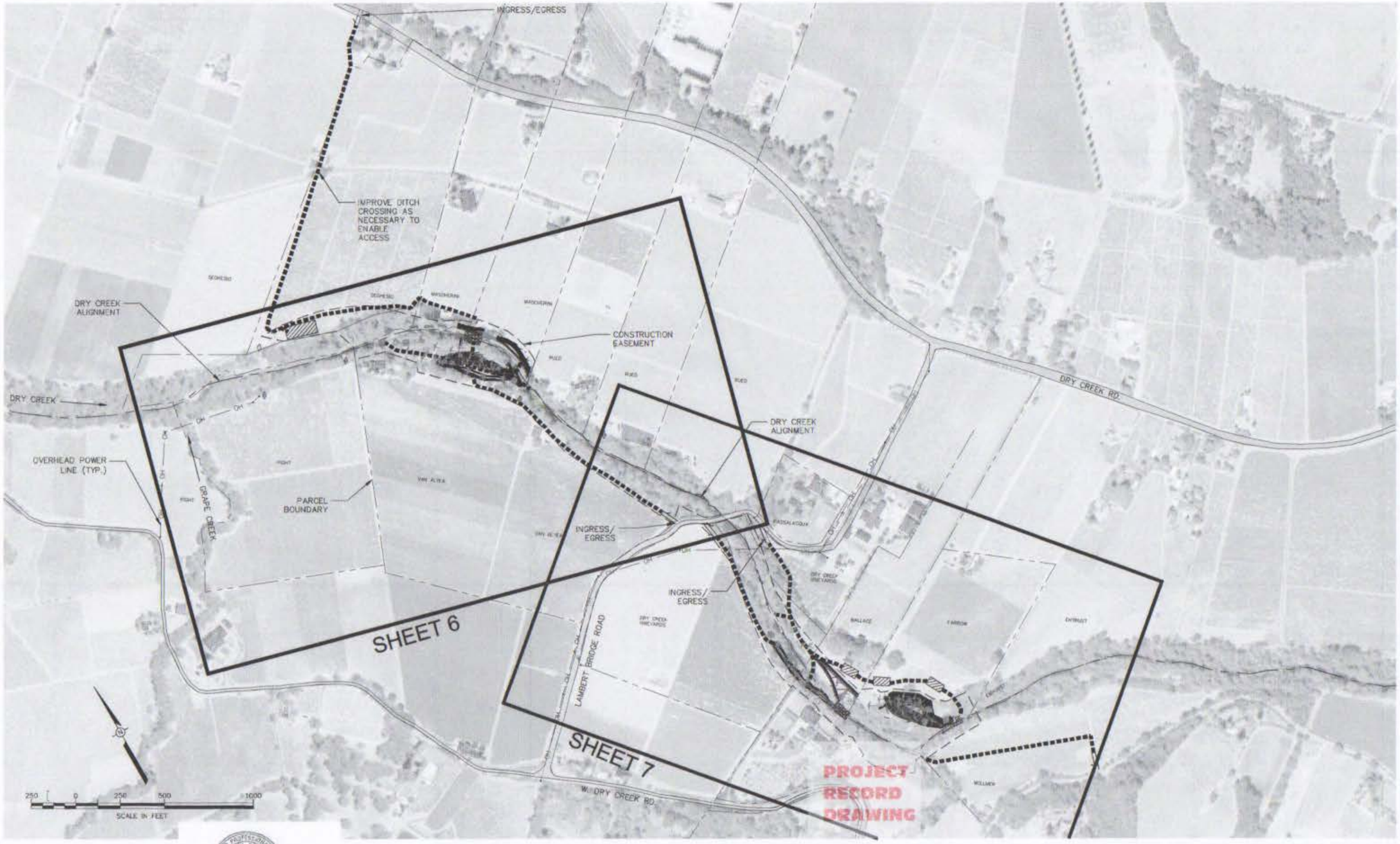
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

SITE PLAN OVERVIEW AND PLAN SHEET KEY

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-743

DRAWING NUMBER:

SHEET 4 OF 46



NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

ACCESS AND STAGING OVERVIEW

FILE NAME: T345
CONTRACT NUMBER: 45-E1-763

DRAWING NUMBER:

SHEET 5 OF 46

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

Interflow

DRY CREEK ALIGNMENT

(E) PUMP

CONFIRM FINAL EXTENTS OF STAGING AREA WITH OWNER AT TIME OF CONSTRUCTION

STAGING AREA

SEGHESIO

MASCHERINI

MASCHERINI

DRY CREEK

384+00

382+00

380+00

378+00

376+00

374+00

372+00

370+00

368+00

MASCHERINI PROPERTY

(E) PUMP

PHASE I ENHANCEMENT N.I.C.

CONSTRUCTION EASEMENT

OFF-CHANNEL ENHANCEMENT AREA C

RUED

OVERHEAD POWER LINE (TYP.)

NO GROUND DISTURBANCE

GRAPE CREEK

KIGHT

KIGHT

STAGING AREA WITHIN LIMITS OF GRADING

RUED

(E) PUMP

VAN ALYEA

PARCEL BOUNDARY

PROJECT EXISTING PAVED ROAD. REPAIR/REPLACE DAMAGED AREAS IN KIND.

(E) SDD

VAN ALYEA

INGRESS/EGRESS (TYP.)

(E) SDD

LAMBERT BRIDGE ROAD

PROJECT RECORD DRAWING

NOTES:
1. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

100 0 100 200 400
SCALE IN FEET

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/18/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: RCP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

ACCESS AND STAGING PLAN – UPPER HALF

FILE NAME: 7345
CONTRACT NUMBER: 40-0.1-7#3

DRAWING NUMBER:

SHEET 6 OF 46

DRY CREEK ALIGNMENT

PASSALACQUA

DRY CREEK VINEYARDS

FARROW

ENTRUST

INGRESS/EGRESS (TYP.)

LIMB TREES AS REQUIRED FOR ACCESS DEVELOPMENT APPROVED BY OWNER

WALLACE

DRY CREEK

ACCESS CORRIDORS FOR BOULDER CLUSTERS TO BE CONFIRMED AT TIME OF CONSTRUCTION, APPROVED BY OWNER

STAGING AREAS

WALLACE PROPERTY

EMHURST

OPTIONAL ACCESS CORRIDOR FOR USE IN CONTROL OF CRANE CREEK FLOWS ONLY

CONSTRUCTION EASEMENT

OVERHEAD POWER LINE (TYP.)

DEVELOPMENT OF SINGLE ACCESS RAMP THIS SIDE WITH OWNER AND LANDOWNER APPROVAL

DRY CREEK VINEYARDS

LAMBERT BRIDGE ROAD

OFF-CHANNEL ENHANCEMENT AREA B

INGRESS/EGRESS (TYP.)

WOLLMER

PARCEL BOUNDARY

LIPTON

OFF-CHANNEL ENHANCEMENT AREA A

CRANE CREEK

W. DRY CREEK RD.

NOTES:
1. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

100 0 100 200 400
SCALE IN FEET

PROJECT RECORD DRAWING

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BOWE C 62986 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1.	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
DESIGNED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

ACCESS AND STAGING PLAN – LOWER HALF

FILE NAME: 7345
CONTRACT NUMBER: 45-81-7#3

DRAWING NUMBER:

SHEET 7 OF 46

STATION 338+00 TO 340+00
INSTALL 1 BOULDER CLUSTER
LOCATIONS AS DIRECTED BY OWNER (1/30)

actual location of boulder clusters with additional boulders.

new actual Installed Location of LWD's

WALLACE PROPERTY
SEE SHEETS 14-16

BANK STABILIZATION TYPE 2 (2/31)

BANK STABILIZATION TYPE 3 (3/31) (4/31)

(1/41) SLOPE LWD, TYP.

OFF-CHANNEL ENHANCEMENT AREA B
SEE SHEETS 17-19

(2/40) POOL ENHANCEMENT LWD, TYP.

(N)CONSTRUCTED RIFFLE (TYP.) (1/29)

(N) OUTFALL SCOUR PROTECTION (1/46)

OFF-CHANNEL ENHANCEMENT AREA A
SEE SHEETS 11-13

(E) SDO

BANK STABILIZATION TYPE 1 (1/31)

BACKWATER CHANNEL LWD (TYP.) (1/40)

FLOODPLAIN LWD, TYP. (2/39)

DRY CREEK ALIGNMENT

EDGE OF WATER, MAY 2010 (TYP.)

CONSTRUCTION EASEMENT (TYP.)

DRY CREEK

(N) BOULDER FIELD (TYP.) (4/39)

LOG JAM, TYP. (1/39)

CRANE CREEK

SCALE IN FEET

NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY; REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.
3. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.
4. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

Drawing for new location

BOULDER CLUSTER, APPROXIMATE LOCATION (TYP.)

EXISTING THALWEG PROFILE

EXISTING ALIGNMENT PROFILE

OFF-CHANNEL AREA B OUTLET I.E. = 111.5

STA: 333+90 I.E. 117.0

STA: 333+02 I.E. 115.0

STA: 334+00 I.E. 114.5

DRY CREEK

CRANE CREEK CONFLUENCE

OFF-CHANNEL AREA A OUTLET I.E. = 108.0

BOULDER FIELD STA: 325+50

333+05 new pool

120

110

340+00 339+00 338+00 337+00 336+00 335+00 334+00 333+00 332+00 331+00 330+00 329+00 328+00 327+00 326+00 325+00 324+00

MAIN CHANNEL PROFILE

SCALE IN FEET 5 50

PROJECT RECORD DRAWING

original

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
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1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
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DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MAIN CHANNEL PLAN AND PROFILE
– STA. 324+00 TO 340+00

FILE NAME: 7345
CONTRACT NUMBER: 45-61-723
DRAWING NUMBER:
SHEET 8 OF 46

STATION 338+00 TO 340+00
INSTALL 1 BOULDER CLUSTER
LOCATIONS AS DIRECTED BY OWNER

(N) OUTFALL SCOUR PROTECTION

OFF-CHANNEL ENHANCEMENT
AREA A
SEE SHEETS 11-13

CONSTRUCTION EASEMENT (TYP.)

WALLACE PROPERTY
SEE SHEETS 14-16

(E) SDO

BANK STABILIZATION
TYPE 1

BACKWATER CHANNEL
LWD (TYP.)

BANK
STABILIZATION
TYPE 2

BANK
STABILIZATION
TYPE 3

DRY CREEK

3.5 FT.
TREE
CLUMP

SLOPE
LWD, TYP.

(N) BOULDER FIELD (TYP.)

OFF-CHANNEL ENHANCEMENT
AREA B
SEE SHEETS 17-19

12 IN.
TREE

FLOODPLAIN
LWD, TYP.

POOL
ENHANCEMENT
LWD, TYP.

ACESS
CORRIDORS

REMOVE ONE 12 IN. DBH ALDER,
PROTECT ALL OTHER EXISTING
TREES, FIT RIFFLE CUTOFF
BETWEEN TREES TO REMAIN

LOG JAM, TYP.

RIFFLE CUTOFF
CENTERLINE

DRY CREEK
ALIGNMENT

(N)CONSTRUCTED
RIFFLE (TYP.)

EDGE OF WATER,
MAY 2010 (TYP.)

CRANE CREEK

SCALE IN FEET

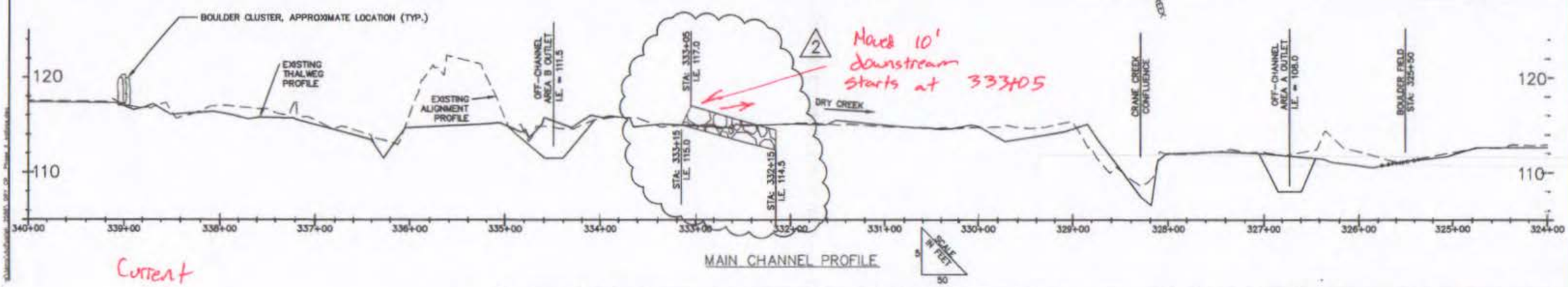
NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.

2. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.

3. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

4. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.



Move 10' downstream starts at 333+05

Current

MAIN CHANNEL PROFILE

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/10/14	FIELD ADJUST	

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

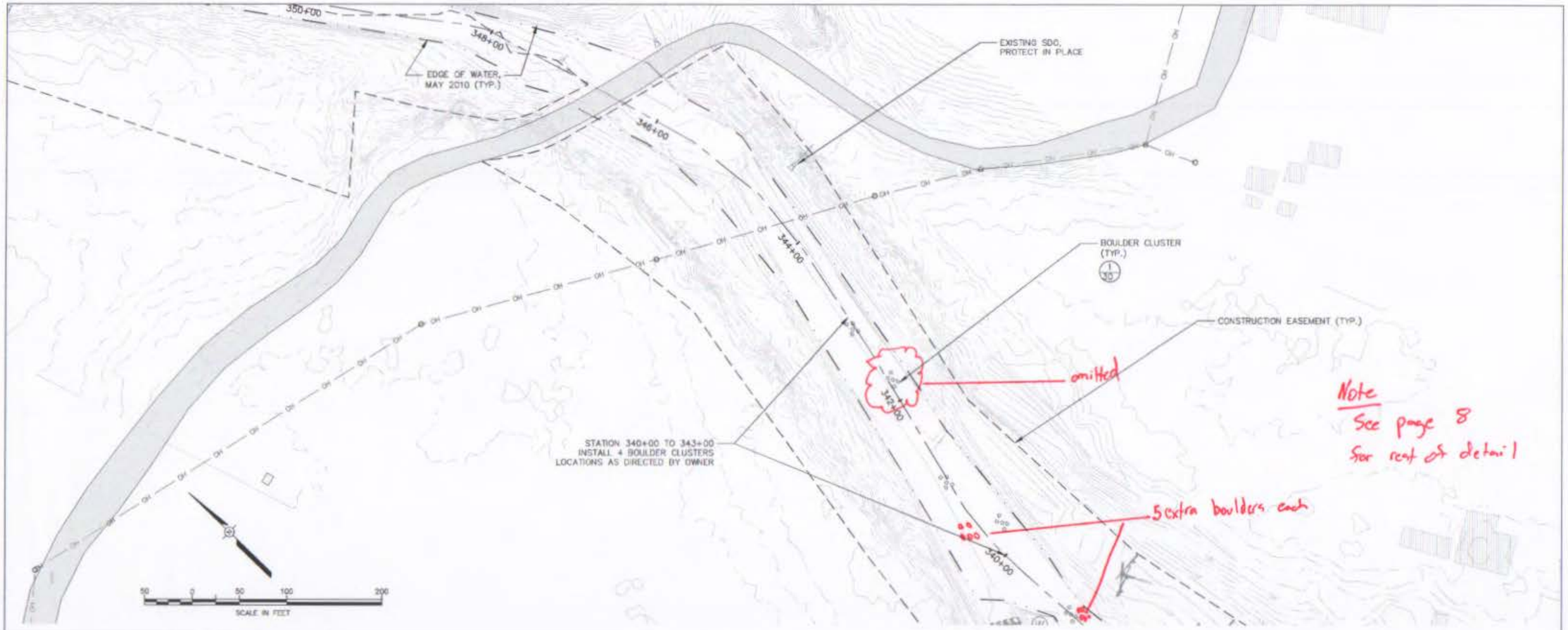
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

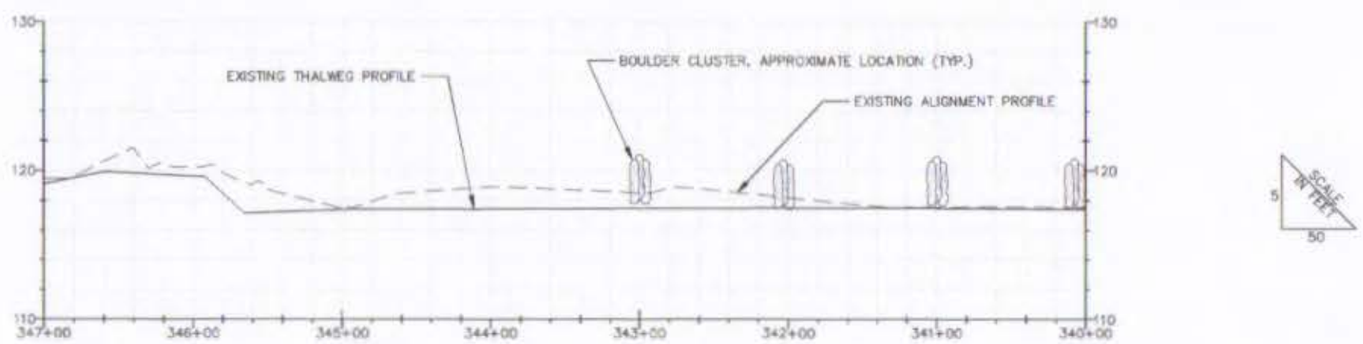
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MAIN CHANNEL PLAN AND PROFILE
– STA. 324+00 TO 340+00

FILE NAME: 7345
CONTRACT NUMBER: 40-81-763
DRAWING NUMBER:
SHEET 8 OF 46



Note
See page 8
for rest of detail

NOTES:
1. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE DETERMINED AT TIME OF CONSTRUCTION.



MAIN CHANNEL PROFILE

PROJECT RECORD DRAWING

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

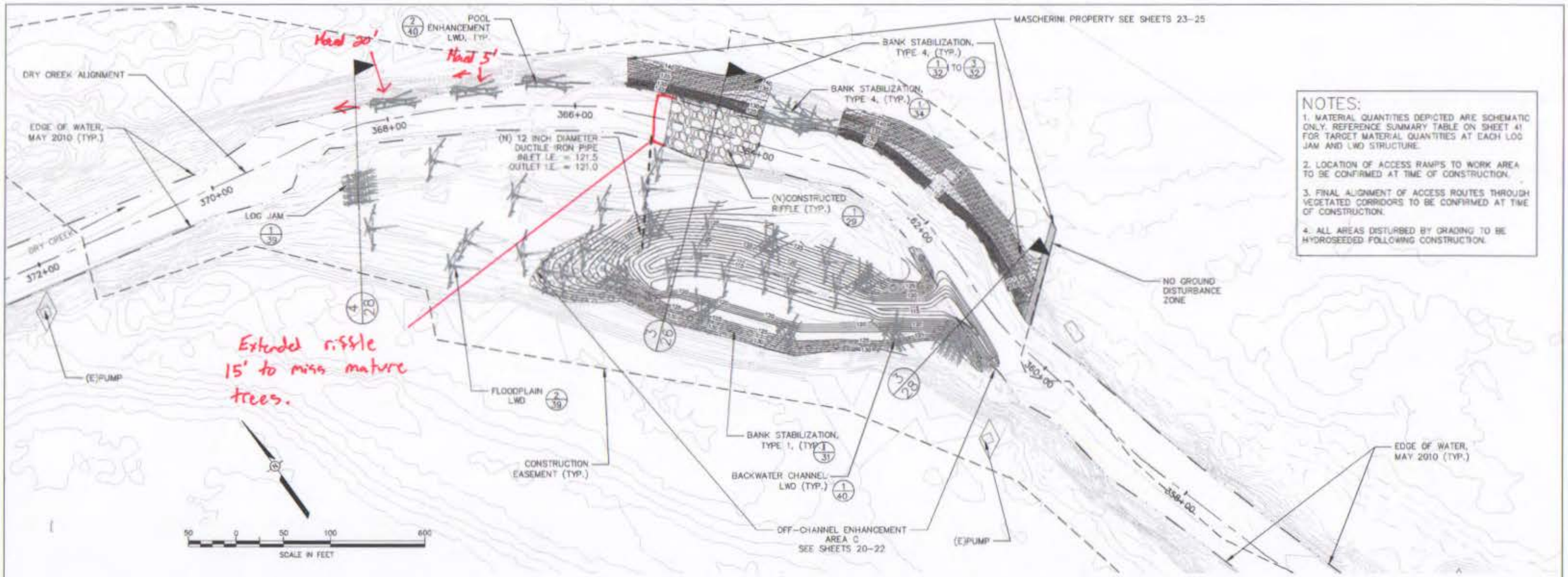
SONOMA COUNTY WATER AGENCY

SCALE
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MAIN CHANNEL PLAN AND PROFILE – STA. 340+00 TO 346+00

FILE NAME: 7345
CONTRACT NUMBER: 45-81-763
DRAWING NUMBER:
SHEET 9 OF 46



NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.
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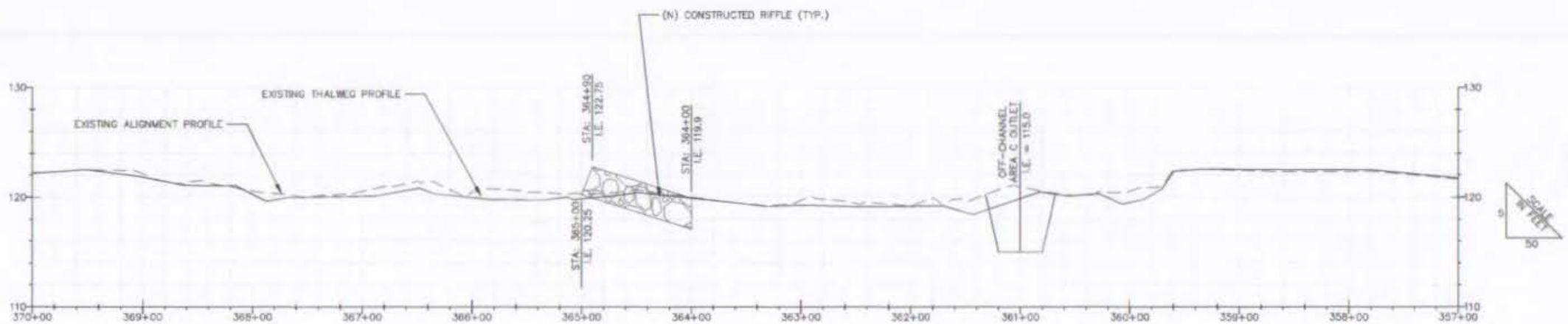
4. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

ORIGINAL



MAIN CHANNEL PROFILE

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
DESIGNED: MB

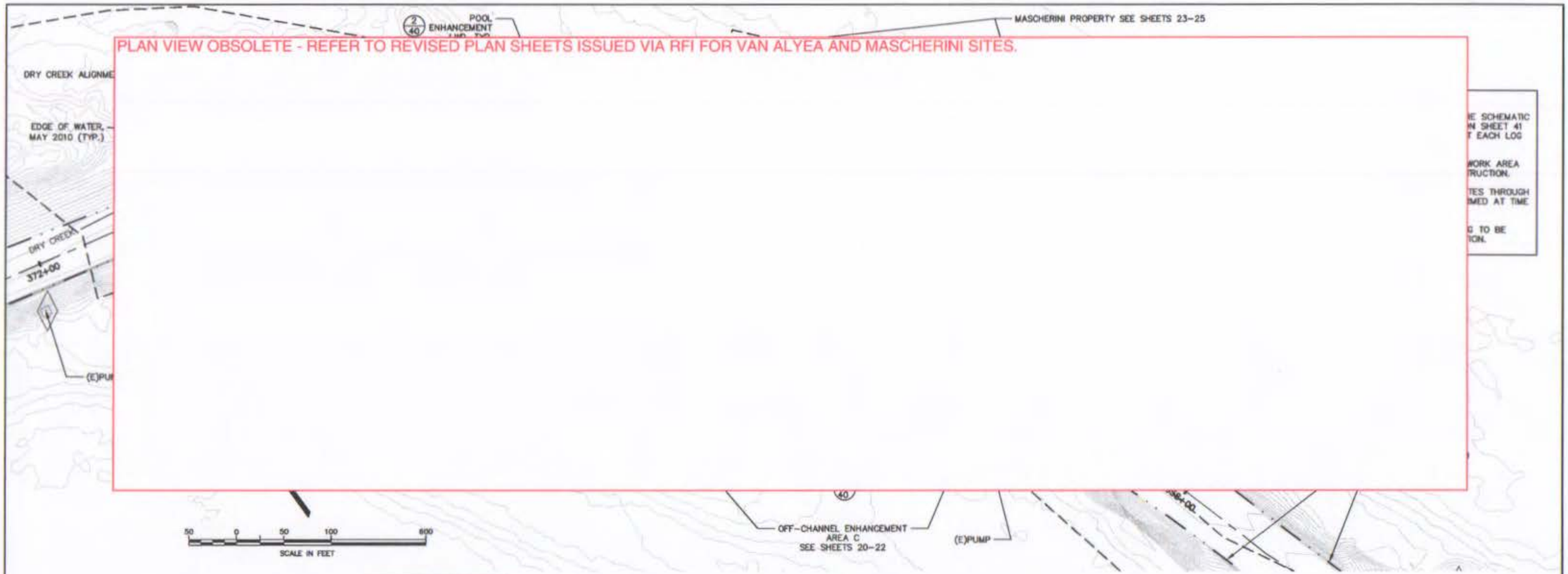
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MAIN CHANNEL PLAN AND PROFILE
– STA. 357+00 TO 370+00

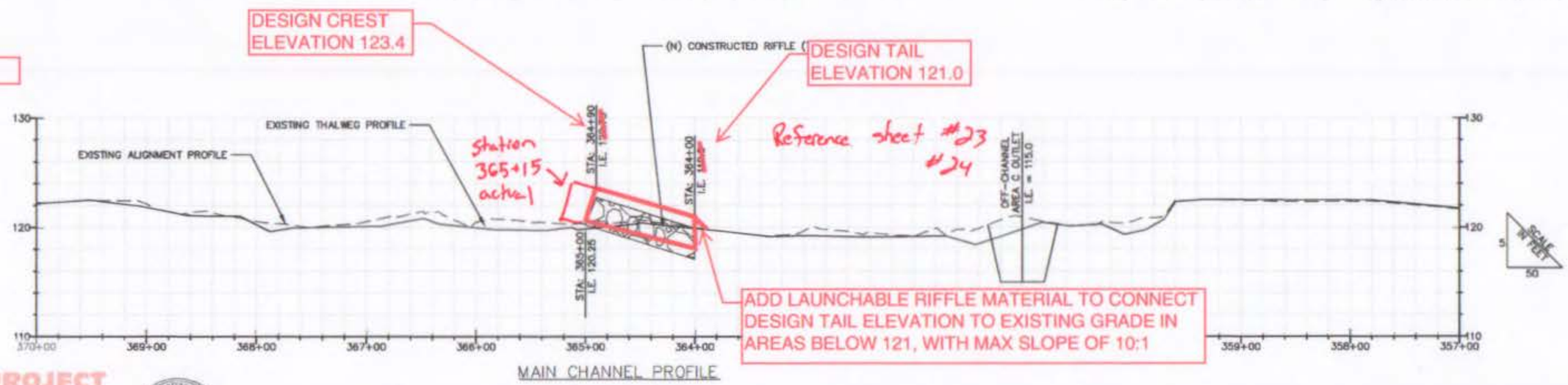
FILE NAME: 7345
CONTRACT NUMBER: 45-0.1-743
DRAWING NUMBER:
SHEET 10 OF 46

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

PLAN VIEW OBSOLETE - REFER TO REVISED PLAN SHEETS ISSUED VIA RFI FOR VAN ALYEA AND MASCHERINI SITES.



CURRENT



MAIN CHANNEL PROFILE

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	

SONOMA COUNTY WATER AGENCY

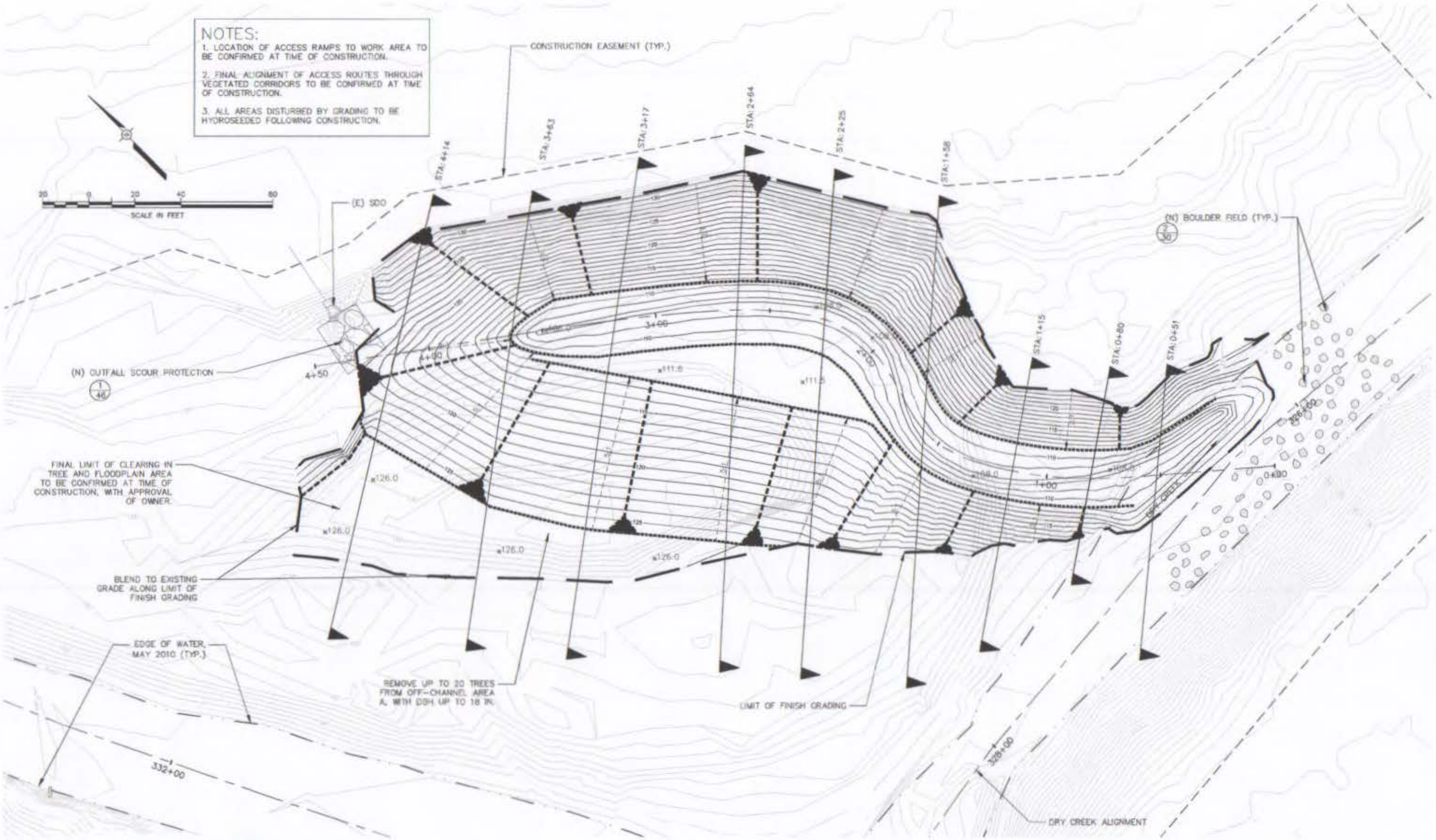
SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
MAIN CHANNEL PLAN AND PROFILE
– STA. 357+00 TO 370+00

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-763
DRAWING NUMBER:
SHEET 10 OF 46

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.
2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.
3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.



PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA A
- GRADING PLAN

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7@3
DRAWING NUMBER:
SHEET 11 OF 46

CONSTRUCTION EASEMENT (TYP.)

ADD FP LWD SHOWN IN MAGENTA (TYP.)

DELETE FP LWD SHOWN IN GREEN (TYP.)

RETAIN STRUCTURES SHOWN IN GRAY OR RED.)

Extended riffle material from out flow to backwater

BACKWATER CHANNEL LWD (TYP.) (1/40)

USE 1 FP LWD TO COVER GAP BETWEEN LOG JAM AND EXISTING VEGETATION. PRESERVE VEGETATION

USE 1 FP LWD TO ROUGHEN OVERBANK BETWEEN LOG JAMS

USE 1 FP LWD TO ROUGHEN FLOW PATH BEHIND LOG JAM INTO EXISTING VEGETATION. PRESERVE VEGETATION

20 0 20 40 80

SCALE IN FEET

BANK STABILIZATION TYPE 1 (1/31)

(N) OUTFALL SCOUR PROTECTION (1/46)

LOG JAM, TYP. (1/39)

(2/30) (N) BOULDER FIELD (TYP.)

additional Boulders

0+00

3+00

4+50

2+00

1+00

0+00

Slope 3:1

DRY CREEK

PACK SLASH BENEATH LWD IN CHANNEL BOTTOM, TYP.

FLOODPLAIN LWD (TYP.) (2/39)

LIMIT OF FINISH GRADING

(3/27)

(2/27)

(1/26)

(1/27)

Omitted

Omitted Boulder

Slope 4:1

DRY CREEK ALIGNMENT

FINAL LIMIT OF CLEARING IN TREE AND FLOODPLAIN AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION, WITH APPROVAL OF OWNER. REMOVE UP TO 20 TREES WITH DBH UP TO 18 IN.

USE 3 FP LWD TO MODERATE FLOW INTO OVERFLOW CHANNEL. PRESERVE VEGETATION.

USE 1 FP LWD TO COVER GAP BETWEEN LOG JAM AND EXISTING VEGETATION

332+00

328+00

EDGE OF WATER, MAY 2010 (TYP.)

NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.

2. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

Burke_CA.jpg

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION 11/11/13 ALL ADJUSMENTS TO BW A ON SINGLE SHEET	

SONOMA COUNTY WATER AGENCY

SCALE:

DATE: 11/14/2012

DRAWN: REP

DESIGNED: MB

REVIEWED:

REVISED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

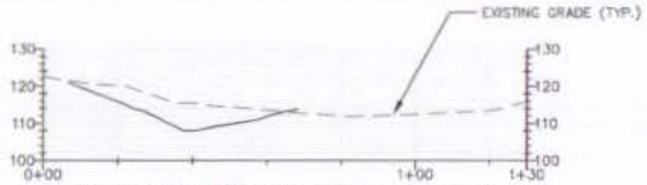
OFF-CHANNEL ENHANCEMENT AREA A – LWD AND BANK TREATMENT PLAN

FILE NAME: 7345

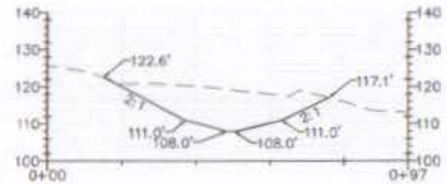
CONTRACT NUMBER: 46-8.1-7#3

DRAWING NUMBER:

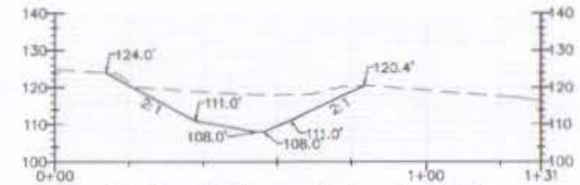
SHEET 12 OF 56



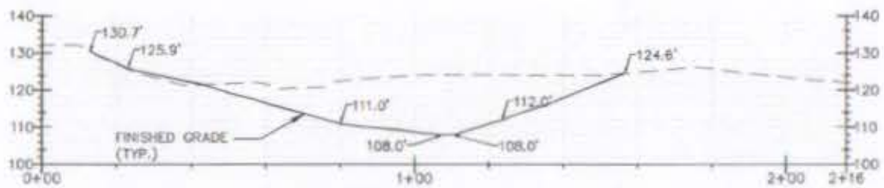
Off-Channel Enhancement Area A – Sta 0+51



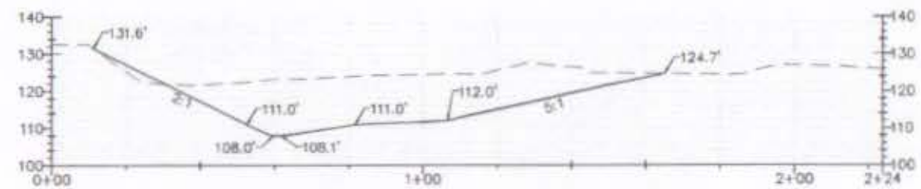
Off-Channel Enhancement Area A – Sta 0+80



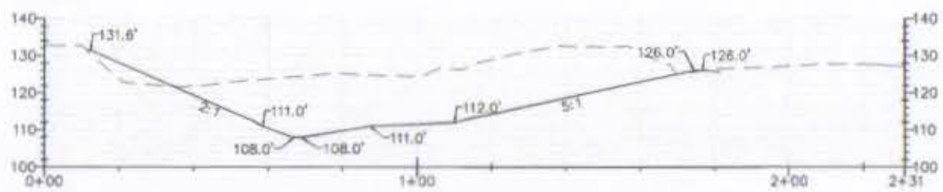
Off-Channel Enhancement Area A – 1+15



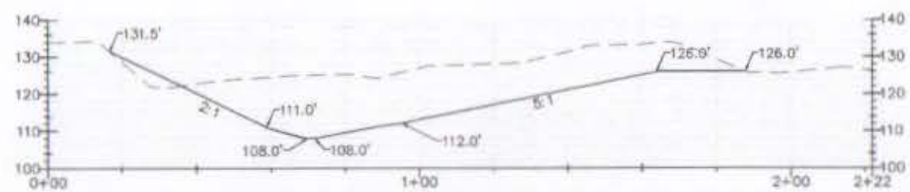
Off-Channel Enhancement Area A – 1+58



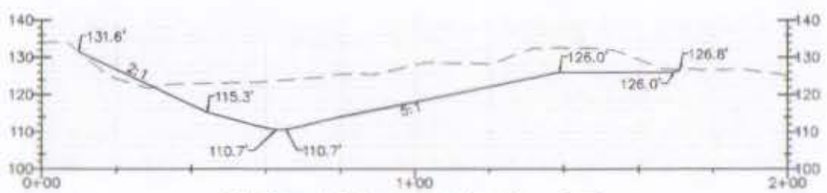
Off-Channel Enhancement Area A – 2+25



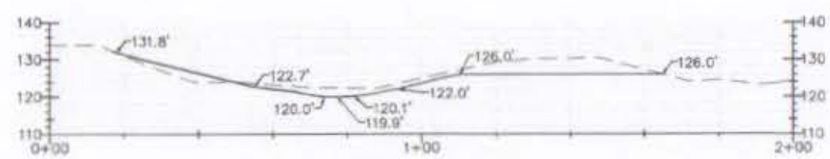
Off-Channel Enhancement Area A – 2+64



Off-Channel Enhancement Area A – 3+17



Off-Channel Enhancement Area A – 3+63



Off-Channel Enhancement Area A – 4+14

NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA A
– GRADING CROSS SECTIONS

FILE NAME: 7345
CONTRACT NUMBER: 45-E1-763
DRAWING NUMBER:
SHEET 13 OF 46

FINISH GRADING SHOWN. GRADING FOR TYPE 2 AND TYPE 3 BANKS EXTENDS BELOW FINISH GROUND SURFACE. SEE GRADING SECTIONS, SHEET 16.

WALLACE PROPERTY ALIGNMENT

STA: 0+25

STA: 0+75

STA: 1+25

STA: 1+75

STA: 2+40

STA: 2+90

0+00

1+00

2+00

3+00

3+50

CONSTRUCTION EASEMENT (TYP.)

24.0

24.0

23.4

23.1

EDGE OF WATER, MAY 2010 (TYP.)

LIMIT OF FINISH GRADING

PRESERVE EXISTING TREES NEAR END OF GRADING. CONFIRM GRADING TIE-IN AT TIME OF CONSTRUCTION

EDGE OF WATER, MAY 2010 (TYP.)

DRY CREEK

334+00

LIMIT OF FINISH GRADING, CHANNEL ENHANCEMENT AREA B

DRY CREEK ALIGNMENT

15 0 15 30 60

SCALE IN FEET

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED WITH OWNER AND LANDOWNER AT TIME OF CONSTRUCTION.
2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.
3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

original

PROJECT RECORD DRAWING

C 43986 REGISTERED PROFESSIONAL ENGINEER MICHAEL P. MINER CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:

DATE: 1/23/2013

DRAWN: REP

CHECKED: MB

REVIEWED

REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

WALLACE PROPERTY – GRADING PLAN

FILE NAME: T345

CONTRACT NUMBER: 45-8.1-743

DRAWING NUMBER:

SHEET 14 OF 46

FINISH GRADING SHOWN. GRADING FOR TYPE 2 AND TYPE 3 BANKS EXTENDS BELOW FINISH GROUND SURFACE. SEE GRADING SECTIONS, SHEET 16.

WALLACE PROPERTY ALIGNMENT

CONSTRUCTION EASEMENT (TYP.)

EDGE OF WATER, MAY 2010 (TYP.)

LIMIT OF FINISH GRADING

PRESERVE EXISTING TREES NEAR END OF GRADING. CONFIRM GRADING TIE-IN AT TIME OF CONSTRUCTION

EDGE OF WATER, MAY 2010 (TYP.)

DRY CREEK

LIMIT OF FINISH GRADING, CHANNEL ENHANCEMENT AREA B

DRY CREEK ALIGNMENT

SCALE in FEET

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED WITH OWNER AND LANDOWNER AT TIME OF CONSTRUCTION.

2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

original

PROJECT RECORD DRAWING

1	03/26/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

DATE 1/23/2013

SCALE 1"=20'

DESIGNED KG

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

WALLACE PROPERTY – GRADING PLAN

SHEET 14 OF 46

CONFORM TYPE 2 BANK ALIGNMENT DOWNSTREAM OF STATION 2+00 FOLLOWING LOG JAM CONSTRUCTION WITH DESIGNER INPUT

DESIGN GRADES AND LINES FOR TYPE 3 BANK MATCH EXISTING GROUND AND DESIGN INTENT

FINISH GRADING SHOWN. GRADING FOR TYPE 2 AND TYPE 3 BANKS EXTENDS BELOW FINISH GROUND SURFACE. SEE GRADING SECTIONS, SHEET 16.

WALLACE PROPERTY ALIGNMENT

DESIGN GRADES AND LINES FOR TYPE 2 BANK UPSTREAM OF STATION 2+00 MATCH EXISTING GROUND AND DESIGN INTENT

CONSTRUCTION EASEMENT (TYP.)

STA: 0+25 | 0+00

STA: 0+75

STA: 1+25

1+00

STA: 1+75 |

STA: 2+40

STA: 2+90

2+00

3+00

3+50

1/2 ton rip-rap and gravel

1/2 ton rip-rap and gravel

Keyed with riffle sheets #16 + #31

EDGE OF WATER, MAY 2010 (TYP.)

added riffle material

LWD 2 snags - 2 logs

AS BUILT 2013

DELETE FP LWD SHOWN IN GREEN (TYP.)

ADD FP LWD SHOWN IN MAGENTA (TYP.)

DRY CREEK

334+00

DRY CREEK ALIGNMENT

15 0 15 30 60

SCALE IN FEET

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED WITH OWNER AND LANDOWNER AT TIME OF CONSTRUCTION.

2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

BUILD LOG JAM IN APPROXIMATELY SAME LOCATION, UPSTREAM BUT ADJACENT TO TREES TO BE PRESERVED. ADJUST CONFIGURATION WITH DESIGNER INPUT

AREA OF EXPANSION FOR LOG JAM 4 RECOMMEND NOT EXCAVATING FULLY UNTIL LOG JAM CONSTRUCTION COMMENCES

PRESERVE EXISTING MATURE WILLOW AND LEANING ALDER

USE 1 FP LWD TO COVER GAP BETWEEN LOG JAM AND TYPE 3 BANK

CRITICAL: PRESERVE EXISTING MATURE WILLOW AND LEANING ALDER, AND ASSOCIATED ROOTS

USE 1 FP LWD TO MODERATE FLOW THROUGH OVERBANK CHANNEL BEHIND LOG JAM COVER GAP BETWEEN VEGETATION AND LOG JAM. PRESERVE VEGETATION.

Burke_CA.jpg

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

interflow

NO.	DATE	REVISION	BY
		RECORD INFORMATION 11/11/13 ALL ADJUSMENTS TO WALLACE ON SINGLE SHEET	

SONOMA COUNTY WATER AGENCY

SCALE:

DATE: 11/14/2012

DRAWN: REP

CHECKED: MB

REVIEWED

REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

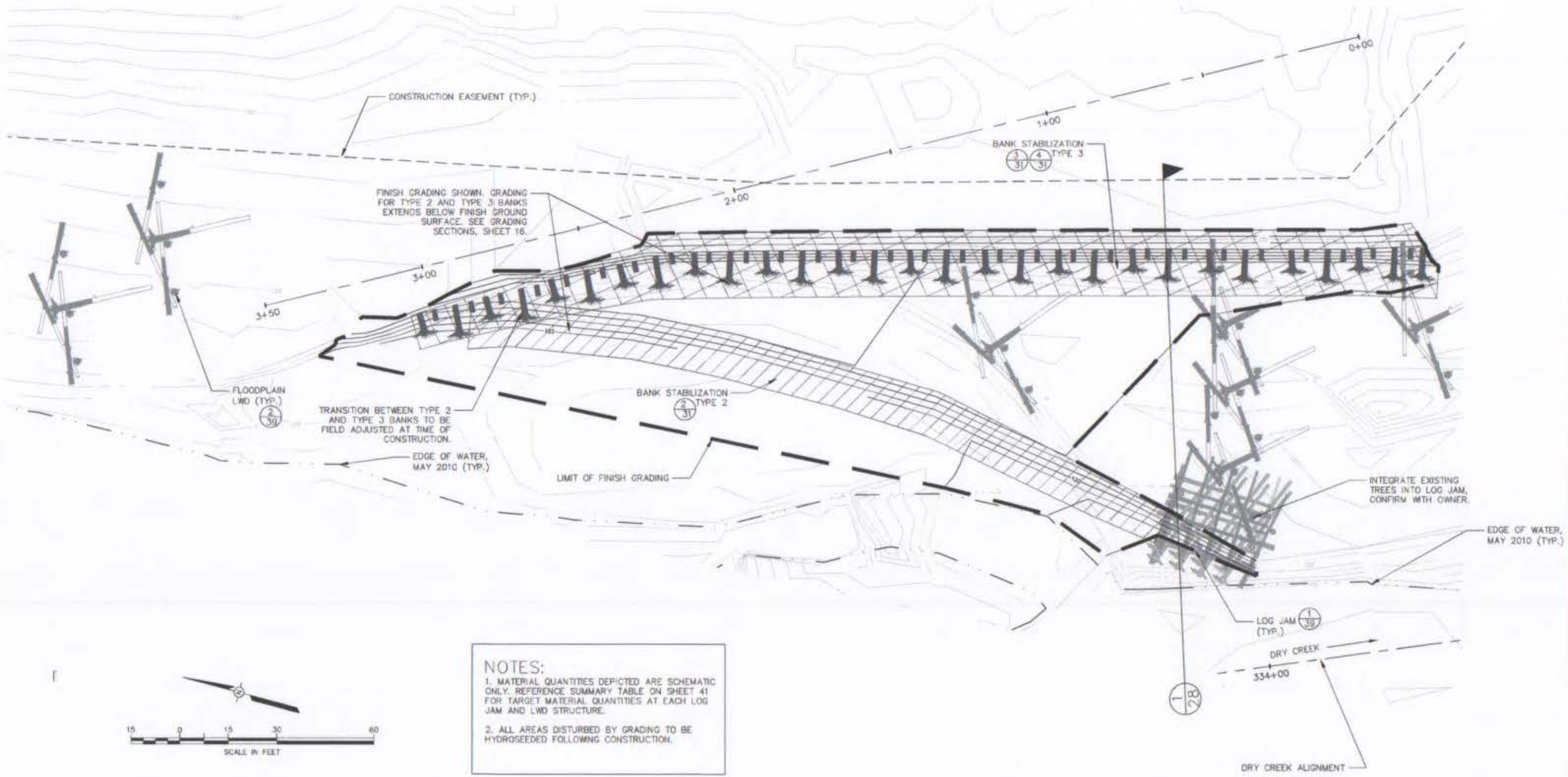
WALLACE PROPERTY – GRADING PLAN

FILE NAME: 7345

CONTRACT NUMBER: 45-8.1-7#3

DRAWING NUMBER:

SHEET 14 OF 56



NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.

2. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

original

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

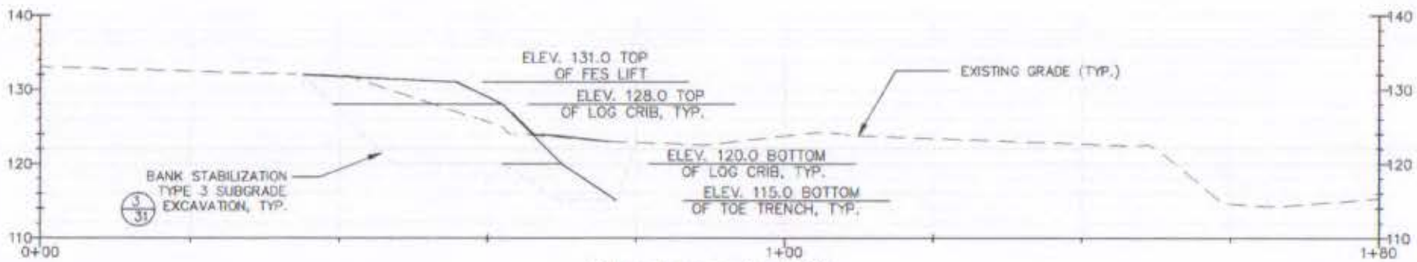
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

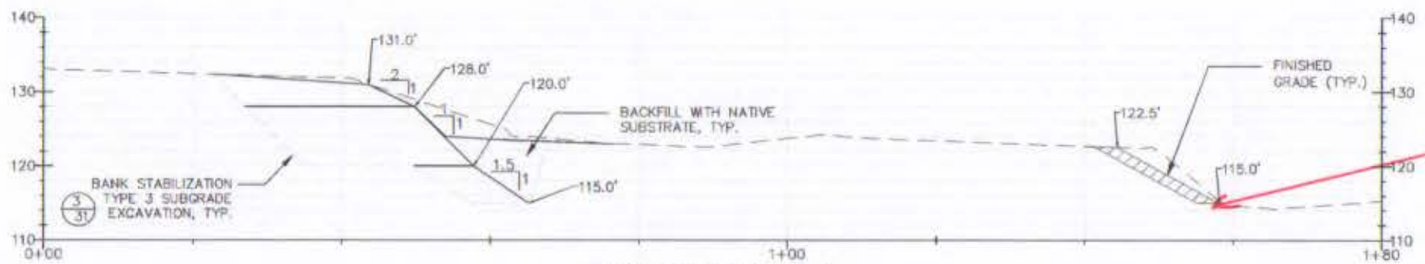
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
WALLACE PROPERTY – LWD AND BANK TREATMENT PLAN

FILE NAME: 7365
CONTRACT NUMBER: 45-61-763
DRAWING NUMBER:
SHEET 15 OF 46



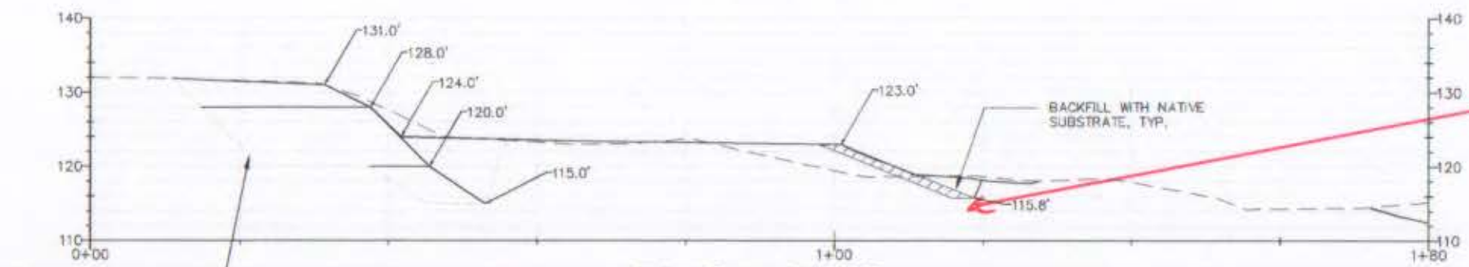
Wallace Property Sta. 0+25

Reference Sheet 31



2.5 ft. riffle material

Wallace Property Sta. 0+75



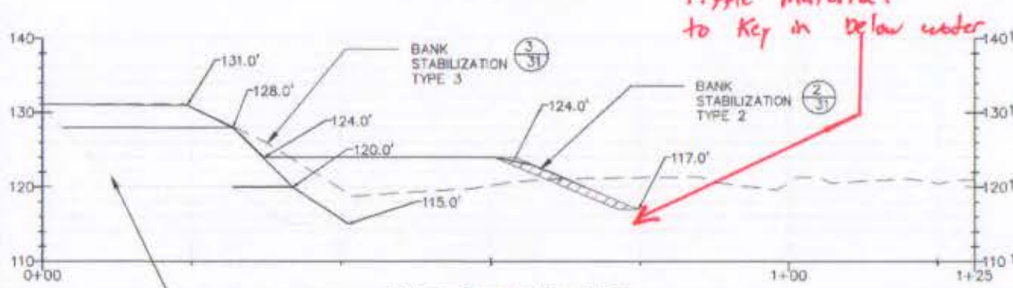
2.5 ft. riffle material

Wallace Property Sta. 1+25

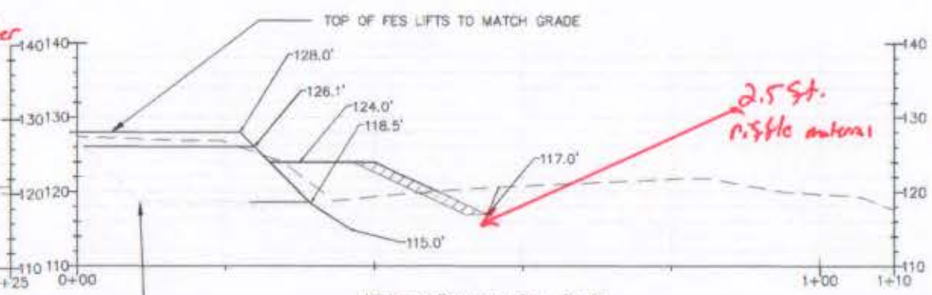
SCALE IN FEET
10
10

NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

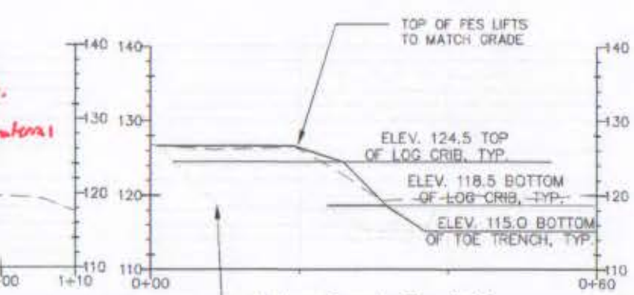
installed 2.5 feet riffle material to key in below water



Wallace Property Sta. 1+75



Wallace Property Sta. 2+40



Wallace Property Sta. 2+90

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
WALLACE PROPERTY –
GRADING CROSS SECTIONS

FILE NAME: 7345
CONTRACT NUMBER: 45-B1-763
DRAWING NUMBER:
SHEET 16 OF 46

LIMIT OF FINISH GRADING, WALLACE SITE

DRY CREEK ALIGNMENT

340+00

EDGE OF WATER, MAY 2010 (TYP.)

