



North Kern Water Storage District

November 2021

Calloway Canal Lining: Fruitvale Avenue to CVC Intertie

WaterSMART Grants: Water and Energy Efficiency Grants for Fiscal Year 2022

NOFO No. R22AS00023



Calloway Canal Lining: Fruitvale Avenue to CVC Intertie

Applicant

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1. Technical Proposal and Evaluation Criteria

1.1 Executive Summary

Date November 3, 2021
Applicant Name North Kern Water Storage District
City, County, State Bakersfield, Kern, California
Applicant Category A

About a decade ago, North Kern Water Storage District (NKWSD, North Kern, or District) commenced implementation of a plan of water delivery efficiency improvements, which identified concrete lining their major canal, the Calloway Canal, as a top priority. Because of the scope and cost, these improvements are being made incrementally as funds are available. Accordingly, North Kern proposes to leverage its resources in a cost-shared Project with the United States Bureau of Reclamation (USBR or Reclamation) to concrete line 5,280 linear feet (LF) of a currently unlined portion of the Calloway Canal, located in Bakersfield, California. The proposed Project, *Calloway Canal Lining: Fruitvale Avenue to CVC Intertie* (Project), is expected to save **1,056 acre-feet (AF)** of water annually by reducing seepage and **1,359,012 kilowatt hours per year (kWh/yr)** in energy by reducing groundwater pumping. This Project is designed to conserve and use water more efficiently, which is consistent with the objective of the subject Notice of Funding Opportunity (NOFO). It is estimated that the Project would be completed within 36 months of the award date. Assuming funding is awarded, and an agreement is signed by April 1, 2022, it is anticipated that the Project could be completed by March 31, 2024 (a detailed schedule is included in Section 1.4). The Project is not located on a Federal Facility.

NKWSD is requesting \$2,000,000 in funding from USBR to implement the *Calloway Canal Lining: Fruitvale Avenue to CVC Intertie* Project as described in this application. The District will fund at least 50 percent of the total Project budget. A detailed budget is included in Section 2.

1.2 Project Location

The Project is located within the District's boundaries in Bakersfield, a city in Kern County, California. Kern County is in the southern portion of California's San Joaquin Valley. The District is in northern Bakersfield, between Highway 43 to the west Highway 99 to the east and the cities of Delano to the north and Bakersfield to the south. The Project starts at 35°22'43.78"N and 119° 5'17.02"W, and ends at 35°23'9.46"N and 119° 4'12.61"W.

Figure 1, included immediately following Section 1.4, shows the location of the District. Figure 2 shows the location of the proposed Project. Figure 3 shows portions of the Calloway Canal that have been lined or are planned to be lined under previous and ongoing agreements with Reclamation.

1.3 Technical Project Description

The scope of the Project consists of lining 5,280 LF of the currently unlined portion of the Calloway Canal between Fruitvale Avenue and the CVC Intertie. The Project will be implemented under the District's direction. Ram Venkatesan, Deputy General Manager and California licensed Civil Engineer will serve as Project Manager and will provide oversight of the project including coordination with the designated construction manager and contractor.

Construction of the Project will be performed by a contractor that will be selected through a competitive bidding process. The construction contract will include furnishing and installing all components necessary to the Project. Consistent with 3.5 miles of previously lined portions of the Calloway Canal, construction will include trimming the canal to a trapezoidal prism with a 50-foot-wide bottom, 3-to-1 side slopes, and a nominal depth of 8.5 feet and then lining it with 4-inch-thick unreinforced concrete. The construction contract will consist of preparing, modifying, re-shaping, and lining approximately 5,280 LF of existing canal including subgrade preparation; relocation of fill dirt; placement, compaction and grading of fill; and other necessary components as defined in the specifications that will be developed during the design phase. The contractor will also be responsible for securing necessary permits and including costs for permits in their proposal.

Costs for other tasks such as Grant Administration, Reporting, Environmental Compliance, Design, Labor Compliance, and Construction Management will be incurred by the District and are not included in this application budget as either Federal or Non-Federal funding, thus they are not described in detail herein. However, the District will comply with all requirements of an agreement including reporting deliverables and environmental documentation and compliance.

1.4 Evaluation Criteria

1.4.1 Evaluation Criterion A – Quantifiable Water Savings

Describe the amount of estimated water savings.

The amount of water conserved by the proposed Project is estimated to be an average of **1,056-acre feet (AF) per year**. The estimated water savings were calculated based on reduction of "irrecoverable" canal seepage (based on historical use of the Calloway Canal) and increased utilization of the Calloway Canal after it is concrete lined to convey water by the district and on behalf of Cawelo Water District. Current losses and support of estimated water savings are included below.

Canal Lining

How has the estimated average annual water savings that will result from the project been determined? How have average annual canal seepage losses been determined?

Historical flow data were compiled (monthly) at various locations along the Calloway Canal as reported in the *North Kern Water Storage District Calloway Canal Diversion Summary* available in the annual *Kern River Reports* prepared by the City of Bakersfield. These data have been summarized in Table 1-1 for the period extending from 1990 through 2010. The tables referenced in this section have been included following Section 1.5. This Diversion Summary indicates that the Calloway Canal has been predominantly used during “wet” hydrologic years and has been used sparingly during “dry” periods, largely due to the high seepage losses associated with its historically unlined condition.

Flow measurements at two locations along the canal (namely, the Buck Owens Weir and the Olive Drive Weir) were used to determine the average annual seepage losses. The amount of water lost due to seepage was calculated as the difference in water measured at the two weir locations, assuming evaporative losses are negligible. As summarized in Table 1-2, an average of 6,975 AF per year was lost to seepage in the 6.2 miles between the weirs. This equates to 1,125 AF per year, per mile of canal (6,975 AF / 6.2 miles). However, the average annual or monthly values are not reflective of daily seepage rates because the canal is only operated for parts of the year. Table 1-3 considers only the summer periods when the canal was typically operated for an entire month. During these periods, the average monthly loss was 1,994 AF per month or 322 AF per mile, per month. **This implies a daily seepage rate of 11 AF per day, per mile (transit loss reduction).**

As noted in the Diversion Summary (Table 1-1), Calloway Canal operations averaged 3.14 months per year, or 96 days per year. The length of the canal to be lined as part of the proposed Project is roughly 5,280 feet (or 1 mile). Therefore, based solely on the historical use of these facilities, the amount of avoided seepage attributable to the proposed Project can be estimated as **1,056 AF/year**.

Additionally, Table 1-1 shows that the average annual flow between the two weirs is 31,458 AF. Therefore, the percentage of the historical flow to be conserved by lining is about 3.3 percent (1,056 acre-feet of avoided canal seepage / 31,458 acre-feet annual flow). Additionally, from time to time, delivery of water can be accomplished by exchange with North Kern with this exchange being captured in the weir measurements. The quantification methodology has been discussed in detail under Section 1.5, Performance Measures.

$$\text{Project Savings} = 11 \text{ AF/day/mile} \times 1 \text{ mile} \times 96 \text{ days/year} = \mathbf{1,056 \text{ AF/year}}$$

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Consistent with 3.5 miles of previously lined portions of the Calloway Canal, construction will include trimming the canal to a trapezoidal prism with a 50-foot-wide bottom, 3-to-1 side slopes, and a nominal depth of 8.5 feet and then lining it with 4-inch-thick unreinforced concrete.

1.4.2 Evaluation Criterion B – Renewable Energy

1.4.2.1 Subcriterion No. B.1: Implementing Renewable Energy Projects Related to Water Management and Delivery

The proposed project does not include construction or installation of renewable energy components. However, efficiencies from the project stemming from lining the Calloway Canal help offset the impacts of climate change by reducing greenhouse gas emissions as described in Section 1.4.2.2.

1.4.2.2 Subcriterion No. B.2: Increasing Energy Efficiency in Water Management

Describe any energy efficiencies that are expected to result from implementation of the water conservation or water efficiency project.

Energy efficiency will be captured by using the proposed Calloway Canal Lining segment to convey the District's Kern River Water and Cawelo's Kern Exchange water. Transport through this route would create energy savings by eliminating seepage losses in the reach, thereby reducing the need to pump an equivalent amount of groundwater to meet in-district irrigation demands.

The primary energy efficiency is expected to result from lining the segment of the Calloway Canal is an equivalent amount less of groundwater pumped to the amount of the seepage eliminated to meet irrigation demands. The surface water deliveries measured at the Weir represents the District's historical Kern River Water and Cawelo's Kern Exchange water deliveries, which are expected to occur in the future at a frequency of wet years similar to the past and possible increases of use due to timing of flows changing with climate change.

In addition, as second energy benefit is the amount of annual seepage saved will correspond to a long-term incremental increase in groundwater elevation through recharge, resulting in an incremental reduced pumping lift for all groundwater pumping over time to meet the district's irrigation demands. This can be estimated using the representation of total pumping that occurs in North Kern in dry years. North Kern maintains about 100 deep wells that pump groundwater into their distribution system, mainly using the Calloway Canal as a regulating reservoir for daily deliveries. North Kern can cycle the deep wells on and off to match off-peak energy rates in most dry years. This ability to cycle on and off typically occurs until very dry conditions during peak irrigation months, where the district needs to run wells continuously to meet irrigation demand.

If quantifiable energy savings is expected to result from the project, please provide sufficient details and supporting calculations. If quantifying energy savings, please state the estimated amount in kilowatt hours per year.

The quantifiable energy saving expected have two components for the Project. An average annual energy savings based on the conserved seepage number in water savings calculation (1,056 AF/Y). A second component is the long-term incremental savings, represented by the average change in the depth to groundwater elevations over the District's irrigated acres for the life of the project.

The change in elevation is based on an assumed rise in water table over the lifespan of the project. This change is calculated by first finding the amount of water saved per District irrigated acre ((50 yr x 1,056 AF/yr) / 52,000 irrigated acres = 1.02 AF water per acre). Assuming 0.18 AF of water per 1 foot rise, the rise in the water table is calculated as follows:

$$[1.02 \text{ AF/ac} \times (1 \text{ ft} / 0.18 \text{ AF})] / 2 = 2.82 \text{ ft of rise water}$$

The total energy savings is determined using the difference between the pre-project and post-project energy use. The assumed pre-project total dynamic head (TDH) or average static water level is 424 feet, and the AF represents the average groundwater pumping in dry years. The post-project total dynamic head (TDH) is adjusted by the rise in the water table and ground water pumping is adjusted by the conserved seepage number. The pre-project and post-project components are calculated using the follow equations:

$$\text{Water hp} = \text{TDH (ft)} \times \text{flow rate (GPM)} \times 449 \text{ GPM/cfs} / 3960.$$

$$\text{Input hp} = \text{Water hp} / \text{overall pump efficiency (OPE)}.$$

By dividing the Input hp by the flow rate and converting the amount to kWh/AF, the estimated energy savings can be found by multiplying the kWh/AF by the average groundwater pumping (AF) in dry years.

The total difference in energy use in a representative dry year pumping groundwater is **1,359,012 kilowatt hours per year (kWh/yr)** or 576 metric tons of carbon dioxide equivalent per year (MTCO₂e/yr). The energy calculation is shown in Table 1-4 following Section 1.5. It is anticipated the energy savings of this magnitude would occur in 4 out of 10 years that are considered dry and require North Kern to pump groundwater (previously recharged and stored surface supply) to meet irrigation demands. Canal lining improvements are expected to last 30 to 50 years.

How will the energy efficiency improvement combat/offset the impacts of climate change, including an expected reduction in greenhouse gas emissions.

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Given that the impacts of climate change may result in a reduction of available water supplies, the dependence on local aquifers has increased substantially. By lining the canal section, surface water supplies delivered through the canal are better managed and seepage losses are eliminated. As a result, the quantity of groundwater pumping will decrease, thereby removing the need to replenish depleted groundwater storage.

The quantity that would be lost due to seepage is 1,056 AF/year. The reduction in greenhouse gas emission is equal to the energy saved because of reduced pumping. The calculation for energy reduction is as follows:

$$1,359,012 \text{ kWh/yr} \times 0.001 \text{ MWh/kWh} \times 0.4241 \text{ MTCO}_2\text{e/MWh} = 576 \text{ MTCO}_2\text{e/yr}$$

If the project will result in reduced pumping, please describe the current pumping requirements and the types of pumps (e.g., size) currently being used. How would the proposed project impact the current pumping requirements and energy usage?

Current pumping requirements range from 1,462 AFY in wet years (2019) and 110,285 AFY in dry years (2020). For the energy usage, the pumping requirement of 107,926 AFY or the average of dry years 2016 and 2020, was used. The district maintains use of approximately 100 deep groundwater wells as part of the conjunctive use program. Wet year supplies from the Kern River are recharged which are then available for recovery in dry years. Well sizes and pumping info is shown in the attached 2021 Well Report Table in Appendix B.

