Appendix D-3

EVALUATION METHODOLOGY

Dry Creek Bypass Pipeline Feasibility Study ***November 11, 2009***

Purpose

This technical memorandum outlines the methodology that will be used to evaluate the Dry Creek bypass pipeline alternatives. This memorandum will present the criteria first used to screen the options then used to rank and compare alternatives.

Facilities Screening and Criteria Evaluation Process

A two step evaluation process was developed to evaluate the bypass pipeline alternatives. Each alternative consists of an inlet facility, pipeline route, and outlet facility. The first step will be to screen options for the location and construction of the inlet facility, pipeline segments, and the outlet facility options. After the screening process, complete alternatives for the bypass pipeline will be developed and evaluated using a common set of evaluation criteria, see Figure 1. The screening and criteria evaluation process is as follows:

1. Screen individual options for the inlet facility, pipeline segments, and outlet facility.
2. Combine the screened inlet, pipeline segment, and outlet options into complete alternatives consisting of an inlet, route, and outlet.
3. Evaluate the alternatives (inlet, route, and outlet) based on a set of common evaluation criteria.

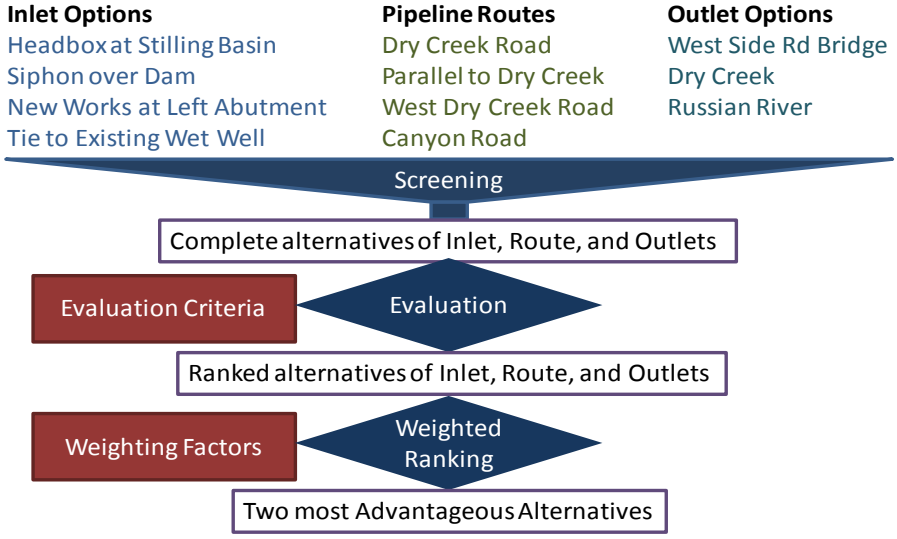

Figure 1. Evaluation Process Flow Chart

Screening Criteria

The screening criteria that will be applied to each project element (i.e., inlet facility, pipeline route, and outlet facility) are listed in Table 1. These criteria will be applied to the facility options to identify fatal flaws and eliminate undesirable and infeasible options. The intent of this effort is to carry forward into the evaluation process the most viable options as feasible alternatives.

Table 1. Summary of Screening Criteria

Inlet Facility	Pipeline Route	Outlet Facility
Design and Construction	Alignment Length	Proximity to the Confluence with Dry Creek and the Russian River
Operability	Topography	Proximity to Pipeline Terminus

Inlet Screening Criteria

Four inlet options have been identified (see Figure 2):

1. Head Box - Construction of a head box at the existing outfall structure. Both the east and west sides of the outfall structure are being considered to accommodate the pipeline route.
2. Siphon - Construction of a piping system over the dam operated by either a siphon or a pump station.
3. New Inlet - Construction of new inlet works through the west abutment of the dam.
4. Integrated Facility - Partner with the U.S. Army Corps of Engineers (Corps) on the construction of an emergency water supply to the fish hatchery. Both a common pipeline and separate pipelines through the dam are being considered.

The inlet options will be screened to confirm both the feasibility of construction and the facility operability, as described below.

Design and Construction

The design and construction criteria include identifying fatal flaw design constraints and unrealistic or extremely difficult construction procedures. Fatal flaw design constraints include a specific design requirement that cannot be achieved through physical law. The construction procedures for this project are generally controlled by geotechnical conditions, tunnel and pipe installation procedures, and dam operation. Geotechnical considerations include soil stability during tunneling operations, potential damage to the grout curtain associated with the dam, and damage to the foundation and embankment due to subsidence resulting from tunneling operations. Tunnel and pipe construction are common practice for projects of this nature, however, the various options presented above present various levels of difficulty with regard to constructability and can be weighed accordingly. The final consideration for the screening process is the ability to coordinate normal dam operation. It is extremely difficult or unrealistic to modify the water surface elevation as a result of construction requirements. As such, all

