Promoting Sustainability in the Inyo-Mono Region: Understanding Regional Groundwater Resources and Upgrading Infrastructure in Disadvantaged Community Water Systems

Attachment 3: Work Plan

Promoting Sustainability in the Inyo-Mono Region: Understanding Regional Groundwater Resources and Upgrading Infrastructure in Disadvantaged Community Water Systems

Introduction

Purpose and Need

We are pleased to be submitting a Proposition 84 Round 2 Implementation Grant proposal on behalf of the Inyo-Mono Integrated Regional Water Management (IRWM) Program to fund four important projects at a total grant request of $2,234,330. The proposal is being submitted by the County of Inyo, who is acting as the grantee for the Round 2 Implementation Grant.

The four projects being submitted for funding represent several of the top-priority issues in the region as identified by the Inyo-Mono Regional Water Management Group (RWMG) through the Inyo-Mono IRWM Phase II Plan and the Round 2 Implementation project ranking process. All four projects are recognized to address one or more Inyo-Mono regional objectives and resource management strategies identified in the Phase II Plan and thus are included in the Plan's project list. These four projects also address several of the statewide program preferences and priorities as discussed in Attachment 9 (Program Preferences).

This proposal touches on several of the main themes of water-related issues confronted in the region: providing assistance to small water systems, disadvantaged communities (DACs), and Native American tribes; upgrading antiquated and/or dysfunctional water infrastructure; gaining a better understanding of the region's groundwater resources; and continuing to foster and build lasting partnerships among stakeholders in the region. An understanding of these themes has resulted from hundreds of hours of working directly with stakeholders in the region through outreach meetings, RWMG meetings, and targeted technical assistance.

Project List

The Inyo-Mono RWMG undertook an extensive project submission and ranking process in preparation for the Round 2 Implementation Grant application. Any Member of the Inyo-Mono RWMG (signatory to the Memorandum of Understanding) was encouraged to submit a pre-proposal for a project for Round 2 Implementation funding. Pre-proposals were first reviewed by topic-specific technical advisory committees who then made recommendations to the RWMG based on the pre-proposals reviewed within that topic. The RWMG evaluated and scored proposals according to thorough project review criteria. Individual RWMG Members' scores for each pre-proposal were averaged, and this resulted in an overall ranking of projects. Based on that ranking, project proponents then coordinated with the Inyo-Mono IRWM Program Office to determine how many projects would be submitted as part of the overall Round 2 Implementation Grant application. The Inyo-Mono IRWM Program Office also communicated with the other IRWM regions in the Lahontan funding region in an attempt to coordinate proposals given the $3.93 million available in Round 2 for the Lahontan funding region. While these conversations did not ultimately result in an agreement with respect to proposal amounts, they did help the Inyo-Mono project proponents to decide to submit the top four projects for funding. The various representatives of the Lahontan region IRWM programs also agreed to communicate and attempt coordination again in future funding rounds.

The following table presents the four projects in order of ranking by the RWMG, as well as other pertinent information for each project. Following this proposal-wide introduction, an introduction and scope of work are presented for each project in order of ranking.

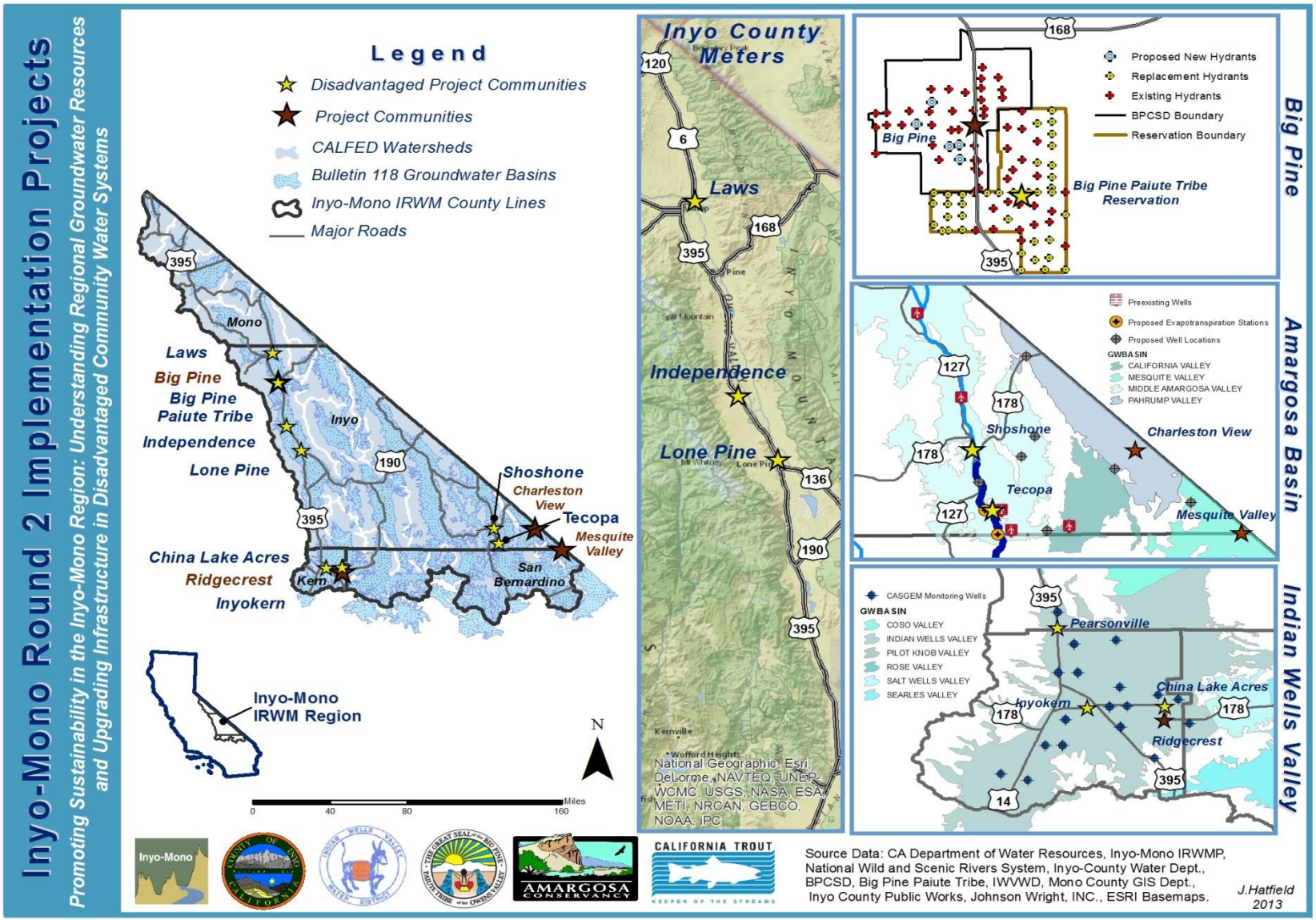
Project	Implementing Agency(ies)	Current Status (% completion of design)	Abstract	DAC Status
Big Pine Fire Protection Improvement Project	Big Pine Paiute Tribe; Big Pine Community Services District	80% completed (only final plans and specifications remain)	Due to the fire history in the Big Pine, CA, area, there is a need for increased fire protection. Big Pine Paiute Tribe (BPPT), which is a disadvantaged community, and the Big Pine Community Services District (BPCSD) are collaborating for the first time in order to realize fire protection benefits for both communities. BPPT has experienced seven catastrophic household fires in the past nine years which could have posed less of a danger to the rest of the community if fire hydrants were able to perform at their peak performance. A majority of the 63 hydrants on the Reservation were installed more than 30 years ago, and most have reached the end of their useful life. The project being proposed here will replace about half of the existing fire hydrants throughout the tribe's distribution system to increase the safety of the residents, prevent a wildfire from spreading to other areas, and reduce the likelihood of water quality impacts to Big Pine Creek. The Big Pine Community Services District (BPCSD) has also experienced catastrophic household fires as wildfires have ignited residences in their service area. The most notable of the recent fires, the Center Fire of March 2011, resulted in the loss of 19 homes within the BPCSD service area. Of the 37 fire hydrants located in the BPCSD service area, one hydrant is nearing the end of its useful life. In addition, the current arrangement of the hydrants has gaps, or areas where emergency access to hydrants is greater than 500 feet in distance (the standard). Replacing the antiquated hydrant and filling the gaps with four additional hydrants will provide emergency fire crews with a system of reliable hydrants, all regularly spaced approximately 500 feet from one another.	BPPT is a DAC and federally-recognized Native American tribe; Big Pine CSD is not a DAC although it is believed that if a current income survey were completed, the town of Big Pine would be defined as a DAC
Amargosa Basin Water,	Amargosa Land Trust; Inyo County Water Department	80%; only applications for right-of-ways still	The Amargosa River Basin of Eastern California and Nevada supports one of the largest arrays of endemic and rare plant and animal species in the United States. In	Shoshone and Tecopa, CA, are DACs; in addition, the

Project	Implementing Agency(ies)	Current Status (% completion of design)	Abstract	DAC Status
Ecosystem Sustainability, and Disadvantaged Communities Project		remain; otherwise, project is ready to begin	addition, groundwater and surface water in the basin support a unique and diverse ecosystem, a free flowing river, and a domestic water supply for the severely economically disadvantaged communities of Shoshone and Tecopa. From previous studies it has been discovered that groundwater flow within and among the five basins making up the Amargosa River watershed is complex. There are several current pressures on the groundwater resources in these basins, including urban and agricultural use and several proposed solar energy developments requiring water. It is not yet known where, or how much, groundwater extraction can occur before devastating impacts to flora, fauna, and human communities are observed. The tasks listed below will provide multiple benefits towards accomplishing the goal of developing an improved understanding of the region's hydrologic system, including enhancing the limited monitoring program, establishing a long-term groundwater monitoring network, and updating the hydrologic model for the five basins of the Amargosa River system, all of which are essential to developing management priorities and tools to adequately protect the unique and diverse ecosystem, the free flowing river, and human water resource needs. The project consists of four key tasks with associated reporting: • Install nine monitoring wells and conduct associated groundwater sampling; • Conduct a robust evapotranspiration investigation along the Amargosa River; • Expand ongoing hydrologic monitoring; and, • Reporting	entire Amargosa River Basin is a DAC according to the smallest census unit that encompasses the area (Inyo County Tract 800, Block Group 1; population 392, median household income $40,417).

Project	Implementing Agency(ies)	Current Status (% completion of design)	Abstract	DAC Status
Inyo County Disadvantaged Communities Meters Project	Inyo County Department of Public Works	10% completion of design; specifications, plans, and bid documents have not yet been developed	Laws (10 services, 30 people), Independence (364 services, 551 people), and Lone Pine (556 services, 2,309 people) are disadvantaged communities in Inyo County, CA. Inyo County Department of Public Works owns and is responsible for infrastructure upgrades in these three water systems. Although the systems are currently metered, the meters are old and largely mis-representing actual water use. The systems frequently exceed their annual water allotment from the Los Angeles Department of Water and Power. This project would replace the current meters in the three water systems (about 950 meters) will new digital Automatic Meter Reading meters. The project would also provide handheld meter reading devices and install new billing software. It is expected that staff time used for meter reading, as well as transportation costs, will be significantly reduced with digital meters. The new meters are expected to last at least 20 years. This project is an early step in a long-term process of reviewing rate structures and developing a capital improvement plan for these Inyo County systems.	The three water systems targeted by this project (Laws, Independence, and Lone Pine, CA) are all DACs by 2010 ACS data.
Indian Wells Valley Groundwater Basin Brackish Water Resources Study	Indian Wells Valley Water District	N/A as this is a feasibility study; however, the project is ready to begin upon receipt of funding	The Indian Wells Valley Water District (IWVWD) is located approximately 120 miles northeast of Los Angeles in the northern part of the Mojave Desert in an unadjudicated groundwater basin. The only source of water in the area is the local groundwater. Water extracted from the aquifer serves the City of Ridgecrest, town of Inyokern, and surrounding rural areas, and supplies the China Lake Naval Air Weapons Station. Total usage is about 30,000 acre feet of water per year (AFY), and IWVWD customers are responsible for about 25% of the total annual usage, or approximately 7,500 AFY. The water budget developed for the basin indicates an estimated annual ground water recharge shortfall (overdraft) of roughly 21,000 AFY in the Indian Wells Valley groundwater basin.	The implementing agency does not represent a DAC; however, all other water users, including two DACs (Inyokern and Searles Valley, which is made up of the communities of Trona, Argus, Pioneer Point, West End, and Valley Wells), will benefit from the results of the study.

Project	Implementing Agency(ies)	Current Status (% completion of design)	Abstract	DAC Status
			The current water portfolio and local efforts conservation efforts include tiered water rate structure, several water conservation ordinances, public water conservation education, recycled water use, and investigating water importation. However, these efforts do not provide sufficient water to meet the future needs of the Indian Wells Valley or offset the current groundwater pumping. Brackish groundwater identified through the Brackish Water Resource Study would help meet the future water needs of the IWVWD and others in the Valley. This study will provide vital information necessary to respond to critical water supply and water quality issues facing the local communities. This project will evaluate the potential for a new water supply to be developed from brackish groundwater through a review of previous studies completed in the groundwater basin, identification of existing data gaps, addressing data gaps, and updating the basin model to better understand the spatial distribution and quality of brackish water. This knowledge would improve water source reliability for the basin and would also become the basis for future decision-making activities associated with ensuring a reliable local water supply.	

Regional Proposal Map



Goals and Objectives

The goal of this proposal is to continue to address high-priority water-related needs in the Inyo-Mono region. The specific objectives of the proposal are:

- To improve understanding of groundwater resources in the region;
- To upgrade antiquated and failing infrastructure in small water systems; and
- To address the needs of disadvantaged communities and Native American tribes in the region.

Taken as a whole, the four projects help to address all but one of the regional objectives developed by the Inyo-Mono RWMG, as depicted in the table on the next page. Individual resource management strategies targeted by each project are identified in each project's work plan.

	Project Name			
Inyo-Mono Objective	**Big Pine Fire Protection Improvement Project**	**Amargosa Basin Water, Ecosystem Sustainability, and Disadvantaged Communities Project**	**Inyo County Disadvantaged Communities Meters Project**	**Indian Wells Valley Groundwater Basin Brackish Water Resources Study**
Objective 1: Protect, conserve, optimize, and augment water supply while maintaining ecosystem health		●	●	●
Objective 2: Protect, restore, and enhance water quality		●		
Objective 3: Provide stewardship of water dependent natural resources		●		
Objective 4: Maintain and enhance water, wastewater, emergency response and power generation infrastructure efficiency and reliability	●	●	●	
Objective 5: Address climate variability and reduce greenhouse gas emissions		●		
Objective 6: Promote participation of small and disadvantaged communities, including Tribes, in IRWM process to identify and work towards meeting their needs	●	●	●	
Objective 8: Promote sound groundwater monitoring, management and mitigation in cooperation with all affected parties		●	●	●

Integrated Elements of Projects

The projects included in this proposal have elements of integration at two levels. First, the combined projects address priority needs of the Inyo-Mono Phase II Plan, and the results, lessons learned, and knowledge gained will be shared with the Inyo-Mono RWMG and integrated into future revisions of the Plan. Given the Plan is a guiding document for the Inyo-Mono IRWM Program, information derived from the four projects will then be integrated to programmatic activities as well.

Secondly, the Inyo-Mono IRWM Program is striving to more functionally integrate efforts with other agency planning activities, particularly County General Plans. Discussions with County representatives have been initiated and first steps will involve an analysis of County General Plans and the Inyo-Mono Plan to identify opportunities to align and integrate information into the respective plans. Moving forward, information and outcomes from each of the projects will aid in working with County personnel with the long-term goal of having both County General Plans and the Inyo-Mono IRWM Plan functionally integrated.

Four themes permeate the projects included in the proposal: supporting disadvantaged communities and Native American tribes, addressing needs of small water systems, improving management of regional groundwater resources management, and building partnerships. Both the Big Pine Fire Improvement Protection Project and the Inyo County Disadvantaged Communities Meters Project will directly contribute to upgrading antiquated infrastructure small water systems and supporting disadvantaged communities and Native American tribes. Likewise, the Amargosa Basin Water, Ecosystem Sustainability, and Disadvantaged Communities Project and the Indian Wells Brackish Water Resources Study address needs of disadvantaged communities and contribute, collectively, to more integrated groundwater resource planning and management. Also, the two groundwater projects will contribute information for the statewide CASGEM program. Working collectively, the Grantee, Inyo-Mono IRWM Program Office, Inyo-Mono RWMG, and project proponents will continue to build lasting partnerships and leverage experiences and lessons learned for the benefit of the region as whole.

Completed Work

Each project's work plan describes work (if any) completed thus far towards the project.

Existing Data and Studies

Each project's work plan describes any existing data and studies used to support the work proposed in the project.

Project Maps

Each project's work plan contains a project map.

Project Timing and Phasing

Each project's work plan contains a section discussing project timing and phasing.

Big Pine Fire Protection Improvement Project

Introduction

The town of Big Pine, CA, includes the Big Pine Paiute Tribe Reservation lands. In the past decade, the town has experienced numerous structural fires as well as wildfires in surrounding lands that affected homes and buildings in town. The tribe and parts of the town, served by the Big Pine Communities Services District, have inadequate capacity for firefighting, thus increasing the threat to the community. This project would replace fire hydrants on reservation land and ensure proper spacing of hydrants throughout town. Both Big Pine Paiute Tribe and the Big Pine Community Services District are Members of the Inyo-Mono RWMG and have demonstrated a commitment to work with others to determine how best to address issues of high importance in the Inyo-Mono region. The Inyo-Mono RWMG ranked this project #1 in its project scoring process for the Round 2 Implementation Grant. The tribe is a disadvantaged community according to median household income data.

Purpose and Need

Wildfire and isolated residential fires have caused extensive destruction of homes and other property over the past decade on the Big Pine Indian Reservation and within the town of Big Pine. The Big Pine Paiute Tribe of the Owens Valley (BPPT) and the Big Pine Community Services District (BPCSD) are located along a wildland-urban interface on the eastern slopes of the Sierra Nevada Mountains. BPPT and BPCSD have independent public water systems that need infrastructure upgrades for improved access to water at fire hydrants to assist the local volunteer fire department and other fire agencies in extinguishing fires within the two communities. This project will replace 38 hydrants on the BPPT public water system which are no longer able to be repaired because parts are obsolete or have reached the end of their useful life. In addition, this project will install four new hydrants to the BPCSD water system and replace one antiquated hydrant. This project helps to achieve objectives and resource management strategies identified in the Inyo Mono IRWM Phase II Plan, including upgrading emergency response infrastructure and promoting participation of small and disadvantaged communities, and was identified in the Plan's project list. This project is the first time that the BPPT and BPCSD have collaborated together by integrating their needs for a shared benefit.

Both BPPT and BPCSD have a history of recent catastrophic fires (Figure 1). BPPT has experienced seven catastrophic household fires in the past nine years that also posed a danger to the rest of the community. The catastrophic nature of these household fires has been attributed to a lack of working fire hydrants within the proximity of the affected homes or to a lack of sufficient fire flow. The sufficient fire flow issue is being resolved through a separate project being conducted by the Tribe to increase the mainline distribution pipe size from 4" to 6" at various areas throughout the distribution system. The project being proposed here will complement the water line replacement project by installing new fire hydrants throughout the

distribution system to increase the safety of the residents, prevent a wildfire from spreading to other areas, and reduce the likelihood of water quality impacts on Big Pine Creek, which occur because of post-fire erosion from affected lands.

The BPCSD has also experienced catastrophic household fires as wildfires have ignited residences in its service area. Notably, the March 2011 Center Fire resulted in the loss of 19 homes within the BPCSD service area. With the addition of the seven BPPT homes lost in the last decade, the total loss of 26 homes to fires in Big Pine has placed a tremendous financial burden on the community. The estimated median house or condo value for Big Pine in 2009 was $232,829 (http://www.city-data.com/city/Big-Pine-California.html#ixzz2A9WpxvaK). Therefore, the destruction of 26 homes to fire in Big Pine over the last 10 years has resulted in a financial loss of over $6 million dollars.

In 2012, the Big Pine FireSafe Council (Council) was formed to protect the homes, communities and environments from wildfire in the Big Pine area. The BPPT and the BPCSD are partners in the Council and through this proposal are working together to protect the Big Pine area by replacing and adding fire hydrants on the Reservation and in the adjacent town.

The BPPT's public water system currently has 61 fire hydrants, and the average hydrant is 32 years old (Water Resources Management Plan 2008; attached as supporting documentation). Most of the hydrants were installed during projects completed in 1978 and 1981. Thirty-eight of the 61 hydrants are in need of replacement because essential repair parts are unavailable or the hydrants have reached the end of their useful life. Hydrants that are unable to be repaired are not exercised on a regular basis because of the risk of not being able to close an antiquated hydrant properly. In addition to the hydrant deficiencies, the BPPT's public water system has limited flow available to serve fire hydrants because of undersized water mains (Water Distribution Improvements 2003; attached as supporting documentation). BPPT is completing designs to increase water main size to maintain adequate fire flow as required by the local Volunteer Fire Chief and is finalizing funding agreements with federal partners to construct the water line replacement project. Once the water line replacement project is completed, replacing fire hydrants is the next critical step to ensure a functioning emergency water system in these communities. The implementation of the proposed project is scheduled to approximately coincide with the completion of the water line project.

This project will also replace one antiquated hydrant and add four new hydrants to the BPCSD water system. This portion of the project will improve the reliability of and accessibility to emergency water sources within the BPCSD. Evaluation of all BPCSD hydrants found that of 37 fire hydrants located in the BPCSD service area, one hydrant is nearing the end of its useful

life and is not repairable because parts are unavailable for purchase. Further, a visual assessment of the current arrangement of hydrants within the BPCSD revealed four areas where distance between hydrants is more than 500 feet. The Big Pine Volunteer Fire Department recommends that hydrants be spaced a maximum of 500 feet apart to ensure adequate fire protection. The installation of an additional four hydrants will provide emergency fire crews with reliable hydrants, all regularly spaced approximately 500 feet from one another, where homes, businesses, and other buildings exist within the BPCSD.

BPPT is a Disadvantaged Community (DAC) and is requesting a DAC match waiver from DWR for the BPPT portion of this project. "A disadvantaged community is defined by California statute as a community with an annual median household income (MHI) that is less than 80% of the statewide annual MHI (Assembly Bill 1747 [2003]). MHI data were not made available at the community level from the 2010 U.S. Census; instead, we have used 2006-2010 American Community Survey (ACS) data to perform an initial identification of DACs within the Inyo-Mono region (http://www.census.gov/acs/www/about_the_survey/american_community_survey/). The statewide annual MHI in California based on the 2006-2010 ACS is $60,883. Communities with annual MHIs less than $48,706 are considered disadvantaged communities by the AB 1747 definition" (I-M IRWMP pg. 13-15).

According to the 2006-2010 ACS data utilized in the I-M IRWMP, the BPPT has an MHI of $43,214 which is below the threshold of a DAC according to California statute. BPPT has a poverty rate nearly 15 percentage points higher (10.9% vs, 24.8%) than that of Inyo County and over 10 percentage points higher (13.2% vs. 24.8%) than the State of California. Further, the unemployment rate is six times (10.0% vs. 62.0%) higher than Inyo County and five times higher (12.4% vs 62.0%) than the State of California.

The Big Pine Census Designated Place (CDP) is not considered a DAC under 2010 ACS data, although it was a DAC according to 2000 U.S. Census data (MHI: $37,115). However, it is known that the BPCSD service area does not follow the exact boundaries of the Big Pine CDP. No income survey was conducted prior to this grant application, so no DAC waiver is claimed for this portion of the project, but it is likely that if a current income survey was completed, BPCSD would be defined as a DAC.

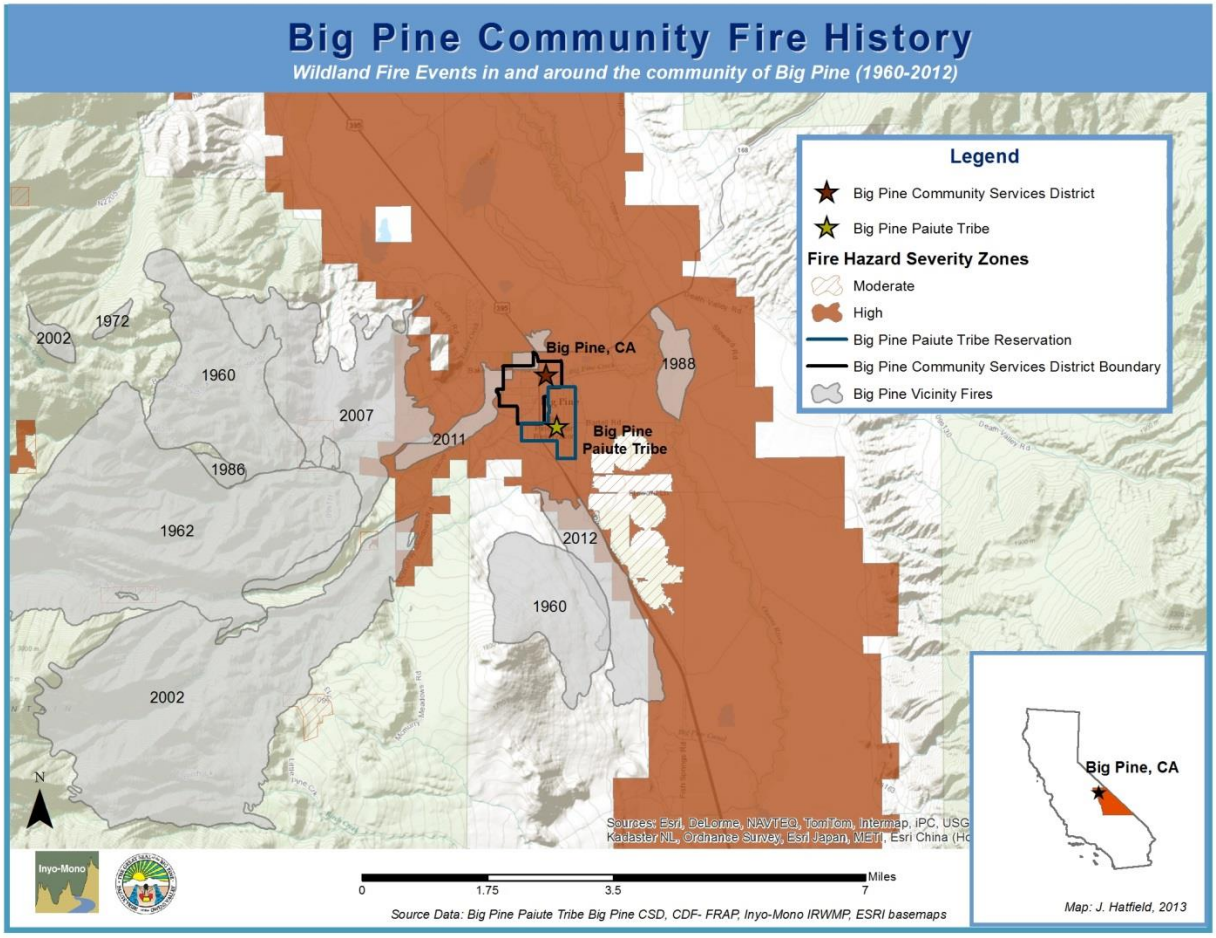


Figure 1. Wildland fire events in and around Big Pine, CA, for the last fifty years.

