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DOMESTIC WATER SYSTEM
2020
WATER GENERAL PLAN

Adopted June 13, 2022
Revised March 31, 2023

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ERRATA SHEET
FOR
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
2020 WATER GENERAL PLAN
JUNE 2022

1. Maps are revised as follows:

   Map 1: Springer Tank capacity changed from 3.0 MG to 2.0 MG

   Map 3: C-Zone No.1 Tank capacity changed from 0.4 MG to 1.0 MG

   Map 4:
   - C-Zone No.1 Tank capacity changed from 0.4 MG to 1.0 MG
   - College Tank capacity changed from 0.6 MG to 0.55 MG
   - College Tank No.2 (0.55 MG) added
   - Gateway Tank (1.0 MG) added

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EXECUTIVE SUMMARY

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The following summary of the Indian Wells Valley Water District's (District or IWVWD) Water General Plan follows the format of the general text, and emphasizes the most important elements of each chapter of the Water General Plan.

I. INTRODUCTION

The District's 2020 Water General Plan is intended to serve as a guide for system improvements during the next 25 to 30 years. Recommended system improvements are based on certain planning assumptions with regard to population growth and community development. If population growth and community development vary from the planning assumptions relied upon, the District may have to advance the construction schedule in order to meet actual demands if they exceed projected demands. Conversely, it may be possible for the District to defer construction of those same facilities if actual demands are less than projected demands.

The District is the primary domestic water purveyor in the Indian Wells Valley, and has a service area of approximately 38 square miles within its boundaries. The District's service area population is currently estimated to be approximately 35,800 people living in 12,600± dwelling units.

The District's existing domestic water system consists of eleven well pumping plants, six booster pumping plants, nine water storage reservoirs, over 1,300,000 linear feet (LF) of water transmission and distribution pipelines, and a radio telemetry system that provides remote monitoring and control capabilities.

II. WATER DEMANDS, PRODUCTION, AND STORAGE REQUIREMENTS

Water demands, production, and storage requirements are set forth in detail in **Chapter II**.

Although it is difficult to accurately predict future water demands and related production requirements, the District anticipates that demands over the next 20 years will increase by an average of approximately 1%/year, as shown in **Chapter II**. Depending on the actual extent of future development and upon the relative success of ongoing water conservation and management measures, the District anticipates no more than a gradual increase in demands and production requirements, and may actually experience a decrease.

The population of the District's service area may increase from about 35,800 persons currently to as many as 43,000 persons by 2045. Correspondingly, the average number of service connections may increase from about 12,600 currently to as many as 15,000 in 2045.

The District's water production averaged about 0.51 acre-feet (AF)/year (Yr)/connection during the five-year-period, 2016 through 2020. The District's conservation efforts have apparently resulted in unit water production requirements that are about 31% lower than they were in 1992-1996.

Based on average per-unit water production over the past five years (0.51 AF/connection), required water production may increase from about 6,300 AF in 2000 to as much as 8,000 AF by 2045.

III. SOURCES OF SUPPLY

Sources of Supply are set forth in detail in **Chapter III**.

The District produces all of its water supply from the Indian Wells Valley Ground Water Basin (hereafter Basin), which is also relied upon by all other producers within the Valley. The Basin has been the subject of a number of investigations and studies, the majority of which conclude that the Basin is in a state of overdraft; ground water levels in some of the areas subject to significant production are declining at a rate of about 1.5 feet/year.

The District is working with the Indian Wells Valley Groundwater Authority (IWVGA) to develop projects to manage basin-wide groundwater consumption and implement groundwater augmentation programs in order to maintain the sustainability of the Indian Wells Valley Groundwater Basin (IWVGB or simply Basin) as a water source for the community.

IV. EXISTING WATER SYSTEM FACILITIES

Existing Facilities are set forth in detail in **Chapter IV**.

The District's existing domestic water system consists of eleven well pumping plants, six booster pumping plants, nine water storage reservoirs, over 1,300,000 LF of water transmission and distribution pipelines, and a radio telemetry system that provides remote monitoring and control capabilities.

The District's existing system comprises five separate pressure zones (A-Zone, B-Zone, C-Zone, D-Zone, and E-Zone), of which the A-Zone is by far the largest, accounting for nearly 80% of total water demands. The system is supplied by eleven well pumping plants with a combined production capacity of approximately 14,000 gallons per minute (gpm). The District's six booster pumping plants have a combined pumping capacity of about 9,300 gpm, and are used to pump water from lower zones to higher zones. The nine storage reservoirs currently in service have a combined storage capacity of 16.5 million gallons (MG). Additional water storage facilities are currently in the initial stages of construction. When completed, these facilities will bring the total to 12 water storage reservoirs with a combined capacity of 18.65 MG.

V. RECOMMENDED WATER SYSTEM IMPROVEMENTS

Recommended water system improvements are set forth in **Chapter V**.

As part of our development of this Plan, we determined the system improvements that would be required to implement a program wherein the District's pumping plants were only operated during Southern California Edison's (SCE's) designated Off Peak periods, thus enabling the District to participate in a program enabling the District to utilize SCE's reduced Off-Peak Power Rates (OPPR). Additional pumping, transmission, and storage capacity would be required to ensure that all pumping took place during off-peak hours. Said facilities are discussed throughout this Plan. However, our analysis ultimately indicated that the cost of constructing and operating such improvements would not be recouped within their service lives, even with the savings achieved in reduced power costs. Therefore, we are not recommending the construction of facilities required to implement a year-round program pf OPPR utilization.

Unless the District desires to proceed with constructing facilities required to take advantage of OPPR, the District's existing production and booster pumping facilities are adequate to satisfy existing and projected demands, but should be replaced at the end of their service lives.

Presently, the District's storage capacity meets minimum storage requirements in all zones except the E-Zone. Minimum storage requirements comprise 20% of Maximum Day Demand for operational storage, fire flow storage in accordance with Kern County Fire Department requirements, and Minimum Emergency Storage of 24 hours of storage at 50% of maximum day demand (100% of average day demand). However, storage in the A-Zone is inadequate to provide Optimum Emergency Storage (24 hours of storage at 100% of maximum day demand; twice the volume of Minimum Emergency Storage) and/or storage to accommodate Off-Peak Power Rate utilization.

The District is initiating construction of additional storage reservoirs in all zones except for A-Zone and D-Zone, after which the storage deficiencies in the E-Zone will be eliminated. Completion of these reservoirs currently in construction, along with the future 3.0 MG A-4 Reservoir and utilization of B-Zone storage facilities to supplement A-Zone, would enable the District to make significant steps towards meeting its optimum storage capacity objectives in the A-Zone, if desired. However, even without construction of the A-4 Reservoir and associated pipeline, substantially more than minimum storage requirements would be achieved in the A-Zone after completion of the reservoirs currently in construction, and the recommended pipeline improvements, by utilizing the supplemental emergency storage available in the B-Zone. This could be accomplished by converting the Springer Flow Control Valve (FCV) Station to a Pressure Reducing Valve (PRV) Station, and making adjustments to the Bowman PRV Station (currently in initial stages of design).

A recommended well replacement program, based on a 50-year service life, is set forth in **Table V-2D.**

Recommended pipeline improvements are set forth, for various conditions of emergency storage and utilization of OPPR, in **Tables V-3A, V-3B, V-3C, and V-4D**, and shown on **Maps 3 and 4**.

These pipeline improvements are intended to (a) enable full use of the Southwest Well Field (SWWF) pumping plants by alleviating pressure spikes in the vicinity of the intersection of Downs

Street and Upjohn Avenue, and (b) to eliminate the lag between the water levels in the Kendall and Bowman reservoirs.

At minimum, we recommend the following pipeline improvements as set forth in **Table V-3A**:

- 30 inch Bowman Road from Brady St. to China Lake Blvd. (10,500 L.F.)
- 24 inch Springer Ave. from Mahan St. to College Heights Blvd. (8,000 L.F.)
- 24 inch Gateway Blvd. from Springer Ave. to Gateway Reservoirs (5,700 L.F.)

The above-listed pipeline improvements, along with recommended improvements to the Springer Flow Control Valve (FCV) Station and the Bowman PRV Station and completion of the storage facilities currently in construction, are suitable for eliminating the lag between the water levels in the Kendall and Bowman reservoirs, eliminating pressure spikes in the B-Zone, and providing Minimum Emergency Storage in the A-Zone without OPPR utilization.

Ultimately, when funds are available, the District should consider construction of the A-4 Reservoir and its associated pipeline, which will provide additional emergency storage for satisfying customer demands after a natural disaster such as fire or earthquake.

VI. RECYCLED WATER

Recycled Water alternatives are discussed in **Chapter VI**.

The District does not currently distribute reclaimed water; and use of recycled water for landscape irrigation within the City of Ridgecrest is currently deemed unlikely. However, the use of recycled water for groundwater replenishment is currently being evaluated by the District and the IWVGA.

CHAPTER I

INTRODUCTION

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INTRODUCTION

A. BACKGROUND, PURPOSE, AND SCOPE

1. Previous General Plans

Krieger & Stewart prepared the District's first Water General Plan in 1977, and supplemented same by preparing a 1985 Water General Plan Addendum. The District's 1990 Water General Plan superseded the 1977 Water General Plan and the 1985 Water General Plan Addendum. The 1990 Water General Plan was superseded by the 1997 Water General Plan, which is now being superseded by the 2020 Water General Plan. The 2020 Water General Plan reflects current conditions within the District's service area based on time-dependent trends which have developed in the intervening years, and also presents projected water requirements and recommended system improvements based on said conditions and trends.

2. General Plan Duration (2045)

The District's 2020 Water General Plan is intended to serve as a guide for system improvements during the next 15 to 25 years, just as the earlier Water General Plans served as guides for system improvements during the past 43 years. Proposed system improvements and related capital expenditures are limited to year 2045, since estimates and projections beyond twenty-five years cannot be made with any degree of certainty. The system improvements recommended herein are considered to be reasonably accurate, particularly through the year 2030; however, the Water General Plan may have to be revised from time to time as conditions and trends change.

B. PROJECT PLANNING AREA

The Project Planning Area constitutes the area wherein the District either already provides or is prepared to provide domestic water service.

1. Historical Service Area Boundary

The District was originally formed as the Ridgecrest County Water District in 1953 to provide water service to the city of Ridgecrest and its environs. The District is situated in the Indian Wells Valley, which lies in the northerly portion of the Mojave Desert, southeasterly of the Sierra Nevada Mountains, and southerly of the Owens Valley; see **Figure I-1**, the Vicinity Map. The District currently serves a population of about 35,800 people through approximately 12,600 service connections.

The District encompasses about 38 square miles of the 360 square mile floor of the Indian Wells Valley. The District's boundary is shown in **Maps 2, 3, and 4**. Of the 38 square miles, approximately eight square miles are public lands (and therefore undevelopable) under the jurisdiction of the United States Bureau of Land Management (USBLM), and slightly more than four square miles are situated within Air Installation Compatible Use Zones (AICUZ) under the jurisdiction of the Naval Air Weapons Station (NAWS) at China Lake. Some of these lands overlap, so there are about ten square miles of land within the District that are unavailable for development.

Existing development primarily occupies the A-Zone, which is situated in the northeasterly portion of the District. It also occupies the B-Zone and higher zones, which are situated southerly, southwesterly, and westerly of the A-Zone. Future development is expected to occur within the A-Zone as infill, and in undeveloped areas within the B-Zone and higher zones.

2. Potential Annexations

The State Water Resources Control Board, Division of Drinking Water (DDW) has provided the District with information on a number of small water systems that the State would like to see annexed by the District. Said systems are as follows:

<u>China Lake Area</u>

- Dune III Mutual Water Company (population 119, 36 residential connections)
- China Lake Acres Mutual Water Company (population 198, 60 residential connections)
- Buttermilk Acres Water System (2 commercial connections)
- Hometown Water Association (population 25, 12 residential connections)
- Sierra Breeze Mutual Water Company (population 150, 60 residential connections)

<u>Inyokern Area</u>

- Inyokern Community Services District (Inyokern CSD) (population 1002, 244 residential connections, 20 commercial connections, 1 irrigation connection)
- East Inyokern Mutual Water Company (population 87, 28 residential connections)
- Gateway Market Water System (2 commercial connections)

<u>South Inyokern Area</u>

- Life Water Co-op (population 27, 18 residential connections)
- Owens Peak West (population 60, 24 residential connections)
- 148 East Water System (population 35, 13 residential connections)
- South Desert Mutual Water Company (population 26, 13 residential connections)
- Owens Peak South (population 40, 17 residential connections)

North Inyokern Area

- West Valley Mutual Water Company (population 70, 41 residential connections)
- Sweet Water Co-op (population 47, 15 residential connections)

At this time, the District only has plans to annex the Dune III Mutual Water Company and Hometown Water Association, which have both requested annexation. These two annexations will be funded with State grant money.

The Groundwater Sustainability Plan developed by the Indian Wells Valley Groundwater Sustainability Agency (see **Chapter III**) includes provisions for preparation of a Shallow Well Mitigation Plan, which will include mitigation measures to relieve impacts of declining water levels to shallow wells owned and operated by rural households, rural domestic/mutual water companies, and small agricultural well-owners. Mitigation measures may include connecting to existing water systems, which could involve annexation of one or more of the above small systems by the District.

The District will consider annexing each of the other small systems listed above if grant funding for the annexation is available.

3. Existing Environment

Ground surface elevations within the District range between 2,250 feet and 3,200 feet above sea level.

Climate in IWVWD's service area and the surrounding Indian Wells Valley is typical of the high desert of Southern California. The area is characterized by periodic high winds, high temperatures often exceeding 100 degrees Fahrenheit (°F) during summer months, and winter lows around 38°F.

The Indian Wells Valley watershed contains about 860 square miles, about 500 square miles in the mountains and hills and about 360 square miles in the valley floor. Average precipitation within the watershed ranges between 5 and 10 inches/year, from less than

5 inches/year in the Ridgecrest/China Lake Area, to about 5 inches/year in the El Paso Mountains to the south, to about 6 inches/year in the Argus Mountains to the east and the Coso Mountains to the north, and to about 10 inches/year in the Sierra Nevada to the west. Most precipitation occurs between October and March; however, short duration thundershowers do sometimes occur during the summer months. Winds of up to 75 miles per hour are known.

About 200,000 AF of precipitation falls annually on the mountains and hills which surround the Indian Wells Valley, and about 100,000 AF of precipitation falls annually on the Valley floor. Of about 300,000 AF of annual precipitation, annual ground water replenishment is estimated in various studies to range between 7,000 and 11,000 acre-feet per year (AF/Yr). See **Chapter III** for a detailed description of the Valley's water resources.

The Indian Wells Valley is one of the more seismically active areas in California. The Garlock Fault Zone (about 20 miles south-southwest) is thought to be capable of a 7.6 moment-magnitude (M_w) earthquake, and the Sierra Nevada Fault Zone (about 12 miles west) is thought to be capable of a 7.1 M_w earthquake. The Little Lake and Airport Lake Fault Zones, which passes through the City of Ridgecrest and the NAWS, are known to be capable of a 7.1 M_w earthquake (see below).

On July 4th and 5th of 2019, a sequence of major earthquakes occurred in the Ridgecrest area. Known as the **2019 Ridgecrest earthquake sequence,** it included three initial main shocks of M_w magnitudes 6.4, 5.4, and 7.1, and many perceptible aftershocks, mainly within the area of the NAWS China Lake. Eleven months later, a M_w 5.5 aftershock took place to the east of Ridgecrest. The M_w 7.1 shock on July 5 was the most powerful earthquake to occur in the state in 20 years. It cut power to at least 3,000 residents in Ridgecrest, and damaged some structures and District facilities.

The shocks took place on a previously unnoticed NE-SW trending fault where it intersects the NW-SE trending Little Lake Fault Zone. The exact fault it occurred on is uncertain, with many small faults encompassing the region, though a United States Geological Survey (USGS) seismologist stated it may have been the Little Lake Fault.

4. Local Economic Influences

Before the 1940s, human activity in the Indian Wells Valley was largely confined to Indians, miners, pioneers, and adventurers. Significant growth began with the rapidly increasing military presence during and immediately after World War II; said military presence was the result of the opening of the U.S. Navy's Naval Ordinance Test Station at China Lake. This facility, which later became the Naval Weapons Center, is now known as the Naval Air Weapons Station (NAWS). Establishment of a military base in the Valley resulted in rapid development of an active on-base community. The town of Ridgecrest was little more than a crossroads and general store in 1943, but began to grow rapidly in the 1950s as the influx of military personnel demanded goods and services beyond what the Navy offered on base.

The economy within the District's boundaries is heavily dependent on the NAWS, and upon the Searles Valley Minerals Inc's (formerly North American Chemical Company (NACC) in 1998 General Plan) soda ash production facility; the latter is located about 25 miles to the east in the Searles Valley. It is also dependent to a lesser extent on other regional enterprises such as mining, irrigated agriculture, geothermal electricity generation, and community support services. The Ridgecrest area is located just a few miles east of Highway 395, which is the main route between population centers of Southern California and recreation opportunities in the eastern Sierra Nevada range and the high desert, and provides food and lodging to numerous travelers. The area experienced growth rates as high as 10%/year during the late 1980s, but the growth rate has declined since about 1991 to levels of less than 1%.

a) Searles Valley Minerals (formerly NACC in 1998 General Plan)

Searles Valley Minerals Inc. (SVMI) is a raw materials mining and production company based in Overland Park, Kansas. It is owned by the Indian company Nirma. It has major operations in the Searles Valley where it is the largest employer of the community of Trona, California. SVMI processes brine solutions from Searles Lake to produce boric acid, sodium carbonate, sodium sulfate, several specialty forms of borax, and salt.

SVMI operates five production wells in the Indian Wells Valley, and extracts approximately 2,700 AF/Yr for use in its minerals recovery and processing operations and for potable use in the small communities of Trona, Westend, Argus, and Pioneer Point in the Searles Valley.

b) China Lake NAWS

The U.S. Navy produces and distributes groundwater for the on-station water uses at the NAWS China Lake. However, the majority of Navy-affiliated staff reside off-station, and the water supply needs of the off-station Navy-affiliated staff and their dependents are supplied by either the Water District, Inyokern CSD, or by privately-owned domestic wells.

In October 2018, the Navy estimated its short-term future water needs on the installation to be approximately 2,041 AF/Yr, which includes a 25% increase in current water use.

C. EXISTING WATER SYSTEM FACILITIES

The District's existing potable water supply system consists of the following: eleven well pumping plants with a combined pumping capacity of 14,000 gpm; nine water storage reservoirs with a combined storage capacity of 16.5 MG; six booster pumping plants with a combined pumping capacity of 9,300 gpm; and over 1,300,000 LF of pipelines with diameters varying between 4 and 30 inches. The District monitors and controls its system through a radio telemetry system. **Table I-1** presents a current inventory of the District's existing well pumping, booster pumping, and storage facilities.

TABLE I-1
EXISTING WELL PUMPING, BOOSTER PUMPING, AND STORAGE FACILITIES

WELL PUMPING FACILITIES	
WELL NO.	PUMPING CAPACITY (gpm)
Well No. 9A	1,000 *
Well No. 10	1,100 *
Well No. 11	1,200
Well No. 13	1,200
Well No. 17	1,200
Well No. 18	1,200
Well No. 30	1,400
Well No. 31	1,200
Well No. 33	1,200
Well No. 34	2,000
Well No. 35	1,200
Total:	13,900

BOOSTER PUMPING FACILITIES	
NAME	PUMPING CAPACITY (gpm)
College	1,200
Gateway	1,400
Salisbury	600
Sunland	2,700
Vulcan	1,900
Ridgecrest Heights	1,500
Total:	9,300

STORAGE FACILITIES	
NAME	STORAGE CAPACITY (gallons)
Bowman No. 1	2,000,000
Bowman No. 2	5,000,000
Ridgecrest Heights	3,000,000
Kendall	2,000,000
Gateway	550,000
C-Zone No. 2	1,000,000
D-Zone No. 2	400,000
College	550,000
Springer	2,000,000
Total:	16,500,000

* Normal production is as noted; however, District can produce 1,400 gpm with special operation modifications.

