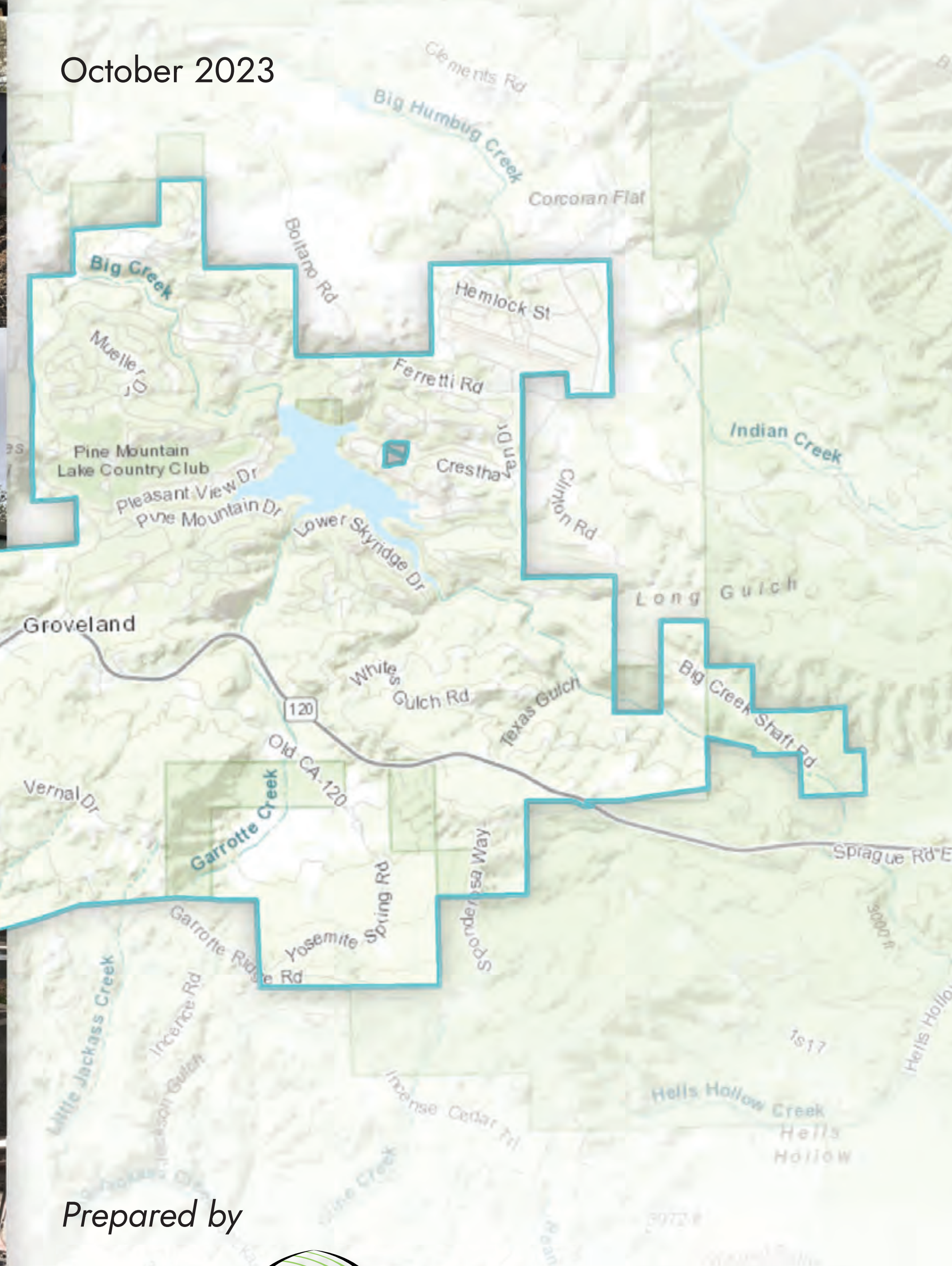
Groveland Community Services District

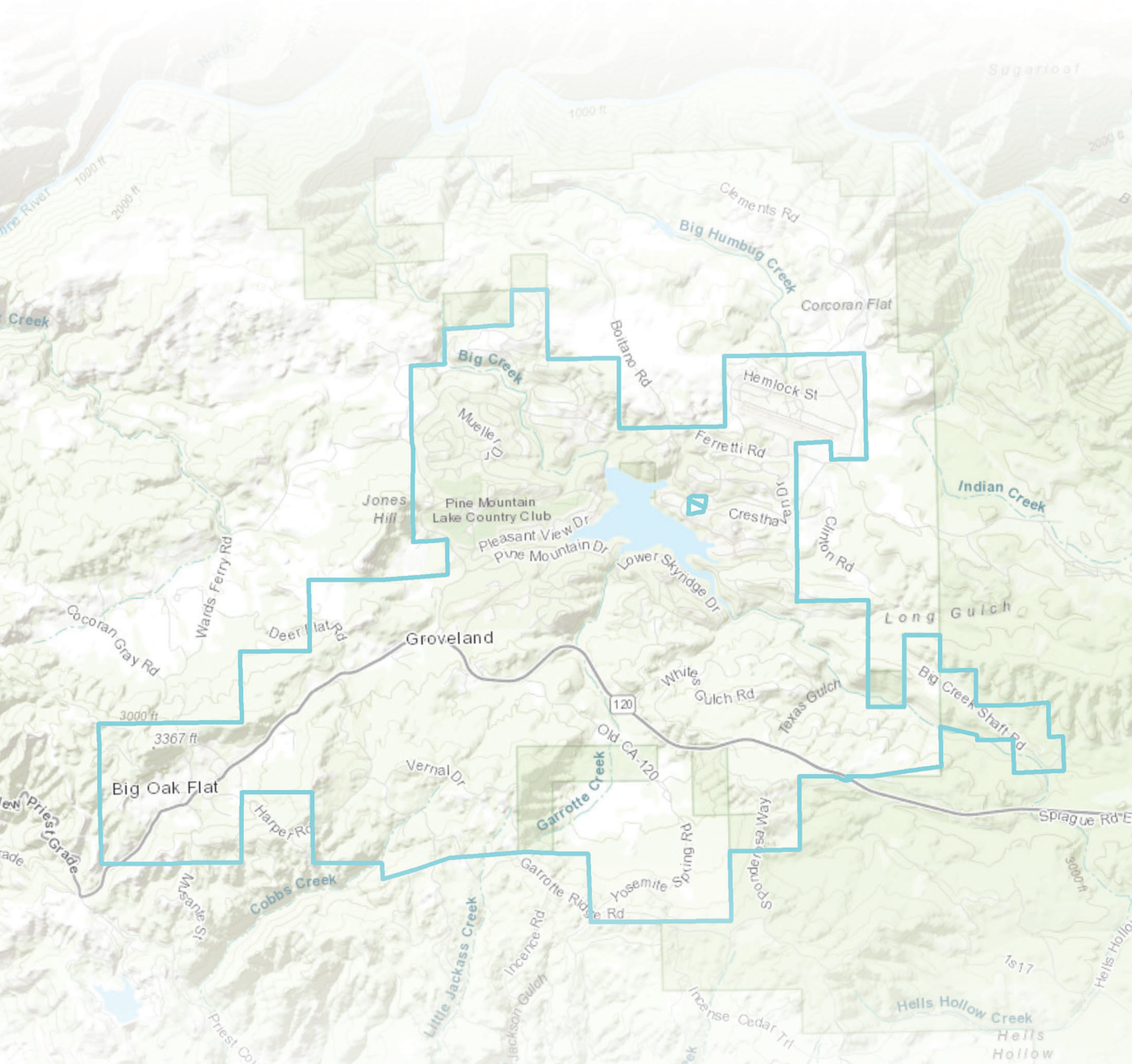
Integrated Water and Wastewater Master Plan

October 2023



Prepared by

WOOD RODGERS



WOOD RODGERS

BUILDING RELATIONSHIPS ONE PROJECT AT A TIME

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Groveland Community Services District

Integrated Water and Wastewater Master Plan

FINAL

October 2023

Prepared By:

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ACKNOWLEDGEMENTS:

Wood Rodgers would like to acknowledge the following District staff for their support during the course of the preparation of the IWWMP:

District Board of Directors

Nancy Mora	President
Janice Kwiatkowski	Vice President
John Armstrong	Director
Spencer Edwards	Director
Robert Swan	Director

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LIST OF ABBREVIATIONS

2G	Second Garrote
AC	Acre
ACP	Asbestos Cement Pipe
ADD	Average Day Demand
ADWF	Average Dry Weather Flow
AWS	Alternative Water Supply
AWWA	American Water Works Association
BC	Big Creek
BOD	Biological Oxygen Demand
BOF	Big Oak Flat
CalOES	California Governor's Office of Emergency Services
CFC	California Fire Code
CF	Cubic Feet
CFS	Cubic Feet per Second
CIP	Capital Improvement Plan
CML&C	Cement Mortar Line & Coated
DDW	Division of Drinking Water
DIP	Ductile Iron Pipe
DU	Dwelling Unit
DWR	California Department of Water Resources
FM	Force Main
FPS	Feet per Second
FT	Feet
GAL	Gallons
GCSD	Groveland Community Services District
GPM	Gallons per Minute
HP	Horsepower
I/I	Inflow and Infiltration
IWWMP	Integrated Water and Wastewater Master Plan
IRWM	Integrated Regional Water Management
KFT	Thousand Feet
kW	Kilowatt
LF	Linear Feet
LS	Lift Station
MDD	Maximum Day Demand
MG	Million Gallons
MGD	Million Gallons per Day
MH	Manhole
MI	Mile(s)
NPDES	National Pollutant Discharge Elimination System

PDWF	Peak Dry Weather Flow
PHD	Peak Hour Demand
PML	Pine Mountain Lake
PRS	Pressure Reducing Station
PRV	Pressure Reducing Valve
PS	Pump Station
PVC	Polyvinyl Chloride
PWWF	Peak Wet Weather Flow
RWQCB	Regional Water Quality Control Board
SFPUC	San Francisco Public Utilities Commission
SS	Sanitary Sewer
STL	Steel
SWRCB	State Water Resources Control Board
TDH	Total Dynamic Head
USGS	United States Geological Survey
UV	Ultra-violet
VCP	Vitrified Clay Pipe
WDR	Waste Discharge Requirements
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Groveland Community Services District (GCSD or the District) was established in 1953 to serve the communities of Groveland and Big Oak Flat in Tuolumne County, California. In the 1970s, the Boise Cascade Company developed the area to the immediate northeast of Groveland, known as Pine Mountain Lake (PML), which significantly increased the customers within the District's service area. The PML community includes a golf course, airport and approximately 5,000 residential lots. GCSD provides potable water, recycled water, wastewater collection and fire protection services to its customers.

GCSD last prepared a Water Master Plan and Sewer Master Plan in 2001. Since 2001, the amount of development within the District boundary has not changed significantly. However, there have been significant changes with respect to water consumption, regulations and the age/condition of its water and wastewater assets.

The purpose of this project is to prepare an Integrated Water and Wastewater Master Plan (IWWMP, Master Plan or Project) that provides the District with a current snapshot of the potable water and wastewater collection system facilities and develops a roadmap for the required system improvements. The IWWMP includes discussions to identify operational efficiencies and compliance with existing and future regulatory requirements.

Included in this Master Plan is the establishment of the minimum performance criteria and planning criteria to be utilized in the water system and wastewater system analysis and evaluation. The criteria identified herein was used to determine if existing deficiencies exist within each system and will be used to determine and size the recommended improvements.

The District comprises approximately 9,371 acres within Tuolumne County (County). An analysis of the parcel data within the District boundary concluded that approximately 2,006 acres (approximately 21% of the District boundary) are currently developed. The population within the District boundary is estimated to be 3,500 persons.

During the preparation of this Master Plan, significant socio-economic events occurred, and policies implemented that have affected housing and land use conditions in California. Specifically, the Covid-19 pandemic has resulted in a migration from urban to rural settings, inflation has resulted in significantly higher housing costs, which is resulting in an increase in higher-density land use. These items, as well as others, have impacted the current and potential future population within the District's service area. Land use and housing is a dynamic and changing condition, it is prudent for the District to plan infrastructure improvements conservatively to account for changing conditions, and to be diligent in evaluating the impacts of all potential development projects within the service area.

With the anticipated and known development the population growth within the District is summarized in **Table ES-1**.

Table ES-1: Total Future Population Projections within District

	2020	2025	2030	2035	2040
Persons	3,500	4,307	4,432	4,557	6,880

The existing and future water demand projections are summarized in **Table ES-2** and **Table ES-3**.

Table ES-2: Existing Water Demand Summary

Demand Condition	Production		Consumption	
	(gpd)	(gpm)	(gpd)	(gpm)
ADD	340,839	237	265,168	185
MDD	944,124	656	734,515	510
PHD	1,888,248	1,311	1,469,030	1,020

Table ES-3: Total Future Water Demand Projections (gpm)

Demand Condition	2020	2025	2030	2035	2040
ADD	185	193	197	210	223
MDD	510	532	543	578	613
PHD	1,020	1,064	1,086	1,156	1,226

The existing and future water demand projections are summarized in **Table ES-4** and **Table ES-5**.

Table ES-4: Existing Wastewater Generation (gpd)

Demand Condition	Wastewater Generation	
	(gpd)	(gpm)
ADWF	119,000	82
PDWF	178,500	123
PWWF	416,500	287

Table ES-5: Total Future Wastewater Generation Projections (gpd)

Demand Condition	2020	2025	2030	2035	2040
ADWF	119,000	129,294	134,510	151,126	167,743
PDWF	178,500	193,940	201,765	226,689	251,614
PWWF	416,500	452,527	470,785	528,942	587,099

A hydraulic model of the District's water distribution system was developed using the Innovyze InfoWater Pro hydraulic modeling platform. The hydraulic model was used to evaluate the capacity of the distribution system, including fire flow availability and system operating pressures. A site visit and visual inspection was performed for each of the major water facilities, including the tanks, pumps stations and water treatment plants. Some of these recommendations will be folded into capital improvement projects, while many of the recommendations, such as are minor repairs, considerations and further observations are not implemented as CIP projects. Recommended projects for the District's water system include projects to accommodate growth, repair and rehabilitate aging facilities, modernize the system, and increase system reliability and redundancy. A summary of the recommended CIP-Water projects is shown in **Table ES-6**.

Table ES-6: Water CIP Summary

Project No.	Project Name	Total Cost
W01	Close Loop on Upper Sky Ridge Drive (PML-C)	$ 115,000
W02	Close Loop on Old State Route 120 (GL-SE)	$ 629,000
W03	Upsize 2G PS Conveyance Pipeline	$ 8,113,000
W04	Provide Redundant Pipeline from 2G Supply to PML	$ 1,970,000
W05	Tank 4 / PML-NE PS Storage and Pumping Project for PML-zones	$ 9,337,000
W06	WTP - Conversion to Packaged Filtration System - Conceptual Study	$ 150,000
W07	Fire Hydrant Replacement Program	$ 7,410,000
W08	GL-S Zone Small Diameter Pipe Replacement	$ 753,000
W09	PRV Replacement Program	$ 2,630,000
W10	Tank 1 Recoating	$ 163,000
W11	ACP Replacement Program	$ 10,104,000
W12	Boitano Road Pipeline and PRV	$ 718,000
W13	Second Garotte PS Upgrades	$ 3,249,000
W14	Service Line Replacement Program	$ 4,114,000
W15	Generator Replacement Program	$ 447,000
W16	Complete SCADA System Upgrades	$ 150,000
W17	Water System GIS and Hydraulic Model Updates	$ 50,000
W18	Valve and ARV Replacement Program	$ 1,410,000
W19	Tank 5 Recoating and Repairs	$ 42,000
W20	Dunn Court PS Improvements	$ 477,000
W21	Smart Meter / Data Logger Install	$ 50,000
W22	Implement Leak Detection / Pipeline Condition Assessment	$ 159,000
W23a	Drought Improvement Project - New Groundwater Well (at Tank 5)	$ 1,105,000
W23b	Drought Improvement Project - New 140,000 Gal Tank at Tank 5 Site	$ 2,710,000
W24	Small Diameter Pipe Replacement Program	$ 6,757,000
	TOTAL	**$ 62,812,000**

A hydraulic model of the sewer collection system was developed using the Innovyze InfoSewer hydraulic modeling platform to evaluate various operating scenarios and system capacity. An evaluation and assessment of the WWTP was performed with District staff to identify potential deficiencies. A summary of the immediate short-term and longer-term remedies to current issues and problems are included herein. An evaluation and assessment of the lift stations was performed with District staff to identify potential deficiencies. Recommended projects for the District's sewer system include prioritizing projects to identify and mitigate the inflow and infiltration (I/I) in the system. By mitigating the system I/I, any capacity issues within the collection system and at the WWTP will likely be resolved. A summary of the recommended CIP-Sewer projects is shown in **Table ES-7**.

Table ES-7: Sewer CIP Summary

Project No.	Project Name	Total Cost
SS01	Flow Monitoring & I/I Study	$ 144,000
SS02	CCTV Inspection Program	$ 1,598,000
SS03	Pipeline and MH Rehabilitation Program	$ 10,453,000
SS04	Lift Station Inspection Program	$ 134,000
SS05	Lift Station Rehabilitation Program	$ 2,109,000
SS06	Implement Odor Control Measures at LS 5, 7, 10, 11, 13, 15, 16	$ 2,367,000
SS07	Replace Lift Station 5	$ 1,335,000
SS08	Install Generator and Pump at Lift Station 4	$ 525,000
SS09	WWTP - Short Term Actions	$ 1,539,000
SS10	WWTP & Recycled Water Master Plan	$ 270,000
SS11	Force Main Cleaning & Inspection Program	$ 651,000
SS12	Replace Lift Station 2	$ 1,448,000
SS13	Replace Lift Station 8	$ 1,493,000
SS14	Replace Lift Station 7	$ 1,380,000
SS15	Replace Lift Station 13	$ 1,515,000
SS16	Reconfigure LS 6 to Bypass LS 7 in an Emergency	$ 276,000
SS17	Install Permanent Effluent PS	$ 415,000
SS18	Septic to Sewer Feasibility Study	$ 164,000
SS19	Odor Control Study	$ 52,000
	TOTAL	**$ 27,868,000**

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I. INTRODUCTION AND PURPOSE

The Groveland Community Services District (GCSD or the District) was established in 1953 to serve the communities of Groveland and Big Oak Flat in Tuolumne County, California. In the 1970s, the Boise Cascade Company developed the area to the immediate northeast of Groveland, known as Pine Mountain Lake (PML), which significantly increased the customers within the District's service area. The PML community includes a golf course, airport and approximately 5,000 residential lots. GCSD provides potable water, recycled water, wastewater collection and fire protection services to its customers.

GCSD last prepared a Water Master Plan and Sewer Master Plan in 2001. Since 2001, the amount of development within the District boundary has not changed significantly. However, there have been significant changes with respect to water consumption, regulations and the age/condition of its water and wastewater assets.

The purpose of this project is to prepare an Integrated Water and Wastewater Master Plan (IWWMP, Master Plan or Project) that provides the District with a current snapshot of the potable water and wastewater collection system facilities and develops a roadmap for the required system improvements. The IWWMP includes discussions to identify operational efficiencies and compliance with existing and future regulatory requirements.

This Project will also help to satisfy one of the GCSD Management Objectives for Fiscal Year 2019/2020); which is Board Goal #3 that states "Plan, fund and implement improvements to the treatment plants and systems that integrate technology and provide for industry standard, efficient maintenance and operations."

The District staff identified the following concerns and goals to be included/addressed in this Project:

- Be proactive in the evaluation and consideration of improvement recommendations with the understanding that the RWQCB will update the WWTP discharge permit in the near term. Consider potential future discharge, monitoring, and regulatory requirements.
- Evaluate the solids handling plan at the WWTP.
- Conduct a high-level cost/benefit evaluation to determine if the current water treatment process is sufficient, or if a filtration system is more efficient.
- Improve the SCADA communication system.
- Assist in establishing better documentation.
- Identify projects that can be implemented and are practical.

- While new development is not anticipated to be significant, the District is experiencing a high number of conversions from single-family dwellings to vacation rentals, likely resulting in higher occupancies than originally planned.

- The purpose is to identify a roadmap of improvements and assist with funding of those improvements. Most projects are not capacity driven, but rather focus on improving operational efficiencies, upgrading existing facilities, and rehabilitating and/or replacing assets before they fail.

- Identify an inflow and infiltration monitoring plan.

- Support the next round of water and wastewater rate increases.

There were a few significant challenges that restricted the ability to analyze the water distribution system and wastewater collection system for this Project:

- Limited Records – The District experienced a data breach a few years back, and many of the District's historical records, drawings, as-builts and files were not recovered. Therefore, some information about the water and wastewater systems were not available. This required assumptions to be made when developing the GIS database and hydraulic models of each system.
- Limited SCADA Data – The District has been implementing upgrades to the SCADA system over the recent years. The current SCADA system does have the ability to store historical data, however the infrastructure to do so is not currently in place, therefore historical data about the system operations was not available. The District is currently working on adding the required infrastructure.

The project approach included the preparation of Technical Memorandums to address specific master plan topics. Through the process of developing this Master Plan, much of the data originally provided in the Technical Memorandums has been amended and updated, therefore the Technical Memorandums are not included as attachments to this report.

II. DISTRICT OVERVIEW

The Groveland Community Services District is located within the Central Sierra Nevada Mountain range, in Tuolumne County, California. The District boundary encompasses approximately 9,371 acres of land and serves the Groveland and Big Oak Flat communities and the Pine Mountain Lake development. The vast majority of the developed land use within the District boundary is for residential purposes, primarily in the PML development. The PML development has grown from a summer-home area to a retirement community to a thriving neighborhood with year-round families, boosting the area to a travel and vacation destination. Some occupancy of area residences is seasonal and significantly higher during the summer months. There are a high number of single-family dwelling units that have been converted to vacation rentals. Groveland is the main town on the Highway 120 route to Yosemite National Park and includes numerous lodging and restaurant businesses.

The District is located 120 miles due east of San Francisco, 30 miles south of Sonora and 26 miles from the west entrance to Yosemite National Park. The District is bounded on the north by the Tuolumne River, on the south by Mariposa County, on the east by the Stanislaus National Forest, and on the west by the unincorporated community of Moccasin. Highway 120 bisects the District running west to east, and the Hetch-Hetchy Aqueduct runs along the southern District boundary. See **Exhibit 1** for the location of the District and the District boundary.

Pine Mountain Lake sits at elevation 2,550 feet and represents the dominant geographic feature within the District boundary. Elevations within the District range between the highest peak of 3,750 feet in the south to 2,300 feet where Big Creek exits the District in the northwest. Elevations served by the District generally fall between 2,400 and 3,300 feet.

The major inflows to Pine Mountain Lake are Big Creek from the southeast, Second Garrote Creek from the south and First Garrote Creek from the southwest. Big Creek continues northward below the Pine Mountain Lake Big Creek Dam.

Exhibit 2 identifies the topography within the District, based on 200-ft contours from USGS data, and identifies the major water courses.

Average temperatures in the area range between 90º F to 48º F in the summer and 54º F to 29º F in the winter with an average rainfall of 40 inches.

The population within the District boundary is estimated to be approximately 3,500 persons. As of 2018, there are approximately 3,230 connections to the District's water system, 3,140 residential connections and 90 commercial connections and 1,590 connections to the District's wastewater system.

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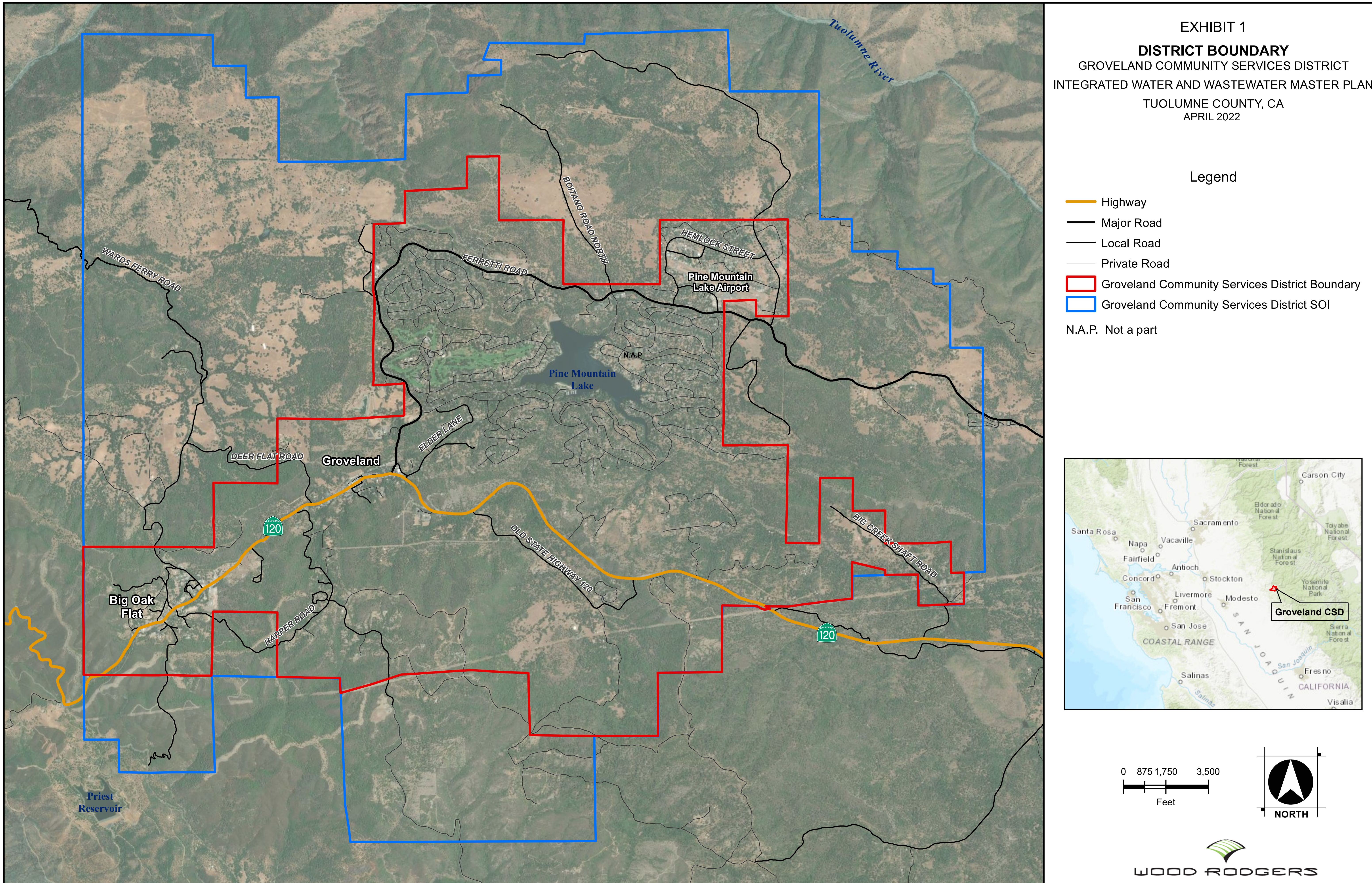

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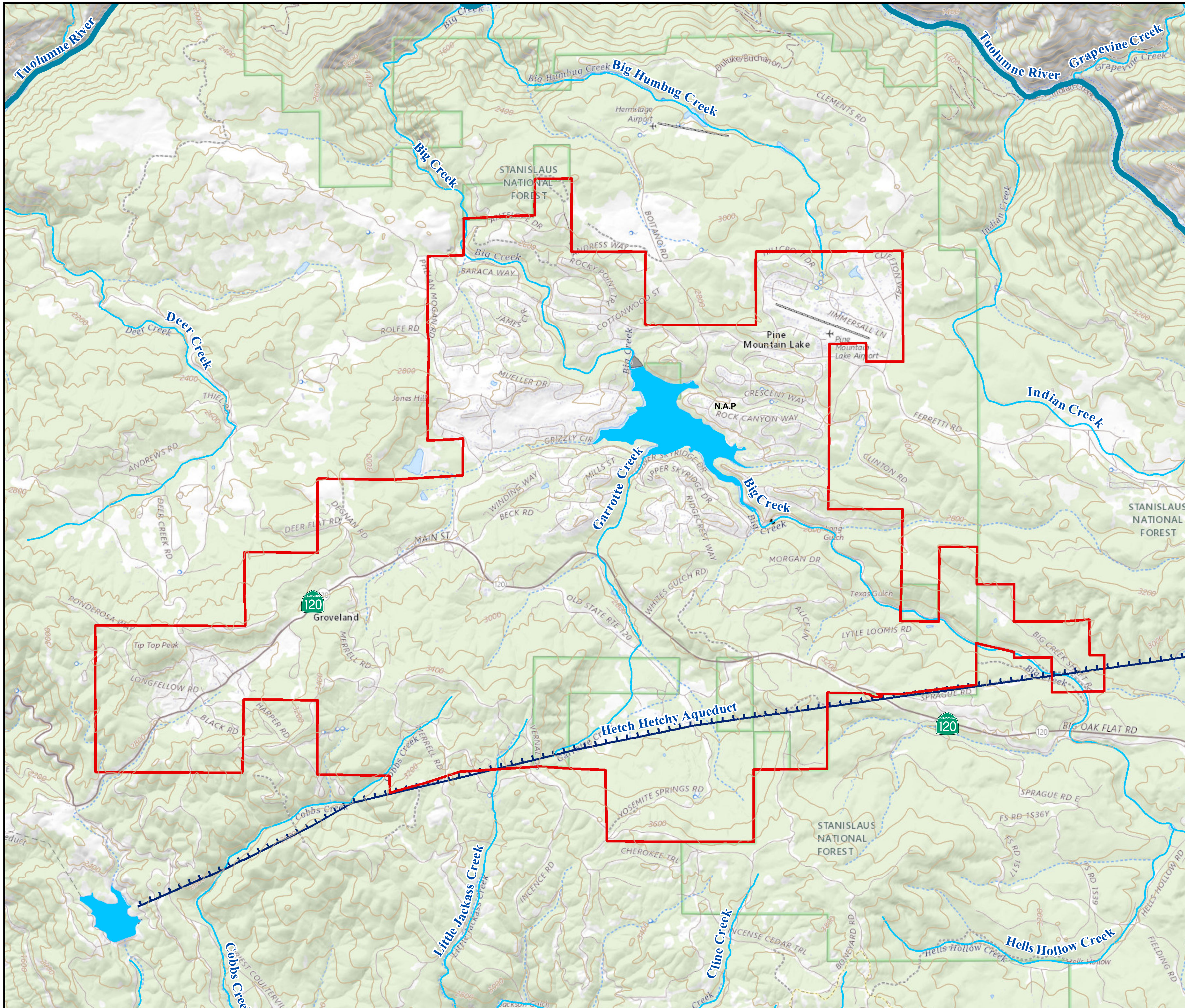

EXHIBIT 2

DISTRICT TOPOGRAPHY

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

APRIL 2022

Legend

- Contour Line (100' Interval)
- Major Streams
- Hetch Hetchy Aqueduct
- Tuolumne River
- Waterbody
- Groveland Community Services District Boundary

N.A.P. Not a part

Togography Source: USGS online map service, April 2022

0 875 1,750 3,500

Feet

NORTH

WOOD RODGERS

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III. ANALYSIS CRITERIA

A. INTRODUCTION

The purpose of this section is to establish the minimum performance criteria and planning criteria to be utilized in the water system and wastewater system analysis and evaluation. The criteria identified herein will be used to determine if existing deficiencies exist within each system and will be used to determine and size the recommended improvements.

B. WATER SYSTEM EVALUATION CRITERIA

The following criteria shall be used to evaluate the existing water distribution system facilities and determine the size of the recommended improvements:

1. System Pressure

The GCSD water system shall be designed, sized, and operated to provide customers with adequate operating pressures under the various demand conditions. Under normal operating and demand conditions, pressure categories are broken down into the following:

Unacceptable:	< 40 psi (< 92 ft)
Low Pressure:	40 – 50 psi (92 – 116 ft)
Normal (Preferred) Operating Pressure:	51 – 80 psi (117 – 186 ft)
High Pressure (pressure regulator required):	81 – 150 psi (187 – 347 ft)
System Overpressure:	>150 psi (> 347 ft)

The minimum and maximum pressures to be used for the analysis and design of system improvements under various demand conditions are as follows:

Minimum Pressure at Peak Hour:	40 psi
Minimum Pressure under Maximum Day plus Fire Flow:	20 psi
Maximum Static Pressure:	150 psi

2. Fire Flow

The water system shall be capable of providing the following minimum fire flows:

Single-family / Duplex Residential:	1,000 gpm*
Townhouse / Multi-family Residential:	1,500 gpm

Commercial:	1,500 gpm
Industrial:	2,500 gpm
School:	3,000 gpm

*Previous GCSD standards specify 500 gpm for these type residences; however, the 2019 California Fire Code (CFC) specifies a minimum of 1,000 gpm for one- and two-family dwellings. Building specific fire flow requirements will be determined by the Fire Department, per the California Fire Code, based upon building size and materials.

3. Pipeline Velocities

Water pipelines shall be sized to keep velocities below the following criteria under the stated demand conditions:

Peak Hour:	8 feet/second (fps)
Maximum Day plus Fire Flow:	15 fps

4. Pipeline Roughness Coefficients

The Hazen Williams "C" Factor pipeline roughness coefficients utilized in the hydraulic model calculations are as follows:

DIP w/ cement lining:	120
PVC:	130
ACP:	140

5. Pipe Headloss

For pipelines 16-inches diameter or larger, the maximum allowable headloss shall not exceed the following criteria under the stated demand conditions:

Average Day:	2 ft/kft
Maximum Day:	5 ft/kft
Maximum Day plus Fire Flow:	10 ft/kft
Peak Hour:	7 ft/kft

For pipelines less than 16-inches diameter:

Average Day:	3 ft/kft
Maximum Day:	5 ft/kft

Maximum Day plus Fire Flow: 12 ft/kft

Peak Hour: 7 ft/kft

6. Storage

Normal storage is defined as storage not designed to accommodate and extended supply outage from the Hetch-Hetchy Aqueduct. Normal storage capacity shall be equal to the sum of the fire storage, plus operational storage (the allowance for system peaking), plus emergency storage. The District's storage criteria per pressure zone are as follows:

Fire Storage:	Maximum fire flow requirement for a duration of 4 hours
Operational Storage:	20% of Maximum Day Demand
Emergency Storage:	Four (4) hours of Maximum Day Demand

7. Pumping Capacity

Pump stations that pump to a pressure zone with sufficient storage capacity shall be designed to meet the larger of the following capacity criteria:

Supply the Maximum Day Demand with the largest pump out of service,

<u>or</u>

Replenish the full tank capacity within a 12-hour window, whichever is greater.