The project will result in **1,056 AFY** less ground water pumping and result in a long-term incremental reduction in pumping lifts as indicated in the calculations on energy reduction.

Please indicate whether your energy savings estimate originates from the point of diversion, or whether the estimate is based upon an alternate site of origin.

The energy savings are estimated based on the use of up to 100 District owned wells during dry years that supplement the surface water deliveries available from the Kern River. North Kern recharges the groundwater during wet years which is stored in the groundwater beneath the District for recovery of Kern River water supply in dry years.

Does the calculation include any energy required to treat the water, if applicable?

No. The District uses non-treated, potable water that is suitable for Agricultural Irrigation use.

Will the project result in reduced vehicle miles driven, in turn reducing greenhouse gas emissions? Please provide supporting details and calculations.

No, GHG reduction is realized through reduced pumping and reduced vehicle miles is not relied on as a measure of reduced greenhouse gas emissions for this project improvement.

Describe any renewable energy components that will result in minimal energy savings/production (e.g., installing small-scale solar as part of a SCADA system).

While the proposed Project does not add additional renewable energy components, the District has recently upgraded their entire SCADA system and included some small-scale solar sites to run PCLs in remote access areas.

1.4.3 Evaluation Criterion C – Sustainability Benefits

1.4.3.1 Enhancing Drought Resiliency

North Kern Water Storage District is part of the Poso Creek IRWM group, which includes several water districts in Kern County. This group was established with a primary purpose of achieving regional collaboration by identifying long-term goals to improve water sustainability within Kern County. The Calloway Canal Lining was identified as an important component in the Poso Creek IRWM Group Plan Update, 2014, to deliver surface supplies to the basin more efficiently, and improve operational flexibility and efficiency within the region. Additionally, the Group is also in the process of developing a Drought Contingency Plan (DCP) in a collaborative effort with Reclamation. The DCP seeks to develop short- and long-term planning to mitigate impacts of drought in the region. As part of this, mitigation actions were developed to help prepare for and better manage during dry or drought periods. One such mitigation action identified for North Kern is the Calloway Canal Lining. This component of the Calloway Canal adds drought resiliency to Kern River water supplies delivered using the Calloway Canal.

Does the project seek to improve ecological resiliency to climate change?

Overall, the canal lining implies lesser dependence on groundwater. This is essential considering the lack of surface water supplies owing to the constraints on conveyance of contract supplies into the region and the occurrences of severe drought in the basin, which are expected to occur more frequently with climate change. Conserved water will go towards meeting existing agricultural demand within North Kern presently met by pumped groundwater, improving the use of groundwater supplies for all uses, since surface supplies conveyed in the Calloway Canal will no longer seep into the groundwater in an area where the water quality of the recovered groundwater would not be suitable for irrigation without costly treatment. Lining the Calloway Canal will minimize seepage losses and help with flexibility for timing of deliveries, which helps ecological resources and resiliency in the region to combat climate change.

Will water remain in the system for longer periods of time?

Lining the Calloway Canal will keep the water in the system for longer periods of time by reducing seepage loss. With lining, the Calloway Canal will be able to deliver more Kern River water to the District, which will help to reduce pumping usage and maintain groundwater levels in the region. As previously discussed, unlined portions of the canal currently lose 11-acre feet per day, per mile from seepage. Lining will seek to mitigate this loss with water savings the

District will directly benefit from over the lifespan of the project which is expected to be 50 years.

Will the project benefit species?

By reducing seepage to marginal quality groundwater, reducing pumping demand on higher quality groundwater, and helping support groundwater elevations underlying irrigated lands, the proposed Project has the potential to benefit local species. Kern County has more than two dozen threatened and endangered species. As demonstrated by the Kern Water Bank, actions that support local groundwater may assist in restoring wetland and upland habitat via in-lieu groundwater recharge. Species that may benefit include the San Joaquin kit fox (*Vulpes macrotis mutica*); Tipton kangaroo rat (*Dipodomys nitratooides nitratooides*); and San Joaquin woolly threads (*Monolopia congdonii*).

The proposed Project will indirectly benefit federally listed threatened or endangered species by improving the regulation of water supplies that have been rendered less reliable due to the imposition of measures designed to protect threatened and endangered species. These measures include seasonal pumping restrictions in the Sacramento River-San Joaquin River Delta (Delta) and restoration of flows below Friant Dam on the San Joaquin River. The pumping restrictions reduce the amount and constrain the timing of deliveries of SWP and Central Valley Project (CVP) water pumped from the Delta and the deliveries of CVP-Friant Division supplies. The Poso Creek Region, to which North Kern belongs, includes districts with contracts for water from both of these sources. With regard to the San Joaquin River, the relevant species is the federally threatened (spring run)/endangered (winter run) Chinook Salmon.

The proposed Project also contributes to the State's co-equal goals, as defined in the Amended Memorandum of Agreement Regarding Collaboration on Planning, Design and Environmental Compliance for the Delta Habitat Conservation and Conveyance Program in Connection with the California Bay Delta Conservation Plan (First Amendment MOA Collaboration BDCP, December 15, 2011). The implementation of co-equal goals is intended to provide reliable water supply for California while protecting, restoring, and enhancing the Delta ecosystem and habitat (SB1, Steinberg- Section 85054). The reach of the Calloway Canal proposed to be lined under this grant proposal, will enhance the use of the Calloway Canal in wet years to enhance flexibility in timing and to complete exchanges of water deliveries that may help with the environmental water deliveries.

With regard to the Delta, relevant species include the following:

- Delta smelt (*Hypomesus transpacificus*) federally threatened;
- Longfin smelt (*Spirinchus thaleichthys*), San Francisco Bay-Delta distinct population segment (DPS), federal candidate;
- Green sturgeon (*Acipenser medirostris*), southern DPS, federally listed threatened;
- Steelhead (*Oncorhynchus mykiss iridium*), California Central Valley DPS, federally threatened;

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- Chinook salmon (*O. tshawytscha*), winter-run, federally endangered; and
- Chinook salmon (*O. tshawytscha*), Sacramento River spring-run, federally threatened.

Will the project directly result in more efficient management of water supply?

Implementation of the Proposed Project will lead to the more efficient management of water supply by allowing for the full delivery of Kern River supplies, which the District relies on to support drought resiliency in the region. A key concern in the basin is the ability to manage water to maintain groundwater levels and provide water for irrigation. By lining this portion of the Calloway Canal, more water can be delivered to the District leading to a reduction in groundwater pumping during dry years when the groundwater system is stressed due to drop in water levels. This also allows for the better use and flexibility of the District's conjunctive use system.

1.4.3.2 Addressing a specific water and/or energy sustainability concern(s)

Will the project address a specific sustainability concern?

This project addresses the issue of supply reliability, a concern that is crucial to the sustainability of the region. The loss of water supply reliability/shortages due to regulatory and judicial actions, as well as climate change and drought, is a fundamental regional concern identified in the Poso Creek Integrated Regional Water Management (IRWM) Plan when it was first drafted in 2007. The proposed Project will aid in addressing this concern at a regional level by substantially completing a series of improvements, constructed over several years, which collectively provide another viable route for effectively conveying imported water into the region. Further, having an additional lined route provides a level of redundancy in regional water conveyance which did not previously exist for getting the most out of wet year water deliveries.

The San Joaquin Valley portion of Kern County falls into a category of critically stressed groundwater basins. Lining the Calloway Canal and implementing Water Delivery Improvements (as described herein) will allow for more efficient delivery of available surface water supplies to the basin; improve the flexibility of the extensive conjunctive use operations within the region; and reduce groundwater pumping during dry years when the groundwater system is subjected to the greatest stress.

The Kern River is the main source of water to the District and is a significant source of supply to other water agencies in Kern County. Implementation of this Project will help facilitate the long-term goal of the Poso Creek IRWM Group to line segments of the Calloway Canal. Lining the canal will prevent a significant amount of water from being lost to seepage and will provide an ideal conveyance facility to provide flexibility for exchanges to bring more surface water into the valley. This process will reduce dependency on the Kern River by giving the District flexibility to time their diversions from the river.

As mentioned previously, this portion of Kern County is categorized as being in a critically overdrafted basin by the Department of Water Resources. Additionally, this region is perpetually in drought with the last 7 out of 10 years classified as dry years. Therefore, the District has prioritized maximizing the use of surface water when available to offset pumping groundwater to meet agricultural demand. As mentioned in section 1.4.1, by lining the canal, the District conserves 1,056 AF/year of surface water that would have otherwise been lost due to seepage. Conserved water (1,056 AF/year) will contribute to meeting existing agricultural demand within NKWSD that is presently being met by pumping groundwater in an area where the water quality of recovered groundwater is not suitable for irrigation without costly treatment. Historical data show the presence of petrochemical discharge present in the groundwater (Figure 4). The presence of phenol makes the groundwater unusable without secondary and tertiary treatment. Any measures which minimize seepage to poor quality groundwater and enable delivery of conserved surface water directly to water users improves the efficiency of water management in the region, reduces demand on the Delta and supports the environmental objectives of the California Bay-Delta Conservation Plan and the San Joaquin River Restoration Program.

1.4.3.3 Other Project Benefits

Disadvantaged or Underserved Communities

Local communities, rural residences, and businesses also rely on groundwater from the Kern County Subbasin (Subbasin) as their main supply. Should climate change result in a reduction in water available from traditional surface supplies, the increased frequency of groundwater pumping, from agricultural water districts and other users, will lead to a decrease in groundwater storage without the necessary means of replenishing the depleted storage. Climate change concerns, such as those listed above, set a high priority for canal lining as it will help conserve water lost from seepage that can be used for recharge in the shared basin of which communities rely on as groundwater supplies for drinking water purposes.

Will the project benefit multiple sectors and/or users?

As an example of how lining a regional canal can provide multiple benefits, lining this segment of the Calloway Canal will enhance surface water exchanges between Cawelo Water District and Buena Vista Water Storage District. Previously lined sections of the Calloway Canal helped with cooperative water management with the City of Bakersfield (City). Water diverted at the Beardsley weir is delivered to North Kern via the lined Beardsley Canal with negligible losses. Lining the proposed reach of the Calloway Canal will, in combination with previously lined reaches, allow North Kern to continue to cooperate with neighboring districts and the City to achieve the stated multi sector benefits while also mitigating canal seepage loss that would otherwise be experienced with this alternative conveyance route.

For example, in 2016, the City prepared an Environmental Impact Report¹ (EIR) for a proposed Project with a goal of providing a “restored and more consistent flow of water in the Kern River throughout the Bakersfield city limits”, citing benefits which included quality of life, recreation, and aesthetics. The flow management and water supply program specifically focused on flows in the Kern River below the Calloway Weir. In 2019, North Kern cooperated with the City in this regard by diverting some of its Kern River water at the Bellevue weir instead of the Beardsley weir, thereby allowing water to flow in the river through town before being diverted, thus contributing to the City’s goal to improve recreation, aesthetics, and quality of life. At the Bellevue weir, the water was diverted into the Cross Valley Canal and then into the Calloway Canal for delivery into North Kern.

Will the project benefit a larger initiative to address sustainability?

In 2014, the state of California passed the Sustainable Groundwater Management Act (SGMA), which presented a timeline for realizing sustainable groundwater management. As a member of the Kern Groundwater Sustainability Agency, North Kern has prepared a Management Area Plan under the Kern Groundwater Authority Groundwater Sustainability Plan (KGA GSP) in compliance with SGMA. Funding and completion of the proposed Project has been included in North Kern’s Management Area Plan as one of several actions that it has determined are necessary to comply with the SGMA. North Kern’s Management Area Plan was finalized in January 2020 and is now in review by the California Department of Water Resources (DWR).

Regarding CVP-Friant supplies, the San Joaquin River Restoration Program includes a water management goal. In particular, the goal is to reduce or avoid adverse water supply impacts to the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided by the restoration program. San Joaquin River restoration efforts envision a program whereby some of the water which was historically diverted into the Friant-Kern Canal will be allowed to flow past Millerton Dam in the San Joaquin River and subsequently diverted into the California Aqueduct and conveyed to and into the Cross Valley Canal for delivery, either directly or indirectly, to Friant Division contractors within Kern County. Diversion of such water from the Cross Valley Canal into the Calloway Canal supports this type of operation and the proposed canal lining improves delivery efficiency for use of segments like this Project in non-wet year operations as additional exchanges may occur once lined.

