FINAL

FACILITIES PLAN FOR THE NORTH PLEASANT VALLEY GROUNDWATER TREATMENT FACILITY

B&V PROJECT NO. 180091

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PREPARED FOR

City of Camarillo

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ACRONYMS

ac	acre
AFD	adjustable frequency drive
B&V	Black & Veatch
Ca	Calcium
CDPH	California Department of Public Health
CIP	clean-in-place
City	City of Camarillo
Cl	Chlorine
CMAR	Construction Management at Risk
CMWD	Calleguas Municipal Water District
CO	Carbon Monoxide
CSDWRP	Camarillo Sanitatary District Water Reclamation Plant
CUE	Camarillo Airport Utility Enterprise
DBIA	Design-Build Institute of America
DO	dissolved oxygen
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ERD	energy recovery device
Fe	Iron
FTE	Full Time Employees
GMF	granular media filtration
gpm	gallons per minute
gpm/sf	gallons per minute per square foot
HDPE	high-density polyethylene
HGL	Hydraulic Grade Line
IS	Initial Study
kW	kilowatts
kWh	kilowatt hour
MCLs	Secondary Maximum Contaminant Levels
MF	microfiltration
mg/L	milligrams per liter
mgd	million gallons per day
mm	millimeter
Mn	Manganese
msl	mean sea level
NaOH	sodium hydroxide
NDMA	N-Nitroso-Dimethylamine
NOP	Notice of Preparation
NOx	Nitrogen oxides
NPV	North Pleasant Valley
O&M	operation and maintenance
PDB	Progressive Design Build

- pCi/L Gross Alpha
- PRVs pressure reducing valves
- RO reverse osmosis
- ROC reactive organic compounds
- SMP Salinity Management Pipeline
- SO_4 Sulfates
- TDS total dissolved solids
- TMDL Total Maximum Daily Load
- VCP vitrified clay pipe
- WDBC Water Design Build Council

Executive Summary

The City of Camarillo (City) is implementing a project to develop a Groundwater Treatment Facility to diversify the region's water supply portfolio and reduce reliance on imported water supplies. The City contracted Black & Veatch (B&V) to develop the Facilities Plan for the North Pleasant Valley (NPV) Groundwater Treatment Facility in support of the Environmental Impact Report and Environmental Assessment efforts for the project. This Executive Summary highlights key findings and recommendations of the Facilities Plan.

INTRODUCTION AND PROJECT OBJECTIVES (CHAPTER 1)

Over the past decade, much of the City's groundwater has shown significant increases in salinity, iron, and manganese. In response to the observed increasing trend, the City has reduced groundwater production, increasing its reliance on imported water, which currently constitutes approximately 60 percent of the City's total water supply. Chapter 1 describes studies and pilot testing performed by the City to select and optimize groundwater treatment technology for a groundwater treatment facility. The facility, planned by the City, is an approximately 7 mgd regional membrane treatment facility and will be developed, built, and owned by the City. The facility may also provide water to neighboring water agencies. The main objectives of the project are to:

- Diversify the region's water supply portfolio
- Reduce the City's reliance on imported water
- Reestablish the City's existing Wells A and B to have a combined production capacity of approximately 3,000 gallons per minute (gpm) and develop an additional 3,000 gpm through one or two new wells
- Develop a cost effective strategy that locates new facilities near existing water pipelines
- Maximize use of existing groundwater available from the northern area of Pleasant Valley Groundwater Basin
- Improve water quality to potable water customers
- Increase recycled water usage with improved water quality at the source

REGULATORY REQUIREMENTS (CHAPTER 2)

As part of the Facilities Plan, historical water quality from Wells A and B was reviewed, and constituents of emerging concern were considered. As discussed in Chapter 2, historical water quality for Wells A and B indicates that concentrations of chloride, sulfate, total dissolved solids (TDS), iron, and manganese has been increasing. Average values for sulfate, TDS, and iron (Well A only) are currently above the Secondary Maximum Contaminant Levels (MCLs) set forth by the California Department of Public Health (CDPH). The constituents identified in the Secondary MCL may adversely affect taste and odor, color, scale, staining, or the appearance of the water.

Table ES-1 lists regulatory standards for constituents and summarizes their concentrations, both in the City's groundwater wells and in the imported water provided to the City by CMWD.

Table ES-1: Secondary MCL for Applicable Groundwater Contaminants

CONSTITUENT	SECONDARY MCL	CITY OF CAMARILLO WELLS			IMPORTED WATER CALLEGUAS MWD [(4)]
		Well A [(1)]	Well B [(2)]	New Well [(3)]	
Chloride, mg/L	250	124	159	136	56
Sulfate, mg/L	250	1,055	658	891	48
TDS, mg/L	1000	1,688	1,361	1,554	260
Iron, mg/L	0.3	0.36	0.17	0.28	-
Manganese, mg/L	0.05	0.23	0.15	0.20	-

[(1)] Average of water quality data from 1998 through 2014
[(2)] Average of water quality data from 2001 through 2014
[(3)] Estimated average using Well A and B data
[(4)] Based on CMWD 2013 Water Quality Report

STUDY AREA CHARACTERISTICS (CHAPTER 3)

Since 1994, the North Pleasant Valley groundwater basin has experienced poor-quality brackish water from upstream discharges (surface water recharge emanating from the Arroyo Las Posas). The surface flows rapidly percolated through the coarse alluvial sediments that comprise the river bed and into the underlying Saugus and Los Posas Sand Formations that comprise the primary aquifer system in NPV. The infiltration of the poor-quality brackish water has resulted in raised groundwater elevations and deteriorated groundwater quality. The groundwater studies concluded that water quality in this area will likely not improve in the foreseeable future and that the City should consider groundwater treatment to fully utilize the local groundwater supply.

The City currently imports the majority of its water supply from the CMWD through a series of metered connections (turnouts) from the 36-inch Oxnard-Santa Rosa Feeder and the 39-inch Camarillo Feeder. This imported supply is supplemented with groundwater supplied through several wells connected directly to the distribution system. Although Annual Average Demand previously reached approximately 9.0 mgd (10,000 acre-feet/year) and was expected to grow to 11.3 mgd (12,700 acre-feet/year) by build-out, these numbers have since been revised downward in the 2015 Master Plan to 7.6 mgd (8.5 AFY) and 8.1 mgd (9.1 AFY), respectively. In support of planning and development of the NPV Groundwater Treatment Facility, the City updated the water distribution system model to modify the point of supply as well as incorporate the Camarillo Airport Utility Enterprise (CUE). Wells which had supplied the CUE as a separate water system have been idled since 2007, and the airport's water distribution has been supplied from and operated as an extension of the City's distribution system.

Chapter 3 summarizes a 2007 report prepared for the City that provided a distribution system hydraulic analysis for the Groundwater Treatment Facility and Airport Addition. The 2007 report evaluated where and how the 7 mgd output from the facility would be supplied into the distribution system. The proposed plant site is within Zone 1 of the City's distribution system, yet Zone 2 could be accessed relatively easily via the Reservoir No. 2 fill line located nearby. Two alternatives were developed and analyzed based upon the proportion of the Groundwater Treatment Facility's output to be supplied into each Zone: 1) Alternative 1, Supply Proportional to Zone Demand, and 2) Alternative 2, Supply Proportional to Hydraulic Capacity. Based on the results of the hydraulic analyses, Alternative 2 was the recommended method for connecting the proposed NPV Groundwater Treatment Facility into Zones 1 and 2 of the distribution system. The recommended pumping capacity for each zone is summarized in Table ES-2. An update to the hydraulics report in 2010 added analysis of an additional potential treatment facility site but did not change the overall conclusions of the study.

Table ES-2: Summary of Recommended Pumping Capacity for Zone 1 and 2

OPERATION MODE	ZONE 1 PUMPING CAPACITY	ZONE 2 PUMPING CAPACITY
Normal	3,600 gpm	1,100 gpm
Non-Standard	1,700 gpm	3,000 gpm

SUMMARY OF ENVIRONMENTAL IMPACT REPORT (CHAPTER 4)

The City of Camarillo prepared an Initial Study (IS) and a Notice of Preparation (NOP) in April 2008 for a similar project. The project was assigned State Clearinghouse No. 2008041159. The City received comments from 10 parties. Responses to these comments are provided in the Final EIR. One of the comments (from Fox Canyon Groundwater Management Agency and its consultants) subsequently led to changing the baseline condition from "no mounding" to "no project". ("Mounding" refers to the increasing surface elevation of brackish groundwater in the North Pleasant Valley Basin.)

The project objectives are summarized as follows:

- Restore groundwater production from Wells A and B to past levels
- Fully utilize existing groundwater allocation in the Pleasant Valley Groundwater Basin
- Address the plume of salty groundwater migrating into the basin
- Reduce dependence on imported potable water
- Reduce salt concentrations in treated wastewater discharged to Conejo Creek
- Minimize capital costs

A full EIR was deemed necessary due to agricultural conversion, annexation issues, and other potentially significant impacts to the environment. An NOP was prepared and distributed on September 27, 2013, and comments were received from 15 parties. A draft EIR was submitted in March 2014. The final EIR is dated May 2015.

WATER SUPPLY CHARACTERISTICS AND FACILITIES (CHAPTER 5)

Chapter 5 presents groundwater quality, product water quality goals, and design criteria for the recommended treatment facilities for the NPV Groundwater Treatment Facilities. Table ES-3 summarizes the final product water quality goals, which were established to meet primary and secondary MCLs as well as the product water quality goals presented in previous City studies. Table ES-3 also indicates the quality of water imported from CMWD. The project goals for TDS, chloride, and sulfate reflect both the City's objectives for drinking water and impacts on meeting Total Maximum Daily Load (TMDL) limits in the Camarillo Sanitary District Water Reclamation Plant (CSDWRP) effluent. The iron and manganese goals reflect conservative targets, improving the aesthetics as well as providing a factor of safety above regulatory limits. For example, excessive levels of iron and manganese can cause water stains at the customer's tap.

Table ES-3: Summary of Final Product Water Quality Goals

CONSTITUENT	PRODUCT WATER QUALITY GOAL	IMPORTED WATER QUALITY(1)
Chloride, mg/L	65(2)	56
Gross Alpha, pCi/L	12	ND
Iron, mg/L	<0.1	-
Manganese, mg/L	<0.03	-
pH	>8.0	8.3
Sulfate, mg/L	70(2)	48
TDS, mg/L	250(2)	260
Total Hardness, mg/L as CaCO3	75-120(3)	100

(1) Based on CMWD 2013 Water Quality Report for Imported Water Values
(2) Established to meet TMDL requirements for CSDWRP and/or match current imported water quality
(3) Range provided to accommodate blending requirements

Key components of the NPV Groundwater Treatment Facility include:

- Groundwater wells delivering brackish groundwater via two existing wells (Well A and B) and either one or two new wells, totaling 6,000 gpm, for treatment
- Pretreatment of the raw groundwater through one of the two options described below
- Reverse osmosis (RO) membrane desalination, with the RO concentrate discharged to the Regional Salinity Management Pipeline (SMP)
- Post-treatment (via decarbonation, RO bypass blending, and pH adjustment) to stabilize the RO permeate
- Primary disinfection through chlorine addition and chloramines residual is maintained when leaving the treatment facility
- Chemical feed facilities (sodium hypochlorite, sodium hydroxide, ammonium sulfate, sodium bisulfate, sulfuric acid, and antiscalant).
- Ancillary facilities (administration building, electrical building, standby power, etc.)

Pretreatment requirements for the RO system will be selected during the design stage of the project. As part of this Facilities Plan, two options were developed. Preliminary design criteria, process flow diagram, site layout, and opinion of probable costs were prepared for each option:

- Pretreatment Option 1 – Oxygen Quenching for Direct RO Application. Oxygen quenching chemical (e.g. sodium bisulfite) would be added at the well head to keep iron and manganese in soluble form. This option was developed in the pilot study and reevaluated as part of the Facilities Plan. A site layout was prepared showing that the total footprint of the treatment facilities required is approximately 17,800 ft^2.

- Pretreatment Option 2 – Chlorine Oxidation + Pretreatment Filtration. Chlorine would be added on combined groundwater to oxidize iron and manganese for removal through pretreatment greensand filters. Based on Black & Veatch experience with waters of similar quality, this option was added to the Facilities Plan because it was noted during the pilot study that oxygen quenching may contribute to increased biofouling potential if ideal operating ranges are not maintained. Pretreatment Option 2 would require significantly more treatment facilities and land, having a total footprint of approximately 38,300 ft^2. The required pretreatment filtration and support facilities account for approximately 20,500 ft^2 of this total.

Anticipated treated water quality is summarized for key constituents in Table ES-4. Treated water from the NPV Groundwater Treatment Facility will be delivered into the existing water distribution system in such as manner as to better balance the hydraulics among the floating reservoirs of each zone. Thus, under normal conditions, approximately 60 to 75 percent of the treated water will be pumped into Zone 1 and 40 to 25 percent into Zone 2 of the City's water distribution system. Operational settings at the Kendall, Rosewood and Flynn Pressure Reducing Valves (PRVs) will allow the extra production fed into Zone 1, conveyed through the Zone and then fed back into Zone 2 at a location which does not cause the hydraulic grade line (HGL) to become unbalanced.

Table ES-4: Anticipated Treated Water Quality

CONSTITUENT	RAW WATER[1] (WELL C)	TREATED[2]	GOAL[3]
Chloride, mg/L	136	20	65
pH	7.4	8.6	>8.0
Sulfate, mg/L	891	70	70
TDS, mg/L	1554	196	250
Calcium, mg/L	240	20	--
Magnesium, mg/L	66	10	--
Hardness, mg/l as $CaCO_3$	896	70	75-120
Gross Alpha, pCi/L	12.6	1.1	12

[1] Average of Well A and Well B used.

[2] Assumes 4% bypass.

[3] From Table ES-3.

Other facilities are an emergency generator (common to both pretreatment options to ensure a reliable source of power to the treatment facilities), offsite conveyance facilities, and monitoring wells. RO concentrate will be discharged to the SMP, operated by CMWD, for ultimate disposal to the Pacific Ocean.

ASSESSMENT OF SITE ALTERNATIVES (CHAPTER 6)

Eight sites for the new NPV Groundwater Treatment Facility were identified and evaluated for the EIR by Padre Associates. Chapter 6 provides summary descriptions of the sites and includes an aerial photograph showing all of the sites. Each of the alternative sites is located within one mile of the well sites and the SMP pipeline alignment. The recommended site was Site No. 2, located immediately north of the City limits in the unincorporated portion of Ventura County along Antonio Drive and across the street from Well B. The parcel is approximately 77 acres and is currently used for agriculture (row crops). The site is in close proximity to the existing groundwater wells and, because it is located along an existing road, minimizes overall agricultural land to be taken out of service.

OPINION OF PROBABLE COST AND O&M COSTS (CHAPTER 7)

The opinion of probable cost for the NPV Groundwater Treatment Facility was developed using the preliminary design criteria established in this Facilities Plan. A summary of the opinion of probable cost for the NPV Groundwater Treatment Facility is provided in Table ES-5. The projected probable operation and maintenance (O&M) cost for the NPV Groundwater Treatment Facility is summarized in Table ES-6.