Goals and Objectives

The overall goal of this project is to increase fire protection capacity in Big Pine, CA. The objective of the project is to replace fire hydrants to improve the emergency water system infrastructure of two public water systems operating in Big Pine.

Three of the principal concerns identified in the Inyo-Mono Integrated Regional Water Management Plan (I-M IRWMP) are water quality, water infrastructure, and institutional/human capacity. On page 14 of the I-M IRWMP it states that "several communities identified concerns about old, outdated, and/or poor-quality water infrastructure…Poor or failing water infrastructure results in substantial water loss and inadequate fire-fighting capabilities."

The Big Pine Fire Protection Improvement Project addresses two of the objectives of the Inyo-Mono IRWM Plan:

> Objective 4: *Maintain and enhance water, wastewater, emergency response and power generation infrastructure efficiency and reliability*

Objective 6: *Promote participation of small and disadvantaged communities, including Tribes, in IRWM process to identify and work towards meeting their needs*

Objective 4 (Enhance emergency response infrastructure efficiency and reliability): Although there are currently hydrants in both the BPPT and BPCSD systems, many of them are old and inadequate for meeting the fire water flow needs of the community. This project will strengthen emergency water infrastructure by replacing and adding new hydrants in the public water systems of the BPPT and BPCSD.

Objective 6 (Participation of small and disadvantaged communities, including tribes): This project provides direct financial assistance to a DAC that is also a tribe (BPPT) and to a CSD that provides water and wastewater services to a very small community (BPCSD, population appx. 1680). This project also provides an opportunity for these two entities to collaborate and work together to solve community-wide problems. By working together, the BPPT and BPCSD are integrating their needs for a shared benefit. This project opens the door for future collaboration since both public water systems utilize similar supplies and equipment for repair and replacement of water distribution infrastructures. In the future, BPPT and BPCSD can continue to assist one another in providing safe, clean water to their customers while supplying adequate fire protection for the communities they serve. In addition, both organizations are active participants in the I-M RWMG and have helped the Group to understand the needs of small and underserved communities.

The following table summarizes specific regional objectives and associated resource management strategies addressed by this project.

Inyo-Mono Objectives and RMS
Objective 4: Enhance emergency response infrastructure efficiency and reliability
RMS 4A: Promote rehabilitation and replacement of aging water and wastewater delivery and treatment facilities in rural communities, including tribal lands.
RMS 4B: Ensure adequate water for fire protection and emergency response.
Objective 6: Promote participation of small and disadvantaged communities, including Tribes, in IRWM process to identify and work towards meeting their needs
RMS 6A: Engage regional communities and tribes in collaborative water and natural resource management related efforts.
RMS 6B: Provide assistance for tribal and DAC consultation, collaboration, and access to funding for development, implementation, monitoring, and long-term maintenance of water resource management projects.

This project will also assist the overall State of California IRWM program by showing direct positive impacts to a tribal community that can be used to help other IRWM regions create better relationships with tribes. Overall, tribes have been underutilizing the opportunities which

exist under IRWMP for completing projects. This project will assist tribes in recognizing the potential opportunities which exist through involvement in their regional IRWMP.

Integrated Elements of Project

For the first time ever, the Big Pine Paiute Tribe and the Big Pine CSD are directly working together to address a mutual problem in the community. By collaborating on this project, both entities acknowledge that together, they can more effectively solve the problem of fire threats to the town than if each entity worked alone. The Tribe and the CSD will continue to collaborate through their involvement in the Big Pine FireSafe Council.

Completed Work and Current Status

BPPT and BPCSD have analyzed their public water systems for fire hydrant deficiencies and have identified fire hydrants in need of replacement because repair parts are no longer available, hydrants are at the end of their useful life, and/or spacing requirements are not currently being met. In addition, BPPT and BPCSD have coordinated with the local volunteer fire department to determine how to best assist firefighters in providing adequate fire protection for the communities. The result of this coordination is this project proposal to install new fire hydrants.

A fire hydrant diagram has been drawn by a project engineer with the Indian Health Service to ensure that installation of replaced hydrants conforms to established American Water Works Association Standard C-502. The diagram is included as supporting documentation for this project. Fire hydrant types and associated materials required for installation have been identified within the diagram. Only final plan and specification documents need to be developed (Task 4). Otherwise, the project is prepared for the construction phase to take place.

Existing Data and Studies

BPPT has conducted a fire flow analysis of the water distribution system to determine water main replacement sizing for optimal cost/benefit analysis. There have been no studies conducted on the replacement of fire hydrants.

Supporting Documentation

The following documents are provided as attachments to this work plan as additional justification for this project:

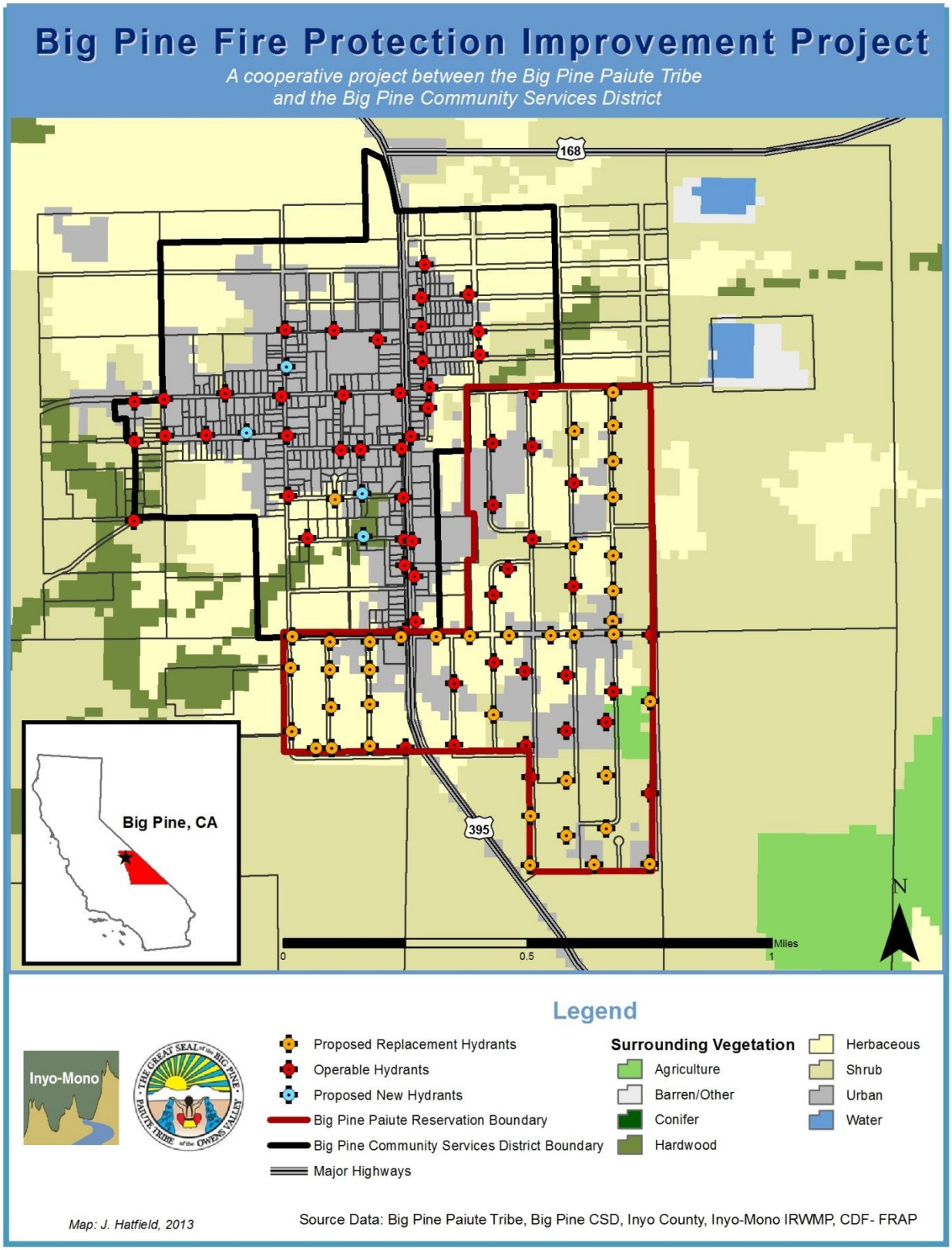
1) Fire hydrant diagram (2012)
2) *Water Resources Management Plan – Big Pine Indian Reservation* (2008)
3) *Water Distribution Improvements to Improve Fire Flow on the Big Pine Indian Reservation* (2003)
4) *Inyo Register* article – "Fire destroys 19 homes in Big Pine" (March 21, 2011)
5) *Inyo Register* article – "Homes lost, but lives saved" (April 3, 2012)
6) *Inyo Register* article – "Big Pine Fire Safe Council gaining momentum" (July 23, 2012)

Project Timing and Phasing

In addition to replacing fire hydrants for BPPT, there is a need to increase the water main size at various locations in the system in order to provide adequate fire flow to fire hydrants. The fire hydrant replacement project and the water main replacement project are stand-alone projects, but both projects complement each other by providing adequate fire flow and modern hydrants for improved access to water. The installation of five hydrants in the BPCSD service area is also a stand-alone project.

The project is ready to begin. The anticipated project start date is October 1, 2013, which will approximately coincide with the completion of the mainline project, and the hydrant project is expected to be complete within twelve months (by September 30, 2014).

Project Map


Big Pine Fire Protection Improvement Project
A cooperative project between the Big Pine Paiute Tribe
and the Big Pine Community Services District
168
395
Big Pine, CA
0
0.5
1
Miles
N
Legend
Proposed Replacement Hydrants
Operable Hydrants
Proposed New Hydrants
Big Pine Paiute Reservation Boundary
Big Pine Community Services District Boundary
Major Highways
Surrounding Vegetation
Agriculture
Barren/Other
Conifer
Hardwood
Herbaceous
Shrub
Urban
Water
Inyo-Mono
Map: J. Hatfield, 2013
Source Data: Big Pine Paiute Tribe, Big Pine CSD, Inyo County, Inyo-Mono IRWMP, CDF- FRAP

Proposed Work Plan

The following work plan includes the tasks necessary to complete the scope of work and includes the information included within Table 6 of the Proposal Solicitation Package, Integrated Regional Water Management, Proposition 84, Round 2 (DWR, 2012).

Budget Category (a): Direct Project Administration Costs

Task 1: Administration

Description: Work to be completed in this task includes BPCSD Board and BPPT Council communications and coordination, budget adjustments, project status meetings, development of invoices, and communication with Inyo County, the grantee.

Deliverables: Signed contract between grantee, BPPT, and BPCSD; invoices conforming to DWR invoice standards.

Task 2: Labor Compliance Program

Description: BPPT and BPCSD will adhere to a Labor Compliance Program. The labor compliance services will include, at a minimum, monitoring and preparation of summary and status reports; receiving, reviewing, and processing certified payroll reports; conducting interviews; and collecting, reviewing, and processing other data. Annual reports to the Department of Industrial Relations (DIR) will also be prepared and submitted. BPPT will abide by the Tribal Employment Rights Ordinance when conducting project activities on the Big Pine Indian Reservation.

Deliverables: Annual reports

Task 3: Reporting

Description: Following execution of the grant agreement, quarterly reports will be prepared assessing the progress and accomplishments of the Fire Hydrant Replacement Project. A project completion report will also be prepared at the end of the project.

As part of this task, BPPT and BPCSD will work with the grantee and the Inyo-Mono IRWM Program Office to finalize the performance indicators for the project and develop a project-specific performance monitoring plan within the first quarter of project implementation. This document will be a compilation of project-specific performance monitoring plans and will, for each project, identify the problem to be addressed by the project, summarize the project tasks, specify the project goals and desired outcomes, and include a project performance measures table presenting output and outcome indicators, measurements tool and methods to be implemented, performance targets, and a monitoring schedule.

This performance monitoring plan will be prepared to:

- ✓ Provide a framework for assessment and evaluation of project performance.
- ✓ Identify measures that can be used to monitor progress toward achieving project goals.
- ✓ Provide a tool to monitor and measure project process and guide final project performance reporting that will fulfill grant agreement requirements.
- ✓ Provide information to help improve current and future projects.
- ✓ Maximize the value of public expenditures to achieve desired environmental results.

This plan will then become part of the proposal-wide Performance Monitoring Plan for the Round 2 Implementation Grant.

Deliverables: Quarterly reports as specified in the Grant Agreement; completion report as specified in the Grant Agreement; project performance monitoring plan.

Budget Category (b): Land Purchase/Easement

The Fire Hydrant Protection Improvement Project involves the replacement of fire hydrants along the water distribution systems of BPPT and BPCSD; therefore, this project does not require the purchase or lease of land or easements. Inyo County and Bureau of Indian Affairs (BIA) Encroachment Permits will be acquired to work in existing County and BIA easements.

Budget Category (c): Planning/Design/Engineering/Environmental Documentation

Task 4: Final Design

Description: BPPT and BPCSD have conducted inventories of their water distribution systems to determine fire hydrant replacement needs, and each organization has designs for fire hydrant installation, so minimal preparation of final design and specifications would be needed to commence the project. The final design will be completed following grant agreement execution (or after a grant award notification from the DWR). For the project, only final (100%) plan and specification documents will be produced and will identify the fire hydrant locations and detail implementation specifications. All installed fire hydrants will comply with design and accuracy specifications of the American Water Works Association (AWWA) Standard C-502. Additionally, Occupational Safety & Health Administration (OSHA) regulations and industry standard practices will be used as health and safety standards.

Deliverables: Final plans and specifications for the Fire Hydrant Replacement Project

Task 5: Environmental Documentation

Description: Prior to project implementation, a categorical exemption will be filed from the California Environmental Quality Act (CEQA) as allowed under Article 19 of the CEQA Guidelines, Section 15301 Existing Facilities (d) which exempts the “restoration or rehabilitation of deteriorated or damaged structures, facilities, or mechanical equipment to meet current

standards of public health and safety, unless it is determined that the damage was substantial and resulted from an environmental hazard such as earthquake, landslide, or flood." A categorical exclusion will also be filed through BPPT's Environmental Policy Ordinance, in lieu of NEPA notification, for activities on the Big Pine Indian Reservation.

Deliverables: Approved and adopted CEQA Categorical Exemption and BPPT Environmental Policy Ordinance approval and adoption.

Task 6: Permitting

Description: An Inyo County Encroachment Permit and Bureau of Indian Affairs Encroachment Permit will be acquired to be allowed to work in County and Bureau of Indian Affairs easements.

Deliverables: Approved Inyo County and Bureau of Indian Affairs Encroachment Permits

Budget Category (d): Construction/Implementation

Task 7: Construction Team Hiring

Description: BPPT will utilize the Tribal Employment Rights Ordinance skills bank to interview and hire a force account crew to implement construction activities associated with the replacement of fire hydrants for the Fire Protection Improvement Project. BPPT regularly uses a force account crew to complete construction activities for projects funded with federal dollars. BPCSD will be utilizing an existing contract to install the new hydrant valve assemblies on the BPCSD system.

Deliverables: Staff list of force account crew and contracted crew members

Task 8: Construction

Description: Construction of the Big Pine Fire Protection Improvement project is expected to begin in February 2014 and end in June 2014. This task is divided into three categories: mobilization and site preparation, project construction, and performance testing and demobilization, as described in the following sections.

Mobilization and Site Preparation

BPPT will mobilize equipment and crew to their respective, designated staging areas. Some of the equipment that will be required for implementation of the Fire Hydrant Replacement Project will include: backhoe, jackhammer, and crew truck.

Project Construction

During project construction, thirty nine fire hydrants will be replaced and four hydrants will be installed at new locations. The four new hydrant locations will need to be hot tapped into existing water lines. Each line will have a hydrostatic test performed for two hours at 150 PSI with chlorine added. The chlorine will remain in the lines for 24 hours and the lines will then be

flushed and retested. Once the bacteria test results have come back and are approved, the hydrants can be installed with supervision from the BPCSD Water Operator. The contractors will perform the installations within OSHA and any other applicable codes, regulations, and ordinances during construction.

Performance Testing and Demobilization

Representatives of the participating partners will perform post-construction inspections to verify proper fire hydrant installation. After installation, the 43 hydrants will be checked for leaks, sprayed on the inside with a chlorine/water mix for disinfecting, and properly flushed before being brought into service. Post-project activities funded through the Operation and Maintenance budget of BPPT and BPCSD shall include regular fire hydrant flushing to exercise valves and record any deficiencies. Additionally, as part of this work item, demobilization and site restoration (as required) by the force account crew will be completed.

Deliverables: Records of bacteria tests and fire hydrant flushing; final report of construction activities.

Budget Category (e): Environmental Compliance/Mitigation/Enhancement

Task 9: Environmental Compliance

Description: A CEQA Categorical Exemption will be filled for this project, so no mitigation measures will be required; however, the force account crew will restore the fire hydrant replacement sites to initial conditions including replacement of any disturbed turf areas, damaged shrubs or damaged trees. These measures are included as part of the construction cost.

Deliverables: Compliance with all permitting requirements.

Budget Category (f): Construction Administration

Task 10: Construction Administration

Description: This task includes construction management services. Construction management for this project will include the following work items:

- ✓ Review force account/contractor crew schedule and make recommendations
- ✓ Manage and coordinate all project inquiries
- ✓ Manage and coordinate all correspondence
- ✓ Maintain detailed project records
- ✓ Receive, log, and distribute all submittals for review
- ✓ Inspect completed construction

Deliverables: Project records; records of correspondence, crew schedules

Budget Category (g): Other Costs

There are no tasks within this budget category.

Budget Category (h): Construction/ Implementation Contingency

The construction budget has been developed based on quotes and local knowledge; however, the replacement and installation of fire hydrants includes a certain amount of unknowns including the condition of the subsurface water distribution infrastructure and the underground material being excavated. Therefore, a 10% contingency of the construction budget has been set aside to be used for unforeseen circumstances encountered during the construction phase.

Amargosa Basin Water, Ecosystem Sustainability, and Disadvantaged Communities Project

Introduction

A high-priority need in the Inyo-Mono IRWM planning region is an improved understanding of the character of groundwater basins underlying the region, including the movement, quantity, and quality of groundwater resources. More than 90% of domestic water resources in the southern half of the region originate as groundwater. Pressures on water resources continue to mount, stemming from agriculture, domestic production, and more recently, solar energy developments. More knowledge about the nature of groundwater basins will help to inform management decisions about domestic, agricultural, industrial, and ecological uses of this precious resource.

Purpose and Need

The Amargosa River Basin of Eastern California and Nevada supports one of the largest arrays of endemic and rare plant and animal species in the United States. Groundwater and surface water in the basin support a unique and diverse ecosystem, a free flowing river, and a domestic water supply for the severely economically disadvantaged communities of Shoshone and Tecopa. Groundwater and spring flow supply municipal, domestic, agricultural, wildlife, stock-watering, mining and other industrial uses in the area. Because the flowing portion of the Amargosa River is a groundwater-fed surface water body, relatively small variations in the groundwater surface elevation can affect spring flow and surface flow in the river. Minor lowering of the groundwater surface in the area could have crippling effects on springs, seeps and wells that supply human and natural communities and the local economy. From previous studies it has been discovered that groundwater flow within and among the five basins making up the Amargosa River watershed is complex. Adding to that complexity, multiple jurisdictions exist within the study area, including two states, federal government land, and private property. Overdrafting of groundwater is a real and constant threat in the Amargosa Basin system.

While the hydrology of the Nevada portion of the bi-state basin has been relatively well-studied through hydrologic studies centered on the Nevada Test Site and the Yucca Mountain Project, the California portion of the basin has seen few regional hydrogeologic investigations. Collaborative groundwater investigations of the California Amargosa have begun[1], but are far from complete. Thus, it is not yet known where, or how much, groundwater extraction can occur before devastating impacts to flora, fauna, and human communities are observed. This grant would provide essential missing information necessary to avoid such impacts from being realized.

[1] Partners in and contributors to this work, in addition to Inyo County and the Amargosa Conservancy, include the BLM, the US Geological Survey, The Nature Conservancy, and Nye County, Nevada.

In 2009, recognizing its unique character and outstanding resources, Congress designated the free flowing portion of the Amargosa River from Shoshone through the Amargosa Canyon as America's first desert Wild and Scenic River. The U.S. Bureau of Land Management (BLM) is developing the management plan for the Wild and Scenic portion of the river, to meet its obligation to protect the unique desert groundwater system in the most arid section of California. A principal goal of that plan is to describe and protect the resource values that led to the river's designation, including the rich array of species and habitats that the basin's groundwater resources support through fresh water spring flows. An improved understanding of the hydrology of the river, including underlying aquifers, will allow for an analysis of potential impacts of regional groundwater pumping to the Wild & Scenic portion of the river. Also, improved knowledge will assist in protecting surface expressions of the groundwater elsewhere in the basin so that human uses can be maintained in the face of potential future groundwater demands in the region and predicted adverse changes in climate and precipitation recharge.

This project serves other purposes as well. There is a growing interest in siting centralized solar energy generation plants in the deserts of the southwestern U.S. Several proposed developments are situated in the Amargosa River Basin. Solar arrays often require readily-available water resources – typically pumped groundwater - for cleaning equipment and other on-site uses. Without a complete understanding of the groundwater resources underlying proposed developments, it is impossible to determine what impact such groundwater pumping for industrial use would have on other users in the basin and in other attached groundwater basins.

Additionally, the proposed project allows Inyo County to increase its compliance with the newly-installed California State Groundwater Elevation Monitoring (CASGEM) program. SBX7-6 (2009) legislation provides that groundwater elevations in all 515 groundwater basins identified in California Department of Water Resources (DWR) Bulletin 118 will be monitored in a manner sufficient to determine seasonal and long-term trends in groundwater elevation. The County of Inyo is charged with carrying out this monitoring throughout the county and is required to provide groundwater monitoring locations for the Amargosa River, Chicago Valley, California Valley, Pahrump Valley, and Mesquite/Sandy Valley groundwater basins in California.

Given the importance of these issues, the tasks listed below will provide multiple benefits by developing an improved understanding of the region's hydrologic system through the enhancement of the monitoring program, establishment of a long-term groundwater monitoring network, and an updated hydrologic model for the five basins of the Amargosa River system, all

of which are essential for developing management priorities and tools to adequately protect the unique and diverse ecosystem, the free flowing river, and human water resource needs. The proposed work consists of the following tasks:

- Siting, permitting, installing, developing and sampling nine monitoring wells;
- Evaluation of evapotranspiration along the Amargosa River (essential to an understanding of the basin's groundwater budget);
- One annual "State of the Basin Report" and a published report (by the U.S. Geological Survey) covering the evapotranspiration work; and
- Continued groundwater level, spring flow and river flow monitoring for 12 months.

Goals and Objectives

The primary goal of the proposed project is to improve the long-term management of groundwater in the Amargosa region. A secondary goal is to support the development of an integrated regional groundwater management program for the Inyo-Mono IRWM region. The specific objectives of the project that will work to accomplish these goals are to:

- Provide data critical to the development of a well-conceived hydrologic conceptual model of the Amargosa Basin;
- Enhance the limited ongoing hydrologic monitoring program by establishing a long-term monitoring program and associated infrastructure;
- Allow the County of Inyo to comply with state-mandated groundwater monitoring requirements;
- Develop scientifically-accurate information, including a baseline of hydrologic conditions, to inform and respond to solar development project proposals; and
- Provide for a better understanding of the Wild and Scenic portion of the Amargosa River so as to better inform the BLM's management plan.

The timing and need for this work is of critical importance. In addition to the Wild and Scenic plan being prepared by the BLM, the solar renewables industry has proposed numerous utility-scale plants in the bi-state Amargosa River drainage that will rely on groundwater. The ongoing and future pressures on the groundwater resource have the potential to critically impact the local economy and the sensitive Mojave desert ecosystem.

This project is consistent with the Inyo-Mono IRWM Plan and has been identified as a high priority need by the Inyo-Mono RWMG. This project helps to address seven of the eight objectives of the IRWM Plan:

Objective 1: *Protect, conserve, optimize and/or augment water supply while maintaining ecosystem health*
Objective 2: *Protect, conserve, and/or enhance water quality*
Objective 3: *Provide stewardship of water dependent natural resources*

Objective 4: *Maintain and enhance water, wastewater, emergency response and power generation infrastructure efficiency and reliability*
Objective 5: *Address climate variability and reduce greenhouse emissions*
Objective 6: *Promote participation of small and disadvantaged communities, including Tribes, in IRWM process to identify and work towards meeting their needs*
Objective 8: *Promote sound groundwater monitoring, management and mitigation in cooperation with all affected parties*

Below is a description of how the project will help to fulfill the region's objectives.

Objective #1 (Water Supply Reliability): The proposed work tasks are all aimed at protecting water supply. Given the lack of a thorough understanding of the basin's conceptual hydrogeologic model, and a general paucity of hydrologic data, groundwater management in the area is severely hampered, and maintenance of critical groundwater levels and spring flow to the region's communities for recreational and domestic uses, and to sensitive ecosystems, cannot be assured. The proposed tasks will each contribute essential information that will influence management of the river system while providing data needed to comply with CASGEM requirements.

Objective #2 (Water/Ecosystem Quality): The health of the Amargosa River and its associated ecosystems is directly influenced by the viability of its sources from various springs. Additionally, the local economic engine of recreation and tourism is tied to the hot springs at Tecopa and the spring-fed vegetation in the Amargosa Canyon. The proposed tasks provide a greater understanding of sources, character, and quality of spring flow and groundwater at various points in the regional ecosystem.

Objective #3 (Stewardship): A primary objective of this project is to enhance watershed stewardship based on scientifically-sound information. Effective management and stewardship of the water resources of the Amargosa require a grounding from a good conceptual hydrologic model of the region and an ongoing hydrologic monitoring program that will provide meaningful data to populate the model. This work will allow for more well-informed management of desert flora and fauna, including the Wild and Scenic stretch of the Amargosa River.

Objective #4 (Infrastructure Reliability): By developing a working knowledge of the Amargosa groundwater system, residential, community, commercial and industrial water users can be assured of sustainable supplies of groundwater. For example, utility-scale solar industry proposals in the area may be hampered by opposition based on absence of

confidence in groundwater supplies. Ongoing monitoring will help to detect overdrafting and allow for expedient decisions regarding groundwater supplies.

Objective #5 (Climate Variability): Understanding how climate variability will affect the basin requires an understanding of the groundwater system. This work may identify specific resources that are particularly sensitive to relatively minor groundwater-level fluctuations. If the results of the project's studies define a groundwater system that is sensitive to recent climatic fluctuations and in decline, proposed increases in groundwater pumping may require adaptation in planned activities or offsetting reductions in other uses. Indirectly, the project will assist in reducing greenhouse gas emissions by expediting solar plant siting decisions while developing appropriate monitoring and mitigation conditions to balance regional water uses.

Objective #6 (DAC Participation): This project goes to the heart of understanding, conserving, and protecting a severely disadvantaged area, including two identified DACs, the economy of which is largely based on the health of local spring systems. Additionally, with easy access information on regional groundwater resources through the Amargosa Conservancy, based in Shoshone, California, along with local events such as the annual Devil's Hole Conference, there will be multiple opportunities for local residents, including tribal members, and visitors to learn about local groundwater resources.