Because of mismatches in timing between supply and demand, regulation will be necessary to correct these imbalances. The Poso Creek Region includes three CVP-Friant contractors which collectively account for about 25 percent of the Friant Division’s Class 1 supply. Two of these entities have already entered into banking arrangements with NKWSD to regulate their contract water supplies and thereby mitigate adverse water supply impacts. Refer to Figure 6 for CVP and SWP water conveyance routes which are involved with the various water banking arrangements.

¹ City of Bakersfield Community Development Department, *Notice of Availability of a Recirculated Draft Environmental Impact Report for the Kern River Flow and Municipal Water Program and Public Hearing*, (2016)

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This directly supports the Settlement Agreement through furtherance of the water management goal.

Lining this segment of the Calloway Canal may also benefit the State of California and Reclamation since it improves delivery efficiency for a regional conveyance route that can be used to help manage recirculation water, though use of exchanges, to meet the San Joaquin River Restoration Water Management Goal.

1.4.4 Evaluation Criteria D – Complementing On-Farm Irrigation Improvements

Describe any planned or ongoing projects by farmers/ranchers that receive water from the applicant to improve on-farm efficiencies

In 2015, NRCS announced the North Kern Water Improvement Project that provides funding through the Bay Delta Initiative for Northern Kern County. The District has a history encouraging direct coordination between the NRCS and growers. The District communicates regarding funding programs with local NRCS staff. As a result, growers within the District have frequently applied to NRCS for funding of on-farm improvements. For example, in 2020, the District received summary information from the NRCS indicating that 833 contracts with individual landowners within Kern County have been signed from 2010 to 2020, demonstrating a high level of cooperation between growers, districts in the County, and the NRCS. The 833 contracts equated to roughly \$55M being brought into the region. In addition, in 2020, the North West Kern Resource Conservation District (NWKRCDD) provided assistance to the NRCS to process 171 incoming EQIP applications, of which 41 were funded for a total of \$4,217,160.

Although North Kern does not have a capital program to fund on-farm enhancements, the District coordinates with local NRCS staff working directly with growers who have applied to the NRCS for funding of on-farm improvements. Because the names of applicants to NRCS programs remain confidential until funding has been awarded, the District does not have advance knowledge of the number of growers within the District who have requested NRCS funding or of the location of lands where on-farm improvements may be located. The local NRCS staff collaborates with North Kern and local growers regarding on-farm improvements through the Bakersfield Service Center (USDA, NRCS, Bakersfield Service Center, 5000 California Ave., Bakersfield, CA). NRCS is currently in discussions with North Kern to implement on-farm improvements that were part of recent Agricultural Water Use Efficiency (AgWUE) awards.

Given North Kern growers have already converted much of the District to low-volume irrigation systems such as drip and micro spray, the District provides some financial support for NRCS on-farm irrigation system evaluations using the Mobile Lab service operated by Brian Hockett of the North West Kern Resources Conservation District (NWKRCDD). These evaluations enable growers to improve operation of their existing systems, improvements that both increase the efficiency of their on-farm water management and enhance their management of nutrients such as nitrogen. North Kern is in the NWKRCDD service area and has funded irrigation system

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evaluations for growers for many years. NRCS funding could enable expansion of this Mobile Lab program.

Furthermore, the District is currently implementing technology to estimate evapotranspiration (ET) throughout its service area through a contract with LandIQ. This technology uses a Data Driven Method (DDM) to interpret remote sensing image data and leverage robust ground station data. Ground measurements from monitored Surface Renewal (SR) stations, and TuleTech stations generates hourly ET data, which will be correlated with satellite imagery. The District anticipates that the ET data generated through this process can be used by the growers to improve irrigation scheduling.

Describe how the proposed WaterSMART project would complement any ongoing or planned on farm improvement.

The Calloway Canal is a principal surface water conveyance facility which benefits the entire crop acreage within the District. This Project will serve as an excellent example to the water community of the value of such conservation projects. As part of the regional planning process, NKWSD has presented Project details and benefits to the other members of the Poso Creek Regional Water Management Group who have expressed interest in improving similar regional conveyance facilities that could further leverage the approach taken in this Project for assisting with on-farm improvements.

A primary on-farm benefit is the improved capacity to deliver surface water to irrigated lands that also rely on groundwater pumped from wells drawing from an aquifer immediately underlying the irrigation service area. The Calloway Canal allows for delivery of water directly to NKWSD, Cawelo Water District, and Shafter-Wasco Irrigation District and by exchange to Kern-Tulare Water District, Delano Earlimart Irrigation District and Southern San Joaquin Municipal Utility District. Surface water deliveries to irrigators allow groundwater to be conserved. North Kern practices conjunctive use, as do the neighboring districts, which means surface water, when available, replaces pumping of groundwater to meet irrigation demand. Additionally, with the introduction of Sustainable Groundwater Management Act (SGMA) regulations, utilizing every bit of surface water available in-lieu of groundwater is of utmost importance. Many growers within North Kern have purchased surface water rights that are typically available during non-irrigation months when there is no water demand. As a result, the growers store their water in spreading grounds or water banks, some located outside the District. The growers depend on multi-district conveyance infrastructure to bring the water back to their farm. The Calloway canal is perfectly located to return the banked surface water from outside the District to the individual landowners. Therefore, it is critical to line the Calloway canal to ensure maximum efficiency while returning the banked water to the landowners. If more surface water is available, less groundwater is pumped, resulting in less energy for the same total water use. As explained previously, the potential benefits of the Project due to reduced reliance on groundwater are directly associated with the 1,056 acre-feet of reduced seepage that will result from canal lining.

Describe the on-farm water conservation or water use efficiency benefits that are expected to result from any on-farm work.

The NRCS Environmental Quality Incentives Program (EQIP) is a voluntary conservation program that provides financial and technical assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. Growers apply directly to the NRCS for EQIP funding, and, since the applicants to the NRCS programs remain confidential until awarded funding, North Kern is generally not aware of the number of growers in the District who have applied for funding until the funding has been awarded. Nevertheless, the District strongly supports grower participation in EQIP as improved on-farm water use efficiency is the cornerstone for improved District and regional water management.

Expanded NRCS funding would benefit both growers and the District by 1) conserving water on irrigated cropland, and 2) reducing leaching of nutrients to groundwater by controlling deep percolation and improving nutrient management. The NWKRCDD provides the water conservation field services necessary to attain these objectives through their on-farm irrigation system performance testing.

The service area boundaries are the same as the District's boundaries, as shows in Figures 1 and 2.

1.4.5 Evaluation Criterion E – Planning and Implementation

1.4.5.1 Subcriterion E.1 – Project Planning

In July 2007, by Resolution of its governing Board of Directors, NKWSD adopted the Poso Creek IRWM Plan and the Plan Update in 2014. This plan was developed over a period of years in collaboration with neighboring districts and the Poso Creek Regional Water Management Group in accordance with guidelines published by the State of California. Subsequently, a Reclamation-funded System Optimization Review (SOR) was conducted for this group². Copies of the documents discussed below are available upon request.

Integrated Regional Water Management Plan

The Plan's Executive Summary identifies the following as the first strategy to be employed to mitigate projected reductions in the Region's surface water supplies:

“Maximize use of available surface water supplies using existing absorptive capability by coordinating mismatches between supply and demand within the Region, i.e., matching supply that exceeds demand in one district with demand that exceeds supply in another

² Semitropic Water Storage District acted as lead agency on the grant from Reclamation to help fund this work.

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district. This applies to both irrigation absorptive capability as well as spreading absorptive capability.”

By expanding the flexibility of water management options available in the region, limiting seepage to impaired groundwater, and reducing groundwater pumping volumes and lifts, the proposed Project is entirely consistent with, and in furtherance of, this strategy.

System Optimization Review (SOR)

The focus of the SOR was to prioritize the implementation of structural water management measures for the region based on their expected benefits to the region’s water supply reliability, and to identify and resolve institutional constraints to exchange water between districts and enhance the use of District groundwater banking facilities that will help mitigate the projected loss of water reliability to the region. The study is complete, and a memorandum was prepared in March 2010 regarding the Plan of Action resulting from the SOR. A Final Report was submitted to Reclamation in early 2011. The Plan of Action identified lining of the Calloway Canal as one of the structural measures required to optimize management of water supplies to the region.

Drought Contingency Plan (DCP)

As previously discussed, North Kern is in the process of developing a DCP with the other members of the Pos Creek IRWM Region. The purpose of the DCP is to focus on drought mitigation and planning to increase resiliency to drought conditions. In addition, planning procedures include developing operational and administrative framework to more efficiently implement drought emergency response actions. The DCP addresses the main elements of drought planning including drought monitoring; assessment of vulnerabilities; mitigation actions for long-term resiliency of drought; response actions; the operational and administrative framework for addressing monitoring, projects, and actions; and the drought plan update process. Mitigation actions in the plan are projects which will be developed for long-term resiliency to drought. Lining the Calloway canal has been identified in the DCP as a top priority to achieve drought resiliency.

1.4.5.2 Subcriterion E.2 – Readiness to Proceed Schedule

The proposed work is limited to construction. Construction includes preparing, modifying, re-shaping, and lining the canal, including subgrade preparation; relocation of fill dirt; placement, compaction and grading of fill; and other necessary components as defined in the specifications that will be developed during the design phase. The contract will be to “furnish and install” the Project, thus the contractor will be responsible for all equipment and permitting costs.

Permits

All necessary permits will be evaluated and filed prior to beginning construction. Apart from permits necessary as part of the CEQA and NEPA documentation, permits, including the NPDES

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SWPPP and PM-10 permits as well as any others that may be necessary to be compliant with all regulations, will be the responsibility of the awarded contractor.

The District will adhere to applicable laws, regulations, and codes and will ensure required approvals and permits are obtained. It is anticipated that some permits will be required. The awarded contractor will be responsible for obtaining all necessary permits and approvals. The Project is located exclusively within maintained rights-of-way owned and operated by North Kern. As such, it is expected that requirements for permits, and approvals will be minimal. The following potential permits and approvals will be addressed.

The construction specifications will include language relating to obtaining permits and approvals prior to construction. In particular, the standard language in the specifications state “The Contractor is an independent contractor and shall, at his sole cost and expense, comply with all laws, rules, ordinances and regulations of all governing bodies having jurisdiction over the work, obtain all necessary permits and licenses therefore...”. Such permits and approvals may include, preparing and implementing a Stormwater Pollution Prevention Plan pursuant to the National Pollution Discharge Elimination System (Clean Water Act Section 402) and obtaining a Construction Notification and Dust Control Plan to the San Joaquin Valley Air Pollution Control District. Additionally, a pre-construction survey for special-status species will be conducted by a qualified biologist immediately prior the start of construction.

Pursuant to Section 17.28.040(B)(5) of the Kern County Code of Ordinances, the District is exempt from obtaining a grading permit. Likewise, pursuant to Section 17.66.020(C)(7) of the City of Bakersfield Municipal Code, the District is exempt from obtaining a grading permit. Accordingly, the District will not seek a County or City grading permit.

Engineering and Design Work

Engineering design drawings have been prepared for segments of the Calloway Canal that have received funding in previous years, including final design drawings and contract documents prepared for bidding. The previously prepared design and bid documents have canal sections of the similar dimensions. If funded, North Kern will complete the design for the proposed area based on the designs that have already been completed.

Once the environmental documentation and design work is complete, the District will go out to bid for the construction phase of the Project. All necessary permits will be obtained prior to beginning of construction activities. The District plans to begin the necessary environmental documentation on April 1st, 2022 (post award date) and expects to complete construction by December 2023, with estimated completion of all construction management and reporting activities by March 2024.

The District has previously prepared several NEPA documents in consultation with the Reclamation for a previously lined canal sections. The District anticipates working closely with

Reclamation to prepare the environmental compliance document required to implement the proposed Project. Section 3 discusses environmental compliance in more detail.

Schedule

A schedule is included below. Because the proposed work is limited to construction, the detailed task in the schedule is limited to construction. However, the overall project duration has been included. Assuming funding is awarded, and an agreement is signed by April 1, 2022, the schedule includes an agreement start date of April 1, 2022. Contract documents will be provided by early 2023 for bidding purposes. Construction is estimated to begin in August 2023 and to be completed by December 2023. All Project work and a Final Project Report will be delivered by March 2024. The Project is not expected to deviate from Reclamation’s proposed start date of April 1, 2022, and completion is anticipated well within the 36-month grant duration. Upon receipt of a signed agreement, the first step would be completion of CEQA and NEPA compliance requirements for the Project area.

Table 1-5. Schedule

Milestone	Estimated Start Date	Estimated Completion Date
Agreement Signed	4/1/2022	4/1/2022
Project Duration	4/1/2022	3/31/2024
Canal Lining Construction	8/1/2023	12/31/2023

1.4.6 Evaluation Criterion F – Collaboration

Is there widespread support for the project? Please provide specific details regarding any support and/or partners involved in the project. What is the extent of their involvement in the process?