Table ES-5: Summary of the Opinion of Probable Capital Costs for the NPV Groundwater Treatment Facility

ITEM	CAPITAL COST (OPTION 1 – DIRECT RO)	CAPITAL COST (OPTION 2 – PRETREATMENT FILTRATION + RO)
Site work and Piping	$ 4,615,000	$ 4,733,000
New Groundwater Wells	$ 3,575,000	$ 3,300,000
Contact Basin and Pretreatment Filtration System	$ -	$ 3,335,000
Washwater Equalization and Recovery System	$ -	$ 1,390,000
RO Feed Tank and Transfer Pumps	$ -	$ 1,293,000
RO System and Cartridge Filters	$ 9,576,000	$ 9,576,000
Decarbonators	$ 1,226,000	$ 1,226,000
Finished Water Pump Station	$ 141,000	$ 141,000
Chemical Feed and Storage	$ 577,000	$ 665,000
Administration, Electrical, Shop/Storage Building, Transformer, and Standby Generator	$ 5,868,000	$ 6,196,000
Land Purchase	$ 400,000	$ 400,000
Connection to SMP	$ 400,000	$ 400,000
Construction Monitoring Cost	$ 1,300,000	$ 1,300,000
Subtotal	**$ 27,678,000**	**$ 33,955,000**
Engineering, General Requirements, Contractor Fees, etc. (15%)	$ 3,836,000	$ 4,778,000
Contingency (30%)	$ 7,672,000	$ 9,555,000
TOTAL PROBABLE COST	**$ 39,186,000**	**$ 48,288,000**
Annualized Cost (25 years @ 5%)	**$ 2,780,000**	**$ 3,426,000**

Table ES-6: Summary of Probable O&M Costs for the NPV Groundwater Treatment Facility

ITEM	ANNUAL O&M COST (OPTION 1 – DIRECT RO)	ANNUAL O&M COST (OPTION 2 – PRETREATMENT FILTRATION + RO)
Electricity(1)	$ 1,046,000	$ 1,261,000
Chemicals	$ 740,000	$ 727,000
RO Membrane Replacement	$ 125,000	$ 112,000
Cartridge Filter Replacement	$ 13,000	$ 13,000
Maintenance, Repairs, and Spares(2)	$ 302,000	$ 440,000
Labor(3)	$ 240,000	$ 240,000
Brine Disposal Fee(4)	$ 928,000	$ 928,000
TOTAL FIRST YEAR O&M COST(5)	**$ 3,394,000**	**$ 3,721,000**
Equivalent Uniform Annual O&M Cost(6)	$ 4,359,000	$ 4,779,000
Annualized Capital Cost	$ 2,780,000	$ 3,426,000
TOTAL ANNUAL COST	**$ 4,139,000**	**$ 8,205,000**
Cost of Product Water (per AF) (7)	**$ 949**	**$ 1,091**

(1) Estimated based on $0.12/kWh
(2) Estimated based on 2% of capital equipment costs
(3) Estimated based on four new FTEs
(4) Cost of brine disposal to the Regional Salinity Management Pipeline used is $500/AF at concentrate flow of 1,855 AF/yr
(5) O&M costs assumed to escalate at 2.5% per year
(6) Converted to a uniform series using 25 year basis and 5% discount rate.
(7) Product water production is 6.7 MGD (7519 AF/Year)

CONSTRUCTION AND OPERATION METHODS (CHAPTER 8)

Project stakeholders expressed an interest in understanding various delivery models by which the project could be permitted, designed, and constructed. The City and other stakeholders met with B&V in a set of two workshops. The first workshop provided an overview of various delivery models, including discussions on design-bid-build, design-build and construction management at risk (CMAR). The second workshop included a more in-depth, round-table discussion between the stakeholders on project drivers and goals. B&V's in-house Pairwise decision tool was utilized to evaluate the decision considerations, to prioritize and apply weighting factors, and to analyze the results from the decision model. It was determined that design-build delivery appears to be the most appropriate choice for the project taking into account stakeholder goals for performance certainty (both quality and quantity)and cost (certainty and competitiveness). Of two design build delivery models available, Progressive Design Build (PDB) was recommended primarily due to its ability to achieve best results for key goals of low initial investment cost and performance certainty, which were the two highest ranked priorities. It was recommended that the key stakeholders advance their evaluation of the PDB delivery model and further explore project-specific benefits.

The NPV Groundwater Treatment Facility and associated groundwater wells would be operated continuously, 24 hours per day and 7 days per week under normal operating modes. A total of nine

(9) full time operation staff is estimated for operating the treatment facility. The operation staff will consist of certified drinking water treatment and distribution system operators and plant maintenance staff. It may be possible to operate the night shift unstaffed under automation with an on-call operator close by.

FACILITY IMPLEMENTATION SCHEDULE (CHAPTER 9)

The implementation schedule for the North Pleasant Valley Groundwater Treatment Facility is presented in Chapter 9. Key features are the completion of the CEQA process, selection of the project management team and design team, respectively, and completion of the Calleguas Brine Pipeline. Project completion (start of operation) is projected to be in the last quarter of 2017.

NON-MONETARY BENEFITS (CHAPTER 10)

The proposed NPV Groundwater Treatment Facility will meet stakeholder objectives and provide several non-monetary benefits to the City and the region:

- Diversity the region's water supply portfolio
- Maximize use of existing groundwater available from the northern area of the Pleasant Valley Groundwater Basin
- Reduce the City's reliance on imported waters
- Improve water quality of the local groundwater basin by reducing current mounding of poor quality groundwater in the basin
- Watershed salts removal

REFERENCES (CHAPTER 11)

Chapter 12 lists the reports and studies consulted during the development of the Facilities Plan.

1 Introduction and Project Objectives

Over the past decade, much of the City of Camarillo's (City) groundwater supply has shown significant increases in salinity, iron, and manganese. With the observed increasing trend, groundwater production by the City has been reduced, and reliance on imported water has increased. Deteriorated groundwater quality has been observed in both Wells A and B, mainly due to elevated levels of chloride, sulfate, total dissolved solids (TDS), iron, and manganese. The City has placed Well A on standby and is blending water from Well B with imported water from the Calleguas Municipal Water District (CMWD) in order to meet drinking water quality standards. The City currently imports approximately 60 percent of its total water supply, relying on groundwater wells for the remaining 40 percent.

In 2004, the City began evaluating the feasibility for treating its groundwater supply in an effort to reduce overall reliance on imported water supplies. As part of this effort, a Groundwater Treatment Facility Feasibility Study was completed in 2005. The purpose of the feasibility study was to determine the appropriate technology and basic configuration of the treatment processes to be used. As a result of the 2005 Feasibility Study, a pilot testing program was completed in 2008 to assess pretreatment requirements and optimal treatment configuration. The pilot study took place over the course of a year, with the primary focus on evaluating pretreatment approaches for reverse osmosis (RO) membrane desalination. In 2013, the Groundwater Treatment Facility evolved into a regional project with CMWD, which will be built and owned by the City, third-party operated, and which may also provide water to neighboring water agencies. The facility planned by the City has is approximately 7 mgd production capacity.

The City and CMWD contracted Black & Veatch (B&V) to develop the Facilities Plan for the North Pleasant Valley (NPV) Groundwater Treatment Facility in support of the Environmental Impact Report (EIR) and Environmental Assessment efforts. The main objectives of the project include:

- Diversify the region's water supply portfolio
- Reduce the City's reliance on imported waters
- Re-establish Wells A and B to have a combined production capacity of approximately 3,000 gallon per minute (gpm)
- Develop a cost effective strategy that locates new facilities near existing water pipelines
- Maximize use of existing groundwater available from the Pleasant Valley Groundwater Basin
- Improve water quality to potable water customers
- Increase recycled water usage with improved water quality at the source

2 Regulatory Requirements

The proposed NPV Groundwater Treatment Facility will provide treatment to existing Wells A and B as well as two new wells of similar water quality within the City. A summary of regulatory requirements and a discussion on constituents of emerging concern is provided in this section.

2.1 HISTORICAL WATER QUALITY AND TREATMENT REQUIREMENTS

As part of the Facilities Plan, historical water quality from Wells A and B was reviewed, and constituents of emerging concern were considered. As discussed in Chapter 2, historical water quality for Wells A and B indicates that concentrations of chloride, sulfate, total dissolved solids (TDS), iron, and manganese has been increasing. Average values for sulfate, TDS, and iron (Well A only) are currently above the Secondary Maximum Contaminant Levels (MCLs) set forth by the California Department of Public Health (CDPH). Relevant constituents of concern in the groundwater supply are summarized in Table 2-1 along with current levels found in the imported water supply. Values for Wells A & B and for Imported CMWD water were taken from the 2008 Pilot Study and any additional available data. Water quality for Well C was estimated by averaging the water quality at Wells A & B.

Table 2-1: Secondary MCL for Applicable Groundwater Contaminants

CONSTITUENT	SECONDARY MCL	CITY OF CAMARILLO WELLS			IMPORTED WATER CALLEGUAS MWD (4)
		Well A (1)	Well B (2)	New Well (3)	
Chloride, mg/L	250	124	159	136	56
Sulfate, mg/L	250	1,055	658	891	48
TDS, mg/L	1000	1,688	1,361	1,554	260
Iron, mg/L	0.3	0.36	0.17	0.28	-
Manganese, mg/L	0.05	0.23	0.15	0.20	-

(1) Average of water quality data from 1998 through 2014
(2) Average of water quality data from 2001 through 2014
(3) Estimated average using Well A and B data
(4) Based on CMWD 2013 Water Quality Report

2.2 CONSTITUENTS OF EMERGING CONCERN

Both the CDPH and Environmental Protection Agency (EPA) have recently identified a number of emerging contaminants, which are not currently regulated, but may have mandated removal in drinking water treatment in the future. These chemicals were previously unknown to be found in drinking water. However due to advances in technology, they can now be detected at very low concentrations. Current research suggests that some of these chemicals may have human health effects. A number of these emerging contaminants were monitored in the 2008 Pilot Study. The monitored chemicals included the following: boron, vanadium, hexavalent chromium, n-nitroso-dimethylamine (NDMA), chloropicrin, methyl bromide (bromomethane), and 1,3-dichloropropene (cis and trans). Only two of the seven emerging contaminants monitored during the 2008 Pilot Study, boron and vanadium, were found at concentrations above the reporting limit.

3 Study Area Characteristics and System Hydraulics

This section summarizes the study area characteristics and system hydraulics.

3.1 STUDY AREA CHARACTERISTICS

Groundwater modeling and analysis of the study area was conducted in 2008 and 2015 by Steve Bachman and Hopkins Groundwater Consultants, respectively. A summary of the study area characteristics is provided in this section. For further details, please refer to the 2008 "Preliminary Hydrogeological Study" and the 2015 report, "Northern Pleasant Valley Groundwater Analysis and Modelling" which are both included as appendices in the Final EIR dated May 2015.

Since 1994, the North Pleasant Valley groundwater basin has experienced poor-quality brackish water from upstream discharges (surface water recharge emanating from the Arroyo Las Posas). The surface flows rapidly percolated through the coarse alluvial sediments that comprise the river bed and into the underlying Saugus and Los Posas Sand Formations that comprise the primary aquifer system in NPV. The infiltration of the poor-quality brackish water has resulted in raised groundwater elevations and deteriorated groundwater quality. The groundwater studies concluded that water quality in this area will likely not improve in the foreseeable future and that the City should consider groundwater treatment to fully utilize the local groundwater supply.

The geologic formation materials in the study area consist of Quaternary geologic age young and older alluvium, the Quaternary/Tertiary age Saugus Formation and the Las Posas Sand Formation. The young and older alluvium is comprised of largely unconsolidated sediment locally deposited by outwash from the Camarillo Hills and flows in the Arroyo Las Posas. These alluvial deposits unconformably lie on top of marine and nonmarine mudstone, sandstone, and conglomerate deposits that comprise the Saugus and underlying Las Posas Sand Formations.

Typical aquifer properties in and surrounding the City consists of:

- Transmissivity = 4,000 to 10,300 ft^2/day
- Storativity = 3.1E-06 to 4.5E-04
- Horizontal hydraulic conductivity = 11 to 30 ft/day

3.2 SYSTEM HYDRAULICS

In support of planning and development of the NPV Groundwater Treatment Facility, the City updated the water distribution system model to modify the point of supply as well as incorporate the Camarillo Airport Utility Enterprise (CUE). A brief summary of the *Distribution System Hydraulic Analysis for the Groundwater Treatment Facility and Airport Addition*, 2007, is provided in this section.

The City currently imports the majority of its water supply from the CMWD through a series of metered connections (turnouts). This imported supply is supplemented with groundwater supplied through several wells connected directly to the distribution system. Although Annual Average Demand previously reached approximately 9.0 mgd (10,000 acre-feet/year) and was expected to grow to 11.3 mgd (12,700 acre-feet/year) by build-out, these numbers have since been revised downward in the 2015 Master Plan to 7.6 mgd (8.5 AFY) and 8.1 mgd (9.1 AFY), respectively. The City proposes to reduce its imported water demand through construction of the NPV Groundwater Treatment Facility, which will treat brackish groundwater pumped from a combination of existing and new groundwater production wells. The new NPV Groundwater Treatment Facility will provide a new point of supply for the City. In addition to modifying the point of supply, the City also incorporated the CUE into the existing water distribution hydraulic model. Wells which had supplied the CUE as a separate water system have been idled since 2007, and the airport's water distribution has been supplied from and operated as an extension of the City's distribution system.

The primary purpose of the 2007 Hydraulic Analysis Report is to:

- Analyze distribution system performance with the new source of finished water from the NPV Groundwater Treatment Facility and recommend the most efficient manner for operation NPV Groundwater Treatment Facility and introduction of the treated groundwater into the distribution system.
- Analyze performance of the Airport Distribution System as a part of the City's distribution system. Recommend improvements for efficient operation and ensure that peak demands and fire flow needs can be met.

The proposed NPV Groundwater Treatment Facility will produce approximately 7 mgd of treated groundwater for distribution. The proposed plant location is physically located within Zone 1 of the distribution system, yet Zone 2 could be accessed relatively easily via the Reservoir No. 2 fill line located nearby. The alternatives analyzed are based upon the proportion of the Groundwater Treatment Facility's output to be supplied into each Zone. The overall operation of the NPV Groundwater Treatment Facility is described in the following:

- **Alternative 1 – Supply Proportional to Zone Demand**. Output will be delivered in proportion to the demand of each zone; roughly 25 to 30 percent into Zone 1 and 70 to 75 percent into the larger Zone 2. The balance of the demand within each zone will continue to be supplied with imported water delivered through the City's turnouts. Treatment production will be held constant, and deliveries through the turnouts will be varied seasonally.
- **Alternative 2 – Supply Proportional to Hydraulic Capacity**. Output will be supplied in such a manner as to better balance the hydraulics among the floating reservoirs of each zone: roughly 60 to 75 percent into Zone 1 and 40 to 25 percent into Zone 2. Operational settings at the Kendall, Rosewood, and Flynn Pressure Reducing Valves (PRVs) will allow the extra production fed into Zone 1, conveyed through the Zone and then fed back into Zone 2 at a location which does not cause the Hydraulic Grade Line (HGL) to become unbalanced.

Based on the results of the hydraulic analyses, Alternative 2 is the recommended method for connecting the proposed NPV Groundwater Treatment Facility into Zones 1 and 2 of the distribution system (2007 Hydraulic Analysis Report). Alternative 2 feeds both zones in a hydraulically balanced manner so that the HGLs remain relatively level across each zone and the floating reservoirs can be equally exercised while being maintained within their normal operating range. This could also be accomplished with the installation of an 18-inch by 21,000 feet transmission main in Ponderosa Dr., which may reduce overall pumping requirements. However, the $36,000 savings in annual pumping costs do not justify the $4.5 million cost of the pipeline (at $12/inches diameter-ft). Especially since the cross-zone capacity already exists in Zone 1 and the distribution system can be operated in this manner without upsetting zone hydraulics. An update to the hydraulics report in 2010 added analysis of an additional potential treatment facility site but did not change the overall conclusions of the study.

In order to provide flexibility for maintenance, emergency and other non-standard operating conditions, it is also recommended that the NPV Groundwater Treatment Facility be equipped to pump the entire Zone 2 supply directly into the Reservoir No. 2 fill line, without using the Kendall PRV. An altitude valve exists on Reservoir No. 2 to prevent it from over-topping when pushing the full Zone 2 supply in from the treatment facility location. Reservoir No. 2 would be maintained full when operated in this manner, but this would likely be acceptable for short periods during emergencies or other non-standard operations.   However, there may be some concern about maintaining reservoir turnover.   It may be necessary to install a control valve at the intersection to close off flow temporarily to allow water to flow out of the reservoir into the distribution system. The recommended pumping capacity for each zone is summarized in Table 3-1.

Table 3-1: Summary of Recommended Pumping Capacity for Zone 1 and 2

OPERATION MODE	ZONE 1 PUMPING CAPACITY	ZONE 2 PUMPING CAPACITY
Normal	3,600 gpm	1,100 gpm
Non-Standard	1,700 gpm	3,000 gpm

4 Summary of Environmental Impact Report

The final EIR, "Environmental Assessment for the North Pleasant Valley Groundwater Treatment Facility," was prepared by Padre Associates, dated May 2015. The contents of the EIR are summarized by section below.

4.1 SECTION 1: PREVIOUS ENVIRONMENTAL DOCUMENTATION

The City of Camarillo prepared an Initial Study (IS) and a Notice of Preparation (NOP) in April 2008 for a similar project. The project was assigned State Clearinghouse No. 2008041159. The City received comments from 10 parties. Responses to these comments are provided in the Final EIR. One of the comments (from Fox Canyon Groundwater Management Agency and its consultants) subsequently led to changing the baseline condition from "no mounding" to "no project." ("Mounding" refers to the increasing surface elevation of brackish groundwater in the North Pleasant Valley Basin.)

The project objectives are summarized as follows:

- Restore groundwater production from Wells A and B to past levels
- Fully utilize existing groundwater allocation in the Pleasant Valley Groundwater Basin
- Address the plume of salty groundwater migrating into the basin
- Reduce dependence on imported potable water
- Reduce salt concentrations in treated wastewater discharged to Conejo Creek
- Minimize capital costs

A full EIR was deemed necessary due to agricultural conversion, annexation issues, and other potentially significant impacts to the environment. An NOP was prepared and distributed on September 27, 2013, and comments were received from 15 parties. A draft EIR was submitted in March 2014.

4.2 SECTION 2: SUMMARY

The treatment process described is Option 2 which utilizes oxidation and greensand filtration to remove iron and manganese. The description includes two new wells to provide raw water in addition to that supplied by the two existing wells. The facility will operate 24-hours per day in three shifts with a total crew of up to nine persons. One Proposed Action Facility site (identified as Site #2 in this report, located north of the City, across from Well B) and two alternatives were described. The Preferred Action Facility site is considered the environmentally superior alternative. There are no major controversies associated with this project. Significant impacts can be feasibly mitigated, resulting in residual impacts that are less than significant.

