Sonoma County Water Agency
Stream Maintenance Program (SMP)

Annual Notification for 2010 Maintenance Projects

Prepared for:
The SMP Inter-Agency Working Group

Sonoma County Water Agency
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Horizon Water and Environment. 2010. *2010 Maintenance Projects—Annual Notification*. April. (HWE 08.002.) Oakland, CA.

Sonoma County Water Agency
Stream Maintenance Program
2010 Projects

TABLE OF CONTENTS

Section

April 28, 2010

Keenan Foster
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Subject: Annual Notification for Sonoma County Water Agency's 2010 Stream Maintenance Projects

Dear Participating Agency,

Enclosed is the Sonoma County Water Agency's (SCWA) Stream Maintenance Program's (SMP) Annual Notification information for the 2010 stream maintenance activities. The following information is provided in this notification packet:

1. Project List and Locations
2. Project Designs
3. Summary of Maintenance Project Sizes, Extents, and Potential Effects
4. Annual Mitigation Plan
5. Annual Sediment Disposal Plan

Overview of 2010 Maintenance Projects

Five localized sediment removal projects, three reach-scale sediment removal projects, and four bank stabilization and repair projects are planned for 2010. The 2010 activities also include clearing of sediment from six sediment basin structures. These maintenance projects are necessary to restore conveyance capacity and maintain proper function of SCWA facilities. All of the projects will be conducted in accordance with the impact avoidance and minimization approaches described in the SMP Manual (Chapter 5) and with the application of program BMPs as described in Chapter 7 of the SMP Manual. The 2010 maintenance projects include the following:

Localized Scale Sediment Removal Projects

Ducker Creek near Middle Rincon Road, Santa Rosa
Hinebaugh Creek near Dawn Court, Rohnert Park
Paulin Creek in several locations from Steele Lane to Cleveland Avenue, Santa Rosa
Russell Creek at Range Ave crossing, Santa Rosa
Todd Creek at Todd Road, north of Rohnert Park

Reach Scale Sediment Removal Projects

Corona Creek Reach 1, upstream of Capri Creek, Petaluma

Laguna de Santa Rosa Creek from west of Wilfred Avenue to Llano Rd, west of Rohnert Park
Lorna Dell Creek at Tacheva Drive (entirely within concrete channel)

Sediment Basin or Instream Basin Clearing

Adobe Creek Reach 2, Petaluma
Cook Creek Reach 2, west of Rohnert Park
Copeland Creek at Country Club Lane, Rohnert Park
Copeland Creek at Snyder Lane, Rohnert Park
Santa Rosa Div1, just upstream of Spring Lake, Santa Rosa
Wilfred Creek at Snyder Lane, in northern Rohnert Park

Bank Stabilization Projects

Hunter Creek near Hunter Lane, north of Rohnert Park
Moorland Creek at downstream terminus of Moorland Creek, north of Rohnert Park
Santa Rosa Creek, upstream of Guerneville Road crossing, west of Santa Rosa
Todd Creek near confluence with Hunter Creek, north of Rohnert Park

Sections 1 through 3 of this Annual Notification packet contain project descriptions, project maps, site plans, site photographs, and additional documentation and reference materials.

In addition to these 2010 maintenance activities, several projects that were previously permitted in 2009 will be completed in 2010. These on-going projects include:

- 2 localized sediment removal projects (at Starr Creek Tributary and Washington Creek);
- 2 reach scale sediment removal projects (Colgan/Kawana Creeks and Crane/Five Creeks);
- 4 bank repair projects (at Peterson 2 and 1, Piner 6, and College 3 creeks); and
- 4 reservoir clearing projects (Brush Creek, Matanzas Creek, Piner, and Santa Rosa Creek reservoirs).

On-Site and Off-Site Mitigation for Maintenance Projects

Section 4 of the Annual Notification Packet includes detailed information for both on-site (Tier 1) and off-site (Tiers 2 and 3) mitigation actions. Details of the on-site (Tier 1) restoration approaches and methods are provided in Chapters 5 and 8 of the SMP Manual. Existing conditions at the maintenance project sites are described in the channel characterizations of Chapter 4 of the SMP Manual.

In terms of off-site mitigation for temporal impacts, three stream restoration projects in Zone 1A and one in Zone 2A have been identified to mitigate for the 2010 maintenance activities. These restoration projects are being conducted by the Bay Institute as part of their Students and Teachers Restoring a Watershed (STRAW) Project. The off-site mitigation projects for 2010 include ecologic enhancement and restoration activities at Petaluma River, Roseland Creek, Copeland Creek, and Matanzas Creek. More detail describing these projects is included in Section 4. These off-site watershed based restoration projects are consistent with the expressed goals of the off-site mitigation program to restore impacted habitats, but to also address larger watershed factors related to stream maintenance such as controlling upstream and upland erosion and sediment sources.

As described in the SMP Manual, the combination of on-site and off-site restoration activities represents a holistic approach to address the impacts from maintenance activities by addressing both the impacts of stream maintenance while also addressing/reducing the ongoing need for such maintenance. The off-site mitigation projects provide mitigation for the temporal impacts occurring between the time that maintenance activities occur, and the point at which on-site (Tier 1) restoration activities have become established and provide ecological function equivalent to or greater than the pre-maintenance condition. This year's mitigation approach directly addresses project impacts on-site and also provides important habitat improvements and erosion source reductions in the broader watershed through the off-site (Tier 3) projects.

In addition to the Tier 1 and Tier 3 mitigation efforts, SCWA will also be conducting compensatory mitigation for ESA and CESA listed species impacted by the 2010 maintenance projects. For 2010, 0.034 acres of mitigation for California tiger salamander will be purchased from an approved bank in the program area to offset impacts to this species. Mitigation banking standards for the SMP follow the guidelines in the SMP Biological Opinion with the USFWS (complete) and Section 2080.1 Consistency Determination by CDFG (in-process) for the SMP.

Closing

On April 28th the IAWG and SCWA project team will tour the 2010 project sites, including visiting some past maintenance sites and watershed mitigation sites. This will be a valuable opportunity for the IAWG members to get a field-based perspective on the projects, ask questions, and confirm conditions right in the field.

SCWA invites each agency to comment on planned maintenance activities, confirm activities, and/or provide a notice to proceed with the 2010 maintenance projects. If SCWA receives no comment at the conclusion of 30 days, it will be understood that this represents a notice to proceed.

Please feel free to contact me, Keenan Foster (kfoster@scwa.ca.gov / (707) 547-1941), directly at SCWA, or contact my associate Jon Niehaus (jon@scwa.ca.gov / 707-5467-1947). You may also wish to contact our consultants Ken Schwarz (ken@horizonh2o.com / 510-986-1851), or Sandy Devoto (sandy@horizonh2o.com / 510-986-1853).

Sincerely,

Keenan Foster

Keenan Foster
Sr. Environmental Specialist and SMP Permit Manager

Attachments

cc: Jon Niehaus
Ken Schwarz
Sandy Devoto
Jim Robins

Section 1

PROJECT LIST AND LOCATIONS

Section 1

Project List and Locations

1A. Sediment Removal and Bank Stabilization Project List and Type

The following sediment removal and bank stabilization projects are anticipated for the 2010 maintenance season:

- **Five Localized Sediment Removal Projects at:**
  - Ducker 2: sediment removal in downstream area of Middle Rincon Road crossing.
  - Hinebaugh 5: sediment removal near Dawn Court.
  - Paulin Creek: several small sediment removal locations (7-20 ft each) between Steele Lane and Cleveland Ave.
  - Russell 1: sediment removal at Range Avenue crossing.
  - Todd 4: sediment removal upstream and downstream of Todd Road crossing.
- **Three Reach Scale Sediment Removal Projects at:**
  - Corona Creek Reach 1: between Corona Creek Reach 2 and Capri Creek Reach 2.
  - Laguna de Santa Rosa Reach 1: from west of Wilfred Avenue to Llano Road.
  - Lorna Dell 1: sediment removal from concrete-lined channel from Tachevah Dr. crossing to 1,260 ft upstream.
- **Sediment Basin/Instream Basin Clearing at:**
  - Adobe Creek Sediment Basin: clearing sediment and vegetation at the Adobe Creek basin (Adobe Creek Reach 2).
  - Cook Creek Sediment Basin: clearing sediment and debris at the basin (Cook Creek Reach 2).
  - Copeland Creek at Country Club Dr.: clearing sediment and debris along the instream Copeland Creek basin located at the crossing at Country Club Road.
  - Copeland Creek at Snyder Ln.: sediment removal at the Copeland Creek instream basin located at the Snyder Lane crossing.

- Santa Rosa Creek Sediment Basin: clearing sediment and debris at the Santa Rosa Creek Diversion structure.
- Wilfred Creek: sediment removal at Wilfred Creek instream basin located on Reach 1, downstream of the culvert outfall at Snyder Lane.

- **Bank Repairs at the following four locations:**
  - Hunter Creek Reach 2: 14 ft long bank repair located approx 1280 ft downstream from Hunter Lane crossing.
  - Moorland Creek Reach 1: one 20ft long and one 15 ft long bank repair located at downstream terminus of Moorland Creek.
  - Santa Rosa Creek Reach 1: 30 ft long bank repair located approx 3,600 ft upstream from Guerneville Road crossing.
  - Todd Creek Reach 4: 73 ft long bank repair located approx 160 ft upstream of Hunter Creek confluence.

1B. Sediment Removal and Bank Stabilization Project Site Locations and Other Geographic Information

The following table presents location and geographic information for each of the 2010 project sites.

Table 1-1: Location and Other Geographic Information for Project Sites

Project Site	Creek	Tributary To	SMP Reach	USGS Quad Township, Range, Section	Latitude/ Longitude
Localized Sediment Removal Projects					
Ducker near Middle Rincon	Ducker Creek	Austin Creek	Ducker 2	Santa Rosa Quad T7N, R7W, Section 6	38°28'23.18"N 122°40'15.92"W
Hinebaugh near Dawn Court	Hinebaugh Creek		Hinebaugh 5	Cotati Quad T6N, R8W	38°21'02.48"N 122°41'51.52"W
Paulin Creek from Steele Lane to Cleveland Ave.	Paulin Creek	Piner Creek	Paulin 2,3,4,6	Santa Rosa Quad T7N, R8W, Section 3	38°27'46.47"N 122°42'32.49"W
Russell Creek at Range Ave	Russell Creek	Piner Creek	Russell 1	Santa Rosa Quad T7N, R8W, Section 3	38°28'15.82"N 122°43'57.85"W
Todd Creek near Todd Road	Todd Creek	Hunter Lane	Todd 4	Santa Rosa Quad T6N, R8W, Section 11	38°23'11.97"N 122°42'39.73"W
Reach Scale Sediment Removal Projects					
Corona Creek upstream of Capri	Corona Creek	Capri Creek	Corona 1	Cotati Quad T5N, R7W	38°27'46.47"N 122°42'32.49"W

Project Site	Creek	Tributary To	SMP Reach	USGS Quad Township, Range, Section	Latitude/ Longitude
Laguna de Santa Rosa	Laguna de Santa Rosa Creek	Russian River	Laguna 1	Two Rock Quad T6N, R8W	38°21'41.21"N 122°45'36.69"W
Lorna Dell upstream of Tacheva Drive	Lorna Dell Creek	Santa Rosa Creek	Lorna Dell 1	Santa Rosa Quad T7N, R7W	38°25'50.57"N 122°40'23.22"W
Sediment Basin/ Instream Basin Clearing Projects					
Adobe Creek Sediment Basin	Adobe Creek	Petaluma River	Adobe 2	Petaluma Quad T5N, R7W	38°13'59.03"N 122°35'57.63"W
Cook Creek Sediment Basin	Cook Creek	Coleman Creek	Cook 2	Cotati Quad T6N, R7W Section 17	38°15'38.49"N 122°39'08.63"W
Copeland Creek Basin at Country Club Drive	Copeland Creek	Laguna de Santa Rosa	Copeland 3 & 4	Cotati Quad T6N, R8W	38°20'35.74"N 122°41'42.68"W
Copeland Creek Basin at Snyder Lane	Copeland Creek	Laguna de Santa Rosa	Copeland 4 & 5	Cotati Quad T6N, R8W	38°20'35.84"N 122°41'17.58"W
Santa Rosa Creek Diversion	Santa Rosa Creek	Laguna de Santa Rosa	SR Div 1	Santa Rosa Quad T7N, R7W	38°27'25.86"N 122°38'23.36"W
Wilfred Creek Basin at Snyder	Wilfred Creek	Bellview-Wilfred Channel	Wilfred 1	Cotati Quad T6N, R7W	38°22'20.18"N 122°41'10.03"W
Bank Stabilization Projects					
Hunter Lane Channel	Hunter Creek	Todd Creek	Hunter 2	Santa Rosa Quad T6N, R8W, Section 11	38°22'53.03"N 122°41'58.74"W
Moorland Channel	Moorland Creek	Todd Creek	Moorland 1	Santa Rosa Quad T6N, R8W	38°22'55.01"N 122°43'06.44"W
Todd Channel	Todd Creek	Bellview-Wilfred Channel	Todd 4	Santa Rosa Quad T6N, R8W, Section 11	38°22'55.71"N 122°42'40.65"W
Santa Rosa Creek	Santa Rosa Creek	Laguna de Santa Rosa	Santa Rosa 1	Sebastopol Quad T7N, R8W, Section 14	38°26'53.31"N 122°49'26.51"W

1C. Sediment Removal and Bank Stabilization Project Settings and Resources

Channel Characterization Sheets and Site Photos

Channel characterization sheets for the 2010 project sites were developed for, and included in, Chapter 4 of the SMP Manual. The channel characterization sheets contained within the Manual provide baseline information on the maintenance reach's setting, physical

processes, geomorphic conditions, biologic conditions, and management considerations. The channel characterization sheets also include photographs depicting typical conditions of the reach. Program reviewers are directed to viewing the reach characterization sheets in the Manual (Chapter 4) to provide a good overview of reach conditions.

Current photographs showing the specific location of maintenance activities for the 2010 project sites are provided in Section 2.

Potential Habitat for Listed Species

Based on possible species occurrence as shown in the table below, the applicable species-specific BMPs (identified in Table 7-1 of the SMP Manual) will be applied when conducting maintenance activities. Specifically, the BMPs which will be applied according to maintenance activity type are listed in Table 1-2. This table is an excerpt of Table 7-2 from the SMP Manual.

Table 1-3 presents habitat potential for listed species by reach. As shown in the table, none of the project reaches are known to support or provide suitable habitat for California freshwater shrimp or Central California Coast Coho. The presence of California Coastal Chinook has been documented in a Santa Rosa Creek Reach 1, and nine project reaches (Copeland 3-5, Hinebaugh 5, Paulin 2, Laguna 1, Santa Rosa 1, Adobe 2, and Santa Rosa Diversion 1) show potential habitat or known occurrence, at or adjacent to the reach, for Central California Coast Steelhead. All project reaches show habitat potential for the western pond turtle.

Hinebaugh Reach 5, Todd Creek Reach 4, Laguna 1, Hunter Creek Reach 2, Moorland 1, Santa Rosa Creek Reach 1, Cook Creek Reach 2, Copeland Reaches 4 and 5, Santa Rosa Div 1, and Wilfred 1 may contain potential upland habitat for CTS, but these reaches are not within 500 ft. of a known occurrence. Nonetheless, SCWA is coordinating with the U.S. Fish and Wildlife Service and the California Department of Fish and Game regarding compensatory mitigation for activities in suitable upland habitat in 2010 project areas. Additional information regarding potential effects on California tiger salamander, areas of disturbance and compensatory mitigation can be found in Section 3C of this notification.

Of the project reaches, Adobe Creek Reach 2, Cook Creek Reach 2, Corona Creek Reach 1, Santa Rosa Div.1, and Ducker Creek 2 are the only 2010 maintenance reaches that are thought to potentially support California red-legged frog. In addition, Adobe Creek Reach 2, Copeland Reach 5 and Santa Rosa Diversion 1, also include potential habitat for Foothill yellow-legged frog. Finally, Upper Laguna Reach 1 and Santa Rosa Creek Reach 1 have the potential to support special-status plant species.

Table 1-2: Best Management Practices by Activity

BMP	Name	Sediment Removal	Bank Stabilization	Vegetation Management							Other Activities	
				Willow Removal	Blackberry Removal	Cattail Removal	Tree Pruning and Exotics Removal	Tree Removal and Relocation	Mowing	Nursery Stock Tree Planting	Reservoir Debris Removal	Sediment Disposal
General Impact Avoidance and Minimization												
GEN-1	Work Window	X	X	X		X	X	X	X		X	X
GEN-2	Staging and Stockpiling of Materials	X	X	X	X	X	X	X	X	X	X	X
GEN-3	Channel Access	X	X	X	X	X	X	X	X	X	X	
Air Quality Protection												
AQ-1	Dust Management	X	X	X	X	X	X	X	X	X	X	X
AQ-2	Enhanced Dust Management	X	X	X	X	X	X	X	X	X	X	X
Biological Resources Protection												
BR-1	Area of Disturbance	X	X	X	X	X	X	X	X	X	X	
BR-2	Pre-maintenance Educational Training	X	X	X	X	X	X	X	X	X	X	
BR-3	Biotechnical Bank Stabilization		X									
BR-4	Impact Avoidance and Minimization During Dewatering	X	X									
BR-5	Fish and Amphibian Species Relocation Plan	X	X									
BR-6	On-Call Wildlife Biologist	X	X	X	X	X	X	X	X	X	X	X
BR-7	Special Status Plants	X	X	X	X	X	X	X	X	X	X	X
BR-8	Nesting Migratory Bird and Raptor Pre-maintenance Surveys	X	X	X	X	X	X	X	X	X	X	X
BR-10	California Red-legged Frog Avoidance and Impact Minimization Measures for Ground-Disturbing Activities	X	X								X	X
BR-11	California Red-legged Frog Avoidance and Impact Minimization for Vegetation Management			X	X	X	X	X	X	X		
BR-12	California Tiger Salamander Avoidance and Impact Minimization Measures for Sediment and Debris Removal	X		X		X					X	X

BMP	Name	Sediment Removal	Bank Stabilization	Vegetation Management							Other Activities	
				Willow Removal	Blackberry Removal	Cattail Removal	Tree Pruning and Exotics Removal	Tree Removal and Relocation	Mowing	Nursery Stock Tree Planting	Reservoir Debris Removal	Sediment Disposal
BR-13	California Tiger Salamander Avoidance and Impact Minimization Measures for Bank Stabilization		X									
BR-14	California Tiger Salamander Avoidance and Impact Minimization Measures for Vegetation Management			X	X		X	X	X	X	X	
BR-15	Foothill Yellow-legged Frog Avoidance and Impact Minimization Measures for Ground-Disturbing Activities	X	X								X	X
BR-16	Foothill Yellow-legged Frog Avoidance and Impact Minimization Measures for Vegetation Management			X	X	X	X	X	X	X		
BR-17	Western Pond Turtle Pre-maintenance Surveys for Ground-Disturbing Activities	X	X	X	X	X	X	X	X	X	X	
BR-18	Zone 1A Salmonid Avoidance and Impact Minimization Measures	X	X	X		X				X		
Cultural Resources Protection												
CR-2	Cultural Resources Investigation		X									
CR-3	Previously Undiscovered Cultural Resources	X	X	X	X	X	X	X	X	X	X	X
CR-4	Previously Undiscovered Palentological Resources	X	X	X	X	X	X	X	X	X	X	X
CR-5	Staff Cultural Resources Training	X	X	X	X	X	X	X	X	X	X	X
CR-7	Ecosystem Restoration Program			X	X	X	X	X	X	X		
Hazardous Materials Safety												
HAZ-1	Spill Prevention and Response Plan	X	X	X	X	X	X	X	X	X	X	X
HAZ-2	Equipment and Vehicle Maintenance	X	X	X	X	X	X	X	X	X	X	X
HAZ-3	Equipment and Vehicle Cleaning	X	X	X	X	X	X	X	X	X	X	X
HAZ-4	Refueling	X	X	X	X	X	X	X	X	X	X	X
HAZ-5	On-Site Hazardous Materials Management	X	X	X	X	X	X	X	X	X	X	X
HAZ-6	Existing Hazardous Sites or Waste	X	X	X	X	X	X	X	X	X	X	X
HAZ-7	Fire Prevention	X	X	X	X	X	X	X	X	X	X	X

BMP	Name	Sediment Removal	Bank Stabilization	Vegetation Management							Other Activities	
				Willow Removal	Blackberry Removal	Cattail Removal	Tree Pruning and Exotics Removal	Tree Removal and Relocation	Mowing	Nursery Stock Tree Planting	Reservoir Debris Removal	Sediment Disposal
HAZ-8	Testing and Disposal of Spoils	X	X								X	X
Vegetation Management												
VEG-1	Removal of Existing Vegetation	X	X	X			X	X		X		
VEG-2	Use of Herbicides			X	X	X	X	X				
VEG-3	Planting and Revegetation After Soil Disturbance	X	X				X	X		X		
Water Quality and Channel Protection												
WQ-1	Apply Erosion Control Fabric to or Hydroseeding of Exposed Soils	X	X	X	X	X	X	X			X	X
WQ-2	Prevent Scour Downstream of Sediment Removal	X										
WQ-3	In-Channel Grading	X	X									
Good Neighbor Policies												
GN-1	Work Site Housekeeping	X	X	X	X	X	X	X	X	X	X	X
GN-2	Public Outreach	X	X	X	X	X	X	X	X	X	X	X
GN-3	Noise Control	X	X	X	X	X	X	X	X	X	X	X
GN-4	Traffic Flow, Pedestrians, and Safety Measures	X	X	X	X	X	X	X	X	X	X	X
GN-5	Odors	X	X								X	X

Table 1-3: Habitat Potential for Listed Species by Reach

Reach	Listed Species								
	California Freshwater Shrimp	California Red-legged Frog	California Tiger Salamander	Foothill Yellow-legged Frog	Western Pond Turtle	Central California Coast Steelhead	Central California Coast Coho	California Coastal Chinook	Plants
Localized Scale									
Ducker 2	U	P	U	U	P	U	U	U	U
Hinebaugh 5	U	U	3	U	P	P(M)	U	U	U
Paulin 2	U	U	U	U	P	O*	U	U	U
Paulin 3	U	U	U	U	P	U	U	U	U
Paulin 4	U	U	U	U	P	U	U	U	U
Paulin 6	U	U	U	U	P	U	U	U	U
Russell 1	U	U	U	U	P	U	U	U	U
Todd 4[a]	U	U	3	U	P	U	U	U	U
Reach Scale									
Corona 1	U	P	U	U	P	U	U	U	U
Laguna 1	U	U	3	U	P	O(M)	U	U	P
Lorna Dell 1	U	U	U	U	P	U	U	U	U
Bank Stabilization									
Hunter 2	U	U	2	U	P	U	U	U	U
Moorland 1	U	U	2	U	U	U	U	U	U
Santa Rosa 1	U	U	4	U	P	(M/R)O	U	(M/S/R)O	P
Sediment Basin/Instream Basin Clearing									
Adobe 2	U	P	U	U	P	O(M)	U	U	U
Cook 2	U	P	4	P	P	U	U	U	U
Copeland 3	U	U	U	U	P	O(M/R)	U	U	U
Copeland 4	U	U	3	U	P	O(M)	U	U	U
Copeland 5	U	U	3	P	P	O(M/R)	U	U	U
Santa Rosa Div. 1	U	P	4	P	P	O*	U	U	U
Wilfred 1	U	U	3	U	P	U	U	U	U

Source: SMP Manual Table 7-1 as updated by the BO processes and new data (Aug 2009)

[a]Note – the maintenance activities at Todd Creek Reach 4 include both a bank stabilization near the Hunter Creek confluence and a localized sediment removal near the upstream terminus of the reach (see project descriptions and locations in Section 1A and 1B above)

Legend

O Known occurrence in reach
O* Presence documented within adjacent reach or tributary; not applicable for fish if known barrier or reach goes dry
P Potential habitat (includes areas rated potential or marginal)
A Aestivation/Upland habitat
M Migration corridor
S Known or potential spawning habitat
U Unsuitable habitat, unlikely to occur and/or no known occurrence

CTS Habitat Rankings

1 - Within 500 ft of a known occurrence
2 - Between 500ft-2200ft of a known occurrence
3 - Between 2200 ft and 1.3 mi of a known occurrence
4 - Greater than 1.3 mi, but within SRPCS range (no mitigation required)

Site Surveys for Presence of Special-Status Plants

A qualified botanist is required to conduct appropriately-timed botanical surveys for special-status species for projects located in areas where state and federally-listed plant species have been identified as potentially occurring (see SMP Manual Table 7-3). For the 2010 project sites, only two reaches have the potential to provide habitat for state and federally-listed plant species: Laguna de Santa Rosa Reach 1 and Santa Rosa Creek Reach 1 (SMP Manual Table 7-3 [version dated August 2009], and Table 1-3 above).

In accordance with BMP BR-7: *Special Status Plants* of the SMP Manual, SCWA will conduct a survey for special-status plants during their blooming season. The recommended blooming season for state and federally-listed plants in the SMP program area is May-June. The Laguna de Santa Rosa Creek Reach 1 and Santa Rosa Creek Reach 1 project sites will be evaluated for potential federally-listed plants during the recommended blooming season. The survey will document the presence of special-status plants and the results will be relayed to the pertinent regulatory agencies through an addendum notification to this Annual Notification.

As specified in BMP BR-7 of the SMP Manual, state and federally listed plant populations identified during the field surveys with potential to be impacted will be enumerated, photographed and conspicuously flagged to maximize avoidance, and determine the total number of individuals affected. If feasible, the projects will be redesigned or modified to avoid direct and indirect impacts on special-status plant species. If impacts to state or federally listed plants are unavoidable, SCWA will coordinate with the appropriate resource agencies and local experts to determine whether transplantation of special-status plant species is feasible. If the agencies concur that it is a feasible mitigation measure a transplantation plan will be developed and implemented in coordination with the appropriate agencies.

Results of Site Surveys for Cultural Resources

Several of SCWA's 2010 projects would involve excavation into native soils. As identified in the SMP Manual, and more specifically in the BMPs for Cultural Resources (SMP Table 7-1), a cultural resources investigation is required prior to performing any such activity. As specified in the Cultural Resources BMPs, this investigation must include a background research and Native American consultation, a pedestrian survey, documentation, and application of management requirements (as required). The Cultural Resources Constraints Report prepared for the SMP was consulted to fulfill the requirements regarding background research and Native American consultation. In addition, SCWA has conducted a pedestrian survey for the four bank stabilization sites on April 22, 2010. These investigations concluded that there are no known cultural resources within the APE of the project sites. However, prior to the commencement of ground-disturbing activities, all SCWA personnel will be briefed on the importance of protecting cultural resources (BMP CR-5: *Staff Cultural Resources Training Program*), and if buried resources are accidentally discovered during ground-disturbing activities, appropriate measures will be implemented. These measures (BMPs CR-3: *Previously Undiscovered Cultural Resources* and CR-4: *Previously Undiscovered Paleontological Resources*) are described in detail in Chapter 7 of the SMP Manual.

1D. Vegetation Management Activities

During the 2010 maintenance season, vegetation maintenance will include tree and brush thinning, and removal of exotic species and other vegetation blockages to improve hydraulic capacity and retain or enhance appropriate habitat. Vegetation maintenance will be completed according to Appendix E of the Stream Maintenance Program Manual (*Vegetation Management Plan*) as well as the associated terms and conditions of all programmatic permits and biological opinions.

For 2010, vegetation maintenance will be completed in the locations as shown below. Note that maintenance generally occurs in only a portion of the identified reach, not the entire reach length. An addendum will be sent out in August to supplement this list if any subsequent requests for vegetation management are made for areas not shown below. The submission and approval of such an addendum is specified in the DFG Streambed Alteration Agreement (No. 1600-2009-0399-R3) for the SMP.

Table 1-4. 2010 Vegetation Management Activities

Creek	Vegetation Management Activity			
	Willow Pruning	*Blackberry Hand Removal*	*Blackberry Mowing*	*Exotics Removal*
Zone 1A				
Windsor Creek Subbasin				
Airport 2	✓		✓	✓
Starr 2	✓			
Windsor1	✓		✓	
Santa Rosa Creek Subbasin				
Austin 1	✓			
Austin 2	✓			✓
Austin 3	✓	✓		✓
Brush 1	✓			
Brush 2	✓		✓	✓
Brush Creek Tributary 10				✓
Coffey 1	✓		✓	
College 1		✓		✓
College 2				
College 3		✓		✓
Ducker 1				✓
Ducker 2				✓
Forestview 2	✓			✓
Oakmont Creek	✓	✓		
Paulin 3	✓	✓		
Paulin 4		✓		✓
Paulin 5		✓		✓
Paulin 6		✓		✓
Peterson 2		✓		✓
Piner 4		✓		✓
Piner 5	✓	✓		✓

Creek	Vegetation Management Activity			
	Willow Pruning	*Blackberry Hand Removal*	*Blackberry Mowing*	*Exotics Removal*
Piner 6		✓	✓	✓
Piner 7	✓			
Russell 1		✓		✓
Santa Rosa 2	✓		✓	
Santa Rosa 4	✓		✓	✓
Santa Rosa 5	✓			
Sierra Park 1				✓
Sierra Park 3	✓	✓	✓	✓
Spring 1	✓	✓		
Steele 1	✓		✓	✓
Steele 3		✓		✓
Steele 4		✓		✓
Steele 5	✓			✓
Roseland and Colgan Subbasin				
Colgan 1	✓			
Colgan 2	✓		✓	
Colgan 5	✓	✓	✓	
Colgan 6	✓	✓		✓
Colgan 7		✓		
Kawana 1	✓	✓		✓
Roseland 3			✓	
Roseland 4			✓	
Upper Laguna Subbasin				
Bellevue-Wilfred 1	✓			
Bellevue-Wilfred 2	✓		✓	
Bellevue-Wilfred 3	✓		✓	
Bellevue-Wilfred 4	✓	✓		
Coleman 1	✓	✓		✓
Cook 1	✓			
Copeland 1	✓			
Copeland 2	✓		✓	✓
Copeland 3	✓		✓	
Copeland 5		✓		
Cotati 2	✓			
Crane 1	✓			
Five 1	✓			
Gossage 3	✓			
Hinebaugh 1	✓		✓	
Hinebaugh 2	✓			
Hinebaugh 3	✓			✓
Hinebaugh 4	✓		✓	✓
Hinebaugh 5			✓	
Hinebaugh 6	✓			✓
Hinebaugh 7			✓	✓
Hunter 1		✓		
Hunter 2	✓	✓		
Hunter 3		✓		✓

Creek	Vegetation Management Activity			
	Willow Pruning	*Blackberry Hand Removal*	*Blackberry Mowing*	*Exotics Removal*
Laguna 1	✓			
Laguna 2	✓		✓	
Laguna 3	✓		✓	
Laguna 4	✓	✓	✓	
Laguna 5	✓	✓		
South Fork Copeland 1	✓			
Todd 1	✓	✓		
Todd 2	✓	✓		
Todd 3	✓	✓		✓
Todd 4	✓			
Todd 5	✓			
Wilfred Extention1	✓			
Zone 2A- Petaluma Subbasin				
Adobe 1	✓			
Adobe 2	✓			
Adobe 3	✓	✓	✓	✓
Adobe 4	✓	✓		
Capri 1	✓			
Capri 4	✓			
Corona 3	✓			
Corona 5	✓			
Corona 6	✓			
Corona 7	✓			
Corona Creek Trib1	✓			
East Fork McDowell Creek 1				✓
East Washington 2	✓			✓
East Washington 3				✓
East Washington4	✓		✓	
Lichau 1	✓			
Lichau 2	✓	✓	✓	
Lichau 3	✓	✓	✓	
Lynch 1	✓		✓	
Washington 1	✓			
Washington 2	✓			
Washington 3	✓			
Washington 4	✓			
Washington 5	✓			
Washington 6	✓	✓		
Washington 7	✓			
Zone 3A- Sonoma Subbasin				
Fryer1		✓		
Fryer3	✓			
Lower East Fork Fryer1	✓			
Lawndale Creek	✓	✓		
Nathanson Creek	✓	✓		
Zone 5A- Russian River Subbasin				
Fife Creek	✓	✓		

Creek	Vegetation Management Activity			
	Willow Pruning	*Blackberry Hand Removal*	*Blackberry Mowing*	*Exotics Removal*
Zone 6A- Dry Creek				
West Slough 1	✓		✓	
Zone 8A				
Bloomfield1	✓		✓	

Section 2

PROJECT DESIGNS

Section 2
Project Designs

This section includes project designs and photographs to describe specific maintenance locations and site conditions. The section begins with before-maintenance site photos of each project location. Following these photographs, design drawings for each project are presented. These drawings display the following information for each 2010 project as well as the 2009 projects with slight design modifications:

- Longitudinal profiles comparing the existing grade and the project design
- Plan views showing existing conditions, OHWM, and maintenance locations
- Channel cross-sections showing existing conditions and the project design

The project designs have been arranged in the following order:

- Ducker, Hinebaugh, and Todd Creek: localized sediment removal designs
- Paulin and Russell creeks: localized sediment removal designs
- Corona Creek: reach-scale sediment removal design
- Laguna de Santa Rosa: reach-scale sediment removal design
- Lorna Dell Creek: reach-scale sediment removal design
- Adobe Creek: sediment basin clearing design
- Cook Creek: sediment basin clearing design
- Copeland and Wilfred creeks: sediment basin clearing designs
- Santa Rosa Div 1: sediment basin clearing design
- Bank Repair Projects – Moorland, Todd, Hunter, and Santa Rosa creeks

The following 2009 permitted project designs have been included due to subsequent refinements since the previous Annual Notification. All other 2009 projects to be implemented this year will follow the original designs as included in the 2009 Annual Notification.

- Crane-Five (2009 permitted project)
- Colgan-Kawana (2009 permitted project)
- Reservoir Inlet Clearing Projects (2009 permitted project)

2010 Maintenance Activities: Site-Specific Photographs

Photo 1: Ducker 2
Sediment removal near Middle Rincon Road
Taken April 22, 2010

Photo 2: Hinebaugh Creek
Sediment removal near Dawn Court
Taken April 22, 2010

Photo 3: Lorna Dell Creek
Reach-scale sediment removal and vegetation clearing in concrete-lined channel upstream of Tacheva Drive (photo looking downstream of pedestrian bridge)
Taken April 22, 2010

Photo 4: Lorna Dell Creek
Reach-scale sediment removal and vegetation clearing in concrete lined channel - looking upstream of pedestrian bridge
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 5: Paulin Creek Reach 2
Sediment removal at West Steele Lane crossing (photo looking upstream)
Taken April 22, 2010

Photo 6: Paulin Creek Reach 3
Sediment and debris removal at Apache Street crossing (photo looking downstream)
Taken April 22, 2010

Photo 7: Paulin Creek Reach 4
Sediment and debris removal and vegetation clearing upstream of Mohawk Drive
Taken April 22, 2010

Photo 8: Paulin Creek Reach 4
Sediment removal at Coffey Lane crossing (photo looking downstream)
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 9: Paulin Creek Reach 6
Sediment removal and vegetation clearing at Range Avenue crossing (photo looking downstream)
Taken April 22, 2010

Photo 10: Paulin Creek Reach 6
Sediment removal and vegetation clearing at McBride Lane crossing (photo looking downstream)
Taken April 22, 2010

Photo 11: Russell Creek Reach 1
Sediment removal downstream of Range Avenue crossing
Taken April 22, 2010

Photo 12: Todd Creek Reach 4
Sediment removal at East Todd Road crossing (photo looking downstream at crossing)
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 13: Corona Creek Reach 1
Reach-scale vegetation clearing and sediment removal – photo looking upstream from mid-reach.
Taken April 22, 2010

Photo 14: Laguna de Santa Rosa Reach 1
Reach scale sediment removal and vegetation clearing: looking upstream near eastern edge of project area.
Taken April 22, 2010

Photo 15: Laguna de Santa Rosa Reach 1
Reach scale: looking downstream from mid-project area.
Taken April 22, 2010

Photo 16: Laguna de Santa Rosa Reach 1
Reach scale- looking downstream from mid-project area
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 17: Laguna de Santa Rosa Reach 1
Reach scale- looking upstream from western edge of project area
Taken April 22, 2010

Photo 18: Adobe Creek Reach 2
In-stream sediment basin clearing (photo looking upstream of S. McDowell Blvd)
Taken April 22, 2010

Photo 19: Adobe Creek Reach 2
In-stream sediment basin clearing (photo looking downstream of S. McDowell Blvd)
Taken April 22, 2010

Photo 20: Cook Creek Reach 2
Sediment basin clearing upstream of Petaluma Hill Road.
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 21: Cook Creek Reach 2
Sediment basin clearing upstream of Petaluma Hill Road: looking at culvert.
Taken April 22, 2010

Photo 22: Copeland Creek at Country Club
In-stream sediment basin clearing at road crossing: looking downstream
Taken April 22, 2010

Photo 23: Copeland Creek at Country Club
In-stream sediment basin clearing at road crossing: looking downstream
Taken April 22, 2010

Photo 24: Copeland Creek at Snyder Lane
In-stream sediment basin clearing at road crossing: looking upstream
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 25: Copeland Creek at Snyder Lane
In-stream sediment basin clearing at road crossing: looking downstream
Taken April 22, 2010

Photo 26: Santa Rosa Creek Diversion Structure
Sediment basin clearing and vegetation removal
Taken April 22, 2010

Photo 27: Santa Rosa Creek Diversion Structure
Sediment basin clearing and vegetation removal
Taken April 22, 2010

Photo 28: Wilfred Creek at Snyder Lane
In-stream sediment basin clearing at road crossing: note sediment accumulation at culvert
Taken April 22, 2010

2010 Maintenance Activities: Site-Specific Photographs

Photo 29: Hunter Creek Reach 2 bank stabilization
(14 ft long repair on northern bank)
Taken April 22, 2010

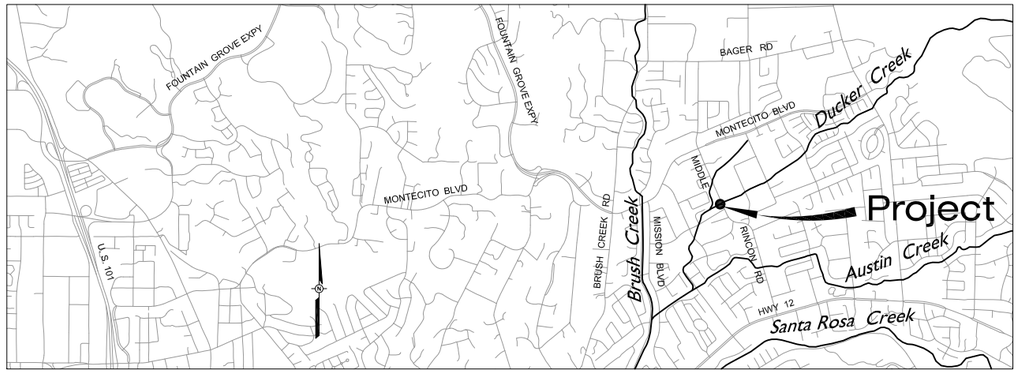
Photo 30: Moorland Creek Reach 1 bank stabilization
Two small bank repairs near Todd Channel
Taken April 22, 2010

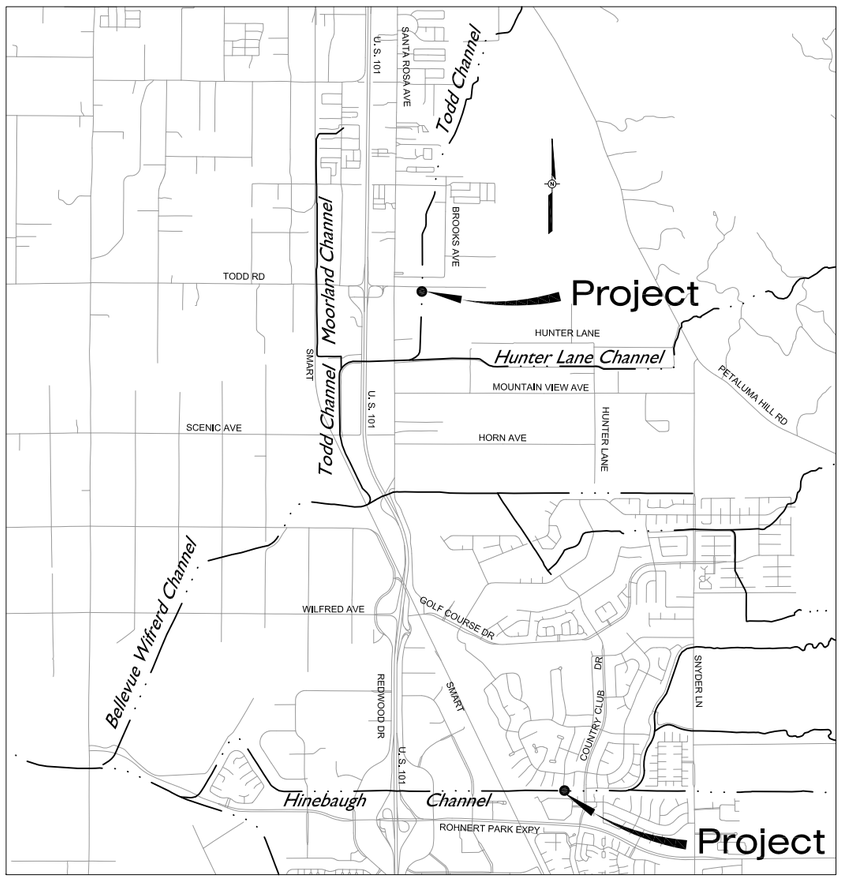
Photo 31: Todd Creek Reach 4 bank stabilization
73 ft long repair on eastern bank
Taken February 23, 2010

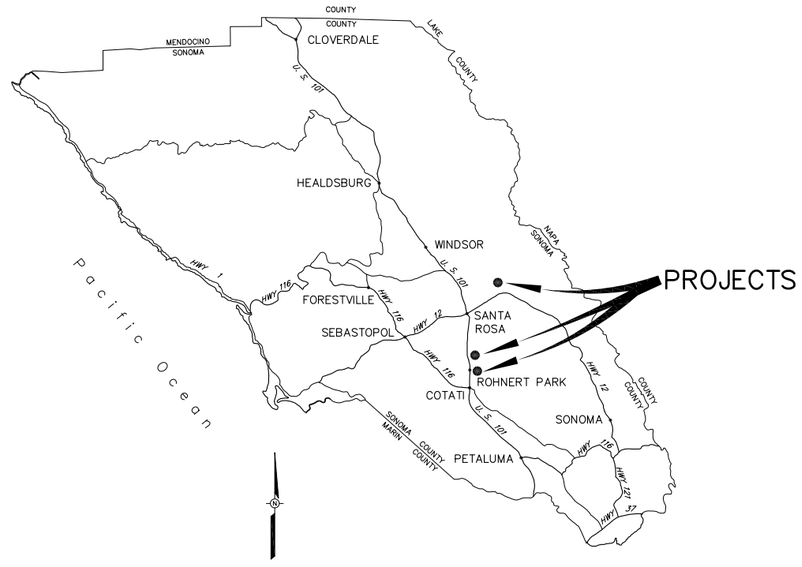
2010 Maintenance Activities: Site-Specific Photographs

Photo 32: Santa Rosa Creek Reach 1 bank stabilization
30 ft long repair on south bank and removal of sediment and existing wooden bridge
Taken February 23, 2010

SEDIMENT REMOVAL
DUCKER CREEK
HINEBAUGH CHANNEL
and
TODD CHANNEL







LOCATION MAP

NOT TO SCALE

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

VICINITY MAPS

NOT TO SCALE

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE : NONE
DATE : MONTH 08
DRAWN : ADF 12/23/09
REVIEWED : ADF

LAGUNA – MARK WEST ZONE 1A
DUCKER CREEK, HINEBAUGH AND TODD CHANNELS
SEDIMENT REMOVAL LOCATION AND VICINITY MAPS

FILE NAME: 2010-G-DUC-HINE-TODD.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G-1
SHEET 1 OF 6

\\Sd-data\Proj\flood control\zone 1a\TODD\2010-G-DUC-HINE-TODD

DUCKER CREEK

EXCAVATION

PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STATION 1001+00 TO STATION 101+90	90	12	1080 BELOW OHW	1.4	56 BELOW OHW

HINEBAUGH CHANNEL

EXCAVATION

PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	CU. YDS. NET CUT AND FILL	
						CUT	FILL
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STATION 41+75 TO STATION 42+95	120	19.5	1514 ABOVE OHW 828 BELOW OHW TOTAL = 2342	0.9	20 ABOVE OHW 58 BELOW OHW TOTAL = 78	19 ABOVE OHW 59 BELOW OHW TOTAL = 78 SEE NOTE 1

TODD CHANNEL

EXCAVATION

PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STATION 76+15 TO STATION 80+05	390	15	1150 ABOVE OHW 4700 BELOW OHW TOTAL = 5850	1.5	29 ABOVE OHW 296 BELOW OHW TOTAL = 325

NOTES:

1. 30 CUBIC YARDS OF ROCK RIPRAP (BELOW OHW) TO BE IMPORTED TO PROTECT TOE PER FIGUE 5-6 TYPICAL SECTION OF SMP MANUEL FOR BANK STABILIZATION DESIGN WILL BE USED FOR BANK RERPAIR.

90% SUBMITTAL

INDEX TO DRAWINGS:

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE : NONE | DATE : NONE 14 MAR 08
DRAWN : ADF 12/23/09
REVIEWED : ADF

LAGUNA – MARK WEST ZONE 1A

DUCKER CREEK, HINEBAUGH AND TODD CHANNELS SEDIMENT REMOVAL INDEX TO DRAWIGS AND TABLES

FILE NAME: 2010–G–DUC–HINE–TODD.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G–2
SHEET 2 OF 6

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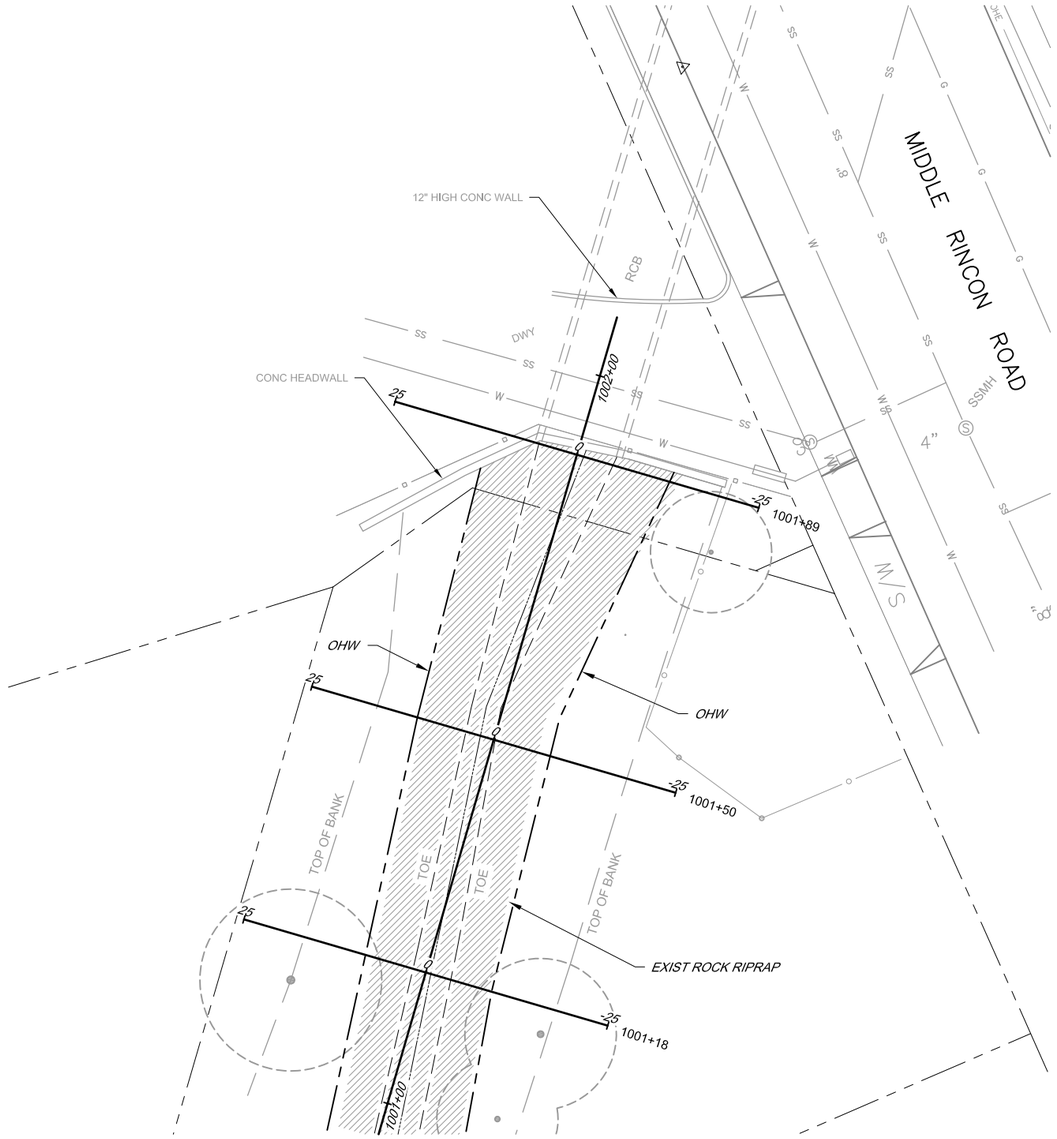
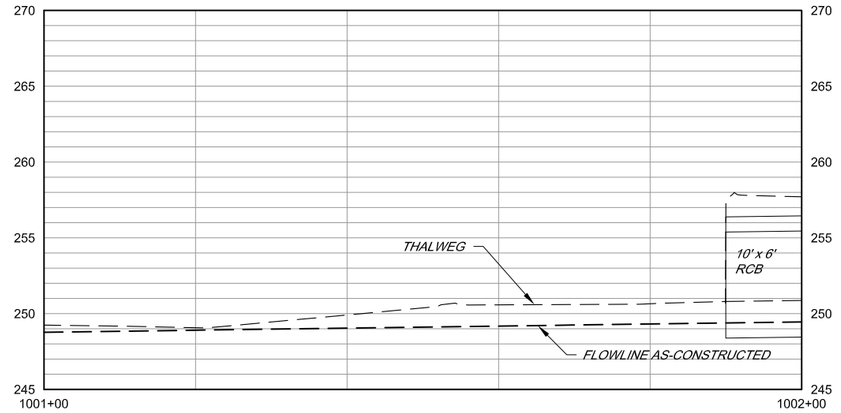
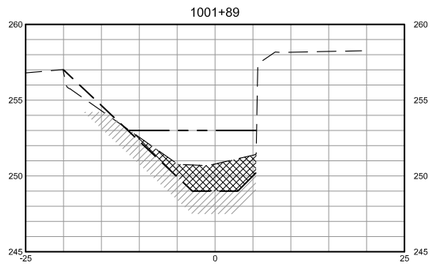
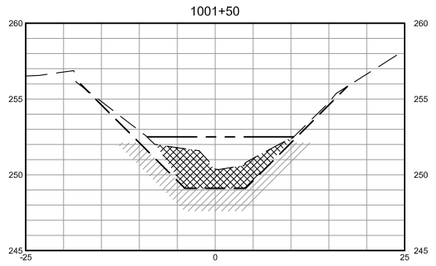


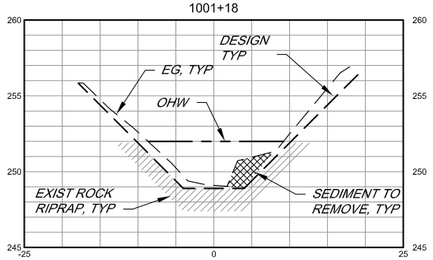
PLAN

SCALE: 1"= 10'









90% SUBMITTAL

SECTIONS

SCALE: HORIZ: 1"= 10'
VERT: 1" = 5'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\flood control\zone 1a\Brush Creek\2010_42A_sed-removal\2010_42A

NO.	DATE	REVISION	BY

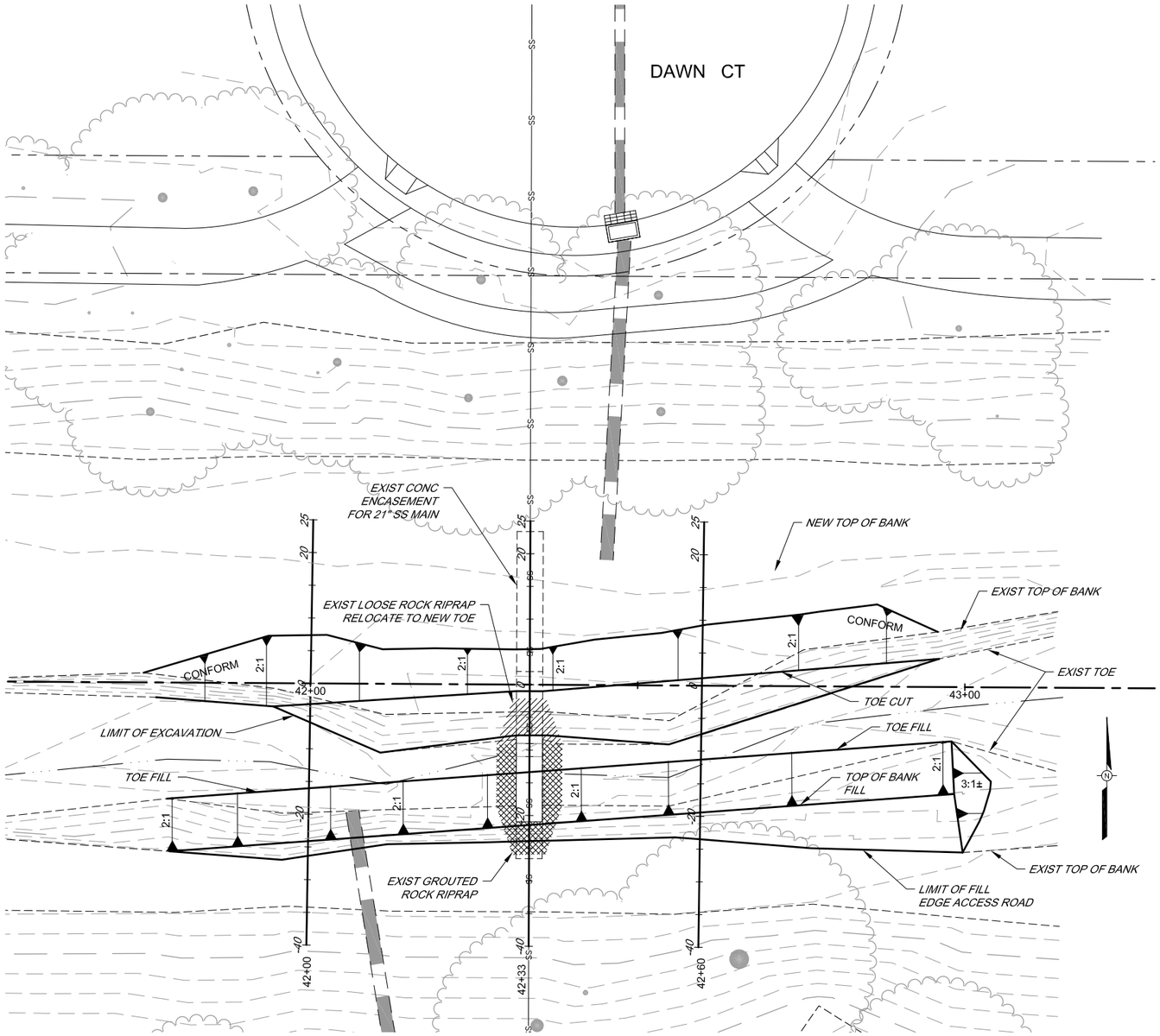
PRELIMINARY
SUBJECT TO REVISION

SONOMA COUNTY WATER AGENCY

SCALE : AS SHOWN
DATE : 12/23/09
DRAWN : ADF
REVIEWED :

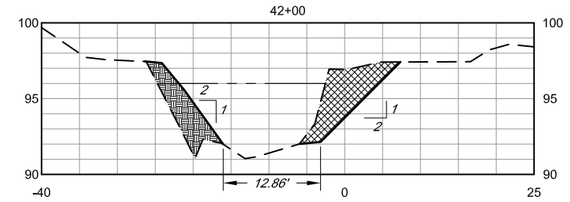
LAGUNA – MARK WEST ZONE 1A
DUCKER CREEK
PLAN, PROFILE AND SECTIONS

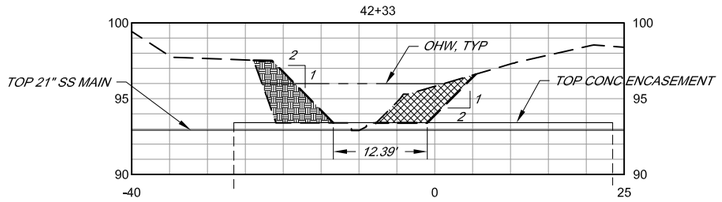
FILE NAME: 2010_42A
CONTRACT NUMBER:
DRAWING NUMBER: C–1
SHEET 3 OF 6

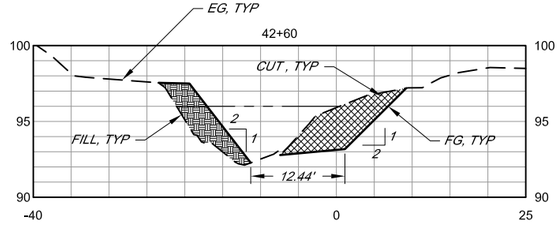


PLAN

SCALE: 1"= 10'







SECTIONS

SCALE: HORIZ 1" = 10'
VERT 1"= 5'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 12/23/09
DRAWN : ADF
REVIEWED :

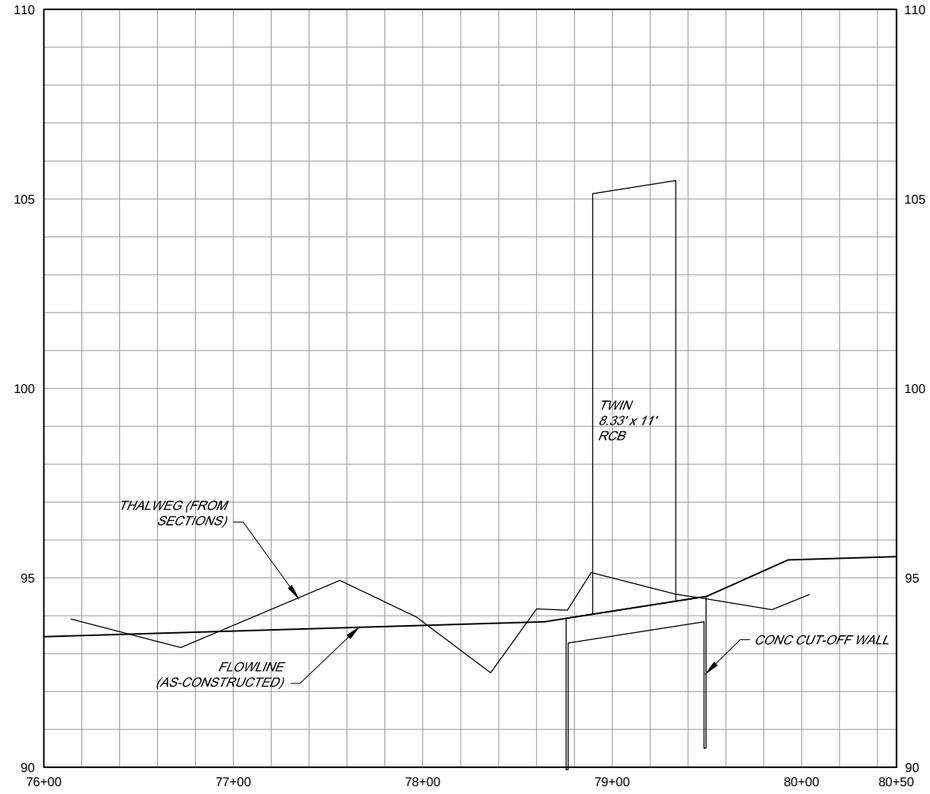
LAGUNA – MARK WEST ZONE 1A
HINEBAUGH CHANNEL – SEDIMENT REMOVAL
PLAN AND SECTIONS – STA 41+75 TO STA 42+95

FILE NAME: H_2010_C.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C–2
SHEET 4 OF 6

\\Sd-data\Proj\flood control\zone 1a\Hinebaugh\2010_SED-REMOVAL\H_2010_C

PLAN

SCALE: 1"= 40'



PROFILE

SCALE: HORIZ 1" = 40'
VERT 1"= 2'

BAR LENGTH ON ORIGINAL
DRAWING EQUALS ONE INCH.
ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
TODD CHANNEL SEDIMENT REMOVAL
STA 76+00 TO STA 80+00 PLAN & PROFILE

FILE NAME: 2009-11-24C-TODD.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-3

SHEET 5 OF 6

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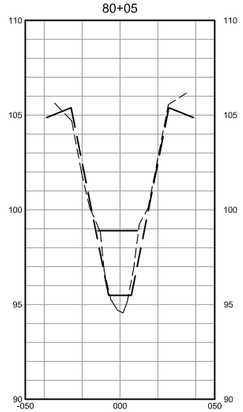
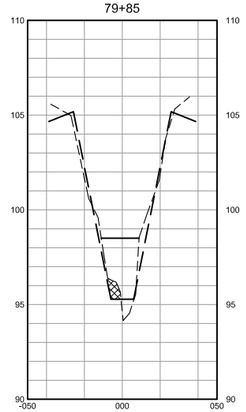
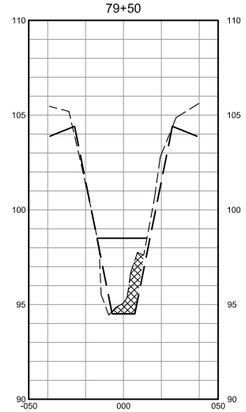
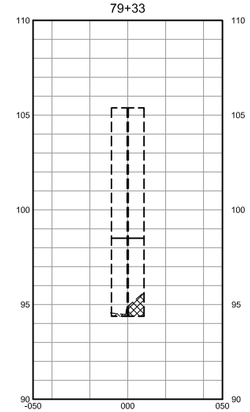
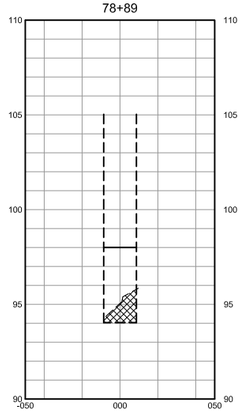
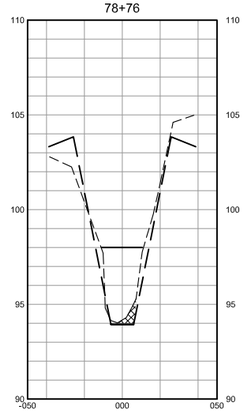


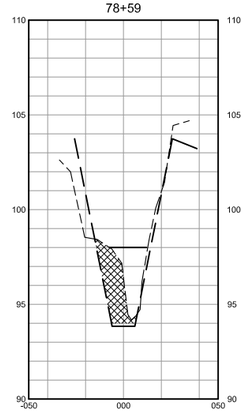


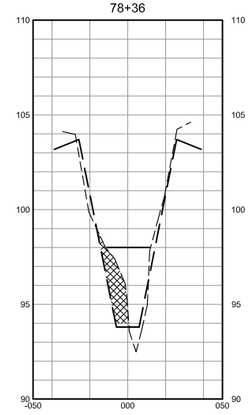


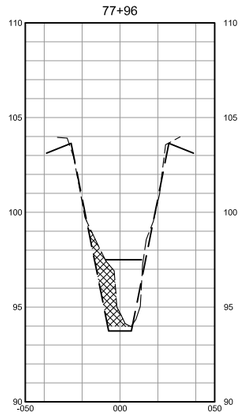


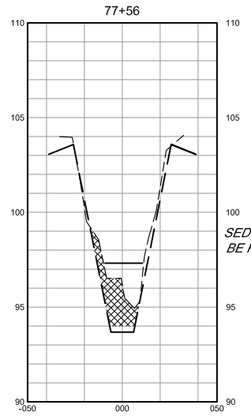


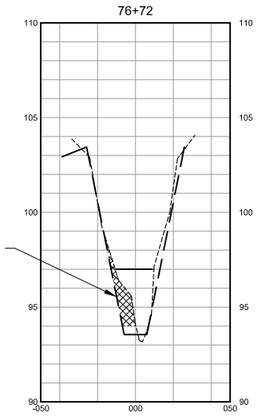


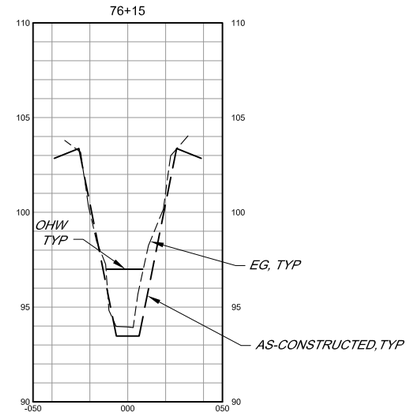












SEDIMENT TO BE REMOVED

SECTIONS

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\flood control\zone 1a\TODD\2009-11-24C-TODD