As previously discussed, North Kern is part of the Poso Creek IRWM Group which is comprised of several neighboring water districts in Kern County. The proposed Project was identified in the 2014 and 2019 Poso Creek IRWM Plan Update as it will all more efficient delivery of surface supplies to the basin and improve operational flexibility and efficiency within the region. Additionally, this project was also identified under the region’s DCP. A Letter of Support from the Group is included in Appendix A.

What is the significance of the collaboration/support?

This project is backed by significant planning and effort as it will benefit multiple water districts in the region. Not only does this project support the regional goals of the Group, but it further embodies the intent of the Integrated Regional Water Management (IRWM) Program to engage in integrated planning to achieve regional sustainability. The proposed canal-lining component involves the Calloway Canal, which is a water conveyance facility of regional importance. This facility, coupled with other previously completed improvements, provides a viable means for State, Federal, and previously banked water supplies to be delivered directly to NKWSD,

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Cawelo Water District, and Shafter-Wasco Irrigation District, as well as indirectly to Kern-Tulare Water District and Delano-Earlimart Irrigation District using exchange agreements. Both CEQA and NEPA documents have been completed to allow the districts to bank, exchange, and transfer water supplies over a 25-year period. Lining the Calloway Canal is integral to improving how water deliveries occur in the region, which is in-line with the Bay Delta Conservation Plan and current SGMA regulations.

Will this project increase the possibility/likelihood of future water conservation improvements by other water users?

As previously mentioned, North Kern is a participant in the Poso Creek IRWM Group. Projects that conserve water have been prioritized as part of the Group's goals outlined in the 2019 Poso Creek IRWM Plan Update (Plan). Implementation of the proposed Project supports the overall intent and purpose of the Poso Creek Plan as well as encourages collaborative efforts with participating member agencies to build off previous planning and construction efforts to conserve water. Participants of the Group have a long history of implementing projects with benefits beyond their district boundaries to support regional sustainability. Implementation of this project fosters increased collaboration and incentive to implement future water conservation improvement by other water users in the region.

1.4.7 Evaluation Criterion G – Additional Non-Federal Funding

$$\frac{\text{Non-Federal Funding}}{\text{Total Project Cost}} = \frac{\$ 2,224,000.00}{\$ 4,224,000.00} = 53\%$$

1.4.8 Evaluation Criterion H – Nexus to Reclamation

Does the applicant have a water service, repayment, or O&M contract with Reclamation? If the applicant is not a Reclamation contractor, does the applicant receive Reclamation water through a reclamation contractor or by any other contractual means? Will the proposed work benefit a Reclamation project area or activity?

Although NKWSD is not a Federal water contractor, they have already entered water banking deals with Federal water contractor neighbors such as Shafter-Wasco Irrigation District, Delano-Earlimart Irrigation District, Southern San Joaquin Municipal Utility District, and Kern-Tulare Water District. Reclamation's Friant-Kern Canal (FKC) flows through the District, which enables the District to bank water from the FKC on behalf of Kern-Tulare Water District and Delano-Earlimart Irrigation District during wet years, principally through use of North Kern's extensive spreading grounds. Figure 5 indicates the flow path of the FKC, and the spreading grounds located in the District, to effectively bank Reclamation's water on behalf of the Federal contractors. In another instance, Shafter-Wasco Irrigation District exchanges Reclamation's water with NKWSD by diverting water into their district from the more conveniently located Calloway Canal. North Kern effectively utilizes its absorptive capacity to bank excess water during wet years for its federal contractor neighbors and returns water to them during the dry

years using canals such as the Calloway Canal. Additionally, as discussed previously, the Calloway Canal provides an alternate conveyance route (Figure 5) for CVP supplies that maybe restricted by restrictions in the FKC. This enables operational flexibility for all these districts by allowing effective utilization of their surface water sources when available and promotes regional cooperation towards making this basin self-sufficient. The proposed Project is located in the Tulare Lake Basin, which also includes Reclamation's Friant-Kern Canal. The Project lands do not involve any Reclamation facility.

Is the applicant a Tribe?

The Project provide benefit to tribes nor is the applicant a tribe.

1.5 Performance Measures

Provide a brief summary describing the performance measure that will be used to quantify actual benefits upon completion of the project (e.g., water saved or better managed, energy generated or saved).

Following completion of the Project, measurements will be taken at Buck Owens and Olive Drive Weirs to estimate the volumetric loss of water. In addition, occasional stream gage measurements will be taken at locations between the Buck Owens Weir and Olive Drive weirs. These locations include segments of the Calloway Canal that were recently lined.

Historically, flow has been measured at various locations along the Calloway Canal and the resulting flow volumes have been recorded and reported in annual Kern River Hydrographic Reports. The reports used in this analysis cover the 21-year period from 1990 through 2010. These data demonstrate that the Canal has been used historically only in "wet" years, which is due in part to the high seepage loss rates. To evaluate the average annual seepage losses, two different flow measurement locations along the Canal were compared; specifically, the Buck Owens Weir (previously named Standard Weir) and the Olive Drive Weir (previously named Laborde Weir). These are sharp-crested weirs equipped with stage recorders and the discharge ratings are periodically checked with stream gaging methods. Considering all deliveries and inflows, the difference in flow volume between these two points is the amount of canal seepage (excepting a relatively small amount attributable to evaporation).

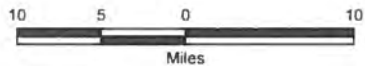
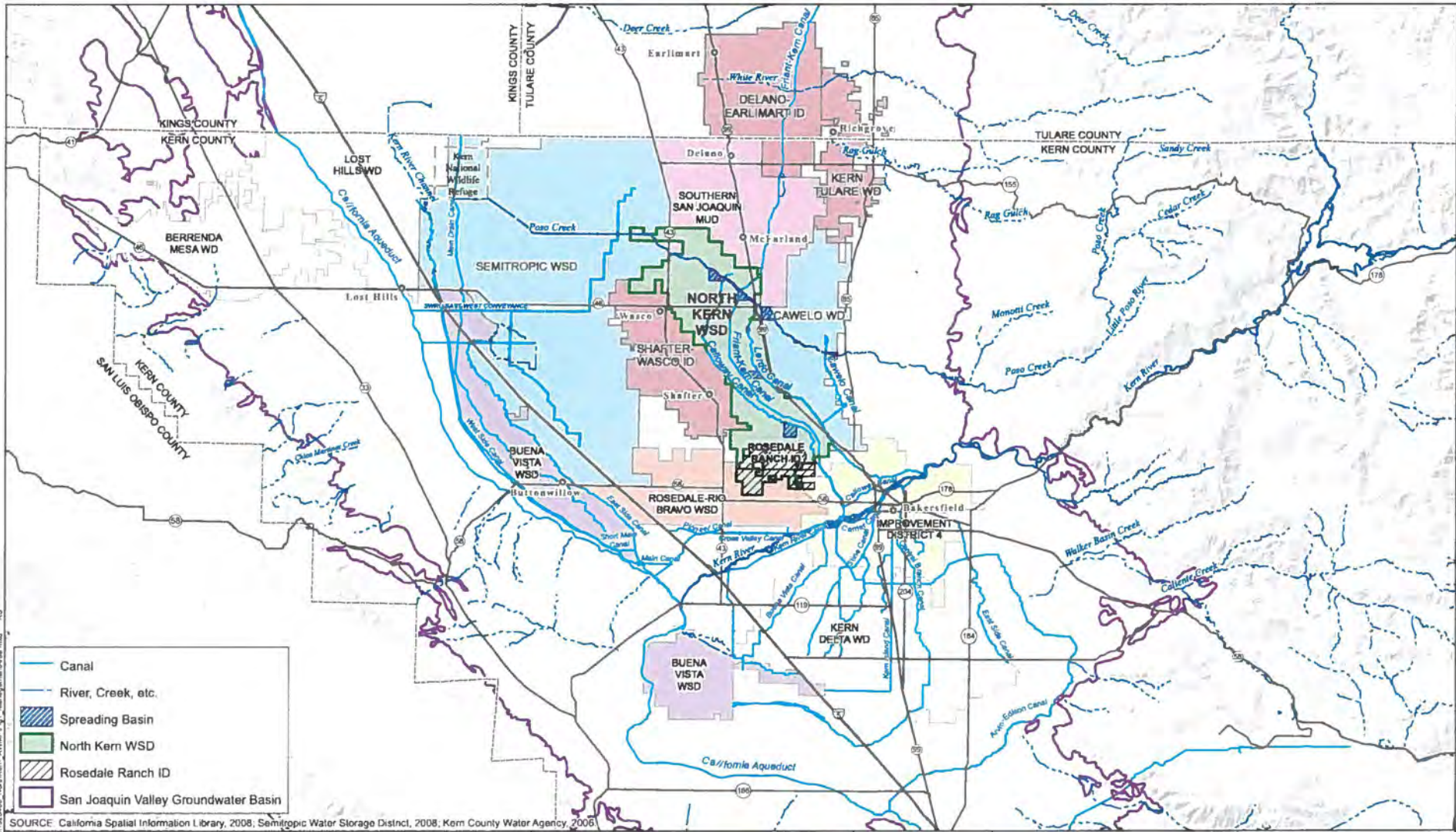
As summarized in Table 1-1, seepage loss at Buck Owens Weir, the 6-mile reach between the Buck Owens and the Olive Drive weirs, lost an average of 6,975 acre-feet per year over the 21-year period. Figure 3 shows the locations of the measuring points. Excluding the non-flow years and non-flow months, the average annual losses are about 12,200 acre-feet (AF) and the average monthly losses are about 1,017 AF (12,200 AFY/ 12 Mo). These numbers are higher and more closely reflect losses when water is flowing. However, during some of the months, the Canal was only operated for part of the month; therefore, averages are not truly reflective of daily losses. Considering only the summer months, when the Canal typically operated for the entire month

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[66 months over the study period, (Table 1-3), the average loss is 1,994 AF or 322 AF per mile. Based on a 30-day month, the implied average loss per day per mile is 11 AF per day per mile].

As mentioned previously, the completion of this Project will enable the District to consider use of the canal for conveyance in addition to the current conveyance of 31,458 AF of Kern River water. With an annual savings of 1,056 AF, this Project increases the efficiency of the canal by 3.4%.

The weir measurements in the annual hydrologic reports will be utilized to measure Project Performance.



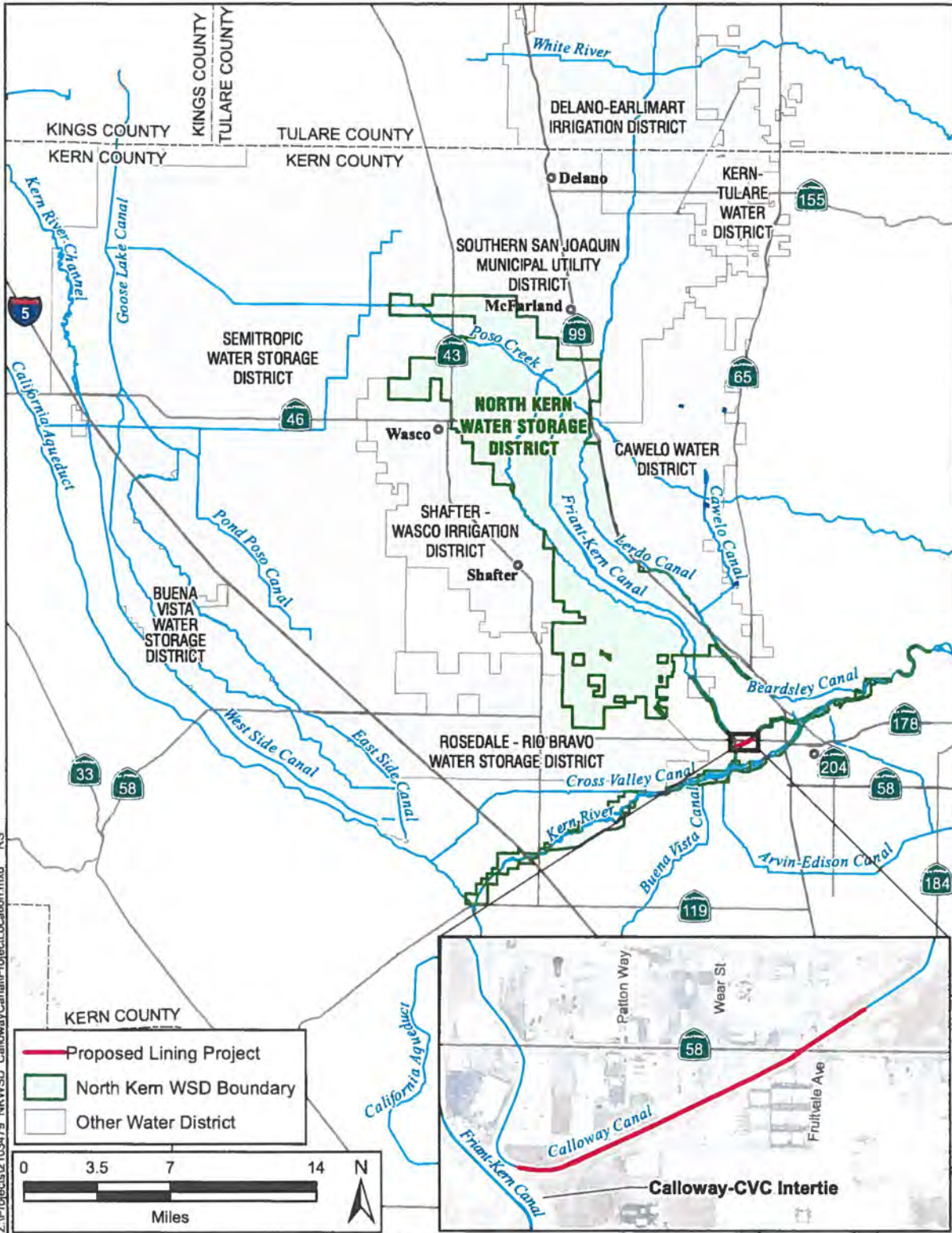
North Kern Water Storage District
Kern County, California