4.3 SECTION 3: PROJECT DESCRIPTION

Because the Proposed Action Facility and the supply wells are located outside of the City Boundaries, the City is proposing a municipal reorganization by annexing the sites to the City and by annexing them to the Camarillo Sanitary District. In addition, the City would pre-zone the sites to R-E (Rural Exclusive) and amend the General Plan to reflect a "Quasi Public/Utility" land use designation.

The facility is described as treating 9,000 acre-feet/year and producing 7,500 acre-feet/year of treated water for the City. A single administration building will house an office, control room, electrical room, and storage area. The RO equipment would be protected by a metal canopy, but not a full building. Three pumping facilities associated with the treatment process would be housed in separate structures or sound enclosures.

Treated water would be pumped to either the City's Zone 1 or Zone 2 (or combination thereof) distribution systems. Two new wells will be installed to provide raw water in addition to that from the existing Well A and Well B. New pipelines would connect the wells to the treatment facility and to connect the facility with distribution system Zone 1 and Zone 2. A brine pipeline would connect the facility to the SMP. There would also be new sewer connections for wastewater. Pipelines would be located in public roadways, in general. Where they are installed in farmlands, they will be buried at least 5 feet below surface to all cultivation above them.

4.4 SECTION 4: ALTERNATIVES TO THE PROPOSED ACTION

The alternatives included the following:

- No Action/No Alternative – utilize existing water sources, blending with imported water from the Calleguas Municipal Water District, placing Well A on standby use only
- Two alternative sites for the facility
  - Site 4 – As described in this report in Chapter 6
  - Site 7 - As described in this report in Chapter 6
- One alternative pumping rates alternative – without the treatment facility

4.5 SECTION 5: ENVIRONMENTAL ANALYSIS

The environmental impacts of the proposed project are summarized below:

AESTHETICS

- Affected Environment – the project area is in an agricultural area the institutional uses (e.g., hospital). The view shed is a mix of level fields and residential and institutional development.

- Environmental Consequences/Impacts – The consequences were similar among the Proposed Action and the two other site alternatives. There are no scenic vistas to be impacted. Some of the industrial-appearing components that may be viewed as incompatible with the visual character or the area will be screened by a wall and landscaping buffer. Night lighting will be limited, and is not anticipated to significantly degrade nighttime views. Solar panels will be covered with anti-relective coating to reduce glare. Cumulative impacts of the project are considered less than significant.

AGRICULTURAL AND FORESTRY RESOURCES

- Affected Environment – The Proposed Action and the two alternative sites are all located in areas zoned for agricultural use.

- Environmental Consequences/Impacts – The Site 4 project requires the largest amount of acreage (6.0 acres) and exceeds the threshold for prime farmland and therefore has a significant impact. The other two alternatives do not exceed this threshold. Neither the Proposed Action nor the two site alternatives have any significant impacts to greenbelt agreements, Land Conservation Act Contracts, or adverse affects on adjacent agricultural operations, or forestry resources. Likewise they are not expected to increase population growth beyond forecast values.

- Mitigation – No mitigation is needed for the Proposed Action. For Site 4, some measures are needed to reduce the project area to below the 5-acre Prime Farmlands threshold. For Site 7, purchase of the full 5.77 acre parcel would be needed because the project, though actually smaller in area would render the remaining parcel unsuitable for continued agricultural production.

- Residual Impacts – The Proposed action and the two alternative sites each have residual impacts that are less than significant after mitigation.

AIR QUALITY

- Affected Environment – The Proposed Action site and the alternative sites are located in the Oxnard Plain Airshed, a sub-basin of the South Central Coast Air Basin.

- Environmental Consequences/Impacts – The impacts for the Proposed Action and the two alternatives are similar. Construction emissions include exhaust and fugitive dust, however, dust control measures will be in effect as part of construction. Diesel exhaust emissions and toxic air contaminants are considered a less than significant impact to air quality. Operations emissions for NOx and ROC are less than the adopted thresholds and are therefore considered a less than significant impact. Potential odors are considered a less than significant impact. Long-term impacts associated with toxic diesel exhaust are considered less than significant. The Proposed Action and its two alternatives are not expected to create or contribute substantially to violation of CO standards. Likewise the Proposed Action and its alternatives are consistent with the local Air Quality Management Plan. The incremental contribution to cumulative impacts is not cumulatively considerable.

CULTURAL RESOURCES

- Affected Environment – The Proposed Action Site and the alternative sites are within the historic territory of the Chumash Native American Indian group. An archeological study was conducted on the Proposed Action site and Site 4 in 2013, but not on Site 7 due to lack of access. No evidence of prehistoric or historic resources was observed at the surveyed sites or along the proposed pipeline routes.

- Environmental Consequences/Impacts – The Proposed Action Site and the alternative sites are located in an active depositional setting, so there is a possible presence of buried archeological materials which could be impacted by project implementation. However, the cumulative impacts to cultural resources is unknown.

- Mitigation – Mitigation measures include having an archeologist and a Chumash representative monitor all project-related earth disturbances and suspending any work that exposes archeological resources or human remains so that the proper authorities can be notified. In addition, Site 7 shall be subjected to a Phase 1 Archeological Investigation as early as possible.
- Residual Impacts – Mitigation measures will reduce potential impacts to less than significant.

GREENHOUSE GAS EMISSIONS

- Affected Environment – Greenhouse gases are a global issue rather than a local or regional concern.
- Environmental Consequences/Impacts – Impacts due to total greenhouse gas emissions (construction plus operation) are less than significant for the Proposed Action site and for the alternative sites.

HAZARDOUS MATERIALS

- Affected Environment – Database search identified no areas of contamination near the project site.
- Environmental Consequences/Impacts – Construction activity could possibly encounter soils contaminated with hazardous materials resulting from previous agricultural production and may contribute to incremental cumulative impacts associated with exposure to them. Water treatment chemicals will used at the proposed facility at the Proposed Action site or the alternative sites. They are not considered acutely hazardous and no hazardous emissions are anticipated. Transportation and storage of these chemicals will be in accordance with State and Federal requirements.
- Mitigation – Soil samples will be taken and analyzed prior to excavation and along pipeline alignments. Soil found to be contaminated will be properly segregated and contained. Cal OSHA requirements will be followed to minimize exposure to the contaminated soils.
- Residual Impacts – Mitigation measures will reduce potential impacts to less than significant.

WATER RESOURCES

- Affected Environment – The project is located within the Calleguas Creek Watershed. It was historically characterized as an ephemeral stream system with substantial surface flow only during the wet season. However, importation of water supply to the watershed has caused an increase in dry weather flows. Salt accumulation within the watershed is of concern as a result of importing water. With respect to groundwater, the project area is located within the Santa Clara-Calleguas Hydrologic Unit. The Proposed Action well sites and City Wells A and B are located within the northeaster portion of the Pleasant Valley Groundwater Basin.

- Environmental Consequences/Impacts – Construction impacts include storm water runoff which will be controlled via a Storm Water Pollution Prevention Plan. In addition concrete residue discharge is a potential significant water quality impact. The Proposed Action Site and the Site 7 alternative are subject to flooding in a storm event. Salt extraction via the projects treatment process is anticipated to lower the salt content in treated wastewater discharged into Conejo Creek which will contribute to meeting the salts TMDL in the Calleguas Creek watershed. Only the Pumping Rate Alternatives are anticipated to affect surface water flow by potentially decreasing dry weather flows. The project is not anticipated to exacerbate conditions for the intrusion of seawater. Project operation is anticipated to substantially reduce the mound of brackish water, resulting in improved groundwater quality in most wells in the NPV basin. However, the Pumping Rate Alternatives will not fully address the mounding of brackish water resulting in stranded salts in the NPV basin under long-term operation. Project-related pumping will reduce the groundwater levels, but not below historic levels. Impacts to groundwater quantity are considered less than significant. However, long-term pumping can potentially have a significant cumulative impact by reducing groundwater levels. Project land subsidence impacts are considered less than significant. However, the project may incrementally contribute to subsidence. Flood related impacts are potentially significant but can be mitigated.

- Mitigation – Stormwater mitigation will be addressed by the Stormwater Pollution Prevention Plan implemented by the construction contractor. Flood walls will be designed and constructed on the property perimeter to minimize the potential property damage and loss of human life during a 100-year storm event. To address the cumulative impact of lowering of groundwater levels, monitoring wills will be installed. Adjustments to project pumping rates will be made, as needed to minimize adverse effects to local wells. Similarly, land surveys will be used to monitor land subsidence. Pumping will be reduced as needed if subsidence is detected. For the Pumping Rate Alternatives, a contingency plan will be developed and implemented if needed to reduce the impact to biological resources resulting from decreases in dry weather surface flows.

- Residual Impacts – Full implementation of identified mitigation measures will reduce water resources impacts to below the level of significance.

LAND USE AND PLANNING

- Affected Environment – The Proposed Action Site and the two site alternatives are located in areas of row crops and orchards. The Proposed Action Site and Site Alternative 4 are in areas where the proposed project is not allowed under current zoning. All three sites are located outside the City's municipal boundaries.

- Environmental consequences/Impacts – For the Proposed Action Site and the Site 4 alternative, the City will request approval for reorganization to annex the sites and well sites to the City, annex the sites to the Camarillo Sanitary District, and detach the facility sites from the Ventura County Resource Conservation District, Ventura County Water Works District No. 19, County Service Area no. 32, and County Service Area no. 33. For the Site 7 alternative, only the wells would need to be annexed and detached, respectively as described for the Proposed Action Site and the Site 4 alternative. No significant impacts were identified for any of the three projects.

NOISE

- Affected Environment – Noise sensitive receptors near the project sites include St. John's Hospital and residential areas.
- Environmental Consequences/Impacts – Construction (including well drilling) is anticipated to produce noise. Operation is anticipated to produce noise, but the equipment will be enclosed in structures or sound enclosures to minimize it. The well equipment will be the submersible type and are therefore anticipated to comply with noise standards. The projects' contribution to incremental noise impacts is not anticipated to be cumulatively considerable.
- Mitigation – To mitigate construction noise associated with well drilling, periods where no drilling should be occurring are recommended along with noise barriers and advance notification of drilling activities. Nighttime noise associated with operation would be mitigated by engineering design review to ensure that all noise-producing equipment are enclosed and shielded to minimize noise generation. In addition, a noise study will be completed within 90 days of start of operation to determine if additional noise reduction measures are needed.
- Residual Impacts – Mitigation measures will reduce operational noise impacts to less than significant, except at the caretaker residence at the western well site during well drilling.

TRANSPORTATION/CIRCULATION

- Affected Environment – Access to the sites is via State Routes 34, 118, and U.S. 101. Traffic volumes indicate that State Routes 34 and 118 are at capacity and are even worse at morning and evening peak traffic hours.
- Environmental Consequences/Impacts – Construction and operation activities will add to the number of trips during peak traffic hour.
- Mitigation – Two mitigation options are available: 1) the City pays a Traffic Impact Mitigation fee to the Ventura County Transportation Department, or 2) the project specification limits the contractor to off-peak trips only in scheduling of worker hours and materials deliveries.
- Residual Impacts – Mitigation reduces the impacts to a level of less than significant.

ENVIRONMENTAL JUSTICE

- Affected Environment – EPA and Cal/EPE have regulations stating that environmental risks cannot be disproportionately shifted to any particular minority or low-income population.
- Environment Consequences/Impacts- The Proposed Action will not have any disproportional effects.

SOCIOECONOMIC EFFECTS

- Affected Environment – Socioeconomic concerns include jobs and tax base associated with agricultural production, commercial operations, and light industrial operations in the area around the projects.

- Environmental Consequences – Building the projects, between 4.6 and 6.0 acres of prime farmland would be lost.

INDIAN TRUST ASSETS

- Affected Environment – Indian Trust Assets are legal interests in property held in trust by the Federal government for the benefit of Indian Tribes or individuals.

- Environmental Consequences – No such assets were identified.

4.6 SECTION 6: GROWTH INDUCEMENT

The overall water supply to the area does not limit population growth in the area. Therefore, the small increase in water made available by this project will not induce growth.

4.7 SECTION 7: CONSULTATION AND COORDINATION

The following consultation and coordination activities have taken place:

- Persons and Agencies Consulted
    - Rick Farris, Ecologist, U.S. Fish and Wildlife Service
    - Gerhardt Hubner, Deputy Director, Fox Canyon Groundwater Management Agency
    - Eric Bergh, Calleguas Municipal Water District
- A notice of Preparation and Initial Study were prepared and distributed to responsible and trustee agencies. The proposed project is also included in the Fox Canyon Groundwater Management Plan.
- Endangered Species Act findings of "No effect: suitable habitat not affected" were made on identified endangered or threatened species. There is no designated critical habitat in proximity of the Proposed Action site, the alternative sites, or the proposed well sites.
- Adverse effects on migratory birds are not anticipated.
- Adverse effects on wetlands are not anticipated.
- The Fish & Wildlife Coordination Act does not apply because the project does not involve modification of any stream or other waterbody.
- Native American consultation was conducted as part of the preparation of the Draft EIR/EA and will continue through the Section 106 process. Such consultation will be initiated by the Federal lead agency.

4.8 SECTIONS 8, 9, 10, 11, AND 12

These sections contain detailed listings. Refer to the EIR document for these lists:

- Section 8: Summary of Mitigation Measures/Environmental Commitments
- Section 9: List of Preparers

- Section 10: References
- Section 11: Distribution List
- Section 12: Response to Comments

5 Water Supply Characteristics and Facilities

This section summarizes the groundwater quality, product water quality goals, and design criteria of the recommended treatment facilities for the NPV Groundwater Treatment Facility.

5.1 GROUNDWATER FEED QUALITY

The water quality of the City's two main groundwater wells, Wells A and B, has progressively declined over the past two decades. Water quality data for Wells A and B, obtained during the 2008 Pilot Study as well as historical data reported in the 2005 Feasibility Study, indicate an increase in several key constituents including TDS, sulfate, and iron, which are above the primary or secondary drinking water standards. Historical trends key water quality constituents are provided in Figure 5-1 through Figure 5-3.

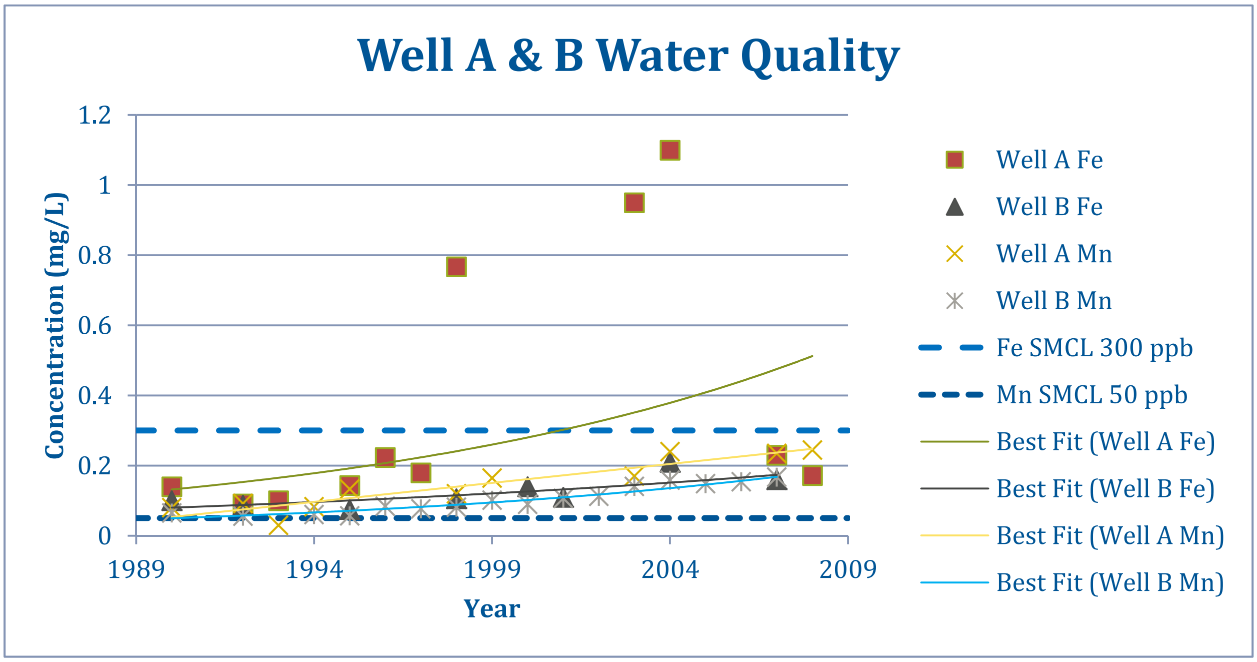

Figure 5-1: Historical Iron and Manganese Data for Wells A and B (1990 - 2008)