DRY CREEK

338+00

LIMIT OF FINISH GRADING

WALLACE SITE SEE SHEETS 14-16

336+00

EDGE OF WATER, MAY 2010 (TYP.)

5+20

5+00

4+00

3+00

2+00

1+00

0+00

334+00

STA: 5+00

STA: 4+50

STA: 4+00

STA: 3+50

STA: 3+00

STA: 2+50

STA: 2+00

STA: 1+50

STA: 1+00

BACKWATER CHANNEL ALIGNMENT

CONSTRUCTION EASEMENT (TYP.)

20 0 20 40 60

SCALE IN FEET

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED WITH OWNER AND LANDOWNER AT TIME OF CONSTRUCTION.

2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA B
- GRADING PLAN

FILE NAME: 7345
CONTRACT NUMBER: 45-61-763
DRAWING NUMBER:
SHEET 17 OF 46

Log jam modified in field. 2 feeder logs and 2 rootwads

For Snags in BW LWD where bedrock is encountered, cut them down to approximately 5' above the top cable tie. Limit total length to 2X the length that is wedged into the structure, below the top cable tie.

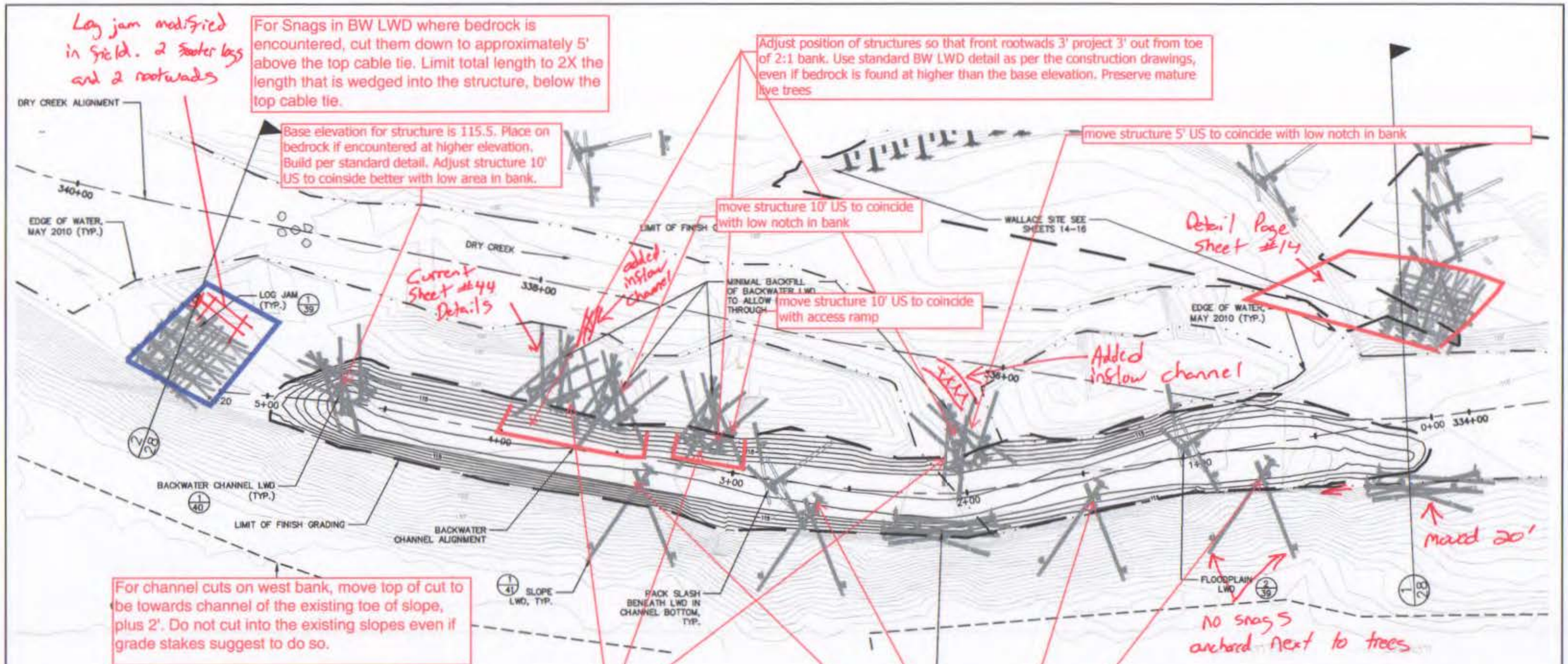
Adjust position of structures so that front rootwads 3' project 3' out from toe of 2:1 bank. Use standard BW LWD detail as per the construction drawings, even if bedrock is found at higher than the base elevation. Preserve mature live trees

Base elevation for structure is 115.5. Place on bedrock if encountered at higher elevation. Build per standard detail. Adjust structure 10' US to coinside better with low area in bank.

move structure 5' US to coincide with low notch in bank

move structure 10' US to coincide with low notch in bank

move structure 10' US to coincide with access ramp



For channel cuts on west bank, move top of cut to be towards channel of the existing toe of slope, plus 2'. Do not cut into the existing slopes even if grade stakes suggest to do so.

Base elevation for structures is 113.5

Adjust Slope LWD locations as needed to take advantage of existing standing trees on bank for wedge LWD against and between.
Adjust as needed to ensure RW and log project into water.
Snag placed at toe of graded slope
For snags on slope:
- wedge LWD between existing stout, mature trees, do not cable to live trees
- drive snags where possible, where mature trees are not present
- if neither of the above possible, cable to existing boulders if competent and stable, or plant new boulder and cable to that, provided boulder can be installed in a stable, buried position.

20 0 20 40 80
SCALE IN FEET

NOTES:
1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

CURRENT

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	

SONOMA COUNTY WATER AGENCY

DATE 1/23/2013
DRAWN REP
CHECKED MB

OFF-CHANNEL ENHANCEMENT AREA B – LWD AND BANK TREATMENT PLAN

FILE NAME: 7345
CONTRACT NUMBER: 40-6.1-763
DRAWING NUMBER:
SHEET 18 OF 46

DRY CREEK ALIGNMENT

340+00

EDGE OF WATER, MAY 2010 (TYP.)

LIMIT OF FINISH GRADING, WALLACE SITE

WALLACE SITE SEE SHEETS 14-16

DRY CREEK

338+00

LOG JAM (TYP.) 1/39

MINIMAL BACKFILL OF BACKWATER LWD TO ALLOW FLOW THROUGH

EDGE OF WATER, MAY 2010 (TYP.)

336+00

3+20

5+00

4+00

3+00

2+00

1+00

0+00

334+00

2/28

BACKWATER CHANNEL LWD (TYP.) 1/40

LIMIT OF FINISH GRADING

BACKWATER CHANNEL ALIGNMENT

1/41 SLOPE LWD, TYP.

PACK SLASH BENEATH LWD IN CHANNEL BOTTOM, TYP.

FLOODPLAIN LWD 2/39

1/28

CONSTRUCTION EASEMENT (TYP.)

2/40 POOL ENHANCEMENT LWD, TYP.

20 0 20 40 60

SCALE IN FEET

NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.

2. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

ORIGINAL

Inter-fluve

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

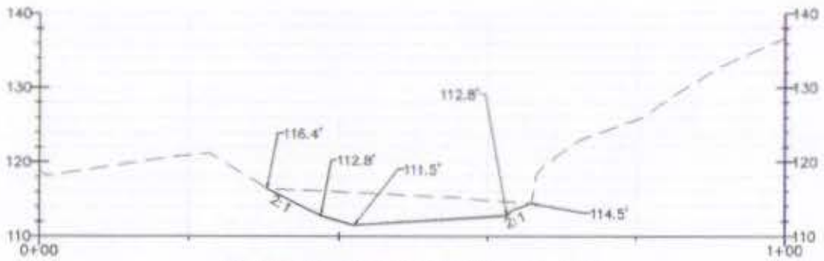
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

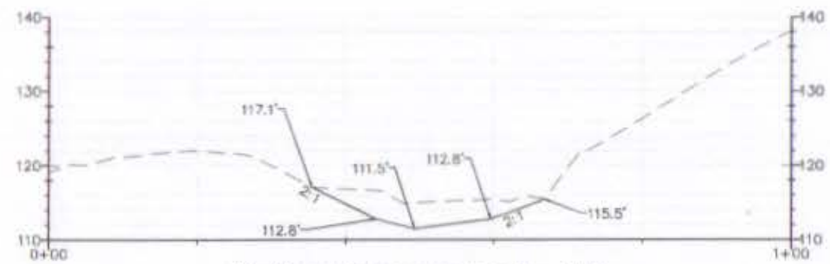
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA B -
LWD AND BANK TREATMENT PLAN

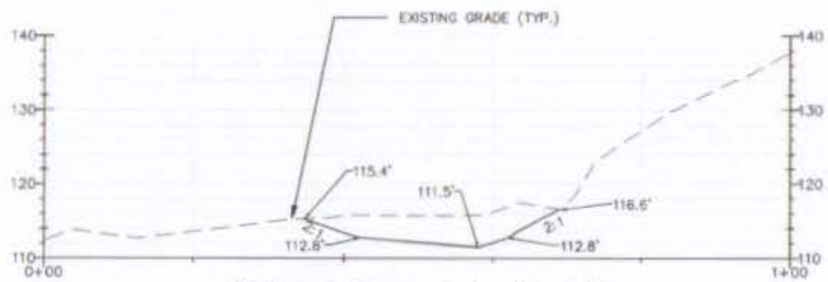
FILE NAME: 7345
CONTRACT NUMBER: 45-E1-762
DRAWING NUMBER:
SHEET 18 OF 46



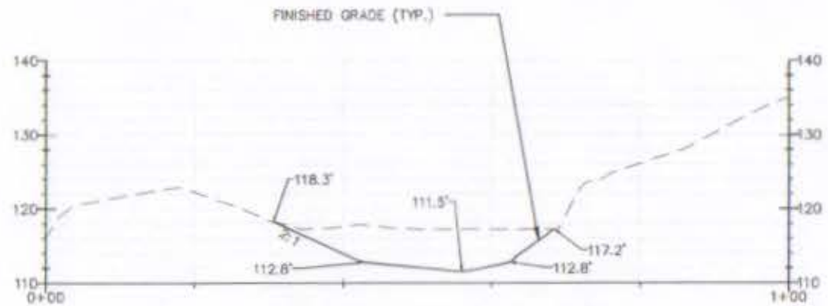
Off-Channel Enhancement Area B – 1+00



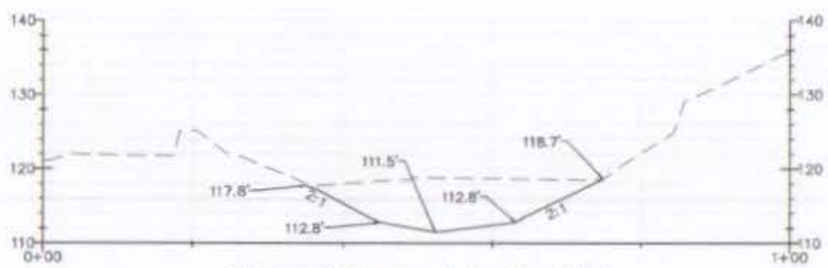
Off-Channel Enhancement Area B – 1+50



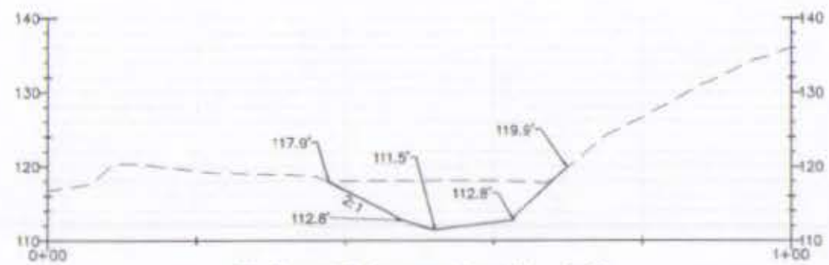
Off-Channel Enhancement Area B – 2+00



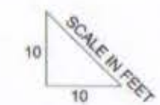
Off-Channel Enhancement Area B – 2+50



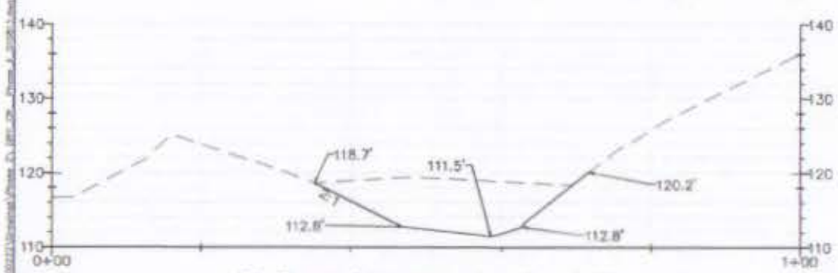
Off-Channel Enhancement Area B – 3+00



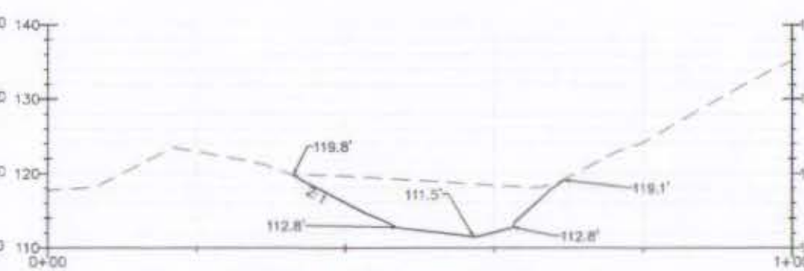
Off-Channel Enhancement Area B – 3+50



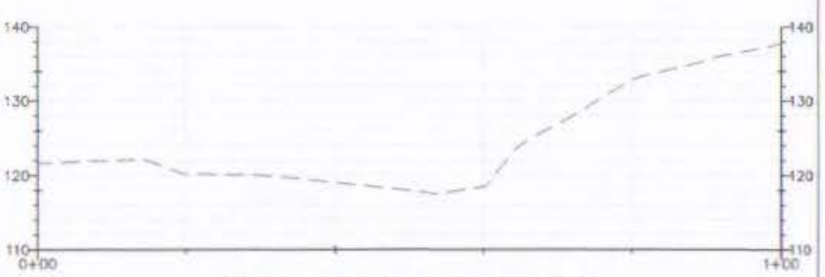
NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.



Off-Channel Enhancement Area B – 4+00



Off-Channel Enhancement Area B – 4+50



Off-Channel Enhancement Area B – 5+00

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/18/13	CONFORMED	

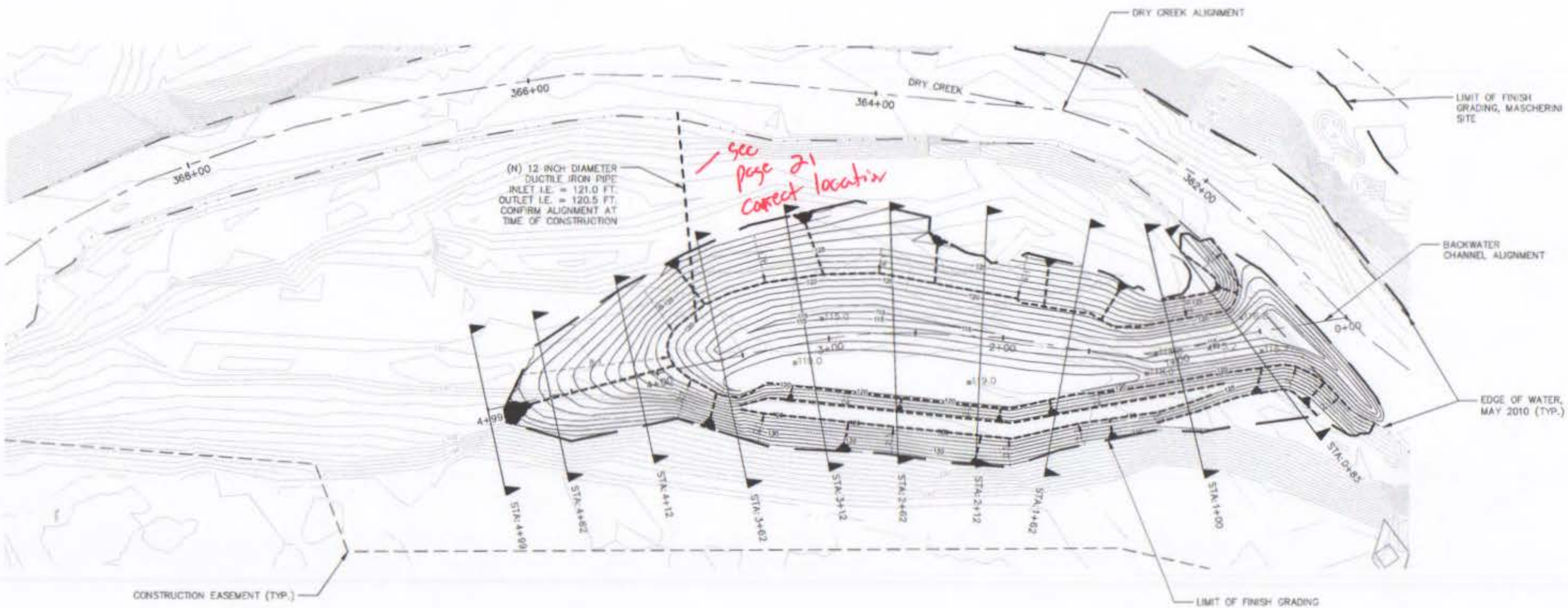
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA B – GRADING CROSS SECTIONS

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7&3
DRAWING NUMBER:
SHEET 19 OF 46



NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.
2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.
3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

30 0 30 60 120

SCALE IN FEET

ORIGINAL

C 42986

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA C – GRADING PLAN

FILE NAME: 7345
CONTRACT NUMBER: 45-E.1-7#3
DRAWING NUMBER:
SHEET 20 OF 46

PRESERVE ALL EXISTING VEGETATION UNLESS OTHERWISE APPROVED BY WATER AGENCY

DRY CREEK ALIGNMENT

LIMIT OF FINISH GRADING, MASCHERINI SITE

DRY CREEK

366+00

364+00

368+00

362+00

370+00

(N) 12 INCH DIAMETER DUCTILE IRON PIPE
INLET I.E. = 121.0 FT.
OUTLET I.E. = 120.5 FT.
CONFIRM ALIGNMENT AT TIME OF CONSTRUCTION

See Page 21 for correct location

BACKWATER CHANNEL ALIGNMENT

FILL TRENCH TO ELEVATION 130', LIMITS TO BE VERIFIED DURING CONSTRUCTION

ORCHARD

0+00

1+00

2+00

3+00

4+00

360+00

EDGE OF WATER, MAY 2010 (TYP.)

SOLAR HOT WATER HEATER

STA: 4+98

STA: 4+82

STA: 4+12

STA: 3+82

STA: 3+12

STA: 2+82

STA: 2+12

STA: 1+82

STA: 1+06

STA: 0+00

LIMIT OF FINISH GRADING

CONSTRUCTION EASEMENT (TYP.)

APPROXIMATE LIMITS OF VEGETATION CANOPY, TYP.

2

3

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.

2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.

3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

CURRENT #1

30 0 30 60 120

SCALE IN FEET

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/21/14	REVISIONS BASED ON SCWA DIRECTION	
3	08/04/14	REVISIONS TO VAN ALYEA MOUTH PER WATER AGENCY DIRECTION	

SONOMA COUNTY WATER AGENCY

SCALE:

DATE: 8/04/2014

DRAWN: REP

CHECKED: MB

REVIEWED

REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

OFF-CHANNEL ENHANCEMENT AREA C – GRADING PLAN

FILE NAME: 7345

CONTRACT NUMBER: 45-8.1-7#3

DRAWING NUMBER:

SHEET 20 OF 46

FILL GAP BETWEEN LOG JAM AND EXISTING TREES WITH 1 ROOT WAD, 2 SAW LOGS, AND 2 SNAGS. PLACEMENT TO BE DIRECTED IN FIELD AT TIME OF CONSTRUCTION.

Reference Sheet #28

POOL ENHANCEMENT LWD, TYP. (2/40)

TING BANK WITH LIVE STAKES AND E STONE AND NATIVE SUBSTRATE,

BRACKET PIPE INLET WITH UP TO 2 PARTIALLY BURIED LOGS, INSTALL UP TO 4 BALLAST BOULDERS BURIED IN BANK. PLACEMENT AND CONFIGURATION TO BE GUIDED DURING CONSTRUCTION

(N)CONSTRUCTED RIFFLE (TYP.) (1/29)

FP LWD ELIMINATED HERE

MASCHERINI SITE SEE SHEETS 23-25

LIMIT OF FINISH GRADING, MASCHERINI SITE

GRADE TO ENCOURAGE OVERFLOW TOWARDS BW LWD. INSTALL OVERFLOW CHUTE WITH RIFFLE MATERIAL AND NATIVE SUBSTRATE

DRY CREEK ALIGNMENT

DRY CREEK

FLOODPLAIN LWD (TYP.) (2/39)

(N) FRESHWATER PIPE 14 IN. MIN. I.D. INLET I.E. = 122.0 FT. OUTLET I.E. = 119.0 FT. CONFIRM ALIGNMENT AT TIME OF CONSTRUCTION PRESERVE VEGETATION TO REMAIN

Structure moved 15' as indicated

risk adjustment

LIMIT OF FINISH GRADING

SUBMERGED LWD WITHIN LINE SHALL BE COMPLETELY BELOW ELEVATION LINE 122.5'

2 rootwads installed

FILL TRENCH TO ELEVATION 130', LIMITS TO BE VERIFIED DURING CONSTRUCTION

BACKFILL DIVERSION PIPE TRENCH TO ELEVATION 129'

EDGE OF WATER, MAY 2010 (TYP.)

BURY 3 LOGS WITH TOP ELEVATION 129.5', AVOID CONFLICT WITH ORCHARD TREES.

TYPE 1 BANK STABILIZATION (TYP.) (1/31)

HDPE 12" pipe actual route

LOG JAM (TYP.) (1/39)

½ ton Rip-Rap

SUBMERGED LWD (TYP.) (1/40)

SUBMERGED LWD WITHIN LINE SHALL BE COMPLETELY BELOW ELEVATION 122.5'

PACK SLASH BENEATH LWD IN CHANNEL BOTTOM, TYP.

BACKWATER LWD (TYP.) (1/40)

SHIFT LOG JAM 5FT TOWARDS CREEK FROM THE LOCATION CURRENTLY STAKED. LOWER BOTTOM ELEVATION TO 121 FT. TO BE DIRECTED IN FIELD.

PIPE MINIMUM 14" I.D.
PIPE MATERIAL C900 SERIES PVC OR CORRUGATED PE DUAL WALL WITH SMOOTH INTERIOR.
IF PVC PIPE IS USED, USE DUCTILE IRON PIPE OF EQUIVALENT I.D. AT INLET AND OUTLET WHERE PIPE IS EXPOSED TO PREVENT UV DEGRADATION.

1. OUTFLOW FLOWLINE SHALL BE 1' ABOVE BW SLOPE
2. INLET FLOWLINE 6" ABOVE CREEK BED
3. MAINTAIN CONSTANT SLOPE. NO DIPS OR INVERSE SLOPES.
4. AVOID SHARP OR ABRUPT BENDS IN PIPE ALIGNMENT
5. ADJUST PIPE ALIGNMENT TO AVOID CONFLICT WITH LWD STRUCTURES.
6. LENGTH OF DUCTILE IRON AT INLET AND OUTLET SHALL BE SUFFICIENT TO EXTENT A MINIMUM OF 3 FEET INTO THE BANK MATERIAL.
7. DUCTILE IRON EXTENSIONS MAY NOT BE REQUIRED IF UV RESISTANT PIPE MATERIAL IS USED.
8. INSTALL PIPE WITH 6" GRANULAR BEDDING AND MINIMUM 1.5' OF COVER COMPACTED TO 85%.

ANTITIES DEPICTED ARE SCHEMATIC
E SUMMARY TABLE ON SHEET 41
TERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.

2. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

2

30 0 30 60 120
SCALE IN FEET

CURRENT #7

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/21/14	REVISIONS BASED ON SCWA DIRECTION	
3	08/04/14	REVISIONS TO VAN ALYEA MOUTH PER WATER AGENCY DIRECTION	
4	09/09/14	REVISIONS TO FRESHWATER PIPE	

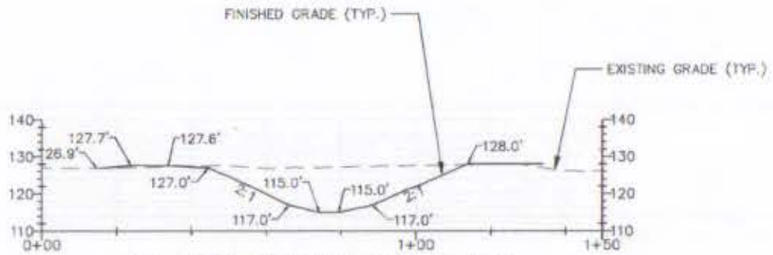
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 09/09/2014
DRAWN: REP
CHECKED: MB

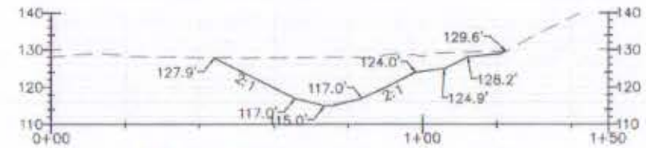
REVISED:
REVISED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA C – LWD AND BANK TREATMENT PLAN

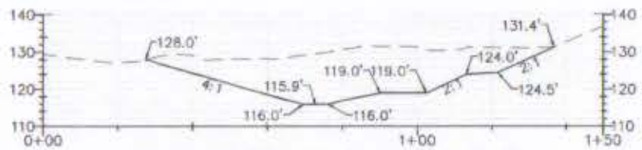
FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7#3
DRAWING NUMBER:
SHEET 21 OF 46



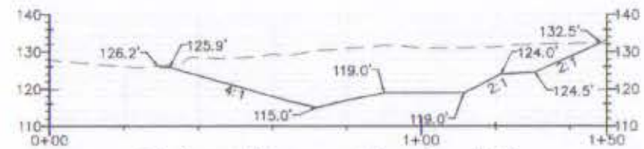
Off-Channel Enhancement Area C – 0+83



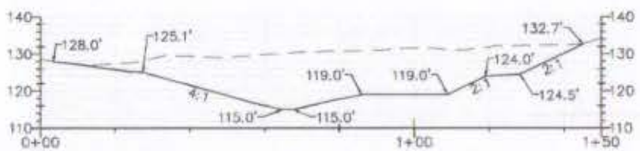
Off-Channel Enhancement Area C – 1+00



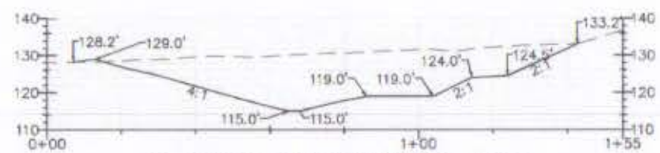
Off-Channel Enhancement Area C – 1+62



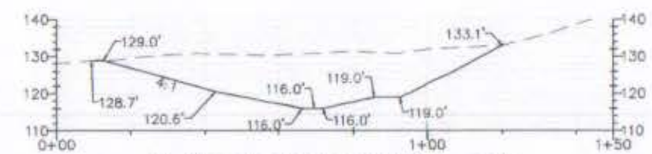
Off-Channel Enhancement Area C – 2+12



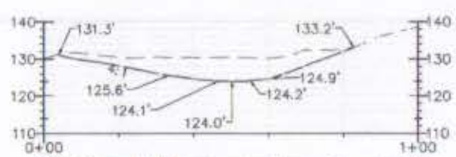
Off-Channel Enhancement Area C – 2+62



Off-Channel Enhancement Area C – 3+12



Off-Channel Enhancement Area C – 3+62



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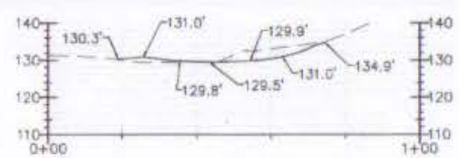


Off-Channel Enhancement Area C – 4+62

Off-Channel Enhancement Area C – 4+99

NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

ORIGINAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

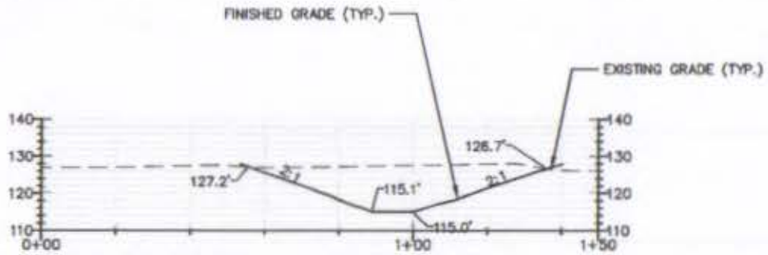
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA C –
GRADING CROSS SECTIONS

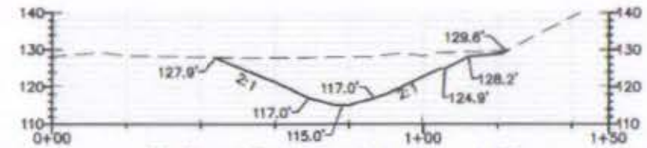
FILE NAME: 7345
CONTRACT NUMBER: 43-0.1-783
DRAWING NUMBER:
SHEET 22 OF 46

2

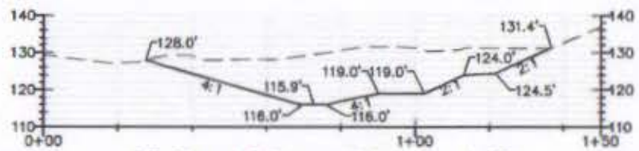
3



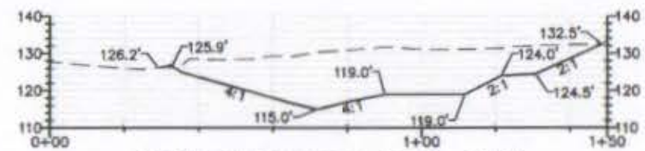
Off-Channel Enhancement Area C – 0+60



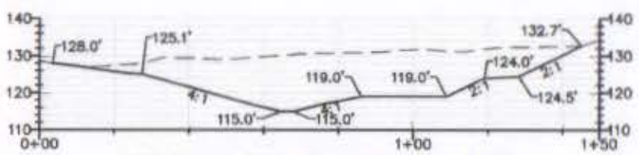
Off-Channel Enhancement Area C – 1+00



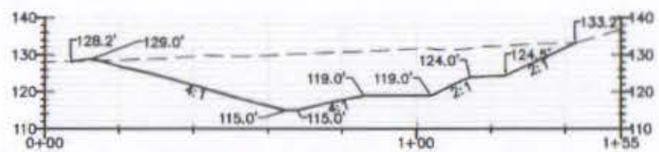
Off-Channel Enhancement Area C – 1+62



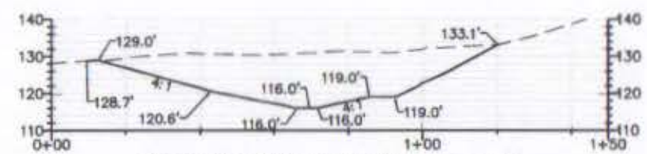
Off-Channel Enhancement Area C – 2+12



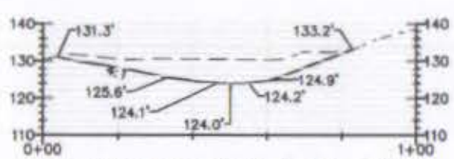
Off-Channel Enhancement Area C – 2+62



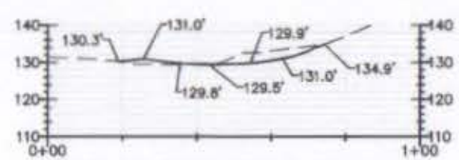
Off-Channel Enhancement Area C – 3+12



Off-Channel Enhancement Area C – 3+62



Off-Channel Enhancement Area C – 4+12



Off-Channel Enhancement Area C – 4+62

Off-Channel Enhancement Area C – 4+99

CURRENT

PROJECT RECORD DRAWING

NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/21/14	REVISIONS BASED ON SCWA DIRECTION	
3	08/04/14	REVISIONS TO VAN ALYEA MOUTH PER WATER AGENCY DIRECTION	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 08/04/2014
DRAWN: REP
CHECKED: MB

REVISED
REVISED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
OFF-CHANNEL ENHANCEMENT AREA C –
GRADING CROSS SECTIONS

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-763
DRAWING NUMBER:
SHEET 22 OF 46

EXISTING IRRIGATION LINE
ELEV.=141.47
EXISTING STRUCTURES
ELEV.=140.65
ELEV.=141.46
STA:5+86
STA:5+38
STA:5+00
STA:4+58
STA:4+20
STA:3+80
STA:3+40
STA:2+97
STA:2+47
STA:2+00
STA:1+55
STA:1+20
STA:0+77
STA:0+42
6+00
5+00
4+00
3+00
2+00
1+00
0+00
REMOVE 36 IN. DBH COTTONWOOD TREE
CONSTRUCTION EASEMENT
LIMIT OF FINISH GRADING
2
MASCHERINI BASELINE
REMOVE UP TO 25 TREES, UP TO 18 IN. DBH
RUED
PARCEL BOUNDARY
DESIGN CREST ELEVATION 123.4
366+00
364+00
DRY CREEK
EDGE OF WATER, MAY 2010 (TYP.)
1/2 ton Rip-Rap installed end of Type 4 Bank enhancement
must 15' extended due to large trees
DESIGN TAIL ELEVATION 121.0
(N)CONSTRUCTED RIFFLE (TYP.)
2/29
ADD LAUNCHABLE RIFFLE MATERIAL TO CONNECT DESIGN TAIL ELEVATION TO EXISTING GRADE IN AREAS BELOW 121, WITH MAX SLOPE OF 10:1
DRY CREEK ALIGNMENT
NO GROUND DISTURBANCE ZONE
8 FT.
360+00
Reference Page #10
See Attached Sheets 1-3 Macherini Bank Repair
20 0 20 40 80
SCALE IN FEET

NOTES:

1. LOCATION OF ACCESS RAMPS TO WORK AREA TO BE CONFIRMED AT TIME OF CONSTRUCTION.
2. FINAL ALIGNMENT OF ACCESS ROUTES THROUGH VEGETATED CORRIDORS TO BE CONFIRMED AT TIME OF CONSTRUCTION.
3. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.
4. PROPERTY OWNER WILL REMOVE AND REPLACE IMPROVEMENTS WHICH ARE IN CONFLICT WITH INSTALLATION OF THE WORK.

CURRENT

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/14/14	REVISED TO PROVIDE CONTINUOUS TREATMENT	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI PROPERTY – GRADING PLAN

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7#3
DRAWING NUMBER:
SHEET 23 OF 46

EXISTING IRRIGATION LINE
ELEV.=141.47
EXISTING STRUCTURES
ELEV.=140.65
ELEV.=141.46
6+00
5+00
4+00
3+00
2+00
1+00
0+00
BANK STABILIZATION, TYPE 4, (TYP.) 1/32 TO 3/32
CONSTRUCTION EASEMENT
LIMIT OF FINISH GRADING
2
BANK STABILIZATION, TYPE 4, (TYP.) 1/32 TO 3/32
RUED
PARCEL BOUNDARY
368+00
366+00
DRY CREEK
EDGE OF WATER, MAY 2010 (TYP.)
363+00
FLOODPLAIN LWD (TYP.) 2/39
(N)CONSTRUCTED RIFFLE (TYP.) 1/29
DRY CREEK ALIGNMENT
NO GROUND DISTURBANCE ZONE
360+00
20 0 20 40 80
SCALE IN FEET

NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.

2. ALL AREAS DISTURBED BY GRADING TO BE HYDROSEEDED FOLLOWING CONSTRUCTION.

See Attached
Sheets 1-3
Mascherini Bank Repair

CURRENT

PROJECT
RECORD
DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/18/13	CONFORMED	
2	04/14/14	REVISED TO PROVIDE CONTINUOUS TREATMENT	

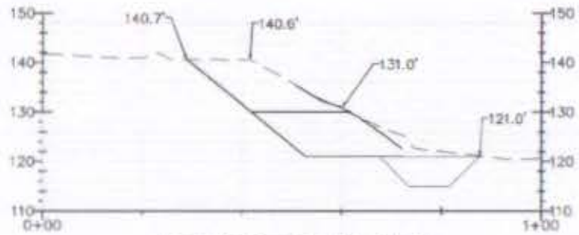
SONOMA COUNTY WATER AGENCY

DESIGN:
DATE: 1/23/2013
DRAWN: REP
RECORD: MB

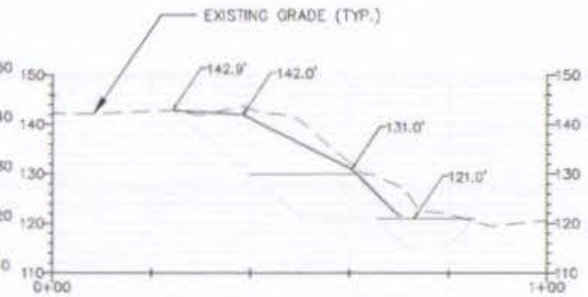
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI PROPERTY – LWD
AND BANK TREATMENT PLAN

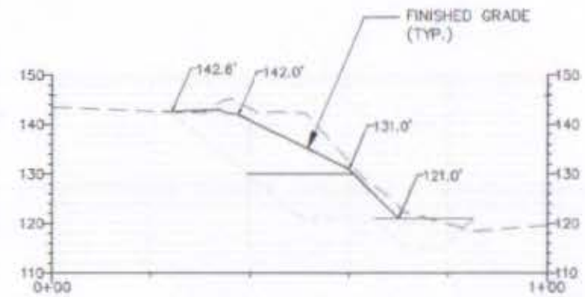
FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-763
DRAWING NUMBER:
SHEET 24 OF 46



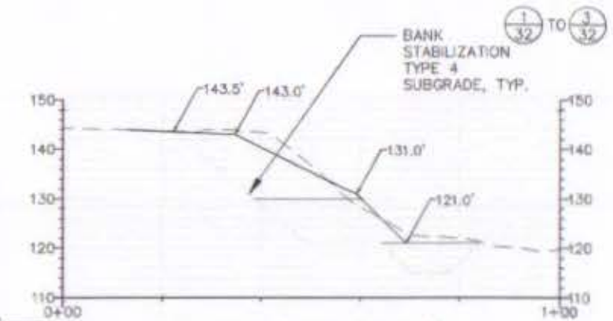
Mascherini Property Sta. 0+42



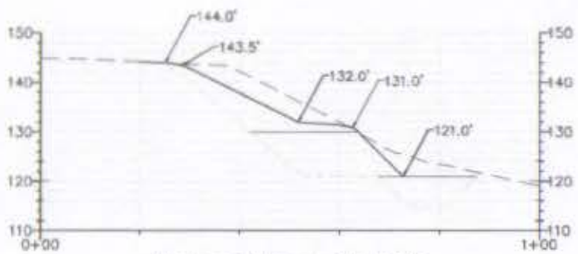
Mascherini Property Sta. 0+77



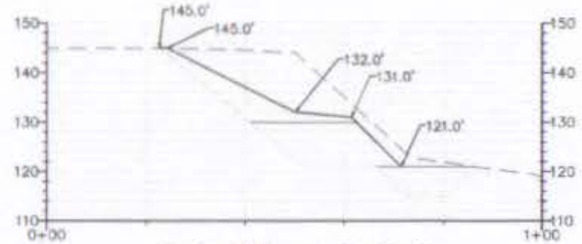
Mascherini Property Sta. 1+20



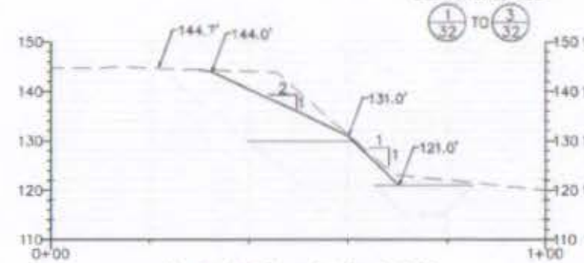
Mascherini Property Sta. 1+55



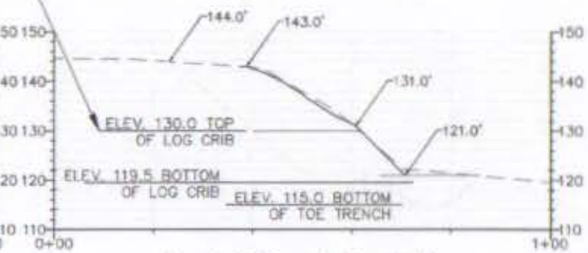
Mascherini Property Sta. 2+00



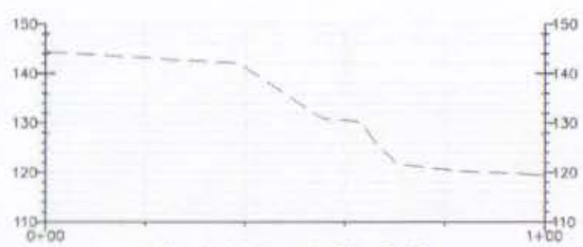
Mascherini Property Sta. 2+47



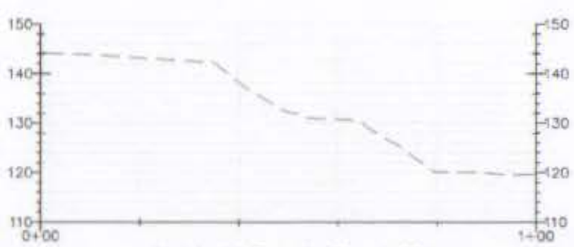
Mascherini Property Sta. 2+97



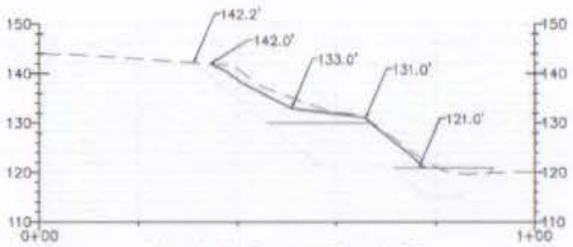
Mascherini Property Sta. 3+40



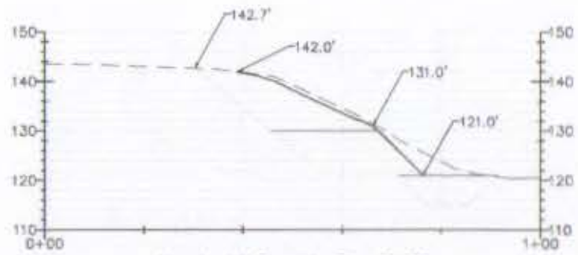
Mascherini Property Sta. 3+80



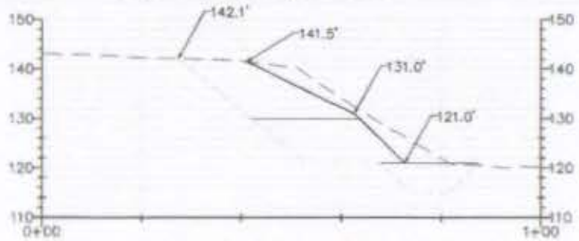
Mascherini Property Sta. 4+20



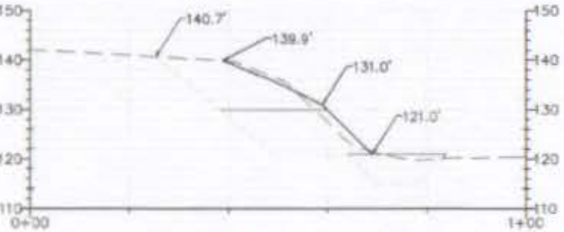
Mascherini Property Sta. 4+58



Mascherini Property Sta. 5+00



Mascherini Property Sta. 5+36



Mascherini Property Sta. 5+86

NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

ORIGINAL

Interflow

C 63966
CIVIL
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

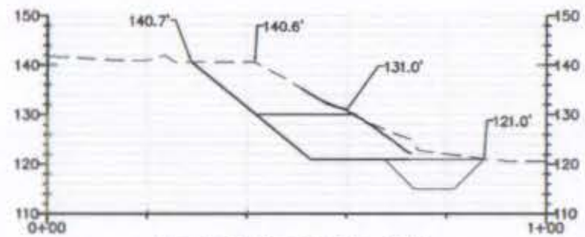
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

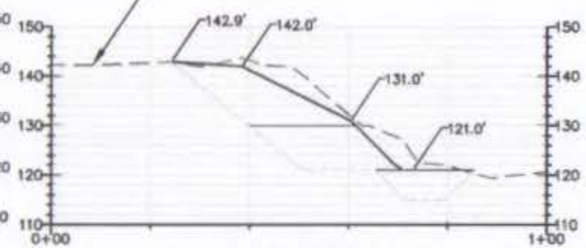
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI PROPERTY –
GRADING CROSS SECTIONS

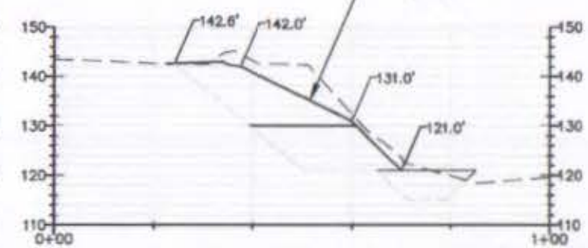
FILE NAME: 7345
CONTRACT NUMBER: 45-0.1-T43
DRAWING NUMBER:
SHEET 25 OF 46



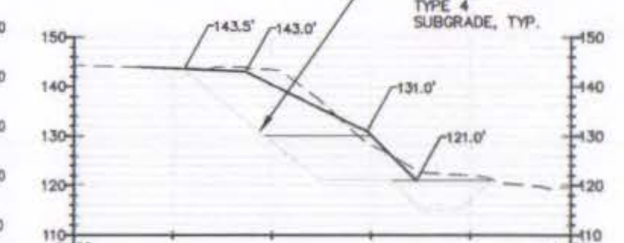
Mascherini Property Sta. 0+42



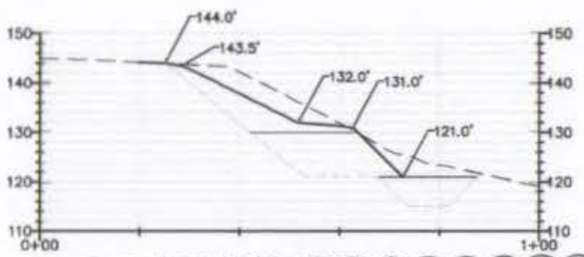
Mascherini Property Sta. 0+77



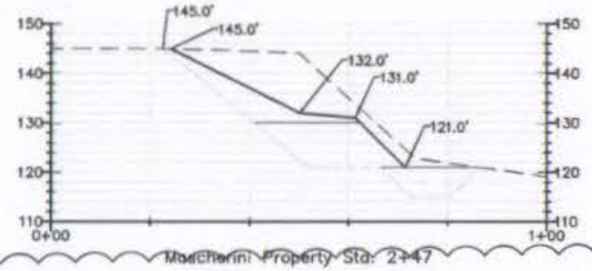
Mascherini Property Sta. 1+20



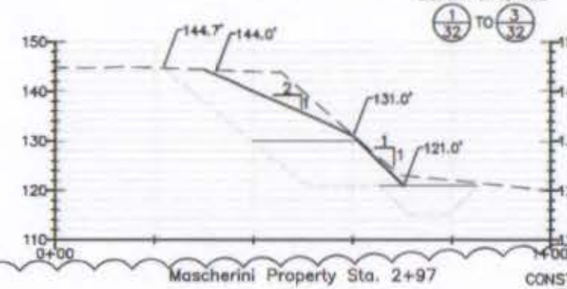
Mascherini Property Sta. 1+55



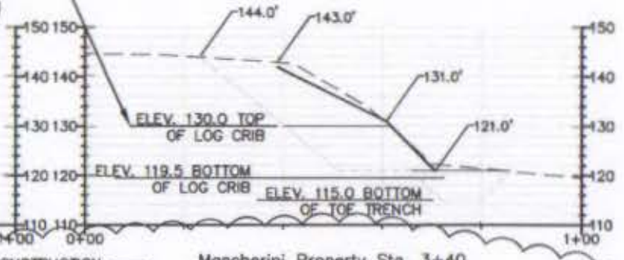
Mascherini Property Sta. 2+00



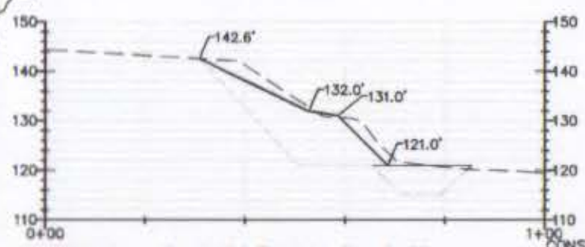
Mascherini Property Sta. 2+47



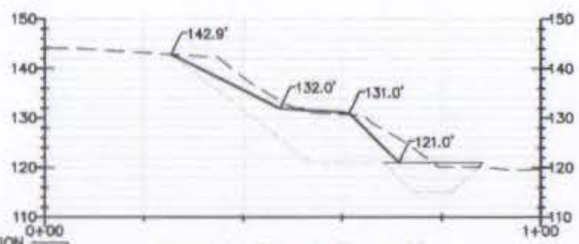
Mascherini Property Sta. 2+97



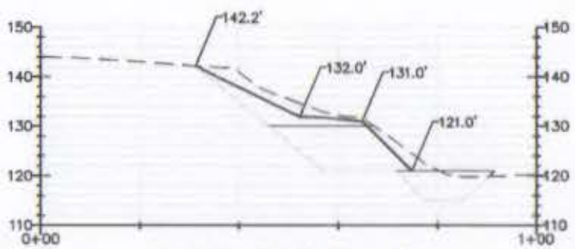
Mascherini Property Sta. 3+40



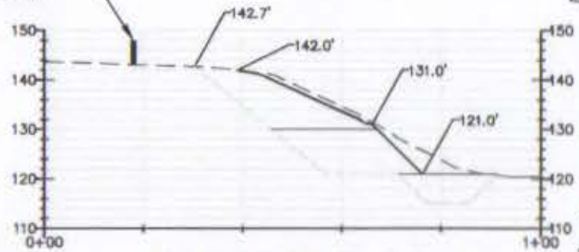
Mascherini Property Sta. 3+80



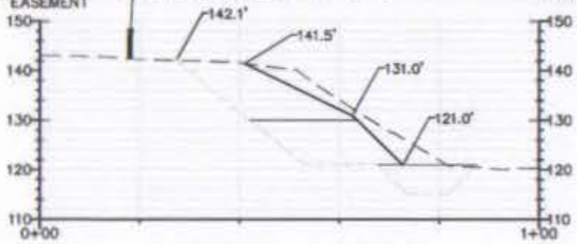
Mascherini Property Sta. 4+20



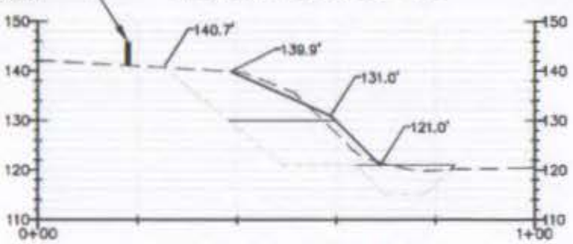
Mascherini Property Sta. 4+58



Mascherini Property Sta. 5+00



Mascherini Property Sta. 5+36



Mascherini Property Sta. 5+86

2

15 SCALE IN FEET 15

NOTE:
1. GRADING CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

PROJECT RECORD DRAWING

CURRENT

Interflow

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/14/14	REVISED TO PROVIDE CONTINUOUS TREATMENT	