During the 23-year period since the 1997 Water General Plan was prepared, the District has constructed significant improvements to its system, including four well pumping plants, two arsenic removal plants, three water storage reservoirs (with a combined capacity of 3.4 MG), a pressure reducing station, over 157,000 LF of 30 inch, 24 inch, 16 inch, and 12 inch diameter transmission pipeline, and about 93,000 LF of 8 inch and 6 inch diameter distribution pipelines; the latter generally replaced existing distribution pipelines that had deteriorated and were leaking significant quantities of water. The District is also in the process of replacing its telemetry system with a new system featuring considerably enhanced monitoring and control capabilities.

The recent additions to the District's system have provided significant improvements in terms of operational flexibility, and have also enabled the District to operate some of its production wells during off-peak electricity consumption hours. The District's production capacity and storage capacity both now exceed the historic maximum day water demand. In addition, the District's leak detection and distribution pipeline replacement program has enabled it to significantly reduce water system losses.

The District operates, maintains, and improves its water system so that it is capable of meeting demands for existing and continuing land development, and corresponding increases in population. System improvements are constructed as needed to provide continued service to existing customers and to future customers. Facilities are designed and constructed to accommodate weather and terrain extremes, meet existing seismic requirements, and provide basic water service. The system improvements recommended herein are intended for development of those water supply facilities and water service facilities that are required to meet immediate as well as long range demands, all in accordance with current land use general plans and zoning maps.

1. Pressure Zones

The District's domestic water system is divided into five pressure zones (A-Zone, B-Zone, C-Zone D-Zone, and E-Zone), which provide service at elevations between 2,230 feet (at the NAWS) and 2,780 feet (at Cerro Coso Community College). About 74% of the water served by the District is delivered to customers in the 2,455 Pressure Zone (A-Zone), and about 18% is served within the 2,555 Pressure Zone (B-Zone).

2. Well Pumping Plants

All water served by the District is produced from ground water extraction wells. The District's system presently has eleven active well pumping plants. All well pumping plants in the District's system are equipped with electric motor driven deep well turbine pumping units, and can be controlled automatically and remotely.

3. Booster Pumping Plants

The District currently operates six booster pumping plants, including: Sunland B-Zone, Vulcan B-Zone, Gateway C-Zone, Ridgecrest Heights C-Zone, Salisbury D-Zone, and College E-Zone.

All booster pumping plants are equipped with electric motor driven close coupled vertical turbine pumping units, except for the Ridgecrest Heights booster pumping plant which is equipped with electric motor driven end suction pumping units.

4. Treatment Facilities

The District currently operates two arsenic treatment facilities, to remove arsenic from groundwater produced by Well Pumping Plants 9A, 10, 11 and 13.

5. Water Storage Facilities

There are nine water storage reservoirs in the District's currently in service in the existing system, with a combined capacity of approximately 16.5 MG. The District's reservoirs are located on eight separate sites, and have capacities ranging from 0.4 MG to 5.0 MG. All of the District's existing reservoirs currently in service are welded steel tanks. The District also has two bolted steel tanks which were damaged in the July 2019 earthquakes and have been off-line since then.

After the 2019 Ridgecrest Earthquake, which damaged several District reservoirs, the District began design of additional storage facilities to replace damaged facilities and provide additional emergency storage. These additional water storage facilities are currently in the initial stages of construction, as follows:

- Construction of a new 1.0 MG reservoir at the Gateway site (B-Zone)
- Replacement of the existing, damaged 0.4 MG reservoir with a new 1.0 MG Reservoir (C-Zone)
- Construction of a new 0.55 MG reservoir at the College site (E-Zone)

When completed, these facilities will bring the total to twelve water storage reservoirs with a combined capacity of approximately 18.65 MG.

Replacement of the existing 0.1 MG reservoir with a new 0.1 MG reservoir at Salisbury site (D-Zone) was initially proposed for construction along with the above-listed facilities, but it was deferred to a later date.

6. Transmission and Distribution Pipelines

There are more than 1,300,000 LF of pipelines within the District's existing domestic water system. The District currently requires new pipelines to be at least 8 inches in diameter, and should replace pipelines smaller than 8 inches in diameter from its inventory as budget permits, in order to improve operating conditions and increase fire flow capability. The District's pipelines are constructed of steel pipe, cement mortar lined/cement mortar coated welded steel pipe (CML/CMC/WSP), asbestos cement pipe (ACP), and polyvinyl chloride pipe (PVCP).

7. Emergency Interconnections to NAWS and SVMI

The District has emergency interconnections with the Navy and with SVMI. The interties are tested annually.

According to testing performed in May 2019, the capacity of the Navy intertie is approximately 1,300 gpm from the Navy to the District, and approximately 2,000 gpm from the District to the Navy.

According to testing performed in April 2019, the capacity of the interconnection at SVMI Well 35 is approximately 750 gpm from the District to SVMI. The District cannot accept water from the SVMI interconnection because SVMI water is not chlorinated until further downstream.

D. ENERGY SUPPLY

1. Energy Providers

The District purchases electric power from the Southern California Edison Company (SCE) and natural gas from the Pacific Gas and Electric Company (PG&E). Both SCE and PG&E are regulated by the California Public Utilities Commission (CPUC).

2. Solar Power Project (Wells 30, 31, and 34)

In 2016-2017, The District installed fixed-tilt solar panel arrays at the sites of six existing District facilities, as follows:

- Wells 9A/10 and Arsenic Treatment Plant No. 2 Site
- Well 30 Site
- Well 31 Site
- Well 33/18 Site
- Well 34 Site
- District Office Site

The District added the Well 35 site to the above list in 2021.

Each site includes a fixed-tilt photovoltaic solar panel array and alternating current (AC) wire and conduit that serves to provide solar-generated electrical power to the facilities thereon.

Approximate power generation at each site is set forth in **Table I-2** below:

TABLE I-2
IWVWD SOLAR PROJECT
ANTICIPATED POWER GENERATION
(IN KILOWATTS, KW)

Site	Number of PV Modules	Power (kW)
Wells 9A/10 and Arsenic Treatment Plant No. 2	1,100	343
Well 30	2,900	915
Well 31	900	286
Well 33	1,100	343
Well 34	500	150
Well 35	396	120
IWVWD Office	150	43

Note: Based on information provided by OpTerra Energy Services

Solar facilities at the Well 30 site are intended to provide power to Well 30, and are on a Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) program rate schedule. With this rate schedule, any power generated at this solar facility in excess of power needed to serve Well 30 is transferred to SCE, and the District receives a credit transfer for said excess power generated. The credit transfer may be used toward the District's costs associated with providing power to Wells 11, 13, and 17; Arsenic Treatment Plant No. 1; and the Gateway, Salisbury, C-Zone, and RCH Boosters.

The solar facilities proposed at the Well 33 site are intended to provide power to Well 33 and Well 18, and are on a Net Energy Metering (NEM) rate schedule. With a NEM rate schedule, power generated by the solar facilities at the Well 33 site is dedicated to operation of District facilities at Wells 33 and 18, and no credit transfer is available. Solar facilities proposed at the Wells 9A/10 and Arsenic Treatment Plant No. 2 site, the Well 31 site, the Well 34 site, the Well 35 site, and the IWVWD Office site are also on the NEM rate schedule, meaning that they provide power only to the facilities on the site on which they are located, and no credit transfer is available.

Water General Plans prepared by Krieger & Stewart for the District previous to 1997 included a chapter dedicated to energy supply and its impact on planning of new facilities and operation of existing facilities. Those energy supply chapters addressed the District's historic use of electrical energy, and evaluated the potential benefits of modifying District facilities and operations to include use of both electricity and natural gas. The past analyses were possible because the providers for each (SCE for electricity and PG&E for natural gas) had published rates for their products, and each used their own distribution facilities to make delivery to the District.

Given the deregulation of the power industry in the 1990s and the resulting growth in the number of competitive suppliers, the power purchase horizon is too unpredictable to make accurate assessments of rates and the most appropriate use of available energy supplies at this time. However, because energy purchases remain one of the largest components of the District's operating budget, the District will continue to actively pursue the most cost-effective purchasing strategy for both electricity and natural gas through organizations like the Association of California Water Agencies' ACWA-USA.

This Water General Plan contains references to Off-Peak Power Rates (OPPR) energy use (i.e. avoiding power consumption during on-peak demand periods), which is likely to remain a component of the power purchasing world (regardless of provider) in some fashion.

E. PLAN PREPARATION

Preparation of the Water General Plan involved the following:

- Conferences with District staff
- Review of District data and records
- Inspection and evaluation of existing water system facilities
- Review of District's GIS database for preparation of hydraulic network model
- Gathering and review of available population data including projections
- Gathering and review of existing and proposed land use data
- Determination of future water requirements
- Evaluation of existing water system facilities
- Determination of required water system improvements (including hydraulic modeling)
- Development of estimated improvement capital costs
- Establishment of improvement construction schedule
- Summary of findings
- Workshops with the District's Board of Directors and public attendees.

Water production, water storage, and water delivery data developed and collected by the District proved particularly helpful. Production and storage data are now collected with sufficient accuracy to permit more reliable determination of peak demands in addition to maximum day, maximum month, and average annual demands.

F. AUTHORITY

The District was organized in 1953 in accordance with State of California County Water District Law (California Water Code Section 30000 et seq.) for the purpose of providing domestic water supplies. The District is empowered to manage water resources and to construct, operate, maintain, repair, and replace water system facilities as needed to provide water service in compliance with applicable standards and regulations. The District routinely constructs new facilities, maintains them, and replaces them as necessary to maintain adequate, reliable, and safe water service to its customers.

G. ABBREVIATIONS AND DEFINITIONS

Since the District's 2020 Water General Plan incorporates a number of abbreviations and terms which may be unfamiliar, the following explanations are set forth for the reader's convenience.

1. Abbreviations

°F	degrees Fahrenheit
AC	alternating current
ACP	asbestos cement pipe
AF	acre-feet AF
AF/Yr	acre-feet per year
AICUZ	Air Installation Compatible Use Zones
AVEK	Antelope Valley-East Kern Water Agency
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	Consumer Confidence Report
CDHS	California Department of Health Services
CDWR	California Department of Water Resources

CEQA	California Environmental Quality Act
City WWTF	City of Ridgecrest Wastewater Treatment Facility
CML/CMC/WSP	cement mortar lined/cement mortar coated welded steel pipe
CPUC	California Public Utilities Commission
DDW	State Water Resources Control Board, Division of Drinking Water
District or IWVWD	Indian Wells Valley Water District
EIR	environmental impact report
FCV	Flow Control Valve
gpcd	Gallons per Capita per Day
gpm	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
hp	horsepower
Inyokern CSD	Inyokern Community Services District
IPR	Indirect Potable Reuse
IWVGA	Indian Wells Valley Groundwater Authority
IWVGB or simply Basin	Indian Wells Valley Groundwater Basin
KCWA	Kern County Water Agency
KernCOG	Kern Council of Governments
kW	Kilowatts
LADWP	Los Angeles Department of Water and Power
LF	Linear Feet
MCL	Maximum Contaminant Level
MG	Million Gallons
mg/L	milligrams per liter
MGD	million gallon per day
Mw	moment-magnitude
MWD	Metropolitan Water District of Southern California
NACC	North American Chemical Company
NAWS	Naval Air Weapons Station
ND	None Detected
NEM	Net Energy Metering

NWWF	Northwest Well Field
OPPR	Off-Peak Power Rates
PRV	Pressure Reducing Valve
PG&E	Pacific Gas and Electric Company
ppm	parts per million
psi	pounds per square inch
PVCP	polyvinyl chloride pipe
RES-BCT	Renewable Energy Self-Generation Bill Credit Transfer
RO	reverse osmosis
SCE	Southern California Edison Company
SGMA	Sustainable Groundwater Management Act
SVMI	Searles Valley Minerals Inc.
SWP	State Water Project
SWWF	Southwest Well Field
TDS	Total Dissolved Solids
TOU	Time-of-Use
USBLM	United States Bureau of Land Management
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WSIP	Water Supply Improvement Plan
WWTF	wastewater treatment facilities
Yr	year

2. Definitions

a. Acre-Foot or Acre-Feet

When discussing water quantities, an acre-foot is the quantity of water required to cover one acre (43,560 square feet) to a depth of one foot. An acre-foot is 43,560 cubic feet, or 325,850 gallons, of water.

b. Artificial Ground Water Recharge (also Artificial Recharge)

The intentional use of imported water or recycled water to recharge/replenish ground water supplies. Artificial ground water recharge is usually accomplished by the construction of either infiltration/percolation basins or injection wells; the former accomplish recharge by allowing water to infiltrate and percolate to ground water, while the latter directly inject water into the ground water body.

c. Basin Sustainable Yield (also Sustainable Yield)

The maximum quantity of groundwater that can be withdrawn annually without causing undesirable results. According to the Groundwater Sustainability Plan, the Basin Sustainable Yield for the Indian Wells Valley Groundwater Basin is currently 7,650 AF/Yr (to be re-evaluated every five years).

d. Conjunctive Water Use (also Conjunctive Use)

The use of two or more water sources in conjunction with each other. Generally, conjunctive use consists of the use of ground water supplies together with surface water supplies, the latter consisting of either local water (i.e. from streams or lakes), imported water, or recycled water. Conjunctive use can take many forms; for instance, ground water can be used for domestic supply at the same time that recycled water is used for irrigation purposes. The intent of conjunctive use is to ensure balanced use (thereby maintaining ground water levels) over the long term, with surface water supplies used during periods of increased precipitation, and ground water supplies used during periods of limited precipitation (e.g. critically dry or drought years).

e. Consumptive Water Use/Nonconsumptive Water Return (also Consumptive Use/Nonconsumptive Return)

Consumptive water use is that portion of each unit of water that is actually used by the consuming organism (e.g. animal or plant) or is carried away into the atmosphere by evapotranspiration or evaporation. The portion that is unused and is returned to the ground water body is referred to as nonconsumptive water return. Both are usually expressed as an estimated percentage of water consumption or production. For example, if 1,000 gallons of water were applied to turf in an area with 60% consumptive use and 40% nonconsumptive return, 600 gallons would be considered consumed and therefore unavailable for ground water recharge, while the remaining 400 gallons would be considered recharge to the ground water body.

f. Ground Water Basin (also Basin)

An underground water body that is confined by various types of impermeable geologic structures, such as significant upthrusts of subterranean bedrock (known as barriers) or mountain ranges. The District's boundaries overlie the Indian Wells Valley Basin.

g. Groundwater Overdraft (also Overdraft)

According to California Department of Water Resources (CDWR) Bulletin 160-09 (2009 California Water Plan Update), overdraft is defined as "the condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions." For example, producing an average of 2,500 AF/Yr from a basin that is only recharged with an average of 1,500 AF/Yr results in groundwater overdraft of 1,000 AF/Yr. Groundwater overdraft is sometimes referred to as "groundwater mining."

According to CDWR Bulletin 118-80 (Groundwater Basins in California), overdraft conditions in a basin become *critical* when "…continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts."

SGMA relies on the definitions of "overdraft" and "critical overdraft" summarized in CDWR Bulletins 180-09 and 118-80, but includes a consideration of groundwater management in its definition of "long-term overdraft" as follows:

"The condition of a groundwater basin where the average annual amount of water extracted for a long-term period, generally 10 years or more, exceeds the long-term average annual supply of water to the basin, plus any temporary surplus. Overdraft during a period of drought is not sufficient to establish a condition of long-term overdraft if extractions and recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods."

h. <u>Imported Water</u>

Water that is brought into an area from an external source. One of the primary sources of imported water in Southern California is the State Water Project (SWP), which conveys water to the region from Northern California through the system of storage reservoirs, power generating stations, pumping stations, canals, and pipelines known as the California Aqueduct.

i. <u>In-Lieu Ground Water Recharge (also In Lieu Recharge)</u>

A method for decreasing the rate of ground water extractions. In-lieu ground water recharge (hereafter referred to as in-lieu recharge) consists of substituting other sources of water supply (such as imported water or recycled water) for ground water.

j. <u>Natural Ground Water Outflow (also Natural Outflow)</u>

The process by which ground water basins/subbasins are naturally depleted. Generally, natural ground water outflow (hereafter referred to as natural outflow) consists of seepage from one basin to an adjacent basin, the latter of which has a lower water level. Natural outflow also occurs when ground water reaches ground surface and evaporates, a common phenomenon at dry lake beds in California deserts.

k. Natural Ground Water Recharge (also Natural Recharge)

The process by which ground water supplies are naturally replenished. Natural ground water recharge (hereafter referred to as natural recharge) consists of water infiltrating the ground surface and percolating to ground water. There are several sources of natural recharge, such as precipitation, runoff, rivers, and lakes.

l. Normal Operation

Operation of the water system without intentional utilization of Off-Peak Power Rates (OPPR).

m. Off-Peak Power Rates (OPPR)

A program of reduced electric power rates offered by Southern California Edison (SCE) for power consumption that is confined to off-peak hours. Consistent operation of the water system to take advantage of SCE's OPPR program requires that pumping plant equipment (e.g. well and booster pumping plants) be shut off during peak energy demand periods. Consequently, additional pumping, storage, and transmission capacity is required.

n. Pumping Depression

A localized reduction in ground water levels that results from ground water extraction.

o. Recycled Water

Treated wastewater that is then filtered and disinfected (to remove disease-causing organisms such as bacteria, viruses, *Cryptosporidium*, and *Giardia lamblia*), and, if necessary, has been subjected to advanced treatment to remove such constituents as nitrogen and total dissolved solids (TDS), to an extent that allows it to be used for various purposes, such as irrigation of food crops, golf courses, and greenbelts, or groundwater recharge.

p. Specific Yield

That portion of the water bearing geologic structure (referred to as the saturated zone) of a ground water basin or subbasin that consists of extractable water; usually expressed as a percentage. For example, if the saturated zone of a ground water subbasin consists of 1,000,000 AF of saturated geologic deposits (e.g. sands, gravels, boulders) and the estimated specific yield is 15%, the quantity of extractable ground water is estimated to be 150,000 AF (1,000,000 x .15 = 150,000). It should be noted that specific yield is always expressed as an average (since geologic conditions can vary considerably within basins and subbasins), and represents an estimate only.

q. Zone of Influence

In the context of ground water production, the area within an aquifer that experiences some reduction in ground water levels as a result of the extraction of water from a well through the operation of a well pumping plant. The zone of influence is the entire area within a specific well's pumping depression.

