Nevada Irrigation District

Staff Report

for the Regular Meeting of the Board of Directors, September 13, 2017

TO: Board of Directors

FROM: Gary King,P.E., PhD, Engineering Manager
Doug Roderick, P.E. Senior Engineer

DATE: September 6, 2017

SUBJECT: **Centennial Reservoir Project – Water Storage Investment Program Application (FATR #7013)**

ENGINEERING

RECOMMENDATION:

Review and discuss application submitted to the California Water Commission Water Storage Investment Program.

BACKGROUND:

Staff has submitted an application to the California Water Commission Water Storage Investment Program (WSIP). Staff will make a presentation on the submitted application.

BUDGETARY IMPACT:

None. Informational item only.

ATTACHMENTS

- Application Packet

DR

Proposal Full View

Print

APPLICANT INFORMATION

Nevada Irrigation District *	Centennial Water Supply Project
Tax ID	946003853
Point Of Contact *	**Division/Address List:** **Address1:** 1036 W Main St **Address2:** **City:** Grass Valley **State:** CA **Zip:** 95945 **First Name:** Doug **Last Name:** Roderick **Email:** roderick@nidwater.com **Phone (Direct):** 5302716866
Point Of Contact Position Title *	Senior Engineer
Proposal Name *	Centennial Water Supply Project
Proposal Objective*	NID is proposing to implement the Proposed Project and construct additional water storage to meet three primary water supply objectives: 1) Compensate for anticipated changes in precipitation and increased frequency and duration of future drought periods, 2) Meet projected future water supply needs, and 3) Improve water supply reliability for NID customers. The Proposed Project, Centennial Reservoir, is likely one of several potential components that NID is considering to implement over the long term to meet the aforementioned objectives. Currently, NID is determining their future water supply needs based on their Master Planning documents as well as the best available climate science. Based on preliminary evaluations, NID's future water supply needs may require the development and implementation of a larger water supply resiliency program, where the Proposed Project is the initial component.

BUDGET

Other Contribution	0
Local Contribution	312050000
Federal Contribution	0

Inkind Contribution	0
Amount Requested *	11950000
Total Proposal Cost *	324000000

GEOGRAPHIC INFORMATION

Latitude *	**DD (+/-):**	39	**MM:**	3	**SS:**	13
Longitude *	**DD (+/-):**	121	**MM:**	0	**SS:**	50
Longitude/Latitude Clarification			**Location**	On the Bear River between Rollins Reservoir and Lake Combie (west of Colfax)		
County*	Nevada					
Ground Water Basin						
Hydrologic Region	Sacramento River					
Watershed	77 5516 Bear River					

LEGISLATIVE INFORMATION

Assembly District*	1st Assembly District
Senate District*	1st Senate District
US Congressional District*	District 1 (CA)

Project Information

PROJECT NAME: CENTENNIAL WATER SUPPLY PROJECT

CENTENNIAL WATER SUPPLY PROJECT

Implementing Organization	Nevada Irrigation District
Secondary Implementing Organization	
Proposed Start Date	1/1/0001
Proposed End Date	1/1/0001
Scope Of Work	

Project Description	
Project Objective	

PROJECT BENEFITS INFORMATION

No records found.

BUDGET

Other Contribution	0
Local Contribution	0
Federal Contribution	0
Inkind Contribution	0
Amount Requested*	0
Total Project Cost*	0

GEOGRAPHIC INFORMATION

Latitude *	**DD (+/-):**	39	**MM:**	3	**SS:**	13
Longitude*	**DD (+/-):**	121	**MM:**	0	**SS:**	50
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Watershed	77 5516 Bear River					

LEGISLATIVE INFORMATION

Assembly District*	1st Assembly District
Senate District*	1st Senate District
US Congressional District*	District 1 (CA)

Section : ELIGIBILITY AND GENERAL PROJECT INFORMATION

ELIGIBILITY AND GENERAL PROJECT INFORMATION TAB

Q.1 Applicant Type:

Specify which of the following describes the applicant:

Public agency

Q.2 Project Type:

Please identify the appropriate project type for the application:

Local Surface Storage

Q.3 Public Benefits:

Please identify the public benefit categories for which Program funding is requested:

a) ☑ Ecosystem Improvements (must be included)
b) ☐ Water Quality Improvements
c) ☐ Flood Control Benefit
d) ☐ Emergency Response
e) ☑ Recreational Purposes

Q.4:

Explain why the proposed project does not adversely affect any river afforded protection pursuant to the California or Federal Wild and Scenic Rivers Act. See section 6003(a)(1)(I) of the regulations.

The proposed project is located on the Bear River. The location of the project on the Bear River and downstream are not designated as a river afforded protection pursuant to the California or Federal Wild and Scenic Rivers Act. The proposed project also does not adversely affect any other river that is afforded protection pursuant to the California or Federal Wild and Scenic Rivers Act.

Q.5:

Is the applicant an agricultural or urban water supplier as defined in section 6001 of the Program regulations? If not, enter "Not Applicable"; if so, has the applicant submitted complete Agricultural or Urban Water Management Plans to DWR? Have those plans been verified as complete by DWR? If not, explain how the applicant is working towards compliance with the requirements of Water Code section 10608.56. See section 6003(a)(1)(J) of the regulations.

Nevada Irrigation District is an agricultural and urban water supplier. The 2012 Agricultural Water Management Plan has been verified as complete by DWR. The 2015 Urban Water Management Plan has been submitted to DWR in 2016 and is under review by Department of Water Resources.

Q.6:

Does the proposed project affect groundwater basins, as defined by Water Code section 10722 *et seq*.? If not, enter "Not Applicable"; if so, identify the affected groundwater basins and describe how the project would be integrated with future GSP(s). Explain how the project would reduce, eliminate, or have an effect on undesirable results (as defined in regulations section 6001(a)(85)) within the affected groundwater basin(s). Describe how the applicant would work with GSA(s) or adjudicated participants of the basin. See regulations section 6003(a)(1)(K).

Not Applicable

A.1 Executive Summary:

Attach the executive summary (max 20 pages). See regulation section 6003(a)(1)(A).

Last Uploaded Attachments: A.1 WSIP_NID_Executive Summary.pdf

A.2 Resolution:

Attach the Resolution, as required by regulations section 6003(a)(1)(C). See Program website for an example resolution.

Last Uploaded Attachments: Resolution_2017-24.pdf

A.3 Project Description:

Project Description. Attach a description of the project that meets the requirements of section 3.3 of the TR. If a full project description is included in another attachment, identify the attachment name and beginning page number in this attachment.

Last Uploaded Attachments: A.3 Project Description.pdf

A.4 Project Description Support:

Attach maps, schematics and engineering design drawings that support the project description, if not already available in other attached documents. See section 6003(a)(1)(B) of the regulations.

Last Uploaded Attachments: Figuers 1 to 11.pdf

A.5 Attestation:

Attach a statement, under penalty of perjury pursuant to the laws of the State of California, attesting that the information provided in the full application is true and correct to the best of the applicant's knowledge. Scanned uploaded documents containing a scanned signature are sufficient. See section 6003(a)(1)(Y) of the regulations.

Last Uploaded Attachments: A.5 Attestation.PDF

A.6 Other Application Information:

OPTIONAL: Attach any other information that would support the application which does not fit easily in another category: for example, other studies or an index of the submitted application documents.

Section : PHYSICAL PUBLIC BENEFITS

PHYSICAL PUBLIC BENEFITS

A.1 Ecosystem Benefits:

Attach completed Ecosystem Priorities worksheets. Be sure to include the general information worksheet as well as worksheets for each priority being claimed for which funds are being requested. Identify at least one Program ecosystem priority for any ecosystem public benefit quantified. See section 6003(a)(1)(Q) of the regulations.

Last Uploaded Attachments: Ecosystem Priorities Application Worksheet-General Information.pdf,Ecosystem Priorities Application Worksheet-Priority 4.pdf,Ecosystem Priorities Application Worksheet-Priority 14.pdf,Ecosystem Priorities Application Worksheet-Priority 15.pdf,Ecosystem Priorities Application Worksheet-Priority 16.pdf

A.2 Ecosystem Benefits:

Attach supporting documentation requested in Ecosystem Priorities worksheets such as maps or other information not already provided elsewhere in the application.

Last Uploaded Attachments: Figure 1. RiverMiles for WQ - Priority Form 4.pdf,Figure 1. Ecological Benefits Locations - Priority Form 14.pdf,Table 1. Centennial Plant List 2017 Priority Form 15.pdf,Figure 2a. Cent_VegCover_BRA_11x17_NORTH(DRAFT04) Priority Form 15.pdf,Figure 2b. Cent_VegCover_BRA_11x17_SOUTH(DRAFT04) Priority Form 15.pdf

A.1 Water Quality Benefits:

Attach completed Water Quality Priorities table(s). If the project is claiming water quality benefits that meet the water quality priorities, be sure to include the general application questions table as well as tables for each priority being claimed for which funds are being requested. Identify at least one Program water quality priority for any water quality public benefit quantified See section 6003(a)(1)(Q) of the regulations.

A.2 Water Quality Benefits:

Attach supporting documentation requested in Water Quality Priorities tables such as maps or other information not already provided elsewhere in the application.

Q.1 Flood Control Benefits: If the proposed project is not claiming flood control benefits, leave the following questions blank.

If applicable, how will the project provide flood control benefits? If some project operations will be for flood control purposes, explain. Are the flood control benefits realized locally and/or throughout the larger flood control system? (TR section 4.9.2.1) Describe any negative impacts of providing the flood control benefit. (TR section 4.9.2.4)

Q.2 Flood Control Benefits: If the proposed project is not claiming flood control benefits, leave the following questions blank.

What methods were used to calculate flood damage reduction? Identify which of the following methods was used to quantify physical flood control benefits:

1. Modeling provided with feasibility study
2. New modeling using historical flood events or historical hydrology
3. New modeling using the climate change hydrology data set provided

If 1 or 2 is used, explain how benefits might be different under the provided future climate and sea levels projections. Provide justification for any methods not identified in section 5.4.3 of the TR. See also regulations section 6004(a)(1)(F).

A.1 Flood Control Benefits: If the proposed project is not claiming flood control benefits, leave the following questions blank.

Attach any relevant flood damage reduction supporting documentation, such as hydraulic and hydrologic modeling studies, and property flood damage analysis (TR section 4.9.4). If information to support this question is located in another attachment, provide the location.

Q.1 Emergency Response Benefits: If the proposed project is not claiming emergency response benefits, leave the following questions blank.

If applicable, how will the project be operated to provide emergency response benefits? Identify the types of emergency benefits the proposed project could provide. (TR section 4.11.1). If additional information to support this question is located in another attachment, provide the location.

A.1 Emergency Response Benefits: If the proposed project is not claiming emergency response benefits, leave the following questions blank.

Attach a description of the amount or share of stored water to be provided for the emergency benefits and define the conditions under which water would be made available. Describe how the applicant can commit to the conditions under which the emergency benefits would be made available. (TR section 4.11.2)

Q.1 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

If applicable, how will the project be operated to provide recreation benefits? If additional information to support this question is located in another attachment, provide the location.

See Attachment A.1 Recreation Benefits

Q.2 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

By providing new recreation benefits, does the proposed project negatively affect any existing recreation activities either at the proposed project site, at another facility, or nearby recreation area? (TR section 4.10.1.1)

See Attachment A.1 Recreation Benefits

Q.3 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

Describe the proposed recreation physical benefits including the size of the facility, recreation activities allowed, recreation facilities associated with these activities, and their capacities and seasonal closures and conditions in which facilities are not usable or activities cannot occur. Any supporting analysis should be attached in A.1 below. (TR section 4.10.1.2)

See Attachment A.1 Recreation Benefits

A.1 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

Attach recreation visitation estimates including documentation of estimation methodology.

Last Uploaded Attachments: A.1 Recreation Benefits.pdf

A.2 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

Attach or provide links to any relevant recreation studies associated with the proposed project.

Section : FEASIBILITY & IMPLEMENTATION RISK

FEASIBILITY & IMPLEMENTATION RISK

A.1 Feasibility Documentation:

Attach feasibility studies or documentation that demonstrates the proposed project's technical, environmental, economic, and financial feasibility as described in TR section 3.5. See also regulations section 6003(a)(1)(O).

Last Uploaded Attachments: A1_FeasibilityDocumentation.pdf

A.2 Permit List:

Provide a listing and status of all local, state, and federal permits, certifications, and other approval necessary for the construction and operation of the project. See section 6003(a)(1)(W) of the regulations.

Last Uploaded Attachments: A.2 Permit List.pdf

A.3 Schedule:

Attach an estimated schedule for the proposed project until the first year of operation. If the schedule is included in another attachment, identify the location. See section 6003(a)(1)(G) of the regulations.

Last Uploaded Attachments: A.3 Schedule.pdf

A.4 Environmental Document:

Attach the most recent publicly available environmental document for the proposed project. If the document is available on a website, provide a link to the document(s). See section 6003(a)(1)(S) of the regulations.

Last Uploaded Attachments: A.4 Environmental Document.pdf

A.5 Impacts and Consultation:

Summarize the project's impacts on environmental or cultural resources and how the project will mitigate or minimize impacts to those resources, or identify where in the CEQA document this information can be found. If any environmental or cultural impacts will not be fully mitigated, explain. See regulations section 6003(a)(1)(T).

If applicable, identify whether Tribal consultation has been initiated for the project. If it has, provide supporting documentation, or identify the location in the CEQA document. If consultation has not been initiated, state whether consultation is expected and when consultation is expected to be initiated. See regulations section 6003(a)(1)(U).

Last Uploaded Attachments: A.5 Impacts and Consultation.pdf,Letter_UAIC_2015_11_23.pdf,NID Centennial Reservoir letter - 120915.pdf,2015_12_15 Initiation of Consultation for Centennial.pdf

Section : BENEFIT CALCULATION, MONETIZATION, and RESILIENCY

BENEFIT CALCULATION, MONETIZATION, and RESILIENCY

Q.1:

Did the applicant use the model products and assumptions described in section 6004(a)(1) of the regulations? See regulations section 6003(a)(1)(CC). If no, provide a description of the models and assumptions used to determine the without-project future conditions for years 2030 and 2070.

The applicant did not use the CalSim-II models, but did use the VIC model results. Alternatively, the applicant used an existing publicly available HEC-ResSim model, developed during the joint Federal Energy Regulatory Commission (FERC) relicensings of Nevada Irrigation District's (NID) Yuba-Bear Hydroelectric Project (FERC Project No. 2266) and of Pacific Gas and Electric's (PG&E) Drum-Spaulding Hydroelectric Project (FERC Project No. 2310). Combined, the hydroelectric projects consist of 42 reservoirs, 16 powerhouses and roughly 275 MW of generation capacity on the Middle Yuba, South Yuba, North Fork of the North Fork American and Bear rivers. This model simulates water years 1976-2008, based on available historical hydrology. This hydrologic period includes a range of conditions, including dry years, wet years, and extended droughts. The model has been modified since it was last used in the FERC relicensing process by extending the model to simulate additional reaches of the Bear River from the Bear River Canal Diversion Dam to the inflow to South Sutter Water District's Camp Far West Reservoir, including NID's Lake Combie and the proposed Centennial Reservoir. Operation of the proposed Centennial Reservoir is turned off for the Without-project scenario. For the 2030 and 2070 conditions model runs, historical unimpaired hydrology input data were modified using the VIC model results. Monthly ratios were produced for each unimpaired hydrology sub-basin relating 2030 VIC model results to 1995 VIC model results, and 2070 VIC model results to 1995 condition VIC model results. Ratios were applied as multipliers to the historical daily unimpaired inflow hydrology on a monthly basis for water years 1976 to 2008. These modified inflow time series were used simulated the Without-project scenarios for 2030 and 2070. To adapt the model for climate change, guide

curves for upper elevation storage reservoirs were modified to allow reservoirs to fill approximately one month sooner to capture the earlier runoff. All existing Division of Safety of Dams requirements for flashboards and gate closures were preserved. Projected 2030 NID water-customer demands are based on NID's Raw Water Master Plan (NID, 2011). PG&E provides water to Placer County Water Agency (PCWA). PCWA's 2030 water-customer demands are based on PCWA's Urban Water Management Plan (PCWA, 2010). Projected 2070 NID and PCWA water-customer demands were developed during FERC relicensings representing 2062 conditions. These estimates are sufficient to characterize 2070 conditions considering the level of uncertainty associated with land use and customer demand growth projections used to make these projections. NID's existing, 2030, and 2070 modeled demands are 139,475 ac-ft, 171,345 ac-ft, and 200,406 ac-ft, respectively. PG&E's existing, 2030, and 2070 modeled demands to PCWA are 104,640 ac-ft, 114,400 ac-ft, and 118,373 ac-ft, respectively. NID and PG&E hydroelectric project operations for 2030 and 2070 are based on proposed FERC license operating requirements, including water year type determination and minimum instream flow requirements. Proposed water year types are based on California DWR Bulletin 120 estimates of watershed runoff for the Yuba River at Smartsville. Water year types in 2030 and 2070 were modified using the VIC model results. Annual water year ratios were produced for the Yuba River at Smartsville (plus Deer Creek) sub-basin relating 2030 VIC model results to 1995 VIC model results, and 2070 VIC model results to 1995 condition VIC model results. Ratios were applied as multipliers to the historical Bulletin 120 runoff forecasts. Revised runoff forecasts were used to determine the water year types for Water Years 1976 to 2008.

A.1 Project Conditions:

Attach description and assumptions of with-project conditions for years 2030 and 2070, as defined in section 6004(a)(2) of the regulations, as well as a description of the with- and without-project current conditions. See also regulations section 6003(a)(1)(BB).

Last Uploaded Attachments: A.1 Project Conditions.pdf

A.2 Preliminary Operations Plan:

Attach the preliminary operations plan for the proposed project. See regulations section 6003(a)(1)(H) for details. If the preliminary operations plan is located in another attachment, identify the attachment and provide the location.

Last Uploaded Attachments: A.2 Project Operations Plan.pdf

A.3 Monetized Benefits Analysis:

Attach the analysis of all public and non-public monetized benefits. Identify at least one Program ecosystem or water quality priority for any ecosystem or water quality public benefit quantified. For each public and non-public benefit, describe the methods used to derive the physical and economic benefits and impacts at a level of detail that allows reviewers to verify your analysis.

Description must include:

- The physical changes that are being monetized, consistent with information requested in the Physical Public Benefits Tab, and describing linkages between physical benefits and monetized benefits. See regulations sections 6004(a)(3) and 6004(a)(4); and
- The monetization method and sources for data used. See regulations section 6004(a)(4).

Last Uploaded Attachments: A.3 Monetized Benefits Analysis.pdf,Economic Analysis for the Water Storage and Investment Program - Unit Values Estimation.pdf

A.4 Mitigation and Compliance Obligation:

For each net public benefit claimed, where applicable, identify any existing environmental mitigation or compliance obligations that are accounted for in each net public benefit as of the date of the CalSim-II model product in section 6004 (a)(1).

- Applicants that use the CalSim-II and DSM2 models to analyze their projects can indicate “within models” for any existing environmental mitigation and compliance obligations contained in those models.
- If applicable to their claimed net public benefit such projects shall also list and account for the non-flow related mitigation and compliance obligations of the State Water Project and Central Valley Project.

Last Uploaded Attachments: A.4 Mitigation and Compliance Obligation.pdf

A.5 Quantification Support:

Provide additional information that supports the physical and monetary quantification of the public and non-public benefits and impacts of the project as required by subsection 6004(a)(4) of the regulations. This includes data, assumptions, analytical methods and modeling results, calculations and relevant sources of information. For reference documents or studies relied upon, applicants may provide links to an existing website in lieu of attaching those documents to the application.

Last Uploaded Attachments: A.5 Benefit Quantification Support.pdf

A.6 Monetization Table:

Attach a table displaying each future economic benefit in 2015 dollars for each year of the planning horizon as required by section 6004(a)(4)(A) of the regulations.

Last Uploaded Attachments: A.6 Monetization Table.pdf,NID_Centennial_Rec Use & Revenue Estimates_Rev 5_2017-0801.xlsx,MFWetland1.xls,CWC_Cost_Benefit_Analysis_NID.xlsx

A.7 Non-Monetized Benefits:

If applicable, provide a summary of public benefits that cannot be monetized. Provide the following information for each non-monetized benefit.

- Justification why benefit cannot be monetized,
- Qualitative description of importance of benefit (who is affected, how and how often),
- Evidence to show how the physical change is beneficial and important to Californians.

Last Uploaded Attachments: A.7 Non-Monetized Benefits.pdf

A.8 Total Project Cost Estimate:

Attach an estimate of the total project costs that includes construction cost, interest during construction, land acquisition, monitoring, environmental mitigation or compliance obligations, operations and maintenance, repair, and replacement costs during the planning horizon using methods described in TR section 6. If the project costs are located in another attachment, identify the location.

The project cost estimates must be reviewed, approved and signed by an engineer licensed by the California Board for Professional Engineers, Land Surveyors, and Geologists.

Last Uploaded Attachments: A.8 Cost Cover Sheet.pdf,Cost summary_NID.xlsx

A.9 Benefit and Cost Analysis:

Attach the benefit and cost analysis for the proposed project. If the analysis is located in another document, identify the location. See regulations section 6004(a)(6).

Last Uploaded Attachments: A.9 Benefit Cost Analysis.pdf

A.10 Cost Allocation:

Provide a proposed allocation of total project costs to all project beneficiaries, including the Program, and an explanation of how the allocation was calculated, consistent with TR section 8 and section 6004(a)(7) of the regulations. If this information is included in another attachment, identify the location.

Last Uploaded Attachments: A.10 Cost Allocation.pdf

A.11 Physical and Economic Summary Table:

Attach the Physical and Economic Benefits Summary tables. These tables can be downloaded from the Commission website and uploaded with the application. See regulations section 6003(a)(1)(N).

Last Uploaded Attachments: A.11 Physical and Economic Benefits Summary Tables.pdf

A.12 Uncertainty Analysis:

Attach the uncertainty analysis. See regulations section 6004(a)(8).

Last Uploaded Attachments: A.12 Uncertainty Analysis.pdf

Section : PROGRAM REQUIREMENTS

PROGRAM REQUIREMENTS

Q.1:

Describe how the project improves the operation of the state water system. See regulations section 6003(a)(1)(M).

The proposed project is a local surface water storage project and does not improve the operation of the state water system.

Q.2:

Describe how the project provides a net improvement in ecosystem and water quality conditions required by Water Code section 79750.

The project provides a net improvement in ecosystem and water quality conditions as described in the Ecosystem Priority Worksheets. The improvements include temperature benefits, creation of wetlands, management of non-native species, and enhancement of habitat for native species.

Q.3:

If applicable, summarize how the applicant is coordinating with the owners and operators of water system facilities not owned or operated by the applicant or project partners that may be affected by the project. See regulations section 6003 (a)(1)(P).

NID is coordinating with the owners and operators of the facilities upstream and downstream of the proposed project.

Q.4:

Describe how the project advances the long-term objectives of restoring the ecological health and improving water management for beneficial uses of the Delta. See regulations section 6003(a)(1)(R).

The proposed project is a local surface water storage project on the Bear River, which is a tributary to the Delta. However, the project because the project is upstream of the Delta, it does not advance the long-term objectives of restoring the ecological health or improve the water management for beneficial uses of the Delta.

Q.5:

Describe how the applicant will ensure that the proposed project will comply with and be consistent with all applicable local, state, and federal laws and regulations, including existing environmental mitigation or compliance obligation requirements. See regulations section 6003(a)(1)(V).

Prior to implementation of the Proposed Project, NID would ensure that the following actions are completed to the satisfaction of the applicable agency/agencies with jurisdiction over the affected area or resource. The following are not listed in the anticipated order of approval: Acquire land for

temporary and permanent construction easements; Obtain authorization to realign Dog Bar Road and bridge from Nevada County and Placer County; Coordinate land use approval and park closure from Placer County Parks and Recreation; Comply with Section 404 of the federal CWA, through permit application to the USACE; Complete Section 7 Consultation for compliance with the Federal ESA; Complete consultation for compliance with the State ESA, and obtain a Section 1602 permit from the CDFW; Comply with Section 106 of the NHPA; Complete consultation with the California NAHC; Comply with Section 401 of the federal CWA, through permit application to the RWQCB; Obtain approval from DWR DSOD for the new dam. Until the necessary approvals and/or permits are received, NID would continue to work with stakeholders of affected properties to refine proposed mitigation measures or to develop suitable alternative measures to address potentially significant impacts identified for the Proposed Project. Additionally, a mitigation monitoring plan would be developed for the Proposed Project to track the progress of, and to ensure the completion of mitigation or other compliance measures outlined in the EIR to be prepared for the Proposed Project. Please refer to the Feasibility & Implementation Risk tab, Permits list for further information regarding anticipated permits and approvals.

A.1 Delta or Tributary Measurable Improvement:

What measurable improvements to the Delta ecosystem or tributary to the Delta does the project provide? Where is the location of the improvement? If the project is not within the watershed of the Delta, what specific water rights or water contracts would be created or amended to ensure public benefits to the Delta ecosystem? Provide supporting documentation of the willingness of these water right or water contract holders to enter into such contracts or amendments. Explain how these changes would assure measurable improvements to the Delta ecosystem. See regulations section 6003(a)(1)(L).

Last Uploaded Attachments: A.1 Delta or Tributary Measurable Improvement.pdf

A.2 Cost Effectiveness:

Provide documentation indicating the proposed project is cost-effective. If there is at least one feasible alternative means of providing the same amount or more of the total public and non-public physical benefits as provided by the proposed project, calculate, display and document the least-cost of these alternative means and justify the proposed project by comparison.

Last Uploaded Attachments: A.2 Cost Effectiveness.pdf

Section : EARLY FUNDING REQUEST

EARLY FUNDING REQUEST

Q.1:

Is early funding for completing environmental documentation and/or permits requested? If yes, answer the following question and provide the requested information. See regulations section 6003(a)(1)(X).

N/A

Q.2:

What is the requested amount?

N/A

A.1 Early Funding Scope, Schedule, Budget:

Attach a schedule, scope of work, and budget.

- Keep in mind that the applicant must provide a 50 percent cost share and reimbursable costs can only go back to November 4, 2014.
- Scope of work must include an explanation of why early funding is critical to the project, the viability of the project in the absence of this funding and how the project will proceed once early funding is expended.
- The scope of work cannot include work performed prior to submittal of the application.
- The tasks in the schedule, scope of work and budget should match.

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Eligibility and General Project Information Tab

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Eligibility and General Project Information Tab

A.1: Executive Summary

A.1: Executive Summary
Nevada Irrigation District - Centennial Water Supply Project
Water Storage Investment Program

1. **Describe the project facilities and operations.**

   Nevada Irrigation District's (NID) water supply system is a "store and release" system, in that reservoirs store snow melt and seasonal rains for release during the typically dry irrigation seasons. Based on the timing of seasonal events, NID's water supply management is dependent on a combination of springtime snowmelt and winter period rains to fill existing storage reservoirs. While there is some natural runoff during the summer months, much of this water is required to meet necessary environmental flows in the rivers; therefore, the irrigation season demand is met primarily with withdrawals from storage reservoirs. Careful management and operation of storage reservoirs is essential to capture the maximum amount of runoff, minimize spillage from reservoirs, and ensure there is sufficient area available in reservoirs to accommodate runoff during the spring snow melt and storm events.

   NID's water supply comes from four main sources: natural runoff (including snowmelt) from the contributing watershed area, carryover storage, contract water purchases, and recycled water. NID's existing system capability is able to meet customer demands based on available water from these four sources.

   As water demand within NID's service area increases, events such as drought and climate change create challenges for NID in maintaining a sustainable water system. According to NID's Raw Water Master Plan (2011), studies indicate that the margin between average watershed runoff volume and demand is diminishing. Increased future demands in the service area will result in increased demand on water storage and greater drawdown of NID's reservoirs, especially during summer months when there is little natural runoff.

   Currently, NID's water system relies too heavily on the water bank provided by the annual mountain snowpack. With warmer temperatures likely, NID needs mid-elevation storage that can capture runoff from rainstorms and snowstorms from both the mountain division and the lower division watersheds. Without this capability, NID will be unable to sufficiently collect and conserve water and prepare the region to weather extended droughts. NID's goal is to continue to provide a dependable, sustainable, high-quality water supply to its customers. NID needs this Proposed Project to offset anticipated system deficiencies, taking into

consideration increasing customer demands and the likelihood of regularly occurring multi-year droughts due to seasonal hydrologic variability exacerbated by climate change.

NID is proposing to construct the Centennial Reservoir (Proposed Project) to provide drought and climate change relief and improve water supply reliability for NID's customers. The Proposed Project involves the construction of a new dam that would form a 110,000 acre-foot reservoir on the Bear River between the existing Rollins Reservoir and Combie Reservoir. The Proposed Project would extend upriver from just above the existing Lake Combie for slightly over six miles to a point west of the Town of Colfax, approximately two miles downstream of the existing Rollins Dam. Low impact public recreational opportunities are anticipated to be included with the Proposed Project. A new raw water conveyance pipeline to serve NID customers adjacent to the proposed reservoir on the Nevada County side, as well as a Bear River bridge crossing to replace the existing bridge crossing are also included as part of the Proposed Project.

Additional detail about the project and its operations are found in the Eligibility Tab, A.3 Project Description and the Benefit Calculation, Monetization, and Resiliency Tab, A.2 Project Operations.

2. **Describe how the project is integrated into one or more state water systems, including use of new water sources such as recycled water or storm water capture. The summary must include information such as the project's inclusion in an integrated regional water management plan, other integrated planning documents, or interactions with existing projects and operations that support the description of integration.**

   NID's current service area covers 287,000 acres in Nevada and Placer counties providing water supply for irrigation, municipal, domestic and industrial purposes. NID also has storage reservoirs and distribution facilities in Sierra and Yuba counties.

   NID currently has water supply networks and storage facilities located in four major watersheds: 1) the Middle Yuba River; 2) tributaries of the South Yuba River; 3) Deer Creek; and 4) the Bear River. All four of these watersheds ultimately flow into the Feather River, and are part of the Sacramento River basin, which drains into the Sacramento-San Joaquin Delta, and then into San Francisco Bay. Figure 1 illustrates the general regional location of the NID's existing water supply network and storage system.

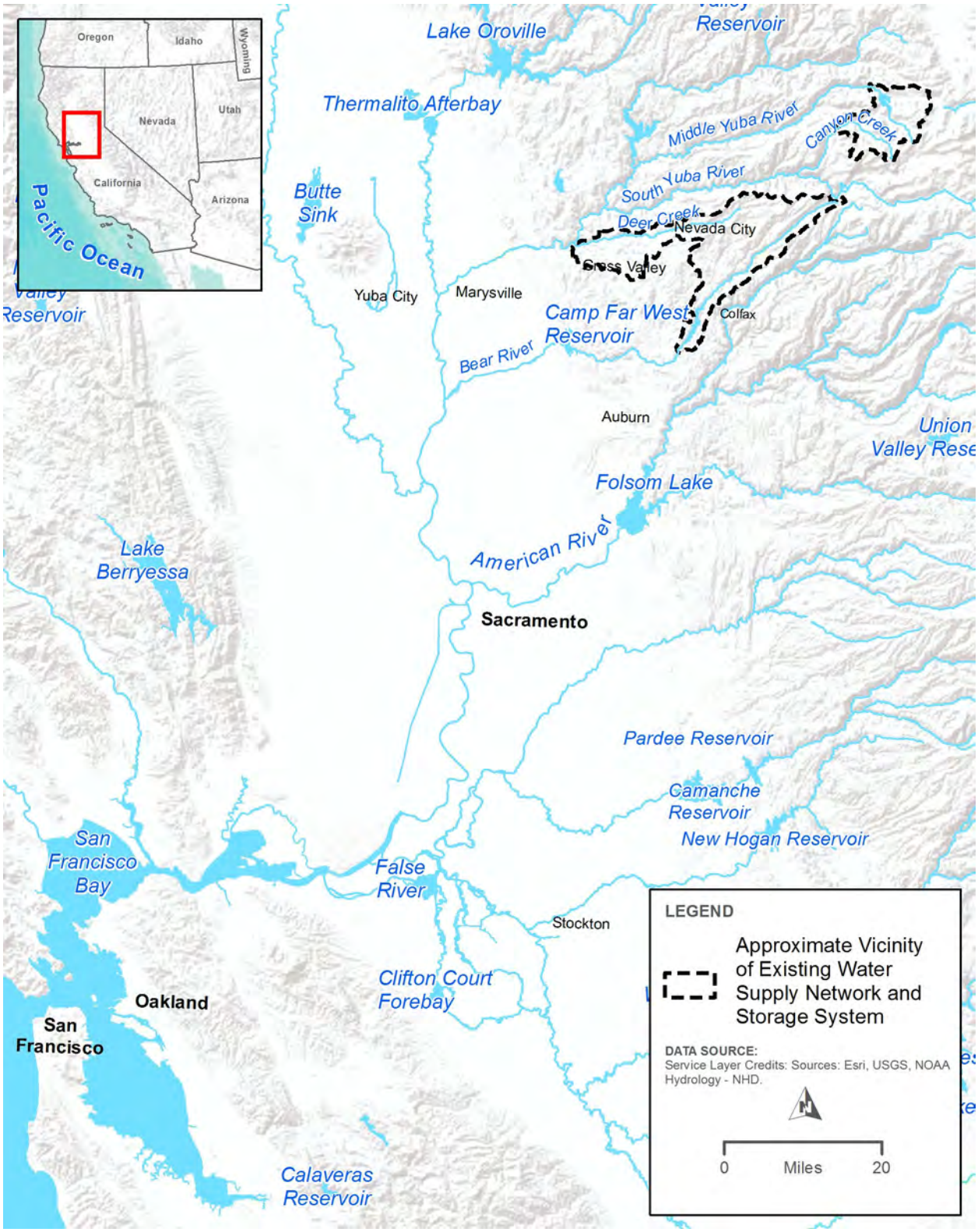


Figure 1: Regional map showing the location of NID's existing water supply network and storage system.

Facilities located in the Middle Yuba and South Yuba river watersheds belong to NID's Mountain Division. From Mountain Division reservoirs and diversions, NID water flows through the Bowman-Spaulding Canal to Pacific Gas and Electric's (PG&E's) Lake Spaulding. It is then routed down either the South Yuba Canal to the Deer Creek watershed, where water is then supplied to NID customers in Scotts Flat and the Nevada City-Grass Valley area, or down the PG&E Drum System along the Bear River where the water is used to generate power for NID and PG&E before supplying NID customers in southern Nevada County and Placer County through various diversion facilities. Collectively, these facilities make up NID's Yuba-Bear system.

NID's Yuba-Bear Hydroelectric Project is operated in conjunction with PG&E's Drum-Spaulding Project under a consolidated contract. NID and PG&E established a Water Management Committee that meets regularly to coordinate reservoir and canal system operations. The committee operates the joint system with the following objectives and priorities:

- Operate NID's system in conjunction with PG&E's Drum-Spaulding system to maximize the use of water for power generation and consumptive use, and minimize spillage;
- Water supply needs and regulatory requirements are given the highest priority; power generation and recreation are given a lower priority.
- Operate to maximize reasonable and beneficial uses within NID's water rights.
- Fulfill all requirements of contracts/agreements (PG&E, Placer County Water Agency [PCWA], California Department of Fish and Wildlife, State Water Resources Control Board, Federal Energy Regulatory Commission [FERC], customers, special agreements, etc.).

Supporting Studies

The following previous studies by NID and others were referenced during development of project alternatives to meet future demands for water within the NID service area.

NID Raw Water Master Plan 2011

NID's Raw Water Master Plan (RWMP) from 2011 is the second update to its 1985 RWMP. The purpose of this series of reports is to: 1) verify water supply, quantify expected future demand, and evaluate the adequacy of the existing water conveyance system to accommodate current and future

demand; and 2) identify capital improvement projects required to meet future demand for water within the NID service area. The 2011 update focuses on the latter of the two.

Major Findings/Conclusions

Major findings related to the adequacy of the existing storage conveyance system in the RWMP include:

- By 2032, projected consumptive demand is expected to approach the average annual runoff volume from NID's watersheds.
- Climate change forecasts estimate that the temperature by mid-century will increase by as much as 5 degrees Celsius and will reduce NID's Mountain Division snowpack by as much as 40 percent. Precipitation will fall as rain instead of snow as the snow line moves higher in elevation. Variations between wet years and dry years will become greater, resulting in greater flood potential and longer, more intense drought periods.
- By 2032, forecasted water supply will be sufficient to address a single dry year without restrictions, but not a multi-year drought period.

The following sections summarize measures identified in the RWMP, as updated, to meet future demand for water within the NID service area.

Increase Conservation – District Facilities and Service Area

Conservation should become routine rather than the first step under a drought contingency plan. Conservation measures include improving customer delivery efficiencies and strategies, managing NID land use development and best practices in watersheds, refining of system operations.

Reduce System Losses

Overall system losses are estimated to be approximately 10 percent of customer delivery volume. While it is infeasible to phase out all open-ditch delivery systems within NID's service area, canals with the highest loss rates and maintenance issues are being prioritized for containment and/or potential improvement. Alternatives for reducing system losses for open ditches include installation of impervious lining or piping of flows.

NID has already begun to make improvements to existing ditches. Completed improvement projects include the Banner-Cascade pipeline project, the Cunningham siphon realignment project, the Drum-Spaulding Canal flume replacement project, and the Mount Vernon Road siphon

project. Current ongoing improvement projects include the Combie Phase I Canal, Bear River Siphon Replacement Project, and the Newtown Canal partial encasement project.

Increase Reservoir Storage

Increasing reservoir storage would provide drought and climate change mitigation, meet projected future water supply needs, and improve water supply reliability for NID customers. Two ways to increase reservoir storage include dredging of existing reservoirs with high rates of sediment accumulation, and by creating additional storage by raising existing dams or constructing a new dam.

2015 Capital Improvement Program for the RWMP

NID's existing water delivery system was further analyzed in the 2015 Capital Improvement Program (CIP) analysis, to determine flow requirements in individual canal segments under 2032 projected demands. Canal segments were identified for potential upgrade to provide more capacity and conveyance capability. Segments were evaluated based on: (1) facility importance; (2) capacity; (3) difficulty of construction; (4) environmental constrains; and (5) NID input. The analysis identified the number of appurtenances (e.g., spoils, checks, and gaging station) and linear objects (e.g., flumes, open channel canals, and siphons) included in each canal segment. The evaluation process was used to prioritize various capital improvement projects.

1957 DWR California Water Plan (Bulletin No. 3)

The California Water Plan is a state-wide master plan to guide and coordinate the planning and construction by all water agencies for the control, protection, conservation, and distribution of California's water resources for the benefit of all areas of the State and for all beneficial purposes. The report served to evaluate both existing supply and future demand, and identify watersheds with surplus water resources.

The California Water Plan considered the Yuba and Bear rivers as a single unit, as it described potential development within these two watersheds. The following bulleted list identifies projects for future development that are relevant to NID:

- New diversion and diversion tunnel from the North Fork Yuba River below Haypress Creek to proposed Jackson Meadows Reservoir. Water would then be diverted to Lake Spaulding (existing) and then to the Bear River.

- New diversion and diversion tunnels at Fordyce Creek, Rattlesnake Creek and the South Yuba River to an enlarged Lake Valley Reservoir. Water would be returned to the South Yuba River at Lake Spaulding (existing) through a new power drop.
- Increased diversions out of Lake Spaulding (existing) through the existing Drum and South Yuba canals.
- New Canal and power drop into proposed Rollins Reservoir, downstream of Dutch Flat Powerhouse (Chicago Park).
- New Rollins Reservoir and Powerhouse
- Increase the existing South Yuba Canal capacity
- Increase the capacity of Scotts Flat Reservoir (existing)
- Increase the capacity of Spaulding #2 and Deer Creek powerhouses (existing)

The California Water Plan identified future development possibility on the Bear River totaling 342,000 acre-feet (ac-ft), 100,000 ac-ft for the proposed Rollins Reservoir and 242,000 ac-ft for an enlarged Camp Far West Reservoir. Construction of Rollins Reservoir was completed in 1965 by NID and Camp Far West was enlarged in 1963 by South Sutter Irrigation District. Current gross storage in this reach (Rollins Reservoir, Lake Combie, and Camp Far West Reservoir) is approximately 176,000 ac-ft. The remaining balance, 166,000 ac-ft, indicates additional development capacity within the watershed.

1926 NID Reconnaissance Project on Bear River

NID's initial development plan of the Bear River (as of May 1924) included a diversion dam on the Bear River below Greenhorn River (Rollins), a dam on South Wolf Creek, and a diversion canal between the two. It was noted that this plan was flawed because of the prohibitive cost to construct the South Wolf Creek Reservoir. The purpose of the 1926 Bear River reconnaissance project was to consider alternative dam sites to replace the proposed South Wolf Creek Reservoir.

Four potential dam sites were investigated: 1) Rollins, 2) Combie Crossing, 3) Dog Bar, and 4) Parker. The following conclusions were made based on the reconnaissance project:

- The Rollins Dam site is not favorable because of the relatively steeper channel gradient than the other sites, and it would quickly fill with mining debris.

- The Combie dam site is adequate, but the stream bed is at an elevation of 1,500 ft, which is less than the optimal 1,700 ft elevation required to serve Penn Valley.
- The Dog Bar Dam site is adequate, but is wider than the dam site at Parker, making it a more expensive option than Parker. Also, Dog Bar reservoir storage relative to the dam height would be less than for Parker reservoir storage.
- The Parker Dam site is the best and most economical reservoir site for storage of water on the Bear River.

Based on its findings that the Parker Dam site was the best location for a new dam on the Bear River, the reconnaissance project included results of a topographical survey of the potential inundation area and a cost estimate for a rock fill dam of various heights ranging from 130 ft to 330 ft. A diversion tunnel was proposed from Parker Reservoir to serve Penn Valley. This tunnel is no longer a proposed feature of the project. The Parker Dam site is generally consistent with the present day proposed Centennial Dam site.

2015 Urban Water Management Plan

Urban Water Management Plans (UWMP) are prepared by California's urban water suppliers to support their long-term resource planning, and ensure adequate water supplies are available to meet existing and future water demands.

Every urban water supplier that either provides over 3,000 ac-ft of water annually or serves more than 3,000 customers is required to assess the reliability of its water sources over a 20-year planning horizon and prepare an UWMP every five years.

NID's UWMP includes a description of the water supply sources, magnitudes of historical and projected water use, and a comparison of water supply water demands during normal, single-dry, and multiple-dry years. Also described is NID's water conservation program and drought contingency Plan.

