Calaveras Public Utility District

Distribution System Feasibility Study

Safe and Affordable Funding for Equity and Resilience Program

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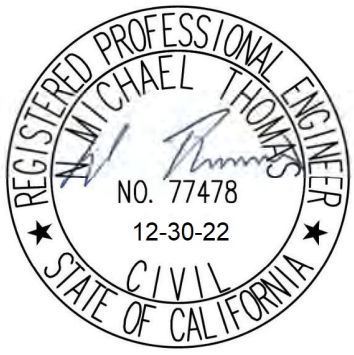
CONTENTS:

TABLES:

FIGURES:

APPENDICES:



1.0 INTRODUCTION

California Rural Water Association (CRWA) is providing technical assistance to the Calaveras Public Utility District (CPUD) under the State Water Resources Control Board (SWRCB) Safe and Affordable Funding for Equity and Resilience (SAFER) Program. This Distribution Feasibility Study (Study) is the second task of a work plan created by CRWA to serve CPUD. The first task was a system evaluation which is incorporated into this Study. The evaluation includes a description of the existing system demand, sources, treatment plant, storage tanks, and distribution system.

The main goal of this Study is to address the distribution system deficiencies faced by CPUD. The Study focuses on the distribution system to identify deficiencies using a hydraulic modeling software in conjunction with CPUD staff insights. Projects to improve the distribution system are identified and compared in the feasibility analysis. A conceptual level engineering design for each project is presented. Construction and operations and maintenance (O&M) costs for each alternative project are estimated. Project recommendations are prioritized for additional planning, engineering, and funding efforts. The last section of the report includes analysis, comparison, and recommendations for metering and data collection technologies to replace the existing water meters.

2.0 BACKGROUND

CPUD is registered with the SWRCB Division of Drinking Water (DDW) as a public community water system, number CA0510002. CPUD provides treated water to 6,254 people through 2,040 service connections in Mokelumne Hill, San Andreas, Paloma, and portions of the Glencoe and Railroad Flat communities in Calaveras County (Figure 1). CPUD's facilities include Jeff Davis Reservoir, one surface water treatment plant, one raw water pump station, two booster pump stations, one clearwell, five storage tanks, one hydropneumatic tank, three hydroelectric generating, pressure reducing stations, 18 miles of transmission main and over 20 miles of distribution main.

CPUD owns, operates, and maintains a treatment plant for surface water treatment. After treatment, the water is stored in the clearwell with a capacity of 0.5 million gallons (MG). From there, the water flows through transmission mains into the distribution system. The transmission mains consist of 16 to 27 inch diameter cement mortar lined and coated steel pipes. The distribution system consists of mains between 2 and 12 inches in diameter. Including the clearwell with the system's five storage tanks with a combined storage capacity of 5.45 MG.

Figure 1: Location Map

3.0 SYSTEM EVALUATION

3.1 Water Demands

CPUD provided daily water production records of the last 10 years (Table 1). Based on these records, the system average day demand (ADD) is 1.12 million gallons per day (MGD). Maximum Day Demand (MDD) and Peak Hourly Demand (PHD) were calculated according to Title 22 of California Code of Regulations (CCR). The day with the highest water usage, MDD, during the most recent 10 years of operation was identified as August 10, 2012, with 3.45 MGD, or 2,397 gallons per minute (gpm). To determine the PHD, the MDD was multiplied by a peaking factor of 1.5, which results in a system wide PHD of 3,500 gpm.

Table 1: 10 Year Average Day and Max Day Water Production

Year	Average Day (MGD)	Max Day (MGD)
2012	1.30	3.45
2013	1.39	2.49
2014	1.06	2.35
2015	0.94	2.19
2016	1.22	2.32
2017	1.15	2.37
2018	1.08	2.05
2019	1.07	2.30
2020	0.99	1.80
2021	0.97	1.86
10 Year Avg Day	1.12	
10 Year Max Day		3.45

3.2 Source of Water

CPUD obtains its water from the Mokelumne River where the system has a diversion dam located just below the confluence of the South and Licking Forks of the River (Figure 2). A safe yield established in Water Right Order 16338 limits the maximum water extraction from the river to 6,656 acre feet per year (AFY), or 2,169 million gallons (MG) each year. The safe yield is more than adequate to supply the 10 year maximum annual demand of 495 MG (year 2013). The dam allows the system to extract the water from the river through the raw water pump station with a capacity of 4.70 MGD (3,300 gpm). The water is then transported via a two mile long, 20 inch main to Jeff Davis Reservoir. The reservoir covers an area of 200 acres and has a capacity of 2,300 acre feet (AF), or 750 MG. Raw

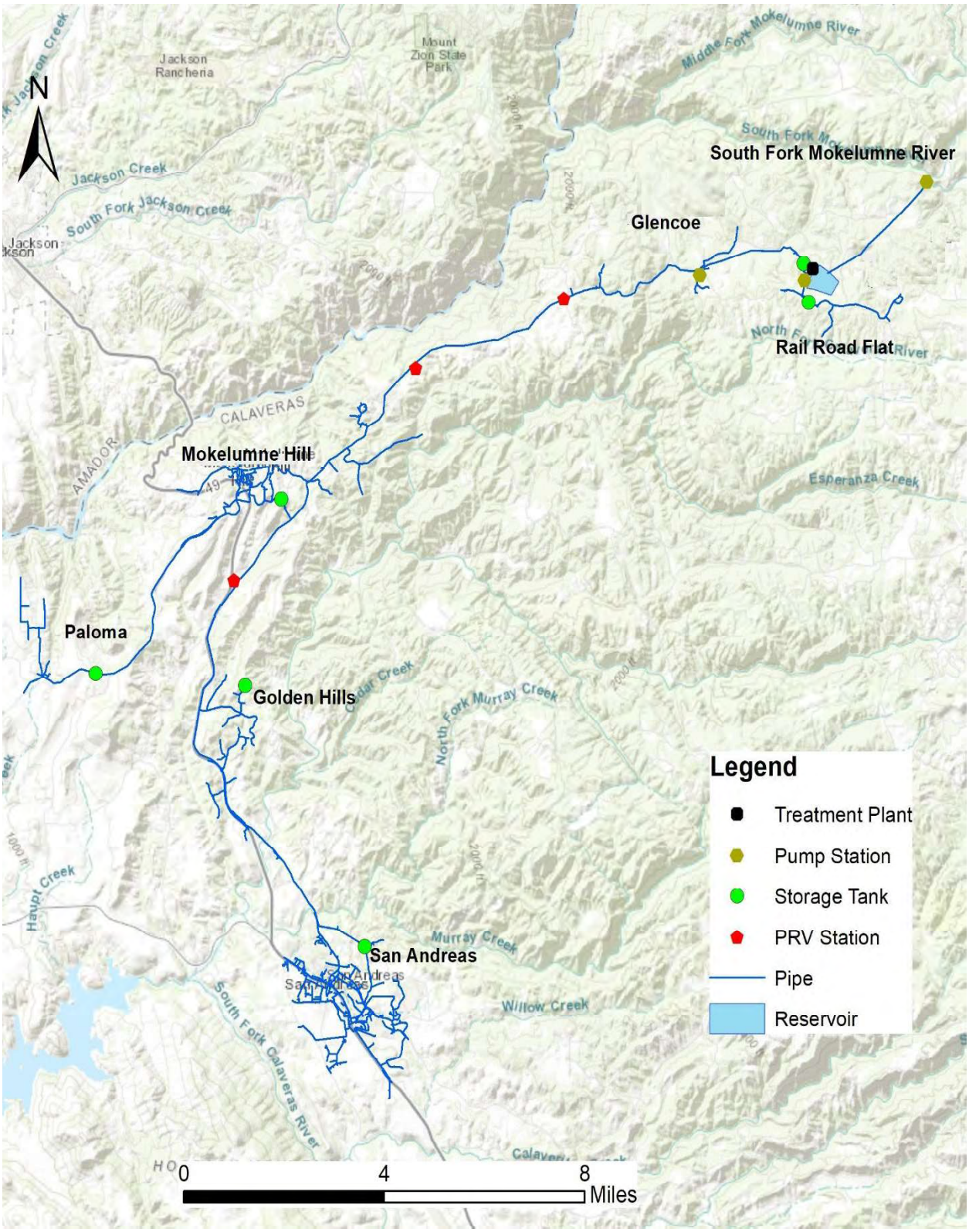


Figure 2: Water System Map

water flows by gravity from the reservoir to the water treatment plant located approximately 400 feet northwest of the reservoir.

CCR Title 22 requires systems with 1,000 or more service connections to meet four hours of PHD with source capacity, storage capacity, or emergency source connections. CPUD's source capacity is limited to the maximum treatment capacity of its treatment facility. The plant has a maximum capacity of 6.0 MGD, or 4,200 gpm, which is more than the PHD of 3,500 gpm. The source capacity meets the Title 22 requirement.

3.3 Water Treatment Plant

The treatment plant consists of six dual media pressure filters with a combined capacity of 6.0 MGD. The plant typically runs between 2.0 and 4.0 MGD and treats raw water using four treatment processes: pretreatment, filtration, disinfection, and corrosion protection. Chlorine (sodium hypochlorite) and polymer are added to the raw water prior to entry into the filters for disinfection and coagulation. Zinc orthophosphate is added to the treated water at the plant prior to the clearwell to control corrosion in the distribution system. Chlorine is also added to the treated water as it leaves the treatment plant. The system maintains a chlorine residual between 0.8 and 2.5 mg/L leaving the treatment plant.

3.4 Water Storage Tanks

CPUD owns and operates one clearwell at the treatment plant site and five additional water storage tanks located throughout the distribution system that store water to meet the daily demands and fire flow requirements. The system has a combined operating storage capacity of 5.45 MG. CPUD storage tanks can supply water for 26 hours at the PHD of 0.21 MGH. Storage tank details are shown in Table 2 below.

Table 2: Water Storage Tanks Details

Tank Name	Diameter (ft)	Height (ft)	Operating Range (ft)	Operating Capacity (MG)
Jeff Davis Clearwell	70	18	10 to 17	0.5
Railroad Flat	47	40	34 to 37	0.5
Mokelumne Hill	80	45	30 to 40	1.5
Golden Hills	20	16	10 to 14	0.035
Paloma	30	24	20 to 22	0.110
San Andreas	110	43	30 to 40	2.8
Total Capacity				5.45

The clearwell has a capacity of 0.5 MG. When clearwell level is 14 feet the treatment plant is turned on and once the level reaches 17 feet, the treatment plant is turned off. The

clearwell critical, or minimum level, is 10 feet. Below this level the volume is reserved for chlorine contact time. A new 0.5 MG tank clearwell is under construction, adjacent to the existing clearwell. The existing clearwell, which is around 50 years old, will be assessed for structural integrity to see if it is safe to continue being used once the new clearwell is completed.

Rail Road Flat Tank has a capacity of 0.5 MG and operates between 34 feet and 37 feet. It is filled by an 8 inch inflow/outflow pipe that comes from Rail Road Flat Pump Station. The Tank has a 12 inch outflow pipe that feeds the Rail Road Flat service area.

Mokelumne Hill Tank has a capacity of 1.5 MG and is filled by an 18 inch pipe supplied by the 18 inch transmission main in the Happy Valley area. The inflow/outflow pipe can supply the transmission main when needed to feed the system when the pressure in the main drops. The inflow/outflow pipe is located at a Tank level of 18 feet. Below this level, water cannot flow back to the transmission main. The Tank has an additional 14 inch outflow pipe at the bottom Tank, supplying water to the Mokelumne Hill service area and the Paloma Tank. Normally the Tank operates between 30 feet and 40 feet.

Paloma Tank has a capacity of 0.11 MG and is gravity fed by a 6 inch pipe that comes from Mokelumne Hill Tank. The Tank operates between 20 feet and 22 feet to ensure there is enough water Tank for emergency use.

Golden Hill Tank has a storage capacity of 0.035 MG and has a 6 inch inflow/outflow pipe. The Garamendi Pressure Reducing Valve (PRV) downstream pressure needs to be at least 90 pounds per square inch (psi) to open the 2 inch valve that feeds the Golden Hill Tank. During high demand, typically in the summer, the pressure may drop lower than 90 psi and the valve is opened manually to feed the Golden Hill Pressure Zone but the Tank cannot be filled because the pressure is not high enough. Normally the Tank operates between 10 feet and 14 feet.

San Andreas Tank is the largest Tank in the system with a capacity of 2.8 MG. The Tank has an operating range between 30 feet and 40 feet. The 18 inch inflow pipe has a 10 inch electrically actuated, Cla-Val, altitude valve which maintains the level in the Tank. The valve opens when Tank level is 35 feet and closes when it reaches 40 feet. The valve is only permitted to open partially because there is not enough supply for Mokelumne Hill Tank when it is fully open. In the summer, the valve opens at 7 AM, even if the level is above 35 feet, to keep more water in Tank for high demand during the day. A normally closed 18 inch bypass next to the control valve can be manually opened during power outages. The Tank has an 18 inch outflow pipe that feeds San Andreas and a 6 inch pipe the feeds a few houses next to the Tank.

3.5 Transmission/Distribution System

Treated water from the treatment plant is carried through approximately 18 miles of transmission main to Mokelumne Hill, Paloma, and San Andreas. Transmission mains are made of mortar lined and coated steel pipe, ranging in size from 16 to 27 inches in diameter. Distribution mains range from 2 to 12 inches in diameter and are made of steel, Polyvinyl Chloride (PVC), high density polyethylene (HDPE), and galvanized iron.

Due to the large differences between the highest and lowest elevations of the system, CPUD utilizes pressure reducing stations to keep the water pressure between35 and 115 psi. The distribution system is divided into 17 pressure zones (PZ) by 17 PRVs, five storage Tanks, and two pump stations (Figure 3). There are three main PRV stations which are used to regulate the pressure in the transmission main. These stations use hydroelectric turbines to generate electricity while reducing pressure.

The distribution system has two pump stations: Rail Road Flat and Glencoe Pump Stations. Rail Road Flat Pump Station pumps water from the clearwell to fill the Rail Road Flat Tank. Rail Road Flat Pump Station has two 25 horsepower (hp) pumps. Pump No. 1 has a capacity of 250 gpm and is turned on when the Rail Road Flat Tank level reaches 35 feet and is turned off when the level is 37 feet. Pump No. 2 has a capacity of 245 gpm and is turned on with Pump No. 1 when the Rail Road Flat Tank level reaches 34 feet and turned off when Tank level reaches 37 feet.

Glencoe Pump Station has two 25 hp pumps that boost water into a hydropneumatic tank at the pumphouse. The hydropneumatic tank has a capacity of 20,000 gallons. The pumps operate in lead and lag sequence. The hydropneumatic tank operates at 120 to 150 psi. Glencoe Pump Station is equipped with a backup generator.

4.0 STATEMENT OF PROBLEM

CPUD's distribution system needs improvements in several areas. There are 18 miles of transmission and over 20 miles of distribution main in the water system, ranging in age from over 50 years old to new installations. Much of this infrastructure has exceeded its design life and needs replacement. The system has several pressure zones with very high pressures that need to be addressed. These high pressure zones coupled with aging pipe result in leaks and significant water loss. Monthly data shows a discrepancy between the treated water meter and customer meter data. This may be a result of pipe leakage

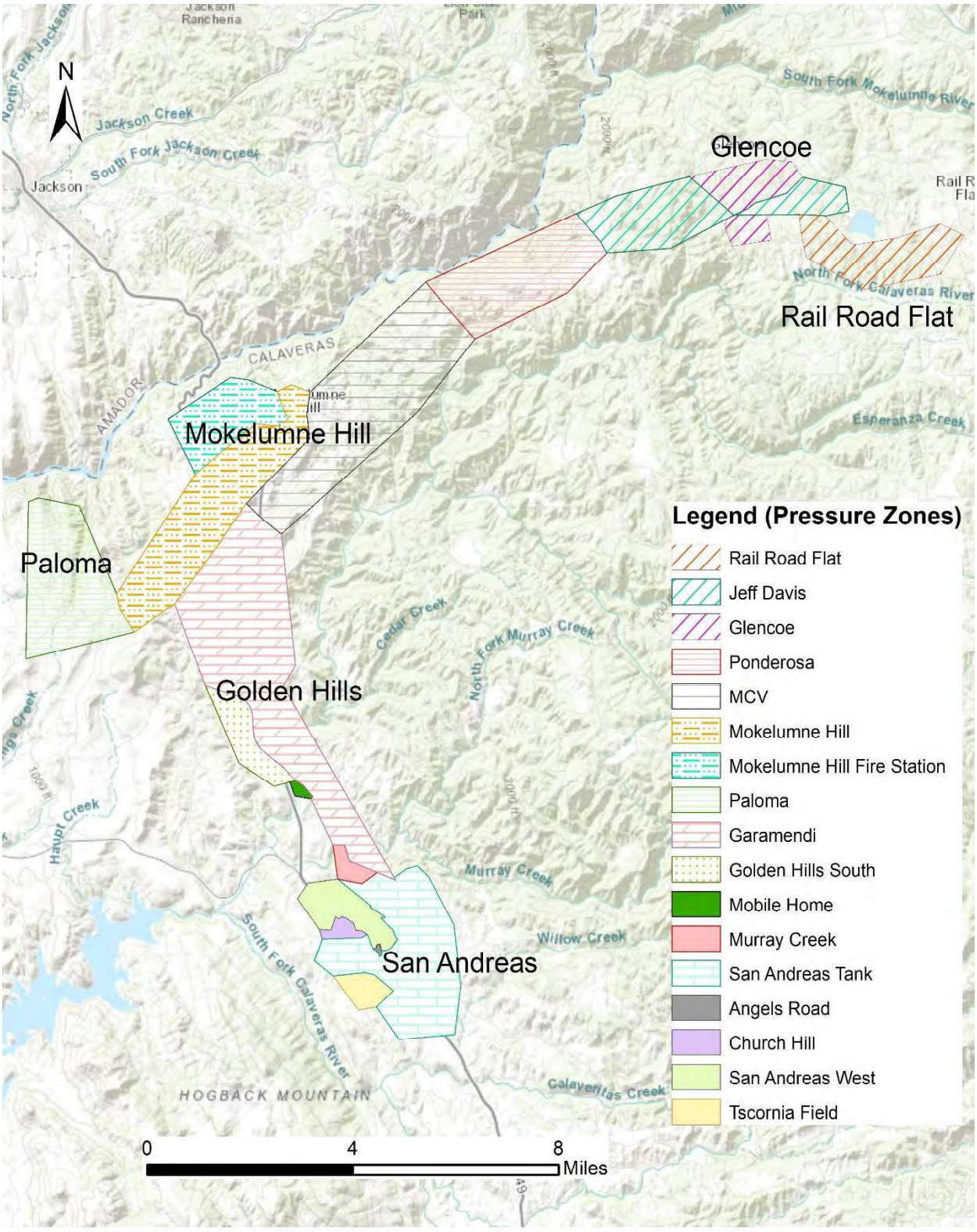


Figure 3: Pressure Zone Map

and old meters not recording accurately. Water meters are past their design life as well and need to be replaced with new meters.

In some areas, the system cannot provide the required flow for fire protection. The system has adequate source capacity but does not have storage, pumping capacity, or large enough pipes to supply fire flow in specific areas. Wildfires are a growing risk in the area, which adds to the importance of fire flow to protect the system.

5.0 DISTRIBUTION SYSTEM FEASIBILITY ANALYSIS

CRWA conducted this Study to evaluate the existing distribution system components and operating conditions, identify the priority needs, and to analyze different approaches to address them. CRWA developed a distribution system hydraulic model to analyze water pressure, pressure zone supply and demand, and fire flow for the distribution system. Based on the results of the hydraulic modeling distribution system improvements for supply reliability and fire protection are proposed. Conceptual level construction, and operations and maintenance cost estimates have been provided as well. Project recommendations are based on the results of the model, site visit observations, and problems reported by CPUD staff. Water meter replacement is analyzed independently of the distribution system feasibility study and is presented in a separate section.