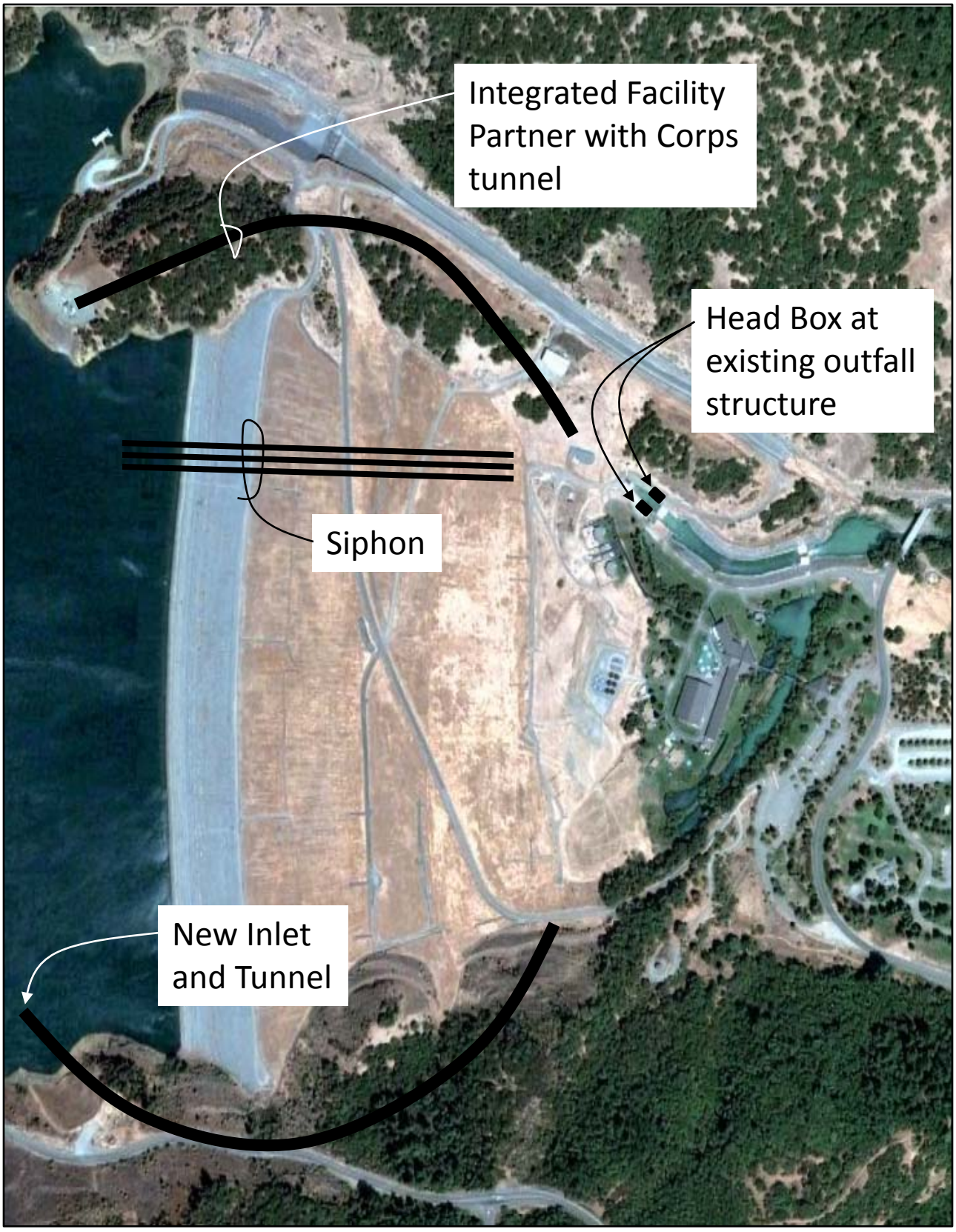

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Figure 2
Preliminary Inlet Works Options
Dry Creek Pipeline Feasibility Study

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construction activities associated with the water side of the dam must be considered as in-water work. The following chart describes the rating criteria that will be applied to each option for Design and Construction.

Rating	Criteria
Best	All factors are acceptable for design and construction procedures.
Satisfactory	All factors of design, geotechnical, tunnel and pipe installation, and construction during normal dam operation are acceptable, but one or more factors may be difficult.
Unacceptable	Geotechnical, tunnel and pipe installation, and construction conflicts with normal dam operation and causes an unacceptable condition.

Operability

When designing a water conveyance system it is important to characterize certain critical factors which have an affect on the systems ability to function or operate as required. The critical factors utilized to determine the level of facility operability are system capacity, available pressure head, and operational complexity. System capacity is the ability of the system to efficiently provide and maintain the required volume of water to the outlet works pipeline. When considering each option, system capacity becomes more complex when integrating the proposed inlet works facilities into the existing structures at the dam.

In addition to system capacity it is necessary to provide and maintain the required pressure head needed to convey the required water to the outlet works. Pressure head is a function of water surface elevation. Each option presents different methods to achieve the required elevation which vary in complexity. Similar to system capacity, maintaining the appropriate pressure head becomes more complex when integrating the proposed inlet works facilities into the existing structures at the dam.

The final consideration for the screening process is operational complexity. This applies to options that require seasonal or more frequent mechanical system operation, such as pumps, gate valves, and gate systems needed to increase water surface elevation. In addition, consideration must be given to an integrated system which would provide water to both the existing fishery and the outlet pipeline.

The following chart describes the rating criteria that will be applied to each option for Facility Operability.

Rating	Description
Best	All factors of system capacity, pressure head, and operational complexity meet project needs.
Satisfactory	All factors of system capacity, pressure head, and operational complexity are acceptable, but one or more factors may be difficult.
Unacceptable	One or more of system capacity, pressure, head and operational complexity cannot be met or is extremely difficult.

Route Screening Criteria

Screening criteria were developed to identify the preferred alignment option when more than one option was identified for a particular pipeline segment. An overview of the route options is illustrated in Figure 3 and listed as follows:

1. Dry Creek Road
    a. In the road
    b. In the road up to a bury depth of 15', then in agricultural property
2. East side agricultural road parallel to Dry Creek
3. Dry Creek Road and Canyon Road
4. West Dry Creek Road
    a. In the road
    b. In the road up to a bury depth of 15', then in agricultural property

Alignment Length

Pipeline length and right-of-way (ROW) acquisition directly affect project complexity and construction costs. Thus, in cases where the length of the alignment options differed by greater than 10 percent, the shorter alignment option will be selected for inclusion in the alignment alternative.