Pump stations that pump to a pressure zone with no storage capacity shall be designed to meet the following criteria:

Supply the Maximum Day Demand plus maximum fire flow requirement with the largest pump out of service,

<u>or</u>

Supply the Peak Hour Demand with largest pump out of service, whichever is greater.

Pump stations shall include provisions for back-up power. Permanent on-site back-up power is preferred, however connections for a portable generator may be adequate in certain conditions if approved by the District.

8. Isolation Valve Locations

Distribution system isolation valves shall be located at a maximum spacing of 1,320 feet. Isolation valves shall be located on each branch of tee (3) and cross (4), unless otherwise directed by the District.

9. Fire Hydrant Locations

Fire hydrants shall be installed at a maximum spacing of 300 feet between hydrants, unless otherwise directed by the District.

C. WASTEWATER COLLECTION SYSTEM EVALUATION CRITERIA

The following criteria shall be used to evaluate the existing wastewater collection system and determine the size of the recommended improvements:

1. Gravity Pipeline Slope

Gravity sewer pipelines shall be designed to meet the minimum slope criteria identified in **Table III-1.**

Table III-1: Gravity Sewer Pipe Slope

Pipe Diameter (in)	Minimum Slope	Maximum Slope
6	0.0050	0.096
8	0.0035	0.065
10	0.0025	0.049
12	0.0020	0.038
15	0.0015	0.029
18	0.0012	0.023

The maximum allowable slope for a gravity main shall be such that the velocity of the wastewater is kept below 10 feet per second (fps) under peak dry-weather flow conditions and maximum d/D criteria.

2. Depth of Flow to Diameter Ratio (d/D)

For the existing gravity pipelines within the collection system, the maximum allowable depth of flow to pipe diameter ratio (d/D) under peak flow conditions is recommended as shown in **Table III-2**.

Table III-2: d/D Criteria for Existing Gravity Sewer Pipelines

Pipe Diameter (in)	PDWF	PWWF
≤12-inch	75%	90%
≥ 15-inch	90%	Full [1]

[1] Wastewater shall be a minimum of 3-feet below the lowest manhole cover.

The maximum d/D ratio to be used for the design of new sewer pipelines is summarized in **Table III-3.**

Table III-3: d/D Criteria for New Gravity Sewer Pipelines

Pipe Diameter (in)	PDWF	PWWF
≤ 12-inch	50%	75%
≥ 15-inch	75%	90%

3. Gravity Sewer Pipeline Velocity

The minimum velocity in a gravity sewer pipeline shall be two (2) feet per second (fps) when the pipe is at the maximum depth of flow per the d/D ratios identified above.

4. Manhole Spacing

The recommended manhole spacing for new pipelines is identified **Table III-4.**

Table III-4: Manhole Spacing

Pipe Diameter (in)	Recommended Max Spacing (ft)	Absolute Max Spacing (ft)
6 to 12	200	300
15 and larger	300	400

5. Roughness Coefficient

The recommended manning's roughness coefficient[1] (n) to be used for pipeline hydraulic calculations per pipe material are identified in **Table III-5**.

Table III-5: Pipeline Roughness Coefficients

Pipe Material	Good Condition	Fair Condition	Deteriorating
PVC	0.010	0.011	0.013
VCP	0.013	0.015	0.017

[1] Source: Mackenzie L Davis, Water and Wastewater Engineering: Design Principles and Practice, 2020

6. Force Main Velocity

The maximum allowable velocity in a force main is 8 fps. The minimum required velocity in a force main is 3 fps.

7. Force Main Cleanout Locations

Cleanouts shall be located along force mains at a maximum spacing of 150 feet between cleanouts, and at all horizontal changes of direction above 22 ½ degrees.

8. Lift Station Pumping Capacity

Lift station pumping capacity is considered acceptable if the pump capacity is greater than or equal to the peak wet weather inflow with the largest pump out of service.

Wet well storage shall be sized to accommodate a minimum of two (2) hours of peak dry weather flow.

Lift stations shall include provisions for back-up power. Permanent on-site back-up power is preferred, however connections for a portable generator may be adequate in certain conditions if approved by the District.

All new lift stations shall be designed to include the capabilities to bypass the lift station.

IV. LAND USE

A. INTRODUCTION

The District comprises approximately 9,371 acres within Tuolumne County (County). The Tuolumne County General Plan (General Plan) states that the population for the County will reach 63,243 by the year 2040 and identifies Groveland as an area targeted for residential growth. The July 2019 Census population estimate of the County is 54,478 persons.

An analysis of the parcel data within the District boundary concluded that approximately 2,006 acres (approximately 21% of the District boundary) are currently developed. The population within the District boundary is estimated to be 3,500 persons.

It is noted that the preparation of the IWWMP is not being driven due to planned growth. However, the proposed improvements shall be sized to meet the needs of today as well as support potential growth within the District. Some growth within the District boundary is planned and assumed. This section summarizes existing land use and future potential development through the planning horizon of Year 2040 in 5-year increments.

Potential development areas, as well as the percentage of each area that can be developed, are identified in the General Plan.

B. LAND USE ANALYSIS

The community of Groveland and the surrounding area served by the District is located in the foothills just outside of Yosemite National Park. While thousands of people call the Groveland-area home year-round, the population can swell during weekends and summer months with vacationers and travelers. Due to the seasonal variations in population, land use is recommended as the basis for future growth projections.

Three methods were utilized to project growth within the District boundary: 1) identify parcels tagged for development by the County, and 2) identify the number of undeveloped lots within Pine Mountain Lake (PML), and 3) incorporate known projects going through the County planning process. For those parcels that are likely to be developed, the growth rate identified by the County in the General Plan was applied to estimate the total acreage of new development in each 5-year planning window through 2040.

Land use and zoning information for the County is identified in the General Plan (adopted December 26, 1996 / latest revision August 2018). Land use data for each parcel was obtained from Tuolumne County in GIS format. Information on assessor parcel number (APN), parcel area and zoning designations were accessible from these GIS files. The County's General Plan provides a complete description of the land use designations and their associated zoning designations (with maximum building intensity in parenthesis). The land use breakdown is shown on **Exhibit 3**. A summary of the existing land use breakdown within the District boundary is identified in **Table IV-1**.

Table IV-1: Land Use Summary within District Boundary

Land Use Category [1]	Acreage
Agricultural	937.3
Business Park	0.8
Estate Residential	450.9
General Commercial	153.9
Heavy Commercial	1.9
Heavy Industrial	14.7
High Density Residential	38.5
Homestead Residential	472.2
Large Lot Residential	297.9
Light Industrial	24.9
Low Density Residential	2,229.1
Medium Density Residential	13.5
Mixed Use	27.8
Neighborhood Commercial	1.7
Open Space	57.2
Parks and Recreation	820.5
Public	1,402.9
Road / Public ROW	412.7
Rural Residential	2,005.1
Special Commercial	7.8
Total	**9,371.2**

[1] From 2018 Tuolumne County General Plan

An analysis of the aerial imagery within the District boundary concluded that approximately 2,006 acres (approximately 21% of the District area) are currently developed, with 1,739 acres developed as “Residential” and 267 acres developed as “Non-Residential.”

C. FUTURE DEVELOPMENT

1. General Plan Growth

County zoning designations were contained within the shapefiles for each parcel. Parcels that are designated as being a site with potential development have the zoning code “PD.” From the attribute table, seven parcels were identified to have the PD zoning code within the GCSD boundary. The seven parcels identified by the County as having potential for future development are numbered 1 through 7 and shown on **Exhibit 4**. **Table IV-2** identifies the parcel zoning codes, total and developed areas, and current percentage of developed land.

Results indicate that with 18% currently developed, about 82% of the land zoned for development has development potential.

Table IV-2: Parcels Identified for Potential Development

ID Number	Total Area (acres)	Developed Area [1] (acres)	Developed Area [1] (%)	Remaining Development Area (acres)
1	0.4	0.0	0.0	0.4
2	21.7	1.5	6.9	20.2
3	4.1	0.0	0.0	4.1
4	25.2	9.3	36.9	15.9
5	10.1	5.1	50.5	5.0
6	25.8	2.6	10.0	23.2
7	20.6	0.9	4.4	19.7
Total	**107.9**	**19.4**	**18.0**	**88.5**

[1] Current Developed Area is approximated based on aerial imagery.

The methodology used to predict the development growth in 5-year increments is based upon the growth rate identified by the County in the General Plan. The August 2018 General Plan Update identifies the total annual growth rate as 0.6 percent between 2015-2040. The General Plan Update documents the estimated net change from 2015 to 2040 in single-family residential, multi-family residential, commercial, and industrial development by dwelling unit or square feet, of which a percent growth can be calculated for each land use designation, as presented in **Table IV-3.**

Table IV-3: Projected Development Under the General Plan Update (County-wide)

Land Use Designation	Existing (Year 2015)	Projected (Year 2040 with General Plan Update)	Net Change	Annual Increase	Growth Rate	
					Annual	5-year
Single Family Residential (du)	19,435	23,767	4,332	173	0.9%	4.5%
Multi-Family Residential (du)	1,805	2,632	827	33	1.8%	9.2%
Commercial (sf)	4,624,000	5,562,000	938,000	37,520	0.8%	4.1%
Industrial (sf)	1,718,000	1,914,000	196,000	7,840	0.5%	2.3%

The County-wide 5-year percent growth was applied to each parcel within the District identified for potential development. Parcels 1, 2 and 3 were considered single family residential, 4 and 6 were considered commercial, and 5 and 7 were considered agricultural. Since an agricultural growth rate was not identified in the General Plan update, the smallest percent growth of 2.3% (Industrial) was utilized for Parcels 5 and 7. Incremental growth per acre was calculated as the percent growth multiplied by the total acres of each parcel. Results are shown in **Table IV-4**.

Table IV-4: Future Developed Areas in Five-Year Increments (acres)

ID Number	Land Use	2025	2030	2035	2040	Total
1	Single-Family	0.0	0.0	0.1	0.0	0.1
2	Single-Family	1.0	1.0	1.0	1.0	3.9
3	Single-Family	0.2	0.2	0.2	0.2	0.7
4	Commercial	1.0	1.0	1.0	1.0	4.1
5	Industrial	0.2	0.2	0.2	0.2	0.9
6	Commercial	1.0	1.0	1.0	1.0	4.2
7	Industrial	0.5	0.5	0.5	0.5	1.9
	Total	**3.8**	**3.9**	**3.9**	**3.9**	**15.7**

2. Pine Mountain Lake Growth

In addition to parcels designated by the County as potential development (zoning code “PD”), the Pine Mountain Lake (PML) Association has identified 531 vacant lots in their jurisdiction that have the potential for residential development. The average lot size within PML is approximately 0.5 acres, resulting in a total acreage of undeveloped (vacant lots) of approximately 265.5 acres. Using the same growth rate methodology for single family residential parcels (0.9% annually)**,** the future development projections for Pine Mountain Lake are shown in **Table IV-5**.

Table IV-5: Future PML Development Area in Five-Year Increments (acres)

Land Use	2025	2030	2035	2040	Total
Single-Family	11.9	11.9	11.9	11.9	47.8

3. Known Projects in Planning Stages Growth

There are two known projects that have begun to process plans and maps through the County. The known projects are:

- Yonder Yosemite
- Long Gulch Ranch

One of the proposed development projects that is currently being processed through Tuolumne County is called the "Yonder Yosemite Project." The project site consists of ten (10) parcels, spanning 36.3 acres currently zoned C-1 (General Commercial). The project site is located along State Route 120 (SR 120), southwest of the intersection of SR 120 and Memorial Drive, in the community of Big Oak Flat, as shown on Exhibit 4. The project is proposed as a hospitality site, that includes a total of 200 guest suites (225 to 350 square feet each), a pool, soaking tubs, event space, outdoor theater, and a lodge with a restaurant, store, library, reception, and lobby. Of the 200 guest suites, 150 guest suites include a bathroom, while 50 guest suites will utilize a shared restroom facility. It is assumed that the project will be completed by year 2025. Based upon the preliminary site plan, it is estimated that approximately 90% of the property will be equivalent to a "Multi-Family" land use designation and 10% will be a used as a "Commercial" land use designation. The estimated land use designations are summarized in **Table IV-6**.

Table IV-6: Yonder Yosemite Proposed Development (acres)

Land Use	2025	2030	2035	2040	Total
Multi-Family	32.7	0.0	0.0	0.0	32.7
Commercial	3.6	0.0	0.0	0.0	3.6
Total	**36.3**	**0.0**	**0.0**	**0.0**	**36.3**

Another proposed development project that is currently being processed through the County is called the Long Gulch Ranch project. The project area consists of three large parcels totaling approximately 329.3 acres. Development plans are currently conceptual and consist of a proposed project to be developed in phases. Based upon the preliminary conceptual plan available, the first phase will consist of 19 single-family residential units (homestead-type lots of 3+ acres) and be developed by 2025 across 66-acres. The second phases will consist of 22-acres of multi-family residential and be developed by 2030, estimated to include approximately 104 apartment units. The third phase will consist of 64 to 100 single-family residential lots (homestead-type lots of 3+ acres) across 192-acres, with half being developed by 2035 and half being developed by 2040. It is noted that portions of this development will require annexation into the District. A summary of the Long Gulch Ranch development is provided in **Table IV-7.**

Table IV-7: Long Gulch Ranch Proposed Development (acres)

Land Use	2025	2030	2035	2040	Total
Single-Family	66.0	0.0	96.0	96.0	258.0
Multi-Family	0.0	22.0	0.0	0.0	20.0
Total	**66.0**	**22.0**	**96.0**	**96.0**	**280.0**

4. Total Estimated Growth

Adding the General Plan land use projections with the Pine Mountain Lake land use projections and the land use projections for the three known projects results in the estimated total projected development within the District boundary, as shown in **Table IV-8**.

Table IV-8: Future Development Growth Area in Five-Year Increments (acres)

Land Use	2025	2030	2035	2040	Total
Single-Family	79.1	13.1	109.1	109.1	310.5
Multi-Family	32.7	22.0	0.0	0.0	54.7
Commercial	5.7	2.1	2.1	2.1	11.9
Industrial	0.7	0.7	0.7	0.7	2.8
Total	**118.2**	**37.9**	**111.9**	**111.9**	**379.8**

A summary of the future development, per the consolidated categories of “Residential” and Non-Residential” land use categories is shown in **Table IV-9**.

Table IV-9: Total Future Development Area in Five-Year Increments (acres)

Land Use	2020	2025	2030	2035	2040
Residential	1,739	1,851	1,886	1,995	2,104
Non-Residential	267	273	276	279	282
Remaining (undeveloped)	7,365	7,247	7,209	7,097	6,985
Total	**9,371**	**9,371**	**9,371**	**9,371**	**9,371**

The total estimated future population is shown in **Table IV-10.** The population growth estimates are based upon the future developments, the 2015 Tuolumne County General Plan average number of persons per household and the residential building density criteria identified in Figure 1.5 of the Land Use Chapter.

Table IV-10: Total Future Population Projections within District

	2020	2025	2030	2035	2040
Persons	3,500	4,307	4,432	4,557	6,880

It is noted that during the preparation of this Master Plan, significant socio-economic events occurred, and policies implemented that have affected housing and land use conditions in California. Specifically, the Covid-19 pandemic has resulted in a migration from urban to rural settings, inflation has resulted in significantly higher housing costs, which is resulting in an increase in higher-density land use. These items, as well as others, have impacted the current and potential future population within the District's service area. Land use and housing is a dynamic and changing condition, it is prudent for the District to plan infrastructure improvements conservatively to account for changing conditions, and to be diligent in evaluating the impacts of all potential development projects within the service area.

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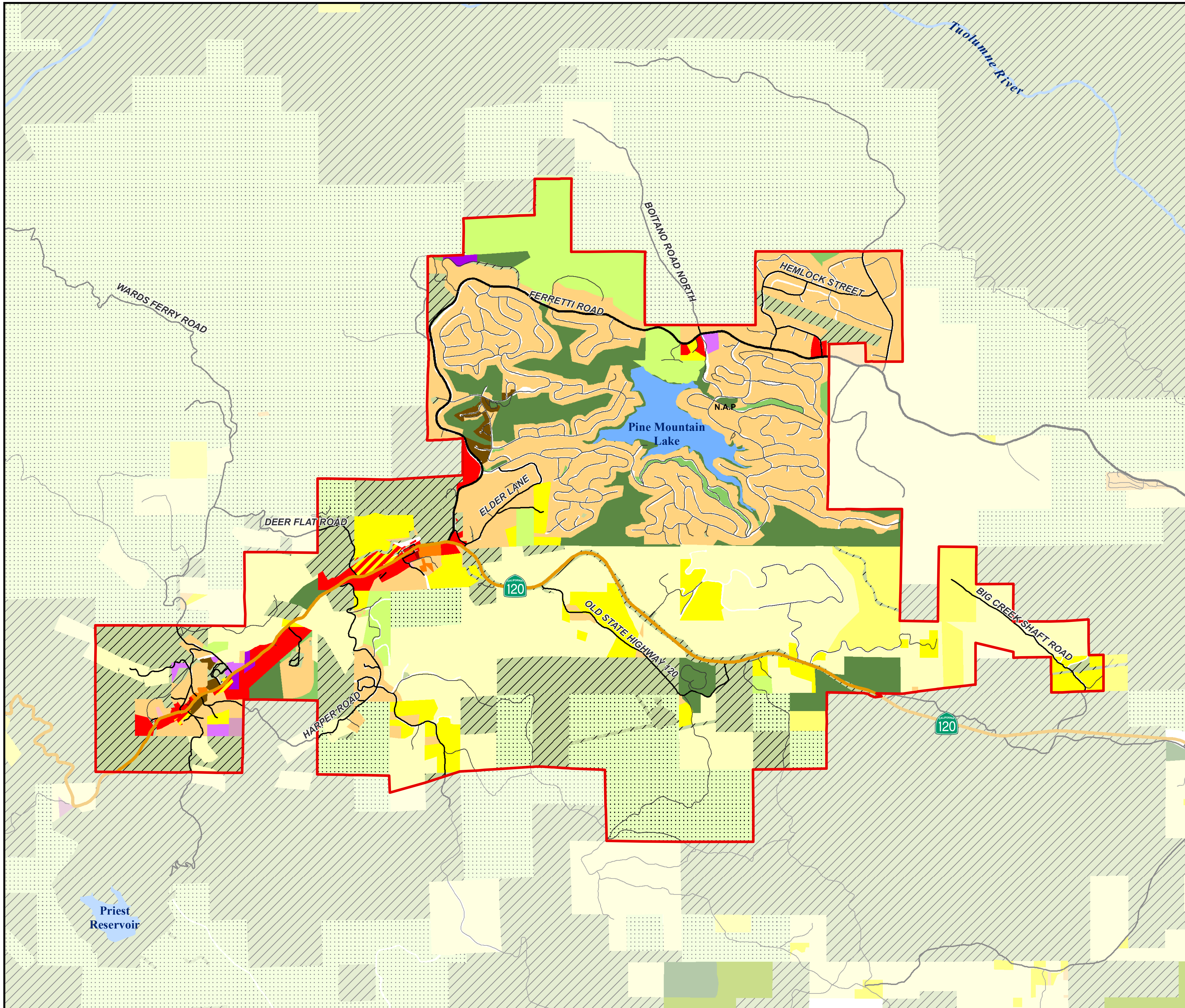

EXHIBIT 3

LAND USE

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

APRIL 2022

Legend

- Highway
- Major Road
- Local Road
- Private Road
- Tuolumne River
- Waterbody
- Groveland Community Services District

Tuolumne County General Plan 2018

- Homestead Residential
- Rural Residential
- Large Lot Residential
- Estate Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Mixed Use
- Neighborhood Commercial
- General Commercial
- Heavy Commercial
- Special Commercial
- Business Park
- Light Industrial
- Heavy Industrial
- Public
- Agricultural
- Open Space
- Parks and Recreation
- Timber Production

0 875 1,750 3,500
Feet

NORTH

WOOD RODGERS

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EXHIBIT 4

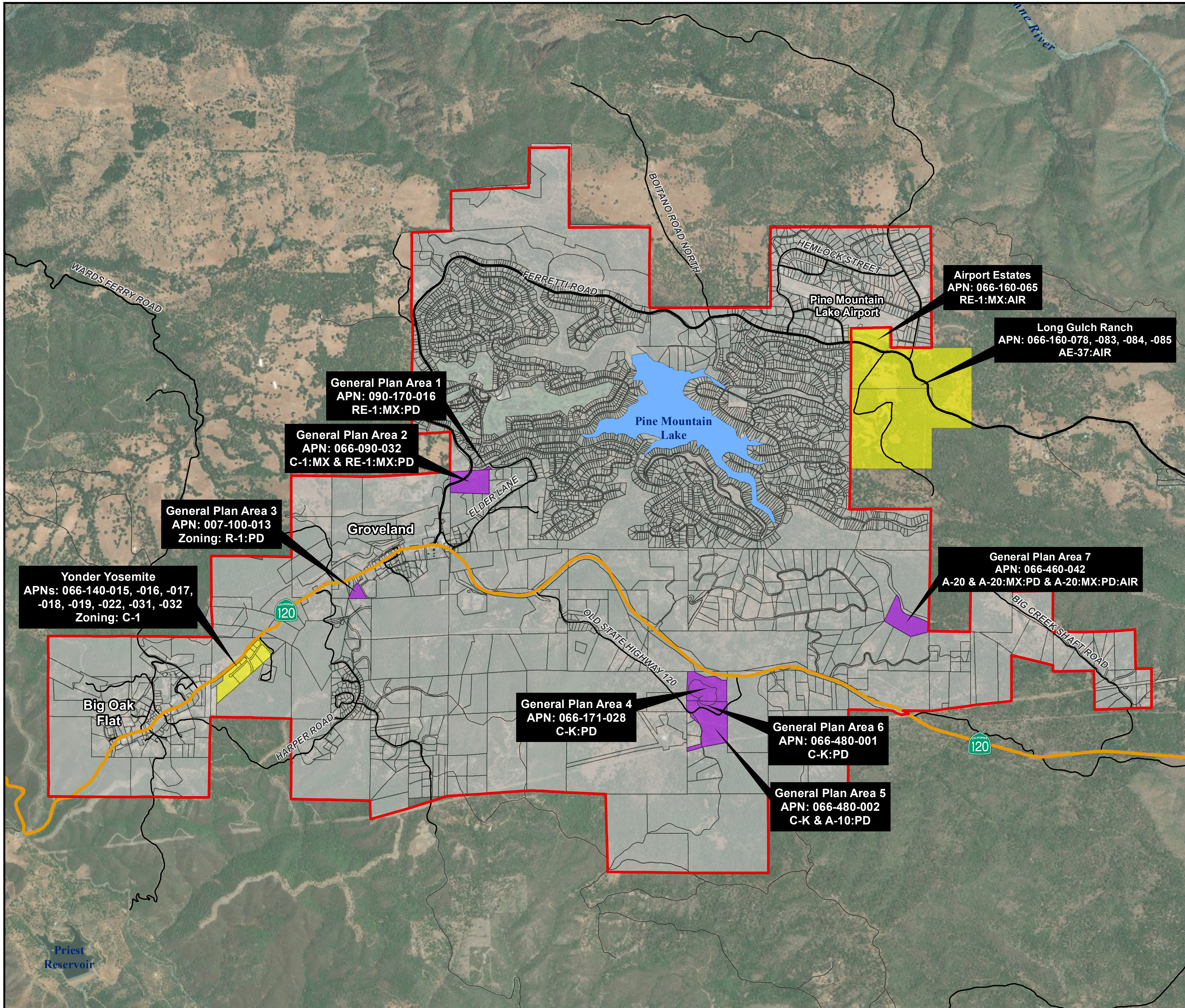
POTENTIAL DEVELOPMENT PARCELS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

APRIL 2022



Legend

- Highway
- Major Road
- Local Road
- Private Road
- <all other values>

Development

- Potential Development (per General Plan)
- Planned Development Project
- Developed & Undeveloped Parcels
- Groveland Community Services District

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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V. HISTORICAL WATER SUPPLY, WATER DEMAND & WASTEWATER GENERATION AND PROJECTIONS

A. Water Production

The District receives and treats raw water from the Hetch-Hetchy Aqueduct at two locations, Second Garrote, and Big Creek, to supply water to its customers. The District provided monthly water production data for years 2016-2020. A summary of the monthly production data is provided in **Table V-1**.

Table V-1: Total District Water Production by Month

Month	Total Production (Million Gallons)					
	2016	2017	2018	2019	2020	Average
January	7.85	8.48	6.69	6.55	3.31	**6.58**
February	6.43	7.53	7.20	5.75	7.07	**6.80**
March	7.42	7.27	6.51	7.18	7.80	**7.24**
April	8.39	8.22	7.39	8.13	7.35	**7.90**
May	10.45	6.30	9.64	10.53	12.14	**9.81**
June	14.91	12.39	12.56	11.48	12.58	**12.79**
July	17.24	13.19	15.31	14.73	16.88	**15.47**
August	15.97	20.05	13.82	15.31	14.65	**15.96**
September	13.20	15.52	12.04	11.45	12.92	**13.02**
October	10.78	12.31	10.15	9.71	13.38	**11.26**
November	8.11	11.08	8.56	8.64	9.42	**9.16**
December	8.78	7.73	8.06	8.12	9.66	**8.47**
Total	**129.75**	**130.30**	**117.93**	**117.59**	**127.17**	**124.55**
Average/month	**10.81**	**10.86**	**9.83**	**9.80**	**10.60**	**10.38**
Average/day (gal)	**354,509**	**356,979**	**323,097**	**322,157**	**347,456**	**340,839**

Over the five-year period from 2016-2020, the District produced an average of 340,839 gallons per day (gpd), which equates to 237 gallons per minute (gpm).

The District provided the maximum day production data for years 2016, 2017 and 2020, as summarized in **Table V-2.**

Table V-2: Maximum Daily Production

Year	Average Day (gal)	Maximum Day (gal)	Date	Factor
2016	354,509	735,960	August 13	2.08
2017	356,979	1,122,000	July 17	3.14
2018	323,097	not available		n/a
2019	322,157	not available		n/a
2020	347,465	2,010,000	November 27	5.78
				2.77

The maximum day demand from 2020 appears to be an anomaly, since it is more than twice the summertime maximum day demand, therefore it was excluded from the maximum day demand factor calculation. Based on the average production data over the past five years, the maximum day factor is 2.77 times the average day, resulting in an average maximum day production of 944,124 gpd (656 gpm).

B. Water Billing Data

The District provided monthly water billing records for years 2016-2020. The District has two billing categories, “Residential” and “Commercial.” Billing data is quantified by the total monthly usage and separated into the following categories: < 4,000; 4,001 – 7,000; 7,001-12,000; and > 12,001. The total number of water service connections (meters) in the District’s system is identified in **Table V-3.**

Table V-3: District Water Meters

Year	Residential Meters	Commercial Meters	Total
2016	3,128	89	3,217
2017	3,131	89	3,220
2018	3,138	89	3,227
2019	3,147	93	3,240
2020	3,156	98	3,254

1. Residential Consumption

A summary of the total “Residential” water consumption per the monthly billing data is provided in **Table V-4**.

Table V-4: Residential Water Consumption by Month

Month	Total Residential Consumption (Gallons)					
	2016	2017	2018	2019	2020	Average
January	5,724,247	5,812,952	5,661,489	5,659,627	5,223,617	**5,616,386**
February	3,853,873	4,713,710	4,963,376	5,480,663	4,900,665	**4,782,457**
March	4,511,402	4,231,853	4,679,889	4,178,048	4,654,882	**4,451,215**
April	4,940,700	5,090,797	5,103,855	4,218,472	5,690,620	**5,008,889**
May	5,134,902	5,087,041	5,739,734	6,186,898	6,687,386	**5,767,192**
June	7,539,218	8,749,432	8,207,248	8,003,720	7,942,636	**8,088,451**
July	12,363,109	11,899,351	11,054,106	9,861,716	11,760,774	**11,387,811**
August	11,319,725	10,796,715	11,891,833	11,446,618	12,739,361	**11,638,850**
September	12,504,452	12,671,843	11,097,679	11,469,997	10,827,870	**11,714,368**
October	8,440,324	7,956,745	7,517,264	7,807,228	9,630,383	**8,270,389**
November	6,325,534	7,266,004	6,825,049	7,655,446	8,442,774	**7,302,961**
December	5,055,824	5,812,715	6,482,232	5,416,761	5,790,048	**5,711,516**
Total	**87,713,310**	**90,089,158**	**89,223,754**	**87,385,194**	**94,291,016**	**89,740,486**
Average/month	**7,309,443**	**7,507,430**	**7,435,313**	**7,282,100**	**7,857,585**	**7,478,374**
Average/day	**239,654**	**246,820**	**244,449**	**239,411**	**257,626**	**245,592**

A summary of the total "Residential" water consumption per meter per month is provided in **Table V-5**.

Table V-5: Residential Water Consumption per Meter per Month

Month	Residential Consumption per Meter (Gallons)					
	2016	2017	2018	2019	2020	Average
January	1,829	1,860	1,804	1,803	1,659	**1,791**
February	1,232	1,507	1,583	1,745	1,556	**1,525**
March	1,444	1,351	1,497	1,330	1,478	**1,420**
April	1,584	1,624	1,626	1,343	1,806	**1,597**
May	1,641	1,622	1,831	1,968	2,122	**1,837**
June	2,416	2,795	2,619	2,546	2,519	**2,579**
July	3,954	3,811	3,527	3,136	3,729	**3,631**
August	3,626	3,448	3,804	3,638	4,038	**3,711**
September	3,985	4,041	3,533	3,645	3,431	**3,727**
October	2,695	2,546	2,392	2,481	3,051	**2,633**
November	2,018	2,313	2,166	2,433	2,675	**2,321**
December	1,613	1,857	2,058	1,721	1,835	**1,817**
Average	**2,337**	**2,398**	**2,370**	**2,314**	**2,490**	**2,382**

2. Commercial Consumption

A summary of the total "Commercial" water consumption per the monthly billing data is provided in **Table V-6.**

Table V-6: Commercial Water Consumption by Month

Month	Total Commercial Consumption (Gallons)					
	2016	2017	2018	2019	2020	Average
January	393,771	375,811	396,912	427,995	351,240	**389,146**
February	288,960	350,678	350,774	496,178	315,661	**360,450**
March	435,302	289,141	354,018	352,594	352,007	**356,612**
April	557,670	356,847	501,252	416,500	274,860	**421,426**
May	566,264	424,452	491,570	649,589	304,536	**487,282**
June	863,466	814,788	671,326	666,789	398,863	**683,046**
July	1,121,537	1,074,416	888,717	913,966	806,351	**960,997**
August	955,708	940,417	887,067	1,107,539	769,891	**932,124**
September	1,012,442	1,062,348	929,985	1,177,289	691,141	**974,641**
October	627,158	629,102	705,050	799,629	614,706	**675,129**
November	495,639	530,548	535,629	624,913	561,985	**549,743**
December	318,719	354,555	402,727	364,534	369,578	**362,023**
Total	**7,636,636**	**7,203,103**	**7,115,027**	**7,997,515**	**5,810,819**	**7,152,620**
Average/month	**636,386**	**600,259**	**592,919**	**666,460**	**484,235**	**596,052**
Average/day	**20,865**	**19,735**	**19,493**	**21,911**	**15,877**	**19,576**

A summary of the total "Commercial" water consumption per meter per month is provided in **Table V-7**.

Table V-7: Commercial Water Consumption per Meter per Month

Month	Commercial Consumption per Meter (Gallons)					
	2016	2017	2018	2019	2020	Average
January	4,424	4,223	4,460	4,756	3,737	**4,320**
February	3,284	3,940	3,941	5,453	3,323	**3,988**
March	5,003	3,213	4,023	3,833	3,667	**3,948**
April	6,196	3,921	5,632	4,478	2,834	**4,612**
May	6,223	4,769	5,462	6,985	3,108	**5,309**
June	9,702	9,155	7,459	7,170	4,070	**7,511**
July	12,602	12,209	9,986	9,828	8,228	**10,570**
August	10,860	10,449	9,967	11,909	7,856	**10,208**
September	11,505	11,936	10,449	12,659	7,052	**10,720**
October	7,127	7,069	8,012	8,598	6,273	**7,416**
November	5,569	5,961	6,018	6,719	5,735	**6,001**
December	3,622	3,984	4,525	3,920	3,771	**3,964**
Average	**7,177**	**6,726**	**6,662**	**7,166**	**4,941**	**6,547**

3. Total Water Consumption

The total water consumed by District customers per month in years 2016-2020, both residential and commercial, per the billing data is summarized in **Table V-8.**

Table V-8: Total District Water Consumption by Month

Month	Total Consumption (Gallons)					
	2016	2017	2018	2019	2020	Average
January	6,118,018	6,188,763	6,058,401	6,087,622	5,574,857	**6,005,532**
February	4,142,833	5,064,388	5,314,150	5,976,841	5,216,326	**5,142,908**
March	4,946,704	4,520,994	5,033,907	4,530,642	5,006,889	**4,807,827**
April	5,498,370	5,447,644	5,605,107	4,634,972	5,965,480	**5,430,315**
May	5,701,166	5,511,493	6,231,304	6,836,487	6,991,922	**6,254,474**
June	8,402,684	9,564,220	8,878,574	8,670,509	8,341,499	**8,771,497**
July	13,484,646	12,973,767	11,942,823	10,775,682	12,567,125	**12,348,809**
August	12,275,433	11,737,132	12,778,900	12,554,157	13,509,252	**12,570,975**
September	13,516,894	13,734,191	12,027,664	12,647,286	11,519,011	**12,689,009**
October	9,067,482	8,585,847	8,222,314	8,606,857	10,245,089	**8,945,518**
November	6,821,173	7,796,552	7,360,678	8,280,359	9,004,759	**7,852,704**
December	5,374,543	6,167,270	6,884,959	5,781,295	6,159,626	**6,073,539**
Total	**95,349,946**	**97,292,261**	**96,338,781**	**95,382,709**	**100,101,835**	**96,893,106**
Average/month	**7,945,829**	**8,107,688**	**8,028,232**	**7,948,559**	**8,341,820**	**8,074,426**
Average/day	**260,519**	**266,554**	**263,942**	**261,322**	**273,502**	**265,170**

The average daily water consumption per the billing data is summarized in **Table V-9.**

Table V-9: Average Daily Consumption Demand

Year	Residential	Commercial	Total
2016 (gpd)	239,654	20,865	**260,519**
2017 (gpd)	246,820	19,735	**266,554**
2018 (gpd)	244,449	19,493	**263,942**
2019 (gpd)	239,411	21,911	**261,322**
2020 (gpd)	257,626	15,877	**273,502**
Average (gpd)	**245,592**	**19,576**	**265,168**
Average (gpm)	**171**	**14**	**185**

A comparison of the total and average daily production and consumption data is provided in **Table V-10.**

Table V-10: Comparison of Production and Consumption Data

Year	Production (gal)		Consumption (gal)		Difference	
	Total	ADD	Total	ADD	ADD (gal)	%
2016	129,750,200	354,509	95,349,946	260,519	93,900	36%
2017	130,297,155	356,979	97,292,261	266,554	90,424	34%
2018	117,930,428	323,097	96,338,781	263,942	59,155	22%
2019	117,587,243	322,157	95,382,709	261,322	60,834	23%
2020	127,168,976	347,456	100,101,835	273,502	73,954	27%
Average	**124,546,800**	**340,839**	**96,893,106**	**265,168**	**75,672**	**29%**
Avg. (gpm)		**237**		**185**		

For the five-years of data (2016-2020), the non-revenue water produced by the District averaged 29% more water than the water billed. This is considered very high per industry standards.