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

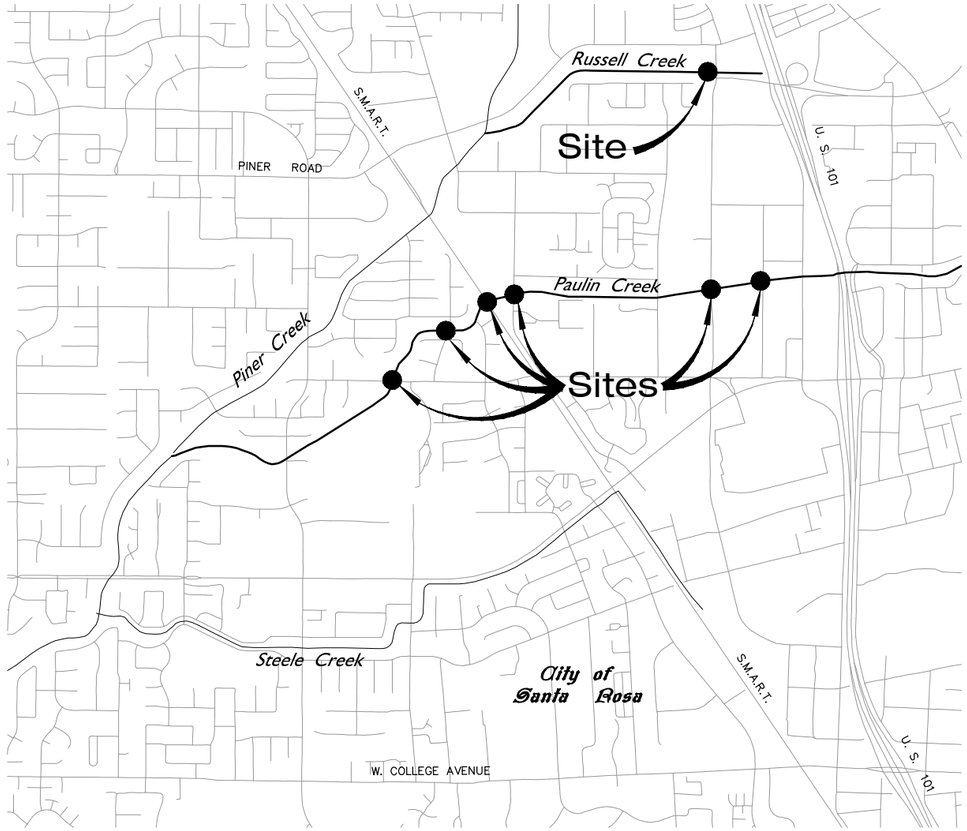
SCALE:	AS SHOWN
DATE :	12/9/09
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
TODD CHANNEL SEDIMENT REMOVAL
STA 76+00 TO STA 80+00 SECTIONS

FILE NAME: 2009-11-24C-TODD.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-4

PAULIN CREEK
and
RUSSELL CREEK
SEDIMENT REMOVAL



VICINITY MAP
SCALE: 1"= 4000'

LOCATION MAP
NOT TO SCALE

90% SUBMITTAL

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G-1	TABLES, INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS
	PAULIN CREEK	
2.	C-1	PLAN AND PROFILE STA 645+00 TO STA 647+00
3.	C-2	PLAN AND PROFILE STA 656+50 TO STA 660+00
4.	C-3	PLAN AND PROFILE STA 664+00TO 666+00 AND STA 668+80 TO STA 671+00
5.	C-4	PLAN AND PROFILE STA 692+50 TO STA 696+80
6.	C-5	PLAN AND PROFILE STA 701+20 TO 703+60
7.	C-6	SECTIONS -STA 645+51 TO 665+50
8.	C-7	SECTIONS -STA 669+04 TO STA 696+60
9.	C-8	SECTIONS - STA 701+51 TO 703+60
	RUSSELL CREEK	
10.	C-9	PLAN, PROFILE AND SECTIONS STA 705+70 TO 706+70

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

PAULIN CREEK (PINER CHANNEL 6C)						
EXCAVATION (BELOW OHW UNLESS OTHERWISE NOTED)						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN CHANNEL	STA 645+80 TO STA 647+40	160	20	3200	0.6	71
	STA 656+70 TO STA 659+51	281	17.3	4861	1.3	234
	STA 664+80 TO STA 665+75	95	16.2	1539	1.0	57
	STA 668+80 TO STA 670+20	140	17.8	2492	0.8	74
	STA 692+90 TO STA 693+35	45	7	315	1.4	16
	STA 694+60 TO STA 696+60	200	10	200 ABOVE OHW 1800 BELOW OHW TOTAL = 2000	2.0	15 ABOVE OHW 133 BELOW OHW TOTAL = 148
	STA 701+40 TO STA 703+60	220	16.8	3696	1.5	205
TOTALS		1,141		18,103		805

RUSSELL CREEK (PINER CHANNEL 6F)						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN CHANNEL	STA 705+70 TO STA 706+70	100	14	140 ABOVE OHW 1260 BELOW OHW TOTAL = 1400	1.4	7 ABOVE OHW 67 BELOW OHW TOTAL = 74

NO.	DATE	REVISION	BY

PRELIMINARY
SUBJECT TO REVISION

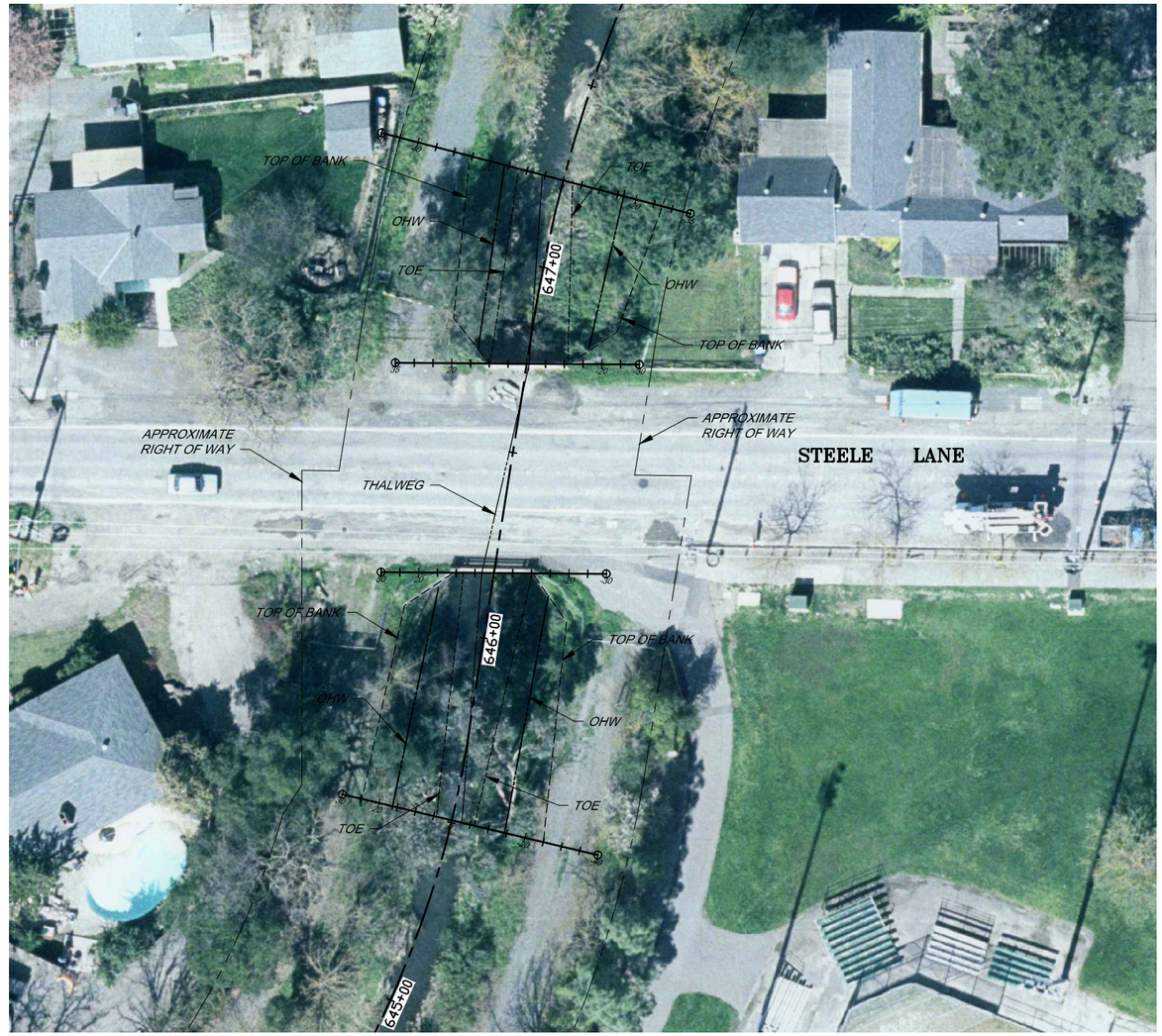
SONOMA COUNTY WATER AGENCY

SCALE :
DATE : 4/14/09
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
SEDIMENT REMOVAL
TABLES, INDEX TO DRAWINGS, LOCATION AND VICINITY MAP

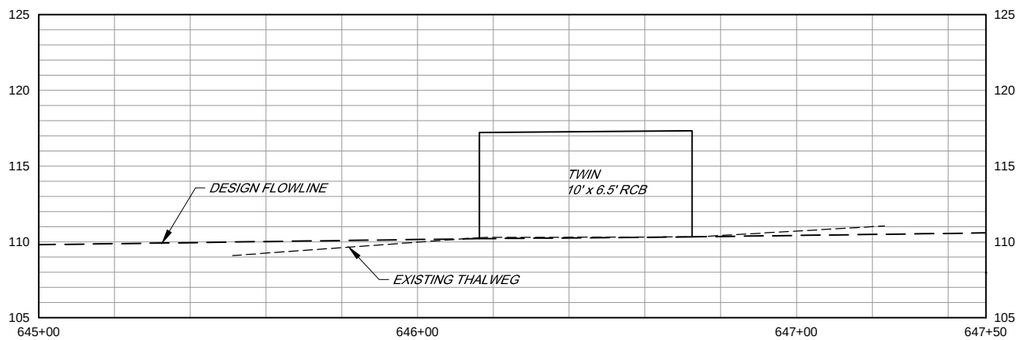
FILE NAME: G-1_PAULIN.dwg
CONTRACT NUMBER: ####
DRAWING NUMBER: G-1
SHEET 1 OF 5

\\Sd-data\Proj\flood control\zone 1a\PAULIN\G-1_PAULIN



PLAN – STEELE LANE (SMP REACH 2)

SCALE: 1"= 20'



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

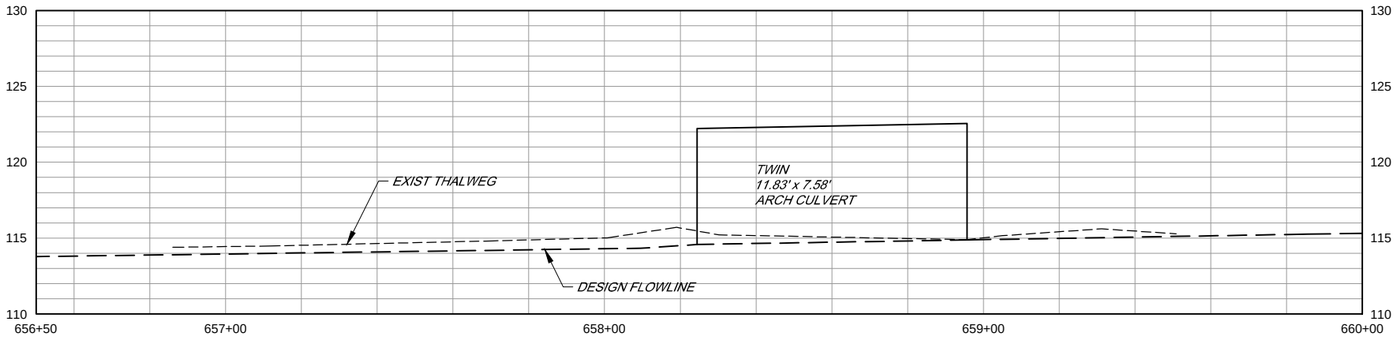
SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 2/23/10
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
PAULIN CHANNEL SEDIMENT REMOVAL
PLAN & PROFILE STA 645+00 TO STA 647+00

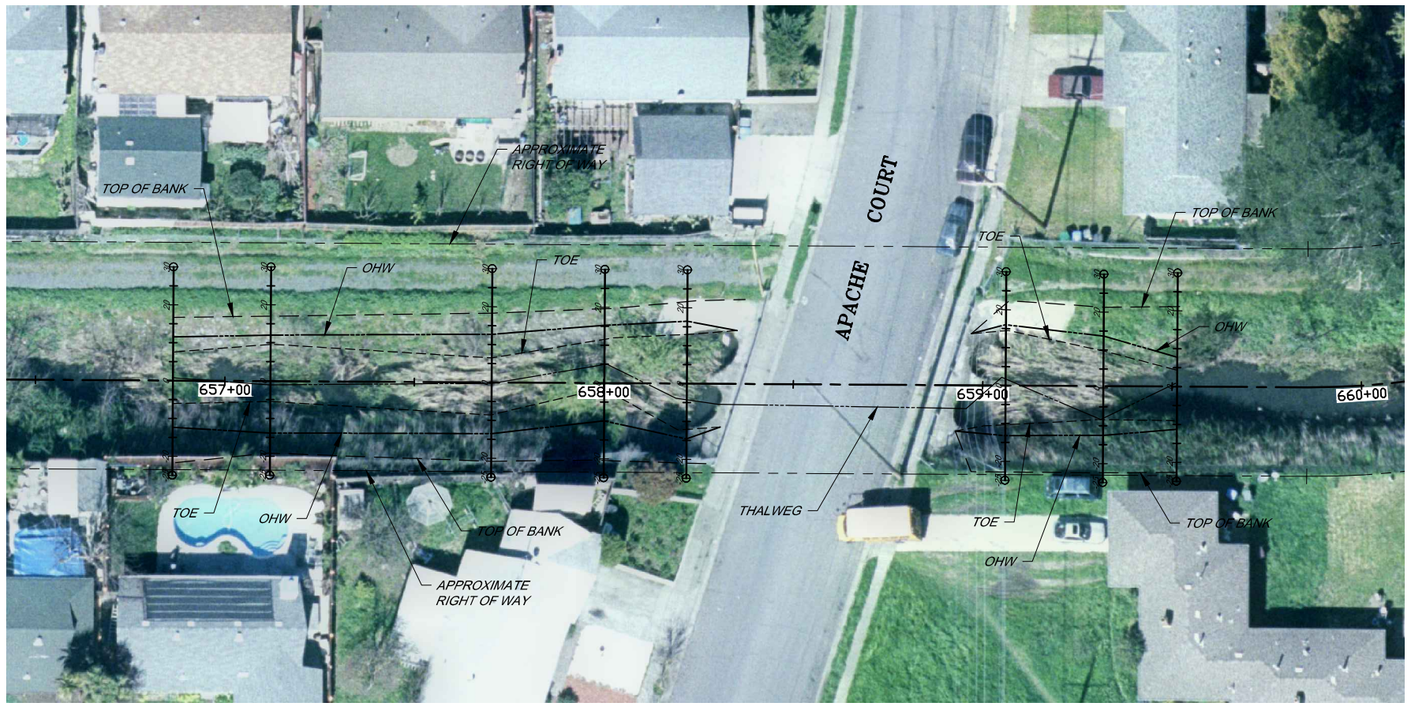
FILE NAME: 2010_C.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C–1
SHEET 2 OF 10

\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN – APACHE COURT (SMP REACH 3)

SCALE: 1"= 20'

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	2/23/10
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

PAULIN CHANNEL SEDIMENT REMOVAL

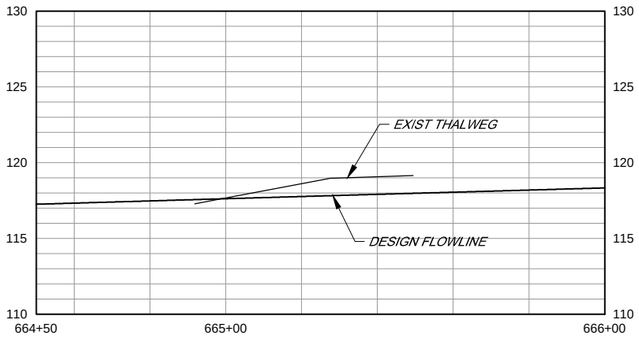
PLAN & PROFILE STA 656+50 TO STA 660+00

FILE NAME: 2010_C.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C–2

SHEET 3 OF 10

\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C

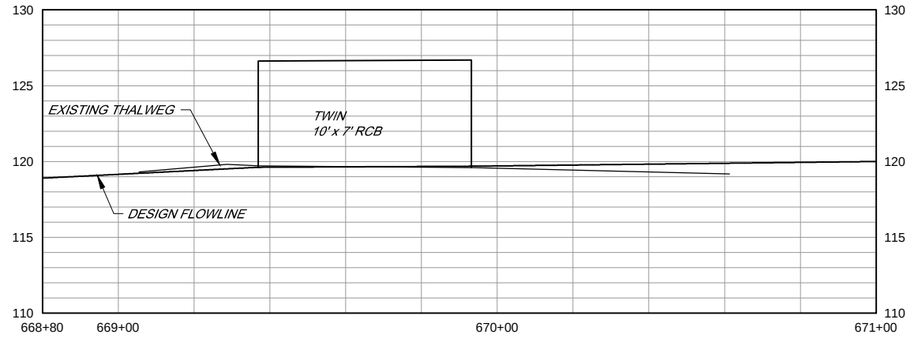


PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

PLAN –S.M.A.R.T. (SMP REACH 3)

SCALE: 1"= 20'



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

PLAN – COFFEY LANE (SMP REACH 4)

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

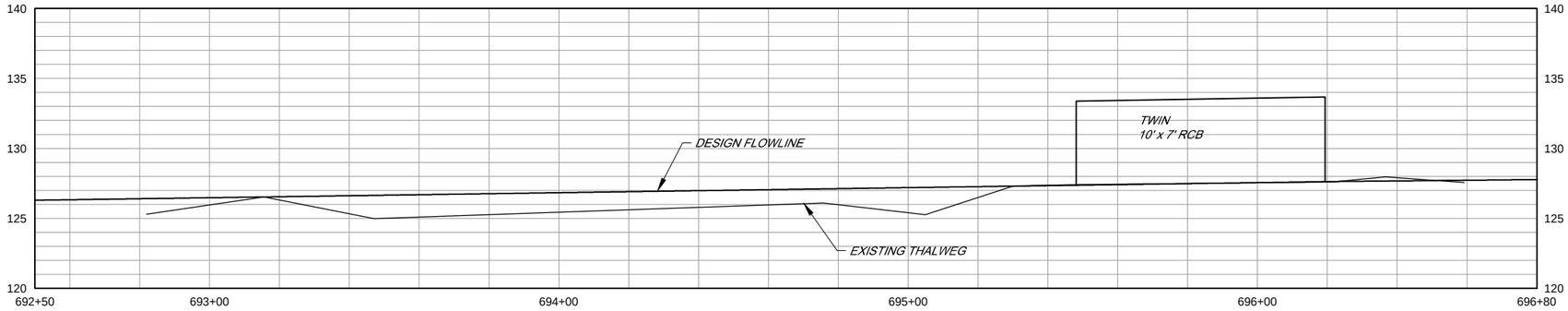
SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 2/23/10
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
PAULIN CHANNEL SEDIMENT REMOVAL
PLAN & PROFILE STA 664+50 TO STA 666+00
AND 668+80 TO STA 671+00

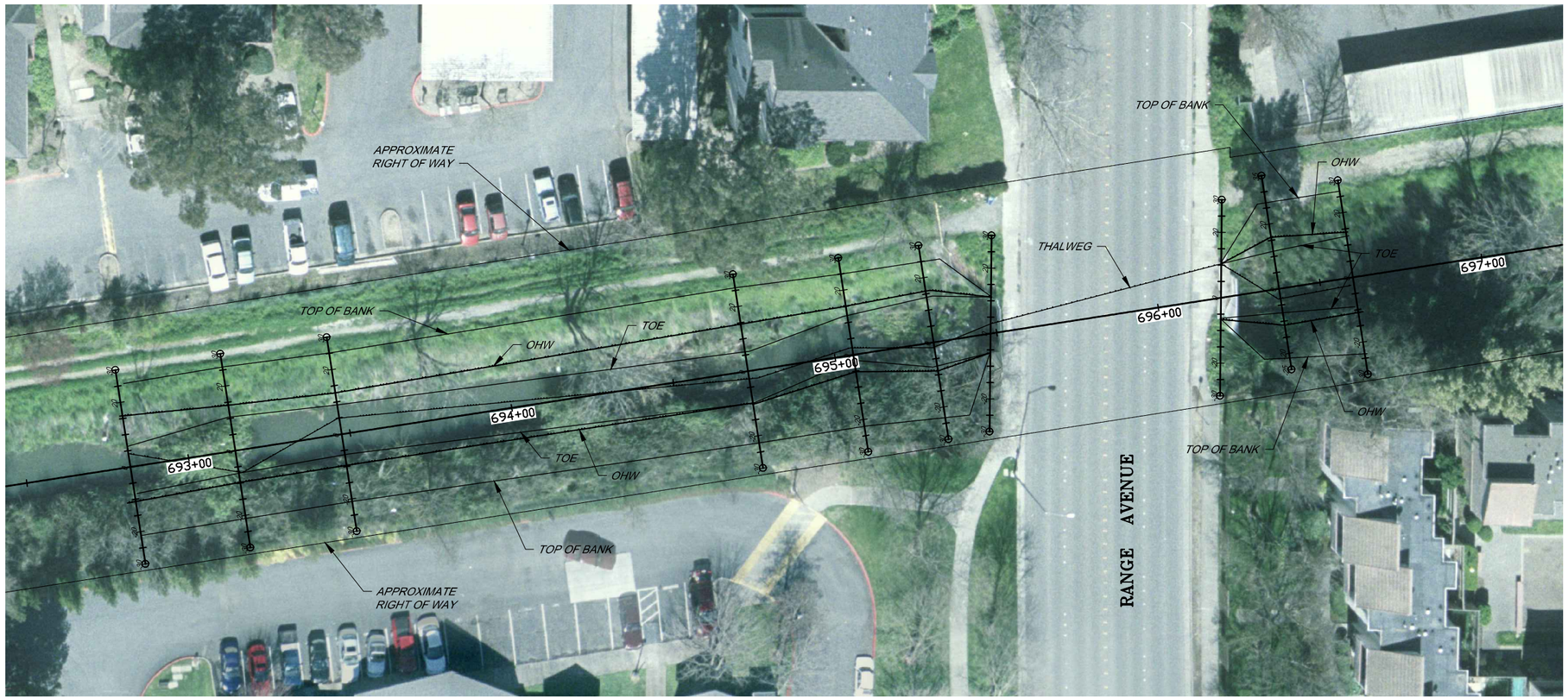
FILE NAME: 2010_C.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-3
SHEET 4 OF 10

\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN –RANGE AVE (SMP REACH 6)

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	2/23/10
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

PAULIN CHANNEL SEDIMENT REMOVAL

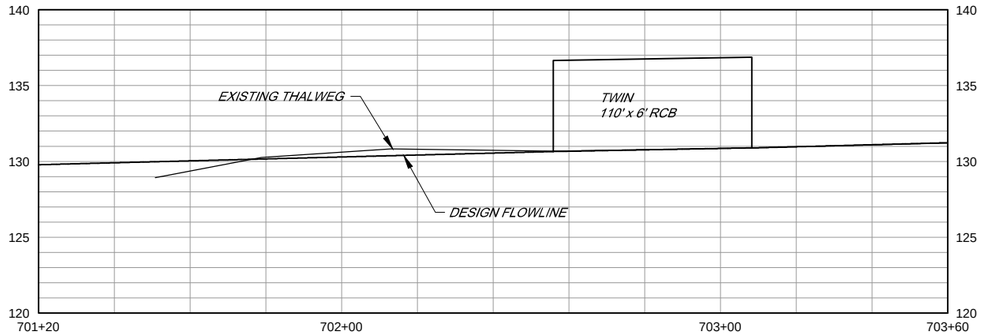
PLAN & PROFILE STA 692+50 TO STA 696+80

FILE NAME: 2010_C.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C–4

SHEET 5 OF 10

\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

PLAN –McBRIDE AVE (SMP REACH 6)

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	2/23/10
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

PAULIN CHANNEL SEDIMENT REMOVAL
PLAN & PROFILE STA 701+20 TO STA 703+60

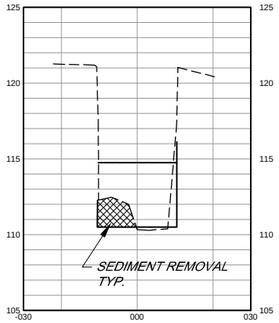
FILE NAME: 2010_C.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C–5

SHEET 6 OF 10

\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C

646+16



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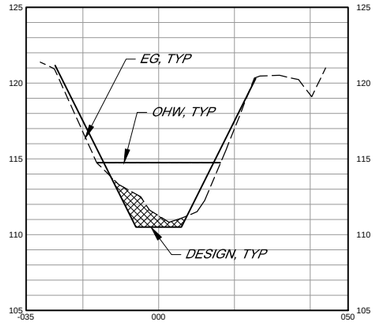
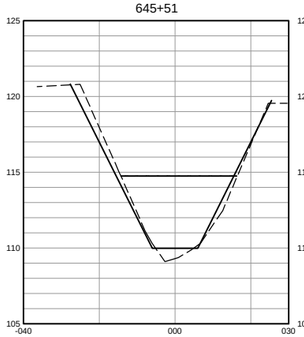


645+51



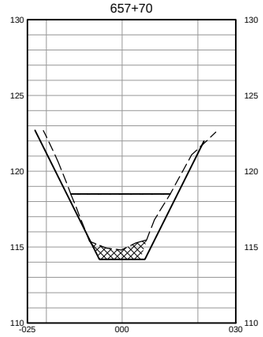
646+72

DOWNSTREAM STEELE

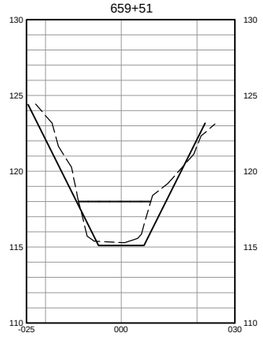
UPSTREAM STEELE

STEELE LANE
(SMP REACH 2)

657+70



659+51



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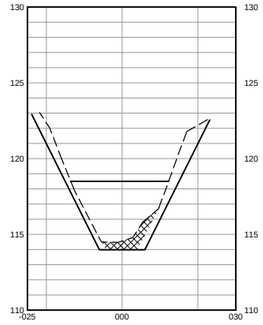
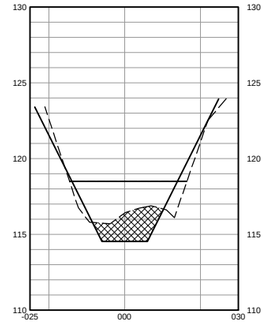
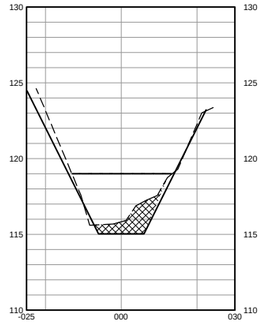


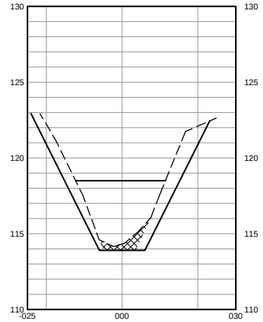
658+22



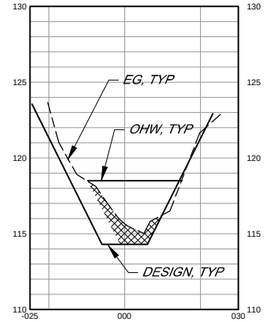
659+32



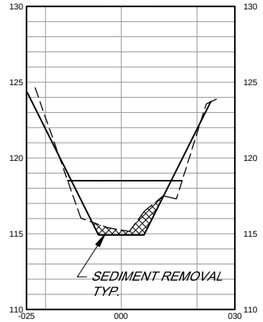
656+86



658+00



659+06

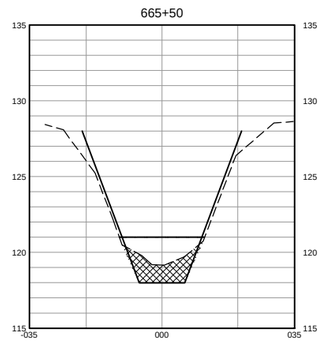


DOWNSTREAM APACHE

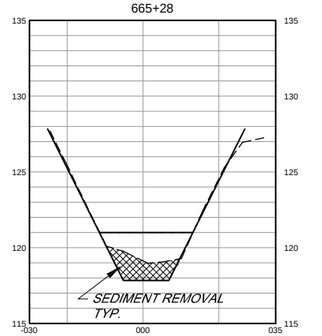
UPSTREAM APACHE

APACHE COURT
(SMP REACH 3)

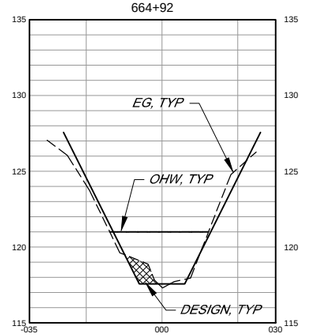
665+50



665+28



664+92



DOWNSTREAM S.M.A.R.T.

S.M.A.R.T.
(SMP REACH 3)

SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE: 2/23/10
DRAWN: ADF
REVIEWED:

LAGUNA – MARK WEST ZONE 1A

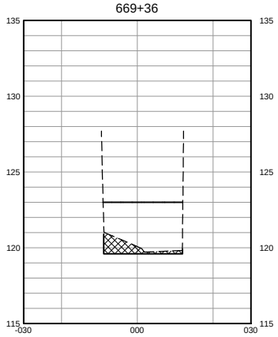
PAULIN CHANNEL SEDIMENT REMOVAL SECTIONS – STA 645+51 TO 665+50

FILE NAME: 2010_C.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C–6

SHEET 7 OF 10

669+36



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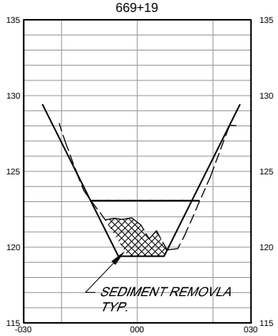
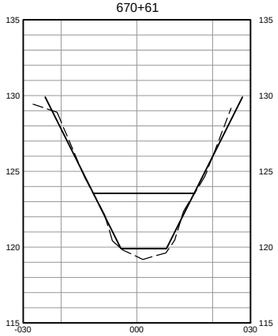


670+61



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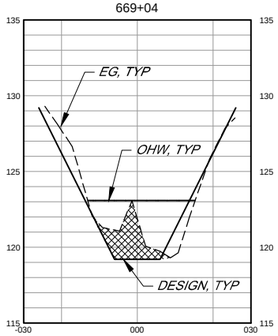

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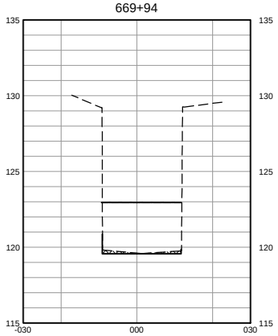
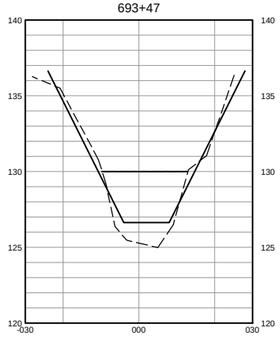


DOWNSTREAM APACHE

UPSTREAM APACHE

COFFEY LANE
(SMP REACH 4)

693+47



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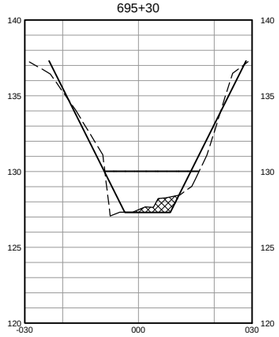
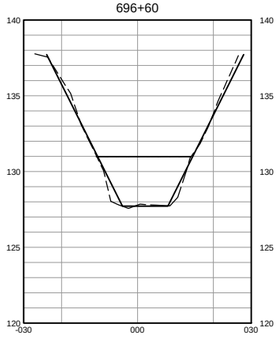


696+60



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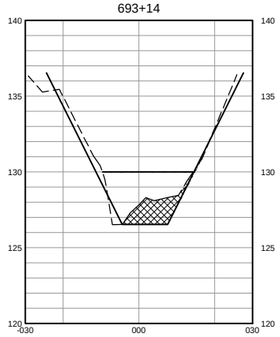

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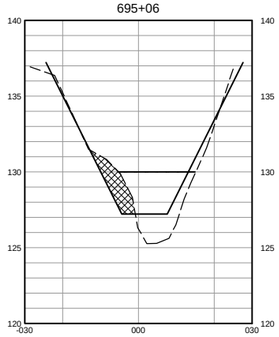

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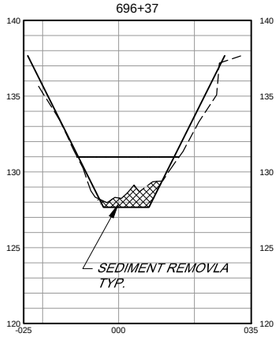

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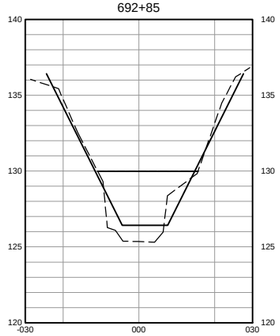

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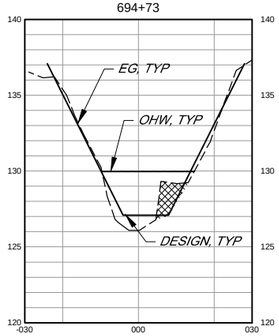

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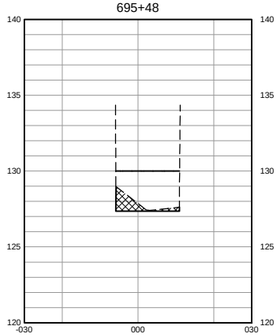
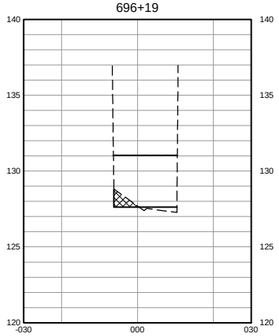


696+19



DOWNSTREAM RANGE

UPSTREAM RANGE

RANGE AVENUE
(SMP REACH 6)

SECTIONS

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	2/23/10
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

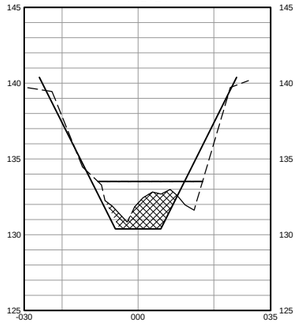
PAULIN CHANNEL SEDIMENT REMOVAL
SECTIONS – STA 669+04 TO STA 696+60

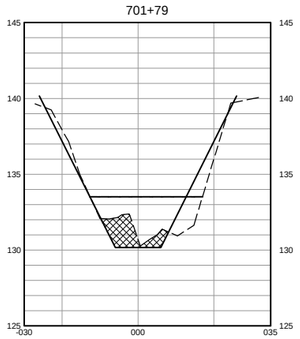
FILE NAME: 2010_C.dwg
CONTRACT NUMBER:

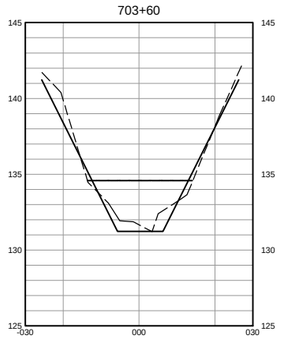
DRAWING NUMBER: C–7

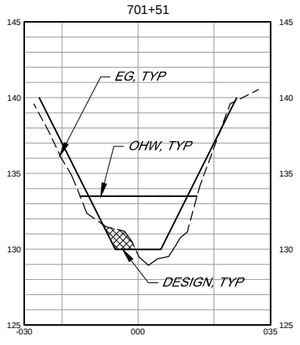
SHEET 8 OF 10

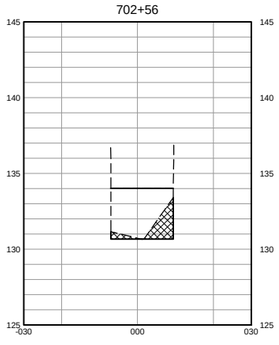
\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C

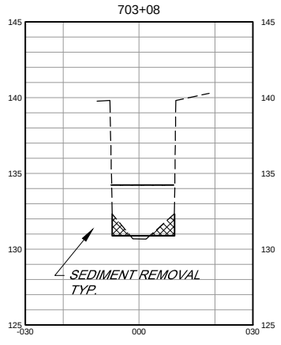












DOWNSTREAM APACHE

UPSTREAM APACHE

McBRIDE AVENUE
(SMP REACH 6)

SECTIONS

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	2/23/10
DRAWN :	ADF
REVIEWED :	

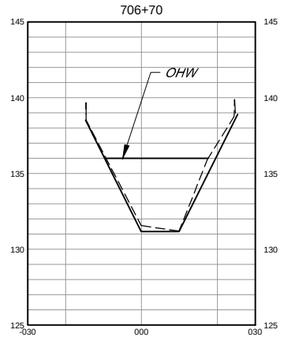
LAGUNA – MARK WEST ZONE 1A
PAULIN CHANNEL SEDIMENT REMOVAL
SECTIONS – STA 701+51 TO STA 703+60

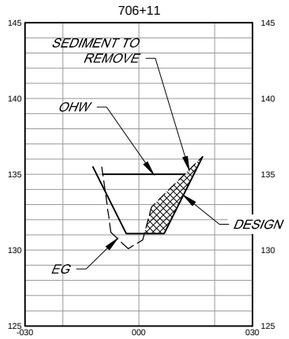
FILE NAME: 2010_C.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C–8

SHEET 9 OF 10

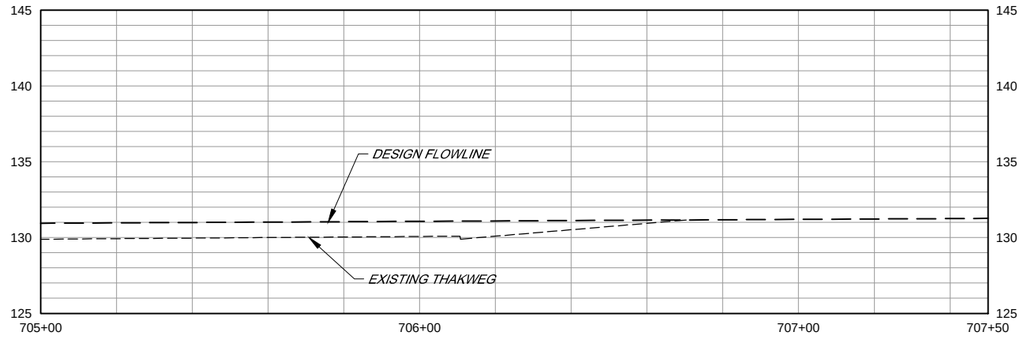
\\Sd-data\Proj\flood control\zone 1a\PAULIN\2010_C





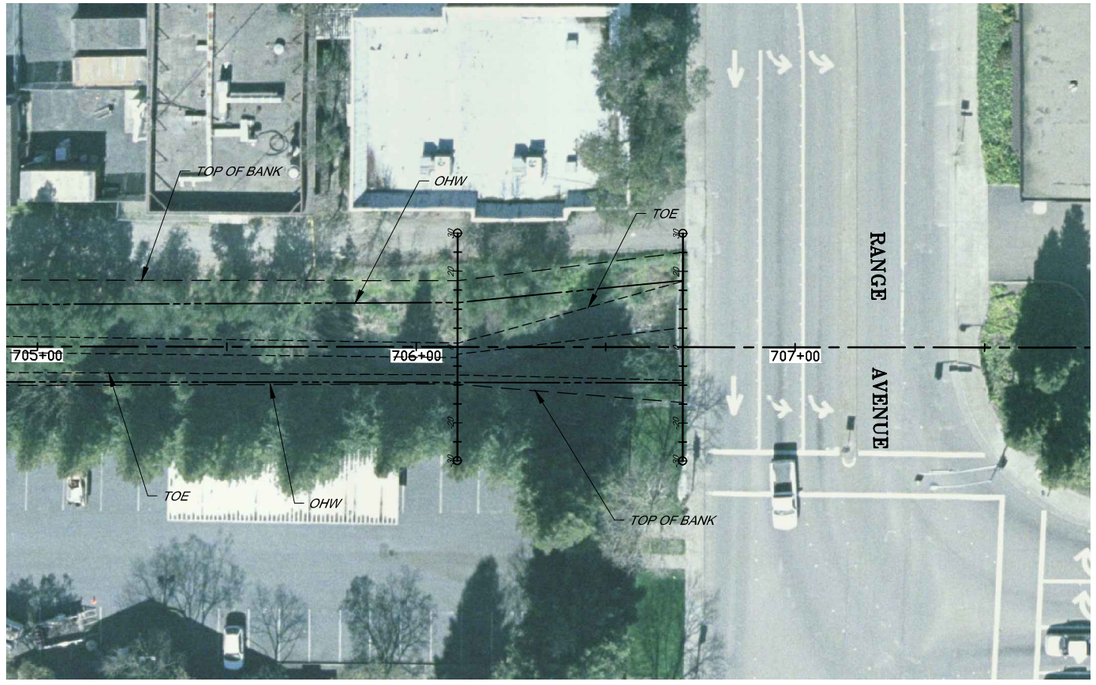
SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1"= 20'

\\Sd-data\Proj\flood control\zone 1a\RUSSELL\RUSSELL_C

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

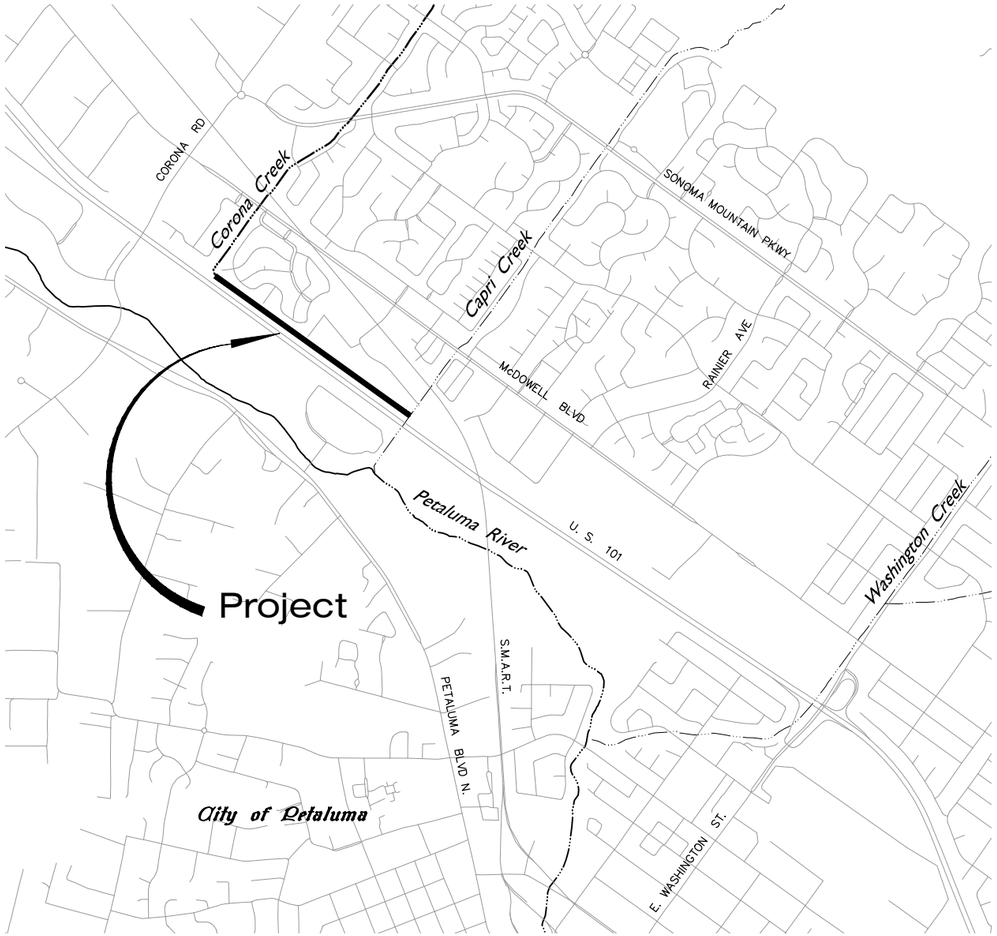
RUSSELL CREEK (PINER CHANNEL 6F) PLAN, PROFILE AND SECTIONS

FILE NAME: RUSSELL_C.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-9

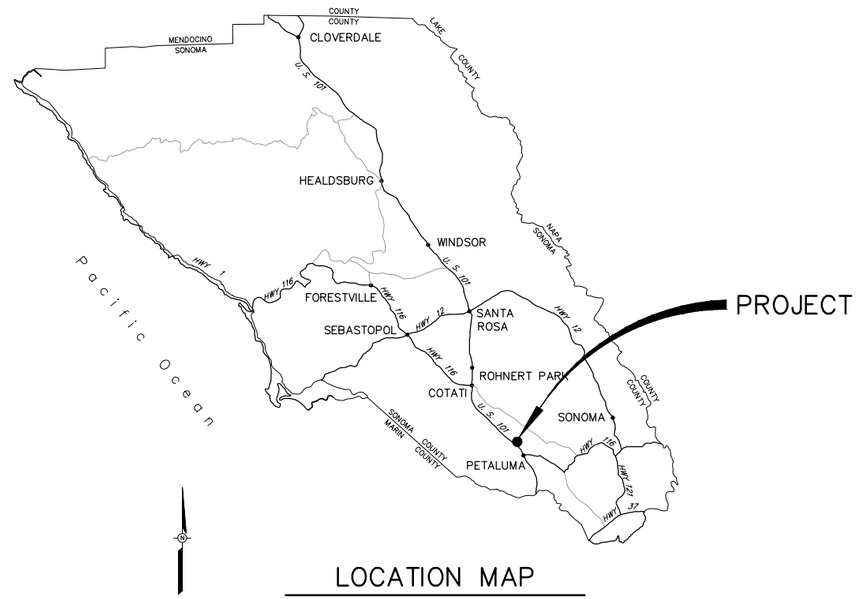
SHEET 10 OF 10

CORONA CREEK SEDIMENT REMOVAL



VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE

CORONA CREEK						
EXCAVATION (BELOW OHW)						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STA 3+30 TO STA 20+90	1760	10	17600	0.5	326
	STA 20+90 TO STA 32+00	500 SEE NOTE	10	5000	0.5	93
TOTAL		2260		22600		421

NOTE:
SEDIMENT REMOVAL AT VARIOUS LOCATIONS STA 20+90 TO STA 32+00 TOTALING 500 LINEAR FEET.

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G-1	INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS
2.	C-1	PLAN AND PROFILE STA 0+00 TO STA 6+00
3.	C-2	PLAN AND PROFILE STA 6+00 TO STA 12+00
4.	C-3	PLAN AND PROFILE STA 12+00 TO STA 18+00
5.	C-4	PLAN AND PROFILE STA 18+00 TO STA 24+00
6.	C-5	PLAN AND PROFILE STA 24+00 TO STA 30+00
7	C-6	PLAN AND PROFILE STA 30+00 TO STA 33+00
8.	C-7	SECTIONS

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

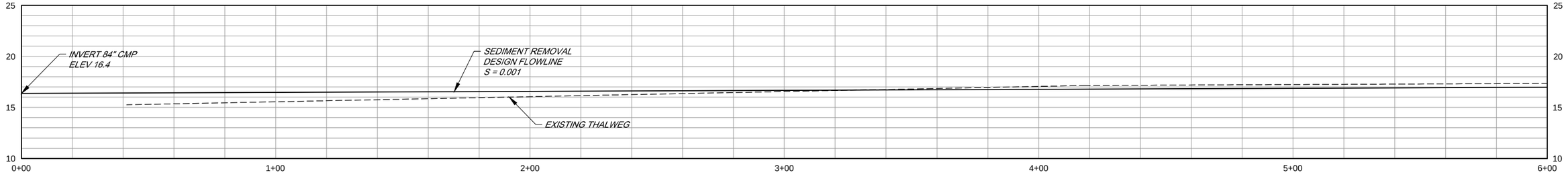
SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 24-Feb-10
DRAWN : A. FACENDINI
REVIEWED :

PETALUMA BASIN ZONE 2A
CORONA CREEK SEDIMENT REMOVAL
INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS

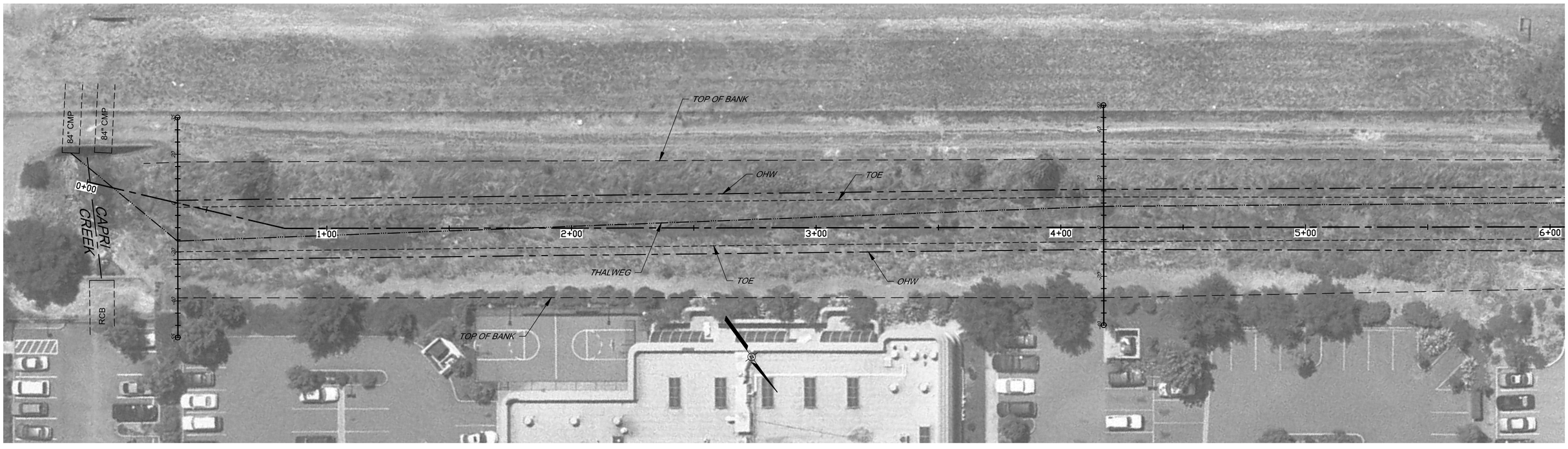
FILE NAME: CORONA_G-1.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G-1
SHEET 1 OF 8

\\Sd-data\Proj\flood control\zone 2a\Corona\CORONA_G-1



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

PETALUMA BASIN ZONE 2A

CORONA CREEK SEDIMENT REMOVAL

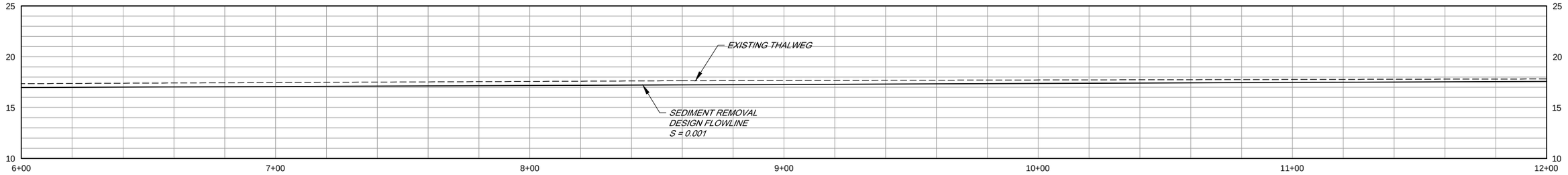
PLAN & PROFILE STA 0+00 TO STA 6+00

FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-1

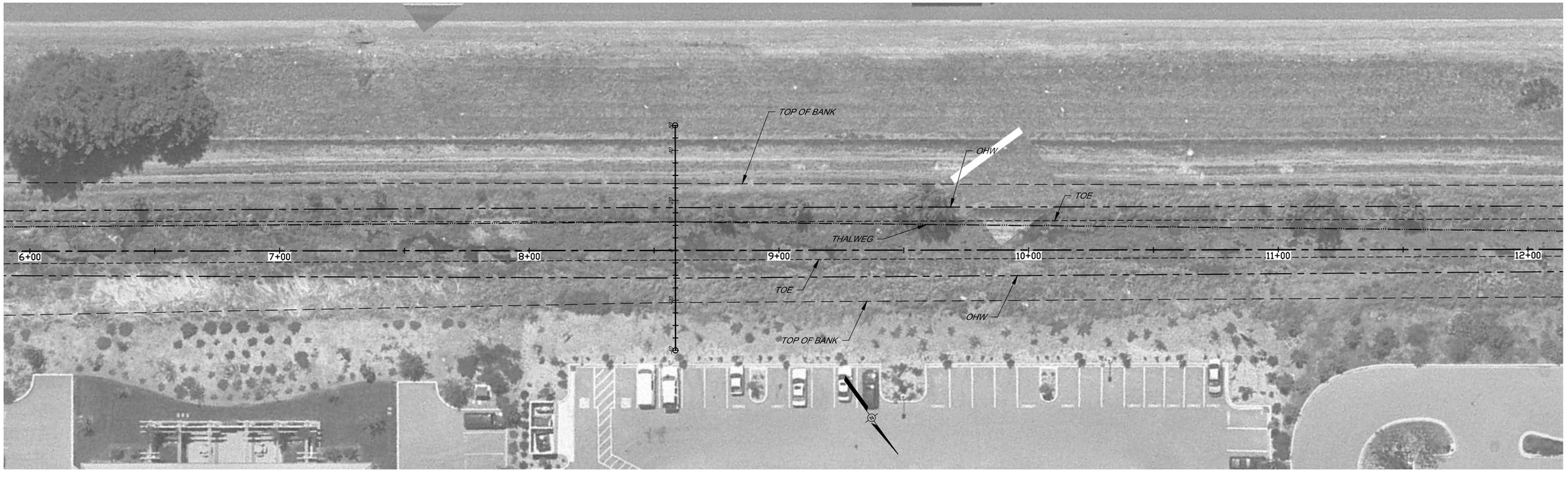
SHEET 2 OF 8

\\Sd-data\Proj\flood control\zone 2a\Corona\2010_Corona



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

PETALUMA BASIN ZONE 2A

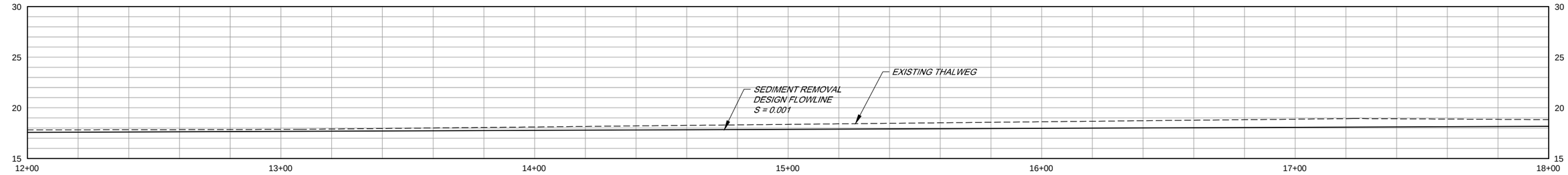
CORONA CREEK SEDIMENT REMOVAL PLAN & PROFILE STA 6+00 TO STA 12+00

FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-2

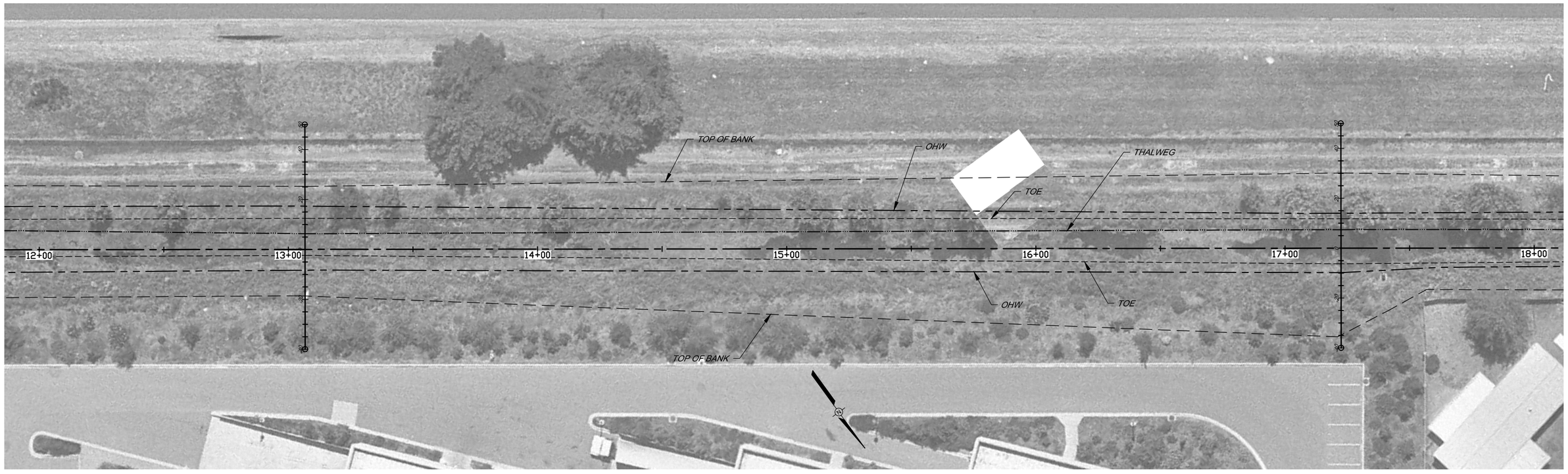
SHEET 3 OF 8

\\Sd-data\Proj\Flood control\zone 2a\Corona\2010_Corona



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

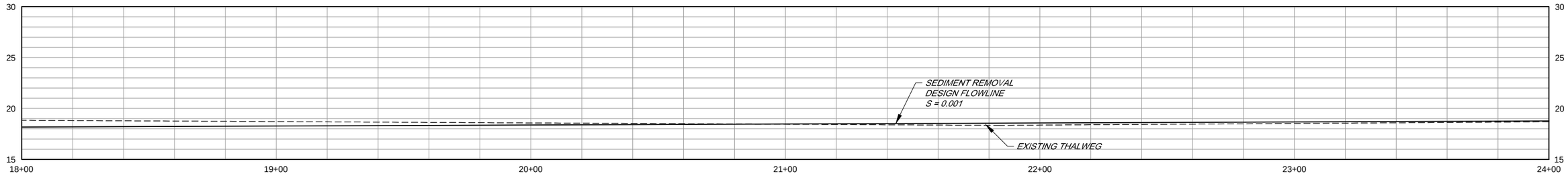
PETALUMA BASIN ZONE 2A

CORONA CREEK SEDIMENT REMOVAL PLAN & PROFILE STA 12+00TO STA 18+00

FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

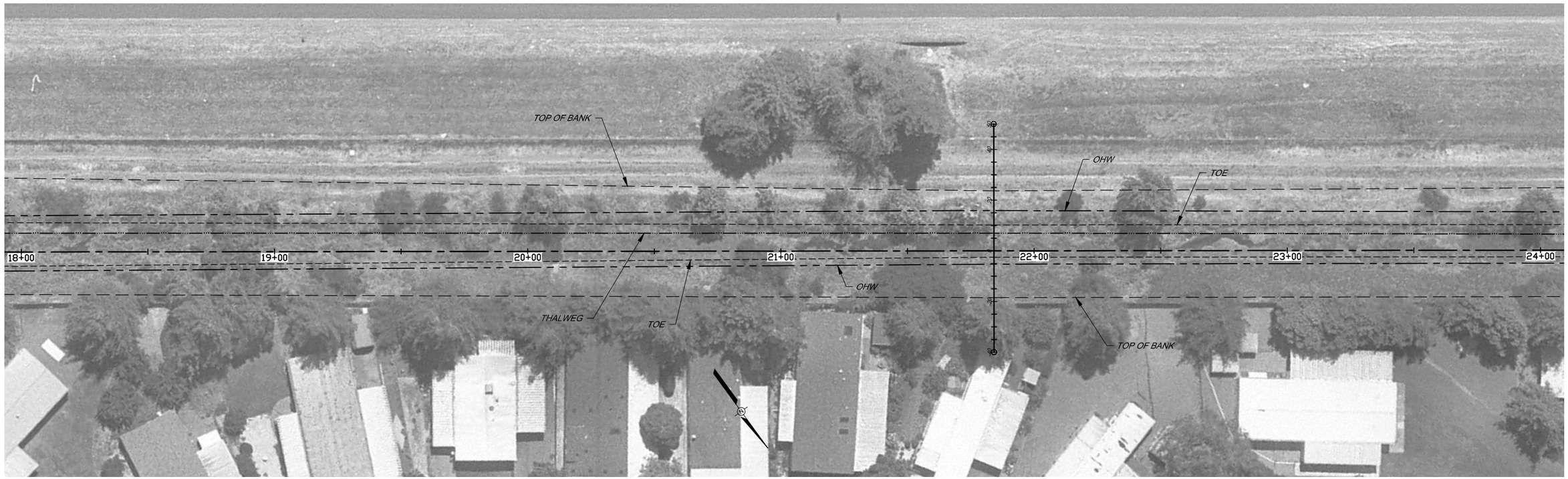
DRAWING NUMBER: C-3

\\Sd-data\Proj\Flood control\zone 2a\Corona\2010_Corona



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

PETALUMA BASIN ZONE 2A

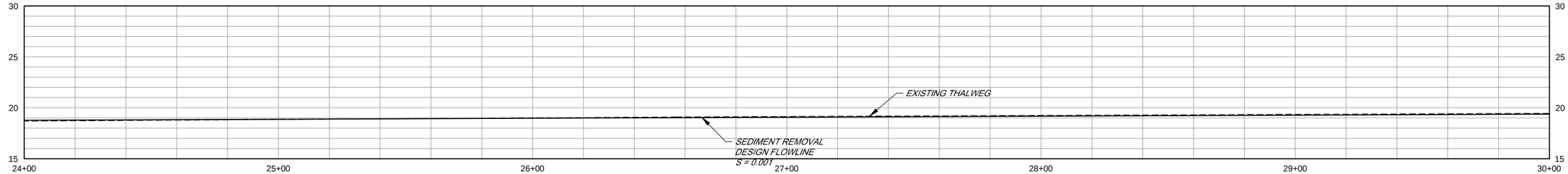
CORONA CREEKSEDIMENT REMOVAL PLAN & PROFILE STA 18+00 TO STA 24+00

FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-4

SHEET 5 OF 8

\\Sd-data\Proj\Flood control\zone 2a\Corona\2010_Corona



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

PLAN

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

PETALUMA BASIN ZONE 2A

CORONA CREEKSEDIMENT REMOVAL

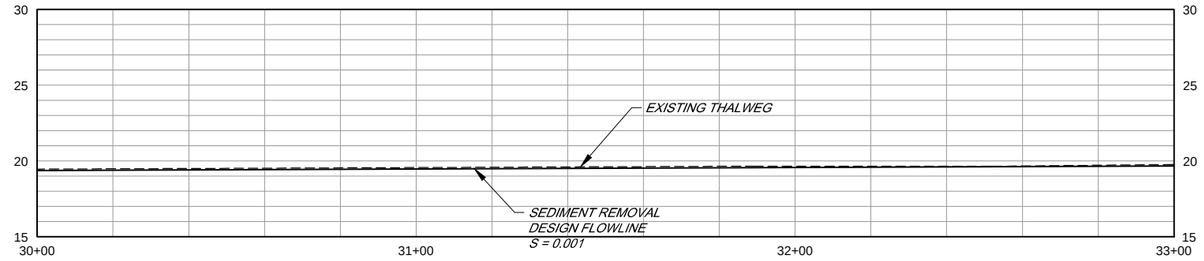
PLAN & PROFILE STA 24+00 TO STA 30+00

FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-5

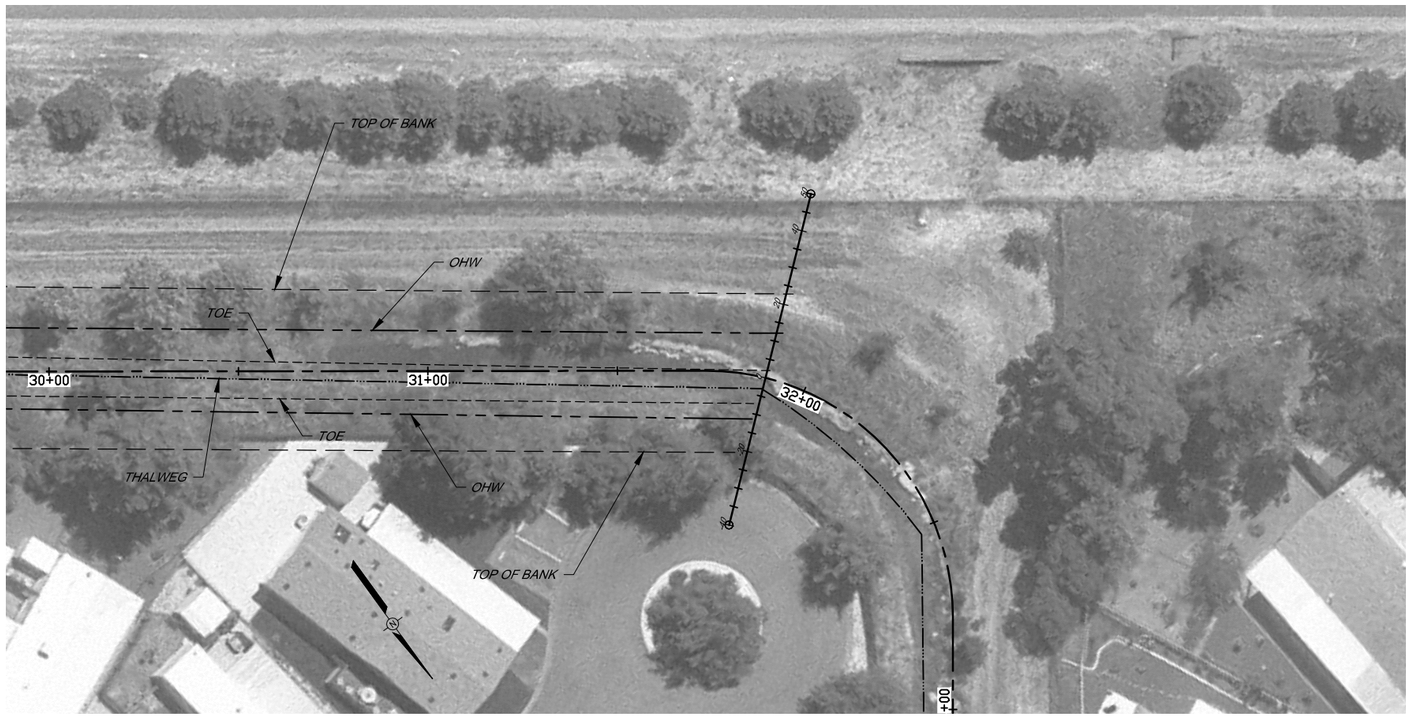
SHEET 6 OF 8

\\Sd-data\Proj\Flood control\zone 2a\Corona\2010_Corona



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1"= 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

PETALUMA BASIN ZONE 2A

CORONA CREEK SEDIMENT REMOVAL PLAN & PROFILE STA30+00 TO STA 33+00

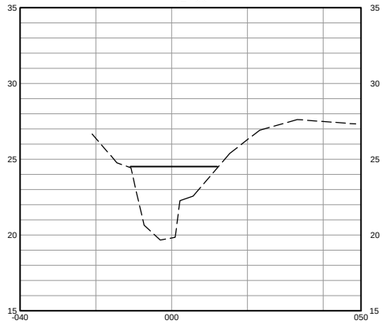
FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-6

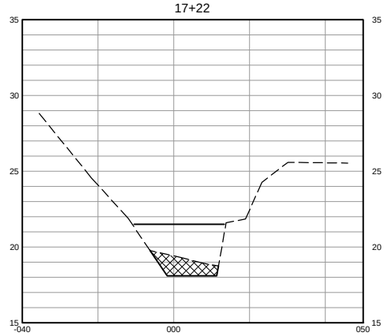
SHEET 7 OF 8

\\Sd-data\Proj\flood control\zone 2a\Corona\2010_Corona

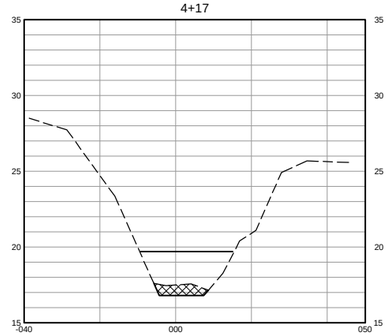
31+89



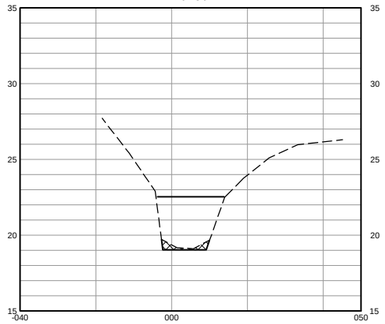
17+22



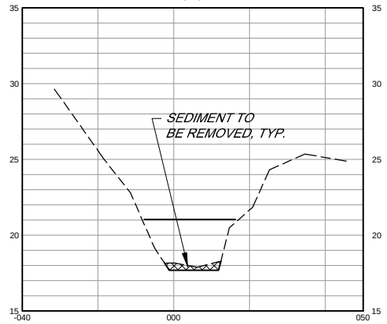
4+17



26+56



13+07



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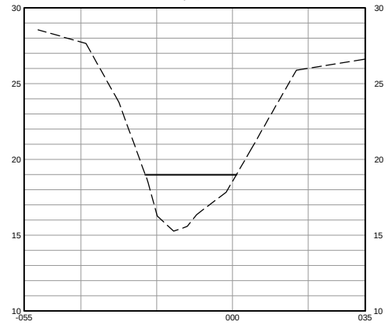
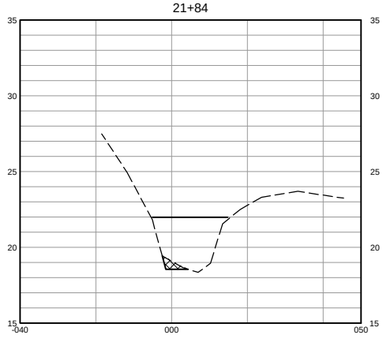
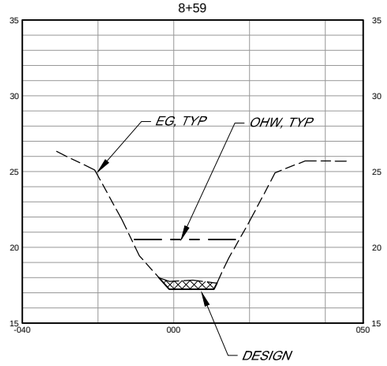


21+84



8+59



SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL
DRAWING EQUALS ONE INCH.
ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\Flood control\zone 2a\Corona\2010_Corona

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

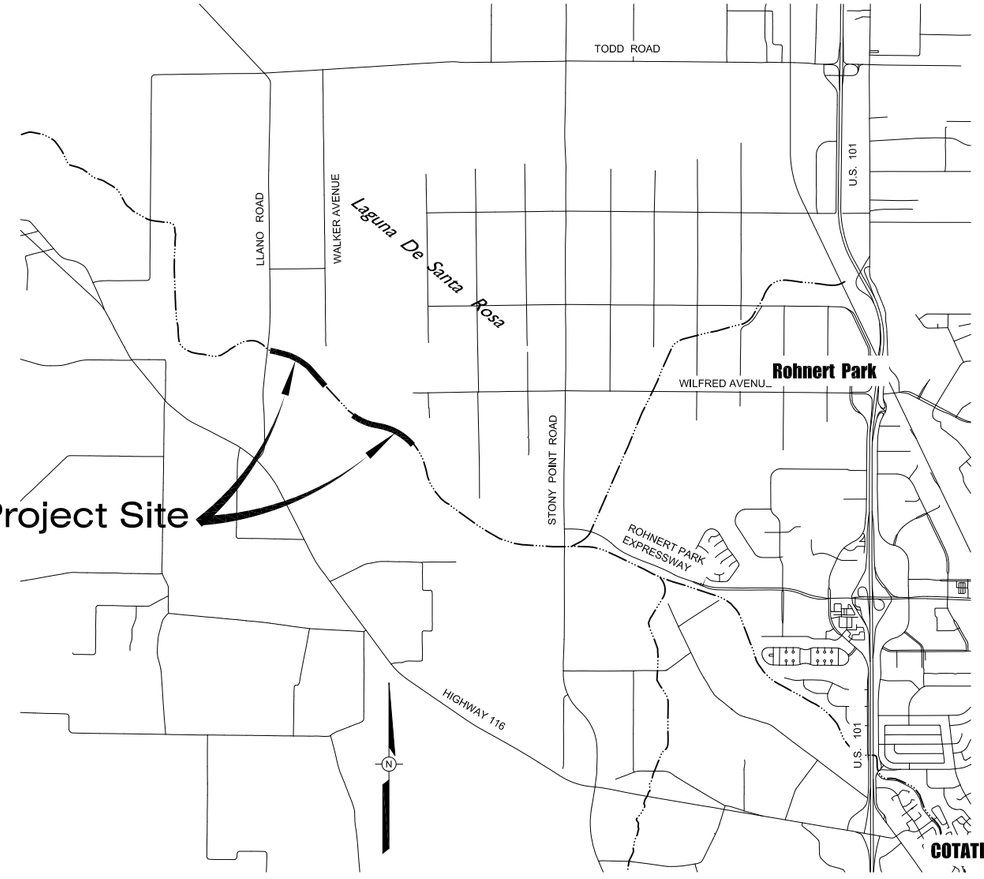
PETALUMA BASIN ZONE 2A
CORONA CREEKSEDIMENT REMOVAL
SECTIONS

FILE NAME: 2010_Corona.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-7

SHEET 8 OF 8

LAGUNA DE SANTA ROSA 'D' LINE
(SMP REACH 1)
SEDIMENT REMOVAL



VICINITY MAP

NTS

LOCATION MAP

NTS

LAGUNA DE SANTA ROSA 'D' LINE						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN CHANNEL	STA 0+00 TO STA 17+00	400 SEE NOTE 1	35	14,000 (ABOVE OHW 4,000 BELOW OHW 10,000	3.85	1,996 (ABOVE OHW 1,000 BELOW OHW 996)
	STA 26+00 TO STA 46+00	2000	50	140,000 (ALL BELOW OHW)	3.37	12,489 (ALL BELOW OHW)
	TOTALS:	2,400		154,000 (ABOVE OHW 4,000) (BELOW OHW 150,00)		14,485 (ABOVE OHW 1,000) (BELOW OHW 13,485)

NOTES:
1. SEDIMENT REMOVAL AT VARIOUS LOCATIONS BETWEEN STA 0+00 TO STA 17+00 TOTALING 400 LINEAR FEET.