Rating	Description
Best	Pipeline segment is greater than 10% shorter than other options. .
Satisfactory	Pipeline segment options are within 10% of each other.
Unacceptable	Pipeline segment is greater than 10% longer than other options.

Topography

This criterion will be used to assess the constructability of the pipeline along a given alignment. Depending on the inlet option, the available hydraulic grade line (HGL) may be limited to only 220 feet above sea level at Warm Springs Dam. Thus, the presence of hills along an alignment could require deep bury depths (e.g., greater than 25 feet) in order to stay below the HGL. In that case, alternate alignments (e.g., across private property) or construction methodologies (e.g., trenchless installation) will be identified, if available.

Rating	Rating
Best	Entire pipeline route is below the HGL.
Satisfactory	Portions of the pipeline route would be above the HGL, although an alternate alignment or construction methodology is feasible.
Unacceptable	Portions of the pipeline route would be above the HGL and no alternate alignments were identified

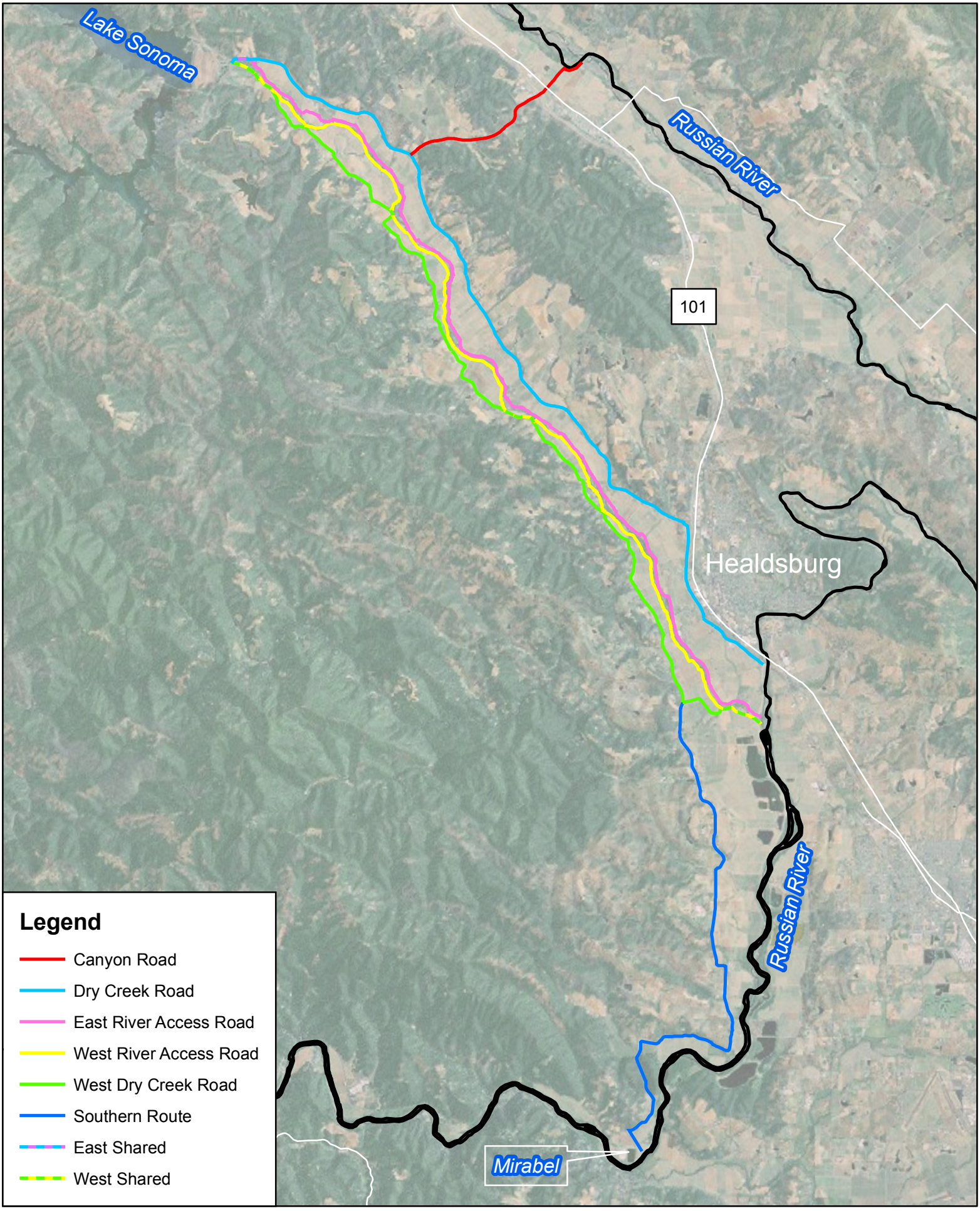

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Figure 3
Preliminary Pipeline Routes
Dry Creek Bypass Pipeline Feasibility Study

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Outlet Screening Criteria

The screening criteria for the outlet facility were developed to identify feasible discharge locations for each of the potential pipeline route termination notes Figure 4 illustrates the four pipeline routes down Dry Creek Valley, the pipeline termination points being considered, and the respective potential discharge area. Figure 5 illustrates the pipeline route over Canyon Road to the Russian River and potential discharge area.

The screening criteria will be applied in sequence to develop a preferred option for each of the discharge areas based on the distance from the pipeline termination point and constructability. Application of the screening criteria in this manner will result in a feasible outlet site near the pipeline termination points. The screening process considers site locations only. The outlet facility type will be evaluated as part of the alternative evaluation.

