Montecito Sanitary District & Montecito Water District
Enhanced Recycled Water Feasibility Analysis

Technical Memorandum 9
INFRASTRUCTURE ANALYSIS

DRAFT FINAL | November 2022

Montecito Sanitary District & Montecito Water District
Enhanced Recycled Water Feasibility Analysis

Technical Memorandum 9
INFRASTRUCTURE ANALYSIS

DRAFT | November 2022

This document is released for the purpose of information exchange review and planning only under the authority of Michael Goymerac, November 2022, California PE No. 84894.

Contents

Appendices

Tables

Figures

-This Page Intentionally Left Blank-

Abbreviations

AACE	Association for the Advancement of Cost Engineering
AFY	acre-feet per year
ADWF	average dry weather flow
amsl	above mean sea level
AWPF	advanced water purification facility
AWWA	American Water Works Association
Caltrans	California Department of Transportation
Carollo	Carollo Engineers
CCC	California Coastal Commission
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CSD	Carpinteria Sanitary District
DDW	Division of Drinking Water
ENR	Engineering News-Record
ERWFS	Enhanced Recycled Water Feasibility Study
ft	feet
GIS	geographic information system
HDPE	high-density polyethylene
hp	horsepower
I&I	inflow and infiltration
MCC	motor control center
MD	maximum day
MG	million gallons
mgd	million gallons per day
Miramar	Rosewood Miramar Beach Resort
MM	maximum month
MSD	Montecito Sanitary District
MWD	Montecito Water District
PVC	polyvinyl chloride
PWWF	peak wet weather flow
RO	reverse osmosis
rpm	rotations per minute
RWA	Raw Water Augmentation
RWFP	Recycled Water Facilities Plan
RWQCB	Regional Water Quality Control Board
Santa Barbara	City of Santa Barbara

SR	California State Route
TDWA	treated drinking water augmentation
TM	technical memorandum
UPRR	Union Pacific Railroad
US 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
WRP	water reclamation plant
WWTP	wastewater treatment plant
WTP	water treatment plant

-This Page Intentionally Left Blank-

Technical Memorandum 9

INFRASTRUCTURE ANALYSIS

9.1 Summary

The purpose of this technical memorandum (TM) – TM9 – is to develop distributed infrastructure alternatives for joint recycled water project concepts originating from Montecito. The analysis was undertaken to support the larger Enhanced Recycled Water Feasibility Analysis (ERWFS or Project), a joint effort by Montecito Sanitary District (MSD) and Montecito Water District (MWD). TMs 1 through 8 provide other aspects of the project including MSD and project partner flows, condition assessment, performance and capacity, treatment criteria, rehabilitation costs, and treatment components and upgrades to achieve the various levels of water reuse.

Table 9.1 and Table 9.2 summarize the components for each alternative and the costs and assessment for each alternative, respectively. The analyzed infrastructure alternatives will be combined with treatment components from the other TMs in a separate document.

Table 9.1 Alternatives – Infrastructure Components

Alt	MSD WWTP[1]	AWPF Location	Use of Existing Facilities	Product Water Storage (MG)	Pipelines (LF)
Montecito NPR					
NPR-1.1	O&G Removal & Tertiary Treatment or MBR	N/A	N/A	0.06	26,400
NPR-1.2				0.06	26,300
NPR-1.3				0.06	24,900
Carpinteria IPR					
IPR-2.1	O&G Removal or MBR	CSD WWTP	CAPP AWPF and pipeline; Carpinteria GW Basin	N/A[2]	52,000
IPR-2.2					51,600
IPR-2.3					56,300
IPR-3	O&G Removal or MBR; AWPF	MSD WWTP	Carpinteria GW Basin	N/A[2]	53,900
Montecito DPR					
DPR-4.1	O&G Removal or MBR; AWPF for RWA	MSD WWTP	Bella Vista WTP	N/A[2]	29,100
DPR-4.2	O&G Removal or MBR; AWPF for TDWA			N/A[2]	37,500
DPR-4.3				0.5[3]	6,400
Santa Barbara DPR					
DPR-5.1	Existing Secondary Treatment	Santa Barbara	Santa Barbara Collection System & El Estero WRP	0.47[3]	3,700
DPR-5.2			El Estero WRP		8,200
DPR-5.3	Abandoned (All MSD wastewater to Santa Barbara)				11,800

Notes:
(1) MSD WWTP treatment improvements and recycled water treatment are addressed in other TMs.
(2) Storage is not needed beyond wet well for product water pump station.
(3) Storage needs defined in section 9.6.2.2.

Table 9.2 Alternatives – Cost and Assessment Summary (Infrastructure Costs Only)

Alt	Total Project Cost ($M) (1)	Yield (AFY)	Unit Cost ($/AF) (2)	Comments
Montecito NPR				
NPR-1.1	$14.8	128	$5,900	NPR-1.1 preferred over NPR-1.2 and 1.3 due to • Highest yield and lowest unit cost; however, benefits are dependent on connecting all identified customers • Preferred US 101 crossing (like NPR-1.2) due to lower cost and more time for project decisions
NPR-1.2	$14.7	113	$6,700	
NPR-1.3	$15.5	102	$7,700	
Carpinteria IPR				
IPR-2.1	$33.4	560	$3,100	IPR-2.2 preferred over IPR-2.1 and -2.3 due to: • Lowest cost along with IPR-2.1 without private easement issues for IPR-2.1 All alternatives have: • Utility unknowns along Ortega Hill Rd/Lillie Ave/Via Real • Construction impacts to Summerland and Carpinteria communities • Major US 101 crossing with permitting risks • Carpinteria AWPF and infrastructure cost share • IPR-3 comments also apply to IPR-2 subalternatives
IPR-2.2	$33.3	560	$3,100	
IPR-2.3	$36.3	560	$3,200	
IPR-3	$32.1	560	$3,000	• IPR-3 has several potential new injection well sites but a preferred or most likely site has not been identified • Water exchange method must be confirmed
Montecito DPR				
DPR-4.1	$17.0	560	$1,700	• DPR-4.2 has the highest cost due to longest distance but feeds the Bella Vista WTP • DPR-4.3 has the lowest cost due to the shortest pipeline difference, but will result in uneven distribution of purified recycled water and requires additional hydraulic analysis to confirm feasibility.
DPR-4.2	$20.8	560	$2,000	
DPR-4.3	$10.3	560	$1,100	
Santa Barbara DPR				
DPR-5.1	$9.9	560	$900	• DPR-5.2 is preferred over DPR-5.1 due to the permitting and constructability risks with the DPR-5.1 alignment • DPR-5.3 is feasible and would send all MSD flows to Santa Barbara
DPR-5.2	$11.9	560	$1,200	
DPR-5.3	$23.0	560	$2,200	

Notes:
(1) Treatment costs are not included in this table. Total Project Cost includes construction cost, contingency, and soft costs (i.e., engineering, administration, and legal) for infrastructure only.
(2) Unit costs includes annualized Total Project Costs and annual operations and maintenance costs. No grant funding is included. Financing assumes 3% over 30 years.

9.2 Introduction

9.2.1 Purpose and Background

The purpose of this TM is to develop various distributed infrastructure components for a joint recycled water project between MSD and MWD. The analysis was undertaken to support the larger Enhanced Recycled Water Feasibility Analysis (ERWFS or Project), a joint effort by MSD and MWD.

The Project analyzes four potential approaches to maximize water reuse from the MSD wastewater treatment plant (WWTP), including non-potable reuse, potable water reuse, and regional potable water reuse projects (one in Carpinteria and one in Santa Barbara). Distributed infrastructure components involved in this analysis include pipelines, pump stations, and various pipeline crossings (highway, railroad, and creek). Also included in this analysis are conversations with non-potable reuse (NPR) customers to better understand how much non potable recycled water could reasonably be supplied and used. The four potential approaches include assorted modifications and upgrades to the WWTP to produce water at varying levels of treatment (included siting an Advanced Water Purification Facility (AWPF) within the MSD's WWTP site), analyzed and presented in detail in other TMs. Within this TM, treatment components are provided for context in sizing the conveyance infrastructure but are not the focus of this TM.

Figure 9.1 shows the potential regional partners.

Figure 9.1 Potential Regional Partners

This TM highlights alternative alignments for each of the four reuse approaches, including design criteria, recommended alignment descriptions cost estimate, schedule, permitting considerations, and a project summary. The TM builds upon the infrastructure analysis conducted as part of the MWD Recycled Water Facilities Plan (RWFP) (Woodard & Curran, 2019).

9.2.2 Project Flows

TM 1 reviewed current and anticipated future wastewater flows into the MSD WWTP to establish representative average dry weather flow (ADWF) and peak wet weather flows (PWWF) for alternative facility sizing needs. TM 1 also evaluated upstream flow equalization (EQ) storage volumes as some of the project alternatives under consideration would send raw wastewater to one of the regional partners. Upstream EQ associated with sizing of treatment components is not included in this TM. Conveyance infrastructure sizing can be optimized if peak flows can be temporarily stored at the MSD WWTP. EQ and storage downstream of the treatment (before conveyance), to support instantaneous peak recycled water use, is evaluated in this TM as part each alternative.

Table 9.3 presents flows for various design conditions. All projects using advanced treated water will treat up to the future MSD WWTP ADWF of 0.7 million gallons per day (mgd) and would produce up to 0.56 mgd of finished water from the AWPF (based upon 80% recovery of water through reverse osmosis (RO) treatment).

Table 9.3 Project Flows

Design Condition	Existing Flow (mgd)[1]	Buildout Flow (mgd)[1]
Average Dry Weather Flow (ADWF)	0.62	0.70
Advanced Water Purification Facility (AWPF) Finished Water		0.56
Instantaneous Peak Wet Weather Flow (PWWF)	7.76	8.76

Notes:
(1) Values from Final TM 1 MSD Flow and NPDES Permit Analysis

9.2.3 Summary of Alternatives

The analysis will consider projects both entirely within MSD/MWD service areas and regional partnerships, non-potable and potable reuse alternatives, and various treatment methods and technologies. The potential alternatives included in the study are as follows:

1. **Montecito Non-Potable Reuse (NPR)** – project producing water meeting Title 22 tertiary quality requirements for irrigation of large landscapes within Montecito.
2. **Carpinteria Indirect Potable Reuse (IPR)** – regional project producing purified water involving a partnership with neighboring special district(s) and the use of the Carpinteria Groundwater Basin.
3. **Montecito Direct Potable Reuse (DPR)** – project producing purified water and utilizing raw water augmentation (RWA) at the MWD water treatment facility or delivery of purified water directly into the potable water distribution system in Montecito, termed "Treated Water Augmentation". This project would be implemented entirely within MSD/MWD service areas.
4. **Santa Barbara DPR** – regional project producing purified water and involving a partnership with the City of Santa Barbara (City) and raw water augmentation at the City's regional water treatment facility.

9.3 Distributed Infrastructure Evaluation Criteria

Overall project criteria were developed that apply to each alternative (Montecito NPR, Carpinteria IPR, Montecito DPR, and Santa Barbara DPR). This section summarizes specific criteria for comparing alignments within each alternative as well as a basis for cost development.

9.3.1 Alignment Comparison Criteria

Conceptual pipeline alignments were developed as part of the 2019 RWFP (Woodward & Curran, 2019). One of the primary goals of this new study is to further refine the conveyance piping alignments into feasible alignments for each alternative project. As part of the alignment refinement and comparison, a number of criteria were developed to evaluate and select a preferred alignment under each alternative. This section discusses the alignment criteria only. An alignment alternatives comparison for each complete recycled water project alternative is provided in Sections 9.4through 9.7. The infrastructure alignment criteria include the following:

- Probable Infrastructure Cost
- Potential Recycled Water Demand
- Highway Crossings
- Railroad Crossings
- Use of Roadways
- Creek Crossings
- Community Impacts
- Easement Acquisition
- Topography
- Permitting

Each alternative alignment is evaluated using the criteria above. For the quantifiable criteria, values are provided. For non-quantifiable criteria the alignments were compared against each other.

Relevant information was collected from MWD and MSD and supplemented by field assessments for each alignment alternative to gather more detailed information. Based on the field assessment the alignment alternatives were refined to address construction feasibility concerns.

The criteria for alignment alternatives are detailed in the following sections.

9.3.1.1 Probable Infrastructure Cost

Generally shorter and more efficient alignments are less expensive but needs to be balanced with the other criteria such as community impacts, additional permitting, and additional highway, railroad or creek crossings. Alternatives are evaluated and compared with each other based on total cost and overall pipeline length. See Section 9.3.3for additional criteria and assumptions used to develop alternative costs.

9.3.1.2 Potential Recycled Water Demand

The overall project benefits (e.g., more water supply) and the cost efficiency of the projects (e.g., economy of scale) are improved if greater recycled water demand can be documented. Each alignment was evaluated based on overall demand by comparing unit costs (dollars per flow (i.e. ,$/acre-foot)). Demand is driven by the number of customers able to be served by the alignment

without additional pipeline branches (i.e., additional cost). Generally the more potential recycled water demand, the more economically feasible an alignment (and an overall project) can be. This criterion only applies to the Montecito NPR alternative project, as the other IPR and DPR projects will be constant production projects and not have variations in demand for different alignments.

9.3.1.3 Highway Crossings

Due to the location of the MSD WWTP, all alternatives except Santa Barbara DPR will need to cross U.S. Highway 101 (US 101). Crossing locations of US 101 were developed based on an evaluation of existing MSD and MWD crossings as summarized in Section 9.3.2. A total of 14 crossing locations were evaluated and narrowed to three preferred locations. The three preferred crossings vary in location, cost, and timing with ongoing California Department of Transportation (Caltrans) US 101 widening project[1]. Alignment alternatives were compared based on the impacts to cost and schedule as a result of the requirements specific to each US 101 crossing location. Depending on timing with the US 101 widening project several crossings could be open cut. Other crossings outside of the widening project area would require pipelines to be installed via trenchless methods which impacts project cost. Also the crossing locations will need to be installed to meet the Caltrans US 101 widening project schedule and have varied schedule impacts on the recycled water project.

9.3.1.4 Railroad Crossings

Railroads typically grant right-of-way permits allowing utilities to locate pipelines within their properties. Railroads have strict standard requirements and well-documented permitting processes for submitting crossing requests. Specific requirements for pipelines within railroad corridors include:

- All pipelines crossing underneath tracks shall be encased in steel by bore and jack, and generally should cross at a right angle to the track, although variances to crossing angles can be obtained
- Pipelines under pressure shall utilize leak proof mechanical or welded joints.
- Casing pipe shall have an internal diameter of 4 inches or greater than the carrier pipe outside diameter. Cathodic protection or coating is not required, but a thicker pipe is required if no protection is used. Casings must extend 25 feet from center of track when terminated below ground. Casing must be 5.5 feet below base of rail.
- Shut off valves must be included within effective distances of each side or railway.

Alignment alternatives will be compared on the impacts from the location of the railroad crossing that can impact cost. In some cases given the proximity of the railroad to US 101, both can be traversed in a single trenchless crossing.

9.3.1.5 Creek Crossings

Provided the location of Montecito along the Santa Ynez Mountain range, creeks originating from the mountains to the north terminate at the Pacific Ocean to the south. Piping alignments will require multiple creek crossing locations typically at existing County of Santa Barbara (County) bridges. Creek crossings at existing bridges were observed during a field evaluation of alignments. It appears at this time most bridge crossings could be installed along the side of the

[1] https://www.hwy101carpinteria-santabarbara.com/

bridge unless otherwise noted in the following sections. For creek crossings not located at bridges or which require installation below the bridge permits through the California Department of Fish and Wildlife (CDFW), U.S. Army Corps of Engineers (USACE), and Regional Water Quality Control Board (RWQCB) may be required. Creek crossings will also include environmental considerations and mitigation measures through the eventual California Environmental Quality Act (CEQA) plans. To the extent practical, alignments will avoid creek crossings. Alignments with less crossings will be scored more favorably due to lower cost and less permitting complexity.

9.3.1.6 Community Impacts

The Montecito community is largely residential. Alignment alternatives were compared with community impacts in mind, such as disruption to localized traffic, access to homes, businesses, and other community resources such as schools, churches, and emergency service centers. The alignment alternatives that are routed in close proximity to homes have a higher potential for these impacts.

The MSD WWTP is also located just across US 101 from the Coast Village, a commercial zone including boutique shopping, restaurants, upscale hotels, and other businesses. Alignments through the Coast Village area would need to consider additional community impacts such as time of work, parking, traffic, noise, and general community disturbance. Although, alignments through commercial districts typically score more favorability as the typically wider streets allow for more room to install pipeline without road closures.

9.3.1.7 Use of Roadways

Alignment alternatives were routed along existing roadways to minimize construction in steep terrain, easement acquisitions, and impacts to property owners. Alignments were compared based on available width of right-of-way, presence of other utilities, levels of anticipated traffic, and potential restoration. Alignments within Montecito and Summerland would comply with County requirements for road restoration. Alignments within City of Santa Barbara and City of Carpinteria would meet road restoration requirements specific to those jurisdictions.

9.3.1.8 Easement Acquisition

Some pipeline alignments cross multiple private parcels. During the development of the alignments, routes were used that minimize, to the extent possible, the number of privately owned parcels crossed. In locations where crossing private property is unavoidable, the pipeline was kept as close as possible to property boundaries to facilitate easement acquisition.

Obtaining easements from private or commercial property owners is generally easier if the pipeline is routed as close as possible to property boundaries, which was considered in the development of alternatives. If required by a given alternative, MSD/MWD would need to negotiate with property owners to obtain the necessary easements.

9.3.1.9 Topography

Montecito is a coastal community located along the Pacific Ocean bound by the Santa Barbara Channel to the south and the Santa Ynez Mountains to the north. As discussed previously, the MSD WWTP is located in an area of south Montecito bound by US 101 and the railroad to the north, the Andrée Clark Bird Refuge to the west, and a narrow area at Fernald Point to the east where US 101 and the railroad are in close proximity to the ocean. The topographical bounds creates an area with pinch points that require traversing of highways, creeks, environmentally

sensitive zones, and other non-ideal areas. The general topography of Montecito is fairly flat in the coastal areas with elevations increasing to the north along the mountains. During development of the alignments, routes were used to minimize steep slopes and to avoid localized high points or low points that could increase operational costs for pumping and maintenance where possible.

9.3.1.10 Permitting

Project permitting can impact the project due to delays and the expense of obtaining and complying with the permit requirements. Specific permits required by the alternatives may include:

- California Coastal Commission Coastal Development Permit
- County Department of Transportation Encroachment Permit for county roads
- Caltrans Encroachment Permit for State roads
- Union Pacific Railroad (UPRR) Encroachment Permit

The following permits shall be evaluated on a case-by-case basis for non-bridge creek crossings or where crossings at bridges may require pipelines to be installed within the normal high water level:

- CDFW Section 1602 permit
- USACE Section 404 permit for creek crossings within the Waters of the U.S. jurisdiction
- RWQCB Section 401 permit within the Waters of the State jurisdiction

While CEQA review and study will be required for any project, individual alternatives are evaluated on overall number of permits required relative perceived difficulty of obtaining permits, and resulting permit requirements and mitigation measures which may add project complexity and cost.

9.3.2 Highway Crossing Evaluation

For all alternatives, except for Santa Barbara DPR, conveyance pipeline alignments will need to cross US 101 and the UPRR. Identifying a location suitable for crossing in Montecito influences the selection of feasible alignment alternatives.

To evaluate all potential US 101 crossings, a detailed list was compiled of existing and future US 101 crossings currently owned or planned for future construction by either MSD or MWD. Many of these existing crossings are being impacted by Caltran's US 101 widening project and are being required to be relocated. A total of 14 crossing locations were identified. Based on input from MSD and MWD, the feasible locations were narrowed to 6 medium and high preference locations. The narrowed list of crossings were evaluated based on factors such as cost, location, size and capacity, availability, viability, and potential impacts by the impending Caltrans US 101 widening project. The remaining low preference crossings were not included in this analysis due to unfavorable alignments, poor timing with Caltrans US 101 widening project, or are in use by the respective district with no viable replacement option.

Figure 9.2 shows the crossing locations. Table 9.4 lists the feasible crossings (6 of 14) with noted inputs from the Districts, Caltrans US 101 project timing, and other critical information.

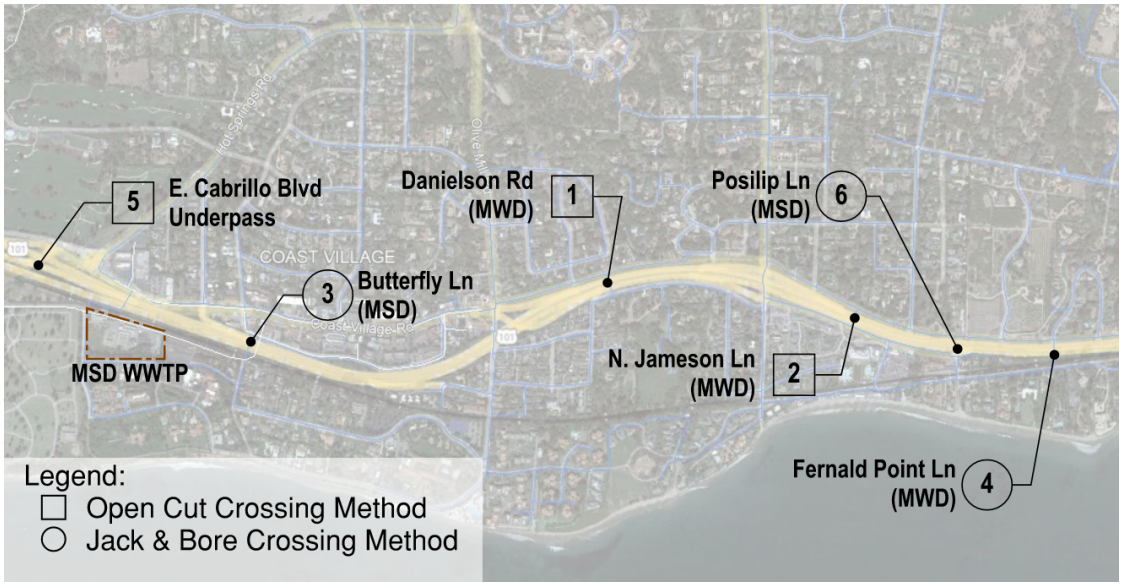


Figure 9.2 Feasible US 101 Crossing Locations

Table 9.4 US 101 Highway Crossing Locations and Rankings

Crossing No.	Prefer. / Ranking	Owner[1]	Crossing Location	Crossing Method	Existing Carrier / Casing Pipe Dia. (in)	Notes/Input
1	High	MWD	Danielson Rd	Open Cut	4 / 16	Either crossing would be installed during Caltrans widening work scheduled for 2024-2025. MWD modeling shows existing crossing could be repurposed for recycled water.
2	High	MWD	N. Jameson Rd (at Miramar)	Open Cut	6 / 16	
3	Medium	MWD	Butterfly Ln.	Jack and Bore	6 / TBD	Planned potable water pipeline crossing of US 101 and railroad in one bore. Recycled water pipeline could be added but would need appropriate separation from potable pipeline.
4	Medium	MWD	Fernald Point Ln.	Jack and Bore	8 / 36	MWD to construct potable water crossing in 2023. Adding recycled water pipeline is not recommended due to tight working constrains and easement requirements.
5	Medium	N/A[2]	E. Cabrillo Blvd. Underpass[2]	Open Cut	NA / NA	The entire underpass is scheduled to be rebuilt with a new roundabout and a pipeline could be installed during construction but Caltrans schedule is not firm. Crossing location adds distance to alignments going east
6	Medium	MSD	Posilipo Ln.	Jack and Bore	8 / 24-26	Crossing is being relocated due to widening of Oak Creek. Crossing relocation is already in design to meet Caltrans timeline so project timing is unfavorable.

Notes:
(1) Current owner of the pipeline crossing US 101 and the associated easement. The easement is being considered for the recycled water pipeline crossing.
(2) Cabrillo Blvd underpass is scheduled to be redesigned including a roundabout as part of the Caltrans US 101 widening project. As such no current crossing exists.

Based on input from MSD and MWD, two high preference crossings (Danielson Road and the Rosewood Miramar Beach Resort [Miramar]) and the first medium preference crossing (Butterfly Lane) were carried forward.

The two crossings with "high" preference would be installed via open cut compared with a higher cost trenchless crossing for Butterfly Lane. MWD is finalizing agreements with Caltrans for the Highway widening contractor to install new highway crossings via open cut means during highway construction instead of using jack and bore methods. Also, the construction is estimated to occur in 2024 or 2025, which gives time for both districts to decide on the preferred recycled water project.

9.3.3 Basis for Project Cost Assumptions

Costs for the NPR alternative include construction capital costs and a percentage-based allowance for engineering, administration, legal fees, and contingencies. Costs were generated for each alternative alignment based on pipeline unit costs as well as the number and location of each crossing (US 101, railroad, and creek).

TM9 capital cost estimates were prepared consistent with Association for the Advancement of Cost Engineering (AACE) International Class IV Estimates for feasibility and project screening. As such, the expected accuracy range could span -50% to +100%. The costs and assumptions used during this exercise were developed from the information available at the time the cost estimate was prepared since the upgrades have not yet been fully designed. There are numerous design related criteria, decisions, and assumptions that will need to be vetted and evaluated, including additional surveys, modeling, permit conditions, and unforeseen circumstances that could impact the cost of the project as the design progresses.

Capital costs include construction and contractor overhead, contingency for unknown conditions and professional services (or "soft costs"). The capital cost estimates are expressed in March 2022 dollars (the corresponding 20-Cities Average Engineering News Record Construction Cost Index of 12,791). Construction costs were developed using cost indexes, quotes from suppliers, recent bids for similar projects, recent engineering estimates, and known industry planning-level unit costs. Quantities were estimated using geographic information system (GIS) based maps of alignments. A percentage of the construction costs is dedicated for contingency to cover as-yet-unknown aspects of the project, in accordance with AACE recommendations. Soft costs are also estimated as a percentage of the construction costs based on typical percentages of total project costs for similar projects. Project costs were annualized and combined with reoccurring operations and maintenance costs to come up with a total annual cost. The annual cost was used to estimate the unit cost based on the annual water delivery (i.e., acre-feet per year (AFY)) for each alternative. A summary of construction, soft cost and escalation assumptions is provided in Table 9.5.

Table 9.5 Summary of Cost Estimate Assumptions

Description	Value	Units	Applied To
Contingency for unknown conditions	30	%	Sum of Contractor Overhead and Construction Costs
Engineering, legal, and administration costs	25	%	Sum of Contractor Overhead and Construction Costs
Financing rate (annualized cost)	3	%	Total project cost (sum of construction, overhead, contingency, and soft costs)
Return period (annualized cost)	30	years	Total project cost (sum of construction, overhead, contingency, and soft costs)

9.3.4 Basis for Hydraulic Characterizations

A hydraulic analysis is performed for each alternative using the criteria presented in Table 9.6 to develop pipeline and pump station capacities for each alternative. Pipeline sizing was calculated balancing minimum velocity, friction loss, and future expected demands. The hydraulic analysis is used to estimate pump design point and a preliminary system curve. Pumps are assumed to be on variable frequency drives to accommodate anticipated demand-based flow variability.

Table 9.6 General Hydraulic Design Criteria

Criteria	Units	Value	Notes
Maximum Design Flow	gpm		Dependent on alternative
Target Operating Flow	gpm		Dependent on alternative
Minimum Operating Flow	gpm		Dependent on alternative
Maximum Velocity	ft/s	5	Set to minimize head losses in pipeline
RO Configuration	NA	2+1	2 duty trains and 1 redundant train at 0.35 mgd each
RO Turndown Capacity	%	10	10% turndown on each RO train
Pump Discharge Elevation	ft amsl	45	Elevation of MSD WWTP used for static head
Highest Delivery Elevation	ft amsl		Dependent on alternative
Friction Loss	unitless	135	Hazen-Williams C-factor for aged PVC pipe
Fitting Loss	%	5	Assumed percentage of minor friction losses
Delivery Pressure (NPR customers)	psi	60	Should be similar to existing pressure
Delivery Pressure (to storage)	psi	10	

9.3.5Pipeline Assumptions

Pressurized recycled water (tertiary or purified water) conveyance piping will be constructed of either C900 polyvinyl chloride (PVC) or ductile iron. In both cases fittings and valves constructed to American Water Works Association (AWWA) standards will be required. Pipeline restraint systems will be required to counteract thrust forces. Where feasible pipelines will be buried to standard depths in accordance with MSD/MWD and County standards. Sufficient appurtenances will be included to allow for future operation of the pipeline including isolation valves, testing stations, blow offs (regional low points), and air-vacuum valves (regional high points).

Sanitary sewer conveyance piping will be constructed to industry and project stakeholder standards using either PVC or high-density polyethylene (HDPE). Pipelines will be installed at depths accommodating the system hydraulics and in consideration of industry and project stakeholder standards. Manholes will be included at sufficient interval spacing and at appropriate locations (i.e., bends, junctions, etc.).

The pipeline alignments will be adjusted for required offsets from existing utilities. Where required offsets from sanitary sewer, storm, or potable water can't be met due to topographical, space, or other constraints, the State of California Division of Drinking Water (DDW) waterworks standards main separation waivers will be prepared for approval. Where offsets can't be met to other utilities, coordination with and approval from the each utility company will be required.

Pipelines will be installed via traditional open cut trench methods unless otherwise noted. Aerial crossings of creeks are assumed to be feasible through attaching the pipe to existing bridge crossings unless otherwise noted. Otherwise, trenchless crossings will be required. Trenchless construction methods (e.g., jack and bore) are assumed to be required at railroad and highway crossings, except for those locations where MWD has reached agreement to install using open cut methods during highway widening work. All railroad and highway crossings will require carrier pipes within casings.

9.3.6 Treated Water Pump Station Assumptions

All alternatives except for Santa Barbara DPR include a new treated water pump station to convey treated water (secondary, tertiary, purified) to various end points. The pump stations will be in a wet-well style configuration. Pump electrical equipment, motor control center (MCC), operator controls, and a hydropneumatics tank (if needed) will be placed nearby as shown on Figure 9.3.

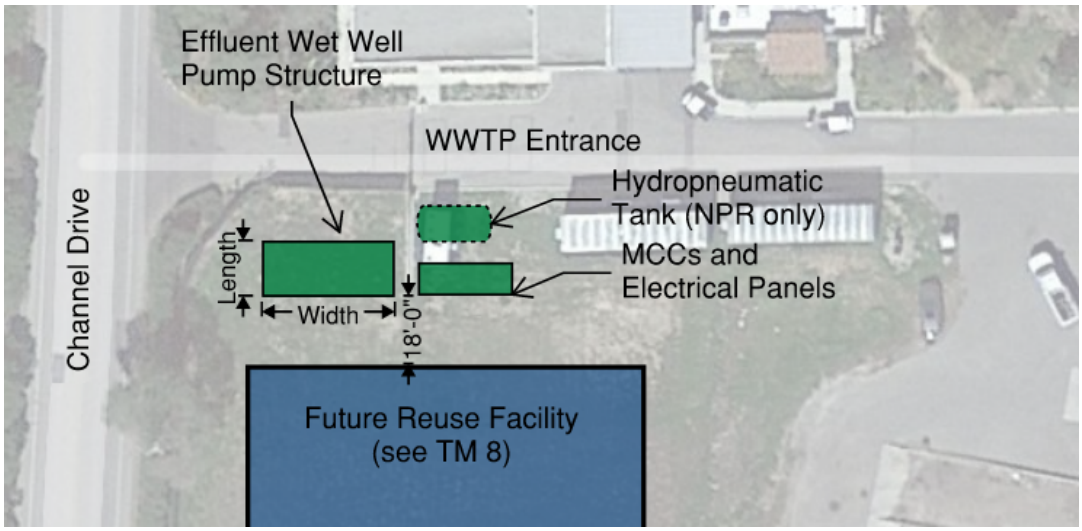


Figure 9.3 Example Pump Station Site Plan

Pumps will be configured with multiple duty pumps and one standby. Pumps will be vertical turbine pumps with motors and discharge heads located on top of the shared wet well structure as shown on Figure 9.4. Appropriate discharge side appurtenances and instruments will be provided for system control and maintenance.

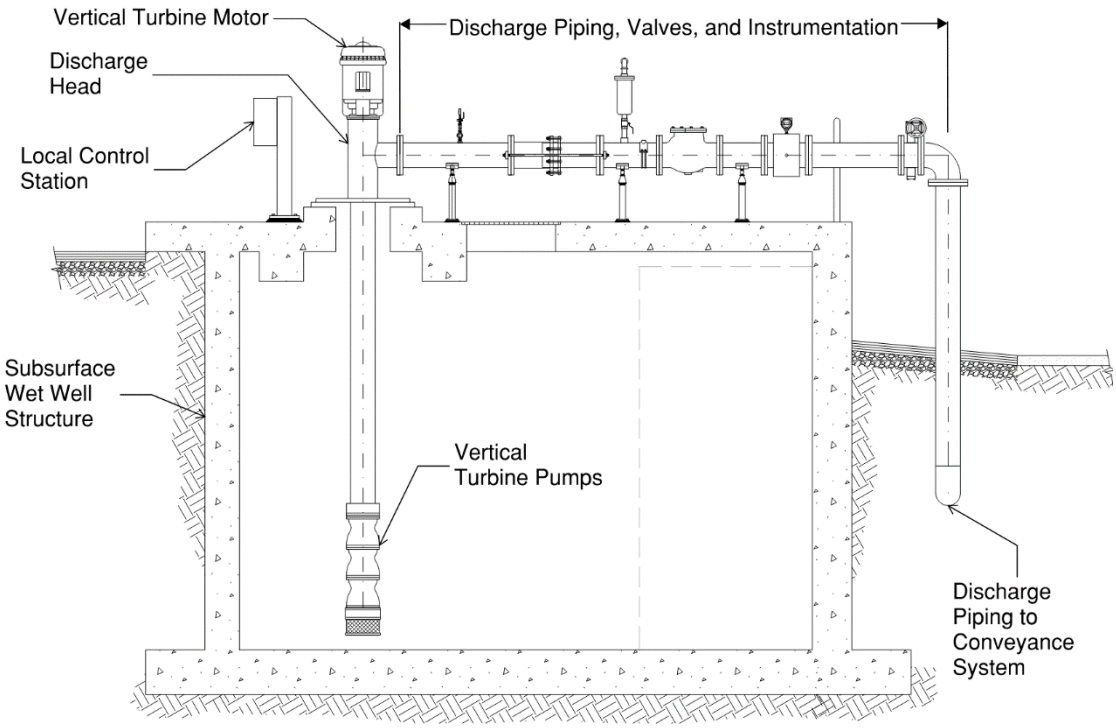


Figure 9.4 Typical Pump Station Preliminary Cross-Section

The wet well will be constructed of cast-in-place concrete with internal semi-divided intake structures dedicated to each pump. For the purposes of estimating costs, wet well bays were sized for larger pumps to allow for flexibility in the event of future system expansion and an additional empty bay was assumed to allow for addition of another duty pump in the future.

The wet well depth will need to be sufficient to provide the required suction head for the pumps, which is anticipated to be approximately 10 ft of working volume plus require structural freeboard. Pumps will discharge to a common header and transition to below ground conveyance piping. Instrumentation will be provided to allow for sufficient flexibility in controls including pressure, flow, and level equipment. Pumps will be provided with VFDs in all project alternatives and pump control will be dependent upon the alternative.

As required by the NPR alternatives, a hydropneumatic tank can be provided for low flow scenarios as well as to protect against surge.

9.4 Montecito NPR

9.4.1 Alternative Introduction

The Montecito NPR alternative represents a project entirely within MSD/MWD service areas with recycled water meeting Title 22 tertiary quality requirements water for unrestricted non-potable use focused on irrigation of large landscapes in Montecito. This alternative would require infrastructure for the delivery of recycled water to customers for landscape irrigation use. Infrastructure assumed under this analysis includes conveyance piping, effluent pump station, NPR storage, and customer connections and retrofits. Potential customers include nearby golf courses, cemetery, hotels, and other facilities.

9.4.2 Potential Customers

The 2019 RWFP identified eight non-potable customers that could provide demand for recycled water within Montecito (Woodward & Curran, 2019). The eight customers include three large "anchor" customers (Birnam Wood Golf Club, Santa Barbara Cemetery, and Valley Club Montecito) as well as other smaller customers that could be served from the pipeline alignments between the MSD WWTP and the "anchor" customers. The RWFP recommended, as a next step, conducting customer demand assessments to better estimate the potential recycled water use at each site since many were difficult to estimate from potable water use records due to the use of on-site groundwater wells.

For this study, the anchor customers were engaged through discussions and a list of questions to better understand potential recycled water service needs. In addition, the team reviewed potable use from 2018 to 2021 for each anchor customer based on MWD billing records. Both golf courses have implemented extensive conservation measures in the past five years, including removing turfgrass and converting turfgrass type to a more drought tolerant variety. In addition, Valley Club constructed groundwater wells that are used to offset the purchase of potable water from MWD for turfgrass irrigation.

Table 9.7 presents updated recycled water demand estimates for potential NPR customers. Demand estimates were developed by focusing on offsetting potable water demand; whereas the 2019 RWFP also included offsetting groundwater demands. Discussions with the golf courses indicated a preference to maximize the use of groundwater from recently installed wells before purchasing recycled water for irrigation. Demands for the five largest customers were updated using potable water demands from 2018 to 2021 and through discussions with each customer. Appendix 9A includes a review of the customer engagement and basis of demand estimates.

Table 9.7 NPR Customer Demands – Average Annual

Customer	2019 RWFP Annual NPR Demand Estimate (AFY)(1)	Private Well(s)	2018-2021 Annual Potable Use for Irrigation (AFY)	Estimated Annual NPR Demand (AFY)
Birnam Wood Golf Club	100	Yes	30 – 60(2)	40
Four Seasons Biltmore	15	Yes	N/A(3)	15(3)
Miramar Resort	11	No	N/A(3)	11(3)
Music Academy of West	2	No	N/A	2
Private Residence	9	Yes	N/A(3)	--(4)
Santa Barbara Cemetery	80	No	16 – 34(2)	30
Ty Warner Hotels	6	Yes	N/A	--(4)
Valley Club Montecito	150	Yes	0 – 35(2)	30
Total	**373**		**46 – 129**	**128**

Notes:
(1) Values from 2019 RWFP (Woodward & Curran, 2019)
(2) Potable water use is based on MWD meter records for dedicated irrigation meters.
(3) Irrigation use is not metered separately so non-potable demand estimate is based on discussions with each customer.
(4) Irrigation demand is assumed to be met with onsite groundwater well.

9.4.3 Design Criteria

Criteria and assumptions were developed to aid in the preliminary sizing of infrastructure. Due to the seasonal nature of irrigation demands, flow requirements range from peak periods during extended hot periods in the summer to no demands during extended wet periods during the winter. Also, recycled water irrigation periods are commonly restricted to nighttime in publicly accessible areas. As shown in Table 9.8, peak hour demands are projected to range from 260 gpm during the day to 430 gpm at night.

Approximately 2,000 gallons of recycled water storage is needed to provide sufficient supply during the nighttime peak demand. This storage will be provided by the wet well for the recycled water pump station, described in Section 9.4.5.

Table 9.8 NPR Customer Demands – Peak Periods

Customer	Estimated Annual NPR Demand (AFY)(1)	Max Day Demand (mgd)(2)	Delivery Period(3)	Peak Hour – Day (gpm)	Peak Hour – Night (gpm)
Birnam Wood Golf Club	40	0.11	Day – 12 hours	149	
Four Seasons Biltmore	15	0.04	Night – 6 hours		112
Miramar Resort	11(2)	0.03	Night – 6 hours		82
Music Academy of West	2	0.01	Night – 6 hours		15
Santa Barbara Cemetery	30	0.08	Night – 6 hours		260(4)
Valley Club Montecito	30	0.08	Day – 12 hours	112	
Total	**128**	**0.34**		**261**	**469**

Notes:

(1) Values from previous table

(2) Assumes 3.0 ratio for max day to average annual demand based on 2.5 ratio for peak month to average annual demand and 20% increase for extended hot periods.

(3) Irrigation with recycled water is generally restricted to nighttime for publicly accessible sites. Golf courses have on-site storage that allows for delivery outside of nighttime hours and, as publicly restricted locations, are able to irrigate during the day if needed.

(4) See assumptions in Non-Potable Customer Assessments Memorandum (Appendix A).

Based on the information above, hydraulic criteria used to develop pipeline and pump station capacities is presented in Table 9.9.

Table 9.9 Montecito NPR – Hydraulic Design Criteria

Criteria	Units	Value	Notes
Maximum Design Flow	gpm	459	Largest Peak Hour
Target Operating Flow	gpm	261	Set to Total Peak Hour – Day demand
Minimum Operating Flow	gpm	40	Based on half of the second smallest Peak Hour – Night demand from Miramar
Maximum Velocity	ft/s	5	Set to minimize head losses in pipeline
Pump Discharge Elevation	ft amsl	45	Elevation of MSD WWTP used for static head
Highest Delivery Elevation	ft amsl	270	Elevation of highest customer used for static head
Friction Loss	unitless	135	Hazen-Williams C-factor for aged PVC pipe
Fitting Loss	%	5	Assumed percentage of minor friction losses
Delivery Pressure (direct service)	psi	60	Three times the minimum pressure (20 psi) required by Cal. Code Regs. Tit. 22, § 64602
Delivery Pressure (to storage)	psi	10	

Notes:

Based on the hydraulic analysis, a minimum 8-inch nominal diameter is anticipated for the Montecito NPR alternative conveyance piping.