Objective #8 (Groundwater monitoring, management, and mitigation): This project will assist in understanding the groundwater flow system and groundwater budget of the Amargosa basin and will expand the groundwater elevation monitoring capability in the region. This information will assist all affected parties, including federal land management agencies, local and regional non-profit organizations, scientists, and community members in cooperating on sound, data-driven groundwater management decisions. The proposed monitoring wells and monitoring program will also be used by Inyo County to comply with the California Groundwater Elevation Monitoring Program.

The following table summarizes each of the proposed tasks to be completed in this work plan, and indicates the specific regional objectives and associated resource management strategies that are addressed by each component of the project.

Table 1. Project task relevance to Inyo-Mono IRWM Objectives and Resource Management Strategies (RMS)

Inyo-Mono Objectives and RMS	Hydrologic Monitoring	Groundwater Monitoring Wells	Evapotranspiration Investigation
Objective 1: Water Supply	x	x	x
RMS 1C: Compliance with state standards		x	
RMS 1J: Planning efforts to provide emergency drinking water	x		
RMS 1L: Water supplies that provide public recreation opportunities	x	x	x
Objective 2: Water Quality	x	x	x
RMS 2D: Public health and aquatic ecosystem sustainability	x	x	x
Objective 3: Stewardship of water-dependent	x	x	x

Inyo-Mono Objectives and RMS	Hydrologic Monitoring	Groundwater Monitoring Wells	Evapotranspiration Investigation
natural resources			
RMS 3A: Protect natural processes, habitats, and T&E species	x	x	x
RMS 3B: Protect ecosystems	x	x	x
RMS 3C: Science-based project to assess region's ecological resources	x	x	x
RMS 3D: Research and monitoring to understand impacts of water-related projects on environmental resources	x	x	x
Objective 4: Infrastructure efficiency and reliability	x	x	x
RMS 4D: Support water use efficiency in power generating facilities	x	x	x
Objective 5: Climate variability and GHG emissions	x	x	x
RMS 5B: Increase understanding of impacts of climate change on water supplies and quality	x	x	x
RMS 5F: Assessment and mitigation of water-related impacts of renewable energy projects	x	x	x
Objective 6: Participation of small and disadvantaged communities	x	x	x
RMS 6A: Engage regional communities in collaborative water and natural resource management efforts	x	x	x
RMS 6B: Assistance for DAC access to funding for development, implementation, monitoring, and long-term maintenance of water resource management projects	x	x	x
RMS 6D: Promote social resilience in DACs to respond to social, economic, environmental disturbances impacting water resources	x	x	x
Objective 8: Sound groundwater monitoring, management, mitigation with all affected parties	x	x	x
RMS 8A: Support and implement state-mandated groundwater and surface water monitoring requirements, and other groundwater monitoring efforts		x	
RMS 8B: Promote efforts to monitor, manage, and mitigate effects of groundwater-dependent projects	x	x	x
RMS 8F: Identify existing gaps in groundwater and surface water quantity data and undertake appropriate assessments/characterization studies	x	x	x
RMS 8G: Collect data and monitor groundwater and surface water supply variability	x	x	x

Project (Task) List

The project consists of four key tasks with associated reporting:

- Install nine monitoring wells and conduct associated groundwater sampling
- Conduct an evapotranspiration investigation along the Amargosa River
- Expand hydrologic monitoring
- Reporting

New Monitoring Wells: Nine new monitoring wells will be installed along with pressure transducers and data-loggers for continuous groundwater-level monitoring. Additionally, geochemical sampling and analysis (for general minerals and metals) will be conducted at each of the newly installed wells.

While increasing understanding of the Amargosa groundwater system, eight of the new wells will also serve as monitoring wells for the County of Inyo, allowing the County to satisfy its CASGEM requirements for this part of the county by collecting groundwater elevations for each groundwater basin and making the data publically available. SBX7-6 legislation provides that groundwater elevations in all 515 groundwater basins identified in California Department of Water Resources (DWR) Bulletin 118 will be monitored in a manner sufficient to determine seasonal and long-term trends in groundwater elevation. The County of Inyo is charged with carrying out this monitoring for the Amargosa River, Chicago Valley, California Valley, Pahrump Valley, and Mesquite/Sandy Valley groundwater basins in California.

Evapotranspiration Study: The evapotranspiration (ET) study will be conducted by the U.S. Geological Survey (USGS) to provide a reliable estimate of groundwater discharge along the Amargosa Wild & Scenic River (AWSR). With ET data, the water balance for the Amargosa system can be established, since plant use of water and surface evaporation, along with spring flow and pumping data, are key components of discharge. These data and information can be used to help determine where to monitor groundwater and to help evaluate up-gradient pumping influences on the quantity and quality of groundwater discharge lower in the basin. The proposed study is relevant to a number of USGS strategic science directions, including developing a water census, understanding ecosystems, predicting ecosystem change, and understanding the impacts of climate variability and change. The funding available from the USGS for this task will match State grant funds dollar for dollar, thereby doubling the effectiveness of Prop. 84 grant funds.

Expanded Hydrologic Monitoring: Currently, hydrologic monitoring consists of river gaging at five locations along the Amargosa River between Tecopa and Dumont Dunes, monitoring groundwater elevations at four wells, and spring monitoring at eighteen locations. The project includes funding for another one year of monitoring at these sites as well as at the additional nine new monitoring wells.

Reporting: The results of monitoring and associated analyses will be reported in an annual "State of the Basin Report". Included in this reporting will be a refined conceptual hydrologic model of the Amargosa River system.

More specific information on each of these tasks can be found in the **Work Plan** section.

Integrated Elements of Project

This work is part of a larger initiative to better understand and manage groundwater resources in the Inyo-Mono IRWM planning region. All of the tasks comprise one largely integrated project devoted to understanding and protecting this desert groundwater system. Individual elements will also be integrated. For example, the Shoshone – Tecopa monitoring well location will be planned with input from the U.S. Geological Survey to provide useful data for the evapotranspiration study. At the same time, this well will also be sited in an important baseline monitoring location and designed to provide important groundwater characterization information.

The eight CASGEM-related monitoring wells will also provide essential monitoring well coverage over a vast area of the desert basin that is currently data sparse or absent, supplying data beyond what is expressly required to meet CASGEM standards.

Additionally, this project combines the needs of the County of Inyo with those of the BLM, the USGS, the Amargosa Conservancy, and The Nature Conservancy, increasing the efficiency of the work and reducing costs that would otherwise be spent on duplicative efforts if individual work elements were funded and conducted separately.

Completed Work and Current Status

None of the proposed work has been completed to date, although substantial work related to and leading up to this project has been completed in the region (see Existing Data and Studies section). Applications for right-of-ways will be submitted prior to the award date, and it is anticipated needed approvals would be promptly forthcoming from the BLM and Amargosa Conservancy. All wells and the evapotranspiration study sites are on BLM land with the exception of one well (head of Willow Creek) that is anticipated to be installed on land owned by the Amargosa Conservancy. No further planning is needed to commence the work described in the work plan.

Existing Data and Studies

To date, the principal hydrologic investigations in the area have been sponsored by the BLM, the USGS, the Amargosa Conservancy and The Nature Conservancy. These have consisted of a number of phases:

- Initial reconnaissance;
- Geologic investigations and mapping
- Geochemical sampling and analysis;
- Installation of two monitoring wells (Willow Creek & Amargosa River);
- Ongoing hydrologic monitoring.

The first phase of work included field reconnaissance and cataloging of all of the known spring systems in the Middle Amargosa River Basin in California, an area encompassing nearly 1,000

square miles (the portion of the basin between the California – Nevada state line and Salt Creek). Additionally, well canvassing over the same area was conducted to identify potential future groundwater monitoring locations. Although numerous wells were found in widely disparate areas, only two were deemed useable as monitoring points (Eagle Mountain and Cynthia's). The results of these reconnaissance activities formed the foundation for the subsequent second phase of work. Among the results of the reconnaissance:

- spring sources within the study area are highly variable;
- elevated temperature and Total Dissolved Solids (TDS) concentrations in some springs (such as at Tecopa Hot Springs) are more likely derived from a deeper regional or geothermal setting; and
- springs exhibiting lower temperatures and TDS concentrations were more likely to be derived from shallow alluvial settings, sourced from runoff from surrounding hills and mountains.

The second phase of work consisted principally of geochemical sampling of springs, the Amargosa River, and Eagle Mountain and Cynthia's groundwater wells, along with continued monitoring of spring flow, river flow and groundwater levels in the Middle Amargosa River Basin. The geochemical work provided evidence that springs within the study area are complex mixtures derived from multiple and mixed recharge and underflow sources, and led to the conclusion that developing an overall water budget for the large Middle Amargosa River Basin would be a complicated endeavor. The most logical means to evaluate the groundwater budget for the California portion of the basin will be to understand the various groundwater discharge components and the subsurface underflow beyond Salt Creek. The results from the geochemical sampling provide the foundation for most of the activities in this proposed work.

A third phase consisted of the installation of two monitoring wells, groundwater sampling and analysis, and installation of continuous groundwater level monitoring equipment in the wells. One well was installed at Willow Creek above the China Ranch Date Farm, and the other was installed along the Amargosa River channel approximately five miles north of Shoshone (Figure 1). Information from these two wells was unpredicted and extremely valuable, and pointed to the substantial uncertainty in hydrologic conditions. It had long been thought that groundwater between Death Valley Junction and Shoshone ran shallow and cool beneath the often dry Amargosa River surface channel. The initial encounter with hot groundwater at 138 feet below ground surface directly next to the river channel (Amargosa River or ARHS-01 location) proved that not to be the case. Water from that well was found to be approximately 35 degrees Celsius, suggesting that the fault that runs along the axis of the Amargosa River (through Tecopa and Shoshone, and then north towards Eagle Mountain) may provide a connection to, and distribution system for, a deeper, geothermal source of water.

The results from the work described above are detailed in the 2012 State of the Basin Report: Amargosa Basin. This document is provided as supporting documentation for this project.

Additional wells to probe the hydrology of the basin were planned but could not be completed due to budgetary constraints. The Nature Conservancy has contracted a firm to install a

monitoring well at 12 Mile Spring, to collect groundwater samples, and to install continuous groundwater level measuring equipment. This work will be conducted during April 2013.

Currently, hydrologic monitoring consists of river gaging at five locations along the Amargosa River between Tecopa and Dumont Dunes, monitoring groundwater elevations at four wells, and spring monitoring at eighteen locations. The data gathered here point to the need for the work proposed in the Proposed Work section below.

Supporting Documentation

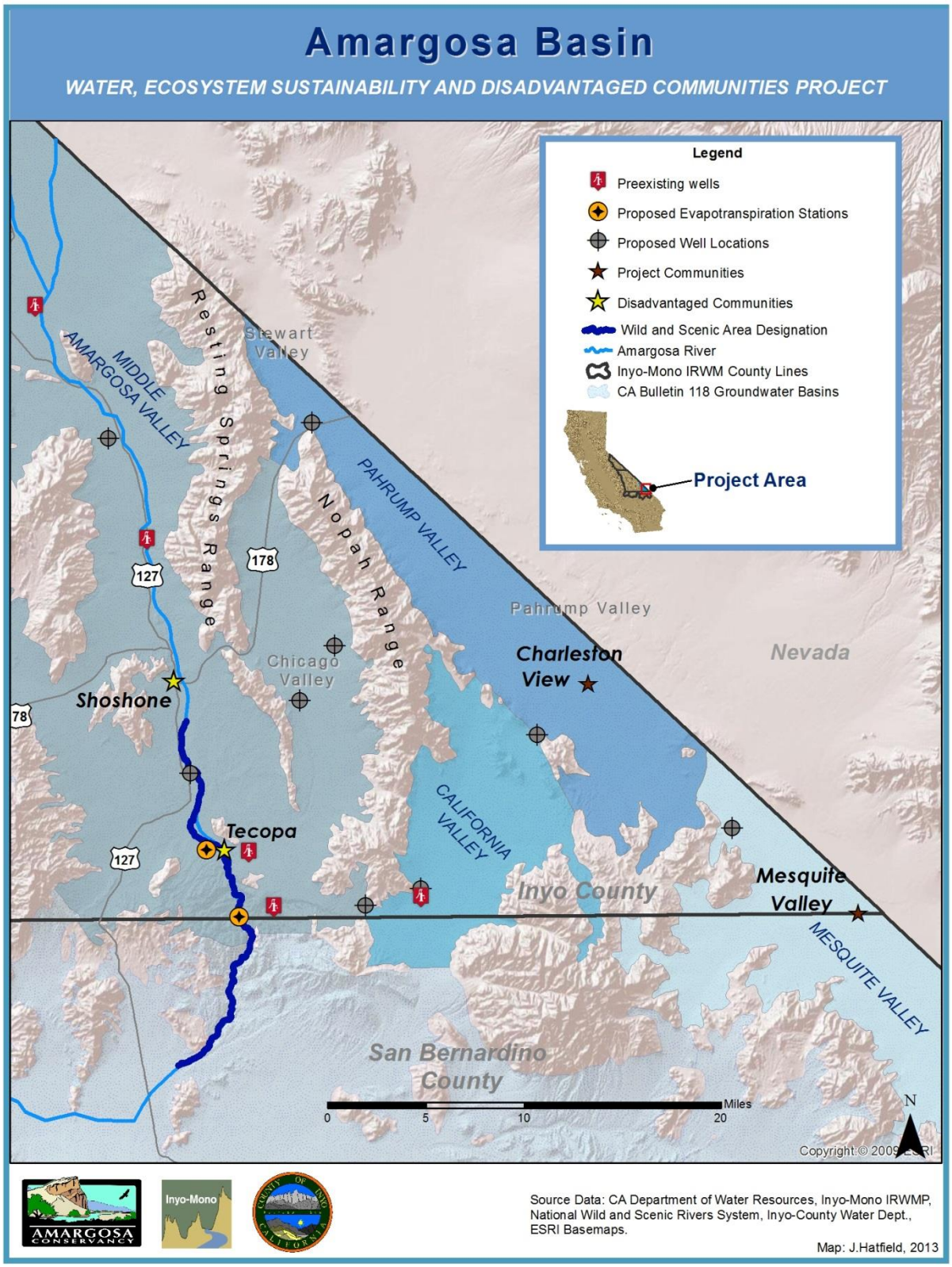
The following document is provided as an attachment to this work plan as additional justification for this project:

1) *2012 State of the Basin Report: Amargosa River Basin* (The Source Group, Inc.)

Project Timing and Phasing

The entirety of this project is stand-alone and is not dependent on other work. The start date of the project is October 1, 2013, and is anticipated to last 3.5 years. All work, including reporting and invoicing, will be complete by March 31, 2017.

Project Map


Amargosa Basin
WATER, ECOSYSTEM SUSTAINABILITY AND DISADVANTAGED COMMUNITIES PROJECT
Legend
Preexisting wells
Proposed Evapotranspiration Stations
Proposed Well Locations
Project Communities
Disadvantaged Communities
Wild and Scenic Area Designation
Amargosa River
Inyo-Mono IRWM County Lines
CA Bulletin 118 Groundwater Basins
Project Area
MIDDLE AMARGOSA VALLEY
Resting Springs Range
Stewart Valley
PAHRUMP VALLEY
Nopah Range
Pahrump Valley
Nevada
Charleston View
Chicago Valley
Shoshone
Tecopa
CALIFORNIA VALLEY
Inyo County
Mesquite Valley
MESQUITE VALLEY
San Bernardino County
127
178
78
Miles
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5
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20
N
Copyright © 2009 ESRI
AMARGOSA CONSERVANCY
Inyo-Mono
Source Data: CA Department of Water Resources, Inyo-Mono IRWMP, National Wild and Scenic Rivers System, Inyo-County Water Dept., ESRI Basemaps.
Map: J.Hatfield, 2013

Proposed Work

The following work plan includes the tasks necessary to complete the scope of work and includes the information included within Table 6 of the Proposal Solicitation Package, Integrated Regional Water Management, Proposition 84, Round 2 (DWR, 2012).

Budget Category (a): Direct Project Administration Costs

Task 1: Administration

Description: Prepare and submit invoices to DWR on a regular basis, working with Inyo County, the grantee.

Deliverables: Signed contract between grantee and Amargosa Conservancy; invoices conforming to DWR invoicing standards.

Task 2: Labor Compliance Program

Description: Perform labor compliance in accordance with the requirements of California Labor Code §1771.5(b).

Deliverables: Execution of labor compliance program; annual reports/documentation furnished to DWR as required by the grant contracts.

Task 3: Reporting

Description: Prepare quarterly progress reports for DWR and the Inyo-Mono RWMG, and final reports including 2015 State of the Basin Report and U.S.G.S. Water Investigations Report (for evapotranspiration investigation).

As part of this task, Amargosa Conservancy will work with the grantee and the Inyo-Mono IRWM Program Office to finalize the performance indicators for the project and develop a project-specific performance monitoring plan within the first quarter of project implementation. This document will be a compilation of project-specific performance monitoring plans and will, for each project, identify the problem to be addressed by the project, summarize the project tasks, specify the project goals and desired outcomes, and include a project performance measures table presenting output and outcome indicators, measurements tool and methods to be implemented, performance targets, and a monitoring schedule. This plan will then become part of the proposal-wide Performance Monitoring Plan for the Round 2 Implementation Grant.

Deliverables: Quarterly progress reports and final reports as specified in the Grant Agreement; project performance monitoring plan.

Budget Category (b): Land Purchase / Easement

There are no tasks applicable to this budget category.

Budget Category (c): Planning / Design / Engineering / Environmental Documentation

Task 4: Permitting and Environmental Documentation

Description: Well construction will be in accordance with California well standards and under permit from Inyo County, under a pre-existing encroachment permit for the California Department of Transportation (Caltrans, for South of Eagle Mountain well) and under agreement with BLM. As with previous monitoring wells installed, a National Environmental Policy Act (NEPA) exemption is anticipated to be completed by BLM for the proposed monitoring wells.

No California Environmental Quality Act (CEQA) or NEPA documentation is expected to be needed for the ongoing hydrological monitoring nor for the evapotranspiration investigation.

Deliverables: All permitting documentation will be included in the final reports.

Budget Category (d): Construction / Implementation

Task 5: Hydrologic Monitoring

Description: Hydrologic monitoring will consist of (1) continuing and extending the existing ongoing hydrologic monitoring being undertaken by a contractor retained by the Amargosa Conservancy and The Nature Conservancy, and (2) startup monitoring for the new monitoring wells.

This project will extend and enhance ongoing hydrologic monitoring for a 12-month period (conducted in three discrete events). Hydrologic monitoring consists of spring flow discharge and groundwater elevation measurements collected on a seasonal basis from springs and wells within the Central Amargosa River Basin. Seepage run monitoring (i.e. the measurement of flow simultaneously at several distinct locations) is currently being conducted along the Wild and Scenic reach of the Amargosa River from Tecopa to below the Dumont Dunes area, where the River crosses California Route 127. The seepage runs are conducted at five distinct monitoring locations including two USGS gage locations and three manual monitoring points. Additional monitoring will include following the movement (progression and regression) of the leading edge of the River near the Dumont Dunes area and seepage run monitoring of Willow Creek just upstream of the confluence with the Amargosa River.

The three goals of the discharge, water level, and seepage run monitoring are:

- Quantify spring discharge rates, groundwater elevations, and river surface flow, and seasonal variations in these parameters;

- Establish a record of discharge from the springs and wells selected for monitoring, including seasonal trend information, in order to provide a more robust baseline for future comparisons; and
- Establish flow gains and losses along the perennially flowing portion of the Amargosa River, including seasonal trend information, again to provide a baseline for future comparisons.

Prior measurement events of discharge rates, groundwater elevation and river surface flow occurred in spring/early summer (April/May), late summer/fall (September) and winter (December) of 2011. This same monitoring schedule will be followed.

The springs designated for ongoing quantifiable discharge measurement include Amargosa Canyon Spring 1, Amargosa Canyon Spring 4, Borax Spring, Bore Hole Spring, Crystal Spring, Horse Thief Spring, Tecopa Hot Spring (measured near the Nature Conservancy-owned parcel), and Willow Spring. Data from other springs are collected as practical, including Resting Spring, Shoshone Spring, Thom Spring and Five Springs. Various methods of measurement are used based on the characteristics of the individual spring.[2] Currently there are no dedicated spring flow measurement stations present in the area.[3]

Wells proposed for ongoing groundwater elevation measurements include the already existing Eagle Mountain and Cynthia's wells, and the recently installed Willow Creek and Amargosa River monitoring wells, along with the 12 Mile Spring well scheduled for installation in April 2013.[4]

Startup monitoring for the nine newly-installed wells will follow the completion of all wells and installation of transducers to record water levels electronically. The transducers will be checked and downloaded on a monthly basis for the first two months following their installation and checked and downloaded thereafter every two months.[5] Bi-monthly monitoring will continue for one year following the installation of the transducers. After that period, they will be field-checked during the seasonal hydrologic monitoring.

All hydrologic monitoring will be conducted by a California Professional Geologist and Certified Hydrogeologist accompanied by a field technician. Activities are conducted under a project-specific health and safety plan. All field equipment is calibrated prior to visiting the field sites

[2] These methods can range from measuring the time it takes for spring flow to fill a bucket of a known volume to the use of a Marsh-McBirney Flo-Mate solid-state flow meter placed in a flowing channel of water. Measurements from the flow meter are combined with cross-sectional dimensions of the flow channel to yield spring discharge.

[3] In these springs, construction of the appropriately sized flow measurement station could result in undesirable environmental conditions such as substantial alteration of the natural spring channel, so we do not propose constructing permanent weirs or other devices to measure flow.

[4] For the Eagle Mountain and Cynthia's wells, water-level measurements are made using a Solinst water level indicator and are measured to 0.01 ft. Continuous water-level recording devices are installed in the Willow Creek and Amargosa River stations and collect hourly groundwater level data.

[5] The downloaded data will be appended to data files for each well and checked for anomalies which might indicate a transducer fault or other problems with the data collection process.

and is field-checked daily during field activities. Hydrologic monitoring is a non-invasive activity and will be conducted under agreement with the BLM, The Nature Conservancy, Amargosa Conservancy and permission from private landowners as appropriate. NEPA/CEQA documentation should not be required for this activity.

Deliverables: Once checked for quality assurance/quality control purposes, data will be published in an annual State of the Basin Report, previous versions of which have been prepared on behalf of the Amargosa Conservancy and publicly released. For this scope of work, the State of the Basin Report will be prepared on behalf of Amargosa Conservancy and the grantee.

Data Management: Data collected in this task will include groundwater-level measurements, Amargosa River flow data, and estimated spring flow data. Once checked for quality assurance/quality control, all data will be made available for public use via the Inyo-Mono IRWM website or the appropriate state or national database. Data distribution will take place only once metadata standards are met to ensure a reputable data source to other organizations and IRWM regions.

Task 6: Groundwater Monitoring Wells

Description: Nine new monitoring wells will be installed in locations where significant groundwater data gaps exist and in locations to satisfy Inyo County's CASGEM requirements in the region in order to:

- Further evaluate the conceptual hydrologic model of the Middle Amargosa River Basin with an emphasis on understanding groundwater flow paths,
- Fill in substantial data gaps in areas where baseline groundwater conditions need to be established to identify future impacts to groundwater levels
- Initiate baseline groundwater level records for regionally distributed basins in this portion of Inyo County

Wells will be completed to varying depths dependent on local conditions, likely ranging from approximately 20 feet below ground surface (ft bgs) to more than 150 ft bgs. Monitoring wells are to be installed at (see Project Map):

- North end of Chicago Valley
- Above Resting Spring
- Mid-Chicago Valley
- South of Eagle Mountain
- Head of Willow Creek
- Tule Spring
- Pahrump Valley
- Mesquite/Sandy Valley
- Shoshone-Tecopa

Actual well depths required at each location are uncertain due to the lack of pre-existing data in the area. Anticipated well depths are based on extrapolation from the groundwater surface map from the State of the Basin Report (SGI, 2011) and from ground surface based on U.S.G.S. topographic maps, along with previous experience with monitoring well installation in the area as described earlier. Should well depths end up shallower than anticipated, funds saved will be allotted to additional long-term hydrologic monitoring. Well construction will be in accordance with California well standards and under permit from Inyo County, under a pre-existing encroachment permit from Caltrans (for South of Eagle Mountain well) and under agreement with BLM. The upper Willow Creek well will likely be installed on Amargosa Conservancy property. Well casings will stick up approximately two-and-a-half feet above the ground surface and will be encased in lockable steel monuments set in concrete. The monitoring wells will be constructed with four-inch diameter casings. Wells will have transducers installed for continuous data collection.

Each well will be developed following installation to prepare it for sampling. Following development, water samples will be collected from each well and analyzed for the following constituents:

- Metals (Sb, As, Be, B, Cd, Cr, Cu, Fe, Pb, Li, Mn, Se, Si, Ag, Sr, Tl, Zn)
- Cations (Ca, Mg, Na, K)
- Anions (SO_4, NO_3, Cl, F)
- Alkalinity, Hardness, Total Dissolved Solids, Specific Conductance

All monitoring well installations will be conducted by a California licensed well driller (C-57 license) and drilling oversight and logging will be performed by a Professional Geologist and Certified Hydrogeologist. All laboratory analyses will be conducted by a California-certified analytical laboratory. Activities will be conducted under a project-specific health and safety plan. All field equipment, including pH /conductivity/temperature meters, will be calibrated prior to visiting the field and field-checked daily during field activities. Well logs will be prepared for each monitoring well. NEPA documentation (exemption) will probably be required for each monitoring well located on BLM land. Based on past experience, this process will take approximately two months. The County of Inyo has received support from the BLM for the well installation program and an access agreement already exists for the South of Eagle Mountain Well. Additionally, well permits will be acquired from the Inyo County Environmental Health Department. Hydrologic monitoring is a non-invasive activity and will be conducted under agreement with the BLM, The Nature Conservancy, Amargosa Conservancy and permission from private landowners as appropriate. Funding for well installations is derived 100% from grant funding with matching administrative contributions from the County of Inyo and Amargosa Conservancy.

<u>Deliverables:</u> Once data are checked for quality assurance/quality control purposes, they will be published in an annual State of the Basin Report that has previously been prepared on behalf of the Amargosa Conservancy. The State of the Basin report will comprise all new data including the well logs from the newly-installed wells as well as data collected from previous

investigations. For this scope of work, the State of the Basin Report will be prepared on behalf of Amargosa Conservancy and the grantee.

Data Management: Data collected in this task will be comprised of well construction data (including well location information and lithologic data from boreholes), groundwater-level measurements, and results of groundwater quality analyses. Once checked for quality assurance/quality control, all data will be made available for public use via the Inyo-Mono IRWM website or the appropriate state or national database. Data distribution will take place only once metadata standards are met to ensure a reputable data source to other organizations and IRWM regions. Additionally, since eight of the nine monitoring wells are designated as future monitoring locations under the state-mandated CASGEM program, data collected from those wells will be available through DWR's Water Data Library.

Task 7: Evapotranspiration Investigation

Description: The approach proposed for refining previous estimates of annual groundwater discharge by ET is (1) measuring groundwater discharge rates in proportionally larger ET units, and (2) applying these rates to groundwater discharge areas delineated using high-resolution remotely-sensed imagery. Since ET is sustained by groundwater, local precipitation, and surface water flooding, the precipitation and flooding data are subtracted from the measured ET, resulting in ET only from the groundwater system. To complete this micro-scale water budget, the change in soil-moisture storage is calculated as the difference between the soil moisture at the beginning and end of the period of record. The combination of high-resolution imagery (1 to 10-meter resolution) and in-situ groundwater discharge measurements will improve and refine existing estimates derived using moderate-resolution Thematic Mapper (TM, 30-meter resolution) imagery and assumed groundwater discharge rates.

