SUNRISE BEACH VILLAGE

WATER DISTRIBUTION SYSTEM IMPROVEMENTS

PHASE 1: MAPPING, MODELING, AND PLANNING

February 22, 2024

HR Green Project No: 2202532

Prepared For:

City of Sunrise Beach Village, TX

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1.0 Introduction

The City of Sunrise Beach Village, Texas (SBV) owns and operates a public water supply system that serves a community of approximately 1,030 metered utility connections. The water source for the community is groundwater wells which are disinfected using a chlorine gas system. The treated water is stored in the clear well located at the main water plant. Three (3) high-service pumps supply treated water to the ground storage tank (GST) located at the existing mountain top site. The existing GST is a bolted steel tank with a usable capacity of approximately 113,358 gallons. The elevated position of the mountain top site allows the GST to function as an elevated storage for direct pressure service to the distribution system. In addition, the clear well, located at the water plant site, has a usable capacity of approximately 19,000 gallons. The City is currently experiencing a reported average daily pumped rate of approximately 190,000 gallons, exceeding the available storage capacity. The City is seeking to construct a larger storage tank, at a location and capacity to be determined, to facilitate achieving required storage to meet residential demand flows and pressure as well as to meet the Texas Commission on Environmental Quality (TECQ) requirements.

Based upon available information provided by the City, the distribution system consists of pipes ranging in size from 2-inch to 8-inch, composed of iron (CI), asbestos concrete (AC), and poly-vinyl chloride (PVC) materials, and ranging in age from 1960’s era to the present, all based upon available records and system information. Due to aging infrastructure and material deterioration, the City is experiencing pipe leaks and breaks/failures and seeks to initiate targeted pipeline replacement projects to minimize the loss of treated water and improve water system distribution efficiency through pipeline upgrades (size and material). Proposed system improvements will be planned and designed in accordance with Texas Administrative Code (TAC) Title 30 Chapter 290 – Public Drinking Water, as regulated by TCEQ.

The City sought qualifications from interested parties and ultimately contracted with HR Green (HRG), a full-service engineering and consulting firm, with local office in Austin, Texas. With over 110 years of service to municipal clients and more than 40 years operating in the State of Texas, HR Green is well-versed in water tanks and water distribution system improvements.

Funding for this project is a combination of American Rescue Plan Act (ARPA) funds, administered by Llano County, and City of Sunrise matching and additional funds. An Interlocal Agreement between Llano County and Sunrise Beach Village was executed November 28, 2022, related to the distribution of the funds, which commended on December 1, 2022, and is in full force and effect to September 30, 2024, with an option to extend in one-year terms upon written agreement in the event the work is not completed by September 30, 2024.

This work is being performed in phases to allow for proper system planning prior to design and construction phases. The first phase is focused on developing a map (electronic) of the water system, modeling the existing water system, evaluating future demands, and concluding with a prioritized plan for water system improvements. The purpose of this report is to present the results of the mapping and hydraulic modeling phase work and resultant analysis to determine necessary improvements for current and future system needs. These improvements include necessary water main improvements, additional storage, and other water distribution assets.

2.0 Water System

2.1 Water System Mapping

Applying existing hard-copy information, an electronic map of the existing water system was developed through a combination of digitizing hard-copy maps and referencing plan documents and field data collection. Global Positioning System (GPS) coordinates of available nodes within the water system were collected by HRG staff and applied to the digitized map data in Geographic Information System (GIS). The HRG team then evaluated the accuracy of the digitized map data by comparing it to the field data collected X-Y-Z coordinates for system features and adjusted the electronic map data. A follow up discussion was conducted with SBV to confirm the accuracy of the physically verified system configuration and to ensure the final GIS map represents the most up-to-date data available.

2.2 Hydraulic Model Evaluation

The performance of SBV’s system under existing and future demand conditions is evaluated using the developed water model. The hydraulic model contains all identified and mapped pipes, valves, storage tanks, and pumps within the potable water system. The model is used to identify hydraulic and storage deficiencies in the water system.

2.3 Hydraulic Modeling Software

WaterGEMS®, developed by Bentley Systems, was the software selected to perform the modeling. WaterGEMS® works in conjunction with AutoCAD, MicroStation, ArcGIS, or as a stand-alone program in Microsoft Windows. The model can be run as a steady-state (SS) simulation, or as an extended period simulation (EPS). SS simulations produce results based on one initial set of conditions (i.e., number of pumps running, tank elevations, etc.). EPSs produce results based on changing conditions (i.e., tanks filling or draining, pumps turning off or on, etc.) over a specified time interval. The EPS represents a “real-life” analysis of the system by analyzing the model dynamically.

2.4 Model Construction in WaterGEMS®

All pipelines and facilities included in the hydraulic model were obtained from the GIS map data information developed by the HRG in the mapping tasks for this project and checked for accuracy with SBV staff. Customer meter demands applied contain user water consumptions. Elevations for the model are derived from contour data (two-foot intervals) obtained from regional LiDAR data. Using the contour data, ground elevations are extracted and assigned to all junctions and facilities in the model. Field mapping using GPS with mapping grade accuracy was used to verify system node elevations including valves, pumps, and tank base elevations during the field data collection tasks. The information required to run the distribution system analysis program includes:

- Water Distribution System Data:
    - Pipe sizes, types, roughness coefficients and lengths.
    - Pipe junction elevations
    - Water storage location, diameter, head range, and elevation
    - Pump locations, elevations, and pump curves
    - Major water users and their locations
    - Consumption meter demand data
    - Pumped data.

Meter demand data and pumped data for the existing water distribution system, provided by the City, was applied in the model for the period of June 20, 2022, through September 30, 2022. SBV experiences a seasonal water demand, with the highest production periods recorded during the Summer months. A significant percentage of the residents in the area are part-time residents, often spending weekends and warmer months in the region. Additionally, the City is currently in the process of replacing demand meters in the system due to identified inaccuracies in the aged consumption meters.

2.5 Existing Water System

The existing water system characteristics have been determined through a combination of map study, field verification, and GPS data collection. Figure 1 and Table 1 provide a visual and tabulated representation of these findings, respectively. Table 1 notes include system’s size and capacity assumptions. Reference Figure 1A and Attachment B for the enlarged view of the Ground Storage Tank (GST) and overall system piping configuration.

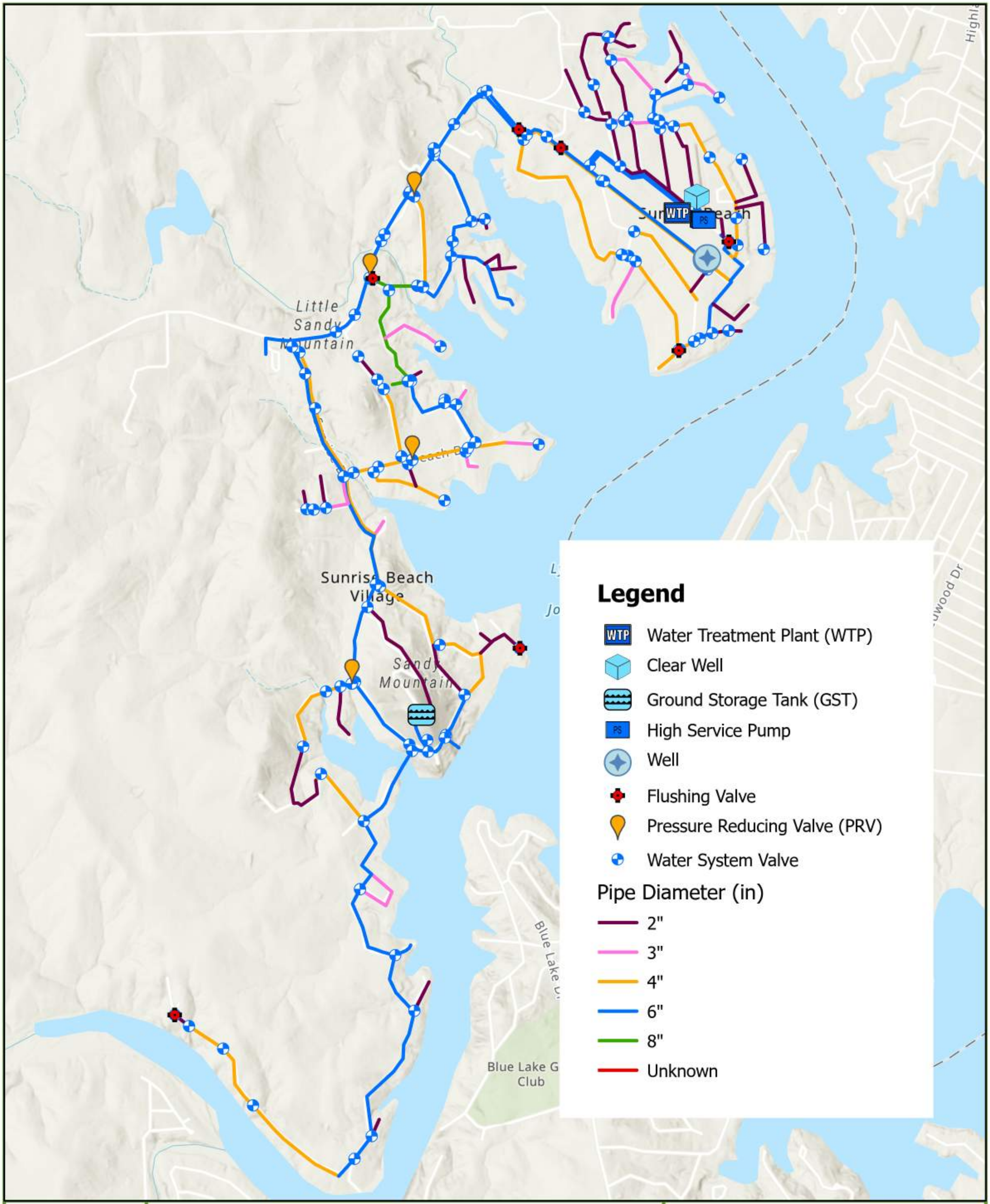

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Figure 1 - Water Distribution System Map
Sunrise Beach Village, TX

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Figure 1A - Water Distribution System Map
Ground Storage Tank (GST) - Enlarged Map

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TABLE 1 – EXISTING SYSTEM CHARACTERISTICS[1]

System Component	Characteristics[1]	Size & Capacity[1]
Water Transmission and Distribution Pipe	2-inch pipe	25,936.3 LF
	3-inch pipe	8,130 LF
	4-inch pipe	31,869.7 LF
	6-inch pipe	41,174.8 LF
	8-inch pipe	2,708.6 LF
	Unknown pipe size	27.4 LF
	Total Pipe Length	109,846.8 LF
Water Transmission and Distribution Pressure Maintenance	Four (4) Pressure Reducing Valves	Three (3) 4” diameter
		One (1) 6” diameter
Storage Capacity	One (1) 113,358 gallons GST	▪ Diameter: 32 feet (ft) ▪ Height: 18 ft ▪ Operating Range: 16.5 ft – 13 ft (high service pump on level) ▪ Overflow Level: 17 ft
	One (1) 19,000 gallons Clear Well	▪ Diameter: 14 ft ▪ Height: 17 ft ▪ Overflow Level: 16.5 ft
Well Production Capacity	Two (2) Operating Groundwater Wells	Well 4b: 250 – 300 gpm[2]
		Well 4c: 380 gpm (max)
Pumping Capacity	Three (3) High Service Pumps[3]	High Service Pump 1: 250 gpm
		High Service Pump 2: 280 gpm
		High Service Pump 3: 260-270 gpm

Table 1 notes:

1. Data provided by the City of Sunrise Beach Village.
2. Confirmation of well 4b capacity is pending City well performance evaluation.
3. High service pumps are not operated concurrently, as per City operations staff.

2.6 Model Run

The hydraulic model with the existing system configuration and pumping data is correlated to field conditions (reported by SBV) to improve the accuracy of the model results and provide a planning tool that can be used to identify system deficiencies and recommend improvements. Model calibration is the process of comparing model results with field results. In the absence of existing system hydrants, the hydraulic model was calibrated based upon the calculated hydraulic grade line of the system with elevated storage and pumping operations.

The existing well pumps were applied to feed supply water into the clear well at a constant head. The three (3) high service pumps were modeled as the source water supply from the clear well to the GST. The elevated position of the mountain top site allows the GST to function as an elevated storage for direct pressure service to the distribution system. Information about the SBV's distribution system was applied in WaterGEMS and hydraulic calculations performed to determine system flows and pressures. The hydraulic model was evaluated as a Steady State (SS) simulation, with no operating system pumps, operating range of GST, and a hydraulic grade line of 1,054 ft (elevation of the tank at low operating point). Pressure reducing valves (PRVs) were disabled from the model to avoid impact on model pressure results. The pumps and PRVs could not be accurately included in the dynamic 48-hour Extended Period Simulation (EPS) hydraulic model due to various system unknowns. Subsurface Utility Engineering (SUE) investigations findings, proposed in Phase 2, will provide an opportunity to update the model to reflect system configuration, system pump connections, and associated operations.

The four (4) system scenarios evaluated for the existing and projected future system include:

A. Existing SBV water system scenarios (reference Figure 2 and Figure 3):
    i. Existing Average Daily Demand (ADD, (SS)
    ii. Existing Maximum Daily Demand (MDD), (SS)
B. Future (2034) projected SBV water system scenarios (reference Figure 4 and Figure 5):
    i. Future Average Daily Demand (ADD), (SS)
    ii. Future Maximum Daily Demand (MDD), (SS)

The existing system scenarios were developed by applying the current system layout shown in Figure 1, the existing 1,030 connections, and the pumped data recorded in the Summer of 2022. The SBV water distribution system was not modified for future scenarios. A total of 1,200 connections have been applied for the 2034 system modeled scenarios. The location of modeled scenarios' low- and high-pressure points are shown in Figures 2A, 3A, 4A, and 5A below. Table 6 identifies system deficiencies based on model results and TCEQ minimum requirements.

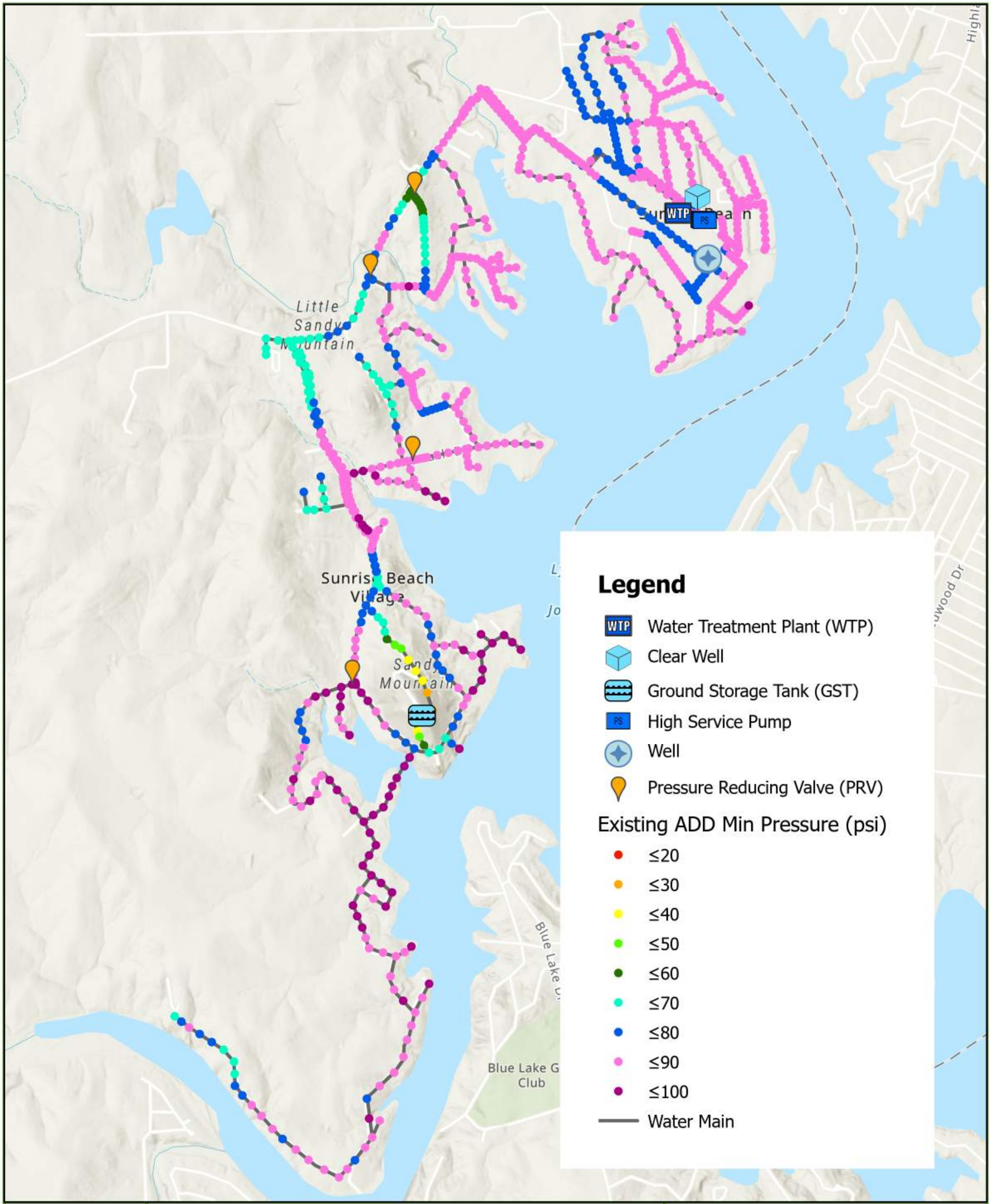

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Figure 2 - Existing Average Daily Demand (ADD) Minimum Pressure Model Results