C. Water Demand & Peaking Factors

Since the District's billing categories are split into two categories, "Residential" and "Non-Residential," water demand factors were developed from the actual billing data based on those two categories. The demand factors are presented in "per-acre" and "per-dwelling unit" alternatives. The residential category factors were adjusted based on density rates presented in the Tuolumne County General Plan and the per capita water usage data.

1. Existing

Table V-11 identifies the current water demand factors based on billing data per land use category.

Table V-11: Water Demand Factors – Existing

Land Use Category	Amount	Unit	Amount	Unit
High Density Residential	2,500	gpd/ac	210	gpd/du
Medium Density Residential	2,000	gpd/ac	175	gpd/du
Low Density Residential	1,000	gpd/ac	140	gpd/du
Estate Residential	90	gpd/ac	140	gpd/du
Homestead/Rural Residential	60	gpd/ac	140	gpd/du
Commercial	75	gpd/ac	n/a	

2. Proposed

When projecting future water demands for proposed projects, it is recommended to use a slightly more conservative factor (approximately 25% higher) to account for uncertainties in development and annual fluctuations based upon climate conditions. **Table V-12** identifies the water demand factors per land use category recommended to be used for future demand projections.

Table V-12: Water Demand Factors – Proposed

Land Use Category	Amount	Unit	Amount	Unit
High Density Residential	3,125	gpd/ac	263	gpd/du
Medium Density Residential	2,500	gpd/ac	219	gpd/du
Low Density Residential	1,250	gpd/ac	175	gpd/du
Estate Residential	113	gpd/ac	175	gpd/du
Homestead/Rural Residential	75	gpd/ac	175	gpd/du
Commercial	94	gpd/ac	n/a	

3. Peaking Factors

The proposed water peaking factors are identified in **Table V-13.**

Table V-13: Water Peaking Factors

Demand Condition	Factor
Maximum Day	2.77 x Average Day
Peak Hour	2.00 x Maximum Day

D. Water Demand Projections

Based upon the water billing and production data, a summary of the existing demand conditions is provided in **Table V-14.**

Table V-14: Existing Water Demand Summary

Demand Condition	Production		Consumption	
	(gpd)	(gpm)	(gpd)	(gpm)
ADD	340,839	237	265,168	185
MDD	944,124	656	734,515	510
PHD	1,888,248	1,311	1,469,030	1,020

Based upon the projected growth within the District and utilizing the proposed water demand factors and peaking factors identified above, the projected future demand increase in 5-year planning horizons is summarized in **Table V-15**.

Table V-15: Water Demand Growth Projections (gpm)

Demand Condition	2025	2030	2035	2040
ADD	8	4	13	13
MDD	22	11	35	35
PHD	44	22	70	70

Adding the growth projections to the current consumption demands results in the total anticipated average day, maximum day and peak hour demands District-wide, as shown in **Table V-16.**

Table V-16: Total Future Water Demand Projections (gpm)

Demand Condition	2020	2025	2030	2035	2040
ADD	185	193	197	210	223
MDD	510	532	543	578	613
PHD	1,020	1,064	1,086	1,156	1,226

As previously mentioned, significant growth within the District is not anticipated, and is not a driver for future improvements.

E. Existing Wastewater Generation

The District measures the inflow into the WWTP on a daily basis at the influent pumps. The District provided the five (5) previous years of complete influent data, which is summarize in **Table V-17**.

Table V-17: WWTP Inflow Data

WWTP Influent (MG)						
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**Average (mgd)**
January	4.41	7.75	3.54	4.74	3.08	0.152
February	3.42	5.71	2.98	5.99	3.04	0.149
March	4.75	4.02	6.28	4.81	4.59	0.158
April	3.60	3.93	5.17	3.97	4.43	0.141
May	3.73	3.91	4.31	4.80	3.93	0.133
June	3.70	4.19	4.07	4.54	3.72	0.135
July	4.22	4.40	4.26	4.57	4.20	0.140
August	3.41	3.92	2.92	4.05	3.38	0.114
September	2.90	2.88	2.92	3.08	3.01	0.099
October	3.12	2.81	2.63	2.45	3.00	0.090
November	2.65	3.40	2.95	2.89	3.23	0.101
December	3.88	2.56	3.55	4.12	3.07	0.111
Total	**43.79**	**49.48**	**45.57**	**50.02**	**42.68**	**0.127**
Avg. Day (mgd)	**0.120**	**0.136**	**0.125**	**0.137**	**0.117**	**0.127**
Max. Day (mgd)	**0.411**	**0.363**	**0.380**	**0.339**	**0.364**	**0.371**
Max. Day Factor	**3.43**	**2.66**	**3.05**	**2.47**	**3.13**	**2.93**

Between years 2016 – 2020, The WWTP saw an average daily inflow range of 0.12 – 0.14 million gallons per day (MGD). Over the five-year period that average daily inflow was 0.127 MGD (88 gpm). The peak daily inflow was measured at 0.411 MGD (285 gpm). The data includes both wet-weather and dry-weather days.

Typically, the months of May through October have little to no rain events, and the data can be used to determine the typical average dry-weather flow. The average dry-weather flow for May through October is 0.12 MGD (82 gpm). The District sees a significant increase in population during the summer months due to vacationers and travelers into Yosemite. As evident in the table above, flows in September and October are the lowest of the year, which is likely due to the dry-weather and minimal tourism. The average dry-weather flow in September and October drops to 0.09 MGD (63 gpm).

F. Wastewater Generation Factors & Peaking Factors

Included below are the calculated wastewater generation factors and peaking factors to determine the current and future wastewater generation projections within the District. Wastewater generation factors were developed based on the water usage date in conjunction with the inflow to the WWTP.

1. Existing

Based on an ADWF of 82 gpm, the wastewater generation within the District is approximately 45% of the water demand. Based on connections, the number of wastewater customers connected to the wastewater system is 49% of the number of customers connected to the water system. There is still a large portion of the District that is served by septic systems. The water return to sewer ratio is calculated to be 90%.

Table V-18 identifies the existing wastewater generation factors based on land use category.

Table V-18: Wastewater Generation Factors – Existing

Land Use Category	Amount	Unit	Amount	Unit
High Density Residential	2,250	gpd/ac	190	gpd/du
Medium Density Residential	1,800	gpd/ac	158	gpd/du
Low Density Residential	900	gpd/ac	125	gpd/du
Estate Residential	81	gpd/ac	125	gpd/du
Homestead/Rural Residential	54	gpd/ac	125	gpd/du
Commercial	68	gpd/ac	n/a	

2. Proposed

Table V-19 identifies the proposed wastewater generation factors based on land use category to be used when calculating future demands. The proposed generation factors are based on the existing factors and include a 25% contingency for planning-level conservatism and to account for annual fluctuations.

Table V-19: Wastewater Generation Factors – Proposed

Land Use Category	Amount	Unit	Amount	Unit
High Density Residential	2,813	gpd/ac	236	gpd/du
Medium Density Residential	2,250	gpd/ac	197	gpd/du
Low Density Residential	1,125	gpd/ac	158	gpd/du
Estate Residential	101	gpd/ac	158	gpd/du
Homestead/Rural Residential	68	gpd/ac	158	gpd/du
Commercial	84	gpd/ac	n/a	

3. Peaking Factors

An analysis of the WWTP influent data resulted in the following wastewater peaking factors **Table V-20.**

Table V-20: Wastewater Peaking Factors

Demand Condition	Factor
PDWF	1.5 x ADWF
PWWF	3.5 x ADWF

G. Wastewater Generation Projections

Based on the past five years of WWTP inflow data, the existing wastewater generated within the District is summarized in **Table V-21.**

Table V-21: Existing Wastewater Generation (gpd)

Demand Condition	Wastewater Generation	
	(gpd)	(gpm)
ADWF	119,000	82
PDWF	178,500	123
PWWF	416,500	287

Based upon the projected growth within the District and utilizing the proposed wastewater generation factors and peaking factors identified above, the projected future demand increase in 5-year planning horizons is summarized in **Table V-22**.

Table V-22: Wastewater Generation Growth Projections (gpd)

Demand Condition	2025	2030	2035	2040
ADWF	10,294	5,216	16,616	16,616
PDWF	15,440	7,825	24,925	24,925
PWWF	36,027	18,257	58,157	58,157

Adding the growth projections to the current generation results in the total anticipated average dry-weather, peak dry-weather and peak wet-weather generation District-wide, as shown in **Table V-23.**

Table V-23: Total Future Wastewater Generation Projections (gpd)

Demand Condition	2020	2025	2030	2035	2040
ADWF	119,000	129,294	134,510	151,126	167,743
PDWF	178,500	193,940	201,765	226,689	251,614
PWWF	416,500	452,527	470,785	528,942	587,099

As previously mentioned, significant growth within the District is not anticipated, and is not a driver for future improvements.

VI. WATER SYSTEM

The potable water supply comes from the SFPUC-owned Hetch-Hetchy Tunnel, which is supplied by the Hetch-Hetchy reservoir in Yosemite. The Tunnel runs along southern border of the District boundary. GCSD extracts water from the Tunnel at two locations: Big Creek Shaft and Second Garrote Shaft. Water from the Hetch-Hetchy Tunnel is disinfected and then boosted into the distribution system. Pine Mountain Lake serves as an alternative water supply in the event the Tunnel is not in service.

The water system normally operates as two (2) sub-systems: The Big Creek (BC) system and the Second Garrote (2G) system, although the two systems are connected for redundancy.

The distribution system consists of five (5) storage tanks (approximately 2.64 MG total), five (5) intra-system pumping stations, eleven (11) pressure zones, seventeen (17) pressure reducing stations with a total of nineteen (19) pressure reducing valves, one (1) pressure sustaining valve, nine (9) pressure relief valves, 538 fire hydrants and approximately seventy-two (72) miles of pipeline. There are approximately 3,230 connections to the District's water system.

A. Existing System Description

This section includes a description of the existing water facilities that comprise the District's water supply and distribution system.

1. Water Supply

Big Creek WTP

The Big Creek WTP is located approximately four miles east of central Groveland along the Hetch Hetchy Tunnel. Access to the facility is an asphalt paved road off of Big Creek Shaft Road north of Highway 120. Raw water supply for the Big Creek WTP is pumped from the Hetch Hetchy Tunnel via a vertical shaft, treated to potable water standards via the water treatment facility, and pumped into the distribution system to meet demand and fill the storage tanks.

The Big Creek WTP was originally constructed in the 1970's, with treatment and storage upgrades performed after 1995, followed by chloramination and ultra-violet (UV) disinfection upgrades after 2006.

Although the water obtained from the Hetch Hetchy Tunnel feeding the WTP originates from a surface water source, the water quality is considered exceptional, with only disinfection and pH adjustment required.

The Big Creek turbine produces approximately 1,300 gpm at 565 feet of head. Currently, the supply pumps operate about 4 hours per day. Big Creek supplies approximately 2/3 of the water to the system.

Second Garrote WTP

The Second Garrote WTP is located approximately two miles southeast of central Groveland, immediately north of the Hetch Hetchy Tunnel. Access to the facility is along an unpaved road, south of old Highway 120. Raw water supply for the Second Garrote WTP is pumped from the Hetch Hetchy Tunnel via a vertical shaft, treated to potable water standards via the water treatment facility, and pumped into the distribution system to meet demand and fill the storage tanks.

The Second Garrote WTP was originally constructed in the 1970's, with upgrades paralleling similar upgrades for the Big Creek WTP, including treatment and storage upgrades, and chloramination and ultra-violet (UV) disinfection upgrades.

Similar to the Big Creek WTP, water quality obtained from the Hetch Hetchy Tunnel feeding the Second Garrote WTP is considered exceptional, with only disinfection and pH adjustment required. Treatment without filtration has been granted 1993 under the same filtration avoidance permit as per the Big Creek WTP.

The Second Garrote turbine produces approximately 700 gpm at 760 feet of head. Currently, the supply pumps operate about 4 hours per day. Second Garrote supplies approximately 1/3 of the water to the system.

Alternate Water Supply WTP

Secondary water supply for the District is provided from Pine Mountain Lake (PML). To utilize water from the lake, GCSD must activate a trailer mounted treatment facility, known as the Alternate Water Supply (AWS). The treatment trailer is above-grade and is manually intensive to operate. The AWS is permitted to produce 600 gpm, however it typically produces approximately 300-550 gpm.

The AWS facility is located at the end of Par Court in the middle of the Pine Mountain Lake Golf Course. The equipment is located on the southeast corner of the paved parking lot. Raw water supply for the AWS is obtained from Pine Mountain Lake located one mile east of the AWS. Treated water is discharged into a pipeline which connects to the nearby potable water distribution main.

Installation of the AWS was implemented to allow the Big Creek and Second Garrote WTPs to be shut down when the Tunnel is taken offline for periodic, planned tunnel inspection and maintenance. The AWS was approved for use as a temporary water source in 2007. The AWS facilities were constructed approximately ten years ago.

Recycled Water

The District produces recycled water at the WWTP. The secondary treated and disinfected effluent is metered and then pumped into Reservoir No. 2, which is a 32 acre-feet capacity open storage facility. The treated effluent is blended with water from Pine Mountain Lake and used to irrigate the Pine Mountain Lake Golf Course.

During times of the year when there is no demand for the effluent from the golf course, it is directed to spray fields, although the spray fields cannot handle the entire recycled water demand if nothing is directed to the golf course. At times there is a need to pump the effluent to both the golf course and the spray fields. There is currently a trailer-mounted pump at the south end of the reservoir that conveys the effluent to the spray fields when the main irrigation pump is being used to direct the effluent to PML. The District's recycled water production for years 2016-2020 is shown in **Table VI-1**. Approximately 85-90% of the recycled water produced is delivered to the Pine Mountain Lake Golf Course.

Table VI-1: District Recycled Water Production (Gallons)

Month	2016	2017	2018	2019	2020
Jan	93,360	0	153,161	32,285	2,648,800
Feb	2,475,818	1,130,752	17,000	0	4,828,840
Mar	851,607	4,100,421	2,045,481	1,391,732	803,000
April	2,420,523	5,161,748	3,834,612	4,776,750	1,377,800
May	4,310,675	8,900,408	4,281,000	3,929,000	4,489,000
June	7,801,271	12,695,362	6,400,267	7,411,000	6,152,000
July	7,960,378	16,222,308	6,912,271	8,803,440	7,761,880
Aug	6,741,275	14,863,168	5,303,481	8,131,240	4,437,000
Sept	6,266,881	11,598,728	2,816,748	8,568,968	1,808,680
Oct	2,338,672	3,214,704	1,340,124	6,615,552	3,435,432
Nov	1,282,937	3,138,322	236,217	2,793,480	2,075,920
Dec	653,552	2,496,002	5,537,818	1,853,676	1,225,224
Total	**43,196,949**	**83,521,923**	**38,878,180**	**54,307,123**	**41,043,576**

This Master Plan recommends that the District aggressively target and resolve the sewer system I/I, which will reduce the amount of WWTP influent and recycled water being produced (especially in the wet months). However, there is a need to find additional means of disposing of the treated recycled water effluent from the WWTP, especially if the PML golf course is unable to take recycled water. It is recommended that the District prepare a focused recycled water master plan that identifies the infrastructure required to deliver recycled water to additional irrigation disposal locations, such as the baseball field, Mary Laveroni Community Park and greenbelt pathways. A focused recycled water master plan should evaluate the variety of recycled disposal conditions and what-if scenarios, such as what happens if/when the PML golf course can't take recycled water? How much flow can the existing spray fields handle (need to consider area, topography, soil data, geology, vegetation, groundwater, etc.)?

2. Treatment

Big Creek WTP

Raw water is pumped at approximately 1,300 gpm from the Tunnel shaft for the Big Creek WTP and is initially treated with chlorine, where it then heads to a welded steel vertical column tank with integral baffling to meet minimum contact time requirements pursuant to the Surface Water Treatment Rule. Water is then injected with aqueous ammonia which combines with the residual chlorine for chloramination disinfection prior to entering the at-grade 2.0-million-gallon welded steel clearwell reservoir. Finished water from the clearwell is fed through a UV disinfection system. The water receives final treatment for disinfection residual from on-site generated sodium hypochlorite, and lime addition for pH adjustment at the treated water booster pump station building prior to entering the distribution system water main. GCSD injects lime into the water to raise the pH to 8.5 or higher to stabilize the chloramines. The following **Figure 1** includes a basic process diagram showing the sequence of the water process.

The capacity of the Big Creek WTP is sufficient to meet the ultimate peak hour demand of 1,226 gpm. The minimum required disinfection for the facility is 99.99% (4-log) removal of viruses, and minimum 99.9% (3-log) removal of Giardia lamblia cysts. The District is currently able to meet all of the State of California SWRCB minimum requirements for municipal potable treatment, as stated under Title 22 of the California Regulations Related to Drinking Water "Water Code."

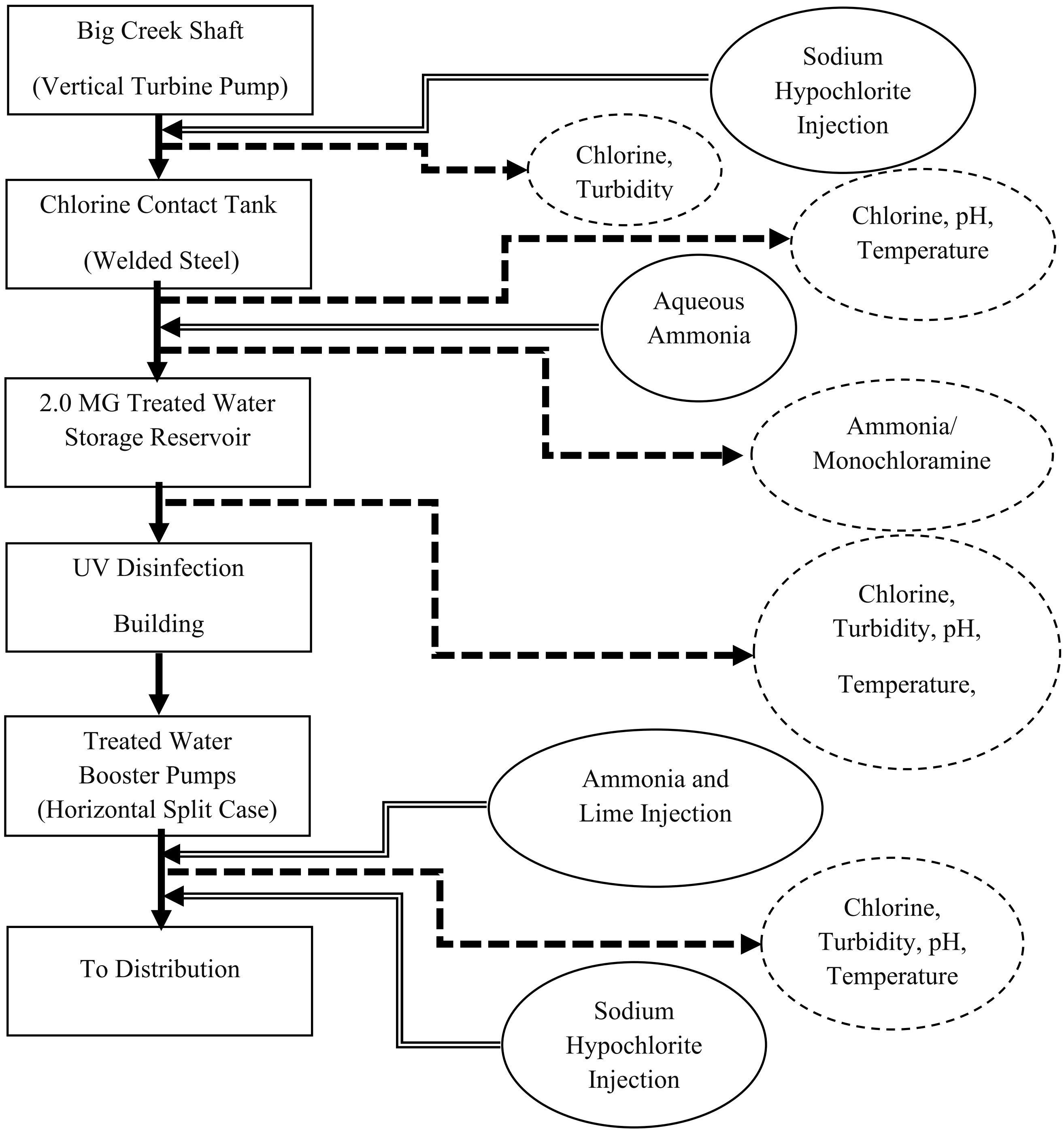


Figure 1 – Big Creek WTP Treatment Process Diagram

Second Garrote WTP

Similar to the arrangement at the Big Creek WTP, raw water is pumped at approximately 700 gpm from the Hetch-Hetchy Tunnel shaft and treated with chlorine. Water then heads to the separate storage and treatment site located approximately 400 feet north, to a welded steel vertical column tank with integral baffling to meet minimum contact time requirements. Water from the contact tank is pumped to the separate storage and treatment site and injected with aqueous ammonia which combines with the residual chlorine for chloramination disinfection prior to entering the at-grade 2.0-million-gallon welded steel clearwell reservoir. Finished water from the clearwell is fed through a UV disinfection system. The water receives final treatment for disinfection residual from on-site generated sodium hypochlorite, and lime addition for pH adjustment at the treated water booster pump station building prior to entering the distribution system water main.

The Second Garrote WTP is also equipped with an emergency packaged membrane filtration system provided by Pall Corporation. The District installed the membrane filtration system to accept an alternative water supply from the Cherry Lake Reservoir during drought conditions associated with the Hetch Hetchy reservoir. It is not typical for Cherry Lake water to be supplied via the mountain tunnel. This was a very rare event and was used to test the ability of Cherry Lake to be used as an alternative water supply if Hetch Hetchy water is unavailable. During the tunnel shutdown, no water is within the tunnel. The filtration unit was installed as a repercussion of the prolonged Hetch Hetchy water supply shutdown.

The use of Cherry Lake water as an alternate source of raw water during the temporary supply shutdown was an arrangement made between the District and Hetch Hetchy (SFPUC). The addition of Cherry Lake water was a precautionary action taken by Hetch Hetchy to test the ability of Cherry Lake to be utilized in the occurrence that the Hetch Hetchy Reservoir becomes so low that it can no longer supply water to the region. Due to the change in water source and quality during this alternate source supply period, procurement and installation of a temporary filtration system was required by the District. The Pall filtration system installed is a portable, trailer-mounted membrane filtration system, which has been plumbed into the existing main WTP process. An equalization tank was installed adjacent to the existing raw water pumps to inhibit cycling of raw water pumping during filter system backwash and rinse cycles.

During the alternate source supply period, the District was able to make successful use of the Pall filtration system, and the Second Garrote WTP continued to supply water to the Groveland community during this alternate source supply period. However, the temporary shutdown and alternate supply from Cherry Lake was ordered stopped by SFPUC due to the poorer water quality San Francisco was receiving, and Hetch Hetchy reservoir was restored as the supply source. The District no longer operates the Pall filtration system for treatment but does maintain service of the filtration system to maintain reliability of the system and maintain the ability to return it to service, if needed.

The following **Figure 2** includes a basic process diagram showing the sequence of the water process at the Second Garrote WTP, which includes the Pall filtration system maintained in an off-line standby service mode.

The capacity of the Second Garrote WTP is sufficient to meet the ultimate maximum day demand of 613 gpm. The minimum required disinfection for the facility is 99.99% (4-log) removal of viruses, and minimum 99.9% (3-log) removal of Giardia lamblia cysts. The District is currently able to meet all of the State of California SWRCB minimum requirements for municipal potable treatment, as stated under Title 22 of the California Regulations Related to Drinking Water “Water Code.”

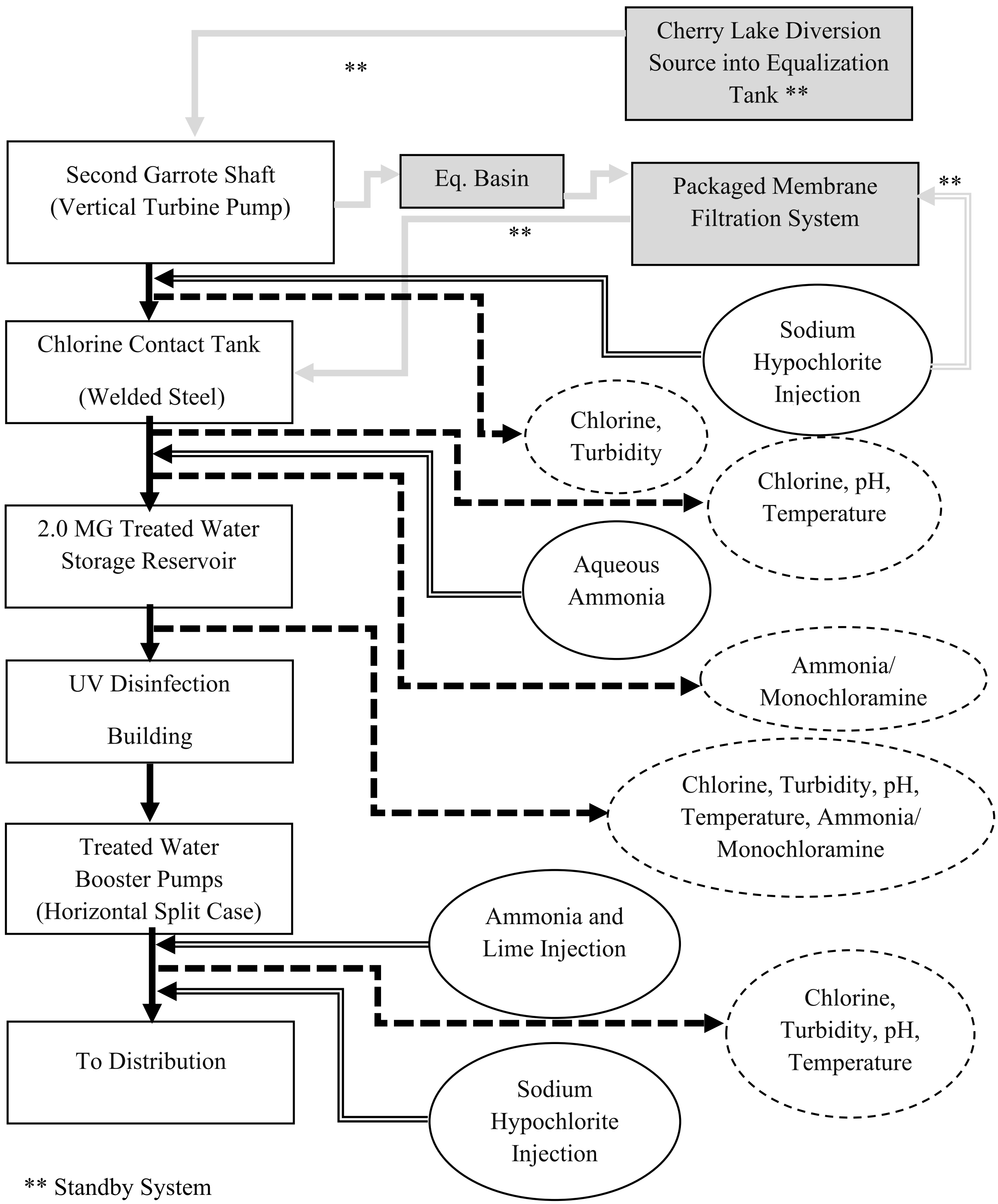


Figure 2 – Second Garrote WTP Treatment Process Diagram

Alternate Water Supply WTP

Raw water for the AWS obtained from Pine Mountain Lake is pumped through a containerized pre-packaged membrane filtration system. The pre-packaged membrane filtration system consists of two banks of membrane modules, piping manifolds, electrical control panels, and an air compressor all housed within a trailer-mounted C-train container. Filtered water is piped to two in-series trailer tanks along with sodium hypochlorite chemical injection, which serve as contact tanks. Water is treated with aqueous ammonia after it leaves the equalization tank (mini-clearwell). Treated water from the clearwell is plumbed to a trailer mounted packaged pump station with multiple vertical in-line pumps, and discharges into piping connected to the distribution system beyond the perimeter of the golf course property. The following **Figure 3** includes a basic process diagram showing the sequence of the water process.

The AWS is permitted to produce 600 gpm, however it typically produces approximately 300-550 gpm. The AWS can adequately meet the ultimate average day demand and may be able to meet the existing maximum day demand, however it is not recommended to operate the AWS during peak summer months if it can be avoided. The AWS should be operated during the low demand periods of the year (November – May).

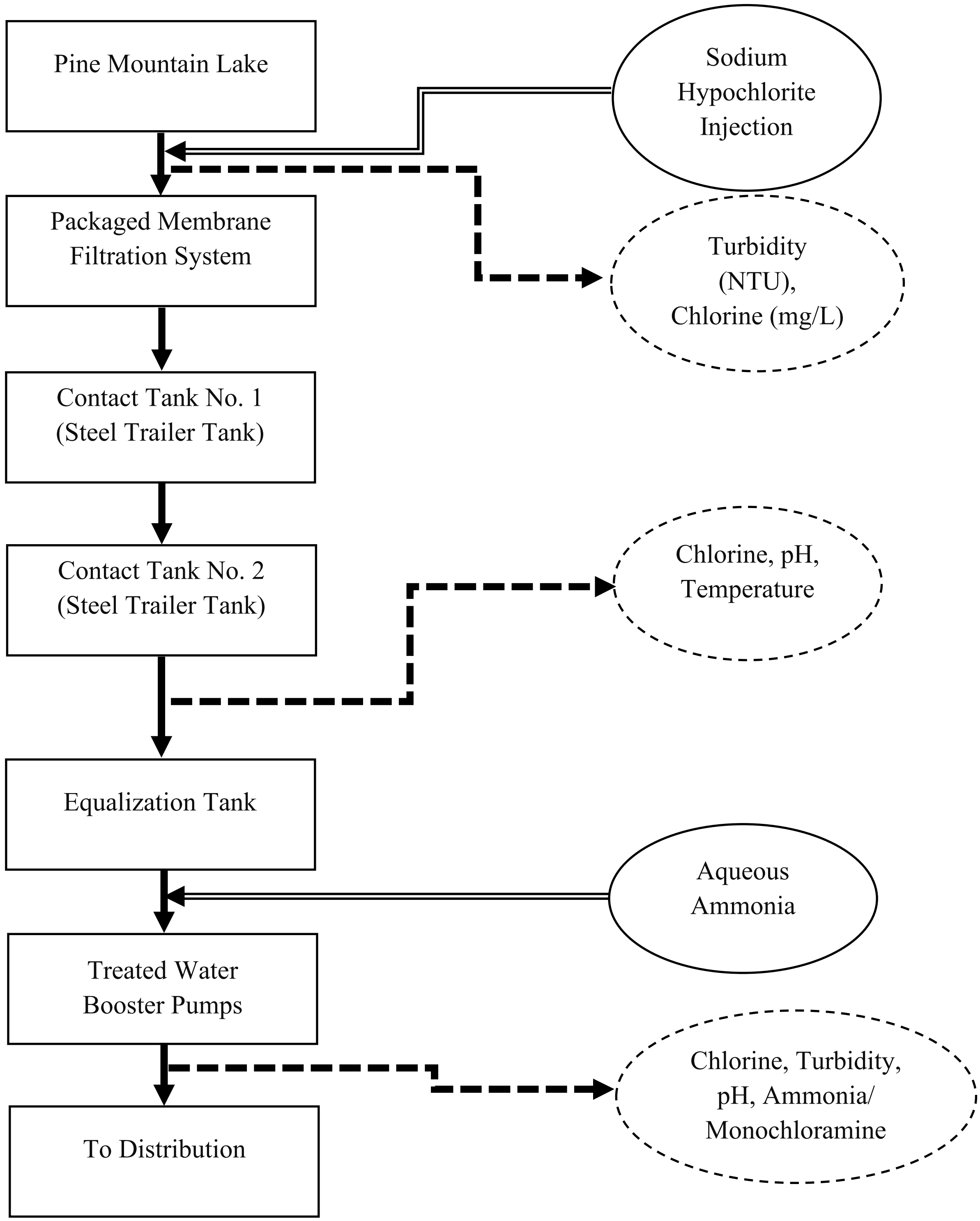


Figure 3 – AWS Treatment Process Diagram

3. Storage

The District maintains five (5) storage facilities within the distribution system that provide 2.64 MG of water storage, excluding the two 2.0 MG clearwells at the 2G and BC WTPs. The District's storage facilities are shown on **Exhibit 5** and listed in **Table VI-2**.

Table VI-2: District Storage Facilities

Tank Name	Pressure Zone		Ground Elevation (ft)	Water Height (ft)			HGL (ft)	Diameter (ft)	Volume (gal)
	Direct	Thru PRV		Min	Max	Overflow			
Tank 1	GL-SE	GL-C, BOF	3136.0	5.0	24.0	24.6	3160.0	60.0	500,000
Tank 2	PML-W	PML-NW	2917.0	5.0	20.0	20.7	2937.0	80.0	750,000
Tank 3	PML-S	PML-C, PML-SW, PML-E	3013.0	5.0	20.0	20.4	3033.0	80.0	750,000
Tank 4	PML-NE PS	n/a	2912.0	5.0	17.4	17.8	2929.6	70.0	500,000
Tank 5	GL-S	GL-S subzone	3429.0	5.0	16.0	16.7	3445.0	38.5	140,000
Total									**2,640,000**

Most storage tanks have a single inlet/outlet pipeline. Tanks 2, 4 and 5 have an internal mixing system (PAX).

4. Pumping

The District maintains five (5) potable water pump stations within the distribution system, excluding the pumping facilities at the 2G, BC and AWS WTPs. The District's pumping facilities are shown on **Exhibit 5** and listed in **Table VI-3**.