5.1 Distribution System Modeling

5.1.1 Building the Network

CPUD provided system information and maps for CRWA to create a hydraulic model of the distribution system using InfoWater, a geographic information system (GIS) enabled hydraulic modeling software. The model was created by adding pipes and major system components such as reservoirs, storage tanks, pumps, and valves.

Pipe diameters and Hazen-Williams ‘C’ factor were entered manually but pipe lengths were calculated by the software based on the location of pipe start and end nodes on the base map. Elevation of the nodes were obtained from a Digital Elevation Model (DEM), downloaded from United States Geological Survey (USGS) website. Elevations were extracted from the DEM based on the location of each node on the map. The Jeff Davis Reservoir was added to the model as a constant head reservoir. The head was assumed to be the elevation difference between the treatment plant and reservoir’s water surface.

PRV locations and settings were obtained from a Diamond Maps digital map provided by CPUD. Storage tanks’ heights, diameters, and operating levels were obtained from Diamond Maps as well. Hydropneumatics tanks, booster pumps, and PRV Stations

operational data were obtained during the site visit. Due to the size and complexity of the system, the hydraulic model includes the transmission mains and a majority of distribution mains sufficient to model the system accurately.

5.1.2 Hydraulic Criteria of the Model

InfoWater uses the Hazen Williams equation for hydraulic analysis. The model software calculates flow and head loss in pipes, demand and pressure at nodes, flow and pressure at pump stations, and water levels in storage tanks. For all existing mains, Hazen Williams 'C' factor of 120 was assigned, in accordance with CPUD Improvement Standards, Section 1005. InfoWater models the reservoir as an external source with infinite supply. The supply from Jeff Davis Reservoir is limited by the capacity of the water treatment plant. Therefore, the flow from the reservoir to the clearwell is limited to the maximum treatment capacity (6.0 MGD) in the model.

Storage tanks operating levels were entered in the model, which control booster pumps and valves' operations. Booster pumps are modeled based on design operating points and are controlled by the tank water levels. The hydropneumatic tank is modeled as a cylindrical storage tank where the maximum and minimum water levels correspond to the high and low pressures, respectively.

Service connections (water meters) were counted from provided maps and assigned to the nearest model node. Each service connection is then assigned an average demand, in gpm, which is obtained by dividing the total demand to the number of service connections. The model is set to analyze the distribution system under extended period simulation of up to one week, to ensure the system could manage several back to back high demand days without experiencing problems. A standard InfoWater diurnal pattern was used to distribute the demand changes over the course of the day.

Fire flow requirements are set forth in Section 1005 F of the District Improvement Standards. The requirement is 500 gpm for single family and duplex residential areas, 1,000 gpm for townhouse and multiple residential areas, and 2,500 gpm for commercial areas. CPUD does not have a fire flow map to identify type of buildings, therefore, a fire flow of 500 gpm (with a minimum residual pressure of 20 psi for a duration of two hours was assumed for all demand nodes to show available fire flow throughout the system.

5.1.3 Model Calibration

CRWA used field tests data from February 2021 to calibrate the model to the actual system. The tests were performed by CPUD staff on fire hydrants throughout the system and included flow, static, and residual pressure data. Both static and residual pressures were compared. Daily water demands from February 2021 were used in the model to

closely match the days which the tests were performed. American Water Works Association (AWWA) *Manual 32-Computer Modeling for Distribution System* guidelines were followed throughout this process. The guideline recommendations are as follows:

1. For distribution system rehabilitation studies and fire flow analysis: model pressures should be within 4.3 psi (10 feet of head) of those recorded in the field.

2. For rural water systems without fire flow: model pressures should be within 8.6 psi (20 feet of head) of those recorded in the field.

The model results throughout the system were within the range of the first category without the need for any adjustments except for Mokelumne Hill Fire Station PZ, which had model pressures around 10 psi below field pressures. This PZ's PRV setting in the model was set at 30 psi but the actual setting during the field tests is unknown, which could be the cause behind this 10 psi difference. The PRV setting was adjusted in the model resulting in a closer match to the actual system.

5.1.4 Analysis and Results

The model simulated the water system from the clearwell through the distribution system and all storage tanks. Flow rates, velocities, pressures, pumping rates, storage levels, demands, and supply under a variety of operating conditions were calculated and analyzed. Both ADD and MDD scenarios were analyzed for extended periods of time, up to one week. Fire flow was also tested under both conditions. Water quality modeling is excluded from this analysis. The demand assigned to each PZ was adjusted with varying multiplication factors as smaller zones would typically have greater variation in demand. Pressures within each PZ are compared with CPUD standard required pressure of 35 to 115 psi. The analysis and results for each PZ is presented below. See Appendix A for model generated pressure maps.

5.1.4.a Rail Road Flat

This PZ is separated from Jeff Davis PZ by Rail Road Flat Pump Station. The pressure throughout the PZ is provided by gravity from Rail Road Flat Tank. There are 49 service connections and 10 fire hydrants in this PZ. The system can supply MDD and fire flow throughout this PZ. Most demand nodes have pressures within CPUD requirements except one area with three services on Simpson Road, which have pressures around 125 psi.

5.1.4.b Jeff Davis

This PZ begins from the clearwell and is separated from Glencoe PZ by Glencoe Pump Station and from Ponderosa PZ by Ponderosa PRV Station. This PZ is gravity fed by the

clearwell and has 32 service connections with a MDD of 38 gpm. There are four fire hydrants in this PZ. The system can supply the MDD and fire flow throughout the PZ. Most demand nodes have pressures within the requirements. Approximately five services on the transmission pipe before the Ponderosa PRV Station have high pressures, around 220 psi.

5.1.4.c Glencoe

This PZ is separated from Jeff Davis PZ by the Glencoe Pump Station. Pressure throughout this PZ is maintained by the hydropneumatics tank which operates between 120 and 150 psi. There are 30 service connections in this PZ with a MDD of 35 gpm. This PZ has four fire hydrants. The system can supply the MDD to all demand nodes in this PZ. However, Glencoe Pump Station and hydropneumatic tank do not have adequate capacity to supply the fire flow for two hours. Approximately seven service connections have pressures above CPUD standard pressure.

5.1.4.d Ponderosa

This PZ begins from Ponderosa PRV Station and ends at MCV PRV Station. This PZ is gravity fed by the overflow from Jeff Davis PZ. There are 16 service connections in this PZ with an estimated MDD of 28 gpm. This PZ has only two fire hydrants. The system can supply the MDD and fire flow in the PZ. The transmission main section before MCV PRV Station has pressures as high as 230 psi.

5.1.4.e MCV

This PZ begins from MCV PRV Station and is separated from Mokelumne Hill and Garamendi PZs by the Mokelumne Hill Tank and Garamendi PRV Station, respectively. This PZ is gravity fed by overflow from Ponderosa PZ. There are 80 service connections in this PZ with a MDD of 94 gpm. This PZ has 17 fire hydrants. The system can supply the MDD and fire flow in the PZ. Around 20 service connections have pressures above CPUD standard pressure. The transmission main section before Garamendi PRV Station has pressures as high as 260 psi.

5.1.4.f Mokelumne Hill

This PZ begins from Mokelumne Hill Tank and is separated from the Mokelumne Hill Fire Station PZ by two PRVs and two closed valves, and from Paloma PZ by the Paloma Tank. This PZ is gravity fed by the Mokelumne Hill Tank. There are 155 service connections in this PZ with an estimated MDD of 182 gpm. This PZ has 13 fire hydrants. The system can supply the MDD and fire flow in the PZ. Approximately 30 service connections in this PZ have pressures above CPUD standard pressure.

5.1.4.g Mokelumne Hill Fire Station

This PZ is separated from Mokelumne Hill PZ by two PRVs and two closed valves. This PZ is gravity fed by Mokelumne Hill Tank. There are 210 service connections in this PZ with a MDD of 247 gpm. There are 28 fire hydrants in this PZ. The system can supply the MDD but cannot supply fire flow to all fire hydrants. About five services in this PZ have pressures of up to 135 psi.

5.1.4.h Paloma

This PZ is separated from Mokelumne Hill PZ by the Paloma Tank and is gravity fed by the Tank. There are 95 service connections in this PZ with a MDD of 112 gpm. This PZ has 16 fire hydrants. The system can supply the MDD and fire flow in the PZ. Approximately 10 service connections have pressures above CPUD standard pressure.

5.1.4.i Garamendi

This PZ begins from Garamendi PRV Station and is separated from Golden Hills South, Mobile Home, Murray Creek, and San Andreas PZs by Golden Hills PRV, Golden Strike Road PRV, Leonard Road PRV, and the San Andreas Tank, respectively. Water from transmission main in higher altitudes flows into the Golden Hills Tank. There are 90 service connections in this PZ with a MDD of 106 gpm. This PZ is gravity fed and has 10 fire hydrants. The system can supply the MDD but cannot supply fire flow to the fire hydrants in the Golden Hills area. Most parts of the transmission pipe in this PZ have high pressures, up to 260 psi.

5.1.4.j Golden Hills South

This PZ is separated from Garamendi PZ by Golden Hills PRV. There are 70 service connections in this PZ with a proportional MDD of 82 gpm. This PZ is gravity fed and has nine fire hydrants. The system can supply the MDD and fire flow in the PZ. Approximately 20 services in this PZ have high pressures of up to 200 psi.

5.1.4.k Mobile Home

This small PZ is separated from Garamendi PZ by Golden Strike Road PRV. There are only two service connections in this PZ with an estimated, proportional MDD of 9 gpm. This PZ is gravity fed and has three fire hydrants. The system can supply the MDD and fire flow in the PZ. All demand nodes have pressures within CPUD's requirements.

5.1.4.l Murray Creek

This PZ is separated from Garamendi and San Andreas PZs by Leonard Road PRV and a closed valve, respectively. There are 26 service connections in this PZ with an estimated

MDD of 31 gpm. This PZ is gravity fed by the overflow from Garamendi PZ. There are seven fire hydrants in this PZ. The system can supply the MDD and fire flow throughout the PZ. All demand nodes have pressures within CPUD's requirements.

5.1.4.m San Andreas Tank

This PZ begins from the San Andreas Tank and is separated from Murray Creek PZ by a closed valve, from San Andreas West PZ by four PRVs, from Angels Road PZ by one PRV, from Church Hill PZ by one PRV, and from Tscornia Field PZ by one PRV. This PZ is gravity fed by the San Andreas Tank. There are 470 service connections in this PZ with a MDD of 552 gpm. There are 60 fire hydrants in this PZ. The system can supply the MDD and fire flow in the PZ. About 30 service connections have pressures above CPUD standard pressure.

5.1.4.n San Andreas West

This PZ is only connected to the San Andreas Tank PZ, through four PRVs; San Andreas Elementary, Forestry, Ken James, and Cemetery 2. There are 500 service connections in this PZ with a MDD of 588 gpm. This PZ is gravity fed by the San Andreas Tank and has 45 fire hydrants. The system can supply the MDD and fire flow in this PZ. Approximately 40 service connections have pressures above CPUD standard pressure.

5.1.4.o Angels Road

This PZ is only connected to San Andreas Tank PZ through Angels Road PRV. There are 18 service connections in this PZ with an estimated MDD of 32 gpm. This PZ is gravity fed by the San Andreas Tank via the PRV and has no fire hydrants. The system can supply the MDD in the PZ. Demand nodes have pressures within CPUD's requirements.

5.1.4.p Church Hill

This PZ is only connected to the San Andreas Tank PZ through the Cemetery 1 PRV. There are 125 service connections in this PZ with a MDD of 147 gpm. This PZ is gravity fed by the San Andreas Tank and has eight fire hydrants. The system can supply the MDD and fire flow in the PZ. All demand nodes have pressures within CPUD's requirements.

5.1.4.q Tscornia Field

This PZ is only connected to San Andreas Tank PZ through Tscornia Field PRV. There are 17 service connections in this PZ with a proportional MDD of 30 gpm. This PZ is gravity fed by the San Andreas Tank and has nine fire hydrants. The system can supply the MDD and fire flow in the PZ. Demand nodes have pressures within CPUD's requirements.

5.2 Distribution System Projects

5.2.1 Main Replacement Projects

A majority of the transmission main and distribution mains are 50 years old and nearing the end of their design life. Mains have been replaced on an as needed basis due to leaks or planned system improvements. CPUD currently has a project initiated to replace the transmission main along the Rich Gulch area in the Ponderosa PZ. Four additional main projects have been identified in this study and presented in the subsequent Sections.

5.2.1.a Transmission Line between Mokelumne Hill and Golden Hills

The transmission main from Mokelumne Hill to Golden Hills is 18 inches in diameter main and approximately 4 miles long. This portion of the system experiences pressures exceeding 200 psi. This transmission main is more than 50 years old. This project was identified as a need for CPUD because there is no redundant main to supply the Golden Hills PZ, and the San Andreas Tank PZ further downstream (Figure 4). Approximately 1,300 service connections depend on this transmission main. The existing transmission main may be repurposed as a redundant backup main or be abandoned during construction. The construction cost for the project is estimated to be $9.5 million. The estimate in Table 3 reflects the best information available to date.

Table 3: Mokelumne Hill to Golden Hills Main Replacement Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$573,000
18 inch main including excavation, backfill, and compaction	22,000	LF	$250	$5,500,000
Valves and fittings	1	LS	$228,400	$228,400
Design, documentation, and fees	1	LS	$523,000	$523,000
Project Administration	1	LS	$485,800	$485,800
Subtotal Estimated Cost				**$7,310,000**
Contingency @ 30%				**$2,193,000**
Conceptual Level Estimated Construction Cost				**$9,503,000**

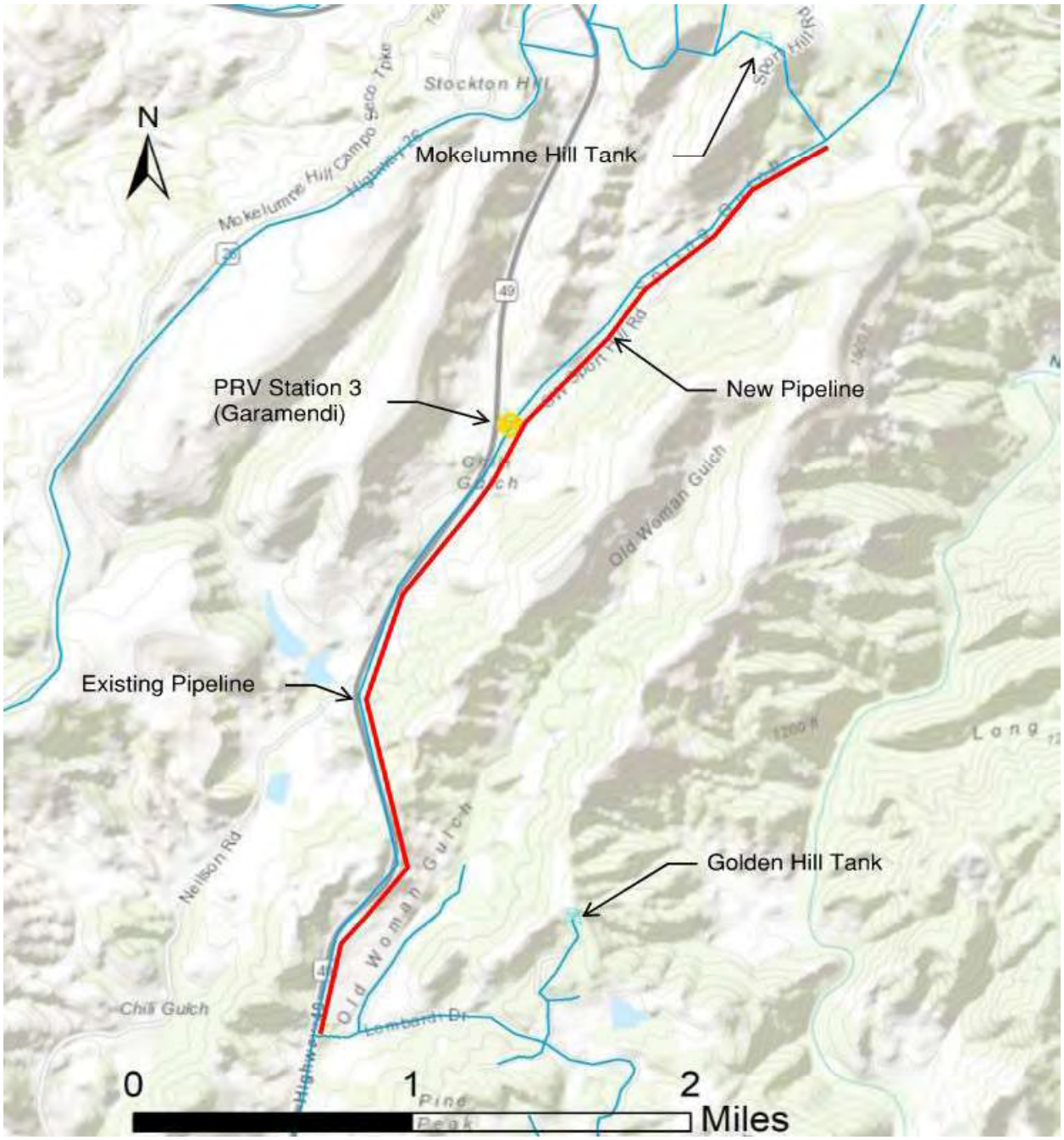


Figure 4: Transmission Main from Mokelumne Hill to Golden Hills

5.2.1.b Transmission Main between Golden Hills and San Andreas

The transmission main from Golden Hills to San Andreas is 18 inches in diameter and approximately 5 miles long. This portion of the system experiences pressures exceeding 200 psi. The transmission main is more than 50 years old. This project was identified as a need for the CPUD as there is no redundant main to supply the San Andreas zones, and in

turn the San Andreas Tank (Figure 5). Over 1,000 CPUD customers depend on the main for their water supply. The construction cost for the project is estimated to be $11.2 million. The estimate in Table 4 reflects the best information available.