Annual groundwater discharge rates will be quantified at a minimum of two sites by concurrently measuring ET, precipitation, groundwater levels, and soil moisture over a period of up to two years. Each site will contain a micrometeorological station collecting eddy-covariance ET and energy-budget data, a bulk precipitation gage to accurately measure precipitation, a tipping bucket rain gage to record event timing and intensity, two soil-water-content sensors to measure soil moisture in the upper 25 cm of soil, and an observation well equipped with a pressure transducer to monitor daily and seasonal fluctuations in groundwater levels. Additionally, soil cores will be collected monthly and analyzed for soil-water content to document seasonal changes in soil-water storage in the upper 1 meter of soil that occurs in response to precipitation and ET.

The initial locations for ET site placement will be determined based on preliminary remote sensing analysis and field verification. The two ET units to be targeted first are most in need of refinement and represent proportionally larger sections of the groundwater discharge area will be targeted first. These areas will likely be (1) the woody riparian corridor of predominately mesquite, willow, and tamarisk south of Tecopa, CA, and classified by Laczniak and others (2001) as "dense meadow and forested vegetation", and (2) a large area within the floodplain

near Tecopa, CA, classified by Laczniak and others (2001) as “moist bare soil”. Each ET site will be operated for up to two years. Depending on results from the first year of data collection, one or both ET stations may be moved to new location(s) for the second year of data collection.

Measured ET rates may be higher in the event of surface flooding caused by severe rain events than during prevailing base flow conditions because a greater portion of the ET source area may contain open water. To identify and remove any flood-water contribution to measured ET, site visits will be made, if possible, during or shortly after flood events to determine the extent and depth of open water within ET source areas. Other parameters recorded at each ET site such as net radiation, sensible heat, and soil heat flux also will provide evidence of flood occurrence and duration. Continuous ET data measured during flood periods will be evaluated, compared against previous and subsequent periods, and adjusted if necessary.

A second approach to evaluate the relative proportion of source waters contributing to measured ET will be the collection and analysis of isotope data to be used as an environmental tracer. Local precipitation, Amargosa River water, plant-stem water, soil, and local groundwater will be sampled at each ET site and analyzed for stable hydrogen- and oxygen-isotope concentrations. For the woody riparian ET site, comparative analyses of source and xylem isotope concentrations collected both during prevailing base-flow and post-flood conditions may establish the degree to which deep-rooted woody riparian vegetation can preferentially utilize relatively shallow surface/soil water when available. When the upper unsaturated zone is at or near saturation, during and after flood events, demand for groundwater may be reduced. For the moist bare soil ET site, soil cores will be sampled seasonally at depths up to 1 meter to evaluate the relative proportion of groundwater contributing to measured ET. All stable hydrogen- and oxygen-isotope samples will be submitted to the USGS Reston Stable Isotope Laboratory for analysis. A minimum of 10 percent of submitted samples will be concurrent replicate samples.

High-resolution remotely-sensed imagery will be used to (1) define the potential area of groundwater discharge (PAGD), and (2) classify ET units. Field validation will result in an improvement in PAGD boundaries and ET unit classification. The PAGD boundaries will be mapped using 1-meter resolution National Agriculture Imagery Program (NAIP) aerial imagery acquired June 4, 5, and 7 2010.

ET unit classification allows for up-scaling groundwater discharge rates to the basin scale by relation to land-cover and/or vegetation-index analyses. Land-cover analysis uses all available bands of the electromagnetic spectrum to group similar vegetation types and density, while vegetation-index analysis relates the near-infrared and infrared bands in a reliable and proven method to estimate vegetation density. Past groundwater discharge studies by the NVWSC have related ET and/or groundwater discharge rates with land-cover and/or vegetation index analyses to classify ET units. For the proposed study, a combination of both land-cover and vegetation-index analyses will be completed prior to site selection using 10-meter resolution, multispectral Systeme Pour l’Observation de la Terre (SPOT 5) imagery. The accuracy of classified ET units will be validated with field-based observations.

Deliverables: A USGS Scientific Investigations Report documenting groundwater discharge by ET from the study area and methods used will be published following the two years of data collection. All ET data will be archived in National Water Information System (NWIS) and made available to the public. Progress will be documented through a series of quarterly updates that detail ongoing activity.

Data Management: Data collected in this task will include groundwater-level measurements, evapotranspiration data, isotope and geochemical data, and lithologic information from boreholes and associated monitoring well construction data. Once checked for quality assurance/quality control, all data will be made available for public use via the Inyo-Mono IRWM website or the appropriate state or national database. Data distribution will take place only once metadata standards are met to ensure a reputable data source to other organizations and IRWM regions. Data collected will also be accessible through the U.S.G.S which may place the data on its website.

Budget Category (e): Environmental Compliance / Mitigation / Enhancement

There are no anticipated tasks under this budget category.

Budget Category (f): Construction Administration

There are no anticipated tasks under this budget category

Budget Category (g): Other Costs

There are no anticipated tasks under this budget category

Budget Category (h): Construction/Implementation Contingency

There are no anticipated tasks under this budget category

Inyo County Disadvantaged Communities Meters Project

Introduction

In the Inyo-Mono IRWM region, there is an ongoing and pressing need to upgrade infrastructure to improve water system efficiency and reliability. This need is particularly apparent in the disadvantaged communities of the region, including the Inyo County communities of Laws, Independence, and Lone Pine. Meters were installed in these towns by the Los Angeles Department of Water and Power in 1979 and have not been replaced since. Today, many of the meters are non-functional or do not accurately report water use. This project would provide a full meter replacement with new digital meters in the three water systems supporting Laws, Independence, and Lone Pine. In addition to providing critical infrastructure upgrades, this project is an early step in a much-needed process of re-examining rate structures and developing a capital improvement plan for these water systems.

Purpose and Need

The Owens Valley communities of Laws, Independence, and Lone Pine are economically disadvantaged based on the legislative definition using Median Household Income data. The Los Angeles Department of Water and Power (LADWP) purchased the water systems of these three communities between the 1930s and the 1960s. One of the provisions of the 1991 Inyo County-LADWP Long Term Water Agreement (LTWA) was a transfer of ownership of the three water systems from LADWP to Inyo County. Inyo County began operating and maintaining these systems in 1999. LADWP provides an annual "allotment" of groundwater as part of its mitigation requirements for the deleterious impacts of pumping groundwater in the Owens Valley and exporting it to the City of Los Angeles. A summary of the three communities, along with their water use, is shown in the following table.

Community	Population (2010)	Median Household Income (2010)	Annual Water Allotment (AF)	Average Annual Water Consumption (AF)	Number of Service Connections
Laws	30	$35,278[1]	50	25	19
Independence	551	$47,883	450	492	364
Lone Pine	2,309	$40,176	550	619	556

[1]: Because Laws is not a census designated place, 2010 American Community Survey data were pulled for the next smallest census unit containing Laws, which is Block Group 1, Tract 100, of Inyo County, CA.

The LADWP had outfitted the water systems of Laws, Independence, and Lone Pine with meters in 1979. By 1999, when Inyo County acquired the three systems, some of the meters were non-operational or were under-reporting true water consumption. Because revenue for these systems is based on water consumption as measured by the meters, under-reporting or non-operational meters mean decreased revenue. On average, about 195 AF of water pumped

into the Independence and Lone Pine systems are unaccounted for each year.

Water rates in these three communities prior to 1999 were kept artificially low by the LADWP as part of its mitigation measures for past water-related activities in the Owens Valley. Because of the difficulty of raising rates once Inyo County took over the systems, the County has had little opportunity to build up a capital improvement fund. A meter service availability rate increase was implemented in 1999 when Inyo County acquired the systems, and another increase took place in 2005, which also provided for an annual adjustment of service availability charge based on inflation. At the time of the latter rate increase, the County called for annual reviews of the systems' water rates and the development of a capital improvement fund. This resulted in a contract to conduct a rate study and develop a Capital Improvement Plan to be funded by the rate structure. The contract expired without either objective being met.

As a part of its involvement in the Inyo-Mono IRWM Program's Round 1 Planning Grant, Inyo County had the opportunity to work with California Rural Water Association (CRWA) in performing technical, managerial, and financial needs assessments for all three water systems. The results from these assessments, performed in 2011, documented the urgent need for new water meters in all three water systems to improve system reliability and efficiency. Other documented needs include a rate study, additional storage, leak detection, and new transmission lines. A separate study performed in 2012 by the California Department of Public Health (CDPH) for the Independence and Lone Pine water systems concluded that, although the systems are operational, capital improvement is inadequately funded by Inyo County.

Among the various needs identified by CRWA and CDPH, Inyo County has chosen to focus on water meter replacement as the first element of a phased approach to meet the identified needs of the three systems. More accurate accounting of water consumption will aid in performing an adequate and fair rate study, which in turn will determine the capacity to perform capital improvements on the three systems. This project will replace approximately 950 outdated analog water meters with automatic meter reading (AMR) water meters and will also provide new billing software and handheld reading equipment. All project work will be overseen by Inyo County Public Works Department staff.

Goals and Objectives

The goal of this project is to help achieve effective and efficient management of the Laws, Independence, and Lone Pine water systems through the accurate metered consumption of water. The primary objective of the project is to install new automatic meter reading meters in

order to provide more accurate data on water consumption. A secondary objective is to build management capacity for three small water systems serving economically disadvantaged communities.

This project is consistent with the Inyo-Mono IRWM Plan and has been identified as a high priority need by the Inyo-Mono RWMG. This project helps to address four of the eight objectives of the IRWM Plan:

Objective 1: *Protect, conserve, optimize and augment water supply while maintaining ecosystem health*
Objective 4: *Maintain and enhance water, wastewater, emergency response and power generation infrastructure efficiency and reliability*
Objective 6: *Increase participation of small and disadvantaged communities, including tribes, in IRWM process to identify and work towards meeting their needs*
Objective 8: *Promote sound groundwater monitoring, management, and mitigation in cooperation with all affected parties*

Below is a description of how the project will help to fulfill the region's objectives.

Objective 1 (Water Supply): The proposed work will help to protect water resources for these three disadvantaged communities through a more accurate understanding of water consumption. This project will also better inform operations management through the systems. Additionally, this project will help Inyo County continue to comply with AB 2572 (2004) for these three communities, which requires installation of water meters on all customer connections in California by 2025.

Objective 4 (Infrastructure Efficiency and Reliability): This project will replace aging and inefficient infrastructure related to water delivery in three disadvantaged rural communities in the Inyo-Mono region. Furthermore, many of the current analog meters are reaching the end of their expected life. Installing more modern and digital meters, along with new billing software and handheld meter reading devices, will improve the operational efficiency of these three water systems and provide more accurate estimates of actual water use.

Objective 6 (Participation of Small and Disadvantaged Communities in the IRWM Process): All three of the communities included in this proposal are small, rural, and disadvantaged communities. This grant provides needed funding for infrastructure upgrades in the three water systems.

Objective 8 (Promote Groundwater Monitoring, Management, and Mitigation): The proposed work promotes intelligent management of groundwater resources through the use of modern and accurate water meters.

The following table summarizes the specific regional objectives and associated resource management strategies (RMS) that are addressed by the project.

Inyo-Mono IRWM Objectives and RMS
Objective 1: Water Supply
RMS 1A: Improve water supply reliability
RMS 1B: Improve system flexibility and efficiency
RMS 1C: Compliance with state standards
RMS 1D: Address local water supply issues through various techniques
RMS 1F: Conserve and adapt water uses to future conditions
Objective 4: Infrastructure efficiency and reliability
RMS 4A: Rehabilitation and replacement of aging water infrastructure
RMS 4B: Adequate water for fire protection and emergency response
RMS 4C: Energy efficiency of water systems and uses
Objective 6: Participation of small and disadvantaged communities
RMS 6B: Assistance for DAC access to funding for development, implementation, monitoring, and long-term maintenance of water resource management projects
Objective 8: Sound groundwater monitoring, management, mitigation with all affected parties
RMS 8B: Promote efforts to monitor, manage, and mitigate effects of groundwater-dependent projects
RMS 8C: Projects that mitigate for the effects of groundwater extraction
RMS 8D: Protect and improve stored groundwater supplies and recharge areas

Integrated Elements of Project

As described in the previous section, this project has been identified as a high-priority need by the Inyo-Mono Regional Water Management Group. Inyo County Department of Public Works realized that it would be more efficient to procure new meters, billing software, and meter reading devices for all three systems at once rather than do one at a time. Completing this project will help to integrate the operations for all three systems into one, more efficient meter reading system.

The project is consistent with local, regional, and state planning efforts, such as the Inyo County General Plan, the Lahontan Basin Regional Plan, and the California Water Plan Update 2009, all of which call for the efficient use of domestic water supplies through water metering.

Finally, lessons learned through the implementation of this project will help other small, rural water systems in the Inyo-Mono IRWM region as they put forward projects to install or replace water meters.

Completed Work and Current Status

Inyo County Department of Public Works has replaced about 100 water meters over the last 13 years with comparable analog meters. Currently, there is a mix of water meter manufacturers represented in the three systems, most of which are reaching their life expectancy. This project would replace all meters in the three systems with new digital meters.

Currently, this project is at 10% (conceptual) design. Specifications have not been completed and are included as costs in this grant proposal. Coarse drawings have been completed for meters of various sizes, though they have not yet been digitized. Specification templates and bid documents are available for Inyo County to use based on projects of similar size. The project sites are the three communities, which are well defined and well understood (Figure 1) based on previous work with the water systems.

Existing Data and Studies

The two studies referenced in the Purpose and Need section support the urgent need for this project. The CRWA needs assessment performed in 2011 documented the problems faced by the County with the current meters. For example, for Laws, County staff reported that annual water use is difficult to calculate because of problematic water meters (CRWA 2012, p. 77).

In 2012, California Department of Public Health conducted a Sanitary Survey, Inspection Report, and Deficiency List and determined that although the three systems are operational, capital improvement projects, such as meters replacement, are currently inadequately funded.

Supporting Documentation

The following documents are provided as attachments to this work plan as additional justification for this project:

1. Excerpts of A & N Technical Services, Inc. “BMP COSTS & SAVINGS STUDY A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices” 2005, prepared for The California Urban Water Conservation Council. 3 pages

2. Los Angeles Department of Water and Power annual overallotment pumping and cost data. 1 page

3. Excerpts of American Water Works Association, ANSI/AWWA G200 “Distribution Systems Operation and Management” AWWA Standard, AWWA Denver, CO. 2 pages

4. Excerpts of “2012 SANITARY SURVEY OF INYO COUNTY DPW-LONE PINE”; Cover letter, Sanitary Survey, Deficiency List; California Public Health Department, September 4, 2012. 10 pages

5. Excerpts of “2012 SANITARY SURVEY OF INYO COUNTY DPW-INDEPENDENCE”; Cover letter, Sanitary Survey, Deficiency List”; California Public Health Department, September 4, 2012. 10 pages

6. Inyo County Department of Public Works: 3 Year Water Systems Audit, 1 page

7. Inyo County Department of Public Works: 11.75 year Water Systems Audit, 1 page

8. Inyo County Department of Public Works: Water Systems Allowable Loss Calculations, 1 page

9. Inyo County Department of Public Works: Mileage Difference between Analog and AMR meter reading, 1 page

10. USA Bluebook Catalog 2012/2013 excerpts, Water Meters, 3 pages

11. Eisel Enterprises “Specifications for Manufacture of Precast Concrete Boxes & Steel Covers”, 1 page

12. Mueller(R) Angle Meter 300™ Ball Valve Specifications, 1 page

13. Mueller(R) Angle Meter 300™ Ball Curb Valve Specifications, 1 page

14. Inyo County Department of Public Works, Typical 1” Water meter installation drawing, 1 page

15. Inyo County Planning Department Memo, August 13, 1997, LADWP Pumping Data 1989-1996, 1 page

16. Excerpts of “Inyo/LA Long Term Water Agreement”, City of Los Angeles, Department of Water and Power and Inyo County, 1991, 3 pages

17. Excerpts of “Volume 1 Draft Environmental Impact Report”, City of Los Angeles, Department of Water and Power and Inyo County, September 1990, 11 pages

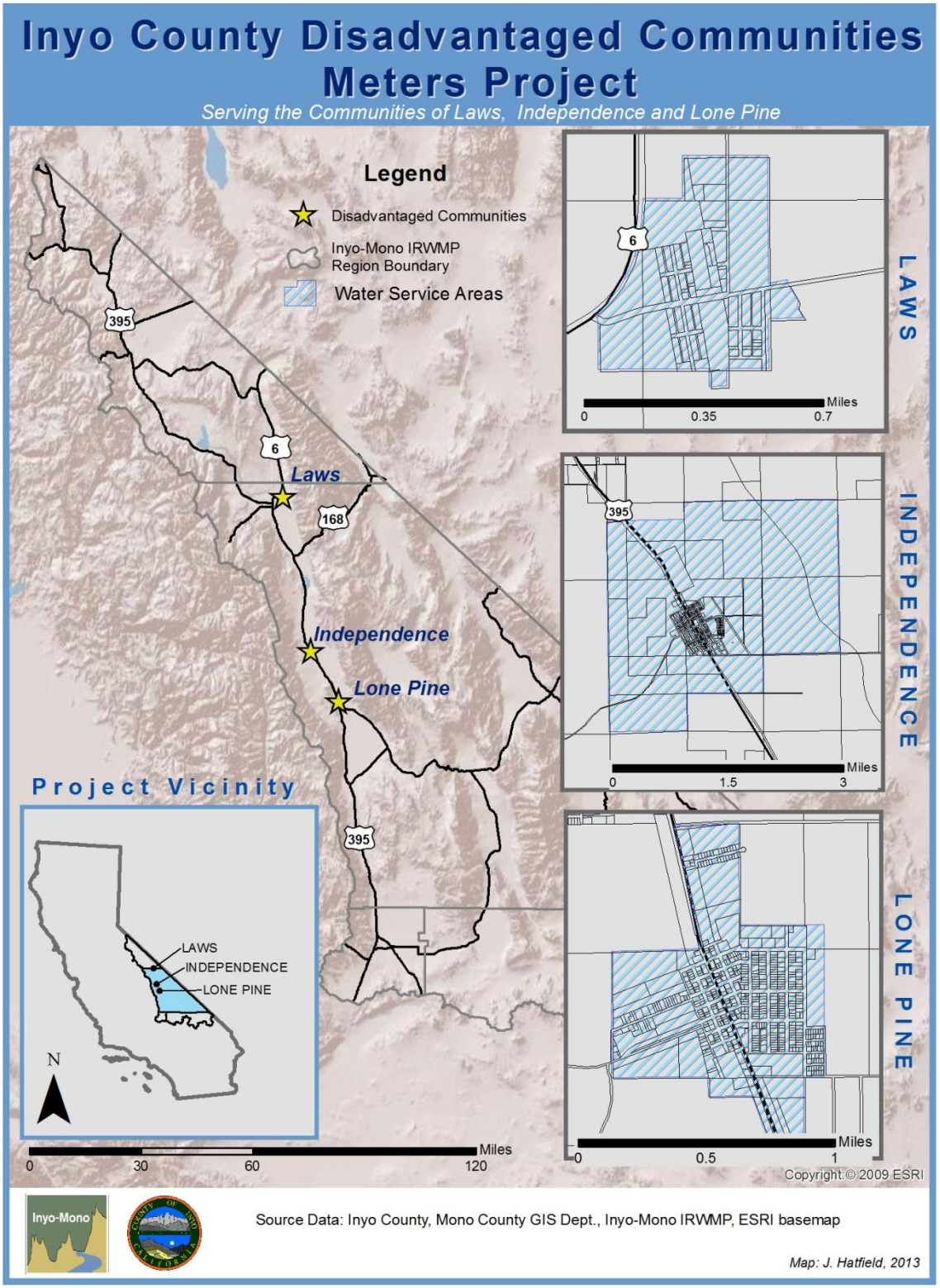
18. Excerpts of “Inyo County Needs Assessment”, California Rural Water Association, 4 pages

Project Timing and Phasing

Although a stand-alone project, this work comprises an early step in a long-term, multi-phase capital improvement program to upgrade infrastructure, reduce leaks, update rate structures, and improve overall system efficiency and reliability. Through a Prop. 84 Round 1 Implementation Grant, Inyo County Department of Public Works is currently implementing a project to upgrade the SCADA system and provide redundancy to groundwater pump controls.

The project will commence on October 1, 2013, and it expected that the project will be complete within 21 months (by June 30, 2015).

Project Map


Inyo County Disadvantaged Communities Meters Project
Serving the Communities of Laws, Independence and Lone Pine
Legend
Disadvantaged Communities
Inyo-Mono IRWMP Region Boundary
Water Service Areas
395
6
168
Laws
Independence
Lone Pine
Project Vicinity
LAWS
INDEPENDENCE
LONE PINE
N
Miles
0
30
60
120
LAWS
Miles
0
0.35
0.7
INDEPENDENCE
Miles
0
1.5
3
LONE PINE
Miles
0
0.5
1
Copyright:© 2009 ESRI
Inyo-Mono
Source Data: Inyo County, Mono County GIS Dept., Inyo-Mono IRWMP, ESRI basemap
Map: J. Hatfield, 2013

Proposed Work

The following work plan includes the tasks necessary to complete the scope of work and includes the information included within Table 6 of the Proposal Solicitation Package, Integrated Regional Water Management, Proposition 84, Round 2 (DWR, 2012).

Budget Category (a): Direct Project Administration Costs

Task 1: Administration

Description: Prepare and submit invoices to DWR on a regular basis.

Deliverables: Signed contract with grantee; invoices conforming to DWR invoicing standards.

Task 2: Labor Compliance Program

Description: Perform labor compliance in accordance with the requirements of California Labor Code §1771.5(b).

Deliverables: Execution of labor compliance program; documentation furnished to DWR as required by the grant contracts.

Task 3: Reporting

Description: Prepare quarterly progress and final project reports for DWR and the Inyo-Mono RWMG.

As part of this task, Inyo County Department of Public Works will work with the grantee and the Inyo-Mono IRWM Program Office to finalize the performance indicators for the project and develop a project-specific performance monitoring plan within the first quarter of project implementation. This document will be a compilation of project-specific performance monitoring plans and will, for each project, identify the problem to be addressed by the project, summarize the project tasks, specify the project goals and desired outcomes, and include a project performance measures table presenting output and outcome indicators, measurements tool and methods to be implemented, performance targets, and a monitoring schedule. This plan will then become part of the proposal-wide Performance Monitoring Plan for the Round 2 Implementation Grant.

Deliverables: Quarterly progress reports and final reports as specified in the Grant Agreement, project performance monitoring plan.

Budget Category (b): Land Purchase / Easement

There are no tasks applicable to this budget category.

Budget Category (c): Planning / Design / Engineering / Environmental Documentation

Task 4: Development of Project Financing

Description: Inyo County Department of Public Works staff will develop a financing plan for the project in conjunction with the County Auditor's office. This plan will include a request to amend the County budget, if applicable. Once a budget modification is approved by the County Board of Supervisors, the auditor can assign budget codes and allocate funding to that budget.

Deliverables: Forms generated in the process of amending budgets and allocating funding will be provided to DWR.

Task 5: Development of Project Design

Description: County staff will prepare plans and specifications specific to this meters project. Once complete, the plans and specs will be approved, signed, and stamped by the Inyo County Department of Public Works Director.

This project will meet or utilize the following standards:

- American Water Works Association (AWWA) ANSI/AWWA G200-09 "Distribution Systems Operation and Management", Section 4.2.8 Metering
- AWWA Manual of Water Supply Practices "Water Meters - Selection, Installation, Testing, and Maintenance"
- AWWA C700-09 "Standard for Cold Water Meters - Displacement type, Bronze Main Case"
- AWWA C707-10 "Standard for Encoder-Type Remote-Registration Systems for Cold-Water Meters"
- AWWA C800-12 "Underground Service Line Valves and Fittings"
- Title 22 California Codes of Regulations, Chapter 16, "California Water Works Standards", Article 7 Additives.
- ANSI/NSF-61, "Drinking Water System Components - Health Effects"
- 2010 California Green Building Standards Code, Section A5.304.2.1 "Outdoor Potable Use"
- ASTM C-857-13 "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures"
- ASTM C-858 10e1 "Standard Specification for Underground Precast Concrete Utility Structures"
- ASTM C33 "Standard Specification for Concrete Aggregates"
- ASTM C-330 "Standard Specification for Lightweight Aggregate for Concrete

construction”

- ASTM C-150 “Standard Specification for Portland Cement”
- ASTM A-82 “Standard Specification for Cold-Drawn Steel Wire for Concrete Reinforcement”
- ASTM B62- 09 “Standard Specification for Composition Bronze or Ounce Metal Castings”

Deliverables: Plans and specifications documents.

Task 6: Environmental Documentation

Description: A California Environmental Quality Act categorical exemption will be claimed for this project. The Notice of Exemption will be approved and signed by the Public Works Director and sent to the State clearinghouse and filed with the Inyo County Recorder.

Deliverable: Notice of categorical exemption as provided to the State clearinghouse.

Task 7: Permitting

Description: It will be necessary to procure encroachment permits from Inyo County and California Department of Transportation for work conducted in the respective agency’s rights-of-way.

Deliverables: Copies of permits.

Budget Category (d): Construction / Implementation

Task 8: Construction Contracting

Description: Prior to construction work being put out to bid, contract scope and budget will be presented to the Inyo County Board of Supervisors for approval. The request for bids will then be advertised in local papers and through professional networks for 60 days. Once bids are received, County staff will prepare a bid summary, and County Counsel will review the bid package and recommended award before presenting to the Board of Supervisors. After the Board of Supervisors approves a bid award, the notice of award and contract documents will be sent to the successful bidder and returned to the County within ten working days. The last step is to execute a contract between Inyo County and the contractor.

Deliverables: Request for bids, contract between Inyo County and contractor.

Task 9: Construction

Description: A pre-construction meeting will be held between the contractor and Inyo County Public Works staff, after which the County will issue a Notice to Proceed. The contractor will

begin mobilization and site preparation work, including finding a staging area for equipment and storage for materials near the work sites in the three communities. Equipment is then moved to the work sites. In general, equipment will be contained within work trucks and removed daily from the work sites.

Once equipment and materials are in place, the contractor will begin installing water meters at each connection. The contractor will also be responsible for the installation of new billing software, the formatting of handheld meter reading devices, and the initiation of downloading data to the billing system and printing statements and bills.

After the new meter system is in place, the contractor will perform testing on a subset of the new meters. A final inspection will then be performed by the County, and if successful, the contractor will remove equipment from the work site and the contract will be complete.

Deliverables: 950 successfully-installed and operational water meters; successful installation of billing software; and printed bills and statements.

Budget Category (e): Environmental Compliance / Mitigation / Enhancement

There are no anticipated tasks under this budget category.

Budget Category (f): Construction Administration

Task 10: Construction Administration

Description: Work in this task will include the creation of construction documentation, such as the Notice of Award to successful bidder, contract between Inyo County and the contractor, the Notice of Completion and Resolution, the final inspection, the 30-day stop notice period, and the final payment to contractor.

Deliverables: The documentation described above.