UWMPs are to be adopted and submitted every five years to the California Department of Water Resources (DWR). Therefore, the 2015 UWMP builds upon, updates, and reports on data since the 2010 UWMP.

2012 Agricultural Water Management Plan

The Agricultural Water Management Plan (AWMP) was prepared by NID in accordance with California Water Code Section 10820 (a), which requires all agricultural water suppliers that provide water to 10,000 or

more irrigated acres to prepare a plan every five years. According to the California Department of Water Resources, the AWMP Act states that agricultural water suppliers should make every effort to assure the appropriate level of reliability in its water service to sufficiently meet the needs of its customers during normal, dry, and multiple dry years. The AWMP includes descriptions of the service area, water supplies, water balance, climate change and efficient water management practices, including the Drought Contingency Plan.

Drought Contingency Plan

NID adopted an updated Drought Contingency Plan in November 2015 to address limited water supplies due to either drought conditions or distribution infrastructure failures. The primary objective of this Plan is to identify water demand reduction goals and to recommend demand management measures. The Drought Contingency Plan is a supplement to NID's UWMP and AWMP. The plan involves the calculation of projected supply shortages at the end of the runoff season (typically late spring) and the implementation of a demand reduction goal, if applicable.

3. **Describe how the project increases the flexibility of the water system(s) it is integrated with, including references to analyses, data, documents, or studies included in other parts of the application that support the added flexibility.**

The proposed Centennial Reservoir would operate as a "fill-and-spill" project, with a prioritization of maximizing reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID's existing reservoir network to provide water to customers in NID's lower Bear River watershed service area. Centennial Reservoir would be managed in coordination with NID's Rollins Reservoir upstream, as well as Lake Combie downstream, with diversions made to PG&E's Bear River Canal and NID's Combie Phase I Canal (see Figure 2). Centennial Reservoir will be used in conjunction with NID's existing Rollins Reservoir to expand the total storage capability in the Bear River watershed, allowing NID to capture additional natural runoff in the Bear River watershed.

Under without-project conditions, releases from Rollins Reservoir are made to meet NID and PG&E's Bear River Canal Diversion Dam diversion demands, and releases to the Bear River below the Bear River Canal Diversion Dam located immediately below Rollins Reservoir. Releases to the Bear River are typically the maximum of 1) NID's diversion demand in the Combie Phase I Canal at Lake Combie, or 2) the FERC license

minimum instream flow requirement. In most months the Combie Phase I Canal demand exceeds the minimum instream flow requirement.

Under With-project conditions, releases to the Bear River below the Bear River Canal Diversion will meet the minimum instream flow only, assuming Centennial Reservoir storage will be used to augment minimum flow releases from Rollins Reservoir to meet the full Combie Phase I Canal demand. This modification to Rollins Reservoir operations allows Rollins to reserve more water in carryover storage to offset drought impacts to NID and PG&E deliveries sourced by water from the Bear River Canal.

Additional detail on with and with-project conditions are found in the Benefit Calculation, Monetization, and Resiliency Tab, A.1 Project Conditions.

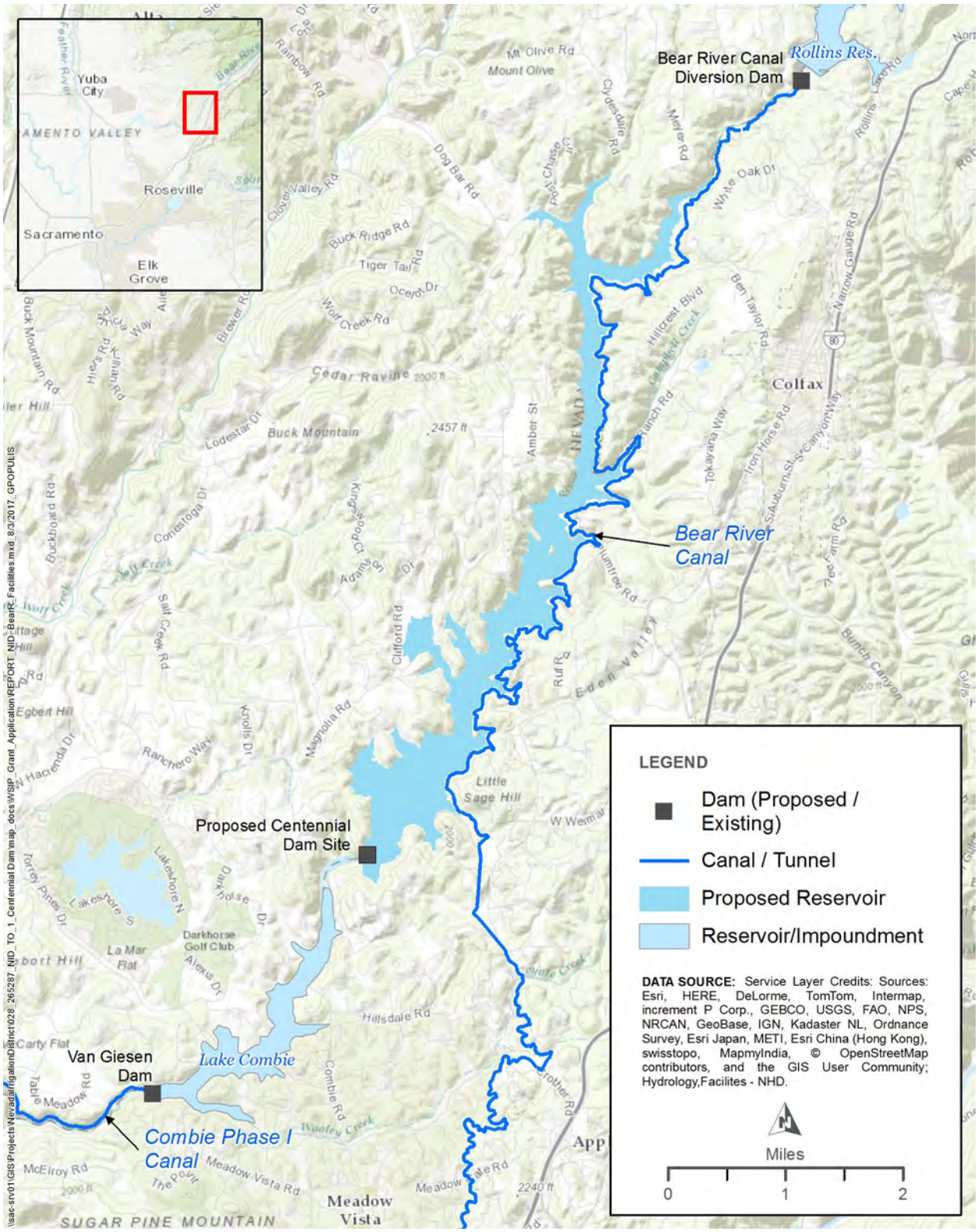


Figure 2: Bear River facilities map.

4. **Describe how the added quantity of water in the water system due to the project, or other metric, is important to increasing water system reliance and achieving public benefits.**

   Future increases in water demand within NID's service area coupled with anticipated events, such as drought and climate change, create challenges for NID in maintaining a sustainable water system. In order for NID to continue to provide a dependable and quality water supply, additional water storage is needed to enhance NID's water supply management capabilities. The proposed project is primarily a water supply project intended to supplement NID's available water supply in dry years and in multi-year droughts. Under coordinated operations with Centennial Reservoir, Rollins Reservoir storage remains higher, particularly in drier years, contributing to increased carryover storage and deficit reductions in both the Bear River Canal and Combie Phase I Canal deliveries, as compared to Without-project conditions.

   In addition to non-public water supply benefits, the project also provides ecosystem (Physical Public Benefits Tab, A.1 Ecosystem Priorities Worksheets) and recreation public benefit (Physical Public Benefits Tab, A.2 Recreation Studies). Rollins Reservoir recreation benefits are enhanced when reservoir water levels are higher during the May through September period when recreation demand is highest. Centennial Reservoir is able to maintain recreation and in-reservoir ecosystem benefits in all but the driest of years under 2030 and 2070 conditions.

5. **Describe the project's ability to contribute to sustainable groundwater management.**

   On May 10, 2017, NID's Board of Directors adopted a resolution establishing NID's membership in the West Placer Groundwater Sustainability Agency, the Groundwater Sustainability Agency responsible for implementing the California Sustainable Groundwater Management Act of 2014 (SGMA) in a portion of the North American Sub-Basin located in western Placer County. The District is contributing technical expertise and funding towards basin management activities. The District does not utilize groundwater as an existing or planned source of water due to limited groundwater availability within NID's service area (per California Department of Water Resources, Bulletin 118). The Proposed Project is not expected to directly contribute to sustainable groundwater management, but may provide the opportunity for regional conjunctive use.

6. Describe the project's ability to expand beyond its current capacity including any planned phases of expansion and explain the current status of any expansion described.

The dam height at Centennial is limited by topographical constraints between the Bear River and Wolf Creek watersheds, therefore the size of the reservoir cannot be any larger. If expansion were needed, NID would consider other measures as part of a water supply program.

7. Describe the physical and economic magnitude of public and non-public benefits.

The benefits of the proposed project include non-public benefits of water supply and public benefits of ecosystem habitat and recreation visitation days. The physical and economic magnitude of these benefits are summarized in Table 1 and presented in detail in the Benefits Monetization Tab.

Table 1. Physical and Economic Benefits

Benefit Type	Physical Benefit – 2030 conditions with climate change	Physical Benefit – 2070 conditions with climate change	Economic Benefit over the planning horizon (2015 Dollars)
Non-public Benefit – Water Supply	3.8 TAF	11.2 TAF	$221 million
Public Benefit – Ecosystem Habitat	201 acres of net wetlands created	201 acres of net wetlands created	$5 million
Public Benefit – Recreation	277,683 visitor days per year	277,683 visitor days per year	$45 million

8. Describe other relevant information the applicant deems necessary to inform the Commission.

The proposed project is still in the development stages. The construction of the proposed project will lead to several public benefits, including some that, at this time have not yet been fully evaluated and therefore, cannot yet be monetized. However, an environmental document and feasibility study are still under development. These studies would involve more field surveys and numerical modeling to fully quantify these benefits, but it is anticipated that all of the benefits once quantified, if possible, would justify the costs of the project.

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Eligibility and General Project Information Tab

A.2: Resolution

RESOLUTION No. 2017-24

OF THE BOARD OF DIRECTORS OF THE NEVADA IRRIGATION DISTRICT

2017 WATER STORAGE INVESTMENT PROGRAM

WHEREAS, the Board of Directors of the Nevada Irrigation District, approve that an application be made to the California Water Commission to obtain 2017 Water Storage Investment Program funding pursuant to Title 23, Division 7, Chapter 1 of the California Code of Regulations, and to enter into an agreement to receive funding for the: Centennial Reservoir

NOW THEREFORE, BE IT RESOLVED, the General Manager of the Nevada Irrigation District, or designee, is hereby authorized and directed to prepare the necessary data, conduct investigations, file such application, execute a funding agreement and any amendments thereto, and sign invoices with California Water Commission.

PASSED AND ADOPTED by the Board of Directors of the Nevada Irrigation District at a regular meeting held on the 9th day of August, 2017, by the following vote:

AYES: Weber, Drew, Miller, Morebeck, Wilcox

NOES: None

ABSENT: None

ABSTAINS: None

Nick Wilcox
President of the Board of Directors

Attest:

Kris Stepanian
Board Secretary

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Eligibility and General Project Information Tab

A.3: Project Description

NID Application

Eligibility and General Project Information Tab

A.3: Project Description

NID Service Area: Within NID's service area, most of the water supply begins as snow. As the snowpack melts, seven mountain division reservoirs—Jackson Meadows Reservoir, Milton Reservoir, French Lake, Faucherie Lake, Jackson Lake, Sawmill Lake, and Bowman Lake—capture the runoff. Water captured at Jackson Meadows Reservoir and Milton Reservoir flows either into the Middle Yuba River or through the Milton-Bowman Diversion Tunnel to Bowman Lake. Water captured at Jackson Lake, French Lake, Faucherie Lake, and Sawmill Lake also flows into Bowman Lake via existing creeks.

From Bowman Lake, water flows either into Canyon Creek or through the Bowman-Spaulding Canal, via Fuller Lake, to Pacific Gas & Electric's (PG&E) Lake Spaulding. It is then routed down the South Yuba/Chalk Bluff Canal to Scotts Flat Reservoir and the Nevada City–Grass Valley area (Deer Creek watershed), or down the PG&E Drum Canal (which flows adjacent to the Bear River) and into the Drum Forebay where it is used to generate power for NID and PG&E before supplying water to customers in southern Nevada and Placer Counties. Figure 1 Existing High Mountain Water Distribution illustrates the existing flow within the NID water supply network that originates in the mountain reservoirs and travels downstream to feed the Bear River, and also illustrates other water conveyances.

Project Overview and Study Area: NID is proposing the Centennial Reservoir to be constructed between the existing Rollins Dam and Combie Reservoir. Both reservoirs are located just within the eastern boundary of NID's service area within both southern Nevada County and western Placer County (see Figure 2 Project Location and Vicinity). The proposed reservoir would extend upriver from just above the existing Combie Reservoir to a point west of the town of Colfax, about 2 miles downstream of the existing Rollins Dam. The Project Area would occupy about 2,126 acres along a 7-mile stretch of the Bear River between the existing Rollins and Combie Reservoirs.

Project Description: The Proposed Project involves construction of a new 110,000-acre-foot reservoir, a new 6.2-mile-long raw water pipe with hydrants, low-impact recreation facilities, and appurtenant facilities and features. A new Bear River bridge crossing the Bear River to replace the existing Dog Bar Road bridge crossing is also included as part of the Proposed Project. The Proposed Project includes the following features/components:

- **New Reservoir:** The Proposed Project involves the construction of a new 110,000 acre-foot reservoir. The reservoir plan is shown in Figure 6 Proposed Centennial Reservoir Plan. The reservoir would be located between Combie Reservoir (downstream) and Rollins Reservoir (upstream), as shown on Figure 7 Proposed Centennial Reservoir Aerial Map. The reservoir capacity would be 110,000 acre-feet at a water depth of 255 feet and at a spillway crest elevation of 1,855 feet above mean seal level (amsl). Dead storage, or storage below the lowest outlet level, would be at an elevation of 1,620 feet amsl. The overall length of the reservoir would extend about 6.25 miles upstream of the dam, and the maximum width across the reservoir would be about 1 mile.

- **New raw water pump station, storage tank, extraction wells/pump intake area, and raw water pipeline:** The Proposed Project involves constructing a new raw water pump station, a 1 million-gallon storage tank, a pump sump/intake structure, and about 32,500 feet (about 6.2 miles) of raw water pipeline. Figure 8 Raw Water Construction Site Layout Conceptual Plan provides a map of the permanent and temporary construction features related to new raw water facilities.

- **Bear River Flow Management Plan:** A preliminary concept for the Bear River diversion and flow management during construction is illustrated in profile in Figures 9 and 10 Conceptual Construction Sequence. These figures show the profile of the RCC dam along the axis of the dam and the sequence of the diversion concept, which involves constructing a temporary reinforced concrete box culvert aligned across the dam footprint and through which river flow would be diverted for the duration of construction.

- **Relocation and Reconstruction of Dog Bar Road Bridge:** Dog Bar Road and the associated bridge would be relocated about 2,600 feet south of the existing road and bridge. The road would connect Magnolia Road on the Nevada County side to Placer Hills Road on the Placer County side. The bridge would be a three-span, cast-in-place, segmental concrete box girder bridge. The bridge would be about 1,200 feet long and would provide about 68 feet of clearance over the full reservoir (see Figure 11 Proposed Lower Reservoir Bridge Crossing and Figure 12 Proposed Bridge and Dam Locations). The road and bridge would be on a new alignment; the existing road and bridge would remain in service during construction. The existing bridge superstructure would be removed after the new road and bridge are in service.

- **Recreational Features:** A suite of recreational features have been included in the Proposed Project (see Figure 13 Overview of Proposed Recreation Features), including:

    - **Reservoir Boating and Use Regulations and Policies:** NID proposes to regulate the reservoir boating and uses through county ordinances as a means to provide safe boating opportunities, minimize impacts to biological resources, minimize human-caused fire risk, and minimize noise-related impacts to the neighboring residential communities.

    - **Centennial Recreation Area:** NID would construct a recreation area consisting of a boat ramp, parking area, marina, campground, designated swim beach, and general store. The recreation area would encompass a total of 25 acres of NID land on the Nevada County side of the reservoir in the southwest part of the reservoir near the dam (quarry area for the Project construction). The recreation area would be accessed off Magnolia Road, where a facility identification sign would be installed that identifies the recreation area and the available facilities, opportunities, and services. A recreation area entrance road would be constructed as part of the larger Project construction activities. The recreation area would consist of two separate complexes—a day-use complex and a camping complex—both accessed off the same primary recreation area entrance road.

        - **Day-use Complex:** The day-use complex would consist of a parking area, boat ramp, marina, swim beach, and general store on about 10 acres of NID land.

        - **Camping Complex:** On the peninsula south of the day-use complex, NID would construct a campground on about 15 acres of NID land. The campground would be accessed via an access road off the main recreation area entrance road after the entrance station.

    - **Magnolia Ranch Birding Area (Nevada County):** NID would develop a birding area on 0.5 acre of NID land in the Magnolia Ranch area on the Nevada County side of the reservoir just upstream of the main recreation area. The facility would consist of an entrance road, parking area, and multiple viewing platforms.

    - **Dog Bar Bridge Day-use Area (Placer County):** NID would develop a day-use area on 2 acres of NID land at 1,880 feet amsl on a south-facing peninsula where the proposed Dog Bar Road bridge would connect to the Placer County side of the reservoir at the southeast part of the reservoir. The facility would consist of a picnic area, parking area, restroom building, and shoreline access area.

    - **Recreational Trail:** NID would construct a 3-mile-long, narrow-surface recreational trail between the high-water line and 1,950 feet amsl. The trail would start on the Nevada County side at the dam and would traverse upstream through the proposed boat ramp entrance road and/or parking area to the proposed Dog Bar Road bridge, go across the Dog Bar Road bridge, and terminate at the Dog Bar Road bridge picnic area on the Placer County side.

    - **Trailheads:** The trail would have a total of three formal trailheads with parking areas. These include the two developed facilities described above (at the Centennial Recreation Area boat ramp parking area and at the Dog Bar day-use area parking area). In addition, NID would construct an additional trailhead parking area on the Nevada County side of the Dog Bar Road bridge.

Please refer to Item 4, Line (i) below for a complete list of figures included with this application.

The following list of supporting maps, which are referenced in this attachment, are included in Attachment A.4 Project Description Support.

Figures referenced above in Line (h) include the following:

- Figure 1 Existing High Mountain Water Distribution
- Figure 2 Project Location and Vicinity
- Figure 3 Project Study Area
- Figure 4 Proposed Centennial Reservoir Plan
- Figure 5 Proposed Centennial Reservoir Aerial Map
- Figure 6 Raw Water Construction Site Layout Conceptual Plan
- Figure 7 Conceptual Construction Sequence 1
- Figure 8 Conceptual Construction Sequence 2
- Figure 9 Proposed Lower Reservoir Bridge Crossing

- Figure 10 Proposed Bridge and Dam Locations
- Figure 11 Overview of Proposed Recreation Features

Figures 3 and 11 show the location of the Proposed Project benefits including the water supply reservoir and recreational facilities. Additional figures showing the ecosystem benefits of the Proposed Project are included in the Physical Benefits Tab, Ecosystem Priorities Worksheets.

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Eligibility and General Project Information Tab

A.4: Maps, Schematics, and Engineering Design Drawings to Support the Project Description

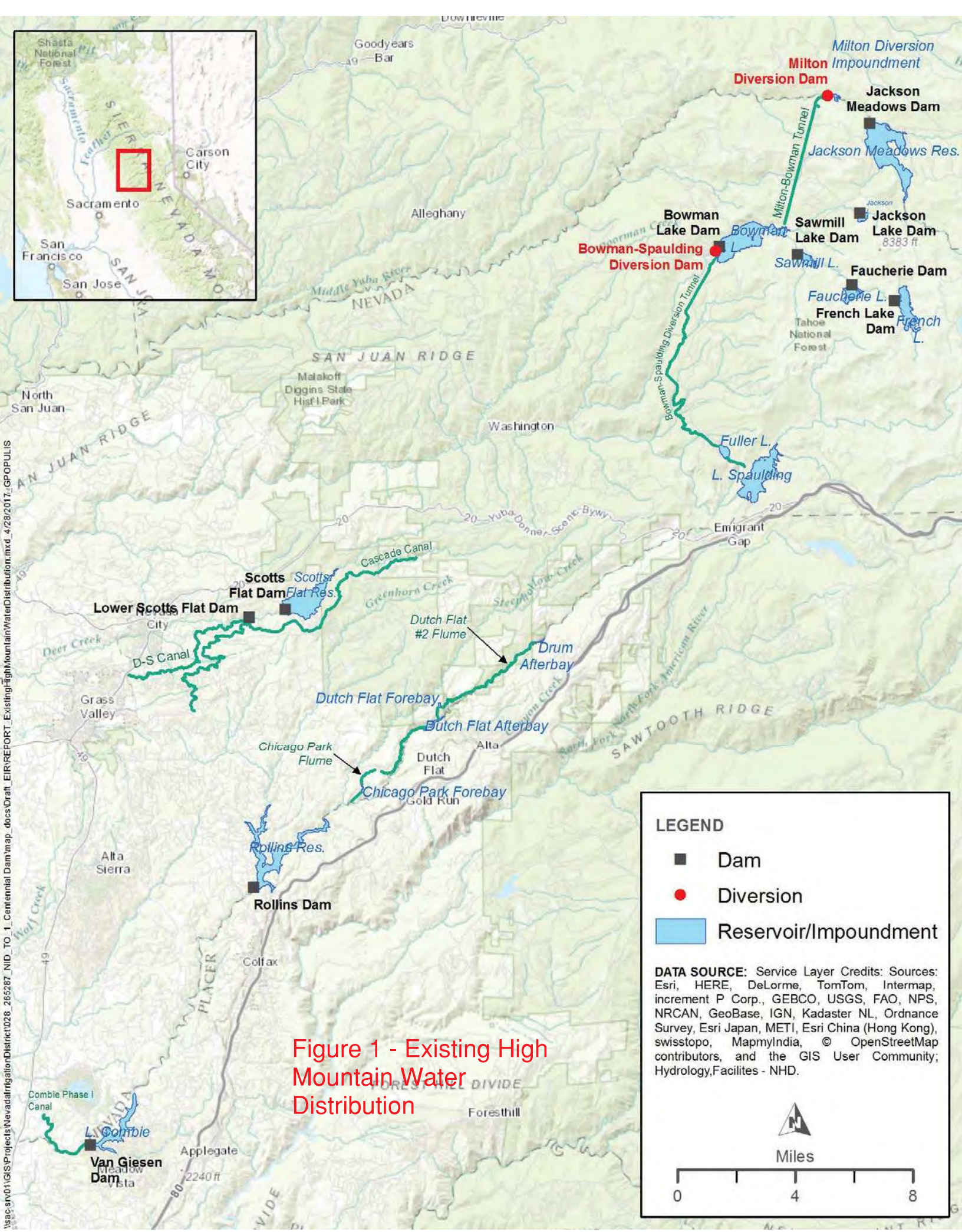


Figure 1 - Existing High Mountain Water Distribution

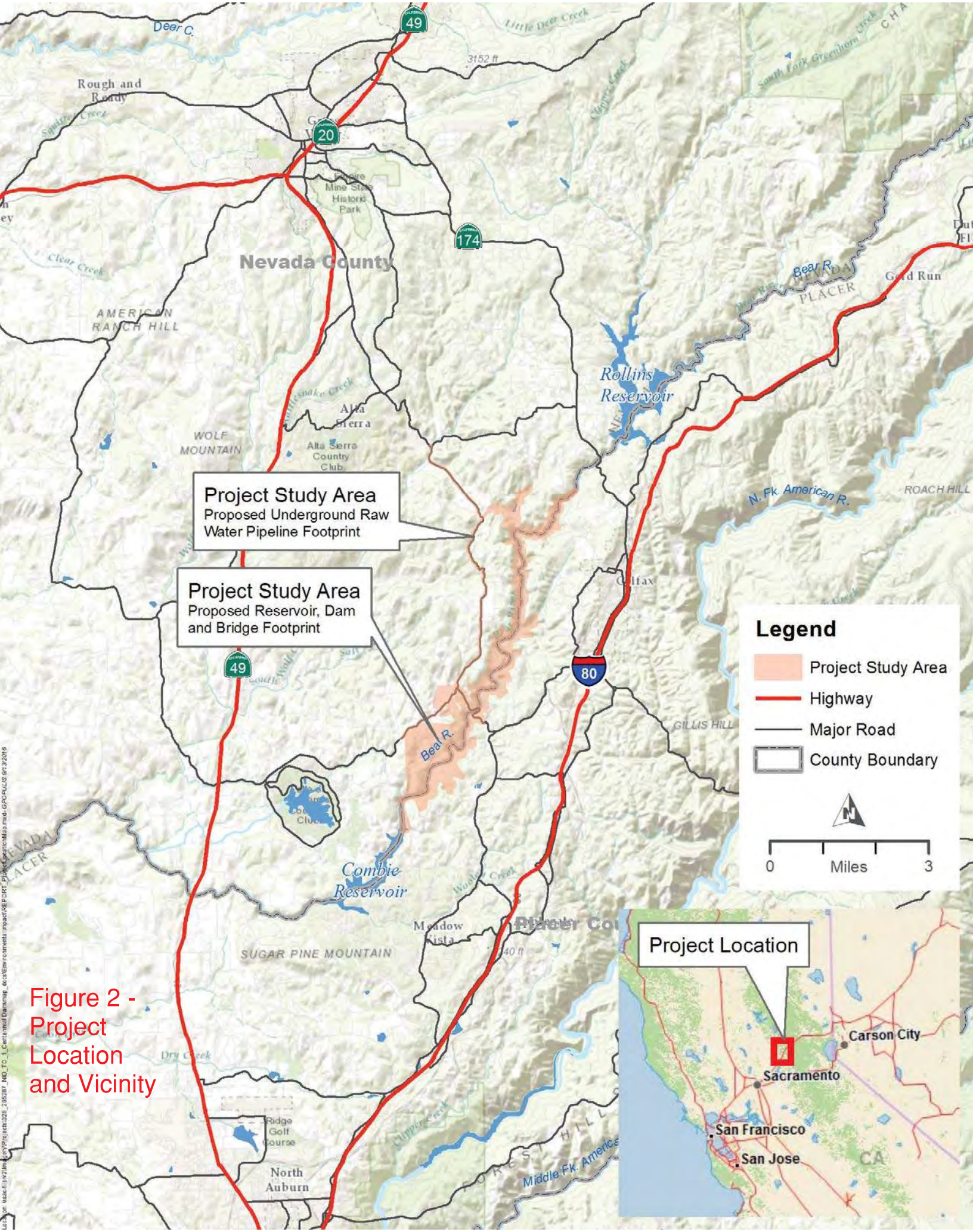


Figure 2 - Project Location and Vicinity

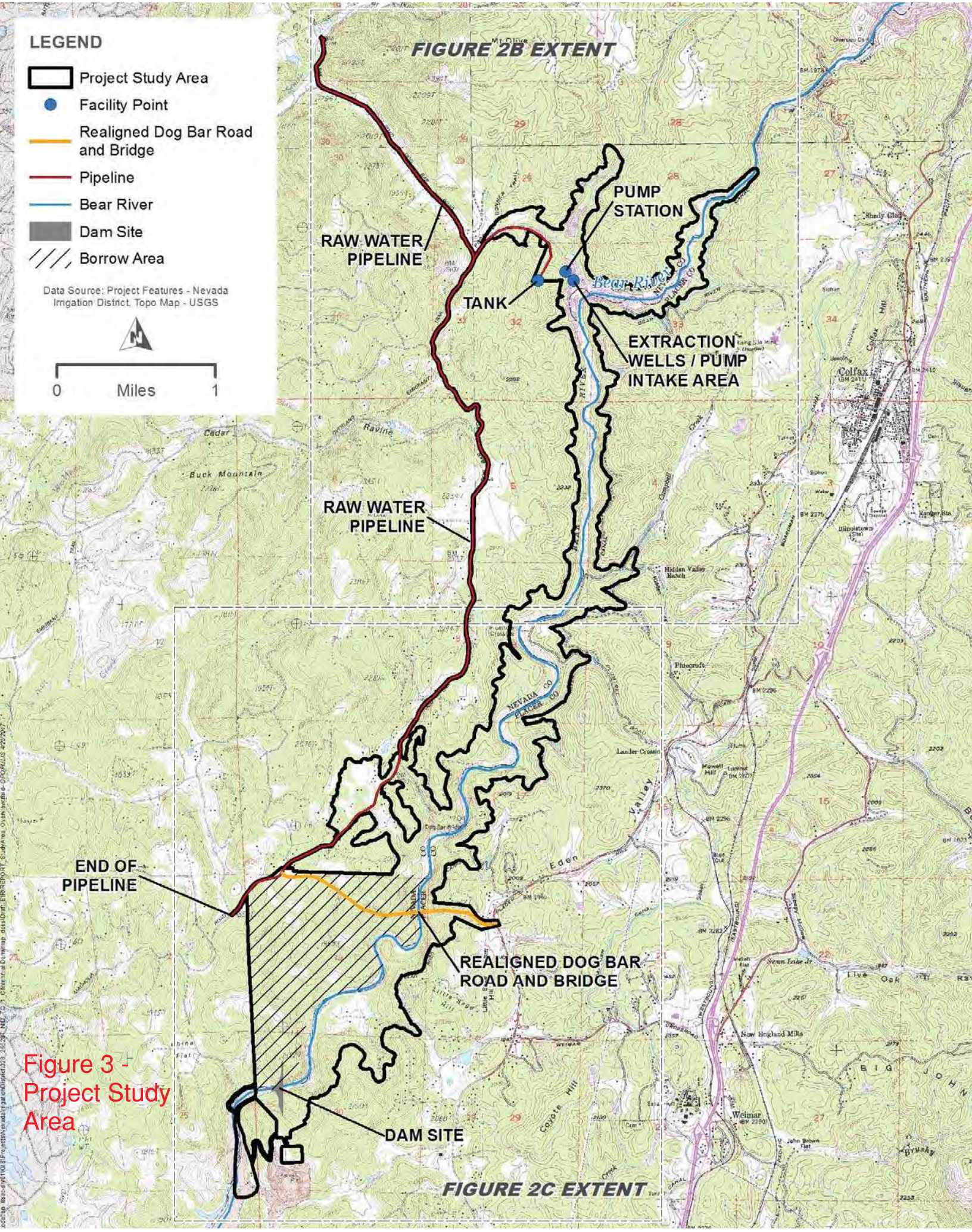


Figure 3 - Project Study Area

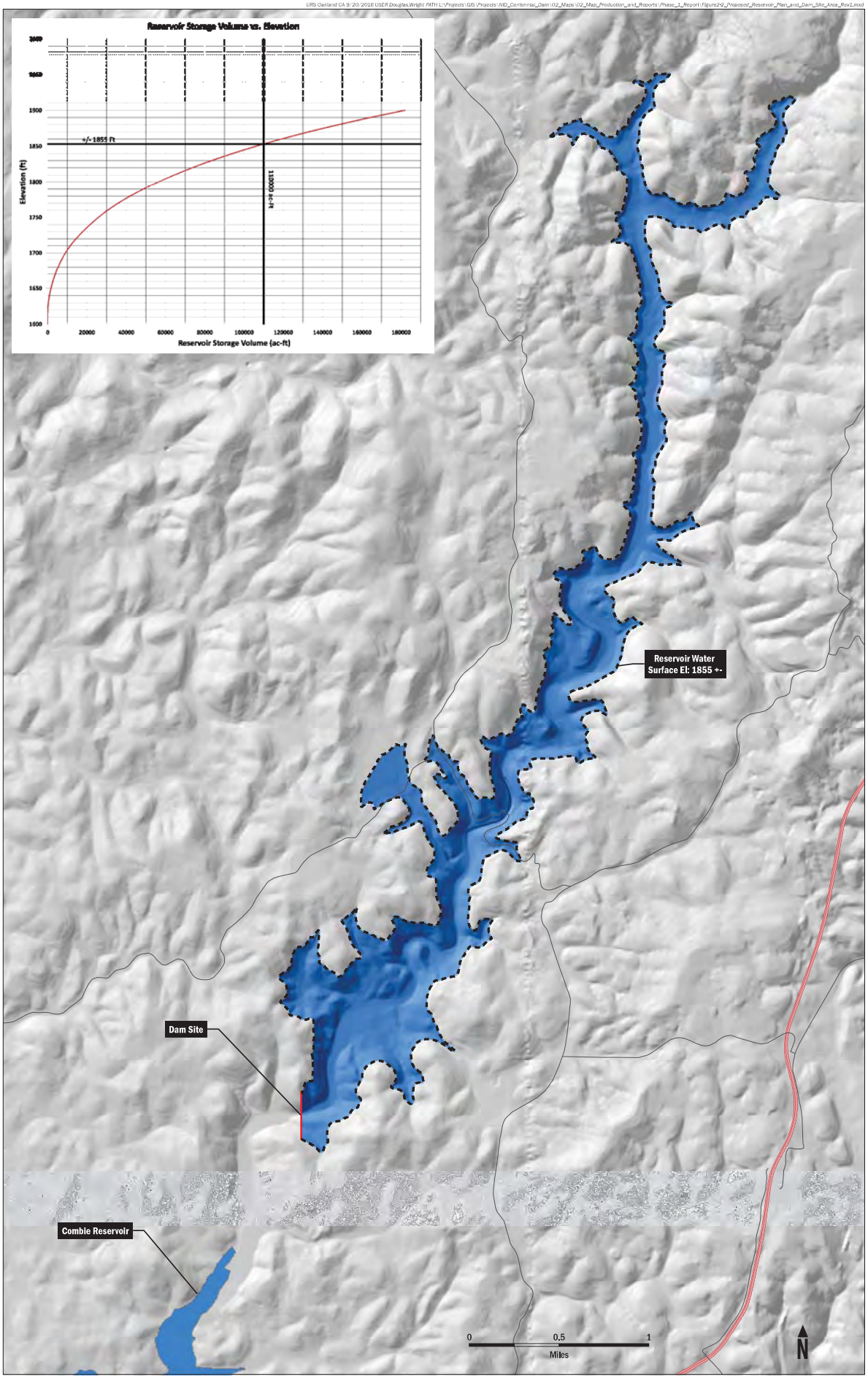


Figure 4

Figure - Centennial Reservoir Plan


Figure 5 - Proposed Centennial Reservoir Aerial Map
ROLLINS RESERVOIR
CENTENNIAL RESERVOIR
LAKE OF THE PINES
LAKE COMBIE

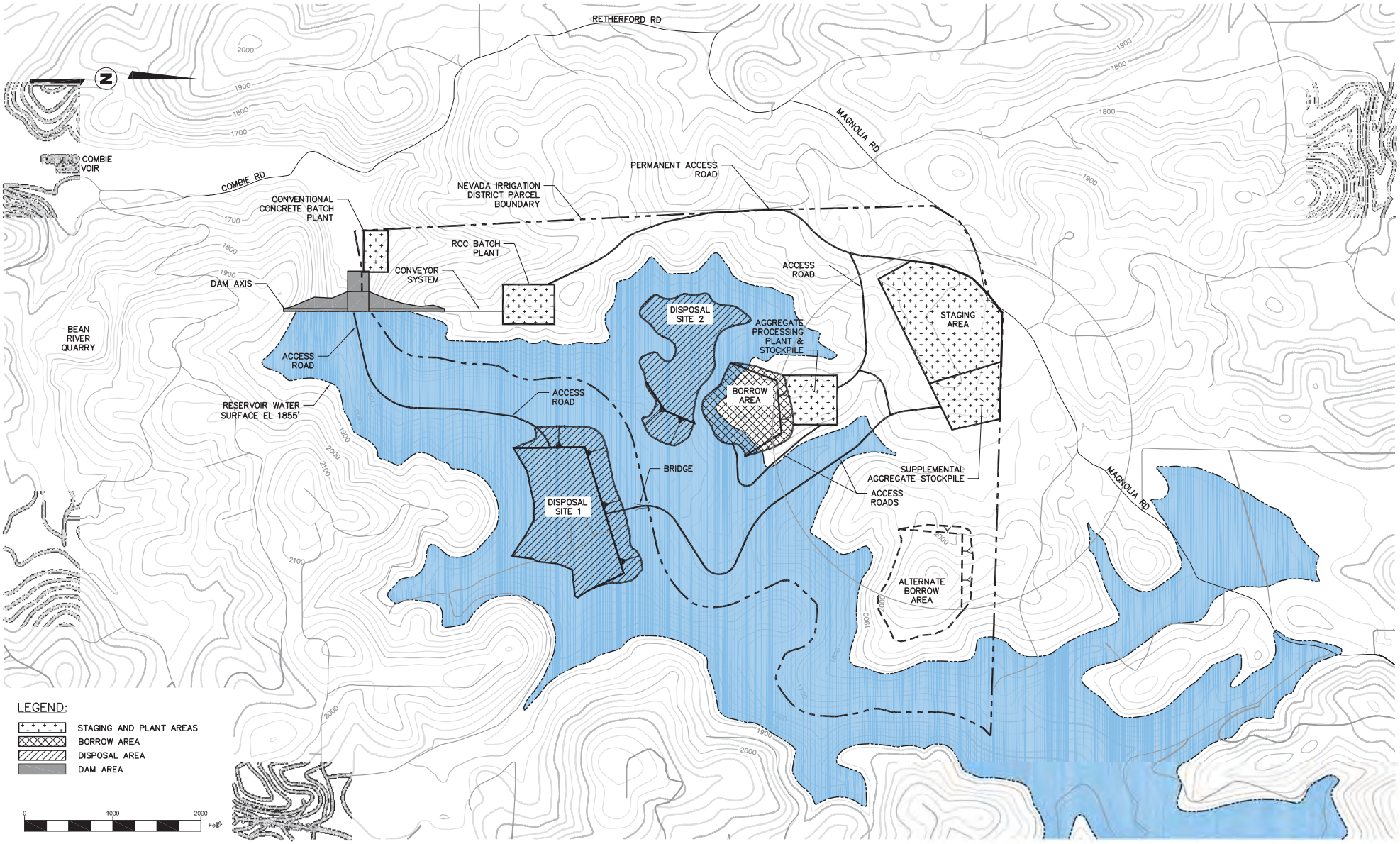
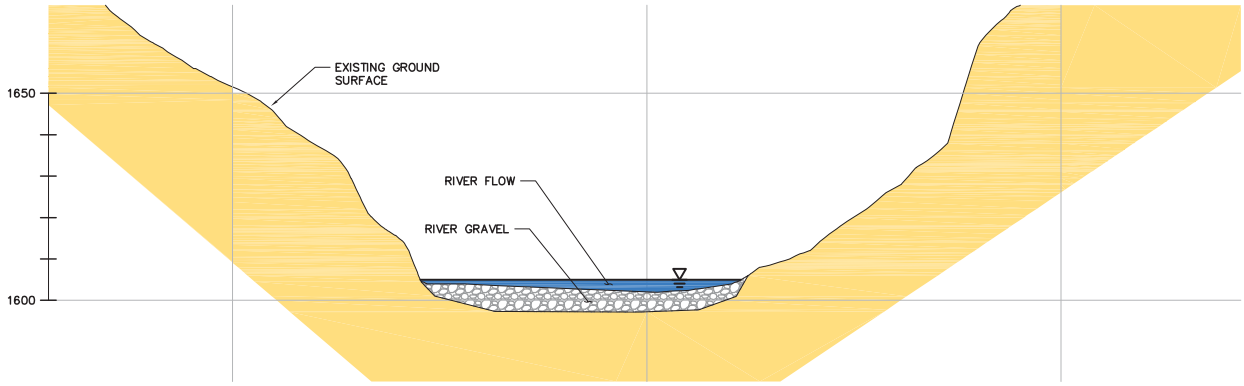
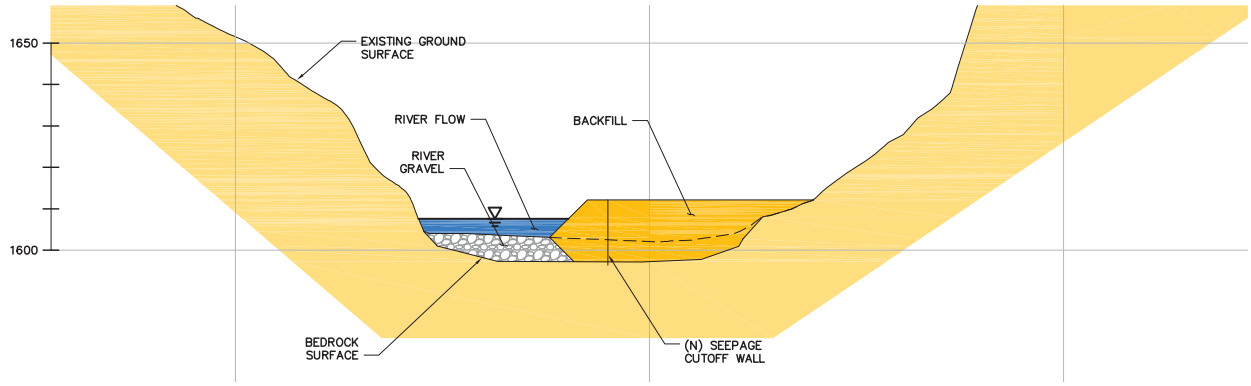


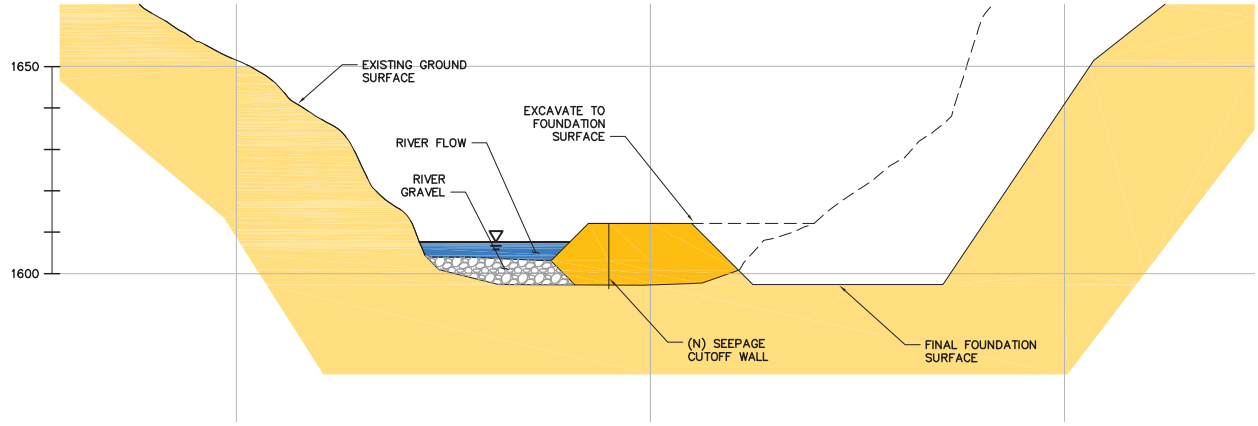
Figure 6 Construction site layout concept plan