Table VI-3: District Pumping Facilities

PS Name	Suction Zone	Discharge Zone	# of Pumps	Pump Flow (gpm)	TDH (ft)	HP	VFD	Generator	
Highlands Station 5 / GL-S	GL-SE	Tank 5	2	200	310	30	N	Y	60 kW
Tank 4 Hydro / PML-NE	Tank 4	PML-NE	2	400	168	40	Y	Y	200 kW
Butler Way Bypass / Intra-System	Big Creek PS	Tank 1	2	690	281	50	N	N	n/a
Tank 2 Hydro	Tank 2	sub-zone	1	25	*n/a*	3	N	Y	150 kW
Tank 2 Transfer	AWS	Tank 2	3	475	386	60	Y	Y	

5. Distribution

The water distribution system consists of approximately 72 miles of pipelines, ranging in diameter from 2-inch to 16-inch. A majority of the system consists of 6-inch diameter pipeline. A majority (approximately 80%) of the pipeline material in the system is ACP. The breakdown of the system pipelines is shown on **Exhibit 6** and **Table VI-4**.

Table VI-4: District Pipelines

Pipe Diameter (in)	Length (ft)	
	(feet)	(miles)
2	502	0.1
4	25,763	4.9
6	283,305	53.7
8	24,791	4.7
10	20,919	4.0
12	10,177	1.9
16	12,245	2.3
Total	**377,702**	**71.5**

Due to the hilly terrain, the District relies on pressure stations to control pressure within the distribution system. The District maintains seventeen (17) pressure reducing stations, as shown on **Table VI-5** and **Exhibit 5**.

Table VI-5: District Pressure Reducing Stations

PRS Name	Upstream Zone	Downstream Zone	Ground Elevation (ft)	Downstream Pressure Setting (psi)	Calculated HGL (feet)	# of Valves	Valve Diameter (in)
BOF-01	GL-SE	BOF	2924	34	3003	1	4
GL-01	GL-SE	GL-C	2986	65	3136	1	4
GL-02	GL-SE	GL-C	2920	54	3045	1	4
GL-03	GL-SE	GL-C	2980	52	3100	1	4
PML-01	PML-S	PML-SW	2774	81	2961	2	6 & 2-1/2
PML-02	PML-SW	PML-C	2668	84	2862	1	4
PML-03	PML-W	PML-NW	2658	31	2730	1	4
PML-04	PML-E	PML-NW	2576	73	2745	1	4
PML-05	PML-E	PML-C	2675	60	2814	1	4
PML-06	PML-SW	PML-C	2739	54	2864	1	4
PML-07	PML-W	PML-NW	2698	31	2770	1	4
PML-08	PML-E	PML-C	2763	49	2876	1	4
PML-09	BC PS (PML-S)	PML-E	2728	125	3017	2	6 & 2
PML-10	BC PS (PML-S)	PML-C	2734	61	2875	1	4
PML-11	PML-S	PML-C	2779	50	2895	1	4
PML-12	GL-SE	Tank 3 (PML-S)	2913	85	3109	1	4
GL-S	GL-S	reduced zone	3160	66	3312	1	4

6. Pressure Zones

There are eleven (11) different pressure zones within the District's water system. The pressure zones are shown on **Exhibit 7** and listed in **Table VI-6**. A hydraulic schematic of the District's water system is shown on **Exhibit 8**.

Table VI-6: District Pressure Zones

Zone Name	HGL (ft)	Elevation Range (ft)		Current Demand (gpm)			Supply In	Supply Out	Storage Facility
		High	Low	ADD	MDD	Peak Hour			
GL-S	3440	3350	3100	12	36	73	GL-S PS	PRV GL-S	Tank 5
GL-SE	3160	3070	2811	19	51	100	Intra-System PS, 2G PS	PRV GL-01, GL-02, GL-03, BOF-01, GL-S PS	Tank 1
GL-C	3050	2962	2722	6	17	34	PRV GL-01, GL-02, GL-03	n/a	Tank 1
BOF	2999	2908	2790	9	24	48	PRV BOF-01	n/a	Tank 1
PML-NE	3092	2977	2762	23	63	126	PML-NE PS	n/a	Tank 4
PML-S	3028	2930	2636	16	48	97	Big Creek PS	PRV PML-01, PML-09, PML-10, PML-11	Tank 3
PML-E	2994	2866	2581	24	65	129	PRV PML-09	PRV PML-04, PML-05, PML-08	Tank 2
PML-W	2932	2805	2626	4	10	20	PRV PML-01	PRV PML-03, PML-07	Tank 2
PML-SW	3007	2903	2636	7	21	44	PRV PML-01	PRV PML-02, PML-06	Tank 1 and 3
PML-C	2886	2769	2565	42	116	230	PRV PML-05, PML-08, PML-10, PML-11	n/a	Tank 1 and 3
PML-NW	2742	2680	2396	22	60	121	PRV PML-03, PML-04, PML-07	n/a	Tank 2
Total				**185**	**510**	**1,020**			

EXHIBIT 5

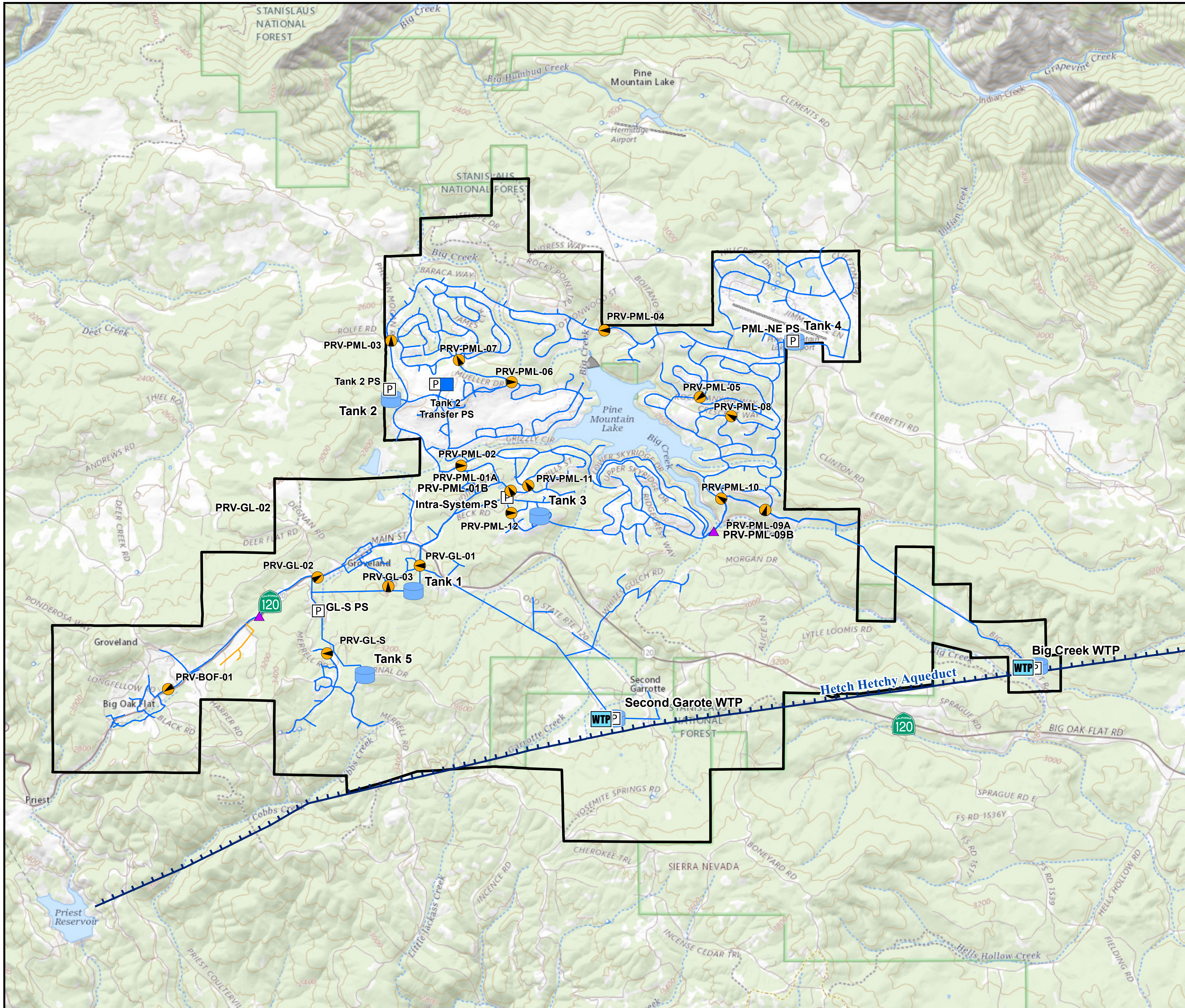
EXISTING WATER SYSTEM

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

MAY 2023



Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Alternate Water Supply
- Water Treatment Plant
- Pipe
- Pipe - Planned
- Hetch Hetchy Aqueduct
- Groveland Community Services District

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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EXHIBIT 6

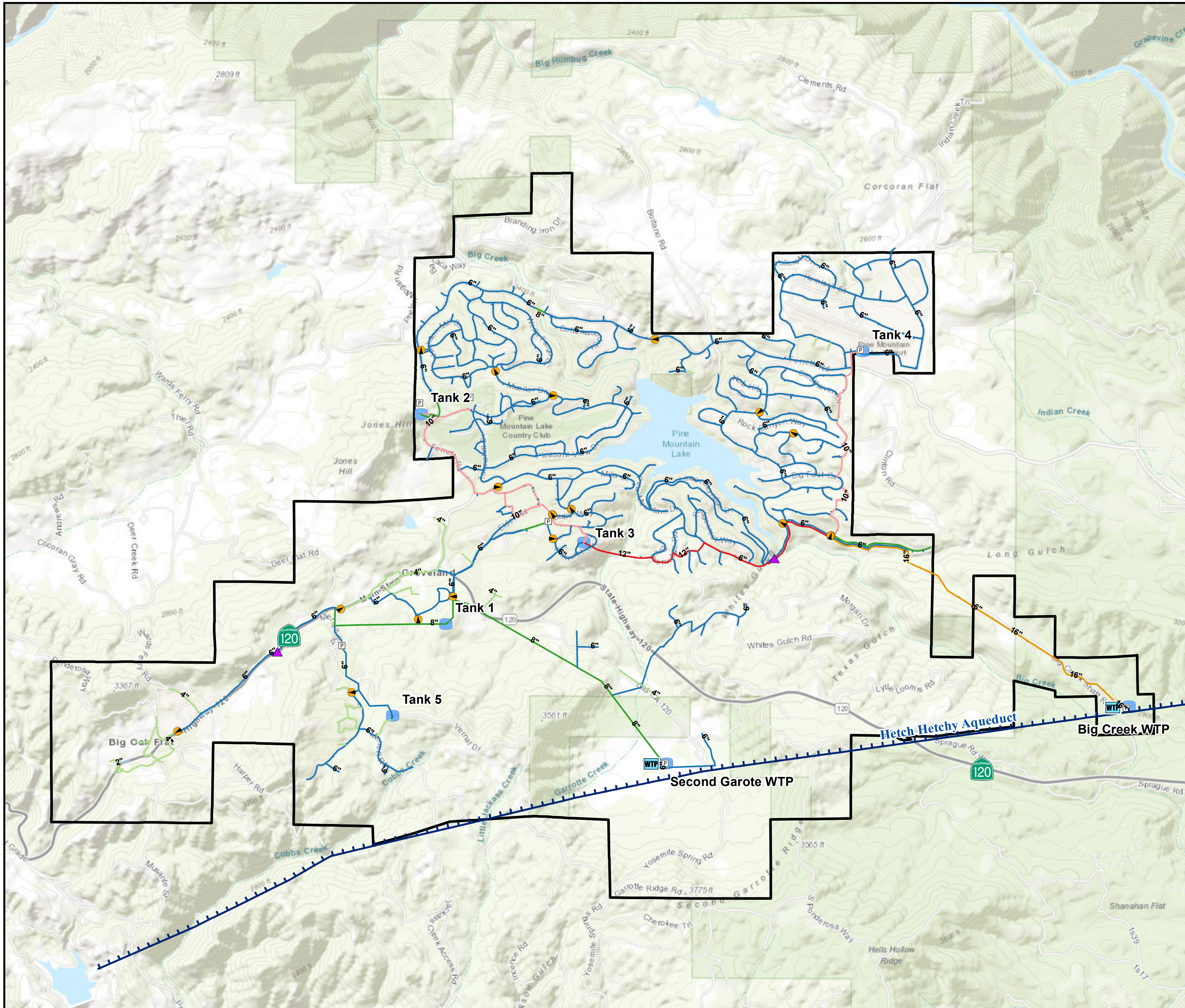
WATER SYSTEM PIPE DIAMETERS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

OCTOBER 2023



Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Water Treatment Plant
- Hetch Hetchy Aqueduct
- Groveland Community Services District

Pipe Diameter (inches)

- 2
- 4
- 6
- 8
- 10
- 12
- 16

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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EXHIBIT 7

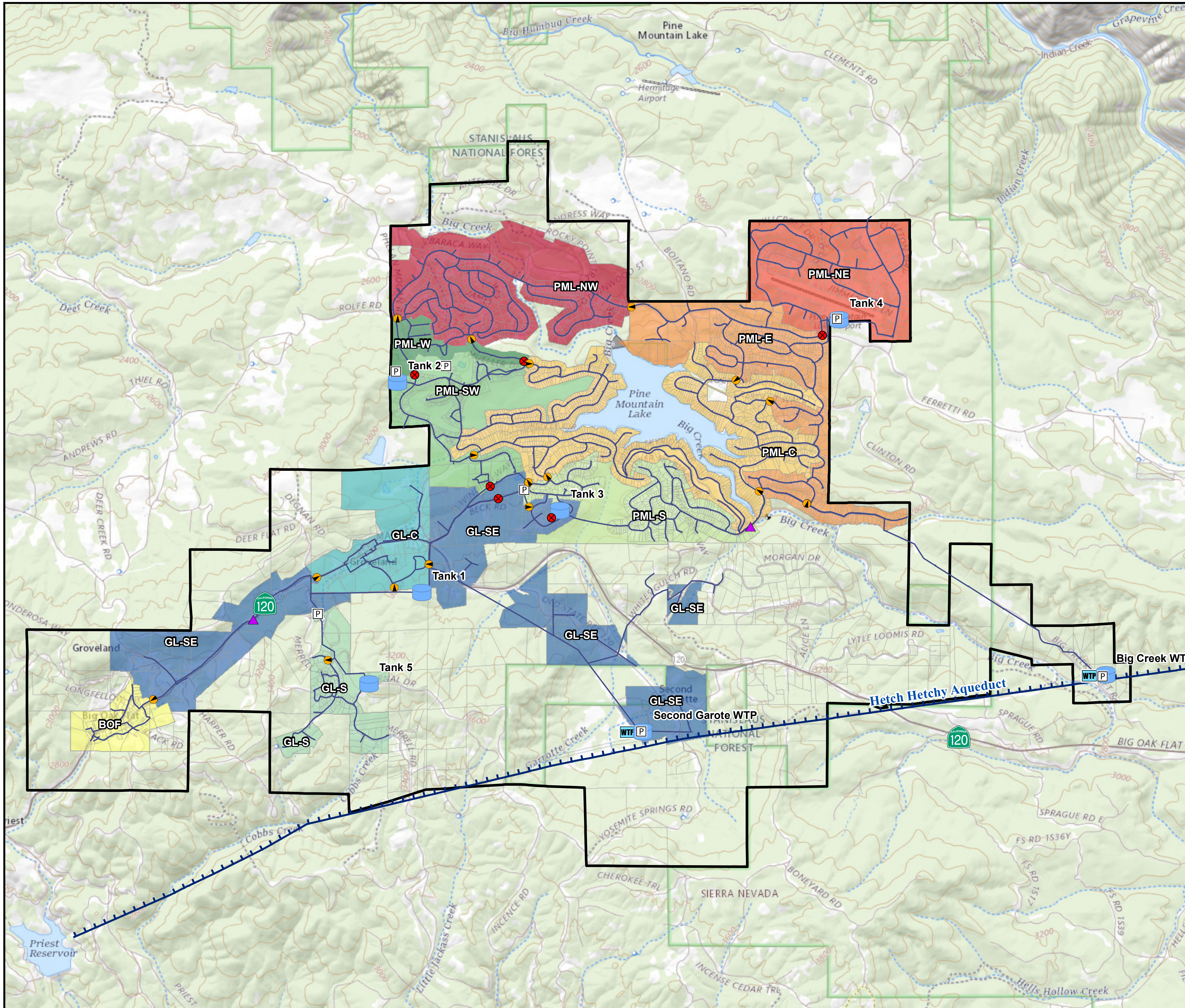
WATER SYSTEM BY PRESSURE ZONES

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

MAY 2023



Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Water Treatment Plant
- Closed Pipe
- Water Main
- Hetch Hetchy Aqueduct
- Parcels
- Groveland Community Services District Boundary

Pressure Zones (HGL)

- BOF (2,999')
- GL-C (3,050')
- GL-S (3,440')
- GL-SE (3,160')
- PML-C (2,886')
- PML-E (2,994')
- PML-NE (3,092')
- PML-NW (2,742')
- PML-S (3,028')
- PML-SW (3,007')
- PML-W (2,932')

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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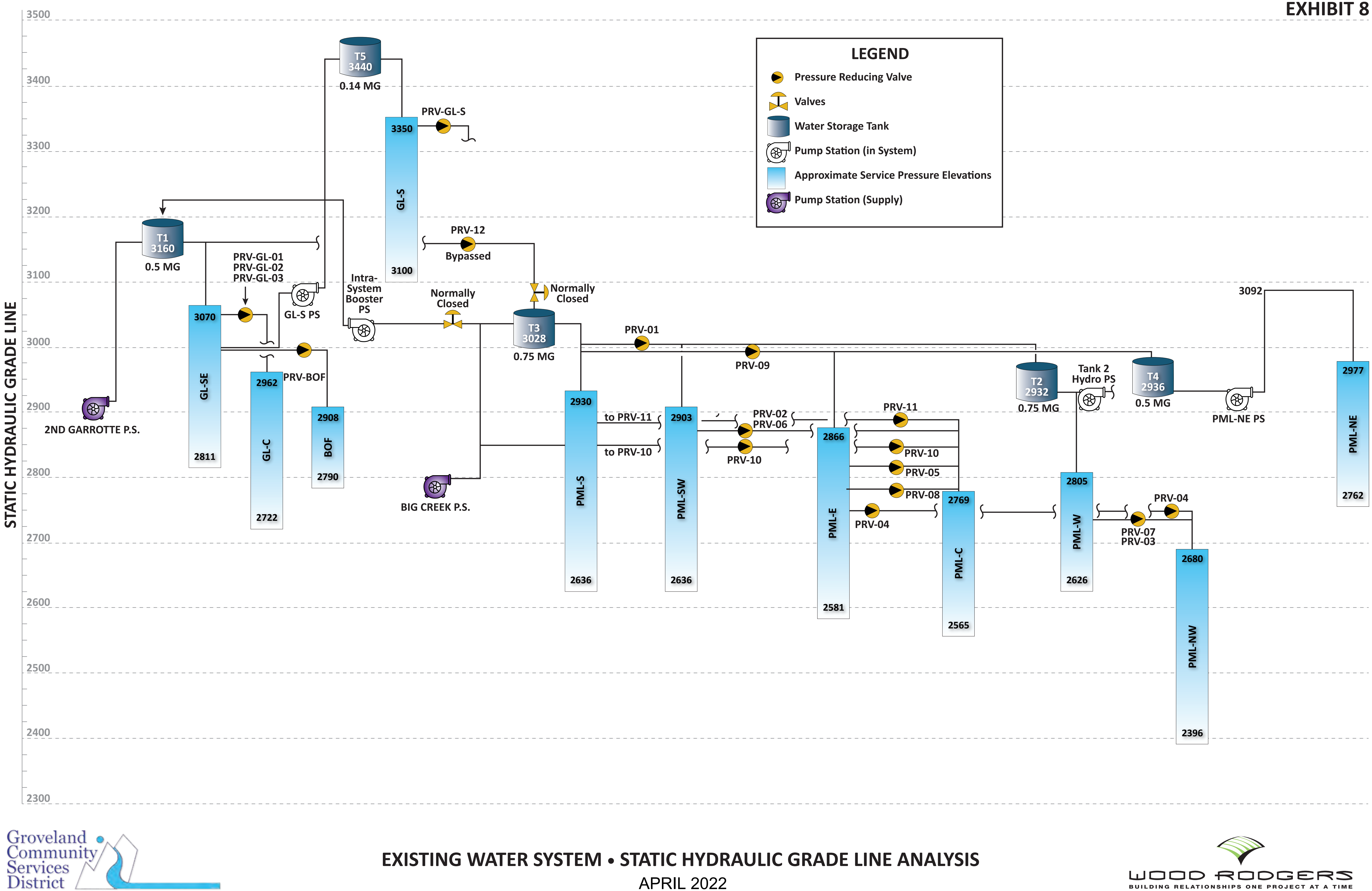
EXHIBIT 8



EXISTING WATER SYSTEM • STATIC HYDRAULIC GRADE LINE ANALYSIS

APRIL 2022

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B. Hydraulic Model

A hydraulic model is a representation of a water distribution system that allows the system to be analyzed and evaluated under various demand and operating conditions. A model typically includes all of the major elements of a water system, including pipes, nodes, pressure reducing valves, pump stations, tanks and supply sources. A hydraulic model of the District's water distribution system was developed using the Innovyze InfoWater Pro hydraulic modeling platform. The hydraulic model was used to evaluate the capacity of the distribution system, including fire flow availability and system operating pressures. A description of the model development and calibration effort is provided below.

1. Data Conversion

Typically, a hydraulic model is built from, and linked to, a GIS database that contains facility attribute data in a three-dimension environment. However, the District did not have a database of the water system. The District did have a file, developed in a software called CalCAD, that provided one-dimensional linework of the water system (with no attribute data) to show the locations of pipes and water facilities. The file contained labeling that provided pipe diameters.

As a part of this project, the CalCAD linework, and its labels were exported, scrubbed, and converted to ArcGIS to begin the development of a water system database. The GIS database allows for various attribute fields to be populated for each component and facility within the system if the data is available. The GIS database was then used as the foundation to build and develop a hydraulic model of the water distribution system.

2. Software

A hydraulic model of the District's water system was built using the InfoWater Pro Version 3.0 software platform developed by Innovyze. The hydraulic model software resides within the ArcGIS environment, which allows for the attribute data in GIS to be utilized by the model, and model results easily exported out to GIS.

3. Development

The water system hydraulic model developed for this project includes all of the District pipelines, pump stations, pressure reducing stations, tanks and supply sources in the existing system. Facility information required to run hydraulic calculations were included, such as:

- Elevations – surface elevations throughout the District were allocated to each node and facility in the model using a USGS topographic file.
- Pipe Diameters – Pipe diameters were extracted from the labels in the CalCAD file.

- Roughness Coefficient – Pipe material and age are unknown, so a “C” value of 120 was allocated to all pipes in the system.
- PRVs – Pressure reducing valve locations were obtained from the CalCAD file, and pressure settings were assigned based upon data provided by District staff.
- Pump Stations – Pump station locations were obtained from the CalCAD file, and pump design flows and TDH were based upon data provided by District staff.
- Tanks – Tank locations were obtained from the CalCAD file, and tank diameters and operating levels were based upon data provided by District staff.
- Supply – Water supply facility locations were obtained from the CalCAD file, and capacity information was provided by District staff.
- Demands – Water demands were developed using billing data and allocated using water demand factors, land use data and the Thiessen polygon method.
- Controls – System operating controls, such as pump and tank settings, were set based upon information provided by the District.

The hydraulic model is a static model and evaluates various demand and operating conditions in a snapshot. Hydraulic models can be further developed to include extended period simulations (EPS), which evaluate system operations over extended periods of time, such as 24-hours, 7-days, 1-month, etc.

The District’s model was set-up to evaluate the following demand scenarios:

- Average Day Demand (ADD)
- Maximum Day Demand (MDD)
- Peak Hour Demand (PHD)
- MDD + Fire Flow

4. Calibration

The model calibration process is a process to validate that the model results are closely mimicking the field data. The calibration process typically includes comparing model results to field data, such as SCADA data or fire hydrant tests, and making adjustments to input data to achieve results within an acceptable level of tolerance. Since historical SCADA data is not available, the model calibration effort included an evaluation and modifications to elevations, HGLs, facility controls, settings, closed valves, and system connectivity.

C. System Capacity Analysis

1. Supply

The District's water supply is provided from the SFPUC's Hetch-Hetchy conveyance system. The District is fortunate in that the water quality from Hetch-Hetchy is of high quality, and there is more than adequate quantity. The District has two locations where it can pull water from the Hetch-Hetchy Tunnel.

The risk for the District is that if the Hetch-Hetchy conveyance system were to be out of service, the back-up water supply system is much less reliable and much lower water availability. In a planned outage of the Hetch-Hetchy system, the District's AWS can meet the demands of the system. However, planned outages usually occur in the winter when demands are much lower. If an unplanned outage were to occur in the peak summer months, the AWS cannot meet the demands of the District.

The District's current MDD is 510 gpm (0.73 MGD) and PHD is 1,020 gpm. Some planned growth will occur over the next 20-year period but is not expected to be significant. The year 2040 MDD is projected to be 613 gpm (0.88 MGD) and PHD 1,226 gpm.

Both the BC WTP, with a capacity of 1,300 gpm (1.9 MGD) if operated continuously, and the 2G WTP, with a capacity of 700 gpm (1.0 MGD) if operated continuously, each individually have enough capacity to meet the existing and long-term demands of the District.

However, if the Hetch-Hetchy system were to experience an unplanned and extended outage in the peak summer months, the peak operational capacity of the AWS at 550 gpm (0.72 MGD) would not be sufficient to meet maximum daily demands. Similarly, as noted in Section VI.D.1 the AWS is located on a tight site, is manually intensive to operate. It is recommended to move the AWS to a larger, more accessible, District-owned site and increase the operational and permitted capacity to 700 gpm.

It is noted that the District is proceeding with the implementation of a "Drought Improvement Project" that includes the construction of a new groundwater well at the Tank 5 site. The project was identified separately from this Master Plan but is included herein.

2. Storage

An analysis was prepared to determine if the District has adequate storage capacity to meet the required storage volume per the criteria established in Section III. The storage analysis considered the most critical fire flow requirement in each zone. The results are shown in **Table VI-7**.

Table VI-7: Storage Analysis

Pressure Zone	MDD	Storage Components (gal)			Total Required	Available	Tank	Surplus / Deficiency
		Fire	Operational	Emergency				
GL-S	36	240,000	10,233	8,527	258,760	140,000	Tank 5	(118,760)
GL-SE	51	360,000	14,581	12,151	408,271	500,000	Tank 1	91,729
GL-C	17		4,853	4,044				
BOF	24		6,896	5,747				
PML-NE	63	600,000	18,129	15,107	633,236	500,000	Tank 4	(133,236)
PML-S	48	720,000	13,726	11,438	888,981	1,500,000	Tank 2 and Tank 3	611,019
PML-E	65		18,720	15,600				
PML-W	10		2,880	2,400				
PML-SW	21		6,069	5,058				
PML-C	116		33,408	27,840				
PML-NW	60		17,368	14,474				
Total	**510**		**146,862**	**122,385**	**2,189,248**	**2,640,000**		**450,752**

The storage analysis shows a small deficiency in the GL-S and PML-NE zones. It is noted that the District experiences nitrification issues at times during the year, which is the result of low water turnover within its tanks. Adding more storage could only exasperate the nitrification issue, unless improvements are implemented to improve water circulation.

It is noted that Tank 4 provides storage for the PML-NE zone, however the storage cannot be accessed by gravity and must be boosted by the PML-NE Pump Station, therefore the PML-NE PS must be able to supply fire flow with emergency back-up power on-site. With much of the future growth planned for the Pine Mountain Lake area, and the area located to the east of Pine Mountain Lake (Long Gulch Ranch), it is recommended to increase storage in this part of the system as development occurs. It is recommended to abandon the existing Tank 4 and relocate it to a higher elevation (approximately 3,100 feet surface elevation) in order to provide gravity storage to the PML-NE zone and adjacent pressure-reduced zones. It is recommended to provide a total of 0.75 MG of storage at the new Tank 4 site. The new tank should be constructed as new development occurs. This project will require a new pump station to fill Tank 4, new pipelines from the pump station to the tank, and from the tank to PML-NE pressure zone (approximately 6,500 LF of 12-inch pipe), the abandonment of the existing Tank 4 and PML-NE PS, and the installation of a new PRV from PML-NE to PML-E (at the site of the existing Tank 4).

It is noted that the District is proceeding with the implementation of a "Drought Improvement Project" that includes the construction of a new 140,000 gallon above-grade steel storage tank at the Tank 5 site. The project also includes retrofitting the existing tank with separate inlet / outlet piping configuration. The two tanks will be connected and will create a new effluent pipeline to improve water circulation. These proposed improvements will help to reduce the nitrification issues that occur. This project was identified separately from this Master Plan but is included herein.

3. Pumping

The District does not have a heavy reliance on the five (5) intra-system pump stations to operate the system on regular basis. The capacity of each pump station is provided in Table VI-3. A capacity analysis was conducted for each of the systems five (5) potable water pump stations to determine if it is capable of meeting the criteria established in Section III, excluding the supply sources. There are two hydropneumatic pump stations, the very small Tank 2 Hydro PS, and the PML-NE PS. The Tank 2 Hydro PS feeds a couple of houses but cannot provide a fire flow. Fire protection is provided from Tank 2. The Tank 4 hydropneumatic pump station has a reliable pumping capacity of 400 gpm, which is not enough to meet the maximum day demand plus fire flow of the PML-NE pressure zone. It is recommended to upsize or replace this pump station (see Tank 4 recommendation later in this Report). The Highland Pump Station (GL-S) has a capacity of 200 gpm and is used to fill Tank 5, which is sufficient to replenish Tank 5 and meet the demands of the GL-S zone.

The two most critical pump stations in the system are the Big Creek (BC) PS and Second Garrote (2G) PS, which provide the water supply to the system. Both pump stations are adequately sized to meet the current maximum day demand of the system. The BC PS has a capacity of 1,400 gpm, while the 2G PS has a capacity of 700 gpm. It is recommended to upsize the 2G PS to provide a firm capacity of 1,300 gpm so that there is full supply redundancy in the event one of the WTPs is out of service for an extended period of time. This is not an immediate need and is considered a longer-term recommendation.

4. Distribution

In order to evaluate the capacity within the distribution system, the hydraulic model was utilized. Hydraulic model analyses were performed under the average day demand condition to identify high pressure areas, under the peak hour demand condition to identify low pressure areas, and under the maximum day plus fire flow demand condition to identify fire flow availability.

High Pressure

The water model was analyzed under an average day demand condition to determine if/where locations within the water system experience high pressure, above 150 psi. The model results indicate several locations within the system where pressures exceed 150 psi, including the southern portion of the GL-SE zone and the center of the PML-NW zone. These areas are depicted on **Exhibit 9.**

Low Pressure

The water model was analyzed under a peak hour demand condition to determine if/where locations within the water system experience low pressure, below 40 psi. The model results were evaluated to eliminate nodes that are located immediately adjacent tanks that are not service nodes and where low pressures are expected. Pressures below 40 psi were observed at several locations within the system, including:

- Little Valley Road in PML-S
- Tip Top Court PML-NW
- Longview Street PML-C
- Vernal Drive in GL-S

In addition, the District mentioned that they experience very low pressures along Whites Gulch Road, Vickey Lan and Noel's Dirt Road, however low pressures only occur in this area when the booster pumps are not running. It appears that this part of the system may not be included in the model. The low-pressure results are depicted on **Exhibit 10.**

Fire Flow

The water model was utilized to was analyzed under a maximum day demand condition to determine the available fire flow throughout the system at a minimum of 20 psi. It is recommended that the system is capable of providing a minimum of 1,000 gpm throughout the system. It is noted that the District's previous minimum criteria was 500 gpm, so a majority of the system was designed to provide 500 gpm. Per the model results, there are several areas in the system that have under 500 gpm of fire flow available, namely the PML-NE zone and BOF zone. The PML-NE zone does not have adequate pumping capacity to meet the fire flow requirement. The BOF zone has commercial areas served by a single dead-end 6-inch waterline, which results in high headloss and low fire flow availability. The results of the fire flow analysis are depicted on **Exhibit 11.**

Pipeline Looping

There are over 60 dead end mains within the District system. Many are on cul-de-sac roads or serve only a few customers. The location of the existing dead-end mains are depicted on **Exhibit 12.**

Looping can be difficult and expensive in hilly terrain. Dead end mains should be avoided, if possible, as they can contribute to poor water quality and lower fire flow availability, and there is no redundancy for the customers if the line breaks as it is a single-feed. A few of the significant areas that are fed by a single feed include the BOF, GL-C and the GL-S zones. The District is preparing to implement a "Water Distribution System Improvements Project," which will eliminate several of the dead-end mains in the BOF and GL-C zones. However, options to loop most of the dead-end mains in the system would be extremely difficult and expensive.

Other practical projects that are recommended for implementation to provide better system looping include:

- Construct 250 LF of 6-inch main on Upper Sky Ridge Drive
- Construct 1,025 LF of 6-inch main Old State Route 120
- Construct 1,100 LF of 6-inch main on Boitano Road to connect PML-E to PML-C. The project will require a new PRV from PML-E to PML-C
- Construct 5,500 LF of 8-inch main on Harper Road from Merrell Road to Black Road. This project will require a PRS from the GL-S zone to the BOF zone

The locations of the proposed pipeline improvements are shown later in this Report on Exhibit 22.

In addition, there is only one pipeline (on Elder Lane) that connects the 2G-fed and BC-fed sub-systems. It is recommended to construct a second pipeline to allow water from the 2G supply source to be better distributed to the northwest portion of the GCSD system. This would provide for redundancy in the system in the event only one of the WTPs is in service. The recommendation includes the following:

- Install 3,125 LF of 12-inch main on Ferretti Road
- Install a new PRV to reduce pressure from GL-SE to PML-SW

Undersized Piping

As noted in Table VI-4, there is approximately 26,265 LF of existing pipe within the water system that is 2-inch and 4-inch. The location of the District's existing 2-inch and 4-inch pipelines are shown on **Exhibit 13**.

It is recommended that the minimum pipe diameter in a public water distribution system be 6-inches, or greater, whenever hydrants are connected in order to provide sufficient fire flow. It is recommended to prioritize the replacement of approximately 3,450 LF small diameter pipelines zone with a minimum of 6-inch pipe, as follows:

- Upsize 800 LF of 4-inch to 6-inch on Old State Route 120 (adjacent to the project to close the loop discussed above)
- Upsize 650 LF of 4-inch to 6-inch on Vernal Drive between Merrell Road and Tank 5
- Upsize 400 LF of 4-inch to 6-inch on N Dome Court
- Upsize 1,600 LF of 4-inch to 6-inch on Wawona Drive and El Capitan Way

It is recommended to upsize the remaining 22,815 LF of small diameter pipe with 6-inch over a 5-year period (small diameter pipe replacement program).

