NORTH COAST RESOURCE PARTNERSHIP

2015 IRWM Project Grant Application

ATTACHMENT 2:
Project Justification

Integrated Regional Water Management Program
Applicant: Humboldt County

Attachment 2. Project Justification

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NORTH COAST 2015 IRWM PROJECT SUMMARY TABLE

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table					
IRWM Project Element		Bear River Band of the Rohnerville Rancheria Reclaimed Water Project	City of Weed Boles Fire Water System Rehabilitation/Water System Restoration	Del Norte County CSA #1 and Crescent City Lift Station Rehabilitation	Gold Ridge RCD Working Landscapes Drought Resiliency Project
IR.1	Water supply reliability, water conservation, and water use efficiency	•	•		•
IR.2	Stormwater capture, storage, clean-up, treatment, and management	•			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands	•			
IR.4	Non-point source pollution reduction, management, and monitoring	•			
IR.5	Groundwater recharge and management projects	•			•
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users				
IR.7	Water banking, exchange, reclamation, and improvement of water quality	•		•	
IR.8	Planning and implementation of multipurpose flood management programs				
IR.9	Watershed protection and management	•	•	•	•
IR.10	Drinking water treatment and distribution		•		
IR.11	Ecosystem and fisheries restoration and protection	•		•	•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Gualala River Watershed Council Flow Bank Program - Phase II	Happy Camp CSD Happy Camp Water Supply Upgrade - Phase I	Hoopa Valley Tribe Hoopa Valley Public Utility District Conservation Project
IR.1	Water supply reliability, water conservation, and water use efficiency	•		•
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management, and monitoring			
IR.5	Groundwater recharge and management projects			
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality		•	•
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management	•		•
IR.10	Drinking water treatment and distribution	•	•	•
IR.11	Ecosystem and fisheries restoration and protection	•		•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Hoopa Valley Tribe Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project	Hopland Band of Pomo Indians Hopland Band of Pomo Indians Test Well and Community Water Security	Humboldt County RCD Restoring Stream Flow and Fish Passage on the Eel River Delta
IR.1	Water supply reliability, water conservation, and water use efficiency		•	
IR.2	Stormwater capture, storage, clean-up, treatment, and management	•		•
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands	•		•
IR.4	Non-point source pollution reduction, management, and monitoring			•
IR.5	Groundwater recharge and management projects	•	•	•
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality			
IR.8	Planning and implementation of multipurpose flood management programs	•		•
IR.9	Watershed protection and management	•		•
IR.10	Drinking water treatment and distribution		•	
IR.11	Ecosystem and fisheries restoration and protection	•		•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Lewiston Mutual Water Company Lewiston Valley Drinking Water Intertie Pipeline	Mattole Restoration Council Lower Mattole River and Estuary Enhancement and Drought Resiliency Project	Mendocino County RCD Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows
IR.1	Water supply reliability, water conservation, and water use efficiency	•		•
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands		•	
IR.4	Non-point source pollution reduction, management, and monitoring		•	•
IR.5	Groundwater recharge and management projects		•	
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality			•
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management	•	•	•
IR.10	Drinking water treatment and distribution	•		
IR.11	Ecosystem and fisheries restoration and protection	•	•	•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Mendocino County RCD Water Conservation Technical Assistance to Mendocino County Tribes	Montague Water Conservation District Instream Flow Enhancement Through Water Conservation	Northwest CA Resource Conservation & Development Council Trinity River Water Reliability and Drought Resiliency Project
IR.1	Water supply reliability, water conservation, and water use efficiency	•	•	•
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management, and monitoring		•	
IR.5	Groundwater recharge and management projects	•		
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality		•	
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management	•	•	•
IR.10	Drinking water treatment and distribution	•		
IR.11	Ecosystem and fisheries restoration and protection	•	•	•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Sanctuary Forest Mattole Flow Program: Mainstem & Tributary Storage and Forbearance	Shasta Valley RCD Shasta River Drought Response and Irrigation Efficiency Project	Resort Improvement District #1 Shelter Cove Water Recycling Project
IR.1	Water supply reliability, water conservation, and water use efficiency	•	•	•
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management, and monitoring		•	•
IR.5	Groundwater recharge and management projects			
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality		•	•
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management	•	•	•
IR.10	Drinking water treatment and distribution	•		•
IR.11	Ecosystem and fisheries restoration and protection	•	•	•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Sonoma County Water Agency Northern Sonoma County Water Conservation Program	Sonoma RCD Russian River Coho Drought Resiliency Planning and Implementation Program	Watershed Research and Training Center South Fork Trinity River - Spring Run Chinook Salmon Restoration Project
IR.1	Water supply reliability, water conservation, and water use efficiency	•	•	
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management, and monitoring			
IR.5	Groundwater recharge and management projects			•
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality			
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management	•	•	•
IR.10	Drinking water treatment and distribution			
IR.11	Ecosystem and fisheries restoration and protection	•	•	•

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table (cont)				
IRWM Project Element		Weott CSD Additional Water Storage	Westhaven CSD Water Storage Tank and Roof Replacement Project	Yurok Tribe Yurok Watershed Restoration and Drinking Water Security
IR.1	Water supply reliability, water conservation, and water use efficiency	•	•	•
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			•
IR.4	Non-point source pollution reduction, management, and monitoring			
IR.5	Groundwater recharge and management projects			
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality			
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management			•
IR.10	Drinking water treatment and distribution	•	•	•
IR.11	Ecosystem and fisheries restoration and protection			•

BEAR RIVER BAND OF THE ROHNERVILLE RANCHERIA, RECLAIMED WATER PROJECT

PROJECT DESCRIPTION

Brief: This project will use reclaimed wastewater to irrigate four stormwater treatment wetlands in the dry season, eliminating the need to irrigate with potable water.

Expanded: The project purpose is to replace with reclaimed water the treated groundwater currently used for irrigation of stormwater treatment wetlands. Reclaimed wastewater will be used to irrigate three stormwater treatment wetlands in the dry season. The current wastewater treatment plant (WWTP) discharges to a failing leach system resulting in surface contamination. The presence of contamination at the surface in the leach field creates health concerns and has resulted in an area of restricted access. To correct this situation, the Tribe is currently constructing a new WWTP to replace existing facilities; the stormwater treatment wetlands are included in its design.

The original design of the new WWTP included the use of reclaimed wastewater for irrigation of 4 stormwater treatment wetlands, but due to financial restrictions this phase was cut from the project. Wetlands studies modeled the water budget for the stormwater treatment wetlands and determined that the budget was negative for several months in the summer and that irrigation would be necessary to keep wetland vegetation alive (Tish Non Village Mitigation and Monitoring Plan, NRM, 2009, page 19). Currently, the Tribe is using potable water (pumped and treated groundwater) to irrigate a functional wetland in the dry season to keep the wetland plants alive. In the wet season, the wetland is used for the biological treatment and sediment reduction of stormwater runoff from parking lots, roads and other developed surfaces. The new WWTP will include an AeroMod Biological Treatment System, Westech Disc Filter, Wedeco UV Disinfection Equipment, reclaimed water pumps, piping and a disposal field for unused reclaimed water during the wet season. The disposal field will result in groundwater recharge. Additionally, a portion of the reclaimed water will be stored in the repurposed aboveground storage tank and will be available for use for fire suppression.

Effluent from the new WWTP will meet California Title 22 Standards for Disinfected Tertiary Recycled Water. This Disinfected Tertiary recycled water is of the highest quality and is suitable for all types of irrigation including irrigation of the four existing Tribal stormwater treatment wetlands with the option of future reclaimed water projects.

The proposed project will install the reclaimed water piping, irrigation systems, and tank repurposing necessary to connect to provide the new WWTP's reclaimed water to the stormwater wetlands. It will also include an educational trail to increase tribal/public awareness of the current drought situation and appropriate responses; signage will describe the generation, use, benefits, and safety of reclaimed water. Connection will be made between reclaimed water projects in relation to current and future drought conditions.

PROJECT PHYSICAL BENEFITS

This project provides multiple benefits, including those listed below, which are provided with rough estimates of their yearly monetary value.

- **Primary: Water supply saved** of approximately 9.2 AFY through implementation of the water reclamation project, providing an estimated monetary benefit of $60,000 per year (20,000 gallons per day * 30 days/month * 5 months/year * $0.02/gallon).
- **Secondary: Habitat improved** in the amount of 10 acres through provision of ample water during five months of summer to allow the plants to flourish year-round. Currently, they receive only enough water during summer months to keep them alive until winter rains arrive. We conservatively estimate that this provides a monetary benefit of approximately $8,333 per year (10 acres * 5/12 (five months out of a year) *$2,000 per acre) given an estimated value of wetland habitat improvement between $2 - $4,000 per year (Woodward and Wui, 2001, *Economic Value of Wetland Services: A Meta-Analysis*, Ecological Economics, 37:257-270).
- **Increased water supply reliability** due to decreased use of treated groundwater for 61 connections will yield an estimated $6,100 monetary benefit per year (61 households * $20 per month * 5 months per year) using a conservative value of $20 per month per household for increased water supply reliability (Barakat & Chamberlin, Inc. 1994, *The Value of Water Supply Reliability: Results of a Contingent Valuation Survey of Residential Customers*).
- **Avoided cost of irrigation labor** estimated to be $4,219 per year (3 persons for 3 hours per day for 3 days per week for 5 months per year ($31.25/hr fully burdened))
- **Increased community capacity**: this project will increase regional and community understanding and acceptance of reclaimed water projects, paving the way for future efforts.
- **Climate mitigation:**
    - **GHG emissions reduction** estimated to provide a monetary benefit of approximately $4,000 per year due to less energy use pumping, treating, and distributing potable water for irrigation. The project proponent estimates this benefit to be about $800 per month for 5 months after comparing electric costs during the dry season to electric costs during the wet season.
    - **Carbon sequestration** from wetlands enhancement – healthier, more robust wetland plants will sequester more atmospheric CO_2.
- **Climate adaptation:** By reducing the demand on groundwater basins during the summer months and recharging to a groundwater basin during the wet season, this project is bolstering community resiliency in the face of expected hotter, drier weather with longer drought cycles.

Table 5.1 a – Annual Project Physical Benefits

Project Name: BEAR RIVER BAND OF THE ROHNERVILLE RANCHERIA RECLAIMED WATER PROJECT

Type of Benefit Claimed: Water supply saved - Primary

Units of the Benefit Claimed : Acre-feet per year

Anticipated Useful Life of Project (years) 20 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	9.2	9.2
2018	0	9.2	9.2
Through 2037	0	9.2	9.2

Comments: Project will be complete in 2016. This project provides an estimated monetary benefit of approximately $60,000 per year (20,000 gallons/day irrigation for 5 months/year at $0.02 per gallon = $60,000 per year). Water cost estimated by Project proponent.

Table 5.1 b – Annual Project Physical Benefits

Project Name: BEAR RIVER BAND OF THE ROHNERVILLE RANCHERIA RECLAIMED WATER PROJECT

Type of Benefit Claimed: Habitat improved - Secondary

Units of the Benefit Claimed : Acres

Anticipated Useful Life of Project (years) 20 year

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	10	10
2018	0	10	10
Through 2037	0	10	10

Comments: Project will be complete in 2016. This project will improve the wetlands by providing up to 120,000 gpd (currently around 40,000 gpd) of treated wastewater for irrigation purposes. Currently, the wetlands are only irrigated with 20,000 gpd during the hot, dry, summer, which is enough to keep the plants alive, but does not allow them to flourish. Doubling the amount of summer irrigation water will improve the wetlands and the ecosystem services - such as CO2 sequestration, filtration, and pollination - that they provide.

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of need

The Water Utility Service Association provides water and sewer services to Tish Non Village which is an economically disadvantaged community (DAC). Tish Non Village consists of single family residential housing, group assisted living, community center, and recreational facility. The water for the community is from groundwater wells that require expensive treatment to make potable. Water conservation is always important, even when drought conditions do not exist. The proposed project is the final phase of a larger project, the construction of a new wastewater treatment plant to replace two undersized and failing wastewater treatment plants. Since the current treatment plants are being operated near capacity, small operational errors can result in potential environmental impacts. The final currently unfunded phase of the project is for distribution of reclaimed water to wetlands. Stormwater treatment wetlands require irrigation in the dry months to maintain the wetland vegetation; this project will alleviate the need for potable water use by providing reclaimed water for irrigation (SHN, 2013, Secondary Disposal Field Suitability Investigation Results and Low-Pressure Pipe Distribution System Design for Disposal of Treated Effluent, Tish Non Village, Bear River Rancheria, Loleta, CA, page 5).

Estimates of Without-Project Conditions

Other projects are not planned that would affect the levels of physical impact anticipated from the project. If this project is not implemented, the Tribe will be forced to continue to use treated, potable groundwater to irrigate the wetlands during the summer months and no reclaimed water would be diverted to the disposal field during the winter months, resulting in continued lowering of groundwater basin water levels. Additionally, the community would not be as resilient to increased drought cycles expected with climate change, and would not be empowered through the learning opportunity that the wetlands trail will provide.

Methods Used to Estimate Physical Benefits

Physical benefits were estimated based on the wetland acreage, water utility records, economics research, project proponent experience and technical assistance from certified professionals. When estimating economics benefits, conservative values were used in order to avoid overestimation.

Identification of All New Facilities, Policies, and Actions

The new facilities required to get the physical benefits include the new wastewater treatment plant (which is already under construction) to generate tertiary quality treated water and this proposed project.

This proposed project includes 2,500 feet of 4” reclaimed water piping to an existing aboveground tank that will be repurposed to supply reclaimed water to three of the wetlands. To repurpose the tank, an existing wastewater line will be abandoned and rerouted to the new WWTP. The rerouted wastewater line to the new WWTP will increase the capacity of the reclaimed water system. The wetland irrigation systems include reclaimed water piping around the perimeter of three wetland areas, sufficient

irrigation sprayers to evenly irrigate the wetland, and an irrigation control system including wiring and irrigation controller (Wahlund Construction, Inc , Comprehensive Project Design, 2015).

Additionally, an educational trail will be developed around the wetland with signage to educate the public about the importance and benefits of recycled water.

Description of Potential Adverse Physical Effects

The potential adverse physical effects from the construction phase of the project include habitat disturbance during installation of the system, which can increase erosion and sedimentation, and disturbance of existing subgrade infrastructure (utilities). To mitigate these effects, some of the irrigation lines will be installed using directional drilling to reduce habitat disturbance, and erosion control BMPs will be used to mitigate erosion and sediment. To avoid disturbing existing infrastructures, all utility lines will be cleared with Tribal staff prior to any subgrade work.

During the operation of the reclaimed water irrigation system, poor quality effluent (partially or poorly treated) could possibly be discharged into the wetland. The adverse physical effects from operational error will be mitigated by operator training, routine system monitoring, and effluent sampling for verification of system performance.

During both construction and operation of the proposed project, professional standards will be met, BMPs will be used, and mitigation actions will be immediately implemented in the unlikely event such effects occur.

Drought Preparedness

This project will implement the following Statewide Priorities related to Drought Preparedness:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Efficient groundwater basin management.

As a result of the current drought conditions, the Bear River Tribe has begun a groundwater monitoring program including monthly measurement and recording of groundwater depths at drinking water wells. Monthly data will be compiled and compared to previous depth readings and the calculated average depth as data is accumulated, however, preliminary measurements seem to indicate a decreasing trend in groundwater depth. Additionally, recent groundwater elevation data for CASGEM Station 406413N1242409W001 – the closest groundwater monitoring point with recent data – indicates that wet season groundwater elevations have been falling since 2012. In response to these indicators, the Tribe has begun working on a water shortage contingency plan.

Since the drought, meter reading data are being audited monthly to identify accounts with excessive use. Accounts with excessive use are being contacted to determine if there is a leaking appliance or other source of loss. Water staff are aggressively identifying water leaks and correcting them.

This project contributes to sustainability of the Tish Non Village water supply by reducing potable water demand during the dry season. During the wet season, reclaimed water unnecessary for irrigation will be used for groundwater recharge. Reducing summer demand will enhance water supply reliability and climate change resilience.

In addition, this project will be used as an educational tool by the Tribe to raise community awareness on drought issues and water conservation techniques. This education and higher level of awareness within the community will be effective in addressing long term drought preparedness. An educational trail associated with the wetland with messages about the use of reclaimed water, the drought, and water conservation will raise the level of awareness on a broader geographic scale. Exposure to the use of reclaimed water will lead to greater public acceptance and is expected to lead to other reclaimed water projects being promoted and accepted in other communities. Such education and public awareness is an important aspect of addressing long term drought preparedness in the region and beyond.

DIRECT WATER RELATED BENEFIT TO A DAC

Tish Non Village is classified as a DAC (*Attachment 7*); all housing in the community is HUD regulated and all residents must meet HUD income guidelines to be eligible for housing. Residents are generally unable to afford the cost of services for sewer and water and are at a low fixed rate that is subsidized by the Tribe.

The direct benefit to Tish Non Village is that the project will result in energy savings, increased drought and climate change resilience, wetland enhancement, increased drought awareness, stormwater treatment, and "reclaimed water-tourism." A trail around the wetlands and educational signs, will promote drought awareness, and reclaimed water use. As the first reclaimed water project in the area, there is an opportunity for this project to be visited by industry and educational groups.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.1 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Project Construction	Irrigation pipe, sprayers, and control systems and refurbished storage tank	Photodocumentation, certified engineer's statement of completion	Upon completion of installation
Water Supply	3,000,000 gallons per year	Effluent flow meter readings and reclaimed water use will be recorded in an operations log book daily. Daily totals will be used to calculate monthly and annual total volume of reclaimed water used for irrigation of wetlands. During the dry season, water production will be measured and compared against pre-project water production.	Daily
Habitat Improvement	Vegetation will survive to 80% of planted densities or have a 90% closed canopy.	A qualified wetland specialist will survey vegetation, soils, and hydrology in the wetland areas according to standards promulgated by the US ACE (Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region (2008). Vegetation surveys will be conducted at each point to determine whether vegetation meets ACE Wetlands Delineation Manual (1987) Technical Report Y-87-1 standards for hydrophytic vegetation.	Every 6 months
GHG Reduction	$4,000 per year at 2015 utility rates	Monthly utility costs for operating the water utility will be calculated and recorded. Total energy savings will be calculated yearly based on 2015 utility rates.	Yearly

Project performance will be monitored and quantified by several independent metrics. The volume of reclaimed water used for irrigation will be monitored on an annual basis. Annual groundwater production will be monitored to verify the reduction of volume due to use of reclaimed water for irrigation. Additionally, power consumption will be monitored annually to verify and quantify the energy

savings provided by the use of reclaimed water for irrigation. The health of the wetland ecosystems will continue to be monitored twice each year.

COST EFFECTIVE ANALYSIS

Table 7 – Cost Effective Analysis **Project name: Bear River Band of the Rohnerville Rancheria Reclaimed Water Project**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) and Habitat improved (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? Yes.
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *The alternative to this project is to purchase water from a local water hauler. The cost per gallon for hauled water is 2.5 to 25 times more expensive than the cost of the Bear River Tribe potable water. Under the hauled water alternative the Tribe would still have the cost of labor for manual irrigation. The alternative of using hauled water would cost between $360,000 to $1,700,000 per year to achieve the same benefit as the proposed project which exceeds the cost for the project.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The proposed project is the least costly alternative. The cost of the project with a projected life of 20 years is approximately $744,000. The conservative cost of the hauling water alternative to achieve the same benefit for 20 years is approximately $7,200,000.*
Comments:	

CITY OF WEED, BOLES FIRE WATER SYSTEM REHABILITATION/ WATER SYSTEM RESTORATION

PROJECT DESCRIPTION

Brief: This project will repair a Disadvantaged Community's aging water supply infrastructure to conserve water, ensure water supply reliability, and reduce losses due to wildfires.

Expanded: The proposed project consists of installing approximately 5,000 linear feet of 6- and 8-inch water mains, including valves and appurtenances; and nine fire hydrants to an area of Weed that is in need of new infrastructure. In September 2014, the Boles Fire ripped through the City of Weed destroying 157 homes, two churches, a portion of Weed Elementary School and numerous secondary buildings. One of the areas hit the hardest was the Angel Valley area; 58 homes were lost in this area alone. It will be necessary to re-route new water services to these homes and an additional 46 lots will require their water mains to be relocated to the street (PACE *Engineering Schematic 2015*).

In addition to the problems caused by the fire, many of the water mains in this area are undersized and run through alleys. Improvements to the water system in this area were identified in the 2003 Master Water Plan Update to bolster fire flows and provide more stable system pressures (PACE Civil, Inc. 2004). It is desirable to abandon the undersized, old steel water mains and install new PVC water mains in the streets where they are more accessible, and where water meters can be read more easily. Several areas of town contain old steel water mains that have an extensive leak history. In fact, according to page 15 of the City's 2003 Master Water Plan Update, up to 33% of water produced is unnaccounted for. Some of these pipelines traverse under existing homes and businesses and many of the existing water mains are 2- and 3-inch steel. In many cases, property owners have filed claim against the City for damage to private property because of leaking water mains.

This project consists of abandonment of 2,400 feet of 4-inch water main, and replacement of about 2,100 feet of 2-inch water main. Eighty-six existing water services will be re-connected to an existing or new water main. Implementation of this project will 1) conserve water, 2) improve water supply reliability, and 3) reduce financial risk and damages from future wildfires.

PROJECT PHYSICAL BENEFITS

This project will yield multiple quantifiable physical benefits, including:

- **Primary: Water supply saved** estimated at 140 AFY at approximately $121 per acre-foot for urban beneficial uses yields a monetary value of $16,940 per year in 2015 dollars
- **Secondary: Improved fire protection** will protect an additional 100 homes per large scale fire event, which have historically occurred every 15 – 20 years but are expected with increasing frequency as the climate becomes drier and hotter (CEC, *Fire and Climate Change in California*, 2012). Using the project proponent's estimate of $150,000 per home protected, this benefit has a monetary value of approximately $15 million in 2015 dollars at least every 15 – 20 years.
- **Avoided water supply projects**: with implementation of this project, the City will avoid needing to locate and develop a new supply well, which has been conservatively estimated to cost $1.0 million.

- **Avoided costs associated with insurance claims** for damage due to leaky water mains will save the City at least $15,000 per year. This estimate is based on averaging previous years' insurance claims.
- **Avoided costs associated with emergency leak repairs** will save the City an estimated $10,000 per year.
- **Reduced pumping and treatment costs** of about $8,300 per year. It is assumed the proposed project would eliminate 140 AFY of water loss. At a well pumping rate of 800 GPM with a 75-HP motor and a power cost of about $0.11 per KW-HR, the total annual savings would be about $8,400 per year.
- **Climate change mitigation:** reduced pumping of 140 AFY will reduce GHG emissions.
- **Climate change adaptation:** by improving water supply reliability and fire protection, this project adds to community resiliency and improves capacity to respond to catastrophic emergencies or extended drought.

Table 5.2 a – Annual Project Physical Benefits

Project Name: __CITY OF WEED BOLES FIRE WATER SYSTEM REHABILITATION/ WATER SYSTEM RESTORATION

Type of Benefit Claimed: _Increased municipal water supply - Primary

Units of the Benefit Claimed : ___AFY

Anticipated Useful Life of Project (years) _75 years_

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	140	140
2018	0	140	140
Through 2091	0	140	140

Comments: Project construction will be complete in 2016. This benefit has an estimated monetary benefit of $121 per acre-foot per year. This value represents the median price paid in California water markets for water purchased for municipal purposes. The value of this benefit accumulates over time (West Water Research 2013. *2013 California Spot Market Price Forecast*.).

Table 5.2 b – Annual Project Physical Benefits			
Project Name: __CITY OF WEED BOLES FIRE WATER SYSTEM REHABILITATION/ WATER SYSTEM RESTORATION			
Type of Benefit Claimed: _Improved fire protection - Secondary			
Units of the Benefit Claimed : ___Number of houses			
Anticipated Useful Life of Project (years)_____75 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017 - 2037	0	100	100
2038 - 2058	0	100	100
2059 - 2091	0	100	100
Comments: Benefits of $15 million are expected once about every 15 - 20 years based on historic fire frequency, however, this is likely an underestimate, since wildfires are predicted to become more frequent with climate change.			

Reviewers are respectfully requested to respond "N/A" for Project Level Evaluation Question # 8 because of the project proponent's DAC status. Even though this is not a planning project, this question should not be applicable to this DAC, which does not have the luxury of having several medium priority projects to choose from that best fit the PSP requirements. This project was locally identified as the most important project to submit to the IRWMP process and was prioritized by the NCRP, the governing body of the North Coast IRWMP as meeting its State-approved goals and objectives. It serves both state and regional goals of improving participation of DACs and under-represented communities and it provides many physical benefits identified by the region and State as important. Please respond "N/A" for Question 8.

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of need

The project consists of abandoning or replacing old steel water mains that have reached or exceeded their useful lives. The subject water mains have an extensive leak history which has led to private property damage and subsequent claims filed against the City. Some of these existing pipelines run under residences and businesses, requiring City Staff to bore through structure floors in order to repair leaks. In 2003, the estimated unaccounted-for water loss within the City was approximately 33.5% (PACE Civil, Inc., 2004). Average water loss in California is about 15% to 20% and “tight” systems are under 5%. No significant improvements have been made to the water system to mitigate this loss since 2003. This water loss amounts to about 227-million gallons per year, or about 700 acre-feet per year. It

is expected that proposed improvements will reduce this loss by up to 20% based on the percentage replacement of old steel water lines, saving an estimated 140 acre-feet per year.

In Angel Valley, fire flow capacities are as low as 900 GPM (PACE Civil, Inc., 2004), which is less than half of California Fire Code requirements (2013 CA Fire Code, Table CC105.1). This project will boost local fire flows to near CFC requirements, providing wildfire protection for this DAC.

When a leak occurs in a domestic water system, portions of the system often depressurize. The City must de-water a portion of the distribution system in order to repair a leak about eight to ten times per year. Pursuant to CCR Title 22, Section 64566, the minimum water pressure shall be maintained at least 20 PSI at all times. When water system pressures fall below this threshold, it is a violation of State law. The City must notify affected residences, disinfect and test the depressurized system before putting back into service. These events incur extra cost and lower consumer confidence. With this project, the City of Weed intends to eliminate the financial and public health burden resulting from private property damage and depressurized water mains when a leak occurs as well as ensuring water supply reliability and fire protection.

Estimates of without-project conditions

If the proposed project does not move forward, there are no other projects within the North Coast Region that could provide any kind of benefit to the City of Weed for mitigating the issues described above. There are no other proposed projects within the City of Weed that could mitigate the issues described above if the proposed project does not go forward. Thus, the steel pipes would continue to leak, businesses and residences in the affected areas would continue to incur losses and the inconvenience of water pressure loss, and the City would continue to bear the costs of pumping, treating, and moving water through leaking pipes and the costs of lawsuits, emergency repairs, and pressure loss testing and notifications. Fire flows to hydrants in Angel Valley will continue to be low and the community will continue to be vulnerable to wildfire and extended drought.

Description of methods used to estimate physical benefits.

Portions of the proposed improvements were identified in the City's 2003 Master Water Plan Update (PACE Civil, Inc. 2004), as *Immediate Recommended Improvements*, with the physical benefits claimed for this project described as the outcome of implementing the improvements. In addition, cost estimates were developed to improve the water system in Angel Valley in 2012 and again in 2014 after the Boles Fire burned through this area.

Avoided cost benefits were estimated based on City records and technical expertise; water loss was estimated by comparing water produced with water consumed. Water produced is considered to be the sum of all well and spring production meters. Water consumed is the sum of all consumption meters served by the city.

New facilities, policies, and actions required to obtain the physical benefits.

The proposed project will improve water delivery infrastructure to about 120 customers, as well as enhancing water supply reliability and providing greater fire protection security to the remaining 900+/- customers in the City.

In Angel Valley, the proposed project consists of installing approximately 5,000 linear feet of 6- and 8-inch water mains, including valves and appurtenances; and nine fire hydrants. It will be necessary to re-route new water services to 58 lots in which homes were destroyed during the Boles Fire, and an additional 46 lots in which water mains are relocated to the street. For South Weed Boulevard, the project consists of abandonment of 2,400 feet of 4-inch water main, and replacement of about 2,100 feet of 2-inch water main with a new 6-inch water main. 86 existing water services would be re-connected to an existing or new water main.

Potential adverse physical effects and what is being done to mitigate those impacts.

Potential adverse physical effects include those normally associated with construction activities in a city setting. All work will be conducted according to safety and professional standards and BMPs will be implemented.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Achieve long-term reduction of water use

Many of the communities residing around the base of Mt. Shasta rely of spring water provided from melting snow and ice on Mt. Shasta. Since the drought began about 3-1/2 years ago, yield from these springs has decreased. There are no other existing viable backup water supplies in the region, other than drilling new wells. Well development in the area can be a challenge given the variability of the volcanic-based subsurface geology. The City of Weed has a water right from their Beaughan Spring supply that has been taxed during peak demand periods. It is felt if the 33.5% water loss can be reduced, the impact to its spring supply can be reduced. In addition, the Mazzei Well provides water to a portion of the project area. This well has been over-pumped to the point that a sand separator had to be added. If water loss can be reduced, the Mazzei Well will not need to work as hard.

Repairing leaky water mains, in and of itself, is a water conservation effort that will reveal immediate and lasting results that will enhance the City's resiliency to anticipated effects of climate change. Eliminating leaks in water mains puts less stress on water supply sources (springs and wells) and frees up water for benefit of other interests.

DIRECT WATER RELATED BENEFIT TO A DAC

The City of Weed is a severely disadvantaged community (43% of State MHI), and the benefits described above will directly benefit it. The Boles Fire in September 2015 destroyed approximately 1/3 of the

homes in the City. Approximately 15% of the families whose homes were destroyed will not be returning to Weed. Please see Attachment 7 for greater detail on DAC status.

Access to high quality, reliable drinking water is necessary for sustainability of life, no matter socioeconomic status. The proposed project ensures high quality drinking water delivery to an economically disadvantaged community that has never recovered from impacts to the lumber industry, and was recently devastated by the 2014 Boles Fire.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.2 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Pipeline installation, meter and hydrant installation	Water mains, fire hydrants, and all appurtenances	Photodocumentation, certified engineer's statement of completion	Upon completion of installation
Increased fire protection in Angel Valley	Increased fire hydrant flows	Perform fire hydrant flow testing after new improvements are installed	Post-project, then during periodic Fire Department testing
Reduced water system leakage	Reduced overall system leakage below 33.5%	Compare pre-project water loss with post-project water loss at 12 months after construction	12 months after end of construction
Reduced operating costs	Reduce operating costs by $10,000	Compare pre- and post-project operating expenditures at 12 months after construction	12 months after end of construction
Reduced occurrences of water system depressurization	No water system depressurization in project areas	Compare pre- and post-project annual work order summary	12 months after end of construction

Performance of the project will be determined by comparing water loss after the proposed improvements are constructed, against prior years. In addition, the City will compare post-project expenditures for leak repairs versus pre-project expenditures.

COST EFFECTIVE ANALYSIS

Table 7.2 – Cost Effective Analysis **Project name: __Boles Fire Water System Rehabilitation/ Water System Restoration_____**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) and Improved fire protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *There are no viable alternatives for mitigating leaks from old steel pipelines that have reached or exceeded their useful lives, other than to eliminate them by replacing water distribution infrastructure. Alternatives for increasing fire flows would consist of constructing additional storage and water supply in deficient areas, however, the cost of this type of infrastructure is much more expensive than replacing undersized water mains and adding fire hydrants.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The only other lower cost alternative is a "do nothing" alternative which would save the up-front capital investment but saddle the City of Weed with on-going expenses associated with leak repairs and incurance claims, not to mention the continued impact on its water supply resources. In addition, deficient fire flow capacity leads to significant economic impacts, as evidenced by the Boles Fire.*
Comments:	

DEL NORTE COUNTY, SERVICE AREA # 1 AND CRESCENT CITY LIFT STATION REHABILITATION

PROJECT DESCRIPTION

Brief: This project will upgrade six sewer lift stations to improve water quality and protect sensitive estuarine habitat and listed wildlife species in Crescent City Harbor.

Expanded: The City of Crescent City operates a wastewater treatment facility that includes a collection system that serves the City of Crescent City and portions of unincorporated Del Norte County. Wastewater lift stations located across the collection system are responsible for pumping wastewater safely to the wastewater treatment plant and are equipped with pumps, mechanical systems and electrical controls over 40 years old that require weekly maintenance to remove debris from the pumps and check controllers. Servicing pumps and controllers require a confined space entry team in dangerous working conditions. Controllers are antiquated mechanical relays that do not allow for remote diagnosis of pump status or operational mode. Due to the location of the wastewater lift stations, failures of the lift stations result in sanitary sewer overflows (SSOs) that in many cases directly impact wetlands, waterways, Crescent City Harbor and the Pacific Ocean. SSOs into these sensitive ecological habitats result in degradation of surface water quality, impacts to plants and animals, and reduce their recreation value.

Del Norte County and Crescent City's economic viability is tied to tourist and visitor services as indicated by numerous lodging and dining options. Visitors come to the area because of its natural beauty including the beaches, Crescent City Harbor, and wetlands and waterways with high water quality that provide habitat to diverse plant and animal communities. These beautiful areas have been impacted by SSOs and are at an ongoing risk of additional impacts from lift station failure and resulting SSOs.

This project will upgrade six lift stations (4 County and 2 City) and install Supervisory Control and Data Acquisition devices (SCADA) in 21 lift stations. Each system has been assessed to determine the extent of rehabilitation warranted. Full rehabilitation of a lift station will consist of replacing pumps with two "chopper" pumps, motors, installing modern electronic controllers, valves, sump pump, blower dehumidifier, and programming and integration of a supervisory control and data acquisition (SCADA) system. "Chopper" pumps macerate solids and do not require regular maintenance to remove debris as is the case with current pumps.

The intended purpose of the project is to: 1) reduce the environmental impacts of SSOs from lift station failures to wetlands, harbors, waterways, and their sensitive habitats, 2) reduced power consumption due to the higher efficiency of the pumps and more efficient operating conditions, 3) reduce regular dangerous confined space entries to service pumps and equipment, and 4) improve lift station operation reliability and allow for remote monitoring and operation through the new SCADA system. Better pumps, better controllers and better remote communications and controls will result in fewer SSOs from lift station failures and cost savings from the current overburdened system.

PROJECT PHYSICAL BENEFITS

This project will provide several benefits, including those listed below.

- **Primary: Habitat improved** in 310 acres of riparian, 350 acres of wetland, and 275 acres of harbor habitat. With conservatively estimated values of $120 per riparian acre and $2,000 per wetland acre, this benefit provides an estimated value of $737,200 per year (Shaw, M., L. Pendleton, D. Cameron, et al. 2009. *The Impact of Climate Change on California's Ecosystem Services. California Climate Change Center*. CEC-500-2009-025-F.; Nordhaus, W. 2008. A Question of Balance: Weighing the Options on Global Warming Policies. New Haven: Yale University Press.; U.S. Department of Energy, Energy Information Administration. 2007. Appendix F. Electricity Emission Factors. Retrieved on October 29, 2012 from www.eia.gov/oiaf/1605/emission_factors.html). We were unable to find an economic value for improved harbor habitat and did not include it in our calculations, thus the actual monetary benefit is likely greater.
- **Secondary: Species protection** of four listed species that use the estuary, riparian areas, and wetlands. These are: tidewater goby (*Eucyclogobius newberryi*), S. OR/N. CA coho salmon (*Oncorhynchus kisutch*), CA coastal chinook Salmon (*Oncorhynchus sthawytscha*), and Steller sea-lion (*Eumetopias jubatus*) (LSC Transportation Consultants, Inc. 2011. *Del Norte 2011 Regional Transportation Plan Final Report*. Prepared for the Del Norte Local Transportation Commission, Crescent City, CA. 325 pp.)
- **Water quality improvements** in watersheds, rivers, streams, estuaries and coastal waters in the Crescent City area. Watersheds and habitat adjacent to, and downstream of, the 21 lift stations being rehabilitated will be maintained, and improved in the future, due to fewer SSOs of municipal and industrial wastewater.
- **Avoided costs of lift station maintenance** equal to approximately $150,000 in 2015 dollars according to project proponent estimates. Additionally, avoided lift station maintenance will improve employee safety; currently confined space entry is required.
- **Enhanced public safety and recreational opportunities** through reduction in number of SSOs, which will improve quality of life and recreational tourism.
- **Climate change mitigation:** reduced energy use and associated GHG emissions due to replacement of old pumps/controllers with energy efficient modern technology. The new pumps are estimated to be 20-30% more efficient; this efficiency combined with fewer maintenance trips for service (reduced VMT) will result in GHG reductions. The estimated monetary value is about $60,000 annually according to project proponent records and estimates.

Table 5.3 a – Annual Project Physical Benefits			
Project Name: Del Norte County CSA # 1 and Crescent City Lift Station Rehabilitation			
Type of Benefit Claimed: Habitat protected - Primary			
Units of the Benefit Claimed : acres			
Anticipated Useful Life of Project (years) 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	935	935
2019	0	935	935
Through 2067	0	935	935
Comments: Water quality improvements in 310 acres of riparian, 350 acres of wetland, and 275 acres of harbor habitat. These improvements are estimated to provide an annual monetary benefit of approximately $737,200 (see text). Benefits will begin to accrue in late 2017, after the project has been completed.			

Table 5.3 b – Annual Project Physical Benefits			
Project Name: Del Norte County CSA # 1 and Crescent City Lift Station Rehabilitation			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	4	4
2019	0	4	4
Through 2067	0	4	4
Comments: Endangered and threatened species that will benefit from project implementation include tidewater goby (*Eucyclogobius newberryi*), S. OR/N. CA coho salmon (O*ncorhynchus kisutch*), CA coastal chinook Salmon (*Oncorhynchus sthawytscha*), and Steller sea-lion (*Eumetopias jubatus*). LSC Transportation Consultants, Inc. 2011. Del Norte 2011 Regional Transportation Plan Final Report. Prepared for the Del Norte Local Transportation Commission, Crescent City, CA. 325 pp. Benefits will begin to accrue in late 2017, after the project has been completed.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The Del Norte County/Crescent City wastewater service area consists entirely of economically disadvantaged communities. Due to its rural location and financial challenges, Del Norte/Crescent City is experiencing deteriorated, inadequate, and defunct conveyance infrastructure (wastewater lift stations). The lack of quality wastewater infrastructure impacts the economic vitality in a number of ways: causing the use of scarce financial/human resources to temporarily shore up failing infrastructure while not having the resources to comprehensively address infrastructure needs; creating a situation where the community is subject to fines and regulatory actions (due to SSOs) that do not support the correction of the underlying problem; and impacts to water quality (wetlands, streams, estuaries, ocean) that affect the ability to attract the financial benefits associated with recreational tourism. Tourism/recreation and natural resources-based industries provide the foundation for the economy. This project implements Policy 7.C.3 in the 2013 Del Norte County General Plan: "…establishing or updating satellite wastewater treatment facilities to reduce hydraulic and nutrient loading… (Mintier & Associates et al., 2013, page 7.3)."

Due to flat terrain in and around Crescent City, a large number of lift stations are required to transport wastewater to the WWTP. The WWTP is fed by 21 lift stations; most lift stations were constructed in the late 70's and have been upgraded with programmable logic controllers (PLC's). This style of controls and alarms are unreliable. Most lift stations contain centrifugal pumps which become clogged with debris, resulting in the system being susceptible to SSOs. SSO's are subject to reporting and response requirements in accordance with State and Federal requirements. Most of the lift stations are located near populated areas and environmentally sensitive wetlands, so elimination of SSOs is important to public safety and the environment. The lift stations are below ground and are confined spaces subject to specific OSHA requirements for entry. Several stations have been significantly upgraded in recent years including Harbor and Elk Valley, however, many are still in need of upgrades.

The project will improve system reliability, prevent SSO's and reduce maintenance and personnel costs associated with unclogging pumps. Installing non clogging grinder pumps will greatly reduce the need to enter a confined space on a frequent basis.

Estimates of Without-Project Conditions

Due to aging infrastructure, our lift stations have the potential to affect ecosystem function by having sanitary sewer overflows (SSOs) drain directly into environmentally sensitive habitat areas and wetlands. The majority of SSOs are the result of our lift station alarms failing at inopportune times. The current alarm system is approaching 40 years old, which is the end of its useful life.

In addition to faulty alarms, SSOs are the result of existing pumps and associated infrastructure being unable to handle large wet weather flows – which are expected to occur with increasing frequency in the future. With few exceptions, lift stations in both the City and the County are approaching 40 years of service, which is the end of their useful life.

If repairs and upgrades are not made to the equipment, SSOs will continue and equipment will continue failing periodically, requiring hasty emergency repairs that provide a short-term fix rather than a long-term solution.

Methods Used to Estimate Physical Benefits.

Physical benefits were estimated by using 20-30% energy demand reduction for the lift station pumps, less vehicle use for maintenance, and ecological benefits were based on six lift stations being upgraded.

Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The proposed project is for the rehabilitation of six wastewater lift stations. Each lift station represents a new facility.

Specific upgrades include:

- Replace existing pumps and motors with grinder style pumps (non-clogging chopper-type pumps).
- Upgrade instrumentation to monitor equipment including ultrasonic level indications and well flow meters.
- Replace valves.
- Install standardized SCADA and PLC for process controls.
- Add dry well camera and sound monitoring for remote monitoring and diagnostics.
- Develop a central SCADA station, using compatible platform utilized at the WWTP for remote viewing of equipment and controls.

New policies will be developed and implemented for the continuous monitoring and periodic inspections of the new lift stations. Additionally, SCADA Control panels with radio transmission capability will be developed and installed on each of the other 15 lift stations.

Potential Adverse Physical Effects

During the construction phase of the project there is a period of time that wastewater will need to be diverted around each of the lift stations being rehabilitated. Wastewater can be pumped around the lift station using pumps and hoses or wastewater can be pumped into vacuum-trucks that will shuttle back and forth to the wastewater treatment plant. During the bypass, or vacuum-truck shuttle process, there is a potential for SSOs to occur. To mitigate the potential for SSOs, all times during the operation of bypass pumps and hoses they will be under direct observation by staff. All pump and piping fittings will be double checked by staff to verify proper connections prior to operation. Spill cleanup supplies, materials, response equipment and staff will be available at the site during bypass pumping. If the pumps, hoses, or other wastewater transfer equipment are operated near a stormwater feature or drop inlet, a drain mat or similar device will be used to protect the inlets.

Drought Preparedness

The City of Crescent City operates the water supply system that services customers in the City and County. Crescent City has been monitoring and reporting water use as required by the State Water

Resources Control Board. Crescent City has developed a water shortage contingency plan that meets the California Water Code requirements. The City has also updated their Municipal Code related to the water shortage contingency plan. The City has declared a Stage II water shortage emergency and provided information to the water customers. The City staff has been trained on the regulations and is responding to reports of water wastage. Additionally, the City preformed an AWWA Water Audit for 2013 and 2014. As a result of the water audit, the City initiated an aggressive leak detection program that resulted in the identification and correction of a significant leak. Correction of that single leak resulted in the savings or 20% of water that entered the distribution system.

This project will enhance community resiliency to climate change by protecting water quality. Coastal areas are predicted to experience sea level rise and greater storm surges (CEC 2012, Coastal Flooding – Potential Projections: 200 – 2100). Increased intensity of rainfall events coupled with increased sea level is predicted to cause more frequent or more severe flooding. This would increase the number and severity of SSOs if lift stations remain unchanged. This project addresses climate change by increasing the capacity and reliability of the lift stations resulting in fewer SSOs as the climate changes.

Because this water quality issue is of greater concern to this DAC than is drought preparedness, we request that this project not be scored relative to drought preparedness in accordance with the 2015 IRWM Implementation Grant Proposal Solicitation Package, page 25. We respectfully submit that Question 11: *Does the proposed project effectively address long-term drought preparedness?* is not pertinent to this water quality improvement project, which has been identified by this DAC as its highest priority water management project. Unlike other communities with greater capacity, Del Norte County and the City of Crescent City do not have the luxury of having several medium priority projects to choose from to best meet PSP requirements. This project was identified locally as being the most critical to implement , it was prioritized by the North Coast Resources Partnership as meeting regional and state Priorities and it provides multiple benefits prioritized by the region and the state. Please answer N/A to Question 11 for this project.

DIRECT WATER RELATED BENEFIT TO A DAC

Del Norte/Crescent City provides wastewater services to 3,715 connections representing a population of 14,820. The median household income is $37,909. The entire population served by this project is DAC or extremely DAC and all benefits described above benefit the community. Twenty two percent of Del Norte County residents live in poverty and 24.2% of Crescent City residents live in poverty. Crescent City and Del Norte County have a 10% unemployment rate.

The direct benefit to the DAC is an improved wastewater conveyance system that will have fewer SSOs, less impact to sensitive ecological systems, and create a healthier environment and community. Additionally, operational costs for sewer system will be reduced by the cost of power for the pumps, and reduced dangerous maintenance activities. Maintaining high water quality in surrounding wetlands and other waterways will increase the ability of this DAC to attract tourism and recreational revenues.

The City and County have no choice but to rehabilitate all of our lift stations and install SCADA. Presently, our lift stations with few exceptions are at or near the end of their useful lives. As a

community, we must invest in our sanitary sewer system in order to protect public health and promote livability. As with the majority of communities, there are only two options: grant funding or loans. We have the distinct disadvantage that the median household income of our community is significantly less than the statewide average ($37,909 vs. $61,094 per 2009-2013 U.S. Census Bureau data). As a result, loan repayment places a higher burden on households in our community. Also, both the City and County sewer rates relative to median household income are greater than 2%. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.3 Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Project implementation to improve lift stations	Photodocumentation and certified engineer's statement of completion	Upon completion of installation	Rehabilitation of six lift stations and SCADA installed in all 21 lift stations
Reduce Sanitary Sewer Overflows	Number of Sanitary Sewer Overflows	Real Time	No SSOs in any Rehabilitated Lift Station
Reduce Maintenance	Frequency of Maintenance	Weekly	50% Reduction in maintenance hours for each Rehabilitated Lift Station
Reduce Power Consumption	Consumption of Power	Monthly	20% Reduction in energy consumption for each Rehabilitated Lift Station

The project performance will be monitored and quantified by several independent metrics. The number and severity (volume) of SSOs will be tracked and compared to historic pre-rehabilitation rates and severities over the same time periods (annually). Additionally, power consumption will be monitored to verify and quantify the energy savings provided by the more efficient chopper pumps, the more efficient controls and operation. Del Norte County and Crescent City both track and report annual labor, materials, and subcontractor costs for the routine maintenance of lift stations. Annual maintenance cost for lift stations will be compared to historic pre-rehabilitation maintenance costs. Performance will

also be measured by monitoring wastewater influent flow during storm events compared to previous storm events that have resulted in SSOs.

COST EFFECTIVE ANALYSIS

Table 7.3 – Cost Effective Analysis **Project name: _Del Norte County CSA # 1 and Crescent City Lift Station Rehabilitation____**	
Question 1	Types of benefits provided as shown in Table 5: *Habitat protect (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. *The alternative method for achieving the same benefit would be to install complete submersible pump systems (on rails to allow service without confined space entry) with submersible chopper pumps, controllers, and plumbing in each lift station. Installation of the submersible pump systems require reconstruction of the wet well and the installation of new foundations in each of the lift stations. The reconstruction of wet wells requires longer pump-around times during installation resulting in a greater risk of an SSO during lift station rehabilitation. Based on some of the distances between access points, pump arounds are not feasible. Submersible pump systems do not require a confined space entry for maintenance. All the equipment is hoisted up rails for maintenance. The estimated cost for this alternative is $150,000 per lift station for a total project cost of $3,000,000. The cost quote for submersible pump systems was from previous projects.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The proposed project method is the least costly alternative to achieve the same physical benefits. Extensive technical discussions were held by the City and CSA with pump manufactures and contractors to determine the best and most cost effective method to reconstruction the lift stations. The proposed method was determined to provide the best value and still provide a product that serves the community well.*
Comments:	

GOLD RIDGE RESOURCE CONSERVATION DISTRICT, WORKING LANDSCAPES DROUGHT RESILIENCY PROJECT

PROJECT DESCRIPTION

Brief: This project increases rainwater capture and storage and enhances soil water holding capacity to build drought resiliency in a partially disadvantaged agricultural community.

Expanded: The severely economically disadvantaged community of Valley Ford serves as a hub for the Estero Americano and adjacent Salmon Creek watersheds in coastal Sonoma County, a region historically composed almost exclusively of agricultural operations that have struggled to maintain economic viability in recent decades. Draining into estuaries that, unlike many coastal wetlands along the Pacific Flyway, have remained relatively undisturbed, this agricultural area provides critical habitat for an array of plant and animal species of concern, sheltering its wetland habitats and coastal grasslands from development through the preservation of its unique continuity of small, multigenerational family-run dairies and livestock ranches.

These same land uses have also led to significant water quality concerns, compromised riparian habitat, and reduced streamflows. Following the development of comprehensive management plans for both watersheds, the Gold Ridge RCD obtained multiple grants to spearhead improvements on dairy and ranch operations, and in doing so established itself as a key partner in the community by working with landowners covering approximately 20% of the two watersheds.

The current drought, now in its fourth year, has exacerbated the agricultural community's existing hardships. Record low rainfall has resulted in abysmal forage production, and increasingly unreliable groundwater has proven insufficient to replace it. Operators have had to redouble their hay purchases despite skyrocketing prices, and many have been forced to resort to trucking in drinking water for their livestock.

This proposal seeks to build long-term drought resiliency for these agricultural operations, by both increasing rainwater capture and storage, and by enhancing soil water holding capacity through soil health improvements. The project team will work with participating farms, ranches, and dairies to conduct comprehensive property plans to assess water storage potential, develop conservation measures, and address soil moisture. The plans will then be used to prioritize and guide the development of rainwater catchment systems, developed to substantially offset or completely eliminate summer stream or groundwater withdrawals, and to target compost applications to enhance soil water holding capacity. Additionally, an innovative 62,000-gallon roof rainwater catchment and 5,000-gallon greywater system, currently in its final design phase, will be constructed as a high-profile demonstration project at the Valley Ford Wool Mill, which currently relies on the town's troubled Water Association supply. A second rainwater catchment system, also in design, will be constructed on a permaculture crop farm along Salmon Creek that was, under its former owner, the largest water user of the Bodega Water Company system.

Finally, the project will build on the streamflow and water quality monitoring programs currently in effect in each watershed to evaluate overall program effectiveness.

PROJECT PHYSICAL BENEFITS

Implementation of this project will provide multiple benefits including:

- **Primary: Water supply produced** of 0.44 AFY from a combination of rainwater catchment and greywater use in place of instream and groundwater withdrawals.
  - Rainwater catchment tanks will provide a new source of water and reduce summer streamflow withdrawals of 0.23 acre-feet per year from constructed system
  - Rainwater catchment tanks will provide a new source of water and reduce groundwater withdrawals of 0.19 acre-feet per year from constructed system
  - Greywater system will provide a new source of water by recycling 5000 gallons of processing water for landscape irrigation, equal to 0.02 acre-feet per year
- **Secondary: Species protection:** Low summer streamflows are the primary limiting factor for endangered coho salmon in Salmon Creek, while exacerbating water quality concerns detrimental to the Estero Americano's threatened steelhead. By reducing stream withdrawals and enhancing summer flows, the project will improve over-summer salmonid survival. Salmon Creek also provides critical habitat for the following special status aquatic species, which will also benefit: California red-legged frog, California freshwater shrimp, and northwestern pond turtle (Salmon Creek Integrated Coastal Watershed Management Plan, 2010).
- **Avoided water purchases** due to rainwater catchment installation of 0.42 acre-feet/year
- **Water supply produced** in the next 3 – 6 years (upon implementation of systems designed under this proposal) in the amount of 2.29 AFY.
  - Rainwater catchment tanks will provide a new source of water and reduced summer streamflow withdrawals of 0.76 acre-feet per year when designed systems are implemented
  - Rainwater catchment tanks will provide a new source of water and reduced groundwater withdrawals of 1.53 acre-feet per year when designed systems are implemented
- **Agricultural soil improvement**: enhanced soil carbon sequestration over 50 acres of farmland (Ryals and Silver 2013, *Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands*, Ecological Applications, 23(1))
- **Community capacity building**: 2workshops/ public tours of the rainwater systems and compost sites will teach residents about the drought and actions to improve community resiliency.
- **Climate change mitigation**: This project will reduce GHG emissions and sequester carbon
  - Reduced GHG emissions from importing feed and water
  - Increased CO2 capture and storage from compost application (Ryals and Silver 2013)
- **Climate change adaptation**:
  - Rainwater catchment systems and the greywater demonstration system greatly enhance this community's capacity for climate change resilience
  - The additional water supply bolster's this partially disadvantaged community's water supply reliability, contributing to the Statewide Human Right to Water.

Table 5.4 a – Annual Project Physical Benefits			
Project Name: Gold Ridge RCD Working Landscapes Drought Resiliency Project			
Type of Benefit Claimed: Water supply augmentation - Primary			
Units of the Benefit Claimed : Acre-feet per year			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	0.44	0.44
2019	0	0.44	0.44
Through 2037	0	0.44	0.44
Comments: The water supply augmentation benefit occurs due to project implementation - installation of rainwater catchment tanks and a greywater system. It does not take into account the benefits that will be realized when the plans developed during this grant cycle are implemented. Implementation of these plans is expected during the next 3 - 6 years and will yield approximately 2.29 AFY when constructed. Tank and greywater system installation associated with this project is scheduled to be completed in 2017.			

Table 5.4 b – Annual Project Physical Benefits			
Project Name: Gold Ridge RCD Working Landscapes Drought Resiliency Project			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	5	5
2019	0	5	5
Through 2037	0	5	5
Comments:Species are: federally/state listed coho (Oncorhynchus kisutch), steelhead (Oncorhynchus mykiss), California red-legged frog (Rana draytonii), and California freshwater shrimp (Syncaris pacifica), and the Northwestern pond turtle (Actinemys marmorata), which has been identified as a CA Species of Special Concern .Tank and greywater system installation associated with this project is scheduled to be completed in 2017.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Many of the family-owned farming operations in these watersheds have been in business for four or five generations, providing a viable agricultural economy while preserving their watershed's wildlife habitat, open space, and farming traditions. The prolonged drought, as a harbinger for climate change, has proved a game-changer, threatening the viability of these cherished land uses in the face of increasingly unpredictable weather patterns. The solutions proposed here are ideal to bolster community resiliency, with water catchment systems designed to capitalize on infrequent yet severe storm events to provide a reliable, summer-long water source. Soil health initiatives will work to sequester atmospheric carbon, building soil organic matter and thus increasing water holding capacity to buffer against longer, hotter dry spells.

The Valley Ford Water Association in the Estero Americano watershed, which provides water to the small number of town residences and businesses within Valley Ford including the Valley Ford Wool Mill, has struggled with surface water contamination and other water quality deficiencies. Restaurants in the town are currently required to truck in potable water, and residents are advised to drink bottled water. The Water Association has been working with Brelje & Race Consulting Engineers to upgrade the system, including above-ground improvements and water treatment at the existing well site, piping from another existing well, and if needed, new well creation. The project is currently in the design and permitting process through Proposition 84 funding. While the well upgrades are essential for short-term water supply for this disadvantaged community, the Wool Mill rainwater project is meant to serve as a demonstration project highlighting alternatives to groundwater reliance, which in the Valley Ford region is highly variable. The design's 5,000-gallon capacity greywater component, capturing water from wool washing, will be used to water a garden of natural dye plants to be used in fiber product production. The Wool Mill hosts a popular annual festival promoting the benefits of sustainable, local processing of agricultural products, which includes educational tours and workshops, making it the ideal location for a demonstration project.

The Bodega Water Company (BWC) within the Salmon Creek watershed is a member-owned, mutual benefit company that supplies water to residences and businesses in Bodega via 37 connections, in an area with little or no available groundwater. Pulling from near-channel wells, BWC is currently significantly affecting summer streamflows within the coho-bearing Salmon Creek, which have been identified as the key limiting factor to coho recovery within this priority watershed (NOAA NMFS 2012, *Central California Coast Coho Salmon Recovery Plan, Focus Populations, Salmon Creek*). A Proposition 84 Round 1 grant provided through the NCRP and cost share sources is allowing for the design and construction of million-gallon storage tanks to eliminate all July-November withdrawals. There is a clear need for limited summer water use by BWC customers to allow this storage to be sufficient, and the Proposition 84 Round 1 grant provided for construction of nine rural residential rainwater catchment systems, which has greatly reduced summer demand. This proposal includes the installation of a 75,000-gallon rainwater catchment system to eliminate summer withdrawals from the BWC system, which will include a binding landowner agreement clearly limiting BWC water use.

Estimates of Without-Project Conditions

Water supply in the project area, including both surface and groundwater sources, are anticipated to become more limited and unreliable. With climate change, rainfall events are expected to become even less predictable and summer temperatures are projected to increase. Unless summer instream flow is bolstered by some other method, it is very likely that salmon, steelhead, and other aquatic species will become severely limited or even extirpated from the watershed due to insufficient summer flows. Without efforts to increase stormwater storage and enhance soil water holding capacity, agricultural operations will become less tenable and may be replaced by other, more resource intensive, land uses. The local and regional food supply would become less sustainable, and the local community would not be resilient to future conditions predicted by climate change models.

Methods used to Estimate Physical Benefits.

Physical benefits were estimated based on previous experience with rainwater collection systems and the specifications of the rainwater collection tanks. Benefits to coho and steelhead are expected based on recommendations contained in the *Salmon Creek Integrated Coastal Watershed Management Plan* (GRRCD 2010) and NOAA's *Central California Coast Coho Salmon Recovery Plan* (NOAA Fisheries 2012). Completed in 2010, the Salmon Creek Plan contains a "*Water Supply Sustainability Action Plan*" that states as one of its primary goals: "Extractive water sources and practices that impact summer streamflows are minimized and replace by alternative water sources or improved storage" (p61), and includes development of off-channel storage and rain water harvesting systems as critical actions. NOAA (2012) identifies Salmon Creek coho as a "focus population" and the first priority for *Preventing Extinction & Improving Conditions* is to "establish a more natural hydrograph, by-pass flows, seasons of diversion, and off stream storage." The Estero Americano Watershed Monitoring Plan, although developed in 2007 before the beginning of the drought and with a focus on water quality, highlights the need for the RCD to "provide technical assistance for conservation ranch planning . . . as well as funding opportunities for infrastructure improvements and recommended best management practices. . . to improve on-farm infrastructure and management practices to control runoff, reduce erosion, and divert stormwater flows away from heavy use areas on agricultural land in the Estero Americano watershed (p58)."

Benefits from soil improvement activities are supported by many studies available through the Marin Carbon Project (e.g., DeLonge et al. 2014, *GHG Mitigation Opportunities in CA Agriculture: Review of California Rangeland Emissions and Mitigation Potential.* Nicholas Institute Report, University of California-Berkeley. *47 p.*, Ryals and Silver 2013, Silver et al. 2010, *Soil Carbon Pools in California's Annual Grassland Ecosystems,* De Longe et al. 2013, *A Lifecycle Model to Evaluate Carbon Sequestration Potential and Greenhouse Gas Dynamics of Managed Grasslands*. Ecosystems 16:962 – 979). New research by the multi-partner Marin Carbon Project (www.marincarbonproject.org) has received national attention for its results showing the significant and long-term soil health benefits of a single application of 1/4 - 1/2 inch of compost to local grasslands (DeLonge et al. 2014). One study indicated that compost application to grasslands is likely to lead to net greenhouse gas offsets across a broad range of potential environmental and management conditions (DeLonge et al. 2013, Ryals & Silver

2013). Other land uses, such as vineyards, often receive inorganic amendments focused more on crop quality, rather than soil quality. Protocols for compost application specific to each land use (range, pasture, orchard, and crop farm) will follow those now being developed by the Gold Ridge RCD and its partners through an NRCS Conservation Innovation grant entitled: *Bay Area Partnership Promoting Climate Beneficial Practices for Environmental Enhancement and Resiliency of Working Lands*.

New Facilities, Policies, and Actions

New water storage infrastructure that will be built includes 2 rainwater catchment systems totaling 137,000 gallons when constructed and 1 greywater system of 5,000 gallon capacity. In addition to these systems, three additional large-scale agricultural water storage projects will be designed. These sites have not yet been identified, but will be selected based on a prioritization process through the water conservation plan development. Plans will be developed for 7-10 properties throughout the two watersheds, and will include assessments of water use and storage capacity on each property, including both rainwater catchment and off-channel pond storage. From this planning process, three properties will be selected for full designs, based on ranking criteria that includes cost-effectiveness, financial need, and feasibility. Landowners will sign binding agreements stating that the increased water storage will be used to offset stream/groundwater withdrawals or imported water, and not to increase production.

The plans will also identify areas appropriate for compost applications designed to increase soil water holding capacity, improve soil health and forage production, enhance drought resiliency, and decrease irrigation water use and feed imports. While some agricultural land uses, such as dairy pasture and cropland, generally receive soil amendments, very little rangeland in this region has ever done so, which has resulted in steadily declining soil fertility and subsequent water holding capacity.

This project will apply an estimated 2,000-3,000 cubic yards of compost to at least 50 acres in accordance with the newly developed Compost Addition to Grazed Grasslands protocol. The protocol was developed through the Marin Carbon Project and approved by the American Carbon Registry (ACR), a nonprofit that oversees creation of rigorous carbon offset protocols as well as independent verification of carbon offset projects. It details the application of certifiably weed- and pathogen-free compost to select agricultural lands to increase carbon sequestration, enhance soil water holding capacity, and improve rangeland health, respecting riparian buffers, slope, soil types, flood risk, and other considerations (Haden et al. 2014, *American Carbon Registry Methodology for Compost Additions to Grazed Grasslands*. Version 1.0).

Potential Adverse Physical Effects

While rainwater catchment systems involve heavy equipment use, these are constructed in the high-impact areas around existing farm infrastructure, and have little associated habitat disturbance. However, pre-construction surveys will be conducted in accordance with CEQA compliance to ensure no risk to listed species or sensitive habitats. Compost applications to rangeland, if not performed at agronomic rates and following established protocols, have the potential to adversely affect water quality or spread invasive species seed. Project managers will work with participating landowners to ensure protocols are strictly followed.

Drought Preparedness

This project meets Statewide Priorities for drought preparedness including:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Achieve long-term reduction of water use
4. Efficient groundwater basin management
5. Solutions that yield a new water supply

Ranches and dairy operations in the Valley Ford area, reliant on rainfall for forage production, have suffered devastating repercussions from the prolonged drought. Ag operators have responded by increasing expensive forage imports, digging deeper wells which further overdrafts groundwater sources, or, particularly in the west part of Sonoma County where groundwater is highly variable, begin trucking water for their livestock. The quality of rangeland, which conventionally does not receive amendments like dairy pastures, has continued to deteriorate as areas are increasingly severely grazed and forage grasses go to seed before sufficient biomass production.

The project will work to both provide agricultural operations and the BWC with large-scale rainwater catchment systems, a sustainable and reliable source even in the face of increasingly sporadic and severe weather patterns, capturing water from major storm events that occur even in the most dire drought years. Binding landowner agreements will ensure the water replaces, rather than augments, stream or groundwater withdrawals. Additionally, the project will work to enhance soil health on rangeland to both better tolerate longer dry periods and better absorb and retain rainfall, providing agricultural resiliency and local food sustainability.

DIRECT WATER RELATED BENEFIT TO A DAC

The proposal targets the dairy, ranch, and farm operators within and around the economically disadvantaged community of Valley Ford in the Estero Americano watershed and the adjacent Salmon Creek watershed. Many of these operators manage large parcels of ecologically significant open space and key riparian corridors, but their farm incomes do not allow them to implement large-scale water storage projects without assistance. The project will enhance drought resiliency and water security for the farm operations that compose the DAC surrounding Valley Ford. Many of these operators have struggled to maintain economic viability through the drought, with exorbitant increases in the cost of imported feed, and in some instances, trucked water as their groundwater supplies have become erratic. The project will work to improve water security and soil health, reducing imported water/forage needs and protecting the watershed's listed wildlife species.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.4 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Water storage and greywater tank construction	Construction of water storage tanks of combined capacity of 137,000 gallons of rainwater storage and 5,000 gallons of greywater storage, with conveyance system	Photodocumentation, certified engineer's statement of completion	Pre- and post-construction
Increased water supply reliability	137,000 gallons of rainwater storage; 5,000 gallons of greywater storage	Water collection and use monitoring: water collection will be recorded via sight glasses installed on each water tank.	Annually: Stored water volume will be recorded at the end of each rainy season. Water use from the tanks will be metered and use recorded.
Increased Instream Flow for Environmental Purposes: Summer streamflow augmentation.	Elimination of summer withdrawals of an estimated 75,000 gallons annually from the Bodega Water Company system, which sources water from Salmon Creek.	Streamflow monitoring: Continuous year-round streamflow monitoring using a stream gauge already in place in Salmon Creek in accordance with the Salmon Creek Streamflow Restoration Monitoring Plan (2013-2019). A flow gauge will be installed in Americano Creek to provide data on flow connectivity.	Streamflow monitoring: Continuous year-round
Reduced groundwater overdraft	Elimination of 62,000 gallons of groundwater withdrawals annually from the Valley Ford Water Association	Water collection monitoring: water collection will be recorded via sight glasses installed on each water tank.	Water collection and use monitoring: Stored water volume will be recorded at the end of each rainy season. Water use from the tanks will be metered and use recorded.
Carbon Sequestration	20 tons CO2 sequestered per year	Estimated CO2 sequestration based on results quantified from COMET-Farm (approximately 0.4 tons CO2/acre over three years)	Total CO2 sequestration will be estimated annually based on area of compost application

Water storage capacity of constructed catchment systems, in conjunction with well metering and monitoring of landowner agreement compliance, can provide easily quantifiable results for rainwater catchment projects. Results of the compost applications will be monitored through the existing cost share funding as part of the larger NRCS-funded *Bay Area Partnership* program designed to expand the Marin Carbon Project activities throughout the North Bay. While longer-term benefits will be evaluated through the carbon farming partnership, photo-monitoring of application areas and adjacent control areas will be conducted within the timeframe of this grant to show effects on forage or crop growth.

The overall effectiveness of the RCD's water conservation program in both watersheds will continue to be evaluated through a continuation of the existing streamflow/water quality monitoring program including the installation of a flow gauge in the Estero Americano watershed. The program is currently funded through the IRWM Prop 84 Round 1 grant and cost share through SCC, which will end in 2017 and we are currently seeking funding to continue. The existing program focuses on water quality analysis, as streamflow data collection is complicated by several factors, including tidal influence and the natural intermittent nature of streamflow along the porous Americano Creek valley bottom.