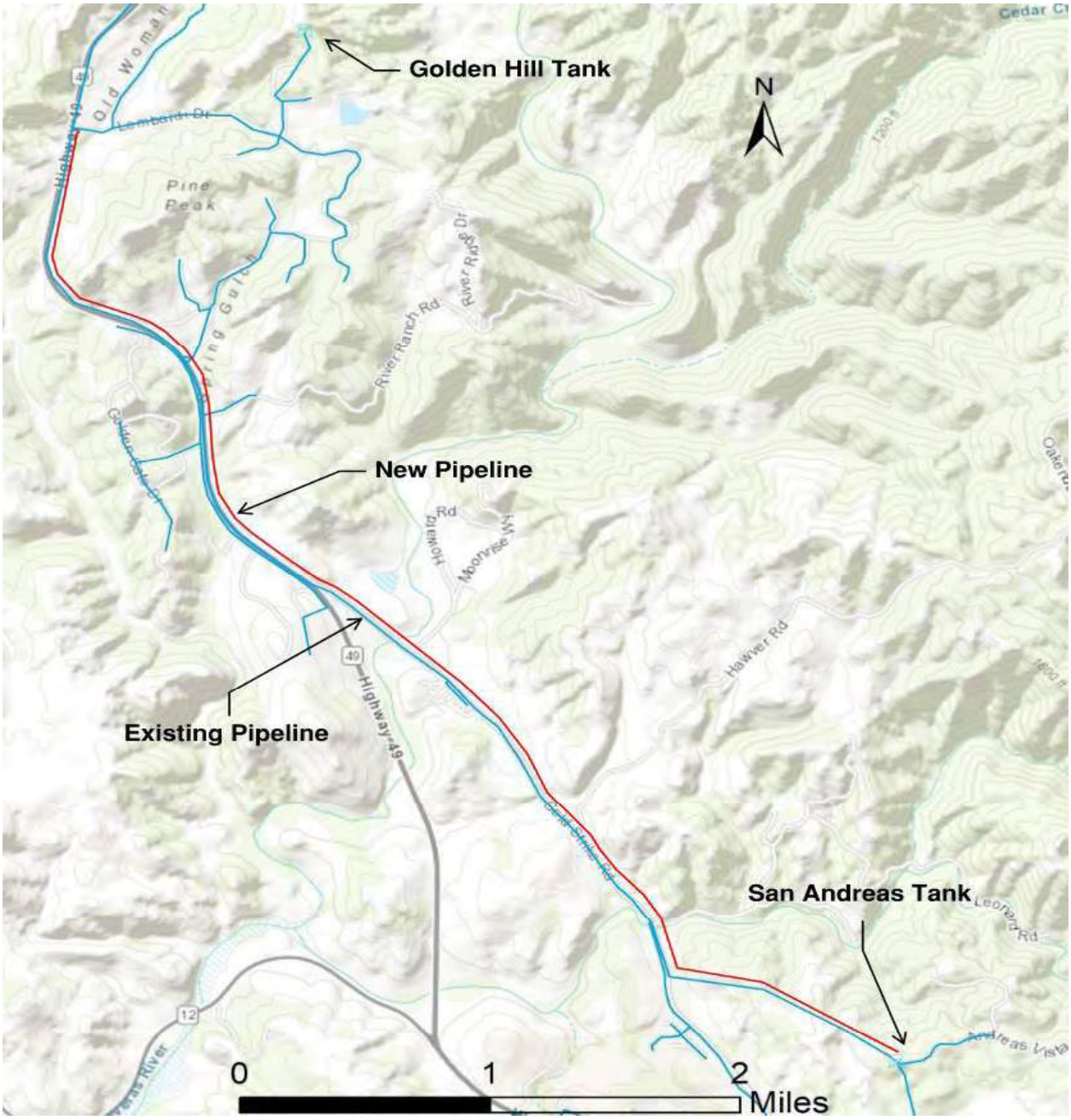


Figure 5: Transmission Main from Golden Hills to San Andreas

Table 4: Golden Hills to San Andreas Main Replacement Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$677,000
18 inch transmission main including excavation, backfill, and compaction	26,000	LF	$250	$6,500,000
Valves and fittings	1	LS	$269,900	$269,900
Design, documentation, and fees	1	LS	$618,100	$618,100
Project Administration	1	LS	$574,100	$574,100
Subtotal Estimated Cost				**$8,639,000**
Contingency @ 30%				**$2,592,000**
Conceptual Level Estimated Construction Cost				**$11,231,000**

5.2.1.c Replace Distribution Mains in San Andreas Tank PZ

The San Andreas Tank PZ contains nearly three miles of distribution main 4 inches in diameter and smaller. These mains restrict the available fire flow in certain areas of the PZ. The mains are nearly 50 years old and near the end of their design life. It is recommended that the pipes be replaced with 8 inch diameter mains. There is a 10 inch diameter transmission main in the PZ that runs along Main Street and Highway 49. The main has had many leaks recently and should also be replaced as part of this project. It is recommended that this pipeline be replaced with a 12 inch diameter pipeline. The construction cost for the project is estimated to be $6.7 million. The conceptual level project construction cost estimate is in Table 5 below.

Table 5: Distribution Mains in San Andreas Tank PZ Replacement Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$319,000
8 inch main including excavation, backfill, and compaction	16,000	LF	$185	$2,960,000
12 inch main including excavation, backfill and compaction	2,750	LF	$220	$605,000
Valves and fittings	1	LS	$276,500	$276,500
Design, documentation, and fees	1	LS	$496,100	$496,100
Project Administration	1	LS	$474,100	$474,100
Subtotal Estimated Cost				**$5,169,000**
Contingency @ 30%				**$1,551,000**
Conceptual Level Estimated Construction Cost				**$6,720,000**

5.2.1.d Replace Undersized Distribution Mains in Mokelumne Hill PZ

The Mokelumne Hill PZ contains approximately 1 mile of mains 4 inches in diameter and smaller. These mains restrict the available fire flow in certain areas of the PZ. The mains are nearly 50 years old and need replacement. It is recommended that the mains be replaced with 8 inch diameter C 900 PVC pipe. Table 6 shows the construction cost for the project estimated to be $1.9 million.

Table 6: Undersized Distribution Mains in Mokelumne Hill PZ Replacement Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$110,000
8 inch main including excavation, backfill, and compaction	5,500	LF	$185	$1,017,500
Valves and fittings	1	LS	$79,200	$79,200
Design, documentation, and fees	1	LS	$156,400	$156,400
Project Administration	1	LS	$138,400	$138,400
Subtotal Estimated Cost				**$1,502,000**
Contingency @ 30%				**$451,000**
Conceptual Level Estimated Construction Cost				**$1,953,000**

5.2.1.e Mokelumne Hill to Paloma Transmission Main Replacement

The transmission main between the Mokelumne Hill Tank and the Paloma Tank is at the end of its useful life. CPUD has identified this project as a concern because the transmission line requires frequent repairs and there is no redundant supply to the Paloma Tank. The current pipe is approximately 5 miles long and 6 inches in diameter and it is recommended to be replaced with 8 inch diameter pipe. The cost to construct the project is estimated to be $8.5 million.

Table 7: Mokelumne Hill to Paloma Transmission Main Replacement Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$110,000
8 inch main including excavation, backfill, and compaction	24,750	LF	$185	$4,579,000
Valves and fittings	1	LS	$79,200	$238,000
Design, documentation, and fees	1	LS	$156,400	$687,000
Project Administration	1	LS	$138,400	$609,000
Subtotal Estimated Cost				**$6,595,000**
Contingency @ 30%				**$1,979,000**
Conceptual Level Estimated Construction Cost				**$8,574,000**

5.2.2 Glencoe PZ Fire Flow Improvements

The booster pumps and hydropneumatic tank at the Glencoe Pump Station currently meet the domestic demand but do not have the capacity to provide fire flow of 500 gpm for two hours. Construction of a 500 gpm fire pump station next to Glencoe Pump Station (Figure 6) would resolve the issue. The pump station would pump water from the 27 inch transmission main in Ridge Road. With this solution a storage tank is not required. The clearwell and treatment plant have the capacity to provide the required fire flow. The fire pump station would only be used during a fire flow emergency, therefore, minimizing the cost of O&M. The cost to construct the project is estimated to be $410,000. A breakdown of the cost is presented in Table 8.

Table 8: Glencoe Fire Flow Pump Station Construction Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$24,000
Fire pump station (500 gpm) including weather enclosure	1	LS	$122,300	$122,300
Pipes, valves, and fittings	1	LS	$31,100	$31,100
Electrical and controls	1	LS	$50,900	$50,900
Design, Documentation, and Fees	1	LS	$34,400	$34,400
Project Administration	1	LS	$52,000	$52,000
Subtotal Estimated Cost				**$315,000**
Contingency @ 30%				**$95,000**
Conceptual Level Estimated Construction Cost				**$410,000**

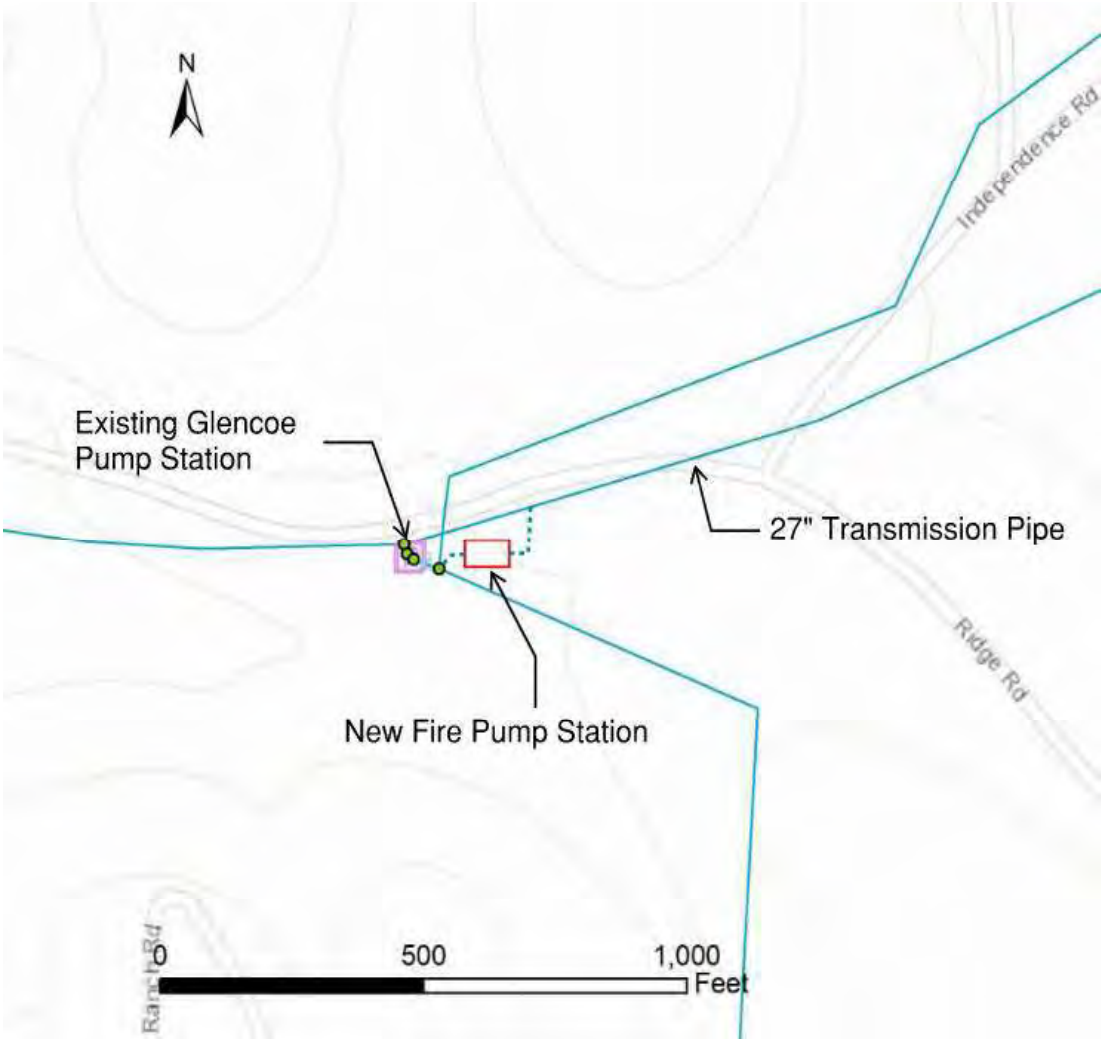


Figure 6: Glencoe Fire Pump Station

5.2.3 Golden Hills Fire Flow Improvements

Golden Hill Tank does not have the capacity to provide fire flow for two hours. This issue could be resolved by replacing the existing 2 inch pipe that connects the PZ to the transmission main with an 8 inch pipe (Figure 7). The existing 2 inch pipe has a length of approximately 250 feet. The system would not need to add additional storage because the pipe intake would be the 16 inch transmission main that is fed by Mokelumne Hill Tank and the clearwell. Adding additional storage is not desirable because of lack of use during low demand seasons, resulting in loss of chlorine residual in the Golden Hill Tank. In addition, the transmission main does not have enough pressure during high demands to fill the Tank. The pressure at this point is high enough to supply domestic and fire flow and would not need the addition of booster pump(s).

The cost to construct the project is estimated to be $116,000. A breakdown of the cost is presented in Table 9. The estimate reflects the best information available to date.

Table 9: Golden Hills Fire Flow Improvements Cost

Item	Quantity	Unit	Unit Cost	Cost
Mobilization / Demobilization	10%	LS	-	$6,000
8 inch main including excavation, backfill, and compaction	250	LF	$185	$46,250
Valves and fittings	1	LS	$12,000	$12,000
Design, documentation, and fees	1	LS	$16,600	$16,600
Project Administration	1	LS	$8,200	$8,200
Subtotal Estimated Cost				$89,000
Contingency @ 30%				$27,000
Conceptual Level Estimated Construction Cost				$116,000

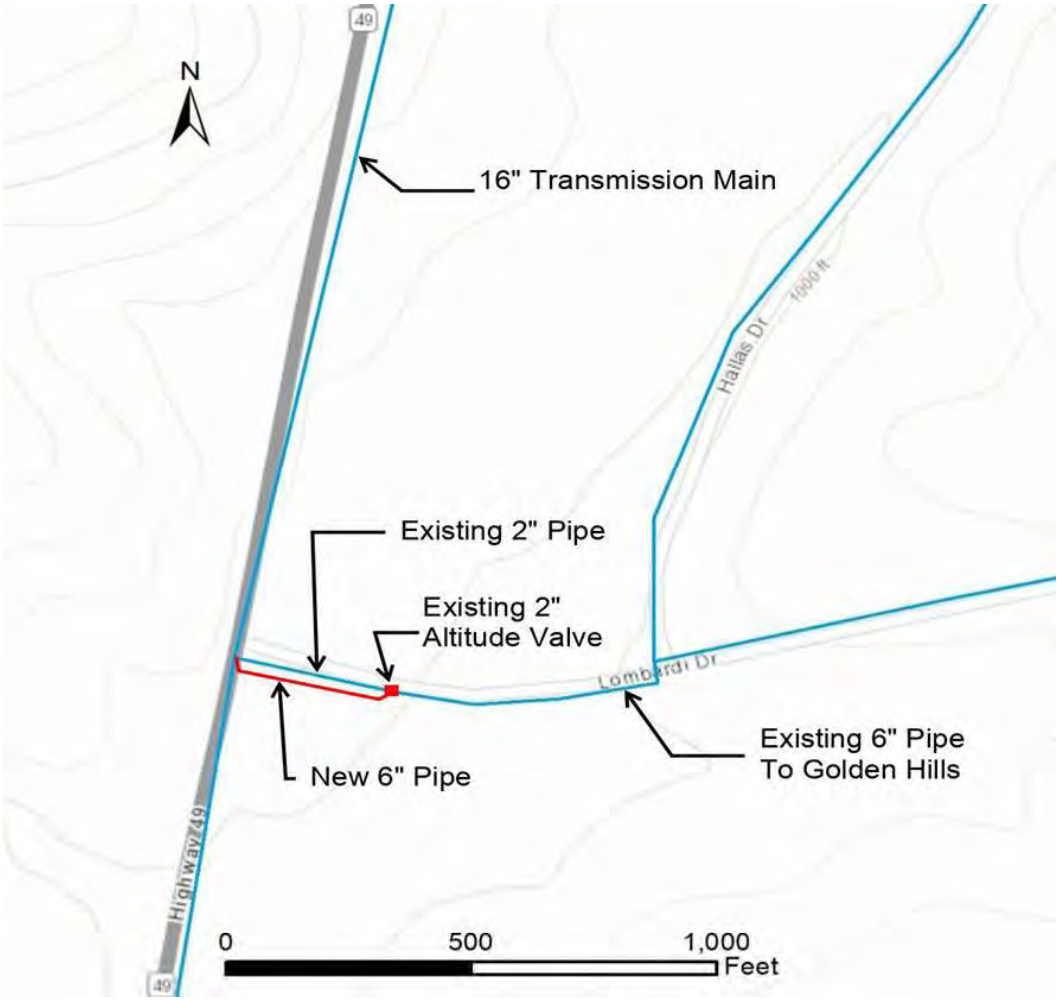


Figure 7: Golden Hills Fire Flow Improvements

5.2.4 Consolidation with a Nearby Water System

There are two water systems located within three miles of CPUD: Amador Water Agency – Buckhorn Plant and Amador Water Agency – Tanner, see Figure 8. However, CPUD is separated from these systems by the Mokelumne River and a canyon with depth of approximately 2,000 feet. For this reason, it is unfeasible to physically connect to these systems. If consolidation were feasible, the issues CPUD is facing would not be solved by consolidation and would still need to be addressed. CPUD needs distribution improvements but has enough source supply and storage capacity to provide water to its customers.

Figure 8: Water Systems Near CPUD

5.3 Conclusion and Recommendations

The projects presented above are of great importance to the overall reliability of the distribution system. In addition to the priority projects mentioned above, CRWA recommends that CPUD assess, prioritize, and plan to replace the remaining mains that are over 50 years old or prone to leaking. Transmission mains must be evaluated carefully, especially in areas that have history of leaks and high pressures. Leak detection technology is available and should be used to assess mains. Mains constructed of inadequate material to withstand high pressures should be replaced with higher pressure rated pipes.

CRWA has prioritized the projects to help CPUD pursue funding and construction based on the urgency of each project, as follows. The projects are all feasible to construct and no viable alternative projects were identified to compare them to.

5.3.1 Priority 1: Replacement of Transmission Lines

CPUD is split into various populated zones which are supplied by the trunk transmission mains. This leaves the lower zones vulnerable because there is no redundancy in the system to supply water in case of a break in the transmission main upstream. The transmission main in the Rich Gulch area leaks and a project is currently in progress to replace that section. The transmission mains discussed in section 5.2.1 are of the same age and may experience the same issues as the Rich Gulch area. These mains are critical and should be replaced with redundant parallel mains that have adequate pressure ratings to ensure reliable supply to the lower portions of the system.

5.3.2 Priority 2: Replace Undersized Distribution Pipes

The undersized mains in the Mokelumne Hill and San Andreas Tank zones limit the available flow in the pressure zones. The pipes are nearly 50 years old and have reached their expected design life. It is recommended the smaller mains be upgraded to 8 inch pipe and the 10 inch main along Highway 49 in the San Andreas Tank zone be replaced with 12 inch pipe to provide reliable distribution and fire flow throughout these two zones.

5.3.3 Priority 3: Replace Mokelumne Hill to Paloma Transmission Main

The existing transmission main between the Mokelumne Hill and Paloma zone is approximately 50 years old and has exceeded the expected design life. Replacement of the existing 6 inch pipe with an 8 inch pipe will provide the Paloma zone with increased flow and reliable supply.

5.3.4 Priority 4: Improve Fire Flow for Glencoe

CPUD, and in particular the Glencoe area, is vulnerable to wildfires. Fire protection system deficiencies should be addressed before projects of lesser importance. CRWA recommends construction of a 500 gpm fire pump station next to the existing Glencoe Pump Station. The new pump station would have minimal O&M costs because it is a backup station that would only be used for fire flow emergency. The existing pumps and hydropneumatic tank will remain in service to provide domestic flows.

5.3.5 Priority 5: Improve Fire Flow for Golden Hills

This project is of the same importance as Priority 2 because it addresses fire flow for an area of similar size. This project would only require a limited pipe replacement. No booster(s) would be needed because the pipe taps off the transmission main which has adequate pressure and flow to supply fire flow throughout the Golden Hills area.

6.0 WATER METER REPLACEMENT

CPUD's water meters are past their design life and need to be replaced with modern equipment. CPUD has a total of 2,438 water meters, ranging in size from 5/8 to 8 inches. These meters have no automatic reading capabilities. CPUD personnel go to each meter box and manually read the dials on the meter to determine billing. With the new technology, this will no longer be needed as this can be done walk by/drive by with a smartphone or laptop, or real time reading from the office (depending on the technology). While a majority of the meters are located adjacent to roadways, some are located in remote areas which require CPUD personnel walk to them. These remote meters can use cellular technology to automatically transfer reading data to the internet. New meters will help the system to:

- Manage water loss and conserve water throughout the system.
- Improve efficiency by reducing both time and costs for meter reading.
- Enhance water and energy conservation.
- Improve accuracy, as a result reducing billing errors and disputes.
- Improve accuracy by replacing older less accurate meters.
- Identify and isolate areas where water loss is occurring so appropriate repairs and upgrades can be made.
- Monitor tampering and enhance security.

There are three types of water meters: displacement (mechanical), nondisplacement, and compound meters. CPUD's current meters are displacement type. Most accurate meters

for potable water application are electromagnetic (mag) and ultrasonic nondisplacement meters. Both are available in sizes from 1/2 to 72 inch, covering CPUD's meter sizes.