TABLE I-3
CONVERSIONS

WEIGHT

1 gal fresh water	=	8.34 lbs	1 gal sea water	=	8.57 lbs
1 cu ft fresh water	=	62.42 lbs	1 cu ft sea water	=	64.13 lbs

PRESSURE

1 atm = 14.697 psi = 33.90 ft of water = 29.92 in of mercury
1 psi = 0.0680 atm = 2.3071 ft of water = 2.0359 in of mercury
1 ft of water = 0.4334 psi = 62.42 psf
1 in of mercury = 1.133 ft of water

FLOW

1 gpm = 0.002228 cfs = 60.0 gph = 1,440.0 gpd = 0.00442 AF/day
1 gph = 0.00003713 cfs = 0.0167 gpm = 24.0 gpd = 0.0000736 AF/day
1 cfs = 7.4805 gps = 448.83 gpm = 26,929.8 gph = 646,315.2 gpd
1 cfs = 0.9917 ac in/hr = 0.0826 AF/hr = 1.9835 AF/day
1 cfs = 50.0 MI (Miners Inch*)
1 MI = 0.1496 gps = 8.9766 gpm = 538.6 gph = 12,926.3 gpd
1 MI = 0.02 cfs = 1.2 cfm = 72 cfd = 0.0397 AF/day
1 AF/day = 0.5042 cfs = 30.25 cfm = 1,815.0 cfh = 43,560.0 cfd

VOLUME

1 gal = 231.0 cu in = 0.1337 cu ft = 0.000003069 AF
1 cu ft = 1,728.0 cu in = 7.4805 gal = 0.000022957 AF
1 acre in = 27,154.25 gal = 3,630.0 cu ft = 0.0833 AF
1 AF = 43,560.0 cu ft = 325,851.4 gal = 12.0 acre in
1 AF = 605.0 MI hr (Miners Inch hour*) = 25.21 MID (Miners Inch Day*)
1 MI hr = 538.6 gal = 72.0 cu ft = 0.001653 AF
1 MID = 12,926.3 gal = 1,728.0 cu ft = 0.0397 AF

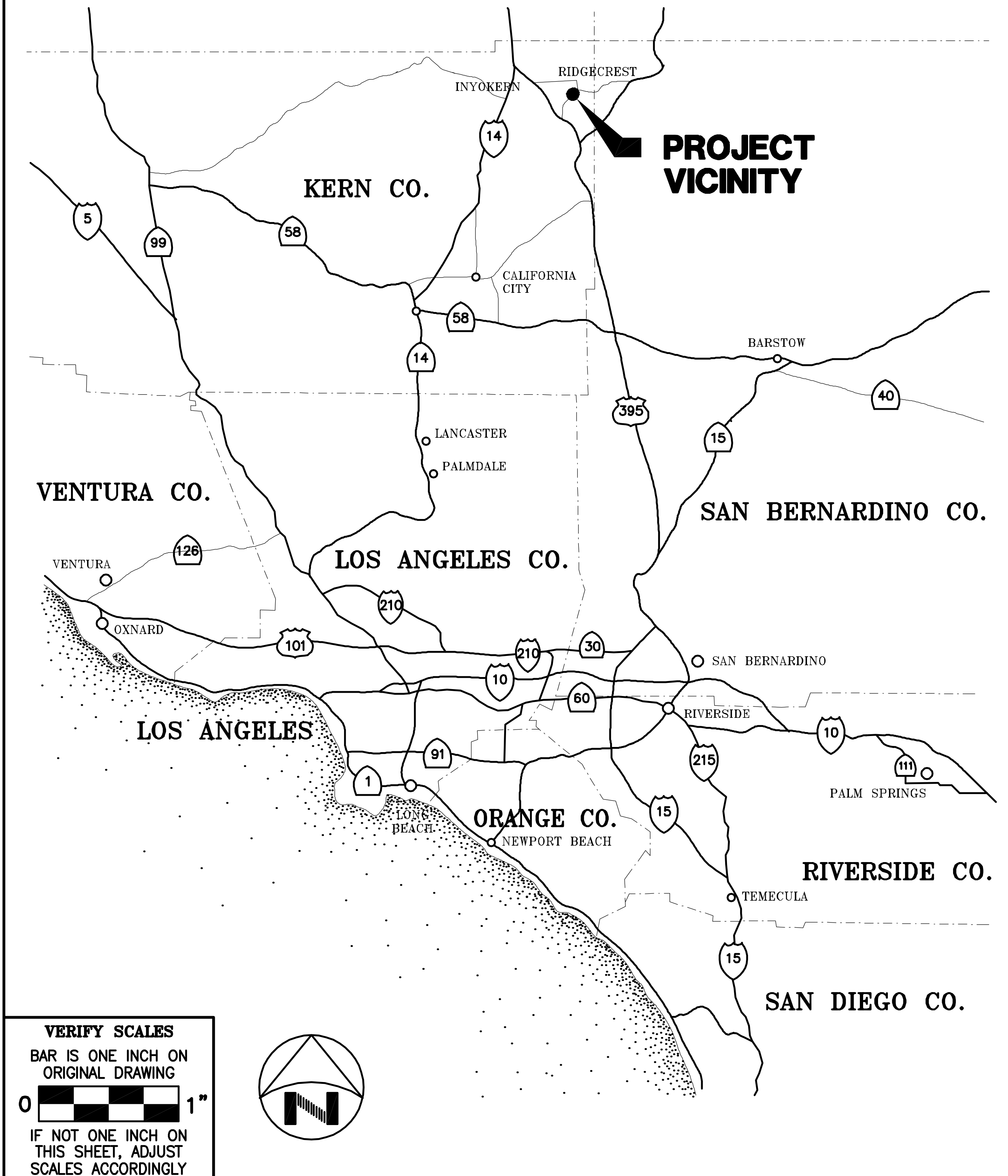
POWER

1 hp = 0.7457 kW = 6,532.3 kWh/yr = 8,760.0 hp hr/yr
1 kW = 1.3405 hp = 8,760 kWh/yr = 11,742.8 hp hr/yr

* Southern California Miners Inch, Miners Inch Hour, and Miners Inch Day, as indicated.

DEFINITIONS

District	Indian Wells Valley Water District
Consumption	Water delivered to customer, measured at service connection
Per Capita Consumption	Water consumption per permanent resident served
Per Capita Production	Water production per permanent resident served
Production	Ground water extractions (pumped water), measured at source of supply
Project Cost	The value in 2020 dollars for facilities including construction cost, 20% allowance for construction contingencies, and 15% allowance for administration, legal, and engineering costs
Service Area	The area within the Indian Wells Valley Water District where service is and can be provided
Service Connection	Connections between domestic water system and customer facility plumbing, consisting of valves, piping, and meter
Unit Consumption	Water consumption per active service connection
Unit Production	Water production per active service connection



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INDIAN WELLS VALLEY WATER DISTRICT

2020 WATER GENERAL PLAN UPDATE

PROJECT VICINITY

FIGURE 1 OF 1

SCALE: N/A DATE: 04/21/22 DRAWN BY: SPK CHECKED BY: DFS W.O.: 178-148

178-148_f1.dwg

CHAPTER II

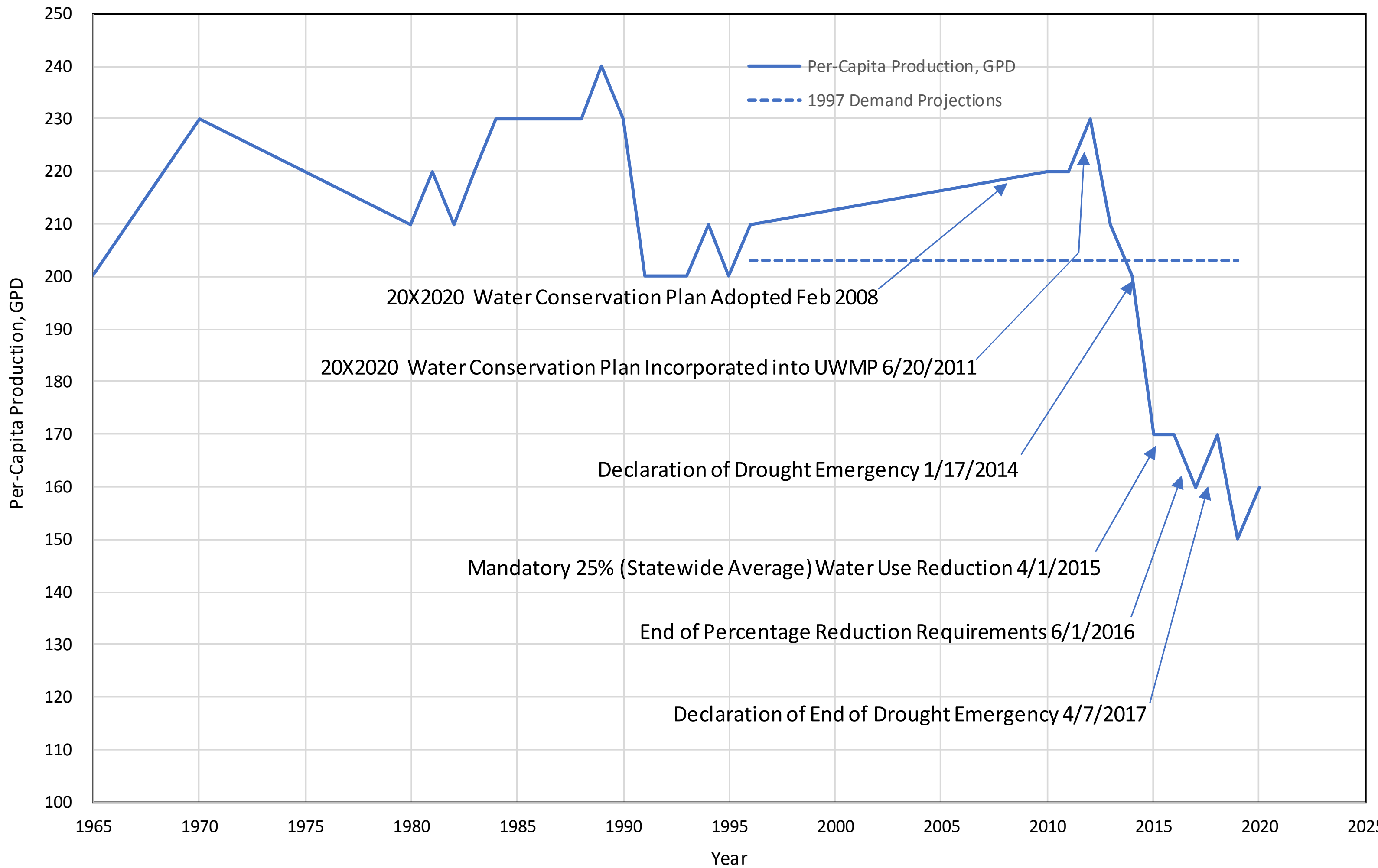
WATER DEMANDS, PRODUCTION, AND STORAGE REQUIREMENTS

CHAPTER II
WATER DEMANDS, PRODUCTION, AND STORAGE REQUIREMENTS

Annual water production within the District's service area increased steadily over the 30 years prior to the 1997 Water General Plan, increasing from about 1,300 AF in 1965 to about 8,500 AF in 1996; but then leveled off until about 2013, then declined slightly through 2020. The highest annual total water production during the last 10 years was 7,633 AF, occurring in 2012 (compare to the highest annual total production in the 30 years prior to the 1997 Water General Plan; 8,770 AF, occurring in 1989). The recent decline in water production occurred despite an 11% service area population increase during the same time period; from about 31,400 persons to about 35,800 persons. Decreased water production is essentially attributable to the District's water conservation efforts, as detailed in the District's 2020 Urban Water Management Plan (UWMP). The changes in water production and population is generally illustrated by **Table II-1**, which sets forth historic water production and consumption.

As indicated on **Table II-1**, per capita water production has ranged between about 0.26 AF/Yr in 2012 and about 0.18 AF/Yr in 2020. Unit water production has correspondingly ranged between about 0.65 AF/Yr/connection in 2012/13 and about 0.50 AF/Yr/connection in 2020. Unit water production averaged about 0.51 AF/Yr/connection during the five-year-period, 2016 through 2020. Changes in per-capita production since 1965 are illustrated in **Figure II-1**. Note the significant declines in per-capita production that have occurred since 2013.

FIGURE II-1
PER-CAPITA PRODUCTION
(GPD)



New connections have, in the past, increased at a rate of about 5% per year, but have increased at a rate of less than 1% per/year since 1991. Due to aggressive conservation efforts, unlined steel pipeline replacement and meter replacement programs,[1] and a tiered rate structure for consumption, the District's total annual water production decreased by 17% between 2010 and 2020, even though the number of connections increased by about 58 (or 0.5%) during the same period, as shown in **Table II-1.**

The projected water demands and production requirements that are set forth herein are based on projected populations, planned land uses, and pertinent water production and consumption data, as well as population, planning, and water use data contained in the prior Water General Plans. The projected water production requirements, which are considered representative of expected water uses based on current development trends and current water use goals, were used to determine existing system deficiencies and to establish required system improvements, both present and future.

A. SERVICE AREA PROFILE

The District's present service area has about 35,800 residents, a small commercial and industrial sector, and limited agricultural activity. About 76% of the water served by the District is distributed to single family and multi-family residential services. **Table II-2** (below) shows the total number of customers served by the District in 2018, and is arranged by customer type. **Table II-3** (at the end of this chapter) shows past, current, and projected water demands, and is also organized by customer type; please note that the projections are based on an average increase in demands of approximately 1%/year.

[1] The District is replacing all meters that are older than 15 years, which is approximately 2/3 of the meters, over the next 3 years. Approximately 1,000 meters have been replaced since the beginning of the program in May 2021. After this initial replacement effort has been completed, the District plans to develop an ongoing replacement plan to replace approximately 800 meters per year to ensure that all meters in the District's service area are functioning within their 15-year useful life.

TABLE II-2
2018 SERVICE AREA PROFILE

CUSTOMER TYPE	SERVICES	% OF TOTAL SERVICES
Single Family	11,697	91.28%
Multi Family	350	2.73%
Commercial	638	4.98%
Other*	64	0.50%
Inactive connections	66	0.52%
Total:	12,815	100.00%

* Fire suppression, street cleaning, line flushing, construction meters and temporary meters.

1. Residential Sector

Residential customers are currently estimated to average about 2.84 persons/connection, with an average consumption rate of 150-160 gallons/capita/day (gpcd). Water efficiency improvements have substantially reduced per capita water use, which was estimated at approximately 220 gpcd in 2010. Growth in the residential sector is expected to be moderate over the span of this Water General Plan.

2. Commercial Sector

The District has a complex mix of commercial customers, ranging from family restaurants, insurance offices, beauty shops, and gas stations to hotels and motels, shopping centers, and high-volume restaurants and other facilities that serve the non-resident population. The commercial sector continues to expand gradually each year, and some growth is expected to continue to occur over the span of this Water General Plan.

3. Industrial Sector

The District serves a small industrial sector, primarily centered on light manufacturing. The industrial sector has not grown much in the last several decades, and is not expected to increase significantly over the span of this Water General Plan.

4. Institutional/Governmental Sector

The District has a stable institutional/governmental sector, primarily local government, schools, visitor-serving public facilities, and a public hospital. This sector is not expected to increase significantly over the span of this Water General Plan.

5. Landscape/Recreational Sector

Landscape and recreational customer demand is expected to increase gradually over the span of this Water General Plan, due to continued growth in visitor-serving facilities.

B. POPULATION PROJECTIONS

1. Historic and Current Population

The population within the District's existing service area has increased sporadically over the past several years (see **Table II-1, below**); with an average annual increase of about 1.5% since 2010.

TABLE II-1
HISTORIC WATER PRODUCTION AND CONSUMPTION, 2010-2020

YEAR	AVERAGE SERVICE CONNECTIONS (EA)	POPULATION SERVED (PERSONS)	WATER PRODUCTION (AF)	WATER CONSUMPTION (AF)	PRODUCTION/ CONSUMPTION RATIO	PRODUCTION		
						UNIT	PER CAPITA	
						AF/CONN	AF/YR	GPD
2010	12,544	31,355 (1)	7,570	Not available	---	0.60	0.24	220
2011	12,043	30,108 (2)	7,364	Not available	---	0.61	0.24	220
2012	11,691	29,228 (2)	7,633	Not available	---	0.65	0.26	230
2013	11,600	32,364 (3)	7,534	5,610	1.343 (8)	0.65	0.23	210
2014	11,629	32,445 (3)	7,319	7,473 (6)	0.979 (7)	0.63	0.23	200
2015	11,677	32,605 (4)	6,244	6,171 (6)	1.012	0.53	0.19	170
2016	11,771	33,430 (5)	6,381	6,129 (6)	1.041	0.54	0.19	170
2017	12,418	35,267 (5)	6,507	5,938	1.096	0.52	0.18	160
2018	12,685	36,025 (5)	6,765	6,380 (6)	1.060	0.53	0.19	170
2019	12,644	35,913 (5)	6,116	5,190	1.178 (8)	0.48	0.17	150
2020	12,602	35,800 (4)	6,311	5,738	1.100 (8)	0.50	0.18	160

(1) Population is from 2015 Urban Water Management Plan, and is based on KernCOG data for Kern County portion of service area, plus 220 for San Bernardino County.

(2) Estimated population based on 2.50 persons per average service connection (31,355 persons/12,544 average service connections=2.50 for 2010).

(3) Estimated population based on 2.79 persons per average service connection (32,605 persons/11,677 average service connections=2.79 for 2015).

(4) Population is based on KernCOG data for Kern County portion of service area, plus number of connections in San Bernardino County x Ridgecrest average dwelling occupancy per U.S. Census data.

(5) Estimated population is based on 2019 total occupancy of 2.84 persons per average service connection (35,800 persons/12,602 average service connections=2.84 for 2020).

(6) Reported consumption data was missing data for other than residential, commercial and industrial. Assumed value of 307 AF (100 MG) has been added.

(7) Questionable consumption data (production/consumption ratio too low).

(8) Questionable consumption data (production/consumption ratio too high).

The District currently serves a total population of approximately 35,800 people through approximately 12,600 active service connections. The population estimates (for 2015 and 2020) and the population projections (for years 2035 and 2042) for the portion of the District's service area within Kern County were provided by the Kern Council of Governments (KernCOG) and are based on data from the U.S. Census, the California Department of Finance, and the California Employment Development Department. Population estimates for the small portion of the District's service area located within San Bernardino County are based on the number of active District connections in that area (83 in 2015 and 95 in 2020), as well as the average number of persons per household (2.57 in 2015 and 2.61 in 2020) for the City of Ridgecrest, obtained from U.S. Census Bureau data.

2. Projected (Through 2045)

a. Anticipated Development and KERNCOG

The population within the District's existing service area is projected to increase at an average of approximately 1% per year through 2045. The population projections from the 1977 Water General Plan, the 1985 Water General Plan Addendum, the 1990 Water General Plan, the 1997 Water General Plan and this 2020 Water General Plan are set forth in **Table II-4** and **Figure II-2 (below)**. The 1990 Water General Plan's population projections were much higher than previous projections, and have been revised sharply downward in response to significant changes in projected growth rates for the Ridgecrest Area.

TABLE II-4
GENERAL PLAN COMPARISON
PROJECTED POPULATION

YEAR	1977 GENERAL PLAN (1)	1985 GENERAL PLAN ADDENDUM (1)	1990 GENERAL PLAN (2)	1997 GENERAL PLAN (3)			2020 GENERAL PLAN
				(-2%)	(0%)	(2%)	
1965	5,700	5,700	5,700	5,700	5,700	5,700	5,700
1970	7,300	7,300	7,300	7,300	7,300	7,300	7,300
1975	11,500	11,500	11,500	11,500	11,500	11,500	11,500
1980	18,100	16,000	16,000	16,000	16,000	16,000	16,000
1990	30,110	25,900	36,700	33,500	33,500	33,500	33,500
1996	34,900	29,300	51,000	35,600	35,600	35,600	35,600
2000	38,700	33,100	69,000	32,800	35,600	38,500	
2005	43,800	36,500	86,000	29,600	35,600	42,500	
2010	46,700	40,300	105,000	26,800	35,600	46,900	31,355 (4)
2015	---	---	---	26,800	35,600	46,900	32,605 (5)
2020	---	---	---	24,200	35,600	51,800	35,800 (5)
2025	---	---	---	24,200	35,600	51,800	36,853 (6)
2030	---	---	---	21,900	35,600	57,200	37,906 (6)
2035	---	---	---	21,900	35,600	57,200	38,959 (6)
2040	---	---	---	19,800	35,600	63,200	40,892 (6)
2045	---	---	---	19,800	35,600	63,200	42,826 (6)

(1) Population based on 3.6 persons per average service connection; excludes Ridgecrest Heights.

(2) Population based on 3.6 persons per average service connection.