COST EFFECTIVE ANALYSIS

Table 7 – Cost Effective Analysis **Project name: Gold Ridge RCD Working Landscapes Drought Resiliency Project**	
Question 1	Types of benefits provided as shown in Table 5: Water supply produced (Primary) and Species protection (Secondary)
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Water conservation plans and subsequent designs to be developed for each agricultural operation will determine the least-cost alternative to on-farm water storage: roof catchment vs. off-channel storage ponds to overland flows, tanks vs. ponds, etc. Ponds capturing overland flow have become increasingly difficult to permit, although some of these regulatory restrictions are being reconsidered with the current drought.*
	If no, why? *Continued groundwater overdraft, stream withdrawals, and water imports are the "do-nothing" alternative to the construction of rainwater catchment infrastructure, and are clearly not sustainable in the long-run. Larger-scale basin-wide groundwater recharge projects are a necessary step, but are in their early concept stages, and will not provide the immediate drought resiliency these farms need now.*
	If yes, list the methods (including the proposed project) and estimated costs. *Increasing groundwater storage through stormwater capture and recharge is a larger-scale solution in appropriate areas, and the RCD is currently working to develop funding sources to allow for basin-wide assessments to determine appropriate areas for groundwater capture. However, these efforts will likely not be feasible everywhere, particularly in the Salmon Creek watershed where groundwater availability is highly fractured and site-specific, and not an immediate drought response.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The construction of large-scale onsite rainwater storage, while posing significant upfront costs, is in the long-run the most cost effective alternative for agricultural water supply sustainability, particularly in a region where most rainfall occurs as isolated storm events and groundwater resources are variable. (Kang, ed. 2010. Water and Agricultural Sustainability Strategies. CRC Press. ISBN 9780415572194).*
Comments:	

GUALALA RIVER WATERSHED COUNCIL, FLOW BANK PROGRAM – PHASE II

PROJECT DESCRIPTION

Brief: This project provides water storage to increase community resiliency to drought and wildfires related to climate change and enhance instream flow to benefit listed salmonids.

Expanded: This project is critically urgent to the survival of coho salmon in the Gualala watershed. A pattern of low flows in the Gualala has caused areas of both main-stem and tributary reaches to dry up, leaving disconnected channels and poor water quality in the remaining reaches. Since the onset of the drought in 2012, creeks are not meeting minimum bypass flow requirements, severely impacting local water companies and triggering increased water costs to customers. Upland forests are extremely dry and fires are a nearly year-round threat. This project will increase flow in the Gualala to benefit endangered salmonids and other aquatic species and increase community resiliency to drought and increased fire frequency related to climate change.

This project will reduce diversions in the Gualala by installing off-stream storage systems for the North Gualala Water Company (NGWC) (Mendocino County) and the Kashaya Tribe (Sonoma County), establishing a more reliable water supply for increasingly severe drought cycles. The NGWC will obtain water for storage from two nearby non-anadromous streams, reducing its withdrawals in the Gualala by 6 million gallons per year, or more than 12%. The alternate diversion sites, which are already permitted, were recommended by the SWRCB as a high priority during Cease and Desist negotiations. This part of the project also contains a water reuse component achieved through installation of a 36,000 gallon backwash recovery tank. The Kashaya storage tanks will increase untreated water storage from 5,000 to 25,000 gallons, allowing the Tribe to adjust withdrawals to maximize instream flow. This tank will increase Tribal water security for a recognized Disadvantaged Community and will also provide water for fire suppression. This increased capacity for water supply reliability and protection from wildfire will strengthen local resiliency and reduce growing conflicts in the watershed about water shortages and sufficient instream flow for salmonids.

This project will also enhance the area's climate change resiliency and increase instream flow by providing a 55,000 gallon rainwater catchment tank for the South Coast Fire Department (SCFD) for training and fire suppression, replacing their use of at least 55,000 gallons of treated, potable water per year from the NGWC. The SCFD provides fire protection service to both Mendocino and Sonoma counties.

The project will be implemented through an existing dynamic program, building upon GRWC partnerships and maximizing outcomes while minimizing costs associated with attainment of Gualala TMDL and Basin Plan goals. Failing to implement solutions to manage and minimize the low-flow crisis will cause devastating impacts to threatened salmonid populations and our local community will be vulnerable to effects of climate change and increasingly beset by tensions and conflicts over water supply.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation include, but are not limited to:

- **Primary: Water supply produced** of approximately 0.73 AFY, replacing water withdrawn from the instream flow-limited Gualala River. This benefit has an estimated monetary value of $58 per year using an estimated monetary value of $80 per AFY (Brown, T.C. 2007. *The Marginal Economic Value of Streamflow from National Forests: Evidence from Western Water Markets*. In:. Advancing the Fundamental Sciences: Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, October 2004. PNW-GTR-689. U.S. Forest Service, p. 458-466).
- **Secondary: Species protection**: this project provides an alternative source of water for withdrawals from the Gualala River, which supports coho salmon and steelhead and the federally Threatened tailed frog (*Ascaphus truei*) and California red-legged frog (*Rana boylei*). Low river flows threaten primary coho rearing habitat and adults are dependent on sufficient rainfall to allow spawning; three consecutive extreme low-flow summers could extirpate coho (NOAA 2012).
- **Increased instream flow** of approximately 18.41 AFY from the NGWC's new storage tank and switching to non-anadromous nearby sources, which will effectively reduce withdrawals from the Gualala by over 6,000,000 gallons per year.
- **Habitat improvement**: Increased instream flow will improve water availability for salmonid migration and juvenile habitat, increasing connectivity and cold water refugia and improving chances for species survival.
- **Water quality improvements**: increased instream flow will reduce contaminant loads, increase levels of Dissolved Oxygen, and decrease temperature.
- **Recycled water** equal to 0.11 AFY, through installing a backwash recovery tank for NGWC
- **Avoided water shortage costs** equal to about $50,400 every two years, given 12,000 gallons per day for 14 days once every 2 years at $0.30 per gallon.
- **Avoided electric costs** of approximately $4,960 per year due to installation of gravity-fed tanks, which will reduce pumping.
- **Disaster preparedness**: increased training and readiness for fire suppression and increased firefighting capacity will enable the community to better prevent and withstand wildfires.
- **Conflict reduction**: new water sources will reduce conflict over withdrawals from the Gualala River.
- **Carbon sequestration** related to fire suppression and associated decrease in catastrophic wildfires.
- **Climate mitigation**: The project includes a reuse component to recycle backwash water at the NGWC. A sound mitigation strategy to reduce GHG emissions includes hiring of local contractors and the use of a gravity fed water supply system.
- **Climate adaptation**: This project supports a resilient community; offstream storage and rainwater harvest are significant local drought adaptation strategies. The project contributes to disaster preparedness by providing storage for fire suppression and firefighting practice in an area expected to experience greater wildfire frequency.

Table 5.5 a – Annual Project Physical Benefits

Project Name: Gualala River Watershed Program The Flow Bank Program Phase II

Type of Benefit Claimed: Water supply produced - Primary

Units of the Benefit Claimed : AFY

Anticipated Useful Life of Project (years) 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0.02	0	0
2017	0.02	0.75	0.73
through 2041	0.02	0.75	0.73
2042	0	0.69	0.69
2043	0	0.69	0.69
Through 2066	0	0.69	0.69

Comments: The tanks will begin providing benefits in 2017, the year after installation. Kashaya tanks are expected to last for approximately 25 years; one 5,000 gallon storage tank is already in place. The NGWC storage project is expected to last 50 years. The estimated monetary value of the project is $80 per AFY (Brown 2007), or $58 per year through 2041 and $55 per year from 2042 through 2066. The value of $80 per AFY is likely an underestimate, given the lengthening drought and increasing coss of water coupled with the immediacy of the threat to salmonid survival in the Gualala River watershed.

Table 5.5 b – Annual Project Physical Benefits			
Project Name: __Gualala River Watershed Program The Flow Bank Program Phase II _			
Type of Benefit Claimed: _Species protection - Secondary_			
Units of the Benefit Claimed : __Number of species_			
Anticipated Useful Life of Project (years)___50 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	4	4
2018	0	4	4
Through 2067	0	4	4
Comments: Tanks will begin providing benefits in 2017, the year after installation. The Gualala River watershed is habitat for coho salmon and steelhead, tailed frog, and California red-legged frog, which are state or federally listed. See text for greater detail and documentation.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

This project is based on current scientific recommendations to alleviate streamflow issues for anadromous salmonids and other aquatic wildlife identified by local, state and federal agencies including the Gualala River Synthesis Report (NCWAP 2003, pages 3-5, 22, 25), and Final Recovery Plan for Central Coast Coho Salmon Evolutionarily Significant Unit (NOAA NMFS 2012, Action Step 4.1.1.9). Degradation and loss of freshwater habitat is a leading cause of salmonid decline (CDFW 2004) and improving instream habitat by decreasing diversions is a high priority recommendation in all studies conducted in the watershed (e.g., Gualala River Estuary Study (Ecorp 2005, pages 36, 117, 125), GRWC Strategic Plan 2010 – 2015 (GRWC 2010, page 7), Gualala River Watershed Management and Enhancement Plan 2012 – 2015 (GRWC 2008)). A lack of summertime storage forces the NGWC to pump when flows at diversion sites are below minimum bypass requirements. The NGWC was issued a Cease and Desist Order in 2008 for pumping when the flow in the North Fork was under winter and summer minimum bypass flow requirements. Since 2010, the NGWC increasingly has not met daily minimum bypass flows requirements, culminating in a total of 247 days in 2013 when the company was not in compliance with SWRCB requirements. A moratorium is currently in place for new water service. The NGWC does not have enough off-site storage to prevent pumping during low flows and the CDO is currently in abeyance while the NGWC negotiates with SWRCB to develop a water management plan with a focus on increasing conservation measures and developing off-site storage capacity.

The Kashaya Tribe is exempt from state permitting requirements, but still generates increased costs to customers and causes environmental impacts with continued pumping during the low flow season. Residents of the watershed have suffered from increasing tension over water use, poor water quality, and in many cases, the expense of importing water.

Instream flow impairments have been well documented through the Gualala River assessments and the GRWC Cooperative Monitoring Program (http://grwc.info/monitoring.html). Water temperature impacts caused by the current drought are evident as demonstrated by the 2013 watershed-wide higher water temperatures (GRWC 2014). Coho are particularly vulnerable because they have a life cycle of only three years. Since the headwaters are their primary habitat, three consecutive extreme low-flow summers could literally wipe out the entire coho population.

Estimates of Without-Project Conditions

The issue of insufficient river surface flows in the Gualala pre-dates the current drought crisis and will continue unless suitable tools such as this project are developed to mitigate the conflict over water use. If the project is not implemented, the local coho population is at risk, the community will continue to experience limited water supply, and it will not be prepared for hydrologic and precipitation changes associated with climate change.

Methods used to estimate physical benefits.

Physical benefits from project implementation were estimated based on project plans and specifications, technical specifications and water use records, GRWC monitoring data and analyses, and technical documents, including NGWC records, GRWC's cooperative Monitoring Report, Thalweg Report, and Annual Stream Monitoring Report (http://grwc.info/monitoring.html) , and information from the USGS Flow Gauges at North Fork and South Fork and the Wheatfield flow gauge report. The North Gualala Water Company Water Supply Contingency Plan (Wagner & Bonsignoire 2015) and North Gualala Water Company site-specific studies report (Stillwater Sciences 2012) are the basis of the NGWC tank and backwash tank installation.

The GRWC FLOW program was designed with the assistance of John Green, Goldridge RCD, Brock Doleman of the Occidental Arts and Ecology Center, the California Department of Conservation, NCRWQCB, Judy Rosales of the Coast Ridge Community Forest, and the North Coast Watershed Coordinators Group to meet the changing needs of residents and wildlife in the Gualala River Watershed. The document on which this part of the project is based is The Flow Bank – DRAFT Program Plan - Protecting Stream Flows in the Gualala River (GRWC. 2014).

Identification of All New Facilities, Policies, and Actions

This project entails construction of two water storage tanks totaling 245,000 gallons of new drinking water storage infrastructure, and a rainwater catchment tank totaling 55,000 gallons for fire suppression, disaster relief, and training exercises. Additionally, a 36,000 gallon backwash recovery tank will be installed at the NGWC. Please see Attachment 3, Work Plan for greater detail on new facilities.

Description of Potential Adverse Physical Effects

Potential adverse physical effects are those normally associated with construction activities in the Gualala River watershed, including increased sedimentation, chemical spills, and transport of invasive non-native species. All construction activities will take place according to industry standards using Best Management Practices meant to avoid and/or minimize such impacts (*see Attachment 3, Work Plan*).

Drought Preparedness

This project will implement the following Statewide Priorities related to Drought Preparedness:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Solutions that yield a new water supply.

Both water districts in this proposal lack summertime water storage and so must continuously pump to provide water to customers, even when flows at the diversion sites are below permitted bypass requirements. Residents served by these companies and their rural neighbors are increasingly beset by tension and conflict over water use, poor water quality, and in many cases, the expense of importing water or the trials of going without.

This project will promote and implement off stream storage and catchment systems as an alternative water source to increase streamflow for endangered coho during the critical summer period while providing the watershed community with sustainable, reliable water supplies. By providing the necessary infrastructure to decrease withdrawals when instream water is most needed by coho, this project increases capacity of the community to withstand long-term drought as well as periodic water shortages. Through our strategic partnerships, and ongoing efforts, the GRWC is addressing the impact of drought conditions in the watershed, increasing community awareness about drought issues facing the watershed, assisting local water entities in promoting conservation measures, monitoring the effectiveness of the systems and identifying best management practices to maximize benefits to people and ecosystems.

This project enhances local autonomy and resiliency to climate change by providing alternative water supplies to offset existing water diversions from the Gualala River. Lack of summertime surface water is a decade-long problem in the watershed and has led to the evolution of The Flow Bank program (GRWC 2014). The current drought has brought the situation to a critical turning point for coho salmon survival and now is impacting the human community as well as other wildlife of the watershed. The GRWC will continue with public education for water conservation within the watershed and to implement future phases of this program toward its goal of eliminating low flow diversions within the watershed.

DIRECT WATER RELATED BENEFIT TO A DAC

The watershed has a population of 3,419 and three unincorporated communities; Gualala, Sea Ranch, Annapolis and Stewarts Point Rancheria (a state recognized DAC). The focus is on the two communities serviced by water companies, Gualala and Stewarts Point Rancheria, along with the more isolated rural population not within water districts, who comprise the majority of residents within the watershed. The

economic viability of the area has historically depended on land use; timber, agriculture and ranching are a main source of income.

The Disadvantaged Stewarts Point Rancheria operates a direct diversion from the Wheatfield Fork; limited off-site storage necessitates pumping during low flow periods. During the summer months water use on the Rancheria increases by 31% and at the same time dry channels encroach on and threaten the diversion site. Installing larger tanks for untreated storage will augment low flow water supplies, increase water reliability, provide increased fire protection, and reduce overall water costs to consumers in this DAC. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.5 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Tank installations	Photodocumentation, certified engineer's statement of completion	Pre- and post-construction	3 storage tanks and 1 backwash recycling tank installed
Increased Instream Flow for Environmental Purposes	North Fork Gualala flow gauge and Wheatfield Fork flow gauge. Baseline and annual flow computed via USGS gauges. Data processed and summarized in an annual report, *The Flow Bank Program-Project Progress*.	Annual data completed by all program participants.	Increased flow during low flow period. Program target: 6,110,000 gallons per year.
Increased Water Supply Reliability	NGWC and Kashaya pumping records, tracking non-compliance pumping notifications, tracking mandatory public water conservation notices due to non-compliance flow. Data processed and summarized in an annual report, *The Flow Bank Program-Project Progress*.	Annual data completed by all program participants.	Increased stream flow, decreased non-compliance notifications, decreased public water conservation notices.
Disaster preparedness - increased firefighting capacity	Fire Department readiness standards	Number of trainings conducted annually	Increased readiness training
Reducing community conflict	Increased community participation in GRWC workshops	Annual	Increased participation in community workshops
Fishery Improvement	GRWC Cooperative Monitoring Program, habitat and population monitoring. GRWC Quality Assurance Project Plan (QAPP), 2002 and QAPP Addendum 1, 2012. GRWC's Population survey protocols are established by the CDFW Coastal Monitoring Program. Monitoring data reported annually in the GRWC Cooperative Monitoring Program's *Thalweg Report* and *Stream Report*.	Pre and post- project monitoring of 4 establishedreference reaches and four reaches downstream	Salmonid habitat and populations expected to increase due to increases in juvenile survival

Project implementation will be monitored through photodocumentation and certified engineers' documentation of tank construction completion according to approved plans and specifications. The GRWC QAPP for Monitoring Sediment Reduction (2008, available: http://grwc.info/monitoring.html) provides the basis for project monitoring to document expected changes to instream flow, habitat improvement, and salmonid population increases.

COST EFFECTIVE ANALYSIS

Table 7.5 – Cost Effective Analysis **Project name: Gualala River Watershed Council Flow Bank Program - Phase II**	
Question 1	Types of benefits provided as shown in Table 5: Water supply produced (Primary) & Species Protection (Secondary)
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *A number of increased off-site storage proposals have been considered, e.g. large centralized storage tanks or reservoirs, but found not to be cost effective. Additionally a large scale project would be lengthy and the instream benefits will not be realized for years, effectively dooming the coho population to extirpation. In comparison, the installation of rainwater catchment systems is a simple, timely, and cost effective measure with immediate instream benefits.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Not only is the proposed project the least cost alternative, it is the most simple and timely method to provide the benefits described. The Flow Bank Program is the most cost effective and timeliest approach to seasonally offset the demand for in-stream flows. Providing an alternative water source and installing rainwater harvesting tanks will reduce the demand for surface flows during low flow periods, increase water security for humans, improve fire protection, and result in more reliable in-stream flows for fish and other aquatic life during the dry season. This project provides an ideal opportunity to concentrate community planning and project implementation efforts to demonstrate the potential of collaborative efforts to reduce water conflicts and provide community driven solutions. Implementing this project through a established GRWC program provides an education and outreach strategy designed to increase public awareness about changing weather patterns and benefits that can be achieved by implementing appropriate climate adaptation strategies.*
Comments:	

HAPPY CAMP COMMUNITY SERVICES DISTRICT, WATER SYSTEM UPGRADES – PHASE I

PROJECT DESCRIPTION

Brief: This project provides continuous monitoring, data logging, and alarms for a Disadvantaged Community's drinking water supply to ensure compliance with enhanced water treatment rules.

Expanded: The current water system requires operators to take daily grab samples at the water storage tank outlet to determine chlorine residual. Drinking water quality monitoring is neither continuous nor are data logging and reporting automated. The amounts of data are limited and this situation provides uncertainty regarding proper treatment of the drinking water supply. The Happy Camp Community Services District (CSD) is obligated under the State Water Resources Control Board and the Federal Environmental Protection Agency to comply with LT1/LT2 Enhanced Surface Water Treatment Rules to ensure water quality and monitoring requirements are met at the outlet of the 1,000,000 gallon water storage tank before potable water enters the distribution system to the community.

This project will install water quality monitoring equipment to provide continuous monitoring, data logging, and alarms for samples taken from the tank outlet pipe for chlorine residual, pH, and temperature, as well as provide an onsite display of these parameters and of tank water levels from the tank pressure transducer and flow meter readings. A water flow meter will be installed on the 12" tank outlet pipe for monitoring storage tank detention time. The existing pressure transducer equipment will be upgraded. Monitoring equipment will be installed in new equipment shed to be built at the tank site. The monitoring equipment will be linked by telephone line to a supervisory control and data acquisition (SCADA) system at the treatment plant building for (1) monitoring , (2) evaluation that required concentration-time (CT) for chlorine disinfection for a minimum 1 log removal of Giardia in the tank inlet piping and the water storage tank is met, (3) operator alarms, and (4) monthly reporting. Electric power service will be installed onsite to power all equipment and telephone service will be extended to the monitoring shed. Due to low temperatures during winter months and high temperatures during summer months, improvements to the shed will include temperature controls.

The purpose of this project is to comply with the LT1/LT2 Enhanced Surface Water Treatment Rules, provide economic assistance to an economically disadvantaged community, and ensure all water users served by the community water system are provided with clean, affordable, accessible water for human consumption, cooking, and sanitation. A significant population of Karuk Tribal and other Tribal members and descendants living in Happy Camp are served by the community water system; this project provides opportunity for Karuk Tribal consultation, collaboration, and access to funding for water programs on behalf of these Native Americans.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project include, but are not limited to:

- **Primary: Water supply protected** in the amount of approximately 400 AFY for the DAC Happy Camp through improved compliance monitoring and alarms, protecting community members from health risks associated with exposure to waterborne disease and pollutants. The improved reliability and reduced uncertainty regarding proper drinking water quality treatment allows all community members to use their drinking water without fear of illness. The additional benefit of having the water quality equipment integrated with the existing treatment plant alarm system means that if there is a problem, operators will be alerted to the problem sooner than under the current without-project conditions. Operators can therefore respond more efficiently to minimize or avoid any social (public) health and safety impacts to water system users.
- **Secondary: Avoided costs associated with manual sampling** will save the CSD about $14,760 annually.
- **Improved community capacity:** project implementation will increase compliance with state and federal water quality regulations, reducing conflict between the CSD and agencies and complying with the State's Human Right to Water Policy. This project will also enhance community appeal to maintain and attract businesses and employment.
- **Avoided costs associated with contamination,** which occurs at least 6 times per year with raw creek water. Currently, when the contamination is detected, operators respond with additional work at the treatment plant to adjust processes to ensure the raw water is treated, resulting in extra costs in labor and materials. These costs will be less when operators are able to respond to such incidents in a timely manner.
- **Increased state and regional environmental justice** by implementing a project vital for meeting the Human Right to Water policy in a Disadvantaged Community and addressing critical water supply and water quality needs of California Native American Tribes (27% of the population is of Karuk descent).

We respectfully respect that reviewers answer "N/A" for Question 8 in the Proposal Level Evaluation due to this community's disadvantaged status. We believe that the question – specifically the units required by the state for quantifying benefits in Table 5 – is not applicable to this project, which was locally prioritized by this DAC and regionally approved under the auspices of the IRWM Program. It provides many valuable benefits to the local community, but those benefits don't happen to be able to be expressed in the units detailed on page 19 of the PSP. This DAC does not have the luxury of having several medium priority projects to choose from that best fit the PSP requirements – it needs to solve a high priority issue as soon as possible simply to ensure the Basic Human Right to Water. Please respond "N/A" for Question 8 for this project.

Table 5.6 a – Annual Project Physical Benefits			
Project Name: Happy Camp CSD Happy Camp Water System Upgrades - Phase 1			
Type of Benefit Claimed: Water supply protected - Primary			
Units of the Benefit Claimed : AFY			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	400	400
2019	0	400	400
Through 2037	0	400	400
Comments: Benefits will be realized after project completion in 2017.			

Table 5.6 b – Annual Project Physical Benefits			
Project Name: Happy Camp CSD Happy Camp Water System Upgrades - Phase 1			
Type of Benefit Claimed: Avoided costs associated with daily manual sampling - Secondary			
Units of the Benefit Claimed : $			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	18, 370	0	0
2018	18, 370	3,610	14,760
2019	18, 370	3,610	14,760
Through 2037	18, 370	3,610	14,760
Comments: Under current conditions, labor costs $18,250/ yr (2 hr/day x 365 days/yr x $25/hr) for grab samples and materials cost $120/yr; with project implementation, labor costs will be $2,280/ yr (0.25 hr/day x 365 days x $25/hr) for daily check of water quality equipment and $600/yr (2 hr/month x 12 months/yr x $25/hr) for calibration of pH, temperature, chlorine residual equipment, and chemical replacement. Materials are estimated at $730/yr upon project implementation. Benefits will be realized after project completion in 2017.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The LT1/LT2 Enhanced Surface Water Treatment rule requirements were recently adopted by the State of California and the State may require additional treatment, monitoring or other requirements, beyond Federal EPA requirements (http://water.epa.gov/lawsregs/rulesregs/sdwa/lt2/regulations.cfm). Noncompliance with drinking water requirements can occur if there is insufficient chlorine disinfection time or conditions to provide a minimum of 1 log removal of Giardia before water leaves the water storage tank. If noncompliance does occur, operators may not know for hours or days after the affected water has entered the distribution system. There are currently no alarms set up to alert operators of this type of problem. Deficiencies under the currently proposed Happy Camp Water System Upgrade - Phase 1 project directly relate to monitoring and reporting compliance for the drinking water treatment and distribution system with the Federal Comprehensive Surface Water Treatment Rules and State adoption of LT1/LT2 Enhanced Surface Water Treatment Rules.

The *Happy Camp Community Services District Water Treatment Evaluation Study* (HydroScience Engineers, Inc. 2010) provides a feasibility level report for the overall water treatment system. This report provided the basis for three separate projects: The 1st project, which includes the installation of a contact clarifier to meet surface water treatment requirements and relocation of existing electrical equipment to a higher elevation outside the 100-year floodplain, is being funded by Indian Health Services (HIS) and a previous IRWM Proposition 84 grant, and will be completed by Fall 2016. The 2nd project is the current proposed project for installation of water quality monitoring equipment. The 3rd project will address treatment plant residuals management. There was also a separate feasibility study completed for the water distribution system. This separate study identified a 4th project, which will replace and rehabilitate water distribution booster station equipment and replace old potentially leaking underground water mains. The projects developed from these feasibility studies were phased using IHS criteria. IHS criteria include health impact, sanitation deficiency level, previous Federal service to the site, capital cost, O&M capability of the operating agency, and other considerations. IHS develops projects based on known sanitation (water, wastewater, solid waste) deficiencies for Tribal utility systems and non-Tribal utility systems that serve Tribes, and presents this information annually to Congress via the IHS national database known as the Sanitation Deficiency System (SDS).

Estimates of Without-Project Conditions

The current water system requires the operators to take grab samples at the water storage tank outlet to determine chlorine residual. Water quality monitoring is neither continuous nor are data logging and reporting automated. The amounts of data are limited and this situation provides uncertainty regarding proper treatment of the drinking water supply. This situation continues into the future under the without-project conditions. There were other possible locations for the proposed water quality monitoring equipment and shed than the current flat area adjacent to the water storage tank (various locations on steep hillsides, within County road right-of-way, or on private property), but these locations were associated with higher costs, traffic hazard issues, and/or real estate/easement issues. There were

no other practical alternatives other than the no-action alternative and the recommended alternative (proposed project). Without-project conditions are presented in detail in the Preliminary Engineering Report developed by Indian Health Services (2013) (see Section 3, Project Planning Area, page 5; Section 4, Existing Facilities, pages 5-6; Section 5, Need for Project, pages 6-7; Section 6, Alternatives Considered, paragraph Alternative 1: no action, page 7; and Section 7, Evaluation and Selection of an Alternative, pages 9-10).

Methods Used to Estimate Physical Benefits

The physical benefits associated with the project are the installation of the equipment, integration of the new equipment with the existing treatment plant and alarm system, and the data logging and reporting functions of the equipment. The current sampling program consists of operators taking pH, temperature, and flow readings at the plant and taking grab samples for chlorine residual at the tank outlet sample tap once each day, five days per week, to determine concentration-time (CT) for chlorine disinfection for Giardia and viruses. The new equipment will take continuous samples (typically one sample every 4 hours per regulatory and equipment requirements) of pH, temperature, chlorine residual, tank water level, and tank outlet flow, along with flow data for the tank inlet pipe and store the results in data logging equipment. Software will be provided to calculate CT and check that disinfection requirements are met. Samples will be taken 24 hours/day, 7 days/week. The system will be set up to have operators log into the system at least monthly, either remotely or onsite, to retrieve the data. The difference between taking single daily samples 5 days/week, and continuous samples 7 days/week provides the estimated physical benefit of increased reliability that drinking water quality requirements are being met. Additionally, the logging and reporting capability of the software will automate the logging and reporting process, reducing the potential for errors.

Operators currently visit the tank site and take grab samples daily, Monday through Friday. Operators also respond to any alarms at the treatment plant on a 24 hour – 7-day per week basis. There are currently no alarms set for the tank site, except for low and high water alarms for the existing tank water level. Operators also currently calibrate and maintain chemical injection equipment and water quality monitoring equipment (including operating and maintaining an existing chlorine residual analyzer with monthly replacement of sampling/testing reagent) at the water treatment plant. Under the proposed project, operators will also need to calibrate the water quality equipment at the tank site per manufacturer requirements, operate and maintain the monitoring equipment, and replace the chlorine residual equipment reagents (typically monthly). New equipment will be similar to existing equipment with which the operators are already familiar. The new equipment will also provide additional alarms via the existing treatment plant control system and phone autodialer system. The new equipment will provide data logging and reporting functions, which will provide automated reports for submittal to the State Office of Drinking Water, and the operators will need to become familiar with using these functions.

New Facilities, Policies, and Actions

New facilities include the new monitoring and alarm equipment: pH/temperature sensor and controller, chlorine analyzer, tank water level readout, tank outlet sample tap, data logger, tank outlet flow meter, alarm system, SCADA system, reporting software (calculates concentration-time (CT) at tank outlet, logs all data parameters, provides remote password protected access to water data, provides reports in acceptable format for submission to State). New actions required include training water operators and use of equipment and reporting software. There are no other facilities, projects, policies or actions required to obtain the physical benefits claimed.

Potential Adverse Physical Effects

No potential adverse physical effects are anticipated at this time. Project is expected to be covered under a NEPA CatEx and CEQA CatEx.

Drought Preparedness

This section is not relevant to this project and we respectfully request that reviewers respond N/A to Scoring Criteria Project Level Evaluation Question 11 based on the following information.

This project was selected through the vetted North Coast Resource Partnership (NCRP) prioritization process (http://www.northcoastresourcepartnership.org/files/managed/Document/8857/NCRP_Project%20Review_Guidelines_2015.pdf) as one of the top twenty-five water management-related projects in the North Coast region for 2015 with respect to a suite of attributes including contribution to Statewide Priorities. It was developed by a DAC to address the water management project most important to the local community; the selected project solves a serious water quality issue that is affecting the community's drinking water supply. In addition to others, this project meets the environmental justice - related Statewide Priorities:

- Improve Tribal Water and Natural Resources and include the development of Tribal consultation, collaboration, and access to funding for water programs
- Increase the participation of small and disadvantaged communities in the IRWM process
- Address safe drinking water and wastewater treatment needs of DACS
- Implement the Human Right to Water Policy

Under these circumstances, it seems unfair to penalize this project for prioritizing local community needs when it clearly meets many important Statewide Priorities and has been prioritized regionally. Please respond N/A to Scoring Criteria Question 11.

DIRECT WATER RELATED BENEFIT TO A DAC

Happy Camp is a Disadvantaged Community located at the top of California in Siskiyou County deep in the heart of the Klamath National Forest and on the banks of the Klamath River at the confluences of Indian and Elk Creeks. Estimated population is 1,100. The project provides more reliable water quality monitoring for the community drinking water system, assists in complying with LT1/LT2 Enhanced Surface Water Rules, reduces the potential exposure of community water system users to waterborne disease, provides alarms and associated improved operator response times in the event of noncompliance, and reduces the potential for adverse administrative actions or fines. This project implements the Human Right to Water Policy.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.6 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Installation of water quality monitoring and reporting equipment	Installation, testing, and start-up of water quality equipment by end of 2017	Photos of pre- and post-construction conditions demonstrating installation of water quality equipment	Prior to and after construction

During project implementation, construction milestones will be monitored for conformance to project schedule. Construction will be monitored for installation of various facilities. Performance will be assessed by successful milestone completion, installation of water quality monitoring and reporting facilities, and effective start-up and use of system.

During project life, water quality parameters (pH, temperature, chlorine residual) and contact time (flow and volume in tank inlet pipe, volume in storage tank, flow rate out of tank at outlet) will be used to determine concentration-time (CT) for chlorine disinfection prior to water entering distribution system and compared to required CT for 1-log removal of Giardia. Monthly data reporting, and any non-compliance events and associated water system operator actions, will be provided to the State Office of Drinking Water. Performance will be assessed by State acceptance of adequacy of reports.

COST EFFECTIVE ANALYSIS

Table 7.6 – Cost Effective Analysis **Project name: Happy Camp CSD Happy Camp Water System Upgrades - Phase I**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply protected (Primary) and Avoided Costs associated with daily manual sampling (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. *Alternative methods were considered in the Happy Camp Community Services District Water Treatment Evaluation Study, by HydroScience Engineers, Inc., dated 12/8/2010. However the only alternatives considered were (1) No Action, and (2) Install Water Quality Monitoring Equipment. Standard practice is to place the water quality monitoring equipment at and adjacent to an existing tank outlet upstream of any water service connections. There were no other practicable lower-cost alternatives. The proposed alternative is in a flat clear fenced area adjacent to the water storage tank. Other alternative locations for the monitoring equipment would place the equipment on steep hillsides, within County road right-of-way (traffic hazard) or on private property. All other alternative sites would require land acquisition/easements, possible grading/clearing, fencing, vegetative removal, and/or other impacts.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The proposed project is the only practical action alternative. Other alternatives for different sites would incur the same costs as shown in supporting documents, plus land acquisition/easement costs, possible grading/clearing costs, fencing costs, and any associated environmental mitigation costs. The proposed project is the least cost action alternative.*
Comments:	

HOOPA VALLEY TRIBE, HOOPA VALLEY PUBLIC UTILITY DISTRICT CONSERVATION PROJECT

PROJECT DESCRIPTION

Brief: This project bolsters water supply by replacing failing PUD water meters that don't meet federal regulations for drinking water safety and thus endanger public health.

Expanded: Hoopa Valley Public Utility District (HVPUD), a tribally chartered entity of the Hoopa Valley Tribe, is requesting funds to replace 873 old, inefficient District water meters that are a public health hazard because they do not meet federal regulation requirements for lead safety rules (see Section 1417 of the Safe Drinking Water Act and the NSF Standard, http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_nsfstandard.cfm). The District cannot account for 50% of the water it produces and some, if not most of this is likely due to the meters being old and under-recording the water consumption. Dara Zimmerman of the Indian Health Service (IHS) provided an analysis indicating HVPUD has an unaccounted system water loss of up to 70%, with an average loss of 50% annually. Of all the community water system needs, replacing old meters is the most cost effective, practical, beneficial, and timely drought intervention activity the HVPUD may take. The project outcomes are also consistent with IRWM initiatives to help ensure public health and safety needs for Hoopa's domestic drinking water supply. This project will help facilitate drought preparedness for a severely disadvantaged Tribal community. In addition to new meter installation, the HVPUD will also purchase Water Leak Detection Equipment that will help identify and mitigate undetected water losses in the system.

Metering is expected to reduce potable water consumption by around 17% based on a recent study in Fresno (Drobac 2015*, Meters Matter: How Water Metering Promotes Conservation and Technological Development*. Earthzine, Tuesday, July 7, 2015. Available: http://earthzine.org/2015/07/07/meters-matter-how-water-metering-promotes-conservation-and-technological-development/) and water not used will be left instream, benefitting coho salmon (*Oncorhynchus kisutch*), which are identified as a core population with a high risk of extinction in the Lower Trinity River (NOAA NMFS 2014, *Southern Oregon/Northern California Coast Coho Recovery Plan, Chapter 38: Lower Trinity River,* p. 38.1). Altered hydrologic function has been identified as a key limiting stress on this population (NOAA NMFS 2014, p. 38-12); increased instream flow will help to restore some function.

PROJECT PHYSICAL BENEFITS

This project provides multiple benefits, including, but not limited to:

- **Primary: Water supply saved** through demand reduction (134,568,300 gallons * 0.17) = 22,842,983 gallons = 70 AFY; these values assume a drop in water use of 17% based on actions of residents of Fresno in 2012 and Davis in 2001 after meters were installed (Drobac 2015, Maddaus 2001, *Effects of Metering on Residential Water Demand for Davis, California*). Demand value of 134,568,300 gallons provided by D. Zimmerman, IHS in *Water Production/Loss Analysis Spreadsheet*. This estimate does not take into account the water saved through leak detection efforts or
- **Secondary: Species protection** for coho salmon (*Oncorhynchus kisutch*); water left instream because of reduced demand, locating and repairing leaks, and conservation measures will improve habitat quality, which is currently considered a medium to high stress for all life stages of coho in the Lower Trinity basin (NOAA NMFS 2014).
- **Water supply reliability** and improved quality provided to 873 metered water connections in a Tribal DAC
- **Improved water management** due to the ability to better understand water use and control that use during droughts.
- **Improved drinking water quality** through reduction in lead by removing old meter fittings that contain toxic lead levels.
- **Avoided water treatments costs** of about 2 million gallons per month estimated to provide a monetary benefit of about $4,800 per year
- **Avoided O&M costs**: Operations and Maintenance Costs are expected to decrease by about 10%.
- **Tribal cultural and subsistence sustainability** with improvements to coho and other fisheries habitat.
- **Conflict reduction** through reducing the amount of water withdrawn from the Trinity River, leaving more water instream during critical summer months and lessening conflicts between environmental and other beneficial uses of water.
- **Climate change mitigation**: New meters will help prevent ongoing substantial system loss, which will translate to energy conservation and reduced GHG emission when pumping and treatment are reduced.
- **Climate change adaptation**: This project increases community resiliency to extended periods of heat and drought expected because of climate change through improving community capacity to manage water use and enhancing water supply reliability.

Table 5.7 a – Annual Project Physical Benefits			
Project Name: Hoopa Valley Tribe Hoopa Valley PUD Conservation Project			
Type of Benefit Claimed: Water supply saved - Primary			
Units of the Benefit Claimed : AFY			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	70	70
2019	0	70	70
2020	0	70	70
Through 2037	0	70	70
Comments: This value assumes a drop in water use of 17% based on actions of residents of Fresno in 2012 after meters were installed (Drobac 2015). We applied the 17% reduction value to the current total recorded customer demand to obtain a conservative value for expected water savings. This value is likely an underestimate because actual customer demand is believed to be much greater. This calculation does not take into account the leaks that will be detected using project leak detection equipment and their subsequent repair, which will provide an even greater Water Supply Saved benefit to this Tribal DAC. Project completion scheduled for 2017.			

Table 5.7 b – Annual Project Physical Benefits			
Project Name: Hoopa Valley Tribe Hoopa Valley PUD Conservation Project			
Type of Benefit Claimed: Species Protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	1	1
2019	0	1	1
2020	0	1	1
Through 2037	0	1	1
Comments: This project will leave more water instream for Beneficial Environmental Uses to support federally threatened coho salmon in the Trinity River. Project completion scheduled for 2017.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The Hoopa Valley Public Utilities District was created in 1981 pursuant to a charter granted by the Hoopa Valley Tribe and provides both drinking water and irrigation to all residents of the Hoopa Valley. The primary drinking water supply for the existing valley wide water system consists of a Ranney-Type collector in the Trinity River, a water treatment plant, and a pump station near the center of the urban zone of the Hoopa Valley community. One "valley-wide" community water system currently serves the Hoopa Valley east and west of the Trinity River. According to the Hoopa Valley Public Utilities District, there are a total of 873 metered service connections in 2015. Approximately 2,100 people are served by the water system. The water system has various surface and groundwater sources, with varying manners of treatment. Overall, about 50 percent of the annual domestic water supply is gravity fed, and the remainder pumped. Storage tanks are located along the valley benches and are connected to the systems throughout the valley. The distribution system generally includes main water trunk lines extending the length of the valley on both sides of the river, with smaller lateral pipes and some main loops. Pressure booster pump stations and water storage tanks higher on the valley benches locally serve the upper portions of the Reservation.

Hoopa Valley's rural community relies on having affordable adequate and safe water for drinking and household needs. The HVPUD depends on limited federal, state, and Tribal grant funding to improve its community water system. The HVPUD's 873 old water meters are unreliable and contain toxic lead, and must be replaced in order to provide safe water and also conserve water due to prolonged drought conditions. On Friday, June 26, the Hoop Valley Tribal Office of Emergency Services and the Hoopa Valley Public Utilities District set emergency water conservation into effect due to use of PUD water to combat recent forest fires (Sims 2015, *Emergency Water Conservation Ordered in the Hoopa Valley. Lost Coast Outpost*, Saturday June 27, 2015. Available: http://lostcoastoutpost.com/2015/jun/27/emergency-water-conservation-ordered-hoopa-valley/).

The Hoopa Valley Tribe has lived in its valley for over 10,000 years and has always depended on the migration and spawning runs of steelhead trout, and chinook and coho salmon in the Trinity River for a large portion of its diet (EPA 2006, *Case Studies in Tribal Water Quality Standards Programs The Hoopa Valley Tribe*). These fisheries have been decreasing due to historic and land use practices and are now severely limited due to lack of sufficient summer instream flow (NOAA NMFS 2014).

Estimates of Without-Project Conditions

The only alternative to this project is to leave the old water meters in its place, but there would be no positive benefits associated with this alternative. The old water meters do not meet federal regulation safety requirement for lead safety rules, so the community would continue to be exposed to unacceptable amounts of lead in their drinking water. Additionally, the District cannot account for 50% of the water it produces and much of it is likely due to the meters being past their useful life and under-recording the water consumption, leading to continued over-withdrawals from the Lower Trinity River watershed system and the negative impacts on fisheries.

Methods Used to Estimate Physical Benefits.

To estimate the amount of water saved through project implementation, we assumed a post-project drop in demand by 17% based on an analysis of decreased water use in Fresno, a resource dependent community in the Central Valley (Drobac 2015), and applied that percentage to currently recorded annual water use for a conservative estimate (since actual use is expected to be much higher than the recorded use according to IHS Water Production/ Water Loss spreadsheets (Zimmerman 2015)) of the amount of water that will be saved after accurate and safe meters are installed. Water quality improvement claims are based on the absence of lead in the new metering equipment.

Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The project consists of: 1) installing 854 household water meters, 2) installing 19 commercial water meters, 3) installing water leak sonic detection equipment.

Potential Adverse Physical Effects

No adverse physical effects are expected from project implementation as the project simply replaces existing water meters attached to existing infrastructure. The leak detector is a tool that will be used to locate leaks; its use will not adversely affect the project area.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Achieve long-term reduction of water use
3. Efficient groundwater basin management

In September 2014, the Hoopa Tribe released its Drought Contingency Plan (Hoopa Valley PUD 2014) and on January 30, 2014, the Hoopa Valley Tribe declared a Drought Emergency (Hostler 2014, *Hoopa Valley Tribe Declares Drought Emergency*. Two Rivers Tribune, January 30, 2014. Available: http://www.tworiverstribune.com/2014/01/hoopa-valley-tribe-declares-drought-emergency/). Emergency water conservation was ordered by the Hoopa Valley Tribal Office of Emergency Services and the Hoopa Valley Public Utilities District in late June, 2015 (Sims 2015).

Management impacts of the prolonged drought are greater restriction on water use and availability due to increased seasonal demand, the risk of long term water shortages, use of potable water for wildfires, low well and stream levels, and stressors on vegetation and shade cover that impact fisheries, recreation and tourism, and the valley's water storage/banking capacity overall. Replacing 873 decrepit water meters with new ones will encourage consumer conservation and allow the PUD to better understand water use and locate leaks. Installation of the new meters will allow the PUD to accurately track customer water use and charge accordingly, which has been shown to generate conservation action, because charging by volume sends a "price signal" to customers to use the resource more efficiently (Pacific Institute 2014, *Metering in California*). When customers begin paying for the amount

of water they are consuming, they are likely to initiate conservation measures, and thus ensure a more reliable, sustainable water supply (Drobac 2015).

DIRECT WATER RELATED BENEFIT TO A DAC

Approximately 2,100 residents receive water from the HVPUD. According to census demographic information, 81.7% of the community identifies as Native American. The Household median Income in 2013 for Hoopa was $32,387.The last Bureau of Indian Affairs (BIA) assessment in 2001 estimated Hoopa Tribal unemployment rate to be 41 percent.

The direct benefits to this DAC include all of those listed above: improving infrastructure and management capacity necessary to address drought preparedness, enhance public health and safety, and promote water conservation awareness and education. Improving community drinking water reliability and infrastructure will also encourage rural development that directly or indirectly supports the vitality and well-being of the Hoopa Tribe's severely economically disadvantaged community. Finally, improving instream habitat for coho salmon will help ensure the sustainability of Tribal culture and subsistence practices.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.7 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Installation of water supply meters that meet federal requirements for lead safety and leak detection equipment to identify leaks for repair	Installation, testing, and start-up of water supply meters and leak detection equipment by end of 2016	Photos of pre- and post-construction conditions demonstrating installation of water supply equipment and certified engineer's statement of completion	Prior to and after construction
Improved water management	20% or less "lost water" in the delivery system	Comparison of amount of water produced to the sum of meter readings	Monthly
Reduction of lead in water supply system	80% reduction in load levels in lead and copper rule samples	Comparison of pre-project and post-project water quality reports	Annually

The performance deliverables will include making sure meters are installed correctly, photo monitoring replaced meters, mapping, detecting water leaks, and reporting to ensure the project budget, and deliverables stay on track as scheduled. Water meter readings will be compared to water production to verify a decrease in unaccounted for water.

COST EFFECTIVE ANALYSIS

Table 7.7 – Cost Effective Analysis **Project name: Hoopa Valley Tribe Hoopa Valley PUD Conservation Project**	
Question 1	Types of benefits provided as shown in Table 5: *Conserved water supply (Primary), Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *N/A*
	If no, why? *Alternative methods will not entirely reduce health risks or alleviate meter failure or water loss.*
	If yes, list the methods (including the proposed project) and estimated costs. *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *This project addresses the most immediate critical water system need and is the most cost effective with the least adverse impacts. It provides the most practical relevent drought preparedness intervention.*
Comments:	

HOOPA VALLEY TRIBE, LOWER SUPPLY FLOOD RISK REDUCTION AND FISHERIES HABITAT IMPROVEMENT PROJECT

PROJECT DESCRIPTION

Brief: This project restores hydrologic connectivity between Supply Creek and its floodplain to reduce flood risk, recharge groundwater, improve water quality, and improve salmonid habitat.

Expanded: After the 1964 flood, the U.S. Army Corps of Engineers (USACE) constructed high, artificial levees on both banks of Supply Creek. These berms disconnected Supply Creek from its former floodplain, impacting salmonid habitat. Removal of the levees along a portion of Supply Creek between Loop Road and Highway 96 will support major project components, including: (1) flood risk reduction, (2) improve salmonid habitat quantity and quality for all life stages, (3) increase drought-resilient salmonid habitat availability, (4) increase the frequency and rate of groundwater recharge by reconnecting Supply Creek with its former floodplain, and (5) removal and relocation of a dilapidated leach field replaced after the 1964 flood that is contributing to elevated fecal and nutrient contaminants.

Similar work on Supply Creek upstream of Loop Road as well as the north bank between Loop Road and Highway 96 began in June '15 (Phase 1). This project (Phase 2) will expand important flood risk reduction and salmonid habitat improvement efforts by supporting removal of the south bank berm between Loop Road and Highway 96, including a portion of Bair Road. Dilapidated and defunct underground utility infrastructure (old storm drains, piping, and a leach field) will be removed through project implementation and appropriately relocated to protect water quality from wastewater contamination impacts. All work proposed for Phase 2 project design and implementation on Supply Creek will be developed to expand upon the beneficial effects of Phase 1 work. Removal of the south bank Supply Creek berm targeted by this proposal will support flood risk reduction by enabling the design and construction of natural, fish-friendly floodplains for off-channel storage of flood peaks. The floodway will be widened, thereby slowing flood velocities.

This project will reconnect Supply Creek with its former floodplain, supporting a more complex and naturally-functioning stream corridor with a restored riparian overstory. This will substantially benefit salmonid habitat by increasing rearing habitat for endangered coho salmon (*Oncorhynchus kisutch*), although rearing and spawning habitat for all salmonids and life stages will be improved. Cold water refugia, large wood and boulder habitat elements, and increased riparian overstory will increase the amount and quality of thermal refugia available to salmonids during periods of drought and low streamflows.

Groundwater recharge will also be improved within the project area. Removing the artificial berm and lowering the high surface constructed after the 1964 flood and reconnecting Supply Creek to its floodplain will increase the rate of groundwater recharge from the creek during flood flows, which is currently impeded by the berm. Revegetation of the channel and floodplain will also help to cool

streamflows in the summer and during periods of drought when warm stream temperatures can cause distress or mortality to juvenile and adult salmonids.

PROJECT PHYSICAL BENEFITS

This project will provide multiple physical benefits; these include, but are not limited to:

- **Primary**: **Habitat Improved**: Riparian habitat restoration of 5.37 acres and 3.54 acres of new channel -adjacent floodplain. The estimated monetary benefit is approximately $644 per year for the riparian habitat restoration (Chaibaiet al. 2009, *Economic Valuation of Forest Ecosystem Services' Methodology and Monetary Estimates*. Fondazione Eni Enrico Mattei Working Paper No. 2009.12. This does not take into account the monetary benefit of the acreage of channel-adjacent floodplain for which we do not have a vetted estimate.
- **Secondary**: **Species protection** for coho salmon: by removing the berm along Supply Creek, natural stream function and habitat will be restored. This will primarily benefit coho salmon, which are listed as an endangered species and are limited by rearing habitat availability (NMFS 2014). Project implementation will result in additional high quality rearing habitat for coho salmon, created by reconnecting Supply Creek to its floodplain, adding large wood and boulder habitat elements, increasing channel sinuosity, and decreasing channel slope.
    - Installation of up to 20 large wood habitat features to increase channel complexity
    - Increase channel length by 95% - from 2,450 ft to 4,772 ft
    - Creation of two new off-channel rearing ponds, and 1 new point bar
- **Increased groundwater recharge** of 47 AFY for an economic value of $2,350 per year, given a conservative estimate of $50 per AFY. This value was estimated by the project proponent based on technical expertise. This benefit was calculated based on the area of the new floodplains available for recharge and the number of days inundated annually.
- **Improved water quality** due to sediment reduction provides a monetary benefit equal to about $463/year. This benefit is based on the volume of Bair Road that would be lost in a 100-yr flood event at $11/ton/year, and is divided by 100 to get a yearly estimate of the one-time benefit.
- **Fishery improvement:** a 49% increase in the Supply Creek fishery is expected based on improvements that have occurred after similar projects.
- **Flood damage reduction**: increased channel capacity and construction of off-channel flood retention basins in the amount of 3.54 acres.
- **Avoided cost of rebuilding Bair Road** after a 100-year flood event (in the project area only) provides a one-time benefit of approximately $280,000.
- **Increased quantity or quality of recreation:** the project is centrally located in a well-used portion of the Hoopa Valley. High levels of recreational use, including summer swimming and wildlife viewing, are expected in the project area post-construction. The monetary value of this benefit is estimated at approximately $39,085 with an expected additional 200 swimming days and 365 wildlife viewing days per year at $33/swimming day and $89/wildlife viewing days (Loomis 2005, *Updated Outdoor Recreation Use Values on National Forests and Other Public Lands*. U.S. Forest Service. General Technical Report PNW-GTR-658).

- **Improved community capacity:** this project provides education and technology benefits for at least 150 students per year who tour the restoration project. Due to its close proximity to the Hoopa Valley Elementary and High School (a large portion of the property adjacent to the site is owned by the school district), the project will be easily accessible for touring by students and teachers for educational purposes. Both the Tribe and the school district have a vested interest in maximizing the education opportunities provided by the project. Additionally, the improved habitat will support the local recreational economy.
- **Tribal cultural benefit**: this project will also help to restore the cultural relationship between the Hoopa Valley Tribe and Supply Creek. The berms have isolated the creek from public access and all manners of use. The project will physically reconnect tribal members to this major stream in the Hoopa Valley, supporting future use for recreational, educational, and ceremonial purposes.
- **Improved social health and safety** from the reduction in fecal and nutrient pollutants in Supply Creek caused by the dilapidated leach field and sewer that will be removed with project implementation.
- **Climate change mitigation**: establishing riparian trees and habitat will sequester CO_2.
- **Climate change adaptation:** by reducing flood risk and improving instream and riparian habitat, this project will increase Hoopa resiliency to effects of climate change, protecting important cultural and subsistence fishery resources in the face of expected hotter, drier conditions and more severe storm events.

Table 5.8 a – Annual Project Physical Benefits

Project Name: Hoopa Valley Tribe Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project

Type of Benefit Claimed: Habitat restored - Primary

Units of the Benefit Claimed : Acres

Anticipated Useful Life of Project (years) 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	8.91	8.91
2020	0	8.91	8.91
Through 2068	0	8.91	8.91

Comments: Riparian plants scheduled to be installed in 2018 with construction completed in 2017. Benefits associated with ecosystem services provided by restored riparian habitat increase over time.

Table 5.8 b – Annual Project Physical Benefits			
Project Name: Hoopa Valley Tribe Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 50 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	1	1
2020	0	1	1
Through 2068	0	1	1
Comments: This project will benefit coho salmon, especially by providing rearing habitat for juveniles. Project will be entirely complete in 2018, so benefits are considered to accrue beginning in 2019.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Supply Creek has high intrinsic potential for endangered coho salmon, but is currently constrained by berms, which impair the streams ability to provide over-summer and wintering habitat for coho and reduces the channel's ability to store gravel and large wood critical for all life stages. Overwintering habitat is critically important in the life history of coho salmon (Peterson and Reid 1984, Brown 2002, CDFW 2004, NMFS 2012), and off-channel habitat is particularly valuable, with coho often experiencing survival rates two to six times higher than fish that utilize main channel habitats. There is only 1 mile of anadromous habitat on Supply Creek, such that the Phase 2 project area is a substantial component of total anadromous length (23%). Supply Creek salmonid habitat was identified as impacted due to disconnection of the floodplain, lack of wood structures, poor riparian conditions and sediment accretion (NOAA NMFS 2014 *Southern Oregon Northern California Coast Coho Salmon Recovery Plan*, *Chapter 38 Lower Trinity River*, page 38-12), but with the potential for re-connectivity with the floodplain (NOAA NMFS 2014, 38 – 22, 23). This project implements Recovery Actions identified in the Plan, including constructing off channel habitats (38-26), and remove, set back, or reconfigure levees and dikes (38-27).

Since the time of levee construction in 1964, flood control techniques have evolved to support natural-functioning stream ecosystems inclusive of functional floodplains. This project seeks to reduce flood damage risk while restoring habitat.

Estimates of Without-Project Conditions

No other projects are planned that will provide the benefits of this project. If the project is not implemented, anadromous fish passage will continue to be limited and Supply Creek will remain channelized and cut off from its floodplain. Habitat for salmonids will continue to be limiting and NOAA NMFS (2014) recommendations for Coho Recovery Actions will not be implemented, jeopardizing the population's persistence in the watershed.

Methods Used to Estimate Physical Benefits

To determine streamflows experienced by Supply Creek (both flood and low flow drought conditions), United States Geologic Survey (USGS) stream gage data was analyzed to develop flow duration and flood frequency curves for Supply Creek, allowing us to target specific elevations for restored floodplains and upland surfaces that would be most beneficial to salmonids (McBain Associates et al. 2014, *100% Design Report for Phase 1 Supply Creek*).

The 100-year flood was modeled with HEC-RAS software to estimate pre-project flood water surface elevations (McBain Associates et al. 2014). The 100-year flood will also be modeled for the post-project design surface to ensure flood risk reduction elements of the projects will be achieved.

Dr. Joshua Strange of Stillwater Sciences evaluated existing aquatic habitat on Supply Creek and identified a reach approximately 1 mile upstream of the project area as a reference reach. This

reference reach was used to target channel dimensions and overall conditions to be applied to the project design, including channel width, sinuosity, and grain size.

All physical metrics reported above result from actual measurements performed in AutoCAD from the attached conceptual design.

New Facilities, Policies, and Actions

Actions required to obtain the benefits include berm removal, removal of dilapidated and defunct underground septic infrastructure, construction of floodplains, and revegetation with native riparian plants and trees. For more detail please see *Attachment 3, Work Plan*.

Potential Adverse Physical Effects

The Tribe will take all actions possible to mitigate environmental impacts associated with project construction, as required by tribal riparian protection ordinances and Endangered Species Act compliance overseen by NOAA's National Marine Fisheries Service. Environmental impact avoidance measures include erosion control protections such as silt fencing, mulching, and other structures to prevent construction-related sediments from entering the stream, avoidance of heavy equipment from flowing water in Supply Creek, and adherence to a spill prevention program, among other standard protection measures required through project environmental permit compliance.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Efficient groundwater basin management

In September 2014, the Hoopa Tribe released its Drought Contingency Plan (Hoopa Valley PUD 2014) and on January 30, 2014, the Hoopa Valley Tribe declared a Drought Emergency (Hostler 2014, *Hoopa Valley Tribe Declares Drought Emergency*. Two Rivers Tribune, January 30, 2014. Available: http://www.tworiverstribune.com/2014/01/hoopa-valley-tribe-declares-drought-emergency/). Emergency water conservation was ordered by the Hoopa Valley Tribal Office of Emergency Services and the Hoopa Valley Public Utilities District in late June, 2015 (Sims 2015, *Emergency Water Conservation Ordered in the Hoopa Valley. Lost Coast Outpost*, Saturday June 27, 2015. Available: http://lostcoastoutpost.com/2015/jun/27/emergency-water-conservation-ordered-hoopa-valley/).

Management impacts of the prolonged drought are greater restriction on water use and availability due to increased seasonal demand, the risk of long term water shortages, use of potable water for wildfires, low well and stream levels, and stressors on vegetation and shade cover that impact fisheries, recreation and tourism, and the valley's water storage/banking capacity overall.

This project makes the Hoopa Valley Tribal community more resilient to increasingly extreme weather events predicted by scientists such as frequent, heavy storms and extended drought. It provides cultural and subsistence values by improving flood and groundwater basin management. Extended residence

time for stormwater will increase groundwater recharge and reconnecting Supply Creek with its floodplain will restore hydrologic function to the creek system. This project will enhance and protect salmonid habitat quantity and quality during periods of extreme drought by decreasing water temperatures through increased groundwater recharge rates and associated hyporheic flow, increased stream shading from a restored riparian overstory, and new in-channel shading and cover from the construction of large wood and boulder habitat structures and associated deep pool habitats. These habitat features are essential to maintaining suitable water temperatures for salmonids during low flow periods and drought conditions.

This project will increase seasonal groundwater recharge to Supply Creek and the nearby mainstem Trinity River. During periods of drought, groundwater (via hyporheic flow) will help maintain suitable water temperatures for salmonid survival, including avoidance of lethal fish disease pathogens which contribute directly to large-scale fish die offs, such as the 2002 Klamath River Fish Kill (CDFW 2004, *September 2002 Klamath River Fish-Kill: Final Analysis of Contributing Factors and Impacts. California Department of Fish and Game, Northern California – North Coast Region, July 2004*. 173 p. Available: http://www.pcffa.org/KlamFishKillFactorsDFGReport.pdf). Flow was recognized as the only controllable factor and tool available in the Klamath Basin to manage risks against future major fish-kills. This project restores hydrologic connectivity to Supply Creek, which ultimately benefits the Klamath Basin.

DIRECT WATER RELATED BENEFIT TO A DAC

By protecting the fisheries that the Hoopa Tribe depends on for cultural and subsistence value from the effects of long-term drought, this project also protects the Hoopa people from the effects of long-term drought. The Hoopa Valley Indian Reservation has a population of more than 3,000, the majority of which are Native Americans and federally recognized tribal members. The Hoopa community suffers from high rates of drug addiction, crime, unemployment, and poverty. The entire community is disadvantaged and will directly benefit from project implementation as described above. The Hoopa Valley Tribe has subsisted by fishing from the Klamath and Trinity Rivers since time immemorial. This project will strengthen the health and resiliency of the Trinity Basin fishery through habitat restoration, and in turn, benefit tribal members through healthier, restored salmonid populations and enhanced subsistence fishing opportunities. This project will provide direct economic benefit to the Hoopa Valley Tribe by employing the Roads Department staff members for 5 months during construction.

This project will also provide the benefit of helping to restore the cultural relationship between the Hoopa Valley Tribe and Supply Creek. The berms have isolated the creek from public access and all manners of use. The project will physically reconnect tribal members to this major stream in the Hoopa Valley, supporting future use for recreational, educational, and ceremonial purposes. Additionally, the project is centrally located in a well used portion of the Hoopa Valley. High levels of recreational use, including summer swimming and wildlife viewing, are expected in the project area post-construction. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.8 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Improved riparian and instream habitat for Supply Creek	Reconnection of Supply Creek to floodplain, riparian restoration, and septic removal	Photos of pre- and post-construction conditions and certified engineer's statement of completion	Prior to and after construction
Fish habitat quantity and quality increase	2700 ft^2 pools, 12,600 ft^2 riffles, 43,200 ft^2 ponds/wetlands	California Department of Fish and Game California Salmonid Stream Habitat Restoration Manual monitoring protocols http://www.dfg.ca.gov/fish/REsources/HabitatManual.asp	Annual
Fish population	49% increase in fishery	HVT juvenile and adult fisheries monitoring	Annual
Riparian restoration	85% native plant recovery	California Rapid Assessment Method (CRAM) method for riparian condition measures: Collins et al 2008 http://www.cramwetlands.org/documents/	Every five years
Flood Risk Reduction	Decreased flooding events	Comparison between post-project flooding events and pre-project flooding events with large storms	After large storms

Since the 1990s, the HVT Fisheries Department has monitored juvenile populations of salmonids in Supply Creek through its annual fyke trap monitoring program during spring and summer months . Adult spawning is similarly monitored throughout the fall and winter. After project implementation, these monitoring efforts will continue. Revegetated areas will be monitored for post-project plant survival and growth.

COST EFFECTIVE ANALYSIS

Table 7.8 – Cost Effective Analysis **Project name: Hoopa Valley Tribe Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project**	
Question 1	Types of benefits provided as shown in Table 5: *Habitat improved (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *Given physical constraints (downstream Hwy. 96 bridge, upstream Loop Rd. bridge, property ownership, and soccer field), the proposed conceptual design best reduces flood damage risk while maximizing possible ecological benefits to Supply Creek. Without addressing physical constraints (e.g., Cal Trans builds a new Hwy. 96 bridge), additional design alternatives are not fiscally feasible at this time. Existing alternative methods not considered for futher analysis were eliminated from consideration due to impacts to infrastructure such as replacement of bridges, major public roadways, recreational fields, etc.) The project proponents do not wish to impact infrastructure and feel funding needed to relocate major infrastructure is cost prohibitive for near-term project implementation. This proposed project does not compromise future ability to implement these alternatives at a future date.*
	If yes, list the methods (including the proposed project) and estimated costs. *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Aside from the no-action alternative, the proposed project is the least cost alternative. Given the physical constraints and the overall small project footprint, additional design alternatives (and thus additional design and implementation budgets) are not feasible. Additionally, the HVT Roads Department will complete excavation at a heavilty discounted rate. Typical market value excavation costs are at $7/yard. HVT will complete the work for $3/yard, contributing $4/yard as a match.*
Comments:	

HOPLAND BAND OF POMO INDIANS, COMMUNITY TEST WELLS AND WATER SECURITY STUDY

PROJECT DESCRIPTION

Brief: This planning project constructs test wells to determine the location for a well to provide reliable water for the Hopland Band and community of Hopland.

Expanded: The Hopland Band of Pomo Indians has been struggling with the ability to provide drinking water to the residents of the Hopland Reservation since the establishment of the Reservation in 1907. There have been numerous attempts to provide adequate water via wells on the Reservation, with 18 wells of varying depths, water quality, and production drilled on the Reservation in the past 100 years . The geology of the Hopland Reservation is not conducive to well development; it consists of fractured aquifers filled with silt and clay. Shallow wells showed great promise only to run dry after one season, and one well with sufficient production (100 gpm) had extremely high levels of bicarbonates, arsenic, boron, barium, and sodium, and actually became a Brownsfield clean-up site (EPA 2007, *Brownfields 2007 Assessment and Cleanup Grant Fact Sheet Hopland Band of Pomo Indians, Hopland Rancheria, CA*). Many engineering, hydrology, and geologist consultants have written in-depth studies of the situation, with all meeting consensus that due to the Franciscan land formations and land fracturing on the Reservation it is highly unlikely that a long term high production well of sufficient water quality to meet the needs of the Hopland Reservation will be discovered (e.g., Consulting Engineer Services 1984, *Engineering Evaluation of Drinking Water Resources of Hopland Water District*; CH2M HILL 1995, *Water Resources of the Hopland Indian Reservation, Mendocino County, California*; Hopland Band of Pomo Indians 2008, *Well Completion Reports and Map*; Hopland Band of Pomo Indians 2009, *Source Water Protection Program Well Abandonment Program – Project Summary*).

In 2007 the Hopland Tribe received funding to build a pipeline to the town of Hopland in order to connect to the Hopland Water system; however, due to the location of the Reservation, (Hopland Reservation is outside of the Russian River Flood Control District, which oversees the distribution of Hopland Water District Water), this project was delayed for several years and the Hopland Tribe once again forced to truck water up to the Reservation to meet the needs of the community. An agreement was made with the State of California and Hopland Water District to recognize Hopland Tribal water rights from surface run-off water that runs down Dooley Creek to the Russian River (above the Hopland Water District well), with the Hopland Water District providing a water wheel to transport water back up to the Reservation. This water is pumped from Hopland Well #1, adjacent to the Russian River, which also provides water to the community of Hopland. While the Hopland Well #1 currently has the capacity (300 gpm) to meet the needs of the Hopland Community and the Hopland Tribe, there is concern about future water security of the Hopland Community and Hopland Tribe. If the Hopland Well #1 goes down or requires extended maintenance, the back-up, Well #3, will not be able to provide enough water to provide for the sanitary and safety needs of both the Hopland Tribe and Hopland Community. The purpose of this project is to establish the legal framework between the Hopland Band of Pomo Indians and the Hopland Water District to investigate and drill three groundwater test well sites in Hopland that have been identified as having high probability of high production. Information resulting from the test

wells will provide the groundwork to apply for additional funding to develop a back up well that will serve both the Hopland Band of Pomo Indians and the Hopland Community.

PROJECT PHYSICAL BENEFITS

This project intends to provide direct water-related benefits to a project area entirely comprised of a DAC (both the Hopland Band of Pomo Indians and the community of Hopland are recognized DACs) **and is in the planning and design phase. There will be only test well construction with this solicitation, no project implementation, so in accordance with instructions on pages 18 & 19 of the 2015 Proposition 84 IRWM PSP, we have not quantified benefits (i.e., completed Table 5).** However, we have provided a qualitative description of the proposed work and the anticipated benefits of the project upon completion of construction.