Both mag meters and ultrasonic meters have no moving parts and require no maintenance. Both meter types provide highly accurate flow readings for water applications. Mag meters have inaccuracies of ±0.5 percent of flow rate or less. In comparison, ultrasonic meters have inaccuracies of ±1 to 2 percent.

There are two advanced technologies for meter reading and data collection. Automated Meter Reading (AMR) and Advanced Metering Infrastructure (AMI). Every AMR and AMI system is made of the following main components:

- Meters: compatible with AMR and AMI systems.
- Registers: devices that record the flow readings measured by the meters.
- Endpoints: devices that transmit the data from Registers to Data Collectors.
- Data Collectors: mobile data collectors for AMR system such as handheld devices or vehicle mounted, and fixed location data collectors for AMI system such as gateways.
- Software: stores and analyzes the data.

6.1 Meter Alternatives

CRWA explored meters and data collection technologies from three leading meter suppliers: Mueller, Kamstrup, and Neptune. Mueller offers the Solid State Meter (SSM) line, an ultrasonic meter for sizes 5/8 to 2 inches and HBMAG electromagnetic meter for sizes 4 and 8 inches. These meters are compatible with both AMR and AMI systems. Mueller's endpoints utilize large lithium batteries to warrant a 20 year life inside the meter endpoint. The endpoints are not integrated with the meters and come separately.

Kamstrup offers the FlowIQ 3200, an ultrasonic meter for sizes 5/8 to 4 inches and MAG 8000, an 8 inch electromagnetic meter. These meters are compatible with both AMR and AMI systems. Kamstrup's endpoints are integrated within the meters. Endpoints have Standard Kamstrup 20 year warranty (10 years full + 10 year prorated).

Neptune offers the T-10® displacement meter for sizes 5/8 to 2 inches and the MACH 10® ultrasonic meter for sizes 4 and 8 inches. These meters are compatible with both AMR and AMI systems. Neptune's endpoints are integrated within the meters. Endpoints have Standard Neptune 20 Year warranty (10 years full + 10 year prorated). A summary of the meters and data collection technologies from these suppliers are presented in Table 10.

Table 10: Technical Comparison of Meter Systems

Supplier	Selected Meters	Key Features of AMI/AMR Technology
Mueller	*Solid State Meter (SSM)* Ultrasonic meter for sizes 5/8" to 2" *HbMAG* Electromagnetic meter for sizes 4" and 8"	- Two AMI options: Long Range Wide Area Network (LoRaWAN) or traditional AMI (Mi.Net®) - Can use either CPUD's server or Mueller's server with Sentryx™ software - Standard warranty: 20 years - One Software for both AMR and AMI - Remote meter shut off/on capability - Leak detection - Cellular data transfer (without AMR/AMI)
Kamstrup	*FlowIQ 3200* Ultrasonic meter for sizes 5/8" to 4" *MAG 8000* Electromagnetic meter for size 8"	- One AMI option: Traditional (Kamstrup AMI) - Can only use Kamstrup server - One Software for both AMR and AMI - Standard warranty: 20 years (10 full/10 prorated) - Cellular data transfer (without AMR/AMI) - Leak detection
Neptune	*T 10* Displacement meter for sizes 5/8" to 2" *MACH 10* Ultrasonic meter for sizes 4" and 8"	- Two AMI options: LoRaWAN or traditional AMI (R900®) - Standard warranty: 20 years (10 full/10 prorated) - Can only use Neptune server - One software (Neptune 360) for both AMR and AMI - Cellular data transfer (without AMR/AMI) - Leak detection

The following sections include technical and cost analysis for three possible configurations for CPUD: Full AMR, Full AMI, and a hybrid system of AMI and AMR.

6.2 Full AMR System

With this system, CPUD personnel no longer need to read the meters manually. Instead, an endpoint is connected to the meter's register and captures water flow and alarm data which is then collected by CPUD personnel by walking or driving by with a data receiver

such as a handheld collector, laptop, or a smartphone, in proximity to the device. After collection, the meter data is uploaded to the CPUD database where CPUD personnel can monitor and analyze usage, troubleshoot issues, and bill customers. This can save time and labor for CPUD, therefore, reduce overall operational costs compared to the current system.

A lump sum cost for full AMR system from suppliers is presented in Table 11. Supplier quotations are presented in Appendix C. The cost estimate does not include installation, service line, and meter boxes costs.

Table 11: Full AMR System Cost

Supplier	Meters + AMR Devices	AMR Software (Annual)
Mueller	$448,500	$980
Kamstrup	$757,600	$2,250
Neptune	$562,200	$3,000

6.3 Full AMI System

AMI is the most advanced meter reading and data collection system currently available. It is an integrated system of water meters, communication networks, and data management systems that enables two way communication between meter endpoints and the system. Unlike AMR, AMI does not require CPUD personnel to collect the data. Instead, endpoints will transmit meter data automatically at a predetermined time once per day to AMI network fixed data collectors (gateways). On demand reads can also be requested anytime and are typically delivered within seconds. The data is then transmitted from the gateways to the host server and from there to CPUD's database for storage and analysis. With a full AMI system, CPUD's labor costs for onsite meter reading and data collection will approach to zero. In addition, it will save time and enhance billing process by being more efficient and on time.

The three suppliers offer the same meter and endpoint systems for AMI as for the AMR systems. Mueller and Neptune have two options for a full AMI system: traditional and LoRaWAN. LoRaWAN is a low power wide area communication network that wirelessly connects battery operated devices to the internet and manages communication between endpoints and system servers. LoRaWAN has many advantages over traditional AMI, including faster data transfer, longer range, low battery usage, and cheaper cost due to use of fewer gateways. Only Neptune provided a quotation and propagation study for both LoRaWAN and traditional AMI systems. The other two suppliers provided quotations

and propagation studies only for traditional AMI system because it is unknown if CPUD's service area has the necessary infrastructure for LoRaWAN. Therefore, CRWA used traditional AMI as the basis for technical and cost comparison between the suppliers. A lump sum cost for AMI system from all three suppliers is presented in Table 12. Supplier quotations are presented in Appendix C. The cost estimate does not include installation, service line, and meter boxes costs.

Table 12: Full AMI System Cost

Supplier	Meters + AMI Devices	AMI Software (Annual)
Mueller	$506,600	$15,800
Kamstrup	$1,275,100	$10,300
Neptune	$801,500	$18,700

6.4 Hybrid System of AMI and AMR

This system would use a combination of AMI and AMR technologies. Each supplier conducted a propagation study of CPUD's water system to determine the feasibility of AMR and AMI systems. The main goal of these studies was to identify parts of the system that are economically suitable for AMI. Areas like San Andreas and Mokelumne Hill that have more meters would have AMI technology; fully automated reading by using fixed antennas at optimal locations. This system would use one or more antennas to read all meters within a certain range. Meters in remote mountainous areas like Glencoe would be read with walk by or drive by (AMR).

The propagation studies from Mueller and Kamstrup show that around 95 percent of the system has good signal coverage for AMI system. While Neptune's study shows 66 percent covered by AMI and 34 percent covered by cellular technology. These are rough estimations and site studies are required to identify the areas and quantify the number of meters and antennas required for hybrid system. Supplier propagation studies are attached in Appendix B. A cost estimate for hybrid system is presented in Table 13. The cost estimate does not include installation, service line, and meter boxes costs.

Table 13: Hybrid AMI/AMR System Cost

Supplier	Hybrid AMR + AMI	Hybrid Software (Annual)
Mueller	$503,600	$15,800
Kamstrup	$1,249,300	$13,500
Neptune	$720,100	$14,100

6.5 Conclusion and Recommendations

For this analysis CRWA selected the apparent lowest cost supplier for each system. Mueller's AMR was selected as the best AMR system because it offers electromagnetic and ultrasonic meters and has the lowest cost. For the best AMI and hybrid systems, Mueller was selected because it offers the lowest cost AMI system without including cellular meters. Although Neptune has similar cost, it has included a high number of cellular meters in their proposal which will result in additional cellular data usage costs. As the meter project progresses through design, Neptune may be reconsidered as an option because they have a similar cost to Mueller and offered a more conservative estimate for this study. Despite offering similar features, Kamstrup was not selected because of very high costs compared to the other two suppliers.

A project net present value (NPV) for 20 years was calculated for the selected AMR, AMI, and hybrid systems. The NPVs are used to evaluate and compare both alternatives by estimating cost of each option over 20 years. NPVs take capital costs and operational costs into consideration and discount future expenses based on an assumed inflation rate. The NPVs for the project were calculated by using the capital costs for the two options and the annual O&M costs that would occur during a 20 year period. A conceptual level construction cost opinion and NPV estimate is included in Appendix D. A cost comparison between the meter reading and data collection systems, is presented in Table 14 below.

Table 14: Cost Comparison Between AMR, AMI, and Hybrid Systems

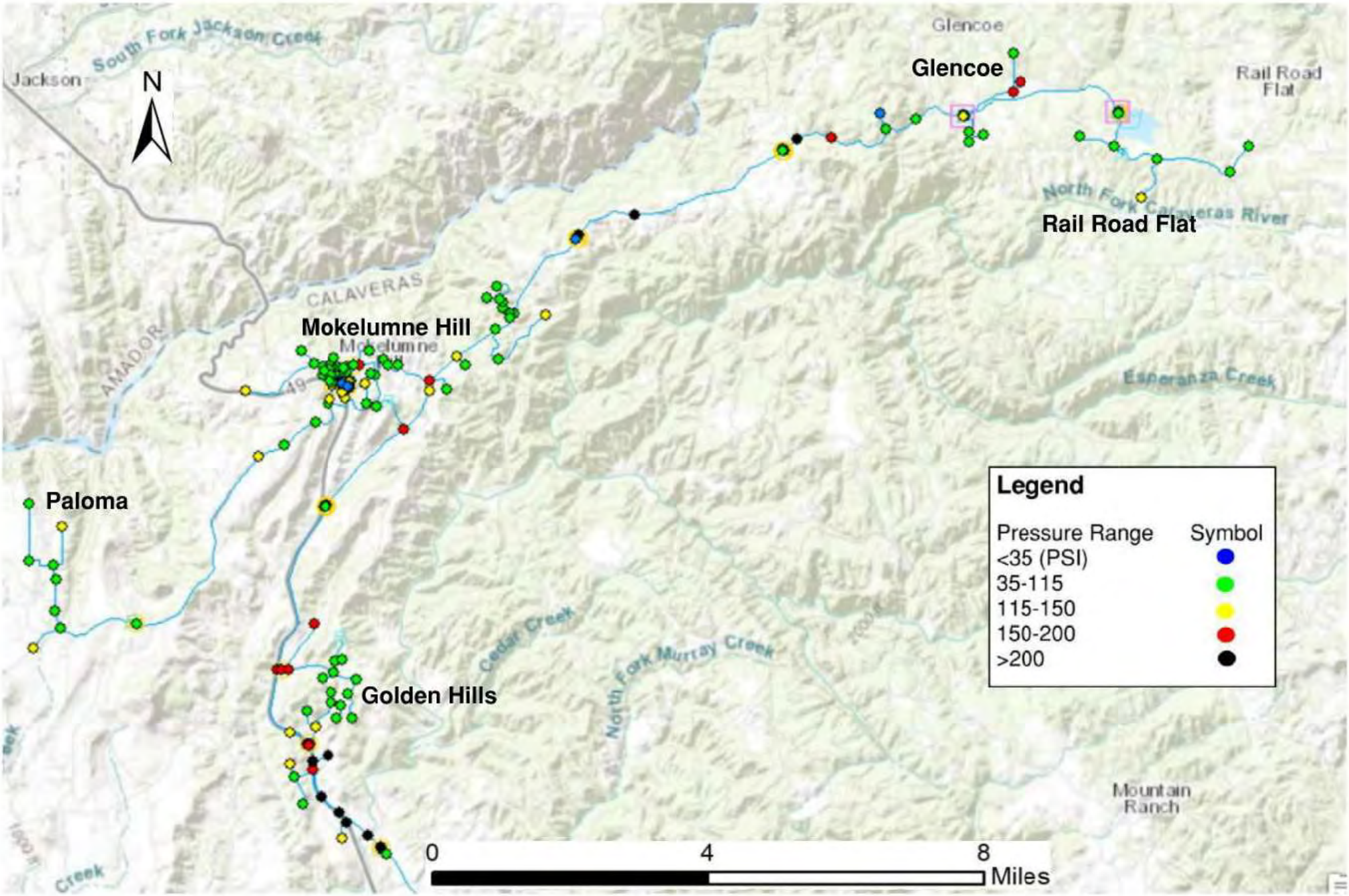
Lowest Cost Alternative	Initial Cost	20 Year O&M	20 Year NPV
AMR (Mueller)	$449,000	$744,000	$1,193,000
AMI (Mueller)	$507,000	$633,000	$1,140,000
Hybrid (Mueller)	$504,000	$789,000	$1,293,000

CRWA recommends a full AMI system for CPUD. Although AMR system has a much lower initial cost compared to full AMI it has a much higher O&M cost than an AMI system resulting in a similar 20 year NPV. In addition, AMI system does not require CPUD

personnel to collect the data, therefore, saves time and enhances the billing process. After 20 years when the meters and endpoints are being replaced, the AMI infrastructure such as antennas/gateways may not need to be replaced therefore could reduce meter replacement costs.

In addition to meters, old meter boxes need to be replaced with new standardized boxes. The new infrastructure would have an expected service life of approximately 40 years, but the transmitters and registers would need to be replaced in about 20 years when the batteries fail.

Appendix A


Glencoe
Glencoe
Rail Road Flat
Rail Road Flat
North Fork Calaveras River
Jackson
South Fork Jackson Creek
N
CALAVERAS
AMADOR
Mokelumne Hill
Mokelumne
Esperanza Creek
Paloma
Golden Hills
Cedar Creek
North Fork Murray Creek
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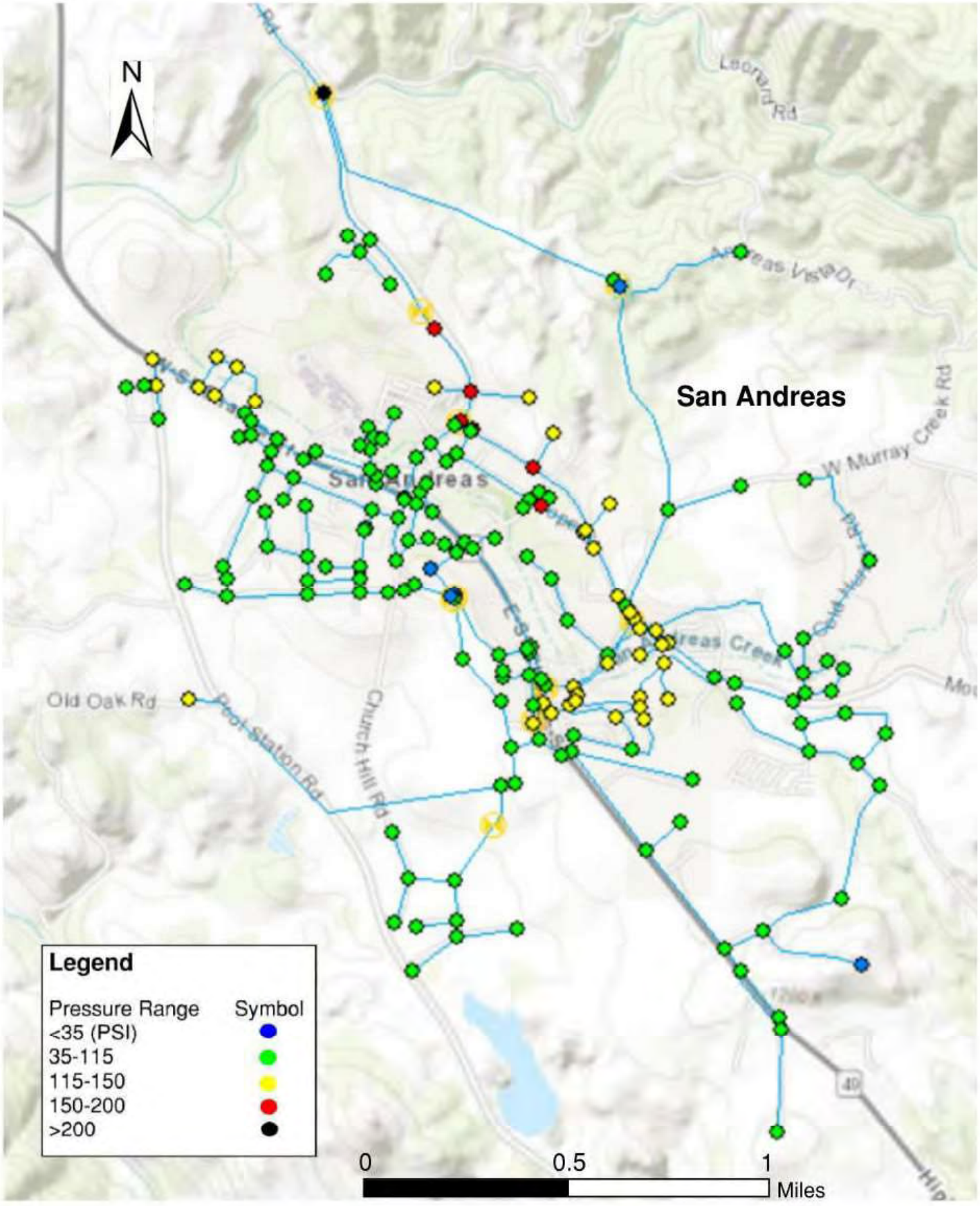
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San Andreas
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Church Hill Rd
W Murray Creek Rd
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Pressure Range
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115-150
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>200
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1
Miles

Appendix B

Mueller Propagation Study

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Study Details

Available Information

- Water Tanks available in the service area
- Utility Properties available in the service area
- 1,936 Water Meters (100% Plastic Pit Lids)

Estimated Infrastructure Requirements

- Twelve (12) Multi-Network Collectors (on Water Tanks, Utility Properties and Proposed Locations)
- Two (2) ACXR Repeaters (on Utility Properties)
- Twenty-seven (27) DCXR Repeaters (on Sign Poles)

Assumptions

- 1,891 meter locations were able to be geocoded for this study. Additional meter locations provided after this study may require additional infrastructure.
- Study assumes water meters mounted under plastic pit lids. Nodes must be mounted through the lid with a Mueller TTLH adapter.
- Areas with low signal strength may require additional infrastructure.
- Assets proposed for infrastructure locations will require a site survey to determine any nearby assets/locations viable for infrastructure placement. After site survey, if there are no viable assets, study will need revision.
- Study assumes an average ambient RF noise floor at or below –115dBm within the Mi.Net operational frequency band. An RF spectrum analysis may be completed during the site survey. High in-band noise may require additional network infrastructure.
- **For asset assumptions see pages labeled 'Infrastructure Installation notes and assumptions'.**

Performance Goals

- RF Coverage of installed base of meter/modules to be at 100%
- Read rate of at least 98.5% over a 3-day window of the installed base of active meter/modules.

Note:

This RF propagation study was conducted using the available information and assumptions stated in this document. Quantities and infrastructure locations are subject to change after detailed site survey following award.