SONOMA COUNTY WATER AGENCY

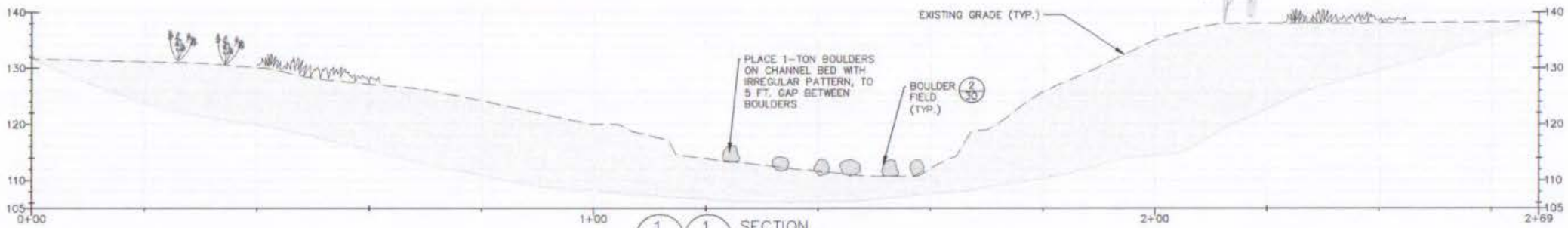
SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVISIONS
REVISIONS

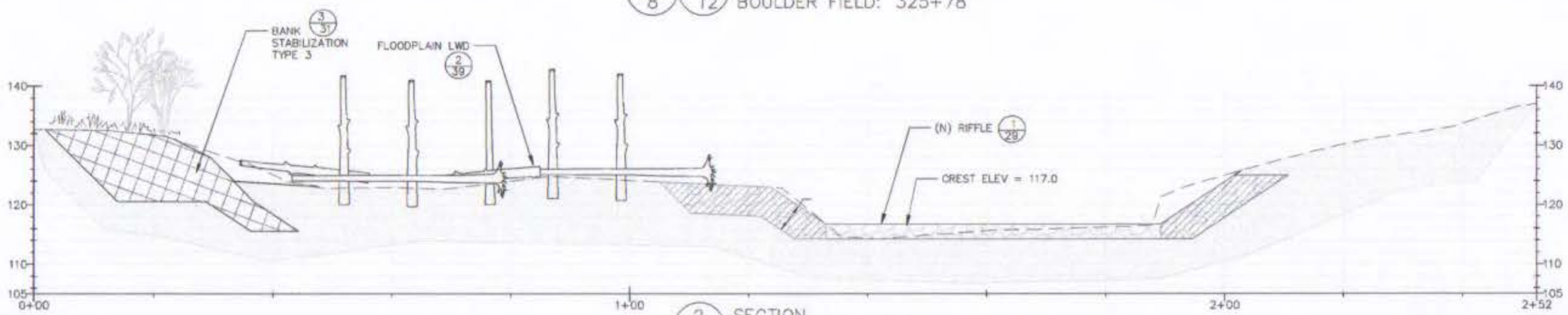
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI PROPERTY –
GRADING CROSS SECTIONS

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7#3
DRAWING NUMBER:
SHEET 25 OF 46

Project Record Drawing



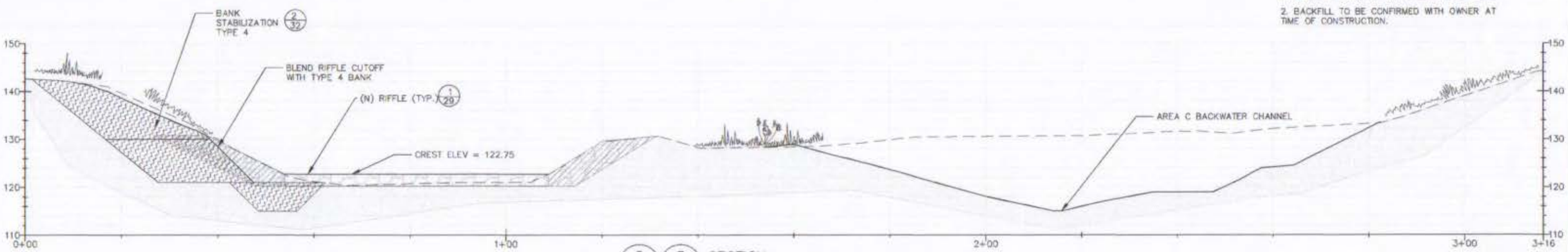
1/8 1/12 SECTION
BOULDER FIELD: 325+78



2/8 SECTION
RIFFLE: 333+95

NOTES:
1. CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

2. BACKFILL TO BE CONFIRMED WITH OWNER AT TIME OF CONSTRUCTION.



3/10 3/21 SECTION
RIFFLE STA: 364+52

ORIGINAL

Interflow

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

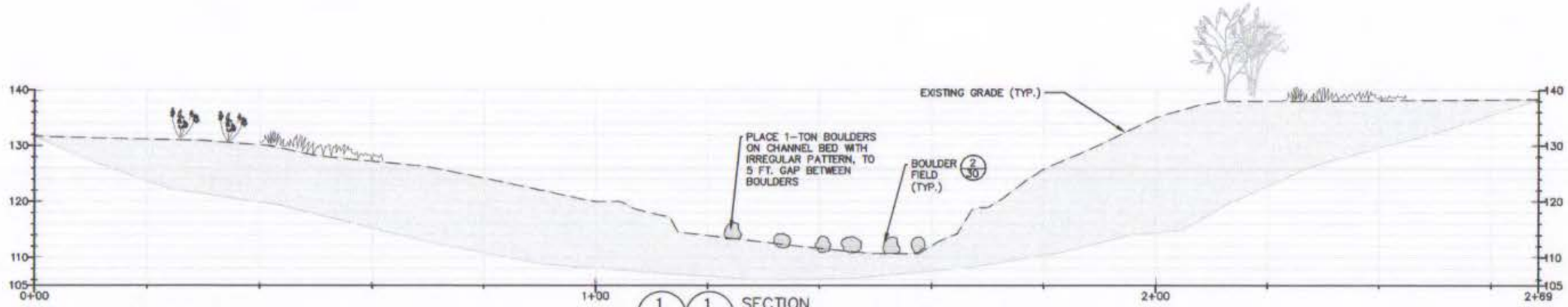
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED
REVIEWED

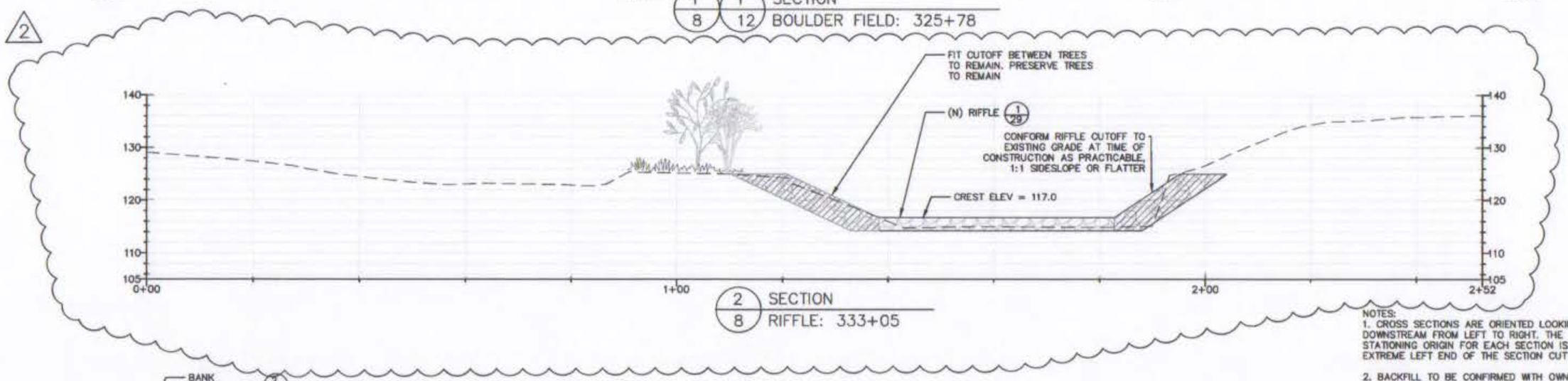
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
SECTIONS – BOULDER FIELD AND RIFFLES

FILE NAME: 7345
CONTRACT NUMBER: 45-61-743
DRAWING NUMBER:
SHEET 26 OF 46



1/8 1/12 SECTION
BOULDER FIELD: 325+78

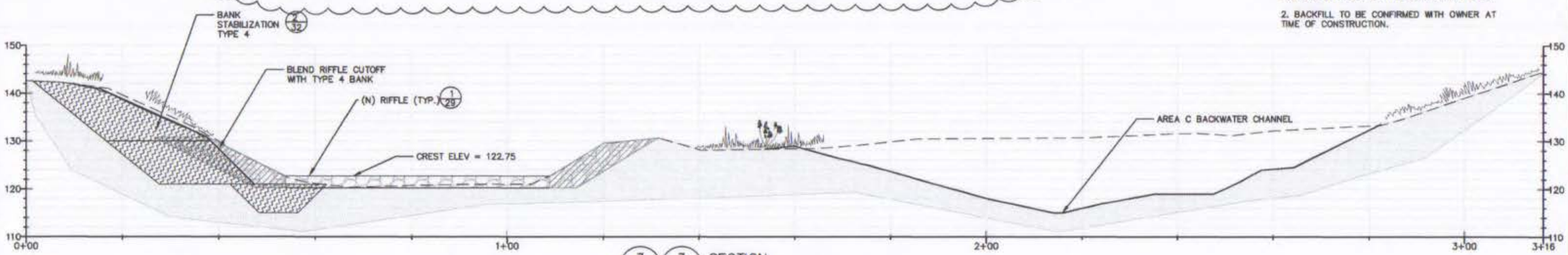
2



2/8 SECTION
RIFFLE: 333+05

NOTES:
1. CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

2. BACKFILL TO BE CONFIRMED WITH OWNER AT TIME OF CONSTRUCTION.



3/10 3/21 SECTION
RIFFLE STA: 364+52

CURRENT

PROJECT RECORD DRAWING

interflow

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/10/14	FIELD ADJUST	

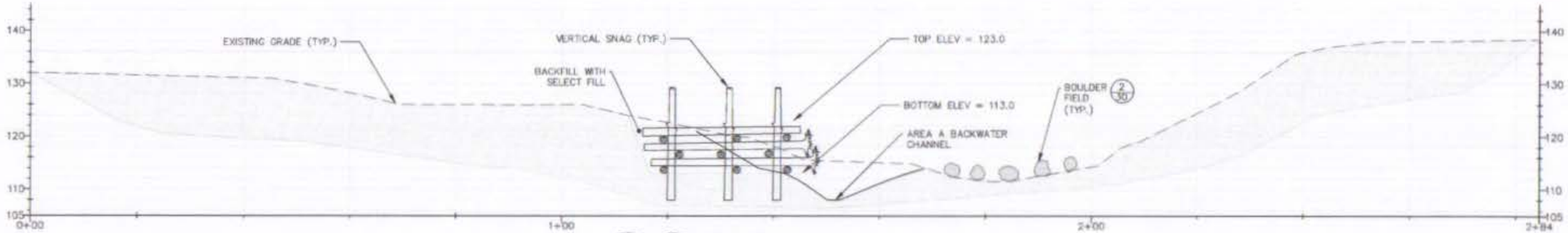
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

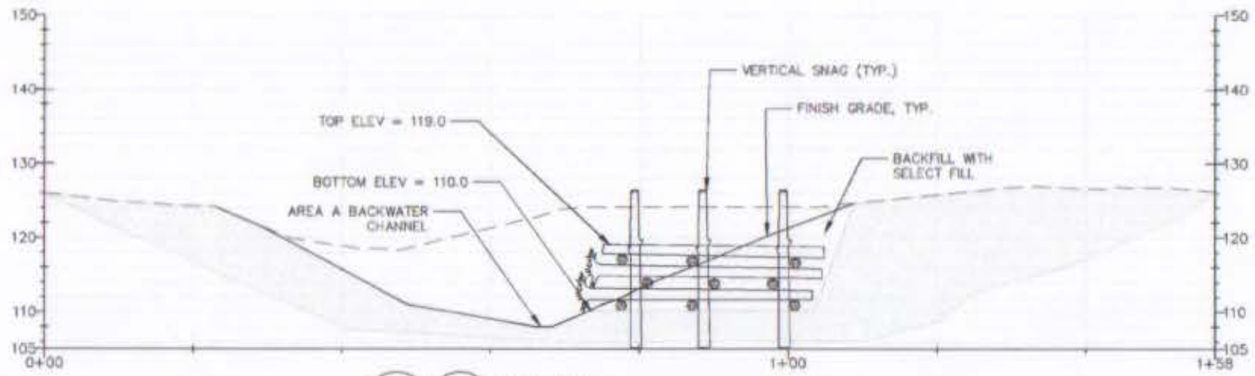
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
SECTIONS – BOULDER FIELD AND RIFFLES

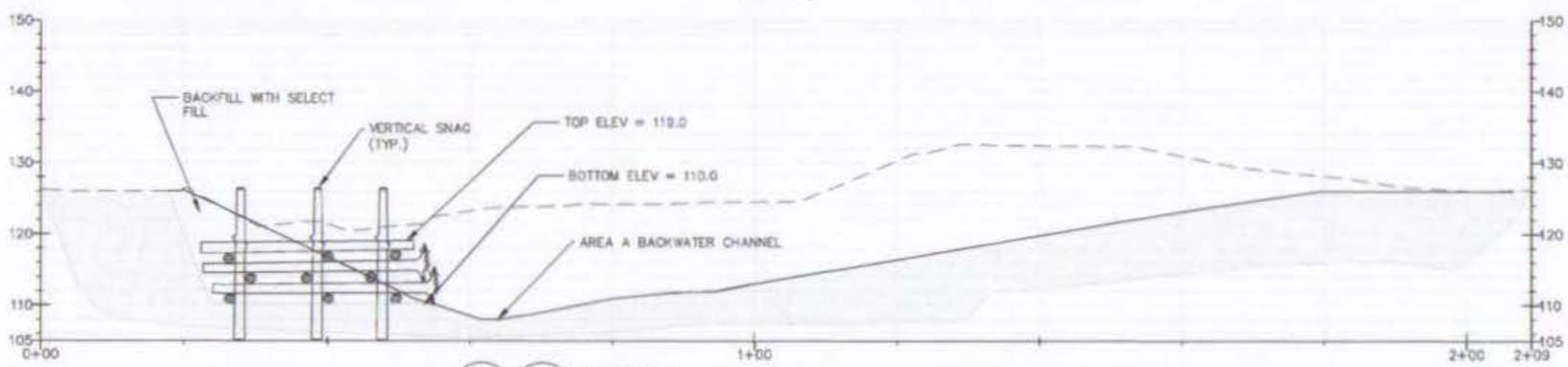
FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7#3
DRAWING NUMBER:
SHEET 26 OF 46



1/12 1/8 SECTION
LOG JAM STA: 326+42



2/12 2/8 SECTION
LOG JAM IN OFF-CHANNEL A, STA: 1+36



3/12 3/8 SECTION
LOG JAM IN OFF-CHANNEL A, STA: 1+86

NOTES:
1. CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.

2. BACKFILL TO BE CONFIRMED WITH OWNER AT TIME OF CONSTRUCTION.

3. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

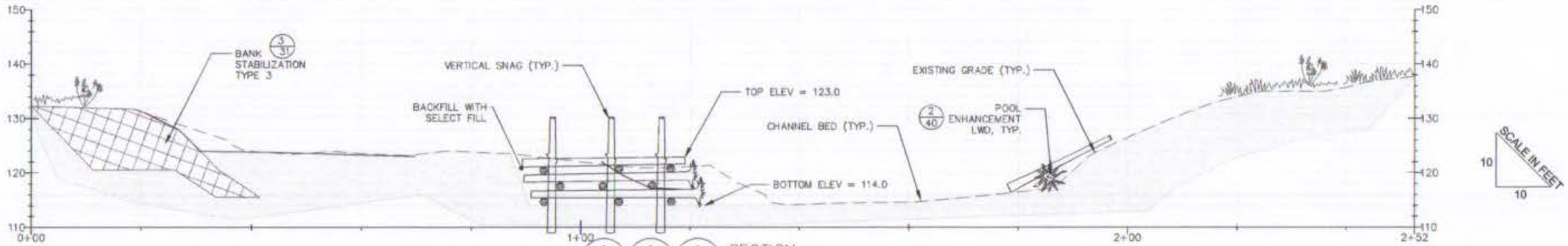
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

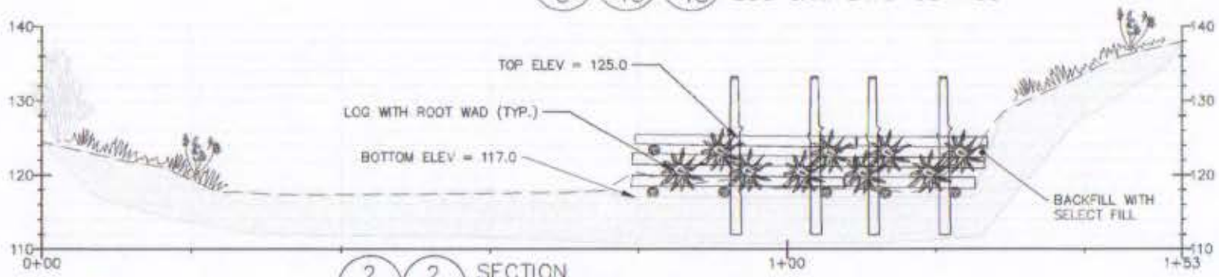
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
SECTIONS – LOG JAMS (1 OF 2)

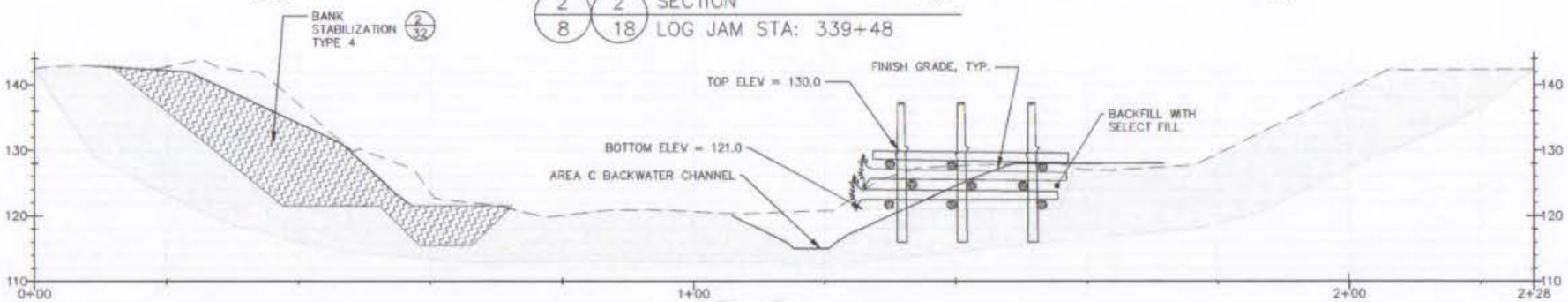
FILE NAME: 7345
CONTRACT NUMBER: 45-0.1-763
DRAWING NUMBER:
SHEET 27 OF 46



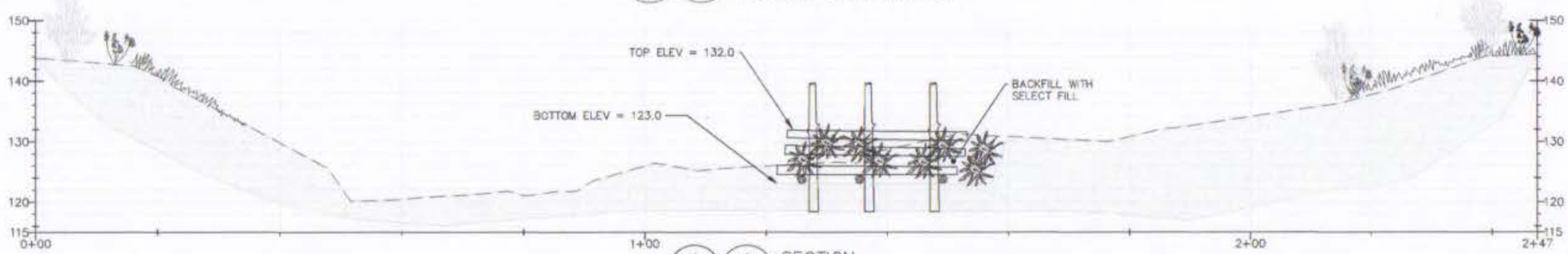
1/8 1/15 1/18 SECTION
LOG JAM STA: 334+39



2/8 2/18 SECTION
LOG JAM STA: 339+48



3/10 3/21 SECTION
LOG JAM STA: 360+99



4/10 4/21 SECTION
LOG JAM STA: 368+34

NOTES:
1. CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.
2. BACKFILL TO BE CONFIRMED WITH OWNER AT TIME OF CONSTRUCTION.
3. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.

ORIGINAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

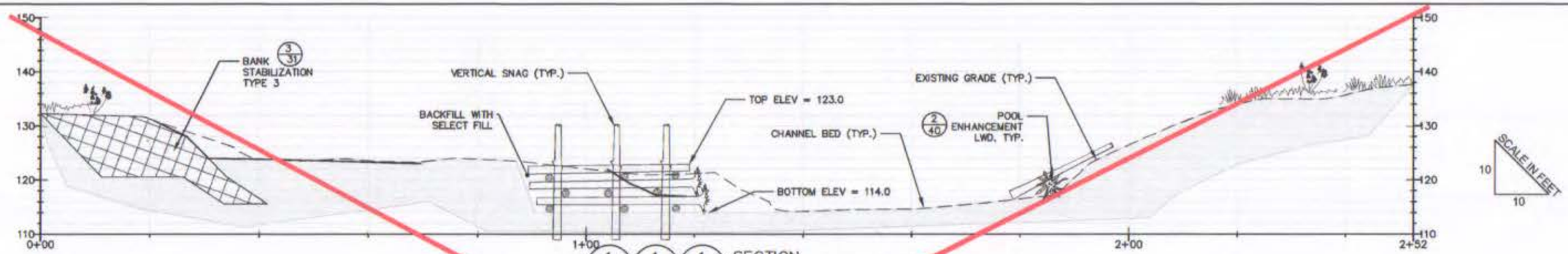
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

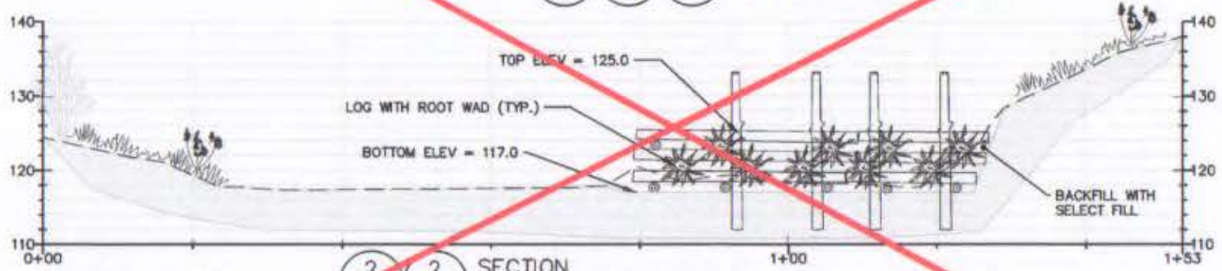
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
SECTIONS – LOG JAMS (2 OF 2)

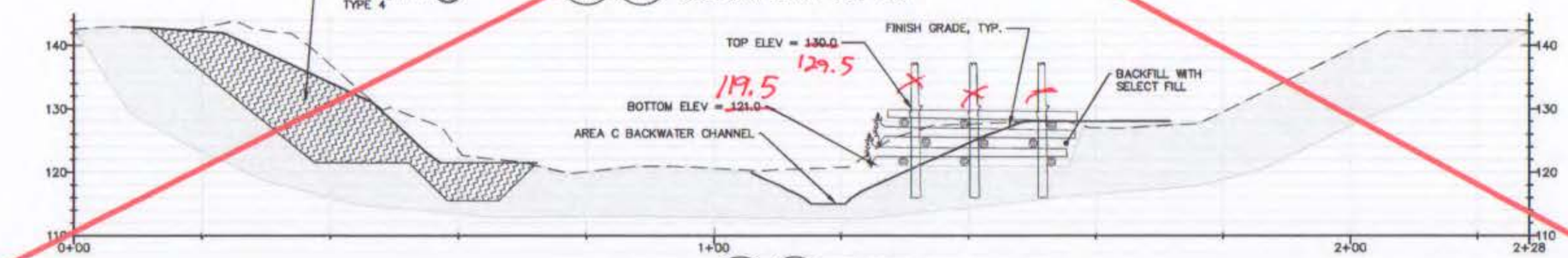
FILE NAME: 7345
CONTRACT NUMBER: 45-81-783
DRAWING NUMBER:
SHEET 28 OF 46



(1/8) (1/15) (1/18) SECTION
LOG JAM STA: 334+39



(2/8) (2/18) SECTION
LOG JAM STA: 339+48



(3/10) (3/21) SECTION
LOG JAM STA: 360+99

Reference sheet #21

(4/10) (4/21) SECTION
LOG JAM STA: 368+34

NOTES:
1. CROSS SECTIONS ARE ORIENTED LOOKING DOWNSTREAM FROM LEFT TO RIGHT. THE STATIONING ORIGIN FOR EACH SECTION IS AT THE EXTREME LEFT END OF THE SECTION CUT LINE.
2. BACKFILL TO BE CONFIRMED WITH OWNER AT TIME OF CONSTRUCTION.
3. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.

PROJECT RECORD DRAWING

interfluve

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	

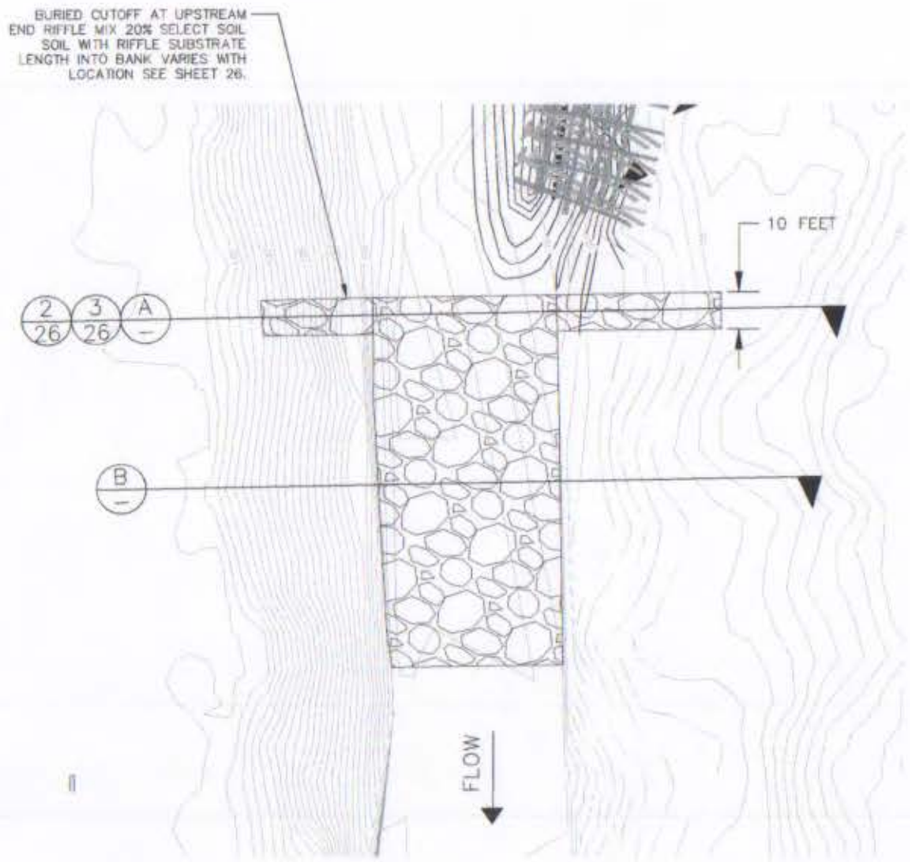
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

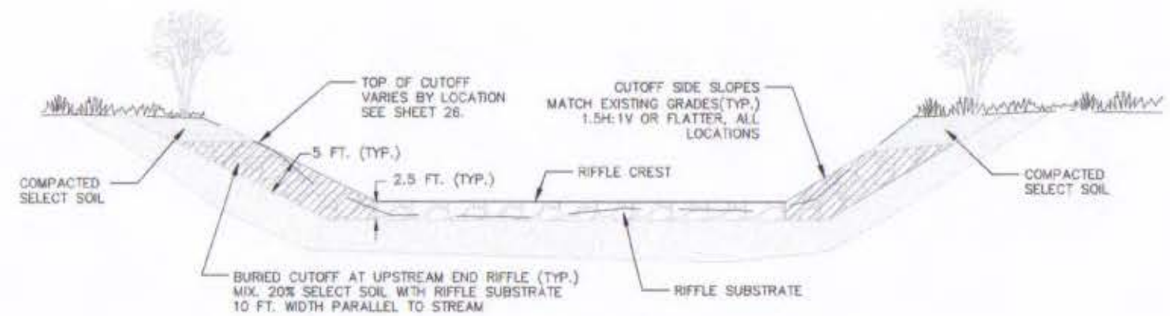
REVIEWED:
REVIEWED: Kent Gylle

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
SECTIONS – LOG JAMS (2 OF 2)

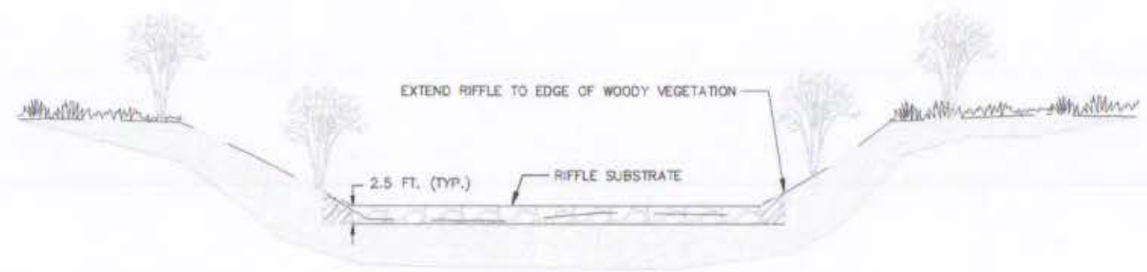
FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7/3
DRAWING NUMBER:
SHEET 28 OF 46



1/8 1/10 1/23 1/24 1/26 TYPICAL PLAN
RIFFLE CONSTRUCTION
SCALE: 1 IN. = 20 FT.



A/– TYPICAL SECTION
RIFFLE CREST
SCALE: 1 IN. = 10 FT.



B/– TYPICAL SECTION
RIFFLE (NON-CREST)
SCALE: 1 IN. = 10 FT.

20 0 20 40 80
SCALE IN FEET

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
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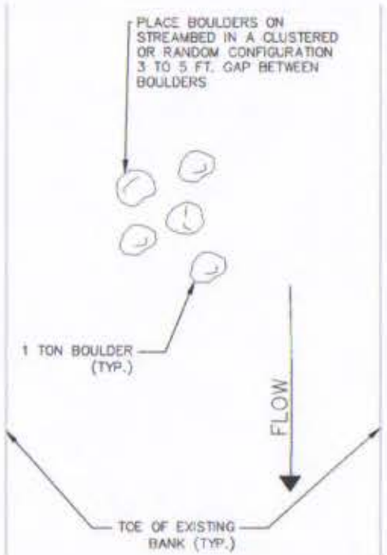
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – RIFFLES

FILE NAME: 7345
CONTRACT NUMBER: 45-61-763
DRAWING NUMBER:
SHEET 29 OF 46

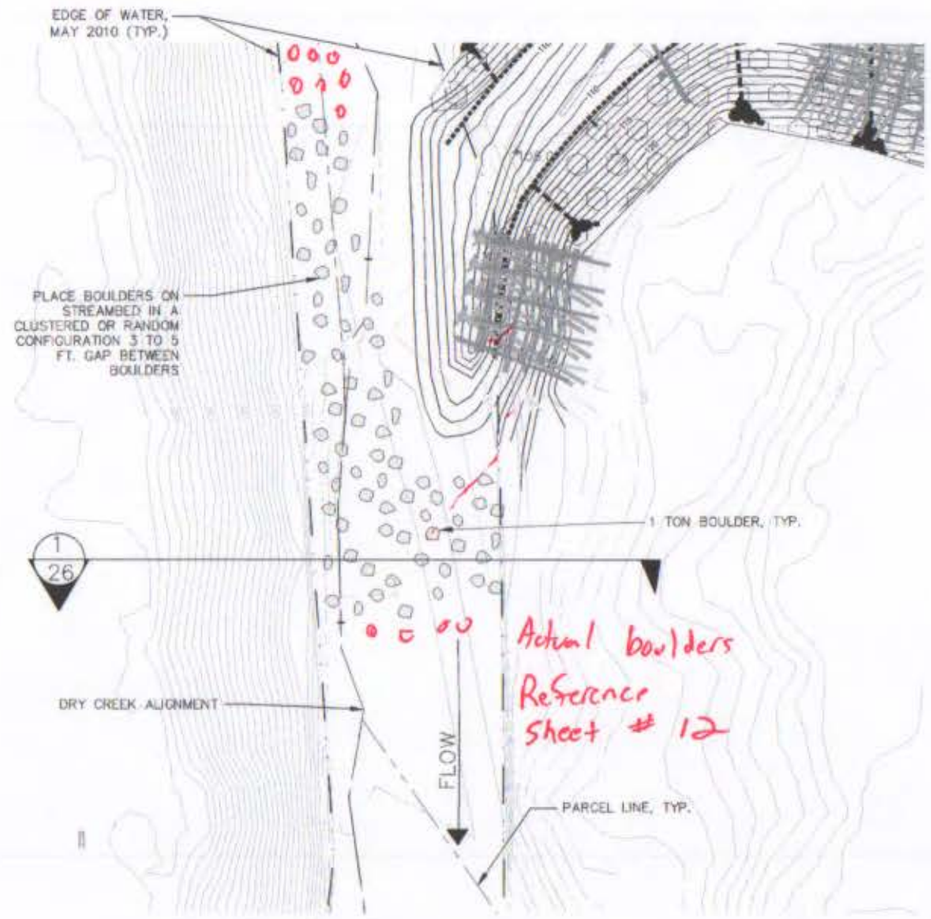


1/8 1/9 TYPICAL PLAN
BOULDER CLUSTER
SCALE: 1 IN. = 10 FT.

NOTE:

1. FINAL LOCATION, ALIGNMENT AND CONFIGURATION OF BOULDER CLUSTERS TO BE CONFIRMED AT TIME OF CONSTRUCTION, APPROVAL BY OWNER.

10 0 10 20 40
SCALE IN FEET



2/8 2/11 2/12 2/26 DETAIL PLAN
BOULDER FIELD
SCALE: 1 IN. = 20 FT.

NOTE:

1. FINAL LOCATION, ALIGNMENT AND CONFIGURATION OF BOULDER FIELD TO BE CONFIRMED AT TIME OF CONSTRUCTION, APPROVAL BY OWNER.

20 0 20 40 80
SCALE IN FEET

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

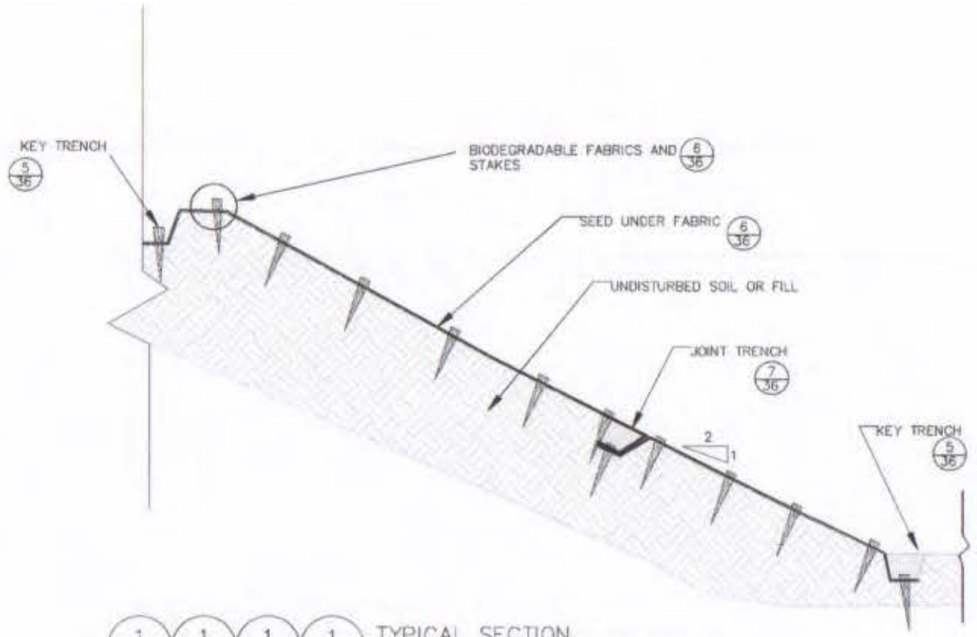
NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

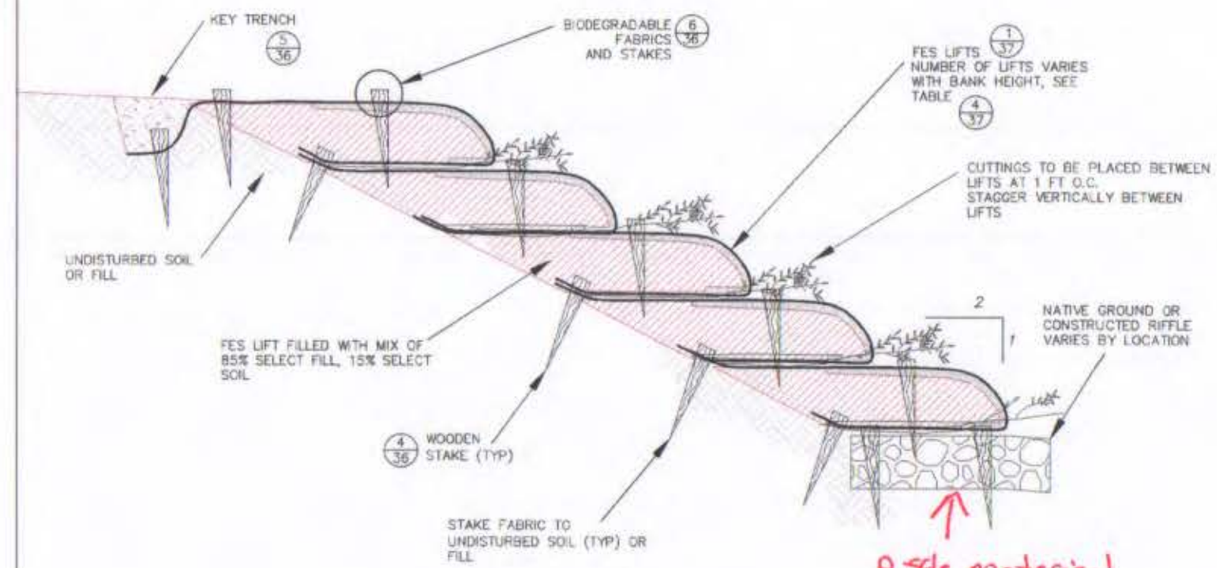
SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – BOULDER CLUSTER AND BOULDER FIELD

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-7#3
DRAWING NUMBER:
SHEET 30 OF 46

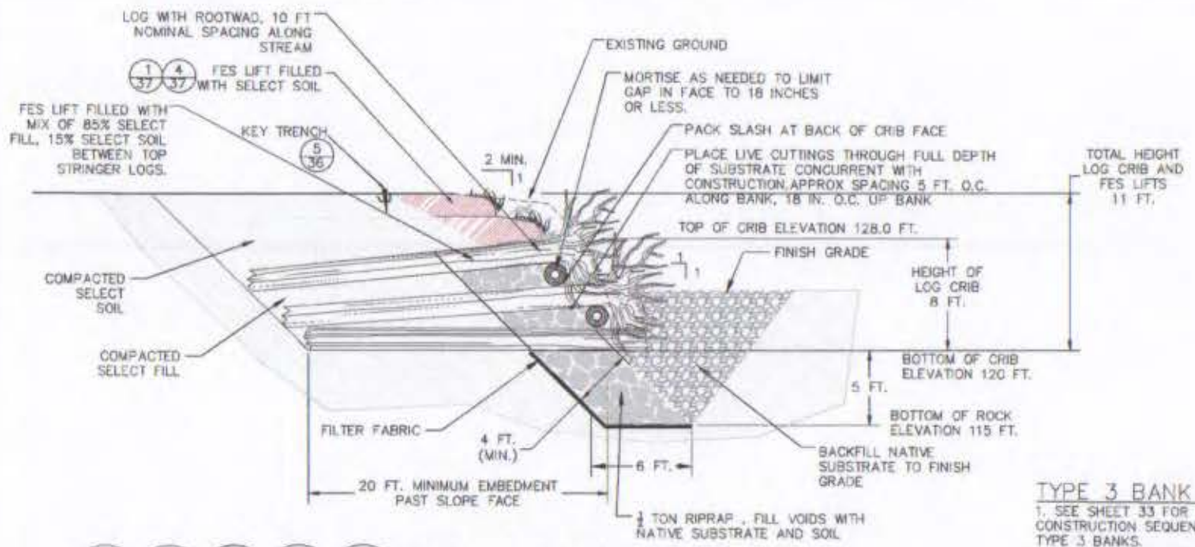


1/8 1/10 1/12 1/21 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 1
NTS



Riffle material substituted on Wallace Type 2 Bank

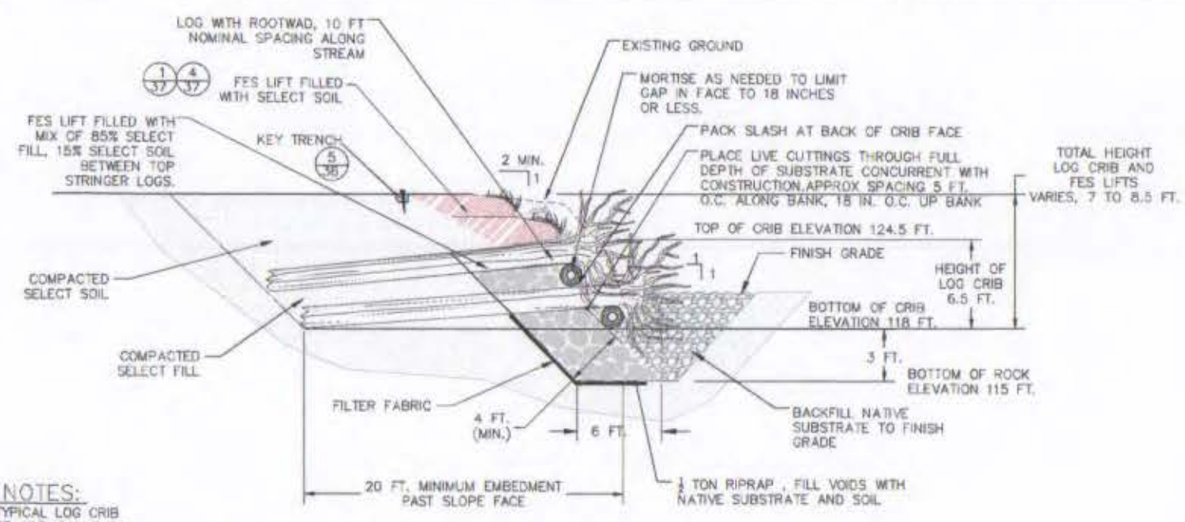
2/8 2/15 2/16 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 2
NTS



3/8 3/15 3/16 3/26 3/28 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 3
WALLACE PROPERTY STA. 0+00 TO 2+30
SCALE: 1 IN. = 5 FT.

TYPE 3 BANK NOTES:

1. SEE SHEET 33 FOR TYPICAL LOG CRIB CONSTRUCTION SEQUENCE APPLICABLE TO TYPE 3 BANKS.
2. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.
3. 25% OF LOGS WITH ROOTWADS SHALL PROJECT AT LEAST 8 FT. PAST NEAT LINE OF BANK.
4. TRANSITION TREATMENT FROM STA. 2+30 TO 2+40.



4/15 4/16 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 3
WALLACE PROPERTY STA. 2+40 TO 3+05
SCALE: 1 IN. = 5 FT.

ORIGINAL

Interflow

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

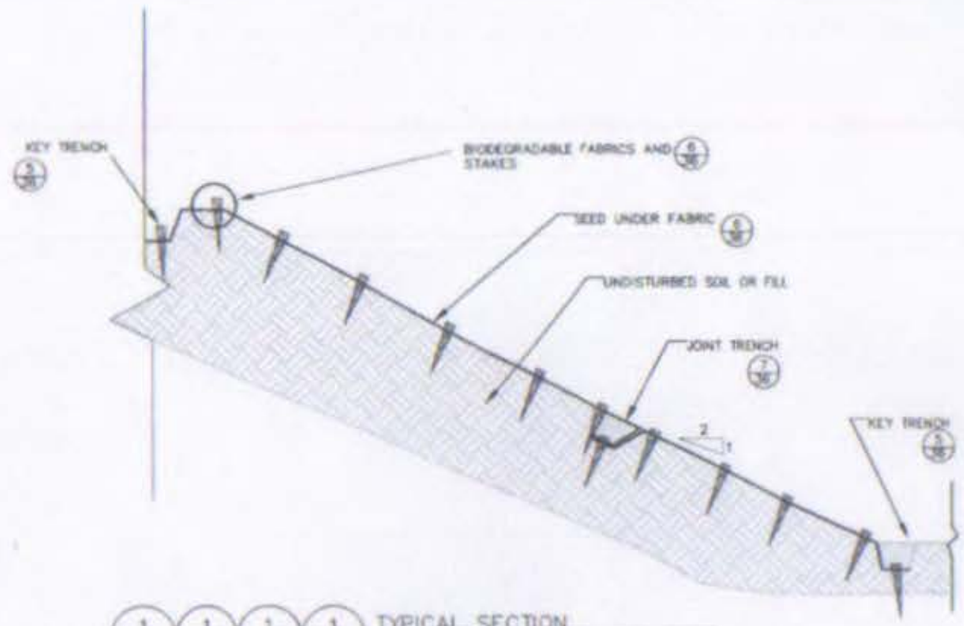
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

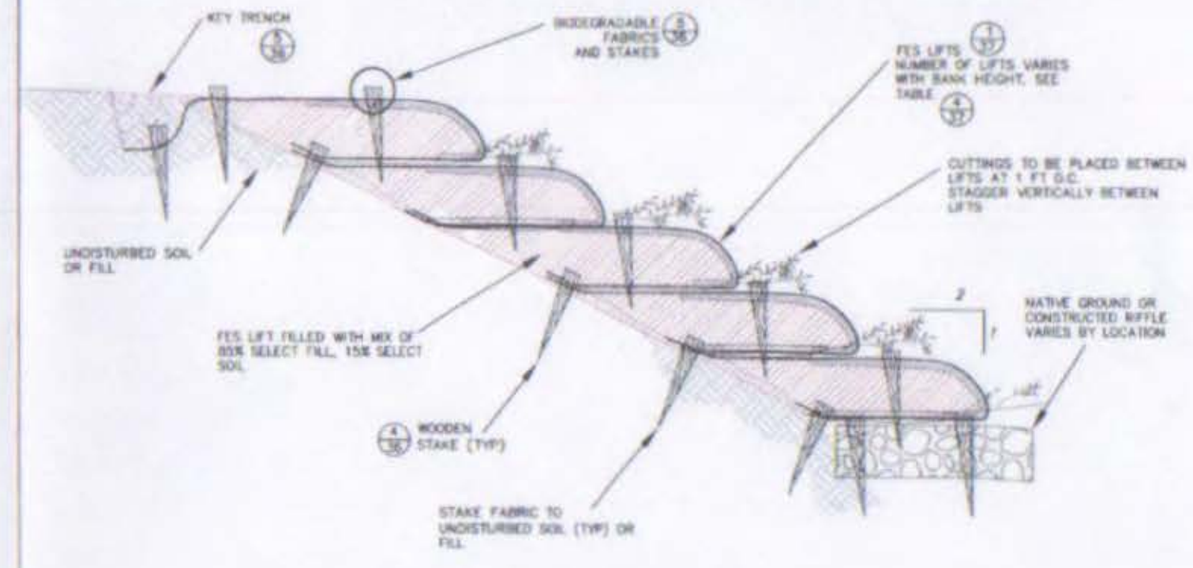
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – TYPE 1-3 BANK

FILE NAME: 7345
CONTRACT NUMBER: 45-61-763
DRAWING NUMBER:
SHEET 31 OF 46

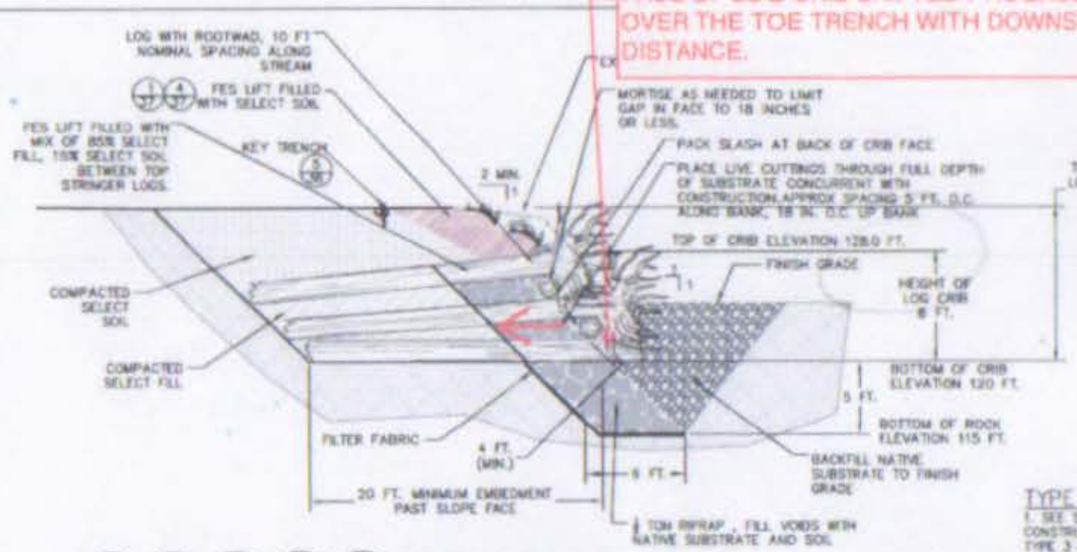


1/8 1/10 1/12 1/21 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 1
NTS



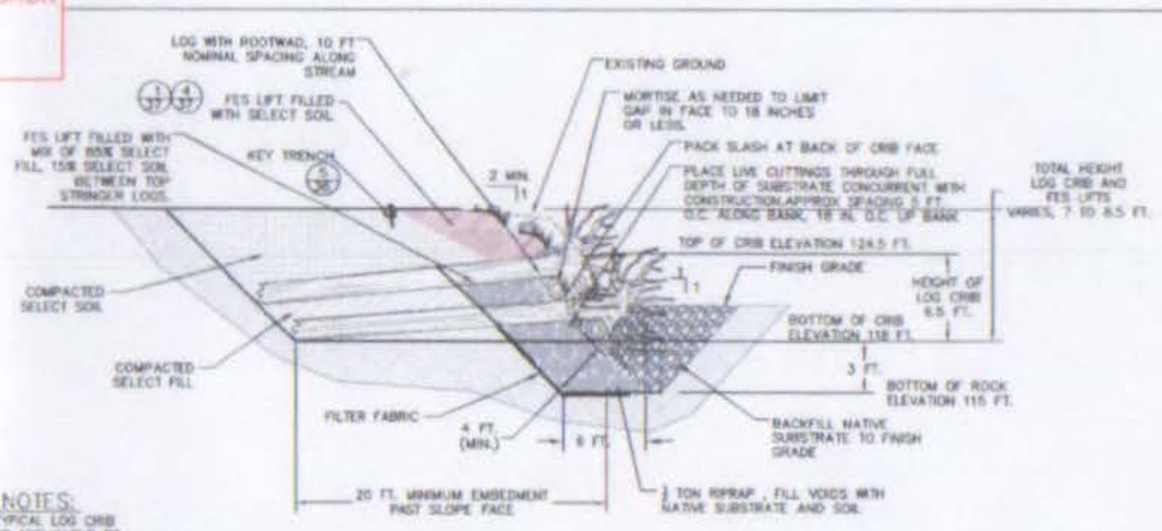
2/8 2/15 2/16 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 2
NTS

FACE OF LOG CRIB SHIFTED PROGRESSIVELY BACK OVER THE TOE TRENCH WITH DOWNSTREAM DISTANCE.