Location of District

NOVEMBER 2021

FIGURE 1



01-Nov-2021 Z:\Projects\103479_NKWSD_CallowayCanal\Project\Location.mxd RS

Water and Energy Efficiency Grant
Kern County, California

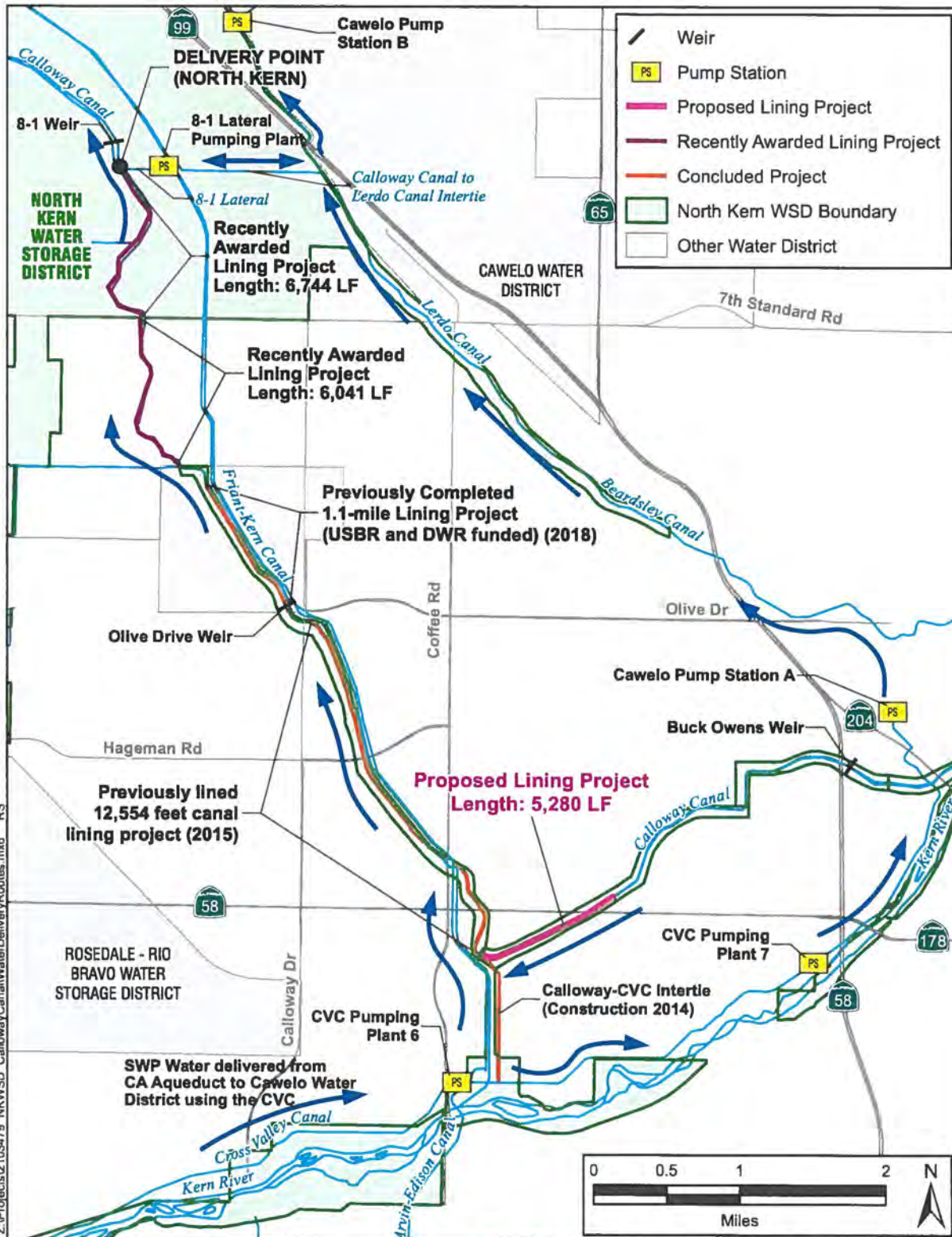
North Kern Water Storage District



NOVEMBER 2021

Project Location
Canal Lining

FIGURE 2



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Water and Energy Efficiency Grant
Kern County, California

North Kern Water Storage District



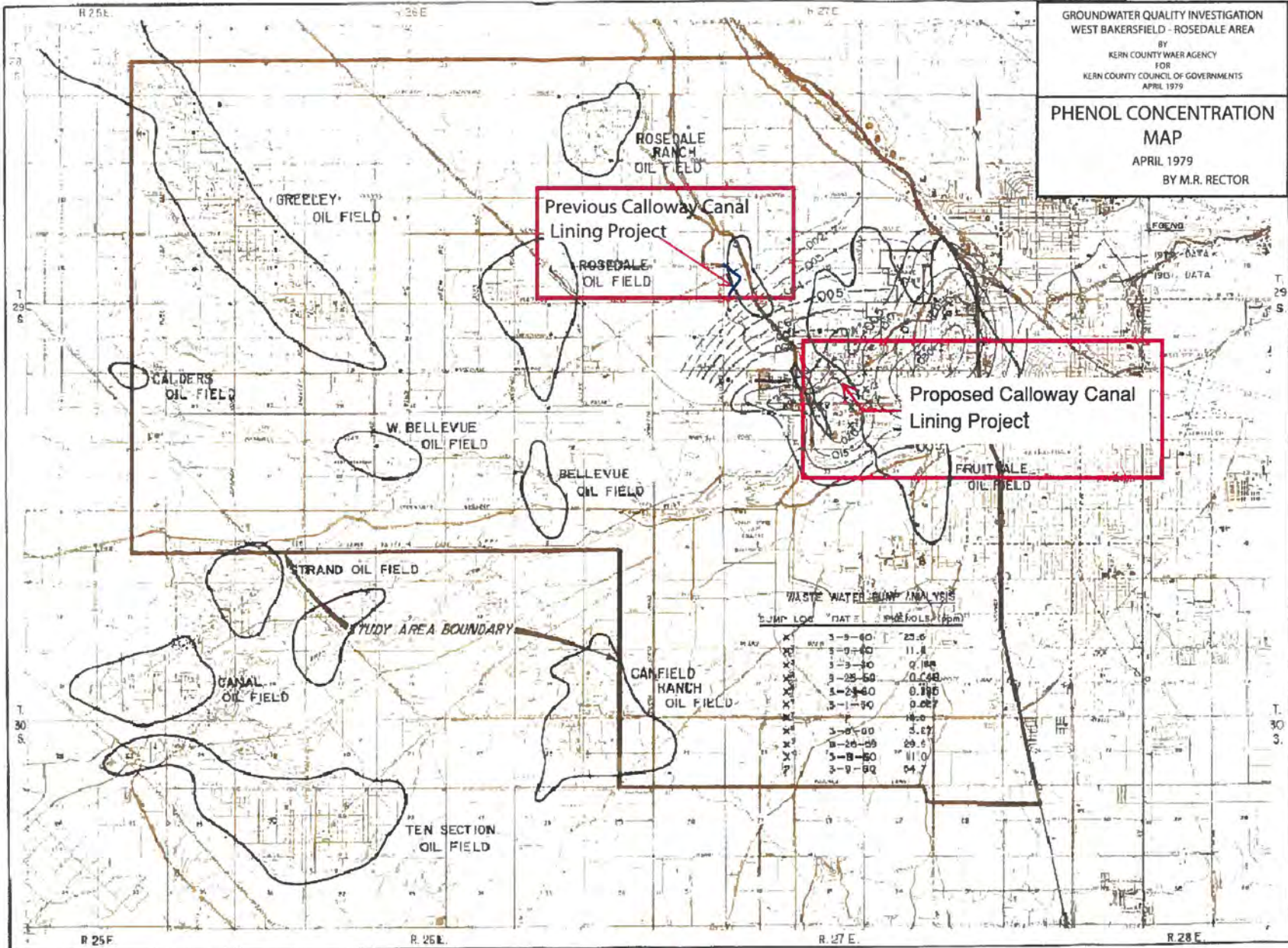
Water Delivery Routes
to North Kern WSD

NOVEMBER 2021

FIGURE 3

GROUNDWATER QUALITY INVESTIGATION
 WEST BAKERSFIELD - ROSEDALE AREA
 BY
 KERN COUNTY WAER AGENCY
 FOR
 KERN COUNTY COUNCIL OF GOVERNMENTS
 APRIL 1979

**PHENOL CONCENTRATION
 MAP**
 APRIL 1979
 BY M.R. RECTOR



North Kern Water Storage District

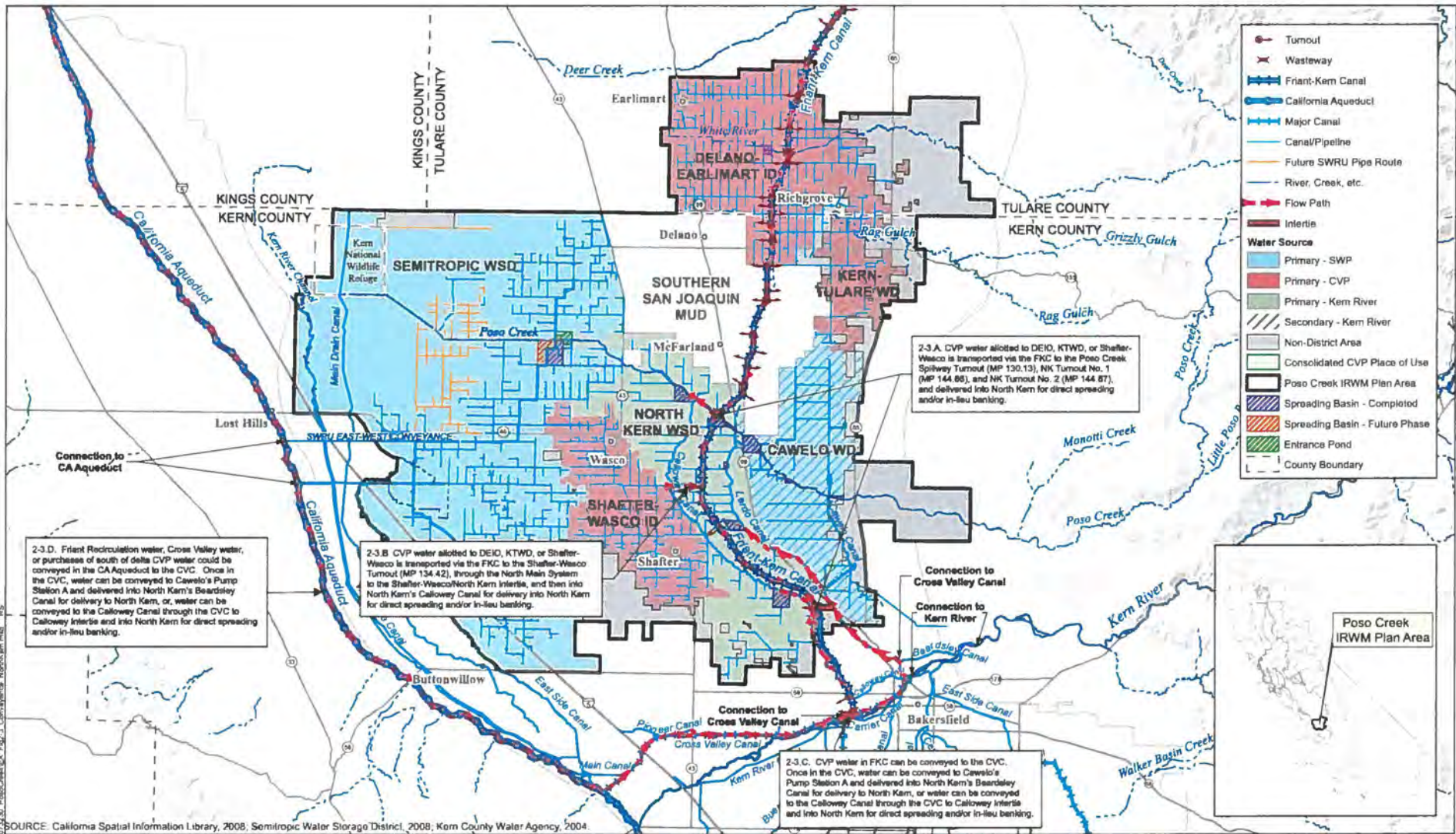
Kern County, California



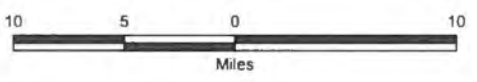
Phenol Concentration Map

NOVEMBER 2021

Figure 4



SOURCE: California Spatial Information Library, 2008; Semitropic Water Storage District, 2008; Kern County Water Agency, 2004.