Results of the hydraulic analysis are included in Appendix 9B. The analysis showed that the range of operating flows (minimum, target, and maximum) could be met with a 3 + 1 pump configuration. As shown in Appendix 9B, the minimum operating flow could be met with a single pump by reducing speed with a VFD. Similarly, the target operating flow could be met with two pumps on reduced speed and the maximum operating flow could be met with three pumps at full speed. Additional details such as size of pumps for the recommended alternative are included in Section 9.4.5

The design flows listed in Table 9.9 do not consider extreme extended drought periods where demands could be much higher. The system was sized using reasonable flow assumptions. Oversizing the system for unknown drought conditions could result in larger than needed pumps, higher capital and operating costs, and piping with excess capacity. Oversized pumps could result in unused pumps and low velocities.

To address expected annual or diurnal periods of low demand a hydropneumatic tank would be coupled with the VFD pumps. The hydropneumatic tank will prevent pumps cycle on and off for short intervals during low- to no- flow periods.

9.4.4 Alignment Analysis and Recommendation

Three alignment options were considered based on review and selection of a narrowed list of preferred US 101 crossings (Section 9.3.1.3). This section describes the assessment and ranking that

was completed for the alignments and provides a recommendation for the preferred alignments.

As shown on Figure 9.5, the NPR alternative alignments differ only at the US 101 crossing location with shared alignments at the beginning (nearest the MSD WWTP) and the furthest customers (past Miramar). The three alignment alternatives are:

- NPR-1.1 – Danielson Road US 101 crossing
- NPR-1.2 –Miramar US 101 crossing
- NPR-1.3 – Butterfly Lane US 101 crossing

The following describe considerations for each Montecito NPR alternative alignment. The following considerations apply to all Montecito NPR alternatives:

- Music Academy of the West: The alignment crosses the academy from the Monte Cristo Lane dead end to North Jameson Way. This will require negotiation and acquisition of an easement.
- Oak Creek: The alignments crosses the creek along Hixon Road.
- San Ysidro Creek: The alignments crosses the creek along San Leandro Lane via an aerial bridge crossing.
- Romero Creek: The alignment crosses the creek (labeled Buena Vista Creek on bridge) along Sheffield Drive via an aerial bridge crossing.
- Birnam Wood Golf Course Lateral: The lateral would extend from Sheffield Drive to the golf course's existing lake and discharged to the lake with an approved air gap.
- Valley Club Lateral: The lateral would continue along Sheffield Drive and east on East Valley Road (California State Route [SR] 192) to the Valley Club northern service entrance. The lateral would discharge into the golf course's existing water tank with an approved air gap.

Alternative	Length (LF)	Highway 101 Crossing	Number of Creek Crossings
NPR-1.1	26,300	South Jameson Lane	5
NPR-1.2	26,200	Danielson Road	5
NPR-1.3	24,900	Butterfly Lane	5

Figure 9.5 Montecito NPR Alignment Alternatives

The following considerations apply to the Montecito NPR alternative(s) listed. Figure 9.6 shows a representative clear alignment through Music Academy of the West.

Figure 9.6 Representative Clear Alignment Path through Music Academy of the West

NPR-1.1 & NPR 1.2

- Railroad: The alignment crosses the railroad along Olive Mill Road via trenchless installation method.
- Olive Mill Road / Virginia Road: This alignment was selected over Danielson Road due to utility congestion (water, sewer, a 16-inch gas main, and telecommunications lines) on Danielson Road that presents a constructability and cost risk due to minimum utility separation requirements and reduced construction rates to protect existing utilities in place.
- Residential Areas: The alignment is within residential areas Hill Road, Virginia Road, and Danielson Road. That will have temporary construction impacts to local residents and have tighter working areas.

Figure 9.7 shows a dense existing utility backdrop along Danielson Road.

Figure 9.7 Existing Utility Markings on Danielson Road

NPR-1.1

- Montecito Creek: The alignment crosses the creek at Miramar via an aerial bridge crossing.
- US 101 Crossing: The existing MWD crossing would be removed and reinstalled via open cut trench methods as part of the Caltrans US 101 widening project extending across the highway to North Jameson Lane.

NPR-1.2

- US 101 Crossing: The existing MWD crossing between Danielson Road and North Jameson Road would be removed and reinstalled via open cut trench methods as part of the Caltrans US 101 widening project extending across the highway.

NPR-1.3

- Railroad and US 101 Crossing: At the northern dead end of Butterfly Lane, the alignment will cross the railroad and US 101 via trenchless installation methods to Coast Village Circle.
- Coast Village Circle / Coast Village Road: The alignment through this business district would have construction impacts for local businesses.

9.4.4.2 Alignment Comparison

The three alternative alignments (NPR-1.1, NPR-1.2, and NPR-1.3) differ primarily in the location of the US 101 crossing, which impacts pipeline length, cost, schedule constraints, customers served, and community impacts.

NPR-1.1

- Pipeline Length: NPR-1.1 is the longer than NPR 1.3 and similar to NPR 1.2.
- Customers: NPR 1.1 serves the identified potential customers with a total demand of 128 AFY.
- US 101 crossing: Preferred crossing location (along with NPR 1.2) due primarily to the lower cost installation method (traditional open cut trench).
- Railroad: A trenchless crossing will be required at Olive Mill Road. The crossing is typical for railroad but further review of available right-of-way and construction staging is required for future design.
- Community Impacts: Similar to NPR 1.2, alignment is in residential areas along Hill Road, Virginia Road, and Danielson Road.
- Roadways: Similar to NPR 1.2, the residential areas are tight due to 25 to 30 foot road widths and existing utilities that include both potable water and sewer lines.

NPR-1.2

- Pipeline Length: NPR-1.2 is longer than NPR 1.3 and similar to NPR 1.1.
- Customers: Serves all but one customer (Miramar) unless a lateral is added
- US 101 Crossing: Preferred crossing location (along with NPR 1.2) due primarily to the lower cost installation method (traditional open cut trench) and additional time to make project decisions.
- Railroad: Similar to NPR 1.1.
- Community Impacts: Similar to NPR 1.1.
- Roadways: Similar to NPR 1.1.

NPR-1.3

- Pipeline Length: NPR-1.3 is the shortest of the three NPR alignment alternatives
- Customers: Serves all but two customers (Miramar and Biltmore) unless laterals are added that follow NPR 1.1 to Miramar
- US 101 Crossing: Requires trenchless crossing at Butterfly Lane that is more expensive than NPR 1.1 and 1.2 and must be installed much sooner, requiring an investment by MSD/MWD before any potential recycled water project is developed further. Also, the addition of a recycled water crossing may require planning with MSD and MWD to meet offset requirements within the available right of way.
- Railroad Crossing: The railroad and US 101 can be crossed in a single mobilization due to their proximity to one another; however, this requires a longer crossing with multiple permitting partners.
- Community Impacts: The route through Coast Village has less residential impacts but will have unique impacts to the Coast Village area businesses and parking along Coast Village Circle.
- Roadways: Due to less alignments in residential areas, there are less potential conflicts along small residential streets with existing utilities.

Evaluation Summary

Table 9.10 includes a summary of the analysis for each alternative. Based on the evaluation of each alternative against each of the developed criteria, NPR-1.1 is the recommended alternative alignment because NPR-1.1:

- Has a preferred US 101 crossing (due to less costly open trench method and more time for project decisions),
- Allows more customers to be served without additional laterals, which results in the lowest unit cost

However, the unit cost and customer criteria advantages are dependent on customers connecting to the system. If Miramar does not want recycled water and Biltmore does want recycled water, then NPR 1.2 would be preferred. If neither Miramar nor Biltmore wants recycled water, NPR 1.3 would be preferred, with the largest tradeoff being impacts to Coast Village versus higher residential area impacts for the other alignments.

Further considerations such as schedule, permitting, and community impacts as well as a full project description including all conveyance infrastructure components for the NPR alternative will be discussed in Section 9.4.5.

Table 9.10 Summary of NPR Alternatives

Criteria	Summary of NPR Alternatives		
	NPR-1.1 (US 101 crossing at Miramar)	NPR-1.2 (US 101 crossing at Danielson Rd)	NPR-1.3 (US 101 crossing at Butterfly Ln)
Capital Cost	$14.8 Mil	$14.7 Mil	$15.5 Mil
Unit Cost	$5,900/AF	$6,700/AF	$7,700/AF
Pipeline Length	26,400 LF	26,300 LF	24,900
Recycled Water Demand	128 AFY	113 AFY	102 AFY
Summary of Benefits	• More favorable US 101 crossing • Most RW customers served	• More favorable US 101 crossing	• Less topographical impacts (i.e, flatter vertical alignment)
Summary of Risks	• Alignment through residential area	• One customer not served • Alignment through residential area	• Two customers not served • Alignment through Coast Village • Less ideal US 101 crossing

9.4.5 Project Summary For Recommended Alternative

This section provides a full project summary including distributed infrastructure components for the recommended NPR alternative (NPR-1.1). Section 9.4.3 presented design criteria for the NPR alternative for sizing of conveyance infrastructure, including pipelines and pump stations. Section 9.4.4 presented an assessment of conveyance piping alignment alternatives from the MSD WWTP to the end recycled water customers. The distributed infrastructure for the NPR-1.1 alternat

ive will include three primary components: NPR pump station located at the MSD WWTP, conveyance piping for delivery to customers, and customer connections and retrofits allowing for permitted use of the recycled water.

9.4.5.1 Project Description

As summarized in TM8, the MSD WWTP will be updated with tertiary treatment. Additional RO treatment may be included to reduce salinity in the recycled water concentrations acceptable to potential customers. If RO is not included, recycled water salinity can be mitigated by blending with other water supplies at the point of use or with on-site management. The treatment alternatives presented int TM8.

Upon discharge from the treatment system the recycled water will be supplied to customers via an NPR pump station located at the MSD WWTP. The NPR pump station will be in a wet-well style configuration. Pump electrical equipment, motor control center (MCC), operator controls, and a hydropneumatic tank will be placed nearby as shown on Figure 9.8.

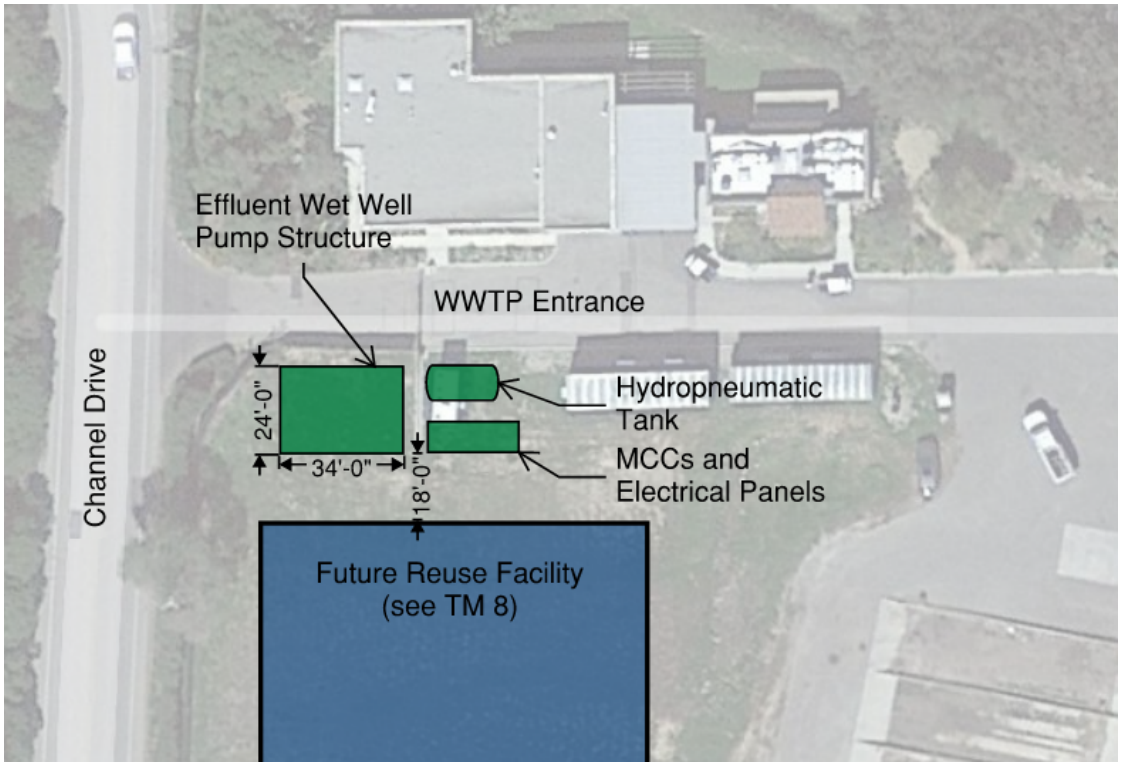


Figure 9.8 NPR Distributed Infrastructure Site Plan

A hydropneumatic tank will also be provided for low demand and flow scenarios as well as protect against surge. Pumps will be configured in a 3+1 with three duty pumps and one standby. The wet well structure will be designed to allow for efficient pump operations and control, with approximately 60,000 gallons of storage (which includes the 2,000 gallons of storage to allow for peak usage) with the dimensions shown on Figure 9.8. Based on the hydraulic analysis, 25 horsepower (hp) pumps with a maximum speed of 1,800 rotations per minute (rpm) are anticipated for the pump station.

Pump control is ultimately dependent on the final operation of the entire recycled water system and demands from the users. If the end usage is highly schedule dependent, pumps may be controlled on a prescribed flow rate at set usage schedule for customers. More than likely the usage is expected to be variable and pump controls will be pressure based (i.e., demand based). A pressure-based control will better integrate with the hydropneumatic tank with a set pressure window programmed to allow pumps to remain off for a minimum of 30 minutes during periods of low demand. Level instrumentation in the wet well will provide high- and low-level overrides.

Turnouts will be provided along the alignment for the various recycled water customers. Sizing of the turnouts will be dependent on anticipated demands specific to each user. Meters will be provided for monitoring specific user demands and for billing purposes. Customer connections and retrofits are specific to each user:

- For the two golf courses (Valley Club and Birnam Wood) piping will be terminated at each facility's specific irrigation storage (e.g., tank or pond). Air gaps will be provided for these types of connections to prevent cross contamination and backflow into the recycled water system.
- For newer resorts, such as Miramar, existing dual plumbed irrigation systems are already in place. The point of connection to the on-site purple pipe system will be identified and a pressurized connection with appropriate backflow devices will be made.
- For other customers, existing irrigation systems will need to be isolated at the irrigation meter (if available). Cross-connection surveys will be performed in accordance with DDW standards and policies.

9.4.5.2 Project Cost and Schedule

Table 9.11 presents a more detailed construction cost break down for the recommended NPR-1.1 alternative including piping and other infrastructure components. For detailed cost breakdowns including other alternatives, see Appendix 9C, Cost Estimates.

Table 9.11 Montecito NPR-1.1 Project Costs

Cost Item	Alternative NPR-1.1
Construction	$9,512,000
Contingency (30%)	*$2,854,000*
Engineering, Admin., and Legal (25%)	*$2,378,000*
Total Project Cost	**$14,744,000**
Annual O&M	$95,300

The Project schedule is dependent on several factors. Once MSD/MWD decide on the preferred recycled water alternative, the Project schedule is dependent on design progress, permitting approvals, regulatory approvals, bid and construction climate, timing of US 101 widening work by Caltrans, and other unforeseen factors. Given these factors, it is estimated that the engineering, funding, and permitting could be completed in 20 to 24 months, project bidding and contracting in 3 months, and distributed infrastructure construction in 18 to 24 months.

The schedule constraint for this project is construction of the US 101 Highway crossing, As discussed in Section 9.3.2, the recommended (and lower cost) crossing would be constructed at the same time as the section of highway is constructed, which is currently projected by Caltrans for

2024 to 2025. MWD currently has plans to reinstall the crossing regardless of a future project for integration into their potable water system. Caltrans construction delays could result in delays in starting project operations if the crossing is constructed after the rest of the project.

9.5 Carpinteria IPR

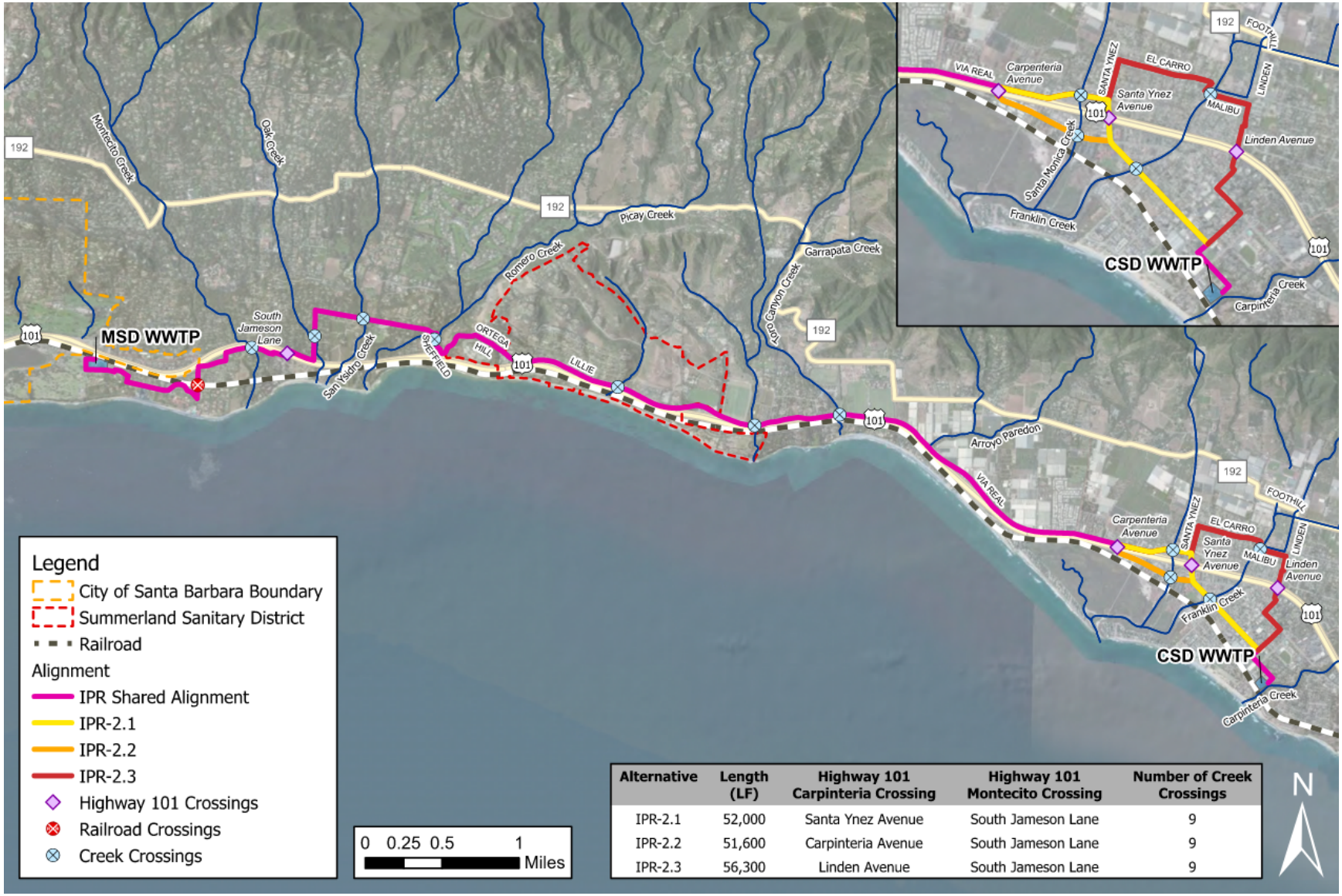
The Carpinteria IPR alternative represents a regional project in partnership with Carpinteria Sanitary District (CSD) and Carpinteria Valley Water District (CVWD). CSD and CVWD are currently developing the Carpinteria Advanced Purification Project (CAPP), an IPR project treating water from the CSD's WWTP and injecting into the Carpinteria Groundwater Basin. A regional IPR partnership would include expanding CAPP with additional source water from MSD's WWTP. Such a regional project has two primary alternatives[2]:

1. IPR 2 alternative (including subalternative alignments IPR-2.1, IPR-2.2, and IPR-2.3) would send 0.7 mgd secondary treated water to the CSD WWTP for advanced treatment as part of an expanded CAPP AWPF, conveyance, and injection. (Figure 9.9)
2. IPR 3 alternative would include advanced treatment at the MSD WWTP and sending 0.56 mgd of purified water to the injection well sites. (Figure 9.10)

The difference in the two primary Carpinteria IPR alternatives is the location of the AWPF required to meet drinking water standards for treatment before eventual injection into the Carpinteria Groundwater Basin. Infrastructure components for the two primary alternatives includes effluent pump station and conveyance piping, and connections to convey either secondary treated water (IPR-2.1, IPR-2.2, and IPR-2.3) or purified water (IPR-3.1).

Each alternative includes a new groundwater production well for CVWD to use the new IPR water. MWD is assumed to receive a similar amount of surface water delivered from Cater WTP in exchange for the purified water injected into the groundwater basin. MWD's exchange volume is assumed to be 90% of the volume of injected water based on leaving behind 10% of recharged water, which is typical for groundwater banking projects.

[2] A third alternative was considered - send raw MSD wastewater from the MSD WWTP to the CSD WWTP for secondary treatment and then incorporation into an expanded CAPP AWPF, conveyance, and injection. However, TM2: CSD and Santa Barbara WRP Capacity evaluated the feasibility of sending raw wastewater to CSD, and while capacity for fully equalized flow marginally exists, CSD would require plant expansion to maintain operational flexibility. As such, this third alternative was not further investigated.



Alternative	Length (LF)	Highway 101 Carpinteria Crossing	Highway 101 Montecito Crossing	Number of Creek Crossings
IPR-2.1	52,000	Santa Ynez Avenue	South Jameson Lane	9
IPR-2.2	51,600	Carpinteria Avenue	South Jameson Lane	9
IPR-2.3	56,300	Linden Avenue	South Jameson Lane	9

Figure 9.9 Carpinteria IPR 2 (CAPP Treatment) Alignment Alternatives

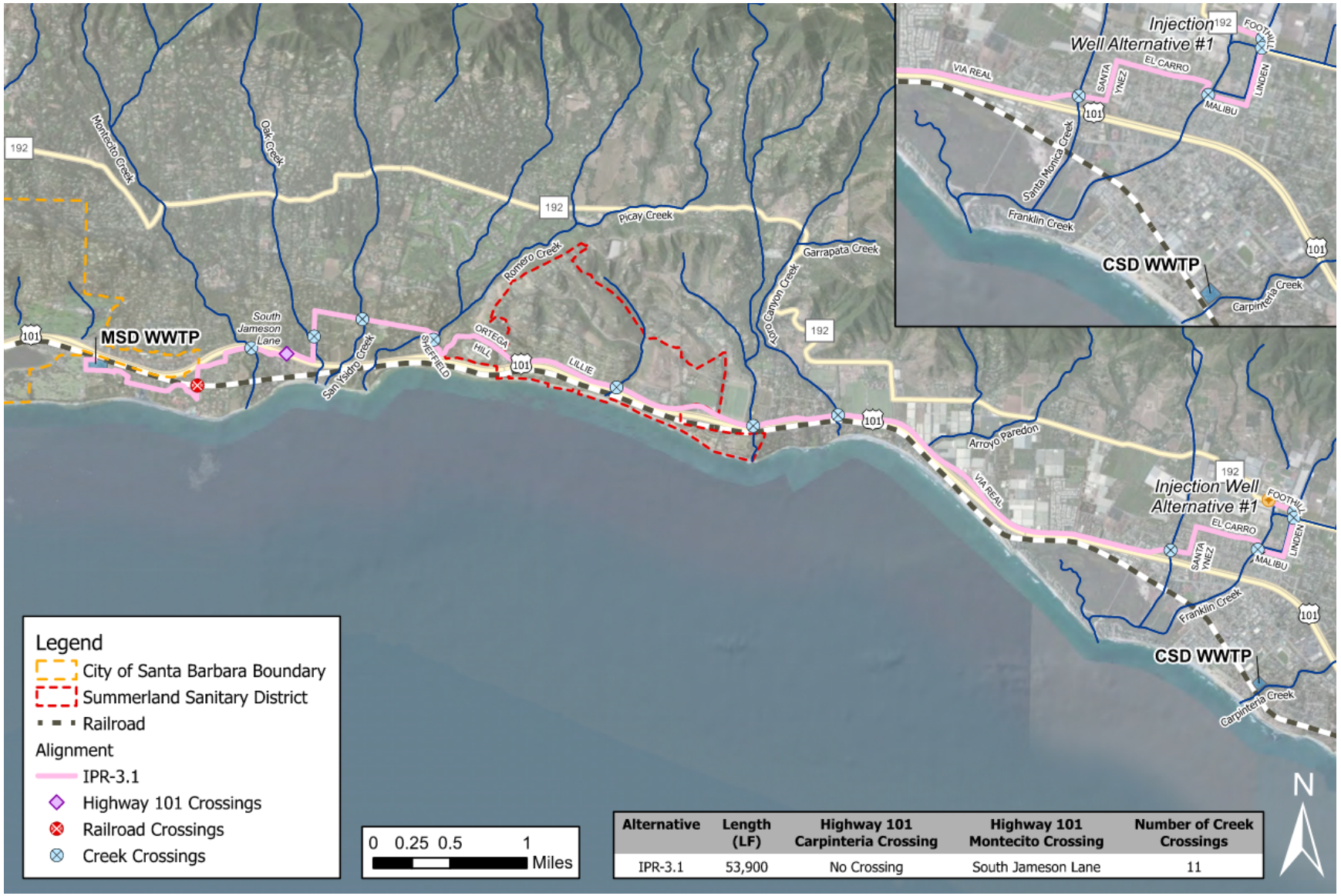


Figure 9.10 Carpinteria IPR 3 (MSD Treatment) Alignment Overview

9.5.1 Design Criteria

Criteria and assumptions were developed to aid in the preliminary sizing of infrastructure. The IPR water will be delivered on a near constant basis with no demand variability. The criteria for the IPR alternatives distributed infrastructure (piping and pump capacity) are provided in Table 9.12 and assume equalized treated water flow at MSD WWTP.

Table 9.12 Carpinteria IPR-2 – Hydraulic Design Criteria

Criteria	Units	Value	Notes
Maximum Design Flow	gpm	486	Equalized, average dry weather flow (0.70 mgd from Table 9.1)
Target Operating Flow	gpm	486	Same as Maximum Design Flow
Minimum Operating Flow	gpm	437	10% turndown of Target Operating Flow
Highest Delivery Elevation	ft amsl	255	Highest elevation in pipeline (205 ft) plus 50ft additional head
Delivery Pressure (to storage)	psi	10	

Table 9.13 Carpinteria IPR-3 - Hydraulic Design Criteria

Criteria	Units	Value	Notes
Maximum Design Flow	gpm	389	0.56 mgd from Table 9.1
Target Operating Flow	gpm	389	Same as Maximum Design Flow
Minimum Operating Flow	gpm	175	10% turndown of Target Operating Flow with 50% of RO equipment off
Highest Delivery Elevation	ft amsl	255	Highest elevation in pipeline (205 ft) plus 50ft additional head
Delivery Pressure (to injection well)	psi	10	

Based on the hydraulic analysis, a minimum 8-inch nominal diameter is anticipated for the Carpinteria IPR-2 and IPR-3 alignments.

For IPR-2 the pump station will be designed to accommodate a range of plant effluent flows. The pump station will have 3 duty pumps and 1 standby pump. Pumps are assumed to be on variable frequency drives to accommodate the lowest flow scenarios. For IPR-3, the pump station will be designed to accommodate the range of RO flows. The pump station will have 2 duty pumps and 1 standby pump. Pumps are assumed to be on variable frequency drives to accommodate the lowest flow scenarios.

Results of the hydraulic analysis for both alternatives are included in Appendix 9B. The analysis showed that the range of operating flows (minimum, target, and maximum) could be met with the pump configuration. As shown in Appendix 9B, the minimum and target operating flow conditions could be met with a single pump by reducing speed with a VFD. Similarly, the maximum operating flow could be met with two pumps on reduced speed. Additional details such as size of pumps for the recommended alternative are included in Section 9.5.4.

9.5.2 Carpinteria IPR-2 Alternative Comparison

This section describes the assessment and ranking that was completed for the alignments, providing a recommendation for selecting an alignment.

As discussed in Section 9.3.1.3, several alignment options were considered to cross US 101 and the list was narrowed to three preferred US 101 crossings. The South Jameson Road (at Miramar) crossing is assumed for the IPR-2 alternatives to be consistent with the recommended alternatives with NPR-1 alternative. From the MSD WWTP to Sheffield Drive, the IPR-2 alternative alignments follow the recommended Montecito NPR-1.1. Analysis for the IPR-2 alternative alignments will begin at the point of divergence from NPR-1.1 at Sheffield Drive and San Leandro Lane.

As shown on Figure 9.9, the Carpinteria IPR 2 alternative alignments differ at the second US 101 crossing location in Carpinteria and the associated pipeline alignments to and from the crossing points:

- IPR 2.1 – Second US 101 crossing in Carpinteria at Santa Ynez Avenue
- IRP 2.2 – Second US 101 crossing in Carpinteria at Carpinteria Avenue
- IPR 2.3 – Second US 101 crossing in Carpinteria at Linden Avenue

The following subsections describe the alternatives in Carpinteria IPR alternatives.

9.5.2.1 Alignment Considerations

Shared Alignment

- Music Academy of the West: Similar to NPR, the alignment would require an easement through the academy property.
- Max Elevation: The alignment gains over 100 ft of elevation in less than a quarter mile (average slope of 8%) before reaching the highest altitude at the top of Ortega Hill Road. This elevation was used as the maximum pumping elevation in the hydraulic analysis.
- Ortega Hill Road: Based on review of field markings, the portion from Sheffield Drive to Ortega Ridge Road includes sanitary sewer, a 16-inch high pressure gas main, potable water, and telecommunications. The presence of these utilities in a narrow and winding road may prove difficult in locating a feasible route for a new recycled water pipeline. Easements may need to be purchased through the commercial property at the top of Ortega Hill for portions of the alignment.
    - Alternatively, the alignment could follow the bike path that parallels Highway 101. This would require an easement from Caltrans and utility investigation. The alignment alternative should be evaluated if this recycled water alternative is selected.
- Lillie Avenue: Based on review of field markings, this segment appears to contain a high-pressure gas main as well as sanitary sewer and potable water mains. Lillie Avenue transitions to Via Real and the alignment route continues.
- Toro Canyon Creek: Creek is crossed via an aerial bridge crossing along Via Real.
- Unnamed Creek: Creek is crossed via an aerial bridge crossing along Via Real.

Figure 9.11 shows a typical bridge crossing along the north side of US 101. Figure 9.12 shows the top of Ortega Hill Road with dense utility backdrop as shown by presence of existing field markings.

Figure 9.11 Typical Bridge Crossing for Carpinteria Alignments

Figure 9.12 Ortega Hill Road Existing Utility Backdrop

IPR-2.1

- US 101 Crossing: Trenchless (jack and bore) from Santa Ynez Avenue to the hotel property located at 4558 Carpinteria Avenue. Easements will need to be secured to route the pipeline with the hotel parking lot to Carpinteria Avenue where the alignment will cross to 7th Street.
- Franklin Creek Crossing: Along 7th Street the alignment will cross Franklin Creek via an aerial bridge crossing.

IPR-2.2

- US 101 Crossing: Trenchless (jack and bore) from Via Real to the Carpinteria Avenue offramp from US 101 South. The lanes of Carpinteria Avenue form a tear drop shaped park near the offramp from US 101 South. The park includes a small grass area, several trees, and a welcoming sign for City of Carpinteria. This tear drop shaped area would provide sufficient space to cross US 101 via trenchless jack and bore to Via Real. The location of the crossing at Via Real is across from a community church. The church property is quite large with minimal development and may provide a suitable location for the start of the trenchless jack and bore or at minimum a construction laydown area.
- Santa Monica Creek Crossing: Along Carpinteria Avenue via an aerial bridge crossing located on Carpinteria Avenue.
- Franklin Creek Crossing: Along 7th Street via an aerial bridge crossing.

Figure 9.13 shows the existing US 101 turnoff onto Carpinteria Avenue. US 101 lanes are located on right of photo.

IPR-2.3

- El Carro Lane: There appears to be two waterlines with one located in each lane and a sanitary sewer in the middle. The presence of these utilities requires additional research into alignment positioning and may require DDW waivers if offsets can't be met.
- Franklin Creek Crossing: Along Malibu Drive via an aerial bridge crossing.
- US 101 Crossing: via trenchless jack and bore from Linden Avenue (north of highway) frontage road to an area just west of Linden Avenue (south of the highway) that used to be the former offramp before the US 101 widening project. Historical photos on Google Earth® and Street View® indicate the area was used for installation of a gas line crossing. Additional utility research will be required if this alignment is part of the selected project.

Figure 9.14 shows the potential north side of the crossing at Linden Avenue. US 101 lanes are located just behind sound wall. Existing utility background (gas lines and markers) are present in foreground of photo.

Figure 9.13 Carpinteria Avenue US 101 Crossing (south end)

Figure 9.14 Linden Avenue US 101 Crossing (north end)

9.5.2.2 Alignment Comparison

The Carpinteria IPR 2 alternative alignments differ at the second US 101 crossing location in Carpinteria and the associated pipeline alignments to and from the crossing points, which impacts pipeline length, cost, and community impacts.

All alternative alignments are over 9 miles, stretch through three distinct shoreline communities (Montecito, Summerland, and Carpinteria), and have the potential for significant community opposition as well as the need for extended easement negotiations. All alternative alignments have shared segments with potential for complicated impacts from existing utilities. Portions of the shared segments have existing large diameter and high-pressure gas mains as well as potable water, sanitary sewer, and telecommunications. Final design will require detailed utility research and significant potholing effort to confirm presence and location of existing utilities.

IPR-2.1

- Pipeline Length: IPR-2.1 is similar to IPR 2.2 and shorter than IPR2.3
- US 101 Crossing: The crossing location would require easement negotiation and purchase with the hotel property owner as well as financial compensation for disruption during construction. Easement acquisition adds variable cost and schedule impacts that are difficult to quantify. Costs presented for this alternative do not include easement acquisition through the hotel property.

IPR-2.2

- Pipeline Length: IPR-2.2 is similar to IPR 2.1 and shorter than IPR2.3
- US 101 Crossing: Entrance and exit pits located within existing right-of-way. Temporary easements could be secured with a church property located near the crossing location on Via Real. Negotiation and purchase with the church property owner may require financial reparation and post-construction repairs. Easement acquisition adds variable cost and schedule impacts that are difficult to quantify at this time. Costs presented for this alternative do not include easement acquisition (if needed) for access to the church property.

IPR-2.3

- Pipeline Length: IPR-2.3 is the longest of the three alternatives.
- US 101 Crossing: The crossing could be completed with jack and bore entrance and exit pits located within existing right-of-way. The north pit would be located within a Linden Avenue frontage road in front of houses. The south pit is located within an area that used to be the former southbound US 101 offramp for Linden Avenue but is no longer used. Temporary or permanent easements do not appear to be needed from private property owners.

Comparison Summary

Table 9.14 includes a summary of the analysis for each alternative. IPR-2.2 is the recommended alternative alignment because it has the most feasible crossing. The location of the IPR-2.1 US 101 crossing in Carpinteria has the most unknowns and will require negotiation of easements with a hotel property owner. The location of the IPR-2.3 US 101 crossing in Carpinteria also has unknowns related to the presence of other existing utilities that may be crossing the highway at the same location and impacts to adjacent residences.

Table 9.14 Summary of IPR Alternatives

Criteria	IPR-2.1 (2nd US 101 crossing at Santa Ynez Ave)	IPR-2.2 (2nd US 101 crossing at Carpinteria Ave)	IPR-2.3 (2nd US 101 crossing at Linden Ave)
Cost	$33.4 Mil	$33.3 Mil	$36.3 Mil
Unit Cost	$3,100/AF	$3,100/AF	$3,200/AF
Pipeline Length	52,000 lf	51,600 LF	56,300 lf
Demand	560 AFY	560 AFY	560 AFY
Summary of Benefits	• No apparent benefits	• More ideal US 101 crossing location	• Likely no additional easements needed
Summary of Risks	• US 101 crossing has significant unknowns due to trenchless crossing in hotel property • Utility unknowns on Ortega Hill Rd • Ownership and maintenance of MSD/MWD pipeline in multiple jurisdictions	• Utility unknowns on Ortega Hill Rd • Ownership and maintenance of MSD/MWD pipeline in multiple jurisdictions	• Requires additional utility research in area of US 101 crossing to determine feasibility • Utility unknowns on Ortega Hill Rd • Ownership and maintenance of MSD/MWD pipeline in multiple jurisdictions

9.5.3 Carpinteria IPR-3

9.5.3.1 Alignment

Alternative IPR-3 follows the same alignment as IPR-2.1 from the MSD WWTP to Via Real in Carpinteria. Potential alignment issues include:

- El Carro Lane: There appears to be two waterlines with one located in each driving lane and a sanitary sewer in the middle. The presence of these utilities requires additional research into alignment positioning and may require DDW waivers if offsets can't be met.
- Franklin Creek Crossing: Along Malibu Drive via an aerial bridge crossing.
- Residential Areas: The alignment is through predominantly residential areas.

From Malibu Drive, the alignment depends on which of the three potential injection well location selected[3]. The Canalino Elementary School Well pipeline turns south on Linden Avenue and east into the Canalino Elementary School. The other two well sites are north on Linden Avenue, which transitions to Foothill Road/SR 192. At the junction with SR 192 the alignment crosses two unnamed canals via culverts. The Family Baptist Church Well site is adjacent to Foothill Road/SR 192. The Carpinteria High School Well pipeline continues west along Foothill Road/SR 192 to the Carpinteria High School.

One well site is assumed to be required for the additional flow contributed from MSD since it is similar to the design flows for the two CAPP injection wells. (Groundwater modeling is needed to

[3] Note that the potential well sites were identified for cost estimating purposes and the owners of the potential well sites have not been contacted.

confirm the injection well assumptions for MWD/MSD). Easements will need to be secured for the well site – at the two school properties or church property.

9.5.4 Project Summary for Recommended Alternative

This section provides a full project summary including distributed infrastructure components for the recommended IPR alternative. Section 9.5.1presented design criteria for the IPR alternative for sizing of conveyance infrastructure including pipelines and pump stations. Section 9.5.2 presented an assessment of IPR-2 conveyance piping alignment alternatives from the MSD WWTP to the CSD WWTP.

The hydraulic analysis showed that the pump sizing is largely dependent on the highest point which happens along a portion of a shared segment along Ortega Hill Road. As such, all IPR alternatives require similar sized pumps making the pump station located at MSD WWTP the same size. The IPR-2 alternatives will require 3 duty pumps to meet the flow requirements where the IPR-3 alternative only needs 2 duty pumps.

The distributed infrastructure for the IPR-2 project will include the following primary components: effluent pump station located at the MSD WWTP, conveyance piping for delivery to CAPP AWPF at CSD WWTP, laterals off CAPP pipelines to a new injection well site, and a new injection well.

The distributed infrastructure for the IPR-3 project will include three primary components: effluent pump station located at the MSD WWTP, conveyance piping for delivery to a new injection well site, and a new injection well.

9.5.4.1 Project Description

For IPR-2, MSD WWTP secondary effluent would be pump secondary effluent to the CAPP AWPF at CSD WWTP while the AWPF would be at the MSD WWTP for IPR-3. In each alternative, the water conveyed via an effluent pump station located at the MSD WWTP. The effluent pump station will be in a wet-well style configuration. Pump electrical equipment, motor control center (MCC), operator controls, and a hydropneumatic tank will be placed nearby as shown on Figure 9.15.

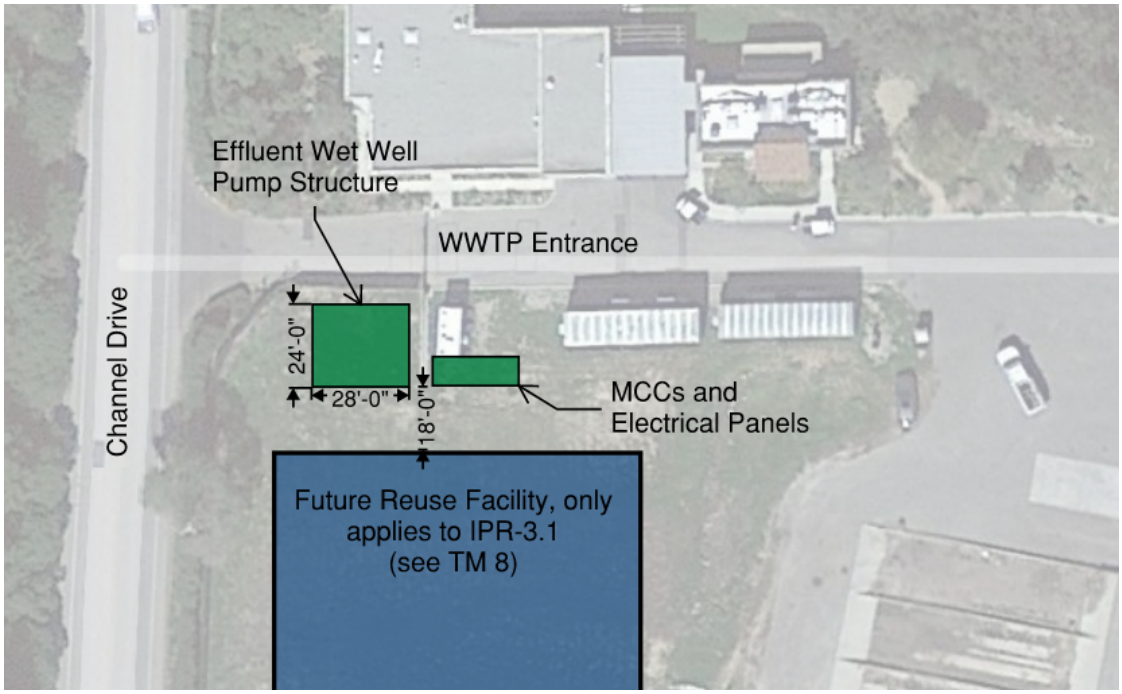


Figure 9.15 IPR Distributed Infrastructure Site Plan

Pumps will be configured in a 3+1 with three duty pumps and one standby. The structure will be designed to allow for approximately 50,000 gallons of storage with the dimensions shown on Figure 9.15.. Based on the hydraulic analysis, 20 horsepower (hp) pumps are anticipated for the pump station.