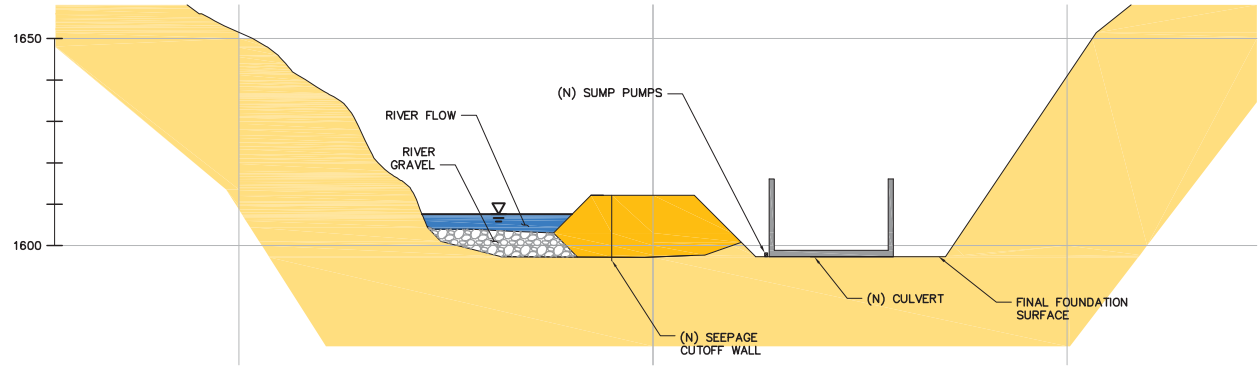
EXISTING CONDITIONS



STEP 1 – COFFERDAM CONSTRUCTION/RIVER DIVERSION



STEP 2 – EXCAVATION FOR BOX CULVERT

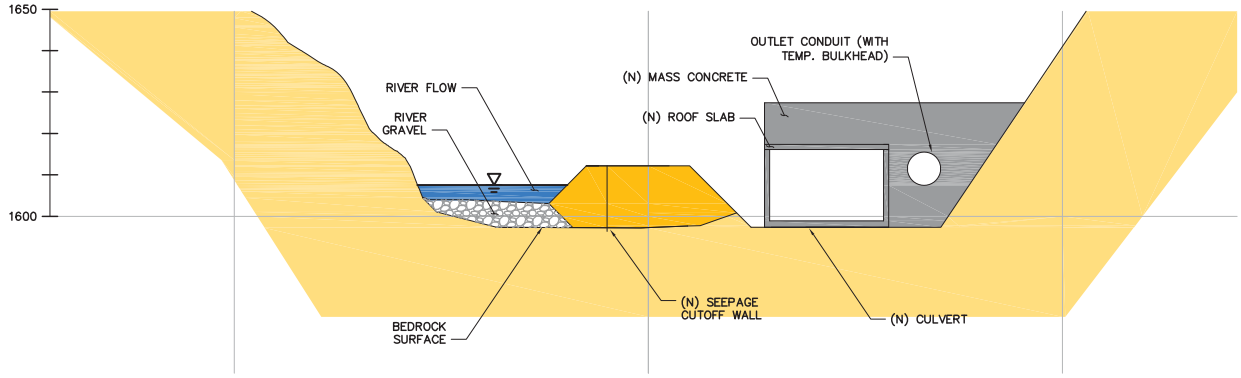


STEP 3 – BOX CULVERT CONSTRUCTION

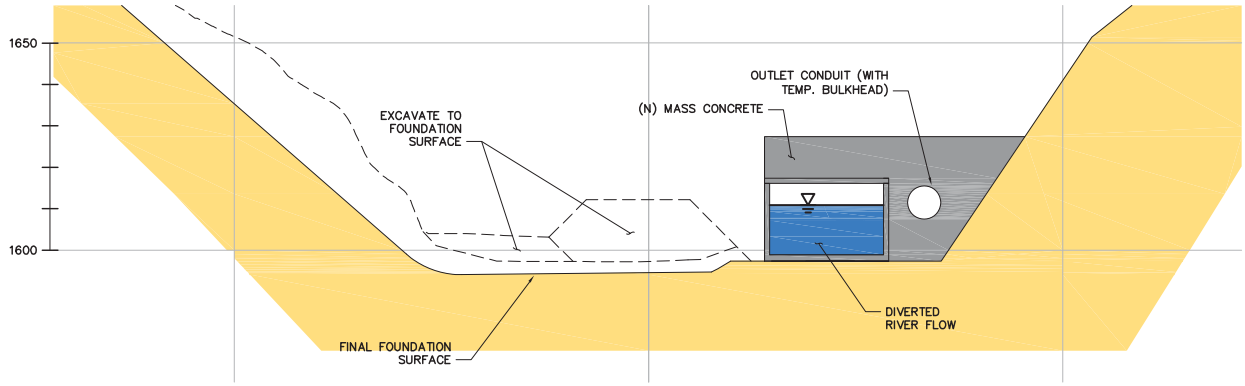
NOTE:

1. SECTIONS ARE SHOWN LOOKING DOWNSTREAM.

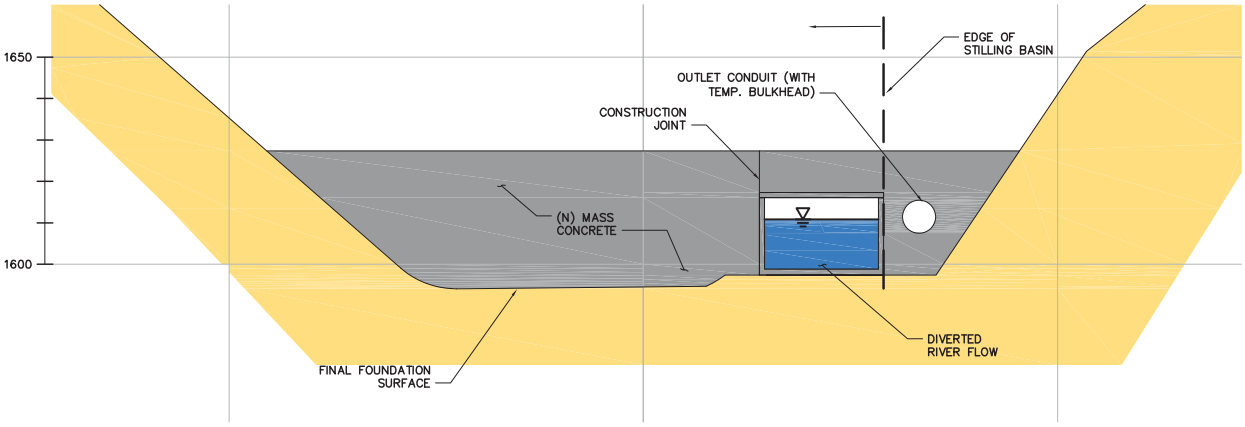
Figure___Conceptual construction sequence



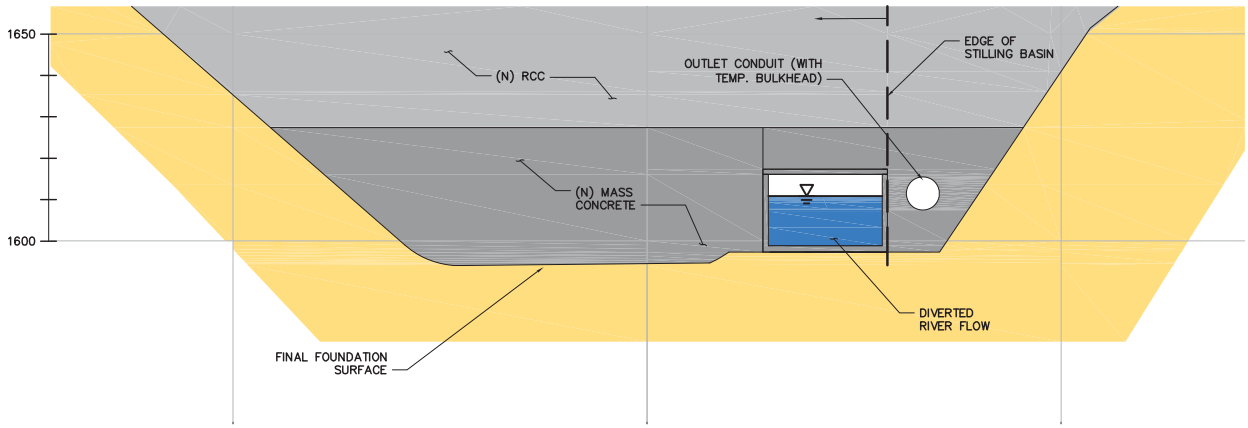
STEP 4 – ROOF SLAB & MASS CONCRETE ENCASEMENT



STEP 5 – RIVER RE–DIVERSION AND FOUNDATION EXCAVATION (COFFERDAM UPSTREAM)



STEP 6 – LEFT SIDE MASS CONCRETE PLACEMENT



STEP 7 – RCC CONSTRUCTION

NOTE:

1. SECTIONS ARE SHOWN LOOKING DOWNSTREAM.

Figure 8 Conceptual construction sequence

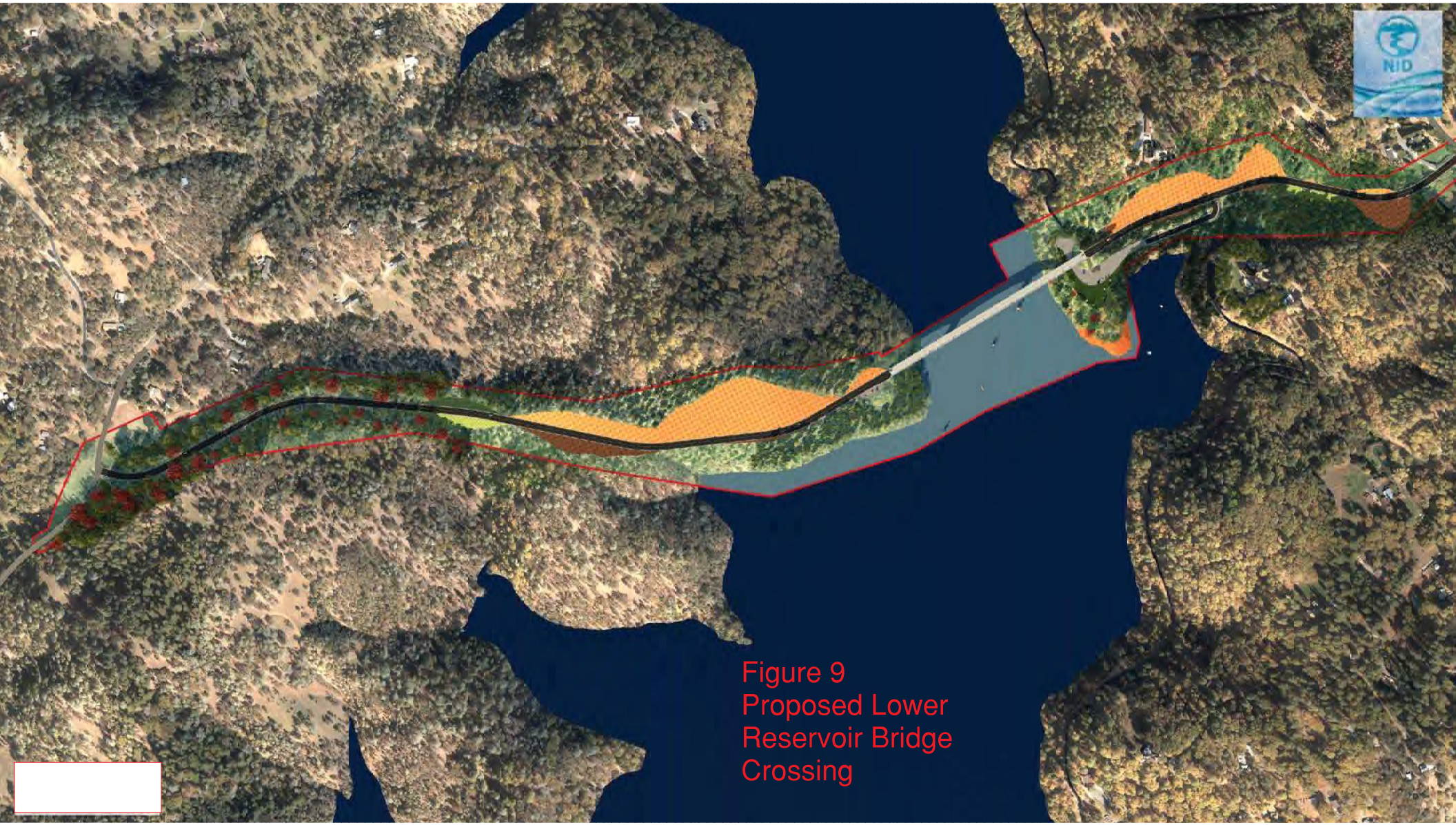


Figure 9
Proposed Lower
Reservoir Bridge
Crossing

Figure 10
Proposed Bridge and Dam Locations

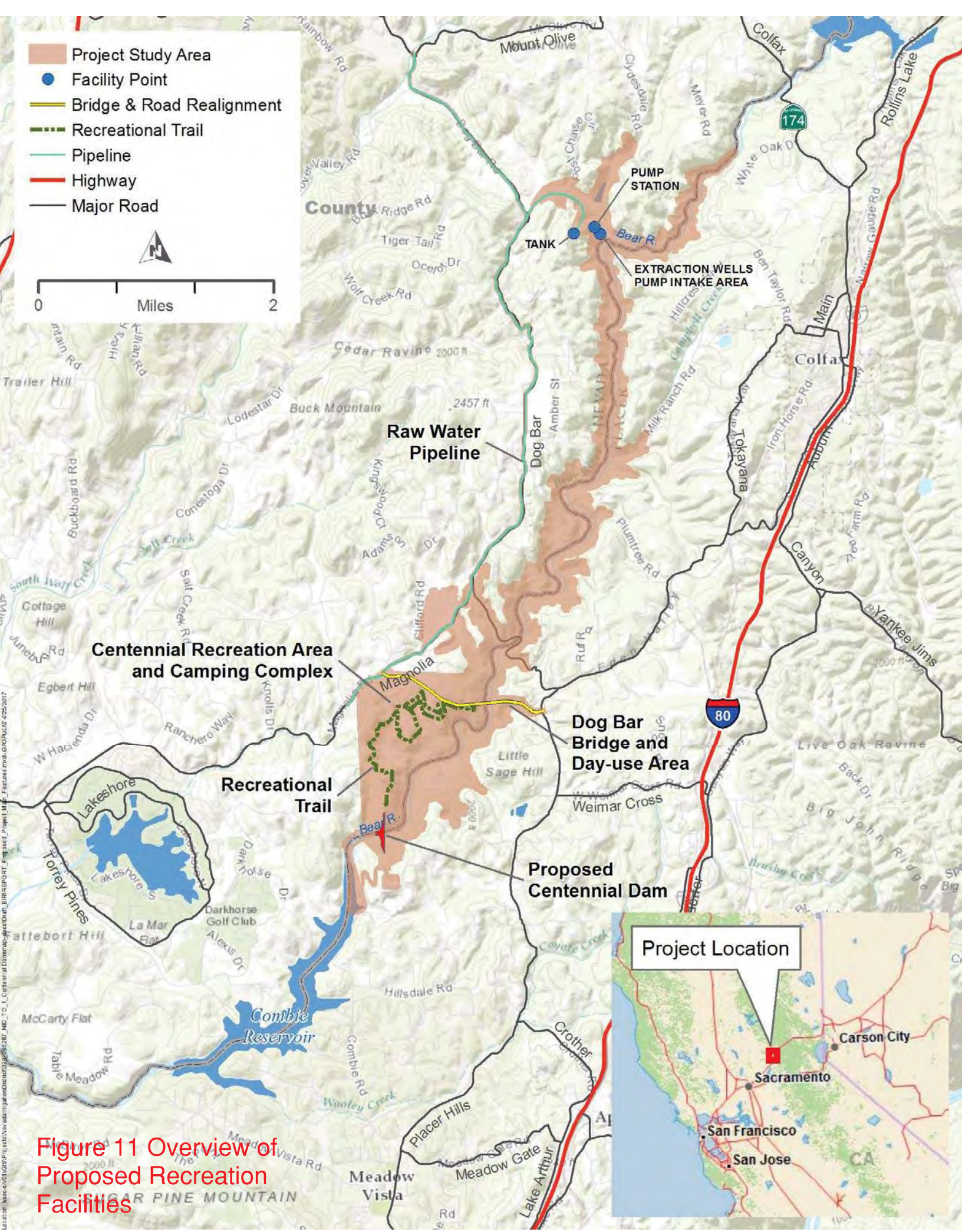


Figure 11 Overview of Proposed Recreation Facilities

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Eligibility and General Project Information Tab

A.5: Attestation

NEVADA IRRIGATION DISTRICT
1036 W. Main Street, Grass Valley, CA 95945-5424
(530) 273-6185 ~ Fax: (530) 477-2646 ~ www.nidwater.com

Date: August 9, 2017

To: California Water Commission, Water Storage Investment Program

From: Remleh Scherzinger, P.E., General Manager, Nevada Irrigation District

Under penalty of perjury pursuant to the laws of the State of California, the information provided in the full application is true and correct to the best of the our knowledge.

Remleh Scherzinger, P.E.

General Manager

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Physical Public Benefits Tab

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Physical Public Benefits Tab

A.1: Ecosystem Benefits

General Info: Ecosystem Priorities and Relative Environmental Value Criteria	
Ecosystem Priorities	
P 1	Provide cold water at times and locations to increase the survival of salmonid eggs and fry.
P 2	Provide flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids.
P 3	Maintain flows and appropriate ramping rates at times and locations that will minimize dewatering of salmonid redds and prevent stranding of juvenile salmonids in side channel habitat
P 4	Improve ecosystem water quality
P 5	Provide flows that increase dissolved oxygen and lower water temperatures to support anadromous fish passage
P 6	Increase attraction flows during upstream migration to reduce straying of anadromous species into non-natal tributaries
P 7	Increase Delta outflow to provide low salinity habitat for Delta smelt, longfin smelt, and other estuarine fishes in the Delta, Suisun Bay, and Suisun Marsh
P 8	Maintain or restore groundwater and surface water interconnection to support instream benefits and groundwater dependent ecosystems.
P 9	Enhance flow regimes or groundwater conditions to improve the quantity and quality of riparian and floodplain habitats for aquatic and terrestrial species.
P 10	Enhance the frequency, magnitude, and duration of floodplain inundation to enhance primary and secondary productivity and the growth and survival of fish
P 11	Enhance the temporal and spatial distribution and diversity of habitats to support all life stages of fish and wildlife species
P 12	Enhance access to fish spawning, rearing, and holding habitat by eliminating barriers to migration
P 13	Remediate unscreened or poorly screened diversions to reduce entrainment of fish
P 14	Provide water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species on State and Federal wildlife refuges and on other public and private lands
P 15	Develop and implement invasive species management plans utilizing techniques that are supported by best available science to enhance habitat and increase the survival of native species
P 16	Enhance habitat for native species that have commercial, recreational, scientific, or educational uses
Relative Environmental Value Criteria (REVs)	
REV 1	Number of different ecosystem priorities, for which corresponding public benefits are, provided by the project.
REV 2	Magnitude of ecosystem improvements.
REV 3	Spatial and temporal scale of ecosystem improvements.
REV 4	Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits.
REV 5	Immediacy of ecosystem improvement actions and realization of benefits
REV 6	Duration of ecosystem improvements.
REV 7	Consistency with species recovery plans and strategies, initiatives, and conservation plans
REV 8	Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
REV 9	Efficient use of water to achieve multiple ecosystem benefits
REV 10	Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Project Information	
Project Name	
Centennial Reservoir Project	
Project Description (Summary)	
The Proposed Project involves construction of a new water supply reservoir of 110,000-acre-foot, reconstruction of Dog Bar Road and Bridge, a new 6.2-mile-long raw water pipeline with hydrants, low-impact recreation facilities, and appurtenant facilities and features. NID is proposing the Centennial Reservoir to be constructed between the existing Rollins Reservoir and Combie Reservoir. Both reservoirs are located just within the eastern boundary of NID's service area within both southern Nevada County and western Placer County. The additional water supply generated from the proposed project would help reduce projected water supply shortages during prolonged droughts under 2030 and 2070 conditions, including consideration of climate change. The proposed project would also provide ecosystem and recreation benefits. Please refer to the Eligibility	

and General Project Information Tab, A.3 Project Description for a full description.
Identify the current conditions date (i.e., year) that will be used within the application.
2015
Ecosystem improvement application instructions:
To complete the ecosystem improvement section of the Water Storage Investment Program application review the 16 ecosystem priorities listed above, determine which priorities will be addressed by your project's ecosystem improvements, and answer all questions for each priority you will address. In addition to answering the priority-specific questions, answer the general questions listed on this worksheet which apply to all priorities addressed by your project. The final relative environmental value of each project will be based on a technical review of each ecosystem priority using relative environmental criteria (REV) 2-10 and the total number of priorities claimed by a project (REV 1).
For the purpose of this application the Current Conditions date will be based on the existing conditions of an applicant's CEQA document. If specific data requested in this application is not available in the CEQA document, the applicant will use the demarcation date of the existing conditions in the CEQA document. An applicant must use the demarcation date of the existing conditions from their CEQA document consistently within the application when identifying current conditions.
REV 1: Number of ecosystem priorities targeted by the project
Briefly explain which ecosystem priorities will be met by this project.
The project meets ecosystem priorities 4, 14, 15, and 16. Please refer to the Ecosystem Priorities Forms for more information.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.
Describe the process through which an adaptive management and monitoring program will be developed for approval by the responsible agency.
The Federal and State permitting processes preceding CEQA and NEPA certification and final project approval will be extensive. NID shall coordinate with USACE, USFWS, and California DFW to prepare adaptive management and monitoring programs to address wetlands and waters of the U.S., federally and state-listed plant and animal species potentially affected by the proposed project as well as native fisheries management. Given that the project is in the early stages of planning and environmental review, such programs have yet to be developed. Please refer to the Ecosystem Priorities Forms for more information.
Describe the framework you will use to develop measurable objectives, performance measures, thresholds, and triggers for your adaptive management and monitoring program.
As stated in the box above, the project is in the early stages of planning and environmental review. As such framework for the adaptive management and monitoring programs to address wetlands and waters of the U.S., federally and state-listed plant and animal species potentially affected by the proposed project as well as native fisheries management has not been established by NID and the resource agencies The Federal and State permitting processes preceding CEQA and NEPA certification and final project approval will be extensive. Please refer to the Ecosystem Priorities Forms for more information.
How will operational decisions be made if physical parameters and biological responses fall outside the range of anticipated benefits?
Although reservoir conditions may vary slightly year to year as a result of seasonal hydrological conditions, the hydrologic conditions in the area that will support ecosystem improvements as a result of water quality, enhanced wetlands, riparian habitat, and native fish habitat, and invasive species management are expected to remain relatively stable. With operation of the reservoir, the benefits of the project for these aforementioned purposes will be ongoing and are inherent to project implementation. Please refer to the Ecosystem Priorities Forms for more information.
What funding sources and financial commitments do you intend to utilize for the formation and implementation of an adaptive management and monitoring program over the duration of the claimed benefits?

As stated in the boxes above, the project is in the early stages of planning and environmental review. As such, framework for the Project adaptive management and monitoring programs is yet to be developed with the resource agencies, therefore, no funding sources or financial commitments have been reviewed yet. Once the requirements for the Project adaptive management and monitoring programs are developed funding source options will be evaluated.
Explain what environmental uncertainties are relevant to your claimed benefit(s) and will be included in your adaptive management and monitoring program (i.e. climate change, sea level rise, earthquakes, variation in snow pack, forest fires, landslides/erosion etc.).
NID's proposal for the creation of a new surface storage facility is key to dealing with the effects of drought and climate change on water supplies for both human and ecosystem needs. Please refer to the Eligibility and General Project Information Tab, A.3 Project Description and the Ecosystem Priorities Forms for more information related to the environmental and climatic uncertainties considered in development of the Proposed Project.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
Will the same unit of water benefit multiple priorities? If so, explain which priorities will benefit, and the anticipated differences in project water availability between priorities.
Yes. As stated above, although reservoir conditions may vary slightly year to year as a result of seasonal hydrological conditions, the hydrologic conditions in the area that would support ecosystem improvements as a result of water quality, enhanced wetlands, riparian habitat, and native fish habitat, and invasive species management are expected to remain relatively stable. With operation of the reservoir, the benefits of the project for these aforementioned purposes would likely be available at the various operational levels and continuously since these improvements are inherent to project implementation. At maximum pool, the proposed reservoir will provide 1,300 acres of open water habitat, which would equally support the ecosystem improvements as a result of water quality, enhanced wetlands, riparian habitat, and native fish habitat, and invasive species management. Please refer to the Ecosystem Priorities Forms for more information.
How will hydrologic connections among priorities be measured and guaranteed?
As stated in the boxes above, the project is in the early stages of planning and environmental review. As such, performance measures, thresholds, and requirements for the Project adaptive management and monitoring programs are yet to be developed with the resource agencies. Once the requirements for the Project adaptive management and monitoring programs are developed hydrologic connection guarantees among the ecosystem priorities will be evaluated.

Priority 4: Improve ecosystem water quality
Constituent Information
What ecosystem water quality constituent(s) are you targeting?
Water temperature
Summarize how the proposed actions will improve the ecosystem water quality in relation to the target constituent.
The proposed project would create a reservoir with a maximum depth of 275 feet. The new reservoir would allow for a thermocline to form at different times of the year likely ranging from 30 to 50 feet in depth based on the water temperature dynamics observed in the nearby Rollins and Camp Far West reservoirs. Water temperatures below the thermocline are expected to remain colder than both the receiving waters and reservoir surface temperatures. This colder water would provide direct benefits to local fish and aquatic invertebrate communities who rely on these conditions, such as local cold water fish (e.g., trout) that can utilize the reservoir as a large-scale dependable source of cold-water refugia during summer months when water temperatures in the Bear River upstream of the project may rise to inhospitable levels. Benefits to the local cold water fish and invertebrate communities could also have a positive effect to organisms higher on the food chain that rely on these fish and invertebrates for food such as bald eagles and osprey. The proposed project could also release this colder water through the low level outlet of the dam which would help provide similar benefits downstream into Lake Combie. These colder water temperature benefits may also be seen in the water released into the Bear River below Lake Combie.
Does the proposed ecosystem water quality improvement benefit habitats or species life stages? How?
Yes. Colder water temperatures are preferred for resident trout which are present in the Bear river at the proposed project location. Fisheries sampling conducted as part of the Yuba-Bear and Drum-Spaulding FERC relicensings identified both brown and rainbow trout were present in the Bear River at the proposed project location. The anticipated cold water pool created by the reservoir could be utilized by adults and juvenile life stages as they move out of the river habitats when water temperatures become too warm. Colder water temperatures released below Lake Combie could also provide better spawning habitat for trout in that reach of the Bear River.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the chemistry, toxicity, and negative effects constituents are described (i.e. Material Safety Data Sheets).
REV 2: Magnitude of ecosystem improvements
What is the expected magnitude of the ecosystem improvement that will address this priority? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value? If the project intends to benefit multiple constituents, the magnitude of the change in each constituent needs to be provided.
The ecosystem improvement would be realized in the summer and early fall period when the reservoir would be stratified and a cold water pool would be available beneath the thermocline. Based on the water temperature dynamics observed in nearby reservoirs (Rollins and Camp Far West) the anticipated thermocline for the proposed project's reservoir is 30 to 50 feet. Based on the preliminary available area – capacity curve, this would create a cold water pool of approximately 61,700 acre-feet when the reservoir is stratified. This available cold water pool would not exist under current or 2030 conditions without the proposed project since the reservoir would not exist.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.
REV 3: Spatial and temporal scale of ecosystem improvements.
What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?
The proposed project is expected to create a reservoir of approximately 110,000 acre-feet. Considering an average thermocline depth of 30 to 50 feet, approximately 61,700 acre-feet of colder water may be maintained due to the proposed project.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.
When during the year will ecosystem water quality improvements be provided? How is ecosystem water quality likely to vary

with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project? If the project intends to benefit multiple constituents, provide the timing of water quality improvements for each constituent separately.
The greatest benefit to water temperature would be in the summer and early fall months when surface waters in the Bear River are typically the warmest. The summer is also when reservoirs typically are the most stratified and the greatest difference in temperature is observed between the epilimnion and hypolimnion. The colder water available throughout the hypolimnion would provide refugia for trout and other cold water species during periods of high water temperature elsewhere in the reach below Rollins Reservoir. The cold water releases from the proposed project would also reduce water temperatures in Lake Combie and in the Bear River below Lake Combie during the same time period. The cold water pool would not exist under current or 2030 conditions without the proposed project since the reservoir would not exist, therefore, ecosystem water quality improvements would not be realized without the project.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of ecosystem water quality improvements are documented.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.
Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.
During development of the environmental document and permits for the Proposed Project, an adaptive management and monitoring program will be prepared in collaboration with federal, state, and local agencies.
REV 5: Immediacy of ecosystem improvement actions and realization of benefits
Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).
Approximately 36 months. It is estimated that the project would take two to three years for construction. Upon completion of construction, the period of time to fill the reservoir is estimated to range up to three years, depending on water year types that occur during the initial fill, the time period to develop a stratified reservoir with hypolimnion and epilimnion would depend upon the time of year and the water year type(s) involved. If initial fill conditions occur during an above normal or wetter water year, a well stratified reservoir with a cold-water pool hypolimnion is predicted to occur in the summer following the first full winter-spring runoff period. Regardless of which combination of water year types that occur during the initial fill period, once the reservoir is filled and the operations have stabilized, the new reservoir would exhibit the predicted ecosystem improvements associated with a cold-water pool in storage.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.
Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)
Approximately 6 to 8 months. The ecosystem improvement of additional cold water availability in the Bear River would be realized in the first summer in which the reservoir has accumulated enough water in storage to stratify, which is estimated to be a minimum of approximately 20,000 ac-ft of useable storage and a water depth of approximately 85 feet. These estimates of stratification at the proposed reservoir are based on water temperature data collected in Camp Far West Reservoir. This initial stratification may occur as early as the first summer after the project is completed depending on the type of water year (wet, above normal) and upstream water operations.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.

REV 6: Duration of ecosystem improvements
How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
100 years. The reservoir and related facilities are expected to be permanent and with appropriate maintenance would last for 100 years. For every year that the aforementioned minimum water pool is available, the reservoir would become stratified in the summer and early fall providing a consistent cold water pool. Over time, as air temperature is predicted to increase this cold water pool would likely remain insulated from atmospheric effects. The relatively narrow and deep nature of the reservoir would also lessen the effects of evaporation on the reservoir, providing additional protections to the cold water pool.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?
The 2014 California Water Action Plan was developed to meet three broad objectives: "more reliable water supplies, the restoration of important species and habitat, and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades." A critical element in achieving these objectives is the creation of additional surface storage. As stated in the plan, "The bottom line is that we need to expand our state's storage capacity, whether surface or groundwater, whether big or small. Today, we need more storage to deal with the effects of drought and climate change on water supplies for both human and ecosystem needs." Opportunities for the development of a major on-stream surface storage project in California are limited as evidenced by the fact that it has been 40 years since the last such project was completed. Centennial reservoir presents an ideal opportunity for developing new significant surface storage. The project would be located on a highly regulated reach of the Bear River located between two existing reservoirs: Combie and Rollins located immediately downstream and upstream, respectively, of the Centennial site.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
None
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.
Figure 1. Approximate River Miles for Water Quality Benefit.
Explain why this location was selected in the context of local environmental conditions and the target constituent(s). Why was this location selected over other potential locations?
The location being evaluated for Centennial Reservoir would effectively work in conjunction with NID's existing Rollins Reservoir to expand the total storage capability in the Bear River watershed. This use would allow additional water to be captured from diversions out of NID's Mountain Division system in the Yuba River watershed, as well as natural runoff in the Bear River watershed (both the runoff in excess of what Rollins Reservoir can store on a seasonal basis as well as the runoff in the sub-basin below the Rollins Dam catchment) for the purpose of maximizing reservoir storage during the winter and early spring runoff period to provide water to customers in NID's lower Bear River watershed service area. Although, the ecosystem

improvements related to water temperature are inherent to project implementation they are not the primary factor in siting the proposed project.
Is the ecosystem water quality improvement location adjacent to, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem water quality improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The proposed reservoir site being considered is not currently adjacent to, within or near other areas protected or managed for conservation purposes.
Additional locations in the application (document name, page number, figure name or number, other) that describe the extent of the ecosystem water quality improvements, the proximity of claimed improvements to other areas already being protected or managed for conservation value, and the degree to which hydrologic connections (if any) occur between claimed improvements and areas already being protected or managed for conservation value.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
If applicable, how will water provided to address this priority be managed? Explain design efficiencies and operational strategies intended to maximize the efficiency of water allocated to ecosystem improvements that address this priority.
The area inundated by the proposed project would be located in a narrow canyon of the Bear River and would result in a deep, narrow reservoir with a low surface area to volume ratio and therefore would be subject to less evaporative losses compared to shallower reservoirs of a similar capacity but with larger surface area, thereby yielding more total water for beneficial uses (cold water) per acre-foot stored. This reservoir configuration would also be more protective of the resulting cold-water pool available during periods of stratification (summer and early fall) due to less wind effects mixing due to a lower surface area to volume ratio. The proposed project would have a static operating pool (no discretionary hydropower generation or flood control operation) which would also help to ensure a reliable cold water pool available during periods of stratification.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.
Refer to Benefit, Calculation, Monetization, and Resiliency Tab, A.1 Project Conditions and A.2. Preliminary Operations Plan.
REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
As stated above under REV 7 and 8, the area being evaluated for the proposed project is considered a suitable location along the Bear River since it would be located on an already regulated reach of the Bear River between two existing reservoirs. The ecosystem improvements related to water temperature would result from coordination with the resource agencies and preparation and implementation of adaptive management and monitoring programs during development of the Proposed Project.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.

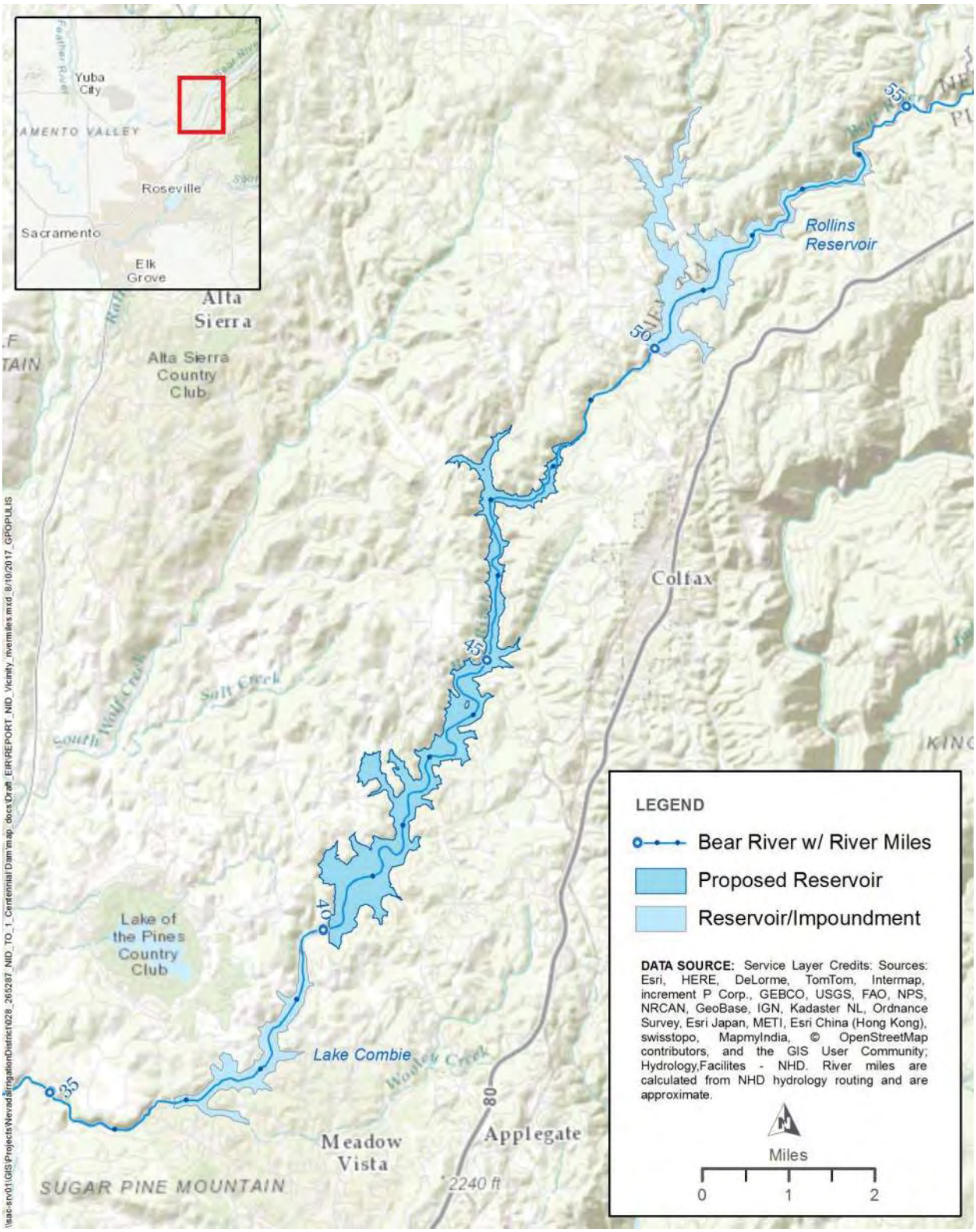


Figure 1. Approximate River Miles for Water Quality Benefit.

Priority 14: Provide water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species on State and Federal wildlife refuges and on other public and private lands

REV 2: Magnitude of ecosystem improvements

What is the expected magnitude of the ecosystem improvement that will address this priority? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value?

As illustrated in the Eligibility and General Project Information Tab, A.3 Project Description, the proposed project would create a new reservoir along the Bear River with a storage capacity of 110,000 acre-feet and a maximum inundation area of approximately 1,300 acres. The proposed Centennial Reservoir would operate as a "fill-and-spill" project, with a priority to maximize reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID's existing reservoir network to provide water to customers in NID's lower Bear River watershed service area. During the majority of years and as hydrologic conditions allow, Centennial Reservoir would be operated at or near its full gross storage (110,000 acre-feet) throughout the year, with any seasonal drawdowns due to minimum instream flow requirements and evaporative losses. In the fall and early winter, Centennial Reservoir would store any watershed runoff (in excess of minimum instream flow requirements) in order to return the reservoir to full pool.

Approximately 1,300 acres of open water habitat created by the proposed project during maximum pool conditions would replace approximately 188.2 acres (Bear River [183.005 ac]; Ponds [5.218 ac]) of open waters identified in the wetlands delineation of the projected area of inundation. In addition to the Bear River and pond, "other waters" habitat, the project would inundate or otherwise affect other habitats considered waters of the U.S. including perennial marshes, riparian wetlands, seasonal marshes, seasonal wetlands, seasonal wetland swales, and seeps, as well as drainage and other features including the ephemeral drainages, intermittent drainages, perennial creeks. The total area of these habitats is 22 acres.

Reservoir development is expected to create conditions adjacent to and within the inundation area that allow for establishment of riparian and wetland habitats, including perennial and seasonal wetlands (i.e., perennial marsh, seasonal marsh, and seasonal wetlands) in existing upland areas that do not currently support the hydrological conditions necessary to maintain such habitats. Adjacent fringe upland areas would be subjected to higher ground water when the reservoir is at or near maximum pool. These hydrologic conditions are expected to promote establishment of aquatic plant species that tap into this source of water and create fringe wetlands in existing upland areas. In addition, preliminary topographic analyses of the proposed reservoir inundation pool indicate that several relatively shallow areas would be formed in coves and other areas that would potentially provide the physical conditions conducive for the establishment of riparian and wetland habitats. The cove areas are primarily located in existing drainage basins that are adjacent to upland shrub and/or forested habitats. Shallow inundation of these area, particularly along the interface of the maximum inundation pool, is expected to convert to riparian and/or wetlands where physical conditions (e.g., water depth, frequency of inundation, suitable soil saturation) allow. It is estimated that 107.87 acres of relatively shallow cove habitat would be created as a result of reservoir inundation. In addition, 115.12 acres of the reservoir would be in 0-10ft of water when the reservoir is at maximum pool. These shallow water areas are also expected to provide the physical conditions where wetland and riparian vegetation may establish. Therefore, the proposed reservoir at or near maximum pool would provide a total of approximately 223 acres that may ultimately support riparian and/or wetland habitats (**Figure 1, Approximate Location of Potential Ecological Benefits**). Subtracting the 22 acres of wetlands and "other waters" that the Project would inundate, the net total benefit is 201 acres.

While it is premature to estimate the extent of riparian and wetland habitat that may establish in coves and other shallow water areas within the proposed reservoir, when at the normal maximum pool approximately 223 acres provide substantial opportunities for newly created riparian and/or wetland areas.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.