Proximity to the Confluence with Dry Creek and the Russian River

The proximity to the confluence with Dry Creek and the Russian River was selected as an initial screening criterion for the following reasons;

(1) Discharge in Dry Creek close to the confluence of the Russian River would address the fishery issues identified in the Biological Opinion and limit the reaches in Dry Creek with increased flows.

(2) Maintaining discharges near the confluence of Dry Creek and the Russian River would mimic the current flow conditions, where discharges from Lake Sonoma combine with natural flows in Dry Creek to increase flows in the River at that location.

(3) Discharges to the Russian River upstream from Dry Creek would be subject to increased losses from evaporation and infiltration than currently occur, which could potentially decrease the amount of water available for diversion by the SCWA downstream. Conversely, discharges downstream of the confluence would similarly decrease the potential losses and would therefore potentially increase the amount of water available for diversion by the SCWA.

For discharge locations on Dry Creek, it would be preferable for the location of the outlet works to be near the confluence of Dry Creek and the Russian River. Discharging at the confluence would eliminate the need to use the creek for conveyance.

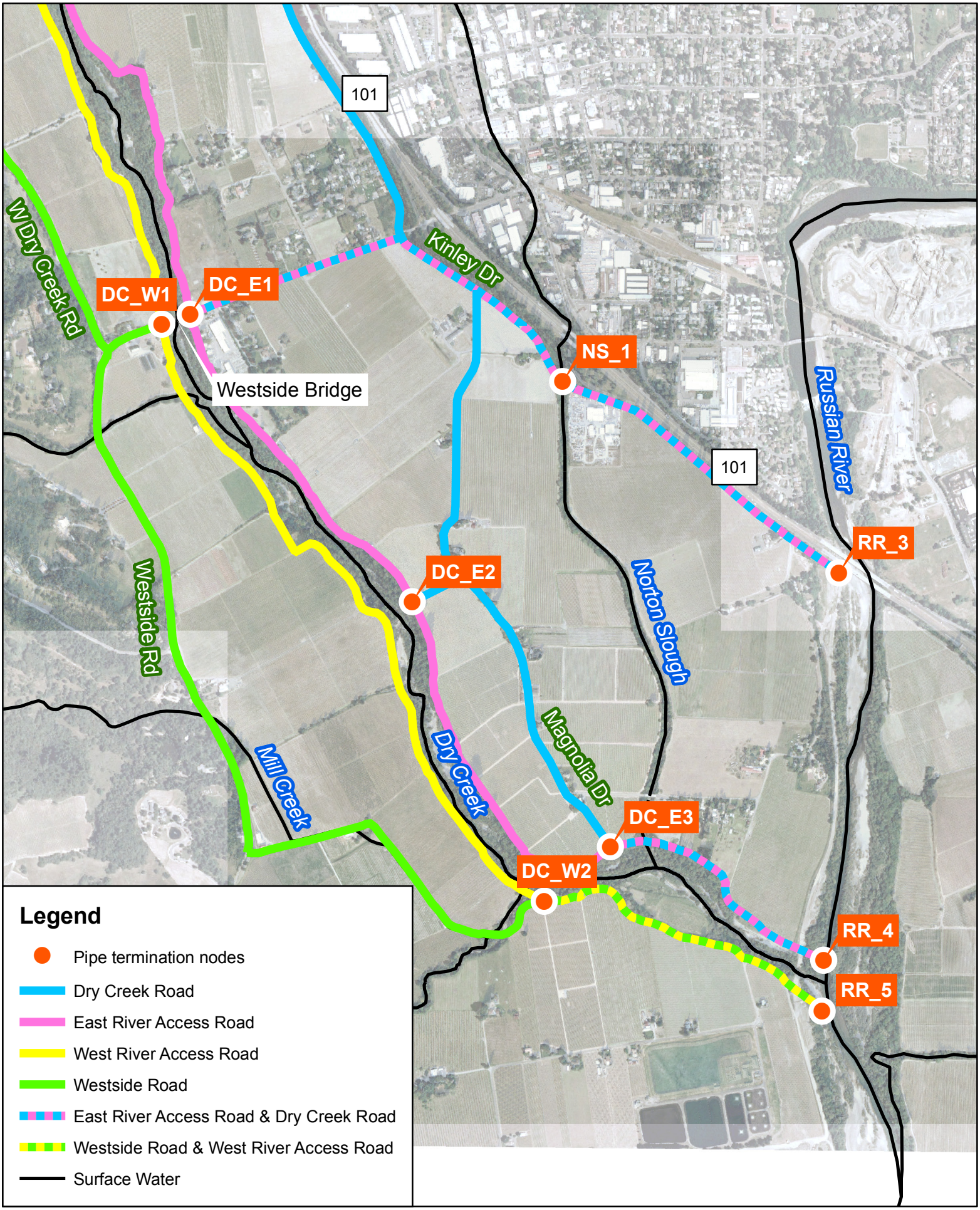

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Figure 4
Potential Outlet Sites Near Dry Creek Confluence
Dry Creek Bypass Pipeline Feasibility Study

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Figure 5
Potential Outlet Sites On Russian River Near Geyserville
Dry Creek Bypass Pipeline Feasibility Study

For discharge locations on the Russian River, it would also be preferable for the location of the outlet works to be near the confluence of Dry Creek and the Russian River. However, there may also be some advantages to discharging downstream of the confluence. The following ratings were assigned to each potential site.