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Multi-Network Collector Locations

Type	Height Assumption	Asset Name	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Labor Part Number
MNC	30ft	Main Control Valve	38.323137	-120.655653	LABOR-COLLECTOR1
MNC	30ft	HWY 26 Tank	38.257704	-120.704873	LABOR-COLLECTOR5
MNC	30ft	Ponderosa Hydro Plant	38.337368	-120.612922	LABOR-COLLECTOR5
MNC	30ft	Railroad Flat Tank	38.336594	-120.542300	LABOR-COLLECTOR1
MNC	30ft	Mokelumne Hill Tank	38.296146	-120.694573	LABOR-COLLECTOR1
MNC	30ft	Poloma Tank	38.260219	-120.747989	LABOR-COLLECTOR1
MNC	30ft	San Andreas Tank	38.204038	-120.670326	LABOR-COLLECTOR1
MNC	30ft	Proposed Location 1	38.300244	-120.709519	LABOR-COLLECTOR7
MNC	30ft	Proposed Location 2	38.343340	-120.593008	LABOR-COLLECTOR7
MNC	30ft	Proposed Location 3	38.337435	-120.517081	LABOR-COLLECTOR7
MNC	30ft	Proposed Location 4	38.232141	-120.712531	LABOR-COLLECTOR7
MNC	30ft	Proposed Location 5	38.311621	-120.671622	LABOR-COLLECTOR7

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

XR Repeaters

Type	Height Assumption	Asset Name	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Labor Part Number
ACXR	30ft	Admin Office	38.200253	-120.690231	LABOR-REPEATER3
ACXR	30ft	PRV Cemetery	38.192472	-120.678674	LABOR-REPEATER3

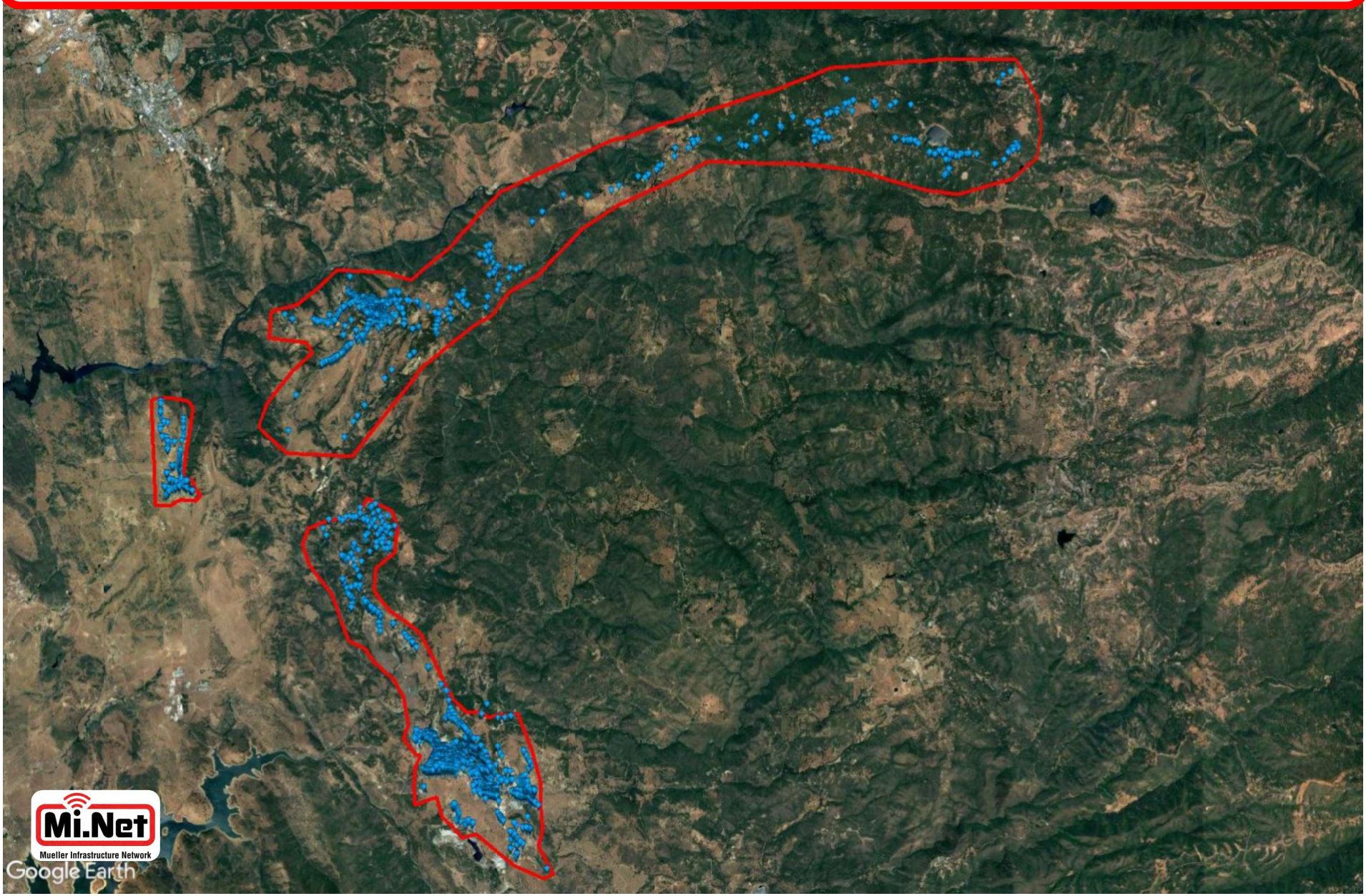
Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

XR Repeaters

Type	Height Assumption	Asset Name	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Labor Part Number
DCXR	10ft	Sign Pole 1	38.172598	-120.663232	LABOR-REPEATER1
DCXR	10ft	Sign Pole 2	38.336016	-120.531186	LABOR-REPEATER1
DCXR	10ft	Sign Pole 3	38.340262	-120.574529	LABOR-REPEATER1
DCXR	10ft	Sign Pole 4	38.345456	-120.570349	LABOR-REPEATER1
DCXR	10ft	Sign Pole 5	38.352500	-120.520771	LABOR-REPEATER1
DCXR	10ft	Sign Pole 6	38.338017	-120.595793	LABOR-REPEATER1
DCXR	10ft	Sign Pole 7	38.333003	-120.621334	LABOR-REPEATER1
DCXR	10ft	Sign Pole 8	38.327534	-120.636199	LABOR-REPEATER1
DCXR	10ft	Sign Pole 9	38.347975	-120.553171	LABOR-REPEATER1
DCXR	10ft	Sign Pole 10	38.309851	-120.663705	LABOR-REPEATER1
DCXR	10ft	Sign Pole 11	38.342607	-120.585306	LABOR-REPEATER1
DCXR	10ft	Sign Pole 12	38.327509	-120.648371	LABOR-REPEATER1
DCXR	10ft	Sign Pole 13	38.296941	-120.707201	LABOR-REPEATER1
DCXR	10ft	Sign Pole 14	38.179943	-120.664124	LABOR-REPEATER1
DCXR	10ft	Sign Pole 15	38.214535	-120.687852	LABOR-REPEATER1
DCXR	10ft	Sign Pole 16	38.192588	-120.687547	LABOR-REPEATER1
DCXR	10ft	Sign Pole 17	38.300097	-120.715813	LABOR-REPEATER1
DCXR	10ft	Sign Pole 18	38.207389	-120.683825	LABOR-REPEATER1
DCXR	10ft	Sign Pole 19	38.288791	-120.718030	LABOR-REPEATER1
DCXR	10ft	Sign Pole 20	38.275429	-120.711132	LABOR-REPEATER1

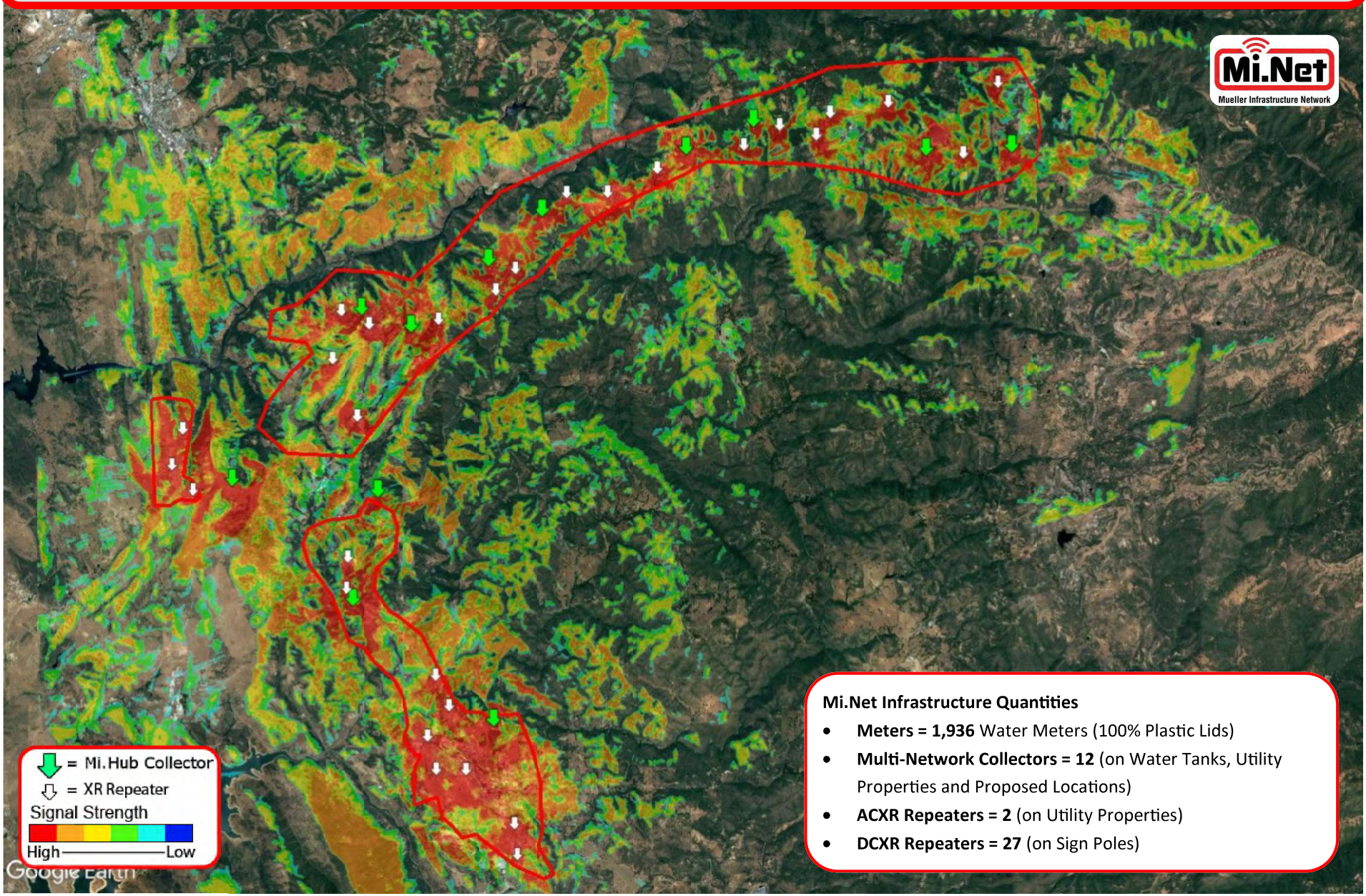
Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Estimated Service Area and Meter locations



Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Estimated RF Analysis Coverage



Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Infrastructure Installation Notes and Assumptions

Type/Part Numbers	Device	Notes/Assumptions
Tank <150': **LN: LABOR-COLLECTOR1** **PN:** MS-MNC-V4-AC-AT3 Tank >150': **LN: LABOR-COLLECTOR2** **PN:** MS-MNC-V4-AC-AT3	MNC/RMR/SMR on utility owned tank	Includes installation of antenna and amplifier/filter on top of tank to existing structure (i.e. corral or railing), running and securing coax from amplifier to collector on available raceway within arm's reach of ladder down the tank. Installation of the Collector at base of tank on utility supplied mounting panel or post, weather proofing all connections and RF sweep of connections. **a.** Assumes available AC source within close (3ft) range of the collectors installed site **b.** Assumes collector can be installed to an existing circuit or to an additional circuit breaker in an existing panel and that a good ground is provided or available for lightning arrestor **c.** Assumes suitable grounding point provided at top of structure, within 6ft of TTU installation location. *Does not include the following:* **d.** Other manual work not directly associated with installation of the Collector such as hand trenching from tank to Collector or electrical junction box and buildup of collector mounting frame **e.** Securing and encasing RF or AC cable in any form of conduit. **f.** Structural analysis or RF study of device with information provided by tower owner upon request, at cost plus 20%.

Mi.Net
Mueller Infrastructure Network

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Infrastructure Installation Notes and Assumptions

Type/Part Numbers	Device	Notes/Assumptions
Communication Tower <150': **LN: LABOR-COLLECTOR3** **PN:** MS-MNC-V4-AC-AT3 Communication Tower >150': **LN: LABOR-COLLECTOR4** **PN:** MS-MNC-V4-AC-AT3	MNC/RMR/SMR on communication tower	Includes installation of Antenna and Amplifier/filter on tower, running and securing coax from amplifier to collector down the tower. Installation of the Collector at base of tower on supplied mounting panel or post, weather proofing all connections, and RF sweep of connections. **a.** Assumes available AC source within close (3ft) range of the collectors installed site **b.** Assumes collector can be installed to an existing circuit or to an additional circuit breaker in an existing panel and that a good ground is provided or available for lightning protection at top of tower for TTU and bottom of tower for hub enclosure *Does not include other manual work not directly associated with installation of the Collector such as hand trenching from tank to Collector or electrical junction box and buildup of collector mounting frame.* **a.** Does not include monthly lease fees (approx. $200 to $500 per month). **b.** Structural analysis or RF study of device with information provided by tower owner upon request, at cost plus 20%. *Assumes MS will negotiate terms of rental agreement on behalf of utility. Utility will enter into agreement with tower owner.*

Mi.Net
Mueller Infrastructure Network

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Infrastructure Installation Notes and Assumptions

Type/Part Numbers	Device	Notes/Assumptions
Utility Asset **LN: LABOR-COLLECTOR5** **PN:** MS-MNC-V4-AC-AT3	MNC/RMR/SMR on Utility asset	Collector and MS provided hardware mounted to utility-provided asset at the height indicated in the prop study. Either bolted or clamped to building/pole provided with no additional mounting considerations using supplied mounting hardware. a. Assumes available AC source within close (3ft) range of the collectors installed site b. Assumes all parts of the installation can be accessed with a ladder and no man-lift required c. Assumes collector can be installed to an existing circuit or to an additional circuit breaker in an existing panel d. Structural analysis or RF study of device with information provided by asset owner upon request, at cost plus 20%.
Pole 25’ or Smaller: **LN: LABOR-COLLECTOR6** **PN:** MS-MNC-V4-AC-AT3 Pole 25.1’ to 55’: **LN: LABOR-COLLECTOR7** **PN:** MS-MNC-V4-AC-AT3	MNC/RMR/SMR with MS Supplied Pole	Includes selected non-telescopic and non-tilting pole provided by MS and labor to locate, set and install pole and collector by MS in utility approved right of way. **a.** Assumes available AC source within close (3ft) range of the collectors installed site **b.** Assumes collector can be installed to an existing circuit or to an additional circuit breaker in an existing panel -Hurricane rated poles or specialized installations priced separately in accordance with requirements. *Any right of way permitting provided by utility.*

Mi.Net
Mueller Infrastructure Network

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Infrastructure Installation Notes and Assumptions

Type/Part Numbers	Device	Notes/Assumptions
Utility Asset **LN: LABOR REPEATER 3** **PN: MSW-NODE4-AC**	ACXR on Utility Asset	Repeater and MS provided hardware mounted to utility-provided asset at the height indicated in the prop study. Either bolted or clamped to building/pole provided with no additional mounting considerations using supplied mounting hardware. **a.** Assumes available AC source within close (3ft) range of the repeater installed site **b.** Assumes all parts of the installation can be accessed with a ladder and no man-lift required **c.** Assumes repeater can be installed to an existing circuit or to an additional circuit breaker in an existing panel.
Pole set **LN: LABOR-REPEATER1** **PN: MSW-NODE4-DC**	DCXR with Pole set	Includes 10’ street sign typepost provided by MS and labor to locate and set post, and install repeater by MS in utility approved right of way. *Any right of way permitting provided by utility.*
Utility Asset **LN: LABOR-REPEATER2** **PN: MSW-NODE4-DC**	DCXR on Utility Asset	Repeater and MS provided hardware mounted to utility provided asset (i.e. street sign type post). Either bolted or clamped to asset provided with no additional mounting considerations using supplied mounting hardware.

Mi.Net
Mueller Infrastructure Network

Calaveras Public Utility District (CA) - Mi.Net V6 Propagation Study

Customer Signature Approval

Customer Approval

By: _____
Authorized Signature

_____
Name (Print or Type)

_____
Title

Mi.Net
Mueller Infrastructure Network

Kamstrup Propagation Study

Propagation Study

Calavera County PUD, CA

Consultant/Radio Planner	KRB
Date	06/21/2022
Version	01.00
Approver	JDM

Facts

No. of Meters: 2000 meters

Meter location: pit with concrete lids

Performance: 98.5% hourly readings

Extra info:

Conditions

The following situations are not included in the measured performance:

- Failure of third-party communications (e.g. GSM network or IP infrastructure)
- Defective meters or collectors
- Meters or collectors that have been affected by external factors (e.g. vandalism, physical harm or enclosure)
- Installations that are not performed or not possible to perform in accordance with the installation instructions and training of the vendor.
- The sites should be established within 50 meters of the specified locations. Alternative locations need approval by Kamstrup.
- Antenna must be placed at minimum the specified height (above ground) and free from surrounding roofs and structures.

Service Area

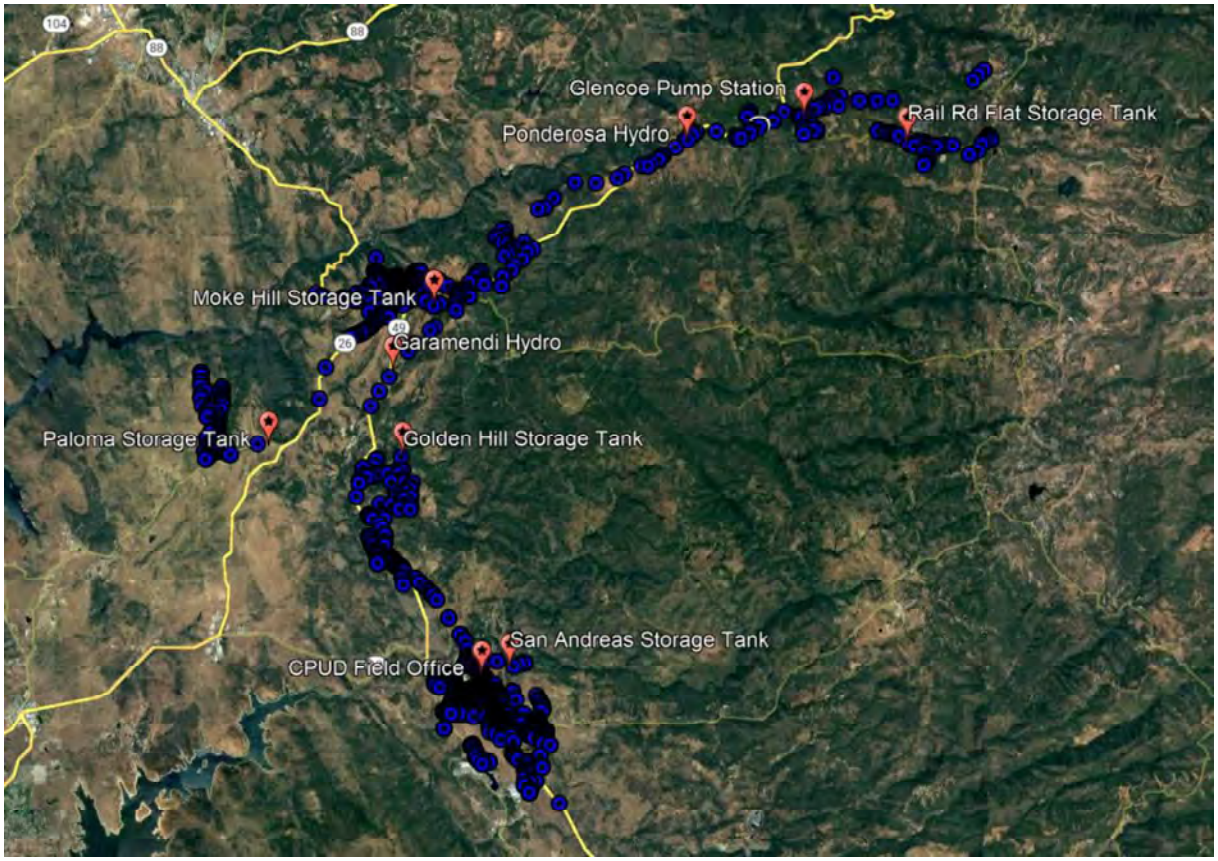


Figure 1 Service area and vertical assets

Site placement & Radio cover

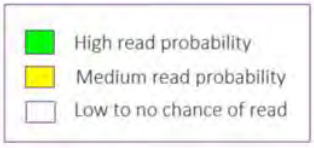
Assets

Asset Description	Address	Min. antenna height
Rail Rd Flat Storage Tank	38.336605°, -120.542315°	40ft
Glencoe Pump Station	38.343019°, -120.575299°	30ft
Ponderosa Hydro	38.337373°, -120.612925°	30ft
Moke Hill Storage Tank	38.296077°, -120.694441°	40ft
Paloma Storage Tank	38.260224°, -120.747996°	36ft
Garamendi Hydro	38.279425°, -120.708065°	30ft
Golden Hill Storage Tank	38.257701°, -120.704874°	40ft
San Andreas Storage Tank	38.203890°, -120.670278°	40ft
CPUD Field Office	38.202076°, -120.679341°	30ft