INDEX TO DRAWINGS:

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE: NONE
DATE: 7-Apr-10
DRAWN: ADF
REVIEWED:

LAGUNA - MARK WEST ZONE 1A
LAGUNA DE SANTA ROSA "D-LINE" SEDIMENT REMOVAL
INDEX TO DRAWINGS, LOCATION AND VICINITY MAP

FILE NAME: 2009_G.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G-1
SHEET 1 OF 6

\\Sd-data\Proj\flood control\zone 1a\LAGUNA\2199_llano-stony_point\2009_G

PLAN

SCALE: 1"= 200'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	NONE
DATE :	14-Jan-10
DRAWN :	ADF
REVIEWED :	

LAGUNA - MARK WEST ZONE 1A

LAGUNA DE SANTA ROSA "D-LINE"

SITE PLAN AND ACCESS ROUTES

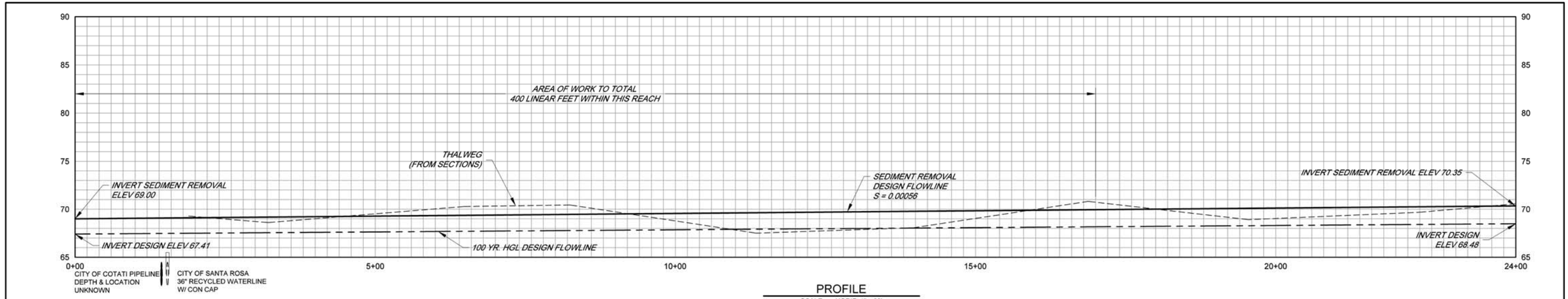
FILE NAME: 2009_C-1.bak.dwg

CONTRACT NUMBER:

DRAWING NUMBER: C-1

SHEET 2 OF 6

\\Sd-data\Proj\flood control\zone 1a\LAGUNA\2199_lleno-stony_point\2009_C-1bak



PROFILE

SCALE: HORIZ. 1" = 80'
VERT 1" = 5'

PLAN

SCALE: 1" = 100'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE:	14-Jan-10
DRAWN:	----
REVIEWED:	

LAGUNA - MARK WEST ZONE 1A

LAGUNA DE SANTA ROSA "D-LINE"

SEDIMENT REMOVAL - STA 0+00 TO STA 24+00

FILE NAME: 2009_C2-4.dwg

CONTRACT NUMBER: ##############

DRAWING NUMBER: C-2

SHEET 3 OF 6

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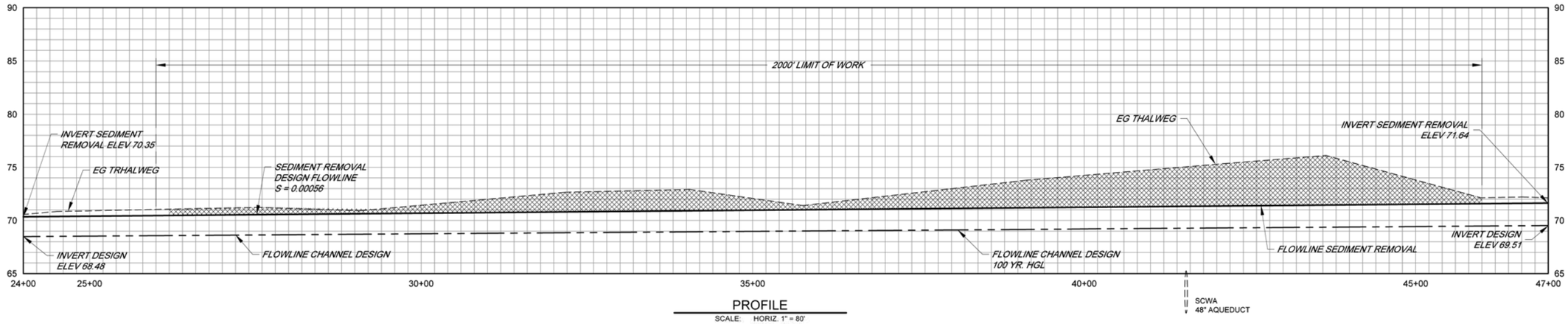
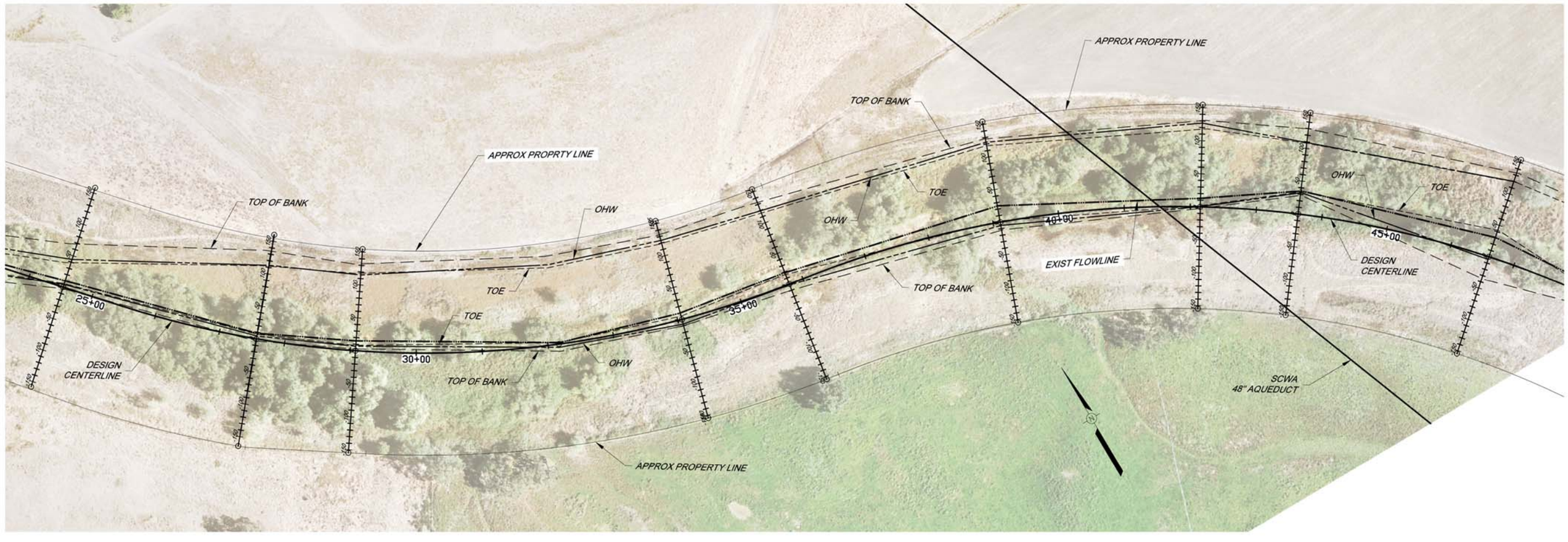


PROFILE

SCALE: HORIZ. 1" = 80'
VERT 1" = 5'



PLAN

SCALE: 1" = 100'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE:	14-Jan-10
DRAWN:	----
REVIEWED:	

LAGUNA - MARK WEST ZONE 1A

LAGUNA DE SANTA ROSA "D-LINE"

SEDIMENT REMOVAL - STA 24+0 TO STA 47+00

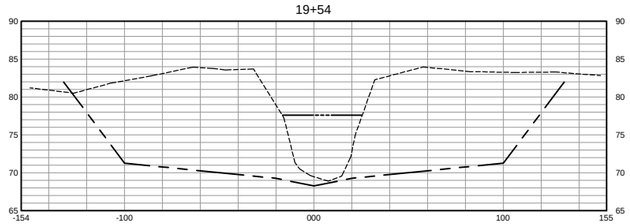
FILE NAME: 2009_C2-4.dwg

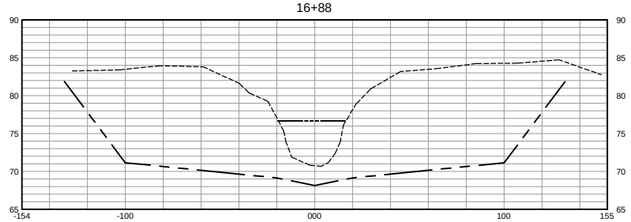
CONTRACT NUMBER:

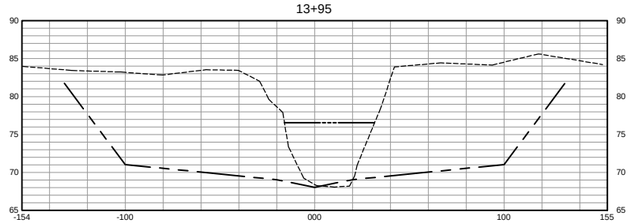
DRAWING NUMBER: C-3

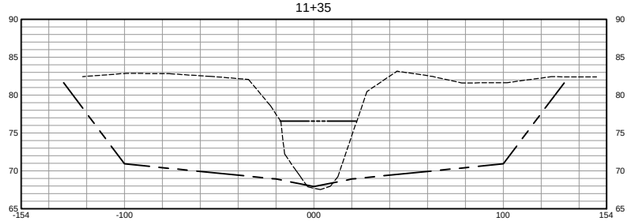
SHEET 4 OF 6

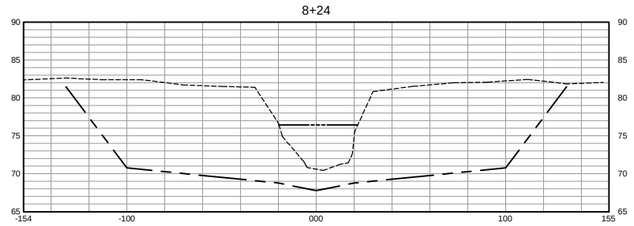
\\Sdr-data\Proj\Flood control\zone 1a\LAGUNA\2199_llano-stony_point\2009_C2-4

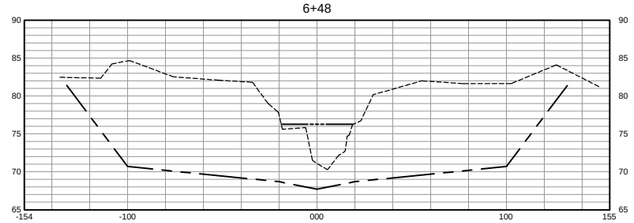


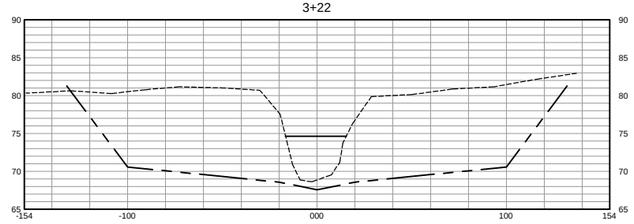


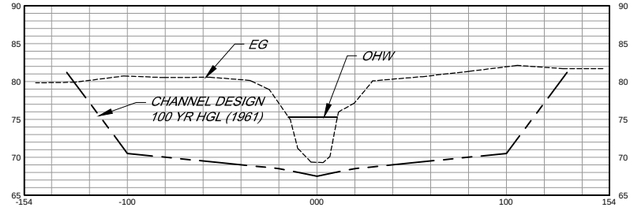






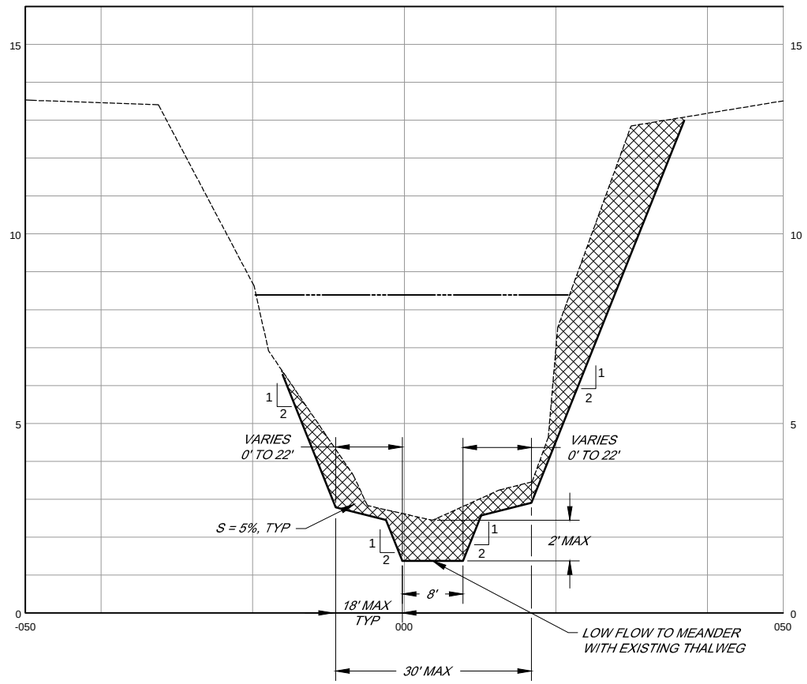






SECTIONS

SCALE: HORIZ 1" = 40'
VERT 1" = 10'



TYPICAL SECTION

SCALE: HORIZ 1" = 10'
VERT 1" = 2'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE:	24-Mar-10
DRAWN:	----
REVIEWED:	

LAGUNA - MARK WEST ZONE 1A

LAGUNA DE SANTA ROSA "D-LINE"

SECTIONS STA 0+00 TO STA 17+00

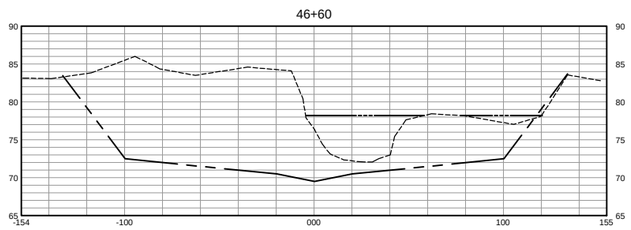
FILE NAME: 2009_C2-4.dwg

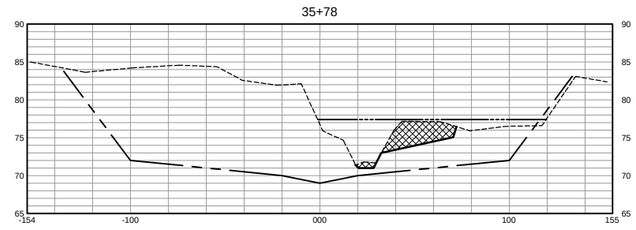
CONTRACT NUMBER:

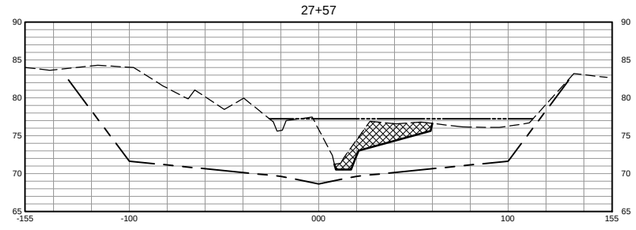
DRAWING NUMBER: C-4

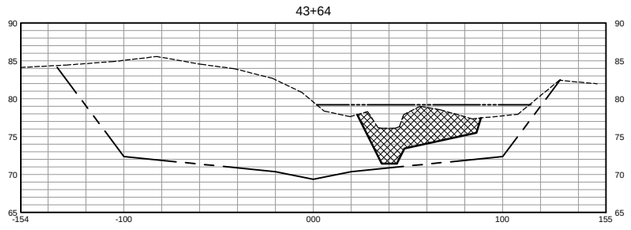
SHEET 5 OF 6

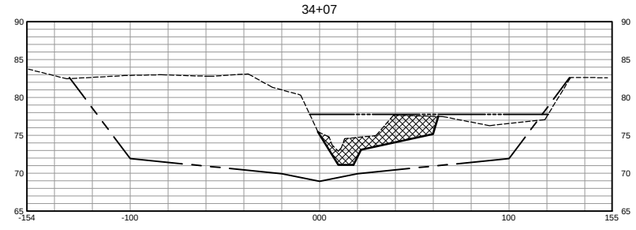
\\Sd-data\Proj\Flood control\zone 1a\LAGUNA\2199_llano-story_point\2009_C2-4

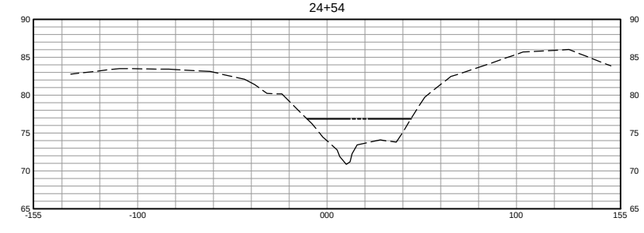


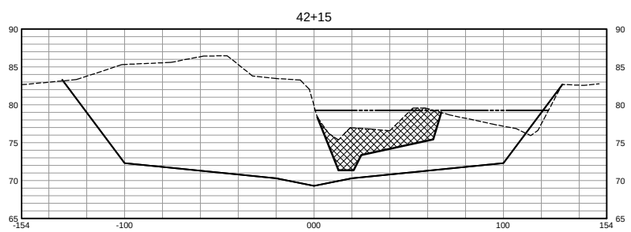


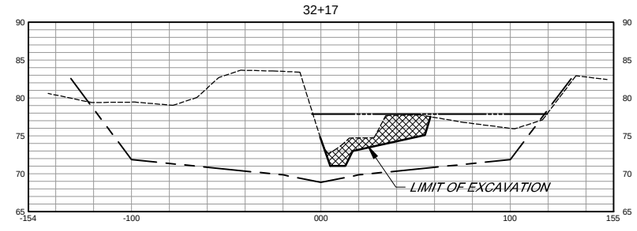


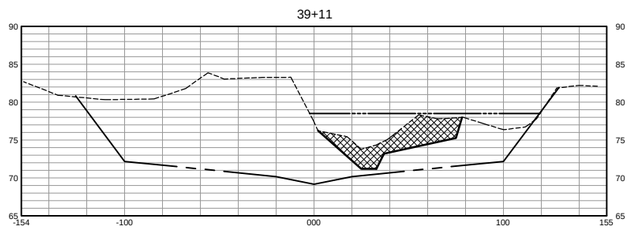


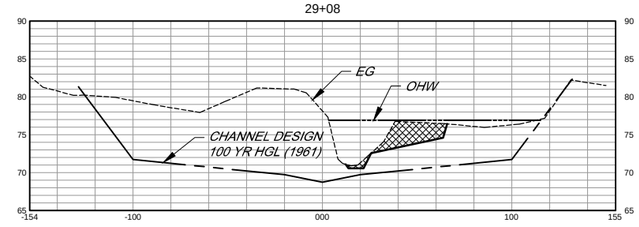






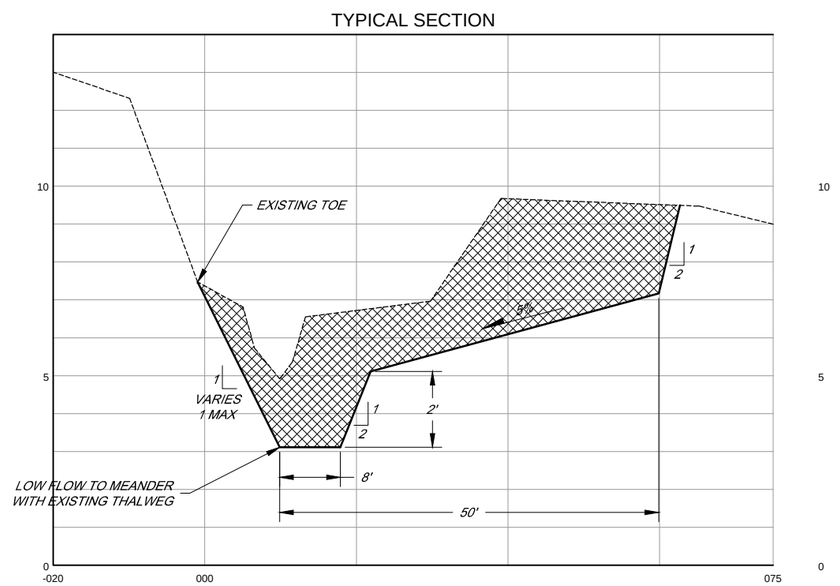






SECTIONS

SCALE: HORIZ 1" = 40'
VERT 1" = 10'



TYPICAL SECTION

SCALE: HORIZ 1" = 10'
VERT 1" = 2'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE:	24-Mar-10
DRAWN:	ADF
REVIEWED:	

LAGUNA - MARK WEST ZONE 1A

LAGUNA DE SANTA ROSA "D-LINE"

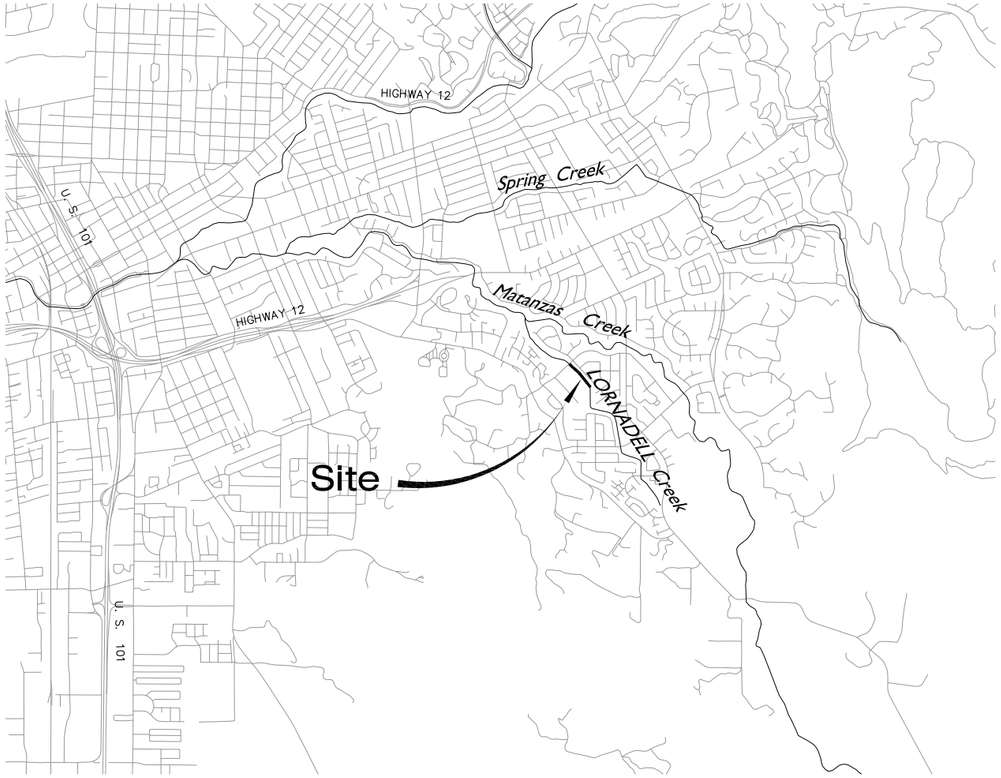
SECTIONS STA 26+00 TO 46+00

FILE NAME: 2009_C2-4.dwg
CONTRACT NUMBER:

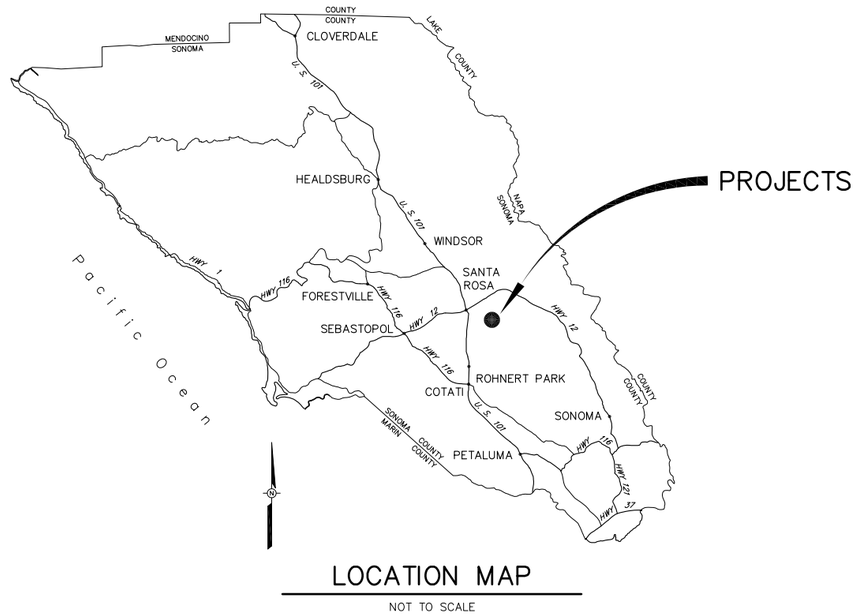
DRAWING NUMBER: C-5

SHEET 6 OF 6

\\Sd-data\Proj\Flood control\zone 1a\LAGUNA\2199_llano-stony_point\2009_C2-4



VICINITY MAP
SCALE: 1"= 4000'



LOCATION MAP
NOT TO SCALE

LORNADELL CREEK SEDIMENT REMOVAL

TACHEVAH DRIVE TO TAMARISK COURT

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

STAMP
Exp. M
STATE OF CALIFORNIA

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE :
DATE : 11/24/09
DRAWN : ----
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
LORNADELL CREEK SEDIMENT REMOVAL
LOCATION AND VICINITY MAP

FILE NAME: 08-03-21_0593-G.dwg
CONTRACT NUMBER: ####

DRAWING NUMBER: G-1

SHEET 1 OF 7

\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-G

LORNADELL CONCRETE CHANNEL (20,604 SQ. FT. BELOW OHW, 19,436 SQ. FT. ABOVE OHW)						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA OF WORK (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STA 20+70 TO STA 33+30	1,260'	10'	12,600	.4	186 (CITY REACH = 9)

INDEX TO DRAWINGS:

\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-G

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

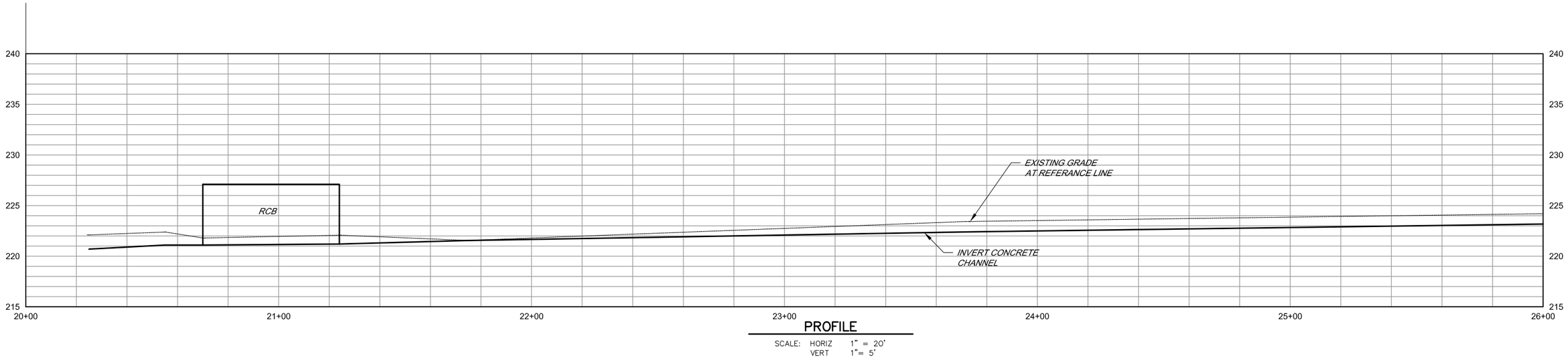
SCALE :
DATE : 11/24/09
DRAWN : ----
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
LORNADELL CREEK SEDIMENT REMOVAL
INDEX TO DRAWINGS AND TABLES

FILE NAME: 08-03-21_0593-G.dwg
CONTRACT NUMBER: ####

DRAWING NUMBER: G–2

SHEET 2 OF 7



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

PLAN

SCALE: 1" = 20'

60% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE :
DATE : 21/03/08
DRAWN : ADF
REVIEWED :

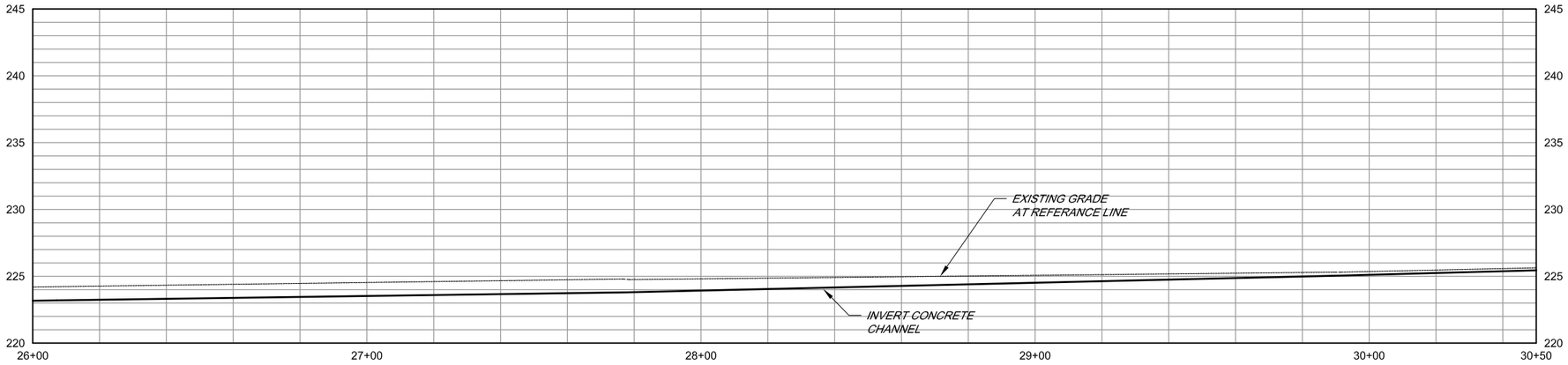
LAGUNA – MARK WEST ZONE 1A
LORNADEL CREEK SEDIMENT REMOVAL
STA 20+25 TO STA 26+00

FILE NAME: 0593-01_air-crk_c.dwg
CONTRACT NUMBER: ####

DRAWING NUMBER: C-5

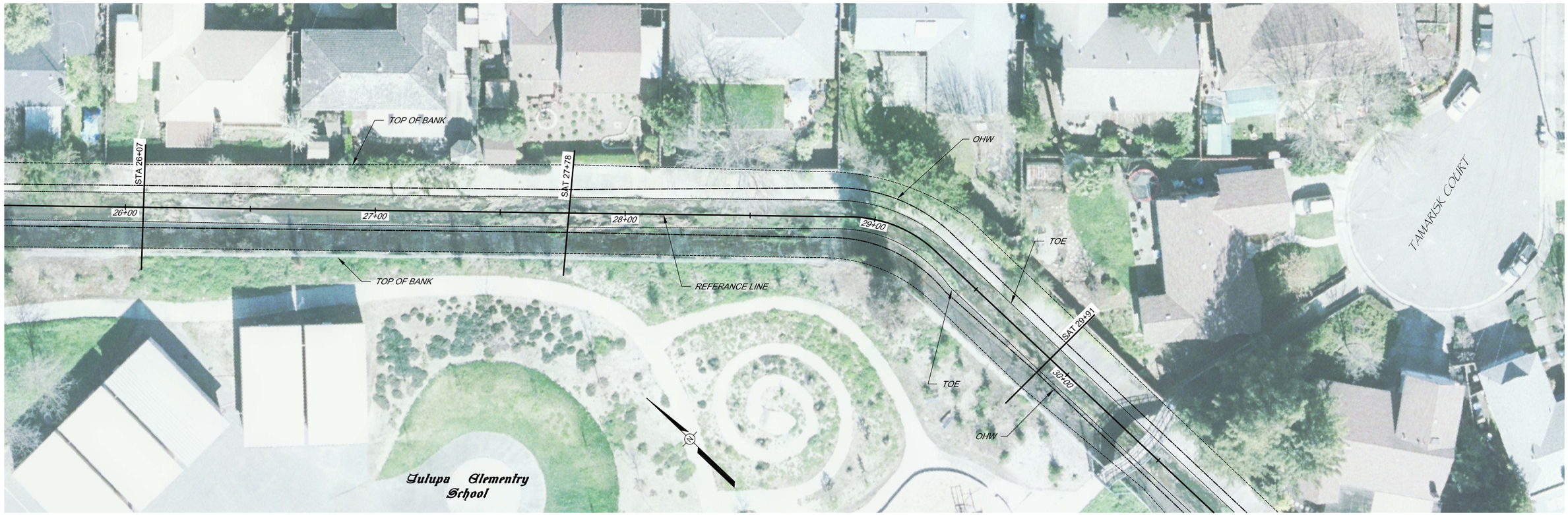
SHEET 7 OF 8

\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-C



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1" = 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

60% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE :
DATE : 21/03/08
DRAWN : ADF
REVIEWED :

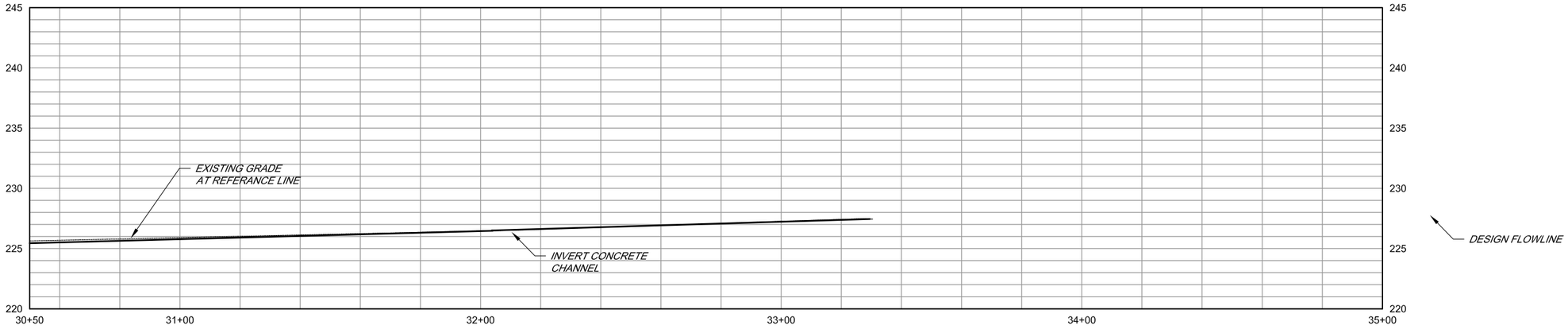
LAGUNA – MARK WEST ZONE 1A
LORNADEL CREEK SEDIMENT REMOVAL
STA 26+00 TO STA 30+50

FILE NAME: 0593-01_air-crk_c.dwg
CONTRACT NUMBER: ####

DRAWING NUMBER: C-5

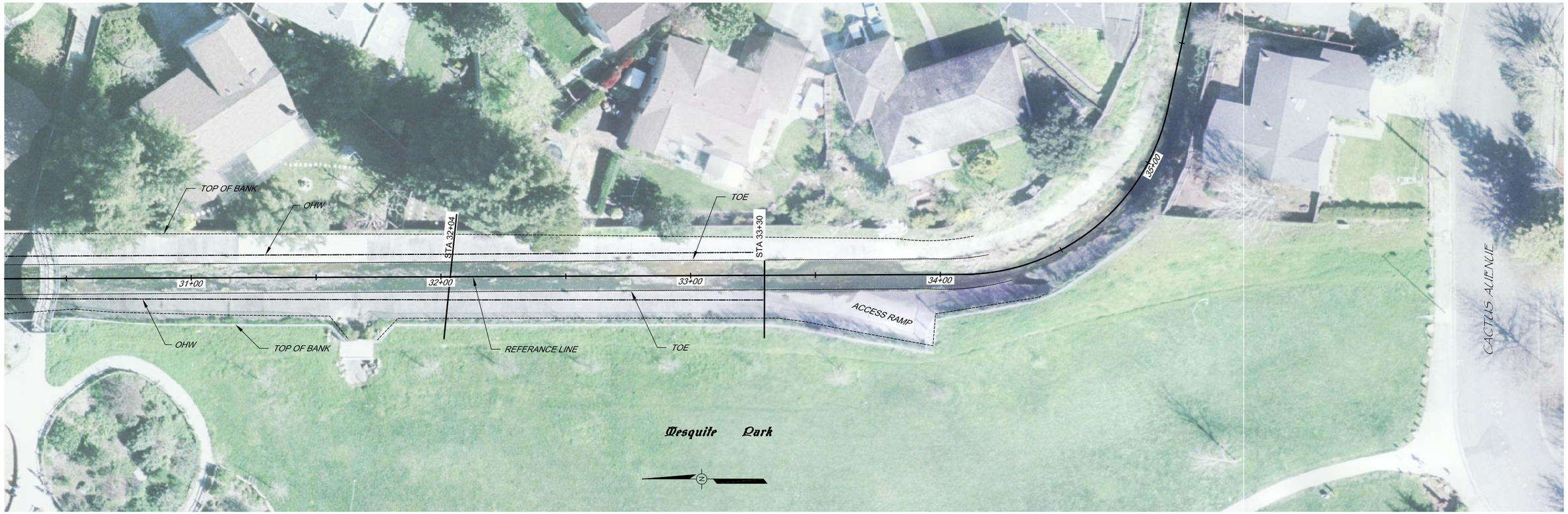
SHEET 7 OF 8

\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-C



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



PLAN

SCALE: 1" = 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

60% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE :
DATE : 21/03/08
DRAWN : ADF
REVIEWED :

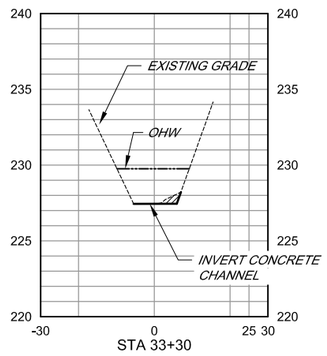
LAGUNA – MARK WEST ZONE 1A
LORNADEL CREEK SEDIMENT REMOVAL
STA 30+50 TO STA 35+50

FILE NAME: 0593-01_air-crk_c.dwg
CONTRACT NUMBER: ####

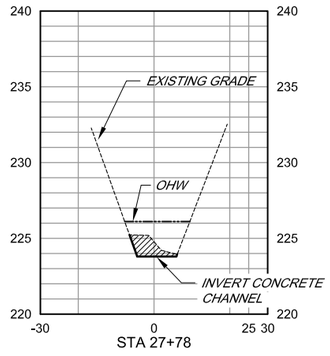
DRAWING NUMBER: C-5

SHEET 7 OF 8

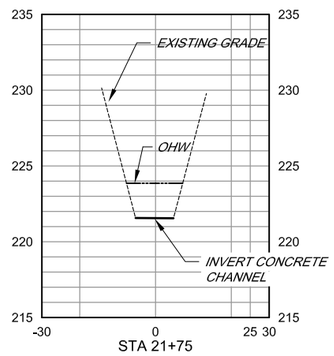
\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-C



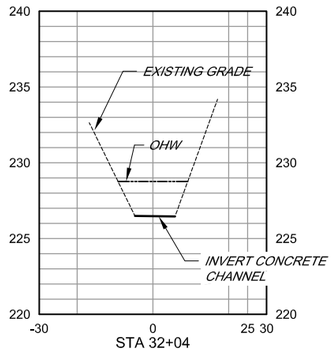
STA 33+30



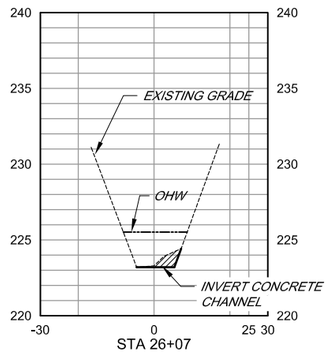
STA 27+78



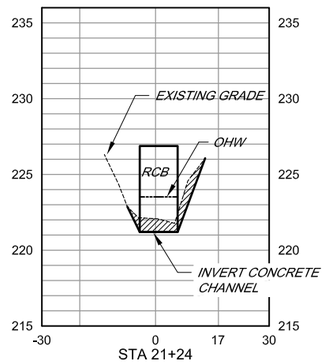
STA 21+75



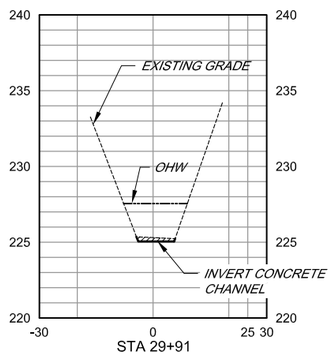
STA 32+04



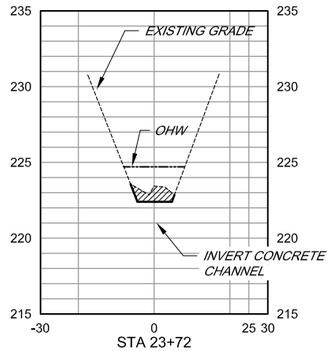
STA 26+07



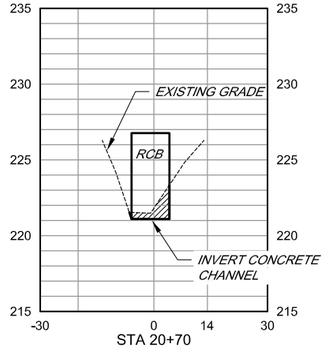
STA 21+24



STA 29+91



STA 23+72



STA 20+70

LEGEND:

SEDIMENT TO BE REMOVED

SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

60% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH, ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-C

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

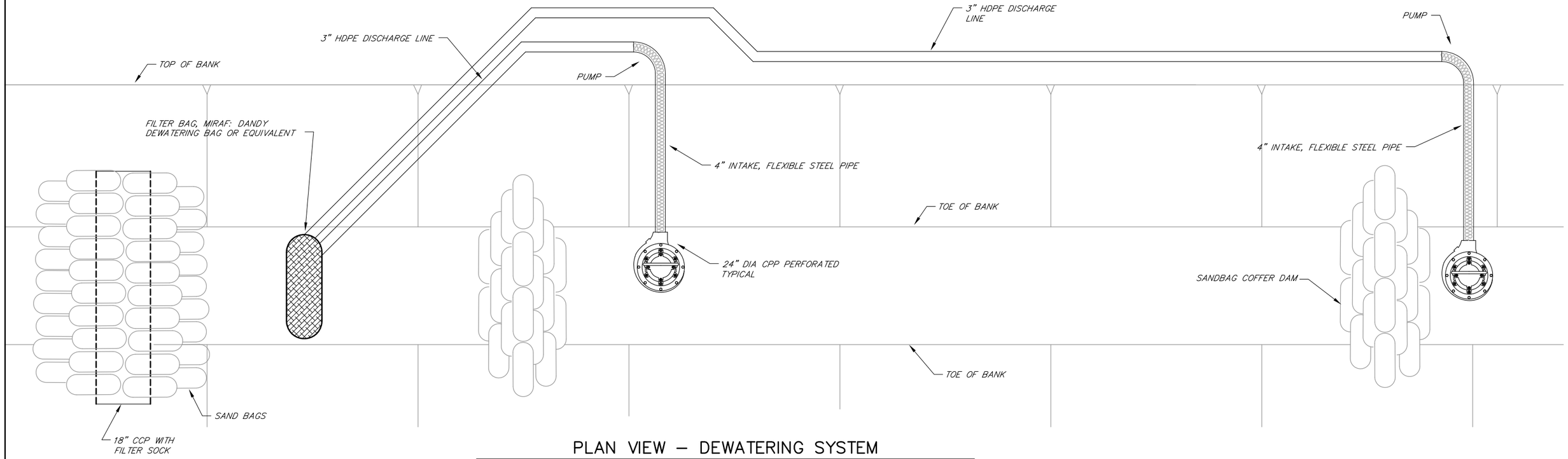
SCALE :
DATE : 21/03/08
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
LORNADEL CREEK SEDIMENT REMOVAL
SECTIONS

FILE NAME: 0593-01_air-crk_c.dwg
CONTRACT NUMBER: ####

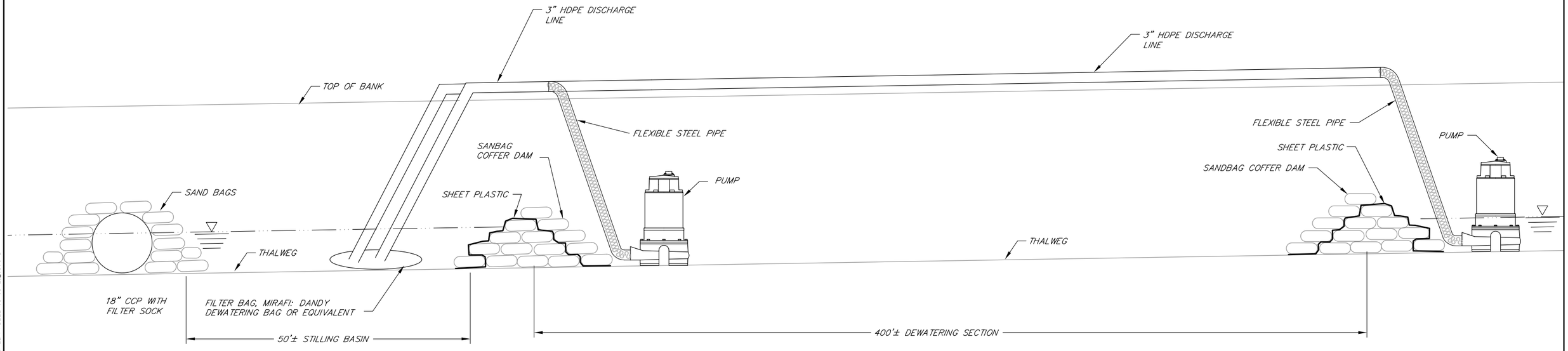
DRAWING NUMBER: C-5

SHEET 7 OF 8



PLAN VIEW – DEWATERING SYSTEM

NOT TO SCALE



PROFILE VIEW – DEWATERING SYSTEM

NOT TO SCALE

90% SUBMITTAL

STAMP
Exp. M/D/Y
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY

PRELIMINARY
SUBJECT TO REVISION

SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 24–Nov–09
DRAWN : A. FACENDINI
REVIEWED :

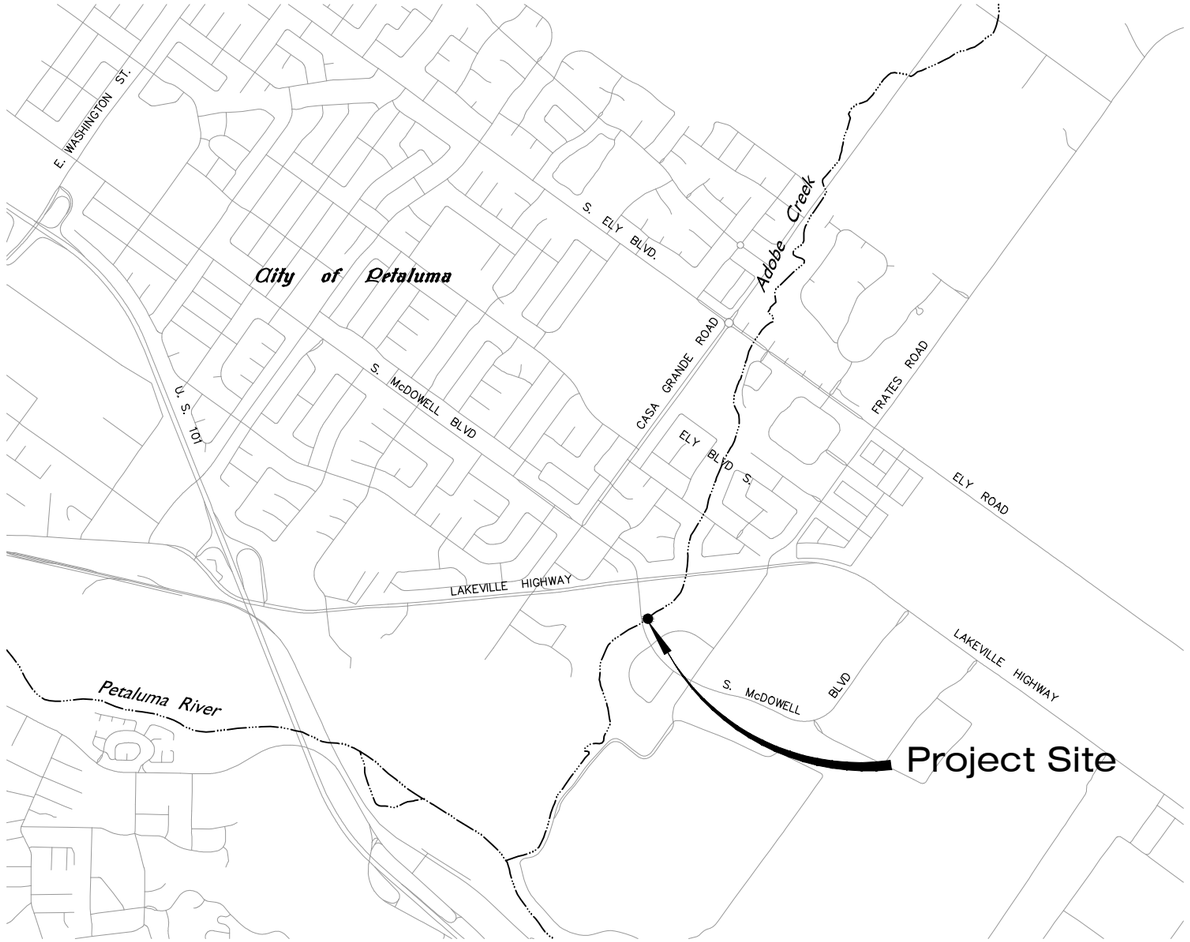
LAGUNA – MARK WESTZONE 1A
LORNADEL CHANNEL SEDIMENT REMOVAL DETAILS

FILE NAME: 08–03–21_0593–D.dwg
CONTRACT NUMBER: 1–4142/014–7 #

DRAWING NUMBER: D–1

SHEET 8 OF 8

\\Sd-data\Proj\flood control\zone 1a\LORNADELL\08-03-21_0593-D



VICINITY MAP

NOT TO SCALE

LOCATION MAP

NOT TO SCALE

ADOBE CREEK SEDIMENT REMOVAL

(SEDIMENT BASIN)

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G–1	INDEX TO DRAWINGS,LOCATION AND VICINITY MAPS
2.	C–1	PLAN AND DETAILS
3.	C–2	DESIGN SECTIONS

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

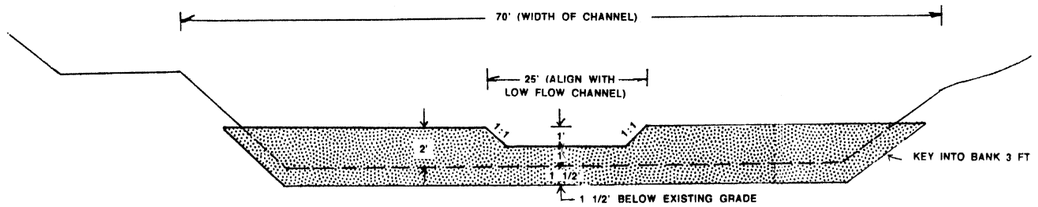
SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 2–Mar–10
DRAWN : ----
REVIEWED :

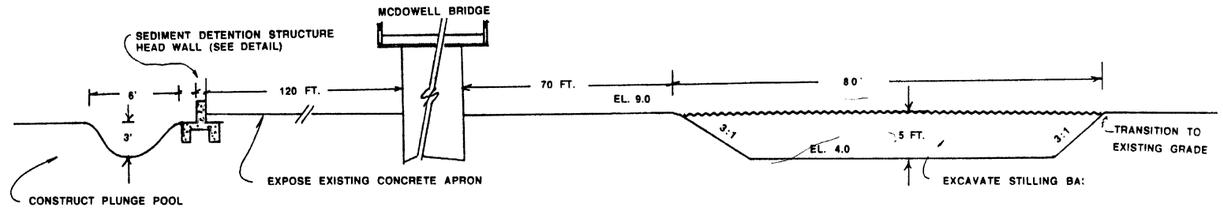
PETALUMA BASIN ZONE 2A
ADOBE CREEK SEDIMENT REMOVAL
INDEX TO DRAWINS, LOCATION AND VICINITY MAPS

FILE NAME: G–1.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G–1
SHEET 1 OF 2

\\Sd-data\Proj\flood control\zone 2a\adobe creek\SED-BASIN_adobe\G-1



SEDIMENT DETENTION STRUCTURE--FRONT VIEW
N.T.S.
(DESIGN)



SEDIMENT DETENTION STRUCTURE--PROFILE
N.T.S.
(DESIGN)

PLAN
SCALE: 1"= 20'

AREA OF EXCAVATION = 3,600 SQUARE FEET
(BELOW O.H.W.)

VOLUME OF EXCAVATION = 500 CUBIC YARDS.