Discharge to Dry Creek

Rating	Description
Best	Less than 1 mile upstream of Confluence with the Russian River
Satisfactory	1 and 3 miles upstream of Confluence with the Russian River
Unacceptable	More than 3 miles upstream of Confluence with the Russian River

Discharge to the Russian River

Rating	Description
Best	Less than 1 mile upstream or downstream from Dry Creek Confluence
Satisfactory	1 and 2 miles upstream or downstream from Dry Creek Confluence
Unacceptable	Greater than 2 miles from Dry Creek Confluence

Proximity to Pipeline Terminus

The proximity to the pipeline terminus was selected as an initial screening criterion since the additional pipeline length required to discharge beyond the end of the pipeline, as identified in the Route Screening TM, would directly impact the construction cost and could potentially have a greater environmental impact.

It would be preferable for the location of the outlet works to be adjacent to or near the pipeline termination point, typically near a bridge or at a section of the road that is close to the creek. However, it is understood that in the natural environment there may be a compelling reason to move the discharge point further upstream or downstream. Therefore, the following ratings were assigned to each potential site.

Rating	Description
Best	Less than 1,000 feet from pipeline terminus node
Satisfactory	Between 1,000 and 2,000 feet from pipeline terminus node
Unacceptable	Greater Than 2000 feet from pipeline terminus node

Evaluation Criteria

The evaluation criteria will be used to evaluate alternatives developed from the screening analysis. Some criteria are common to the inlet facility, pipeline routes, and outlet facility evaluations, and some are specific to only one element.

On October 22, 2009, a meeting was held with interested members of the Dry Creek Advisory Committee to discuss evaluation criteria. The concerns/criteria identified during that meeting and the method in which these concerns/criteria were addressed and incorporated into the study are listed below:

1. Loss of trees along Dry Creek due to damage to roots during construction. HDR contacted an arborist, who said that limited damage to the tree would occur if the pipe was installed outside of the drip line (i.e. tree canopy diameter). This concern has been added as a new criterion.

2. Right of way issues along riparian corridor. These will be addressed along with other right of way criteria, as described in the evaluation criteria presented in this memorandum.

3. Concerns about stability or structures/banks with high flows. These will be addressed along with other impacts such as scour.

4. Impacts to the Russian River, control of water loss, and impact at Dry Creek/Russian River confluence resulting from a release at Geyserville. This issue will be integrated into the operations criteria.

5. Impacts to groundwater and water loss under different scenarios/routes; especially after a series of dry years. This is important, but not a criterion because a minimum flow in Dry Creek will provide for groundwater recharge. This issue will be addressed in a technical memorandum regarding flows in Dry Creek and the bypass pipeline.

6. Construction seasonality, especially impacts to agricultural operations and impacts to recreation (especially cycling). This criterion has been added to pipeline constructability.

In considering complete alternatives, the evaluation criteria will be applied to each element of the alternative as listed in Table 2, on the following page.

Engineering

The engineering criteria range between excellent and undesirable. Based on the specific criteria, as few as three rating categories are needed to describe the range of conditions.

Table 2 Evaluation Criteria Applied to Each Element of the Alternatives

Inlet Facility	Pipeline Route	Outlet Facility
Engineering		
Reliability and Enhancement	Reliability and Enhancement	Reliability and Enhancement
Constructability	Constructability	Constructability
Permitting	Permitting	Permitting
Operations	Operations	Operations
Right of Way Acquisition	Right of Way Acquisition	Right of Way Acquisition
Liquefaction and Hazard Potential	Liquefaction and Hazard Potential	Liquefaction and Hazard Potential
	Hydropower Potential	River Channel Stability
	Special Crossings	Accessibility
Environmental		
Wetlands	Wetlands	Wetlands
Habitats and Sensitive Species	Habitats and Sensitive Species	Habitats and Sensitive Species
Hazardous materials	Hazardous materials	Hazardous materials
	Impact to trees (roots)	
Cultural Resources	Cultural Resources	Cultural Resources
		Water Quality/Fisheries
Economic		
Capital Cost	Capital Cost	Capital Cost
O&M	O&M	O&M
Net Present Value	Net Present Value	Net Present Value

Reliability and Enhancement

Because the capacity of Dry Creek to receive flow has not been specifically determined, the flexibility of the inlet, outlet, and pipeline alternatives are important. Some alternatives have greater flexibility when it comes to handling increasing or decreasing flow capacity. A system having the ability to handle a broad range of flows is more reliable and flexible in the long term. Specific issues such as the potential for erosion and bank stability at the outlet works are addressed for each system component.

Some of the pipeline routes and discharge points have an increased opportunity to enhance specific areas through the supply of additional water to tributaries, decreasing water temperature, and increasing dissolved oxygen (DO). Improvements should be consistent with the biological opinion, basin plan, and plans to improve Dry Creek.

Rating	Description
Excellent	All elements of the alternative can handle the range of flows and has the ability to enhance specific areas.
Above Average	All elements of the alternative can handle the range of flows, but has a limited ability to enhance specific areas.
Satisfactory	Elements of the alternative can dominantly cover the range of flows with no or very limited ability to enhance specific areas.
Poor	Some elements of the alternate cannot cover the range of flows.
Undesirable	Elements cannot cover the range of flows.

Constructability

Constructability is composed of several sub-criteria, including utility conflicts, tree conflicts, topography, access, excavation and dewatering. Utility conflicts consider overhead utility lines and existing or planned large-diameter utilities. Topography and access impact the construction efficiency and effort required to perform the work. The excavation required to install the facilities can be a significant work effort for all of the project elements.

Inlet Works Constructability Criteria

Interconnection with the existing temperature control structure requires significant tunneling and complex construction methods to tie the bypass pipeline to the existing stand-pipe. The headbox requires limited excavation and construction of a concrete box at the ground surface. Constructability was evaluated on the complexity of construction.