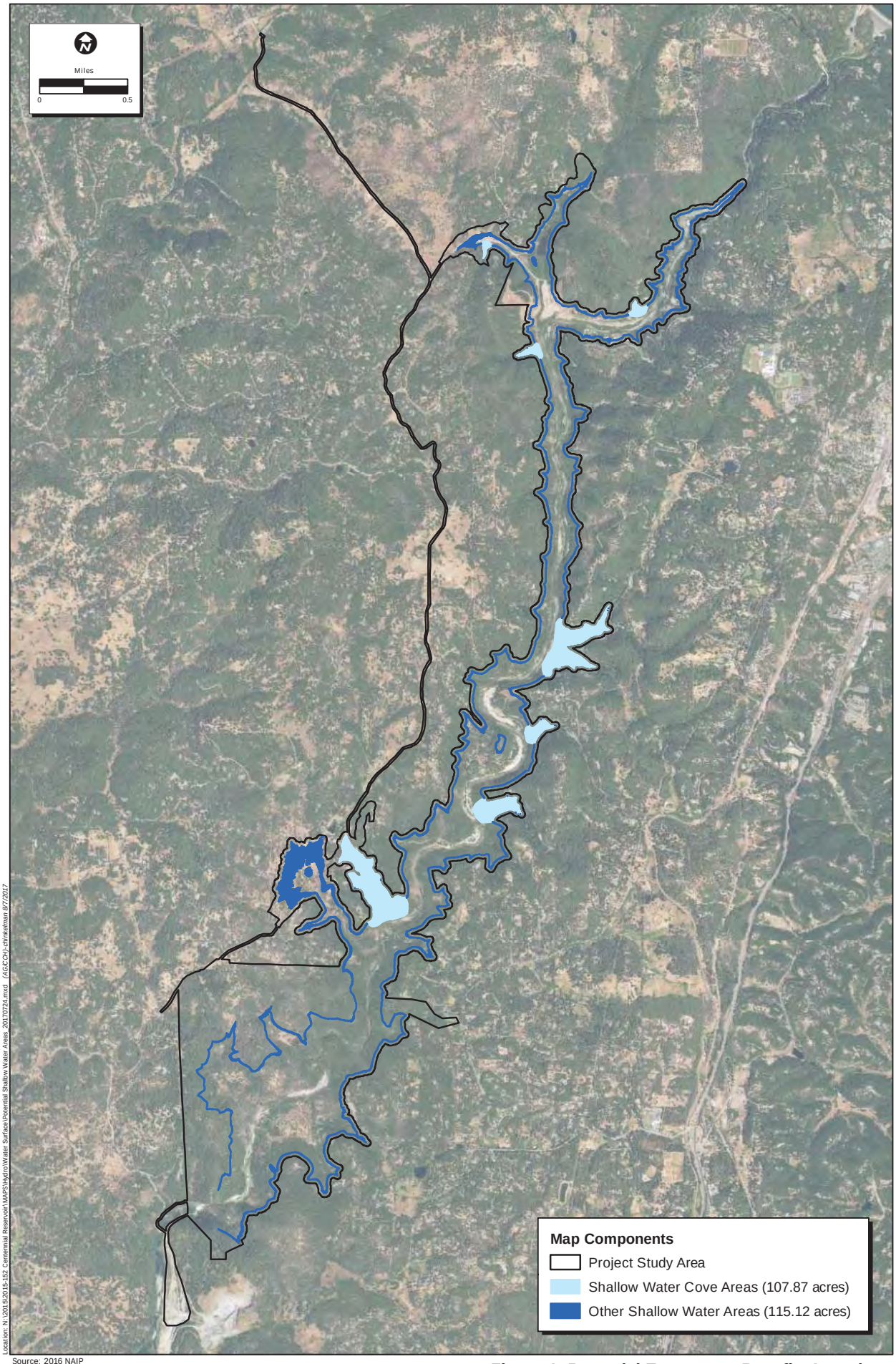
REV 3: Spatial and temporal scale of ecosystem improvements.

What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?
As shown in **Figure 1: Approximate Location of Potential Ecological Benefits**, the proposed project would create 107.86 acres of shallow cove areas which, as noted above would support the establishment of riparian and wetland habitats, including perennial and seasonal wetlands (i.e., perennial marsh, seasonal marsh, and seasonal wetlands) in existing upland areas that do not currently support the hydrological conditions necessary to maintain such habitats. At maximum pool, the proposed reservoir would provide 1,300 acres of open water habitat, supplanting 175 acres of open water that is extant in the Bear River [169.534 ac]; Ponds [5.218 ac])
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.
When during the year will water be provided for seasonal wetlands, permanent wetlands, and riparian habitat? How are seasonal wetlands, permanent wetlands, and riparian habitat likely to vary with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project?
As stated above, the proposed Centennial Reservoir would operate as a "fill-and-spill" project, with the goal to maximize reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID's existing reservoir network to provide water to customers in NID's lower Bear River watershed service area. This use would allow additional water to be captured from diversions out of NID's Mountain Division system in the Yuba River watershed, as well as natural runoff in the Bear River watershed (both the runoff in excess of what Rollins Reservoir can store on a seasonal basis as well as the runoff in the sub-basin below the Rollins Dam catchment). During the majority of years and as hydrologic conditions allow, Centennial Reservoir would be operated at or near its full gross storage (110,000 acre-feet) throughout the year, with any seasonal drawdowns due to minimum instream flow requirements and evaporative losses. In the fall and early winter, Centennial Reservoir would store any watershed runoff (in excess of minimum instream flow requirements) in order to return the reservoir to full pool. During a dry year, Centennial Reservoir storage could be used to augment the reliability of NID's water supply in the Bear River watershed. Seasonal drawdown would vary based on the severity of the annual (or multi-year) drought condition. Seasonal Releases - Releases from Centennial Reservoir would vary by season and hydrologic year type and would consist of a combination of minimum environmental flows (yet to be established), discretionary releases for water supply, and spill. Seasonally, flows in the Bear River below Centennial Reservoir are expected to peak in the late summer as water deliveries are passed through Centennial Reservoir (via Rollins Reservoir) for delivery to Lake Combie and NID's Phase I Canal . In most years, winter and spring spill can be anticipated to reach Combie Reservoir during heavy rain events in the Bear River watershed. The lowest seasonal releases from Centennial Reservoir would occur during the late fall through early winter in most years, as the reservoir refills from any mid-year drawdown and downstream water delivery demands wane. Preliminary reservoir operations are described above. To the extent that reservoir creation and operation would improve hydrological conditions in upland areas currently unable to support seasonal wetlands, permanent wetlands, and riparian wetlands conditions, the creation and operation of the reservoir would allow the creation and maintenance of wetland habitat in areas where topographic and soils conditions are suitable. As noted, however, the reservoir would be operated to maximize reservoir storage during the winter and early spring runoff period to provide water to customers in NID's lower Bear River watershed service area. Operations would not be altered for the purpose of wetland habitat development and maintenance. Although reservoir conditions may vary slightly year to year as a result of seasonal hydrological conditions, the hydrologic conditions in the area that would support wetlands and riparian habitats are expected to remain stable. Thus, with the proposed project there is the potential to create up to 223 acres of enhanced wetlands and riparian habitat. These enhanced wetlands and riparian habitat would exist through the lifetime of the project (i.e. beyond 2030). Without the project, the river channel would remain the same and there would only be 22 acres of wetland or "other waters" habitat available.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of water releases for seasonal wetlands, permanent wetlands, or riparian habitat improvements are described and quantified.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance

measures, thresholds, and triggers to achieve ecosystem benefits.
Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.
The Federal and State permitting processes preceding CEQA and NEPA certification and final project approval will be extensive. NID shall coordinate with USACE, USFWS, and California DFW to prepare adaptive management and monitoring programs to address wetlands and waters of the U.S., federally and state-listed plant and animal species potentially affected by the proposed project as well as native fisheries management. Given that the proposed project is in the early stages of planning and environmental review, such programs have yet to be developed.
REV 5: Immediacy of ecosystem improvement actions and realization of benefits
Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).
Approximately 36 months. It is estimated that the project would take two to three years for construction. Upon completion of construction, the period of time to fill the reservoir is estimated to range up to three years. The benefits for the establishment of early successional wetland habitat are anticipated to be immediate upon the attaining reservoir maximum pool.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.
Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)
Approximately 0 months. The ecosystem improvement opportunity for the establishment of early successional wetland and riparian habitat is anticipated to be established immediately in the first year in which the reservoir is filled. As stated above, it is anticipated that upon completion of construction, the period of time to fill the reservoir is estimated to range up to three years. The benefits for the establishment of early successional wetland habitat are anticipated to be immediate upon the attaining reservoir maximum pool. The development of mid-succession and late-succession species in wetland and/or riparian areas created by the proposed project would be an ongoing process subsequent to the completion of the proposed project.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.
REV 6: Duration of ecosystem improvements
How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
100 years. The reservoir and related facilities are expected to be permanent and with appropriate maintenance would last for 100 years. Reservoir operations under the proposed project are envisioned to continue for the foreseeable future. With operation of the reservoir, the benefits of the proposed project for the purpose of wetland habitat development would be ongoing.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?

The 2014 California Water Action Plan was developed to meet three broad objectives: "more reliable water supplies, the restoration of important species and habitat, and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades." A critical element in achieving these objectives is the creation of additional surface storage. As stated in the plan, "The bottom line is that we need to expand our state's storage capacity, whether surface or groundwater, whether big or small. Today, we need more storage to deal with the effects of drought and climate change on water supplies for both human and ecosystem needs." Opportunities for the development of a major on-stream surface storage project in California are limited as evidenced by the fact that it has been 40 years since the last such project was completed. Centennial reservoir presents an ideal opportunity for developing new significant surface storage. The proposed project would be located on a highly regulated reach of the Bear River located between two existing reservoirs: Combie and Rollins located immediately downstream and upstream, respectively, of the Centennial site.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.
Figure 1 referenced above shows the location of potential areas of ecological benefits associated with the proposed project.
Explain why this location was selected. How does this location enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species in the context of local environmental conditions?
As described above, the location being evaluated for Centennial Reservoir would effectively work in conjunction with NID's existing Rollins Reservoir to expand the total storage capability in the Bear River watershed. This use would allow additional water to be captured from natural runoff in the Bear River watershed (both the runoff in excess of what Rollins Reservoir can store on a seasonal basis as well as the runoff in the sub-basin below the Rollins Dam catchment) for the purpose of maximizing reservoir storage during the winter and early spring runoff period to provide water to customers in NID's lower Bear River watershed service area. Reservoir creation in this location would substantially alter the hydrology of upland areas that have the topography and soils conditions to support wetland habitat, but not the water source. Although, enhanced wetland and riparian habitat is inherent to project implementation it is not the primary factor in siting the proposed project.
Is the ecosystem improvement location adjacent to, within, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The proposed reservoir site being considered is not currently adjacent to, within or near other areas protected or managed for conservation purposes.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the spatial extent of the ecosystem improvement, the proximity of the ecosystem improvement to other areas already being protected or managed for conservation value, and the degree to which hydrologic connections (if any) occur between the ecosystem improvement and areas already being protected or managed for conservation value.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
How will water provided to address this priority be managed? Explain design efficiencies and operational strategies intended to maximize the efficiency of water allocated to ecosystem improvements that address this priority.
Refer to REV 3, above.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.

REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
As noted under REV 7 above, the proposed project would help meet the statewide need for more surface water storage to help address the uncertainties of future drought and climate change and their effects on water supplies for both human and ecosystem needs. Centennial Reservoir presents an ideal opportunity for developing new significant surface storage. Also as stated above under REV 7 and 8, the area being evaluated for the proposed project is considered a suitable location along the Bear River since it would be located on an already regulated reach of the Bear River between two existing reservoirs. The ecosystem improvements related enhanced wetland and riparian habitats would result from coordination with the resource agencies and preparation and implementation of adaptive management and monitoring programs during development of the Proposed Project.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.



Location: N:\2015\2015-152 Centennial Reservoir\MAPS\Hydro\Water Surface\Potential Shallow Water Areas_20170724.mxd (AGICOH)-chrinkelman 8/7/2017

Source: 2016 NAIP

Figure 1. Potential Ecosystem Benefits Locations

Priority 15: Develop and implement invasive species management plans utilizing techniques that are supported by best available science to enhance habitat and increase the survival of native species

Species Information

What invasive species are you targeting?

Invasive plant species: Invasive species management may include management of non-native plant species. A total of 129 non-native plant species were identified within the project study area; a comprehensive list of plant species identified in the project study area is included in the table: *Centennial Reservoir Project: Plant Species Observed On-Site* (**See Table 1**) Non-native species observed are indicated by asterisk (*). Invasive species targeted for this grant include: wild oats (*Avena fatua*) and soft brome (*Bromus hordeaceus*) found in 49.7 acres of California Annual and Perennial Grassland habitat within the project study area and ripgut brome (*Bromus diandrus*), meusahead grass (*Elymus caput-medusae*), and yellow star-thistle (*Centaurea solstitais*) found in 11.3 total acres of Mediterranean California Naturalized Annual and Perennial Grassland habitat within the project study area. An Invasive Plant Species Management Plan would be developed for the project, in consultation with the resource agencies, to control the further spread of non-native invasive plants during project implementation.

Invasive wildlife species: Invasive species management would include management and/or removal of non-native wildlife species such as bullfrogs that are known predators of native fauna such as foothill yellow-legged frog.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the biology of the invasive species and their impacts on native fish and wildlife are described and quantified.

Table 1: Centennial Reservoir Project: Plant Species Observed On-Site.

REV 2: Magnitude of ecosystem improvements

When implemented what is the expected magnitude of habitat enhancement and increased survival of native species? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value?
If the project intends to target multiple invasive species, the magnitude of the ecosystem improvement for each species needs to be provided.

The proposed inundation of approximately 1,300 acres is anticipated to reduce targeted invasive plant species and other non-native plants observed during botanical field surveys of the Project Study Area (as listed in Table 1). Reservoir creation is also anticipated to present a formidable obstacle to the disbursement of populations of invasive species found to the north and south of the proposed reservoir.

In addition, reservoir development is anticipated to create conditions adjacent to and within the inundation area that allow for establishment of native riparian and wetland habitats, including perennial and seasonal wetlands (i.e., perennial marsh, seasonal marsh, and seasonal wetlands). Establishment of native riparian and wetlands areas would benefit native wildlife that utilize such habitat types including nesting songbirds and small mammals such as bobcat, ringtail cat, and mink.

At this time, quantification of the magnitude of the habitat enhancement and increased survival of native species as a result project implementation has not occurred. This would occur upon development of adaptive management and monitoring programs to address invasive and native species.

Under current and 2030 conditions without the project, invasive species would remain in place and the survival rate for native species would also remain.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.

Figure 1: Location of Ecological Benefits included with Priority Form #14.

REV 3: Spatial and temporal scale of ecosystem improvements.

What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?

The proposed reservoir at maximum pool would inundate approximately 1,300 acres.

Additional locations in the application, supporting documentation or attachments (document name, page number, figure name

or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.
When during the year will the project manage invasive species for the benefit of native species? How is the distribution of invasive species likely to vary with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project? If the project intends to target multiple invasive species, provide the timing of management actions for each invasive species separately.
As illustrated in the Eligibility and General Project Information Tab, A.3 Project Description, the proposed project would create a new reservoir along the Bear River with a storage capacity of 110,000 acre-feet and a maximum inundation area of approximately 1,300 acres. The reservoir would be operated as a "fill-and-spill" project, with a prioritization of maximizing reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID's existing reservoir network to provide water to customers in NID's lower Bear River watershed service area. During the majority of years and as hydrologic conditions allow, Centennial Reservoir would be operated at or near its full gross storage (110,000 acre-feet) throughout the year, with any seasonal drawdowns due to minimum instream flow requirements and evaporative losses. In the fall and early winter, Centennial Reservoir would store any watershed runoff (in excess of minimum instream flow requirements) in order to return the reservoir to full pool. Clearing of terrestrial invasive species is anticipated to occur during proposed project construction. Management of invasive species would occur through implementation of adaptive management and monitoring programs developed in coordination with the resource agencies. However, the high frequency and extended duration of maintaining the reservoir at maximum pool would likely restrict the establishment of targeted and other non-native plant species within the area of inundation. Without the project, invasive species management would not occur now or in the future since there is no plan for invasive species management is proposed in the project area.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of ecosystem improvements that address this priority are described and quantified.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.
Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.
The Federal and State permitting processes preceding CEQA and NEPA certification and final project approval will be extensive and include provisions for invasive species management and benefits to native plant and wildlife species. NID would coordinate with USFWS, California DFW, and other entities to prepare adaptive management and monitoring programs to address invasive and native species concerns. Given that the proposed project is in the early stages of planning and environmental review, such programs have yet to be developed.
REV 5: Immediacy of ecosystem improvement actions and realization of benefits
Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).
An invasive species management plan would be developed in consultation with the resource agencies, and the approved plan would include timeframes for implementation.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.
Refer to the Eligibility and General Project Information Tab, A.3 Project Description.
Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)
An invasive species management plan would be developed in consultation with the resource agencies, and the approved plan

would include timeframes for implementation.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.
REV 6: Duration of ecosystem improvements
How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
100 years. Reservoir operations under the proposed project are envisioned to continue for the foreseeable future. With operation of the reservoir, the benefits of the proposed project for the purpose of control of invasive species would be maintained per the invasive species plan to be developed in consultation with the resource agencies.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?
The 2014 California Water Action Plan was developed to meet three broad objectives: "*more reliable water supplies, the restoration of important species and habitat, and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades.*" A critical element in achieving these objectives is the creation of additional surface storage. As stated in the plan, "*The bottom line is that we need to expand our state's storage capacity, whether surface or groundwater, whether big or small. Today, we need more storage to deal with the effects of drought and climate change on water supplies for both human and ecosystem needs.*" Opportunities for the development of a major on-stream surface storage project in California are limited as evidenced by the fact that it has been 40 years since the last such project was completed. Centennial reservoir presents an ideal opportunity for developing new significant surface storage. The proposed project is located on a highly regulated reach of the Bear River located between two existing reservoirs (Combie and Rollins) located immediately downstream and upstream, respectively, of the project site. With the anticipated minimization of invasive plant species within the area of inundation and the likely obstacle to dispersal of species the future reservoir would present, the proposed project would help facilitate the objectives of the CDFW Invasive Species Program in relation to plants.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.
Refer to the attached figures: **Figure 2a: Vegetation Alliances and Land Cover Types - North, and Figure 2b: Vegetation Alliances and Land Cover Types – South**. These figures show vegetation and cover types identified that contain invasive plants located within areas to be inundated by the proposed reservoir at maximum pool, as described in the first box above.
Explain why the location of invasive species management was selected. How is the location beneficial to the survival of native species in the context of local environmental conditions and species' needs?
As described above, the location being evaluated for Centennial Reservoir would effectively work in conjunction with NID's existing Rollins Reservoir to expand the total storage capability in the Bear River watershed. This use would allow additional

water to be captured from natural runoff in the Bear River watershed (both the runoff in excess of what Rollins Reservoir can store on a seasonal basis as well as the runoff in the sub-basin below the Rollins catchment) for the purpose of maximizing reservoir storage during the winter and early spring runoff period to provide water to customers in NID's lower Bear River watershed service area. Although, invasive species management is inherent to project implementation it is not the primary factor in siting the proposed project.
Is the ecosystem improvement location adjacent to, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The proposed project is not located near other areas currently being managed for invasive plant species control. Additionally, no programs for the control of aquatic animal species are currently in effect at Rollins Reservoir upstream of the project site or at Combie Reservoir, downstream of the project. It should be noted however, that NID, in partnership with the California Division of Boating and Waterways (CDBW) and CDFW, is developing an Aquatic Invasive Species Program. The program would focus on Quagga and Zebra Mussels, which pose a serious threat to state waters and fisheries and the spread of these mussels threatens aquatic ecosystems, water delivery systems, hydroelectric facilities, agriculture, and recreation. In 2017 the program would include water chemistry monitoring, visual surveys, boat inspections, and the development of a Quagga and Zebra Mussel Prevention and Monitoring Plan. It is assumed that once the Aquatic Invasive Species Program is developed it would be implemented at the proposed project site as well as at Rollins and Combie reservoirs.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of ecosystem improvements that address this priority are described and quantified.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
If applicable, how will water be efficiently managed to implement invasive species management?
Refer to REV 3, above.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.
REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
As noted under REV 7 above, the proposed project would help meet the statewide need for more surface water storage to help address the uncertainties of future drought and climate change and their effects on water supplies for both human and ecosystem needs. Centennial Reservoir presents an ideal opportunity for developing new significant surface storage. Also as stated above under REV 7 and 8, the area being evaluated for the proposed project is considered a suitable location along the Bear River since it would be located on an already regulated reach of the Bear River between two existing reservoirs. The ecosystem improvements related to invasive species control would result from implementing the invasive species management plan that would be developed in consultation with the resource agencies for implementation during and after development of the Proposed Project.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.

Table 1. Centennial Reservoir Project:
Plant Species Observed On-Site
(11-13, 17-19, and 31 May, 7 and 8 June, and 12-15, 18-22, and 26 July 2016; 2-5 May and 27-29 June 2017)

An Asterisk (*) indicates a non-native species.

SCIENTIFIC NAME	COMMON NAME
ADOXACEAE	**MUSKROOT FAMILY**
Sambucus nigra ssp. *caerulea*	Blue elderberry
AGAVACEAE	**AGAVE FAMILY**
Chlorogalum pomeridianum	Soap plant
ALISMATACEAE	**WATER-PLANTAIN FAMILY**
Alisma triviale	Broad-leaf water plantain
ALLIACEAE	**ONION FAMILY**
Allium sanbornii var. *sanbornii*	Sanborn's onion
ANACARDIACEAE	**SUMAC FAMILY**
*Pistacia chinensis**	Chinese pistache
Rhus aromatica	Fragrant sumac
Toxicodendron diversilobum	Poison oak
APIACEAE	**CARROT FAMILY**
Angelica breweri	Brewer's angelica
*Conium maculatum**	Poison-hemlock
*Daucus carota**	Queen Anne's lace
Daucus pusillus	American wild carrot
Eryngium castrense	Button-celery
Lomatium caruifolium	Alkali parsnip
Lomatium utriculatum	Common lomatium
Osmorhiza berteroi	Mountain sweetcicely
Perideridia kelloggii	Squawroot
Sanicula bipinnata	Poison sanicle
Sanicula bipinnatifida	Purple sanicle
Sanicula crassicaulis	Pacific sanicle
Tauschia kelloggii	Kellogg's umbrellawort
*Torilis arvensis**	Torilis (hedge parsley)

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SCIENTIFIC NAME	COMMON NAME
APOCYNACEAE	**DOGBANE FAMILY**
Apocynum androsaemifolium	Spreading dogbane
Apocynum cannabinum	Indianhemp dogbane
Asclepias cordifolia	Purple milkweed
Asclepias speciosa	Showy milkweed
*Vinca major**	Periwinkle
ARACEAE	**ARUM FAMILY**
Lemna sp.	Duckweed
ARISTOLOCHIACEAE	**PIPEVINE FAMILY**
Aristolochia californica	California pipevine
Asarum lemmonii	Lemmon's wild ginger
ASPHODELACEAE	**ASPHODELUS FAMILY**
*Kniphofia uvaria**	Redhot poker
ASTERACEAE	**SUNFLOWER FAMILY**
Achillea millefolium	Common yarrow
Agoseris heterophylla	Annual agoseris
Anaphalis margaritacea	Pearly everlasting
*Anthemis cotula**	Mayweed
Artemisia douglasiana	Mugwort
Artemisia dracunculus	Herbaceous sagewort
Baccharis pilularis	Coyote bush
*Bellis perennis**	English daisy
Brickellia californica	California brickelbush
Calycadenia fremontii	Fremont's calycadenia
*Carduus pycnocephalus**	Italian thistle
*Centaurea cyanus**	Bachelor buttons
*Centaurea melitensis**	Tocalote
*Centaurea solstitialis**	Yellow star-thistle
Centromadia fitchii	Fitch's spikeweed

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SCIENTIFIC NAME	COMMON NAME
ASTERACEAE	**SUNFLOWER FAMILY**
*Chondrilla juncea**	Skeleton weed
*Cichorium intybus**	Chicory
Cirsium occidentale	Cobweb thistle
*Cirsium vulgare**	Bull thistle
Ericameria arborescens	Goldenfleece
Erigeron foliosis	Leafy daisy
Erigeron philadelphicus var. *philadelphicus*	Philadelphia fleabane
Eriophyllum lanatum var. *croceum*	Common wooly sunflower
Eurybia radulina	Roughleaf aster
Grindelia camporum	Common gum plant
Helenium puberulum	Sneezeweed
Helianthella californica	California Helianthella
Hieracium albiflorum	White flowered hawkweed
Holocarpha virgata	Sticky tarweed
*Hypochaeris glabra**	Smooth cat's-ear
*Hypochaeris radicata**	Perennial cat's-ear
Jensia rammii	Ramm's madia
*Lactuca serriola**	Prickly lettuce
*Leontodon saxatilis**	Hairy hawkbit
*Logfia gallica**	Herba impia
Madia elegans	Common madia
Madia gracilis	Slender tarweed
Malacothrix floccifera	Wooly dandelion
*Matricaria discoidea**	Pineapple weed
*Mauranthemum paludosum**	Paludosum daisy
Micropus californicus	Cotton top
Microseris sp.	Silverpuffs
Pseudognaphalium beneolens	Cudweed
Psilocarphus tenellus	Slender woolly-heads
Rigiopappus leptocladus	Wireweed
Senecio integerrimus	Mountain butterweed

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SCIENTIFIC NAME	COMMON NAME
ASTERACEAE	**SUNFLOWER FAMILY**
*Senecio vulgaris**	Common groundsel
Sericocarpus oregonensis	Oregon whitetop aster
*Silybum marianum**	Milk thistle
*Soliva sessilis**	Field burrweed
*Sonchus asper**	Prickly sowthistle
*Taraxacum officinale**	Common dandelion
*Tragopogon dubius**	Goat's beard
*Tragopogon porrifolius**	Goat's beard
Uropappus lindleyi	Lindley's silverpuffs
Wyethia angustifolia	Mule ears
Wyethia mollis	Mule ears
Xanthium strumarium	Rough cockle-bur
BERBERIDACEAE	**BARBERRY FAMILY**
Berberis aquifolium var*. repens*	Creeping oregon grape
BETULACEAE	**BIRCH FAMILY**
Alnus rhombifolia	White alder
Corylus cornuta	Beaked hazelnut
BIGNONIACEAE	**TRUMPET-CREEPER FAMILY**
*Catalpa bignonioides**	Cigar-tree
BLECHNACEAE	**CHAIN FERN FAMILY**
Woodwardia fimbriata	Giant Chain Fern
BORAGINACEAE	**BORAGE FAMILY**
Allophyllum divaricatum	Purple false gilia
Amsinckia menziesii	Rancher’s fireweed
Cryptantha flaccida	Beaked cryptantha
Cynoglossum grande	Grand hound's tongue
Eriodictyon californicum	California yerba santa
*Myosotis discolor**	Changing forget-me-not

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SCIENTIFIC NAME	COMMON NAME
BORAGINACEAE	**BORAGE FAMILY**
Nasturtium officinale	Watercress
Nemophila heterophylla	Canyon nemophila
Nemophila maculata	Five spot
Nemophila menziesii	Baby blue eyes
Nemophila parviflora	Small flowered nemophila
Phacelia hastata	Mountain phacelia
Plagiobothrys greenei	Greene's popcornflower
Plagiobothrys nothofulvus	Rusty popcorn-flower
Plagiobothrys stipitatus	Slender popcorn-flower
BRASSICACEAE	**MUSTARD FAMILY**
Barbarea orthoceras	American wintercress
*Brassica nigra**	Black mustard
*Capsella bursa-pastoris**	Shepherd's purse
Cardamine californica	California bitter-cress
Cardamine pensylvanica	Pennsylvania bittercress
Erysimum capitatum	Western wallflower
*Hirschfeldia incana**	Shortpod mustard
*Lepidium campestre**	Cow cress
*Raphanus sativum**	Cultivated radish
Rorippa curvipes	Bluntleaf yellow cress
Streptanthus sp.	Jewel flower
Thysanocarpus curvipes	Fringepod
Thysanocarpus radians	lacepod
CALYCANTHACEAE	**CALYCANTHUS FAMILY**
Calycanthus occidentalis	Western sweetshrub
CAMPANULACEAE	**BELLFLOWER FAMILY**
Githopsis specularioides	Common bluecup

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SCIENTIFIC NAME	COMMON NAME
CAPRIFOLIACEAE	**HONEYSUCKEL FAMILY**
Lonicera hispidula	Pink honeysuckle
Lonicera interrupta	Chaparral honeysuckle
Symphoricarpos albus var*. laevigatus*	Common snowberry
Symphoricarpos mollis	Creeping snowberry
CARYOPHYLLACEAE	**PINK FAMILY**
*Cerastium glomeratum**	Mouse-ear chickweed
*Lychnis coronaria**	Rose campion
Minuartia californica	California sandwort
*Petrorhagia dubia**	Petrorhagia
*Saponaria officianalis**	Bouncing Bet
Scleranthus annuus spp*. annuus*	German knotgrass
*Silene gallica**	Catchfly
Silene lancinata ssp*. californica*	California indian pink
Silene occidentalis	Western campion
*Spergularia rubra**	Purple sandspurry
CONVOLVULACEAE	**MORNING-GLORY FAMILY**
Calystegia occidentalis spp*. occidentalis*	Chapparal false bindweed
*Convolvulus arvensis**	Morning glory
CORNACEAE	**DOGWOOD FAMILY**
Cornus glabrata	Brown dogwood
Cornus nuttallii	Pacific dogwood
CRASSULACEAE	**STONECROP FAMILY**
Crassula aquatica	Water pygmy-weed
Dudleya cymosa	Canyon liveforever
Sedum spathulifolium	Pacific stonecrop
CUCURBITACEAE	**GOURD FAMILY**
Marah fabacea	Wild cucumber

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SCIENTIFIC NAME	COMMON NAME
CUPRESSACEAE	**CYPRESS FAMILY**
Calocedrus decurrens	Incense cedar
Sequoia sempervirens	Coast Redwood
CYPERACEAE	**SEDGE FAMILY**
Carex inferminervia	Weak nerved sedge
Carex senta	Rough sedge
Carex simulata	Short beaked sedge
Cyperus eragrostis	Tall flatsedge
Eleocharis acicularis	Needle spikerush
*Isolepis setacea**	Bristle leaf bulrush
DRYOPTERACEAE	**WOOD FERN FAMILY**
Dryopteris arguta	California wood fern
Polystichum imbricans	Cliff sword fern
EQUISETACEAE	**HORSETAIL FAMILY**
Equisetum arvense	Field horsetail
Equisetum hyemale	Rough horsetail
Equisetum laevigatum	Smooth scouring-rush
ERICACEAE	**HEATH FAMILY**
Arbutus menziesii	Pacific madrone
Arctostaphylos viscida	Whiteleaf manzanita
Chimaphila menziesii	Little prince's pine
Rhododendron occidentale	Western azalea
EUPHORBIACEAE	**SPURGE FAMILY**
Chamaesyce serpyllifolia	Thyme leaved spurge
Croton setiger	Turkey mullein
Euphorbia crenulata	Chinese caps
FABACEAE	**LEGUME FAMILY**
Acmispon americanus	Spanish clover

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SCIENTIFIC NAME	COMMON NAME
FABACEAE	**LEGUME FAMILY**
Acmispon brachycarpus	Short-podded lotus
Acmispon parviflorus	Hill lotus
Cercis occidentalis	Western redbud
*Cytisus scoparius**	Scotch broom
*Genista monspessilana**	French broom
*Gleditsia triacanthos**	Honeylocust
Hoita macrostachya	Large leather root
Hoita orbicularis	Creaping leather root
Lathyrus nevadensis	Sierra pea
Lathyrus sulphureus var*. sulphureus*	Brewers pea
*Lotus corniculatus**	Birdsfoot trefoil
Lupinus albifrons	Bush lupine
Lupinus bicolor	Bicolored lupine
Lupinus latifolia var*. columbianus*	Broad leaved lupine
Lupinus latifolius	Big leaf lupine
Lupinus microcarpus	Chick lupine
Lupinus nanus	Sky lupine
Lupinus stiversii	Harlequin lupine
*Medicago polymorpha**	Bur clover
*Melilotus albus**	White sweetclover
*Melilotus officinalis**	Yellow sweetclover
*Robinia pseudoacacia**	Black locust
*Trifolium campestre**	Hop clover
Trifolium ciliolatum	Foothill clover
Trifolium depauperatum	Dwarf sack clover
*Trifolium dubium**	Shamrock clover
*Trifolium hirtum**	Rose clover
*Trifolium incarnatum**	Crimson clover
Trifolium microcephalum	Hairy clover
*Trifolium repens**	White clover
*Trifolium subterraneum**	Subterranean clover

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SCIENTIFIC NAME	COMMON NAME
FABACEAE	**LEGUME FAMILY**
Trifolium variegatum	White-tip clover
Trifolium willdenovii	Tomcat clover
Vicia americana	American vetch
*Vicia sativa**	Common vetch
*Vicia villosa**	Winter vetch
FAGACEAE	**OAK FAMILY**
Notholithocarpus densiflorus	Tanoak
Quercus chrysolepis	Canyon live oak
Quercus douglasii	Blue oak
Quercus kelloggii	Black oak
Quercus lobata	Valley oak
Quercus wislizeni	Interior live oak
Quercus x morehus	Oracle oak
GENTIANACEAE	**GENTIAN FAMILY**
Zeltnera muehlenbergii	Muehlenberg's centary
GERANIACEAE	**GERANIUM FAMILY**
*Erodium botrys**	Filaree
*Erodium cicutarium**	Filaree
*Geranium dissectum**	Cut-leaved geranium
*Geranium molle**	Hairy geranium
GROSSULARIACEAE	**GOOSEBERRY FAMILY**
Ribes roezlii	Sierra gooseberry
HYDRANGEACEAE	**HYDRANGEA FAMILY**
Philadelphus lewisii	Lewis' mock orange
HYPERICACEAE	**ST. JOHN'S WORT FAMILY**
*Hypericum perforatum**	Klamath weed

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SCIENTIFIC NAME	COMMON NAME
IRIDACEAE	**IRIS FAMILY**
*Iris hartwegii**	Rainbow Iris
Sisyrinchium bellum	Blue eyed grass
ISOETACEAE	**QUILLWORT FAMILY**
Isoetes sp.	Quillwort
JUGLANDACEAE	**WALNUT FAMILY**
Juglans californica	California black walnut
JUNCACEAE	**RUSH FAMILY**
Juncus balticus	Baltic rush
Juncus bufonius	Toad rush
Juncus effusus	Soft rush
Juncus tenuis	Poverty rush
Luzula comosa	Common wood rush
Luzula subcongesta	Donner wood rush
JUNCAGINACEAE	**ARROW-GRASS FAMILY**
Triglochin scilloides	Flowering quillwort
LAMIACEAE	**MINT FAMILY**
*Marrubium vulgare**	Common horehound
*Melissa officinalis**	Bee balm
*Mentha pulegium**	Pennyroyal
Monardella brewerii	Brewer's monardella
Monardella odoratissima ssp. *glauca*	Follett's monardella
Monardella sheltonii	Shelton's monardella
Monardella villosa	Coyote mint
Prunella vulgaris	Common self heal
Scutellaria californica	California skullcap
Scutellaria tuberosa	Danny's skullcap
Stachys rigida	Rough Hedgenettle

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SCIENTIFIC NAME	COMMON NAME
LAURACEAE	**LAUREL FAMILY**
Umbellularia californica	California bay
LILIACEAE	**LILY FAMILY**
Calochortus albus	White globe lily
Calochortus monophyllus	Yellow star tulip
Calochortus superbus	Yellow mariposa
Calochortus venustus	Butterfly mariposa lily
Fritillaria affinis	Checker lily
Lilium humboldtii ssp. *humboldtii*	Humboldt's lily
Lilium parvum	Sierra tiger lily
LIMNANTHACEAE	**MEADOWFOAM FAMILY**
Limnanthes alba	White meadowfoam
LINACEAE	**FLAX FAMILY**
*Linum bienne**	Narrow-leaved flax
LYTHRACEAE	**LOOSESTRIFE FAMILY**
*Lythrum hyssopifolia**	Hyssop loosestrife
MALVACEAE	**MALLOW FAMILY**
*Abutilon theophrasti**	velvet leaf
*Malva parviflora**	Cheeseweed
Sidalcea calycosa ssp. *calycosa*	Annual checker-mallow
Sidalcea gigantea	Giant checkerbloom
MELANTHIACEAE	**FALSE-HELLEBORE FAMILY**
Trillium sp.	Wakerobin
MONTIACEAE	**MINER'S LETTUCE FAMILY**
Calandrinia ciliata	Red maids
Montia fontana	Fountain miner’s-lettuce

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SCIENTIFIC NAME	COMMON NAME
MORACEAE	**FIG FAMILY**
*Ficus carica**	Common fig
MYRSINACEAE	**MYRSINE FAMILY**
*Lysimachia arvensis**	Scarlet pimpernel
OLEACEAE	**OLIVE FAMILY**
Fraxinus latifolia	Oregon ash
ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Clarkia biloba ssp. *brandageeae*	Brandagee's clarkia
Clarkia gracilis ssp. *gracilis*	Graceful clarkia
Clarkia purpurea ssp. *purpurea*	Four-spot clarkia
Clarkia purpurea ssp. *quadrivulnera*	Winecup clarkia
Clarkia unguiculata	Elegant clarkia
Epilobium brachycarpum	Annual fireweed
Epilobium campestre	Smooth spike primrose
Epilobium ciliatum	Fringed willowherb
Epilobium densiflorum	Dense-flower spike primrose
Epilobium foliosum	California willowherb
Epilobium torreyi	Brook spike primrose
ORCHIDACEAE	**ORCHID FAMILY**
Piperia elongata	Dense flowered reinorchid
Spiranthes romanzoffiana	Hooded ladies tresses
OROBANCHACEAE	**BROOMRAPE FAMILY**
Castilleja applegatei ssp. *pinetorum*	Wavy leaf indian paintbrush
Castilleja attenuata	Valley tassels
Castilleja exserta	Purple owl's-clover
Cordylanthus pilosus	Hairy bird's beak
Cordylanthus tenuis	Slender bird's beak
Tryphysaria eriantha	Butter 'n' eggs

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SCIENTIFIC NAME	COMMON NAME
OXALIDACEAE	**OXALIS FAMILY**
Oxalis corniculata	Creeping woodsorrel
PAPAVERACEAE	**POPPY FAMILY**
Eschscholzia caespitosa	Foothill poppy
Eschscholzia californica	California poppy
Eschscholzia lobbii	Frying pan poppy
Platystemon californicus	Cream cups
PHRYMACEAE	**LOPSEED FAMILY**
Mimulus angustatus	Narrow leaved pansy monkeyflower
Mimulus cardinalis	Scarlet monkeyflower
Mimulus guttatus	Seep monkeyflower
Mimulus kelloggii	Kellogg's monkeyflower
Mimulus tricolor	Tri-color monkeyflower
PINACEAE	**PINE FAMILY**
Pinus lambertiana	Sugar pine
Pinus ponderosa	Ponderosa pine
Pinus sabiniana	Gray pine
Pseudotsuga menziesii	Douglas-fir
PLANTAGINACEAE	**PLANTAIN FAMILY**
Callitriche heterophylla	Larger water-starwort
Callitriche marginata	Winged water-starwort
Collinsia heterophylla	Purple Chinese houses
Collinsia sparsiflora	Few flowered collinsia
Collinsia tinctoria	Tincture plant
*Digitalis purpurea**	Foxglove
Keckiella breviflora	Bush beardtongue
Keckiella breviflora var. *glabrisepala*	Hairless gaping keckiella
*Kickxia elatine**	Sharp leaved fluellin
Penstemon heterophyllus	Foothill penstemon

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SCIENTIFIC NAME	COMMON NAME
PLANTAGINACEAE	**PLANTAIN FAMILY**
Plantago erecta	Plantain
*Plantago lanceolata**	English plantain
*Plantago major**	Common plantain
*Veronica anagallis-aquatica**	Water speedwell
Veronica peregrina ssp. *xalapensis*	Purslane speedwell
*Veronica persica**	Bird's eye speedwell
POACEAE	**GRASS FAMILY**
*Aegilops triuncialis**	Barbed goatgrass
*Aira caryophyllea**	Hairgrass
Alopecurus aequalis	Short awned foxtail
*Anthoxanthum odoratum**	Sweet vernal grass
*Arrhenatherum elatius**	Tall oatgrass
*Avena barbata**	Slender wild oat
*Avena fatua**	Wild oat
*Briza maxima**	Big quaking grass
*Briza minor**	Little quaking grass
*Bromus arenarius**	Australian brome
Bromus carinatus	California brome
*Bromus diandrus**	Ripgut brome
*Bromus hordeaceus**	Soft brome
Bromus madritensis ssp. *rubens**	Red brome
Bromus orcuttianus	Orcutt's brome
*Bromus sterilis**	Poverty brome
*Bromus tectorum**	Cheatgrass
*Cynodon dactylon**	Bermuda grass
*Cynosurus echinatus**	Hedgehog dog-tail grass
*Dactylis glomerata**	Orchard grass
Deschampsia danthonioides	Annual hairgrass
*Elymus caput-medusae**	Medusahead grass
Elymus elymoides	Squirreltail

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SCIENTIFIC NAME	COMMON NAME
POACEAE	**GRASS FAMILY**
Elymus glaucus	Blue wild-rye
Festuca microstachys	Small fescue
*Festuca myuros**	Rat-tail vulpia
Festuca occidentalis	Western fescue
*Festuca perennis**	Italian Ryegrass
Gastridium phleoides	Nit grass
*Holcus lanatus**	Velvet grass
Hordeum marinum ssp. *gussoneanum**	Mediterranean barley
*Hordeum murinum**	Barley
Melica imperfecta	California melica
Melica torreyana	Torry's melica
Muhlenbergia rigens	Deergrass
Panicum acuminatum	Western panicgrass
*Paspalum dilatatum**	Dallis grass
*Phalaris aquatica**	Harding grass
*Poa annua**	Annual bluegrass
*Poa bulbosa**	Bulbous bluegrass
Poa howellii	Howell's bluegrass
*Poa nemoralis**	Wood bluegrass
*Poa pratensis**	Kentucky bluegrass
Poa secunda	Perennial bluegrass
*Polypogon monspeliensis**	Annual rabbit-foot grass
*Triticum aestivum**	Cultivated wheat
POLEMONIACEAE	**PHLOX FAMILY**
Collomia heterophylla	Variable leafed collomia
Gilia capitata	Bluehead gilia
Gilia tricolor	Bird’s eye gilia
Leptosiphon bicolor	Linanthus
Navarretia intertexta	Needleleaf navarretia
Navarretia pubescens	Purple navarretia

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SCIENTIFIC NAME	COMMON NAME
POLEMONIACEAE	**PHLOX FAMILY**
Navarretia tagetina	Marigold navarretia
POLYGALACEAE	**MILKWORT FAMILY**
Polygala cornuta var*. cornuta*	Sierra milkwort
POLYGONACEAE	**BUCKWHEAT FAMILY**
Eriogonum nudum	Naked buckwheat
Persicaria amphibia	Water smartweed
*Polygonum aviculare**	Prostrate knotweed
*Rumex acetosella**	Sheep sorrel
*Rumex crispus**	Curly dock
*Rumex pulcher**	Fiddle dock
Rumex salicifolius	Willow dock
POLYPODACEAE	**POLYPOD FAMILY**
Polypodium calirhiza	Licorice fern
PORTULACEAE	**PURSLANE FAMILY**
Claytonia parviflora ssp*. parviflora*	Narrow leaved miner's lettuce
Claytonia perfoliata	Miner’s lettuce
PRIMULACEAE	**PRIMROSE FAMILY**
Lysimachia latifolia	Western star flower
PTERIDACEAE	**BRAKE FAMILY**
Adiantum jordanii	California maidenhair
Myriopteris gricillima	Lace lip fern
Pellaea mucronata	Bird's foot fern
Pentagramma triangularis	Goldenback fern
Pteridium aquilinum	Western brakenfern
RANUNCULACEAE	**BUTTERCUP FAMILY**
Aquilegia formosa	Columbine

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SCIENTIFIC NAME	COMMON NAME
RANUNCULACEAE	**BUTTERCUP FAMILY**
Clematis lasiantha	Chaparral clematis
Delphinium gracilentum	Meadow larksur
Ranunculus aquatilis	White water buttercup
Ranunculus bonariensis var. *trisepalus*	Carter's buttercup
Ranunculus californicus	Buttercup
*Ranunculus muricatus**	Spiny-fruit buttercup
Ranunculus occidentalis	Western buttercup
Thalictrum fendleri	Fendler's meadow rue
RHAMNACEAE	**BUCKTHORN FAMILY**
Ceanothus cuneatus	Buck brush
Ceanothus integerrimus	Deer brush
Ceanothus lemmonii	Lemon’s ceanothus
Frangula californica	Coffeeberry
Frangula californica ssp. *tomentella*	Hoary coffeeberry
Frangula rubra	Red buckthorn
Rhamnus ilicifolia	Holly-leaf redberry
ROSACEAE	**ROSE FAMILY**
Amelanchier alnifolia	Serviceberry
Aphanes occidentalis	Western lady's mantle
Cercocarpus betuloides var. *betuloides*	Mountain mahogany
Chamaebatia foliolosa	Mountain misery
*Crataegus monogyna**	Hawthorn
Drymocallis glandulosa	Sticky cinquefoil
Fragaria vesca	California strawberry
Heteromeles arbutifolia	Toyon
*Malus pumila**	Apple (cultivated)
Physocarpus capitatus	Ninebark
*Prunus armeniaca**	Apricot (cultivated)
*Prunus avium**	Sweet cherry
*Prunus cerasifera**	Cherry plum

Centennial Reservoir Project:
Plant Species Observed On-Site
(11-13, 17-19, and 31 May, 7 and 8 June, and 12-15, 18-22, and 26 July 2016; 2-5 May and 27-29 June 2017)

An Asterisk (*) indicates a non-native species.