BAR LENGTH ON ORIGINAL
DRAWING EQUALS ONE INCH.
ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY

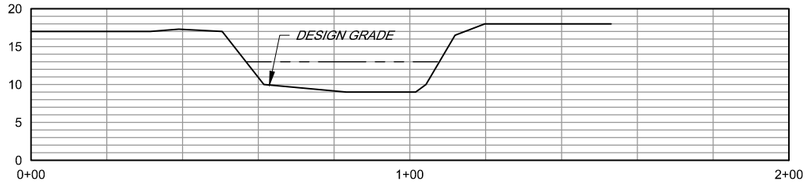
SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE: 3/2/10
DRAWN: ADF
REVIEWED:

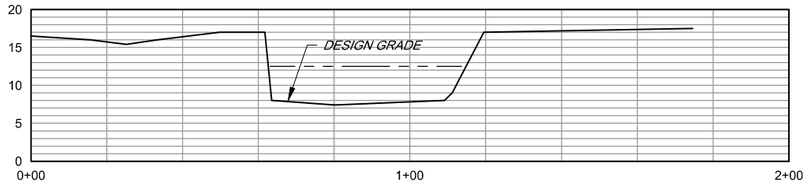
PETALUMA BASIN ZONE 2A
ADOBE CREEK
SEDIMENT REMOVAL PLAN AND DETAILS

FILE NAME:
CONTRACT NUMBER:
DRAWING NUMBER: C-1
SHEET 2 OF 3

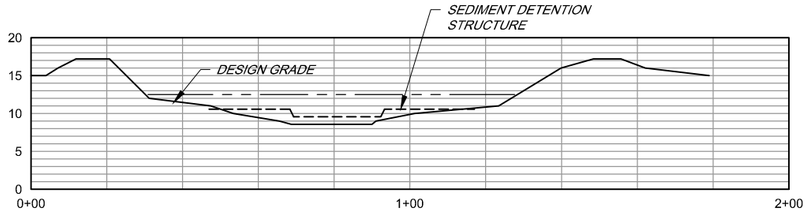
\\Sd-data\Proj\flood control\zone 2a\adobe creek\SED-BASIN_adobe\377_C-adobe



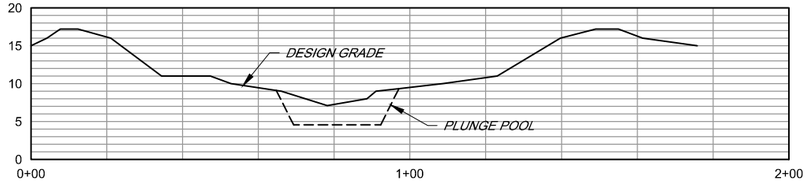
SECTION 4



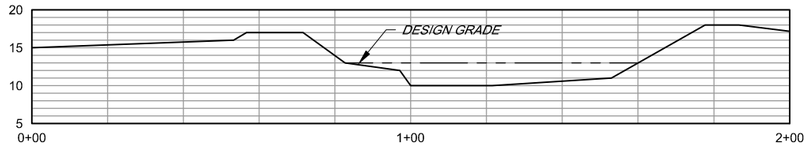
SECTION 3



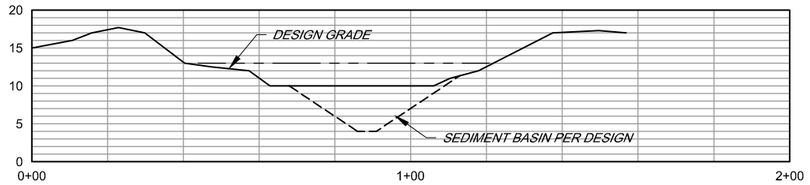
SECTION 2



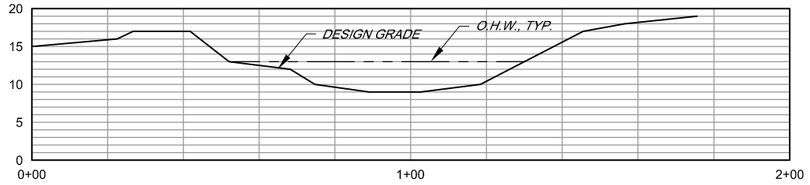
SECTION 1



SECTION 7



SECTION 6



SECTION 5

NOTE:
SECTIONS DRAWN FROM DESIGN CONTOURS SHOWN ON THE DESIGN PLAN PRIOR TO CONSTRUCTION OF SEDIMENT DETENTION BASIN AND SEDIMENT DETENTION STRUCTURE

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

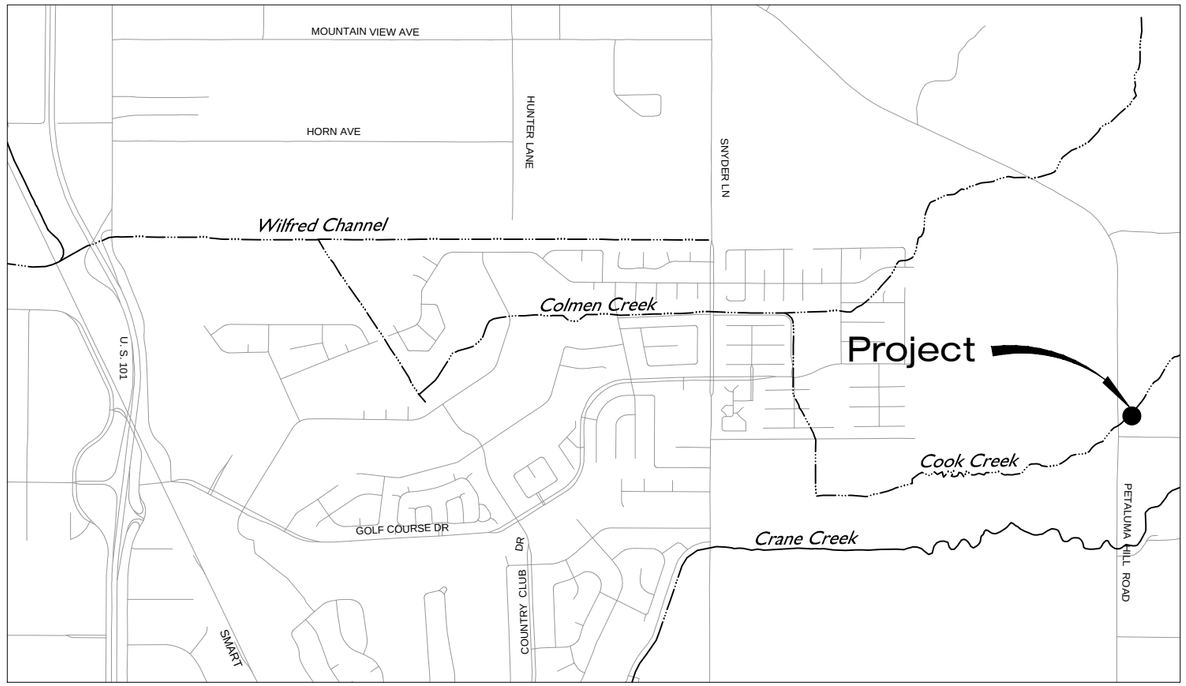
SCALE : AS SHOWN
DATE : 3/2/10
DRAWN : ADF
REVIEWED :

PETALUMA BASIN ZONE 2A
ADOBE CREEK
SEDIMENT REMOVAL DESIGN SECTIONS

FILE NAME:
CONTRACT NUMBER:
DRAWING NUMBER: C-2
SHEET 3 OF 3

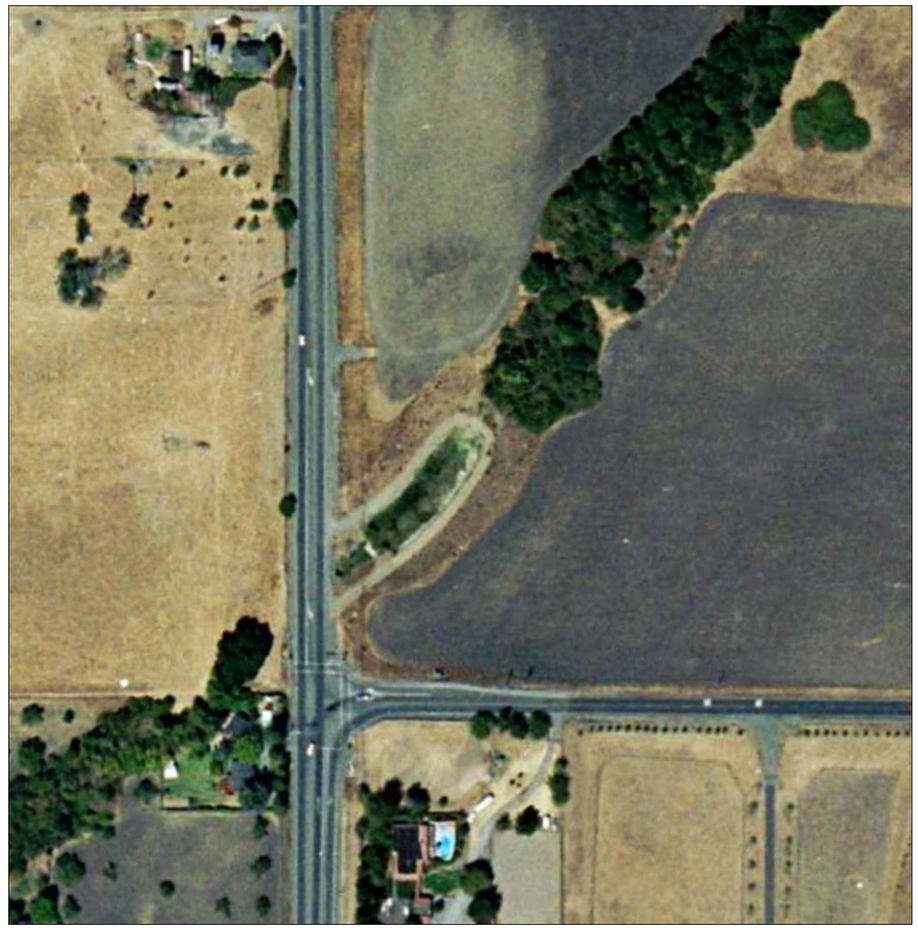
\\Sd-data\Proj\flood control\zone 2a\adobe creek\SED-BASIN_adobe\377_C.adobe

COOK CREEK
SEDIMENT BASIN
SEDIMENT REMOVAL



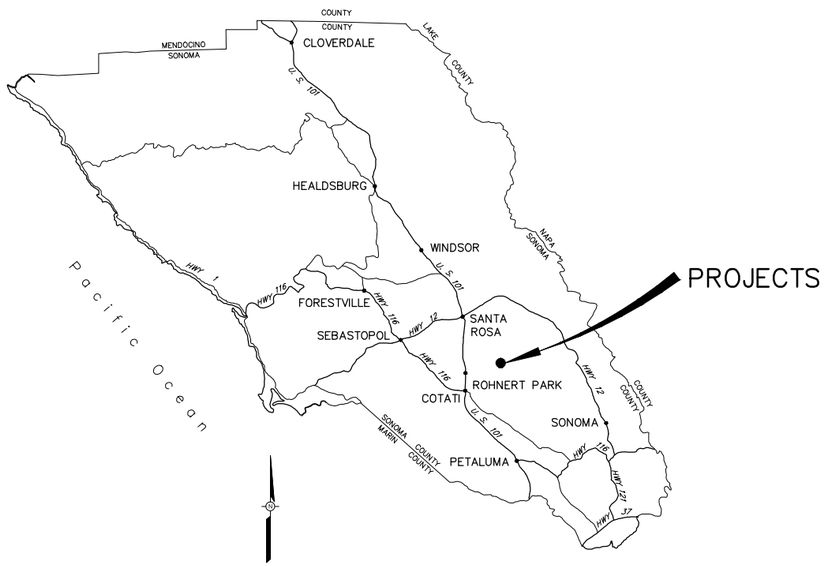
VICINITY MAP

NOT TO SCALE



AERIAL

NOT TO SCALE



LOCATION MAP

NOT TO SCALE

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G–1	INDEX TO DRAWINGS, AERIAL, LOCATION AND VICINITY MAPS
2.	1–4131/040/010–102.3	GRADING PLAN

SEDIMENT REMOVAL:
AREA = 10,000 Square Feet
VOLUME = 100 Cubic Yards

90% SUBMITTAL

LAGUNA – MARK WEST ZONE 1A

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

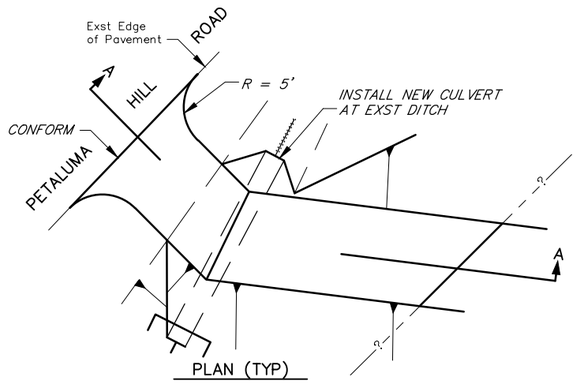
SONOMA COUNTY WATER AGENCY

SCALE : NONE
DATE : 3/3/10
DRAWN : ADF
REVIEWED :

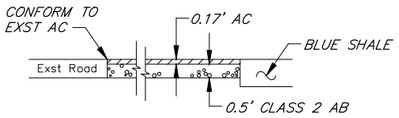
COOK CREEK SEDIMENT BASIN
INDEX TO DRAWINGS, AERIAL
LOCATION AND VICINITY MAPS

FILE NAME: 2010_G–1.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G–1
SHEET 1 OF 2

\\Sd-data\Proj\flood control\core 1a\cook crk basin\sed-removal\2010_G-1



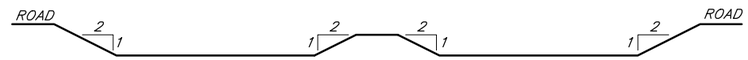
PLAN (TYP)



SECTION A–A

STANDARD DRIVEWAY DETAILS

NOT TO SCALE



SECTION B–B

NOT TO SCALE

PETALUMA HILL ROAD

Edge of A.C.

A.C. DWY

OHE

Gate

Dirt Road

PP

200

205

210

195

R/W

CONFORM

3:1

S = 0.12484

TYP 8%

12' SHALE ROAD

6'

2:1

WARP

FG 187.24

FG 187.48

FG 187.72

FG 187.96

FG 188.24

FG 188.50

FG 188.75

FG 188.88

FG 189.00

N 47°23'42" E 12.00'

N 47°12'00" E 94.00'

N 35°37'17" E 143.00'

FG 190.66

FG 189.24

FG 187.00

FG 188.38

FG 188.20

FG 188.56

FG 188.38

N 57°15'20" E 42.41'

8'x5' RCB

S 55°43'51" W

12" cmp

FG 197.90

FG 194.04

FG 198.14 S=0.133±

FG 194.28

Trans. Slab

N 255600
E 1809300

T/B

COOK CREEK

N 255300
E 1809300

AREA OF SEDIMENT REMOVAL

CRANE CANYON ROAD

20 0 20 40 80

SCALE : 1" = 20'

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	1" = 20'
DATE :	MARCH 5, 1998
DRAWN :	JLW
CHECKED :	

APPROVED DEPUTY CHIEF ENGINEER	RCE C54302
SUBMITTED	RCE C046862
DESIGNED	RCE C046862

LAGUNA – MARK WEST ZONE 1A

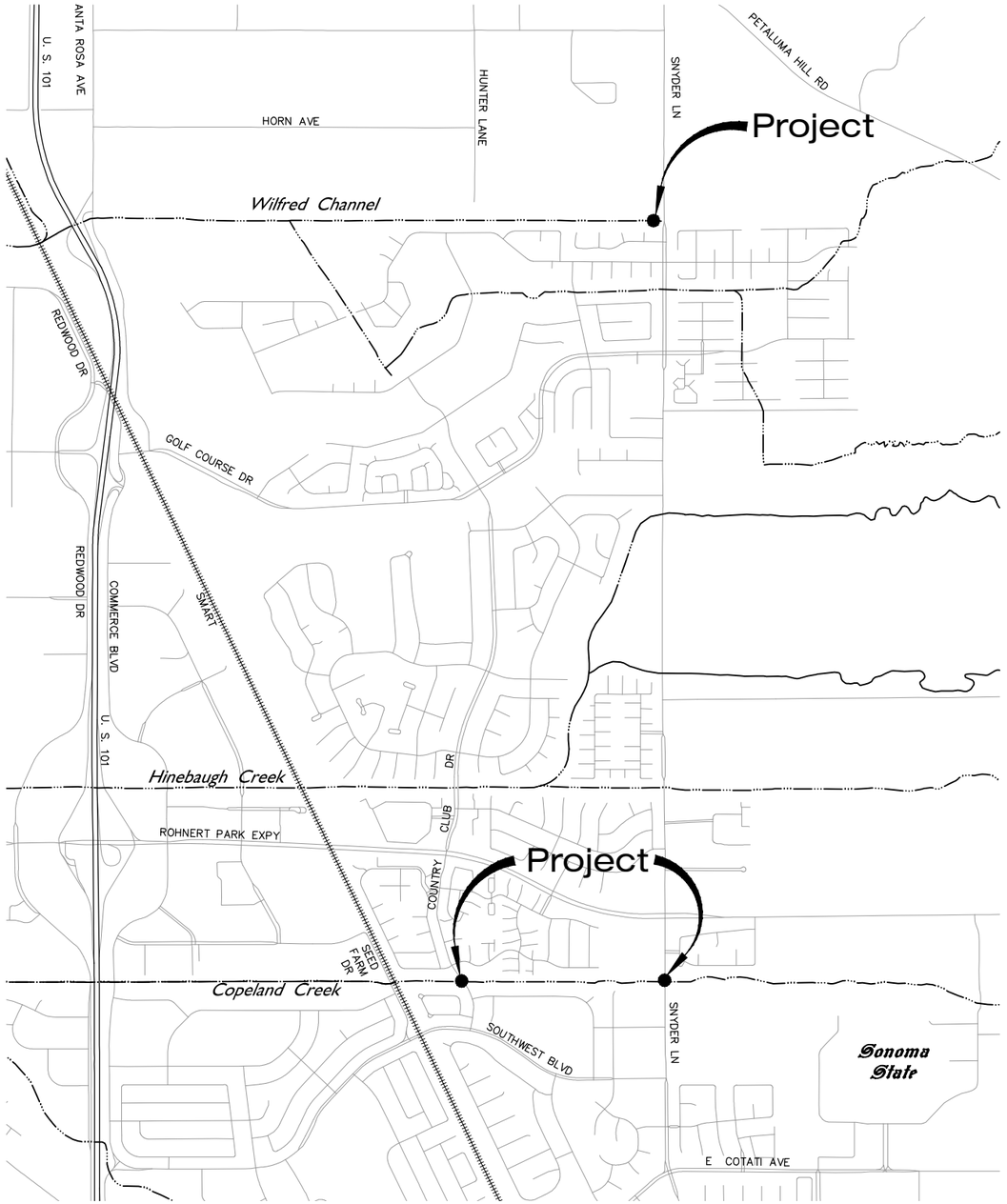
COOK CREEK SEDIMENT BASIN GRADING PLAN

P:\1-DWGS\FLOOD CONTROL\ZONE 1A\COOK CRK BASIN\PHRSB004

DRAWING NUMBER 1-4131/040/010-102.3

SHEET NO. 4 OF 6

COPELAND CREEK
AND
WILFRED CHANNEL SEDIMENT REMOVAL



VICINITY MAP

NOT TO SCALE

LOCATION MAP

NOT TO SCALE

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G–1	INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS
		COPELAND CREEK
2.	C–1	PLAN AND SECTIONS STA 49+00 TO STA 51+75
3.	C–2	PLAN AND SECTIONS STA 77+00 TO STA 80+00
		WILFRED CHANNEL
4.	C–3	PLAN AND SECTIONS STA 76+00 TO STA 79+00

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\Flood control\zone 1a\copeland\sediment_removal\2010\2010_G1_COPELAND

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

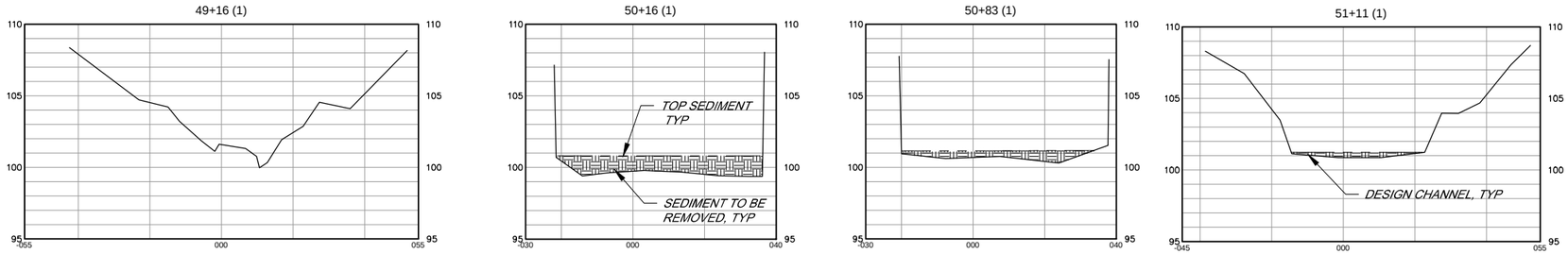
SCALE:	AS SHOWN
DATE :	10–Mar–10
DRAWN :	A. FACENDINI
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
SEDIMENT REMOVAL
INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS

FILE NAME: 2010_G1_COPELAND.dwg
CONTRACT NUMBER: 1–4142/014–7 #

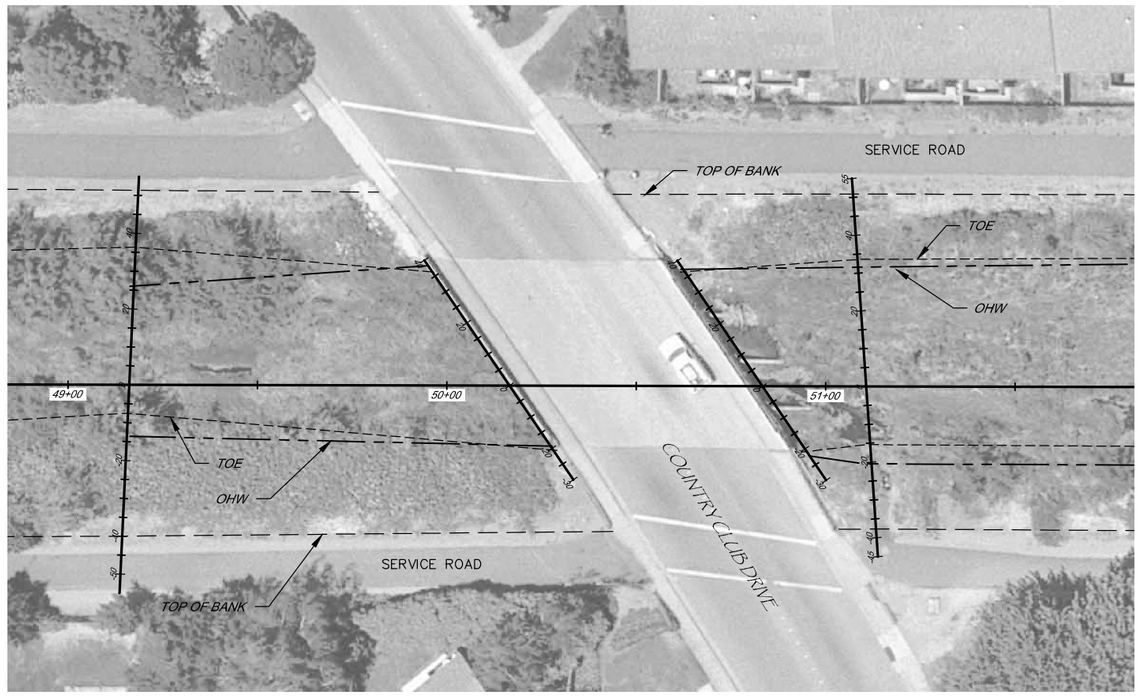
DRAWING NUMBER: G–1

SHEET 1 OF 10



SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 4'



PLAN

SCALE: 1"= 20'

COPELAND CREEK						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STA 49+60 TO STA 51+60	200	45	9000	1	333

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH, ADJUST SCALE ACCORDINGLY

NOTE:
AERIAL PHOTOGRAPHY FLOWN IN 2000

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

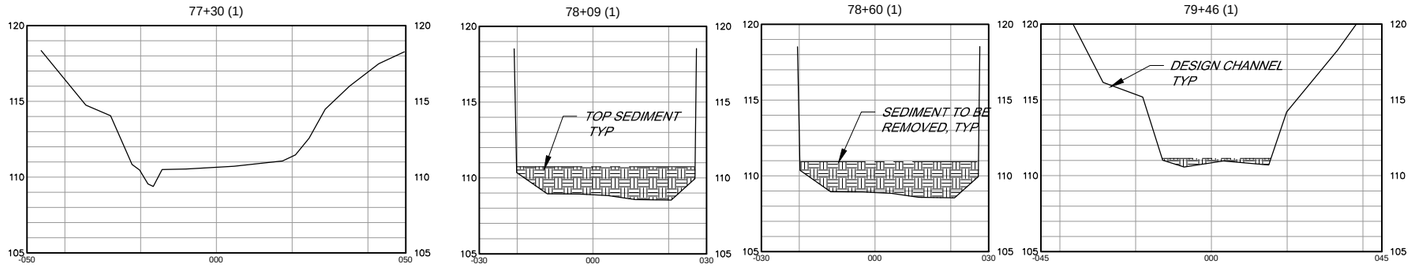
SONOMA COUNTY WATER AGENCY

SCALE : AS SHOWN
DATE : 1/18/2008
DRAWN : A. Facendini
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
COPELAND CREEK SEDIMENT REMOVAL
STA 49+00 TO STA 51+75

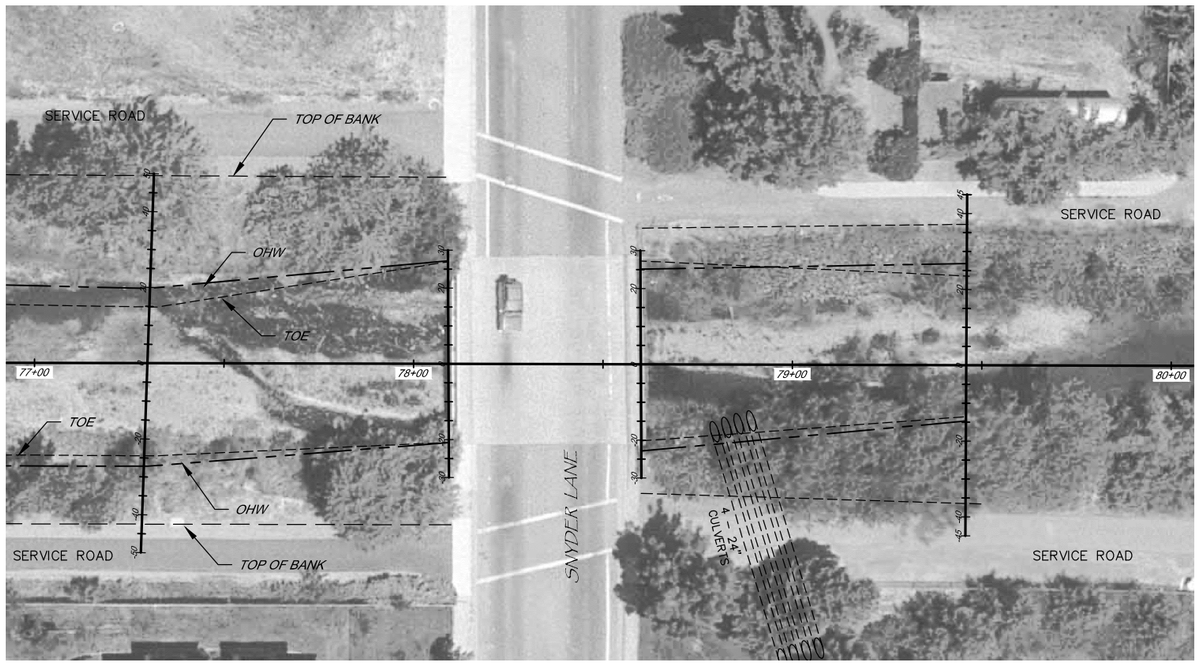
FILE NAME: 2010_ C1-2_COPELAND.dwg
CONTRACT NUMBER: 1-4142/014-7 #
DRAWING NUMBER: C-1
SHEET 3 OF 10

\\Sd-data\Proj\Flood control\zone 1a\copeland\sediment_removal\2010-2010_ C1-2_COPELAND



SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 4'



PLAN

SCALE: 1"= 20'

COPELAND CREEK						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STA 77+50 TO STA 79+55	205	45	9,225	2	683

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NOTE:
AERIAL PHOTOGRAPHY FLOWN IN 2000

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

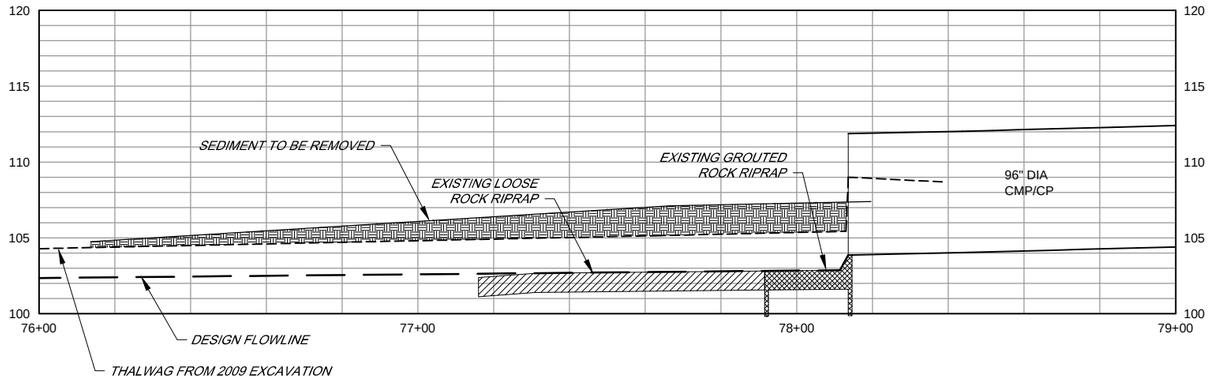
SONOMA COUNTY WATER AGENCY

SCALE : AS SHOWN
DATE : 1/18/2008
DRAWN : A. Facendini
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
COPELAND CREEK SEDIMENT REMOVAL
STA 77+50 TO STA 80+00

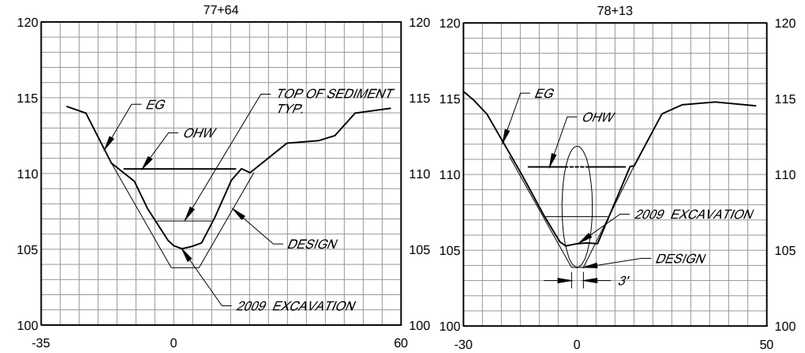
FILE NAME: 2010_ C1-2_COPELAND.dwg
CONTRACT NUMBER: 1-4142/014-7 #
DRAWING NUMBER: C-5
SHEET 7 OF 10

\\Sd-data\Proj\flood control\zone 1a\copeland\sediment_removal\2010\2010_ C1-2_COPELAND



PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'



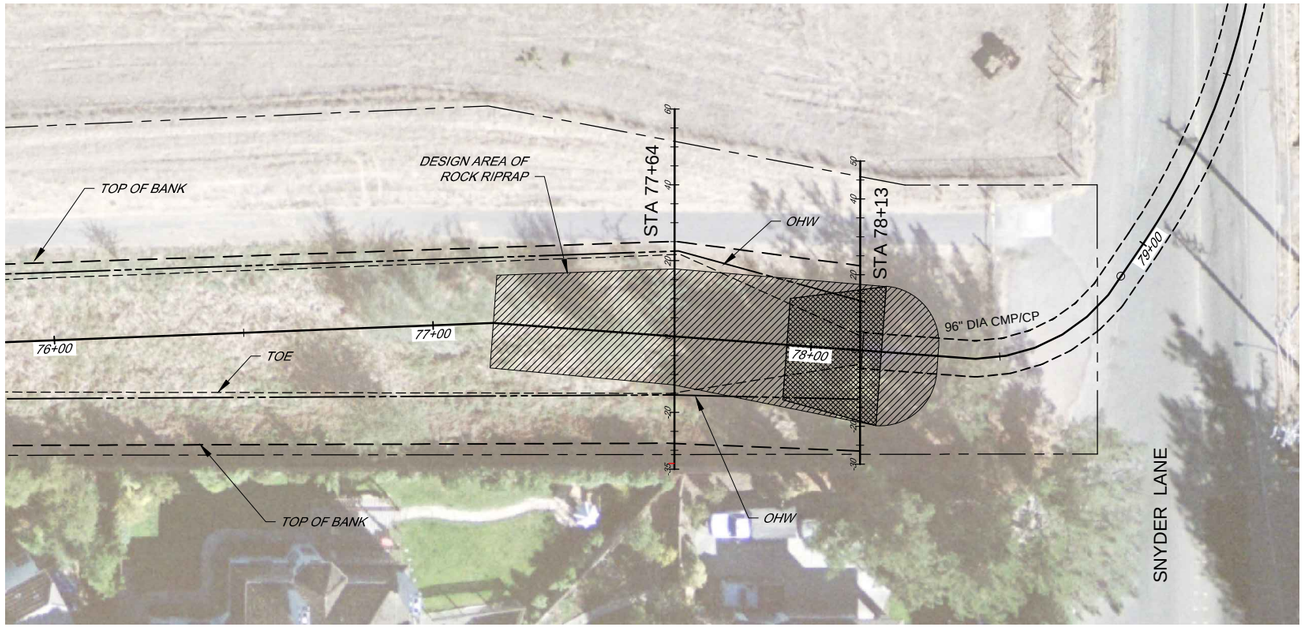
SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

WILFRED CREEK

EXCAVATION

PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OPERATING FROM SERVICE ROAD	STA 76+14±± TO STA 78+14	200	14	2800	1	104



PLAN

SCALE: 1"= 20'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\flood control\zone 1a\WILFRED\2010\C

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE: NONE
DATE : 9-Mar-10
DRAWN : ADF
REVIEWED :

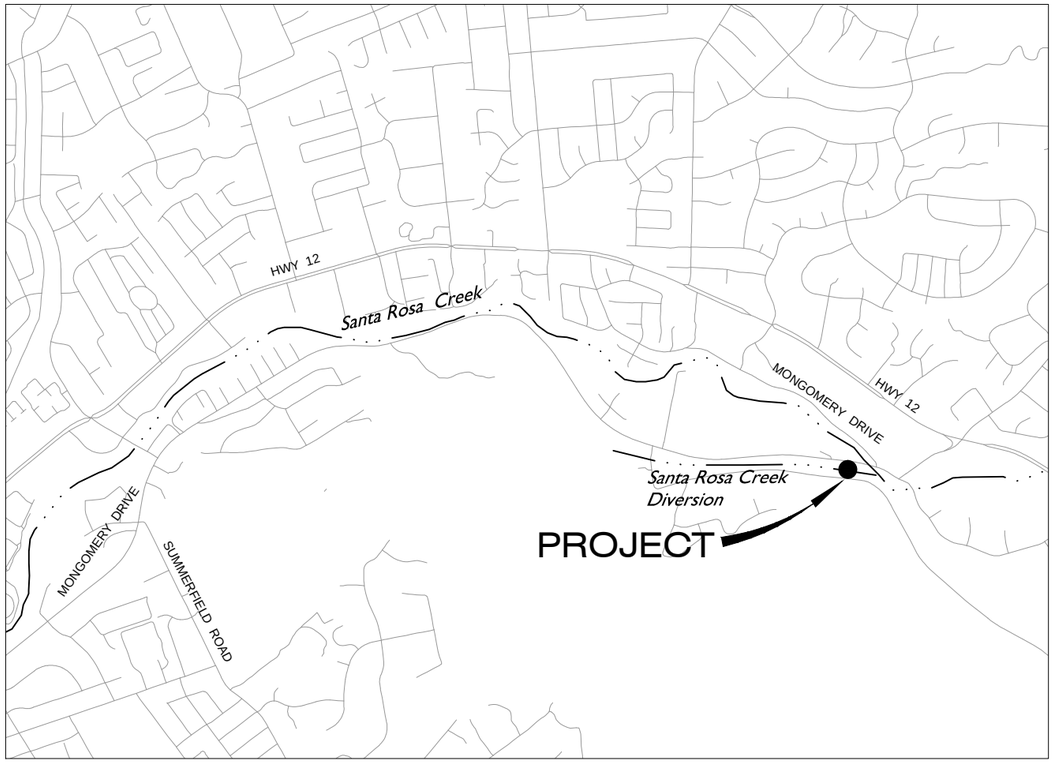
LAGUNA - MARK WEST ZONE 1A
WILFRED CREEK SEDIMENT REMOVAL
STA 76+00 TO STA 79+00

FILE NAME: C.dwg
CONTRACT NUMBER: ##########

DRAWING NUMBER: C-3

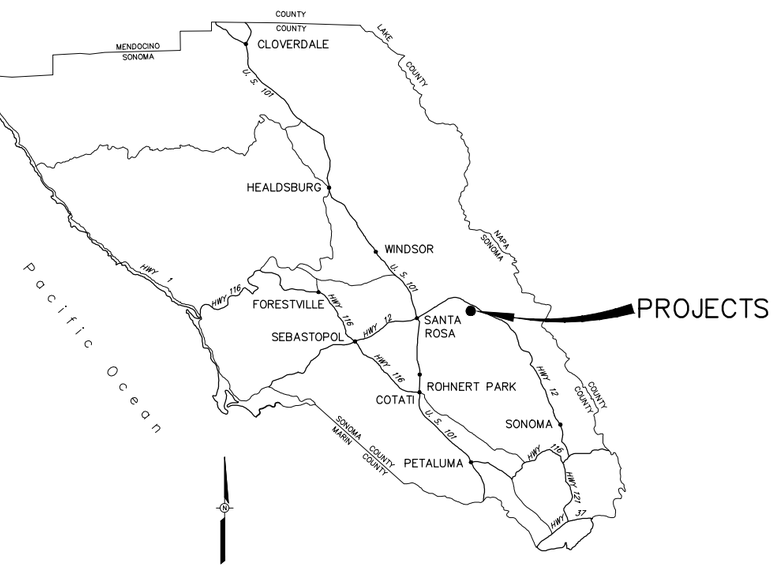
SHEET 4 OF 4

SANTA ROSA CREEK DIVERSION
STRUCTURE SEDIMENT REMOVAL



VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G–1	INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS
2.	C–1	AERIAL AND VIEWS
3.	1–9140–102.5	DIVERSION PLAN, AS–BUILT

NOTE:
AREA SEDIMENT REMOVAL 6,200 SQUARE FEET
VOLUME 300 CUBIC YARDS
SEDIMENT TO BE REMOVED.

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE : NONE
DATE : 3/2/10
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
SANTA ROSA CREEK DIVERSION
INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS

FILE NAME: G–1.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G–1
SHEET 1 OF 3

\\Sd-data\Proj\flood control zone 1a\SantaRosa Vortex_Chan-Sediment_Removal\G-1

VIEW– LOOKINK DOWNSTREAM

NTS

AERIAL (2008)

SCALE: 1"= 20'

VIEW– LOOKING UPSTREAM

NTS

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

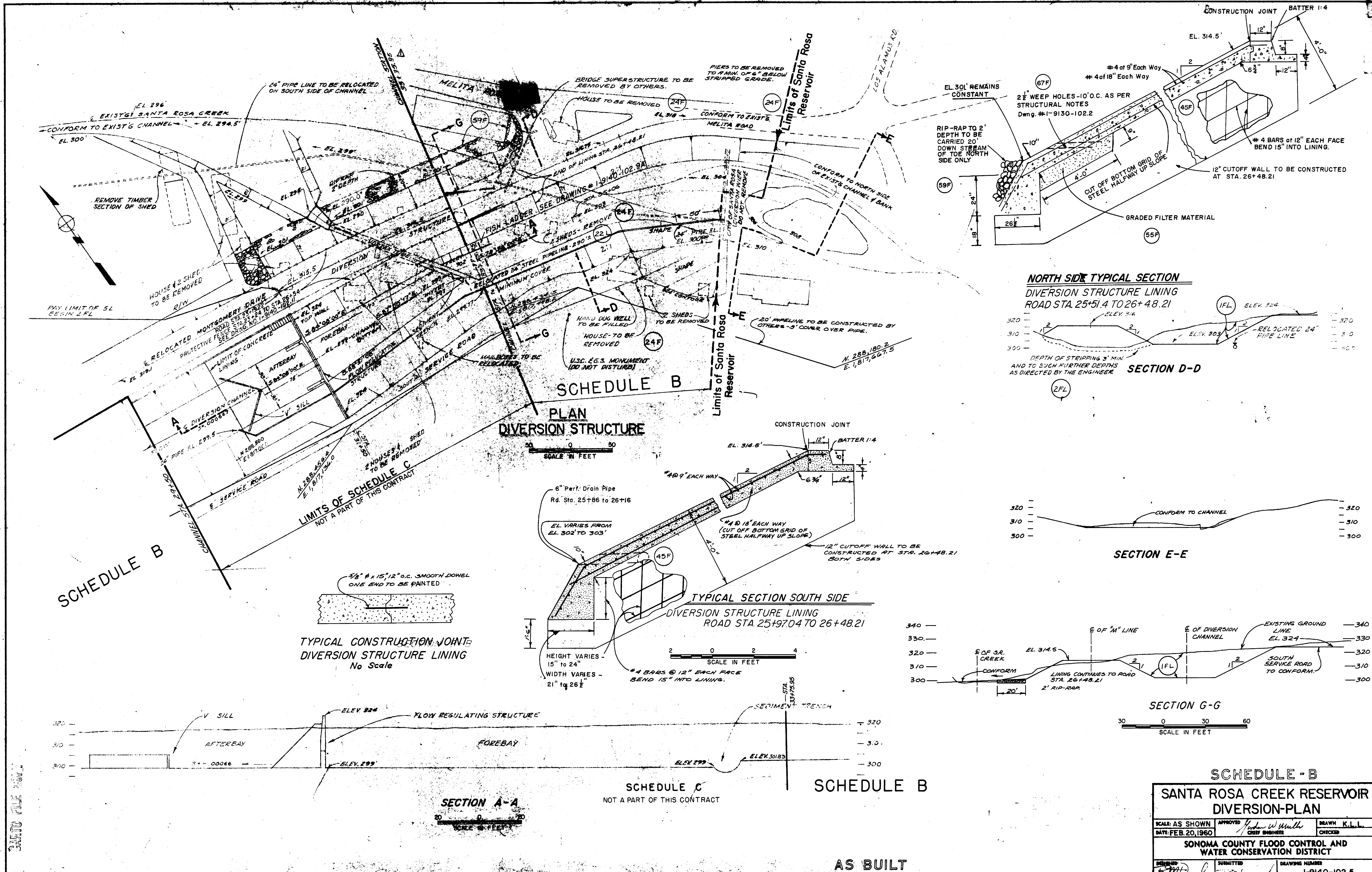
SANTA ROSA CREK DEVERSION SEDIMENT REMOVAL AERIAL AND VIEWS

FILE NAME: C-1_PLAN.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C–1

SHEET OF

\\Sd-data\Proj\Flood control\zone 1a\SantaRosa\Vortex_Chan-Sediment_Removal\C-1_PLAN



SCHEDULE - B

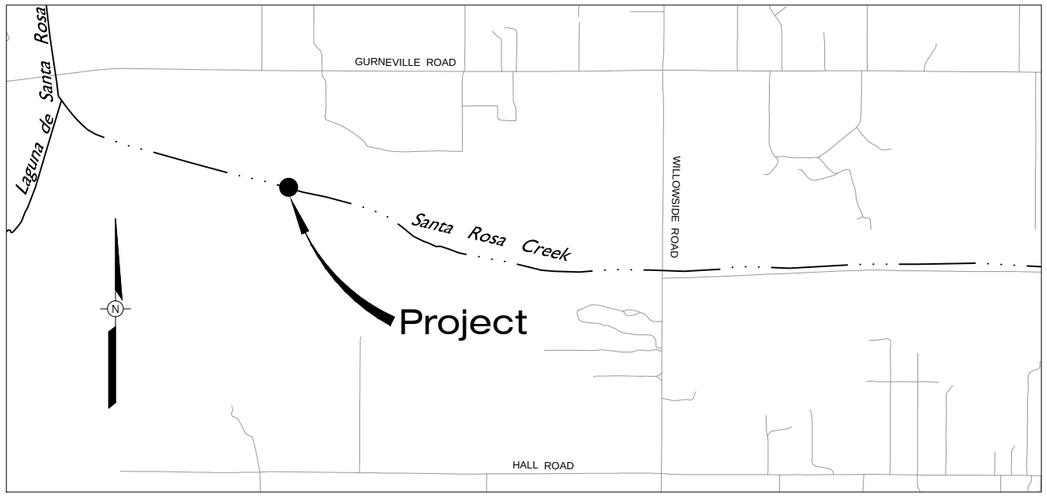
SANTA ROSA CREEK RESERVOIR
DIVERSION-PLAN

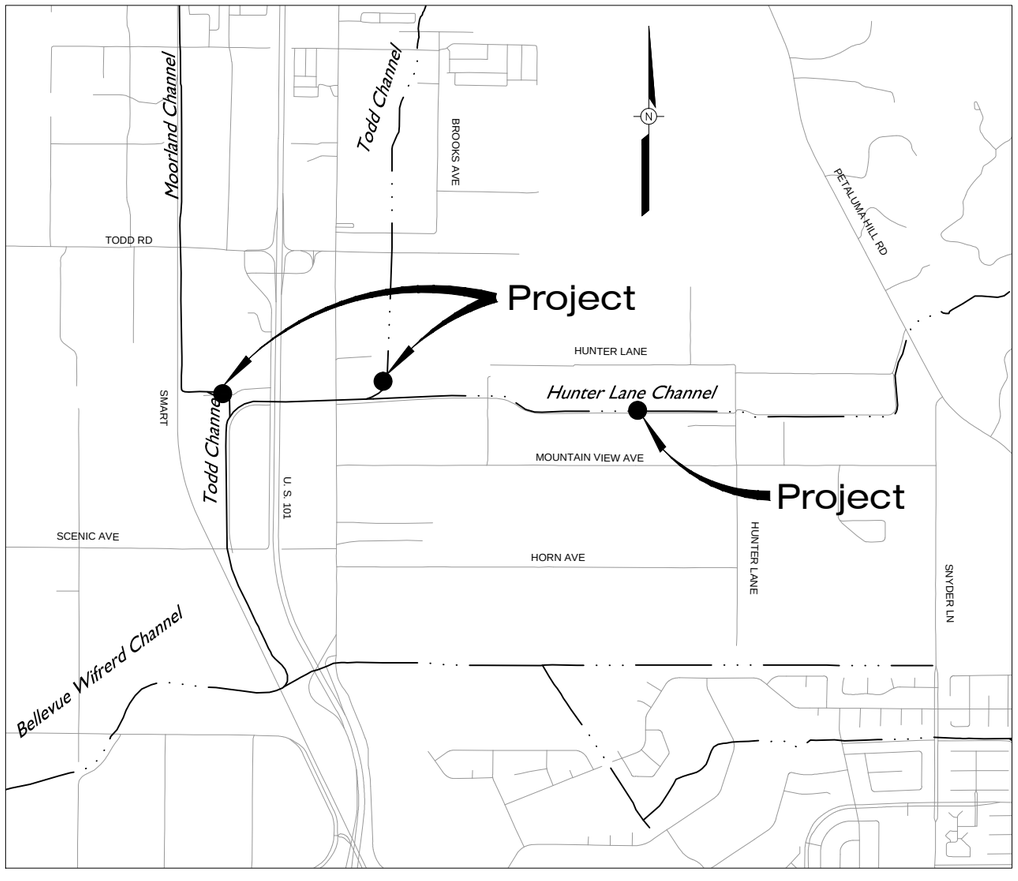
SCALE: AS SHOWN	APPROVED: [signature] CHIEF ENGINEER	DRAWN: K.L.L.
DATE: FEB. 20, 1960		CHECKED

SONOMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED	SUBMITTED	DRAWING NUMBER
[signature]	[signature]	1-9140-102.5

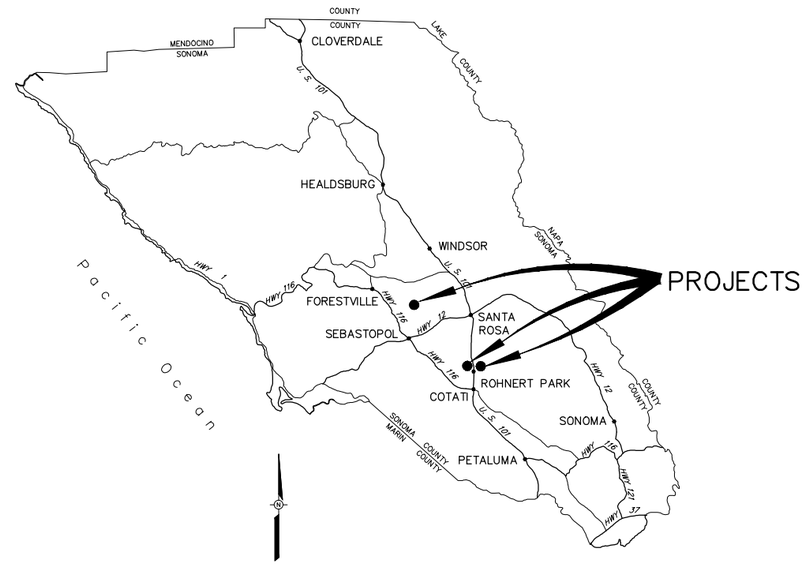
BANK REPAIR
MOORLAND CHANNEL
TODD CHANNEL
HUNTER LANE CHANNEL
and
SANTA ROSA CREEK





VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G–1	LOCATION AND VICINITY MAPS
	MOORLAND	
2.	C–1	BANK AND CHANNEL BOTTOM REPAIR PLAN, SECTION AND VIEWS
	TODD CHANNEL	
3.	C–2	PLAN AND VIEWS
	HUNTER LANE CHANNEL	
4.	C–3	PLAN AND VIEWS
	SANTA ROSA CREEK	
5.	C–4	PLAN AND SECTION

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH, ADJUST SCALE ACCORDINGLY

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

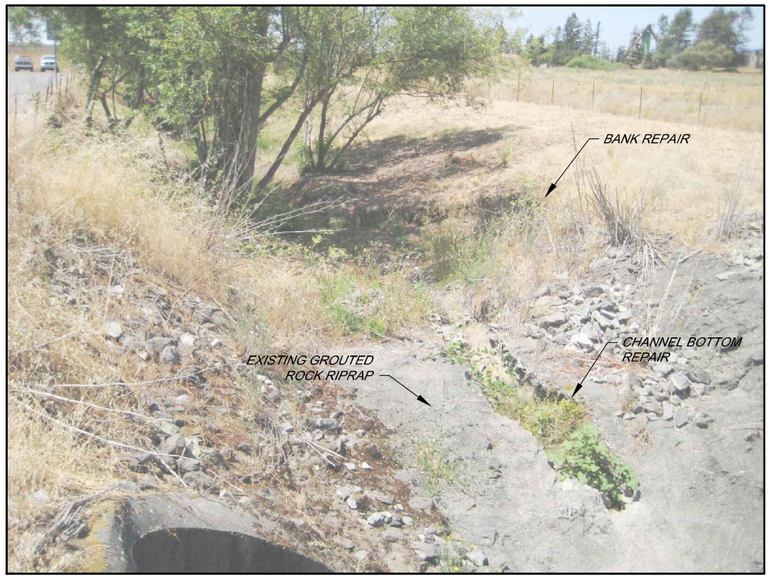
SCALE : NONE
DATE : 2/23/10
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A

MOORLAND, TODD, HUNTER LANE CHANNELS
AND SANTA ROSA CREEK
BANK REPAIR LOCATION AND VICINITY MAPS

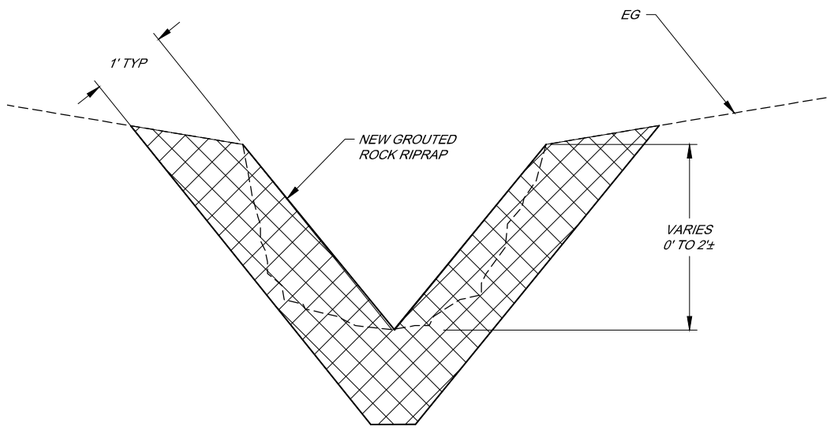
FILE NAME: 2010–G–MOOR_TODD.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G–1
SHEET 1 OF 5

\\Sd-data\Pro\flood control\zone 1a\Moorland\2010-G-MOOR_TODD



VIEW – BANK AND BOTTOM REPAIR AREAS

(LOOKING UP STREAM)
NOT TO SCALE



TYPICAL BOTTOM REPAIR SECTION

NOT TO SCALE

PLAN

SCALE: 1"= 10'

LEFT BANK SLIDE

FILL BELOW OHWM
ROCK RIPRAP
90 sq. ft.
5 cu. yds.

FILL ABOVE OHWM
ROCK RIPRAP
110 sq. ft.
6 cu. yds.

TOTAL AREA = 200 sq. ft.
TOTAL FILL = 11 cu. yds.

CHANNEL BOTTOM REPAIR

FILL BELOW OHWM
ROCK RIPRAP
60 sq. ft.
3 cu. yds.

GENERAL NOTE:
FIGURE 5-6 TYPICAL SECTION OF SMP MANUAL FOR BANK STABILIZATION DESIGN WILL BE USED FOR BANK REPAIRS.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

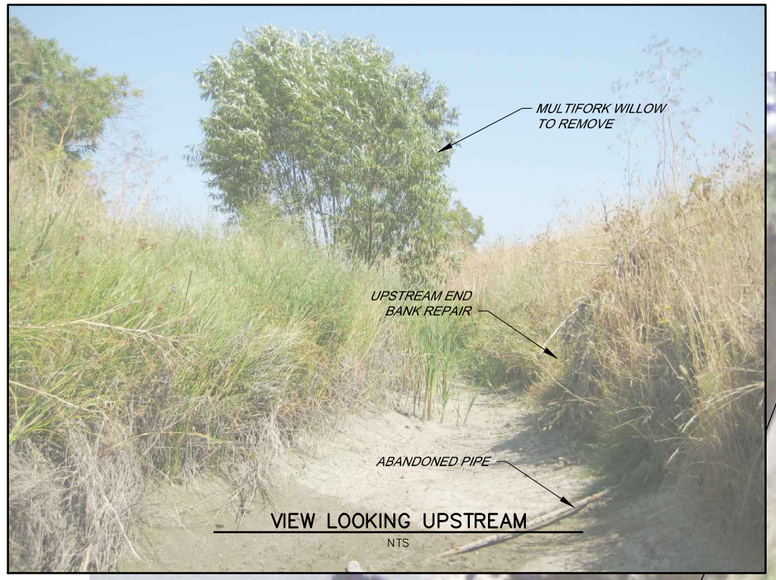
SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	----
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
MOORLAND CHANNEL
BANK AND CHANNEL BOTTOM REPAIR

FILE NAME: 2009-11-24C-TODD.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-1
SHEET 2 OF 5

\\Sd-data\Proj\flood control\zone 1a\TODD\2009-11-24C-TODD



VIEW LOOKING UPSTREAM
NTS

PLAN
SCALE: 1"= 10'

VIEW LOOKING DOWNSTREAM
NTS

BANK REPAIR
FILL BELOW OHWM
ROCK RIPRAP
438 sq. ft.
32 cu. yds.

GENERAL NOTE:
FIGURE 5-6 TYPICAL SECTION OF SMP MANUAL FOR BANK STABILIZATION DESIGN WILL BE USED FOR BANK REPAIRS.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY

PRELIMINARY
SUBJECT TO REVISION

SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 23-Feb-10
DRAWN : ADF
REVIEWED :

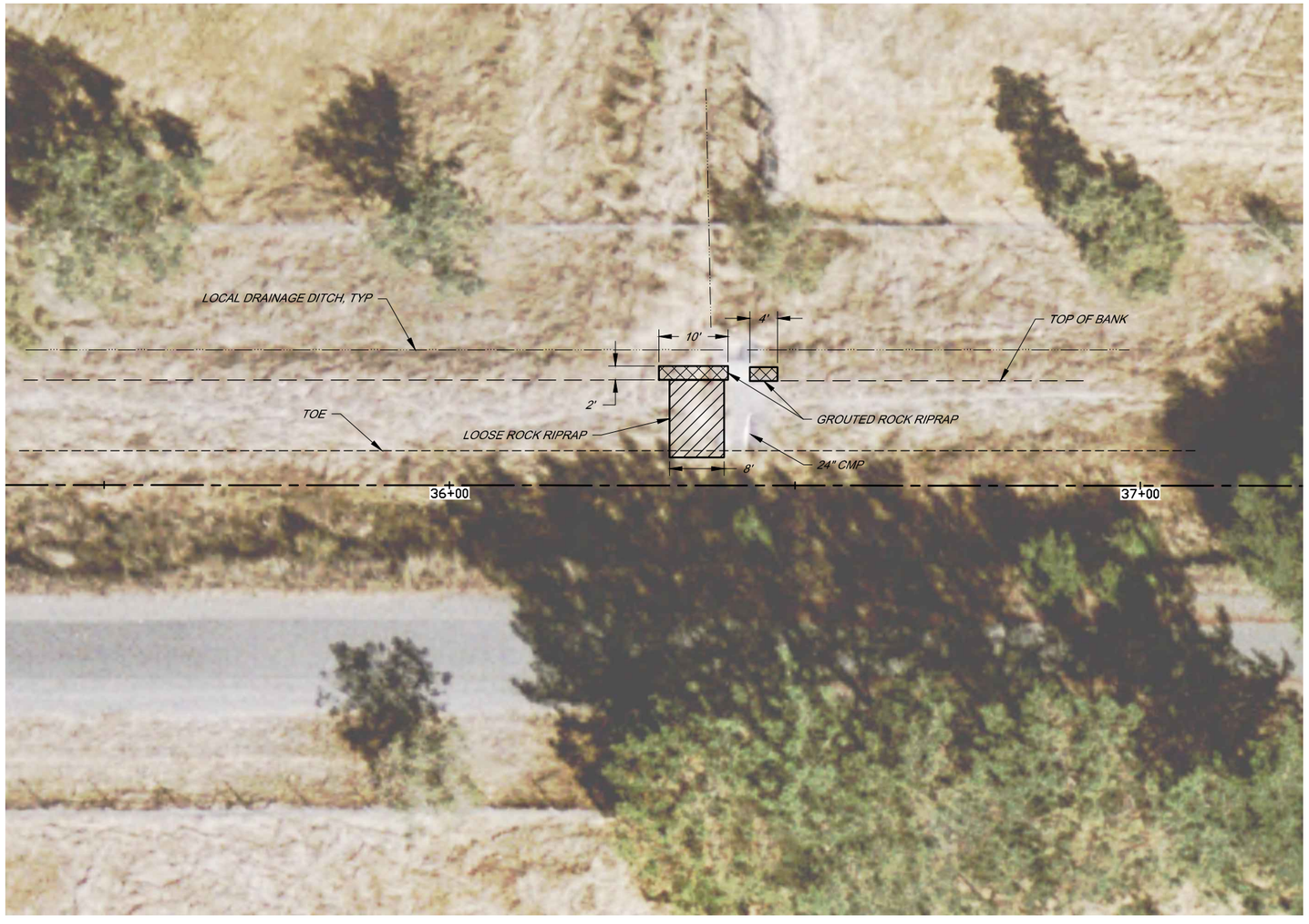
LAGUNA – MARK WEST ZONE 1A
TODD CHANNEL
BANK RERPAIR

FILE NAME: 2009-11-24C-TODD.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-2
SHEET 3 OF 5

\\Sd-data\Proj\Flood control\zone 1a\TODD\2009-11-24C-TODD

VIEW – WASHOUT
SCALE: N.T.S.

VIEW – SIDE INLET
SCALE: N.T.S.



PLAN
SCALE: 1"= 10'

GENERAL NOTE:
FIGURE 5-6 TYPICAL SECTION OF SMP MANUAL FOR BANK STABILIZATION DESIGN WILL BE USED FOR BANK REPAIRS.

FILL BELOW OHW
75 sq. ft.
LOOSE ROCK RIPRAP
6 cu. yds.

FILL ABOVE OHW
49 sq. ft.
GROUTED ROCK RIPRAP
2 cu. yds.
LOOSE ROCK RIPRAP
2 cu. yds.

TOTAL AREA = 124 sq. ft.
TOTAL FILL = 10 cu. yds.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

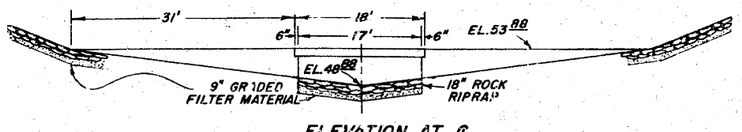
SONOMA COUNTY WATER AGENCY

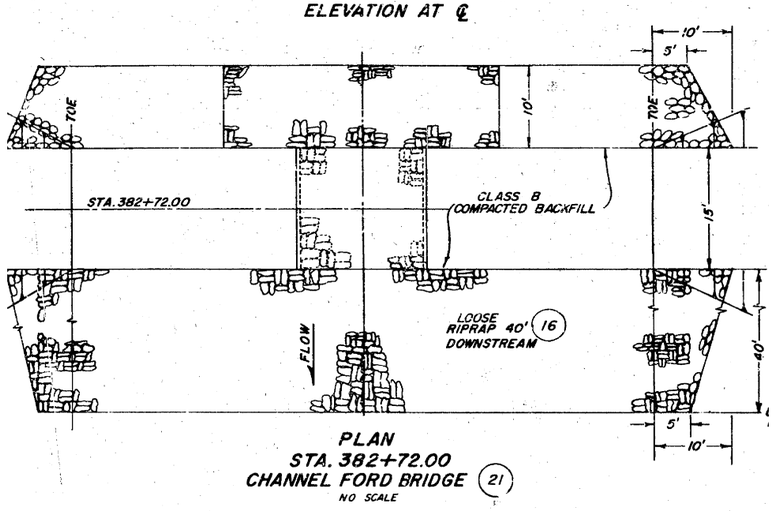
SCALE:	AS SHOWN
DATE :	2/23/10
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
HUNTER LANE CHANNEL
BANK REPAIR

FILE NAME: HUNTER_BANK-REPAIR.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-3
SHEET 4 OF 5

\\Sd-data\Proj\Flood control\zone 1a\HUNTER_CRK\HUNTER_BANK-REPAIR



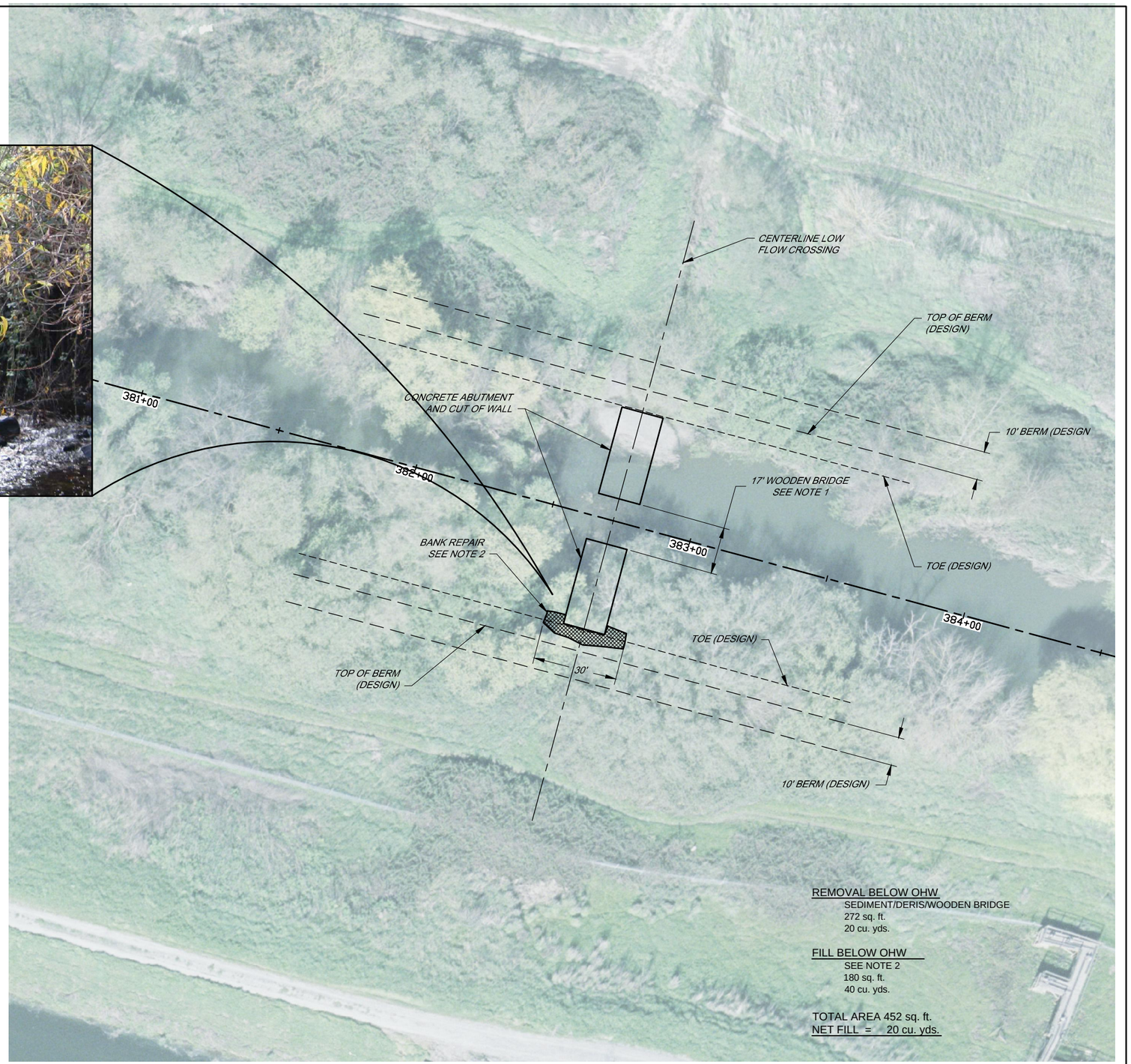


NOTES:

1. WOODEN BRIDGE SECTION AND DEBRIS/SEDIMENT TO BE REMOVED TWO FEET BELOW TOP OF CONCRETE ABUTMENT AT CROSSING ONLY.
2. FIGURE 5-5 TYPICAL SECTION OF SMP MANUAL FOR BANK STABILIZATION DESIGN WILL BE USED FOR BANK REPAIR.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL



REMOVAL BELOW OHW
SEDIMENT/DERIS/WOODEN BRIDGE
272 sq. ft.
20 cu. yds.

FILL BELOW OHW
SEE NOTE 2
180 sq. ft.
40 cu. yds.

TOTAL AREA 452 sq. ft.
NET FILL = 20 cu. yds.