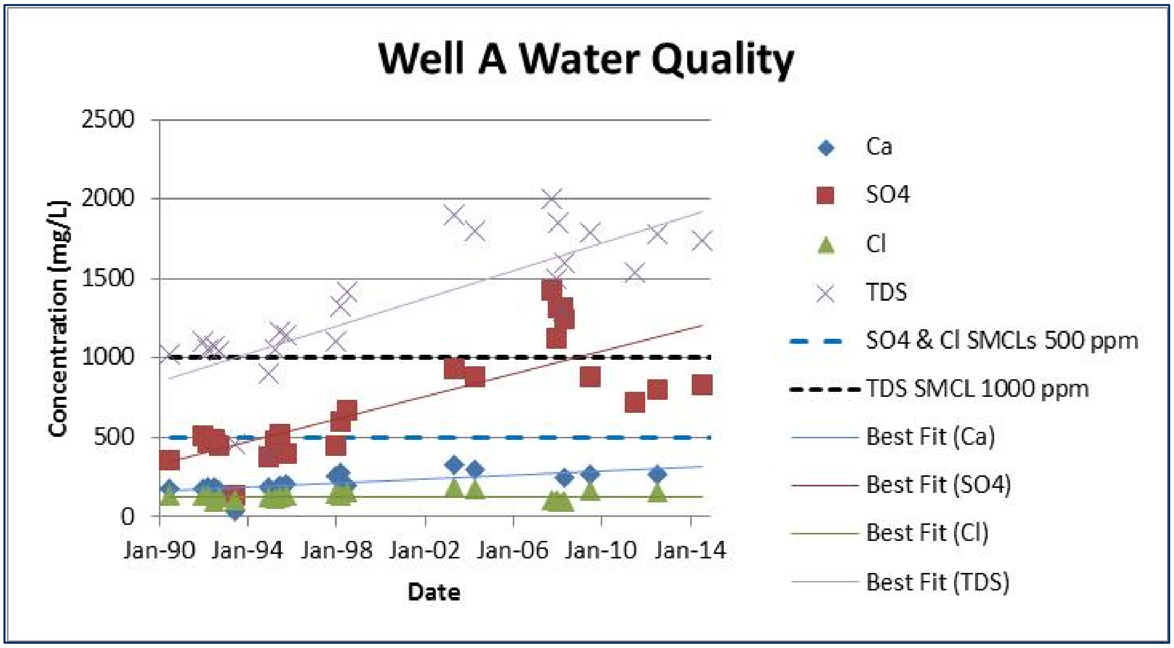

Figure 5-2: Historical data for calcium, sulfates, chloride, and TDS in Well A (1990 – 2014)

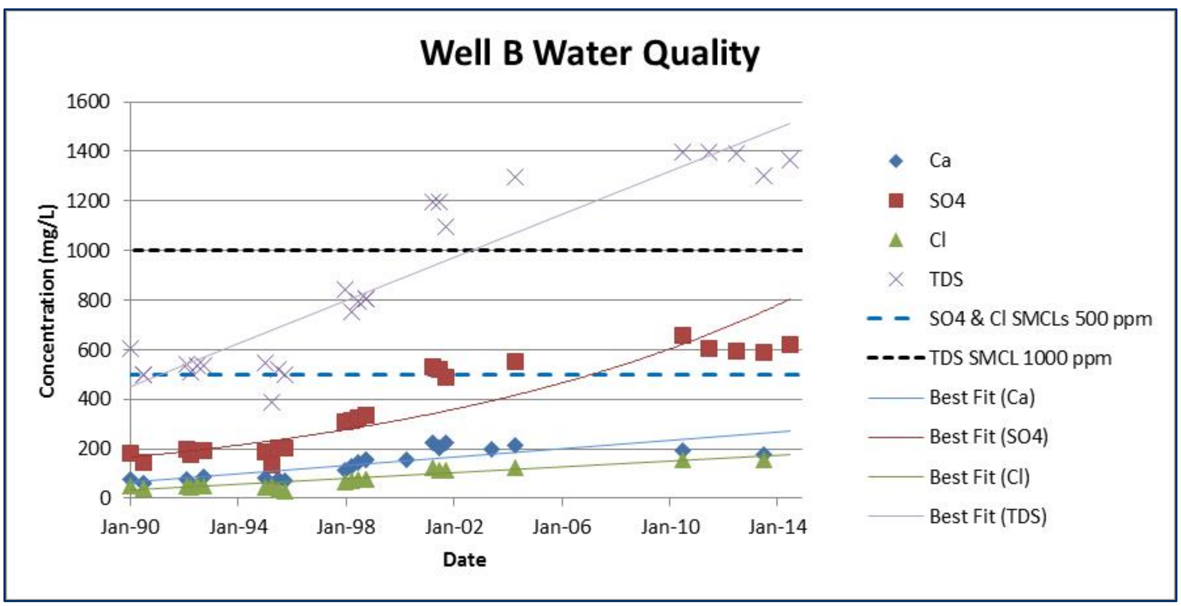

Figure 5-3: Historical data for calcium, sulfates, chloride, and TDS in Well B (1990 – 2014)

Combined water quality data average values of the water quality data from the 2005 Feasibility Study, the 2008 Pilot Study, and subsequent data through 2014 are summarized in Table 5-1. For Wells A and B, the values provided in Table 5-1 are average values from available data. The Well C (new well) values are estimated by taking the average of Well A and B values. The range of blended water quality values provided represents the range of data from both Well A and B. It is recommended that the design of the NPV Groundwater Treatment Facility be based on the max values while average values are used for estimating O&M costs, chemical consumption, etc. It should be noted that increasing trends in TDS and sulfate have been observed from historical data, and projections of these constituents should be considered when carrying out the design (e.g. projecting maximum values).

Table 5-1: Groundwater Quality

CONSTITUENT	UNITS	WELL A	WELL B	WELL C	RANGE OF BLENDED WATER QUALITY
pH		7.4	7.5	7.4	7.1-7.9
Conductivity	uS/cm2	2499	1945	2297	1800-2960
UV254	cm-1	0.04		0.04	0.03-0.04
Color	C.U	6		6.1	2.5-15
Total Iron	mg/L	0.36	0.17	0.28	0.14-1.1
Total Manganese	mg/L	0.23	0.15	0.20	0.13-0.28
Alkalinity	mg/L as CaCO3	289	223	269	210-310
Total Hardness	mg/L as CaCO3	976	709	896	648-1100
TDS	mg/L	1688	1361	1554	1300-2000
TOC	mg/L	1.7	1.6	1.7	1.5-1.9
Ammonia	mg/L	0.46	0.38	0.44	0.25-0.81
Total Boron	mg/L	0.69	0.55	0.65	0.46-0.75
Calcium	mg/L	270	201	240	184-300
Chloride	mg/L	124	159	136	92-183
Magnesium	mg/L	78	51	66	46-97
Silica	mg/L	32	45	34	29-45
Sodium	mg/L	205	147	176	130-221
Sulfate	mg/L	1055	658	891	550-1430
Gross Alpha	pCi/L	15.7	6.5	12.6	3.9-20.4

5.2 PRODUCT WATER QUALITY GOALS

The overall project product quality goals are to meet the concentrations listed in Table 5-2 as well as all primary and secondary drinking water standards. The project goals for TDS, chloride, and sulfate reflect both the City's objectives for drinking water and impacts on meeting TMDL limits in the CSDWRP effluent (Table 5-3). The iron and manganese goals reflect conservative targets, improving the aesthetics as well as providing a factor of safety above regulatory limits. For instance, excessive levels of iron and manganese can cause discolored water at the customers' tap. The secondary standards for iron and manganese are set at 0.3 mg/L and 0.05 mg/L respectively; above these limits, customers may find the stains objectionable. From our past experience, iron concentrations < 0.1 mg/L and manganese concentrations < 0.03 mg/L are generally well accepted by the public. A summary of the product water quality goals, established by the 2005 Feasibility Study and 2008 Pilot Study, is provided in Table 5-2 . The current imported water supply quality from CMWD is provided as well for comparison to treatment goals for the NPV Groundwater Treatment Facility. It should be noted that the SMP (where the brine concentrate will be sent) also has TMDL limits imposed on it in the NPDES permit (as of July 2015), though it is not anticipated that these TMDLs will affect operations at the NPV Groundwater Treatment Facility.

Table 5-2: Summary of Final Product Water Quality Goals

CONSTITUENT	PRODUCT WATER QUALITY GOAL	IMPORTED WATER QUALITY(1)
Chloride, mg/L	65(2)	56
Gross Alpha, pCi/L	12	ND
Iron, mg/L	<0.1	-
Manganese, mg/L	<0.03	-
pH	>8.0	8.3
Sulfate, mg/L	70(2)	48
TDS, mg/L	250(2)	260
Total Hardness, mg/L as CaCO3	75-120(3)	100

(1) Based on CMWD 2013 Water Quality Report for Imported Water Values
(2) Established to meet TMDL requirements for CSDWRP (refer to Table 5-3) and/or match current imported water quality
(3) Range provided to accommodate blending requirements

Table 5-3: CSDWRP TMDL Requirements

CONSTITUENT	TMDL
Chloride, mg/L	150
Sulfate, mg/L	250
TDS, mg/L	850

5.3 PILOT STUDY FINDINGS

The 2008 Pilot Study was conducted to test RO membranes for brackish water desalination and to evaluate various pretreatment options to protect RO membranes from iron and manganese fouling. Five pretreatment options were evaluated:

- Oxygen Quenching – dose sodium thiosulfate to quench dissolved oxygen (DO) and keep iron and manganese in reduced state.
- Aeration + Granular Media Filtration (GMF) – oxidize iron and manganese using air and remove with media filtration.
- Chlorine Dioxide + GMF - oxidize iron and manganese using chlorine dioxide and remove with media filtration.
- Chlorine + Greensand Filtration - oxidize iron and manganese using free chlorine and remove with greensand media filtration.
- Aeration + Microfiltration (MF) - oxidize iron and manganese using air and remove with MF.

The 2008 Pilot Study recommended Pretreatment Option 1: Oxygen Quenching for the full-scale facility. Available oxygen quenching agents include sodium bisulfite, sodium thiosulfate, and sodium metabisulfite. The pilot study recommended that the final chemical selection should be based on bench-scale testing with the final source water. Low pressure low energy brackish water RO elements were recommended. Up to 5 percent of the RO feed water could be bypassed around the RO system for stabilization and to meet treated water quality goals.

5.4 TREATMENT PROCESS DESCRIPTION

Key components of the NPV Groundwater Treatment Facility include:

- Groundwater pumping via two existing wells (Well A and B) for a total of 3,000 gpm
- Drilling of one or two new groundwater wells to provide up to 3,000 gpm
- Pretreatment of groundwater for RO membrane desalination
  - Pretreatment Option 1 – Sequester iron and manganese for direct RO application
  - Pretreatment Option 2 – Oxidize and remove of iron/manganese through pretreatment filtration and associated washwater recovery process
- RO membrane system
- Post-treatment to stabilize the RO permeate and disinfection
- Treated water distribution
- Addition of supporting chemical feed facilities
- Off-site facilities
- Monitoring wells to monitor groundwater conditions

Description and design criteria for each treatment process are summarized in this section.

5.4.1 Raw Water Supply

The City's two existing wells (A & B) have capacities of 1,500 gpm each, for a total combined capacity of 3,000 gpm. It is anticipated that up to two new groundwater wells would be required to provide an additional 3,000 gpm. Thus, the total groundwater flow to the NPV Groundwater Treatment Facility will be approximately 6,000 gpm. The treatment capacity or final treated water flow at the NPV Groundwater Treatment Facility will be based on pretreatment requirements and RO operating recovery, which ranges from 6.5 mgd up to 7 mgd.

5.4.2 Pretreatment Process

Pretreatment requirements for the RO system will be confirmed during the design stage of the project. Two options for pretreatment are summarized below based on findings of the pilot study and Black & Veatch's past design experience with groundwater desalination facilities treating similar water quality. The process flow diagram reflects the two pretreatment options are provided in Figure 5-4 and Figure 5-5. Process Flow Diagram for Pretreatment Option 2 (Chlorine + Pretreatment Filtration).

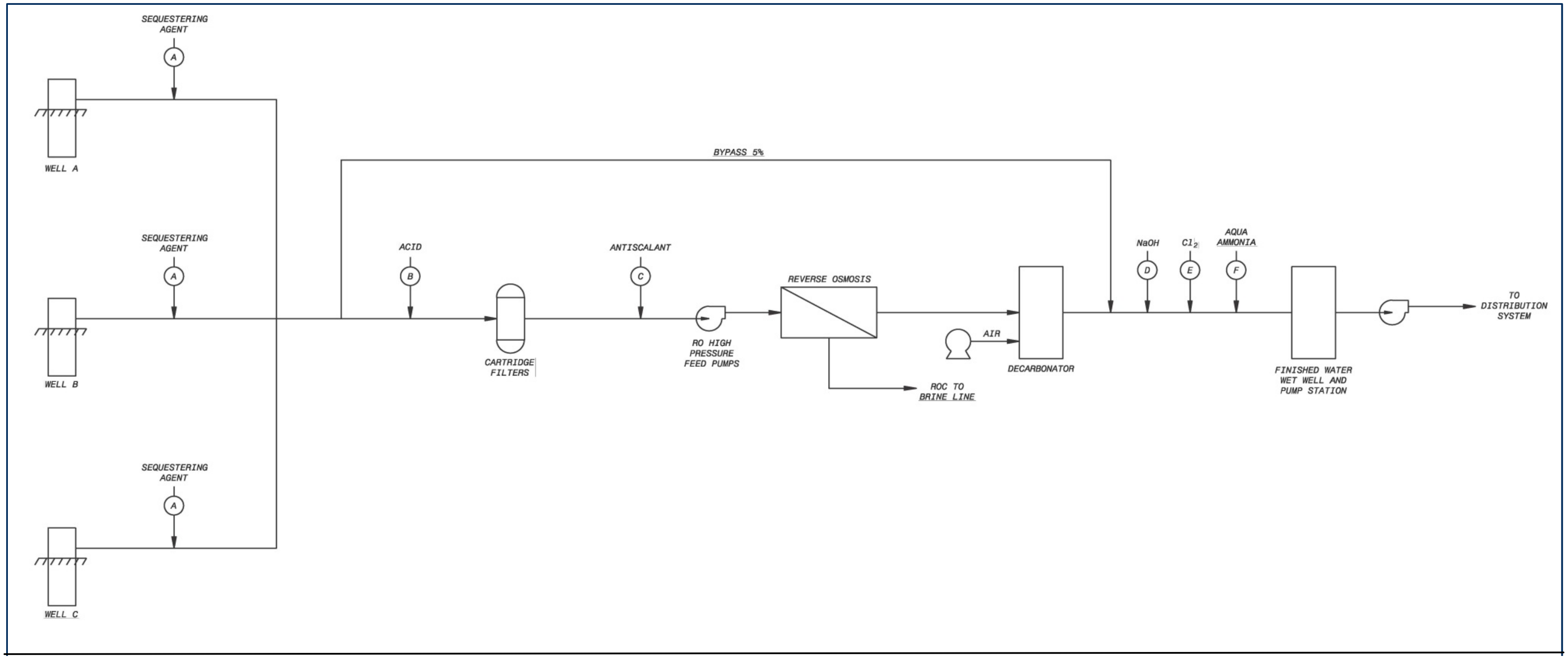

Figure 5-4: Process Flow Diagram for Pretreatment Option 1 (Oxygen Quenching for Direct RO)

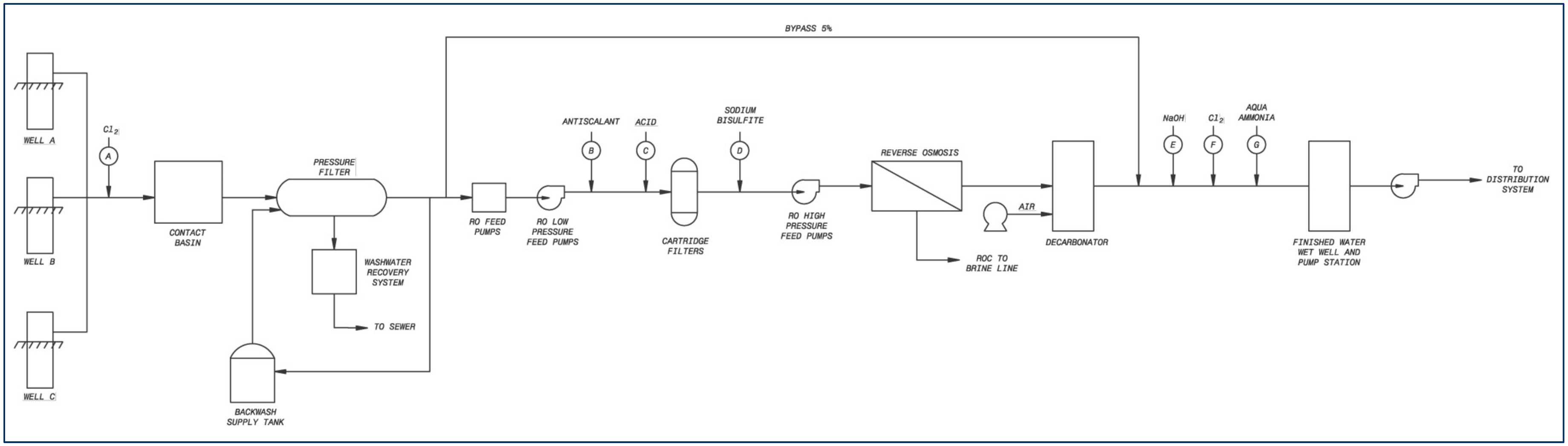

Figure 5-5: Process Flow Diagram for Pretreatment Option 2 (Chlorine + Pretreatment Filtration)

5.4.2.1 Pretreatment Option 1 – Oxygen Quenching for Direct RO Application

The 2008 Pilot Study demonstrated that pretreatment removal of iron and manganese may not be required with the addition of an oxygen quenching agent and keeping the iron and manganese in soluble/dissolved form. Under this option, sodium bisulfite will be added at each well head to quench any DO that may be present in the groundwater and sent directly to the RO system at the NPV Groundwater Treatment Facility. Design criteria of the well head sodium bisulfite storage and feed system are provided in Section 5.4.6.