Table 1 Vertical Assets Data

Study results

When analyzing the scenarios presented in this section, refer to the legend below:

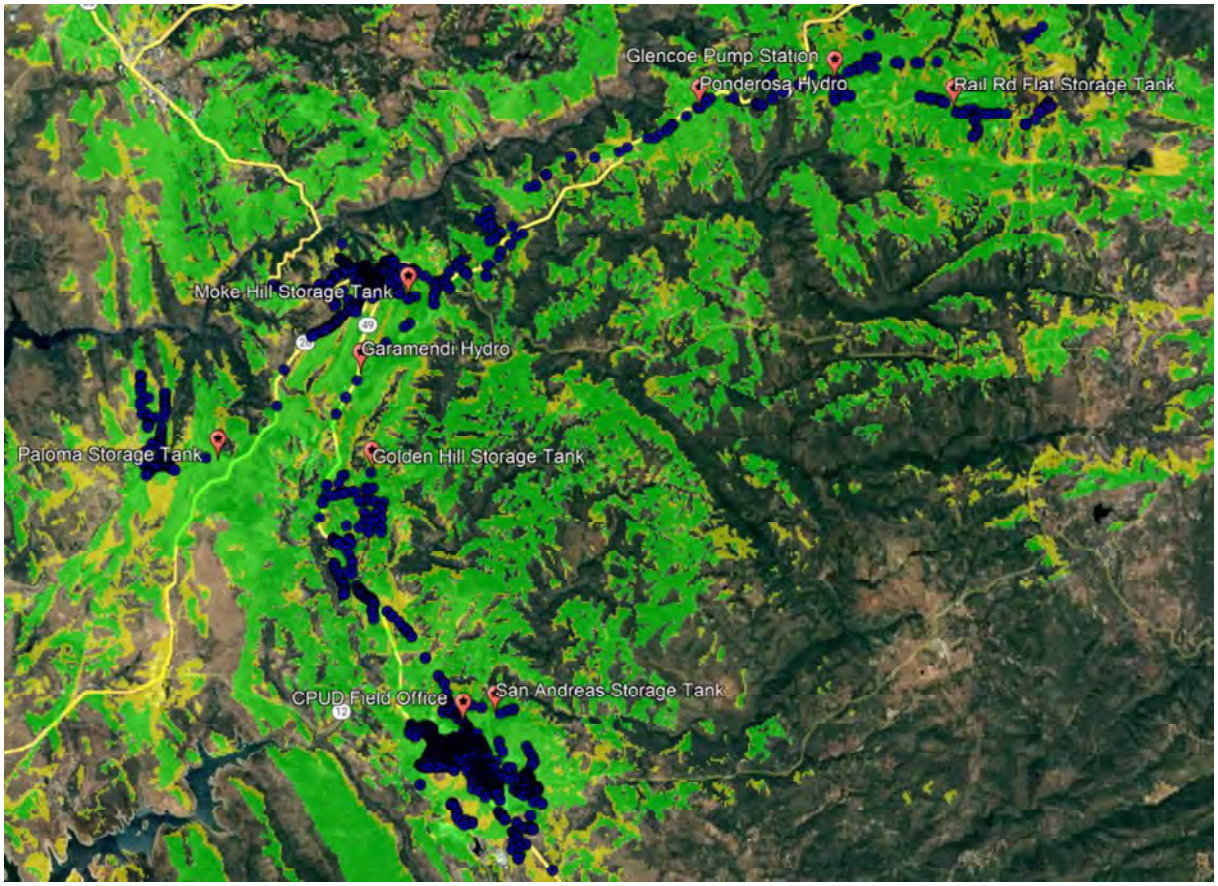


High Read Probability: Highlighted Green on the Map – very likely to receive daily reads from meter

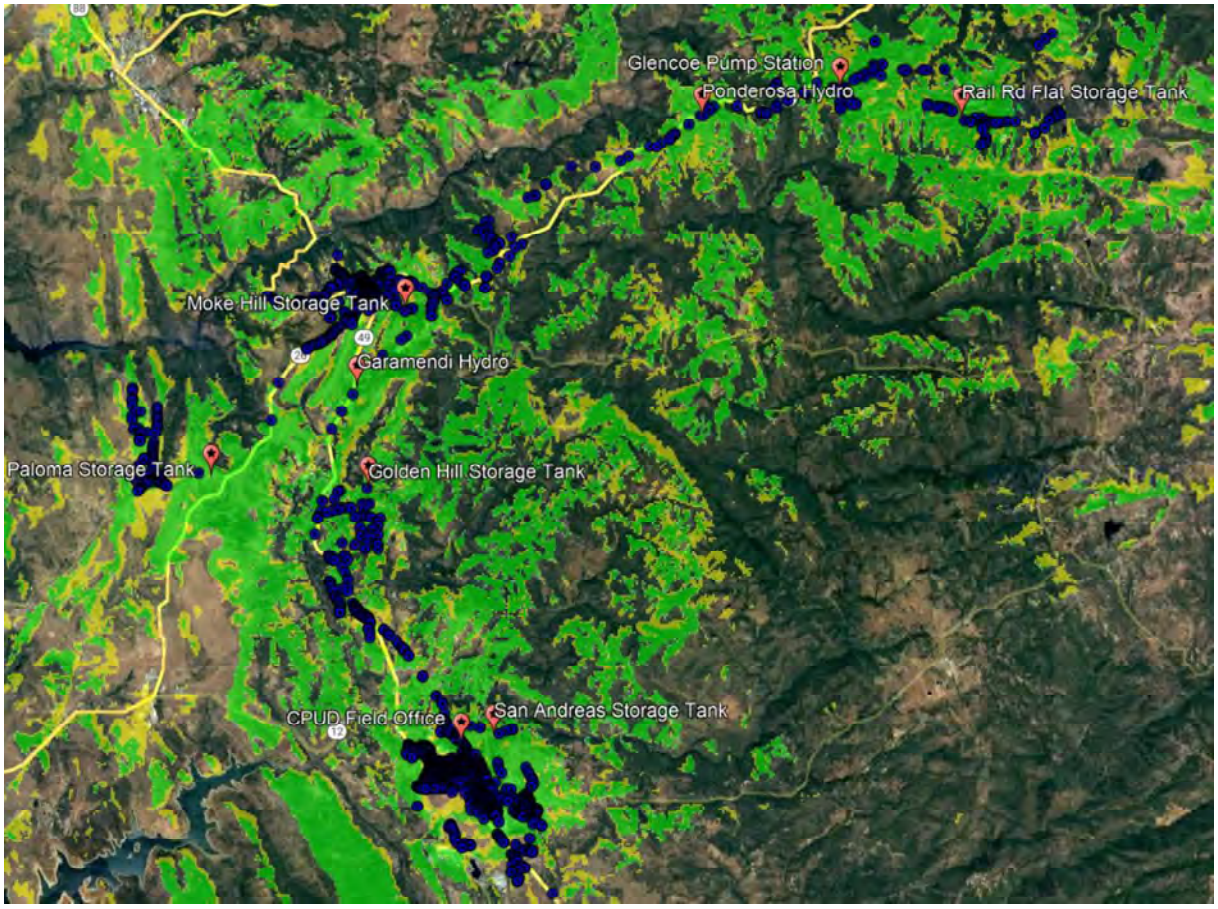
Medium Read Probability: Highlighted Yellow on the map – likely to receive reads every other day to every seven days

Low read Probability: No highlighting shown on map – likely to not have radio signal coverage from collector

Coverage - dry pit with polymer lids



Coverage - dry pit with concrete lids



Results of the propagation study

The service area is in an area with hills. With the provided 11 vertical assets, it is recommended to install collectors on 9. As the exact height of the vertical assets are unknown, the heights used are estimates.

There are approximately 5% of the meters outside coverage.

Budget with 9 collectors and 10% external meter antennas or swap pit lid polymer.

Neptune Propagation Study

R900 Propagation Analysis

Calaveras Public Utilities District- San Andres, CA

July 1st, 2022

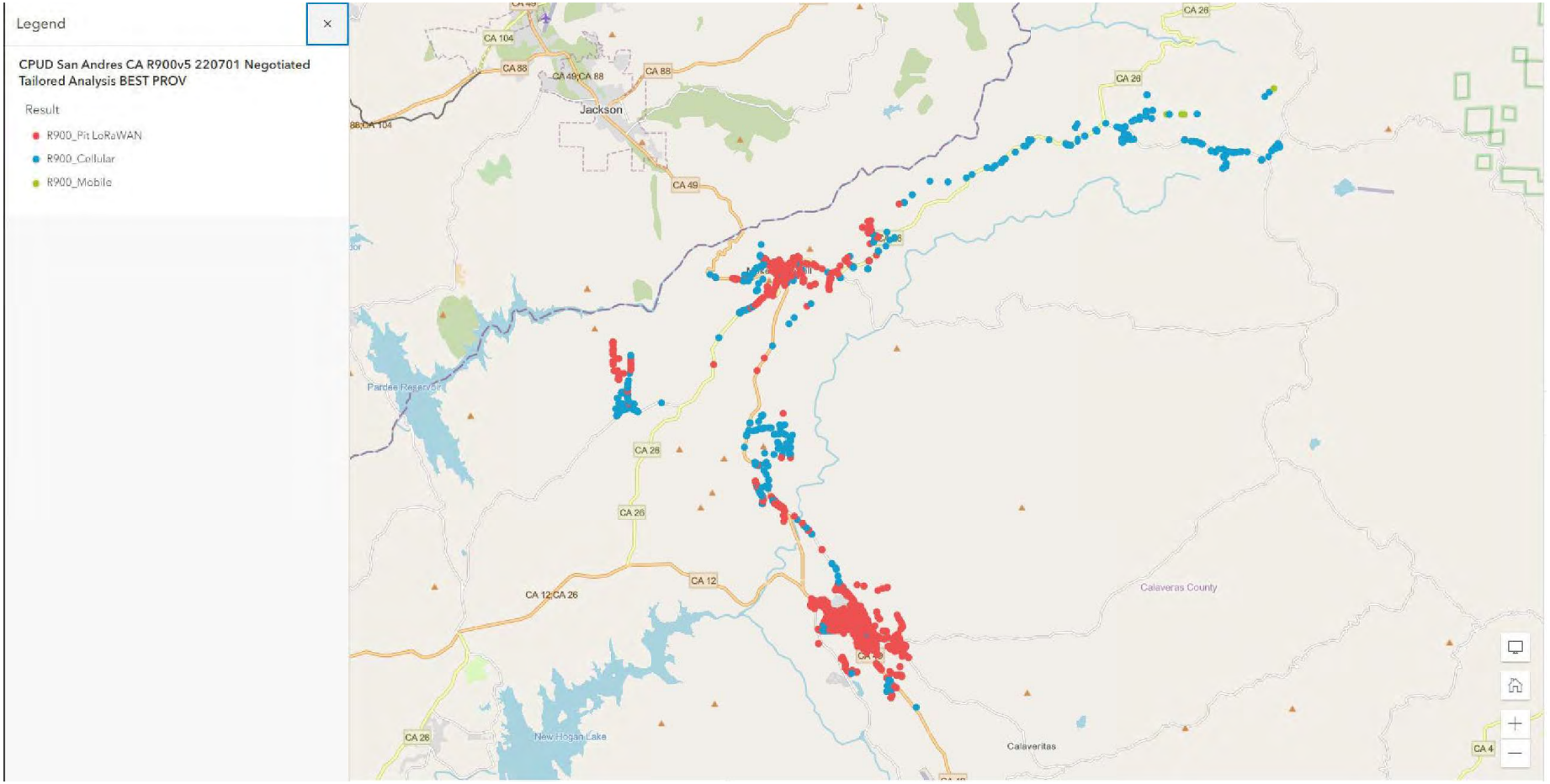
NEPTUNE TECHNOLOGY GROUP

Predicted Coverage Results:

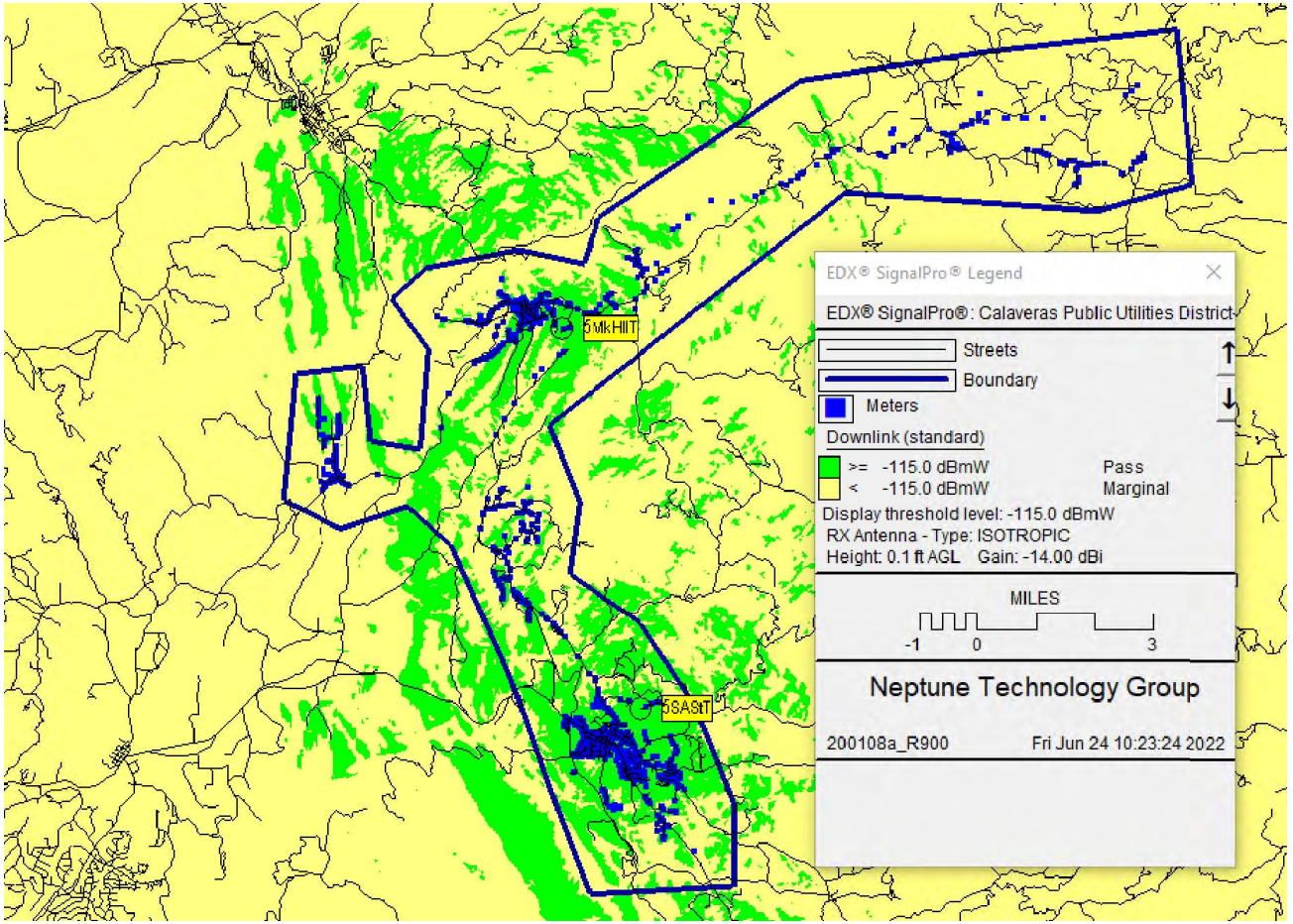
Coverage	# Services	% Services
R900_v5 Pit LoRaWAN	1449	75.51%
R900_Cellular	466	24.28%
R900_Mobile	4	0.21%
NonGeo	0	0.00%
Totals	1919	100.00%

Map	Description	Provided Services		1,919	Geocoded Services	1,919	Area (sq Miles)	57.48
		#Coll	MIU Type	Read Type	Projected	% Projected	Projected	% Projected
2	Best Provided	2	R900v5 Pit	Billing	1,449	75.50%	15.05	26.18%

Map 1: Tailored Coverage



Map 2: R900 Gateway Coverage



Gateway Locations:

Map	Location	Latitude	Longitude	Collector	Elev(m)	AntHgt(m)	Elev(ft)	AntHgt(ft)	Coax Type	Coax(ft)	Antenna
1	5SAStT	38.203889	-120.670278	Tmega	405	12	1328	40	LMR400	15	2xMFB9155
1	5MkHllT	38.296111	-120.694444	Tmega	556	12	1823	40	LMR400	15	2xMFB9155

Assumptions:

1. Propagation based on defined MIU (External Wall or Pit w/External Antenna) with specified gateway/collector. Older equipment should be replaced. Propagation is subject to change based on equipment specifications and performance. Performance cannot be confirmed until final system evaluation and analysis complete. Propagation model is based on performance for >90% daily read success and typical noise level <-120dBm. Use of this propagation analysis done with this understanding and there is no guarantee of product or performance. Additional gateways could be required. Antenna heights are set to 75 feet as default unless heights provided. This affects Find (search ring) and asset locations.

2. MIUs mounted inside structures not recommended for fixed network solutions. Various building materials used within structures affect RF signal differently. An average loss value applied to the propagation model for inside MIU studies. Relocate non-performing inside MIUs to structure exterior. Inside R900i MIUs not recommended for fixed network solutions and may require replacement with External Wall MIU.

3. Check FAA; ASR; and AM Tower Screening results to identify potential work by owner or contractor. FAA obstruction evaluation based on proximity to airports. https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm ; Check ASR (Antenna Structure Registration) requirements at http://wireless.fcc.gov/antenna/index.htm?job=home ; Check AM Tower screening results for structures within 3km of AM stations; LBA Group (https://www.lbagroup.com/client-portal/index.php) & Sitesafe (http://am.sitesafe.com/) offer free evaluations and proposals for engineered solutions for AM detuning.

4. Coverage is not based on MIU specifications. Contains AT&T Proprietary and Confidential information – use only pursuant to company direction. Coverage and signal levels are based on stationary on-air outdoor predictions and are not guaranteed. Actual coverage may differ and may be affected by terrain; weather; foliage; buildings; other construction; high-usage periods; customer equipment; and other factors. Indoor uses would be worse depending on the building construction. Signal levels do not equate to speed. LTE Tri-Level Ranges: Best = 0 to -100; Good = -100 to -110 Moderate = -110 to -116. Tri-level coverage is the most detailed signal level information we are allowed to share with customers. The tri-level breakout is signal strength estimates output by the RAN design tools for the various technologies and merge them into three bands. The band breakouts were selected by HQ RAN engineers to represent what level of service customers would likely have outside (remember all our estimates are for outside coverage not in-building) in an area or at an address.