Rating	Description
Excellent	Low technology, open construction
Satisfactory	Complex technology, underground
Undesirable	Unusually complex construction

Pipeline Route Constructability Evaluation Criteria

Utilities - Along the pipeline route are overhead power lines, trees, plantings, and roadside improvements. Reaches of some route alternatives have water, sewer, natural gas, and fiber optic lines in parallel and crossing the proposed route. This criterion evaluates the degree of difficulty required to accommodate utilities, trees, and roadside improvements.

Rating	Description
Excellent	Minimal existing utility conflicts. Minimal tree conflicts. Excellent topography and easy access. Minimal excavation and/or dewatering requirements.
Above Average	Minimal existing utility conflicts. Minimal tree conflicts. Good topography with some access coordination needed. Increased excavation and/or dewatering requirements.
Satisfactory	Moderate existing utility conflicts. Moderate tree conflicts. Some topography and access coordination. Increased excavation and/or dewatering requirements. Some trenchless boring required for creek crossings and to avoid wetlands or vineyards.
Poor	Significant existing utility conflicts. Significant tree conflicts. Poor topography and tight access requirements. Significant excavation and/or dewatering requirements. Some tunneling required, lengths greater than 1,000 ft.
Undesirable	Significant existing utility conflicts. Significant tree conflicts. Very poor topography requiring special construction with critical access needs. Significant excavation and/or dewatering requirements. Significant tunneling required.

Impacts to Agricultural Operations and Recreation - The Dry Creek valley contains about 9,000 acres of vineyards and 63 wineries. The harvest season is critical and adds an increased amount of traffic flow associated with transportation of crops. Throughout the year, visitors come to the area for the scenery, wine, boating, and recreational activities. Dry Creek road is a critical access route throughout the valley. Major events occur from spring through fall.

In general, the project will be designed to minimize the disruption during harvest and during critical area-wide events. The contractor will be directed to stop work and provide access during these periods. At all other times, the contractor will provide traffic control and safe passage. The following rating criteria are based on the impact to main roads and ability to provide alternative paths around the construction.

Rating	Description
Excellent	Minimum interruption with construction in non-arterial routes and alternative travel options.
Satisfactory	Minimum interruption with construction within arterial traffic routes.
Undesirable	Routes that would create access problems for agricultural activities and the public.

Outlet Works Constructability Criteria

Proximity to Channel - Some outlet alternatives are closer and some further from the existing channel. Distance from the channel impacts stream and potentially bank stabilization and effects the construction requirements to mitigate problems at and downstream from the discharge location.

Rating	Description
Excellent	Less than 100 ft from channel
Satisfactory	Between 100 and 150 feet from channel
Undesirable	More than 150 feet from channel

Access - Some outlet locations are near paved roads or roads providing industrial or commercial access. Other areas are along unpaved roads regularly used to access industry or commercial areas. Undesirable locations have access that is only through a vineyard or private residence, typically on a dirt road.

Rating	Description
Excellent	Near a high volume road in an industrial or commercial area
Satisfactory	Near low volume road in a industrial or commercial area
Undesirable	Only access is through a vineyard or private residence

Floodplain - For this criterion, outlet works are either in or out of the 100-year floodplain.

Rating	Description
Excellent	All of the site is out of the 100-year floodplain
Satisfactory	Most of site is outside the 100-year floodplain
Undesirable	Most of site is inside the 100-year floodplain

Permitting

The discharge permitting criterion was used to identify sites with the greatest potential or significant obstacles to obtain a permit. Discharge to surface waters is regulated under the Clean Water Act's NPDES permit program and administered by the Regional Water Quality Control Board (RWQCB). The discharge permit program accounts for the potential impacts of direct discharge and sets limits on it. It is not clear at this time how the North Coast RWQCB will regulate the discharge of water from Lake Sonoma from the bypass pipeline.

Construction permitting is also considered in this criterion and addresses whether a potential site is known to contain any unique conditions that would require special permitting relative to other sites. For example, a site near a bridge would have additional permitting coordination requirements with Caltrans or the agency that maintains the bridge, increasing the permitting risk. Areas identified as having cultural resources may also have additional coordination requirements with the Office of Historic Preservation, which would similarly increase the permitting risk.

Rating	Description
Excellent	Low relative permitting risk.
Satisfactory	Average relative permitting risk.
Undesirable	High permitting risk

Operations

The pipeline and outlet works are designed to be free from operator attention. Some maintenance will be required, but there is no seasonal or regular operation required. The inlet works have varying decrees of operational needs based on the strategy used to create the flow split between the hatchery flows, bypass flows, and additional flow discharged to Dry Creek. Operating criteria also includes the distance from the outlet to the SCWA well field as a measure of response between release and water availability.

Rating	Description
Excellent	No operator attention
Satisfactory	Seasonal operator attention to adjust weirs, valves, or gates
Undesirable	Monthly or weekly attention to adjust weirs, valves, or gates

Right of Way Acquisition

ROW acquisition can add a significant amount of time, complexity, and cost to the project. Construction in an existing ROW is always preferred over ROW acquisition. It is expected that some ROW acquisition will be required for all alternatives. Sites requiring the acquisition of fewer ROW are preferred. For direct discharge, some sites would require an easement on only one parcel to accommodate facilities, whereas others might require several. Sonoma County Assessors Parcel maps will be used to determine potentially affected parcels.