Pump control is ultimately dependent on the final alternative. It's likely the pumps will be controlled off wet well levels or a set flow point that is coordinated with the MSD WWTP treatment output. In all cases a remote pressure sensor may be required at the regional high point along Ortega Hill Road to ensure sufficient pressure in the pipeline and vacuum conditions don't occur. Level instrumentation in the wet well will provide high- and low-level overrides. Local control stations will be provided at each pump with a nearby motor control center.

As discussed previously end connections are dependent on the selected IPR project and final CAPP integration location:

- For IPR-2, flows are assumed to be discharge to the CAPP EQ basin that feeds the AWPF.
- For IPR-3, flow will be delivered under pressure to a new injection well.

9.5.4.2 Project Cost and Schedule

Table 9.15 presents a more detailed construction cost break down for the recommended IPR-2.2 alternative as well as the IPR-3.1 alternative including piping and other infrastructure components. For detailed cost breakdowns including other alternatives, see Appendix 9C.

Table 9.15 Carpinteria IPR Project Costs

Cost Item	Alternative IPR-2.2	Alternative IPR-3.1
Construction	$21,467,000	$20,697,000
Contingency (30%)	*$6,441,000*	*$6,210,000*
Engineering, Admin., and Legal (25%)	*$5,367,000*	*$5,175,000*
Total Project Cost	**$33,275,000**	**$32,082,000**
Annual O&M	$233,400	$226,900

Project schedule is dependent on several factors once the decision from MSD/MWD on the preferred recycled water alternative, including design progress, permitting, regulatory approvals, bid and construction climate, timing of Caltrans US 101 widening work, and other unforeseen factors. Given these factors, it is estimated that the engineering, funding, and permitting could be completed in 20 to 24 months, project bidding and contracting in 3 months, and distributed infrastructure construction in 32 to 34 months.

The Project is also dependent on the timing of CAPP, which is currently planned to start construction in early 2024 and start operations in late 2025. Although, timing for CAPP is subject to receipt of grant funding.

Another schedule constraint for this project is construction of the US 101 Highway crossing. As discussed in Section 9.3.2, the recommended (and lower cost) crossing would be constructed at the same time as the section of highway is constructed, which is currently projected by Caltrans for 2024 to 2025. MWD currently has plans to reinstall the crossing regardless of a future project for integration into their potable water system. Caltrans construction delays could result in delays in starting project operations if the crossing is constructed after the rest of the project.

9.6 Montecito DPR

The Montecito DPR alternative represents a project entirely within MSD/MWD service areas. This alternative would require infrastructure for the delivery of purified recycled water meeting drinking water quality standards to the influent of the MWD surface water treatment plant or potable distribution system. Infrastructure assumed under this analysis includes effluent pump station and conveyance piping, and potable connections.

9.6.1 Design Criteria

The DPR water will be delivered on a near constant basis. As such, the distributed infrastructure (piping and pump capacity) are largely tied to RO system output (overall capacity, train capacity, and turndown). A number of criteria and assumptions were developed to aid in the preliminary sizing of infrastructure. Hydraulic criteria used to develop pipeline and pump station capacities is presented in Table 9.16.

Table 9.16 Montecito DPR Hydraulic Design Criteria

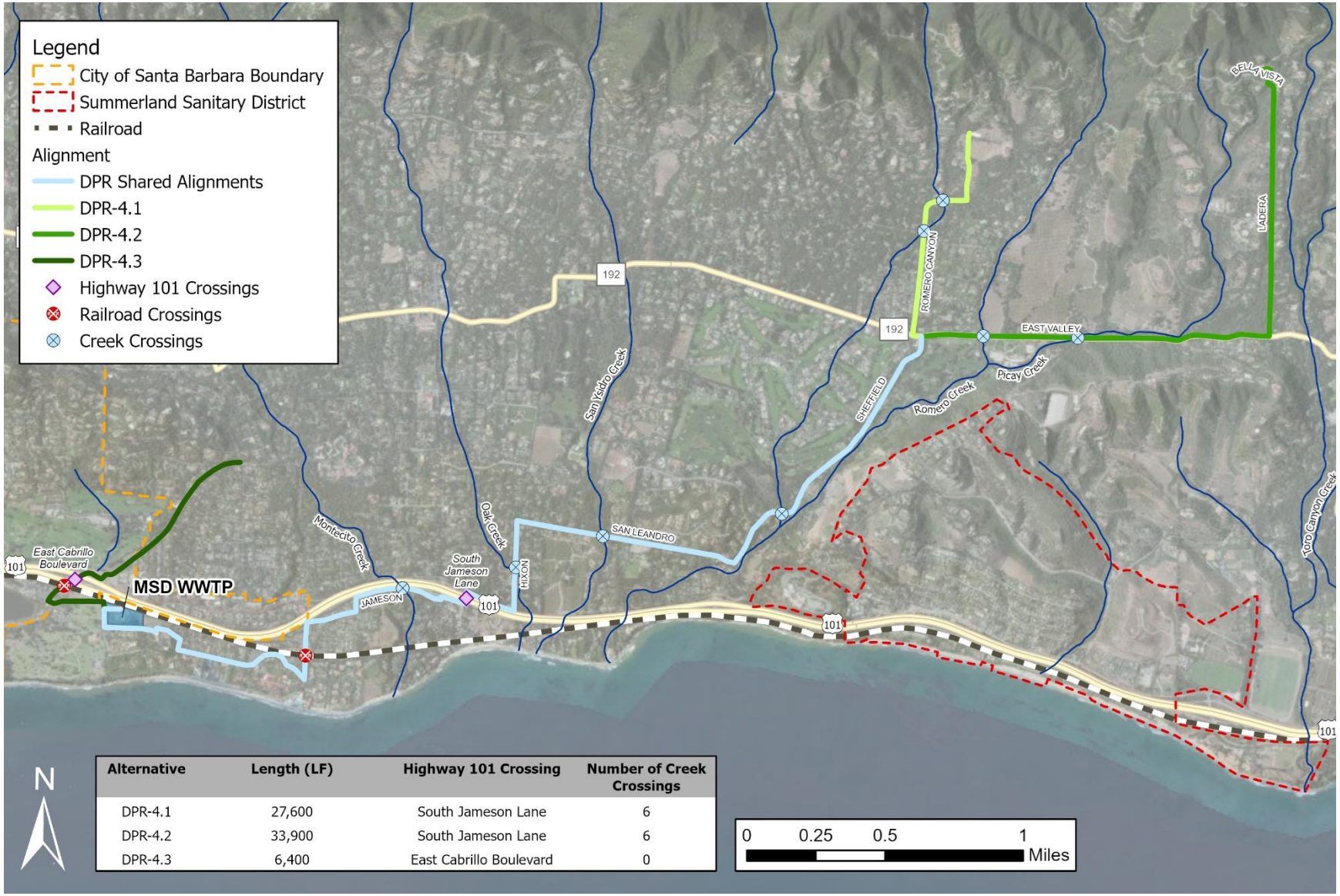
Criteria	Units	Value	Notes
RO Configuration	NA	2+1	2 duty trains and 1 redundant train at 0.35 mgd each
RO Turndown Capacity	%	10	10% turndown on each RO train
RO Efficiency	%	80	TM 8
Maximum Design Flow	gpm	389	80% of 0.7 mgd from Table 9.1
Target Operating Flow	gpm	194	80% of 0.35 mgd individual RO train capacity
Minimum Operating Flow	gpm	175	10% turndown of Target Operating Flow
Maximum Velocity	ft/s	5	Assumed maximum value
Pump Discharge Elevation	ft amsl	45	Elevation of MSD WWTP used for static head
Highest Delivery Elevation	ft amsl	1080	Elevation of the Bella Vista WTP
Friction Loss	unitless	135	Hazen-Williams C-factor for PVC pipe
Fitting Loss	%	5	Assumed percentage of friction losses
Delivery Pressure (to potable water system)	psi	135	As reported by MWD
Delivery Pressure (to WTP influent storage)	psi	10	

Notes:

A hydraulic analysis was performed using the criteria above for three alignment alternatives (Figure 9.16):

- DPR 4.1 – to Romero Canyon Reservoir
- DRP 4.2 – to Bella Vista WTP
- DPR 4.3 – to nearest large diameter (≥ 12-in) potable main

The terminating location at each alternative is meant to provide bounds on the project for various options (i.e., reservoir, WTP, and direct connection). Other reservoirs or direct system connection points could provide additional benefits and should be evaluated during future preliminary design.



Alternative	Length (LF)	Highway 101 Crossing	Number of Creek Crossings
DPR-4.1	27,600	South Jameson Lane	6
DPR-4.2	33,900	South Jameson Lane	6
DPR-4.3	6,400	East Cabrillo Boulevard	0

Figure 9.16 Montecito DPR Alignment Alternatives

The conveyance pipeline sizing was calculated balancing maximum velocity and friction loss. A minimum 10-inch nominal diameter is anticipated for the Montecito DPR-4.1 and DPR4.2 alignments. The Montecito DPR-4.3 alignment can accommodate an 8-inch nominal diameter pipeline due to the lower overall pipeline length and resulting less friction headloss. Using anticipated head losses, the hydraulic analysis was used to further determine the future pump design point and preliminary system curve. TM 8 includes analysis and preliminary sizing of the reverse osmosis (RO) system. Treatment trains with RO systems have limited turndown capacity, and the effluent pump station will be designed to accommodate the range of RO flows. Similar to the RO configuration (2 duty trains and 1 standby train) the effluent pump station will have 2 duty pumps and 1 standby pump. Pumps are assumed to be on variable frequency drives to accommodate the 10 percent (%) turndown of each RO train as well as anticipated demand-based flow variability.

9.6.2 Alignment Analysis and Recommendation

Several alignment options were considered based on review and selection of a narrowed list of preferred US 101 crossings. For the purposes of the Montecito DPR analysis, the preferred a portion of the NPR-1.1 alignment was used for the US 101 crossing at Miramar. As shown on Figure 9.16, the alternative alignments presented in the following section differ only at the MWD potable water system connection point. The following subsections describe the alternatives in Montecito DPR alignments and connection points.

Figure 9.17 shows the bridge crossing at Romero Creek along Sheffield Drive.

Figure 9.17 Romero Creek Crossing on Sheffield Drive

9.6.2.1 Alignment Considerations

DPR-4.1

Romero Canyon Road: Narrow semi-rural road with existing potable water line, sewer line, and gas main. Alignment follows Romero Canyon Road as it bends east before turning on a private driveway to access MWD's Romero Reservoir.

DPR-4.2

From Sheffield Drive the alignment will turn east on East Valley Road/SR 192. Along East Valley Road/SR 192 the alignment will cross two creeks, Romero Creek and Picay Creek, via aerial bridge crossings. From East Valley Road/SR 192 the alignment will turn north on Ladera Lane. The alignment will follow Ladera Lane north before briefly turning west on Bella Vista Drive. The alignment will then turn on a private driveway to access MWD's Bella Vista WTP.

Figure 9.18 shows a secondary Romero Creek crossing on East Valley Road/SR 192.

Figure 9.18 Romero Creek Crossing at East Valley Road/SR 192

DPR-4.3

The alignment for alternative DPR-4.3 differs from DPR-4.1 and DPR-4.2. The alignment exits the west side of the MSD WWTP and heads west along Channel Drive, then turning north onto East Cabrillo Boulevard. From East Cabrillo Boulevard the alignment will go under US 101 overpass, through Old Coast Highway and continuing north on Hot Springs Road. The alignment will follow a long east trending sweep in Hot Springs Road before connecting with the MWD system at the intersection of Hot Springs Road and Sycamore Canyon Road.

9.6.2.2 Hydraulics Requirements

DPR-4.1

MWD's Romero Reservoir is located at approximately 550 ft elevation and is lower in elevation than MWD's Bella Vista Water Treatment Plant (WTP) which is the connection point for alternative DPR-4.2. The lower elevation (smaller required static head) requires smaller pumps (less stages) and motors (40 hp) than those required for alternative DPR-4.2. Smaller pumps are generally less capital and require less operational costs (lower energy demand).

DPR-4.2

MWD's Bella Vista WTP is located at approximately 1,085 ft elevation. The higher elevation (larger static head) requires larger pumps (more stages) and motors (75 hp) than those required for alternative DPR-4.1.

DPR-4.3

The connection point in Hot Springs Road and Sycamore Canyon Road is significant in that it represents one of the nearest large diameter pipelines (12-inches) within MWD's distribution system. Accordingly, this option also does not uniformly distribute the purified water into the MWD system, compared to DPR-4.1 and DPR-4.2, which sends all water to Bella Vista. The proposed connection point is located at approximately 180 ft elevation, which is significantly lower than the connection points for alternatives DPR-4.1 and DPR-4.2. Although the elevation is lower the pumps will need to meet the distribution system hydraulic gradient in this area (i.e., minimum regional distribution pressure). The lower elevation (smaller required static head) requires smaller pumps (less stages) and motors (30 hp) than those required for higher static head alternatives. Both alternatives DPR-4.1 and DPR-4.2 make use of existing potable water storage, however, this alternative would include additional storage (0.5 MG) at the MSD WWTP to supply the potable system during diurnal periods when potable water demand may exceed the DPR production.

9.6.2.3 Alternative Alignment Evaluation

The three alternatives (DPR-4.1, DPR-4.2, and DPR-4.3) differ primarily in the MWD potable water system connection point. Table 9.17 provides a summary of the alternatives. DPR-4.2 is the most expense of the three alternatives but it provides the only RWA connection. DPR-4.1 and DPR-4.3 are less expensive due to shorter pipelines but entail TDWA. Further considerations such as schedule, permitting, and community impacts as well as a full project description including all conveyance infrastructure components for the DPR alternative are included in Section 9.6.3

Table 9.17 Summary of Montecito DPR Alternatives

Criteria	DPR-4.1 (TDWA to Romero Reservoir)	DPR-4.2 (RWA to Bella Vista WTP)	DPR-4.3 (TDWA to Distribution System)
Capital Cost	$17.0 Mil	$20.8 Mil	$10.3 Mil
Unit Cost	$1,700/AF	$2,000/AF	$1,100/AF
Pipeline Length	29,100 LF	37,500 LF	6,380 LF
Summary of Benefits	• Enables greater distribution of DPR supply across MWD versus DPR-4.3	• Connection point allows for RWA • Enables greater distribution of DPR supply across MWD versus DPR-4.3	• Significantly shorter and cheaper • Less impacts to sensitive residential areas
Summary of Risks	• Much longer than DPR-4.3 • Impacts to sensitive residential areas	• Highest cost • Impacts to sensitive residential areas	• Integration with existing potable water system capacity

9.6.3 Project Summary

This section will provide a full project summary including distributed infrastructure components for the Montecito DPR alternative. Section 9.6.1 presented design criteria for the Montecito DPR alternative for sizing of conveyance infrastructure including pipelines and pump stations. Section 9.3 presented alignment evaluation criteria and Section 9.6.2 assessment of conveyance piping alignment alternatives from the MSD WWTP to the end potable water connection point. The distributed infrastructure for the DPR alternative will include three primary components: effluent pump station located at the MSD WWTP, conveyance piping for delivery to potable water connection point, and end connections and retrofits allowing for permitted direct potable reuse of the water.

9.6.3.1 Project Description

The effluent pump station will be in a wet-well style configuration. Pumps will be configured in a 2+1 with two duty pumps and one standby. Given potable water demand far exceeds DPR production, no smaller pump was assumed for the alternatives DPR-4.1 and DPR-4.2 since existing potable water system storage can be used to even out diurnal demands. In these alternatives pump station will deliver all produced water from the treatment system. The DPR-4.3 alternative directly connects to the system and require an additional jockey pump and storage at MSD. Instrumentation will be provided to allow for sufficient flexibility in controls including pressure, flow, and level equipment.

Pump control is ultimately dependent in this alternative on the final operation of the entire DPR system. Given the limitations on treated effluent production, it is expected controls will be based on levels in the wet well structure or a set flow rate based on treatment capacity. Level instrumentation in the wet well will also provide high- and low-level overrides.

Each alternative discharges to a different location within MWD's potable water system as summarized below:

- The DPR-4.1 alternative would discharge into the existing Romero Canyon Reservoir which is one of nine reservoirs operated by MWD.
- The DPR-4.2 alternative would discharge on the raw water side of the Bella Vista WTP for eventual treatment.
- The DPR-4.3 alternative would connect directly with a 12-inch distribution main in the intersection of Hot Springs Road and Sycamore Canyon Road.

9.6.3.2 Project Cost and Schedule

Table 9.18 presents a summary of construction cost estimates for the three alternative alignments and other infrastructure components. For detailed cost breakdowns, see Appendix 9C, Cost Estimates.

Table 9.18 Montecito DPR Project Costs

Cost Item	Alternative DPR-4.1	Alternative DPR-4.2	Alternative DPR-4.3
Construction	$10,953,000	$13,405,000	$6,639,000
Contingency (30%)	*$3,286,000*	*$4,022,000*	*$1,992,000*
Engineering, Admin., and Legal (25%)	*$2,739,000*	*$3,352,000*	*$1,660,000*
Total Project Cost	**$16,978,000**	**$20,779,000**	**$10,291,000**
Annual O&M	$162,000	$166,000	$117,200

Project schedule is dependent on several factors most importantly the decision from MSD/MWD on the preferred recycled water alternative, design progress, numerous permitting hurdles, regulatory approvals, bid and construction climate, timing of Caltrans US 101 widening work, and other unforeseen factors. In addition, the State plans to issue final DPR regulations in December 2023. Given these factors, it is estimated that the engineering, funding, permitting, and DPR regulatory compliance could be completed in 24 to 36 months, project bidding and contracting in 3 months, and distributed infrastructure construction in 23 to 25 months.

Another schedule constraint for this project is construction of the US 101 Highway crossing. As discussed in Section 9.3.2, the recommended (and lower cost) crossing would be constructed at the same time as the section of highway is constructed, which is currently projected by Caltrans for 2024 to 2025. MWD currently has plans to reinstall the crossing regardless of a future project for integration into their potable water system. Caltrans construction delays could result in delays in starting project operations if the crossing is constructed after the rest of the project.

9.6.3.3 Project Considerations

The project also has the potential to affect sensitive segments of the community including residential areas with small streets limiting work access and with potential for noise and other environmental impacts.

9.7 DPR in Santa Barbara

The Santa Barbara DPR alternative represents a regional project in partnership with the City of Santa Barbara (Santa Barbara). Santa Barbara has developed conceptual plans for a potential future DPR project that includes: new AWPF supplied from and near the Santa Barbara's El Estero Water Reclamation Plant (WRP); use of the existing NPR distribution system combined with new pipelines to deliver purified water to the Lauro Reservoir; blending with surface water supplies from Lake Cachuma and State Water Project in the reservoir; and final treatment at the

Cater Water Treatment Plant (WTP). Treated water from Cater WTP is delivered to Santa Barbara's potable water system and is conveyed to MWD via the South Coast Conduit transmission pipeline.

This alternative would convey MSD's wastewater flows to the El Estero WRP to supplement Santa Barbara wastewater flows and potentially increase the size of Santa Barbara's planned DPR project. This alternative requires infrastructure to deliver MSD treated wastewater or raw wastewater to the El Estero WRP with new pipelines and the existing the Santa Barbara collection system. Potential infrastructure includes new gravity sewer alignments, upsizing of existing Santa Barbara collection system segments, and new pipelines to convey purified water to the Cater WTP. The treated water would be conveyed to MWD via the South Coast Conduit.

Three alternatives are evaluated:

- DPR-5.1: Convey MSD dry weather flow by upsizing segments of the existing Santa Barbara collection system.
- DPR-5.2: Convey MSD dry weather flow by constructing a new gravity sewer
- DPR-5.3: Convey MSD wet weather flow (instantaneous peak) by constructing a new gravity sewer

For DPR-5.1 and DPR-5.2, these two options are either transport of treated secondary effluent to Santa Barbara (and thus maintain the operation of the MSD WWTP) or are equalized raw wastewater and require construction of a large equalization tank to handle all flow in excess of the ADWF.

9.7.1 Design Criteria

Criteria and assumptions were developed to aid in the preliminary sizing of infrastructure. The alternatives include conveyance of only MSD dry weather flows or all MSD flows (including peak wet weather flows). Santa Barbara requested that dry weather flows be delivered to El Estero WRP overnight to help increase wastewater flows to El Estero when they receive their lowest flows. The criteria for the DPR alternatives distributed infrastructure (gravity piping) are provided in Table 9.19. A hydraulic analysis was performed using an existing Santa Barbara sanitary sewer model in InfoSewer® by Innovyze.

Table 9.19 Santa Barbara DPR - Hydraulic Design Criteria

Criteria	Units	Value	Notes
MSD Dry Weather Flow (DPR-5.1 and DPR-5.2)	mgd	2.1	Average Dry Weather flow delivered over 8-hour period, Table 9.1
MSD Instantaneous Peak (DPR-5.3)	mgd	8.76	Wet Weather Flow, Table 9.1
MSD WWTP Influent Pipe Elevation	ft amsl	21.0	MSD estimate of 20.5 ft – 21.5 ft based on May 2022 field investigation
Downstream MH Elevation	ft amsl	-4.8	Elevation per City of Santa Barbara collection system model, MH located near intersection of E. Cabrillo Blvd. and Calle Puerto Vallarta
Maximum Pipe Capacity (q/Q)	unitless	0.6	Used for sizing gravity sewer pipes

Santa Barbara's existing collection system includes parts of Montecito – primarily the Coast Village Road area. A Santa Barbara sewer routes through the MSD WWTP (as shown on Figure 9.19). The Santa Barbara sewer easement provides a convenient location to connect MSD's system for a joint DPR project. The flows associated with each alternative dictate the extent and size/capacity of the upgrades required to convey MSD flows to the El Estero WRP. Preliminary discussions with both MSD and Santa Barbara indicated the preference for a gravity flow system (versus pressurized force main) if feasible from MSD WWTP to El Estero WRP. Surveying was not performed in preparation of the ERWFS, however, MSD staff were able to take field invert measurements and determine the approximate elevation of the influent line from previous surveys. Elevations would need to be confirmed during future preliminary and final design phases to confirm the extent of new gravity pipeline installation needed if this project is selected. The infrastructure components of the Santa Barbara DPR alternatives are presented in the following section.

9.7.2 Alternative Comparison

The Santa Barbara DPR alternatives differ in the discharge volume or alignment. The alternatives discussed in the following sections describe varying gravity sewer alignments to convey wastewater from MSD to Santa Barbara's El Estero. Improvements required for all alternatives, such as conveying purified water from a new AWPF to Cater WTP is discussed in the project summary (Section 9.7.3). The following subsections describe the alternatives in Santa Barbara DPR alternatives.

.

Alternative	Length (LF)	Number of Creek Crossings
DPR-5.1	5,400	0
DPR-5.2	8,200	1
DPR-5.3	11,700	1

Figure 9.19 Santa Barbara DPR Alignment Alternatives

9.7.2.1 Santa Barbara Alternative DPR-5.1

Under alternative DPR-5.1, the MSD WWTP would produce secondary effluent and effluent would be stored for discharge at night (8 hours) to the El Estero WRP. While resulting in retreating the effluent at El Estero, this option preserves the MSD treatment facilities and leaves options open for future variations of water reuse.

For this option, the storage would be sized at 0.47 MG enough to accept 16 hours of flow (0.7 mgd) during non-discharge times. The MSD effluent would discharge to the Santa Barbara system at the manhole located in the intersection of Channel Drive and East Cabrillo Boulevard. This would require approximately 1,700 ft of new 8-inch gravity that would be installed parallel to the existing 8-inch sewer. According to the model results the full capacity of the existing 8-inch is just under 0.5 mgd, therefore a parallel line would be required to release the 2.1 mgd at night (Table 9.19).

Beyond the manhole, a new 18-inch gravity sewer main would be required replacing the existing alignment along Los Patos Way and the north side of the Andree Clark Bird Refuge (Figure 9.20). The 42-acre Andree Clark Bird Refuge is bound by US 101 and includes an artificially modified estuary that supports brackish wetlands and wildlife. The park provides passive recreation opportunities such as bird watching, hiking, and biking. There are a number of sensitive wildlife species, such as tidewater goby, southwest pond turtle, and several birds protected under the Migratory Bird Treaty Act. Once through the Andree Clark Bird Refuge, the new pipe would reconnect with an existing manhole located within the Santa Barbara Zoo.

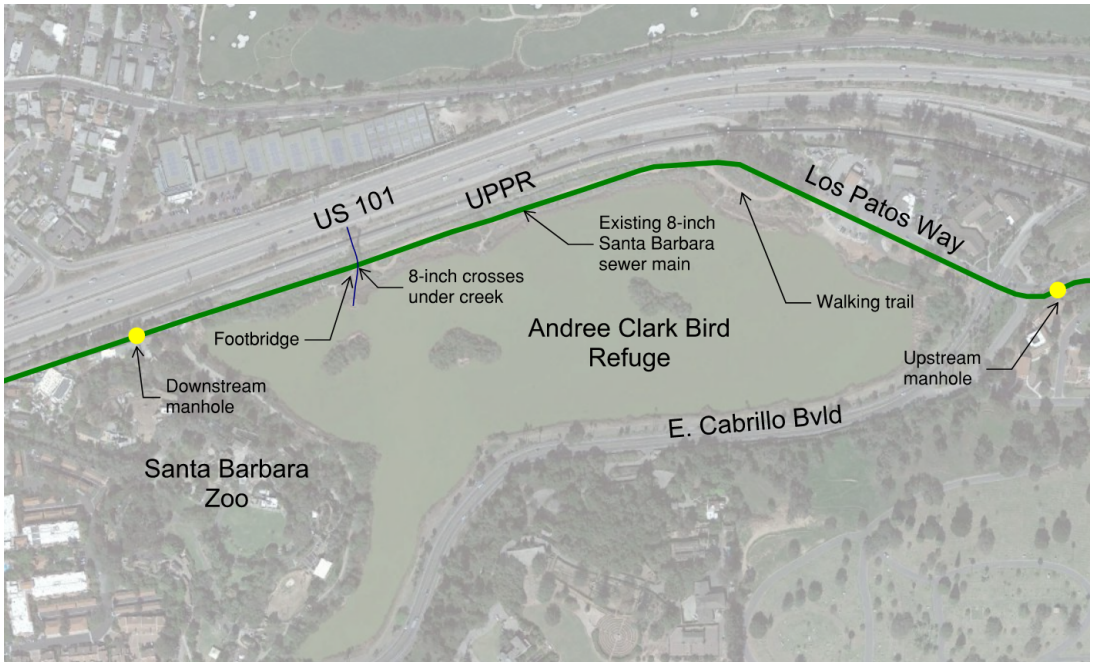


Figure 9.20 DPR-5.1 Alignment along Andree Clark Bird Refuge Area

The existing gravity main alignment is between UPRR (and US 101) to the north and the estuary to the south (Figure 9.20). The narrow corridor is ranges from approximately 80 to 160 ft bound by the natural variability of the north bank of the Andree Clark Bird Refuge estuary and the UPRR property. Replacing the main here will require overcoming numerous challenges including envi

ronmental permitting, constructability, access and working constraints, and navigating a creek crossing on the upland inlet to the estuary. Figure 9.21 shows the path the existing sewer follows with an existing manhole pictured. The sewer would cross below the creek at a similar vertical alignment as the existing pipeline. The environmental permitting and resulting mitigation measures will add complexity, cost, and lengthen schedule. Construction windows may be limited to off-breeding seasons and there will be temporary impacts to recreational activities during this time. In addition, future coastal inundation and sea level rise should be considered for the pipeline alignment. MWD/MSD will need to work with Santa Barbara on how to best address this issue.

The alternative would include upsizing the existing 8-inch to an 18-inch gravity main, replacement of approximately 10 existing manholes, and tie-ins to the existing system.

Figure 9.21 Andree Clark Bird Refuge Existing Sewer and Path

9.7.2.2 Santa Barbara Alternative DPR-5.2

Alternative DPR-5.2 is similar to DPR-5.1 except that a new sewer is proposed in East Cabrillo Boulevard instead of upsizing the existing sewer. Similar to DPR-5.1, DPR-5.2 includes:

- Use of secondary effluent from MSD WWTP
- 0.47 MG storage of effluent for nighttime discharge (similar to DPR-5.1)
- 1,700 ft of new 8-inch gravity main to the manhole at Channel Drive and East Cabrillo Boulevard

Beyond the manhole, a 15-inch gravity sewer main along East Cabrillo Boulevard paralleling the coastline. The alignment along East Cabrillo Boulevard may require an inverted siphon as the

hydraulic gradient may be impacted by the elevation of a culvert associated with the estuary. The gravity main will also cross Sycamore Creek. If hydraulics allow, the crossing may be suspended from the bridge or placed over the highwater mark. If the hydraulic gradient is unfavorable in this location a second inverted siphon may be required. The new gravity main would terminate at an existing manhole located at East Cabrillo Boulevard and Calle Puerto Vallarta.

Figure 9.22 shows the existing culvert at the estuary outlet and Figure 9.23 shows the existing bridge and pedestrian bridge over Sycamore Creek.

Figure 9.22 Culvert Crossing along Cabrillo Boulevard

Figure 9.23 Sycamore Creek Crossing along Cabrillo Boulevard

DPR-5.2 would be located within an existing roadway thereby reducing the environmental impact, constructability, and permitting risks. However, the DPR-5.2 carries unique risks. The alignment requires potentially two inverted siphons in close proximity due to culvert and creek crossings. DPR-5.2 is lower in elevation and closer to the ocean. The California Coastal Commission recently released new guidance for new infrastructure within the coastal zone particularly those in proximity to the coast. Sea level rise will increase risk to water infrastructure from hazards such as inflow and infiltration (I&I), saltwater intrusion, tidal inundation, rising groundwater, coastal erosion, and storm flooding (California Coastal Commission, 2021). Similar to DPR-5.1, future coastal inundation and sea level rise should be considered for the pipeline alignment. MWD/MSD will need to work with Santa Barbara on how to best address this issue.

9.7.2.3 Santa Barbara Alternative DPR-5.3

Under Alternative DPR-5.3, the MSD WWTP would not operate and all MSD flows would be conveyed to the El Estero WRP. DPR-5.3 uses the same alignment as DPR-5.2 but has a larger gravity main (24-inches) to accommodate instantaneous peak flows (up to 8.8 mgd) and continues to the El Estero WRP rather than stopping at Calle Puerto Vallarta. This would require crossing the UPRR with a new pipeline via trenchless methods by Chase Palm Park.

Similar to DPR-5.2, this alternative would require an inverted siphon at the estuary culvert as well as the potential for a second inverted siphon at the Sycamore Creek crossings. The alternative would also include 0.47 MG of storage at MSD WWTP to capture dry weather flows during the day for delivery at night, similar to delivery plans for DPR 5-1 and 5.2.

DPR-5.3 carries risks similar to DPR-5.2 due to the need for at least one and likely two inverted siphons in close proximity for culvert and creek crossings as well as sea level rise risks. DPR 5.3 also has a trenchless crossing will be required at the railroad.

9.7.2.4 Alternative Evaluation

The Santa Barbara DPR alternatives differ in the flow design criteria and alignment path. DPR-5.1 and DPR-5.2 have the same flow assumptions but the DPR-5.2 alignment follows a southerly route along East Cabrillo Boulevard. Conversely, DPR-5.2 and DPR-5.3 share similar alignments but vary in the end flow assumptions driving pipeline capacity and sizing. Ultimately the recommended Santa Barbara DPR alternative depends largely on permitting constraints and the plan for the MSD WWTP.

DPR-5.1's alignment through the Andree Clark Bird Refuge introduces permitting constraints, environmental impacts, access issues, and constructability risk that greatly lower the feasibility of this alternative. A new sewer in East Cabrillo Boulevard, which has its own permitting risks, would be the most feasible route from the MSD WWTP to the El Estero WRP. All three DPR alternatives are carried forward for the complete analysis of water reuse options.

Table 9.20 Summary of DPR Alternatives

Criteria	DPR-5.1 (2 mgd Nighttime flows)	DPR-5.2 (2 mgd Nighttime flows)	DPR-5.3 (8.76 mgd instantaneous peak)
Cost	$9.9 Mil	$11.9 Mil	$23.0 Mil
Unit Cost	$900/AF	$1,200/AF	$2,200/AF
Pipeline Length	3,665 LF	8,180 LF	11,780 LF
Summary of Benefits	• Shortest overall length	• Pipeline installed entirely in roads; No easement acquisitions • Lower residential impacts	• Same as DPR-5.2
Summary of Risks	Project setting causes: • Permitting risks • Environmental and community impacts mitigation and risks • Constructability issues due to difficult access • Ownership and maintenance of MSD/MWD pipeline in another jurisdiction	• Inverted siphons required for creek and culvert crossings • CA Coastal Commission permitting approvals • Future maintenance concerns with I&I and sea level rise • Ownership and maintenance of MSD/MWD pipeline in another jurisdiction	• Same as DPR-5.2 • Add'l required pipe to El Estero

9.7.3 Project Summary for Recommended Alternatives

The DPR alternatives include three primary components: 1) MSD WWTP modifications; 2) Gravity main from MSD WWTP to El Estero WRP; and 3) conveyance from new Santa Barbara AWPF to Cater WTP.

9.7.3.1 MSD WWTP Modifications

DPR-5.1 and DPR-5.2 propose to convey secondary effluent and DPR-5.3 propose to convey raw wastewater. As a result, MSD WWTP modifications differ greatly:

- DPR-5.1/DPR-5.2: MSD WWTP would continue operate without improvements. 0.47 MG of storage would be needed to store daytime dry weather flows for discharge to El Estero WRP at night.
- DPR-5.3: MSD WWTP would be abandoned and retrofitted to provide 0.47 MG of storage to store daytime dry weather flows for discharge to El Estero WRP at night. Wet weather flows would be conveyed without any equalization.

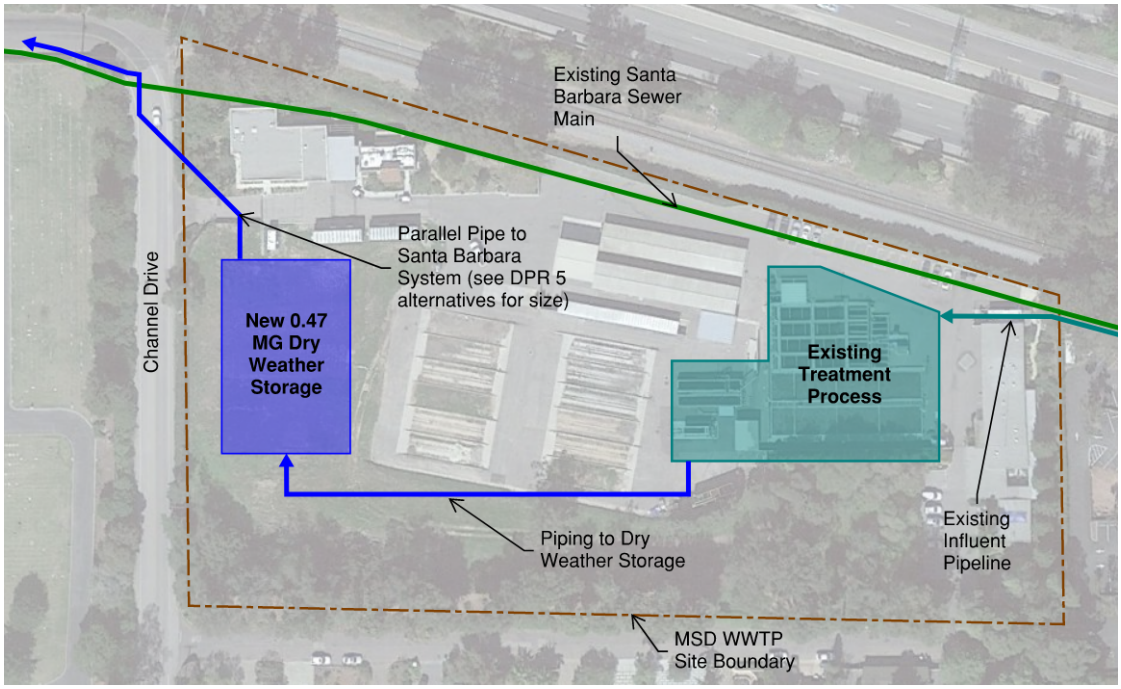


Figure 9.24 Santa Barbara DPR Infrastructure Site Plan

9.7.3.2 Purified Water Conveyance

Modifications will be required to Santa Barbara's existing recycled water conveyance infrastructure for the new DPR conveyance to the Cater Water Treatment Plant. The 2017 Potable Reuse Feasibility Study (Carollo Engineers, Inc., 2017) alternative 1B recommends repurposing an existing 12-inch NPR pipeline and adding a parallel 12-inch conveyance pipeline to accommodate the projected 5.7 mgd project flows. TM8 estimates project flows will be either 3.7 or 6.2 mgd. Required modifications to Santa Barbara's NPR system is summarized in Table 9.21.

Table 9.21 Santa Barbara DPR, Purified Water Conveyance Pipeline Sizing

Project Flows, TM 8 (mgd)	Velocity in Existing 12-inch (ft/sec)	Needs parallel pipe? (over 5 ft/sec)	Size of Parallel Pipe (in)
6.2	12.21	Yes	16
3.7	7.29	Yes	8

Modifications would include approximately 14,000 linear feet of piping at the diameters presented in Table 9.21. WSC estimates $3,864,000 (8-inch) to $5,096,000 (16-inch) of additional piping costs as presented in Table 9.22. The conveyance piping would be a shared cost between project partners and is not included in the totalized amount.

9.7.3.3 Project Cost and Schedule

Table 9.22 presents a more detailed construction cost break down for the DPR alternatives including piping and other infrastructure components. For detailed cost breakdowns including other alternatives, see Appendix 9C, Cost Estimates.

Table 9.22 Santa Barbara DPR Infrastructure Project Costs

Cost Item	Alternative DPR-5.1	Alternative DPR-5.2	Alternative DPR-5.3
Construction	$6,374,000	$7,661,000	$14,816,000
8-inch DPR Conveyance (not included in total)	*$3,864,000*	*$3,864,000*	*$3,864,000*
16-inch DPR Conveyance (not included in total)	*$5,096,000*	*$5,096,000*	*$5,096,000*
Contingency (30%)	*$1,913,000*	*$2,299,000*	*$4,445,000*
Engineering, Admin., and Legal (25%)	*$1,594,000*	*$1,916,000*	*$3,704,000*
Total Project Cost	**$9,881,000**	**$11,876,000**	**$22,965,000**
Annual O&M	$37,700	$93,700	$163,100

Project schedule is dependent on several factors but most importantly the decision from MSD/MWD on the preferred recycled water alternative and the City of Santa Barbara's plans to implement DPR. Overall project schedule is dependent on outside factors such as timing of regulations and Santa Barbara's project. The State plans to issue final DPR regulations in December 2023 and Santa Barbara currently doesn't foresee implementing DPR until at least 2035.

9.8 References

California Coastal Commission. (2021). *Draft Critical Infrastructure at Risk: Sea Level Rise Planning Guidance for California's Coastal Zone.*

Carollo Engineers, Inc. (2017). *Potable Reuse Feasibility Study.* City of Santa Barbara.

Woodward & Curran. (2019). *Recycled Water Facilities Plan.*

Appendix 9A

CUSTOMER DEMAND ASSESSMENT SUMMARY

Memorandum

Date: 8/22/2022

Prepared by: Rob Morrow, PE

Reviewed by: Michael Goymerac, PE

Project: Montecito Enhanced Recycled Water Feasibility Study

SUBJECT: **NON-POTABLE CUSTOMER ASSESSMENTS**

---

1 Introduction

The 2019 RWFP identified eight non-potable customers that could provide demand for recycled water within Montecito (Woodward & Curan, 2019). The eight customers include three large "anchor" customers (Birnam Wood Golf Club, Santa Barbara Cemetery, and Valley Club Montecito) as well as other smaller potential customers that could be served from the pipeline alignments between the MSD WWTP and the "anchor" customers. The RWFP recommended, as a next step, conducting customer assessments to better estimate the potential recycled water use at each site since many were difficult to estimate from potable water use records due to the use of on-site groundwater wells.

For this study, the larger customers were engaged through in person and remote discussions and a list of questions to understand potential recycled water service needs. In addition, potable use from 2018 to 2021 was reviewed for each customer based on MWD billing records. This memo summarizes the information collected from these conversations combined with data available from MWD.