Budget Category (g): Other Costs

There are no anticipated tasks under this budget category.

Budget Category (h): Construction/Implementation Contingency

There are no anticipated tasks under this budget category.

Indian Wells Valley Groundwater Basin Brackish Water Resources Study

Introduction

Ridgecrest, CA, and the surrounding environs comprise a rapidly-growing region in the eastern California desert. The communities, several of which are economically disadvantaged, in this region rely solely upon groundwater for domestic, industrial, agricultural, and military uses. Currently, the groundwater basin is being overdrafted by 1 to 1.5 feet per year. Although water managers in the area know that brackish water makes up a portion of the groundwater basin, it is not known precisely where, what amount, and what quality of brackish water is available. This project, building upon previous work completed in the basin, would investigate the location, amount, and quality of brackish water in the Indian Wells Valley as a next step towards a project to begin desalting brackish water. This study will also contribute to the Inyo-Mono IRWM groundwater resources management program by providing needed information about a little-understood resource.

Purpose and Need

The Indian Wells Valley Water District (District) is located approximately 120 miles northeast of Los Angeles in the northern part of the Mojave Desert, southeast of the Sierra Nevada Mountains and south of the Owens Valley (Figure 1). The Indian Wells Valley groundwater basin (DWR groundwater basin 6-54) is not adjudicated. The only source of water in the area is the local groundwater underlying the Indian Wells Valley (IWV).

In addition to serving Water District customers within and adjacent to the City of Ridgecrest, water extracted from the aquifer is supplied to the Naval Air Weapons Station-China Lake (NAWS), Inyokern Community Services District, and numerous private wells. Groundwater is also extracted for agricultural use in the northwest portion of the basin, and by the Searles Valley Minerals (SVM) Corporation for their potable water system and mining operations in the Searles Valley located about 25 miles east of the IWV. Throughout the Indian Wells Valley groundwater basin, water use includes domestic, landscape irrigation, manufacturing and agriculture. Combined usage (human water use and evapotranspiration) is about 30,000 acre feet of water annually (AFY), and Water District customers are responsible for about 25% of the total annual usage, or approximately 7,500 acre feet per year.

The Water District obtains all of its raw water supply from groundwater supply wells drawn from two main areas in the south and southwest portions of the groundwater basin (Figure 1). Groundwater levels have been chronically declining in the basin on an average of 1 to 1 ½ feet per year for over 50 years without recovery. The water budget developed for the basin indicates a total recharge off the eastern face of the Southern Sierra Nevada Mountains of approximately 7,500 AFY with underflow into the basin primarily from the north of roughly 1,500 AFY. Outflow is from evapotranspiration of 6,000 AFY, and pumping of 24,000 AFY. This water balance suggests an estimated annual groundwater recharge shortfall (overdraft) of roughly 21,000 AF of water in the Indian Wells Valley groundwater basin.

Previous studies of the Indian Wells Valley groundwater basin indicate that the water budget is not only in a deficit, but also that the water of highest quality and lowest salinity is being extracted now. With groundwater as the only source of water in the area, the District's alternatives for developing new water supplies are limited.

The current water portfolio and local efforts include tiered water rate structure, several water conservation ordinances, public water conservation education, increasing recycled water use through wastewater treatment plant expansion/upgrade, and investigating an imported water supply project. However, these efforts do not provide a timely solution to provide the necessary amounts of water identified by the Water District. This project will investigate the spatial extent of brackish water resources in the IWV, along with their quality, in order to improve the groundwater basin model and inform future decision-making with respect to developing brackish water as a potable water source for the valley. Brackish water sources identified through the Brackish Water Resource Study would help meet the urgent water needs of the Water District. The Study will provide vital information necessary to address critical water supply and quality issues facing the local communities.

Goals and Objectives

The primary goal of this project is to evaluate the potential for a new water supply source to be developed for the IWV in an environmentally sound way. This knowledge will improve water source reliability and contribute to the long-term benefits of this growing inland community, which includes a military base vital to national security. This project would also become the basis for future decision-making activities associated with ensuring a reliable local water supply.

The objectives of this study are:

- Evaluate the lateral and vertical distribution of brackish water resources (total dissolved solids [TDS] concentration of 1,000 to 10,000 mg/L) in the IWV groundwater basin
- Refine the groundwater basin conceptual model to include brackish and fresh water distribution
- Improve the understanding of groundwater recharge and flow in the groundwater basin
- Provide a better understanding of the distribution and volume of potable and brackish water in the groundwater basin to compare against current and future demand scenarios

Tasks associated with this project include:

- Groundwater basin delineation preliminary analysis,
- Groundwater chemistry evaluation,
- Identify and address data gaps where possible, using geophysics, additional wells, and water quality sampling as appropriate and possible under the funding for this proposed project,

- Groundwater flow and brackish water modeling, and
- Report preparation.

The final deliverable will be a report that includes the findings and conclusions from the study and provides recommendations for development of the brackish water supply.

The project is consistent with two Inyo-Mono IRWM Plan Objectives:

Objective 1: *Protect, conserve, optimize and augment water supply while maintaining ecosystem health*
Objective 8: *Promote sound groundwater monitoring, management and mitigation in cooperation with all affected parties*

Below is a description of how the project will help to fulfill the region's objectives.

Objective #1 (Water Supply Reliability): This project will evaluate the potential for augmenting the existing water supply in the IWV, thereby allowing the District and other end users to reduce their demand on limited, and severely over-drafted, supply of high-quality groundwater in the Indian Wells Valley. The project will also include outreach to and education for residents of the Indian Wells Valley about the current concerns about water supply and potential solutions.

Objective #8 (Groundwater Monitoring, Management, and Mitigation): To evaluate the potential to treat brackish water in the valley, the quantity of water available must be estimated and the appropriate site for construction of a treatment facility must be chosen based on the best available data. This project will identify data gaps and work to fill them; will consider quality and quantity of groundwater stored in the Indian Wells Valley basin; and will continue to collaborate with major users of groundwater in the basin, through the Indian Wells Valley Collaborative Groundwater Management Group, to develop the most beneficial and cost-effective solutions possible.

The following table summarizes each of the proposed tasks to be completed in this work plan, and indicates the specific regional objectives and associated resource management strategies that are addressed by each component of the project.

Inyo-Mono Objectives and RMS
Objective 1: Water Supply
RMS 1A: Improve water supply reliability
RMS 1B: Improve system flexibility
RMS 1D: Address water supply issues through various techniques
RMS 1E: Optimize existing storage capacity
RMS 1F: Conserve and adapt water uses to future conditions
RMS 1I: Promote public education about water supply issues and needs
Objective 8: Promote sound groundwater management
RMS 8C: Support projects that mitigate for the

Inyo-Mono Objectives and RMS
effects of groundwater extraction
RMS 8D: Protect and improve quality and quantity of stored groundwater supplies and recharge areas
RMS 8F: Identify gaps in groundwater data and undertake appropriate assessments/ characterization studies
RMS 8G: Collect data on groundwater supply variability

Integrated Elements of Project

This project is seeking a solution to a problem facing an entire groundwater basin and all the water users within it. Cooperation and integration is already taking place among water users through the Indian Wells Valley Cooperative Groundwater Management Group, and participants recognize that any long-term solution to water reliability issues must be holistic and include representation of all interests. In addition, the results of this study will help to support the larger effort within the Inyo-Mono RWMG toward improving understanding of groundwater resources in order to better manage these resources in the future.

Completed Work and Current Status

To protect the current groundwater resource and develop a plan to assure a safe and reliable water supply for the residents of the IWV, a Cooperative Groundwater Management Group (IWVCGMG) was formed in 1995, and a Cooperative Groundwater Management Plan was signed and approved by several private and public entities and updated in 2006. The Cooperative Groundwater Management Group includes the Water District, NAWS, SVM, Inyokern Community Service District, Inyokern Airport District, Kern County Water Agency, the U.S. Bureau of Land Management (BLM), Quist Farms, Eastern Kern County Resource Conservation District, and the City of Ridgecrest (http://www.iwvgroundwater.org). This group, which meets monthly, was formed to coordinate efforts, share data, and avoid redundancies. The IWVCGMG has provided a letter of support for this project that is included with this proposal as supporting documentation. In addition, the Groundwater Management Plan is included as supporting documentation.

A technical sub-group continually reviews and monitors ongoing efforts to better understand local water resources. This group, which also meets monthly, is responsible for an extensive well monitoring program and a groundwater recharge study. Numerous studies have been conducted to better understand the complex groundwater resource in the Valley, yet precise quantification remains elusive. Rain and stream gages have been placed in strategic locations in the basin, over 100 wells are monitored, and a groundwater flow model has been developed.

The stakeholders in the IWV basin have worked together cooperatively over the past several years to achieve a number of key accomplishments, which include:

- Well spacing and design improvements to spatially distribute the effects of continued withdrawals on declining groundwater levels.
- Well abandonment program to minimize impacts from cross connection of aquifers.

- Enhanced and increased conservation programs to reduce water use.
- Increased and continuous groundwater-level and water quality monitoring.
- Increased number of monitoring wells through cooperative program involving the Navy SeaBee well drillers.
- Completed two California State local assistance grant projects to develop a Geographic Information System (GIS) of the groundwater data, installation of wells, implementation of a comprehensive groundwater monitoring program, and completion of a hydrogeologic study to update the hydrogeologic conceptual model.
- Development of a basin-wide MODFLOW groundwater flow model.
- Adoption of seven basin planning objectives which cover basin groundwater monitoring, groundwater extraction, water conservation, water reuse, participation in the Inyo-Mono Integrated Regional Water Management Plan (IRWMP) and other alternative water management options, continued cooperative groundwater data efforts to improve basin understanding, and an inter-agency management framework.
- A feasibility study regarding the ability to treat that water using the most efficient technology was undertaken by the Water District in 2005 by Carollo Engineers. Following the feasibility study, the District decided that reverse osmosis followed by electrodialysis reversal would be the best technology for performing a pilot study to investigate the viability of brackish groundwater desalting. The year-long pilot study was undertaken in 2008 and financed by Proposition 50 desalination funds. The pilot study demonstrated that the selected treatment train of reverse osmosis (RO) followed by electrodialysis reversal (EDR) was technically feasible and can effectively produce potable water. The study found that this method would be more reliable and likely less costly than water importation. The final report was delivered to DWR in May 2010, and the executive summary is included with this proposal as supporting documentation. The next step is to more fully understand the location and quality of brackish water resources in the IWV basin.

Existing Data and Studies

The current efforts conducted in the IWV are under the leadership of the Water District, Indian Wells Valley Cooperative Groundwater Management Group, SVM, Kern County Water Agency, BLM, and NAWS. This work includes meetings of the Indian Wells Valley Cooperative Groundwater Management Group Technical Advisory Committee and the Water District's Alternate Water Supply Committee.

Key ongoing or upcoming projects include:

- California Statewide Groundwater Elevation Monitoring (CASGEM): the IWV Basin is compliant with CASGEM and we continue to monitor groundwater elevations in the Basin. The Indian Wells Valley Cooperative Groundwater Management Group is the official Monitoring Entity for the Basin;
- Spatial redistribution of Water District pumping including the possible location of supply wells on NAWS land;

- Cooperative groundwater banking project with Los Angeles Department of Water & Power (LADWP);
- Increased wastewater effluent reuse with a possible tertiary wastewater treatment plant upgrade; and
- Brackish water supply treatment.

Supporting Documentation

The following documents are provided as attachments to this work plan as additional justification for this project:

1) Letter of support from Indian Wells Valley Cooperative Groundwater Management Group
2) Executive summary of report from pilot study investigating the viability of brackish water desalting
3) Indian Wells Valley Groundwater Management Plan
4) Letter of support from the Naval Air Weapons Station – China Lake

Project Timing and Phasing

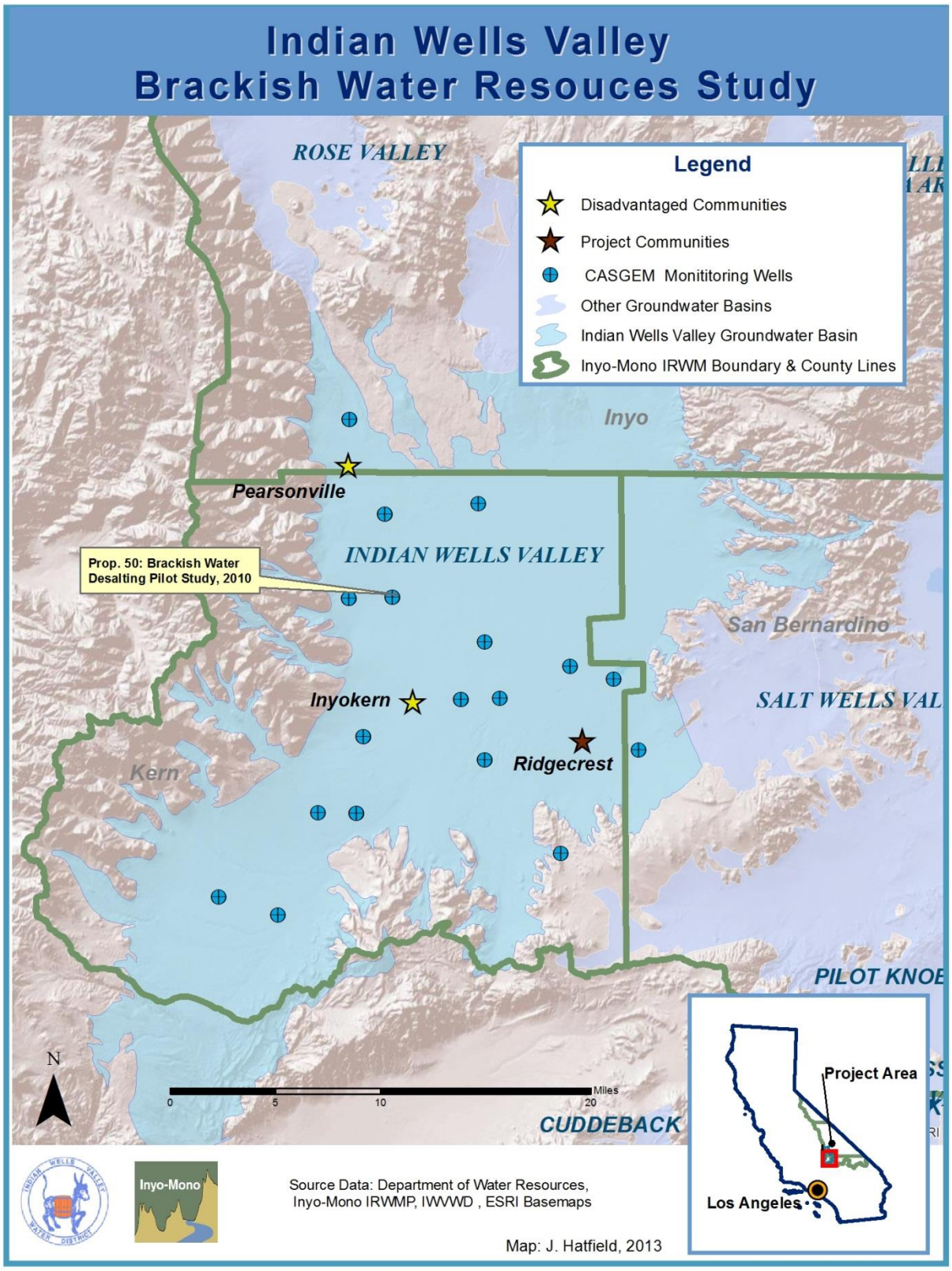
This project is Phase III of a five-phase effort to identify and treat brackish water resources in the Indian Wells Valley:

- Phase I – Feasibility Study (completed in 2007)
- Phase II - Brackish Water Treatment Pilot Project (completed in 2009; used Prop 50 grant funds toward this project)
- Phase III – Brackish Water Resources Study (this project proposal)
- Phase IV – Economic Study
- Phase V – Construction

Now that the treatment technology has been tested, and approximate costs of treating brackish water determined, the next step is to evaluate how much brackish water is available in the basin and where best to locate a full-scale facility. Once the District has this information, an economic analysis can be performed to determine if construction of a full-scale facility is feasible and assist the District and other possible partners determine what funding will be needed.

The project is ready to commence upon receipt of funding. The assumed start date is October 1, 2013, and the project will run for 15 months, ending December 31, 2014.

Project Map


Indian Wells Valley
Brackish Water Resouces Study
ROSE VALLEY
Legend
Disadvantaged Communities
Project Communities
CASGEM Monititoring Wells
Other Groundwater Basins
Indian Wells Valley Groundwater Basin
Inyo-Mono IRWM Boundary & County Lines
Inyo
Pearsonville
INDIAN WELLS VALLEY
Prop. 50: Brackish Water Desalting Pilot Study, 2010
San Bernardino
Inyokern
SALT WELLS VAL
Ridgecrest
Kern
PILOT KNOB
N
Miles
0
5
10
20
CUDDEBACK
Project Area
Los Angeles
Inyo-Mono
Source Data: Department of Water Resources, Inyo-Mono IRWMP, IWVWD , ESRI Basemaps
Map: J. Hatfield, 2013

Proposed Work

Previous groundwater studies in the basin indicate that the groundwater budget in the IWV is in deficit, and that while there appears to still be an abundant supply of groundwater, the water of highest quality is being extracted now. Eventually brackish water will need to be treated and used in order to continue supplying potable water to the residents of IWV. Additionally, it may be possible to extract and treat brackish water and then re-inject a portion of the treated water into the deeper aquifer for recharge and subsequent use.

The following work plan includes the tasks necessary to complete the scope of work and includes the information included within Table 6 of the Proposal Solicitation Package, Integrated Regional Water Management, Proposition 84, Round 2 (DWR, 2012).

Budget Category (a): Direct Project Administration Costs

Task 1: Administration

Description: Grant project administration will be done by the Chief Engineer with assistance from hydrogeological consultant Parker Groundwater. This task will consist of the following activities:

Grant Administration

The Chief Engineer will:

- Have regular contact with the consulting firms via e-mail, phone and/or meetings in person or via the internet. Communication will remain as open as possible to ensure all information necessary for a quality Study is being exchanged/received and incorporated.
- Establish and maintain project communication with the grantee and the Inyo-Mono IRWM Program Office.
- Review deliverables/work products submitted to the District
- Review consulting firm's invoices and ensure timely payment.
- Ensure compliance with invoicing requirements per grant agreement.

Project Oversight and Monitoring

The Chief Engineer will provide oversight and monitoring for the project as follows:

- A kick-off meeting will be conducted with IWVWD staff and consultants
- Bi-weekly teleconferences will be conducted with the consultant for QA/QC
- Provide regular updates to the IWVCGWMG and Inyo-Mono IRWM during the project
- The final product will be presented to the District's Board of Directors, the IWVCGWMG, and the Inyo-Mono RWMG. Other community and/or conference presentations will be made as opportunities arise.
- Invoices will be paid to consultants upon review of progress
- The IWVCGMG's Technical Advisory Committee will review all reports.

There is no labor compliance program associated with this project as the project is not a public works effort, and IWVWD already has a contract with a consulting firm to do the work outlined in

Tasks 3-8.

Deliverables: Signed contract with grantee; invoices to DWR complying with invoicing requirements; notes from meetings and teleconferences

Task 2: Reporting

Description: Reporting to meet grant requirements as needed and as specified in the agreement will include the following activities:

Complete Quarterly, Annual and Final Reports as Specified in the Grant Agreement

In conformance with grant requirements, the District will comply with all the progress reports and provide DWR via the grantee with the requisite quarterly, annual, and final reports. These will be submitted to the grantee/DWR in a timely manner in conformance with the grant agreement.

Monitoring, Assessment, and Performance Measurement

As part of this task, the District will work with the grantee and the Inyo-Mono IRWM Program Office to finalize the performance indicators for the project and develop a project-specific performance monitoring plan within the first quarter of project implementation. This document will be a compilation of project-specific performance monitoring plans and will, for each project, identify the problem to be addressed by the project, summarize the project tasks, specify the project goals and desired outcomes, and include a project performance measures table presenting output and outcome indicators, measurements tool and methods to be implemented, performance targets, and a monitoring schedule. Furthermore, the District will review and update outcome indicators, including identifying potential partners and end users of treated brackish groundwater. This plan will then become part of the proposal-wide Performance Monitoring Plan for the Round 2 Implementation Grant.

Once the project is completed and possible site(s) for a brackish water treatment facility have been selected and probable partners identified, the next steps will be to conduct an economic feasibility study and then proceed to construction of a full-scale treatment facility.

Deliverables: Quarterly progress reports and final reports as specified in the Grant Agreement; project performance monitoring plan.

Budget Category (b): Land Purchase/Easement

This Project does not require the purchase of land or easements because it is for the most part a study. However, the site(s) for new monitoring well(s) will be federal government-owned land; either Department of the Navy or Bureau of Land Management.

Budget Category (c): Planning/Design/Engineering/Environmental Documentation

Task 3: Groundwater Basin Delineation Preliminary Analysis

Description: Numerous studies have been performed regarding the hydrogeology of the groundwater basin. Two studies were performed for Local Ground Water Assistance Program AB303 grants (TtEMI, 2003; Stoner and Bassett, 2010). Data from these and other previous studies were incorporated into a groundwater flow model of the region (Cain, 2009). This groundwater flow model was used to simulate groundwater level declines for the next 27 years to assess potential impacts on Water District operations.

These previous studies generally focused on the basin from a fresh water supply perspective. The goal was to identify and understand the sources of available fresh water. The depth of the aquifer and the vertical and lateral distribution of brackish water are not well understood. We will review the same data sources used in the previous studies to develop a conceptual model that identifies and includes brackish water sources as much as possible. This conceptual model will also include a re-evaluation of basin recharge focused on identifying brackish water age, origin, and general recharge to the groundwater basin. The studies and data sources that will be reviewed in this task are listed in the References section.

The proposed approach will be to first gather data. The following existing data will be compiled and reviewed: boring and well log records; geophysical surveys; and the interpretation of the hydrogeology in previous studies as discussed above. Our review will focus on data relative to brackish water in the basin that have not been previously incorporated into the existing basin conceptual models. We will incorporate this new information/perspective into the basin conceptual model and evaluate the model data gaps that would help complete our understanding of the system, as summarized below.

- Review existing groundwater basin data, including:
  - ✓ Boring and well log records;
  - ✓ Geophysical surveys;
  - ✓ Well yields; and
  - ✓ Previous interpretations of the hydrogeology from previous studies.
- Incorporate new information into the conceptual model of the basin aquifer.
- Identify data gaps.

Review of Boring Logs and Existing Conceptual Models

Recently Stoner and Bassett (2010) added eight monitoring wells to address data gaps identified in previous hydrogeologic studies (TtEMI, 2003). These wells are located along the western and southwestern corner of the valley and were installed primarily to improve the conceptual model in this portion of the valley. However, there is still insufficient data to deterministically specify hydrostratigraphic units throughout the basin (Cain, 2009). Data gaps appear to be the greatest in the deepest portions of the aquifer where brackish water occurs.

The hydrogeologic conceptual model of the IWV groundwater basin has been refined in multiple studies (von Huene, 1960; Bean, 1989; O'Brien, 1989; Berenbrock and Martin, 1991; Steinpress et al., 1994; TtEMI, 2003; Stoner and Bassett, 2010) over the past 40 years. TtEMI (2003) provided a comprehensive description of the conceptual groundwater basin. Stoner and Bassett (2010) then refined the conceptual model using a 3D geologic simulator and conducted additional work on identifying sources of groundwater recharge. Generally the unconsolidated Quaternary deposits have been divided into two main aquifers: a shallow aquifer and deep aquifer. The shallow aquifer occurs in the eastern portion of the valley and generally has high concentrations of dissolved solids (brackish water). The underlying deep aquifer is much larger

and provides the water for regional public water supply. Previous studies have identified brackish water at the bottom of the deep aquifer and generally throughout the upper aquifer (TtEMI, 2003; Stoner and Bassett, 2010; Cain, 2009). The hydraulic connection between the two aquifers is not well characterized. Continued pumping from the deep aquifer may be inducing recharge from the upper aquifer, and this pumping may be contributing to declining water quality in the deep aquifer (Stoner and Bassett, 2010).

Data will be reviewed from borings advanced since the 2010 Stoner and Bassett report, and we will review the other reports referenced above for any additional information that can help expand our understanding of the groundwater basin. The data review will be focused to increase our understanding of those areas that are believed to contain brackish water. In addition, we will try to better understand the distribution of transmissivity and hydraulic connection between the upper and lower aquifers.

Geophysical Data Review

Geophysical survey data are useful for providing supplementary information to boring log data. Down hole geophysics can provide greater clarity in the interpretation of well borings, and surface geophysical studies can provide stratigraphic information in areas where few boring logs exist. In addition, geophysical studies can be designed to delineate fresh water from brackish water. Several geophysics studies were completed previously. As a beginning step, several existing reports will be reviewed that consist of the interpretation and results of down-hole geophysical logs, gravity surveys, and seismic surveys. In addition, other geophysical studies in the region will be reviewed and evaluated. Unless more recent data are found to the contrary, it will be assumed the data in these reports are correctly interpreted and staff will not spend effort re-analyzing raw data.

The focus of the review will be to improve delineation of the lateral and vertical distribution of brackish zones of the groundwater basin based on existing information. This review will also increase our understanding of the interconnectedness of the shallow and deep aquifers.

Deliverable: Technical memorandum discussed in Task 5.

Task 4: Groundwater Basin Water Quality Preliminary Analysis

Description: Water chemistry is variable throughout the IWV, both horizontally and with depth (TtEMI, 2003; Stoner and Bassett, 2010). Currently, shallow groundwater is generally of lower quality with high total dissolved solids (TDS), while the deep aquifer is generally good quality. However, there is a zone of very deep water that has the highest concentrations of total dissolved solids (TtEMI, 2003). Additionally, water chemistry is expected to change as pumping in the basin continues, groundwater quality gradually degrades, and brackish water becomes more prevalent.

While there is known variability and expected chemistry changes due to pumping, the interactions between the shallow and deep aquifer and recharge are not well understood. Previous studies have focused mostly on water-quality degradation. This study will identify, map, and assess the potential to use brackish water as a source that can be treated and delivered for potable use. The study will also focus on the entire IWV groundwater basin while most other studies have focused on specific areas within the basin.

Review Previous Water Quality Reports and New Raw Water Quality Data

Since several new studies have been completed, and some data gaps have been addressed in

recent years, we will begin by reviewing those new studies. While these studies include groundwater quality and provide historical data, additional water quality data have been collected within the groundwater basin since 2007. These most current data have not been incorporated into the existing water quality framework. The data collected since 2007 will be integrated into the existing data and new analyses will be conducted. Data sources may include the US Geological Survey, the California Department of Water Resources, NAWS China Lake, and the Water District. The studies and data sources that will be reviewed as a part of this task are listed in the References section.

Understanding groundwater recharge to the basin is an important element when trying to establish the source and flow of brackish water in an aquifer. The review and evaluation of aquifer recharge will be based primarily on the integration of the groundwater basin delineation preliminary analysis and the water-quality preliminary analysis.

Preliminary Mapping and Analysis

Preliminary mapping and analysis of existing water quality data will be attempted in order to show preliminary distribution of water level conditions and estimated volumes of brackish water. This preliminary work will help identify existing data gaps within the water quality data; mapping will be completed using GIS. Graphs and transects will also be developed. Mapping and analysis will be completed for TDS, EC, some major ions, and stable isotopes. Where age-dating has been completed, staff will also evaluate the amount and quality of the data gathered.