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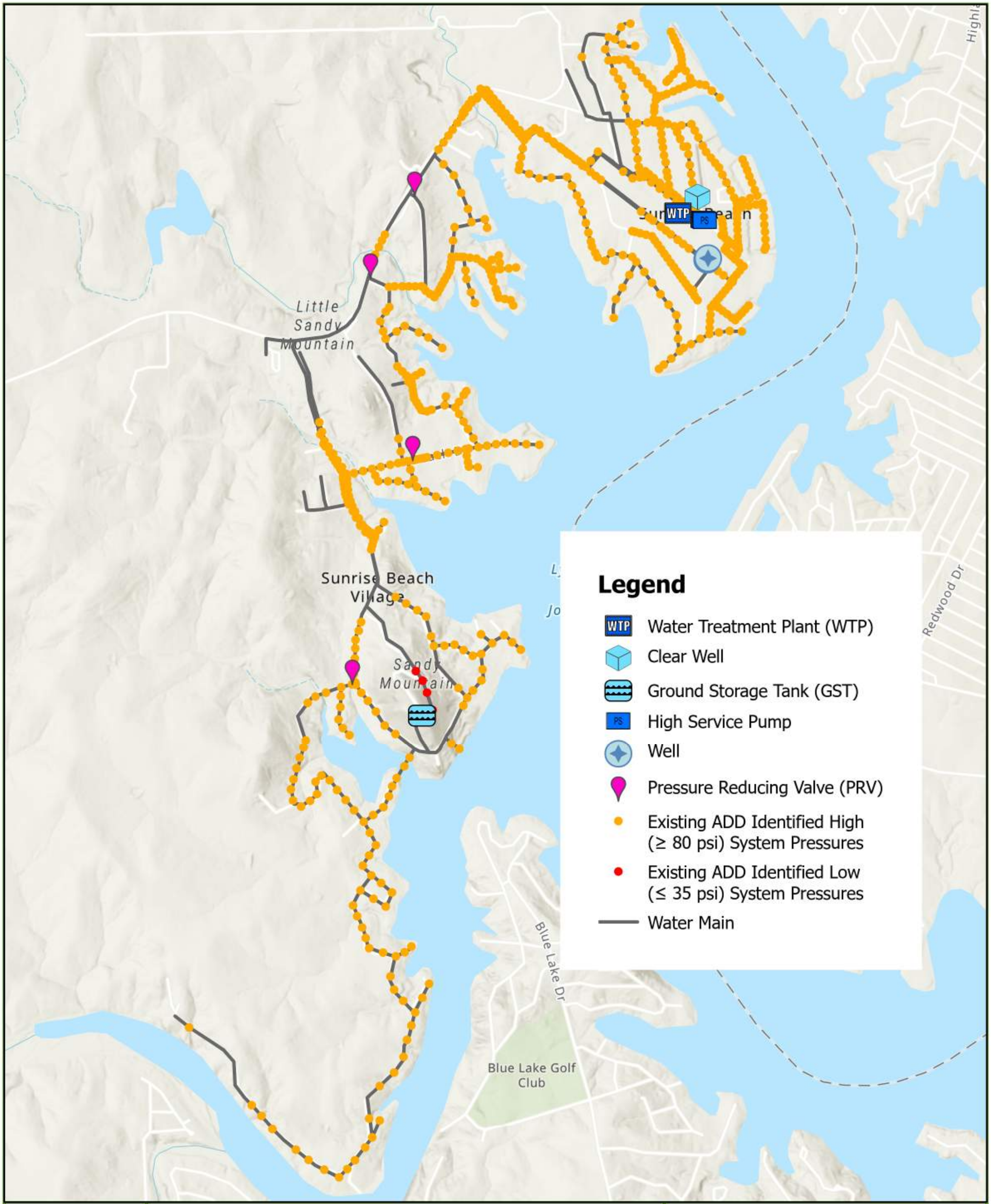

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Figure 2A - Existing Average Daily Demand (ADD) Identified System Pressure Issues Model Results

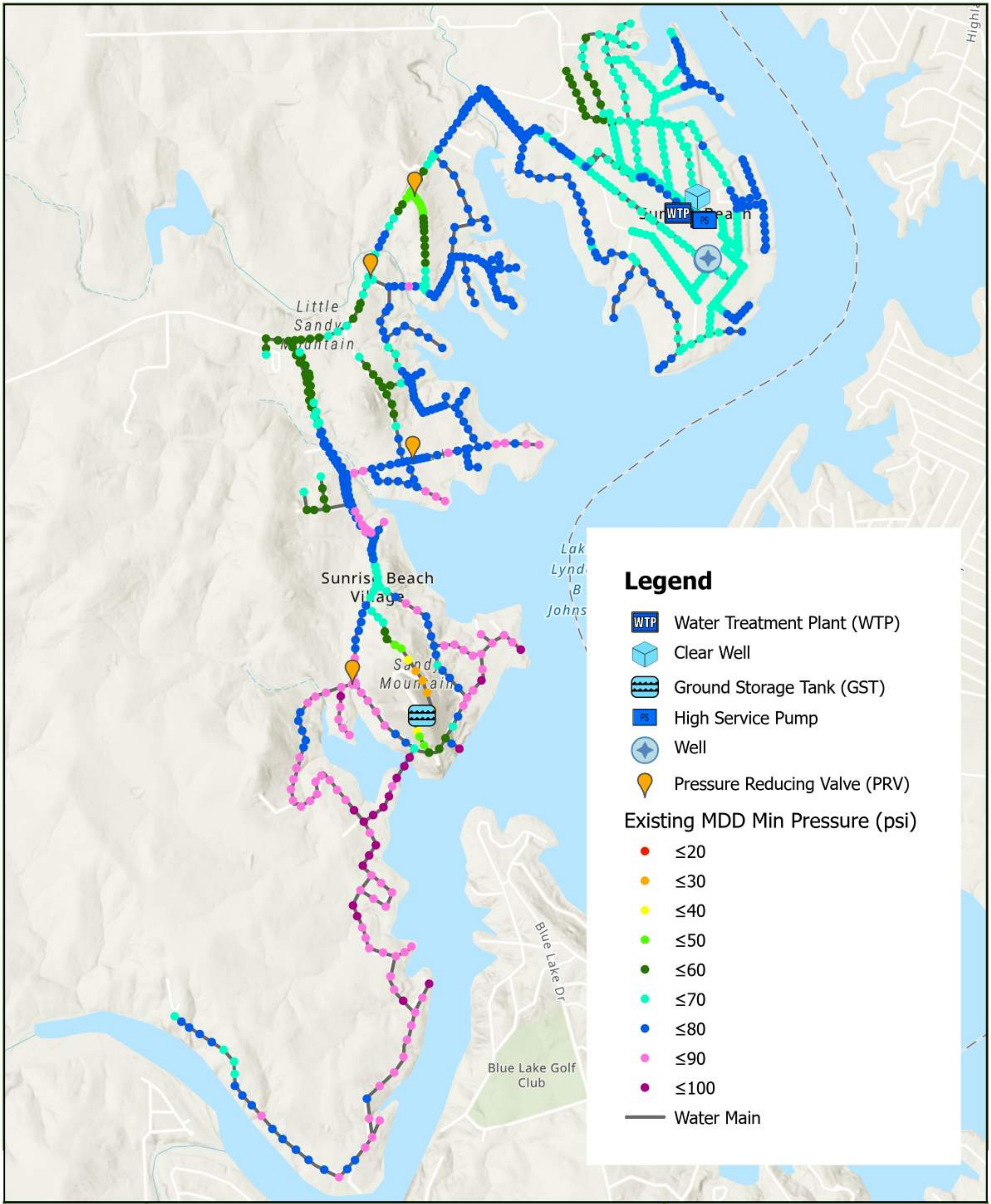

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Figure 3 - Existing Maximum Daily Demand (MDD) Minimum Pressure Model Results

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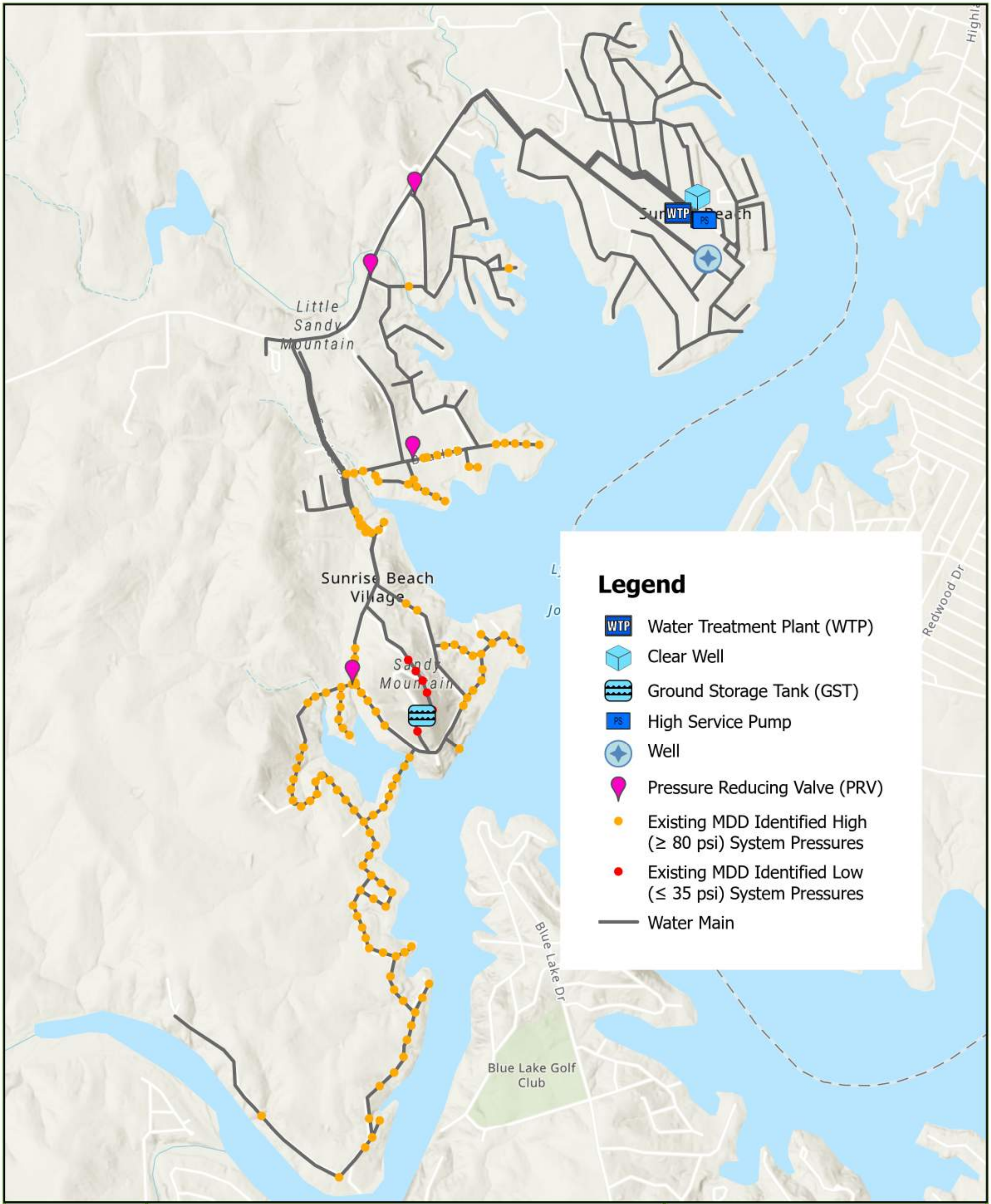

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Figure 3A - Existing Maximum Daily Demand (MDD) Identified System Pressure Issues Model Results

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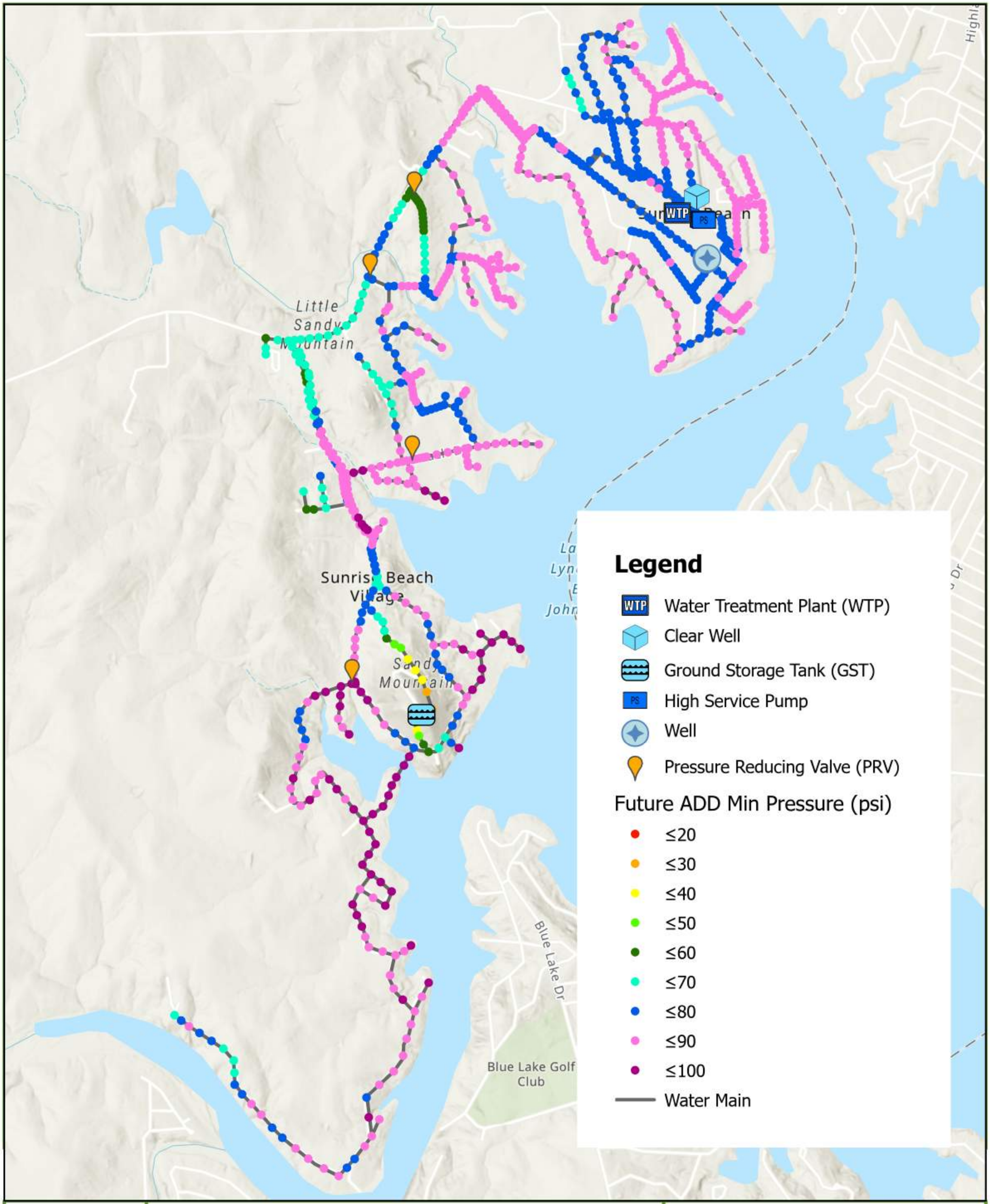

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Figure 4 - Future Average Daily Demand (ADD) Minimum Pressure Model Results

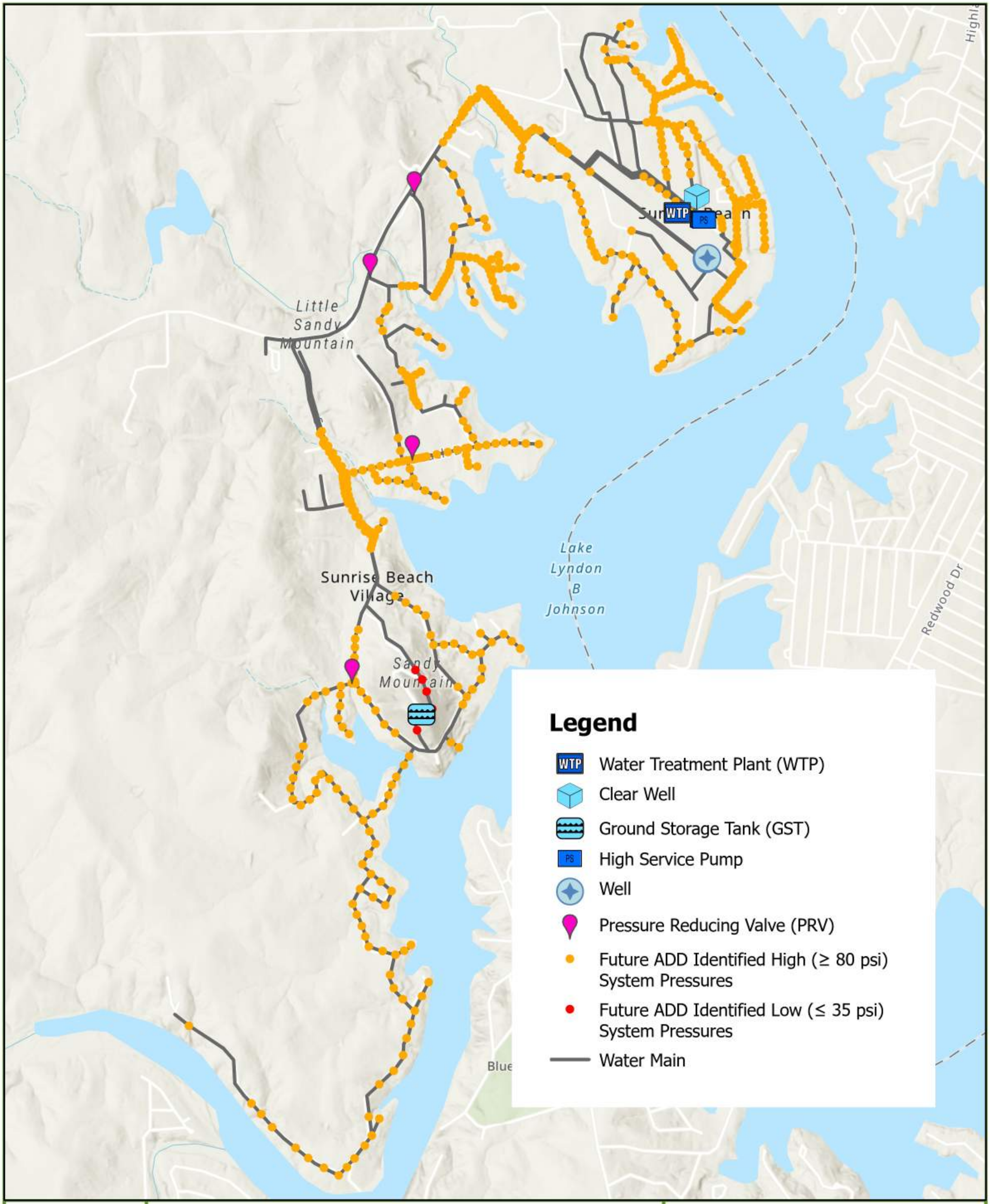

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Figure 4A - Future Average Daily Demand (ADD) Identified System Pressure Issues Model Results