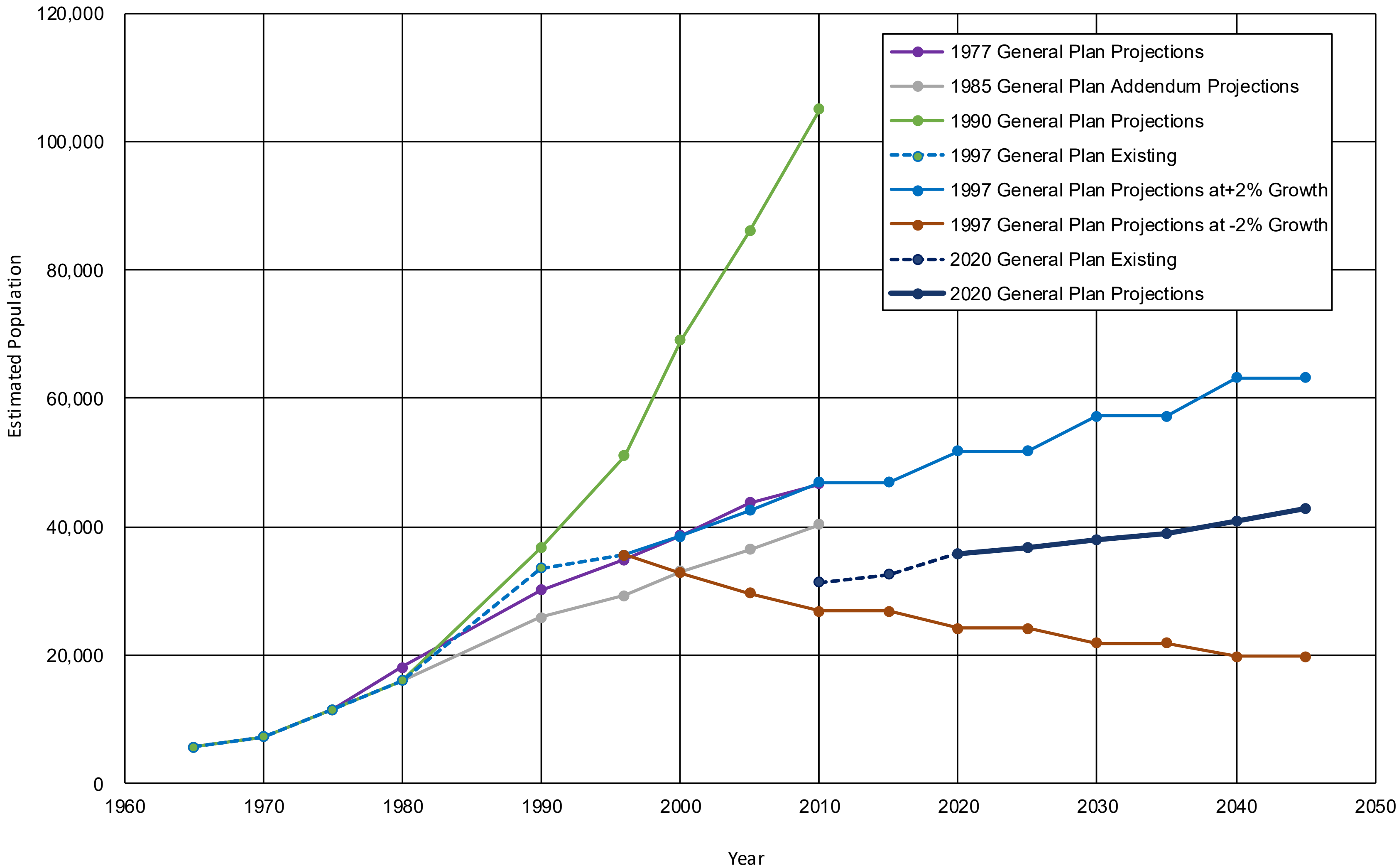
(3) Population based on 3.3 persons per average service connection.

(4) Population from 2015 UWMP, based on KernCOG data

(5) Population based on figures received from KernCOG on November 18, 2019 for 2015, 2020, 2035, and 2042 and number of connections in S.B. Co.

(6) Population projections calculated based on figures received from KernCOG for 2015, 2020, 2035, and 2042 and proportionate growth in S.B. Co.

FIGURE II-2
GENERAL PLAN COMPARISON
PROJECTED POPULATION



The projected population presented in the 1977 Water General Plan was based on then-current growth trends indicated by various population projections, including those prepared by the City of Ridgecrest and the KernCOG. The projected population developed for the 1977 Water General Plan anticipated that the population within the District would be 46,700 persons in 2010.

The projected population developed for the 1985 Water General Plan Addendum was based on population data obtained subsequent to the 1977 Water General Plan. Because the observed population trend between 1977 and 1985 generally conformed with the 1977 Water General Plan, it was determined that the 1977 Water General Plan projections were accurate. The projected population set forth in the 1985 Water General Plan Addendum anticipated that the population within most of the District (including Ridgecrest and China Lake Acres but excluding Ridgecrest Heights) would be 40,300 persons in 2010.

During the late 1980s, the Ridgecrest Area experienced growth rates of 8% to 10%/year, resulting in actual water production approaching or exceeding levels that were not expected to occur until 2000, thus indicating the need to reexamine the District's earlier predictions. Based on research through a number of public agencies, utilities, and private entities, the 1990 Water General Plan presented a revised set of population projections indicating much more rapid and extensive growth; for instance, the 2010 service area population projection included in the 1990 Water General Plan was 104,650 persons.

The alternative projected populations set forth in the 1997 Water General Plan for 2010 were 26,800 (-2% growth), 35,600 (0% growth), or 46,900 (+2% growth) persons.

The actual population in 2010 was 31,355 persons, according to the 2015 Urban Water Management Plan, reflecting significantly lower growth than anticipated by previous Water General Plans.

Based on available information and recent trends, water production requirements have been projected in this 2020 Water General Plan through 2045, see **Table II-5 (below)**.

TABLE II-5
PROJECTED WATER PRODUCTION REQUIREMENTS AND SERVICE CONNECTIONS

YEAR	PROJECTED WATER PRODUCTION REQUIREMENTS (AF)	PROJECTED SERVICE CONNECTIONS (EA)
2018	6,765 (1)	12,685 (1)
2020	6,311 (1)	12,602 (1)
2025	6,930	12,976
2030	7,130	13,347
2035	7,690	14,399
2040	7,830	14,671
2045	8,050	15,079

(1) Actual

b. <u>Annexations</u>

The State Water Resources Control Board, Division of Drinking Water (DDW) has provided the District with information on a number of small water systems that the State would like to see annexed by the District. Said systems are as follows:

<u>China Lake Area</u>

- Dune III Mutual Water Company (population 119, 36 residential connections)
- China Lake Acres Mutual Water Company (population 198, 60 residential connections)
- Buttermilk Acres Water System (2 commercial connections)

- Hometown Water Association (population 25, 12 residential connections)
- Sierra Breeze Mutual Water Company (population 150, 60 residential connections)

Inyokern Area

- Inyokern CSD (population 1002, 244 residential connections, 20 commercial connections, 1 irrigation connection)
- East Inyokern Mutual Water Company (population 87, 28 residential connections)
- Gateway Market Water System (2 commercial connections)

South Inyokern Area

- Life Water Co-op (population 27, 18 residential connections)
- Owens Peak West (population 60, 24 residential connections)
- 148 East Water System (population 35, 13 residential connections)
- South Desert Mutual Water Company (population 26, 13 residential connections)
- Owens Peak South (population 40, 17 residential connections)

North Inyokern Area

- West Valley Mutual Water Company (population 70, 41 residential connections)
- Sweet Water Co-op (population 47, 15 residential connections)

Population data from KernCOG for the IWVWD service area in Kern County include the China Lake Acres, Dune III, Buttermilk Acres, and Hometown areas (total population 342). The Sierra Breeze system and the Inyokern-area systems are not included in the KernCOG population data. However, there has been no decision made to proceed with these annexations, and there is currently no schedule for doing so (at this time, the District only has definite plans to annex the Dune III Mutual Water Company and Hometown Water Association). Therefore, the populations of the Sierra Breeze system and the Inyokern-area systems have not been included in the population projections set forth herein.

c. China Lake NAWS Growth

Changes in the national economy resulting from the end of the Cold War in 1989 have caused a scaling back of anticipated activities and staffing levels at NAWS, which in turn has reduced growth rates significantly within the District's service area. KernCOG's projections include approximate projections for populations associated with NAWS.

C. PROJECTED WATER PRODUCTION REQUIREMENTS (THROUGH 2045)

The projected annual water production requirements presented in the 1977 Water General Plan, the 1985 Water General Plan Addendum, and the 1990 Water General Plan were based on projected populations and historic per capita water production (0.83 AF/Yr/connection and 3.6 persons/connection). The projected annual water production requirements for the 1997 Water General Plan were also based on projected populations and historic per capita water production; however, the production/connection and per capita production figures were revised to 0.75 AF/Yr/connection and 3.3 persons/connection to reflect 1997 conditions. The projected annual water production requirements for this 2020 Water General Plan are 0.50 AF/Yr/connection and 2.84 persons/connection to reflect current conditions.

Projected annual water production requirements for the five separate Water General Plans are set forth in **Table II-6 (below)** for comparison. The annual water production requirements set forth in the 1997 Water General Plan were significantly lower than the annual water production requirements set forth in the 1990 Water General Plan, and increased at a lower rate. The annual water production requirements set forth in the 2020 Water General Plan are still lower.

TABLE II-6
GENERAL PLAN COMPARISON
PROJECTED ANNUAL WATER PRODUCTION REQUIREMENTS
(ACRE-FEET)

YEAR	1977 GENERAL PLAN	1985 GENERAL PLAN ADDENDUM (1)	1990 GENERAL PLAN	1997 GENERAL PLAN			2020 GENERAL PLAN
				(-2%)	(0%)	(2%)	
1980	3,735	3,820 (2)	----	----	----	----	----
1990	6,942	5,968	8,770	8,664 (2)	8,664 (2)	8,664 (2)	----
1996	8,047	6,748	12,250	8,500 (2)	8,500 (2)	8,500 (2)	----
2000	8,925	7,636	16,500	7,840	8,500	9,200	----
2005	10,100	8,425	20,500	7,090	8,500	10,160	----
2010	10,774	9,300	25,000	6,410	8,500	11,220	7,570 (2)
2015	----	----	----	5,790	8,500	12,390	6,245 (2)
2018	----	----	----	----	----	----	6,765 (2)
2020	----	----	----	----	----	----	6,730
2025	----	----	----	----	----	----	6,930
2030	----	----	----	----	----	----	7,130
2035	----	----	----	----	----	----	7,690
2040	----	----	----	----	----	----	7,830
2045	----	----	----	----	----	----	8,050

(1) Excludes Ridgecrest Heights
(2) Actual Metered Production

The number of District service connections remained relatively constant between 2010 and 2019, increasing by only 58 connections total. Despite the small increase in service connections, water production requirements decreased substantially during the same period. Unaccounted-for water averaged about 8% of total production between 2013 and 2019, and was about 15% in 2019. Unaccounted-for water is the difference between production meter records and customer meter records, and includes water attributed to construction, line flushing, theft, and leakage, as well as inaccuracies of production and consumption meters. Again, **Table II-3** illustrates past, current, and projected water demands in acre-feet/year.

Projected water demands by pressure zone are set forth in **Table II-7 (below)**. It has been assumed for this 2020 Water General Plan that demands will change in all pressure zones at the same rate. As long-term demand data becomes available by pressure zone, it will be possible to either confirm or revise demands according to pressure zone.

TABLE II-7
PROJECTED WATER DEMANDS(1)
BY PRESSURE ZONE IN GALLONS PER MINUTE

ZONE	WATER DEMANDS	YEAR					
		2018(2)	2025	2030	2035	2040	2045
2,455 (A) Zone	Average Day	2,935	3,034	3,153	3,274	3,471	3,671
	Maximum Day	5,870	6,068	6,306	6,547	6,942	7,343
2,555 (B) Zone	Average Day	697	692	690	687	698	707
	Maximum Day	1,395	1,384	1,380	1,374	1,396	1,413
2,660 (C) Zone	Average Day	190	189	189	189	189	189
	Maximum Day	380	379	379	379	379	379
2,775 (D) Zone	Average Day	39	41	41	41	41	41
	Maximum Day	79	81	81	81	81	81
2,885 (E) Zone	Average Day	92	93	93	93	93	93
	Maximum Day	183	187	187	187	187	187
System Total	Average Day	3,954	4,049	4,166	4,284	4,492	4,701
	Maximum Day	7,907	8,098	8,332	8,568	8,984	9,402

(1) Excluding Losses
(2) Actual Water Demands

1. Monthly Water Production Requirements

Monthly water production requirements (monthly production requirements) vary seasonally with changes in the weather. Temperatures in the Ridgecrest area increase substantially in summer months and cause significant increases in water demands. Monthly production requirements for the five-year-period, 2015 through 2019, are set forth in **Table II-8** (below).

TABLE II-8
HISTORIC MONTHLY WATER PRODUCTION
2015 THROUGH 2019

	YEAR										AVERAGE MONTHLY PRODUCTION 2015-2019	
	2015		2016		2017		2018		2019			
MONTH	AF	%	AF	%	AF	%	AF	%	AF	%	AF	%
JAN	315.1	5.05	296.0	4.64	299.7	4.61	364.2	5.38	369.6	6.04	328.9	5.14
FEB	308.1	4.93	340.3	5.33	346.6	5.33	425.7	6.29	277.9	4.54	339.7	5.31
MAR	339.3	5.43	405.0	6.35	449.2	6.90	394.5	5.83	327.2	5.35	383.0	5.98
APR	500.0	8.01	439.3	6.88	445.3	6.84	522.3	7.72	507.8	8.30	482.9	7.54
MAY	592.4	9.49	581.3	9.11	639.2	9.82	597.6	8.83	522.1	8.54	586.5	9.16
JUN	732.0	11.72	698.9	10.95	713.5	10.97	699.8	10.34	618.0	10.10	692.4	10.81
JUL	711.0	11.39	786.1	12.32	817.5	12.56	838.0	12.39	769.7	12.58	784.5	12.25
AUG	764.9	12.25	795.5	12.47	769.6	11.83	844.1	12.48	733.6	11.99	781.5	12.21
SEP	661.7	10.60	692.4	10.85	639.3	9.83	662.9	9.80	669.1	10.94	665.1	10.39
OCT	528.6	8.47	556.5	8.72	578.9	8.90	610.9	9.03	576.2	9.42	570.2	8.91
NOV	434.3	6.95	448.6	7.03	437.6	6.73	462.3	6.83	350.0	5.72	426.6	6.66
DEC	357.1	5.72	341.3	5.35	370.4	5.69	342.9	5.07	395.0	6.46	361.3	5.64
TOTAL	6,244.5	100.00	6,381.2	100.00	6,506.8	100.00	6,765.2	100.00	6,116.2	100.00	6,402.6	100.00

Historically, high demands have occurred from June through September, with maximum demands normally occurring in July and August but occasionally in June. Low demands have normally occurred from December through March, with minimum demands normally occurring in January or February. Summer demands have ranged between 12% and 14% of total average annual demands, while winter demands have ranged between 3% and 5% of total annual demands.

For analysis and design purposes, 2018 monthly demands were used, which had maximum month demands at approximately 14% of annual production (168% of average annual production), and minimum monthly demands at approximately 5% of annual production (60% of average annual production), matching historical data.

2. Daily Water Production Requirements

Water demands vary with human activity and weather conditions. They are normally very low during early morning hours and very high during late morning and afternoon hours. Maximum daily demands normally occur during the months of maximum demand (i.e. July or August, and infrequently June), but occasionally they occur during months other than months of maximum demand.

For the most part, periods of extremely high temperatures (≥110°F) are relatively short, lasting two to three days at most; however, at somewhat more moderate temperatures (≥100°F), hot spells last for several days, perhaps a week or more.

The tabulation below, which is based on the last 30 years of record data, indicates the temperature range (degrees Fahrenheit) experienced in the Ridgecrest Area. As indicated below, the majority of the year's hottest days occur during the summer months, particularly during July and August (source: NAWS).

Month	Highest Record	Average High	Average	Average Low	Lowest Record
January	76	60.3	45.2	30.1	15
February	81	64.4	49.8	35.2	19
March	92	71.1	55.8	40.6	22
April	97	77.8	62.1	46.3	28
May	109	87.9	71.7	55.4	40
June	112	96.9	79.8	62.7	47
July	116	103.3	86.2	69.1	58
August	111	101.7	84.5	67.3	55
September	106	93.9	76.7	59.5	43
October	100	81.5	64.7	47.9	33
November	86	68.9	52.9	36.8	13
December	77	59.0	44.3	29.6	8.0
Annual	116	80.6	64.5	48.4	13

D. UNIT DEMAND FACTORS

1. Historical Average Day and Max Day Demands

All of the District's preceding Water General Plans have indicated that maximum day demand approximates 200% of average day demand. Maximum day demand therefore is about 120% of average day maximum month demand. The same relationship has been utilized for this 2020 Water General Plan. Maximum day water demands for each pressure zone are projected through 2045 on **Table II-9 (below)**.

TABLE II-9
PROJECTED MAXIMUM DAY WATER DEMANDS(1)
BY PRESSURE ZONE IN MILLION GALLONS PER DAY

ZONE	YEAR					
	2018(2)	2025	2030	2035	2040	2045
2,455 A-Zone	8.45	8.74	9.08	9.43	10.00	10.57
2,555 B-Zone	2.01	1.99	1.99	1.98	2.01	2.03
2,660 C-Zone	0.55	0.55	0.55	0.55	0.55	0.55
2,775 D-Zone	0.11	0.12	0.12	0.12	0.12	0.12
2,885 E-Zone	0.26	0.27	0.27	0.27	0.27	0.27
System Total	11.39	11.67	12.00	12.34	12.94	13.54

(1) Excluding Losses
(2) Actual Maximum Demands

2. Unit Demand Factors for Demand Projections

The unit demand factors, which were derived in the 1977 Water General Plan and utilized in the 1985 Water General Plan Addendum, 1990 Water General Plan, and 1997 Water General Plan, have been accepted as valid and remain unchanged for this 2020 Water General Plan, except for OPPR storage (SCE has revised its high-rate period from 6 hours to 5 hours). They are summarized as follows:

Average Day Maximum Month Demand	=	1.68 Average Day Demand
Maximum Day Demand	=	2.00 Average Day Demand
Peak Hour Maximum Day Demand	=	1.80 Maximum Day Demand

Minimum Hour Maximum Day Demand	=	0.35 Maximum Day Demand
Operational Storage	=	0.20 Maximum Day Demand
Emergency Storage		
Minimum	=	1.00 Average Day Demand
Optimum	=	1.00 Maximum Day Demand
OPPR Storage	=	0.21 Maximum Day Demand

E. FIRE FLOW REQUIREMENTS

The following fire flow requirements have been established for analysis of existing and proposed water system facilities:

Zone Designation		Fire Flow (gpm)	Duration (hours)	Storage Requirements (gallons)
Elevation	Name			
2,455	A	4,000	4	960,000
2,555	B	2,000	4	480,000
2,660	C	2,000	2	240,000
2,775	D	1,500	2	180,000
2,885	E	3,000	3	540,000

The above fire flow requirements are based upon the 1985 Water General Plan Addendum as modified by current Kern County Fire Department requirements and as further modified in accordance with current District standards. The fire flows are considered conservative because building ordinances require developers to equip new commercial and industrial developments with fire sprinklers; the requirement for sprinklers in new buildings greatly reduces potential fire flow demand on the water system. Regardless, adequate fire flows are needed for fire suppression in old commercial and industrial developments which are not equipped with fire sprinklers.

F. SYSTEM LOSSES

Over the past 5 years, unaccounted-for water system losses have ranged between a low of 73 AF (2015) and a high of 926 AF (2019), as shown in **Table II-3**. These figures are approximately 1% and approximately 15% of total production, respectively. Both figures appear extreme, and likely do not represent actual unaccounted-for water system losses, since the unaccounted-for water percentages from 2016 through 2018 average approximately 6% of total production. For planning purposes, the future unaccounted-for water system losses are assumed to be 6% of total production.

To combat system losses, the District is implementing a program to replace all meters that are older than 15 years, as described earlier in this chapter.

G. PRODUCTION AND STORAGE REQUIREMENTS

1. Water Production Requirements

Minimum production requirements (in gpm) based on projected annual water demands adjusted to include unaccounted-for water are set forth in **Table II-10 (at the end of this chapter)**. The unaccounted-for water factor is based upon average unaccounted-for water over the period of 2013 through 2019, which is approximately 6% of overall production.

2. Storage Requirements

Storage requirements for Normal Operation consist of three components, namely: operational (equalization) storage; fire storage; and emergency storage. When utilized, OPPR storage becomes a fourth component.

a. <u>Operational Storage</u>

Operational storage, also known as equalization storage, is the storage required for day-to-day system operation.

b. <u>Fire Storage</u>

Fire Storage is the volume needed to meet a specified fire flow and duration as determined by the jurisdictional fire authority: in this case, the Kern County Fire Department (see **Section F** herein).

c. Emergency Storage

Emergency Storage provides continuity of storage during periods when normal production has been interrupted. At minimum, emergency storage should provide a full 24 hours of service to customers at Average Day Demand (Minimum Emergency Storage). Ideally, however, emergency storage should provide a full 24 hours of service to customers at Maximum Day Demand (Optimum Emergency Storage).

d. Off-Peak Power Rate (OPPR) Considerations

Off-Peak Power Rate (OPPR) production and storage, also known as Time-of-Use (TOU) production and storage, are needed to maintain service to customers during periods when wells and boosters are turned off to avoid high on-peak electrical pumping rates and, correspondingly, to take advantage of lower off-peak electrical pumping rates. OPPR production is production in excess of MDD needed to meet MDD with wells and boosters turned off during on-peak electrical service periods. OPPR storage is storage in excess of equalizing storage needed to store TOU production.

e. Storage Factors

The unit storage factors, which were derived in the 1977 Water General Plan and utilized in the 1985 Water General Plan Addendum, 1990 Water General Plan, and 1997 Water General Plan, have been accepted as valid and remain unchanged for this 2020 Water General Plan, except for OPPR storage (SCE has revised its high-rater period from 6 hours to 5 hours). They are summarized as follows:

Operational Storage	=	0.20 Maximum Day Demand
Emergency Storage		
Minimum	=	1.00 Average Day Demand
Optimum	=	1.00 Maximum Day Demand
OPPR Storage	=	0.21 Maximum Day Demand

f. Projected Storage Requirements

Minimum storage requirements based on projected annual water demands and calculated unit demand factors are set forth by existing pressure zone in **Table II-11** (at the end of this chapter). The storage requirements set forth in **Table II-12** (at the end of this chapter; also arranged by pressure zone) represent optimum storage capacity for each zone which will be constructed, if economically feasible, to provide additional emergency storage.