**North Kern Water Storage District
Kern County, California**



CONVEYANCE OF WATER FROM POSO CREEK IRWM GROUP CVP CONTRACTORS TO NORTH KERN FOR GROUNDWATER STORAGE

NOVEMBER 2021

FIGURE 5

21-Aug-2021 11:23:00 PhotoCred: G.A. Esp. J. Contreras, NorthKern.mxd

Table 1-1
 Calloway Canal Flow at Buck Owens Weir
 (values in acre-feet)

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1990	-	-	-	-	-	-	-	-	-	-	-	-	0
1991	-	-	-	-	-	-	-	-	-	-	-	-	0
1992	-	-	-	-	-	-	-	-	-	-	-	-	0
1993	-	-	2,737	3,314	4,395	13,793	15,872	4,149	859	3,175	1,857	-	50,151
1994	-	-	-	-	-	-	-	-	-	-	-	-	0
1995	1,656	4,587	5,088	10,227	18,621	19,900	20,604	17,669	10,975	10,468	10,143	1,674	131,612
1996	1,370	1,638	766	792	12,948	11,700	12,355	7,857	1,222	1,065	-	-	51,713
1997	7,842	10,145	13,866	5,829	9,677	12,474	12,058	7,090	1,004	-	-	-	79,985
1998	5,461	5,011	5,827	5,940	8,279	18,434	22,526	20,013	10,584	1,764	-	-	103,839
1999	6,651	4,533	63	541	3,511	5,342	6,044	4,810	2,839	3,820	371	-	38,525
2000	-	476	1,081	-	-	-	-	-	-	168	20	4	1,749
2001	-	-	16	-	-	-	-	-	-	-	-	2,184	2,200
2002	1,486	-	-	-	-	-	-	-	-	-	36	44	1,566
2003	-	-	-	-	-	-	-	-	-	-	-	-	0
2004	-	-	-	-	-	-	-	-	-	-	-	-	0
2005	18	2,440	1,341	264	1,457	18,488	19,241	4,201	-	1,087	522	10,038	59,097
2006	12,113	-	559	1,656	22,387	29,151	26,337	5,687	327	-	-	-	98,217
2007	-	-	-	-	-	-	-	-	-	-	-	-	0
2008	-	-	-	-	-	-	-	-	-	-	-	-	0
2009	-	-	-	-	-	-	-	-	-	-	-	-	0
2010	-	-	4	454	12,174	10,488	14,104	-	-	-	-	4,744	41,968
Total	36,597	28,830	31,348	29,017	93,449	139,770	149,141	71,476	27,810	21,547	12,949	18,688	660,622
Average	1,743	1,373	1,493	1,382	4,450	6,656	7,102	3,404	1,324	1,026	617	890	31,458
Non-Zero Average	4,575	4,119	2,850	3,224	10,383	15,530	16,571	8,935	3,973	3,078	2,158	3,115	55,052

Source: Annual Hydrographic Reports for Kern River.

Table 1-2
 Seepage Losses between Buck Owens and Olive Drive Weirs
 (values in acre-feet)

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1990	-	-	-	-	-	-	-	-	-	-	-	-	0
1991	-	-	-	-	-	-	-	-	-	-	-	-	0
1992	-	-	-	-	-	-	-	-	-	-	-	-	0
1993	-	-	2,238	1,496	378	1,153	1,492	1,431	573	1,211	972	-	11,444
1994	-	-	-	-	-	-	-	-	-	-	-	-	0
1995	1,656	2,905	1,889	1,645	1,340	1,722	1,828	1,676	1,613	1,658	1,507	688	20,727
1996	926	678	587	710	2,321	1,560	1,598	1,710	778	1,305	-	-	11,873
1997	1,116	1,138	1,271	1,291	1,287	1,226	996	1,210	713	95	65	-	10,738
1998	1,862	1,244	1,269	986	1,287	1,601	1,271	1,037	1,214	914	560	-	13,245
1999	1,484	1,276	63	541	1,149	1,752	1,496	1,037	1,149	1,593	194	-	11,734
2000	-	476	1,081	-	-	-	-	-	-	168	20	4	1,749
2001	-	-	10	-	-	-	-	-	-	-	-	2,100	2,102
2002	1,363	-	-	-	-	-	-	-	-	-	36	44	1,443
2003	-	-	-	-	-	-	-	-	-	-	-	-	0
2004	-	-	-	-	-	-	-	-	-	-	-	-	0
2005	18	2,440	1,341	264	1,457	8,297	2,318	1,466	-	1,087	522	3,152	22,422
2006	2,152	-	559	1,656	3,379	3,675	3,423	2,717	327	-	-	-	18,518
2007	-	-	-	-	-	-	-	-	-	-	-	-	0
2008	-	-	-	-	-	-	-	-	-	-	-	-	0
2009	-	-	-	-	-	-	-	-	-	-	-	-	0
2010	-	-	4	454	7,511	4,913	5,045	-	-	-	-	2,376	20,403
Total	10,877	10,157	10,318	5,043	21,509	25,899	19,577	17,314	6,397	8,031	3,876	3,430	146,478
Average	518	484	491	431	1,329	1,233	930	586	305	382	185	401	6,975
Non-Zero	1,360	1,451	938	1,005	2,401	2,878	2,170	1,539	914	1,004	485	1,405	12,207
Average													
Maximum	2,152	2,905	2,238	1,656	7,511	8,297	5,045	2,717	1,613	1,658	1,507	3,152	22,422

Source: Annual Hydrographic Reports for Kern River

6,975 AF lost over 6.2 miles
 equals 11 AF/day/mile

Table 1-3

Seepage Loss between Buck Owens and Olive Drive Weirs (Full Flow Months)

(values in acre-feet)

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1990	-	-	-	-	-	-	-	-	-	-	-	-	0
1991	-	-	-	-	-	-	-	-	-	-	-	-	0
1992	-	-	-	-	-	-	-	-	-	-	-	-	0
1993	-	-	2,238	1,496	-	1,153	1,492	1,431	-	1,211	-	-	9,021
1994	-	-	-	-	-	-	-	-	-	-	-	-	0
1995	1,656	2,905	1,869	1,645	1,940	1,722	1,828	1,676	1,613	1,658	1,507	-	20,039
1996	-	-	-	-	2,021	1,550	1,598	1,710	-	1,305	-	-	8,194
1997	1,416	1,138	1,771	1,091	1,787	1,776	-	1,710	-	-	-	-	8,839
1998	1,862	1,244	1,269	-	1,287	1,601	1,271	1,037	1,214	-	-	-	10,785
1999	1,484	1,276	-	-	1,149	1,752	1,496	1,037	1,349	1,553	-	-	10,936
2000	-	-	1,061	-	-	-	-	-	-	-	-	-	1,081
2001	-	-	-	-	-	-	-	-	-	-	-	2,165	2,166
2002	1,363	-	-	-	-	-	-	-	-	-	-	-	1,363
2003	-	-	-	-	-	-	-	-	-	-	-	-	0
2004	-	-	-	-	-	-	-	-	-	-	-	-	0
2005	-	2,440	1,341	-	1,457	6,297	2,378	1,466	-	1,067	-	3,152	21,618
2006	2,152	-	-	1,656	3,979	2,675	3,423	2,747	-	-	-	-	17,632
2007	-	-	-	-	-	-	-	-	-	-	-	-	0
2008	-	-	-	-	-	-	-	-	-	-	-	-	0
2009	-	-	-	-	-	-	-	-	-	-	-	-	0
2010	-	-	-	-	7,511	4,913	5,045	-	-	-	-	2,375	19,845
Total	9,933	3,003	9,069	6,688	30,731	25,899	18,531	12,314	3,676	6,854	1,507	7,694	121,619

Source: Modified from Table 1

Total Months = 66
131,619 AF/ 66 Mo. = 1,994 AF/Month

66 full-flow months in 21 years =
3.14 months/year

Table 1-4
Energy Calculation

Annual Operational Electrical Energy Savings

Post-Project	Water hp	Q	TDH (ft)	OPE	Input hp	kWh/AF	AF	kWh	MWh	CO2e (MT)	Cost
Well Pumping	239	5	421.2	56.4%	423	764	106,870	81,651,576	81,652	34628	\$ 12,247,736

Pre-Project	Water hp	Q	TDH (ft)	OPE	Input hp	kWh/AF	AF	kWh	MWh	CO2e (MT)	Cost
Well Pumping	240	5	424	56.4%	426	769	107,926	83,010,588	83,011	35205	\$ 12,451,588

Assumptions

Difference =	(1,056)	(1,359,012)	(1,359)	(576)	\$ (203,852)
---------------------	----------------	--------------------	----------------	--------------	---------------------

Average Pre-project pumping depth = 424'
 Average Post-Project pumping depth = 421' adjusting for 2.8' rise in water table
 Average Pre-project District pumping of 107,926 AFY
 1056 AFY of reduced groundwater pumping
 Emission Factor conversion from MWh to kgCO2e = 424.1
 Ag Energy Rate Average = \$0.15/kWh

2. Project Budget

2.1 Funding Plan and Letters of Commitment

The District will designate monetary funds from their construction capital account, a District revenue account, for the Non-Federal Share of this Project. As needed, the District has sold bonds to fund projects. At this time, it is not anticipated that there will be any funding provided by anyone other than the applicant, aside from the requested Federal Share. The Budget Proposal does not include any costs that have been incurred prior to the award.

2.2 Budget Proposal

The proposed work is limited to construction; thus, the Budget Proposal and Budget Narrative have been limited to construction. The Project cost is estimated to be \$4,224,000. As shown in Table 2-1, the requested Federal Funding is \$2,000,000. The Budget Proposal is included as Table 2-2, including estimated unit cost and quantity.

Table 2-1. Total Project Cost

Source	Amount
Costs to be reimbursed with the requested Federal funding	\$ 2,000,000.00
Costs to be paid by the applicant	\$ 2,224,000.00
Value of third-party contributions	\$ -
Total Project Cost	\$ 4,224,000.00

Table 2-2. Budget Proposal

BUDGET ITEM DESCRIPTION	COMPUTATION		QUANTITY TYPE	TOTAL COST
	\$/Unit	Quantity		
SALARIES/WAGES				\$0.00
FRINGE BENEFITS				\$0.00
TRAVEL				\$0.00
EQUIPMENT				\$0.00
SUPPLIES AND MATERIALS				\$0.00
CONTRACTUAL				
Contract 1 - Construction	\$800.00	5,280	LF	\$4,224,000.00
THIRD-PARTY CONTRIBUTIONS				\$0.00
OTHER				\$0.00
TOTAL DIRECT COSTS				\$4,224,000.00
INDIRECT COSTS				\$0.00
TOTAL ESTIMATED COSTS				\$4,224,000.00

2.3 Budget Narrative

Estimated construction costs alone satisfy the required percentage of costs to be paid by the applicant; therefore, engineering and other tasks are not included in the Budget Proposal. Contractual construction costs are the only costs included in the Budget Proposal and are therefore the only costs discussed below. While not included in the Budget Proposal, the District understands environmental documentation and review must be completed prior to ground disturbing activities. Further, the District understands that costs incurred by Reclamation for environmental compliance and review may be withheld from the award amount.