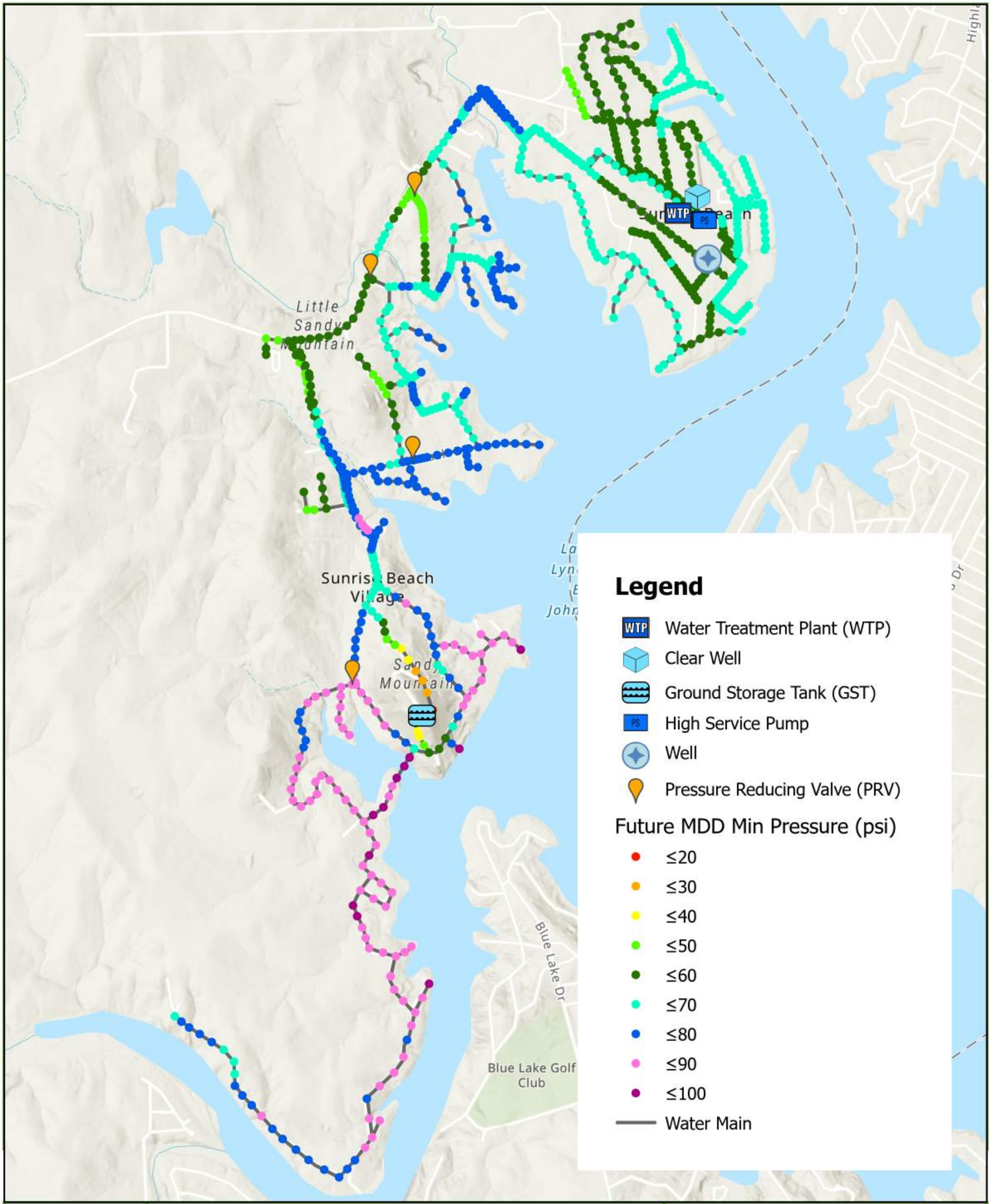

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Figure 5 - Future Maximum Daily Demand (MDD) Minimum Pressure Model Results

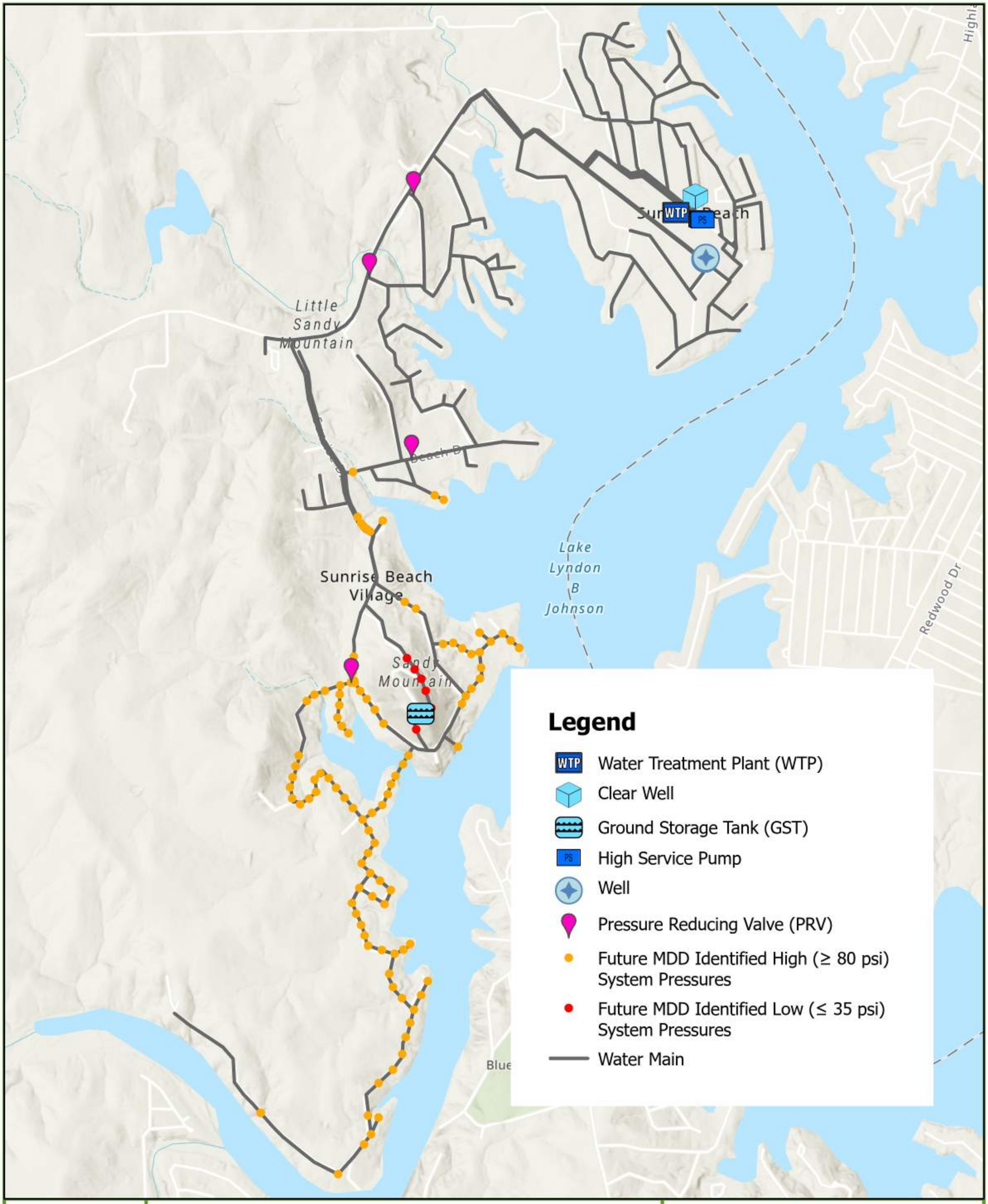

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Figure 5A - Future Maximum Daily Demand (MDD) Identified System Pressure Issues Model Results

3.0 System Analysis and Recommendations

3.1 TCEQ Requirements Discussion and System Analysis

The TCEQ provides rules and regulations for public water systems through the Texas Administrative Code (TAC) Title 30 Chapter 290 – Public Drinking Water. Below is a summary of the published rules and regulations referenced in the analysis of the SBV potable water system:

§290.38(26) Emergency operations. The operation of an affected utility during an extended power outage at a minimum water pressure of 35 pounds per square inch.

§290.38(27) Emergency power. Either mechanical power or electric generators which can enable the system to provide water under pressure to the distribution system in the event of a local power failure. With the approval of the executive director, dual primary electric service may be considered as emergency power in areas which are not subject to large scale power outages due to natural disasters.

§290.38(60) Peak hourly demand. In the absence of verified historical data, peak hourly demand means 1.25 times the maximum daily demand (prorated to an hourly rate) if a public water supply meets the commission's minimum requirements for elevated storage capacity and 1.85 times the maximum daily demand (prorated to an hourly rate) if the system uses pressure tanks or fails to meet the commission's minimum elevated storage capacity requirement.

TABLE 2 – §290.44(C) MINIMUM WATERLINE SIZES

Maximum Connections	Minimum Line Sizes (inches)
10	2
25	2.5
50	3
100	4
150	5
250	6
>250	8 and large

§290.44(d) Minimum pressure requirement. The system must be designed to maintain a minimum pressure of 35 psi at all points within the distribution network at flow rates of at least 1.5 gallons per minute per connection.

§290.45(b)(1)(D) For more than 250 connections, the system must meet the following requirements:

- **§290.45(b)(1)(D)(i)** two or more wells having a total capacity of 0.6 gpm per connection.

- **§290.45(b)(1)(D)(ii)** a total storage capacity of 200 gallons per connection.
- **§290.45(b)(1)(D)(iii)** two or more pumps that have a total capacity of 2.0 gpm per connection or that have a total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service, whichever is less, at each pump station or pressure plane. For systems which provide an elevated storage capacity of 200 gallons per connection, two service pumps with a minimum combined capacity of 0.6 gpm per connection are required at each pump station or pressure plane. If only wells and elevated storage are provided, service pumps are not required.
- **§290.45(b)(1)(D)(iv)** an elevated storage capacity of 100 gallons per connection or a pressure tank capacity of 20 gallons per connection. If pressure tanks are used, a maximum capacity of 30,000 gallons is sufficient for up to 2,500 connections.
- **§290.45(b)(1)(D)(v)** emergency power for systems which serve more than 250 connections and do not meet the elevated storage requirement. Sufficient emergency power must be provided to deliver a minimum of 0.35 gpm per connection to the distribution system in the event of the loss of normal power supply. Emergency power facilities in systems serving 1,000 connections or greater must be serviced and maintained in accordance with level 2 maintenance requirements contained in the current National Fire Protection Association (NFPA 110 Standard).

§290.45(b)(3) Any community public water system that is an affected utility shall have an emergency preparedness plan approved by the executive director and must meet the requirements for emergency operations contained in subsection (h) of this section. This includes any affected utility that provides 100 gallons of elevated storage capacity per connection.

3.2 Water Demands, Water Storage and Pumping

Based on data provided by City administration, SBV currently serves 1,030 connections and is projected to increase to approximately 1,200 connections by the year 2034. This potential increase in the number of connections served results in increased water demands and water supply requirements. For the current 1,030 connections, the system meets the TCEQ TAC Title 30 Chapter 290 minimum published requirements for water supply and pressure maintenance, although it does not meet the storage capacity and booster pumping requirements (reference Table 3). Table 4 and Table 5 display the system demand and the representation of capacity surplus and/or deficits for both the existing (2023) and projected future (2034) systems, respectively. Reference Tables 3, 4, and 5 notes for respective calculations and assumptions.

TABLE 3 – WATER SYSTEM CAPACITY PER CONNECTION BASED ON 30 TAC §290.45(B)(1)(D)

System Parameters	TCEQ Minimum System Requirements[1]	Existing System Capacity (1,030 connections)	Projected 2034 System Capacity (1,200 connections) with Existing System
Water Supply	0.60 gpm/conn	0.66 gpm/conn[2]	0.57 gpm/conn[2]
Storage Capacity	200 gal/conn	129 gal/conn[3]	110 gal/conn[3]
Pumping Capacity	2.00 gpm/conn	0.78 gpm/conn[4]	0.67 gpm/conn[4]
Pressure Maintenance	100 gal/con	110 gal/conn[5]	94.5 gal/conn[5]

Table 3 notes:

1. All minimum requirements are based on 30 TAC §290.45(b)(1)(D), as referenced in Section 3.2.
2. The calculated maximum water supply capacity is based on Well 4b and Well 4c combined capacity of 680 gpm, divided by 1,030 and 1,200 connections, respectively.
3. The calculated maximum storage capacity is based on the GST and clear well combined capacity of 132,358 gallons, divided by 1,030 and 1,200 connections, respectively.
4. The maximum pumping capacity is based on the scenario for which all high service pumps are running concurrently, at a combined rate of 800 gpm. The calculated capacities are established by the ratio of 800 gpm to 1,030 and 1,200 connections, respectively. High service pumps cannot be operated concurrently due to existing system configuration and operations, per City Operations staff.
5. The elevated GST position allows the tank to function as an elevated storage for direct pressure service to the distribution system. The pressure maintenance maximum capacity is based on the GST volume of 113,358 gallons, divided by 1,030 and 1,200 connections, respectively.

TABLE 4 – EXISTING SYSTEM DEMAND AND STORAGE VS. 30 TAC §290.45(B)(1)(D) REQUIREMENTS

System Parameters	TCEQ Minimum System Requirements	Existing (2023) System Capacity	Existing System Difference[1]
Average Daily Demand	N/A	192,412 gpd[2]	N/A
Maximum Daily Demand	N/A	393,916 gpd[2]	N/A
Water Supply (Well 4b + 4c)	618 gpm	680 gpm[3]	+62 gpm
Storage Capacity (GST + Clear Well)	206,000 gal	132,358 gal	(73,642 gal)
Pumping Capacity	2,060 gpm	800 gpm[4]	(1,260 gpm)
Pressure Maintenance (GST)	103,000	113,358 gal[5]	+10,358 gal

Table 4 notes:

1. The existing system difference is calculated as the delta between TCEQ 30 TAC minimum requirements and City provided existing system supply capacity.
2. There are no minimum or maximum raw average daily demand and maximum daily demand outlined on TCEQ requirements. Both values have been included in the tables for reference only. The system demands were reported by City staff for 2022 summer months.

3. The calculated maximum water supply capacity is based on Well 4b capacity of 300 gpm, and Well 4c capacity of 380 gpm. Based on discussions with City, Well 4b is not consistently yielding 300 gpm, thus 680 gpm may not represent actual system supply.
4. The maximum pumping capacity is based on the scenario for which all high service pumps are running concurrently, at a combined rate of 800 gpm. Per City operations, all three pumps do not typically run concurrently due to system configuration, thus 800 gpm may not represent actual system supply.
5. The elevated GST position allows the tank to function as an elevated storage for direct pressure service to the distribution system. The 2034 projected system and differences are calculated as the delta between TCEQ 30 TAC minimum requirements and City provided existing system supply capacity. No improvements projections were included as part of this table.

TABLE 5 – PROJECTED 2034 SYSTEM DEMAND AND STORAGE VS. 30 TAC §290.45(B)(1)(D) REQUIREMENTS

Parameters	**TCEQ Minimum Requirement**	**2034 Projected System Capacity[1]**	**2034 System Projected Difference[1]**
Average Daily Demand	N/A	224,169 gpd[2]	N/A
Maximum Daily Demand	N/A	458,931 gpd[2]	N/A
Water Supply (Well 4b + 4c)	720 gpm	680 gpm[3]	(40 gpm)
Storage Capacity (GST + Clear Well)	240,000 gal	132,358 gal	(107,642 gal)
Pumping Capacity	2,400 gpm	800 gpm[4]	(1,600 gpm)
Pressure Maintenance (GST)	120,000	113,358 gal[5]	(6,642 gal)

Table 5 notes:

1. The 2034 projected system and differences are calculated as the delta between TCEQ 30 TAC minimum requirements and City provided existing system supply capacity. No improvements projections were included as part of this table.
2. There are no minimum or maximum raw average daily demand and maximum daily demand outlined on TCEQ requirements. Both values have been included in the tables for reference only. The system demands were reported by City staff for 2022 summer months, and calculated for 2034 based on projected connection count.
3. The calculated maximum water supply capacity is based on Well 4b capacity of 300 gpm, and Well 4c capacity of 380 gpm. Based on discussions with City, Well 4b is not consistently yielding 300 gpm, thus 680 gpm may not represent actual system supply.
4. The maximum pumping capacity is based on the scenario for which all high service pumps are running concurrently, at a combined rate of 800 gpm. Per City operations, all three pumps do not typically run concurrently due to system configuration, thus 800 gpm may not represent actual system supply.
5. The elevated GST position allows the tank to function as an elevated storage for direct pressure service to the distribution system.

SBV's existing supply source consists of groundwater only. SBV does have water rights for surface water from the Lower Colorado River Authority (LCRA) should they seek to utilize surface water for additional water supply in the future. Substantial additional distribution system and facility infrastructure (treatment, pumping, storage) will be required if surface water rights are planned to be utilized as an additional water source.

3.3 Water Distribution System Pipelines and Pressures

Referencing TCEQ TAC Title 30 Chapter 290 requirements and the results of the system modeling, the following locations in the system were identified for improvements in Table 6. Reference Table 6 notes for improvements assumptions and recommendations.

TABLE 6 – WATER SYSTEM IDENTIFIED ISSUES & CONCERNS

P[1]	Location (listed from North to South)	Size	Length (LF)	Issue/Concerns	Reason
P1	Mountain Top	2”	1,925	Less than 35 psi & less than 4”	Number of connections exceed or have potential to exceed 30 TAC §290.44(C) requirements.[3]
P1	South of GST	6"	681.4	Less than 35 psi	Insufficient pressure due to elevation proximity to GST; cannot provide adequate service
P1	Circle Dr	4"	2,632	Bottleneck	Transition from 6” to 4”, then back to 6”
P1	Circle Dr	3"	79.8	Bottleneck & less than 4”	Transition from 4” to 3”, then back to 4”
P1	From Airview Blvd to Lakeshore Ln	4"	9,154.1	Bottleneck	Transition from 6” to 4”, then back to 6”
P1	Waterview Ln	2"	4,79.6	Bottleneck & less than 4”	Transition from 4” to 2”, then back to 4”
P1	Winding Way	4"	1,505.1	Bottleneck	Transition from 6” to 4”, then back to 6”
P1	Winding Way	6"	95.3	Bottleneck	Upon adjacent 6" improvements, it'll transition from 8" to 6", then back to 8"
P1	Hi View	2"	400	Bottleneck & less than 4”	Transition from 4” to 2”, then back to 4”
P1	Canyon Oaks	2"	200.7	Bottleneck & less than 4”	Transition from 8” to 2”, then to 6”
P1	From Beach Dr to Skyline Dr	4"	6,543.6	Bottleneck	Transition from 6” to 4”, to 3”, then back to 4”, then to 6”
P1	From Beach Dr to Skyline Dr	3"	253.7	Bottleneck & less than 4”	Transition from 6” to 4”, to 3”, then back to 4”, then to 6”
P1	Inspiration Dr	2"	923.7	Bottleneck	Transition from 4” to 2”, then to 6”
P1	Sandy Mountain Dr	4"	2,380.3	Bottleneck	Transition from 6” to 4”, to 2”, then back to 4”, then to 6”
P1	Sandy Mountain Dr	2"	1,475.4	Bottleneck & less than 4”	Transition from 6” to 4”, to 2”, then back to 4”, then to 6”
P2	Throughout System	661 locations		Greater than 80 psi	Potential need for PRVs[2]
P2	Throughout System	2"	18,488.2	Greater than 80 psi	Potential need for PRVs[2]
P2	Throughout System	3"	7,491.2	Greater than 80 psi	Transition from 6” to 4”, to 2”, then back to 4”, then to 6”
P2	Throughout System	4"	29,471.8	Greater than 80 psi	Potential need for PRVs[2]
P2	Throughout System	6"	33,152.7	Greater than 80 psi	Potential need for PRVs[2]
P2	W Lakeshore Dr	8"	2,324.3	Greater than 80 psi	Potential need for PRVs[2]
P2	Throughout System	2"	20,531.9	Less than 4”	Transition from 6” to 4”, to 2”, then back to 4”, then to 6”
P2	Throughout System	3"	7,796.5	Less than 4”	Number of connections exceed or have potential to exceed 30 TAC §290.44(C) requirements.[3]
P2	Well Header	Unknown	27.4	Unknown pipe size	System reliability and performance
P3	From Clear well to GST	6"	16,510.3	System reliability and performance	

Table 6 notes:

1. Priorities identified herein are further explained in Section 3.4.
2. An Extended Phase Simulation (EPS) model will be developed during Phase 2 to assess the need for PRVs.
3. All pipe segments smaller than 4 inches not included in Priority 1 have been recommended as part of Priority 2 improvements to provide improved distribution and reliability to system performance.