TABLE II-3
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PAST, CURRENT, AND PROJECTED WATER DEMANDS
BY CUSTOMER TYPE
(IN ACRE-FEET PER YEAR)

CUSTOMER TYPE	YEAR														
	2015	2016	2017	2018	2019	2020	2021 (1)	2022 (1)	2023 (1)	2024 (1)	2025 (1)	2030	2035	2040	2045
Single Family	4,440	4,432	4,465	4,592	3,735	4,393	4,353	4,437	4,521	4,605	4,688	4,824	5,203	5,297	5,446
Multi Family	547	523	519	538	438	490	510	520	530	540	549	565	610	621	638
Commercial	877	780	595	943	767	547	894	911	928	946	963	991	1,068	1,088	1,119
Other	307	393	359	307	250	307	291	297	302	308	313	322	348	354	364
Unaccounted-For (2)	73	252	569	385	926	379	386	394	401	408	416	428	461	470	483
Total*:	6,244	6,381	6,507	6,765	6,116	6,311	6,435	6,559	6,682	6,806	6,930	7,130	7,690	7,830	8,050

(1) Estimates based on interpolation of population projections from Table II-1 and customer-type proportions and production/connection from 2018.

(2) Unaccounted-For water is the difference between production meter records and customer meter records, and includes water attributed to line flushing, theft, and leakage, as well as inaccuracies of production and consumption meters. Unaccounted-for water is projected at 6% of total production, based on 2018 figures.

* Total Production

TABLE II-10A
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECTED PRODUCTION REQUIREMENTS
BY PRESSURE ZONE IN GALLONS PER MINUTE
(NORMAL OPERATION)

PRESSURE ZONE	PRODUCTION DEMAND	2018	2025	2030	2035	2040	2045	EXISTING PRODUCTION	REQUIRED PRODUCTION INCREASE				
									2025	2030	2035	2040	2045
A-Zone	Average Day	3,112	3,217	3,343	3,471	3,680	3,893						
(2,455)	Maximum Day	6,225	6,434	6,686	6,942	7,361	7,786	8,500	0	0	0	0	0
B-Zone	Average Day	739	742	744	745	746	749						
(2,555)	Maximum Day	1,478	1,483	1,487	1,490	1,492	1,498						
C-Zone	Average Day	201	201	201	201	201	201						
(2,660)	Maximum Day	402	402	402	402	402	402						
D-Zone	Average Day	43	43	43	43	43	43						
(2,775)	Maximum Day	86	86	86	86	86	86						
E-Zone	Average Day	99	99	99	99	99	99						
(2,885)	Maximum Day	198	198	198	198	198	198	4,400 (2)	0	0	0	0	0
SYSTEM TOTAL	**Average Day**	**4,194**	**4,301**	**4,429**	**4,559**	**4,769**	**4,985**						
	Maximum Day	**8,388**	**8,603**	**8,859**	**9,118**	**9,538**	**9,969**	**12,900** (1)	**0**	**0**	**0**	**0**	**0**

(1) Not including Wells 35 and 36.
(2) B-Zone prodution supplies C-, D- and E-Zones.

TABLE II-10B
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECTED PRODUCTION REQUIREMENTS
BY PRESSURE ZONE IN GALLONS PER MINUTE
(OFF PEAK POWER) (3)

PRESSURE ZONE	PRODUCTION DEMAND	2018	2025	2030	2035	2040	2045	EXISTING PRODUCTION	REQUIRED PRODUCTION INCREASE				
									2025	2030	2035	2040	2045
A-Zone	Average Day	3,931	4,064	4,223	4,385	4,649	4,917						
(2,455)	Maximum Day	7,863	8,127	8,446	8,769	9,297	9,835	8,500	0	0	270	800	1,340
B-Zone	Average Day	934	937	939	941	943	946						
(2,555)	Maximum Day	1,867	1,874	1,879	1,882	1,885	1,893						
C-Zone	Average Day	254	254	254	254	254	254						
(2,660)	Maximum Day	507	507	507	507	507	507						
D-Zone	Average Day	54	54	54	54	54	54						
(2,775)	Maximum Day	109	109	109	109	109	109						
E-Zone	Average Day	125	125	125	125	125	125						
(2,885)	Maximum Day	250	250	250	250	250	250	4,400 (2)	0	0	0	0	0
SYSTEM TOTAL	**Average Day**	**5,298**	**5,433**	**5,595**	**5,759**	**6,024**	**6,296**						
	Maximum Day	**10,595**	**10,867**	**11,190**	**11,517**	**12,048**	**12,593**	**12,900** (1)	**0**	**0**	**0**	**0**	**0**

(1) Not including Wells 35 and 36.

(2) B-Zone prodution supplies C-, D- and E-Zones.

(3) Requires Maximum Day Production over a 19 hour period (no production between 4:00 PM and 9:00 PM).

TABLE II-11
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECTED MINIMUM WATER STORAGE REQUIREMENTS
BY PRESSURE ZONE IN MILLION GALLONS

ZONE	STORAGE COMPONENT	YEAR					
		2018*	2025	2030	2035	2040	2045
2,455 A-Zone	Equaliztion	1.79	1.85	1.93	2.00	2.12	2.24
	Fire	0.96	0.96	0.96	0.96	0.96	0.96
	Emergency	4.48	4.63	4.81	5.00	5.30	5.61
	Subtotal:	7.23	7.45	7.70	7.96	8.38	8.81
	OPPR	2.24	2.32	2.41	2.50	2.65	2.80
	Total:	9.48	9.76	10.11	10.46	11.03	11.61
2,555 B-Zone	Equaliztion	1.21	1.21	1.21	1.21	1.21	1.21
	Fire	0.48	0.48	0.48	0.48	0.48	0.48
	Emergency	1.06	1.07	1.07	1.07	1.07	1.08
	Subtotal:	2.75	2.75	2.76	2.76	2.76	2.77
	OPPR	0.53	0.53	0.54	0.54	0.54	0.54
	Total:	3.28	3.29	3.29	3.30	3.30	3.30
2,660 C-Zone	Equaliztion	0.12	0.12	0.12	0.12	0.12	0.12
	Fire	0.24	0.24	0.24	0.24	0.24	0.24
	Emergency	0.29	0.29	0.29	0.29	0.29	0.29
	Subtotal:	0.64	0.64	0.64	0.64	0.64	0.64
	OPPR	0.14	0.14	0.14	0.14	0.14	0.14
	Total:	0.79	0.79	0.79	0.79	0.79	0.79
2,775 D-Zone	Equaliztion	0.02	0.02	0.02	0.02	0.02	0.02
	Fire	0.18	0.18	0.18	0.18	0.18	0.18
	Emergency	0.06	0.06	0.06	0.06	0.06	0.06
	Subtotal:	0.27	0.27	0.27	0.27	0.27	0.27
	OPPR	0.03	0.03	0.03	0.03	0.03	0.03
	Total:	0.30	0.30	0.30	0.30	0.30	0.30
2,885 E-Zone	Equaliztion	0.06	0.06	0.06	0.06	0.06	0.06
	Fire	0.54	0.54	0.54	0.54	0.54	0.54
	Emergency	0.14	0.14	0.14	0.14	0.14	0.14
	Subtotal:	0.74	0.74	0.74	0.74	0.74	0.74
	OPPR	0.07	0.07	0.07	0.07	0.07	0.07
	Total:	0.81	0.81	0.81	0.81	0.81	0.81
System Total	Equaliztion	3.20	3.26	3.33	3.40	3.52	3.65
	Fire	2.40	2.40	2.40	2.40	2.40	2.40
	Emergency	6.04	6.19	6.38	6.56	6.87	7.18
	Subtotal:	11.64	11.85	12.11	12.37	12.79	13.22
	OPPR	3.02	3.10	3.19	3.28	3.43	3.59
	Total:	14.66	14.95	15.30	15.65	16.22	16.81

* Actual Water Demands

TABLE II-12
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECTED OPTIMUM WATER STORAGE REQUIREMENTS
BY PRESSURE ZONE IN MILLION GALLONS

ZONE	STORAGE COMPONENT	YEAR					
		2018*	2025	2030	2035	2040	2045
2,455 A-Zone	Equaliztion	1.79	1.85	1.93	2.00	2.12	2.24
	Fire	0.96	0.96	0.96	0.96	0.96	0.96
	Emergency	8.96	9.27	9.63	10.00	10.60	11.21
	Subtotal:	11.72	12.08	12.51	12.96	13.68	14.41
	OPPR	2.24	2.32	2.41	2.50	2.65	2.80
	Total:	13.96	14.39	14.92	15.46	16.33	17.22
2,555 B-Zone	Equaliztion	1.21	1.21	1.21	1.21	1.21	1.21
	Fire	0.48	0.48	0.48	0.48	0.48	0.48
	Emergency	2.13	2.14	2.14	2.15	2.15	2.16
	Subtotal:	3.82	3.82	3.83	3.83	3.84	3.84
	OPPR	0.53	0.53	0.54	0.54	0.54	0.54
	Total:	4.35	4.36	4.36	4.37	4.37	4.38
2,660 C-Zone	Equaliztion	0.12	0.12	0.12	0.12	0.12	0.12
	Fire	0.24	0.24	0.24	0.24	0.24	0.24
	Emergency	0.58	0.58	0.58	0.58	0.58	0.58
	Subtotal:	0.93	0.93	0.93	0.93	0.93	0.93
	OPPR	0.14	0.14	0.14	0.14	0.14	0.14
	Total:	1.08	1.08	1.08	1.08	1.08	1.08
2,775 D-Zone	Equaliztion	0.02	0.02	0.02	0.02	0.02	0.02
	Fire	0.18	0.18	0.18	0.18	0.18	0.18
	Emergency	0.12	0.12	0.12	0.12	0.12	0.12
	Subtotal:	0.33	0.33	0.33	0.33	0.33	0.33
	OPPR	0.03	0.03	0.03	0.03	0.03	0.03
	Total:	0.36	0.36	0.36	0.36	0.36	0.36
2,885 E-Zone	Equaliztion	0.06	0.06	0.06	0.06	0.06	0.06
	Fire	0.54	0.54	0.54	0.54	0.54	0.54
	Emergency	0.28	0.28	0.28	0.28	0.28	0.28
	Subtotal:	0.88	0.88	0.88	0.88	0.88	0.88
	OPPR	0.07	0.07	0.07	0.07	0.07	0.07
	Total:	0.95	0.95	0.95	0.95	0.95	0.95
System Total	Equaliztion	3.20	3.26	3.33	3.40	3.52	3.65
	Fire	2.40	2.40	2.40	2.40	2.40	2.40
	Emergency	12.08	12.39	12.76	13.13	13.73	14.36
	Subtotal:	17.68	18.04	18.49	18.93	19.66	20.40
	OPPR	3.02	3.10	3.19	3.28	3.43	3.59
	Total:	20.70	21.14	21.68	22.21	23.09	23.99

* Actual Water Demands

CHAPTER III

SOURCES OF SUPPLY

CHAPTER III
SOURCES OF SUPPLY

A. EXISTING SOURCES OF SUPPLY

1. Groundwater

Currently, the sole source of potable water supply in the Indian Wells Valley is groundwater. The groundwater body from which the District and all other Valley water producers extract water has been labeled the Indian Wells Valley Groundwater Basin (hereafter IWVGB or simply Basin) by the California Department of Water Resources (see CDWR Bulletin 118-75). It is catalogued as Basin No. 6-054 in CDWR Bulletin 118.

The Basin underlies approximately 382,000 acres (approximately 600 square miles) of land in portions of the Counties of Kern, Inyo, and San Bernardino. It is bordered on the west by the Sierra Nevada Mountain Range, on the north by the Coso Range, on the east by the Argus Range, and on the south by the El Paso Mountains. Surface water flows from the surrounding mountains drain to China Lake, a large playa (dry lake) located in the central north-east part of the Basin.

Most reports that are specific to the Basin identify four primary areas of water supply: the **Ridgecrest Area**, which generally lies within the city of Ridgecrest; the **Intermediate Area**, which lies between the city of Ridgecrest and the community of Inyokern; the **Southwest Area,** which lies to the southwest of Ridgecrest and south of Inyokern; and the **Northwest Area**, which lies to the northwest of Ridgecrest and north of Inyokern.

Originally, the District derived its water supply from the Ridgecrest Area; however, it now obtains most of its water supply from the Intermediate and Southwest Areas.

Groundwater extractions within the Indian Wells Valley presently total about 27,740 AF/Yr; said extractions are partially offset by estimated average natural recharge of between 7,000 and 11,000 acre-feet, with an average annual loss of storage of approximately 25,000 AF/Yr. Available information indicates that groundwater levels in the Indian Wells Valley are declining at a rate of 1.0 to 2.0 feet/year, which affects production capacity within areas that are subject to significant production. According to various studies, the Basin has been in overdraft since the 1960s, if not earlier. CDWR Bulletin 118-16 (dated January 2016) indicates the Basin is subject to critical conditions of overdraft.

In an effort to better manage the Basin, the District has developed a well field in the Southwest Area. Construction of said well field was intended to reduce the concentration of groundwater extractions in the Basin, thus moderating localized depressions in the water table.

The Intermediate and Southwest Areas are the portions of the Basin from which most water is currently produced for all purposes. Water in the Northwest Area is of generally poorer quality and may not be usable for production purposes unless it receives significant amounts of treatment or is blended with good quality water, and most water produced therefrom has historically been used predominantly for agricultural purposes.

Groundwater quantity and quality vary significantly within the Basin. Various investigations have contributed to differing opinions which can basically be divided into two groups, with one group espousing a "closed basin" concept with recharge resulting from infiltration/percolation and discharge through groundwater extraction and some evapotranspiration, and the other group espousing a "regional flow system" with groundwater moving under the basin at depth from the Sierra Nevada Mountains and continuing under the Argus and El Paso Mountains. In recent years, the "closed system" concept has become nearly universally accepted. Regardless of these differing opinions, most reports conclude that current natural groundwater replenishment is insufficient to maintain constant groundwater levels, which are declining in most areas of the Valley (except in the playa region), especially in those areas which are subject to significant groundwater production.

a. <u>Investigations and Studies</u>

Groundwater availability has been and continues to be the subject of great concern in the Indian Wells Valley. Numerous investigations or studies have been conducted in years past by various entities and individuals including, among others, the USGS, the United States Bureau of Reclamation (USBR), and a number of geologists, including Austin, Bean, Erskine, St. Amand, Dutcher and Moyle, and Whelan. Since the Bean and St. Amand studies more specifically addressed immediately available groundwater supplies and since the USBR investigation was the one most recently completed, they are discussed in more detail in Chapter III of the 1997 Water General Plan.

The USBR, Bean, and St. Amand all suggest dispersing groundwater production within the Indian Wells Valley to alleviate the pumping depressions in the Intermediate and Ridgecrest Areas and to arrest or reduce the threat of migration of highly mineralized water into the potable groundwater supply. The USBR emphasized the importance of well development in the Southwest Area. Bean suggested locating wells where water quantity and water quality are adequate, while St. Amand recommended locating wells to avoid exacerbating existing pumping depressions which could eventually lead to contamination of available groundwater supplies.

The District has adopted policies with respect to water conservation, water reclamation, and groundwater pumping. It has expanded conservation activities with an aggressive water conservation program, and it is currently investigating the use of reclaimed water for groundwater replenishment. Development of the Southwest Area, which is consistent with the recommendations of USBR, Bean, and St. Amand, has reduced the District's dependence upon the Intermediate Area's groundwater supply. As sources of supply from the Southwest Area have augmented the District's water supply, groundwater conditions in the Intermediate Area have improved.

For purposes of this 2020 Water General Plan, water supplies will continue to be derived from the Basin. The District will continue to use its facilities in the Southwest and Intermediate Areas. During the implementation of this Water General Plan, the District will continue to develop groundwater management practices, and to explore and develop additional water supplies, including blended, treated, imported, and recycled water options.

1) Water Supply Improvement Plan (WSIP)

In April 2010, a WSIP Technical Memorandum was submitted by Tony Morgan, PG, CHG, to the District. The plan included multiple suggestions for improving production and efficiency of existing District wells (Phase I) and for drilling up to three additional wells. Over the ensuing months, the recommendations of the Technical Memorandum were refined and reformulated as the District's WSIP, consisting of two phases: Phase I was intended to meet existing and future maximum day demand with an increased redundancy of 20% to accommodate reduction in capacity that could result from a mechanical failure or water quality issue in one or more of IWVWD's production facilities on a maximum demand day; and Phase II to accommodate anticipated future demand increases. Phase I consisted of improvements to Wells 18 and 34 (in the SWWF); and Phase II consisted of constructing a new well, Well 35. A draft environmental impact report (EIR) for the WSIP was adopted by the District on October 2011 and certified as a Final EIR in February 2012.

The WSIP was subsequently modified to consist of improvements to Well 34 to increase its nominal capacity from 1,200 gpm to 2,000 gpm and constructing new Well 35 at a nominal capacity of 1,200 gpm (Phase I), and increasing the capacity of Well 35 to 2,200 gpm (Phase II). The Modified WSIP was set forth in an Addendum to the EIR approved by the District's Board of Directors in December 2015.

2) Brackish Groundwater Treatment Pilot Study

In 2010, the District completed a feasibility study, preliminary design report, and a pilot study for treatment of brackish water from the site of the former Neal Ranch in the northwest portion of the Indian Wells Valley.

The studies, conducted for the District by Carollo Engineers, evaluated treatment alternatives and produced preliminary design criteria. Although the District no longer owns the former Neal Ranch site, it is currently evaluating potential scenarios for implementation of the report's findings, and is moving forward with a brackish water resource study in partnership with other local stakeholders to identify the potential brackish water resources within the Indian Wells Valley that can be cost-effectively exploited using the technology identified in the feasibility study.

3) Brackish Groundwater Resource Study

The *Brackish Water Siting and Resource Quantification Study* is currently in progress (funded by CDWR grant). The study is intended to identify and quantify potential sources of brackish groundwater suitable for treatment and domestic (or other) use.

b. Regulations and Plans

1) Sustainable Groundwater Management Act (SGMA)

In 2014, faced with declining groundwater levels (most notably in California's Central Valley), the California Legislature enacted the SGMA which was intended to provide a framework for the sustainable management of groundwater resources throughout California, primarily by local authorities. SGMA consisted of three bills, AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), and was signed into law by Governor Brown on September 16, 2014, initially becoming effective on January 1, 2015.

SGMA required local authorities to form local Groundwater Sustainability Agencies (GSAs) by June 30, 2017, which are required to evaluate conditions in their local water basins and adopt locally-based Groundwater Sustainability Plans (GSPs) tailored to their regional economic and environmental needs. SGMA allows a 20-year time frame for GSAs to implement their GSPs and achieve long-term groundwater sustainability. It protects existing water rights and does not affect current drought response measures.

SGMA provides local GSAs with tools and authority to:

- Monitor and manage groundwater levels and quality
- Monitor and manage land subsidence and changes in surface water flow and quality affecting groundwater levels or quality or caused by groundwater extraction
- Require registration of groundwater wells
- Require reporting of annual extractions
- Require reporting of surface water diversions to underground storage
- Impose limits on extractions from individual wells
- Assess fees to implement local GSPs
- Request revisions of basin boundaries, including establishing new subbasins

In response to 2010 legislation, CDWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. Through its CASGEM program, CDWR ranked the priority of each groundwater basin in California as either very low, low, medium, or high.