PLAN
SCALE: 1"= 20'

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

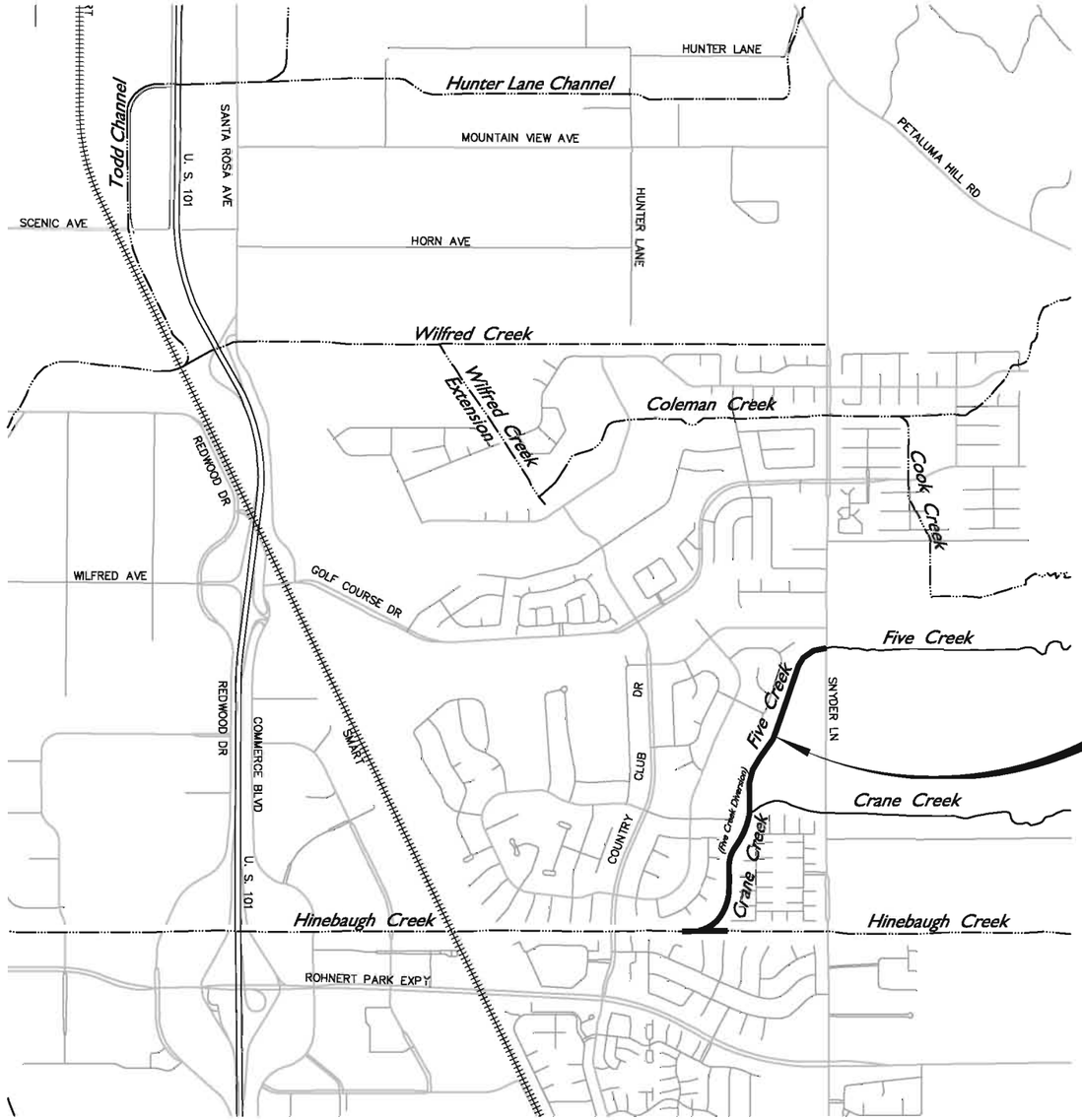
SCALE:	AS SHOWN
DATE :	12/2/09
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
SANTA ROSA CREEK
BANK REPAIR

FILE NAME: 10-02-03_S_R_CRK.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-4
SHEET 5 OF 5

\\Sd-data\Proj\Flood control\zone 1a\SantaRosa\BANK_REPAIR\10-02-03_S_R_CRK

CRANE AND FIVE CREEK SEDIMENT REMOVAL



LOCATION MAP

NOT TO SCALE

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G–1	INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS
2.	G–2	TABLES
3.	G–3	GENERAL DETAILS4.
4.	C–1	CRANE CREEK STA 1+00 TO STA 8+00
5.	C–2	CRANE CREEK STA 8+00 TO STA 20+00
6.	C–3	FIVE CREEK STA 20+00 TO STA 32+00
7.	C–4	FIVE CREEK STA 32+00 TO STA 42+00
8.	C–5	FIVE CREEK STA 42+00 TO STA 46+00
9.	C–6	CRANE CREEK SECTIONS
10.	C–7	FIVE CREEK SECTIONS
11.	D–1	DEWATERING PLAN AND PROFILE

1000 0 1000 2000 4000

SCALE : 1" = 1000'

VICINITY MAP

NOT TO SCALE

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

STAMP

Exp. M/D/Y

STATE OF CALIFORNIA

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12–Mar–09
DRAWN :	A. FACENDINI
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

CRANE CREEK SEDIMENT REMOVAL

LOCATION AND VICINITY MAPS

FILE NAME: CRANE–FIVE_09–02–20_G.dwg

CONTRACT NUMBER: 1–4

DRAWING NUMBER: G–1

SHEET 1 OF 11

\\Sd-data\Proj\flood control\zone 1a\FIVE_CRK-deversion\CRANE-FIVE_09-02-20_G

CRANE CREEK DEVERSION

EXCAVATION

PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN SEASONAL DRY CHANNEL (IF FLOW ENCOUNTERED, THEN DEWATERING APPROCH AS INDICATED ON SHEET 7 WILL BE USED.	STA 9+60 TO STA 10+10 STA 12+90 TO STA 15+70 STA 16+70 TO STA 17+20	100 290 110 TOTAL = 500	25	2,500 7,250 2,750 TOTAL = 12,500	1.5 1 1 AV. 1.17	139 268 102 TOTAL = 509
SIDE DRAIN CHANNEL SILT REMOVAL	LEFT BANK (EAST SIDE) OF CHANNEL	28' PER SIDE DRAIN	15.5	16	1	16 (PER SIDE DRAIN)
	RIGHT BANK (WEST SIDE) OF CHANNEL	28' PER SIDE DRAIN	40.5	42	1	42 (PER SIDE DRAIN)

FIVE CREEK

EXCAVATION

PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN SEASONAL DRY CHANNEL (IF FLOW ENCOUNTERED, THEN DEWATERING APPROCH AS INDICATED ON SHEET 7 WILL BE USED.	STA 20+00 TO STA 45+20	2,520	40	100,800	1.2	4480
CONSTRUCTION SEDIMENT BASIN, SEDIMENT AND DIRT REMOVAL	STA 39+90 TO STA 40+90	100	28	2800	1.5	156
ACCUMULATED SEDIMENT REMOVAL TWIN 6' x 12' RCB	STA 45+20 TO STA 45+90±	70	24	1680	1.2	140
SIDE DRAIN CHANNEL SILT REMOVAL	EAST SIDE OF CHANNEL	28' PER SIDE DRAIN	15.5	16	1	16 (PER SIDE DRAIN)
	WEST SIDE OF CHANNEL	28' PER SIDE DRAIN	40.5	42	1	42 (PER SIDE DRAIN)

CRANE CREEK

Vegetation Management- Species to be Removed			
Scientific Name	**Common Name**	**Vegetation Zone**	**Approximate # removed or square footage**
Rubus discolor	Himalayan blackberry	In-Channel and Channel Side Bank	16,500 square feet
Inchannel habitat	catails, various grasses, sedges	In-Channel	16,500 square feet

FIVE CREEK

Vegetation Management- Species to be Removed			
Scientific Name	**Common Name**	**Vegetation Zone**	**Approximate # removed or square footage**
*Salix lasiolepis-saplings/*root wads	arroyo willow	In Channel	square feet
Salix laevigata	red willow	In-Channel	
Rubus discolor	Himalayan blackberry	In-Channel and Channel Side Bank	54,000 square feet
Inchannel habitat	catails, various grasses, sedges	In-Channel	54,000 square feet

Seedmix and Application Rates		
Scientific Name	**Common Name**	**Application Rate (lbs/acre)**
Leymus triticoides	beardless ryegrass	20
Hordeum brachyantherum	meadow barley	20
Festuca rubra	red fescue	10
Lupinus bicolor	bicolor lupine	5
Vulpia microstachys	Nuttall's fescue	5
Total lbs/acre		**60**

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

STAMP
Exp. M/D
STATE OF CALIFORNIA

NO.	DATE	REVISION	BY

PRELIMINARY
SUBJECT TO REVISION

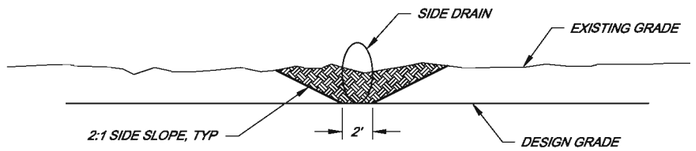
SONOMA COUNTY WATER AGENCY

SCALE: NONE
DATE : 12-Mar-09
DRAWN : A. FACENDINI
REVIEWED :

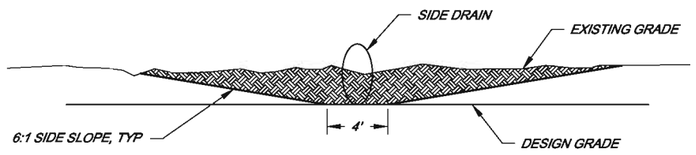
LAGUNA – MARK WEST ZONE 1A
CRANE AND FIVE CREEK SEDIMENT REMOVAL
GENERAL DETAILS AND TABLES

FILE NAME: CRANE-FIVE_09-02-20_G.dwg
CONTRACT NUMBER: 1-4
DRAWING NUMBER: G-2
SHEET 2 OF 11

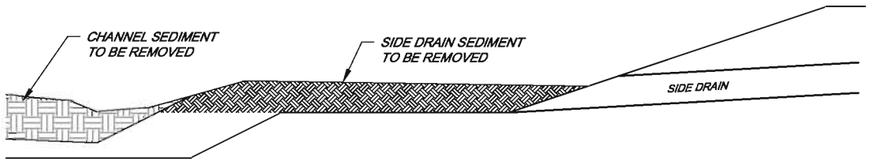
\\Sd-data\Proj\flood control\zone 1a\FIVE_CRK-deversion\CRANE-FIVE_09-02-20_G



SECTION - EAST SIDE OF CHANNEL



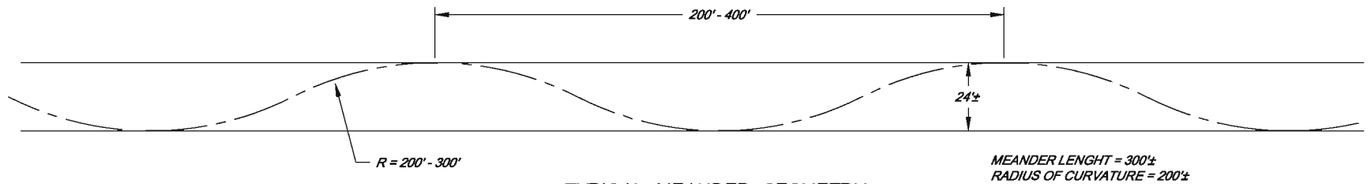
SECTION - WEST SIDE OF CHANNEL



PROFILE

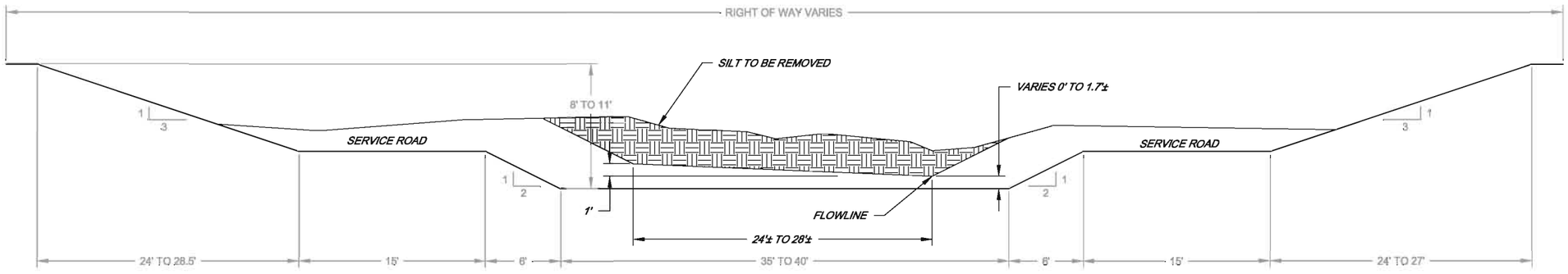
SIDE DRAIN

NOT TO SCALE



TYPICAL MEANDER GEOMETRY

NOT TO SCALE



TYPICAL SECTION (1971 DESIGN PRIOR DEVELOPMENT)

(LOOKING DOWN STREAM)
NOT TO SCALE

90% SUBMITTAL

STAMP
Exp. M/D
STATE OF CALIFORNIA

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

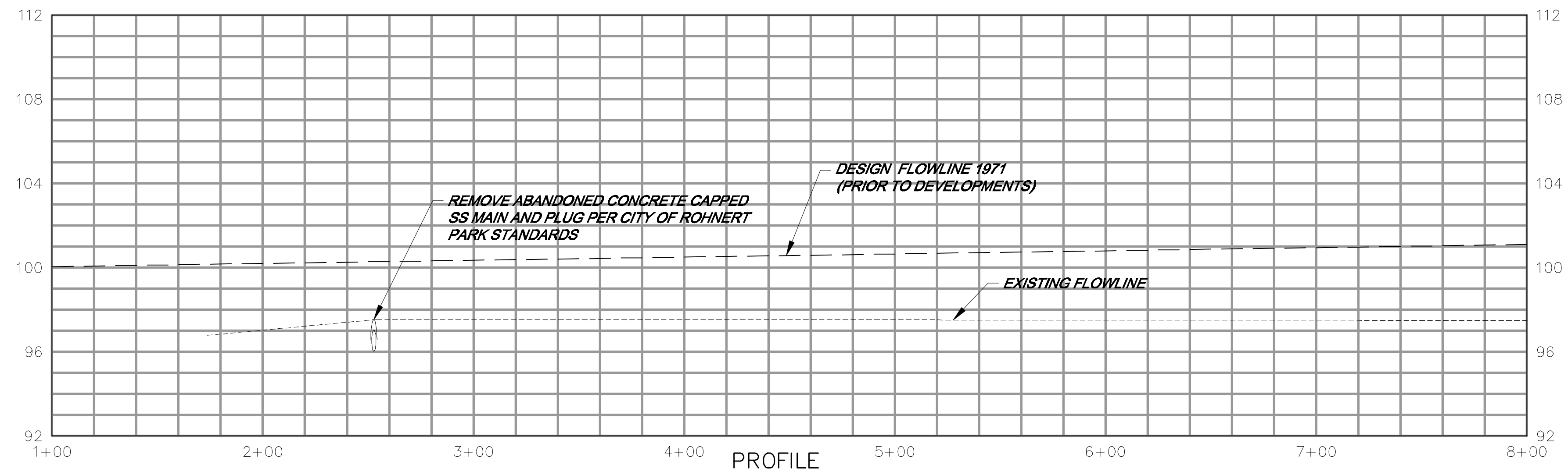
SONOMA COUNTY WATER AGENCY

SCALE:	NONE
DATE :	12-Mar-09
DRAWN :	A. FACENDINI
REVIEWED :	

LAGUNA - MARK WEST ZONE 1A
CRANE AND FIVE CREEK SEDIMENT REMOVAL
GENERAL DETAILS AND TABLES

FILE NAME: CRANE-FIVE_09-02-20_G.dwg
CONTRACT NUMBER: 1-4
DRAWING NUMBER: G-3
SHEET 3 OF 11

\\Sd-data\Proj\flood control\zone 1a\FIVE_CRK-deversion\CRANE-FIVE_09-02-20_G



PROFILE

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

PLAN

SCALE: 1"= 40'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY

PRELIMINARY
SUBJECT TO REVISION

SONOMA COUNTY WATER AGENCY

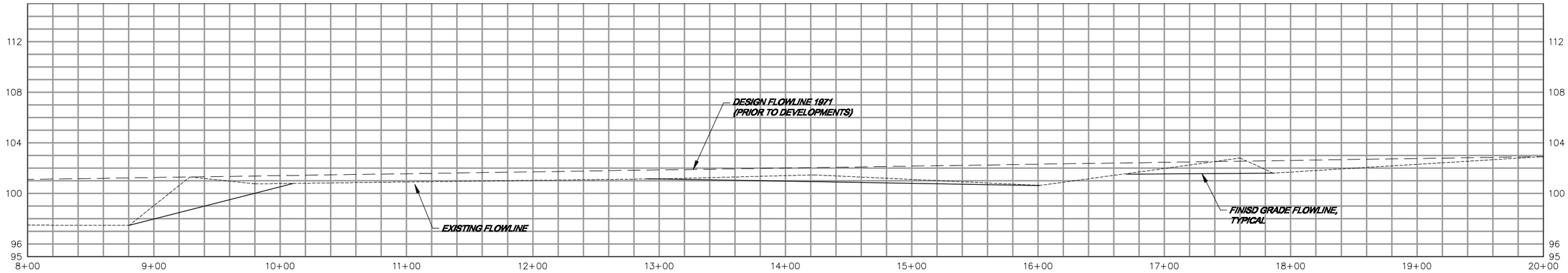
SCALE: AS SHOWN
DATE: 12–Mar–09
DRAWN: ––––
REVIEWED:

LAGUNA – MARK WEST ZONE 1A
CRANE CREEKK STA 1+00 TO STA 8+00
CRANE CREEK SEDIMENT REMOVAL

FILE NAME: CRANE_09-02-20_C.dwg
CONTRACT NUMBER: ###

DRAWING NUMBER: C–1

SHEET 4 OF 11



PROFILE

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

PLAN

SCALE: 1"= 40'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 12-Mar-09
DRAWN : ----
REVIEWED :

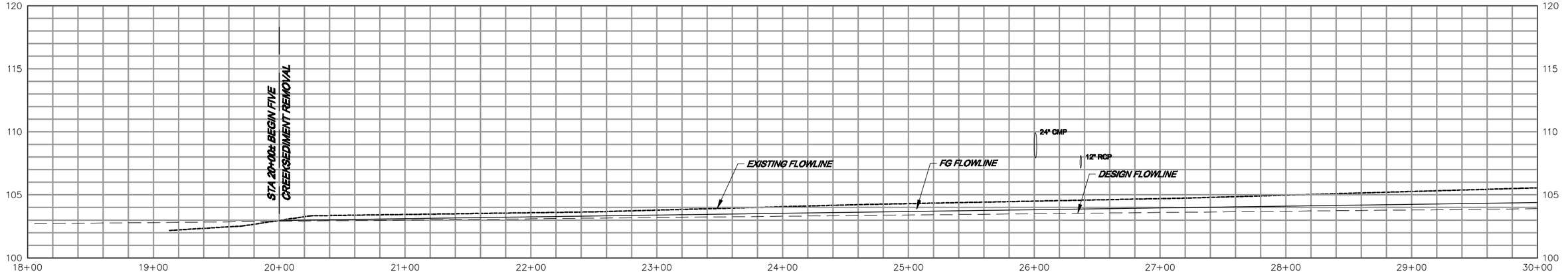
LAGUNA – MARK WEST ZONE 1A
CRANE CREEK SEDIMENT REMOVAL
STA 8+00 TO STA 20+00

FILE NAME: CRANE_09-02-20_C.dwg
CONTRACT NUMBER: ###

DRAWING NUMBER: C-2

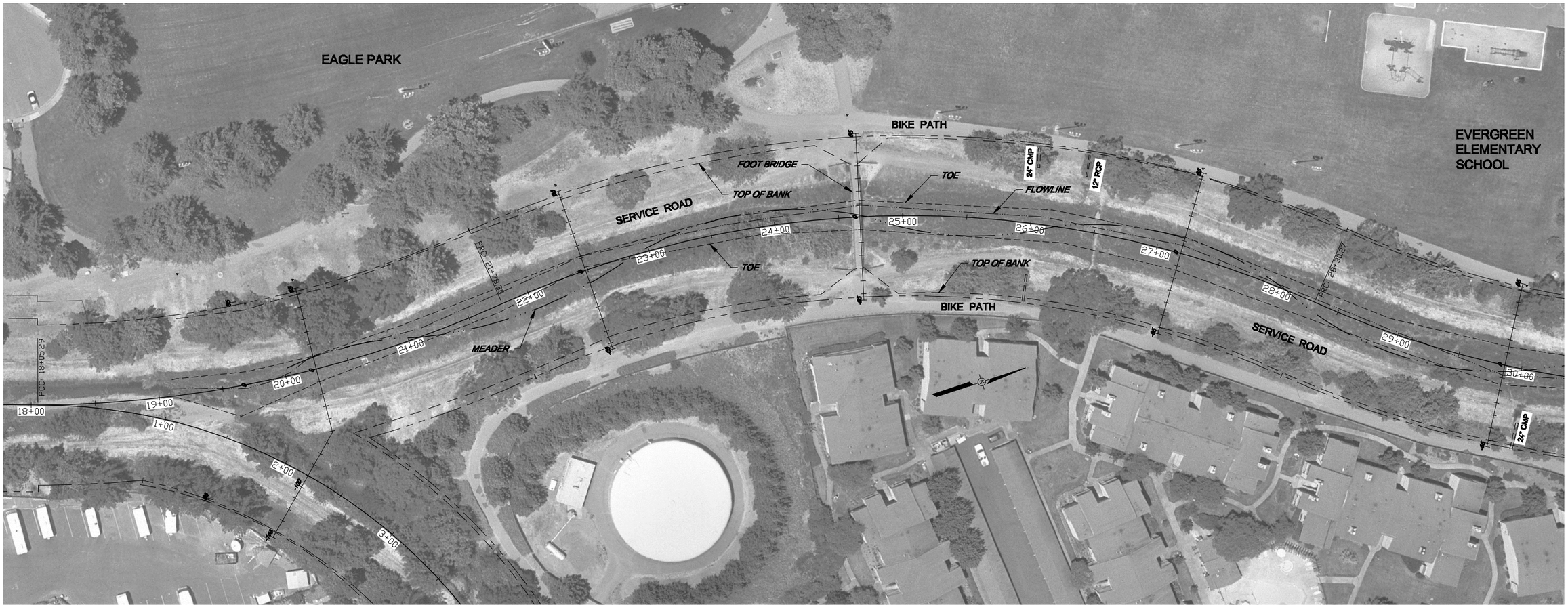
SHEET 5 OF 11

\\Bd-data\Proj\flood control\zone 1a\FIVE_CRK\design\CRANE_09-02-20_C



PROFILE

SCALE: HORIZ 1" = 40'
VERT 1"= 4'



PLAN

SCALE: 1"= 40'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12-Mar-09
DRAWN :	----
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

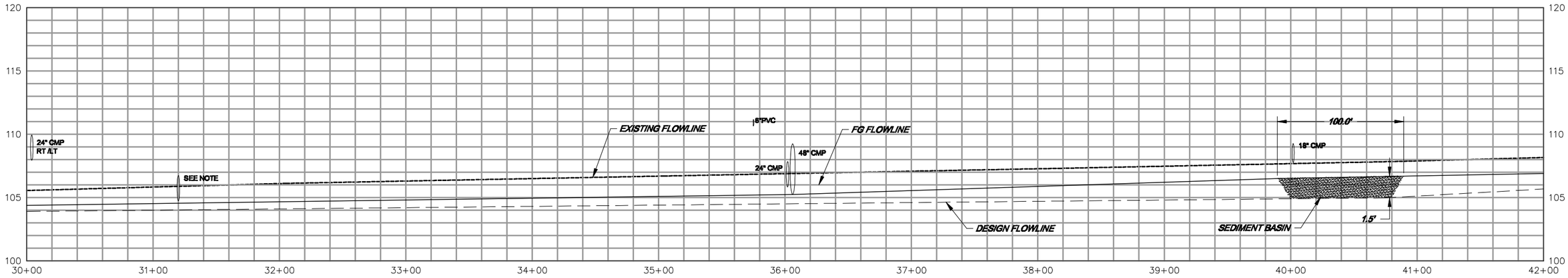
FIVE CREEK SEDIMENT REMOVAL
STA 18+00 TO STA 30+00

FILE NAME: FIVE_09-02-25_P&P.dwg
CONTRACT NUMBER: ###

DRAWING NUMBER: C-3

SHEET 6 OF 11

\\Sdr-data\Proj\flood control\zone 1a\FIVE_CRK-deversion\FIVE_09-02-25_P&P



PROFILE

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

PLAN

SCALE: 1"= 40'

NOTE:
AT STA 31+21±, 21½ RIGHT, CITY PAINT LOCATION MARK SIDE DRAIN, DEPTH AND SIZE UNKNOWN. FLOW OBSERVED FROM UNDER VEGETATION.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12–Mar–09
DRAWN :	----
REVIEWED :	

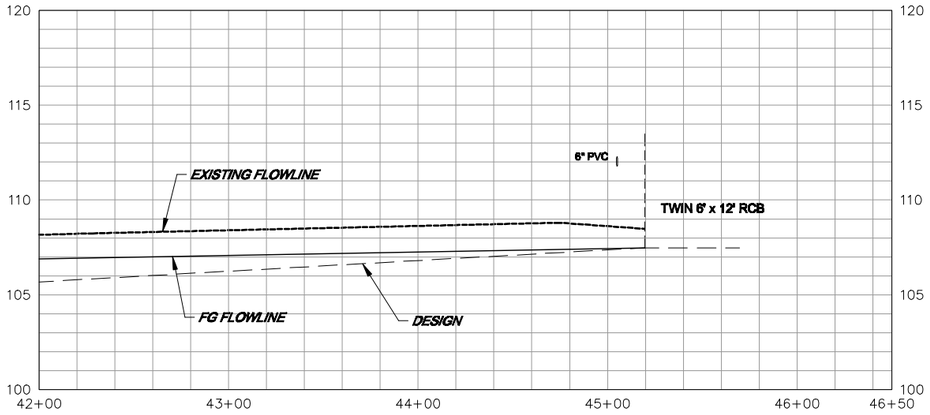
LAGUNA – MARK WEST ZONE 1A
FIVE CREEK SEDIMENT REMOVAL
STA 30+00 TO STA 42+00

FILE NAME: FIVE_09-02-25_P&P.dwg
CONTRACT NUMBER: ###

DRAWING NUMBER: C-4

SHEET 7 OF 11

\\Sd-data\Proj\flood control\zone 1a\FIVE_CRK-deversion\FIVE_09-02-25_P&P



PROFILE

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

PLAN

SCALE: 1"= 40'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\flood control\zone 1a\FIVE_CRK-deversion\FIVE_09-02-25_P&P

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

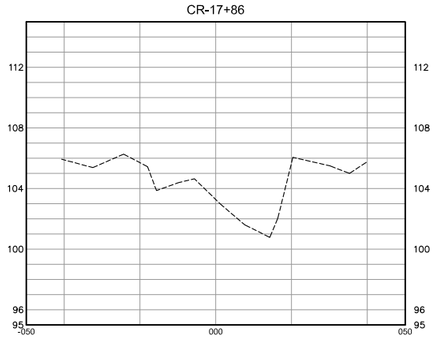
SCALE:	AS SHOWN
DATE :	12-Mar-09
DRAWN :	----
REVIEWED :	

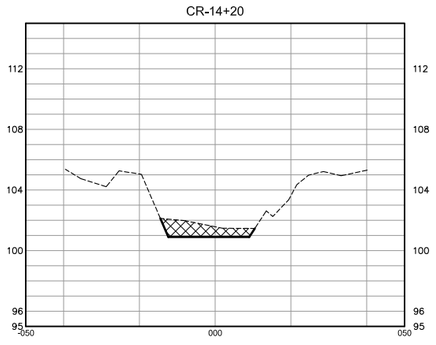
LAGUNA – MARK WEST ZONE 1A

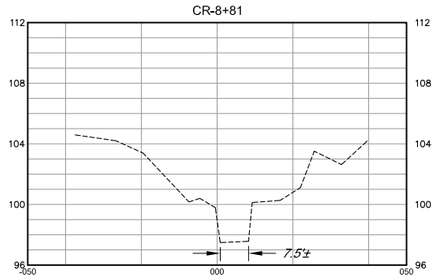
FIVE CREEK SEDIMENT REMOVAL STA 42+00 TO STA 46+00

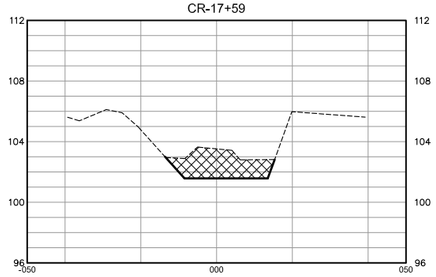
FILE NAME: FIVE_09-02-25_P&P.dwg
CONTRACT NUMBER: ###

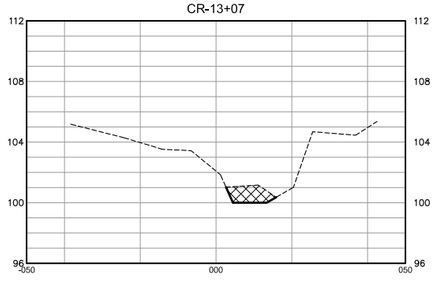
DRAWING NUMBER: C-5

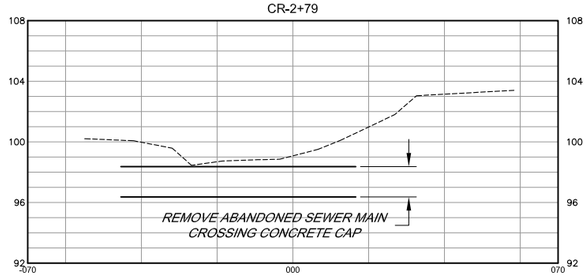


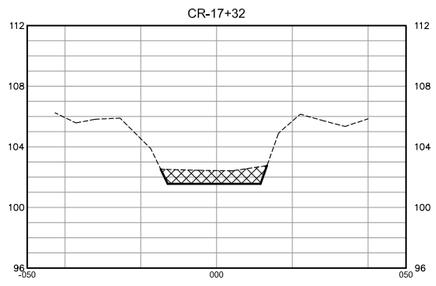


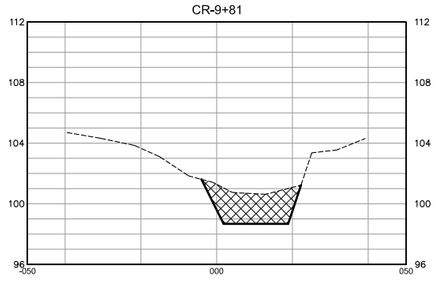


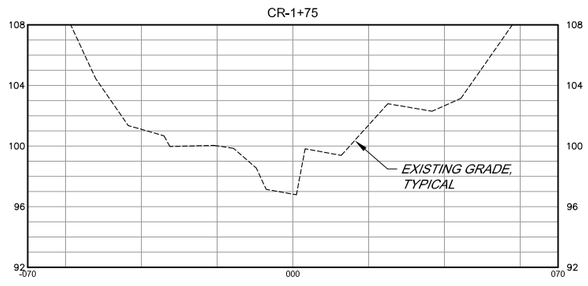


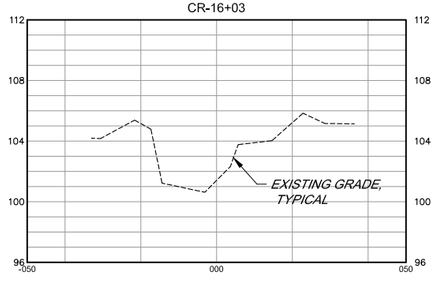


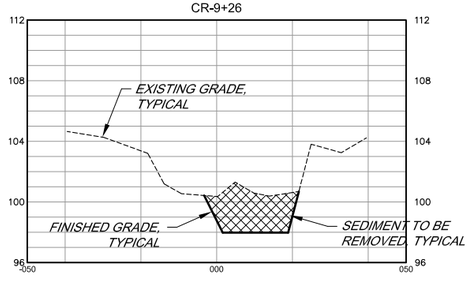












SECTIONS

SCALE: HORIZ 1" = 40'
VERT 1"= 4'

BAR LENGTH ON ORIGINAL
DRAWING EQUALS ONE INCH.
ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	12-Mar-09
DRAWN :	----
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
CRANE CREEK SEDIMENT REMOVAL
SECTIONS

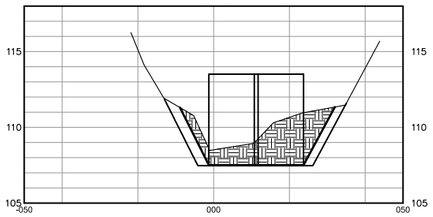
FILE NAME: CRANE_09-02-20_C.dwg
CONTRACT NUMBER: ###

DRAWING NUMBER: C-6

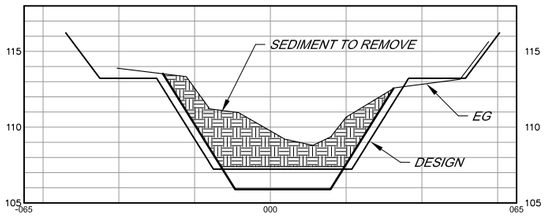
SHEET 9 OF 11

I:\Sd-data\Proj\flood control\zone 1a\FIVE_CRK-devers\on\CRANE_09-02-20_C

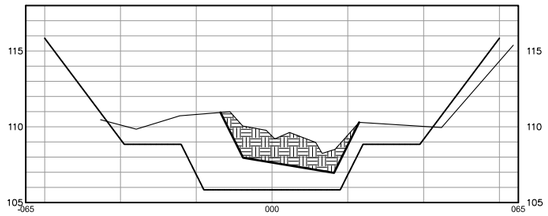
45+20



44+74



42+28



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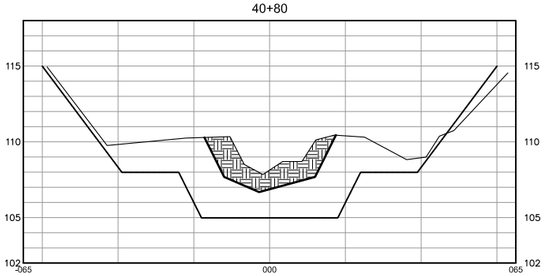
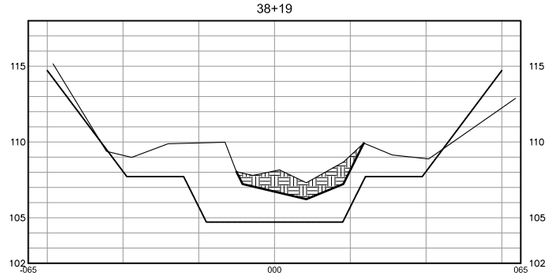
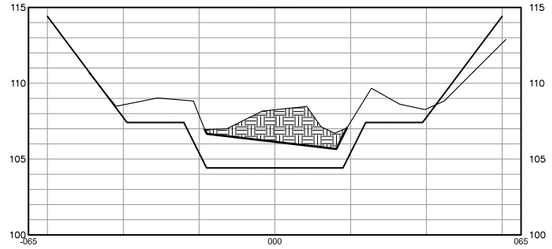


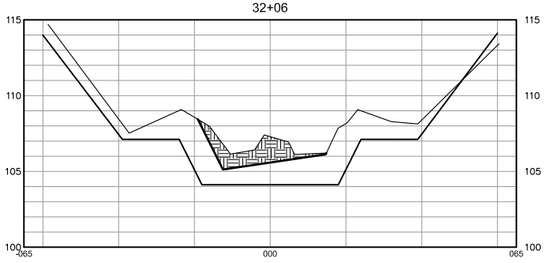
38+19



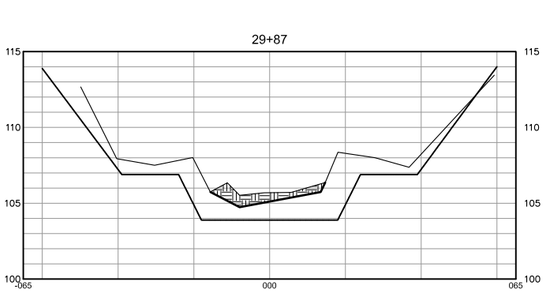
35+04



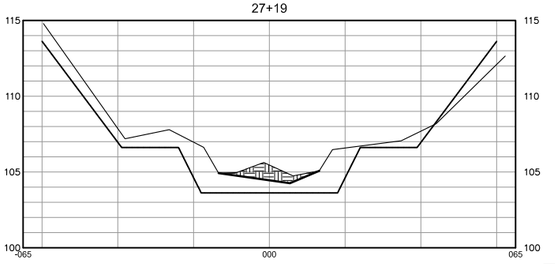
32+06



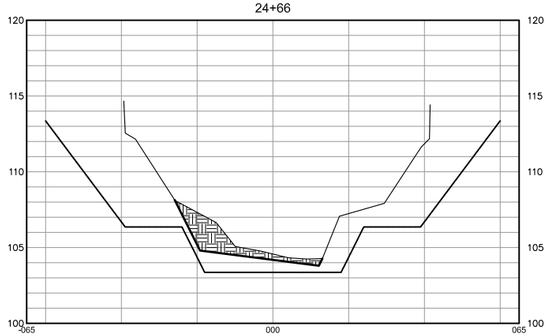
29+87



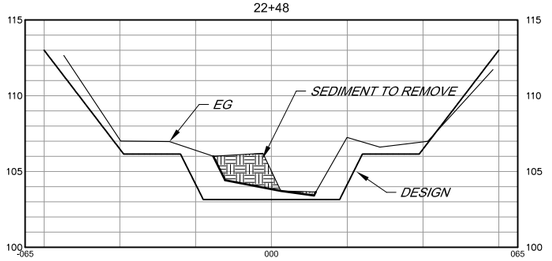
27+19



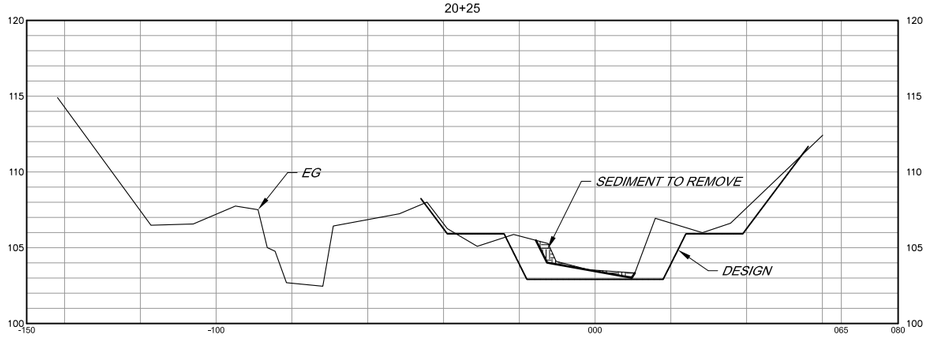
24+66



22+48



20+25



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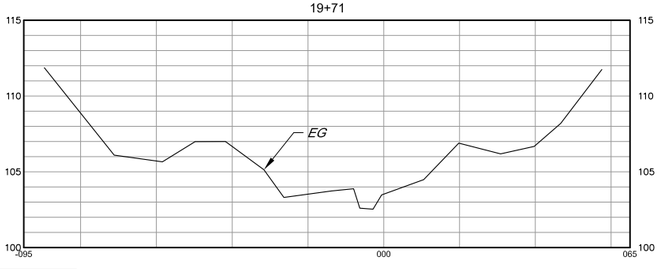


90% SUBMITTAL

PROFILE

SCALE: HORIZ 1" = 20'
VERT 1"= 5'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Proj\Flood control\zone 1a\FIVE_CRK-deversion\FIVE_09-02-25_P&P

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

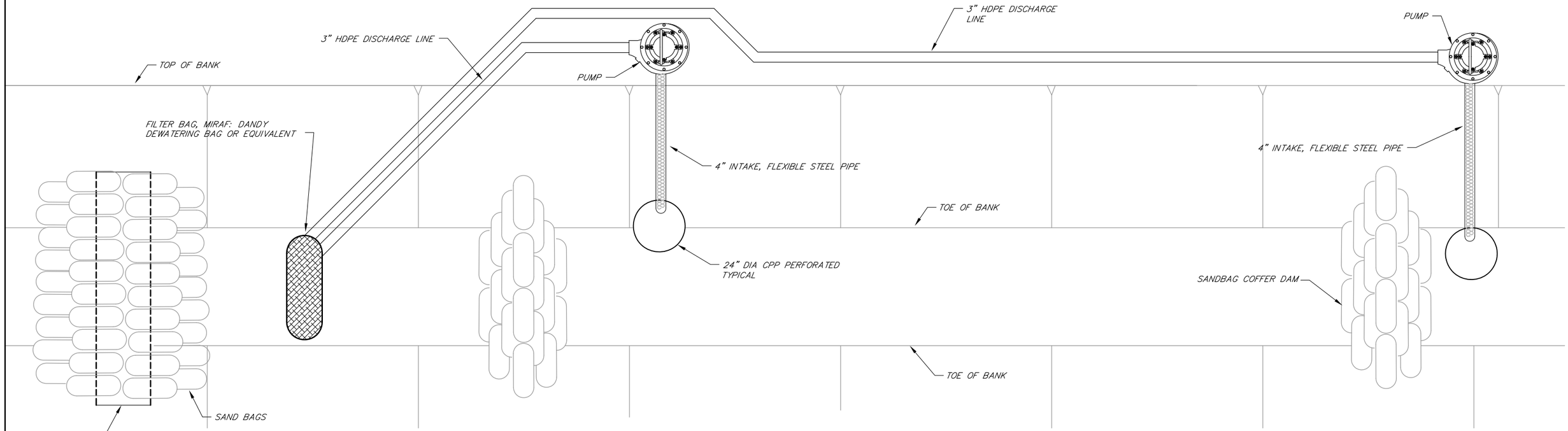
SONOMA COUNTY WATER AGENCY

SCALE: AS SHOWN
DATE : 12-Mar-09
DRAWN : ----
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
FIVE CREEK SEDIMENT REMOVAL SECTIONS

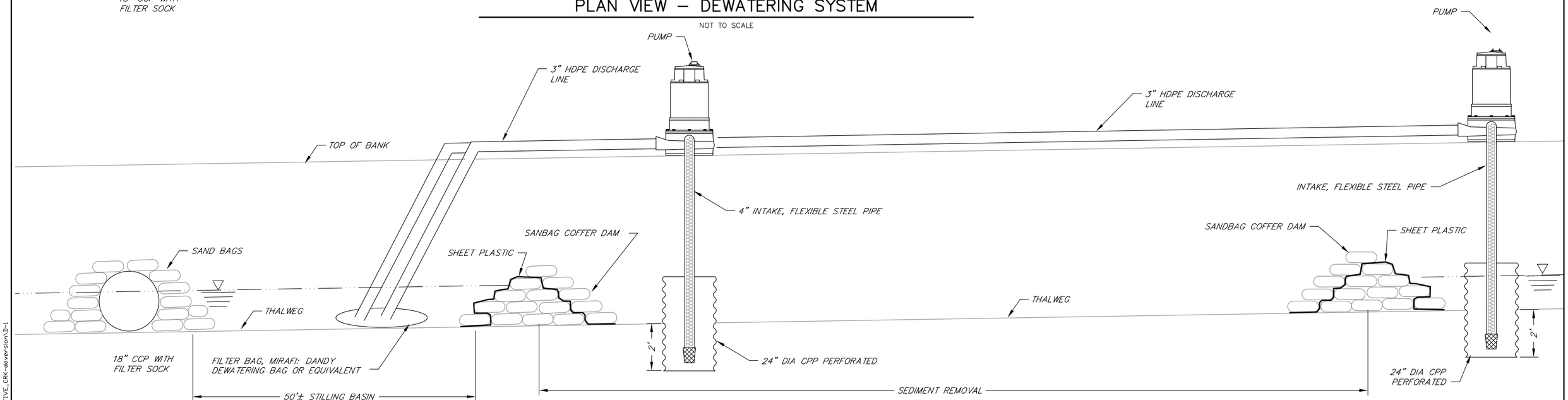
FILE NAME: FIVE_09-02-25_P&P.dwg
CONTRACT NUMBER: ###

DRAWING NUMBER: C-7



PLAN VIEW – DEWATERING SYSTEM

NOT TO SCALE



PROFILE VIEW – DEWATERING SYSTEM

NOT TO SCALE

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY

PRELIMINARY
SUBJECT TO REVISION

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	6–Mar–09
DRAWN :	A. FACENDINI
REVIEWED :	

LAGUNA – MARK WESTZONE 1A
CREEK SEDIMENT REMOVAL
DEWATERING PLAN AND PROFILE

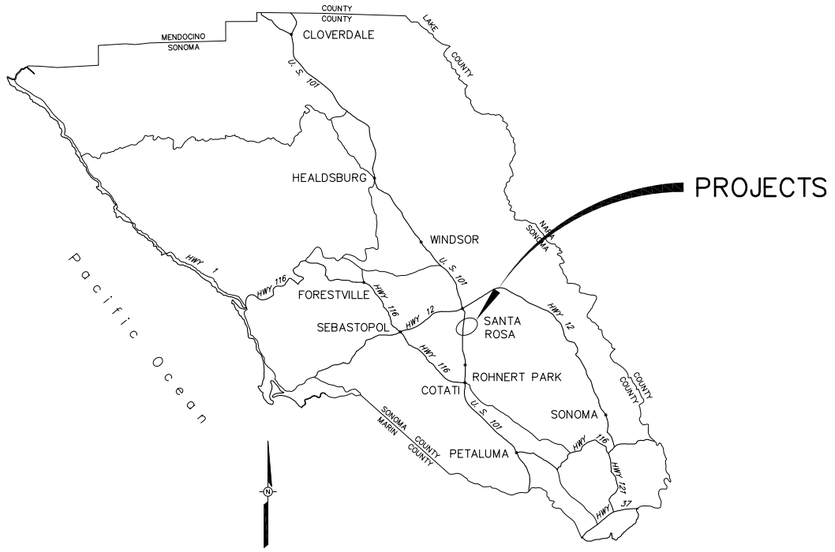
FILE NAME: D-1.dwg
CONTRACT NUMBER: 1-4142/014-7 #

DRAWING NUMBER: D-1

SHEET 11 OF 11

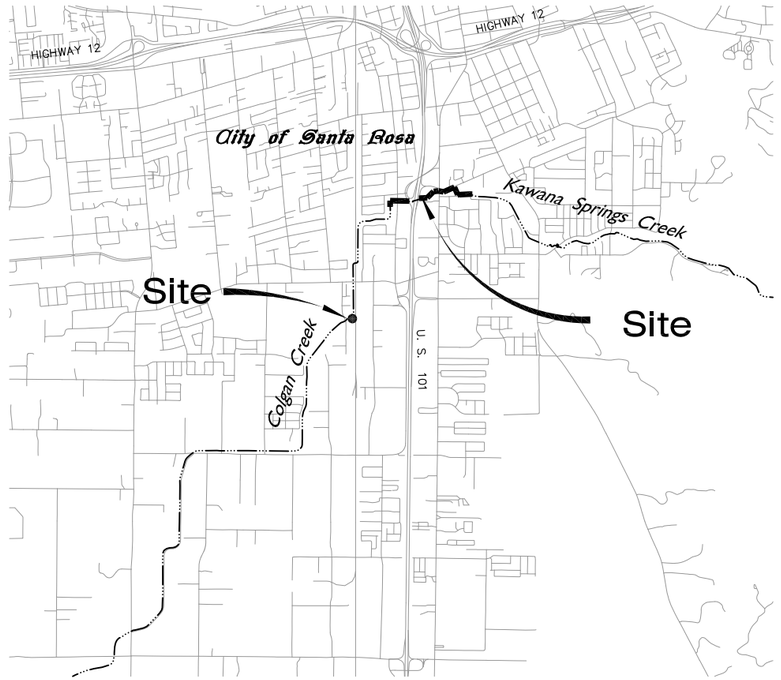
\\Sd-data\Proj\Flood control\zone 1a\FIVE_CRK-deversion\D-1

SEDIMENT REMOVAL
COLGAN CREEK
and
KAWANA SPRINGS CREEK



LOCATION MAP

NOT TO SCALE



VICINITY MAP

SCALE: 1"= 2000'

COLGAN CREEK						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STA 273+11± TO STA 275+11± STA 311+00± TO STA 316+10± STA 319+44± TO STA 328+93±	1659	12	19,908	1.3	958

KAWANA SPRINGS CREEK						
EXCAVATION						
PROJECT ACTIVITY DESCRIPTION	LOCATION AND STATIONING	LENGTH (LINEAR FT.)	AVERAGE WIDTH (LINEAR FT.)	AREA (SQUARE FT.)	DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL.	STA 0+00 TO STA 6+25±	625	12	7500	1	278
CONSTRUCTING SEDIMENT BASIN. SEDIMENT REMOVAL (ONLY) USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED CHANNEL 1	STA 6+80± TO STA 9+10±	230	18.5	4600	2.2	347

INDEX TO DRAWINGS:

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

\\Sd-data\Pro\flood control\zone 1a\sediment_removal\2009-04-14\Colgan-Kawana_G-09-02-25

PRELIMINARY
SUBJECT TO REVISION

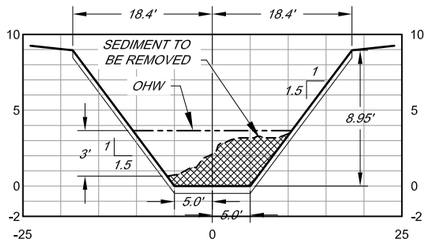
NO.	DATE	REVISION	BY
1	3/24/2010	REVISED & ADDED SEDIMENT BASIN TO KAWANA SPRINGS CREEK TABLE	DD

SONOMA COUNTY WATER AGENCY

SCALE :
DATE : 4/14/2009
DRAWN : ----
REVIEWED :

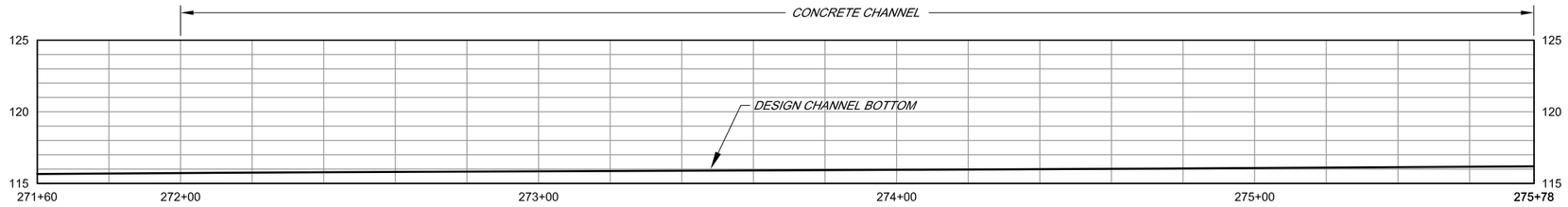
LAGUNA – MARK WEST ZONE 1A
SEDIMENT REMOVAL – INDEX TO DRAWINGS, TABLES, LOCATION AND VICINITY MAP

FILE NAME: Colgan-Kawana_G-09-02-25.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G–1
SHEET 1 OF 7



TYPICAL SECTION

SCALE: HORZ. 1" = 10'
VERT 1" = 5'



PROFILE

SCALE: HORZ. 1" = 20'
VERT 1" = 5'

PLAN

SCALE: 1" = 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	NONE
DATE :	4/14/09
DRAWN :	ADF
REVIEWED :	

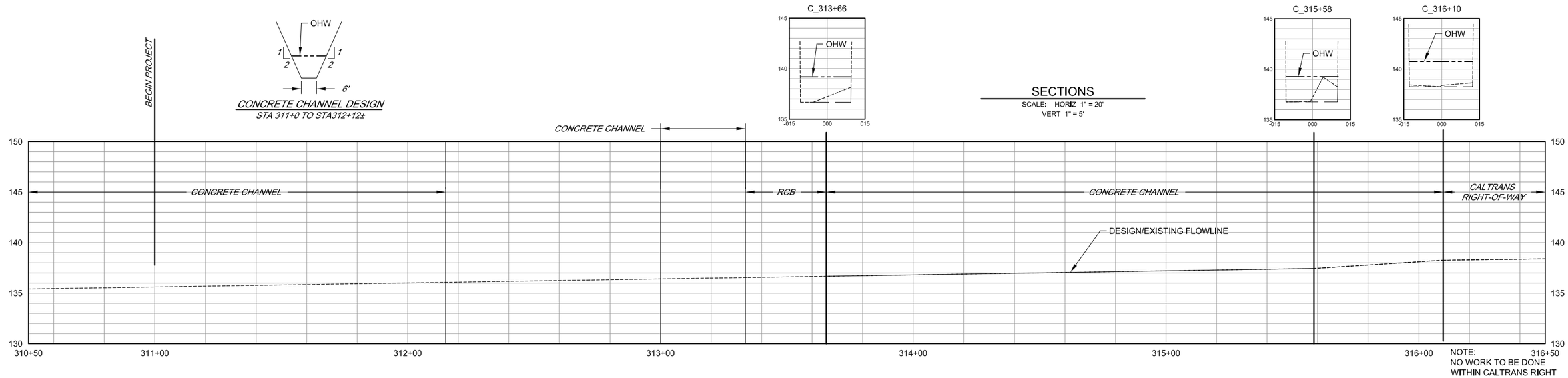
LAGUNA - MARK WEST ZONE 1A
COLGAN CREEK
STA 271+60 TO STA 275+78±

FILE NAME: COLGAN_3B_c-1_09-04-07.dwg
CONTRACT NUMBER: ##############

DRAWING NUMBER: C-1

SHEET 2 OF 7

\\Sd-data\Proj\Flood control\zone 1a\sediment_removal\2009-02-24\COLGAN_3B_c-1_09-04-07



SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1" = 5'

NOTE: 316+50
NO WORK TO BE DONE WITHIN CALTRANS RIGHT OF WAY

PROFILE

SCALE: HORIZ 1" = 20'
VERT 1" = 5'

PLAN

SCALE: 1" = 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE:	NONE
DATE :	4/14/09
DRAWN :	----
REVIEWED :	

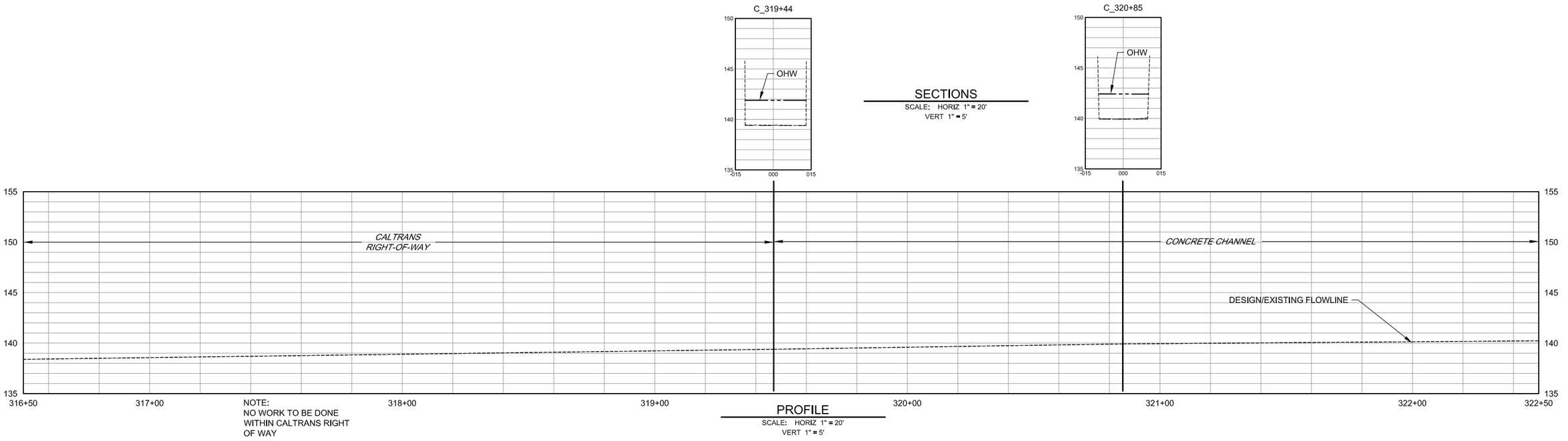
LAGUNA – MARK WEST ZONE 1A
SEDIMENT REMOVAL
COLGAN CREEK STA 310+50± TO STA 316+50

FILE NAME: Colgan-Kawana_C-09-02-25.dwg
CONTRACT NUMBER: ##############

DRAWING NUMBER: C-2

SHEET 3 OF 7

\\Sd-data\Proj\flood control\zone 1a\sediment_removal\2009-02-24\Colgan-Kawana_C-09-02-25



\\Sd-data\Proj\flood control\zone 1a\sediment_removal\2009-02-24\Colgan-Kawana_C-09-02-25

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY	
		SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

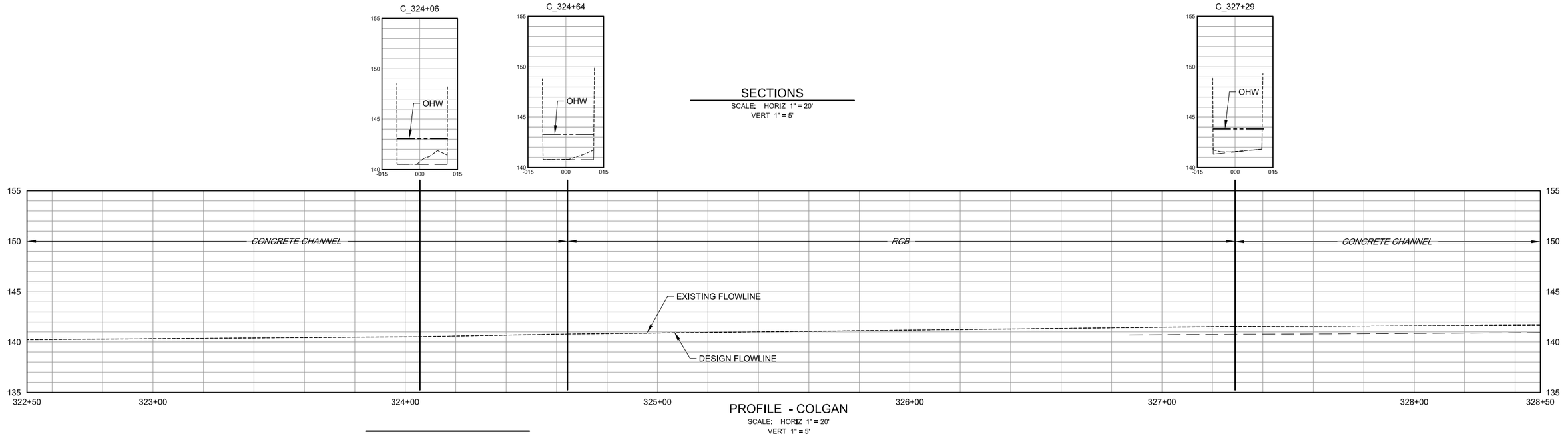
SCALE:	NONE
DATE :	4/14/09
DRAWN :	----
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A
SEDIMENT REMOVAL
COLGAN CREEK STA 316+50 TO STA 322+50

FILE NAME: Colgan-Kawana_C-09-02-25.dwg
CONTRACT NUMBER: ##############

DRAWING NUMBER: C-3

SHEET 4 OF 7

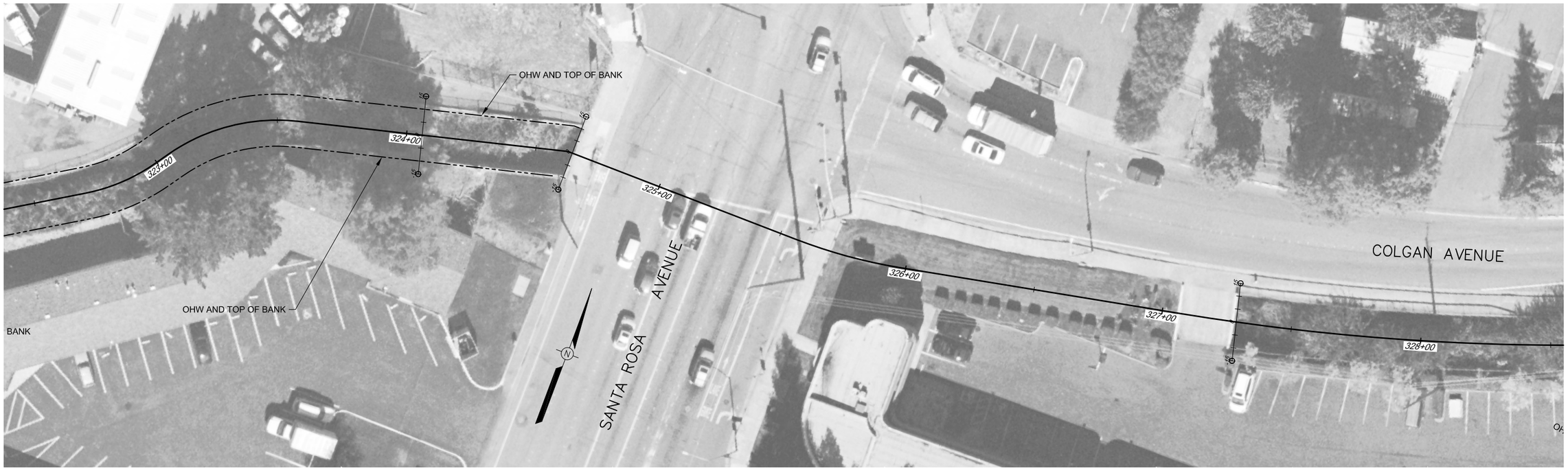


SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1" = 5'

PROFILE - COLGAN

SCALE: HORIZ 1" = 20'
VERT 1" = 5'



PLAN

SCALE: 1" = 20'

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY

SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

SCALE:	NONE
DATE :	4/14/09
DRAWN :	----
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

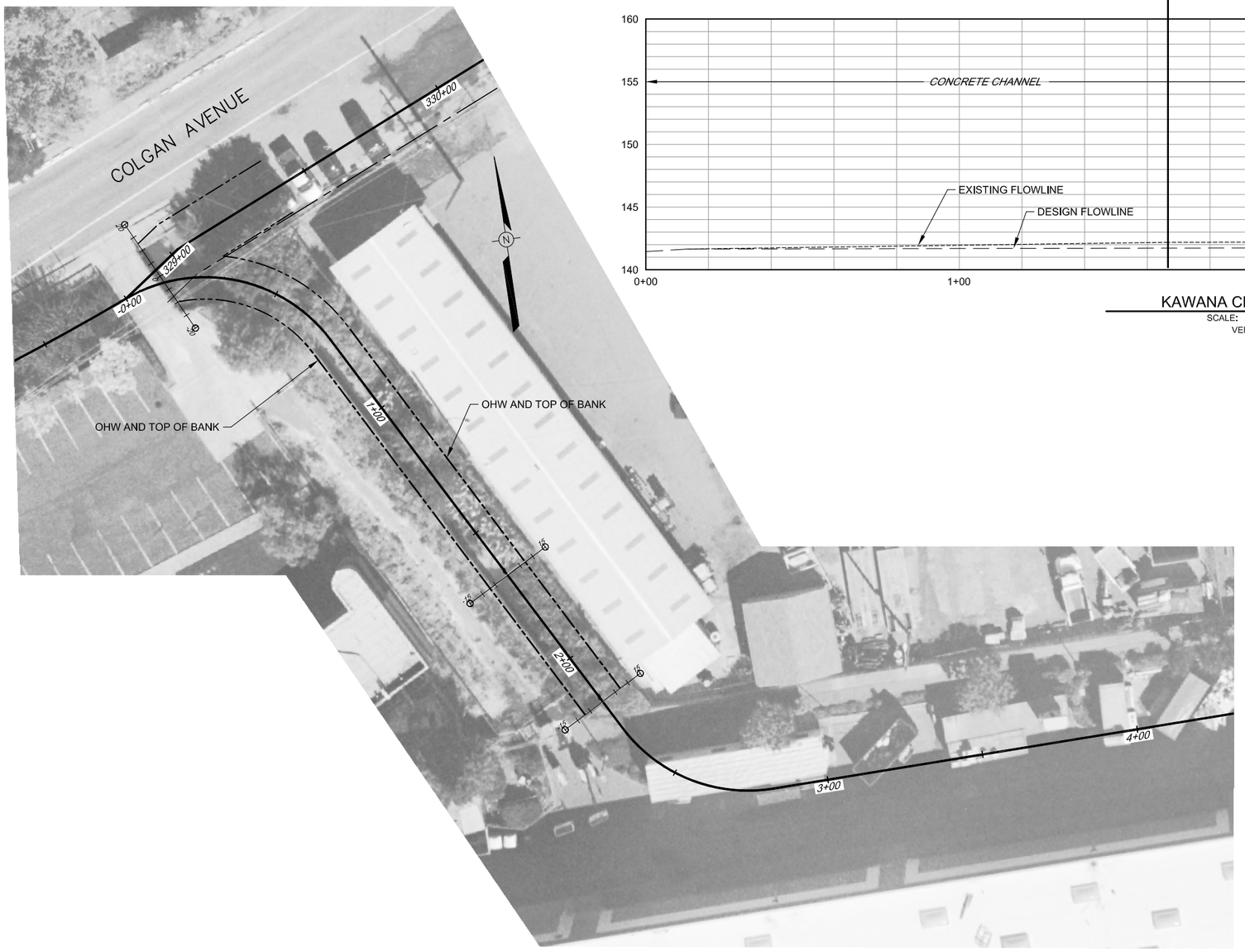
SEDIMENT REMOVAL – COLGAN CREEK STA 325+00 TO STA 322+50 TO STA 328+50