3.4 Recommended Improvements

Recommendations are divided into three categories:

- Priority 1 improvements – Improvements to the existing system required to comply with TCEQ requirements.
    - Priority 1A – Improvements to existing system to comply with TCEQ requirements for minimum pressure.
    - Priority 1B – Improvements to existing system to comply with TCEQ requirements for number of connections and minimum service line diameter.
    - Priority 1C – Improvements to existing system to comply with TCEQ requirements for number of connections and minimum service line diameter.
- Priority 2 improvements – Improvements to reliably achieve maximum daily demand in existing system.
- Priority 3 improvements – Improvements to meet demand needs for projected 2034 system connections (for projected 1,200 system connections).

Improvements related to pipe head losses and velocities were not identified as part of the Phase 1 model results, and will be evaluated based upon Subsurface Utility Engineering (SUE) investigations performed in Phase 2 analysis. An updated model will be developed based on the SUE findings to reflect updated system configuration and system pump connections and associated operations.

The recommendations' prioritization was established to first achieve TCEQ compliance, and construction sequencing proposed in Section 3.5 is dependent upon available funding for each fiscal year.

3.4.1 Priority 1 Findings and Recommendations

Modeled pressure results identified a need for a storage tank elevation that achieves a hydraulic grade line (pressure head) of 1,088 ft to meet the TCEQ minimum pressure requirement of 35 psi throughout the system. Existing GST has a base elevation of 1,041 ft. The lowest point in the system is at an elevation of approximately 820 feet, indicating a shortfall that can be addressed through the implementation of a GST with pumps, an Elevated Storage Tank (EST), or a combination of both. Infrastructure planning and sighting of additional storage capacity in Phase 2 will be essential for effective implementation. Pumping and emergency power requirements will be assessed to accommodate increased capacity reliably.

A comprehensive water loss audit is recommended to address the 24% water loss calculated based on recorded pumping and consumption data (all data provided by City with no assumed level of accuracy). Retail public utilities with less than 3,300 connections providing potable water are required by the TCEQ Title 31 TAC Chapter 358 – State Water Planning Guidelines to perform a water loss audit every five years. High system water loss is typically due to potential system leaks and system metering issues. Additionally, the replacement of consumption demand water meters and calibration of pump meters and SCADA output is advised to remedy inaccuracies in pumping and consumption demand measurements. Per City Operations staff, the SCADA system is not properly calibrated to the metering system, resulting in a high degree of error between pump flows and SCADA output. Whether the existing SCADA system can be calibrated or requires upgrade is a function of field findings, design, and engineering, which will be performed as part of Phase 2.

Reference Table 7 notes for detailed overview of calculations and assumptions. Considering available funds and construction sequencing, Priority 1 has been broken down into three sub-priorities: Priority 1A, 1B, and 1C. Priority breakdown was determined by physical proximity to account for construction sequencing and feasibility. The order of the three sub-priorities was established to first achieve TCEQ compliance with pressure deficiencies identified in the analysis.

TABLE 7 – SUMMARY OF PRIORITY 1 WATER SYSTEM IMPROVEMENTS

Category	Improvements Description	Quantity	Unit
P	Pipeline improvements for pressure deficiencies[1]		
	Priority 1A	*9,605.30*	*feet*
	Priority 1B	*1,600.40*	*feet*
	Priority 1C	*11,786.10*	*feet*
SD	Small diameter pipeline replacement for pipelines with a diameter 4 - inches and smaller[2]		
	Priority 1A	*4,978.80*	*feet*
	Priority 1B	*201.70*	*feet*
	Priority 1C	*559.40*	*feet*
S	Storage Improvements	75,000 – 110,000[3]	gal
PC	Pumping Capacity Improvements	1,260 – 1,600[3]	gpm

Table 7 notes:

1. Identified low pressure (less or equal to 35 psi) pipes and pipe bottlenecks (transition from larger to smaller to larger diameters), excluding 2” and 3” pipes.
2. 2” and 3” pipes experiencing either low pressures or at bottleneck locations.

3. Recommended storage improvement is based on calculated additional system storage capacity needed to meet TCEQ minimum requirements for 1,030 connections (reference Table 4). With a projected growth of up to 1,200 connections, an additional capacity of 35,000 gallons will be needed by 2034. It is recommended to combine improvements, and plan for a single tank with capacity of 110,000 gallons (reference Table 5). This approach benefits the overall available capacity, while allowing the City to operate at a lower capacity to prevent water age issues. It allows for a true fill draw diurnal rather than running pumps continuously and keeping the GST at maximum volume.
4. Similar to the recommendations for storage improvements, the additional minimum calculated pump capacity needed to meet TCEQ requirements for the existing system is 1,260 gpm. Should the City decide to plan for 2034 system improvements as part of Priority 1, new pumps will be needed to supply the additional capacity reliably. The minimum pumping capacity required by TCEQ for 1,200 connections is 1,600 gpm.

3.4.2 Priority 2 Findings and Recommendations

An updated model reflecting the revised system configuration and pumping connections will be developed based on the Phase 2 SUE findings. The current model simulations indicate areas with pressures exceeding 80 psi. In the next phase of work, an Extended Phase Simulation (EPS) model run will help assess the need for PRVs to reduce the occurrence of pressures in the system greater than 80 psi. Additionally, all pipe segments smaller than 4 inches not included in Priority 1 have been recommended as part of Priority 2 improvements to provide for improved distribution and reliability to system performance.

Reference Table 8 notes for detailed overview of calculations and assumptions.

TABLE 8 – SUMMARY OF PRIORITY 2 WATER SYSTEM IMPROVEMENTS

Category	Improvements Description	Quantity	Unit
P	Pipeline improvements for pressure deficiencies[1]	90,928.80	feet
SD	Small diameter pipeline replacement for pipelines with a diameter 4 - inches and smaller[2]	28,355.70	feet
PC	Pumping Capacity Improvements[3]	TBD	gpm

Table 8 notes:

1. Identified high pressure (greater or equal to 80 psi) pip segments. Upon Phase 2 SUE investigation, the identified pipe segments will be evaluated for the need to add PRVs.
2. 2” and 3” pipes not addressed as part of Priority 1 improvements.
3. Needs for additional pumping capacity may be identified during Phase 2 ESS model run.

3.4.3 Priority 3 Findings and Recommendations

Depending upon improvements made from Priority 1 and 2 recommendations, additional improvements will be required to meet both TCEQ TAC 30 requirements and system performance for future connections.

For example, should storage improvements be implemented to achieve the existing 1,030 connections, additional storage will be required to meet the requirements for the projected up to 1,200 connections (as reflected in Priority 3, Table 9). In addition, piping and pumping improvements may be required to facilitate any additional storage requirements.

Reference Table 9 notes for detailed overview of calculations and assumptions.

TABLE 9 – SUMMARY OF PRIORITY 3 WATER SYSTEM IMPROVEMENTS

Category	Improvements Description	Quantity	Unit
P	Pipeline improvements for system resiliency[1]	15,828.90	feet
S	Storage Improvements	35,000[2]	gal
PC	Pumping Capacity Improvements	340[3]	gpm
WP	Water Production Capacity	40[4]	gpm
PM	Pressure Maintenance Capacity	17,000[5]	gal

Table 9 notes:

1. This improvement is dependent upon the storage and associated infrastructure improvements made in Priority 1 and the need for additional storage in Priority 3.
2. The recommended approach is to add 110,000 gallons of storage as part of Priority 1 improvements (reference Table 7 footnotes). If City does not follow Priority 1 recommendations, additional 35,000 gallons are then recommended as part of Priority 3.
3. Similar to the recommended storage improvements, if 1,260 gpm of pumping capacity are added as part of Priority 1 improvements, an additional calculated capacity of 340 gpm will be needed to meet minimum TCEQ requirements and to supply the additional capacity reliably.
4. Feasibility study is recommended to evaluate ground water source supply capacity. Several wells were drilled in close proximity, resulting in pumping operations issues, and impacting the yield draw capacity of the existing system wells. Wells 4b and 4c are the only active wells that have been found to be consistently drawing.
5. The need for pressure maintenance capacity is contingent upon location of new storage improvements, and whether the new tank will function as an elevated storage for direct pressure service to the distribution system.

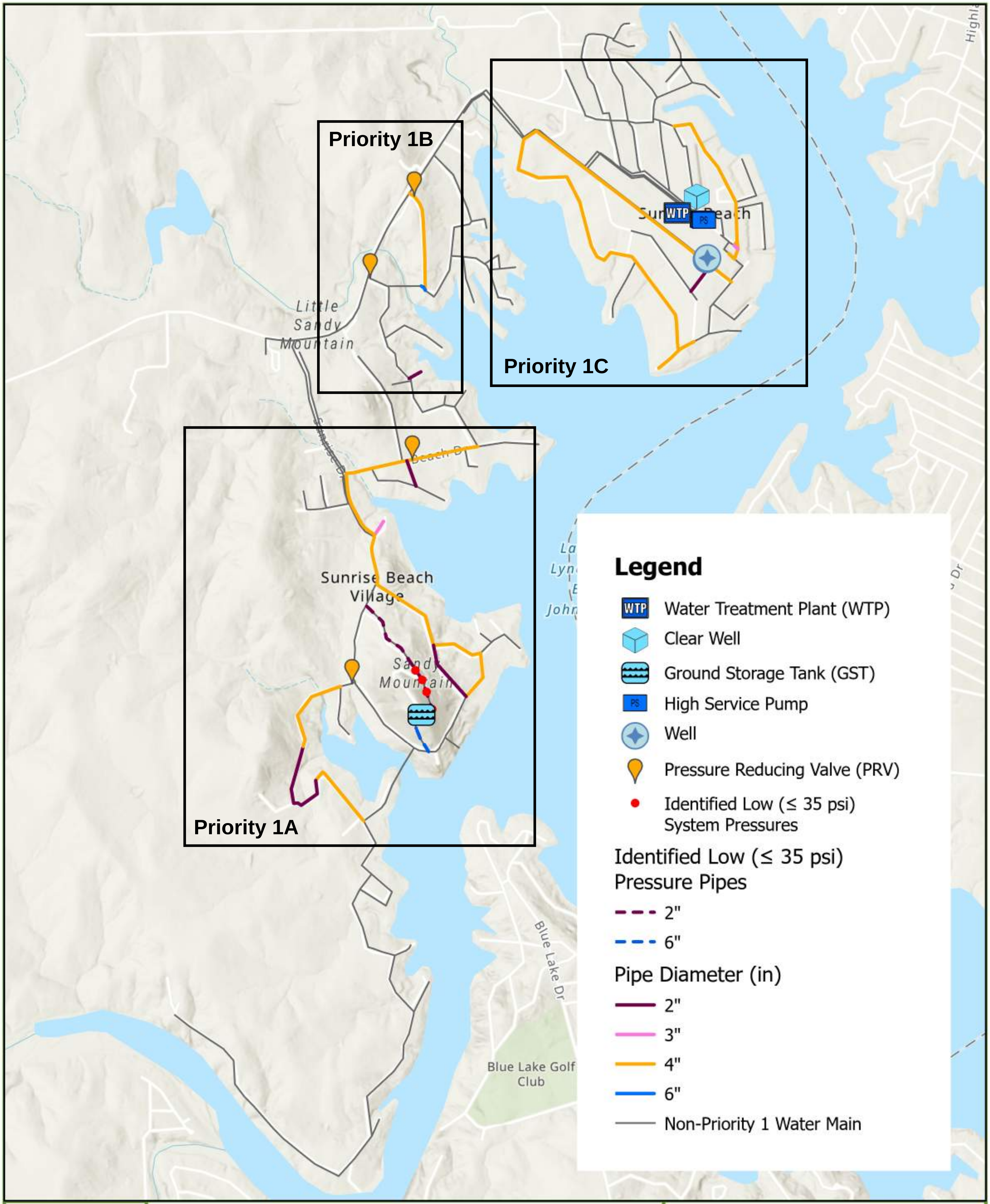

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Figure 6 - Water Distribution System Map
Priority 1 Improvements

N W E S

0 500 1,000
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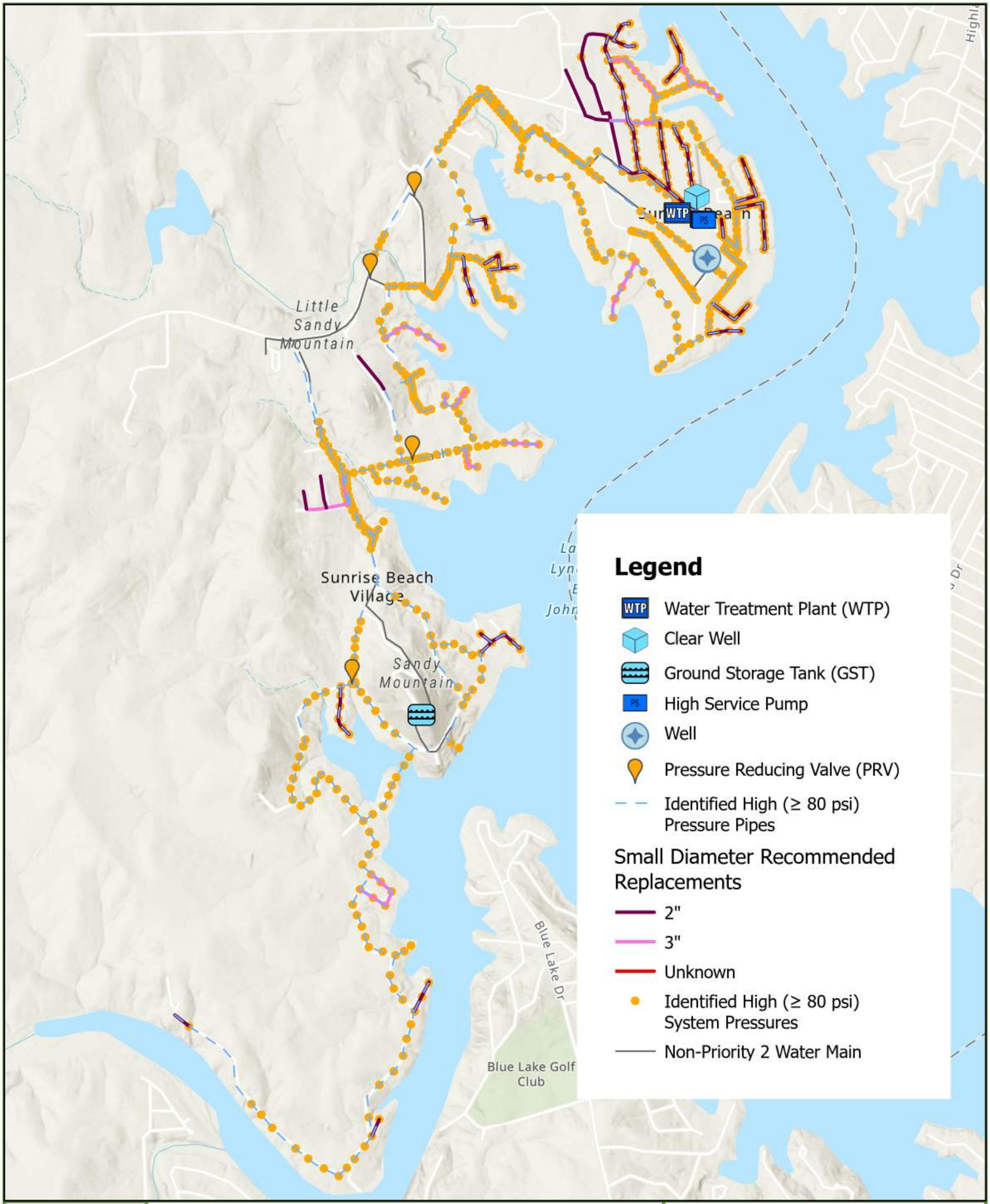

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Figure 7 - Water Distribution System Map
Priority 2 Improvements

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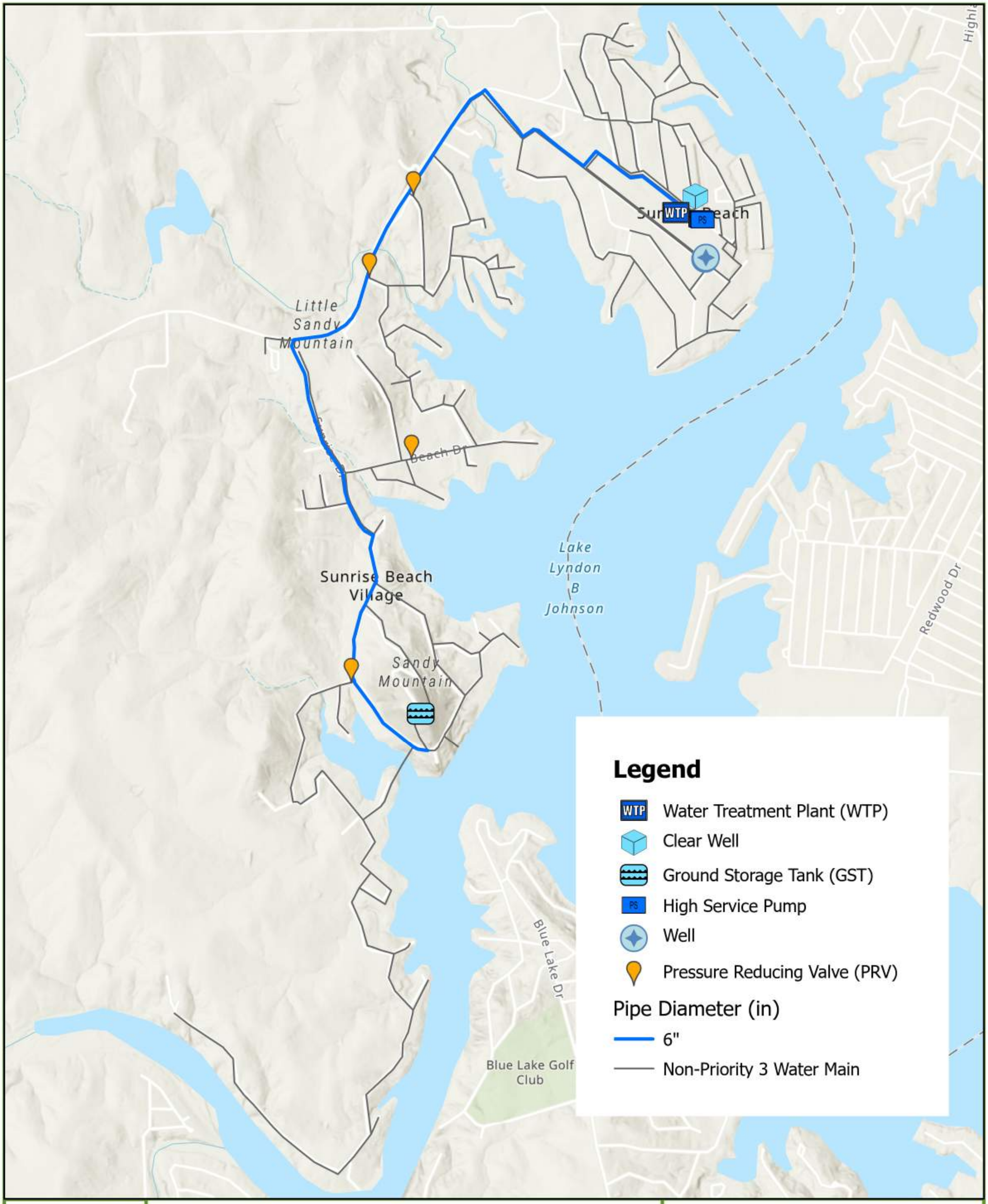

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Figure 8 - Water Distribution System Map
Priority 3 Improvements

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Feet

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3.5 Cost Estimates for All Water System Improvements

The presented costs are calculated using 2024 (first quarter) dollars, and have not been escalated to account for time and inflation. The total costs values include a contingency of 30 percent, and 15 percent for engineering cost and construction.