Rating	Description
Excellent	Public ROW with sufficient area or width (40 feet minimum) available.
Above Average	Mostly public ROW with sufficient width (40 feet minimum) available, temporary/permanent local easements required at limited locations (≤ 20% of the pipeline alignment).
Satisfactory	Mostly public ROW but with limited or restricted width, private easements required along alignment, (≤ 40% of the pipeline alignment).
Poor	Limited access to public ROW. Significant private easements required (≤ 50% of the pipeline alignment).
Undesirable	Very limited access to public or utility-owned ROW. Multiple private easements required (.>50% of the pipeline alignment)

Liquefaction and Seismic Hazard Potential

This criterion will be used to assess the likelihood that a prospective site would experience liquefaction during a seismic event, which could cause significant damage to the facility.

Earthquakes can cause soil movement when soils are saturated with groundwater. As soils become unstable, they cannot support forces in the pipe or support infrastructure built along the slopes next to the river. Liquefaction maps for the Dry Creek and Russian River area are available from U.S. Geological Survey (USGS) OFR 00-444 (Knudsen et al., 2000) and USGS OFR 06-1037 (Witter et al., 2006). USGS classifications of liquefaction used are very high, high, moderate, and low. In general, all of the soils on or near the river have a high potential of liquefaction.

Rating	Description
Excellent	No or minimal apparent seismic, landslide, or erosion hazards exist along the pipeline route or at the discharge location (low USGS classification).
Satisfactory	A moderate portion of the pipeline route has one or more seismic/landslide/erosion hazards and requires some piling, stabilization, or remediation effort to mitigate (moderate USGS classification).
Undesirable	A more than significant portion of the pipeline route has multiple seismic/landslide/erosion hazards and requires extensive piling, stabilization, or remediation effort to mitigate (high and very high USGS classifications).

Hydropower

Hydropower can be obtained from the existing generator discharging through the outlet structure or through a new turbine on the bypass pipeline. Power generation varies with the flow demand and the split between flow through Dry Creek and the bypass pipeline.

Hydropower capacity is based on the remaining hydraulic head available to generate hydropower and the flow through the generator. Flows vary depending on the amount of flow discharged to Dry Creek versus the flow to be bypassed.

Rating	Description
Excellent	Use of the existing generator up to its maximum capacity.
Satisfactory	Installation of a new generator and use up to its maximum capacity.
Poor	Two generators and a flow split that does not maximize the capacity of the generators.
Undesirable	No excess power generation, thus no revenue from generation.

Special Crossings

Crossings of state highways or multi-lane streets, railroads, and waterways and wetlands may require trenchless construction, piling supports, or other engineering solutions. “Difficult” crossings may be considered to be those with deep/long borings, high groundwater conditions, or difficult soil conditions.

Rating	Description
Excellent	<4 special crossings along the pipeline route; none are considered difficult. No state highway or railroad crossings.
Above Average	4 - 8 special crossings along the pipeline route; less than 3 may be considered difficult. No state highway or railroad crossings.
Satisfactory	6 -10 special crossings along the pipeline route; 3 – 4 may be considered difficult. No state highway or railroad crossings.
Poor	8 - 12 special crossings along the pipeline route; 4 - 5 may be considered difficult.
Undesirable	More than 12 special crossings along the pipeline route; 5 or more may be considered difficult.

River Channel Stability

Channel stability includes the evaluation of bank stability, degree of meander and potential for scour. Relevant data were collected during recent field investigations, through historical aerial photography, and by GIS evaluation. Together, these three evaluation criteria provide a good indication of the stability of a channel and suitability for an outlet facility.

Bank Stability

Bank stability is considered to be the potential for a riverbank to erode or experience undercutting over time. Factors affecting bank stability are vegetation, angle of bank inclination, and location of the primary channel on the inside or outside of the bend. Increased vegetation generally increases stability. Angles of inclination for banks should be relatively low unless comprised mostly bedrock. Banks on the outside of a bend are generally less stable because of higher shear velocities.

Rating	Description
Excellent	High degree of riverbank stability.
Satisfactory	Less stable to slightly eroding bank requiring more engineering stabilization.
Undesirable	Eroding bank.

Meander

The degree of meander, or the meander envelope, is assessed based on the degree to which the low-flow channel moves within a wider channel over time. These criteria are important because facilities located in reaches of the river with a high potential for scour or erosion, or a high potential for the channel to move away from its current location, have a great likelihood of failure. The change in meander of the river has been traced and summarized for the past 65 years for the Russian River and for the past 40 years for Dry Creek, through a series of aerial photographs and topographic maps. Meander was categorized as low, moderate, and high, with high indicating the greatest likelihood of the channel to move based on the historic record.

Rating	Description
Excellent	Low degree of river meander.
Satisfactory	Modest meander that would not impact the discharge works.
Undesirable	High degree of meander that would require stabilization and maintenance.

Scour

Scour is the removal of material from the bed and banks of a river by stream flow. It can be affected by many factors, including changes in hydrologic conditions, engineered structures such as bridges or riprap, the curvature or sinuosity of the stream, channel width, the presence of point bars, gradient, and the strength of the geologic materials in which the stream flows. Scour potential was summarized as high, moderate, and low.

Rating	Description
Excellent	Low scour potential.
Satisfactory	Moderate scour potential.
Undesirable	High scour potential.

Environmental Considerations

Environmental criteria have been defined using a scale ranging from excellent to undesirable. It is expected that the evaluation of environmental impacts will be further developed during the CEQA process.

Cultural Resources

The presence of cultural materials and artifacts may slow construction and require the investigation and relocation of artifacts prior to and during construction. Sites with identified cultural resources would require coordination with the State Office of Historical Preservation and possibly county agencies. This could bring into play additional construction requirements and significant schedule delays.