The following sections summarize the latest basis for recycled water service to the five largest potential customers:

- Birnam Wood Golf Club
- Valley Club Montecito
- Santa Barbara Cemetery
- Four Seasons Resort The Biltmore Santa Barbara at Montecito
- Rosewood Miramar Beach Resort

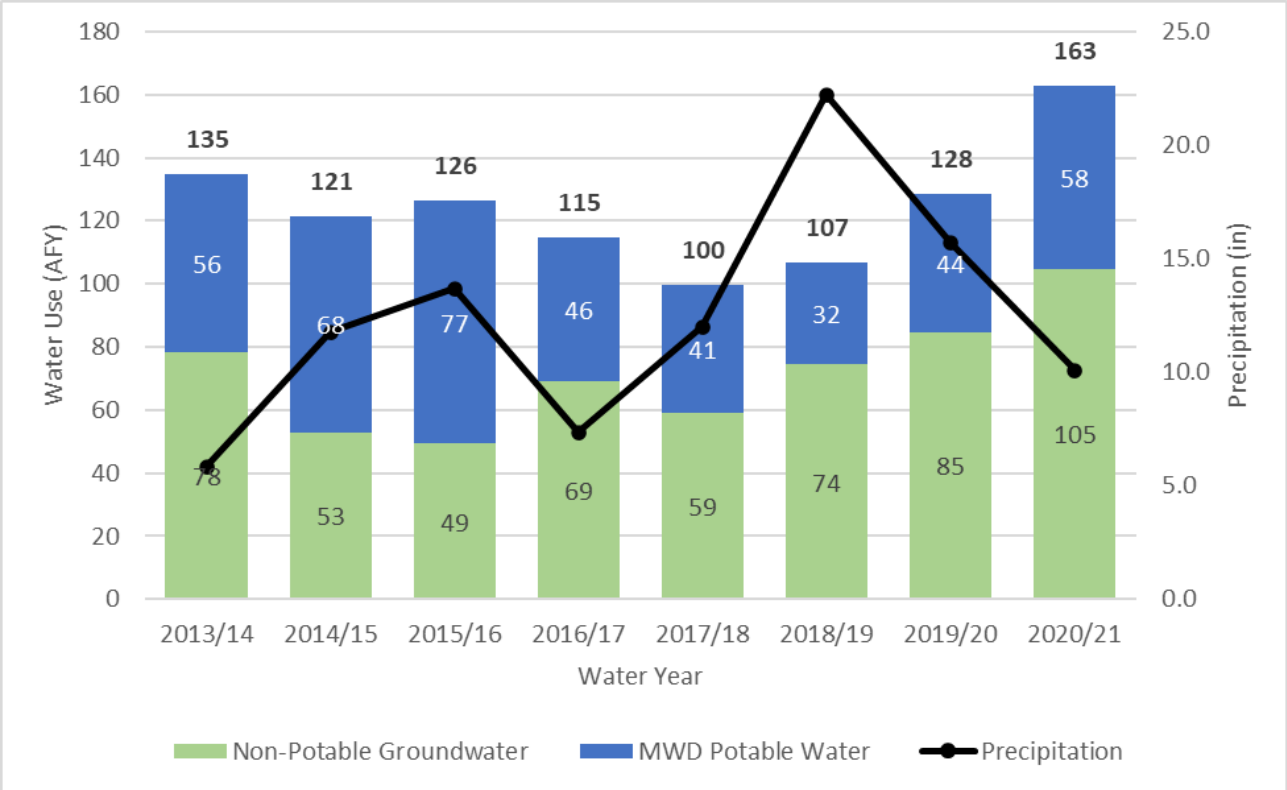
2 Birnam Wood Golf Couse

Birnam Wood Golf Club (Birnam Wood) uses untreated groundwater and potable water for irrigation. MWD operates non-potable wells at Birnam Wood and, in turn, Birnam Wood, pays for this water at the non-potable water rate. Birnam Wood generally uses groundwater first and takes delivery of potable water from MWD to meet the balance of irrigation water demand. Birnam Wood blends groundwater and potable water in a pond, which is roughly 400,000 gallons and is located off of Birnam Wood Drive. The irrigation system is supplied from the pond. Most irrigation occurs at night while some targeted watering occurs during the day. For the purpose of this study, it was assumed that recycled water would offset potable water use and be delivered to the pond.

MWD delivers non-potable groundwater to Birnam Wood from five wells – three are shallow and two are deeper: Las Fuentes well and Valley Club well. The shallow wells frequently go dry during drought conditions so the two deeper wells historically provide the bulk of groundwater to Birnam Wood.

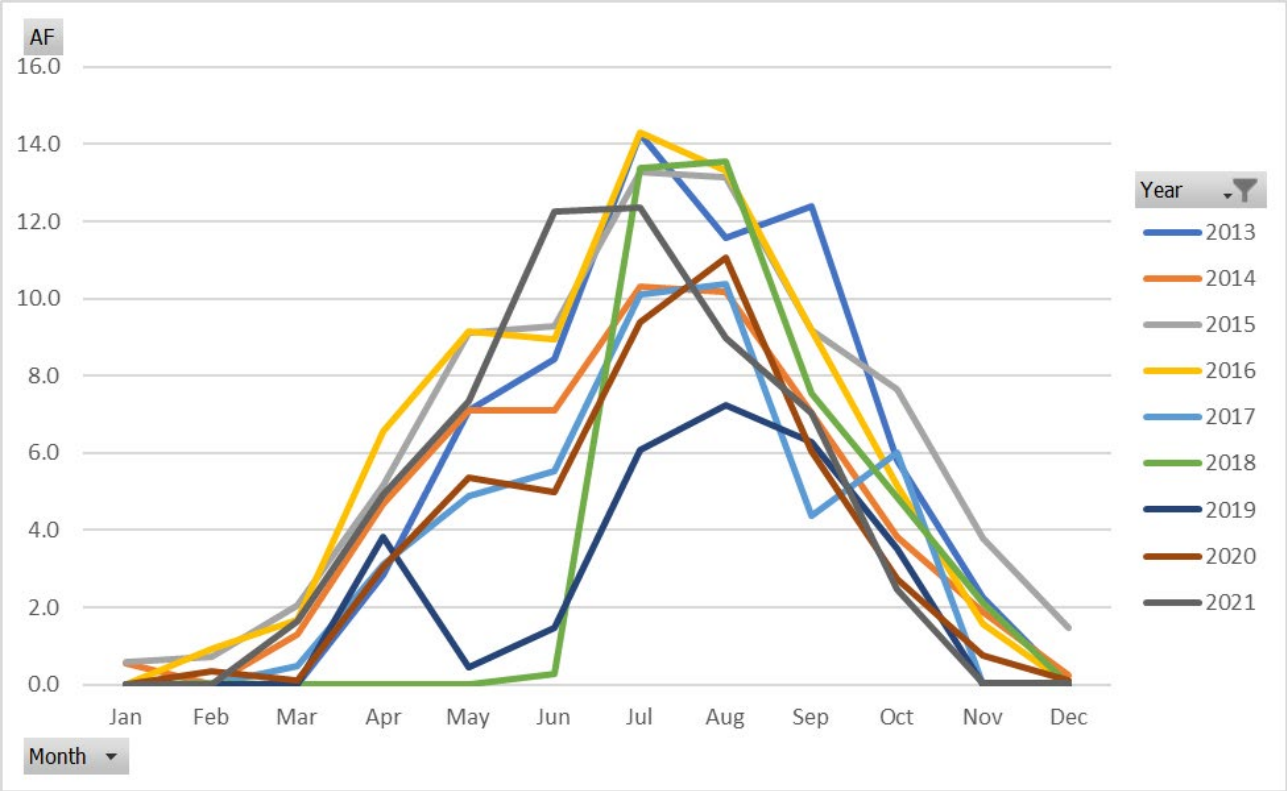
Potable water use has ranged from 32 to 58 AFY in the previous four water years. As shown in **Figure 1**, demand decreased during the previous drought as conservation measures were implemented but have rebounded in the past two years due to unprecedented dry conditions – only water year (WY) 2018/19 had precipitation (22.2 inches) greater than the 30-year average (20.0 inches) in the last 8 years. The conservation measures included removing some turf and installing Bermuda grass, which is more drought tolerant and more tolerant of a range of irrigation water quality. Bermuda grass was installed in fairways and rough areas in 2014. New grass for the greens was more recently installed. In addition, Birnam Wood is currently conducting an irrigation system audit to identify more measures to implement to reduce water use. Also, Birnam Wood is currently designing a new irrigation system.

Figure 1. **Birnam Wood Golf Course, Annual Water Use, Water Years 2013/14 – 2020/21**



As shown in **Figure 2**, monthly water use of potable water peaks in the summer months but the peak month demand varies depending on total water demand and available groundwater. In the last four years, the highest peak month demand was 13.6 AF (in 2018) while lowest peak month demand was 7.2 AF (in 2019). The monthly peaking factor (versus average demand) ranged from 2.6 to 3.9 with a median value of 3.0.

Figure 2. Birnam Wood Golf Course, Monthly Potable Water Use, 2013 – 2021



Recycled water would offset potable water but Birnam Wood has a wide range of potable water use because potable water supplements non-potable groundwater for irrigation. However, cost-effective recycled water systems must be designed to meet a more targeted range of demands so that sufficient recycled water use (e.g., sales, revenue) can justify system facilities sizes (and costs). Therefore, for Birnam Wood, the study assumes an annual average recycled water use of 43 AFY (average demand since 2018) and along with a peak month demand of 13 AF (equivalent to max month since 2018). Max day irrigation demands are typically 20% higher than peak month demand, which is equivalent to 0.20 million gallons per day (mgd).

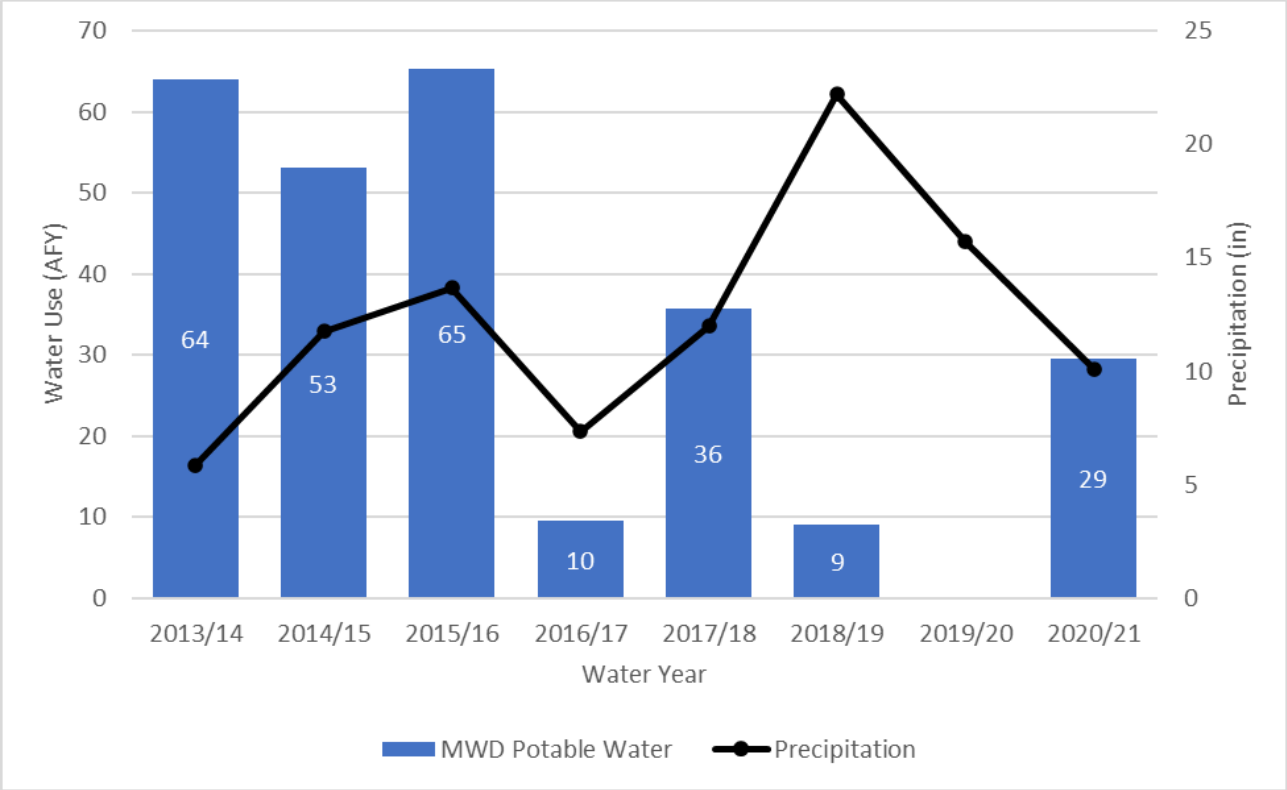
3 Valley Club of Montecito

Valley Club of Montecito (Valley Club) previously only used MWD potable water for irrigation but the club constructed two wells in recent years for irrigation. Valley Club uses groundwater as the primary irrigation water supply and supplements with potable water when groundwater cannot meet demands. The two waters are blended in an open air reservoir located near East Valley Road and Sheffield Drive. The irrigation system is supplied from the reservoir. Recycled water would offset potable water use and be delivered to the reservoir.

Potable water use has ranged from 0 to 36 AFY in the previous four water years. (Note that, unlike Birnam Wood, groundwater use data by Valley Club is not publicly available). As shown in **Figure 3**, potable water use has decreased substantially following conservation measures implemented during the previous drought and construction of groundwater wells. The conservation measures included removing some turf and installing Bermuda grass, which is more drought tolerant and more tolerant of a range of irrigation water quality. Bermuda grass was installed in fairways and

rough areas in the last 15 years. Potable water use by Valley Club has shown an inverse relation to precipitation in recent years since groundwater can meet irrigation demands in a typical year but potable water is needed following multiple dry years.

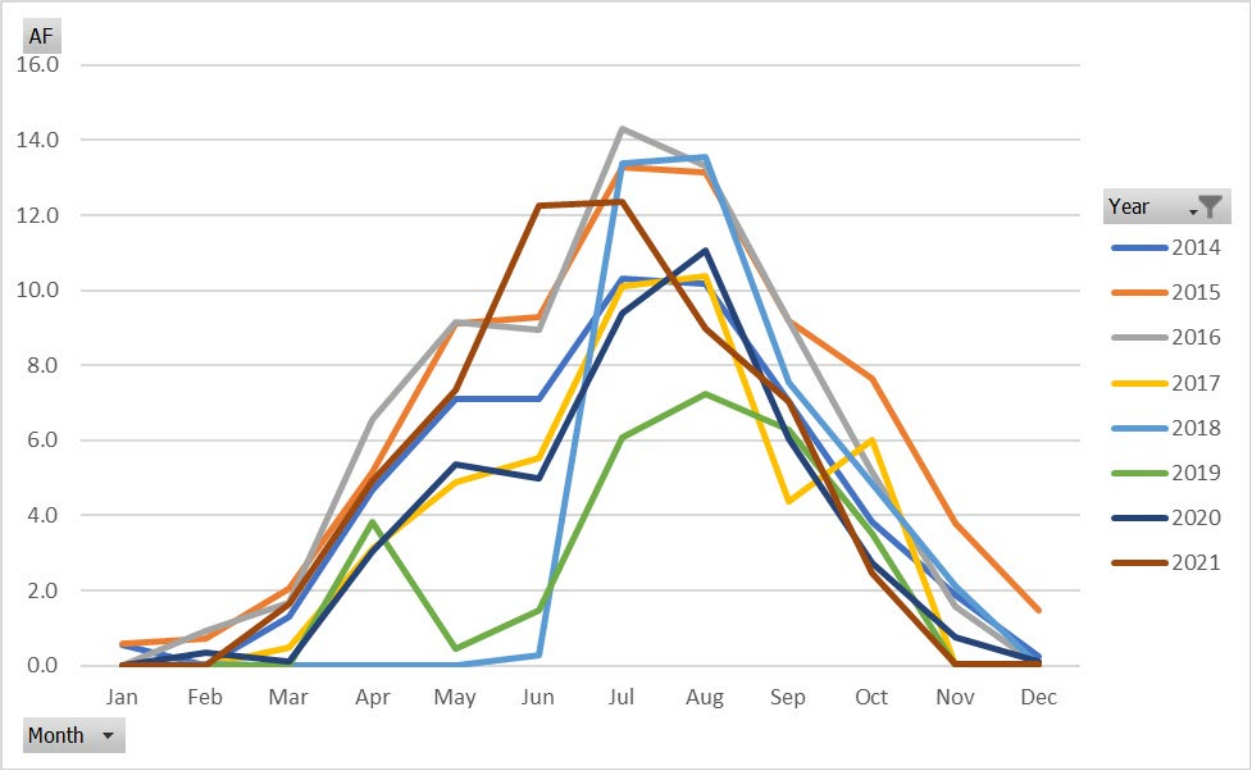
Figure 3. Valley Club of Montecito, Annual Water Use, Water Years 2013/14 – 2020/21



As shown in **Figure 4**, monthly water use of potable water peaks in the summer months but the peak month demand varies depending on total water demand and available groundwater. In the last four years, the highest peak month demand was 13.7 AF (in 2018) while lowest summer month demand was 0 AF (in 2019 and 2020). The monthly peaking factor (versus average demand) averaged 3.7 in years when potable water is used.

Recycled water would offset potable water use but Valley Club has a wide range of potable water use because potable water supplements groundwater for irrigation. Valley Club has used an average of 19 AFY of potable water use the last four water years, including 29 straight months without any potable water use. In years when Valley Club has needed potable water, use has averaged 37 AFY. However, cost-effective recycled water systems must be designed to meet a more targeted range of demands so that sufficient recycled water use (e.g., sales, revenue) can justify system facilities sizes (and costs). Extending a recycled water system to Valley Club requires a minimum amount of recycled water use to justify the infrastructure investment. Therefore, an annual average recycled water use of 30 AFY is assumed for Valley Club. A peak month demand of 13 AF (equivalent to max month since 2018) is assumed. Max day irrigation demands are typically 20% higher than peak month demand, which is equivalent to 0.20 million gallons per day (mgd).

Figure 4. Valley Club of Montecito, Monthly Potable Water Use, 2013 – 2021



4 Santa Barbara Cemetery

Santa Barbara Cemetery uses only MWD potable water for irrigation. As shown in **Figure 5**, Potable water use has ranged from 19 to 37 AFY in the previous four years with an average of 27 AFY. Based on discussions with the cemetery, annual irrigation water use is tied annual budget such that water use decreased when rates were increased during drought stages.

The cemetery receives potable water at two, 3-inch meters located along Channel Drive: 1) across from the MSD WWTP; and 2) near Fairway Road. Recycled water would be used to replace potable water used for irrigation and could be connected to the cemetery's irrigation system at these locations. However, the cemetery's potable system must be separated from the irrigation system. If a non-potable reuse project is selected, an important next step is a review of the on-site water system to evaluate system retrofit requirements.

As shown in **Figure 6**, in the last four years, the highest peak month demand was 5.7 AF (in 2018). Max day irrigation demands are typically 20% higher than peak month demand, which is equivalent to 0.09 mgd. Due to public access, recycled water use would be restricted to night time hours. Assuming 6 hours per day, this is equivalent to 260 gallons per minute (gpm) for 6 hours.

Figure 5. Santa Barbara Cemetery, Annual Water Use, Water Years 2013/14 – 2020/21

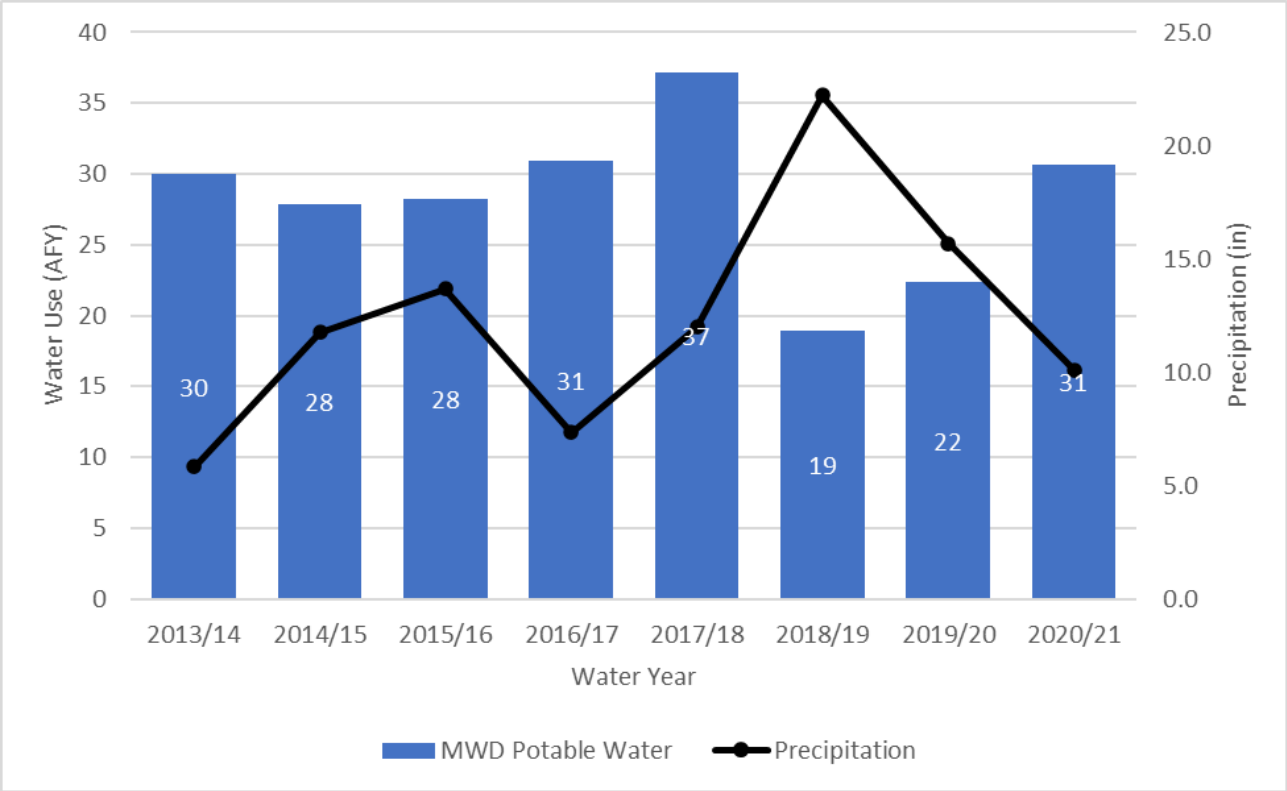
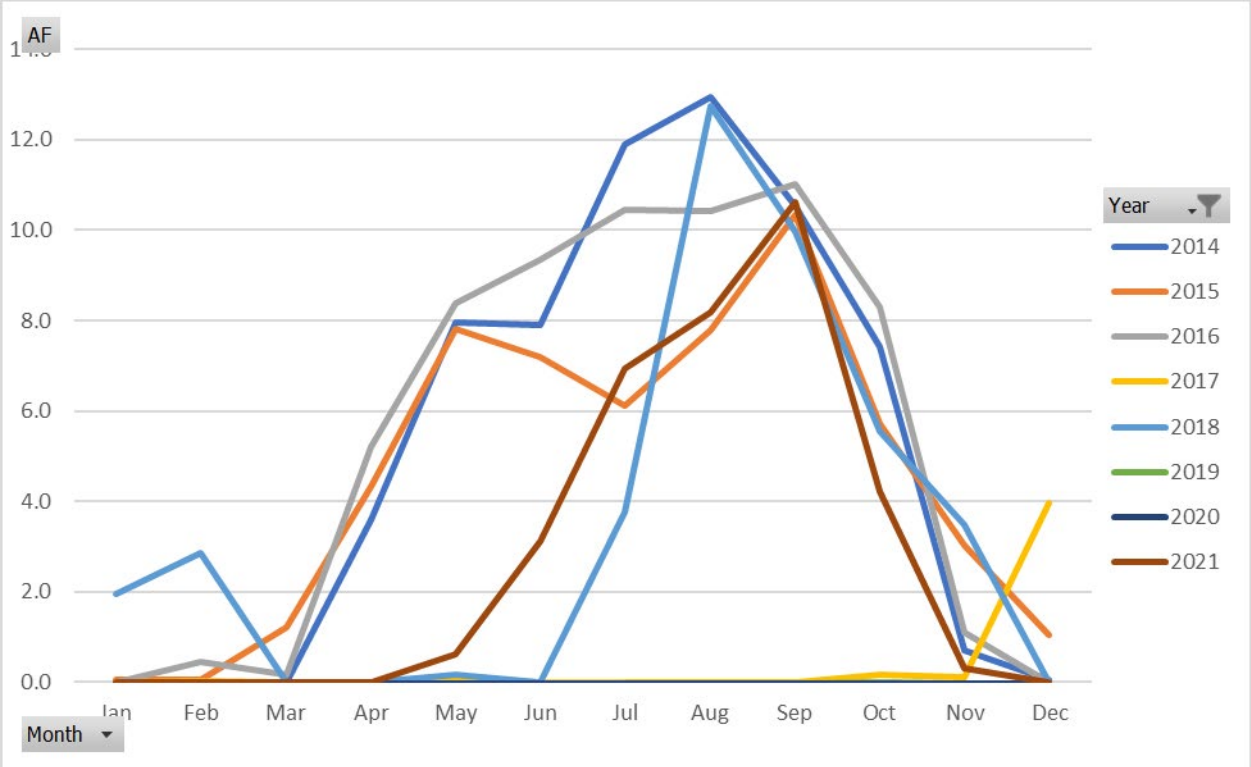


Figure 6. Santa Barbara Cemetery, Monthly Potable Water Use, 2014 – 2021



5 Four Seasons Resort The Biltmore Santa Barbara at Montecito

MWD contacted the Four Seasons Resort, the Biltmore Santa Barbara at Montecito (Biltmore) about their interest in using recycled water. The Biltmore expressed an interest in using recycled water to replace use of on-site groundwater wells with high chlorides (~500 mg/L). The majority of their irrigation system is sprinklers (versus drip).

The Biltmore does not have a separate irrigation meter and did not have an estimated irrigation demands so the previous estimate of 15 AFY is used for this estimate. If a non-potable reuse project is selected, a next step is to temporarily monitor flow in the irrigation system to more accurately estimate demand.

In addition, the Biltmore has two cooling towers that use potable water. Recycled water can be used in cooling towers; however, cooling towers tend to have high sensitivity to salinity and metals so a site-specific water quality assessment would be needed to determine feasibility of using recycled water on the cooling towers. This demand was not included in the analysis.

6 Rosewood Miramar Beach Resort

MWD contacted the Rosewood Miramar Beach Resort (Miramar) about their interest in using recycled water. The Miramar expressed an interest in using recycled water for their drip irrigation system, which includes all irrigation needs except for their “great lawn” due to potential impacts to the grass.

The Miramar does not have a separate irrigation meter and did not have an estimated demand for irrigation demands or drip irrigation demands so the previous estimate of 11 AFY is used for this estimate. If a non-potable reuse project is selected, a next step is to temporarily monitor flow in the drip irrigation system to more accurately estimate demand.

7 Water Quality

Water quality of existing irrigation water sources and projected recycled water quality are compared in **Table 1**. As shown in the table, projected recycled water from MSD has higher salinity than existing MWD potable water and MWD non-potable groundwater wells at Birnam Wood but is similar to the groundwater quality for the Biltmore and the Miramar irrigation wells. (Water quality data for Valley Club groundwater wells was not available). As a result, use of recycled water at the golf courses will likely result in the use of irrigation water with higher salinity than in current irrigation water. However, the golf courses will be blending recycled water with their groundwater supplies, which will lower manage salinity to acceptable levels.

Table 1. Supply Sources Salinity Comparison

Supply Source	Total Dissolved Solids[1] (mg/L)	Specific Conductance (umhos/cm)	Chloride (mg/L)
Projected MSD Recycled Water[2]	*1,360 – 1410*	*2,300 – 2,430*	*382 – 401*
MWD Potable Water[3]	584 – 710	872 – 1,167	6 - 148
Las Fuentes Well (Birnam Wood)[4]	750	1140	73
Valley Club Well (Birnam Wood)[4]	720	1160	149
Biltmore Groundwater Well[5]	1,330	2,210	502
Well 6A & 6B (Miramar)[6]	1,360 – 1,690	1,980 – 2,520	329 - 523

Notes:

1. MSD effluent TDS concentrations were analyzed using method EPA Method 200.1 while the other TDS concentrations were reported using Standard Method 2540, which tends to be 10% to 20% higher.
2. Range is from three samples collected in March 2022.
3. 2022 Consumer Confidence Report. Range provided from average concentration for each source (Jameson Lake, Cachuma Lake, Groundwater).
4. Sample collected on November 7, 2018.
5. Sample collected in on April 21, 2021. Well is only used for irrigation.
6. Sampled on January 28, 2022. Lower values are from Well 6A. Wells are only used for irrigation.

MWD/MSD recently contacted the City of Santa Barbara as well as the Goleta Water District (GWD) and Goleta Sanitary District (GSD) about their recycled water quality and customer's salinity concerns. Below is a summary of their feedback.

Goleta

GWD/GSD completed a study in the early 1990s that specific micro-climate of the users and the species of plants receiving the water. From this study they determined that the maximum allowable chlorides would be 300 mg/L. Current chloride concentrations are approximately 270 mg/L. They have not been made aware of any salinity issues or complaints from customers. Although, both golf courses (Sandpipe Golf Course and Glen Annie Golf Course) use recycled water for irrigation of fairways but use potable water for greens and tee boxes.

Santa Barbara

The City has been using recycled water since the early 1990s for irrigation of local schools, parks, and golf courses. Customers had initial concerns with salinity but no long-term impacts have been observed. The City completed a decade long study testing soil irrigated by recycled water in the 1990s and was unable to identify any long-term issue related to recycled water use. The study showed that salt concentration were driven by rainfall or lack of rainfall.

Recent recycled water quality averaged around 1,000 mg/L for TDS and 340 mg/L for chloride. La Cumbre Country Club had salinity concerns but after doing research concluded that they could manage the situation with the ability to blend with potable water.

8 Summary

Table 2 presents updated recycled water demand estimates for potential NPR customers. Demand estimates were developed by focusing on offsetting potable water demand; whereas the 2019 RWFP also included offsetting groundwater demands. As shown in **Table 3**, peak hour demands are projected to range from 260 gpm during the day to 430 gpm at night.

Table 2 NPR Customer Demands – Average Annual

Customer	2019 RWFP Annual NPR Demand Estimate (AFY)[1]	Private Well(s)	2018-2021 Annual Potable Use for Irrigation (AFY)	Estimated Annual NPR Demand (AFY)
Birnam Wood Golf Club	100	Yes	30 – 60[2]	40
Four Seasons Biltmore	15	Yes	N/A[3]	15[3]
Miramar Resort	11		N/A[3]	11[3]
Music Academy of West	2		N/A[3]	2
Private Residence	9	Yes	N/A[3]	--[4]
Santa Barbara Cemetery	80		16 – 34[2]	30
Ty Warner Hotels	6	Yes	N/A[3]	--[4]
Valley Club Montecito	150	Yes	0 – 35[2]	30
Total	**373**		**46 – 129**	**128**

Notes:

1. Values from 2019 RWFP (Woodward & Curan, 2019).
2. Potable water use is based on MWD meter records for meter predominantly used for irrigation.
3. Irrigation use is not metered separately so non-potable demand estimate is based on discussions with each customer.
4. Irrigation demand is assumed to be met with onsite groundwater well.

Table 3. NPR Customer Demands – Peak Periods

Customer	Estimated Annual NPR Demand (AFY)[1]	Max Day Demand (mgd)	Delivery Period[3]	Peak Hour – Day (gpm)	Peak Hour – Night (gpm)
Birnam Wood Golf Club	40	0.11[2]	Day – 12 hours	149	
Four Seasons Biltmore	15	0.04[2]	Night – 6 hours		112
Miramar Resort	11	0.03[3]	Night – 6 hours		82
Music Academy of West	2	0.01[3]	Night – 6 hours		15
Santa Barbara Cemetery	30	0.08[3]	Night – 6 hours		260
Valley Club Montecito	30	0.08[2]	Day – 12 hours	112	
Total	**128**	**0.34**		**261**	**469**

Notes:

1. Values from previous table.
2. Based on 2018 to 2021 monthly potable water use.
3. Assumes 3.0 ratio for max day to average annual demand based on 2.5 ratio for peak month to average annual demand and 20% increase for extended hot periods.
4. Irrigation with recycled water is generally restricted to nighttime for publicly accessible sites. Golf courses have on-site storage that allows for delivery outside of nighttime hours and, as publicly restricted locations, are able to irrigate during the day if needed.

9 References

Woodward & Curan. (2019). *Recycled Water Facilities Plan.*

Attachment A – Water Quality Reports

March 29, 2022

Montecito Sanitary District
Attn: Carole Rollins, Mg.
1042 Monte Cristo Lane
Santa Barbara, CA 93108

Description : Secondary Clarifier Eff (SCE)
Project : Feasibility Study

Lab ID : SP 2203948-001
Customer : 2001797

Sampled On : March 10, 2022
Sampled By : Carole Rollins, Mgr.
Received On : March 11, 2022
Matrix : Waste Water

General Irrigation Suitability Analysis

Test Description	Result				Graphical Results Presentation				
Cations	mg/L	Meq/L	% Meq	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem
Calcium	90	4.5	20	240	**				
Magnesium	46	3.8	17	130	**				
Potassium	59	1.5	7	160	**				
Sodium	286	12	56	780					
Anions									
Carbonate	<10	0	0	0					
Bicarbonate	140	2.3	11	380	**				
Sulfate	235	4.9	24	640	**				
Chloride	401	11	55	1100					
Nitrate	130	2.1	10	350					
Nitrate Nitrogen	29.4			80					
Fluoride	0.6	0.032	0	2					
Minor Elements									
Boron	0.70			1.9					
Copper	0.020			0.054					
Iron	0.030			0.082					
Manganese	<0.01			0					
Zinc	0.040			0.11					
TDS by Summation	1390			3800					
Other									
pH	7.6	units							
E. C.	2.43	dS/m							
SAR	6.10								
Crop Suitability									
No Amendments	Poor								
With Amendments	Poor								
Amendments									
Gypsum Requirement	0.9	Tons/AF							
Sulfuric Acid (98%)	7.70	oz/1000Gal			Or 19 oz/1000Gal of urea Sulfuric Acid(15/49)				
Leaching Requirement	21	%							

Good — Problem

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.
** Used in various calculations; mg/L = Milligrams Per Liter (ppm) meq/L = Milliequivalents Per Liter.

March 29, 2022

Montecito Sanitary District

Description : Secondary Clarifier Eff (SCE)
Project : Feasibility Study

Lab ID : **SP 2203948-001**
Customer : **2001797**

Sampled By : Carole Rollins, Mgr.
Matrix : Waste Water

Micro Irrigation System Plugging Hazard

Test Description	Result		Graphical Results Presentation
Chemical			Slight / Moderate / Severe
Manganese	<0.01	mg/L	
Iron	0.03	mg/L	
TDS by Summation	1390	mg/L	
No Amendments			
pH	7.6	units	
Alkalinity (As CaCO3)	110	mg/L	
Total Hardness	414	mg/L	
With Amendments			
Alkalinity (As CaCO3)	22	mg/L	
Total Hardness	22	mg/L	
pH	5.4 - 6.7	units	

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Water Amendments Application Notes:
The Amendments recommended on the previous pages include:

Gypsum:
This should be applied at least once a year to the irrigated soil surface area. Gypsum can also be applied in smaller quantities in the irrigation water.Apply the smaller (bracketed) amount of gypsum when also applying the recommended amount of Sulfuric Acid and the larger amount when applying only Gypsum.

Sulfuric Acid:
These products should be applied as needed to prevent emitter plugging in micro irrigation systems and/or as a soil amendment to adjust soil pH to improve nutrient availability and to facilitate leaching of salts. Please exercise caution when using this material as excesses may be harmful to the system and/or the plants being irrigated. The reported Acid requirement is intended to remove approximately 80 % of the alkalinity. The final pH should range from 5.4 to 6.7. We recommend a field pH determination to confirm that the pH you designate is being achieved. This application is based upon the use of a 98% Sulfuric Acid product. The application of Urea Sulfuric Acid is based upon the use of a product that contains 15% Urea (1.89 lbs Nitrogen), 49% Sulfuric Acid and has a specific gravity of 1.52 at 68 °F.
Please contact us if you have any questions.

BRW:KEH

Reviewed and Approved By **Ben Waddell**
Digitally signed by Ben Waddell
Title: Director of Ag. Services
Date: 2022-03-29

ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

March 29, 2022

Montecito Sanitary District
Attn: Carole Rollins, Mg.
1042 Monte Cristo Lane
Santa Barbara, CA 93108

Description : SCE
Project : Feasibility Study

Lab ID : SP 2204127-001
Customer : 2001797

Sampled On : March 13, 2022
Sampled By : Carole Rollins, Mgr.
Received On : March 15, 2022
Matrix : Waste Water

General Irrigation Suitability Analysis

Test Description	Result				Graphical Results Presentation				
Cations	mg/L	Meq/L	% Meq	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem
Calcium	88	4.4	21	240	**				
Magnesium	42	3.5	17	110	**				
Potassium	53	1.4	7	140	**				
Sodium	265	12	56	720					
Anions									
Carbonate	<10	0	0	0					
Bicarbonate	130	2.1	10	350	**				
Sulfate	236	4.9	24	640	**				
Chloride	382	11	53	1000					
Nitrate	166	2.7	13	450					
Nitrate Nitrogen	37.6			100					
Fluoride	0.5	0.026	0	1					
Minor Elements									
Boron	0.60			1.6					
Copper	0.020			0.054					
Iron	<0.03			0					
Manganese	<0.01			0					
Zinc	0.040			0.11					
TDS by Summation	1360			3700					
Other									
pH	7.8	units							
E. C.	2.3	dS/m							
SAR	5.80								
Crop Suitability									
No Amendments	Poor								
With Amendments	Poor								
Amendments									
Gypsum Requirement	0.8	Tons/AF							
Sulfuric Acid (98%)	7.70	oz/1000Gal			Or 19 oz/1000Gal of urea Sulfuric Acid(15/49)				
Leaching Requirement	20	%							

Good — Problem

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.
** Used in various calculations; mg/L = Milligrams Per Liter (ppm) meq/L = Milliequivalents Per Liter.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

March 29, 2022

Montecito Sanitary District

Description : SCE
Project : Feasibility Study

Lab ID : **SP 2204127-001**
Customer : **2001797**

Sampled By : Carole Rollins, Mgr.
Matrix : Waste Water

Micro Irrigation System Plugging Hazard

Test Description	Result		Graphical Results Presentation
Chemical			Slight / Moderate / Severe
Manganese	<0.01	mg/L	
Iron	<0.03	mg/L	
TDS by Summation	1360	mg/L	
No Amendments			
pH	7.8	units	
Alkalinity (As CaCO3)	110	mg/L	
Total Hardness	392	mg/L	
With Amendments			
Alkalinity (As CaCO3)	22	mg/L	
Total Hardness	22	mg/L	
pH	5.4 - 6.7	units	

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Water Amendments Application Notes:
The Amendments recommended on the previous pages include:

Gypsum:
This should be applied at least once a year to the irrigated soil surface area. Gypsum can also be applied in smaller quantities in the irrigation water.Apply the smaller (bracketed) amount of gypsum when also applying the recommended amount of Sulfuric Acid and the larger amount when applying only Gypsum.

Sulfuric Acid:
These products should be applied as needed to prevent emitter plugging in micro irrigation systems and/or as a soil amendment to adjust soil pH to improve nutrient availability and to facilitate leaching of salts. Please exercise caution when using this material as excesses may be harmful to the system and/or the plants being irrigated. The reported Acid requirement is intended to remove approximately 80 % of the alkalinity. The final pH should range from 5.4 to 6.7. We recommend a field pH determination to confirm that the pH you designate is being achieved. This application is based upon the use of a 98% Sulfuric Acid product. The application of Urea Sulfuric Acid is based upon the use of a product that contains 15% Urea (1.89 lbs Nitrogen), 49% Sulfuric Acid and has a specific gravity of 1.52 at 68 °F.
Please contact us if you have any questions.

BRW:KEH

Reviewed and Approved By **Ben Waddell**
Digitally signed by Ben Waddell
Title: Director of Ag. Services
Date: 2022-03-29

March 29, 2022

Montecito Sanitary District
Attn: Carole Rollins, Mg.
1042 Monte Cristo Lane
Santa Barbara, CA 93108

Description : SCE
Project : Feasibility Study

Lab ID : SP 2204127-002
Customer : 2001797

Sampled On : March 13, 2022
Sampled By : Carole Rollins, Mgr.
Received On : March 15, 2022
Matrix : Waste Water

General Irrigation Suitability Analysis

Test Description	Result				Graphical Results Presentation				
Cations	mg/L	Meq/L	% Meq	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem
Calcium	94	4.7	21	260	**				
Magnesium	45	3.7	17	120	**				
Potassium	57	1.5	7	160	**				
Sodium	286	12	56	780					
Anions									
Carbonate	<10	0	0	0					
Bicarbonate	140	2.3	11	380	**				
Sulfate	235	4.9	23	640	**				
Chloride	393	11	53	1100					
Nitrate	160	2.6	12	440					
Nitrate Nitrogen	36.1			98					
Fluoride	0.5	0.026	0	1					
Minor Elements									
Boron	0.60			1.6					
Copper	0.020			0.054					
Iron	<0.03			0					
Manganese	<0.01			0					
Zinc	0.040			0.11					
TDS by Summation	1410			3800					
Other									
pH	7.7	units							
E. C.	2.33	dS/m							
SAR	6.10								
Crop Suitability									
No Amendments	Poor								
With Amendments	Poor								
Amendments									
Gypsum Requirement	0.9	Tons/AF							
Sulfuric Acid (98%)	8.40	oz/1000Gal			Or 20 oz/1000Gal of urea Sulfuric Acid(15/49)				
Leaching Requirement	20	%							

Good Problem

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.
** Used in various calculations; mg/L = Milligrams Per Liter (ppm) meq/L = Milliequivalents Per Liter.

March 29, 2022

Montecito Sanitary District

Description : SCE
Project : Feasibility Study

Lab ID : **SP 2204127-002**
Customer : **2001797**

Sampled By : Carole Rollins, Mgr.
Matrix : Waste Water

Micro Irrigation System Plugging Hazard

Test Description	Result		Graphical Results Presentation
Chemical			Slight / Moderate / Severe
Manganese	<0.01	mg/L	
Iron	<0.03	mg/L	
TDS by Summation	1410	mg/L	
No Amendments			
pH	7.7	units	
Alkalinity (As CaCO3)	120	mg/L	
Total Hardness	420	mg/L	
With Amendments			
Alkalinity (As CaCO3)	24	mg/L	
Total Hardness	24	mg/L	
pH	5.4 - 6.7	units	

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Water Amendments Application Notes:
The Amendments recommended on the previous pages include:

Gypsum:
This should be applied at least once a year to the irrigated soil surface area. Gypsum can also be applied in smaller quantities in the irrigation water.Apply the smaller (bracketed) amount of gypsum when also applying the recommended amount of Sulfuric Acid and the larger amount when applying only Gypsum.