Storage improvements costs for Priority 2 and Priority 3 were not developed, as most recommended improvements will be contingent upon construction of Priority 1. Pipeline improvements for Priority 2 and Priority 3 were calculated considering Priority 1 recommendations have been implemented. Table 10 summarizes the Engineering Opinion of Probable Construction Costs (EOPCC) and proposed implementation schedule.

Reference Attachment A for EOPCC's breakdown.

TABLE 10 – SUMMARY OF ALL WATER SYSTEM IMPROVEMENTS

Recommended Improvements	2024 ($)	Design	Construction
Priority 1 Water System Improvements[1]			
Storage	$946,000	FY 2024 – 2025	FY 2025 – 2026
Pipeline Improvements for Deficiencies[2]			
Priority 1A	$7,363,000	FY 2025 – 2026	FY 2026 – FY 2028
Priority 1B	$1,034,000	FY 2026 – 2027	FY 2027 – FY 2028
Priority 1C	$5,869,000	FY 2027 - 2028	FY 2028 – FY 2030
Subtotal	$15,213,000		
Priority 2 Water System Improvements[3]			
Pipeline Improvements for Deficiencies	$11,339,000	FY 2031 – FY 2033	FY2032 – FY 2036
Storage	Dependent upon improvements made in Priority 1		
Priority 3 Water System Improvements[4]			
Pipeline Improvements for Deficiencies	$10,101,000	FY 2036 – FY 2038	FY 2037 – FY 2040
Storage	Dependent upon improvements made in Priority 1 and 2		

Table 10 Notes:

1. Priority 1 improvements are to be performed in sequence with storage improvements first and pipeline improvements to follow based upon pipeline system improvements required to facilitate

increased system storage and resultant system distribution capacity. Construction schedule is dependent upon available funding each fiscal year.

2. Reference Figure 6 and Appendix A for a breakdown of Priority 1 into Priority 1A, 1B, and 1C. Priority breakdown was determined by physical proximity to account for construction sequencing and feasibility. The order of the three sub-priorities was established to first achieve TCEQ compliance with pressure deficiencies identified in the analysis.
3. Priority 2 improvements are to be performed following the completion of Priority 1 improvements and as funding allows in subsequent budget years.
4. Priority 3 improvements are to be performed following the completion of Priority 1 and 2 improvements and dependent upon experienced system growth and number of connections added to the system, as funding allows and in subsequent budget years.

Attachment A

Engineering Opinion of Probable Construction Costs

Engineering Opinion of Probable Construction Costs (EOPCC)
Phase 1 Improvements: Priority 1 Storage & Pumping Improvements
City of Sunrise Beach Village

		Qty	Unit	Unit Price	Subtotal Price
	General Requirements				
	General Contractor Overhead, Mobilization, etc.	1	LS	$ 60,000	$ 60,000
	Subtotal General Requirements				**$ 60,000**
	Storage & Pumping Improvements				
Note 1	110,000-gal Storage Tank	1	LS	$ 350,000	$ 350,000
	1,600-gpm Pumping Capacity	1	LS	$ 105,000	$ 105,000
Note 4	Associated Storage & Pumps Improvements	1	LS	$ 136,500	$ 136,500
	Subtotal Storage & Pumping Improvements				**$ 591,500**
	Subtotal				**$ 652,000**
	Contingency (30%)				$ 196,000
Note 2, 3	Engr Design/Admin (15%)				$ 98,000
	Total				**$ 946,000**

Notes:

1. Infrastructure planning and sighting of additional storage capacity will be performed in Phase 2.
2. Survey (topographic, SUE) and geotechnical work is not included in the Engr Design/Admin 15% and dependent upon site selected for storage improvements.
3. Phase 2 includes calibrating the model with additional field data collection at an additional cost not reflected in the engineering design/admin 15% estimate.
4. Storage system improvements design my require additional system improvements subject to the site selection.

Engineering Opinion of Probable Construction Costs (EOPCC)
Phase 1 Improvements: Priority 1A Pipeline Improvements
City of Sunrise Beach Village

		Qty	Unit	Unit Price	Subtotal Price
	General Requirements				
	General Contractor Overhead, Mobilization, etc.	1	LS	$ 462,000	$ 462,000
	Subtotal General Requirements				**$ 462,000**
	Pipeline Improvements				
	New 4-inch Water Line				
	Bottleneck: Ex. 2" - Hi Vw	400	LF	$ 250	$ 100,000
	New 6-inch Water Line				
	Bottleneck: Ex. 4" - From Beach Dr to Skyline Dr	6,544	LF	$ 300	$ 1,963,080
	Bottleneck: Ex. 3" - From Beach Dr to Skyline Dr	254	LF	$ 300	$ 76,110
	Bottleneck: Ex. 2" - Inspiration Dr	924	LF	$ 300	$ 277,110
	Bottleneck: Ex. 4" - Sandy Mountain Dr	2,380	LF	$ 300	$ 714,090
	Bottleneck: Ex. 2" - Sandy Mountain Dr	1,475	LF	$ 300	$ 442,620
	New 10-inch Water Line				
	Less than 35psi: Ex. 2" - Mountain Top	1,925	LF	$ 400	$ 770,000
Note 1	*Less than 35psi: Ex. 6" - South of GST*	681	LF	$ 400	$ 272,560
	Subtotal Pipeline Improvements				**$ 4,615,570**
				Subtotal	**$ 5,078,000**
				Contingency (30%)	$ 1,523,000
	Note 2			Engr Design/Admin (15%)	$ 762,000
				Total	**$ 7,363,000**

Notes:

1. Proposed water main size to be confirmed upon Phase II model results.
2. Survey (topographic, SUE) and geotechnical work is not included in the Engr Design/Admin 15% and dependent upon location of work.

Engineering Opinion of Probable Construction Costs (EOPCC)
Phase 1 Improvements: Priority 1B Pipeline Improvements
City of Sunrise Beach Village

		Qty	Unit	Unit Price	Subtotal Price
	General Requirements				
	General Contractor Overhead, Mobilization, etc.	1	LS	$ 65,000	$ 65,000
	Subtotal General Requirements				**$ 65,000**
	Pipeline Improvements				
Note 1	*Bottleneck: Ex. 4" - Winding Way*	1,505	LF	$ 360	$ 541,836
Note 1	*Bottleneck: Ex. 6" - Winding Way*	95	LF	$ 360	$ 34,308
	Bottleneck: Ex. 2" - Canyon Oaks	201	LF	$ 360	$ 72,252
	Subtotal Pipeline Improvements				**$ 648,396**
				Subtotal	**$ 713,000**
				Contingency (30%)	$ 214,000
	Note 2			Engr Design/Admin (15%)	$ 107,000
				Total	**$ 1,034,000**

Notes:

1. Recommended upsizing both segments to 8" to avoid future bottleneck issues upon execution of Priority 3 Improvements. Upsizing existing 1505 LF of 4" to 6" is sufficient for current system bottleneck issues.
2. Survey (topographic, SUE) and geotechnical work is not included in the Engr Design/Admin 15% and dependent upon location of work.

Engineering Opinion of Probable Construction Costs (EOPCC)
Phase 1 Improvements: Priority 1C Pipeline Improvements
City of Sunrise Beach Village

	Qty	Unit	Unit Price	Subtotal Price
General Requirements				
General Contractor Overhead, Mobilization, etc.	1	LS	$ 368,000	$ 368,000
Subtotal General Requirements				**$ 368,000**
Pipeline Improvements				
New 4-inch Water Line				
Bottleneck: Ex. 2" - Waterview Ln	480	LF	$ 250	$ 119,900
New 6-inch Water Line				
Bottleneck: Ex. 4" - Circle Dr	2,632	LF	$ 300	$ 789,600
Bottleneck: Ex. 3" - Circle Dr	80	LF	$ 300	$ 23,940
Bottleneck: Ex. 4" - From Airview Blvd to Lakeshore Ln	9,154	LF	$ 300	$ 2,746,230
Subtotal Pipeline Improvements				**$ 3,679,670**
			Subtotal	**$ 4,048,000**
			Contingency (30%)	$ 1,214,000
Note 1			Engr Design/Admin (15%)	$ 607,000
			Total	**$ 5,869,000**

Notes:

1. Survey (topographic, SUE) and geotechnical work is not included in the Engr Design/Admin 15% and dependent upon location of work.

Engineering Opinion of Probable Construction Costs (EOPCC)
Phase 1 Improvements: Priority 2 Pipeline Improvements
City of Sunrise Beach Village

		Qty	Unit	Unit Price	Subtotal Price
	General Requirements				
	General Contractor Overhead, Mobilization, etc.	1	LS	$ 711,000	$ 711,000
	Subtotal General Requirements				**$ 711,000**
	Pipeline Improvements for System Resiliency				
Note 1	**New 4-inch Water Line**				
	Existing 2"	20,532	LF	$ 250	$ 5,132,975
	Existing 3"	7,797	LF	$ 250	$ 1,949,125
	Existing Unknown Size	27	LF	$ 250	$ 6,850
Note 2	**Pressure Release Valves (PRVs)**	4	EA	$ 5,000	$ 20,000
	Subtotal Pipeline Improvements for System Resiliency				**$ 7,108,950**
				Subtotal	**$ 7,820,000**
				Contingency (30%)	$ 2,346,000
	Note 3			Engr Design/Admin (15%)	$ 1,173,000
				Total	**$ 11,339,000**

Notes:

1. All pipe segments smaller than 4" and not included as part of Priority 1 improvements have been herein recommended for upsizing. Reference Figure 7 for map of proposed improvements.
2. From Phase 2 Subsurface Utility Engineering (SUE) investigation findings, the identified pipe segments in Figure 7 will be evaluated for the need to add PRVs.
3. Survey (topographic, SUE) and geotechnical work is not included in the Engr Design/Admin 15% and dependent upon location of work.

Engineering Opinion of Probable Construction Costs (EOPCC)
Phase 1 Improvements: Priority 3 Pipeline Improvements
City of Sunrise Beach Village

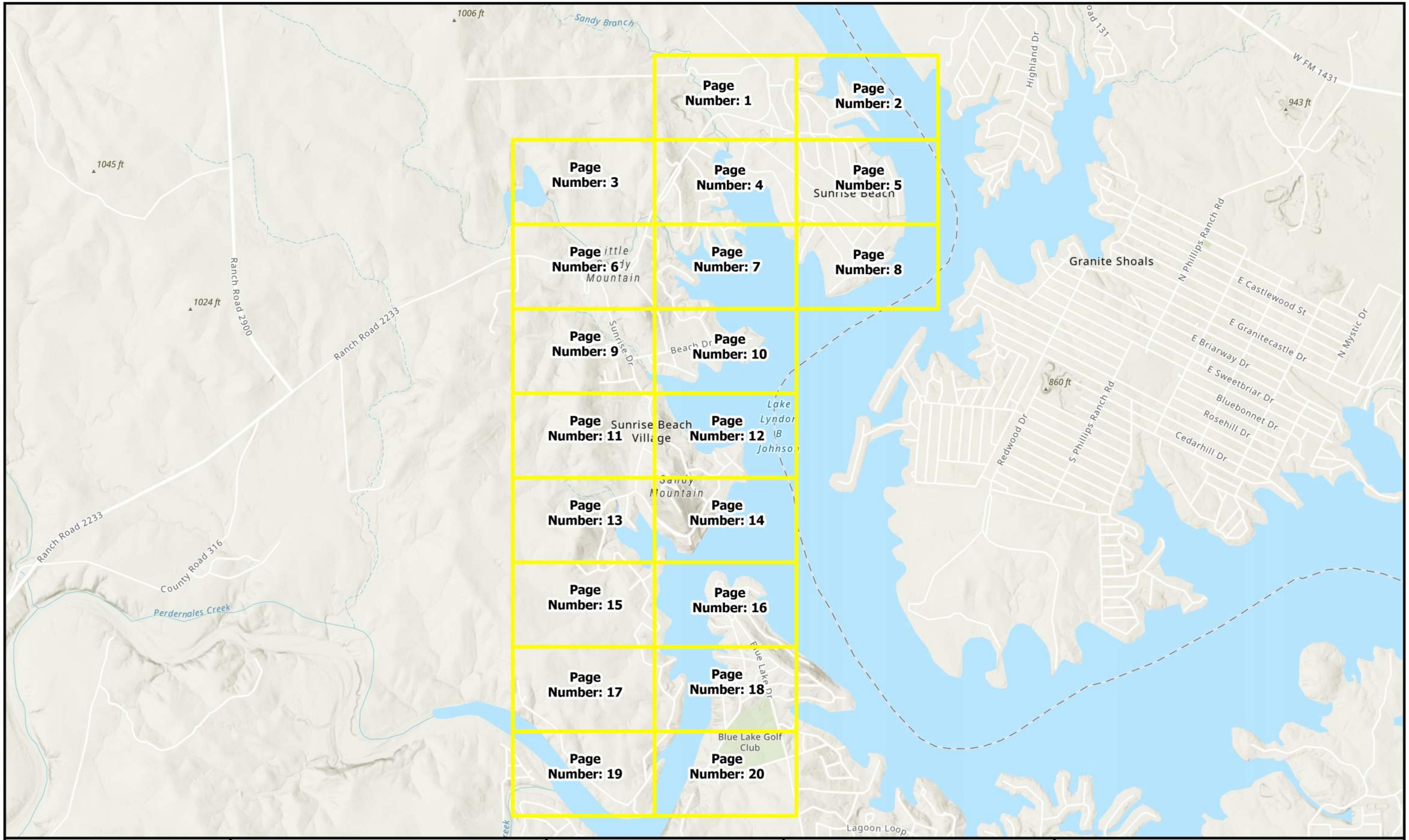
		Qty	Unit	Unit Price	Subtotal Price
	General Requirements				
	General Contractor Overhead, Mobilization, etc.	1	LS	$ 634,000	$ 634,000
	Subtotal General Requirements				**$ 634,000**
	Pipeline Improvements for System Resiliency				
Note 1	New 10-inch Water Line - from Clear Well to GST	15,829	LF	$ 400	$ 6,331,560
	Subtotal Pipeline Improvements for System Resiliency				**$ 6,331,560**
				Subtotal	**$ 6,966,000**
				Contingency (30%)	$ 2,090,000
Note 2				Engr Design/Admin (15%)	$ 1,045,000
				Total	**$ 10,101,000**

Notes:

1. Proposed water main size to be confirmed upon Phase II model results. Quantities exclude Priority 1 and Priority 2 improvements.
2. Survey (topographic, SUE) and geotechnical work is not included in the Engr Design/Admin 15% and dependent upon location of work.

Attachment B

Map Book of Sunrise Beach Village Water System



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Map Book of Sunrise Beach Village Water System Coversheet

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WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

GENERAL
COVERSHEET

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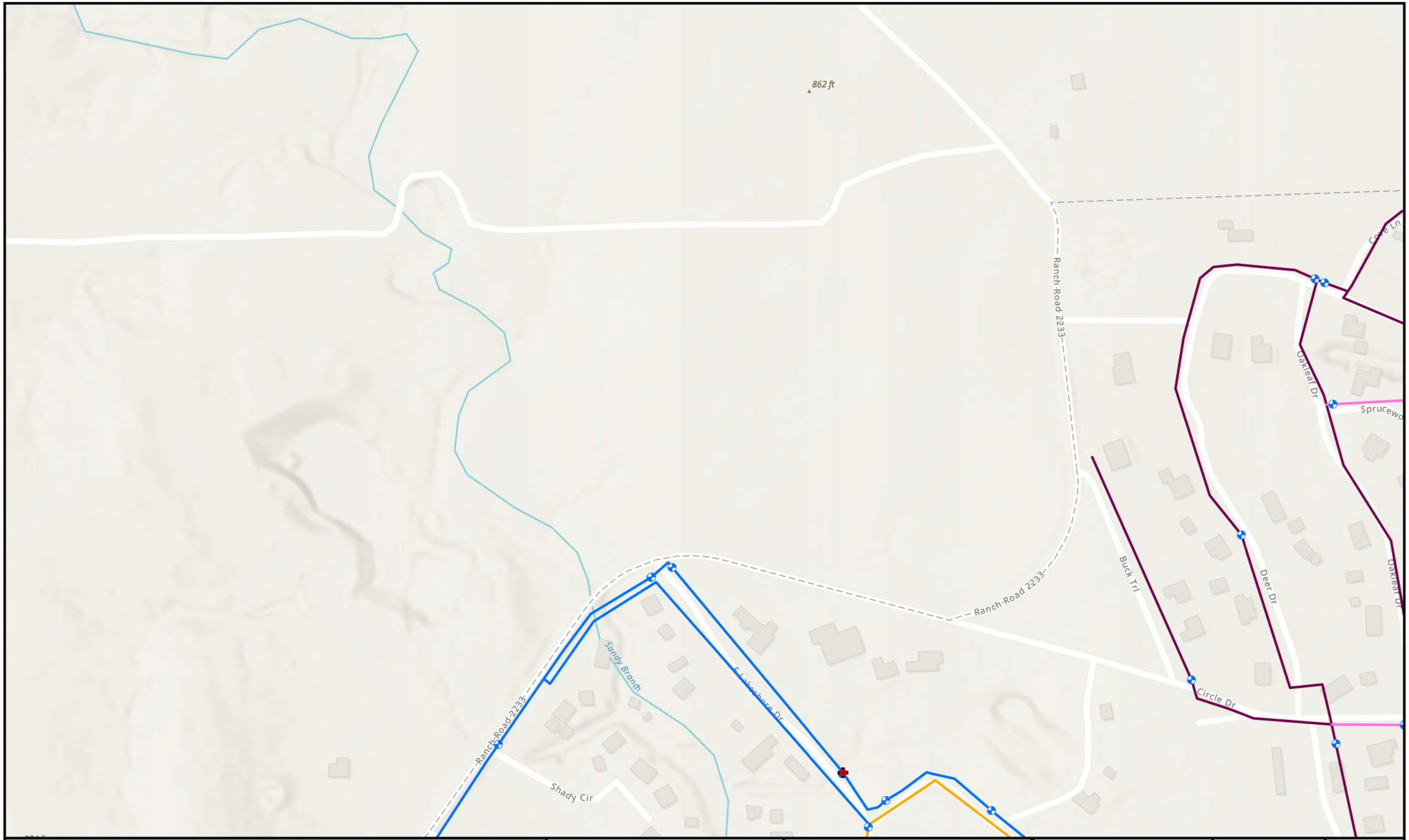