FILE NAME: Colgan-Kawana_C-09-02-25.dwg
CONTRACT NUMBER: ##############

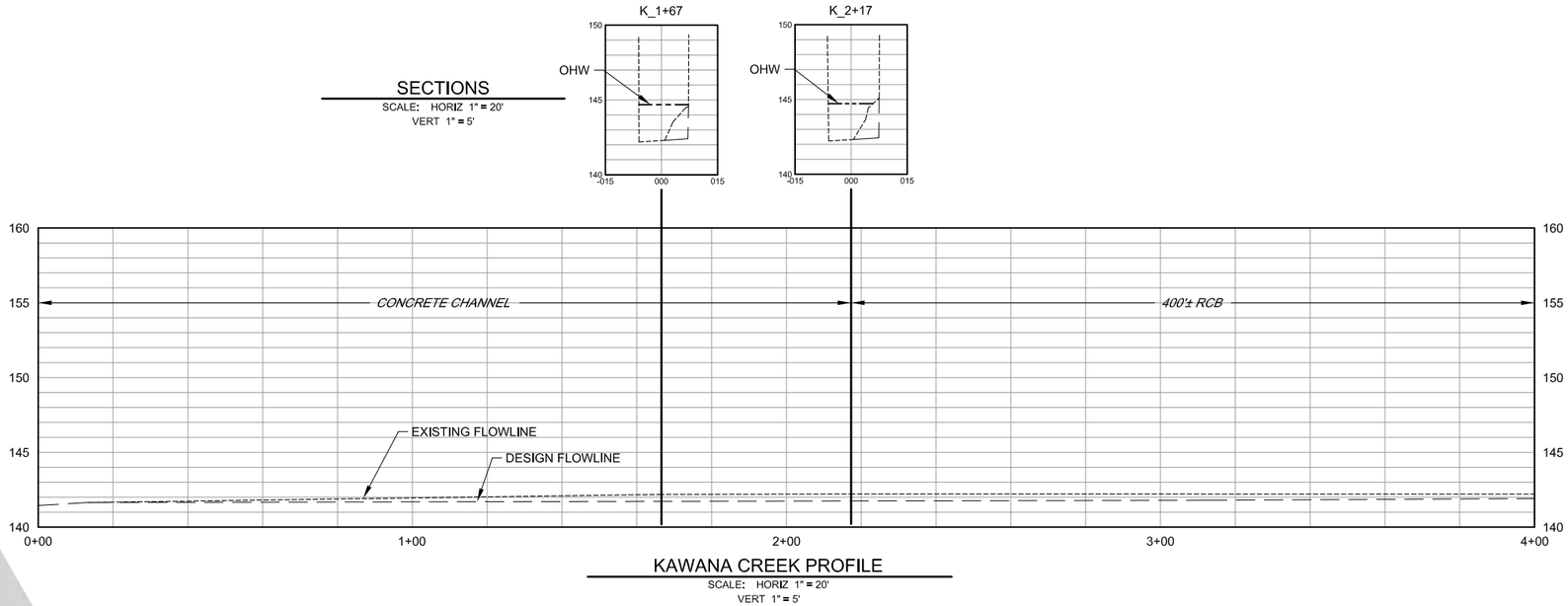
DRAWING NUMBER: C-4

SHEET 5 OF 7

\\Sd-data\Proj\flood control\zone 1a\sediment_removal\2009-02-24\Colgan-Kawana_C-09-02-25

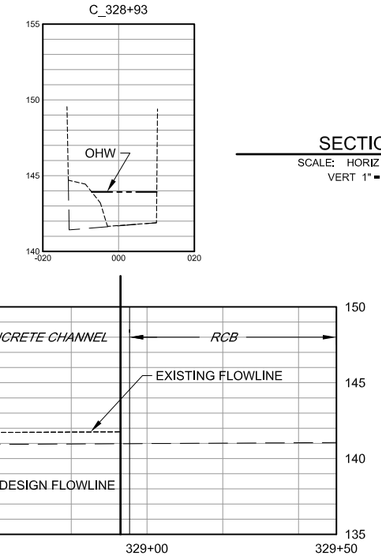


PLAN
SCALE: 1" = 20'



SECTIONS
SCALE: HORIZ 1" = 20'
VERT 1" = 5'

KAWANA CREEK PROFILE
SCALE: HORIZ 1" = 20'
VERT 1" = 5'



SECTION
SCALE: HORIZ 1" = 20'
VERT 1" = 5'

COLAGAN CREEK PROFILE
SCALE: HORIZ 1" = 20'
VERT 1" = 5'

90% SUBMITTAL

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE: NONE
DATE: 4/14/09
DRAWN: ----
REVIEWED:

LAGUNA – MARK WEST ZONE 1A

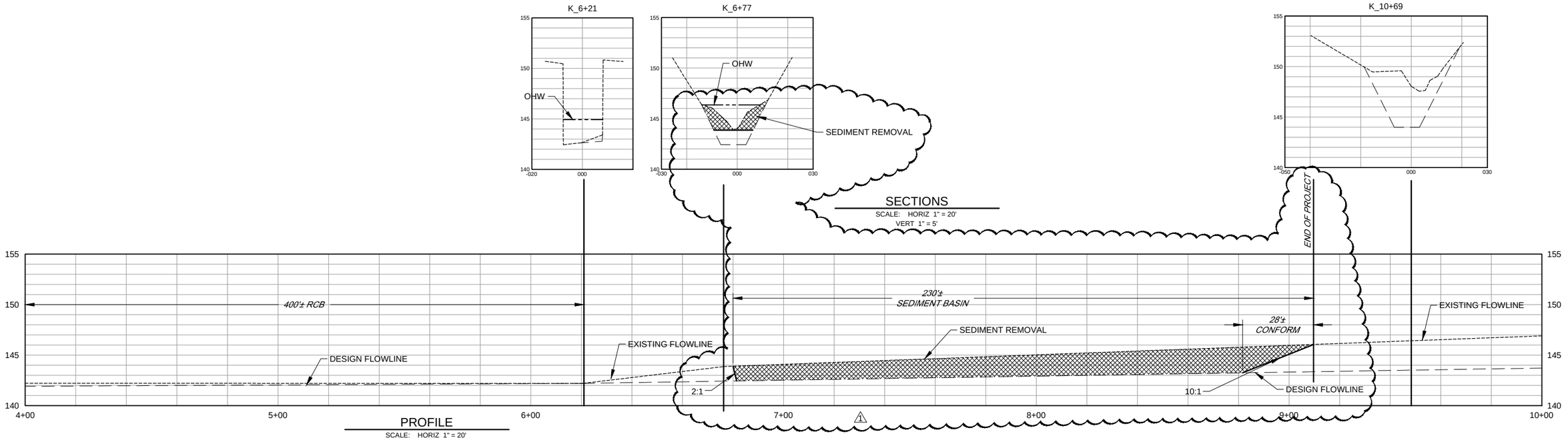
SEDIMENT REMOVAL - COLGAN CREEK STA 328+50 TO STA 329+50 - KAWANA CREEK STA 0+00 TO STA 4+00

FILE NAME: Colgan-Kawana_C-09-02-25.dwg
CONTRACT NUMBER: ##############

DRAWING NUMBER: C-5

SHEET 6 OF 7

\\Sd-data\Proj\Flood control\zone 1a\sediment_removal\2009-02-24\Colgan-Kawana_C-09-02-25

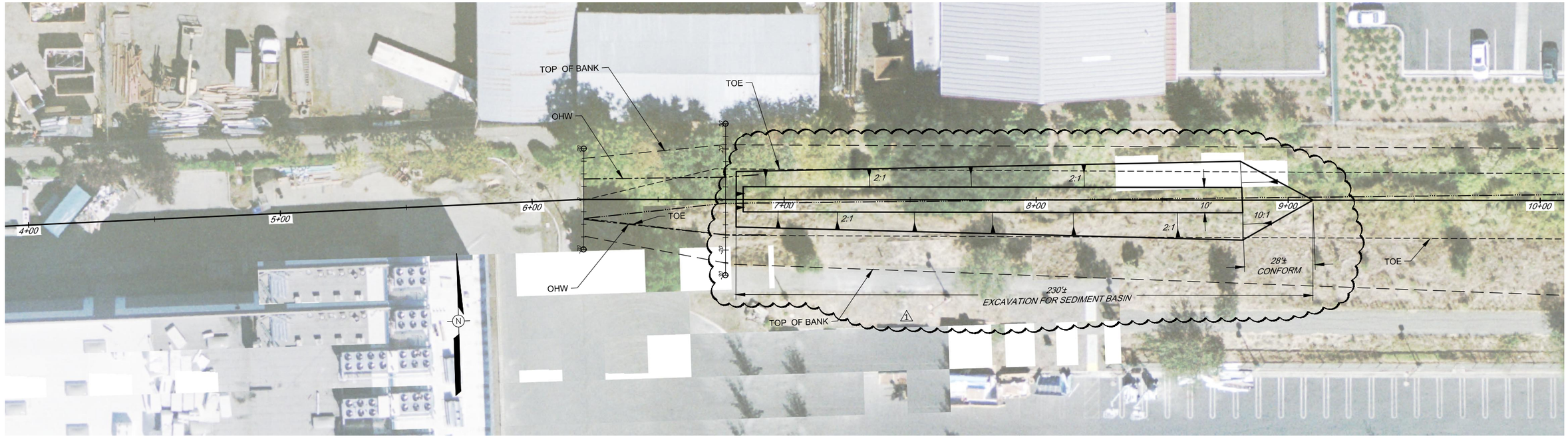


SECTIONS

SCALE: HORIZ 1" = 20'
VERT 1" = 5'

PROFILE

SCALE: HORIZ 1" = 20'
VERT 1" = 5'



PLAN

SCALE: 1" = 20'

PRELIMINARY

SUBJECT TO REVISION

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
1	3/24/2010	ADDED SEDIMENT BASIN	DD

SONOMA COUNTY WATER AGENCY

SCALE:	AS SHOWN
DATE :	3/24/10
DRAWN :	ADF
REVIEWED :	

LAGUNA – MARK WEST ZONE 1A

KAWANA CREEK – SEDIMENT REMOVAL

KAWANA STA 4+00 TO STA 10+00

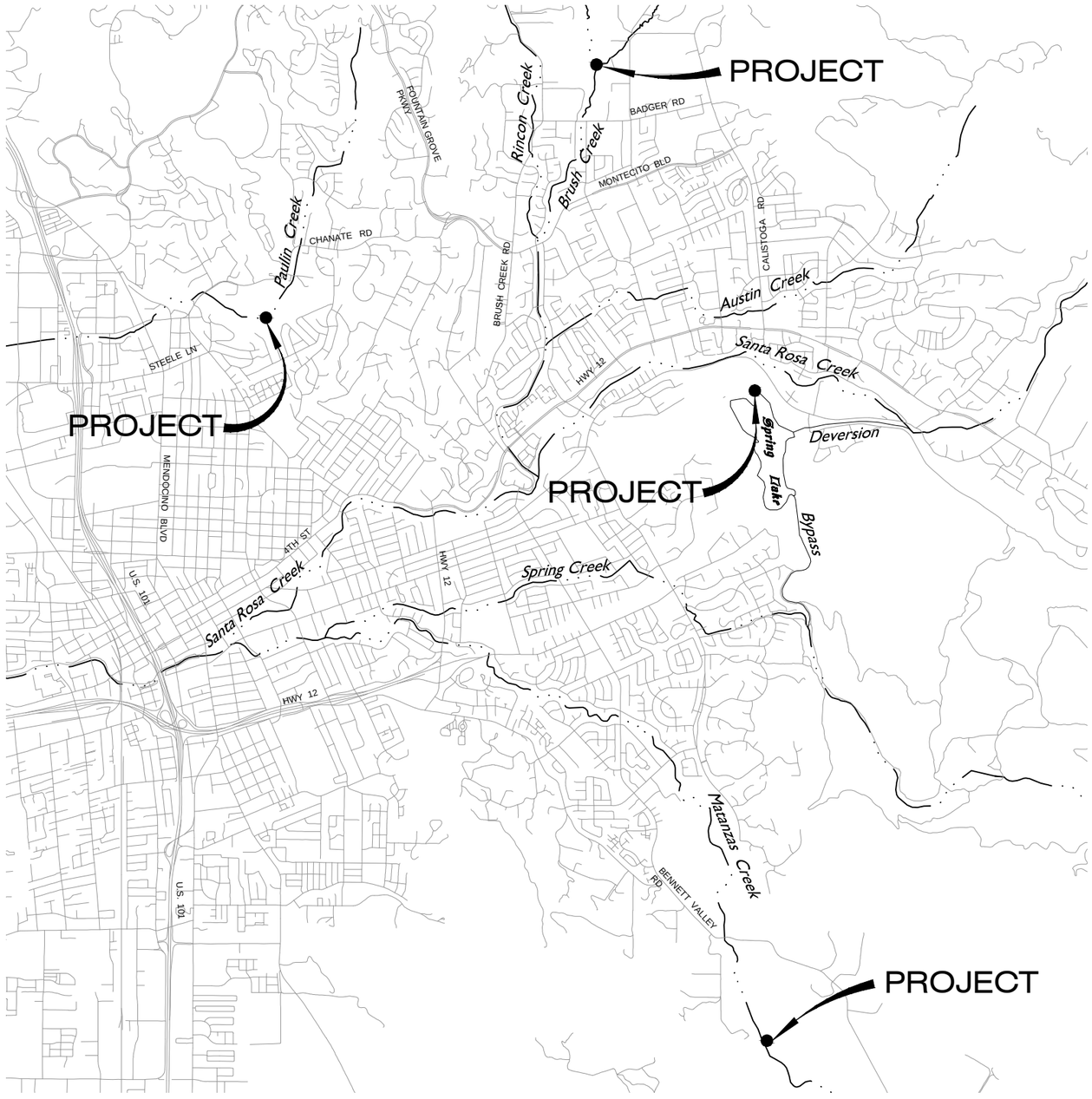
FILE NAME: Colgan-Kawana_C-09-02-25.dwg
CONTRACT NUMBER:

DRAWING NUMBER: C-6

SHEET 7 OF 7

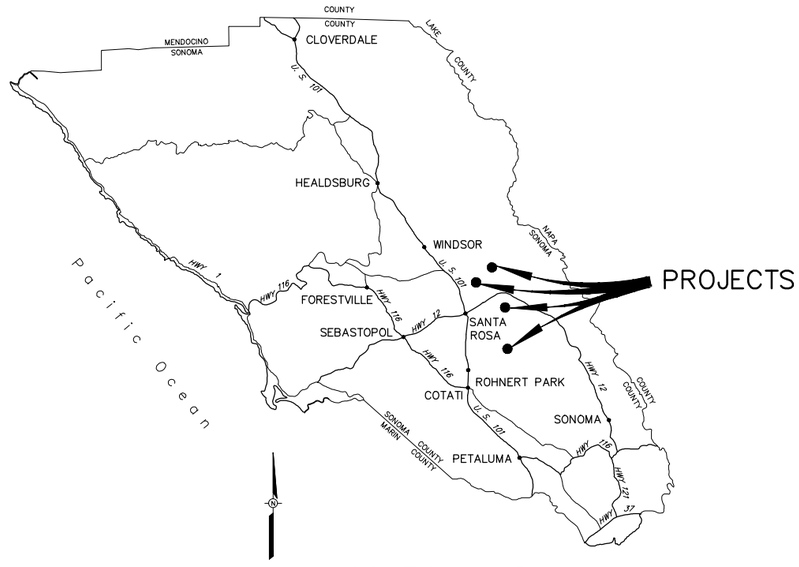
\\Sd-data\Proj\Flood control\zone 1a\sediment_removal\2009-04-14\Colgan-Kawana_C-09-02-25

BRUSH CREEK RESERVOIR
PINER CREEK RESERVOIR (Paulin Creek)
MATANZAS CREEK RESERVOIR
and
SANTA ROSA CREEK RESERVOIR
(Spring Lake)
OUTLET STRUCTURE SEDIMENT REMOVAL



VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE

INDEX TO DRAWINGS:

SHEET NO.	DRAWING NO.	TITLE
1.	G-1	INDEX TO DRAWINGS, LOCATION AND VICINITY MAPS
		BRUSH CREEK RESERVOIR
2.	C-1	PLAN (AERIAL)
3.	D56-7	(AS-BUILT) PRINCIPAL SPILLWAY PLAN AND SECTIONS
		PINER CREEK RESERVOIR
4.	C-2	PLAN (AERIAL)
5.	1-5045-102.17	(AS-BUILT) SEWER ENCASEMENT PRICIPAL SPILLWAY PROFILES
		MATANZAS CREEK RESERVOIR
6.	C-3	PLAN (AERIAL)
7.	D57-4	PRINCIPAL SPILLWAY, GENERAL PLAN
		SANTA ROSA CREEK RESERVOIR
8.	C-3	PLAN (AERIAL)
9.	1-9130-012.13	(AS-BUILT) PRINCIPAL SPILLWAY DETAILS – SAT 0+00 TO 3+00

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

SONOMA COUNTY WATER AGENCY

SCALE : NONE | DATE : 3/9/10
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
RESERVOIR OULTET STRUCTURE SEDIMENT REMOVAL
LOCATION AND VICINITY MAPS

FILE NAME: G-1_RESERVOIRS-.dwg
CONTRACT NUMBER:
DRAWING NUMBER: G-1
SHEET 1 OF 6

\\Sd-data\Proj\flood control\zone 1a\Brush_Crk-reservoir\G-1_RESERVOIRS-

PLAN

1"=40'

EXCAVATION				
PROJECT ACTIVITY DESCRIPTION	LOCATION	AREA (SQUARE FT.)	AVERAGE DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED AREA IN RESERVOIR	AROUND OUTLET STRUCTURE	1,080	1	40

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

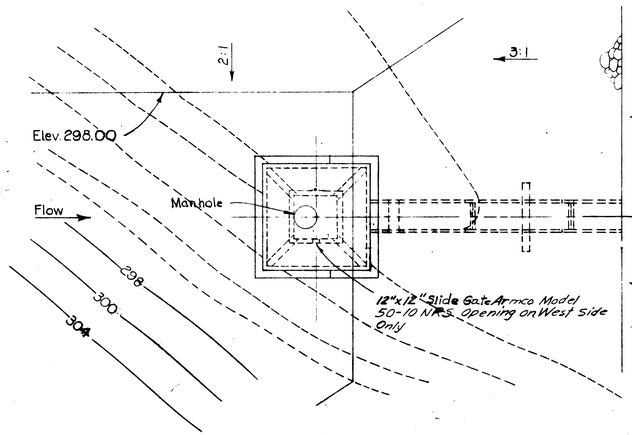
SONOMA COUNTY WATER AGENCY

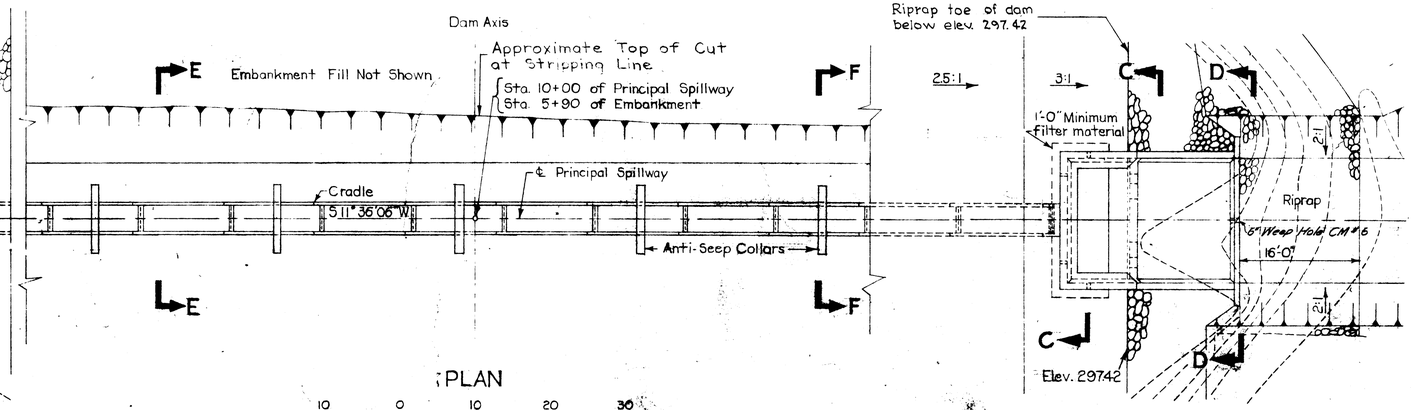
SCALE : AS SHOWN
DATE : 3/9/10
DRAWN : ADF
REVIEWED :

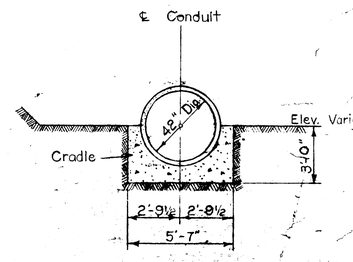
LAGUNA – MARK WEST ZONE 1A
BRUSH CREEK RESERVOIR OUTLET
PLAN – OUTLET

FILE NAME: C-1_aerial.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-1
SHEET 2 OF 9

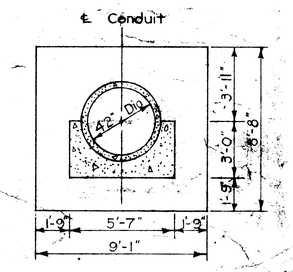
\\Sd-data\Proj\flood control\zone 1a\Brush_Crk-reservoir\C-1_aerial







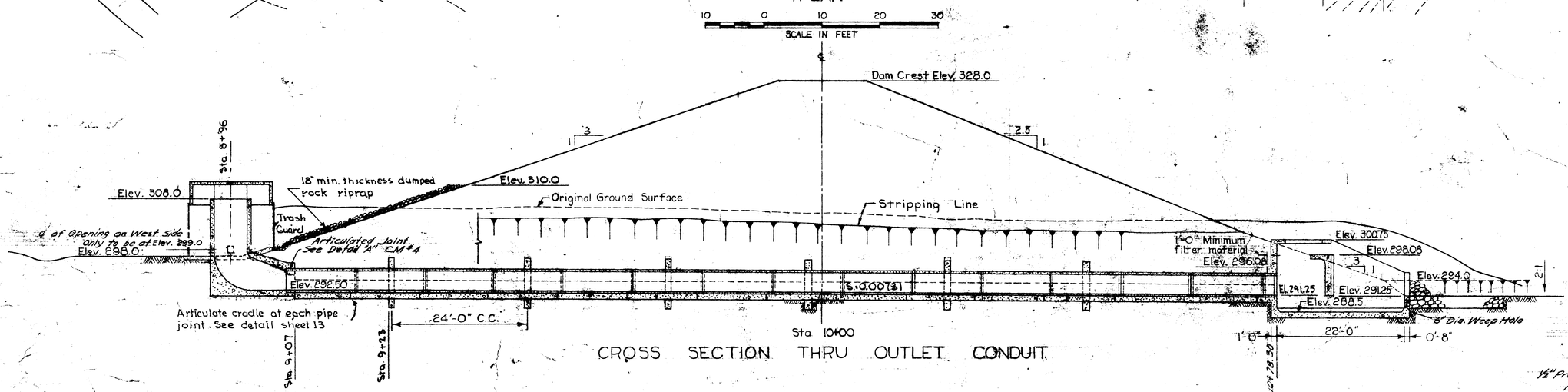
SECTION E-E



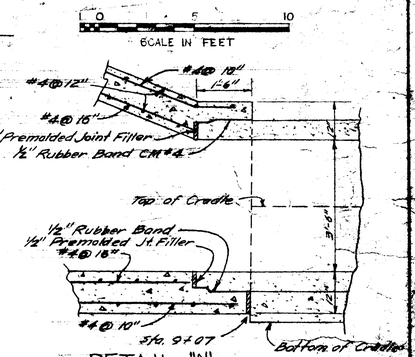
SECTION F-F

PLAN

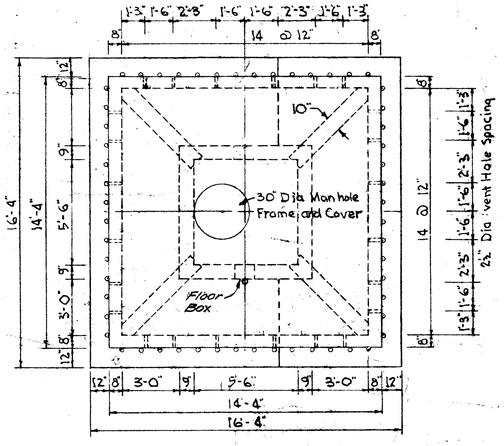
10 0 10 20 30
SCALE IN FEET



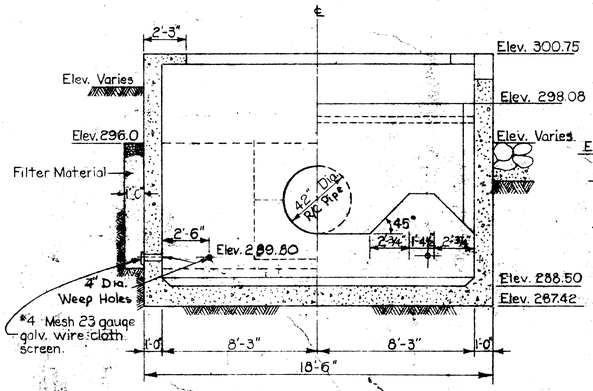
CROSS SECTION THRU OUTLET CONDUIT



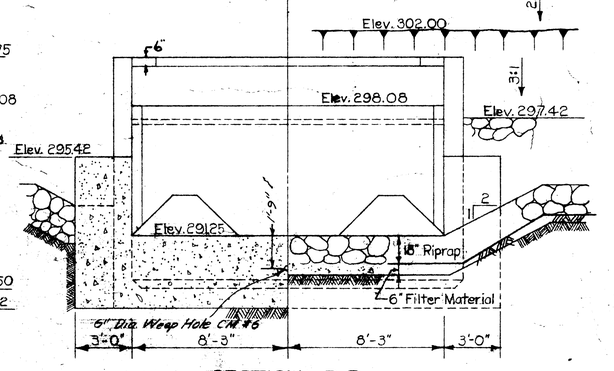
DETAIL "A"
1-7019/011-102.8



PLAN



SECTION C-C



SECTION D-D

0 5 10
SCALE IN FEET

AS BUILT

NO.	DATE	REVISION	BY
1	12-60	Vert. Trash Rack, Base Slab, Gate Control	E.B.O.

SONOMA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
APPROVED
DATE: 5/1/61
CHIEF ENGINEER

STATE OF CALIFORNIA
Department Of Water Resources
FOR THE CHIEF ENGINEER
APPLICATION No. 1002-3
APPROVED AS TO SAFETY: W. A. Bourn
DATE Jan. 29, 1963 Supervisor, Safety of Dams

PRINCIPAL SPILLWAY PLAN AND SECTIONS
BRUSH CREEK - MIDDLE FORK
CENTRAL SONOMA WATERSHED PROJECT
SONOMA COUNTY, CALIF.

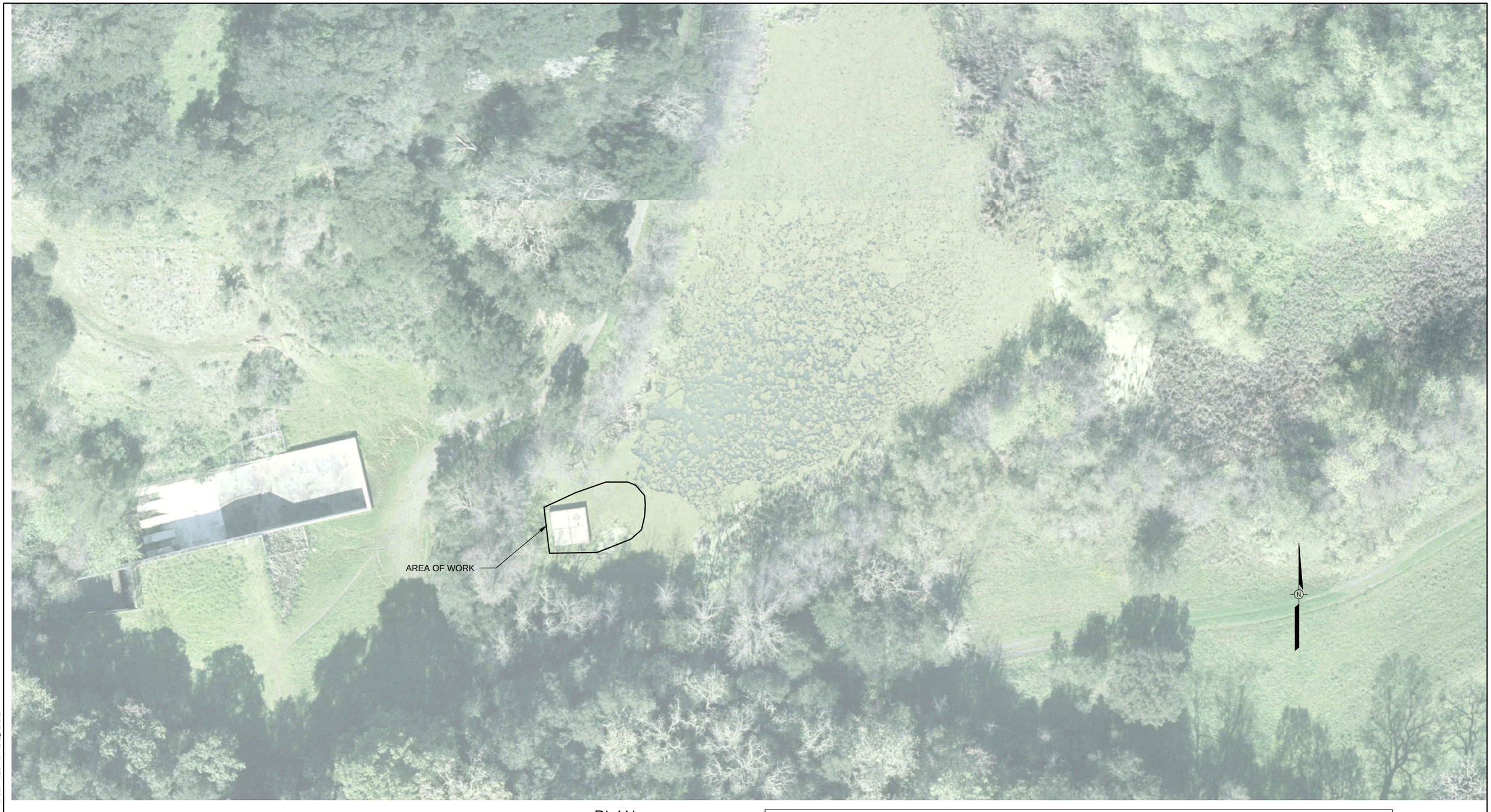
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed R.L.H.	7-60	Approved by	
Drawn R.W.M.	7-60	Title Head, E & W.P. Unit	
Traced		Title State Conservation Engineer	
Checked H.L.C., E.B.M.' 3-61		Sheet No. 7 of 16	Drawing No. D56-7

USDA SCS PORTLAND, OREG. M-3551

PM2-12

7-E-20343



PLAN

SCALE: 1" = 20'

EXCAVATION				
PROJECT ACTIVITY DESCRIPTION	LOCATION	AREA (SQUARE FT.)	AVERAGE DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED AREA IN RESERVOIR	AROUND OUTLET STRUCTURE	1,080	1	40

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

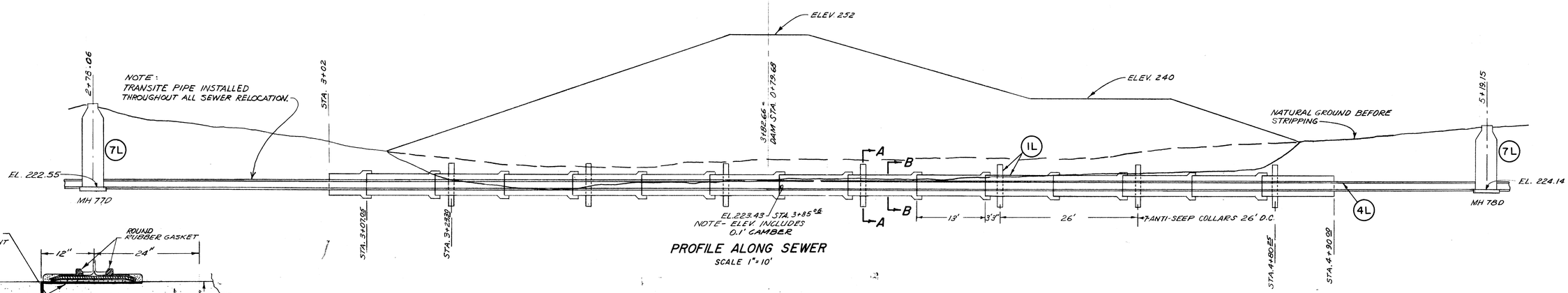
SONOMA COUNTY WATER AGENCY

SCALE : NONE
DATE : 3/9/10
DRAWN : ADF
REVIEWED :

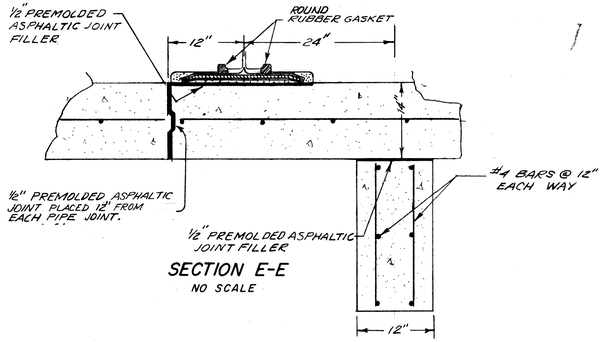
LAGUNA – MARK WEST ZONE 1A
PINER CREEK RESERVOIR
PLAN – OUTLET

FILE NAME: c-2_AERIAL.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-2
SHEET 4 OF 9

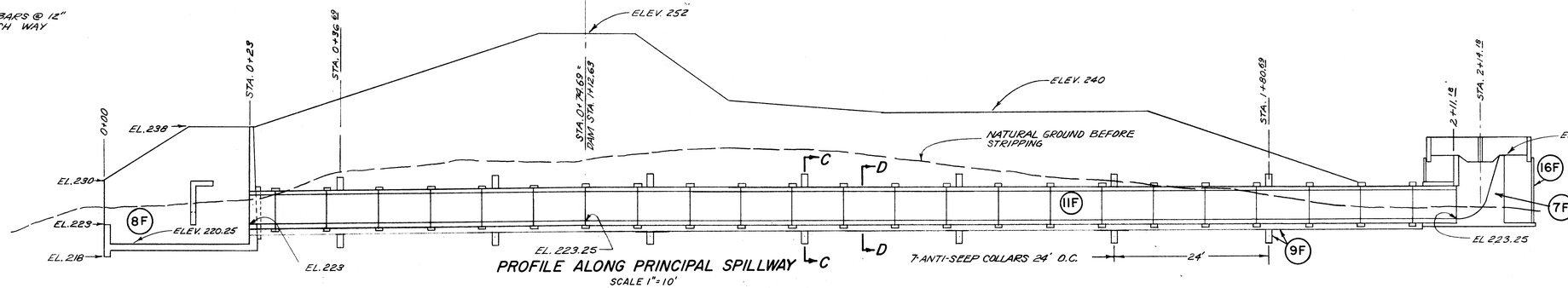
\\Sd-data\Proj\flood control\zone 1a\Piner Creek Reservoir\c-2_AERIAL



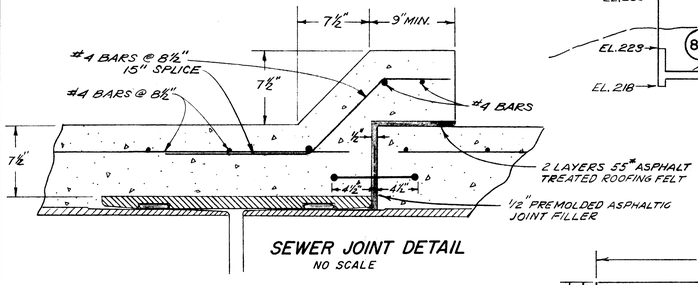
PROFILE ALONG SEWER
SCALE 1"=10'



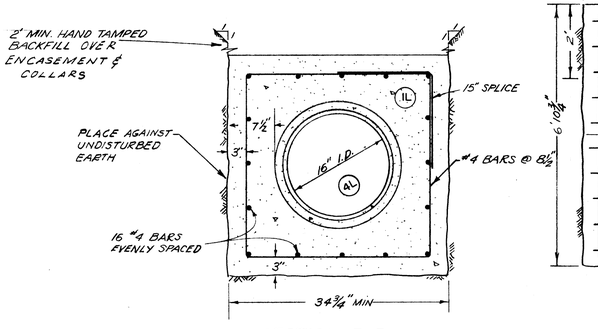
SECTION E-E
NO SCALE



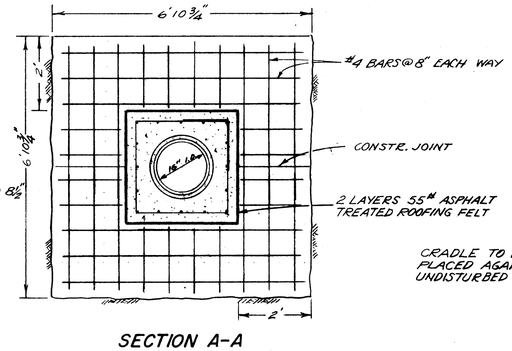
PROFILE ALONG PRINCIPAL SPILLWAY
SCALE 1"=10'



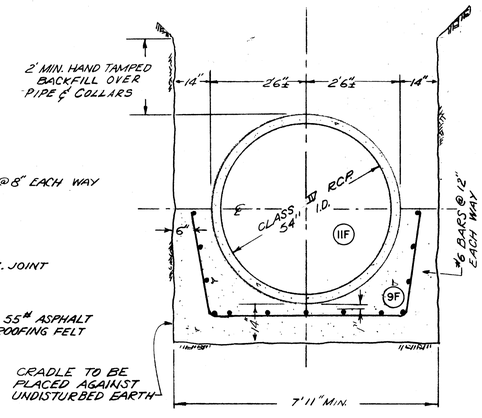
SEWER JOINT DETAIL
NO SCALE



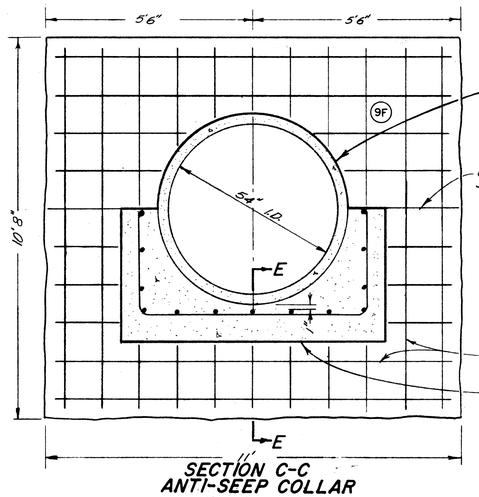
SECTION B-B
SCALE 1"=1'



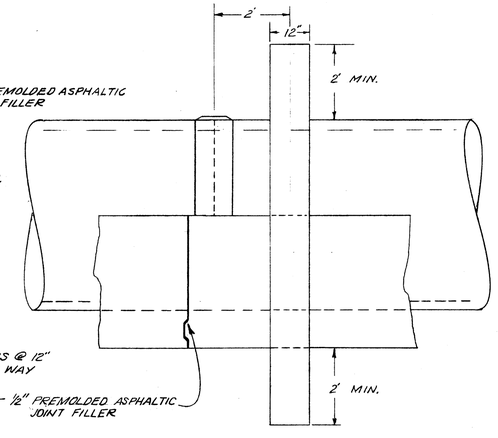
SECTION A-A
ANTI-SEEP COLLAR
SCALE 1/2"=1'



SECTION D-D
SCALE 1/2"=1'



SECTION C-C
ANTI-SEEP COLLAR
SCALE 1/2"=1'



MASTIC JOINT IN CONCRETE CRADLE AT PIPE JOINT
SCALE 1/2"=1'

NOTE:
FOR FIBER GLASS COUPLING BAND ALTERNATE, CRADLE & PIPE SHALL BE SEPARATED WITH ASPHALTIC PAINT BETWEEN THE PIPE JOINT & CRADLE JOINT.

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

APPLICATION NO. 1002-2

APPROVED AS TO SAFETY

DATE

AS BUILT

PINER CREEK RESERVOIR
SEWER ENCASEMENT & PRINCIPAL SPILLWAY PROFILES

SCALE: AS SHOWN	APPROVED Gordon W. Wilhelm CHIEF ENGINEER	DRAWN SKMc
DATE: 1/23/1961		CHECKED

SONOMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED	SUBMITTED	DRAWING NUMBER
		1-5045-102.17

Penciled sheet

PRINTED ON DIEPO NO. 1000N CLEARPRINT
USDA-SCS-PORTLAND OREG. 1961 M-3351

7-Sd-16683

PLAN

SCALE: 1" = 20'

EXCAVATION				
PROJECT ACTIVITY DESCRIPTION	LOCATION	AREA (SQUARE FT.)	AVERAGE DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED AREA IN RESERVOIR	AROUND OUTLET STRUCTURE	2,700	1	100

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

NO.	DATE	REVISION	BY
		PRELIMINARY SUBJECT TO REVISION	

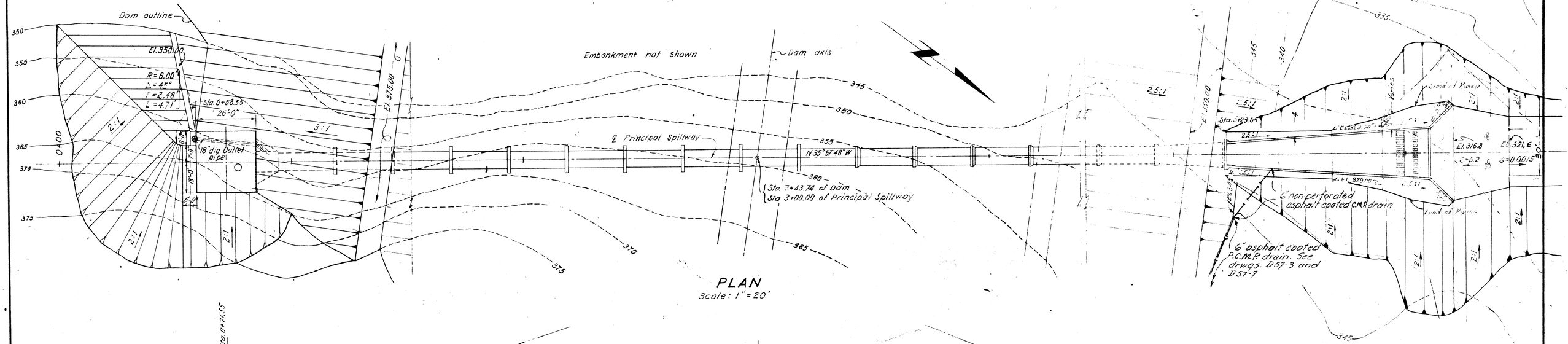
SONOMA COUNTY WATER AGENCY

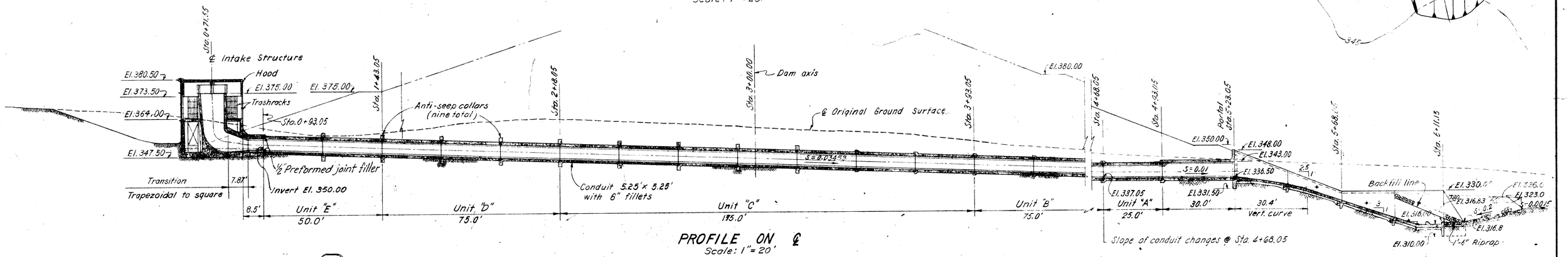
SCALE : NONE | DATE : 3/9/10
DRAWN : ADF
REVIEWED :

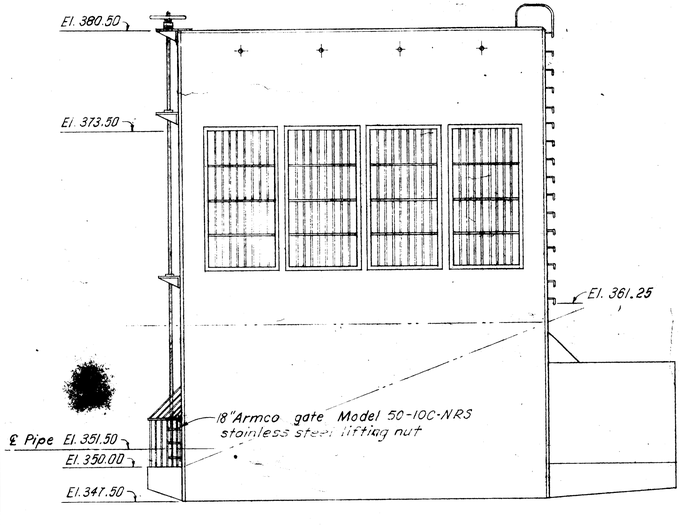
LAGUNA – MARK WEST ZONE 1A
MATANZAS CREEK RESERVOIR
PLAN – OUTLET

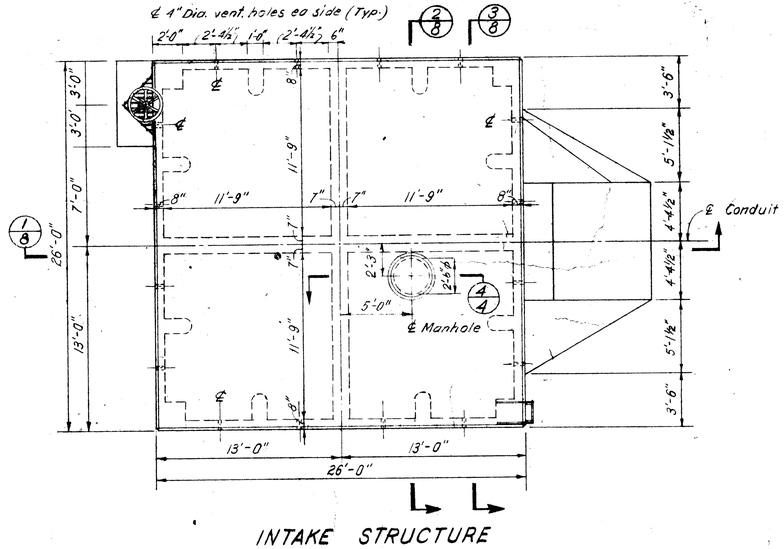
FILE NAME: C-3_AERIAL.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-4
SHEET 8 OF 9

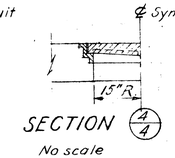
\\Sd-data\Proj\flood control\core 1a\matanzas_crk_reservoir\outlet\C-3_AERIAL











Note: C.I. Frame and locking cover to weigh not less than 500 #

GRAPHIC SCALES

0 20 40 60 Feet
Scale: 1" = 20'

0 6 12 18 Feet
Scale: 3/16" = 1'-0"

NOTES:
1. For Intake Structure Details see Dwgs D57-5 and D57-6.
2. For Conduit Details see Dwg D57-6.
3. For Outlet Chute and Stilling Basin Details see Dwg D57-7.
4. For Dam Embankment Details see Dwg. D57-3

REGISTERED PROFESSIONAL ENGINEER STANLEY F. GUERNSEY #10352 CIVIL STATE OF CALIFORNIA

AS BUILT I-6054-102.12AB

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION No. 1002-4
APPROVED AS TO SAFETY
FOR THE CHIEF ENGINEER
AUG 5 1966
Robert B. Jansen
DIVISION ENGINEER, REG. C.E. N° 8218

WOODWARD, CLYDE, SHERARD & ASSOCIATES
CONSULTING CIVIL ENGINEERS — OAKLAND, CALIF.

DESIGNED: W.I.T.
CHECKED: V.S.D.
DRAWN: G.R.I.
APPROVED BY: Stanley F. Guernsey

SONOMA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
CENTRAL SONOMA WATERSHED PROTECTION PROJECT

MATANZAS CREEK
PRINCIPAL SPILLWAY
GENERAL PLAN

APPROVED — SOIL CONSERVATION SERVICE		APPROVED — SONOMA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
STATE CONSERVATION ENGINEER		CHIEF ENGINEER
DATE: MARCH, 1962	SCALE: AS NOTED	DRWG. NO.: D57-4
		SHEET OF

USDA-SCS-PORTLAND, OREG. 1962 M-3706

PHG-tc 1002-4

7-Sd-172 75

PLAN

SCALE: 1" = 40'

EXCAVATION				
PROJECT ACTIVITY DESCRIPTION	LOCATION	AREA (SQUARE FT.)	AVERAGE DEPTH (FT.)	C.Y. (TO REMOVE)
ACCUMULATED SEDIMENT REMOVAL USING EXCAVATOR OR FRONT END LOADER OPERATING IN THE DEWATERED AREA IN RESERVOIR	AROUND OUTLET STRUCTURE	2,700	1	100

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

90% SUBMITTAL

PRELIMINARY
SUBJECT TO REVISION

NO.	DATE	REVISION	BY

SONOMA COUNTY WATER AGENCY

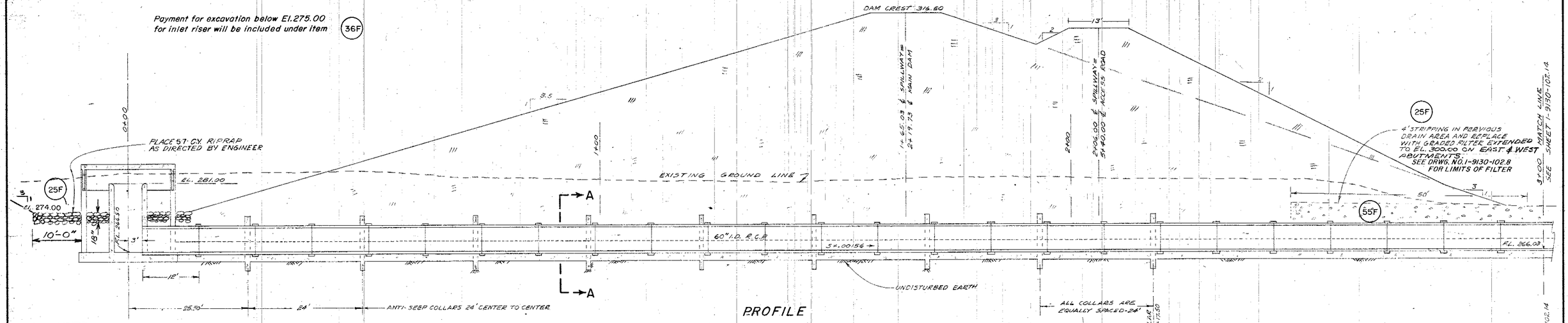
SCALE : NONE
DATE : 3/9/10
DRAWN : ADF
REVIEWED :

LAGUNA – MARK WEST ZONE 1A
SANTA ROSA CREEK RESERVOIR (SPRING LAKE)
PLAN – OUTLET

FILE NAME: C-4_aerial.dwg
CONTRACT NUMBER:
DRAWING NUMBER: C-4
SHEET 8 OF 9

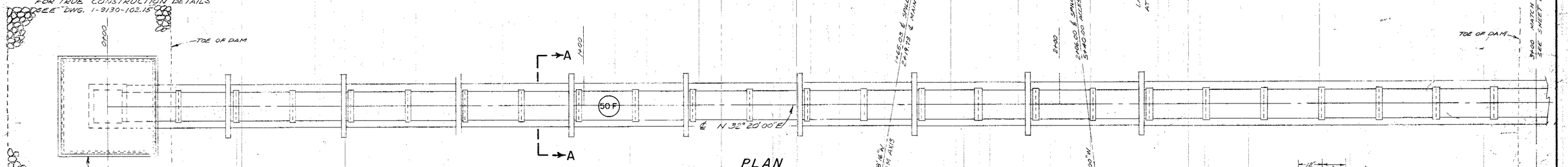
\\Sd-data\Proj\flood control\zone 1a\SPRING LAKE\OUTLET\C-4_aerial

Payment for excavation below El. 275.00 for inlet riser will be included under item (36F)



PROFILE

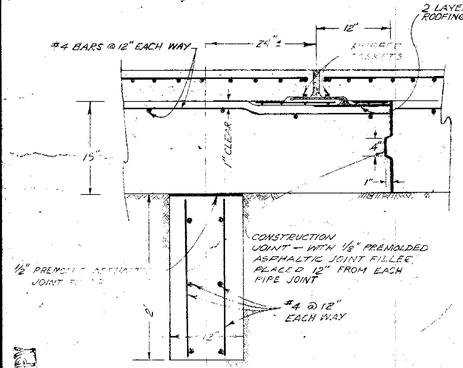
NOTE:
PRINCIPAL INLET RISER SHOWN HERE FOR REFERENCE ONLY FOR TRUE CONSTRUCTION DETAILS SEE DWG. 1-9130-102.15



NOTE: CRADLE TO BE ARTICULATED AT EACH PIPE JOINT

PLAN

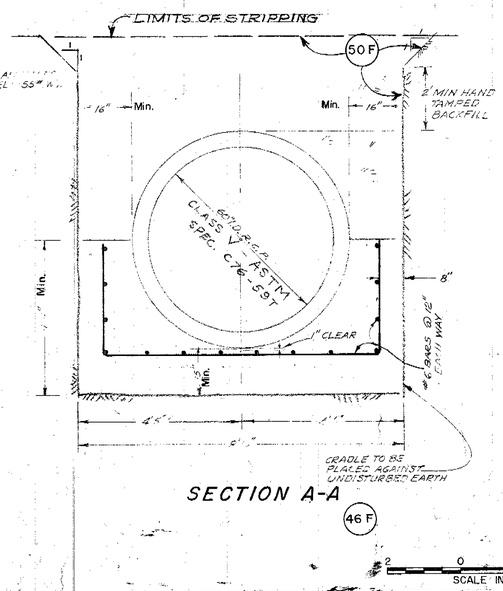
10 0 10 20
SCALE IN FEET



JOINT DETAIL SECTION B-B

SHOWING RELATIONSHIP OF PIPE JOINTS AND COLLARS BASED ON 12' PIPE LENGTHS END TO END AND DOES NOT REFLECT THE STYLE OF REINFORCED CONCRETE PIPE

0 1 2
SCALE IN FEET



SECTION A-A

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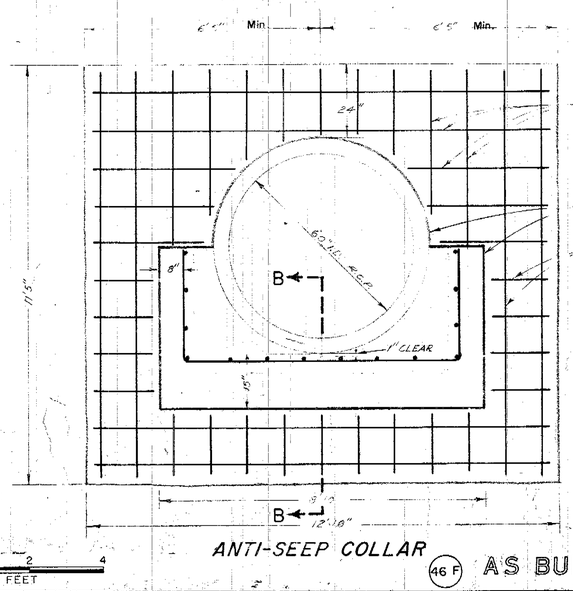
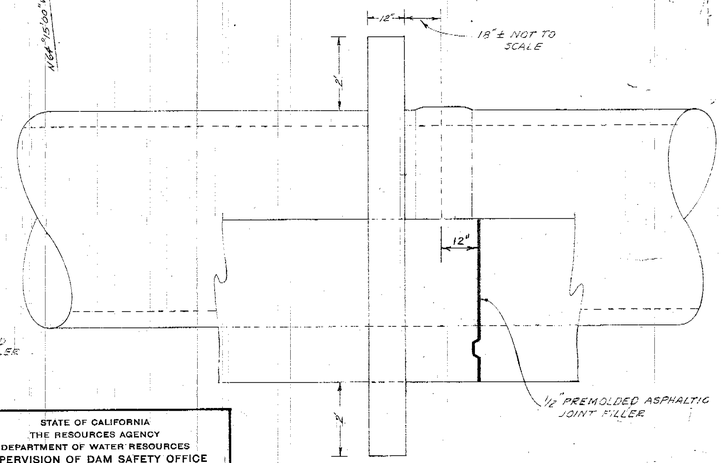


ANTI-SEEP COLLAR

(46F) AS BUILT



MASTIC JOINT IN CONCRETE CRADLE AT PIPE JOINT

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SCALE IN FEET

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SUPERVISION OF DAM SAFETY OFFICE

APPLICATION No. 1002-5

APPROVED AS TO SAFETY FOR THE CHIEF ENGINEER

FEB 4 1965 Robert B. Jansen
Supervising Safety of Dams

SCHEDULE - B

SANTA ROSA CREEK RESERVOIR
PRINCIPAL SPILLWAY DETAILS STA. 0+00 TO 3+00

SCALE: AS SHOWN	APPROVED Chief Engineer	DRAWN R.G. Jr.
DATE: 4/1/1960		CHECKED

SONOMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED	SUBMITTED	DRAWING NUMBER
R.G.A. Vaughn		1-9130-102.13

7-Sd-16683

U.S. BUREAU OF RECLAMATION PORTLAND, OREGON 1962 M-3656

Section 3

SUMMARY OF MAINTENANCE PROJECT SIZES, EXTENTS, AND POTENTIAL EFFECTS

Section 3

Summary of Maintenance Project Sizes, Extents, and Potential Effects

The following tables describe the areal and length extents of the 2010 maintenance projects and their potential effects to Waters of the State/U.S. and listed species.

3A. Sediment Removal Projects

Project Site	Length (linear feet)	Volume Removed (cu. yds.)	Acres Disturbed	
			Waters of the U.S. (below OHWM)	Waters of the State (area below TOB)
Localized Scale				
Ducker 2	90	56	0.02	—
Hinebaugh 5	120	78	0.02	0.03
Paulin 2, 3, 4 and 6	1,141	805	0.41	0.005
Russell 1	100	74	0.03	0.003
Todd 4	390	325	0.12	0.03
Reach Scale				
Corona 1	2,260	421	0.52	—
Laguna 1	2,400	14,485	3.4	0.09
Lorna Dell 1	1,260	186	0.47	0.45
Sediment Basin/Instream Basin Clearing				
Adobe 2	276	500	0.08	—
Cook Creek 2	146	100	0.23	—
Copeland at Country Club Dr.	200	333	0.21	—
Copeland at Snyder Ln.	205	683	0.21	—
Santa Rosa Div. 1	200	300	0.14	—
Wilfred 1	200	104	0.06	—
Project Totals	**8,988**	**18,450**	**5.92**	**0.61**

3B. Bank Stabilization Projects

Project Site	Length (linear feet)	Area Disturbed (sq ft)		Volume of Fill (cu.yds, net)	Treatment Approach (SMP Manual Figures 5-5, 5-6, or 5-7)
		Waters of the U.S. (below OHWM)	Waters of the State (below Top of Bank)		
Hunter 2	10	75	49	10	5-6
Moorland 1	35	150	110	14	5-6
Santa Rosa 1	30	272	180	20	5-6
Todd 4	73	438	0	32	5-6
Totals	**148**	**935**	**339**	**76**	

3C. Listed Species – Potential Area of Effect

California Tiger Salamander

As described above in Section 1C and Table 1-3, there are three species listed under the Federal Endangered Species Act that could be potentially impacted by the 2010 maintenance projects. One of these species, California tiger salamander, is also listed under the California Endangered Species Act. The SMP Manual and its associated Biological Opinions from the USFWS and NMFS describes the necessary avoidance and minimization measures required for these species to provide incidental take authorization.

SCWA SMP managers, SCWA biologists, consultants, and USFWS biologists reviewed the 2010 maintenance project locations and proposed activities. Based on this analysis, project managers and reviewers concluded that impacts to California tiger salamander (CTS) are the only potential impacts to listed species that require compensatory mitigation.

Table 3-1 below identifies 2010 SMP maintenance reaches within 1.3 miles of known CTS occurrences. Maintenance project areas (above the ordinary high water mark – the zone thought to potentially support rodent burrows and CTS) are given for the project areas within the 1.3 mile buffer zone of known occurrences. It should be noted that these data reflect the most recent occurrence data and include recent observations at the Horn Avenue Mitigation Bank. These data are not in the CNDDB yet, but have been incorporated into the SMP and the 2010 notification package.

Table 3-1. 2010 Projects Requiring Compensatory Mitigation for CTS

Project Site	Acres Disturbed (above OHWM)	Compensatory Mitigation Required (as per FWS BO)	
		Ratio	Total required (sq.ft.)
Localized Scale Sediment			
Hinebaugh 5	1,514	0.2:1	303
Reach Scale Sediment			
Laguna 1	4,000	0.2:1	800
Bank Stabilization			
Hunter 2	50	1:1	50
Moorland 1	110	1:1	110
Todd 4 (+localized)	1,150	0.2:1	230
Sediment Basin			
Wilfred 1	0	0.2:1	0
Copeland 4 and 5	0	0.2:1	0
Project Totals	**6,824 sq.ft. (0.157 acres)**		**1,493 sq.ft. (0.034 acres)**

As per the guidance of the SMP's Programmatic USFWS Biological Opinion and the pending Consistency Determination from the CDFG, SCWA agrees to compensate for effects to California tiger salamander through purchase of credits from a USFWS and CDFG approved conservation bank equivalent to 0.07 acre for the California tiger salamander. This area is intended to fully mitigate for impacts resulting from 2010 Projects as well as 2011 projects (e.g. 2010 mitigation of 0.034 acres x 2 = 0.07 acres).

SCWA shall provide the USFWS and CDFG with a copy of the credit purchase agreement for the required credits of USFWS and CDFG-approved documentation that shows sufficient funding has been secured for the actual costs of the credits. This mitigation for CTS habitat disturbance is provided in addition to already required SMP on-site and off-site mitigation activities which will be implemented in 2010 (see Section 4).

Moreover, SCWA will purchase credits prior to project impacts. SCWA will be responsible for all actual costs for credit purchase. If the credits are not purchased prior to project impacts, funding assurances for credit purchase will be secured by an Irrevocable Letter of Credit (LOC) or other mechanism approved by the USFWS and CDFG and with language reviewed and approved by the USFWS and CDFG and the issued LOC shall be provided prior to project impacts. The funding assurance provided for credit purchase shall be based on the cost of credits for 0.07 acre for the California tiger salamander.

California Red-Legged Frog

To address stream maintenance effects on California Red-Legged Frog in locations where the species has the potential to occur (See SMP Manual Table 7-3), SCWA will (according to BMPs BR-10 and BR-11 California Red-legged Frog Avoidance and Impact Minimization Measures for Ground-Disturbing and Vegetation Management Activities and the USFWS BO) undertake the following measures:

1. For ground-disturbing maintenance activities occurring in areas where California red-legged frog has been identified as potentially occurring (see SMP Manual Table 7-3), a qualified biologist will conduct USFWS-approved protocol level surveys to determine the potential presence of red-legged frogs. For ground-disturbing maintenance activities that are in areas where California red-legged frogs are identified as potentially occurring and no protocol level surveys are conducted, red-legged frogs will be presumed present.

2. If suitable breeding is habitat is encountered, the USFWS will be contacted and any site-specific recommendations will be implemented.

3. If red-legged frogs are present or assumed present, a qualified biological monitor, or a biologist with an Incidental Take Permit pursuant to Section 10(A)(1)(b) for the Act, will inspect the area daily before the start of work and will be present during maintenance activities in sensitive habitats. If appropriate, SCWA will install exclusionary fencing.

4. In the event that a red-legged frog is encountered within the maintenance area, the USFWS will be contacted within 48 hours of any red-legged frog observations, and a qualified biologist will move the frog to a safe location outside of the project area. Actions taken to move red-legged frog will be consistent with applicable Service and CDFG regulations and permits. The biological monitor will have the authority to stop work if a red-legged frog is encountered until such a time as the frog may be moved to an area outside of the project area fencing.

5. If dewatering of a creek is required, dipnet and seine surveys for red-legged frog tadpoles will be completed prior to initiation of dewatering. Captured tadpoles will be moved to a safe location elsewhere in the creek.

As of publication of this notification, SCWA biologist Dave Cook is in the process of performing protocol level surveys for all 2010 ground-disturbing project sites within the area considered potential habitat for the California red-legged frog (SMP Table 7-3). Details of these surveys will be sent to the USFWS prior to commencing project activities. Table 3-2, below, highlights the 2010 project sites that entail ground-disturbing within potential habitat for this species. The table also notes whether protocol surveys are underway or complete. As protocol level surveys are completed for these stream segments and maintenance activities are monitored, the SMP database will continue to track current spatial presence or absence of the species and these data will be shared with the USFWS.