SCIENTIFIC NAME	COMMON NAME
ROSACEAE	**ROSE FAMILY**
*Prunus dulcis**	Almond (cultivated)
Prunus emarginata	Western choke cherry
Prunus subcordata	Sierra plum
Prunus virginiana ssp. *demissa*	Western choke cherry
Rosa californica	California rose
Rosa gymnocarpa	Dwarf rose
*Rubus armeniacus**	Himalayan blackberry
Rubus leucodermis	White stemmed raspberry
Rubus ursinus	California blackberry
*Sanguisorba minor**	Small burnet
RUBIACEAE	**MADDER FAMILY**
Cephalanthus occidentalis	Common buttonbush
Galium aparine	Goose grass
*Galium parisiense**	Wall bedstraw
Galium porrigens	Climbing bedstraw
*Sherardia arvensis**	Field madder
RUSCASEA	**BUTCHER'S BROOM FAMILY**
Maianthemum racemosum	Feathery false lily of the valley
SALICACEAE	**WILLOW FAMILY**
Populus fremontii	Fremont's cottonwood
Populus trichocarpa	Black cottonwood
*Salix babylonica**	Weeping willow
Salix exigua	Sandbar willow
Salix gooddingii	Goodding's black willow
Salix laevigata	Red willow
Salix lasiandra	Pacific willow
Salix lasiolepis	Arroyo willow

Centennial Reservoir Project:
Plant Species Observed On-Site
(11-13, 17-19, and 31 May, 7 and 8 June, and 12-15, 18-22, and 26 July 2016; 2-5 May and 27-29 June 2017)

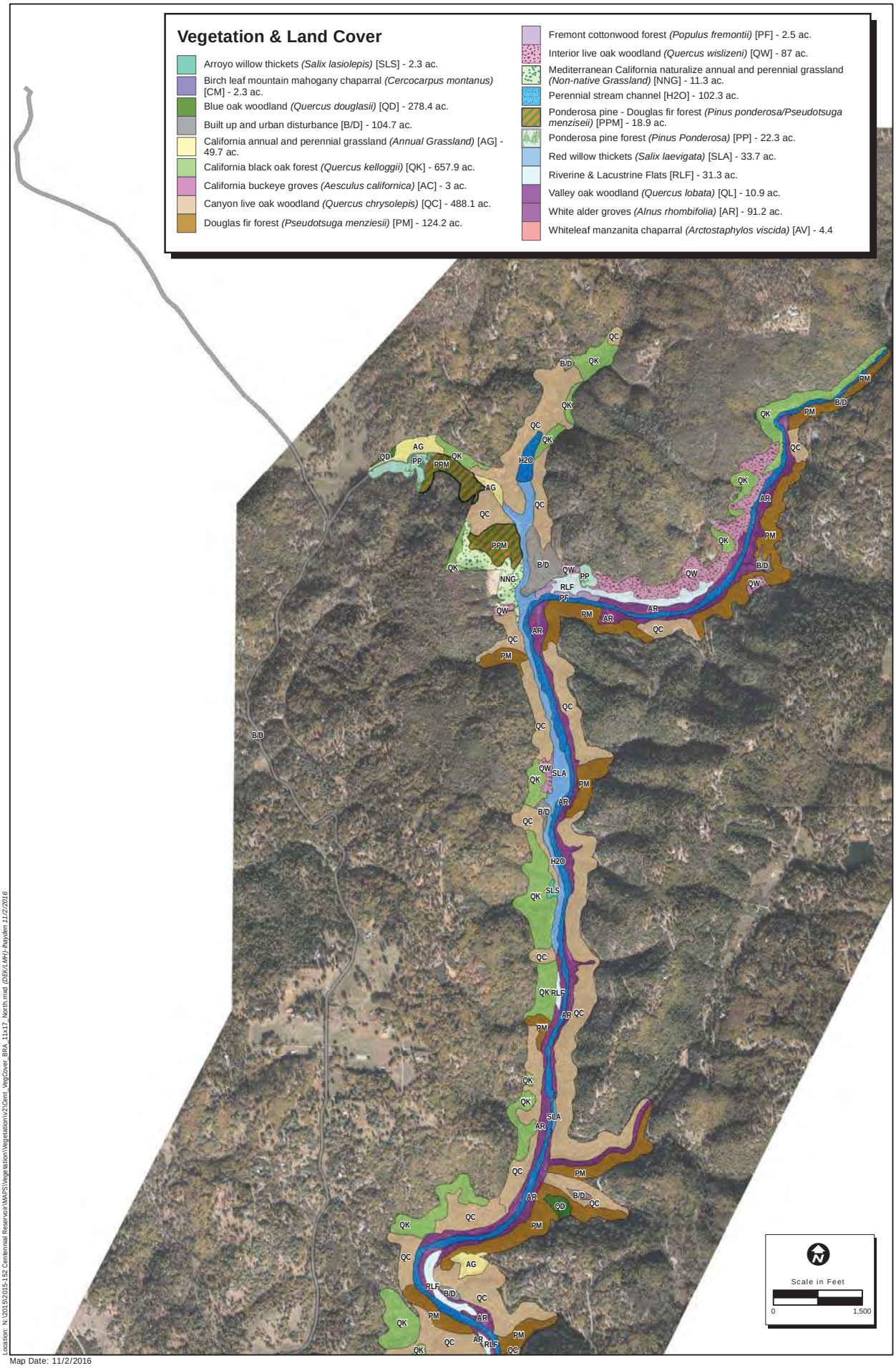
An Asterisk (*) indicates a non-native species.

SCIENTIFIC NAME	COMMON NAME
SAPINDACEAE	**SOAPBERRY FAMILY**
Acer macrophyllum	Big leaf maple
Aesculus californica	California buckeye
SAXIFRAGACEAE	**SAXIFRAGE FAMILY**
Darmera peltata	Indian rhubarb
Heuchera micrantha	Alum root
Lithophragma bolanderi	Bolander's woodland star
SCROPHULARIACEAE	**FIGWORT FAMILY**
*Verbascum blattaria**	Moth mullein
*Verbascum thapsus**	Common mullein
SELAGINELLACEAE	**SPIKEMOSS FAMILY**
Selaginella sp.	Spikemoss
SIMAROUBACEAE	**QUASSIA FAMILY**
*Ailanthus altissima**	Tree-of-heaven
SOLANACEAE	**NIGHTSHADE FAMILY**
*Datura stramonium**	Jimson weed
Solanum sp.	Nightshade
TECOPHILAEACEAE	**TECOPHILAEA FAMILY**
Odontostomum hartwegii	Hartweg's odontostomum
THEMIDACEAE	**BRODIAEA FAMILY**
Brodiaea elegans	Harvest brodiaea
Brodiaea minor	Dwarf brodiaea
Dichelostemma capitatum	Blue dicks
Dichelostemma congestum	Fork toothed ookow
Dichelostemma multiflorum	Wild hyacinth
Dichelostemma volubile	Twining brodiaea
Triteleia bridgesii	Bridge's brodiaea

Centennial Reservoir Project:
Plant Species Observed On-Site
(11-13, 17-19, and 31 May, 7 and 8 June, and 12-15, 18-22, and 26 July 2016; 2-5 May and 27-29 June 2017)

An Asterisk (*) indicates a non-native species.

SCIENTIFIC NAME	COMMON NAME
THEMIDACEAE	**BRODIAEA FAMILY**
Triteleia hyacinthina	Hyacinth brodiaea
Triteleia laxa	Ithuriel's spear
TYPHACEAE	**CATTAIL FAMILY**
Typha latifolia	Broad-leaf cattail
VALERIANACEAE	**VALERAIN FAMILY**
Plectritis congesta	Shortspur seablush
VERBENACEAE	**VERBENA FAMILY**
Verbena lasiostachys	Common verbena
VIOLACEAE	**VIOLET FAMILY**
Viola lobata	Pine violet
VITACEAE	**GRAPE FAMILY**
Vitis californica	California wild grape
WOODSIACEAE	**CLIFF FERN FAMILY**
Athyrium filix-femina	Common ladyfern
Crystopteris fragilis	Bladder fern



Location: N:\2015\2015-152 Centennial Reservoir\MAPS\Vegetation\Vegetation\v2\Cent_VegCover_BRA_11x17_North.mxd (DEK/LMH)-hayden 11/2/2016

Map Date: 11/2/2016

Figure 2a. Vegetation Alliances and Land Cover Types - North

2015-152 Centennial Reservoir

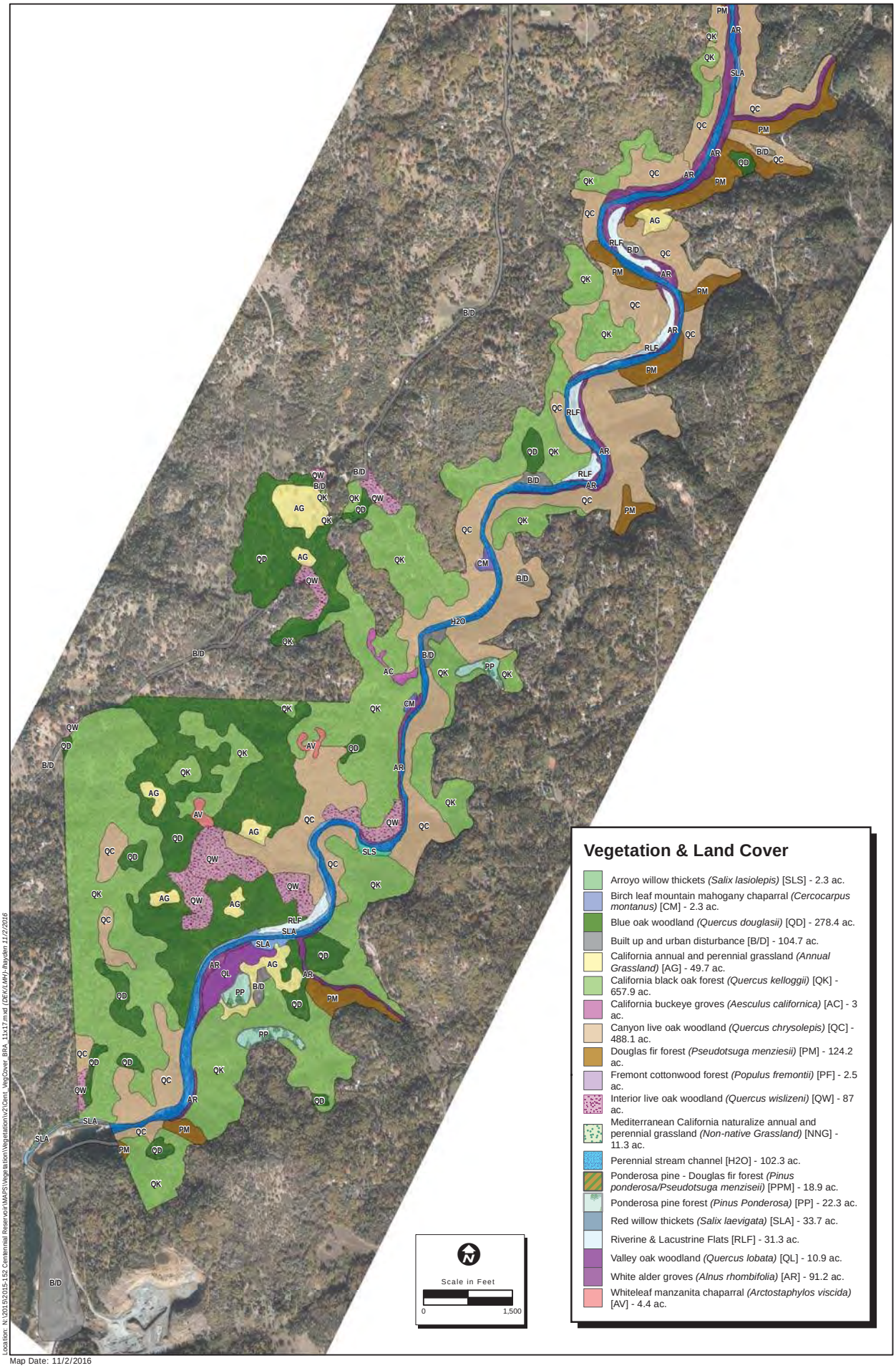


Figure 2b. Vegetation Alliances and Land Cover Types - South

2015-152 Centennial Reservoir

Priority 16: Enhance habitat for native species that have commercial, recreational, scientific, or educational uses

REV 2: Magnitude of ecosystem improvements

What is the expected magnitude of the ecosystem improvement that will address this priority? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value?

The Proposed Project is anticipated to create enhanced habitat for native terrestrial and aquatic species, which would result in enhanced recreational opportunities such as fishing, camping, hiking, and birding. As illustrated in the Eligibility and General Project Information Tab, A.3 Project Description, the proposed project would create a new reservoir along the Bear River with a storage capacity of 110,000 acre-feet and a maximum inundation area of approximately 1,300 acres. The proposed Centennial Reservoir would operate as a "fill-and-spill" project, with a goal of maximizing reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID's existing reservoir network to provide water to customers in NID's lower Bear River watershed service area. During the majority of years and as hydrologic conditions allow, Centennial Reservoir would be operated at or near its full gross storage (110,000 acre-feet) throughout the year, with any seasonal drawdowns due to minimum instream flow requirements and evaporative losses. In the fall and early winter, Centennial Reservoir would store any watershed runoff (in excess of minimum instream flow requirements) in order to return the reservoir to full pool.

Approximately 1,300 acres of open water habitat created by the proposed project during maximum pool conditions would replace approximately 175 acres (Bear River [169.534 ac]; Ponds [5.218 ac]) of open waters identified in the wetland delineation survey of the projected area of inundation. Although the proposed project would inundate riverine habitat, the project would create up to 1,300 acres of lacustrine habitat that would provide enhanced native fisheries habitat and would be stocked for recreational purposes.

The enhanced terrestrial and aquatic habitats for recreational opportunities would exist upon proposed project construction through the lifetime of the reservoir (i.e. beyond 2030).

Without the proposed project these habitats would remain in their current state, which is lacking in recreational value. The only recreational facility in the area is the Bear River Campground, which includes 23 family campsites and 2 group campsites. Recreational fishing along the river is limited because access to the river is only available through the Bear River Campground. The Proposed Project would substantially increase recreational opportunities in the regional area, as described in detail in Physical Public Benefits Tab, Recreation Benefits Q.1, Q.2, Q.3.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.

Physical Public Benefits Tab, Recreation Benefits Q.1, Q.2, Q3.

REV 3: Spatial and temporal scale of ecosystem improvements.

What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?

The proposed reservoir at maximum pool would inundate approximately 1,300 acres. Therefore, the proposed project would create up to 1,300 acres of lacustrine habitat that could provide enhanced native fisheries habitat for recreational purposes.

Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.

When during the year will the project enhance habitat for native species that have commercial, recreational, scientific or educational uses? How is habitat for native species likely to vary with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project?

The proposed reservoir would create year-round habitat to warm and cool water fish species of recreational value, specifically trout. During the majority of years and as hydrologic conditions allow, Centennial Reservoir is anticipated to be operated at or near its full gross storage (110,000 acre-feet) throughout the year, with any seasonal drawdowns due to minimum instream flow requirements and evaporative losses. In the fall and early winter, Centennial Reservoir would store any watershed runoff (in excess of minimum instream flow requirements) in order to return the reservoir to full pool.

During a dry year, Centennial Reservoir storage would be used to augment the reliability of NID's water supply in the Bear River

watershed. Seasonal drawdown would vary based on the severity of the annual (or multi-year) drought condition.

Seasonal Releases - Releases from Centennial Reservoir would vary by season and hydrologic year type and would consist of a combination of the minimum requirement environmental flows (yet to be established), discretionary releases for water supply, and spill. Seasonally, flows in the Bear River below Centennial Reservoir are expected to peak in the late summer as water deliveries are passed through Centennial Reservoir (via Rollins Reservoir) for delivery to Lake Combie and NID's Phase I Canal. In most years, winter and spring spill can be anticipated to reach Combie Reservoir during heavy rain events in the Bear River watershed. The lowest seasonal releases from Centennial Reservoir would occur during the late fall through early winter in most years, as the reservoir refills from any mid-year drawdown and as downstream water delivery demands wane.

Although reservoir conditions may vary slightly year to year as a result of seasonal hydrological conditions, the aquatic habitat that would support native fisheries resources is expected to remain stable. Thus, with the proposed project there is the potential to create up to 1,300 acres of lacustrine habitat that would provide enhanced native fisheries habitat for recreational purposes. These enhanced native fisheries would exist through the lifetime of the project (i.e. beyond 2030). Without the project, the river channel would remain the same and there would only be 175 acres of aquatic habitat available.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.

REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.

Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.

The Federal and State permitting processes preceding CEQA and NEPA certification and final project approval will be extensive. NID shall coordinate with USFWS and California DFW to prepare adaptive management and monitoring programs to address federally and state-listed plant and animal species potentially affected by the proposed project as well as native fisheries management. Given that the project is in the early stages of planning and environmental review, such programs have yet to be developed.

REV 5: Immediacy of ecosystem improvement actions and realization of benefits

Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).

Approximately 36 months. It is estimated that the project would take two to three years to construct the facilities. Upon completion of construction, the period of time to fill the reservoir is estimated to range up to three years. The full benefits (up to 1,300 acres) for the establishment of enhanced native fish habitat would be realized upon attaining reservoir maximum pool.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.

Refer to Priority Form #4 for further description.

Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)

Approximately 0 months. The ecosystem improvement opportunity for enhanced native fisheries habitat would be established immediately in the first year in which the reservoir is filled. As stated above, it is anticipated that upon completion of construction, the period of time to fill the reservoir is estimated to range up to three years. The full benefits (up to 1,300 acres) for the establishment of enhanced native fish habitat would be realized upon attaining reservoir maximum pool.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.

REV 6: Duration of ecosystem improvements

How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
100 years. The reservoir and related facilities are expected to be permanent and with appropriate maintenance would last for 100 years. Reservoir operations under the proposed project are envisioned to continue for the foreseeable future. With operation of the reservoir, the benefits of the proposed project for the purpose of creating habitat for native fish species would be ongoing.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?
The 2014 California Water Action Plan was developed to meet three broad objectives: "*more reliable water supplies, the restoration of important species and habitat, and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades.*" A critical element in achieving these objectives is the creation of additional surface storage. As stated in the plan, "*The bottom line is that we need to expand our state's storage capacity, whether surface or groundwater, whether big or small. Today, we need more storage to deal with the effects of drought and climate change on water supplies for both human and ecosystem needs.*" Opportunities for the development of a major on-stream surface storage project in California are limited as evidenced by the fact that it has been 40 years since the last such project was completed. Centennial reservoir presents an ideal opportunity for developing new significant surface storage. The project is located on a highly regulated reach of the Bear River located between two existing reservoirs (Combie and Rollins) located immediately downstream and upstream, respectively, of the Centennial site.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.
Refer to the Eligibility and General Project Information Tab, A.3 Project Description Figures and Figure 1: Approximate Location of Potential Ecological Benefits included with Priority Form #14.
Explain why this location was selected. How is the location of enhanced habitat beneficial in the context of local environmental conditions?
As described above, the location being evaluated for Centennial Reservoir would effectively work in conjunction with NID's existing Rollins Reservoir to expand the total storage capability in the Bear River watershed. This use would allow additional water to be captured from natural runoff in the Bear River watershed (both the runoff in excess of what Rollins Reservoir can store on a seasonal basis as well as the runoff in the sub-basin below the Rollins Dam catchment) for the purpose of maximizing reservoir storage during the winter and early spring runoff period to provide water to customers in NID's lower Bear River watershed service area. Reservoir creation in this location would substantially alter the hydrology of upland areas that have the topography and soils conditions to support wetland habitat, but not the water source. Although enhanced native fish habitat is inherent to project implementation, it is not the primary factor in siting the proposed project.

Is the ecosystem improvement location adjacent to, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The project is not located near other areas currently being managed for conservation values related to native fisheries. However, as stated in Priority Form #15, NID in partnership with the California Division of Boating and Waterways (CDBW) and CDFW, is developing an Aquatic Invasive Species Program. The program would focus on Quagga and Zebra Mussels, which pose a serious threat to state waters and fisheries and the spread of these mussels threatens aquatic ecosystems, water delivery systems, hydroelectric facilities, agriculture, and recreation. In 2017 the program would include water chemistry monitoring, visual surveys, boat inspections, and the development of a Quagga and Zebra Mussel Prevention and Monitoring Plan. It is assumed that once the Aquatic Invasive Species Program is developed it would be implemented at the proposed project site as well as at Rollins and Combie reservoirs, which are located immediately upstream and downstream of the Centennial Reservoir site, respectively.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the spatial extent of the ecosystem improvement, the proximity of the ecosystem improvement to other areas already being protected or managed for conservation value, and the degree to which hydrologic connections (if any) occur between the ecosystem improvement and areas already being protected or managed for conservation value.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
If applicable, how will water provided to address this priority be managed? Explain design efficiencies and operational strategies intended to maximize the efficiency of water allocated to ecosystem improvements that address this priority.
Water will not be allocated specifically to maintain enhanced native fisheries for recreational purposes. However, based on the proposed operations for the Centennial Reservoir, efficiencies would be seen the majority of the year as described under REV 3 above.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.
REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
As noted under REV 7 above, the proposed project would help meet the statewide need for more surface water storage to help address the uncertainties of future drought and climate change and their effects on water supplies for both human and ecosystem needs. Centennial Reservoir presents an ideal opportunity for developing new significant surface storage. Also as stated above under REV 7 and 8, the area being evaluated for the proposed project is considered a suitable location along the Bear River since it would be located on an already regulated reach of the Bear River between two existing reservoirs. The ecosystem improvements related to enhanced native fisheries would result from coordination with California DFW to prepare adaptive management and monitoring programs to address native fisheries management for implementation after development of the Proposed Project.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Physical Public Benefits Tab

A.1: Recreation Benefits

RECREATION BENEFITS

Q.1 - If applicable, how will the project be operated to provide recreation benefits? If additional information to support this question is located in another attachment, provide the location.

The project will provide recreational opportunities and access at four developed recreation facilities at Centennial Reservoir, each of which will provide varying types of access to the reservoir and shoreline lands for reservoir-based and shoreline recreation opportunities, respectively. The facilities will be operated to provide year-round access and opportunities for overnight camping and day-use activities including picnicking, wildlife viewing, sightseeing, hiking, biking, swimming, fishing, low-speed motorized boating, and non-motorized boating.

Reservoir Lake Recreation. The project will provide both land-based shoreline recreation activities and on-water recreation opportunities. The project will provide four new developed recreation facilities that provide a variety of recreational activities and opportunities. The recreation facilities include Centennial Recreation Area (193 acres), Dog Bar Bridge Day Use Area (5 acres), Magnolia Ranch Birding Area (9 acres) and a recreational trail (3 acres) – all on NID land. Each of these facilities is described in detail in the response to Q.3 below. But, overall, the project will provide diverse overnight camping opportunities at the Centennial Recreation Area including RV sites with hookups as well as tent camping sites along or near the reservoir shoreline. The project will also include facilities that support a variety of day use activities including picnicking, wildlife viewing, sightseeing, educational opportunities, hiking, biking, swimming, and boat and shoreline fishing. Day use activities will be provided to varying degrees at all four of the project recreation facilities – each of which provides a slightly different setting and experience by facility. All of the facilities will be open year-round, publicly accessible by vehicle, and have appropriate sanitation facilities and meet current accessibility standards.

Regarding reservoir-based recreation, the project will allow reservoir boating albeit restricted to 5 mph. This boating policy was selected for four primary reasons, including: 1) for public safety due to the narrow reservoir setting; 2) to minimize audible sounds of recreation/boats to the surrounding residents and environment; 3) to provide a unique reservoir boating setting that contrasts with the higher speed boating reservoirs in the area (e.g., Rollins Reservoir, Folsom Reservoir, etc.); and 4) to provide a water-based setting that is more similar to the existing riverine setting of the proposed project site along the Bear River and relatively unique to the project area/vicinity. Boating uses will include low-speed motorized boating and non-motorized boating using canoes, kayaks, standup paddleboards, row boats, etc. To support these reservoir boating uses, the project will include a developed boat launch at Centennial Recreation Area on the west shoreline with a 2-lane launch ramp and parking for 50 vehicle plus trailer spaces and 75 single vehicle spaces. This facility will be the primary location for trailered launching but also provide access for cartop launching. In addition, a shoreline day use area (Dog Bar Bridge Day Use Area) on the east shoreline will provide parking and launching opportunities for small, non-motorized craft via shoreline access paths from the parking area.

Net Increase in Available Recreation Facilities. As noted below in Q.2 below, the project will result in the loss of one developed campground and day use facility and one undeveloped river access site. However, the project will provide a net increase in available recreation facilities overall (Table 1). Of note, only the overall length of the available recreational trails would be a net decrease with 1 to 2 less miles. However, the project's recreational trail will be a continuous 3-mile trail that also connects three of the four developed recreation facilities to be provided as well as connecting the Nevada and Placer county sides of the project reservoir via a pedestrian walkway abutting the new Dog Bar Road bridge.

The trail will also include an overlook with interpretive displays that highlight the area's biological resources, history and the project's purpose and benefits. In contrast, the existing 4 to 5 miles of trail within the Bear River Park and Campground are not continuous, only provide trail access and connections within the facility, and does not have an overlook or scenic vista.

Table 1. Change in available recreation facilities and opportunities.

Type of Facility	Amenities	Existing/Inundated Facilities*	project	Net Change
Camping Facilities	Family	23	100	+77
	Group Campsites	2	3	+1
	Group Capacity (people)	100	175	+75
	RV Hookups	0	100	+100
	RV Dump Station	0	1	+1
	Toilet Type	pit	vault	n/a
Day Use Areas	Shoreline facilities	2	3	+1
	Boat Ramp	0	1	+1
	Parking Spaces	72	145	+73
	Toilet Type	pit	vault	n/a
	Picnic Sites	0	5	+5
	Store	0	1	+1
Trails	Trail Length (miles)	4 to 5	3	-1 to -2
	Trailhead Parking	0	10	+10
	Overlook/Vista	no	yes	n/a
	Connects to Other Facilities	no	yes	n/a
	Connects Placer & Nevada Counties	no	yes	n/a

* These facilities will be inundated.

Enhanced Surface Water Recreation on Other Nearby Reservoirs. The operation of the project would be coordinated with Rollins Reservoir upstream of the project. The coordinated operations would allow NID to reserve more water for storage in Rollins Reservoir, which would result in higher water-surface elevations and increased surface areas at Rollins Reservoir overall under existing conditions, 2030 conditions and 2070 conditions. In particular, during the peak recreation season (May through September), both the water-surface elevations and the surface area of Rollins Reservoir would improve with the operation of the project. This improvement represents a beneficial effect on Rollins Reservoir recreation since higher water levels and surface area generally equate to improved recreation experiences and better conditions for water-based recreation activities and access to the shoreline for shore-based activities.

Centennial Reservoir will also provide different and unique reservoir-based recreational opportunities and settings overall as compared to the other reservoirs in the project vicinity. As such, the project would not provide a practical alternative to the existing recreation areas in the vicinity and is not likely to impact the recreation use at the other area reservoirs and recreation areas. Specifically, the proposed Centennial Reservoir will provide a reservoir-wide low-speed (up to 5 mph) reservoir boating setting, which is very different than the other nearby reservoirs that offer higher speed reservoir boating opportunities. For comparison, Rollins Reservoir allows boating speeds up to 50 miles per hour and Combie Reservoir and Lake of the Pines Reservoir provide for speeds up to 35 miles per hour – all of which with only provide select low-speed boating zones in coves and inlets. These higher

speed reservoirs are more compatible with water skiing, wakeboarding and jet skiing, which would not be permitted at the project reservoir. In comparison, Centennial Reservoir's low-speed boating setting is best suited for boat-based fishing and particularly non-motorized boating uses (e.g., canoeing, kayaking and stand up paddleboarding). Beyond the different boating settings, both Combie and Lake of the Pines reservoirs are essentially only accessible to private residents along the reservoir shorelines, whereas Centennial Reservoir would be publicly accessible. Rollins Reservoir is a publicly accessible reservoir, but it provides a high density recreation setting with four highly developed recreation complexes that each offer camping, shoreline day use and boating facilities. In all, Rollins Reservoir provides 332 campsites, four 2-lane concrete boat launches, parking for 415 vehicles, flush toilet buildings, two marinas, and two general stores. In contrast, the project is intended to provide modern developed recreational facilities, but with a lower-density experience in a narrow, low-speed boating reservoir setting with similar types of recreational opportunities to what is currently available at the proposed project site.

Q.2 - By providing new recreation benefits, does the proposed project negatively affect any existing recreation activities either at the proposed project site, at another facility, or nearby recreation area? (TR section 4.10.1.1)

Recreation Losses Due to Inundation. The project would result in the inundation of approximately seven miles of the nine total miles of the Bear River between Rollins and Combie reservoirs. As such, the project would result in a predominantly reservoir-based recreation opportunity rather than river-based; and would substantially reduce the river-based recreation opportunities and uses such as river angling, gold panning, river swimming, whitewater boating or floating/tubing in the project area. Opportunities in the project area would still exist for these river-based uses upstream of the project for approximately 1.5 miles to Rollins Reservoir at Highway 174. Outside of the project area, locations for river-based uses are prevalent along both the Bear River upstream of Rollins Dam within a 5 to 20 mile radius from the upstream end of the project; on the North and Middle Fork American River drainages to the east of the project within a 5 to 10 mile radius; and on the South Yuba River to the north of the project within a 20 mile radius.

In addition, the project would eliminate one existing developed recreation facility (Bear River Park and Campground) due to inundation of the Bear River. This facility is located on the Placer County side of the Bear River along the shoreline and provides 23 family campsites with very limited RV access, pit toilets; two group campsites (50 people each) with pit toilets; a day use area with parking and pit toilets; and recreational trails (Table 3). In addition, a single, undeveloped recreation site will also be inundated by the project at the Dog Bar Road bridge crossing. This site provides a popular but limited access to the Bear River via approximately eight single vehicle pullouts along Dog Bar Road, where direct access to the river occurs via several informal trails.

Table 3. Recreation Facilities or Sites that Would Be Inundated and Need to Be Replaced.

Inundated Facility	Camping Facilities	Day Use Facilities	Trails
Bear River Park and Campground	23 family campsites with vault toilets 2 group campsites (50 people each) with vault toilets	Shoreline access area Parking area Vault toilets	4-5 miles of native surface hiking trails
Dog Bar Road Bridge crossing	None	Informal river access with roadside parking (approx. 8 pullouts) No toilets	Informal river access trails

Whitewater Boating

The project would inundate the Bear River where two existing whitewater boating runs currently exist. These include the upper run, a 2.3-mile segment between Highway 174 and Ben Taylor Road (Class III to IV+ run); and the lower run, a 9.5-mile segment from Ben Taylor Road to Combie Reservoir (a beginner run with some Class II rapids) (Holbeck and Stanley 1998).

First, the project would only partially impact the upper run since the first 1.5 miles of the run would not be inundated by the project. Based on NID's 2011 Yuba-Bear Hydroelectric Project Recreational Flow Study that included this run, the run has a local demand, is a good Class IV+ reach with two solid rapids, and is primarily utilized in late summer/fall as spring boaters would likely go elsewhere (NID 2011). Overall, this reach is available throughout the year, but is not as high quality as other reaches in the vicinity or region. Overall, while this whitewater run is significant within the project vicinity, it is not regionally significant due to the presence of other Class III-IV whitewater runs in the region with much higher demand, particularly the 4.2-mile Edwards Crossing to Purdons Crossing run on the South Yuba River and the 16.5-mile Tunnel Run on the Middle Fork of the American River (NID 2011). Both of these offer longer runs with substantially more whitewater features/challenges also for a wide variety of craft types.

Second, the project would inundate the entire lower run from Ben Taylor Road downstream to Dog Bar Road bridge. Overall, this is a beginner run with some Class II rapids, but has little demand for whitewater boating and is primarily a river segment used for floating or tubing stretches adjacent to the Ben Taylor Road access, Bear River Park and Campground area and the Dog Bar Road bridge area (NID 2011). Overall, the impact to this run would be less than significant for whitewater boating given the lack of whitewater features and demand.

Other River-Dependent Uses

The project would result in the loss of areas for other river-dependent uses such as river angling, river swimming and gold panning. Areas for river angling and swimming would be substantially reduced in the inundation area but, general angling and swimming would be provided or available in a reservoir setting with the project reservoir. In contrast, areas for gold panning would also be substantially reduced by the inundation for the project but would not be available in a reservoir setting since it is entirely river-dependent. However, areas for all three of these uses (gold panning, river angling and river swimming) are still widespread and available elsewhere upstream of the project on the Bear River (immediately below Rollins Reservoir, upstream of Rollins Reservoir), on the North and Middle Forks of the American River to the east of the project, and on the South Yuba River to the north of the project. In addition, angling under the existing conditions on the Bear River typically only occurs during the late spring and early summer months due to the rising temperatures and reduced flows that come in the summer months (NID 2011). The project may have a beneficial impact on angling by providing a more consistent and longer period for angling in the reservoir setting as compared to the riverine setting.

River-Based Uses

Other river-based, but not river-dependent recreational uses would also be substantially reduced in a riverine setting with the inundation of the project. These uses include camping, picnicking, trail use, and wildlife viewing/nature observation. However, the project would replace the lost facilities and opportunities with the construction of new recreation facilities and shoreline access sites albeit in a reservoir setting. The new camping and day use facilities and opportunities would provide similar opportunities, but in a reservoir/flat-water setting. At times, the uses would be substantially farther from the shoreline than under existing riverine conditions given the draw down anticipated for the project reservoir. This may affect visitor experiences and potentially willingness to participate in

recreation at times of significant reservoir draw down. Although the project would reduce recreation opportunities within the Bear River, the project would provide some entirely new opportunities such as flat-water boating, modern RV campsites, and longer, contiguous shoreline trail opportunities with multiple access points that would likely enhance the recreational experience.

While the above noted river-based uses and areas would be lost due to the implementation of the project, the new project recreation facilities will provide a beneficial impact by providing recreation facilities, opportunities and experiences that are important to Californians and in high demand as identified in the State of California Outdoor Recreation Plan (SCORP). In particular, of the 15 activities with the highest latent (unmet) demand in California, the project would provide opportunities for at least 10 of the activities, including: 1) picnicking in picnic areas; 2) walking for fitness or pleasure on paved surfaces; 3) camping in developed sites with facilities such as tables and toilets; 4) beach activities; 5) day hiking on unpaved trails; 6) wildlife viewing, bird watching, viewing natural scenery; 7) driving on paved surfaces for pleasure, sightseeing, driving through natural scenery; 8) swimming in fresh water lakes; 9) jogging and running for exercise (on trails, streets, sidewalks, paths); and 10) bicycling on paved surfaces (CDPR 2015). The project may also provide opportunities for two additional activities with high unmet demand, including attending outdoor cultural events and visiting historic or cultural sites. In addition, the 2015 SCORP identified the top four activities that most respondents would like to participate in more often -- picnicking (55.1%), walking (37.4%), camping (35.1%), and beach activities (34.6%) (CDPR 2015). The project provides opportunities to participate all four of these activities, including at multiple areas and in different settings within the project.

Impacts on Without-Project Recreation. Regarding potential impacts to other existing recreation areas in the project area, the project will provide different and unique reservoir-based recreational opportunities and settings overall as compared to the other reservoirs in the area and therefore the project would not provide a practical alternative or negatively affect the existing recreation areas. Specifically, the proposed Centennial Reservoir will provide a reservoir-wide low-speed (up to 5 mph) reservoir boating setting, which is very different than the other nearby reservoirs that offer higher speed reservoir boating opportunities. For comparison, Rollins Reservoir allows boating speeds up to 50 miles per hour and Combie Reservoir and Lake of the Pines Reservoir provide for speeds up to 35 miles per hour – all of which with only provide select low-speed boating zones in coves and inlets. These higher speed reservoirs are more compatible with water skiing, wakeboarding and jet skiing, which would not be permitted at the project. In comparison, Centennial Reservoir's low-speed boating setting is best suited for boat-based fishing and particularly non-motorized boating uses (e.g., canoeing, kayaking and stand up paddleboarding). Beyond the different boating settings, both Combie and Lake of the Pines reservoirs are essentially only accessible to private residents along the reservoir shorelines, whereas Centennial Reservoir would be publicly accessible. Rollins Reservoir is a publicly accessible reservoir, but it provides a high density recreation setting with four highly developed recreation complexes that each offer camping, shoreline day use and boating facilities.

Q.3 - Describe the proposed recreation physical benefits including the size of the facility, recreation activities allowed, recreation facilities associated with these activities, and their capacities and seasonal closures and conditions in which facilities are not usable or activities cannot occur. Any supporting analysis should be attached in A.1 below. (TR section 4.10.1.2)

NID will construct four new recreation facilities at Centennial Reservoir that would be open to the public year-round. Land-based recreation and reservoir access will be limited to these recreation facilities. The recreational facilities include Centennial Recreation Area, Dog Bar Bridge Day-use Area, Magnolia

Ranch Birding Area and a recreational trail. A summary of these facilities, the recreational uses, site capacities and open season are provided in Table 4 below.

Table 4. Project recreation facility size, uses, site capacities and open season.

Type of Facility	Facility Size (acres)	Open Season	Recreational Uses	Site Capacities
Centennial Recreation Area	125 acres	Year-round	• RV camping • Tent camping • Motorized boating • Non-motorized boating • Fishing • Swimming • Picnicking • Hiking • Biking • Wildlife viewing • Sightseeing	• 100 family campsites • 3 group campsites (175 persons) • 50 vehicle plus trailer spaces • 75 single vehicle spaces • 2-lane boat ramp • Swim beach • RV dump station • General store • Vault toilets
Dog Bar Bridge Day Use Area	2 acres	Year-round	• Picnicking • Swimming • Non-motorized boating • Wildlife viewing • Sightseeing • Interpretation and education • Fishing • Hiking • Biking	• 10 single vehicle spaces • 5 picnic sites • Vault toilet • Interpretive display
Magnolia Ranch Birding Area	2 acres	Year-round	• Wildlife viewing • Sightseeing • Interpretation and education	• 10 single vehicle spaces • 3 to 5 viewing platforms • Vault toilet • Interpretive display
Recreational Trail	3 acres	Year-round	• Hiking • Biking • Wildlife viewing • Sightseeing • Interpretation and education	• 3 miles long • Trailhead parking area (10 vehicles) • Overlook with interpretive display

Centennial Recreation Area. This facility will be located on the Nevada County side of the project on approximately 193 acres of NID land. The facility will provide family camping, group camping, shoreline day use and boating facilities and opportunities; as well as visitor services. The camping complex will consist of 100 family campsites including RV campsites, and three group campsites with a total capacity of 175 people (50 people each at 2 sites and 75 people at 1 site). The day use complex will provide parking for 50 vehicles with a trailer and 75 single vehicles, a 2-lane boat ramp, swim area, store and RV dump station. Overall, this complex will not only replace the lost facilities with similar facilities, but the new recreation area will also provide new, expanded and enhanced facilities that did not exist, such as a boat ramp, general store, RV accommodations (RV campsites and a dump station) and modern sanitation facilities and modern camping and day-use facilities.