In addition, CDWR, as required by SGMA, identified the basins and subbasins that are in conditions of critical overdraft. Twenty-one basins and subbasins in California were identified as critically-overdrafted basins.

In its 2016 Bulletin 118 interim update, CDWR identified the IWVGB as a critically overdrafted basin of medium priority.

On July 15, 2016, Kern County, Inyo County, San Bernardino County, the City of Ridgecrest, and the IWVWD entered into a joint exercise of powers agreement to form the *Indian Wells Valley Groundwater Authority* (IWVGA). On December 8, 2016, the IWVGA Board of Directors adopted Resolution No. 02-16, establishing the IWVGA as the exclusive GSA for the entirety of the IWVGB.

GSAs responsible for high-priority and medium-priority critically overdrafted basins, such as the IWVGB, must adopt GSPs by January 31, 2020.

By eliminating overdraft conditions, the goal of SGMA is to create statewide groundwater conditions that are "sustainable". SGMA defines the term "sustainable yield" as follows:

"The maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result."

"Undesirable results" are defined in SGMA as:

1. *"Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods."*

2. *"Significant and unreasonable reduction of groundwater storage."*

3. *"Significant and unreasonable seawater (salt water) intrusion."*

4. *"Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies."*

5. *"Significant and unreasonable land subsidence that substantially interferes with surface land uses."*

6. *"Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses"*

Sustainability must be achieved within 20 years after adoption of the GSP, i.e., by January 1, 2040.

2) Groundwater sustainability Plan (GSP)

The IWVGA, as the sole GSA for the IWVGB, is responsible for complying with SGMA requirements, including the preparation and implementation of the GSP. The GSP for the IWVGB (Stetson, 2020) was adopted by the IWVGA Board of Directors on January 16, 2020, submitted to CDWR for approval on January 31, 2020, and approved by CDWR on January 13, 2022.

The GSP includes an estimated sustainable yield for the Basin (defined by SGMA as the maximum quantity of water that can be withdrawn annually without causing undesirable results) of 7,650 AF/Yr.

The sustainable yield may change as projects and management actions are implemented that artificially recharge the basin and increase the volume of water that can be withdrawn annually without causing undesirable results. Therefore, the sustainable yield will be reevaluated in each five-year update to the GSP.

The GSP includes water supply and demand management projects and measures to reduce groundwater production and to augment natural sustainable yield with direct recharge projects (e.g. recycled water or imported water) in order to create an operating sustainable yield higher than the natural sustainable yield. Implementation of water supply projects is deemed a priority, to lessen impacts to the community and current ways of life that would inevitably be altered if drastic water use reductions are required in order to reduce groundwater production to levels within the current natural sustainable yield.

Water supply, demand management, and direct recharge projects set forth in the GSP are as follows:

- Management Action No. 1: Implement Annual Pumping Allocation Plan, Transient Pool and Fallowing Program
- Planned Project No. 1: Develop Imported Water Supply
    - Option 1: Direct Use Project with Antelope Valley-East Kern Water Agency (AVEK)
    - Option 2: Groundwater Recharge Project with Los Angeles Department of Water and Power (LADWP)
- Planned Project No. 2: Optimize Use of Recycled Water
    - Recycled Water Subproject 1 – Landscape Irrigation in the City and NAWS China Lake
    - Recycled Water Subproject 1a – Landscape Irrigation at Cerro Coso Community College
    - Recycled Water Subproject 2 - Groundwater Recharge
- Planned Project No. 3: Basin-wide Conservation Efforts
- Planned Project No. 4: Shallow Well Mitigation Program

- Planned Project No. 5: Dust Control Mitigation Program
- Planned Project No. 6: Pumping Optimization Project
- Conceptual Project No. 1: Brackish Groundwater Project
- Conceptual Project No. 2: Direct Potable Reuse Project

c. Available Storage

The GSP estimates that the amount of available groundwater in storage in 2017 was 1,750,000 AF, based on USBR (1993) estimates of 2,370,000 AF of available groundwater in storage and an estimated cumulative change of 620,000 AF of groundwater in storage since 1992 based on a groundwater model run using historical data.

The GSP also includes an estimated reduction of groundwater in storage of 25,000 AF/Yr, based on a water budget.

d. Water Rights

The IWVGB is presently in the formal adjudication process. Although the Basin is not yet formally adjudicated, the JPA participants are bound to abide by the pumping allocations and Augmentation Fees, along with Transient Pool Allocations, to be set forth in the Annual Pumping Allocation Plan (Management Action No. 1 as described in the GSP) to be developed by the IWVGA. Water produced within the sustainable yield of the Basin (7,650 AF/Yr), may be charged a General Administration fee. Water produced in excess of the sustainable yield will be subject to Augmentation (Replenishment) Fees. Collected fees will be used to fund groundwater augmentation projects, such as water importation and replenishment.

IWVGA has determined that 5,000 AF/Yr must be imported, and has adopted a Replenishment Fee to fund the needed water importation. According to IWVGA 03-20, all groundwater extractions, with the exception of federal and De Minimis extractions, must pay a Replenishment Fee of $2,130/AF. Federal

(Navy) groundwater extractions are not subject to fees or restrictions developed by IWVGA under SGMA. The Navy has asserted that its water needs include the off-Station demands for its workforce and their dependents, meaning that water supplied to its workforce through those off-Station water providers is also exempt from the Replenishment Fee. The Navy's water demands have been allocated to the various off-Station groundwater extractors, and, as a result, IWVWD will be responsible for paying the Replenishment Fee for 2,117 AF/Yr of its groundwater extraction.

e. Natural Replenishment

According to the GSP, the principal source of natural replenishment to the IWVGB is mountain front recharge, estimated at 7,650 AF/Yr.

2. Conservation

The District's 2020 UWMP set forth the District's water conservation efforts and their effects on water usage. As shown in the UWMP, the District's conservation efforts have contributed to significant reductions in unit production. As indicated on **Table II-1** (see **Chapter II**), unit and total water production and consumption rates have all been reduced since 2013 even as the service area population and total number of connections has increased. For instance, the District produced 7,534 AF in 2013 to serve approximately 32,400 people through 11,600 service connections. In 2019, the District produced 6,116 AF to serve approximately 35,900 people through 12,644 service connections. It is therefore evident that the District's conservation programs have been effective in reducing consumption and increasing water use efficiency.

The District's individual water conservation programs are described in detail in the UWMP.

B. CURRENT WATER QUALITY

The District's 2020 Consumer Confidence Report (CCR) indicated no violations of Maximum Contaminant Levels (MCLs) for any of the monitored constituents. The average nitrate--nitrogen concentration was 1.2 milligrams per liter (mg/L) with a range of None Detected (ND) to 2.7 mg/L. The average TDS concentration was 312 mg/L with a range of 190 mg/L to 580 mg/L.

C. FUTURE SOURCES OF SUPPLY

1. Local Groundwater

The District's maximum day production requirement is currently estimated to be about 10,550 gpm (see **Chapter II, Table II-10**), while the existing system's production capacity is approximately 14,000 gpm.

The District will continue to derive its water supply from the Basin until it becomes necessary to secure alternative supplies.

Past groundwater extractions by the District and others in the Ridgecrest and Intermediate Areas led to pumping depressions within said areas. The District has abandoned most of its wells within the Ridgecrest Area in favor of the wells it has constructed in the Intermediate and Southwest Areas. The District elected to relocate its water supply to the Intermediate and Southwest Areas because of water quality deterioration and the deepening groundwater depression in the Ridgecrest Area. Currently, District Wells 9A through 13, 17, 30, and 31 are situated in the Intermediate Area, and District Wells 18, 33, 34, and 35 are situated in the Southwest Area (the SWWF).

Even after construction of the wells in the SWWF, the District has continued to produce groundwater from the Intermediate Area. Intermediate Area wells may also be replaced as necessary to maintain production capacity, provided that suitable water supplies continue to be available within the Intermediate Area.

Certain assumptions have been made with regard to the District developing additional groundwater supplies within the Indian Wells Valley. These assumptions have been made based on currently available data. As additional data becomes available the assumptions may need to be changed to reflect new information. The District will utilize all readily available data in implementing its groundwater development program, whether it is rehabilitating or replacing existing wells or constructing new wells.

Intermediate Area

Wells 9A, and 10 are situated in close proximity on the same site. Since the wells are located so close to one another, they produce (when all are in operation simultaneously) over 2,200 gpm from what is effectively a single well.

The District's Intermediate Area wells are currently capable of providing about 8,500 gpm to the District's water supply. As wells are abandoned and replaced, production capacity within the Intermediate Area will change accordingly. The District's Intermediate Area production capacity should be maintained to meet peaking demands during summer months, but long-term groundwater extractions therefrom should be minimized.

As the District continues to construct wells in the Southwest Area to augment its existing supply, annual Intermediate Area production should be reduced to allow the underlying groundwater levels to recover. By distributing a portion of its production to the Southwest Area, the District will place less demand on the groundwater in storage underlying the Intermediate Area.

Southwest Area

Testing by the District in 1989 and 1996 indicated that the SWWF had the ability to sustain production of at least 2,400 gpm, and the produced water had a TDS of approximately 250 parts per million (ppm), which is suitable for domestic use without treatment or blending.

The District has constructed Wells 18, 33, 34 and 35 in the Southwest Area.

Northwest Area

The Northwest Area contains a significant quantity of extractable groundwater; however, water in the Northwest Area is of generally poorer quality.

Water quality from the four Northwest Wellfield (Neal Ranch) agricultural wells was tested as part of a pilot study for brackish water treatment in 2004-2005. TDS concentrations in the four wells ranged between 620 mg/L and 3,180 mg/L. In addition, several of the Neal

Ranch wells had concentrations of nitrate, sulfate, chloride, arsenic, iron, manganese, selenium, gross alpha radiation, and uranium that exceeded the MCLs of those constituents.

In addition, the USBR discovered while drilling Wells NR-1 and NR-2 that the geologic formation in the Northwest Area includes extensive clay layers, which can pose difficulties for construction of productive wells.

Water from the Northwest Area is therefore unusable for production purposes unless it is blended with higher quality water, subjected to extensive levels of treatment, or both treated and blended. An abundant supply does remain within the Northwest Area, and feasibility studies are underway to determine whether the construction of treatment facilities there is a cost-effective means of augmenting the District's water supply.

2. Cooperative Efforts

In addition to its participation in the IWVGA, the District has participated in funding and producing Valley-wide groundwater studies conducted by CDWR, USGS, and the USBR. The District participated with the USGS in its groundwater investigation program for 25 years, and participated with the USBR in its groundwater investigation (exploratory well project) between 1991 and 1993.

District representatives also participate in various organizations which are concerned about water supply within the Indian Wells Valley, and the District routinely participates in cooperative efforts to improve water supply conditions within the Valley. Generally, these cooperative efforts have also involved NAWS and SVMI, among others.

In 2016, Kern County, Inyo County, San Bernardino County, the City of Ridgecrest, and the IWVWD entered into a joint exercise of powers agreement to form the IWVGA in compliance with the requirements of the Sustainable Groundwater Management Act (see section above on SGMA).

The District, NAWS, and SVMI have also entered into water system interconnection agreements, and have constructed interconnections between their respective systems; the capacities of said interconnections are indicated on **Table III-1**. All interconnections are tested annually. Details regarding each interconnection agreement follow.

TABLE III-1
EMERGENCY INTERCONNECTIONS WITH
NAVAL AIR WEAPONS STATION AND
SEARLES VALLEY MINERALS, INC.

SOURCE	MAXIMUM TRANSFER RATE (GPM)		MAXIMUM DAILY CAPACITY (GAL)	
	FROM DISTRICT	TO DISTRICT	FROM DISTRICT	TO DISTRICT
Interconnection 1 (NAWS)	2,000	1,300	2,880,000	1,872,000
Interconnection 2 (SVMI)	750	0	1,080,000	0
Totals:	2,750	1,300	3,960,000	1,872,000

a. Naval Air Weapons Station

In a cooperative effort, the District and NAWS have constructed an emergency water system interconnection between their respective water systems. The interconnection, improved around 2012, permits either entity to deliver water to the other as needed to meet water supply requirements during emergencies caused by well pumping plant or transmission pipeline failure. It is not intended to augment the normally available water supply of either entity. The emergency interconnection (16-inch diameter) is located northerly of Inyokern Road (Highway 178) in the vicinity of Primavera Street.

According to testing performed in May 2019, the capacity of the Navy interconnection is approximately 1,300 gpm from the Navy to the District, and approximately 2,000 gpm from the District to the Navy.

b. Searles Valley Minerals Inc. (SVMI)

Emergency Interconnection

In 1986, the District and SVMI (then Kerr-McGee) entered into an agreement to permit the District to use an existing SVMI well (Well 35) to augment (for emergency purposes only) its water supply. The District and SVMI subsequently negotiated an emergency interconnection agreement that permits exchanges of water for emergency purposes. Said agreement (which superseded the 1986 agreement) is limited to existing facilities.

According to testing performed in April 2019, the capacity of the SVMI interconnection is approximately 750 gpm from the District to SVMI. Currently, the District cannot accept water from the SVMI interconnection because SVMI water is not chlorinated until further downstream.

3. In-Valley Water Supply Development

Independently of the IWVGA's efforts, the District has considered several possible scenarios for developing water supplies within the Indian Wells Valley, as described below. None of these represent "new sources of water" for purposes of conformance with net extraction limitations set forth in the draft GSP.

a. Surface Water Capture

1) Infiltration Galleries in Sierra Nevada Canyons

- Description: The District would construct infiltration galleries within Fivemile, Ninemile, Sand, Grapevine, and Indian Wells Canyons, along with a collector pipeline running southerly generally along Highway 395 to a treatment plant at the Northwest Well Field (NWWF), and a treated water conveyance pipeline from the NWWF to the District's system at Victor Street.
- Benefits: Augmentation of District water supply by approximately 2,600 AF/Yr collected over a six-month period.
- Significant Challenges: Environmental and water rights issues; reduction of in-Valley groundwater recharge by 2,600 AF/Yr, with associated impacts to groundwater pumpers.
- Conclusion: Challenges currently outweigh benefits.

2) Surface Water Diversions in Sierra Nevada Canyons

- Description: The District would construct facilities to capture surface water flows in Indian Wells and Grapevine Canyons, including production wells in the canyons and a transmission pipeline. A hydro-power plant and/or water treatment plant could optionally be included.
- Benefits: Augmentation of District water supply by approximately 1,000 AF/Yr.
- Significant Challenges: Environmental and water rights issues; reduction of in-Valley groundwater recharge by 1,000 AF/Yr, with associated impacts to groundwater pumpers.
- Conclusion: Challenges currently outweigh benefits.

3) Capture of Groundwater Potentially Trapped Behind Mountain-front Fault

- Description: The District would construct wells and a transmission/distribution pipeline to extract and distribute groundwater from a hypothetical isolated groundwater aquifer, separated from the main Indian Wells Valley aquifer by the mountain-front fault. Extensive hydrogeological investigation would be required.
- Benefits: District utilization of potentially new, isolated source of groundwater with unknown potential.
- Significant Challenges: Uncertain hydrogeological conditions; environmental and water rights issues, including potential impacts to small number of in-basin pumpers.
- Conclusion: Insufficient information currently available to adequately evaluate benefits versus challenges--therefore, data should continue to be gathered.

4) Brackish Groundwater Treatment

- Description: The District would construct facilities to produce, desalinate, transmit, and distribute poorer-quality groundwater within the Indian Wells Valley.
- *Brackish Water Siting and Resource Quantification Study* is currently in progress (funded by CDWR grant).
- Feasibility Study, Pilot Study, and Preliminary Design Report by Carollo Engineers were prepared in 2006, based on locating treatment plant at NWWF.
- Benefits: District utilization of previously unusable groundwater. May help mitigate impact on shallow wells by increasing distribution of groundwater pumping. Potential for usage of treatment reject water by Coso Geothermal and Searles Valley Minerals.
- Significant Challenges: Brine disposal by evaporation requires lined ponds and would require coordination with NAWS regarding potential impacts to Navy facilities and operations; increase of in-Valley groundwater extraction.
- Conclusion: Feasibility of this project is currently being studied by both the District and IWVGA. It is listed as a Conceptual Project in the GSP.

5) Groundwater Blending

- Description: The District would construct blending facilities (storage and pumping) to blend existing poorer-quality water resources (e.g. NWWF, existing northern farming operations) with high-quality water (e.g. SWWF) to produce a usable water source.
- Benefits: Utilization of previously unusable groundwater.
- Significant Challenges: Diminished water quality; environmental issues; increase of in-Valley groundwater extraction.
- Conclusion: Challenges currently outweigh benefits.

6) Recycled Water

As stated previously, the GSP's list of projects includes three options for development and optimization of recycled water within the Indian Wells Valley: landscape irrigation at sites within in the City of Ridgecrest and at NAWS China Lake; landscape Irrigation at Cerro Coso Community College; and groundwater recharge.

The District has independently considered various alternatives for the use recycled water, and is currently considering a scenario for the use of recycled water for groundwater replenishment via deep-well injection, as presented in detail in **Chapter VI**.

7) SVMI Self-Sufficiency

- Description: The District would provide SVMI with an alternative source of water for industrial use, thereby reducing SVMI's need to pump groundwater in the Indian Wells Valley. Alternative sources may include recycled water or desalinated brackish groundwater. SVMI has a total potential demand of approximately 2,000 - 2,100 AF/Yr, which would correspond to the reduction of water pumped by SVMI from the Indian Wells Valley.
- Benefits: Salt export from Indian Wells Valley.
- Significant Challenges: high-quality water is required for SVMI's industrial processes, requiring that brackish or recycled water be treated prior to use by SVMI. The reduction in Indian Wells Valley pumping by SVMI would be balanced by export of in-Valley brackish or recycled water, resulting in no net decrease of Indian Wells Valley pumping. Treated recycled and brackish groundwater could be used for other purposes in-Valley.
- Conclusion: From the District's perspective, challenges outweigh benefits. SVMI is currently negotiating with City of Ridgecrest for a share of the City's recycled water production.

8) El Paso Subarea Exploration

The District is currently engaged in an investigation into the potential of the El Paso Subarea, which is the southwesterly portion of the IWVGB, as a potential groundwater source.

4. Water Importation

As stated previously, the GSP's list of projects includes two options for development of imported water supplies to the Indian Wells Valley: a direct use project with AVEK and a groundwater recharge project with LADWP. Water importation represents introduction of "new sources of water" for purposes of conformance with net extraction limitations set forth in the draft GSP.

The direct use project with AVEK entails the purchase of SWP Table A Entitlement or potentially a combination of other short and long-term water supplies by IWVGA in coordination with Kern County Water Agency (KCWA). The IWVGA would arrange for the purchased water supply to be wheeled through existing AVEK facilities, specifically through existing AVEK surface water treatment facilities and the California City Pipeline.

The Groundwater recharge project with LADWP entails the purchase of SWP Table A Entitlement or potentially a combination of other short and long-term water supplies by IWVGA in coordination with KCWA. The IWVGA would arrange for the purchased water supply to be delivered to Metropolitan Water District (MWD) and subsequently provided to LADWP for use in LADWP's service area. In exchange, LADWP would provide Owens Valley water from the L.A. Aqueduct to the IWVGB for use in a groundwater recharge project. A new turnout from the L.A. Aqueduct would be required, along with a raw water pipeline conveying Owens Valley water to a potential new groundwater replenishment facility (percolation ponds) located northwest of the Inyokern Airport.

The District has also independently considered several alternatives for importing water to the Valley, as discussed in the following paragraphs.

a. East Side Water Production Wheeled through L.A. Aqueduct

- Description: The District would arrange for the delivery of water from potential dedicated water sources on the east side of Sierra Nevada to LADWP. LADWP would transmit the water to Indian Wells Valley, and the District would construct a new turnout from the L.A. Aqueduct, a groundwater replenishment facility (percolation ponds or injection wells) in the Inyokern area, and a raw water pipeline conveying water from the turnout to the replenishment facility.
- Benefits: District utilization of entirely new source of water. There would also be a potential to institute a banking program and accumulate stored water as part of an agreement with LADWP.
- Significant Challenges: institutional, political, environmental, financial, and water rights issues.
- Conclusion: Feasible, but costly. The District is in regular communication with LADWP, but there are no current negotiations regarding wheeling of East Side water purchases via the L.A. Aqueduct.

b. State Water Project (SWP) Allocations (Entitlements) Exchanged and Wheeled through L.A. Aqueduct

- Description: The District would acquire existing (available) SWP allocations. The District would arrange for delivery of the acquired SWP allocations to be delivered to MWD and subsequently provided to LADWP for use in LADWP's service area. In exchange, LADWP would provide Owens Valley water from the L.A. Aqueduct to the District for use in a groundwater recharge project, similar to that described in paragraph A, above.
- Benefits: District utilization of entirely new source of water. There would also be a potential to institute a banking program and accumulate stored water as part of an agreement with LADWP.