Table 3-2. 2010 Projects on Reaches requiring CRLF protocol level and habitat level surveys

Location	Area of Disturbance (sq.ft.)	Protocol Level Survey Conducted
Localized Scale Sediment		
Starr Creek Tributary (2009 permitted project)	17,631	Y (started in April 2010)
Washington 3 (2009 permitted project)	7,680	Y (started in April 2010)
Ducker 2	1,080	Y (started in April 2010)
Reach Scale Sediment		
Corona 1	22,500	Y (started in April 2010)
Sediment Basin Clearing		
Cook Creek	10,000	Y (started in April 2010)
Adobe Creek	3,600	Y (started in April 2010)
Santa Rosa Creek Diversion	6,200	Y (started in April 2010)
Reservoir Inlet Clearing (2009 permitted projects)		
Matanzas	2,700	Y (started in April 2010)
Piner Creek	1,080	Y (Conducted in 2009)
Brush Creek	1,080	Y (Conducted in 2009)
Spring Lake	2,700	Y (started in April 2010)
Project Totals	**88,851**	

In addition to the conservation measures articulated for ground-disturbing activities, SCWA will also conduct the following CRLF measures to avoid potential impacts to frogs during vegetation maintenance activities occurring within potential habitat for the species:

1. For vegetation maintenance activities occurring in areas where red-legged frog has been identified as potentially occurring (see SMP Manual Table 7-3), a qualified biologist will conduct pre-maintenance surveys of aquatic habitats and identify potential red-legged frog breeding and foraging areas. These areas will be flagged and avoided by maintenance crews.

2. In areas where red-legged frog could potentially occur, field crews conducting hand trimming of vegetation will access channel banks by foot only and will avoid entering open water. Vehicles will be restricted to existing access roads.

3. In work sites where potential red-legged frog breeding and foraging areas were identified during the pre-maintenance survey, a qualified biological monitor or a biologist with an Incidental Take Permit, pursuant to Section 10(a)(1)(b) of the Act will be on-site during project activity in sensitive habitats. The biological monitor will have the authority to stop work if a red-legged frog (or any of its life stages) is encountered until such a time as the frog may be moved to an area away from the project site.

4. The USFWS will be contacted within 48 hours of any red-legged frog observations.

Listed Plants

The following six listed plants are known to occur within the SMP Program: Sonoma alopecurus (*Alopecurus aequalis var. sonomensis*) (alopecurus), Sonoma sunshine (Blennosperma bakeri), Sonoma white sedge (*Carex albida*) (white sedge), Burke's goldfields (*Lasthenia burkei*) (Burke's goldfields), Sebastopol meadowfoam (*Limnanthes vinculans*) (meadowfoam), and many-flowered navarretia (*Navarretia leucocephalis plieantha*) (navarretia). As per the SMP USFWS BO, white sedge, navarretia, or alopecurus are not likely to be adversely affected by the SMP Program. If white sedge, navarretia, or alopecurus are discovered during floristic surveys, no further SMP activities will occur within the reach, the Service and CDFG will be notified of their discovery within 48 hours, and SCWA will not continue any maintenance activities within the reach without Service and CDFG approval.

The SMP BO finds that activities could result in adverse effects to Sonoma sunshine, Burke's goldfields, and Sebastopol meadowfoam. These adverse effects will be minimized by conducting appropriately timed pre-maintenance surveys for rare plants. Table 3-3 lists the 2010 project reaches from SMP Table 7-3 that could provide potential habitat for listed plants. As per the terms and conditions of the USFWS BO and SMP Manual BMPs, SCWA botanists will conduct appropriately timed floristic surveys at both these project locations in the spring of 2010, prior to project implementation. If any special status plants are observed during surveys, the project will either be redesigned to avoid effects or these plants will be flagged and/or fenced off to avoid them to the maximum extent possible. If not special status plants are observed, the project will be implemented as designed and no further measures will be put in place for protection of special status plants and results of the surveys will be appended to the SMP Annual Report.

Initial surveys for these species were begun April 19-23, 2010. These three vernal pool species typically bloom between April and June. Follow-up surveys will be conducted in May (by the 15th) and in early June 2010. If listed plants such as Sonoma sunshine, goldfields, or meadowfoam are observed during plant surveys, the USFWS and CDFG will be notified prior to project implementation. If effects are unavoidable through re-design or flagging, the plants will be transplanted at an appropriate and secure location on- or off-site. Transplantation will be conducted in consultation with the USFWS and/or CDFG. If transplantation is not feasible or not approved by the Service or CDFG, then credits will be purchased from a Service or DFG-approved preservation bank.

Table 3-3. 2010 Projects on Reaches requiring Listed Plant Species Surveys

Location	Area of Disturbance (sq.ft.)	Survey Required
Reach Scale Sediment		
Laguna 1	154,000	Sebastopol meadowfoam, Burke's gold fields, Sonoma sunshine
Bank Repair		
Santa Rosa 1	452	Sebastopol meadowfoam, Burke's gold fields, Sonoma sunshine
Peterson 1 (2009 permitted project)	1,520	Sebastopol meadowfoam, Burke's gold fields, Sonoma sunshine
Peterson 2 (2009 permitted project)	5,372	Sebastopol meadowfoam, Burke's gold fields, Sonoma sunshine
Project Totals	**161,344**	

Section 4

ANNUAL MITIGATION PLAN

Section 4

Annual Mitigation Plan

This section describes the mitigation activities proposed for the 2010 maintenance projects. Sections 4A and 4B describe on-site and off-site mitigation activities, respectively. Table 4-6 summarizes maintenance project funding for the off-site Watershed Partnerships Program (WPP). Table 4-7 provides summary statistics for areas impacted and mitigated for the 2010 maintenance season.

4A. On-Site Mitigation Activities (Tier 1)

On-site impact mitigation will be implemented at the specific project reach where the maintenance work was conducted. SMP Chapter 8 provides detail on how on-site mitigation is evaluated and designed to address impacts in the immediate maintenance project area, considering restoration and enhancement opportunities in the reach. On-site mitigation activities will restore or improve habitat that is affected by the sediment removal or bank stabilization activities within the general reach footprint in which the disturbance has occurred. On-site restoration typically restores and enhances a larger area than is impacted by maintenance activities. However, for simplicity in accounting, the on-site mitigation is calculated as a 1:1 ratio (acres disturbed to acres restored). As described in Chapter 8 of the SMP Manual, Tier 1 on-site mitigation activities include a robust planting program to develop a fuller riparian corridor, the removal of exotic and invasive species, and the construction of low-flow channels and other geomorphic features to enhance instream habitat and remove migration barriers.

4B. Off-Site Mitigation Activities (Tiers 2 and 3)

As described in the SMP Manual, off-site mitigation is provided to address the temporal gap between when on-site impacts occur and when on-site mitigation is provided. Tier 2 mitigation provides in-kind mitigation at neighboring SMP reaches that afford an opportunity for mitigation. Tier 3 mitigation projects provide restorative and mitigating watershed solutions that address SMP impacts at an off-site location. Tier 2 and 3 mitigation is implemented through a 10% matching contribution of SMP maintenance costs. SMP off-site watershed mitigation is led and funded by SCWA through a grant program to

distribute funding to partnering agencies. The Watershed Partnerships Program (WPP) that was formed by SCWA funds and implements projects collaboratively with local non-profit agencies and Resource Conservation Districts (RCDs).

The Bay Institute's (TBI's) *Students and Teachers Restoring a Watershed* (STRAW) Project has been selected to provide off-site mitigation for the Agency's 2010 maintenance projects. TBI is one of several WPP Partners that were identified through an outreach process during the development of the SMP Manual. Several of the projects described below have already been implemented and thus represent "pre-mitigation" for the SMP project impacts. Information regarding TBI's general mission and example project types (as well as for the other WPP Partners) is provided in Table 8-5 of the SMP Manual. As described below, the projects to be funded by SCWA under STRAW program effectively address the impacts of 2010 maintenance activities by conducting in-kind riparian and stream restoration in geographic proximity to this year's SMP maintenance. The success criteria and commitments described in the SMP Manual regarding implementation of off-site restoration projects apply to all of the 2010 TBI projects. These criteria and commitments include describing planting success rates (85%), a 5-yr monitoring period with annual reporting, and a description of what happens in the event of unsuccessful projects.

The Bay Institute's STRAW Project

The STRAW Project coordinates and sustains a network of teachers, students, restoration specialists, and other community members as they plan and implement restoration projects in Marin and Sonoma counties. STRAW provides teachers and students with the scientific, educational and technical resources to prepare them for hands-on ecological restoration of riparian corridors.

TBI and SCWA have identified a total of 4 restoration projects that will be used to mitigate SCWA's 2010 maintenance activities. These projects are located along the Petaluma River, Roseland Creek, Copeland Creek, and Matanzas Creek. Figure 4-1 provides general locations of the restoration sites. The Petaluma River Restoration at Denman Reach is located in SCWA's Zone 2A, while the remaining three sites are located in Zone 1A. Details for each site are shown in Table 4-1.

These projects are appropriate mitigation for temporal SMP maintenance impacts because they provide benefits of reducing erosion and sediment input to creeks, and will enhance fragmented habitat. In addition, these projects provide community education and outreach by engaging volunteers and students from local schools in the active enhancement of their community watershed. While these 2010 funded TBI/STRAW mitigation projects have already been implemented, none have ever been used for any mitigation credit for any regulatory process. A more detailed description for each of the TBI restoration projects is provided below.

Figure 4-1: General Location Map for the 2010 Off-site (Tier 2 and 3) mitigation projects conducted by The Bay Institute

Table 4-1: List of Tier 3 Restoration Projects

Project Name	Project Size	Project Cost	Year Completed	Project Purpose
TBI: 2010Petaluma River – Denman Reach Restoration Project	0.60 acres	$21, 545	2010	Plant installation at various elevations on or near the constructed floodplain
TBI: 2010 Roseland Creek Phase II Restoration Project	0.39 acres	$21,545	2010	Removal of sporadic populations of the non-native Himalayan Blackberry and planting of native trees and shrubs
TBI: 2009/2010 Copeland Creek Phase VI Restoration Project	0.57 acres	$43,090	2009/2010	Two day restoration consisting of planting on south side of creek upstream of crossing.
TBI: 2010 Hoen-Matanzas Creek Phase I Restoration Project	0.21 acres	$21,545	2010	Two day restoration: removed non-native English Ivy and Himalayan Blackberry, and planted native understory shrubs and grasses

TBI: 2010 Petaluma River - Denman Reach Restoration Project

The Denman Reach section of the Petaluma River was selected as a restoration site because of the project's potential to increase the habitat destroyed during an earlier flood event after the project was initially constructed. The goals of this project were to enhance the habitat value of the floodplain, and to continue the work of the City of Petaluma and all of its partners at this site to completion.

Restoration Activities

The restoration was conducted on January 26, 2010 and included the planting of the species listed below at various elevations on or near the constructed floodplain:

Symbol	Species		Quantity
	Trees		
AN	*Acer negundo*	boxelder	15
AC	*Aesculus californica*	buckeye	5
FL	*Fraxinus latifolia*	ash	10
QA	*Quercus agrifolia*	coast live oak	5
QL	*Quercus lobata*	valley oak	15
	Shrubs		
HA	*Heteromeles arbutifolia*	toyon	5
RhC	*Rhamnus californica*	coffeeberry	5
SM	*Sambucus nigra ssp. Canadensis*	elderberry	10
		Total	70

Maintenance and Monitoring

Now that the site has undergone revegetation, it will be maintained and monitored for a 5-yr period to ensure successful establishment and long-term viability. The following monitoring services will be provided by TBI:

- Regular inspections of plantings from late spring through early fall for three years – as often as once per week, but no less that once per month for the first year, and once per month for the following two years.
- Maintenance of plantings at a minimum by weeding, repairing browse protectors and spraying of deer repellent if required.
- Irrigation of plantings at least once per week (2 gallons/plant) using installed drip system. Additional irrigation will occur when conditions require increased water application. Maintenance of drip system function.
- Monitoring plant survival by species in October to inform future planting designs.
- Performing annual photomonitoring using the State Water Resources Control Board's SOP 5.2.3.
- Coordination of additional monitoring activities with PRBO Conservation Science and UC Cooperative Extension staff if additional funding is available.

Community Involvement

49 students and 15 parent volunteers participated in this one day restoration project. The students were 4th and 5th graders from the La Tercera School located in Petaluma, Ca.

Restoration Costs

Table 4-2 presents a cost breakdown for the Petaluma River-Denman Reach Restoration Project.

Table 4-2. Petaluma River-Denman Reach Restoration Costs

Tasks	Cost
Restoration Design, Training and Implementation	$11,480.00
Maintenance, Monitoring, Reporting	$4,565.00
Technical Consultants	$2,200.00
Plants, Materials	$800.00
Irrigation Supplies	$800.00
Implementation Costs (storage, portable toilet etc.)	$300.00
Travel, Meetings	$1,400.00
TOTAL	***$21,545.00***

Restoration Activity Permit Requirements

This restoration activity has already been implemented and does not require any additional permitting to complete the maintenance and monitoring phase.

TBI: 2010 Roseland Creek Phase II Restoration Project

Roseland Creek is a tributary to the Laguna de Santa Rosa, the largest sub-watershed of the Russian River. This is a multi-phase project along the reach between Stony Point Road and Corporate Center Parkway in Santa Rosa. This year's project site is located just downstream of the proposed Restoration Reach in the City Council-adopted Citywide Creek Master Plan, and is a continuation of the previous restoration project completed in 2008. This project continued the improvement in riparian habitat and water temperature control proposed in the Master Plan, and meets or exceeds the habitat goals for Roseland Creek of the Sonoma

County Water Agency. This project also minimizes future impacts to the creek due to flood control maintenance, as a healthy, functioning riparian forest allows for much less invasive and frequent channel treatments. Prior to the restoration, the site had sparse overstory vegetation, and a non-functioning understory, consisting of primarily the non-native Himalayan Blackberry (*Rubus discolor*).

Restoration Design and Planting Palette

This restoration activity included the removal of sporadic populations of the non-native Himalayan Blackberry (*Rubus discolor*) as well as additional planting of native trees and shrubs that were selected from studies of reference reaches within Roseland Creek and the Laguna de Santa Rosa watershed. At the section just downstream of the Stony Point Road bridge, native sedges and rushes were installed to minimize any potential complications with vegetation maintenance at the bridge exit.

This project focused on two sections of the reach. Near the concrete culvert at Stony Point Road, left (south) bank, TBI removed Himalayan blackberry root masses and planted 10 sedges, 10 rushes and 16 grasses along the toe of the slope once the Himalayan blackberry was removed. The major vegetative component of the blackberry was removed prior to the planting day, so that the students could access the canes and remove the roots to minimize re-growth potential. Additionally, one more boxelder was installed at the toe.

About 400 feet downstream (at the end of the 2008 planting), TBI planted the additional trees and shrubs listed below.

Quantity	*Species*	Common Name
10	*Acer negundo*	boxelder
3	*Aesculus californica*	buckeye
10	*Fraxinus latifolia*	Oregon ash
3	*Quercus lobata*	valley oak
4	*Sambucus mexicana*	elderberry
30		
16	*Leymus triticoides*	Creeping Wild Rye
10	*Carex barbarae*	basket sedge
10	*Juncus bolanderi or effusus*	rush
66		

Maintenance and Monitoring

Now that the site has undergone revegetation, it will be maintained and monitored for a period that will last 5 years to ensure successful establishment and long-term viability. The following monitoring services will be provided by TBI:

- Regular inspections of plantings from late spring through early fall for three years – as often as once per week, but no less that once per month for the first year, and once per month for the following two years.
- Maintenance of plantings at a minimum by weeding, inspecting/replacing Rainbird Irrigation Supplement (RIS) gel packs, and repairing browse protectors, and spraying of deer repellent if required. In addition, supplemental irrigation will be performed as necessary.

- Procure RIS gel packs sufficient to install 2 packs per plant, 3 times each year for two years, and 2 times in year 3.
- Monitor gel packs for replacement, typically in June/July and late August/September.
- Monitoring plant survival by species in October to inform future planting designs.
- Performing annual photomonitoring using the State Water Resources Control Board's SOP 5.2.3.
- Coordination of additional monitoring activities with PRBO Conservation Science and UC Cooperative Extension staff if additional funding is available.

Community Involvement

90 students and 13 parent volunteers participated in this one day restoration project. The students were all 6th graders from the Sheppard School located in Santa Rosa, Ca.

Restoration Costs

Table 4-3 presents a cost breakdown for the Roseland Creek Restoration Project.

Table 4-3: Roseland Creek Phase II Restoration Costs

Tasks	Cost
Restoration Design, Training and Implementation	$11,080.00
Maintenance, Monitoring, Reporting	$4,565.00
Technical Consultants	$2,200.00
Conservation Corps North Bay Americorps	$400.00
Plants, Materials	$800.00
Irrigation Supplies	$800.00
Implementation Costs (storage, portable toilet etc.)	$300.00
Travel, Meetings	$1,400.00
TOTAL	***$21,545.00***

Restoration Activity Permit Requirements

This restoration activity has already been implemented and does not require any additional permitting to complete the maintenance and monitoring phase.

TBI: 2009/2010 Copeland Creek - Phase VI Restoration Project

This section of Copeland Creek at the base of Sonoma Mountain has been selected as a restoration site because of highly-erosive banks and fragmented habitat. The goals of this 2009/2010 project were to stabilize many of the exposed banks with native vegetation to reduce sediment inputs, as well as to connect existing, quality habitat that is present both up and downstream. This phase is the continuation of five previous years of work done by the Bay Institute and community members of Rohnert Park, which include teachers that have been planting the site since the project's inception, and one new school. On the

landscape, this year's work extended the restored area closer to the upstream property line and existing habitat.

Restoration Activities

This year's project completed the gap on the south side of the creek (left bank) that is about 770 feet upstream from the crossing and irrigation hook up over two planting days (November 12, 2009 and January 7, 2010). The restoration area starts at the 4-inch pipe crossing and about 400 feet up to the old buckeye. Plants were placed mostly close to the bank. Plants selected included:

Quantity	*Species*	Common Name
10	*Acer macrophyllum*	big leaf maple
33	*Acer negundo*	box elder
15	*Crataegus douglasii*	hawthorn
10	*Fraxinus latifolia*	Oregon ash
28	*Quercus agrifolia*	coast live oak
15	*Quercus lobata*	valley oak
11	*Sambucus mexicana*	elderberry
122		

Maintenance and Monitoring

Now that the site has undergone revegetation, it will be maintained and monitored for a period that will last 5 years to ensure successful establishment and long-term viability. The following monitoring services will be provided by TBI:

- Regular inspections of plantings from late spring through early fall for three years – as often as once per week, but no less that once per month for the first year, and once per month for the following two years.
- Maintenance of plantings at a minimum by weeding, repairing browse protectors and spraying of deer repellent if required.
- Irrigation of plantings at least once per week (2 gallons/plant) using installed drip system. Additional irrigation will occur when conditions require increased water application. Maintenance of drip system function.
- Monitoring plant survival by species in October to inform future planting designs.
- Performing annual photomonitoring using the State Water Resources Control Board's SOP 5.2.3.
- Coordination of additional monitoring activities with PRBO Conservation Science and UC Cooperative Extension staff if additional funding is available.

Community Involvement

94 junior high school students and 66 kindergartners, along with 50 teacher/parent volunteers participated in this two day restoration project. The students were from the Mt. Shadows Middle School and the Waldo Rohnert Elementary School, both located in Rohnert Park, Ca.

Restoration Costs

Table 4-4 presents a cost breakdown for the Copeland Creek Phase VI Restoration Project.

Table 4-4. Copeland Creek - Phase VI Restoration Costs

Tasks	Cost
Restoration Design, Training and Implementation	$22,960.00
Maintenance, Monitoring, Reporting	$9,130.00
Technical Consultants	$4,400.00
Plants, Materials	$1,600.00
Irrigation Supplies	$1,600.00
Implementation Costs (storage, portable toilet etc.)	$600.00
Travel, Meetings	$2,800.00
TOTAL	***$43,090.00***

Restoration Activity Permit Requirements

This restoration activity has already been implemented and does not require any additional permitting to complete the maintenance and monitoring phase.

TBI: 2010 Hoen-Matanzas Creek - Phase I Restoration Project

Matanzas Creek is a tributary to the Laguna de Santa Rosa, the largest sub-watershed of the Russian River. This is a new, multi-phase project along the reach across Hoen Avenue from Montgomery High School. The site currently has healthy, heritage overstory vegetation, and a non-functioning understory, consisting of dense populations of non-native English Ivy (Hedera helix) and Himalayan Blackberry (Rubus discolor). TBI has chosen to leave their previous site on Matanzas Creek at Doyle Park due to increased vandalism. This new site at Hoen Avenue is more protected and does not experience the same amount of pedestrian traffic.

This 2010 restoration project included removal of populations of the non-native English Ivy (Hedera helix) and Himalayan Blackberry (Rubus discolor) along approximately 100 linear

feet of creek bank. Approximately 80 native shrubs and grasses were installed that have been selected from studies of reference reaches within Matanzas Creek and the Laguna de Santa Rosa watershed, including transplants from an adjacent Santa Barbara sedge site. In addition, this project engaged students from local schools in active enhancement of their community watershed and builds off six years of previous work completed by the STRAW Project and these teachers at a site downstream. These schools are actively involved in many additional studies of Matanzas Creek and surrounding watersheds.

Restoration Activities

This project focused primarily on removing invasive species to allow for the development of a more suitable, functioning understory. In addition, a section of local, Santa Barbara sedge was transplanted to the site once the invasive plants were cleared. TBI also planted the additional species listed below:

Quantity	Species	Common name	Minimum Size
40	*Carex spp*	local sedge	local transplants
10	*Cornus sericea*	dogwood	sprigs
10	*Festuca rubra molate*	molate red fescue	Deepot or gallon
10	*Melica torreyana*	oniongrass	Deepot or gallon
10	*Symphoricarpos albus*	snowberry	Deepot or gallon
80			

Maintenance and Monitoring

Now that the site has undergone revegetation, it will be maintained and monitored for a period that will last 5 years to ensure successful establishment and long-term viability. The following monitoring services will be provided by TBI:

- Regular inspections of plantings from late spring through early fall for three years – as often as once per week, but no less that once per month for the first year, and once per month for the following two years.
- Maintenance of plantings at a minimum by weeding, inspecting/replacing Rainbird Irrigation Supplement (RIS) gel packs, and repairing browse protectors, and spraying of deer repellent if required. In addition, supplemental irrigation will be performed as necessary.
- Procure RIS gel packs sufficient to install 2 packs per plant, 3 times each year for two years, and 2 times in year 3.
- Monitor gel packs for replacement, typically in June/July and late August/September.
- Monitoring plant survival by species in October to inform future planting designs.

- Performing annual photomonitoring using the State Water Resources Control Board's SOP 5.2.3.
- Coordination of additional monitoring activities with PRBO Conservation Science and UC Cooperative Extension staff if additional funding is available.

Community Involvement

A total of 197 students and 40 parents/adult volunteers participated in the two day restoration at this site. The schools who participated included Brook Hill Elementary, Doyle Park Elementary, and Montgomery High School, all located in Santa Rosa, Ca.

Restoration Costs

Table 4-5presents a cost breakdown for the Matanzas Creek Phase VI Restoration Project.

Table 4-5. Matanzas Creek - Phase I Restoration Costs

Tasks	Cost
Restoration Design, Training and Implementation	$11,480.00
Maintenance, Monitoring, Reporting	$4,565.00
Technical Consultants	$2,200.00
Plants, Materials	$800.00
Irrigation Supplies	$800.00
Implementation Costs (storage, portable toilet etc.)	$300.00
Travel, Meetings	$1,400.00
TOTAL	***$21,545.00***

Restoration Activity Permit Requirements

This restoration activity has already been implemented and does not require any additional permitting to complete the maintenance and monitoring phase.

Table 4-6a. Summary of Maintenance Costs and Off-Site Mitigation Contributions

Project	Cost	Off-Site Mitigation Contribution
2010 Localized Sediment Removal Projects		
Ducker Creek	$8,578	$858
Hinebaugh 5	$17,157	$1,716
Paulin Creek	$97,353	$9,735
Russell 1	$16,225	$1,623
Todd 4	$25,735	$2,574
2010 Sediment Basin/Instream Basin Clearing Projects		
Adobe Creek Sediment Basin (Zone 2A)	$29,121	$2,912
Cook Creek Sediment Basin	$9,707	$971
Copeland Creek at Country Club	$18,311	$1,831
Copeland Creek at Snyder	$36,622	$3,662
Santa Rosa Creek Sediment Basin	$19,414	$1,941
Wilfred Creek at Snyder	$9,155	$915
2010 Reach Scale Sediment Removal Projects		
Corona Creek Reach 1 (Zone 2A)	$40,295	$4,030
Laguna 1	$285,000	$28,500
Lorna Dell 1	$29,156	$2,916
2010 Bank Repair Projects		
Hunter 1	$12,581	$1,258
Moorland 1	$12,581	$1,258
Santa Rosa 1	$12,581	$1,258
Todd 4	$12,581	$1,258
2009 Permitted Projects to be Implemented in 2010[1]		
Colgan 5 (localized)	$9,638	$964
Starr Creek Trib 1 (localized)	$17,980	$1,798
Washington 3 (localized, Zone 2A)	$24,683	$2,468
Crane 1/Five1 (reach-scale)	$195,345	$19,535
Colgan 7/Kawana 1(reach-scale)	$96,382	$9,638
College Creek (bank repair)	$22,237	$2,224
Peterson Creek 2 (bank repair)	$22,237	$2,224
Peterson Creek 1 (bank repair)	$14,824	$1,482
Piner Channel (bank repair)	$22,237	$2,224
Brush (reservoir inlet clearing)	$8,142	$814
Matanzas(reservoir inlet clearing)	$16,283	$1,628
Piner (reservoir inlet clearing)	$4,071	$407
Spring (reservoir inlet clearing)	$4,071	$407
Cost and Mitigation Totals		
Zone 1A total	$1,056,184	$105,618
Zone 2A total	$94,099	$9,410
Maintenance Cost and Mitigation Requirements (Total)	***$1,150,283***	***$115,028***

*located in Zone 1A unless otherwise denoted

1 – Though permitted in 2009, mitigation funding for these projects has not yet been collected, this funding will be collected for the 2010 maintenance season.

Table 4-6b. Mitigation Projects

2010 WPP Mitigation Projects	
TBI: 2010Petaluma River, Denman Reach (Zone 2A)	$21,545
TBI: 2010 Roseland Creek Phase II	$21,545
TBI: 2009/2010 Copeland Creek, San Giacomo (Phase VI)	$43,090
TBI: 2010 Hoen-Matanzas Creek (Phase I)	$21,545
WPP Zone 1A total	*$86,180*
WPP Zone 2A total	*$21,545*
Off Site Mitigation Funding provided by SCWA in 2010	***$107,725***
Carry-over Mitigation Projects from 2009	***$71,978***
Total Off Site Mitigation Funding	***$179,703***
2010 Off Site Mitigation Funding Requirement	**($115,028)**
Funded Mitigation Credit Available to Apply to Subsequent Seasons	**$64,675**

*located in Zone 1A unless otherwise denoted

Table 4-7. Accounting of Impacts and Mitigation (Waters of the State)

Project and Type	Impact (acres)	Mitigation (acres)	Ratio of Mitigation to Impact
On-Site Mitigation			
2010 Maintenance Projects			
Ducker Creek – localized sediment removal	0.02	0.02	1:1
Hinebaugh 5– localized sediment removal	0.05	0.05	1:1
Paulin Creek– localized sediment removal	0.42	0.42	1:1
Russell 1 – localized sediment removal	0.03	0.03	1:1
Todd 4 – localized sediment removal	0.13	0.13	1:1
Adobe Creek -sediment basin (Zone 2A)	0.08	0.08	1:1
Cook Creek - sediment basin	0.23	0.23	1:1
Copeland Creek at Country Club – sediment basin	0.21	0.21	1:1
Copeland Creek at Snyder – sediment basin	0.21	0.21	1:1
Santa Rosa Creek – sediment basin	0.06	0.06	1:1
Wilfred at Snyder – sediment basin	0.06	0.06	1:1
Corona Creek – reach scale sediment removal (Zone 2A)	0.52	0.52	1:1
Laguna 1 – reach scale sediment removal	3.53	3.53	1:1
Lorna Dell 1 – reach scale sediment removal (entirely within concrete channel)	n/a	n/a	n/a
Hunter 1 – bank stabilization	0.003	0.003	1:1
Moorland 1 – bank stabilization	0.005	0.005	1:1
Santa Rosa 1 – bank stabilization	0.01	0.01	1:1
Todd 4 – bank stabilization	0.01	0.01	1:1
2009 Permitted Projects to be implemented in 2010			
Colgan 5 – localized sediment removal	0.10	0.10	1:1
Starr Trib 1 – localized sediment removal	0.13	0.13	1:1
Washington 3 – localized sediment removal	0.09	0.09	1:1
Crane 1/Five 1 – reach scale sediment removal	2.69	2.69	1:1
Colgan 7/ Kawana 1 – reach scale sediment removal	0.62	0.62	1:1
College 3 – bank stabilization	0.005	0.005	1:1
Peterson 2 – bank stabilization	0.006	0.006	1:1
Peterson 1 – bank stabilization	0.002	0.002	1:1
Piner 6 – bank stabilization	0.003	0.003	1:1
Total	**9.22**	**9.22**	
Off-Site Mitigation			
Off-Site Mitigation Projects new for 2010			
TBI: 2010 Petaluma River, Denman Reach (Zone 2A)		0.60	
TBI: 2010 Roseland Creek Phase II		0.39	
TBI: 2009/2010 Copeland Creek, San Giacomo (Phase VI),		0.57	
TBI: 2010 Hoen-Matanzas Creek (Phase I)		0.21	
New 2010 Project total		*1.77*	
2009 carryover mitigation available for use toward 2010 projects		*1.16*	
Total Off Site Mitigation Area Available		**2.93**	
Ratio of Tier 1 Mitigation to Impact			1:1
Ratio of Tier 2 and 3 Mitigation to Impact			0.32:1
Total Ratio of Mitigation to Impact			**1.32:1**

Section 5

ANNUAL SEDIMENT DISPOSAL PLAN

Section 5

Annual Sediment Disposal Plan

The 2010 annual sediment testing and disposal plan was developed in collaboration with the North Coast Regional Water Quality Control Board (Regional Board). The sediment testing requirements for the Stream Maintenance Program are defined in the Regional Board's Monitoring and Reporting Program (MRP) issued for the joint Order for 401 Certification and Waste Discharge Requirements (Order No. R1-2009-0049). At the request of SCWA and through discussions with the Regional Board, the testing requirements were refined in 2010 to better target pollutant sources.

This section provides an overview of the refined sediment testing plan and the proposed disposal sites for the 2010 maintenance projects. At this time (April 28, 2010), sediment test results are pending and will be provided to regulatory agencies, once lab results are received, anticipated in mid-May.

5A. Sediment Sampling and Testing

Approach and Methods

At the time the MRP was developed, little was known regarding the nature and extent of potential environmental pollutants in stream sediments within the SMP area. Thus, the MRP was developed with a conservative and comprehensive analyte list that includes Resource Conservation and Recovery Act (RCRA) priority pollutants and emerging pollutants of concern.

The 2009 maintenance year was the first year which the MRP sediment testing requirements were implemented. Sediment testing results from 2009 varied due to methodology consistency issues at the laboratory and using different sediment sampling protocols during collection. In addition to these issues, in 2009 the Regional Board was uncertain about which standards the sediment disposal site should be held to. As a result, the 2009 sediment disposal site was not approved for use in 2009, and the majority of 2009 sediment removal activities were not conducted.

In preparation for the 2010 maintenance season, SCWA met with the Regional Board on two occasions in early 2010 to review the MRP sampling requirements, and the required analyte testing list in particular. Through discussions with Regional Board staff, the analyte list was refined to better detect sediment characteristics relevant to the SMP program area.

Based on guidance from the Regional Board, the analyte list was refined to consider watershed position, surrounding land use, sediment type (gravel, sand, clay content) on a site-by-site bases. This screening approach based on these watershed conditions improved the methodology for detecting anthopogenic contaminants (as opposed to naturally occurring contaminants). For example, maintenance sites located in or near industrial areas in the lower watershed would be tested for a wider range of potential contaminants; whereas, sites located in residential areas in the upper watershed would tested for a smaller range of potential contaminants. Refinements to the MRP are described further below and illustrated in Tables 5-1 and 5-2. Appendix A includes a copy of the memo prepared to document justification for the MRP revisions for 2010 sediment sampling and outlines a plan for future modification to the MRP based on results from the 2010 sampling events.

For 2010, sediment sampling techniques were standardized and improved compared to previous sediment sampling efforts. Additional time was spent to train the sampling crew in proper decontamination and handing of sampling equipment and on proper sampling techniques. All equipment that contacts sediment samples were decontaminated with Alconox soap (an anionic, residue-free detergent) and isopropyl alcohol, then thoroughly rinsed with deionized water. The sampling equipment was rewashed with Alconox soap and thoroughly rinsed with deionized water immediately prior to and between each sampling event (between sampling sites, but not between composite samples). Latex-free gloves were worn by the sampling crew at all times. Decontaminated equipment and the lab sample containers were transported to and from the decontamination area and the sampling site in a plastic bag to prevent contamination.

To ensure the quality of test results received this year would meet MRP reporting level requirements, SCWA contracted with Columbia Analytical Laboratories (CAS) in Kelso, Washington. This laboratory specializes in analysis of freshwater sediments and operates a specialized lab for low-level detection of dioxin.

Analytes Tested by Site

Table 5-1 includes the EPA test methods and reporting limits applied to the 2010 sediment samples. This list reflects the modifications made to the original 2009 MRP analyte list. The specific revisions made to the MRP analyte table are listed below and discussed in Appendix A.

- Total Metals – list reduced to the following 9 metals consistent with Method 6020A for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc.
- Volatile Organic Compounds (VOCs) – Method 8260B (no change)
- Polycyclic Aromatic Hydrocarbons (PAHs) – Method 8270C (using more targeted subset within broad Method 8270C list)
- Polychlorinated biphenyls (PCBs) and Organochlorine Pesticides – Method 8082A instead of 8081 (no analysis for Kepone because it is not used in the U.S.)

- Organophosphorus Pesticides – Method 8270C instead of 8141A (no analysis for azinphos-ethyl, ethion, famphur, simazine, thionazin because these pesticides are not used in the U.S.)
- Dioxin/Furans – Method 8290 (lab that can properly meet the detection limits)
- Total Organic Carbon – added to better detect for anthropogenic hydrocarbons in conjunction with Method 8270C (PAHs) which substitutes for TPH testing.
- pH, fluoride, asbestos, nonylphenol – no change from MRP

Table 5-1: 2010 SMP Analyte List

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
pH – Method 9045	pH Units		
Total Metals – Method 6020A			
Arsenic	0.086	Mercury (or 7470/7471- cold vapor)	0.05
Cadmium	0.12	Nickel	1.1
Chromium	0.66	Selenium	0.074
Copper	0.26	Zinc	2.4
Lead	1.1		
Polychlorinated biphenyls (PCBs) – Method 8082A			
8 - 2,4'-Dichlorobiphenyl	0.002	126 - 3,3',4,4',5-Pentachlorobiphenyl	0.002
18 - 2,2',5-Trichlorobiphenyl	0.002	128 - 2,2',3,3',4,4'-Hexachlorobiphenyl	0.002
28 - 2,4,4'-Trichlorobiphenyl	0.002	138 - 2,2',3,4,4',5'-Hexachlorobiphenyl	0.002
44 - 2,2',3,5'-Tetrachlorobiphenyl	0.002	153 - 2,2',4,4',5,5'-Hexachlorobiphenyl	0.002
52 - 2,2',5,5'-Tetrachlorobiphenyl	0.002	170 - 2,2',3,3',4,4',5- Heptachlorobiphenyl	0.002
66 - 2,3',4,4'-Tetrachlorobiphenyl	0.002	180 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl	0.002
77 - 3,3',4,4'-Tetrachlorobiphenyl	0.002	187 - 2,2',3,4',5,5',6-Heptachlorobiphenyl	0.002
101 - 2,2',4,5,5'-Pentachlorobiphenyl	0.002	195 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl	0.002
105 - 2,3,3',4,4'-Pentachlorobiphenyl	0.002	206 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	0.002
118 - 2,3',4,4',5-Pentachlorobiphenyl	0.002	209 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	0.002
Volatile Organic Compounds (VOCs) – Method 8260B (MDL and MRLs may be elevated due to moisture content)			
Acetone	0.020	1,1-Dichloropropene	0.0050
Benzene	0.0050	cis-1,3-Dichloropropene	0.0050
Bromobenzene	0.0050	trans-1,3-Dichloropropene	0.0050
Bromochloromethane	0.0050	Ethylbenzene	0.0050
Bromodichloromethane	0.0050	Hexachlorobutadiene	0.0050
Bromoform	0.0050	Isopropylbenzene	0.0050
Bromomethane	0.0050	p-Isopropyltoluene	0.0050
n-Butylbenzene	0.0050	Methyl ethyl ketone	0.015
sec-Butylbenzene	0.0050	Methyl isobutyl ketone	0.010
tert-Bertylbenzene	0.0050	Methyl tert-butyl ether (MTBE)	0.0050

Table 5-1: 2010 SMP Analyte List

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
Carbon tetrachloride	0.0050	Methylene chloride	0.0050
Chlorobenzene	0.0050	Naphthalene	0.0050
Chloroethane	0.0050	n-Propylbenzene	0.0050
Chloroform	0.0050	Styrene	0.0050
Chloromethane	0.0050	1,1,1,2-Tetrachloroethane	0.0050
2-Chlorotoluene	0.0050	1,1,2,2-Tetrachloroethane	0.0050
4-Chlorotoluene	0.0050	Tetrachloroethene	0.0050
Dibromochloromethane	0.0050	Toluene	0.0050
1,2-Dibromo-3-chloropropane	0.0050	1,2,3-Trichlorobenzene	0.0050
1,2-Dibromoethane	0.0050	1,2,4-Trichlorobenzene	0.0050
Dibromomethane	0.0050	1,1,1-Trichloroethane	0.0050
1,2-Dichlorobenzene	0.0050	1,1,2-Trichloroethane	0.0050
1,3-Dichlorobenzene	0.0050	Trichloroethene	0.0050
1,4-Dichlorobenzene	0.0050	Trichlorofluoromethane	0.0050
Dichlorodifluoromethane	0.0050	Trichlorotrifluoroethane	0.0050
1,1-Dichloroethane	0.0050	1,2,3-Trichloropropane	0.0050
1,2-Dichloroethane	0.0050	1,2,4-Trimethylbenzene	0.0050
1,1-Dichloroethene	0.0050	1,3,5-Trimethylbenzene	0.0050
cis-1,2-Dichloroethene	0.0050	Vinyl chloride	0.0050
trans-1,2-Dichloroethene	0.0050	m,p-Xylene	0.0050
1,2-Dichloropropane	0.0050	o-Xylene	0.0050
1,3-Dichloropropane	0.0050	Xylenes (total)	0.0050
Polycyclic Aromatic Hydrocarbons (PAHs) – Method 8270C			
Naphthalene	0.0050	C1-Fluoranthenes/Pyrenes	0.0050
C1-Naphthalenes	0.0050	C2-Fluoranthenes/Pyrenes	0.0050
C2-Naphthalenes	0.0050	C3-Fluoranthenes/Pyrenes	0.0050
C3-Naphthalenes	0.0050	C4-Fluoranthenes/Pyrenes	0.0050
C4-Naphthalenes	0.0050	Benz[a]anthracene	0.0050
Biphenyl	0.0050	Chrysene	0.0050
Acenaphthylene	0.0050	C1-Chrysenes	0.0050
Acenaphthene	0.0050	C2-Chrysenes	0.0050
Fluorene	0.0050	C3-Chrysenes	0.0050
C1-Fluorenes	0.0050	C4-Chrysenes	0.0050
C2-Fluorenes	0.0050	Benzo[b]fluoranthene	0.0050
C3-Fluorenes	0.0050	Benzo[k]fluoranthene	0.0050
Anthracene	0.0050	Benzo[e]pyrene	0.0050
Phenanthrene	0.0050	Benzo[a]pyrene	0.0050
C1-Phenanthrenes/Anthracenes	0.0050	Perylene	0.0050
C2-Phenanthrenes/Anthracenes	0.0050	Indeno[1,2,3-cd]pyrene	0.0050
C3-Phenanthrenes/Anthracenes	0.0050	Dibenz[a,h]anthracene	0.0050
C4-Phenanthrenes/Anthracenes	0.0050	Benzo[g,h,i]perylene	0.0050
Fluoranthene	0.0050	Benz[a]anthracene	0.0050
Pyrene	0.0050		
Organochlorine pesticides – Method 8181A			
Aldrin	0.0050	Endosulfan I	0.0050

Table 5-1: 2010 SMP Analyte List

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
α-HCH (hexachlorocyclohexane)	0.0050	Endosulfan II	0.0050
β-HCH	0.0050	Endosulfan sulfate	0.0050
γ-HCH (Lindane)	0.0050	Endrin	0.0050
δ-HCH	0.0050	Endrin aldehyde	0.0050
Chlordane (tech)	0.20	Heptachlor	0.0050
4,4'-DDD	0.0050	Heptachlor epoxide	0.0050
4,4'-DDE	0.0050	Methoxychlor	0.0050
4,4'-DDT	0.0050	Mirex	0.10
Dieldrin	0.0050	Toxaphene	0.20
Organophosphorous pesticides – Method 8270C			
Azinphos-methyl	0.10	Fenthion	0.025
Bolstar (Sulprofos)	0.050	Malathion	0.025
Chlorpyrifos	0.025	Mevinphos	0.050
Coumaphos	0.10	Parathion, ethyl	0.025
Demeton-O	0.050	Parathion, methyl	0.025
Demeton-S	0.050	Phorate	0.025
Diazinon	0.025	Ronnel	0.050
Dichlorvos (DDVP)	0.050	Stirophos	0.025
Dimethoate	0.10	Tokuthion	0.050
Disulfoton	0.025	Trichloronate	0.0050
EPN	0.050		
Ethoprop	0.050		
Nonylphenol (GC/MS SIM) ASTM	0.2		
Asbestos	1% (PLM EPA Qualitative Method) 0.005 to 0.001 (TEM by EPA Quantitative Method)		
Fluoride – Method 340.2	1 mg/L in water		
Total organic carbon (TOC) – Method 9060 (%)	0.1		
Dioxins/Furans – Method 8290[3]	1.0 pg/g		

[1] The most recent version of EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", also known as SW-846, will be used with modification to achieve lower detection limits, and reduce potential laboratory contamination and sample matrix interferences.

[2] All laboratory analytical reports will include the detection and reporting limits, any flags, and a QA/QC report. All results will be reported as dry-weight concentrations. Electronic (PDF) submittals and Electronic Data Deliverables (EDD) as MS Excel are preferred.

[3] For dioxin/furans all congeners and their TEQs will be reported.

Table 5-2, on the following pages, is a matrix listing the maintenance projects, number of samples obtained from each project, and analytes tested for each site.

Table 5-2: Sonoma County Water Agency 2010 Sediment Sampling Plan

Creek Name	Reach	Watershed Position (Headwater, Upper, Middle, Lower)	Land Use (Open Space [OS], Agricultural [A], Residential [R], Commercial [C])	Sediment Type (gravel, coarse sand, medium sand, fine sand, silt, clay, mud)	Number of Samples to be Collected	Sediment Analytes											
						Total Metals	pH	Total Organic Carbon	Semivolatile Organics – PAH extended list	VOCs	Dioxin/ Furans	Pesticide and PCB Congeners	Organo-chlorine Pesticides	Organo-phosphorus Pesticides	Fluoride	Nonylphenol	Asbestos
Grossi Site	n/a	Middle	A		2	X	X	X	X	X	X	X	X	X	X	X	X
Reach Scale Sediment Removal Projects																	
Crane Creek/Five Creek*	Crane 1/ Five 1	Upper	R	Cobbles, sand/silt	5	X	X	X	X	X	X				X	X	X
Kawana Creek/ Colgan Creek*	Kawana 1/ Colgan 7	Middle	C	Coarse to med sand	2	X	X	X	X	X	X	X	X	X			
Laguna de Santa Rosa	Laguna 1	Lower	A (dairy), OS, C, R	Fine sand	5	X	X	X	X		X	X	X	X	X	X	X
Localized Scale Sediment Removal Projects																	
Colgan Creek*	Colgan 5	Middle	C	Coarse to fine sand	1	X	X	X	X	X	X	X	X	X	X	X	X
Ducker Creek	Ducker2	Middle	R	Sand/gravel	1	X	X	X	X	X	X				X	X	X
Hinebaugh Creek	Hinebaugh 5	Middle	R	Fine sand	1	X	X	X	X	X							
Lorna Dell Creek	Lorna Dell 1	Upper	R	Sand on concrete	1	X	X	X	X	X							

Creek Name	Reach	Watershed Position (Headwater, Upper, Middle, Lower)	Land Use (Open Space [OS], Agricultural [A], Residential [R], Commercial [C])	Sediment Type (gravel, coarse sand, medium sand, fine sand, silt, clay, mud)	Number of Samples to be Collected	Sediment Analytes											
						Total Metals	pH	Total Organic Carbon	Semivolatile Organics – PAH extended list	VOCs	Dioxin/ Furans	Pesticide and PCB Congeners	Organo-chlorine Pesticides	Organo-phosphorus Pesticides	Fluoride	Nonylphenol	Asbestos
Paulin Creek	Paulin 2, 3, 4, 6	Middle	R	Sand	1	X	X	X	X	X							
Russell Creek	Russell 1	Middle	C	Silt – mud	1	X	X	X	X	X		X	X	X			
Starr Creek *	Starr 1	Middle	R	Fine sand to mud	1	X	X	X	X	X							
Todd Creek	Todd 4	Middle	C, OS	Silt to mud	1	X	X	X	X	X	X				X	X	X
Bank Repair Projects																	
College Creek*	College 3	Middle	R	Coarse sand	1	X	X	X	X	X							
Peterson Creek*	Peterson 2	Lower	A (grazing), C, R	Cobbles to silt	1	X	X	X	X		X				X	X	X
Santa Rosa Creek	Santa Rosa 1	Lower	OS, A (dairy), C, R	Med to fine sand	1	X	X	X	X		X				X	X	X

Representative Sampling Photos

The exact locations of all the sediment sampling sites will be provided in a matrix along with the sample results. Below are two photos taken during sediment sampling events conducted in March 2010.

Reach Five 1– Sampling Site 3 (3/25/2010)

Reach Laguna 1 – Sampling Site 1 (3/30/2010)

5B. Sediment Disposal and Reuse

As described in the SMP Manual, SCWA will continue to make every effort to beneficially reuse as much of the excavated materials from the maintenance sites as possible. SCWA also supports local businesses and seeks partnerships with landowners and local businesses in close proximity to the maintenance sites who may wish to use the collected sediment. To support the 2010 maintenance activities, SCWA has identified three local landowners and businesses to potentially receive sediment excavated from the stream channels. These include Wheeler Zamaroni, Grab N' Grow Soil Products, and Ed Grossi. Each of these sites are upland and would not directly discharge water or sediment to surface waterbodies.

Use of these sites would be approved by the regulatory agencies prior to the onset of maintenance. Site approval is based on the sediment test results which will be reviewed in May/June 2010.

Wheeler Zamaroni

Wheeler Zamaroni is a local company that sells landscape and building materials, and custom fabricated stone. The company operates at a 30-acre facility located at 3500 Petaluma Hill Road in south Santa Rosa. Wheeler Zamaroni has the capacity to receive the entirety of the sediment removed as part of 2010 maintenance activities.

Sediment from SMP maintenance activities would be reused as soil products including soil mixes for gardening, bioswale and green roofing mixes, soil amendments, and other specialty mixes such as bedding for horse arenas and bocci ball courts. Due to its central Santa Rosa location, the majority of sediment excavated from the Santa Rosa area would potentially be taken to this site.

Grab N' Grow Soil Products

Grab N' Grow Products processes and sells soil products for farmers, gardeners, and landscapers. The company is located at 2759 Llano Road in Santa Rosa. The facility recycles over 80,000 cubic yards of organic materials including green waste (tree trimmings and landscaping waste) and agricultural waste each year. Grab N' Grow produces soil mixes, compost, and groundcover materials.

This facility has the potential capacity to receive the entirety of the sediment removed as part of 2010 maintenance activities. However, it is anticipated that sediment from maintenance activities conducted at the Laguna 1 site will be transported to Grab N' Grow for recycling. All of the estimated 14,485 cubic yards of sandy material excavated from the Laguna 1 project would potentially be transported to Grab N' Grow for recycling.

Grossi Site

An additional alternative is to dispose the collected sediment at Mr. Ed Grossi's nursery property located at 6652 Petaluma Hill Road in Rohnert Park. Mr. Grossi has an existing agreement with SCWA and this site has been used for sediment disposal in the past. The memorandum of agreement between Ed Grossi and SCWA was previously submitted to the regulatory agencies with the 2009 notification report.

This Grossi site has the potential capacity to receive the entirety of sediment excavated from the 2010 maintenance sites. The majority of sediment excavated from the Rohnert Park and Cotati areas would be taken to Grossi's property to reduce transportation costs. SMP sediment will not be used for agricultural purposes, such as growing row crops or feed grasses. At the Grossi site, the sediment will not be used for any agricultural purpose to prevent any potential bio-accumulation issues. The sediment will be sorted into size classes and sold as grading material or used as potting soil for nursery planters.

Looking north from southeast corner of Grossi property to area where sediment will be placed for sorting and reuse (3/24/2010)

Appendix A

SEDIMENT DISPOSAL MEMORANDUM TO NORTH COAST REGIONAL WATER QUALITY CONTROL BOARD

Memorandum

Subject: **Review of MRP R1-2009-0049 for the Sonoma County Water Agency's (SCWA's) Stream Maintenance Program (SMP)**

March 15, 2010

To: Mark Neely, North Coast Regional Water Quality Control Board (NCRWQCB)
Stephen Bargsten (NCRWQCB)

From: Ken Schwarz, Horizon Water and Environment (Horizon)
Michael Stevenson (Horizon)
Jill Sunahara (Horizon)

Cc: Jon Niehaus, Sonoma County Water Agency (SCWA)
Michael Thompson (SCWA)

1. Introduction and Purpose

The California Regional Water Quality Control Board, North Coast Region (Regional Board or NCRWQCB) issued (July 2, 2009) a joint Order for Waste Discharge Requirements (WDR – No. R1-2009-0049) and a Section 401 Water Quality Certification for the Sonoma County Water Agency's (SCWA) Stream Maintenance Permit (SMP) (WDID No. 1B09026WNSO). In support of the joint WDR Order and 401 Certification, the Regional Water Board also issued an Order describing the Monitoring and Reporting Program (MRP) requirements that are necessary to follow during the term of the WDR/401 Order.

2009 was the inaugural maintenance season under these new programmatic agreements. SCWA provided the Regional Board an Annual Notification report (April 28, 2009) that described the 2009 maintenance activities and locations. The Annual Notification also described the various impact avoidance, minimization, and Best Management Plans (BMPs) that would be implemented, referencing the detailed descriptions of these approaches provided in the SMP Manual. The Annual Notification also described 2009 mitigation for maintenance activities including both on-site and off-site restoration projects.

Provision 34 of the joint WDR/401 describes that:

> *After each maintenance season, the Applicant (e.g. SCWA) and the Regional Water Board staff shall meet to discuss the performance of SMP components, review lessons learned from the completed construction season, and to determine the need to incorporate improved stream maintenance techniques and BMPs into the SMP. All improvements and modifications shall be incorporated into the SMP upon written approval of the Executive Officer…*

This memorandum is provided to the Regional Board in preparation for such a meeting as described in Provision 34.

During the 2009 maintenance season, SCWA conducted its maintenance in accordance with the guidance provided by the SMP Manual, the 2009 Annual Notification, and the terms/conditions of the joint WDR/401 and its supporting MRP.

In reviewing the activities and results of the 2009 maintenance season, SCWA seeks to discuss the following topics with the Regional Board with the goal of revising the MRP:

- Revising the original list of analytes based on the program setting and likelihood of detection
- Revising the sediment testing methodologies and protocols
- Assessing the concerns and risks related to Dioxin

Background for these topics and recommendations for potential adjustments for the SMP are described in Section 2 below. Section 3 discusses next steps in preparation for the 2010 maintenance season. In particular, Section 3 presents sediment disposal options recommended for the 2010 season.

2. Recommendations for On-Going Program Sediment Sampling and Testing

At the time the MRP was developed, little was known regarding the nature and extent of potential environmental pollutants in stream sediments within the SMP area. Thus, the MRP was developed with a conservative and comprehensive analyte list that includes Resource Conservation and Recovery Act (RCRA) priority pollutants and emerging pollutants of concern. Now that the first years' sediment quality data has been collected and reviewed by the Regional Board, it is worthwhile to evaluate the findings and consider potential program adjustments. As stated in the MRP:

> *"Sampling parameters/analytes listed in Table 3 may be modified after a history of sampling is obtained. This may result in not requiring monitoring for some of these contaminants under certain situations or at certain locations, or the addition of more parameters/analytes if deemed necessary by the Executive Officer"*

Sediment sampling for the past 2009 maintenance season was conducted according to the requirements of the MRP. However, because the sediment sampling occurred in the Spring prior to the issuance of the WDR/401 (and without complete knowledge of the requirements of the MRP at that time), not all of the proposed 2009 maintenance sites were tested for the full list of MRP analytes listed in Table 3. The sites that were fully tested included the Colgan Creek and Starr Creek Tributary project sites. The other 9 maintenance sites were tested for the majority of the required analytes. Note that only a small number of potential pollutants of concern were not tested for the 2009 maintenance sites. **Table A** summarizes maintenance activities conducted during the summer of 2009.

Table A: 2009 Maintenance Projects Status

Maintenance Project	Length (linear feet) Completed/ estimated	Volume Removed (cu. yds.) Completed /estimated	Project Complete?	Project Conducted According to Notification Report?	Comments
Localized Scale Sediment Removal					
Colgan 5	0 ft/ est. 200	0 cy/ est. 200	No	-	Project not initiated due to sediment disposal constraint.
Starr Creek Trib 1	0 ft/ est. 291	0 cy / est. 215	No	-	Project not initiated due to sediment disposal constraint.
Washington 3	0 ft / est. 260	0 cy/ est. 296	No	-	Project not initiated due to lack of permitting authorization.
Copeland 4 at Snyder Lane	250 ft/ est. 250 ft	240 cy/ est. 240 cy	Yes	n/a[1]	Permitted in 2008
Copeland 4 at Country Club Dr.	200 ft/ est. 200 ft	168 cy/ est. 168 cy	Yes	n/a[1]	Permitted in 2008
Adobe Creek	150 ft/ est. 150ft	256 cy/ est. 256	Yes	n/a[1]	Permitted in 2008
Intermediate Scale Sediment Removal					
Wilfred 1	2,502 ft / est. 2,502	2,720 cy/ est. 3,250	Yes	Yes	Project completed.
Reach Scale Sediment Removal					
Crane 1/Five1	300 ft/ est. 3,248	450 cy / est. 5,213	Partially	Project not completed	Additional work downstream to be completed in 2010.
Colgan7/ Kawana1	0 ft/ est. 2,136	0 cy/ est. 1,059	No	-	Project not initiated.
Cotati 1 & 2	1,122 ft/ est. 1,122	500 cy / est. 416	Yes	Yes	Project completed.
Bank Stabilization					
College Creek	0 ft/ est. 122	n/a	No	-	Project not initiated due to need to work outside of OHWM
Peterson Creek 2	0 ft/ est. 86	n/a	No	-	Project not initiated due to need to work outside of OHWM
Peterson Creek 1	0 ft/ est. 20	n/a	No	-	Project not initiated due to need to work outside of OHWM
Piner Channel	0 ft/ est. 40	n/a	No	-	Project not initiated due to need to work outside of OHWM

[1] *These projects were permitted in 2008 as individual projects, prior to the development of programmatic permits. The work undertaken in 2009 was to complete these projects according to the described activities in their individual permit applications (submitted in 2008).*

[2] *The Matanzas Creek Reservoir is the only inlet requiring sediment removal. This sediment removal will only occur within the inlet concrete box structure. Maintenance activities at the other reservoirs include vegetation and debris removal from around the inlet structures. Vegetation removal includes removing some cattails from Piner Reservoir and thinning and removing some tree limbs at Spring Reservoir.*

To provide additional support and review of the existing MRP sampling program, Maxon Consulting, a firm that specializes in analysis and interpretation of water and sediment quality, was asked to conduct a thorough review of the sediment test results from the 2009 maintenance sites and provide recommendations to refine the SMP sampling program. Detailed memos were prepared (included in **Attachments A and B**) and key conclusions are summarized here.

- As described in the SMP Manual, the large majority of sediment delivered to SMP channels originates in the undeveloped mountains and hills (generally east of the urbanized areas of the Santa Rosa Plain) as a result of natural and human exacerbated (grazing, etc.) erosional processes. A comparatively small percentage of sediment is delivered to the SMP flood control channels from the local industrial and commercial areas in the lower watershed lands. It is from such industrial and commercial land uses where the potential to transmit pollutants to the SMP channels is highest.
- Based on the 2009 sediment testing results, and in consideration of the sediment source areas, sediment collected in SMP-maintained creeks is relatively clean. This statement is supported by the 2009 sampling results, in which only a handful of constituents were detected above reporting limits by the laboratory.
- Detectable constituents cannot always be interpreted as indicators of contamination due to multiple reasons, including introduced laboratory contamination, laboratory quality control issues, and matrix interferences. Also, the comparison of results between creek and background samples provides important information in evaluating the relative risk of contamination. This issue is discussed more below and in detail in Attachment A.
- Some of the test methods required in the MRP are inappropriate or require modifications to remove potential interferences from organically enriched soils or sediments, to achieve detection limits appropriate to evaluate ecological risk, or to enable comparison with risk-based benchmarks (e.g., NOAA SQuiRTs).
- Some of the analytes required in the MRP are found at trace levels in environmental media throughout California from either natural or anthropogenic sources – and therefore, should not be considered contaminants unless concentrations are significantly elevated above background.
- Some of the analytes required in the MRP are commonly introduced from analytical laboratory processing – and therefore, should not be considered contaminants without review of the associated quality control data and interpretation of sample results by a qualified chemist.
- Some of the analytes required in the MRP degrade relatively quickly in the environment and do not bioaccumulate. Therefore, it is unlikely that these analytes will be detected at concentrations above risk-based thresholds.

Based on these conclusions, we recommend revising Table 3 of the MRP. These suggested recommendations will improve the detection of potential contaminant concentrations in sampled sediment and will help identify potential contaminant sources for channels maintained under the SMP. Further details to support these recommendations are provided in Attachment A.

We propose the following omissions from Table 3 of the MRP:

1. Omit STLC (soluble) metals (Method 6010/7000 series) from future sampling unless TTLC (total) metal concentrations are >10 times the regulatory limit (per California Code of Regulations, Title 22, Chapter 11, Article 3). TTLC metal concentrations for all 15 of the 2009 SMP samples were well below regulations requiring the analysis of STLC metals.
2. Omit TPH (Method 8015). Method 8015 was developed as a screening method for sites contaminated with moderate to heavy amounts of petroleum. When used without modification, the method is prone to interferences from organic material, including the cattails, leaves, and grasses that line most of the SMP creeks. There are modified protocols to Method 8015 that remove plant detrital and humic material; however, the modified methods are primarily for samples with higher concentrations of petroleum than biogenic material, unlike the sediment in the SMP channels. Additionally, the presence of petroleum can be detected using Method 8270C (see Recommendation #6).

We propose to retain or adjust the following existing MRP sampling requirements from Table 3:

3. Retain organophosphorous pesticides (Method 8041A) for at least one additional year of sampling. Organophosphorous pesticides have very limited use in California (most are not sold in the U.S. or are very restricted in their use, for example Diazinon, Disulfoton, Parathion), degrade relatively quickly in the environment, and do not bioaccumulate. It is unlikely that these analytes will be detected above risk-based threshold concentrations in future SMP samples and none of these analytes were detected in any of the 2009 SMP samples. However, due to the potential for occurrence of these contaminants from past land management activities, such as weed control along railroad lines and Highway 101, targeted analysis of sediment will be conducted.
    - Evaluate whether to retain organophosphorus pesticides in future sampling efforts following the 2010 SMP results.
4. Retain chlorinated pesticides (Method 8081B or 8275A) to achieve MRP required detection limits for at least one additional year of sampling. Measure PCB Aroclors as PCB congeners as recommended by SWRCB (2009) and NOAA (2009) using Method 8082A with dual column confirmation or Method 8275A. These contaminants have been banned from use in the U.S. for over 10 years, but they are considered contaminants of concern due to their persistence in the environment and high bioaccumulation potential in aquatic and terrestrial food webs. Due to the potential for occurrence of these contaminants from past land management activities, such as weed control along railroad lines and Highway 101, targeted analysis of sediment will be conducted.
    - Evaluate whether to retain PCBs in future sampling efforts following the 2010 SMP results.
5. Retain volatile organic compounds (Method 8260B) for at least one additional year of sampling. Volatile organics do not persist in surface soil or sediment without a chronic input source due to their high volatility, and corresponding short half-lives. They are often measured in environmental investigations of air and groundwater, but are rarely contaminants of concern in sediments without a known or suspected input source. Many of the MRP volatile analytes are associated with petroleum-related contamination (e.g., BTEX,

MTBE), which can be identified using a revised PAH analyte list (see Recommendation #6). However, to compile an adequate history of sediment characteristics in the SMP area, VOCs will be analyzed for targeted areas where potential contaminant sources are present.

- Evaluate whether to retain VOCs in future sampling efforts following the 2010 SMP results.

6. Revise the list of semi-volatile organic analytes (Method 8270C) to include an expanded list of polycyclic aromatic hydrocarbons (PAHs) which is a more appropriate method for detecting petroleum-related contamination in organically enriched sediment.
   - Use EPA Method 8270D or 8270C-modifed with NOAA (2009) recommended cleanup and extraction methods to ensure achievement of MRP detection limits.
   - Omit the remaining MRP semi-volatile compounds that consist of industrial solvents, degreasers, laboratory extraction solvents, and plasticizers that have no known or suspected source to sediment in SMP channels, and other than the laboratory contaminant, Bis (2-ethylhexyl) phthalate, were not detected in any of the 2009 SMP samples.
7. Add analysis of total organic carbon (TOC) to future monitoring. This is a routine analysis for water quality and beneficial use evaluations and interpretation of organic pollutant data, since TOC tends to adsorb contaminants.
8. Analyze dioxins/furans (Method 8290) using a laboratory that can achieve lower detection limits and that uses protocols consistent with DTSC recommendations for quantification. These recommendations are supported by the discussion on dioxin presented in Attachment B.
   - The results reported for the 2009 SMP samples are suspect due to laboratory quality control issues (e.g., contamination in the method blank, and insufficient peak to noise ratios).
   - Future samples will be collected from areas which are considered representative of sediment sources from upland, industrial, and lowland regions of maintained channels in the program area. The goal of this approach is to develop an understanding of background dioxin levels in the program area and identify future sampling needs, especially as related to sediment disposal/reuse.
   - As the Regional Board develops sediment criteria for dioxin, the SMP sampling and analysis program may change to meet the criteria.
   - We propose to evaluate whether to retain dioxins/furans in future sampling efforts following the 2010 SMP results.
9. Reduce the number of TTLC metals from 17 to 9.
   - Omit antimony, barium, beryllium, cobalt, molybdenum, silver, vanadium, and thallium. These metals were detected at normal background geochemical concentrations or were below detection limits in all 15 the 2009 SMP samples. Further, there is no known or suspected anthropogenic source of these metals to sediment in the SMP channels, as they generally enter the environment as pollutants from specialized industrial practices.

- Retain arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc as TTLC metals for future sediment sampling. Although none of these metals, except zinc[1], were detected above background geochemical levels, they are associated with myriad pollutant sources, including gas stations, automobile releases, plating shops, agricultural fertilizers, and mining. These land uses occur throughout the SMP program area and represent potential sources to SMP sediments. Because of this risk, these constituents should continue to be sampled and evaluated yearly.

10. Retain asbestos, fluoride, and nonylphenol for at least one more year of sampling. Sediment was collected from Colgan Creek close to potential commercial pollutant sources and no asbestos, fluoride, or nonylphenol were detected. There are no known or suspected sources of these analytes to SMP channels and these constituents are not typically associated with freshwater channels in residential or light commercial areas. However, to compile an adequate history of sediment characteristics in the SMP area, these constituents will be analyzed from representative samples throughout the program area.
    - Evaluate whether to retain asbestos, fluoride, and nonylphenol in future sampling efforts following the 2010 SMP results.

[1] The Santa Rosa sub-region background range for zinc is 15.9-84.4 mg/kg. The NOAA SQuiRT values for zinc in freshwater sediment are 315 mg/kg (probable effects level) and 520 mg/kg (upper effects level). Zinc concentrations above the Santa Rosa sub-region background upper limit were reported for one Cotati Creek sample (220 mg/kg), and for two Colgan Creek samples (100 and 180 mg/kg). All three of these samples are below the NOAA SQuiRT effects level values for freshwater sediment. The most common soil pollutant sources of zinc are particulates from automobile brake liners and tires. The Colgan Creek and Cotati Creek samples were composited from subsamples collected near residential roads, and the other Colgan Creek sample was collected next to Hwy 101 and an automotive repair shop.

The proposed analyte list for 2010 SMP stream channel sampling is shown in **Table B**, below.