5.4.2.2 Pretreatment Option 2 – Chlorine + Pretreatment Filtration

An alternative pretreatment approach is included in the Facilities Plan as it was noted during the pilot study that oxygen quenching may lead to increased biofouling potential if ideal operating ranges are not maintained (e.g. pH range and sequestering agent dose). In addition, should the groundwater wells require periodic shock chlorination to control iron bacteria fouling, it would complicate operations for an oxygen quenching pretreatment approach. The practice of shock chlorination would oxidize iron and manganese and, without pretreatment filtration, the well water would need to be flushed out and disposed of before the treatment facility could be placed back into service. Based on Black & Veatch's past experience, an alternative pretreatment system consisting of chlorine addition and filtration is included in the Facilities Plan. Additional facilities required to support the pretreatment filtration system include:

- Contact Tank – to provide contact time between oxidant and iron and manganese and also act as a raw water blend tank that receives groundwater from the various groundwater wells
- Sodium Hypochlorite Feed System – an additional set of chemical metering pumps for dosing upstream of the pretreatment filters from the bulk storage tank
- Pretreatment Filtration System – to remove oxidized iron and manganese via greensand filtration
- Washwater Equalization Tank and Recovery System – to equalize and treat backwash waste from pretreatment filtration system to maximize overall treatment efficiency
- RO Feed Tank and Low Pressure Feed Pump – to provide a hydraulic buffer to maintain steady-state RO operations irrespective of the pretreatment filtration system

5.4.2.2.1 Contact Tank

Chlorine is added prior to entering the Contact Tank in order to promote the oxidation of iron and manganese in the raw water. The contact tank will also act as a raw water equalization basin for the various groundwater wells serving the NPV Groundwater Treatment Facility. Design criteria for the contact tank and pretreatment filter feed pump station are provided in Table 5-4. Design criteria for the additional set of chemical metering pumps dosing upstream of the contact tank are provided in Section 5.4.7.

Table 5-4: Contact Tank and Pretreatment Filter Feed Pump Design Criteria

PARAMETER	CRITERIA
CONTACT TANK	
Detention Time, minutes	15
Capacity, gallons	90,000
PRETREATMENT FILTER FEED PUMP	
Number	2 duty and 1 standby
Type	Vertical Diffusion Vane
Rated Capacity (each), gpm	3,800
Rated Head, feet	60
Motor, hp	100

5.4.2.2.2 Pretreatment Filtration System

The main purpose of the pretreatment filters is to remove iron and manganese from the feed water to protect the RO membranes from iron and manganese oxide particles can foul RO membranes by depositing on the membrane surface. The water quality goal for RO feed water is <0.05 mg/L combined concentration of total iron and manganese. This is based on previous experience on brackish groundwater desalination facilities of similar water quality. The greensand filters will be operated with up to 1 mg/L free chlorine residual passing through the filter at all times. Over time, the filter media becomes coated with manganese dioxide and ferric hydroxides or ferric oxides under an oxidized environment. By maintaining free chlorine residual through the filter, continuous adsorptive uptake of divalent manganese by chemical oxidation on the media surface is achieved.

Manganese greensand is a purple-black medium, derived by coating the naturally-occurring glauconite sand with a thin layer of manganese dioxide by treating it with manganous sulfate and potassium permanganate. Greensand typically has an effective size of 0.30 to 0.35 millimeters (mm), a uniformity coefficient of <1.60, and a specific gravity of about 2.4. The greensand media is soaked in concentrated solution of permanganate or chlorine prior to initial use to “activate” the manganese dioxide sites on the media surface. Following initial preconditioning, removal of iron and manganese in the raw water occurs through both filtration and adsorption, and chlorine is used to continuously regenerate the media. A layer of larger anthracite media over the greensand is provided to remove a portion of the precipitating ferric hydroxide particles, thereby reducing overall rate of headloss accumulation through the filter and maximizing the greensand’s run time prior to backwashing. Manufactured greensand is also available wherein silica sand is coated with manganese dioxide.

Greensand filters are typically backwashed at rates of 12 to 18 gpm/sf for 8 to 12 minutes. Air scour could be used to assist in removal of iron/manganese oxide deposits. While lower backwash rates are reported to be effective in removing the metal oxide deposits from the media bed, backwash rates of 15 to 18 gpm/sf are required to restratify the greensand and anthracite layers in the filter bed. Filter-to-waste following backwashes may be required to ensures high quality RO feed water with low iron and manganese concentrations at all times of on-line operation. The filter-to-waste duration should be optimized during plant start-up, depending on the final number of filter units provided. To optimize constructability, cost, and footprint, pressure filter vessels will be used to house the media. Preliminary design criteria for the pretreatment greensand filter system are provided in Table 5-5.

Table 5-5: Pretreatment Greensand Filter Design Criteria

PARAMETER	CRITERIA
FILTRATION SYSTEM	
Type	Pressurized
Number	4
Cells Per Filter	2
Design Loading Rate, gpm/sf	3.0
Filter Size, each	
Overall Length, feet (2 filter cells)	40-45
Diameter, feet	12-14
Working Pressure, psi	75
FILTER MEDIA	
Media Type	Dual
Total Media Depth, inches	30-42
Media Material	
Material #1	Anthracite
Depth, inches	12-18
Effective Size, mm	0.6 – 0.8
Uniformity Coefficient	<1.6
Material #2	Greensand
Depth, inches	18-24
Effective Size, mm	0.3 – 0.35
Uniformity Coefficient	<1.6
BACKWAH REQUIREMENT	
Rate, gpm/sf	15
Duration, min	15

Backwashing of the greensand filters will remove the waste solids and expand the media bed. The backwash is carried out using water that has previously passed through the filters and into the backwash holding tank. Design criteria for the backwash supply tank and pump station are provided in Table 5-6.

Table 5-6: Backwash Supply Tank and Pump Station Design Criteria

PARAMETER	CRITERIA
BACKWASH SUPPLY TANK	
Usable Capacity, gallons	100,000
Capacity Criteria	Minimum of 2 filter backwashes
BACKWASH SUPPLY PUMPS	
Number	1 duty and 1 standby
Type	Vertical Diffusion Vane
Rated Capacity, gpm, each	3,400
Rated Head, feet	45
Motor, hp	60
Drive	Adjustable Frequency

Backwash waste from the pretreatment greensand filters will be sent to a washwater equalization tank and pumped to a packaged inclined plate settler system for further treatment. Solids will be kept in suspension within the tank using propeller-type mixers. From the equalization tank, the washwater will be pumped to a package treatment unit. The equalization tank and the associated pumps will be designed to empty between filter backwashes. The package treatment unit will include a flocculation basin equipped with vertical flocculator, a sedimentation basin equipped with inclined plate settlers, and a sludge hopper. The clarified effluent from the package treatment unit will be returned to the head of the plant. Sludge collected from the inclined plate settlers will be conveyed to an existing sewer line.

Design criteria for the washwater equalization tank and recovery system are provided in Table 5-7.

Table 5-7: Washwater Equalization Tank and Recovery System Design Criteria

PARAMETER	CRITERIA
WASHWATER EQUALIZATION TANK	
Capacity, gallons	112,000
Capacity Criteria	2x 15-minute filter backwashes + 30 minutes filter to waste for one filter
WASHWATER RECOVERY SYSTEM	
Type	Packaged Inclined Plate Settler
Number	1
Capacity, gpm	250

5.4.2.2.3 RO Feed Tank and Low Pressure RO Transfer Pump Station

Filtered water from the greensand filtration system will be split with up to 5 percent of the flow directed to the RO bypass pipeline and the remainder to the RO feed tank. The RO feed tank will provide a hydraulic buffer to equalize the flow to the RO system. This ensures that the RO system can be operated in a steady state, irrespective of the operation of the pressure filters. Provisions for the addition of sodium bisulfite at either the tank influent or effluent are provided to de-chlorinate the filtered water effluent or after the cartridge filters. Typically, the filtered water is de-chlorinated at the influent to the RO feed tank. However, dechlorination after the cartridge filters has shown benefits in controlling biofouling of the cartridge filters in brackish groundwater desalination applications. In addition, periodic chlorine residual maintained through the RO feed tank also helps to control biological growth. Thus, provisions for de-chlorination should be provided at the influent to the RO feed tank as well as downstream of the cartridge filters for operational flexibility.

Low pressure pumps will convey water from the RO feed tank through the cartridge filters to the suction side of the RO high pressure feed pumps. Design criteria for the RO feed tank and low pressure RO transfer pump station are provided in Table 5-8.

Table 5-8: RO Feed Tank and Low Pressure RO Transfer Pump Station Design Criteria

PARAMETER	CRITERIA
RO FEED TANK	
Detention time, minutes	15
Capacity, gallons	90,000
LOW PRESSURE RO TRANSFER PUMPS	
Number	3 duty and 1 standby
Type	Vertical Diffusion Vane
Rated Capacity, gpm, each	2,000
Rated Head, feet	100
Motor, hp	125
Drive	Adjustable Frequency

5.4.3 RO System

Water exiting the RO feed tank will be dosed with sulfuric acid and antiscalant to reduce the potential for precipitation of sparingly soluble salts on the RO membranes. Sodium bisulfite will also be fed to the filtered water to neutralize the chlorine residual. The RO system consists of: cartridge filters, the RO high pressure feed pumps, RO trains, RO flush system, and RO CIP system.

5.4.3.1.1 Cartridge Filters

Cartridge filters will be provided upstream of the RO membranes to serve as a final barrier for removal of any particulate matter that may be present in the RO feed tank. Removal of particulate material is critical to prevent fouling of the feed channels in the RO membrane elements. The cartridge filter vessels will be connected to a common feed and discharge header. The cartridge filters will be valved to allow isolation of a single vessel. During normal operation, all duty vessels will be used irrespective of the number of RO units operating to prevent water stagnation within a cartridge filter and biological growth. When the differential pressure between the feed and discharge headers exceed the design set point, the spare vessel will be brought into service and elements in each of the duty vessels will be sequentially replaced. Spent cartridges can be discarded in normal trash. The last duty vessel will then become the spare vessel. Design criteria for the cartridge filters are provided in Table 5-9.

Table 5-9: Cartridge Filter Design Criteria

PARAMETER	VALUE
Number of cartridge filter vessels	4
Design flow rate per vessel	2,000 gpm
Design loading rate	3.5 gpm/10” equivalent length
Vessel orientation	Horizontal
Cartridge filter element dimensions	2.5” diameter and 40” long
Cartridge filter element rating	5 um nominal pore size

5.4.3.1.2 RO System

The high pressure RO feed pumps draw water from the cartridge filters and further boost the feed water pressure to that required for operation of the RO skids. The pressurized feed water to each RO unit is supplied by a dedicated high pressure pump equipped with an adjustable frequency drive (AFD). The AFD for each pump is controlled to achieve a set total permeate from each RO unit. This arrangement simplifies the pump controls to match flows when skids are brought online or taken offline. Design criteria for the RO high pressure fed pumps are provided in Table 5-10.

Table 5-10: RO High Pressure Feed Pump Design Criteria

PARAMETER	VALUE
Number of feed pumps	4 (one dedicated for each RO unit)
Nominal flow rate (gpm)	2,000
Rated head, psi	TBD
Type of pump	Vertical turbine in barrel
Motor	AFD

The RO trains will remove the dissolved salts and contaminants, which will be discharged or wasted in the concentrate stream. The RO system will be designed to operate over a recovery range of 75-85 percent, depending on the blended groundwater well water quality (e.g. silica concentration) and effectiveness of the antiscalant chemical that is applied. The 2008 Pilot Study recommended a recovery of 75 percent. The RO system design criteria, established based on the results of the 2008 Pilot Study, are summarized in Table 5-11. Alternative configurations, such as a 3-stage system or 440-ft^2 RO elements could be considered during detailed design to maximize recovery and minimize cost. An energy recovery device (ERD) will be included in the RO system design to provide inter-stage boosting for flux balancing and minimize overall energy consumption of the RO system.

Table 5-11: RO System Design Criteria

PARAMETER	VALUE
RO Recovery	75%
Number of RO trains	4 (3 duty, 1 standby)
Design permeate flow rate per train (gpm)	1,500
Design feed water flow rate per train (gpm)	2,000
Number of stages per train	2
Initial Feed Pressure, psi	200
Energy Recovery Device (inter-stage boost), gpm	1,000
Pressure Vessels (each train)	
1st Stage	40
2nd Stage	20
Elements/vessel	7
Total Elements	420
Membrane Elements	
Size	8-inch diameter x 40-inch in length
Total Installed Number	1680
Average Flux Rate, gfd	<14
Material	Thin Film Composite/Polyamides (TFC/PA)

5.4.3.1.3 RO Support Systems

The systems that support the RO system are the following:

- RO flush System
- Clean-in-place (CIP) System

Periodically, RO trains are taken out of service due to reduced demand and to constantly rotate the various RO trains. For instance, even if the facility is operating at full capacity, the spare train should be brought into operation periodically to prevent degradation of membranes and all moving parts. This is typically achieved by operating membranes in a round robin fashion, to ensure that no train is left off-line for an extended period of time. Whenever an RO train is taken out of service, it is flushed automatically with permeate.

The flushing system will consist of a permeate flush tank and pumps summarized in Table 5-12. One system will be provided to flush all the units. Part of the permeate from the common header will be diverted to fill the permeate tank. The flushing tank is designed to hold sufficient water for roughly one volumetric displacement of the water in the piping and one RO train.

Table 5-12: RO Flush Tank and Flush Pump Design Criteria

PARAMETER	VALUE
Flush Tank	
Number	1
Tank Capacity, gallons	3,800
Tank Material	FRP
Flush Pump	
Number	1 duty and 1 standby
Capacity (each), gpm	1,600 @45 Psi

The RO membranes will become gradually fouled with inorganic and organic material over time. The degradation in the performance of the RO membranes is assessed based on the following parameters:

- Normalized permeate flow drops by more than 10 percent
- Normalized differential pressure across any stage increases by 15 percent
- Normalized salt passage increases by 10 percent

Depending on the membrane element selected, these values may be adjusted to meet the membrane element manufacturer's recommendations. Normalization is typically done to account for variations in operational practices such as recovery, water temperature and quality.

When any of the above mentioned parameters trigger a cleaning, the relevant RO train will be taken out of service. Depending on the nature of foulants, cleaning will be performed using either acidic or basic solutions or both. Typically, acidic cleaning solutions are used to remove inorganic foulants, while basic solution is used for removal of organic foulants. It is anticipated that, for this water, acidic cleaning will be done more frequently than basic. Typically, citric acid is used for cleaning inorganic constituents and caustic with detergents is used for removal of organic material. Preliminary design criteria for the RO CIP system are provided in Table 5-13. Typically, CIP procedures can be optimized while the RO system is online.

Table 5-13: RO CIP System Design Criteria

PARAMETER	VALUE
CIP Tank	
Number	2
Tank Capacity, gallons	4,500
Tank Material	FRP
CIP Pump	
Number	1 duty and 1 standby
Capacity (each), gpm	2,000
Motor	AFD
Cartridge Filter	
Nominal Flowrate, gpm	2,100
Element Loading Rate	5 gpm/10-inch equivalent length
Neutralization Tank	
Number	1
Tank Capacity, gallons	5,500
Tank Material	FRP

5.4.4 Brine Management

The RO concentrate will be discharged to the Regional Salinity Management Pipeline (SMP), operated by CMWD, for ultimate disposal to the Pacific Ocean. The RO concentrate flow will range from 850 to 1,450 gpm depending on selected recovery of the RO system. The connection to the Regional SMP is approximately 3,700 ft away from the preferred location of the NPV Groundwater Treatment Facility. The option of gravity or pressurized pipeline that connects the treatment facility to the Regional SMP should be investigated during the design stage.

5.4.5 Post-Treatment

Post-treatment stabilization of the RO permeate consists of decarbonation, blending with RO bypass flow, and addition of sodium hydroxide for final pH adjustment. Initial estimates indicate that up to 5 percent of the RO feed water, depending on RO recovery, could be bypassed and blended to stabilize the RO permeate. Design criteria for decarbonation and disinfection are provided in this section. Design criteria for the chemical feed systems are provided in Section 5.4.7.