Contractual

It is anticipated that a single contract will be awarded for all elements of Project construction including preparing, modifying, re-shaping, and lining approximately 5,280 LF of existing canal and other necessary components as defined in the specifications. The contract will be to “furnish and install” the Project; therefore, the awarded contractor will be responsible for all equipment, supplies and materials, and permitting costs.

The District will advertise that sealed proposals are being solicited for the construction of the Project. A contract will be awarded to the lowest responsible bidder, assuming the proposal is in line with the District’s cost estimate and/or is approved by the District’s Board of Directors.

The estimated cost is based on the District’s experience with similar canal lining projects and recent increases in prices noted by local contractors. Specifically, the price per linear foot (LF) of a previous project (construction contract NK 611, completed in December 2018) was approximately \$619. The NK 611 contract totaled \$3,434,618 for construction of 5,553 LF of canal lining ($\$3,434,618 \div 5,553 \text{ LF} = 618.52$). A local contractor familiar with this type of work estimated in October 2021 that pricing has increased by approximately 30%. This is in line with the District’s recent experience with other material cost increases; therefore, \$800 per LF was used to estimate the construction cost ($\$619 \times 1.30 = \804).

3. Environmental and Cultural Resources Compliance

In February 2006, North Kern completed an Initial Study (IS) for the 2006 System Operations Improvement Project, which included lining over a six-mile portion of the Calloway Canal. In January 2007, based on the IS, North Kern adopted a Negative Declaration for the 2006 System Operations Improvement Project. Given that the canal lining segment of the Project is east of the area and connects to the described canal reaches in the previous documentation, California Environmental Quality Act (CEQA) will need to be evaluated for the proposed Project.

For this past lining of the Calloway Canal that was under the 2006 CEQA documentation, Reclamation completed four Environmental Assessments (EAs), including the *Cawelo Water District Calloway Canal Lining Project – Reach A* (12-08-MP in December 2012), *Cawelo Water District Calloway Canal Lining Project – Reach B* (EA-14-02-MP in July 2014), *Cawelo Water District and North Kern Water Storage District Calloway Canal Lining Project – Reaches C1, C2, and D* (EA-15-01-MP in March 2015), *North Kern Water Storage District Calloway Canal Lining and Water Delivery Improvements* (EA-17-23-MP in October 2017). Reclamation prepared a combined Categorical Exclusion Checklist (CEC) for the *Calloway Canal Lining (North of Snow Road) and Water Delivery Improvements* and *Calloway Canal Lining (North of Snow Road 2200 LF to 6041 LF)*; the CEC was completed in April 2021. It is assumed that the Project will include a combined CEQA and NEPA evaluation that is like the previous environmental documentation completed for past Canal Lining projects. The District will assign the environmental and cultural compliance tasks to a Consultant who has worked through similar environmental evaluations with Reclamation on the past Calloway Canal Lining segments.

Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

The extent (footprint) of the proposed Project is relatively small and is located exclusively within maintained rights-of-way owned and operated by North Kern.

For the canal lining, earth-disturbing activities would include trimming the canal to conform to the lined prism (i.e., trapezoidal profile), which is not an extensive movement of quantities of material. All work on the site is subject to the requirements of an approved dust control plan as part of the San Joaquin Valley Air Pollution Control District's Rule 8021. The District will engage a qualified biologist to conduct a pre-construction survey shortly before the start of construction to ensure that the construction area remains unoccupied by sensitive (endangered) species. In addition, standard avoidance and minimization protocols will be included in the Project specifications and will be followed during construction. Moreover, the duration of the construction activity is expected to be relatively short (i.e., construction to occur over period of few months within the two-year window for utilizing the grant funds).

Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would these be affected by any activities associated with the proposed project?

As part of the NEPA process, Reclamation will prepare a Biological Assessment and complete consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA). Several federally listed wildlife and plant species, such as San Joaquin kit fox, kangaroo rat, blunt-nosed leopard lizard, Kern mallow, and San Joaquin woolly-threads, are known to occur in Kern County; however, it is anticipated that these federally listed species would not be affected by the proposed Project with the incorporation of avoidance and minimization measures. Finally, designated critical habitat is not located within or near the proposed Project area.

Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as “Waters of the United States?” If so, please describe and estimate any impacts the proposed project may have.

There are no wetlands or other surface waters inside the Project boundaries that fall under CWA jurisdiction as “waters of the United States”.

When was the water delivery system constructed?

North Kern’s canal and pipeline distribution system and related works were originally completed in the 1950s, with additional features and enlargements (e.g., pumping stations, discharge pipelines, and reservoir systems) constructed with the expansion of the District’s service area (i.e., increased water demand). Kern County Land and Water Company, who subsequently lengthened it to its current 30-mile length, originally constructed the Calloway Canal between 1875 by O.P. Calloway and 1877. Over time, the canal’s prism (i.e., trapezoidal shape), head gates, weirs and other features have been replaced, repaired, or improved to allow for greater capacity and flow delivery to water users (Districts). As of late, modifications have been made to accommodate commercial, housing, and road development as the City of Bakersfield has slowly been expanding to the north. It is worth noting that the Project will not result in any modifications or effects to individual irrigation system features (e.g., headgates, canals, or flumes).

Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

The proposed Project will not alter any existing features of an irrigation system other than placing a concrete lining in the existing canal prism.

Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.

Based on the past NEPA documents prepared for the Calloway Canal it was the only cultural resources located within the Area of Potential Effect (APE). The canal, however, was determined to not be eligible for inclusion on the National Register of Historic Places. Therefore, it is assumed the Office of Historic Preservation would concur with a finding of no historic properties affected during National Historic Preservation Act Section 106 consultation.

Are there any known archeological sites in the proposed project area?

Based on the past NEPA document prepared for the Calloway Canal segments, which included a pedestrian survey and record search, no prehistoric or historic-era archaeological sites were found. Therefore, it is assumed there are no archeological sites in the proposed Project area.

Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?

Based on the past NEPA document prepared for the Calloway Canal segments, Reclamation did not identify adverse human health or environmental effects on any population. Therefore, it is assumed the proposed Project would not have a significant or disproportionately negative impact on low-income or minority individuals.

Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

Based on the past NEPA document prepared for the Calloway Canal segments, the nearest Indian Trust Asset (ITA) is a public domain allotment located approximately 40 miles northeast of the Project site. The Project would not impact the ITA. Moreover, the Project would not limit access to, and ceremonial use of, Indian sacred sites.

Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

North Kern would implement best management practices to ensure that the proposed Project would not contribute to the introduction or spread of noxious weeds or non-native invasive species. Because of routine maintenance, which North Kern will continue, noxious weeds and non-native invasive species do not presently exist within the Calloway Canal.

4. Permits and Approvals

Applicants must state in the application whether any permits or approvals are required and explain the plan for obtaining such permits or approvals. Recipients shall adhere to Federal, state, territorial, tribal, and local laws, regulations, and codes, as applicable, and shall obtain all required approvals and permits. Recipients shall also coordinate and obtain approvals from site owners and operators.

The District will adhere to applicable laws, regulations, and codes and will ensure required approvals and permits are obtained. It is anticipated that some permits will be required. The awarded contractor will be responsible for obtaining all necessary permits and approvals. The Project is located exclusively within maintained rights-of-way owned and operated by North Kern. As such, it is expected that requirements for permits, and approvals will be minimal. The following potential permits and approvals will be addressed.

The construction specifications will include language relating to obtaining permits and approvals prior to construction. In particular, the standard language in the specifications state “The Contractor is an independent contractor and shall, at his sole cost and expense, comply with all laws, rules, ordinances, and regulations of all governing bodies having jurisdiction over the work, obtain all necessary permits and licenses therefore...”. Such permits and approvals may include, preparing and implementing a Stormwater Pollution Prevention Plan pursuant to the National Pollution Discharge Elimination System (Clean Water Act Section 402) and obtaining a Construction Notification and Dust Control Plan to the San Joaquin Valley Air Pollution Control District. Additionally, a pre-construction survey for special-status species will be conducted by a qualified biologist immediately prior the start of construction.

Pursuant to Section 17.28.040(B)(5) of the Kern County Code of Ordinances, the District is exempt from obtaining a grading permit. Likewise, pursuant to Section 17.66.020(C)(7) of the City of Bakersfield Municipal Code, the District is exempt from obtaining a grading permit. Accordingly, the District will not seek a County or City grading permit.

5. Official Resolution

A draft of the Official Resolution is included on the following pages. The Official Resolution will be approved at the District's November Board Meeting. The final version will be submitted to Reclamation separately.

BEFORE THE BOARD OF DIRECTORS
OF THE NORTH KERN WATER STORAGE DISTRICT

ON BEHALF OF ITSELF AND ROSEDALE RANCH IMPROVEMENT DISTRICT

IN THE MATTER OF: RESOLUTION NO. _____

RESOLUTION OF INTENTION OF NORTH KERN WATER STORAGE DISTRICT
TO FILE AN APPLICATION WITH THE BUREAU OF RECLAMATION FOR A GRANT
UNDER THE *WATERSMART GRANTS: WATER AND ENERGY EFFICIENCY GRANTS FOR
FISCAL YEAR 2022 R22AS00023*

WHEREAS, North Kern Water Storage District partnered with several neighboring water districts and formulated the Poso Creek Integrated Regional Water Management Plan (Plan), adopted in July 2007 and updated in 2014 and 2019 by each of the districts for their collective area; and

WHEREAS, District staff, in conjunction with surrounding water districts, communities, and stakeholders, has formulated a plan of improvements; and

WHEREAS, the Plan identified regional projects that, once implemented, would improve the water management of the Region and the ability for North Kern to regulate water supplies available to the district; and

WHEREAS, the Plan promotes a regional recharge, reduction of overdraft, and operation changes in responding to reductions in water supply reliability to the region; and

WHEREAS, District staff has formulated a project improvement, referred to as *Calloway Canal Lining: Fruitvale Avenue to CVC Intertie* which has the support of surrounding water districts and communities; and would be funded by a combination of North Kern Water Storage District funds and grant funds; and

WHEREAS, water will be conserved by lining improvements made to the Calloway Canal; and

WHEREAS, the United States Bureau of Reclamation is currently soliciting proposals for grant funding assistance under their *WaterSMART Grants: Water and Energy Efficiency Grants for Fiscal Year 2022* (Funding Opportunity No. R22AS00023); and

WHEREAS, District staff has formulated a grant proposal to line a portion of the Calloway Canal.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the North Kern Water Storage District as follows:

- a. The District's General Manager, David Hampton and Deputy General Manager, Ram Venkatesan, are hereby authorized and directed to submit the grant application and are authorized to enter into an agreement with Reclamation on behalf of North Kern Water Storage District for grant funding under Reclamation's *WaterSMART Grants: Water and Energy Efficiency Grants*.
- b. The District's Board of Directors has reviewed and supports the submission of a grant application to Reclamation entitled *Calloway Canal Lining: Fruitvale Avenue to CVC Intertie*
- c. The Applicant is capable of providing the amount of funding specified in the application.
- d. The Applicant will work with Reclamation to meet established deadlines for entering into a grant or cooperative agreement.

PASSED, APPROVED AND ADOPTED on this _____ day of _____, 2021 by the following roll-call vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

NORTH KERN WATER STORAGE DISTRICT

President/Board of Directors

ATTEST:

Board of Directors

6. System of Award Management

The District is registered in the System for Award Management (SAM), as shown in the figure below, and will maintain an active SAM registration with current information while it has active Federal awards or applications under consideration. The District's unique entity identifier is 081783946 and is included on the SF-424.

The screenshot displays the SAM.GOV website interface. At the top left is the SAM.GOV logo. Below it are navigation links: Home, Search, Data Base, Data Services, and Help. On the right side, there are links for Download and Follow. The main content area is titled "NORTH KERN WATER STORAGE DISTRICT". On the left, there is a sidebar menu with the following items: Entity Registration (highlighted), Core Data, Business Information, Entity Types, Financial Information, Points of Contact, Assertions, Regs and Certs, and Exclusions. The main content area contains the following information:

DUNS	Unique Entity ID	Expiration Date	Registration Status
081783946		Aug 18, 2023	Active

SAM Unique Entity ID: **QAR2DDM3PM6S**

CAGE/NCAGE: **SP2XS**

Physical Address: **33380 Cawelo AVE
Bakersfield, California
93308-9575, United States**

Mailing Address: **P.O. Box 81435
Bakersfield, California
93380-1435, United States**

Purpose of Registration: **Federal Assistance Awards Only**

**The DUNS number is currently the official Unique Entity ID.

Figure 6-1. System of Award Management Registration

Appendix A

Letter of Support



1101 Central Avenue, Wasco, CA 93280
661-758-5113

October 29, 2021

Mr. Ram Venkatesan
Deputy General Manager
North Kern Water Storage District
33380 Cawelo Avenue
Bakersfield, CA 93308

Re: Proposed Project – *Calloway Canal Lining: Fruitvale Avenue to CVC Intertie*

Dear Mr. Venkatesan,

On behalf of the Poso Creek Integrated Regional Water Management (IRWM) Group, I would like to express support of North Kern Water Storage District's (NKWSD) efforts to improve the Calloway Canal.