Upon construction of a secondary water supply well in the Hopland area (location to be determined by test wells constructed through this planning grant), this project is expected to achieve the following physical benefits:

- **Primary: water supply produced** to benefit the Hopland Band of Pomo Indians (30 AFY) and the Hopland community (350 AFY)
- **Secondary: Avoided water supply purchases** of 5,000 gallons per day for the Hopland Tribe will provide an estimated monetary benefit of $109,500 per year given a conservative use of 20 gallons per person per day, which is much less than average use (USGS 2015, The USGS Water Science School Website http://water.usgs.gov/edu/qa-home-percapita.html). Truckloads of water are estimated at $0.06 per gallon. These costs would be incurred if Hopland's Well #1 is no longer able to supply water and the Tribe is forced to once again truck water for its potable needs. Given the extended drought and projected conditions associated with climate change, this will occur eventually if no action is taken to secure another water source.
- **Water supply reliability** for the Hopland Tribe and Hopland community serves state and regional environmental justice goals, meets the Human Right to Water Policy, and improves community capacity.
- **Drinking water quality improvements** for the Hopland Tribe. Wells of good quality are typically shallow, less than 100 feet, and last only through the early months of the dry season before going dry. Deeper wells may produce more water, but many minerals and metals tend to leach into these waters, leading to undesirable levels of arsenic, boron, barium, manganese, magnesium, sodium, TSS, TDS, discoloration, sulfur smells, bicarbonates, and iron. Hopland has struggled for years to treat water on the Reservation with greensand filtration, potassium permanganate, and chlorination. However, the final product is often below EPA drinking water standards as well as community acceptance standards. Groundwater basins in the valley do not have these issues.
- **Conflict reduction:** This project sets the groundwork for collaboration between the Hopland Band and the community of Hopland over groundwater management. By seeking out and obtaining a high quality, adequate water supply, the communities are preparing for continued drought conditions expected with climate change. Additionally, this collaboration builds

capacity for future challenges; having already successfully solved this problem, the communities are more likely to collaborate in the future.

- **Climate mitigation:** A reliable water supply will result in avoided GHG emissions because the Hopland Tribe will not need to import water.
- **Climate adaptation:** Increasing sources of water supply will enable the communities to better withstand expected hotter, drier conditions expected with climate change. Additionally, the social capital developed during this collaboration will enhance community capacity to respond to other challenges associated with climate change.

We respectfully respect that reviewers answer "N/A" for Question 8 in the Project Level Evaluation due to this community's disadvantaged status. We believe that the question – specifically the units required by the state for quantifying benefits in Table 5 – is not applicable to this project, which was locally prioritized by this DAC and regionally approved under the auspices of the IRWM Program. It provides many valuable benefits to the local community, but those benefits don't happen to be able to be expressed in the units detailed on page 19 of the PSP. This DAC does not have the luxury of having several medium priority projects to choose from that best fit the PSP requirements – it needs to solve a high priority issue as soon as possible simply to ensure the Basic Human Right to Water. Please respond "N/A" for Question 8 for this project.

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The Hopland Band of Pomo Indians has a qualified EPA and Utilities Department that has been monitoring ground and surface water for over twenty years. The Tribe has also contracted with Indian Housing Services, and USGS to provide additional supporting in surface and groundwater resources not only on the Hopland Reservation, but also in the Hopland Basin. Numerous scientific studies have confirmed the low potential for adequate drinking water from wells on the Hopland Reservation, and the high likelihood of abundant production wells on the valley floor. Monitoring wells on the valley floor have confirmed this, and show little effect from the drought thus far. A highly fractured geological landscape on the Reservation leads to shallow wells that go dry quickly, and deep wells are unsuitable for drinking, with high levels of arsenic and other heavy metals (CH2M HILL 1996, *Water Supply Concepts and Cost Estimates for the Hopland Rancheria*). The Hopland Basin has little of the contamination of the Hopland Reservation, and higher production (USGS 1985, *Ground-Water Resources in Mendocino County*, California).

Given the uncertainty of the impacts of climate change, the current drought situation, and the lack of back-up drinking water for the Hopland Tribe and Hopland Community this project is a high priority for the water supply reliability and climate change resilience for the greater Hopland area. Developing a collaborative relationship for the management of water resources between the Hopland Tribe and Hopland Water District is a vital step in not only managing drinking water, but also laying the groundwork for collaborative management of the Hopland area groundwater basin.

*Estimates of Without-Project Conditions **

Without this project there is the potential for both Hopland Tribe and Hopland Community facing severe water shortages. Hopland Utilities does not have the resources to drill test wells, and the Hopland Tribe does not have the resources to develop their own infrastructure for water from Hopland. By collaborating on this project a win-win situation can ensure the health and wellbeing of both communities.

*Methods Used to Estimate Physical Benefits **

Studies conducted on behalf of the Hopland Reservation over the past 40 years have consistently emphasized that due to the Franciscan Rock formations with fractured aquifers, topped with silt and clay leave little opportunity for large consistent quantities of drinking water quality water to be available on the Hopland Reservation. Wells of good quality are typically shallow, under 100 feet, and last only through the early months of the dry season before going dry. Deeper wells may produce more water, but many minerals and metals tend to leach into these waters, leading to undesirable levels of arsenic, boron, barium, manganese, magnesium, sodium, TSS, TDS, discoloration, sulfur smells, bicarbonates, and iron. The geological structure 4 miles to the west of the Reservation (Sanel Valley-Hopland) is completely different though, with alluvial deposits covering a bedrock base of anywhere from 20-40 feet. This is a northwestern facing basin located within the Coast Ranges of southeastern Mendocino

County. The Sanel Valley Groundwater Basin is refined by the areal extent of Tertiary continental basin deposits and Quaternary Alluvium. Water drawn from this area is clear of the minerals and metals common in the wells on the Reservation (DWR 2004, *North Coast Hydrologic Region California's Groundwater Sanel Valley Groundwater Basin Bulletin 118*). Well reports from throughout the Hopland Valley floor have been studied to locate the most promising location for test wells, with top priority given to locations near the existing Hopland Public Utilities District infrastructure. The DWR Groundwater Monitoring Well Installation Dry Year Monitoring Program has been gathering well depths for the monitoring wells; these results show consistent water levels, even during dry years (DWR 2003, *Groundwater Monitoring Well Installation Dry Year Groundwater Monitoring Program Mendocino County*, California Technical Memorandum Report).

New Facilities, Policies, and Actions *

This is a research and planning project submitted by a Disadvantaged Tribal Community. The only new infrastructure built will be three solar-powered test wells. In order to gain the greatest benefit from this project, it will be necessary for the Hopland Tribe and Hopland Utilities to develop a working, legal framework for the sharing of the water resources. Without this legal framework, there is the potential for litigation occurring, draining financial resources form two equally needy organizations. After this is accomplished, both entities will be able to go forward with confidence that the needs of their respective communities will be well served.

Potential Adverse Physical Effects *

This project will adhere to OSHA standards for all employees and contractors. On-site safety during well drilling will be closely monitored and test well development will be conducted using standard protocols. Any environmental impact will be contained and/or mitigated using appropriate BMPs. If any of the test wells have high levels of contaminants that could impact surface or groundwater, they will be contained and/or destroyed.

Drought Preparedness *

This project will contribute toward the Hopland Band of Pomo Indians and the Township of Hopland achieving the following Drought Preparedness implementation goals:

1. Efficient groundwater basin management
2. Establish system interties
3. Solutions that yield a new water supply

The Hopland Band of Pomo Indians is working on a 25% reduction in water usage, throughout the Community and the Casino. The Hopland Band of Pomo Indians has a Drought Contingency Plan in place, sends out monthly reminders and hints to the community about how to conserve water, is active in leak repair, and is researching methods of utilizing reclaimed water and rainwater catchment. Priority projects include leak detection and repair, outreach and education to community on water saving techniques, and researching techniques to use reclaimed and greywater.

This project will support water supply reliability for the Hopland Tribe and Hopland community by researching feasible areas for drilling back-up wells to provide backup for the current functioning well. The Hopland Tribe and Hopland Community both depend on one well in downtown Hopland for their entire water supply. If there is an equipment malfunction such as pump failure, or if the well fails to recharge after 4 years of drought, both the Hopland Tribe and Hopland Community would be facing an emergency situation, and would face trucking in water. There is the possibility of one small back-up well being brought on line, but during the dry summer months the back-up well is capable of pumping less than 100 gpm, less than a quarter of what is needed to meet current demands.

* Although this project is exempt from responding to all but the *Explanation of Need* because it provides direct water-related benefits to a DAC in the planning phase and is not intending to complete construction, we provided answers that are as complete as possible to the other parts of the *Technical Justification Section*. We chose to answer these questions to provide as complete a picture as possible of the proposed project and its importance to local and regional water management.

DIRECT WATER RELATED BENEFIT TO A DAC

There are two distinct communities being served by this project: the Hopland Band of Pomo Indians and the community of Hopland. The main beneficiaries will be the Hopland Band of Pomo Indians, a disadvantaged community with a population of over 250 residents living on the Hopland Reservation. The Hopland Reservation has extremely high unemployment rates and poverty among the residents, many struggling to pay their monthly utilities bills. The residents of the township of Hopland are a mix of field workers, commuters to Santa Rosa and Ukiah. Both communities are classified as Disadvantaged by the State of California.

This project will provide water reliability security to the Hopland Band of Pomo Indians, who cannot afford to truck water in for their community if the Hopland Public Wells go down due to maintenance, extended drought, or some other issue. Additionally, there are many low income residents in the town of Hopland that would struggle to purchase trucked in or bottled water if the Hopland wells go down.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Although projects intending to provide direct water-related benefits to a project area entirely comprised of a DAC that are in the planning or design phase and not intending to complete construction with this funding **are not required to complete this section**, the Hopland Band of Pomo Indians has provided a Project Performance Monitoring Table.

Table 6.9 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
3 test wells constructed	Identifying sites, creating bid packets, sending out to bid, choosing contractor,	Monthly monitory of bid status	Bid packets created and sent out, contractor chosen,
Landowner agreements and easements for wells	Signing of agreements,	Monthly until agreements are signed	Signed agreements by 04/30/2016
Legal documents outlining the framework for a Hopland Band of Pomo Indians/Hopland Public Utilities Water District water project collaboration	Project agreement document reviewed by legal council	Monthly until agreement is signed by Hopland Band of Pomo Indians and Hopland Public Utilities Water District.	Rough draft reviewed 01/30/2016, final draft signed 03/30/2016
Testing of wells for drinking water quality.		3 times 06/01/2016, 08/01/2016, 10/01/2016	VOC,Nitrates, Nitrites Phosphorus Non Detect Fecal and Total Coliforms Non detect. Metals and minerals including arsenic, sodium, barium, boron, manganese, sodium, TSS, TDS, EPA Drinking Water Standards. Ph 6.7-7 Well depth and recharge rate

COST EFFECTIVE ANALYSIS

Although projects intending to provide direct water-related benefits to a project area entirely comprised of a DAC that are in the planning or design phase and not intending to complete construction with this solicitation **are not required to complete this section**, the Hopland Band of Pomo Indians has provided this information.

Table 7.9 – Cost Effective Analysis **Project name: Hopland of Pomo Indians Test Well and Community Water Security**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply produced (Primary) and Avoided water supply purchases (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *Numerous hydrology, geologic, and well logs from the Hopland Reservation verify that the potential for finding water of sufficient quantity and acceptable quality is very slim, and economically unfeasible. If water is found the cost of treatment and resulting environmental implications of thousands of gallons of backwash contaminated with arsenic and other metals. There have been numerous well sites considered on the Hopland Reservation, unfortunately due to geologic formations these efforts have not been successful.*
	If yes, list the methods (including the proposed project) and estimated costs.
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Yes, this is the least cost alternative. Drilling additional wells on the Hopland Reservation involves not only the cost of drilling the wells, but potential ongoing treatment of the water, maintaining a water treatment facility, monitoring and testing the water to EPA standards, and if the well goes bad as has happened previously, destroying the well and conducting a clean-up. In the long term, given the costs of water treatment, labor, maintenance and equipment upgrades it is more cost effective drilling a groundwater well at a site that has potential for water that does not need extensive treatment than to continue drilling wells in sites that have given disappointing results, such as on the Hopland Reservation.*
Comments:	

HUMBOLDT COUNTY RESOURCE CONSERVATION DISTRICT, RESTORING STREAM FLOW AND FISH PASSAGE ON THE EEL RIVER DELTA

PROJECT DESCRIPTION

Brief: This project will restore habitat, hydrologic function and connectivity between Francis Creek, Salt River, and the Eel River Estuary, enhancing community resilience to climate change.

Expanded: This multi-benefit project is a community-driven, public/private partnership to provide flood control benefits by restoring hydrologic function across a watershed that provides critical fish habitat for several listed and threatened fish species including coho (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), longfin smelt (*Spirinchus thaleichthys*), and tidewater goby (*Eucyclogobius newberryi*). Francis Creek is a second order stream with approximately 5.2 miles of blue line stream that historically supported steelhead and coastal cutthroat trout as well as coho salmon. Currently its lower reach, including its confluence with Salt River, is severely restricted by clogged culverts, sediment build-up, invasive vegetation, and debris. Francis Creek is one of three main tributaries to Salt River, which is the lowermost tributary to the Eel River Estuary. From its headwaters in the Wildcat Hills, Francis Creek flows as a natural stream to the valley floor then enters a hardened, channelized zone through the City of Ferndale (constructed in response to frequent flooding). It then transitions back to a natural stream with an excellent reference reach. However; as it nears its intended confluence with Salt River, the channel is completely aggraded. This creates a complete barrier to fish passage and backs rain and storm waters onto productive agricultural land, and floods roads, residences, and city, county and private infrastructure.

The major components of the Francis Creek project include excavation and hauling per design specifications to re-establish connectivity between Francis Creek and the Salt River and to rehabilitate and restore the lower 2,745 feet of Francis Creek. Native riparian vegetation will be installed on the floodplain to create a diverse riparian area protected by livestock exclusion fence. To accommodate the wider and deeper channel, the existing agricultural bridge over the creek will be replaced with a 55 ft. bridge. The project will construct a non-hardened sediment management area near the confluence that enables off-channel sediment retention and management while not impeding fish passage.

The project purpose is to restore habitat, hydrologic function and connectivity between Francis Creek, Salt River, and the Eel River Estuary as part of a multi-phase, watershed-scale restoration, known as the Salt River Ecosystem Restoration Project (SRERP). The Francis Creek project area is directly upstream of restoration work completed in 2013 and 2014 to greatly enhance tidal prism and streamflow by restoring 330 acres of tidal marsh and 3.3 miles of Salt River channel and riparian floodplain upstream of the Eel River Estuary. Work is continuing upstream each year and, when complete, the SRERP will have 1) restored approximately 7 miles of river channel and riparian floodplain, 2) re-connected 3 main tributaries, 3) implemented numerous projects on private land throughout the upper watershed to control erosion, reduce sediment, enhance riparian habitat and improve water quality; 4) restored and enhanced approximately 600 acres of fish and wildlife habitat, including tidal marsh, aquatic areas, mudflats, freshwater wetlands, riparian forest, and grassland; and 5) improved drainage and reduced

flood damage; thereby enhancing agricultural productivity on more than 800 acres in the project vicinity and reducing economic losses.

PROJECT PHYSICAL BENEFITS

Physical benefits include, but are not limited to:

- **Primary: Habitat improved and restored**: totaling about 3.76 acres of vital instream, riparian, and flood plain habitat. This provides an estimated monetary benefit of $150 given an estimated $120 per year for riparian habitat (Woodward and Wui 2001, *Economic Value of Wetland Services: A Meta-Analysis*, Ecological Economics, 37:257-270). This value is likely an underestimate because we do not currently have an estimated value for instream habitat.
    - Approximately 2.5 acres (2,745 feet * average of 40' wide/ 43,560 ft^2/acre) of Francis Creek will be restored for hydrologic conveyance with LWD installed for improved fish habitat. This restoration will provide fish passage to an additional 5.9 miles of historic habitat, which will be accessible for the first time in decades.
    - Approximately 1,100 feet of native riparian vegetation will be installed along with 2500 live sedge plantings, resulting in at least 1.26 acres of restored riparian habitat assuming average riparian width of 50 feet.
- **Secondary: Species protection:** Protection of 5 listed species: Chinook and coho salmon, steelhead, tidewater goby, and longfin smelt through improvement of habitat and restored fish passage.
- **Fishery benefits** of increased flow rate of up to 800 cfs or about 21,732 AFY available for environmental beneficial uses. This is due to the increase in Francis Creek channel capacity from 10' wide by 4.5' deep to 40' wide and 5 feet deep. Given a conservative value of $120 per AF; this benefit provides a yearly monetary value of approximately $2,607,840 (Brown 2007,*The Marginal Economic Value of Streamflow from National Forests: Evidence from Western Water Markets*. In: Advancing the Fundamental Sciences: Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, October 2004. PNW-GTR-689. p. 458-466).
- **Flood damage reduction**: an approximate 5 acre Sediment Management Area at the confluence of Francis Creek and Salt River will conduct and slow flows to allow significant amounts suspended sediments to drop out.
    - The Francis Creek Channel capacity will increase on average from 10' wide and 4.5' to 40' wide and 5' deep allowing for up to 800 cfs stormwater passage (~25 year flood event) to effectively flow to the Salt River, reducing upstream flooding.
    - Reduced flooding on Port Kenyon road, which is currently closed due to flooding and sediment deposition for about 6 months per year
    - Reduced costs for Humboldt County for Port Kenyon road cleanup estimated by project proponent to be approximately $15,000 per year
- **Improved water quality:** Sediment reduction of 14,000 tons per year with an estimated monetary benefit of $84,000 per year using the conservative estimate of $6 per ton (Hansen and

Ribaudo 2008, *Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment*. U.S. Department of Agriculture. Technical Bulletin No. 1922.)

- **Improved community capacity**: The City of Ferndale's Waste Water Treatment Plant will benefit from having a functioning receiving water body which at this time does not exist or is severely restricted, benefitting 1,400 residents. Residents who use Port Kenyon Road will benefit from being able to use the road for the entire year.
- **Climate adaptation**: This project greatly improves climate change resiliency for the community of Ferndale by enhancing flood control, restoring hydrologic connectivity and function to Francis Creek, and restoring instream, wetland, and riparian habitat.

Table 5.10 a – Annual Project Physical Benefits

Project Name: Humboldt RCD Restoring Stream Flow and Fish Passage on the Eel River Delta

Type of Benefit Claimed: Habitat restored - Primary

Units of the Benefit Claimed : acres

Anticipated Useful Life of Project (years) 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	3.76	3.76
2018	0	3.76	3.76
2019	0	3.76	3.76
Through 2066	0	3.76	3.76

Comments: Habitat restored includes an estimated 2.5 acres of instream habitat and at least 1.26 acres of riparian habitat. Implementation will be completed in 2016 and benefits will begin to accrue in 2017.

Table 5.10 b – Annual Project Physical Benefits

Project Name: Humboldt RCD Restoring Stream Flow and Fish Passage on the Eel River Delta

Type of Benefit Claimed: Species protection

Units of the Benefit Claimed : Number of species - Secondary

Anticipated Useful Life of Project (years) 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	
2017	0	5	5
2018	0	5	5
2019	0	5	5
Through 2066	0	5	5

Comments: Salt River and tributaries are Essential Fish Habitat for Chinook and coho salmon. Key Limiting Stresses are "Impaired Estuary/Mainstem Function" and "Lack of Floodplain and Channel Structure (NOAA NMFS 2014)." Re-connecting Francis Creek to Salt River restores 6.2 miles of fish passage from the Pacific Ocean and provides access to 5.9 miles of fish habitat in the upper watershed. Post-restoration fish surveys in the 2013-restored estuary portion of the larger Salt River project have identified juvenile and adult coho, steelhead, Chinook (*Oncorhynchus tshawytscha*), longfin smelt , tidewater goby, and several other fish species utilizing the new Salt River channel. Implementation will be completed in 2016 and benefits will begin to accrue in 2017.

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

European settlement and reclamation activities in the 1800s led to a dramatic decrease in Salt River tidal prism (the volume of water exchanged on each tidal cycle). This negatively impacted sediment transport in the Salt River, leading to substantial sediment deposition over the ensuing years. The effects of the resulting channel aggradation have steadily migrated upstream, leading to hydrologic dysfunction of the Salt River and its tributaries.

Habitat conditions are currently highly degraded with fish passage completely blocked and invasive vegetation filling the channel. Farmland surrounding the project area is negatively impacted by repeated flooding and long periods of standing water; resulting in ecological and economic impacts to dairy producers. Flooding and silt annually closes a section of County road necessary for ingress and egress. Multiple homeowners suffer from annual flooding. Observations and anecdotal reports by surrounding landowners describe notable drainage improvements in areas restored in prior years. Continuing implementation upstream will leverage the rapid ecological response documented in post-project fish and vegetation surveys of the previously completed tidal marsh and channel downstream from proposed project area. Fish surveys confirm presence of salmonids and other listed species in previously restored areas.

CDFW fish surveys in Francis Creek during 2002-2004 documented presence of steelhead and coastal cutthroat trout. In 2005 coho salmon were also documented. Fish passage barriers are the primary limiting factor to salmonid production in the watershed. Complimenting this proposed project is the 2015 removal of several blocked culverts on Francis Creek which will be replaced with a large pre-fabricated arch culvert. This will eliminate a major barrier to fish passage. This project will then re-connect Francis Creek to Salt River and construct a non-hardened off-channel sediment basin for ongoing management. Excavated sediment will be off-hauled and re-used as an agronomic amendment on local pastures per sediment re-use plans approved by the State Coastal Commission (*Excavation Materials Management Plan*).

Over the past 30 years, project proponents for the overarching watershed restoration project, within which this project falls, have completed multiple technical studies and planning documents. A few of those reports are: *Draft Basis of Design Report, Volumes 1,2,3*; *Sources, Magnitude and Mitigation of Erosion and Sedimentation in the Salt River Basin with Emphasis on Francis and Williams Creek Basins*; *Salt River Watershed Assessment*; *Francis Creek suspended sediment yield – turbidity threshold sampling 2007-2014*; *Conceptual Strategies for Streamflow and Sediment Management on Williams Creek*; and *Excavation Materials Management Plan*. A Final Environmental Impact Report (EIR) (Grassetti Environmental Consulting 2011)for the current extent of the larger project, inclusive of this project to restore and re-connect lower Francis Creek, was adopted by HCRCD in February of 2011 (available: http://humboldtrcd.org/index_files/salt_river_ecosystem_restoration_project.htm).

Estimates of Without-Project Conditions

Currently no other projects are slated to address this area of Francis Creek. Therefore, repeated flooding and standing water on farm land surrounding the project area will continue to impact producers; county roads will remain closed during winter months due to flooding and sedimentation; residential homes and businesses will be incrementally flooded or buried during each storm cycle; Ferndale's waste water treatment plant will not have a reliable water body for discharge; and fish passage will continue to be nonexistent from the Salt River to Francis Creek.

The California Energy Commission and Scripps Institution of Oceanography state that low-lying coastal locations prone to flooding will be more affected as the sea level rises; by the end of the twenty first century, extreme flooding events that now occur about once every century will occur annually (CEC and SIO 2012, *Coastal Flooding – Potential Projections: 2000 - 2100*).

Methods Used to Estimate Physical Benefits.

The EIR (Grassetti Environmental Consulting 2011, 2-23 to 2-25, fig 2-11 and 2-12, 2-72 to 2-74) provides the basis by which the project estimates the physical benefits associated with restoration. Methods estimating benefits for Water Supply, Water Quality, and Flood Management all stem from the hydrological studies made in the Salt River watershed and sub-watersheds and referenced above. Habitat benefits are also based on hydrologic studies and CDFW's field work and watershed assessment (Downie and Lucie 2005, *Salt River Watershed Assessment*, pages 3, 8 – 10, 20, 37. 40, 50, 53 – 54, 66).

Methods used to estimate flooding benefits are described below.

Agricultural Lands: Dairy pastures continue to be inundated due to flooding storm waters and the inability of those waters to drain into a functioning hydrologic system. Engineers and hydrologist have designed the project plans to address the hydrologic function in the area. Landowner interviews have been held during the project development where maps were created to describe the area that flood and length of inundation. These landowner maps additionally depict predicted areas that will improve with increased drainage. Specific inundation maps are available upon request.

Residential: Impacts to residents surrounding Francis Creek has been well documented and experienced by project proponents. Current impacts due to annual flood water and accumulated sedimentation are specifically due to the undersized Francis Creek channel, no channel connection to the Salt River, and a road crossing the creek passes under. The designed excavated channel and new road crossing will contain a common flood event equivalent to a peak flow of 168 cfs (*SRERP Basis of Design Report Vol 1* pgs 2-34 to 2-35). Relief from annual sedimentation in and around residential housing will also occur with the decrease flooding (*Annual Francis Creek Suspended Sediment Yield* – Turbidity Threshold Sampling Reports for sediment loads).

City of Ferndale Wastewater Treatment Plant: Currently, Francis Creek flow is diverted to an agricultural field where it is left to collect and evaporate. The Francis Creek channel is non-functional; therefore the City's Wastewater Treatment Plant has no receiving water to release their treated effluent. The City has a temporary agreement with the State's Regional Water Quality Control Board for effluent release to

allow the City to function its sewer system. However this agreement may be reassessed in the future (*Final Environmental Impact Report* pgs 3.1-32, 36).

New Facilities, Policies, and Actions

Project design incorporates a suite of sediment management approaches, including; upslope sediment reduction projects on private land, excavation of the main channel and tributaries to improve and maintain velocity and sediment transport fuction, a variety of design features to trap sediment out of the main channel along the floodplain, and a non-hardened, fish-friendly constructed sediment management area for large scale trapping and removal of sediment. Sediment is being re-used in cooperation with local dairy producers as an agronomic amendment on pastures.

Approximately 2400 feet of livestock exclusion fencing will restrict livestock access to the Francis Creek project area. A temporary water diversion system will be developed and installed and 4,500 Cubic Yards of sediment will be excavated from the channel and sediment management area and off-hauled to agricultural fields. The agricultural bridge will be replaced and native trees and plants will be installed.

Potential Adverse Physical Effects

Temporary impacts from construction will be mitigated as detailed in the *Salt River Project EIR*, *Habitat Monitoring and Mitigation Plan* (HT Harvey & Associates and Winzler & Kelly 2012), and as described in the project *Storm Water Pollution Prevention Plan*. These documents are available at: http://humboldtrcd.org/index_files/salt_river_ecosystem_restoration_project.htm. Should post-project monitoring reveal any adverse physical impacts, they will be mitigated utilizing Best Management Practices as approved in the project Adaptive Management Plan.

Drought Preparedness

Agricultural wells are being rehabilitated, deepened, or newly-constructed and water use is being restricted in accordance to the Governor's 2015 directive (http://www.water.ca.gov/waterconditions/declaration.cfm). Although this project is not a drought-preparedness project, it provides freshwater inputs to the Salt River that will provide fisheries benefits as the fresh water will offset the salinity of the tidal inputs to the Salt River that inflow upstream from the estuary. As a side benefit to the project, the landowner has agreed to end the annual diversion of surface water from Francis Creek for irrigation.

DIRECT WATER RELATED BENEFIT TO A DAC

The community in and around the Salt River Watershed will directly benefit from the flooding reduction benefits of the project, while the larger community will benefit from improved water quality and habitat. Approximately 2,500 people reside in the watershed, which includes residents in the City of Ferndale, a recognized DAC. The population outside of the City of Ferndale consists of primarily dairy producers, ranching operations, and rural residents. The watershed supports family-owned dairy and beef operations; a critical part of the Humboldt County economy.

The DAC of Ferndale will benefit from the Project in all ways detailed above, including the following:

1. Repeated flooding and standing water on farm land surrounding the project area will be alleviated, resulting in positive ecological and economic benefits for producers;
2. County roads will remain open due to reduced flooding and sedimentation;
3. Residential homes and businesses will no longer be incrementally flooded or buried during each storm cycle;
4. The City's waste water treatment plant will have a reliable water body for discharge.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.10 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Restored habitat, hydrologic function and connectivity between Francis Creek, Salt River, and the Eel River Estuary	Bridge removal, sediment excavation, new bridge installation, cattle exclusion fencing, and riparian and wetland revegetation	Photomonitoring and certified engineer's statement of completion	Prior to and upon completion of project
Salmonid Habitat – water quality	DO > 7.0 mg; Tem < 23 C; Salinity < 35ppt; TDS < 275ppm; Coductivity < 375 microS; pH 6.5 to 8.5; Total Alkalinity > 20ppm	Water sampling with a multiparameter meter and deployment of temperature meters - CDFW Salmonid Stream Habitat Restoration Manual and NCRWQCB Plan	Annual
Maintain Channel Structure	Channel geometry not to reduce or enlarge by 10%	Cross-Section and Longitudinal Profiles with survey level equipment – SRERP Adaptive Management Plan and Standard Protocols	Annual
Fish Passage	Maintain fish passage at all flows	Observe and inspect channel for fish passage – SRERP Adaptive Management Plan and CDFW Salmonid Stream Habitat Restoration Manual	Annual
Reduce Sediment into the System	Retain storage capacity of 75%	Observe and inspect the Sediment Management Area - SRERP Adaptive Management Plan	2 X Year
Instream Habitat Monitoring	No significant degradation of habitat	Resurvey Francis Creek index reach - CDFW Salmonid Stream Habitat Restoration Manual/habitat Typing Protocol	Annual

Initial and long term monitoring of the proposed Francis Creek Project is outlined in the *Salt River Ecosystem Restoration Project Adaptive Management Plan* (AMP) (HT Harvey & Associates et al. 2011). The AMP provides project goals, objectives, and monitoring protocols drawn from a number of documents developed during project planning. Cross-sectional survey sites will be established on Francis Creek. Annual surveys will determine whether channel erosion or siltation stays within a +/-10% threshold. The sediment management area will be inspected after each 1-Year storm event and formally inspected annually to determine when capacity reaches 25% reduction. Annual visual inspection of the entire project reach will monitor vegetation cover and survival, fish passage, debris jams, and channel integrity. If monitoring determines that thresholds are breached, established protocols call for holding community and regulatory stakeholder meetings to determine the best course of action to achieve project goals.

COST EFFECTIVE ANALYSIS

Table 7.10 – Cost Effective Analysis **Project name: __Humboldt County RCD Restoring Stream Flow and Fish Passage on the Eel River Delta_____**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. *During project development, full restoration to historic channel size was considered and dismissed as impractical, due to cost, current land ownership, and land management constraints. Project design reflects a balanced approach to achieve project goals while preserving and protecting agriculture and restoring and enhancing fish and wildlife habitat. The project EIR examined 4 alternatives: No Project; Partial Restoration of Tidal Estuary and Upslope Sediment Reduction; Partial Restoration of Channel and Upslope Sediment Reduction; and Full Ecosystem Restoration- the selected alternative. In approving the project, the HCRCD Board determined that the selected alternative as described in the Final EIR provides the greatest long term environmental benefit to fish passage, riparian habitat, and improved water quality and best meets the goals and objectives of the project to re-establish and restore a functioning riverine, riparian, wetland and estuarine ecosystem.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *N/A.*
Comments:	

LEWISTON MUTUAL WATER COMPANY, LEWISTON VALLEY DRINKING WATER INTERTIE PIPELINE

PROJECT DESCRIPTION

Brief: This project constructs an intertie between two small water suppliers in a Severely Disadvantaged Community to bolster supply reliability, improve firefighting capabilities, and improve habitat.

Expanded: There are two drinking water treatment and distribution companies that serve the most concentrated populations of the Disadvantaged, rural town of Lewiston. One company, operated by the Lewiston Community Services District (LCSD) serves about 66 homes and businesses and has a brand new facility (operational in August 2015) for the treatment and storage of surface water from the Trinity River. The other company - Lewiston Park Mutual Water Company (LPMWC) uses groundwater supplied from 5 wells for most of the year and serves 167 homes and small businesses and an elementary school. During drought conditions, the LPMWC wells have drastically declined production, necessitating pumping water from the Trinity River to meet the needs of customers. In 2014, summer well production dropped 44% compared to production before the drought. In June 2010, the wells produced 7.5 million gallons, as compared to June 2014 when the well produced 4.2 million gallons. Because the surface water treatment plant is so old and inadequate a Boil Water Notice is required to be issued whenever river water is pumped into the distribution system (California Department of Public Health 2013, *Letter regarding Public Notification Requirements and Inspection of Lewiston Park Mutual Water Company's Drinking Water System*; LPMWC 2013, LPMWC 2014, *Consumer Confidence Reports;* LPMWC 2014, *Boil Water Notice*). Inadequately treated water may contain disease-causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches. If the current drought continues and no ground water is available, the customers of the LPMWC will be severely rationed in water use and the Boil Water notices will continue. The forested area surrounding the town is very prone to wildfires (four major wildfires in in past decade). The LPMWC has a 150,000 gallon gravity fed redwood storage tank that would be emptied rapidly during firefighting efforts, while the LCSD has double that supply with a new (in 2015) 318,000 gallon storage tank.

The two drinking water treatment facilities described above are close in proximity and could be joined by an intertie pipeline. The intertie would provide heightened water availability and water security for the customers of each system – especially during drought conditions – and provide easily accessible water for firefighting efforts.

The Trinity River contains habitat for coho salmon (*Oncorhynchus kisutch*) that has been identified as limited with respect to "altered hydrologic function," with one of two key limiting threats identified as "dams/diversions (NOAA NMFS 2014, Southern Oregon Northern California Coast Coho Salmon Recovery Plan, Chapter 39, Upper Trinity River, p 39 -1)." The highest priority recovery actions include increasing instream flows, which this project provides.

In order to promote beneficial water use and water security for the communities and protect endangered coho in the Trinity River, this project will join the two drinking water systems by an intertie pipeline to allow the sharing of water between the two systems in emergency situations.

PROJECT PHYSICAL BENEFITS

Physical benefits provided by this project include, but are not limited to:

- **Primary: Water supply saved** in the amount of 1.33 AFY not pumped from the Trinity River each summer season. This water will be available for instream beneficial uses because it will instead be provided by the LCSD from their existing allotment of Trinity River water.
- **Secondary: Species protection:** Coho salmon will benefit from increased instream flows during the critical summer months.
- **Increased water supply reliability:** about 500 residents and their associated infrastructure would have water security in times of severe drought or disaster. There are about 200 households, several small businesses, one elementary school, a church, a community center and park, and volunteer fire department.
- **Improved public safety and water quality** by reducing the number of boil water notices and potential health problems from exposure to contaminated water. The prolonged need to boil water and buy bottled water is a true hardship for this severely disadvantaged community. Additionally, the health risks to the elderly within this population of drinking inadequately treated water are much higher.
- **Fire risk reduction**: in a fire emergency, the availability of water for firefighting will help to protect habitat and community infrastructure, estimated by the project proponent to have an economic value of about $100,000 from fire damage and associated losses (200 homes valued at about $100,000 each). Lewiston CSD provides fire service.
- **Avoided water treatment costs** of about $5000 per year as estimated by the project proponent from costs savings associated with filtering, backwashing, and rinsing water diverted from the Trinity River. These estimated savings include coagulant chemicals, chlorine, electricity for pumping, equipment maintenance, and labor.
- **Increased property values**: This project will provide economic stability in Lewiston for the 160 homes connected to the LPMWC considering the project proponent's estimate that property values of each home have dropped by $10,000 due to sustained boil water advisory notices six months per year. This benefit has an estimated one-time monetary value of approximately $1,600,000.
- **Climate adaptation:** response actions, including expanding management of multiple water supply sources, system modifications that address anticipated climate change impacts, and water use efficiency
- **Environmental justice and regional equity**: this project increases the participation of small and disadvantaged communities in the IRWM process, thus empowering this DAC while simultaneously ensuring water supply reliability to address safe drinking water needs of DACs

Table 5.11 a – Annual Project Physical Benefits			
Project Name: _Lewiston Mutual Water Company Lewiston Valley Drinking Water Intertie Pipeline _			
Type of Benefit Claimed: __Water supply saved - Primary			
Units of the Benefit Claimed : __AFY			
Anticipated Useful Life of Project (years)__20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	1.33	1.33
2018	0	1.33	1.33
2019	0	1.33	1.33
Through 2036	0	1.33	1.33
Comments: This amount of water will remain instream in the Trinity River to support environmental and other beneficial uses of water. Project implementation occurs in 2016; benefits will begin to accrue in 2017.			

Table 5.11 b – Annual Project Physical Benefits			
Project Name: _Lewiston Mutual Water Company Lewiston Valley Drinking Water Intertie Pipeline _			
Type of Benefit Claimed: _Species protection - Secondary			
Units of the Benefit Claimed : _Number of species_			
Anticipated Useful Life of Project (years)___20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0	1	1
2018	0	1	1
2019	0	1	1
Through 2036	0	1	1
Comments: Coho salmon will benefit from increased instream flows. Project implementation occurs in 2016; benefits will begin to accrue in 2017.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Delivery of safe drinking water to the communities is the primary goal of all water companies. Lewiston has two small drinking water systems located side-by-side. The original surface water treatment plants were built in 1957 to use water from the Trinity River. These surface water treatment plants are old and sub-standard and create real public health risks. The Lewiston Park Mutual Water Company (LPMWC) can deliver quality drinking water when not using river water but the demands are greater than the capacity of current well production during the summer months. Because the surface water treatment plant is so old, a Boil Water Notice is required to be issued whenever river water is pumped into the system. Water rates have been raised recently, but this has created a financial burden for many families in this DAC. The LPMWC does not have the financial resources to make the costly upgrades necessary to comply with current standards for surface water treatment.

The LPMWC has functioned under the threat of a Cease and Desist Order for a number of years due to the age and dilapidated condition of the surface water treatment plant. The plant has a number of violations going back many years (LPMWC multiple dates, *Historic Reports & Letters*). During severe drought conditions, when the wells are not producing, the river water treatment plant must be operating to supply minimal tap water to the customers. During these times, the plant operates under a Boil Water Notice (LPMWC 2014, *Consumer Confidence Reports;* LPMWC 2014, *Boil Water Notice)*. If these conditions continue, a Cease and Desist order could be issued. If this project were implemented, LPMWC could conceivably buy or borrow treated surface water from LCSD to get through a severe drought season. Water would also be available to fight fires or for other unforeseen emergencies.

The LCSD water system has had the same issues in the past. However, when their new system upgrades are complete, they will have a new surface water treatment plant which will go online during the summer of 2015 complete with a new 318,000 gallon storage tank.

The LPMWC submitted a Planning Application for funding under the Tier 2 Safe Drinking Water State Revolving Fund (SDW SRF). The purpose of the Tier 2 SDW SRF Planning Grant is to provide bid-ready construction documents for a project that will provide safe and reliable drinking water for the community of the Lewiston Park subdivision that is separate from the LCSD. This SDW SRF planning project will evaluate if they can decrease their dry-season demands and possibly increase groundwater production to reduce and/or eliminate their reliance on surface water. When the Planning Grant feasibility study is completed, the LPMWC will be looking for funding to complete the construction project. Such a project is several years down the road and dependent on funding; the proposed project will provide immediate relief to Lewiston Park residents and guarantee their Human Right to Water.

This project will address an immediate need in a timely manner: following the completion of upgrades and construction projects for the LCSD Water system, it will be feasible to install an intertie pipeline between the water storage tanks of the two drinking water systems. Lewiston Park Mutual and Lewiston CSD would be able to support one another in times of water shortage and emergency. Both are small systems, but together they would have increased source water supply and treated water storage to

prevent water outages and fight fires. This will allow water to be shared between the two systems for emergency needs, such as fighting structure and vegetation fires by allowing localized fire hydrants to be charged, and provide safe drinking water in times of severe drought conditions or other natural disasters.

Additionally, the project will enhance instream flow and habitat for coho, which are currently limited in the Upper Trinity watershed. NOAA NMFS states that coho were once well distributed throughout the Upper Trinity River sub-basin (NOAA NMFS 2014) and increasing instream flow has been identified as a high priority action.

Estimates of Without-Project Conditions

There are no other projects that have been identified that are feasible, affordable, and can provide the same immediate benefits to both the human and aquatic residents of the watershed. If this project is not implemented, the community of Lewiston Park will continue to endure Boil Water Notices half of each year and be subjected to the health risks associated with such water being delivered through the tap. The community will continue to be at risk from wildfires and drought conditions and will lack resiliency to meet challenges anticipated with climate change. Instream habitat for coho will continue to be impaired and the population at risk.

Methods Used to Estimate Physical Benefits

Benefits were estimated using LPMWC records with technical assistance from the State Water Resources Control Board (Bunte, Drinking Water Field Operations Branch, SWRCB, *Letter of Support regarding North Coast Resource Partnership 2015 Priority Projects, Proposition 84, Lewiston Park Mutual Water Company, Intertie Pipeline Project*). Additionally, the North Coast Resource Partnership *Demonstration Project for Lewiston Park Mutual Water Company Alternatives Analysis for Improved Drinking Water Quality* (2014) provided information for benefits and project analysis.

New Facilities, Policies, and Actions

The LCSD will have a new 317,000 gallon storage tank during the summer of 2015 while the LPMWC has an old 150,000 gallon redwood storage tank with a new liner purchased in 2012. The proposed intertie pipeline would connect both systems for added clean water storage to be used for emergencies or in severe drought conditions.

Additionally, the installation of an intertie pipeline joining two drinking water systems will require a Memorandum of Understanding signed by both parties. It is also likely there will be permits required from the Trinity County Planning Department and from State regulating authorities; these will be obtained in a timely manner to facilitate project implementation.

Potential Adverse Physical Effects

As with any construction project in the area, the potential for spills and sedimentation exists, however, all work will be completed according to accepted professional standards and using industry BMPs to avoid or minimize impacts. Any adverse physical effects will be immediately remediated using the best available technology.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Efficient groundwater basin management
3. Establish system interties

The LPMWC is a very small water company with limited resources and technical capacity. The challenges have been many; educating the customers has been time consuming and has caused resentment by some who have been accustomed to paying very little for what they perceived was "unlimited " water. The perception was that LOMWC could withdraw as much water as we needed from the Trinity River. This attitude began to change during the drought as declining well production required the use of river water to meet demand. Most of the customers now realize the severity of the current drought and that LPMWC will not tolerate water waste. LPMWC is currently in Stage 2 of the Drought Contingency Plan (LPMWC 2015) and may soon move to Stage 3, which limits outdoor irrigation, filling pools, requires leak repairs, and enforces these conditions with fines. Water meters will be installed on all connections by the end of 2015.

The purpose of the SDW SRF Planning Grant referred to above is to determine options for construction of upgrades to the drinking water system. When funding for that project is obtained and construction is completed, we will be in a much better position to provide adequate and safe drinking water during water shortages.

DIRECT WATER RELATED BENEFIT TO A DAC

The population served is a mixture of elderly and retired people living on fixed incomes, and young families with children, all of whom will receive the benefits described above. Some of the homes have been in the same family since they were built in 1957 and generations have grown up in them. For many retired people, their home is their main investment. Some older homes have been completely renovated while others are in a state of disrepair. A number of homes have gone into foreclosure in the past two years and remain unoccupied. Some homes are rental investments rented to young families with children. A survey of household incomes within the LPMWC service area was recently completed by the Rural Community Assistance Corporation (RCAC). The results of this survey (MHI=$24,000) qualifies the Lewiston Park Subdivision and service area for the LPMWC, as a severely disadvantaged community as defined by the State Water Resources Control Board and the United States Department of Agriculture

(RCAC 2015, *Letter re: Lewiston Park Mutual Water Company Median Household Income*). All benefits listed above will directly benefit this SDAC. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.11 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Physical connection between LPMWC and LCSD to enable water sharing	Intertie system between new LCSD water tank and existing LPMWC tank	Photodocumentation and certified engineer's statement of completion	Prior to and after project construction
Increased drinking water quality assurance	500 Residents Lewiston Park Subdivision (SDAC)	Adequate treatment of surface water for drinking water. No Boil Water Advisories issued.	Daily after construc-tion
Drinking water security	Non- use of LPMWC surface WTP during drought.	Adequate supply of quality potable water during drought and emergencies	Monthly after construc-tion
Coordinated supply of potable water	MOU signed by LCSD and LPMWC	Agreement of the two water companies under what circumstances to use the intertie pipeline.	Weekly after construc-tion grant awarded.
Public safety enhanced supply of water to fight fires.	1900 residents Lewiston and surronding wildlife habitat.	Available supply of water to fire hydrants in the community to fight fires.	Monthly checks of fire hydrants.
Reduced risk to health from bacterial contamination of drinking water	Non-use of LPMWC surface WTP during drought.	Chlorine contact and residuals and turbidities of drinking water in distribution monitored daily. Testing for bacterial contamination monthly as required.	Daily after constuction

The intertie pipeline is not expected to be used on a regular basis. It will be available for use to ensure water security in emergency situations. Agreement as to use in specific situations will be adopted by

both parties in a Memorandum of Understanding. Project implementation will be monitored using photo-documentation and certified engineer completion statements. Other project benefits will be monitored on a daily or monthly basis as necessary to maintain water quality and supply for the community.

COST EFFECTIVE ANALYSIS

Table 7.11 – Cost Effective Analysis **Project name: Lewiston Park CSD Lewiston Valley Drinking Water Intertie Pipeline**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *The following alternatives were evaluated in the "Demonstration Project for Lewiston Park Mutual Water Company Alternatives Analysis for Improved Drinking Water Quality, Technical Assistance for Disadvantaged Water and Wastewater Providers, North Coast Resources Partnership, California Department of Water Resources (Water Works Engineers, 2014)." 1) upgrading the existing treatment plant; 2) building a new treatment plant; or 3) merging with the neighboring CSD. Alternative 3) was the least expensive, and most feasible. The proposed intertie in this NC project is a component of Alternative 3). The proposed intertie pipeline will be benefit both communities by providing a source of emergency water that is derived from a different source. Estimated costs are provided in the budget section.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *N/A.*
Comments: *For greater detail about alternatives, please see: Water Works Engineers. 2014. Demonstration Project for the Lewiston Park Mutual Water Company: Alternatives Analysis for Improved Drinking Water Quality. North Coast Resource Partnership, California Department of Water Resources Technical Assistance for Disadvantaged Water and Wastewater Providers.* *http://www.northcoastresourcepartnership.org/files/managed/Document/8750/NCRP_DemoProject_Lewiston_Park_MWC%20Alt%20Anylysis%20(2014-09-26).pdf*	

MATTOLE RESTORATION COUNCIL, LOWER MATTOLE RIVER AND ESTUARY ENHANCEMENT AND DROUGHT RESILIENCY PROJECT

PROJECT DESCRIPTION

Brief: This project will increase community drought resilience by restoring ecosystem processes to the Lower Mattole River and Estuary to benefit fish and wildlife.

Expanded: The proposed Project is part of a larger 5-year restoration effort that is being undertaken by the Mattole Salmon Group, the Mattole Restoration Council, the California Department of Fish and Wildlife, The State Coastal Conservancy, the California Department of Water Resources, The Nature Conservancy, the U.S. Bureau of Land Management, NOAA-NMFS, the National Fish and Wildlife Foundation, the U.S. Fish and Wildlife Service, and private landowners. Historic logging and 100 year flood events have impacted habitat conditions throughout the lower Mattole River. Currently, summer habitat conditions in the Lower River and estuary are generally poor for juvenile Pacific salmon. The area is broad, shallow, and lacks complex habitats for fish to hide from predators. Many of the riparian floodplains are void of long-lived riparian tree species that provide shade, floodplain stability, and future wood recruitment. Summer water temperatures regularly exceed levels thought to be lethal to Pacific salmon.

The goal of this large, coordinated effort is to restore ecosystem processes to the estuary and Lower River, while enhancing habitat for fish and wildlife species and addressing drought issues. This will be accomplished through the placement of large wood at key sites to facilitate stable island formation, multiple channel formation (anabranching), and scour (where appropriate), installing trenched willow treatments to eroding terrace margins to protect existing riparian woodlands, and extensive plantings of cottonwood, willow, and other native species on established, unvegetated islands and along edges of stream channels to increase riparian floodplain forest. These tasks will increase the estuary's drought resilience through improved habitat conditions in the system's primary salmonid use area during droughts.

There are three phases of the project proposed herein: (1) pre-project planning, design, permitting, and monitoring, (2) implementation, and (3) post-implementation assessment and monitoring. This proposal seeks funds for implementation, phase (2).

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation include, but are not limited to:

- **Primary: Habitat restored and improved**: 40 acres of riparian forest will be planted, and 15 pools will be created**.**
- **Secondary: Species protection**: Wood placement will provide new critical habitat in the form of pools and cover for juvenile salmonids. This restoration method is a well-documented practice designed to increase and enhance habitat for juvenile coho (*Oncorhynchus kisutch*), Chinook salmon (*Oncorhynchus tshawytscha*), and steelhead (*Oncorhynchus mykiss*). When placed

directly in the channel, whole trees provide optimal cover habitat for juvenile fish, as branches, logs and roots, offer increased shade in the summer, winter and spring-time flow refuge, feeding opportunities, and refuge from predators.

- **Climate change mitigation**: GHG emissions will be reduced by this project by reducing fire risk on native prairies caused by encroaching trees that will be removed; through native bunch grass planting at regraded disturbed sites; and placement of the removed whole trees in river locations. Wet wood decomposes slower, storing carbon longer. Riparian planting and protection will increase soil moisture content over longer times storing more GHG and carbon; the establishment of 17,000 riparian trees is expected to provide an estimated economic benefit of $9,000 per year. Slough excavation also enhances wetlands, which are a carbon sink (NOAA NMFS, *Carbon Sequestration 101*, http://www.habitat.noaa.gov/coastalcarbonsequestration.html).
- **Climate change adaptation**: this project provides ecosystem and community resiliency for the Mattole River estuary, a vital habitat area for several listed species. By improving habitat quality, the system will be able to provide vital ecosystem services such as water quality improvement (filtration), flood damage reduction, and carbon sequestration through changing climatic conditions, bolstering both the wildlife and the human communities which depend upon it.

Table 5.12 a – Annual Project Physical Benefits

Project Name: Mattole Restoration Council Lower Mattole River and Estuary Enhancement and Drought Resiliency Project

Type of Benefit Claimed: Habitat restored and improved - Primary

Units of the Benefit Claimed : Acres

Anticipated Useful Life of Project (years) 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2019	0	0	0
2020	0	50	50
2021	0	50	50
Through 2069	0	50	50

Comments: Forty acres of riparian forest will be planted and in a separate location 10 acres of invasive plants will be removed. Project implementation will be complete in October 2019.

Table 5.12 b – Annual Project Physical Benefits			
Project Name: _Mattole Restoration Council_Lower Mattole River and Estuary Enhancement and Drought Resiliency Project_			
Type of Benefit Claimed: __Species protection - Secondary_____			
Units of the Benefit Claimed : __Number of species_____			
Anticipated Useful Life of Project (years)__50 years_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2019	0	0	0
2020	0	3	3
2021	0	3	3
Through 2069	0	3	3
Comments: Three listed salmonid species - Chinook, coho, and steelhead - will be protected through project implementation, which creates and improves important Lower River and estuarine habitat vital to summer survival, particularly during drought conditions.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The need for this project is based in historic issues that have continued to the present day. 'In 1965, the year following the second major flood event in ten years, the Department of Water Resources speculated that there had been a significant reduction in the size of the Mattole Basin anadromous fish runs. They felt this was a result of large increases in siltation and debris jams following land disturbance from intensive logging that started in 1950, coupled with two major flood events. The fisheries began steady declines in the 1960s. By the late 1970s, fish populations had collapsed to levels that alerted locals to their depressed conditions (North Coast Watershed Assessment Program (NCWAP) 2003).'

The proposed project aims to counter current poor habitat conditions by following recommendations set forth in the *Mattole Watershed Assessment Report* (NCWAP 2003) and the Bureau of Land Management (BLM) *Mattole Estuary Restoration Plan 2012-2017* (BLM, USFWS, NOAA, MRRP, CDFW 2012) to increase pool depth, cold water available to juvenile salmon, cover, and habitat complexity for the restoration of the estuary/lagoon. The project will result in a significant increase of instream wood, riparian cover, and floodplain structure and function throughout the estuary and lower mainstem, not only immediately creating habitat for juvenile coho salmon, but also aiding in the restoration of estuarine processes over the long term.

Restoring the natural estuarine processes and increasing channel complexity will provide a greater buffer for salmonid response to potentially negative effects of climate change and irregular weather

patterns, such as drought and flooding. Restoring and enhancing Mattole wetlands will reduce GHG emissions and store more carbon.

Restoration of fish habitat in the Mattole River estuary requires a comprehensive multi- year approach. The approach presented here is driven by a set of biological objectives, which, in turn, are controlled by various physical processes at work in the lower Mattole River.

Estimates of Without-Project Conditions

Without this project, the estuary would have decreased salmonid survival during low-flow periods, and less winter refuge habitat. The estuary would have less complexity and higher water temperatures as a result of lower riparian cover and shallow conditions. The Lower River and estuarine ecosystem and surrounding human community would be vulnerable to effects of climate change involving flooding, severe storms, and extended drought conditions.

Methods Used to Estimate Physical Benefits

This project is based on a robust technical and scientific understanding of water quality stressors and water supply limitations within the Mattole River watershed, and proposes implementation and monitoring efforts that are consistent with regionally and nationally accepted protocols for watershed and fisheries restoration. The Mattole has been the subject of numerous watershed assessments and prioritization exercises. The *North Coast Basin Plan* designates TMDL implementation within North Coast watersheds as a central non-point source pollution control activity (*Water Quality Control Plan for the North Coast Region* North Coast Regional Water Quality Control Board 2007). More recently, a multi-agency watershed assessment of the Mattole River was completed (NCWAP 2003). The resulting Mattole River Watershed Assessment Report presented an analysis of salmonid limiting factors. The Report makes a variety of basin, sub-basin, tributary and reach level recommendations which are implemented in this project (NCWAP 2003, pages 9 – 11, 187).

The Project involves the placement of large wood structures in the estuary and Lower River. This restoration method is a well-documented practice designed to increase and enhance habitat for juvenile coho, Chinook salmon, and steelhead (Opperman et al. 2006, *Maintaining Wood in Streams: A Vital Action for Fish Conservation*). In fact, on January 1, 2013, the *Coho Salmon Habitat Leading to Preservation Act* went into effect (CDFW 2015, Coho HELP Act https://www.dfg.ca.gov/fish/Resources/Coho/HELP/#footer). This Act allows entities to request approval for a "coho salmon habitat enhancement project" that is exempt from permitting and licensing if it accomplishes one or more of the following: road crossing removal, streambank restoration using bioengineering, and "**wood placement that benefits naturally reproducing fish stocks by creating or enhancing fish habitat and/or increasing stream complexity** (CDFW 2015)." When placed directly in the channel, whole trees provide optimal cover habitat for juvenile fish, as branches, logs and roots, offer increased shade in the summer, winter and spring-time flow refuge, feeding opportunities, and refuge from predators. When trees are placed so as to encourage channel complexity and anabranching, there is a resulting increase in the amount of wetted channel in contact with riparian vegetation, thus increasing the availability roughness elements and food for juvenile salmonids from these sources.

Additionally, from a management perspective, larger wood – especially whole trees with attached rootwads and limbs– tends to be more stable and longer lasting than logs when placed in the river, thus making the overall outcome more cost-effective and sustainable.

Identification of all new facilities, policies, and actions required to obtain the physical benefits.

This project addresses these issues through the implementation of 2 major components:

Component 1. Riparian and Floodplain Restoration -Planting of 17,000 containerized riparian plants, installation of 6000 ft. of livestock exclusion fencing, installation of 11,000 ft. of trenched large willow at terrace margins unvegetated islands, large wood placement sites, and slough restoration sites and removal of invasive plants on 10 acres

Component 2. In-stream Habitat Enhancement -Placement of 400 whole trees in various estuary location, trees will be removed from grassland encroachment areas and planted with native grasses to restore 4 acres of coastal prairie

Description of any potential adverse physical effects and what is being done to mitigate those impacts.

The tree removal sites are part of existing grasslands management plans and some ground disturbance will occur. All disturbed ground will be graded, seeded with native bunch grasses, and mulched to prevent erosion. All other project tasks are fully integrated and mitigated to minimize any negative impacts.

Drought Preparedness

This project implements the following Statewide Drought Preparedness Priority:

1. Efficient groundwater basin management

By restoring hydrologic function to the Lower Mattole River and estuary, this project is contributing to groundwater recharge, a vitally important function in the face of expected hotter, drier conditions and longer drought cycles expected in the face of climate change. Groundwater recharge is very important in this watershed, in which most rural residents rely on private groundwater wells.

This project also boosts Mattole River ecosystem resiliency to drought through habitat enhancement. Reduced river flows and lack of rain at certain times of the year have led to restricted salmonid access to headwaters spawning grounds. The estuary becomes critically important to the survival of these listed salmonid species under these drought conditions.

In the winter of 2013-2014 almost all salmonid spawning occurred in the lower river, putting increased pressure on the estuary carrying capacity. This 5 Year Estuary Restoration Plan increases the capacity of the estuary to support salmonids at several stages of their life histories.

DIRECT WATER RELATED BENEFIT TO A DAC

Residents and landowners of the Mattole River watershed will be the primary population served by this project. The median household income for the area is less than 64% of the statewide average; this community is state-recognized as disadvantaged. The number of residents and landowners within the watershed is approximately 2500. In addition to these private residents, the Bureau of Land Management also owns land within the Mattole watershed and will benefit by the project's water quality and watershed enhancement goals. Please see Attachment 7 for greater detail on DAC status.

This project benefits the local disadvantaged community by creating jobs in fisheries restoration in the hopes of restoring fish populations so that one day the community can once again benefit from catching fish for their food supply. This project also improves the ecological health of the watershed, which indirectly benefits the health of the people in the community.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.12 – Project Performance Monitoring Table

Proposed Physical Benefits	Targets	Measurement Tools and Protocols	Monitoring Frequency
Riparian and floodplain restoration and instream enhancement	) containerized riparian plants, 6000 ft. of fencing, 11,000 ft. of trenched large willow, large wood placement, slough restoration sites, removal of invasive plants on 10 acres ees installed instream, 4 acres coastal prairie	Photodocumentation and certified professional's statement of completion	d post- project implementation
Large Woody Debris	400 whole trees	GIS	Annual
Riparian Cover	11,000ft	GIS	Annual
Terrace Margin Stabilization	1900 ft	GIS	Annual
Native Plant Cover	17,000 plants	GIS	Annual
Grassland Restoration	4 acres	GIS	Annual
Invasive Species Removal	10 acres	GIS	Annual

Containerized planting: Plants will be monitored for survival annually throughout the project and will be flagged with a color coded pin flag. Pre- and post-project photos will be taken.

Trenched willow baffle monitoring: Sites will be monitored for survival annually throughout the project. Site area and length will be used to determine percent of baffle remaining and increase in area of vegetative growth.

Invasive Plant Removal Sites: Monitored annually throughout the project. Pre-treatment and post-treatment acreages will estimated. Pre and post project photos will be taken for all sites.

Fish use and water quality monitoring of the sloughs and nearby river locations will be completed; all placed whole trees will be Pit tagged, GPS located, and mapped into an annual river survey in the Estuary area; and photo documentation will be conducted before, during, and after implementation.

COST EFFECTIVE ANALYSIS

Table 7.12 – Cost Effective Analysis **Project name: Mattole Restoration Council Lower Mattole River and Estuary Enhancement and Drought Resiliency Project**	
Question 1	Types of benefits provided as shown in Table 5: Species protection (Primary) and Habitat improved and restored (Secondary)
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *In 10 years we installed 10 ELJ Wood structures (10 trees each) in the Mattole Estuary at $50,000 per structure. That is $500,000 for 100 trees placed with metal. We placed 200 whole trees for $500,000 without metal using the helicopter. That is more cost effective and natural with over twice the benefit. In twelve hours of helicopter work we completed twice what it took us 10 years to do by truck. This project also integrates fuels management and fire protection, with native prairie restoration, large wood placement for fish habitat enhancement, and slough excavations with riparian forest restoration and protection. Deep trenched willow baffles dug into the summer water table are more cost effective and have higher rates of survival then continuous irrigation practices. This information is documented in our final report to TNC on our Phase 1 Estuary Restoration Project*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. N/A
Comments:	

MENDOCINO COUNTY RESOURCE CONSERVATION DISTRICT, IMPLEMENTING ON-FARM WATER CONSERVATION PROJECTS IN THE NAVARRO TO ADDRESS CRITICAL LOW FLOWS

PROJECT DESCRIPTION

Brief: This project implements on-farm water conservation projects and conducts educational activities to benefit listed salmonids and provide critical drought relief for local agriculture.

Expanded: To provide relief from critically low summer base flows and water shortages in the Navarro River, MCRCD, working with Natural Resources Conservation Service (NRCS) and The Nature Conservancy (TNC), proposes to implement (3) on-farm projects to achieve measurable water savings through improved irrigation and water storage BMPs. These projects Implement "Immediate Restoration Actions" identified by NOAA NMFS (*NOAA NMFS 2012, Central California Coast Coho Salmon Recovery Plan, Navarro River,* p. 432) and will result in greater instream flows to benefit listed salmonid species as well as improving community capacity and resiliency to future conditions expected from climate change. Community conflicts have accelerated in the Navarro watershed over the perceived misuse of water by the Agricultural Community (Ag) during the record 4-year drought period. MCRCD will work with Ag partners to implement water conservation/water-use efficiency projects to demonstrate water saving measures, including water storage, specifically in orchards and small farms. Projects include:

1. Implementing three water conservation/water use-efficiency projects: including installing (1) 40,000 gallon rainwater storage tank, upgrading one failing/faulty irrigation system, and retrofitting sprinkler heads on 13 acres of organic apple orchard, retrofitting one 61.1 acre commercial apple orchard to under-tree microsprayers, collectively resulting in 31.1 acre feet of annual water savings.

2. Conduct a series of (3) workshops and tours, targeting (90) landowners, that highlight BMPs, techniques and technologies demonstrating measurable water savings to other Ag producers and landowners in the watershed.

This technical approach to water conservation will be conducted in collaboration with NRCS to implement BMPs and emerging technologies, such as upgrading failing or faulty irrigations systems and installing additional storage tanks. These actions are recommended by the University of California Cooperative Extension (McGourty et al. 2013, *Meeting Agricultural Water Needs in the Navarro River Watershed, Mendocino County, California* p. 4, 33). Projects will be developed in partnership with NRCS through its Environmental Quality Incentives Program (EQIP). TNC has installed 18 additional gages in the Navarro River since June 2013. Initial data analysis identified the high priority sites with regard to location and/or high level/need for implementing water-saving projects to benefit imperiled salmonids. Participating landowners will be required to monitor the water savings that each practice brings. Photo documentation will be conducted and water savings will be calculated and measured for each feature or practice implemented. BMPs will be demonstrated to other landowners and community members to extend the project's benefits beyond this funding cycle.

PROJECT PHYSICAL BENEFITS

Physical benefits are expected to include, but are not limited to:

- **Primary: Water supply saved** in the amount of 31.1 AFY for instream flow for Environmental Beneficial Uses. The estimated monetary benefit is approximately $80 per AF, for an estimated annual benefit of $2,488 (West Water Research. 2013. *2013 California Spot Market Price Forecast*).
- **Secondary: Species protection**: This project will benefit coho (*Oncorhynchus kisutch*), Chinook (*Oncorhynchus tshawytscha*), and steelhead (*Oncorhynchus mykiss*) by implementing two out of "Immediate Restoration Actions" identified by NOAA NMFS for coho recovery: developing BMP's (such as off-channel storage) for landowners conducting water diversions and eliminating the depletion of summer flows (NOAA NMFS 2012).
- **Habitat Improvement** of instream habitat due to increased summer flows, which will reduce instream temperatures and increase Dissolved Oxygen. Increased summer base flows will enhance salmonid habitat by helping to provide connectivity, decreased stream temperatures, and improved habitat. In the past few summers, fish were stranded, flows were frequently sub-surface, and water temperatures were too high in many reaches to support juvenile salmonids, particularly endangered California Central Coast coho salmon (NOAA NMFS 2012, p. 436 - 440).
- **Increased quantity and quality of recreation or public access**: the project proponent estimates an increase in swimming days by 20 each year due to project implementation. At an estimated monetary value of $33 per day, this benefit provides an estimated economic benefit of $660 per year (Loomis 2005, *Updated Outdoor Recreation Use Values on National Forests and Other Public Lands*, PNW-GTR-658).
- **Conflict reduction**: "The availability for all rural and urban water users in Mendocino County, and the Navarro River Watershed specifically, is an increasingly contentious and acute issue (McGouty et al. 2013 p. 6)" and this project will reduce conflict by enabling several Ag producers to reduce withdrawals from the Navarro by 31.1 AFY and by educating others about BMPs that will save even more instream water and demonstrate to the larger community Ag commitment to sustainable water use.
- **Climate change mitigation:** More efficient irrigation and pumping systems will result in greater energy efficiency in pump timing and use which will reduce GHG emissions and lower pumping costs.
- **Climate change adaptation**: this project will increase local resiliency by providing the community with the tools and knowledge to conserve water in the face of a hotter drier climate with longer and more extreme drought cycles. MCRCD and its conservation partners are adaptively managing for climate resiliency by upgrading faulty irrigation delivery systems, switching from overhead sprayers to micro-sprinklers, and developing a water storage/catchment system.

Table 5.13 a – Annual Project Physical Benefits			
Project Name: __Mendocino County RCD Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows_			
Type of Benefit Claimed: _Water supply saved - Primary_			
Units of the Benefit Claimed : __AFY_			
Anticipated Useful Life of Project (years)__40 years_			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	31.1	31.1
2020	0	31.1	31.1
2021	0	31.1	31.1
Through 2058	0	31.1	31.1
Comments: Project implementation occurs in 2018; benefits begin to accrue the following year.			