5.4.5.1 Decarbonation

Decarbonators will be located downstream of the RO system to treat RO permeate. The decarbonators will remove carbon dioxide from the RO permeate and reduce the amount of sodium hydroxide (NaOH) required for stabilization of the treated water. The design should include provisions for hydrogen sulfide removal and potentially off-gas scrubbers if high levels are present in the new groundwater wells. Design criteria for the decarbonators are provided in Table 5-14.

Table 5-14: Decarbonator Design Criteria

PARAMETER	VALUE
Type	Packed Tower
Number	2
Design flow (each), gpm	2,250
Blowers	
Number	1
Capacity, scfm	6,000

5.4.5.2 Disinfection

Disinfection of the treated water is provided by formation of chloramines through addition of aqua-ammonia and sodium hypochlorite following the decarbonators. These chemical addition facilities are sized for a target residual of 1.2 to 1.5 mg/L total chlorine. Design criteria for the chemical feed systems are provided in Section 5.4.7.

5.4.6 Treated Water Distribution

Treated water will be collected into a 43,000 gallon pump well below the finished water pump station. The pumps would be housed in sound enclosures for noise control. The pump station would have the capability to pump all of the water produced either to the City's Zone 1 or Zone 2 distribution system or to a combination of the two zones. Under normal operations, two pumps will be in operation for Zone 1, and one pump will be in operation to serve Zone 2. Preliminary design criteria for the treated water pump station are provided in Table 5-15. The final treated water production capacity of the NPV Groundwater Treatment Facility will be based on pretreatment option selected and optimized RO recovery.

Table 5-15: Treated Water Pump Station Design Criteria

PARAMETER	VALUE
Treated Water Sump	
Capacity, gallons	43,000
Zone 1 Distribution Pumps	
Number	2 duty and 1 standby
Capacity (each), gpm	1800
Rated Head, feet	155
Motor	AFD
Zone 2 Distribution Pumps	
Number	1 duty and 2 standby
Capacity (each), gpm	1100
Rated Head, feet	72
Motor	AFD

5.4.7 Chemical Feed Facilities

The following chemicals will be utilized as part of the treatment system:

- Sodium Hypochlorite - to aid in the oxidation of iron and manganese through the Pretreatment Filtration System (Option 2) and used for disinfection as part of the chloramination process
- Sodium Bisulfite – injected at the well head to sequester oxygen (Pretreatment Option 1) or added upstream of RO system (Pretreatment Option 2) to remove any residual free chlorine present in the RO feed water
- Sulfuric Acid - added to the RO feed water to maintain the desired pH within the range of 6.7 to 7.0 to minimize scaling on the RO membranes
- Antiscalant (Threshold Inhibitor) - added to the RO feed water to minimize the potential for inorganic scaling on the membrane surface
- Sodium Hydroxide – to increase the pH of the softened, treated water and reduce its corrosivity
- Aqua ammonia - added along with sodium hypochlorite to form a combined monochloramine residual in the treated water

Sizing of each chemical feed system is based on a minimum storage capacity of 30 days for each chemical at average chemical doses.

5.4.7.1 Sodium Hypochlorite

One sodium hypochlorite feed system will be supplied to feed 12.5 trade percent sodium hypochlorite to the well pumps, raw water inlet and to the finished water from the RO system depending on the pretreatment option selected for design. Sodium hypochlorite will be delivered to the site by tanker truck and will be stored in bulk storage tanks sized to accept a full truck load. Requirements for one or two storage tanks will be determined during the design stage. The sodium hypochlorite will be delivered to the feed points by metering pumps designed to feed sodium hypochlorite over the full range plant flows and doses. Preliminary design criteria for the sodium hypochlorite feed system for the two pretreatment options and disinfection are summarized in Table 5-16 and Table 5-17.

Table 5-16: Sodium Hypochlorite Feed System Design Criteria (Pretreatment Option 1 – Direct RO)

PARAMETER	VALUE
Chemical	Sodium Hypochlorite
Chemical Concentration	12.5%
Chemical Dose, mg/L	1.5 (avg), 0.5-2.5 (range)
Storage Tank	
Number	1
Capacity, gallons	5,000
Days	60[1]
Chemical Metering Pumps	
Feed Point	Upstream of RO
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	7

(1) Larger tank provided in order to accept one full delivery of sodium hypochlorite to minimize chemical delivery cost

Table 5-17: Sodium Hypochlorite Feed System Design Criteria (Pretreatment Option 2 – Pretreatment Filtration + RO)

PARAMETER	VALUE
Chemical	Sodium Bisulfite
Chemical Concentration	25%
Chemical Dose, mg/L	1.5
Storage Tank	
Number	1
Capacity, gallons	5,900
Days	30
Chemical Metering Pumps	
Feed Point	Raw water, upstream of contact tank
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	7
Feed Point	Blended treated water
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	7

5.4.7.2 Sodium Bisulfite

One sodium bisulfite feed system will be supplied to feed 25 percent sodium bisulfite either at the Well Head (Pretreatment Option 1 – Direct RO) or upstream of the RO system (Pretreatment Option 2 – Pretreatment Filtration + RO). The sodium bisulfite will be delivered to the feed point by metering pumps designed to feed sodium bisulfite over the full range flows and dosages. Preliminary design criteria for the well head and treatment facility feed systems are provided in Table 5-18 and Table 5-19, respectively.

Table 5-18: Well Head Sodium Bisulfite Feed System Design Criteria (Pretreatment Option 1 –Direct RO)

PARAMETER	VALUE	
Chemical	Sodium Bisulfite	
Chemical Concentration	25%	
Chemical Dose, mg/L	2.0[1]	
Storage Tote		
Well Head Capacity, gpm	1,500	3,000[2]
Type	Tote	Totes
Number	2	3
Capacity Each, gallons	300	300
Days	30	
Chemical Metering Pumps		
Feed Point	Well Head	
Type	Peristaltic	
Number of Pumps	2	
Pump Capacity Each, gph	0.6	1.2

[1] Dose based on 2008 Pilot Study
[2] The new well(s) may be either 1,500 or 3,000 gpm in capacity

Table 5-19: Bulk Sodium Bisulfite Feed System Design Criteria (Pretreatment Option 2 – Pretreatment Filtration + RO)

PARAMETER	VALUE
Chemical	Sodium Bisulfite
Chemical Concentration	25%
Chemical Dose, mg/L	2.0
Storage Tank	
Number	1
Capacity, gallons	1,700
Days	30
Chemical Metering Pumps	
Feed Point	Upstream of RO
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	2

5.4.7.3 Sulfuric Acid

One sulfuric acid feed system will be supplied to feed 93 percent sulfuric acid upstream of the RO system. Sulfuric acid will be delivered to the site by tanker truck and will be stored in a bulk storage tank sized to accept a full truck load. The sulfuric acid will be delivered to the feed point by two metering pumps designed to feed sulfuric acid over the full range flows and doses. Design criteria for the sulfuric acid feed system are provided in Table 5-20.

Table 5-20: Sulfuric Acid Feed System Design Criteria

PARAMETER	VALUE
Chemical	Sulfuric Acid
Chemical Concentration	93.2%
Chemical Dose, mg/L	90[(1)]
Storage Tank	
Number	1
Capacity, gallons	13,000
Days	30
Chemical Metering Pumps	
Dosing Location	Upstream of RO
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	20

[(1)] Dose based on 2008 Pilot Study

5.4.7.4 Antiscalant

One antiscalant feed system will be supplied to feed antiscalant upstream of the RO system. Antiscalant will be delivered to the site in totes and will be stored in the delivered totes. Antiscalant will be delivered to the feed point by metering pumps designed to feed over the full range flows and doses. Preliminary design criteria for the antiscalant feed system are provided in Table 5-21.

Table 5-21: Antiscalant Feed System Design Criteria

PARAMETER	VALUE
Chemical	Antiscalant
Chemical Concentration	100
Chemical Dose, mg/L	1-5
Storage Tote	
Number	1
Capacity, gallons	530
Days	45
Chemical Metering Pumps	
Dosing Location	Upstream of RO
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	0.6

5.4.7.5 Sodium Hydroxide

One sodium hydroxide feed system will be supplied to feed 25 percent sodium hydroxide to the finished water. Sodium hydroxide will be delivered to the site by tanker truck as a 50 percent solution and will be diluted and stored in a bulk storage tank sized to accept a full truck load plus dilution water. The sodium hydroxide will be delivered to the finished water by two metering pumps designed to feed sodium hydroxide over the full range of flows and doses. Preliminary design criteria for the sodium hydroxide feed system are provided in Table 5-22.

Table 5-22: Sodium Hydroxide Feed System Design Criteria

PARAMETER	VALUE
Chemical	Sodium Hydroxide
Chemical Concentration	50% (delivered), 25% (stored)
Chemical Dose, mg/L	3-5[(1)]
Storage Tank	
Number	1
Capacity, gallons	4,500
Days	30
Chemical Metering Pumps	
Dosing Location	Blended treated water (RO Permeate + RO Bypass)
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	5

[(1)] Dose range based on 2008 Pilot Study

5.4.7.6 Aqua Ammonia

One aqua ammonia feed system will be supplied to feed 19 percent aqua ammonia to the finished water to form chloramines. The aqua ammonia will be delivered to the finished water by two metering pumps designed to feed over the full range flows and doses. Preliminary design criteria for the aqua ammonia feed system are provided in Table 5-23.

Table 5-23: Aqua Ammonia Feed System Design Criteria

PARAMETER	VALUE
Chemical	Aqua Ammonia
Chemical Concentration	19%
Chemical Dose, mg/L	0.3-1.5[(1)]
Storage Tank	
Number	1
Capacity, gallons	1,200
Days	30
Chemical Metering Pumps	
Dosing Location	Blended treated water (RO Permeate + RO Bypass)
Type	Peristaltic
Number of Pumps	2
Pump Capacity Each, gph	2.5

[(1)] Dose based on 2008 Pilot Study

5.4.8 Site Layout

Two site layouts were prepared for the NPV Groundwater Treatment Facility based on the two pretreatment options available. The site layouts are provided in Figure 5-6 and Figure 5-7.

The majority of the treatment facilities will be located outdoors and under a canopy. The administration building (which includes the control room), electrical room, and storage room/shop will be located near the main entrance gate. The only other building provided will be for the RO high pressure feed pumps for noise attenuation. An access road is provided along the perimeter of the site to provide truck access for chemical deliveries and equipment maintenance. The total footprint of the NPV Groundwater Treatment Facility is approximately 104,755 square feet.

For Pretreatment Option 1 – Direct RO, the raw groundwater would be pumped to site and will be sent directly to the cartridge filtration system and boosted to the RO system. The RO permeate will then undergo post-treatment consisting of blending with RO bypass water, decarbonation, and chemical conditioning (sodium hydroxide addition) for final pH adjustment. The treated water will flow by gravity from the decarbonators into the finished water wet well and pumped to Zone 1 and Zone 2 for distribution. The total footprint of the treatment facilities required for Pretreatment Option 1 is approximately 17,800 square feet.

For Pretreatment Option 2 – Pretreatment Filtration + RO, the raw water from the various groundwater wells will be pumped to the contact tank, then fed to the pretreatment greensand filters. The pretreated water would then flow to the RO feed tank, then be transferred to the cartridge filters before it is boosted to the RO system. Post-treatment operations and treated water distribution would be the same between the two options. As indicated in Figure 5-7, the pretreatment filtration option would require significantly more treatment facilities and land than Pretreatment Option 1 – Direct RO. The total footprint of the treatment facilities required for Pretreatment Option 2 is approximately 38,300 feet squared. The required pretreatment filtration and support facilities accounts for approximately 20,500 ft^2 of the total 38,300 feet squared.

An emergency generator, common to both options, would be provided at the Groundwater Treatment Facility site to ensure a reliable source of power to the treatment facilities. The emergency generator may also be used to provide emergency power to the proposed groundwater wells (if located within close proximity). The emergency generator would only be used during power outages and for short periods during maintenance. The generator would produce up to 2,000 kilowatts (KW) and would be powered by a diesel engine.

The overall foot prints of the facilities are provided in Table 5-15.

Table 5-24: Treated Water Pump Station Design Criteria

PARAMETER	VALUE
Facilities Foot Print (sq Ft)	
Pretreatment Option 1	17,800
Pretreatment Option 2	38,300
Total Area within Site Fencing	104,755
Total Area of new facility (includes 25’ buffer around facility	141,100

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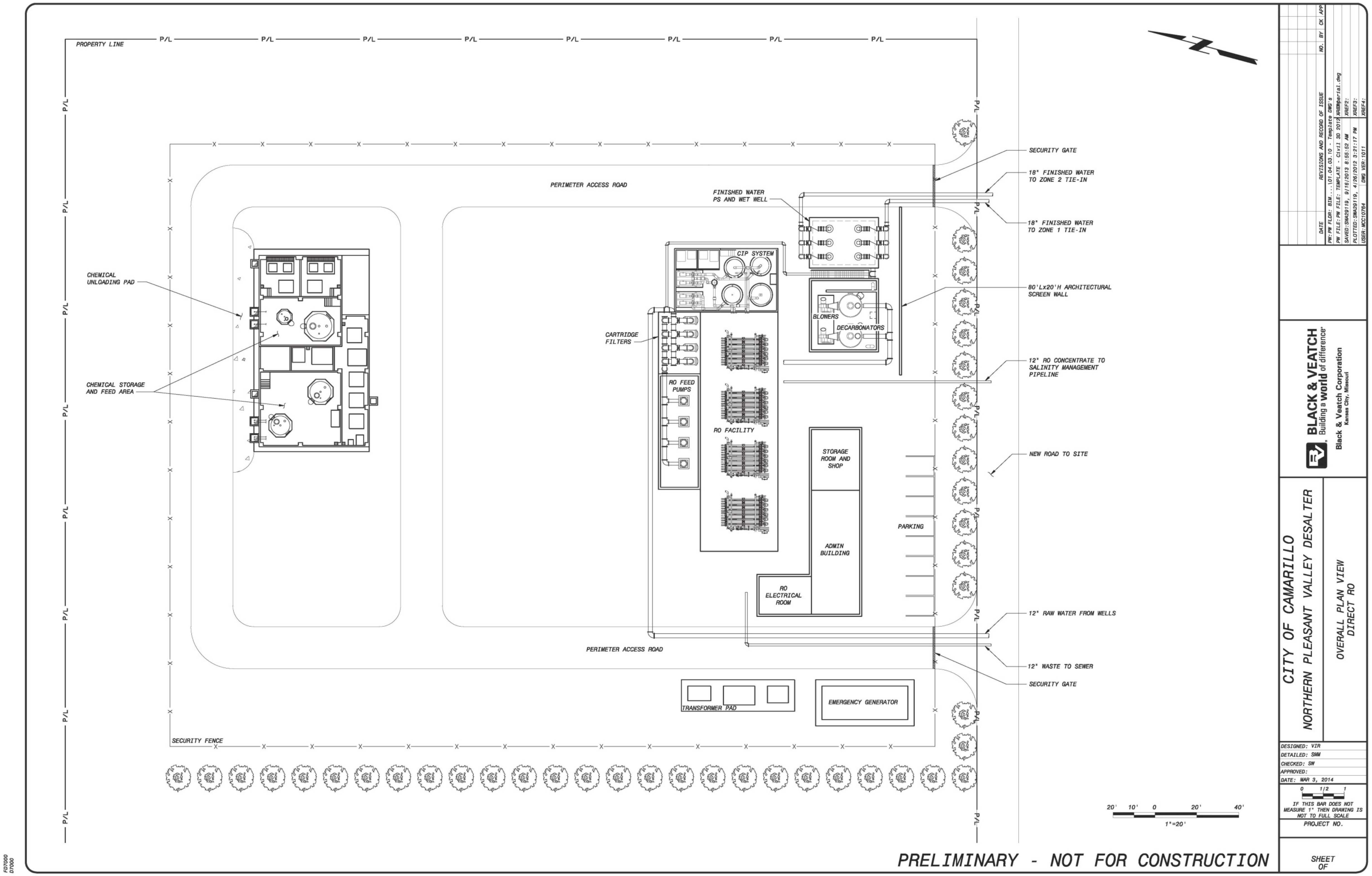

Figure 5-6: Site Layout for the NPV Groundwater Treatment Facility (Pretreatment Option 1 – Direct RO)