Deliverables: Technical memorandum discussed in Task 5.

Task 5: Identify Data Gaps

The next step is to identify gaps in data and knowledge.

Update Conceptual Model

Data gaps will be identified by first updating the existing conceptual model using information from our preliminary review and analysis of the existing basin and groundwater-quality data. Primary improvements in the conceptual model are anticipated to include a better understanding of:

- Brackish water vertical and lateral distribution in the basin;
- Well yield distribution in the basin;
- Interaction between the upper and lower aquifers; and
- Groundwater flow paths and recharge to the basin.

Revise Maps and Tables

Maps of the basin will be updated to reflect the refined groundwater basin conceptual model. Areas best suited for additional brackish water exploration and study will be identified by generating refined cross-sections of the basin. Relevant factors to be considered will include anticipated well yields, estimated volume of groundwater in storage, depth to groundwater, and estimated lateral and vertical distribution of TDS concentrations.

Prepare Technical Memorandum

Based on knowledge gained from previous studies and recommendations from local technical

experts, the following gaps in knowledge and/or data are already apparent:

- Groundwater flow paths and recharge into the aquifer;
- Areas where the aquifer bottom is not delineated;
- Lack of knowledge regarding the interconnectedness of different zones;
- Unknown saturated thickness of the aquifer in some areas;
- Extent of the brackish water zones in each of the shallow and deep aquifers;
- The extent of the deepest zone where TDS concentrations are highest;
- Insufficient number of samples taken from a well or area;
- Insufficient constituents analyzed in a particular well or area;
- Unknown depth of the screened interval for a particular well; and
- Lack of seasonal information.

Additional data gaps may be discovered through the course of the comprehensive data review. The results of the reviews in subtasks 3.1, 3.2 and 3.3 will be briefly summarized in a Technical Memorandum. The Technical Memorandum will include recommendations for steps to address data gaps (subtask 3.6). The Technical Memorandum will also be used to assist in preparation of the Final Report.

Deliverable: Technical memorandum described above.

Task 6: Address Data Gaps

Description: While the data gaps identified above are expected, the full scope of what is required to address the data gaps is uncertain. However, we can generally anticipate the steps that are required to fill these data gaps. Staff will limit the uncertainty in scope by focusing our efforts to address the data gaps on the area(s) where the greatest potential for brackish water is identified based on our review of the literature in Tasks 3 and 4.

Geophysical Surveys to Determine Groundwater Basin Geometry & Identify Brackish Water Zones

Groundwater applications of geophysics include mapping the depth and thickness of aquifers, mapping aquitards/confining units, locating preferential fluid migration paths such as fractures and fault zones, and mapping groundwater water quality contrasts, such as that from saltwater or brackish water intrusion. The overall objective of the proposed geophysical survey program is to further characterize the subsurface geology of the IWV, and to further delineate the lateral and vertical extent of zones of brackish water within the deeper portions of the unconsolidated aquifer. Based on experience in similar geologic terrains, a geophysical exploration program is proposed, consisting of a gravity survey (gravimetry) and an electromagnetic subsurface survey (controlled source audiomagnetotellurics [CSAMT/MT] or Time Domain Electromagnetic Induction [TEM]).

Specifically, within the IWV, the gravity survey will be utilized to help further define the depth to and the configuration of the surface of the basement rock complex, and fault zones within the basement rock complex.

The proposed electromagnetic survey will be utilized (in conjunction with the gravity survey results) to help define:

- The lateral and vertical extent of significant electrically conductive brackish water zones within the unconsolidated aquifers;
- Zones of higher electrical resistivity material (i.e. potential permeable sand and gravel zones) and lower electrical resistivity zones (i.e. lower permeability lacustrine clay and delta deposits);
- Depth to and the configuration of the surface of the basement rock complex; and
- Fault and fracture zones within the basement rock complex.

The gravity survey will consist of a series of profile lines (comprised of approximately 400 individual stations with consistent spacing) that will be strategically positioned in the sub-region where additional data are needed to provide sufficient data coverage. The results of the gravity survey will be used to define areas for the electromagnetic survey. For example, areas where suspected faults or thicker sequences of unconsolidated material (bedrock lows) or areas with documented poor water quality will be surveyed with electromagnetics to delineate suspected brackish water zones. In addition, electromagnetics (approximately 80 individual stations) will also be conducted in the sub-region where additional data are needed to further define subsurface geologic conditions. At the conclusion of the geophysical exploration program, all data will be processed and modeled to further define the subsurface geology and potential zones of brackish water within the IWV.

Drill New Borings and Install Additional Monitoring Wells

The local China Lake Naval Weapons Center and Navy SeaBees have committed to supporting this project and drilling up to four monitoring wells. Once previous data and reports have been reviewed and geophysical surveys completed, new monitoring wells may be needed to:

- Identify the saturated thickness of the aquifer;
- Determine interactions between the shallow and deep aquifer;
- Determine the extent of the brackish water; or
- Expand the spatial distribution of water-quality samples.

The Navy SeaBees have previously drilled numerous monitoring wells in IWV as part of their normal training program. The drilling of the new wells will be supervised by the local Navy geologist. The cost of drilling the wells would be covered by the Navy SeaBees as an in-kind contribution, though that cost is not currently known and has not been included in the costs for this project.

Address NEPA Requirements

The new wells can only be installed either on NAWS or BLM land. Therefore, only NEPA requirements will need to be addressed. If the wells are installed on NAWS land, NAWS will prepare the environmental documents to address NEPA as required; if on BLM land, the BLM will prepare the necessary environmental documents. In both cases, the environmental documentation will be prepared in-kind services for this project.

Conduct New Water Quality Sampling

We anticipate needing to collect up to 25 water-quality samples from new and existing monitoring wells and will analyze them to determine water source, age of the water, zones of brackish water, and interconnectedness of the aquifer. Samples will be analyzed for major ion composition, EC, stable isotopes, and radioactive isotopes. The specific isotopes analyzed will be based both on existing data and the most appropriate and cost-effective methods.

Conduct Aquifer Pumping Tests

One way to determine the interconnectedness of aquifers is to perform an aquifer test. Previous work in the basin has included the installation of paired wells. If these paired wells are located in areas where additional data are needed, we would use these existing monitoring wells to conduct aquifer tests. The paired wells would allow us to pump water out of the aquifer and then measure and monitor the effects of the pumping on both the shallow and deep aquifers. If needed, up to four, 24-hour constant rate aquifer pumping tests will be completed. If there are no wells in areas where data are needed, then this type of aquifer testing would not be performed.

Deliverables: Data and qualitative information to be included in the final report (Task 8).

Task 7: Analyze Groundwater Basin Flow and Geochemistry

Description: The results of the data review and new data collection will be incorporated into the existing data set:

Spatial and Temporal Analysis

Spatial and temporal analysis will be completed on this newer and more complete dataset. The final methods used for the analysis will be determined by the quantity and quality of data available. However, we will likely use Mann-Kendall trend analysis, GIS, and graphs/transects to evaluate the groundwater basin, water-quality trends through time and space, and to finalize our basin conceptual model. Mapping will also be used to visualize and interpret the newest data sets. These graphics will help inform an understanding of the groundwater basin and water quality.

We will evaluate:

- Aquifer stratigraphy;
- Brackish water in the basin;
- The relationship between pumping rates and water quality;
- Temperature with depth;
- Major ion composition (Ca, Mg, Na, Cl, Br, SO_4, CO_3, CO_2, I) to help determine source water;
- Ratios and plots of some major ions (Na/Cl, Br/I, Br/Cl, Mg/Cl)
- Stable isotope data to help determine source water

Update Conceptual Model

The analysis of the data will result in a refined conceptual model of the groundwater basin with the greatest detail in the area where we concentrate our geophysical survey field work. The conceptual model will describe the groundwater basin geometry, the vertical water-quality and temperature profiles, and the flow of water into and out of the local area. Our improved understanding of basin recharge relative to water quality will be incorporated into the conceptual model, allowing better assessment of the potential change in water quality with continuous pumping. The refined understanding of basin recharge will be applied over the entire basin.

The conceptual model will be depicted with updated maps of the groundwater basin and detailed sub-region. Maps and graphs will illustrate the aquifer stratigraphy anticipated well yields, estimated volume of groundwater in storage, depth to groundwater, and estimated lateral and vertical distribution of TDS concentrations. If the deepest water has higher TDS concentrations, a separate map will be created for the deepest zones. We will also update our

previously generated maps and graphs in the preliminary data analysis.

Use of Groundwater Model to Estimate the Impact of Pumping On Brackish Water Distribution

The regional MODFLOW groundwater flow model developed by Cain (2009) will be used as the basis to better understand the changes in brackish water distribution by natural groundwater flows and effects from groundwater withdrawals. We will modify the existing model to include the effects of pumping on brackish water distribution by creating a simple MT3D transport model. It is expected that new wells and zones of brackish water (simulated as solute) will be added to the model. Structural and broad, basin-wide changes are not expected to be made to the model. However, model parameters may be updated at a local scale with information from the updated conceptual model and to account for brackish water transport. The model will be used to evaluate various pumping scenarios in an area where a brackish water resource may be developed. The model runs will provide information to help predict impacts from continuous pumping of a brackish-water well and may include the following items:

- Change in water concentrations out of the well over time,
- Potential effects of water quality in the basin,
- Groundwater flow paths and well capture zones.

The model is expected to be used at a coarse level to see if an economic feasibility study would be justified for the brackish water development. The scope of this work would not include the use of a density dependent model such as SEAWAT but we recommend such consideration for future work to characterize the brackish water extent and migration.

Deliverables: Results of analysis and updated conceptual groundwater model to be incorporated into final report (Task 8).

Task 8: Deliverables

Description: The results of the study will be described in a draft and final report. The report will include the review of previous studies, initial analysis, data gaps identified, work performed to address these data gaps including methods, data, and analysis, and conclusions and recommendations. The final conclusions and recommendations will provide:

- A refined groundwater basin conceptual model;
- New maps and figures identifying the lateral and vertical distribution of brackish water in the basin;
- Viability of developing a brackish water supply;
- If applicable, recommended location(s) for brackish water supply development; and
- If applicable, impacts of brackish water source development on the groundwater basin and other pumping centers.

Budget Category (d): Construction / Implementation

There are no anticipated tasks under this budget category.

Budget Category (e): Environmental Compliance / Mitigation / Enhancement

There are no anticipated tasks under this budget category.

Budget Category (f): Construction Administration

There are no anticipated tasks under this budget category

Budget Category (g): Other Costs

There are no anticipated tasks under this budget category

Budget Category (h): Construction/Implementation Contingency

Although this is not a construction/implementation project, a contingency is included due to uncertainties that may be encountered while performing Task 1 in Budget Category (a) and Tasks 3, 4, 5, 6, 7, and 8 in Budget Category (c).

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March 21, 2013

Keith Wallace, Program Manager
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Division of Integrated Regional Water Management
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Letter Supporting Neighboring IRWM Regions' Proposition 84 Round 2 Grant Applications

Dear Mr. Wallace,

The Integrated Regional Water Management (IRWM) Regions within the Lahontan Funding Area have recently engaged in a collaborative process to discuss options regarding our applications for Proposition 84 Round 2 Implementation Grants. Through this process we have learned about our neighboring IRWM regions' stakeholder involvement processes, top priorities, and proposed projects. As of this date, the Antelope Valley, Inyo-Mono, Mojave, and Tahoe-Sierra IRWM Regions have been involved in these discussions. These conversations were beneficial to all IRWM groups in the Lahonton region and we plan on continuing these discussions, inviting all other IRWM groups within our region as well.

We support our neighboring IRWM Regions' projects and grant applications. We intend to pursue even greater collaboration in Proposition 84 IRWM Implementation funding rounds, including potential agreement on an equitable distribution of funds among the IRWM groups in the region.

We have found that this collaborative effort with neighboring regions has been valuable to our IRWM planning processes, and we wanted to share these efforts with Department of Water Resources.

Sincerely,

Antelope Valley Region
Inyo-Mono Region
Mojave Region
Tahoe-Sierra Region

CC: Fremont Valley Region, Lahontan Region

Water Resources Management Plan
Big Pine Indian Reservation

Prepared By:
Alan Bacock
Water Program Coordinator
Big Pine Paiute Tribe of the Owens Valley
Big Pine, CA

August 2008

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Big Pine Indian Reservation

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Water is the basis for life and all things need water to be able to survive. As the population and consumption of water has grown on the Big Pine Indian Reservation, the Big Pine Tribal Council requested the Bureau of Indian Affairs for funds to create a document which would help the Tribe better manage the precious resource of water.

Water is a finite resource. It is renewable, but it has its limits. In 2007, U.S. headlines were declaring that 36 states would face water shortages within the next 5 years. In Tennessee, the town of Orme had to truck in water from Alabama because their water source dried up. The reservoir's in upstate New York have dropped to record lows. Georgia is experiencing a drought which affects millions. The Sierra Nevada snowpack which recharges the groundwater aquifer under the Big Pine Indian Reservation is melting faster every year.

Modern society has come to view water only as a resource that is there for the taking, rather than a living system that drives the workings of a natural world we depend on. The Big Pine Paiute Tribe of the Owens Valley sees the need to meet human needs with those of a healthy environment. The need to reduce water waste is greater now than ever before and as a result the Big Pine Tribe of the Owens Valley is enacting this water plan to be a better steward of it's water resources.

1.0 Overview of the Big Pine Indian Reservation

The Big Pine Indian Reservation is home to the federally recognized Big Pine Paiute Tribe of the Owens Valley (Tribe). The Big Pine Indian Reservation is home to 425 Tribal members and 155 Non-Indians, making the total population 580.

The Reservation itself is 299 acres (including a 20.5 acre parcel acquired from the Los Angeles Department of Water and Power for sewage treatment) which is contiguous to the town of Big Pine, California located in Inyo County. Land use consists of residential / agricultural, community facilities, commercial, and industrial zoning. US Highway 395 runs north and south through the Reservation. Bishop, Inyo County's only incorporated city, is located 15 miles north of Big Pine.

The Bureau of Indian Affairs through its Water Management, Planning, and Pre-Development Program has provided funding for the Tribe to develop a Comprehensive Water Management Plan for the Reservation. This Comprehensive Water Management Plan will assist the Tribe in better managing water resources on the Reservation.

1.1 Background

On April 20, 1937, the U.S. Congress authorized a land exchange between the City of Los Angeles and the Department of the Interior. This exchange was completed in 1939, and the United States Government exchanged 2,913.5 acres of land held in trust for the Owens Valley Paiute Indians for 1,391.48 acres of land owned by the Los Angeles Department of Water and Power. The exchange resulted in the creation of the Big Pine, Bishop and Lone Pine Indian Reservations. The Big Pine Indian Reservation was allocated 279.08 acres from the exchange.

Included in the exchange was an agreement by the City of Los Angeles to supply four acre-feet of water per acre in perpetuity to the lands. Therefore, the water entitlement for the Big Pine Reservation is 1,116.32 acre feet per year. Water rights attached to the lands were not exchanged with the lands so that today the City of Los Angeles continues to hold the water rights beneath the Reservation and the federal government continues to hold the water rights of the exchanged lands.

In addition to the 279.08 acres associated with the 1939 land exchange, the Tribe acquired a 20.5 acre parcel of land from the Los Angeles Department of Water and Power for sewage treatment in 1989.

The Reservation includes a portion of Big Pine Creek as it flows in a northeasterly direction across the northwest corner of the Reservation. In addition to Big Pine Creek, there are two other surface water features in the vicinity of the Reservation. The Owens River flows in a southeasterly direction about 1 mile east of the Reservation and the Big Pine Canal lies adjacent to the eastern boundary of the Reservation.

1.2 Geography

The Reservation is located in the northern portion of Inyo County within the Owens Valley. The Owens Valley is bounded by the Sierra Nevada Mountains on the west and the White Mountains and Inyo Mountains on the east. As previously mentioned, U.S. Highway 395 bisects the Reservation and accommodates large volumes of north and south bound private and commercial traffic. The average elevation of the Reservation is 4,000 feet above sea level. The terrain of the Reservation is relatively flat and slopes easterly towards the Owens River at grades ranging from 1% to 4% (SCS Engineers Environmental Assessment Report for the Big Pine Indian Reservation; July 1999).

1.3 Climate

The Reservation is located in an arid region with cold winters and hot summers.

> The Sierra Nevada Mountains barrier influences the climate of the Owens Valley. Air moving up the west side of the mountains from the Pacific Ocean cools, and releases its accumulated moisture by the time it reaches the Sierra crest. Dry air descending the eastern side of the Sierras warms and evaporates moisture from the ground below, resulting in arid lower slopes and valleys.
>
> Spring is the region's most unpredictable season. A "false" spring occurs from mid-February to late march of most years. Maximum daily temperatures during that period are high enough to initiate bloom and fruit set of ornamentals and fruit trees while temperatures remain above freezing. In most years, this false spring is interrupted by periods of sub-freezing temperatures which damage or kill the flowers and fruit.
>
> Summer daily temperatures usually are in the range 90 degrees to 100 degrees in the early afternoon and dip into the 50's at night.

> The sun shines during 90 percent of the day in the summer and about 70 percent of the day in the winter. Prevailing winds blow from the North or South at average speeds of 5 to 10 miles per hour. March, April and May tend to be the windiest months of the year.
>
> Average monthly air temperature and total precipitation are the two climatic variables that have the most significant impact on any agricultural water use determination. (NRCS, Water Rights Quantification; 1993)

The Reservation's annual precipitation is less than 5 inches and occurs primarily as rain in the winter months.

1.4 Community Profile

There are currently 210 housing units and 7 tribal operations/commercial units on the Reservation. The housing units are scattered throughout the Reservation except for one mobile home park which has 31 housing units located within a 5 acre area.

In addition to the housing units, there are 5 tribal operation units which includes the Tribal Offices, an elders building, a community center which holds the Tribe's Education department and a preschool, and Tribal Temporary Assistance to Needy Families (TANF) office. The various tribal operation units provide office space primarily, though the community center is also used by community groups for various functions.

There are also 2 units on the Reservation which were used as commercial facilities, but now operations at both facilities have been discontinued. Plans are now being developed by the Tribe's Economic Development Department to begin using those facilities in the future. One facility will be used as another tribal operation unit and will provide office space for Tribal programs within the next year. The Tribe's Economic Development Department is currently looking into a new economic endeavor for the Tribe to pursue in the other facility.

2.0 Domestic Water System

The Reservation operates a Community Water System which has 179 service connections. The majority of the service connections are for residential users. The original water supply system was constructed by the Bureau of Indian Affairs around 1960 and many upgrades to the system have been performed up until the present time.

The Community Water System has a total of 4 wells. Well No. 1 is located in the southwest corner of the Reservation. It was drilled in 1973 to a depth of 234 feet, 10 inches in diameter and is equipped with a 15 Hp submersible pump. It was discovered in 2002 that Well No. 1 now has a depth of 198 feet and the decreased depth is probably the result of sediment deposits. Well No. 1 is not fenced in.

Well No. 2 is also located in the southwest corner of the Reservation. It was drilled in 1981 and is 235 feet deep, 8 inches in diameter and is equipped with a 10 Hp submersible pump. It is fenced in along with the pump house. The pump controls and treatment equipment for Wells No. 1 and 2 are located in a 12' x 12' block building located in the southwest corner of the Reservation. The pump house is fenced and locked.

Well No. 3 is located near Highway 395 south of the Tribal Administration building. It was drilled approximately 30 years ago and is 138 feet deep, 8 inches in diameter, lined with a 6 inch sleeve and is equipped with a 5 Hp submersible pump. Well No. 3 is not currently being used. The pump controls for Well No. 3 are located in a 6'x8' wooden building. The pump house and well are fenced and locked.

Table 1: Big Pine Domestic Water Well Data

Well ID	Depth	Diameter	Pump	Pump Rate	Voltage/Phase
Well #1	198 ft.	10 in.	15 hp	160 gpm	230/Three
Well #2	235 ft.	8 in.	10 hp	90 gpm	230/Three
Well #3	138 ft.	8 in. (6 in. sleeve)	5 hp	30 gpm	230/Single
Well #4	305 ft.	10 in.	40 hp	400 gpm	460/Three

Well No. 4 is located in the northeast corner of the Reservation. It was drilled in 2002 and is 305 feet deep, 10 inches diameter and is equipped with a 40 Hp submersible pump. The pump controls and treatment equipment for Well No. 4 are located in a 9'-4" x 20' block building. The pump house and well are fenced and locked.

The pump controls located in the pumphouses use automatic controls to fill the water storage tank. The function of the pump controls is to measure the water in the storage tank and turn on or off the water pumps as necessary to keep the storage tank level from getting too high resulting in overflow or getting too low resulting in inadequate system pressure and insufficient fire reserve.

Water storage is provided by a 250,000 gallon water storage tank which was constructed in June of 1980. The 250,000 gallon tank does not conform to AWWA D100-96 seismic zone 4 requirements. Currently, a new 348,000 gallon welded steel tank is being constructed. The new water storage tank will be placed within the footprint of the older tank. It will be located just west of the Reservation and should be completed in the summer of 2008.

The community water system is currently being disinfected with chlorine using chemical feed pumps in each of the pump houses. Fluoridation equipment has been installed in the pump houses, but have not been in operation.

The water distribution system consists of 4" and 6" PVC water mains. There are 21,900 feet of 6-inch PVC main and 9,400 feet of 4-inch PVC main. There is 9400 feet of The 9,500 feet of 4-inch PVC main has been identified as insufficient to meet the fire flow needs of the Big Pine Volunteer Fire Department. The 4-inch PVC main is also old, has had numerous repairs and is undersized for the growing community of the Big Pine Tribe. In 2006, the tribal utility operator

fixed 7 leaks along the 4-inch portion of the distribution system saving approximately 1 million gallons a month in water loss. The 4-inch PVC main runs along Crater Street, Hill Street, Callina Street, a portion of Bartell, along the west side of Highway 395 from Well #3 and across Highway 395 from Well #3.

A Fire Flow Analysis was conducted by the Indian Health Service in 2003 in order to determine if the water distribution system was capable of providing at least 1,000 gpm for fire flow. The 1,000 gpm rate was given by the Big Pine Volunteer Fire Department as the minimum flow to provide adequate fire protection to the Big Pine Indian Reservation. The Fire Flow Analysis determined that the existing water distribution system was not able to provide the 1,000 gpm rate needed for sufficient fire protection.

The model was changed by replacing the 4" piping along Crater Street with 8" piping and all other 4" piping (except the piping along Spratt Lane) with 6" piping. The results show that the replacement of piping would result in fire flows above 1,000 gpm on a peak day.

There are 61 fire hydrants located throughout the water distribution system. The average age of the hydrants located throughout the system is 28 years old and 93% of the existing hydrants are 30 years old. The age of the hydrants is a concern which should be handled through a hydrant replacement program.

Another concern is that the fire hydrants vary in size (1 - 2½", 25 - 4½" and 35 - 5¼"). The 2½" hydrant as well as the 25 - 4½" hydrants are in need of replacement due to parts being unavailable if a need to repair the hydrants was necessary.

Table 2: Hydrant Placement for Improved Fire Protection

Location	No. of New Hydrants	No. of Replacement Hydrants
US 395 crossing	2	0
Well #3 to Blake	0	1
Hill Street	1	1
Crater Street (south of Bartell)	2	5
Crater Street (north of Bartell)	2	3
Richards Street (south of Bartell)	2	4
Callina Street	0	3
Total	**9**	**14**

2.1 Leak Detection Survey

In June of 2003 a leak survey was conducted at each residence on the Big Pine Indian Reservation. This survey was conducted to locate plumbing leaks, determine the number of working and non-working smoke detectors, identify visible addresses for the Fire Department and install water conservation/safety devices (low flow showerheads, faucet aerators, and smoke detectors) for the hearing impaired and elderly.

BP Fire Safe Council gaining momentum

July 23, 2012

By
Deb Murphy/Sports Editor
dmurphy@inyoregister.com

An aerial view of the 2011 Center Fire shows the path and patchwork of wind-driven wildland fires in relation to the community of Big Pine. File photo

At Monday's fifth meeting of the Big Pine Fire Safe Council, residents learned just how close the bullet the community dodged on Saturday, July 7 actually came.

The large turnout, perhaps spurred on by two consecutive Saturdays of brush fires in or near the town, also began to come together with the first small steps in protecting themselves and their homes from the constant threat of wildland fires.

Eric Abrams, a CalFire and Big Pine Volunteer firefighter, briefed the residents on the details of the Fish Fire, the blaze that scorched 1,103 acres of brush south of the community. "It was a hard-charging fire," he said of the blaze that started just north of Fish Springs Road and was driven by gusting winds out of the south. "It was the quick action of the agencies that stopped it."

According to Abrams, the firefighters got ahead of the blaze and created a buffer zone between the fire and the south end of Big Pine.

A big factor was the air support. Abrams said the aircraft were called up by CalFire when it got the dispatch, before the crews and equipment left the station in Bishop. "The air support was already in orbit," said Abrams. "We were able to divert them from the west side of the mountains."

The picture Abrams drew was grim. Without the buffer and the air support, the fire would have followed the same path the Center Fire had taken 18 months earlier on its way to destroying 19 homes.

The first four meetings of the newly-formed council had been overwhelmed with issues of fuel reduction and larger issues of fire safety. Fourth District Supervisor Marty Fortney and council member Kent Schlick suggested the group take on simpler projects to start with, specifically putting up visible numbers on homes to help emergency responders locate residents.

Just that single goal illustrated the complexity of a community made up of two areas: one to the north and the older, original community of Big Pine straddling U.S. 395. The recommended

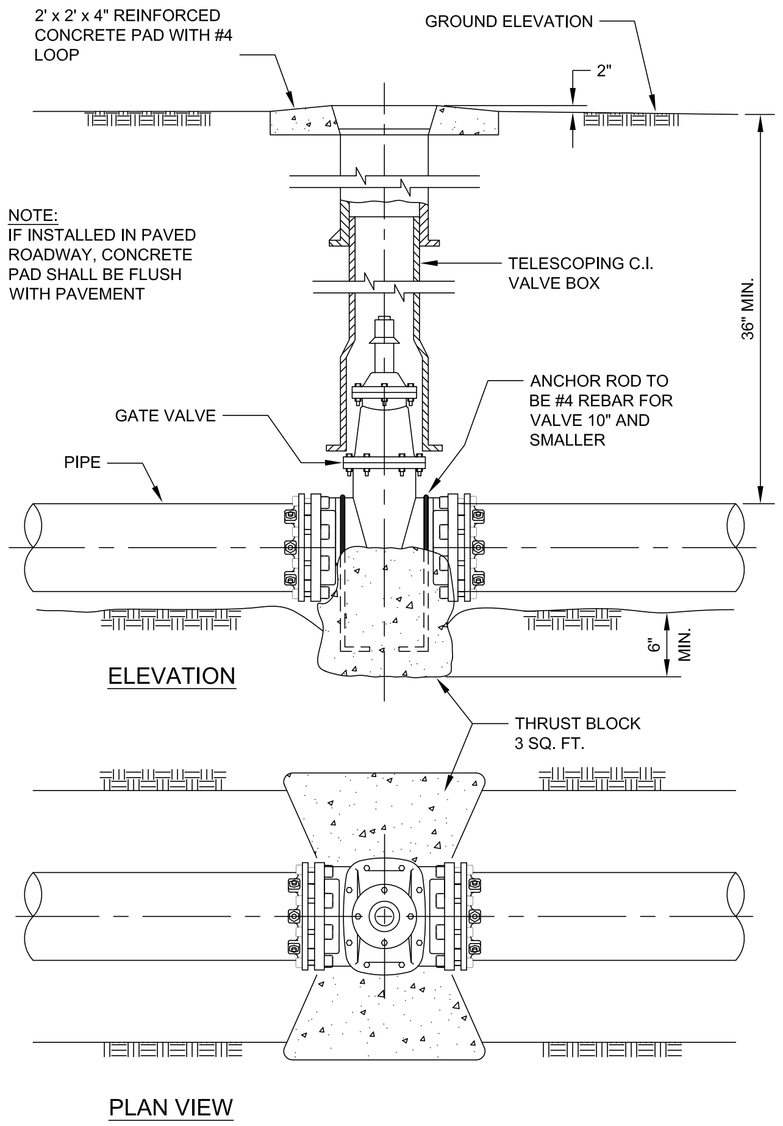
location for reflective address numbers is on the residence and on the curb. “Much of Big Pine doesn’t have curbs or sidewalks,” said Fortney.