A focused records search will be conducted of the North Central Information Center (NCIC) of the California Historical Resources Information System (CHRIS). In addition, Native American groups may be consulted regarding the presence of major population centers in the records search area, including unmapped burial sites and cemeteries.

Rating	Description
Excellent	No resources within area of potential effect.
Satisfactory	Resources within area of potential effect not likely to be affected.
Undesirable	Resources within area of potential effect likely to be affected.

Wetlands and Other Waters of the U.S.

Waters of the U.S. include streams (including intermittent streams) and wetlands. Construction in waters of the U.S. requires permitting and mitigation. Sites or routes having streams and/or wetlands would be less desirable if other sites or route alternatives are available.

The U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps will be used to estimate the acreage of streams and wetlands for the various alternatives. USGS 7.5 minute quadrangle maps will be used to estimate the acreage of streams, including blue-line streams that would be potentially affected.

Rating	Description
Excellent	No wetlands or streams.
Satisfactory	Minor or temporary impacts to wetlands and streams.
Undesirable	Permanent impacts to wetlands and streams.

Sensitive Habitats and Species

Construction in areas with protected habitat and sensitive plant and animal species requires additional permitting and sometimes significant mitigation. Sites and pipeline routes with sensitive habitat and species will be identified using the California Natural Diversity Database

(CNDDB) developed by the Department of Fish and Game (CDFG). The primary function of the CNDDB is to gather information on the status of rare and endangered plants, animals, and vegetation types. The database is intended to provide the most current information available to the government agencies, the private sector, and conservation groups in order to promote better-informed land-use decisions.

The CNDDB is an ongoing and continuously updated database; however, it does not constitute an official response from any state agency and will not in itself meet the requirements of the California Endangered Species Act. It should also be noted that absence of data in the CNDDB does not constitute the basis for a negative declaration.

Sensitive habitat and species that are likely to occur in the project area will also be identified using the USFWS's Sacramento Fish and Wildlife Office website and CDFG's Special Animals List and Special Plant List.

Rating	Description
Excellent	No protected habitat and/or sensitive species present.
Satisfactory	Potential protected habitat and/or sensitive species may be present.
Undesirable	Protected habitat and/or sensitive species present.

Hazardous Materials

Construction through areas where hazardous materials are present requires the removal and disposal of the materials prior to construction and could invoke additional permitting requirements and significant schedule delays. A hazardous waste assessment was conducted to identify recognized environmental conditions (RECs) or Notable Findings with the potential to negatively impact environmental conditions at a given location. As defined by the American Society of Testing and Materials (ASTM) E 1527-05 for the performance of a Phase I ESA, a REC is "the presence or likely presence of any hazardous substance or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substance or petroleum products into the structure, on the property, or into the ground, groundwater, or surface water of the property." Additional details about the hazardous waste assessment will be provided in the Hazardous Waste TM.

Rating	Description
Excellent	No known hazardous materials. Previous hazardous materials are cleaned up; or isolated.
Satisfactory	Past or present hazardous material likely near project location.
Undesirable	Significant hazardous materials/large near project location.

Potential Loss of Trees

Construction may require tree removal because of route limitations. Construction within the "drip line" (diameter of the canopy) has the potential of damaging the tree. The tree may go

into shock because of the loss of root system or become susceptible to topping over in high winds. Final determination of the pipeline route and impact to trees will be evaluated by a local arborist. For the purpose of evaluation, the linear footage of pipe to be constructed within the canopy will be estimated using the high resolution aerial photos and field survey.

Rating	Description
Excellent	Limited need for tree removal and/or proximity of pipeline construction within the tree drip line.
Satisfactory	Some need for tree removal and/or proximity of pipeline construction within the tree drip line.
Undesirable	Significant need for tree removal and/or proximity of pipeline construction within the tree drip line.

Impacts to Fisheries

The most significant issues associated with the bypass pipeline and release of bypassed water back to Dry Creek or the Russian River are those associated with water quality. Key water quality criteria to consider include temperature, dissolved oxygen (DO), turbidity, and channel morphology/ velocity.

Water quality

Temperature and DO – Temperatures should be at or less than the ambient water temperature. Ideally temperatures should be less that 65^{o}F. Dissolved oxygen (DO) should be at or greater than the ambient dissolved oxygen levels. Satisfactory DO levels are at least greater than 8ppm.

Rating	Description
Excellent	Ability to provide DO levels at or near Saturation, no increase in temperature.
Satisfactory	Ability to meet or exceed ambient DO and temperature.
Undesirable	Reductions in stream DO <5 ppm or increases in temperature > 65^{o}F due to diversion discharge.

Turbidity – There is a low likelihood of discharge containing increased turbidity levels than currently occur (suitable). However, the design of the outfall facility must carefully consider the potential for erosion of the bank and channel and fluidization of bottom sediments over time so that increases in turbidity would not occur as a result of the discharge facility.

Rating	Description
Excellent	Low likelihood of discharge containing or increasing turbidity.
Satisfactory	Some risk of increased minor movement of fines but increase is not significant.
Undesirable	Increases in turbidity and gravel movement that potentially impact fisheries.

Channel morphology – Discharge volumes/velocities that can affect banks and the channel bottom could be harmful to fish habitats, especially to habitat attributes such as substrate composition and integrity of critical habitat. Velocities greater than 8 feet per second (ft/s) form impediments to adult migration. Higher velocities should not be an issue with juvenile

migration. The design of the discharge facility would address maximum velocities and available area for fish passage.

Rating	Description
Excellent	Channel velocities less than 2 ft/s
Satisfactory	Channel velocities less than between 2 and 4 ft/s.
Undesirable	Channel velocities greater than 4 ft/s.