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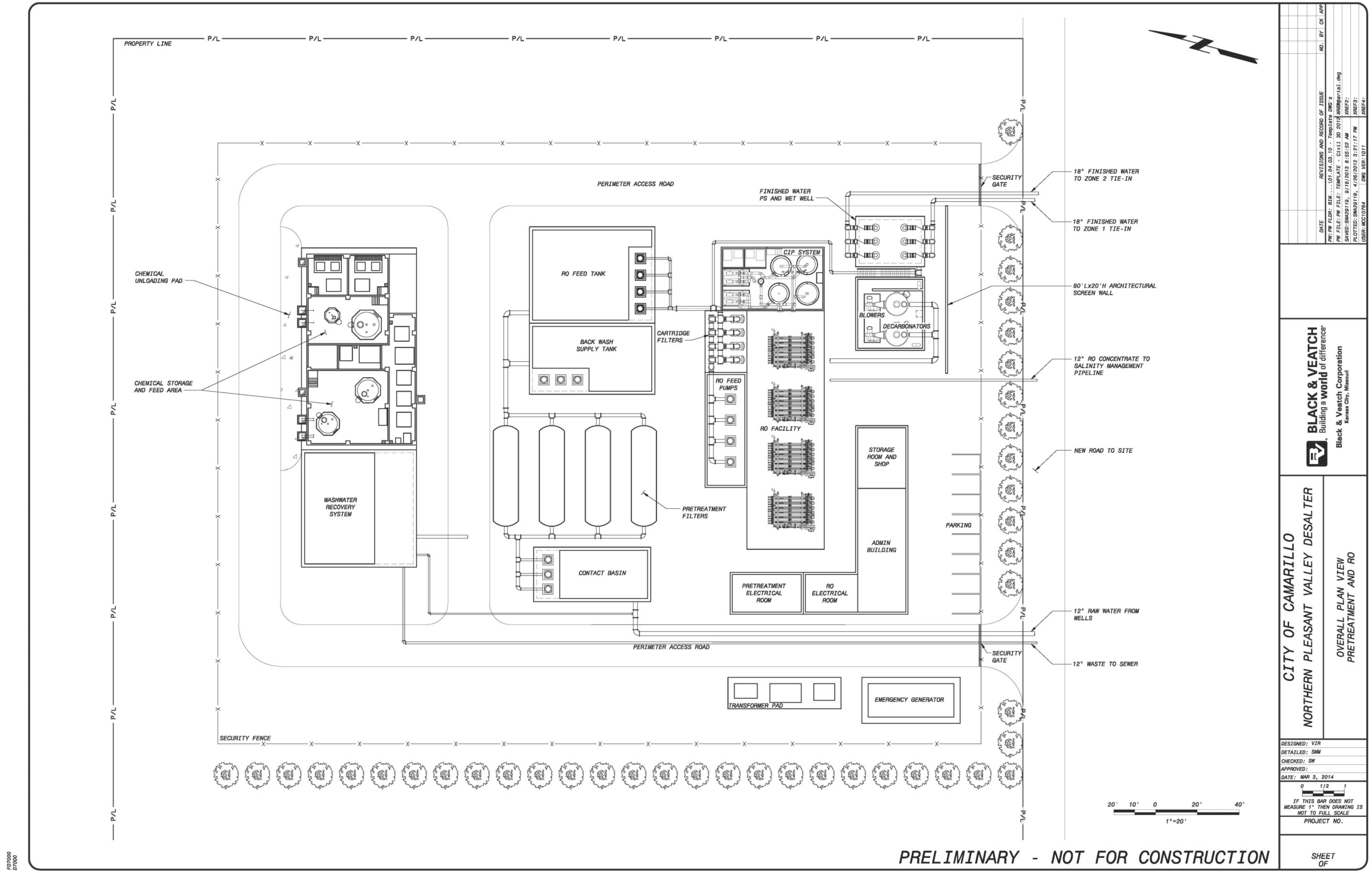

Figure 5-7: Site Layout for the NPV Groundwater Treatment Facility (Pretreatment Option 2 – Pretreatment Filtration + RO)

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5.5 OFFSITE FACILITIES

5.5.1 Conveyance

Finished water from the NPV Groundwater Treatment Facility will be pumped to either Zone 1 or Zone 2. Zone 1 operates at a higher pressure of 155 ft, while Zone 2 operates 72 ft. In November 2007, a Distribution System Hydraulic Analysis determined that that the most efficient method for connecting to the finished water system was to supply the majority of the water from the NPV Groundwater Treatment Facility into Zone 1 and use the conveyance capacity of Zone 1 to transfer the Zone 2 supply across the city, breaking head at the Kendall PRV and feeding it into Zone 2. A portion of the Zone 2 water will be fed directly into the Zone 2 line near the facilities. The tie-in points determined in that study to be most cost efficient are at the intersection of Antonio Ave and East Las Posas Rd for Zone 1, and at the corner of Antonio Ave and North Ponderosa Dr for Zone 2. The proposed operation flow rates are shown in Table 5-25.

Table 5-25: Production / Distribution for NPV Groundwater Treatment Facility

PARAMETER	CRITERIA
Zone 1 Pumping	3,600 gpm @ 155 ft
Zone 2 Pumping	1,100 gpm @ 75 ft

An overview of the off-site facilities and pipeline tie-in locations (e.g. raw water pipelines, treated water pipelines, potential new well location, and salinity management pipeline connection location) are provided in Figure 5-8. The approximate pipeline distances are as follows: Zone 1 piping = 1,500 feet, Zone 2 piping = 1,500 feet, Raw Water piping = 7,000 feet (total), and piping to Regional Salinity Management Pipeline = 3,500 feet.

5.5.2 Waste Disposal

The RO concentrate will be discharged to the Regional SMP, operated by CMWD, for ultimate disposal to the Pacific Ocean. The 32 inch high-density polyethylene (HPDE) SMP has been constructed up through Phase 2C terminating in Lewis Rd just north of Pas Posas/Upland road. The RO concentrate stream will be piped from the project site along Antonio Ave to Upland Road. It is anticipated the RO concentrate line will tie into the SMP at or below manhole No. 9, about 4 feet downstream from the end of the line.

The solids discharged from the site as well as any waste streams from the Administration Building will be discharged to the local sewer. There is an 8-inch vitrified clay pipe (VCP) at the intersection of Antonio Drive and Mar Vista. It is anticipated that the available sewer capacity and final tie-in points will be confirmed during detailed design.

5.5.3 Monitoring Wells

The 2015 “Northern Pleasant Valley Desalter Groundwater Analysis and Modelling” report (Bachman) recommends three monitoring wells (Figure 5-9). Their purpose would be to 1) establish baseline information and 2) to track progress of the desalter project as it pull salts from the basin. The locations are based on modeling that tracked movement of brackish water over a 17 year simulation period. Bachman further information on these monitoring wells can be found in that report. The locations of the wells relative to Well B are indicated in this figure.

5.6 ANTICIPATED TREATED WATER QUALITY

Anticipated treated water quality, based on the blended raw water (Well C) from Table 5-1, is presented below in Table 5-26 with comparison to the water quality goals.

Table 5-26: Anticipated Treated Water Quality

CONSTITUENT	RAW WATER[1] (WELL C)	PERMEATE	REJECT	PRODUCT (TREATED)[2]	GOAL[3]
Chloride, mg/L	136	12	640	20	65
pH	7.4	5.6	7	8.6	>8.0
Sulfate, mg/L	891	30	4340	70	70
TDS, mg/L	1554	97	8980	196	250
Calcium, mg/L	240	8	1180	20	--
Magnesium, mg/L	66	2	330	10	--
Hardness, mg/l as $CaCO_3$	896	26	4250	70	75-120
Gross Alpha, pCi/L	12.6	0.6	60	1.1	12

[1] Average of Wells A and B. Refer to Table 5-1.

[2] Assumes 4% bypass.

[3] From Table 5-2.

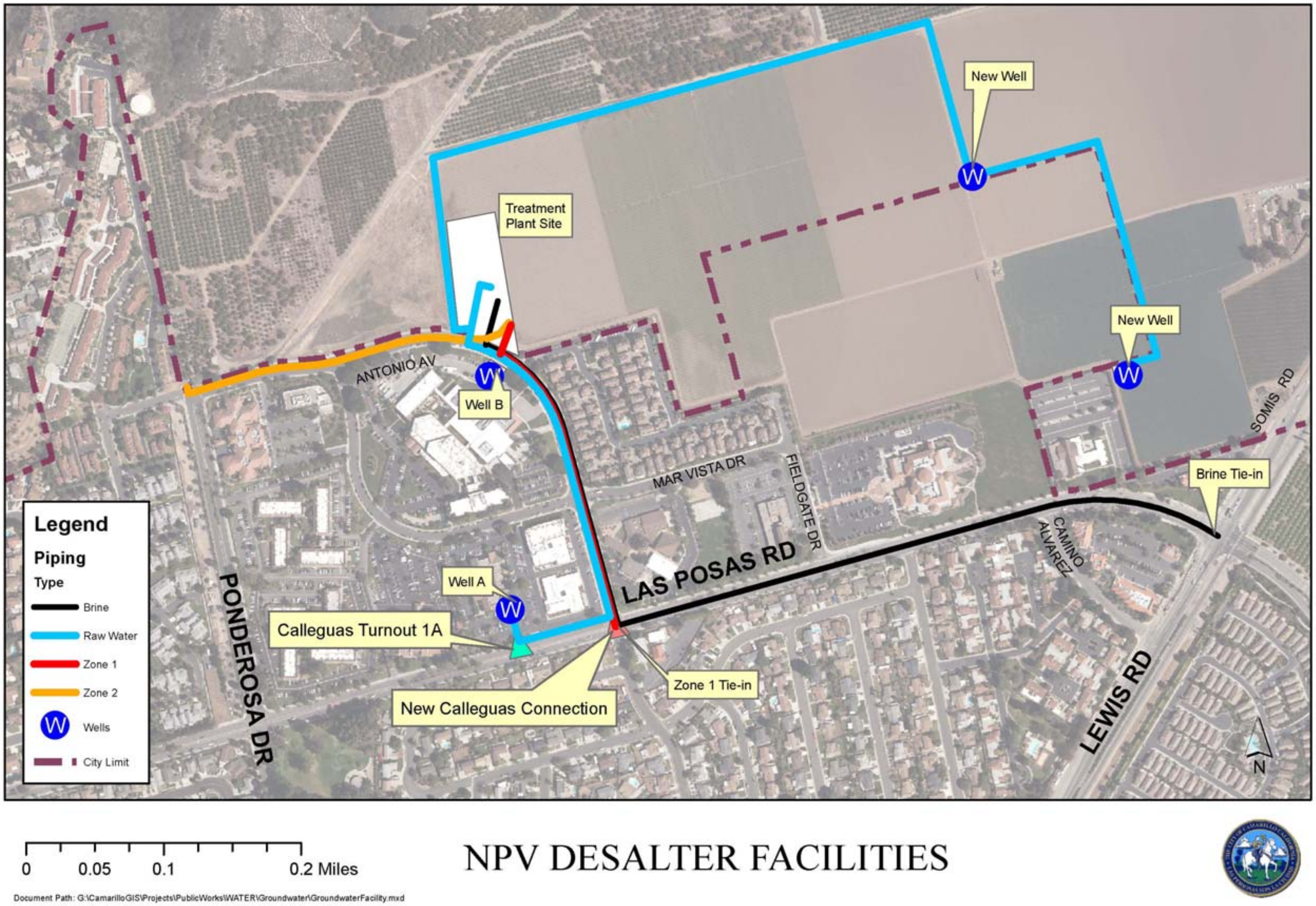

Figure 5-8: Overview of Off-Site Facilities and Tie-In Locations for Preferred Site Location #2

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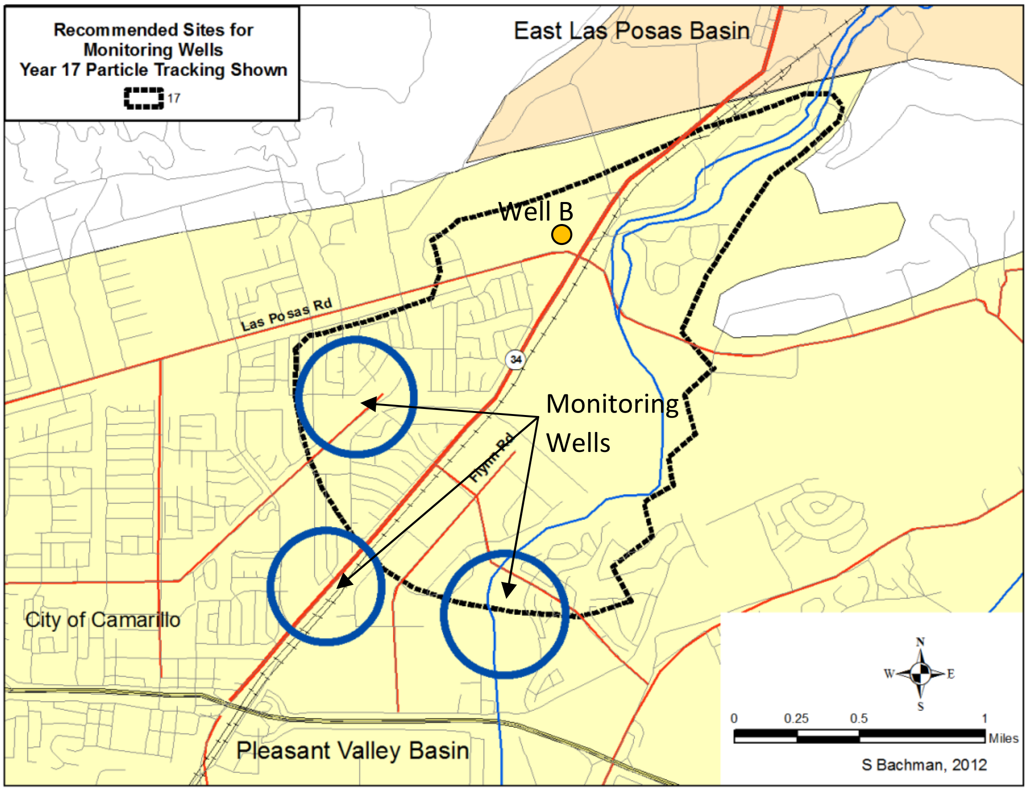

Figure 5-9: Recommended Monitoring Wells (excepted from 2015 Bachman "Northern Pleasant Valley Desalter Groundwater Analysis and Modeling" report with annotation added)

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6 Assessment of Site Alternatives

A total of eight sites for the new NPV Groundwater Treatment Facility were identified and evaluated for the EIR. Each of the alternative sites is located within one mile of the well sites and the Regional Salinity Management pipeline alignment. The locations of the eight sites are listed below and provided in Figure 6-1. The eight sites were evaluated by Padre Associates for the EIR.

- Site #1 – located immediately north of the City limits in the unincorporated portion of Ventura County near the intersection of Ponderosa Drive and Antonio Drive. The site is currently zoned AE-40 ac (Agriculture Exclusive, 40 acre minimum parcel size). The parcel is approximately 58 acres and is currently used for agriculture (orchards).
- Site #2 - located immediately north of the City limits in the unincorporated portion of Ventura County along Antonio Drive and across the street from Well B. The site is currently zoned AE-40 ac. The parcel is approximately 77 acres and is currently used for agriculture (row crops).
- Site #3 - located immediately north of the City limits in the unincorporated portion of Ventura County near the intersection of Antonio Drive and Villamonte Court. It is also located across the street from Well B. The site is currently zoned AE-40 ac. The parcel is approximately 77 acres and is currently used for agriculture (row crops).
- Site #4 - located immediately north of the City limits adjacent to an existing housing community. The site is located near the intersection of Villamonte Court and Fieldgate Drive. The site is currently zoned AE-40 ac. The parcel is approximately 77 acres and is currently used for agriculture (row crops).
- Site #5 – located near the intersection of Las Posas Road and Lewis Road. The site is currently zoned AE-40 ac. The parcel is approximately 40 acres and is currently used for agriculture (row crops).
- Site #6 – located adjacent to Site #5 along Somis Road. The site is currently zoned AE-40 ac. The parcel is approximately 40 acres and is currently used for agriculture (row crops).
- Site #7 – located within City limits and zoned RE (rural exclusive), near the intersection of Lewis Road and Upland Road. The parcel is approximately 6 acres and is currently used for agriculture (orchards).
- Site #8 – located approximately 1,000 feet north of existing City limits and within the unincorporated portion of Ventura County. The site is currently zoned AE-40 ac. The parcel is approximately 58 acres and is currently used for agriculture (orchards).

Site #2 is currently identified as the preferred location for the new NPV Groundwater Treatment Facility. Site #2 is in close proximity to the existing groundwater wells and minimizes overall agricultural land take by being located along an existing road.

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Figure 6-1: Site Locations for the Proposed NPV Groundwater Treatment Facility

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7 Opinion of Probable Cost and O&M Costs

7.1 OPINION OF PROBABLE COST

The opinion of probable cost for the NPV Groundwater Treatment Facility was developed using the preliminary design criteria established in Section 5. A summary of the opinion of probable cost for the NPV Groundwater Treatment Facility is provided in Table 7-1.