- Significant Challenges: Institutional, political, environmental, financial, and reliability issues.
- Conclusion: Feasible, but costly. The District is in regular communication with LADWP, but there are no current negotiations regarding wheeling of SWP allocations via the L.A. Aqueduct.

c. West Side Water Purchase Exchanged and Wheeled through L.A. Aqueduct

- Description: The District would purchase banked, wet-year surplus water in western Kern County. The District would arrange for delivery of the acquired water to be delivered to MWD and subsequently provided to LADWP for use in LADWP's service area. In exchange, LADWP would provide Owens Valley water from the L.A. Aqueduct to the District for use in a groundwater recharge project, similar to that described in paragraph A, above.
- Benefits: District utilization of entirely new source of water. There would also be a potential to institute a banking program and accumulate stored water as part of an agreement with LADWP.
- Significant Challenges: Institutional, political, environmental, financial, and reliability issues. The surplus water would be an interruptible supply, subject to the needs of the rights holder.
- Conclusion: Feasible, but costly. The District is in regular communication with LADWP, but there are no current negotiations regarding wheeling of West Side water purchases via the L.A. Aqueduct.

d. Capture of Coso Geothermal Steam Discharges

- Description: The District would construct facilities for capture, recovery, treatment, transmission and distribution of water currently being discharged by the Coso Geothermal Facility as steam to atmosphere.
- Benefits: Utilization of entirely new source of water delivering up to approximately 10,000 AF/Yr.

- Significant Challenges: Environmental, water rights, and political issues. The Coso facility has recently changed ownership, and the new owner's interest in such a program has yet to be established.
- Conclusion: Technically feasible, but the interest of the new owner of the Coso facility in the project is currently uncertain.

e. LADWP Groundwater Banking

- Description: District would construct a new turnout from the L.A. Aqueduct, along with transmission, treatment (if necessary), injection, and extraction facilities, to allow LADWP to bank water from the L.A. Aqueduct in the El Paso Subarea, with an agreement that allocates a portion of banked water to remain within the Indian Wells Valley for local use. In addition, LADWP would wheel District-produced water from the District's properties in the Olancha area via the L.A. Aqueduct for groundwater replenishment, as in Alternative (a) above.
- Benefits: Utilization of entirely new source of water (quantity subject to negotiation with LADWP).
- Significant Challenges: environmental, water rights, and political issues.
- Conclusion: The District is in regular communication with LADWP, but discussions regarding a groundwater banking program agreement are currently on hold.

CHAPTER IV

EXISTING WATER SYSTEM FACILITIES

CHAPTER IV
EXISTING WATER SYSTEM FACILITIES

The District's existing domestic water system consists of eleven well pumping plants, six booster pumping plants, eleven water storage reservoirs, over 1,300,000 LF of water transmission and distribution pipelines, and a radio telemetry system that provides remote monitoring and control capabilities. The existing system is shown on **Maps 1 and 2**, and is described in detail in the following sections.

Since the District's 1997 Water General Plan was adopted, the District has constructed the following improvements to its domestic water system:

- 2.0 MG Springer Reservoir (2,555 Pressure Zone (B-Zone))
- 1.0 MG C-Zone Reservoir No. 2 (2,660 Pressure Zone (C-Zone))
- 0.4 MG D-Zone Reservoir No. 2 (2,775 Pressure Zone (D-Zone))
- Bowman Pressure Reducing Station (2,455 Pressure Zone (A-Zone))
- Well Pumping Plants 9A, 18, 33, 34 and 35
- Arsenic Removal Facilities for Wells 9A and 10, and Wells 11 and 13.
- Transmission piping (37,000± LF of 30 inch, 15,000± LF of 24 inch, 11,000± LF of 16 inch, and 94,000± LF of 12 inch pipeline)
- Distribution piping (84,000± LF of 8 inch and 8,500± LF of 6 inch pipeline)
- Disinfection facilities at each well pumping plant

The District has replaced significant amounts of substandard pipeline (particularly 6 inch diameter and smaller pipeline constructed of unlined and uncoated steel) within its existing distribution system with new pipelines meeting all current industry and District standards. Some of the replacement pipelines constructed prior to 2002 no longer meet current standards and will need to be replaced in the future.

The improvements noted above have helped to alleviate a number of the operational difficulties identified in the 1997 Water General Plan, and have significantly improved the reliability and operational flexibility of the District's domestic water system.

A. PRESSURE ZONES

The District's existing domestic water system consists of five separate pressure zones (A-Zone, B-Zone, C-Zone, D-Zone, and E-Zone), which provide service at elevations between 2,230 feet (at the NAWS) and 2,780 feet (at Cerro Coso Community College). About 74% of the water served by the District is delivered to customers in the 2,455 Pressure Zone (A-Zone), and about 18% is served within the 2,555 Pressure Zone (B-Zone). Pressure zone data, including the approximate range of elevations served and approximate static pressures, are set forth in **Table IV-1**. The current pressure zones are shown on **Maps 1 through 4**.

B. WATER PRODUCTION FACILITIES

All water served by the District is produced from ground water extraction wells. The District's system presently has eleven active well pumping plants and one well to be equipped in the future. All well pumping plants in the District's system are equipped with electric motor driven deep well turbine pumping units, and can be controlled automatically and remotely.

Since the 1997 Water General Plan was adopted, the District has destroyed four old wells, constructed five large and modern well pumping plants, and purchased one well (Well 36 from Circle M Farming). Since the 1986 Water General Plan, the District has destroyed a total of 24 wells with an estimated combined production capacity of approximately 9,600 gpm (see **Table IV-2**). The five new well pumping plants, District Wells 9A, 18, 33, 34, and 35, have a combined production capacity of 6,500 gpm.

1. Well Data

The District's existing wells are identified and described in **Table IV-3**. The oldest active well was constructed in 1974, while the newest well was constructed in 2021. Wells range from 700 feet to 1,200 feet in depth.

Four of the District's wells are equipped with louvered casing, three wells are equipped with shaped wire wrapped screen, and one older well is equipped with slotted casing. Generally, the older wells have less perforated interval. The data set forth in **Table IV-3** illustrate the changes which have occurred in well design and construction over the years, as well as the status of each well.

a. Well Siting

Prior to 1998, District wells were constructed in clusters located in two areas, the Yard Field (Wells 1 through 7, all of which have been abandoned) and the Well Field (Wells 8, 9, 9A and 10). By the late 1970s, it had become apparent that clustering was causing pumping depressions that were significantly affecting the water levels in the Intermediate and Ridgecrest Areas, and might also be causing hydraulic gradient reversal from the China Lake playa (and subsequent deterioration of water quality).

In 2011 an arsenic removal facility was constructed to treat the water produced by Wells 9A and 10. Wells 8 and 9 were abandoned because their casings had reached the end of their service lives. The Well Field site has adequate space for replacement of either Well 9A or Well 10, if necessary.

Wells 11 and 13 are expected to produce water throughout the span of this Water General Plan; however. In 2011 an arsenic removal facility was constructed to filter the water produced by Wells 11 and 13. Both wells were sited to result in improved distribution of pumping areas, and no additional production wells will be located within one mile of any of these active wells unless such a location is either mandated by operational requirements or aquifer testing supports closer well spacing.

Well 16 (formerly China Lake Acres Well 2) is located approximately one mile west of Well 17. Well 16's location is consistent with the District's policy of distributing pumping, but it had limited capacity, produced sand, and periodically posed water quality problems as a result of the well being taken out of service for maintenance. Well 16 is no longer in service and is used for groundwater monitoring.

Well 17 (the Lane Acres Replacement Well) was completed in 1989 and, even though it periodically requires maintenance for a calcium carbonate scaling problem, should produce water over the span of this Water General Plan. No additional production wells will be constructed within one mile of Well 17 unless such a location is either mandated by operational considerations or aquifer testing supports closer spacing.

The District completed an exploratory drilling and test pumping program in its SWWF, located approximately three miles south of Inyokern, in 1989. Wells 18, 33, 34 and 35 were subsequently constructed within the SWWF. Well 18 (constructed 1989) is located approximately 2,500 feet west and approximately 3,500 feet south of the intersection of Bowman and Brown Roads. Well 33 (constructed 1999) is located near the corner of Oriole Street and Dolphin Avenue. Well 34 (constructed 2006) is located near the corner of Bowman Road and Randsburg Inyokern Road. Well 35 (constructed 2021) is located near the corner of Bowman Road and Star Place. Wells 18 and 34 are both located approximately 0.5 miles from Well 33, and approximately 0.9 miles from each other. Well 35 is located approximately 0.5 miles from Well 34. The District owns property adjacent to the existing SWWF well sites, which could provide for future replacement sites proximal to existing power and pipeline facilities.

Wells 30 and 31 were both completed in 1992, and should produce water throughout the span of this Water General Plan. No additional production wells will be located within one mile of either well unless such a location is either mandated by operational considerations or aquifer testing supports closer spacing.

Well 36 was purchased from Circle M Farming (Mead) in 2013 and is currently unequipped. It may be equipped in the future and would produce water throughout the span of this Water General Plan. It may also be used for dye testing and/or pilot testing for a future program of groundwater replenishment using recycled water.

b. Water Levels

Static water levels obtained during SCE hydraulic tests are set forth in **Table IV-4**; these water levels were obtained by measuring depth from ground surfaces to water table, and essentially reflect annual changes in ground water levels. However, they may not be entirely accurate since static water levels are frequently measured shortly after pumping units have been shut down and before ground water levels have had an opportunity to fully recover.

c. Specific Capacities and Specific Capacity Factors

Specific capacities (gallons/minute/foot of water table drawdown) and specific capacity factors (specific capacity/foot of perforated well casing) for the District's well pumping plants, together with selected water well data, are presented in **Tables IV-5 and IV-6**; said capacities and factors were derived from data collected during SCE tests.

A well's specific capacity may decline with time as fine material migrates through the aquifer and becomes lodged in the aquifer zone near the well's gravel pack. Specific capacity can be improved, but not completely restored, by redeveloping wells, particularly by pumping (overpumping) and surging. Although specific capacities, and therefore specific capacity factors, have fluctuated with time, they differ significantly from well to well; the differences are attributable to aquifer characteristics, well construction techniques, and well screen sizes and dimensions.

A comparison of specific capacities indicates better well production conditions towards Little Dixie Wash, as evidenced by the higher specific capacity values for Wells 17, 18, 30, 31, 33, 34 and 35. The lower specific capacity values for Wells 9A, 10, and 11 indicate poorer water production conditions away from the Wash.

2. Well Pumping Plant Operations

The District's well pumping plants are operated as required to meet demands. During winter months the arsenic removal facilities (Wells 9A, 10, 11 and 13) are not typically operated, while all plants are typically operated at half of their design capacity during summer months. Currently, transmission system deficiencies, storage limitations, and limited production capacities preclude the system-wide use of OPPR; pumping plants are needed to maintain adequate service during summer months.

The District's operations staff (hereafter operators) checks active well pumping plants daily to verify that they are in order and are operating properly. They conduct visual inspections of each plant, giving particular attention to any leaks, odors, or vibrations. They record water production and energy consumption periodically. Operators also periodically secure water samples for analysis as required by CDHS regulations.

Operators measure power conditions (amps and volts), oil temperatures, pumping unit vibrations, and ground water levels monthly. They also check all hydraulic valve controls and clean each plant monthly.

Every 3,000 operating hours or six months (whichever is less), operators clean each well pumping plant's electrical equipment, check electrical conductors and equipment with infrared scanning equipment, tighten motor conductor connections at the starters, analyze pumping unit vibration, and change motor bearing oil. Drained motor bearing oil is analyzed periodically to determine if it has been contaminated and, if so, by what.

Operators have SCE hydraulically test the pumping units every five years, and also rehabilitate hydraulic control valves and regulators annually. During testing, pumping units are tested for at least three operating conditions, with at least 20 to 25 pounds per square inch (psi) discharge pressure difference between each operating condition. Each operating condition is tested long enough to ensure that hydraulic conditions have stabilized. If possible, well pumping plants are shut down at least one full day in advance of testing to allow static ground water levels to fully recover.

As a result of the constant attention given to the well pumping plants by the operators, they are able to anticipate certain failures, particularly with respect to motor bearings and pump bearings. When pumping unit vibrations increase significantly (i.e. beyond original specifications), the pumping units, or portions thereof, are removed, examined, repaired, and replaced before extensive damage occurs.

As time and funds permit, operators modify and upgrade older plants to meet current standards, and also install additional control and protective devices to ensure that pumping units and related equipment are not damaged when operating under adverse or abnormal conditions. Power monitors, lightning arrestors, and protective capacitors are installed at each pumping plant and for each pumping unit, if appropriate.

Well pump performance data is set forth in **Table IV-7**. The data indicates that of the District's eleven operational well pumping plants, six are operating at 65% to 69% efficiency, an acceptable efficiency range. Four well pumping plants are operating at or below 61% efficiency. Well 35 has not been tested for efficiency. As water levels change (either rise or fall) and as pumping unit components wear, the indicated efficiencies will change.

3. Wells and Well Pumping Plants

Basic well pumping plant performance and operating data are set forth in **Table IV-7**. **Figures IV-1 through IV-12** illustrate the construction details and current water level information for each of the District's wells. The District's wells and well pumping plants are described more specifically as follows:

a. Well 9A

Well 9A is located in the District's Well Field, near the corner of Primavera Street and Sydnor Avenue, and was constructed in 2003 to a depth of 1020 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inches, and has 456 feet of perforations between the depths of 300 feet and 460 feet, and 600 feet and 796 feet below ground surface. The well was rehabilitated in 2008.

An SCE performance test was performed in January 2018. At that time the static water level was 225 feet below ground surface and the pumping water level was 261 feet below ground surface (see **Figure IV-1**). The pump is set at a depth of 485 feet below ground surface, 224 feet below the 2018 pumping water level.

Well Pumping Plant 9A is currently equipped with a 150 hp pumping unit that produces about 1,100 gpm. A diesel engine generator set is present at the site but is not in use.

b. <u>Well 10</u>

Well 10 is located in the Well Field, near the corner of Primavera Street and Sydnor Avenue, and was constructed in 1974 to a depth of 800 feet. The well casing is constructed of 5/16 inch steel with a diameter of 16 inches, and has 490 feet of perforations between the depths of 250 feet and 800 feet below ground surface. The well was rehabilitated in 2020.

An SCE performance test was performed in January 2018. At that time the static water level was 225 feet below ground surface and the pumping water level was 256 feet below ground surface (see **Figure IV-2**). The pump is set in perforated casing 401 feet below ground surface, 145 feet below the 2018 pumping water level.

Based on the above information, the pumping water level is within the perforations. When the well is operated, water most likely cascades through the exposed perforations and entrains air in the water, thus causing operational disturbances by introducing air into the system.

Well Pumping Plant 10 is currently equipped with a 150 hp pumping unit that produces about 1,100 gpm. A diesel engine driver provides standby mechanical power to the pumping unit through a right angle gear drive.

Well 10's casing is nearing the end of its 50 year service life. If Well 10 is to be replaced at the end of its service life, it should be replaced by 2024. There is adequate room on the Well Field site for replacement of Well 10, if necessary.

c. Well 11

Well 11 is located near Mahan Street south of Los Flores Avenue, and was constructed in 1977 to a depth of 620 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inches, and has 200 feet of perforations between the depths of 260 feet and 600 feet below ground surface. The well was rehabilitated in 2020.

An SCE performance test was performed in January 2018. At that time the static water level was 213 feet below ground surface and the pumping water level was 250 feet below ground surface (see **Figure IV-3**). The pump is set at a depth of 303 feet below ground surface, 53 feet below the 2018 pumping water level.

Well Pumping Plant 11 is currently equipped with a 150 hp pumping unit that produces about 1,200 gpm.

Well Pumping Plant 11 is nearing the end of its 50 year service life. If Well 10 is to be replaced at the end of its service life, it should be replaced by 2027. There is adequate room on the Well Field site for replacement of Well 11, if necessary.

d. Well 13

Well 13 is located near the corner of Mahan Street and Halchrist Avenue, and was constructed in 1983 to a depth of 720 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inches, and has 180 feet of perforations between the depths of 520 feet and 700 feet below ground surface. The perforations are below a bentonite seal which is located 430 feet below ground surface, limiting ground water extractions to deeper aquifer zones. The well was rehabilitated in 2005.

An SCE performance test was performed in January 2018. At that time the static water level was 205 feet below ground surface and the pumping water level was 271 feet below ground surface (see **Figure IV-4**). The pump is set at a depth of 360 feet below ground surface, 89 feet below the 2018 pumping water level.

Well Pumping Plant 13 is currently equipped with a 150 hp pumping unit that produces about 1,200 gpm. Well Pumping Plant 13 is expected to remain in operation throughout its 50 year service life, which would end in 2033. There is adequate room on the Well Field site for replacement of Well 13, if necessary.

e. <u>Well 17</u>

Well 17 is located at the corner of Pinto Street (also known as Quarter Street) and Highway 178 in Lane Acres, and was constructed in 1989 to a depth of 1,030 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inches, and has wire wrapped screen providing 380 feet of perforations between the depths of 410 feet and 490 feet, 540 feet and 560 feet, and 735 feet and 1,015 feet below ground surface. The well was rehabilitated in 2007

An SCE performance test was performed in January 2018, at which time the static water level was 264 feet below ground surface and the pumping water level was 275 feet below ground surface (see **Figure IV-5**). The pump is set at a depth of 580 feet below ground surface, 35 feet below the 2018 pumping water level.

Well Pumping Plant 17 is currently equipped with a 200 hp pumping unit that produces about 1,200 gpm. Well Pumping Plant 17 is expected to remain in operation throughout its 50 year service life, which would end in 2039. There is adequate room on the Well Field site for replacement of Well 17, if necessary.

f. <u>Well 18</u>

Well 18 is located in the SWWF, approximately three miles south of Inyokern, approximately 2,500 feet west and approximately 3,500 feet south of the intersection of Bowman and Brown Roads. The well site lies within the Southwest quarter of Section 8, Township 27 South, Range 39 East, Mount Diablo Meridian. Well 18 was constructed in 1989 to a depth of 1,020 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inches, and has 440 feet of perforations between the depths of 560 feet and 1,000 feet below ground surface. The sounding tube was swagged in 2012, due to corrosion causing sand and gravel to enter to well, as well as causing coliform issues. Due to sand intrusion, an 11 inch diameter liner was installed in June 2017, with a bottom of 885 feet and top of 550 feet.

An SCE performance test was performed in April 2015. At that time the static water level was 414 feet below ground surface and the pumping water level was 422 feet below ground surface (see **Figure IV-6**). The pump is set at a depth of 505 feet below ground surface, 77 feet below the April 2015 pumping water level.

Well Pumping Plant 18 is currently equipped with a 200 hp pumping unit that produces about 1,200 gpm. Well Pumping Plant 18 has experienced some corrosion issues; however, it is expected to remain in operation throughout its 50 year service life, which would end in 2039. If replacement of Well 18 becomes necessary, it may be replaced on District property proximal to existing SWWF facilities.

g. Well 30

Well 30 is located at the corner of Victor Street and Highway 178, and was constructed in 1993 to a depth of approximately 1,200 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inch, and has wire wrapped screen that provides 600 feet of perforations between the depths of 600 feet and 1,200 feet below ground surface. The well was rehabilitated in 2019.

Water levels were measured by the District in 2019, at which time the static water level was 286 feet below ground surface and the pumping water level was 313 feet below ground surface (see **Figure IV-7**). The pump is set at a depth of 360 feet below ground surface, 47 feet below the January 2018 pumping water level.