R900 Propagation Analysis

Calaveras Public Utilities District- San Andres, CA

July 1st, 2022

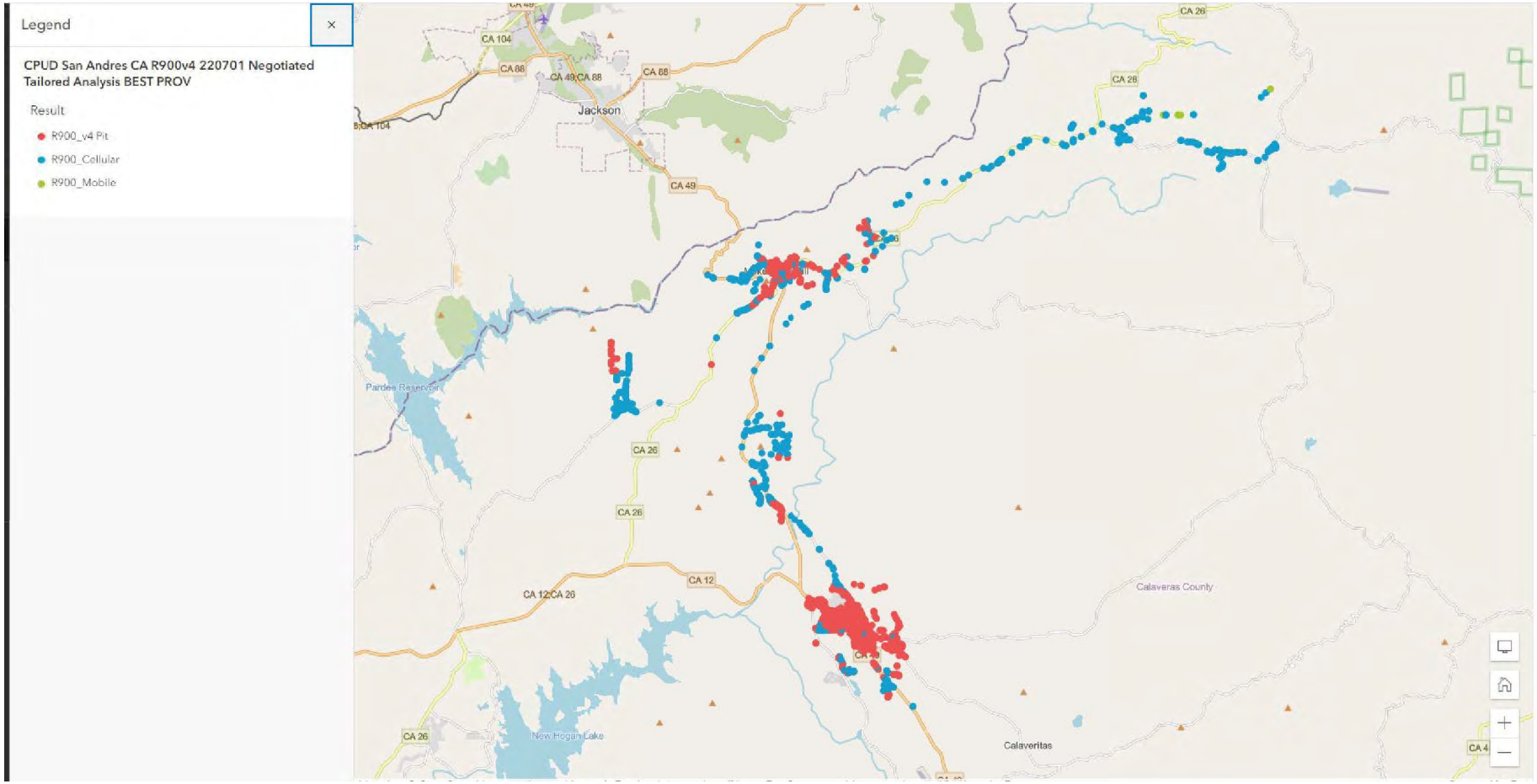
NEPTUNE TECHNOLOGY GROUP

Predicted Coverage Results:

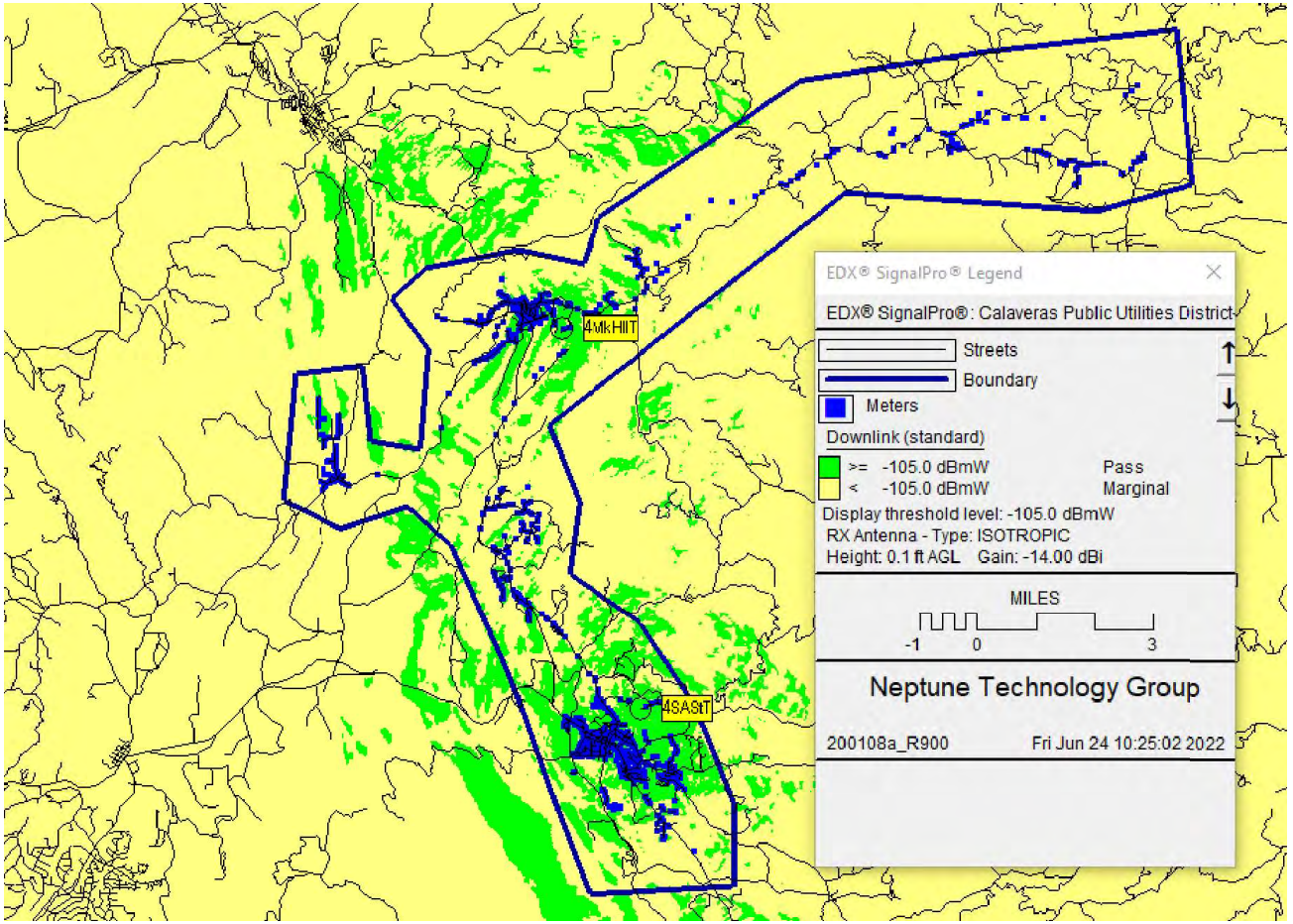
Coverage	# Services	% Services
R900_v4 Pit	1272	66.28%
R900_Cellular	643	33.51%
R900_Mobile	4	0.21%
NonGeo	0	0.00%
Totals	1919	100.00%

Map	Description	Provided Services		1,919	Geocoded Services	1,919	Area (sq Miles)	57.48
		#Coll	MIU Type	Read Type	Projected	% Projected	Projected	% Projected
2	Best Provided	2	R900v4 Pit	Billing	1,272	66.28%	10.46	18.20%

Map 1: Tailored Coverage



Map 2: R900 Gateway Coverage



Gateway Locations:

Map	Location	Latitude	Longitude	Collector	Elev(m)	AntHgt(m)	Elev(ft)	AntHgt(ft)	Coax Type	Coax(ft)	Antenna
1	4MkHllT	38.296111	-120.694444	GPV4	556	12	1823	40	LDF4	90	MFB9155
1	4SAStT	38.203889	-120.670278	GPV4	405	12	1328	40	LDF4	90	MFB9155

Assumptions:

1. Propagation based on defined MIU (External Wall or Pit w/External Antenna) with specified gateway/collector. Older equipment should be replaced. Propagation is subject to change based on equipment specifications and performance. Performance cannot be confirmed until final system evaluation and analysis complete. Propagation model is based on performance for >90% daily read success and typical noise level <-120dBm. Use of this propagation analysis done with this understanding and there is no guarantee of product or performance. Additional gateways could be required. Antenna heights are set to 75 feet as default unless heights provided. This affects Find (search ring) and asset locations.

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3. Check FAA; ASR; and AM Tower Screening results to identify potential work by owner or contractor. FAA obstruction evaluation based on proximity to airports. https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm ; Check ASR (Antenna Structure Registration) requirements at http://wireless.fcc.gov/antenna/index.htm?job=home ; Check AM Tower screening results for structures within 3km of AM stations; LBA Group (https://www.lbagroup.com/client-portal/index.php) & Sitesafe (http://am.sitesafe.com/) offer free evaluations and proposals for engineered solutions for AM detuning.

4. Coverage is not based on MIU specifications. Contains AT&T Proprietary and Confidential information – use only pursuant to company direction. Coverage and signal levels are based on stationary on-air outdoor predictions and are not guaranteed. Actual coverage may differ and may be affected by terrain; weather; foliage; buildings; other construction; high-usage periods; customer equipment; and other factors. Indoor uses would be worse depending on the building construction. Signal levels do not equate to speed. LTE Tri-Level Ranges: Best = 0 to -100; Good = -100 to -110 Moderate = -110 to -116. Tri-level coverage is the most detailed signal level information we are allowed to share with customers. The tri-level breakout is signal strength estimates output by the RAN design tools for the various technologies and merge them into three bands. The band breakouts were selected by HQ RAN engineers to represent what level of service customers would likely have outside (remember all our estimates are for outside coverage not in-building) in an area or at an address.

Appendix C

Mueller Quotation

MUELLER

SALES QUOTATION

Phone: (800) 423-1323
Website: www.MuellerSystems.com

Attention: Travis Small
Phone: (209) 754-9442
Email: travis.small@cpud.org

Company Address:
506 West Saint Charles Street
San Andreas,CA,95249

Prepared For:
CALAVERAS PUBLIC UTILITY DISTRICT (CA)
Account #:

End User:
CALAVERAS PUBLIC UTILITY DISTRICT (CA)

Created Date: 06/16/2022
Quote #: Q-107629
Quote Expires: 06/15/2022

Terms are located at:
www.MuellerSystems.com/Support

ARO: "A" & Stock items 30 Days.
Project items Stock to 120 days unless specified in contract

Currency Type: USD

Prepared by:
Daniel Whittemore

Comments & Consideration

$50 minimum order, $75 non-box quantity
Should you have any questions, please do not hesitate to contact Daniel-Whittemore

Quote Line Items

Mueller AMI Quotation

AMI Devices (One Time Costs)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MSW-NODE4-AC	AC REPEATER	2	1,260.00	2,520.00
MSW-NODE4-DC	DC REPEATER	27	1,030.00	27,810.00
MS-TTL-A	THRU THE LID ANTENNA ASSEMBLY	2,000	5.00	10,000.00
MSW-NODE6-1P-05	RADIO ENDPOINT	2,000	82.00	164,000.00
MS-MNC-V4-AC-AT1	COLLECTOR	12	9,600.00	115,200.00
MS-H4-RADIO	INSTALL RADIO	1	2,250.00	2,250.00
MS-G-MHUB	MAINTENANCE RADIO	1	2,800.00	2,800.00
			AMI Devices (One Time Costs) TOTAL:	USD 324,580.00

Mueller AMI Quotation

AMI Labor Install

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
LABOR-COLLECTOR5	COLLECTOR INSTALLTION ON UTILITY ASSET	7	3,055.20	21,386.40
LABOR-COLLECTOR7	MUELLER SUPPLIED POLE AND COLLECTOR INSTALL LABOR	5	7,316.40	36,582.00
LABOR-REPEATER1	DC (BATTERY POWERED) REPEATER WITH A SIGN POST	2	1,303.15	2,606.30
LABOR-REPEATER3	DC (BATTERY POWERED) REPEATER ATTACHED TO EXISTING ASSET	27	3,055.20	82,490.40
			AMI Labor Install TOTAL:	USD 143,065.10

AMI Software (Annual Cost)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MS-CELLULAR	4G CELLULAR BACKHAUL PER MNC COLLECTOR	12	401.22	4,814.64
MSW-S-PH-ALL-5K	SaaS SENTRYX AMI SOFTWARE (HES/ MDMS)	2,000	5.50	11,000.00
			AMI Software (Annual Cost) TOTAL:	USD 15,814.64

Project Costs (One Time Cost)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MS-T-TRAIN-DAY	SOFTWARE TRAINING - PER DAY	3	3,000.00	9,000.00
MS-T-CIS-FILE	CIS FILE INTERFACE DEVELOPMENT (METER SWAP/ AND BILLING FILE) BETWEEN SENTRYX AND CIS SYSTEM	1	12,000.00	12,000.00
PROJECT-MGMT	PROJECT MANAGEMENT FEES AND MOBILIZATION	265	200.00	53,000.00
			Project Costs (One Time Cost) TOTAL:	USD 74,000.00

AMI Hardware (Optional Annual Cost) EXTENDED WARRANTY

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MS-G-M-YR	MNC COLLECTOR EXTENDED WARRANTY	12	2,530.37	30,364.44
MS-G-M-YR-MHUB	MAINTENANCE RADIO EXTENDED WARRANTY	1	502.44	502.44

Mueller AMI Quotation

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MS-R-M-YR	REPEATER EXTENDED WARRANTY	29	463.73	13,448.17
			AMI Hardware (Optional Annual Cost) TOTAL:	USD 44,315.05

Meters PD Nutating Disk Positive Displacement All Bronze Meters

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
VEGB123N	5/8X3/4,420B,BB,ME8,CF,5'NIC	1,700	115.00	195,500.00
VEKB123N	1"452B,BB,ME8,CF,5'NICOR	250	170.00	42,500.00
WENB123N	1-1/2" 562B,2B,ME8,SG,5'NICOR	20	500.00	10,000.00
WEPB123N	2"572B,2B,ME8,SG,5'NICOR	35	560.00	19,600.00
			Meters PD TOTAL:	USD 267,600.00

Meters SSM Ultrasonic Meter Option

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
U0303N	5/8X3/4 AQUAIENT ULTRASONIC METER-METAL ALLOY NSF62 COMPLIANT	300	126.00	37,800.00
S0410EN	SSM3/4STD,CF.01V,8E,EXTPR 18"N	1,400	115.00	161,000.00
S0510EN	SSM 1",CF,.01V,8E,EXT PRO 18"N	250	186.00	46,500.00
			Meters SSM TOTAL:	USD 245,300.00

Meter Lids (Optional) Estimated until actual box types are provided

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
XXXXXX	B-24 Box Lid	2,011	130.99	263,420.89
			Meter Lids (Optional) Estimated until actual box types are provided TOTAL:	USD 263,420.89

SALES QUOTATION

Phone: (800) 423-1323
Website: www.MuellerSystems.com

Attention:
Phone:
Email:

Company Address:
506 West Saint Charles Street
San Andreas,CA,95249

Prepared For:
CALAVERAS PUBLIC UTILITY DISTRICT
(CA)
Account #:

End User:
CALAVERAS PUBLIC UTILITY DISTRICT
(CA)

Created Date: 05/09/2022
Quote #: Q-105388
Quote Expires: 07/20/2022

Terms are located at:
www.MuellerSystems.com/Support

ARO: "A" & Stock items 30 Days.
Project items Stock to 120 days
unless specified in contract

Currency Type: USD

Prepared by:
Daniel Whittemore

Comments & Consideration
$50 minimum order, $75 non-box quantity
Should you have any questions, please do not hesitate to contact Daniel-Whittemore
Quote Line Items

Mueller AMR Quotation

AMR Devices (One Time Cost)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MSW-NODE5-1P-05	MINET-M W/5'NICOR	2,011	75.00	150,825.00
MS-MNMMOBILE-HW-KIT	MINETM MOBILE TRANSCEIVER KIT	1	7,500.00	7,500.00
			AMR Devices (One Time Cost) TOTAL:	USD 158,325.00

AMR Software (One Time Cost)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
AHRMOBILE-SW-SUITE	EZREADER MOBILE SOFTWARE SUITE	1	700.00	700.00
			AMR Software (One Time Cost) TOTAL:	USD 700.00

Mueller AMR Quotation

Meters SSM Ultrasonic

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
U0303N	5/8X3/4 AQUAIENT 5' NICOR	1,700	125.00	212,500.00
S0510SN	SSM 1",CF,.01V,8E,STD PRO 18"N	250	0.00	0.00
S0610SN	SSM 1.5,CF,.01V,8E,STDPRO 18"N	20	0.00	0.00
S0710SN	SSM 2",CF,.01V,8E,STD PRO 18"N	35	0.00	0.00
			Meters SSM Ultrasonic TOTAL:	USD 212,500.00

Meters Positive Displacement

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
VEGB123N	5/8X3/4,420B,BB,ME8,CF,5'NIC	1,700	115.00	195,500.00
VEKB123N	1"452B,BB,ME8,CF,5'NICOR	250	170.00	42,500.00
WENB113N	1-1/2" 562B,2B,ME8,CF,5'NICOR	20	500.00	10,000.00
WEPB113N	2"572B,2B,ME8,CF,5'NICOR	35	560.00	19,600.00
			Meters Positive Displacement TOTAL:	USD 267,600.00

Large Meters

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
M0031F125	3"MAG,FM,CF,COMP,4D BAT,25'NIC	1	2,300.00	2,300.00
HBRING3	3" HBMAG GROUNDING RING	1	20.00	20.00
M0042F125	4"HBMAG,FM,SG,COM,4DBAT,25'NIC	5	2,650.00	13,250.00
HBRING4	4" HBMAG GROUNDING RING	10	25.00	250.00
M0081F125	8"MAG,FM,CF,COMP,4D BAT,25'NIC	1	6,000.00	6,000.00
HBRING8	8" HBMAG GROUNDING RING	2	33.00	66.00
			Large Meters TOTAL:	USD 21,886.00

AMR Software Maintenance (Optional Annual Cost)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
IAEZMAINT-SW-3K	EZ YR MAINT (1-2.5K)	1	980.00	980.00
			AMR Software Maintenance (Optional Annual Cost) TOTAL:	USD 980.00

Mueller AMR Quotation

AMR Hardware Maintenance (Optional Annual Cost)

PART #	DESCRIPTION	UNITS	SALE PRICE	EXTENDED NET
MS-MNMMAINT-TRANSCVER	MOBILE TRANSCEIVER YRLY MAINT	1	1,800.00	1,800.00
			AMR Hardware Maintenance (Optional Annual Cost) TOTAL:	USD 1,800.00

Kamstrup Quotation

Bid Proposal for Calaveras PUD, CA Metering Quote

CUSTOMER

All Bidders

Job
Calaveras PUD, CA Metering Quote
Bid Date: 07/29/2022
Bid #: 2418604

CONTACT

Sales Representative
Christopher Mensinga
(M) 585-831-2053
(T) 585-424-5800
(F) 585-424-7275
Chris.Mensinga@coreandmain.com

Core & Main
1268 Vanderbilt Circle
Manteca, CA 95337
(T) 209-823-7500

NOTES

Pricing is based on July 1st pricing. Two quotes have been provided, the first is the AMR (Drive-by) and the second is the AMI (Fixed base).