Sulfuric Acid:
These products should be applied as needed to prevent emitter plugging in micro irrigation systems and/or as a soil amendment to adjust soil pH to improve nutrient availability and to facilitate leaching of salts. Please exercise caution when using this material as excesses may be harmful to the system and/or the plants being irrigated. The reported Acid requirement is intended to remove approximately 80 % of the alkalinity. The final pH should range from 5.4 to 6.7. We recommend a field pH determination to confirm that the pH you designate is being achieved. This application is based upon the use of a 98% Sulfuric Acid product. The application of Urea Sulfuric Acid is based upon the use of a product that contains 15% Urea (1.89 lbs Nitrogen), 49% Sulfuric Acid and has a specific gravity of 1.52 at 68 °F.
Please contact us if you have any questions.

BRW:KEH

Reviewed and Approved By **Ben Waddell**
Digitally signed by Ben Waddell
Title: Director of Ag. Services
Date: 2022-03-29

December 4, 2018

Montecito Water District
Attn: Chad Hurshman
583 San Ysidro Rd.
Santa Barbara, CA 93108

Lab ID : SP 1814799
Customer : 2-16013

Laboratory Report

Introduction: This report package contains total of 8 pages divided into 3 sections:

Case Narrative	(2 pages)	: An overview of the work performed at FGL.
Sample Results	(4 pages)	: Results for each sample submitted.
Quality Control	(2 pages)	: Supporting Quality Control (QC) results.

Case Narrative

This Case Narrative pertains to the following samples:

Sample Description	Date Sampled	Date Received	FGL Lab ID #	Matrix
Las Fuentes Well	11/07/2018	11/07/2018	SP 1814799-001	GW
Valley Club Well	11/07/2018	11/07/2018	SP 1814799-002	GW

Sampling and Receipt Information: All samples were received in acceptable condition and within temperature requirements, unless noted on the Condition Upon Receipt (CUR) form. All samples arrived on ice. All samples were prepared and analyzed within the method specified hold time. All samples were checked for pH if acid or base preservation is required (except for VOAs). For details of sample receipt information, please see the attached Chain of Custody and Condition Upon Receipt Form.

Quality Control: All samples were prepared and analyzed according to the following tables:

Inorganic - Metals QC

200.7	11/08/2018:216398 All analysis quality controls are within established criteria.
	11/09/2018:216560 All analysis quality controls are within established criteria.
	11/07/2018:213282 All preparation quality controls are within established criteria, except: The following note applies to Boron: 435 Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

December 4, 2018 Lab ID : SP 1814799
Montecito Water District Customer : 2-16013

Inorganic - Wet Chemistry QC

2510B	11/08/2018:216406 All analysis quality controls are within established criteria.
	11/08/2018:213313 All preparation quality controls are within established criteria.
2540CE	11/12/2018:213446 All preparation quality controls are within established criteria.
300.0	11/08/2018:216550 All analysis quality controls are within established criteria.
	11/07/2018:213416 All preparation quality controls are within established criteria.
4500NH3G	11/12/2018:216606 All analysis quality controls are within established criteria.
	11/12/2018:213430 All preparation quality controls are within established criteria.

Certification:: I certify that this data package is in compliance with ELAP standards, both technically and for completeness, except for any conditions listed above. Release of the data contained in this data package is authorized by the Laboratory Director or his designee, as verified by the following electronic signature.

KD:DMB

Approved By **Kelly A. Dunnahoo, B.S.** Digitally signed by Kelly A. Dunnahoo, B.S.
Title: Laboratory Director
Date: 2018-12-04

December 4, 2018

Montecito Water District
Attn: Chad Hurshman
583 San Ysidro Rd.
Santa Barbara, CA 93108

Description : Las Fuentes Well
Project : Birnam Samples

Lab ID : SP 1814799-001
Customer ID : 2-16013

Sampled On : November 7, 2018-09:00
Sampled By : Austin Prince
Received On : November 7, 2018-15:00
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Metals, Total								
Boron	ND	0.1	mg/L		200.7	11/07/18:213282	200.7	11/09/18:216560
Sodium	66	1	mg/L		200.7	11/07/18:213282	200.7	11/08/18:216398
Wet Chemistry								
Chloride	73	1	mg/L		300.0	11/07/18:213416	300.0	11/08/18:216550
Specific Conductance	1140	1	umhos/cm		2510B	11/08/18:213313	2510B	11/08/18:216406
Nitrate Nitrogen	3.0	0.1	mg/L		300.0	11/07/18:213416	300.0	11/08/18:216550
Total Dissolved Solids (TFR)	750	20	mg/L		2540CE	11/12/18:213446	2540C	11/13/18:216650
Ionized Ammonia Nitrogen	ND	--	mg/L		4500NH3G	11/12/18:213430	4500NH3G	11/12/18:216606
Ammonia Nitrogen	ND	0.1	mg/L		4500NH3G	11/12/18:213430	4500NH3G	11/12/18:216606

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

December 4, 2018

Montecito Water District
Attn: Chad Hurshman
583 San Ysidro Rd.
Santa Barbara, CA 93108

Description : Las Fuentes Well
Project : Birnam Samples

Lab ID : SP 1814799-001
Customer ID : 2-16013

Sampled On : November 7, 2018-09:00
Sampled By : Austin Prince
Received On : November 7, 2018-15:00
Matrix : Ground Water

Sample Result - Support

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Field Test								
pH (Field)	7.13		units			11/07/18 09:00	4500-H B	11/07/18 09:00
Temperature	19.1		°C			11/07/18 09:00	2550B	11/07/18 09:00

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

December 4, 2018

Lab ID : SP 1814799-002
Customer ID : 2-16013

Montecito Water District
Attn: Chad Hurshman
583 San Ysidro Rd.
Santa Barbara, CA 93108

Sampled On : November 7, 2018-08:45
Sampled By : Austin Prince
Received On : November 7, 2018-15:00
Matrix : Ground Water

Description : Valley Club Well
Project : Birnam Samples

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Metals, Total								
Boron	ND	0.1	mg/L		200.7	11/07/18:213282	200.7	11/09/18:216560
Sodium	76	1	mg/L		200.7	11/07/18:213282	200.7	11/08/18:216398
Wet Chemistry								
Chloride	149	5*	mg/L		300.0	11/07/18:213416	300.0	11/08/18:216550
Specific Conductance	1160	1	umhos/cm		2510B	11/08/18:213313	2510B	11/08/18:216406
Nitrate Nitrogen	7.4	0.1	mg/L		300.0	11/07/18:213416	300.0	11/08/18:216550
Total Dissolved Solids (TFR)	720	20	mg/L		2540CE	11/12/18:213446	2540C	11/13/18:216650
Ionized Ammonia Nitrogen	ND	--	mg/L		4500NH3G	11/12/18:213430	4500NH3G	11/12/18:216606
Ammonia Nitrogen	ND	0.1	mg/L		4500NH3G	11/12/18:213430	4500NH3G	11/12/18:216606

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

December 4, 2018

Montecito Water District
Attn: Chad Hurshman
583 San Ysidro Rd.
Santa Barbara, CA 93108

Description : Valley Club Well
Project : Birnam Samples

Lab ID : SP 1814799-002
Customer ID : 2-16013

Sampled On : November 7, 2018-08:45
Sampled By : Austin Prince
Received On : November 7, 2018-15:00
Matrix : Ground Water

Sample Result - Support

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
Field Test								
pH (Field)	6.97		units			11/07/18 08:45	4500-H B	11/07/18 08:45
Temperature	19.9		°C			11/07/18 08:45	2550B	11/07/18 08:45

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

December 4, 2018 Lab ID : SP 1814799
Montecito Water District Customer : 2-16013

Quality Control - Inorganic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Metals								
Boron	200.7		MS	mg/L	4.000	86.9 %	75-125	
		(STK1855989-001)	MSD	mg/L	4.000	71.6 %	75-125	435
			MSRPD	mg/L	4000	13.5%	≤20.0	
	200.7	11/09/18:216560AC	CCV	ppm	5.000	100 %	90-110	
			CCB	ppm		0.012	0.1	
			CCV	ppm	5.000	94.6 %	90-110	
			CCB	ppm		0.009	0.1	
Sodium	200.7		MS	mg/L	12.00	3.2 %	<¼	
		(STK1855989-001)	MSD	mg/L	12.00	33.1 %	<¼	
			MSRPD	mg/L	4000	3.4%	≤20.0	
	200.7	11/08/18:216398AC	CCV	ppm	25.00	100 %	90-110	
			CCB	ppm		0.13	1	
			CCV	ppm	25.00	105 %	90-110	
			CCB	ppm		0.15	1	
			CCV	ppm	25.00	100 %	90-110	
			CCB	ppm		0.17	1	
Wet Chem								
Conductivity	2510B	11/08/18:216406JMG	ICB	umhos/cm		0.15	1	
			CCV	umhos/cm	999.0	103 %	95-105	
			CCV	umhos/cm	999.0	103 %	95-105	
E. C.	2510B	11/08/18:213313jmg	Blank	umhos/cm		ND	<1	
		(SP 1814794-002)	Dup	umhos/cm		0.3%	5	
Total Dissolved Solids (TFR)	2540CE	11/12/18:213446CTL	Blank	mg/L		ND	<20	
			LCS	mg/L	993.1	94.1 %	90-110	
		(SP 1814799-001)	Dup	mg/L		0.9%	5	
		(SP 1814799-002)	Dup	mg/L		3.5%	5	
Chloride	300.0	11/07/18:213416MCA	Blank	mg/L		ND	<1	
			LCS	mg/L	25.00	104 %	90-110	
			MS	mg/L	500.0	100 %	85-121	
		(VI 1845757-004)	MSD	mg/L	500.0	99.6 %	85-121	
			MSRPD	mg/L	100.0	0.5%	≤19	
			MS	mg/L	500.0	99.6 %	85-121	
		(VI 1845765-001)	MSD	mg/L	500.0	99.1 %	85-121	
			MSRPD	mg/L	100.0	0.5%	≤19	
	300.0	11/08/18:216550MCA	CCB	ppm		0.04	1	
			CCV	ppm	25.00	105 %	90-110	
			CCB	ppm		-0.01	1	
			CCV	ppm	25.00	107 %	90-110	
Nitrate	300.0	11/07/18:213416MCA	Blank	mg/L		ND	<0.4	
			LCS	mg/L	20.00	104 %	90-110	
			MS	mg/L	400.0	99.7 %	85-119	
		(VI 1845757-004)	MSD	mg/L	400.0	99.4 %	85-119	
			MSRPD	mg/L	100.0	0.3%	≤19	
			MS	mg/L	400.0	99.3 %	85-119	
		(VI 1845765-001)	MSD	mg/L	400.0	98.9 %	85-119	
			MSRPD	mg/L	100.0	0.4%	≤19	
	300.0	11/08/18:216550MCA	CCB	ppm		-0.027	0.5	
			CCV	ppm	20.00	105 %	90-110	
			CCB	ppm		-0.028	0.5	
			CCV	ppm	20.00	107 %	90-110	
Ammonia Nitrogen	4500NH3G		MS	mg/L	2.000	106 %	70-130	
		(SP 1814831-001)	MSD	mg/L	2.000	105 %	70-130	
			MSRPD	mg/L	2.000	0.6%	≤20	
	4500NH3G	11/12/18:216606JDD	CCB	mg/L		0.027	0.1	
			CCV	mg/L	2.000	106 %	90-110	

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

December 4, 2018 Lab ID : SP 1814799
Montecito Water District Customer : 2-16013

Quality Control - Inorganic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Wet Chem								
Ammonia Nitrogen	4500NH3G	11/12/18:216606JDD	CCB	mg/L		0.054	0.1	
			CCV	mg/L	2.000	108 %	90-110	

Definition

ICB	: Initial Calibration Blank - Analyzed to verify the instrument baseline is within criteria.
CCV	: Continuing Calibration Verification - Analyzed to verify the instrument calibration is within criteria.
CCB	: Continuing Calibration Blank - Analyzed to verify the instrument baseline is within criteria.
Blank	: Method Blank - Prepared to verify that the preparation process is not contributing contamination to the samples.
LCS	: Laboratory Control Standard/Sample - Prepared to verify that the preparation process is not affecting analyte recovery.
MS	: Matrix Spikes - A random sample is spiked with a known amount of analyte. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSD	: Matrix Spike Duplicate of MS/MSD pair - A random sample duplicate is spiked with a known amount of analyted. The recoveries are an indication of how that sample matrix affects analyte recovery.
Dup	: Duplicate Sample - A random sample with each batch is prepared and analyzed in duplicate. The relative percent difference is an indication of precision for the preparation and analysis.
MSRPD	: MS/MSD Relative Percent Difference (RPD) - The MS relative percent difference is an indication of precision for the preparation and analysis.
ND	: Non-detect - Result was below the DQO listed for the analyte.
<¼	: High Sample Background - Spike concentration was less than one forth of the sample concentration.
DQO	: Data Quality Objective - This is the criteria against which the quality control data is compared.

Explanation

435	: Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery.

Well Owner Report

Owner	**FOUR SEASONS RESORT BILTMORE HOTEL**	***Well Name***	**Biltmore Hotel**
Station ID	**342508119383101**	***GAMA ID***	**SB-10**
Station Name	**004N026W19H003S**	***Sample Date***	**4/21/2021 @ 1030**

Your well was one of several sampled for the Santa Barbara area basins study unit Trends Sampling of the Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project (PBP). Results from all sites will be published in a USGS Data Release report; your well will be identified by only the GAMA-ID in all publications and presentations.

This report lists the concentrations of chemical constituents detected in raw groundwater collected from your well. To put the results in some context, the concentrations of regulatory (r) and non-regulatory (nr) benchmarks set by the U.S. Environmental Protection Agency (USEPA) and the California State Water Resources Control Board Division of Drinking Water (SWRCB-DDW) for drinking water are also listed. This comparison is for context only; it does not indicate compliance or non-compliance with regulatory benchmarks. One category of benchmark listed here is the Health-Based Screening Level, a benchmark developed by the USGS National Water-Quality Assessment Program for contaminants that do not have other human health benchmarks (for more information see <http://water.usgs.gov/nawqa/HBSL> or <doi:10.5066/F71C1TWP>). Please contact your local Health Department if you have questions about potential health effects.

The chemical constituents are organized in the following groups: 1) field water-quality indicators, 2) major ions, 3) nutrients, 4) trace elements, 5) radioactivity (not a part of Trends sample schedule), 6) volatile organic compounds, 7) pesticides, 8) geochemical and age-dating tracers, 9) microbiological constituents (not a part of Trends sample schedule), and 10) constituents of special interest. Only detected constituents are reported here. Typical uses or sources are listed for all constituents; other sources not listed also may affect the concentrations of constituents in groundwater in your area.

See the List of Potentially Sampled Constituents for a complete list of potentially analyzed constituents evaluated by the GAMA PBP program. Not all constituents may have been evaluated for your well.

Thank you again for allowing the USGS to sample your well for the GAMA Project.

Connor J McVey
cmcvey@usgs.gov
(916) 278-3039

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain

AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide

MCL-CA = SWRCB-DDW Maximum Contaminant Level (nr)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
RL-CA = SWRCB-DDW Response Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Concentrations of all chemical constituents detected in raw groundwater collected from your well were less than USEPA and SWRCB-DDW regulatory and non-regulatory benchmarks applied to drinking water, with the following exceptions:

Field Water Quality Indicators: pH, field, Specific Conductance, field
Major and Minor Ions: Chloride, Total dissolved solids (TDS)
Trace Elements: Manganese

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain

AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide

MCL-CA = SWRCB-DDW Maximum Contaminant Level (nr)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
RL-CA = SWRCB-DDW Response Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOT** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **4/21/2021 @ 1030**

Detected constituents on the **Trends** *schedule* *Water level*

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
1 Field Water Quality Indicators					
Bicarbonate (HCO3)	mg/L	**254**			Naturally occurring
Carbonate (CO3)	mg/L	**0**			Naturally occurring
Barometric pressure	mm of mercury	**759**			
Flow rate	gal/min	**15**			
Water Temperature	deg Celsius	**19.5**			
Specific Conductance, field	µS/cm	**2210**	1600	SMCL-CA	Naturally occurring
pH, field	standard units	**6.2**	<6.5, >8.5	SMCL-US	Naturally occurring
Dissolved Oxygen	mg/L	**0.5**			Naturally occurring
2 Major and Minor Ions					
Alkalinity (CaCO3), field	mg/L	**208**			Naturally occurring
Calcium	mg/L	**143**			Naturally occurring
Magnesium	mg/L	**54.1**			Naturally occurring
Potassium	mg/L	**2.07**			Naturally occurring
Sodium	mg/L	**236**			Naturally occurring
Bromide	mg/L	**1.04**			Naturally occurring

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain

AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide

MCL-CA = SWRCB-DDW Maximum Contaminant Level (nr)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
RL-CA = SWRCB-DDW Response Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOT** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **4/21/2021 @ 1030**

Detected constituents on the **Trends** *schedule* *Water level*

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
Chloride	mg/L	**502**	500	SMCL-CA	Naturally occurring
Fluoride	mg/L	**0.54**	2	MCL-CA	Naturally occurring
Iodide	mg/L	**0.03**			Naturally occurring
Silica	mg/L	**39**			Naturally occurring
Sulfate	mg/L	**153**	500	SMCL-CA	Naturally occurring
Alkalinity (CaCO3), laboratory	mg/L	**216**			Naturally occurring
Total dissolved solids (TDS)	mg/L	**1330**	1000	SMCL-CA	Naturally occurring
Hardness	mg/L as CaCO3	**582**			Naturally occurring
3 Nutrients					
Nitrate, as nitrogen	mg/L	**7.26**	10	MCL-US	
Nitrite, as nitrogen	mg/L	**0.004**	1	MCL-US	Natural, fertilizer, sewage
Total nitrogen (ammonia, nitrite, nitrate, organic nitrogen)	mg/L	**7.46**			Natural, fertilizer, sewage
Orthophosphate, as phosphorus	mg/L	**0.142**			Natural, fertilizer, sewage
4 Trace Elements					
Chromium (VI)	µg/L	**0.1**	20	HBSL-NC	
Antimony	µg/L	**0.196**	6	MCL-US	Naturally occurring

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain

AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide

MCL-CA = SWRCB-DDW Maximum Contaminant Level (nr)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
RL-CA = SWRCB-DDW Response Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOT** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **4/21/2021 @ 1030**

Detected constituents on the **Trends** *schedule* *Water level*

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
Arsenic	µg/L	**0.44**	10	MCL-US	Naturally occurring
Barium	µg/L	**184**	1000	MCL-CA	Naturally occurring
Boron	µg/L	**205**	6000	HAL-US	Naturally occurring
Cadmium	µg/L	**0.31**	5	MCL-US	Naturally occurring
Cobalt	µg/L	**1.27**			Naturally occurring
Lithium	µg/L	**39.7**			Naturally occurring
Manganese	µg/L	**273**	50	SMCL-CA	Naturally occurring
Molybdenum	µg/L	**0.351**	40	HAL-US	Naturally occurring
Nickel	µg/L	**6**	100	MCL-US	Naturally occurring
Strontium	µg/L	**961**	4000	HAL-US	Naturally occurring
Uranium	µg/L	**0.284**	30	MCL-US	Naturally occurring
Vanadium	µg/L	**0.93**	500	RL-CA	Naturally occurring
Zinc	µg/L	**43.2**	5000	SMCL-CA	Naturally occurring

5 Radioactivity **Not Sampled**

6 Volatile Organic Compounds **Not Sampled**

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain

AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide

MCL-CA = SWRCB-DDW Maximum Contaminant Level (nr)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
RL-CA = SWRCB-DDW Response Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOT** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **4/21/2021 @ 1030**

Detected constituents on the **Trends** *schedule* *Water level*

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
7 Pesticides and Pesticide Degradates		**Samples Ruined**			
8 Geochemical and Age-Dating Tracers					
Tritium	pCi/L	**2.66**	20000	MCL-CA	For dating recent water
Hydrogen stable isotope ratio of water	per mil	**-35.2**			Info about recharge source area
Oxygen stable isotope ratio of water	per mil	**-5.53**			Info about recharge source area
9 Microbiological Constituents		**Not Sampled**			
10 Constituents of Special Interest					
Perchlorate	µg/L	**1**	6	MCL-CA	Natural, rocket fuel, fertilizer

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain

AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide

MCL-CA = SWRCB-DDW Maximum Contaminant Level (nr)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
RL-CA = SWRCB-DDW Response Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner	**FOUR SEASONS RESORT BILTMORE HOTEL**	*Well Name*	**Biltmore Hotel**
Station ID	**342508119383101**	*GAMA ID*	**SB-10**
Station Name	**004N026W19H003S**	*Sample Date*	**2/8/2011 @ 1500**

Your well was one of several sampled for the Santa Barbara area basins study unit of the Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project (PBP). Results from all sites will be published in a USGS Data Series report; your well will be identified by only the GAMA-ID in all publications and presentations.

This report lists the concentrations of chemical constituents detected in raw groundwater collected from your well. To put the results in some context, the concentrations of regulatory (r) and non-regulatory (nr) benchmarks set by the U.S. Environmental Protection Agency (USEPA) and the California State Water Resources Control Board Division of Drinking Water (SWRCB-DDW) for drinking water are also listed. This comparison is for context only; it does not indicate compliance or non-compliance with regulatory benchmarks. One category of benchmark listed here is the Health-Based Screening Level, a benchmark developed by the USGS National Water-Quality Assessment Program for contaminants that do not have other human health (for more information see <http://water.usgs.gov/nawqa/HBSL> or <doi:10.5066/F71C1TWP>). Please contact your local Health Department if you have questions about potential health effects.

The chemical constituents are organized in the following groups: 1) field water-quality indicators, 2) major ions, 3) nutrients, 4) trace elements, 5) radioactivity, 6) volatile organic compounds, 7) pesticides, 8) geochemical and age-dating tracers, 9) microbiological constituents (not a part of sample schedule), and 10) constituents of special interest. Only detected constituents are reported here. Typical uses or sources are listed for all constituents; other sources not listed also may affect the concentrations of constituents in groundwater in your area.

See the List of Potentially Sampled Constituents for a complete list of potentially analyzed constituents evaluated by the GAMA PBP program. Not all constituents may have been evaluated for your well.

Thank you again for allowing the USGS to sample your well for the GAMA Project.

Connor J McVey
cmcvey@usgs.gov
(916) 278-3039

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ng/L = nanograms per liter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain
AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide
MCL-CA = SWRCB-DDW Maximum Contaminant Level (r)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Concentrations of all chemical constituents detected in raw groundwater collected from your well were less than USEPA and SWRCB-DDW regulatory and non-regulatory benchmarks applied to drinking water, with the following exceptions:

Field Water Quality Indicators: pH, field, Specific Conductance, field
Major and Minor Ions: Total dissolved solids (TDS)
Trace Elements: Manganese

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ng/L = nanograms per liter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value

M = presence verified, but quantity uncertain
AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide

HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide
MCL-CA = SWRCB-DDW Maximum Contaminant Level (r)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOTEL** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **2/8/2011 @ 1500**

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
1 Field Water Quality Indicators					
Barometric pressure	mm of mercury	**761**			
Water Temperature	deg Celsius	**19**			
Specific Conductance, field	µS/cm	**1660**	1600	SMCL-CA	Naturally occurring
pH, field	standard units	**6.3**	<6.5, >8.5	SMCL-US	Naturally occurring
Dissolved Oxygen	mg/L	**0.3**			Naturally occurring
2 Major and Minor Ions					
Calcium	mg/L	**101**			Naturally occurring
Magnesium	mg/L	**39.1**			Naturally occurring
Potassium	mg/L	**1.78**			Naturally occurring
Sodium	mg/L	**174**			Naturally occurring
Bromide	mg/L	**0.998**			Naturally occurring
Chloride	mg/L	**314**	500	SMCL-CA	Naturally occurring
Fluoride	mg/L	**0.55**	2	MCL-CA	Naturally occurring
Iodide	mg/L	**0.03**			Naturally occurring
Silica	mg/L	**36**			Naturally occurring
Sulfate	mg/L	**134**	500	SMCL-CA	Naturally occurring

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ng/L = nanograms per liter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain
AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide
MCL-CA = SWRCB-DDW Maximum Contaminant Level (r)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOTEL** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **2/8/2011 @ 1500**

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
Alkalinity (CaCO3), laboratory	mg/L	**218**			Naturally occurring
Total dissolved solids (TDS)	mg/L	**1070**	1000	SMCL-CA	Naturally occurring
Hardness	mg/L as CaCO3	**415**			Naturally occurring
3 Nutrients					
Nitrate, as nitrogen	mg/L	**7.39**	10	MCL-US	
Nitrite, as nitrogen	mg/L	**0.004**	1	MCL-US	Natural, fertilizer, sewage
Total nitrogen (ammonia, nitrite, nitrate, organic nitrogen)	mg/L	**7.63**			Natural, fertilizer, sewage
Orthophosphate, as phosphorus	mg/L	**0.157**			Natural, fertilizer, sewage
4 Trace Elements					
Aluminum	µg/L	**2.3**	1000	MCL-CA	Naturally occurring
Arsenic	µg/L	**0.35**	10	MCL-US	Naturally occurring
Barium	µg/L	**192**	1000	MCL-CA	Naturally occurring
Beryllium	µg/L	**0.009**	4	MCL-US	Naturally occurring
Boron	µg/L	**150**	6000	HAL-US	Naturally occurring
Cadmium	µg/L	**0.13**	5	MCL-US	Naturally occurring
Copper	µg/L	**5.1**	1300	AL-US	Natural, pipe corrosion
Lithium	µg/L	**30.1**			Naturally occurring

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ng/L = nanograms per liter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain
AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide
MCL-CA = SWRCB-DDW Maximum Contaminant Level (r)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOTEL** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **2/8/2011 @ 1500**

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
Manganese	µg/L	**190**	50	SMCL-CA	Naturally occurring
Molybdenum	µg/L	**0.356**	40	HAL-US	Naturally occurring
Nickel	µg/L	**4.4**	100	MCL-US	Naturally occurring
Selenium	µg/L	**0.2**	50	MCL-US	Naturally occurring
Strontium	µg/L	**688**	4000	HAL-US	Naturally occurring
Uranium	µg/L	**0.198**	30	MCL-US	Naturally occurring
Vanadium	µg/L	**1.2**	500	RL-CA	Naturally occurring
Zinc	µg/L	**11.4**	5000	SMCL-CA	Naturally occurring
5 Radioactivity					
Gross-beta radioactivity, 30 day count	pCi/L	**1.69**			Naturally occurring
Gross-beta radioactivity, 72 hr count	pCi/L	**2.04**	50	MCL-US (trigger)	Naturally occurring
Radon-222	pCi/L	**757**			Naturally occurring
6 Volatile Organic Compounds					
Methyl tert-butyl ether (MTBE)	µg/L	**1.87**	13	MCL-CA	Gasoline oxygenate and degradate
7 Pesticides and Pesticide Degradates		**None Detected**			
8 Geochemical and Age-Dating Tracers					

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ng/L = nanograms per liter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain
AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide
MCL-CA = SWRCB-DDW Maximum Contaminant Level (r)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

Well Owner Report

Owner **FOUR SEASONS RESORT BILTMORE HOTEL** *Well Name* **Biltmore Hotel**

Station ID **342508119383101** *GAMA ID* **SB-10**

Station Name **004N026W19H003S** *Sample Date* **2/8/2011 @ 1500**

Constituent Name	*Units*	*Value*	*Benchmark Value and Type*		*Typical Use or Source*
Carbon stable isotope ratio of dissolved inorganic carbon	per mil	**-16.59**			For dating ancient water
Carbon-14	percent modern	**87.28**			For dating ancient water
Tritium	pCi/L	**3.89**	20000	MCL-CA	For dating recent water
Hydrogen stable isotope ratio of water	per mil	**-34.9**			Info about recharge source area
Oxygen stable isotope ratio of water	per mil	**-5.55**			Info about recharge source area
9 Microbiological Constituents		**Not Sampled**			
10 Constituents of Special Interest					
Perchlorate	µg/L	**1.03**	6	MCL-CA	Natural, rocket fuel, fertilizer

mg/L = milligrams per liter
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
ng/L = nanograms per liter
ppm = parts per million
ppb = parts per billion
pCi/L = picocuries per liter
E = estimated value
M = presence verified, but quantity uncertain
AL-US = USEPA Action Level (r)
HAL-US = USEPA Lifetime Health Advisory (nr)
HBSL-C = USGS Cancer Health-Based Screening Level
HBSL-NC =USGS Noncancer Health-Based Screening Level
HHBP-C = USEPA Cancer Human Health Benchmark for Pesticide
HHBP-NC = USEPA Noncancer Human Health Benchmark for Pesticide
MCL-CA = SWRCB-DDW Maximum Contaminant Level (r)
MCL-US = USEPA Maximum Contaminant Level (r)
NL-CA = SWRCB-DDW Notification Level (nr)
SMCL-CA = SWRCB-DDW Secondary Maximum Contaminant Level (nr)
SMCL-US = USEPA Secondary Maximum Contaminant Level (nr)

February 23, 2022

Montecito Water District-GSA
Attn: Nick
583 San Ysidro Rd.
Santa Barbara, CA 93108

Lab ID : SP 2201596
Customer : 2-27330

Laboratory Report

Introduction: This report package contains total of 8 pages divided into 3 sections:

Case Narrative	(2 pages)	: An overview of the work performed at FGL.
Sample Results	(2 pages)	: Results for each sample submitted.
Quality Control	(4 pages)	: Supporting Quality Control (QC) results.

Case Narrative

This Case Narrative pertains to the following samples:

Sample Description	Date Sampled	Date Received	FGL Lab ID #	Matrix
Well 6 A	01/28/2022	01/28/2022	SP 2201596-001	GW
Well 6 B	01/28/2022	01/28/2022	SP 2201596-002	GW

Sampling and Receipt Information: All samples were received, prepared and analyzed within the method specified holding except those as listed in the table below.

Lab ID	Analyte/Method	Required Holding Time	Actual Holding Time
SP 2201596-001	pH	15	5805 Minutes
SP 2201596-002	pH	15	5719.8 Minutes

All samples arrived on ice. All samples were checked for pH if acid or base preservation is required (except for VOAs). For details of sample receipt information, please see the attached Chain of Custody and Condition Upon Receipt Form.

Quality Control: All samples were prepared and analyzed according to the following tables:

Inorganic - Metals QC

200.7	01/31/2022:201574 All analysis quality controls are within established criteria
	01/31/2022:201168 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

February 23, 2022 Lab ID : SP 2201596
Montecito Water District-GSA Customer : 2-27330

Inorganic - Wet Chemistry QC

2320B	02/07/2022:201871 All analysis quality controls are within established criteria
	02/06/2022:201388 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)
2510B	02/01/2022:201571 All analysis quality controls are within established criteria
	02/01/2022:201186 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)
2540CE	01/31/2022:201156 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)
300.0	01/28/2022:201514 All analysis quality controls are within established criteria
	01/28/2022:201064 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)
4500-H B	02/01/2022:201212 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)
4500HB	02/01/2022:201587 All analysis quality controls are within established criteria
5540C	01/31/2022:201556 All analysis quality controls are within established criteria
	01/28/2022:201174 All preparation quality controls are within established criteria (performed at FGL-SP ELAP# 1573)

Certification:: I certify that this data package is in compliance with ELAP standards, both technically and for completeness, except for any conditions listed above. Release of the data contained in this data package is authorized by the Laboratory Director or his designee, as verified by the following electronic signature.

KD:MKH

Approved By **Kelly A. Dunnahoo, B.S.** Digitally signed by Kelly A. Dunnahoo, B.S.
Title: Laboratory Director
Date: 2022-02-23

February 23, 2022

Lab ID : SP 2201596-001
Customer ID : 2-27330

Montecito Water District-GSA
Attn: Nick
583 San Ysidro Rd.
Santa Barbara, CA 93108

Sampled On : January 28, 2022-10:30
Sampled By : Nick Kunstec
Received On : January 28, 2022-14:15
Matrix : Ground Water

Description : Well 6 A
Project : MGSA Seawater Intrusion

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral								
Total Hardness as CaCO3	588	2.5	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Calcium	145	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Magnesium	55	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Potassium	3	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Sodium	254	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Total Cations	22.9	---	meq/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Boron	0.2	0.1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Copper	ND	10	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Iron	130	30	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Manganese	310	10	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Zinc	50	20	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
SAR	4.6	0.1	--		200.7	01/31/22:201168	200.7	01/31/22:201574
Total Alkalinity (as CaCO3)	200	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Hydroxide as OH	ND	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Carbonate as CO3	ND	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Bicarbonate as HCO3	250	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Sulfate	157	0.5	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Chloride	523	12*	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Nitrate as NO3	32.4	0.4	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Nitrite as N	ND	0.2	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Nitrate + Nitrite as N	7.3	0.1	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Fluoride	0.5	0.1	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Total Anions	22.7	---	meq/L		2320B	02/06/22:201388	2320B	02/07/22:201871
pH	7.1	--	units		4500-H B	02/01/22:201212	4500HB	02/01/22:201587
Specific Conductance	2520	1	umhos/cm		2510B	02/01/22:201186	2510B	02/01/22:201571
Total Dissolved Solids	1690	20	mg/L		2540CE	01/31/22:201156	2540C	02/01/22:201588
MBAS Extraction	ND	0.1	mg/L		5540C	01/28/22:201174	5540C	01/31/22:201556
Aggressiveness Index	12.0	1	--		4500-H B	02/01/22:201212	4500HB	02/01/22:201587
Langelier Index (20°C)	0.03	1	--		4500-H B	02/01/22:201212	4500HB	02/01/22:201587
Nitrate Nitrogen	7.3	0.1	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Metals, Total								
Silica	36	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Wet Chemistry								
Bromide	1.14	0.03	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

February 23, 2022

Lab ID : SP 2201596-002
Customer ID : 2-27330

Montecito Water District-GSA
Attn: Nick
583 San Ysidro Rd.
Santa Barbara, CA 93108

Sampled On : January 28, 2022-11:55
Sampled By : Nick Kunstec
Received On : January 28, 2022-14:15
Matrix : Ground Water

Description : Well 6 B
Project : MGSA Seawater Intrusion

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral								
Total Hardness as CaCO3	628	2.5	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Calcium	161	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Magnesium	55	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Potassium	2	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Sodium	135	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Total Cations	18.5	---	meq/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Boron	0.2	0.1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Copper	ND	10	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Iron	510	30	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Manganese	20	10	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Zinc	40	20	ug/L		200.7	01/31/22:201168	200.7	01/31/22:201574
SAR	2.3	0.1	--		200.7	01/31/22:201168	200.7	01/31/22:201574
Total Alkalinity (as CaCO3)	210	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Hydroxide as OH	ND	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Carbonate as CO3	ND	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Bicarbonate as HCO3	260	10	mg/L		2320B	02/06/22:201388	2320B	02/07/22:201871
Sulfate	203	0.5	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Chloride	329	7*	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Nitrate as NO3	23.8	0.4	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Nitrite as N	ND	0.2	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Nitrate + Nitrite as N	5.4	0.1	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Fluoride	0.3	0.1	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Total Anions	18.2	---	meq/L		2320B	02/06/22:201388	2320B	02/07/22:201871
pH	7.2	--	units		4500-H B	02/01/22:201212	4500HB	02/01/22:201587
Specific Conductance	1980	1	umhos/cm		2510B	02/01/22:201186	2510B	02/01/22:201571
Total Dissolved Solids	1360	20	mg/L		2540CE	01/31/22:201156	2540C	02/01/22:201588
MBAS Extraction	ND	0.1	mg/L		5540C	01/28/22:201174	5540C	01/31/22:201556
Aggressiveness Index	12.1	1	--		4500-H B	02/01/22:201212	4500HB	02/01/22:201587
Langelier Index (20°C)	0.2	1	--		4500-H B	02/01/22:201212	4500HB	02/01/22:201587
Nitrate Nitrogen	5.4	0.1	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514
Metals, Total								
Silica	30	1	mg/L		200.7	01/31/22:201168	200.7	01/31/22:201574
Wet Chemistry								
Bromide	0.92	0.03	mg/L		300.0	01/28/22:201064	300.0	01/28/22:201514

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

February 23, 2022 Lab ID : SP 2201596
Montecito Water District-GSA Customer : 2-27330

Quality Control - Inorganic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Metals								
Boron	200.7		MS	mg/L	4.000	94.4 %	75-125	
		(SP 2201596-001)	MSD	mg/L	4.000	91.3 %	75-125	
			MSRPD	mg/L	4000	3.3%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	5.000	97.8 %	90-110	
			CCB	ppm		0.005	0.1	
			CCV	ppm	5.000	97.8 %	90-110	
			CCB	ppm		0.01	0.1	
			CCV	ppm	5.000	99.0 %	90-110	
			CCB	ppm		0.002	0.1	
Calcium	200.7		MS	mg/L	12.00	58.3 %	<¼	
		(SP 2201596-001)	MSD	mg/L	12.00	89.1 %	75-125	
			MSRPD	mg/L	4000	2.4%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	25.00	99.0 %	90-110	
			CCB	ppm		-0.02	1	
			CCV	ppm	25.00	96.8 %	90-110	
			CCB	ppm		-0.01	1	
			CCV	ppm	25.00	96.3 %	90-110	
			CCB	ppm		-0.02	1	
Copper	200.7		MS	ug/L	800.0	104 %	75-125	
		(SP 2201596-001)	MSD	ug/L	800.0	102 %	75-125	
			MSRPD	ug/L	4000	2.8%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	1.000	104 %	90-110	
			CCB	ppm		-0.0002	0.01	
			CCV	ppm	1.000	105 %	90-110	
			CCB	ppm		0.0006	0.01	
			CCV	ppm	1.000	107 %	90-110	
			CCB	ppm		-0.0011	0.01	
Iron	200.7		MS	ug/L	4000	99.3 %	75-125	
		(SP 2201596-001)	MSD	ug/L	4000	100 %	75-125	
			MSRPD	ug/L	4000	0.9%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	5.000	98.0 %	90-110	
			CCB	ppm		-0.0065	0.03	
			CCV	ppm	5.000	97.1 %	90-110	
			CCB	ppm		-0.0087	0.03	
			CCV	ppm	5.000	95.4 %	90-110	
			CCB	ppm		0.0014	0.03	
Magnesium	200.7		MS	mg/L	12.00	88.2 %	75-125	
		(SP 2201596-001)	MSD	mg/L	12.00	93.1 %	75-125	
			MSRPD	mg/L	4000	0.9%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	25.00	102 %	90-110	
			CCB	ppm		0.02	1	
			CCV	ppm	25.00	100 %	90-110	
			CCB	ppm		0.03	1	
			CCV	ppm	25.00	98.9 %	90-110	
			CCB	ppm		0.001	1	
Manganese	200.7		MS	ug/L	800.0	103 %	75-125	
		(SP 2201596-001)	MSD	ug/L	800.0	103 %	75-125	
			MSRPD	ug/L	4000	0.2%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	1.000	105 %	90-110	
			CCB	ppm		0.0068	0.01	
			CCV	ppm	1.000	103 %	90-110	
			CCB	ppm		-0.0091	0.01	
			CCV	ppm	1.000	101 %	90-110	
			CCB	ppm		-0.0011	0.01	
Potassium	200.7		MS	mg/L	12.00	110 %	75-125	

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

February 23, 2022 Lab ID : SP 2201596
Montecito Water District-GSA Customer : 2-27330

Quality Control - Inorganic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Metals								
Potassium	200.7	(SP 2201596-001)	MSD	mg/L	12.00	108 %	75-125	
			MSRPD	mg/L	4000	1.8%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	25.00	103 %	90-110	
			CCB	ppm		0.15	1	
			CCV	ppm	25.00	103 %	90-110	
			CCB	ppm		0.03	1	
			CCV	ppm	25.00	105 %	90-110	
			CCB	ppm		0.01	1	
Silicon	200.7	(SP 2201596-001)	MS	mg/L	2.400	80.8 %	75-125	
			MSD	mg/L	2.400	86.3 %	75-125	
			MSRPD	mg/L	4000	0.7%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	5.000	102 %	90-110	
			CCB	ppm		0.001	1	
			CCV	ppm	5.000	102 %	90-110	
			CCB	ppm		0.005	1	
			CCV	ppm	5.000	103 %	90-110	
			CCB	ppm		-0.03	1	
Sodium	200.7	(SP 2201596-001)	MS	mg/L	12.00	27.4 %	<¼	
			MSD	mg/L	12.00	77.9 %	75-125	
			MSRPD	mg/L	4000	2.3%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	25.00	98.4 %	90-110	
			CCB	ppm		0.09	1	
			CCV	ppm	25.00	98.2 %	90-110	
			CCB	ppm		0.06	1	
			CCV	ppm	25.00	98.2 %	90-110	
			CCB	ppm		0.05	1	
Zinc	200.7	(SP 2201596-001)	MS	ug/L	800.0	94.6 %	75-125	
			MSD	ug/L	800.0	90.2 %	75-125	
			MSRPD	ug/L	4000	4.4%	≤20.0	
	200.7	01/31/22:201574AC	CCV	ppm	1.000	98.0 %	90-110	
			CCB	ppm		-0.0024	0.02	
			CCV	ppm	1.000	98.7 %	90-110	
			CCB	ppm		0.0003	0.02	
			CCV	ppm	1.000	99.1 %	90-110	
			CCB	ppm		-0.0001	0.02	
Wet Chem								
Alkalinity (as CaCO3)	2320B	(SP 2201621-009)	Dup	mg/L		1.5	10	
	2320B	02/07/22:201871AMM	CCV	mg/L	235.8	103 %	90-110	
			CCV	mg/L	235.8	96.4 %	90-110	
Bicarbonate	2320B	(SP 2201621-009)	Dup	mg/L		1.7	10	
Carbonate	2320B	(SP 2201621-009)	Dup	mg/L		0.0	10	
Hydroxide	2320B	(SP 2201621-009)	Dup	mg/L		0.0	10	
Conductivity	2510B	02/01/22:201571sta	ICB	umhos/cm		0.0700	1	
			ICV	umhos/cm	999.0	97.9%	95-105	
			CCV	umhos/cm	999.0	97.8%	95-105	
E. C.	2510B	02/01/22:201186sta	Blank	umhos/cm		ND	<1	
		(CC 2280281-001)	Dup	umhos/cm		0.4%	5	
Total Dissolved Solids (TFR)	2540CE	01/31/22:201156CTL	Blank	mg/L		ND	<20	
			LCS	mg/L	991.0	101 %	90-110	
		(VI 2240607-001)	Dup	mg/L		2.8%	5	
		(VI 2240607-001)	Dup	mg/L		1.7%	5	
Bromide	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.03	
			LCS	mg/L	5.000	95.6 %	90-110	
			MS	mg/L	10.00	86.8 %	86-118	