Table 5.13 b – Annual Project Physical Benefits			
Project Name: __Mendocino County RCD Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows _			
Type of Benefit Claimed: __Species protection - Secondary_			
Units of the Benefit Claimed : __Number of species_			
Anticipated Useful Life of Project (years)__40 years_			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	3	3
2020	0	3	3
2021	0	3	3
Through 2058	0	3	3
Comments: Project implementation occurs in 2018; benefits begin to accrue the following year. Species benefitting from project implementation are: coho, Chinook, and steelhead.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The Navarro River watershed covers approximately 315 square miles and is the largest coastal watershed in Mendocino County. The watershed is forested in the coastal belt and inland mountains; approximately 50,000 acres are owned and managed by Mendocino Redwood Company. The North Fork Navarro and portions of the mainstem, Indian Creek, and lower Rancheria Creek support endangered California Central Coast coho salmon. Steelhead trout are also a listed salmonid species and occupy all five sub basins in the watershed. Land Use in the watershed includes forestland (70%), rangeland (25%), and agriculture (5%) with a small percentage devoted to rural residential development (Entrix 1998 *Navarro Watershed Restoration Plan*). Currently, the working landscapes include: commercial and non-industrial timber harvesting, viticulture, orchards, and grazing. As of 2010, the population in the watershed was approximately 3,000, with Boonville being the largest community hub; the rural community straddles Highway 128 between Yorkville and the Pacific Ocean, and is commonly referred to as Anderson Valley.

California's Mediterranean climate is characterized by extreme variability and seasonality in precipitation and stream flow. For example, mean daily stream discharge in the Navarro River can vary annually from below 20 cfs to above 45,100 cfs (Figure 4). Flood events such as those that occurred in 1955, 1964, 1974, and 2005 are complemented by low flow years such as 1976, 1977, 1987, 1990, and 1994. The variability in flow is further confirmed by the juxtaposition of high and low flow years like 1955 and 1956 or 1986 and 1987 (McGourty et al. 2013, p.17-19). The Navarro River is 303(d) listed for impairments associated with excessive sediment and high temperatures. The North Coast Water Quality Control Board (NCRWQCB) recommends the following: 1) projects that conserve water, resulting in reduced diversion of cold water from springs, streams, and aquifers in connection with surface waters; and 2) water storage projects that result in reduced diversion of water during the drier months (NCRWQCB 2013, *Staff Report Supporting the Policy for the Implementation of the Water Quality Objectives for Temperature and Action Plan to Address Temperature Impairment in the Mattole River Watershed, Action Plan to Address Temperature Impairment in the Navarro River Watershed, and Action Plan to Address Temperature Impairment in the Eel RiverWatershed* p. 48). "Historically, agricultural water use in the Navarro River watershed occurs during the early spring frost season (March-May), as well as the late summer dry season (July-Oct). It is important that any management strategies account for this coincidence of supply and demand in order to effectively meet biological and agricultural water demand (McGourty et al. 2013, p. 17)."

This Project focuses on three urgent water conservation issues related to drought conditions: 1) Critical low summer base flows; 2) On-farm water inefficiencies; and 3) Community conflicts over Ag water use and alternative drought strategies. Mendocino County Resource Conservation District (MCRCD), together with the USDA Natural Resources Conservation Service (NRCS), and The Nature Conservancy (TNC) have selected areas within the watershed where opportunities to address water-efficiencies and water conservation measures have been prioritized. The family farms participating in the Project will demonstrate water conservation and water–use efficiencies that will provide measurable water savings.

In UCCE's recent water study of the Navarro River, orchards represent the highest water use, and vineyards are the next highest (McGourty et al. 2013).

Of critical relevance to this study is the seasonality of instream flows and agricultural water demand. The bulk of high stream flows occur during the late fall, winter, and early spring months. Historically, agricultural water use in the Navarro River watershed occurs during the early spring frost season (March-May), as well as the late summer dry season (July-Oct). It is important that any management strategies account for this coincidence of supply and demand in order to effectively meet biological and agricultural water demand (McGourty et al. 2013).

On-Farm Water Use Efficiency/Water Conservation Projects:

The selected on-farm water use/conservation projects, include: 1) Gowan's Orchards—MCRCD worked with the landowner and encouraged their application for NRCS' Drought Initiative, along with support from TNC. MCRCD will upgrade most of the inefficient irrigation pipes and install under tree micro-sprinklers for an estimated annual water savings of 24.9 acre ft./year; 2)The Apple Farm—will replace faulty mainline irrigation piping and waterpump, and retrofit sprinkler heads with basic water management for an estimated water savings of 6.2 acre/ft. annually; and 3) Blue Meadow Farm--will install (1) 40,000 gallon rainwater catchment tank to off-set time of use and limit summer diversion on Mill Creek, for an estimated water savings of 40,000 gallons annually/30-year lifespan of the storage tank.

The Navarro River during this extended 4-year drought has exhibited critical low summer flows, particularly from June-October when flows have dropped to 0.5 cubic feet per second (cfs) for more than 30 days at a time. This results in large sections of the river going dry with only residual pools remaining. Low flows and the corresponding elevated water temperatures increase stress levels in endangered and threatened salmonids during a crucial stage in their lifecycle (NOAA NMFS 2012). Locally, these river conditions coincide with the time of year when there is also the greatest demand for on-farm water. Whereas corporate-owned entities are frequently ahead of the curve because they can afford capital outlays for infrastructure improvements and advanced technologies, many small family farms need financial and technical assistance to implement water-saving strategies.

Estimates of Without-Project Conditions

Drought conditions may continue into the foreseeable future; without project implementation, unfavorable flow and temperature conditions will exacerbate an already critical situation in the Navarro. Longitudinal data indicate that annual summer base flows have continued to decline over the past 30 to 40 years in the Navarro. Public perception in the watershed will continue to target Ag landowners as responsible for the decline in flows and community relations will continue to be contentious.

Additionally, if these projects aren't implemented any further infrastructure planning for off stream storage will still require water use efficiency measures as the first logical step .

Methods Used to Estimate Physical Benefits.

In May 2013, UCCE completed a study entitled *Meeting Agricultural Water Needs in the Navarro River Watershed* citing seasonality of instream flows and agricultural water demand as critical to water management strategies. Surveys indicate that growers irrigated an average of 60 hours annually with the water demand coinciding with the lowest surface flow time of the year (McGourty et al. 2013 p. 33). In the past three years, the Navarro River reached a record low of 0.5 cubic feet per second (cfs) during the late summer, July-Sept season. To help address critical low-flows in the Navarro, MCRCD and its conservation partners will work together to reduce summer diversions and support an increase in summer base flows. Water savings for the treatments were calculated with the NRCS Irrigation Water Savings Tool (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/tools/#Irrigation0).

New Facilities, Policies, and Actions

This project will install one 40,000 gallon rainwater storage tank and replace leaking mainline and retrofit sprinkler heads, replace hand-move sprinklers with microsprayers, and overhead sprinklers with under-tree microsprayers on 74.1 acres.

The project will also conduct a series of three workshops and tours, targeting 90 landowners, to highlight BMPs and techniques and technologies demonstrating measurable water savings to other Ag producers and landowners in the watershed.

Potential Adverse Physical Effects

MCRCD will work closely with ag landowners and conservation partners to implement projects that do not result in any adverse physical impacts, however, there is the potential for sedimentation and other pollutant spills during project activities. To avoid physical impacts, BMPs will be used and immediate action will be taken to mitigate such should they occur.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Achieve long-term reduction of water use

The Navarro River exhibits critical low summer flows, particularly from June-October when the flow has dropped to 0.5 cubic feet per second (cfs) for weeks at a time. Over the past four summers, large sections of the river have gone dry with only residual pools remaining. These low flows and corresponding elevated water temperatures occur during a crucial stage in the lifecycle of endangered and threatened salmonids, increasing stress that can lead to mortality and potential extirpation of coho salmon. Locally, these river conditions coincide with the time of year when there is also the greatest need for on-farm water. Whereas corporate-owned entities are frequently ahead of the curve because

they can afford the capital outlays for infrastructure improvements, many small family farms need assistance to implement water conservation measures.

By implementing on-farm water conservation/water-use efficiency projects in the Navarro watershed on irrigated lands, the project will increase emergency drought preparedness and build climate resiliency. Through additional storage, replacing inefficient irrigation lines, and retrofitting from rainbird sprinklers to microsprayers, this Project will result in water savings of over 31 acre feet of water per year and decrease reliance on a finite source of available water in the late summer. It will also build climate change resiliency by increasing water security, improving base flows, and providing a net benefit for fish and farmers--their families, workers and the community.

These irrigated Ag land partners are very aware of their dependence on limited water resources and understand the critical issue of time-of-use related to the life cycle of fish and do their best to use resources wisely. However, capital improvements are often beyond their immediate reach. Flow meters will be a mandatory component in all of these projects along with soil moisture probes. MCRCD, NRCS, and TNC are confident that the resulting water savings will support all beneficial uses. These upgrades will have at minimum 30-year life span, and potentially longer. Landowner maintenance agreements will ensure new infrastructure will be maintained well beyond the grant period.

DIRECT WATER RELATED BENEFIT TO A DAC

This project will benefit the entire Navarro River Watershed population including the DAC Philo, but focuses on irrigated Ag users where conservation and water-use efficiency projects will have the greatest net benefit towards increasing summer base flows during the critical June-October period. The project will also offer working landscapes additional water security, improve on-farm water use efficiency, and reduce energy costs associated with pumping, storing and conveying water to crops.

The costs associated with infrastructure upgrades can be prohibitive for family farmers. Without Proposition 84 funding, proposed project elements would need to be phased over a multi-year period, or only would only be partially implemented. Proposition 84 funds will accelerate these on-farm water conservation measures, supporting the local farm economy. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.13 – Project Performance Monitoring Plan			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
1. Improve water savings and limit summer diversion on Mill Creek	Install (1) 40,000 gallon rainwater storage tank	Engineered design plans developed in conformation to Mendocino County Building Code, photomonitoring	Pre, during, and post project
2. Improve water-use efficiency on mainstem Navarro on Apple Farm property	Upgrade (1) failing/inefficient irrigation system, and retrofitting sprinkler heads on 13 acres of organic apple orchard,	Using NRCS design plans and protocols and NRCS Basic Water Irrigation Mgmt. practices, including monitoring via flow meters and mandatory reporting, photomonitoring	Pre- and post-project, thereafter a minimum of annually
3. Improve water-use efficiency on mainstem Navarro on Gowan's Apple Orchards	Retrofit 61.1 acres to microsprayers	Using NRCS design plans and protocols and NRCS Basic Water Irrigation Mgmt. practices, including monitoring via flow meters and mandatory reporting, photomonitoring	Pre- and post-project, thereafter a minimum of annually
4. Demonstrate water conservation BMPs to the wider public	Conduct a series of (3) workshops and tours, targeting (90) landowners, to highlight BMPs and demonstrate measurable water savings to other Ag producers and landowners.	Copies of promotional materials, PSAs, and sign-in sheets	Once per workshop/ Final Report

Under the guidance and direction of NRCS and TNC, landowners will be reporting water-use savings, meters will be installed and the participating farms will be working with project staff on basic irrigation water management.

COST EFFECTIVE ANALYSIS

Table 7.13 – Cost Effective Analysis **Project name: Mendocino County RCD_Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Off-stream storage ponds were determined at this time to be too expensive and take too much time for regulatory approval. These water conservation project components still need to be implemented to address inefficiencies in the systems as a first step. Each landowner has considered development of a pond as an alternative to direct diversion or water storage tanks. In 2 of the 3 family farms, the cost to develop and permit a pond project was prohibitive or there was inadequate land to accommodate a pond. Rainwater storage was preferable to a pond for the market garden as the water from a tank better meets the new Food Safety Rules. Ponds were considered but take time to obtain regulatory approval, potentially could be more expensive and require more maintenance, and are not feasible in a short-term emergency situation. Ponds potentially could be considered in the next phase.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Yes, this project is the least cost alternative. In the long-term, in a few of the project sites, a pond could provide necessary storage to alleviate draw on the river. But the permit process is time consuming and the landowner will not receive cost-share unless their storage permit has been approved. These water-use conservation and efficiency projects will be necessary even if long-term storage strategies are implemented in the future.*
Comments:	

MENDOCINO COUNTY RESOURCE CONSERVATION DISTRICT, WATER CONSERVATION TECHNICAL ASSISTANCE TO INLAND MENDOCINO COUNTY TRIBES

PROJECT DESCRIPTION

Brief: This project will provide water audit technical assistance and training to assist Tribal water suppliers meet water conservation goals that benefit salmonids and Tribal communities.

Expanded: This project will provide water audit technical assistance and training to assist Tribal water suppliers in meeting water conservation goals that benefit both drinking water supply and instream flow for salmonids. It will provide leak detection for distribution systems and explore and facilitate the creation of a smartphone app for small suppliers that will ultimately be available to Tribes and small water suppliers throughout California. This project will also partner with the Rural Community Assistance Corporation to extend the reach of the technical assistance beyond Mendocino County.

Tribal water suppliers are underserved utilities that face unique hardships during the drought. Previous MCRCD work with Tribes has indicated that they are vulnerable to water shortages and water supply insecurity and that water conservation assistance, customer outreach and leak detection in distribution lines are important needs. Recently, new technologies have enabled large utilities to help customers reduce water use by 5% within six months; however, due to data compatibility and other issues, this software is not currently available for Tribal and small water suppliers. This project will address these issues.

The major components of the project are:

1. Water Audit Technical Assistance - water audits identify water waste and leakage problems and recommend changes that can dramatically reduce water consumption. Through this project, the MCRCD would provide both free water audits for customers and water audit trainings to enable Tribal staff to conduct additional audits in the future.

2. Leak Detection in Distribution Systems - Leaking distribution pipes are a leading cause of water loss. The MCRCD will contract with a licensed leak detection company to provide this service for Tribes with an identified need.

3. Access to New Technology for Underserved Communities - MCRCD will investigate how to adapt existing software for a Tribal supplier and liaise with a software company or a university to explore options for app development.

This project will result in improved efficiency in water distribution lines and reduced losses due to leaks, resulting in up to 20% reduction in water usage and reduced reliance on surface water and groundwater. It will also improve efficiency in residential water use due to identification and remediation of hidden water wasting fixtures, for water usage savings of 5-25% per household audited. Additionally, training will increase capacity for Tribal water managers and staff to conduct water audits as needed on Tribal properties, providing benefits beyond the scope of this project. Finally, initial

development of a smartphone app for Tribes will provide the potential for substantial long-term water savings (Deatley 2015, *Drought: New apps take much closer look at water use*, Press Enterprise 7/17/15). To ensure relevance to Tribal needs the preliminary development will include a needs assessment to identify components of most value to Tribal water managers and identification of an appropriate software designer.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation include, but are not limited to:

- **Primary: Water supply saved** equal to approximately 100 AFY due to water conservation measures implemented. This benefit will provide an estimated economic value of $80 per AF, providing an estimated annual monetary value of $8,000 per year (West Water Research 2013, *2013 California Spot Market Price Forecast*).
- **Secondary: Species protection**: The Eel, Garcia, and the Russian River watersheds all have endangered salmonids and are listed for temperature TMDLs (http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/). Increased water conservation will reduce dependence on summer flows and will enhance salmonid habitat by providing connectivity and decreased stream temperatures. During the summer of 2014, the Eel River went dry with exposed substrate near Loleta and other locations (Higgins 2015, *Eel River Recovery Project Fall Chinook Salmon 2014 – 2015 Citizen Monitoring* available: http://www.eelriverrecovery.org/doc/ERRP_FCH_2014_2015_Final_Rpt_05_26_15_EDITED.pdf).
- **Fishery benefits**: This project will yield an estimated increased flow in the Eel and Russian watersheds of 0.05 cfs during critical summer months.
- **Community resilience**: The installation of conservation measures will decrease Tribal reliance on limited water supply, increasing community capacity to withstand extended drought periods while protecting important cultural and subsistence fish populations. Additionally, this project provides increased technical capacity for Tribal water managers and staff to conduct water audits as needed on Tribal properties. Finally, the preliminary development of a smartphone app for Tribes has benefits that will extend beyond the life of this funding cycle by providing the potential for substantial long-term water savings.
- **Climate change mitigation**: Decreased water use and leak identification and repair will decrease energy used in pumping and treating that water, reducing the amount of GHGs released and saving the associated energy costs.
- **Climate change adaptation**: By identifying leaks, upgrading water-wasting fixtures, identifying conservation habits, and integrating effective new technologies, the MCRCD and its Tribal partners will enable long-term water conservation and adaptively manage for climate resiliency.

Table 5.14 a – Annual Project Physical Benefits			
Project Name: _Mendocino County RCD Water Conservation Technical Assistance to Mendocino County Tribes_			
Type of Benefit Claimed: _Water supply saved - Primary_____			
Units of the Benefit Claimed : ___AFY_____			
Anticipated Useful Life of Project (years)_____15 years_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	100	100
2019	0	100	100
2020	0	100	100
Through 2032	0	100	100
Comments: Project will be completed in 2017 and benefits will begin to accrue the following year. This benefit will provide an estimated economic value of $80 per AF, providing an estimated annual monetary value of $8,000 per year (West Water Research 2013).			

Table 5.14 b – Annual Project Physical Benefits			
Project Name: _Mendocino County RCD Water Conservation Technical Assistance to Mendocino County Tribes_			
Type of Benefit Claimed: _Species protection - Secondary_____			
Units of the Benefit Claimed : ___Number of species_____			
Anticipated Useful Life of Project (years)____15 years_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	2	2
2019	0	2	2
2020	0	2	2
Through 2032	0	2	2
Comments: Project will be completed in 2017 and benefits will begin to accrue the following year. Species protected are Chinook (Oncorhynchus tshawytscha) and steelhead (Oncorhynchus mykiss).			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of need for the project

Tribal water suppliers are underserved utilities that face unique challenges during the drought. Previous MCRCD work with Tribes indicated that they would like assistance with water conservation outreach, training for water usage assessment, and with infrastructure upgrades and that significant water savings can be achieved when identified through water audits, leak detection and water saving devices. A case study of the Hopland Tribe revealed that in addition to compromised water rights, the Tribe was losing significant water from aging distribution pipes and the Rural Community Assistance Corporation has identified leaking pipes as a leading source of water loss for Tribes. In addition, significant behavior change can be achieved through targeted Smartphone apps (Water Smart Software undated, *Engagement and Analytics Solutions Brochure*), however, this solution is currently unavailable to small water systems. Discussions with one software company revealed that information gaps exist before such software can be made available to small systems and that a liaison was needed to identify priorities for Tribes. MCRCD intends to be that liaison and assist with identification of Tribal priorities.

As long ago as 1997, DFW assessed the Eel River watershed and provided recommendations for restoration of salmonids; primary recommendations included reducing water withdrawals (DFW 1997, *Eel River Salmon and Steelhead Restoration Action Plan*). In light of the current four-year drought conditions coupled with increasing ambient temperatures, this recommendation is even more relevant today than it was nearly 20 years ago. Conditions in the Garcia and Russian Rivers are similar to those in the Eel – instream water and the associated high summer temperatures and low Dissolved Oxygen are limiting to the survival of salmonids (Sonoma County Water Agency 2015, *Fisheries Research, multiple studies* and The Nature Conservancy 2015, *Salmon Snapshots Garcia River*). This project meets several goals of the *Russian River Integrated Coastal Watershed Management Plan* (MCRCD 2012), including use of ambient information systems to influence water use behavior, peak demand water use education, public outreach, and technical assistance (p. 103 – 104), and upgrading aging distribution systems "to reduce energy needs, accommodate increased flows, and improve water quality (p. 104)."

Estimates of without-project conditions

Without-project conditions will maintain the status quo, in which water demand exceeds available resources. During the summer of 2014, the Eel River went dry with exposed substrate near Loleta and other locations. Already in August 2015, the West Fork Russian River near Ukiah has nearly stopped flowing (0.40 cfs), as indicated by the USGS gage (http://waterdata.usgs.gov/ca/nwis/uv?site_no=11461000). If the project is not implemented, Tribes will continue to experience hardship in meeting the Human Right to Water and fisheries will continue to be stressed during critical summer months with potentially dire consequences. State and regional goals of environmental justice will not be addressed and disadvantaged Tribal communities will continue to bear a disproportionate share of the burdens placed on all California residents with continued drought conditions.

Methods Used to Estimate Physical Benefits

Water leak detection, household water audits, and other water conservation strategies promoted, demonstrated and technologies transferred, through this project are based on up-to-date best management practices supported by the State of California, County of Mendocino, and not for profit organizations including the American Water Works Association. Detailed below are specific methods used to estimate physical benefits.

Improved efficiency in water distribution lines and reduced losses due to leaks: Estimate of leak loss multiplied by total gallons per system per day (obtained from Tribal water operators).

Improved efficiency in residential water use due to identification and remediation of hidden water wasting fixtures: MCRCD conducted a direct comparison of actual water use for fixtures evaluated versus retrofit use with water-efficient fixtures to calculate water savings with retrofit. Final report for audited properties includes a spreadsheet of potential savings for each improvement and a three year analysis of water usage prior to audit.

New Facilities, Policies, and Actions

Six to nine water systems will be surveyed for leaks, including evaluation of approximately 10 miles of distribution line for leaks, and at least 400 Tribal members will be reached through trainings. The potential reach of new app upon development is estimated to be in the tens of thousands. These actions are described in greater detail below.

1. Leak Detection in Distribution Systems

Leaking distribution pipes are a leading cause of water loss. The MCRCD will contract with a licensed leak detection company to provide this service for Tribes with an identified need.

2. Water Audit Technical Assistance

Water audits identify water waste and leakage problems and recommend changes that can dramatically reduce water consumption. Through this project, the MCRCD will provide both free water audits for customers and water audit trainings to enable Tribal staff to conduct additional audits in the future.

3. Access to New Technology for Underserved Communities

MCRCD will investigate how to adapt existing software for a Tribal supplier and liaise with a software company or a university to explore options for app development.

Potential Adverse Physical Effects

No potential adverse physical effects are expected from the trainings and leak detection activities. These activities do not include any ground breaking, but instead focus on identifying leaks in distribution lines and education on best water conservation practices.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Achieve long-term reduction of water use
3. Efficient groundwater basin management

The drought has affected Mendocino County Tribes disproportionately due to a variety of factors including lack of water rights and economic disadvantage. The Sherwood Valley Rancheria has declared a drought emergency this year (Governor's Office of Emergency Services (GOES) 2015, *Drought Update Tuesday, July 28, 2015*). Additionally, the Sherwood Valley Rancheria and Hopland Band of Pomo Indians have established drought task forces to coordinate tribal drought response (GOES 2015).

Leaks account for up to 14% of water usage in a typical home (Grace Communications Foundation 2015, *Indoor Water Use at Home*, available: http://www.gracelinks.org/124/indoor-water-use-at-home). Providing access to auditing and leak detection services is vital to attaining water conservation needs. For Tribes with insecure water rights, water conservation is essential for the health and safety of the community. Behavioral Smartphone apps have demonstrated a track record of water conservation savings (Deatley 2015). The WaterSmart app has been shown to increase water use efficiency by 5% within six months (Water Smart Software 2014, *New Technology Reduces Home Water Use by 5%,* available: http://www.watersmart.com/press-release/new-technology-reduces-home-water-use-5-percent/).

This proposal is entirely drought preparedness focused on Disadvantaged Tribal Communities. It will enhance Tribal water management self-sufficiency through a three tiered approach: 1) identification of water conservation needs household by household through water audits and trainings, and distribution of leak detection supplies, 2) improve water distribution efficiency through identification of system-wide leaks, and 3) facilitate development of water conservation technologies that have been demonstrated to reduce long-term water usage by at least 5%.

DIRECT WATER RELATED BENEFIT TO A DAC

The populations served by this project are disadvantaged Tribal communities living on Rancherias and dependent on water systems that are vulnerable in terms of water security and failing infrastructure and without the capacity to provide water conservation technical assistance to end users of potable water.

Through MCRCD's previous outreach to Tribes, many water security and drinking water safety issues have surfaced. MCRCD has offered to work with Tribal offices and councils to empower them to identify and solve water infrastructure and conservation challenges. MCRCD is the applicant rather than an individual Tribe in order to create a sufficiently large sample size for technology needs assessment and beta-testing and to distribute trainings and services as broadly as possible. The project will provide much needed resources to Tribal communities and Rancherias, as well as underserved small districts to address failing water infrastructure and water supply reliability. Currently, these communities do not

have access to the same technologies and resources as large utilities, which is an environmental justice issue that this project will address. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.14 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Water conservation assistance to Disadvantaged Tribal Communities	Leak detection in 6 – 9 water systems, leak audit training and implementation, and preliminary development of water conservation app	Statement of completion by certified professionals, photodocumentation, reports	Upon project completion
Improved efficiency in water distribution lines and reduced losses due to leaks	20% reduction in water usage per system evaluated	-Miles of distribution line evaluated -Estimate of leak loss (provided by contractor) multiplied by total gallons per day. -Before and after leak fixes comparison of water use (*if available*)	Six months after leak detection
Improved efficiency in residential water use due to identification and remediation of hidden water wasting fixtures	water usage savings of 5-25% per household audited	-Number of audit conducted and gallons used per site -Direct comparison of actual water use for fixtures evaluated versus retrofit use with water-efficient fixtures to calculate water savings with retrofit. -Three year analysis of water usage prior to audit.	Six months after audit
Distribute fifty or more water conservation kits and devices	50 kits distributed	Number of kits distributed	Quarterly

Project metrics will be based on number of individuals reached, number of tribes included, number of assessments returned, status of app availability, and miles of distribution lines evaluated. A Project Assessment and Evaluation Plan (PAEP) will be developed to track project targets, outputs, and results.

COST EFFECTIVE ANALYSIS

Table 7.14 – Cost Effective Analysis Project name: _Mendocino County RCD Water Conservation Technical Assistance to Mendocino County Tribes	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) and Species Protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *This proposal represents a series of alternatives for water conservation that are combined to maximize benefits across watersheds with widely distributed populations. It is the timeliest alternative to address critical resource needs for both Tribal communities and the aquatic resources that are vital to their culture.*
	If yes, list the methods (including the proposed project) and estimated costs. *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Alternatives to education and infrastructure upgrades for encouraging water conservation usually involve vastly increasing the price of water, an approach that is not desirable in a disadvantaged community. Water conservation is the least cost alternative that addresses both human and environmental needs.*
Comments:	

MONTAGUE WATER CONSERVATION DISTRICT, INSTREAM FLOW ENHANCEMENT THROUGH WATER CONSERVATION

PROJECT DESCRIPTION

Brief: This project will line a water delivery canal to improve water supply reliability for agricultural and municipal users and enhance instream conditions to benefit salmonids.

Expanded: The Shasta River, a major tributary to the Klamath River, has experienced competitive use issues similar to many watersheds in the west. However, the Shasta River has been recognized as the most important tributary to restore the anadromous runs of salmon in the Klamath River (NRC 2004, *Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery*). The Shasta River supports runs of Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*) and Pacific lamprey (*Lampreta tridentata*), all species of cultural and subsistence importance to local Native American Tribes. The Southern Oregon Northern California Coho (SONCC) population was listed as 'Threatened' by the Federal Endangered Species Act (ESA) and the California ESA (CESA) in 1997 and 2002, respectively. Both NOAA (NOAA NMFS 2014, *Southern Oregon Northern California Coho Recovery Plan*) and CDFW (CDFW 2004, *Recovery Strategy for California Coho Salmon*) have presented recovery objectives and strategies that identify measures needed to restore the Shasta River Coho population that will be implemented by this project.

Montague Water Conservation District (MWCD) is the largest irrigation District in the Shasta River and operates Dwinnell Reservoir, the only significant storage facility (49,000 acre-feet (AF)) in the watershed. The objective of MWCD has been to develop, permit and implement a comprehensive long term conservation strategy, including significant instream flow and water quality enhancements with conserved water. MWCD's long-term conservation strategy, of which this project is a part, is titled *MWCD's CHERP (Conservation and Habitat Enhancement and Restoration Program*). MWCD has worked with agencies and conservation entities to develop the project components of CHERP to address water quality issues and limiting factors for Coho salmon.

MWCD is seeking implementation funds to cost share to line 1.3 miles of MWCD's Main Canal where significant transmission or delivery loss occurs. In exchange for lining reaches of MWCD's Main Canal, MWCD will permanently allocate the volume of water conserved, estimated at 680 AFY, for instream benefit. MWCD is working with the SWRCB to protect the conserved water for instream use through California Water Code 1707, which enables those with water rights to change their water right to preserve or enhance wetlands habitat, fish and wildlife resources (CWC 1700 – 1707, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=01001-02000&file=1700-1707).

While increasing delivery dependability to MWCD's irrigators and municipal water for the City of Montague, this proposal presents numerous opportunities to enhance instream conditions in the most important spawning and rearing reach of the Shasta River, specifically for the listed SONCC coho salmon. All of the water conserved will be provided for instream use to reduce the conflict between agricultural,

municipal and instream uses with the Shasta River through more efficient delivery and improved infrastructure within MWCD facilities.

PROJECT PHYSICAL BENEFITS

Physical benefits are expected to include, but are not limited to:

- **Primary: Water supply saved** equal to 680 AFY. This project will provide 680 AFY on a flow schedule approved by state and federal agencies. Increased flows will improve stream habitat for up to six miles of the Shasta River throughout the year. This benefit will provide an estimated monetary benefit of $80 per AFY, or $54,400 per year. (West Water Research 2013, *2013 California Spot Market Price Forecast*).
- **Secondary: Species protection**: This project implements recommendations by NOAA and CDFW to enhance habitat for coho, steelhead, and Chinook along with other aquatic species in the Shasta River.
- **Fishery benefits**: This project will provide up to 6.0 cfs of cold water for instream over summering habitat. Additionally, the increased flow volume throughout the year will provide increased thermal mass, which protects aquatic habitat from sudden increases in temperature.
- **Water quality improvements**: This project addresses listed impairments of the Shasta River; the river is listed as impaired for excessive water temperature and low Dissolved Oxygen levels (NCRWQCB 2006, *Final Shasta TMDL Action Plan*). Per developing temperature models, the proposed flow schedule focuses on improving temperature, Dissolved Oxygen and wetland expansion which addressing nutrient loading (CDFW 2015, *Shasta River between Dwinnell Dam and Parks Creek – Environmental Water Montioring Results*). A 2.5° C reduction in water temperature over 2 miles of river is expected and an increase in Dissolved Oxygen is expected over 1 mile of river. Water temperature will be improved through incorporation of Flying L Pumps that deliver cold water to the Shasta River rather than the historical practice of delivering to MWCD Main canal to supplement irrigation.
- **Improved habitat**: This project is expected to improve instream habitat in 6.4 miles of the Shasta River.
- **Flood protection**: Dwinnell Reservoir has 50,000 acre feet of storage for flood events. Capability to divert flood water from Parks Creek into Dwinnell depends on capacity to reduce flood risk downstream. This project proponent estimates the monetary benefit as $70,000 per flooding event.
- **Avoided O&M costs** for 1.3 miles of lined canal will provide an estimated benefit of $12,000 per mile/year for an estimated yearly benefit of $15,600 per year.
- **Conflict reduction**: Implementation of this project will reduce conflict in the Shasta and Klamath basins – a location nationally recognized for contentious relations between agricultural and environmental interests for over a decade. MWCD has been developing its larger program of which this project is a part – the CHERP – over a number of years and the strategy of conserving water to provide increased instream flows is supported by involved interest groups, tribes, and District landowners. In 2013, MWCD entered into a settlement agreement with Karuk Tribe and

Klamath Riverkeeper that resolved litigation under the Endangered Species Act regarding MWCD's water diversions (MWCD 2013, *Statement by the Montague Water Conservation District on the lawsuit settlement with the Klamath Riverkeepers and Karuk Tribal leadership*, available: http://pienpolitics.com/?cat=52&paged=2; NOAA NMFS, *Chapter 37, Shasta River Population*, p 37-9). CHERP is not required as mitigation or in response to any judicial or regulatory order, but an important part of the settlement agreement is a recognition and support for CHERP and its goal to restore and enhance habitat in the Shasta River watershed.

- **Climate change adaptation**: This project will reduce water loss in a watershed with severely limited water supply, bolstering both community and environmental resiliency to climate change. Additionally, MWCD's storage facilities can address effects of climate change and provide flood protection by capturing and holding significant precipitation events and wet periods for use later when conditions are dry through improved and efficient facilities and conjunctive management.

Table 5.15 a – Annual Project Physical Benefits

Project Name: Montague Irrigation District_Instream Flow Enhancment Through Water Conservation

Type of Benefit Claimed: Water supply saved - Primary

Units of the Benefit Claimed : AFY

Anticipated Useful Life of Project (years) 40 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	680	680
2020	0	680	680
2021	0	680	680
Through 2058	0	680	680

Comments: Project implementation will occur in 2018 and benefits will begin to accrue in 2019. This benefit will provide an estimated monetary benefit of $80 per AFY, or $54,400 per year (West Water Research 2013).

Table 5.15 b – Annual Project Physical Benefits			
Project Name: _Montague Irrigation District_Instream Flow Enhancment Through Water Conservation_____			
Type of Benefit Claimed: _Species protection - Secondary_____			
Units of the Benefit Claimed : _Number of species_____			
Anticipated Useful Life of Project (years)____40 years_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	0	3	3
2017	0	3	3
	0	3	3
Etc. through Last Year of Project Life	0	3	3
Comments: Project implementation will occur in 2018 and benefits will begin to accrue in 2019. Species protected through project implementation include coho, steelhead, and Chinook.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

MWCD holds two water right permits from the SWRCB for diversion to storage at Dwinnell Reservoir. Permit No. 2452, issued on Application No. 3544 authorizes diversion from the Shasta River, and Permit No. 2453, issued on Application No. 3555 authorizes diversion from Parks Creek. Season of diversion for MWCDs storage rights are during the winter and spring periods (10/1-6/15) to be stored in Dwinnell Reservoir for irrigation use during the spring and summer months. During irrigation season (4/1-10/1), water stored in Dwinnell Reservoir is released to MWCD's 19.4 mile long main canal that connects Dwinnell Reservoir to the MWCD Irrigation District, located in northeastern part of Shasta Valley.

MWCD provides irrigation water to 220 water users and family farms within the 15,500 acre Irrigation District. MWCD also provides municipal water to the City of Montague and instream benefit for the ESA and CESA Threatened Coho Salmon. NOAA NMFS has identified increasing instream flows as one of the highest priority recovery actions (NOAA NMFS 2014, *Chapter* 37, Shasta River Population, p. 37-1, 37-25).

One of the critical limitations of MWCD in meeting demand is the inefficiency of the main canal where 26% of the flow in the canal is lost over the most inefficient 8.4 miles of the main canal. By lining 1.3 miles of the canal, 680 acre feet of water can be saved annually for other uses. In exchange for lining the main canal, MWCD proposes to permanently dedicate the conserved 680 AF of water to instream

benefit. MWCD has been working with agencies, neighbors and interest groups to develop a flow strategy to enhance one of the most critical stream reaches in the watershed.

Estimates of Without Project Conditions

If the canal is not lined, it will continue to lose 680 AFY and coho, Chinook, and steelhead in the basin will continue to be threatened by low flows, high heat, and low Dissolved Oxygen levels. The community will continue to deal with controversy between agricultural and environmental users, prolonging and potentially intensifying the conflict. The community will be vulnerable to effects of climate change as will instream habitat.

Methods Used to Estimate Physical Benefits

MWCD has been addressing canal loss since its inception and has reduced canal loss from 60% in the 1950's to 30% today. The most effective and long term treatment has been shot-crete or gunite lining including an underlayment of geo-membrane material. Recent canal loss values were determined through investigations in 2009, 2010 (Watercourse Engineering Inc. 2010, *Montague Main Canal Conveyance Efficiency Study for 2009*; Watercourse Inc. 2011, *MWCD Main Canal Conveyance Efficiency Study for 2010*), 2012 (DWR) and 2015 (NRCS). The investigations were conducted on the full 19.4 mile long main canal and loss rates have been generally consistent. The investigations found 85% of the loss occurred over 8.4 miles of canal, reducing the focus area considerably. MWCD proposes to line or pipe 8.4 miles of canal. 2.0 miles of lining was recently funded by BOR. This proposal seeks funding to line 1.3 miles of canal. On average, each mile of lined canal will conserve about 525 acre feet per year (Watercourse Engineering Inc. 2010 & 2011).

Recent investigations have also been conducted to determine necessary flow volumes to support salmonid populations and year round habitats in the Shasta River below Dwinnell Dam to Parks Creek confluence (McBain Associates 2013, *Big Springs Complex Interim Instream Flow Needs*). MWCD and proactive neighboring landowners recognize instream flow values are necessary targets to obtain a balance with the limited water resources and beneficial uses of water in the watershed, especially cold water habitats during the summer. Therefore, MWCD is proposing to provide all of the conserved water for instream benefit to reduce the conflict between instream flow needs and irrigation.

MWCD agrees to hold the conserved water in storage for release based upon a flow schedule and water quality parameters (developed with managing agencies including an adaptive management component) to maximize instream values, primarily for coho salmon.

The six mile reach of the Shasta River below Dwinnell Reservoir and associated springs is one of the most critical reaches in the watershed for salmonids. Threatened coho salmon occupy this reach throughout the year and the reach possesses habitats for all necessary life stages. CDFW has monitored Coho use and movement using PIT-tag arrays since 2009 (Adams, CDFW 2014). Collected fish response, utilization and habitat condition data greatly assisted MWCD, NOAA and CDFW in developing CHERP & a flow strategy.

New Facilities, Policies, and Actions

New infrastructure includes 1.3 miles of lined canal and 4 flow gages to benefit 800 municipal users and 220 agricultural users. Additionally, MWCD is working with SWRCB to obtain approvals through change petitions and has acquired a Low Threat Discharge permit from NCRWQCB for the Flying L Pumps to be released.

Potential Adverse Physical Effects

MWCD has lost considerable water to deep percolation through reservoir storage loss, main canal and lateral ditch delivery loss. Concern about the potential unintended impacts resulting from reduced deep percolation exists and inquiries about the lost water providing potential benefit to sectors of the watershed have arisen. Groundwater transport rates and directional flow in the Shasta Valley is very complex. Uncontrolled transmission loss of water resources is not a prudent management strategy. Rather, justified efficient and balanced use of limited water resources is MWCD and partners objective. MWCD, agencies, and partners will continue to consider this situation and cooperatively address it should it become an issue.

The Flying L Pumps, located near Dwinnell Reservoir, have been used by MWCD to deliver groundwater to MWCDs main canal for decades to supplement irrigation delivery. Instead, CHERP proposes to deliver water from Flying L Pumps to the Shasta River to provide cold water habitat. Confusion exists that the Flying L Pumps are a new groundwater withdraw but only the use or purpose is different.

Environmental impacts from construction activities will be minimized by using accepted professional standards and BMPs. Should impact occur, it will immediately be remediated according to best practices in order to minimize adverse physical effects.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

3. Promote water conservation, conjunctive use, reuse and recycling
4. Improve landscape and agricultural irrigation efficiencies
5. Achieve long-term reduction of water use

MWCD's season of diversion for Dwinnell Reservoir is during the winter and spring months (10/1-6/15). MWCD's water rights are incorporated into the Shasta Decree (http://www.californiaresourcecenter.org/viewpage.php?page_id=96). Winter precipitation and spring snowmelt contribute mostly to MWCD's storage for use through the year. During spring months, MWCD's lower priority water rights are can be reduced or even shut off if stream flow is not sufficient. During drought years, reduced winter precipitation coupled with low priority rights during the spring can have severe impacts on MWCDs storage volumes in Dwinnell Reservoir. Inefficiencies in delivery conduits like MWCDs main canal are most noticable during drought years. Further, the canal inefficiencies are often exacerbated in drought years as earthen ditches crack and leak even more.

Reduced storage and increased inefficiencies inherent in earthen ditches during drought conditions prevent MWCD from meeting its obligations to irrigators, municipals users and instream beneficial uses.

Four thousand, four hundred (4,400) acre feet is expected to be conserved per year when the most inefficient 8.4 miles of canal is lined. This proposal intends to line 1.30 miles of canal, conserving 680 acre feet per year, approximately 7% of the volume of water sold to users in the district annually. This amount of water equates to 10 cfs of instream flow for 34 days. Given that Shasta River flows near Yreka Creek (located at the base of Shasta Valley) during 2014 were under 20 cfs for 80 days, the volume of water considered in this proposal is significant to alleviate drought conditions in the Shasta River.

DIRECT WATER RELATED BENEFIT TO A DAC

MWCD provides municipal water to the City of Montague as well as irrigation water for 15,500 acres surrounding Montague. Two hundred twenty families depend on MWCD to deliver water for some or their entire income base. MWCD also provides released water for instream benefit that aides listed species, watershed health and coastal communities that depend on commercial and recreational fishing and harvest.

The City of Montague and Shasta Valley, Siskiyou County, California, are recognized as Disadvantaged Communities and they are the population directly served by this project. Indirectly, the project benefits other disadvantaged fishing dependent and Tribal communities through enhancement of instream habitat for steelhead, lamprey, Chinook and Coho salmon. The project also benefits fishing dependent communities that depend on Klamath stocks of salmon on the northern California Coast.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.15 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Prevention of 680 AFY water loss	Photodocumentation, certified engineer's statement of completion	Pre- and post-project implementation	1.3 miles of lining on Main Canal
Conserved Water through improved delivery efficiency	Continuous in-canal flow gages that bracket reaches to be treated	Continuous to be downloaded and evaluated monthly	10% accuracy of better
Release of conserved water from Dwinnell to Shasta River for instream benefit	Continuous flow gage that measures flow released for instream benefit	Continuous and real-time via existing DWR operated CDEC - DFB	10% accuracy or better

Upon completion of the canal lining, MWCD accepts full maintenance responsibilities of the canal lining, which is expected to last over 40 years. Based on loss assessments, MWCD will provide 525 acre feet of conserved water for instream benefit per mile of main canal lined. Conserved water will then be dedicated for instream benefit with SWRCB concurrence and approval based upon a developed instream flow schedule. Water released to the Shasta River for instream benefit will be verified by existing real time gages on DWR's public data collection site, California Data Exchange Center (CDEC). The gages are located below MWCD's Dwinnell Dam. While the gages and water temperature probes are currently active, the gauging complex and CDEC sites will be upgraded under a proposal submitted to CDFW's Fisheries Restoration Grants Program (FRGP). DWR manages and verifies proper operation of the gages and instrumentation per a continuing contract with MWCD. Annual release summaries are reviewed and provided by DWR. MWCD's Operations Plan will summarize and verify this commitment.

COST EFFECTIVE ANALYSIS

Table 7.15 – Cost Effective Analysis Project name: _Montague Irrigation District Instream Flow Enhancement Through Water Conservation_____	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) & Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Numerous alternatives have been considered within MWCD, with consulting firms and with agencies, including piping the full 19.4 mile canal to deliver 70 cfs to the district. The cost of piping was determined to be unreasonable (exceed 20 million), especially since the district has lined four miles of canal with long term success thus far. A second alternative included releasing water to the Shasta River to be picked up 24 miles downstream. While this would benefit instream conditions for part of the year, it also risks inundating cold water habitats with warmer water released from Dwinnell Reservoir during the summer. Also, this alternative would require pumping 70 cfs with a lift of 280'. The energy consumption and project footprint would be excessive. This proposal allows for additional work to be conducted in a phased manner including some portions of alternatives where the cost benefits for smaller scale projects are more favorable.* *Assessments, watershed plans and objectives in conjunction with Coho recovery plans indicate the components of CHERP as both stand-alone projects and a comprehensive project address many of the flow, habitat, agricultural management and competitive use issues within the watershed. Further the components are cost effective when compared to regional or statewide water conservation projects or valuation through a more intrinsic species recovery value process.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *While canal lining is less efficient than a buried pipeline, canal lining is often selected mostly due to increased material and installation costs. The cost of piping material alone to carry 70 cfs is nearly $1 million for a mile. After installation costs, the cost to pipe the canal versus lining would exceed $1.3 million per mile versus $600,000 per mile for lining. The proposed is the least expensive option and still provides water for livestock and wildlife along the Main Canal.*
Comments:	

NORTHWEST CA RESOURCE CONSERVATION & DEVELOPMENT COUNCIL, TRINITY RIVER WATER RELIABILITY AND DROUGHT RESILIENCY PROJECT

PROJECT DESCRIPTION

Brief: This project preserves instream flows in high priority watersheds to improve residential water supply reliability and enhance summer instream flows to protect listed salmonids.

Expanded: The project's purpose is to preserve instream flows in high priority watersheds during critical dry periods and allow landowners in two watersheds (Browns Creek & East Fork Hayfork Creek) and the Weaverville Community Services District (WCSD) on East Weaver Creek to meet potable water needs. In the Trinity River watershed, 2013 and 2014 were the driest water years on record. Many major streams went dry (see *Project Need* & *Drought Preparedness* sections).

Dry conditions pose a challenge for people living outside of a public water supply as with Browns and East Fork Hayfork Creeks residents. Few people have any water storage in place. Many had to pay for water deliveries to meet basic potable needs in 2014 and likely will again in 2015.

WCSD serves the largest town in Trinity County and derives more than 70% of its water from East Weaver Creek. There are several riparian water rights holders and inefficient ditches diverting creek water for private use. "Altered hydrologic function" and "dams/diversions" have been identified as key limiting stresses and threats respectively in the Upper Trinity River and increased instream flows is one of six "highest priority recovery actions" recommended for both East Weaver and Browns Creeks (NOAA NMFS, *Southern Oregon Northern California Coast Coho Recovery Plan, Chapter 39, Upper Trinity River Population*, page 39-1, 39-26, 39-27). Last summer, several coho salmon did not survive the warm and relatively crowded conditions. With low flows and dry conditions killing coho, the WCSD could face regulatory scrutiny and action for "take." It could be required to reduce its diversion if conditions persist. It's in the best interest of the public water supply and the creek to reduce diversions through more efficient infrastructure and usage practices. Landowners on three ditches are targeted in this proposal.

This project proposes to outreach to landowners in these 3 priority watersheds that have riparian rights or appropriative rights with the point of diversion in a creek or ditch. The Council will assist landowners in these economically disadvantaged communities to improve the efficiency of their water use and convert their diversion systems to utilize slow flow, lower impact pumps that collect water during the wet season for use in the dry season. Installation of the infrastructure is the bulk of the cost of this proposal.

Once the slow flow infrastructure solutions proposed here are implemented in East Weaver Creek, they're estimated to result in a reduction to the diversions of ~2,000,000 gallons/day (2.9 cfs). One project component is to identify participants in Browns and East Fork Hayfork Creeks. Thus the instream benefits in these creeks can't yet be quantified.

Mechanism for forgoing dry season water diversions: The type of water storage proposed here to more sustainably draw water from creeks during the wet season will require all landowners being in compliance with their water right filings and apply for a Small Domestic Use Appropriation Registration (SDU). Council staff will assist landowners with both of these processes as part of this project. Part of the SDU process entails review by the California Department of Fish & Wildlife (CDFW). With rare exception, CDFW requires a Lake & Streambed Alteration Agreement (LSA) that includes provisions that prohibit diverting water during the dry season. The timing and length of the dry season restrictions would be determined based on the size of the diversion and other specifics of each location. Council staff has discussed this process with local CDFW staff, who have expressed understanding of and support for this project and approach. CDFW staff has confirmed that the LSA provisions, which are incorporated into the SDU registration, would bind landowners to forgo dry season diversions. This is essential to the achievement of the project's goals. With these provisions in place, landowners would forgo diverting water during the dry season, minimizing impacts on instream habitat and wildlife during the most critical periods. The landowner agreements with the Council will grant Council and partner staff access to the sites in order to conduct a home water audit, complete design, implement infrastructure improvements, provide education on proper day to day maintenance of systems, and monitor system conditions and function as well as to confirm dry season diversion restrictions. The monitoring aspect would include project performance as well as instream conditions (e.g., physical flow measurements). This approach will be used in all target watersheds.

PROJECT PHYSICAL BENEFITS

Physical benefits are the expected to include, but are not limited to:

- **Primary: Fishery benefits** in the form of increased instream flow during the critical low flow summer months of approximately 3 – 6 cfs
- **Secondary: species protection** for coho (*Oncorhynchus kisutch*) and steelhead (*Oncorhynchus mykiss*). Browns and East Weaver Creeks both support coho salmon (NOAA NMFS 2014, *SONCC Coho Recovery Plan Chapter 39*) and East Weaver supports steelhead (DFW 2009, *2009 Report Trinity River Tributaries Steelhead Spawning Survey Report*). In 2014, a coho salmon fish kill was observed firsthand by Council and CDFW staff because they could not survive the overly warm conditions of the pool that they were stranded in when the creek stopped flowing.
- **Water quality improvements** to instream flow including decreased water temperature and increased Dissolved Oxygen.
- **Reduced cost of water deliveries** for landowners is estimated to be about $40,000 per year assuming $200 per water truck delivering 2000 gallons.
- **Increased community capacity:** This project will result in a community with better understanding of issues associated with the drought and methods for reducing water use. Additionally, water stored near residences will increase fire safety because homes will have a water supply for neighborhood fire suppression.
- **Climate change adaptation**: Proposed slow flow systems are capable of sustainably diverting during wet seasons and during times of more modest flow because they can slowly fill storage tanks for later use in the dry season. With more unpredictable climate patterns, these systems are more adaptable to a host of conditions, making them more resilient to drought and long terms changes in climate.

Table 5.16 a – Annual Project Physical Benefits			
Project Name: Northwest CA Resource Conservation & Development Council Trinity River Water Reliability and Drought Resiliency Project			
Type of Benefit Claimed: Fishery benefits - Primary			
Units of the Benefit Claimed : cfs			
Anticipated Useful Life of Project (years) 25 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2019	0	0	0
2020	0	3-6	3-6
2021	0	3-6	3-6
2022	0	3-6	3-6
Through 2044	0	3-6	3-6
Comments: Project will be completed in 2019 and benefits will begin to accrue the following year. This project will provide fishery benefits of an increased 3 - 6 cfs during critical low flow summer months.			

Table 5.16 b – Annual Project Physical Benefits			
Project Name: Northwest CA Resource Conservation & Development Council Trinity River Water Reliability and Drought Resiliency Project			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 25 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2019	0	0	0
2020	0	2	2
2021	0	2	2
2022	0	2	2
Through 2044	0	2	2
Comments: Project will be completed in 2019 and benefits will begin to accrue the following year. Species protected are coho and steelhead.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Drought conditions pose a challenge for people living outside of a community/public water supply. Relatively few people in the prioritized watersheds have any water storage in place to meet basic potable needs. As a result of the drought, many streams went dry for the first time last year including the targeted creeks. There has been close to normal precipitation in 2015 so far, but nearly all of it has fallen in just three intense and warm storms that had high runoff rates and yielded minimal to no snowpack. Because of the extremely dry/thirsty soil conditions created by the last two water years, there is less water available for streams, springs, or even wells. On-the-ground conditions still resemble drought conditions even though the precipitation in the first part of 2015 was close to average. In East Weaver Creek, the WCSD could face regulatory action and diversion reductions due to insufficient water and last year's coho fish kills in the creek supplying its main diversion.

Residents who are not connected to WCSD have had to truck water in for basic potable use, interfering with their Human Right to Water. These conditions are expected to continue as the climate becomes drier and warmer and droughts more frequent with storms more episodic.

Estimates of Without-Project Conditions

There are no alternative approaches to increasing instream flows. The only way to increase flows is to decrease diversions. Decreases in diversions can be accomplished by increasing water use efficiency (devices), more efficient delivery, and/or off season water storage. The only other alternatives are forbearance and comprehensive pumping restrictions that would require de-population or changes in land use. This grant provides the only reasonable method to increase instream flows without social upheaval.

The East Weaver Creek existing conditions (in 2015) have resulted in the stream not providing all of its beneficial uses and in 2014 the drying up of Browns Creek and East Fork Hayfork indicate similar overuse of instream flows. Without this project, the current water diversion rates will continue and will lead to unreliable water supplies for residents in a disadvantaged community, increased conflicts over water withdrawals, impacts to agricultural production and continued loss of anadromous salmonid fish.

Methods Used to Estimate Physical Benefits

The quantity of the diversions in East Weaver Creek is based on actual measurements of flow in the Hansen Ditch and estimated quantities based on observation in the Howe and McKnight ditches (Lancaster /Northwest CA RC&DC 2014, *Weaver Creek Water Conservation, Reliability, and Habitat Restoration Project, Final Report,* p. 3, 9, 10). Because participants in the other two watersheds will be identified as part of the project, those benefits were not quantified, but are qualitatively described. Part of the basis supporting the project's reduced dry season diversions relies on the diversion restrictions contained in the LSA that is incorporated into each SDU for each site. Those provisions commit the landowner to forgo those dry season diversions, which is key to the overall project goal. CDFW staff has

agreed to work with the Council to discuss the LSAs pursued under this project programmatically to increase efficiency and ideally improve the processing time of the SDU applications.

A water use study is in progress for users of the Hansen and McKnight ditch systems. Their summer use is being monitored to determine a baseline water need. From this data, water delivery systems will be designed to deliver adequate water needs while reducing the amount diverted water. Monitoring flows in Hansen Ditch in 2013 and 2014 documented daily flows in the 600,000 - 1,000,000 gallons per day into the ditch with the water right holders having a total water right of 82,000 gallons per day. While excessive flows were documented at the end of the ditch, significant flows were lost to leakage and evapotranspiration along the ditch length. The Hansen Ditch landowners have forgone installation of the water diversion into the ditch in 2015 in part to facilitate a water use study and to protect fisheries in East Weaver Creek. Based on past flow observations and the results of the on-going study it can be estimated that ~80%-90% of the Hansen Ditch flow can be retained in East Branch East Weaver Creek while meeting landowner needs when a more efficient pipe is installed and water storage tanks have been constructed to meet daily peak demand.

Similar results are expected for the nearby McKnight and Howe Ditch systems. Based on the measured and observed data at the Hansen Ditch, the water savings for similar projects on these ditches can be reasonably estimated to range from 2-5 cfs. The physical benefits of high flows of that magnitude are reflected in numerous research papers (e.g. CDFW 2015, *Instream flow study plans, technical reports, flow recommendations, etc.* Available: http://www.dfg.ca.gov/water/instream_flow.html). In addition, flow monitoring downstream of all three ditches has been in place since 2011 (Redwood Science Lab, USDA Arcata, CA). While changes in flows are a reflection of precipitation patterns and other climatic variables as well as diversions, this 8 year record of pre-project data (project implementation in 2019) combined with post-project flow monitoring is expected to document changes in flow trends due to management actions.

In 2014 the 5C Program installed 4 rooftop rainwater systems in Weaverville but flow and precipitation patterns since their installation have not been sufficient to provide quantifiable water benefits yet. Review of older rainwater systems in the area (Miller, pers comm. 2014) have shown that they can be highly effective in reducing or eliminating surface water diversions for small to medium sized lawns and gardens. Off stream winter storage and carry over to summer has been well documented in the Mattole watershed and similar benefits are anticipated for the Weaver, Browns and East Fork watershed.

Target watershed selection: Browns Creek, the 6th largest Trinity River tributary, is one of the most productive anadromous fisheries systems (including local coho salmon, a federally threatened species) with >22 miles of salmon spawning habitat. Project proponents have worked with landowners here on past and current sediment reduction projects and have found many of them to be very concerned about the drought and local water supplies. They even convened a meeting with local conservation groups and regulatory agencies to discuss broad concerns about the creek and flow as well as land use practices and possible options and solutions. Many are very receptive to the idea of participating in this project.

The East Fork of Hayfork Creek is the second most productive steelhead tributary to Hayfork Creek, which is the biggest tributary to the South Fork Trinity River. The Watershed Center is currently utilizing a CDFW FRGP grant to conduct an analysis to determine the best locations for storage and water forbearance projects within the SFTR watershed. The final analysis will be complete by early 2016, but preliminary results have shown that East Fork Hayfork Creek is a high priority subwatershed due to its relatively low population density, high quality anadromous fisheries, and land use types.

East Weaver Creek provides >70% of the water for the WCSD via a dammed diversion. During low flow periods in late summer and fall, the WCSD "has often diverted all the available water in the creek" (WCSD, *Weaverville Water Master Plan*). Last summer, several coho salmon were stranded in pools. Council staff coordinated with CDFW staff to monitor the fish. As there was no suitable place for relocation by CDFW, they did not survive the warm water temperatures and relatively crowded conditions. There are many historic ditches still in use and numerous riparian water rights and illegal diversions in the creek. Nearly all ditches have substantial loss through leakage and evapotranspiration. Steelhead trout are in many of these ditches. The ditches targeted in this proposal are Hansen Mine (East Branch of East Weaver Creek), McKnight (East Weaver), and Howe Ditch (USFS owned off East Weaver). With low flows and dry conditions killing coho, the WCSD could face regulatory action for take and possible diversion reductions if conditions persist. It doesn't have many affordable options for increasing its water supply based on its current supply, since that would require a costly request to increase their Trinity River water right. Increasing diversions from West Weaver Creek would not be possible without violating the terms of their water right and imperiling those instream habitat conditions.

It's in the best interest of the public water supply and the creek to reduce diversions through more efficient infrastructure and usage practices. For the unique situation in the East Weaver Creek system and associated ditches, three ditches would be lined. Private diversions off of those ditches would be converted to the slow flow technology described in the project description. Although the type of work proposed by the larger project is new for the Trinity River, the work with East Weaver Creek landowners will complement conservation efforts that were recently completed or are in progress now. The Council implemented irrigation efficiency projects with a small group of landowners collectively diverting 680,000 gallons per day. The last/end landowner was using 120,000 gallons per day on average via an unscreened diversion for flood irrigation. After the efficiency project, only about 33,000 gallons per day was used for irrigation, a 67% reduction in water use. During the implementation, 320 steelhead trout were relocated out of the ditch. Two other ditches will be targeted in this proposal. Howe and McKnight haven't been formally monitored. But based on observations, each of these two ditches is estimated to divert at least roughly 650,000 (1 cfs) gallons per day, likely more. Even if the WCSD critical concerns were not a reality, this is a gross use of water that should be addressed. Other than the Trinity River Lumber Mill, which has worked with the regional water board on a cleanup and abatement order to reduce its diversion by using recycled water, there are no other large diversions downstream of the project. The proposed project is estimated to reduce the volume of the diversions collectively by at least 2,000,000 gallons per day (2.9 cfs). This is estimated to be enough water savings to retain flow in East Weaver Creek and beyond to Weaver Creek as well. The WCSD has also been working with Council staff

and landowners to collectively address the cumulative impacts that could jeopardize the ability of the WCSD to use East Weaver Creek as the primary source of its water.

New Facilities, Policies, and Actions

Up to 21 trickle fill water systems and FDC systems, up to five rooftop rainwater systems, and up to five grey water systems will be constructed. LSA and SDU agreements will be required from all participating landowners in addition to access agreements for construction activities and pre- and post- project inspections. Water conservation education will be emphasized to maximize a reduction in demand and water use by participating landowners.

Potential Adverse Physical Effects

No adverse physical effects are expected as no instream disturbance is anticipated, however with any construction project, there is potential for sedimentation and spills. All work will be conducted according to established and accepted professional standards using BMPs to minimize impact. Should adverse physical effects occur, they will be remediated immediately using BMPs. Additionally, if a simple fish migration barrier condition is observed and entails a low-cost fix, it would be pursued – after obtaining proper permits – using accepted practices given that it is a restoration effort that would have lasting positive impacts.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Achieve long-term reduction of water use
3. Solutions that yield a new water supply

All but the East Weaver Creek watershed landowners are outside of a public water supply service area. Those landowners are left to manage their water sources with neighbors, which often doesn't amount to much beyond discussing on-site conditions with immediate neighbors. Many streams, including those targeted by this proposal, went dry in 2014 - some for the first time in recorded history. The precipitation in targeted areas was close to normal for the 2015 water year. However most of it fell as rain in just 3 storms instead of being steadily delivered and/or being stored as. The drought has exacerbated water shortages due to the dry soil conditions, shortened wet seasons, and other factors. Prior to the drought, most landowners were able to meet their needs without storage. In these DAC areas, most people lack resources to simply build needed storage. This leaves them few affordable options to create drought resiliency.

Most people lack monetary resources for the infrastructure needed to store water during the wet season for use during the dry season. This project would identify and install the needed infrastructure for each participant to divert water responsibly and more efficiently conserve water. The SDU registration & LSA process would enact provisions to ensure they do not divert water during the dry season. Upon project completion, participants will know how to use water more judiciously and be able

to take what they need when it has a minimal impact to the creek. Home fixtures will be audited and upgraded as needed to help change long term water use. Agreements with landowners will require that they do long term maintenance, which they'll learn through educational outreach. Council staff will monitor project performance for several years and the infrastructure will be in place for at least 25 years, providing long term resiliency.

East Weaver Creek landowners get potable water from the WCSD. As noted, the creek provides >70% of the WCSD water supply. The extreme low flow and dry conditions in the creek that have been exacerbated by the drought are of particular concern. The WCSD may face regulatory scrutiny and possibly requirements to reduce its diversion because dry instream conditions lead to fish kills that impact listed coho salmon. If the WCSD is required to reduce its diversion, it does not have the capacity from other sources to make up the difference. Therefore, working with landowners below the WCSD diversion to reduce water usage and diversion will help the WCSD maintain a secure, reliable water supply.

Participating landowners will be required to go through a home audit of water fixtures to ensure efficient fixtures are in place. They will also be required to participate in education on general indoor and outdoor residential water conservation techniques.

DIRECT WATER RELATED BENEFIT TO A DAC

All areas are rural and economically or severely DAC. The East Fork of Hayfork Creek is incredibly rural with Hayfork as its closest community. This proposal will target East Weaver Creek (Weaverville), Browns Creek (Douglas City), and East Fork of Hayfork Creek (Hayfork). The entire South Fork Trinity River, which the East Fork of Hayfork Creek falls into, is a Severely Economically DAC. Note that the activities proposed in East Weaver Creek directly affect the WCSD, which serves the community of Weaverville and a portion of the Douglas City community.

After project completion, participants in Browns and East Fork Hayfork Creeks will no longer have to pay for water deliveries to meet basic potable needs. Such deliveries are unstainable and very costly. Landowners in East Weaver Creek will be able to meet their water needs without having to use highly inefficient ditches and diversion systems. Larger benefits to the WCSD include reduced risk of regulatory diversion reductions that could arise from agency scrutiny for continued “take” of coho.

Another benefit to participating landowners in these DAC areas will be that water storage systems will also provide them safety benefits in that they will be better able to respond to fire threats.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.16 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Slow flow pumps and storage tanks to increase community resiliency	Photodocumentation and certified engineer's statement of completion	Pre- and post - project implementation	Rooftop rainwater systems at up to 5 sites, greywater systems at up to 5 sites, Trickle fill water and FDC systems for up to 21 sites
Flow in Streams (cfs and ac. ft./year)	Onset Data Logger - U20L-04. Established cross sections will be used in order to establish a rating curve. USGS Style A Staff Gages will be installed.	Record water level at 15 minute increments set on the hour (PST).	Maintain or increase streamflow compared to pre-project flows
Stream Water Temperature (C^o)	Onset Data Logger - U20L-04	Record water temperature at 15 minute increments set on the hour (PST).	Maintain or reduce average stream temperature compared to pre-project conditions
Flow in Ditches (cfs and ac. ft./year)	Periodic discharge measurements will be made at established cross sections in order to establish a rating curve. A Pygmy flow meter will be used for velocities.	Periodic (weekly or more frequent) measurements as needed based on initial monitoring of flow variation during the day	Determine daily water delivery in ac. ft. compared to pre-project flows
Rooftop Rainwater Collection (gallons/year and ac. ft. per year)	Depth of water in storage tanks	Landowners will report following rainstorms changes in tank depth	Quantity water stored

Table 6.16 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Water Conservation Device Installation (gallons/year and ac. ft./year)	Self-reporting by property owners. Owners will provide a summary of all water conservation devices installed (toilets, low flow faucets, water tanks, etc)	One time report per participant	Estimate annual water saving from installation of low flow devices
Community Education Workshops	Sign In Sheets, Agenda, questionnaires. A questionnaire will be distributed at the beginning and end of workshop to assess changes in responses based on workshop presentations.	2-3 based on number of community meetings	Reach as many target water users as possible (~75 individuals or more)
Landowner Outreach and Education Outreach	Number of flyers distributed	As needed	Reach as many target water users as possible (~75 individuals or more)

Council staff will conduct site visits when landowners begin to use the new slow flow diversion infrastructure to store water to ensure that those systems are performing as designed. Additional site visits will be done if a landowner encounters any issues that they can't resolve during the water diversions. Another set of site visits will be done during the dry season to both document instream conditions and verify compliance with the terms of the SDU and LSA. This will

Table 7.16 – Cost Effective Analysis Project name: Northwest CA Resource Conservation & Development Council Trinity River Water Reliability and Drought Resiliency Project	
Question 1	Types of benefits provided as shown in Table 5: *Fishery benefits (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Water deliveries are an alternative for Browns and East Fork Hayfork Creek that were actually used last year. However, as explained above, that is not sustainable and causes a huge economic burden on these economically DAC residents. The average single water truck delivery of 2,500 gallons is estimated to be $200-$300 each. Typically this lasts between 7 to 20 days depending on the household size when people are financially very motivated to conserve in these extreme circumstances. Creating a new community water supply district to service residents in target watersheds that are not on a community supply is on theory an option, but is very cost prohibitive to pursue and would not result in the same water conservation education and upgrades included in this proposal. This option would have a multi-million dollar price tag that would cost exponentially more than this proposed project.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *N/A*
Comments:	

SANCTUARY FOREST, MATTOLE FLOW PROGRAM: MAINSTEM & TRIBUTARY STORAGE AND FORBEARANCE

PROJECT DESCRIPTION

Brief: This water storage and forbearance project improves salmonid habitat protection and ecological functions while addressing human water needs, security, public health and environmental justice.

Expanded: This project provides an adaptive strategy to climate change and drought that improves salmonid habitat protection and ecological functions while addressing human water needs, security, public health and environmental justice issues in the Disadvantaged Mattole headwaters community of Whitethorn. The project is needed because local water resources have been impacted by climate change and drought for 10 of the last 14 years. The Mattole River headwaters provide both the water supply for residents and businesses and habitat for endangered salmonids and other wildlife. In low flow years there is not enough water for basic human needs. Diversions during low flows result in drying of pools and loss of juvenile salmonid populations. There is no municipal water system and each landowner is on their own to develop their water diversion and supply system.