Bid Proposal for Calaveras PUD, CA Metering Quote

All Bidders
Bid Date: 07/29/2022
Core & Main 2418604

Kamstrup AMR Quotation

Core & Main
1268 Vanderbilt Circle
Manteca, CA 95337
Phone: 209-823-7500

Seq#	Qty	Description	Units	Price	Ext Price
		DUE TO CURRENT SUPPLY CHAIN DISRUPTIONS, MATERIALS			
		ARE SUBJECT TO PRICING AT TIME OF SHIPMENT. MATERIAL			
		AVAILABILITY AND TIMELINESS OF SHIPMENTS CANNOT BE			
		GUARANTEED. THIS TERM SUPERSEDES ALL OTHER			
		CONTRACTUAL PROVISIONS.			
10		**** DRIVE-BY AMR SOLUTION ****			
20	1700	5/8X3/4 FLOWIQ 2100 AMR MTR COMPOSITE	EA	273.60	465,120.00
		PART #: 02U-57-C04-8UX			
40	250	1" FLOWIQ 3101 AMR MTR SS	EA	589.50	147,375.00
		PART #: 03U-57-C0Q-8UX			
60	20	1-1/2" FLOWIQ 3101 AMR MTR SS	EA	1,061.11	21,222.20
		PART #:03U-23-C0J-8EX			
80	35	2" FLOWIQ 3101 AMR MTR SS	EA	1,629.00	57,015.00
		17"LL, PART #: 03U-23-C0K-8EX			
100	5	4" FLOWIQ 3101 AMR MTR SS	EA	3,650.40	18,252.00
		14"LL, PART #: 03U-23-C0N-8EX			
120	1	8" MAG8000 METER W/ GROUNDING	EA	7,334.00	7,334.00
		RINGS & READY GATEWAY			
140	350	AMR ANTENNA F/ FLOWIQ 2100 PLUG-IN	EA	39.00	13,650.00
150	350	KIT FOR WALL/PIT ANTENNA FLOWIQ 2200	EA	46.00	16,100.00
160		**** SOFTWARE / EQUIPMENT ****			
170	1	KAMSTRUP READY ADVANCED US CONVERTER 669640000.2	EA	3,490.72	3,490.72
180	1	ANDROID TABLET	EA	550.00	550.00
190	1	ANNUAL HOSTING FEES <2,400 PTS	EA	2,254.00	2,254.00
200		**** ONE TIME FEES ****			
210	1	SOFTWARE SET UP & INTEGRATION	EA	3,490.72	3,490.72
220	1	SOFTWARE TRAINING	EA	4,000.00	4,000.00
				DRIVE-BY AMR SOLUTION	**759,853.64**

Bid Proposal for Calaveras PUD, CA Metering Quote

Bid #: 2418604

Seq#	Qty	Description	Units	Price	Ext Price
240		**** AMI FIXED BASE SOLUTION ****			
250	1700	5/8X3/4 FLOWIQ 2200 AMI MTR	EA	443.20	753,440.00
		PART #: 02-K-02-D-1-8A-8-UB			
270	250	1 FLOWIQ 2200 AMI MTR SS	EA	648.81	162,202.50
		PART #: 02-L-02-D-1-8D-8-UB			
290	35	2" FLOWIQ 3101 AMR MTR SS	EA	1,629.00	57,015.00
		17"LL, PART #: 03U-23-C0K-8EX			
310	5	4" FLOWIQ 3101 AMR MTR SS	EA	3,650.40	18,252.00
		14"LL, PART #: 03U-23-C0N-8EX			
330	1	8" MAG8000 METER W/ GROUNDING	EA	7,334.00	7,334.00
		RINGS & READY GATEWAY			
350	350	6' WALL ANTENNA F/ AMI MTR	EA	93.60	32,760.00
360	350	6' PIT ANTENNA F/ AMI MTR	EA	58.40	20,440.00
370		**** EQUIPMENT ****			
380	1	KAMSTRUP READY ADVANCED US CONVERTER 669640000.2	EA	3,490.72	3,490.72
390	1	READY BLUETOOTH OPTICAL HEAD	EA	744.80	744.80
400	1	ANDROID TABLET	EA	550.00	550.00
410	9	KAMSTRUP AMI RF COLLECTOR	EA	11,885.72	106,971.48
420	9	COLLECTOR INSTALLATION	EA	9,000.00	81,000.00
430		**** SOFTWARE ****			
440	1	READY MANAGER WATER AMI <2,401 (ONE TIME FEE)	EA	11,045.05	11,045.05
450	1	READY MANAGER HOSTING FEE (ANNUAL)	EA	4,247.20	4,247.20
460	1	AMI SYSTEM ROLLOUT PROJ. MGMT	EA	19,431.75	19,431.75
470		**** LEAK DETECTOR SOFTWARE ****			
480	1	LEAK DETECTOR ANNUAL SOFTWARE	EA	6,047.20	6,047.20
490	1	LEAK DETECTOR UP & RUNNING (ONE TIME FEE)	EA	453.00	453.00
500		**** OPTIONAL ADD-ONS ****			
510	1	EMAIL / TEXT OF INFO CODES (ANNUAL FEE)	EA	190.19	190.19
520	1	METER EXCHANGE SOFTWARE (ONE TIME FEE)	EA	1,628.91	1,628.91
530	1	METER EXCHANGE SFTWARE HOSTING (ANNUAL FEE)	EA	812.00	812.00
540	1	DISTRICT ANALYZER FOR AMI (ANNUAL FEE)	EA	2,148.00	2,148.00
550	1	DISTRICT ANALYZER UP & RUNNING (ONE TIME FEE)	EA	453.00	453.00
			AMI FIXED BASED SOLUTION		**1,290,656.80**

UNLESS OTHERWISE SPECIFIED HEREIN, PRICES QUOTED ARE VALID IF ACCEPTED BY CUSTOMER AND PRODUCTS ARE RELEASED BY CUSTOMER FOR MANUFACTURE WITHIN THIRTY (30) CALENDAR DAYS FROM THE DATE OF THIS QUOTATION. CORE & MAIN LP RESERVES THE RIGHT TO INCREASE PRICES TO ADDRESS FACTORS, INCLUDING BUT NOT LIMITED TO, GOVERNMENT REGULATIONS, TARIFFS, TRANSPORTATION, FUEL AND RAW MATERIAL COSTS. DELIVERY WILL COMMENCE BASED UPON MANUFACTURER LEAD TIMES. ANY MATERIAL DELIVERIES DELAYED BEYOND MANUFACTURER LEAD TIMES MAY BE SUBJECT TO PRICE INCREASES AND/OR APPLICABLE STORAGE FEES. THIS BID PROPOSAL IS CONTINGENT UPON BUYER'S ACCEPTANCE OF SELLER'S TERMS AND CONDITIONS OF SALE, AS MODIFIED FROM TIME TO TIME, WHICH CAN BE FOUND AT: https://coreandmain.com/TandC/

Neptune Quotation

FERGUSON WATERWORKS

FERGUSON WW #1423
7601 14TH AVENUE
SACRAMENTO, CA 95820-3601

Phone: 916-381-6100
Fax: 916-455-3402

Deliver To:
From: Adam Arevalo
Comments:

FERGUSON WATERWORKS #1423
Price Quotation
Phone: 916-381-6100
Fax: 916-455-3402

Bid No: B453126
Bid Date: 04/08/22
Quoted By: AA

Cust Phone: 916-381-6100
Terms: CASH ON DEMAND

Customer: CASH SALE ACCT - #1423
CVS - SACRAMENTO STORE
SACRAMENTO, CA 95826-6008

Ship To: CUSTOMER PICK-UP

Cust PO#: Neptune AMR Quotation

Job Name: CAL RURAL WATER

Item	Description	Quantity	Net Price	UM	Total
SP-NED2B22RPWG11	LF 5/8X3/4 T10 MTR P/C BRZ USG R900	1700	220.000	EA	374000.00
SP-NED2F22RPWG11	1 T10 MTR BRZ/BRZ P/C R900I USG	250	333.000	EA	83250.00
NED2H11RPWG11	LF 1-1/2 T10 MTR P/C R900I USG PIT	20	586.000	EA	11720.00
NED2J11RPWG11	LF 2 T10 MTR P/C R900I USG PIT	35	720.000	EA	25200.00
SP-NEU3C2G1	4 MACH10 R900I USG 14" LL	5	3313.000	EA	16565.00
SP-NEU4A2G1	8 MACH10 20 LL USG V4 R900I	1	8744.000	EA	8744.00
	METERS				519479.00

N13442200	R900 V4 PIT MIU W/ 6 FT WIRE	200	126.000	EA	25200.00
	RETROFIT MIUS				25200.00

N13980001	NEPTUNE 360 AMR SETUP FEE	1	1765.000	EA	1765.00
SP-N13980004	NEPTUNE 360 8 HR ONSITE TRAINING	1	1765.000	EA	1765.00
	SOFTWARE SETUP & TRAINING				3530.00

N13980103	NEPTUNE 360 AMR - 1001-2500	1	3000.000	EA	3000.00
	YEARLY SOFTWARE SUB FEE				3000.00

N13655100	MRX920 MOBILE DATA COL V4	1	8667.000	EA	8667.00
N13302100	R900 BELT CLIP TRANSCEIVER V3	1	5334.000	EA	5334.00
	READING EQUIPMENT				14001.00

Net Total:	$565210.00
Tax:	$49455.89
Freight:	$0.00
Total:	$614665.89

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complete a survey about your bids:
https://survey.medallia.com/?bidsorder&fc=1423&on=411383

FERGUSON WATERWORKS

FERGUSON WATERWORKS #1423
Price Quotation

Fax: 916-455-3402

15:05:32 APR 08 2022

Reference No: B453126

Quoted prices are based upon receipt of the total quantity for immediate shipment (48 hours). SHIPMENTS BEYOND 48 HOURS SHALL BE AT THE PRICE IN EFFECT AT TIME OF SHIPMENT UNLESS NOTED OTHERWISE. QUOTES FOR PRODUCTS SHIPPED FOR RESALE ARE NOT FIRM UNLESS NOTED OTHERWISE.

CONTACT YOUR SALES REPRESENTATIVE IMMEDIATELY FOR ASSISTANCE WITH DBE/MBE/WBE/SMALL BUSINESS REQUIREMENTS.

Seller not responsible for delays, lack of product or increase of pricing due to causes beyond our control, and/or based upon Local, State and Federal laws governing type of products that can be sold or put into commerce. This Quote is offered contingent upon the Buyer's acceptance of Seller's terms and conditions, which are incorporated by reference and found either following this document, or on the web at https://www.ferguson.com/content/website-info/terms-of-sale
Govt Buyers: All items are open market unless noted otherwise.

LEAD LAW WARNING: It is illegal to install products that are not "lead free" in accordance with US Federal or other applicable law in potable water systems anticipated for human consumption. Products with *NP in the description are NOT lead free and can only be installed in non-potable applications. Buyer is solely responsible for product selection.
WATER FLOW RATE NOTICE: Lavatory Faucets with flow rates over 0.5 GPM are not allowed for 'public use' in California.
COVID-19 ORDER: ANY REFERENCE TO OR INCORPORATION OF EXECUTIVE ORDER 14042 AND/OR THE EO-IMPLEMENTING FEDERAL CLAUSES (FAR 52.223-99 AND/OR DFARS 252.223-7999) IS EXPRESSLY REJECTED BY SELLER AND SHALL NOT APPLY AS SELLER IS A MATERIALS SUPPLIER AND THEREFORE EXEMPT UNDER THE EXECUTIVE ORDER.

FERGUSON WATERWORKS

FERGUSON WW #1423
7601 14TH AVENUE
SACRAMENTO, CA 95820-3601

Phone: 916-381-6100
Fax: 916-455-3402

Deliver To:
From: Adam Arevalo
Comments:

FERGUSON WATERWORKS #1423
Price Quotation
Phone: 916-381-6100
Fax: 916-455-3402

Bid No: B460266
Bid Date: 07/06/22
Quoted By: AA

Cust Phone: 916-381-6100
Terms: CASH ON DEMAND

Customer: CASH SALE ACCT - #1423
CVS - SACRAMENTO STORE
SACRAMENTO, CA 95826-6008

Ship To: CUSTOMER PICK-UP

Cust PO#: Neptune AMI Quotation

Job Name: CALAVERAS PUD

Item	Description	Quantity	Net Price	UM	Total
SP-D2B22RYMG11SG89	5/8X3/4 T10 MTR BRZ R900I V5 W/ 6'	1434	296.000	EA	424464.00
NED2B22RPHG21	LF 5/8X3/4 T10 MTR P/C BRZ USG PIT	266	313.000	EA	83258.00
SP-N13966200	R900C PIT W/ 6' WIRE INT ANT	266	0.000	EA	0.00
	CELL MIU INCLUDED IN METER PRICE				
SP-D2F22RYMG11SG89	1 T10 ECDR R900I V5 USG W/ 6'	250	432.000	EA	108000.00
SP-D2H11RYMG11SG89	1-1/2 T10 ECDR R900I V5 GAL W/ 6'	20	736.000	EA	14720.00
SP-D2J11RYMG11SG89	2 T10 ECDR R900I V5 W/ 6' USG	35	896.000	EA	31360.00
SP-NEU3C5G1SG90	4 MACH10 14LL R900I V5 USG W/ 20'	5	3800.000	EA	19000.00
SP-NEU4A5G1SG90	8 MACH10 R900I V5 20 LL USG 20' ANT	1	10003.000	EA	10003.00
SP-N13966200	R900C PIT W/ 6' WIRE INT ANT	200	165.000	EA	33000.00
	METERS				723805.00

N13791100	R900 GATEWAY V5 ETHERNET VERIZON	2	10286.000	EA	20572.00
N13878000	UPS KIT R900I IOT GATEWAY	2	8043.000	EA	16086.00
N13146100	R900 GATEWAY RF ANTENNA	4	435.000	EA	1740.00
FNAMI	NEPTUNE - INFRASTRUCTURE INSTALL	2	15000.000	EA	30000.00
N13655100	MRX920 MOBILE DATA COL V4	1	9286.000	EA	9286.00
	HARDWARE & INFRASTRUCTURE				77684.00

N13980203	NEPTUNE 360 AMI - 1001-2500	1	6257.250	EA	6257.25
SP-N13980303	N360 & FIRSTNET 1001-2500	1	6500.200	EA	6500.20
SP-N13980002	NEPTUNE 360 AMI SET UP FEE	1	4062.500	EA	4062.50
SP-N13980004	NEPTUNE 360 8 HR ONSITE TRAINING	1	1875.000	EA	1875.00
	SOFTWARE YEAR 1				18694.95

Net Total:	$820183.95
Tax:	$71766.11
Freight:	$0.00
Total:	$891950.06

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complete a survey about your bids:
https://survey.medallia.com/?bidsorder&fc=1423&on=411383

FERGUSON WATERWORKS #1423
Price Quotation

Fax: 916-455-3402

11:39:26 JUL 07 2022

Reference No: B460266

Quoted prices are based upon receipt of the total quantity for immediate shipment (48 hours). SHIPMENTS BEYOND 48 HOURS SHALL BE AT THE PRICE IN EFFECT AT TIME OF SHIPMENT UNLESS NOTED OTHERWISE. QUOTES FOR PRODUCTS SHIPPED FOR RESALE ARE NOT FIRM UNLESS NOTED OTHERWISE.

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Appendix D

California Rural Water Association **20-yr Net Present Value Calculation**

CPUD Meters, AMR

Initial cost:		Adj. 20 yr O&M:		Net Present Value:
$449,000	+	$744,000	=	$1,193,000

Operations and Maintenance	Quantity	Unit	Period	Cost/Unit	Annual Cost	Overhaul Cost	Notes
General Labor	80	hour	quarterly	$90.00	$28,800.00		AMR reading of entire system, 4 days 2 employees & Checking meters / issues
Software Fee	1	Each	annual	$980.00	$980.00		AMR software annual cost
Administration and Billing	32	hour	monthly	$65.00	$24,960.00		4 days, 1 employees, every month
			Years				
Full Overhaul Materials		LS	20			$0.00	
Overhaul Labor		hour	20			$0.00	
				Totals:	$54,740.00	$0.00	

Calculations of Annual Costs:

Assumed Discount Rate: 4.0%

Year	NPV Ann. Cost	NPV O/H Cost:
1	$52,634.62	
2	$50,610.21	
3	$48,663.66	
4	$46,791.98	
5	$44,992.29	
6	$43,261.82	
7	$41,597.90	
8	$39,997.98	
9	$38,459.60	
10	$36,980.38	
11	$35,558.06	
12	$34,190.44	
13	$32,875.43	
14	$31,610.99	
15	$30,395.18	
16	$29,226.13	
17	$28,102.05	
18	$27,021.20	
19	$25,981.93	
20	$24,982.62	$0.00
Total:	$743,934.46	$0.00

California Rural Water Association **20-yr Net Present Value Calculation**

CPUD Meters, AMI

Initial cost:		Adj. 20 yr O&M:		Net Present Value:
$507,000	+	$633,000	=	$1,140,000

Operations and Maintenance	Quantity	Unit	Period	Cost/Unit	Annual Cost	Overhaul Cost	Notes
General Labor	16	hour	quarterly	$90.00	$5,760.00		Checking meters / issues
Software Fee	1	Each	annual	$15,815.00	$15,815.00		AMR software annual cost
Administration and Billing	32	hour	monthly	$65.00	$24,960.00		4 days, 1 employees, every month
			Years				
Full Overhaul Materials		LS	20			$0.00	
Overhaul Labor		hour	20			$0.00	
				Totals:	$46,535.00	$0.00	

Calculations of Annual Costs:

Assumed Discount Rate: 4.0%

Year	NPV Ann. Cost	NPV O/H Cost:
1	$44,745.19	
2	$43,024.22	
3	$41,369.45	
4	$39,778.31	
5	$38,248.38	
6	$36,777.29	
7	$35,362.78	
8	$34,002.67	
9	$32,694.87	
10	$31,437.38	
11	$30,228.25	
12	$29,065.62	
13	$27,947.72	
14	$26,872.80	
15	$25,839.23	
16	$24,845.42	
17	$23,889.82	
18	$22,970.98	
19	$22,087.49	
20	$21,237.97	$0.00
Total:	$632,425.84	$0.00

California Rural Water Association **20-yr Net Present Value Calculation**

CPUD Meters, Hybrid

Initial cost:		Adj. 20 yr O&M:		Net Present Value:
$504,000	+	$789,000	=	$1,293,000

Operations and Maintenance	Quantity	Unit	Period	Cost/Unit	Annual Cost	Overhaul Cost	Notes
General Labor	48	hour	quarterly	$90.00	$17,280.00		AMR reading of entire system, 2 days 2 employees & Checking meters / issues
Software Fee	1	Each	annual	$15,815.00	$15,815.00		AMR software annual cost
Administration and Billing	32	hour	monthly	$65.00	$24,960.00		4 days, 1 employees, every month
			Years				
Full Overhaul Materials		LS	20			$0.00	
Overhaul Labor		hour	20			$0.00	
				Totals:	$58,055.00	$0.00	

Calculations of Annual Costs:

Assumed Discount Rate: 4.0%

Year	NPV Ann. Cost	NPV O/H Cost:
1	$55,822.12	
2	$53,675.11	
3	$51,610.68	
4	$49,625.66	
5	$47,716.98	
6	$45,881.71	
7	$44,117.03	
8	$42,420.22	
9	$40,788.67	
10	$39,219.88	
11	$37,711.42	
12	$36,260.98	
13	$34,866.33	
14	$33,525.32	
15	$32,235.88	
16	$30,996.04	
17	$29,803.88	
18	$28,657.58	
19	$27,555.37	
20	$26,495.54	$0.00
Total:	$788,986.40	$0.00