This facility would replace the existing family and group camping facilities at the project site but with increased site capacities and improved facilities including paved access roads and vehicle spurs, RV-specific campsites with hookups (water and electric), a sanitary dump station for RVs, and potable water. This facility would also provide similar day use facilities and access as the Bear River Park and Campground with parking for 75 vehicles and 50 vehicles with trailers, shoreline access area for swimming and waterplay activities, vault and flush restrooms and trash facilities. In addition, the project would have some additional day use facilities that do not exist currently, including a 2-lane boat ramp, RV dump station and general store.

The Centennial Recreation Area would provide the primary reservoir access for water-based uses. NID proposes to regulate the reservoir boating and uses through Nevada and/or Placer County ordinances as a means to provide safe boating opportunities and minimize impacts to resources, human-caused fire risk, and noise-related impacts to the neighboring residential communities. The reservoir would have a 5 mph speed limit, counter-clockwise watercraft rotation pattern, camping in developed campgrounds only (i.e., no shoreline or boat-based camping), and no hunting at reservoir recreation facilities and sites. These policies would provide for somewhat similar uses and experiences as are currently found in the Bear River albeit in a reservoir setting.

Dog Bar Bridge Day-Use Area. NID would develop a day-use area on 5 acres of NID land on a south-facing peninsula where the proposed new Dog Bar Road bridge would connect to the Placer County side of the reservoir at the southeast part of the reservoir. The facility would consist of a picnic area (5 sites), parking area (10 single vehicle spaces), a vault restroom, and shoreline access paths and areas. This facility would also replace the day use facilities by providing a formal day use area on the Placer County side of the reservoir with picnic sites, shoreline access, parking area and vault restrooms. This facility would be readily accessible by users on the Placer County side of the reservoir along a traditionally popular access point (Dog Bar Road) and would provide improved and increased parking capacity as compared to the existing riverine uses at Dog Bar Road bridge.

Magnolia Ranch Birding Area. NID would construct a birding/wildlife view area on 9 acres of NID land in the Magnolia Ranch area on the Nevada County side of the reservoir just upstream of the Centennial Recreation Area. The facility would consist of a parking area (10 single vehicle spaces), a vault restroom, interpretive displays and multiple viewing platforms along the shoreline. This facility will provide a facility isolated from the other recreational facilities and uses that allows for wildlife viewing along the reservoir shoreline similar to what is available throughout the Bear River currently. This facility is intended to replace the wildlife viewing and natural setting experience provided throughout the existing Bear River Park and Campground by providing a quiet, low-key facility for enjoying wildlife and the natural setting separate from the other recreational facilities and uses. This facility will enable visitors to experience a similar natural setting along the water's edge.

Recreational Trail. NID would construct a 3-mile-long, narrow-surface recreational trail near the high-water line of the project reservoir on 3 acres of NID land. The trail would start on the Nevada County side near the dam and would traverse upstream through the Centennial Recreation Area to the proposed Dog Bar Road bridge. The trail would be designed for hiking and pedestrian uses with a native soil surface. Notably, the new Dog Bar Road bridge design will include an 8-foot-wide pedestrian walkway across the bridge connecting to the proposed Dog Bar Bridge Day Use Area on the Placer County side of the project. In addition to trail parking at the Centennial Recreation Area and Dog Bar Bridge Day Use Area, NID will construct an additional trailhead parking area on the Nevada County side of the Dog Bar Road bridge for five single vehicles. The recreational trail will replace the trail system within Bear River Park and Campground and also provide a non-motorized connection between most of the project recreation facilities as well as a connection across the reservoir between Placer and Nevada counties. The trail will be designed for similar pedestrian and non-motorized uses, but also provide interpretive and educational opportunities, particularly in the dam overlook area and at Dog Bar Bridge Day Use Area.

A.1 - Attach recreation visitation estimates including documentation of estimation methodology.

The estimated annual number of recreational users would be approximately 278,000 visitors annually (Table 5). This visitation estimate is based on the number of proposed facilities and the occupancy rates at NID's nearby Rollins Reservoir and other nearby similar recreation facilities, which are similar in type and development.

Table 5. Recreation visitation estimates at the project.

Type of Facility	Total Units	People per Unit	Open Season	Annual Occup-ancy Rate	Total Visitation (Visitor Days*)	Methodology/Assumptions
Centennial Recreation Area - Family Campground	100 campsites	8 people	Year-round (365 days)	55%	160,600	Uses 2009 relicensing visitor survey data at Rollins Reservoir, including average occupancy rate at all of Rollins Reservoir's campgrounds (55%). Assumes 8 people per campsite based on camping use at NID's Rollins Reservoir.
Centennial Recreation Area - Group Campground	3 campsites	175 people total (2, 50-person sites and 1, 75-person site)	Year-round (365 days)	66%	42,158	Uses 2009 relicensing visitor survey data at NID's Faucherie Group Campground (66%). Assumes full capacity at each site (175 total people for all 3 sites).
Centennial Recreation Area - Boat Ramp & Swim Beach	125 spaces	3.5 people	Year-round (365 days)	37%	59,084	Uses 2009 relicensing visitor survey data at Rollins Reservoir, including 1) average occupancy rate at all of Rollins Reservoir's boat ramp and day use facilities; and 2) average people per vehicle data at all Rollins Reservoir recreation area boat ramp and day use facilities.
Dog Bar Bridge Day Use Area	10 spaces (vehicles)	3.5 people	Year-round (365 days)	37%	4,727	Uses 2009 relicensing visitor survey data at Rollins Reservoir, including 1) average occupancy rate at all of Rollins Reservoir's boat ramp and day use facilities; and 2) average people per vehicle data at all Rollins Reservoir recreation area boat ramp and day use facilities.
Magnolia Ranch Birding Area	10 spaces (vehicles)	3.5 people	Year-round (365 days)	37%	4,727	Uses 2009 relicensing visitor survey data at Rollins Reservoir, including 1) average occupancy rate at all of Rollins Reservoir's boat ramp and day use facilities; and 2) average people per vehicle data at all Rollins Reservoir recreation area boat ramp and day use facilities.
Recreational Trail	10 spaces (vehicles)	3.5 people	Year-round (365 days)	50%	6,388	Assumes: 1) 50% occupancy of trailhead parking area (no data points to base this on); and 2) other users come from other Project recreation facilities which are counted above.
				Total	**277,683**	

While recreational visitation or use estimates for the existing Bear River recreational facilities and opportunities are not available, the project would provide a similar types of recreational facilities as found currently in the proposed project area. It is likely that the recreational user population would be higher than the existing conditions with the construction of new facilities due to increased camping and parking capacities, new and different facilities to be provided (boat ramp, wildlife viewing area, etc.), and an overall increase in the number of available facilities at the proposed project site. Much of the existing recreation use in the area occurs via undeveloped access areas where use is not monitored

and the lone developed facility, the Bear River Park and Campground, lacks recreation visitation data making it unclear what the exact level of annual recreation visitation is within the area. Importantly, the project will provide developed and managed recreation facilities that will provide adequate site capacities to manage the proposed levels of recreation use.

A.2 - Attach or provide links to any relevant recreation studies associated with the proposed project.

References Cited

California Department of Parks and Recreation (CDPR), California State Parks. 2015. 2015 California Statewide Comprehensive Outdoor Recreation Plan. Sacramento, California.

Holbek, L. and C. Stanley. 1998. The best whitewater in California: the guide to 180 runs. Third Edition. Watershed Books. Coloma, California.

Nevada Irrigation District (NID). 2011. Recreational Flow Study Technical Memorandum 8-2a - Yuba-Bear Hydroelectric Project. Prepared for the Relicensing of NID's Yuba-Bear Hydroelectric Project (FERC Project No. 2266).

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Feasibility and Implementation Risk Tab

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Feasibility and Implementation Risk Tab

A.1: Feasibility Documentation

NID Application

Feasibility and Implementation Risk Tab

A.1: Feasibility Documentation

A feasibility study is still under development and will be completed by the required date of January 1, 2022.

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Feasibility and Implementation Risk Tab

A.2: Permit List

NID Application

Feasibility and Implementation Risk Tab

A.2: Permit List

A summary of the anticipated permits and approvals that may be required for the Proposed Project is provided below. Agencies with jurisdiction over those permits or approvals would consider the information provided in the future environmental documents and engineering reports in determining under what conditions to issue permits or approvals. Currently no permits or approvals have been sought for the Project.

- Department of Water Resources (DWR), Division of Safety of Dams (DSOD) Approval of Plans and Specifications
- Clean Water Act (CWA) Section 404 Permit (U.S. Army Corps of Engineers [USACE])
- Section 7 consultation for Federal Endangered Species Act (ESA) compliance (National Marine Fisheries Service [NMFS])
- Section 7 consultation for Federal ESA compliance (U.S. Fish and Wildlife Service [USFWS])
- Section 106 consultation for National Historic Preservation Act (NHPA) compliance (State Historic Preservation Officer [SHPO])
- Consultation for State ESA compliance and Streambed Alteration Agreement (California Department of Fish and Wildlife [CDFW])
- Consultation for effects on Native American burials or artifacts (California Native American Heritage Commission [NAHC])
- National Pollutant Discharge Elimination System General Permit for Stormwater Discharge Associated with Construction Activities (Regional Water Quality Control Board [RWQCB])
- Clean Water Act Section 401 Water Quality Certification (RWQCB)
- Consultation for Authority to Construct Permits (Northern Sierra Air Quality Management District, Placer County Air Pollution Control District)

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Feasibility and Implementation Risk Tab

A.3: Schedule

NID Application

Feasibility and Implementation Risk Tab

A.3: Schedule

Each of the four main construction components of the schedule—dam and outlet works; Dog Bar Road realignment and new bridge; raw water pump station, tank, and pipeline; and reservoir clearing and recreational features—is discussed individually below. In general, NID estimates that the road and bridge construction would take about the same amount of time to complete as would the dam construction, and NID assumes as a worst-case scenario that these activities would occur concurrently. However, the road and bridge construction do not depend on each other, and, if possible, the bridge and road realignment could begin earlier than the dam construction. NID assumes that reservoir clearing and construction of the recreation facilities would follow dam, road, and bridge construction.

Dam and Outlet Works: Allowing 3 months of "float" in the schedule to account for adverse weather, particularly during the winter, NID estimates that the RCC dam could be constructed in about 2½ years.

Dog Bar Road Realignment and New Bridge: The overall construction schedule for the new Dog Bar Road and Bridge and existing Dog Bar Bridge Removal is estimated to be about 2½ years to complete. NID anticipates that several components of this Project would be constructed at the same time. Included in the schedule are a number of inclement weather/permit restriction days. Overall, the Project schedule is potentially subject to additional weather-related delays and contractor efficiencies.

Raw Water Pump Station, Tank, and Pipeline: The overall construction schedule for the new raw water pump station tank and pipeline is estimated to be about 1½ years to complete. NID anticipates that several components of this Project would be constructed at the same time. Included in the schedule are a number of inclement weather days. Overall, the Project schedule is potentially subject to additional weather-related delays.

Recreational Features: The majority of the recreational facilities would be constructed upon completion of dam construction and the Dog Bar Road and Bridge construction. Some recreational facilities could be constructed concurrently with the dam and bridge construction, however, build out of the Centennial Day use facility could not be completed until the proposed staging area for the dam is cleared. In total, the construction schedule for the recreational facilities is estimated to be 1½ years to complete.

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Feasibility and Implementation Risk Tab

A.4: Environmental Document

NID Application

Feasibility and Implementation Risk Tab

A.4: Environmental Document

An environmental document is still under development.

Nevada Irrigation District
Centennial Water Supply Project
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Feasibility and Implementation Risk Tab

A.5: Impacts and Consultation

NID Application

Feasibility and Implementation Risk Tab

A.5: Impacts and Consultation

The environmental and cultural resources impacts are still being evaluated as part of the development of the environmental document. The following table shows a preliminary assessment of impacts.

Resource	Impact and Mitigation Summary	
	Summary of Impacts	Avoidance, Minimization, and/or Mitigation Measures
Aesthetics	The proposed facilities would be placed within potential view of sensitive land uses, such as recreational and residential uses. However, the existing wooded vegetation and areas of steep terrain characteristic of the general project vicinity may limit views of these new elements. Further, although this area may represent a scenic viewshed for some viewers, the project site is not designated as a scenic vista by the Placer or Nevada County General Plans, and no scenic highways, as designated by Caltrans, are located in the vicinity.	Project implementation would be coordinated with the affected jurisdictions to ensure consistency with aesthetic standards for development.
Air Quality	Prior to construction, an air quality technical study would be prepared to evaluate potential air quality impacts as a result of project implementation. Project implementation would not be anticipated to generate additional vehicle traffic beyond the construction phase, and would not establish any new stationary emissions sources. Further, feasible control measures could be implemented to reduce particulate matter emissions during construction. Project implementation would comply with the policies of the Placer and Nevada County General plans and County Code requirements, to the extent feasible, as they relate to construction air quality impacts. However, with implementation of control measures and compliance with applicable regulations, there is still the potential that construction emissions could exceed established standards in areas that are already designated as non-attainment.	Project implementation would include best management practices (BMPs) during construction, such as dust suppression techniques and equipment operation limitations. Project implementation would also require application for, and compliance with, the conditions of an Authority to Construct permit from the Placer County Air Pollution Control District (PCAPCD) and the Northern Sierra Air Quality Management District (NSAQMD).
Agriculture and Forestry Resources	Project implementation is anticipated to include development in areas currently designated for agriculture and/or forestry, and could result in a change to the current land use designations as a result of project development occurring in these areas. However, the proposed use of these lands for water supply would be consistent with the continued support of agricultural resources and operations within both Nevada and Placer Counties.	To the extent feasible, project implementation would comply with the applicable policies and regulations of the Counties and state, as intended for the protection of agriculture and forestry resources. Further, a timber harvest plan would be prepared to outline the harvesting plan, methods, and measures to protect the environment during harvesting.
Geology and Soils	Ground disturbance caused by construction activities has the potential to increase erosion and sedimentation rates above existing conditions, as well as the associated potential for construction-related soil erosion to affect receiving water quality. Prior to construction, a geotechnical investigation would be prepared to evaluate potential geologic hazard areas that could affect project implementation. It is anticipated that soil conditions and quality in the project area would also be evaluated for remnant mercury.	The project would be designed to address potential issues related to soil stability, and to include erosion and runoff control measures to minimize soil-related hazards and stormwater pollution during construction. In accordance with National Pollutant Discharge Elimination System (NPDES) regulations, the project must obtain a General Permit to minimize the potential effects of construction runoff on receiving water quality.
Greenhouse Gas Emission	Construction-related greenhouse gas (GHG) emissions would mainly be associated with engine exhaust from construction equipment, transport trucks hauling materials, and worker commute trips. Although any increase in GHG emissions would add to the quantity of emissions that contribute to global climate change, it should be noted that construction-related emissions would be temporary and finite, and would occur over a phased construction period. Prior to construction, an air quality technical study would be prepared to evaluate potential air quality impacts as a result of project implementation, including an evaluation of estimated GHG emissions as a result of project implementation. Project implementation is not anticipated to conflict with the objectives of AB 32 or any other applicable plan, policy or regulation adopted for the purpose of reducing GHG emissions.	To the extent feasible, project implementation would comply with the policies of the Placer and Nevada County General plans as they relate to GHG emissions during construction.
Hazards and Hazardous Materials	During project implementation, is anticipated that limited quantities of miscellaneous hazardous substances (such as petroleum-based products/fluids, solvents, and oils) would be employed in the project and staging areas during excavation, grading, and construction activities. As a result, the operation and storage of construction equipment in the project and staging areas increases the potential hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Project implementation would also place new facilities and features within a high wildfire hazard area. However, the project area is currently served by fire protection services, and would require the continued commitment from the service providers for the new features and facilities (see Public Services description below for further detail).	Implementation of best management practices would help minimize the risk of accidental spills and releases to the environment. Further, project implementation would comply with all relevant Federal, state, and local statutes and regulations related to transport, use, or disposal of hazardous materials.
Hydrology, Water Quality, and Water Supply	Construction activities could cause or result in erosion and/or siltation of onsite soils, which can lead to increased levels of suspended sediments and turbidity in receiving waters, and could potentially impact water quality and result in a violation of water quality standards. One of the purposes of the Proposed Project is to meet future water supply needs, so for that reason, the Proposed Project itself would not generate a need for increased water service.	Project implementation would require coverage under the NPDES General Permit, and would include preparation of a Stormwater Pollution Prevention Plan (SWPPP) with BMPs to reduce impacts from erosion and sedimentation during construction. Implementation of spill prevention measures would address the accidental or inadvertent release of oil, grease, or fuel into adjacent waterways and would further help minimize potential construction-related water quality impacts.
Land Use and Planning	Project implementation would alter the intended land use for the parcels within the project area, and would result in property acquisitions for easements and/or project construction. While the Proposed Project would result in significant land use changes in the project area, when evaluated in terms of currently designated land use and zoning designations, the Proposed Project would not be in direct conflict with any applicable land use plans, policies, regulations, or ordinances.	To the extent feasible, project implementation would comply with the applicable land use guidelines and zoning regulations for Nevada and Placer Counties, and would include early consultation to help guide the development process.
Noise	Project implementation would result in temporary construction-related noise disturbance in the vicinity of the project area, which includes noise sensitive land uses, such as residential and recreational land uses. However, following the completion of project construction, project operation would not be anticipated to generate excessive levels of noise at noise sensitive receptors located in the vicinity of the project area.	To the extent feasible, project implementation would include compliance with the noise ordinances of Placer and Nevada Counties as they relate to construction noise limits.
Population and Housing	Project implementation is not anticipated to contribute to population growth in the vicinity of the project area. Although project implementation would not result in the division of an established community, the project location would require the displacement of existing housing, including an estimated 25 single-family residences.	Residents that are displaced by NID would be provided with equivalent compensation to that of their existing home value prior to construction.

Resource	Impact and Mitigation Summary	
	Summary of Impacts	Avoidance, Minimization, and/or Mitigation Measures
Public Services, Utilities, and Service Systems	The addition of project features would require continued commitment of the local law enforcement resources and fire response services that are currently serving the area. However, project implementation is not anticipated to contribute greatly to an increased need for police or fire protection services, since the project would not contribute to population growth in the vicinity of the project area. For this reason, project implementation is also not anticipated to impact existing schools or other government facilities. Project implementation is not anticipated to increase demand for solid waste disposal or wastewater treatment, and as such would not require service by local utility providers. Temporary service disruptions (i.e., electrical, gas, telecommunications, etc.) are anticipated due to the need for relocation of utilities	Advanced and continuous consultation with service providers would help to ensure that impacts to public services and utilities would be less than significant, and no mitigation would be required. Continuous consultation with service providers during construction would minimize interference with electrical, gas, and telecommunication lines.
Recreation	Project implementation is not anticipated to result in an increased use of recreational facilities, since the project would not contribute to population growth in the vicinity of the project area. However, project implementation may temporarily preclude use of existing recreational facilities in the project area. Following construction, recreational facilities would be replaced with improved facilities, and project operation would not affect recreational access in the long-term.	To the extent feasible, the addition of recreational features to the project area would comply with the guidelines outlined in the Placer and Nevada County General Plans intended for the protection of recreational resources.
Terrestrial and Aquatic Biological Resources	Construction activities have the potential to impact special status species and habitats known to occur in the project area. Direct permanent impacts from construction activities including clearing and grubbing of lands in the project area. Temporary indirect impacts from construction activities include sedimentation, dust, and soil erosion that may occur in sensitive habitats located adjacent to construction activities. Prior to project implementation, biological studies and wetland delineation of the project area would be conducted to determine the estimated project impact to sensitive species and habitats, and to develop avoidance, minimization, and mitigation measures intended to protect such resources.	Early and ongoing agency consultation would help to ensure that required permits are obtained and appropriate protection measures are implemented in the project area during construction.
Transportation and Traffic	Project implementation has the potential to temporarily affect transportation and traffic during construction. Dog Bar Road crosses the Bear River west of Eden Valley and provides the only public connection between Placer County and Nevada County within the project area. Additionally, in some areas access through the general project vicinity would be permanently altered by project implementation. However, project implementation is anticipated to include advanced construction traffic planning to maintain residential access routes, as well as the development of a traffic safety plan to ensure the continuation of emergency response services during construction activities. Project implementation is not anticipated to result in long-term effects on local and regional transportation and traffic.	To the extent feasible, the addition of project features would comply with the Placer and Nevada County General Plan guidelines for maintaining safe and efficient operating conditions on all county roadways
Cultural and Tribal Cultural Resources	Based on previous surveys in the project area, several parcels are known to contain built resources (buildings, structures, or objects). Several of these parcels contain private, single-family homes. Based on assessor parcel data of these parcels, some buildings may be more than 50 years old. Prior to construction, staff with expertise in cultural, archeological, and historic resources assessment would be required to conduct agency consultation regarding the potential for such resources to be located with the project's area of potential effect. Based on previous surveys conducted, project implementation would not be anticipated to result in the alteration of, or adverse physical or aesthetic effect to any significant historical resources. However, the potential remains that previously unknown historical resources could be discovered during grading and excavation work associated with new construction.	Project implementation would include mitigation measures intended for the protection of cultural resources, including the halting of construction activities in the event that cultural materials, human remains, or paleontological resources are discovered.

The following describes the status of tribal consultation:

By letter dated November 23, 2015 (received December 4, 2015) NID received a general request letter from the United Auburn Indian Community (UAIC) for consultation under AB 52 on NID projects (attached). By letter dated December 9, 2015 NID noticed UAIC by letter with an opportunity to consult on the Centennial Water Supply project (attached). By e-mail dated December 10, 2015 NID received a response from UAIC representative Marcos Guerrero acknowledging receipt of notice and opportunity to consult under AB 52 and requested additional information. By letter dated December 15, 2015 NID officially initiated consultation with UAIC for the Centennial Reservoir Project (attached). On January 19, 2016 an initial consultation meeting was held between UAIC and NID, with assistance from HDR and ECORP, at the NID office. Since that initial consultation meeting, numerous consultation meetings, field visits, and other activities have occurred (we can provide dates if necessary). In addition, UAIC has provided a tribal representative (paid by NID) to participate in the entirety of all cultural resources field investigations including survey and archaeological test excavations. That same UAIC representative is also currently completing Oral History interviews of UAIC tribal elders and compiling a history of tribal information for inclusion in the cultural resources study. NID has also formally requested a records search from UAIC. NID has also provided UAIC all known recorded cultural resources site data as draft DPR 523 records, scanned field notes, and GIS shapefiles.

MIWOK MAIDU United Auburn Indian Community of the Auburn Rancheria

Gene Whitehouse, Chairman | John L. Williams, Vice Chairman | Danny Rey, Secretary | Brenda Adams, Treasurer | Calvin Moman, Council Member

November 23, 2015

Nevada Irrigation District Representative
1036 W. Main Street
Grass Valley, CA 95945

RE: AB 52 Notification Request, California Environmental Quality Act Public Resources Code section 21080.3, subd. (b) Request for Formal Notification of Proposed Projects within the United Auburn Indian Community (UAIC) of the Auburn Rancheria's Geographic Area of Traditional and Cultural Affiliation

Dear Nevada Irrigation District Representative:

In accordance with Public Resources Code Section 21080.3.1, subd. (b), The United Auburn Indian Community (UAIC) of the Auburn Rancheria, which is traditionally and culturally affiliated with a geographic area within your agency's geographic area of jurisdiction, requests formal notice of and information on proposed projects for which your agency will serve as a lead agency under the California Environmental Quality Act (CEQA), Public Resources Code Section 21000 et seq.

Enclosed with this letter is a copy of a map that depicts the ancestral territory that the UAIC is traditionally and culturally affiliated with. UAIC's traditionally and culturally affiliated geographic area is supported by, and has been developed through, multiple lines of evidence including oral tradition, history, ethnography, geography, linguistic, kinship, biology, archaeology, anthropology, folklore, other relevant information and expert opinion, and Congressional action through the Auburn Indian Restoration Act of 1994 (H.R. 4228 [103rd]).

Pursuant to Public Resources Code section 21080.3.1, subd. (b), and until further notice, we hereby designate the following person as the tribe's lead contact person for purposes of receiving notices of proposed projects from your agency:

Lead Contact:
Gene Whitehouse,
Chairman
10720 Indian Hill Road
Auburn, CA 95603
916-883-2320

Copies to:
Jason Camp
Tribal Historic Preservation Officer
10720 Indian Hill Road
Auburn, CA 95603
(530) 883-2320
jcamp@auburnrancheria.com

Marcos Guerrero
Cultural Resources Manager
10720 Indian Hill Road
Auburn, CA 95603
(530) 883-2364
mguerrero@auburnrancheria.com

We request that all notices be sent via certified U.S. Mail with return receipt and that your notices specify a lead contact person for your agency. Following receipt and review of the information your agency provides, within the 30-day period outlined in Public Resources Code section 21080.3.1, subd. (d), the UAIC may request consultation, as defined by Public Resources Code section 21080.3.1, subd. (b), pursuant to Public Resources Code section 21080.3.2 to discuss issues including the type of environmental review to be conducted, project alternatives, significant effects of the project and mitigation measures for any project impacts (direct, indirect and cumulative) a specific project may cause to tribal cultural resources.

For your information, UAIC's policy is to be present during project cultural resource surveys, including initial pedestrian surveys, to identify tribal cultural resources. UAIC's policy is also to be provided all existing cultural resource assessments, including the request for and results of any records search that may have been conducted prior to the initial survey or consultation meeting. Finally, UAIC's general policy is preservation in place and avoidance of tribal cultural resources, and any subsurface testing or data recovery must not occur without first consulting with UAIC and receiving UAIC's written consent.

We recommend that your agency retain this correspondence in your permanent files. If you have any questions or need additional information, please contact Marcos Guerrero, Cultural Resources Manager, at (530) 883-2364 or by email at mguerrero@auburnrancheria.com.

Sincerely,

Gene Whitehouse,
Chairman

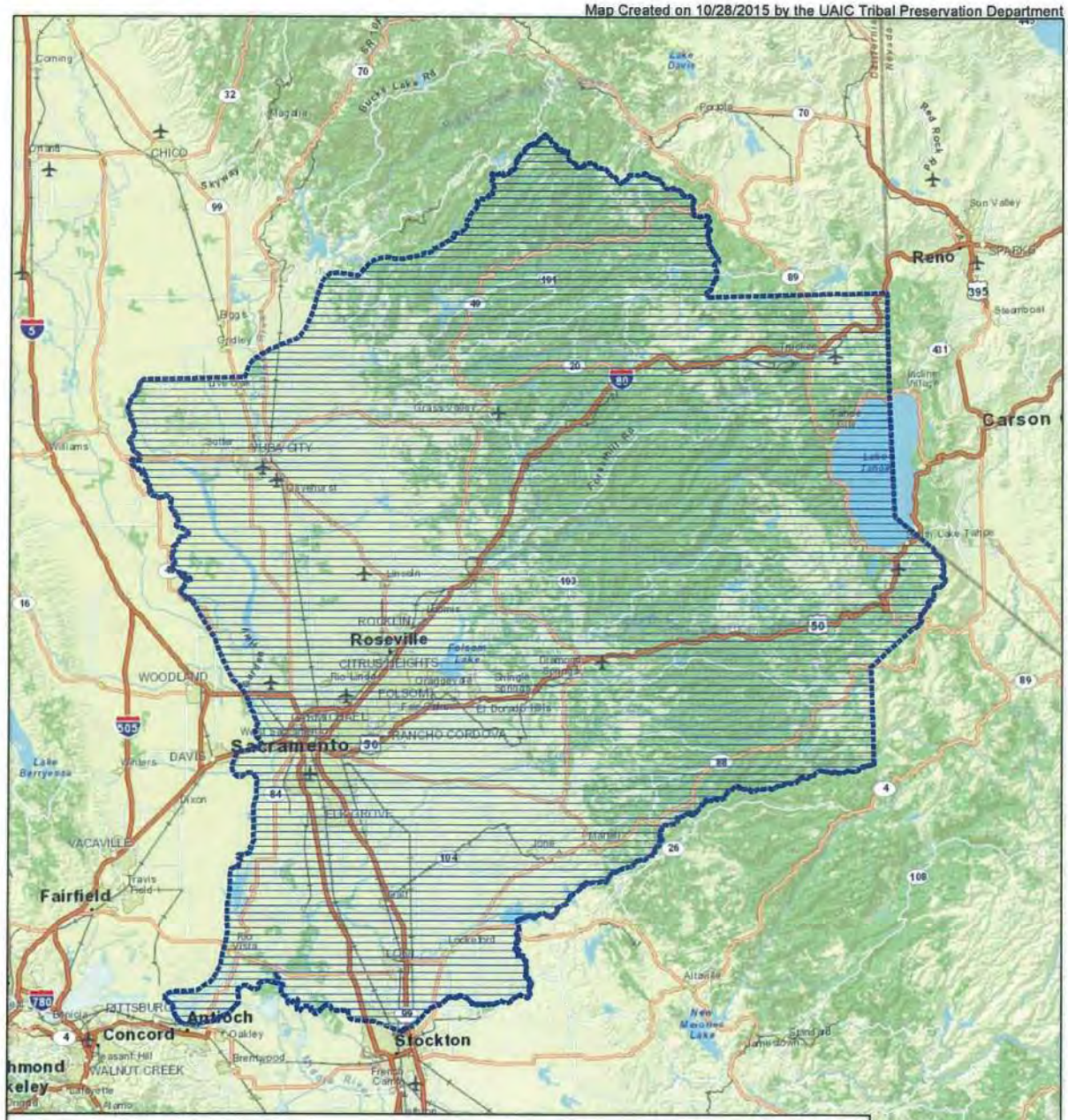
CC: Jason Camp, THPO
Marcos Guerrero, CRM
Cynthia Gomez, NAHC

UAIC Geographic Area of Traditional and Cultural Affiliation

(for the purposes of California AB 52)

This area includes all of Amador, El Dorado, Nevada, Placer, Sacramento, Sutter and Yuba counties as well as portions of Butte, Plumas, San Joaquin, Sierra, Solano, and Yolo counties.

Map Created on 10/28/2015 by the UAIC Tribal Preservation Department



This map is no substitute for direct consultation with UAIC prior to considering any proposed project or commencing any archaeological activities in or around sensitive areas.

Note: While we make every effort to identify Tribal Cultural Resources that exist within the UAIC Geographic Area of Traditional and Cultural Affiliation, it is highly probable that there are additional, older sites that we have not yet identified due to restricted access or other reasons or that agricultural or construction activities have distributed burials and cultural materials beyond the previously known boundaries of these sites. Even if these materials are in a disturbed condition, they still retain cultural value to UAIC and should be respected and protected. Because of this, thorough survey with a qualified Native American Monitor to confirm site boundaries and search for unknown sites is critical. This survey should be conducted after consultation with the Tribe and prior to the final determination of the type of environmental document to be used.

NEVADA IRRIGATION DISTRICT

1036 W. Main Street, Grass Valley, CA 95945-5424 ~ www.nidwater.com
(530) 273-6185 ~ Fax: (530) 477-2646 ~ Toll Free: (800) 222-4102

December 9, 2015

Via Electronic Mail
Hardcopy To Follow via U.S. Postal Service Certified Mail and Returned Receipt

Gene Whitehouse, Chairman
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

RE: Notice of Opportunity to Consult for the Proposed Centennial Reservoir Project in Nevada County, California

Dear Chairman Whitehouse:

The Nevada Irrigation District (NID) is proposing to implement the Centennial Reservoir Project (Proposed Project) to provide drought-mitigation and improve water supply reliability for NID's customers. NID has determined that its current water system is over-reliant on runoff from the annual mountain snowpack, resulting in an urgent and greater need for lower elevation storage to capture runoff from rain storms as well as snow storms. The Proposed Project is being planned at a site that was initially identified in 1926 as part of an early NID reconnaissance project on the Bear River, and which was found to be a good water storage location. The Proposed Project would allow NID to continue to meet existing water delivery commitments and to bring more flexibility in meeting the future water supply needs of customers in all parts of NID's service area.

The Proposed Project involves the construction of a new 110,000 acre-foot reservoir on the Bear River between the existing Rollins and Combie reservoirs and would involve construction of a new dam and associated facilities. Low impact public recreational opportunities are also anticipated to be included with the Proposed Project. The Project area would extend upriver from just above the existing Combie Reservoir for 6 miles to a point west of the Town of Colfax, California, approximately 1.5 miles downstream of the existing Rollins Dam (see enclosed Figures 1 and 2).

On December 4, 2015, NID received your request to receive written notifications of proposed projects for which NID will serve as Lead Agency for environmental review under the California Environmental Quality Act (CEQA). In accordance with Assembly Bill 52 (AB 52) and Section 21080.3.1(d) of the California Public Resources Code (PRC), we are responding to your request. We are hereby notifying you of an opportunity to consult with NID regarding the potential for this Proposed Project to impact Tribal Cultural Resources, as defined in PRC Section 21074. The purposes of tribal consultation under AB 52 are to determine, as part of the CEQA review process, whether or not Tribal Cultural Resources are present within the Proposed Project area, and if so, whether or not those resources will be significantly impacted by the Proposed Project. If Tribal Cultural Resources may be significantly impacted, then consultation will also help to determine the most appropriate way to avoid or mitigate those impacts.

In accordance with Section 21080.3.1(d) of the PRC, you have 30 days from the receipt of this letter to either request or decline consultation in writing for this Proposed Project. Please send your written response to:

Remleh Scherzinger, P.E.
General Manager
Nevada Irrigation District
1036 West Main Street
Grass Valley, CA 95945

If we do not receive a response from you within 30 days, it will be noted in our files and we will continue to move forward with the Proposed Project.

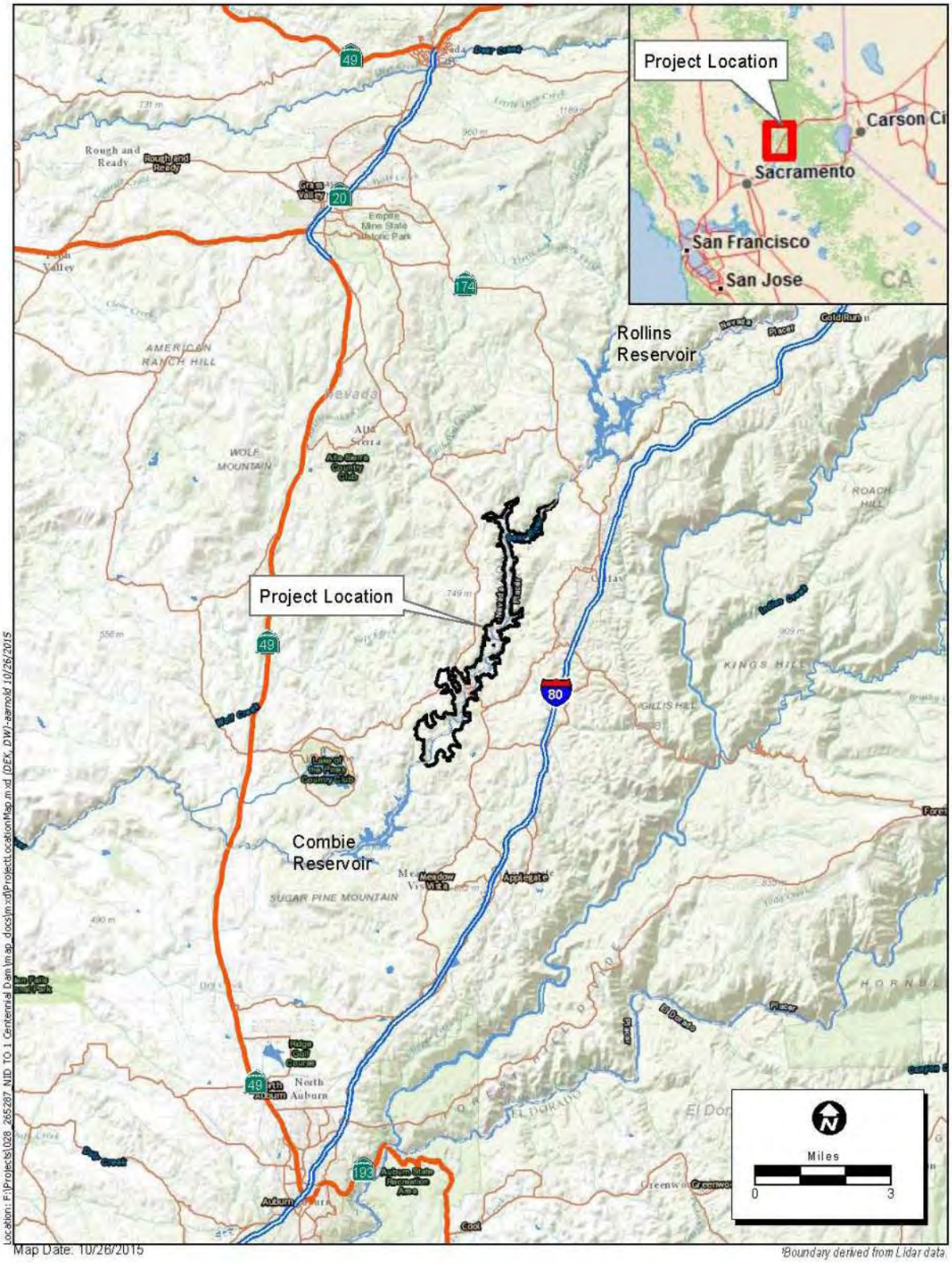
Thank you and we look forward to your response.

Sincerely,

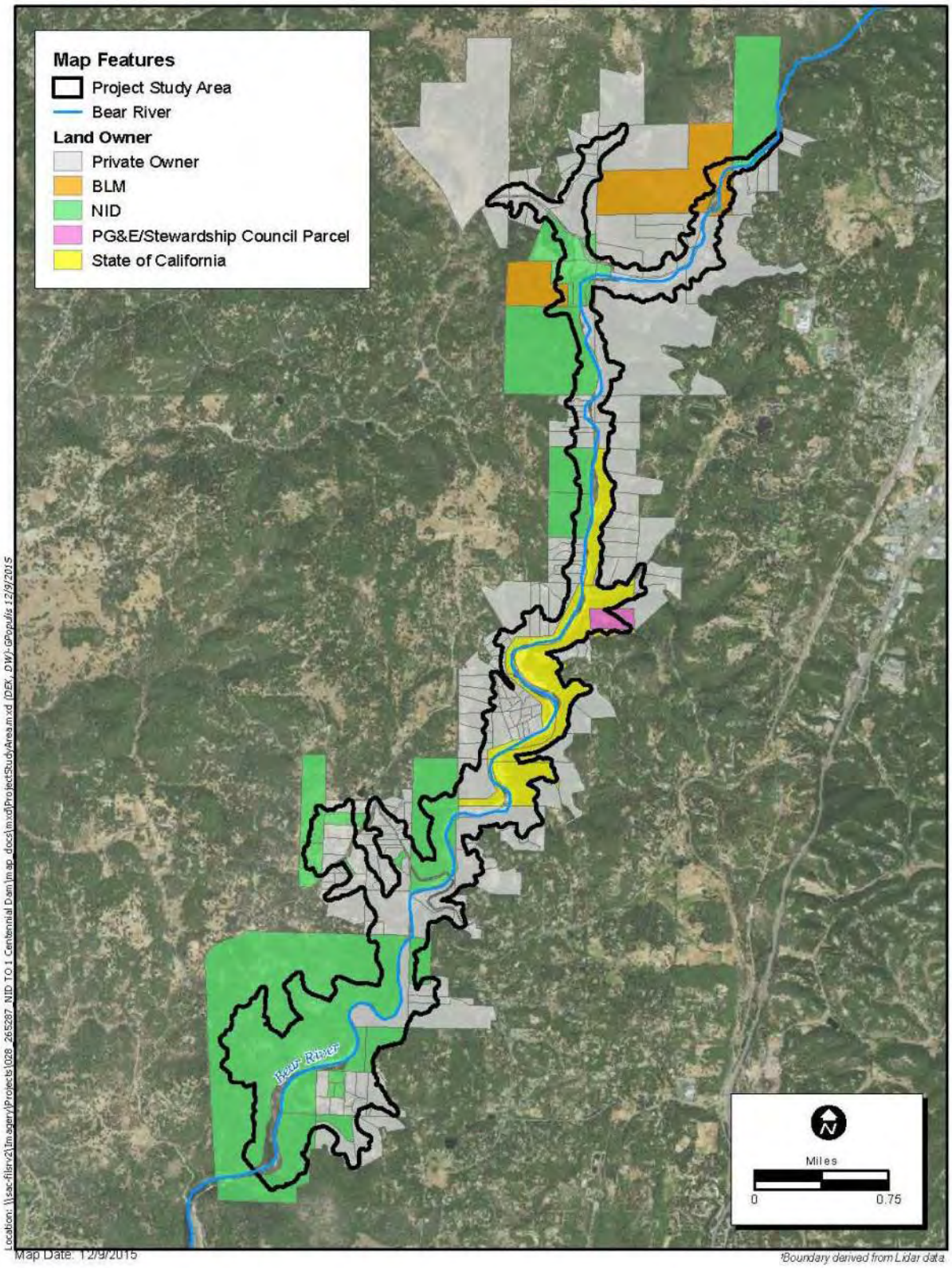
Remleh Scherzinger
General Manager
Nevada Irrigation District

Attachments: Proposed Project Location and Vicinity Map
Proposed Project Study Area

cc: Jason Camp, Tribal Historic Preservation Officer
Marcos Guerrero, Cultural Resources Manager
Cynthia Gomez, Native American Heritage Commission



Project Location and Vicinity Map



Project Study Area

NEVADA IRRIGATION DISTRICT
1036 W. Main Street, Grass Valley, CA 95945-5424 ~ www.nidwater.com
(530) 273-6185 ~ Fax: (530) 477-2646 ~ Toll Free: (800) 222-4102

December 14, 2015

Via Electronic Mail
Hardcopy to Follow via U.S. Postal Service Certified Mail and Return Receipt

Gene Whitehouse, Chairman
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

RE: Initiation of Consultation for the Centennial Reservoir Project

Dear Chairman Whitehouse:

On December 9, 2015, the Nevada Irrigation District (NID) formally notified the United Auburn Indian Community of the Auburn Rancheria (UAIC) of an opportunity to consult under Assembly Bill 52 (AB 52) regarding potential impacts to UAIC Tribal Cultural Resources associated NID's Centennial Reservoir Project (proposed project).

On December 10, NID received an e-mail response from UAIC's Cultural Resources Manager, Marcos Guerrero, suggesting UAIC's desire to consult with NID regarding the proposed project. NID welcomes consultation with the UAIC on the proposed project.

In accordance with AB 52 and Section 21080.3.1(e) of the California Public Resources Code, NID hereby initiates consultation with the UAIC regarding the proposed project.