3/8 3/15 3/16 3/26 3/28 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 3
WALLACE PROPERTY STA. 0+00 TO 2+30

TYPE 3 BANK NOTES:
1. SEE SHEET 33 FOR TYPICAL LOG CRIB CONSTRUCTION SEQUENCE APPLICABLE TO TYPE 3 BANKS.
2. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.
3. 25% OF LOGS WITH ROOTWADS SHALL PROJECT AT LEAST 8 FT. PAST NEAT LINE OF BANK.
4. TRANSITION TREATMENT FROM STA. 2+30 TO 2+40.



4/15 4/16 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 3
WALLACE PROPERTY STA. 2+40 TO 3+05
SCALE: 1 IN. = 5 FT.

CURRENT

rev. 8-2-13

PROJECT RECORD DRAWING

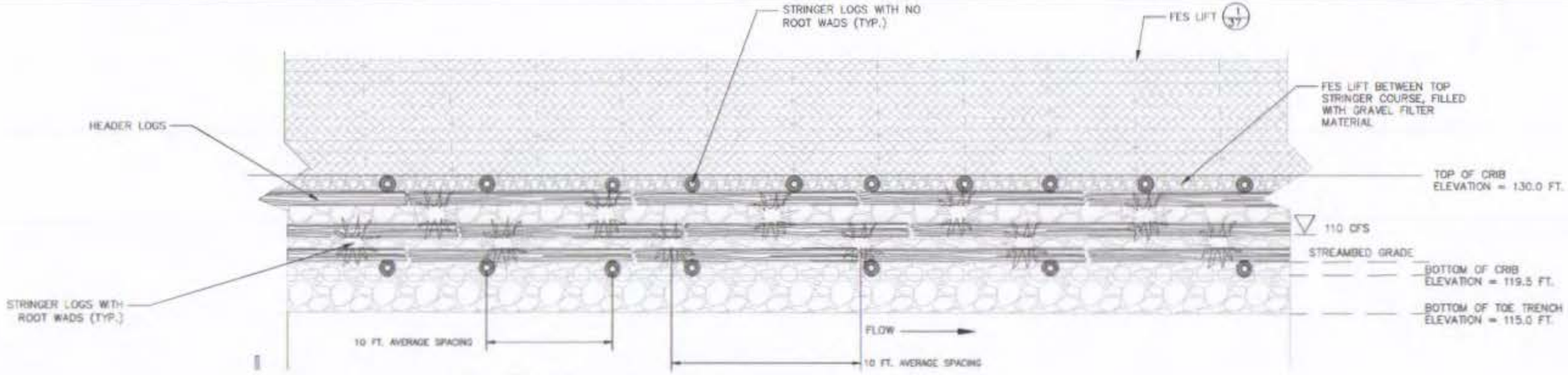
RECORD INFORMATION

SONOMA COUNTY WATER AGENCY

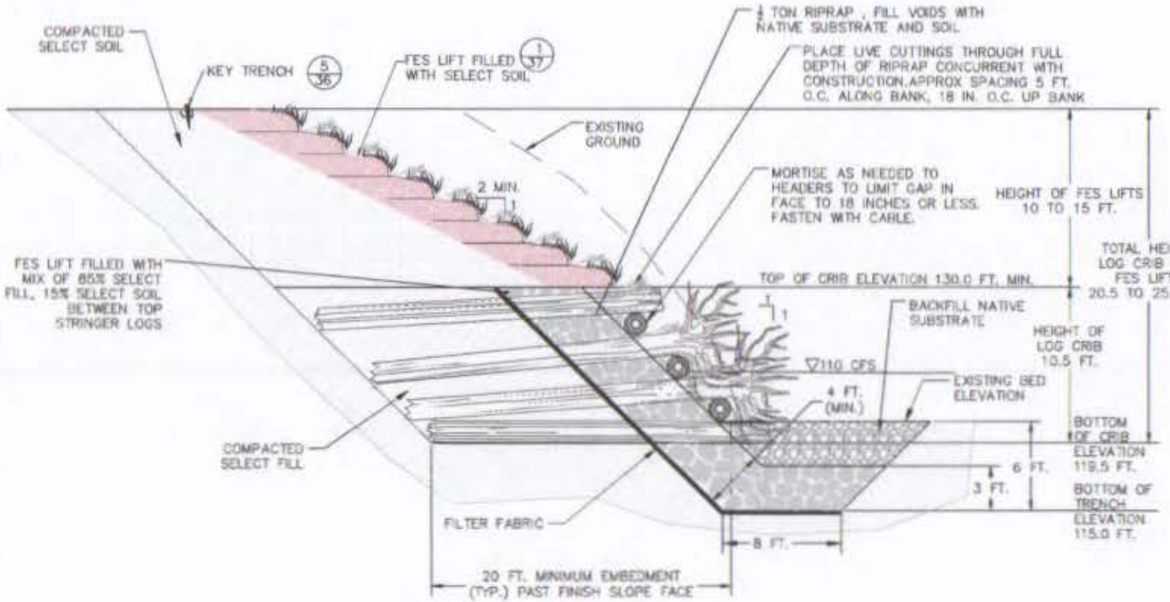
1/23/2013
RED
MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
TYPICAL DETAILS – TYPE 1–3 BANK

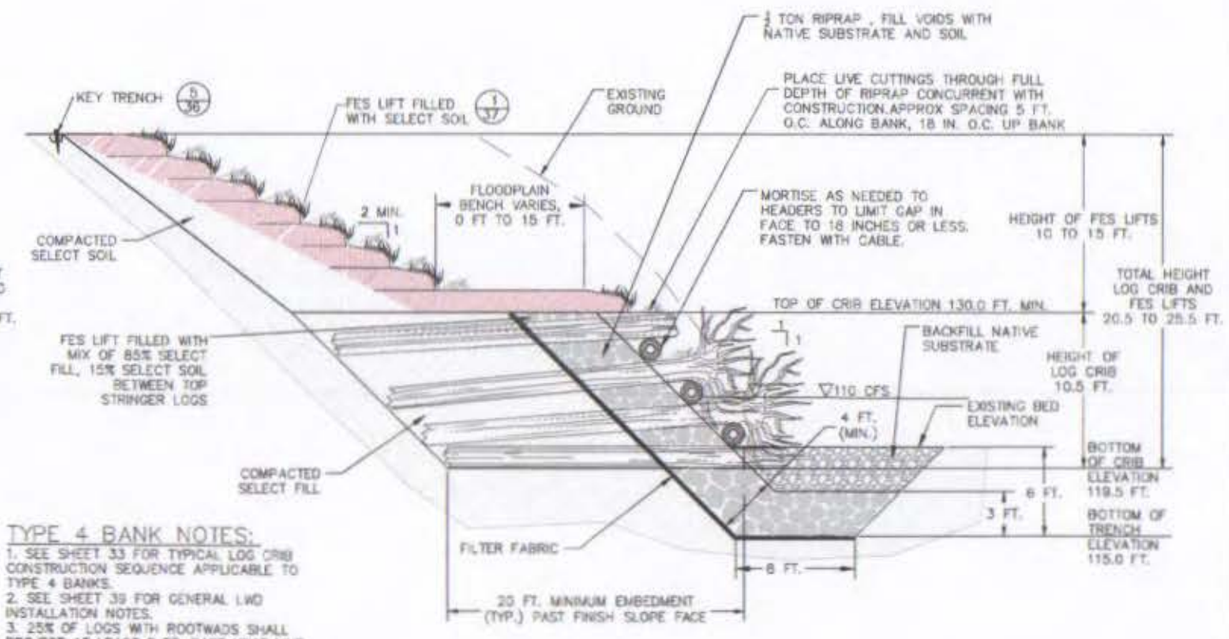
SHEET 31 OF 46



1/10 1/24 1/25 TYPICAL ELEVATION VIEW
BANK CONSTRUCTION, TYPE 4
NTS



2/10 2/24 2/25 2/26 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 4 WITH NO BENCH
STA: 0+55 TO 1+55, 3+00 TO 3+60, 5+00 TO 6+15
SCALE: 1 IN. = 5 FT.



TYPE 4 BANK NOTES:

1. SEE SHEET 33 FOR TYPICAL LOG CRIB CONSTRUCTION SEQUENCE APPLICABLE TO TYPE 4 BANKS.
2. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.
3. 25% OF LOGS WITH ROOTWADS SHALL PROJECT AT LEAST 8 FT. PAST NEAT LINE OF BANK.

3/10 3/24 3/25 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 4 WITH BENCH
STA: 0+20 TO 0+55, 1+55 TO 3+00, 4+40 TO 5+00
SCALE: 1 IN. = 5 FT.

ORIGINAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

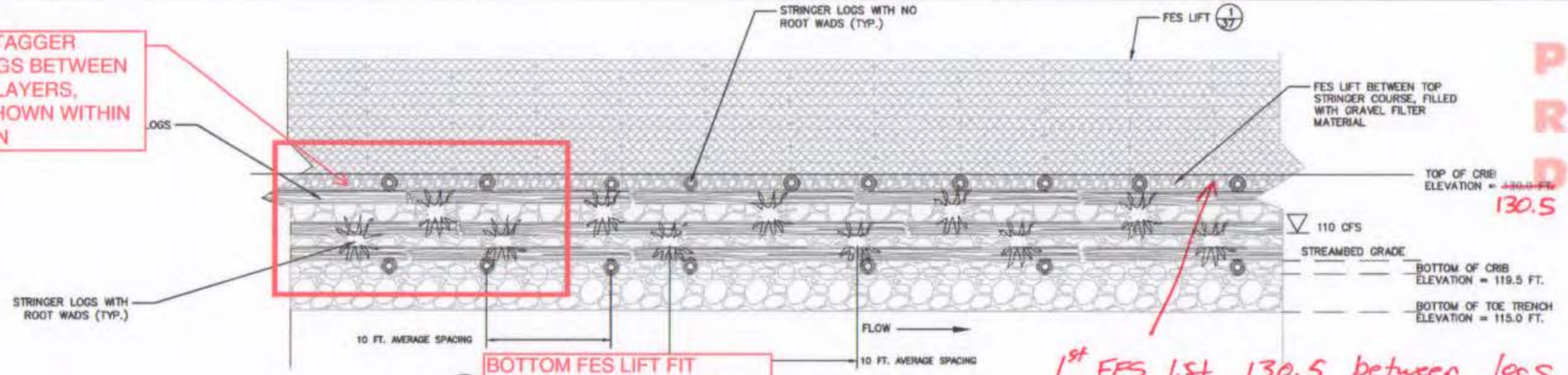
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS –
TYPE 4 BANK (1 OF 4)

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-763
DRAWING NUMBER:
SHEET 32 OF 46

LATERALLY STAGGER STRINGER LOGS BETWEEN SUCCESSIVE LAYERS, SIMILAR TO SHOWN WITHIN THIS POLYGON

PROJECT RECORD DRAWING



CURRENT

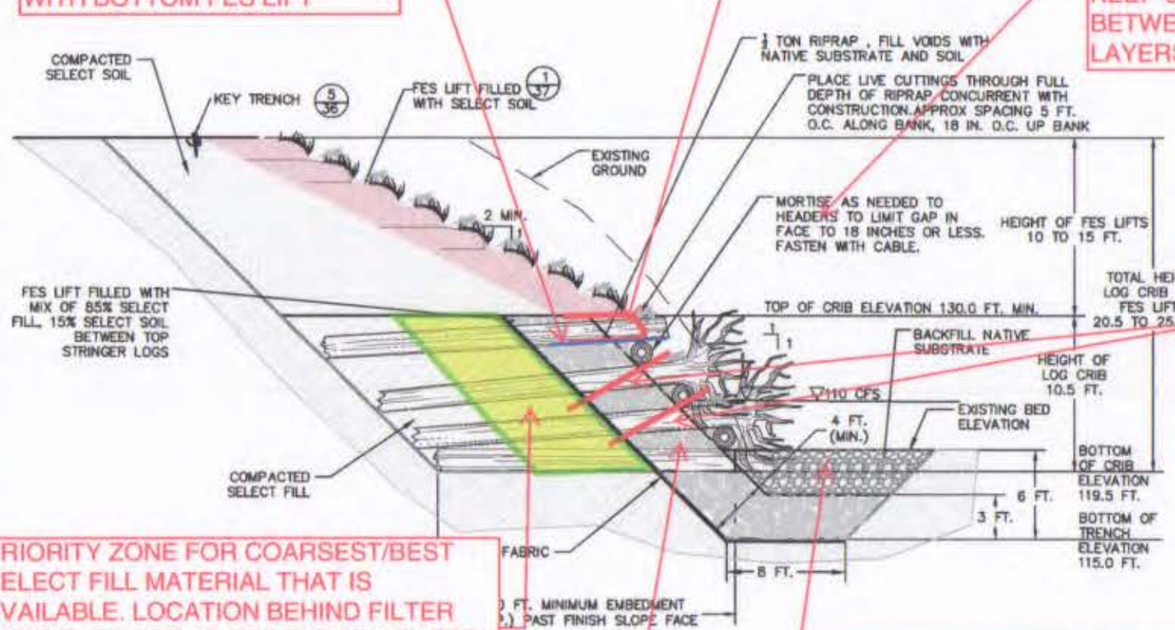
1st FES lift 130.5 between logs
2nd FES lift 132.0 to make top of Bench

BOTTOM FES LIFT FIT BETWEEN TOP STRINGER LOGS.

1/10 N VIEW ON, TYPE 4

BOTTOM-MOST LIVE CUTTING PLACED IN CONJUNCTION WITH BOTTOM FES LIFT

ENDEAVOR TO KEEP GAPS BETWEEN LAYERS TO ~18"



PRIORITY ZONE FOR COARSEST/BEST SELECT FILL MATERIAL THAT IS AVAILABLE. LOCATION BEHIND FILTER FABRIC, TO ACT AS SECONDARY FILTER

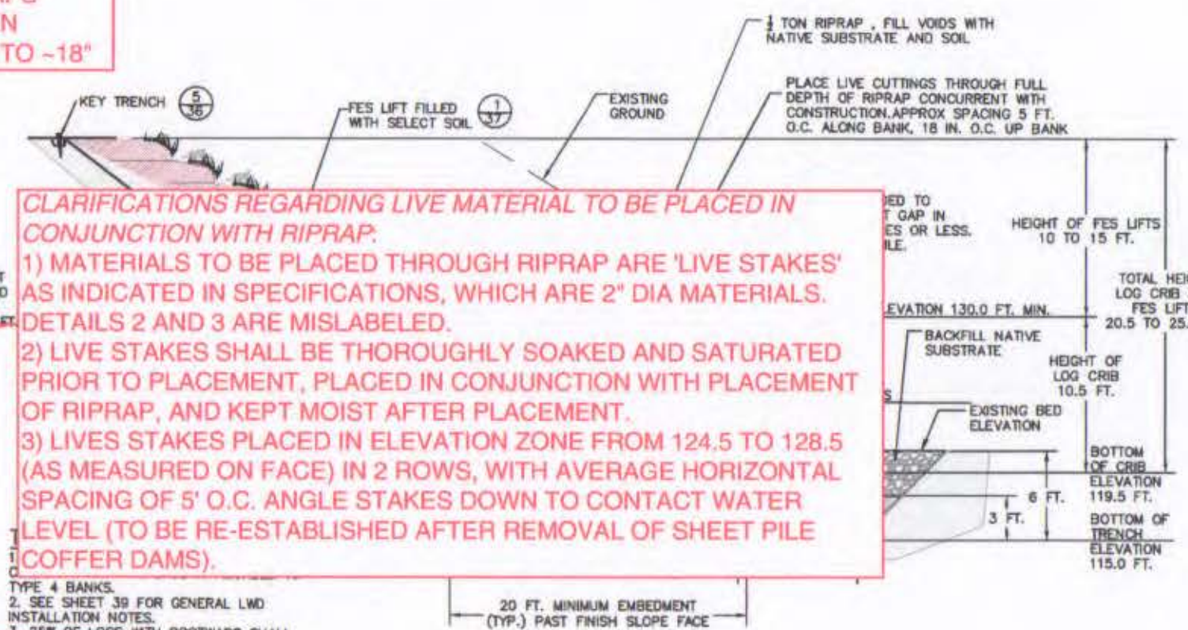
2/10 2/24 2/25 2/26 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 4
STA: 0+55 TO 1+55, 3+00 T
= 5 FT.

CRITICAL TO MAINTAIN STONE TO STONE CONTACT WHEN PLACING 1/2 TON STONE. AVOID EXCESSIVE POCKETS OF INTERSTITIAL FILL THAT MAY BE ERODED.

PRIMARY FUNCTION OF NATIVE SUBSTRATE BACKFILL IS BIOLOGICAL, HENCE SHOULD BE RELATIVELY CLEAN MATERIAL WITH LIMITED SAND AND FINE SOIL (SILTS AND CLAYS ESPECIALLY SHOULD BE LIMITED)

CLARIFICATIONS REGARDING LIVE MATERIAL TO BE PLACED IN CONJUNCTION WITH RIPRAP:

1) MATERIALS TO BE PLACED THROUGH RIPRAP ARE 'LIVE STAKES' AS INDICATED IN SPECIFICATIONS, WHICH ARE 2" DIA MATERIALS. DETAILS 2 AND 3 ARE MISLABELED.
2) LIVE STAKES SHALL BE THOROUGHLY SOAKED AND SATURATED PRIOR TO PLACEMENT, PLACED IN CONJUNCTION WITH PLACEMENT OF RIPRAP, AND KEPT MOIST AFTER PLACEMENT.
3) LIVES STAKES PLACED IN ELEVATION ZONE FROM 124.5 TO 128.5 (AS MEASURED ON FACE) IN 2 ROWS, WITH AVERAGE HORIZONTAL SPACING OF 5' O.C. ANGLE STAKES DOWN TO CONTACT WATER LEVEL (TO BE RE-ESTABLISHED AFTER REMOVAL OF SHEET PILE COFFER DAMS).



3/10 3/24 3/25 TYPICAL SECTION
BANK CONSTRUCTION, TYPE 4 WITH BENCH
STA: 0+20 TO 0+55, 1+55 TO 3+00, ~~4+40~~ TO 5+00
SCALE: 1 IN. = 5 FT.
3+60

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	RECORD INFORMATION / REVISION	BY

SONOMA COUNTY WATER AGENCY

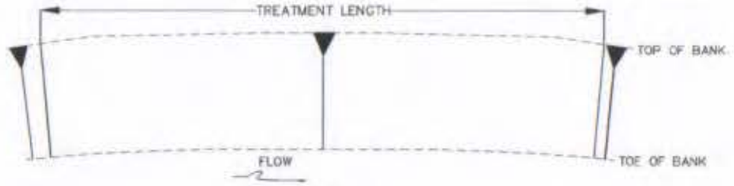
SCALE:
DATE: 1/23/2013
DRAWN: REP
DESIGNED: MB
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
TYPICAL DETAILS – TYPE 4 BANK (1 OF 4)

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7/3
DRAWING NUMBER:
SHEET 32 OF 46

STEP 1.

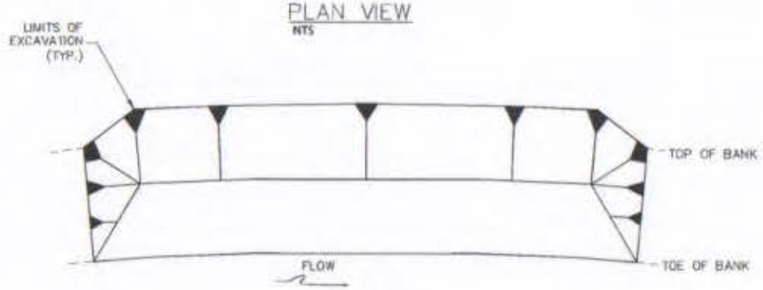
1. CLEAR SITE WITHIN LIMITS OF TREATMENT. AVOID TREES DESIGNATED FOR PRESERVATION.



PLAN VIEW
NTS

STEP 2.

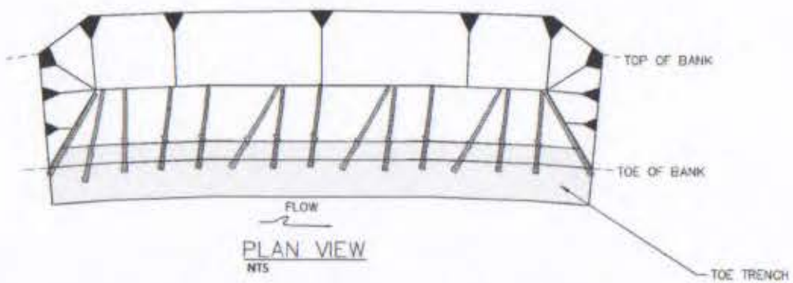
1. EXCAVATE SUBGRADE TO TOP ELEVATION FOR BOTTOM COURSE OF LOGS.



PLAN VIEW
NTS

STEP 3.

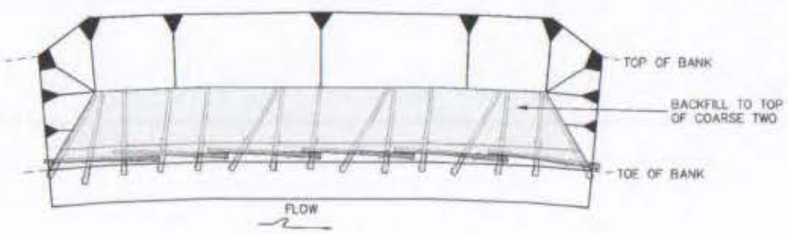
1. EXCAVATE AND INSTALL TOE TRENCH. BACKFILL TRENCH WITH NATIVE SUBSTRATE.
2. INSTALL LWD COURSE 1 (STRINGERS) BY TRENCHING EACH LOG INTO SUBGRADE TO DESIGN DEPTH.
3. ANGLE LWD AT END TERMINATIONS TO EXTEND TO THE FULL LIMITS OF BANK TREATMENT.



PLAN VIEW
NTS

STEP 4.

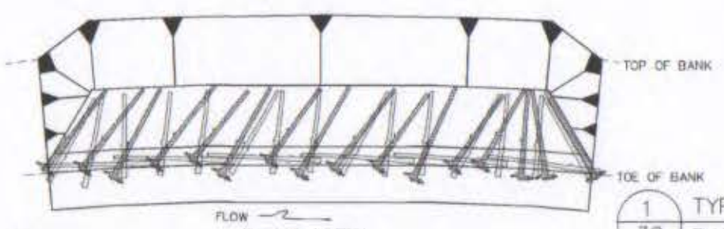
1. INSTALL AND CABLE LWD COURSE 2 (HEADERS).
2. PACK SLASH AGAINST BANK SIDE OF CRIB FORMED BY LWD COURSES 1 AND 2.
3. ALTERNATELY INSTALL LIVE CUTTINGS, SELECT FILL, FILTER FABRIC, GRAVEL FILTER, AND SUBSTRATE BACKFILL TO TOP OF LWD COURSE 2.



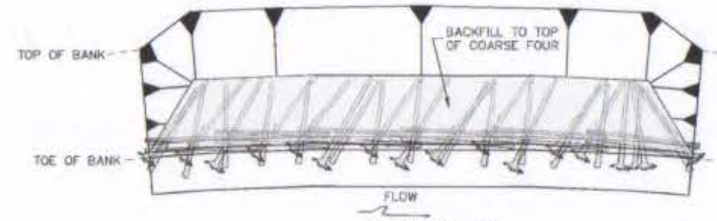
PLAN VIEW
NTS

STEP 5.

1. INSTALL AND CABLE LWD COURSE 3 (STRINGERS). 25% OF LWD WITH ROOTWADS SHALL EXTEND AT LEAST 8 FEET PAST THE NEAT LINE OF THE BANK INTO THE CHANNEL.
2. ANGLE LWD AT END TERMINATIONS TO EXTEND TO THE FULL LIMITS OF BANK TREATMENT AND BLEND TO EXISTING GRADE.



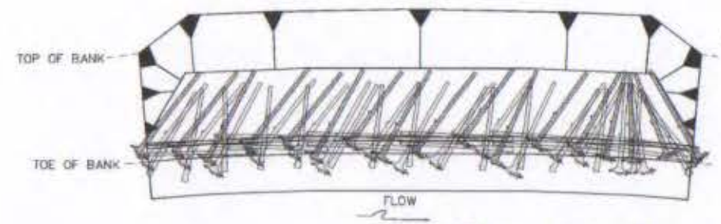
PLAN VIEW
NTS



PLAN VIEW
NTS

STEP 6.

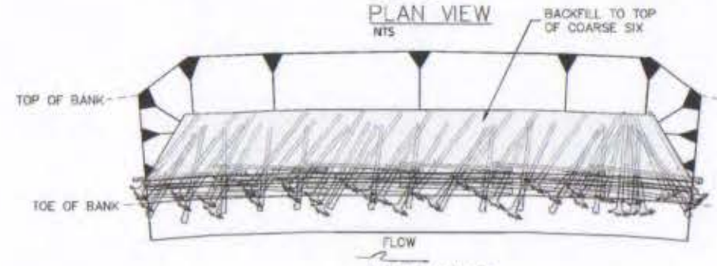
1. INSTALL AND CABLE LWD COURSE 4 (HEADERS).
2. PACK SLASH AGAINST BANK SIDE OF CRIB FORMED BY LWD COURSES 3 AND 4.
3. ALTERNATELY INSTALL LIVE CUTTINGS, SELECT FILL, FILTER FABRIC, GRAVEL FILTER, AND SUBSTRATE BACKFILL TO TOP OF LWD COURSE 4.



PLAN VIEW
NTS

STEP 7.

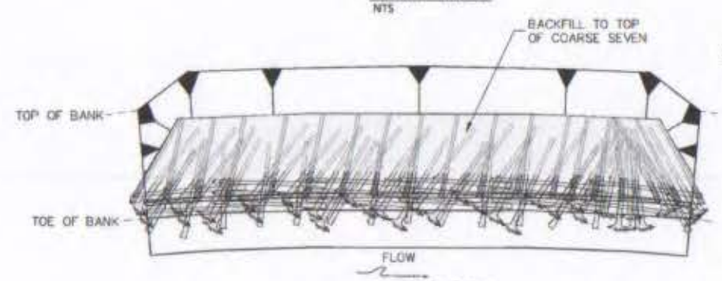
1. INSTALL AND CABLE LWD COURSE 5 (STRINGERS). 25% OF LWD WITH ROOTWADS SHALL EXTEND AT LEAST 8 FEET PAST THE NEAT LINE OF THE BANK INTO THE CHANNEL.
2. ANGLE LWD AT END TERMINATIONS TO EXTEND TO THE FULL LIMITS OF BANK TREATMENT AND BLEND TO EXISTING GRADE.



PLAN VIEW
NTS

STEP 8.

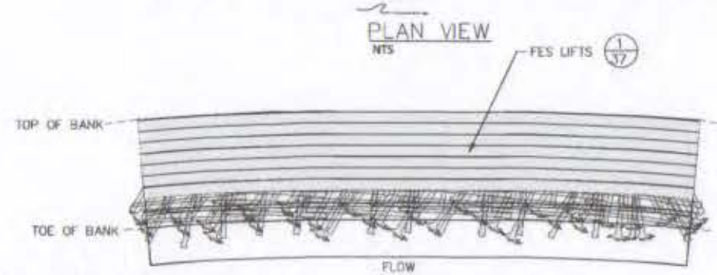
1. INSTALL AND CABLE LWD COURSE 6 (HEADERS).
2. PACK SLASH AGAINST BANK SIDE OF CRIB FORMED BY LWD COURSES 5 AND 6.
3. ALTERNATELY INSTALL LIVE CUTTINGS, SELECT FILL, FILTER FABRIC, GRAVEL FILTER, AND SUBSTRATE BACKFILL TO TOP OF LWD COURSE 6.



PLAN VIEW
NTS

STEP 9.

1. INSTALL AND CABLE LWD COURSE 7 (STRINGERS).
2. ANGLE LWD AT END TERMINATIONS TO EXTEND TO THE FULL LIMITS OF BANK TREATMENT AND BLEND TO EXISTING GRADE.
3. BETWEEN COURSE 7 STRINGERS, PLACE LIVE CUTTINGS ON TOP OF COURSE 6 HEADERS.
4. BETWEEN COURSE 7 STRINGERS, INSTALL GRAVEL FILTER MATERIAL IN FES AT BANK FACE.
5. ALTERNATIVELY INSTALL SELECT FILL, FILTER FABRIC, AND GRAVEL FILTER IN REMAINING AREA TO TOP OF LWD COURSE 7.



PLAN VIEW
NTS

STEP 10.

1. ALTERNATELY INSTALL LIVE CUTTINGS AND FES LIFTS TO FINISH UPPER BANK TREATMENT.

1/32 TYPICAL CONSTRUCTION SEQUENCE
BANK CONSTRUCTION TYPE 4
SCALE: 1 IN. = 20 FT.

PROJECT RECORD DRAWING

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 CIVIL STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
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SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
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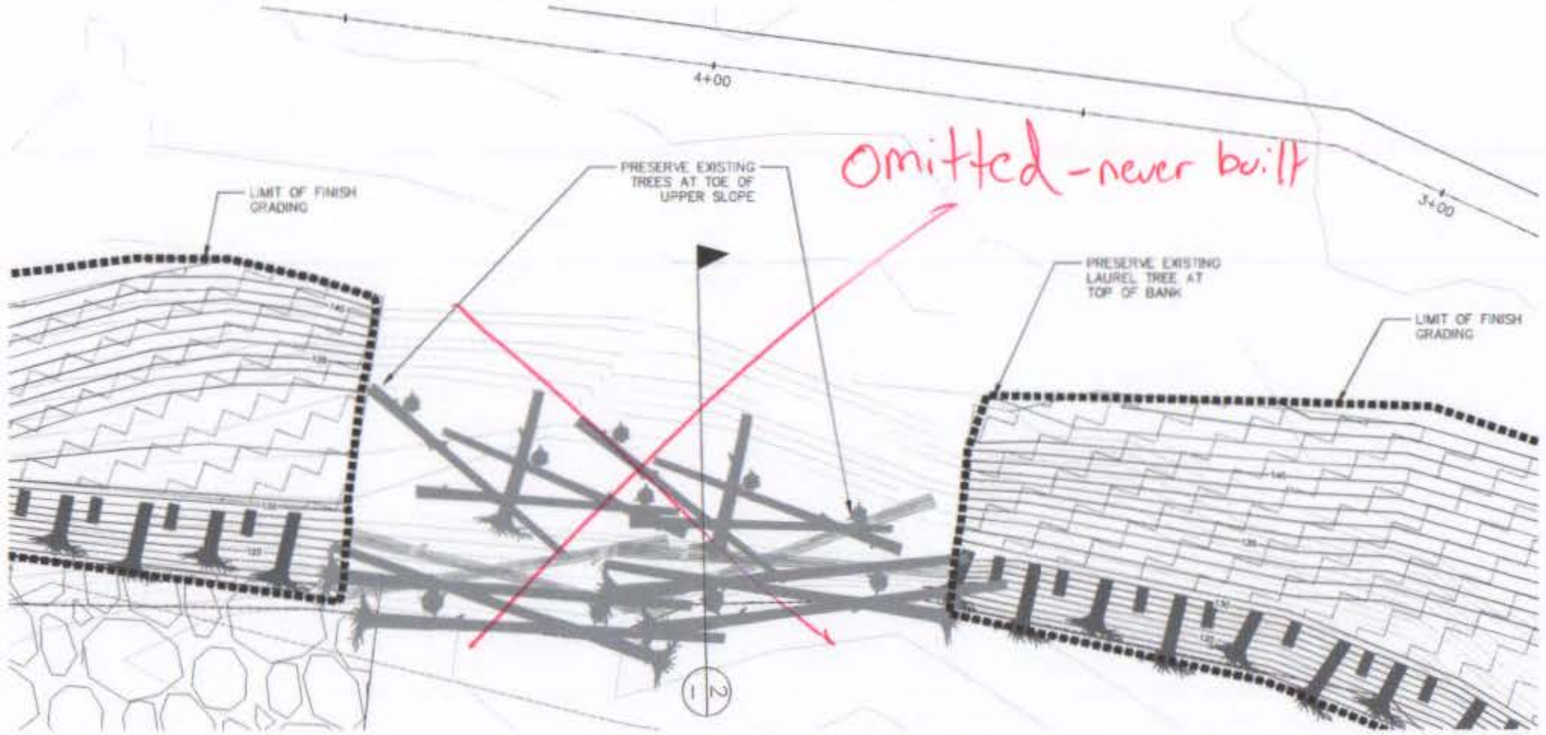
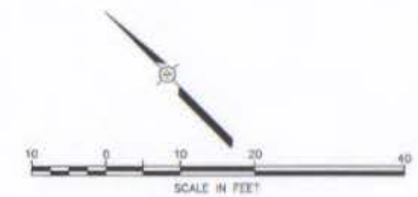
CHECKED: MB

REVIEWED:
REVIEWED:

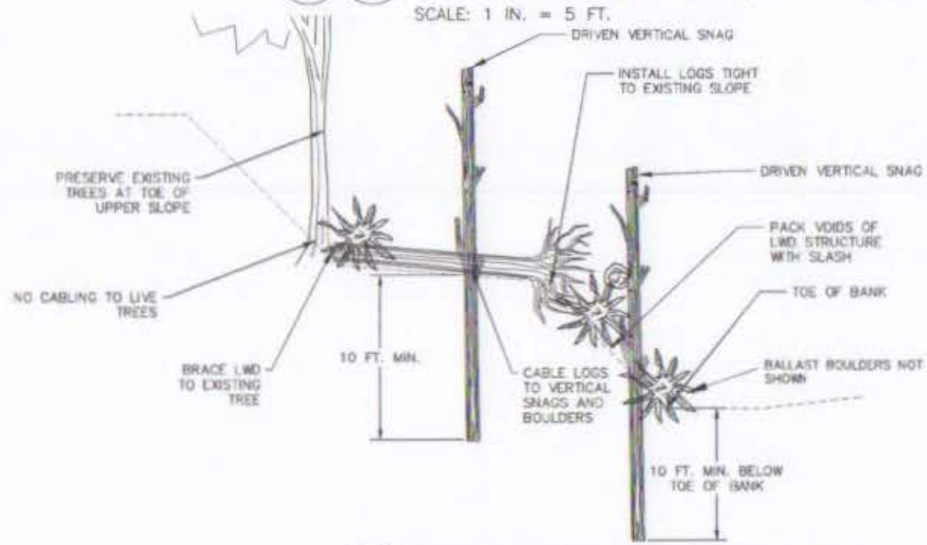
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – TYPE 4 BANK (2 OF 4)

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-7#3
DRAWING NUMBER:
SHEET 33 OF 46





1/10 1/24 PLAN – STA: 3+60 TO 4+40
BANK CONSTRUCTION TYPE 4, NO GRADING
SCALE: 1 IN. = 5 FT.



2/– TYPICAL SECTION STA: 3+60 TO 4+40
BANK CONSTRUCTION TYPE 4
SCALE: 1 IN. = 5 FT.

GENERAL NOTES:
1. SEE SHEET 39 FOR GENERAL LWD INSTALLATION NOTES.

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

DATE: 1/23/2013
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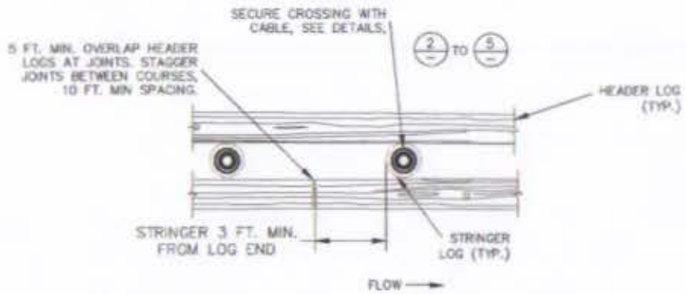
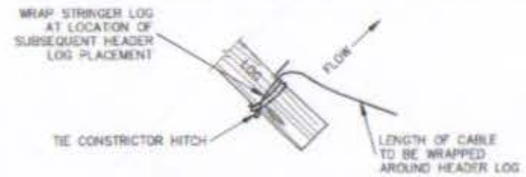
CHECKED: MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – TYPE 4 BANK (3 OF 4)

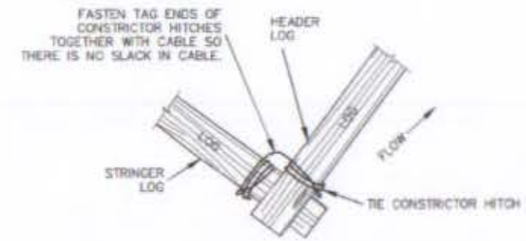
FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-743
DRAWING NUMBER:
SHEET 34 OF 46



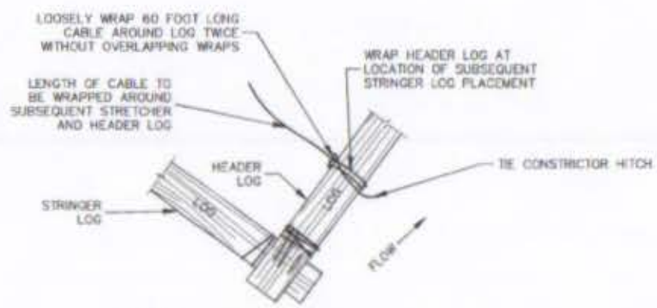
1 TYPICAL ELEVATION DETAIL
HEADER LOG JOINTS
NTS



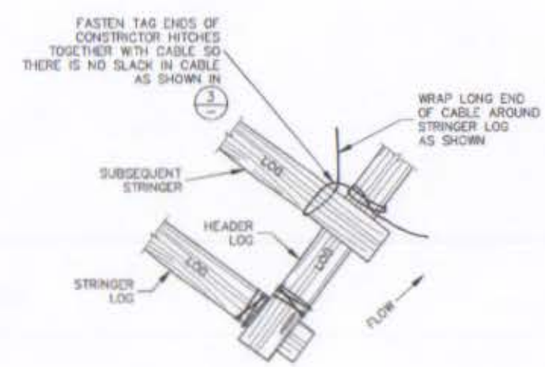
2 TYPICAL DETAIL
CABLE WRAP SEQUENCE 1
NTS



3 TYPICAL DETAIL
CABLE WRAP SEQUENCE 2
NTS



4 TYPICAL DETAIL
CABLE WRAP SEQUENCE 3
NTS



5 TYPICAL DETAIL
CABLE WRAP SEQUENCE 4
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

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SONOMA COUNTY WATER AGENCY

DATE: 1/23/2013
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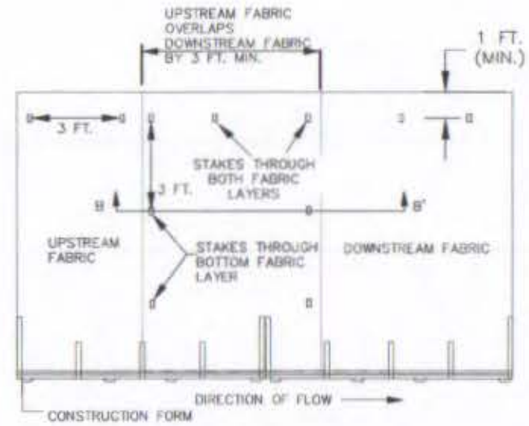
CHECKED: MB

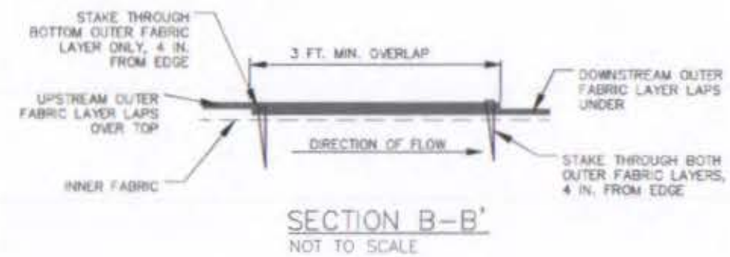
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – TYPE 4 BANK (4 OF 4)

FILE NAME: 7345
CONTRACT NUMBER: 45-B.1-7#3
DRAWING NUMBER:
SHEET 35 OF 46

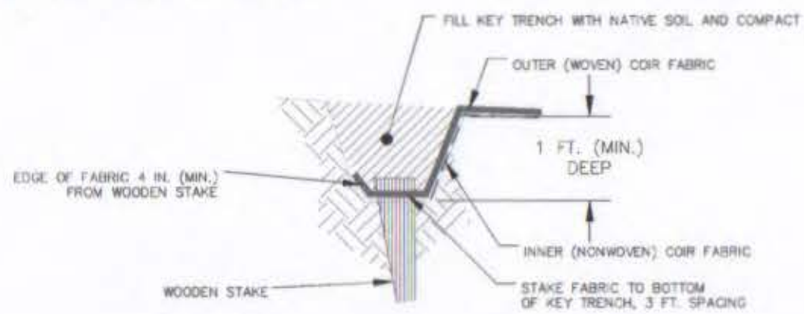
1 / – TYPICAL PLAN DETAIL
FOLDING OF CONTINUOUS OUTER COIR FABRIC AT BENDS
NTS



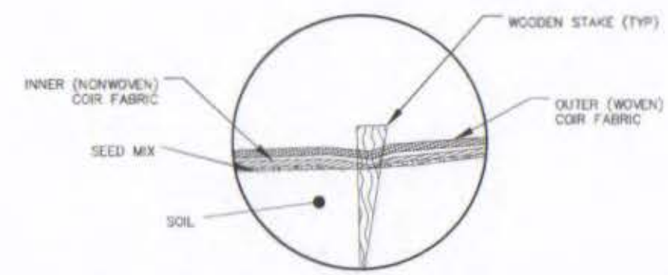
2 / – TYPICAL PLAN DETAIL
OUTER FABRIC JOINING DETAILS
NTS



4 / 31 WOODEN STAKE FABRICATING DETAILS
NTS



5 / 31 5 / 32 KEY TRENCH DETAIL
TRENCH INTO SOIL
NTS



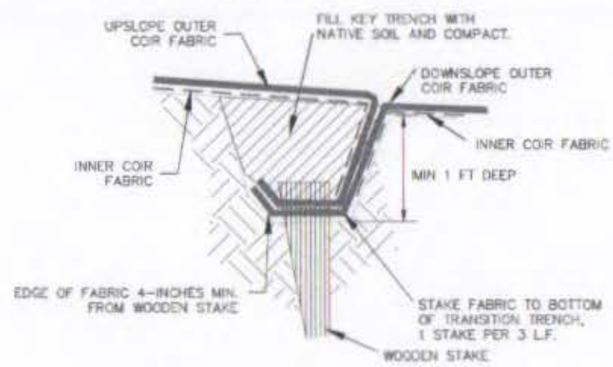
6 / 31 TYPICAL DETAIL
BIODEGRADABLE FABRICS AND STAKES
NTS

GENERAL NOTES ON SECURING COIR FABRIC

1. THE HOLES FOR STAKES SHALL NOT BE PRECUT. ALLOW THE STAKE TO BREAK THE MINIMUM NUMBER OF STRANDS AS IT IS BEING DRIVEN. DRIVE STAKES SO THAT 3 IN. OF THE TOP OF STAKE IS LEFT EXPOSED.

2. FORMS MAY BE ANGLED TO CREATE BENDS IN THE LIFTS AS NEEDED. FABRIC SHALL BE FOLDED AS SHOWN. NO BEND SHALL EXCEED A 15 DEGREE ANGLE. FOLDS SHALL BE MADE IN AN UPSTREAM TO DOWNSTREAM DIRECTION. STAKE THE FOLDS AS SHOWN.

3. OUTER FABRIC ENDS SHALL BE JOINED BY LAPPING THE UPSTREAM PIECE OF FABRIC OVER THE DOWNSTREAM PIECE AS SHOWN. OVERLAPS SHALL BE A MINIMUM OF 3 FEET. INNER FABRIC ENDS SHALL BE BUTTED TOGETHER, NOT OVERLAPPED. OVERLAPS IN OUTER FABRIC SHALL BE STAGGERED FROM LIFT TO LIFT BY A MINIMUM OF 10 FT.



7 / 31 JOINT TRENCH DETAIL
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
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SONOMA COUNTY WATER AGENCY

DATE: 1/23/2013
DRAWN: REF
CHECKED: MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – FABRIC INSTALLATION

FILE NAME: 7345
CONTRACT NUMBER: 45-B1-7#3
DRAWING NUMBER:
SHEET 36 OF 46

FIG A.

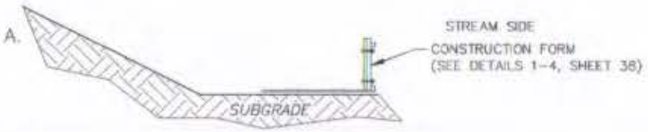


FIG B.

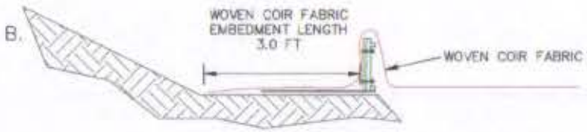


FIG C.

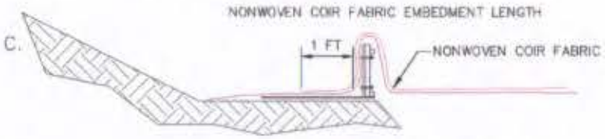


FIG D.

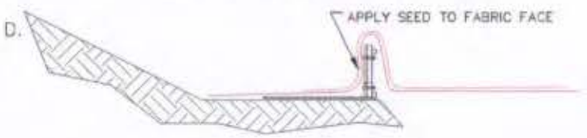


FIG E.

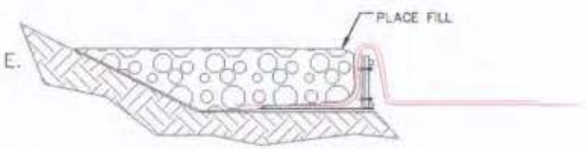


FIG F.

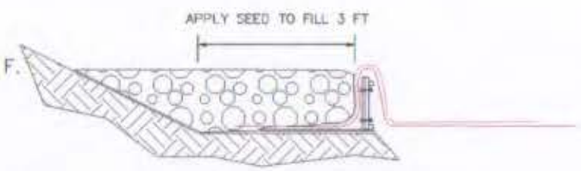


FIG G.

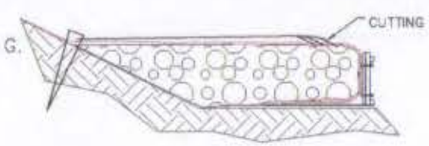
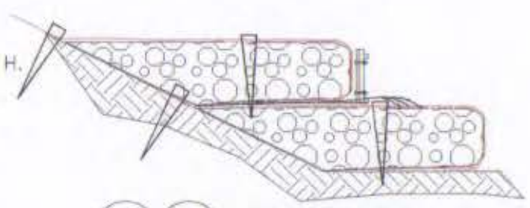


FIG H.



1/31 1/32 TYPICAL SECTION
TYPICAL CONSTRUCTION SEQUENCE FOR FES LIFTS
NTS

FIG 1. PLACE A ROW OF CONSTRUCTION FORMS ALONG DESIRED CHANNEL ALIGNMENT FOR FIRST LIFT.

FIG 2. CONSTRUCT FABRIC WRAP LIFTS ALONG LENGTH OF FIRST SET OF FORMS AND THEN BEGIN PLACEMENT OF FORMS AND CONSTRUCTION OF SECOND LIFT.

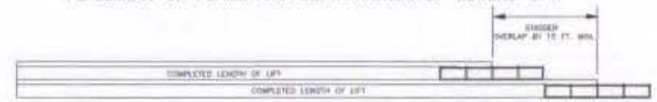


FIG 3. STAGGER FABRIC OVERLAPS A MINIMUM OF 15 IN. BETWEEN LIFTS.

2/– TYPICAL ELEVATION VIEW
CONSTRUCTION SEQUENCE FOR FES LIFTS
NTS

1. FES LIFTS MAY BE CONSTRUCTED IN EITHER AN UPSTREAM OR DOWNSTREAM DIRECTION, AS LONG AS THE FABRIC IS OVERLAPPED IN THE PROPER DIRECTION.

2. EACH LIFT MAY HAVE A UNIQUE FILL COMPOSITION AND VARYING PLACEMENT OF CUTTINGS.

3. PLACE A SERIES OF THREE OR MORE FORMS ON THE GROUND SO THAT THE FORMS FOLLOW THE PROPOSED STREAM BANK ALIGNMENT. BUTT THE ENDS OF THE FORMS TIGHTLY TOGETHER.

4. UNROLL THE WOVEN COIR FABRIC PARALLEL TO THE LONG AXIS OF THE CHANNEL AND POSITION IT SO THAT 3.0 FEET EXTENDS FOR EMBEDMENT ON THE BANK SIDE OF THE FORMS (FIG B), AND A MINIMUM 3 FEET EXTENDS LENGTHWISE BEYOND THE LAST FORM FOR OVERLAP. DRAPE THE REMAINDER OF THE FABRIC OVER THE TOP OF THE FORMS ON THE STREAM SIDE (FIG B).

5. UNROLL THE NONWOVEN COIR FABRIC OVER THE TOP OF THE WOVEN COIR FABRIC AND POSITION IT SO THAT AT LEAST 1 FOOT OF THE INNER FABRIC EXTENDS AS AN EMBEDMENT LENGTH ON THE BANK SIDE OF THE FORMS (FIG C). DRAPE THE REMAINDER OF THE FABRIC OVER THE TOP OF THE FORMS ON THE STREAM SIDE AND ALIGN THE LONG EDGES OF THE COIR FABRICS. STRETCH AND PULL THE FABRIC LAYERS TO REMOVE WRINKLES.

6. APPLY NATIVE SEED MIX TO NONWOVEN COIR FABRIC ALONG VERTICAL EDGE OF LIFT (FIG D). PLACE SPECIFIED FILL OVER THE FABRIC ON THE BANK SIDE OF THE FORMS. LEVEL THE FILL AND COMPACT (FIG E).