February 23, 2022 Lab ID : SP 2201596
Montecito Water District-GSA Customer : 2-27330

Quality Control - Inorganic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Wet Chem								
Bromide	300.0	(VI 2240385-001)	MSD	mg/L	10.00	90.8 %	86-118	
			MSRPD	mg/L	10.00	4.5%	≤11	
			MS	mg/L	10.00	97.3 %	86-118	
		(CH 2270539-001)	MSD	mg/L	10.00	99.0 %	86-118	
			MSRPD	mg/L	10.00	1.7%	≤11	
	300.0	01/28/22:201514njb	CCB	mg/l		0.00	0.03	
			CCV	mg/l	5.000	99.2%	90-110	
			CCB	mg/l		0.00	0.03	
			CCV	mg/l	5.000	98.7%	90-110	
Chloride	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<1	
			LCS	mg/L	25.00	98.4 %	90-110	
			MS	mg/L	50.00	86.3 %	85-121	
		(VI 2240385-001)	MSD	mg/L	50.00	91.2 %	85-121	
			MSRPD	mg/L	10.00	5.0%	≤19	
			MS	mg/L	50.00	95.1 %	85-121	
		(CH 2270539-001)	MSD	mg/L	50.00	98.3 %	85-121	
			MSRPD	mg/L	10.00	2.6%	≤19	
	300.0	01/28/22:201514njb	CCB	mg/l		0.0780	1	
			CCV	mg/l	25.00	103%	90-110	
			CCB	mg/l		0.0680	1	
			CCV	mg/l	25.00	103%	90-110	
Fluoride	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.1	
			LCS	mg/L	2.500	97.3 %	90-110	
			MS	mg/L	5.000	87.1 %	87-120	
		(VI 2240385-001)	MSD	mg/L	5.000	90.7 %	87-120	
			MSRPD	mg/L	10.00	4.0%	≤16	
			MS	mg/L	5.000	98.3 %	87-120	
		(CH 2270539-001)	MSD	mg/L	5.000	99.9 %	87-120	
			MSRPD	mg/L	10.00	1.6%	≤16	
	300.0	01/28/22:201514njb	CCB	mg/l		0.00	0.1	
			CCV	mg/l	2.500	102%	90-110	
			CCB	mg/l		0.00	0.1	
			CCV	mg/l	2.500	102%	90-110	
Nitrate	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.4	
			LCS	mg/L	20.00	97.4 %	90-110	
			MS	mg/L	40.00	87.0 %	85-119	
		(VI 2240385-001)	MSD	mg/L	40.00	91.3 %	85-119	
			MSRPD	mg/L	10.00	4.8%	≤19	
			MS	mg/L	40.00	97.7 %	85-119	
		(CH 2270539-001)	MSD	mg/L	40.00	100 %	85-119	
			MSRPD	mg/L	10.00	2.2%	≤19	
	300.0	01/28/22:201514njb	CCB	mg/l		0.00	0.5	
			CCV	mg/l	20.00	101%	90-110	
			CCB	mg/l		0.00	0.5	
			CCV	mg/l	20.00	101%	90-110	
Nitrate + Nitrite as N	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.1	
Nitrate Nitrogen	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.1	
Nitrite	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.5	
			LCS	mg/L	15.00	98.5 %	90-110	
			MS	mg/L	30.00	87.1 %	74-126	
		(VI 2240385-001)	MSD	mg/L	30.00	92.1 %	74-126	
			MSRPD	mg/L	10.00	5.6%	≤20	
			MS	mg/L	30.00	99.3 %	74-126	
		(CH 2270539-001)	MSD	mg/L	30.00	103 %	74-126	

February 23, 2022 Lab ID : SP 2201596
Montecito Water District-GSA Customer : 2-27330

Quality Control - Inorganic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Wet Chem								
Nitrite	300.0	01/28/22:201064NJB	MSRPD	mg/L	10.00	3.4%	≤20	
	300.0	01/28/22:201514njb	CCB	mg/l		0.00	0.5	
			CCV	mg/l	15.00	104%	90-110	
			CCB	mg/l		0.00	0.5	
			CCV	mg/l	15.00	103%	90-110	
Nitrite Nitrogen	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.2	
Sulfate	300.0	01/28/22:201064NJB	Blank	mg/L		ND	<0.5	
			LCS	mg/L	50.00	98.2 %	90-110	
			MS	mg/L	100.0	86.5 %	82-124	
		(VI 2240385-001)	MSD	mg/L	100.0	91.3 %	82-124	
			MSRPD	mg/L	10.00	5.3%	≤23	
			MS	mg/L	100.0	95.2 %	82-124	
		(CH 2270539-001)	MSD	mg/L	100.0	98.5 %	82-124	
			MSRPD	mg/L	10.00	3.0%	≤23	
	300.0	01/28/22:201514njb	CCB	mg/l		0.0890	0.5	
			CCV	mg/l	50.00	104%	90-110	
			CCB	mg/l		0.0910	0.5	
			CCV	mg/l	50.00	104%	90-110	
pH	4500-H B	(SP 2201645-002)	Dup	units		0.3%	4.80	
	4500HB	02/01/22:201587jba	CCV	units	8.000	101%	95-105	
			CCV	units	8.000	101%	95-105	
MBAS	5540C	01/31/22:201556jba	CCB	mg/l		-0.0611	0.25	
			CCV	mg/l	1.000	103%	90-110	
			CCB	mg/l		-0.0611	0.25	
			CCV	mg/l	1.000	104%	90-110	
MBAS Extraction	5540C	01/28/22:201174jba	Blank	mg/L		ND	<0.1	
			LCS	mg/L	0.5000	103%	86-114	
			BS	mg/L	0.5000	102%	86-114	
			BSD	mg/L	0.5000	104%	86-114	
			BSRPD	mg/L	0.5000	2.7%	≤5	

Definition

ICV	: Initial Calibration Verification - Analyzed to verify the instrument calibration is within criteria.
ICB	: Initial Calibration Blank - Analyzed to verify the instrument baseline is within criteria.
CCV	: Continuing Calibration Verification - Analyzed to verify the instrument calibration is within criteria.
CCB	: Continuing Calibration Blank - Analyzed to verify the instrument baseline is within criteria.
Blank	: Method Blank - Prepared to verify that the preparation process is not contributing contamination to the samples.
LCS	: Laboratory Control Standard/Sample - Prepared to verify that the preparation process is not affecting analyte recovery.
MS	: Matrix Spikes - A random sample is spiked with a known amount of analyte. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSD	: Matrix Spike Duplicate of MS/MSD pair - A random sample duplicate is spiked with a known amount of analyte. The recoveries are an indication of how that sample matrix affects analyte recovery.
BS	: Blank Spikes - A blank is spiked with a known amount of analyte. It is prepared to verify that the preparation process is not affecting analyte recovery.
BSD	: Blank Spike Duplicate of BS/BSD pair - A blank duplicate is spiked with a known amount of analyte. It is prepared to verify that the preparation process is not affecting analyte recovery.
Dup	: Duplicate Sample - A random sample with each batch is prepared and analyzed in duplicate. The relative percent difference is an indication of precision for the preparation and analysis.
MSRPD	: MS/MSD Relative Percent Difference (RPD) - The MS relative percent difference is an indication of precision for the preparation and analysis.
BSRPD	: BS/BSD Relative Percent Difference (RPD) - The BS relative percent difference is an indication of precision for the preparation and analysis.
ND	: Non-detect - Result was below the DQO listed for the analyte.
<¼	: High Sample Background - Spike concentration was less than one forth of the sample concentration.
DQO	: Data Quality Objective - This is the criteria against which the quality control data is compared.

February 16, 2022

Montecito Water District-GSA
Attn: Nick
583 San Ysidro Rd.
Santa Barbara, CA 93108

Subject: Subcontract Analysis for FGL Lab No. SP 2201596

Enclosed please find results for the following sample(s) which were received by FGL.

- Sub Inorganic-Iodide

Please note that this analysis was performed by Weck Laboratories, Inc. (ELAP Certified Laboratory)

Thank you for using FGL Environmental.

Sincerely,

Cindy Aguirre Digitally signed by Cindy Aguirre
Title: Customer Service Rep
Date: 2022-02-16

Enclosure

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders: 2B01011

Project: SP 2201596

Attn: Cindy Aguirre

Client: FGL Environmental
853 Corporation Street
Santa Paula, CA 93060

Report Date: 2/11/2022

Received Date: 2/1/2022

Turnaround Time: 7 workdays

Phones: (805) 392-2012

Fax: (805) 525-4172

P.O. #:

Billing Code:

Dear Cindy Aguirre,

Enclosed are the results of analyses for samples received 2/01/22 with the Chain-of-Custody document. The samples were received in good condition, at 2.6 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Sample Results

Sample: Well 6 A — Sampled: 01/28/22 10:30 by Client

2B01011-01 (Water)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Method: EPA 332.0M		**Instr:** LCMS04				
Batch ID: W2A1210 **Preparation:** _NONE (LC)		**Prepared:** 02/08/22 10:02				**Analyst:** kan
Iodide	**13**	1.0	ug/l	1	02/08/22	

Sample: Well 6 B — Sampled: 01/28/22 11:55 by Client

2B01011-02 (Water)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Method: EPA 332.0M		**Instr:** LCMS04				
Batch ID: W2A1210 **Preparation:** _NONE (LC)		**Prepared:** 02/08/22 10:02				**Analyst:** kan
Iodide	**1.2**	1.0	ug/l	1	02/08/22	

14859 Clark Avenue,City of Industry CA, 91745 | Phone: (626) 336-2139 | Fax: (626) 336-2634

www.wecklabs.com

Quality Control Results

Iodide by LC-MS-MS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W2A1210 - _NONE (LC)										
Blank (W2A1210-BLK1)				**Prepared & Analyzed: 02/08/22**						
Iodide	ND	1.0	ug/l							
LCS (W2A1210-BS1)				**Prepared & Analyzed: 02/08/22**						
Iodide	9.92	1.0	ug/l	10.0		99	80-120			
Matrix Spike (W2A1210-MS1)	**Source: 2B01011-01**			**Prepared & Analyzed: 02/08/22**						
Iodide	21.6	1.0	ug/l	10.0	*13.2*	85	80-120			
Matrix Spike Dup (W2A1210-MSD1)	**Source: 2B01011-01**			**Prepared & Analyzed: 02/08/22**						
Iodide	21.3	1.0	ug/l	10.0	*13.2*	81	80-120	2	20	

14859 Clark Avenue,City of Industry CA, 91745 | Phone: (626) 336-2139 | Fax: (626) 336-2634

www.wecklabs.com

Notes and Definitions

Item	Definition
%REC	Percent Recovery
Dil	Dilution
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.

All results are expressed on wet weight basis unless otherwise specified.

All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS002.

Reviewed by:

Rahul R. Nair
Project Manager

ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • LACSD #10143 • NJ-DEP #CA015 • NV-DEP #NAC 445A • SCAQMD #93LA1006

This is a complete final report. The information in this report applies to the samples analyzed in accordance with the chain-of-custody document. Weck Laboratories certifies that the test results meet all requirements of TNI unless noted by qualifiers or written in the Case Narrative. This analytical report must be reproduced in its entirety.

14859 Clark Avenue,City of Industry CA, 91745 | Phone: (626) 336-2139 | Fax: (626) 336-2634

www.wecklabs.com

WECK LABORATORIES, INC.

Sample Receipt

WORK ORDER:	2B01011	**Printed:**	2/2/2022 5:32:13PM
Client:	FGL Environmental	**Project Manager:**	Rahul R. Nair
Project:	FGL Environmental	**Project Number:**	SP 2201596

Report To:
FGL Environmental
Cindy Aguirre
853 Corporation Street
Santa Paula, CA 93060
Phone: (805) 392-2012
Fax: (805) 525-4172

Invoice To:
FGL Environmental
Accounts Payable - Jackie Barnes
853 Corporation Street
Santa Paula, CA 93060
Phone :(805) 392-2038
Fax: (805) 525-4172

Date Due:	02/10/22 09:00 (7 day TAT)		
Received By:	Algabriel T. Holanda	**Date Received:**	02/01/22 09:40
Logged In By:	Algabriel T. Holanda	**Date Logged In:**	02/01/22 10:10

Samples Received at: **2.6°C**

All containers intact	**Yes**	Sample labels & COC agree	**Yes**	Sufficient holding time for all tests	**Yes**
		Samples preserved properly	**Yes**	Received on Ice	**Yes**
Chain of custody completed	**Yes**	Sample volume sufficient	**Yes**	Appropriate sample containers	**Yes**

Samples

Analysis	Expires	Analysis Comments
2B01011-01 Sample Name: Well 6 A [Water] Sampled 1/28/2022 10:30		
332.0M EPA_w Iodide	02/25/22 23:59	
2B01011-02 Sample Name: Well 6 B [Water] Sampled 1/28/2022 11:55		
332.0M EPA_w Iodide	02/25/22 23:59	

Note:
If any of the information included in this sample receipt acknowledgement is incorrect (sample information, analysis, etc), please contact the lab at (626) 336-2139. Thank you.

14859 Clark Avenue, City of Industry, California 91745-1396 (626) 336-2139 FAX (626) 336-2634
www.wecklabs.com

ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

Subcontract to Weck Laboratories, Inc.

7B01011

CHAIN OF CUSTODY
AND ANALYSES REQUEST FORM

Chain of Custody Information

Lab Number:

Client: Fruit Growers Laboratory
Address: 853 Corporation St.
Santa Paula, CA 93060-3005

Phone: Fax:
Contact:
Project: **SP 2201596**
Purchase Order:

Sampler(s): Nick Kunstec

Compositor Setup Date: Time:

Samp Num	Location Description	Date Sampled	Time Sampled	Method of Sampling: Composite (C) Grab(G)	Type of Sample	Potable(P) Non-Potable(NP) Ag Waiver (AgW)	Bacti Type: Other(O) System(SYS) Source(SR) Waste(W)	Bacti Reason: Routine(ROUT) Repeat(RPT) Replace(RPL) Other(O) Special(SPL)	Test Description(s): Sub Inorganic-Iodide 8oz(P)								
1	Well 6 A	01/28/2022	10:30	G	GW				1								
2	Well 6 B	01/28/2022	11:55	G	GW				1								

Remarks
email loginsp@fglinc.com to confirm samples arrived.

Relinquished	Date	Time	Relinquished	Date	Time	Relinquished	Date	Time
[signature]	1/31/22	17:30	GLS	2/1/22	940			
Received By:	**Date**	**Time**	**Received By:**	**Date**	**Time**	**Received By:**	**Date**	**Time**
GLS			[signature]	2.6°				
				T-0254				

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

WECK LABORATORIES, INC.

Sample Receipt Checklist

Weck WKO: 2B01011
WKO Logged by: Algabriel Holanda
Samples Checked by: ATH
Date/Time Received: 02/01/22 @ 09:40
# of Samples: 2
Delivered by: GLS

	Task	Yes	No	N/A	Comments
COC	COC present at receipt?	☒	☐		
	COC properly completed?	☒	☐		
	COC matches sample labels?	☒	☐		
	Project Manager notified?	☐	☐	☒	
Receipt Information	Sample Temperature	2.6 °C			
	Samples received on ice?	☒	☐		
	Ice Type (Blue/Wet)	Wet			
	All samples intact?	☒	☐		
	Samples in proper containers?	☒	☐		
	Sufficient sample volume?	☒	☐		
	Samples intact?	☒	☐		
	Received within holding time?	☒	☐		
	Project Manager notified?	☐	☐	☒	
Sample Preservation Verification?	Sample labels checked for correct preservation?	☒	☐	☐	
	VOC Headspace: none, <6mm/<Pea size? 524.2, 524.3, 624.1, 8260, 1666 P/T, LUFT	☐	☐	☒	
	pH verified upon receipt? Metals <2; H2SO4 pres tests <2; 522<4; TOC <2; 608.3 5-9	☐	☐	☒	
	Free Chlorine Tested <0.1	☐	☐	☒	
	O&G pH <2 verified?	☐	☐	☐	pH paper Lot# / pH Reading:
	pH adjusted for O&G	☐	☐	☐	Acid Lot# / Amt added:
	Project Manager notified?	☐	☐	☒	

PM Comments

Sample Receipt Checklist Prepared by:
Signature: _____ Date: 02/01/22

ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

www.fglinc.com

CHAIN OF CUSTODY
AND ANALYSIS REQUEST DOCUMENT

ORIGINAL

CLIENT DETAILS — SECTION I

Client: Montecito Water District - GSA

☐ New Customer Customer Number: 2027330

Address: 583 San Ysidro Rd
Santa Barbara, CA 93108

Phone: 805-881-1990 Fax: _____

E-Mail: ~~Nick~~ nkunstek@montecitogsa.com

Project name: ~~Nick Kunstek Montecito~~

Contact person: → MGSA Seawater Intrusion - N.M.

Billing Information (if different from above) → Nick Kunstek

Name: _____

Address: _____

Phone: _____ Fax: _____

E-Mail: _____

Contact person: _____

Purchase order/contract/FGL quote number: SP 20210308802

Pre Log Required: yes ____ Frequency: Monthly ☐ Weekly ☐ Quarterly ☐ Other ☐ _____

SAMPLING — SECTION II

Sampler (s): Nick Kunstec

(per bottle)

Comp Sampler Set up Date: _____ Time: _____

Time: _____ Mileage: _____

Shipping Charge: _____ Pickup Charge: _____

REPORT INFORMATION — SECTION III

Rush Analysis (surcharge will apply):

☐5 Day ☐4 Day ☐3 Day ☐2 Day ☐24 hour

Rush pre-approved by lab: _____

Electronic Data Transfer: ☐yes ☐no

If yes, To: State ____ Client ____ Other ____

Lab number: 2201596

SAMPLE INFORMATION — SECTION IV

Sample Number	Location/Description	Date Sampled	Time Sampled	Type of Sampling: Composite (C) or Grab (G)	Number of Containers	Type of Containers: (G) Glass (P) Plastic (V) VOA (MT) Metal Tube	(P) Potable (NP) Non-Potable	(SW) Surface Water (MW) Monitoring Well (GW) Ground Water (TB) Travel Blank (AgW) Ag Water (WW) Wastewater (DW) Drinking Water	(S) Soil (SLG) Sludge (SLD) Solid (O) Oil	BacT: (Sys) System (SRC) Source (W) Waste	BacT: Routine (ROUT) Repeat (RPT) Other (OTH) Replace (RPL)	(LT) Leaf Tissue (PET) Petiole Tissue (PRD) Produce	Preservative: (1) NaOH + ZnAc, (2) NaOH, (3) HCL (4) H_2SO_4, (5) HNO_3, (6) $Na_2S_2O_3$, (7) Other ____	Analyses Requested	Gen Min: 25aal(P)-HWS, B_2(P)	Wet Chem: Br (Pa)	Sub Inorganic - Iodide	Silica - 1602	Please have results by 2/10/22
1	Well 6A	1/28/22	10:30	G	S	P	NP	GW							1	1	1	1	
2	Well 6B	1/28/22	11:55	G	S	P	NP	GW							1	1	1	1	

REMARKS — SECTION V

Results asked for by 2/10/22

CUSTODY — SECTION VI

Relinquished by and subject to the terms and conditions on the reverse of this document:

[signature]	Date: 1/28/22	Time: 12:00	Relinquished by: CeRede	Date: 1/28/22	Time: 1304
Received by: CeRede	Date: 1/28/22	Time: 1415	Received by: CRA	Date: J	Time: J
Relinquished by:	Date:	Time:	Relinquished by:	Date:	Time:
Received by:	Date:	Time:	Received by:	Date:	Time:

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805) 392-2000
FAX: (805) 525-4172

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209) 942-0182
FAX: (209) 942-0423

Office & Laboratory
563 East Lindo Avenue
Chico, CA 95926
TEL: (530) 343-5818
FAX: (530) 343-3807

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805) 783-2940
FAX: (805) 783-2912

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559) 734-9473
FAX: (559) 734-8435

ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

Subcontract to Weck Laboratories, Inc.

CHAIN OF CUSTODY
AND ANALYSES REQUEST FORM

Chain of Custody Information

Lab Number:

Client: Fruit Growers Laboratory
Address: 853 Corporation St.
Santa Paula, CA 93060-3005

Phone: Fax:
Contact:
Project: **SP 2201596**
Purchase Order:

Sampler(s): Nick Kunstec

Compositor Setup Date: Time:

Samp Num	Location Description	Date Sampled	Time Sampled	Method of Sampling: Composite (C) Grab(G)	Type of Sample	Potable(P) Non-Potable(NP) Ag Waiver (AgW)	Bacti Type: Other(O) System(SYS) Source(SR) Waste(W)	Bacti Reason: Routine(ROUT) Repeat(RPT) Replace(RPL) Other(O) Special(SPL)	Test Description(s): Sub Inorganic-Iodide 8oz(P)								
1	Well 6 A	01/28/2022	10:30	G	GW				1								
2	Well 6 B	01/28/2022	11:55	G	GW				1								

Remarks
email loginsp@fglinc.com to confirm samples arrived.

Relinquished	Date	Time	Relinquished	Date	Time	Relinquished	Date	Time
Received By:	Date	Time	Received By:	Date	Time	Received By:	Date	Time

Corporate Offices & Laboratory
853 Corporation Street
Santa Paula, CA 93060
TEL: (805)392-2000
Env FAX: (805)525-4172 / Ag FAX: (805)392-2063
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209)942-0182
FAX: (209)942-0423
CA ELAP Certification No. 1563

Office & Laboratory
563 E. Lindo Avenue
Chico, CA 95926
TEL: (530)343-5818
FAX: (530)343-3807
CA ELAP Certification No. 2670

Office & Laboratory
3442 Empresa Drive, Suite D
San Luis Obispo, CA 93401
TEL: (805)783-2940
FAX: (805)783-2912
CA ELAP Certification No. 2775

Office & Laboratory
9415 W. Goshen Avenue
Visalia, CA 93291
TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

Condition Upon Receipt (Attach to COC) SP 2201596

Sample Receipt at SP:

1. Number of ice chests/packages received: **1**
2. Shipper tracking numbers _____
3. Were samples received in a chilled condition?
   Temps: **ROI** / **10c** / _____ / _____ / _____ / _____ / _____
4. Surface water (SWTR) bact samples: A sample that has a temperature upon receipt of >10C, whether iced or not, should be flagged unless the time since sample collection has been less than two hours.
5. Do the number of bottles received agree with the COC? **Yes** No N/A
6. Verify sample date, time, sampler **Yes** No N/A
7. Were the samples received intact? (i.e. no broken bottles, leaks, etc.) **Yes** No
8. Were sample custody seals intact? Yes No **N/A**

Sample Verification, Labeling and Distribution:

1. Were all requested analyses understood and acceptable? **Yes** No
2. Did bottle labels correspond with the client's ID's? **Yes** No
3. Were all bottles requiring sample preservation properly preserved? **Yes** No N/A **FGL**
   [Exception: Oil & Grease, VOA and CrVI verified in lab]
4. VOAs checked for Headspace? Yes No **N/A**
5. Were all analyses within holding times at time of receipt? **Yes** No
6. Have rush or project due dates been checked and accepted? Yes No **N/A**

Include a copy of the COC for lab delivery. (Bacti. Inorganics and Radio)

Sample Receipt, Login and Verification completed by: Reviewed and Approved By **Celina Acosta** Digitally signed by Celina Acosta Title: Sample Receiving Date: 01/31/2022-12:13:35

Discrepency Documentation:

Any items above which are "No" or do not meet specifications (i.e. temps) must be resolved.

1. Person Contacted: _____ Phone Number: _____
   Initiated By: _____ Date: _____
   Problem:

   Resolution:

2. Person Contacted: _____ Phone Number: _____
   Initiated By: _____ Date: _____
   Problem:

   Resolution:

(2027330)
Montecito Water District-GSA
SP 2201596
CRA-01/31/2022-12:13:35

MONTECITO WATER DISTRICT

RELIABLE SINCE 1921

2021 ANNUAL DRINKING WATER CONSUMER CONFIDENCE REPORT

This report explains where your water comes from, provides information on water quality and how it is measured, and presents the District's 2021 test results which show that ***drinking water met, or was better than, state and federal water quality standards.***

Montecito Water District was founded in 1921 to address the challenge of providing sufficient water to a growing community in a semiarid region.

For the last century, the District has successfully achieved its mission:
to provide an adequate and reliable supply of high quality water to the residents of Montecito and Summerland, at the most reasonable cost.

In carrying out this mission, the District places particular emphasis on providing outstanding customer service, conducting its operations in an environmentally sensitive manner, and working cooperatively with other agencies.

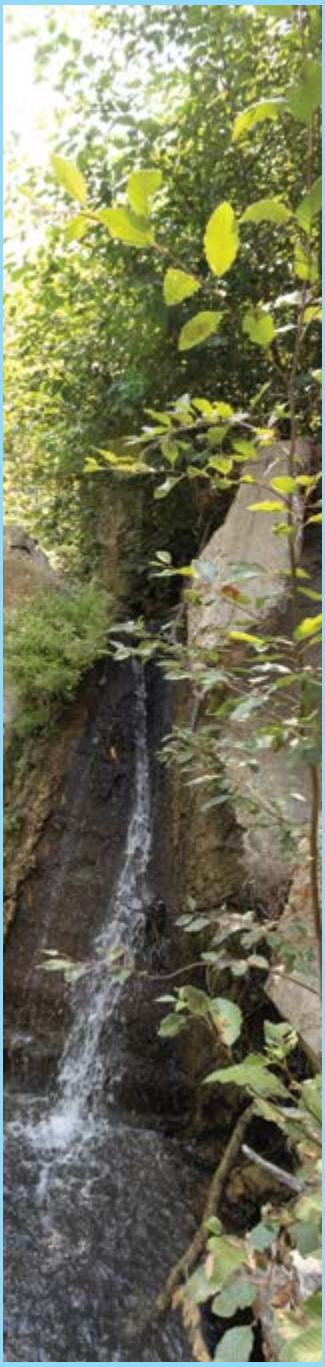
Foresight and action over the years has made this possible. The creation of Jameson Lake, participation in the Cachuma Project, and investment in the State Water Project are some of the District's most noteworthy accomplishments in its first 75 years.

Drought reached unprecedented levels in the past decade, and due to its reliance on rainfall dependent supplies the District found itself in a vulnerable position. Since 2015 we've made tremendous strides—maximizing current investments and securing more local, more reliable supplies.

Through a century of experience we've learned: Change is certain in all arenas. We'll continue to focus on maintaining quality and improving resiliency. We'll also be asking all customers to do their part and practice efficient water use.

The District takes pride in continuing to deliver a reliable supply of high-quality water to the communities of Montecito and Summerland and plans to be well positioned to ensure a future of ongoing reliability and resilience—for the next 100 years!

Nick Turner,
General Manager



Reliable water service is essential for our health and safety, fire protection and to preserve the community's unique character.

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien. Para información en español llame al 805.969.2271.

MONTECITO WATER DISTRICT
583 San Ysidro Road, Santa Barbara, CA 93108
phone: 805.969.2271
email: info@montecitowater.com

Montecito Water District's Water Quality Summary 2021

Primary Standards (PDWS)	Units	Maximum Contaminant Level	Public Health Goal (MCLG)	Jameson Lake Average	Jameson Lake Range	Ground Water Average	Ground Water Range	Cachuma Lake Average	Cachuma Lake Range	Common Sources of Contamination in Drinking Water
Water Clarity										
Treated Turbidity	NTU	TT = 1 NTU TT = 95% of Samples ≤ 0.3	NA	0.05	0.03-0.20 100.0%	<0.1	<0.1 100%	NA	ND -0.07 100%	Soil runoff.
Radioactive Contaminants (2020)										
Gross Alpha Particle Activity	pCi/L	15	(0)	1.33	1.33	2.63	1.22 - 3.86	NA	NA	Erosion of natural deposits.
Inorganic Contaminants										
Aluminum	µg/L	1000	600	10	ND-10	ND	ND	26	ND - 83	Erosion of natural deposits; residue from some surface water treatment processes.
Arsenic	µg/L	10	0.004	ND	ND	0.33	ND-1	NA	NA	
Barium	mg/L	1	2	ND	ND	0.08	0.06-0.09	NA	NA	Discharges of oil drilling wastes: erosion of natural deposits.
Fluoride	mg/L	2	1	0.2	0.2	0.8	0.5 - 1.0	0.4	0.32 - 0.44	Erosion of natural deposits; discharge from fertilizer.
Mercury	µg/L	2	1.2	ND	ND	0.13	0.09-0.20	NA	NA	
Nickel	µg/L	100	12	ND	ND	1	ND-2.0	NA	NA	
Nitrate as N (Nitrogen)	mg/L	10	10	ND	ND	2.1	0.6-2.9	0.13	ND - 0.23	Runoff or leaching from fertilizer use; leaching from septic tanks and sewage; erosion from natural deposits
Selenium	µg/L	0.05	30	ND	ND	4	2.0-6.0	ND	NA	Discharge from petroleum, glass, and metal refineries; erosion of natural deposits; discharge from mines and chemical manufacturers; runoff from livestock lots (feed additive).

Primary Standards for Distribution System	Units	Maximum Contaminant Level	Public Health Goal (MCLG)	Distribution System Average	Distribution System Range	Common Sources of Contamination in Drinking Water
Disinfectant						
Free Chlorine Residual	mg/L	MRDL, 4.0	MRDLG, 4.0	0.76	0.20-2.01	Drinking water disinfectant added for treatment
Disinfection Byproducts						
Total Trihalomethanes	µg/L	80	NA	Highest LRAA, 51.3	14-64	Byproduct of drinking water disinfection
Haloacetic Acids	µg/L	60	NA	Highest LRAA, 44.3	9.0-66	Byproduct of drinking water disinfection
Bromate (Cachuma Lake)	µg/L	10	0.1	3.8	1.8 - 5.3	Byproduct of drinking water disinfection
Total Organic Carbon (DBP Precursor)	mg/L	TT	NA	3.0	1.5-3.7	Various natural and manmade sources. Total Organic Carbon (TOC) has no health effects. However, it provides a medium for the formation of disinfection byproducts.
Microbiological Contaminant Samples						
Total Coliform Bacteria	% Tests Positive	<5% of Monthly Samples of minimum 48 samples	0	0.00%	0	Naturally present in the environment.

Lead and Copper Rule (2020)	Units	RAL	PHG	Samples collected	Above RAL	90th Percentile	Schools Testing Again in 2022
Lead	µg/L	15	0.2	36	0	ND	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper	µg/L	1300	300	36	0	232	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives.

Lead and Copper Rule Every three years, a minimum of 30 residences are tested for lead and copper levels at the tap. The most recent set of 36 samples was collected in 2020. All of the samples were well below the regulatory action level (RAL). Copper was detected in 28 samples. The 90th percentile value was at 232 ug/L. Lead was not detected in any of the samples. The 90th percentile value was Non-Detect. If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Montecito Water District is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/lead.

Secondary Standards	Units	Maximum Contaminant Level	Jameson Lake Average	Jameson Lake Range	Ground Water Average	Ground Water Range	Cachuma Lake Average	Cachuma Lake Range	Common Sources of Contamination in Drinking Water
Aesthetic Standards									
Color	Units	15	12	12	ND	ND	ND	NA	Naturally-occurring organic minerals.
Chloride	mg/L	500	6	6	148	89-198	29	28 - 31	Runoff or leaching from natural deposits; seawater influence.
Iron	µg/L	300	ND	ND	6.2	ND-250	12	ND - 17	Leaching from natural deposits; industrial wastes.
Manganese	µg/L	50	ND	ND	5.8	ND-100	1.3	ND - 2.2	Leaching from natural deposits.
Threshold Odor at 60 degrees celcius	Units	3	ND	ND	ND	ND	3	2 - 4	Naturally-occurring organic minerals.
Specific Conductance	µS/cm	1600	872	863-881	1167	910-1390	923	890 - 1005	Substances that form ions in water; seawater influence.
Sulfate	mg/L	500	218	218	149	128-195	262	249 - 290	Runoff or leaching from natural deposits; industrial wastes.
Total Dissolved Solids	mg/L	1000	584	578-590	710	560-890	710	598 - 776	Runoff or leaching from natural deposits.
Zinc	mg/L	5	ND	ND	0.017	ND - 0.030	ND	NA	Runoff or leaching from natural deposits; industrial wastes.

Secondary Standards	Units	Maximum Contaminant Level	Jameson Lake Average	Jameson Lake Range	Ground Water Average	Ground Water Range	Cachuma Lake Average	Cachuma Lake Range
Additional Constituents Analyzed								
pH	pH units	NS	8.3	7.1-9.1	7.6	7.6-7.7	7.64	7.31 - 7.79
Total Hardness	mg/L	NS	372	344-400	311	225-461	391	368 - 432
Total Alkalinity	mg/L	NS	188	168-220	207	200-220	193	180 - 229
Boron	mg/L	1000 (RAL)	ND	ND	0.6	ND-0.6	0.38	0.37 - 0.39
Calcium	mg/L	NS	99	99	78	57-117	85	80 - 96.1
Magnesium	mg/L	NS	26	26	28	20-41	42	38 - 45
Sodium	mg/L	NS	28	28	97	72-137	53	48 - 58
Potassium	mg/L	NS	3	3	0.7	ND-1.0	4.0	3.8 - 4.5
Unregulated Contaminant Monitoring Rule 4 (2019-20)								
HAA5	µg/L	NS	32.87	23.98 - 44	NA	NA	13	ND - 32
HAA6Br	µg/L	NS	8.03	4.24 - 14.09	NA	NA	14	ND - 24
HAA9	µg/L	NS	39.95	32.57 - 48.94	NA	NA	24	ND - 51
Bromochloroacetic Acid	µg/L	NS	3.29	1.89 - 5.45	NA	NA	3.9	ND - 8.2
Bromodichloroacetic Acid	µg/L	NS	2.95	2.15 - 4.05	NA	NA	3.5	ND - 5.8
Chlorodibromoacetic Acid	µg/L	NS	0.85	0 - 1.9	NA	NA	2.2	ND - 3.3
Dibromoacetic Acid	µg/L	NS	0.71	0 - 1.9	NA	NA	2.3	ND - 4.2
Dichloroacetic Acid	µg/L	NS	12.34	7.75 - 20	NA	NA	6.0	ND - 16
Monobromoacetic Acid	µg/L	NS	0.24	0 - 0.8	NA	NA	2.3	ND - 4.9
Monochloroacetic Acid	µg/L	NS	1.17	ND - 1.6	NA	NA	2.3	ND - 4.9
Trichloroacetic Acid	µg/L	NS	18.41	10.75 - 26	NA	NA	4.2	ND - 12

This Consumer Confidence Report (CCR) reflects changes in drinking water regulatory requirements during 2021. These revisions add the requirements of the federal Revised Total Coliform Rule, effective since April 1, 2016, to the existing state Total Coliform Rule. The revised rule maintains the purpose to protect public health by ensuring the integrity of the drinking water distribution system and monitoring for the presence of microbials (i.e., total coliform and E. coli bacteria). The U.S. EPA anticipates greater public health protection as the rule requires water systems that are vulnerable to microbial contamination to identify and fix problems. Water systems that exceed a specified frequency of total coliform occurrences are required to conduct an assessment to determine if any sanitary defects exist. If found, these must be corrected by the water system. The state Revised Total Coliform Rule became effective July 1, 2021.

Nitrate as N (Nitrogen): Nitrate in drinking water at levels above 10 mg/L is a health risk for infants of less than six months of age. Such nitrate levels in drinking water can interfere with the capacity of the infant's blood to carry oxygen, resulting in a serious illness; symptoms include shortness of breath and blueness of the skin. Nitrate levels above 10 mg/L may also affect the ability of the blood to carry oxygen in other individuals, such as pregnant women and those with certain specific enzyme deficiencies. If you are caring for an infant, or you are pregnant, you should ask advice from your health care provider. MWD's highest nitrate level in 2021 was 2.9 mg/L

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include: Microbial contaminants, such as viruses and bacteria, that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and herbicides, that may come from a variety of sources such as agriculture, urban storm water runoff, and residential uses.

Organic chemical contaminants, including synthetic and volatile organic chemicals, that are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, agricultural application, and septic systems.

Radioactive contaminants, that can be naturally-occurring or be the result of oil and gas production and mining activities.

People with Sensitive Immune Systems

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Drinking Water Info

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the U.S. Environmental Protection Agency's (USEPA's) Safe Drinking Water Hotline (1-800-426-4791).

In order to ensure that tap water is safe to drink, the U.S Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH) prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. CDPH regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

Source Water Assessment: A comprehensive source water assessment of the District's drinking water sources was adopted in June 2021. A copy of this report is available for public inspection at the District Office.

Last year, as in years past, your tap water met all EPA and State drinking water health standards. Montecito Water District vigilantly safeguards its water supplies and once again we are proud to report that our system has never violated a maximum contaminant level or any other water quality standard. This brochure is a snapshot of last year's water quality. Included are details about where your water comes from, what it contains, and how it compares to State standards. We are committed to providing you information because informed customers are our best allies.

WATER QUALITY TERMINOLOGY

Maximum Contaminant Level (MCL): The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCLs are set to protect the odor, taste, and appearance of drinking water.

Maximum Contaminant Level Goal (MCLG): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the U.S. Environmental Protection Agency.

Public Health Goal (PHG): The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

Primary Drinking Water Standard (PDWS): MCLs and MRDLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.

Maximum Residual Disinfectant Level Goal (MRDLG): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Regulatory Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

Treatment Technique (TT): A required process intended to reduce the level of a contaminant in drinking water.

mg/L: Milligrams per liter, or parts per million. 1 mg/L is equal to about one drop in 17 gallons of water.

ug/L: Micrograms per liter, or parts per billion. 1 ug/L is equal to about one drop in 17,000 gallons of water.

< : Less than.

≤ : Less than or equal to.

NA: Not applicable.

NS: No Standard.

ND: Non-detected.

pCi/L: Pico curies per liter, a measure of radiation.

umhos/cm: Micromhos per centimeter (an indicator of dissolved minerals in water).

NTU: Nephelometric turbidity unit.

LRAA: Locational Running Annual Average

For Water Softeners: MWD's surface water has a hardness range of 20 to 23 grains per gallon, while groundwater has a hardness range of 13 to 27 grains per gallon. One grain per gallon equals 17.1 mg/L.

Footnotes: The State allows us to monitor for some contaminants less than once per year because the concentrations of these contaminants do not change frequently. Some of our data, though representative, are more than one year old.

Surface water sources include the District's Jameson Lake and Lake Cachuma. The District's Amapola Well, Paden Well No. 2, Ennisbrook Well No. 5, Ennisbrook Well No. 2 and T Mosby Well No. 2 were used as groundwater supply sources.

An average number of 52 coliform samples were collected each month at 12 District sampling stations in compliance with the Federal Revised Total Coliform Rule. All sample results were negative.

Turbidity is a measure of the cloudiness of the water. Montecito Water District monitors for it continuously because turbidity is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants. 100% of the District's samples met the Turbidity Performance standard. The highest single surface water turbidity measurement during the year was 0.20 NTU.

WATER SOURCES 2021

Most water supplies are rainfall dependent, and become limited in times of drought. As the District looks to the future, it aims to increase its access to local, reliable supplies.

Doulton Tunnel, a horizontal well, source of groundwater and conveyance from Jameson Lake.

Cachuma Project (Lake Cachuma), a federally owned surface water facility.

Jameson Lake, a District owned surface water facility.

Groundwater wells, source from the Montecito Groundwater Basin.

Conservation - Water efficiency.

State Water Project & Supplemental Water Purchase.

FACILITIES

The District's water source portfolio and array of facilities is highly diversified. The combination of its own assets and involvement with many partners provides regional water supply management opportunities and added resiliency.

Conservation — water supply that is attained through efficiency of use — is unique in that it is people dependent. As climate change increases the uncertainty of hydrologic conditions, the District will continue to look to its customers for their partnership in using water wisely.

- **2 Surface Water Treatment Plants**
- **7 Pumping Stations**
- **9 Storage Reservoirs**
- **12 Groundwater Wells**
- **114 (approximate) Miles of Pipeline**
- **1 Surface Water Reservoir, Dam and Groundwater Conveyance Tunnel**
- **943 Fire Hydrants**

We encourage public participation.

For meeting times, agendas, and additional resources: **www.montecitowater.com**

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien. Para información en español llame al 805.969.2271.