By this letter, you are invited to an orientation meeting at NID's office at 1036 West Main Street, Grass Valley, California at 3:00 PM on Tuesday, December 22, 2015, to discuss the proposed project and to determine the best way to continue consultation. If you are unable to attend this meeting, please contact Jim Lynch of HDR at jim.lynch@hdrinc.com or (916) 679-8740 to schedule an alternate date for the orientation meeting.

In addition, if you are not able to personally participate in the consultation, we request that prior to the orientation meeting you provide to NID a written delegation of authority to those who will consult with NID on your behalf.

At this time, NID is not engaging UAIC as a consultant to NID, or otherwise authorizing UAIC to perform any work on behalf of NID with regards to the proposed project.

Thank you and we look forward to seeing you at the orientation meeting.

Sincerely,

Remleh Scherzinger
General Manager
Nevada Irrigation District

cc: Jason Camp, Tribal Historic Preservation Officer
Marcos Guerrero, Cultural Resources Manager
Cynthia Gomez, Native American Heritage Commission
Doug Roderick, NID

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Benefit Calculation, Monetization, and Resiliency Tab

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Benefit Calculation, Monetization, and Resiliency Tab

A.1: Project Conditions

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.1: Project Conditions

Project Conditions

The Proposed Project involves the construction of a new 110,000 acre-foot reservoir, on the Bear River between the existing Rollins and Combie reservoirs. The Proposed Project would involve construction of a new 275-foot dam. Figure 1 is an area-capacity curve for the proposed Centennial Reservoir. Figure 2 in an outflow capacity curve for Centennial Reservoir.

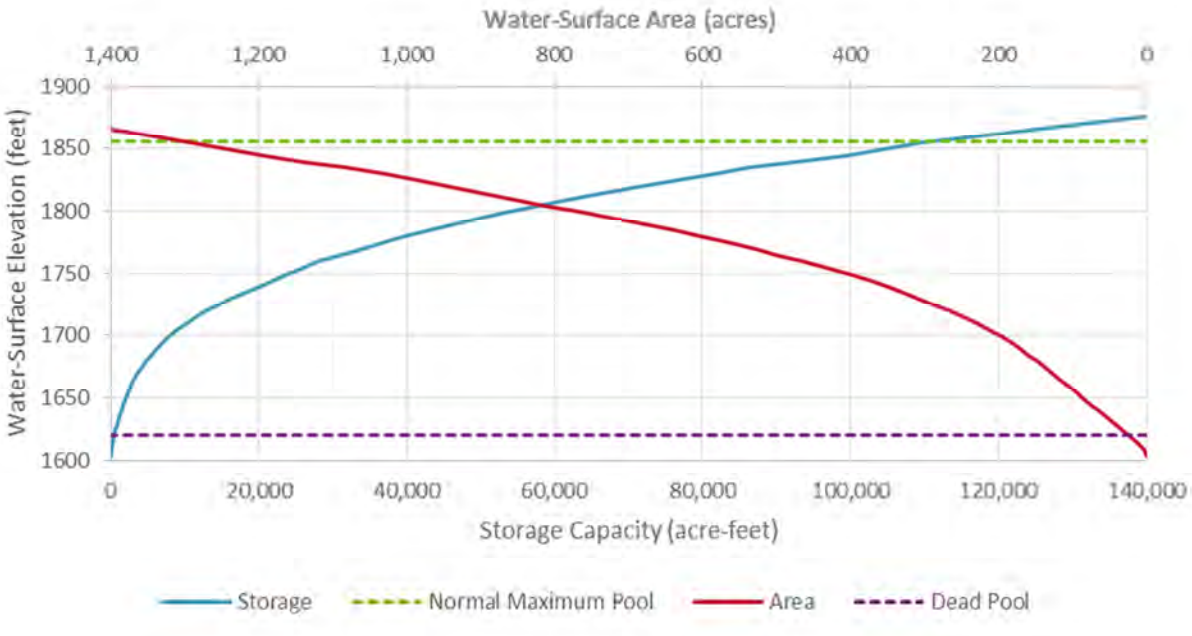


Figure 1: Area-capacity curve for the proposed Centennial Reservoir

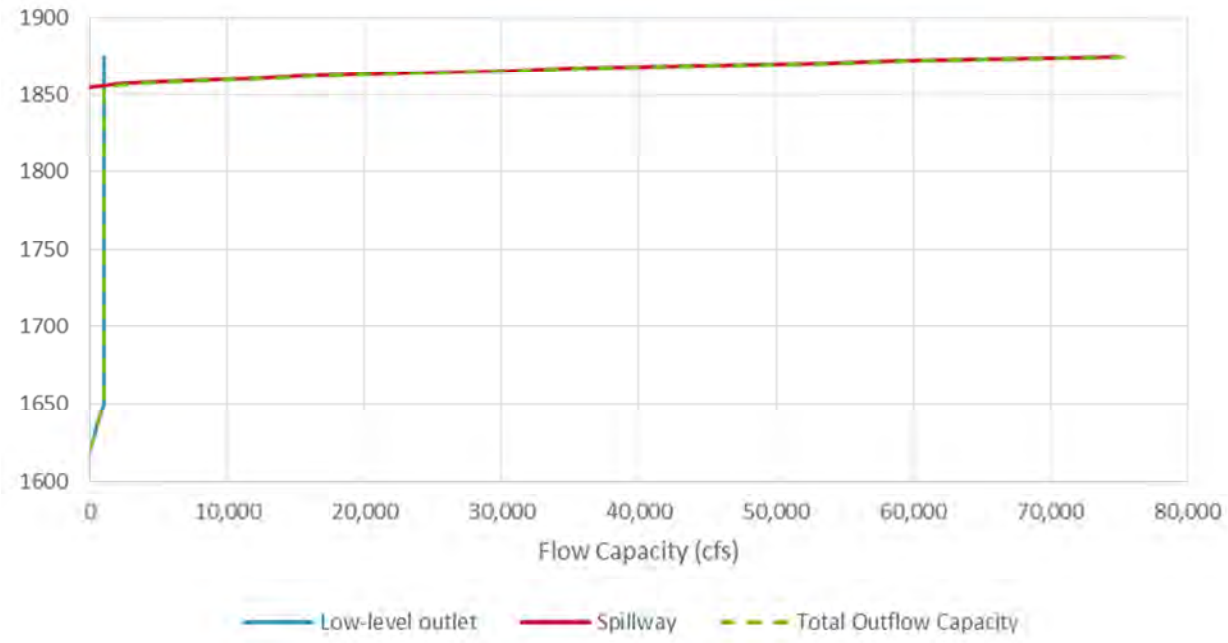


Figure 2: Flow capacity for the proposed Centennial Reservoir

The proposed Centennial Dam and Reservoir would operate as a “fill-and-spill” project, with a prioritization of maximizing reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID’s existing reservoir network to provide water to customers in NID’s lower Bear River watershed service area. Centennial Reservoir would be managed in coordination with NID’s Rollins Reservoir upstream, as well as Lake Combie downstream, with diversions made to NID’s Combie Phase I Canal (see Figure 3). Centennial Reservoir could effectively be used in conjunction with NID’s existing Rollins Reservoir to expand the total storage capability in the Bear River watershed. This use would allow additional natural runoff in the Bear River watershed.

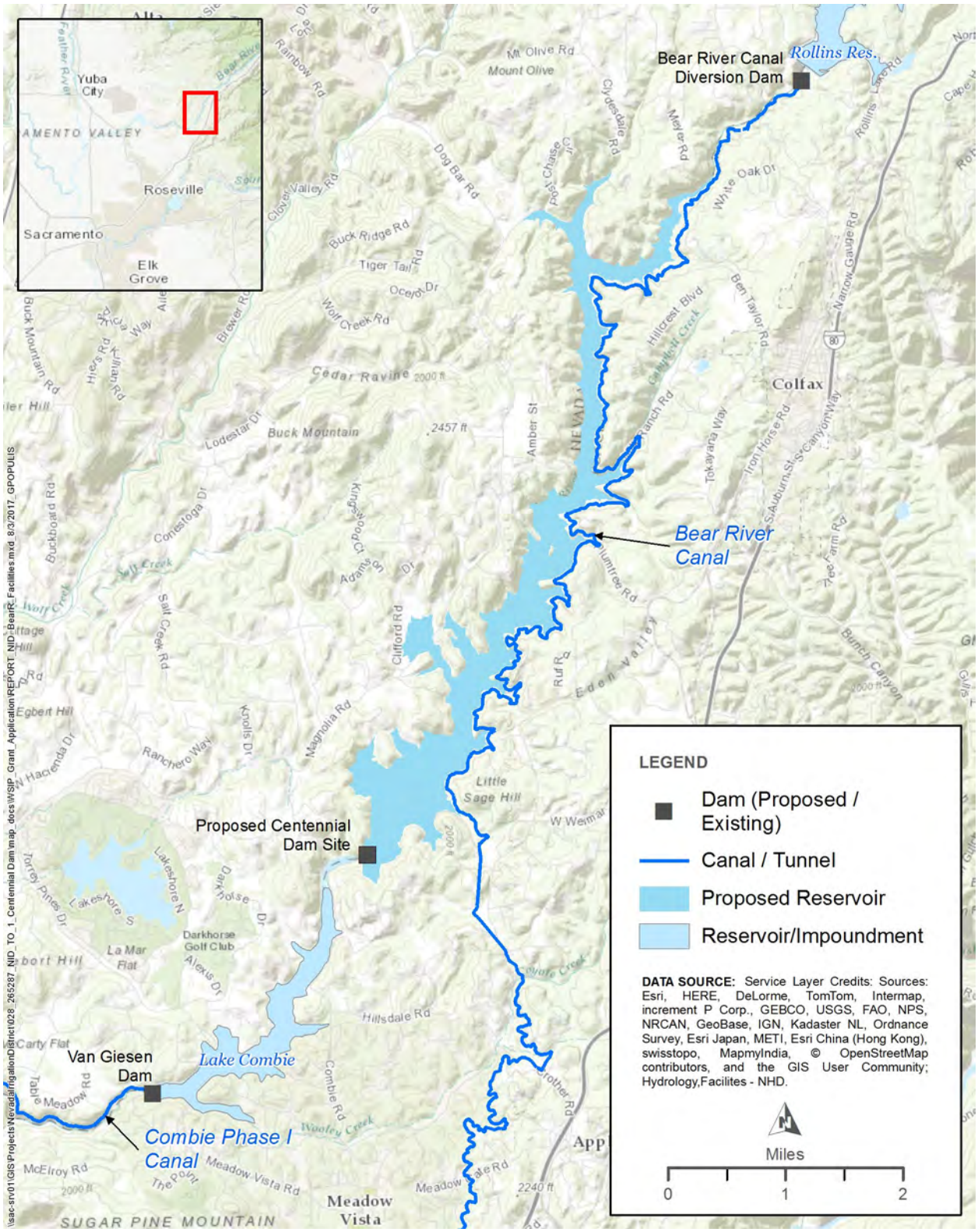


Figure 3: Bear River facilities map.

Hydrologic Conditions

The following sections describe the with- and without-project hydrologic conditions.

Hydrologic Input Data

NID previously developed historical unimpaired hydrology data during the FERC relicensing project of the Yuba-Bear Project (2266) for the period of water years 1976 to 2008. These data will be used to characterize existing condition hydrology. For the 2030 and 2070 conditions model runs, existing condition unimpaired hydrology input data will be modified using the VIC model results. Monthly ratios can be produced for each unimpaired hydrology sub-basin relating 2030 VIC output to 1995 VIC output, and 2070 VIC output to 1995 VIC output. Ratios will be applied as multipliers to the existing daily unimpaired inflow hydrology on a monthly basis for water years 1976 to 2008. These modified unimpaired hydrology will be used simulated the With- and Without-project scenarios for 2030 and 2070 using the HEC-ResSim operations model.

With-Project Reservoir Operations Model Setup

The With-project scenarios will be identical to the Without-project scenarios upstream of Rollins Reservoir, in the Bear River. To simulate the current condition, 2030 and 2070 With-project scenarios, The Without-project HEC-ResSim models will be used with the operation of Centennial Reservoir turned on. This includes reservoir releases for the existing minimum instream flow requirement below Lake Combie and water delivery releases, and losses due to evaporation. A static conservation curve equaling 110,000 ac-ft will be assumed. Table 1 summarizes evaporation rate assumptions, based on data from Rollins Reservoir.

Table 1: Assumed monthly evaporation rates for Centennial Reservoir

Month	**Evaporation (inches)**
January	0.89
February	0.83
March	1.91
April	3.30
May	5.62
June	7.68
July	9.41
August	8.89
September	6.53
October	4.58
November	1.82
December	0.96

The difference between the simulated water deliveries under With-project conditions versus Without-project conditions will be used to quantify water supply yield of for benefit calculations.

Coordination with Rollins Reservoir and Lake Combie

Under Without-project conditions, simulated releases from Rollins Reservoir will be made to meet NID and PG&E's Bear River Canal Diversion Dam diversion demands, and releases to the Bear River below the Bear River Canal Diversion Dam located immediately below Rollins Reservoir. Releases to the Bear River are typically the maximum of 1) NID's diversion demand in the Combie Phase I Canal at Lake Combie, or 2) the Federal Energy Regulatory Commission (FERC) license minimum instream flow requirement. In most months the Combie Phase I Canal demand exceeds the minimum instream flow requirement.

Under With-project conditions, simulated releases to the Bear River below the Bear River Canal Diversion Dam will be made to meet the minimum instream flow only, assuming Centennial Reservoir storage will be used to augment minimum flow releases from Rollins Reservoir to meet the full Combie Phase I Canal demand. It is anticipated that this modification to Rollins Reservoir operations will allow Rollins to reserve more water in carryover storage to offset drought impacts to NID and PG&E deliveries sourced by water from the Bear River Canal.

Water Year Types

Water Year types used in this application will be NID's Yuba-Bear and PG&E's Drum-Spaulding hydroelectric projects proposed water year types, as accepted by FERC in the Final Environmental Impact Statement for Hydropower License (FERC/EIS-F-0244, December 2014). Water Year types are based on the DWR forecast of total unimpaired Runoff in the Yuba River at Smartsville or the DWR Full Natural Flow (FNF) near Smartsville. Water Year types are updated in the months of February, March, April, May and October as defined in Table 2. For the purposes of this application Extreme Critically Dry and Critically Dry year types are grouped together into Critically Dry for reporting.

Table 2. Water Year types for NID's Yuba-Bear and PG&E's Drum-Spaulding hydroelectric projects (FERC/EIS-F-0244, Volume 2, Table 3-98).

Water Year Type	**DWR Forecast of Total Unimpaired Runoff in the Yuba River at Smartsville in Thousand Acre-Feet or DWR Full Natural Flow Near Smartsville for the Water Year in Thousand Acre-Feet[1]**
Extreme Critically Dry	Equal to or Less than 615
Critically Dry	616 to 900
Dry	901 to 1,460
Below Normal	1,461 to 2,190
Above Normal	2,191 to 3,240
Wet	Greater than 3,240

[1] DWR rounds the Bulletin 120 Forecast to the nearest 1,000 acre-feet. The Full Natural Flow is provided to the nearest acre-foot, and Licensee will round DWR's Full Natural Flow to the nearest 1,000 acre-feet.

Existing condition Water Year types are based on historical DWR Bulletin 120 forecasts and Full Natural Flow. For 2030 and 2070 condition Water Year types, historical DWR Bulletin 120 runoff forecasts and FNF values were modified using the VIC model results. Annual ratios will

produce a representation of unimpaired runoff at the Yuba River at Smartsville plus Deer Creek. Ratios will be applied as multipliers to historical Bulleting 120 and FNF values within each Water Year.

Ecosystem Conditions

Ecosystem With- and Without-project conditions are summarized in the Ecosystem Priority worksheets under the Physical Benefits tab.

Recreation Conditions

Recreation With- and Without-project conditions are summarized in the Recreation Benefits summary under the Physical Benefits tab.

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Benefit Calculation, Monetization, and Resiliency Tab

A.2: Preliminary Operations Plan

Reservoir Operations

The proposed Centennial Water Supply Project would have a normal-maximum useable storage of 105,000 acre-feet (assuming 5,000 acre-feet of dead pool below the low-level outlet) and would be operated to provide maximum seasonal carryover storage in years where the balance of NID's water supply system is able to meet its service area demands. The proposed Centennial Reservoir would operate as a "fill-and-spill" project, with a prioritization of maximizing reservoir storage during the winter and early spring runoff period. During the water delivery period (late spring through early fall), Centennial Reservoir would be used in coordination with NID's existing reservoir network to provide water to customers in NID's lower Bear River watershed service area. Centennial Reservoir would be managed in coordination with NID's Rollins Reservoir upstream, as well as Lake Combie downstream, with diversions made to NID's Combie Phase I Canal (Figure 1). Centennial Reservoir could effectively be used in conjunction with NID's existing Rollins Reservoir to expand the total storage capability in the Bear River watershed. This use would allow additional water to be captured from diversions out of NID's Mountain Division system in the Yuba River watershed, as well as natural runoff in the Bear River watershed (both the runoff in excess of what Rollins Reservoir can store on a seasonal basis as well as the runoff in the sub-basin below the Rollins Dam catchment).

During the majority of years and as hydrologic conditions allow, Centennial Reservoir would be operated at or near its full gross storage (110,000 acre-feet) throughout the year, with any seasonal drawdowns due to minimum instream flow requirements, water supply deliveries, and evaporative losses. In the fall and early winter, Centennial Reservoir would store any watershed runoff (in excess of minimum instream flow requirements) in order to return the reservoir to full pool.

During a dry year, Centennial Reservoir storage would be used to augment the reliability of NID's water supply in the Bear River watershed. Seasonal drawdown would vary based on the severity of the annual (or multi-year) drought condition.

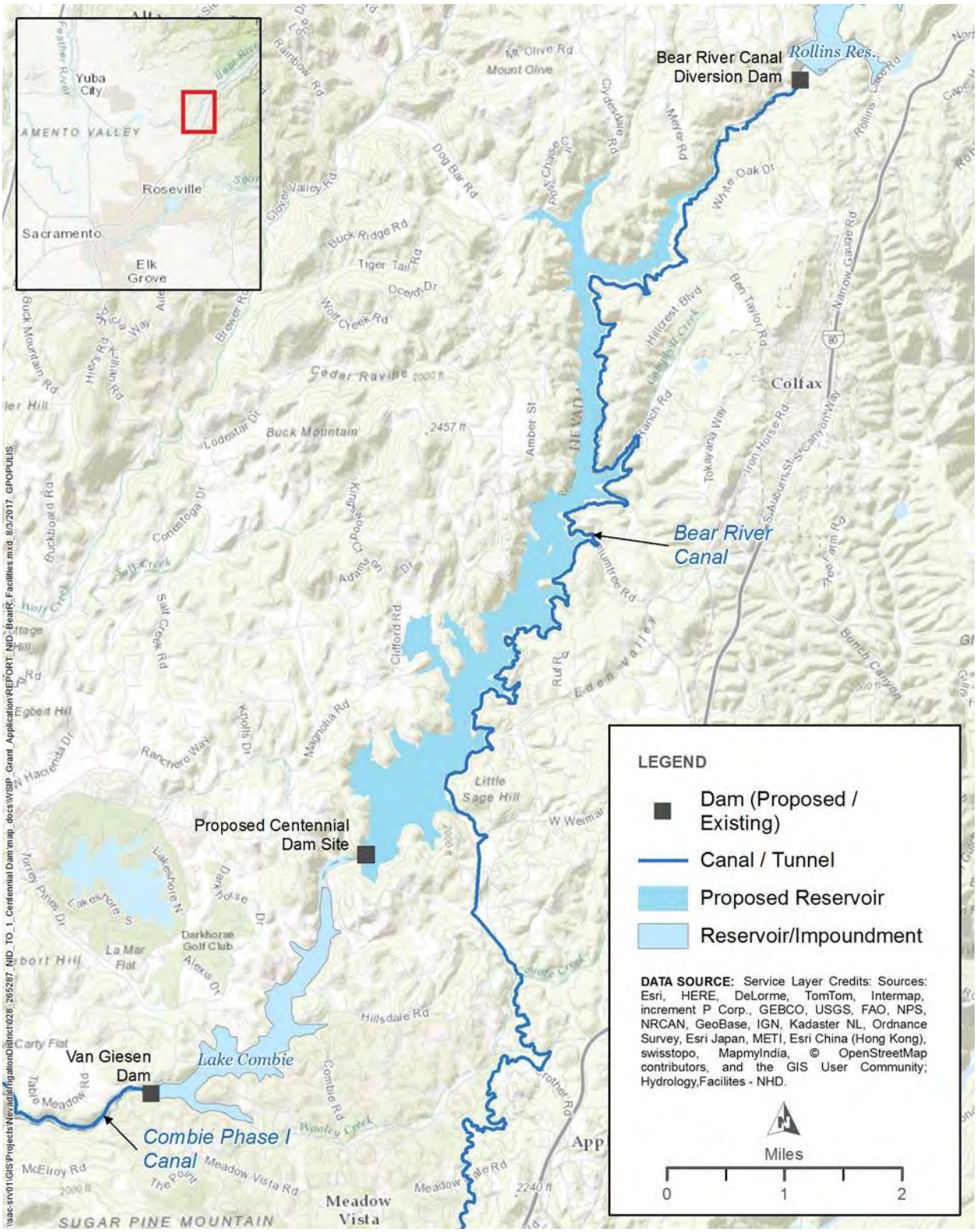


Figure 1: Bear River facilities map.

Seasonal Releases

Releases from Centennial Reservoir would vary by season and hydrologic year type and would consist of a combination of minimum environmental flows (yet to be established), discretionary releases for water supply, and spill. Seasonally, flows in the Bear River below Centennial Reservoir are expected to peak in the late summer as water deliveries are passed through Centennial Reservoir (via Rollins Reservoir) for delivery to Lake Combie and NID's Phase I Canal. In most years, winter and spring spill can be anticipated through an ungated spillway during heavy rain events in the Bear River watershed. The lowest seasonal releases from Centennial Reservoir would occur during late fall through early winter in most years, as the reservoir refills from any mid-year drawdown and downstream water delivery demands wane.

Coordinated Operations

Under current operations, demands at NID's Combie Phase I Canal are met through a combination of natural inflows to NID's Lake Combie (including from the upper Bear River watershed) and regulated releases from NID's Rollins Dam, which includes imported water from NID's Mountain Division watersheds in the Yuba River basin. The Combie Phase I Canal diverts directly from Lake Combie. With the Proposed Project, Centennial Dam and Reservoir would be used to store water released by Rollins Dam, which would be released as regulated outflow and/or spill for release at Lake Combie to the lower Bear River or diversion at the Combie Phase I Canal.

Project Maintenance

There would be no permanent on-site personnel for maintenance and inspection. NID personnel would monitor the dam site facilities daily Monday through Friday. This would involve one or two staff traveling to the site in a pickup truck. Maintenance and inspection would typically include the following:

- Dam, spillway and intake – removing debris and vegetation
- Mechanical and electrical equipment – periodically exercising the valves and checking the valve actuators
- Instrumentation – taking manual readings of dam performance instrumentation
- Site area – repairing erosion areas and removing vegetation

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Benefit Calculation, Monetization, and Resiliency Tab

A.3: Monetized Benefits Analysis

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.3: Monetized Benefits Analysis

Monetized Benefits Analysis

NID used various methods to monetize the benefits associated with the proposed project. A summary of the analysis is provided below.

Non-Public Benefits – Water Supply

The tool used to monetize the Non-Public Benefits of Water supply is described in a separate attachment, Economic Analysis for the Water Storage and Investment Program - Unit Values Estimation, August 2017.

Public Benefits - Ecosystem

The proposed project provides ecosystem public benefits through habitat acreage. As suggested in the Technical Reference, the method of benefit transfer was used to monetize the benefits from the habitat acreage. Benefit transfer is the technique of interpolating or extrapolating benefit estimates from studies done for other similar locations or resources and then applying those values to the proposed project, for which such studies have not been performed. The tool used was the Benefit Transfer and Recreation Use Estimating Model Toolkit[1] (Toolkit) from the Agricultural and Resource Economics Department of Colorado State University. The Toolkit consists of several spreadsheet tables, templates, and models that estimate values for wildlife recreation, common wildlife habitats, and threatened and endangered species. For the proposed project, the Total Economic Value of Wetlands per Acre spreadsheet tool was used.

Public Benefits - Recreation

The proposed project is located in the vicinity of numerous existing reservoir recreation areas operated by NID, particularly Rollins Reservoir and Scotts Flat Reservoir. Both of these reservoirs have recreational developments that are similar in size and type to those proposed at the project; and includes diverse user fee structures that align with the recreational developments at the proposed project. Thus, NID has monetized the recreation benefits for the recreational developments based on the recreational facility fee structure, occupancy rates and user patterns at these existing reservoir recreation areas.

Regarding the fee structure, NID utilized the fees for corresponding size and type of facilities, which included RV camping, group camping, watercraft, day use and other fees. Regarding the occupancy rates that drive the total number of sites and fee multiplier, NID predominantly utilized the recent (2009) FERC hydropower relicensing data at Rollins Reservoir that included comprehensive recreational use level, occupancy and user pattern data. Finally, to address the less significant fees (i.e., extra vehicle, watercraft and pet fees), NID made assumptions on the percentage of visitors at applicable facilities that would incur those fees based on its general experience operating similar facilities since specific data does not exist for these fee parameters.

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[1] Loomis, J. and L. Richardson. 2008. Technical Documentation of Benefit Transfer and Visitor Use Estimating Models of Wildlife Recreation, Species and Habitats. National Council for Science and the Environment. 2006 Wildlife Habitat Policy Research Program Project Topic 1H: Development of an Operational Benefits Estimation Tool for the U.S. Dept. of Agricultural and Resource Economics, Colorado State University, Fort Collins, June.

Overall, the monetization used the site capacity for each facility (i.e., number of campsites or parking spaces) as the foundation for the revenue projections and multiplied them by the applicable occupancy rate and period of use (year-round or 365 days for all facilities) to come up with a total annual number of sites occupied for each facility type. The sites occupied parameter was then multiplied by the applicable primary fee structures (i.e., campsite fee or day use fee) as well as secondary fees (e.g., extra vehicles, pets and watercraft) and summed to create a total monetary benefit for each facility. Finally, each facility was summed to arrive at a total monetary benefit for the project's recreational developments. Note that this monetization does not include potential revenue from ancillary services provided at the general store at Centennial Recreation Area.

Economic Analysis for the Water Storage and Investment Program

Unit Values Estimation

August 2017

Contents

Introduction

This document provides supporting information on the inputs and analyses used to estimate various unit values for the water supply benefits for projects that are applying for funding from the Water Storage Investment Program (WSIP). The unit values are estimated for a variety of benefit categories, end user locations, and timeframes to support the economic feasibility requirements for WSIP applications. The water supply benefit categories included in this document are Municipal and Industrial (M&I), Refuge, and Agriculture. All unit values are estimated through the application of an economic model that estimates the costs of water acquired on the spot market. Unit values are estimated for 2015, 2030, and 2045. Due to the uncertainty associated with long-term projections, unit values are not estimated for 2070.

Organization of This Document

This document is organized as follows:

Chapter 1, **Introduction**, provides an overview of the purpose of this appendix.

Chapter 2, Municipal and Industrial Water Supply Reliability, describes methods used to estimate unit values associated with M&I water supply reliability.

Chapter 3, Refuge Water Supply Reliability Benefits, describes refuge water supply reliability benefits.

Chapter 4, Agricultural Water Supply Reliability Benefits, describes emergency water supply benefits.

Chapter 5, Summary of Estimated Unit Values, provides a summary of estimated unit values by end use category, location, and year type.

Chapter 6, References, contains sources of information used to prepare the appendix.

Chapter 2
Municipal and Industrial Water Supply Reliability Benefits

In this analysis, the benefits to M&I water users are measured according to the cost of the most likely alternative water supply that would be pursued in the absence of development of the proposed projects. For water supply reliability benefits, the cost of the most likely alternative represents the next unit of water supply the water user would purchase, or develop, if the project under consideration were not in place. The cost of the most likely alternative assumes that if the preferred alternative is not implemented, the alternative action most likely to take place provides a relevant comparison. This valuation approach relies upon the costs associated with observed market transactions for water. As a result, the resulting estimates may underestimate willingness to pay.

M&I water users rely on the water transfer market to augment existing supplies and avoid shortages. For example, Bay Area water providers purchased more than 40,000 acre-feet (AF) during 2015 at unit prices between $300 and $700 per AF (not including conveyance costs). In addition, water market purchases are included as part of the long-term water supply portfolio for many water providers in the region. This analysis relies in part on market prices paid to purchase water on an annual basis from willing sellers. The market prices are reported according to the payments made directly to the sellers. The buyers incur additional costs to convey the water to their M&I service areas. These costs include both conveyance losses, which diminish the volume of water delivered to end users, as well as wheeling and power charges. Conveyance losses are incorporated into the adjusted water market price by dividing the estimated water market price paid to sellers by the proportion of acquired water that is delivered to the end use. The conveyance costs are estimated for M&I water users benefiting from the alternative plans, and added to the estimated market prices to acquire the water to develop an estimate of the full cost associated with additional water supply obtained in the transfer market. Figure 1 illustrates the information used to estimate the value of M&I water supplies.

Figure 1. General M&I Water Value Estimation Procedures

Water Transfer Pricing Estimation Method

A database of California surface water market sales was developed for use in estimation of the water transfer pricing model. Information for each transaction was researched and recorded to allow statistical analysis of a variety of factors influencing water trading activity and prices. During the research, transactions occurring from 1990 through 2016 were documented. The transactions were filtered for this analysis according to the following criteria:

- Water sales originating outside the operating region of the SWP facilities were excluded. These regions include the North Coast, North Lahontan, and South Lahontan regions.

- The water transfer pricing model, which relies upon the database of water transactions described above, is intended to estimate spot market prices and trading activity. Thus, multi-year transfers and permanent water entitlement sales were excluded.

- "Within-project" transfers were removed from the analysis, because they do not reflect "arms-length" transactions, whereby buyers and sellers are separate parties acting in their individual interests.

- Transactions associated with SWP Turnback Pool supplies were excluded because they are associated with rules that limit market participation.

- Purchases of "flood" supplies (e.g. SWP Article 21 and CVP 215) were excluded as prices are administratively set and do not have comparable reliability to the water supply from the proposed projects.

- Reclaimed and desalination water sales were removed from the analysis because they represent cost rather than market-based supplies.

- Leases of groundwater pumping allocations within adjudicated groundwater basins were excluded because they take place within isolated markets with different regulatory conditions from the market for surface water.

- Water sales with incomplete or inadequate information were excluded.

From 1990 through 2016, the database contains information on approximately 6,000 spot market (single year) transactions. Many of these involve groundwater leases within adjudicated basins. Following application of the above criteria, 678 spot market transfers remained to support the statistical analysis. All prices were adjusted to July 2015 dollars using the Consumer Price Index. As previously described, prices and volumes are presented from the seller's perspective and do not include conveyance charges or losses.

Although Federal and State government agencies have recently been more active in recording some information related to water sales or leases, California has few sources that track water transfers between private individuals. Most of the recorded transfers involve a Federal or State government party either because an agency had to approve the transfer, as is the case when a transfer involves CVP or SWP water, or because the government agency was directly involved in the transfer as a purchaser or a seller. Transfers involving private parties are more difficult to track, because the State does not have any reporting requirements.

In California, single-year transfers of water entitlements issued before 1914 are allowed without review by the State Water Resources Control Board (State Water Board) as long as they do not adversely impact the water rights of a third party (CALFED, 2000). For entitlements issued after 1914, the buyer and seller can petition the State Water Board for a 1-year temporary transfer. Nonetheless, prices for these transfers are not well documented. As a result, the data for this study were obtained from a mixture of public and private sources. Public sources include the following:

- Water Acquisition Program (WAP), Reclamation
- Resources Management Division, Environmental Water Account (EWA)
- State Water Bank, DWR
- OnTap database, DWR
- State Water Board, California Environmental Protection Agency (Cal/EPA)
- Various irrigation districts and water agencies

These sources provided information on the WAP, EWA, State Water Bank, and other public water transfers. State Water Bank observations included transfers to the State Water Bank to capture the price the seller receives.

Information on water transfers was also obtained from the January 1990 through December 2010 issues of the Water Strategist. The publication, previously called *Water Intelligence Monthly*, assembles information on public and private water transfers. Although not all transfers are recorded in the Water Strategist, the publication represents a primary source for water market research. Many of the transfers reported in the *Water Strategist* were independently researched to obtain more specific information and confirm transaction terms. *The Water Strategist* ceased to report on transactions in 2010. In addition, transactions not covered by the *Water Strategist* were researched and verified through direct communication with the transfer participants.

Benefit Estimation Procedures

This study applies a water transfer pricing regression model and builds on a previous analysis completed by Mann and Hatchett (2006) by applying an expanded data set and considering additional factors that influence water market trading activity and prices. Unlike the Mann and Hatchett analysis, which estimated a recursive regression model using Ordinary Least Squares techniques, the water transfer pricing model developed in this study is non-recursive, using Two-Stage Least-Squares. The first equation estimates the unit price for spot market water transfers, and the second estimates annual spot market trading activity. The coefficients from the models may be used to forecast future water prices north of Delta (NOD) and south of Delta (SOD).

The regression model theorizes that prices and volume of water traded can be estimated through consideration of the following market factors: water supply, geographic location, real water price escalation, buyer type, and State and Federal water supply acquisition programs.[1] These factors are described below.

Water Supply

As previously described, hydrologic conditions are a primary driver of water transfer market activity and prices. Therefore, it is important to include variables that appropriately capture water supply conditions to describe water trading activity and prices. In this analysis, water supply conditions are measured using the final annual SWP allocation (DWR, 2017a), the final CVP allocation (Reclamation, 2017), and the Sacramento River Water Year Index (DWR, 2017b).

Geographic Location

Water prices and trading activity vary by location according to water year type. Consequently, the origin of the water source for each transaction is used to determine geographic differences in water prices. Water sales applied in the regression analysis were allocated among the hydrologic regions identified by DWR (DWR and Reclamation, 2006). Binary variables are used to denote the different geographic regions of buyers and sellers including a variable identifying spot market transfers that involved through-Delta conveyance.

Real Water Price Escalation

Due to the growing urban water demand in the State, water transfer prices are anticipated to increase over time. To test for hypothesized price appreciation, the model includes an independent variable taking on the value of the year in which the transfer occurred.

Buyer Type

Previous economic analyses of water prices have concluded that the type of buyer (e.g., M&I, agricultural, and environmental) influences water prices. The water pricing equation tests the influence of buyer type on water price and trading. In

[1] Additional demand and supply factors were tested in the model but did not result in an improvement in overall explanatory power.

this analysis, binary variables are used to estimate price differences among environmental, urban, and agricultural buyers.

Seller Type

CVP and SWP agricultural contractors are the most common water sellers in the spot market. In order to test the influence of the two projects on water prices, a binary variable identifying sellers that are SWP contractors is included in the model.

Drought Water Bank and Environmental Water Account

The State has participated in the water market during drought years to facilitate trades. Under this program, DWR sets up a State Water Bank to facilitate water transfers, primarily from NOD agricultural users to SOD buyers. To account for the market conditions that existed during operation of the State Water Bank.

The EWA acquired water supplies for environmental purposes annually between 2001 and 2007. The implementation of the EWA impacted spot market trading and prices by introducing a large, new demand for water supplies. A dummy variable separating acquisitions by the EWA from other buyers is included to test for the price impacts of the program. A binary variable is included in the model to test the influence of the two programs on prices and trading activity.

Results

Two equations are constructed to estimate the economic benefits of increased M&I water supplies. The first equation forecasts water transfer prices based on hydrologic conditions, price appreciation over time, water supplier region, buyer type, buyer location, and premiums associated with DWR Drought Water Bank and EWA transactions. Information on 678 spot market water transfers is included in the data, allowing the model to forecast spot-market prices.

The second equation predicts the total annual volume of water traded in the spot market. Total annual trading volume is calculated using 678 spot market transfers, and is reported in thousands of acre-feet. The trading volume equation projects total annual volume traded based on hydrologic conditions, environmental water acquisition programs, and water transfer prices predicted by the first equation. The predicted water transfer prices obtained from Equation 1 are used as the explanatory price variable *lnadjpricehat* in Equation 2. Each equation's specification and variables are defined, and the Two-Stage Least-Squares regression results are presented in Table 1.

Equation 1

lnadjprice=scbuyer+nodbuyer+nodsod+lnyear+lntwpper+ag+env+dwbewa+swpseller+e

lnadjprice=Natural logarithm of price per acre-foot, adjusted to July 2015 dollars

scbuyer=1 if South Coast Region Water Buyer (binary)
nodbuyer=1 if the Buyer is North of the Delta (binary)
nodtosod=1 if North of Delta Water Supplier and South of the Delta buyer (binary)
lnyear=Natural log of the year in which the transfer occurred
lntwpper=Natural log of the percentage of Project water that was allocated in the year of the transfer
ag=1 if Agricultural end users (binary)
env=1 if Environmental (refuge) end user (binary)
dwbewa=1 if State Water Bank/Dry Year Water Acquisitions or the Environmental Water Account (binary)
swpseller=1 if the seller was a State Water Project contractor (binary)
e=Error Term

Equation 2

lnspottaft=drycrit+lnadjpricehat+ewayear+e

lnspottaft=Natural logarithm of total acre-feet traded annually (thousands)
drycrit=1 if a dry or critical year as indicated by the Sacramento River Water Year Index (binary)
lnadjpricehat=Values of the variable lnadjprice predicted by Equation 1

ewayear=1 if year in which the EWA operated (binary)

e = Error Term

Table 1. Regression Results

Equation[1] Dependent Variables	Observations	Parameters	RMSE	R-Squared	F-Statistic	P-Value (P > F)
lnadjprice	678	9	0.35	0.34	130.01	0
lnspottaft	678	3	0.56	0.64	120.34	0
Stage 1: Dependent Variable lnadjprice						
Independent Variables	**Coefficient**	**Standard Error**	**t-Statistic**	**P-Value (P > |t|)**	**95% Confidence Interval**	
scbuyer	0.25	0.09	2.71	0.01	0.07	0.44
nodbuyer	-0.35	0.08	-4.52	0.00	-0.51	-0.20
nodtosod	-0.16	0.07	2.28	0.02	-0.29	-0.02
lnyear	117.97	6.73	17.54	0.00	104.79	131.16
lntwpper	-0.79	0.08	-9.98	0.00	-0.94	-0.63
ag	-0.15	0.06	-2.54	0.01	-0.27	-0.04
env	-0.30	0.08	-3.57	0.00	-0.46	-0.13
dwbewa	0.29	0.06	4.77	0.00	0.17	0.40
swpseller	0.55	0.07	8.49	0.00	0.42	0.68
cons	-892.28	51.13	-17.45	0.00	-992.48	-792.07
Stage 2: Dependent Variable lnspottaft						
Independent Variables	**Coefficient**	**Standard Error**	**t-Statistic**	**P-Value (P > |t|)**	**95% Confidence Interval**	
drycrit	0.47	0.03	16.39	0.00	0.41	0.52
lnadjpricehat	-0.06	0.02	-3.23	0.00	-0.09	-0.02
ewayear	0.38	0.04	9.78	0.00	0.30	0.45
cons	5.75	0.11	53.64	0.00	5.54	5.96

Note:
[1] Equations and variables are defined in Equations 1 and 2 above.
Key:
RMSE = root-mean-square error

All estimated relationships between dependent and independent variables are statistically significant at the 99 percent confidence level. The quality of the two-stage least squares modeling results are dependent upon the results of the first stage estimation.

Equation 1 Discussion

The variable *lntwpper* is a measure of annual water availability. The amount of water available was calculated using the SWP and CVP maximum contract amounts, and the percentage of the maximum contract that was delivered each year to the different contractors. The SWP and CVP allocations decrease during drought conditions. Regulatory actions such as the Delta pumping constraints could further impact water deliveries. The statistical relationship between *lnadjprice* and *lntwpper* is attributable to increased demand for additional water supplies under the hydrologic and regulatory scarcity conditions that drive reduced water allocations. As an example, the coefficient value of -0.7872 on the *lntwpper* variable indicates that water transfer prices increase by approximately 50 percent in response to a decrease in percentage of total project water allocation from 50 percent to 30 percent, all else held equal.

The coefficient value on the variable *lnyear* indicates that water transfer prices rose at a real annual rate of approximately 6 percent between 1990 and 2016.[2]

The binary variables in the price equation describe conditions that influence prices, but are qualitative in nature. The coefficients for *env* and *ag* represent the influence that end-water use has on price. When these variables are zero, the model estimates prices to urban water users. Agricultural and environmental water users generally paid less for water than urban users, as indicated by the negative coefficients on the two variables. The results show environmental water buyers have paid 26 percent less per acre-foot than urban buyers in the market, with all else being equal. Similarly, water leases for agricultural use were priced 14 percent per acre-foot less than urban water leases, with all else being equal. These results may reflect the relative budget constraints among the three buyer categories.

The variable *dwbewa* is an indicator that the lease was either a State water lease through the Drought Water Bank of 1991, 1992, 1994, and 2009, or a lease through the EWA program. The binary variable is used to account for the price premium that occurred during operation of the bank and the EWA program. The coefficient value indicates that water leased during the operation of the Drought Water Bank, and water that was purchased through the EWA program, was priced 33 percent higher than other transactions, with all else being equal.

The variable *nodbuyer* is a binary variable measuring the difference in spot market prices between water originating and remaining NOD, compared to water that originated SOD. Sales from NOD suppliers to NOD buyers were 30 percent lower than sales originating SOD, suggesting there is a higher value for water SOD.

The variable *nodtosod* is a binary variable that captures the difference in spot market prices between water transactions where the water originated NOD and was transferred SOD, compared to water that originated SOD. NOD to SOD sales were priced 15 percent lower than sales where water originated SOD. This discount is attributable to water losses and other challenges that occur for supplies conveyed through the Delta.

According to the coefficient estimated for *scbuyer*, water transactions involving buyers in the South Coast region were priced 29 percent higher than acquisitions by buyers in other regions, with all else being equal. Premium prices paid by South Coast buyers result from strong competition for water supplies in the region, and the relatively high-value water uses in the area.

The variable *swpseller* is a binary variable measuring the premium paid for purchasing SWP water. The coefficient on *swpseller* indicates SWP sellers

[2] Example Calculation: $2.71828^{(116.392*\ln(Year_T))} = A$; $2.71828^{(116.392*(\ln(Year_{T-1}))} = B$; $(A-B)/B = 6\%$.

receive a premium of approximately 74 percent over CVP and non-project sellers, on average.