The proposed project improves summertime streamflows in the Mattole River headwaters by seasonally limiting diversions through storage and forbearance, thereby increasing water quantity, improving water quality, enhancing rearing habitat, and facilitating fish passage. The water conserved includes conservation improvements and leak-proofing, together with tank storage and cessation of all diversions during summer low flows. The project also provides water security for institutional and residential use in a rural community that is completely dependent on surface water diversions. Expected outcomes include 1) installation of 200,000 gallons of storage and associated water conservation and system improvements resulting in water security for 3 residential landowners (4 families); 2) improved streamflow and salmonid habitat in two tributaries and 5 miles of the Mattole headwaters mainstem where the project takes place; 3) improved protection of juvenile salmonids through installation of pump intake screens on 4 pumps; 4) operation of seasonal forbearance program with direct streamflow benefits in 9 miles of the Mattole headwaters mainstem and 5) increased community and regional climate resiliency due to water conservation resulting from education associated with the project.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation include, but are not limited to:

- **Primary: Water supply produced** equal to 0.61 AFY from construction of 200,000 gallon storage tanks, which provides a monetary benefit of about $49 per year (West Water Research. 2013, *2013 California Spot Market Price Forecast)*
- **Secondary: Species protection** of coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and Chinook (*Oncorhynchus tshawytscha),* which will benefit through increased instream flows during critical summer months. The project improves summertime streamflows by seasonally limiting diversions through storage and forbearance, thereby increasing water quantity, improving water quality, enhancing rearing requirements, and facilitating fish passage. Increased flows enhance water quality through oxygenation and help maintain viable pool habitat and pool connectivity for rearing and emigration. The project also protects juvenile salmonids from injury caused by inadequately screened diversions. Other species of special concern protected include River lamprey (*Lampetra ayresii*), Western tailed frog (*Ascaphidae truei*), Southern torrent salamander (*Rhyacotriton variegates*), and Foothill yellow-legged frog (*Rana boylii*).
- **Fishery benefits**: Water conservation improvements and leak proofing will conserve 0.55 AFY for instream flow; turning off 4 pumps @ 10 gpm each will provide 0.9 cfs of instream flow during critical summer months for the approximately 105 day period when the stream is too low for pumping. This benefit has a monetary value of approximately $44 per year (West Water Research 2013).
- **Habitat improved**: this project will improve fish habitat and passage benefitting 5.5 miles of mainstem and tributaries
- **Increased community capacity**: This project will increase community awareness of the effects of extended drought and methods to enhance water supply reliability while protecting instream habitat in a watershed with much interest and participation in water supply issues. Water conservation outreach and education will target 100 landowners and occur during six events to increase public awareness of conservation options. Additionally, nearby water storage will reduce wildfire risk to infrastructure.
- **Climate change adaptation**: The project promotes community resiliency by diverting water from the wet seasons for use during the dry season and provides adequate water for extended dry seasons and drought caused by climate change. Impacts on water resources and wildlife habitat are reduced through utilization of stored water in times of water scarcity, providing ecosystem resiliency.

Table 5.17 a – Annual Project Physical Benefits			
Project Name: Sanctuary Forest Mattole Flow Program: Mainstem & Tributary Storage and Forbearance			
Type of Benefit Claimed: Water supply produced - Primary			
Units of the Benefit Claimed : AFY			
Anticipated Useful Life of Project (years) 40 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	0.61	0.61
2020	0	0.61	0.61
2021	0	0.61	0.61
Through 2058	0	0.61	0.61
Comments: Project will be constructed in 2018; benefits will begin to accrue the following year.			

Table 5.17 b – Annual Project Physical Benefits			
Project Name: Sanctuary Forest Mattole Flow Program: Mainstem & Tributary Storage and Forbearance			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 40 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	7	7
2020	0	7	7
2021	0	7	7
Through 2058	0	7	7
Comments: Project will be constructed in 2018; benefits will begin to accrue the following year. Species protected include the state and/or federally listed coho, Chinook, and steelhead and 4 Species of Special Concern: river lamprey, Western tailed frog, Southern torrent salamander, and foothill yellow-legged frog.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Sanctuary Forest has researched causes and solutions to the low flow problem for 11 years (e.g., Mattole River and Range Partnership 2009, *Mattole Integrated Coastal Watershed Management Plan*, Foresight 20/20; Mattole River and Range Partnership 2011, *Mattole Coho Recovery Strategy*) and concluded that climate change accompanied by a longer dry season is the primary cause. As of the end of 2014, 10 out of the last 14 years had the lowest flows in 64 years of record at the Petrolia gage (USGS 2015, *USGS 11469000 Mattole R NR Petrolia CA*). All of these low flow years correspond with a longer dry season - 4 to 5 months without rain as compared to the historic norm of 3 months. Land use impacts to ground and surface water hydrology are also very significant and restoration of natural hydrologic systems is needed to provide resilience to drought (Trout Unlimited and Center for Ecosystem Management and Restoration 2013, *Mattole River Headwaters Streamflow Improvement Plan*).

Water management impacts due to the 2014 drought include insufficient local water supplies for local residents as well as insufficient regional water supplies normally relied on for water deliveries when local supplies are insufficient. Impacts to fish and wildlife have increased under drought conditions because there is not enough surface water for basic human needs and for wildlife. Water theft and conflicts over water also increased with the 2014 drought. The Mattole headwaters forbearance period was longer in 2013 & 2014 due to the drought and a dry spring in 2015 has resulted in an earlier forbearance season, significantly lower groundwater levels (measured at groundwater monitor wells where no groundwater pumping takes place) and streamflow levels typical of one month later into the dry season.

Off-stream storage has become a widely recognized solution to this problem (Klein 2015, *Hydrologic Assessments of Low Flows in the Mattole River Basin 2004 – 2014*, p. 10 – 18). The California Department of Fish and Wildlife and the State Water Resources Control Board have developed expedited permitting for permits needed to divert and store water during high flows for use during low flows as an emergency response to the 2014 drought. The March 13, 2014 CDFW news release announced this decision along with information about how to apply (CDFW 2014, *State Streamlines Domestic Water Tank Storage Process in Response to Drought*, available: https://cdfgnews.wordpress.com/2014/03/page/2/). The article names Sanctuary Forest as one of the groups that contributed to this solution.

The urgency and need for the Mattole Flow Program - Tributary Water Storage and Forbearance project is extreme. Climate change and a pattern of longer dry seasons (5 months as compared to the historic norm of 3.5 months) have severely impacted the Mattole salmonid and human communities. Monitoring of the two Mattole tributaries of this proposal show that in drought years (10 out of the last 14), flows drop to zero, resulting in disconnected pools with hundreds of trapped salmonids. Because these mainstem and tributary reaches have been assessed with high habitat value for coho and steelhead by state and federal agencies, the need to improve instream flows is very high (NOAA NMFS 2014, *Southern Oregon Northern California Coast Coho Recovery Plan, Chapter 29. Mattole River*

Population, p. 29 – 1, 29-11, 29-13,29-18-19). Additionally, the need for water security by the residents of these tributaries is very high, both to meet basic water needs and for fire safety.

Estimates of Without-Project Conditions

Without-project conditions include the following impacts: lack of water security for household and business use; lack of fire suppression water supply; and cumulative impacts to streamflow of 40 gallons/minute (0.1 cfs) if all 4 landowners are diverting water at the same time. Because streamflows in the Mattole headwaters where the diversions take place drop to 0.2 cfs or 90 gallons/minute in low flow years and zero in extreme drought years, the cumulative impacts can be catastrophic to juvenile salmonids. In the stream reaches where this project takes place, diverting during the low flow season can completely dewater pools and cause fish kills. Without project implementation, these conditions will persist.

Lack of potable water supply is also a critical problem. There is no municipal water supply in the Mattole headwaters; each landowner must develop their own water system. Most landowners are dependent on surface water and springs that dry up or become very low in drought years. Wells are not usually an option because most of the wells that have been drilled in the headwaters either do not yield any water or the water is of poor quality. Therefore, storing water for the dry season or trucking in water are the only available options. Currently, the closest water available for purchase is from the town of Fortuna (40 miles) and it is unknown how long Fortuna will be able to continue supplying water to other watersheds. Without the project, sufficient storage to last the dry season cannot be installed due to the expense of storage and the corresponding lack of resources in this Disadvantaged Community. Lack of adequate water supply for fire suppression is already an issue. During the drought in January 2014, lack of water resulted in loss of home in Whitethorn that could have been saved if water was available and stored nearby. Without project implementation, these conditions will persist and worsen.

Methods Used to Estimate Physical Benefits.

The methods used to estimate the physical benefits for water supply and conservation include landowner interviews with the landowners included in the project as well as estimates based on community wide water use questionnaires and 8 years of experience implementing the Mattole storage and forbearance program. Human water use is significant when flows are low and in the Mattole headwaters represents 20 - 100% of the flow. Therefore, Sanctuary Forest has developed two strategies to address drought: changing human use and restoration of ground and surface water hydrology.

In the 8 years Sanctuary Forest has been implementing the storage and forbearance program, 50,000 gallons of storage has been proven to be sufficient for a 3 person family and 1500 sq. ft. of irrigated garden, lawn or orchard for a period of 105 days. The amount of water conserved is estimated from the pre project water use, the improvements that will be incorporated with the storage system, and the allocated water use per day provided by the storage system for each landowner. The pre- project combined water use per day for the 4 landowners is 3600 gallons/day. The amount allocated per day is equal to the total storage of 200,000 gallons/105 days or 1905 gallons/day. The difference between the

pre project water use and the allocation per day is estimated: 3600-1905= 1695 gallons/day (Sanctuary Forest, 2015, *Conceptual Plans*).

The largest component of the conserved amount is leak proofing along with weekly monitoring of water use by the landowner. Again, our 8 years of experience has shown 100% landowner success with reducing their water use to the allocated amount through water conservation, leak proofing and vigilant monitoring of water use; the amount of storage and the quality of the water has been sufficient for all landowners in all the years of the program. Additionally, because landowners are able to pump and store water when clarity and quality are good, their stored water is of better quality then when they were practicing direct diversion. The streamflows have improved as compared to pre-project flows and water conservation awareness in the entire community has increased. The instantaneous streamflow benefits of this project are equal to the sum of the 4 pumps or 0.09 cfs. The amount of streamflow needed for pool connectivity is 0.2 cfs. Therefore this project significantly contributes to maintaining minimum flows and pool connectivity, which results in improved instream habitat to benefit listed and special concern aquatic wildlife species.

Water quality benefits are based on specific project design and engineering for each system. Watershed rehabilitation benefits are based on evaluation of existing systems and identification of surface water diversion locations and pumping rates for each landowner. Climate change adaptation benefits are based on 10 years of monitoring streamflow in the Mattole headwaters as well as analysis of the Petrolia gage indicating that 9 out of the last 13 years have the lowest flows in the 64 year record.

New Facilities, Policies, and Actions

This project involves the construction of a water storage tank and appurtenances, installation of fish screens, and outreach to residents. Additionally, continued operation of the forbearance program is needed to obtain the physical benefits. This includes monitoring streamflows at site MS6 in the Mattole headwaters to determine forbearance threshold flows; outreach to participants and the community with no- pumping alerts; letters and phone communication with all participants giving notice at the beginning and end of the forbearance season and landowner compliance monitoring. Sanctuary Forest is currently working on streamlining the monitoring component of this work to reduce the cost of the program in future years. This approach is based on developing flow relationships between the USGS Ettersburg gage and the MS6 headwaters site such that MS6 flows can be estimated from the Ettersburg gage. Continued operation of the Ettersburg gage is needed to achieve this goal.

Potential Adverse Physical Effects

There is minimal grading and vegetation removal for preparation of the water storage sites. However all work is conducted under the CDFW mitigated negative declaration and approved by CDFW staff. No work is conducted that would impact rare or endangered plants, and any adverse physical effects will be immediately mitigated using appropriate BMPs.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Achieve long-term reduction of water use
3. Solutions that yield a new water supply

Humboldt County has issued a drought emergency proclamation and initiated a Drought Taskforce (DWR 2015, *Drought Update July 28, 2015*). Water management impacts due to the current drought include insufficient local water supplies for local residents as well as waning regional water supplies normally relied on for water deliveries when local supplies are insufficient. Impacts to fish and wildlife have increased under drought conditions because there is not enough surface water for both basic human needs and wildlife. Water theft and conflicts over water also increased with the 2014 drought. The Mattole headwaters forbearance period was longer in 2013/2014 due to the drought and extended until 2/12/14 for tributary diversions. The summer drought-related fire danger will be extreme with insufficient water storage and water in the streams to fight the fire. If the drought continues into 2016 all of these impacts will be exacerbated.

This project increases water supply reliability through diversion of water during higher flows and storage for use during low flows. Water conservation and efficiency improvements are also incorporated. The water storage infrastructure improvements effectively address long term drought preparedness by providing storage systems with a 40 year expected lifespan. Additionally watershed protection and management is addressed through the direct benefit of reducing summertime diversions as well as the education and outreach incorporated in the project. Ecosystem and fisheries restoration and protection are addressed through improved flows and through installation of pump intake screens.

The project includes adaptive management and flow monitoring as part of operating the summertime storage and forbearance program. These elements are essential to drought preparedness because they provide a system for alerting the community to low flows, informing participants and the community when to fill tanks and when to forbear and providing technical assistance to address water scarcity and to address water system problems

DIRECT WATER RELATED BENEFIT TO A DAC

This project will serve the Mattole River headwaters community of Whitethorn, a State recognized DAC, with a residential population of approximately 128 households, an elementary school, a business/residential complex, and two farmers' market sized farms. This project helps provide safe reliable drinking water and water security. This project has strong community support with 20 forbearance program participants and most of the other residents practicing water conservation along with forbearance to the extent feasible. Local support is also demonstrated through landowner cost share and local volunteer commitments. Please see Attachment 7 for greater detail on DAC status.

The project serves all of the existing 20 participants and the Mattole Headwaters community as well as the new forbearance families proposed through operation of the seasonal forbearance program. This seasonal program is essential to the success of the forbearance program because thresholds are based on streamflows not calendar dates and therefore both stream monitoring and landowner notifications along with compliance monitoring are needed. The seasonal forbearance program also incorporates the CDFW 1602 for water diversions and thereby increases landowner collaboration by decreasing the necessary paperwork and reduces the CDFW 1602 staff workload (CDFW 2015, *Lake and Streambed Alteration Program*). The flow alerts and forbearance instructions are also shared with the entire community through radio, roadside signage and website.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.17 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Increased Water supply Reliability	Pre and Post project photos	Before and after implementation at 4 sites	200,000 gallons installed and 4 families served
Increased juvenile salmonid protection from pump diversions	Pre and Post project photos	Before and after implementation at 4 sites	Four CDFW compliant fish screens installed
Increased flow for fish and wildlife	Streamflow monitoring ; Quality Assurance and Quality Control Plan for Mattole Flow Program: Streamflow Trend Monitoring	Twice monthly during the low flow season	378,000 gallons/season from 4 family project
Increased flow for fish and wildlife	Streamflow monitoring: Quality Assurance and Quality Control Plan for Mattole Flow Program: Streamflow Trend Monitoring	Twice monthly during the low flow season	20 gallons/minute for entire headwaters forbearance (25 participants)
Increased flow for fish and wildlife	Posting of streamflow levels and pumping restrictions on public road sign	Maintain annually June- December with streamflow level updates twice monthly	40 gallons/minute for entire headwaters community (~128 families)

The performance of the project will be monitored both for water security benefits and streamflow benefits. Annual landowner monitoring includes review of the landowner water use log, and adequacy

and quality of the stored water. Annual landowner monitoring is also used to ensure compliance with the forbearance agreement. Streamflow benefits are evaluated through regular seasonal streamflow monitoring at established monitoring sites bracketing the project reach. The post project data will be compared with 4 years of pre-project monitoring to determine improvements in flows.

COST EFFECTIVE ANALYSIS

Table 7.17 – Cost Effective Analysis **Project name: Sanctuary Forest Mattole Flow Program: Mainstem & Tributary Storage and Forbearance**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply produced (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Groundwater recharge along with installation of cisterns and pumping of shallow groundwater could be used in conjunction with water storage tanks with less tank storage needed along with groundwater storage benefits for streamflow. However further development is needed for design and permitting of this type of project, which would take years while the wildlife and community of Whitethorn would continue to suffer from worsening drought conditions.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The proposed project is a proven technique to provide drought relief to both communities and ecosystems in a timely manner. Costs of the alternative above would likely be similar to the costs for the storage and forbearance program. The reduced costs resulting from less storage tanks would be offset by the costs of building the groundwater recharge basin, associated cistern, and delivery infrastructure.*
Comments:	

SHASTA VALLEY RESOURCE CONSERVATION DISTRICT, SHASTA RIVER DROUGHT RESPONSE AND IRRIGATION EFFICIENCY PROJECT

PROJECT DESCRIPTION

Brief: This project includes on-farm water efficiency upgrades and technical assistance to improve water quality in the Shasta to benefit salmonids and increase community climate resiliency.

Expanded: Funding for this project is requested in order to continue existing efforts by the Shasta Valley Resource Conservation District (SVRCD) to implement water quality and irrigation efficiency improvement projects in the Shasta River watershed. Average precipitation in the Shasta River basin is 12", and snow is an essential component of the watershed's hydrography. A reduction in the snow-pack due to the persistent drought conditions has in turn reduced the amount of cold water delivered to the Shasta River. According to the Southern Oregon Northern California Coho Recovery Plan, the threat of extinction 'high' for the Shasta River coho (*Oncorhynchus kisutch*) population due to increasing temperatures, changes to the hydrograph, agricultural water use, and impacts to water quality (NMFS 2012*, Southern Oregon Northern California Coho Recovery Plan, Chapter 37. Shasta River Population*, p. 37-1, 37-2 – 37-8). The Shasta River is 303(d) listed for high temperature and low dissolved oxygen, and agricultural activities (livestock impacts and irrigation) have been identified as the main source of these impairments (NCRWQCB 2012, *The Integrated Report – 303(d) List of Water Quality Limited Segments and 305(b) Surface Water Quality Assessment*, available: http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/303d/). In light of the current and persistent drought and the 2005 ESA listing of coho salmon, there is increasing pressure on private agricultural landowners within the Shasta Valley to improve water conservation and irrigation efficiencies to maintain and improve instream flows. The projects outlined in this proposal will aid this severely economically disadvantaged community in achieving their TMDL voluntary water conservation targets.

The Shasta River watershed's surface water resources are over-allocated during the summer months. The proposed projects will directly assist landowners in controlling irrigation efficiency and directly address the concerns of the Shasta River TMDL by improving water conveyance infrastructure, replacing failing flow measurement equipment, and providing associated water efficiency monitoring and advisory support to landowners. The projects are located in Reach 3 of the Shasta River (Willow Creek to the mouth of the Little Shasta River) and will have a synergistic impact on water quality and water conservation. While there has been some work done in the Reach, notably the removal of a diversion dam at the Shasta Water Users Association take-out; many irrigation infrastructure improvements are still needed to ensure maximum water efficiency in this reach. This work is directly related to water quality improvement work in the Shasta River watershed, and is an important part of these coordinated efforts.

This proposal includes the installation of on-farm flow measuring sites and equipment and designs for replacement of earthen ditches with pipeline. Another component involves starting a drought response service providing assistance with leak detection, irrigation assessments, and water management

training. An outreach component aligns this project with the Shasta Watershed Stewardship framework which tracks and shares stewardship actions and benefits.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation include, but are not limited to:

- **Primary: Water supply saved** of 579 AFY
    - Increased streamflow for agricultural purposes estimated to be 339 AFY for an estimated monetary benefit of $19,323 per year using a conservative value of $57 per AF per year for increased instream flow for agricultural purposes (West Water Research 2013, *2013 California Spot Market Price Forecast*).
    - Increased streamflow for environmental purposes estimated to be 240 AFY, providing an estimated monetary benefit of 19,200 per year using a conservative value of $80 per AF per year for increased instream flow for environmental purposes (West Water Research 2013).
- **Secondary: Species protection** for coho and Chinook salmon and steelhead: Many irrigators impact the instream conditions in the Shasta River and its salmon species. Projects such as these provide new tools and education for a voluntary approach to water conservation and irrigation efficiency that implements the Shasta River TMDL and recommendations in the Southern Oregon Northern California Coast Coho Recovery Plan (NOAA NMFS 2014, *Chapter 37. Shasta River Population*, p.37-25 – 37-28). Valuable cool water in the river can be protected when irrigation is monitored more accurately, leading to improved habitat for over-summering juvenile Coho salmon. Elevated water temperatures and low flows are the primary limiting factors for Coho abundance in the Shasta
- **Habitat improvement** to instream habitat through increased flow during summer months and the associated decrease in temperature and increase in Dissolved Oxygen
- **Avoided electrical costs** of $3,140 for a reduction in electrical costs of 39,250 kWh at $0.08 per kWh (PP&L) due to pumping less hours for a reduction in total volume of water pumped. Pumps are likely to be turned off for a few days each month with project implementation.
- **Decreased Operation and Maintenance** costs due to reduced need to drive throughout the districts to visually inspect gauges and other measuring equipment and to manually adjust flows.
- **Conflict reduction**: This project will reduce water resource conflicts between agricultural users and other beneficial uses of water in a basin well-known for controversy between agricultural and environmental stakeholders. This benefit is expected to provide a monetary value conservatively estimated at $10,000 per year for five years in the form of reduced need for legal services.
- **Climate mitigation**: This project will mitigate CO2 through two mechanisms: less VMT due to remote monitoring and control of irrigation infrastructure and decreased GHGs due to decreased pump use.

- **Climate change adaptation**: These projects in total are a package designed to improve management options and strategies by the districts that impact instream conditions in the Shasta River and provide community resiliency for expected conditions associated with climate change including hotter drier weather and droughts of increasing duration. Water measuring is a science that has come of age only in the last decade in the Shasta River due to the interplay between the cost of water and the cost of measuring equipment. Technological advances often seen as standard in parts of California are being implemented by this project, such as remote monitoring of flows, and billing by usage. Additionally, this project will increase community capacity through education; at least 325 people will learn about irrigation efficiency measures, which is expected to provide physical benefits beyond the scope of this project that will increase community resiliency to the more unpredictable precipitation events and longer drought periods expected with climate change.

Table 5.18 a – Annual Project Physical Benefits			
Project Name: Shasta Valley RCD Shasta River Drought Response and Irrigation Efficiency Project			
Type of Benefit Claimed: Water supply saved - Primary			
Units of the Benefit Claimed : AFY			
Anticipated Useful Life of Project (years) 10 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	144.75	579	434.25
2020	144.75	579	434.25
2021	144.75	579	434.25
Through 2028	144.75	579	434.25
Comments: Project implementation will occur in 2018; benefits will begin to accrue the following year. According to the project proponent, about 25% of the physical benefits provided by this project will be implemented through other funding.			

Table 5.18 b – Annual Project Physical Benefits			
Project Name: Shasta Valley RCD Shasta River Drought Response and Irrigation Efficiency Project			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 10 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	1	3	2
2020	1	3	2
2021	1	3	2
Through 2028	1	3	2
Comments: Project implementation will occur in 2018; benefits will begin to accrue the following year. Species protected are coho, Chinook, and steelhead. According to the project proponents, about 25% of the physical benefits provided by this project will be implemented through other funding. Because a partial species does not make sense, we chose to show this through a 33% match in benefits. In actuality, all three species would benefit more from project implementation and all three species will also receive some benefit from the projects funded through other sources.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Irrigation in the project areas has been underway for over one hundred years. Improvements have been made along the way, but are currently rudimentary, outdated, and inaccurate. Economic conditions in this Disadvantaged Community are such that very few landowners or districts can afford the infrastructure and equipment that is needed to bring their system up to date in terms of improved accuracy and water efficiency. Recent conditions include water quality issues exacerbated by drought, an over-adjudicated system in the Shasta, and declining salmonid habitat and numbers.

The Shasta River is considered an impaired water body by the Regional Water Board, for dissolved oxygen and temperature with a TMDL adopted in January 2007 by the Environmental Protection Agency (NCRWQCB 2006, *Staff Report for the Action Plan for the Shasta River Watershed Temperature and Dissolved Oxygen Total Maximum Daily Loads*). Furthermore, the Southern Oregon/Northern California Coho has been listed as threatened both state and federally (NOAA NMFS 2014). Current irrigation practices present challenges for juvenile salmonid outmigration and adult spawning. Outmigration typically coincides with the onset of irrigation season and low flows are associated with impaired habitat, reduced fish passage, increased water temperature and low dissolved oxygen, leading to reduced habitat quality and ultimately, reduced juvenile survivorship (CDFW 2015, *Scott River and Shasta River Instream Flow Study Plan Development, Shasta River Habitat Suitability Criteria*). Similarly, Chinook spawners are affected by low flows in the lower reaches of the Shasta River as upward migration can be impeded by low flows and poor water quality conditions.

Estimates of without-project conditions

The without-project conditions are continuation of the status quo, in which the watershed's irrigators are sorely lacking in physical and technologic advances that can bring them into a world of water conservation and incentive-based operations. Improvements are slowly being made through past and current projects, but it is important that this work is not done piecemeal but rather as one large effort in which all work is compatible and connected. This project plays an important role in responding to drought conditions and providing immediate action for irrigation efficiency. Without this project, the physical benefits can be estimated at 25% of those expected for this project through work that is being done by other funding.

Description of methods used to estimate physical benefits

The physical benefits were estimated using a 2003 study entitled *Water Conservation Study* (Forsgren Associates, Inc. 2003); it was conducted for The Great Northern Corporation on behalf of the Shasta Water Users Association (SRWA) and funded by the California Department of Fish and Game. Methods used and references are as follows:

- Flow and fishery improvement: Allocated a percentage of water savings in the 5 to 10 % range per project area upon completion of the entire project Method and percentage for SRWA

(Forsgren Associates, Inc. 2003, p 22) was applied to other areas using the same approach. Flow was split into Agricultural and Environmental as some flow does not apply to both.

- Avoided electrical costs: Based on information from irrigators regarding how many days they could reduce or delete pump activity. Electrical usage costs were obtained from a schedule from the power company.
- Temperature reduction and dissolved oxygen increase: Estimated by similar modeling efforts in Shasta Valley based on the flow increase estimate (SVRCD and McBain & Trush 2013, *Study Plan to Assess Shasta River Salmon and Steelhead Recovery Needs*, p. 22-35, 43).
- Decreased operation and maintenance costs: Estimated by known similar number of hours needed and estimated labor cost of $10 per hour.
- Education or technology benefits: Number of irrigators receiving information and training.
- Avoided water resources conflicts: Estimated from similar known legal retainer fees or costs.

Identification of all new facilities, policies, and actions required to obtain the physical benefits

This project will install twelve new irrigation measuring structures to improve control and delivery of irrigation water and designs for irrigation conveyance pipelines. No new policies are required, but the improved infrastructure will improve the management and provide economic incentive to use water efficiently due to new pumping costs. Education and outreach for a new billing structure for SRWA will be a component of this project. This project will provide improved water measuring sites by installing accurate measuring equipment; irrigators must be willing to change their irrigation practices and tracking (i.e. billing) methods in order to fully maximize the potential project benefits.

Description of any potential adverse physical effects and what is being done to mitigate those impacts.

This project includes updating existing irrigation infrastructure to convey and measure water more efficiently in the Shasta watershed. At this point no adverse physical effects are expected as new water measurement structures will utilize existing ditch systems and will not involve re-routing or new ground disturbance. This work will occur on heavily disturbed irrigated pasture lands with predominately non-native grasses and forage that are grazed by cattle, making them unlikely locations for rare or endangered plants. These active farming locations have roads and common staging areas that are already well established. An initial study will be completed under the California Environmental Quality Act which will survey the ground for potential physical effects, and propose mitigation measures if it is deemed necessary but this is not expected.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Achieve long-term reduction of water use

The Shasta River is fully adjudicated and has water-mastering service for the irrigation districts, associations and individual users. During this drought, the management and water-mastering of surface flows has become increasingly difficult. Due to the current drought, several irrigation districts, including the Montague Water Conservation District (MCWD) were not able to deliver more than 1 cycle to their 220 customers in 2014, resulting in severe impacts including widespread livestock feed and water shortages. Siskiyou County is in a severe drought, and is experiencing the 3rd driest year on record as of this date (Siskiyou County Agriculture Department et al. 2014, *Agricultural Drought Survey Report*); the county has issued a Drought Emergency Proclamation and initiated a Drought Taskforce (DWR 2015, *Drought Update July 28, 2015*). The City of Montague, which has also declared a Drought Emergency (DWR 2015), implemented mandatory water shortage emergency procedures as early as April 2014. Long-term impacts related to the drought are difficult to quantify, but qualitative information is widespread with economic hardship common in the agricultural community.

Shasta River surface water resources have always been limited and are dependent on cooperative strategies to extend and sustain them. These projects and many more like them have been valuable for partners and irrigators in learning to work together for long term agricultural and environmental security. Combining improved water measuring with water conservation structural improvements such as pipelines will extend our ability to manage surface water for multiple benefits at an economically viable scale. Over the next few decades, these improvements will be critical in balancing expected long-term drought cycles in the basin.

DIRECT WATER RELATED BENEFIT TO A DAC

Siskiyou County is 90% rural and poor in terms of relative economic wealth in California. This project is located within the "Severely Economically Disadvantaged Community" designation under DAC Block ID (06093003001and 06093003003), and is an area with a sparse population of agricultural landowners. There are 365 economically disadvantaged working family farmers with 138,000 irrigated acres that will be served by this project. All benefits described above will accrue directly to the community and indirectly to the region and the entire state and nation inasmuch as they contribute to the survival of listed salmonid species.

This project has direct benefits to the economy of the area by supporting ranching viability through efforts to hire local contractors and provide support to Shasta River watershed landowners. Shasta River watershed agricultural landowners are under increased scrutiny to meet the targets of the TMDL, ensure no incidental take, and improve irrigation efficiency. These projects are cost prohibitive for landowners within this Economically Disadvantage Community to undertake on their own, thus, this project provides environmental justice benefits as well as the quantitative benefits described.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.18 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Project infrastructure	Photo points will be established using State Water Board's stream photo documentation procedure (SOP 4.2.1.4)	Pre- and post-project implementation	Technologically appropriate irrigation monitoring and control equipment
Increased Instream Flow for Environmental Purposes	New water billing structure will outline water usage pre-and post- project	Quarterly	240 acre-feet/year
Increased Instream Flow for Agriculture	New water billing structure will outline water usage pre-and post- project	Quarterly	339 acre-feet/year
Avoided Electrical Costs	New water billing structure will outline water usage and savings on irrigation pump costs pre-and post- project	Quarterly	39,250 kw/year
Critical Times Flows	Utilization of DWR gages	April- October Hourly gage measurement	339 AF
Fishery Improvement	New water billing structure will outline water usage pre-and post- project	Annually	240 acre-feet/year
Decreased Operation and Maintenance Costs	District records	Annually	$20,000 reduction in O&M: $5,000 for two years for remote access to measuring equipment

Irrigation structures will be used to refine flow measuring within 2 irrigation districts. In order to assess future water conveyance improvements, pre-project ditch loss assessments will occur in order to quantify the water seepage currently occurring in unlined ditches. New infrastructure including water boxes will be able to relay the amount of saved acre-feet of water per irrigation season. Monitoring will also include flow, temperature and dissolved oxygen measurements to quantify changes pre- and post-project in Reach 3. Photo points will be established using the *USFS Photopoint Monitoring Handbook* (USFS 2005, PNW-GTR-526) to document change. The SVRCD has maintained an extensive monitoring program since 2008 under SWAMP and CEDEN protocols and is a contributor to the Klamath Basin Monitoring Program.

Water conservation benefits and energy savings can be further refined by the Water Conservation Technician after project funding and job development. The SVRCD will calculate ditch loss measurements in all sections where pipeline designs are completed for construction benchmark data collection. Other metrics including measuring the overall benefits of improved water scheduling and delivery based on better measuring technology, which will require landscape-scale analysis. SVRCD staff will work with the irrigation districts' staff to quantify benefits including power savings, water conservation benefits, and possibly instream benefits.

COST EFFECTIVE ANALYSIS

Table 7.18 – Cost Effective Analysis Project name: _Shasta Valley RCD Shasta River Drought Response and Irrigation Efficiency Project_____	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) & Species Protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Several projects are in the planning phase and design alternatives are to be explored. Other alternatives do exist but have not been considered for design cost estimates as they will not achieve the same benefits. The Water Conservation Study completed by Forsgren includes a discussion of conversion of a portion of the SRWA to sprinklers. This has not been widely adopted by landowners due to a variety of factors, including cost of water, delivery schedules, crops grown, topography and soils constraints. All projects partnering with the USDA NRCS have project planning and landowner alternatives discussion as part of the official record for the project. This proposal includes 6-8 projects. In most cases, alternatives have been extensively explored during the planning process with landowners, agencies and other interested stakeholders. Often these discussions are not systematically recorded or made part of the final proposal. While this often can become an oversight, it is difficult to recreate all the stages and phases of project development of these multi-year and multi-agency funded efforts.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The planning phase eliminates all non-cost-effective options. Only the most preferred cost effective designs are considered.*
Comments:	

RESORT IMPROVEMENT DISTRICT NO. 1, SHELTER COVE WATER RECYCLING PROJECT

PROJECT DESCRIPTION

Brief: This project designs a recycled water system to improve water supply reliability for disaster preparedness and landscape and agricultural irrigation, and to mitigate water theft.

Expanded: The Resort Improvement District #1 (RID) provides potable water to the Shelter Cove (SC) community. All water used by the RID is primarily provided by one stream (Telegraph Creek) and the RID also operates and maintains 13 ground water wells and one spring. Telegraph Creek is a small creek with limited capacity that is highly vulnerable to drought and seasonal flow restrictions. RID has a permit mandating a minimum bypass flow of 0.775 cubic feet per second for the benefit of Telegraph Creek. RID provides wastewater services to the majority of the homes in the Community, and there are approximately 464 connections; 95% of these are residential and 5% are commercial. The service includes wastewater collection, treatment, and disposal. RID has an NPDES permit to discharge to the Pacific Ocean; however, this discharge is to an Area of Special Biological Significance (ASBS) and adjacent a Marine Protected Area (MPA).

In response to prolonged drought and state mandates, the RID endeavors to reduce water use and limit diversions from Telegraph Creek. Therefore, the RID proposes to design and engineer a tertiary water recycling system that will expand its existing water recycling program, which currently serves only part of its 9-hole golf course. Upon construction (with funding to be obtained at a later date), the upgrades will further reduce the RID's ocean discharge and will provide residents with recycled water for landscape and small-scale agricultural irrigation. This proposal is for the design of a tertiary water recycling system that will expand the capacity of the existing tertiary recycled water treatment system, and install a recycled water storage. Once RID residents have agreed to abide by State requirements for the use of recycled water, which includes onsite inspections, they will be allowed to allocate recycled water from a secure storage tank for landscape and small scale agricultural irrigation. This increased capacity will reduce discharge of treated wastewater into the Pacific and provide an alternative to water theft.

State policy strongly encourages the use of recycled water where feasible. The Shelter Cove Fire Department generally responds to approximately 30 wildfires each year within two miles of the community and will use tertiary treated recycled water for fire suppression. In addition, over the past two years approximately 30% of Shelter Cove's water supply is unaccounted for partially due to recent water theft from private water tanks and hydrants, thought to be associated with illegal marijuana growing operations. Additional water recycling and storage, when built, would provide water to the community and mitigate against ongoing water theft.

Shelter Cove is geographically remote and must be prepared for episodic events like earthquakes and drought disasters. It has NO external water source. The physical, economic, and environmental benefits of expanding tertiary water recycling are consistent with IRWM initiatives for outreach/partnerships, economic vitality for disadvantage communities, and drought preparedness.

PROJECT PHYSICAL BENEFITS

This project intends to provide direct water-related benefits to a project area entirely comprised of a DAC (Shelter Cove is a State-recognized Disadvantaged Community) **and is in the planning and design phase. There will be only test well construction with this solicitation, no project implementation, so in accordance with instructions on pages 18 & 19 of the 2015 Proposition 84 IRWM PSP, we have not quantified benefits (i.e., completed Table 5).** However, we have provided a qualitative description of the proposed work and the anticipated benefits of the project upon completion of construction.

Physical benefits anticipated upon completion of construction (when future funding is obtained) include, but are not limited to:

- **Primary: Water supply recycled** in the amount of 0.77 AFY, reducing demand on Telegraph Creek and other creeks in the watershed currently being impacted by diversions for illegal marijuana cultivation.
    - The value of water lost due to water thefts is estimated at $376,234 per year and will be partially remedied with water reuse and recycling. The RID estimates it could reduce water thefts up to 80% providing an estimated monetary benefit of $300,987 per year.
    - Residential landscape irrigation represents the single largest end use of residential water, accounting for up to 35% of total use (DWR, 2009, *California Water Plan Update 3009. Bulletin 160-09, Volumes 2 and 5*). The RID uses a conservative estimate of 10% for local residential demand used for irrigation purposes. Using this figure, disadvantaged residents can realize a savings of $165 annually using recycled water for their irrigation needs.
    - The project will make 40 – 50,000 gpd available for ag use during dry periods
    - Approximately 60,000 gpd will be used for spray irrigation of the Golf Course and 32,000 gpd for agricultural users.
    - At any one given time, up to 100,000 gallons of treated wastewater will be available for firefighting purposes and once used, this amount will be refilled for further use.
- **Secondary: Species protection:** By providing a legal, alternative source of water for marijuana grows, this project is expected to benefit endangered coho (*Oncorhynchus kisutch*), which have been negatively impacted by altered or diminished instream flows (CDFW 2004, *Recovery Strategy for Coho Salmon*). Recent studies have found that marijuana cultivation has a negative impact on watershed health and sensitive aquatic species (Bauer et al. 2015, *Impacts of surface Water Diversions for Marijuana Cultivation on Aquatic Habitat in Four Northwestern California Watersheds*, PLOS One, 3.18.2015).
- **Habitat improvement**: This project will reduce impacts of surface water diversions for marijuana cultivation on aquatic habitat in the Telegraph Creek watershed by allowing growers access to an alternative water source. Unfortunately, due to the poorly regulated nature of marijuana cultivation, the acreage or terrestrial or aquatic habitat improved through reduced withdrawals by marijuana growers is beyond the capacity of this DAC to estimate. Indeed, State and federal officials are currently grappling with methods for understanding ecosystem impacts from illegal diversions for marijuana cultivation (Bauer et al. 2015).

- **Enhanced fire-fighting capabilities**: Having available a reliable source of water for fire protection and suppression during drought conditions is paramount to protect life, property and the economically important ecosystem of Shelter Cove. At any given time, up to 100,000 gallons of treated wastewater will be available for firefighting purposes in an area zoned "Very High Fire Hazard Severity" in the *Humboldt County Community Wildfire Protection Plan* (Humboldt County 2013).
- **Climate change adaptation**: by increasing recycled water capacity, Shelter Cove is increasing its drought and climate resiliency. With a hotter drier climate and increased drought cycles predicted, greater availability of recycled water for non-potable needs such as irrigation and fire suppression are vital to this community's sustainability.

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Existing drought conditions provide the need for the further development of this project. Making additional recycled water available to the community will reduce the amount of limited treated water being utilized for landscaping by approximately 40,000 gallons daily. Additionally, the ability of the District to provide recycled water to the community will provide a reasonable relief from thefts of the drinking water supply used for "garden" irrigation (thought to be unregulated marijuana cultivation). Just one instance of theft this year totaled 146,800 gallons of potable water.

Additionally, the District's geographical situation centers it in an area of wildfire potential, the most recent in 2013, and the most recent wildfire in the King Range National Conservation Area requiring drinking water supply for wildfire suppression was in 2006. The *Humboldt County Community Wildfire Protection Plan* (CWPP) *Chapter IV.13.3* describes Shelter Cove as being in a very high fire hazard severity zone. Shelter Cove's total residential and commercial property value in 2014 was $246,365,547 as supplied by the Humboldt County tax roll and the District owns over $15M in assets which would be in jeopardy should a wildfire burn through the area.

Shelter Cove residents use treated potable domestic water delivered by the RID for landscape and domestic agriculture irrigation needs. CA Government Code *(§ 65601 – 65607*), in the *Water Recycling in Landscaping Act* (http://www.leginfo.ca.gov/cgi-bin/displaycode?section=gov&group=65001-66000&file=65601-65607) identifies the use of potable domestic water for landscaped areas as a waste or unreasonable use of potable water (if recycled water is available) and strongly encourages replacement with recycled water where feasible. The RID is seeking to expand its recycled water program to include the sale of water to individuals for landscape and small scale agricultural/horticultural irrigation. As conceived, the RID would offer recycled water in bulk for sale at the wastewater treatment plant. Customers would fill their personal water tanks and transport recycled water to their home sites. Currently treated wastewater is discharged into the Pacific Ocean or is used to irrigate public land. Summer discharge is 100,000 gpd and 38% is used to irrigate public land. This project will provide an additional 40-50,000 gpd for home landscape and agricultural use during dry periods.

*Estimates of Without-Project Conditions **

This grant is for the design and engineering to increase wastewater recycling. Without the D&E, the project may not proceed, and the District would not be able to capitalize in increasing its use of recycled water, and its current NPDES discharge to the ocean would remain unchanged. The discharge point is into an Area of Special Biological Significance (ASBS #7). Additionally, the benefits outlined above, including protection of coho habitat through decreasing instream withdrawals, would not occur, making the watershed and its residents more vulnerable to extended drought conditions, increased fire frequency, and hotter, drier conditions expected with climate change.

*Methods Used to Estimate Physical Benefits **

The State Water Resources Control Board has established a Recycled Water Policy which establishes a mandate to increase the use of recycled water in California by 200,000 AFY by 2020 and by an additional 300,000 AFY by 2030. In accordance with the provisions of the Recycled Water Policy, a Constituents of Emerging Concern Advisory Panel has been established to address questions about regulating CECs with respect to the use of recycled water. A report produced by the CEC Advisory Panel entitled *Development of Bioanalytical Techniques for Monitoring of Constituents/chemicals of Emerging Concern (CECs) in Recycled Water Applications for the State of California* sets forth the scientific basis for the reduction of pathogens in wastewater treated to a level that meets public safety requirements. The report concluded that treatment systems designed to meet or exceed the Title 22 guidelines are safe for non-potable uses. Estimates of amounts of water recycled and put to other uses are based on RID records and technical expertise and historic records.

*All New Facilities, Policies, and Actions **

This grant is for the design and engineering phase of the project. Subsequent to successful design and permitting of the project, the construction of project will still be required. The construction phase will entail the replacement of existing tertiary treatment system with one of greater daily production and necessary pumps and piping to further distribute water to distribution points near the wastewater treatment plant. This tertiary treatment plant will entail construction of a new sand filtration treatment system at the existing wastewater treatment plant, approximately 500 feet of pipe, an underground 100,000 gallon storage tank, and a 50,000 gallon disbursement tank.

The use of treated wastewater will require an amendment to RID's existing discharge permit. Protection of public health is a condition in recycled water use, covered by the CWC sections 13521, 13522 and 13550(a)(3). A report will be filed with the Regional Water Quality Control Board and the Regional Water Board will determine the necessary requirements for the proposed use. The California Department of Public Health will assess the compliance of the system under Title 22.

*Potential Adverse Physical Effects **

Due to a preconceived perception on the use of treated wastewater, there might be community reluctance to use the proposed program. Additionally, the uses of treated wastewater must be

monitored by RID, which will necessitate an education campaign. Upon construction of the plant, RID will establish guidelines in written form for use, transport and operation of the recycled water filling station. All users will be required to register with RID and complete an application for a water reuse permit. Recycled water customers shall routinely monitor their sites and submit Recycled Water Use Self-Monitoring Reports to RID. Educational materials in the form of handouts, RID's web site and RID's Newsletter will provide educational materials on the safety and property use of recycled water. The filling station will be within a locked area and will be open during established hours. A RID attendant will be available to assist users in filling approved containers. Commercial users will be required to submit a separate application.

Drought Preparedness *

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Achieve long-term reduction of water use

Major impacts involving water management include reduced flows from Telegraph Creek along with the State mandated reduction of water consumption by 25%. The RID is concerned that the continuing drought will increase water theft, significantly increase the likelihood of wildfires, negatively impact small businesses, and impact the financial solvency of RID. Public health and safety impacts associated with small water systems and private residential wells were common in past droughts. California's small water systems have historically experienced the bulk of reported health and safety impacts, as well as the majority of water shortage emergencies—regardless of water year type (NCRP 2013, *NCRP Water & Wastewater Service Provider Outreach & Support Program, Regional Need and Program Objectives*, available: http://www.northcoastresourcepartnership.org/app_pages/view/7970). Drought adds another stressor for small water systems, exacerbating the potential for problems in geographically vulnerable locations.

Wastewater reuse provides a reliable, local supply of water during regional shortages. By diversifying its water supply portfolio, RID is better able to meet the needs of its water users and the environment in both wet and dry periods and under other stresses. Since a portion of Telegraph Creek withdrawals by private individuals can be replaced by water reuse, more water will be available to meet environmental needs of Telegraph Creek instream habitat and less effluent will be discharged into the fragile habitat of the "Lost Coast." The reuse of water for agricultural irrigation includes the advantage of being a constant, reliable water source and reduces the amount of water extracted from the environment and the theft of water. Finally, having available a reliable source of water for fire protection and suppression during drought conditions is paramount to protect life, property and the economically important ecosystem of Shelter Cove.

Small utility systems such as RID's have limited financial resources and rate bases that constrain the ability to undertake major capital improvements. Most small system drought problems stem from dependence on an unreliable water source as in the case Telegraph Creek. RID has instituted drought

preparedness programs and through leak detection has discovered significant water thefts. Additionally, law enforcement has unveiled significant water tank thefts within our district. This situation is unique to small rural districts that are located in areas where marijuana growing is common. This situation will require special programs such as the one we are proposing in order to address vulnerability during droughts.

* Although this project is exempt from responding to all but the *Explanation of Need* because **it provides direct water-related benefits to a DAC in the planning phase and is not intending to complete construction**, we provided answers that are as complete as possible to the other parts of the *Technical Justification Section*. We chose to answer these questions to provide as complete a picture as possible of the proposed project and its importance to local and regional water management.

DIRECT WATER RELATED BENEFIT TO A DAC

Shelter Cove is a small disadvantaged community of 693 residents according to the 2010 US census. The RID serves approximately 1500 people during its peak tourist season in summer. According to RID staff, the RID's population growth rate is 4.3%. Assuming this growth rate continues, the RID's estimated 2025 summer population is projected at 2,984. The RID provides wastewater services to approximately 89% of homes within the district boundary (approximately 464 connections).

Currently, Shelter Cove residents with irrigation needs use treated potable domestic water delivered by the RID. It is estimated that about 10% is used for irrigation purposes. Disadvantaged residents can realize a savings of $165 annually using recycled water for their irrigation needs. It is anticipated that water thefts approach 5,000+ gpd, and will be minimized, allowing for reductions in water fees. Additionally, recycled water can be used for washing salt water off cars and other equipment, extending their useful life.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Although projects intending to provide direct water-related benefits to a project area entirely comprised of a DAC that are in the planning or design phase and not intending to complete construction with this funding are **not required to complete this section**, the RID has provided a Project Performance Monitoring Table.

Table 6.19 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Ability to move to construction phase	Engineering and Design Phase completion	Document Completed	Monthly
Ability to move to construction phase	Amend Discharge Permit	Permit Amendment Submission and then Permit Amendment completion	Monthly
Initiate Permit for Project	Permit Application Completed	Permit Application Completed	Monthly
Initiate Negative Declaration for CEQA	Draft Negative Declaration completed	Draft Completed	Monthly

Upon issuance of a grant award, RID will meet with the project consultants and finalize a specific work plan. Within this workplan, a timeline with milestones will be established. RID's Project Manager will work with project consultants to develop an implementation package with respect to the development of the Preliminary Engineering Report and CEQA/Permitting scope. Monitoring of this planning project will be based on the milestones identified in the implementation schedule. Draft reports will be reviewed by RID and the final reports will be presented by LACO to the RID board of directors. Payments will be dispersed on the basis of satisfactory completion of milestones.

COST EFFECTIVE ANALYSIS

Although projects intending to provide direct water-related benefits to a project area entirely comprised of a DAC that are in the planning or design phase and not intending to complete construction with this solicitation are **not required to complete this section**, the RID has provided this information to provide a comprehensive description of this project.

Table 7.19 – Cost Effective Analysis **Project name: Resort Improvement District #1 Shelter Cove Water Recycling Project**	
Question 1	Types of benefits provided as shown in Table 5: *Water supply recycled (Primary) & Species protected (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *Alternative methods for wastewater reuse or recycling for fire protection and small agricultural use are limited. Instead of wastewater reuse and recycling, sea water desalination could be an alternative for the production of water for agricultural uses. However, the cost of developing a desalination plant, the high electrical costs for operation and the subsequent disposal of sea water waste products, renders this alternative infeasible.*
	If yes, list the methods (including the proposed project) and estimated costs. *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Reusing treated municipal wastewater from domestic sources has been cited by DWR as a lower cost alternative to meet future demand. The process usually results in a decrease in the use of freshwater supplies (DWR, California Water Plan, 2013). Benefits of recycling wastewater include reduced supply cost and improved reliability, as well as reduced costs for wastewater disposal. Finally, the State-mandated reduction of water consumption of 25% does not apply to treated wastewater.*
Comments:	

SONOMA COUNTY WATER AGENCY, NORTHERN SONOMA COUNTY WATER CONSERVATION PROGRAM

PROJECT DESCRIPTION

Brief: This project will implement BMPs to reduce water demand through rebates and consumer education to enhance community water supply resiliency and protect listed salmonids.

Expanded: Sonoma County is facing drought conditions after four consecutive dry years and the driest year on record in 2013 (Sonoma County Department of Health Services 2015, *Drought in Sonoma County*, http://www.sonoma-county.org/health/topics/drought.asp). The need for water efficiency has never been greater. All Northern Sonoma County communities are affected by the drought and those that depend on Lake Mendocino are once again in the position to be out of water by the end of the year. While increasing water supply infrastructure is key to long term water supply resiliency, the most cost effective and immediate way to reduce demands is through water conservation programs, specifically rebates and education.

The Northern Sonoma County Water Conservation Program will implement BMPs to reduce water demands to address the ongoing, limited water supply in Lake Mendocino and ensure Lake Sonoma supplies are used prudently. The program will consist of rebates and direct customer education on actions to save water. Rebate Programs will be expanded to the region for the installation of high efficiency clothes washers, high efficiency toilets and urinals, and turf conversions. In addition, the program will launch a Residential Water Audit Program which provides site specific assistance to homeowners on ways to save water (check for leaks, provide an appropriate irrigation schedule, and prequalify customers for rebates) and allow business customers the opportunity to receive the same in-depth service to achieve significant water savings per the Governor's water reduction mandate. The intended purpose is to reduce demand, increase local resiliency, and expand water conservation programs for these water utilities that are severely drought stricken. High levels of participation are expected based on past programs.

Through water demand reduction, more water will be left instream in the Russian River, providing critical flows for coho (*Oncorhynchus kisutch*), Chinook (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*). These salmonid species have shown declining trends in the past ten years (NOAA NMFS 2011, *North-Central California Coast Recovery Domain 5-Year Review: Summary and Evaluation of California Coastal Chinook Salmon ESU Central California Coast Coho Salmon ESU*; NOAA NMFS 2011, *North-Central California Coast Recovery Domain 5-year Review: Summary and Evaluation of Central California Coastal Steelhead DPS Northern California Steelhead DPS*). Water diversions and other habitat alterations have impacted these populations (CDFW 2015, *Steelhead Trout*); in fact, coho are nearly extirpated (NOAA 2012, *Central California Coast Coho Recovery Plan, Russian River*;).

The project focuses on drought-affected areas that historically have not implemented water conservation programs by providing incentives directly to customers. Early adopters will serve as role models in their communities. The Water Agency will mentor partner agencies to help establish

conservation programs in their service areas that partner agencies will eventually manage independently.

PROJECT PHYSICAL BENEFITS

Physical benefits provided by the project include, but are not limited to:

- **Primary: Water supply saved** estimated at 176 AFY, providing an estimated annual benefit of $14,080 using a value of $80 per AF for instream flow for environmental purposes (Brown 2009)
- **Secondary: Species protection**: Coho, Chinook salmon and steelhead will be protected through this project. Water conservation will translate into fewer withdrawals from the Russian River, resulting in increased instream flow, which improves habitat quality. The Russian River provides wildlife habitat including warm and cold freshwater habitat for fish migration and spawning. Low flows caused by record-dry weather are putting anadromous fish at risk. This project supports efforts to provide critical flows to maintain suitable habitat for salmonids throughout the Russian River watershed to give fish resources a better chance of survival during this difficult drought.
- **Increased water supply reliability** for an estimated 1,632 households, providing an annual monetary benefit of $372,096, given an estimated willingness to pay of about $19 per month per household to avoid shortages and water rationing (Barakat & Chamberlin, Inc. 1994, *The Value of Water Supply Reliability: Results of a Contingent Valuation Survey of Residential Customers)*. This estimate assumes year-round benefit given the current ongoing drought in California.
- **Avoided project costs** of $4 million (one time cost) to design and build a 200 AF water storage reservoir. In addition to the one-time cost, annual O&M costs for the avoided project are conservatively estimated at $30,000. These estimates are based upon project proponent experience on other projects of similar size and scope.
- **Increased quantity or quality of recreation and public access**: boating. The project proponent estimates an increase in 30 days per year open for recreational boating at an estimated value of $33/day, equal to an estimated annual benefit of $990 per year (Loomis 2005, *Updated Outdoor Recreation Use Values on National Forests and Other Public Lands*, U.S. Forest Service, PNW-GTR-658).
- **Climate mitigation**: this project will implement BMPs in water use efficiency and water conservation, reducing GHG emissions by an estimated 15,600 kWh annually. This benefit provides a monetary value of approximately $3,120 per year using a value of $0.20 per kWh.
- **Climate adaptation**: this project prepares local Disadvantaged residential and commercial water consumers to prepare for anticipated conditions associated with climate change including a drier climate with increasingly long drought events.

Table 5.20 a – Annual Project Physical Benefits			
Project Name: Sonoma County WA Northern Sonoma County Water Conservation Program			
Type of Benefit Claimed: Water supply saved - Primary			
Units of the Benefit Claimed : AFY			
Anticipated Useful Life of Project (years) 10 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	161	161
2019	0	176	176
2020	0	176	176
Through 2028	0	176	176
Comments: Project implementation will be complete by January 31st, 2018 and benefits will begin to accrue immediately. Benefits in 2018 have been reduced by 1/12 in order to avoid any overestimation.			

Table 5.20 b – Annual Project Physical Benefits			
Project Name: Sonoma County WA Northern Sonoma County Water Conservation Program			
Type of Benefit Claimed: Species protection -Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 10 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	3	3
2019	0	3	3
2020	0	3	3
Through 2028	0	3	3
Comments: Project implementation will be complete by January 31st, 2018 and benefits will accrue immediately. Species benefitting from project implementation include coho, Chinook, and steelhead.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

On April 1, 2015, Governor Brown issued the fourth in a series of Executive Orders on actions necessary to address California's severe drought conditions, citing potential water shortages. The Executive Order directed the State Water Resources Control Board to implement mandatory water reductions in urban areas to reduce potable urban water usage by 25% statewide. On May 5, 2015, the State Water Board adopted an emergency conservation regulation in accordance with the Governor's directive. The provisions of the emergency regulation went into effect on May 18, 2015.The mandate requires further conservation of the following cities: Rohnert Park (11%), Santa Rosa (18%), and Sonoma (13%). These enhanced water conservation measures demonstrate the need and justification for the implementation of the project.

The State Water Resources Control Board announced July 1, 2015 that statewide residential water use declined 28.9 % in May, the steepest drop since Governor Jerry Brown called on all Californians to conserve water in the face of limited supplies. “The numbers tell us that more Californians are stepping up to help make their communities more water secure, which is welcome news in the face of this dire drought,” said State Water Board Chair Felicia Marcus. “The public is beginning to understand the significance of the drought and consumers are eager to do their part. It is imperative to keep water conservation programs available to support long-term water conservation measures. Residential water customers are demonstrating that they understand the urgency of this drought and they want to do their part to finding sustainable solutions. The community has an opportunity for a behavioral systems change regarding a long-term water conservation strategy among consumers. The project area is historically underserved and many communities are precluded from current rebate programs. The region as a whole has limited resources necessary to implement this program at the present time. The project cannot be completed with the existing financial resources of the project partners. Residential and commercial customers do not have the financial resources to undertake program activities on their own within a short period of time to help alleviate drought-related impacts.

The entire Russian River watershed is impaired for sediment and temperature (SWRCB 2015, *Russian River TMDLs*, http://www.swrcb.ca.gov/northcoast/water_issues/programs/tmdls/russian_river/). Recent data show a pathogen indicator of bacteria impairment throughout the watershed. Green Valley Creek is listed as impaired for dissolved oxygen. Lake Sonoma, Lake Mendocino, and the Laguna de Santa Rosa are impaired for mercury. The Laguna de Santa Rosa is also impaired for phosphorus and dissolved oxygen. When flows are limited, these pollutants are more concentrated, further impacting water quality for both salmonids and other aquatic wildlife. Project implementation will also address instream flow needs to support migration and rearing habitat for the threatened salmonids supported by the Russian River watershed.

Estimates of Without-Project Conditions

If the project is not implemented, the projected water savings of 176 AFY will not occur or be delayed indefinitely. Many areas within the Project Area have not had water conservation programs due to the

lack of funding or an entity to implement the programs. The opportunity for a behavioral systems change regarding a long-term water conservation strategy among consumers may also be lost if consumers "burn out" or the region experiences normal or above normal precipitation for a year or two.

Threatened salmonid populations will continue to be limited by instream flow and may become extirpated from the watershed.

Methods Used to Estimate Physical Benefits

The project area is in extreme drought. Lake Mendocino remains critical at 65% of capacity. The current drought has led to an increase in water resource volatility and uncertainty. When reservoir water levels and ground water tables drop, water supplies, human health, and the environment are put at serious risk. Lower water levels can contribute to higher concentrations of natural and human pollutants. The project supports the lowest-cost alternative to increasing water in the reservoir. The project can be implemented immediately for net benefits now and over the long-term while helping to modify consumer behaviors toward water conservation. The alternative is to increase storage capacity at Lake Mendocino which is a costly, long-term strategy.

The technical basis for this water use efficiency project is based on estimates for water savings per residential household for turf replacement, high efficiency toilet/urinal rebates, and washing machine rebates. Water savings for this project were calculated using figures citing water savings in product information guides from the manufacturers. Potential water savings attributable to turf replacement vary depending on climate, variability in landscape, irrigation replacement options, and human behavior. Per DWR, water savings for turf-replacement vary from 18% to 83%. The volume of water saved ranges from 13 to 70 or more gallons per square foot, per year.

The technical basis for this water use efficiency project is based on the following data from state and federal agencies:

<u>Turf Replacement</u>

The Governor's Executive Order B-29-15 directs the first ever statewide mandatory water reductions. The Executive Order also directs the California Department of Water Resources (DWR) to "lead a statewide initiative, in partnership with local agencies, to collectively replace 50 million square feet of lawns and ornamental turf with drought tolerant landscapes with two primary goals:

- Water savings*:* Both short term, as homeowners cut back or stop lawn irrigation this summer, and long term as turf is replaced with low water use landscapes.
- Environmental benefits: Low-water-use landscapes provide multiple environmental benefits including reduced run-off, improved water quality, and reduction in the energy requirements and greenhouse gas emissions associated with landscape maintenance and water production and treatment."

DWR reports that statewide, residential and large landscape irrigation accounts for approximately 45% of urban water demand because lawns represent a significant portion of our urban landscape

and water waste is common — water running down street gutters, leaks, broken sprinklers, watering during rainstorms, etc. Lawn removal and conversion to water-efficient landscapes could significantly contribute to the overall reduction of water demand in the urban sector.

High-Efficiency Washer

High-Efficiency washers use only 20% to 66% of the water used by traditional agitator washers. Energy use can be as little as 20 to 50% of the energy used by traditional agitator washers because there is much less water to heat. These savings translate directly to long-term cost savings for consumers and significant long-term environmental benefits of conserved water and energy resources.

High-Efficiency Toilets/Urinals

EPA Water Sense reports that toilets are by far the main source of water use in the home, accounting for nearly 30% of an average home's indoor water consumption. Older, inefficient toilets can use as much as 6 gallons per flush. Recent advancements have allowed toilets to use 1.28 gallons or less per flush while still providing equal or superior performance. This is 20% less water than the current federal standard of 1.6 gallons per flush. The WaterSense label is used on toilets that are independently certified to meet rigorous criteria for both performance and efficiency. By replacing old, inefficient toilets with WaterSense labeled models, the average family can reduce water used for toilets by 20 to 60%, nearly 13,000 gallons of water savings annually.

New Facilities, Policies, and Actions

This project involves offering rebate programs to areas traditionally underserved by such opportunities. Incentives will be provided directly to customers for the purchase and installation of high-efficiency clothes washers, toilets and urinals and for the conversion of turf to climate-appropriate low water use plants. A Residential Water Audit Program will be launched to check for leaks, assess existing water fixtures and appliances, and irrigation.

Potential Adverse Physical Effects

There are no adverse physical effects from implementing the project. The project will educate the public on the benefits of water use efficiency, install high efficiency plumbing fixtures in participating residences, and encourage sustainable, drought tolerant landscapes through turf removal rebate programs.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Achieve long-term reduction of water use

Lake Mendocino is continuing into the fourth consecutive year of severe drought. The reservoir is currently 65% full, well below the target going into the dry summer months. On May 18, PG&E received a temporary variance for flows released from Lake Pillsbury through the Potter Valley Water Project. Water released though this Project typically flows to Lake Mendocino. Accordingly, inflows have been significantly reduced and the Lake's water supply is declining faster than is typical. This places Lake Mendocino in the precarious position of potentially running out of water.

Communities served by Lake Sonoma are in better shape than those served by Lake Mendocino but are also facing severe cutbacks and dwindling supplies. Similarly, communities and/or residents served by private wells are at risk of having their wells go dry as low river flows reduce groundwater recharge.

These communities, particularly those served by Lake Mendocino, are in great need of programs that reduce demand. The Project provides the tools for communities to address drought issues. The rebates for new fixtures will provide an incentive for water customers to adapt to the shrinking water supply that has become an annual issue. It is proven that rebates promote fixture replacement at a faster rate than if a rebate was not available.

DIRECT WATER RELATED BENEFIT TO A DAC

This project is partially located in several Disadvantaged Communities, including: Guerneville, Rio Nido, Guerneville Park, Villa Grande, Monte Rio, Valley Ford, Cazadero, as well as portions of Windsor, Santa Rosa, Cloverdale, Sebastopol, and Healdsburg.

The project focuses on residential and commercial water customers in the most vulnerable communities that historically have been precluded from such conservation programs. The project area includes the major population centers of Santa Rosa, Rohnert Park, Cotati, Windsor, Healdsburg and Cloverdale. It also includes Guerneville, Forestville, Rio Nido, Monte Rio, Geyserville, Occidental, Jenner, Sea Ranch, Larkfield, Wikiup, and private well users in unincorporated areas. The project will provide residents in historically underserved communities with rebates for installation of efficient clothes washers, toilets and urinals, and low water use plant material. Onsite home water use assessments will be offered to assist DACs to reduce water use thus saving money on their monthly water bills while conserving water, which benefits the entire watershed population.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.20 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Reduced water use through implementation of water conservation fixtures and practices	Photomonitoring, records, reports	Post-project	1,632 households participating in water audits and conservation measures: turf removal, toilet replacement, washer replacement
Increased water supply reliability	Number of households with access to improved water supply reliability	Annual	1,632 households
Avoided electric costs	kWh saved	Annual	15,600 kWh
Increased instream flow for environmental, agricultural and municipal purposes	Acre feet of water left instream	Annual	176 ac ft
Increased quantity or quality of recreation or public access: Motor boating	Increase in open days per year for motor boating	Annual	30 days

Project performance will be monitored for the type and number of high efficiency fixtures that are installed and the amount of turf removed. All installations will be tracked which will serve as data to document this project and future projects. Records will be kept by each participating partner and data will be shared with the Water Agency. The program will also be evaluated on the Water Agency's role to mentor participating partners and help them to establish water conservation programs that they are able to manage independently.

COST EFFECTIVE ANALYSIS

Table 7.20 – Cost Effective Analysis Project name: _Sonoma Count WA Northern Sonoma County Water Conservation Program_	
Question 1	Types of benefits provided as shown in Table 5: *Water supply saved (Primary) & Species protected (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *For the residential and commercial customer, there are no other alternatives to achieve the same type and amount of physical benefits. In order to increase capacity at Coyote Valley Dam the alternative is to raise the dam at Lake Mendocino. Raising the dam is a multi-million dollar project that will take years to design, permit, and construct before benefits reach the community. This strategy would have no effect on communities suffering from the effects of drought at the present time.*
	If yes, list the methods (including the proposed project) and estimated costs. *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *The proposed project is the most cost effective means to achieving the proposed physical benefits. It is imperative to modify consumer behaviors regarding water use, water efficiency, and conservation. In order to positively influence consumer behavior, the project will work directly with consumers. It is crucial to develop communities of efficient water users. Residential and commercial customers need the right tools to get the job done. Good planning and water use management is critical. We need to build resilience for stressed watersheds as climate changes. If we continue to pretend that future climate is going to look like the past, we will fail to put in place the policies needed to bring our water system into any sort of sustainable balance. California's paleoclimatic record shows extreme droughts plagued the state for over two millennia, including mega-droughts of 100 years. It is imperative for the region to preserve water supply and plan for current and future droughts.*
Comments:	

SONOMA RESOURCE CONSERVATION DISTRICT, RUSSIAN RIVER COHO DROUGHT RESILIENCY PLANNING AND IMPLEMENTATION PROGRAM

PROJECT DESCRIPTION

Brief: This project develops comprehensive water conservation plans along key reaches of important salmonid streams and implements demonstration rainwater catchment projects to provide community climate resiliency.

Expanded: The current drought, now in its fourth year, is having acute and devastating effects on water resources throughout the Russian River watershed, both for the agricultural operations that are the backbone of the region's economy and the wildlife dependent on streamflows, most notably the endangered Central Coast coho (CCC) salmon (*Oncorhynchus kisutch*). Focusing on the five tributaries identified by the National Fish and Wildlife Foundation (NFWF) and local, state and federal agencies as having the highest potential for streamflow enhancement and coho recovery, this project seeks to work with the largest water users in each subwatershed to significantly and measurably reduce summer stream withdrawals.

Since the release of NFWF's *Business Plan for the Russian River Coho* in 2009, the Sonoma and Gold Ridge RCDs have served as key participants in the Russian River Coho Water Resources Partnership (Coho Partnership; http://www.cohopartnership.org/), which works through limited NFWF and Sonoma County Water Agency funding to monitor coho populations and streamflows, perform outreach, and prioritize projects in five critical subwatersheds (Green Valley, Dutch Bill, Mill, Mark West, and Grape Creeks) to restore stream flows and improve local water supply reliability. A flow availability assessment for several of these tributaries is nearly complete, which will allow the Coho Partnership to more accurately target streamflow enhancement projects in the precise reaches where they will have the most benefit to coho survival.