The Poso Creek IRWM Group is supportive of and interested in the *Calloway Canal Lining: Fruitvale Avenue to CVC Intertie* Project, as it will conserve groundwater by more effectively delivering surface supplies into the basin and will improve operational flexibility and efficiency within the region.

This Project is an important improvement that will be of great benefit to both NKWSD and other districts within the Poso Creek IRWM Region. I hope that our expressed support is helpful in your efforts to secure grant funding assistance to implement this project. If the funding agency would like to discuss our interest and support of your project, I would be happy to do so.

Sincerely,

Isela Medina
Secretary/Treasurer, Poso Creek IRWM Regional Water Management Group
imedina@semitropic.com
(661) 758-5113

Appendix B

North Kern Water Storage District Wells

2021 WELL REPORT

WELL #	Township	Year Drilled	Cas. Size	Total Depth	Perf	Blank Cas.	Pump Setting	Pump Info	PVC for GW Sensor
88-00-003	28	Aug-08	18"	1020	500'	520'	620	6 Stg 14" DKHA7 FLOWAY New 2008	Yes
88-00-006	28	Jan-16	20" Steel, 17.4" PVC	1220'	400' Steel, 400' PVC	420'	660		Yes
88-00-009	28	May-21	18"	1020'	610'	410'	600	7 Stg 12 CHC New 2013	
88-00-010	28	Dec-15	18"	1000'	600'	400'	560		Yes
88-00-013	28	Jan-09	18"	1020'	500'	520'	540	6 Stg 14" FKH Floway Rebuilt 2013	Yes
88-00-014	28	Jul-16	20" Steel, 17.4" PVC	1200'	400' Steel, 400' PVC	400'	660		Yes
88-00-026	28	Jul-08	18"	1020	500'	520'	540	6 Stg 14" FKH Floway Rebuilt 2013	
88-00-027	28	Nov-10	18"	1152'	565'	587'	540	5 Stg 14" FHC New 2012	
88-00-029	28	Feb-09	18"	1020'	520'	500'	540	6 Stg 14" FKH Floway New 2009	Yes
88-00-030	28	Dec-15	18"	1040'	640'	400'	540		Yes
88-00-036	28	Nov-15	18"	1180'	760'	420'	560		Yes
88-00-047	28	May-21	18"	1,095'	710'	385'	620	6 Stg 14RHM New 2004	
88-00-051	28	Dec-15	18"	1080'	680'	400'	580		Yes
88-00-055	28	Nov-17	18"	1082'	661'	421'	500	6 Stg 14HMC Rebuilt 1991	Yes
88-00-057	27	Jan-16	18"	1200'	800'	400'	560		Yes
88-00-059	27	Jan-88	16"	960'	480'	480'	560	6 Stg 14" FKH A-6 Floway Rebuilt 2002	Yes
88-00-062	27	Sep-00	18"	975'	502'	473'	520	6 Stg New 2008	Yes
88-00-070	27	Jul-21	18"	1210'	850'	360'	620	7 Stg Bowl Rebuilt 2008	
88-00-075	27	May-54	16"	800'	460'	340'	540	8 Stg Rebuilt 2013	
88-00-081	27	Feb-76	16"	804'	372'	432'	600	9 Stg 14" RJMC New 2004	Yes
88-00-085	27	Aug-87	16"	970'	530'	440'	520	6 Stg FKH Full diameter New 94	No Fit
88-00-088	27	Aug-53	14"	846'	506'	340'	560	11 Stg 12"DKH Floway Rebuilt 2013	
88-00-090	27	Sep-87	16"	960'	500'	460'	530	6 Stg 14" DKH New 92	
88-00-093	27	Feb-16	18"	1000'	600'	400'	620		Yes
88-00-096	27	Mar-16	18"	1080'	680'	400'	640		Yes
88-00-098	27	Oct-53	16 1/4"	982'	587'	383'	520	10 Stg 12 HH165 Rebuilt 1992	
88-01-010	28	Nov-11	18"	992'	592'	400'	580	6 Stg 14" FKHA8 Floway New 2012	
88-01-013	28	Oct-11	18"	1060'	860'	400'	500	6 Stg 14" FKHA8 Floway New 2012	
88-03-009	28	May-54	16"	725'	425'	300'	420	7 Stg 12" EHM Rebuilt 2013	
88-03-012	28	Oct-54	16 1/2"	704'	404'	300'	460	7 Stg 12" EHM New 2009	
88-03-021	28	Apr-54	16"	702'	402'	300'	500	7 Stg 12" EH New 2002	
88-03-030	28	Mar-02	18"	1000'	420'	580'	500		
88-03-036	28	Oct-54	16 1/2"	704'	404'	300'	480	7 Stg 12" EHM New 2009	
88-03-047	28	Aug-77	16 1/4"	712'			460	6 Stg Bowls Rebuilt 2008	
88-05-003	28	Feb-91	18"	1080'	360'	720'	460	7 Stg 14" DKH6-A1B Trim Floway Rebuilt 2005	Yes
88-05-011	28	Oct-96	18"	903'	461.0	442.0	460	6 Stg 14" FKHA-2B2 Floway New 2000	
88-07-004	28	Feb-91	18"	1040'	440'	640'	540	7 STG Rebuilt 2014	Yes
88-07-006	28	Oct-96	18"	944'	502'	442'	460	6 Stg 14" FKH A-2B-2 New 2000	Yes
88-09-006	27	May-12	18"	1020'	400'	600'	550		
88-09-009	27	Oct-05	18"	1003'	513'	490'	540		
88-11-011	27	Jul-12	18"	1020'	400'	600'	550		
88-11-021	27	Sep-12	18"	1020'	400'	600'	550		
88-17-009	27	May-54	16"	804'	462'	342'	530	5 Stg 14" FHC New 2012	
88-17-015	27	Oct-98	16"	803'	462'	341'	520	6 Stg 14" FKH New 2000	
88-17-022	27	Apr-01	18"	935'	452'	483'	520	5 Stg 14" FKH A-5 New 2001	
88-17-023	27	Apr-05	18"	990'	500'	490'	520		
88-17-024	27	Jun-05	18"	1000'	500'	500'	520		
88-17-036	27	Jan-16	18"	1100'	700'	400'	540		
88-17-059	27	Oct-87	16"	940'	540'	400'	520	7 Stg 14" DKH New 2012	
88-19-003	27	Apr-91	18"	1100'	390'	574'	560	7 Stg 14" DKH Floway New 2005	
88-21-005	27	May-91	18"	1100'	420'	560'	560	14" Floway New 2009	
88-21-016	27	May-91	18"	1011'	510'	501'	520	14" Floway New 2009	
88-25-005	27	Sep-54	16"	800'	460'	340'	520	5 Stg Rebuilt 1993	
88-25-010	27	Mar-16	20" Steel, 17.4" PVC	1252'	400' Steel, 380' PVC	472'	660		
88-25-013	27	May-16	20" Steel, 17.4" PVC	1212'	400' Steel, 360' PVC	452'	560		
88-25-016	27	Jul-87	16"	1020'	620'	400'	560	14" DKH Rebuilt 1990	
88-25-030	26	Aug-00	18"	1003'	542'	461'	500		
88-25-031	27	Apr-92	18"	1050'	593'	457'	540	6 Stg 14" FKH New 1992	
88-29-006	27	Oct-53	16"	836'	400'	436'	560	5 Stg 14" DK floway New 1989	
88-29-009	27	May-54	18"	1020'	620'	400'	560	9Stg 14" Flowserve Bowl rebuilt 2014	
88-29-013	26	Nov-11	18"	1001'	564'	437'	580	6 Stg 14" FKHA6 Floway New 2012	
88-29-014	26	Aug-05	18"	1000'	500'	500'	540		
88-29-015	26	Aug-53	16"	800'	464'	336'	500	9 stg 12" DKH New 1992	
88-29-035	26	Oct-53	16"	800'	464'	336'	500	8 Stg 12" FKL New 1990	
88-29-039	26	Oct-53	16"	800'	460'	340'	580	9 Stg 12" DKH New 1992	
99-00-003	28	Sep-54	16 1/2"	704'	404'	300'	540	7 Stg 12EHM Rebuilt 2014	

2021 WELL REPORT

99-00-006	28	Sep-54	16 1/2"	704	404'	300'	420	8 Stg 12NKL Rebuilt 2013	
99-00-008	28	Sep-54	16 1/2"	704'	404'	300'	420	6 Stg 12LC new 2008	
99-00-009	28	Dec-17	18"	1110'	640'	470'	500	8 Stg 12CMC New 2008	
99-00-012	28	Feb-88	16"	840'	360'	480'	530	5 Stg 14"FKH Floway New 2001	
99-00-017	28	Sep-87	16"	840'	400'	440'	500	12Stg 12"Rebuilt 2012	
99-00-018	28	Jul-05	18"	992'	605'	387'	500	6 Stg 12" New 2011	
99-00-022	28	Sep-54	16 1/2"	704'	404'	300'	440	7 Stg 12NKL New 2002	
99-00-026	28	Sep-54	16 1/2"	704'	404'	300'	400	8 Stg New 2002	No Fit
99-00-032	28	Sep-54	16 1/2"	704'	404'	300'	400	8 Stg New 2002	
99-00-035	28	Jan-88	16"	880'	480'	400'	450	5 Stg 14RHMC New 2004	
99-00-067	28	May-12	18"	1000'	410'	590'	500		
99-00-081	27	May-54	16"	800'	459'	341'	520	6 Stg 12" JKH A-% B-1 Floway New 2002	
99-00-084	27	May-54	16"	802'	459'	343'	500	7 Stg12" FKL Floway New 2012	
99-00-090	27	Aug-21	18"	1110'	710'	400'	620	7 Stg 12" MB Rebuilt 2002	
99-00-096	27	May-54	16"	800'	458'	342'	575	7 Stg 12" MB A-7 Rebuilt 2002	
99-00-102	27	May-54	16"	800'	458'	342'	520	6 Stg 12" JKH A-5 B1 Floway New 2002	
99-00-106	27	Apr-54	16"	800'	460'	340'	440	6 Stg 12" JKH A-5 B-41 Floway New 2002	
99-00-108	26	Apr-54	16"	800'	460'	340'	440	7 Stg 12" HC A-7 Jacussi New 2002	No Fit
99-00-114	26	Oct-53	16"	800'	460'	340'	475	8 Stg 12" DKH Floway New 2012	
99-00-117	26	Oct-53	16"	800'	460'	340'	540	7 Stg 12" MB Rebuilt 2002	
99-00-119	26	Mar-73	16 1/4"	800'	400'	400'	500	9 Stg 12" DKH New 1991	
99-02-004	28	Feb-91	18"	950	550'	400'	560	5 Stg 14" FKH Rebuilt 2013	Yes
99-02-006	28	Aug-10	18"	1008'	565'	443'	560	10 Stg J12XHC Rebuilt 2013	Yes
99-02-008	28	Oct-10	18"	1062'	605'	457'	500	5 Stg 14FHC New 2011	
99-02-024	28	Jun-11	18"	953'	553'	400'	500	6 Stg 14 RHHC New 2011	Yes
99-04-05	28	Jun-11	18"	1003	603'	400'	500	5 Stg 14FHC New 2011	Yes
99-06-08	28	Jan-12	18"	980'	490'	490'	500	6 Stg 14" FKHA6 New 2012	
99-22-010	26	Apr-53	16"	800'	460'	340'	480	8 Stg 12" DKH Floway New 1991	
99-22-014	26	Oct-00	18"	922'	482'	440'	460	6 Stg 14" FKHA-4 Floway New 2001	Yes
99-22-029	26	Apr-54	16"	800'	450'	340'	520	9 Stg New 1990	
99-22-041	26	Apr-53	16"	800'	460'	340'	500	7 Stg 14" DKL A-5 B-2 Floway New 1992	
99-22-084	26	Mar-53	16"	800'	460'	340'	480	9 Stg 12" NKL New 1991	
99-26-010	26	Sep-53	16"	800'	460'	340'	460	7 Stg 12" MCA New 1988	
99-26-026	26	Dec-90	18"	948'	502'	446'	480	6 Stg 16" MKMA3B3 New 1990	
99-26-085	26	Jun-53	16"	900'	560'	340'	480	9 Stg 12" DKH A-9 New 1992	