The District's conveyance pipeline from the 2G WTP to the distribution system is currently a 6-inch and 8-inch pipeline. It is recommended to upsize this pipeline to 12-inch to be able to move more water from the 2G WTP into the system and accommodate future expansion of the 2G WTP and PS. The project includes the upsizing of approximately 15,035 LF of cross-country pipeline and along Elder Lane from the 2G WTP to Tank 1 and the Intra-System PS.

<u>Planned Improvement Project</u>

The District has recently been awarded funding to construct the "Water Distribution System Improvements Project." The project will install new and upsized water piping in the Big Oak Flat and Groveland areas. All piping to be installed will be 8-inch diameter. The project will replace aging infrastructure, increase system looping and fire flow availability. The location of the proposed improvements is shown on **Exhibit 14.** Any deficiencies that were identified in the project area that will be resolved with this project are not included in the recommendations or projects identified herein.

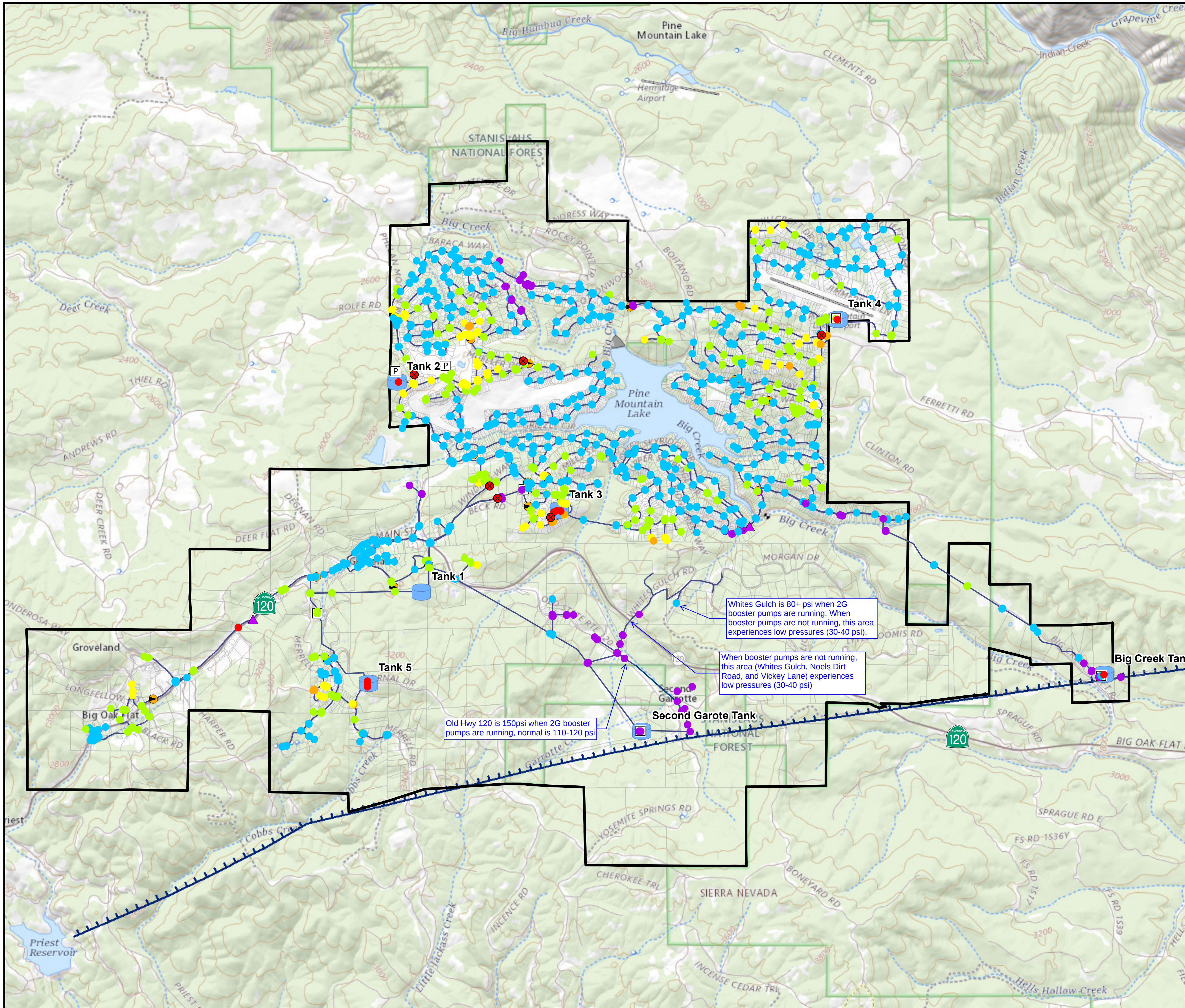

EXHIBIT 9

AVERAGE DAY DEMAND
MODEL PRESSURE RESULTS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

MAY 2023

Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Closed Pipe

Pressure

- 0-29 psi
- 30-39 psi
- 40-57 psi
- 58-79 psi
- 80-149 psi
- >150 psi
- Water Main
- Hetch Hetchy Aqueduct
- Parcels
- Groveland Community Services District

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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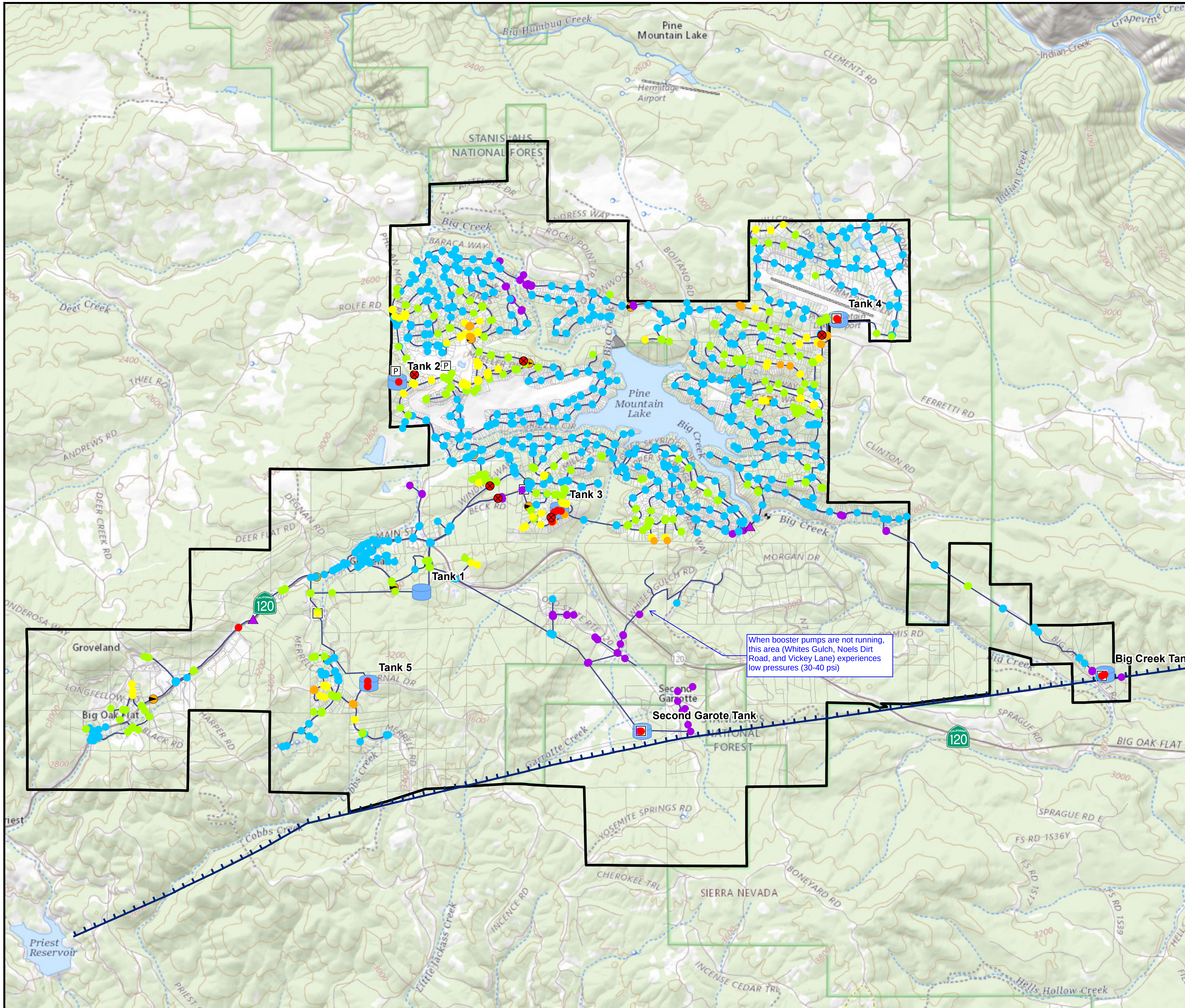

EXHIBIT 10

PEAK HOUR DEMAND
MODEL PRESSURE RESULTS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

MAY 2023

Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Closed Pipe

Pressure

- 0-29 psi
- 30-39 psi
- 40-57 psi
- 58-79 psi
- 80-149 psi
- >150 psi
- Water Main
- Hetch Hetchy Aqueduct
- Parcels
- Groveland Community Services District

0 800 1,600 3,200
Feet

NORTH

WOOD RODGERS

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EXHIBIT 11

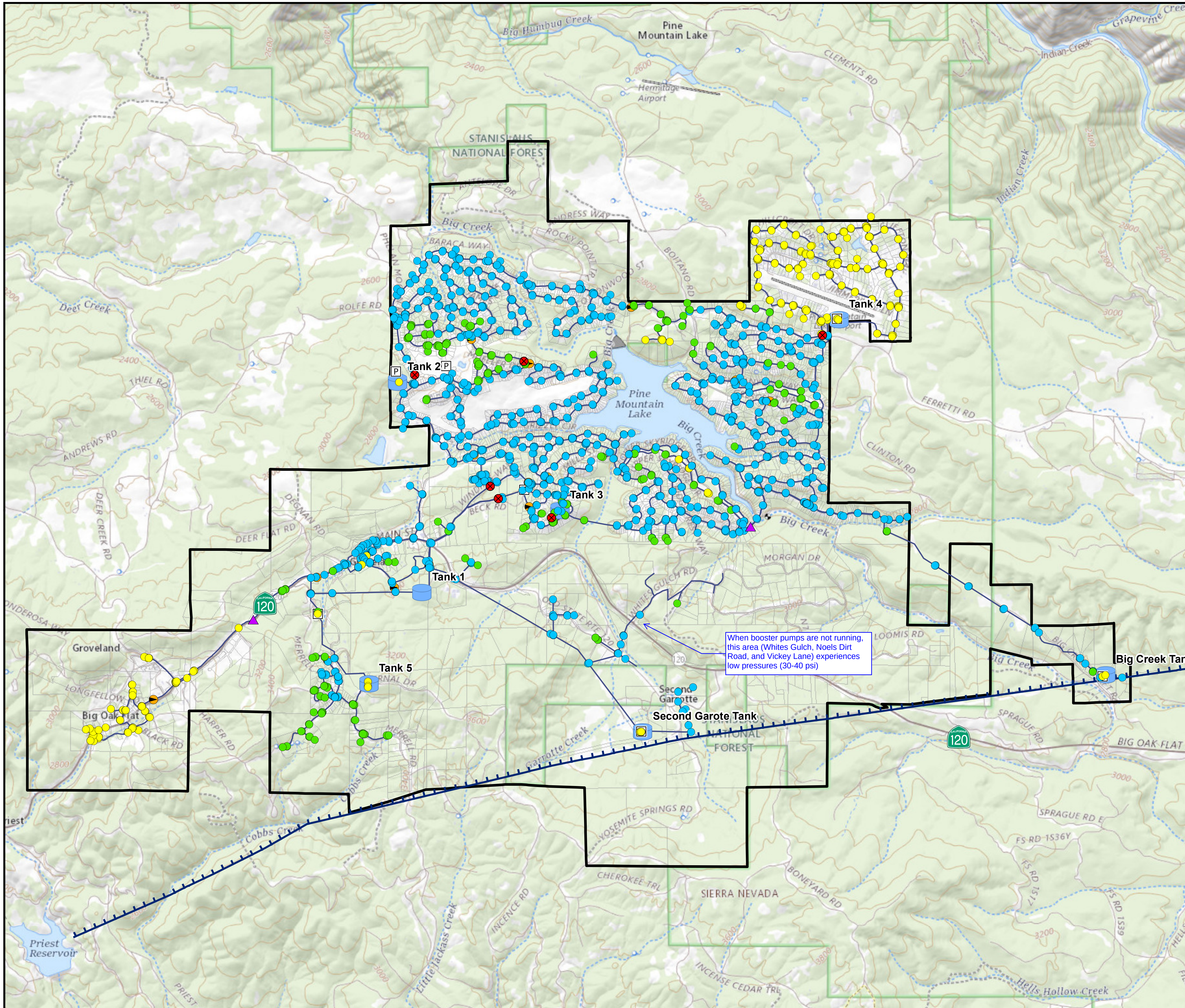
MAX DAY DEMAND
+ FIRE FLOW MODEL RESULTS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

MAY 2023



Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Closed Pipe

Fire Flow at 20 psi

- <500 gpm
- 500-1,000 gpm
- >1,000 gpm
- Water Main
- Hetch Hetchy Aqueduct
- Parcels
- Groveland Community Services District

0 800 1,600 3,200
Feet

NORTH

WOOD RODGERS

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EXHIBIT 12

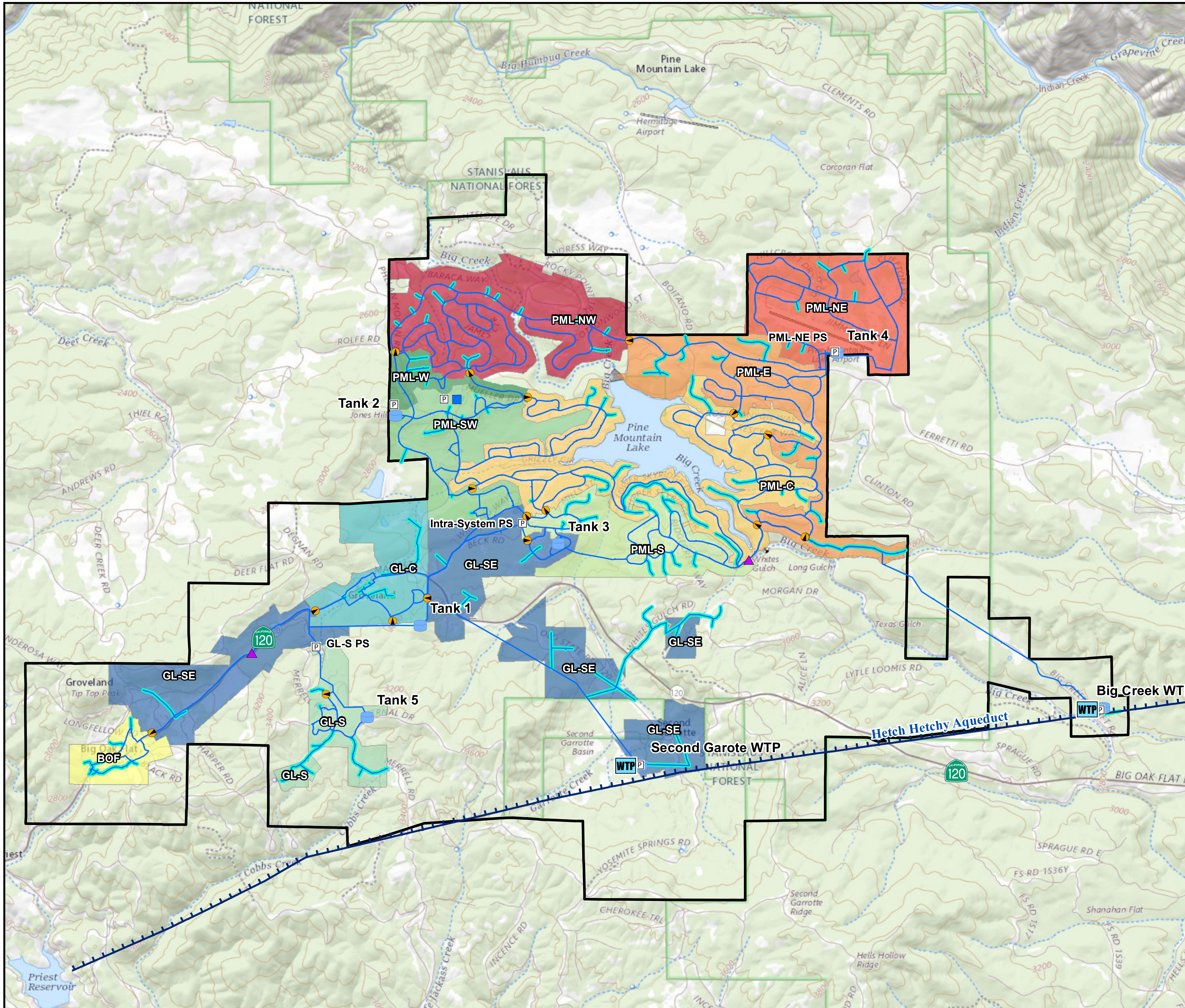
EXISTING WATER SYSTEM DEAD-END PIPELINES

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

OCTOBER 2023



Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Alternate Water Supply
- Water Treatment Plant
- Dead-end Water Mains
- Pipe
- Hetch Hetchy Aqueduct
- Groveland Community Services District

Pressure Zones (HGL)

- BOF (2,999')
- GL-C (3,050')
- GL-S (3,440')
- GL-SE (3,160')
- PML-C (2,886')
- PML-E (2,994')
- PML-NE (3,092')
- PML-NW (2,742')
- PML-S (3,028')
- PML-SW (3,007')
- PML-W (2,932')

0 800 1,600 3,200
Feet

NORTH

WOOD RODGERS

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EXHIBIT 13

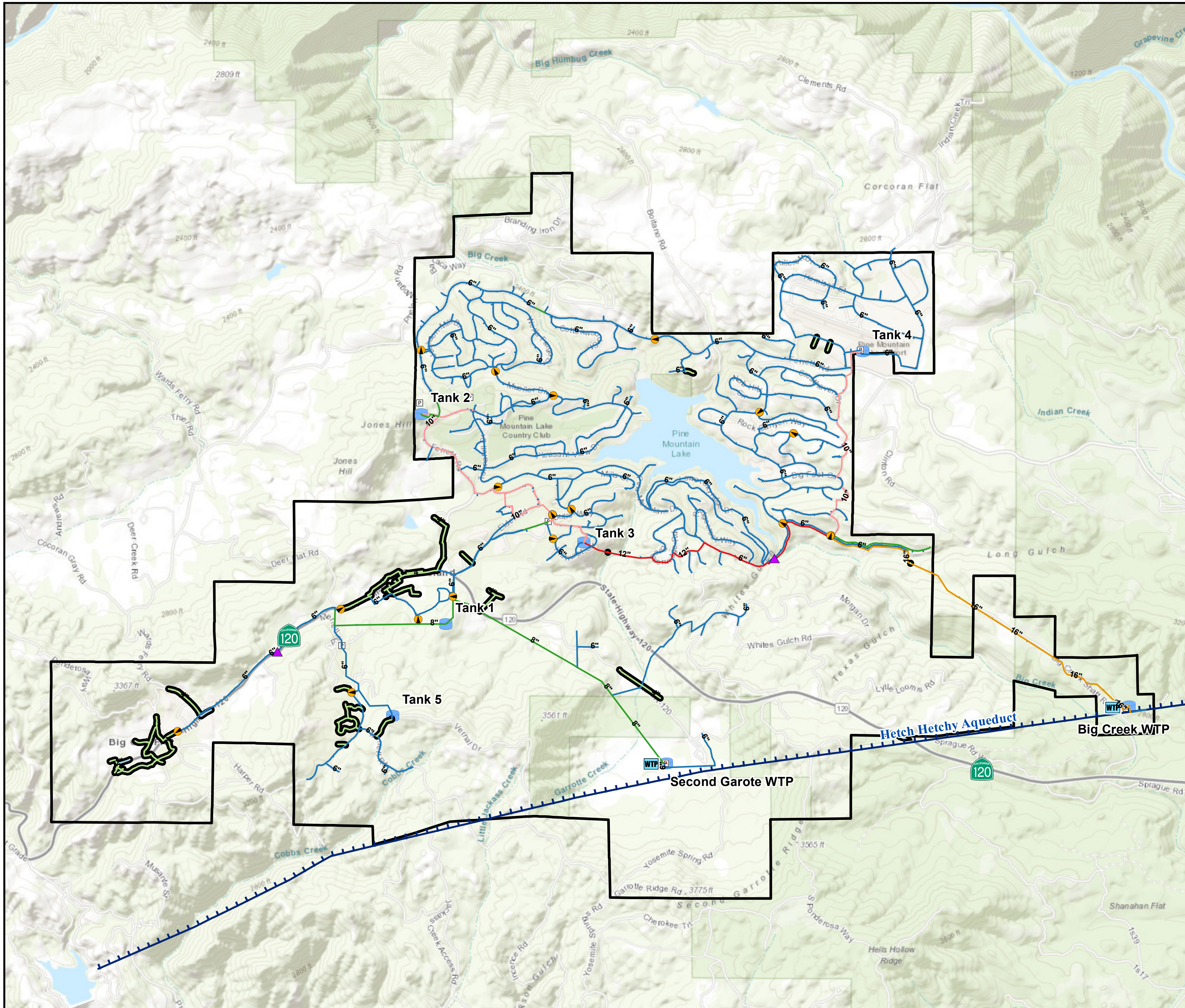
EXISTING SMALL DIAMETER PIPES

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

OCTOBER 2023



Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Water Treatment Plant
- Hetch Hetchy Aqueduct
- Groveland Community Services District

Existing Pipe Diameter (inches)

- 2
- 4
- 6
- 8
- 10
- 12
- 16
- Small Pipe (Smaller than 6")

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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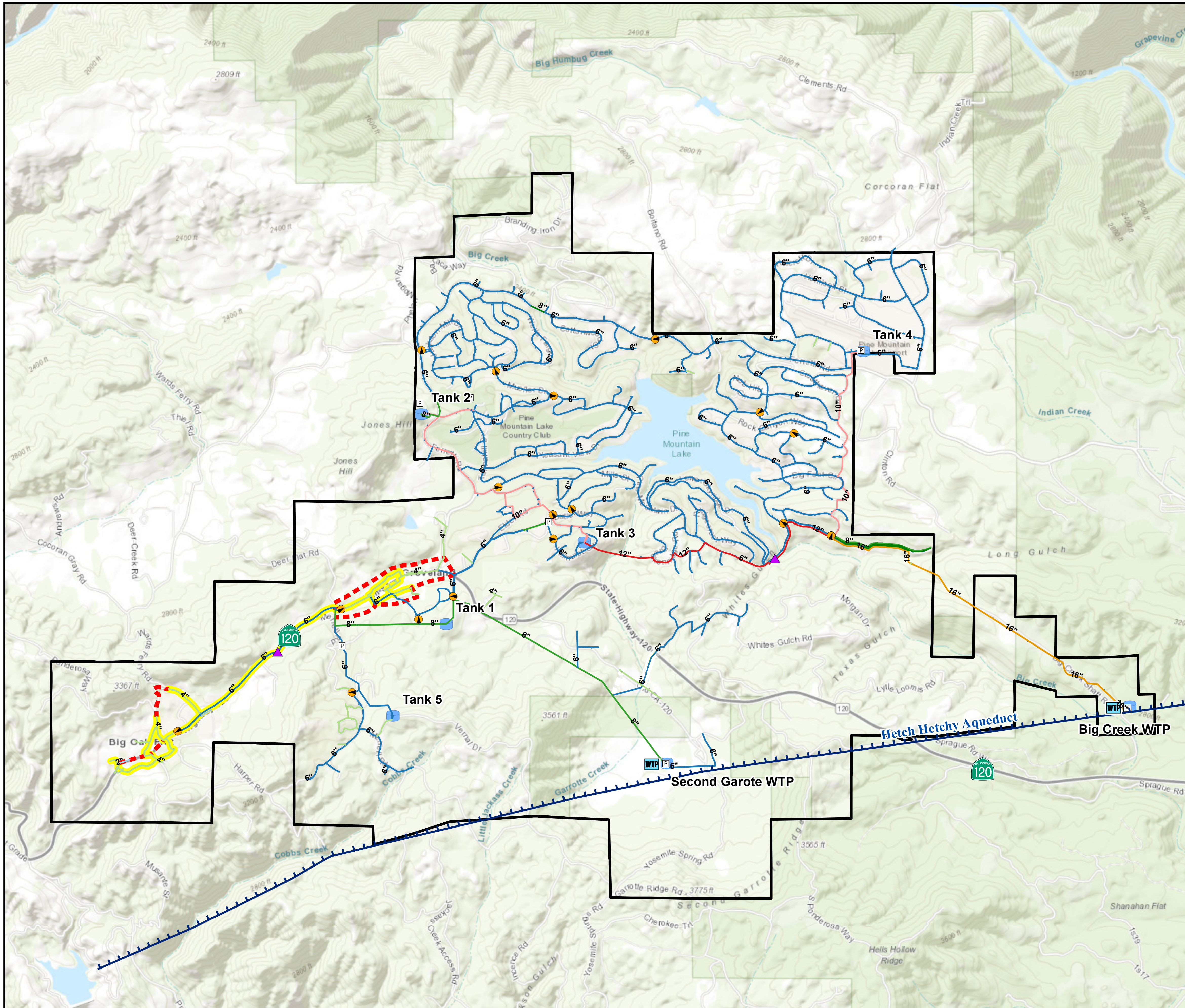

EXHIBIT 14

WATER DISTRIBUTION SYSTEM IMPROVEMENT PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

MAY 2023

Legend

- Pressure Reducing Station
- Surge Valve
- Booster Pump Station
- Tank
- Water Treatment Plant
- Hetch Hetchy Aqueduct
- Groveland Community Services District

Existing Pipe Diameter (inches)

- 2
- 4
- 6
- 8
- 10
- 12
- 16

Proposed Pipeline Improvements

- Upsize to 8"
- New 8"

0 800 1,600 3,200

Feet

NORTH

WOOD RODGERS

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D. Facility Condition Assessment

A site visit and visual inspection was performed for each of the major water facilities, including the tanks, pumps stations and water treatment plants. Some of these recommendations will be folded into capital improvement projects, while many of the recommendations, such as are minor repairs, considerations and further observations are not implemented as CIP projects. Likewise, some of these recommendations may not be required if a CIP project to replace the facility is recommended. A summary of the findings and observations are included below.

1. Treatment Plants

The following is the list of observations and recommended improvements recommended for the three water treatment plans (2G, BC and AWS).

Big Creek WTP

- Extend treated water booster pump discharge control valve drain over a floor drain or fix leak.
- Revise lime injection system injection piping configuration:
    - Add solenoid valve to allow lime injection waste to drain. Locate the valve immediately upstream of the line injection point.
    - Reconfigure control scheme to begin lime injection prior to booster pump start. Booster pump call to start shall initially call for the lime feed pump to turn on and the solenoid valve waste to drain to open. After expiration of time delay (the travel time for lime injection between the water flush tie-in on the lime injection system, to the lime solenoid waste/drain valve), the booster pump will start.
    - Maintain current control scheme to flush lime injection piping/tubing with water for a set duration after treated water booster pump shutdown.
    - Improve dust control by using dry lime with a dust controlled covered hopper that uses an auger feed.
- Explore the option of using soda ash in lieu of lime to adjust ph.
- Consider replacement of analyzers to reagent-less systems when new analyzers are needed.
- Upgrade the building exhaust system as it has exceeded its useful life.

Second Garrote WTP

General Site Access

- Consider crushed rock or asphaltic concrete roadway surface improvements for the main access road, to improve all-weather access.

Upper Hill Side Facilities

- Perform coating repair of outdoor electrical equipment enclosures.
- Consider providing exterior wall under awning to protect the existing outdoor electrical enclosures from wind driven rain or enclose in a building.

Lower Hill Side Facilities

- Replace corroded conduit enclosure box below analyzers.
- Extend/reroute analyzer samples to not drip directly over the conduit enclosure box below.
- Provide polyethylene pallet(s) and utilize for bagged salt storage to keep salt off the ground and dry.
- Revise lime injection system injection piping configuration:
    - Add solenoid valve to allow lime injection waste to drain. Locate the valve immediately upstream of the line injection point.
    - Reconfigure control scheme to begin lime injection prior to booster pump start. Booster pump call to start shall initially call for the lime feed pump to turn on and the solenoid valve waste to drain to open. After expiration of time delay (the travel time for lime injection between the water flush tie-in on the lime injection system, to the lime solenoid waste/drain valve), the booster pump will start.
    - Maintain current control scheme to flush lime injection piping/tubing with water for a set duration after treated water booster pump shutdown.
    - Improve dust control by using dry lime with a dust controlled covered hopper that uses an auger feed.
- Consider adding a splash guard / splash shield panel above the enclosure box to prevent water from dripping directly on enclosure.

- Consider replacement of analyzers to reagent-less systems when new analyzers are needed.
- Upgrade the building exhaust system as it has exceeded its useful life.

Alternate Water Supply (AWS)

Recommended improvements including establishment of a secured site, a more affixed piping arrangement, relocation of equipment away from under the oak tree, the ability to fit a larger clearwell, as desired. Ideally a more secure installation with upgrades to improve access and maintenance at a new alternate site is recommended. The new alternate site must be based on land space available, and the proximity to potential tie-ins from the Pine Mountain Lake water source and to the District water distribution system. The following is the list of improvements recommended for the AWS:

Short Term Improvements (performed at the existing site)

- Coordinate with the landowner of the existing site for trimming of the large oak tree over the District's equipment below.
- Replace the collapsible hose on the raw water inlet supply with rigid piping. A flanged bellows or other means to accommodate pipe flexure or misalignment may be implemented as required.
- Relocate the finished water turbidimeter (currently in the raw water analyzer cabinet) to the finished water analyzer cabinet to reduce risk of operator confusion of sample source.
- Insulate and heat trace exposed piping.
- Provide a pass-through tank on the filter backwash discharge piping, to reduce and regulate flow to sewer.

Long Term Improvements (performed at a new alternate site)

- Relocate the entire facility to a separate District owned/maintained property for improved security and eliminate the formation of drainage ice sheets on the existing lot.
- Install a more permanent interconnecting piping arrangement at the new alternate location and insulate exposed piping.

- Provide dedicated chemical storage area with separation of chemicals via containment curbs or walls. Provide secondary containment which is covered, or which can accommodate volume of rainfall and means for draining or pumping collected rainwater.
- Consider replacement of analyzers to reagent-less systems when new analyzers are needed.
- Consider relocating the booster pumps in a larger trailer, or a small building or shed structure to improve maintenance and repair access.
- Review the clearwell tank size and replace with a larger size as adequate.

Chemical Treatment

All three WTPs provide for multiple chlorine injection points along the process, with both the Big Creek and Second Garrote WTPs implementing aqueous ammonia injection at multiple locations. Continuous monitoring for chlorine and monochloramine residual is performed at all sites as well. There have been reported concerns of risk of nitrate formation, which for chloramination based water treatment facilities, nitrate formation may be caused by the addition of too much ammonia to the treatment process. Even when dosing calculations may be correct for ammonia dose based on upstream chlorine residual, substantial lag time exists amongst:

- Chlorine sample travel time from upstream chlorine sample supply source to the chlorine analyzer
- Ammonia/monochloramine sample travel time from downstream ammonia sample supply source to the ammonia/monochloramine analyzer

It must be noted that travel time of the main process water flow stream may be subtracted from the sum of the above to determine total lag time. However, if main plant process water flow varies, the slowest anticipated rate and lowest travel velocity is the preferred consideration when calculating total lag time, otherwise control will be optimized only for higher flow rates yet be based on old residual information at the lowest rate.

The lag time must be accounted for in any programmable logic control (PLC) programming, so ammonia feed is not based residuals several minutes prior. Additionally, chemical dosing pump rate of change of output is recommended to be limited, to inhibit the ability of a dosing pump to provide rapidly reacting increases or decreases in chemical output, when control is based on analyzer residual. Only rapid changes in main process water flow mandate equivalently proportioned rapid changes in metering pump adjustment.

Too much ammonia may lead to nitrification issues. Control of both ammonia dosing to prevent an ammonia overfeed, incorporation of the appropriate lag time in the PLC program, along with control of rate of change of dosage output from an aqueous ammonia metering pump in response to a residual sample, may reduce the risk of ammonia overfeed and nitrification, or underfeed and taste and odor dichloramine production issues. It must be noted that water temperature and residence time may also increase the risk of nitrification. However, these are aspects that the District may have very limited ability to control without significant modifications to distribution system operational strategies.

2. Tanks

The list of observations and recommended improvements from the condition assessment of the water tanks is included in **Table VI-8**.

Table VI-8: Water Tank Observations and Recommendations

Tank #	Deficiency	Recommendation
1	Slight surface rust on exterior shell of tank	Recoat tank interior and exterior
2	Minor cracks observed on wall of tank but no leakage at time of visit	Monitor cracks and if leakage is present or cracks increase, consider tank rehabilitation
3	Minor cracks observed on wall of tank but no leakage at time of visit	Monitor cracks and if leakage is present or cracks increase, consider tank rehabilitation
4	Potentially poor drainage around reservoir exterior that could lead to ponding water against exterior of reservoir structure	Tank 4 is planned for replacement when development occurs. If replacement is delayed, grade site to improve positive drainage away from reservoir structure, install crushed rock around perimeter of reservoir
5	Per a November 2021 dive inspection report (separate project), corrosion was observed on the interior and exterior of the tank at several locations. The entry hatch has no weather-stripping present.	The bolted seams on the interior floor should be sandblasted and recoated. The bolts around the pipes and ladder braces should be recoated. The exterior roof has a few areas of surface corrosion. These areas need to be taken down to white metal and recoated. Install weather stripping at the entry hatch to create a good seal and minimize corrosion between the metal lid and the riser. The roof entry hatch needs corrective action and/or replacement.

3. Pump Stations

The list of observations and recommended improvements from the condition assessment of the water pump stations is included in **Table VI-9**.