Table B: Proposed 2010 MRP Analyte List

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
pH – Method 9045	pH Units		
Total Metals – Method 6020A			
Arsenic	0.086	Mercury (or 7470/7471- cold vapor)	0.05
Cadmium	0.12	Nickel	1.1
Chromium	0.66	Selenium	0.074
Copper	0.26	Zinc	2.4
Lead	1.1		
Polychlorinated biphenyls (PCBs) – Method 8082A or 8275A			
8 - 2,4'-Dichlorobiphenyl	0.002	126 - 3,3',4,4',5-Pentachlorobiphenyl	0.002
18 - 2,2',5-Trichlorobiphenyl	0.002	128 - 2,2',3,3',4,4'-Hexachlorobiphenyl	0.002
28 - 2,4,4'-Trichlorobiphenyl	0.002	138 - 2,2',3,4,4',5'-Hexachlorobiphenyl	0.002
44 - 2,2',3,5'-Tetrachlorobiphenyl	0.002	153 - 2,2',4,4',5,5'-Hexachlorobiphenyl	0.002
52 - 2,2',5,5'-Tetrachlorobiphenyl	0.002	170 - 2,2',3,3',4,4',5- Heptachlorobiphenyl	0.002
66 - 2,3',4,4'-Tetrachlorobiphenyl	0.002	180 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl	0.002
77 - 3,3',4,4'-Tetrachlorobiphenyl	0.002	187 - 2,2',3,4',5,5',6-Heptachlorobiphenyl	0.002
101 - 2,2',4,5,5'-Pentachlorobiphenyl	0.002	195 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl	0.002
105 - 2,3,3',4,4'-Pentachlorobiphenyl	0.002	206 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	0.002
118 - 2,3',4,4',5-Pentachlorobiphenyl	0.002	209 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	0.002
Volatile Organic Compounds (VOCs) – Method 8260B-modified			
Acetone	0.020	1,1-Dichloropropene	0.0050
Benzene	0.0050	cis-1,3-Dichloropropene	0.0050
Bromobenzene	0.0050	trans-1,3-Dichloropropene	0.0050
Bromochloromethane	0.0050	Ethylbenzene	0.0050
Bromodichloromethane	0.0050	Hexachlorobutadiene	0.0050
Bromoform	0.0050	Isopropylbenzene	0.0050
Bromomethane	0.0050	p-Isopropyltoluene	0.0050
n-Butylbenzene	0.0050	Methyl ethyl ketone	0.015
sec-Butylbenzene	0.0050	Methyl isobutyl ketone	0.010
tert-Bertylbenzene	0.0050	Methyl tert-butyl ether (MTBE)	0.0050
Carbon tetrachloride	0.0050	Methylene chloride	0.0050
Chlorobenzene	0.0050	Naphthalene	0.0050
Chloroethane	0.0050	n-Propylbenzene	0.0050
Chloroform	0.0050	Styrene	0.0050
Chloromethane	0.0050	1,1,1,2-Tetrachloroethane	0.0050
2-Chlorotoluene	0.0050	1,1,2,2-Tetrachloroethane	0.0050
4-Chlorotoluene	0.0050	Tetrachloroethene	0.0050
Dibromochloromethane	0.0050	Toluene	0.0050
1,2-Dibromo-3-chloropropane	0.0050	1,2,3-Trichlorobenzene	0.0050
1,2-Dibromoethane	0.0050	1,2,4-Trichlorobenzene	0.0050

Table B: Proposed 2010 MRP Analyte List

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
Dibromomethane	0.0050	1,1,1-Trichloroethane	0.0050
1,2-Dichlorobenzene	0.0050	1,1,2-Trichloroethane	0.0050
1,3-Dichlorobenzene	0.0050	Trichloroethene	0.0050
1,4-Dichlorobenzene	0.0050	Trichlorofluoromethane	0.0050
Dichlorodifluoromethane	0.0050	Trichlorotrifluoroethane	0.0050
1,1-Dichloroethane	0.0050	1,2,3-Trichloropropane	0.0050
1,2-Dichloroethane	0.0050	1,2,4-Trimethylbenzene	0.0050
1,1-Dichloroethene	0.0050	1,3,5-Trimethylbenzene	0.0050
cis-1,2-Dichloroethene	0.0050	Vinyl chloride	0.0050
trans-1,2-Dichloroethene	0.0050	m,p-Xylene	0.0050
1,2-Dichloropropane	0.0050	o-Xylene	0.0050
1,3-Dichloropropane	0.0050	Xylenes (total)	0.0050
Polycyclic Aromatic Hydrocarbons (PAHs) – Method 8270D or 8270C-modified			
Naphthalene	0.0050	C1-Fluoranthenes/Pyrenes	0.0050
C1-Naphthalenes	0.0050	C2-Fluoranthenes/Pyrenes	0.0050
C2-Naphthalenes	0.0050	C3-Fluoranthenes/Pyrenes	0.0050
C3-Naphthalenes	0.0050	C4-Fluoranthenes/Pyrenes	0.0050
C4-Naphthalenes	0.0050	Benz[a]anthracene	0.0050
Biphenyl	0.0050	Chrysene	0.0050
Acenaphthylene	0.0050	C1-Chrysenes	0.0050
Acenaphthene	0.0050	C2-Chrysenes	0.0050
Fluorene	0.0050	C3-Chrysenes	0.0050
C1-Fluorenes	0.0050	C4-Chrysenes	0.0050
C2-Fluorenes	0.0050	Benzo[b]fluoranthene	0.0050
C3-Fluorenes	0.0050	Benzo[k]fluoranthene	0.0050
Anthracene	0.0050	Benzo[e]pyrene	0.0050
Phenanthrene	0.0050	Benzo[a]pyrene	0.0050
C1-Phenanthrenes/Anthracenes	0.0050	Perylene	0.0050
C2-Phenanthrenes/Anthracenes	0.0050	Indeno[1,2,3-cd]pyrene	0.0050
C3-Phenanthrenes/Anthracenes	0.0050	Dibenz[a,h]anthracene	0.0050
C4-Phenanthrenes/Anthracenes	0.0050	Benzo[g,h,i]perylene	0.0050
Fluoranthene	0.0050	Benz[a]anthracene	0.0050
Pyrene	0.0050		
Organochlorine pesticides – Method 8082B or 8275A			
Aldrin	0.0050	Endosulfan I	0.0050
α-HCH (hexachlorocyclohexane)	0.0050	Endosulfan II	0.0050
β-HCH	0.0050	Endosulfan sulfate	0.0050
γ-HCH (Lindane)	0.0050	Endrin	0.0050
δ-HCH	0.0050	Endrin aldehyde	0.0050
Chlordane (tech)	0.20	Heptachlor	0.0050
4,4'-DDD	0.0050	Heptachlor epoxide	0.0050
4,4'-DDE	0.0050	Kepone	0.5
4,4'-DDT	0.0050	Methoxychlor	0.0050
Dieldrin	0.0050	Mirex	0.10
		Toxaphene	0.20

Table B: Proposed 2010 MRP Analyte List

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
Organophosphorous pesticides – Method 8141B or 8270D			
Azinphos-ethyl	0.10	Famphur	0.10
Azinphos-methyl	0.10	Fenthion	0.025
Bolstar (Sulprofos)	0.050	Malathion	0.025
Chlorpyrifos	0.025	Mevinphos	0.050
Coumaphos	0.10	Parathion, ethyl	0.025
Demeton-O	0.050	Parathion, methyl	0.025
Demeton-S	0.050	Phorate	0.025
Diazinon	0.025	Ronnel	0.050
Dichlorvos (DDVP)	0.050	Simazine	0.050
Dimethoate	0.10	Stirophos	0.025
Disulfoton	0.025	Thionazin	0.050
EPN	0.050	Tokuthion	0.050
Ethion	0.025	Trichloronate	0.0050
Ethoprop	0.050		
Nonylphenol (GC/MS SIM)	0.2		
Fluoride – Method 340.2	1 mg/L in water		
Asbestos	1% (PLM EPA Qualitative Method) 0.005 to 0.001 (TEM by EPA Quantitative Method)		
Total organic carbon (TOC) – Method 9060 (%)	0.1		
Dioxins/Furans – Method 8290[3]	1.0 pg/g		

[1] The most recent version of EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", also known as SW-846, will be used with modification to achieve lower detection limits, and reduce potential laboratory contamination and sample matrix interferences.

[2] All laboratory analytical reports will include the detection and reporting limits, any flags, and a QA/QC report. All results will be reported as dry-weight concentrations. Electronic (PDF) submittals and Electronic Data Deliverables (EDD) as MS Excel are preferred.

[3] For dioxin/furans all congeners and their TEQs will be reported.

The revised sampling list will also result in cost savings for the stream maintenance program. Continuing to sample sediments according to the full analyte list of the MRP's Table 3 would be cost prohibitive and unsustainable by SCWA. A cost comparison between the existing MRP Table 3 analytes and the recommended analyte list (from Table A above) for a single site sample is shown in **Table C**, below. Considering that the SMP may involve testing up to 15-30 sites per year, the accumulated program costs are significant, and the cost savings represented by the potentially revised analyte listing (as recommended in this memo) would make the continued sediment sampling program possible.

Table C: Cost Comparison between Existing MRP and Recommended Analytes

2009 MRP Analysis	2009 Cost per Sample	Recommended 2010 MRP Analysis	Estimated 2010 Cost per Sample	Potential 2011 MRP Analysis	Estimated 2011 Cost per Sample
8141A - Organophos. Pesticides	200.00	8141B - Organophos. Pesticides	200.00		
8260B - VOCs	200.00	8260B - VOCs	200.00		
8270C - Semivolatile Organics	350.00	8270D/C-modified - PAH extended list	350.00	8270D/C-modified - PAH extended list	350.00
8081 - Pesticides and PCBs	200.00	8081B/8082A - Pesticides & PCB Congeners	400.00*		
8015 - TPH Diesel	48.63				
8015 - TPH Gas	48.63				
STLC Metals (17)	216.98				
TTLC Metals (17)	270.00	TTLC Metals (9)	120.00	TTLC Metals (9)	120.00
8290 - Dioxin	1,250.00	8290 - Dioxin	650.00*	8290 - Dioxin	650.00*
Asbestos	150.00	Asbestos	150.00		
300 - Fluoride	50.00	300 – Fluoride	50.00		
Nonylphenol	175.00	Nonylphenol	175.00		
		TOC	55.00	TOC	55.00
		pH	15.00	pH	15.00
TOTAL	**$3,159.24**	**TOTAL**	**$2,365.00**	**TOTAL**	**$1,190.00**

* assumes use of Columbia Analytical Services in Washington

3. Next Steps and 2010 Project Planning

Based on feedback on this memo and discussions with RWQCB staff, SCWA has incorporated the recommended sampling improvements described in this memo into the 2010 sediment sampling plan (**Table D**). Preliminary information for the maintenance sites including approximate length, volume to be removed, and number of samples to be analyzed are shown in **Table F**. More detailed information for each of the 2010 maintenance sites will be included in the SMP Annual Notification which will be sent to the RWQCB at the end of April.

The overall idea is to "tune", or refine, the SMP's sampling program to apply the right level of effort to adequately capture and track our understanding of sediment quality, but without requiring inefficient, redundant, or unneeded testing that is prohibitively expensive.

As discussed with RWQCB staff, refining the SMP sediment sampling regimen should be viewed as a long-term process. Because existing background data for the stream and disposal sites is relatively sparse, the continued collection of sediment quality data will help to build up overall understanding of sediment quality conditions in the program area. With this increased understanding, we expect we will have greater confidence for future decisions as to what tests are needed versus which tests can be suspended. With this in mind, the 2010 maintenance season will continue to support a fairly robust sampling plan, though the 2010 sampling approach is more focused than in previous years and will employ higher quality lab procedures.

SCWA SMP managers will plan to meet with RWQCB staff again in Spring 2010 to review the results from the proposed sediment sampling approach as shown in Table D. Additionally, the sediment testing results will be incorporated into the project database to keep track of sediment quality conditions.

In terms of sediment disposal locations for the 2010 season, we anticipate using the Grossi Site again. In 2009, following guidance from Regional Board staff regarding concerns for Dioxin, sediment disposal at the Grossi Site was halted. Based on more recent discussions with the Regional Board, as well as sampling results, potential adjustments to sediment disposal protocol or farming land practices at the Grossi Site may be implemented, including not using any of the land to receive SMP sediment for agricultural uses.

In closing, we would also like to discuss with RWQCB staff the most efficient protocol for complying with the SMP permit/order which requires signatures of the Executive Officer or Assistant Executive Officer for implementing changes to the MRP. We propose that this Memo in combination with the proposed sampling plan of Table D may suffice for providing documentation support for such a signature. We look forward to discussing these topics more closely with the RWQCB.

Table D: 2010 Sediment Sampling Plan

Creek Name	Reach	Watershed Position (Headwater, Upper, Middle, Lower)	Land Use (Open Space [OS], Agricultural [A], Residential [R], Commercial [C])	Sediment Type** (gravel, coarse sand, medium sand, fine sand, silt, clay, mud)	Sediment Analytes								
					Total Metals	pH	Total Organic Carbon	Semivolatile Organics – PAH extended list (EPA 8270D or C Modified)	VOCs (8260B)	Dioxin (EPA 8290)	Pesticide and PCB Congeners (EPA 8081B/8082A)	Organophosphorus Pesticides (EPA 8141B or 8270D)	Asbestos, Fluoride, Nonylphenol
Grossi Site	n/a	Middle	A		X	X	X	X	X	X	X	X	X
Reach Scale Sediment Removal Projects													
Crane Creek/Five Creek*	Crane 1/ Five 1	Upper	R	Cobbles, sand/silt	X	X	X	X	X	X			X
Kawana Creek/ Colgan Creek*	Kawana 1/ Colgan 7	Middle	C	Coarse to med sand	X	X	X	X	X	X	X	X	
Laguna de Santa Rosa	Laguna 1	Lower	A (dairy), OS, C, R	Fine sand	X	X	X	X		X	X	X	X
Localized Scale Sediment Removal Projects													
Colgan Creek*	Colgan 5	Middle	C	Coarse to fine sand	X	X	X	X	X	X	X	X	X
Ducker Creek	Ducker2	Middle	R	Sand/gravel	X	X	X	X	X	X			X
Hinebaugh Creek	Hinebaugh 5	Middle	R	Fine sand	X	X	X	X	X				
Lorna Dell Creek	Lorna Dell 1	Upper	R	Sand on concrete	X	X	X	X	X				
Paulin Creek	Paulin 2	Middle	R	Sand	X	X	X	X	X				
Paulin Creek	Paulin 3	Middle	R	Sand	X	X	X	X	X		X	X	
Paulin Creek	Paulin 4	Middle	C	Sand	X	X	X	X	X		X	X	
Paulin Creek	Paulin 6	Middle	R	Sand	X	X	X	X	X		X	X	
Russell Creek	Russell 1	Middle	C	Silt – mud	X	X	X	X	X		X	X	
Starr Creek *	1	Middle	R	Fine sand to mud	X	X	X	X	X				
Todd Creek	Todd 4	Middle	C, OS	Silt to mud	X	X	X	X	X	X			X
Bank Repair Projects													
College Creek*	College 3	Middle	R	Coarse sand	X	X	X	X	X				
Peterson Creek*	Peterson 2	Lower	A (grazing), C, R	Cobbles to silt	X	X	X	X		X			X
Santa Rosa Creek	Santa Rosa 1	Lower	OS, A (dairy), C, R	Med to fine sand	X	X	X	X		X			X

**= project permitted in 2009*

***= TBD based on future sediment texture testing that will be conducted by SCWA starting in 2010*

Guidance for Table D:

In the attached sheet, we present our proposed sampling locations for the 2010 maintenance projects. The rationale for how sites were selected is as follows, and represented in the table below:

- **Metals, Semivolatile Organics:** Residential, commercial, and to a lesser extent, agricultural areas could be sources for these contaminants. Since all of the 2010 sites drain one or more of those three land uses, sampling for metals and semivolatile organics will be sampled at all sites. It is possible that if a substantial number of the samples are non-detect, more focused sampling may be appropriate in future years.
- **pH, Total Organic Carbon:** these are basic tests that should be conducted in all locations.
- **Volatile Organics:** these contaminants are unlikely to be found except in areas draining commercial and residential land uses. Therefore, sampling focuses on creeks draining those land use types. As with metals and semi-volatile organics, it is possible that if a substantial number of the samples are non-detect, more focused sampling may be appropriate in future years.
- **Dioxin, Asbestos, Flouride, Nonylphenol:** The potential for these contaminants to be present above background levels is low. However, given the relatively little information about their presence in the SMP area, representative sampling locations were chosen that cover the full range of watershed positions and land use types found in this year's projects. In addition, all of the lower watershed locations are proposed for sampling, since they have the largest contributing watershed areas and drain the greatest diversity of land use types. Based on these results, sampling in future years may be focused on particular land uses or watershed positions.
- **Pesticides, PCBs, OP Pesticides:** These contaminants are only expected near rights-of-way, such as the UPRR and Caltrans. Therefore the sampling focuses on sites which cross, or are adjacent to, a highway or railroad. Should results be negative, a reduction in future sampling effort may be indicated.

Land Use (Open Space [OS], Agricultural [A], Residential [R], Commercial [C])	**Sediment Analytes**								
	Total Metals	pH	Total Organic Carbon	Semivolatile Organics – PAH extended list (EPA 8270D or C Modified)	VOCs (8260B)	Dioxin (EPA 8290)*	Pesticide and PCB Congeners (EPA 8081B/8082A)	Organophosphorus Pesticides (EPA 8141B or 8270D)	Asbestos, Fluoride, Nonylphenol*
A	X	X	X	X		X			X
C	X	X	X	X	X	X			
R	X	X	X	X	X	X			X
OS		X	X			X			X
Rights-of-way							X	X	

** representative samples should be taken, rather than at all sites.*

Table F: 2010 Maintenance Projects Sediment Sampling Summary

Maintenance Project	Length (linear feet)	Volume Removed (cu. yds.)	# of Samples to be Analyzed	Comments
Grossi Site	N/A	N/A	2	One from hay field and one from a non-agricultural production area
Reach Scale Sediment Removal				
Crane 1/ Five1*	3,248	5,213	5	Composite of 2 locations each (10 subsamples = 5 samples for analysis)
Colgan7/ Kawana1*	2,136	1,059	2	Taken from upstream and downstream of Santa Rosa Avenue
Laguna 1	2,400	15,424	5	Composite of 2 locations each (10 subsamples = 5 samples for analysis)
Localized Scale Sediment Removal				
Colgan 5*	200	200	1	
Ducker2	90	56	1	
Hinebaugh 5	120	78	1	Sample to be taken from the sediment removal area, not from the area to be filled
Lorna Dell 1	1,260	186	1	
Paulin 2, 3, 4, 6	881	805	1	
Russell 1	TBD	TBD	1	
Starr Trib 1*	291	215	1	
Todd 4	390	325	1	
Bank Repair Projects				
College 3*	122	<50	1	
Peterson 2*	86	<50	1	
Santa Rosa 1	80	<50	1	

*= project permitted in 2009

MEMORANDUM

Sonoma County Water Agency Sediment Disposal Planning

TO: Kenneth Schwarz, PhD
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COPIES: Jill Sunahara

FROM: Cynda Maxon
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DATE: January 14, 2010

1. Purpose of Memo

The purpose of this memo is to recommend changes to Monitoring and Reporting Program No. R1-2009-0049 (MRP) issued by the North Coast Regional Water Quality Control Board (Regional Board) in association with Waste Discharge Requirements and 401 Water Quality Certification (Order No. R1-2009-0049) of the Sonoma County Water Agency (SCWA) Stream Maintenance Program (SMP). As stated on the top of Page 4 of the MRP:

> *"Sampling parameters/analytes listed in Table 3 may be modified after a history of sampling is obtained. This may result in not requiring monitoring for some of these contaminants under certain situations or at certain locations, or the addition of more parameters/analytes if deemed necessary by the Executive Officer"*

At the time the MRP was developed, little was known regarding the nature and extent of environmental pollutants in sediments within the SMP area. Without benefit of existing site data, a conservative approach was used to generate a comprehensive analyte list that included RCRA priority pollutants and emerging pollutants of concern. As will be discussed in this memo, some of the test methods required in the MRP are inappropriate for organically enriched soils or sediments, and produce inaccurate results without method modifications (Cantillo and Parris, 1993; NOAA, 1991). Additionally, some of the MRP analytes are found at trace levels in environmental media throughout California from either natural or anthropogenic sources; and others are common laboratory contaminants.

A list of recommendations to the MRP analyte list and methods are provided in Section 5 of this memo. In brief, sediment sampling requirements should be revised because: 1) some of the analytes listed in Table 3 of the MRP have no known or suspected source to the stream channels maintained within the SMP area; and 2) the 2009 sediment test results were below laboratory detection limits or present at natural or rural anthropogenic background levels.

2. MRP Analytes and Laboratory Methods

All analyses, except dioxins/furans, asbestos, and nonylphenol were conducted by Alpha Analytical Laboratory (Ukiah, CA) or Basic Laboratory (Redding, CA) using standard EPA procedures from *SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2009). Analytical methods and target analytes applied to sediment from the 2009 stream maintenance sites were consistent with those specified in Order No. R1-2009-0049; however, reported detection limits were often higher. Overall, quality control performance met or exceeded EPA SW-846 criteria; however, laboratory contamination and sample matrix interferences contributed to false positive results and elevated detection limits for several samples. MRP analyte groups, methods, and corresponding detection limits are summarized in **Table 1**. Analytes detected and probable sources to SMP channels are listed in **Table 2**.

EPA SW-846 is a multi-volume document that was developed to analyze moderate to high concentrations of priority pollutants in solid waste, including sewage, sludge, and soil. Because most of the SW-846 methods were developed in the 1970's and 80's, some of the target analytes are no longer in use. Many of the SW-846 halogenated analytes persist at historically contaminated sites (e.g., Superfund; Brownfield sites); however, they are not typically found in residential or light-commercial freshwater sediment without an associated source. These contaminants include polychlorinated biphenyls (PCBs), most of the chlorinated pesticides (e.g., DDT), the semivolatile chlorinated and brominated hydrocarbons, and other relic industrial pollutants.

Most SW-846 methods must be modified to analyze trace level pollutants in environmental media that are prone to matrix interferences, including moderate concentrations of organic carbon, which is prevalent in SCWA sediment. Therefore, reported results often have quality control issues, including laboratory contamination of field samples, matrix interferences, and analyte misidentification, even when all SW-846 quality control criteria are met. Other common quality control problems occur from cross-contamination from other environmental samples, method extraction solvents, floor waxes, and cleaning solvents. Trace levels of these "laboratory-generated" contaminants are routinely reported when analyzing environmental samples. Previously analyzed environmental samples present the greatest potential source of contamination to unrelated field samples, occurring primarily from "column bleed" or contamination of extraction equipment. Analysis of method blank quality control samples is required by SW-846 to detect potential laboratory contamination; however, detection is sporadic since method blanks are analyzed only once per analytical batch, often using a sample matrix that is different from the corresponding field samples. Common trace laboratory contaminants include extraction and cleaning solvents (e.g., acetone, methylene chloride, toluene, chlorobenzenes); floor wax (e.g., naphthalenes); tubing (e.g., phthalates, vinyl chloride); and instrumentation, plumbing, and fixtures (e.g., various metals). Concentrations of laboratory contaminants are typically in the part-per-billion or low part-per-million range, and present a problem in the analysis of samples with trace concentrations of target analytes, such as sediment associated with SMP activities.

Accurate identification of laboratory contamination requires knowledge of analytical procedures and forensic evaluation of reported contaminants. For example, reported concentrations of methylene chloride, toluene, benzene, and other common laboratory solvents without other co-occurring environmental pollutants provide a clear indication of laboratory sources, regardless of non-detection in the method blank. Also, reportable concentrations of TPH, without detectable

concentrations of polycyclic aromatic hydrocarbons (PAHs), indicate that the result is not petroleum related. Review of sample chromatograms can be used to confirm whether or not the reported TPH is plant material, a common matrix interference to TPH Method 8015.

Table 1. Detected analytes, potential sources, and reporting limits for the 2009 SMP field survey.

Analyte Group	US EPA SW-846 Method	Laboratory Reporting Limits	SMP Target Reporting Limits
Total Metals (TTLC)	6010 (inductively coupled plasma spectroscopy)	0.074-2.4 mg/kg	0.2-15 mg/kg
Soluble Metals (STLC)	6010 (ICP) and 7000 series (atomic absorption with graphite furnace and flame detection)	0.05-1.0 mg/L	0.1-1.0 mg/L
Total Petroleum Hydrocarbons (TPH)	8015DRO (gas chromatography with flame ionization detector)	1.0-2.0 mg/kg	1.0-2.0 mg/kg
Volatile Organic Compounds (VOCs)	8260B (gas chromatography with mass spectrometer)	0.005-0.17* mg/kg	0.005-0.02 mg/kg
Organochlorine pesticides and PCB Aroclors	8081/8082 (gas chromatography with electron capture)	0.1-40* mg/kg	0.005-0.2 mg/kg
Organophosphorous compounds (pesticides)	8141A (gas chromatography capillary column technique)	0.005-1.0* mg/kg	0.005-0.1 mg/kg
Semivolatile Organic Compounds (SVOCs)	8270 (gas chromatography with mass spectrometer)	0.062-16* mg/kg	0.062-2.0 mg/kg
Dioxins/Furans	8290 modified (gas chromatograph with high resolution mass spectrometer)	0.75-5.3 pg/g	1.0 pg/g

*elevated reporting limits were observed with one or more analytes and/or samples due to sample matrix interferences

Table 2. Detected analytes and potential sources.

Analytes Detected in 2009 SMP Sediment	Probable Sources
Total Metals (Method 6010)	
As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, Se, V	Naturally occurring – geochemical
Zn	Particulates associated with automobile brake liners or tires
Soluble Metals(Method 6010 and 7000)	
As, Ba, Cr, Cu, Ni, Pb, V, Zn	Naturally occurring – leached from soil by STLC method
TPH (Method 8015m)	Misreported due to matrix interference. Naturally occurring plant material.
Volatile Organics (Method 8260B)	
Acetone, toluene	Lab contamination – common lab cleaning and extraction solvents
Methyl-tert-butyl ether (MTBE)	Laboratory contamination – cross-contamination from non-related field samples
Methylene chloride	Lab contamination – common laboratory extraction solvent
1,2,4-trimethylbenzene	Laboratory contamination – cross-contamination from non-related field samples or other laboratory-related source
1,3,5-trimethylbenzene	Laboratory contamination – cross-contamination from non-related field samples or other laboratory-related source
Semivolatile Organics (Method 8270)	
Bis(2-ethylhexyl)phthalate	Lab contamination – widely used as a plasticizer in articles made of PVC
Dioxins/Furans (Method 8290)	Ubiquitous anthropogenic background in California soils. Reported results uncertain due to laboratory reporting and quality control issues.

3. Summary of 2009 SMP results

Sediment sampling and analysis under Order No. R1-2009-0049 was conducted between June and September 2009 for the SMP maintenance sites. Seven creeks/tributaries, located throughout the SMP area, met the RMP sampling criteria of having at least 250 yd^3 (cy) of sediment designated for disposal. Twenty-one sediment samples were analyzed – 15 from SMP sites (4 at Wilfred Creek, 1 at Cotati Creek, 1 at Kawana Springs Creek, 3 at Colgan Creek, 1 at Crane Creek, 4 at Five Creek, 1 at Starr Creek Tributary), and six from the Ed Grossi disposal site. One sample each, collected at Colgan Creek and Starr Creek Tributary, included the additional analytes, asbestos, nonylphenol, and fluoride, which were added to the list of MRP analytes after the other samples had been analyzed.

Twenty-five out of 227 analytes were detected in 2009 sediment samples, most at naturally occurring or low anthropogenic background concentrations. Fourteen of the 25 detected analytes were natural geochemical metals, most of which were detected in all samples. Other than TPH, the only other analytes detected in two or more samples were common laboratory contaminants, the gasoline additive MTBE, and dioxins/furans. Detected analytes fell into four general categories: 1) naturally occurring background; 2) rural anthropogenic background; 3) misreported due to sample matrix interferences; and 4) common laboratory contaminants (see Table 2). Results for analytes detected in 2009 SMP sediment samples are summarized in **Table 3** and discussed below.

3.1 Analytes not detected in any 2009 SMP sample

Organophosphorus compounds (Method 8141A). None of the 28 organophosphorous pesticides were detected in 2009 SMP sediment samples. Detection limits reported by the laboratory ranged from 0.005-1.0 mg/kg, and met the MRP required detection limits for all but several analytes. These results are expected since only a few of these pesticides are used in California, and with limited application. Several of the 28 organophosphorous pesticides (e.g., Dementon, Trichloronate) are not sold for use in the U.S., or are very restricted in their use (e.g., Diazinon, Disulfoton, Parathion). Most of the MRP-listed organophosphorus pesticides are short-lived in soils with half-lives ranging from 0.5 to 30 days (http://npic.orst.edu/). Four (Ethion, Phorate, Simazine, Trichloronate), however, have longer half-lives of 60 to 150 days. Simazine is a broadleaf herbicide, which is sometimes used to control algae. It is not a pesticide and is practically nontoxic (http://extoxnet.orst.edu/pips/simazine.htm).

Organochlorine pesticides and PCB Aroclors (Method 8081/8082). None of the 19 organochlorine pesticides or any of the seven PCB Aroclors were detected in the 2009 SMP sediment samples. However, detection limits reported by the laboratory were approximately 2-20 times higher than the MRP required detection limits, and above the thresholds typically used to estimate potential adverse effects to humans and wildlife. Organochlorine pesticides and PCB Aroclors have been banned from use in the U.S. for 10 or more years; they remain contaminants of concern due to their persistence in the environment and high bioaccumulation potential in aquatic and terrestrial food webs.

Semivolatile Organics (Method 8270). Except for the detection of Bis(2-ethylhexyl)phthalate in a single sample (0.51 mg/kg), none of the 68 semivolatile compounds were detected in the 2009 SMP samples. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant, used as one of several plasticizers in the fabrication of flexible vinyl products (e.g., tubing, laboratory equipment). It has been suggested as a possible natural product in animals and plants (http://www.scorecard.org/chemical-profiles/html/dehp.html). It is insoluble in water and does not bioaccumulate in human food webs.

Laboratory detection limits were generally 2-10 times higher than MRP detection limits, however, most were below the NOAA Screening Quick Reference Tables (aka SQuiRT) effects-based sediment thresholds (NOAA, 2010), except for PAHs and phenols. These benchmark values are commonly used by regulators and scientists to evaluate freshwater and marine sediment contamination (SWRCB, 2009).

Semivolatile organics analyzed using Method 8270 consist of a wide range of compounds including, polycyclic aromatic hydrocarbons (PAHs), phthalates, phenols, phenyls, and various chlorine-, and

bromine-alkylated isomers of fused and sigma-bonded ringed compounds. Semivolatile organics include compounds associated with petroleum, solvents, degreasers, plastics, and various other industrial pollutants. Some of these compounds are commonly used by the same laboratories that analyze environmental samples, hence it is not uncommon to see semivolatile laboratory contaminants reported in results.

Except for PAHs, semivolatile organic compounds are mostly associated with industrial-related contamination, and are rarely associated with residential or light commercial activities, such as the SMP area. PAHs are ubiquitous contaminants, mainly from the combustion of fossil fuels, which are measured in rural background sediment and soil samples in the low or sub part-per-billion range. Other than PAHs, there are no known or suspected sources of semivolatile organics to sediment within the SMP area.

Analytes added to the 2009 MRP (Asbestos, Fluoride, and Nonylphenol). These analytes were measured in only two sediment samples, collected after completion of the June-July 2009 SMP sampling program. Results for all three analytes were below laboratory detection limits and the lowest NOAA SQuiRT thresholds for freshwater sediment for fluoride (i.e., 200 µg/L in surface water; 210 mg/kg natural background limit of fluorine in soil) and nonylphenol (i.e., Threshold Effects Level=1.4 mg/kg in freshwater sediment). There are no NOAA SQuirT values for Asbestos in soil or sediment.

Table 3. Summary results for analytes detected in 2009 SMP sediment samples.

Analyte	No. of Samples	No. Detected	Detected Minimum	Detected Maximum	Sample with Maximum Concentration
Total Metals (Method 6010) (mg/kg)					
Arsenic	15	15	2.4	7.6	Five Ck# Sta# 36+05- 36'' (09F1044-04)
Barium	15	15	81	190	Colgan Ck# Sta# 328+60 -30'' (09G0088-04)
Beryllium	15	2	0.37	0.39	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
Cadmium	15	2	0.516	0.857	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
Chromium	15	15	14	120	Wilfred Ck# Sta# 27+15 +/- -12'' (09F0748-03)
Cobalt	15	10	10	56	Colgan Ck# Sta# 328+60 -30'' (09G0088-04)
Copper	15	13	12	29.1	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
Lead	15	10	6.3	21.9	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
Mercury	15	5	0.21	0.69	Wilfred Ck# Sta# 63+48 +/- -39'' (09F0748-01)
Molybdenum	15	3	0.42	38.2	Starr Ck# Sta# 12+15-30'' (09I0064-02)
Nickel	15	14	0.65	150	Colgan Ck# Sta# 328+60 -30'' (09G0088-04)
Selenium	15	1	0.42	0.42	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
Vanadium	15	15	19	43	Crane Ck# Sta# 2+15- 30'' (09F1044-01)

Analyte	No. of Samples	No. Detected	Detected Minimum	Detected Maximum	Sample with Maximum Concentration
					09:25
Zinc	15	15	27	220	Cotati Ck# Sta# 20+65 -18'' (09G0088-01)
TPH (Method 8015DRO) (mg/kg)					
TPH as Diesel	15	10	2.2	30	Wilfred Ck# Sta# 76+50 +/- -38'' (09F0748-02)
TPH as Gasoline	2	2	1.5	2.5	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
TPH as Motor Oil	15	11	2.7	200	Cotati Ck# Sta# 20+65 -18'' (09G0088-01)
Volatile Organic Compounds (Method 8260B) (mg/kg)					
Acetone	15	1	0.12	0.12	Crane Ck# Sta# 2+15- 30'' (09F1044-01)
Methyl tert-butyl ether (MTBE)	15	2	0.0066	0.02	Crane Ck# Sta# 2+15- 30'' (09F1044-01)
Methylene chloride	15	2	0.039	0.072	Crane Ck# Sta# 2+15- 30'' (09F1044-01)
Toluene	15	1	0.0064	0.0064	Crane Ck# Sta# 2+15- 30'' (09F1044-01)
1,2,4-Trimethylbenzene	15	1	0.0095	0.0095	Wilfred Ck# Sta# 76+50 +/- -38'' (09F0748-02)
1,3,5-Trimethylbenzene	15	1	0.0057	0.0057	Wilfred Ck# Sta# 76+50 +/- -38'' (09F0748-02)
Semivolatile Organic Compounds (Method 8270) (mg/kg)*					
Bis (2-ethylhexyl) phthalate	10	1	0.51	0.51	Wilfred Ck# Sta# 27+15 +/- -12'' (09F0748-03)
Dioxins/Furans (Method 8290)					
Dioxin-TEQ	2	2	4.24**	17.91**	Colgan Ck# Sta# 274+10-36'' (09I0064-01)
Furan-TEQ	2	2	1.26**	3.93**	Colgan Ck# Sta# 274+10-36'' (09I0064-01)

*not analyzed in Crane Creek or Five Creek samples; **includes detection limit results for non-detected analytes

3.2 Analytes occurring at natural background levels

Total Metals (Method 6010). Zinc was the only metal reported above naturally occurring soil or sediment geochemical concentrations. Antimony, silver, and thallium were not detected in any sample. All other metals detected in 2009 SMP sediment samples were at or below Santa Rosa sub-region background concentrations reported in a 1994 interoffice memorandum by the North Coast Regional Board (see **Appendix A**), or in natural continental crust concentrations (Wedepohl, 1981). The Santa Rosa sub-region background range for zinc is 15.9-84.4 mg/kg. The NOAA SQuiRT values for zinc in freshwater sediment are 315 mg/kg (probable effects level) and 520 mg/kg (upper effects level). Zinc concentrations above the Santa Rosa sub-region background upper limit were reported for one Cotati Creek sample (220 mg/kg), and for two Colgan Creek samples (100 and 180 mg/kg). The most common soil pollutant sources of zinc are particulates from automobile brake liners and tires. Colgan Creek and Cotati Creek samples with elevated zinc were composited from subsamples

collected near residential roads, and in the case of Colgan Creek, next to Hwy 101 and an automotive repair shop.

Soluble Metals (Method 6010). In general, detected STLC metals were the same as detected TTLC metals for each sediment sample. Arsenic, barium, copper, nickel, vanadium, and zinc were detected most often. Except for barium and zinc, concentrations of all STLC metals were < 2 mg/L. Concentrations of barium and zinc had maximum concentrations of 7.0 and 9.6 mg/L, respectively, which are considered low and non-toxic (NOAA, 2009). The corresponding STLC thresholds for California Title 22 hazardous waste are 100 mg/L for barium and 250 mg/L for zinc. The most common forms of naturally occurring barium in California soils are the sulfate, barite, and the carbonate, witherite, with concentrations ranging from 100-3,000 mg/kg.

3.3 Analytes misreported due to sample matrix interferences

Total Petroleum Hydrocarbons (Method 8015DRO). TPH results were reported for most of the 2009 SMP samples; however, most results were qualified by the laboratory as "the sample chromatogram contains resolved peaks within the diesel/motor oil range that do not resemble diesel/motor oil". Close examination of the TPH chromatograms indicated aliphatic hydrocarbon inputs from detrital and humic material, which are common interferences to EPA 8015 method. Chromatograms of samples with petroleum-based contamination are distinguished by both odd- and even-numbered carbon peaks, while terrestrial plant matter is dominated by odd-carbon peaks. All of the 2009 SMP chromatograms displayed a characteristic odd-carbon preference associated with terrestrial detrital and humic material. Corroboratory evidence of this interpretation is provided in the lack of any detectable concentrations of polycyclic aromatic hydrocarbons (using Method 8270) in any samples with reported TPH. Petroleum-based products, including fuels, typically have 1-5 percent PAH, depending on the crude oil source. PAHs are more resilient than the aliphatic hydrocarbons that are detected using method 8015, and therefore, are always detected in environmental samples with petroleum-related contamination (provided sufficient detection limits are used).

3.4 Analytes associated with laboratory contamination

Volatile Organics (Method 8260B). Six of the 65 volatile organic compounds were detected in 1-2 of the 2009 SMP samples. Detection limits reported by the laboratory met the MRP required detection limits for all but several samples, due to matrix interferences. Three of these (acetone, methylene chloride, and toluene) are common laboratory contaminants. Methylene chloride is the main extraction solvent used in Method 8270. Acetone is a common extraction and cleaning solvent. Toluene is a general purpose laboratory reagent that is also found in petroleum fuels. However, without the co-occurrence of benzene and ethylbenzenes, the most likely source of toluene is cross-contamination from the laboratory. Two volatile compounds (1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene) were detected in a single sample (Wilfred Creek) at trace concentrations of 0.0095 and 0.0057 mg/kg, respectively. These compounds are found in gasoline, but at low concentrations and without other indicator compounds of gasoline (e.g., BTEX, PAH), their most likely source is from trace-level laboratory contamination. The remaining volatile compound detected in 2009 SMP sediment samples was methyl-tert-butyl-ether (MTBE), a gasoline additive that is no longer in use. It was measured in one Crane Creek sample (0.02 mg/kg) and in one Wilfred Creek sample (0.0066 mg/kg) without other less volatile indicators of gasoline, indicating laboratory contamination as the most probable source. MTBE and both trimethylbenzenes are on the U.S. Environmental Protection Agency Method 524.2 analyte list for monitoring in groundwater, surface

water, and drinking water and, in California, are considered unregulated chemicals requiring monitoring (Title 22, California Code of Regulations §64450). However, none of the volatile organics persist in surface soil or sediment without a chronic input source due to their high volatility (estimated half-life of a few hours to a few days).

4. Dioxins/Furans (Method 8290).

Dioxins and furans were analyzed in only two samples (Colgan Creek; Starr Creek Tributary), with several compounds detected at low part-per-trillion (pg/g) concentrations. The analyses were performed by Maxxam Laboratory in Mississauga, Ontario, Canada. Review of reported results revealed several laboratory quality control issues (i.e., Dioxin/Furan concentrations in the method blank; poor signal to noise peak ratio); and the laboratory has been asked to resubmit results, which are currently pending.

Dioxins and furans are highly regulated compounds that are ubiquitous throughout U.S. soils and sediments due mainly from aerial fallout from numerous natural and anthropogenic sources. Historic sources of dioxins/furans are mainly from incineration (e.g., municipal, hazardous and medical waste); however, forest fires recently have been reported as the primary source to U.S. soils (Gullett and Touati, 2003). It should be noted that all environmental samples have reportable concentrations of dioxins/furans, regardless of detection, due to the California Department of Toxic Substances (DTSC) and EPA's procedures for quantifying and reporting results. This is because both agencies recommend including non-detected values as either the detection limit or one-half the detection limit in the TEQ summation. Therefore, reported results will be higher for laboratories with higher detection limits. Non-detected individual concentrations of dioxins and furans in 2009 SMP sediment samples ranged from 1.0 to 5.3 pg/g. These values were included in the Dioxin and Furan TEQ even when compounds were not detected by the laboratory.

DTSC issued a Human Health Risk Assessment (HHRD) interim note on dioxin regulation, citing background concentrations of 1-6 pg/g Dioxin TEQ in rural California soils (DTSC, 2009). DTSC-recommended remedial goals for California soils are summarized in **Table 4**. There are no corresponding DTSC goals for Furans. Results for both 2009 SMP samples were below the DTSC agricultural soil remedial goal of <40 pg/g Dioxin-TEQ, which is considered protective of human health and the environment. The reported Dioxin-TEQ for Starr Creek Tributary (4.24 pg/g) was in the mid-range of soil background concentrations for rural California. The reported Dioxin-TEQ for Colgan Creek (17.91 pg/g) was higher than rural background; however, results for the three highest compounds were estimated due to elevated detection limits. These compounds were also detected in the corresponding method blank sample, indicating contribution from trace-level laboratory contamination.

Table 4. Summary of DTSC Remedial Goals for total Dioxins-TEQ in California soils (DTSC, 2009).

Dioxin-TEQ Remedial Goals for Sites in California Landscape Scenario	WHO-TEQ/kg dry matter (pg/g)
Residential	50
Commercial/Industrial	200 -1000
Agricultural	<40

5. Recommendations for future SMP sampling and analysis.

The following recommended revisions to the SMP sampling program and MRP are based on 1) 2009 results for 15 sediment samples, 2) likelihood of an existing or future contaminant source to the SMP area; and 3) sediment testing guidelines used by other agencies or regulatory programs. A list of recommended target analytes, analytical methods, and laboratory detection (reporting) limits are provided in **Appendix B**. Future analyses should be based on SW-846 methods recommended by NOAA (2009) for the analysis of freshwater sediment to reduce the potential of laboratory-generated contamination, and to ensure achievement of MRP detection limits.

1. Omit organophosphorous pesticides (Method 8041A) from future sampling. None of these analytes were detected in any of the 2009 SMP samples, indicating the absence of an existing contaminant source to the study area. Since organophosphorous pesticides have very limited use, degrade relatively quickly in the environment, and do not bioaccumulate, it is unlikely that these analytes will be detected above risk-based threshold concentrations in future SMP samples.

2. Omit STLC metals (Method 6010/7000 series) from future sampling unless TTLC metal concentrations are >10 times the regulatory limit (per California Code of Regulations, Title 22, Chapter 11, Article 3). TTLC metal concentrations for all 15 of the 2009 SMP samples were well below regulations requiring the analysis of STLC metals.

3. Omit TPH (Method 8015) from future sampling. Method 8015 was developed as a screening method for sites contaminated with moderate to heavy amounts of petroleum. When used without modification, the method is prone to interferences from organic material, including the cattails, leaves, and grasses that line most of the SMP creeks. There are modified protocols to Method 8015 that remove plant detrital and humic material; however, the method is primarily for samples with higher concentrations of petroleum than biogenic material, unlike the sediment in the SMP channels. Additionally, the presence of petroleum can be detected using Method 8270C (see Recommendation No. 8).

4. Omit volatile organic compounds (Method 8260B) from future sampling. Many of the RMP volatile analytes are associated with petroleum-related contamination (e.g., BTEX, MTBE), which can be identified using a revised PAH analyte list (see Recommendation #8). Volatile organics do not persist in surface soil or sediment without a chronic input source due to their high volatility, and corresponding short half-lives. They are typically measured in environmental investigations of air and groundwater, and are not included as contaminants of concern in marine or estuarine sediments by the State Water Resources Control Board (SWRCB, 2009). Few volatile organic compounds have corresponding NOAA SQuiRT threshold values; and the only volatile analytes detected in 2009 SMP sediments were associated with laboratory contamination.

5. Omit the recently added analytes - asbestos, fluoride, and nonylphenol, as none were detected in 2009 SMP sediments. Although only two SMP samples were analyzed, one was from Colgan Creek, close to potential commercial pollutant sources. There are no known or suspected sources of these analytes to SMP channels; and they are not typically associated with freshwater channels in residential or light commercial areas.

6. Retain chlorinated pesticides and PCB Aroclors (Method 8081), but analyze using EPA Method 8081/8082-modified (with dual column confirmation) or EPA Method 8275A (gas chromatography with mass detector with selected ion monitoring) to achieve MRP required detection limits. Measure PCB Aroclors as PCB congeners as recommended by SWRCB (2009) and NOAA (2009). Evaluate whether to retain PCBs in future sampling programs following 2010 SMP results.

7. Reduce the number of TTLC metals from 17 to 9. Omit antimony, barium, beryllium, cobalt, molybdenum, silver, vanadium, and thallium. These metals were detected at normal background geochemical concentrations or were below detection limits in all 15 the 2009 SMP samples. Further, there is no known or suspected anthropogenic source of these metals to sediment in the SMP channels, as they generally enter the environment as pollutants from specialized industrial practices. Retain arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc as TTLC metals in future sampling. Although all of these metals, except zinc, were detected at or below background geochemical levels, they are associated with myriad pollutant sources, including gas stations, automobile releases, plating shops, agricultural fertilizers, and mining; and therefore, could have future potential sources to SMP sediments.

8. Revise the list of semivolatile organic analytes (Method 8270C) to include an expanded list of polycyclic aromatic hydrocarbons (PAH) appropriate for use in detecting petroleum-related contamination. Use EPA Method 8270C with NOAA (2009) recommended cleanup and extraction methods to ensure achievement of MRP detection limits. Omit the remaining MRP semivolatile compounds that consist of industrial solvents, degreasers, laboratory extraction solvents, and plasticizers that have no known or suspected source to sediment in SMP channels, and other than the laboratory contaminant, Bis (2-ethylhexyl) phthalate, were not detected in any of the 2009 SMP samples.

9. Analyze dioxins/furans (Method 8290) using a laboratory with lower detection limits and protocols consistent with DTSC recommendations for quantification (e.g., Columbia Analytical Services, Kelso, Washington). Results reported for the 2009 SMP samples are suspect due to laboratory quality control issues (e.g., contamination in the method blank, and insufficient peak to noise ratios). It is the opinion of this reviewer that future analyses of SMP samples will result in dioxin/furan concentrations that are consistent with California rural soil background levels when reported using DTSC guidelines for quantification.

10. Add analysis of total organic carbon (TOC) to future monitoring. This is a routine analysis for beneficial use evaluation and interpretation of organic pollutant data, since TOC tends to adsorb contaminants.

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Appendix A

1994 interoffice memorandum by North Coast RWQCB

REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION

Interoffice Memorandum

TO: **All SMU** **DATE:** May 25, 1994

FROM: **David Wenslawski**

RE: **Background levels for metals**

==========

I have compiled the following table for our reference. I hope you find it useful. If anybody has more information they would like to add, please give it to me and I will update the table.

Background Metal Concentrations from Various Sites

SOIL BACKGROUND LEVELS

ELEMENT	SEA RANCH ppm	USA MARTI F. ppm	SR GRACE ppm	SR GADDIS ppm	CRUST ppm	GRANITE ppm	BASALT ppm	SHALE ppm	SANTA ROSA SUBREGION ppm	WESTERN SONOMA Co ppm
Sb	nd	na	<10	na	0.2	0.2	0.2	1.5	na	na
As	4.9	6.1	4.43	<10	1.8	1.5	2	10	0.8 - 8.9	na
Ba	64	560	283	<100	500	700	300	600	321-752	na
Be	nd	0.6	<2	na	3	5	0.5	3	na	na
Cd	nd	<1	<2	<1	0.15	0.1	0.2	0.3	0.2-0.7	<0.02 - 0.2
Cr	21	38	113	<10	100	20	200	100	38.2-330	na
Co	7.1	8	29.6	na	22	3	48	20	na	na
Cu	8.9	21	36	60	50	12	100	50	6.6-49	1.9-20.3
Pb	7.6	18	16	<5	12.5	20	3.5	20	4-10.7	1.2-16.2
Hg	nd	55	0.2	<1	0.02	0.03	0.01	0.3	<0.06 - .25	na
Ni	13	16	174	na	75	0.8	150	80	12.8-310	1.7-42.9
Se	nd	0.25	<0.5	<5	0.05	0.05	0.05	0.6	0.42-1.2	<0.2 - 0.3
Ag	nd	<0.5	<2	<10	0.07	0.04	0.1	0.1	<0.7	na
Ta	nd	na	<20	na	8.5	20	1.5	12	na	na
V	44	na	70.7	na	110	50	250	130	na	na
Zn	38	51	72.1	<50	70	50	100	90	15.9-84.4	1.4-25.7

Appendix B

Recommended Analytes, Methods, and Reporting Limits for the 2010 SCWA SMP Sediment Sampling and Analysis Program

Table B1. Sediment Sample Analyte List Recommended for 2010 SMP

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
pH – Method 9045	pH Units	Total Organic Carbon – Method 9060	0.1%
Total Metals – Method 6020A			
Arsenic	0.086	Mercury (Method 245.5)	0.05
Cadmium	0.12	Nickel	1.1
Chromium	0.66	Selenium	0.074
Copper	0.26	Zinc	2.4
Lead	1.1		
Polychlorinated biphenyls (PCBs) – Method 8081-modified			
8 - 2,4'-Dichlorobiphenyl	0.02	126 - 3,3',4,4',5-Pentachlorobiphenyl	0.02
18 - 2,2',5-Trichlorobiphenyl	0.02	128 - 2,2',3,3',4,4'-Hexachlorobiphenyl	0.02
28 - 2,4,4'-Trichlorobiphenyl	0.02	138 - 2,2',3,4,4',5'-Hexachlorobiphenyl	0.02
44 - 2,2',3,5'-Tetrachlorobiphenyl	0.02	153 - 2,2',4,4',5,5'-Hexachlorobiphenyl	0.02
52 - 2,2',5,5'-Tetrachlorobiphenyl	0.02	170 - 2,2',3,3',4,4',5-Heptachlorobiphenyl	0.02
66 - 2,3',4,4'-Tetrachlorobiphenyl	0.02	180 - 2,2',3,4,4',5,5'-Heptachlorobiphenyl	0.02
77 - 3,3',4,4'-Tetrachlorobiphenyl	0.002	187 - 2,2',3,4',5,5',6-Heptachlorobiphenyl	0.02
101 - 2,2',4,5,5'-Pentachlorobiphenyl	0.02	195 - 2,2',3,3',4,4',5,6-Octachlorobiphenyl	0.02
105 - 2,3,3',4,4'-Pentachlorobiphenyl	0.02	206 - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	0.02
118 - 2,3',4,4',5-Pentachlorobiphenyl	0.02	209 - 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	0.02
Volatile Organic Compounds (VOCs) – Method 8260-modified			
Acetone	0.020	1,1-Dichloropropene	0.0050
Benzene	0.0050	cis-1,3-Dichloropropene	0.0050
Bromobenzene	0.0050	trans-1,3-Dichloropropene	0.0050
Bromochloromethane	0.0050	Ethylbenzene	0.0050
Bromodichloromethane	0.0050	Hexachlorobutadiene	0.0050
Bromoform	0.0050	Isopropylbenzene	0.0050
Bromomethane	0.0050	p-Isopropyltoluene	0.0050
n-Butylbenzene	0.0050	Methyl ethyl ketone	0.015
sec-Butylbenzene	0.0050	Methyl isobutyl ketone	0.010
tert-Bertylbenzene	0.0050	Methyl tert-butyl ether (MTBE)	0.0050
Carbon tetrachloride	0.0050	Methylene chloride	0.0050
Chlorobenzene	0.0050	Naphthalene	0.0050
Chloroethane	0.0050	n-Propylbenzene	0.0050
Chloroform	0.0050	Styrene	0.0050
Chloromethane	0.0050	1,1,1,2-Tetrachloroethane	0.0050
2-Chlorotoluene	0.0050	1,1,2,2-Tetrachloroethane	0.0050

[1] The most recent version of EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", also known as SW-846, will be used with modification to achieve lower detection limits, and reduce potential laboratory contamination and sample matrix interferences.

[2] All laboratory analytical reports will include the detection and reporting limits, any flags, and a QA/QC report. All results will be reported as dry-weight concentrations. Electronic (PDF) submittals and Electronic Data Deliverables (EDD) as MS Excel are preferred.

Analyte and EPA Method[1]	Reporting Limit for Soil[2] (mg/kg)	Analyte and EPA Method[1] (cont.)	Reporting Limit for Soil[2] (mg/kg)
4-Chlorotoluene	0.0050	Tetrachloroethene	0.0050
Dibromochloromethane	0.0050	Toluene	0.0050
1,2-Dibromo-3-chloropropane	0.0050	1,2,3-Trichlorobenzene	0.0050
1,2-Dibromoethane	0.0050	1,2,4-Trichlorobenzene	0.0050
Dibromomethane	0.0050	1,1,1-Trichloroethane	0.0050
1,2-Dichlorobenzene	0.0050	1,1,2-Trichloroethane	0.0050
1,3-Dichlorobenzene	0.0050	Trichloroethene	0.0050
1,4-Dichlorobenzene	0.0050	Trichlorofluoromethane	0.0050
Dichlorodifluoromethane	0.0050	Trichlorotrifluoroethane	0.0050
1,1-Dichloroethane	0.0050	1,2,3-Trichloropropane	0.0050
1,2-Dichloroethane	0.0050	1,2,4-Trimethylbenzene	0.0050
1,1-Dichloroethene	0.0050	1,3,5-Trimethylbenzene	0.0050
cis-1,2-Dichloroethene	0.0050	Vinyl chloride	0.0050
trans-1,2-Dichloroethene	0.0050	m,p-Xylene	0.0050
1,2-Dichloropropane	0.0050	o-Xylene	0.0050
1,3-Dichloropropane	0.0050	Xylenes (total)	0.0050
Polycyclic Aromatic Hydrocarbons (PAHs) – Method 8270C			
Naphthalene	0.005	C1-Fluoranthenes/Pyrenes	0.005
C1-Naphthalenes	0.005	C2-Fluoranthenes/Pyrenes	0.005
C2-Naphthalenes	0.005	C3-Fluoranthenes/Pyrenes	0.005
C3-Naphthalenes	0.005	C4-Fluoranthenes/Pyrenes	0.005
C4-Naphthalenes	0.005	Benz[a]anthracene	0.005
Biphenyl	0.005	Chrysene	0.005
Acenaphthylene	0.005	C1-Chrysenes	0.005
Acenaphthene	0.005	C2-Chrysenes	0.005
Fluorene	0.005	C3-Chrysenes	0.005
C1-Fluorenes	0.005	C4-Chrysenes	0.005
C2-Fluorenes	0.005	Benzo[b]fluoranthene	0.005
C3-Fluorenes	0.005	Benzo[k]fluoranthene	0.005
Anthracene	0.005	Benzo[e]pyrene	0.005
Phenanthrene	0.005	Benzo[a]pyrene	0.005
C1-Phenanthrenes/Anthracenes	0.005	Perylene	0.005
C2-Phenanthrenes/Anthracenes	0.005	Indeno[1,2,3-cd]pyrene	0.005
C3-Phenanthrenes/Anthracenes	0.005	Dibenz[a,h]anthracene	0.005
C4-Phenanthrenes/Anthracenes	0.005	Benzo[g,h,i]perylene	0.005
Fluoranthene	0.005	Benz[a]anthracene	0.005
Pyrene	0.005		
Dioxins/Furans – Method 8290[3]	1.0 pg/g		
Total organic carbon (TOC) – Method 9060 (%)			0.1

[3] For dioxin/furans all congeners and their TEQs will be reported

MEMORANDUM

Sonoma County Water Agency Sediment Disposal Planning

TO: Kenneth Schwarz, PhD
Horizon Water and Environment
Oakland, CA 94602

COPIES: Jill Sunahara

FROM: Cynda Maxon
Maxon Consulting
San Diego, CA 92122

DATE: January 24, 2010

1. Purpose of Memo

The purpose of this memo is to provide information on source, fate, toxicity, and laboratory analysis and reporting of dioxins/furans with respect to Monitoring and Reporting Program No. R1-2009-0049 (MRP) issued by the North Coast Regional Water Quality Control Board (Regional Board) in association with Waste Discharge Requirements and 401 Water Quality Certification (Order No. R1-2009-0049) of the Sonoma County Water Agency (SCWA) Stream Maintenance Program (SMP). This memo also presents current regulatory guidance for the protection of human health and recommendations for future analysis of dioxins/furnace to support the evaluation of disposal options for SMP sediment.

2. Dioxin sources and environmental fate

Dioxins and furans are highly regulated compounds that are ubiquitous throughout U.S. soils and sediments due mainly from aerial fallout from numerous natural and anthropogenic combustion sources. Regulated dioxins consist of the polychlorinated di- and tri-benzo-dioxins (respectively, PCDD and TCDD). There are also groups of related "dioxin-like" chlorinated compounds with similar chemical structures and biological activity found in the environment, including furans (Figure 1). There are 75 possible types of chlorinated dioxin molecules, of which seven exhibit toxicity and are regulated throughout the world, including the U.S. Regulated furans consist of ten individual compounds.

Up until the 1970's, waste incineration (e.g., municipal, hazardous and medical) was the primary source of dioxins to the environment. Federal and state regulations, and clean-up actions have produced declining dioxin concentrations in the environment; and forest fires are now the largest single source of dioxins (WHO, 2007; EPA, 2003). Dioxin emissions from forest fires originate predominantly from low-temperature combustion of biogenic matter, and not from the vaporization of dioxins bound to vegetation (Gullett and Touati, 2003).

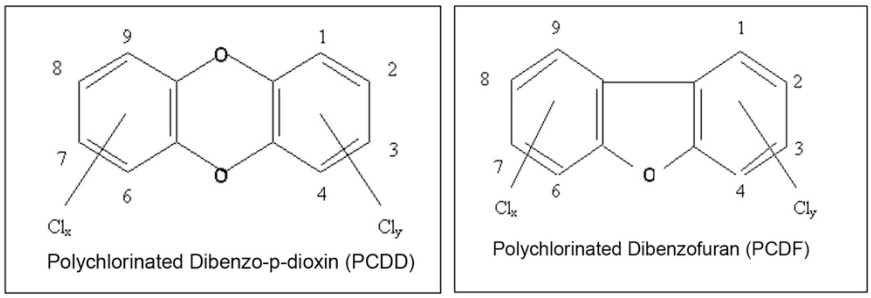

Figure 1. Generic structures of dibenzo dioxin and furan.

Dioxins are almost insoluble in water, although they are very soluble in organic solvents, fats and some oils. Most of the dioxins that enter surface water become strongly attached to particles and eventually settle in sediment. Dioxins deposited on land bind strongly to soil particles and organic matter in soil and freshwater sediment, but are not significantly taken up by plants. Soils contaminated with dioxins can occasionally result in contamination of groundwater. Soil erosion and surface runoff can also transport dioxins into receiving water and sediment. Dioxin levels found in plants, water, and air are typically one to several orders of magnitude lower than those found in soil, sediment, and adsorbed onto plants (WHO 2007). Dioxins are reasonably stable and can persistent unchanged in the environment for decades.

3. Human and ecological health concerns

Dioxins have been characterized by the US EPA as human carcinogens and at sufficient doses are anticipated to increase the risk of cancer (http://www.epa.gov/pbt/pubs/dioxins.htm). The International Agency for Research on Cancer classified the best studied dioxin compound, 2,3,7,8, TCDD, as a known human carcinogen, accounting for approximately 10% of human background dioxin risk. Effects in animals include changes in hormone systems, alterations in fetal development, reduced reproductive capacity, and immune-suppression. Effects specifically observed in humans include changes in markers of early development and hormone levels. At much higher doses, dioxins can cause a serious skin disease called chloracne. There are many difficulties in evaluating dioxin health effects in humans. Available health data are limited to studies involving occupational or accidental exposures to complex mixtures of potentially toxic compounds that include dioxins. Thus, it is not possible to attribute the observed effects exclusively to dioxins. Also, the mixtures in these studies were often contained in an unusual matrix (e.g., pesticide mixtures, contaminated rice cooking oil) that may not resemble environmental matrices or mixtures to which most people are exposed.

The primary pathway by which humans are exposed to dioxins is from the deposition of airborne particulates onto plant and soil surfaces, followed by the ingestion of surface contaminated vegetation and soil by food animals. Inhalation and water ingestion are not considered significant exposure pathways for terrestrial mammals, including humans. For terrestrial animals, the intake of vegetation (roughage) with adsorbed dioxin from aerial fallout is considered the most important exposure factor (Fries 1995). Of lesser importance, are feeds derived from seeds, since seeds are not directly exposed to the airborne particulate fallout. As a result, food animals, such as poultry and swine, restricted to grain-based diets, have lower potential dioxin exposures than do ruminants (e.g., cows), where roughage is the primary food source. Cattle held in feedlots have been reported

to significantly reduce concentrations of dioxins in their meat, as a result of being fed a grain based diet prior to slaughter, suggesting that dioxin tissue burdens decline relatively quickly in the absence of a contamination source (Lorber, et al. 1994). Concentrations of dioxin and dioxin-like compounds usually increase with each step in the food chain. This process (aka biomagnification) results in greater tissue concentrations in top predators (e.g., carnivores) of multi-trophic food webs, compared with lower-trophic farm-raised animals that graze on rural agricultural land.

The California Department of Toxic Substances Control (DTSC) is responsible for the protection of public health and the environment from toxic harm. DTSC issued guidelines for the protection of human health from dioxin (and dioxin-like compounds, including furans) in a Human Health Risk Assessment (HHRD) interim note based on protective regulations used in Germany, the Netherlands, and Sweden (DTSC, 2009). These guidelines include exposure routes originating from rural agricultural soils, including transfer in the soil and plant-agricultural animal-human food web. DTSC guidelines for dioxin in agricultural soils (based on total TEQ[1]) are <40 pg/g (maximum concentration) and 10 pg/g (95th upper confidence limit). The HHRD interim note also cites rural background concentrations of 1-6 pg/g Dioxin TEQ in California soils, including rural Sonoma County. DTSC-recommended remedial goals for dioxin in California soils are summarized in the below table. Since the guidance includes "dioxin-like compounds", it is assumed to apply to furan measured in soil.

Results for both 2009 SMP samples were below the DTSC agricultural soil remedial goal of <40 pg/g Dioxin-TEQ. The reported Dioxin-TEQ for Starr Creek Tributary (4.24 pg/g) was in the mid-range of soil background concentrations for rural California. The reported Dioxin-TEQ for Colgan Creek (17.91 pg/g) was higher than rural background; however, results for the three highest compounds were estimated due to elevated detection limits. With only two SMP samples, it was not possible to calculate a 95th UCL.

4. Laboratory analysis and reporting of dioxin

Dioxins and furans are analyzed primarily using gas chromatography with high resolution mass spectrometer detection (e.g., SW-846 Method 8290; EPA, 2009) to achieve low or sub part-per-trillion concentrations in solid matrices (e.g., sediment, soil). The method has gone through several revisions since the 1980's to produce increasingly lower detection limits. There are only a few commercial laboratories in the U.S. and Canada capable of meeting the strict quality control requirements to report dioxin/furan concentrations in the low or sub part-per-trillion range. Hence, reported results by many laboratories (including the laboratory that analyzed the 2009 SMP samples) are compromised mainly due to trace level laboratory contamination, and by reporting estimated values (with higher uncertainty) due to poor signal to noise ratios and elevated detection limits. These problems are readily apparent in reported data through observed concentrations in the method blank, and by EPA-qualified (e.g., " J" or other qualifier) results reported for field samples.

Since the seven regulated dioxin (and 10 furan) compounds exhibit different toxicities, the US EPA requires results reported in both concentration units (e.g., pg/g dry weight) and in Toxicity Equivalencies, or TEQs. TEQs are calculated by multiplying the reported concentration (in pg/g) by its corresponding Toxic Equivalency Factor (TEF) to provide an estimate of relative toxicity (Van den

[1] Total TEQ defined in Section 4

Berg, et al., 1998; WHO, 2007). Dioxins 2,3,7,8 TCDD and 1,2,3,7,8 PCDD are considered the most toxic and are each assigned a TEF unitless value of one. The remaining five individual dioxins have TEF values ranging from 0.0003 (least toxic) to 0.1. To calculate the total dioxin-TEQ (aka Dioxin-TEQ or WHO-TEQ), the measured concentration (in pg/g dry weight) for each of the seven individual dioxin compounds is multiplied by its respective TEF and the results are summed. The same procedure is used to calculate the total furan-TEQ, based on results for the 10 individual furans.

It should be noted that all environmental samples have reportable concentrations of dioxins/furans, regardless of detection, due to EPA and in California, Department of Toxic Substances Control (DTSC) procedures for quantifying and reporting results. This is because both agencies require the inclusion of non-detected values as either the detection limit or one-half the detection limit in the TEQ summation. Therefore, reported results will be higher for laboratories with higher detection limits. For example, non-detected individual concentrations of dioxins and furans in 2009 SMP sediment samples ranged from 1.0 to 5.3 pg/g. These values were included in the reported Dioxin and Furan TEQs even when compounds were not detected by the laboratory. Additionally, trace concentrations of dioxins (>2 pg/g total) and furans (~2 pg/g total) were detected in the associated method blank; and several dioxin analytes were qualified by the laboratory as "peak detected does not meet ratio criteria and has resulted in an elevated detection limit". Both of these quality control issues contributed to higher reported dioxin/furan concentrations in reported results for the two SMP sediment samples analyzed in 2009.

5. Recommendations for future monitoring of Dioxin/Furan

Dioxins/furans should be analyzed using EPA Method 8290 by a laboratory capable of meeting all SW-846 quality control criteria and target detection limits (≤ 1 Dioxin-TEQ pg/g per individual compound) using protocols consistent with DTSC recommendations for quantification. Results reported for the 2009 SMP samples are suspect due to laboratory quality control issues (e.g., contamination in the method blank, and insufficient peak to noise ratios). It is the opinion of this reviewer that future analyses of SMP samples will result in dioxin/furan concentrations that are consistent with California rural soil background levels when reported using DTSC guidelines for quantification.

6. References

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