For more information please contact **Chad Hurshman**, Water Treatment and Production Superintendent, at 805.969.7924

MONTECITO WATER DISTRICT

RELIABLE SINCE 1921

www.montecitowater.com

BOARD OF DIRECTORS:

Tobe Plough, *President*
Ken Coates, *Vice-President*
Floyd Wicks, *Director*
Cori Hayman, *Director*
Brian Goebel, *Director*
Nick Turner, P.E.
General Manager & Board Secretary

Appendix 9B

HYDRAULIC ANALYSIS

NPR-1.1 and NPR-1.2 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cell

Basic Equations Used

Piping Losses (Hazen Williams Formula):

$$H_p = (10.44)(L[ft])\frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$$

Velocity:

$$V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$$

Minor Losses:

$$H_f = \frac{KV^2}{2g} = K'(Q)^2$$

Total Dynamic Head:

$$TDH = StaticHead[H_s] + H_p + H_f$$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impeller Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	270	feet	Elev. Per Google Earth at VC connection (corner of Valley Club Dr and E V
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	700	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	230	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flow

<-- selecting two parallel duty pumps

Straight Piping Losses

$$K_1' = 10.44\left(\frac{L}{C^{1.85}d^{4.8655}}\right) * \left(\frac{Q_1}{Q_T}\right)^{1.85} \qquad h_{L1} = 10.44\left(\frac{L * Q_1^{1.85}}{C^{1.85} * d^{4.8655}}\right)$$

L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	8 in	10.0 ft	33%	120	76 gpm	7.71759E-08	0.48 ft/sec	0.00 ft	Yes
2	Conveyance Piping	PVC	8 in	26400.0 ft	100%	135	230 gpm	0.001274097	1.47 ft/sec	29.81 ft	
							Sum of K1'	0.001274175	Sum of H_{L1}	29.81 ft	

Delivery pressure at Miramar:
13,400 LF between VC and Miramar
15.13213 ft of loss between VC and miramar
0.756606 ft of fitting loses
15.88873 ft of total losses
16 change in elevation between WWTP and Miramar
10 add psi to VC to boost pressure at Mirarmar
83.66298 psi at miramar

Fitting Losses

$$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_1}{Q_T}\right)^2 \qquad h_{L2} = n\frac{KV^2}{2g}$$

V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction
						Sum of K2'	0	Sum of H_{L2}	1.49 ft	

* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.

5% ***Using 5% of friction loss

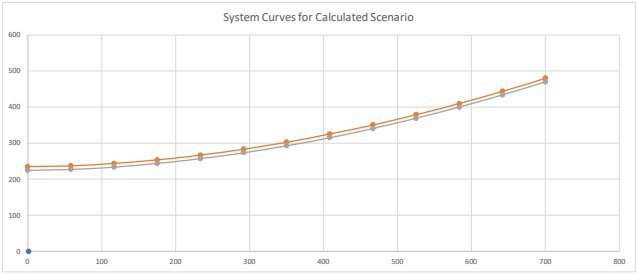
Max Static + H_{L1} + H_{L2} at Design Flow 266.30 ft <-- need 4.3290043 add'l ft at VC to maintain 60psi min pressure at Miramar

Calculations Table

$$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$$

Q (gpm)	Q mgd	Piping HL H_{L1}	Fitting HL H_{L2}	Hs max	Hs min	System Curve M	System Curve Min
0	0.00	0.00	0.00	235	225	235.00	225.00
58	0.08	2.36	0.12	235	225	237.47	227.47
117	0.17	8.49	0.42	235	225	243.92	233.92
175	0.25	17.98	0.90	235	225	253.88	243.88
233	0.34	30.62	1.53	235	225	267.15	257.15
292	0.42	46.27	2.31	235	225	283.58	273.58
350	0.50	64.83	3.24	235	225	303.07	293.07
408	0.59	86.22	4.31	235	225	325.53	315.53
467	0.67	110.38	5.52	235	225	350.90	340.90
525	0.76	137.25	6.86	235	225	379.12	369.12
583	0.84	166.79	8.34	235	225	410.13	400.13
642	0.92	198.95	9.95	235	225	443.90	433.90
700	1.01	233.70	11.69	235	225	480.39	470.39

System Curve Plots

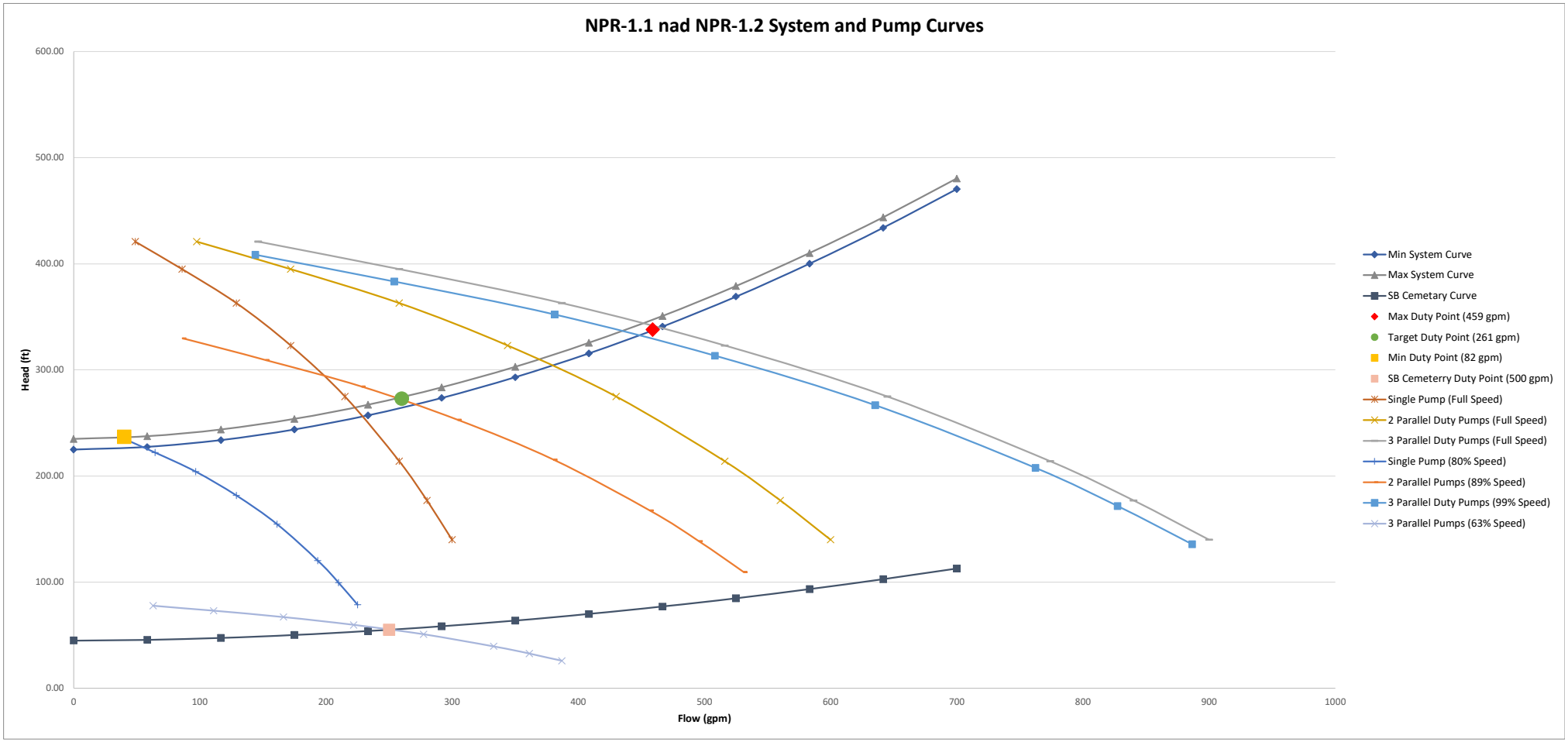


NPSHa Calculation

$$NPSH_a = h_{bar} + h_{static} - h_{L,s} - h_{vap}$$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	29.81	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = 5.28 **AT THE DESIGN POINT**
Maximum NPSHr 0.28 **AT THE DESIGN POINT**


NPR-1.1 nad NPR-1.2 System and Pump Curves
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Head (ft)
0
100
200
300
400
500
600
700
800
900
1000
Flow (gpm)
Min System Curve
Max System Curve
SB Cemetary Curve
Max Duty Point (459 gpm)
Target Duty Point (261 gpm)
Min Duty Point (82 gpm)
SB Cemeterry Duty Point (500 gpm)
Single Pump (Full Speed)
2 Parallel Duty Pumps (Full Speed)
3 Parallel Duty Pumps (Full Speed)
Single Pump (80% Speed)
2 Parallel Pumps (89% Speed)
3 Parallel Duty Pumps (99% Speed)
3 Parallel Pumps (63% Speed)

NPR-1.3 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cell

Basic Equations Used

Piping Losses (Hazen Williams Formula):

$$H_p = (10.44)(L[ft])\frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$$

Velocity:

$$V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$$

Minor Losses:

$$H_f = \frac{KV^2}{2g} = K2'(Q)^2$$

Total Dynamic Head:

$$TDH = StaticHead[H_S] + H_p + H_F$$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impeller Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	270	feet	Elev. Per Google Earth at VC connection (corner of Valley Club Dr and E V
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	500	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	230	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flow

<-- selecting two parallel duty pumps

Straight Piping Losses

$$K_1' = 10.44\left(\frac{L}{C^{1.85}d^{4.8655}}\right) * \left(\frac{Q_i}{Q_T}\right)^{1.85} \qquad h_{L1} = 10.44\left(\frac{L * Q_i^{1.85}}{C^{1.85} * d^{4.8655}}\right)$$

L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	8 in	10.0 ft	33%	120	76 gpm	7.71759E-08	0.48 ft/sec	0.00 ft	Yes
2	Conveyance Piping	PVC	8 in	24900.0 ft	100%	135	230 gpm	0.001201705	1.47 ft/sec	28.12 ft	
							Sum of K1'	0.001201783	Sum of H_{L1}	28.12 ft	

Fitting Losses

$$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_i}{Q_T}\right)^2 \qquad h_{L2} = n\frac{KV^2}{2g}$$

V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction	
* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.						Sum of K2'	0	Sum of H_{L2}	1.41 ft		5%

***Using 5% of friction loss

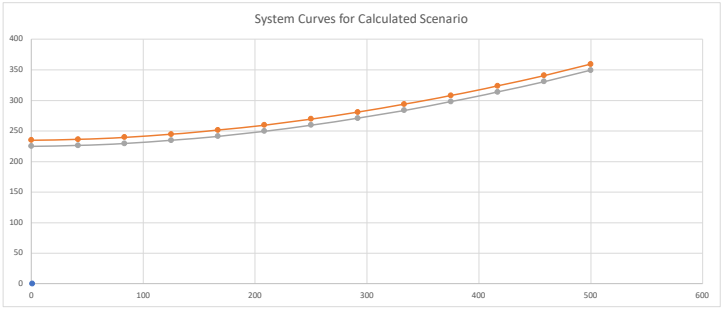
Max Static + H_{L1} + H_{L2} at Design Flow: 264.52 ft

Calculations Table

$$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$$

		Piping HL	Fitting HL				
Q (gpm)	Q mgd	H_{L1}	H_{L2}	Hs max	Hs min	stem Curve M	System Curve Min
0	0.00	0.00	0.00	235	225	235.00	225.00
42	0.06	1.19	0.06	235	225	236.25	226.25
83	0.12	4.30	0.21	235	225	239.51	229.51
125	0.18	9.10	0.46	235	225	244.56	234.56
167	0.24	15.50	0.77	235	225	251.27	241.27
208	0.30	23.42	1.17	235	225	259.59	249.59
250	0.36	32.81	1.64	235	225	269.45	259.45
292	0.42	43.64	2.18	235	225	280.82	270.82
333	0.48	55.87	2.79	235	225	293.66	283.66
375	0.54	69.47	3.47	235	225	307.94	297.94
417	0.60	84.42	4.22	235	225	323.64	313.64
458	0.66	100.70	5.03	235	225	340.73	330.73
500	0.72	118.28	5.91	235	225	359.20	349.20

System Curve Plots



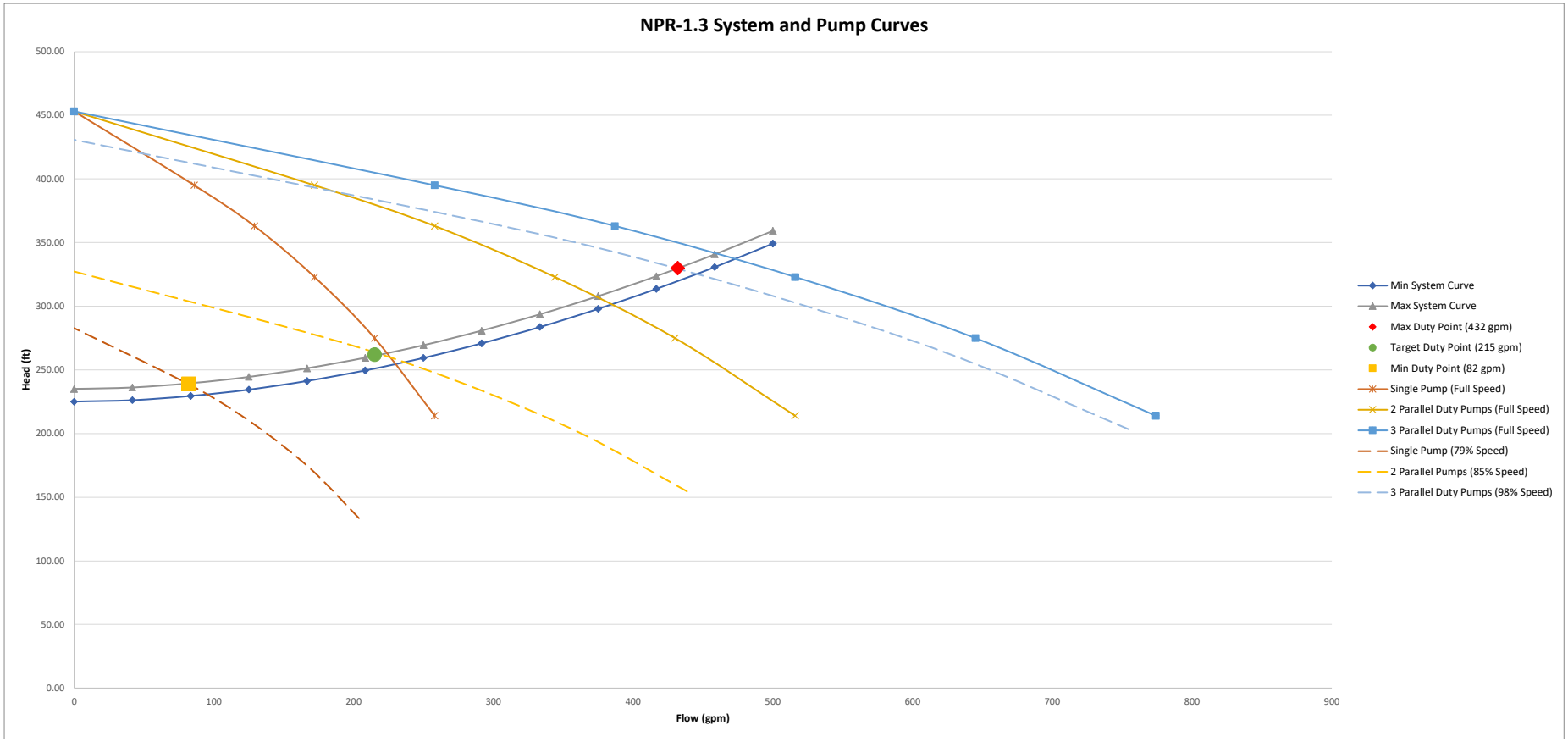
NPSHa Calculation

$$NPSH_a = h_{bar} + h_{static} - h_{L,s} - h_{vap}$$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	28.12	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = 6.97 AT THE DESIGN POINT

Maximum NPSHr 1.97 AT THE DESIGN POINT


NPR-1.3 System and Pump Curves
Head (ft)
Flow (gpm)
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
0
100
200
300
400
500
600
700
800
900
Min System Curve
Max System Curve
Max Duty Point (432 gpm)
Target Duty Point (215 gpm)
Min Duty Point (82 gpm)
Single Pump (Full Speed)
2 Parallel Duty Pumps (Full Speed)
3 Parallel Duty Pumps (Full Speed)
Single Pump (79% Speed)
2 Parallel Pumps (85% Speed)
3 Parallel Duty Pumps (98% Speed)

IPR 2 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cel

Basic Equations Used

Piping Losses (Hazen Williams Formula):

$$H_p = (10.44)(L[ft]) \frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$$

Velocity:

$$V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$$

Minor Losses:

$$H_f = \frac{KV^2}{2g} = K2'(Q)^2$$

Total Dynamic Head:

$$TDH = StaticHead[H_S] + H_P + H_F$$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impelier Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	255	feet	<-- using highest point along pipeline +50ft
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	800	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	486	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flows

<-- selecting two parallel duty pumps

Straight Piping Losses

$$K_1' = 10.44 \left(\frac{L}{C^{1.85} d^{4.8655}}\right) * \left(\frac{Q_L}{Q_T}\right)^{1.85} \qquad h_{L1} = 10.44 \left(\frac{L * Q_L^{1.85}}{C^{1.85} * d^{4.8655}}\right)$$

L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	4 in	10.0 ft	50%	120	243 gpm	4.85274E-06	6.20 ft/sec	0.13 ft	Yes
2	Conveyance Piping	PVC	8 in	18796.8 ft	100%	135	486 gpm	0.000907157	3.10 ft/sec	84.71 ft	
							Sum of K1'	0.00091201	Sum of H_{L1}	84.84 ft	

<---only length to highest poin

Additional pipe loss after highpoint
149.64 ft
Additional fitting loss after highpoint:
7.48 ft
157 ft
Residual pressure at discharge point (elev. 15 ft)
35.9 psi

Fitting Losses

$$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_L}{Q_T}\right)^2 \qquad h_{L2} = n \frac{KV^2}{2g}$$

V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction	
* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.						Sum of K2'	0	Sum of H_{L2}	4.24 ft	5%	***Using 5% of friction loss

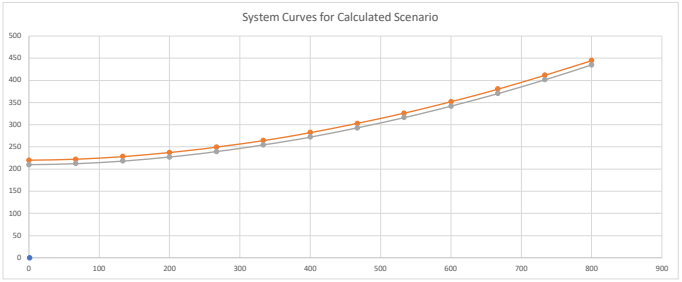
Max Static + H_{L1} + H_{L2} at Design Flow **309.08 ft**

Calculations Table

$$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$$

		Piping HL	Fitting HL				
Q (gpm)	Q mgd	H_{L1}	H_{L2}	Hs max	Hs min	stem Curve M	System Curve Min
0	0.00	0.00	0.00	220	210	220.00	210.00
67	0.10	2.16	0.11	220	210	222.27	212.27
133	0.19	7.78	0.39	220	210	228.17	218.17
200	0.29	16.48	0.82	220	210	237.30	227.30
267	0.38	28.06	1.40	220	210	249.46	239.46
333	0.48	42.40	2.12	220	210	264.52	254.52
400	0.58	59.40	2.97	220	210	282.37	272.37
467	0.67	79.01	3.95	220	210	302.96	292.96
533	0.77	101.15	5.06	220	210	326.20	316.20
600	0.86	125.77	6.29	220	210	352.06	342.06
667	0.96	152.84	7.64	220	210	380.48	370.48
733	1.06	182.31	9.12	220	210	411.42	401.42
800	1.15	214.15	10.71	220	210	444.86	434.86

System Curve Plots

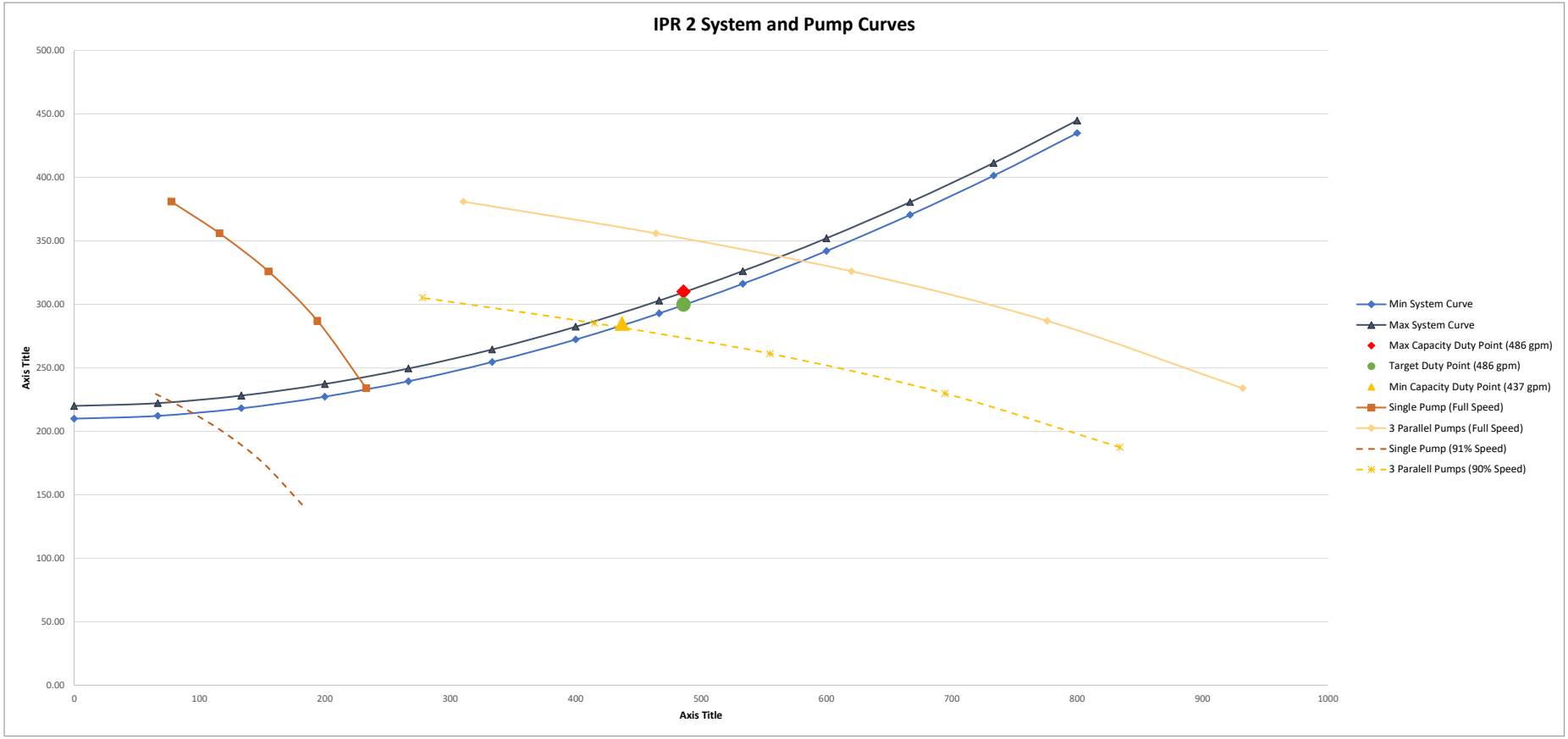


NPSHa Calculation

$$NPSH_a = h_{bar} + h_{static} - h_{L,S} - h_{vap}$$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	84.84	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = -49.75 **AT THE DESIGN POINT**
Maximum NPSHr -54.75 **AT THE DESIGN POINT**


IPR 2 System and Pump Curves
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Axis Title
0
100
200
300
400
500
600
700
800
900
1000
Axis Title
Min System Curve
Max System Curve
Max Capacity Duty Point (486 gpm)
Target Duty Point (486 gpm)
Min Capacity Duty Point (437 gpm)
Single Pump (Full Speed)
3 Parallel Pumps (Full Speed)
Single Pump (91% Speed)
3 Paralell Pumps (90% Speed)

IPR 3 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cell

Basic Equations Used

Piping Losses (Hazen Williams Formula): $H_p = (10.44)(L[ft]) \frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$

Velocity: $V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$

Minor Losses: $H_f = \frac{KV^2}{2g} = K2'(Q)^2$

Total Dynamic Head: $TDH = StaticHead[H_s] + H_p + H_F$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impeller Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	255	feet	<-- using highest point along pipeline +50ft
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	800	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	194	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flows

<-- selecting two parallel duty pumps

Straight Piping Losses

$K_1' = 10.44\left(\frac{L}{C^{1.85}d^{4.8655}}\right) * \left(\frac{Q_1}{Q_T}\right)^{1.85}$ $h_{L1} = 10.44\left(\frac{L * Q_1^{1.85}}{C^{1.85} * d^{4.8655}}\right)$ L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	4 in	10.0 ft	50%	120	97 gpm	4.85274E-06	2.48 ft/sec	0.02 ft	Yes
2	Conveyance Piping	PVC	8 in	18796.8 ft	100%	135	194 gpm	0.000907157	1.24 ft/sec	15.49 ft	
							Sum of K1'	0.00091201	Sum of H_{L1}	15.52 ft	

<----only length to highest point

Additional pipe loss after highpoint
30.91 ft
Additional fitting loss after highpoint:
1.55 ft
32 ft
Residual pressure at discharge point (elev 35 ft)
81.2 psi

Fitting Losses

$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_1}{Q_T}\right)^2$ $h_{L2} = n\frac{KV^2}{2g}$ V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction	
* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.						Sum of K2'	0	Sum of H_{L2}	0.78 ft	5%	**Using 5% of friction loss

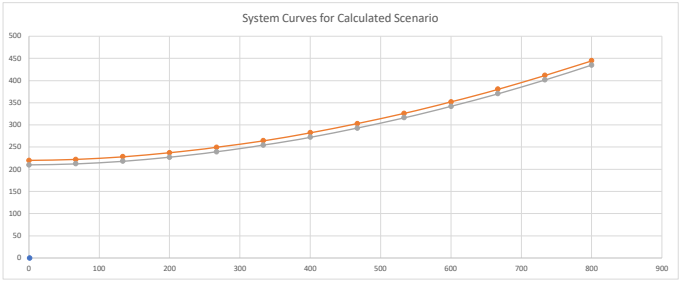
Max Static + H_{L1} + H_{L2} at Design Flow 236.29 ft

Calculations Table

$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$

Q (gpm)	Q mgd	Piping HL H_{L1}	Fitting HL H_{L2}	Hs max	Hs min	stem Curve Ma	System Curve Min
0	0.00	0.00	0.00	220	210	220.00	210.00
67	0.10	2.16	0.11	220	210	222.27	212.27
133	0.19	7.78	0.39	220	210	228.17	218.17
200	0.29	16.48	0.82	220	210	237.30	227.30
267	0.38	28.06	1.40	220	210	249.46	239.46
333	0.48	42.40	2.12	220	210	264.52	254.52
400	0.58	59.40	2.97	220	210	282.37	272.37
467	0.67	79.01	3.95	220	210	302.96	292.96
533	0.77	101.15	5.06	220	210	326.20	316.20
600	0.86	125.77	6.29	220	210	352.06	342.06
667	0.96	152.84	7.64	220	210	380.48	370.48
733	1.06	182.31	9.12	220	210	411.42	401.42
800	1.15	214.15	10.71	220	210	444.86	434.86

System Curve Plots

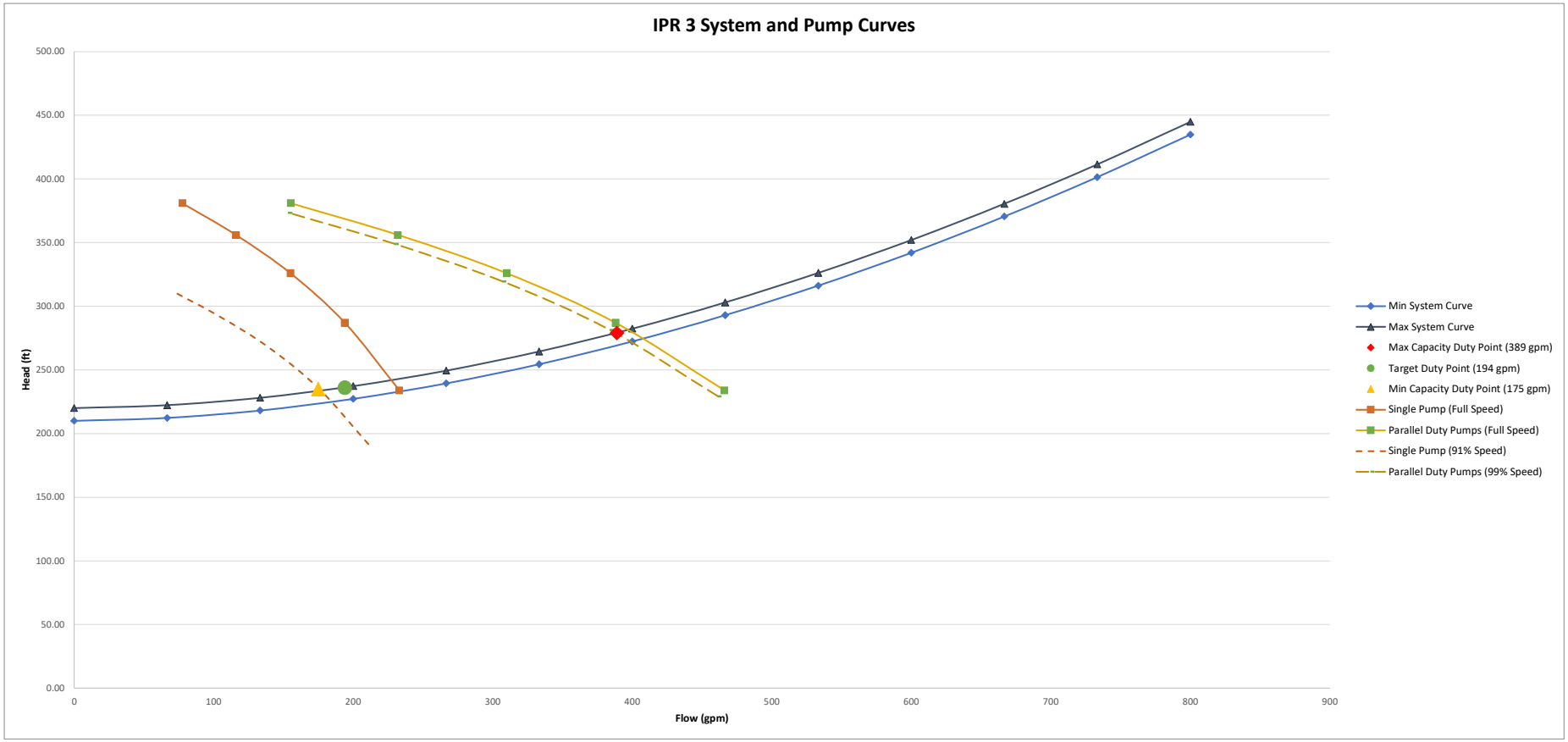


NPSHa Calculation

$NPSH_a = h_{bar} + h_{static} - h_{L,S} - h_{vap}$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	15.52	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = 19.58 **AT THE DESIGN POINT**
Maximum NPSHr 14.50 **AT THE DESIGN POINT**


IPR 3 System and Pump Curves
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Head (ft)
0
100
200
300
400
500
600
700
800
900
Flow (gpm)
Min System Curve
Max System Curve
Max Capacity Duty Point (389 gpm)
Target Duty Point (194 gpm)
Min Capacity Duty Point (175 gpm)
Single Pump (Full Speed)
Parallel Duty Pumps (Full Speed)
Single Pump (91% Speed)
Parallel Duty Pumps (99% Speed)

DPR-4.1 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cell

Basic Equations Used

Piping Losses (Hazen Williams Formula):

$$H_p = (10.44)(L[ft])\frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$$

Velocity:

$$V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$$

Minor Losses:

$$H_f = \frac{KV^2}{2g} = K2'(Q)^2$$

Total Dynamic Head:

$$TDH = StaticHead[H_S] + H_P + H_F$$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impeller Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	550	feet	Elev. Per Google Earth at VC connection (corner of Valley Club Dr and E V
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	800	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	389	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flow

<-- selecting two parallel duty pumps

Straight Piping Losses

$$K_1' = 10.44\left(\frac{L}{C^{1.85}d^{4.8655}}\right) * \left(\frac{Q_i}{Q_T}\right)^{1.85} \qquad h_{L1} = 10.44\left(\frac{L * Q_i^{1.85}}{C^{1.85} * d^{4.8655}}\right)$$

L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	4 in	10.0 ft	50%	120	195 gpm	4.85274E-06	4.97 ft/sec	0.08 ft	Yes
2	Conveyance Piping	PVC	10 in	29100.0 ft	100%	135	389 gpm	0.000474216	1.59 ft/sec	29.33 ft	
							Sum of K1'	0.000479069	Sum of H_{L1}	29.42 ft	

Fitting Losses

$$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_i}{Q_T}\right)^2 \qquad h_{L2} = n\frac{KV^2}{2g}$$

V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction	
* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.						Sum of K2'	0	Sum of H_{L2}	1.47 ft		5% ***Using 5% of friction loss

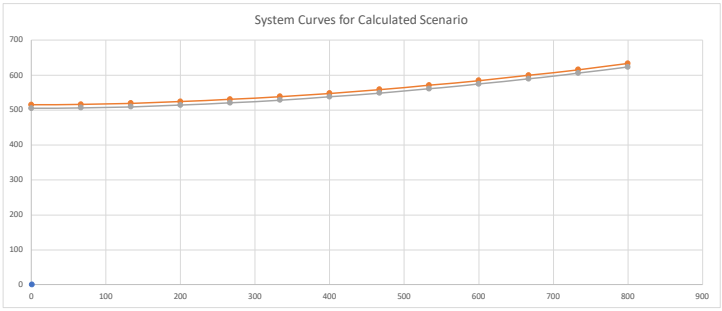
Max Static + H_{L1} + H_{L2} at Design Flow 545.89 ft

Calculations Table

$$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$$

		Piping HL	Fitting HL				
Q (gpm)	Q mgd	H_{L1}	H_{L2}	Hs max	Hs min	stem Curve M	System Curve Min
0	0.00	0.00	0.00	515	505	515.00	505.00
67	0.10	1.13	0.06	515	505	516.19	506.19
133	0.19	4.09	0.20	515	505	519.29	509.29
200	0.29	8.66	0.43	515	505	524.09	514.09
267	0.38	14.74	0.74	515	505	530.47	520.47
333	0.48	22.27	1.11	515	505	538.38	528.38
400	0.58	31.20	1.56	515	505	547.76	537.76
467	0.67	41.50	2.08	515	505	558.58	548.58
533	0.77	53.13	2.66	515	505	570.79	560.79
600	0.86	66.07	3.30	515	505	584.37	574.37
667	0.96	80.28	4.01	515	505	599.30	589.30
733	1.06	95.76	4.79	515	505	615.55	605.55
800	1.15	112.49	5.62	515	505	633.11	623.11

System Curve Plots



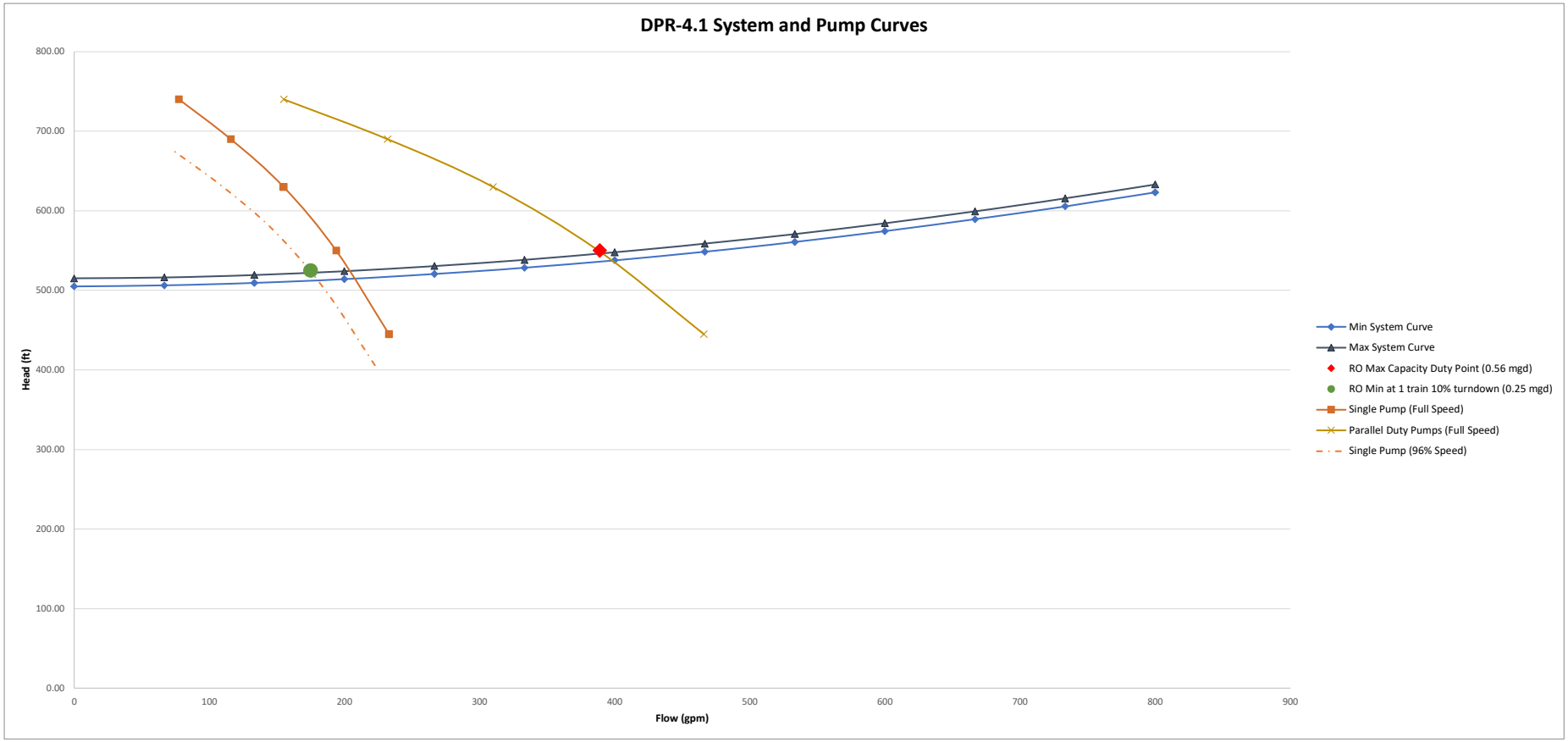
NPSHa Calculation

$$NPSH_a = h_{bar} + h_{static} - h_{L,s} - h_{vap}$$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	29.42	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = 5.67 AT THE DESIGN POINT

Maximum NPSHr 0.67 AT THE DESIGN POINT


DPR-4.1 System and Pump Curves
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Head (ft)
0
100
200
300
400
500
600
700
800
900
Flow (gpm)
Min System Curve
Max System Curve
RO Max Capacity Duty Point (0.56 mgd)
RO Min at 1 train 10% turndown (0.25 mgd)
Single Pump (Full Speed)
Parallel Duty Pumps (Full Speed)
Single Pump (96% Speed)

DPR-4.2 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cell

Basic Equations Used

Piping Losses (Hazen Williams Formula):

$$H_p = (10.44)(L[ft])\frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$$

Velocity:

$$V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$$

Minor Losses:

$$H_f = \frac{KV^2}{2g} = K2'(Q)^2$$

Total Dynamic Head:

$$TDH = StaticHead[H_S] + H_P + H_F$$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impeller Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	1085	feet	Elev. Per Google Earth at VC connection (corner of Valley Club Dr and E V
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	800	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	389	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flow

<-- selecting two parallel duty pumps

Straight Piping Losses

$$K_1' = 10.44\left(\frac{L}{C^{1.85}d^{4.8655}}\right) * \left(\frac{Q_i}{Q_T}\right)^{1.85} \qquad h_{L1} = 10.44\left(\frac{L * Q_i^{1.85}}{C^{1.85} * d^{4.8655}}\right)$$

L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	4 in	10.0 ft	50%	120	195 gpm	4.85274E-06	4.97 ft/sec	0.08 ft	Yes
2	Conveyance Piping	PVC	10 in	37500.0 ft	100%	135	389 gpm	0.000611103	1.59 ft/sec	37.80 ft	
							Sum of K1'	0.000615956	Sum of H_{L1}	37.89 ft	

Fitting Losses

$$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_i}{Q_T}\right)^2 \qquad h_{L2} = n\frac{KV^2}{2g}$$

V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction	
* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.						Sum of K2'	0	Sum of H_{L2}	1.89 ft		5%

***Using 5% of friction loss

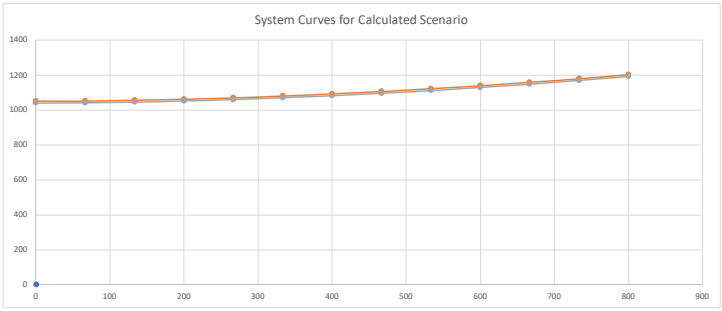
Max Static + H_{L1} + H_{L2} at Design Flow 1089.78 ft