Table VI-9: Water Pump Station Observations and Recommendations

PS Name	Type	Deficiency	Recommendation
Dunn Court	Raw	Existing wood clad/framed building in poor condition - dry rot and difficult access for maintenance of the vertical turbine pump	The building exterior siding and trim was replaced in August 2021. Building interior needs rehabilitation
		Vertical turbine pump base does not appear to have adequate anchorage and is in poor condition	Upgrade pump base and anchorage system to provide adequate anchorage, bracing, and seismic restraint
		The PS utilizes a gravity suction line to fill the wet well. The suction line is sloped downwards towards the lake. When the primer pump is utilized to fill the wet well, the water drains back into the lake	Alt. #1 - Install a slide gate on wet well interior to prevent backflow into the suction line when the primer pump is operating. Alt. #2 – Abandon primer pump, slip-line and extend suction line, install Gorman-Rupp Super T Series Pumps (or equal)
		Electrical control cabinets are in poor condition	Replace control cabinets
AWS	Potable	Sounds attenuation material within trailer is not bonded to walls and is delaminating/falling off	AWS Permanently affix sound attenuation material to trailer
Butler Way	Potable	Concrete vault flooded with storm water completely immersing pumps, motors, valves, electrical, and mechanical appurtenances	Complete replacement/upgrade (project underway)
Highlands (GL-S)	Potable	Emergency generator routinely runs interruption faults and is suspected to be undersized	N/A – District recently purchased a new 150 kW generator and will be installed in in 2022
		Electrical control cabinets are in poor condition	Replace control cabinets
Tank 2 Transfer	Potable	N/A	N/A
Tank 4 Hydro	Potable	Station has operational issues related to the programming of the programmable logic controller	Replace MCC and have a system integrator contracted to determine the programming issues
		The system currently uses a manual air compressor on a timer to inject air into the tank	Convert the air compressor to operate automatically, not on a timer
		The operations building is in poor condition	Replace operations building

4. Asset Replacement

Much of the District's water system is aging. The District maintains a database (Cartegraph) documenting the water system assets. The database currently does not have the installation year or age of each asset entered. It is recommended that the District update the database with the install year for the major assets so that the District can proactively plan for the rehabilitation and/or replacement of the major water assets. The District has indicted this process has begun and should be completed by the end of 2022.

Based on the condition assessment effort, and conversations with District staff, the water assets currently in most need of replacement or rehabilitation are the fire hydrants, pressure-reducing stations, generators, air-release and vacuum valves, gate valves, some service lines, and the older ACP water lines.

The District has 17 pressure reducing stations that are aging. It is recommended to proactively replace one station per year, including new vault, hatch, valves, and connection to the SCADA system with remote pressure monitoring capabilities.

The District has approximately 538 fire hydrants that are aging. An estimated 75 fire hydrants will be replaced with the upcoming "Water System Improvements Project" and other recommended projects. It is recommended to replace the estimated remaining 465 fire hydrants over a period of 8 years (~60 per year).

The District has emergency generators at all pump stations, except the Butler Way Bypass PS. The Butler Way Bypass PS utilizes a portable trailer-mounted generator when needed. The Tank 4 Hydro PS was replaced in 2021. The remaining generators should be replaced every 15 years. It is recommended to implement/plan to replace one generator every four years.

It is recommended that the District implement programs to proactively rehabilitate or replace the major water system assets before they fail. The proposed life span (jn years) that the major water assets are recommended to be rehabilitated and/or replaced are listed in **Table VI-10.**

Table VI-10: Water System Asset Replacement Schedule

Water System Asset	Estimated Life Span (years)	
	Rehabilitate	Replace
Pipelines		
PVC	n/a	100
DIP	n/a	100
Cast Iron	n/a	75
ACP	n/a	100
Steel (unlined)	n/a	75
CML&C Steel	n/a	100
Tanks		
Inspect & Clean	5	
Coatings	15	n/a
Structure	30	50
Pump & Motor	15	25
Hydropneumatic Tank	15	25
Electrical Equipment	n/a	15
Generator	n/a	15
Pressure Reducing Station		
PRVs	15	25
Vault & Hatch	n/a	25
Fire Hydrants	n/a	50
Valves		
Buried Isolation Valves	n/a	40
Diaphragm / Control Valves	15	30
Meters	n/a	30

5. Filtration Avoidance / Alternative Water Treatment

The District's Hetch Hetchy water source is relatively pristine and, as a result, the District has been able to avoid filtration. The City of San Francisco Public Utilities Commission (SFPUC) prepared an application for "filtration avoidance" in 1993. The conclusion was that the Hetch Hetchy water source met all eleven criteria for EPA filtration avoidance as of June 29, 1993. SFPUC has provided routine monitoring of the watershed and has avoided the need to provide filtration ever since.

As noted by District staff, the operations and maintenance of the existing treatment process at the WTPs is labor-intensive and costly due to the handling of chemicals and equipment maintenance. It is the District's interest to simplify and improve the operability and potentially the automation of the treatment; therefore, alternatives to the current systems were considered.

The Second Garrote and the PML AWS WTPs currently operate Pall Water treatment systems as a backup treatment process. As such, similar systems were evaluated to replace the existing treatment systems at the Second Garrote and Big Creek WTPs. A Pall Water membrane filtration unit and a WesTech dual stage engineered media with conventional filtration unit were evaluated herein.

<u>Process</u>

As mentioned, it is the District's desire to minimize maintenance at the WTP. As such, the process flow diagrams (PFD) for Pall Water and WesTech are shown in **Figure 4** and **Figure 5**, respectively, to aid in understanding the mechanical components for each system and the corresponding maintenance and operational complexities that each component may introduce.

Primary features of the Pall Water system include various mixing/storage tanks, an air supply, recirculation lines, and other mechanical and electrical equipment as shown in Figure 4. The membrane requires frequent backwash and cleaning. Backwash with filtered water occurs daily, a chemically enhanced backwash occurs every three days, and a clean in place occurs monthly. All backwash discharges to the sewer, and the backwash involving chemicals requires neutralization prior to discharge to sewer. An equalization basin may be considered to eliminate the need for chemical neutralization. The air supply is required for operation of pneumatic valves and aids in the backwash process.

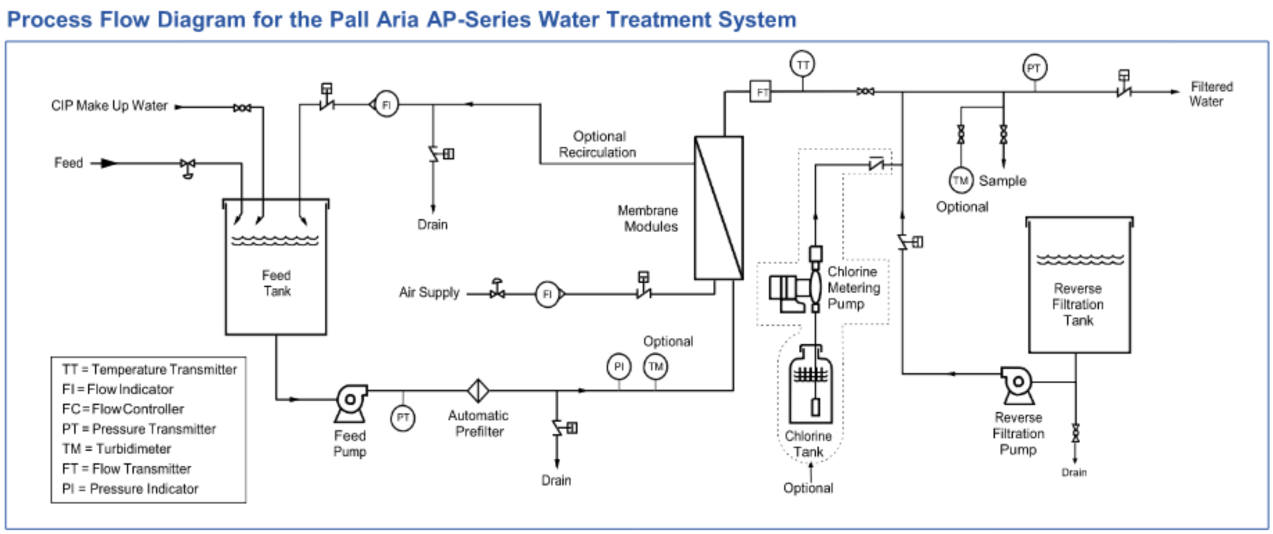

Figure 4: Process Flow Diagram (Pall Water)

Primary features of the WesTech system include coagulant dosing/polymer dosing, an adsorption clarifier with media, filter with conventional media, a static mixer, an air supply, backwash, and recycle lines as shown in **Figure 5**. Sludge and backwash would be discharged to sewer.

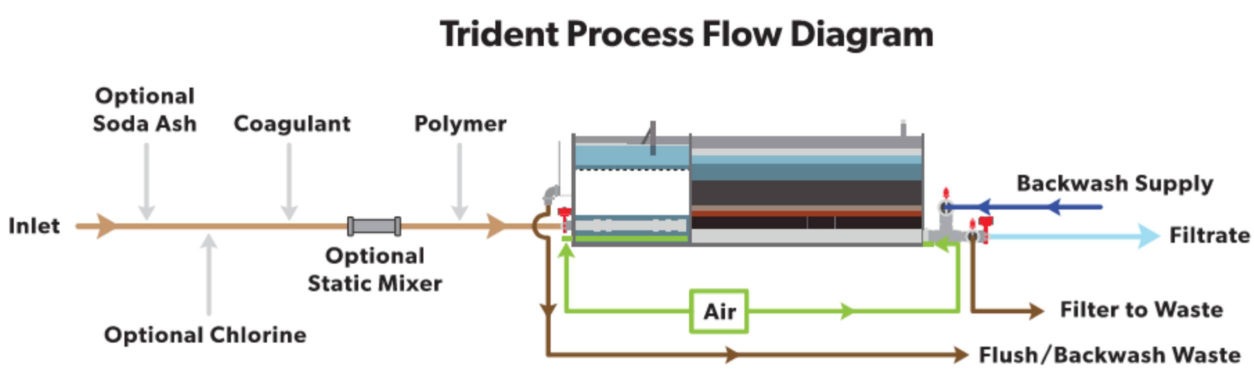

Figure 5: Process Flow Diagram (WesTech)

Ultimately depending on the final configuration, both packaged treatment systems will likely introduce new mechanical elements that the existing system does not contain.

<u>Treatment</u>

The influent (source) water is high quality, and the treatment goals are defined through disinfection, pH adjustment, and disinfection residual only. Currently the WTPs have been granted a filtration avoidance permit, and the following parameters are monitored:

- pH
- Temperature
- Turbidity
- Chloramine Residual/Virus Deactivation
- Fecal Coliform
- E. Coli
- HPC
- Finish Water Total Chlorine
- Nitrite in the distribution system

Both packaged systems remove the following contaminants via filtration:

- Turbidity
- Bacteria
- Cysts and Oocysts
- Iron and Manganese
- Arsenic
- TOC
- Phosphorous
- Color

Pending current influent water quality testing, consideration of drought conditions, and revisiting the 1993 filtration avoidance permit, filtration appears to be unwarranted for these water treatment plants. Influent water quality characteristics will need to be concisely defined to confirm filtration is not necessary and, if considered necessary, coordinated with manufactures to ensure high filtration efficacy.

In order to achieve treatment goals, adding filtration will not eliminate the need for chlorine, pH adjustment, and disinfection residual; therefore, adding a packaged treatment system does not replace all of the existing treatment processes, and adds additional components. A simplified process flow diagram is shown in **Figure 6** should one of the packaged treatment systems be selected.

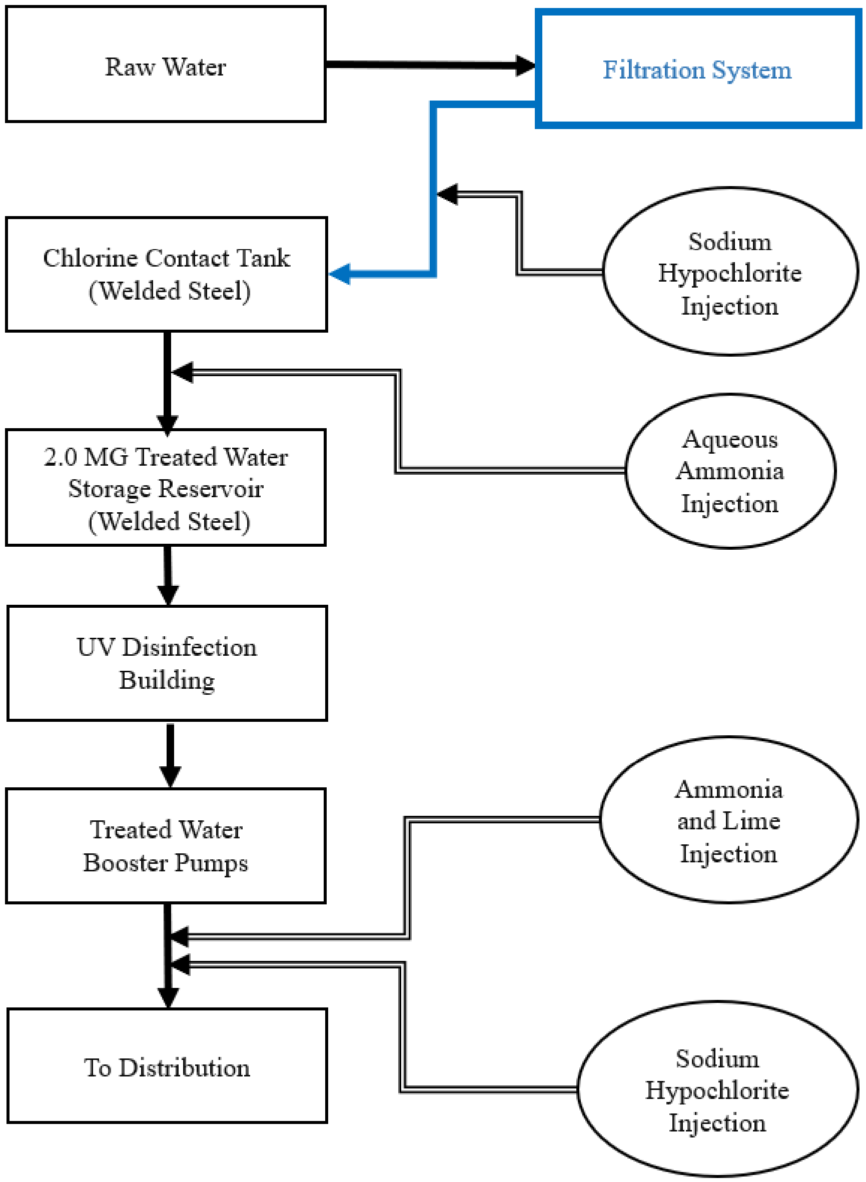

Figure 6: Simplified Process Flow Diagram (with packaged system)

Costs

Operational parameters of the packaged treatment systems are depicted in **Table VI-11**. For Pall Water, the larger system is a custom package, whereas the smaller, 700 gpm system, comes skid-mounted.

Table VI-11: Summary of Treatment Alternatives

	Big Creek WTP		Second Garrote WTP	
Required Flow (gpm) [mgd]	1400 [2.0]		1300 [1.0]	
Specific Water Quality Parameters	Disinfection, pH, chloramine residual		Disinfection, pH, chloramine residual	
Type	**Dual Stage** Engineered Adsorption Media | Anthracite, Silica Sand, Garnet	Hollow-Fiber Membrane Filtration	**Dual Stage** Engineered Adsorption Media | Anthracite, Silica Sand, Garnet	Hollow-Fiber Membrane Filtration
Manufacturer	WesTech	Pall Water	WesTech	Pall Water
Model	Trident Packaged Treatment Unit, TR-840A	Aria AP-8	Trident Packaged Treatment Unit, TR-840A	Aria AP-6X
Service Life (yrs)	10	10	10	10
Max Capacity per Unit (gpm)	1,400	1,600	1,300	1,300
Total Units Required	3	2	3	2
Footprint per Unit	39'10"L x 11'11"W x 10'H	54'6"L x 20'W x 11'H	39'10"L x 11'11"W x 10'H	54'6"L x 20'W x 11'H
Approximate Total Footprint (ft^2)	2,160	3,300	2,160	3,300
Cost Exclusions	Interconnecting piping, wiring, valves, and pumps not integral to system, tank and mixer for coagulant, structural pads, installation	Interconnecting piping, wiring, valves, and pumps not integral to system, chemical storage equipment, structural infrastructure, installation	Interconnecting piping, wiring, valves, and pumps not integral to system, tank and mixer for coagulant, structural pads, installation	Interconnecting piping, wiring, valves, and pumps not integral to system, chemical storage equipment, structural infrastructure, installation
Additional Considerations	Air supply Polymer and coagulant dosing Flush/Backwash and filter to waste (eq basin, route to sewer)	Air supply Neutralization or equalization basin for discharge to sewer Additional chemical storage for membrane cleaning	Air supply Polymer and coagulant dosing Flush/Backwash and filter to waste (eq basin, route to sewer)	Air supply Neutralization or equalization basin for discharge to sewer Additional chemical storage for membrane cleaning
Operator Certification	T4	No new certification required	T4	No new certification required
Permitting	DDW Permit Amendment	DDW Permit Amendment	DDW Permit Amendment	DDW Permit Amendment
U.S. Installations of Similar Size?	Yes	Yes	Yes	Yes

GCSD operations staff provided estimated hours and annual costs associated with each existing treatment system, and the major items are outlined as follows:

- Handling and material costs for lime
- Handling and material costs for ammonia
- Maintenance of UV system
- Operational issues and procedures (such as tank flushing) associated with nitrification (typically occurs during the summer months)
- Energy costs
- Water Quality testing
- Miscellaneous mechanical equipment replacement

Budgetary equipment costs and the associated 10-year net present value of each option (including the existing condition) is shown in **Table VI-12**. The life cycle costs analysis assumes construction in 2030 and a 10-year life cycle.

Table VI-12: Present Value Cost Estimate

	Second Garrote WTP		
Type	**Dual Stage** Engineered Adsorption Media | Anthracite, Silica Sand, Garnet	Hollow-Fiber Membrane Filtration	*Existing System*
Equipment Cost, 2021 dollars ($)	1,699,290	1,503,125	-
Other Capital Cost, 2021 dollars ($)(1)	849,645	751,563	*400,000*
Annual O&M Cost, 2021 dollars ($) (4)	300,000	300,000	*240,500*
10-Year Net Present Value ($) (2), (3)	6,612,000	6,277,000	*3,428,000*

	Big Creek WTP		
Type	**Dual Stage** Engineered Adsorption Media | Anthracite, Silica Sand, Garnet	Hollow-Fiber Membrane Filtration	*Existing System*
Equipment Cost, 2021 dollars ($)	1,830,000	1,850,000	-
Other Capital Cost, 2021 dollars ($)(1)	915,000	925,000	*600,000*
Annual O&M Cost, 2021 dollars ($) (4)	300,000	300,000	*361,000*
10-Year Net Present Value ($) (2), (3)	6,836,000	6,870,000	*5,315,000*

Notes
(1) Assumed 50% of equipment costs for new WTP. Includes estimated rehab costs for existing WTP.
(2) 4.0% inflation rate and 2.5% discount rate assumed
(3) Assumes construction in 2030
(4) Includes current O&M costs

As shown in Table IV-12, the no-action alternative is the least costly option, however not by much. The cost to build new conventional water treatment plants is only slightly higher than the cost to upgrade and continue to operate the existing water treatment plants. Therefore, it is recommended that the District conduct a more detailed and focused conceptual study to evaluate the feasibility of switching to conventional treatment.

<u>Summary & Recommendation</u>

By evaluating the processes, treatment requirements, and preliminary costs associated with the treatment alternatives at each WTP, the recommended next steps are to obtain and review the influent water quality characteristics and revisit the filtration avoidance permit. Once the data has been collected, coordination with manufacturers, and the development of a detailed conceptual design report is required to determine the most efficient treatment system is selected.

The analysis conducted herein is a very high-level analysis to consider switching to an alternative treatment process. It is recommended that the District conduct a detailed treatment analysis to further evaluate the options for a conventional treatment plant to deal with drought and potential turbidity issues, as well as the potential to reduce labor, electricity, chemical, sampling, and other costs.

As noted previously, the District is planning to construct a new groundwater well at the Tank 5 site as a part of a "Drought Improvement Project." It is noted that the quantity and quality of groundwater available may impact the ultimate capacity and proposed treatment process of the WTPs. However, developing a second water supply source will assist the District in becoming more resilient during drought conditions.

VII. WASTEWATER SYSTEM

Due to the mountainous terrain and the concentration of residences around the low-lying Pine Mountain Lake, the vast majority of wastewater flows within GCSD require pumping to the Wastewater Treatment Plant (WWTP). The entire system consists of sixteen (16) lift stations, approximately 35 miles of gravity mains, 812 manholes, 159 cleanouts and seven (7) miles of force mains. The WWTP is permitted for a maximum daily influent of 0.5 MGD. There are approximately 1,590 connections to the District's wastewater collection system.

A. Existing System Description

1. Wastewater Treatment Plant

The wastewater treatment plant (WWTP) is located in north Groveland, west of Ferretti Road. It provides treatment for wastewater generated from 1,590 connections. The District operates the WWTP under their discharge permit, WDR (Waste Discharge Requirements) No. 87-121, and is required to abide by the State Water Resources Control Board No. 2006-0003 DWQ, entitled "General Waste Discharge Requirements for Sanitary Sewer Systems" (General WDRs).

Under WDR No. 87-121, the WWTP is able to treat up to 400,000 gallons per day (gpd) under dry weather conditions, and 500,000 gpd in wet weather, provided the effluent discharge water quality limits continue to be met. The discharge quality limits set by WDR No. 87-121 are shown in the permit, which outlines several other performance and monitoring criteria.

Since 2000, the District's wastewater system has been subject to a number of regulatory enforcement actions, almost all of which related to sanitary sewer overflows (SSOs) within the conveyance system. There does not appear to have been any enforcement actions required at the WWTP that related to effluent water quality violations. Infractions at the WWTP relating to flow meter calibration and a requirement to adopt a sludge disposal plan have been previously highlighted by the regulators. Beyond the enforcement actions, the District generally receives a few formal complaints, and numerous complaints filed via social media platforms, each year about odors emanating from the WWTP. Over the last two years the complaints have increased significantly. The plant operators feel this is from three locations: the head works, the equalization basin, and the sludge drying beds. These odor complaints generally occur in the summer months, between Memorial Day and Labor Day.

The WWTP's facilities, its treatment processes and their sequence are shown on a process flow diagram included as **Figure 7**.

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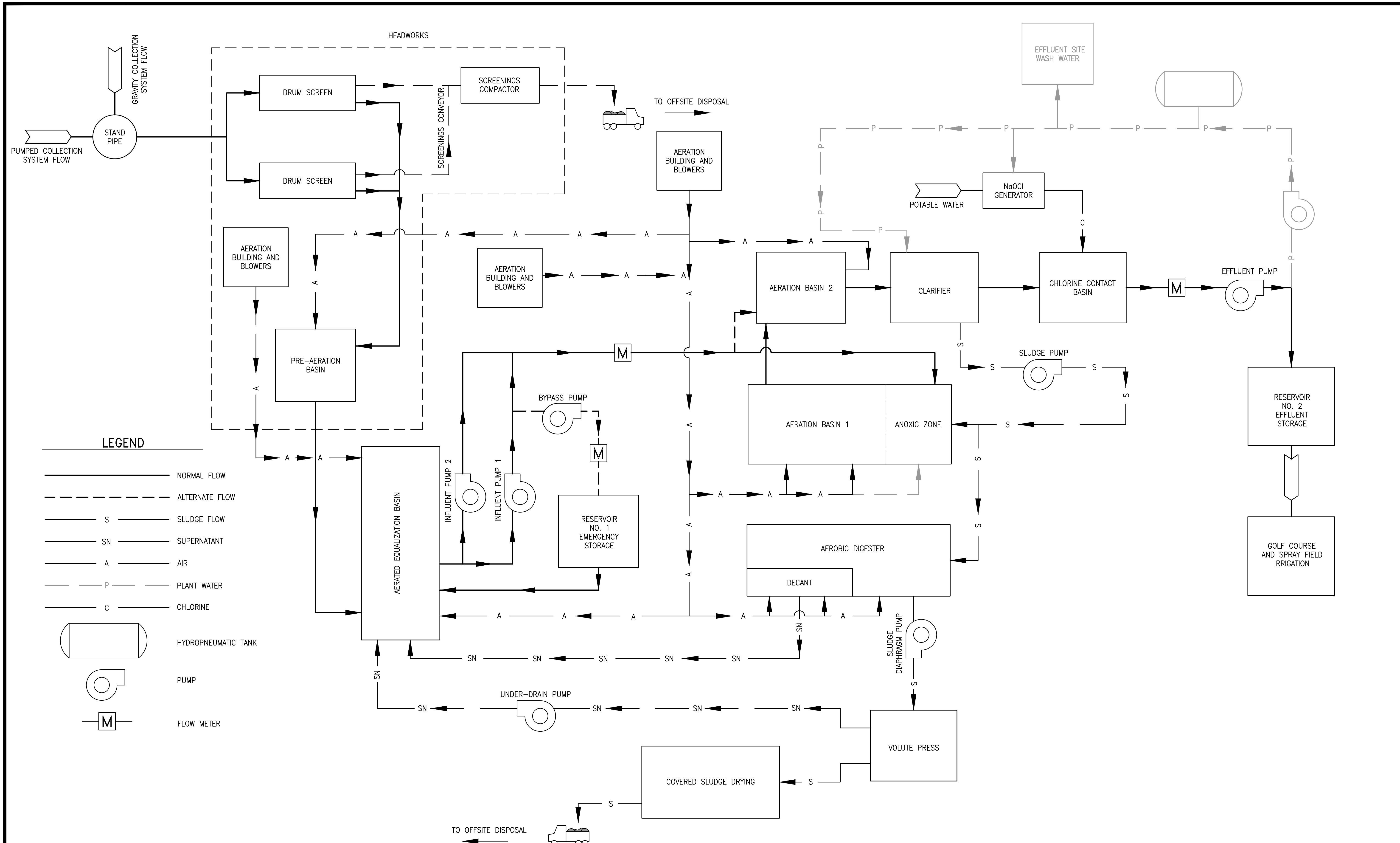

COLEMAN ENGINEERING

COLEMAN ENGINEERING
1358 BLUE OAKS BOULEVARD
SUITE 200
ROSEVILLE, CA 95678
(916) 791-1188

BAR IS ONE INCH AT FULL SCALE
0 1"
IF NOT ONE INCH ON THIS SHEET SCALE ACCORDINGLY

NO.	REVISIONS	BY	APP	DATE
6				
5				
4				
3				
2				
1				

GROVELAND CSD INTEGRATED WATER AND WASTEWATER MASTER PLAN

FIGURE 7: FLOW SCHEMATIC

GROVELAND COMMUNITY SERVICES DISTRICT **CALIFORNIA**

DESIGNED UNDER THE DIRECTION OF:

SIMON N. GRAY DATE
R.C.E. No. 60311 - REGISTRATION EXPIRES 06-30-20

DESIGN: DATE:
DRAWN: MS DATE: 10/4/19
CHECKED: SNG DATE: 10/4/19

SCALE
NTS
DRAWING NUMBER

SHEET NUMBER
1 OF 1 SHEETS

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The approximately 60-year-old WWTP is an activated sludge treatment facility that still operates using some of its original equipment. Some upgrades and addition of new facilities were undertaken in 1982. Over the past five years, the treatment plant operates at an average daily flow of approximately 119,000 gpd, with peak wet weather flows reaching 416,500 gpd.

The WWTP receives raw wastewater from the collection system, which comprises both force main and gravity piping, which are collected at an inlet standpipe. The wastewater is then transferred to the headworks for screening and flow equalization. Screening facilities consist of two drum screens, a screenings conveyor belt, and screenings press assembly. Screenings are compacted for offsite disposal. The drum screens have replaced bar screens and a comminutor that were previously in operation. Grit is inadvertently removed by the drum screens: the is no specific grit removal facility at the headworks. Downstream of the screens is the pre-aeration basin. Aeration is provided by blowers that also support the downstream aeration basins.

Following the headworks, the wastewater flows into a flow equalization basin that also provides pre-aeration of the raw wastewater. The aerated equalization basin has a maximum storage volume of 570,000 gallons (approximately four days retention at current average daily flows). It was added to the WWTP in 1982, and its current lining was installed in 2010. The basin has 18 diffusers on the basin floor. These have to be cleaned at least once a month in order for them to work efficiently. The equalization basin also includes a medial berm that allows for just half of the basin to be in operation at a time during low flow conditions.

Flow from the aerated equalization basin is pumped into the anoxic zone of aeration basin 1, and then flows into the aerated portion of this basin. Flow then is discharged into aeration basin 2. Aeration basin 2 is directly connected to the downstream secondary clarifier. Flow can also be directed into aeration basin 1 and basin 2 simultaneously. The WWTP can also be operated in an alternative flow mode, where the equalization basin feeds into aeration basin 2. By so doing, aeration basin 1 is bypassed. This alternate path is shown on Figure 3. This alternate flow mode is rarely used, as no water quality benefits have been seen from changing the flow direction.

Aeration to all of these facilities, and to the pre-aeration basin, is provided by blowers located in four separate locations. One of the locations is the buildings located close to the aerated equalization basin, the second is on the south side of an office building and also contains the sodium hypochlorite (NaOCl) disinfection equipment, the third is located in the headworks and only supplies the aerated equalization basin, and the fourth location is by the screw press and only supplies the digester. The two blowers located in the building close to the aerated equalization basin were replaced between 2012 and 2014.

Secondary clarification takes place in a single settlement tank downstream of the aeration process. Return Activated Sludge (RAS) drawn from the clarifier is pumped by the original positive displacement RAS pump "Omar" back into the aeration basin 1, while wasted sludge (WAS) is directed to the WWTP's single aerobic digester.

Disinfection of the effluent from the secondary clarifier takes place in a chlorine contact basin. In a 2001 Wastewater Master Plan prepared for the District, the chlorine dosage is described as being in a high (and non-typical) range of 25-45 mg/L. Since then, the operators report that the dosage level has been set much lower at approximately 1-2 mg/L and performance is satisfactory.

Disinfected effluent is metered and then pumped into Reservoir No. 2, which is a 32 acre-feet capacity open storage facility. The effluent from the WWTP is blended with water from the Pine Mountain Lake before it is used to irrigate the Pine Mountain Lake Golf Course (PML). No chlorine content issues have been reported by PML.

When there is no demand for the effluent from PML, it is directed to the spray fields. At times there is a need to pump the effluent to PML and the spray fields. There is currently a trailer-mounted pump at the south end of the reservoir that conveys the effluent to the spray fields when the main irrigation pump is being used to direct the effluent to PML.

Supernatant from the aerobic digester is decanted and returned to the aerated equalization basin. After digestion, sludge is first dewatered using a new volute press, and then transferred to a covered sludge drying area. Once dried, it is stored under cover on-site, and hauled to the land application periodically. The supernatant liquor from the volute press is pumped via an underdrain pump back into the aerated equalization basin. This pump is also used to pump any liquid from the drying beds, including wash water from when this area is washed down.

At times of high inflow, wastewater can be pumped from the aerated equalization basin into Reservoir No. 1 for emergency storage, until it can be returned for treatment. This reservoir, which has a capacity of 3-million gallons, is currently used:

- During periods of wet weather, or high flow when the WWTP cannot handle all of the inflow.
- As temporary storage during maintenance operations on Groveland CSD's pump station wet wells.
- As a temporary storage for treated effluent that does not meet WDR permit standards. This wastewater is stored separately, and reintroduced to the WWTP at the standpipe, and not at the aerated equalization basin.

Inflows often increase to greater than the capacity of the WWTP during the vacation season, as more local housing is used as vacation rentals. Operators report that this is especially true during the holiday periods. In addition, the collection system suffers from high inflow and infiltration (I/I), resulting in high peaking of flows. High flows generally occur during wet weather events. At these high flows, the aeration system cannot maintain sufficient dissolved oxygen in the treatment process. As BOD exceeds available oxygen, anaerobic conditions prevail, and odor issues result. High summer flows and high BOD cause insufficient air issues. High wet-weather flows cause low to no BOD, which makes it difficult to sustain an adequate food source for the biological process. Reservoir No.1 is now used as temporary emergency storage during high-flow events, and this has alleviated some of this problem.

It is recommended that the District prepare a focused WWTP and Recycled Water Master Plan to determine the cost/benefit of replacing/upgrading the wastewater treatment plant versus continuing to repair and maintain the existing facility. The master plan should also evaluate the treated recycled water effluent and the ability to utilize the recycled water throughout the District. Tertiary treated recycled water can be used / permitted for many sues beyond irrigation, such as construction water, recharge, impoundment, indoor plumbing, cooling towers, etc. The master plan should consider recycled water regulations.

2. Lift Stations

Due the hilly terrain of the District system, lift stations are required to move wastewater flow to the WWTP. The District owns, operates, and maintains sixteen (16) lift stations. The lift station locations are shown on **Exhibit 15** and listed in **Table VII-1.**

Table VII-1: Lift Stations

LS Name	Wet Well						Pumps			Generator (Y/N)
	Diameter (in)	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Volume (cf)	Volume (gal)	# of Pumps	Pump Flow (gpm)	TDH (ft)	
LS1	72	2548.15	2553.65	5.50	155.5	1,163	2	300	46	Y
LS2	72	2548.44	2556.90	8.46	239.2	1,789	1	210	67	Y
LS3	60	2545.00	2554.00	9.00	176.7	1,322	2	142	42	Y
LS4	36	2529.00	2535.50	6.50	45.9	344	1	45	8	N
LS5	108	2540.90	2553.85	12.95	823.8	6,162	2	522	109	Y
LS6	108	2618.10	2629.25	11.15	709.3	5,306	2	485	60	Y
LS7	108	2616.20	2629.30	13.10	833.4	6,234	2	1125	109	Y
LS8	72	2539.00	2554.50	15.50	438.2	3,278	2	450	11	Y
LS9	72	2560.00	2567.00	7.00	197.9	1,480	2	78	55	Y
LS10	72	2529.00	2535.50	6.50	183.8	1,375	2	140	282	Y
LS11	48	2773.30	2784.30	11.00	138.2	1,034	2	131	156	Y
LS12	72	2694.40	2708.00	13.60	384.5	2,876	2	152	29	Y
LS13	72	2426.60	2445.00	18.40	520.3	3,891	2	660	63	Y
LS14	72	2538.90	2547.40	8.50	240.3	1,798	2	320	25	Y
LS15	72	2542.43	2548.75	6.32	178.7	1,337	2	78	66	Y
LS16	5x12	2776.60	2787.80	11.20	672.0	5,027	2	119	374	Y

A schematic depicting the elevations and connectivity of the lift stations is shown on **Exhibit 20.**

3. Conveyance

The District's sewer collection system includes a network of gravity sewer mains, manholes, cleanouts and force mains to deliver wastewater to the WWTP. The District recently completed an effort to GPS locate all of the sewer manholes and cleanouts in the sewer collection system. The results of the GPS survey identified 812 manholes and 159 cleanouts in the system. The GPS data was merged with the CalCAD data to map the existing system based on current and best available data. The location of the pipes and pipe diameters are shown on **Exhibit 16** and listed in **Tables VII-2 and VII-3**.