Plans included a bulk mailing to residents with fire safe literature and information on the recommended reflective address numbers: no less than four inches in height on a contrasting background.

The bigger issues of fuel reduction on Los Angeles Department of Water and Power land and action against owners of abandoned homes that had degenerated into fire traps, a misdemeanor the Inyo County District Attorney will not prosecute, will be dealt with eventually. Schlick’s comment from the outset of the council meetings was that residents had to do what they could to protect their own homes before moving toward larger targets.

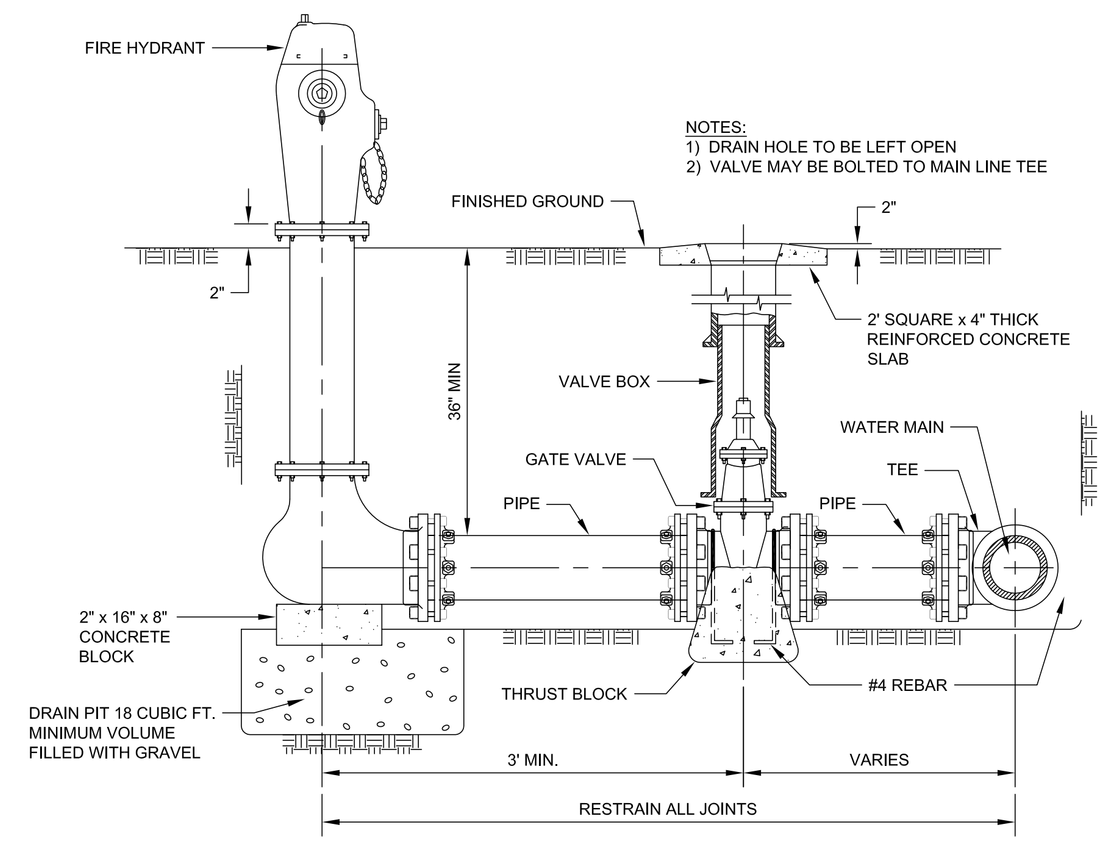
According to Fortney, the issues of abandoned fire traps was being transferred to the Inyo County Counsel’s Office with the hope of some action.

The next meeting of the Big Pine Fire Safe Council is 7 p.m. Monday, Aug. 20, at the Town Hall on Dewey Street.



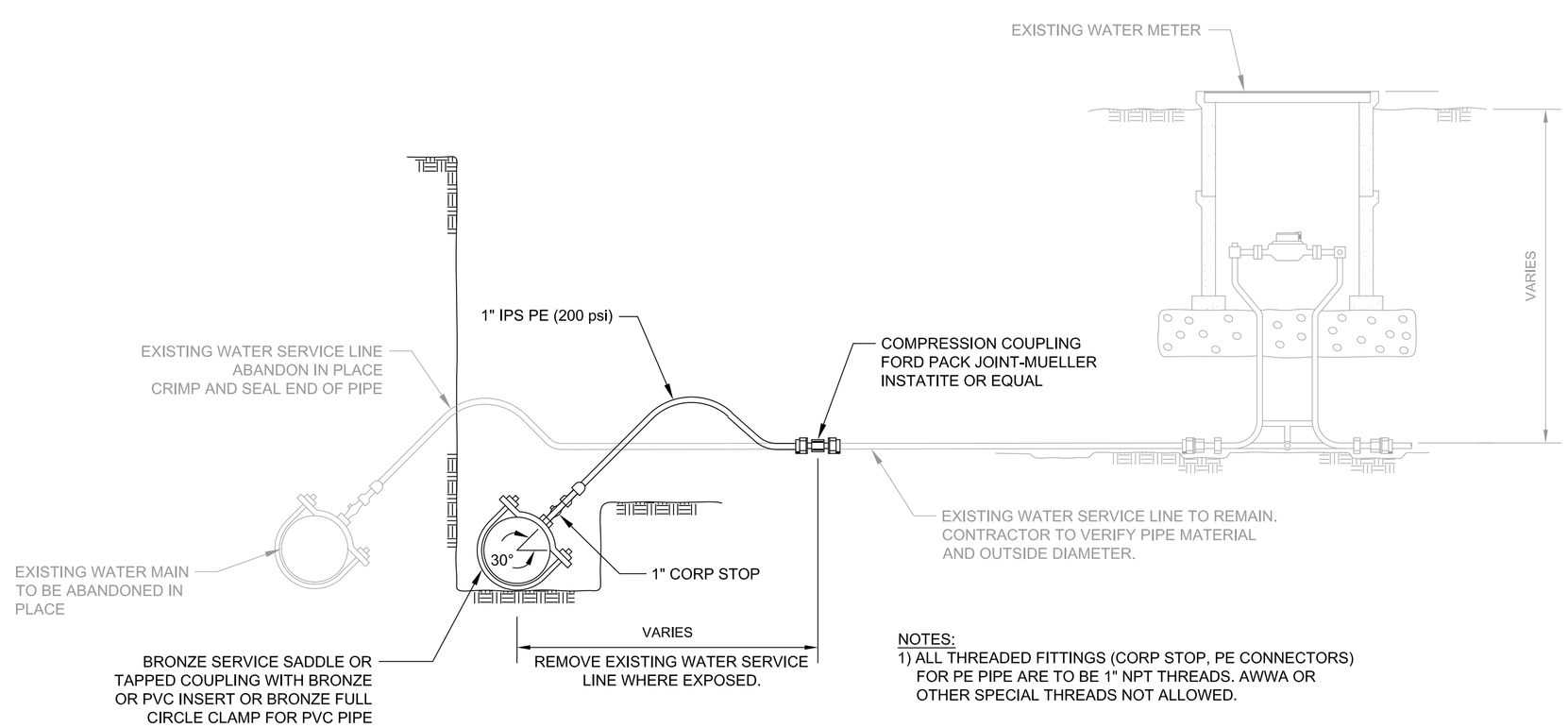
4 RESILIENT WEDGE GATE VALVE, BOX & COVER

Scale: N.T.S.



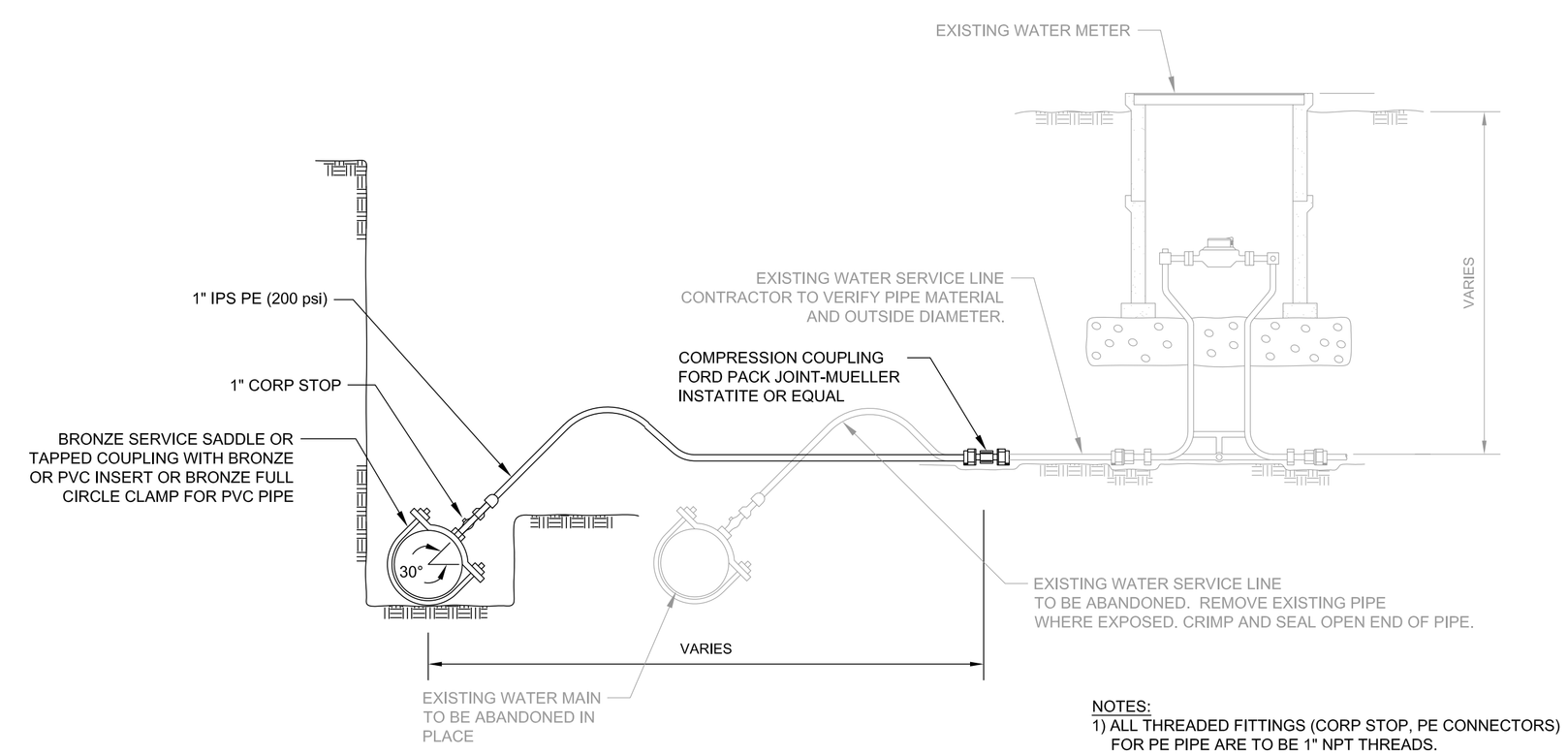
3 NEW FIRE HYDRANT DETAIL

Scale: N.T.S.



1 WATER SERVICE CONNECTION (TYPE 1)

Scale: N.T.S.



2 WATER SERVICE CONNECTION (TYPE 2)

Scale: N.T.S.

DATE	REVISIONS	INIT.

INDIAN HEALTH SERVICE
OFFICE OF ENVIRONMENTAL HEALTH & ENGINEERING

RENO DISTRICT OFFICE
1395 GREG STREET, SUITE 101
SPARKS, NV 89431
(775) 784-5327

INDIAN HEALTH SERVICE 1955

THE BIG PINE PAIUTE TRIBE

BIG PINE – INYO COUNTY, NEVADA
BIG PINE WATER SYSTEM IMPROVEMENTS
DETAILS – 2
PH09-T59

RN NUMBER: N/A
DRAWN BY: BLB
CHECKED BY: GDP
SCALE: 1" = 1'
DATE: ----
DATE: JULY 2012
FILE NAME: RENO-C-DTWATR
LAYOUT NAME: C-502
PROJ ENG: BRANDON L. BECKMAN, PE

C-502

SHEET 10 OF---

Fire destroys 19 homes in Big Pine

March 21, 2011

By
Mike Gervais/Register Staff
mgervais@inyoregister.com


An ariel view of Big Pine (l) Saturday shows the path of the Center Fire and damage to various homes throughout the community. Photo courtesy Kiana Wyatt. Solemn residents and firefighters gather next to what was once a home (r), now reduced to smoldering ash and a lone chimney. The county has declared a State of Emergency and if approved, money and resources will follow to help the victims and the community. Photo by Mike Bodine

While many residents were able to return to their homes in Big Pine Saturday morning, the homecoming was bittersweet as some found they had no homes to return to, their residences and worldly possessions destroyed during the night by the 800-acre Center Fire.

A total of 19 homes were destroyed in the fire, which broke out at about 3:30 p.m. Friday near the Bernasconi Center west of town. The cause of the fire is under investigation.

Preliminary estimates put the cost of damages from the fire at $4.5 million.

A number of fundraisers and relief efforts have been established to assist those rendered homeless by the blaze or otherwise impacted by the fire (see accompanying story on pg. 1).

Due to high winds, the fire spread rapidly, driven north-east into Big Pine. Local law enforcement officers from the Inyo County Sheriff's Department and California Highway Patrol began the first of a series of mandatory evacuations at about 5 p.m.

Sheriff Bill Lutze said that the execution of evacuation orders went smoothly, considering the speed of the blaze and danger to homes.

"I thought all and all the evacuations went well, everyone was cooperative and Health and Human Services did a great job of opening evacuation centers," Lutze said.

Displaced residents were sent to the Big Pine High School Auditorium, Eastern Sierra Tri-County Fairgrounds in Bishop or Lone Pine High School.

The mandatory evacuation order was lifted at about midnight Friday, allowing most residents to return to their homes.

During the evacuation and throughout much of the night, U.S. 395 was closed to traffic from Bishop to Independence. Many residents who were evacuated were required to travel to

Independence for shelter as the fire threatened to jump the highway.
At the fire's peek, more than 250 firefighters from across the state, including volunteer firefighters from local communities from Lone Pine to Mammoth.
The blaze spread quickly, moving from Bernasconi northeast, hitting first the westernmost areas of town including the Glacier View Mobile Home Park and the area near Rossi Road.
Big Pine resident Jarrett Coons, who lives in the Glacier View Mobile Home Park, said he was fishing on the canal around 4 p.m. when he noticed the fire and began to see ash blowing into town. When he returned home he received the mandatory evacuation order from local sheriff's deputies.
"Everybody got out – the sheriff's did a great job considering how fast everything happened," he said, "but we didn't have time to really get anything out of the house."
Coons said volunteer firefighters remained at the park to protect homes, despite the fire's progression, and managed to save about half of the dwellings there.
Coons was able to return to Big Pine at about 7 a.m. Saturday, and was relieved to see that his was one of the homes in the park that was spared.
"We were relieved that our house is still here, the guys did an awesome job saving what they could, but we have a lot of friends in the park who lost everything. There were parts of homes that were just vaporized," Coons said.
In addition to the number of trailers burned at Glacier View, portions of the 100-plus-year-old Rossi homestead sustained major and/or complete damage, however the extent could not be confirmed. At least one home was completely lost.
From the trailer park, spot fires hit east of Baker Creek Campground, burning livestock fields near County Road and School Street and prompting the evacuation of dozens of horses from the Big Pine Saddle Club and approximately 15 cats and dogs from the Inyo County Animal Shelter on County Road.
Inyo County Animal Shelter Manager Julie Sutton said county animal control staff evacuated the shelter at about 4:30 p.m. Friday, taking the animals to Bishop Veterinary Hospital.
No animals were inured during the fire, and the shelter was not damaged.
The animals were returned Sunday afternoon.
At the Big Pine Saddle Club, residents scrambled to load up their horses and transport them to the Tri-County Fairgrounds in Bishop, where free stables were provided and Dr. Ken and Nancy Gilliland and Peter Stickles of Zack Ranch provided hay to the refugee equines.
Also, Lee Roeser of Independence made his way to Big Pine early Friday evening with a large stock trailer to help get horses from the fields near School Street to safety as the blaze made its way there.
CalFire Public Information Officer Julie Hutchinsen said firefighters were able to get a handle on the fire by 9 p.m. Friday evening because the high winds began to die down. Later in the evening, firefighters got another break in the form of light precipitation that helped quell the blaze.
Saturday saw more relief for local volunteers, many of whom had been on the fire all night.
"Everyone worked so well together, the local fire agencies really deserve some recognition. The first responders had to wait four hours for back-up from down south, and they just did a phenomenal job," Hutchinsen said.
The fire was almost fully contained Saturday evening, and any hot spots that may have persisted throughout the weekend were completely exitinguished Sunday, when Big Pine experienced heavy rain.

Over the course of the weekend many rumors about the blaze circulated through communities of the Eastern Sierra, claiming that Bernasconi, Palisade Glacier High School, the Big Pine Animal Shelter, Big Pine Saddle Club and the Roosevelt Tree at the intersection of U.S. 395 and State Route 168 had been destroyed. Despite close calls at each of those locations, none were claimed by the fire.

Other rumors have persisted claiming that several local youth were arrested in connection to the blaze. Sheriff Lutze said that no arrests have been made, adding that CalFire investigators continue to look into the source of the blaze.

No deaths have been reported in relation to the fire, but Hutchinsen said one Inyo County sheriff's deputy was injured by flying debris Friday night. That injury, she added, was caused by wind, not fire.

Sheriff Lutze said the officer suffered injuries to his chest after a sign struck him as he helped with the evacuation effort. He was treated for his injuries and will be off work for the next few days, but is expected to make a full recovery.

County leaders will hold a special meeting today at 3 p.m. at the One Stop Center on Main Street in Bishop to ratify a Declaration of a State of Emergency due to the fire and hear a request from Inyo County Integrated Waste to waive all gate and disposal fees associated with debris from the fire.

WATER DISTRIBUTION IMPROVEMENTS TO IMPROVE FIRE FLOW ON THE BIG PINE INDIAN RESERVATION

Prepared by Douglas E. Marx, P.E., September, 2003

INTRODUCTION

The Big Pine Paiute Tribe (the Tribe) wants their water system to be capable of providing a fire flow of at least 1,000 gpm throughout the distribution system. They asked the Indian Health Service (IHS) to analyze their existing water distribution system to determine if it was capable of doing so, and if not, to suggest improvements that could be made to meet their objective. The following report describes the preparation of a model of the water system that was used to analyze the system and the recommended changes that could be made to meet their objective. The report does not discuss other issues affecting fire suppression, including water storage.

ESTIMATES OF FUTURE WATER DEMANDS

It is necessary to estimate future water system demands to evaluate changes to the water distribution system. These demands are important because the water system must continue to deliver domestic demands concurrent with delivering 1000 gpm to fight a fire. Demands are usually calculated based on the consumption of water per person or per residential equivalent (one single family residence). Typical figures for water systems that are similar to the one on the Big Pine Reservation can be used. However, it is better to estimate future demands using actual water usage figures.

Between November 2, 1998 and October 29, 1999, the two well pumps produced an average of 227,000 gpd (157 gpm). The Feasibility Study for the Improvements to the Big Pine Water Storage Tank, November 2001 stated that the Reservation population was 595 people. By comparison, the 2000 United States Census data indicates there are 462 people on the Reservation. The Feasibility Study also indicates a 1.0% population growth rate. Using the figures in the feasibility study, the population in 1999 is estimated to be 583, so the per capita usage in that year was 389 gallons per day (gpd). This is significantly higher than the average annual residential use in Nevada which is 200 gallons per capita per day (Nevada Water Facts, 1992).

During the summer months usage increases, primarily due to increased outdoor watering. Each summer from 1998 to 2001, the highest monthly usage averaged around 400,000 gpd (278 gpm). The percentage increase in usage is consistent with other water systems serving mostly residences. On any given day, the usage is not constant but varies from around 50% to 150% of the average usage on that day. For the purposes of estimating future demands in the water system, it will be assumed that the population in 1999 was 583, the growth rate is 1.0% per year, the per capita usage is 389 gpd, the peak day is 1.8 times the average day, and the peak demand on any day is 150% of the average demand on that day. Relevant demands are calculated from these assumptions and are shown in the table on the next page. The year 2054 was chosen based on a 50 year life for any proposed distribution pipe.

Another approach to designing the water distribution system is to determine the demands once no more development can take place. It may be assumed that this will occur when every existing lot on the Reservation contains one single family residence. The plat map of the Reservation contains 487 individual lots on 21 different blocks that are separated by streets. Since the Reservation contains 279 acres, each lot is about 0.5 acres in size. The Feasibility Study indicates there are 155 service connections. For comparison, the 2000 United States Census data indicates there are 160 housing units with an additional 21 housing units being vacant. If it is assumed that each connection serves one home, the average occupancy is 3.84 people per home. If this average is assumed to continue indefinitely, the population once all 487 lots are developed will be 1,869. Using the same 1.0% population growth rate, this will occur in the year 2116. The demands for that year are included in the table below.

DEMAND ESTIMATES	1999	2054	Build Out (2116)
Population	583	1,008	1,869
Average Usage (gpd)	227,000	392,000	727,000
Average Usage (gpm)	157	272	505
Peak Day (Avg. x 1.8)	283	490	909
Peak Hour (Peak Day x 1.5)	425	735	1,363

WATER DISTRIBUTION MODEL

A model of the existing water distribution system was prepared to determine what piping changes should be considered. The primary source of information to model the existing piping was a composite drawing of the distribution system that was prepared by the IHS in 1999. The map shows the approximate location of each pipe (4" and larger) and notes its nominal size. All piping is believed to be PVC. The only addition to the distribution system since 1999 was the construction of a 6" water line along Bowers Street north of Bartell Street.

Nominal pipe sizes were used instead of actual pipe inside diameter. A Hazen-Williams coefficient of 150 was used for PVC. Junction elevations were estimated from a topo map that was prepared from an aerial survey that was completed in the late seventies. The map shows contours at 4' intervals. The two graphs in the appendix illustrate the model. The first graph shows the existing pipe sizes and street names. The second graph shows the labels assigned to each pipe and each junction (or node).

The number of lots in the vicinity of each junction were counted. In this way, any system demand is spread evenly throughout the Reservation. No attempt was made to spread the demand by locating existing structures or predicting where future growth would occur, except for the demand from the existing trailer park. The park contains approximately 33 trailers located on 12 lots. The additional demand from these trailers was distributed to the adjacent junctions. The number of lots in the vicinity of each junction is shown on Graph 1.

The existing 250,000 gallon water storage tank was built in 1980. A right-of-way map (IHS drawing #383-02, Sheet 3) indicates the tank is about 1175 feet west of School Street. Pressure gauge readings in the treatment building at the corner of West Sepsey Lane and School Street (elevation 4050') show a maximum pressure of 36 psi, indicating the high water level in the tank has an elevation of 4133'. The tank is 32' tall, so assuming a maximum depth of 30', the ground below the tank has an elevation of 4103'. This is within a few feet of the elevation determined from a recent survey or estimated from a USGS topo map.

The model prepared for Big Pine is based only on information available in the IHS office in Reno. This data is believed to be sufficient to evaluate the distribution system and determine the outcome of any changes. However, flow test data should be collected and compared to output from the model to confirm its accuracy.

ANALYSIS USING DOMESTIC DEMANDS

The pressure range in the distribution system is primarily determined by the water level in the storage tank and the elevation of each home. With 30' of water in the tank, the pressure at the lowest lot (Block 1, Lot 30) is 75.3 psi. The pressure at the highest lot (Block 18, Lot 11) is 36.4 psi. The model was used to evaluate the effects of future domestic demands. The results are shown in the table below. The hydraulic grade line (HGL) at any junction indicates the amount of pressure loss due to pipe friction.

YEAR	Static	1999	2054	BUILD OUT
Peak Hour Demand	0 gpm	425 gpm	735 gpm	1,363 gpm
Minimum Pressure	38.1 psi	36.6 psi	34.0 psi	22.8 psi
Minimum HGL (J-13)	4130.0	4122.3	4108.5	4062.9
Maximum HGL (J-33)	4130.0	4126.7	4120.7	4100.9

The model shows that even at build out, the distribution system can maintain a residual pressure greater than 20 psi. This is generally considered an acceptable pressure. The minimum pressure occurs below the tank at either node J-33 or J-34 as a result of the head loss in the 8" pipe that connects the tank to the system (P-53). The head loss in that pipe accounts for 43% of the head loss occurring at Node J-13. Node J-13 is served by 4" pipe and is far from the tank, so the maximum drop in pressure occurs there.

Table 1 in the appendix lists each pipe by headloss gradient during peak hour demand in the year 2054. Since all water demands must flow from the tank through the pipes near the tank, the highest flows are seen in those pipes. Consequently, these pipes have the highest headloss gradients. Although the headlosses do not result in excessive friction losses, the table shows which pipes should be replaced first to maintain the hydraulic grade line and thereby minimize pressure losses throughout the system.

FIRE FLOW ANALYSIS

The model of the existing distribution system was also used to determine the available fire flow at each junction. The Nevada Administrative Code (Section 232) indicates that the system should maintain a residual of at least 20 psi during maximum day demand and fire flow. Throughout an entire year, the actual demands are estimated to exceed the maximum demands approximately 3% of the time (Figure 5 in Water Supply Engineering). These two conditions were applied to the current system. The results are shown in Table 2. A fire flow of greater than 1,000 gpm can be provided at all nodes except those that are not connected to the distribution system by a 6" or 8" pipe. The 8 nodes on 4" pipes have fire flow capacities between 690 gpm and 890 gpm. If the head loss from Pipe P-53 is eliminated, the available flow at these 8 nodes increases by about 100 gpm. The existing system therefore does not provide the fire flow desired by the Tribe.

ALTERNATIVES

The model was first used to determine whether a water storage tank constructed at Node J-12 would provide the required fire flows. Peak day demand was increased to 490 gpm so that any solution would accommodate assumed growth through the year 2054. The minimum zone pressure was allowed to drop below 20 psi. The results are shown in Table 3. Five of the 8 nodes on the 4" pipe now can provide more than 1,000 gpm. However, three cannot. Therefore, this alternative alone is not acceptable.