Equation 2 Discussion

The California water transfer market is governed by a complex set of legal, institutional, and physical conditions and is not an efficient (perfectly competitive) market. However, the successful estimation of the demand function (Equation 2) supports the use of water transfer prices for quantifying NED municipal and industrial water supply reliability benefits. The ability to estimate demand as a function of price in California's water transfer market confirms that the market is active and, through prices, provides to both sellers and buyers the marginal value of water in its higher-valued uses (Brookshire et al. 2004). Thus, forecasted water transfer prices estimated by the model (Equation 1) represent an appropriate measure of NED municipal and industrial water supply reliability benefits.

Equation 2 estimates total annual water market activity in spot market transfers according to hydrologic conditions, demand, and the current range of water transfer prices.

The dependent variable in the second equation, *lnspottaft*, is measured as the natural logarithm of the total annual volume of water (in TAF) traded in regions within the SWP service area through the recorded spot market water transfers beginning in 1990. As expected, the level of market activity holds an inverse relationship with water transfer prices (*lnadjpricehat*), indicating a down-sloping demand curve. Under the same hydrologic and demand conditions, more water trading occurs as prices drop.

Several different proxies for physical water scarcity conditions were tested, including annual CVP allocations, the Sacramento River Water Year Index, and a binary variable separating dry and critically dry years from wetter years. The selected variable *drycrit* held the strongest statistical relationship with *lnspottaft*.

The binary variable *ewayear* estimates the impacts of environmental water acquisition programs on trading activity. The positive coefficients on each variable demonstrate that environmental water acquisition programs shift the water market demand curve out, resulting in a larger volume traded, with all else being equal.

Future Water Market Prices

In this section, the model is used to estimate water prices for 2015, 2030, and 2045 by geographic region and hydrologic condition. Table 2 provides estimated water market prices for M&I water acquisitions for the selected years and regions. NOD and SOD were selected as supplier regions used to estimate the value of the increased water supply. For SBA water providers during wet and above-normal

water years, the analysis applies SOD prices to value increased M&I supplies due to conveyance limitations for NOD supplies. During below-normal, dry, and critical years, the analysis applies NOD prices due to increased capacity to move the relatively less expensive NOD water through the Delta. For EBMUD and Sacramento Valley, it was assumed that all purchased water would come from NOD.

Table 2. Estimated M&I Water Prices by Region ($/AF)

Region	Year Type	2015	2030	2045
EBMUD	Wet	$191	$432	$1,030
	Above Normal	$202	$457	$1,089
	Below Normal	$248	$560	$1,336
	Dry	$256	$580	$1,384
	Critical	$327	$741	$1,767
Sacramento Valley	Wet	$191	$432	$1,030
	Above Normal	$202	$457	$1,089
	Below Normal	$248	$560	$1,336
	Dry	$256	$580	$1,384
	Critical	$327	$741	$1,767
South Bay	Wet	$224	$506	$1,030
	Above Normal	$236	$535	$1,089
	Below Normal	$290	$560	$1,336
	Dry	$300	$580	$1,384
	Critical	$384	$741	$1,767

Notes:
Sacramento Valley Water Year Hydrologic Classification Index used to define water year types.
Dollar values are expressed in July 2015 price levels.
Estimated prices are for water transferred among parties located in different hydrologic regions.
Key:
Wet = Total SWP and CVP deliveries is 89% of contracted volume.
Above Normal = Total SWP and CVP deliveries is 83% of contracted volume.
Below Normal = Total SWP and CVP deliveries is 64% of contracted volume.
Dry = Total SWP and CVP deliveries is 61% of contracted volume.
Critical = Total SWP and CVP deliveries is 45% of contracted volume.
M&I = Municipal and industrial
NOD = Supplier located North of the Delta
SOD = Supplier located South of the Delta

Estimated Conveyance Charges

This section summarizes the estimated water conveyance charges by buyer location. The power costs associated with conveying the water purchase on the spot market to the end user is added to the estimated water purchase price described above. The cost to convey water to M&I users is estimated according

to the cost to move water through SWP facilities. Conveyance cost varies by location and user type. For example, SWP contractors pay a unit variable cost to move water based on a melded power rate. In comparison, non-SWP contractors pay a wheeling charge for access to SWP facilities, in addition to a market rate for the power required to pump the water. This analysis applies a wheeling charge of $110/AF for water delivered to EBMUD through the Freeport facility.[3] Water delivered to the SBA is charged a wheeling rate of $63/AF.[4] Water delivered to the Sacramento Valley is charged $30.51/AF based upon the conveyance costs associated with recent CVP water transfers.

Estimated Conveyance Losses

It is necessary to estimate conveyance losses to adjust estimated water market prices according to the geographic source of the supply. For example, an estimated delivery of 1,000 acre-feet to an M&I user may require the purchase of 1,111 acre-feet at the source, if 10 percent conveyance losses apply. Due to limited information regarding conveyance losses and specific sources of the transfer water, this analysis applies a 25 percent conveyance loss to water originating NOD and delivered to the South Bay Aqueduct.[5] Conveyance losses for water supplies to the South Bay Aqueduct originating SOD are assumed to be 10 percent. Water delivered to EBMUD through the Freeport Facility is assessed a 15 percent loss.[6] Conveyance losses are not applied to water purchases in the Sacramento Valley.

Combined water market prices, carriage losses, and conveyance costs are provided in Table 3. The values reflect the total cost of water (water price + conveyance losses + conveyance charges) to M&I water user by location and year type in 2015, 2030, and 2045. For the purposes, of the Nevada Irrigation District's (NID) proposed project, Centennial Reservoir, unit values for the Sacramento Valley were used.

[3] Personal communication with Senior Civil Engineer with Water Supply Improvements Division at EBMUD.
[4] This is the average wheeling rate for non-SWP water delivered using the SBA.
[5] This includes an estimated 20 percent conveyance loss for through-Delta transfers and a 5 percent conveyance loss assigned to non-project water supplies conveyed through SOD canals. It should be noted that conveyance losses (or carriage water) vary according to a variety of factors including conditions in the Delta and water source. For example, through Delta conveyance losses have ranged from 20 percent to 30 percent from 2009 through 2013. The conveyance losses applied here are intended to reflect the average across all conditions. Source: Personal communication with Supervisory Engineer (Bureau of Reclamation) and Chief of Water Management Branch (DWR).
[6] Personal communication with Senior Civil Engineer from Water Supply Improvements Division at EBMUD.

Table 3. Estimated M&I Water Supply Unit Values ($/AF)

Region	Year Type	2015	2030	2045
EBMUD	Wet	$354	$638	$1,342
	Above Normal	$367	$667	$1,411
	Below Normal	$421	$789	$1,702
	Dry	$431	$812	$1,757
	Critical	$515	$1,001	$2,208
Sacramento Valley	Wet	$221	$463	$1,061
	Above Normal	$232	$487	$1,120
	Below Normal	$278	$591	$1,367
	Dry	$287	$611	$1,414
	Critical	$358	$772	$1,797
South Bay	Wet	$335	$649	$1,231
	Above Normal	$349	$681	$1,297
	Below Normal	$491	$851	$1,886
	Dry	$504	$877	$1,949
	Critical	$615	$1,092	$2,460

Chapter 3
Refuge Water Supply Benefits

The 19 federal wildlife refuges in the Central Valley are part of the U.S. Wildlife Refuge system. Through the passage of the CVPIA in 1992, fish and wildlife were given equal priority as other water uses in the CVP service area. As a result, the federal government was required to provide a clean and reliable supply of water to wetland habitats in these refuges in support of fish and wildlife species. This is being accomplished through the Refuge Water Supply Program (Reclamation and USFWS 2009).

Reclamation delivers water to wildlife refuges in the Central Valley as a requirement of the CVPIA, as Level 2 supply (firm supply) and Incremental Level 4 supply (purchased from willing sellers). Currently, Incremental Level 4 refuge demands are not being fully met, and the new water supply developed by the proposed projects may be used to provide a more reliable supply to meet Level 4 refuge demands.

This section addresses the refuge water supply benefits that may be realized by providing additional refuge water supplies to help meet Incremental Level 4 refuge water needs. The approach to estimate refuge water supply benefits considers the estimated short-term market purchase price as the most likely alternative in the absence of firm water supply from the proposed projects. In addition, to address risk and uncertainty, a sensitivity analysis that addresses the habitat production value of additional water in terms of increased willingness to pay by recreation visitors to affected refuges.

Market Price for Water to Refuges

Historically, Incremental Level 4 water supplies have been primarily obtained through water lease agreements. In this analysis, the benefits of refuge water supply associated with the proposed projects are measured according to the estimated cost of obtaining the water supply through continued spot market leases. The water transfer pricing model described in Chapter 2 is applied here to estimate the benefits of improved refuge water supply. As previously described, the economic model consists of a statistical analysis of documented spot market water transactions in California. The model seeks to explain the factors that influence California water market prices and is used to estimate 2015, 2030, and 2045 prices under a variety of conditions including seller and buyer location, buyer type, and hydrologic conditions.

Table 4 provides the estimated water market prices assuming:

- The water is being leased for environmental (refuge) purposes. As shown by the coefficient value for model variable *env* (presented in Table 1,

above), environmental buyers are typically able to acquire water for a lower price than urban buyers.

- Water is leased from lower priced NOD sources during below normal, dry, and critical years when Delta conveyance capacity is available. During above normal and wet year types water is leased from SOD sources.

- A 25 percent conveyance loss factor is applied to water leased from NOD sources and 10 percent to water leased from SOD sources.

Table 4. Estimated Refuge Water Prices ($/AF)

Region	Year Type	2015	2030	2045
Delta Mendota Canal	Wet	$166	$399	$951
	Above Normal	$176	$422	$1,006
	Below Normal	$184	$442	$1,053
	Dry	$191	$458	$1,091
	Critical	$244	$584	$1,393
California Aqueduct	Wet	$166	$399	$951
	Above Normal	$176	$422	$1,006
	Below Normal	$184	$442	$1,053
	Dry	$191	$458	$1,091
	Critical	$244	$584	$1,393

In addition to the market price for water, buyers incur conveyance costs that vary with location and infrastructure. This analysis assumes that the refuge water delivered to the California Aqueduct is conveyed to the Dos Amigos Pumping Plant at a cost of approximately $30/AF. The power cost for refuge water delivered to the Delta Mendota Canal is estimated at the Banks Pumping Plant and is approximately $20/AF[7]. Combined water market prices, carriage losses, and conveyance costs for refuge water supplies are provided in Table 5. The values reflect the total cost of water (water price + conveyance losses + conveyance charges) to refuge water users by location and year type.

[7] [7] *Sources:* California Department of Water Resources, Management of the California State Water Project: Bulletin 132-12. Table 7. Kilowatt-Hour Per Acre-Foot Factors for Allocating Off-Aqueduct Power Facility Costs, 2012.
Jones, Jon. Charges for Wheeling Non-State Water Project Water Through State Water Project Facilities, State Water Project Analysis Office Division of Operations and Maintenance, January 17, 2012.

Table 5. Estimated Refuge Water Supply Unit Values ($/AF)

Region	Year Type	2015	2030	2045
Delta Mendota Canal	Wet	$207	$466	$1,079
	Above Normal	$218	$491	$1,140
	Below Normal	$272	$616	$1,431
	Dry	$281	$637	$1,481
	Critical	$351	$806	$1,883
California Aqueduct	Wet	$218	$477	$1,090
	Above Normal	$229	$502	$1,151
	Below Normal	$286	$629	$1,444
	Dry	$294	$650	$1,494
	Critical	$365	$819	$1,897

Chapter 4
Agricultural Water Supply Benefits

The proposed projects have the potential to improve water supply reliability for agricultural producers. Due to increased plantings of permanent crops and limited groundwater availability, agricultural producers in the region have consistently purchased water from other entities to satisfy crop water demands. For example, the San Luis Delta and Mendota Water Authority (SLDMWA) entered into a multiple-year agreement to purchase up to 60 TAF annually from the San Joaquin Exchange Contactors. SLDMWA and Tehama Colusa Canal have also purchased water from Sacramento Valley sources in recent years on the spot market. The additional water supply from proposed projects has the potential to benefit agricultural producers by offsetting a portion of future water purchase costs.

The approach to estimate agricultural water supply benefits considers the estimated short-term market purchase price as the most likely alternative in the absence of firm water supply from the proposed projects.

Market Price for Water to Agriculture

The water transfer pricing model described above is applied here to estimate the benefits of improved refuge water supply. As previously described, the economic model consists of a statistical analysis of documented spot market water transactions in California. The model seeks to explain the factors that influence California water market prices and is used to forecast prices under a variety of conditions including seller and buyer location, buyer type, and hydrologic conditions.

Table 6 provides the estimated water market prices assuming:

- The water is being leased for agricultural purposes. As shown by the coefficient value for model variable *ag* (presented in Table 1, above), agricultural buyers are typically able to acquire water for a lower price than urban buyers.

- For water delivered to the Delta Mendota Canal, water is leased from lower priced NOD sources during below normal, dry, and critical years when Delta conveyance capacity is available. During above normal and wet year types water is leased from SOD sources.

- A 25 percent conveyance loss factor is applied to water leased from NOD sources and 10 percent to water leased from SOD sources.

Table 6. Estimated Agricultural Water Prices ($/AF)

Region	Year Type	2015	2030	2045
Sacramento Valley	Wet	$164	$393	$936
	Above Normal	$173	$415	$989
	Below Normal	$212	$509	$1,214
	Dry	$220	$527	$1,257
	Critical	$281	$673	$1,605
Delta Mendota Canal	Wet	$192	$460	$1,096
	Above Normal	$203	$486	$1,159
	Below Normal	$212	$509	$1,214
	Dry	$220	$527	$1,257
	Critical	$281	$673	$1,605

In addition to the market price for water, agricultural buyers incur conveyance costs that vary with location and infrastructure. This analysis assumes that the purchased water is conveyed to agricultural users at a cost of approximately $30/AF. Combined water market prices, carriage losses, and conveyance costs for agricultural water supplies are provided in Table 7. The values reflect the total cost of water (water price + conveyance losses + conveyance charges) to agricultural water users by location and year type. For the purposes, of the NID's proposed project, Centennial Reservoir, unit values for the Sacramento Valley were used.

Table 7. Estimated Agricultural Water Unit Values ($/AF)

Region	Year Type	2015	2030	2045
Sacramento Valley	Wet	$194	$423	$966
	Above Normal	$204	$446	$1,020
	Below Normal	$243	$540	$1,244
	Dry	$250	$558	$1,287
	Critical	$311	$704	$1,635
Delta Mendota Canal	Wet	$235	$533	$1,240
	Above Normal	$247	$563	$1,310
	Below Normal	$310	$706	$1,645
	Dry	$320	$730	$1,702
	Critical	$401	$924	$2,166

Chapter 5
Summary of Estimated Unit Values

This document presents estimates of the economic benefits associated with increased water supplies. The estimated unit values were developed using an economic model of water transfer costs. This approach is consistent with the alternative cost method identified in the Technical Reference (California Water Commission, 2016).

Table 8 provides a summary of the estimated unit values by end use, location, and year type. Unit values were estimated for 2015, 2030, and 2045. Unit values were not estimated for 2070 due to the uncertainty associated with estimating water values that far into the future.

Table 8. Summary of Estimated Unit Values ($/AF)

End Use/Region	Year Type	2015	2030	2045
Municipal/EBMUD	Wet	$354	$638	$1,342
	Above Normal	$367	$667	$1,411
	Below Normal	$421	$789	$1,702
	Dry	$431	$812	$1,757
	Critical	$515	$1,001	$2,208
Municipal/Sacramento Valley	Wet	$221	$463	$1,061
	Above Normal	$232	$487	$1,120
	Below Normal	$278	$591	$1,367
	Dry	$287	$611	$1,414
	Critical	$358	$772	$1,797
Municipal/South Bay	Wet	$335	$649	$1,231
	Above Normal	$349	$681	$1,297
	Below Normal	$491	$851	$1,886
	Dry	$504	$877	$1,949
	Critical	$615	$1,092	$2,460
Refuge/Delta Mendota Canal	Wet	$207	$466	$1,079
	Above Normal	$218	$491	$1,140
	Below Normal	$272	$616	$1,431
	Dry	$281	$637	$1,481
	Critical	$351	$806	$1,883
Refuge/California Aqueduct	Wet	$218	$477	$1,090
	Above Normal	$229	$502	$1,151
	Below Normal	$286	$629	$1,444

	Dry	$294	$650	$1,494
	Critical	$365	$819	$1,897
Agriculture/Sacramento Valley	Wet	$194	$423	$966
	Above Normal	$204	$446	$1,020
	Below Normal	$243	$540	$1,244
	Dry	$250	$558	$1,287
	Critical	$311	$704	$1,635
Agriculture/Delta Mendota Canal	Wet	$235	$533	$1,240
	Above Normal	$247	$563	$1,310
	Below Normal	$310	$706	$1,645
	Dry	$320	$730	$1,702
	Critical	$401	$924	$1,605

Chapter 6
References

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Benefit Calculation, Monetization, and Resiliency Tab

A.4: Mitigation and Compliance Obligation

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.4: Mitigation and Compliance Obligation

At this time there are no environmental mitigation or compliance obligations for the public benefits claimed by the proposed project.

Nevada Irrigation District
Centennial Water Supply Project
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Benefit Calculation, Monetization, and Resiliency Tab

A.5: Benefit Quantifcation Support

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.5: Benefit Quantification Support

The benefits are quantified using the following attached spreadsheet tools:

1. NID_Centennial_Rec Use & Revenue Estimates_Rev 5_2017-0801.xlsx to calculate Recreation benefits.
2. MFWetland1.xls from the Benefit Transfer and Recreation Use Estimating Model Toolkit from the Agricultural and Resource Economics Department of Colorado State University to calculate ecosystem benefits.
3. CWC_Cost_Benefit_Analysis_NID.xlsx to monetize all public and non-public benefits, allocate costs, and determine grant request.

The tools and methods are described in A.3: Monetized Benefits Analysis.

Nevada Irrigation District
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Benefit Calculation, Monetization, and Resiliency Tab

A.6: Monetization Table

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.6: Monetization Table

Summary

Values in $Million (2015 Dollars)

		Non-Public	Non-Public	Public	Public
Planning Year	**Calendar Year**	**M&I Water Supply NOD**	**Agricultural Water Supply NOD**	**Recreation**	**Ecosystem Habitat**
1	2021	$ 233	$ 1,816	$ 1,572	$ 175
2	2022	$ 225	$ 1,755	$ 1,519	$ 169
3	2023	$ 217	$ 1,696	$ 1,468	$ 163
4	2024	$ 210	$ 1,638	$ 1,418	$ 158
5	2025	$ 203	$ 1,583	$ 1,370	$ 152
6	2026	$ 196	$ 1,529	$ 1,324	$ 147
7	2027	$ 189	$ 1,478	$ 1,279	$ 142
8	2028	$ 183	$ 1,428	$ 1,236	$ 137
9	2029	$ 177	$ 1,379	$ 1,194	$ 133
10	2030	$ 171	$ 1,333	$ 1,154	$ 128
11	2031	$ 195	$ 1,522	$ 1,115	$ 124
12	2032	$ 220	$ 1,716	$ 1,077	$ 120
13	2033	$ 245	$ 1,913	$ 1,041	$ 116
14	2034	$ 271	$ 2,113	$ 1,005	$ 112
15	2035	$ 296	$ 2,313	$ 971	$ 108
16	2036	$ 322	$ 2,514	$ 939	$ 104
17	2037	$ 348	$ 2,715	$ 907	$ 101
18	2038	$ 374	$ 2,914	$ 876	$ 97
19	2039	$ 399	$ 3,111	$ 847	$ 94
20	2040	$ 424	$ 3,307	$ 818	$ 91
21	2041	$ 449	$ 3,499	$ 790	$ 88
22	2042	$ 473	$ 3,687	$ 764	$ 85
23	2043	$ 497	$ 3,872	$ 738	$ 82
24	2044	$ 520	$ 4,052	$ 713	$ 79
25	2045	$ 662	$ 5,159	$ 689	$ 77
26	2046	$ 640	$ 4,984	$ 665	$ 74
27	2047	$ 618	$ 4,816	$ 643	$ 72
28	2048	$ 597	$ 4,653	$ 621	$ 69
29	2049	$ 577	$ 4,495	$ 600	$ 67
30	2050	$ 557	$ 4,343	$ 580	$ 64
31	2051	$ 538	$ 4,197	$ 560	$ 62
32	2052	$ 520	$ 4,055	$ 541	$ 60
33	2053	$ 503	$ 3,917	$ 523	$ 58
34	2054	$ 486	$ 3,785	$ 505	$ 56
35	2055	$ 469	$ 3,657	$ 488	$ 54
36	2056	$ 453	$ 3,533	$ 472	$ 52
37	2057	$ 438	$ 3,414	$ 456	$ 51

Summary

Values in $Million (2015 Dollars)

		Non-Public	Non-Public	Public	Public
Planning Year	**Calendar Year**	**M&I Water Supply NOD**	**Agricultural Water Supply NOD**	**Recreation**	**Ecosystem Habitat**
38	2058	$ 423	$ 3,298	$ 440	$ 49
39	2059	$ 409	$ 3,187	$ 425	$ 47
40	2060	$ 395	$ 3,079	$ 411	$ 46
41	2061	$ 382	$ 2,975	$ 397	$ 44
42	2062	$ 369	$ 2,874	$ 384	$ 43
43	2063	$ 356	$ 2,777	$ 371	$ 41
44	2064	$ 344	$ 2,683	$ 358	$ 40
45	2065	$ 333	$ 2,593	$ 346	$ 38
46	2066	$ 321	$ 2,505	$ 334	$ 37
47	2067	$ 311	$ 2,420	$ 323	$ 36
48	2068	$ 300	$ 2,338	$ 312	$ 35
49	2069	$ 290	$ 2,259	$ 302	$ 34
50	2070	$ 280	$ 2,183	$ 291	$ 32
51	2071	$ 271	$ 2,109	$ 282	$ 31
52	2072	$ 261	$ 2,038	$ 272	$ 30
53	2073	$ 253	$ 1,969	$ 263	$ 29
54	2074	$ 244	$ 1,902	$ 254	$ 28
55	2075	$ 236	$ 1,838	$ 245	$ 27
56	2076	$ 228	$ 1,776	$ 237	$ 26
57	2077	$ 220	$ 1,716	$ 229	$ 25
58	2078	$ 213	$ 1,658	$ 221	$ 25
59	2079	$ 206	$ 1,602	$ 214	$ 24
60	2080	$ 199	$ 1,547	$ 207	$ 23
61	2081	$ 192	$ 1,495	$ 200	$ 22
62	2082	$ 185	$ 1,445	$ 193	$ 21
63	2083	$ 179	$ 1,396	$ 186	$ 21
64	2084	$ 173	$ 1,349	$ 180	$ 20
65	2085	$ 167	$ 1,303	$ 174	$ 19
66	2086	$ 162	$ 1,259	$ 168	$ 19
67	2087	$ 156	$ 1,216	$ 162	$ 18
68	2088	$ 151	$ 1,175	$ 157	$ 17
69	2089	$ 146	$ 1,135	$ 152	$ 17
70	2090	$ 141	$ 1,097	$ 146	$ 16
71	2091	$ 136	$ 1,060	$ 142	$ 16
72	2092	$ 131	$ 1,024	$ 137	$ 15
73	2093	$ 127	$ 989	$ 132	$ 15
74	2094	$ 123	$ 956	$ 128	$ 14
75	2095	$ 119	$ 924	$ 123	$ 14
76	2096	$ 115	$ 892	$ 119	$ 13
77	2097	$ 111	$ 862	$ 115	$ 13
78	2098	$ 107	$ 833	$ 111	$ 12
79	2099	$ 103	$ 805	$ 107	$ 12

Summary

Values in $Million (2015 Dollars)

		Non-Public	Non-Public	Public	Public
Planning Year	**Calendar Year**	**M&I Water Supply NOD**	**Agricultural Water Supply NOD**	**Recreation**	**Ecosystem Habitat**
80	2100	$ 100	$ 778	$ 104	$ 12
81	2101	$ 96	$ 751	$ 100	$ 11
82	2102	$ 93	$ 726	$ 97	$ 11
83	2103	$ 90	$ 701	$ 94	$ 10
84	2104	$ 87	$ 678	$ 90	$ 10
85	2105	$ 84	$ 655	$ 87	$ 10
86	2106	$ 81	$ 633	$ 84	$ 9
87	2107	$ 78	$ 611	$ 82	$ 9
88	2108	$ 76	$ 591	$ 79	$ 9
89	2109	$ 73	$ 571	$ 76	$ 8
90	2110	$ 71	$ 551	$ 74	$ 8
91	2111	$ 68	$ 533	$ 71	$ 8
92	2112	$ 66	$ 515	$ 69	$ 8
93	2113	$ 64	$ 497	$ 66	$ 7
94	2114	$ 62	$ 480	$ 64	$ 7
95	2115	$ 60	$ 464	$ 62	$ 7
96	2116	$ 58	$ 449	$ 60	$ 7
97	2117	$ 56	$ 433	$ 58	$ 6
98	2118	$ 54	$ 419	$ 56	$ 6
99	2119	$ 52	$ 405	$ 54	$ 6
100	2120	$ 50	$ 391	$ 52	$ 6

Nevada Irrigation District
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Benefit Calculation, Monetization, and Resiliency Tab

A.7: Non-Monetized Benefits

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.7: Non-Monetized Benefits

The construction of the proposed project will lead to several public benefits, including some that, at this time have not yet been fully evaluated and therefore, cannot yet be monetized. The Proposed Project's primary non-monetized benefits include:

- Improved ecosystem water quality – water temperature.
- The development and implementation invasive species management plans utilizing techniques that are supported by best available science to enhance habitat and increase the survival of native species.
- Enhanced habitat for native species that have commercial, recreational, scientific, or educational uses.

These benefits are described in the Ecosystem Priorities worksheets. A summary of the qualitative benefits include:

- A cold water pool of 81,600 acre-feet when the reservoir is stratified. This colder water will provide direct benefits to local fish and aquatic invertebrate communities who rely on these conditions, such as local cold water fish (e.g., trout) that can utilize the reservoir as a large-scale dependable source of cold-water refugia during summer months when water temperatures in the Bear River upstream of the project may rise to inhospitable levels. Benefits to the local cold water fish and invertebrate communities could also have a positive effect to organisms higher on the food chain that rely on these fish and invertebrates for food such as bald eagles and osprey, both of which inhabit the regional area.
- The creation of the reservoir would eliminate targeted invasive species and other non-native plants and would also present a formidable obstacle to the disbursement of invasive species. In addition, reservoir development is expected to create conditions adjacent to and within the inundation area that allow for establishment of native riparian and wetland habitats, including perennial and seasonal wetlands (i.e., perennial marsh, seasonal marsh, and seasonal wetlands). Establishment of native riparian and wetlands areas will benefit native wildlife that utilize such habitat types including nesting songbirds and small mammals such as bobcat, ringtail cat, and mink.

These anticipated benefits would still be quantified and potentially monetized. However, an environmental document and feasibility study are still under development. These studies would involve more field surveys and numerical modeling to fully quantify these benefits, but it is anticipated that all of the benefits once quantified, if possible, would justify the costs of the project.

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Benefit Calculation, Monetization, and Resiliency Tab

A.8: Total Project Cost Estimate

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.8: Total Project Cost Estimate

NID
NEVADA IRRIGATION DISTRICT

The preliminary cost estimate for the Proposed Project is shown in the attached spreadsheet. The preliminary costs are allocated in the Benefit tool in the attached spreadsheet in A.5: Benefit Quantification Support. The preliminary cost estimate has been reviewed, approved, and signed by Remleh Scherzinger of Nevada Irrigation District, who is the General Manager and an engineer licensed by the California Board for Professional Engineers, Land Surveyors, and Geologists.

Remleh Scherzinger, General Manager, P.E. #66835

Capital Cost Summary (detials on following tabs)

Component	Capital Cost (2015 Dollars)	
Dam	$	247,342,995.17
Pipeline	$	9,447,500.00
Storage Tank	$	1,460,000.00
Pump Station	$	1,750,000.00
Bridge and Roadway	$	63,300,000.00
Recreation	$	20,859,903.38
Environmental Mitigation	$	27,485,500.00
Total	**$**	**371,645,898.55**

Assume Construction over 3 years

1/3 of capital cost = $ 123,881,966.18

Nevada Irrigation District
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Benefit Calculation, Monetization, and Resiliency Tab

A.9: Benefit Cost Analysis

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.9: Benefit Cost Analysis

At this time the benefit cost ratio of this project is 0.64. However, as described in Benefits Calculation, Monetization, and Resiliency Tab, A.7: Non-Monetized Benefits, this project provides several benefits that have not yet or cannot yet be monetized. These anticipated benefits, ecosystem water quality, invasive species management, and enhanced habitat, would still be quantified and potentially monetized. However, an environmental document and feasibility study is still under development. These studies would involve more field surveys and numerical modeling to fully quantify these benefits, but it is anticipated that all of the benefits once quantified, if possible, would justify the costs of the project.

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Benefit Calculation, Monetization, and Resiliency Tab

A.10: Cost Allocation

NID Application

Benefits Calculation, Monetization, and Resiliency Tab

A.10: Cost Allocation

The costs for the proposed project were allocated by the same percentages as the allocation of the benefits. Details are provided in A.5 Benefit Quantification Support.

Summary of Benefits

	Ecosystem	Water Quality	Flood Control	Emergency Response	Recreation	Total Public Benefits	M&I Water Supply	Agricultural Water Supply	M&I Water Quality	Hydropower	Total Non-Public Benefits	TOTAL BENEFITS
Benefits Net Present Value (NPV)	$ 5.01	$ -	$ -	$ -	$ 45.01	**$ 50.02**	$25.17	$ 196.26	$ -	$ -	**$221.44**	**$271.45**
Ratio of Total Benefits	1.84%	0.00%	0.00%	0.00%	16.58%	**18.43%**	9.27%	72.30%	0.00%	0.00%	**81.57%**	**100.00%**
Ratio of Public Benefits	10.01%	0.00%	0.00%	0.00%	89.99%	**100%**						
Ratio of Non-Public Benefits							11.37%	88.63%	0%	0%	**100%**	

Cost Allocation

	Ecosystem	Water Quality	Flood Control	Emergency Response	Recreation	Total Public Benefits	M&I Water Supply	Agricultural Water Supply	M&I Water Quality	Hydropower	Total Non-Public Benefits	TOTAL COSTS
Allocated NPV Costs	$ 7.77	$ -	$ -	$ -	$ 69.84	**$ 77.61**	$ 39.06	$ 304.53	$ -	$ -	**$343.59**	**$421.19**
Allocated Capital Costs	$ 5.98	$ -	$ -	$ -	$ 53.72	**$ 59.70**	$ 30.05	$ 234.25	$ -	$ -	**$264.30**	**$324.00**

Nevada Irrigation District
Centennial Water Supply Project
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Benefit Calculation, Monetization, and Resiliency Tab

A.11: Physical and Economic Benefits Summary

Physical and Economic Benefits Summary

July 2017

Part 1. Physical and Economic Benefits. Repeat this block for each category of public or non-public benefit quantified							
PUBLIC BENEFITS							
ECOSYSTEM IMPROVEMENT							
1. Physical Benefit Name: *Ecosystem*				Notes:			
2. Physical Benefit Measurement Units: acres				Notes:			
3. Net Physical Benefit Measurement[1]		2030			2070		
	Page #	With Project	Without Project	Difference	With Project	Without Project	Difference
		201.0	0.0	201.0	201.0	0.0	201.0
4. Annual Economic Benefit, 2015 $ Million/Year				$ 0.22			$ 0.22
RECREATION							
1. Physical Benefit Name: Recreation				Notes:			
2. Physical Benefit Measurement Units: visitor days per year				Notes:			
3. Net Physical Benefit Measurement[1]		2030			2070		
	Page #	With Project	Without Project	Difference	With Project	Without Project	Difference
		277,683	-	277,683	277,683	-	277,683
4. Annual Economic Benefit, 2015 $ Million/Year				$ 1.93			$ 1.93
5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)				$ 2.15			$ 2.15
NON-PUBLIC BENEFITS							
1. Physical Benefit Name: ***Water Supply (M&I and Agriculture)***				Notes:			
2. Physical Benefit Measurement Units: **thousand** acre-feet per year				Notes:			
3. Net Physical Benefit Measurement[1]		2030			2070		
	Page #	With Project	Without Project	Difference	With Project	Without Project	Difference
		3.8	0.0	3.8	11.2	0.0	11.2
4. Annual Economic Benefit, 2015 $ Million/Year				$ 2.52			$ 16.34

[1] Net of any non-mitigated physical effects

Part 2. Total Economic Net Benefits and Allocated Cost by Benefit Category in 2015 $ Million

Sum of Annual Economic Net Benefits by Type	Page #	Ecosystem	Water Quality	Flood Control	Emergency Response	Recreation	Total Public Benefits	Non-Public Benefits	Total public and non-public benefits[1]
Sum of 2030 benefits from Part 1, Row 5		$ 0.22	$ -	$ -	$ -	$ 1.93	$ 2.15	$ 2.52	
Sum of 2070 benefits from Part 1, Row 5		$ 0.22	$ -	$ -	$ -	$ 1.93	$ 2.15	$ 16.34	
Present Value of Benefits over Planning Horizon using 3.5% Discount Rate		$ 5.01	$ -	$ -	$ -	$ 45.01	$ 50.02	$ 221.44	$ 271.45
Present Value of Total Project Costs Allocated to each Benefit Category		$ 7.77	$ -	$ -	$ -	$ 69.84	$ 77.61	$ 343.59	$ 421.19
Capital Costs Allocated to Each Benefit Category		$ 5.98	$ -	$ -	$ -	$ 53.72	$ 59.70	$ 264.30	$ 324.00
Total Requested Program Cost Share									

[1] Present value of total public and non-public benefits, total project costs, and total Program funding request must match numbers in Part 3

Part 3. Present Value of Project Costs, Cost-Effectiveness Measure, and Public Benefit Ratio, Million 2015 $ Present Value

	Page #	2015 $ Million Present Value
Project Costs		
Capital costs as defined in Program regulations		$ 324.00
Interest during construction		$ 17.07
Annual Costs (including future environmental/compliance, OM&R, and replacement costs)		$ 80.12
		$ -
		$ -
		$ -
Present Value of Total Project Costs[1]		$ 421.19
Present Value of Cost of Least-Cost Alternative that Provides the Same Total Physical Benefits		TBD
Present Value of All Public and Non-public Benefits[1]		$ 271.45
Ratio of Present Value of Total Monetized Net Benefits to the Total Project Costs		0.64
Present Value of Public Benefits[1]		$ 50.02
Total Requested Program Cost Share[1]		$ 11.95
Public Benefit Ratio: Ratio of Present Value of Monetized Net Public Benefits to the Total Requested Program Cost Share		4.19

[1] Must match numbers in Part 2

Nevada Irrigation District
Centennial Water Supply Project
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Benefit Calculation, Monetization, and Resiliency Tab

A.12: Uncertainty Analysis

Uncertainty Analysis

Several sources of uncertainty are considered including water supply impacts due to climate change, changes in water management, projected customer demand uncertainty, and drought. Public benefits that are potentially impacted are recreation and ecosystem. Non-public benefits are potentially impacted are water supply.

Climate Change

The largest source of climate change uncertainly under 2030 and 2070 conditions is the seasonal timing and volume of watershed runoff. Watershed runoff is NID's primary water supply source, followed by reservoir carryover storage. Both of which are potentially impacted by climate change. Public recreation and ecosystem benefits are greatest when reservoirs are at their fullest (see description of recreation and ecosystem benefits under Physical Public Benefits Tab). Drier conditions result in reduced water levels and less public benefits provided by the project. Wetter would provide more public benefits. Public recreation benefits are enhanced when reservoir water levels are higher during the May through September period when recreation demand is highest.

VIC output from bounding scenarios provided by the CWC will be used to simulate various extreme levels of climate change using the HEC-ResSim model described in 'A.1 Project Conditions' within 'Benefit Calculation, Monetization, and Resiliency'. The 2030 and 2070 conditions model runs and historical unimpaired hydrology model input data will be modified using the VIC model output. Monthly ratios will be then produced for each unimpaired hydrology sub-basin relating extreme climate change VIC output to 1995 VIC output. Ratios can be applied as multipliers to the historical daily unimpaired inflow hydrology on a monthly basis for water years 1976 to 2008. These modified inflow time series will be used to simulate With- and Without-project scenarios.

The proposed project is primarily a water supply project intended to supplement NID's available water supply in dry years and in multi-year droughts. It is anticipated that model results will show that the project effectively helps NID manage its available water supply to meet customer demand under a wide range of future hydrologic conditions.

It is anticipated that public benefits will be maintained except for the driest years under the Drier/Extreme Warming (DEW) scenario, when both Rollins and Centennial Reservoirs are both drawn down to their minimum pool water levels.

2070 Drier/Extreme Warming (DEW) Operations Model Results

Rollins Reservoir will benefit from the additional capacity the Centennial Reservoir provides in most years of the DEW simulated period of record (1976-2008), except under the driest conditions. It is believed that the increased Rollins Reservoir storage will provide additional

public recreation benefits under With-project conditions compared to Without-project conditions (Physical Public Benefits Tab, A.2 Recreation Studies). Preliminary indications are that Centennial Reservoir will be able to fill in 20 years out of the 33 year period of record, providing additional carryover storage to better manage for drought conditions, and maximum ecosystem and recreation public benefit (Physical Public Benefits Tab, A.1 Ecosystem Priorities Worksheets).

2070 Wetter/Moderate Warming (WMW) Operations Model Results

Rollins Reservoir will benefit from the additional capacity the Centennial Reservoir provides in all years of the MWM simulated period of record (1976-2008) except for 1977. Increased Rollins Reservoir storage will provide additional public recreation benefits under With-project conditions compared to Without-project conditions (Physical Public Benefits Tab, A.2 Recreation Studies). Preliminary indications are that Centennial Reservoir will be able to fill in 32 years out of the 33 year period of record, providing additional carryover storage to better manage for drought conditions, and consistently providing quality recreation (Physical Public Benefits Tab, A.2 Recreation Studies) and ecosystem (Physical Public Benefits Tab, A.1 Ecosystem Priorities Worksheets) public benefits.

Future Project and Water Management Actions

NID's previous FERC license expired April 30, 2013. NID Yuba-Bear Hydroelectric Project is currently operating on annual licenses until FERC issues a new license. Changes in environmental flow requirements have the largest potential to impact to the Proposed Project. Environmental flow requirements under the old license totaled 7,700 acre-feet per year. Under the new license, environmental flow requirements are expected (based on FERC's Final Environmental Impact Statement) to increase, ranging from a total of 10,200 acre-feet per year to a total of 41,800 acre-feet per year depending on Water Year type. Future environmental flow requirements could be different than what was assumed for this grant application, but are unlikely to change significantly to impact the resiliency of the Proposed Project.

Other Sources of Uncertainty

Customer Demand

The second largest source of uncertainty is projected customer demand. Customer demand is forecast in NID's Raw Water Master Plan (NID, 2011) through 2032. Demand estimates are based on assumptions of population growth rates, land use, and conservation within NID's service area. Projected demands were extrapolated to estimate 2062 customer demand during FERC relicensing of NID's Yuba-Bear hydroelectric project, which were used as the estimated 2070 customer demand. Projected demands include a customer conservation rate of 20% by 2020, as mandated by the 20x2020 Water Conservation Act (SBx7 7).

Customer Demand uncertainty can come from many sources, including:

- Population growth rate
- Land use changes
- State or Federally imposed conservation targets

- State curtailment of Licensed diversions
- "Human Right to Water" water rights modifications
- Expansion of marijuana cultivation resulting from passage of California Proposition 64
- Delta unimpaired flow requirements

The Proposed Project will help NID continue to provide a dependable, quality water supply to its customers into the future acknowledging that there is uncertainty in future customer demand.

Drought

As directed by the CWC's WSIP Technical Reference (November 2016), a 5-year drought will be analyzed to assess system flexibility and resiliency for 2070 conditions. 2070 conditions are described in 'A.1 Project Conditions' within the Benefit Calculation, Monetization, and Resiliency Tab. The driest 5-year period in the modeling period of record is water years 1987 through 1991. The water years selected and water year types are summarized in Table 3. Water year classification is based on the Smartsville Index, also described in 'A.1 Project Conditions.' Water Year types based on the Sacramento Valley Index (http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST) are also provided for comparison. The Yuba River watershed was slightly wetter in most of these drought years than Northern California as a whole. There weren't any 5-year periods in the period of record with back-to-back Dry or Critical years according to the Smartsville Index.

Table 3: Summary of water years and water year types for the chosen 5-year drought period (1987-1991).

Water Year	Smartsville Index Water Year Type	Sacramento Valley Index Water Year Type
1986	Wet	Wet
1987	Critically Dry	Dry
1988	Dry	Critically Dry
1989	Above Normal	Dry
1990	Dry	Critically Dry
1991	Dry	Critically Dry

Model results show that under drought conditions the project would still provide public ecosystem benefits of water quality, enhanced wetlands, riparian habitat, native fish habitat, and invasive species management. A cold water pool benefit will be maintained throughout the 5-year drought, assuming a maximum thermocline depth of 30 to 50 feet that occurs in summer and early fall. Annual minimum water-surface elevations typically occur in late spring throughout the 5-year drought, before the thermocline has reached its maximum depth. Ecosystem improvements and benefits would be scaled proportionally with the decrease of reservoir storage and water-surface area below the NMWSE. Given the topographical variances in the Bear River Canyon, decreased water levels during a drought would also likely result in fewer coves available for enhanced wetlands development.

It is believed that the public recreation benefits generated by the proposed project will not be substantially impacted by the drought according preliminary assumptions.

Nevada Irrigation District
Centennial Water Supply Project
Water Storage Investment Program

Program Requirements Tab

Nevada Irrigation District
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Program Requirements Tab

A.1: Delta or Tributary Measurable Improvement

NID Application

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A.1: Delta or Tributary Measurable Improvement

The proposed project does not provide measureable improvement to the Delta Ecosystem or tributary to the Delta.

Nevada Irrigation District
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Program Requirements Tab

A.2: Cost Effectiveness

NID Application

Program Requirements Tab

A.2: Cost Effectiveness

A feasibility study is still under development and will be completed by the required date of January 1, 2022. Other alternatives will be formulated and evaluated to determine the cost effectiveness of the proposed project.