Table VII-2: Gravity Sewer Pipelines

Pipe Diameter (in)	Length (ft)	Length (mi)
4	578	0.1
6	180,639	34.2
8	6,078	1.2
10	6,983	1.3
12	2,487	0.5
18	1,494	0.3
Total	**198,259**	**37.5**

Table VII-3: Force Mains

Pipe Diameter (in)	Length (ft)	Length (mi)
3	114	0.0
4	18,170	3.4
6	6,863	1.3
8	4,310	0.8
Total	**29,457**	**5.6**

4. Septic Systems

There are portions of the District's system where customers rely on septic systems for sewer service. The District has considered connecting the septic areas to the sewer collection system, however there are currently capacity concerns at the WWTP due to high I/I. Significant improvements will be required within the existing collection system, or at the WWTP before the system can be expanded to connect the septic areas the system. This Master Plan does not consider expansion of the collection system to connect the septic areas. It is recommended to conduct a comprehensive Septic to Sewer Feasibility Study. The septic areas are shown on **Exhibit 17.**

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EXHIBIT 15

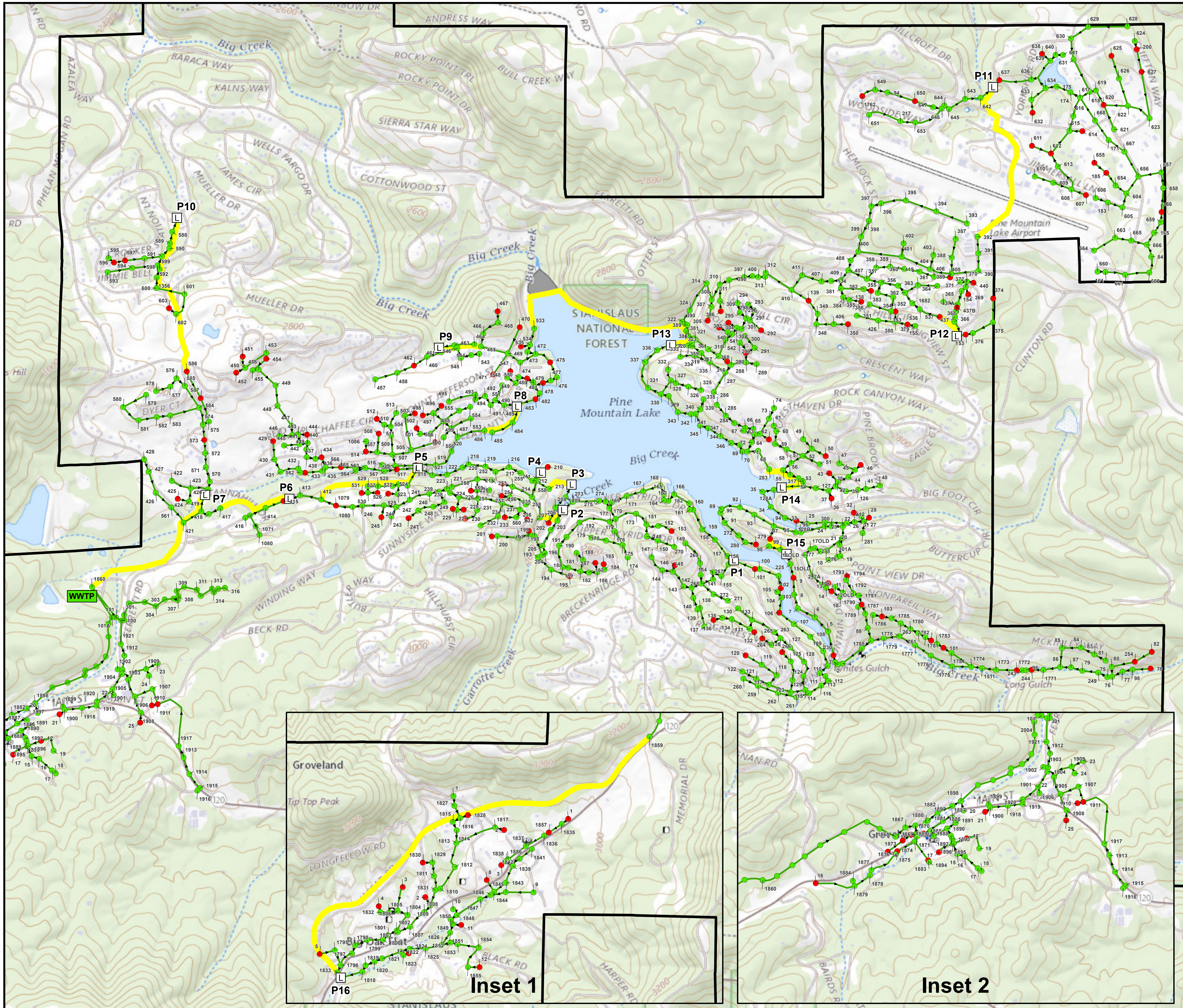
EXISTING SEWER SYSTEM

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

OCTOBER 2023



Legend

- L Lift Station
- WWTP Wastewater Treatment Plant
- Cleanout
- Manhole
- Pipe
- Force Main
- Groveland Community Services District Boundary

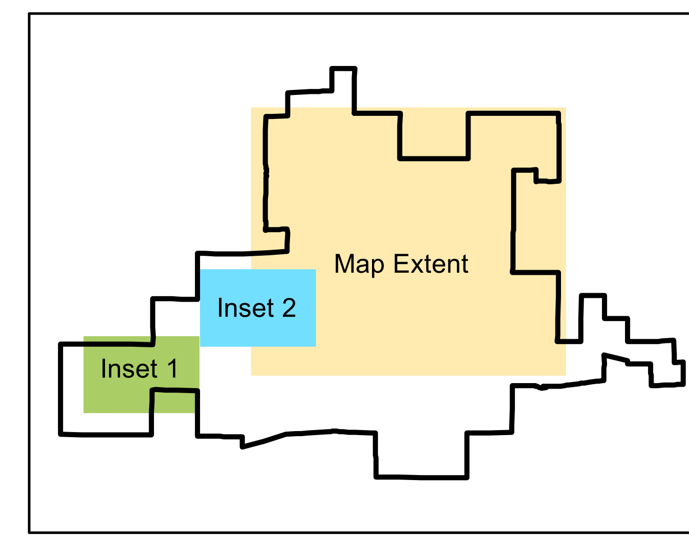


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EXHIBIT 16

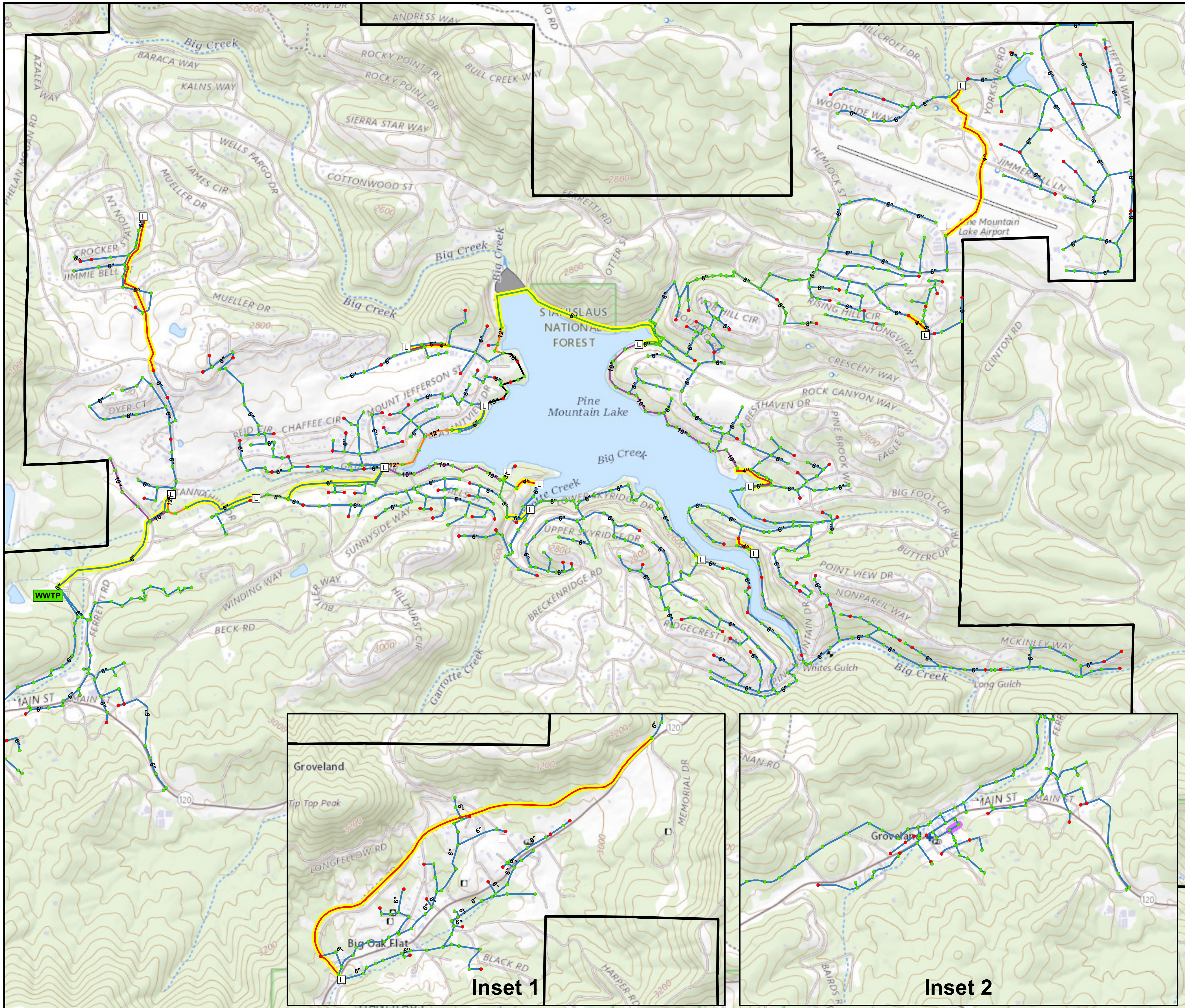
SEWER SYSTEM PIPE DIAMETERS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

OCTOBER 2023

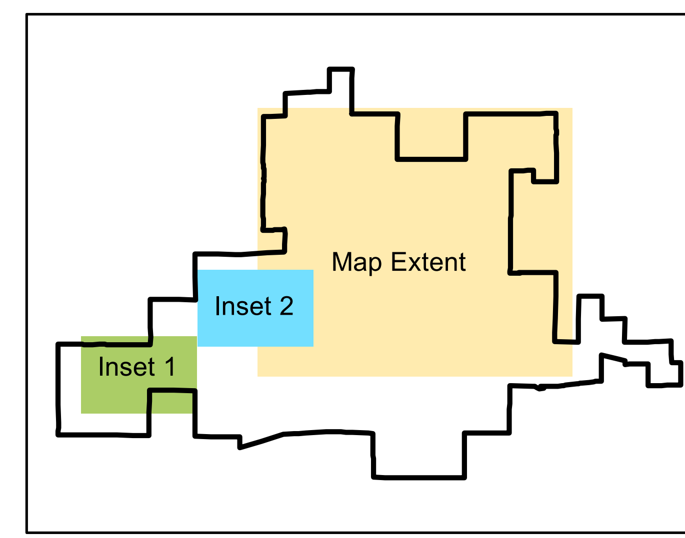


Legend

- Lift Station
- Wastewater Treatment Plant
- Cleanout
- Manhole
- Force Main

Pipe Diameter (inches)

- 4
- 6
- 8
- 10
- 12
- 18
- Groveland Community Services District Boundary



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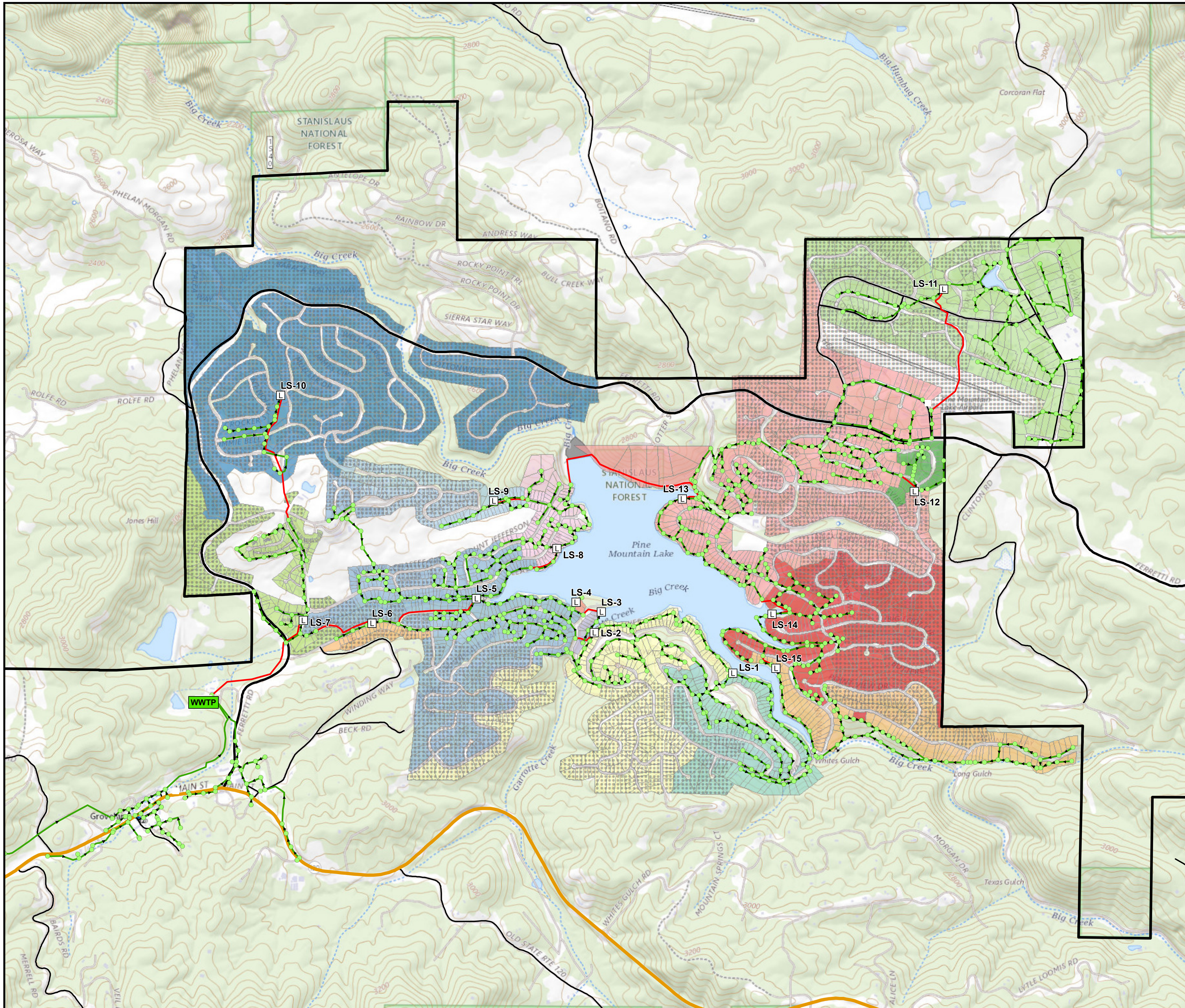

EXHIBIT 17

EXISTING SEPTIC AREAS

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE, CA

OCTOBER 2023

Legend

- Lift Station
- Manhole
- Wastewater Treatment Plant
- Pipe
- Force Main
- Area Serviced by Septic System
- Groveland Community Services District Boundary

Lift Station Service Area

- LS-1
- LS-2
- LS-3
- LS-4
- LS-5
- LS-6
- LS-7
- LS-8
- LS-9
- LS-10
- LS-11
- LS-12
- LS-13
- LS-14
- LS-15

0 375 750 1,500
Feet

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B. Hydraulic Model

A hydraulic model of the sewer collection system was developed to evaluate various flow conditions and operating scenarios.

1. Data Conversion

In order to develop a hydraulic model for the sewer system, the locations of gravity mains, force mains, lift stations, and the WWTP were imported in ArcGIS 10.7.1 from a CalCAD file extracted the District's previous web-based viewer. Once the basic line work was imported into the GIS platform, the line work was converted to be converted into a model platform by "initializing" the project. When the project is initialized, it creates a feature class for manholes, chamber manholes, an outlet, gravity mains, force mains, wet wells, and pumps. Field mapping is used to connect the imported line work and manholes to the model. Once field mapping is complete, the model is populated with information from the GIS database.

The CalCAD file had very basic information about the locations of the sewer collection system and did not contain any attribute data. An exhibit from a previous Septic Study was georeferenced into the model and the areas still on septic were removed from the active facility (the facility set determines which nodes and pipes are hydraulically modeled).

2. Software

The sewer model was developed using the InfoSewer Suite version 7.6. SP1 (Update #17) by Innovyze. InfoSewer sits on top of ArcGIS, which allows for easy exchange of information.

3. Development

For this model, pipe invert elevations and manhole rim elevations were not known so Relative Elevation Modeling (REM) data, As-Built drawings, and information extracted from the previous Wastewater Master Plan (2001) were used to populate the model components. Where As-Built drawings were decipherable and easily translated to model components, pipe invert elevations and lengths, manhole rim elevations, and lift station parameters were input into the model. Most of the lift station parameters were able to be determined based on As-Builts and the previous Master Plan.

Where the As-Built data was not easily converted to model information, REM data was relied on. For this approach, the manhole rim elevation was taken to be the surface elevation and the pipe invert was assumed to be 6-feet below the manhole rim. This method created some adverse slopes which were mitigated in two ways. The first method was used if the adverse sloped pipe had an adjacent pipe with known slope and consisted of adjusting the invert that is supposed to be higher such that the slope of the adverse pipe matched the slope of the known pipe. If there were no known slopes adjacent to the adverse pipe, the pipe inverts were adjusted so that the pipe has a minimum slope of 0.005. It is noted that the District recently implemented an effort to GPS locate all sewer manholes and measure the manhole depth. This data should be incorporated into the GIS database and hydraulic model.

Once all information was filled into the model, three scenarios were developed: average dry weather flow (ADWF), peak dry weather flow (PDWF), and peak wet weather flow (PWWF). The ADWF scenario models the conditions experienced by the system on average without any rain. The PDWF scenario also models the season without any rain, but instead of modeling the average flows, it models the maximum flows experienced. The PWWF condition models the PDWF scenario while adding in loads that occur due to inflow and infiltration occurring during the rainy season. The model scenarios are static scenarios.

In order to allocate sewage generation (loads) for the model, a land use-based approach was used. First, the parcels in the system were divided into two categories: Residential and Non-Residential. Each land use type was assigned a different generation factor (in gallons per minute per acre) that was determined from influent data at the WWTP for years 2016 to 2020 and compared to the water billing records.

To allocate the wastewater loads, the Thiessen polygon method was used. This process is automated in InfoSewer and for the purpose of this project was done using a boundary layer (GCSD service area boundary) and the nodes within the system, each node receiving one polygon. Once the polygons were created from the boundary layer, the load allocation tool was used. This tool works by taking a primary layer (the Thiessen polygons) and a secondary layer (the parcels within the sewer system) and allocating load to each manhole based on how many acres of each land use type are encompassed by the Thiessen polygon. Once the load allocation tool finishes and manholes have load allocated to them, this loading represents the ADWF scenario. The total load allocated by the model was compared to the load calculated by land use to ensure accuracy in loading. To get from the ADWF to PDWF scenario, a peaking factor of 2.5 was multiplied to all loaded manholes. The factor was retrieved from the previous master plan and used to maintain consistency.

In order to get the loads for PWWF, the base loads experienced were loaded into the model. Next, load needed to be added to account for inflow and infiltration into the system. For this, the average day and maximum day influent flow at the WWTP for each year 2016 to 2020 was determined. The average day was then subtracted from the maximum day for each year to get a net flow and the net flow for all of the years was averaged. The average net flow was then divided evenly into all of the manholes in the system. The combination of the PDWF and average net flow represents the PWWF flow.

4. Calibration

Since as-built data was limited and SCADA data was not available, the calibration process consisted of modifying pipe slopes to reflect minimum slope conditions when data was not available, adjusting initial setting of wet well levels ensure pumps were being called on, and a comparison of total inflow into the WWTP to the WWTP influent data.

C. System Capacity Analysis

1. Treatment

The WWTP is permitted to treat up to 400,000 gallons per day (gpd) under dry weather conditions, and 500,000 gpd in wet weather conditions. Based on influent data from 2016 through 2020, the average dry-weather inflow is 127,000 gpd, and the peak wet-weather flow was measured at 411,000 gpd. There is currently adequate permitted capacity at the WWTP, however when the District experiences significant I/I, the plant capacity pushes it upper operating limits.

The collection system I/I problem has a drastic impact on the District's WWTP infrastructure and the District's to meet the effluent requirements covered in the WDR. It also results in significant manhours the District must put in to ensure proper treatment is achieved.

The District's WWTP was not designed to handle the amount of I/I that it is observing and for this reason, the treatment units, such as the EQ basin and reservoir 1 are unable to serve the purpose they were designed for as they are undersized for the flows being introduced.

However, it is recommended that the District focus resources on solving the I/I problem in the collection rather that upsizing the treatment plant to handle the current I/I.

In regard to the recycled water produced by the WWTP, it is very difficult for the District to dispose of the effluent primarily via the irrigation spray fields, especially during the rainy season as the Pine Mountain Lake golf course does not need irrigation water when it is raining. The District also cannot use the spray fields for 24 hours after rain has stopped, which results in concerns regarding the available capacity of Reservoir 2 during the wet months. In addition, the District is very concerned with the growing regulations for recycled water reuse and the discharge to the Pine Mountain Lake golf course being terminated.

The District believes that transitioning to a new modern WWTP would be better than replacing the aging infrastructure. A detailed treatment plant analysis and master plan is recommended to conduct a cost-benefit analysis of transitioning to a new/modern WWTP. The WWTP Master Plan should address the following items, at a minimum:

- Determine feasibility to replace the aging wastewater infrastructure at the WWTP or if a new treatment facility should be constructed in lieu.
- Upgrading the WWTP to Title 22 effluent.
- Develop a water balance that compares the ability of the WWTP to dispose of its effluent utilizing the following: 1) only the irrigation spray fields, 2) only PML, and 3) both together.
- Explore alternative means of recycled water disposal to address the water balance deficiencies.
- If a new means of disposal is not feasible, explore the addition of more spray fields to address the deficiencies at Groveland CSD owned locations such as green belts, parks, sport fields, etc.

2. Lift Stations

Utilizing the PDWF scenario in the model, the lift stations were analyzed to determine if the existing pump capacities can accommodate the expected inflow and if the wet wells have adequate capacity to provide 2 hours of emergency storage. Pump capacities identified in the table were provided by District staff or gathered during site investigations. The results of the analysis are shown in **Table VII-4**.

Table VII-4: Lift Station Capacity Analysis

LS Name	Wet Well Volume (gal)	# of Pumps	Design Pump Flow (gpm)	Estimated PDWF into LS (gpm)	Capacity Deficiency or Surplus (gpm)	Storage Time based on Model Flow (min)
LS1	1,163	2	250	5.5	244.5	212.7
LS2	1,789	1	210	525.7	(315.7)	3.4
LS3	1,322	2	100	0.3	99.7	4,605.7
LS4	344	1	45	0.1	44.9	5,925.4
LS5	6,162	2	420	874.4	(454.4)	7.0
LS6	5,306	2	490	510.1	(20.1)	10.4
LS7	6,234	2	490	602.1	(122.1)	10.4
LS8	3,278	2	450	1147.5	(697.5)	2.9
LS9	1,480	2	80	1.2	78.8	1,239.9
LS10	1,375	2	140	2.2	137.8	622.9
LS11	1,034	2	130	14.4	115.6	72.0
LS12	2,876	2	150	1.6	148.4	1,809.0
LS13	3,891	2	660	977.7	(317.7)	4.0
LS14	1,798	2	320	282.1	37.9	6.4
LS15	1,337	2	80	2.2	77.8	609.8
LS16	5,027	2	150	13.9	136.1	360.6

Items in red boxes do not meet criteria. These findings are based on the hydraulic model, which was developed with limited information and the findings should be further evaluated to determine if a deficiency exists.

Many of the District's lift stations pump in series to deliver flow to the WWTP. Lift Stations 5, 6, 7, 8 and 13 are critical hubs in the system as they collect and convey a majority of the flows. A critical hub is defined as a lift station that has at least four (4) other lift stations located upstream. If LS 7 were to go down unexpectedly, it would create significant operational challenges for the District.

The capacity evaluation found that LS 2, 5, 7, 8 and 13 are all significantly deficient from both a pumping capacity and wet well storage standpoint. It is recommended to replace lift stations 2, 5, 7, 8 and 13 with a larger wet well and pump capacity.

LS 6, 11 and 14 all have less than the desired 120 minutes of storage capacity, however they do all have existing on-site generators. These stations should be monitored, however adding additional storage at this time is not recommended.

The capacity of LS 6 is slightly deficient, but upsizing is not recommended at this time. LS 6 is located in close proximity and sits at a similar elevation as LS 7. A bypass gravity pipeline to from LS 7 to LS 6 would allow for a back-up in the event LS 7 were to be down for an extended period of time. The LS 6 force main would need to be extended, with a bypass valve, to allow for LS 6 to bypass LS 7.

3. Conveyance

The District's system experiences significant I/I during wet-weather events. The excessive I/I problem has a significant impact on the District's WWTP infrastructure and the ability of the District to meet the effluent requirements covered in the WDR. It also results in significant amount of District manhours required to maintain the collection system and treatment process.

The main source of I/I is not believed to come directly from surface water entering the system (inflow), but rather from saturation of the soils and entering through pipe joints or cracks (infiltration). Resolving the I/I issue within the collection system will alleviate capacity concerns at the WWTP.

It is recommended to conduct a multi-step inspection and flow monitoring process to identify and alleviate the I/I. An I/I study will target the locations and volumes of where the I/I is occurring and allow the District to focus resources to those areas where the I/I is the most significant. The recommended process is as follows:

- Step 1 – perform a comprehensive flow monitoring program in the winter of 2022-2023 to better identify the locations and sources of I/I.
- Step 2 – conduct CCTV investigations in the regions with excessive I/I to identify the pipe condition and determine the appropriate corrective action.
- Step 3 – Implement a pipeline and manhole rehabilitation program to reduce I/I.

The hydraulic model was utilized to analyze the system capacity of the system under PDWF and PWWF conditions. The model results indicated that approximately 7,700 linear feet (LF) of gravity pipe and manholes are surcharging in PDF conditions, and approximately 8,800 LF of gravity sewer pipe and manholes are surcharging under PWWF conditions.

The locations of the surcharging pipes and manholes in the PDWF scenario are depicted in **Exhibit 18**. The locations of the surcharging pipes and manholes in the PWWF scenario are depicted in **Exhibit 19.**

At this time, no pipeline capacity improvement projects are recommended. The proposed I/I study will identify areas where high I/I is occurring and will result in pipeline and manhole rehabilitation projects to reduce the I/I and thereby restore system capacity. It is recommended to monitor the locations where surcharging pipes are identified in the model to determine if any actual capacity issues are occurring. The District is currently undertaking a GPS survey effort to verify pipe inverts throughout the collection system. It is also recommended to further calibrate the hydraulic model with flow monitoring data and the survey data to confirm and update manhole inverts and pipeline diameters.

The higher priority recommendation is to implement a flow monitoring study to identify the source of inflow and infiltration into the system. The Study should be performed over 3-month period in the winter months. It is recommended to install flow monitors at 12 locations, as shown on **Exhibit 21.**

Once the areas of I/I are identified, it is recommended to conduct a CCTV investigation of those areas to determine the reason for the I/I, and implement improvements to mitigate the I/I. Identifying the source of the I/I and rehabilitating the system to mitigate I/I will prevent the unnecessary of upsizing of pipelines.

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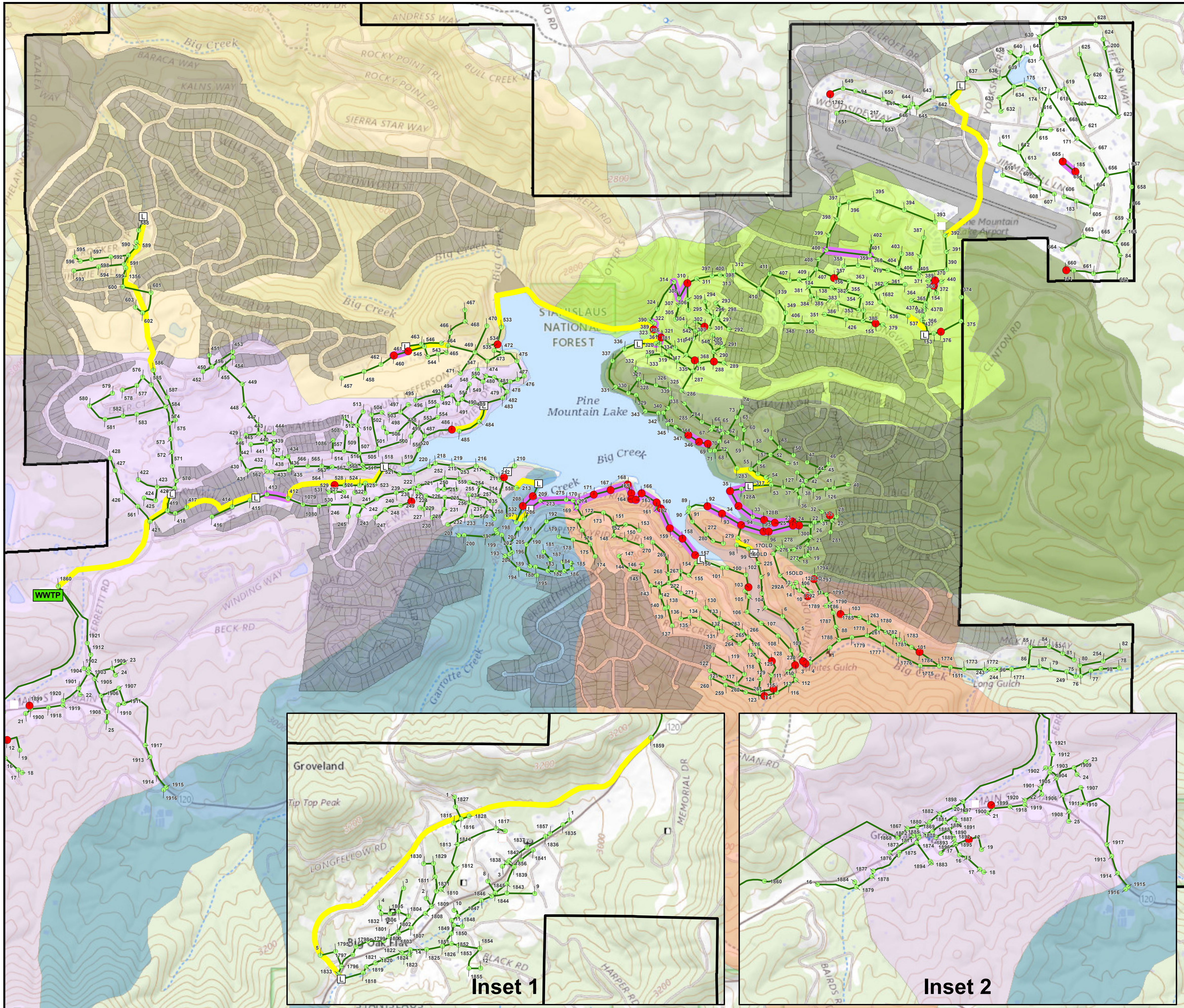


EXHIBIT 18

SURCHARGING PIPES UNDER PEAK DRY WEATHER FLOW

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

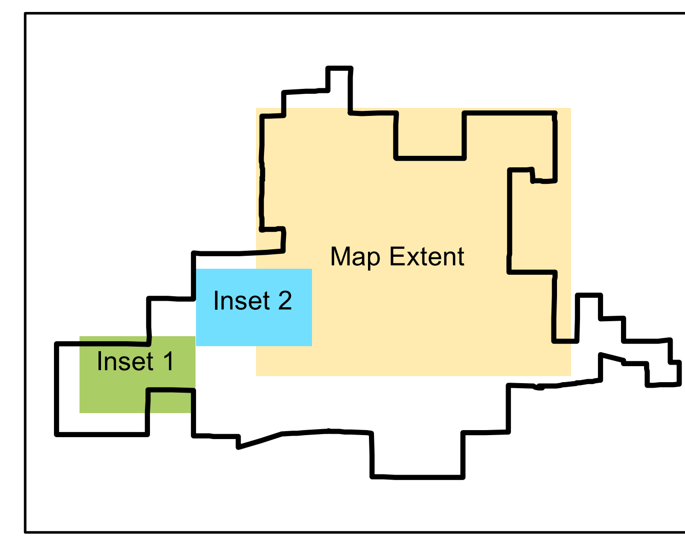
OCTOBER 2023

Legend

- Lift Station
- Wastewater Treatment Plant
- Manhole
- Surcharging Manhole
- Surcharging Pipe
- Gravity Main
- Force Main
- Groveland Community Services District Boundary
- Parcel on Septic System

Watersheds

- Big Creek Inflow
- Big Creek Outflow
- First Garrotte Creek
- PML East
- PML Northeast
- Second Garrotte Creek