7. APPLY NATIVE SEED MIX TO TOP OF FILL FROM THE FRONT OF THE LIFT TO 3 FT BACK FROM FRONT OF THE LIFT (FIG F).

8. FOLD THE LOOSE ENDS OF THE TWO COIR FABRIC LAYERS BACK OVER THE COMPACTED FILL MATERIAL AND STRETCH TIGHTLY TO REMOVE WRINKLES (FIG G). SECURE WITH WOODEN STAKES 1 PER 3 L.F. ALONG THE BACK EDGE AND INTO UNDISTURBED SOIL.

9. REMOVE THE FORMS FROM THE FRONT OF THE COMPLETED LIFTS (DETAIL 2 THIS SHEET). LEAVE THE LAST FORM IN PLACE AT THE END OF THE NEWLY CONSTRUCTED LIFT (DETAIL 2 THIS SHEET). PLACE CUTTINGS ON TOP OF THE FINISHED LAYER FOR THE NEXT LIFT (FIG G). PLACE A SMALL AMOUNT OF SOIL OVER THE CUTTINGS. CAREFULLY RESET THE FORMS ON TOP OF THE FINISHED LAYER FOR THE NEXT LIFT (FIG H) TO AVOID DAMAGING THE CUTTING.

10. PROCEED WITH A NEW SERIES OF LIFTS BY EXTENDING A NEW ROW OF FORMS. OFFSET FORMS TO ESTABLISH THE DESIGN BANK SLOPE BEGINNING AT THE END FORM THAT WAS LEFT IN PLACE. LAY OUT TWO NEW LAYERS OF FABRIC AS PREVIOUSLY DESCRIBED, MAKING SURE TO OVERLAP THE NEW FABRIC LAYERS WITH THE PREVIOUS LAYERS. STAGGER OVERLAPS, BETWEEN ADJACENT LIFTS BY A MINIMUM OF 15 FEET (FIG 2).

11. UPON COMPLETTION OF TOP LIFT, INSTALL KEY TRENCH PARALLEL TO THE BANK AT THE LANDWARD EDGE OF THE WOVEN FABRIC. SEED DETIAL 5 SHEET 36.

12. BACKFILL THE KEY TRENCH WITH NATIVE SOIL AND SMOOTH TO MERGE WITH EXISTING CONTOURS. APPLY SEED MIX TO KEY TRENCH AREA.

3/– TYPICAL SEQUENCE
CONSTRUCTION OF FES LIFTS
NTS

TOTAL VERTICAL BANK HEIGHT (FT)	NUMBER OF LIFTS	TOTAL VERTICAL BANK HEIGHT (FT)	NUMBER OF LIFTS
1.0 TO 1.5	1	9.1 TO 10.5	7
1.6 TO 3.0	2	10.6 TO 12.0	8
3.1 TO 4.5	3	12.1 TO 13.5	9
4.6 TO 6.0	4	13.6 TO 15.0	10
6.1 TO 7.5	5		
7.6 TO 9.0	6		

FES LIFT NOTES:
1. TOP AND BOTTOM LIFTS SHALL USE 13 FOOT WIDE WOVEN COIR FOR THE OUTER FABRIC. MIDDLE LIFTS SHALL USE 10 FOOT WIDE WOVEN COIR FOR THE OUTER FABRIC.
2. MAXIMUM LIFT HEIGHT IS 18 IN.

4/31 4/32 DETAIL TABLE
NUMBER OF FES LIFTS FOR BANK HEIGHT

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

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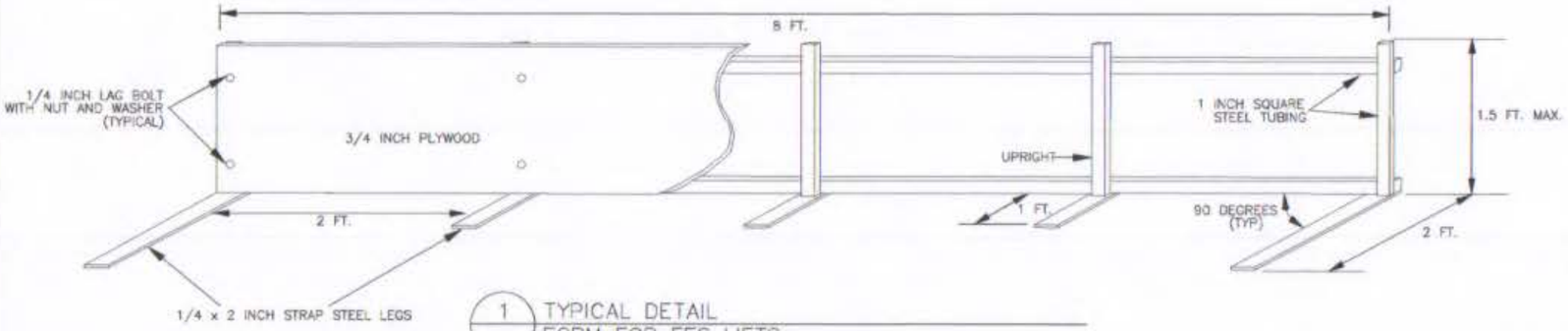
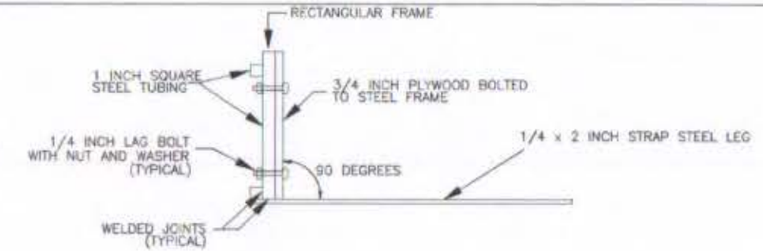
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II

TYPICAL DETAILS – FES LIFT (1 OF 2)

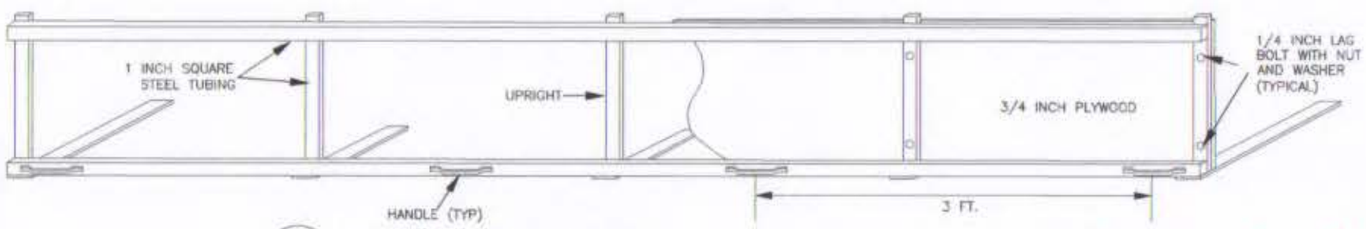
FILE NAME: 7345
CONTRACT NUMBER: 45-61-765
DRAWING NUMBER:
SHEET 37 OF 46



1 TYPICAL DETAIL
FORM FOR FES LIFTS
NTS
ISOMETRIC VIEW FROM REAR

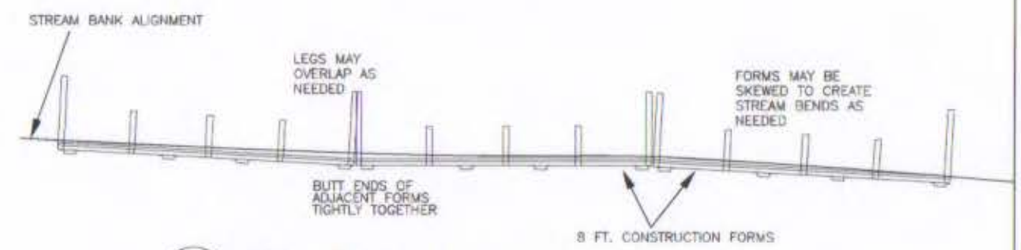


3 TYPICAL SECTION
FORM FOR FES LIFTS
NTS

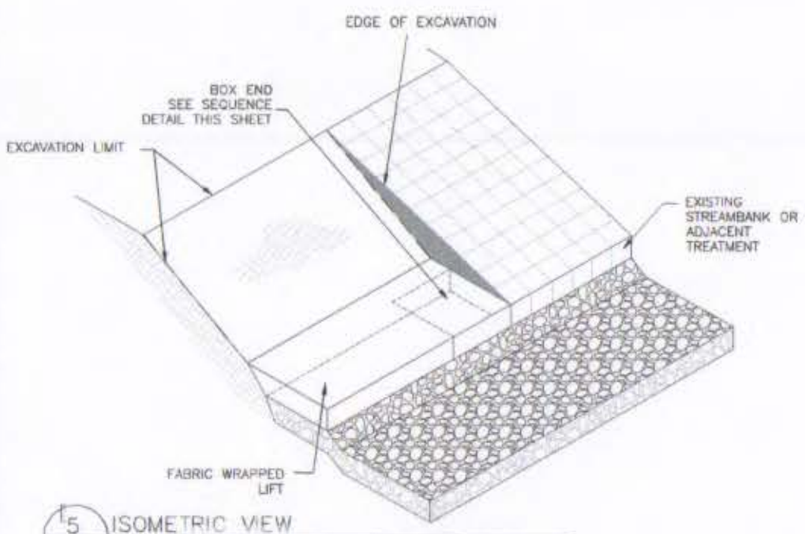


2 TYPICAL ISOMETRIC DETAIL
FABRICATED FORM FOR FES LIFTS
NTS
ISOMETRIC VIEW FROM FRONT

Used different forms

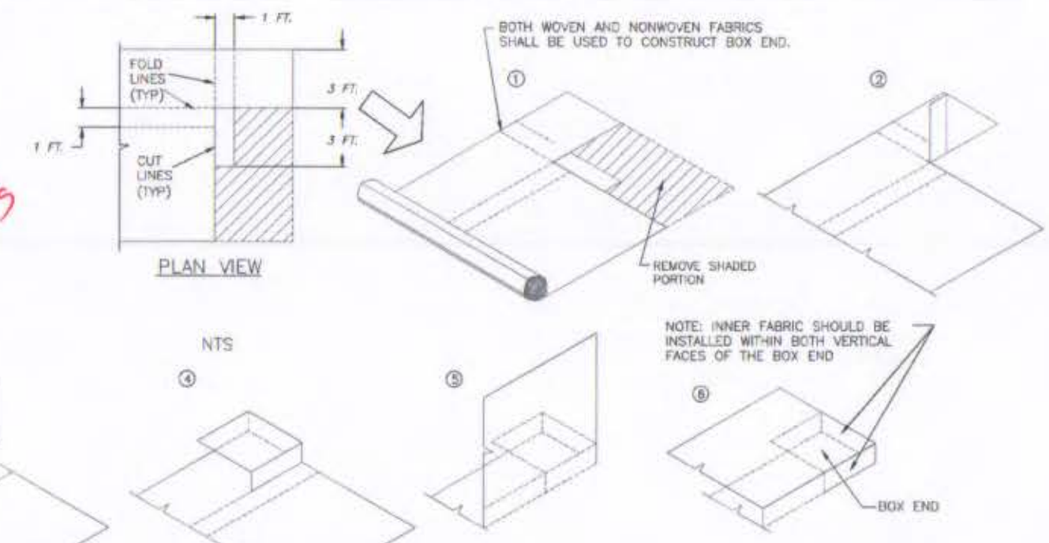


4 TYPICAL PLAN DETAIL
PLACEMENT OF FORMS FOR FES LIFTS
NTS



5 ISOMETRIC VIEW
BOX END AT FES
LIFT TERMINATION
NTS

Folded in with cutting fabric



6 TYPYICAL SEQUENCE
BOX END AT FES LIFT TERMINATION
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

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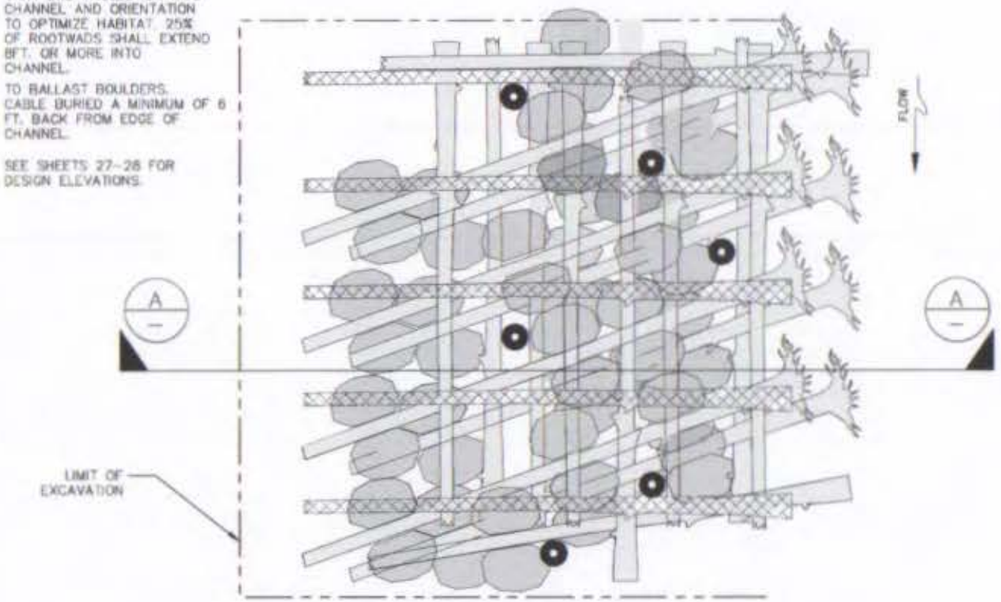
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – FES LIFT (2 OF 2)

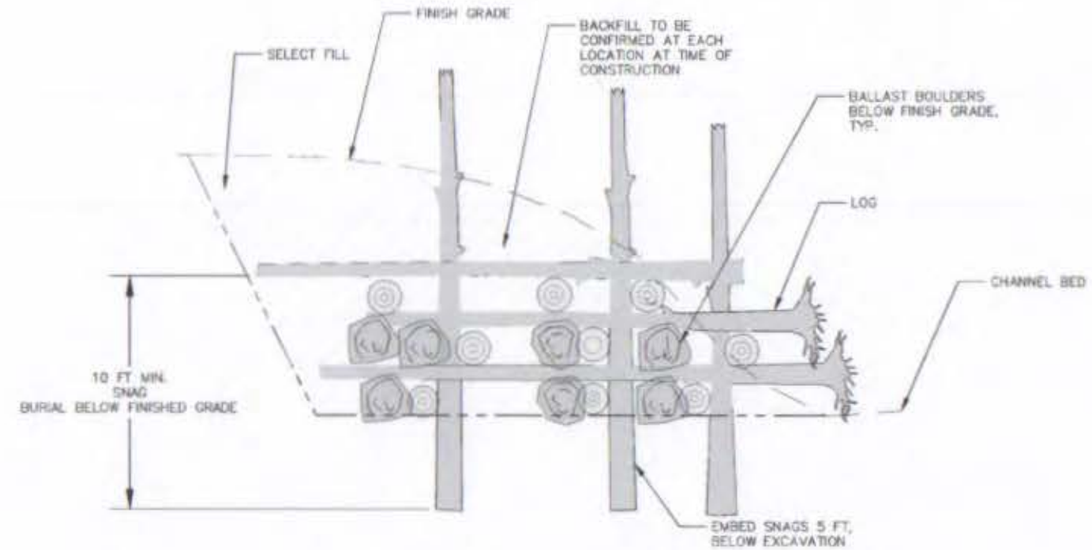
FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-743
DRAWING NUMBER:
SHEET 38 OF 46

LOG JAM SPECIFIC NOTES:

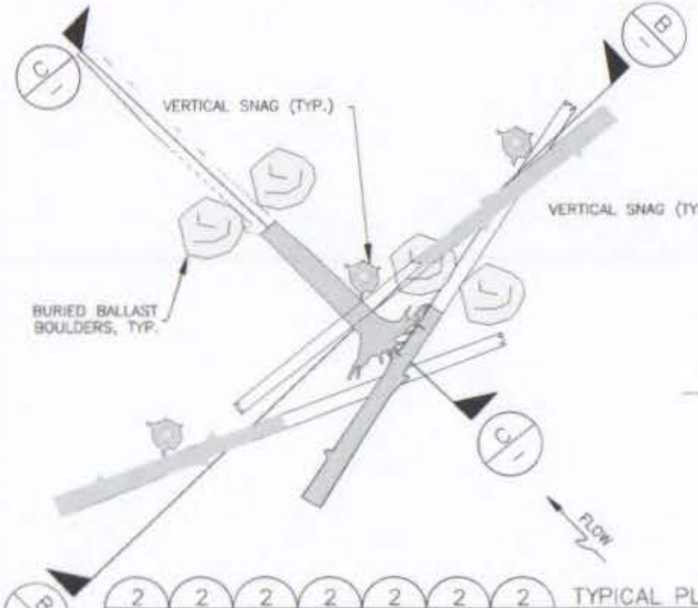
1. VARY LWD PROJECTION INTO CHANNEL AND ORIENTATION TO OPTIMIZE HABITAT. 25% OF ROOTWADS SHALL EXTEND 8FT. OR MORE INTO CHANNEL.
2. TO BALLAST BOULDERS. CABLE BURIED A MINIMUM OF 6 FT. BACK FROM EDGE OF CHANNEL.
3. SEE SHEETS 27-28 FOR DESIGN ELEVATIONS.



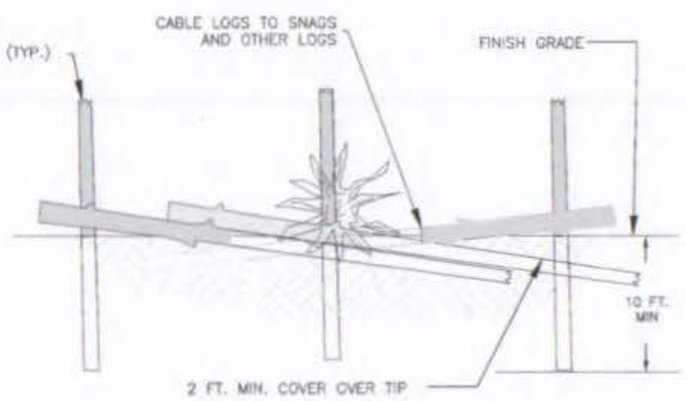
1/8 1/10 1/12 1/15 1/18 1/21 TYPICAL PLAN DETAIL
LOG JAM
NTS



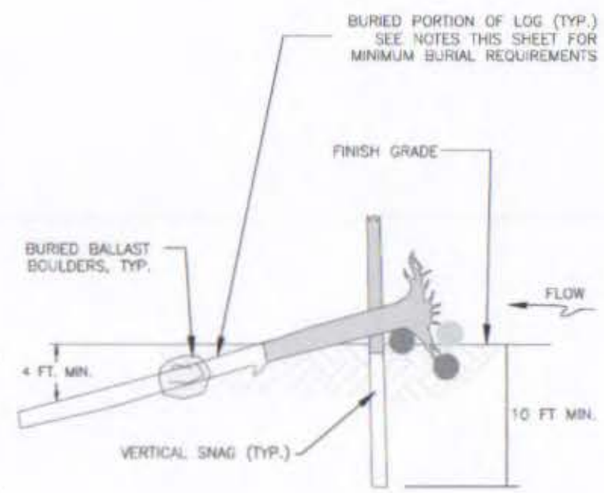
A/– TYPICAL SECTION
LOG JAM



2/8 2/10 2/12 2/18 2/21 2/24 2/26 TYPICAL PLAN
FLOODPLAIN LWD
NTS



B/– TYPICAL ELEVATION VIEW
FLOODPLAIN LWD
NTS



C/– TYPICAL SECTION
FLOODPLAIN LWD
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES BELOW
3. SEE SHEET 42 FOR LOGJAM CONSTRUCTION SEQUENCE.
4. SEE SHEET 43 FOR FLOODPLAIN LWD CONSTRUCTION SEQUENCE.
5. SEE SHEET 45 FOR CABLING DETAILS.

GENERAL LWD INSTALLATION NOTES:

1. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
2. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
3. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO VERTICAL SNAGS OR BOULDERS, OR OTHER METHODS.
4. EXISTING TREES MAY BE SUBSTITUTED FOR SNAGS IN SELECT LOCATIONS, BUT SHALL NOT BE CABLED. SUBSTITUTION ONLY WITH OWNERS APPROVAL.
5. BALLAST BOULDERS TO BE PLACED BELOW FINISH GRADE ONLY.

ORIGINAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

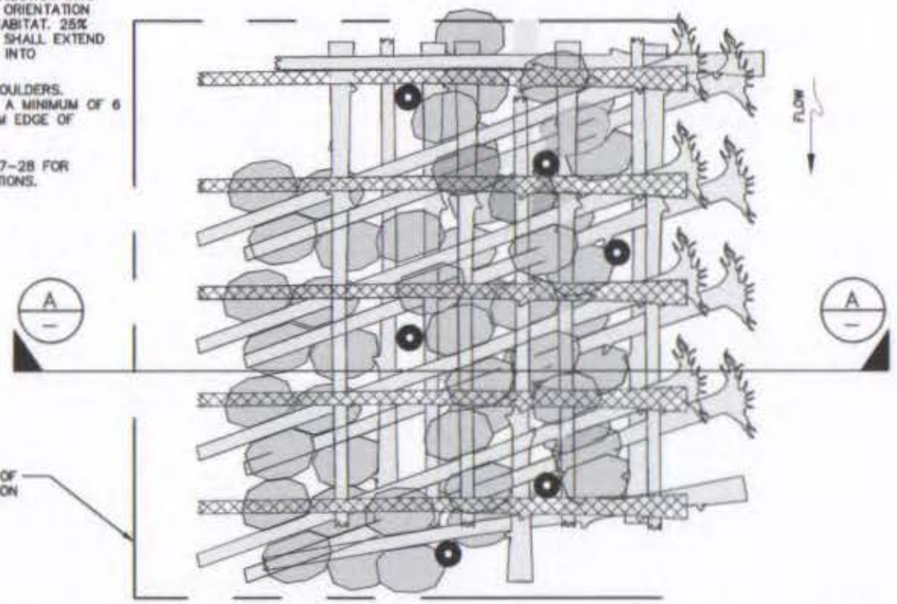
DATE: 1/23/2013
DRAWN: REP
DESIGNED: MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LWD DETAILS – LOG JAM
AND FLOODPLAIN LWD

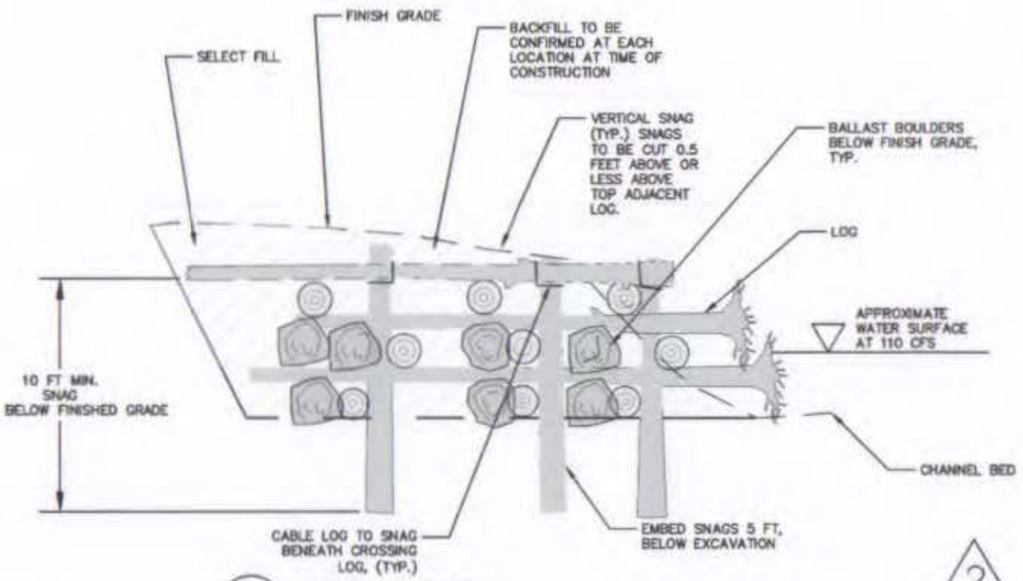
FILE NAME: 7345
CONTRACT NUMBER: 45-S1-763
DRAWING NUMBER:
SHEET 39 OF 46

LOG JAM SPECIFIC NOTES:

1. VARY LWD PROJECTION INTO CHANNEL AND ORIENTATION TO OPTIMIZE HABITAT. 25% OF ROOTWADS SHALL EXTEND 8FT. OR MORE INTO CHANNEL.
2. TO BALLAST BOULDERS. CABLE BURIED A MINIMUM OF 6 FT. BACK FROM EDGE OF CHANNEL.
3. SEE SHEETS 27-28 FOR DESIGN ELEVATIONS.



1/8 1/10 1/12 1/15 1/18 1/21 TYPICAL PLAN DETAIL
LOG JAM
NTS

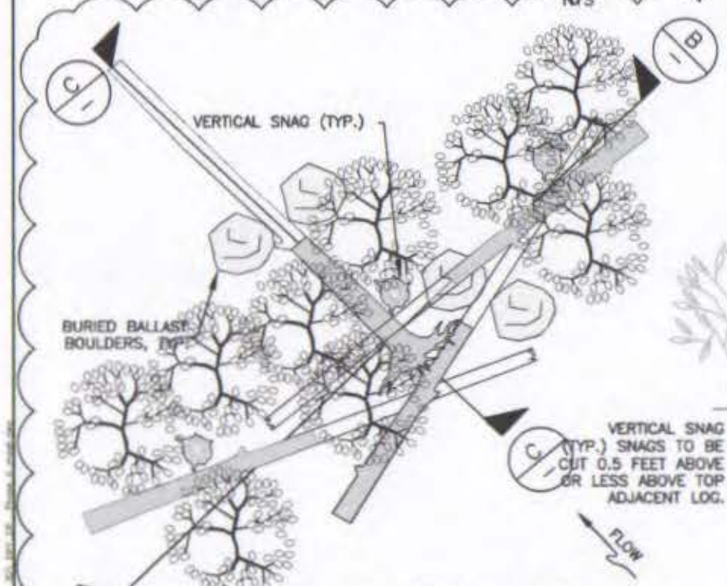


A/– TYPICAL SECTION
LOG JAM

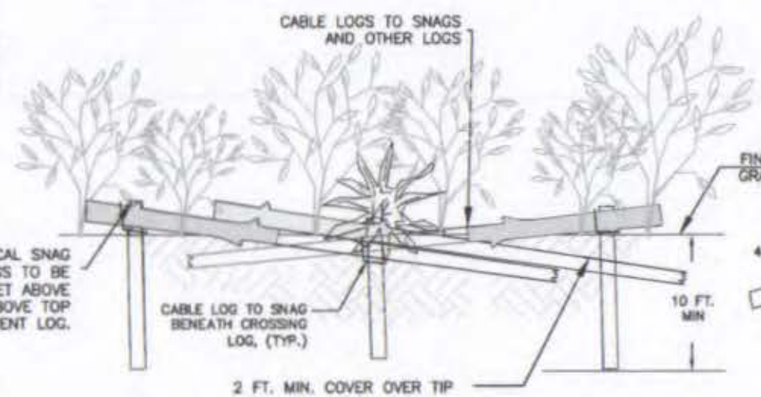
2

GENERAL FLOODPLAIN LWD INSTALLATION NOTES:

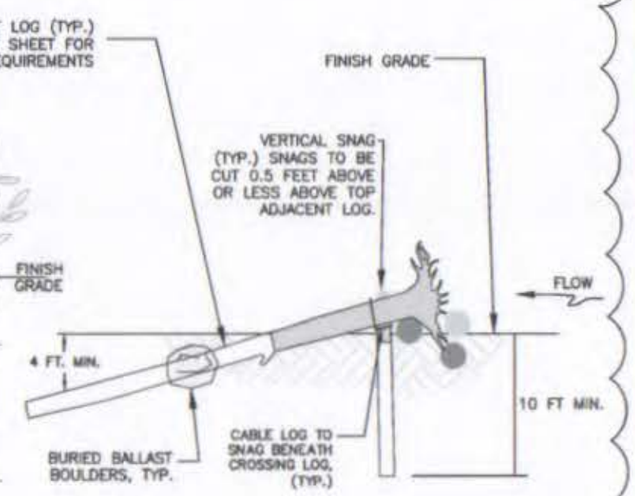
1. INSTALL THREE 2 IN. CALIPER ALDER TREES SURROUNDING EACH CUTOFF SNAG FOR FLOODPLAIN LWD ABOVE ELEVATION 124 FEET.
2. BOULDER BALLAST MAY BE OMITTED FOR FLOODPLAIN LWD ABOVE ELEVATION 128 FEET.



2/8 2/10 2/12 2/18 2/21 2/24 2/26 TYPICAL PLAN
FLOODPLAIN LWD
NTS



B/– TYPICAL ELEVATION VIEW
FLOODPLAIN LWD
NTS



C/– TYPICAL SECTION
FLOODPLAIN LWD
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES BELOW
3. SEE SHEET 42 FOR LOGJAM CONSTRUCTION SEQUENCE.
4. SEE SHEET 43 FOR FLOODPLAIN LWD CONSTRUCTION SEQUENCE.
5. SEE SHEET 45 FOR CABLING DETAILS.

GENERAL LWD INSTALLATION NOTES:

1. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
2. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
3. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO VERTICAL SNAGS OR BOULDERS, OR OTHER METHODS.
4. EXISTING TREES MAY BE SUBSTITUTED FOR SNAGS IN SELECT LOCATIONS, BUT SHALL NOT BE CABLED. SUBSTITUTION ONLY WITH OWNERS APPROVAL.
5. BALLAST BOULDERS TO BE PLACED BELOW FINISH GRADE ONLY.

interflow

CURRENT

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

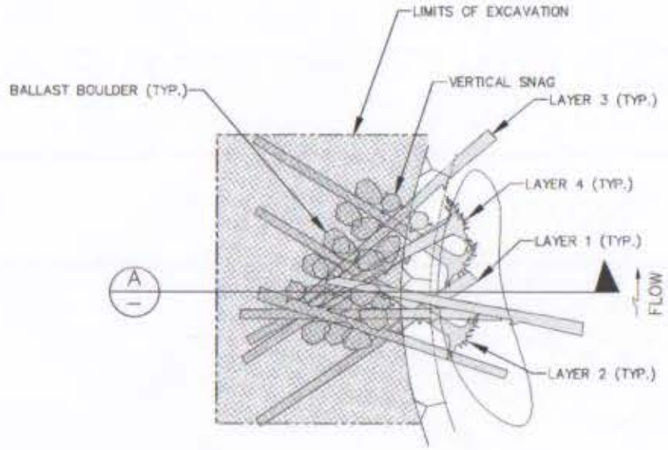
NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/18/13	CONFORMED	
2	04/21/14	REVISIONS BASED ON SCWA DIRECTION	

SONOMA COUNTY WATER AGENCY

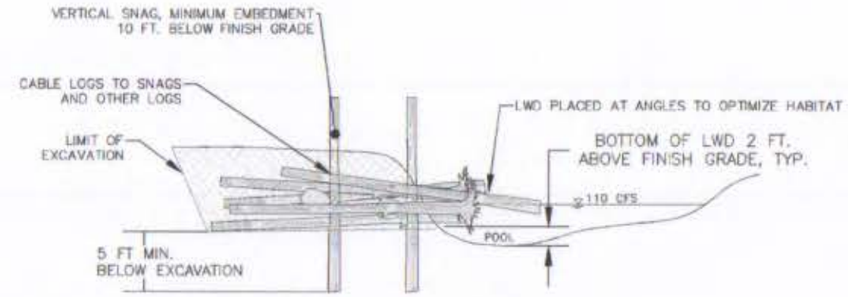
DATE: 5/08/2014
DRAWN: REP
CHECKED: MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LWD DETAILS – LOG JAM AND FLOODPLAIN LWD

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7/3
DRAWING NUMBER:
SHEET 39 OF 46



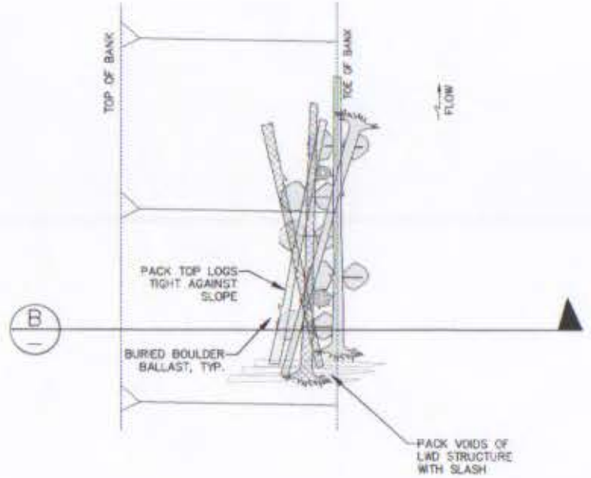
1/8 1/10 1/12 1/18 1/21 TYPICAL PLAN DETAIL
BACKWATER CHANNEL LWD
NTS



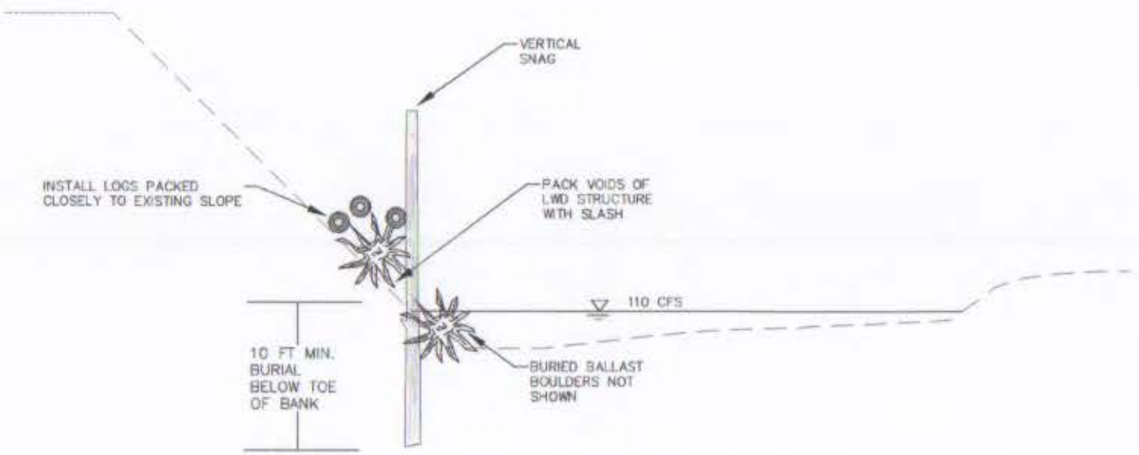
A TYPICAL SECTION
BACKWATER CHANNEL LWD
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES ON SHEET 39.
3. SEE SHEET 44 FOR BACKWATER CHANNEL LWD TYPICAL CONSTRUCTION SEQUENCE.
4. SEE SHEET 43 FOR TYPICAL POOL LWD CONSTRUCTION SEQUENCE.
5. SEE SHEET 45 FOR TYPICAL CABLING DETAILS.



2/8 2/10 2/18 2/21 2/28 TYPICAL PLAN DETAIL
POOL ENHANCEMENT LWD
NTS



B TYPICAL SECTION
POOL ENHANCEMENT LWD
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

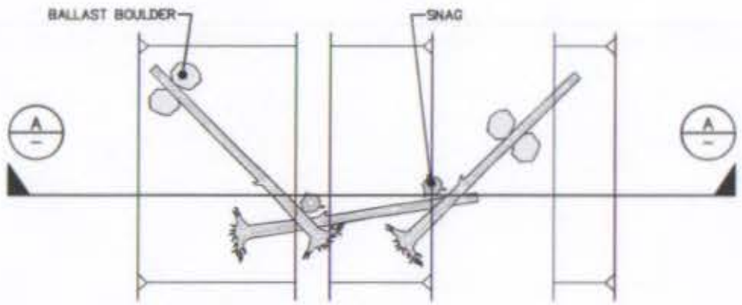
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

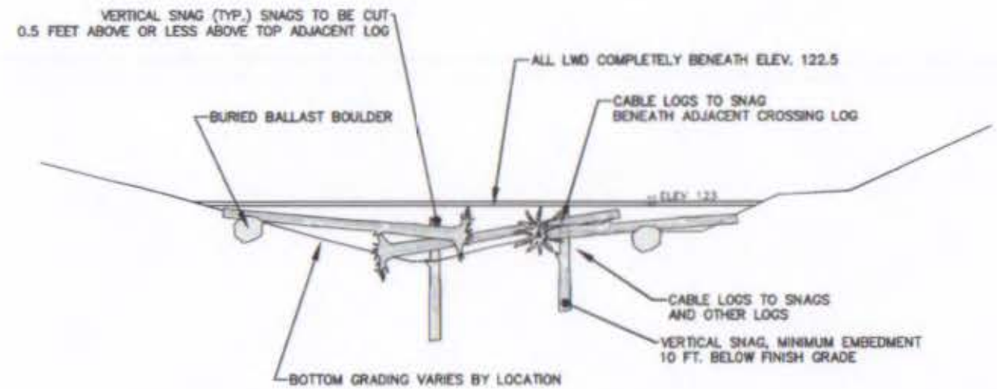
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LWD DETAILS – BACKWATER CHANNEL AND POOL ENHANCEMENT

FILE NAME: 7345
CONTRACT NUMBER: 45-61-743
DRAWING NUMBER:
SHEET 40 OF 46



XX / – TYPICAL PLAN
SUBMERGED LWD
NTS



A / – TYPICAL SECTION
SUBMERGED LWD
NTS

Note: Area B
Area C
Install 4 boulder per log or submerge Rootwad

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES BELOW
3. SEE SHEET 42 FOR LOGJAM CONSTRUCTION SEQUENCE.
4. SEE SHEET 43 FOR FLOODPLAIN LWD CONSTRUCTION SEQUENCE.
5. SEE SHEET 45 FOR CABLING DETAILS.

GENERAL LWD INSTALLATION NOTES:

1. SPECIFIC ORIENTATION OF LWD AND BALLAST MATERIALS MAY VARY FROM TYPICAL DRAWINGS DEPENDING ON SITE CONDITIONS AND SIZE AND SHAPE OF MATERIALS DELIVERED TO THE SITE.
2. OWNER WILL COORDINATE WITH CONTRACTOR DURING PLACEMENT OF LWD TO CONFIRM PLACEMENT, ORIENTATION AND BALLASTING DURING INSTALLATION.
3. LWD WILL BE BALLASTED TO RESIST BUOYANCY BY PARTIAL BURIAL, CABLING TO OTHER LWD, SECURING TO VERTICAL SNAGS OR BOULDERS, OR OTHER METHODS.
4. EXISTING TREES MAY BE SUBSTITUTED FOR SNAGS IN SELECT LOCATIONS, BUT SHALL NOT BE CABLED. SUBSTITUTION ONLY WITH OWNERS APPROVAL.
5. BALLAST BOULDERS TO BE PLACED BELOW FINISH GRADE ONLY.

2

PROJECT
RECORD
DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

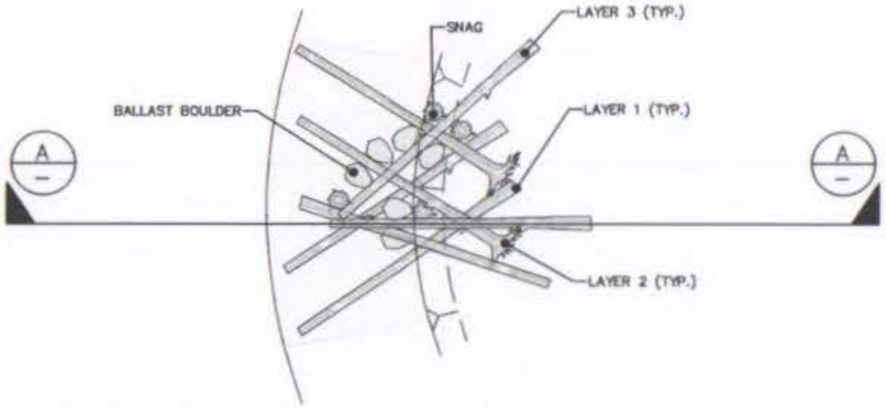
NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/21/14	REVISIONS BASED ON SCWA DIRECTION	

SONOMA COUNTY WATER AGENCY

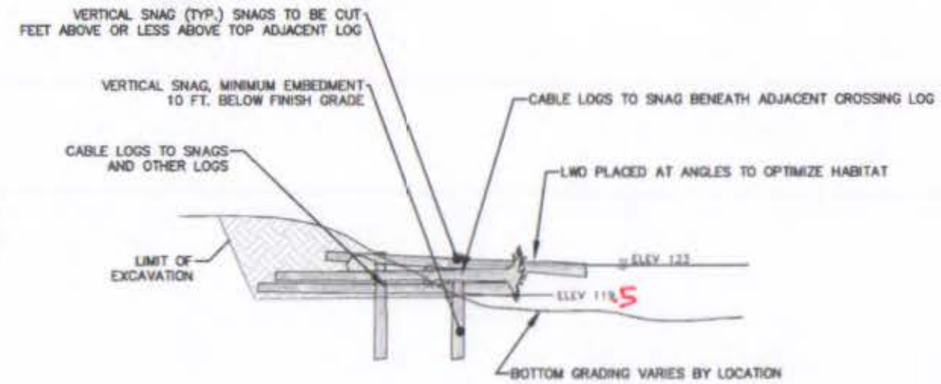
SCALE:
DATE: 5/08/2014
DRAWN: REP
CHECKED: MB
REVIEWED:
REVISED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LWD DETAILS –
SUBMERGED LWD

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7#3
DRAWING NUMBER:
SHEET 40a OF 46



1/8 1/10 1/12 1/18 1/21 TYPICAL PLAN DETAIL
BACKWATER LWD
NTS

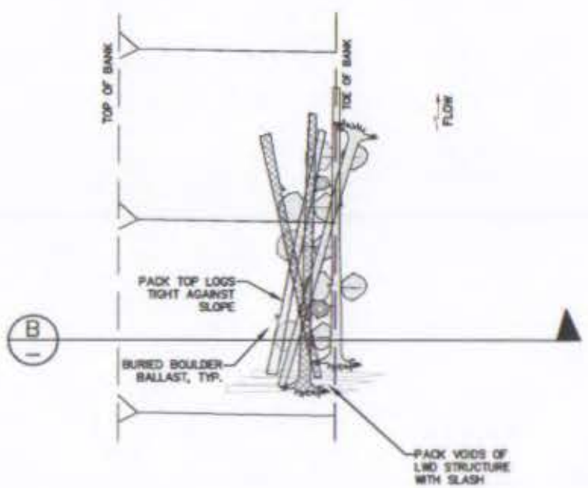


A/– TYPICAL SECTION
MODIFIED BACKWATER CHANNEL LWD
NTS

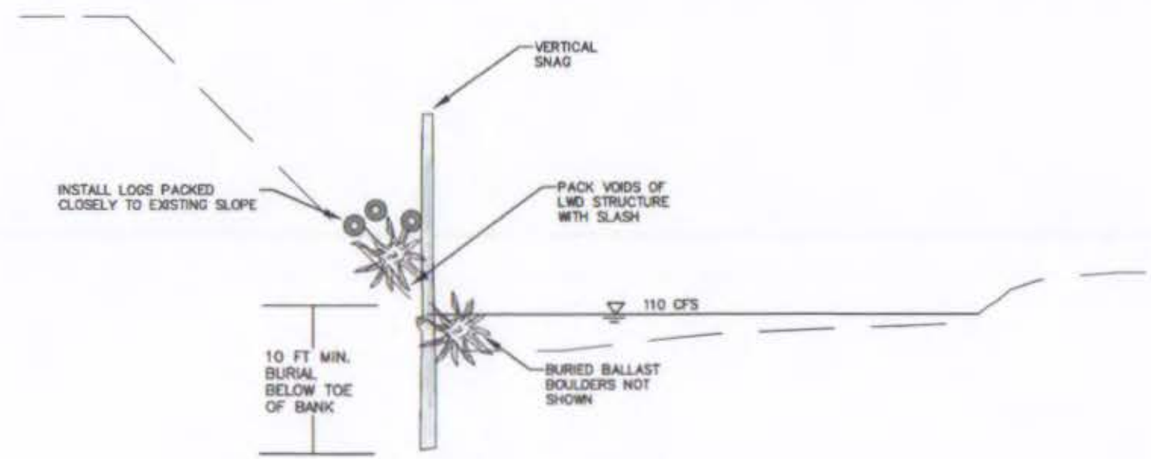
GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES ON SHEET 39.
3. SEE SHEET 44 FOR BACKWATER CHANNEL LWD TYPICAL CONSTRUCTION SEQUENCE.
4. SEE SHEET 43 FOR TYPICAL POOL LWD CONSTRUCTION SEQUENCE.
5. SEE SHEET 45 FOR TYPICAL CABLING DETAILS.

2



2/8 2/10 2/18 2/21 2/28 TYPICAL PLAN DETAIL
POOL ENHANCEMENT LWD
NTS



B/– TYPICAL SECTION
POOL ENHANCEMENT LWD
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

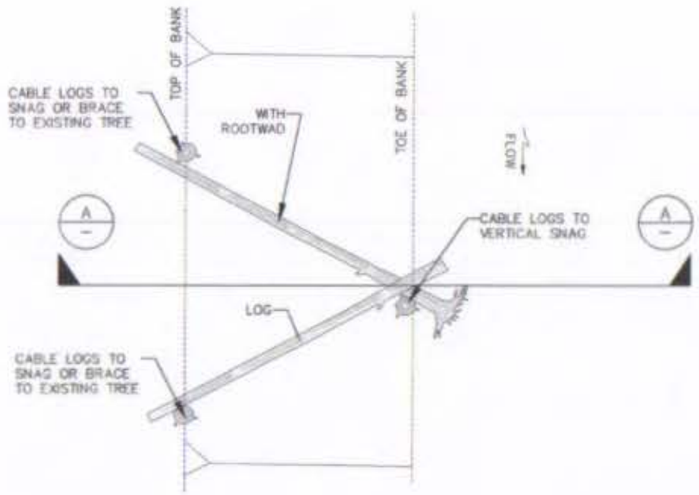
NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	
2	04/21/14	REVISIONS BASED ON SCWA DIRECTION	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 5/08/2014
DRAWN: REP
CHECKED: MB
REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LWD DETAILS – BACKWATER CHANNEL AND POOL ENHANCEMENT

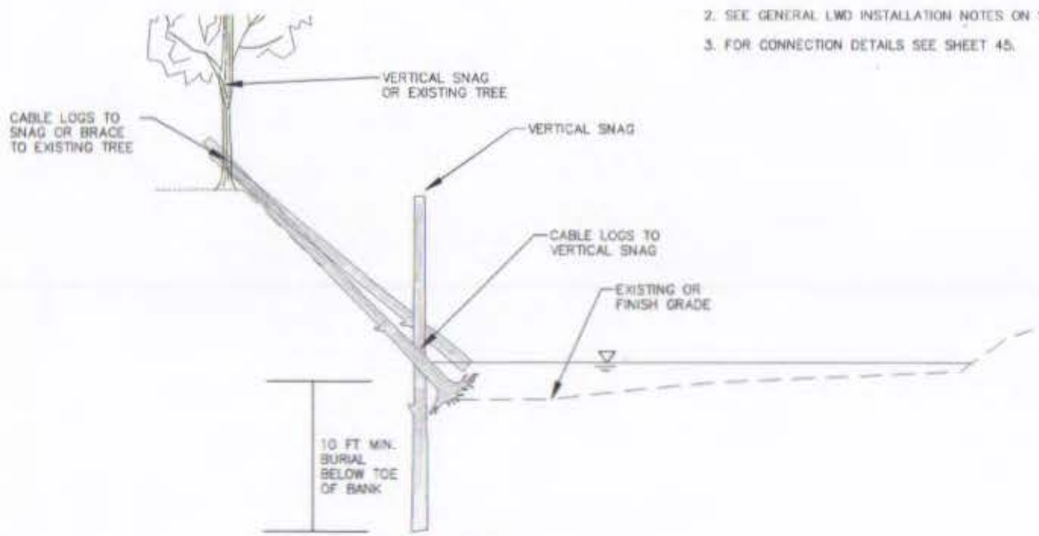
FILE NAME: 7345
CONTRACT NUMBER: 40-6.1-763
DRAWING NUMBER:
SHEET 40b OF 46



1/8 1/18 TYPICAL PLAN DETAIL
SLOPE LWD

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON THIS SHEET FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES ON SHEET 39
3. FOR CONNECTION DETAILS SEE SHEET 45.



A — TYPICAL SECTION
SLOPE LWD

STATION	TYPE*	NUMBER	LOGS	LOGS WITH ROOTWADS	SNAGS	CABLE ATTACHMENTS	BALLAST BOULDERS
OFF-CHANNEL ENHANCEMENT AREA A							
M326+25**	LJ	1	16	8	6	48	52
A1+50**	LJ	1	16	8	6	48	52
A2+00**	LJ	1	16	8	6	48	52
–	BW	5	30	15	20	90	90
–	FP	13	39	13	39	78	52
–	MISC	–	10	5	10	44	25
TOTAL AREA A			127	57	87	356	323
WALLACE PROPERTY							
M334+00**	LJ	1	16	8	6	48	52
–	TYPE 3***	1	55	65	0	125	0
–	FP	8	24	8	24	48	32
–	MISC	–	15	5	15	50	35
TOTAL WALLACE PROPERTY			110	86	45	271	119
OFF-CHANNEL ENHANCEMENT AREA B							
M340+25**	LJ	1	16	8	6	48	52
–	BW	5	30	15	20	90	90
–	P	1	2	3	2	10	10
–	SL	4	4	4	4	16	0
–	FP	2	6	2	6	12	8
–	MISC	–	10	5	5	30	13
TOTAL AREA B			68	37	43	206	173
OFF-CHANNEL ENHANCEMENT AREA C							
M361+00**	LJ	1	16	8	6	48	52
M368+25**	LJ	1	16	8	6	48	52
–	BW	7	42	21	28	126	126
–	FP	20	60	20	60	120	80
–	MISC	–	15	7	15	50	35
TOTAL AREA C			149	64	115	392	345
MASCHERINI PROPERTY							
–	TYPE 4****	1	165	110	10	330	28
–	MISC	–	10	5	3	30	30
TOTAL MASCHERINI PROPERTY			175	115	13	360	58
MAINSTEM INSTREAM POOL ENHANCEMENTS							
–	P	3	6	9	6	30	30
–	MISC	–	2	3	2	10	10
TOTAL INSTREAM POOL ENHANCEMENTS			8	12	8	40	40
TOTALS			**637**	**371**	**311**	**1625**	**1058**

* LJ: LOG JAM
BW: BACKWATER LWD
FP: FLOODPLAIN LWD
P: POOL ENHANCEMENT LWD
SL: SLOPE PLACEMENT LWD
MISC: SUPPLEMENTAL LWD ALLOWANCE
TYPE 3: TYPE 3 BANK
TYPE 4: TYPE 4 BANK

** TREATMENT LENGTH 40 FT. MEASURED PARALLEL TO LOG JAM FACE
*** TREATMENT LENGTH 315 FT. MEASURED PARALLEL TO TREATMENT FACE
**** TREATMENT LENGTH 515 FT. MEASURED PARALLEL TO TREATMENT FACE

2 — SUMMARY TABLE
LOG JAM AND LWD INSTALLATION QUANTITIES

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: RCP
CHECKED: MB
REVIEWED:
REVIEWED:

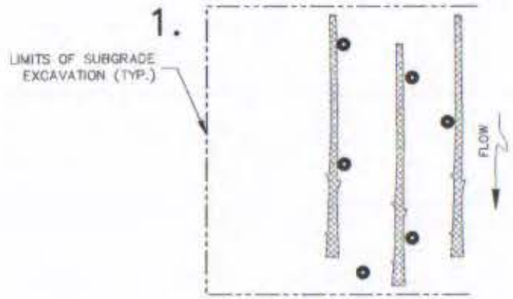
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
LWD DETAILS – SLOPE LWD
AND LWD SUMMARY TABLE

FILE NAME: 7345
CONTRACT NUMBER: 45-0.1-793
DRAWING NUMBER:
SHEET 41 OF 46

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LOG JAM CONSTRUCTION.
3. SEE GENERAL LWD CONSTRUCTION NOTES ON SHEET 39.
4. SEE SHEETS 27–28 FOR DESIGN ELEVATIONS FOR EACH LOG JAM.
5. FOR CONNECTION DETAILS SEE SHEET 45.
6. EXISTING TREES MAY BE INTEGRATED INTO LOG JAMS AT SELECT LOCATIONS IF DESIGNATED BY OWNER.