The goal of this project is to provide that crucial next step to allow these efforts to culminate in rapid response: developing and implementing comprehensive water conservation plans for landowners along key reaches of the five tributaries. Plans will include a suite of components: rainwater catchment to both replace stream withdrawals and enhance agricultural water supply reliability, off-channel storage development, use of soil and plant monitoring devices to decrease irrigation demand, irrigation efficiency upgrades, wind machines for frost protection, and stormwater management/groundwater recharge. Participating properties comprise a variety of land uses including vineyards, rangelands, orchards, crop farms, and private environmental centers/camps.

The project will also implement three rainwater catchment projects whose designs are nearly complete, which will serve as highly-visible demonstration projects. Additional catchment projects identified during water conservation plan development will be submitted for implementation funding as they are designed and funding becomes available.

PROJECT PHYSICAL BENEFITS

Physical benefits provided by this project include, but are not limited to:

- **Primary: Water supply produced and saved** in the amount of 15.52 AFY
    - **Irrigation use reductions** totaling an estimated 15 AFY, for an estimate economic value of $1,200 per year given an estimated value of $80 per AFY (West Water Research 2013, *2013 California Spot Market Price Forecast*).
    - **Increased agricultural water supply** of 70,000 gallons per year (0.21 AF), estimated to have a monetary benefits of $4,200 per year based on an estimated price of $0.06 per gallon.
- **Secondary: Species protection:** The project focuses on the five Russian River subwatersheds identified by NFWF as most crucial to California Central Coast coho survival. By enhancing streamflow through the implementation of rainwater catchment, water use efficiency improvements, and frost protection alternatives in the most vital reaches of those streams, the project will address the primary limiting factor to both coho and steelhead (*Oncorhynchus mykiss*) populations and also benefit Chinook (*Oncorhynchus tshawyscha*) (NOAA NMFS 2012, *Central California Coast Coho Recovery Plan, Russian River*, p 642, 645, 665).
- **Fishery benefits**: Increased instream flow for fishery benefits estimated at 0.3 cfs
- **Climate change mitigation**: GHG reduction from reduced trucking of water estimated by project proponent to equal about 100 tons of CO_2 equivalents per year, providing an estimated value of $1,500 per year using the estimated value of $15 per ton CO_2 equivalent (California Environmental Protection Agency, Air Resources Board 2014, *California Air Resources Board Quarterly Auction 6, February 2014: Summary Results Report.* Available: http://www.arb.ca.gov/cc/capandtrade/auction/february-2014/results.pdf).
- **Climate change adaptation**: By promoting rainwater catchment, water use efficiency, and frost protection alternatives, the project serves as an ideal strategy for adaptation to the rainfall variability predicted by regional climate change models.

Table 5.21 a – Annual Project Physical Benefits			
Project Name: Sonoma RCD Russian River Coho Drought Resiliency Planning and Implementation Program			
Type of Benefit Claimed: Water supply produced & saved - Primary			
Units of the Benefit Claimed : AFY			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2019	0	0	0
2020	0	15.21	15.21
2021	0	15.21	15.21
Through 2029	0	15.21	15.21
2030	0	0.21	0.21
2031	0	0.21	0.21
Through 2039	0	0.21	0.21
Comments: Project will be completed in 2019; benefits will begin to accrue the following year. Irrigation upgrades have an expected life of 10 years, therefore we have dropped the irrigation benefits (Water supply saved - see text) after 10 years, however, it is likely that the fixtures will be replaced with similar or more efficient technology, maintaining or improving the amount of water saved (with associated costs).			

Table 5.21 b – Annual Project Physical Benefits			
Project Name: Sonoma RCD Russian River Coho Drought Resiliency Planning and Implementation Program			
Type of Benefit Claimed: Species protection - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2019	0	0	0
2020	0	3	3
2021	0	3	3
Through 2039	0	3	3
Comments: Project will be completed in 2019; benefits will begin to accrue the following year. Species protected are the listed coho, steelhead, and Chinook.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Stream flow gauge data gathered since 2009 in all five tributary watersheds by the Center for Ecosystem Management and Restoration show a steady decline of instream flow during summer months, effective coho salmon survival (CEMAR 2015, *Streamflow Data Center*, available: http://cemar.org/streamflow-data.html). Recent drought conditions have prompted putting an Emergency Order in Place by the State Water Resources Control Board on July 6, 2015 because of the dire conditions for coho salmon in four of the five tributaries (Kovner 2015, *State regulators approve water restrictions to aid Sonoma County salmon streams*, available: http://www.pressdemocrat.com/home/4082224-181/state-regulators-approve-water-restrictions).

Streamflow gauging in Russian River tributaries and life cycle analysis of coho salmon show that minimal amounts of streamflow improvements can have dramatic and positive impacts to species survival. In key tributaries of the Russian River such as Green Valley, Dutch Bill, Mill and Mark West creeks, surveys counting juvenile coho salmon in 2014 showed 97 percent fewer fish than in 2013 (Howard and Bonham 2015, *Close to Home: A plea to North Coast to help coho salmon*, available: http://www.pressdemocrat.com/opinion/3837416-181/close-to-home-a-plea), in large part due to drought conditions. Voluntary programs such as this project are a critical tool to assist local agricultural landowners with changes in water management and water conservation to support remaining coho populations in these watersheds.

Estimates of Without-Project Conditions

Without project implementation, conditions in the Russian River are expected to deteriorate for salmonids and summer water supply will continue to be limited for residential and agricultural uses. Coho could become extirpated from the watershed and Chinook and steelhead populations are likely to continue to decline.

Methods Used to Estimate Physical Benefits.

The scientific basis for the project's geographic focus is clear: the National Marine Fisheries Service (NMFS) identified the Russian River watershed, which contains 33% of all CCC ESU targeted habitat, as essential for coho recovery, yet it had the second-poorest habitat conditions (NOAA NMFS 2012). This distinction led to the development of the National Fish and Wildlife Foundation (NFWF) Keystone Initiative's *Business Plan for the Russian RIver Coho* in 2009 (http://www.nfwf.org/coho/Documents/Russ_River_Coho_Biz_Plan.pdf), which identified five tributaries as critical for near-term recovery: Green Valley, Dutch Bill, Mark West, Grape, and Mill Creeks, and identified low summer streamflows in these tributaries as the primary limiting factor to coho recovery.

The basis for the project's approach to evaluating agricultural water use savings is based on localized work on vineyards. Ample local field trials have documented the efficacy of devices such as soil

moisture probes and weather stations in conserving irrigation water (e.g., http://www.scwa.ca.gov/files/docs/conservation/Final200920VineyardConservation.pdf). A demonstration in Alexander Valley documented water savings of 60% and more in vineyards through the delay of irrigation initiation as late as possible in the growing season, coupled with precision irrigation monitored using soil moisture probes. At some vineyard sites, wind machines can entirely eliminate the use of water for frost protection, eliminating the use of 50 gallons per minute per acre. Effectiveness of this frost protection method has been widely studied, and is documented in the RCD's publication *Frost Protection: a Guide for Northern Coastal California (*2011). These same methods can be extrapolated to crop farms, which have much higher summer water use than vineyards.

Rainwater catchment and winter water storage have significant and easily calculable benefits when designed with sufficient capacity to eliminate or significantly offset summer stream withdrawals throughout the May-November dry season. The economic value for agricultural water supply was obtained from the current cost of trucked water, upon which many of the participating producers rely.

Quantifying the economic and environmental benefits of rural agricultural water conservation projects working on dispersed farms can be challenging, particularly in comparison to the more easily quantifiable single-site water system infrastructure upgrade projects. The water storage projects presented here are measured in gallons/year, as opposed to acre-feet, and may appear to have relatively insignificant effects on streamflows. However, the project sites identified through this work are in stream reaches specifically identified in flow availability analyses or other watershed-scale assessments as being most essential to coho summer survival (e.g., CEMAR 2015, *Report on the Hydrologic Conditions of Mark West Creek*, available: http://cemar.org/pdf/ReportontheHydrologicCharacteristicsofMarkWestCreek.pdf) . The water storage quantities for each site are sufficient to significantly offset or even eliminate all stream withdrawals from these rearing pools during the most critical summer months, having substantial environmental benefit.

New Facilities, Policies, and Actions

Site-specific rainwater capture systems will be implemented on high-priority sites to offset stream withdrawals, which require some infrastructure upgrades, tank placement, or off-channel pond construction. Implementation includes installation of two rainwater catchment systems totaling at least 70,000 gallons storage capacity.

Potential Adverse Physical Effects

While rainwater catchment systems involve heavy equipment use, these are constructed in the high-impact areas around existing farm infrastructure, and have little associated habitat disturbance. Wind machines, which may be included in water conservation plans as appropriate, have the potential to disturb raptor or migratory bird habitat. Biologists at the Natural Resource Conservation Service have determined that a 200' buffer between the wind machine and riparian or other established tree habitat is sufficient to avoid these impacts. Such a buffer (or documentation justifying a variation) will be required in order for wind machines to be considered in plan designs. All work will be conducted

according to accepted professional standards using appropriate BMPs and in the event of adverse effects, immediate action will be taken to mitigate impacts.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Promote water conservation, conjunctive use, reuse and recycling
2. Improve landscape and agricultural irrigation efficiencies
3. Achieve long-term reduction of water use
4. Solutions that yield a new water supply

Due to drought conditions and Governor Jerry Brown's executive orders, the Department of Fish and Wildlife (DFW) created a voluntary drought initiative for Mill, Mark West, Dutch Bill, and Green Valley Creeks in an effort to work with local and landowners to restore streamflow to these streams at critical times for fish. In the absence of a sustainable voluntary commitment to not take water, the State Water Board passed emergency regulations that compel curtailments by water right holders along these tributaries that went into effect July 3 to about 10,000 landowners on 130 square miles across Dutch Bill, Green Valley, Mark West, and Mill Creeks (Kovner 2015). The RCDs and the Coho Partnership are seeking to assist landowners by providing information on water conservation education and technical assistance programs as well as pursuing funding for implementation such as the proposed project.

Reducing water use and improving use efficiency are obvious first steps towards sustainability within a water-scarce climate. This project will begin by developing comprehensive plans for agricultural operations along critical stream reaches to allow for long-term water use reduction. This planning process will include a feasibility assessment for water storage capacity to create more reliable and sustainable alternatives to stream or groundwater withdrawals. Rainwater catchment and onsite water storage is a promising and highly appropriate water conservation strategy in Sonoma County, where significant yet increasingly unpredictable rainfall occurs within a short time period, and can be captured and stored for use when agricultural water demand is greatest and streamflow is at its lowest. These efforts serve to both protect coho-bearing stream flows and enhance the resiliency of the county's agricultural heritage.

These projects provide rural drought resiliency. These are small, family-run operations that are integral to our county's agricultural economy, rural tourism industry, and pastoral character. This type of site-specific adaptation strategy is proving essential for the long term sustainability of our region's rural economy, local food base and community resiliency to anticipated effects of climate change.

DIRECT WATER RELATED BENEFIT TO A DAC

The proposal targets rural and agricultural populations who provide the backbone for the county's agricultural economy and local food production, yet are facing an increasingly uncertain water supply. Many manage large parcels of ecologically significant open space and key riparian corridors, but their farm incomes do not allow them to prioritize projects without significant economic benefits, such as water conservation that would replace stream or groundwater withdrawals.

This project is partially located within the Severely Disadvantaged community of Monte Rio and the Dutch Bill Creek watershed, which is recognized by the State as Disadvantaged (DAC). The project includes the severely disadvantaged river communities surrounding Monte Rio (Severely DAC) and Dutch Bill Creek (DAC) watershed's disadvantaged rural areas, whose landowners steward essential but water-limited coho stream reaches. The project will work with several landowners within the delineated area whose water supplies are currently inadequate or in jeopardy. Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.21 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Onsite water conservation plans and implementation to decrease withdrawals from tributaries and increase water supply reliability	At least 2 rainwater catchment tanks, implementation of 6 – 8 water conservation plans	Photomonitoring; certified engineer's statement of completion	Pre- and post-project implementation
Increased Water Supply for Environmental Purposes and fisheries	Save 15 acre feet of water	Stream Flow Gauges	Monthly and ongoing during summer months

Project performance will be monitored through several different parameters. Rainwater catchment projects have clearly measurable targets for water conservation based on the capacity of the systems constructed and withdrawal offsets. Effectiveness of water use efficiency upgrades will be monitored through well/pump metering. Additionally, project reporting will include results from streamflow monitoring efforts currently underway in each subwatershed, administered through the Coho Partnership to establish multiple gauges in each watershed to collect stream data including water depth, water temperature, and air temperature (cohopartnership.org/streamflow-data.html). In addition, the Coho Partnership, in collaboration with UCCE, conducts coho survival and life-cycle monitoring in each of the 5 subwatersheds and project reporting will include these results.

COST EFFECTIVE ANALYSIS

Table 7.21 – Cost Effective Analysis Project name: Sonoma RCD Russian River Coho Drought Resiliency Planning and Implementation Program	
Question 1	Types of benefits provided as shown in Table 5: *Water supply produced (Primary) & Species protected (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Once reliant on streamflows and variable groundwater sources and currently facing water shortages and potential curtailments, landowners in these priority subwatersheds have resorted to digging deeper wells or even trucking in water to meet their needs. These strategies are unsustainable in the long-run. Groundwater basins throughout the focus subwatersheds are becoming increasingly overdrafted or unreliable, with landowners experiencing lowered water tables. Trucking water is not only very expensive and a significant source of greenhouse gas emissions, but the source of the water is frequently no more plentiful than at its destination: water trucked throughout west county is usually pumped from near-channel Russian River wells.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Onsite water storage, in combination with water use reduction, is the least-cost alternative to both reducing summer stream withdrawals and enhancing drought resiliency over the long term. Trucked water costs approximately $0.06/gallon.*
Comments:	

WATERSHED RESEARCH AND TRAINING CENTER, SOUTH FORK TRINITY RIVER SPRING RUN CHINOOK SALMON RESTORATION PROJECT

PROJECT DESCRIPTION

Brief: This project will enhance salmonid habitat through installation of constructed wood jams and native tree planting in accordance with well-established, comprehensive, process-based restoration plans.

Expanded: The South Fork Trinity River (SFTR) is the largest un-dammed river in the State of California, federally designated as a wild and scenic river, and is a keystone watershed within the Klamath River basin supporting one of the last remaining populations of wild spring-run Chinook salmon. This once abundant fishery is in peril, and the spring run Chinook (*Oncorhynchus tshawytscha*) are nearing the brink of extirpation from this unique stronghold (South Fork Trinity River Spring Chinook Subgroup (SFTRSCS) 2013, *Spring Chinook in the South Fork Trinity River: Recommended Management Actions and the Status of their Implementation*, January 29th 2013). Ecosystem restoration action is urgent and this proposal seeks the necessary funding to support reach-scale implementation to improve watershed health in the face of climate change and mismanaged/illegal water diversions that are destroying necessary water quality and quantity.

The SFTR is a ninety-two mile long southern exposed river, flowing from the headwaters in the Yollo Bolly Mountains to the confluence with the mainstem Trinity River near Salyer located in both Trinity and Humboldt Counties. The South Fork (SF) Trinity River watershed in Trinity County has been listed as sediment impaired in California's 303(d) list, adopted by the State of California North Coast Regional Water Quality Control Board. This sediment impairment has, according to NCRWQCB, resulted in non-attainment of designated beneficial uses, primarily salmonid habitat (NCRWQCB 2015, *2012 California Integrated Report for the Clean Water Act Section 303(d) List*, available: http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/303d/).

This project will increase wild spring run Chinook populations through in-stream restoration techniques targeted at improving adult and juvenile salmonid habitats, restoring reach-scale physical geomorphic processes, and improving water quality related to thermal refugia. Large wood restoration implementation is the primary method for achieving the above goals. Due to the remote geographic setting of the SFTR, a unique restoration technique is proposed using a helicopter to place large wood at strategic locations across a fifteen mile reach. The wood will be placed at key locations within proximity to cold water tributary confluences. The large wood will be transported from upslope timber harvesting zones by helicopter and placed in designed arrangements to interact with hydraulic forces to induce scour pools, create habitat complexity, provide instream cover, and promote floodplain connectivity.

Large wood is a critical element and driver for the interplay between ecosystem health, in-stream habitat complexity, and geomorphic processes in the formation of deep pool habitat for cool water refugia. Strategic implementation of large wood log jams will help provide the necessary reach-scale thermal resiliency for wild spring chinook to migrate through and hold in the SFTR, as well as promote

the habitat complexity required by juvenile spring chinook for successful rearing and emigration (McHenry et al. 2007, *The Physical and Biological Effects of Engineered Logjams in the Elwha River, Washington*).

PROJECT PHYSICAL BENEFITS

Physical benefits provided by the project include, but are not limited to:

- **Primary: Habitat restored**: 1.48 acres of cold water refugia habitat and 2.5 acres of riparian habitat
- **Secondary: Species protected**: Chinook and coho salmon, 2 species
    - Improved survival of adults estimated at 15% increase in survival until spawning
- **Climate mitigation**:
    - Carbon sequestration of approximately 121 tons of carbon from whole tree materials placed instream for an approximate monetary value of $1,815. This assumes that 30% of the equivalent tree volume of stored carbon is lost to the atmosphere in association with transporting and processing logs to lumber.
    - Carbon sequestration from restoration of 2.5 acres of mature riparian forest will sequester approximately 1.25 tons CO_2 per year upon maturity, around 2036. This would provide a minimum of $18.75/year in monetary value, given an estimated value of $15 per ton of carbon sequestered by trees (California Environmental Protection Agency, Air Resources Board. 2014. *California Air Resources Board Quarterly Auction 6, February 2014: Summary Results Report)*. This estimate does not include carbon stored in soil.
- **Climate adaptation**: Restoration of hydrologic connectivity with the floodplain for groundwater recharge will promote cold water hyporheic exchange and provide drought and climate change ecosystem resiliency.

Table 5.22 a – Annual Project Physical Benefits			
Project Name: Watershed Research & Training Cntr S Fork Trinity River Spring Run Chinook Salmon Restoration Project			
Type of Benefit Claimed: Habitat restored - Primary			
Units of the Benefit Claimed : Acres			
Anticipated Useful Life of Project (years) 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	0	0
2019	0	3.98	3.98
2020	0	3.98	3.98
2021	0	3.98	3.98
Through 2068	0	3.98	3.98
Comments: Project installation will be complete in 2018; benefits will begin to accrue the following year.			

Table 5.22 b – Annual Project Physical Benefits			
Project Name: Watershed Research & Training Cntr S Fork Trinity River Spring Run Chinook Salmon Restoration Project			
Type of Benefit Claimed: Species protected - Secondary			
Units of the Benefit Claimed : Number of species			
Anticipated Useful Life of Project (years) 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	0	2	0
2017	0	2	0
2018	0	2	0
Through 2065	0	2	0
Comments: Project installation will be complete in 2018; benefits will begin to accrue the following year. Multiple aquatic and terrestrial species will benefit from project implementation, this project claims 2 listed species, coho and Chinook salmon.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

Like many timber towns, Hayfork's economy had been based on natural resource extraction. The geo-political situation (Hayfork is surrounded by the Trinity National Forest) has made the community vulnerable to public lands management changes. In 1996, when Hayfork's mill closed as a result of changes in forest management, 40% of the payroll in the community was lost.

The WRTC was formed in order to rebuild the economy based on an ethic of land stewardship and restoration. To those ends, the organization has re-trained woods workers, innovated forest restoration and wood utilization techniques, promoted the responsible use of prescribed fire, hosted youth and community education programs, developed watershed monitoring and community engagement initiatives in the South Fork Trinity River, helped lead local collaborative efforts, and is working with partners to develop and implement landscape-scale restoration strategies across the Klamath-Siskiyou bioregion. http://www.thewatershedcenter.com/

Over the past ten years, the Watershed Center has been laying the foundation for a robust Watershed Restoration Program focused primarily on the South Fork of the Trinity River (SFTR) and its tributaries. They have built partnerships with agencies, organizations, and individual landowners working in the SFTR and throughout the Klamath Basin and have conducted watershed assessments, developed watershed management plans, and performed monitoring and restoration work. Through these activities, specific opportunities have been identified for implementation in the near future. The SFTR has one of the last remaining wild spring Chinook runs in California. WRTC is partnering with the Yurok Tribe, Humboldt State University, the USFS, and CA Department of Fish and Game to learn more about these dwindling spring Chinook populations. The four priorities in this initiative include facilitating basic monitoring in the SFTR, Hayfork Creek and their tributaries, a Limiting Factors Analysis for the spring run Chinook, a Genetics Study, and educating local communities of Chinook salmon's precarious status (http://www.thewatershedcenter.com/?page_id=645).

Historically, the SFTR in the Klamath River watershed has been a stronghold for wild spring-run Chinook salmon (TCRCD 2003, *South Fork Trinity River Water Quality Monitoring Project*). The spring Chinook salmon populations were the most abundant anadromous runs in the SFTR basin (PWA 1994, *Action Plan for the Restoration of the South Fork Trinity River Watershed and its Fisheries*) due largely to the high quality of anadromous habitat in the SFTR and its tributaries (Dean 1996, *Life history, distribution, run size, and harvest of spring Chinook Salmon in the South Fork Trinity, 1994 – 1995 season*). This robust population was instrumental in the recovery and recolonization of the main stem of the Trinity River after its populations were devastated by intense mining in the late 19th and early 20th century (Kinziger et al. 2008, *Genetic structure of Chinook salmon in the Klamath-Trinity Basin: implications for within-basin genetic stock identification*; Dutra and Thomas 1999, *1998-99 chinook and coho spawning report*, USDA Forest Service Six Rivers National Forest). The SFTR is the largest undammed river in the state of California (Foster Wheeler 2001, *Hidden Valley, Plummer Creek and Rattlesnake Creek watershed analysis*; Truman & Associates and PWA 1996, *Final Draft – Coordinated Resource Management Plan*).

In recent decades there has been a substantial decline in the numbers of fish returning to the SFTR and its tributaries (Dean 1996). Spring Chinook populations within the SFTR have declined precipitously over the last 45 years, falling from 11,604 in 1964 to an average of less than 200 per year today. Declines in spring Chinook salmon in the SFTR are attributed to both natural and anthropogenic disturbances. In 1964, LaFaunce estimated that 11,604 adult spring chinook salmon were holding in the SFTR (La Faunce 1967, *A king salmon spawning survey of the South Fork Trinity River, 1964*) while over the past decade the run size has been averaging around 200 fish (SFTRSCS 2013). Geneticists warn that the population is near an "extinction vortex" that will lead to extirpation if the population does not rebound soon.

A history of timber extraction and associated infrastructure development coupled with a huge precipitation event in 1964 caused substantial sediment to be mobilized to and deposited in the SFTR and its tributaries (Higgins 1996, *Results of fine sediment monitoring in Rusch Creek using volunteers*; TCRCD 2003). The US Geologic Survey website states that the maximum discharge in the history of record at the Hyampom gage was 75,000 cubic feet per second on Feb. 17, 1986 (though the 1964 flood was estimated at 88,000 ft3/s on basis of a USGS flood-routing study) (http://waterdata.usgs.gov/nwis/uv?site_no=11528700). This flood event is often cited as the major factor in the decline in spring Chinook: "the effects of the 1964 flood and erosion coming from poorly managed lands in the western and central portion of the SFTR basin led to destruction of valuable spawning, rearing and holding habitat, and resulted in the long term reduction in the numbers of anadromous fish (PWA 1994)." "In particular, available data and anecdotal observations indicate that, following the December 1964 flood, numerous landslides and debris flows delivered considerable quantities of sediment to the stream channel in some reaches, resulting in formation of river deltas in some locations, channel aggradation and widening, decreased depths and numbers of pools, decreased numbers of fish, increases in fine sediments in the bed material, and, apparently, increases in temperatures associated with decreased depths and loss of riparian canopy (United States Environmental Protection Agency Region 9, 1998). The overall quantity of sediment delivery to the stream has decreased since then, but chronic inputs of sediment from roads as well as episodic inputs from washouts and mass wasting continues (Farber et al. 1998, *Water temperatures in the South Fork Trinity River Watershed in Northern California*). While the impacts of the flood were dramatic, there is evidence that the impacts from disturbances were temporary and that recovery is possible.

An assessment done in 1978 (DWR 1979, *SFTR Watershed Erosion Investigation*) showed that timber harvest was wide spread throughout the South Fork watersheds. The assessment suggests that clear cuts and other more intensive harvest methods were employed without regard for the potential instability of soils. Fifty-two percent of the watershed (1280 km^2) was logged up to 1977, of that 52 percent, 4.5 percent (110 km2) was patch clear cut by USFS, and of the remaining 47.5 percent, approximately 8 percent was seed-tree clear cut on private land, and the rest selective cut on public land. Private timberlands less than 70 percent cut are not assessed, so the overall impact may have been higher (TRCD 2003). It is suggested that road construction associated with timber harvesting was the largest human impact on the watersheds (DWR 1979); however, a more recent review done on the erosional features in the Lower South Fork Trinity has shown that about one third of the erosional features appear to have been related to human activities within the watershed. Management related

slides account for 18% of total sediment delivery, while 82% are attributed to natural mass wasting (Catalico 2011, *Lower South Fork Trinity Restoration History*).
In 1982 (DWR 1982, *SFTR Salmonid Habitat Enhancement Studies*), instability hotspots were identified in the South Fork watersheds. No indication of the severity or area of many of these slides is in the report. The Department of Conservation classified the entire SFTR watershed as 'severe' and 'very severe' in terms of overall soil erodibility (DWR 1982). The report indicated a general increase in hazard from east to west and from south to north, with very severe hazards occurring along South Fork Mountain, along the inner gorge of the SF Trinity River from Forest Glen to the mouth, and in the Grouse and Madden Creek watersheds (DWR 1982). Timber harvest activities and associated road building are particularly worrisome in the 'severe and very severe' soil instability zones. Also, there is widespread support to help spring chinook and nearly everyone would support projects to help prevent the species from becoming endangered enough to be listed under the ESA.

After nearly two decades of road upgrade and decomission work by the TCRCD and USFS, the SFTR is seeing some recovery. Initial sediment monitoring results show that sediment is routing through the system (Cook and Dresser, Six Rivers National Forest, pers. comm.), however is the timeframe of natural recovery occuring fast enough to save a species on the brink of extinction? This project seeks to enhance natural processes to ensure sustainability of salmonid fisheries in the SFTR.

Estimates of Without-Project Conditions

Without project implementation, salmonid populations will continue to be limited in the SFTR and ecosystem function will continue to be impaired. Floodplains will continue to be disconnected from the river channel, resulting in flooding risk and impaired groundwater recharge. There will be less riparian forests providing filtration, carbon sequestration, and other ecosystem services. Additionally, socioeconomic and cultural capacity will not be bolstered, leaving the community less adapted to changing conditions associated with climate change and geo-political patterns (e.g., the recent recession).

Methods Used to Estimate Physical Benefits.

This project will result in significant improvements to instream and riparian habitats within several reaches of the SFTR. Installing constructed wood jams will facilitate pool formation and increase floodplain connectivity, promote development of productive and resilient riparian forests, and sort and meter sediment in ways that support vital processes such as formation and retention of high quality salmonid spawning gravels and storage of fine-grained materials on floodplains (Abbe et al. 2003a, *Wood in River Rehabilitation and Management*, In: The Ecology and Management of Wood in World Rivers, p. 367 – 389). Restoration techniques proposed will also help facilitate groundwater recharge (surface water "slow it, spread it, sink it") and increased floodwater retention. These activities will also help rebuild productive floodplain soils expected to help reduce evaporation and heating of groundwater. Planting streamside trees and installing numerous willow baffles will increase riparian forest resiliency, sequester significant quantities of carbon, and increase stream shading to help maintain cool water in the face of climate change. Restoration actions were developed to promote once

prevalent natural processes and therefore we expect to provide immediate and long-term (self-maintaining) benefits to native salmonids and both aquatic and terrestrial wildlife.

The primary restoration tool proposed for this project is installing Constructed Wood Jams (CWJs) on a reach-scale within the St John's and Hyampom areas of the SFTR. CWJs proposed for this project are a variation of Engineered Log Jams (ELJs) described by Abbe et al. (2003a) (2003b, *Integrating Engineered Log Jam Technology into Reach-Scale River Restoration*, In: Restoration of Puget Sound Rivers, p. 443 - 482); and will mimic naturally occurring features such as bar apex jams (large-scale CWJ), deflector jams, and bar roughness jams. The use of CWJs and ELJs to recover habitat complexity and protect streambanks and riparian forests within river systems is widely applied in Washington and Oregon (e.g., McHenry et al. 2007). A driving principle in ELJ technology is that habitat restoration is more likely to be effective and sustainable if done in a manner that mimics natural geomorphic processes (Abbe et al. 2003b). Wood accumulations (i.e. jams) in dynamic fluvial habitats can act as stable foundations and protective elements capable of facilitating forest development and providing long-term forest refugia (Abbe et al. 2003a, 2003b). Rehabilitating resilient streamside forests in the SFTR is a critical measure for providing long-term benefits for native fish and wildlife. Resilient riparian forests help increase channel stability, provide long-term recruitment of wood to fluvial habitats, and help drive food webs. Positive responses by salmonids to wood jams, especially by juveniles, are well documented in the Pacific Northwest. Wood jams create low-velocity microhabitats with complex overhead and instream cover for fish. Salmonids use these areas as velocity refugia to conserve energy and as predator protection elements and they have been shown to increase juvenile salmonid density and reduce competition for rearing habitat by providing visual isolation of conspecifics (Cederholm et al. 1997, *Response of Juvenile Coho Salmon and Steelhead to Placement of Large Wood Debris in a Coastal Washington Stream*, North American Journal of Fisheries Management, 17:947-963; Pess et al. 2011, *Juvenile salmon response to the placement of engineered log jams (ELJs) in the Elwha River, Washington State, USA*, River Research and Applications, 28(7): 872–881). Improving conditions for juvenile salmonids can help increase survival and growth and thus result in increased numbers of returning adults. CWJs and resilient streamside forests also promote improved salmonid spawning conditions (i.e. increased cover elements, velocity refuge, and sorting and retention of high quality spawning gravels).

This project was designed to provide long-term, sustainable benefits including protection and enhancement of riparian soils and forests to help maintain high quality, cold water habitats for native salmonids in the face of climate change. Planting streamside trees and increasing riparian forest resiliency will sequester significant quantities of carbon, while CWJs will facilitate increased flood retention and groundwater recharge, and help meter sediment delivery and reduce pool and thermal refugia filling events. A similar approach implemented by Mr. Fiori and YTFP in lower Terwer Creek (Klamath River) has proven effective in increasing channel stability and mainstem, off-channel, and floodplain habitat complexity (Beesley and Fiori 2012, *Lower Terwer Creek Riparian Revegetation Project*).

Carbon sequestration: Whole tree materials sequestration value assumes that 30% of the equivalent tree volume of stored carbon is lost to the atmosphere in association with transporting and processing logs to lumber. Additionally, we estimate that wood loading and treated floodplain areas will result in a riparian forest with density of 30 trees/acre and trapping and storage of fine and coarse organic carbon into soils at a minimum rate of 0.5 tons/acre/year.

New Facilities, Policies, and Actions

Approximately 500 trees will be removed from upslope approved areas with a certified Timber Harvest Plan (THP) with 10 trees harvested with root wad, loaded, and hauled per day in preparation for helicopter placement. Hand crews will harvest small diameter trees in the upland and stage near the river for placement as slash for habitat under helicopter placed trees. Helicopter loading of Large Wood/Trees will occur during a one week period with the goal of placing approximately 500 whole trees at 30 distinct locations of approximately 16 trees per site complex. Trees will be placed at the range of 30-18" DBH with the average around 24" DBH. Engineering support consisting of a multi-disciplinary team of an engineer, geomorphologist, and restoration biologist will provide on-site direction of exact locations of tree placement and troubleshoot any design changes or engineering considerations while the helicopter is actively placing trees.

Potential Adverse Physical Effects

Potential physical impacts of this project include those associated with forestry practices, which include sedimentation and pollutant spills, however, tree removal will be covered by a certified THP and will be conducted according to acceptable professional standards and using BMPs. Any impacts will be immediately remediated using best practices.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Efficient groundwater basin management

A goal of the project is to increase pool depth and frequency, increase storage of instream gravel, and improve floodplain connectivity. An outcome of these changes will be to prolong the duration and quantity of surface flows during periods of low rainfall and stream flow. WRTC has documented low unprecedented flows in a majority of the South Fork Trinity River during summer periods and even during winter. The ecological benefits of our project will include increasing hyporheic exchange of surface and groundwater, improve water quality and quantity during base flow periods, and increase the amount of available habitat for juvenile and adult salmonids during low flow periods.

The SFTR is already listed as 303(d) impaired for temperature and a major limiting factor for spring chinook has been high stream temperatures. The current drought is exacerbating this temperature problem. Low precipitation and increased agricultural use has greatly reduced streamflows. Diminished streamflows increase stream temperatures and nutrient concentrations, both of which have led to increased algae blooms and reduced dissolved oxygen (Van de Water et al. 2006, *Klamath River*

Hydroelectric Project California Klamath Wild and Scenic River Preliminary Determination Report). The proposed large wood implementation enhancement projects will be placed at or near cold water inputs which will enhance thermal and water quality refugia for spring Chinook salmon in both adult and juvenile life history stages. The large wood projects will engage hyporheic flow and promote hyporheic exchange which also improves water quality and reduces stream temperatures. The project will help mitigate the impacts of this historic drought on salmonid populations to allow for adult migration.

Additionally, by protecting salmonid populations from the effects of the extended drought, this project enhances the cultural and subsistence sustainability of local Native American Tribes. The Yurok Tribe is a project participant and their community has historically borne the brunt of diminished salmonid habitat and the corresponding decreases in salmonid populations. Thus, the project supports environmental justice objectives to protect Native American Tribes from the effects of the drought as well as legacy land use and socio-political discrimination.

DIRECT WATER RELATED BENEFIT TO A DAC

Trinity County is sparsely populated with a populationsof around 13,000 people. Population density is generally light with an average density of 2 persons per 2/km² (4/mi²). The median income for a family is about $34,000. The communities of Hayfork and Hyampom are rural and have very high unemployment rates. Hyampom has less than 300 residents. Historically these populations have been subsistence hunters and fishermen and the lack of fish remains a problem both socially and economically.

The project will support the Watershed Research and Training Center (WRTC), a locally based NPO with a mission that focuses on creating employment for the DAC of Hayfork. Hayfork has some of the highest unemployment rates in California and the WRTC employs around 30-50 people per year in the community. This project will contribute to employment in the area by hiring local contractors, equipment operators, a WRTC hand crew, and project management and administration. The project also has the potential to help re-connect the local communities to their local rivers and foster stewardship values. The South Fork Trinity River, its problems and its potential, can be a catalyst which connects the community's well-being with the health of its ecosystems.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.22 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
Improved instream habitat	Photomonitoring, certified professional's statement of completion, final report	Pre- and post-project	Construction of 15 engineered log jams and revegetation of 2.5 acres of riparian habitat
Increased juvenile and adult salmonid densities in project reaches	Direct observation/counting adult holding/spawning and juvenile rearing before and after project implementation via snorkel surveys and spawning surveys.	2-4 times per year from 2015 – 2019.	Increased numbers of fish utilizing the project sites than are currently utilizing.
Geomorphic/physical evolution of scour, deposition, substrate composition	Pre-Post topographic/geomorphic surveys using thalweg, cross section and/or aerial photography to document changes.	Conduct geomorphic surveys once in 2015 and again post implementation.	Measureable scour, deposition, change in substrate, and pool depth in the area.
Localized improvements in water quality.	Data loggers to measure temperature, DO, nutrients and surveys to measure macroinvertebrate production (SWAMP).	Annually	Measureable localized change in water quality.
Increase in riparian vegetation.	Photopoint monitoring	Once pre implementation & once post.	Noticeable increase in riparian vegetation.
Install constructed wood jams	Photopoint monitoring.	Annually	15-25 CWJ constructed
Increased area of cold water refugia	Utilization of HOBO thermograph data loggers to monitor temperature and GPS survey of refugia extents	Annual GPS of extent and 30 minute readings for temperatures	Measureable decrease in maximum daily temperatures
Increase pool frequency, residual pools depths/area and instream cover to increase mesohabitats the project reaches.	Habitat typing (CSSHRM 98)	Once pre implementation & once post.	Increase of pool frequency by 30-50% instream cover by 30-50%

COST EFFECTIVE ANALYSIS

Table 7.22 – Cost Effective Analysis Project name: Watershed Research & Training Cntr S Fork Trinity River Spring Run Chinook Salmon Restoration Project	
Question 1	Types of benefits provided as shown in Table 5: *Habitat restored (Primary) & Species protected (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *Yes.*
	If no, why? *N/A*
	If yes, list the methods (including the proposed project) and estimated costs. *Alternative Method 1: Improve watershed health and quantity of flow rates in the tributaries and mainstem SFTR. Currently more than 50% of the water from tributary influence in the SFTR watershed is being diverted by illegal marijuana growing operations in upslope areas. This is a law enforcement and/or water regulatory issue, for which enforcement is spread extremely thin. Alternative method 2: Add wood by hauling the materials from upload areas and placement via tracked excavator type equipment. This is the typical approach for this type of restoration project, but due to the remoteness and difficult logistics to access the riparian zone, it has been determined as infeasible for most, if not all the project area. Alternative Method 3: In-stream wood harvesting and placement by cutting large trees in the riparian zone strategically (chop-drop). This is not the preferred alternative as the trees will be void of the rootwad, which is critical to performance.*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Alternative 3 is a lower cost option, but as described above this alternative would have negative consequences to the riparian corridor and will not effectively achieve the project goals of inducing geomorphic processes and promoting physical benefits of pool scour. This is the least cost alternative in the Hidden Valley, River Spirit, and St. John's river reach due to the inaccessibility of this remote reach or river. This reach is the highest priority section on the SFTR due to its historical spring-run chinook utilization and degraded habitat.*
Comments: *There are very few viable alternatives left to help restore the wild spring-run Chinook Salmon populations. Due to the historical degradation from logging, mass wasting, water diversion, and climate change, the situation on the SFTR is critical. Alt methods 1 and 2 are likely not feasible for political and logistics issues. Alt Method 3 could be used but may result in slope instability, loss in riparian canopy/shading, and large wood without rootwads are not as effective in promoting scour and more likely to move downstream.*	

WEOTT COMMUNITY SERVICES DISTRICT, ADDITIONAL WATER STORAGE

PROJECT DESCRIPTION

Brief: This project ensures water supply reliability for a Disadvantaged Community through construction of additional water storage to improve community resiliency to disasters and drought.

Expanded: The Weott Community Services District (WCSD) currently only has a capacity to hold an approximate 3 day water supply for consumers. In the event of a severe drought or any other emergency situation, this supply is not sufficient to properly deal with an emergency situation. In such an emergency not only would the CSD enact stage 3 of their drought contingency plan, but they would also have to make arrangements to purchase potable water, and try to resolve any additional issues that may arise. This project involves developing the planning phase of an additional water storage tank to ensure water supply reliability in the case of extended drought conditions or emergency situations.

The proposed tank will be a 500,000 gallon steel tank; a tank of this size will boost water storage capacity to 30 days, which would provide sufficient time to rectify most emergency situations. The WCSD diverts source water from an unnamed tributary and Decker Creek; the unnamed tributary has slowed over the last 3 years as drought conditions have continued. In addition to boosting water supply for emergencies, the additional tank would allow for more winter water diversion when the flow is in full stream, helping the CSD avoid pumping during low flow summer months. The WCSD only divert a small amount from the sources for treatment with the overflow of untreated water diverted back into the Eel River.

Additional storage would enable the WCSD to have sufficient time to deal with water shortages associated with extended drought conditions. The WCSD has enacted very strict water conservation methods to reduce demand; all customers are metered and water usage allotments are in place with an overuse charge if permitted allocations are exceeded. An outdoor potable water use restriction has recently been enforced allowing only two days per week to for outdoor use of potable water. Additionally, one of the two small water storage tanks currently in use is beyond its nearing the end of its useful life (built in 1972). It is concrete, leaky and in need of repair; a new tank would allow for retiring the old tank and also provide the benefit of water quality improvement.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation when it occurs include, but are not limited to:

- **Primary: water supply produced**: when implemented, this project will provide a 30-day supply of water in the amount of 1.5 AF for a DAC that currently has only a 3-day supply (approximately 0.15 AF).
- **Secondary**: **Avoided costs of water shortage**: The WCSD estimates that the cost of purchasing potable water and having it trucked in is approximately $650.00 per truck load. It takes 2 trucks to provide just a 1 day supply, so the project would provide an estimated benefit of $19,500 in avoided water shortage costs. This benefit would be realized during emergencies or periods of extreme drought.
- **Climate change adaptation**: increased water storage will allow for the more efficient use of water and buffer the community against prolonged drought and increased heat, which are expected outcomes of climate change.
- **Increased community capacity**: the WCSD provides water to the Agnes J. Johnson School, a Cal-Fire Station and Humboldt Redwoods State Park Campground; improving services to these entities will ensure their continued viability and contributions to socioeconomic stability for the community. Additionally, more water will be available for wildfire suppression, reducing the community's fire risk.
- **Regional equity and environmental justice**: This project increases the participation of small and disadvantaged communities in the IRWM process, especially enabling a DAC to develop and design a project critical to the community. The project also addresses safe drinking water needs and the Human Right to Water by providing extended, reliable access to safe, clean, and affordable water that is adequate for human consumption, cooking and sanitary purposes.

We respectfully respect that reviewers answer "N/A" for Question 8 in the Project Level Evaluation due to this community's disadvantaged status. We believe that the question – specifically the units required by the state for quantifying benefits– is not applicable to this project, which was locally prioritized by this DAC and regionally approved under the auspices of the IRWM Program. When implemented, it will provide many valuable benefits to the local community, but those benefits don't happen to be able to be expressed in the units detailed on page 19 of the PSP. This DAC does not have the luxury of having several medium priority projects to choose from that best fit the PSP requirements – it needs to solve a high priority issue as soon as possible simply to ensure the Basic Human Right to Water. Please respond "N/A" for Question 8 for this project.

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The WCSD currently only has a capacity to hold an approximate 3 day water supply. In the event of a severe drought or emergency situation, this supply is not sufficient to ensure the Basic Human Right to Water. The existing water supply infrastructure is at the end of its useful life and this DAC does not have the resources to implement the project on its own. The WCSD operates at a loss or very small profit

each year and cannot afford such expenditures and the community which depends upon it for potable water cannot bear the expense of infrastructure upgrades through rate increases.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

6. Solutions that yield a new water supply

The WCSD's current storage capacity of just three days is not a sustainable or reliable amount in the event of water shortage due to emergency conditions or the extended drought conditions expected with climate change. A 500,000 gallon tank would boost the water storage supply capacity to 30 days. Additionally, the water currently diverted would be collected and stored more efficiently with increased storage capacity.

In keeping with the instructions in the Proposition 84 2015 PSP on page 20, and **because this project is intending to provide direct water-related benefits to a DAC and it is in the planning/design phase and not intending to complete construction with this solicitation**, we have only responded to the first and sixth question in the *Technical Analysis* section. Even though the response for Drought Preparedness is not required, we have provided it in order to present the most complete picture of the project and its benefits.

DIRECT WATER RELATED BENEFIT TO A DAC

The former economic base for Weott residents—primary and secondary lumber industries—has largely disappeared. Some locals commute to jobs in nearby communities or work with government entities such as the school district or Humboldt-Redwoods State Park. Retirees also make up an important part of the community. The 2010 United States Census reported that Weott had a population of 288 and the community is a State recognized DAC. Please see Attachment 7 for greater detail on DAC status.

The proposed additional water storage will directly benefit the community by storing a sufficient amount of water to provide enough supply to respond to an emergency or possible drought related issue, ensuring that the community would not have to bear the burden of extended water shortage. It would increase water supply reliability, avoiding the costs a water shortage would incur.

PROJECT PERFORMANCE MONITORING PLAN

Projects intending to provide direct water-related benefits to a project area entirely comprised of a DAC that are in the planning or design phase and not intending to complete construction with this funding are not required to complete this section.

COST EFFECTIVE ANALYSIS

Projects intending to provide direct water-related benefits to a project area entirely comprised of a DAC that are in the planning or design phase and not intending to complete construction with this solicitation are not required to complete this section.

WESTHAVEN COMMUNITY SERVICES DISTRICT, WATER STORAGE TANK AND ROOF REPLACEMENT PROJECT

PROJECT DESCRIPTION

Brief: This project increases potable water storage capacity and provides water supply reliability for a DAC by repairing a water system identified by CDPH as defective.

Expanded: The water system of Westhaven CSD (District) relies on a single 100,000 gallon concrete storage tank with a metal roof supported by wood trusses that are in an advanced state of decomposition. A 2005 annual inspection conducted by the California Department of Public Health (CDPH) listed the tank's condition as "system or operational defect and/or potential health hazard – costly to correct – to be included in any long range water improvement project." In response, the District applied for and received Proposition 84 IRWM funding in 2012 (http://www.northcoastresourcepartnership.org/files/managed/Document/8074/NorthCoastConf13_Project-Westhaven.pdf) in to complete a tank upgrade project, which consists of: 1) Installing a new 85,000 gallon storage tank that meets current seismic standards; 2) Installing associated piping, pump, and controls; 3) Replacing the roof on the existing tank; 4) Using the new tank to modify operating parameters to better understand and ultimately reduce Disinfection by-products (DBPs); and 5) Determining if there is a relationship between water color and Dissolved Organic Carbon (DOC) levels. The District received $360,000 under Proposition 84 Phase II to complete the project. However, the funding request was based on old quotes from suppliers and details such as additional piping were not included in the cost estimate. In addition, the estimate for the new tank did not consider prevailing wage rates, and California's seismic code requirements had changed from the Uniform Building Code to the International Building Code, both increasing project costs. Therefore, the District is requesting an additional $159,000 to cover these additional expenses.

A new roof will complete the repairs recommended by CDPH in 2005 and protect the District's treated water from possible contamination. The existing tank's metal and wood roof does not meet seismic standards and may fail in an earthquake. Installing a second tank in order to repair the failing roof on the existing tank will provide water supply reliability to the community, as well as additional emergency and equalizing storage to the system. The second tank will also allow the District to investigate key factors in DBP formation. The system currently produces high levels of DBP with haloacetic acid concentrations recorded as high as 400 µg/l (State maximum is 60 µg/l). Haloacetic acids occur when naturally-occurring organic and inorganic materials in the water react with disinfectants such as chlorine; long-term ingestion of these compounds have been associated with increased risk of cancer (EPA 2013, *Basic Information about Disinfection Byproducts in Drinking Water: Total Trihalomethanes (TTHM), Haloacetic Acids, Bromate, and Chlorite*, available: http://water.epa.gov/drink/contaminants/basicinformation/disinfectionbyproducts.cfm). Also, additional storage will allow the District to possibly cease producing water during periods of heavy rain, which is hypothesized to reduce DOC levels (DOCs are pre-cursors to DBP formation).

The new water tank will increase water supply and improve water quality. It is not expected that installing a second tank will reduce DBP levels to the State maximum; however, it will help the District identify the major factors associated with DBP formation (such as DOC, chlorine concentration, chlorine contact time, and pH), and test the effectiveness of operating the system under different parameters. This information will be useful in reducing DBP levels and will be shared with appropriate agencies to increase capacity of other water systems in similar circumstances.

PROJECT PHYSICAL BENEFITS

Physical benefits expected from project implementation include, but are not limited to:

- **Primary: Water supply produced** equal to 0.26 AFY from new water storage tank
- **Secondary: Avoided costs of roof failure**: if the roof fails, the District's sole source of drinking water would be contaminated and their system storage would be eliminated. While the tank was out of service, the system could be supplied directly from the gravity fed slow sand filter, but would require augmenting with untreated unpotable water from an old open reservoir. The District estimates that it would cost $20,000 to disinfect the District system and $40,000 to flush customer lines, for a total one-time cost of $60,000 in addition to the costs of building new storage tank and roof (the cost of this project, adjusted for differences in costs between 2015 and the date the roof fails). Additional, uncounted costs would occur from consumers needing to boil water and any health issues which arose from an untreated water supply.
- **Improved drinking water quality**: although it is not expected that the second tank will reduce DBP levels to the State maximum, it will allow the District to begin to investigate causes of the elevated levels and methods for reducing them with an overall improvement for public health and safety.
- **Water supply reliability** for 500 people in a state-recognized Disadvantaged Community; this is an environmental justice issue in providing the Basic Human Right to Water.
- **Avoided cost of bottled drinking water**: 500 customers @ $2/person/day/180 days = $180,000. This is an environmental justice issue; this DAC can ill afford the cost of replacing unusable water supply with bottled water.
- **Avoided cost of Boil Water Orders** equal to $300 per year.
- **Avoided cost of emergency repairs** to protect the water supply in the event of roof failure is estimated to provide a monetary benefit of approximately $6,525. Project proponent estimates 35 sheets of plywood @ $35 and 3 tarps @ $100 and a 4 person work crew and equipment for one week (~ $5,000)
- **Increased fire safety**: the new water tank will bring the District into compliance with fire and emergency reserve standards, and reduce fire risk for the community.
- **Conflict reduction**: the new water tank would bring the District into compliance with fire and emergency reserve standards, and this project is mandated by the SWRCB Division of Drinking Water. Project implementation will alleviate conflict with regulators.

- **Climate change adaptation**: a reliable source of drinking water is paramount to ensure the Human Right to Water in this DAC in the face of prolonged drought conditions expected with climate change.

We respectfully respect that reviewers answer "N/A" for Question 8 in the Project Level Evaluation due to this community's disadvantaged status. We believe that the question – specifically the units required by the state for quantifying benefits in Table 5 – is not applicable to this project, which was mandated by the SWRCB, locally prioritized by this DAC and regionally approved under the auspices of the IRWM Program. It provides valuable benefits to the local community, but those benefits don't happen to be able to be expressed in the units detailed on page 19 of the PSP. This DAC does not have the luxury of having several medium priority projects to choose from that best fit the PSP requirements – it needs to solve this high priority issue as soon as possible simply to ensure the Basic Human Right to Water. Please respond "N/A" for Question 8 for this project.

Table 5.24 a – Annual Project Physical Benefits

Project Name: Westhaven CSD Water Storage Tank and Roof Replacement Project

Type of Benefit Claimed: Primary: Water supply produced - Primary

Units of the Benefit Claimed : AFY

Anticipated Useful Life of Project (years) 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017	0.31	0.57	0.26
2018	0.31	0.57	0.26
2019	0.31	0.57	0.26
Through 2066	0.31	0.57	0.26

Comments: Project implementation will occur in 2016; benefits will begin to accrue the following year.

Table 5.24 b – Annual Project Physical Benefits			
Project Name: Westhaven CSD Water Storage Tank and Roof Replacement Project			
Type of Benefit Claimed: Avoided costs of tank failure - Secondary			
Units of the Benefit Claimed : $			
Anticipated Useful Life of Project (years) 50 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2016	0	0	0
2017 - 2066	0	60,000	60,000
Comments: Project implementation will occur in 2016; benefits will begin to accrue the following year. This benefit would accrue if the roof failed; if the roof fails, the District's sole source of drinking water would be contaminated and their system storage would be eliminated. While the tank was out of service, the system could be supplied directly from the gravity fed slow sand filter, but would require augmenting with untreated unpotable water from an old open reservoir. The District estimates that it would cost $20,000 to disinfect the District system and $40,000 to flush customer lines, for a total one-time cost of $60,000 in addition to the costs of building new storage tank and roof (the cost of this project, adjusted for differences in costs between 2015 and the date the roof fails). Additional, uncounted costs would occur from consumers needing to boil water and any health issues which arose from an untreated water supply.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

This project is necessary to comply with California Department of Public Health requirements regarding maximum contaminant levels for HAA5 and TTHM. The water system of Westhaven CSD (District) relies on a single 100,000 gallon concrete storage tank with a metal roof supported by wood trusses that are in an advanced state of decomposition. A 2005 annual inspection conducted by the California Department of Public Health (CDPH) listed the tank's condition as "system or operational defect and/or potential health hazard – costly to correct – to be included in any long range water improvement project." Since, the District has repeatedly received *Notice of Violation for Maximum Contaminant Level for Haloacetic Acids* (Redding Branch, August 8, 2012, February 2, 2012, September 13, 2012, August 17, 2011, March 8, 2011, September 23, 2010, and April 14, 2010).

Westhaven CSD suffers from extremely limited source capacity. Source capacity currently varies between 40-60 gpm, compared to a maximum daily demand of approximately 46 gpm (0.66 MGD). The system is supplied 75% by a creek and 25% by a 100-foot deep well. Additional sources have been sought but none have been identified. Protection of the existing drinking water supply through the roof replacement project is of utmost importance.

The wood trusses supporting the roof of District's storage tank are rotting and subject to failure during an earthquake. Should the roof fail, the District's sole source of drinking water would be contaminated and their system storage would be eliminated. CDPH has determined that the failing roof is a potentially serious system health hazard (Wiedemann 2005, *Inspection of Westhaven CSD Public Water System*, CDPH p. 9) and should be replaced as soon as possible. Roof failure would also affect emergency storage and flows related to tank/system equalization and fire protection.

In addition, the District has extremely high levels of carcinogens (DBPs) in their distribution system. The addition of the second tank will allow the District to test the effectiveness of different operating parameters to reduce DBP, such as reducing initial chlorine contact levels, increasing chlorine contact time, and reducing DOC (important in the formation of DBP) by not drawing source water during or after periods of high rainfall. Rains increase DOC concentrations (Heisig 2009, *Nutrients, dissolved organic carbon, color, and disinfection byproducts in base flow and stormflow*, p. 36, 44, 54-67), and by tracking untreated water color (Heisig 2009), the District hopes to determine if there is a correlation between color, rainfall, and DOC, as well as to determine the relationship between raw water DOC levels and finished water DBP concentrations. Should the District determine that DOC is a primary contributor to the formation of DBPs, it can then focus State Revolving Fund grant money on removing DOC from their raw water. Also, if the District determines that there is a relationship between water color, DOC, and rainfall, it could turn off its treatment system during periods of heavy rains, and lower DBP concentrations in the distribution system.

Chlorine concentrations are a key factor in the production of DBPs (Hong et al. 2007, *Modeling of trihalomethane (THM) formation via chlorination of the water from Dongjiang River*, Science of the Total Environment, p. 51 – 52; Hua et al. 2008, *DBP formation during chlorination and chloramination: Effect of reaction time, pH, dosage, and temperature*, American Water Works Association, August 2008, 100:8, Figures 2, 3, 8, 9; Oneby, et al. 2009, *Model Shed Light on TTHM Formation*, Water Works Association, November 2009, p 2) and the District cannot currently reduce chlorine levels because it is required to maintain a high initial chlorine concentration to meet DPH disinfection requirements. Time is also a factor in DBP production. However, studies appear to indicate that most DBPs are produced within 72 hours of chlorination (Hua 2008). The District's current residence time during the winter months (when DBP concentrations peak), is between three and five days. Therefore, the additional storage, and consequently additional chlorine contact time, is not expected to further increase DBP concentrations. The addition of the second tank will allow the District to test the effectiveness of different operating parameters to reduce DBP, such as reducing initial chlorine contact levels, increasing chlorine contact time, and reducing DOC (important in the formation of DBP) by not drawing source water during or after periods of high rainfall. Although the additional storage may not solve the District's DBP problem, it will allow flexibility to test different operating parameters to develop an understanding of how DOC and chlorine create DBPs in the system.

Estimates of without-project conditions

The roof has exceeded its lifespan. The deterioration of the trusses is such that a catastrophic event such as an earthquake or heavy winds could cause the roof to collapse. Without repair, it is highly likely the roof would fail in the next 5 years.

If the roof failed it would require about six months repair the existing tank and roof. In the interim, the District would issue a boil water order and provide bottled drinking water to its 450 users. After the initial cleanup, which would require several days, the District would keep the tank in service and provide non-potable water during construction of a new tank. While the tank was out of service, the District would supply the system directly from the gravity fed slow sand filter. During peak demand, the District would augment these supplies with untreated water directly from an open reservoir. Residents would be without a potable water source for the entire duration of construction of the replacement roof—six months—and without any water source for the duration of construction of the temporary roof—about five days.

If the roof does not fail, the community will continue to be exposed to health risks associated with elevated DBPs. In short, this DAC would continue to experience environmental justice issues that interfere with the Human Right to Water.

Description of methods used to estimate physical benefits

Methods for estimation include the water quality studies and CDPH inspection reports referenced above. Staff and consulting engineering reports provide detailed documentation of the water system's current deficiencies.

Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The project consists of: 1) Installing a new 85,000 gallon storage tank that meets current seismic standards; 2) Installing required piping, pump, and controls; and 3) Replacing the roof of the existing tank. 4) Using the new tank to modify operating parameters to better understand and ultimately reduce Disinfection by-products (DBPs); and 5) Determining if there is a relationship between water color and Dissolved Organic Carbon (DOC) levels.

Potential Adverse Physical Effects

The project may produce temporary environmental impacts and possible temporary effects related to water supply for customers during construction. All work will be conducted according to accepted professional standards and any adverse impacts would be mitigated to the extent required by permits obtained for the work and other California regulations.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

1. Solutions that yield a new water supply

The District's spring flows have dropped below normal and the one well is showing signs of going dry. The District has reduced flows from the well, and the water surface elevation in the well has dropped from 55 feet to just a few feet above the pump. The District has documented that its source streams have seen a 30% reduction in flow due to the drought.

Constructing the second tank would raise the available storage from 100,000 to 185,000 gallons and bring the District into compliance with fire protection and emergency storage reserve requirements. 135,000 gallons is the amount of storage recommended by the American Water Works Association of a District the size of the Westhaven Community Services District.

Small water systems have historically experienced the majority of health and safety impacts and water shortage emergencies regardless of drought conditions or water year type. Drought further stresses small water systems, particularly in geographically vulnerable locations or lightly-populated rural areas such as Westhaven where opportunities for interconnections with other systems or water transfers are limited. Small systems also have limited financial resources and rate bases that constrain their ability to undertake major capital improvements. The North Coast Region has historically been considered an at-risk geographic area due to dependence on unreliable water sources and groundwater in fractured rock systems or in small coastal terrace groundwater basins. The high spatial variability of groundwater conditions in fractured rock settings typically makes regional-scale monitoring impractical. In addition, improvements in alluvial basin groundwater monitoring being brought about through CASGEM and the requirements of shortage contingency planning associated with Urban Water Management Plans are not applicable to smaller systems.

DIRECT WATER RELATED BENEFIT TO A DAC

Westhaven CSD provides water to 75% of Westhaven-Moonstone residents. In 2014, the District provided water service to 233 residential customers (CDPH 2014, *Annual Inspection Report*). The greater unincorporated area of Westhaven-Moonstone is almost entirely residential. The current population of Westhaven-Moonstone (greater than the WCSD service area) is 1,528 and the median household income is $45,206, thus the community is Disadvantaged. All benefits from this project will directly benefit the community. Completing construction of the new storage tank and replacing the roof of the existing tank is essential to ensuring that this Disadvantaged Community's drinking water is protected from potential contamination.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 6.24 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Measurement Tools and Protocols**	**Monitoring Frequency**	**Targets**
85,000 gallon tank construction – Increased water storage	Construction monitoring • Construction update with test results • Construction observation reports • Photomonitoring • Tank closeout report • Project status summary	Monthly	• Final plan, specifications, and geotechnical report • Bid results • Bid award • Contract with contractor
New roof construction over existing tank – Protecting existing water storage	Construction monitoring • Construction update with test results • Construction observation reports • Photomonitoring • Tank closeout report • Project status summary	Monthly	• Demolish existing roof • Construction of new roof • Final inspection
Water Quality Monitoring	• Monitoring of water quality • Record rainfall levels • Test for Halo Acetic Acids • Test for THM's with water treatment system off during heavy rains • Test for THM's with water treatment system on during heavy rains	• Monitoring and testing will be Daily • Operational water testing for THM's will be during heavy rains.	• Determine if there is a correlation between water color and disinfection byproducts • Determine if tank operational changes can reduce disinfection byproducts.

Monthly progress reports will be submitted through project completion. Reports will describe project progress, activities completed, problems encountered, and percent complete for all project tasks. A Project Performance and Monitoring Plan will be developed that: 1) Identifies performance goals related to DBP monitoring; 2) Defines performance indicators for each goal related to DBP monitoring; 3) Identifies the method, frequency, and schedule for collection of DBP data; 4) Identifies the party responsible for data collection and management; and 5) Interprets and summarizes data to be included in the final report.

COST EFFECTIVE ANALYSIS

Table 7.24 – Cost Effective Analysis Project name: Westhave CSD Water Storage Tank and Roof Replacement Project	
Question 1	Types of benefits provided as shown in Table 5: *Water supply produced (Primary), Avoided costs of tank failure (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *This project is mandated by the SWRCB, Division of Drinking Water.*
	If yes, list the methods (including the proposed project) and estimated costs. *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *N/A*

YUROK TRIBE, YUROK WATERSHED RESTORATION AND DRINKING WATER SECURITY

PROJECT DESCRIPTION

Brief: This project combines water storage and habitat restoration to bolster water supply reliability and protect culturally important special status species for a Tribal DAC.

Expanded: The Yurok Tribe is proposing a comprehensive resource management project comprised of two components: an Alternative Drinking Water Storage Component (Water Storage) and a Watershed Restoration Component (Watershed Restoration). This coordinated project was developed to meet the following high priority Tribal Trust water resource protection and restoration needs: improving water security for tribal members while protecting cold water tributary flows, increasing community and watershed resiliency to climate change affects, and implementing effective habitat restoration measures in priority Lower Klamath tributaries. Lower Klamath tributaries support numerous anadromous fish populations as well as provide vitally important cold water inputs to the mainstem Klamath during summer (i.e. thermal refugia) (CDFW 2004, *Recovery Strategy for California Coho Salmon*; NOAA NMFS 2014, *Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon*).

Anadromous fish from throughout the Klamath Basin rely on thermal refugia for survival while migrating to the ocean as juveniles or to their spawning grounds as adults. In the face of climate change and the current drought, there is a critical need to protect and/or enhance "cold" water sources while also ensuring reliable domestic water supplies for disadvantaged communities (Sanctuary Forest 2014, *Resilience in a Time of Drought: A Transferable Model from Collective in North Coast Watersheds*, available: http://www.calsalmon.org/sites/default/files/files/GuideForCollectiveAction_2014.pdf).

The Water Storage component will work with five landowners with surface drinking water systems on Klamath tributaries identified as important for supporting thermal refugia for native fish. These landowners indicated that they must divert 25-40% of their tributaries during summer and do not have filtration systems or float valves. We will install 3-2500 gallon tanks and filter systems to provide these landowners additional water storage capabilities during the rainy season with the goals of providing adequate supplies of filtered drinking water during the driest part of the year (August-September), and eliminating summer diversions to provide increased thermal refugia benefits. This is a pilot program and if successful, it will be expanded to increase water security throughout the sub-basin.

The Watershed Restoration component consists of designing and implementing feasible instream habitat restoration in Blue Creek, and decommissioning priority legacy roads and stream crossings in Terwer Creek to provide long-term water quality benefits. Blue and Terwer creeks support spawning runs of chinook (*Oncorhynchus tshawyscha*), coho (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and coastal cutthroat trout (*Oncorhynchus clarkii clarkii*) as well as provide vitally important summer thermal refugia in the Klamath River (Beesley and Fiori 2008). These tasks were selected to support larger-scale Yurok restoration initiatives: comprehensive restoration of Terwer Creek, and future management of lower Blue Creek as a salmon sanctuary. Blue Creek is the largest Lower Klamath

tributary and is the highest priority watershed for receiving protection and restoration. Therefore, developing and implementing effective restoration designs capable of facilitating multiple and long-term water resource benefits (i.e. increased salmonid productivity, improved water quality, and climate change resiliency) is critically important.

PROJECT PHYSICAL BENEFITS

Physical benefits by this project include, but are not limited to:

- **Primary: Water supply produced** of 0.2 AFY.
- **Secondary: Species protection** of 3 species: coho, steelhead and Chinook salmon.
- **Fishery benefit** of increased instream flow amounting to 0.0003155 CFS, a 30% increase for 60 days during the hot summer months when instream flow is limited.
- **Water quality improvements**: Sediment savings of 2,694 tons of sediment prevented from entering valuable instream habitat yearly. This benefit is estimated to provide a monetary value of $16,164 using a conservative estimate of $6/ton (Hansen and Ribaudo 2008, *Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment*, U.S. Department of Agriculture, Technical Bulletin No. 1922)
- **Habitat restoration:** Installation of a minimum of 215 whole trees to improve instream storage and sorting of sediment and hyporheic processes.
- **Water supply reliability** for 5 households in a Tribal DAC
- **Avoided costs of water purchases** of about $8,000 per year. We estimate 100 gallons per day per each of five households or 30,000 gallons over 60 days. Local water haulers provide 3,000 gallons per load at $800 per load.
- **Environmental justice and increased community capacity**: Improved instream and riparian habitat will support fisheries to sustain Yurok subsistence and cultural relationship with the Klamath River and its resources.
- **Climate change mitigation**: Whole tree materials used in this project will divert approximately 121 tons of carbon to long term in-channel storage for an economic value of approximately $1,815 (California Environmental Protection Agency, Air Resources Board 2014, *California Air Resources Board Quarterly Auction 6, February 2014: Summary Results Report,* http://www.arb.ca.gov/cc/capandtrade/auction/february-2014/results.pdf).
- **Climate change adaptation**: The Water Storage component was designed specifically to meet the challenges of drought and climate change by increasing Tribal members' ability to store water during storm events for use during the dry season rather than relying solely on surface diversions with flows expected to become increasingly more unpredictable. Restoring watershed health and productivity is likely the most meaningful way to increase habitat and species resiliency to drought and climate change and will thus better support our communities and local economies as well as cultural and subsistence values.

Table 5.25 a – Annual Project Physical Benefits			
Project Name: _Yurok Tribe Yurok Watershed Restoration and Drinking Water Security			
Type of Benefit Claimed: _Water supply produced - Primary			
Units of the Benefit Claimed : __AFY			
Anticipated Useful Life of Project (years)___15 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	0.2	0.2
2019	0	0.2	0.2
2020	0	0.2	0.2
Through 2032	0	0.2	0.2
Comments: Water Storage component will be implemented in 2017 and benefits will begin to accrue the following year. The expected life of the polyethylene tanks installed is 15 years.			