Calculations Table

$$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$$

		Piping HL	Fitting HL				
Q (gpm)	Q mgd	H_{L1}	H_{L2}	Hs max	Hs min	stem Curve M	System Curve Min
0	0.00	0.00	0.00	1050	1040	1050.00	1040.00
67	0.10	1.46	0.07	1050	1040	1051.53	1041.53
133	0.19	5.26	0.26	1050	1040	1055.52	1045.52
200	0.29	11.13	0.56	1050	1040	1061.69	1051.69
267	0.38	18.95	0.95	1050	1040	1069.90	1059.90
333	0.48	28.63	1.43	1050	1040	1080.07	1070.07
400	0.58	40.12	2.01	1050	1040	1092.13	1082.13
467	0.67	53.36	2.67	1050	1040	1106.03	1096.03
533	0.77	68.31	3.42	1050	1040	1121.73	1111.73
600	0.86	84.94	4.25	1050	1040	1139.19	1129.19
667	0.96	103.22	5.16	1050	1040	1158.39	1148.39
733	1.06	123.13	6.16	1050	1040	1179.28	1169.28
800	1.15	144.63	7.23	1050	1040	1201.86	1191.86

System Curve Plots



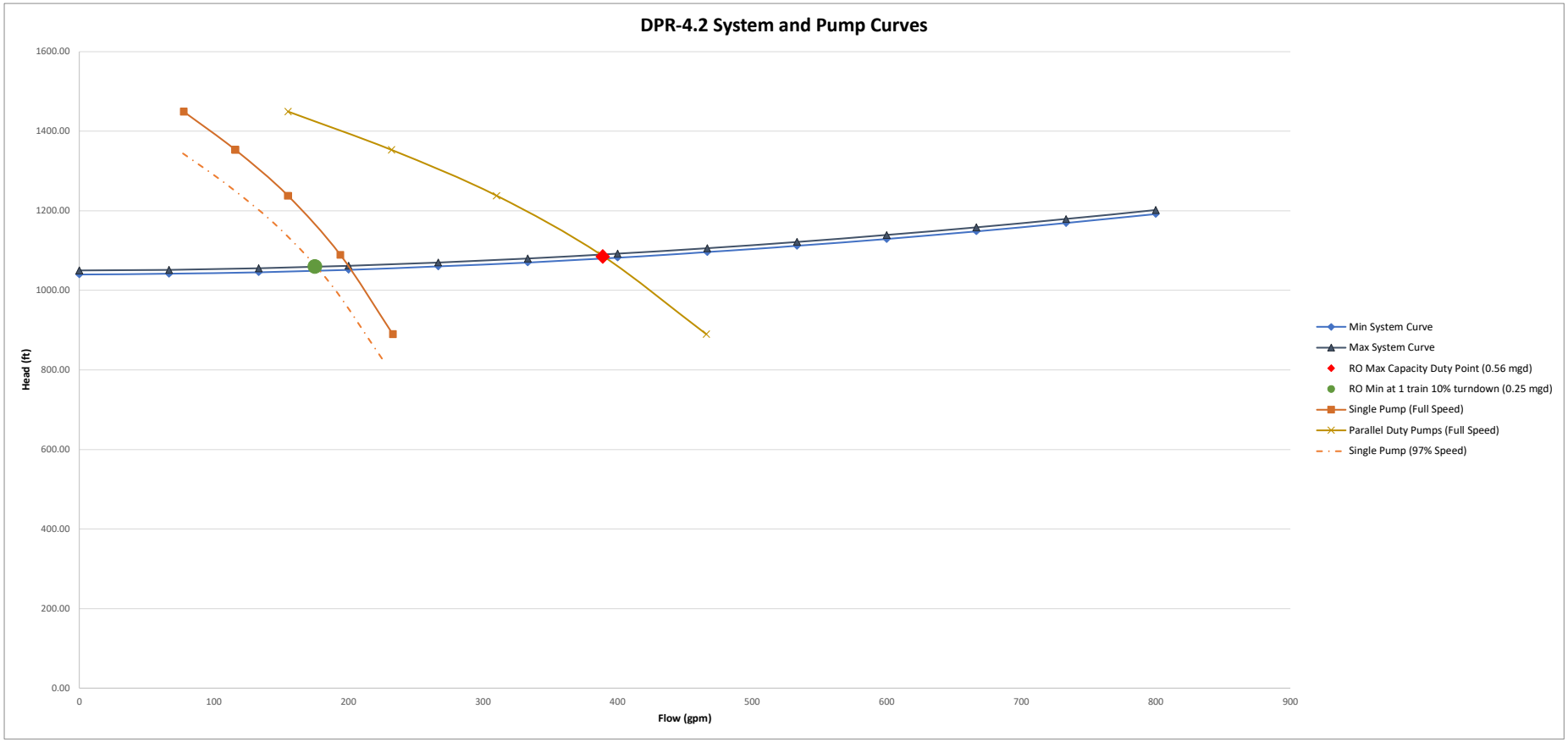
NPSHa Calculation

$$NPSH_a = h_{bar} + h_{static} - h_{L,s} - h_{vap}$$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	37.89	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = -2.79 **AT THE DESIGN POINT**

Maximum NPSHr -7.79 **AT THE DESIGN POINT**


DPR-4.2 System and Pump Curves
1600.00
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
Head (ft)
0
100
200
300
400
500
600
700
800
900
Flow (gpm)
Min System Curve
Max System Curve
RO Max Capacity Duty Point (0.56 mgd)
RO Min at 1 train 10% turndown (0.25 mgd)
Single Pump (Full Speed)
Parallel Duty Pumps (Full Speed)
Single Pump (97% Speed)

DPR-4.3 Hydraulics Analysis and Calculations

Spreadsheet Legend

	Input cell
	Calculated cell, referenced from this sheet
	Referenced cell from other tab
	Spreadsheet info or standard cell

Basic Equations Used

Piping Losses (Hazen Williams Formula):

$$H_p = (10.44)(L[ft])\frac{Q[gpm]^{1.85}}{(C)^{1.85}(d[inches])^{4.8655}}$$

Velocity:

$$V = \frac{Q[gpm]}{448.8 x \pi x D[ft]^2 / 4}$$

Minor Losses:

$$H_f = \frac{KV^2}{2g} = K2'(Q)^2$$

Total Dynamic Head:

$$TDH = StaticHead[H_S] + H_P + H_F$$

Inputs

Elevations	Value	Units	Notes
Max WSEL Suction	45	feet	Elev. Per Google Earth at MSD WWTP
Min WSEL Suction	35	feet	Assumed 10' below Max
Pump Impeller Elevation	32	feet	Used in NPSHa Calculations Below
Discharge Static Elevation 1	410.6	feet	100psi + Elev. Per Google Earth at VC connection (corner of Valley Club D
Discharge Static Elevation 2		feet	
Discharge Static Elevation 3		feet	

Flow Rates	Value	Units	Notes
Max Flow	800	gpm	This sets the plot range for the System Curve
Min Flow	0	gpm	This sets the plot range for the System Curve
Design Flow	389	gpm	This is input for straight pipe and fitting loss calcs below, see Tab9-1 Flow

<-- selecting two parallel duty pumps

Straight Piping Losses

$$K_1' = 10.44\left(\frac{L}{C^{1.85}d^{4.8655}}\right) * \left(\frac{Q_i}{Q_T}\right)^{1.85} \qquad h_{L1} = 10.44\left(\frac{L * Q_i^{1.85}}{C^{1.85} * d^{4.8655}}\right)$$

L in feet, Q in gpm, d in inches

Seg no.	Pipe Name	Material	Diameter	Length	% of Design Flow	C	Flow	K1'	Velocity	Headloss (H_{L1})	Suction
1	Suction Piping	Steel	4 in	10.0 ft	50%	120	195 gpm	4.85274E-06	4.97 ft/sec	0.08 ft	Yes
2	Conveyance Piping	PVC	8 in	6380.0 ft	100%	135	389 gpm	0.000307907	2.48 ft/sec	19.05 ft	
							Sum of K1'	0.00031276	Sum of H_{L1}	19.13 ft	

Fitting Losses

$$K_2' = \frac{K}{2g * A^2} * \left(\frac{Q_i}{Q_T}\right)^2 \qquad h_{L2} = n\frac{KV^2}{2g}$$

V in ft/s, g in ft/s^2, A in ft^2

Seg No.	Fitting Type	Fitting Code	Number	Diameter	K tot	Flow	K2'	Velocity	Headloss (H_{L2})	Suction	
* K tot is the total K for this fitting, it is multipled by the number of fittings in the row.						Sum of K2'	0	Sum of H_{L2}	0.96 ft		5% ***Using 5% of friction loss

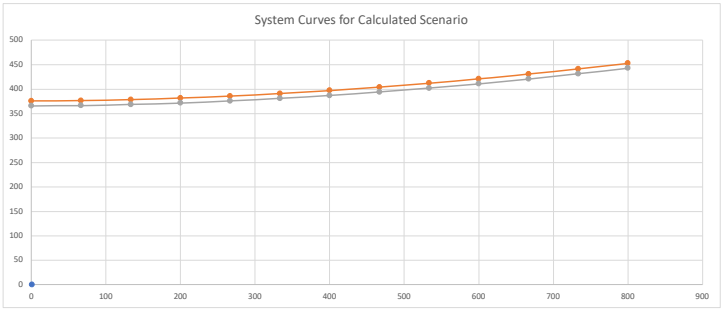
Max Static + H_{L1} + H_{L2} at Design Flow 395.69 ft

Calculations Table

$$h_L = \sum K_1' * Q^{1.85} + \sum K_2' * \left(\frac{Q}{448.8}\right)^2$$

		Piping HL	Fitting HL				
Q (gpm)	Q mgd	H_{L1}	H_{L2}	Hs max	Hs min	stem Curve M	System Curve Min
0	0.00	0.00	0.00	376	366	375.60	365.60
67	0.10	0.74	0.04	376	366	376.38	366.38
133	0.19	2.67	0.13	376	366	378.40	368.40
200	0.29	5.65	0.28	376	366	381.53	371.53
267	0.38	9.62	0.48	376	366	385.70	375.70
333	0.48	14.54	0.73	376	366	390.87	380.87
400	0.58	20.37	1.02	376	366	396.99	386.99
467	0.67	27.09	1.35	376	366	404.05	394.05
533	0.77	34.69	1.73	376	366	412.02	402.02
600	0.86	43.13	2.16	376	366	420.89	410.89
667	0.96	52.41	2.62	376	366	430.63	420.63
733	1.06	62.52	3.13	376	366	441.25	431.25
800	1.15	73.44	3.67	376	366	452.71	442.71

System Curve Plots



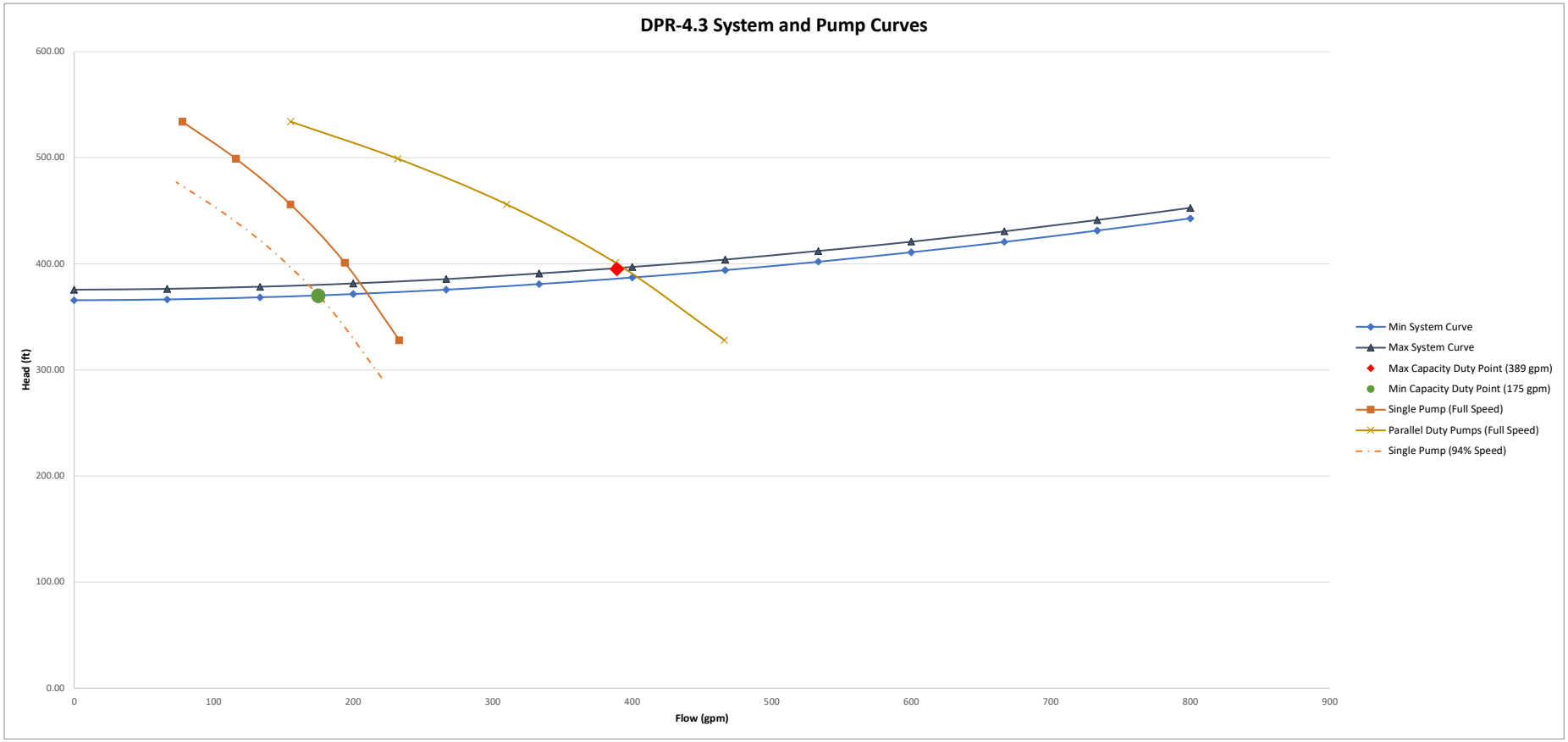
NPSHa Calculation

$$NPSH_a = h_{bar} + h_{static} - h_{L,s} - h_{vap}$$

Description	Notes	Value	Units
Site Elevation	Round up to nearest 500-feet	500	Feet
Pump Inlet Diameter	From selected pump cutsheet	8	inches
Suction Headloss Totals (H_{L1} + H_{L2})	Referenced in from Calculations above	19.13	feet
Suction Lift	Negative if Suction WSEL is above the pump impeller	3	feet
Maximum Water Temperature	Take a conversative estimate	80	degF

NPSHa = 15.96 AT THE DESIGN POINT

Maximum NPSHr 10.96 AT THE DESIGN POINT


DPR-4.3 System and Pump Curves
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Head (ft)
0
100
200
300
400
500
600
700
800
900
Flow (gpm)
Min System Curve
Max System Curve
Max Capacity Duty Point (389 gpm)
Min Capacity Duty Point (175 gpm)
Single Pump (Full Speed)
Parallel Duty Pumps (Full Speed)
Single Pump (94% Speed)

Appendix 9C

COST ESTIMATES

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	NPR-1.1	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$621,400
Bonds and Insurance	1	LS	2.00%	$168,500
General Conditions	1	LS	3.00%	$255,400
Shop Drawings and O&M Manuals	1	LS	2.50%	$211,700
Contractor Overhead Subtotal				**$1,257,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	26,400	LF	$5	$132,000
Private property, driveway, sidewalk, landscape repair allowance	264	100 LF	$125	$33,000
Traffic control for piping project	26,400	LF	$25	$660,000
Piping and Appurtenances				
Piping, 8", PVC	26,400	LF	$176	$4,646,400
Hydrant, mechanical joints	3	EA	$6,010	$18,030
Blow off valve, 3"	8	EA	$2,970	$23,760
Air release and vacuum valve, 2" inlet	8	EA	$1,200	$9,600
Pump Station				
Vertical Turbine Pump, 25HP, 13 stage	4	EA	$82,800	$331,200
Discharge head, piping, valves, and mechanical	4	EA	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Hydropnuematic Tank (10k gallons)	1	LS	$216,000	$216,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
8" trenchless railroad crossing	1	LS	$101,600	$101,600
Creek crossings	5	EA	$132,000	$660,000
Creek protections, environmental and permitting	5	EA	$10,000	$50,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$8,255,000**
Constractor Overhead Costs Subtotal				$1,257,000
Construction Subtotal				**$9,512,000**
Contingency for unknown conditions	30%	PERCENT		$2,854,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$2,378,000
Total Project Cost				**$14,744,000**
Project Flow	128	AFY		
Annualized Project Cost				$658,000
Annualized O&M Cost (see below)				$95,300
Total Annual Cost				**$753,300**
Unit Cost		$/AF		**$5,900**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	122,481	$22,047
Pump Station Annual Maintenance	5%	PERCENT	$1,463,100	$73,155
Pipeline Annual Maintenance	1%	PERCENT	$4,697,790	$46,978
Total Annual O&M Cost				**$95,300**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	NPR-1.2	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$617,600
Bonds and Insurance	1	LS	2.00%	$167,500
General Conditions	1	LS	3.00%	$253,800
Shop Drawings and O&M Manuals	1	LS	2.50%	$210,400
Contractor Overhead Subtotal				**$1,250,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	26,200	LF	$5	$131,000
Private property, driveway, sidewalk, landscape repair allowance	262	100 LF	$125	$32,750
Traffic control for piping project	26,200	LF	$25	$655,000
Piping and Appurtenances				
Piping, 8", PVC	26,200	LF	$176	$4,611,200
Hydrant, mechanical joints	3	EA	$6,010	$18,030
Blow off valve, 3"	6	EA	$2,970	$17,820
Air release and vacuum valve, 2" inlet	6	EA	$1,200	$7,200
Pump Station				
Vertical Turbine Pump, 25HP, 13 stage	4	EA	$82,800	$331,200
Discharge head, piping, valves, and mechanical	4	EA	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Hydropnuematic Tank (10k gallons)	1	LS	$216,000	$216,000
Crossings				
Highway 101 crossing - Danielson Road	1	EA	$221,000	$221,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	5	EA	$132,000	$660,000
Creek protections, environmental and permitting	5	EA	$10,000	$50,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$8,205,000**
Constractor Overhead Costs Subtotal				$1,250,000
Construction Subtotal				**$9,455,000**
Contingency for unknown conditions	30%	PERCENT		$2,837,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$2,364,000
Total Project Cost				**$14,656,000**
Project Flow	113	AFY		
Annualized Project Cost				$654,000
Annualized O&M Cost (see below)				$95,300
Total Annual Cost				**$749,300**
Unit Cost		$/AF		**$6,700**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	122,481	$22,047
Pump Station Annual Maintenance	5%	PERCENT	$1,463,100	$73,155
Pipeline Annual Maintenance	1%	PERCENT	$4,654,250	$46,543
Total Annual O&M Cost				**$95,300**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	NPR-1.3	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$649,600
Bonds and Insurance	1	LS	2.00%	$176,200
General Conditions	1	LS	3.00%	$267,000
Shop Drawings and O&M Manuals	1	LS	2.50%	$221,300
Contractor Overhead Subtotal				**$1,315,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	24,900	LF	$5	$124,500
Private property, driveway, sidewalk, landscape repair allowance	249	100 LF	$125	$31,125
Traffic control for piping project	24,900	LF	$25	$622,500
Piping and Appurtenances				
Piping, 8", PVC	24,900	LF	$176	$4,382,400
Hydrant, mechanical joints	3	EA	$6,010	$18,030
Blow off valve, 3"	6	EA	$2,970	$17,820
Air release and vacuum valve, 2" inlet	6	EA	$1,200	$7,200
Pump Station				
Vertical Turbine Pump, 25HP, 13 stage	4	EA	$82,800	$331,200
Discharge head, piping, valves, and mechanical	4	EA	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Hydropnuematic Tank (10k gallons)	1	LS	$216,000	$216,000
Crossings				
Highway 101 & UPRR crossing - Butterfly Lane	1	EA	$1,017,000	$1,017,000
Creek crossings	5	EA	$132,000	$660,000
Creek protections, environmental and permitting	5	EA	$10,000	$50,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$8,630,000**
Constractor Overhead Costs Subtotal				$1,315,000
Construction Subtotal				**$9,945,000**
Contingency for unknown conditions	30%	PERCENT		$2,984,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$2,487,000
Total Project Cost				**$15,416,000**
Project Flow	102	AFY		
Annualized Project Cost				$688,000
Annualized O&M Cost (see below)				$95,300
Total Annual Cost				**$783,300**
Unit Cost		$/AF		**$7,700**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	122,481	$22,047
Pump Station Annual Maintenance	5%	PERCENT	$1,463,100	$73,155
Pipeline Annual Maintenance	1%	PERCENT	$4,425,450	$44,255
Total Annual O&M Cost				**$95,300**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	IPR 2.1	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$1,407,400
Bonds and Insurance	1	LS	2.00%	$381,600
General Conditions	1	LS	3.00%	$578,300
Shop Drawings and O&M Manuals	1	LS	2.50%	$479,500
Contractor Overhead Subtotal				**$2,847,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	52,000	LF	$5	$260,000
Private property, driveway, sidewalk, landscape repair allowance	520	100 LF	$125	$65,000
Traffic control for piping project	52,000	LF	$25	$1,300,000
Piping and Appurtenances				
Piping, 8", PVC	52,000	LF	$176	$9,152,000
Hydrant, mechanical joints	6	EA	$6,010	$36,060
Blow off valve, 3"	12	EA	$2,970	$35,640
Air release and vacuum valve, 2" inlet	12	EA	$1,200	$14,400
Piping, 6", PVC	1,800	LF	$132	$237,600
Injection Well Site and Equipping				
Injection Well Drilling	1	EA	$700,000	$700,000
Monitoring Well Drilling	2	EA	$575,000	$1,150,000
Well Site Equipping	1	LS	$1,700,000	$1,700,000
Pump Station				
Vertical turbine pump, 20HP, 5 stage	4	EA	$69,400	$277,600
Discharge head, piping, valves, and mechanical	4	LS	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
Highway 101 crossing - Santa Ynez Avenue	1	EA	$1,017,000	$1,017,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	9	EA	$132,000	$1,188,000
Creek protections, environmental and permitting	9	EA	$10,000	$90,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$18,698,000**
Constractor Overhead Costs Subtotal				$2,847,000
Construction Subtotal				**$21,545,000**
Contingency for unknown conditions	30%	PERCENT		$6,464,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$5,387,000
Total Project Cost				**$33,396,000**
Project Flow	560	AFY		
Annualized Project Cost				$1,491,000
Annualized O&M Cost (see below)				$233,900
Total Annual Cost				**$1,724,900**
Unit Cost		$/AF		**$3,100**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	97,985	$17,637
Pump Station Annual Maintenance	5%	PERCENT	$1,409,500	$70,475
Well Site Annual Maintenance	3%	PERCENT	$1,700,000	$51,000
Pipeline Annual Maintenance	1%	PERCENT	$9,475,700	$94,757
Total Annual O&M Cost				**$233,900**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	IPR 2.2	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$1,402,300
Bonds and Insurance	1	LS	2.00%	$380,300
General Conditions	1	LS	3.00%	$576,200
Shop Drawings and O&M Manuals	1	LS	2.50%	$477,700
Contractor Overhead Subtotal				**$2,837,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	51,600	LF	$5	$258,000
Private property, driveway, sidewalk, landscape repair allowance	516	100 LF	$125	$64,500
Traffic control for piping project	51,600	LF	$25	$1,290,000
Piping and Appurtenances				
Piping, 8", PVC	51,600	LF	$176	$9,081,600
Hydrant, mechanical joints	6	EA	$6,010	$36,060
Blow off valve, 3"	12	EA	$2,970	$35,640
Air release and vacuum valve, 3" inlet	12	EA	$2,400	$28,800
Piping, 6", PVC	1,800	LF	$132	$237,600
Injection Well Site and Equipping				
Injection Well Drilling	1	EA	$700,000	$700,000
Monitoring Well Drilling	2	EA	$575,000	$1,150,000
Well Site Equipping	1	LS	$1,700,000	$1,700,000
Pump Station				
Vertical turbine pump, 20HP, 5 stage	4	EA	$69,400	$277,600
Discharge head, piping, valves, and mechanical	4	EA	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
Highway 101 crossing - Carpinteria Avenue	1	EA	$1,017,000	$1,017,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	9	EA	$132,000	$1,188,000
Creek protections, environmental and permitting	9	EA	$10,000	$90,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$18,630,000**
Constractor Overhead Costs Subtotal				$2,837,000
Construction Subtotal				**$21,467,000**
Contingency for unknown conditions	30%	PERCENT		$6,441,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$5,367,000
Total Project Cost				**$33,275,000**
Project Flow	560	AFY		
Annualized Project Cost				$1,486,000
Annualized O&M Cost (see below)				$233,400
Total Annual Cost				**$1,719,400**
Unit Cost		$/AF		**$3,100**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	97,985	$17,637
Pump Station Annual Maintenance	5%	PERCENT	$1,409,500	$70,475
Well Site Annual Maintenance	3%	PERCENT	$1,700,000	$51,000
Pipeline Annual Maintenance	1%	PERCENT	$9,419,700	$94,197
Total Annual O&M Cost				**$233,400**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	IPR 2.3	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$1,529,100
Bonds and Insurance	1	LS	2.00%	$414,600
General Conditions	1	LS	3.00%	$628,300
Shop Drawings and O&M Manuals	1	LS	2.50%	$520,900
Contractor Overhead Subtotal				**$3,093,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	56,300	LF	$5	$281,500
Private property, driveway, sidewalk, landscape repair allowance	563	100 LF	$125	$70,375
Traffic control for piping project	56,300	LF	$25	$1,407,500
Piping and Appurtenances				
Piping, 8", PVC	56,300	LF	$176	$9,908,800
Hydrant, mechanical joints	6	EA	$6,010	$36,060
Blow off valve, 3"	12	EA	$2,970	$35,640
Air release and vacuum valve, 2" inlet	12	EA	$1,200	$14,400
Piping, 6", PVC	1,800	LF	$132	$237,600
Injection Well Site and Equipping				
Injection Well Drilling	1	EA	$700,000	$700,000
Monitoring Well Drilling	2	EA	$575,000	$1,150,000
Well Site Equipping	1	LS	$1,700,000	$1,700,000
Pump Station				
Vertical turbine pump, 20HP, 5 stage	4	EA	$69,400	$277,600
Discharge head, piping, valves, and mechanical	4	EA	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
Highway 101 crossing - Linden Avenue	1	EA	$1,743,000	$1,743,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	9	EA	$132,000	$1,188,000
Creek protections, environmental and permitting	9	EA	$10,000	$90,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$20,315,000**
Constractor Overhead Costs Subtotal				$3,093,000
Construction Subtotal				**$23,408,000**
Contingency for unknown conditions	30%	PERCENT		$7,023,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$5,852,000
Total Project Cost				**$36,283,000**
Project Flow	560	AFY		
Annualized Project Cost				$1,620,000
Annualized O&M Cost (see below)				$142,400
Total Annual Cost				**$1,762,400**
Unit Cost		$/AF		**$3,200**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	97,985	$17,637
Pump Station Annual Maintenance	5%	PERCENT	$1,409,500	$70,475
Well Site Annual Maintenance	3%	PERCENT	$1,700,000	$51,000
Pipeline Annual Maintenance	1%	PERCENT	$323,700	$3,237
Total Annual O&M Cost				**$142,400**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	IPR 3.1	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$1,352,000
Bonds and Insurance	1	LS	2.00%	$366,600
General Conditions	1	LS	3.00%	$555,600
Shop Drawings and O&M Manuals	1	LS	2.50%	$460,600
Contractor Overhead Subtotal				**$2,735,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	53,900	LF	$5	$269,500
Private property, driveway, sidewalk, landscape repair allowance	539	100 LF	$125	$67,375
Traffic control for piping project	53,900	LF	$25	$1,347,500
Piping and Appurtenances				
Piping, 8", PVC	53,900	LF	$176	$9,486,400
Hydrant, mechanical joints	6	EA	$6,010	$36,060
Blow off valve, 3"	12	EA	$2,970	$35,640
Air release and vacuum valve, 2" inlet	12	EA	$1,200	$14,400
Injection Well Site and Equipping				
Injection Well Drilling	1	EA	$700,000	$700,000
Monitoring Well Drilling	2	EA	$575,000	$1,150,000
Well Site Equipping	1	LS	$1,700,000	$1,700,000
Pump Station				
Vertical turbine pump, 20HP, 5 stage	3	EA	$69,400	$208,200
Discharge head, piping, valves, and mechanical	3	EA	$90,000	$270,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	11	EA	$132,000	$1,452,000
Creek protections, environmental and permitting	11	EA	$10,000	$110,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$17,962,000**
Constractor Overhead Costs Subtotal				$2,735,000
Construction Subtotal				**$20,697,000**
Contingency for unknown conditions	30%	PERCENT		$6,210,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$5,175,000
Total Project Cost				**$32,082,000**
Project Flow	560	AFY		
Annualized Project Cost				$1,432,000
Annualized O&M Cost (see below)				$226,900
Total Annual Cost				**$1,658,900**
Unit Cost		$/AF		**$3,000**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	97,985	$17,637
Pump Station Annual Maintenance	5%	PERCENT	$1,250,100	$62,505
Well Site Annual Maintenance	3%	PERCENT	$1,700,000	$51,000
Pipeline Annual Maintenance	1%	PERCENT	$9,572,500	$95,725
Total Annual O&M Cost				**$226,900**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	DPR 4.1	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$715,500
Bonds and Insurance	1	LS	2.00%	$194,000
General Conditions	1	LS	3.00%	$294,000
Shop Drawings and O&M Manuals	1	LS	2.50%	$243,800
Contractor Overhead Subtotal				**$1,448,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	29,100	LF	$5	$145,500
Private property, driveway, sidewalk, landscape repair allowance	276	100 LF	$125	$34,500
Traffic control for piping project	27,600	LF	$25	$690,000
Piping and Appurtenances				
Piping, 10", PVC	27,600	LF	$220	$6,072,000
Hydrant, mechanical joints	3	EA	$6,010	$18,030
Blow off valve, 3"	10	EA	$2,970	$29,700
Air release and vacuum valve, 2" inlet	10	EA	$1,200	$12,000
Pump Station				
Vertical Turbine Pump, 40HP, 10 stage	3	EA	$88,700	$266,100
Discharge head, piping, valves, and mechanical	3	EA	$90,000	$270,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	6	EA	$132,000	$792,000
Creek protections, environmental and permitting	6	EA	$10,000	$60,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$9,505,000**
Constractor Overhead Costs Subtotal				$1,448,000
Construction Subtotal				**$10,953,000**
Contingency for unknown conditions	30%	PERCENT		$3,286,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$2,739,000
Total Project Cost				**$16,978,000**
Project Flow	560	AFY		
Annualized Project Cost				$758,000
Annualized O&M Cost (see below)				$162,000
Total Annual Cost				**$920,000**
Unit Cost		$/AF		**$1,700**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	195,970	$35,275
Pump Station Annual Maintenance	5%	PERCENT	$1,308,000	$65,400
Pipeline Annual Maintenance	1%	PERCENT	$6,131,730	$61,317
Total Annual O&M Cost				**$162,000**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study			
Alternative:	DPR 4.2		***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate		***Reviewed by:***	***RM, SD***
			Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$875,700
Bonds and Insurance	1	LS	2.00%	$237,500
General Conditions	1	LS	3.00%	$359,800
Shop Drawings and O&M Manuals	1	LS	2.50%	$298,300
Contractor Overhead Subtotal				**$1,772,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	37,500	LF	$5	$187,500
Private property, driveway, sidewalk, landscape repair allowance	375	100 LF	$125	$46,875
Traffic control for piping project	37,500	LF	$25	$937,500
Piping and Appurtenances				
Piping, 10", PVC	37,500	LF	$220	$8,250,000
Hydrant, mechanical joints	4	EA	$6,010	$24,040
Blow off valve, 3"	10	EA	$2,970	$29,700
Air release and vacuum valve, 2" inlet	10	EA	$1,200	$12,000
Pump Station				
Vertical Turbine Pump, 40HP, 10 stage	1	EA	$88,700	$88,700
Discharge head, piping, valves, and mechanical	1	EA	$90,000	$90,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Crossings				
Highway 101 crossing - South Jameson Lane	1	EA	$221,000	$221,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Creek crossings	6	EA	$132,000	$792,000
Creek protections, environmental and permitting	6	EA	$10,000	$60,000
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Construction Costs Subtotal				**$11,633,000**
Constractor Overhead Costs Subtotal				$1,772,000
Construction Subtotal				**$13,405,000**
Contingency for unknown conditions	30%	PERCENT		$4,022,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$3,352,000
Total Project Cost				**$20,779,000**
Project Flow	560	AFY		
Annualized Project Cost				$928,000
Annualized O&M Cost (see below)				$166,000
Total Annual Cost				**$1,094,000**
Unit Cost		$/AF		**$2,000**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	195,970	$35,275
Pump Station Annual Maintenance	5%	PERCENT	$950,600	$47,530
Pipeline Annual Maintenance	1%	PERCENT	$8,315,740	$83,157
Total Annual O&M Cost				**$166,000**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	DPR 4.3	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$433,700
Bonds and Insurance	1	LS	2.00%	$117,600
General Conditions	1	LS	3.00%	$178,200
Shop Drawings and O&M Manuals	1	LS	2.50%	$147,800
Contractor Overhead Subtotal				**$878,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	6,400	LF	$5	$32,000
Private property, driveway, sidewalk, landscape repair allowance	64	100 LF	$125	$8,000
Traffic control for piping project	6,400	LF	$25	$160,000
Piping and Appurtenances				
Piping, 10", PVC	6,400	LF	$220	$1,408,000
Hydrant, mechanical joints	1	EA	$6,010	$6,010
Blow off valve, 3"	5	EA	$2,970	$14,850
Air release and vacuum valve, 2" inlet	5	EA	$1,200	$6,000
Pump Station				
Vertical Turbine Pump, 15HP, 3 stage	3	EA	$67,700	$203,100
Jockey Pump, 5HP	1	EA	$15,000	$15,000
Discharge head, piping, valves, and mechanical	4	EA	$90,000	$360,000
Site work	1	LS	$117,400	$117,400
Effluent wet well structure	1	LS	$300,500	$300,500
Electrical and Controls	1	LS	$354,000	$354,000
Storage				
Welded steel storage for potable water	500,000	GAL	$1.50	$750,000
Crossings				
Highway 101 crossing - East Cabrillo Boulevard	1	EA	$1,453,000	$1,453,000
8" trenchless railroad crossing	1	EA	$101,600	$101,600
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$20,000	$20,000
Major traffic control	90	DAYS	$5,000	$450,000
Pedestrian control, bridge access, signs, etc.	1	LS	$1,500	$1,500
Construction Costs Subtotal				**$5,761,000**
Constractor Overhead Costs Subtotal				$878,000
Construction Subtotal				**$6,639,000**
Contingency for unknown conditions	30%	PERCENT		$1,992,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$1,660,000
Total Project Cost				**$10,291,000**
Project Flow	560	AFY		
Annualized Project Cost				$459,000
Annualized O&M Cost (see below)				$117,200
Total Annual Cost				**$576,200**
Unit Cost		$/AF		**$1,100**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pump Station Energy Costs	$0.18	$/kW-HR	195,970	$35,275
Pump Station Annual Maintenance	5%	PERCENT	$1,350,000	$67,500
Pipeline Annual Maintenance	1%	PERCENT	$1,434,860	$14,349
Total Annual O&M Cost				**$117,200**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	DPR 5.1	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$416,400
Bonds and Insurance	1	LS	2.00%	$112,900
General Conditions	1	LS	3.00%	$171,100
Shop Drawings and O&M Manuals	1	LS	2.50%	$141,900
Contractor Overhead Subtotal				**$843,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	5,400	LF	$5	$27,000
Private property, driveway, sidewalk, landscape repair allowance	54	100 LF	$125	$6,750
Traffic control for piping project	5,400	LF	$25	$135,000
Piping and Appurtenances				
Sewer, 18", SDR	5,400	LF	$630	$3,402,000
Install 15-ft deep manhole	6	EA	$20,000	$120,000
18" trenchless waterway crossing	*100*	*LF*	*$2,400*	*$240,000*
Pipe to manhole connection and repair	6	EA	$1,000	$6,000
Storage				
Post-treated storage	470,000	GAL	$1.75	$822,500
Environmental and Other				
Bird sanctuary environmental protection, permit compliance, and BMPs	1	LS	$50,000	$50,000
Constructability factor	15%	PERCENT	$4,809,250	$721,388
Construction Costs Subtotal				**$5,531,000**
Constractor Overhead Costs Subtotal				$843,000
Construction Subtotal				**$6,374,000**
Contingency for unknown conditions	30%	PERCENT		$1,913,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$1,594,000
Total Project Cost				**$9,881,000**
Project Flow	560	AFY		
Annualized Project Cost				$441,000
Annualized O&M Cost (see below)				$37,700
Total Annual Cost				**$478,700**
Unit Cost		$/AF		**$900**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Pipeline Annual Maintenance	1%	PERCENT	$3,768,000	$37,680
Total Annual O&M Cost				**$37,700**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study			
Alternative:	DPR 5.2		***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate		***Reviewed by:***	***RM, SD***
			Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$500,400
Bonds and Insurance	1	LS	2.00%	$135,700
General Conditions	1	LS	3.00%	$205,700
Shop Drawings and O&M Manuals	1	LS	2.50%	$170,500
Contractor Overhead Subtotal				**$1,013,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	8,200	LF	$5	$41,000
Private property, driveway, sidewalk, landscape repair allowance	82	100 LF	$125	$10,250
Traffic control for piping project	8,200	LF	$25	$205,000
Piping and Appurtenances				
Sewer, 15", SDR	8,200	LF	$525	$4,305,000
Install 15-ft deep manhole	12	EA	$20,000	$240,000
Pipe to manhole connection and repair	12	EA	$1,000	$12,000
Infrastructure				
15" inverted siphon	*1*	*EA*	*$500,000*	*$500,000*
15" trenchless waterway crossing	*90*	*LF*	*$2,200*	*$198,000*
15" trenchless waterway crossing	*120*	*LF*	*$2,200*	*$264,000*
Storage				
Post-treated storage	470,000	GAL	$1.75	$822,500
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$50,000	$50,000
Construction Costs Subtotal				**$6,648,000**
Constractor Overhead Costs Subtotal				$1,013,000
Construction Subtotal				**$7,661,000**
Contingency for unknown conditions	30%	PERCENT		$2,299,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$1,916,000
Total Project Cost				**$11,876,000**
Project Flow	560	AFY		
Annualized Project Cost				$530,000
Annualized O&M Cost (see below)				$93,700
Total Annual Cost				**$623,700**
Unit Cost		$/AF		**$1,200**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Inverted Siphon Annual Maintenance	5%	PERCENT	$962,000	$48,100
Pipeline Annual Maintenance	1%	PERCENT	$4,557,000	$45,570
Total Annual O&M Cost				**$93,700**

Preliminary Design Opinion of Probable Cost Computation

Project:	Montecito Enhanced Recycled Water Feasibility Study		
Alternative:	DPR 5.3	***By:***	***MG***
Task:	Task 3.5 / AACE Class IV Cost Estimate	***Reviewed by:***	***RM, SD***
		Date:	***11/22/2022***

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTRACTOR OVERHEAD COSTS				
Mobilization/Demobilization	1	LS	7.00%	$967,900
Bonds and Insurance	1	LS	2.00%	$262,500
General Conditions	1	LS	3.00%	$397,700
Shop Drawings and O&M Manuals	1	LS	2.50%	$329,700
Contractor Overhead Subtotal				**$1,958,000**
CONSTRUCTION COSTS				
General Construction				
Sheeting and shoring protection	6,380	LF	$5	$31,900
Private property, driveway, sidewalk, landscape repair allowance	118	100 LF	$125	$14,728
Traffic control for piping project	11,782	LF	$25	$294,550
Piping and Appurtenances				
Sewer, 24", SDR	11,782	LF	$840	$9,896,880
Install 15-ft deep manhole	16	EA	$20,000	$320,000
Pipe to manhole connection and repair	16	EA	$1,000	$16,000
Infrastructure				
24" inverted siphon	*1*	*EA*	*$500,000*	*$500,000*
24" trenchless waterway crossing	*90*	*LF*	*$3,400*	*$306,000*
24" trenchless waterway crossing	*120*	*LF*	*$3,400*	*$408,000*
Storage				
Post-treated storage	470,000	GAL	$1.50	$705,000
Crossings				
24" trenchless railroad crossing	1	EA	$314,200	$314,200
Environmental and Other				
Environmental protection, permit compliance, and BMPs	1	LS	$50,000	$50,000
Construction Costs Subtotal				**$12,858,000**
Constractor Overhead Costs Subtotal				$1,958,000
Construction Subtotal				**$14,816,000**
Contingency for unknown conditions	30%	PERCENT		$4,445,000
Engineering, Administration, and Legal Costs	25%	PERCENT		$3,704,000
Total Project Cost				**$22,965,000**
Project Flow	560	AFY		
Annualized Project Cost				$1,025,000
Annualized O&M Cost (see below)				$163,100
Total Annual Cost				**$1,188,100**
Unit Cost		$/AF		**$2,200**
ANNUAL OPERATIONS & MAINTENANCE COSTS				
Inverted Siphon Annual Maintenance	5%	PERCENT	$1,214,000	$60,700
Pipeline Annual Maintenance	1%	PERCENT	$10,232,880	$102,329
Total Annual O&M Cost				**$163,100**