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✚ Flushing Valve

● Water System Valve

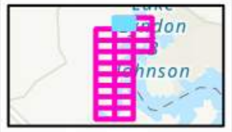
— 2"

— 6"

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024



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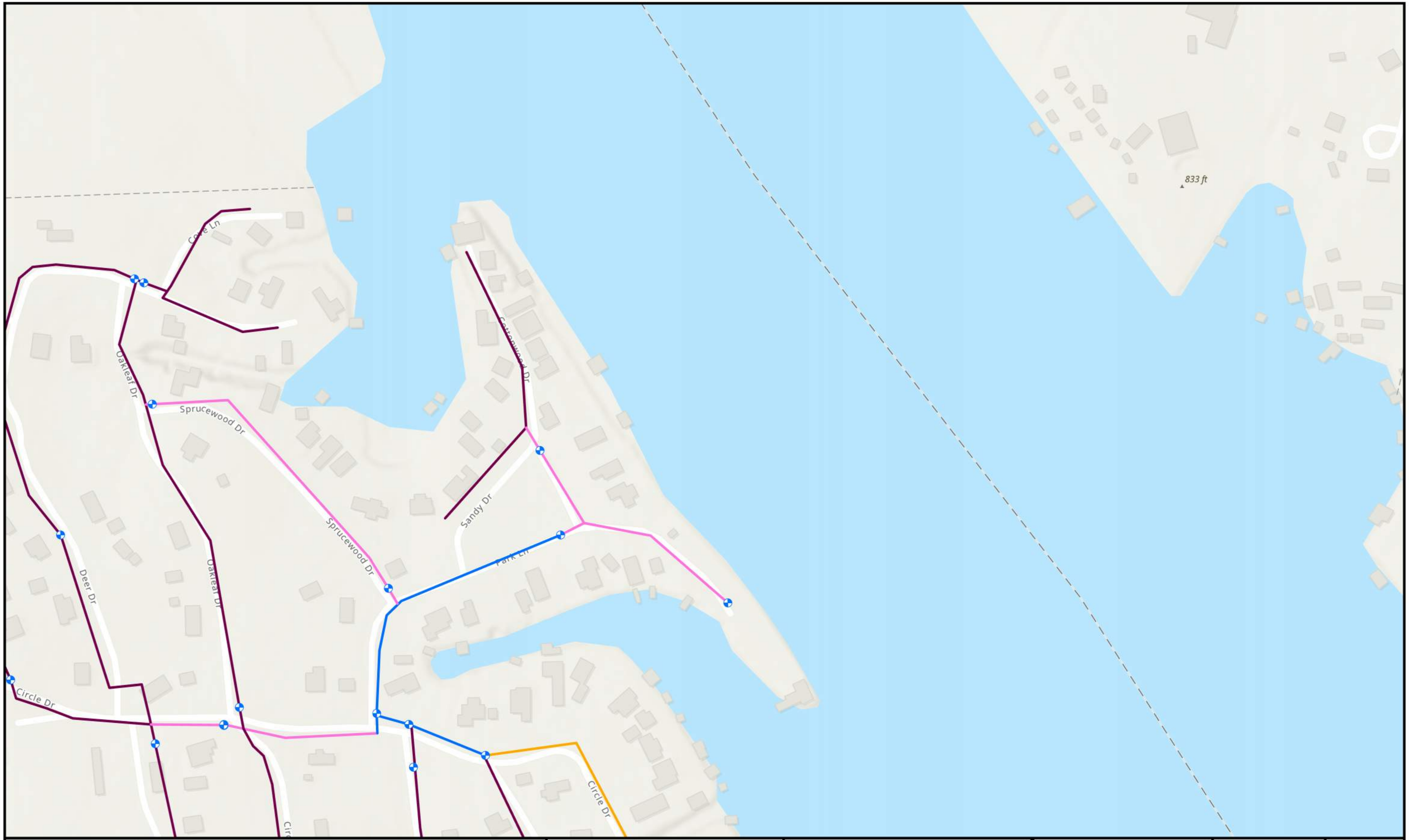

● Water System Valve
— 2"
— 3"
— 4"
— 6"

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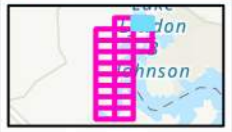
0 125 250 500
Feet
1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024



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2 of 20

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⊕ Water System Valve

— 6"

See Page 6

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1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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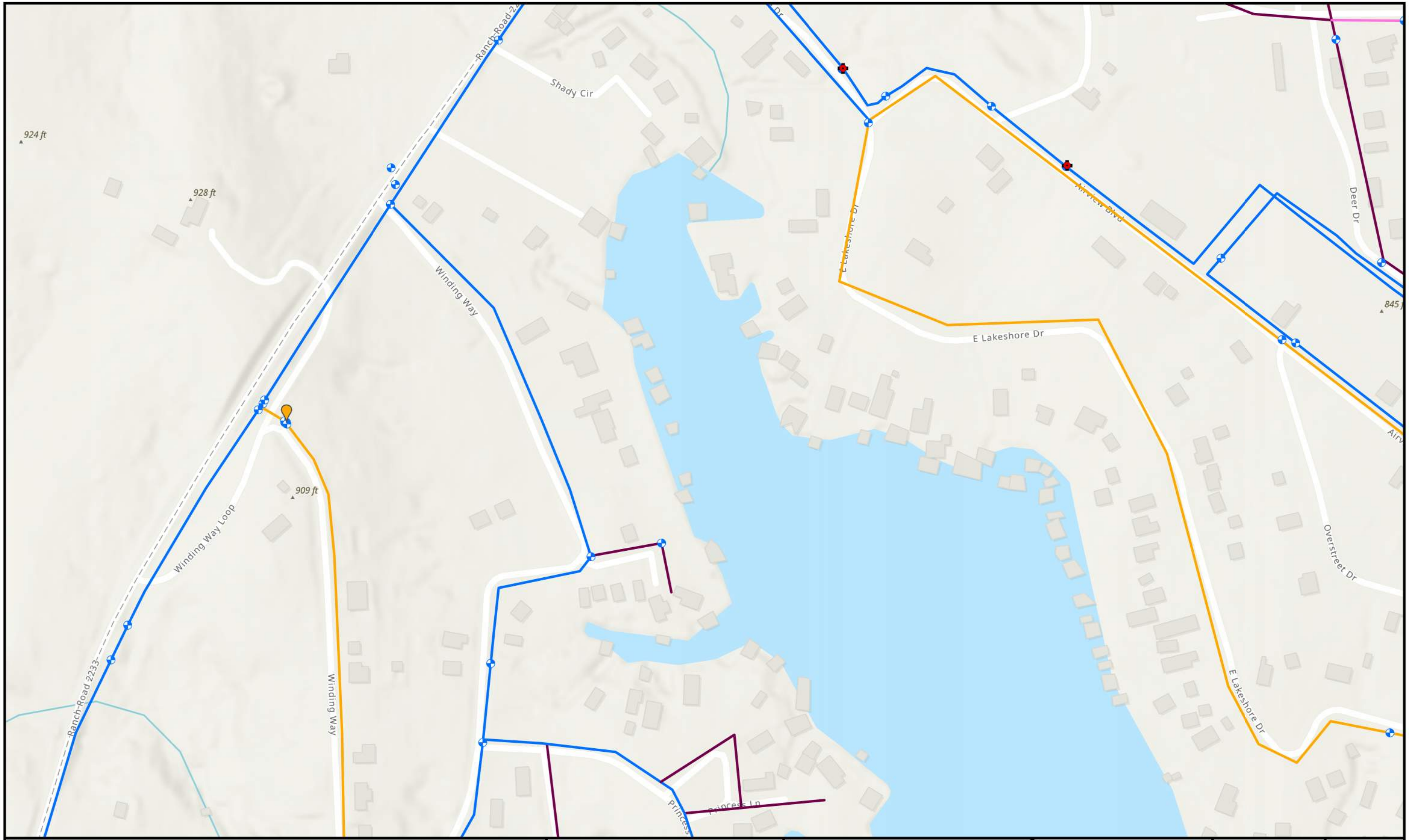


✚ Flushing Valve

Pressure Reducing Valve (PRV)

Water System Valve

6"

2"

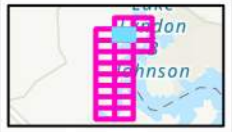
4"

HRG
HRGreen

See Page 7

0 125 250 500
Feet
1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024



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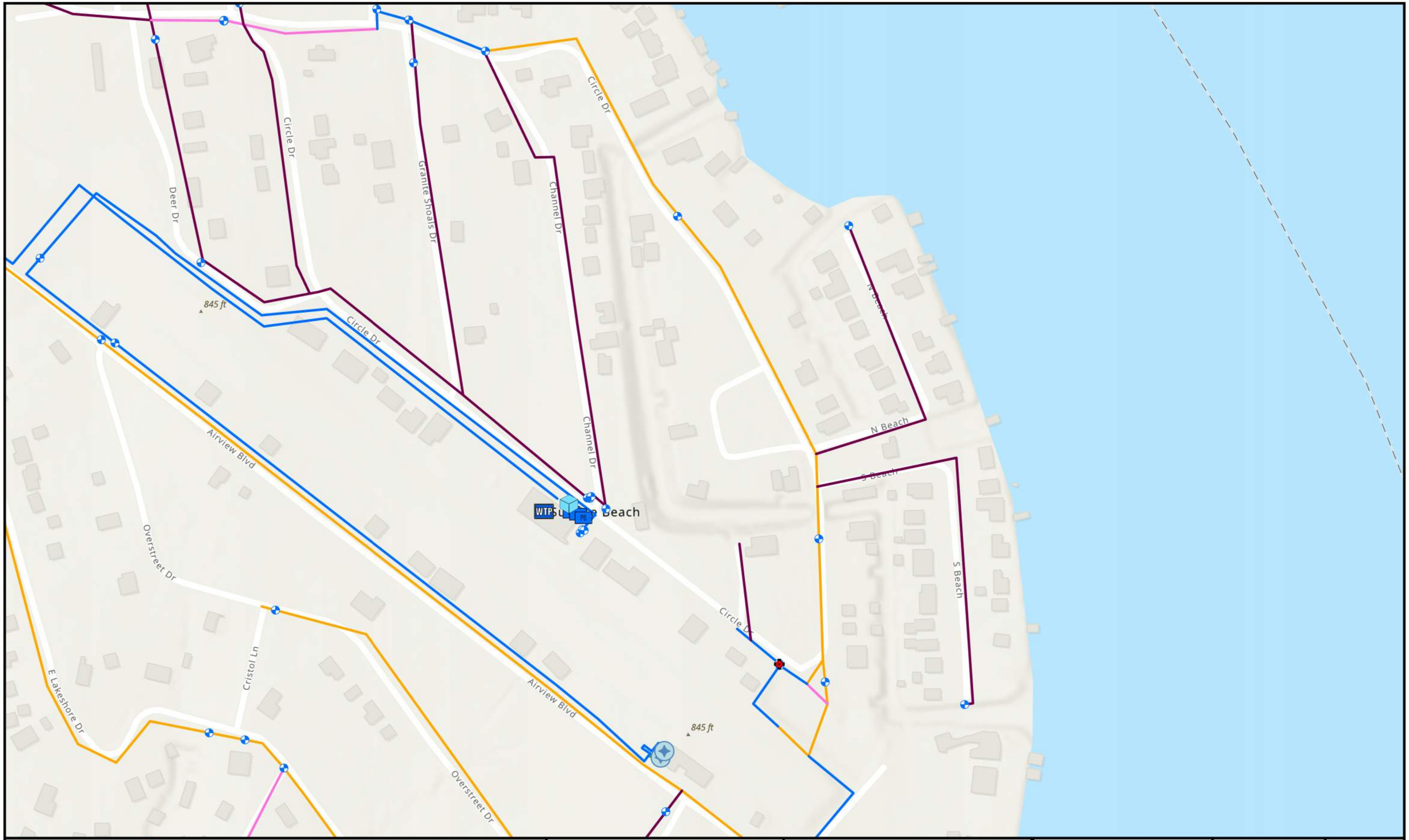

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✚ Flushing Valve
WTP Water Treatment Plant (WTP)
Clear Well
PS High Service Pump
Well
Water System Valve
— 2"
— 3"
— 4"
— 6"
— 8"
— Unknown

HRGreen

0 125 250 500 Feet
1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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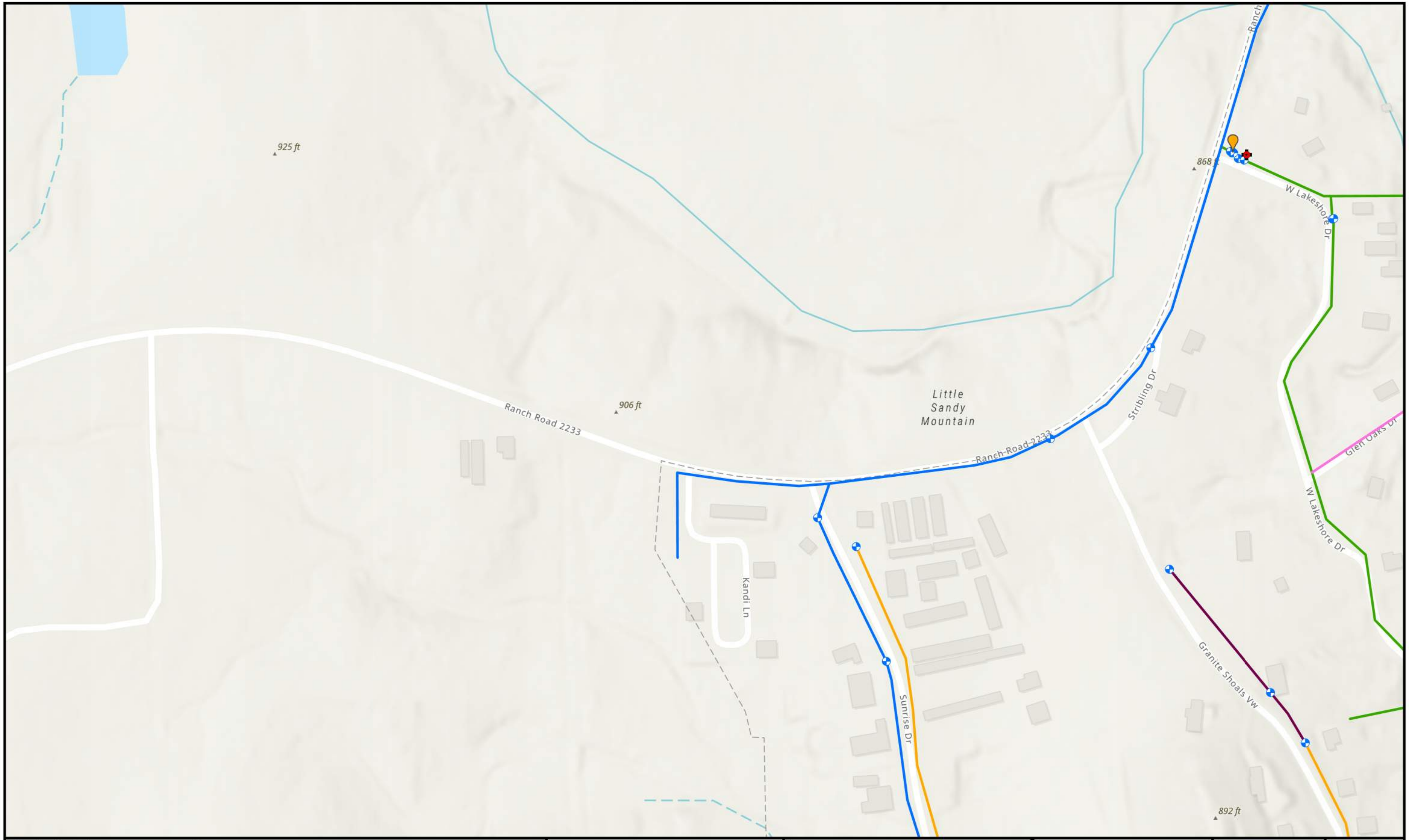

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✚	Flushing Valve	—	2"
●	Pressure Reducing Valve (PRV)	—	4"
●	Water System Valve	—	6"
		—	8"

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See Page 9

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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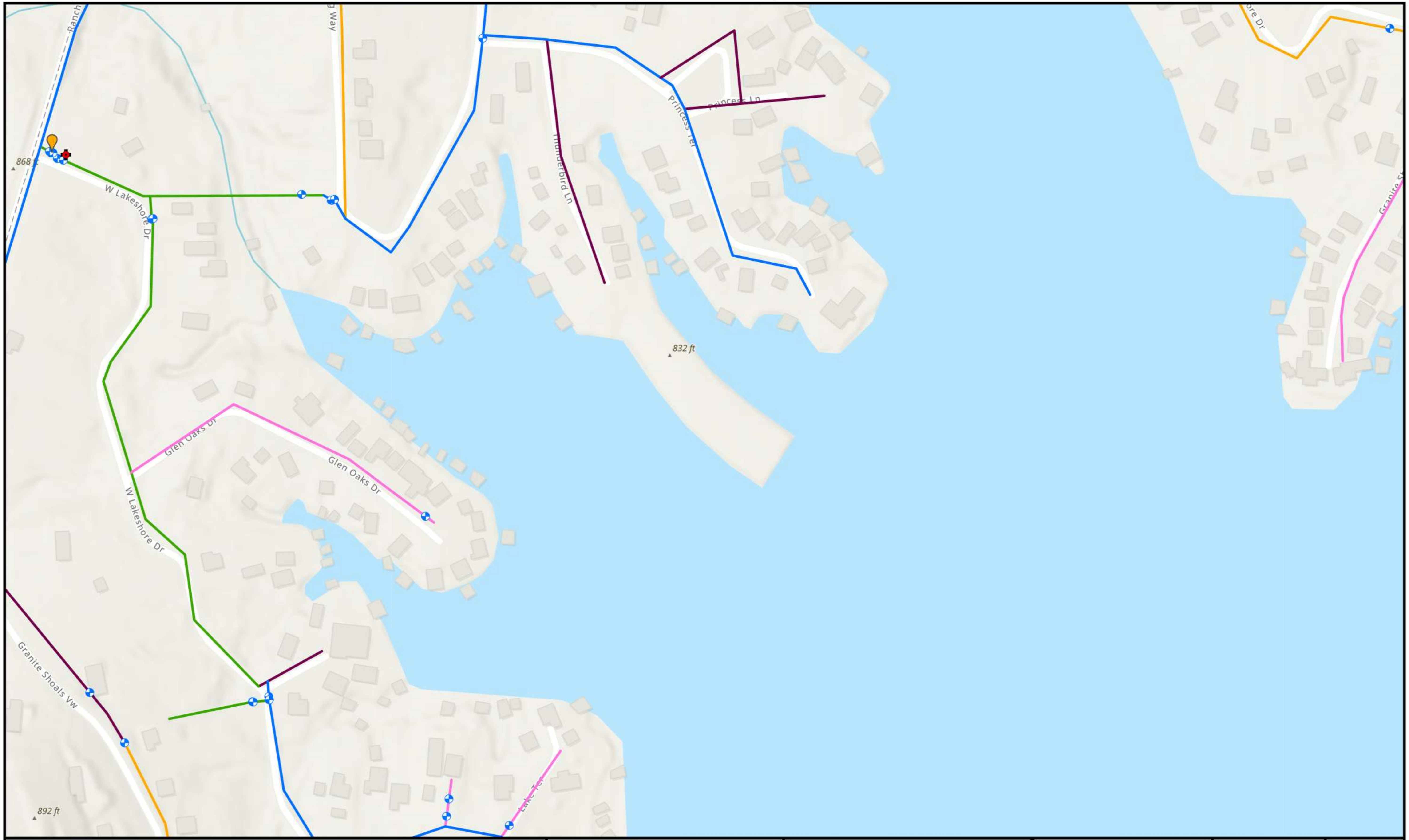