Table 7-1: Opinion of Probable Cost for the NPV Groundwater Treatment Facility

ITEM	CAPITAL COST (OPTION 1 – DIRECT RO)	CAPITAL COST (OPTION 2 – PRETREATMENT FILTRATION + RO)
Site work and Piping	$ 4,615,000	$ 4,733,000
New Groundwater Wells	$ 3,575,000	$ 3,300,000
Contact Basin and Pretreatment Filtration System	$ -	$ 3,335,000
Washwater Equalization and Recovery System	$ -	$ 1,390,000
RO Feed Tank and Transfer Pumps	$ -	$ 1,293,000
RO System and Cartridge Filters	$ 9,576,000	$ 9,576,000
Decarbonators	$ 1,226,000	$ 1,226,000
Finished Water Pump Station	$ 141,000	$ 141,000
Chemical Feed and Storage	$ 577,000	$ 665,000
Administration, Electrical, Shop/Storage Building, Transformer, and Standby Generator	$ 5,868,000	$ 6,196,000
Land Purchase	$ 400,000	$ 400,000
Connection to SMP	$ 400,000	$ 400,000
Construction Monitoring Cost	$ 1,300,000	$ 1,300,000
Subtotal	**$ 27,678,000**	**$ 33,955,000**
Engineering, General Requirements, Contractor Fees, etc. (15%)	$ 3,836,000	$ 4,778,000
Contingency (30%)	$ 7,672,000	$ 9,555,000
TOTAL PROBABLE COST	**$ 39,186,000**	**$ 48,288,000**
Annualized Cost (25 years @ 5%)	**$ 2,780,000**	**$ 3,426,000**

7.2 OPERATING AND MAINTENANCE COSTS AND TOTAL UNIT COST

The projected probable operation and maintenance (O&M) cost for the NPV Groundwater Treatment Facility is summarized in Table . The following assumptions were made in developing the probable O&M cost:

- Electricity rate = $0.12 per kWh
- RO membrane replacement frequency of 5 years

- A total of four new full time employees (FTE) will be hired to operate the facility
- Maintenance, repair, and spare requirements is assumed to be 2% of the capital cost of each treatment facility

Table 7-2: Summary of Probable O&M Costs for the NPV Groundwater Treatment Facility

ITEM	ANNUAL O&M COST (OPTION 1 – DIRECT RO)	ANNUAL O&M COST (OPTION 2 – PRETREATMENT FILTRATION + RO)
Electricity(1)	$ 1,046,000	$ 1,261,000
Chemicals	$ 740,000	$ 727,000
RO Membrane Replacement	$ 125,000	$ 112,000
Cartridge Filter Replacement	$ 13,000	$ 13,000
Maintenance, Repairs, and Spares(2)	$ 302,000	$ 440,000
Labor(3)	$ 240,000	$ 240,000
Brine Disposal Fee(4)	$ 928,000	$ 928,000
TOTAL FIRST YEAR O&M COST(5)	**$ 3,394,000**	**$ 3,721,000**
Equivalent Uniform Annual O&M Cost(6)	$ 4,359,000	$ 4,779,000
Annualized Capital Cost	$ 2,780,000	$ 3,426,000
TOTAL ANNUAL COST	**$ 4,139,000**	**$ 8,205,000**
Cost of Product Water (per AF) (7)	**$ 949**	**$ 1,091**

(1) Estimated based on $0.12/kWh
(2) Estimated based on 2% of capital equipment costs
(3) Estimated based on four new FTEs
(4) Cost of brine disposal to the Regional Salinity Management Pipeline used is $500/AF at concentrate flow of 1,855 AF/yr
(5) O&M costs assumed to escalate at 2.5% per year
(6) Converted to a uniform series using 25 year basis and 5% discount rate.
(7) Product water production is 6.7 MGD (7500 AF/Year)

8 Construction and Operation Methods

This section summarizes the construction/delivery approach and operation of the proposed NPV Groundwater Treatment Facility.

8.1 CONSTRUCTION APPROACH

Key stakeholders of the project (City, CMWD, City of Thousand Oaks, and Camrosa Water District) expressed an interest in understanding various delivery models by which the subject project could be permitted, designed and constructed. In particular, the City expressed an interest in bringing the stakeholders together to discuss alternative delivery approaches in achieving best value in procurement and execution of the project, taking into consideration the project drivers, legislative constraints, and other factors affecting the overall delivery of the project. The stakeholders met with B&V in a set of two workshops during October 2013 to 1) understand the various delivery options for the project and 2) discuss the project drivers and stakeholder objectives.

The first workshop provided an overview of various delivery models, including discussions on design-bid-build, design-build and construction management at risk (CMAR). The second workshop included a more in-depth, round-table discussion between the stakeholders on project drivers and goals. B&V's in-house Pairwise decision tool was utilized to evaluate the decision considerations, to prioritize and apply weighting factors, and to analyze the results from the decision model.

Highlights of the two workshops are summarized below:

- Low initial investment to prove out business case, competitive cost, and performance certainty were identified as the highest ranked goals affecting the project success from the key stakeholder's perspective.
- Design-build delivery appears to be the most appropriate choice for the project taking into account the goals of the primary stakeholders. From a project perspective, the desire for performance certainty (both quality and quantity), and cost factors (certainty and competitiveness) are offered through this delivery model as substantiated by recent surveys provided by both DBIA (Design-Build Institute of America) and the WDBC (Water Design Build Council)
- Of the two design build delivery models, Progressive Design Build (PDB) is recommended primarily due to its ability to achieve best results for key goals of low initial investment cost and performance certainty, which were the two highest ranked priorities.
- From a PDB perspective, the key stakeholders would recognize significant benefit utilizing this delivery model due to the low initial investment cost for proving out the business case for the project.

In consideration of these factors, it was recommended that the key stakeholders advance their evaluation of the PDB delivery model and further explore the benefits specific to the project and to the program currently envisioned by the stakeholders.

8.2 OPERATIONS

The NPV Groundwater Treatment Facility and associated groundwater wells would be operated continuously, 24 hours per day and 7 days per week under normal operating modes. It is anticipated that would be staffed with two 8-hour shifts during the day (two to three operators per shift) and one night 8-hour shift (single operator). One or two of the operation staff at each day time shift would have overlapping shifts to maintain continuous operations during shift change. Alternatively, the night time shift could also be an on-call operator that's in close proximity to the NPV Groundwater Treatment Facility to respond to alarms and emergencies. A total of nine (9) full time operation staff is estimated for operating the treatment facility 24 hours per day and 7 days per week throughout the year. The operation staff will consist of certified drinking water treatment and distribution system operators and plant maintenance staff.

8.3 TRIGGERS FOR OPERATIONAL CHANGES

Operational contingency plans call for cutting back pumping rates when water levels in nearby wells drop too low. The first trigger point for cutting back on pumping is when water levels drop to -126 feet mean sea level (msl). Pumping cutbacks are as shown in Table 8-1. If water levels recover pumping can be increased using the same cutback formula in reverse.

Table 8-1: Pumping Rate Cutback Contingency Plan

WATER LEVEL (FT MSL)	ACTION
-126	10% cutback
-140	20% cutback
-150	30% cutback
-155	40-50% cutback[1]
-160	75% cutback
-168	100% cutback

[1] Pending FCGMA project approval.

Additional contingencies have also been considered:

- Assure that brackish water is what is pumped – City is considering using manganese as an indicator by comparing concentrations in Wells A and B compared with those from Well D.
- Seawater intrusion – cease pumping when water level in well 35M2 and a future monitoring well (near Ponderosa and Arneil) drop to -120 ft msl.
- Subsidence – cease pumping if subsidence of 0.5 feet is detected within 6 months due to groundwater withdrawl.

9 Facility Implementation Schedule

The implementation schedule for the North Pleasant Valley Groundwater Treatment Facility is shown on Figure 9-1. Key features are the completion of the CEQA process, selection of the project management team and design team, respectively, and completion of the Calleguas Brine Pipeline. Project completion (start of operation) is projected to be in the last quarter of 2017.

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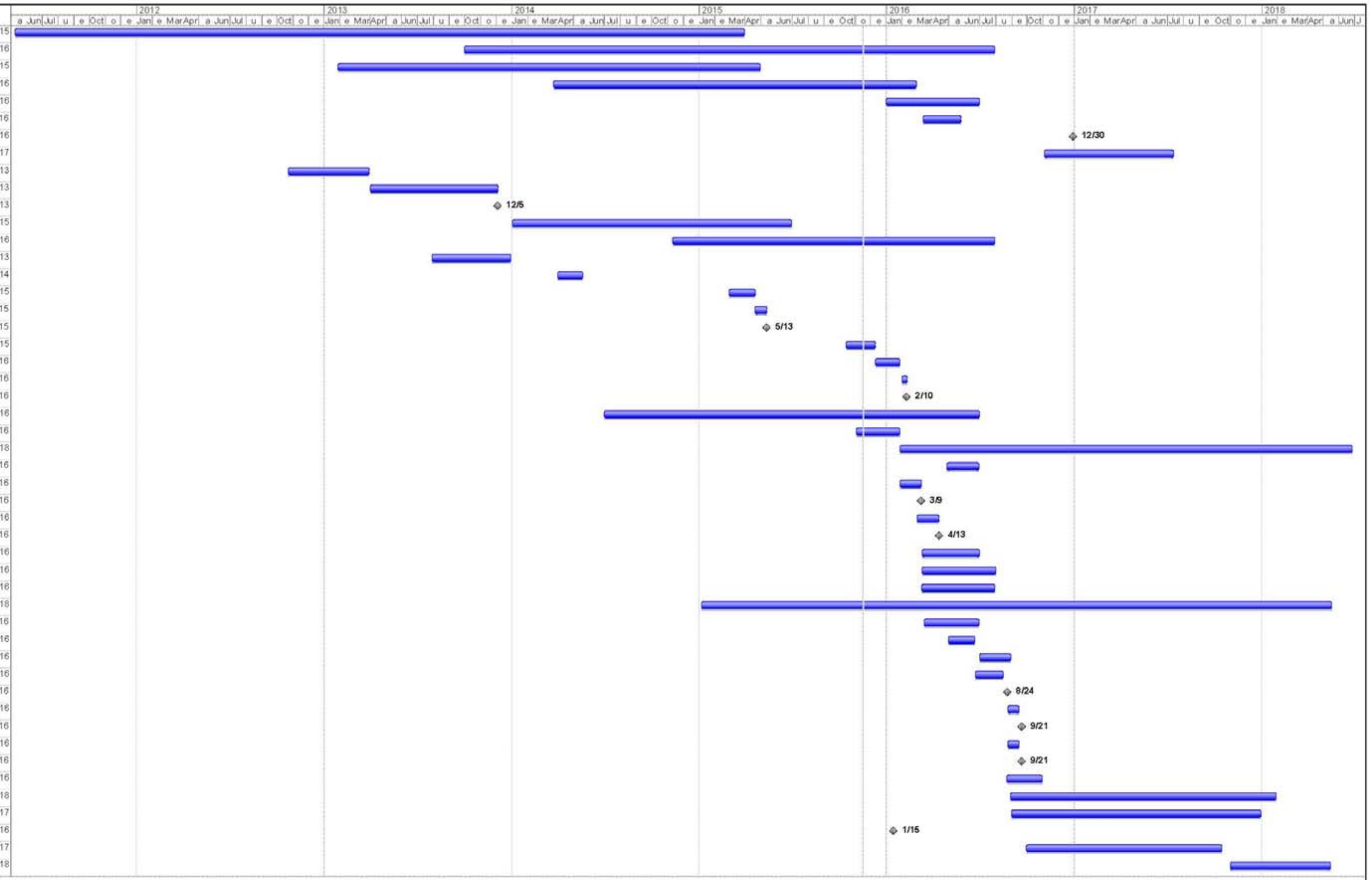
ID	Task Name	Start	Finish
1	Groundwater Study	Tue 5/10/11	Mon 3/30/15
2	Grant Agreement	Tue 10/1/13	Sat 7/30/16
3	Fox Canyon GMA Permit Phase 1	Mon 1/28/13	Thu 4/30/15
4	Fox Canyoun GMA Permit - Phase 2	Mon 3/24/14	Sun 2/28/16
5	RWQCB - NPDES Dewatering Permit	Fri 1/1/16	Thu 6/30/16
6	SWRCB - NPDES Construction Permit	Sun 3/13/16	Wed 5/25/16
7	CDPH - Amend Permit	Fri 12/30/16	Fri 12/30/16
8	CMWD - Brine Connection Permit	Fri 11/4/16	Thu 7/13/17
9	Prop. 84 Grant Application Prep	Tue 10/23/12	Fri 3/29/13
10	Prop. 84 Application Review Period	Mon 4/1/13	Thu 12/5/13
11	Prop. 84 - Results	Thu 12/5/13	Thu 12/5/13
12	Prop. 84 - Agreement Period	Fri 1/3/14	Tue 6/30/15
13	Prop. 84 - Grand Acceptance	Tue 11/11/14	Sat 7/30/16
14	CEQA - Consultant	Tue 7/30/13	Mon 12/30/13
15	CEQA - Draft EIR	Tue 4/1/14	Mon 5/19/14
16	CEQA - Recirculated DEIR (Water)	Sun 3/1/15	Mon 4/20/15
17	CEQA - Final EIR	Mon 4/20/15	Wed 5/13/15
18	CEQA - City Council Approval (FEIR)	Wed 5/13/15	Wed 5/13/15
19	CEQA - Amendment EIR Preparation	Thu 10/15/15	Thu 12/10/15
20	CEQA - Amendment EIR 45-day public review	Fri 12/11/15	Wed 1/27/16
21	CEQA - Amendment Final EIR	Mon 2/1/16	Wed 2/10/16
22	CEQA - City Council Approval (Amended FEIR)	Wed 2/10/16	Wed 2/10/16
23	Property Purchase	Tue 7/1/14	Thu 6/30/16
24	Project Management Team - Selection	Wed 11/4/15	Wed 1/27/16
25	Project Management Team in Place	Thu 1/28/16	Tue 6/26/18
26	Major Equipment Selection/Prepurchase	Thu 4/28/16	Wed 6/29/16
27	Engineering Design Selection - Treatment Facil	Thu 1/28/16	Wed 3/9/16
28	Engineering Design Award - Treatment Facility	Wed 3/9/16	Wed 3/9/16
29	Construction Management - Selection	Tue 3/1/16	Tue 4/12/16
30	Construction Management Award	Wed 4/13/16	Wed 4/13/16
31	Design 30%	Fri 3/11/16	Thu 6/30/16
32	Design - Pipelines	Fri 3/11/16	Mon 8/1/16
33	Design - 2 new wells	Thu 3/10/16	Sat 7/30/16
34	Project Management Plan - Grant Req'd	Tue 1/6/15	Thu 5/17/18
35	Design/Build Contract Development	Tue 3/15/16	Wed 6/29/16
36	Design/Builld Contractor Pre-Qualification	Sun 5/1/16	Tue 6/21/16
37	Financing (Bond Processing)	Fri 7/1/16	Tue 8/30/16
38	Design/Builld - Bid Solicitation	Thu 6/23/16	Mon 8/15/16
39	Design/Build - Bid Award	Wed 8/24/16	Wed 8/24/16
40	Construction Bid - Pipeleine	Thu 8/25/16	Thu 9/15/16
41	Construction Award - Pipeline	Wed 9/21/16	Wed 9/21/16
42	Construction Bid - Wells	Thu 8/25/16	Thu 9/15/16
43	Construction Award - Wells	Wed 9/21/16	Wed 9/21/16
44	Design/Build - Design 100% Treatment Facility	Tue 8/23/16	Sun 10/30/16
45	Construction Administration	Tue 8/30/16	Mon 1/29/18
46	Design/Build - Construction	Thu 9/1/16	Sat 12/30/17
47	Calleguas Brine Completion @ Upland/Lewis	Fri 1/15/16	Fri 1/15/16
48	Connection to Calleguas Brine Line	Fri 9/30/16	Sun 10/15/17
49	Design/Build - Operation	Wed 11/1/17	Tue 5/15/18



Project: Camarillo_Schedule
Date: Mon 11/16/15

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 1

Figure 9-1: NPV Groundwater Desalter Schedule

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10 Non-Monetary Benefits

Over the past decade, much of the City's groundwater supply has shown significant increases in salinity, iron, and manganese. With the observed increasing trend, groundwater production (existing Wells A and B) by the City has been reduced, and reliance on imported water has increased. The proposed NPV Groundwater Treatment Facility will provide treatment to local groundwater supplies and reduce reliance on the current imported water supply. The project will provide several non-monetary benefits to the City as well as to the region, including:

- Diversify and enhance sustainability of the region's water supply portfolio
- Maximize use of local water supplies from the northern area of the Pleasant Valley Groundwater Basin
- Reduce the City's reliance on imported water supply
- Improve water quality of the local groundwater basin by reducing current mounding of poor quality groundwater in the basin
- Watershed salts removal

11 References

Bachman, Steve. North Pleasant Valley Desalter Groundwater Analysis and Modeling Final Report, 2013.

Black & Veatch. City of Camarillo Groundwater Treatment Facility Feasibility Study, 2005.

Black & Veatch. Distribution System Hydraulic Analysis and Groundwater Treatment Facility and Airport Addition, 2007.

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Hopkins Groundwater Consultants. City of Camarillo Preliminary Hydrogeologic Study, 2003.

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Padre Associates, Inc. Draft Environmental Impact Report Environmental Assessment for the North Pleasant Valley Groundwater Treatment Facility, 2014.