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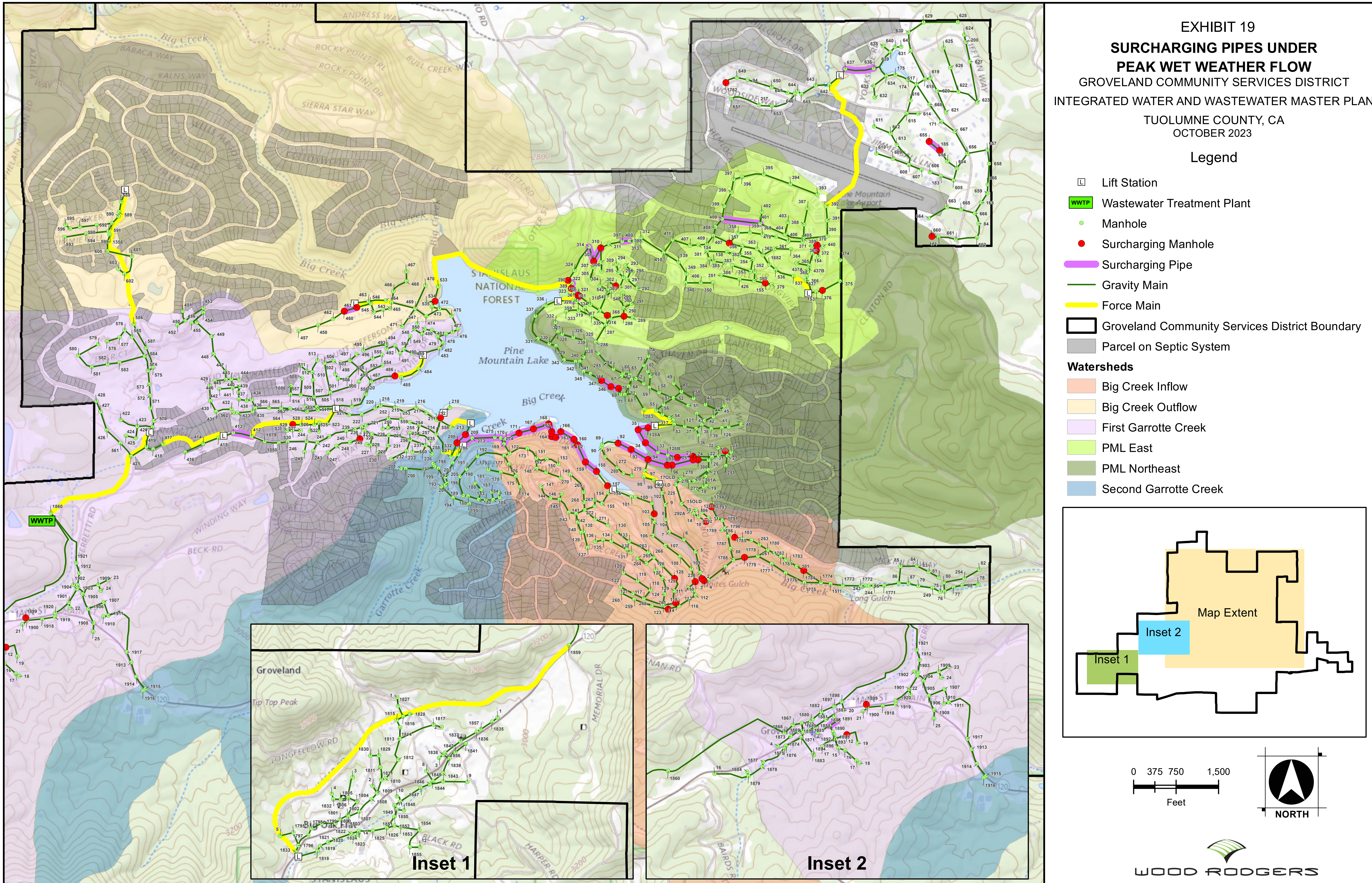

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EXHIBIT 20

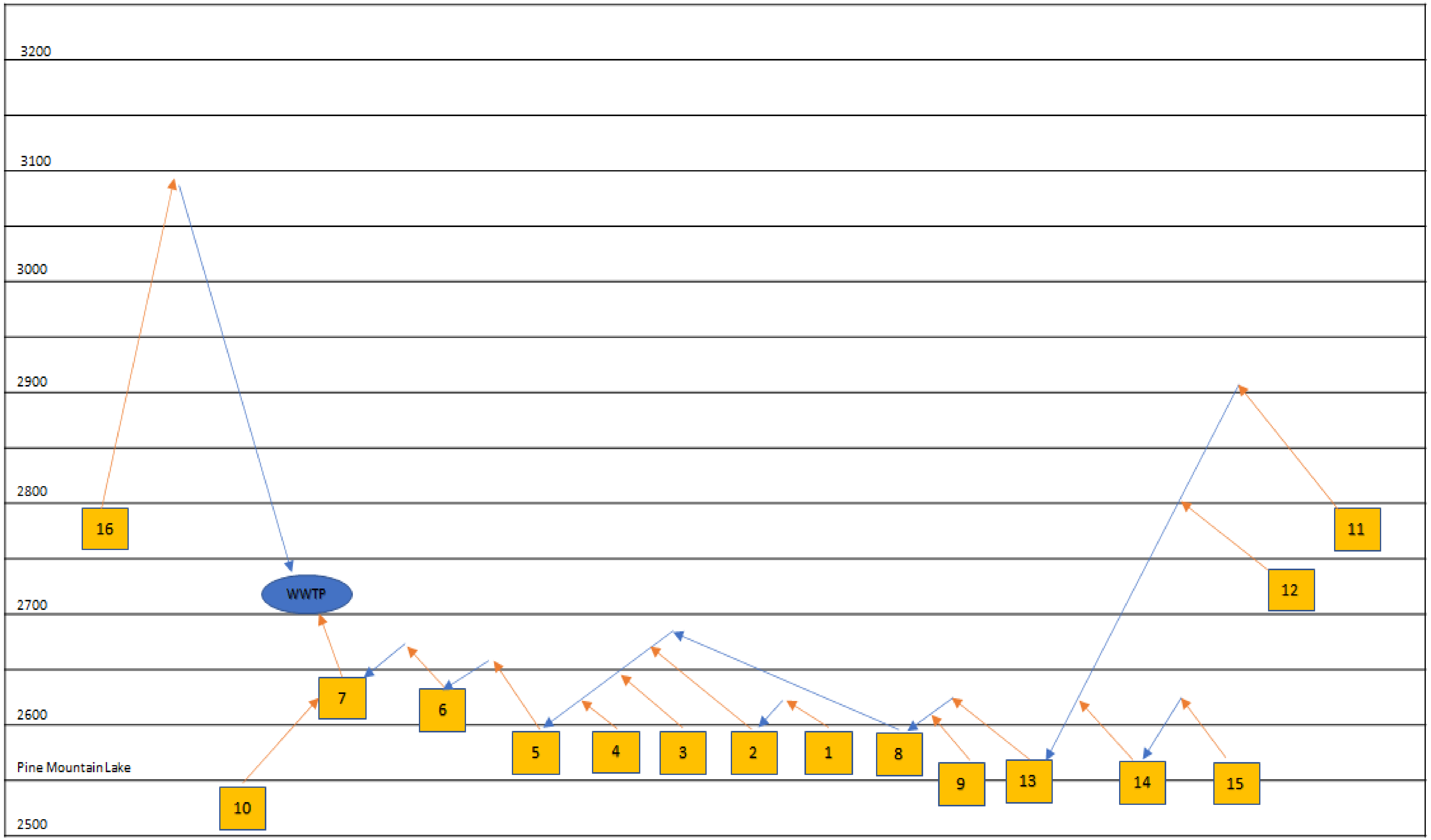
EXISTING SEWER SYSTEM HYDRAULIC SCHEMATIC

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

APRIL 2022



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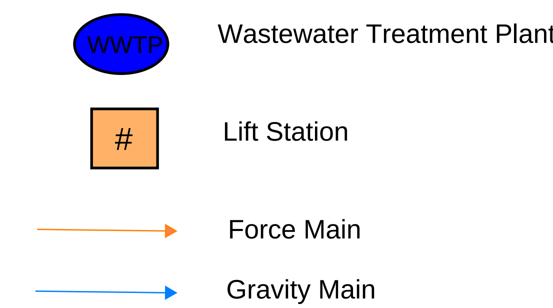

Note:
All elevations are surface elevations in feet relative to sea level.

WOOD RODGERS

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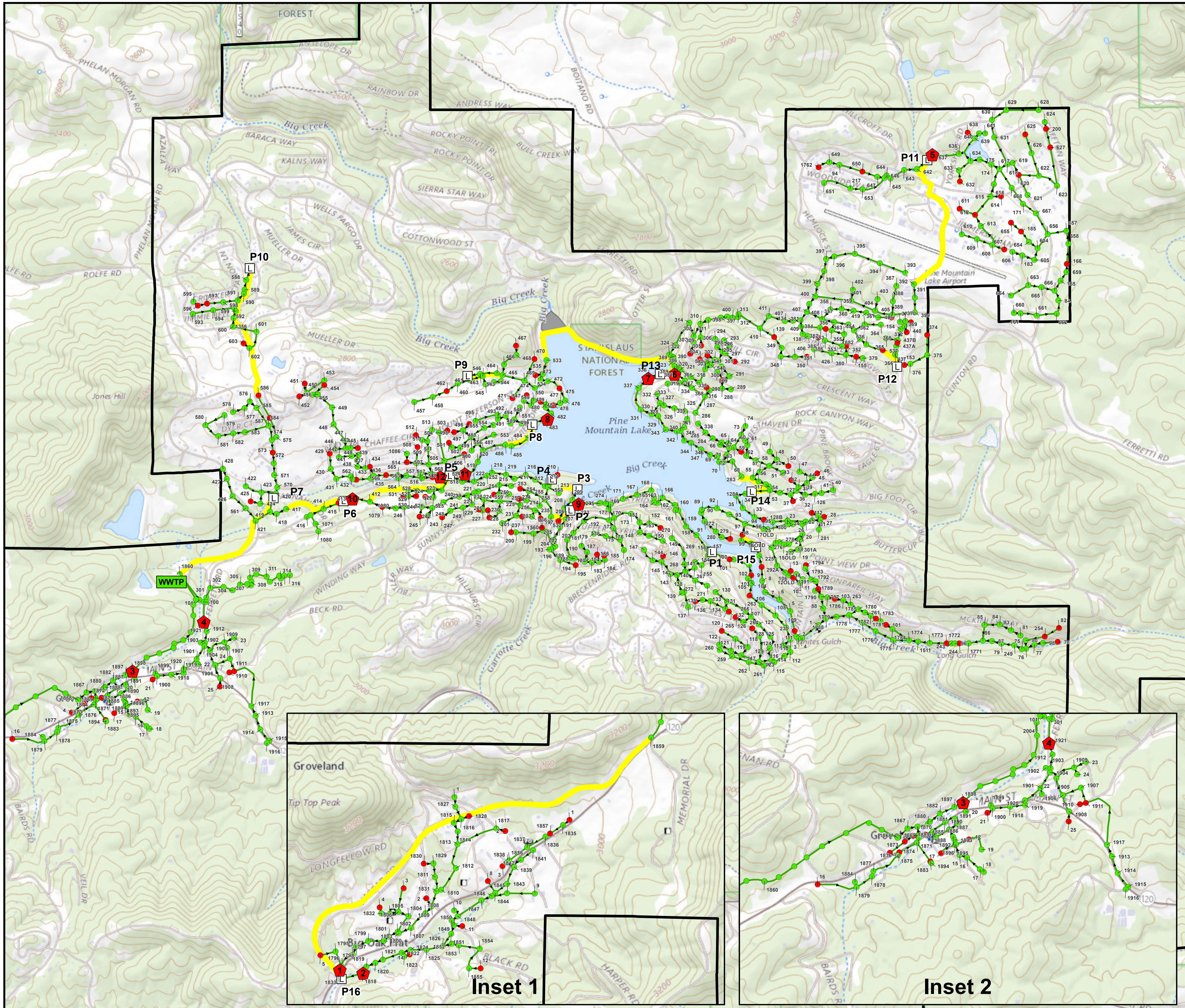

EXHIBIT 21

PROPOSED SEWER FLOW MONITORING

GROVELAND COMMUNITY SERVICES DISTRICT

INTEGRATED WATER AND WASTEWATER MASTER PLAN

TUOLUMNE COUNTY, CA

OCTOBER 2023

WOOD RODGERS

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D. Facility Condition Assessment

1. Treatment

An evaluation and assessment of the WWTP was performed with District staff to identify potential deficiencies. A summary of the immediate short-term and longer-term remedies to current issues and problems are included herein.

Short-term Actions:

- Improvements to the headworks screens (already in process).
- The influent pump to transfer peak flows to Reservoir No. 1 needs to be replaced.
- Install odor control system including piping, concrete work, odor control unit, equalization basin cover, new electrical service and electrical improvements.
- Simplification of the method of placing the diffusers in the Aerated Equalization Basin in order to remove stagnant spots.
- Conduct an assessment of the lining of the aerated equalization basin.
- The aeration system, pipelines and blowers must be evaluated in detail and repaired to improve the existing systems.
- Fixing potential safety issues, including rusting gratings, handrails and covers.
- A pumping and control system should be evaluated to automate moving sludge to the drying beds. Provide the ability to pump dewatered sludge from the volute press to the drying beds so that manual moving and spreading with a tractor can be avoided.
- Conduct a condition assessment and evaluation of electrical components.
- Upgrade SCADA for additional monitoring capabilities.
- Evaluate limitations of the spray-fields as a means to dispose of recycled water in wet months.

Longer-term Actions:

- Improve control at the headworks, equalization basin, and sludge handling area. It is believed that the odor is generated from the screenings not being properly collected, washed and stored prior to disposal. They may not be regularly removed from the WWTP, which would also contribute to an odor problem. There are plans to replace the existing screens and conveyors (both in poor shape) with new screens that each had a dedicated screenings washer/compactor. Implementation of this project will improve odors at the headworks. At the aerated equalization basin - ensuring adequate aeration (new aeration system) across the full range of flows and across the full basin would reduce odors at this location. That should be tried first before embarking on an expensive covering of the basin. At the sludge handling area - odors may be a result of the manual operating process and may improve if automated. Otherwise, fully enclosing the area and providing ventilation to a scrubber system is an option.

- Additional disinfection contact time during PWWF flows. *This item may be resolved through rehabilitation of the collection system to reduce I/I.*
- Review of the potential for additional spray fields.
- Install a permanent pump station (to replace the existing pump station located in a vault, which includes a trailer mounted rental pump) at Reservoir 2 to facilitate concurrent effluent transfer to the spray fields and the PML. This project is currently in design and includes a new, elevated pump pedestal, weather-proof enclosure, two 450 gpm (75 HP) pumps, VFDs and flow meter.
- Increase the capacity of Reservoir 2 (treated effluent), which has approached the required freeboard in wet years. The current capacity of Reservoir 2 is 32 acre-feet. *This item may be resolved through rehabilitation of the collection system to reduce I/I.*

2. Lift Stations

An evaluation and assessment of the lift stations was performed with District staff to identify potential deficiencies. A summary of the observations and recommendations are included in **Table VII-5**.

It was noted during the assessments that there are several locations in the system that experience odor issues. These locations are all at the downstream end of the long force mains, where sewage stagnates in the force main and develops excessive hydrogen sulfide gases. It is noted that the District is currently evaluating an Integrated Municipal Odor Control System (carbon adsorber filter) at LS 6 and 8. If the units' function well, similar systems may be implemented at the remaining lift stations with odor issues. It is recommended for the District to further study the carbon adsorption filter system and compare it to alternative odor control systems. The preferred odor control system shall be installed at LS 5, 6, 7, 8, 10, 11, 13, 15 and 16 to reduce the H2S gas and odor issues.

Table VII-5: Sewer Lift Station Observations and Recommendations

Lift Station	Deficiency	Recommendation
1	Corrosion throughout structure	Rehabilitate wet well, ensure structurally sound/watertight. Remove/replace corroded metal
2	Top half of wet well, discharge pipes, and valves corroded	Replace LS in its entirety.
3	Corrosion on top half of wet well	Monitor condition and repair corrosion as needed
4	Lift station only has one pump	Upgrade to include permanent back-up pump and add generator.
5	All sewage flows through old wet well and accumulates solids before entering new one making cleaning a challenge	Replace LS in its entirety.
6	Junction box corroded and conduit seals within missing	Replace corroded wiring and install conduit seals within junction box
	Piping within valve vault significantly corroded and standing water in wet well	Remove corrosion, clean piping/appurtenances, and apply protective coating to exposed surfaces
	Heavy cake build-up within the pumping wet well with strong odor	If feasible through PLC programming, initiate "clean-up" pumping cycle. Consider installing odor control system
7	Corrosion of wiring	Replace LS in its entirety.
	All sewage flows through old wet well and is difficult to clean due to the depth and high rate of flow	
8	Hatch latches on wet well are failing	Replace LS in its entirety.
	Corrosion observed on piping in valve vault	
	Auto-dialer is sending false alarm for high-high alarm	
9	Interior of electrical panel is not ventilated	Install louvered openings on sides of electrical panel to increase air flow and reduce heat load
	Safety latch for valve vault not functioning	Repair or replace safety latch immediately
	Communications cable is exposed and can be easily tampered with or cut	Relocate communications cable to inaccessible area (burial recommended)
10	Minor root intrusion at wet well inlet	Remove root intrusion and (if feasible) any nearby trees in close proximity to wet well
	Electrical issues	Evaluate electrical and instrumentation system
11	Ladder within wet well in poor condition	Remove and replace ladder
12	n/a	n/a
13	No safety grating over wet well.	Replace LS in its entirety.

	Minor corrosion and spalling on concrete wet well	
14	Significant root intrusion at joints and wet well broken/cracked in several locations	Upgrade/replace wet well
	Corrosion observed on piping within the valve vault	Remove corrosion, clean piping/appurtenances, and apply protective coating to exposed surfaces
15	Wet well linings are failing. Steel components are corroding.	Recoat wet well and all exposed steel.
16	n/a	n/a
5, 6, 7, 8, 9 and 10	Wet wells are old, and linings may be failing	Empty and clean wet wells to inspect wet wells for coating failures and inflow and infiltration
All	Generators are aging	Replace generators when either replacing or rehabilitating the lift stations
5, 6, 7, 8, 10, 11, 13, 15 and 16	Long force mains result in elevated hydrogen sulfide gases and odors.	Install air injection systems or carbon adsorber filters at the lift station to mitigate gas and odor issues.

It is noted that LS 1, 6, 9, 10, 11, 14 and 15 are recommended to be included in a lift station rehabilitation program. The District noted that the existing force mains have never been taken off-line for cleaning and/or inspection. It is recommended to implement an annual force main cleaning and inspection program. The installation of inspection ports will be required to facilitate the insertion of the cameras and other equipment.

3. Collection System

The collection system was not inspected as a part of this project. The District is currently completing a system-wide sewer collection system improvement project (expected to be completed in October 2023) to rehabilitate portions of the system. It is noted that the following deficiencies were identified by District staff through discussions:

- The system experiences high amounts of inflow and infiltration. The WWTP will see flow increase by 2x and 3x during significant rain events.
- The force mains have never been cleaned or inspected.
- There are several manholes located in, or adjacent to, creeks that require the MHs cover to be raised.
- Sewer pipelines crossing the creeks are typically ductile iron and soils in the Big Oak Flat area are corrosive. The pipelines crossing creeks should be inspected.
- Some MHs have experienced solids build-up on the bottom, and some have experienced concrete deterioration. A comprehensive cleaning program should be initiated, and manholes repaired.

VIII. RECOMMENDED IMPROVEMENTS

A summary of deficiencies and recommended improvements discussed in the Master Plan are summarized below.

A. Water System

1. Pipelines

The following pipeline projects are recommended to eliminate some dead end mains and provide better system looping, which will improve water quality and increase fire flow availability:

- Construct 250 LF of 6-inch main on Upper Sky Ridge Drive
- Construct 1,025 LF of 6-inch main Old State Route 20
- Construct 1,100 LF of 6-inch main on Boitano Road to connect PML-E to PML-C. The project will require a new PRV from PML-E to PML-C
- Construct 3,125 LF of 12-inch main on Ferretti Road (includes a new PRV to reduce pressure from GL-SE to PML-SW)
- Construct 5,500 LF of 8-inch main on Harper Road from Merrell Road to Black Road. This project will require a PRS from the GL-S zone to the BOF zone

The following pipeline projects are recommended for upsizing to reduce system headloss, increase system pressure and fire flow availability:

- Upsize 800 LF of 4-inch to 6-inch on Old State Route 120 (adjacent to the project to close the loop discussed above)
- Upsize 650 LF of 4-inch to 6-inch on Vernal Drive between Merrell Road and Tank 5
- Upsize 400 LF of 4-inch to 6-inch on N Dome Court
- Upsize 1,600 LF of 4-inch to 6-inch on Wawona Drive and El Capitan Way
- Upsize remaining 22,815 LF of small diameter pipe with 6-inch (small diameter pipe replacement program)
- Upsize 15,035 LF from the 2G WTP to 12-inch diameter, sections include:
    - 10,300 LF of cross-country pipeline from the 2G WTP to Tank 1
    - 4,735 LF from PRV GL-01 along Elder Lane to the Intra-System PS

2. Pump Stations

The following pump station projects are recommended to increase pumping capacity and efficiency:

- Abandon the existing PML-NE PS and construct a new pump station to fill the new location of Tank 4. The project also includes new 12-inch pipelines from the pump station to the tank and from the tank to PML-NE pressure zone, the abandonment of the existing Tank 4 and PML-NE PS, and the installation of a new PRV from PML-NE to PML-E (at the site of the existing Tank 4).
- Upsize the 2G PS to provide a firm capacity of 1,300 gpm so that there is full supply redundancy in the event one of the WTPs is out of service for an extended period of time.
- Upgrade Dunn Court Pump Station to install a check valve to prevent backflow into the suction line when the primer pump is operating. Upgrade pump base and anchorage system to provide adequate anchorage, bracing, and seismic restraint.

3. Tanks

The following projects are recommended to mitigate the storage deficiencies, extend the life of the exiting tanks, and improve system hydraulics:

- Provide a total of 0.75 MG of storage at the new Tank 4 site. The tank can be constructed as development occurs. This project will require a new pump station to fill Tank 4, 6,500 LF of new 12-inch pipeline from the pump station to the tank and from the tank to PML-NE pressure zone, the abandonment of the existing Tank 4 and PML-NE PS, and the installation of a new PRV from PML-NE to PML-E (at the site of the existing Tank 4).
- Recoat the interior and exterior of existing Tank 1.
- Construct a second 0.14 MG tank at the Tank 5 site to mitigate the storage deficiency. Project includes improving the inlet / outlet piping configuration of the existing tank to improve water circulation.
- Recoat and repair Tank 5 per the 2021 inspection report.

4. WTP

The following projects are recommended for the water treatment plants:

- Perform a detailed conceptual design study to determine the cost, water quality and environmental impacts to eliminating the filtration avoidance process and installing a packaged filtration treatment system at 2G and BC.
- Relocate the AWS to a larger, more accessible, District-owned site and increase the operational and permitted capacity to 700 gpm.

5. Asset Renewal and Replacement

Based on the condition assessment effort, and conversations with District staff, the water assets currently in most need of replacement or rehabilitation are the fire hydrants, pressure-reducing stations, valves, air-release vacuum valves and generators. The District should explore various grant programs to fund the replacement of aging infrastructure, including CalOES and the DWR Integrated Regional Water Management (IRWM) grant programs. The following projects are recommended:

- Replace one pressure reducing station per year with, including new vault, hatch, valves and connect to the SCADA system with remote pressure monitoring capabilities.
- Replace the remaining 465 hydrants over a period of 8 years.
- Replace isolation valves and air-release vacuum valves on annual basis.
- Replace existing generators every fifteen years at a rate of one generator per every four years.

It is recommended that the District update the Cartegraph database with the install year for the major assets so that the District can proactively plan for the rehabilitation and/or replacement of the major water assets.

6. Miscellaneous Recommendations

The following recommendations are system-wide:

- Complete the hardware and software upgrades to the SCADA system so that the District can monitor and record data at all water facilities.
- Install temporary data loggers on individual meters throughout the system to record real-time water usage to help refine District specific water demand factors and peaking factors for the various customer types. It is recommended to install 10-15 meters for each customer type throughout the District (single-family residential, multi-family residential, commercial and industrial). The meters should be spread throughout the District and monitor for a minimum period of 3 months (preferably in the summer). Smart meter devices area available from companies like "Flume."
- Update the GIS database with missing attribute data.
- Upgrade the hydraulic model to an extended period simulation.
- Conduct a well siting study to determine if a groundwater well in BOF can produce sufficient water to serve the BOF area.
- Complete the SCADA system upgrades to allow for remote monitoring, control, and data storage throughout the system.

- A majority (approximately 80%) of the pipeline material in the water system is ACP. It is recommended to implement an ACP replacement program, replacing approximately 1 mile per year.
- It is recommended to replace the existing service lines replacement program when conducting pipeline replacement projects. It is estimated to replace approximately 50 per year.
- The District experiences approximately 29% water loss between water produced and water billed, which is very high as compared to the industry standard of 6-10%. It is recommended to conduct a water audit and leak detection program. The AWWA M36 Manual provides a guide to conduct a water audit. The goal is to allow the operators to find the destinations of water supplied through the distribution system and to quantify volumes of consumption and loss. The auditing process is organized at three levels, each adding increasing refinement:
    - *Top-down approach* - the initial desktop process of gathering information from existing records, procedures, data, and other information systems.
    - *Leakage component analysis* - a technique that models leakage volumes based on the nature of leak occurrences and durations. This technique can also be used to model various occurrences of apparent losses by looking at the nature and duration of the occurrence.
    - *Bottom-up approach* - validating the top-down results with actual field measurements such as leakage losses calculated from integrated zonal or district metered area (DMA)[2] night flows. Similarly, physical inspections of customer properties can uncover apparent losses from defective or vandalized customer meters, or unauthorized consumption. Process flowcharting of customer billing systems can be used to identify systematic billing errors.

  The water auditor can better validate and improve the accuracy of the water audit when it is augmented by leakage component analysis, bottom-up field measurements, or both. The AWWA M36 recommended water audit approach uses AWWA Free Water Audit Software (Audit Software) and AWWA Water Audit Reference Dataset (WARD). This recommendation includes conducting a non-destructive leak (condition) assessment program within the older parts of the District's system. Leak detection can be implemented without the system being taken out of service using acoustic methods (similar to Echologics).

[2] DMA is a small zone of the distribution system with measured supply input flow of sufficiently small volume that individual leakage events can be quantified, thereby guiding leak detection deployment decisions. See chapters 6 and 7 for details.

B. Wastewater System

1. Gravity Pipelines

The following projects are recommended for the gravity pipeline system:

- Conduct a flow monitoring / I/I Study for 3-months at 12 locations to identify the source of I/I.
- Perform CCTV inspection of entire system over a 5-year period.
- Implement pipeline and manhole rehabilitation program based on the results of the CCTV inspection.

2. Lift Stations and Force Mains

The following projects are recommended for the lift stations and force mains:

- Implement a Lift Station (LS) inspection program (8 stations over 4 years)
- Based on the results of the inspection program, implement a LS rehabilitation program of 1 per year for LS 1, 6, 9, 10, 11, 14 and 15.
- Implement force main cleaning and inspection program over an 8-year period. Requires the installation of inspection/access ports.
- Install odor control (air injection system or carbon filter system) at LS 5, 6, 7, 8, 10, 11, 13, 15 and 16. *Temporary odor control systems are installed at LS 6 and 8.*
- Install generator at LS 4
- Replace LS 5
- Replace LS 2
- Replace LS 8
- Replace LS 7
- Replace LS 13
- Reconfigure LS 6 to bypass LS 7 in an emergency

3. WWTP

Conducted a detailed analysis of the WWTP process. The WWTP Master Plan should address the following items, at a minimum:

- Determine feasibility to replace the aging wastewater infrastructure at the WWTP or if a new treatment facility should be constructed in lieu.
- Upgrading the WWTP to Title 22 effluent.
- Develop a water balance that compares the ability of the WWTP to dispose of its effluent utilizing the following: 1) only the irrigation spray fields, 2) only PML, and 3) both together.

- Explore alternative means of recycled water disposal to address the water balance deficiencies.
- If a new means of disposal is not feasible, explore the addition of more spray fields to address the deficiencies at Groveland CSD owned locations such as green belts, parks, sport fields, etc.

A summary of the immediate short-term remedies to current issues and problems at the WWTP are included below.

<u>Short-term Actions:</u>

- Improvements to the headworks screens (already in process).
- The influent pump to transfer peak flows to Reservoir No. 1 needs to be replaced.
- Simplification of the method of placing the diffusers in the Aerated Equalization Basin in order to remove stagnant spots.
- Conduct an assessment of the lining of the aerated equalization basin.
- The aeration system, pipelines and blowers must be evaluated in detail and repaired to improve the existing systems.
- Fixing potential safety issues, including rusting gratings, handrails and covers.
- A pumping and control system should be evaluated to automate moving sludge to the drying beds. Provide the ability to pump dewatered sludge from the volute press to the drying beds so that manual moving and spreading with a tractor can be avoided.
- Conduct a condition assessment and evaluation of electrical components.
- Upgrade SCADA for additional monitoring capabilities.
- Evaluate limitations of the spray-fields as a means to dispose of recycled water in wet months.

A summary of the longer-term actions to be considered at the WWTP are included below. It is noted that the long-term actions are not included in the CIP, as many of these items may no longer be applicable after the preparation of the WWTP Master Plan.

<u>Longer-term Actions:</u>

- Improve odor reduction / control at the headworks, equalization basin, and sludge handling area.
- Additional disinfection contact time during PWWF flows. *This item may be resolved through rehabilitation of the collection system to reduce I/I.*
- Review of the potential for additional spray fields.
- Install a permanent pump station (to replace the existing pump station located in a vault, which includes a trailer mounted rental pump) at Reservoir 2 to facilitate concurrent

effluent transfer to the spray fields and the PML. This project is currently in design and includes a new, elevated pump pedestal, weather-proof enclosure, two 450 gpm (75 HP) pumps, VFDs and flow meter.

- Increase the capacity of Reservoir 2 (treated effluent), which has approached the required freeboard in wet years. The current capacity of Reservoir 2 is 32 acre-feet. *This item may be resolved through rehabilitation of the collection system to reduce I/I.*

4. Miscellaneous Recommendations

The following recommendations are system-wide:

- Complete the hardware and software upgrades to the SCADA system so that the District can monitor and record data at all lift stations.
- Update the GIS database with missing attribute data and additional manhole data.
- Upgrade the hydraulic model to an extended period simulation.
- Conduct a comprehensive Septic to Sewer Feasibility Study.
- Conduct an Odor Control Study.

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IX. CAPITAL IMPOVEMENT PLAN

This section provides the recommendations for a 10-year Capital Improvement Plan based upon the analysis and recommended projects developed within this study.

A. Cost Basis

The cost basis to develop the capital improvement project budgets are included as **Table IX-1** - Water System and **Table IX-2** - Sewer System. The cost basis includes soft costs, contingencies, and escalation.

B. Prioritization

The projects have been prioritized over the 10-year planning horizon based on criticality.

C. Water System

Table IX-3 provides a summary of the recommended Water System CIP Projects. The breakdown of cost for each project is included in the **Appendix.** The location of the Water System CIP projects are depicted on **Exhibit 22.**

D. Wastewater System

Table IX-4 provides a summary of the recommended Sewer System CIP Projects. The breakdown of cost for each project is included in the **Appendix.** The location of the Water System CIP projects are depicted on **Exhibit 23.**

E. Current or Upcoming Projects (not included in CIP)

Below is a list of projects that the District is currently undertaking or planning to initiate in the coming months and are excluded from this CIP.

<u>Water Distribution System</u>

- Reconstruction of the Butler Way Bypass PS
- Tank 4 Hydro Pump Station Generator Upgrades
- Big Oak Flat / Groveland Water Distribution System Improvement project (See **Exhibit 14**)

<u>Water Treatment Plants</u>

- BC Clearwell interior and exterior recoating and roof corrosion fixes

Sewer Collection System

- Big Oak Flat / Groveland Sewer Collection System Renovation Project (Loan of $1,461,392 and an SWRCB Grant of $4,384,176 for total funding of $5,845,568).
- Odor control systems at LS 6 and 8.

Wastewater Treatment Plant

- WWTP Headworks Improvements

F. Potential Funding Sources

Table IX-5 provides a summary of potential sources of funding for the recommended projects.

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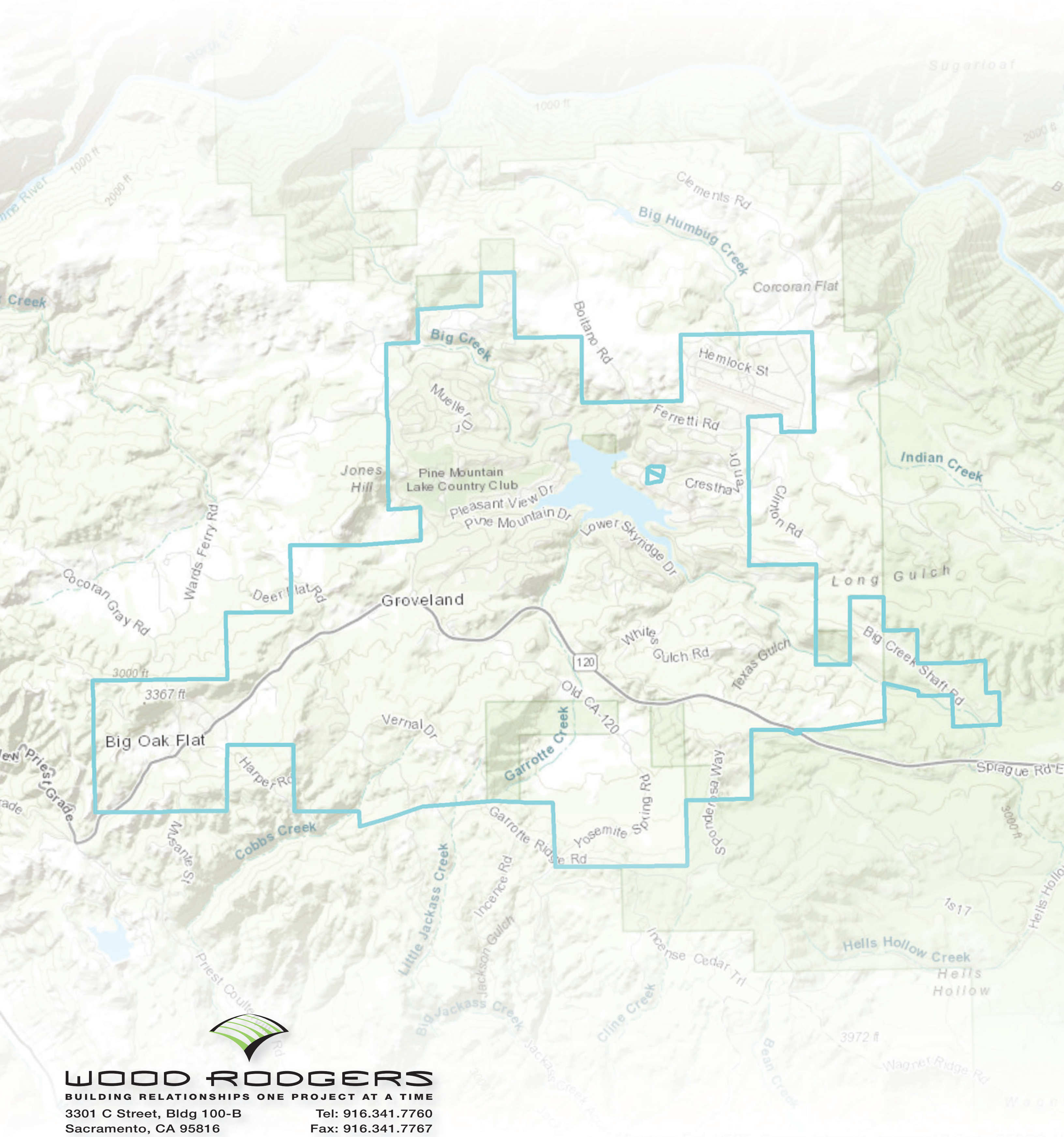

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