● Water System Valve
2"
3"
4"
6"
8"

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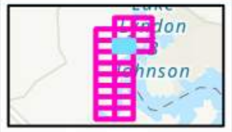
0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024



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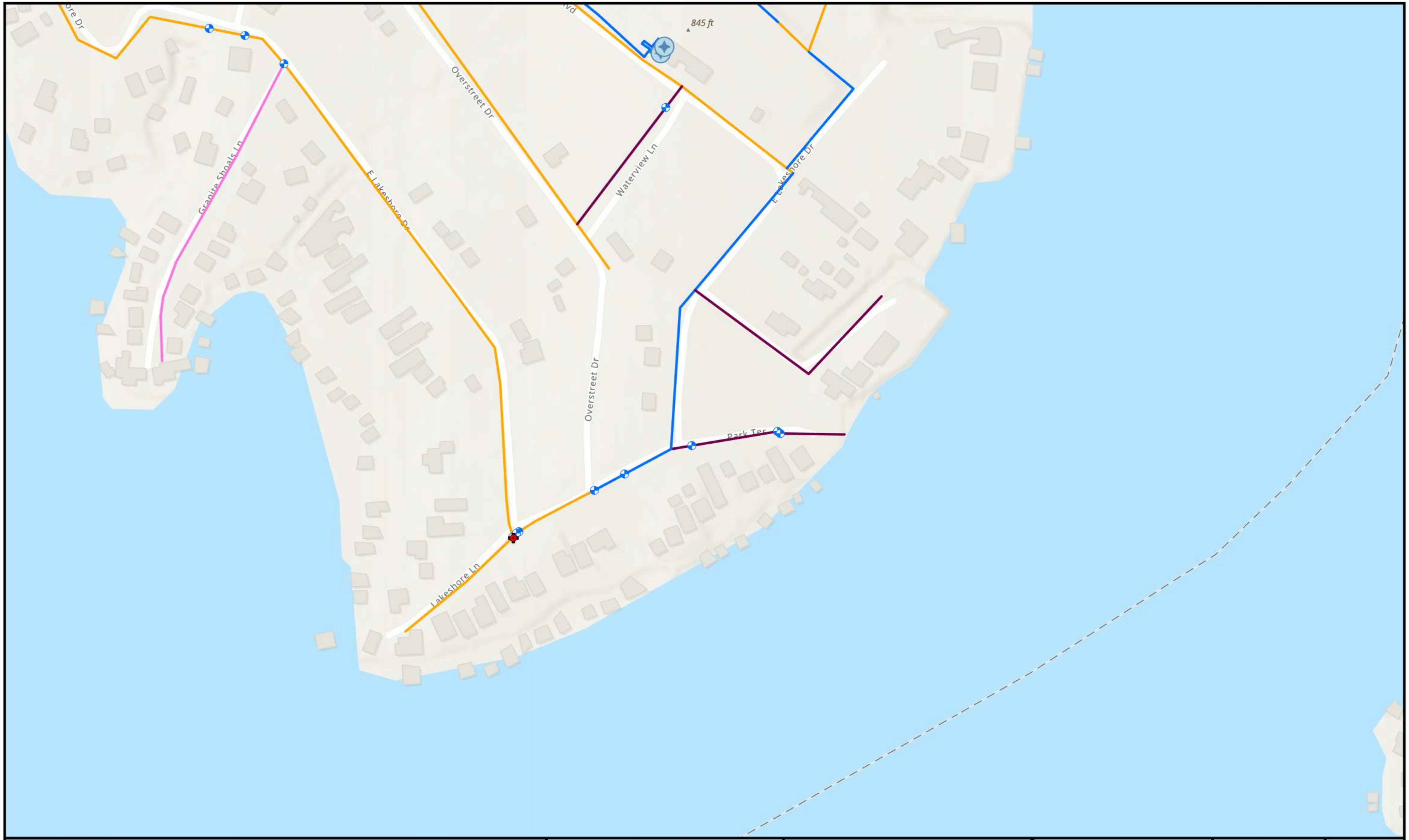

✚ Flushing Valve

● Water System Valve

— 2"

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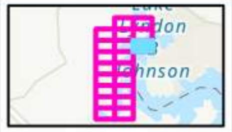
0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024



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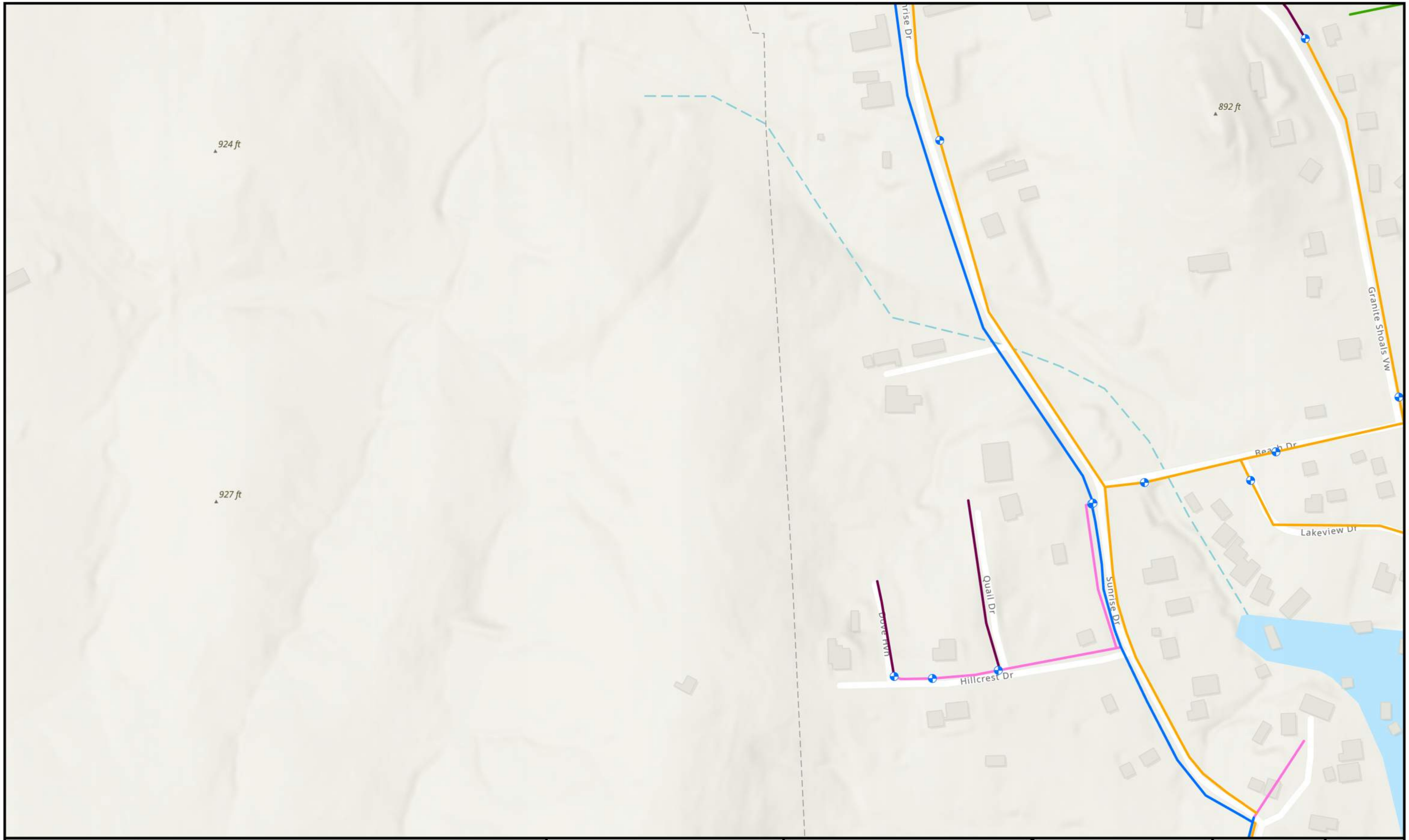

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● Water System Valve
━ 2"
━ 3"
━ 4"
━ 6"

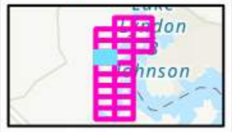
HRGreen

See Page 11

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024



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- Pressure Reducing Valve (PRV)
- Water System Valve
- 2"
- 3"
- 4"
- 6"

HRGreen

See Page 12

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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● Water System Valve	4"
2"	6"
3"	

See Page 13

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

HRG PLOT: 4:54 PM 1/22/2024 BY: mariana.williams FILE: J:\2022\2202532\Design\GIS\ArcPro\Sunrise Beach Village, TX.aprx

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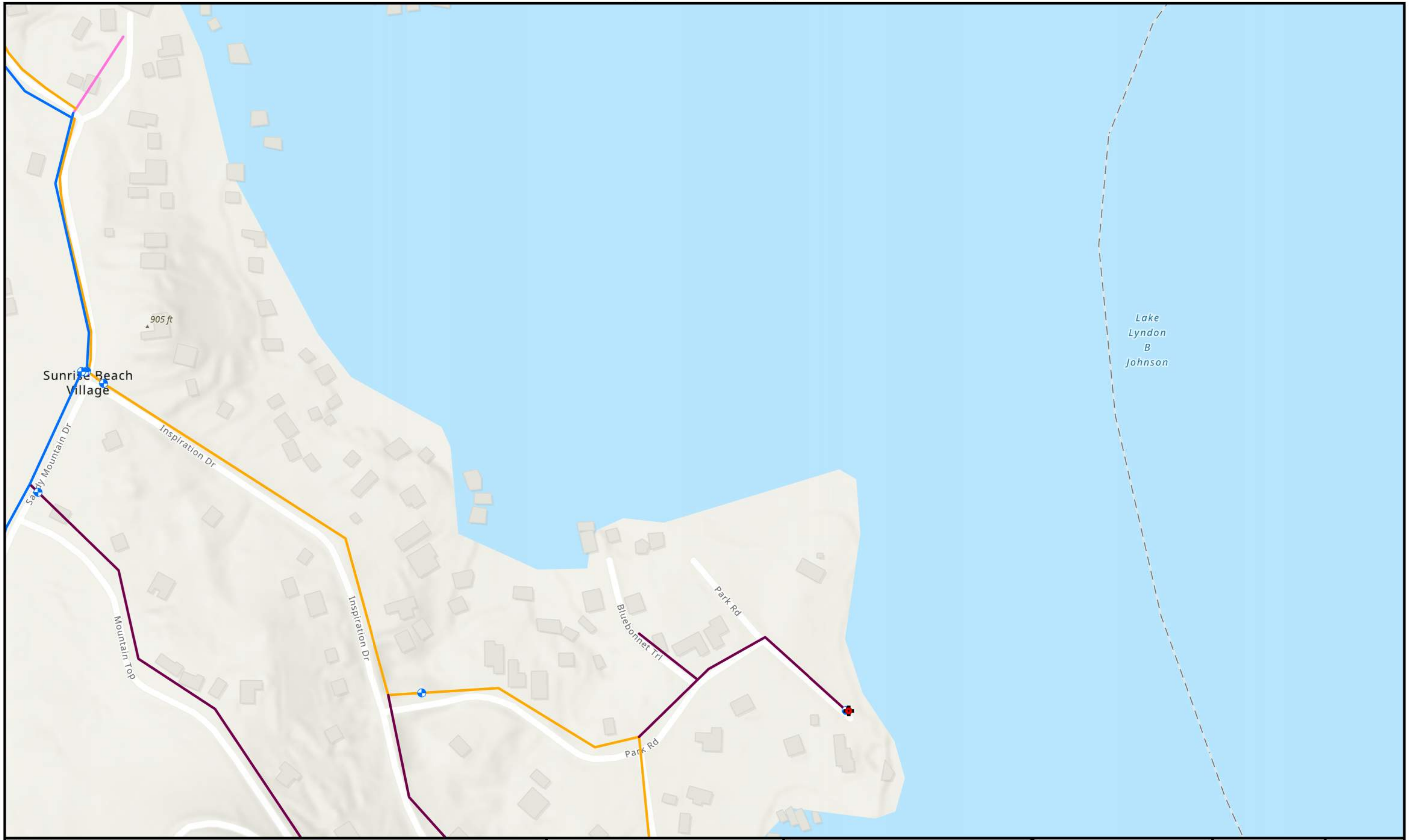
See Page 11



✚	Flushing Valve	—	4"
●	Water System Valve		
—	2"		

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0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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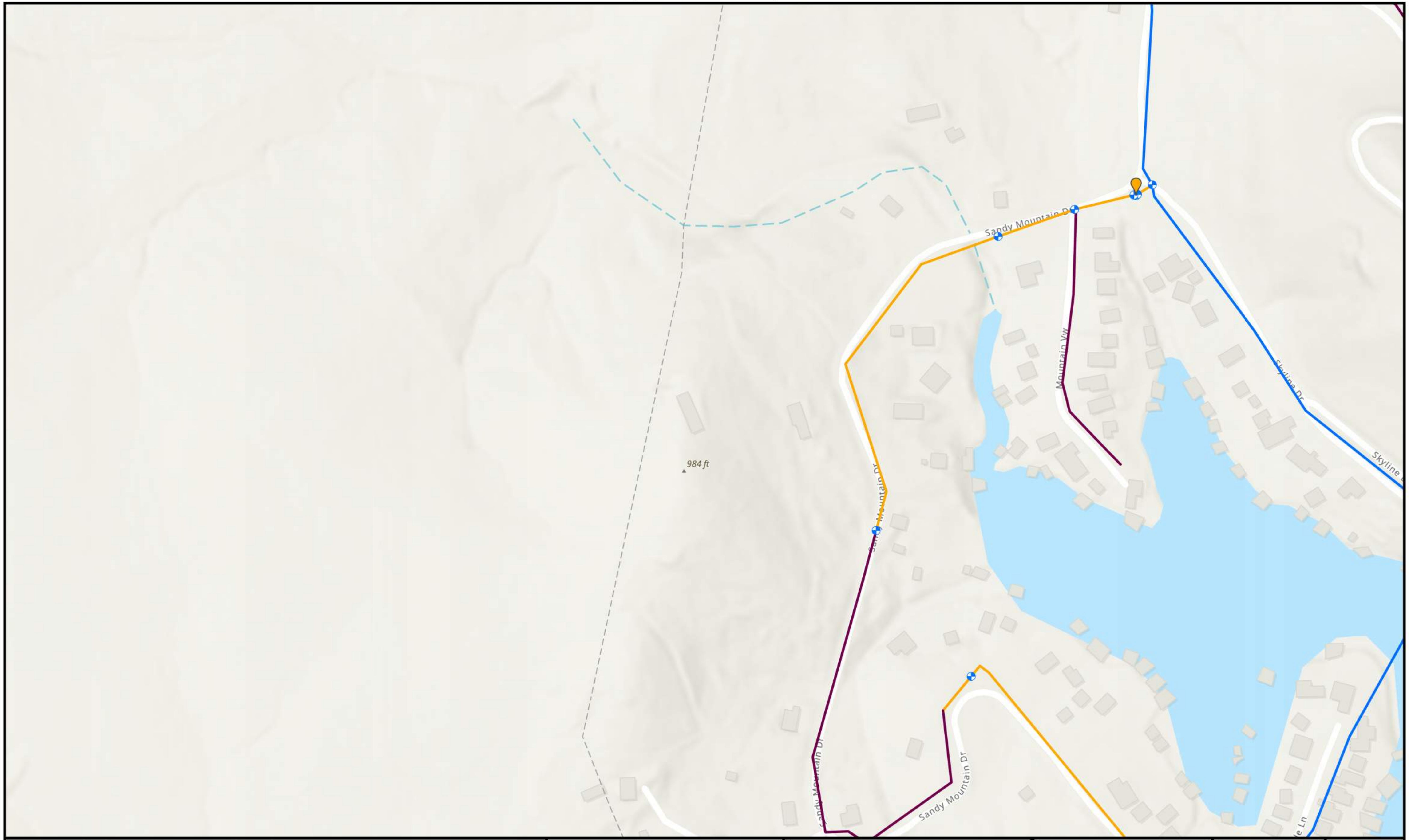

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- Pressure Reducing Valve (PRV)
- ● Water System Valve

🟪	2"
🟧	4"
🟦	6"

HRGreen

0 125 250 500 Feet

1 inch = 250 feet

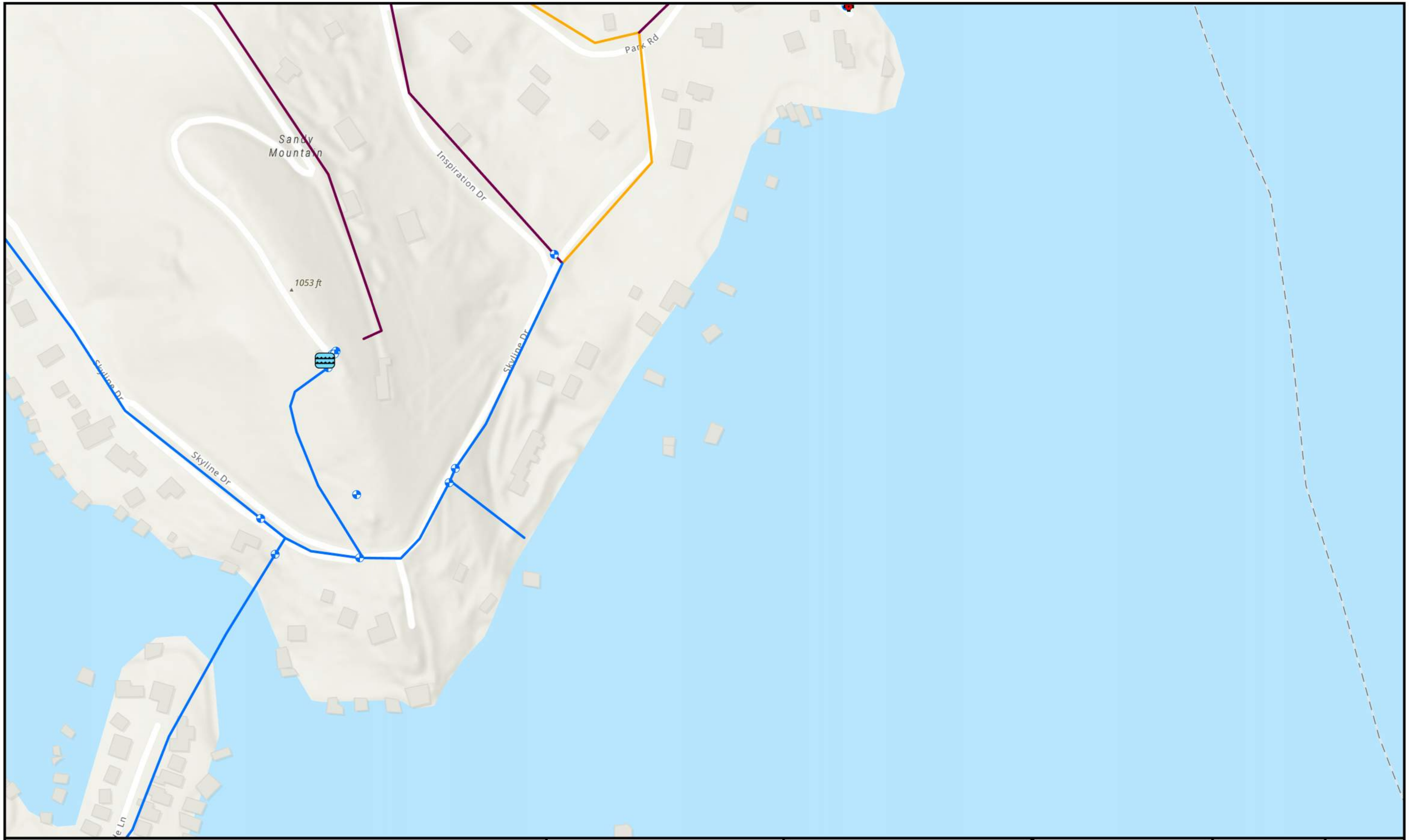
WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

PAGE NO.