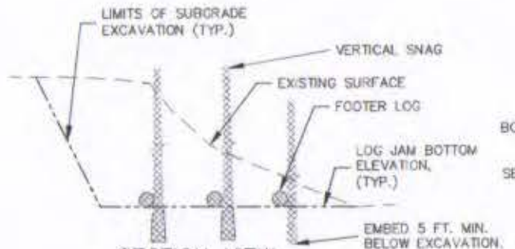
1.



PLAN VIEW
NTS

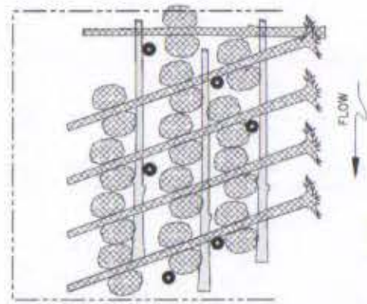
TYPICAL LAYER 1. SEQUENCING

1. PREPARE SITE
2. EXCAVATE TO SUBGRADE.
3. INSTALL LAYER 1 FOOTER LOGS.
4. INSTALL VERTICAL SNAGS



SECTION VIEW
NTS

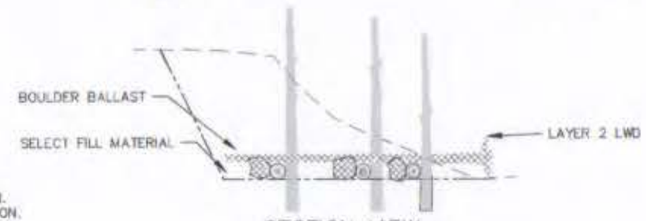
2.



PLAN VIEW
NTS

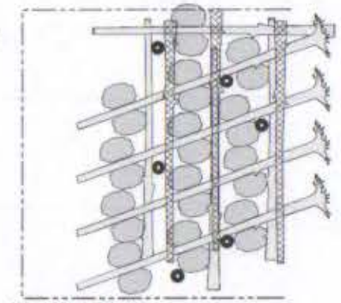
TYPICAL LAYER 2. SEQUENCING

1. INSTALL LAYER 2 LWD.
2. PLACE BOULDERS FOR BALLASTING. BOULDER BALLAST TO BE PLACED AS APPROVED BY OWNER.
3. ANCHOR LAYER 2 LWD TO BOULDER BALLAST WHERE CONNECTIONS ARE AVAILABLE.
4. CABLE LAYER 1 AND 2 LWD MINIMUM 2 CONNECTIONS PER LWD. CONNECTIONS INCLUDE LWD TO LWD, LWD TO SNAG, OR LWD TO BOULDERS.
5. BACKFILL AND COMPACT WITH SELECT FILL MATERIAL TO TOP OF LAYER 1.



SECTION VIEW
NTS

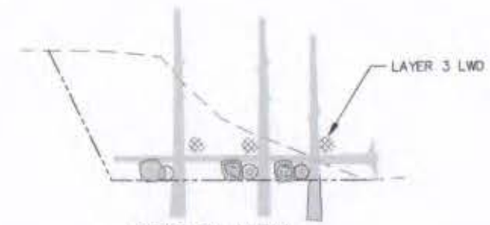
3.



PLAN VIEW
NTS

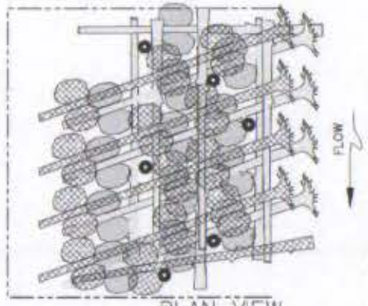
TYPICAL LAYER 3. SEQUENCING

1. INSTALL LAYER 3 HEADER LOGS.



SECTION VIEW
NTS

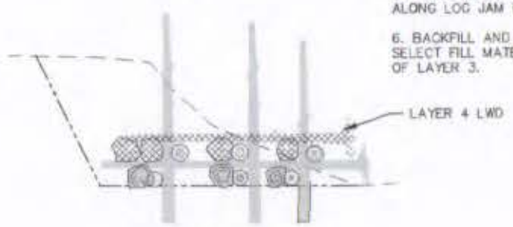
4.



PLAN VIEW
NTS

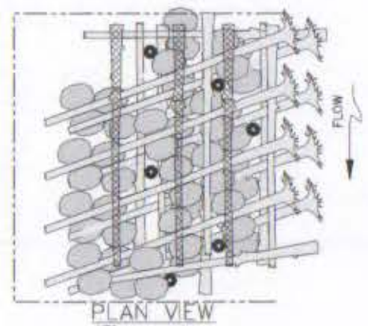
TYPICAL LAYER 4. SEQUENCING

1. INSTALL LAYER 4 LWD.
2. PLACE BOULDERS FOR BALLASTING. BOULDER BALLAST TO BE PLACED AS APPROVED BY OWNER.
3. ANCHOR LAYER 4 LWD TO BOULDER BALLAST WHERE CONNECTIONS ARE AVAILABLE.
4. CABLE LAYER 3 AND 4 LWD. MINIMUM 2 CONNECTIONS PER LWD. CONNECTIONS INCLUDE LWD TO LWD, LWD TO SNAG, OR LWD TO BOULDERS.
5. PACK SLASH INTO VOIDS ALONG LOG JAM FACE.
6. BACKFILL AND COMPACT WITH SELECT FILL MATERIAL TO TOP OF LAYER 3.



SECTION VIEW
NTS

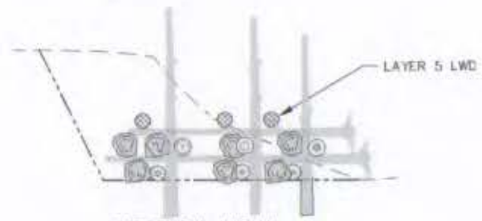
5.



PLAN VIEW
NTS

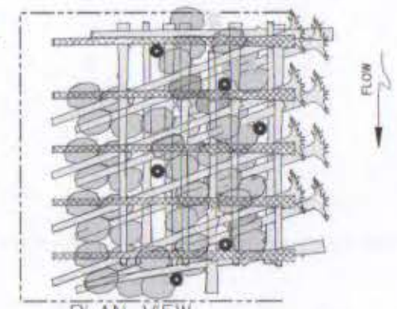
TYPICAL LAYER 5. SEQUENCING

1. INSTALL LAYER 5 LWD.



SECTION VIEW
NTS

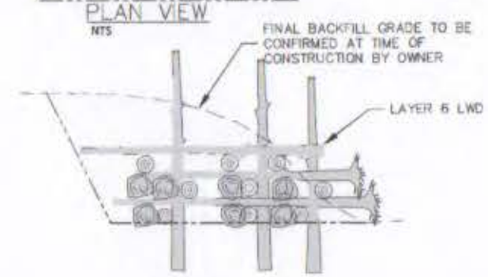
6.



PLAN VIEW
NTS

TYPICAL LAYER 6. SEQUENCING

1. INSTALL LAYER SIX LWD.
2. CABLE LAYER 5 AND 6 LWD. MINIMUM 2 CONNECTIONS PER LWD. CONNECTIONS INCLUDE LWD TO LWD, LWD TO SNAG, OR LWD TO BOULDERS.
3. PACK SLASH INTO VOIDS ALONG LOG JAM FACE.
4. BACKFILL AND COMPACT WITH SELECT FILL. BACKFILL GRADE TO BE CONFIRMED AT TIME OF CONSTRUCTION BY OWNER.



SECTION VIEW
NTS

(1) TYPICAL SEQUENCE
LOG JAM
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

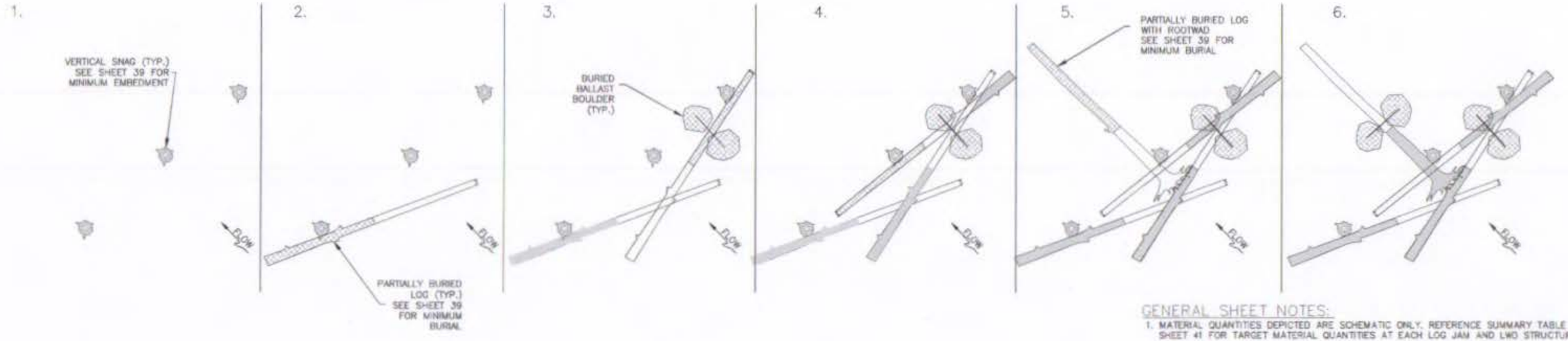
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL SEQUENCE DETAILS – LOG JAM

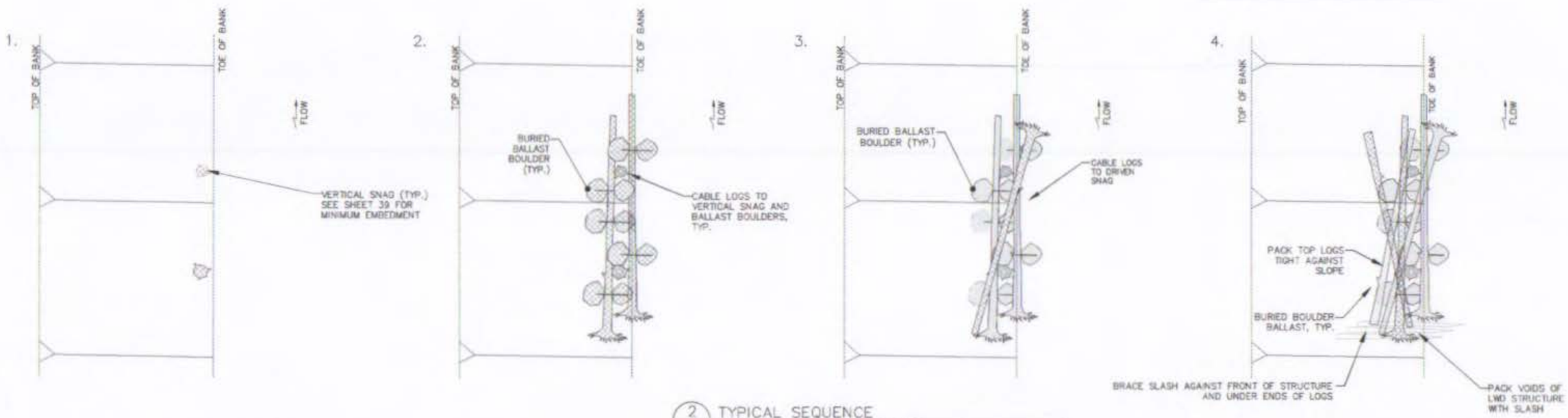
FILE NAME: 7345
CONTRACT NUMBER: 45-61-743
DRAWING NUMBER:



1 TYPICAL SEQUENCE
FLOODPLAIN LWD

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LWD CONSTRUCTION.
3. SEE GENERAL LWD INSTALLATION NOTES ON SHEET 39
4. SEE SHEET 45 FOR CABLING DETAILS.



2 TYPICAL SEQUENCE
POOL ENHANCEMENT LWD

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

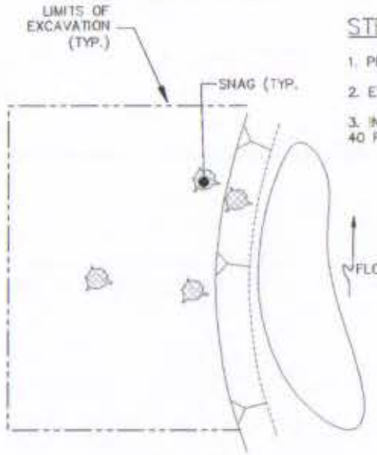
NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL SEQUENCE DETAILS – FLOODPLAIN AND POOL ENHANCEMENT LWD

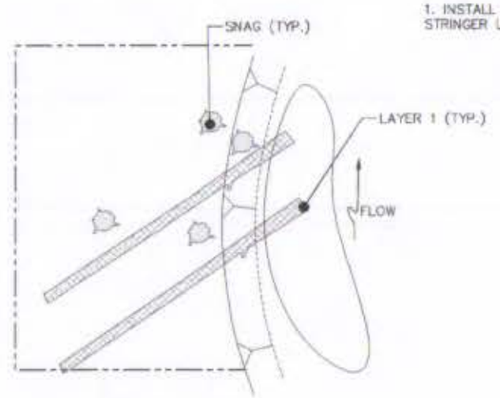
FILE NAME: 7345
CONTRACT NUMBER: 45-0.1-743
DRAWING NUMBER:
SHEET 43 OF 46



STEP 1.

1. PREPARE SITE
2. EXCAVATE TO SUBGRADE.
3. INSTALL SNAGS. SEE SHEET 40 FOR MINIMUM EMBEDMENT

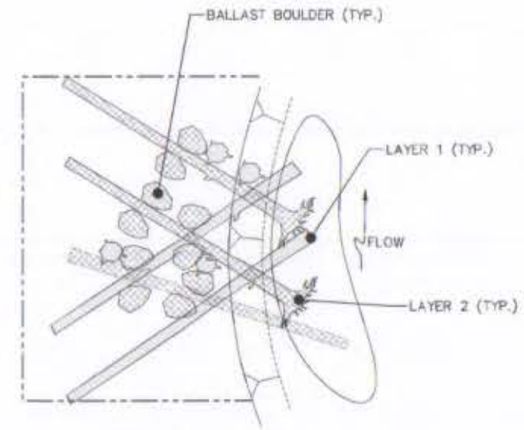
PLAN VIEW
NTS



STEP 2.

1. INSTALL LAYER 1 STRINGER LOGS

PLAN VIEW
NTS



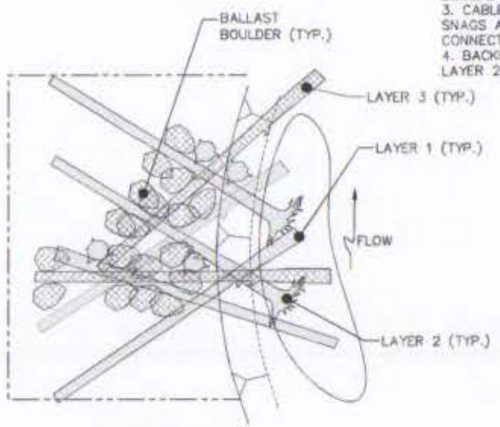
STEP 3.

1. INSTALL LAYER 2 LWD.
2. INSTALL ASSOCIATED BOULDERS.
3. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LOG.
4. BACKFILL LAYER 1

PLAN VIEW
NTS

STEP 4.

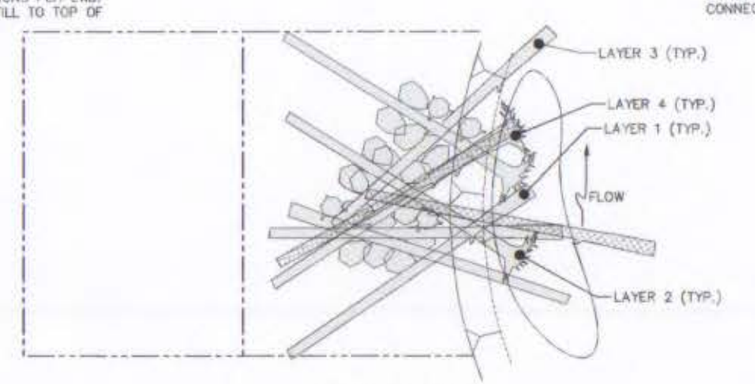
1. INSTALL LAYER 3 LWD.
2.INSTALL ASSOCIATED BOULDERS.
3. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LWD.
4. BACKFILL TO TOP OF LAYER 2.



PLAN VIEW
NTS

STEP 5.

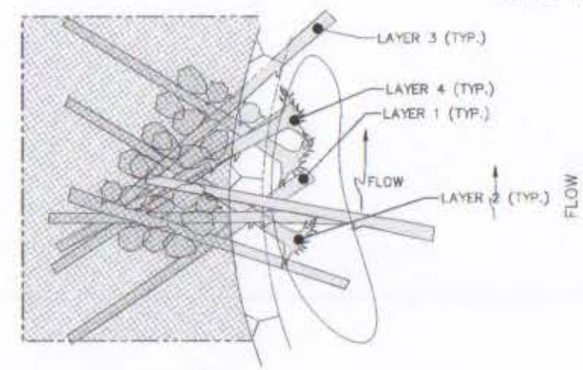
1. INSTALL LAYER 4 LWD.
2. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LWD.



PLAN VIEW
NTS

STEP 6.

1. BACKFILL WITH SELECT FILL. CONFIRM BACKFILL EXTENT WITH OWNER.



PLAN VIEW
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES ON SHEET 39.
3. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LWD CONSTRUCTION.
4. FOR CONNECTION DETAILS SEE SHEET 45.

1 TYPICAL SEQUENCE
BACKWATER LWD
NTS

ORIGINAL

interflow

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1.	04/16/13	CONFORMED	

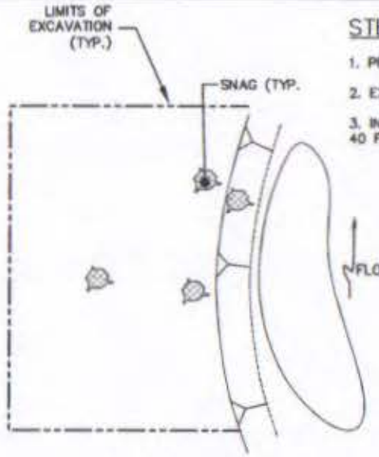
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL SEQUENCE DETAILS – BACKWATER LWD

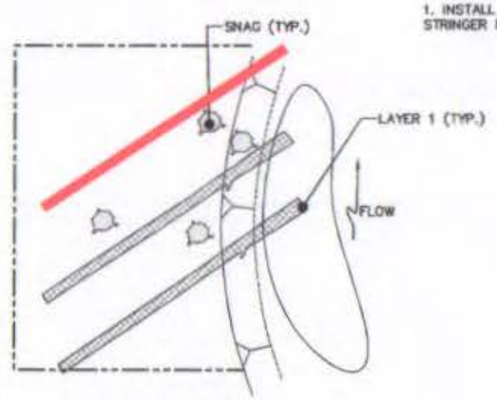
FILE NAME: T345
CONTRACT NUMBER: 45-6.1-763
DRAWING NUMBER:
SHEET 44 OF 46



STEP 1.

1. PREPARE SITE
2. EXCAVATE TO SUBGRADE.
3. INSTALL SNAGS. SEE SHEET 40 FOR MINIMUM EMBEDMENT

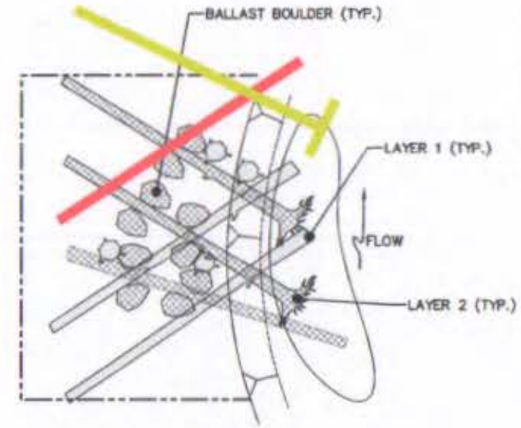
PLAN VIEW
NTS



STEP 2.

1. INSTALL LAYER 1 STRINGER LOGS

PLAN VIEW
NTS



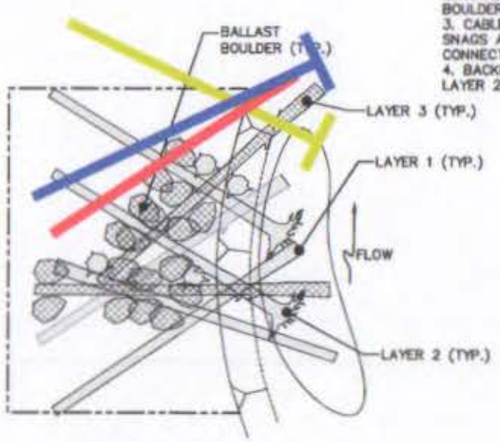
STEP 3.

1. INSTALL LAYER 2 LWD.
2. INSTALL ASSOCIATED BOULDERS.
3. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LOG.
4. BACKFILL LAYER 1

PLAN VIEW
NTS

STEP 4.

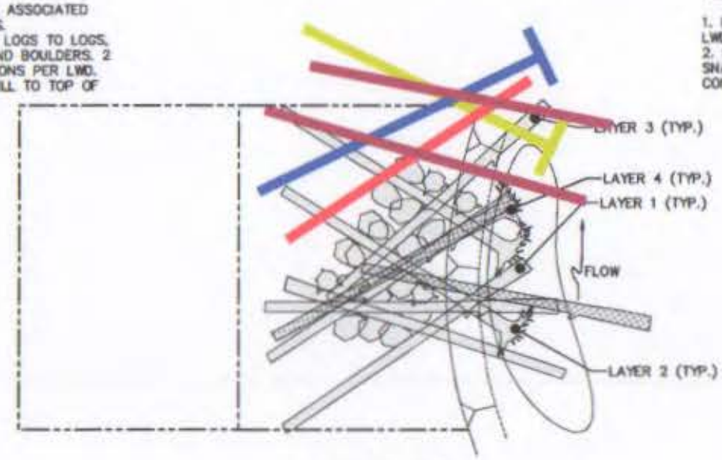
1. INSTALL LAYER 3 LWD.
2.INSTALL ASSOCIATED BOULDERS.
3. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LWD.
4. BACKFILL TO TOP OF LAYER 2.



PLAN VIEW
NTS

STEP 5.

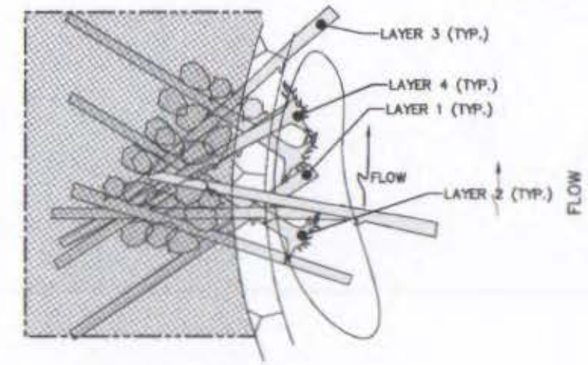
1. INSTALL LAYER 4 LWD.
2. CABLE LOGS TO LOGS, SNAGS AND BOULDERS. 2 CONNECTIONS PER LWD.



PLAN VIEW
NTS

STEP 6.

1. BACKFILL WITH SELECT FILL. CONFIRM BACKFILL EXTENT WITH OWNER.



PLAN VIEW
NTS

Note Colored Area on sequence details on sheet #18 for combined structure station 337+75 BWD-LWD

1 TYPICAL SEQUENCE BACKWATER LWD
NTS

GENERAL SHEET NOTES:

1. MATERIAL QUANTITIES DEPICTED ARE SCHEMATIC ONLY. REFERENCE SUMMARY TABLE ON SHEET 41 FOR TARGET MATERIAL QUANTITIES AT EACH LOG JAM AND LWD STRUCTURE.
2. SEE GENERAL LWD INSTALLATION NOTES ON SHEET 39.
3. SEQUENCING PROVIDED TO REFLECT GENERAL LEVEL OF EFFORT FOR LWD CONSTRUCTION.
4. FOR CONNECTION DETAILS SEE SHEET 45.

CURRENT

PROJECT RECORD DRAWING

C 43985

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

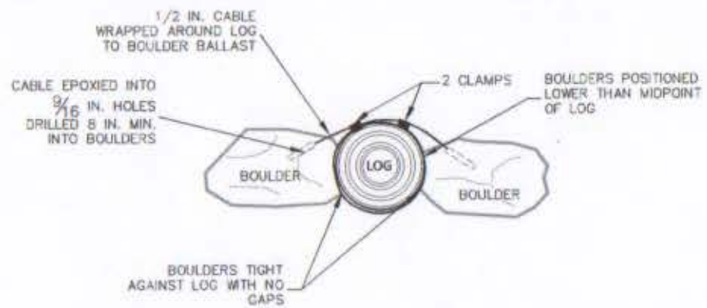
NO.	DATE	REVISION	BY
		RECORD INFORMATION	

SONOMA COUNTY WATER AGENCY

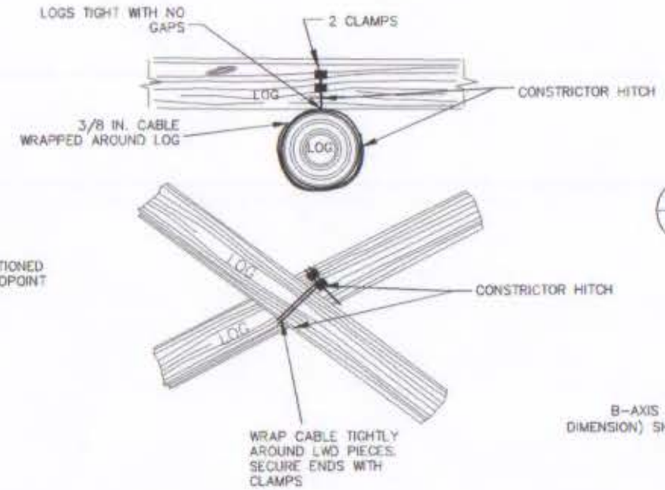
SCALE:
DATE 1/23/2013
DRAWN REP
CHECKED MB

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT
TYPICAL SEQUENCE DETAILS – BACKWATER LWD

FILE NAME: 7345
CONTRACT NUMBER: 46-8.1-7#3
DRAWING NUMBER:
SHEET 44 OF 46

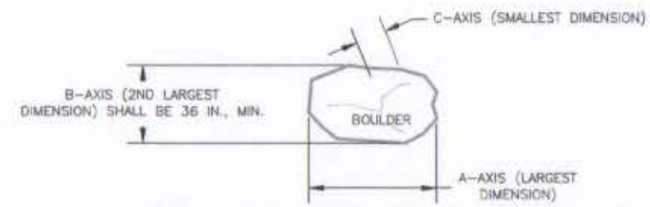


1 TYPICAL DETAIL
LOG CABLED TO BOULDERS
NTS



2 TYPICAL DETAIL
LOG CABLED TO LOG
NTS

4 TYPICAL DETAIL
CABLE SPLICE
NTS



3 TYPICAL DETAIL
BALLAST BOULDER
NTS

GENERAL NOTES

1. FINAL POSITIONING OF THE ANCHORED LOG STRUCTURES SHALL BE IN THE APPROXIMATE LOCATION AS SHOWN ON THE PLANS, ADJUSTED TO FIELD CONDITIONS, AND AS APPROVED BY THE BY THE OWNER. CABLING SITES AS APPROVED BY OWNER.
2. NO GAPS SHALL EXIST BETWEEN BOULDERS AND CABLED LWD. NO SLACK SHALL EXIST IN CABLE FOLLOWING EPOXY SET. NO GAPS SHALL EXIST BETWEEN LWD AT LWD TO LWD CONNECTIONS.
3. BOULDER BALLAST AND CABLE CONNECTIONS SHALL BE INSTALLED BELOW FINISH GRADE TO EXTENT PRACTICABLE.

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1.	04/16/13	CONFORMED	

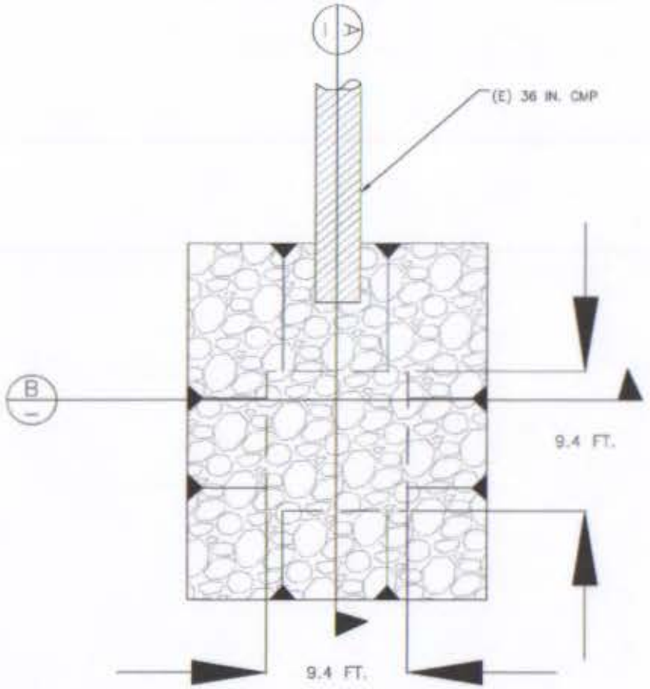
SONOMA COUNTY WATER AGENCY

SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

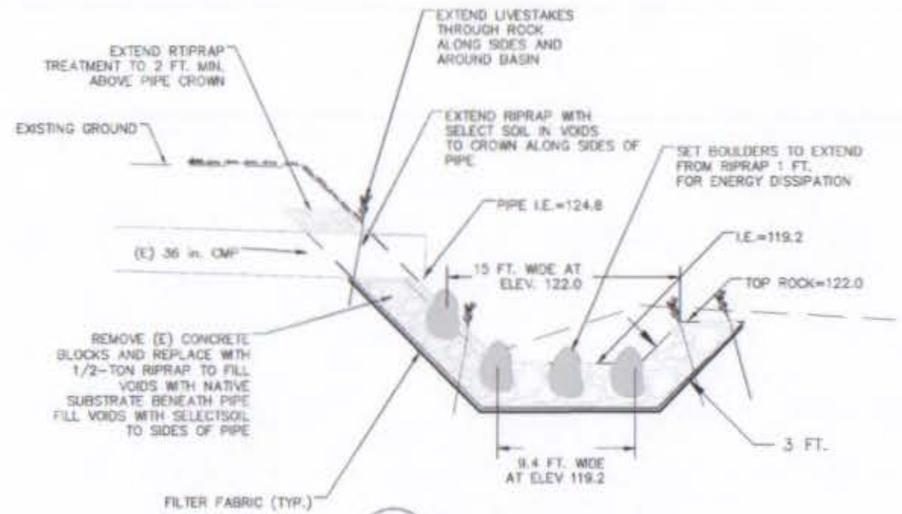
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
TYPICAL DETAILS – LWD
CABLING AND BALLASTING

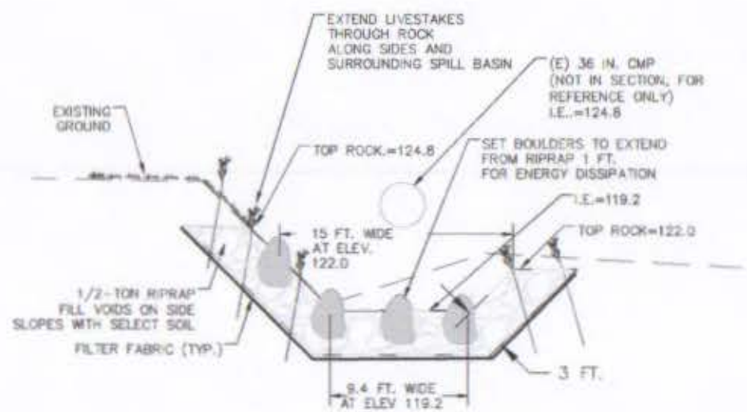
FILE NAME: 7345
CONTRACT NUMBER: 45-61-7#3
DRAWING NUMBER:
SHEET 45 OF 46



1/8 1/11 1/12 PLAN
SDO SCOUR PROTECTION
NTS



A SECTION
SDO SCOUR PROTECTION
NTS



B SECTION
SDO SCOUR PROTECTION
NTS

PROJECT RECORD DRAWING

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/18/13	CONFORMED	

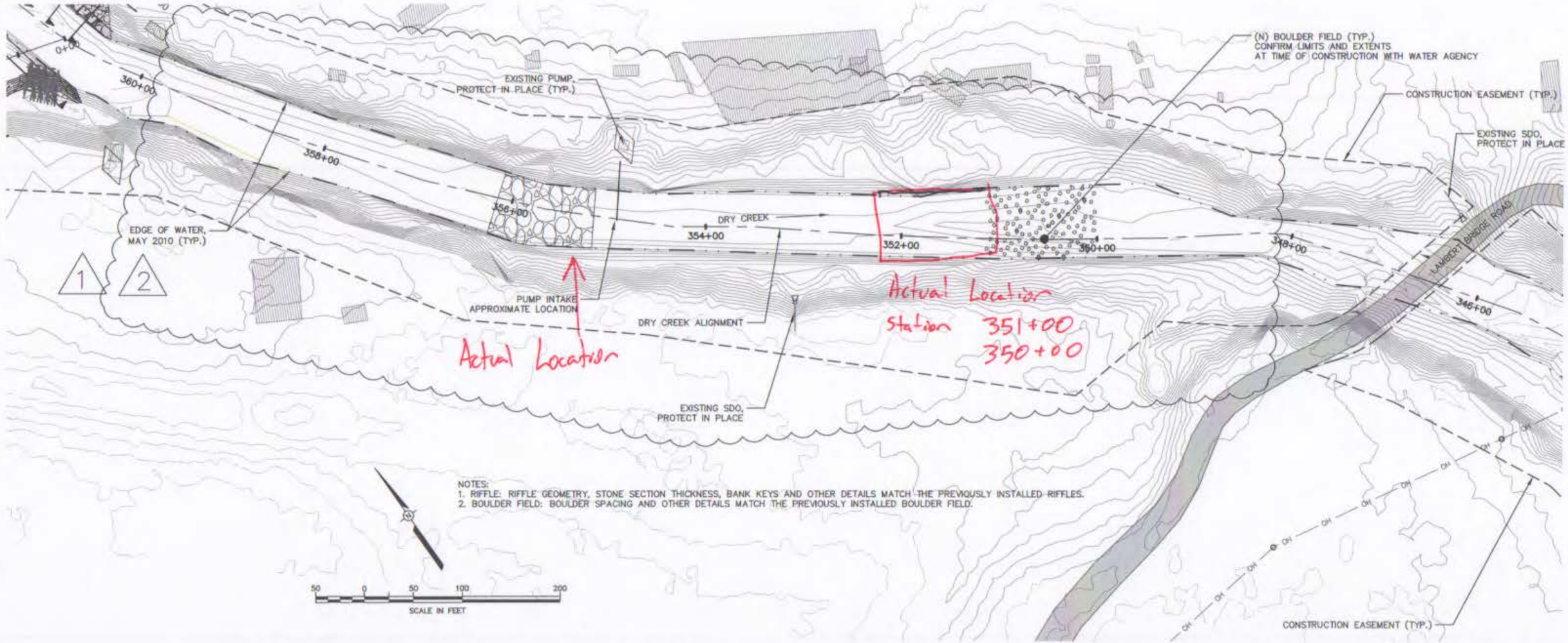
SONOMA COUNTY WATER AGENCY

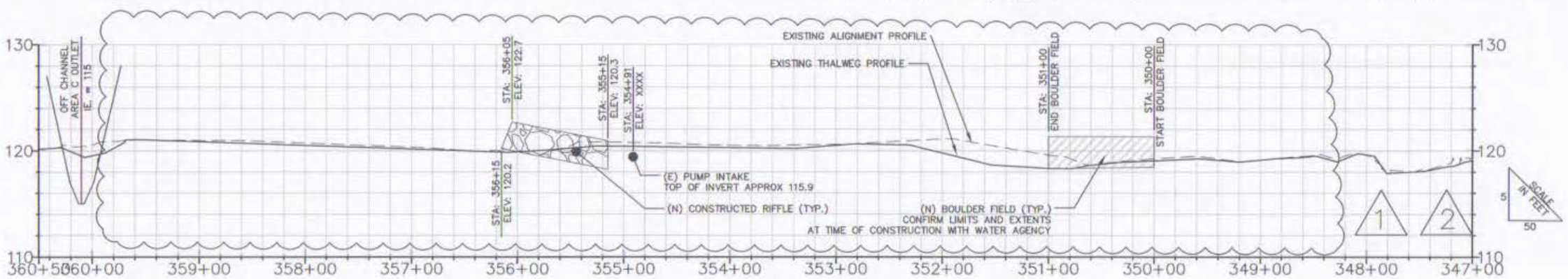
SCALE:
DATE: 1/23/2013
DRAWN: REP
CHECKED: MB

REVIEWED:
REVIEWED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
DETAILS – SDO
SCOUR PROTECTION

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-763
DRAWING NUMBER:
SHEET 46 OF 46





MAIN CHANNEL PROFILE

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. BURKE C 62986 EXP. ____ CIVIL STATE OF CALIFORNIA

interflow

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO	DATE	REVISION	BY
		RECORD INFORMATION	
1	05/06/14	ADDED RIFFLES AT DIRECTION OF WATER AGENCY	
2	09/09/14	REVISIONS TO RIFFLES AT DIRECTION OF WATER AGENCY	

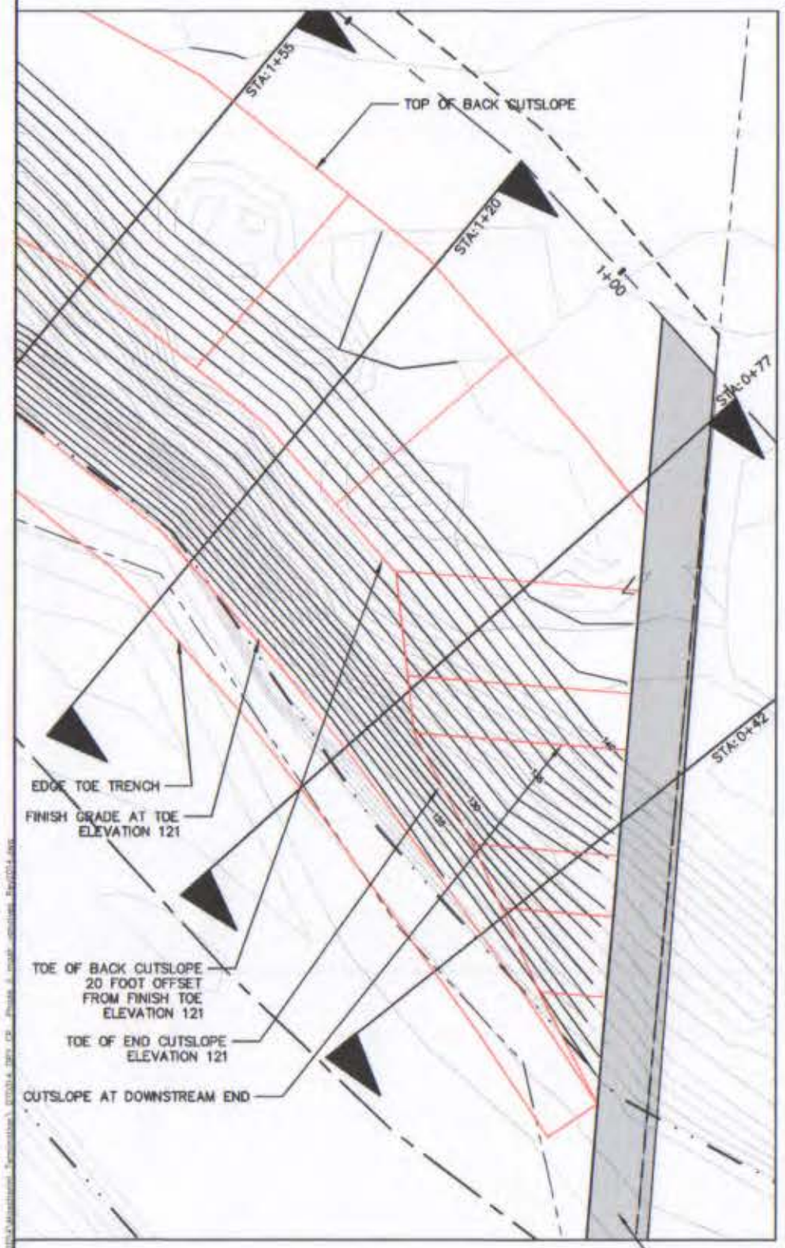
SONOMA COUNTY WATER AGENCY

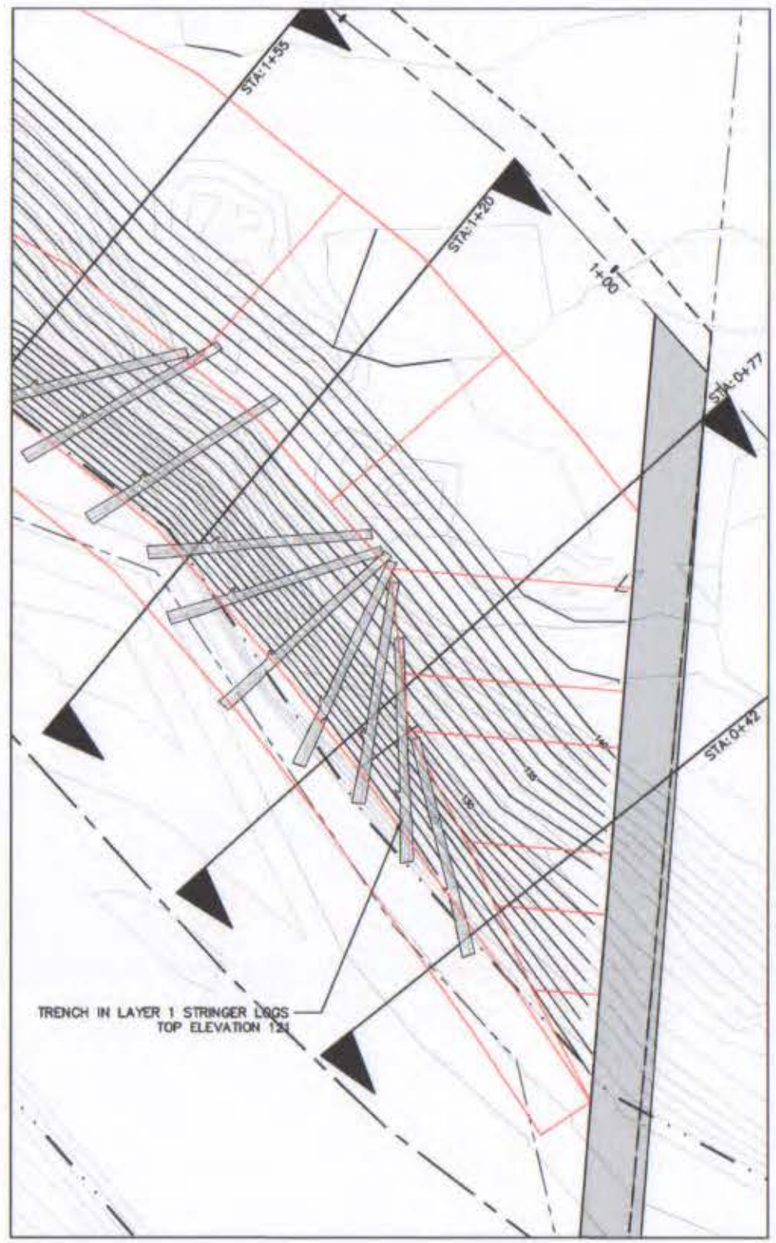
SCALE:
DATE: 09/09/2014
DRAWN: REP
CHECKED: MB
REVIEWED:
REVIEWED:

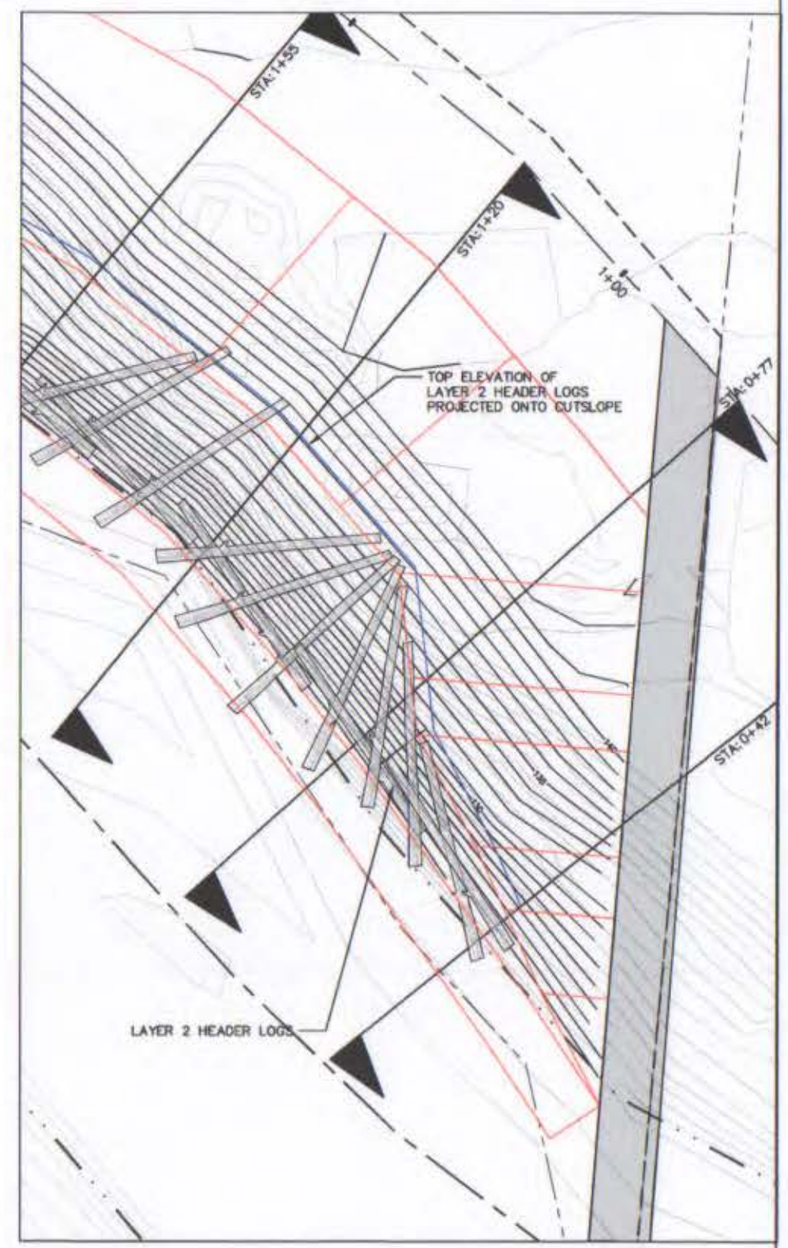
DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT

MAIN CHANNEL PLAN AND PROFILE STA. 346+00 TO 360+00

FILE NAME:
CONTRACT NUMBER: XXXXX
DRAWING NUMBER:
SHEET 1 OF 1







PROJECT
RECORD
DRAWING

interflow

10 0 10 20 40
SCALE IN FEET

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

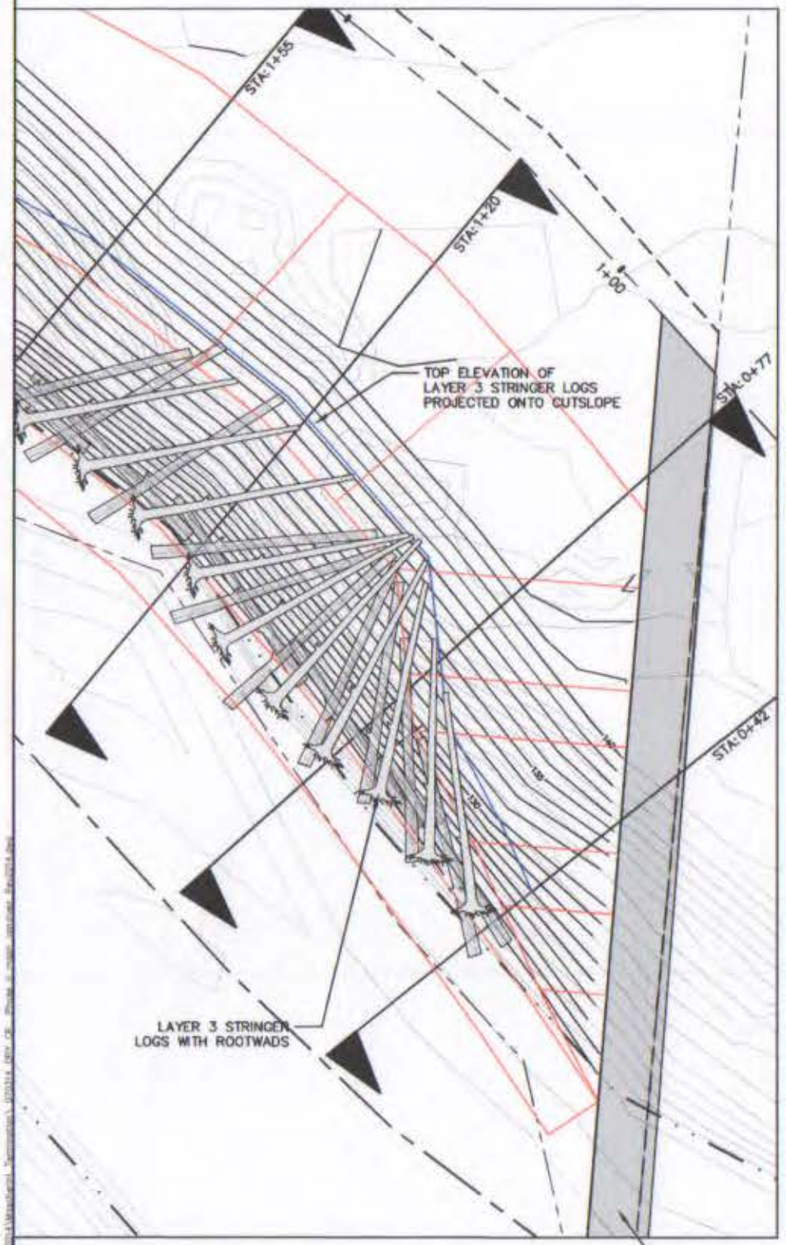
SONOMA COUNTY WATER AGENCY

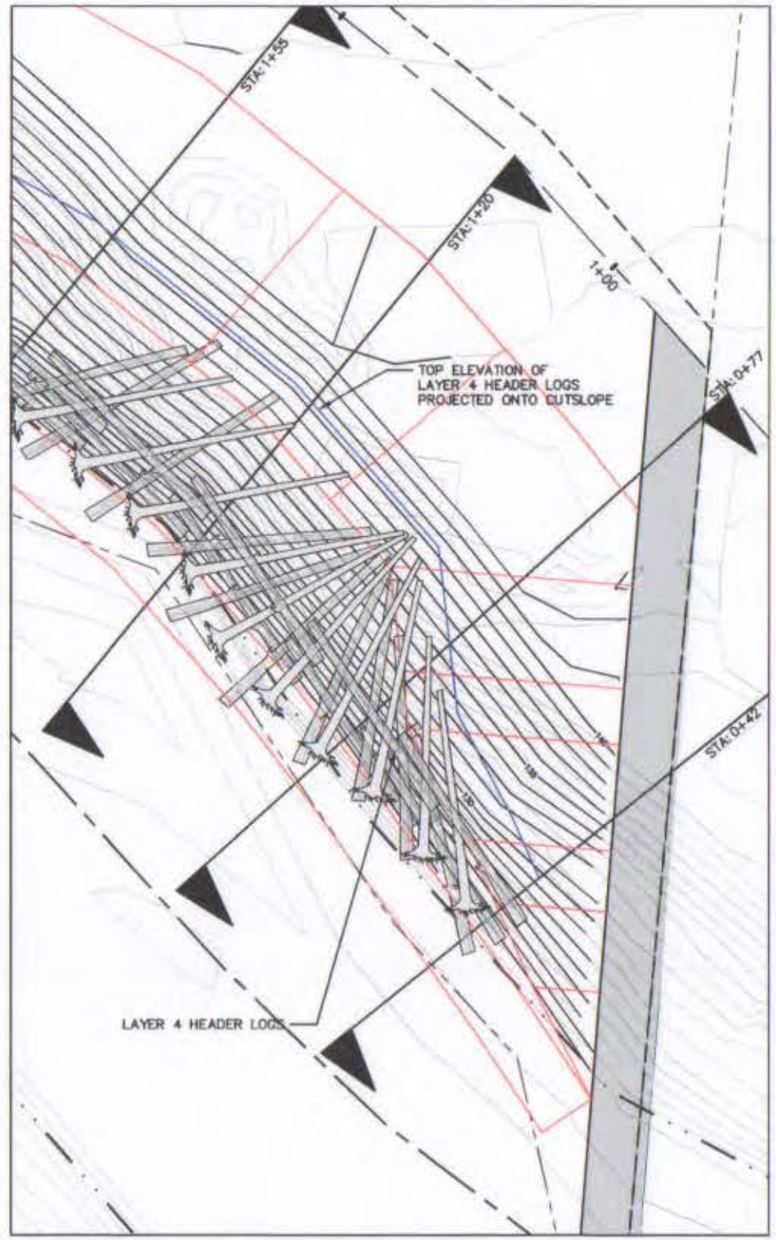
SCALE:
DATE: 7/7/14
DRAWN: REP
CHECKED: MB