It was assumed from the start of this exercise that the 4" piping would not support fire flows of 1,000 gpm. The model was changed to replace the 4" piping along Carter Street with 8" piping and all other 4" piping (except the piece on Spratt Lane) with 6" piping. The results are shown in Table 4. All nodes except J-34 can now provide fire flows above 1,000 gpm on peak day in the year 2054.

COST ESTIMATE

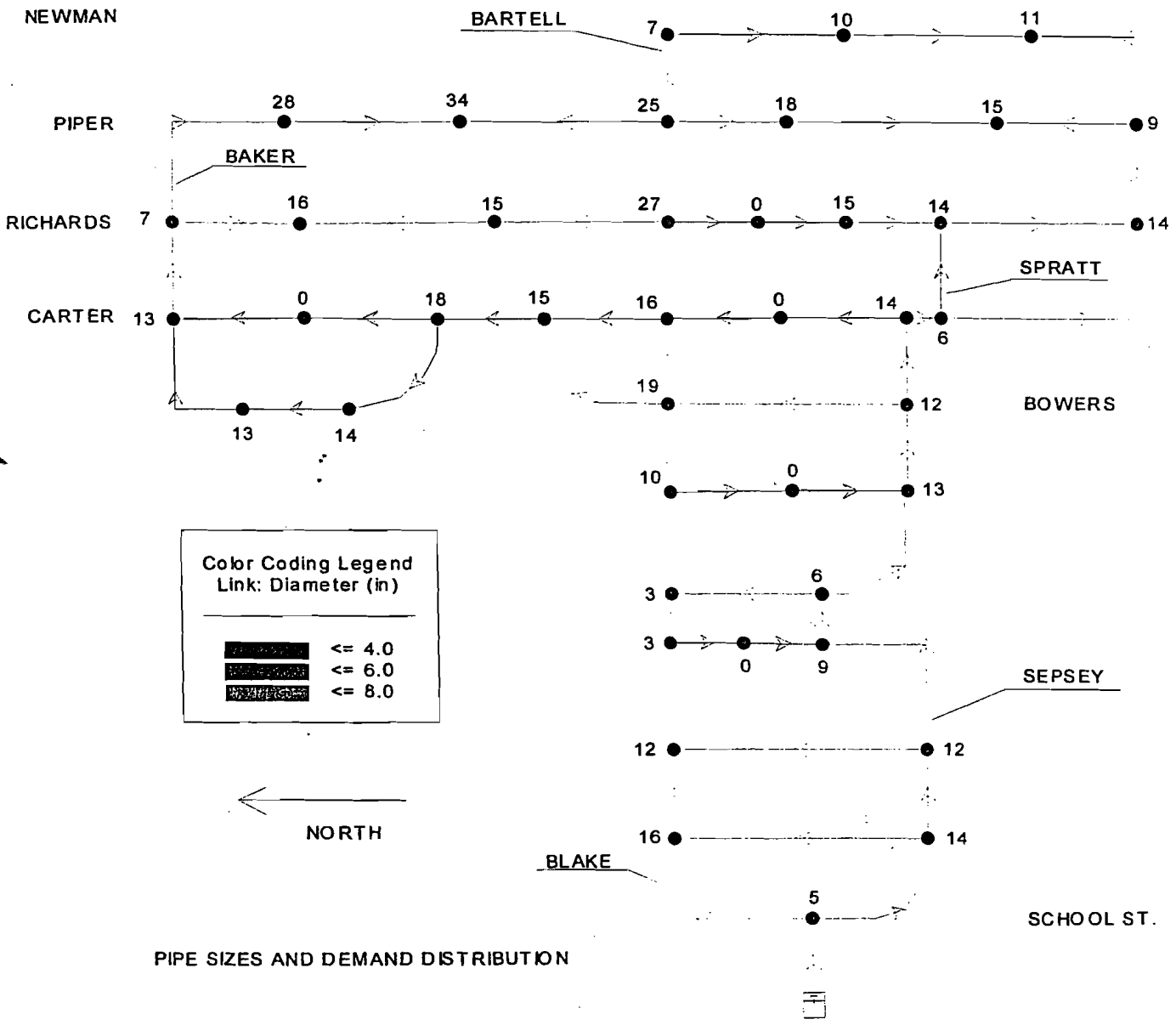
A total of 9,000 feet of 6" and 8" piping is needed to provide fire flows along the existing 4" piping. There is no need to abandon the existing 4" diameter pipe. The proposed pipes can be installed parallel with the existing pipes and should be connected to the 6" and 8" mains at either end. Hydrants should be installed on the new water mains to provide protection for existing and future construction. Hydrant spacing should be determined by the local authority.

Every lot on the Reservation is adjacent to an existing water main except those on Newman Road north of Bartell Road. These lots are not adequately protected by the water main on Piper Street. A 6" water main should be constructed along this road and on Baker Lane to provide fire protection to this area. This line will be about 3,080 feet long.

APPENDIX

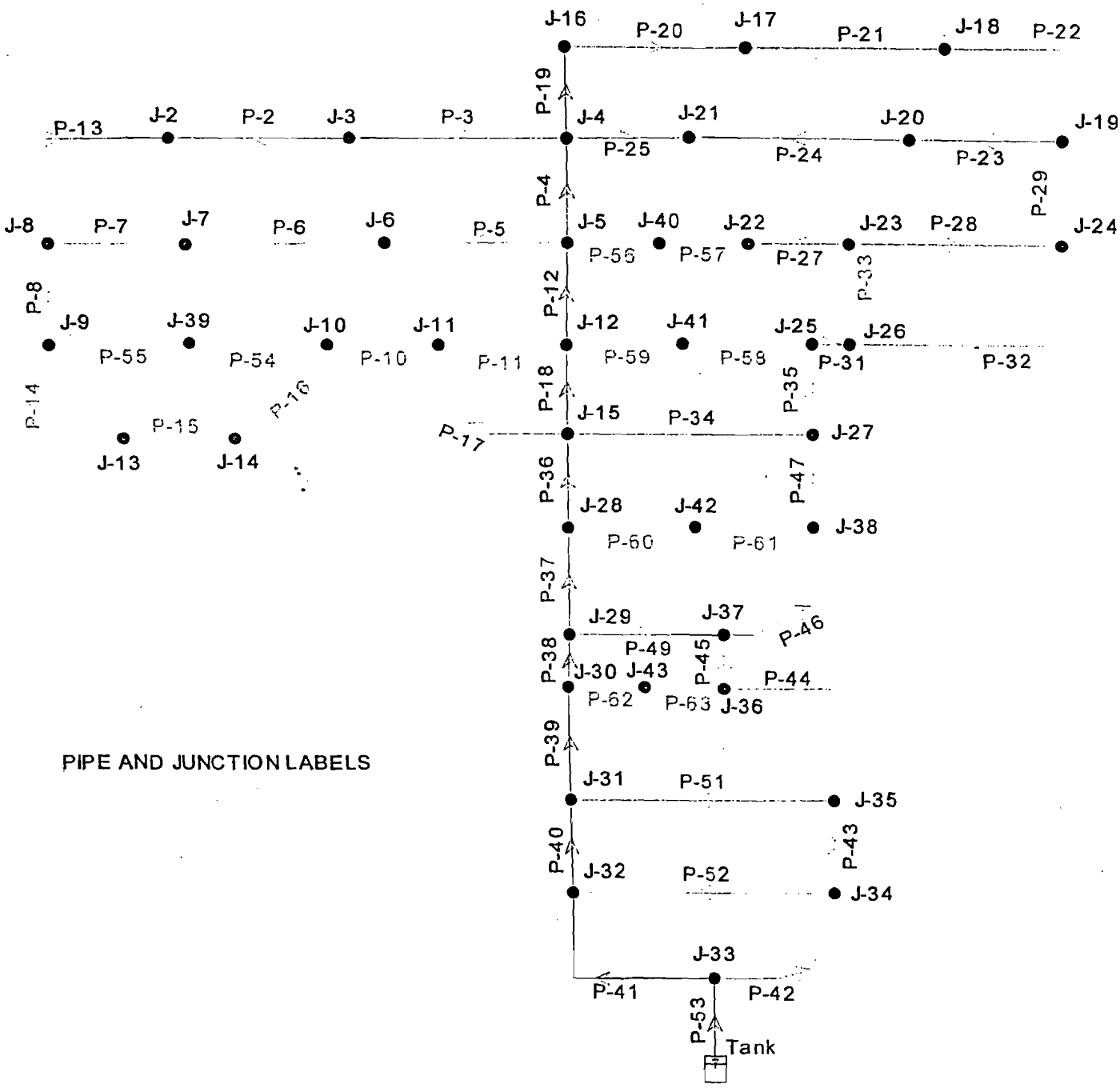
Graph 1: Pipe Sizes and Demand Distribution
Graph 2: Pipe and Junction Labels
Table 1: Headloss Gradients in Existing Piping
Table 2: Fire Flow Analysis of Existing Piping
Table 3: Fire Flow Analysis of Tank at Node 12
Table 4: Fire Flow Analysis of Installation of 6" and 8" piping

Scenario: Existing Piping



PIPE SIZES AND DEMAND DISTRIBUTION

Scenario: Existing Piping



PIPE AND JUNCTION LABELS

Scenario: Existing Piping
Steady State Analysis
Pipe Report

PEAK HOUR 2054

LOOK AT HEAD LOSSES IN PIPING

SORTED BY

Label	Length (ft)	Diameter (in)	Material	Discharge (gpm)	Headloss Gradient (ft/1000ft)	Calculated Friction Headloss (ft)	Velocity (ft/s)	Open?
P-53	1,170	8.0	PVC	737	7.96	9.3	4.70	true
P-42	800	6.0	PVC	266	4.88	3.9	3.01	true
P-39	380	8.0	PVC	492	3.77	1.4	3.14	true
P-40	440	8.0	PVC	471	3.47	1.5	3.00	true
P-38	120	8.0	PVC	470	3.45	0.4	3.00	true
P-41	1,190	8.0	PVC	464	3.38	4.0	2.96	true
P-43	440	6.0	PVC	215	3.31	1.5	2.44	true
P-37	380	8.0	PVC	457	3.28	1.2	2.91	true
P-10	450	4.0	PVC	69	2.90	1.3	1.76	true
P-36	440	8.0	PVC	423	2.84	1.3	2.70	true
P-47	440	6.0	PVC	165	2.01	0.9	1.87	true
P-46	800	6.0	PVC	164	2.00	1.6	1.86	true
P-45	120	6.0	PVC	164	2.00	0.2	1.86	true
P-44	950	6.0	PVC	159	1.89	1.8	1.81	true
P-18	440	8.0	PVC	313	1.63	0.7	2.00	true
P-35	440	6.0	PVC	142	1.52	0.7	1.61	true
P-12	440	8.0	PVC	293	1.45	0.6	1.87	true
P-33	440	4.0	PVC	42	1.18	0.5	1.08	true
P-31	250	6.0	PVC	115	1.03	0.3	1.30	true
P-17	1,150	6.0	PVC	88	0.63	0.7	1.00	true
P-16	350	4.0	PVC	30	0.60	0.2	0.75	true
P-3	1,050	6.0	PVC	81	0.54	0.6	0.91	true
P-5	940	6.0	PVC	80	0.52	0.5	0.90	true
P-4	440	8.0	PVC	164	0.49	0.2	1.05	true
P-32	1,530	6.0	PVC	64	0.35	0.5	0.72	true
P-6	1,000	6.0	PVC	58	0.29	0.3	0.66	true
P-48	1,320	4.0	PVC	19	0.27	0.4	0.49	true
P-29	440	6.0	PVC	54	0.25	0.1	0.61	true
P-50	750	4.0	PVC	18	0.24	0.2	0.46	true
P-51	1,320	6.0	PVC	39	0.14	0.2	0.44	true
P-9	1,440	4.0	PVC	13	0.14	0.2	0.34	true
P-7	700	6.0	PVC	35	0.11	0.1	0.39	true
P-2	1,000	6.0	PVC	31	0.09	0.1	0.35	true
P-52	1,320	6.0	PVC	30	0.09	0.1	0.34	true
P-26	1,120	4.0	PVC	10	0.08	0.1	0.26	true
P-14	790	4.0	PVC	10	0.08	0.1	0.25	true
P-15	700	4.0	PVC	9	0.07	4.9e-2	0.24	true
P-23	850	6.0	PVC	24	0.06	4.8e-2	0.27	true
P-25	790	6.0	PVC	24	0.06	4.5e-2	0.27	true
P-30	1,320	4.0	PVC	7	0.04	0.1	0.17	true
P-22	1,030	6.0	PVC	17	0.03	3.1e-2	0.19	true
P-8	440	6.0	PVC	15	0.02	1.1e-2	0.17	true
P-20	1,050	6.0	PVC	14	0.02	2.1e-2	0.15	true
P-19	440	8.0	PVC	24	0.01	6.3e-3	0.15	true
P-27	450	6.0	PVC	12	0.01	6.3e-3	0.13	true
P-28	1,090	6.0	PVC	11	0.01	1.4e-2	0.12	true
P-13	1,030	6.0	PVC	9	0.01	1.0e-2	0.11	true
P-49	750	6.0	PVC	9	0.01	6.3e-3	0.10	true
P-11	750	4.0	PVC	3	0.01	5.9e-3	0.07	true
P-34	1,320	6.0	PVC	5	3.7e-3	4.9e-3	0.06	true
P-24	1,000	6.0	PVC	2	4.88e-4	4.9e-4	0.02	true

TANK OUTLET

T-1-1 - 1 - Headloss Gradients in Existing Piping

Scenario: Existing Piping
Fire Flow Analysis
Fire Flow Report

ELIMINATE HEAD LOSS IN 8" LINE TO TANK

MIN 20 PSI AT ALL NODES

Q = 283 (PEAK DAY, 1999)

Only nodes not achieving 1000 gpm are those that are not served by a 6" or 8" pipe.

J-34 is near the tank

	Zone	Label	Available Fire Flow (gpm)	Total Flow Available (gpm)	Calculated Residual Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction
gpm)	Zone-1	J-2	1,118.0	1,133.6	20.0	21.8	J-34
	Zone-1	J-3	1,140.5	1,159.4	20.0	21.3	J-34
	Zone-1	J-4	1,189.6	1,203.5	30.5	20.0	J-34
	Zone-1	J-5	1,189.6	1,204.6	29.7	20.0	J-34
	Zone-1	J-6	1,141.0	1,149.3	20.0	21.2	J-34
	Zone-1	J-7	1,119.2	1,128.1	20.0	21.8	J-34
	Zone-1	J-8	1,156.6	1,160.5	20.8	20.0	J-9
	Zone-1	J-9	1,070.9	1,078.1	20.0	20.7	J-13
914	Zone-1	J-10	880.1	890.1	20.0	21.9	J-14
	Zone-1	J-11	1,160.3	1,168.6	20.0	20.8	J-34
	Zone-1	J-12	1,189.6	1,198.5	29.2	20.0	J-34
759	Zone-1	J-13	692.2	699.4	20.0	31.0	J-34
792	Zone-1	J-14	715.6	723.4	20.0	30.6	J-34
	Zone-1	J-15	1,189.6	1,200.2	28.8	20.0	J-34
	Zone-1	J-16	1,189.6	1,193.5	31.0	20.0	J-34
	Zone-1	J-17	1,168.2	1,173.7	20.0	20.6	J-34
	Zone-1	J-18	1,164.4	1,170.5	20.0	20.7	J-34
	Zone-1	J-19	1,189.6	1,194.6	21.5	20.0	J-34
	Zone-1	J-20	1,144.7	1,153.1	20.0	21.2	J-34
	Zone-1	J-21	1,189.6	1,199.6	20.1	20.0	J-34
	Zone-1	J-22	1,025.2	1,033.6	20.0	24.1	J-34
	Zone-1	J-23	1,103.2	1,111.0	20.0	21.1	J-22
	Zone-1	J-24	1,168.3	1,176.0	20.0	20.6	J-34
	Zone-1	J-25	1,189.5	1,197.3	22.8	20.0	J-34
	Zone-1	J-26	1,184.7	1,188.0	20.0	20.1	J-34
	Zone-1	J-27	1,189.4	1,196.1	23.1	20.0	J-34
	Zone-1	J-28	1,189.7	1,195.3	27.9	20.0	J-34
	Zone-1	J-29	1,190.1	1,191.8	28.1	20.0	J-34
	Zone-1	J-30	1,191.0	1,192.7	26.7	20.0	J-34
	Zone-1	J-31	1,197.6	1,204.2	26.0	20.0	J-34
	Zone-1	J-32	1,225.6	1,234.5	24.3	20.0	J-34
	Zone-1	J-33	1,374.0	1,376.7	20.0	22.3	J-34
	Zone-1	J-34	1,112.2	1,120.0	20.0	24.9	J-33
	Zone-1	J-35	1,173.2	1,179.8	20.5	20.0	J-34
	Zone-1	J-36	1,187.0	1,192.0	22.3	20.0	J-34
	Zone-1	J-37	1,187.3	1,190.7	23.2	20.0	J-34
	Zone-1	J-38	1,177.5	1,184.7	20.0	20.3	J-34
328	Zone-1	J-39	749.9	749.9	20.0	30.0	J-34
585	Zone-1	J-40	865.9	865.9	20.0	27.6	J-34
942	Zone-1	J-41	827.7	827.7	20.0	28.4	J-34
998	Zone-1	J-42	771.7	771.7	20.0	29.5	J-34
1092	Zone-1	J-43	891.2	891.2	20.0	27.1	J-34

Table 2: Fire Flow Analysis of Existing Piping

IF TANK IS PLACED AT NODE J-12

Scenario: Existing Piping
Fire Flow Analysis
Fire Flow Report

MIN 10 PSI IN SYSTEM
MIN 20 PSI AT FIRE NODE
Q = 490 (PEAK DAY, 2054)

CIRCLED NODES ON 4" PIPE
6 NODES NOW DROP BELOW 1000 GPM (490 GPM MIN.)

	Zone	Label	Available Fire Flow (gpm)	Total Flow Available (gpm)	Calculated Residual Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction
	Zone-1	J-2	989.8	1,016.8	20.0	19.8	J-34
	Zone-1	J-3	1,005.3	1,038.1	20.0	19.4	J-34
	Zone-1	J-4	1,209.0	1,233.1	20.0	13.7	J-34
	Zone-1	J-5	1,197.0	1,223.0	20.0	14.1	J-34
	Zone-1	J-6	1,003.6	1,018.0	20.0	19.5	J-34
	Zone-1	J-7	988.5	1,003.9	20.0	19.9	J-34
	Zone-1	J-8	1,030.1	1,036.9	20.0	18.4	J-13
	Zone-1	J-9	947.0	959.5	20.0	19.8	J-13
24	Zone-1	J-10	781.2	798.6	20.0	21.2	J-14
	Zone-1	J-11	1,020.1	1,034.6	20.0	19.0	J-34
	Zone-1	J-12	1,194.3	1,209.7	20.0	14.2	J-34
244	Zone-1	J-13	624.3	636.9	20.0	28.3	J-34
097	Zone-1	J-14	640.4	653.9	20.0	28.0	J-34
	Zone-1	J-15	1,193.9	1,212.2	20.0	14.2	J-34
	Zone-1	J-16	1,215.6	1,222.3	20.0	13.5	J-34
	Zone-1	J-17	1,038.5	1,048.2	20.0	18.5	J-34
	Zone-1	J-18	1,036.5	1,047.1	20.0	18.6	J-34
	Zone-1	J-19	1,061.4	1,070.1	20.0	17.9	J-34
	Zone-1	J-20	1,010.4	1,024.8	20.0	19.3	J-34
	Zone-1	J-21	1,051.7	1,069.0	20.0	18.2	J-34
	Zone-1	J-22	907.1	921.6	20.0	21.9	J-34
	Zone-1	J-23	969.0	982.5	20.0	20.4	J-34
	Zone-1	J-24	1,014.3	1,027.8	20.0	19.2	J-34
	Zone-1	J-25	1,078.8	1,092.3	20.0	17.4	J-34
	Zone-1	J-26	1,026.5	1,032.3	20.0	18.9	J-34
	Zone-1	J-27	1,080.5	1,092.1	20.0	17.4	J-34
	Zone-1	J-28	1,188.6	1,198.2	20.0	14.3	J-34
	Zone-1	J-29	1,210.0	1,212.9	20.0	13.7	J-34
	Zone-1	J-30	1,178.1	1,181.0	20.0	14.7	J-34
	Zone-1	J-31	1,181.3	1,192.8	20.0	14.8	J-34
	Zone-1	J-32	1,169.3	1,184.7	20.0	16.0	J-34
	Zone-1	J-33	1,167.1	1,171.9	20.0	21.8	J-34
	Zone-1	J-34	925.1	938.6	20.0	24.6	J-33
	Zone-1	J-35	1,006.1	1,017.7	20.0	19.1	J-34
	Zone-1	J-36	1,065.9	1,074.6	20.0	17.7	J-34
	Zone-1	J-37	1,085.8	1,091.6	20.0	17.2	J-34
	Zone-1	J-38	1,007.6	1,020.2	20.0	19.3	J-34
942	Zone-1	J-39	678.8	678.8	20.0	27.2	J-34
195	Zone-1	J-40	780.1	780.1	20.0	25.0	J-34
140	Zone-1	J-41	746.5	746.5	20.0	25.7	J-34
022	Zone-1	J-42	693.2	693.2	20.0	26.9	J-34
261	Zone-1	J-43	791.5	791.5	20.0	24.7	J-34

Table 3: Fire Flow Analysis of Tank at Node 12

Scenario: Existing Piping
Fire Flow Analysis
Fire Flow Report

SORTED BY

Zone	Label	Available Fire Flow (gpm)	Total Flow Available (gpm)	Calculated Residual Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction
Zone-1	J-34	926.3	939.8	20.0	24.6	J-33
Zone-1	J-35	1,009.7	1,021.3	20.0	19.0	J-34
Zone-1	J-20	1,020.9	1,035.4	20.0	19.0	J-34
Zone-1	J-42	1,028.0	1,028.0	20.0	18.8	J-34
Zone-1	J-22	1,036.1	1,050.6	20.0	18.6	J-34
Zone-1	J-24	1,042.1	1,055.6	20.0	18.4	J-34
Zone-1	J-3	1,043.6	1,076.4	20.0	18.4	J-34
Zone-1	J-14	1,045.5	1,059.0	20.0	18.4	J-34
Zone-1	J-6	1,046.5	1,061.0	20.0	18.3	J-34
Zone-1	J-18	1,046.7	1,057.3	20.0	18.3	J-34
Zone-1	J-38	1,047.5	1,060.0	20.0	18.3	J-34
Zone-1	J-17	1,048.5	1,058.1	20.0	18.3	J-34
Zone-1	J-13	1,049.9	1,062.4	20.0	18.2	J-34
Zone-1	J-23	1,050.3	1,063.8	20.0	18.2	J-34
Zone-1	J-2	1,059.1	1,086.1	20.0	18.0	J-34
Zone-1	J-21	1,062.4	1,079.8	20.0	17.9	J-34
Zone-1	J-26	1,069.0	1,074.8	20.0	17.7	J-34
Zone-1	J-43	1,071.3	1,071.3	20.0	17.6	J-34
Zone-1	J-7	1,073.5	1,089.0	20.0	17.6	J-34
Zone-1	J-40	1,076.5	1,076.5	20.0	17.5	J-34
Zone-1	J-19	1,078.2	1,086.8	20.0	17.5	J-34
Zone-1	J-36	1,097.2	1,105.8	20.0	16.9	J-34
Zone-1	J-37	1,104.8	1,110.6	20.0	16.7	J-34
Zone-1	J-27	1,105.3	1,116.9	20.0	16.7	J-34
Zone-1	J-25	1,146.8	1,160.3	20.0	15.5	J-34
Zone-1	J-10	1,153.9	1,171.2	20.0	15.3	J-34
Zone-1	J-41	1,160.9	1,160.9	20.0	15.1	J-34
Zone-1	J-39	1,167.0	1,167.0	20.0	15.0	J-34
Zone-1	J-33	1,167.1	1,171.9	20.0	21.8	J-34
Zone-1	J-32	1,169.4	1,184.8	20.0	15.9	J-34
Zone-1	J-30	1,180.3	1,183.2	20.0	14.6	J-34
Zone-1	J-31	1,181.8	1,193.3	20.0	14.8	J-34
Zone-1	J-11	1,185.0	1,199.5	20.0	14.4	J-34
Zone-1	J-8	1,189.5	1,196.2	20.0	14.3	J-34
Zone-1	J-28	1,192.3	1,201.9	20.0	14.2	J-34
Zone-1	J-15	1,196.6	1,214.9	20.0	14.1	J-34
Zone-1	J-9	1,197.9	1,210.4	20.0	14.1	J-34
Zone-1	J-12	1,209.2	1,224.6	20.0	13.7	J-34
Zone-1	J-29	1,210.3	1,213.2	20.0	13.7	J-34
Zone-1	J-5	1,215.6	1,241.6	20.0	13.6	J-34
Zone-1	J-4	1,226.4	1,250.5	20.0	13.2	J-34
Zone-1	J-16	1,231.1	1,237.8	20.0	13.1	J-34

MIN 10 PSI IN SYSTEM

MIN 20 PSI AT FIRE NODE

Q = 490 gpm

Change 4" pipe on Carter Street to 8". Change other 4" pipe to 6".

Table 4: Fire Flow Analysis of Installation of 6" and 8" piping

The Inyo Register
"Delivering your hometown news since 1870"

Home lost, but lives saved

April 3, 2012

BYREGISTER STAFF
mgervais@inyoregister.com

A Big Pine resident is being hailed as a hero after noticing smoke coming from a neighbor's house and breaking down the door to wake the sleeping occupants.

According to the Inyo County Sheriff's Department, Galen and Veronica Moore, of 994 Bowers St. in Big Pine, saw black smoke rising from their neighbor's home at 994 Hill St. Saturday morning.

"As Galen ran up to the residence he could see flames on the east side of the residence," the press release states. "Galen attempted to open the front door but the door handle was too hot."

He then grabbed a metal pipe nearby and hit the door handle until it broke off.

"Galen kicked in the front door and flames shot out of the house as it opened," the press release states. "The heat was so intense Galen could only go into the entryway."

With flames fully engulfing the kitchen and ceiling, Moore began yelling and hitting the door, walls and glass around him to wake up the residents.

Members of the Big Pine Volunteer Fire Department were called out to 994 Hill St. in Big Pine Saturday morning for a house fully engulfed by fire. A neighbor reported the fire to authorities, before breaking into the home to wake two sleeping residents, possibly saving their lives. Photos by Angie Calloway

It took about a minute, but the two residents, Harold and Daniel Pierce, woke up and escaped the fire.

"Those guys would have been (dead) if that guy wasn't there," Inyo County Sheriff's Deputy Joshua Nicholson said of Moore's efforts to rouse Harold and Daniel Pierce.

Nicholson said that by the time law enforcement and the Big Pine Volunteer Fire Department arrived at the scene, the house was fully engulfed in flames.

He went on to say that both Harold and Daniel lost all their possessions to the fire.

The first call to authorities regarding the fire came in at 10 a.m. Saturday morning. The fire burned for about two hours, with law enforcement leaving the scene at noon, as firefighters remained to ensure that no hot spots re-ignited the fire.