Table 5.25 b – Annual Project Physical Benefits			
Project Name: _Yurok Tribe Yurok Watershed Restoration and Drinking Water Security			
Type of Benefit Claimed: _Species protection - Secondary			
Units of the Benefit Claimed : __Number of species			
Anticipated Useful Life of Project (years)___50 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	3	3
2019	0	3	3
2020	0	3	3
Through 2067	0	3	3
Comments: Water storage component will be implemented in 2017; in 2018 species benefits will begin to accrue. Restoration component will be implemented in 2018 with project life expected to be over 50 years. Species protected include coho, Chinook, and steelhead.			

TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

Explanation of Need

The Klamath River is the life blood of the Yurok and central to tribe's culture and livelihood is the harvest of anadromous fish. Lower Klamath habitats have been significantly impacted and fish stocks continue to decline due to land use practices occurring since the mid-1800s (Gale and Randolph 2000, *Lower Klamath River Sub-basin Watershed Restoration Plan*, Yurok Tribal Fisheries Program, Klamath, California, available: http://www.yuroktribe.org/departments/fisheries/reportsandpublications.htm). Declining fish numbers and alterations to flow resulting from dam operations in the upper parts of the basin have significantly impacted tribal members' ability to sustain their livelihoods. The Yurok Reservation is extremely remote and surface water has been the main source of water for tribal members for many years. Climate change impacts such as less summer precipitation and the current drought have resulted in extremely low creek flows. These impacts negatively affect both the fish and the people in various ways. Households relying on creeks for their drinking water are diverting >25% of their flow during the driest summer months (August-September) which further impacts the fisheries these communities rely on.

Estimates of Without-Project Conditions

The five households have all indicated inadequate drinking water storage and lack of drinking water supply during low flow periods. During low flows, diversions may exceed the available water supply in the creeks. Without the project, the community will continue to experience water outages and conditions necessitating water purchases.

Without active and comprehensive watershed restoration as proposed for this project, Lower Klamath tributaries will continue to remain in a degraded condition and not provide adequate habitat for numerous Tribal Trust fish and wildlife species. Degraded conditions equate to poor water quality (i.e. excessive sediment delivery), instream and riparian forest habitat dysfunction (i.e. lack of salmonid spawning/rearing habitat; lack of forest resiliency and lack of forest services such as stream shading and fluvial wood recruitment).

Methods Used to Estimate Physical Benefits.

The Water Storage component was designed from an assessment of creek flow data gathered to develop a tribal residential surface water policy. At that time, surface water diversion rates >25% were mapped. Tribal staff and landowners collaborated to design the water storage tank project. The Yurok Tribal Watershed Restoration Program (YTWRP) completed a Terwer Creek watershed assessment and road inventory in 2004 that identified and prioritized potential roads for decommissioning (YTWRP 2004, *Terwer Creek Watershed Assessment and Road Inventory*). Since 2007, YTWRP has decommissioned seven high priority roads and developed additional site specific road treatments including those proposed for this project (i.e. *Terwer K10 & T10 Road Removal & Sediment Reduction Design*). Blue Creek restoration is identified in YTFP's Phase I Blue Creek planning document (Beesley and Fiori 2008, *Restoration Planning in Lower Blue Creek, Lower Klamath River: Phase* I. Yurok Tribal

Fisheries Program, Klamath, California. Available: http://www.yuroktribe.org/departments/fisheries/documents/YTFP_2008_BlueCreekRestorationPlan-PhaseIFINAL_001.pdf) and instream restoration actions proposed in West Fork Blue Creek are described in a conceptual design report.

Fisheries protection from water storage: The amount of water in gallons per minute was calculated at each in-take to determine the household diversion amount on the creeks (with landowner permission). A weir was constructed and a 5-gallon bucket was used to calculate the amount of water flowing into the intake. The landowner provided water scarcity and diversion information and >25% diversion was calculated based on creek flows. The project estimated 50 gallons per person, per household, per day for two months (August and September). Creek diversions greater than 10% of the creek flow were determined to be significant diversions for potential cold water refugia sources. The Water Storage project design incorporates the methodology and technical basis of the project from *Resilience in a Time of Drought: A Transferable Model from Collective Action in North Coast Watersheds* (Sanctuary Forest 2014).

Restoration actions include installation of constructed wood jams (CWJs), removal of legacy roads and stream crossings, and planting riparian trees. These actions have a demonstrated ability to provide immediate and long-term resource benefits such as enhanced salmonid rearing and spawning habitat quality/quantity, improved water quality, and productive riparian forests (CDFW 2004, *Recovery Strategy for California Coho Salmon,* Priority recovery tasks: KR-KG-04, KR-KG-05, KR-KG-06, KR-KG-08, KR-KG-13, KR-KG-14, KR-KG-15, KR-KG-16, KR-KG-17, KR-KG-23, and KR-KG-24 (https://nrm.dfg.ca.gov/coho/coho_tasks.aspx). ; CDFW 1998-2010, *California Salmonid Stream Habitat Restoration Manual, VII Project Implementation, X Upslope Erosion Inventory and Sediment Control Guidance, and XI Riparian Habitat Restoration*). CWJs will increase low velocity refuge for adults and juveniles over the full range of flows; help retain quality spawning gravel; and increase pool area, volume, cover, and pool: riffle metrics. Research from Washington found juvenile coho production increased in stream reaches where more complex structures were installed compared to simple log structures (Cederholm et al. 1997, *Response of Juvenile Coho Salmon and Steelhead to Placement of Large Woody Debris in a Coastal Washington Stream*. North American Journal of Fisheries Management. Vol. 17: 947-963.). Treatment of mid-slope and streamside road segments and stream crossings will greatly reduce the potential of these features delivering excessive amounts sediment directly into salmonid spawning and rearing reaches of Terwer Creek, restore natural flow and vegetation patterns, and promote more groundwater recharge by removing roads and associated drainage features.

A goal of the project is to increase pool depth and frequency, increase storage of instream gravel, and improve floodplain connectivity. An outcome these changes will be to prolong the duration and quantity of surface flows during periods of low rainfall and stream flow. YTFP has documented low and subsurface flows in a majority of Lower Klamath tributaries, even during winter (YTFP various dates, *Yurok Fisheries Reports*). The ecological benefits of our project will include increasing hyporhic exchange of surface and groundwater, improve water quality and quantity during baseflow periods, and increase

the amount of available habitat for juvenile and adult salmonids during low flow periods (Beesley and Fiori 2012, *Lower Terwer Creek Riparian Revegetation Project*).

The sediment reduction estimate is based on the following equation, observations and assumptions: i) Sediment reduction (per year) = annual trapped sediment x trapping efficiency of treated surface x treated surface area; ii) fine grain sediments are trapped and stored at existing floodplain and riparian restoration sites at approximately 0.25 inch/year (depending on water year type); ii) trapping efficiency of treated floodprone surface areas of 50% ; and iii) Proposed treatment areas in Blue and Terwer Creeks are 1.4 and 8.7 acres, respectively.

Whole tree materials used in this project will divert approximately 121 tons of carbon to long term in-channel storage for an economic value of approximately $1,815 (Hansen and Ribaudo 2008). This assumes that 30% of the equivalent tree volume of stored carbon is lost to the atmosphere in association with transporting and processing logs to lumber. We estimate that wood loading and treated floodplain areas will result in a riparian forest with density of 30 trees/acre and trapping and storage of fine and coarse organic carbon into soils at a minimum rate of 0.5 tons/acre/year.

New Facilities, Policies, and Actions

This project will construct three 2,500 gallon water tanks, roughing filters and sand filtration systems to increase water supply reliability in this DAC Tribal community. It will also decommission 2.34 miles of unmaintained roads, install 21 fish habitat structures in West Fork Blue Creek, remove 12 stream crossings in Terwer Creek, and plant 2,500 native trees to increase quality and reduce sedimentation of salmonid spawning and rearing habitats.

Potential Adverse Physical Effects

Potential physical impacts of this project include those associated with forestry practices and construction activities, which include sedimentation and pollutant spills, however all activities will be conducted according to acceptable professional standards and using BMPs. Any adverse impacts will be immediately remediated using best practices. A CEQA Negative Declaration will be obtained for this project.

Drought Preparedness

This project will achieve the following Drought Preparedness implementation goals:

- Providing a solution that yields a new water supply

The Yurok Tribe reasserted the 2014 Drought Declaration by Declaring a Drought Emergency by Resolution in April 2015 and is currently developing a Yurok Drought Contingency Plan to identify drought thresholds for Yurok water systems. Out of 259 households, 190 rely on surface water from Lower Klamath tributaries and springs. Drought conditions have caused more of these community members to experience summer outages and low flows. The tribe has been delivering water for the past two months and will continue as needed for drinking water but at great expense. Drought and water

management impacts have also been extremely challenging for native salmonids that rely on the river for suitable cool water habitats while migrating to spawning grounds as adults or to the ocean as juveniles. The drought has magnified fishery and water resource impacts associated with wide-spread habitat degradation resulting from historic and on-going land use in tributaries not affected by water diversions.

The Tribal Drinking Water Diversion Alternative directly supplies water to households that currently lack year- round water security. The water storage tanks will be a source of long-term drought and climate change preparedness by providing additional storage during times of water availability. Implementing comprehensive watershed restoration measures such as removing legacy roads to reduce sediment impacts to tributary and mainstem Klamath habitats and enhancing stream and riparian habitats will result in long-term water quality benefits. These restoration measures are critically important to the recovery and sustainability of native fish runs and the Tribal members who rely on their harvest for their subsistence. With the current drought and in the face of climate change, the Yurok Tribe is actively pursuing multiple actions and adaptation strategies to increase community and watershed resiliency.

DIRECT WATER RELATED BENEFIT TO A DAC

The Yurok Tribal community is a recognized DAC and all benefits of this project will accrue to the community as well as to the region and beyond (fisheries sustainability). The project will provide drinking water security for community members with the goal of expanding this program to include providing off stream water storage for more homes and further address residential factors impacting cold water sources. Landowners have greatly assisted the Tribe in identifying the need for the proposed Water Storage component of this project. All of the participating households have indicated a concern for their long-term drinking water security, water quality, and scarcity of water in the creeks resulting from summer diversions.

The project will also provide employment for Yurok Tribal members in the short- and long-term. A restored fishery will increase employment and bring in significant local revenue annually via ecotourism and recreational and commercial fishing. Yurok people harvest native fish for cultural, nutritional and economic purposes, thus fisheries recovery is essential to a sustainable, resilient community.

Please see Attachment 7 for greater detail on DAC status.

PROJECT PERFORMANCE MONITORING PLAN

Table 5.25 – Project Performance Monitoring Table			
Proposed Physical Benefits	**Targets**	**Measurement Tools and Protocols**	**Monitoring Frequency**
Increased Drinking Water Storage	3 2,500 gallon storage tanks installed	Photomonitoring and certified engineer's statement of completion	Pre- and post-project
Increase Instream Habitat Complexity	Install 21 Constructed Wood Jams (CWJs) (215 Whole Trees Installed)	Photo-Monitoring & CWJ Surveys/Count	Pre- and post-project
Increase Riparian Forest Resiliency	Plant 2,500 Native Conifers in Riparian	Photo-Monitoring & Physical Count	Pre- and post-project
Reduce Potential Sediment Impacts	Treat 33 Erosion Sites with Potential of Delivering 9,980 Cubic Yards of Sediment to Salmonid Stream	Photo-Monitoring & Physical Surveys	Pre- and post-project
Improve Natural Flow Patterns	Remove 12 Stream Crossings & Treat 2.34 Miles of Legacy Roads	Photo-Monitoring & Physical Surveys	Pre- and post-project

Water Storage: Performance targets include increased long-term water security to the Yurok reservation community and increased drought preparedness. The methods used to monitor the projects ability to achieve the benefits are to provide water storage tanks that will be filled during high flows, sand filtration and a roughing filter, and float value for overflow to households on creek surface water systems.

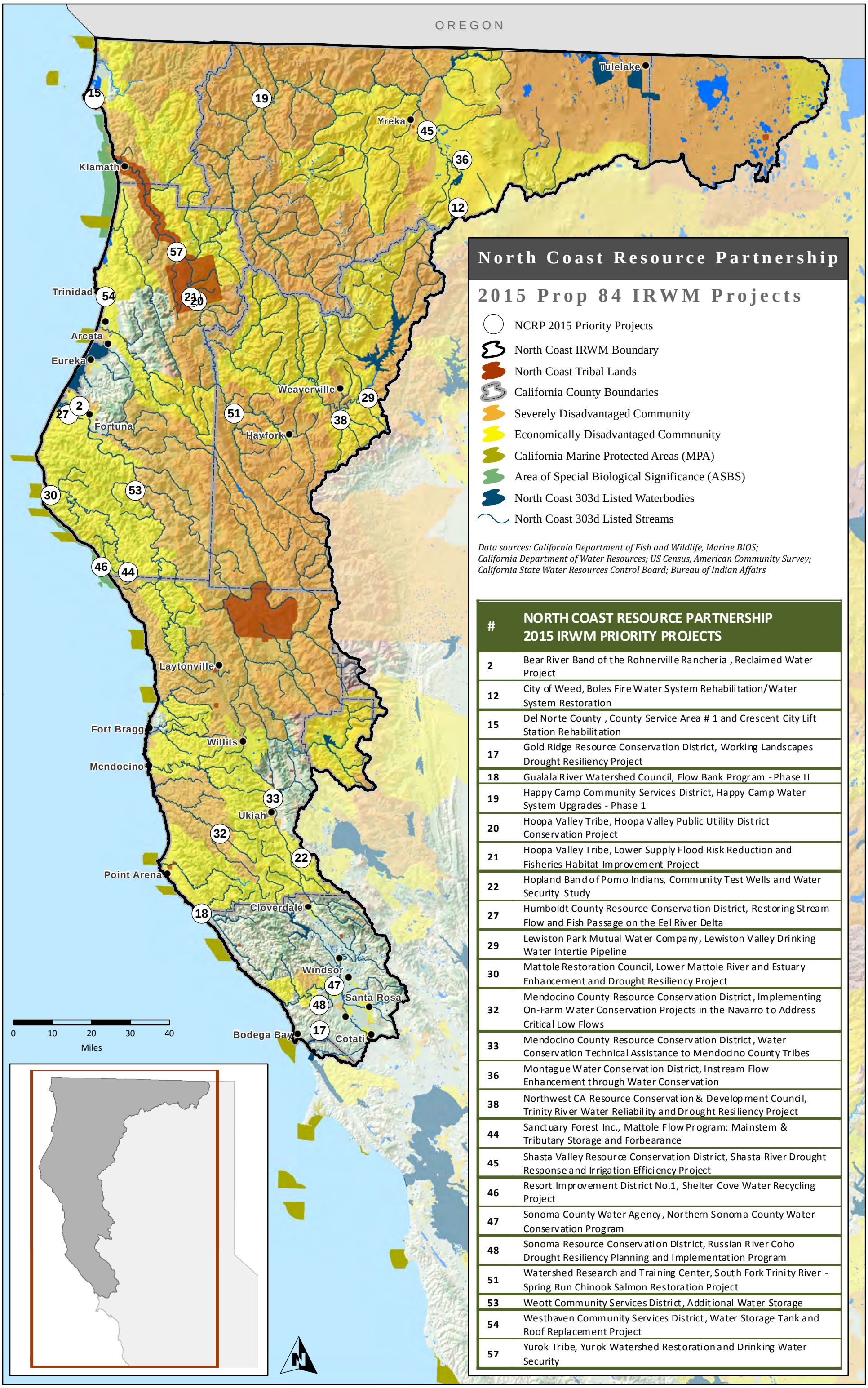
Restoration: Performance targets include reduced potential of sediment delivery and flow alteration impacts, and increased instream and riparian habitat complexity. Standard metrics will be measured and documented throughout the project's duration. Performance measures will be detailed in a DWR approved Monitoring plan. Photo-monitoring will be conducted for all project aspects to help document pre- and post-project conditions.

COST EFFECTIVE ANALYSIS

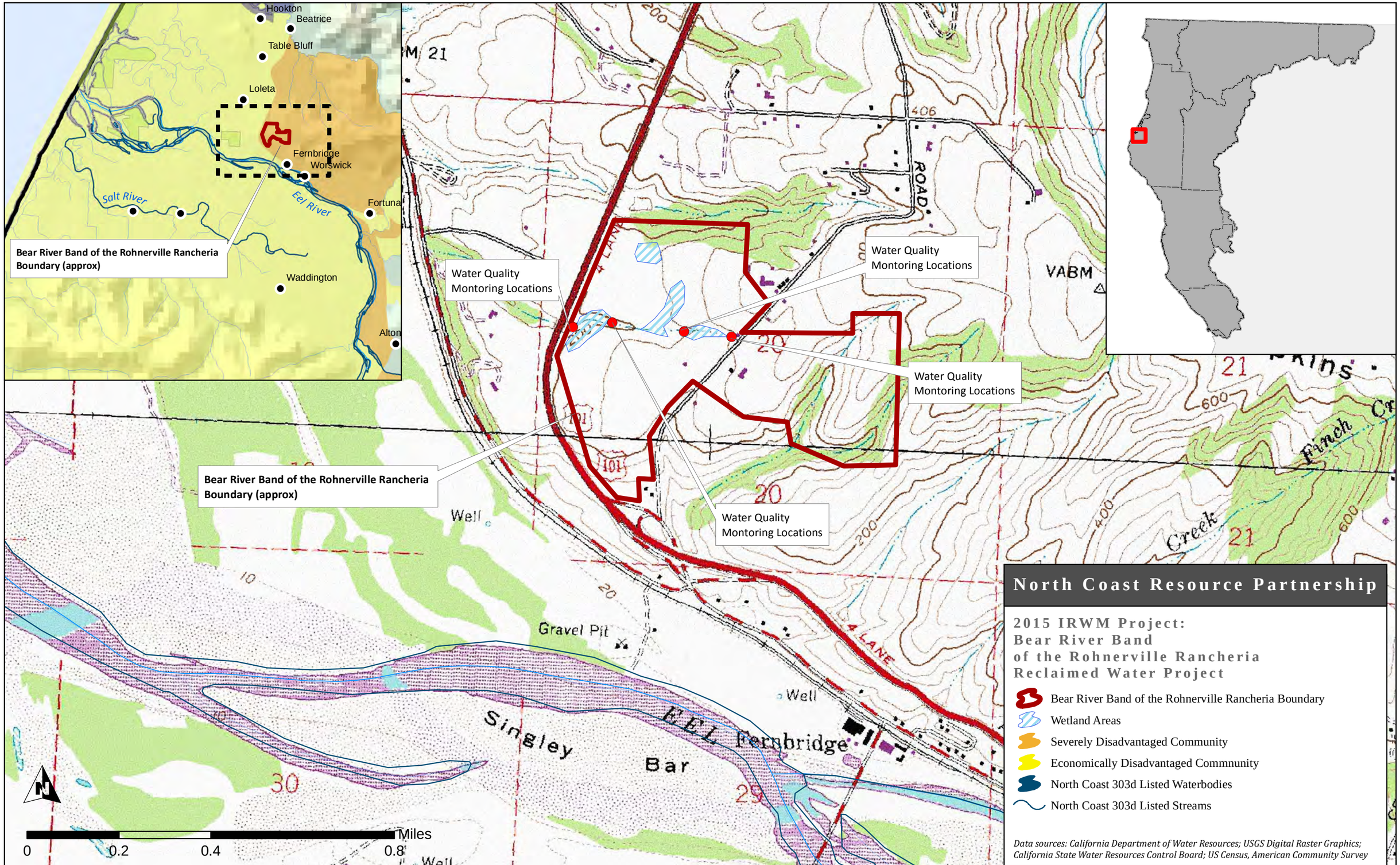
Table 7.25 – Cost Effective Analysis Project name: __Yurok Tribe Yurok Watershed Restoration and Drinking Wate Security_____	
Question 1	Types of benefits provided as shown in Table 5: *Water supply produced (Primary) and Species protection (Secondary)*
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? *No.*
	If no, why? *Watershed restoration is the only feasible approach to native fish recovery and long-term sustainability of the disadvantaged communities living along the Lower Klamath River. Restoration techniques proposed by the Yurok Tribe have wide-spread natural resource agency support and have proven to be effective at meeting resource goals. Although alternative methods to provide community members with water exist, they were deemed not cost-effective and/or not capable of achieving the desired resource and community resiliency benefits. Connecting all Tribal members to a community water system is not feasible given the lack of capacity of the existing systems and the difficulties or extremely high costs associated with constructing the waterways in such steep terrain. As previously discussed, hauling water to remote households is also not cost-effective. Neither of these alternatives address climate change impacts such as water scarcity or the need for increased thermal refugia benefits. No alternatives for habitat restoration measures were considered because methods proposed have Tribal, state, and federal support and are deemed to be the most cost-effective approach. Alternative water security measures were considered but were deemed not cost-effective or capable of providing much need resource benefits (i.e. increased cold water inputs to the Klamath River during summer).*
	If yes, list the methods (including the proposed project) and estimated costs: *N/A*
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. *Habitat restoration including water quantity/quality improvement measures such as those proposed is the most cost-effective way to provide immediate and long-term resource and community benefits (i.e. climate change adaptation, water security, cold water protection).*
Comments:	

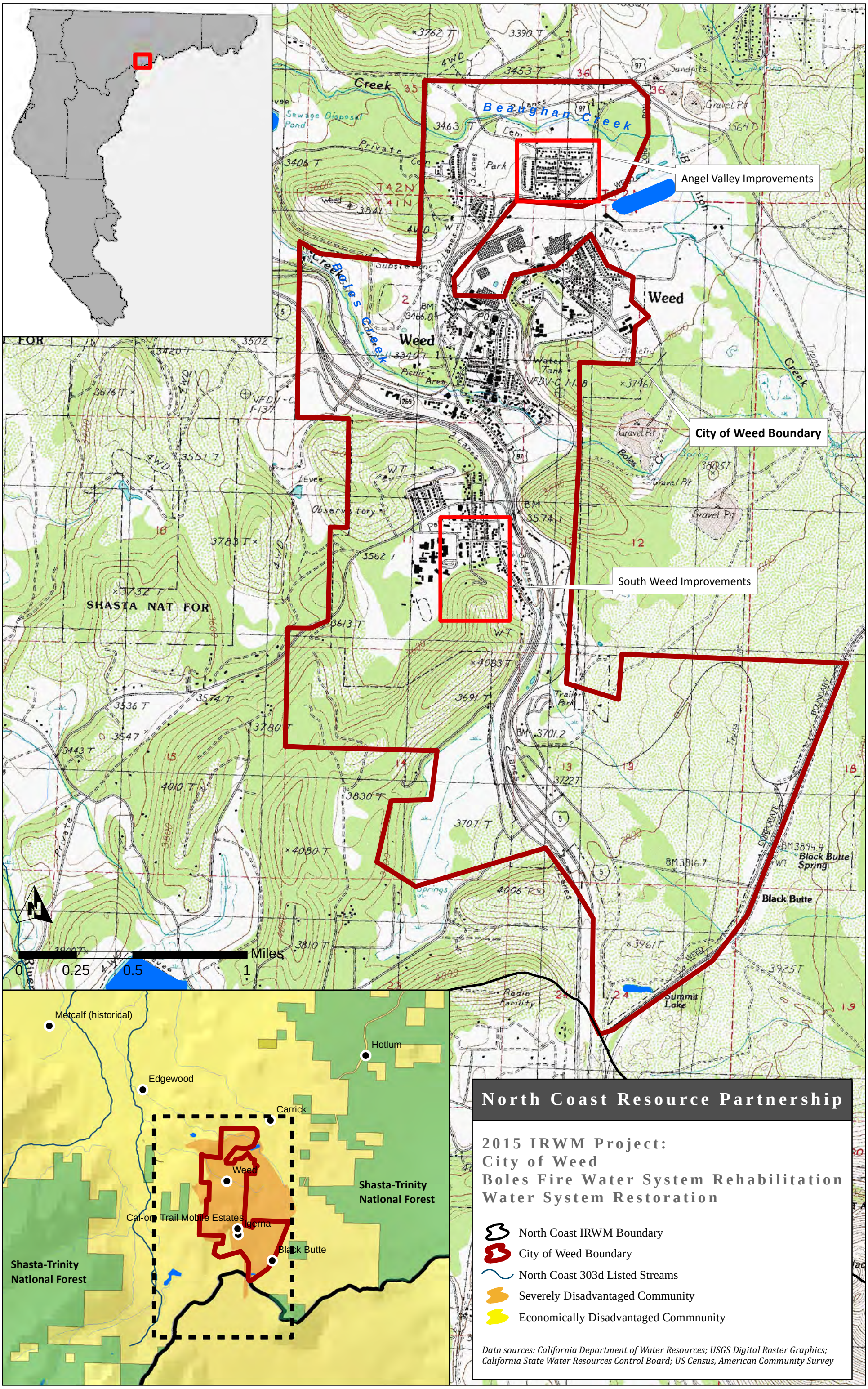
NORTH COAST RESOURCE PARTNERSHIP

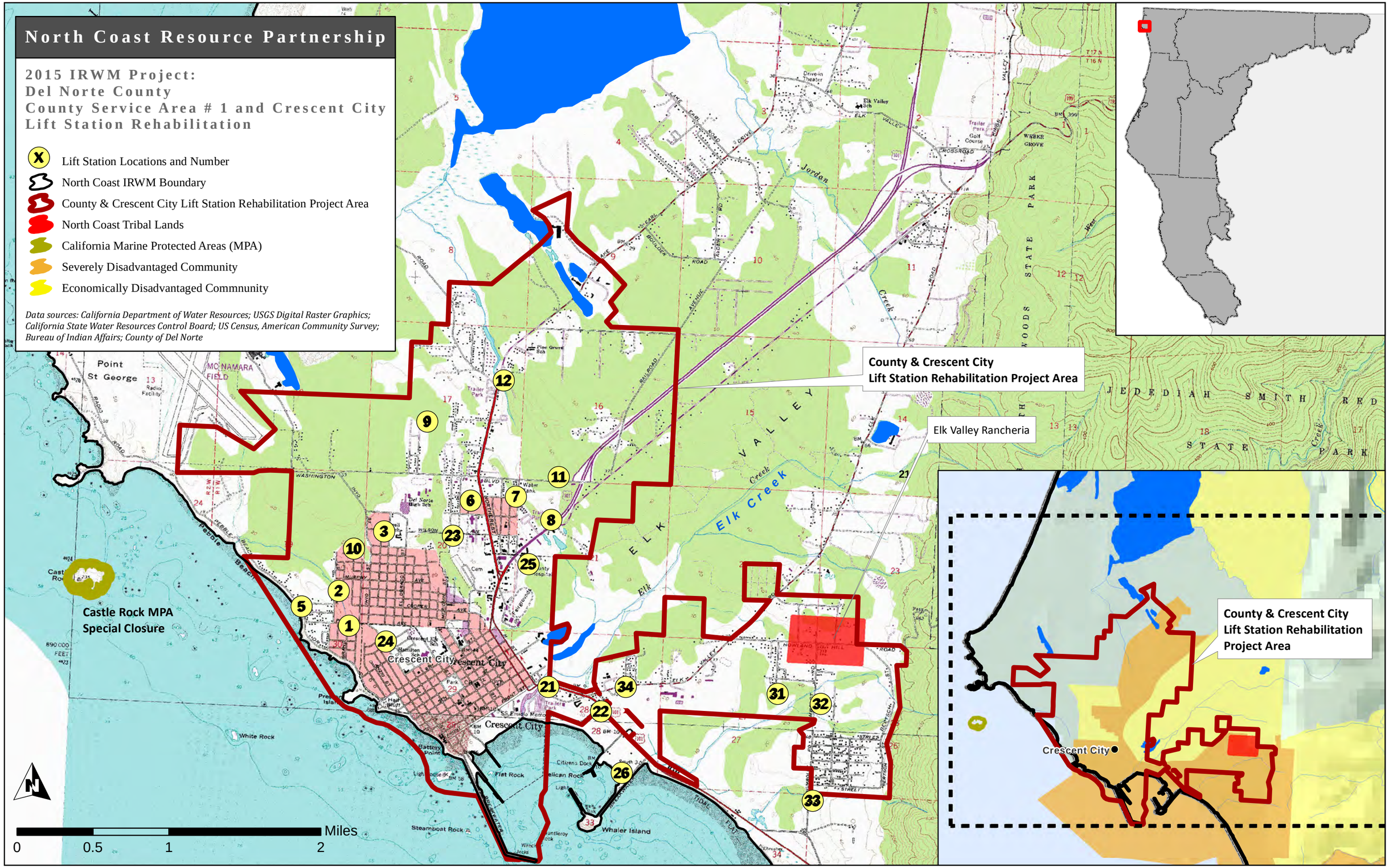
NORTH COAST 2015 IRWM PROPOSAL AND PROJECT MAPS

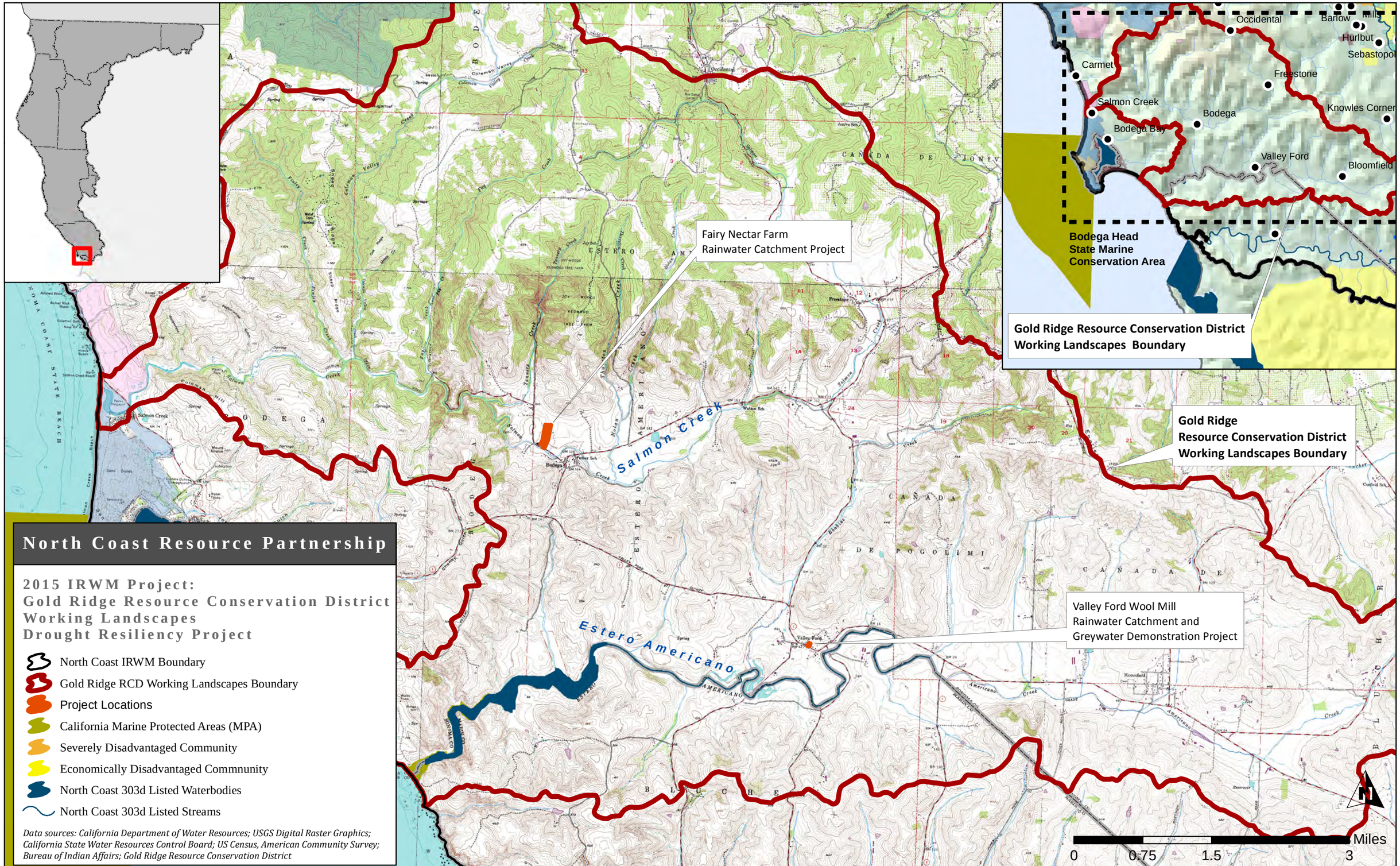


#	NORTH COAST RESOURCE PARTNERSHIP 2015 IRWM PRIORITY PROJECTS
2	Bear River Band of the Rohnerville Rancheria , Reclaimed Water Project
12	City of Weed, Boles Fire Water System Rehabilitation/Water System Restoration
15	Del Norte County , County Service Area # 1 and Crescent City Lift Station Rehabilitation
17	Gold Ridge Resource Conservation District, Working Landscapes Drought Resiliency Project
18	Gualala River Watershed Council, Flow Bank Program - Phase II
19	Happy Camp Community Services District, Happy Camp Water System Upgrades - Phase 1
20	Hoopa Valley Tribe, Hoopa Valley Public Utility District Conservation Project
21	Hoopa Valley Tribe, Lower Supply Flood Risk Reduction and Fisheries Habitat Improvement Project
22	Hopland Band of Pomo Indians, Community Test Wells and Water Security Study
27	Humboldt County Resource Conservation District, Restoring Stream Flow and Fish Passage on the Eel River Delta
29	Lewiston Park Mutual Water Company, Lewiston Valley Drinking Water Intertie Pipeline
30	Mattole Restoration Council, Lower Mattole River and Estuary Enhancement and Drought Resiliency Project
32	Mendocino County Resource Conservation District, Implementing On-Farm Water Conservation Projects in the Navarro to Address Critical Low Flows
33	Mendocino County Resource Conservation District, Water Conservation Technical Assistance to Mendocino County Tribes
36	Montague Water Conservation District, Instream Flow Enhancement through Water Conservation
38	Northwest CA Resource Conservation & Development Council, Trinity River Water Reliability and Drought Resiliency Project
44	Sanctuary Forest Inc., Mattole Flow Program: Mainstem & Tributary Storage and Forbearance
45	Shasta Valley Resource Conservation District, Shasta River Drought Response and Irrigation Efficiency Project
46	Resort Improvement District No.1, Shelter Cove Water Recycling Project
47	Sonoma County Water Agency, Northern Sonoma County Water Conservation Program
48	Sonoma Resource Conservation District, Russian River Coho Drought Resiliency Planning and Implementation Program
51	Watershed Research and Training Center, South Fork Trinity River - Spring Run Chinook Salmon Restoration Project
53	Weott Community Services District, Additional Water Storage
54	Westhaven Community Services District, Water Storage Tank and Roof Replacement Project
57	Yurok Tribe, Yurok Watershed Restoration and Drinking Water Security


Hookton
Beatrice
Table Bluff
Loleta
Fernbridge
Worswick
Salt River
Eel River
Fortuna
Waddington
Alton
Bear River Band of the Rohnerville Rancheria Boundary (approx)
Water Quality Montoring Locations
Water Quality Montoring Locations
Water Quality Montoring Locations
Water Quality Montoring Locations
Bear River Band of the Rohnerville Rancheria Boundary (approx)
Well
Gravel Pit
Well
Singley Bar
EEL
Fernbridge
Well
Well
4 LANE
ROAD
VABM
Finch Cr
Creek
N
0
0.2
0.4
0.8
Miles
North Coast Resource Partnership
2015 IRWM Project:
Bear River Band
of the Rohnerville Rancheria
Reclaimed Water Project
Bear River Band of the Rohnerville Rancheria Boundary
Wetland Areas
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey


Angel Valley Improvements
City of Weed Boundary
South Weed Improvements
Beaughan Creek
Boles Creek
Weed
SHASTA NAT FOR
Black Butte
Black Butte Spring
Summit Lake
Miles
0
0.25
0.5
1
Metcalf (historical)
Hotlum
Edgewood
Carrick
Weed
Cal-ore Trail Mobile Estates
Igerna
Black Butte
Shasta-Trinity National Forest
Shasta-Trinity National Forest
North Coast Resource Partnership
2015 IRWM Project:
City of Weed
Boles Fire Water System Rehabilitation
Water System Restoration
North Coast IRWM Boundary
City of Weed Boundary
North Coast 303d Listed Streams
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey


North Coast Resource Partnership
2015 IRWM Project:
Del Norte County
County Service Area # 1 and Crescent City
Lift Station Rehabilitation
Lift Station Locations and Number
North Coast IRWM Boundary
County & Crescent City Lift Station Rehabilitation Project Area
North Coast Tribal Lands
California Marine Protected Areas (MPA)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; County of Del Norte
County & Crescent City
Lift Station Rehabilitation Project Area
Elk Valley Rancheria
Castle Rock MPA
Special Closure
Crescent City
Elk Creek
Point St George
Pebble Beach
Whaler Island
Miles
0
0.5
1
2
County & Crescent City
Lift Station Rehabilitation
Project Area
Crescent City

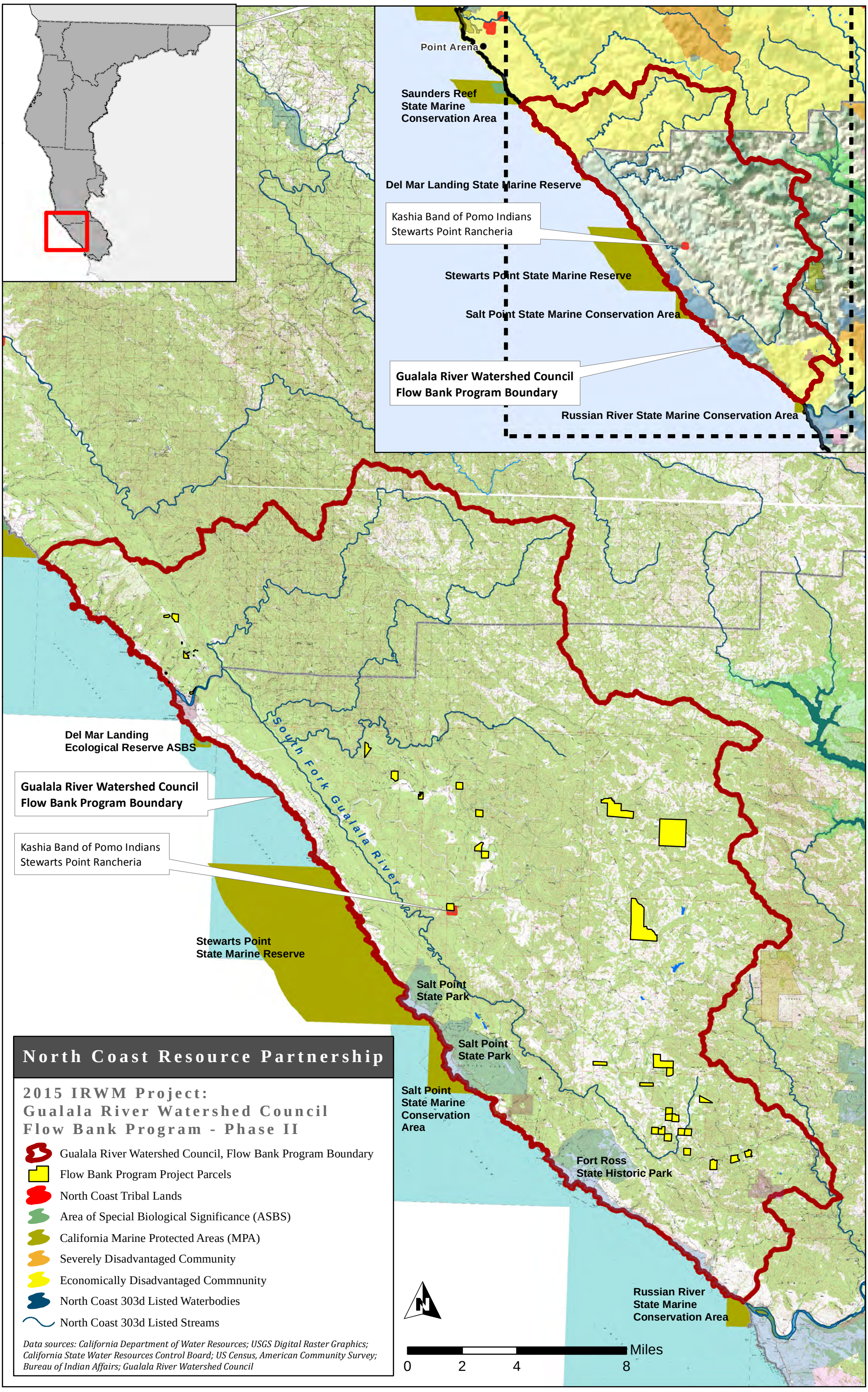


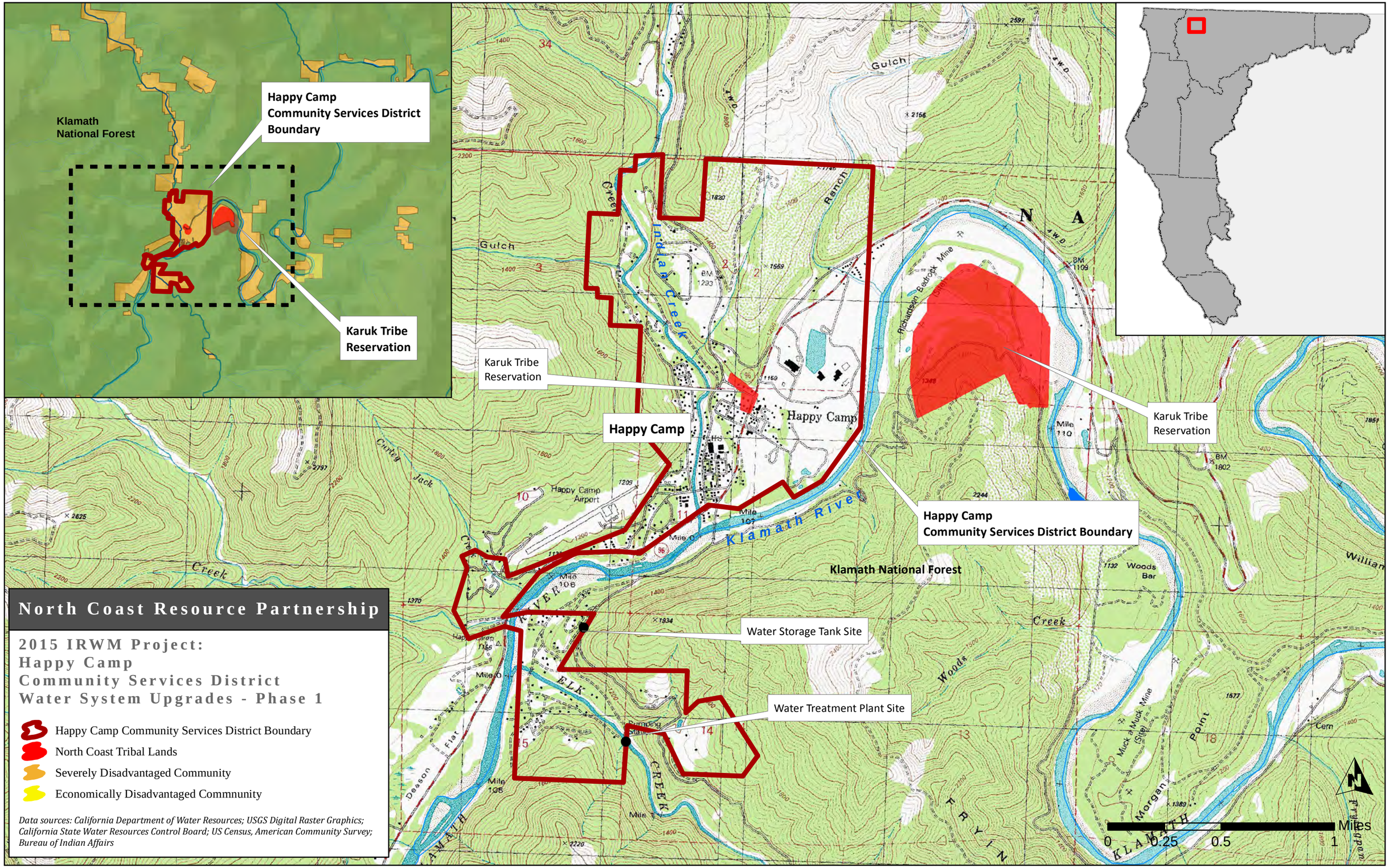
North Coast Resource Partnership

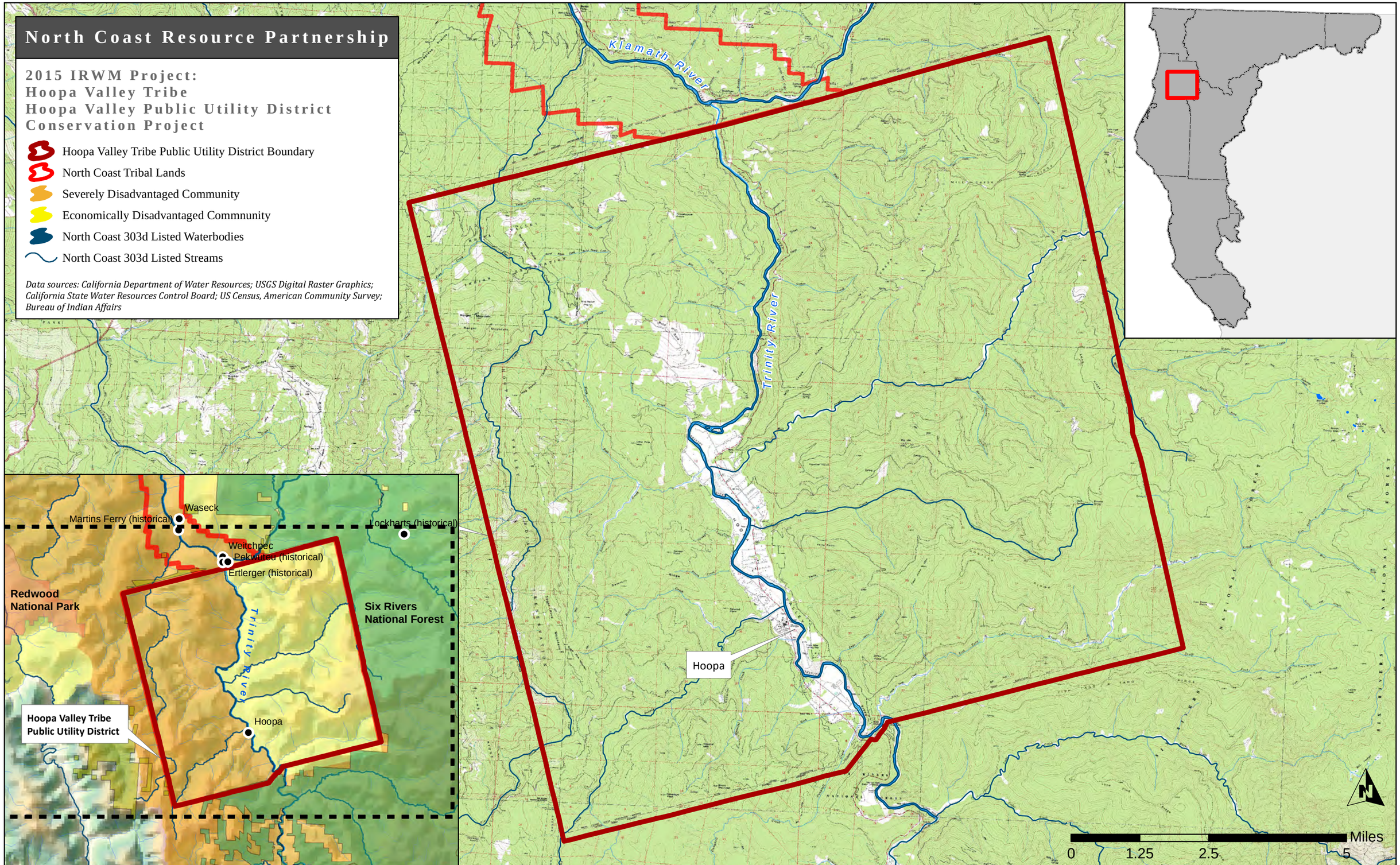
2015 IRWM Project:
Gold Ridge Resource Conservation District
Working Landscapes
Drought Resiliency Project

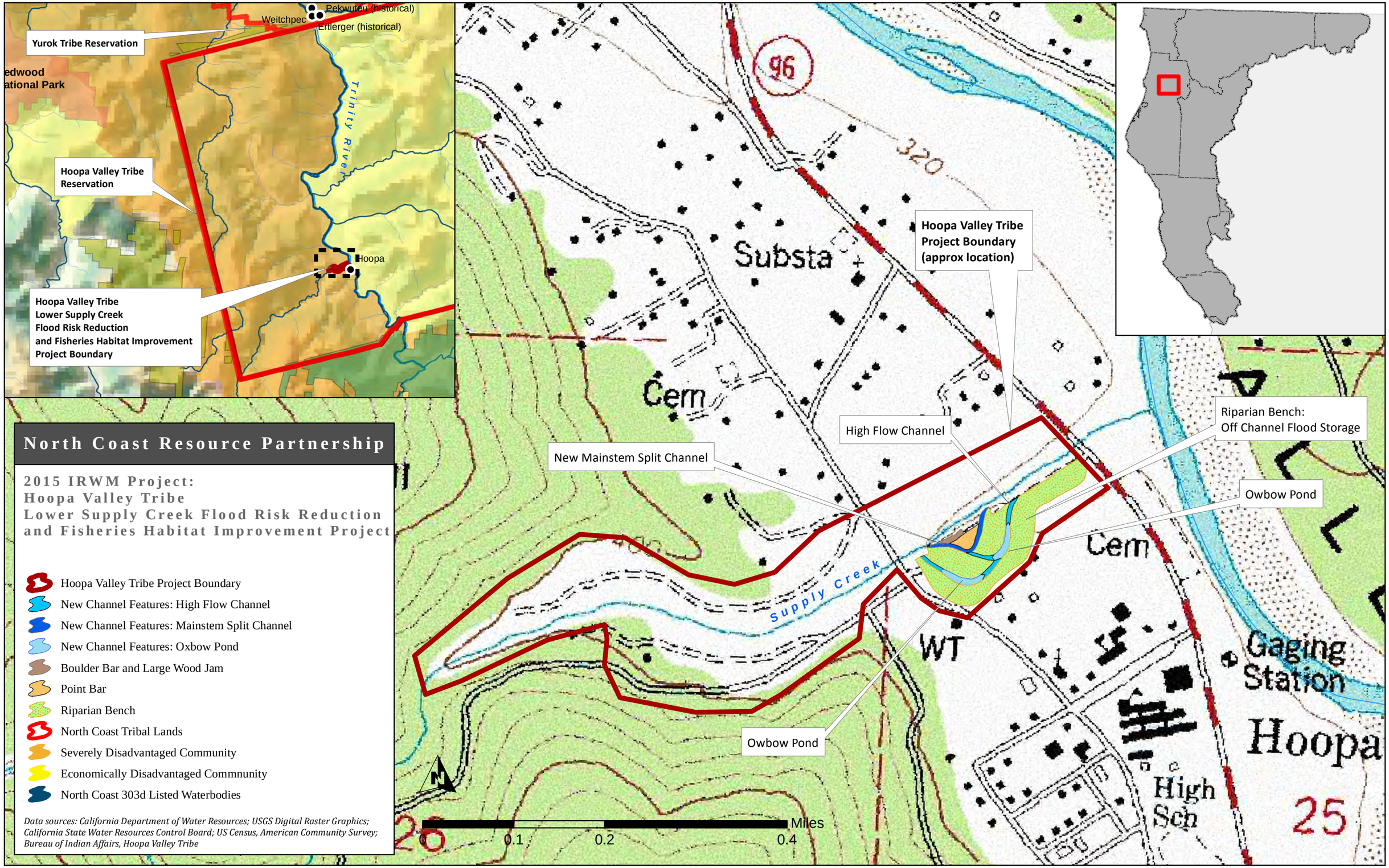
- North Coast IRWM Boundary
- Gold Ridge RCD Working Landscapes Boundary
- Project Locations
- California Marine Protected Areas (MPA)
- Severely Disadvantaged Community
- Economically Disadvantaged Commnunity
- North Coast 303d Listed Waterbodies
- North Coast 303d Listed Streams

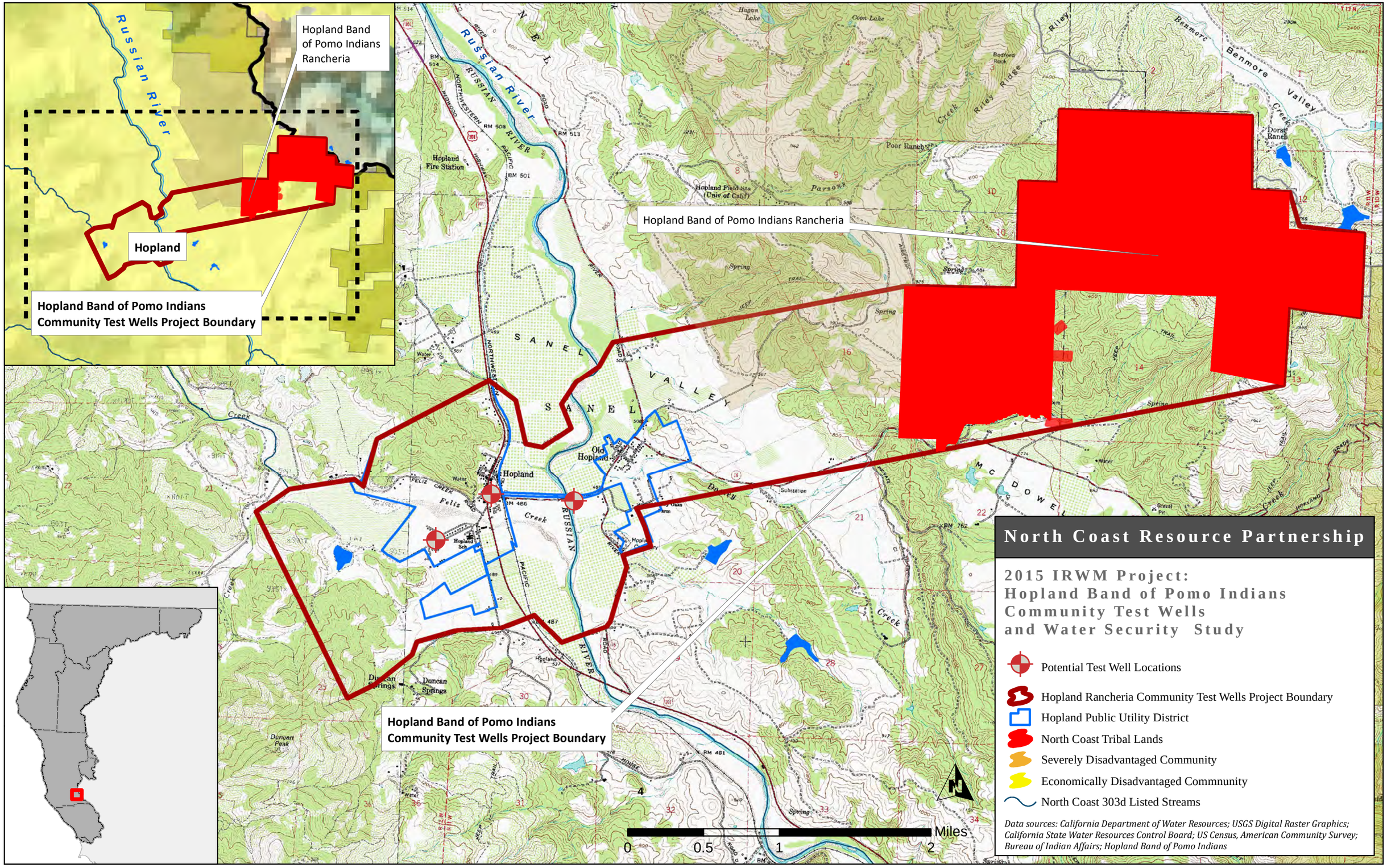
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Gold Ridge Resource Conservation District

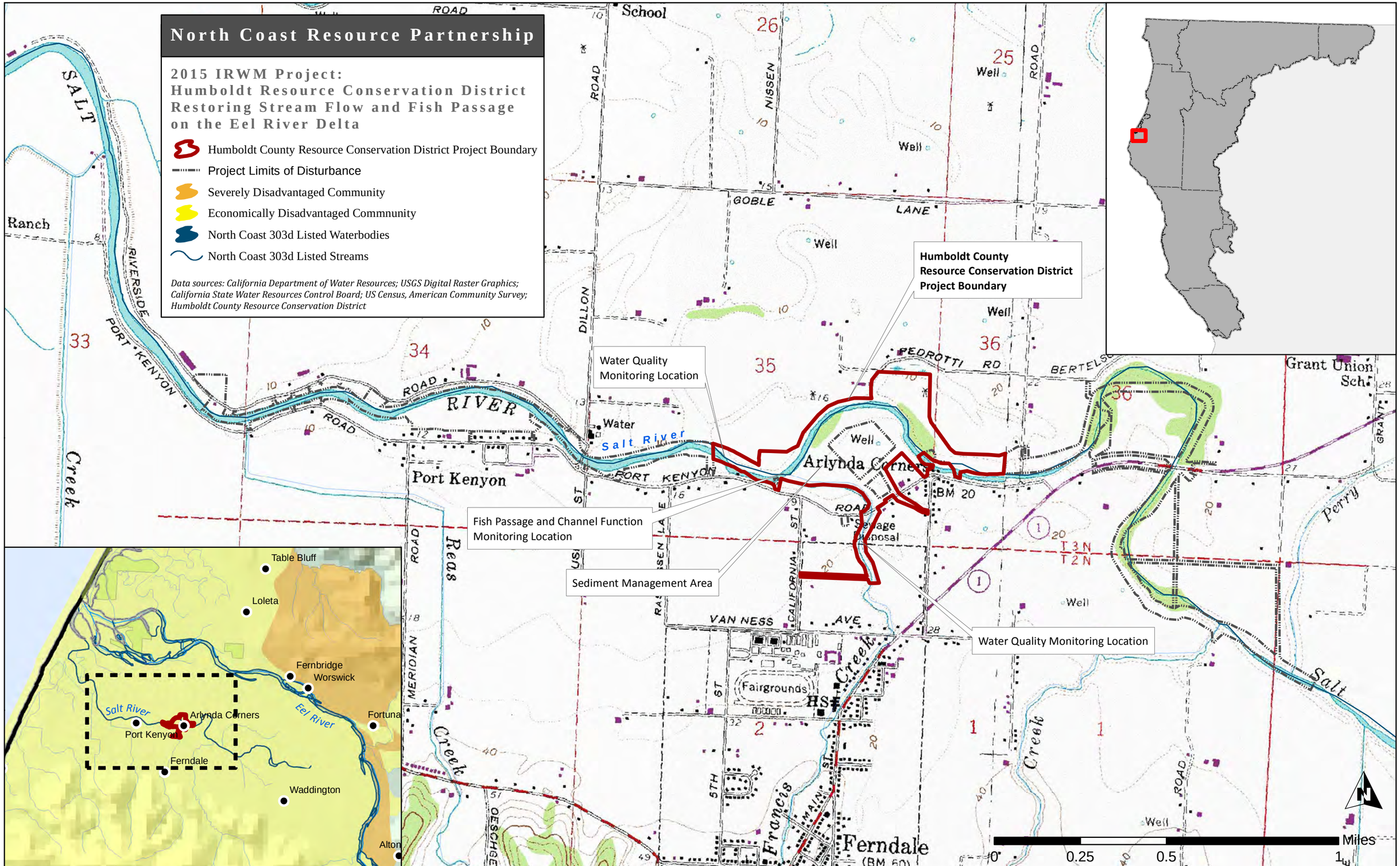

Point Arena
Saunders Reef
State Marine
Conservation Area
Del Mar Landing State Marine Reserve
Kashia Band of Pomo Indians
Stewarts Point Rancheria
Stewarts Point State Marine Reserve
Salt Point State Marine Conservation Area
Gualala River Watershed Council
Flow Bank Program Boundary
Russian River State Marine Conservation Area
Del Mar Landing
Ecological Reserve ASBS
Gualala River Watershed Council
Flow Bank Program Boundary
Kashia Band of Pomo Indians
Stewarts Point Rancheria
South Fork Gualala River
Stewarts Point
State Marine Reserve
Salt Point
State Park
Salt Point
State Park
Salt Point
State Marine
Conservation
Area
Fort Ross
State Historic Park
Russian River
State Marine
Conservation Area
N
0
2
4
8
Miles
North Coast Resource Partnership
2015 IRWM Project:
Gualala River Watershed Council
Flow Bank Program - Phase II
Gualala River Watershed Council, Flow Bank Program Boundary
Flow Bank Program Project Parcels
North Coast Tribal Lands
Area of Special Biological Significance (ASBS)
California Marine Protected Areas (MPA)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Gualala River Watershed Council

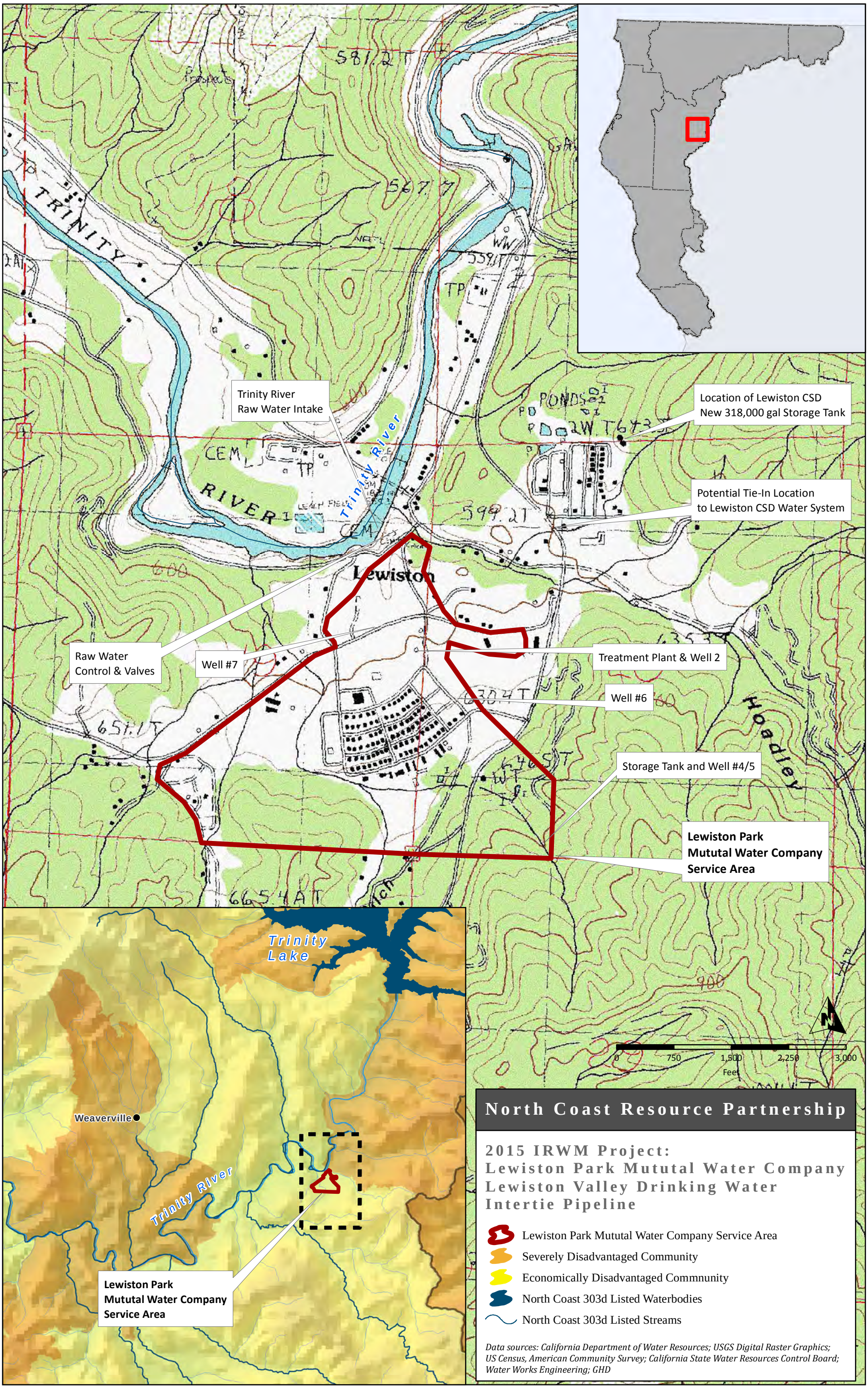

Klamath National Forest
Happy Camp Community Services District Boundary
Karuk Tribe Reservation
Karuk Tribe Reservation
Happy Camp
Karuk Tribe Reservation
Happy Camp Community Services District Boundary
Klamath National Forest
Water Storage Tank Site
Water Treatment Plant Site
Happy Camp
Indian Creek
Klamath River
Elk Creek
Happy Camp Airport
Richardson Bedrock Mine
Woods Bar
Muck a Muck Mine (Site)
Morgan Point
Desson Flat
Curly Jack Creek
Woods Creek
Mile 0
Mile 101
Mile 106
Mile 110
Mile 105
Mile 1
Pumping Station
Cem
Frygpan
Mile
0
0.25
0.5
1
North Coast Resource Partnership
2015 IRWM Project:
Happy Camp
Community Services District
Water System Upgrades - Phase 1
Happy Camp Community Services District Boundary
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs