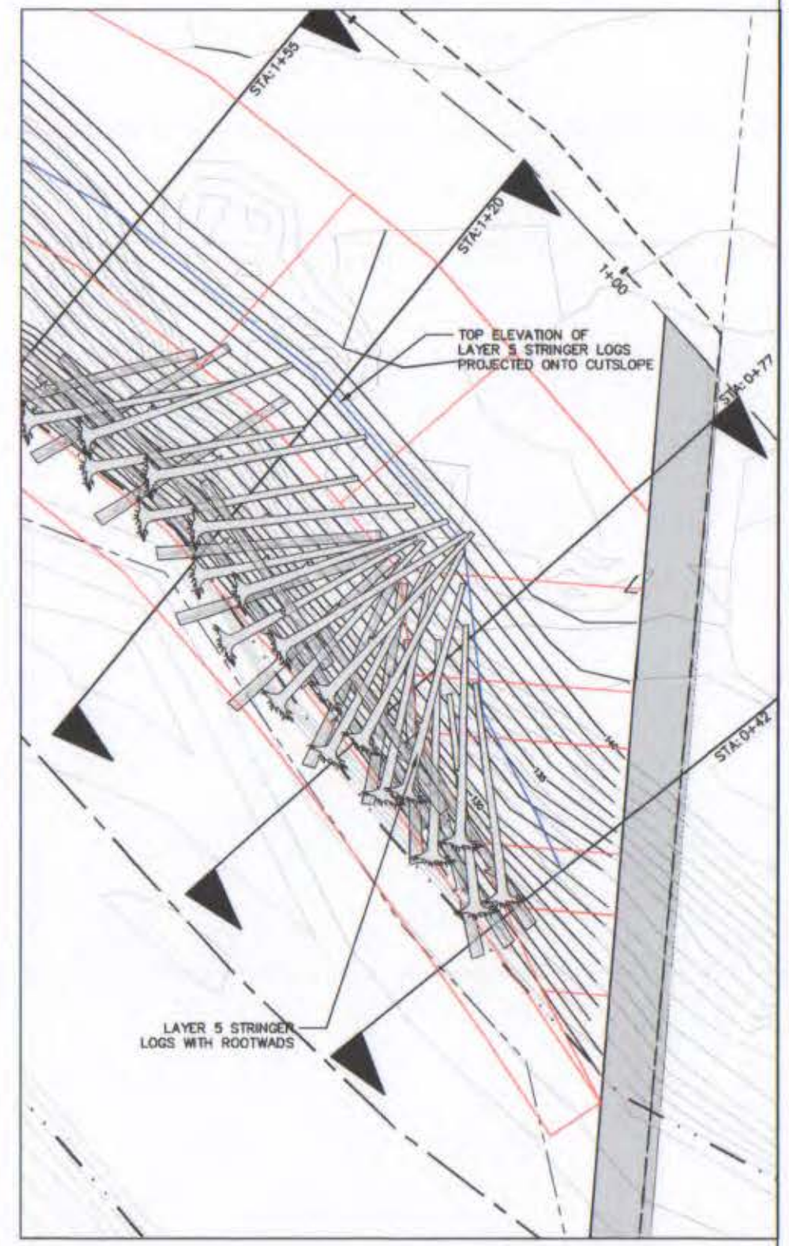
REVIEWED
REVIEWED

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI BANK REPAIR
DOWNSTREAM TERMINATION DETAIL, 1 OF 3

FILE NAME: 7345
CONTRACT NUMBER: 45-8.1-7#3
DRAWING NUMBER:
SHEET 1 OF 3







PROJECT
RECORD
DRAWING

Interflow

10 0 10 20 40
SCALE IN FEET

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

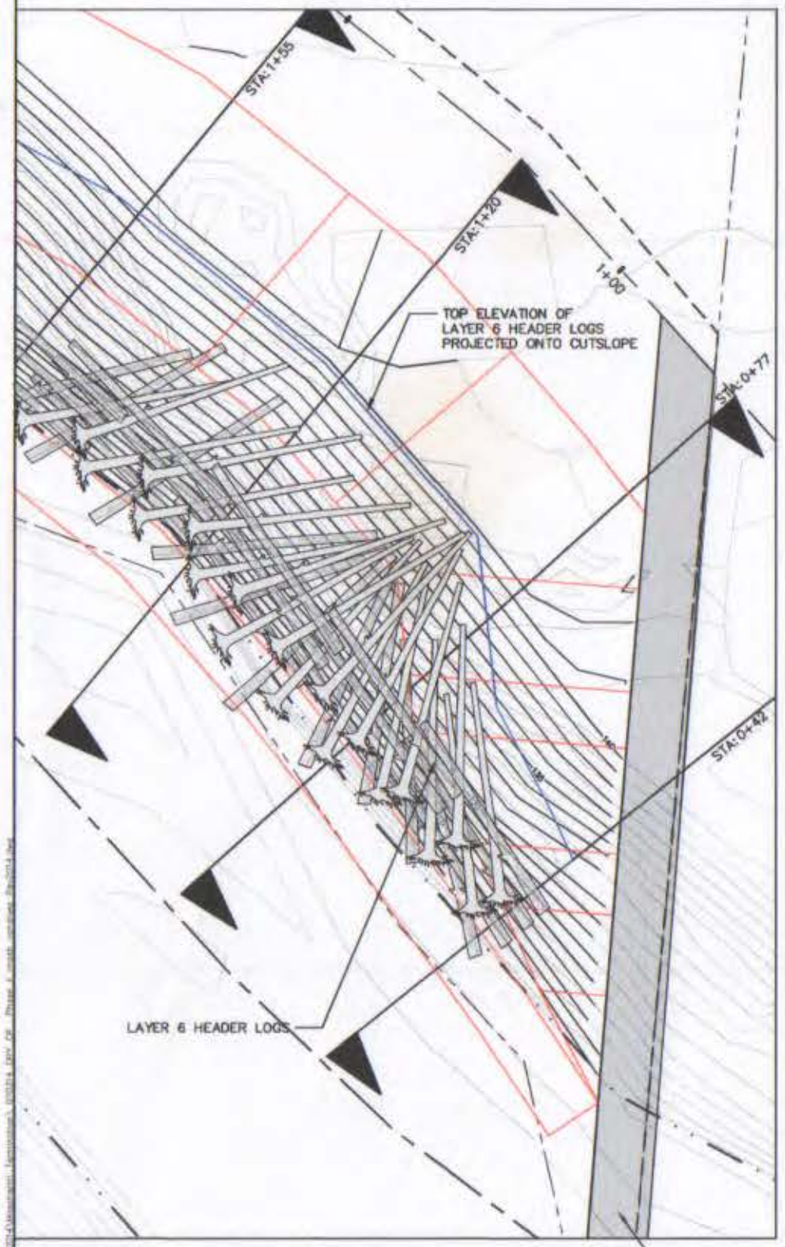
SONOMA COUNTY WATER AGENCY

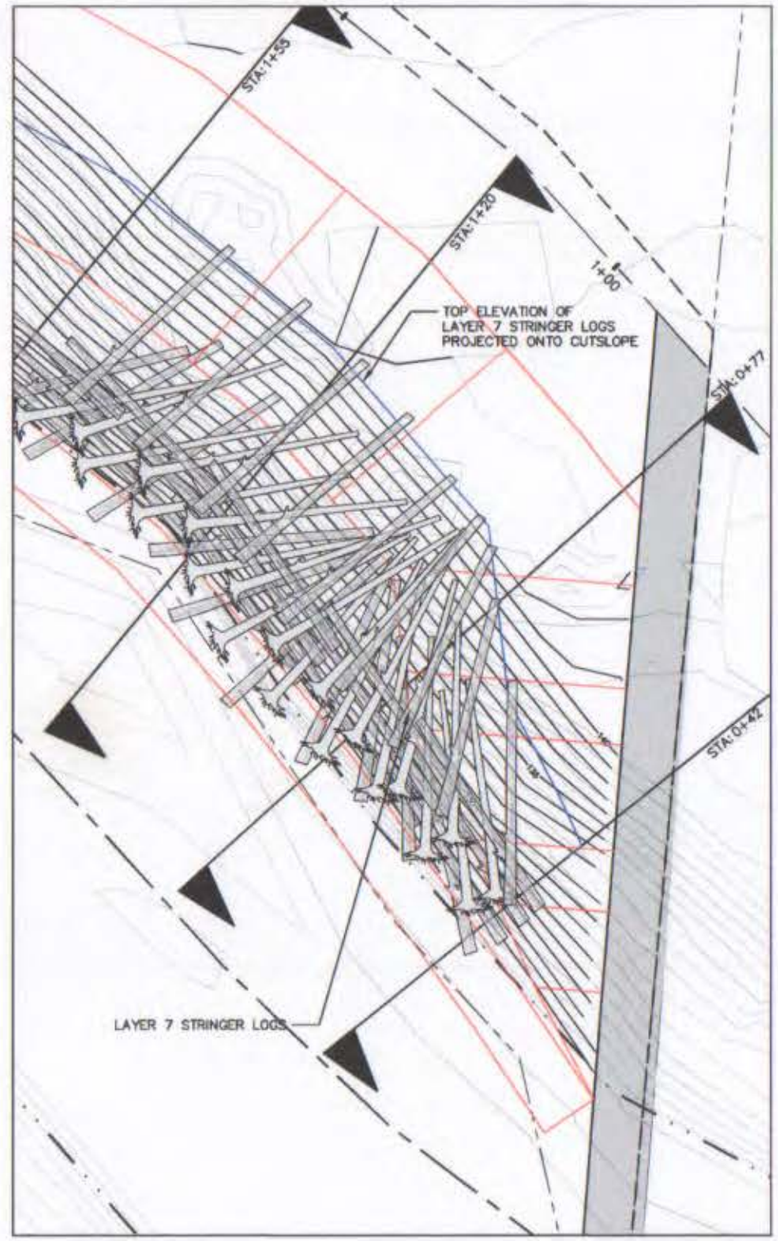
SCALE:
DATE: 7/7/14
DRAWN: REP
CHECKED: MB

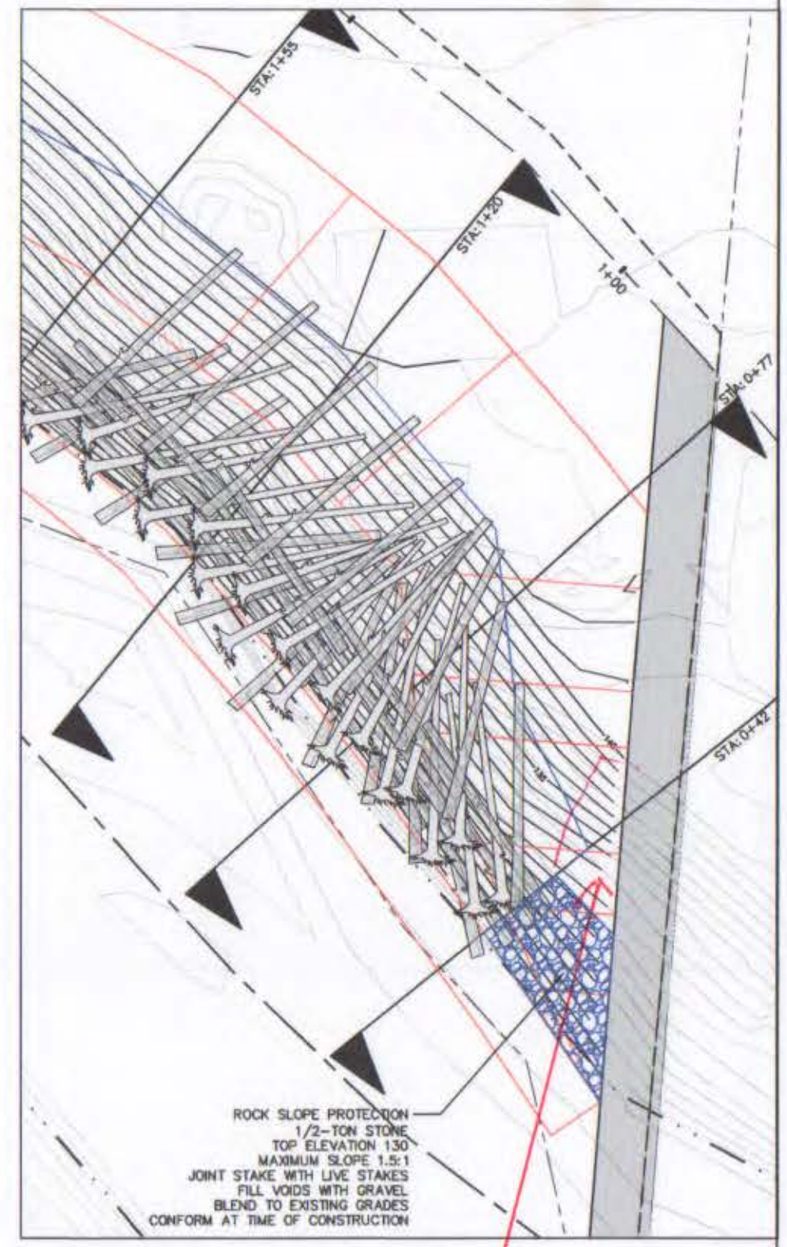
REVIEWED:
REVISIONS:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI BANK REPAIR
DOWNSTREAM TERMINATION DETAIL, 2 OF 3

FILE NAME: 7345
CONTRACT NUMBER: 45-6.1-7/3
DRAWING NUMBER:
SHEET 2 OF 3







additional 1/2 ton rip-rap installed to elevation 137

PROJECT
RECORD
DRAWING

Interflow

10 0 10 20 40
SCALE IN FEET

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		RECORD INFORMATION	
1	04/16/13	CONFORMED	

SONOMA COUNTY WATER AGENCY

SCALE:	
DATE:	7/7/14
DRAWN:	REP
CHECKED:	MB

REVIEWED:
REVISED:

DRY CREEK HABITAT ENHANCEMENT DEMONSTRATION PROJECT PHASE II
MASCHERINI BANK REPAIR
DOWNSTREAM TERMINATION DETAIL, 3 OF 3

FILE NAME: 7345
CONTRACT NUMBER: 45-61-73
DRAWING NUMBER:
SHEET 3 OF 3

Appendix D

Implementation Monitoring Forms

on back

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION	
Reach #: 15	Project Title: USACE Dry Creek		page 1 of 2
Site ID: 7	Site Name:		
Date&Time: 11/6/13	Evaluator: Bob Coey, Gregg Horton, Greg Cox, Ben White		

		Project Feature Number	1 (1)	2	3
		Feature Type Code	HFR	INL	POO
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. *Actual length of feature: (ft)*		90	85	118
	b. *Width of the feature: (ft)*		25	24	25
	c. *Area of the feature installed within bankfull channel: (ft²)*				
	d. *Length of aquatic habitat disturbed during implementation: (ft)*		N/A	85	118
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*		Good	Good	
	3. Are problems with the feature visible?		NO	NO	NO
	a. *Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*				
	4. Was the feature placed in the approved location along the channel?		N/A	yes	
	5. Was the feature placed in the approved position?		N/A	yes	yes
	a. *Position: LBK, MDC, RBK, SPN, OTH*		LBK	MDC	MDC
	6. Was the feature oriented as approved?		N/A	yes	yes
	a. *Orientation: DNS, MUL, PRL, PRP, UPS, OTH*			PRL	PRL
	7. Were approved materials used for the feature?		yes	yes	yes
	a. *Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH*		BOL/LWD	GRV	LWD
	8. Were the sizes of materials used the same as approved?		yes	yes	partial
	9. Was the feature anchored as approved?		partial	N/A	yes
	a. *Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH*		CBL	N/A	CBL
	10. If applicable, was the approved bank or channel excavation carried out?		N/A	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	yes
	a. *Types: FAB, NTR, NTM, OFR, PLN*, SEE, SLF, STM, OTH*		SEE	SEE	SEE
Habitat	12. If applicable, was the habitat type modification completed as approved?		N/A	yes	yes
	a. *Habitat created: FLT, POO, RIF, OTH*		(1)	FLT	POO
	13. If applicable, was gravel added to the stream as approved?		N/A	yes	N/A
	a. *Volume of gravel added to stream: (cy)*		N/A	See plan	N/A
	14. Total number of pieces of Large Woody Debris used in this feature:		6	Ø	9
	a. *Type: LWD / RTW / LWD with attached RTW: (#)*		3/0/3	1/1	3/1/5
Bank	15. If applicable, was the bank constructed to the approved angle?		N/A	yes	No
	a. *As-built bank angle: (degrees)*			1:3	1:1
Implementation	16. Does the feature meet design, contract & permit specifications?		partial (2)	yes	partial
	a. *If not, were modifications beneficial to performance?*		yes	N/A	No
	b. *Is non-compliance significant enough to jeopardize performance?*		NO	NO	NO
	c. *Are corrections needed?*		NO	NO	NO
	17. Would a different treatment or design have been preferable? If Y, comment.		NO	NO	yes (3)
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Good	Good	Good
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*					

Comments

F2: Depth max = 4.0' / ave = 3.1' (@ mouth = 2.6) F3: max = 7' / ave = 4-6'

☐ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

(1) High flow refugia
(2) Loose Cable
(3) 3 LWD too small + bank angle possibly off

Dam Release 138 CFS

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title:	page 2 of 2
Site ID: 1	Site Name:	
Date&Time:	Evaluator:	

	Project Feature Number	4		
	Feature Type Code	OUT		
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)	66		
	b. Width of the feature: (ft)	8		
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)	66		
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?	NO		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes		
	5. Was the feature placed in the approved position?	yes		
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK		
	6. Was the feature oriented as approved?	yes		
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	DNS		
	7. Were approved materials used for the feature?	yes		
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	COB		
	8. Were the sizes of materials used the same as approved?	yes		
	9. Was the feature anchored as approved?	N/A		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	N/A		
	10. If applicable, was the approved bank or channel excavation carried out?	yes		
	11. Were approved erosion control measures applied to disturbed areas?	none		
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	N/A		
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes		
	a. Habitat created: FLT, POO, RIF, OTH	FLT		
	13. If applicable, was gravel added to the stream as approved?	yes		
	a. Volume of gravel added to stream: (cy)	see plan		
	14. Total number of pieces of Large Woody Debris used in this feature:	Ø		
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?	yes		
	a. As-built bank angle: (degrees)	45°		
Implementation	16. Does the feature meet design, contract & permit specifications?	yes		
	a. If not, were modifications beneficial to performance?	N/A		
	b. Is non-compliance significant enough to jeopardize performance?	N/A		
	c. Are corrections needed?	N/A		
	17. Would a different treatment or design have been preferable? If Y, comment.	NO		
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	Good		
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			
Comments	F4: max 2.4'/ave 2.0'/@ mouth = 2.0'			

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE Dry Creek	page 1 of 1
Site ID: 2	Site Name:	
Date&Time: 11/6/13	Evaluator:	

		Project Feature Number	1	2	3
		Feature Type Code	FLT	POO	OUT
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. *Actual length of feature: (ft)*		67	61	29
	b. *Width of the feature: (ft)*		14.5	19	17
	c. *Area of the feature installed within bankfull channel: (ft²)*				
	d. *Length of aquatic habitat disturbed during implementation: (ft)*		67	61	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*				
	3. Are problems with the feature visible?		NO	NO	NO
	a. *Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*		—	—	—
	4. Was the feature placed in the approved location along the channel?		yes	yes	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. *Position: LBK, MDC, RBK, SPN, OTH*		MDC	MDC	RBK
	6. Was the feature oriented as approved?		yes	yes	yes
	a. *Orientation: DNS, MUL, PRL, PRP, UPS, OTH*		PRL	PRL	PRP
	7. Were approved materials used for the feature?		yes	yes	yes
	a. *Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH*		LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?		yes	yes	yes
	9. Was the feature anchored as approved?		yes	yes	yes
	a. *Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH*		CBL	CBL	CBL
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	yes
	a. *Types: FAB, NTR, NTM, OFR, PLN*, SEE, SLF, STM, OTH*		SEE	SEE	SEE
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	yes
	a. *Habitat created: FLT, POO, RIF, OTH*		FLT	POO	FLT
	13. If applicable, was gravel added to the stream as approved?		yes	NO	unk
	a. *Volume of gravel added to stream: (cy)*		see plan		
	14. Total number of pieces of Large Woody Debris used in this feature:		1	8	0
	a. *Type: LWD / RTW / LWD with attached RTW: (#)*		0/1/0	3/0/5	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?		yes	yes	yes
	a. *As-built bank angle: (degrees)*				
Implementation	16. Does the feature meet design, contract & permit specifications?		yes	yes	yes
	a. *If not, were modifications beneficial to performance?*		—	—	—
	b. *Is non-compliance significant enough to jeopardize performance?*		—	—	—
	c. *Are corrections needed?*		—	—	—
	17. Would a different treatment or design have been preferable? If Y, comment.		NO	NO	NO
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Good	Excellent	Good
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***					

Comments

F1= Depth max-2.5' / ave= 1-2.5'
F2= max= 4' / ave= 2-4'
F3= max=2' / ave 1.5-2'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #:	**Project Title:**			**page of**
Site ID:	**Site Name:**			
Date&Time:	**Evaluator:**			

	Project Feature Number			
	Feature Type Code			
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)			
	b. Width of the feature: (ft)			
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?			
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.			
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE Dry Creek	page 1 of 1
Site ID: 3	Site Name:	
Date&Time: 11/6/13	Evaluator:	

		Project Feature Number	1	2	3
		Feature Type Code	FLT	POO	OUT
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. *Actual length of feature: (ft)*		138	80	33
	b. *Width of the feature: (ft)*		11	16	13
	c. *Area of the feature installed within bankfull channel: (ft²)*				
	d. *Length of aquatic habitat disturbed during implementation: (ft)*		11	80	33
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*				
	3. Are problems with the feature visible?		No ①	No ①	No
	a. *Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*		—	—	—
	4. Was the feature placed in the approved location along the channel?		yes	yes	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. *Position: LBK, MDC, RBK, SPN, OTH*		MDC	MDC	RBK
	6. Was the feature oriented as approved?		yes	yes	yes
	a. *Orientation: DNS, MUL, PRL, PRP, UPS, OTH*		PRL	PRL	PRP
	7. Were approved materials used for the feature?		yes	yes	yes
	a. *Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH*		GRV/COB	LWD	COB
	8. Were the sizes of materials used the same as approved?		yes	yes	yes
	9. Was the feature anchored as approved?		N/A	yes	—
	a. *Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH*		N/A	CBL	—
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	yes
	a. *Types: FAB, NTR, NTM, OFR, PLN*, SEE, SLF, STM, OTH*		SEE	SEE	SEE
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	No
	a. *Habitat created: FLT, POO, RIF, OTH*		FLT	POO	FLT
	13. If applicable, was gravel added to the stream as approved?		yes	NO	yes
	a. *Volume of gravel added to stream: (cy)*		see plan	—	
	14. Total number of pieces of Large Woody Debris used in this feature:		Ø	6	1
	a. *Type: LWD / RTW / LWD with attached RTW: (#)*		/ /	3/0/3	0/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?		partial ①	partial ①	yes
	a. *As-built bank angle: (degrees)*				
Implementation	16. Does the feature meet design, contract & permit specifications?		yes	yes	No ②
	a. *If not, were modifications beneficial to performance?*		—	—	unknown ③
	b. *Is non-compliance significant enough to jeopardize performance?*		—	—	unk
	c. *Are corrections needed?*		—	—	NO
	17. Would a different treatment or design have been preferable? If Y, comment.		NO	NO	partial
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Good	Good	Fair
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***					

Comments

F1: max depth 2' / range 1-2'
F2: max 4.8' / range 2-5'
F3: max 1.8' / range 1-2' / @ outlet 1.0'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

① bank angle too steep on some places

② openings smaller than contract specs: 3ft = LB / 5ft = RB (currently functioning more as an inlet.)

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #:	**Project Title:**			**page of**
Site ID:	**Site Name:**			
Date&Time:	**Evaluator:**			

	Project Feature Number			
	Feature Type Code			
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)			
	b. Width of the feature: (ft)			
	c. Area of the feature installed within bankfull channel: (ft^2)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?			
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.			
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

DEFECTIVE CHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE Dry Creek	
Site ID: 4	Site Name:	page 1 of 2 (on back)
Date&Time:	Evaluator:	

		Project Feature Number	1	2	3
		Feature Type Code	FLT	POO	FLT
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. Actual length of feature: (ft)		69	53	84
	b. Width of the feature: (ft)		10	20	20
	c. Area of the feature installed within bankfull channel: (ft²)				
	d. Length of aquatic habitat disturbed during implementation: (ft)		79	53	84
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*				
	3. Are problems with the feature visible?		No	No	NO
	a. Types: *ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*		—	—	—
	4. Was the feature placed in the approved location along the channel?		yes	yes	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. Position: *LBK, MDC, RBK, SPN, OTH*		MDC	MDC	MDC
	6. Was the feature oriented as approved?		yes	yes	yes
	a. Orientation: *DNS, MUL, PRL, PRP, UPS, OTH*		PRL	PRL	PRL
	7. Were approved materials used for the feature?		yes	yes	yes
	a. Materials: *CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH*		N/A	LWD	N/A
	8. Were the sizes of materials used the same as approved?		N/A	yes	N/A
	9. Was the feature anchored as approved?		N/A	yes	N/A
	a. Anchoring: *BUR, CBL, REB, STK, TIE, NON, OTH*		—	CBL	—
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	yes
	a. Types: *FAB, NTR, NTM, OFR, PLN*, SEE, SLF, STM, OTH*		SEE	SEE	SEE
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	yes
	a. Habitat created: *FLT, POO, RIF, OTH*		FLT	POO	FLT
	13. If applicable, was gravel added to the stream as approved?		yes	NO	yes
	a. Volume of gravel added to stream: *(cy)*				
	14. Total number of pieces of Large Woody Debris used in this feature:		Ø	5	Ø
	a. Type: *LWD / RTW / LWD with attached RTW: (#)*		/ /	/ / 4	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?		partial ①	yes	yes
	a. As-built bank angle: *(degrees)*				
Implementation	16. Does the feature meet design, contract & permit specifications?		yes	yes	yes
	a. If not, were modifications beneficial to performance?		—	—	—
	b. Is non-compliance significant enough to jeopardize performance?		—	—	—
	c. Are corrections needed?		—	—	—
	17. Would a different treatment or design have been preferable? If Y, comment.		No	NO	No
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Good	Excellent	Good
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*					

Comments

F1: max 24' / range 1-24'
F2: max 4' / range 1-4'
F3: max 2' / range 1-2'

☐ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

① a little steep in some places

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #:	Project Title:	page 2 of 2
Site ID: 4	Site Name:	
Date&Time:	Evaluator:	

	Project Feature Number	4		
	Feature Type Code	OUT		
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)	32		
	b. Width of the feature: (ft)	13		
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)	32		
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?	NO		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	—		
	4. Was the feature placed in the approved location along the channel?	yes		
	5. Was the feature placed in the approved position?	yes		
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK		
	6. Was the feature oriented as approved?	yes		
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	DNS		
	7. Were approved materials used for the feature?	yes		
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	GRV/COB		
	8. Were the sizes of materials used the same as approved?	yes		
	9. Was the feature anchored as approved?	N/A		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	—		
	10. If applicable, was the approved bank or channel excavation carried out?	yes		
	11. Were approved erosion control measures applied to disturbed areas?	yes		
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE		
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes		
	a. Habitat created: FLT, POO, RIF, OTH	FLT		
	13. If applicable, was gravel added to the stream as approved?	yes		
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	Ø		
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?	partial NO		
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes		
	a. If not, were modifications beneficial to performance?	—		
	b. Is non-compliance significant enough to jeopardize performance?	—		
	c. Are corrections needed?	—		
	17. Would a different treatment or design have been preferable? If Y, comment.	NO		
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	Good		
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*				
Comments	F4: max = 1.6' / range = 1-2' / outlet = 1.1'			

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

① steep in some places

Cont on next sheet

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE DRY CREEK	page 1 of 2
Site ID: 15	Site Name:	
Date&Time: 11/6/13	Evaluator:	

		Project Feature Number	1	2	3
		Feature Type Code	POO	FLT	POO
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. Actual length of feature: (ft)		118	109	64
	b. Width of the feature: (ft)		21	16	15
	c. Area of the feature installed within bankfull channel: (ft²)				
	d. Length of aquatic habitat disturbed during implementation: (ft)		118	109	64
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*				
	3. Are problems with the feature visible?		No	NO	NO
	a. Types: *ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*		—	—	—
	4. Was the feature placed in the approved location along the channel?		yes	yes	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. Position: *LBK, MDC, RBK, SPN, OTH*		MDC	MDC	MDC
	6. Was the feature oriented as approved?		yes	yes	yes
	a. Orientation: *DNS, MUL, PRL, PRP, UPS, OTH*		PRL	PRL	PRL
	7. Were approved materials used for the feature?		yes	yes	yes
	a. Materials: *CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH*		LWD	N/A	LWD
	8. Were the sizes of materials used the same as approved?		yes	N/A	partial (1)
	9. Was the feature anchored as approved?		yes	N/A	yes
	a. Anchoring: *BUR, CBL, REB, STK, TIE, NON, OTH*		CBL	—	CBL
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	yes
	a. Types: *FAB, NTR, NTM, OFR, PLN*, SEE, SLF, STM, OTH*		SEE	SEE	SEE
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	yes
	a. Habitat created: *FLT, POO, RIF, OTH*		POO	FLT	FLT
	13. If applicable, was gravel added to the stream as approved?		NO	yes	NO
	a. Volume of gravel added to stream: *(cy)*		—	see plan	—
	14. Total number of pieces of Large Woody Debris used in this feature:		0	0	4
	a. Type: *LWD / RTW / LWD with attached RTW: (#)*		4/0/5	/ /	3/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?		yes	yes	yes
	a. As-built bank angle: *(degrees)*				
Implementation	16. Does the feature meet design, contract & permit specifications?		yes	yes	partial (1)
	a. If not, were modifications beneficial to performance?		yes	yes	unk
	b. Is non-compliance significant enough to jeopardize performance?		—	—	unk
	c. Are corrections needed?		—	—	unk
	17. Would a different treatment or design have been preferable? If Y, comment.		No	No	yes (2)
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Good	Good	Fair
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*					

Comments

BACKWATER / ALCOVE

F3: max 3' / range 2-3'

F2: max 4' / range 2-4'

F2: max 2.5' / range 1-2.5'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

(1) 3 LWD structures are smaller than specs.

(2) Larger wood preferably used.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE Dry CK	page 2 of 2
Site ID: 5	Site Name:	
Date&Time: 11/6/13	Evaluator:	

	Project Feature Number	4		
	Feature Type Code	IN L		
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)	88		
	b. Width of the feature: (ft)	12		
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)	88		
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?	No		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	—		
	4. Was the feature placed in the approved location along the channel?	yes		
	5. Was the feature placed in the approved position?	yes		
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK		
	6. Was the feature oriented as approved?	yes		
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS		
	7. Were approved materials used for the feature?	yes		
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	N/A		
	8. Were the sizes of materials used the same as approved?	N/A		
	9. Was the feature anchored as approved?	N/A		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	—		
	10. If applicable, was the approved bank or channel excavation carried out?	yes		
	11. Were approved erosion control measures applied to disturbed areas?	yes		
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE		
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes		
	a. Habitat created: FLT, POO, RIF, OTH	FLT		
	13. If applicable, was gravel added to the stream as approved?	yes		
	a. Volume of gravel added to stream: (cy)	see plan		
	14. Total number of pieces of Large Woody Debris used in this feature:	0		
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?	yes		
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes		
	a. If not, were modifications beneficial to performance?	—		
	b. Is non-compliance significant enough to jeopardize performance?	—		
	c. Are corrections needed?	—		
	17. Would a different treatment or design have been preferable? If Y, comment.	No		
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	Good		
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

FH: range 1-2' / max 1.8' / @ mouth 1.3'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #:	**Project Title:**			page of
Site ID:	**Site Name:**			
Date&Time:	**Evaluator:**			

	Project Feature Number			
	Feature Type Code			
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)			
	b. Width of the feature: (ft)			
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?			
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.			
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

next Shee

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE DRY CREEK	page 1 of 2
Site ID: 6	Site Name:	
Date&Time: 11/6/13	Evaluator:	

		Project Feature Number	1	2	3
		Feature Type Code	POO	FLT	RW
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. Actual length of feature: (ft)		103	105	140
	b. Width of the feature: (ft)		27	18	20
	c. Area of the feature installed within bankfull channel: (ft²)				
	d. Length of aquatic habitat disturbed during implementation: (ft)		103	105	140
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*				
	3. Are problems with the feature visible?		partial D	ND	NO
	a. Types: *ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*			—	
	4. Was the feature placed in the approved location along the channel?		yes	yes	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. Position: *LBK, MDC, RBK, SPN, OTH*		MDC	MDC	LBK
	6. Was the feature oriented as approved?		yes	yes	yes
	a. Orientation: *DNS, MUL, PRL, PRP, UPS, OTH*		PRL	PRL	PRP
	7. Were approved materials used for the feature?		yes	yes	N/A
	a. Materials: *CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH*		LWD	N/A	—
	8. Were the sizes of materials used the same as approved?		partial D	N/A	—
	9. Was the feature anchored as approved?		yes	N/A	—
	a. Anchoring: *BUR, CBL, REB, STK, TIE, NON, OTH*		CBL	N/A	—
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	NO
	a. Types: *FAB, NTR, NTM, OFR, PLN*, SEE, SLF, STM, OTH*		SEE	SEE	—
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	yes
	a. Habitat created: *FLT, POO, RIF, OTH*		POO	FLT	RW
	13. If applicable, was gravel added to the stream as approved?		NO	yes	NO
	a. Volume of gravel added to stream: *(cy)*		—		
	14. Total number of pieces of Large Woody Debris used in this feature:		6	0	NO
	a. Type: *LWD / RTW / LWD with attached RTW: (#)*		1 / 1 / 4	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?		yes	yes	yes
	a. As-built bank angle: *(degrees)*				
Implementation	16. Does the feature meet design, contract & permit specifications?		partial D	yes	yes
	a. If not, were modifications beneficial to performance?		unk	—	—
	b. Is non-compliance significant enough to jeopardize performance?		unk	—	—
	c. Are corrections needed?		unk	—	—
	17. Would a different treatment or design have been preferable? If Y, comment.		yes ①	—	—
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Fair	Good	Excellent
	FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*				

Comments

~~① BACK WATER~~ (F3 is adjacent to F2)

F1: max 5' / range 2-5' F3: range 0.5-2' / max 1.5'

F2: max 3' / range 1-3'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

① 5 LWD's are smaller than specs,

② Larger wood preferable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: USACE Dry Creek	page 2 of 2
Site ID: 6	Site Name:	
Date&Time: 11/6/17	Evaluator:	

		Project Feature Number	4	5	
		Feature Type Code	PLB	OUT	
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. Actual length of feature: (ft)		88	33	
	b. Width of the feature: (ft)		17	35	
	c. Area of the feature installed within bankfull channel: (ft²)				
	d. Length of aquatic habitat disturbed during implementation: (ft)		88	33	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*				
	3. Are problems with the feature visible?		NO	NO	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH		–	–	
	4. Was the feature placed in the approved location along the channel?		yes	yes	
	5. Was the feature placed in the approved position?		yes	yes	
	a. Position: LBK, MDC, RBK, SPN, OTH		N/A	LBK	
	6. Was the feature oriented as approved?		yes	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL	DNS	
	7. Were approved materials used for the feature?		yes	yes	
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH		LWD	N/A	
	8. Were the sizes of materials used the same as approved?		Partial D	N/A	
	9. Was the feature anchored as approved?		yes	N/A	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		CBL	N/A	
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	
	11. Were approved erosion control measures applied to disturbed areas?		yes	yes	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*		SEE	SEE	
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	
	a. Habitat created: FLT, POO, RIF, OTH		POO	FLT	
	13. If applicable, was gravel added to the stream as approved?		NO	yes	
	a. Volume of gravel added to stream: (cy)		–	2	
	14. Total number of pieces of Large Woody Debris used in this feature:		8	0	
	a. Type: LWD / RTW / LWD with attached RTW: (#)		1 / 1 / 6	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?		yes	yes	
	a. As-built bank angle: (degrees)				
Implementation	16. Does the feature meet design, contract & permit specifications?		Partial D	yes	
	a. If not, were modifications beneficial to performance?		unk	–	
	b. Is non-compliance significant enough to jeopardize performance?		unk	–	
	c. Are corrections needed?		unk	–	
	17. Would a different treatment or design have been preferable? If Y, comment.		yes ②	–	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		Fair	Good	
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***					

Comments

① OUTLET

F4: max 4' / range 1-4'

F5: max 2.5' / range 2-2.5' / @ mouth 2.5'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

① 6 LWD's smaller than specs

② Larger wood preferable

OFF CHANNEL

~~INSTREAM~~ HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	Project Title: VACE Dry Creek	page of
Site ID: 7	Site Name:	
Date&Time: 11/6/13	Evaluator:	

	Project Feature Number	1	
	Feature Type Code	ALC	
Metrics	1. Was the length of channel or bank treated the same as approved?		
	a. Actual length of feature: (ft)	120	
	b. Width of the feature: (ft)	12	
	c. Area of the feature installed within bankfull channel: (ft²)		
	d. Length of aquatic habitat disturbed during implementation: (ft)	120	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*		
	3. Are problems with the feature visible?	NO	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	—	
	4. Was the feature placed in the approved location along the channel?	yes	
	5. Was the feature placed in the approved position?	yes	
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	
	6. Was the feature oriented as approved?	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	PRL	
	7. Were approved materials used for the feature?	—	
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	—	
	8. Were the sizes of materials used the same as approved?	—	
	9. Was the feature anchored as approved?	—	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	—	
	10. If applicable, was the approved bank or channel excavation carried out?	yes	
	11. Were approved erosion control measures applied to disturbed areas?	yes	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE	
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	
	a. Habitat created: FLT, POO, RIF, OTH	ALC	
	13. If applicable, was gravel added to the stream as approved?	No	
	a. Volume of gravel added to stream: (cy)		
	14. Total number of pieces of Large Woody Debris used in this feature:	Ø	
	a. Type: LWD / RTW / LWD with attached RTW: (#)		
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	
	a. As-built bank angle: (degrees)		
Implementation	16. Does the feature meet design, contract & permit specifications?	NO	
	a. If not, were modifications beneficial to performance?	yes	
	b. Is non-compliance significant enough to jeopardize performance?	No	
	c. Are corrections needed?	No	
	17. Would a different treatment or design have been preferable? If Y, comment.	work	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	good	
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*			
Comments	F1: max 0.3' / range 0-0.5'		

☐ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #:	Project Title:	page of
Site ID:	Site Name:	
Date&Time:	Evaluator:	

	Project Feature Number			
	Feature Type Code			
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)			
	b. Width of the feature: (ft)			
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?			
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.			
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	**Project Title:** USACE DRY CREEK	page 1 of 1
Site ID: 8	**Site Name:**	
Date&Time: 11/6/13	**Evaluator:**	

	Project Feature Number	1		
	Feature Type Code	RUN		
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)			
	b. Width of the feature: (ft)			
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?	YES		
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.			
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

NATIVE GRAVEL WASHED AND PLACED IN MAIN CHANNEL (NTR)

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 15	**Project Title:** USACE DRY CREEK	page 1 of 1
Site ID: 9	**Site Name:**	
Date&Time: 11/6/13	**Evaluator:**	

	Project Feature Number	1		
	Feature Type Code	RUN		
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)			
	b. Width of the feature: (ft)			
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?	YES		
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.			
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

NATIVE GRAVEL WASHED AND PLACED IN MAIN CHANNEL (NTR)

Depth [illegible] 2-3'

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT			IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project		
Site ID: 1	**Site Name:** Quivira		**page** 1 **of** 1
Date&Time: 10/30/2012	**Evaluator:** D. Cuneo, G. Horton (SCWA), B. Coey, R. Rogers (NMFS), E. Doss, R. Watanabe (CDFW)		

		Project Feature Number	1	2	3
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?			
		a. Actual length of feature: (ft)	56	23	16
		b. Width of the feature: (ft)	46	59	45
		c. Area of the feature installed within bankfull channel: (ft²)	2576	1357	720
		d. Length of aquatic habitat disturbed during implementation: (ft)	36	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	Good	Good	Good
	3.	Are problems with the feature visible?	No	No	No
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	A	A	A
	4.	Was the feature placed in the approved location along the channel?	Yes	Yes	Yes
	5.	Was the feature placed in the approved position?	Yes	Yes	Yes
		a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6.	Was the feature oriented as approved?	No	Yes	Yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	Vertical	MUL	MUL
	7.	Were approved materials used for the feature?	Yes	Yes	Yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	Yes	Yes	Yes
	9.	Was the feature anchored as approved?	No	Yes	Yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	CBL	CBL	CBL
	10.	If applicable, was the approved bank or channel excavation carried out?	Yes	NA	NA
	11.	Were approved erosion control measures applied to disturbed areas?	Yes	Yes	Yes
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE	SEE	SEE
Habitat	12.	If applicable, was the habitat type modification completed as approved?	Yes	Yes	Yes
		a. Habitat created: FLT, POO, RIF, OTH	Shelter	Shelter	Shelter
	13.	If applicable, was gravel added to the stream as approved?	No	No	No
		a. Volume of gravel added to stream: (cy)	A	A	A
	14.	Total number of pieces of Large Woody Debris used in this feature:		5	6
		a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	4 / /1	5/ /1
Bank	15.	If applicable, was the bank constructed to the approved angle?	NA	NA	NA
		a. As-built bank angle: (degrees)			
Implementation	16.	Does the feature meet design, contract & permit specifications?	partially	Yes	Yes
		a. If not, were modifications beneficial to performance?	Yes	A	A
		b. Is non-compliance significant enough to jeopardize performance?	No	A	A
		c. Are corrections needed?	No	A	A
	17.	Would a different treatment or design have been preferable? If Y, comment.	No	No	No
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	**Excellent**	**Excellent**	**Excellent**
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			**Excellent**		

Comments

1-6 Vertical orientation of upright logs for all 3 features changed due to unexpected encounter of bedrock
1-8 Assorted material subject to fracture/cable pullout - concern noted
2-9 Live trees used as vertical anchors

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT				IMPLEMENTATION
Reach #: 7	**Project Title:**	Dry Creek Habitat Enhacement Demonstration Project		
Site ID: 2	**Site Name:**	Quivira		**page** 1 **of** 2
Date&Time: 10/30/2012	**Evaluator:**	D. Cuneo, G. Horton (SCWA), B. Coey, R. Rogers (NMFS), E. Doss, R. Watanabe (CDFW)		

		Project Feature Number	1	2	3
		Feature Type Code			
Metrics	1.	Was the length of channel or bank treated the same as approved?			
		a. Actual length of feature: (ft)	78	40	90
		b. Width of the feature: (ft)	49	22	16
		c. Area of the feature installed within bankfull channel: (ft²)			
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	Good	Good	Good
	3.	Are problems with the feature visible?	No	No	No
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	A	A	A
	4.	Was the feature placed in the approved location along the channel?	Yes	Yes	Yes
	5.	Was the feature placed in the approved position?	Yes	Yes	Yes
		a. Position: LBK, MDC, RBK, SPN, OTH	MUL	MUL	MUL
	6.	Was the feature oriented as approved?	No	No	No
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	OTH	OTH	OTH
	7.	Were approved materials used for the feature?	Yes	Yes	Yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	Yes	Yes	Yes
	9.	Was the feature anchored as approved?	Yes	Yes	Yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	CBL	CBL	CBL
	10.	If applicable, was the approved bank or channel excavation carried out?	Yes	Yes	Yes
	11.	Were approved erosion control measures applied to disturbed areas?	Yes	Yes	Yes
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB	FAB	SEE
Habitat	12.	If applicable, was the habitat type modification completed as approved?	Yes	Yes	Yes
		a. Habitat created: FLT, POO, RIF, OTH	Shelter	Shelter	Shelter
	13.	If applicable, was gravel added to the stream as approved?	No	No	No
		a. Volume of gravel added to stream: (cy)	A	A	A
	14.	Total number of pieces of Large Woody Debris used in this feature:			
		a. Type: LWD / RTW / LWD with attached RTW: (#)	18 / /7	4 / /3	15/ /2
Bank	15.	If applicable, was the bank constructed to the approved angle?	Yes	Yes	No
		a. As-built bank angle: (degrees)	See plans	See plans	See plans
Implementation	16.	Does the feature meet design, contract & permit specifications?	Yes	Yes	Yes
		a. If not, were modifications beneficial to performance?	A	A	A
		b. Is non-compliance significant enough to jeopardize performance?	A	A	A
		c. Are corrections needed?	A	A	A
	17.	Would a different treatment or design have been preferable? If Y, comment.	No	No	No
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	**Excellent**	**Excellent**	**Excellent**
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***					

Comments

1a Entire length of backwater (both sites combined) is 302'
1-6 RBK LWD combined w/upstream LWD feature
3-6 2 separated LWD structures on left bank combined with with one larger structure
3-15 Bank steep, slight slumping could occur
9a Overall recommendation: prefer to see threaded rebar anchoring instead of cabling when feasible

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT				IMPLEMENTATION
Reach #: 7	**Project Title:**	Dry Creek Habitat Enhacement Demonstration Project		
Site ID: 2	**Site Name:**	Quivira		**page** 2 **of** 2
Date&Time: 10/30/2012	**Evaluator:**	D. Cuneo, G. Horton (SCWA), B. Coey, R. Rogers (NMFS), E. Doss, R. Watanabe (CDFW)		

		Project Feature Number	4	5	6
		Feature Type Code	LWD	LWD	outlet/inlet
Metrics	1.	Was the length of channel or bank treated the same as approved?			
		a. Actual length of feature: (ft)	21	13	85
		b. Width of the feature: (ft)	23	16	41
		c. Area of the feature installed within bankfull channel: (ft²)			
		d. Length of aquatic habitat disturbed during implementation: (ft)	0		97
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3.	Are problems with the feature visible?			
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4.	Was the feature placed in the approved location along the channel?			
	5.	Was the feature placed in the approved position?			
		a. Position: LBK, MDC, RBK, SPN, OTH			
	6.	Was the feature oriented as approved?			
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7.	Were approved materials used for the feature?			
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8.	Were the sizes of materials used the same as approved?			
	9.	Was the feature anchored as approved?			
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10.	If applicable, was the approved bank or channel excavation carried out?			
	11.	Were approved erosion control measures applied to disturbed areas?			
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12.	If applicable, was the habitat type modification completed as approved?			
		a. Habitat created: FLT, POO, RIF, OTH			
	13.	If applicable, was gravel added to the stream as approved?			
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:			
		a. Type: LWD / RTW / LWD with attached RTW: (#)	2 / /1	1 / /1	18/ /5
Bank	15.	If applicable, was the bank constructed to the approved angle?			
		a. As-built bank angle: (degrees)			
Implementation	16.	Does the feature meet design, contract & permit specifications?			
		a. If not, were modifications beneficial to performance?			
		b. Is non-compliance significant enough to jeopardize performance?			
		c. Are corrections needed?			
	17.	Would a different treatment or design have been preferable? If Y, comment.			
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	**Excellent**	**Excellent**	**Excellent**
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			**Excellent**		

Comments

1a Entire length of backwater (both sites combined) is 302'
1b Average width of site = 14.4' (measured widths: 10', 11', 14', 15', 22')
1d Length of face of feature 6 = 97 feet therefore used this as length of habitat disturbance
* Recommend removing cable at top of bank - girdle potential for black walnut, several other locations where girdling could occur

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

CHANNEL RECONSTRUCTION & BANK STABILIZATION			IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project		**page** 1 **of** 1
Site ID: 3	**Site Name:** Quivira		
Date&Time: 10/30/2012	**Evaluator:** D. Cuneo, G. Horton (SCWA), B. Coey, R. Rogers (NMFS), E. Doss, R. Watanabe (CDFW)		

		Project Feature Number	1	2
		Feature Type Code	willow wall	willow wall
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)		89	41
	b. Length of bank stabilized by the feature: (ft)		66	41
	c. Area of the feature installed within bankfull channel: (ft²)		660	451
	d. Length of aquatic habitat disturbed during implementation: (ft)		23	0
	2. If applicable, was gravel added to the stream as approved?		NA	NA
	a. Volume of gravel added to stream: (cy)			
	3. Was bioengineering used at this feature? If Y, use RT also.		Yes	Yes
	4. Is feature a grade control boulder weir? If Y, use FB instead.		No	No
Structure	5. Structural condition: *Excl, Good, Fair, Poor, Fail*		Excl	Excl
	6. Are problems with the feature visible?		Yes	No
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			A
	7. Was the feature placed in the approved location along the channel?		NA	NA
	8. Was the feature placed in the approved position?		NA	NA
	a. Position: LBK, MDC, RBK, SPN, OTH		LBK	RBK
	9. Was the feature oriented as approved?		NA	NA
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL	PRL
	10. Were approved materials used for the feature?		No	No
	a. Materials: CON, LWD, MTL, NTR, OFR, RTW, VEG, WOO, ROC, OTH		willow	willow
	11. Were the sizes of materials used the same as approved?		NA	NA
	12. Was the feature anchored as approved?		NA	NA
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		OTH	OTH
	13. Number of pieces of large wood debris used in this feature: (#)		0	0
Reconstruction	14. If applicable, was the approved bank or channel excavation carried out?		NA	NA
	15. Was the channel recontoured as approved?			
	a. Was the channel reconstructed in a new location?			
	b. Length of channel recontoured: (ft)			
	16. Were streambanks reconstructed as approved?			
	a. Were the banks reconstructed in a new location?			
	b. Length of bank reconstructed (note if length includes both banks): (ft)			
	17. Was the bank constructed or recontoured to the approved angle?			
	a. Average as-built bank angle: (degrees)			
	18. Were approved erosion control measures applied to disturbed areas?			
	a. Type: FAB, NTM, PLN, ROC, SEE, SLF, STM, OTH*			
Implementation	19. Does the feature meet design, contract & permit specifications?			
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	20. Would a different treatment or design have been preferable? If Y, comment.		Yes, see 6	No
	21. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		**Good**	**Excellent**
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*			**Good-Excellent**	

Comments

1-6 Recommend extending willow wall face of bank along main channel of Dry Creek
1-7 Added feature

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT				IMPLEMENTATION		
Reach #:	7	**Project Title:**	Dry Creek Habitat Enhacement Demonstration Project			
Site ID:	1	**Site Name:**	Van Alyea			
Date&Time:		**Evaluator:**	Curtes			

		Project Feature Number	1	2	3
		Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. Actual length of feature: (ft)		50	50	50
	c. Width of the feature: (ft)		25	25	25
	b. Area of the feature installed within bankfull channel: (ft²)		1250	1250	1250
	d. Length of aquatic habitat disturbed during implementation: (ft)		50	50	50
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*		excl	excl	excl
	3. Are problems with the feature visible?		no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH				
	4. Was the feature placed in the approved location along the channel?		no	no	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH		LBK	LBK	LBK
	6. Was the feature oriented as approved?		yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL	PRL	PRL
	7. Were approved materials used for the feature?		yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH		LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?		yes	yes	yes
	9. Was the feature anchored as approved?		yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		CBL	CBL	CBL
	10. If applicable, was the approved bank or channel excavation carried out?		N/A	N/A	N/A
	11. Were approved erosion control measures applied to disturbed areas?		N/A	N/A	N/A
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*				
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes ~~N/A~~	yes ~~N/A~~	yes ~~N/A~~
	a. Habitat created: FLT, POO, RIF, OTH		SHL	SHL	SHL
	13. If applicable, was gravel added to the stream as approved?		N/A	N/A	N/A
	a. Volume of gravel added to stream: (cy)				
	14. Total number of pieces of Large Woody Debris used in this feature:		5	5	5
	a. Type: LWD / RTW / LWD with attached RTW: (#)		LWD	LWD	LWD
Bank	15. If applicable, was the bank constructed to the approved angle?		N/A	N/A	N/A
	a. As-built bank angle: (degrees)				
Implementation	16. Does the feature meet design, contract & permit specifications?		no	no	no
	a. If not, were modifications beneficial to performance?				
	b. Is non-compliance significant enough to jeopardize performance?		no	no	no
	c. Are corrections needed?		no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.		no	no	no
	18. Feature Implementation Rating: *Excl, Good, Fair, Poor, Fail*		Excl	Excl	Excl

Possible field verification needed - design shows 7 logs. Only see 5 in photos

FINAL SITE LEVEL RATING (feature level rollup): ***Excl, Good, Fair, Poor, Fail***

Comments

4.1 feature moved upstream approx. 20 feet to avoid impacts to existing vegetation
4.2 " " " " 5 feet " " " "

16.1,2,3: Pool enhancement LWD feature designs showed 7 logs total for each structure. Modified to avoid impacts to existing riparian vegetation

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project	**page** 1 **of** 1
Site ID: 2	**Site Name:** Van Alyea	
Date&Time:	**Evaluator:** Cuneo	

		Project Feature Number	1	2	3
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?	yes	yes	yes
		a. Actual length of feature: (ft)	30	25	25
		b. Width of the feature: (ft)	60	60	60
		c. Area of the feature installed within bankfull channel: (ft²)	1800	1500	1500
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3.	Are problems with the feature visible?	no	no	no
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4.	Was the feature placed in the approved location along the channel?	yes	yes	yes
	5.	Was the feature placed in the approved position?	yes	yes	yes
		a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6.	Was the feature oriented as approved?	yes	yes	yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	UPS
	7.	Were approved materials used for the feature?	yes	yes	yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	yes	yes	yes
	9.	Was the feature anchored as approved?	yes	yes	yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10.	If applicable, was the approved bank or channel excavation carried out?	yes	N/A	N/A
	11.	Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	NTR	see	FAB/see
Habitat	12.	If applicable, was the habitat type modification completed as approved?	N/A	N/A	N/A
		a. Habitat created: FLT, POO, RIF, OTH			
	13.	If applicable, was gravel added to the stream as approved?	NA	N/A	N/A
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:	30	7	7
		a. Type: LWD / RTW / LWD with attached RTW: (#)	LWD	LWD	LWD
Bank	15.	If applicable, was the bank constructed to the approved angle?	N/A	N/A	N/A
		a. As-built bank angle: (degrees)			
Implementation	16.	Does the feature meet design, contract & permit specifications?	NO	yes	yes
		a. If not, were modifications beneficial to performance?	Partially	N/A	N/A
		b. Is non-compliance significant enough to jeopardize performance?	no	N/A	N/A
		c. Are corrections needed?	no	no	no
	17.	Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
		FINAL SITE LEVEL RATING (feature level rollup); *Excellent, Good, Fair, Poor, Fail*			

Comments

1.1 length treated same as approved, width of structure was expanded to block flow path between structure and riparian vegetation.