HRG PLOT: 4:54 PM 1/22/2024 BY: mariana.williams FILE: J:\2022\2202532\Design\GIS\ArcPro\Sunrise Beach Village, TX.aprx

See Page 12

See Page 13



🟦	Ground Storage Tank (GST)
●	Water System Valve
—	2"
—	4"
—	6"

HRGreen

See Page 16

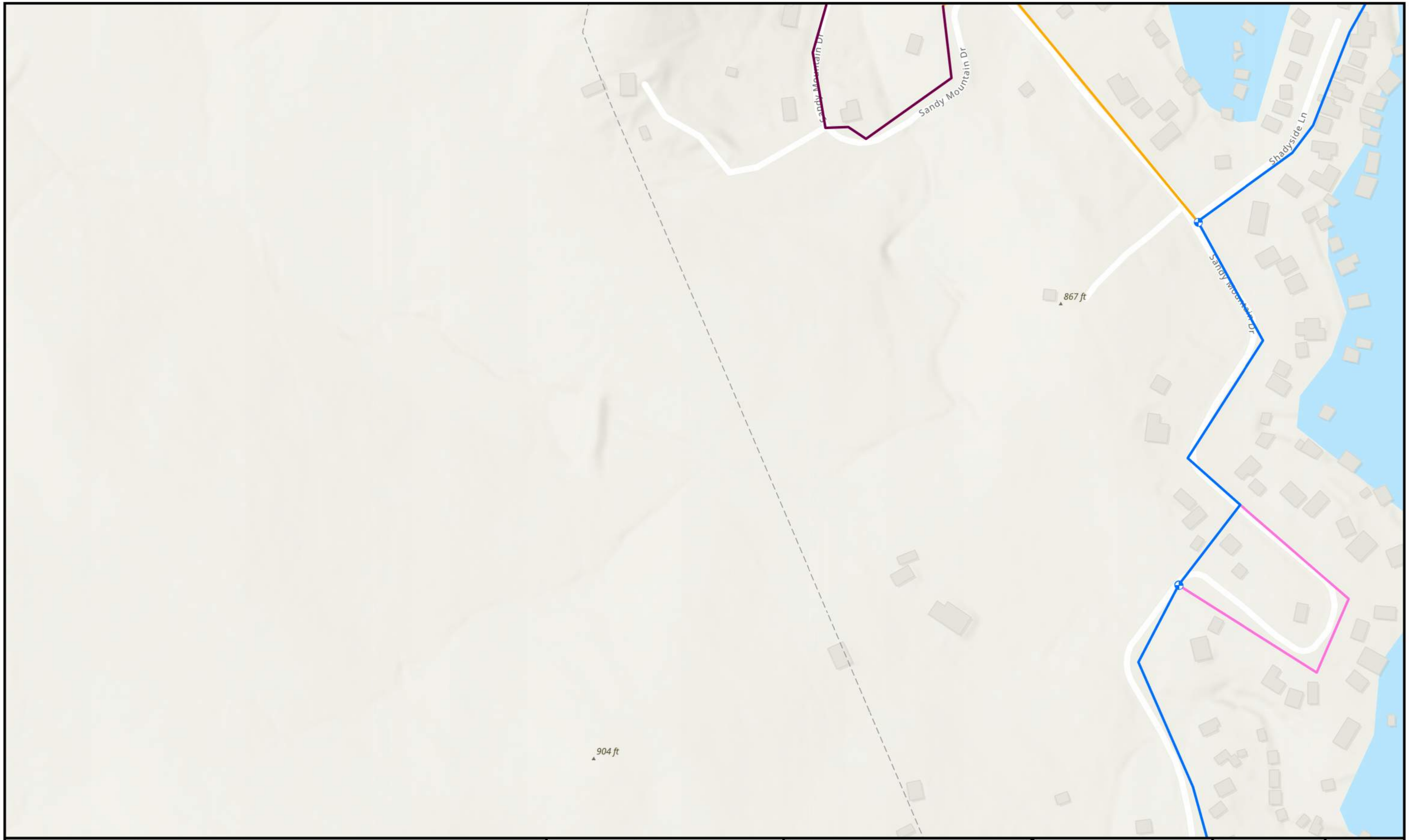
0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

HRG PLOT: 4:55 PM 1/22/2024 BY: mariana.williams FILE: J:\2022\2202532\Design\GIS\ArcPro\Sunrise Beach Village, TX.aprx

See Page 13



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● Water System Valve
— 2"
— 3"
— 4"
— 6"

HRGreen

See Page 17

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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— 3"
— 6"

See Page 18

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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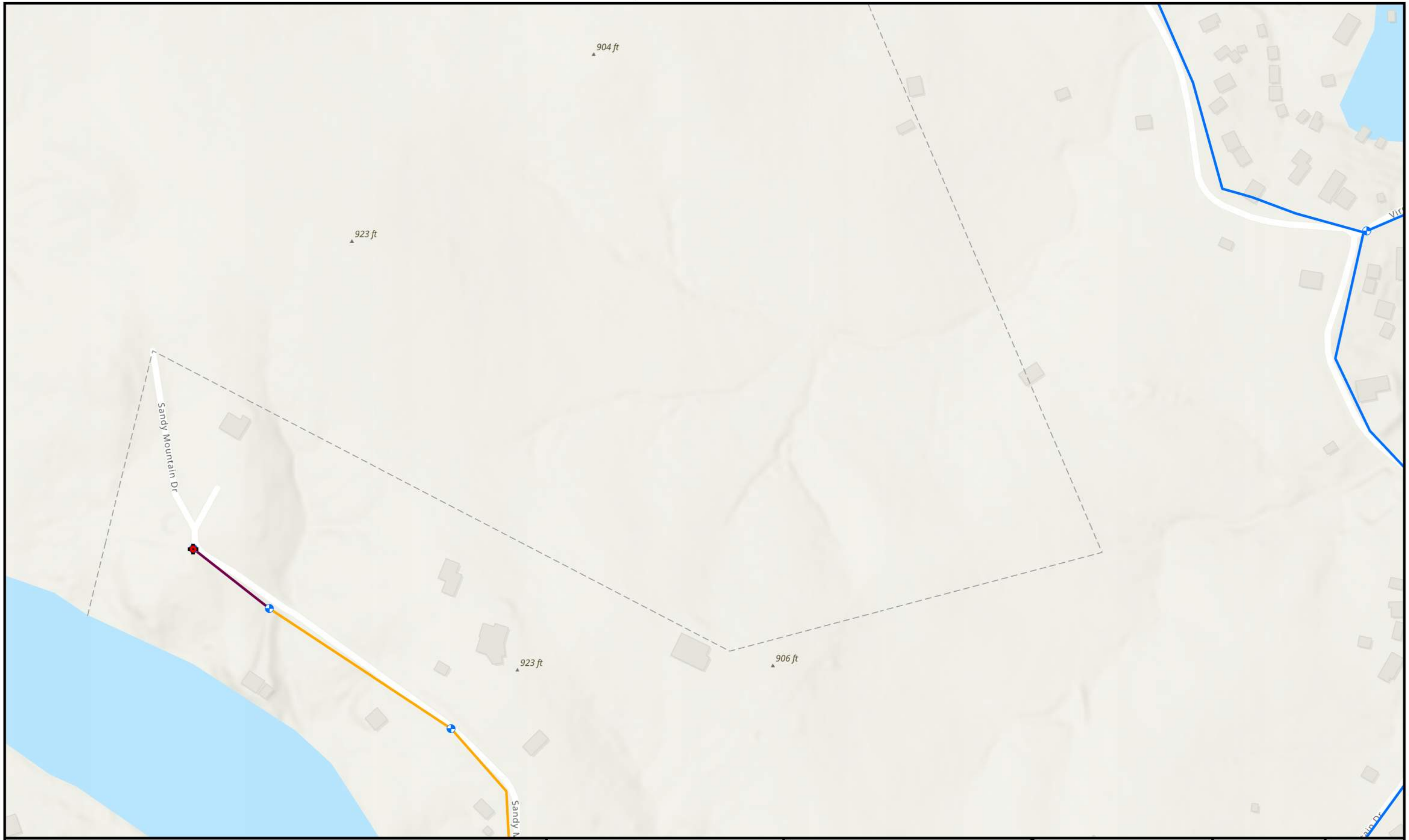
See Page 15



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✚ Flushing Valve
● Water System Valve
— 2"
— 4"
— 6"

HRGreen

0 125 250 500 Feet
1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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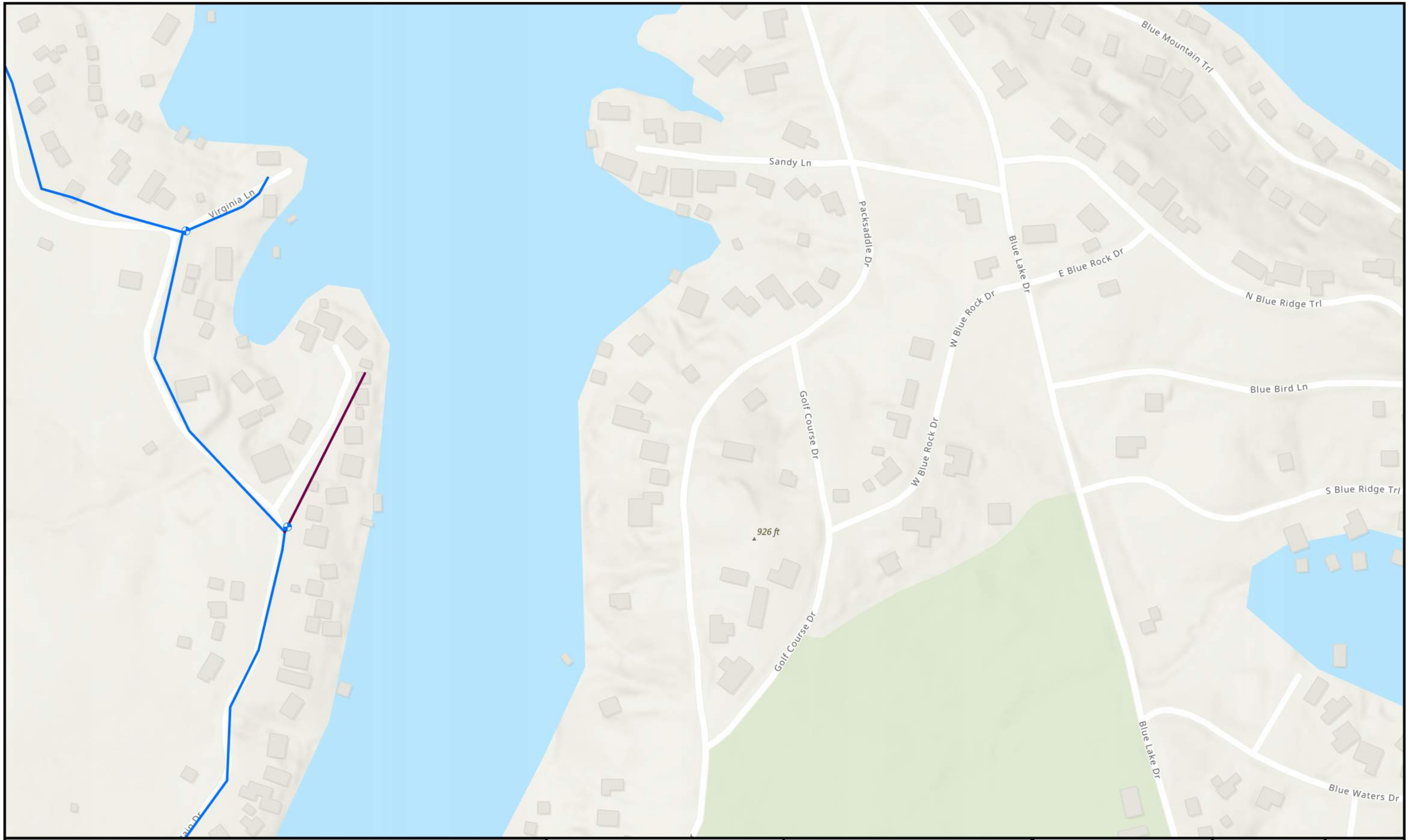

⊕	Water System Valve
▬	2"
▬	6"

See Page 20

0 125 250 500 Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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● Water System Valve
— 2"
— 4"
— 6"

0 125 250 500 Feet
1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024

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HRG PLOT: 4:57 PM 1/22/2024 BY: mariana.williams FILE: J:\2022\2202532\Design\GIS\ArcPro\Sunrise Beach Village, TX.aprx

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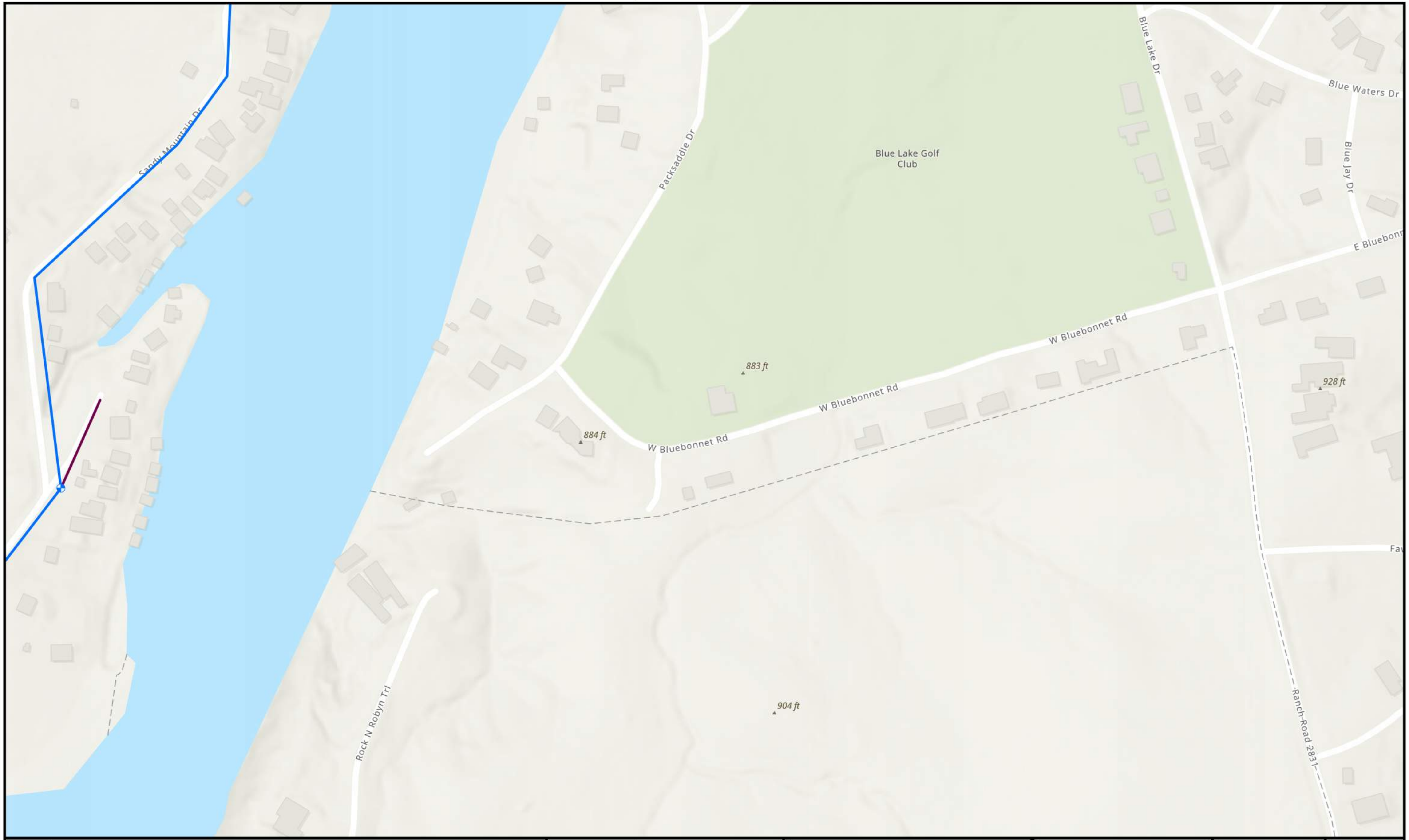
See Page 19



— 6"

HRGreen

0	125	250	500

Feet

1 inch = 250 feet

WATER SYSTEM MAP
SUNRISE BEACH VILLAGE, TX
2024