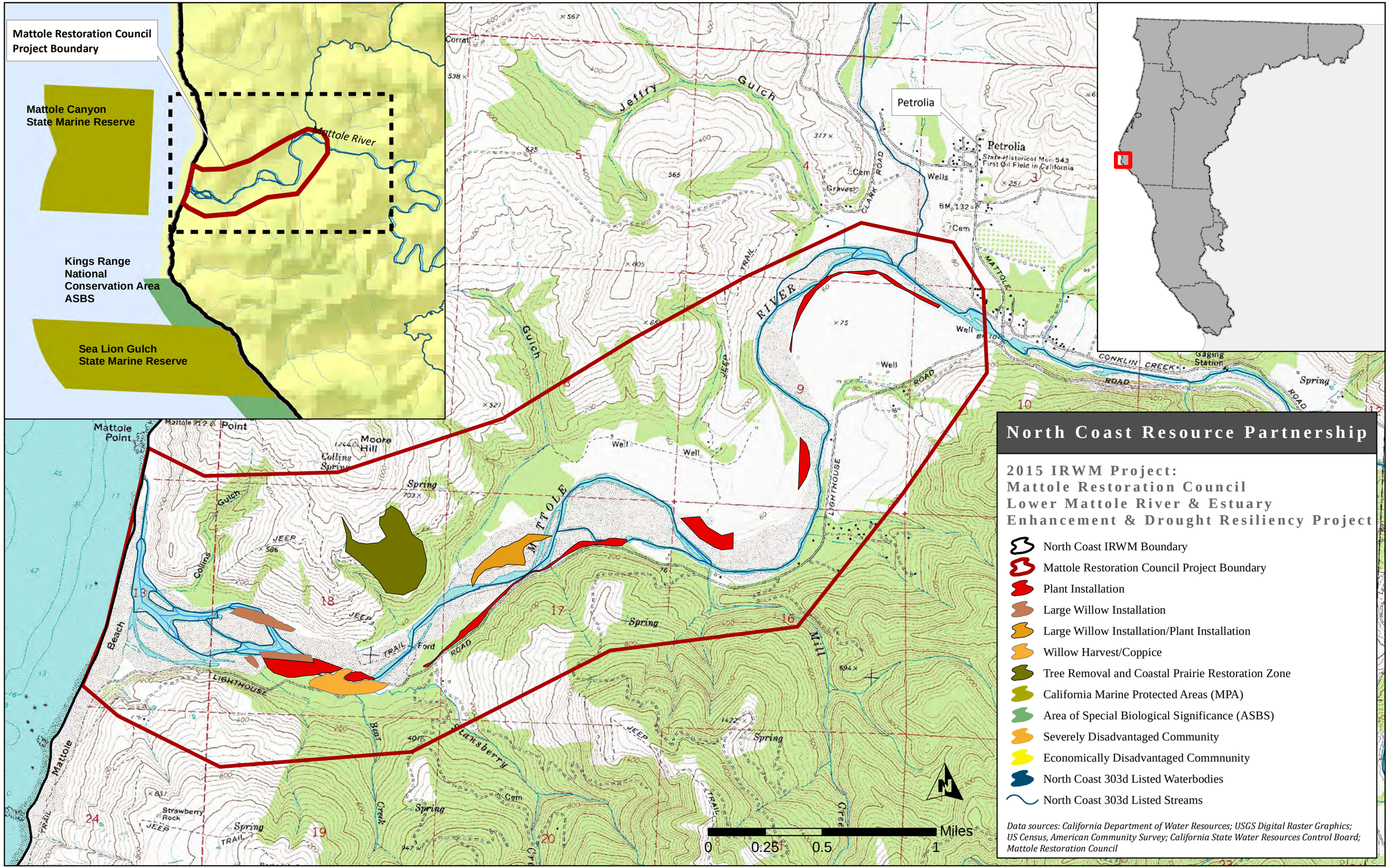

North Coast Resource Partnership
2015 IRWM Project:
Hoopa Valley Tribe
Hoopa Valley Public Utility District
Conservation Project
Hoopa Valley Tribe Public Utility District Boundary
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs
Klamath River
Trinity River
Hoopa
Martins Ferry (historical)
Waseck
Lockharts (historical)
Weitchpec
Pekwiteu (historical)
Ertlerger (historical)
Redwood National Park
Six Rivers National Forest
Hoopa Valley Tribe Public Utility District
Miles
0
1.25
2.5
5

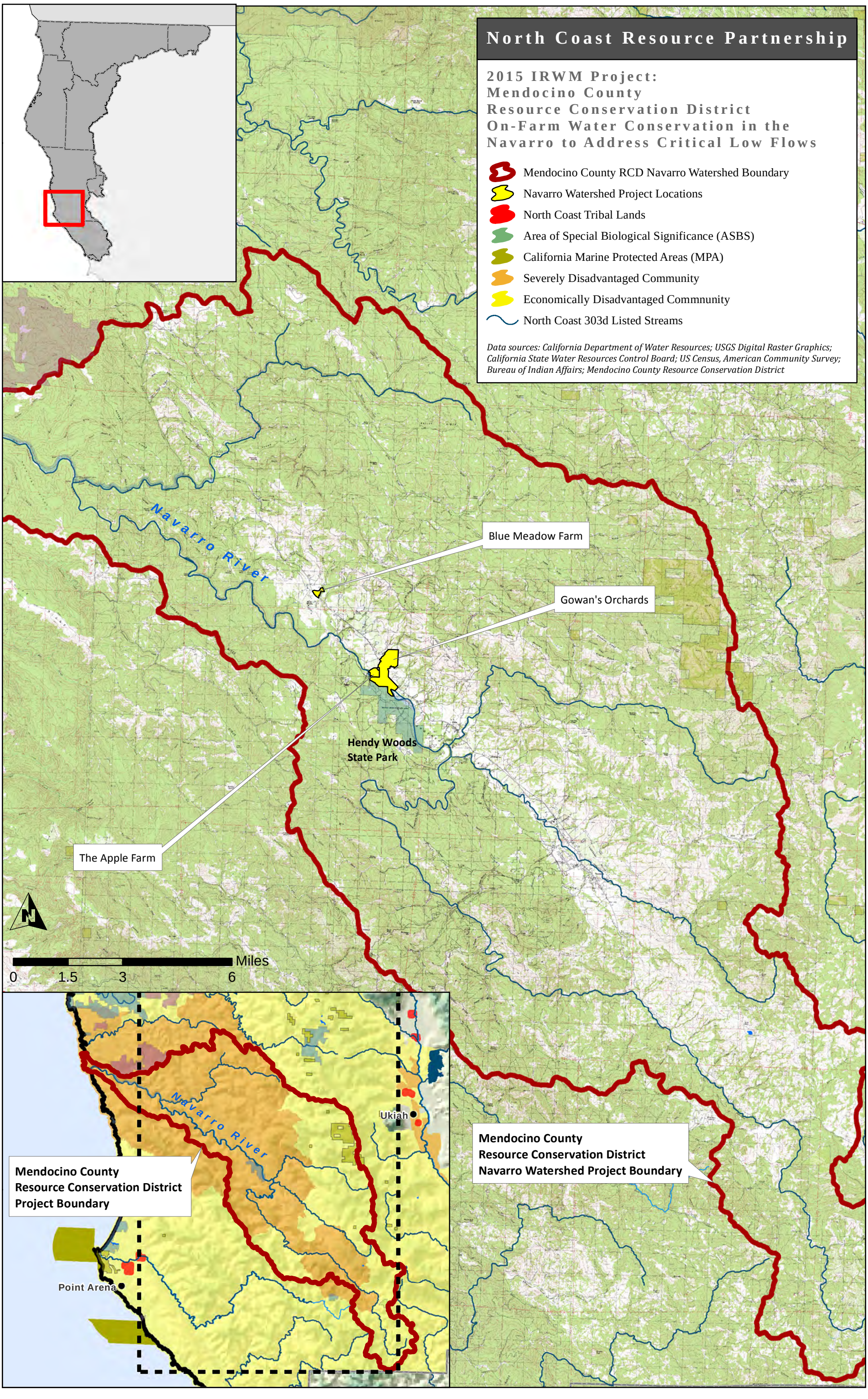

Yurok Tribe Reservation
Weitchpec
Pekwuteu (historical)
Ertlerger (historical)
edwood
ational Park
Trinity River
Hoopa Valley Tribe
Reservation
Hoopa
Hoopa Valley Tribe
Lower Supply Creek
Flood Risk Reduction
and Fisheries Habitat Improvement
Project Boundary
North Coast Resource Partnership
2015 IRWM Project:
Hoopa Valley Tribe
Lower Supply Creek Flood Risk Reduction
and Fisheries Habitat Improvement Project
Hoopa Valley Tribe Project Boundary
New Channel Features: High Flow Channel
New Channel Features: Mainstem Split Channel
New Channel Features: Oxbow Pond
Boulder Bar and Large Wood Jam
Point Bar
Riparian Bench
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs, Hoopa Valley Tribe
96
320
Substa
Cem
Hoopa Valley Tribe
Project Boundary
(approx location)
High Flow Channel
New Mainstem Split Channel
Riparian Bench:
Off Channel Flood Storage
Owbow Pond
Supply Creek
Cem
WT
Gaging
Station
Hoopa
High
Sch
25
Owbow Pond
N
0
0.1
0.2
0.4
Miles

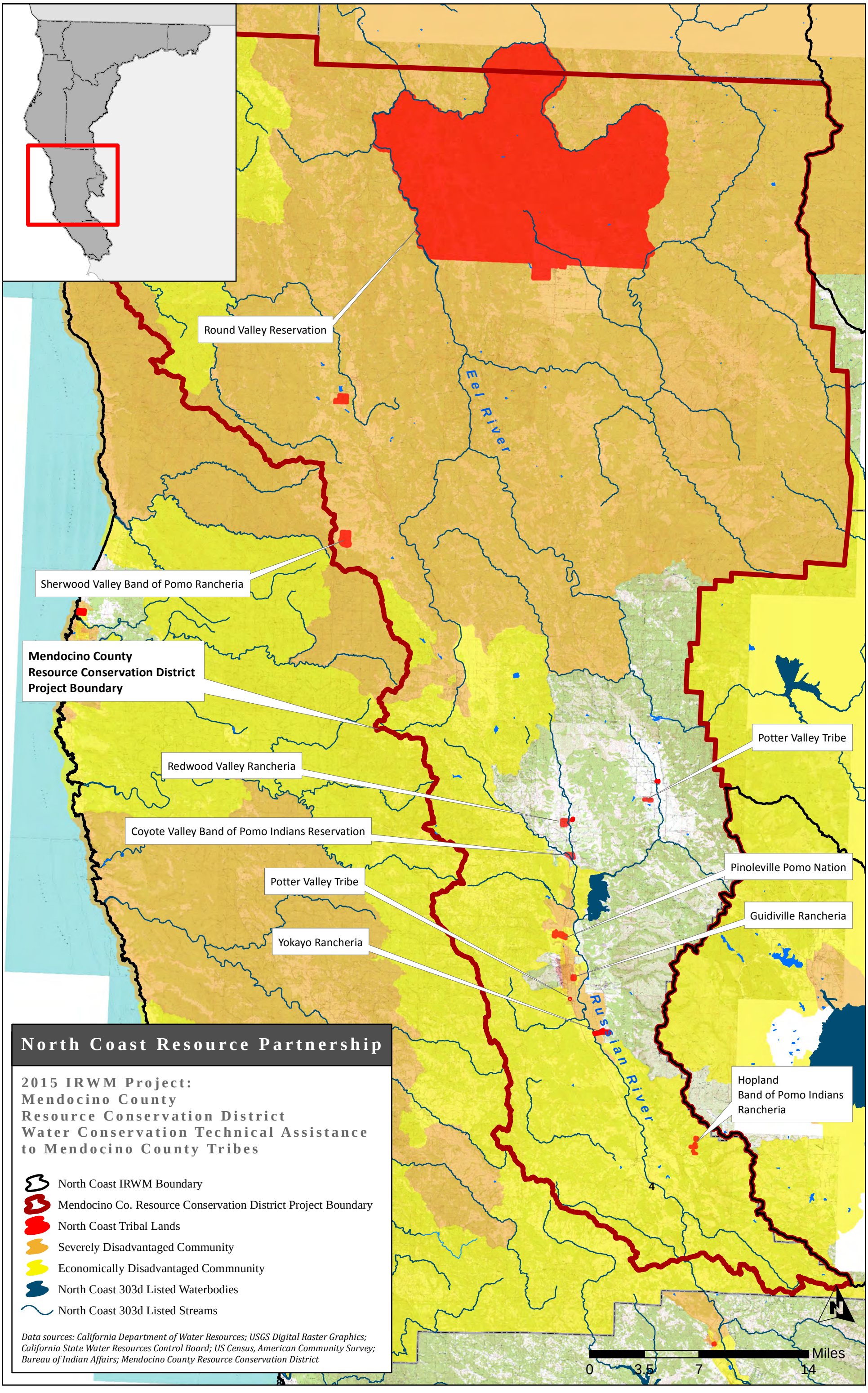

Hopland Band of Pomo Indians Rancheria
Hopland
Hopland Band of Pomo Indians Community Test Wells Project Boundary
Hopland Band of Pomo Indians Rancheria
Hopland Band of Pomo Indians Community Test Wells Project Boundary
Russian River
Hopland
Old Hopland
Duncan Springs
Hopland Fire Station
Hopland Field Sta (Univ of Calif)
Poor Ranch
Dorst Ranch
Benmore Valley
Riley Ridge
Sanel Valley
Feliz Creek
Duncan Peak
Miles
0
0.5
1
2
North Coast Resource Partnership
2015 IRWM Project:
Hopland Band of Pomo Indians
Community Test Wells
and Water Security Study
Potential Test Well Locations
Hopland Rancheria Community Test Wells Project Boundary
Hopland Public Utility District
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Hopland Band of Pomo Indians

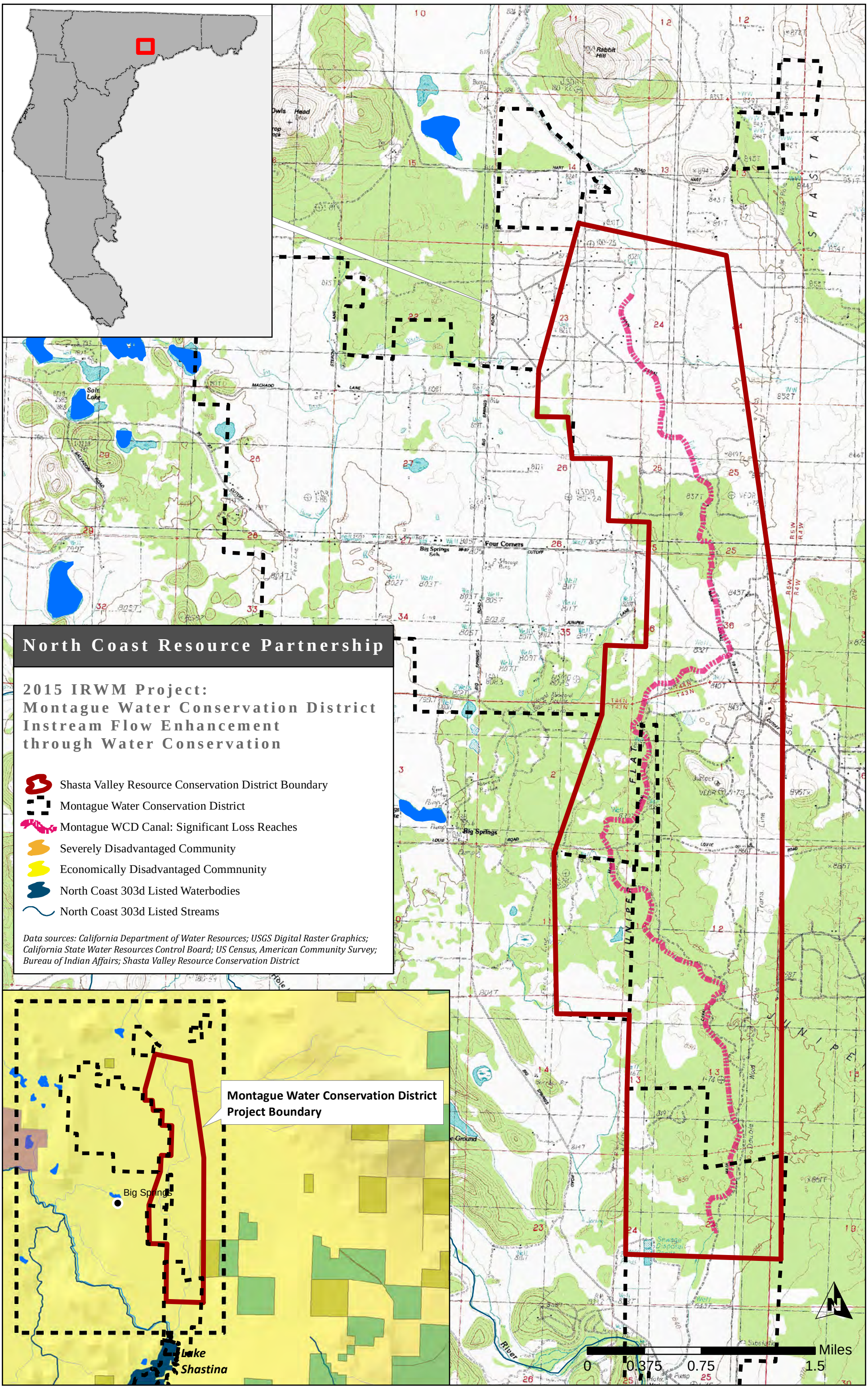

North Coast Resource Partnership
2015 IRWM Project:
Humboldt Resource Conservation District
Restoring Stream Flow and Fish Passage
on the Eel River Delta
Humboldt County Resource Conservation District Project Boundary
Project Limits of Disturbance
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Humboldt County Resource Conservation District
Humboldt County Resource Conservation District Project Boundary
Water Quality Monitoring Location
Fish Passage and Channel Function Monitoring Location
Sediment Management Area
Water Quality Monitoring Location
Table Bluff
Loleta
Fernbridge
Worswick
Salt River
Arlynda Corners
Port Kenyon
Ferndale
Eel River
Fortuna
Waddington
Alton
Miles
0
0.25
0.5
1

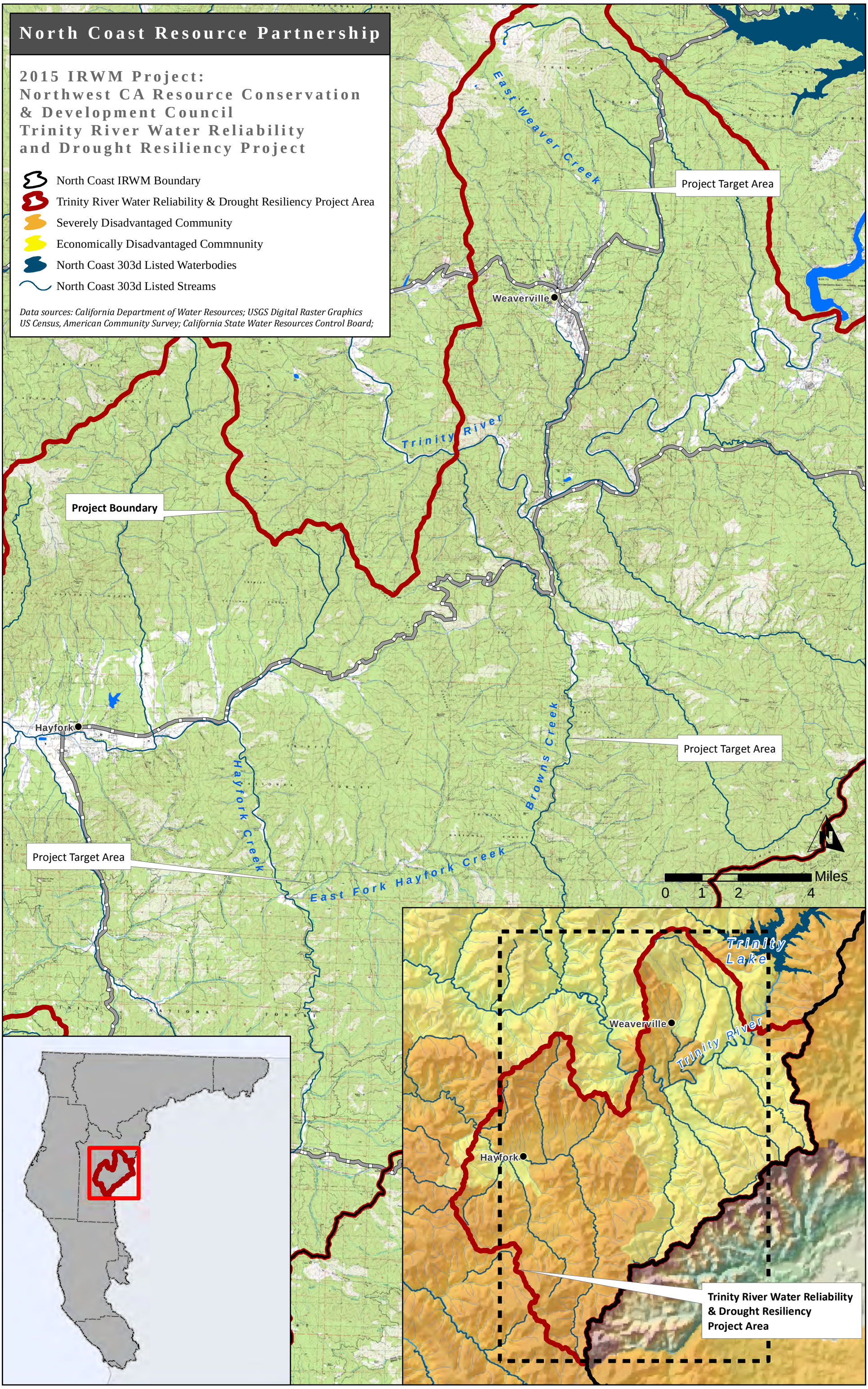

Trinity River
Raw Water Intake
Location of Lewiston CSD
New 318,000 gal Storage Tank
Potential Tie-In Location
to Lewiston CSD Water System
Raw Water
Control & Valves
Well #7
Treatment Plant & Well 2
Well #6
Storage Tank and Well #4/5
Lewiston Park
Mututal Water Company
Service Area
Lewiston
Trinity River
Trinity Lake
Weaverville
0
750
1,500
2,250
3,000
Feet
North Coast Resource Partnership
2015 IRWM Project:
Lewiston Park Mututal Water Company
Lewiston Valley Drinking Water
Intertie Pipeline
Lewiston Park Mututal Water Company Service Area
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; US Census, American Community Survey; California State Water Resources Control Board; Water Works Engineering; GHD

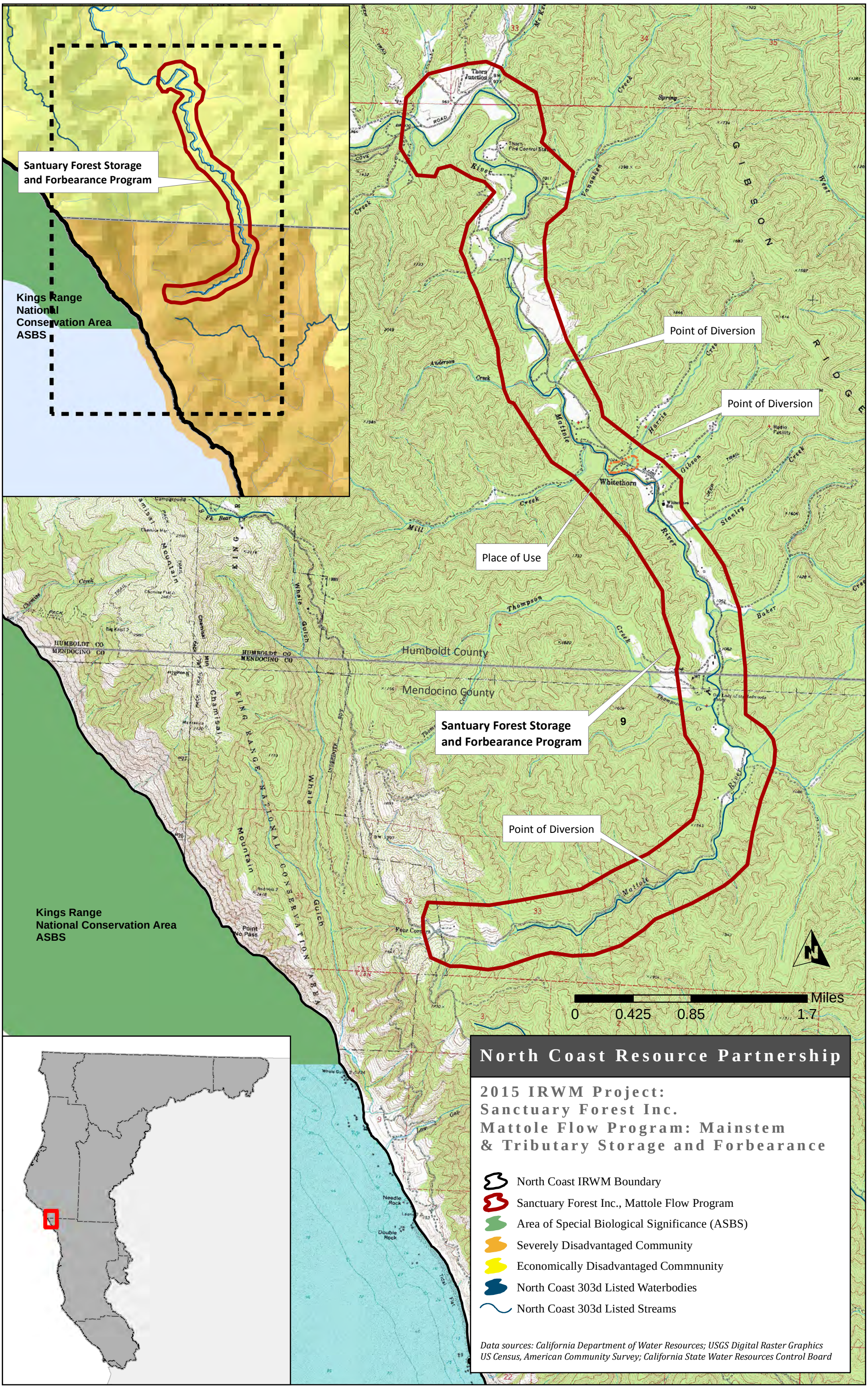

Mattole Restoration Council Project Boundary
Mattole Canyon State Marine Reserve
Kings Range National Conservation Area ASBS
Sea Lion Gulch State Marine Reserve
Mattole River
Petrolia
Petrolia
State Historical Mon. 543
First Oil Field in California
Jeffry Gulch
Clark Road
Mattole River
Jeep Trail
Conklin Creek Road
Gaging Station
Mattole Point
Moore Hill
Collins Spring
Beach
Lighthouse
Ford Trail
Strawberry Rock
Bear Creek
Strawberry
Mill Creek
Miles
0
0.25
0.5
1
North Coast Resource Partnership
2015 IRWM Project:
Mattole Restoration Council
Lower Mattole River & Estuary
Enhancement & Drought Resiliency Project
North Coast IRWM Boundary
Mattole Restoration Council Project Boundary
Plant Installation
Large Willow Installation
Large Willow Installation/Plant Installation
Willow Harvest/Coppice
Tree Removal and Coastal Prairie Restoration Zone
California Marine Protected Areas (MPA)
Area of Special Biological Significance (ASBS)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; US Census, American Community Survey; California State Water Resources Control Board; Mattole Restoration Council

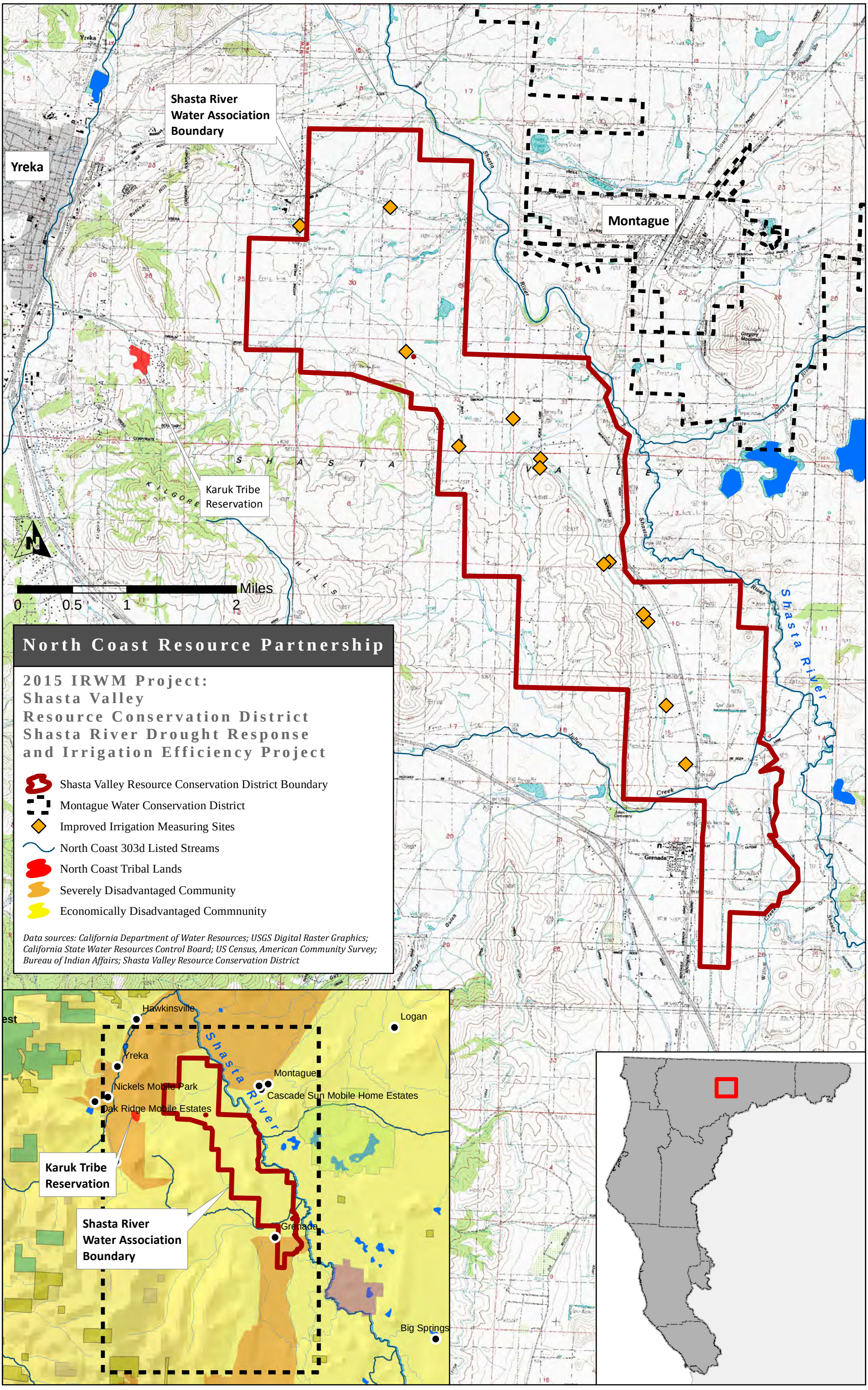

North Coast Resource Partnership
2015 IRWM Project:
Mendocino County
Resource Conservation District
On-Farm Water Conservation in the
Navarro to Address Critical Low Flows
Mendocino County RCD Navarro Watershed Boundary
Navarro Watershed Project Locations
North Coast Tribal Lands
Area of Special Biological Significance (ASBS)
California Marine Protected Areas (MPA)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Mendocino County Resource Conservation District
Navarro River
Blue Meadow Farm
Gowan's Orchards
Hendy Woods State Park
The Apple Farm
N
Miles
0
1.5
3
6
Navarro River
Ukiah
Point Arena
Mendocino County Resource Conservation District Project Boundary
Mendocino County Resource Conservation District Navarro Watershed Project Boundary

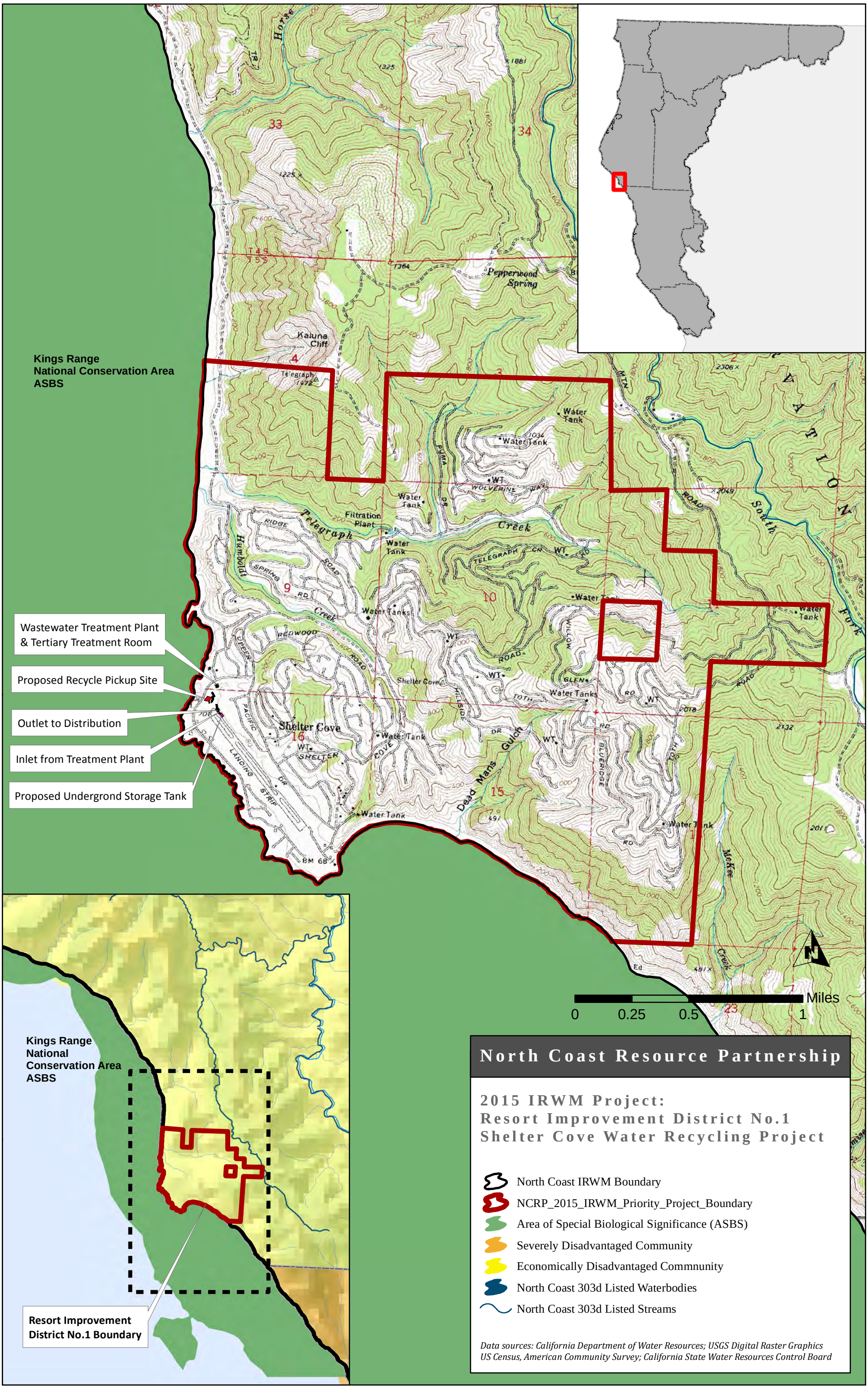

Round Valley Reservation
Eel River
Sherwood Valley Band of Pomo Rancheria
Mendocino County
Resource Conservation District
Project Boundary
Potter Valley Tribe
Redwood Valley Rancheria
Coyote Valley Band of Pomo Indians Reservation
Pinoleville Pomo Nation
Potter Valley Tribe
Guidiville Rancheria
Yokayo Rancheria
Russian River
Hopland
Band of Pomo Indians
Rancheria
North Coast Resource Partnership
2015 IRWM Project:
Mendocino County
Resource Conservation District
Water Conservation Technical Assistance
to Mendocino County Tribes
North Coast IRWM Boundary
Mendocino Co. Resource Conservation District Project Boundary
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Mendocino County Resource Conservation District
N
Miles
0
3.5
7
14

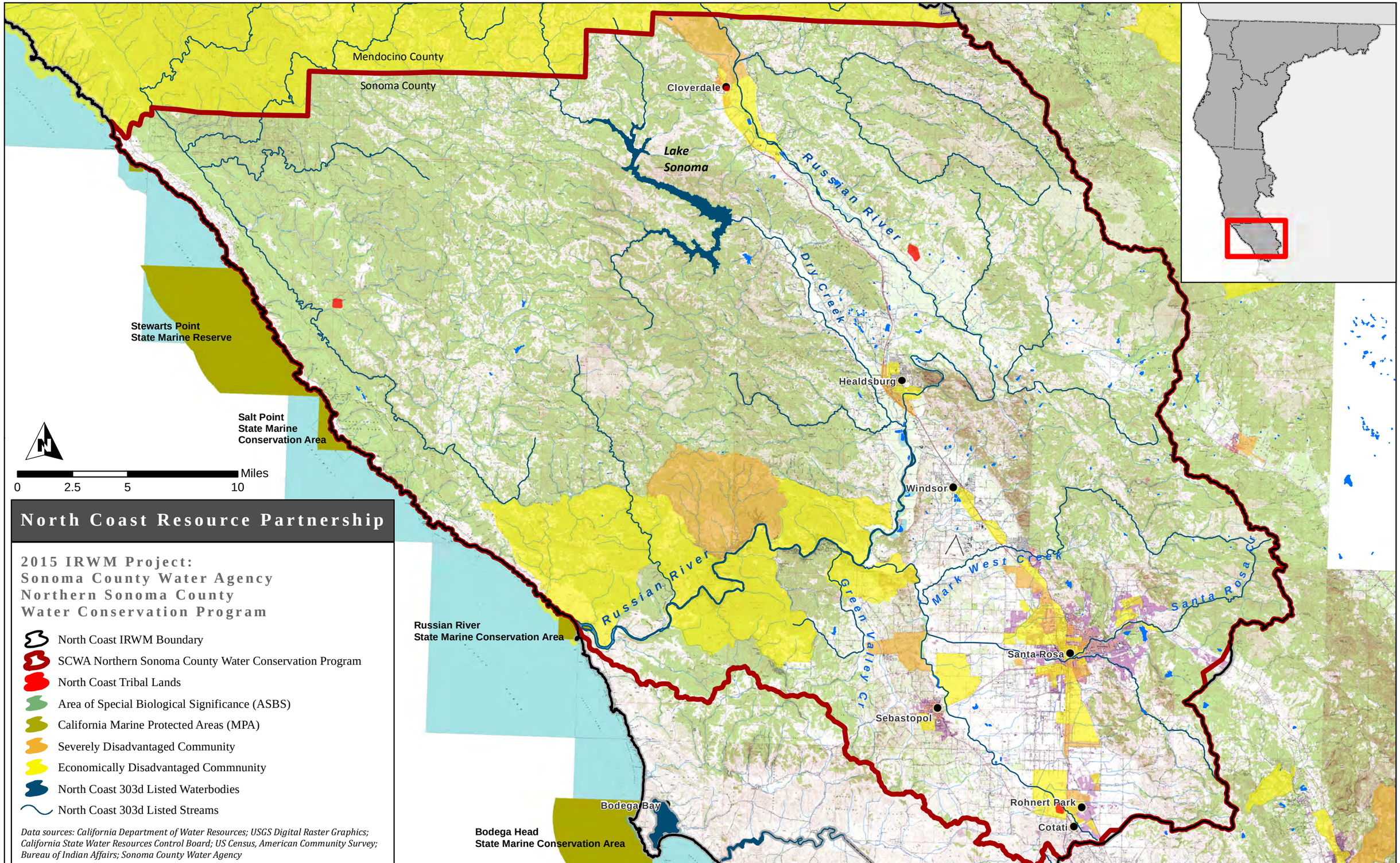

North Coast Resource Partnership
2015 IRWM Project:
Montague Water Conservation District
Instream Flow Enhancement
through Water Conservation
Shasta Valley Resource Conservation District Boundary
Montague Water Conservation District
Montague WCD Canal: Significant Loss Reaches
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Shasta Valley Resource Conservation District
Montague Water Conservation District Project Boundary
Big Springs
Lake Shastina
Four Corners
Big Springs
Miles
0
0.375
0.75
1.5

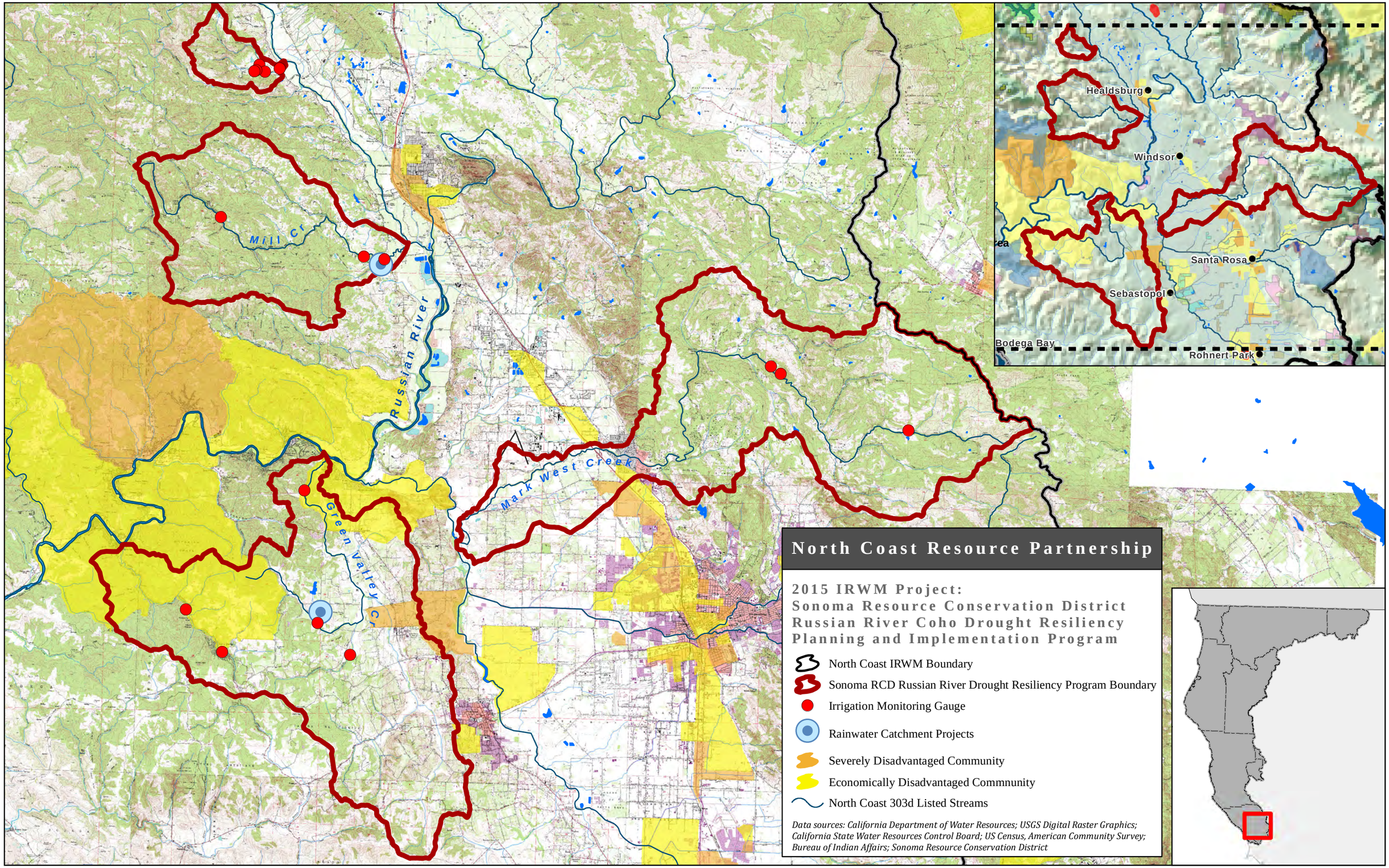

North Coast Resource Partnership
2015 IRWM Project:
Northwest CA Resource Conservation & Development Council
Trinity River Water Reliability and Drought Resiliency Project
North Coast IRWM Boundary
Trinity River Water Reliability & Drought Resiliency Project Area
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics
US Census, American Community Survey; California State Water Resources Control Board;
East Weaver Creek
Project Target Area
Weaverville
Trinity River
Project Boundary
Hayfork
Hayfork Creek
Browns Creek
Project Target Area
Project Target Area
East Fork Hayfork Creek
Miles
0 1 2 4
Trinity Lake
Weaverville
Trinity River
Hayfork
Trinity River Water Reliability & Drought Resiliency Project Area

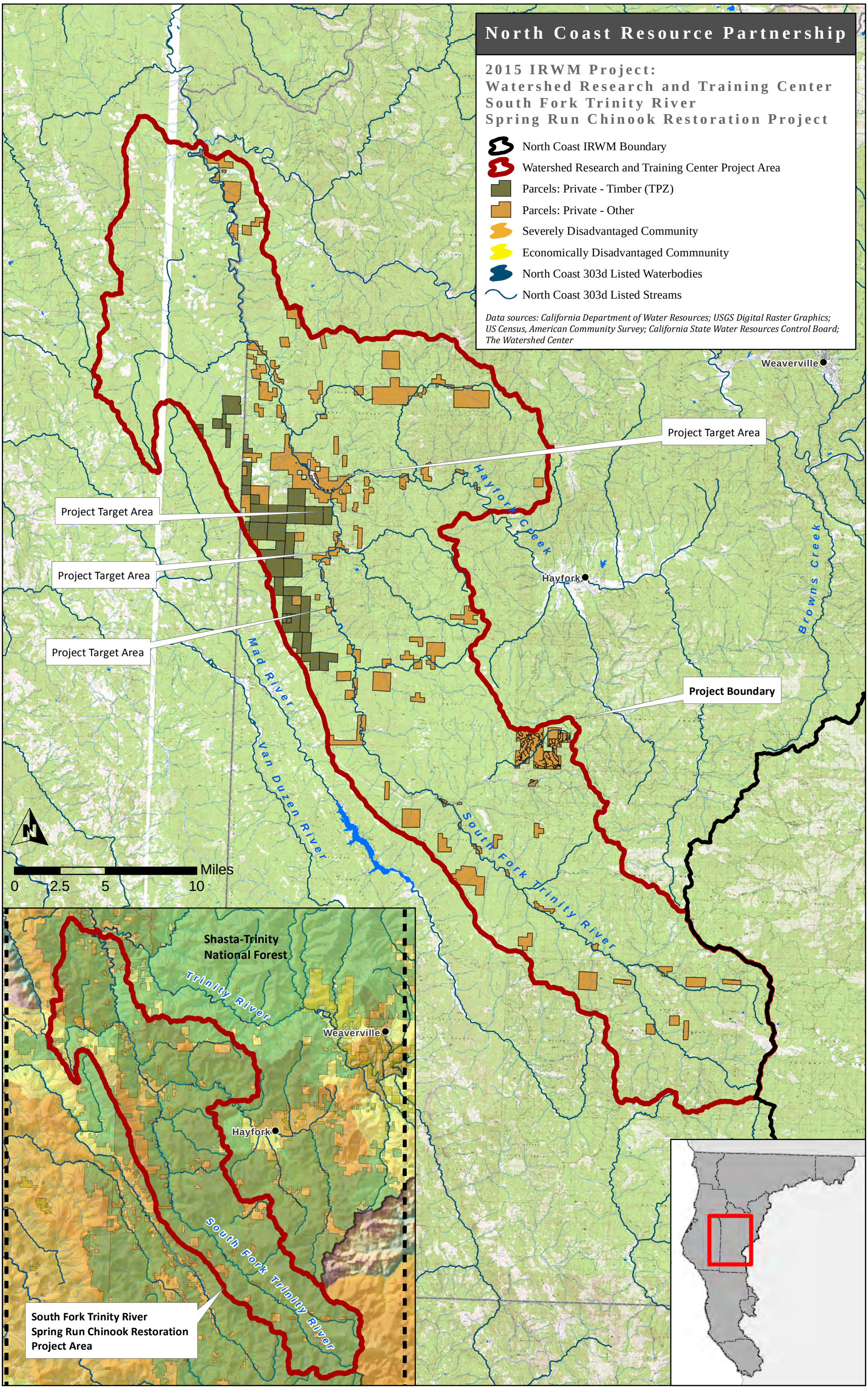

Santuary Forest Storage and Forbearance Program
Kings Range National Conservation Area ASBS
Point of Diversion
Point of Diversion
Place of Use
Santuary Forest Storage and Forbearance Program
Point of Diversion
Kings Range National Conservation Area ASBS
Humboldt County
Mendocino County
Whitethorn
Thorn Junction
Miles
0
0.425
0.85
1.7
North Coast Resource Partnership
2015 IRWM Project:
Sanctuary Forest Inc.
Mattole Flow Program: Mainstem & Tributary Storage and Forbearance
North Coast IRWM Boundary
Sanctuary Forest Inc., Mattole Flow Program
Area of Special Biological Significance (ASBS)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics
US Census, American Community Survey; California State Water Resources Control Board

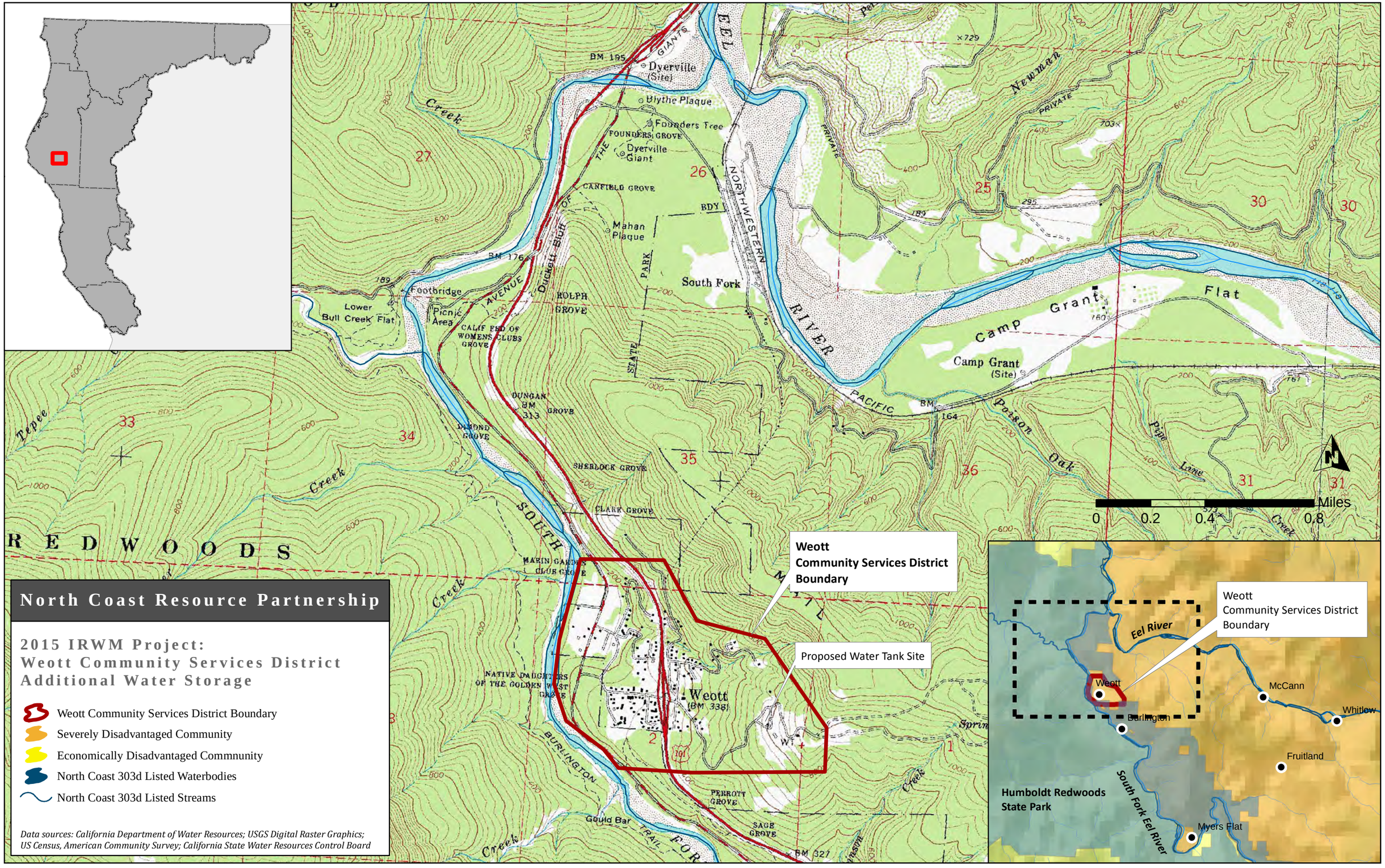

Yreka
Shasta River Water Association Boundary
Montague
Karuk Tribe Reservation
Miles
0
0.5
1
2
North Coast Resource Partnership
2015 IRWM Project:
Shasta Valley Resource Conservation District Shasta River Drought Response and Irrigation Efficiency Project
Shasta Valley Resource Conservation District Boundary
Montague Water Conservation District
Improved Irrigation Measuring Sites
North Coast 303d Listed Streams
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Shasta Valley Resource Conservation District
Shasta River
Grenada
Hawkinsville
Logan
Yreka
Montague
Nickels Mobile Park
Cascade Sun Mobile Home Estates
Oak Ridge Mobile Estates
Karuk Tribe Reservation
Shasta River Water Association Boundary
Grenada
Big Springs

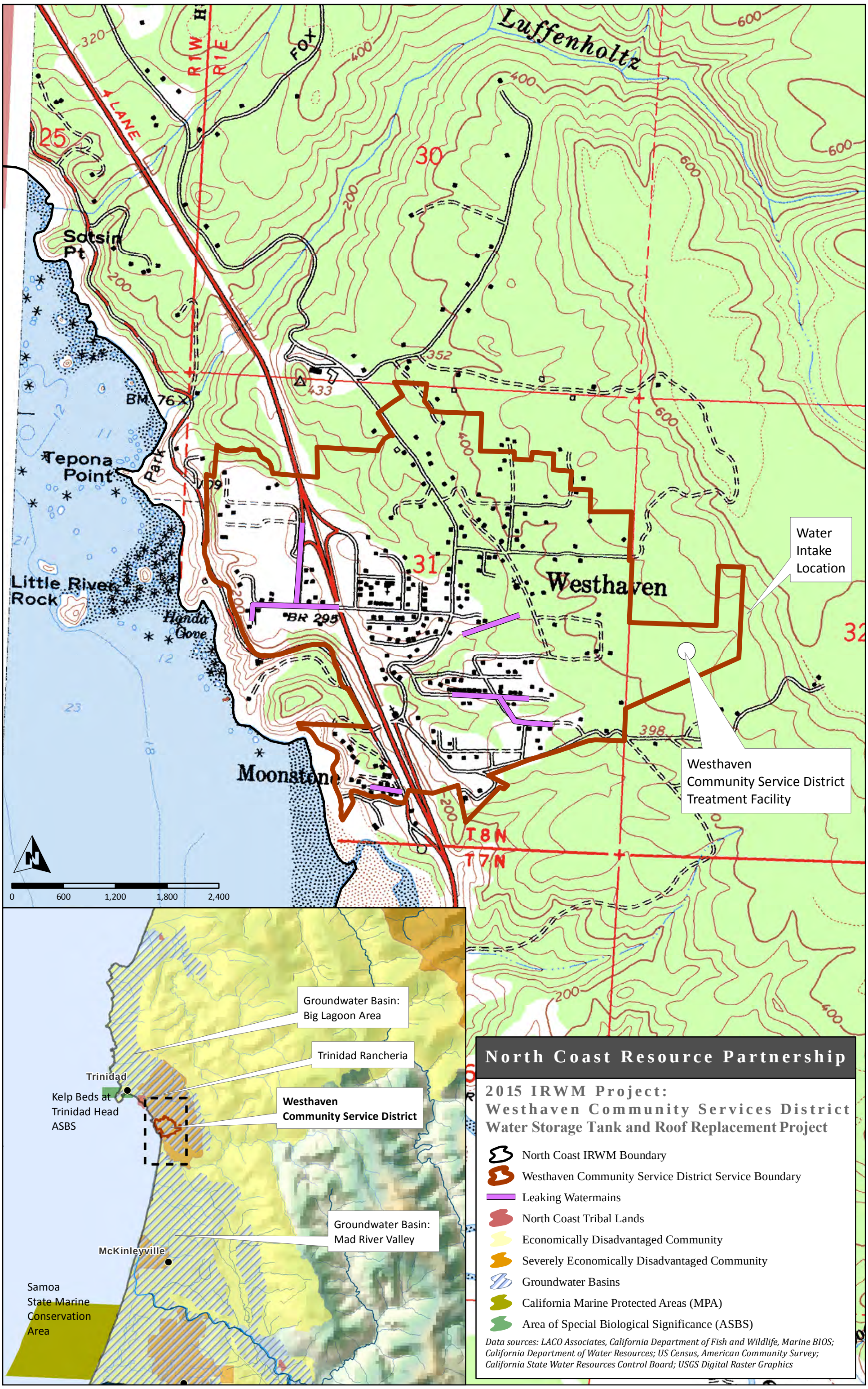

Kings Range
National Conservation Area
ASBS
Wastewater Treatment Plant
& Tertiary Treatment Room
Proposed Recycle Pickup Site
Outlet to Distribution
Inlet from Treatment Plant
Proposed Undergrond Storage Tank
Shelter Cove
Telegraph Creek
Dead Mans Gulch
Pepperwood Spring
Kaluna Cliff
Filtration Plant
Water Tank
Water Tanks
Kings Range
National
Conservation Area
ASBS
Resort Improvement
District No.1 Boundary
0
0.25
0.5
1
Miles
North Coast Resource Partnership
2015 IRWM Project:
Resort Improvement District No.1
Shelter Cove Water Recycling Project
North Coast IRWM Boundary
NCRP_2015_IRWM_Priority_Project_Boundary
Area of Special Biological Significance (ASBS)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics
US Census, American Community Survey; California State Water Resources Control Board

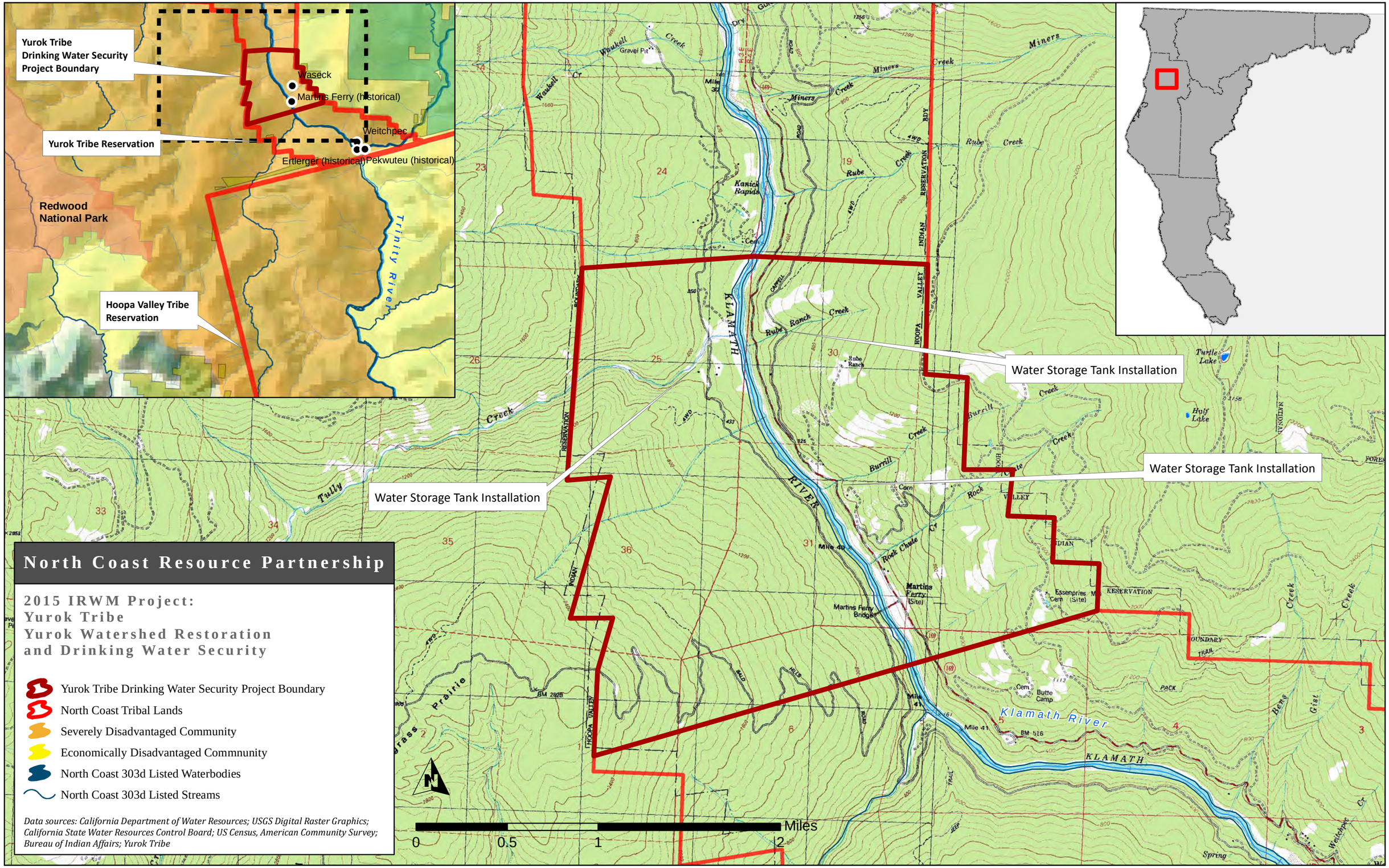

Mendocino County
Sonoma County
Cloverdale
Lake Sonoma
Russian River
Dry Creek
Stewarts Point State Marine Reserve
Salt Point State Marine Conservation Area
Healdsburg
Windsor
Mark West Creek
Santa Rosa Cr
Green Valley Cr
Russian River
Russian River State Marine Conservation Area
Santa Rosa
Sebastopol
Bodega Bay
Bodega Head State Marine Conservation Area
Rohnert Park
Cotati
Miles
0
2.5
5
10
North Coast Resource Partnership
2015 IRWM Project:
Sonoma County Water Agency
Northern Sonoma County
Water Conservation Program
North Coast IRWM Boundary
SCWA Northern Sonoma County Water Conservation Program
North Coast Tribal Lands
Area of Special Biological Significance (ASBS)
California Marine Protected Areas (MPA)
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Sonoma County Water Agency


Healdsburg
Windsor
Santa Rosa
Sebastopol
Bodega Bay
Rohnert Park
Mill Cr
Russian River
Mark West Creek
Green Valley Cr
North Coast Resource Partnership
2015 IRWM Project:
Sonoma Resource Conservation District
Russian River Coho Drought Resiliency
Planning and Implementation Program
North Coast IRWM Boundary
Sonoma RCD Russian River Drought Resiliency Program Boundary
Irrigation Monitoring Gauge
Rainwater Catchment Projects
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Sonoma Resource Conservation District


North Coast Resource Partnership
2015 IRWM Project:
Watershed Research and Training Center
South Fork Trinity River
Spring Run Chinook Restoration Project
North Coast IRWM Boundary
Watershed Research and Training Center Project Area
Parcels: Private - Timber (TPZ)
Parcels: Private - Other
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; US Census, American Community Survey; California State Water Resources Control Board; The Watershed Center
Weaverville
Project Target Area
Project Target Area
Project Target Area
Project Target Area
Hayfork Creek
Hayfork
Browns Creek
Mad River
Van Duzen River
South Fork Trinity River
Project Boundary
N
Miles
0
2.5
5
10
Shasta-Trinity National Forest
Trinity River
Weaverville
Hayfork
South Fork Trinity River
South Fork Trinity River Spring Run Chinook Restoration Project Area


North Coast Resource Partnership
2015 IRWM Project:
Weott Community Services District
Additional Water Storage
Weott Community Services District Boundary
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; US Census, American Community Survey; California State Water Resources Control Board
Weott Community Services District Boundary
Proposed Water Tank Site
Weott
(BM 338)
Dyerville (Site)
Blythe Plaque
Founders Tree
Dyerville Giant
Mahan Plaque
South Fork
Camp Grant (Site)
Footbridge
Lower Bull Creek Flat
Picnic Area
Eel River
Newman Creek
Tepee Creek
Oak Flat
Pipe Line Creek
Burlington Gould Bar Trail
Humboldt Redwoods State Park
Eel River
Weott
Burlington
McCann
Whitlow
Fruitland
Myers Flat
South Fork Eel River
0 0.2 0.4 0.8 Miles


Luffenholtz
Sotsin Pt
Tepona Point
Little River Rock
Honda Cove
Moonstone
Westhaven
Park
BM 76
BR 295
Fox
LANE
R1W
R1E
T8N
T7N
25
30
31
32
Water Intake Location
Westhaven Community Service District Treatment Facility
0
600
1,200
1,800
2,400
Groundwater Basin: Big Lagoon Area
Trinidad Rancheria
Trinidad
Kelp Beds at Trinidad Head ASBS
Westhaven Community Service District
Groundwater Basin: Mad River Valley
McKinleyville
Samoa State Marine Conservation Area
North Coast Resource Partnership
2015 IRWM Project:
Westhaven Community Services District
Water Storage Tank and Roof Replacement Project
North Coast IRWM Boundary
Westhaven Community Service District Service Boundary
Leaking Watermains
North Coast Tribal Lands
Economically Disadvantaged Community
Severely Economically Disadvantaged Community
Groundwater Basins
California Marine Protected Areas (MPA)
Area of Special Biological Significance (ASBS)
Data sources: LACO Associates, California Department of Fish and Wildlife, Marine BIOS; California Department of Water Resources; US Census, American Community Survey; California State Water Resources Control Board; USGS Digital Raster Graphics


Yurok Tribe
Drinking Water Security
Project Boundary
Yurok Tribe Reservation
Waseck
Martins Ferry (historical)
Weitchpec
Ertlerger (historical)
Pekwuteu (historical)
Redwood
National Park
Hoopa Valley Tribe
Reservation
Trinity River
Water Storage Tank Installation
Water Storage Tank Installation
Water Storage Tank Installation
Klamath River
Miles
0
0.5
1
2
North Coast Resource Partnership
2015 IRWM Project:
Yurok Tribe
Yurok Watershed Restoration
and Drinking Water Security
Yurok Tribe Drinking Water Security Project Boundary
North Coast Tribal Lands
Severely Disadvantaged Community
Economically Disadvantaged Commnunity
North Coast 303d Listed Waterbodies
North Coast 303d Listed Streams
Data sources: California Department of Water Resources; USGS Digital Raster Graphics; California State Water Resources Control Board; US Census, American Community Survey; Bureau of Indian Affairs; Yurok Tribe