14.1 30 visible; more buried

16.1 see note 1.1; additional wood added. Vertical stray heights limited/reduced.

14.2,3: 1 rootwad w/ log, 6 logs

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project	**page** 1 **of** 1
Site ID: 2	**Site Name:** Van Alyea	
Date&Time:	**Evaluator:** Cuneo	

		Project Feature Number	4	5	6
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?	yes	yes	yes
		a. Actual length of feature: (ft)	25	25	25
		b. Width of the feature: (ft)	60	60	60
		c. Area of the feature installed within bankfull channel: (ft²)	1500	1500	1500
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3.	Are problems with the feature visible?	no	no	no
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4.	Was the feature placed in the approved location along the channel?	yes	yes	yes
	5.	Was the feature placed in the approved position? yes	~~RBK~~	yes	yes
		a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6.	Was the feature oriented as approved?	yes	yes	yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	UPS
	7.	Were approved materials used for the feature?	yes	yes	yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	yes	yes	yes
	9.	Was the feature anchored as approved?	yes	yes	yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10.	If applicable, was the approved bank or channel excavation carried out?	N/A	N/A	N/A
	11.	Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	see	see	see
Habitat	12.	If applicable, was the habitat type modification completed as approved?	N/A	N/A	N/A
		a. Habitat created: FLT, POO, RIF, OTH			
	13.	If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:	7	7	7
		a. Type: LWD / RTW / LWD with attached RTW: (#)	LWD	LWD	LWD
Bank	15.	If applicable, was the bank constructed to the approved angle?	N/A	N/A	N/A
		a. As-built bank angle: (degrees)			
Implementation	16.	Does the feature meet design, contract & permit specifications?	yes	yes	yes
		a. If not, were modifications beneficial to performance?	N/A	N/A	N/A
		b. Is non-compliance significant enough to jeopardize performance?	N/A	N/A	N/A
		c. Are corrections needed?	no	no	no
	17.	Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
		FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

14,4,5 1 rootwad w/log + 6 logs for each feature.
Feature 5 + 6 probably better suited to be considered part of VanAlyea site 3

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT			IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project		
Site ID: 2	**Site Name:** Van Alyea		**page** 1 **of** 1
Date&Time:	**Evaluator:** Cuneo		

	Project Feature Number	7		
	Feature Type Code	LWD		
Metrics	1. Was the length of channel or bank treated the same as approved?	no		
	a. Actual length of feature: (ft)	0		
	b. Width of the feature: (ft)	0		
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?			
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?			
	5. Was the feature placed in the approved position?			
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?			
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?			
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?			
	9. Was the feature anchored as approved?			
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?			
	11. Were approved erosion control measures applied to disturbed areas?			
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?			
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?			
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?			
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	no		
	a. If not, were modifications beneficial to performance?	yes		
	b. Is non-compliance significant enough to jeopardize performance?	no		
	c. Are corrections needed?	no		
	17. Would a different treatment or design have been preferable? If Y, comment.	no		
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*			
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

Feature 7 was omitted during construction because installation of the LWD wood feature at this location would have required removing existing live trees that were already providing the same function (and more) than the proposed feature.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT			IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project		page 1 of 1
Site ID: 3	**Site Name:** Van Alyea		
Date&Time:	**Evaluator:** Cuneo		

		Project Feature Number	1	2	3
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?	yes	yes	yes
		a. Actual length of feature: (ft)	25	25	50
		b. Width of the feature: (ft)	60	60	50
		c. Area of the feature installed within bankfull channel: (ft²)	1500	1500	2500
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3.	Are problems with the feature visible?	no	no	no
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4.	Was the feature placed in the approved location along the channel?	yes	yes	yes
	5.	Was the feature placed in the approved position?	yes	yes	yes
		a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	~~RBK~~ OTH
	6.	Was the feature oriented as approved?	yes	yes	yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	DNS
	7.	Were approved materials used for the feature?	yes	yes	yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	yes	yes	yes
	9.	Was the feature anchored as approved?	yes	yes	yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10.	If applicable, was the approved bank or channel excavation carried out?	N/A	N/A	yes
	11.	Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB/see	FAB/SEE	FAB/see
Habitat	12.	If applicable, was the habitat type modification completed as approved?	N/A	N/A	yes
		a. Habitat created: FLT, POO, RIF, OTH			POO
	13.	If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:	7	7	10
		a. Type: LWD / RTW / LWD with attached RTW: (#)	LWD	LWD	LWD
Bank	15.	If applicable, was the bank constructed to the approved angle?	N/A	N/A	yes
		a. As-built bank angle: (degrees)			see plans
Implementation	16.	Does the feature meet design, contract & permit specifications?	yes	yes	yes
		a. If not, were modifications beneficial to performance?	N/A	N/A	N/A
		b. Is non-compliance significant enough to jeopardize performance?	N/A	N/A	N/A
		c. Are corrections needed?	no	no	no
	17.	Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
		FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

14.1,2 1 rootwad w/log + 6 logs for these features (floodplain LWD)
14.3 2 rootwad w/log + 8 logs for backwater LWD

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT			IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project		page 1 of 1
Site ID: 3	**Site Name:** Van Alyea		
Date&Time:	**Evaluator:** Cuneo		

	Project Feature Number	4	5	6
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	50	25	30
	b. Width of the feature: (ft)	50	60	60
	c. Area of the feature installed within bankfull channel: (ft²)	2500	1500	1800
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	OTH	OTH	MDC
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	DNS	UPS	UPS
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	N/A
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB/SEE	SEE	N/A
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	10	7	5
	a. Type: LWD / RTW / LWD with attached RTW: (#)	LWD	LWD	LWD
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)	see plans	see plans	see plans
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?	N/A	N/A	N/A
	b. Is non-compliance significant enough to jeopardize performance?	N/A	N/A	N/A
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

outlet of freshwater pipe from creek located at Feature 4 location.
14: Feature 5; 1 log w/rootwad + 6 logs
14: Feature 6; 3 log w/rootwad + 2 logs
14: Feature 4; 2 rootwad logs + 8 logs for backwater LWD

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT			IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project		
Site ID: 3	**Site Name:** Van Alyea		**page** 1 **of** 1
Date&Time:	**Evaluator:** Cuneo		

		Project Feature Number	7	8	9
		Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?		yes	yes	yes
	a. Actual length of feature: (ft)		50	30	50
	b. Width of the feature: (ft)		50	60	50
	c. Area of the feature installed within bankfull channel: (ft²)		2500	1800	2500
	d. Length of aquatic habitat disturbed during implementation: (ft)		0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*		Excl	excl	excl
	3. Are problems with the feature visible?		no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH				
	4. Was the feature placed in the approved location along the channel?		yes	yes	yes
	5. Was the feature placed in the approved position?		yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH		RBK	MDC	LBK of Pool
	6. Was the feature oriented as approved?		yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL	UPS	PRL
	7. Were approved materials used for the feature?		yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH		LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?		yes	yes	yes
	9. Was the feature anchored as approved?		yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?		yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?		N/A	N/A	N/A
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*		N/A	N/A	N/A
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH		POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?		N/A	N/A	N/A
	a. Volume of gravel added to stream: (cy)				
	14. Total number of pieces of Large Woody Debris used in this feature:		10	5	10
	a. Type: LWD / RTW / LWD with attached RTW: (#)		LWD	LWD	LWD
Bank	15. If applicable, was the bank constructed to the approved angle?		yes	yes	yes
	a. As-built bank angle: (degrees)		see plans	see plans	see plans
Implementation	16. Does the feature meet design, contract & permit specifications?		yes	yes	yes
	a. If not, were modifications beneficial to performance?		N/A	N/A	N/A
	b. Is non-compliance significant enough to jeopardize performance?		N/A	N/A	N/A
	c. Are corrections needed?		no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.		no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		excl	excl	excl
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

14: Feature 7; 2 rootwad logs + 8 logs for backwater LWD
14: feature 8; 3 log w/rootwads + 2 logs.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project	page 1 of 1
Site ID: 3	**Site Name:** Van Alyea	
Date&Time:	**Evaluator:** Cuneo	

		Project Feature Number	10	11	12
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?	yes	yes	yes
		a. Actual length of feature: (ft)	30	50	25
		b. Width of the feature: (ft)	60	50	60
		c. Area of the feature installed within bankfull channel: (ft²)	1800	2500	1500
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	good	excl
	3.	Are problems with the feature visible?	no	yes	no
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH		OTH	
	4.	Was the feature placed in the approved location along the channel?	yes	yes	yes
	5.	Was the feature placed in the approved position?	yes	yes	yes
		a. Position: LBK, MDC, RBK, SPN, OTH	mdc	RBK	LBK & pool
	6.	Was the feature oriented as approved?	yes	yes	yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	PRL	UPS
	7.	Were approved materials used for the feature?	yes	yes	yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	yes	yes	yes
	9.	Was the feature anchored as approved?	yes	yes	yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	cbl	bur/cbl	bur/cbl
	10.	If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11.	Were approved erosion control measures applied to disturbed areas?	N/A	N/A	N/A
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	N/A	N/A	N/A
Habitat	12.	If applicable, was the habitat type modification completed as approved?	yes	yes	yes
		a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13.	If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:	5	10	7
		a. Type: LWD / RTW / LWD with attached RTW: (#)	LWD	LWD	LWD
Bank	15.	If applicable, was the bank constructed to the approved angle?	yes	yes	yes
		a. As-built bank angle: (degrees)	See Plans	See Plans	See Plans
Implementation	16.	Does the feature meet design, contract & permit specifications?	yes	yes	yes
		a. If not, were modifications beneficial to performance?	N/A	N/A	N/A
		b. Is non-compliance significant enough to jeopardize performance?	N/A	N/A	N/A
		c. Are corrections needed?	no	no	no
	17.	Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	good	excl
		FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

14-feature 10; 3 logs w/rootwads + 2 logs
3-feature 11; Partial loss of one log in structure - appears to have been broken in half by construction equipment; minimal loss of wood - more damaging to structure to try and replace at this point.
14-feature 11; 2 rootwad logs + 8 logs for backwater LWD

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

14-feature 12; 1 log w/rootwad + 6 logs

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhacement Demonstration Project	page 1 of 1
Site ID: 3	**Site Name:** Van Alyea	
Date&Time:	**Evaluator:** Cuneo	

		Project Feature Number	13	14	15
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?	yes	yes	yes
		a. Actual length of feature: (ft)	30	50	50
		b. Width of the feature: (ft)	60	50	50
		c. Area of the feature installed within bankfull channel: (ft²)	1800	2500	2500
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3.	Are problems with the feature visible?	no	no	no
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4.	Was the feature placed in the approved location along the channel?	yes	yes	yes
	5.	Was the feature placed in the approved position?	yes	yes	yes
		a. Position: LBK, MDC, RBK, SPN, OTH	MDC	LBK of MDC	RBK
	6.	Was the feature oriented as approved?	yes	yes	yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	PRL	PRL
	7.	Were approved materials used for the feature?	yes	yes	yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	yes	yes	yes
	9.	Was the feature anchored as approved?	yes	yes	yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	cbl	bur/cbl	bur/cbl
	10.	If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11.	Were approved erosion control measures applied to disturbed areas?	N/A	N/A	N/A
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	N/A	N/A	N/A
Habitat	12.	If applicable, was the habitat type modification completed as approved?	yes	yes	yes
		a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13.	If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:	5	10	10
		a. Type: LWD / RTW / LWD with attached RTW: (#)	LWD	LWD	LWD
Bank	15.	If applicable, was the bank constructed to the approved angle?	yes	yes	yes
		a. As-built bank angle: (degrees)	See plans	See Plns	See Plns
Implementation	16.	Does the feature meet design, contract & permit specifications?	yes	yes	yes
		a. If not, were modifications beneficial to performance?	N/A	N/A	N/A
		b. Is non-compliance significant enough to jeopardize performance?	N/A	N/A	N/A
		c. Are corrections needed?	no	no	no
	17.	Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
		FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

14, feature 5 - 3 logs w/ rootwads + 2 logs

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT			IMPLEMENTATION
Reach #: 7	**Project Title:**	Dry Creek Habitat Enhacement Demonstration Project	
Site ID: 3	**Site Name:**	Van Alyea	
Date&Time:	**Evaluator:**		

		Project Feature Number	16		
		Feature Type Code	LWD		
Metrics	1. Was the length of channel or bank treated the same as approved?		yes		
	a. Actual length of feature: (ft)		50		
	c. Width of the feature: (ft)		45		
	b. Area of the feature installed within bankfull channel: (ft²)		2250		
	d. Length of aquatic habitat disturbed during implementation: (ft)		150		
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*		excl		
	3. Are problems with the feature visible?		no		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH				
	4. Was the feature placed in the approved location along the channel?		yes		
	5. Was the feature placed in the approved position?		yes		
	a. Position: LBK, MDC, RBK, SPN, OTH		RBK		
	6. Was the feature oriented as approved?		yes		
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL/UPS		
	7. Were approved materials used for the feature?		yes		
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH		LWD		
	8. Were the sizes of materials used the same as approved?		yes		
	9. Was the feature anchored as approved?		yes		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		bur/cbl		
	10. If applicable, was the approved bank or channel excavation carried out?		yes		
	11. Were approved erosion control measures applied to disturbed areas?		yes		
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*		see/FAB		
Habitat	12. If applicable, was the habitat type modification completed as approved?		yes		
	a. Habitat created: FLT, POO, RIF, OTH		POO		
	13. If applicable, was gravel added to the stream as approved?		N/A		
	a. Volume of gravel added to stream: (cy)		N/A		
	14. Total number of pieces of Large Woody Debris used in this feature:		30		
	a. Type: LWD / RTW / LWD with attached RTW: (#)		LWD		
Bank	15. If applicable, was the bank constructed to the approved angle?		yes		
	a. As-built bank angle: (degrees)		see plans		
Implementation	16. Does the feature meet design, contract & permit specifications?		yes		
	a. If not, were modifications beneficial to performance?		N/A		
	b. Is non-compliance significant enough to jeopardize performance?		N/A		
	c. Are corrections needed?		no		
	17. Would a different treatment or design have been preferable? If Y, comment.		no		
	18. Feature Implementation Rating: *Excl, Good, Fair, Poor, Fail*		excl		
FINAL SITE LEVEL RATING (feature level rollup): *Excl, Good, Fair, Poor, Fail*					

Comments

1.d. Feature 16; length includes outlet of pond work also
14 - feature 16; 8 logs w/rootwads + 22 logs

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

CHANNEL RECONSTRUCTION & BANK STABILIZATION		IMPLEMENTATION
Reach #: 7	Project Title: Dry Creek Habitat Demonstration Project	page of
Site ID: 1	Site Name: Muscherini	
Date&Time:	Evaluator: Cuneo	

		Project Feature Number	F1	
		Feature Type Code	TPS/FLP	
Metrics	1. Was the length of channel or bank treated the same as approved?		yes	
	a. Actual length of feature: (ft)		620	
	b. Length of bank stabilized by the feature: (ft)		620	
	c. Area of the feature installed within bankfull channel: (ft²)		25,000	
	d. Length of aquatic habitat disturbed during implementation: (ft)		640	
	2. If applicable, was gravel added to the stream as approved?		N/A	
	a. Volume of gravel added to stream: (cy)			
	3. Was bioengineering used at this feature? If Y, use RT also.		yes	
	4. Is feature a grade control boulder weir? If Y, use FB instead.		NO	
Structure	5. Structural condition: *Excl, Good, Fair, Poor, Fail*		excl	
	6. Are problems with the feature visible?		no	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	7. Was the feature placed in the approved location along the channel?		yes *	
	8. Was the feature placed in the approved position?		yes	
	a. Position: LBK, MDC, RBK, SPN, OTH		LBK	
	9. Was the feature oriented as approved?		yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL	
	10. Were approved materials used for the feature?		yes	
	a. Materials: CON, LWD, MTL, NTR, OFR, RTW, VEG, WOO, ROC, OTH		LWD/MTL/NTR/ROC	
	11. Were the sizes of materials used the same as approved?		yes	
	12. Was the feature anchored as approved?		yes	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		Bur/cbl	
	13. Number of pieces of large wood debris used in this feature: (#)		±350	
Reconstruction	14. If applicable, was the approved bank or channel excavation carried out?		yes	
	15. Was the channel recontoured as approved?		yes	
	a. Was the channel reconstructed in a new location?		no	
	b. Length of channel recontoured: (ft)		N/A	
	16. Were streambanks reconstructed as approved?		yes	
	a. Were the banks reconstructed in a new location?		no	
	b. Length of bank reconstructed (note if length includes both banks): (ft)		620 LBR only	
	17. Was the bank constructed or recontoured to the approved angle?		yes	
	a. Average as-built bank angle: (degrees)		see plans	
	18. Were approved erosion control measures applied to disturbed areas?		yes	
	a. Type: FAB, NTM, PLN, ROC, SEE, SLF, STM, OTH*		FAB/SEE	
Implementation	19. Does the feature meet design, contract & permit specifications?		yes	
	a. If not, were modifications beneficial to performance?		N/A	
	b. Is non-compliance significant enough to jeopardize performance?		N/A	
	c. Are corrections needed?		no	
	20. Would a different treatment or design have been preferable? If Y, comment.		no	
	21. Feature Implementation Rating: Excellent, Good, Fair, Poor, Fail		excl	
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

7 - Feature 1; original design had section in middle that was to be treated differently; determined prior to start of construction to modify design to include bank stabilization work consistently throughout feature.

☐ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

13. Feature #1 = approx. 200 logs and 150 logs with rootwads.

used Channel Reconstruction + Bank Stabilization Sheet for feature 1

INSTREAM HABITAT ENHANCEMENT				IMPLEMENTATION	
Reach #: 7	**Project Title:**	Dry Creek Habitat Enhacement Demonstration Project			page 1 of 1
Site ID: 1	**Site Name:**	Mascherini			
Date&Time:	**Evaluator:**				

		Project Feature Number	1	2	
		Feature Type Code		RIF	
Metrics	1. Was the length of channel or bank treated the same as approved?		yes	yes	
	a. Actual length of feature: (ft)			115	
	c. Width of the feature: (ft)			60	
	b. Area of the feature installed within bankfull channel: (ft²)			6900	
	d. Length of aquatic habitat disturbed during implementation: (ft)			200	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			excl	
	3. Are problems with the feature visible?			no	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH				
	4. Was the feature placed in the approved location along the channel?			yes	
	5. Was the feature placed in the approved position?			yes	
	a. Position: LBK, MDC, RBK, SPN, OTH			SPN	
	6. Was the feature oriented as approved?			yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			OTH	
	7. Were approved materials used for the feature?			yes	
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			NTR/OFR	
	8. Were the sizes of materials used the same as approved?			yes	
	9. Was the feature anchored as approved?			N/A	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH				
	10. If applicable, was the approved bank or channel excavation carried out?			yes	
	11. Were approved erosion control measures applied to disturbed areas?			N/A	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*				
Habitat	12. If applicable, was the habitat type modification completed as approved?			yes	
	a. Habitat created: FLT, POO, RIF, OTH			RIF	
	13. If applicable, was gravel added to the stream as approved?			yes	
	a. Volume of gravel added to stream: (cy)			≈ 80	
	14. Total number of pieces of Large Woody Debris used in this feature:			0	
	a. Type: LWD / RTW / LWD with attached RTW: (#)				
Bank	15. If applicable, was the bank constructed to the approved angle?			N/A	
	a. As-built bank angle: (degrees)				
Implementation	16. Does the feature meet design, contract & permit specifications?			yes	
	a. If not, were modifications beneficial to performance?			N/A	
	b. Is non-compliance significant enough to jeopardize performance?			N/A	
	c. Are corrections needed?			no	
	17. Would a different treatment or design have been preferable? If Y, comment.			no	
	18. Feature Implementation Rating: *Excl, Good, Fair, Poor, Fail*			excl	
FINAL SITE LEVEL RATING (feature level rollup): ***Excl, Good, Fair, Poor, Fail***					

Comments

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: Ried - Boulder Field + Riffle			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F1	F2	
	Feature Type Code	RIF	Bould	
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	
	a. Actual length of feature: (ft)	115	140	
	b. Width of the feature: (ft)	60	60	
	c. Area of the feature installed within bankfull channel: (ft²)	6900	8400	
	d. Length of aquatic habitat disturbed during implementation: (ft)	115	140	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	
	3. Are problems with the feature visible?	no	no	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes *1	yes *3	
	5. Was the feature placed in the approved position?	yes	yes	
	a. Position: LBK, MDC, RBK, SPN, OTH	SPN	SPN	
	6. Was the feature oriented as approved?	yes	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS/DNS	OTH	
	7. Were approved materials used for the feature?	yes	yes	
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	ROCK/COB	Bol	
	8. Were the sizes of materials used the same as approved?	yes	yes	
	9. Was the feature anchored as approved?	yes	yes	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	OTH	OTH	
	10. If applicable, was the approved bank or channel excavation carried out?	yes	N/A	
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE	SEE/OTH	
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	NO	
	a. Habitat created: FLT, POO, RIF, OTH	RIF	OTH	
	13. If applicable, was gravel added to the stream as approved?	N/A *2	N/A	
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	0	0	
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?	NA	NA	
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excel	excel	
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

*F1 - original design location had riffle approx. 75 feet further downstream. Riffle location was modified during construction by design engineer to limit impacts to existing riparian vegetation.

*2 F1 - Rock imported, native cobble/gravel used.

*3 F2 - original design was for a riffle slightly further downstream. Design engineer substituted a boulder field to limit disturbance and to not backwater F1 riffle.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhancement	page of
Site ID: 1	**Site Name:** Wallace - boulder cluster	
Date&Time: 12/18/13	**Evaluator:** Cuneo, Horton, Coey, Wuzanabe, McKenny, Oass, Wilson	

	Project Feature Number	1	3	4
	Feature Type Code	BC	Boulders	Boulders
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)	21	24	19
	b. Width of the feature: (ft)	31	24	21
	c. Area of the feature installed within bankfull channel: (ft²)	651	576	399
	d. Length of aquatic habitat disturbed during implementation: (ft)	21	24	19
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	good	good	good
	3. Are problems with the feature visible?	OTH	OTH	OTH
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	MDC	MDC	MDC
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?	see comments below		
	9. Was the feature anchored as approved?	N/A	N/A	N/A
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?	N/A	N/A	N/A
	11. Were approved erosion control measures applied to disturbed areas?	N/A	N/A	N/A
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?	N/A	N/A	N/A
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	0	0	0
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?	N/A	N/A	N/A
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?	N/A	N/A	N/A
	b. Is non-compliance significant enough to jeopardize performance?	N/A	N/A	N/A
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	Good	Good	Good
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			Good	

Comments

(1) 11 boulders moved with 37
(2) 10 boulders
Recommend larger boulders; unclear whether boulders will move

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Proj.			page of
Site ID: 1	Site Name: Wallace - boulder cluster			
Date&Time: 12/18/13	Evaluator: Cuneo, Horton, Coey, Watanabe, McKanney, Doss, Wilson			

	Project Feature Number	5	6	2
	Feature Type Code	Boulders	Boulders	
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	
	a. Actual length of feature: (ft)	30	20	
	b. Width of the feature: (ft)	24	8	
	c. Area of the feature installed within bankfull channel: (ft²)	720	160	
	d. Length of aquatic habitat disturbed during implementation: (ft)	30	20	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	good	good	
	3. Are problems with the feature visible?	See comments		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	OTH	OTH	
	4. Was the feature placed in the approved location along the channel?	yes	yes	
	5. Was the feature placed in the approved position?	yes	yes	
	a. Position: LBK, MDC, RBK, SPN, OTH	MDC	MDC	
	6. Was the feature oriented as approved?	yes	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?	yes	yes	
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	ROC	ROC	
	8. Were the sizes of materials used the same as approved?	See comments		
	9. Was the feature anchored as approved?	N/A	N/A	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?	N/A	N/A	
	11. Were approved erosion control measures applied to disturbed areas?	N/A	N/A	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?	N/A	N/A	
	a. Habitat created: FLT, POO, RIF, OTH			
	13. If applicable, was gravel added to the stream as approved?	N/A	N/A	
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	0	0	
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?	N/A	N/A	
	a. As built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	Good	Good	
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*		Good		

Comments

(4) 11 boulders
(5) 5 boulders
Recommend larger boulders; unclear whether boulders will move
Feature #2 omitted during construction, no suitable location for boulders at site location.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 2	Site Name: Wallace			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F1	F2	F3
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	30	30	30
	b. Width of the feature: (ft)	60	60	60
	c. Area of the feature installed within bankfull channel: (ft²) 1800	1800	1800	1800
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel? *1	no	no	no
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	UPS
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	BUR/CBL	BUR/CBL	BUR/CBL
	10. If applicable, was the approved bank or channel excavation carried out?	N/A	N/A	N/A
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	see	see	see
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	OTH	OTH	OTH
	13. If applicable, was gravel added to the stream as approved?	N/A	N/A	N/A
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	7	7	7
	a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	6/0/1	6/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?	NA	NA	NA
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*				

Comments

*1 F1, F2, + F3 : minor position adjustments made during construction by design engineer. Location substantially the same as approved. A fourth floodplain wood structure was added in this location during construction (F3b). F3b → same rating/info as F1, F2, + F3

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

CHANNEL RECONSTRUCTION & BANK STABILIZATION		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhancement Demonstration	page of
Site ID: 3	**Site Name:** Wallace	
Date&Time: 12/18/13	**Evaluator:** Curtis, Harris, Coughlanarabe, McKenney, Doss, Wilson	

		Project Feature Number	1	2	3
		Feature Type Code	Ter	FLP	LDA
Metrics	1. Was the length of channel or bank treated the same as approved?				
	a. Actual length of feature: (ft) *		350	180	87
	b. Length of bank stabilized by the feature: (ft)		350	180	62
	c. Area of the feature installed within bankfull channel: (ft²)				
	d. Length of aquatic habitat disturbed during implementation: (ft)		0	0	72
	2. If applicable, was gravel added to the stream as approved?		NA	NA	NA
	a. Volume of gravel added to stream: (cy)				
	3. Was bioengineering used at this feature? If Y, use RT also. Yes		yes		yes
	4. Is feature a grade control boulder weir? If Y, use FB instead. No				No
Structure	5. Structural condition: *Excl, Good, Fair, Poor, Fail*		good	excl	
	6. Are problems with the feature visible?		yes		
	a. Types: *ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH*		ANC		ANC
	7. Was the feature placed in the approved location along the channel?		y	y	y
	8. Was the feature placed in the approved position?		y	y	N*1
	a. Position: *LBK, MDC, RBK, SPN, OTH*		LBK	LBK	OTH
	9. Was the feature oriented as approved?		y	y	no
	a. Orientation: *DNS, MUL, PRL, PRP, UPS, OTH*		PRL	PRL	OTH
	10. Were approved materials used for the feature?		y	y	y
	a. Materials: *CON, LWD, MTL, NTR, OFR, RTW, VEG, WOO, ROC, OTH*		LWD, RTW, veg	VEG	LWD, RTW, VEG, ROC
	11. Were the sizes of materials used the same as approved?		y	y	y
	12. Was the feature anchored as approved?		y	engineered	yes
	a. Anchoring: *BUR, CBL, REB, STK, TIE, NON, OTH*		CBL, BUR		CBL, BUR, ROC
	13. Number of pieces of large wood debris used in this feature: (#)				
Reconstruction	14. If applicable, was the approved bank or channel excavation carried out?		y	y	y
	15. Was the channel recontoured as approved?		y	y	y
	a. Was the channel reconstructed in a new location?		Partial	P	NA
	b. Length of channel recontoured: (ft) see original topo				NA
	16. Were streambanks reconstructed as approved?		y	y	NA
	a. Were the banks reconstructed in a new location?				n
	b. Length of bank reconstructed (note if length includes both banks): (ft)				62
	17. Was the bank constructed or recontoured to the approved angle?		y	y	y
	a. Average as-built bank angle: (degrees)				
	18. Were approved erosion control measures applied to disturbed areas?		y		y
	a. Type: *FAB, NTM, PLN*, ROC, SEE, SLF, STM, OTH*		FAB, SEE, Plants		see
Implementation	19. Does the feature meet design, contract & permit specifications?		P	yes	P
	a. If not, were modifications beneficial to performance?		no		P*1
	b. Is non-compliance significant enough to jeopardize performance?		no		UNK
	c. Are corrections needed?		yes*		yes*
	20. Would a different treatment or design have been preferable? If Y, comment.		yes 2*		no
	21. Feature Implementation Rating: Excellent, Good, Fair, Poor, Fail		Good	excellent	Good
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***					

Comments

Feature 1: width 26', willow/dogwood cuttings in each layer of (270 bank stabilization code)
Feature 2: width 16' 271
Anchor cabling loose, extra ends should be removed 201

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

* Tightening & trimming

2* reconsider not using cabling for anchor, preferable to flip rootwad

Feature 3: width 69', anchor issue/ballasting could result in movement, prefer to see threaded rebar
*1, logjam size increased to save existing trees & field design fit.
Float wood orientation moved, logjam larger

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 3	**Site Name:** Wallace	
Date&Time: 12/18/13	**Evaluator:** Cuneo, Horton, Coey, Watanabe, McKenney, Doss, Wilson	

	Project Feature Number	4	5	
	Feature Type Code	LWD	LWD	
Metrics	1. Was the length of channel or bank treated the same as approved?			
	a. Actual length of feature: (ft)	37	36	
	b. Width of the feature: (ft)	25	24	
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?	*	non	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	Partial	Partial	
	5. Was the feature placed in the approved position?	Partial		
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?	yes	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?	yes	yes	
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?	yes	yes	
	9. Was the feature anchored as approved?	yes	yes	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	BUR, CBL		
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB, SEE		
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	
	a. Habitat created: FLT, POO, RIF, OTH	ALC		
	13. If applicable, was gravel added to the stream as approved?	NA	NA	
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:			
	a. Type: LWD / RTW / LWD with attached RTW: (#)	/ /	/ /	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?	NA		
	a. As built bank angle: (degrees)	NA		
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excellent	excellent	
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

1* wrapped cables loose, boulder ballast anchors look good
should de-bark @ cable wrap locations before wrapping

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 4	Site Name: Wallace	
Date&Time:	Evaluator: Cuneo	

	Project Feature Number	F1	F2	F3
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	35	35	20
	b. Width of the feature: (ft)	40	25	25
	c. Area of the feature installed within bankfull channel: (ft²)	1400	875	500
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excel	excel	excel
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	OTH	OTH
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	BUR/CBL	BUR/CBL	BUR/CBL
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE/PLN	SEE/PLN	SEE/PLN
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	OTH ~~POO~~	POO	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	30	13	13
	a. Type: LWD / RTW / LWD with attached RTW: (#)	22/0/8	10/0/3	10/0/3
Bank	15. If applicable, was the bank constructed to the approved angle?	NA	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	exc	exc	exc
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments	1. features constructed in the dry.			

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 4	**Site Name:** Wallace	
Date&Time:	**Evaluator:** Cuneo	

	Project Feature Number			
	Feature Type Code	F4	F5	F6
Metrics	1. Was the length of channel or bank treated the same as approved?	LWD	LWD	LWD
	a. Actual length of feature: (ft)	20	20	20
	b. Width of the feature: (ft)	25	25	25
	c. Area of the feature installed within bankfull channel: (ft²)	500	500	500
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	15	15
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	exc	exc	exc
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	PRL	PRL	PRL
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	see/pln	see/pln	see/pln
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	13	13	13
	a. Type: LWD / RTW / LWD with attached RTW: (#)	10/0/3	10/0/3	10/0/3
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	exc	exc	exc
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 4	Site Name: Wallace	
Date&Time:	Evaluator: Cuneo	

	Project Feature Number	F7	F8	F9
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	35	50	25
	b. Width of the feature: (ft)	45	15	40
	c. Area of the feature installed within bankfull channel: (ft²)	1575	750	1000
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	80	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	exc	exc	exc
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	PRL	PRL
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	see/PLN	see/PLN	see/PLN
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	7	7	5
	a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	4/0/3	4/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	exc	exc	exc
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 4	Site Name: Wallace			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F10	F11	F12
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	25	50	25
	b. Width of the feature: (ft)	40	15	40
	c. Area of the feature installed within bankfull channel: (ft²)	1000	~~[illegible]~~ 750	1000
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	exc	exc	exc
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	RBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	PRL	PRL	PRL
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	see/PLN	see/PLN	see/PLN
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	5	7	5
	a. Type: LWD / RTW / LWD with attached RTW: (#)	4/0/1	4/0/3	4/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	exc	exc	exc
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 4	Site Name: Wallace			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F13	F14	
	Feature Type Code	LWD	LWD	
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	
	a. Actual length of feature: (ft)	25	35	
	b. Width of the feature: (ft)	40	45	
	c. Area of the feature installed within bankfull channel: (ft²)	1000	1575	
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	exc	exc	
	3. Are problems with the feature visible?	no	no	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	
	5. Was the feature placed in the approved position?	yes	yes	
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	RBK	
	6. Was the feature oriented as approved?	yes	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	PRL	UPS	
	7. Were approved materials used for the feature?	yes	yes	
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	
	8. Were the sizes of materials used the same as approved?	yes	yes	
	9. Was the feature anchored as approved?	yes	yes	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	seePLN	seePLN	
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	
	13. If applicable, was gravel added to the stream as approved?	NA	NA	
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	5	7	
	a. Type: LWD / RTW / LWD with attached RTW: (#)	4/0/1	6/0/1	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	
	a. As built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	exc	exc	
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 5	Site Name: Wallace			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F1		
	Feature Type Code	RIF		
Metrics	1. Was the length of channel or bank treated the same as approved?	yes		
	a. Actual length of feature: (ft)	100		
	b. Width of the feature: (ft)	55		
	c. Area of the feature installed within bankfull channel: (ft²)	5500		
	d. Length of aquatic habitat disturbed during implementation: (ft)	200		
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	exc		
	3. Are problems with the feature visible?	no		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes		
	5. Was the feature placed in the approved position?	yes		
	a. Position: LBK, MDC, RBK, SPN, OTH	SPN		
	6. Was the feature oriented as approved?	yes		
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	DNS/UPS		
	7. Were approved materials used for the feature?	yes		
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	Rock/cob		
	8. Were the sizes of materials used the same as approved?	yes		
	9. Was the feature anchored as approved?	yes		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	OTH		
	10. If applicable, was the approved bank or channel excavation carried out?	yes		
	11. Were approved erosion control measures applied to disturbed areas?	yes		
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	SEE/PLN		
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes		
	a. Habitat created: FLT, POO, RIF, OTH	RIF		
	13. If applicable, was gravel added to the stream as approved?	NA		
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	0		
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?	NA		
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes		
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.	no		
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	exc		
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: Farrow			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F1	F2	F3
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	35	35	35
	b. Width of the feature: (ft)	45	45	60
	c. Area of the feature installed within bankfull channel: (ft²)	1575	1575	2100
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes (2)	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6. Was the feature oriented as approved?	no (1)	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	PRL	UPS	UPS
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	no (2)
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB/SEE/PLN	FAB/SEE/PLN	FAB/SEE/PLN
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	OTH	OTH	OTH
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	7	7	13
	a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	6/0/1	11/0/2
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

(1) F1 - floodplain wood structure was oriented a different direction per the design engineers request during construction.

(2) F3 - structure was approx. doubled in size per design engineers recommendation during construction. Increased size to block potential flow paths.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: FARROW			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F4	F5	F6
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	35	35	25
	b. Width of the feature: (ft)	60	45	40
	c. Area of the feature installed within bankfull channel: (ft²)	2100	1575	1000
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	good	excl	excl
	3. Are problems with the feature visible?	yes (1)	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH	HYD		
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK ~~RBK~~	LBK	LBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	PRL
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	no (2)	yes	~~yes~~ no (3)
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB/SEE/PLN	FAB/SEE/PLN	FAB/SEE/PLN
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	OTH	OTH	OTH
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	9	7	5
	a. Type: LWD / RTW / LWD with attached RTW: (#)	8/0/1	6/0/1	4/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. Actual bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	good	excl	excl
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

(1) F4 - localized erosion from culvert outflow potentially affecting this feature.

(2) F4 - feature size was expanded during construction per design engineer; to interrupt potential flow paths.

(3) F6 - original design showed floodplain LWD structure; slope protection LWD installed; similar in scale, just different orientation of wood for slope placement. F7 changed also.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: Farrow			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F7	F8	F9
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	25	35	40
	b. Width of the feature: (ft)	40	45	70
	c. Area of the feature installed within bankfull channel: (ft²)	1000	1575	2800
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	PRL	UPS	UPS/DNS
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	no (1)	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	FAB/see/PLN	FAB/see/PLN	OTH
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	OTH	OTH	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	5	7	26
	a. Type: LWD / RTW / LWD with attached RTW: (#)	4 / 0 / 1	6 / 0 / 1	20 / 0 / 6
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. Approved bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
	FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***			

Comments

(1) F7 - Same as F6, slope LWD configuration substituted for floodplain LWD.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: Farrow			
Date&Time:	Evaluator: Cuneo			

	Project Feature Number	F10	F11	F12
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	35	25	25
	b. Width of the feature: (ft)	45	45	45
	c. Area of the feature installed within bankfull channel: (ft²)	1575	1125	1125
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS/PRL	UPS/PRL
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	NA	NA	NA
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	7	13	13
	a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	10/0/3	10/0/3
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments				

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 1	Site Name: Farrow	
Date&Time:	Evaluator: Cured	

	Project Feature Number	F13	F14	F15
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	yes
	a. Actual length of feature: (ft)	35	25	35
	b. Width of the feature: (ft)	45	45	45
	c. Area of the feature installed within bankfull channel: (ft²)	1575	1125	1575
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes	yes	yes
	5. Was the feature placed in the approved position?	yes	yes	yes
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6. Was the feature oriented as approved?	yes	yes	yes
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS/PRL	mul
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	no(1)
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	NA	NA	NA
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	7	13	26
	a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	10/0/3	20/0/6
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. As-built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	yes
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*				

Comments

(1) F15 - The island. Pool LWD feature was substantially expanded and design modified during construction to create an island at this feature. Intent was to increase edge habitat and provide a location for trees to grow to better provide shade/cover for the backwater pond. Combined two backwater LWD features.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project	
Site ID: 1	Site Name: Farrow	page of
Date&Time:	Evaluator: Cuneo	

		Project Feature Number	F16	F17	F18
		Feature Type Code	LWD	LWD	LWD
Metrics	1.	Was the length of channel or bank treated the same as approved?	yes	yes	yes
		a. Actual length of feature: (ft)	35	35	35
		b. Width of the feature: (ft)	45	45	30
		c. Area of the feature installed within bankfull channel: (ft²)	1575	1575	1050
		d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2.	Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3.	Are problems with the feature visible?	no	no	no
		a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4.	Was the feature placed in the approved location along the channel?	yes	yes	yes
	5.	Was the feature placed in the approved position?	yes	yes	yes
		a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6.	Was the feature oriented as approved?	yes	yes	yes
		a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	UPS/PRL
	7.	Were approved materials used for the feature?	yes	yes	yes
		a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8.	Were the sizes of materials used the same as approved?	yes	yes	yes
	9.	Was the feature anchored as approved?	yes	yes	yes
		a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10.	If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11.	Were approved erosion control measures applied to disturbed areas?	NA	NA	NA
		a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12.	If applicable, was the habitat type modification completed as approved?	yes	yes	yes
		a. Habitat created: FLT, POO, RIF, OTH	POO	POO	POO
	13.	If applicable, was gravel added to the stream as approved?	NA	NA	NA
		a. Volume of gravel added to stream: (cy)			
	14.	Total number of pieces of Large Woody Debris used in this feature:	7	7	32
		a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	6/0/1	24/0/8
Bank	15.	If applicable, was the bank constructed to the approved angle?	yes	yes	yes
		a. As-built bank angle: (degrees)			
Implementation	16.	Does the feature meet design, contract & permit specifications?	yes	yes	yes
		a. If not, were modifications beneficial to performance?			
		b. Is non-compliance significant enough to jeopardize performance?			
		c. Are corrections needed?	no	no	no
	17.	Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18.	Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*					
Comments					

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: Farrow			
Date&Time:	Evaluator: Cuneo			

		19	20	21
	Project Feature Number	F19	F20	F21
	Feature Type Code	LWD	LWD	
Metrics	1. Was the length of channel or bank treated the same as approved?	yes	yes	
	a. Actual length of feature: (ft)	35	35	
	b. Width of the feature: (ft)	30	60	
	c. Area of the feature installed within bankfull channel: (ft²)	1050	2100	
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	
	3. Are problems with the feature visible?	no	yes	
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH		Hyd. (2)	
	4. Was the feature placed in the approved location along the channel?	yes	yes	
	5. Was the feature placed in the approved position?	yes	yes	
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	
	6. Was the feature oriented as approved?	yes	yes	
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS/PRL	UPS/PRL	
	7. Were approved materials used for the feature?	yes	yes	
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	
	8. Were the sizes of materials used the same as approved?	yes	no (1)	
	9. Was the feature anchored as approved?	yes	yes	
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	
	11. Were approved erosion control measures applied to disturbed areas?	NA	NA	
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	
	a. Habitat created: FLT, POO, RIF, OTH	POO	POO	
	13. If applicable, was gravel added to the stream as approved?	NA	NA	
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	32	48	
	a. Type: LWD / RTW / LWD with attached RTW: (#)	24/0/8	36/0/12	/ /
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	
	a. As built bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes	yes	
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?	no	no	
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	good	
	FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*			

Comments

(1) F20 - size of log jam LWD was approximately doubled during construction per design engineers direction.

(2) F20 - minor erosion of material from within structure; uncertain as to whether it will effect structure; structure appears stable.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION		
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project			page of
Site ID: 1	Site Name: Furrow			
Date&Time:	Evaluator: Cuneo			

		22	23	24
	Project Feature Number	F22	F23	F24
	Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved? (1)	no ~~yes~~	no ~~yes~~	no ~~yes~~
	a. Actual length of feature: (ft)	35	35	35
	b. Width of the feature: (ft)	45	45	45
	c. Area of the feature installed within bankfull channel: (ft²)	1575	1575	1575
	d. Length of aquatic habitat disturbed during implementation: (ft)	0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*	excl	excl	excl
	3. Are problems with the feature visible?	no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	NA ~~yes~~	NA ~~yes~~	NA ~~yes~~
	5. Was the feature placed in the approved position?	NA ~~yes~~	NA ~~yes~~	NA ~~yes~~
	a. Position: LBK, MDC, RBK, SPN, OTH	LBK	LBK	LBK
	6. Was the feature oriented as approved?	NA ~~yes~~	NA ~~yes~~	NA ~~yes~~
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH	UPS	UPS	UPS
	7. Were approved materials used for the feature?	yes	yes	yes
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH	LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?	yes	yes	yes
	9. Was the feature anchored as approved?	yes	yes	yes
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH	bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?	yes	yes	yes
	11. Were approved erosion control measures applied to disturbed areas?	yes	yes	yes
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*	~~yes~~/see	see/pln	see/pln
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes	yes	yes
	a. Habitat created: FLT, POO, RIF, OTH	OTH	OTH	OTH
	13. If applicable, was gravel added to the stream as approved?	NA	NA	NA
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	7	7	7
	a. Type: LWD / RTW / LWD with attached RTW: (#)	6/0/1	6/0/1	6/0/1
Bank	15. If applicable, was the bank constructed to the approved angle?	yes	yes	yes
	a. Actual bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	no ~~yes~~	no ~~yes~~	no ~~yes~~
	a. If not, were modifications beneficial to performance?	yes	yes	yes
	b. Is non-compliance significant enough to jeopardize performance?	no	no	no
	c. Are corrections needed?	no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment.	no	no	no
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	excl	excl	excl
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				

Comments

(1) F22 - new LWD structure not on original plans. added during construction
(1) F23 - same
(1) F24 - same

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

OFFCHANNEL HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	Project Title: Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 1	Site Name: Furrow	
Date&Time:	Evaluator: Cuneo	

		Project Feature Number	F25	F26	F27
		Feature Type Code	LWD	LWD	LWD
Metrics	1. Was the length of channel or bank treated the same as approved? (1)		no	no	no
	a. Actual length of feature: (ft)		20	20	20
	b. Width of the feature: (ft)		20	40	40
	c. Area of the feature installed within bankfull channel: (ft²)		400	800	800
	d. Length of aquatic habitat disturbed during implementation: (ft)		0	0	0
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*		excl	excl	excl
	3. Are problems with the feature visible?		no	no	no
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH				
	4. Was the feature placed in the approved location along the channel?		NA	NA	NA
	5. Was the feature placed in the approved position?		NA	NA	NA
	a. Position: LBK, MDC, RBK, SPN, OTH	RBK	~~RBK~~ RL	~~RBK~~ RL	~~RBK~~ RL
	6. Was the feature oriented as approved?		NA	NA	NA
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH		PRL/UPS	PRL/UPS	PRL/UPS
	7. Were approved materials used for the feature?				
	a. Materials: CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH		LWD	LWD	LWD
	8. Were the sizes of materials used the same as approved?				
	9. Was the feature anchored as approved?				
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH		bur/cbl	bur/cbl	bur/cbl
	10. If applicable, was the approved bank or channel excavation carried out?				
	11. Were approved erosion control measures applied to disturbed areas?				
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*		buried/see	buried/see	buried/see
Habitat	12. If applicable, was the habitat type modification completed as approved?				
	a. Habitat created: FLT, POO, RIF, OTH		OTH	OTH	OTH
	13. If applicable, was gravel added to the stream as approved?		NA	NA	NA
	a. Volume of gravel added to stream: (cy)				
	14. Total number of pieces of Large Woody Debris used in this feature:		5	5	5
	a. Type: LWD / RTW / LWD with attached RTW: (#)		5/0/0	5/0/0	5/0/0
Bank	15. If applicable, was the bank constructed to the approved angle?		NA	NA	NA
	a. Actual bank angle: (degrees)				
Implementation	16. Does the feature meet design, contract & permit specifications?		no	no	no
	a. If not, were modifications beneficial to performance?		yes	yes	yes
	b. Is non-compliance significant enough to jeopardize performance?		no	no	no
	c. Are corrections needed?		no	no	no
	17. Would a different treatment or design have been preferable? If Y, comment. (2)		yes	yes	yes
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*		excl	excl	excl
	FINAL SITE LEVEL RATING (feature level rollup): *Excellent, Good, Fair, Poor, Fail*				

Comments

(1) F25 - new buried LWD. Not on original design. added during construction
(1) F26 - same
(1) F27 - same
(2) above ground LWD would have been preferred; landowners would not accept at this location.

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.

INSTREAM HABITAT ENHANCEMENT		IMPLEMENTATION
Reach #: 7	**Project Title:** Dry Creek Habitat Enhancement Demonstration Project	page of
Site ID: 1	**Site Name:** Farrow	
Date&Time: 12/18/13	**Evaluator:** Cuneo, Horton, Coey, Watanabe, McKanney, Doss, Wilson	

	Project Feature Number	21		
	Feature Type Code	BF		
Metrics	1. Was the length of channel or bank treated the same as approved?	Partial		
	a. Actual length of feature: (ft)	195		
	b. Width of the feature: (ft)	54		
	c. Area of the feature installed within bankfull channel: (ft²)			
	d. Length of aquatic habitat disturbed during implementation: (ft)			
Feature (Structure)	2. Structural condition: *Excl, Good, Fair, Poor, Fail*			
	3. Are problems with the feature visible?	no		
	a. Types: ANC, BBB, CRF, MAT, SHF, STR, SWA, UND, UNS, WSH, OTH			
	4. Was the feature placed in the approved location along the channel?	yes		
	5. Was the feature placed in the approved position?	yes		
	a. Position: LBK, MDC, RBK, SPN, OTH			
	6. Was the feature oriented as approved?	yes		
	a. Orientation: DNS, MUL, PRL, PRP, UPS, OTH			
	7. Were approved materials used for the feature?	yes		
	a. Materials:CON, LWD, MTL, NTR, OFR, REB, RTW, VEG, WOO, OTH			
	8. Were the sizes of materials used the same as approved?	yes		
	9. Was the feature anchored as approved?	NA		
	a. Anchoring: BUR, CBL, REB, STK, TIE, NON, OTH			
	10. If applicable, was the approved bank or channel excavation carried out?	NA		
	11. Were approved erosion control measures applied to disturbed areas?	NA		
	a. Types: FAB, NTR, NTM, OFR, PLN, SEE, SLF, STM, OTH*			
Habitat	12. If applicable, was the habitat type modification completed as approved?	yes		
	a. Habitat created: FLT, POO, RIF, OTH	POW		
	13. If applicable, was gravel added to the stream as approved?	NA		
	a. Volume of gravel added to stream: (cy)			
	14. Total number of pieces of Large Woody Debris used in this feature:	0		
	a. Type: LWD / RTW / LWD with attached RTW: (#)			
Bank	15. If applicable, was the bank constructed to the approved angle?	NA		
	a. Actual bank angle: (degrees)			
Implementation	16. Does the feature meet design, contract & permit specifications?	yes		
	a. If not, were modifications beneficial to performance?			
	b. Is non-compliance significant enough to jeopardize performance?			
	c. Are corrections needed?			
	17. Would a different treatment or design have been preferable? If Y, comment.	UNK		
	18. Feature Implementation Rating: *Excellent, Good, Fair, Poor, Fail*	Good		
FINAL SITE LEVEL RATING (feature level rollup): ***Excellent, Good, Fair, Poor, Fail***				
Comments	Boulder field modified (excavated) during construction UNK – whether boulders will stay			

□ Comment on back. Y=Yes, N=No, P=Partially, D=Don't know, A=Not Applicable.