Well Pumping Plant 30 is currently equipped with a 200 hp pumping unit that produces about 1,400 gpm. Well Pumping Plant 30 is expected to remain in operation throughout its 50 year service life, which would end in 2042.

h. Well 31

Well 31 is located at the corner of Victor Street and Drummond Avenue, and was constructed in 1993 to a depth of approximately 1,200 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inch, and has wire wrapped screen that provides 600 feet of perforations between the depths of 600 feet and 1,200 feet below ground surface. The well was rehabilitated in April 2008.

An SCE performance test was performed in January 2018, at which time the static water level was 285 feet below ground surface and the pumping water level was 330 feet below ground surface (see **Figure IV-8**). The pump is set at a depth of 370 feet below ground surface, 40 feet below the 2018 pumping water level.

Well Pumping Plant 31 is currently equipped with a 200 hp pumping unit that produces about 1,200 gpm. Well Pumping Plant 31 is expected to remain in operation throughout its 50 year service life, which would end in 2042.

i. Well 33

Well 33 is located in the SWWF, near the corner of Oriole Street and Dolphin Avenue, and was constructed in 1999 to a depth of approximately 1,020 feet. The well casing is constructed of 1/4 inch steel with a diameter of 16 inch, and has 440 feet of perforations between the depths of 560 feet and 1,000 feet below ground surface. The well was modified in 2017 with a 11 inch diameter liner to a depth of 770 feet and 190 feet of perforations.

An SCE performance test was performed in January 2018, at which time the static water level was 412 feet below ground surface and the pumping water level was 438 feet below ground surface (see **Figure IV-9**). The pump is set at a depth of 510 feet below ground surface, 72 feet below the 2018 pumping water level.

Well Pumping Plant 33 is currently equipped with a 200 hp pumping unit that produces about 1,200 gpm. Well Pumping Plant 33 has experienced some corrosion issues; however it is expected to remain in operation throughout its 50 year service life, which would end in 2049. If replacement of Well 33 becomes necessary, it may be replaced on District property proximal to existing SWWF facilities.

j. Well 34

Well 34 is located in the SWWF, near the corner of Bowman Road and Randsburg Inyokern Road, and was constructed in 2006 to a depth of approximately 955 feet. The well casing is constructed of 5/16 inch steel with a diameter of 20 inch , and has 355 feet of perforations between the depths of 550 feet and 865 feet, and 895 feet to 935 feet below ground surface. The well was rehabilitated in March 2018.

Water levels were measured by the District in March 2018, at which time the static water level was 396 feet below ground surface and the pumping water level was 468 feet below ground surface (see **Figure IV-10**). The pump is set at a depth of 520 feet below ground surface, 97 feet below the 2018 pumping water level.

Well Pumping Plant 34 is currently equipped with a 250 hp pumping unit that produces about 2,000 gpm. Well Pumping Plant 34 is expected to remain in operation throughout the span of this Water General Plan.

k. Well 35

Well 35 is located in the SWWF, near the corner of Ridgecrest Boulevard and Mercury Street, and was constructed in 2021 to a depth of approximately 1,020 feet. The well casing is constructed of 5/16 inch steel with a diameter of 20 inch, and has 440 feet of perforations between the depths of 560 feet and 1,000 feet below ground surface.

A pump performance test was performed in March 2021, at which time the static water level was 402 feet below ground surface and the pumping water level was 442 feet below ground surface (see **Figure IV-11**). The pump is set at a depth of 520 feet below ground surface, 78 feet below the 2021 pumping water level.

Well Pumping Plant 35 is currently equipped with a 250 hp pumping unit that produces about 1,200 gpm. Well Pumping Plant 35 is expected to remain in operation throughout the span of this Water General Plan.

l. Well 36

Well 36 is located near the corner of Bowman Road and Star Place, and was constructed in 2013 to a depth of approximately 1,010 feet. The well casing is constructed of 3/8 inch steel with a diameter of 18 inch, and has 502 feet of perforations between the depths of 500 feet and 1,002 feet below ground surface.

The Districted gathered sounding data in December 2019, at which time the static water level was 349 feet below ground surface (see **Figure IV-11**).

Well 36 is currently unequipped. It may be equipped in the future, and, if so, would produce water throughout the span of this Water General Plan. It may also be used for dye testing and/or pilot testing for a future program of groundwater replenishment using recycled water.

C. WATER TREATMENT FACILITIES

The District currently operates two arsenic treatment facilities, to remove arsenic from groundwater produced by Well Pumping Plants 9A, 10, 11 and 13.

1. Wells 9A/10 Arsenic Removal Facilities

IWVWD's Well 9A/10 Arsenic Treatment Facility consists of an oxidation, coagulation, and filtration treatment system for arsenic removal, and can accommodate flows of approximately 1,200 to 1,500 gpm, with a nominal capacity of 2,100 gpm.

Untreated water produced by Well 10 is conveyed via a 12-inch diameter pipeline to the treatment facility at the nearby Well 9A site for blending with treated Well 9A water, and the blended water then enters IWVWD's distribution system via a short section of 16-inch diameter pipe.

2. Wells 11/13 Arsenic Removal Facilities

IWVWD's Well 11/13 Arsenic Treatment Facility consists of an oxidation, coagulation, and filtration treatment system for arsenic removal, and can accommodate flows of approximately 1,200 to 1,500 gpm, with a nominal capacity of 2,100 gpm.

Untreated water produced by Well 11 is conveyed to the treatment facility at the Well 13 site via a 12 inch pipeline where water from both wells are treated, and the flow from Well 11 and 13 then enter IWVWD's distribution system near Well 13.

D. BOOSTER PUMPING FACILITIES

The District currently operates six booster pumping plants, including: Sunland B-Zone, Vulcan B-Zone, Gateway C-Zone, Ridgecrest Heights C-Zone, Salisbury D-Zone, and College E-Zone.

All booster pumping plants are equipped with electric motor driven close coupled vertical turbine pumping units, except for the Ridgecrest Heights booster pumping plant which is equipped with electric motor driven end suction pumping units. All plants are controlled automatically and remotely. The combined brake horsepower for the District's booster pumping plants is 500 and their combined pumping capacity is approximately 9,680 gpm, and all booster plants contain multiple pumping units with standby capacity.

1. Booster Pumping Plant Operations

The District operates its booster pumping plants as required to meet demands. Most booster pumping plants are operated on demand; however, the Sunland and Gateway Booster Pumping Plants are operated during off-peak electrical energy periods whenever possible, and are only operated during on-peak electrical energy periods when absolutely necessary.

Operators check active plants daily to verify that they are in order and are operating properly. They conduct visual inspections of each plant, giving particular attention to any leaks, odors, or vibrations. They record water production and energy consumption periodically. Operators also measure power conditions (amps and volts), oil temperatures, and pumping unit vibrations monthly. They also check all hydraulic valve controls and clean each plant monthly.

Every 3,000 operating hours or six months (whichever is less), the operators clean the electrical equipment, check electrical conductors and equipment with infrared scanning equipment, tighten motor conductor connections at starters, analyze pumping unit vibration, and change motor bearing oil. Drained motor bearing oil is analyzed periodically to determine if it has been contaminated and, if so, by what.

Operators have SCE hydraulically test the pumping units every five years, and also rehabilitate hydraulic control valves and regulators annually. During testing, pumping units are tested for at least three operating conditions, with at least 20 to 25 psi discharge pressure difference between each operating condition, and each operating condition is tested long enough to ensure that hydraulic conditions have stabilized.

Booster pumping plant performance data are set forth in **Table IV-8**. Said data indicates that, of the District's 13 booster pumping units, four are operating at 70% to 83% efficiency, a desirable efficiency range, six are operating at 63% to 67% efficiency, an acceptable efficiency range, five are operating at 57% efficiency or less.

As changes are made to the distribution system (e.g. pipelines added or deleted), discharge head conditions for the booster pumps will change; however, these changes should be gradual and should not significantly affect pumping unit operations. Booster pumping units should operate between 65% and 75% efficiency.

2. Booster Pumping Plants

Basic performance and operating data for the District's booster pumping plants are set forth in **Table IV-8**. The plants are described individually as follows:

a. <u>Sunland Booster Pumping Plant</u>

The Sunland Booster Pumping Plant is equipped with two 50 hp units with a capacity of approximately 1,300 gpm/unit. The plant pumps to the B-Zone.

b. <u>Vulcan Booster Pumping Plant</u>

The Vulcan Booster Pumping Plant is equipped with one 40 hp unit with a capacity of approximately 1,100 gpm and one 40 hp unit with a capacity of approximately 900 gpm. The plant pumps water to the B-Zone.

c. <u>Gateway Booster Pumping Plant</u>

The Gateway Booster Pumping Plant is equipped with two 50 hp units with a capacity of approximately 800 gpm/unit. The plant pumps to the C-Zone reservoir.

d. Ridgecrest Heights Booster Pumping Plant

The Ridgecrest Heights Booster Pumping Plant is equipped with one 40 hp unit with a capacity of approximately 800 gpm and two 20 hp units with a capacity of approximately 400 gpm/unit. The plant pumps to the C-Zone.

e. Salisbury Booster Pumping Plant

The Salisbury Booster Pumping Plant is equipped with two 20 hp units with a capacity of approximately 300 gpm/unit. The plant pumps to the D-Zone from the Gateway Reservoir.

f. College Booster Pumping Plant

The College Booster Pumping Plant is equipped with two 50 hp units with a capacity of approximately 650 gpm/unit. The plant pumps to the E-Zone College Reservoir from the C-Zone reservoir.

E. WATER STORAGE FACILITIES

There are eleven water storage reservoirs in the District's existing system, with a combined capacity of approximately 17.0 MG. The District's reservoirs are located on eight separate sites, and have capacities ranging from 0.1 MG to 5.0 MG. All of the District's existing reservoirs are welded steel tanks, except for the C-Zone No. 1 and the D-Zone No. 1, both of which are bolted steel. The existing water storage reservoirs are described in **Table IV-9**.

In 1996, the system had ten reservoirs with a combined capacity of about 14.7 MG. The District significantly improved system storage since then through the construction of the 2.0 MG Springer Reservoir, the 1.0 MG C-Zone No. 2 Reservoir and the 0.4 MG D-Zone No. 2, completion of which greatly the District's storage capacity in the C- and D-Zones. The District's improvements to the system allowed them to abandon the Well Field and China Lake Acres source plant reservoirs.

Operators inspect and clean each reservoir site at least monthly, and visit each site at least weekly. They verify water levels daily, either by site visit (i.e. through remote observation of water level indicators visible from advantageous locations) or by observation of remote telemetry indicators. Operators clean and inspect reservoir floats and probes semi-annually, and clean and inspect each reservoir (especially the interior coatings) every two to three years depending on the specific reservoir's condition, use, and availability.

F. PIPELINE SYSTEM

There are more than 1,300,000 LF of pipelines within the District's existing domestic water system.

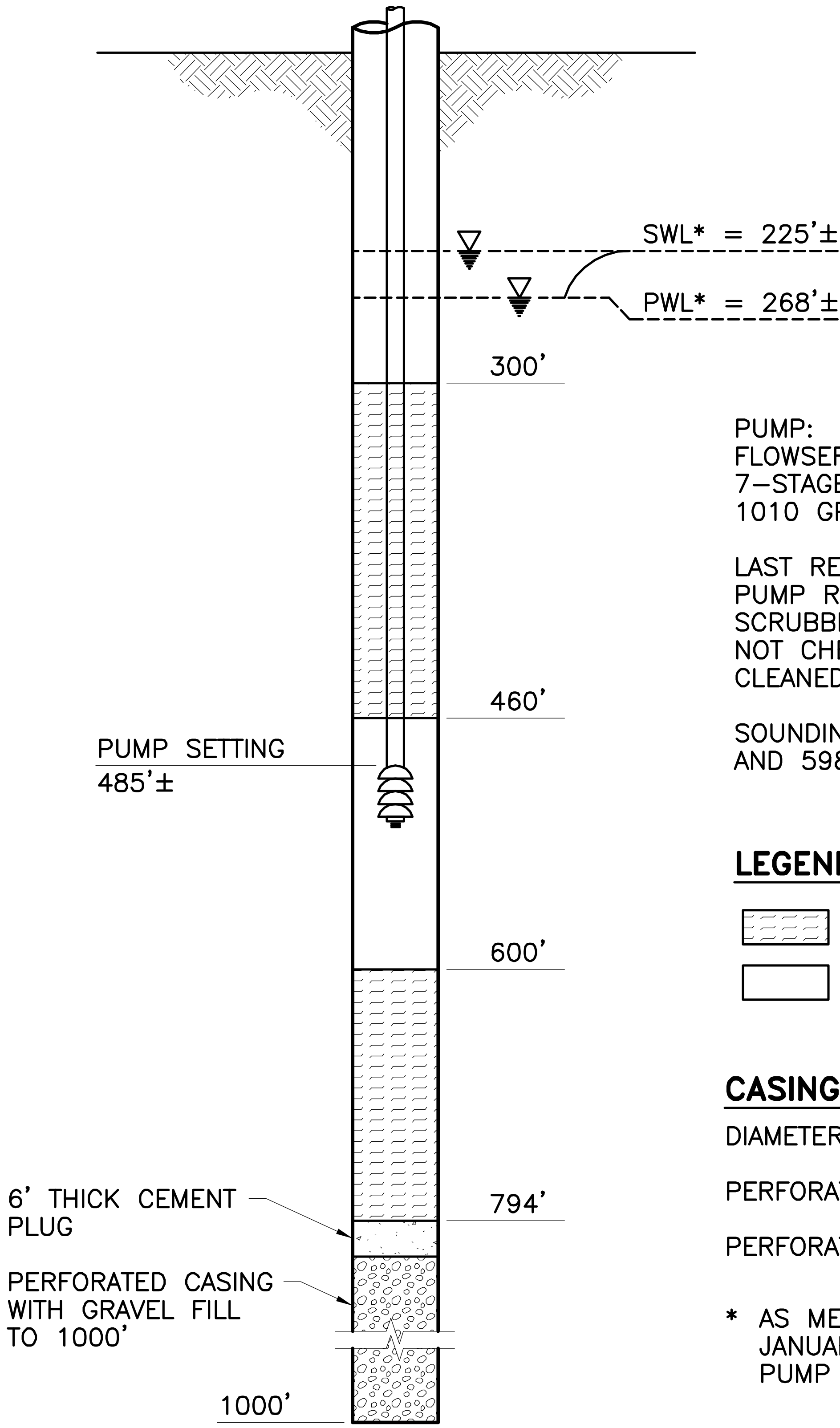
1. Transmission Pipelines

Since 1998, the District constructed a number of new transmission pipelines that have solved most transmission-related operational difficulties. The improvements consisted of constructing over 37,000 LF of 30 inch pipeline, over 15,000 LF of 24 inch pipeline, over 11,000 LF of 16 inch pipeline, and about 94,000 LF of 12 inch pipeline, most of which is located within the A- and B-Zones.

2. Distribution Pipelines

In 1998, the District's system consisted of about 1,160,000 LF of pipeline, with about 30% equal to or less than 6 inches in diameter. The District's pipelines are constructed of steel pipe, CML/CMC/WSP, ACP, and PVCP.

Pipelines constructed of steel pipe which is not cement mortar lined and cement mortar coated are being systematically replaced, as are pipelines smaller than 8 inches in diameter. Since 1998, the District replaced approximately 40,000 LF of substandard distribution pipeline, and the distribution pipeline system will be significantly improved operationally and hydraulically when the remainder of said pipelines have been replaced.



PUMP:
FLOWSERVE 12EMM
7-STAGE
1010 GPM

LAST REHAB (2008):
PUMP REBUILT.
SCRUBBED CASING,
NOT CHEMICALLY
CLEANED.

SOUNDING TUBES AT 596'
AND 598'.

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 60 SLOT

PERFORATION TYPE: LOUVER (FUL-FLO)

* AS MEASURED DURING JANUARY 23, 2018 SCE PUMP PERFORMANCE TEST.

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INDIAN WELLS VALLEY WATER DISTRICT

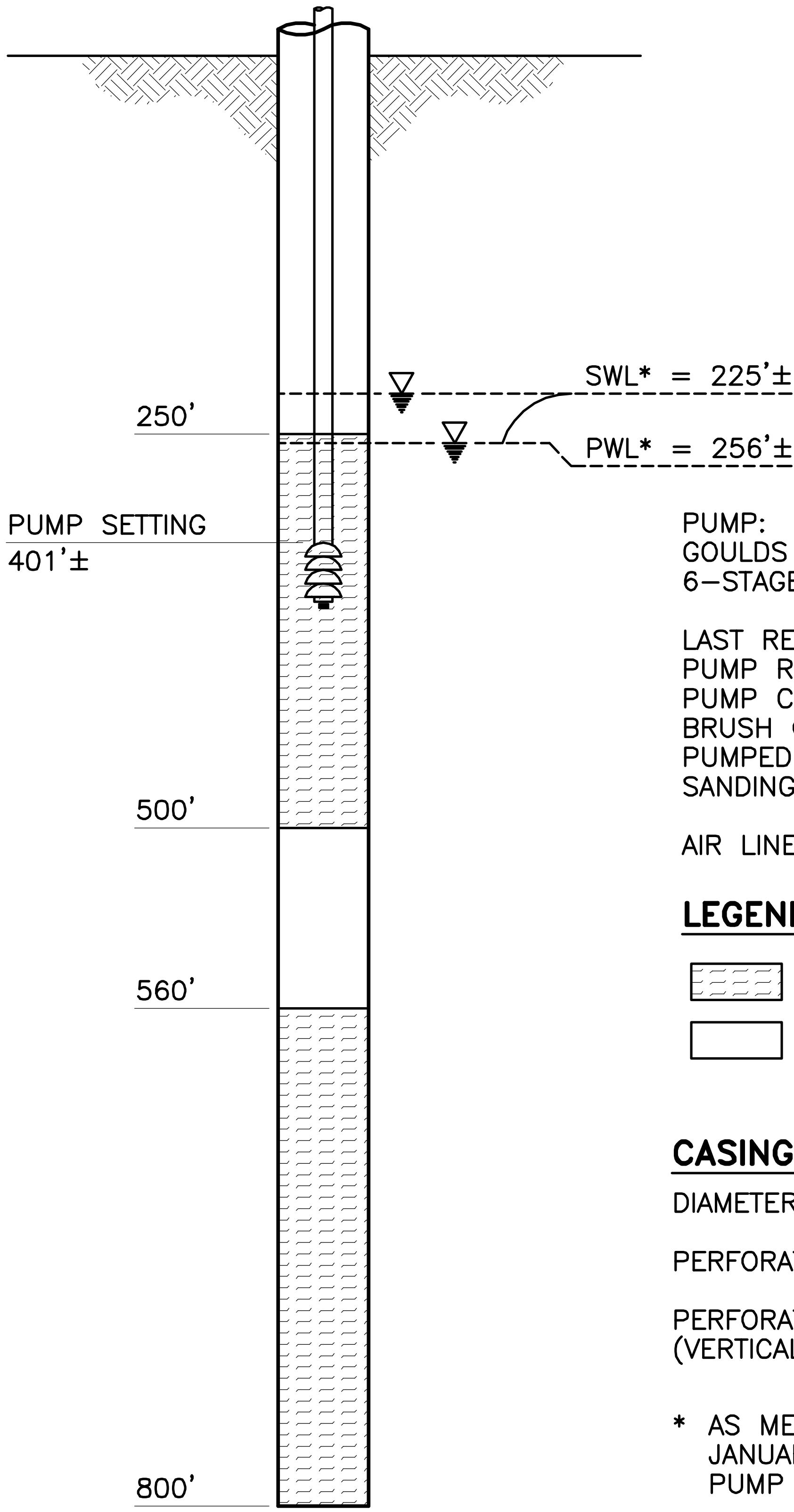
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.9A
WELL SCHEMATIC

FIGURE IV-1

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV1



PUMP:
GOULDS 12 CHC
6-STAGE (1999)

LAST REHAB (2020):
PUMP REBUILT, ALL NEW PUMP COLUMN, NYLON BRUSH ONLY. TEST PUMPED TO ALLEVIATE SANDING ISSUE.

AIR LINE AT 401'

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 5/16"

PERFORATION TYPE: SLOT (VERTICAL, MACHINE CUT)

* AS MEASURED DURING JANUARY 24, 2018 SCE PUMP PERFORMANCE TEST.

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INDIAN WELLS VALLEY WATER DISTRICT

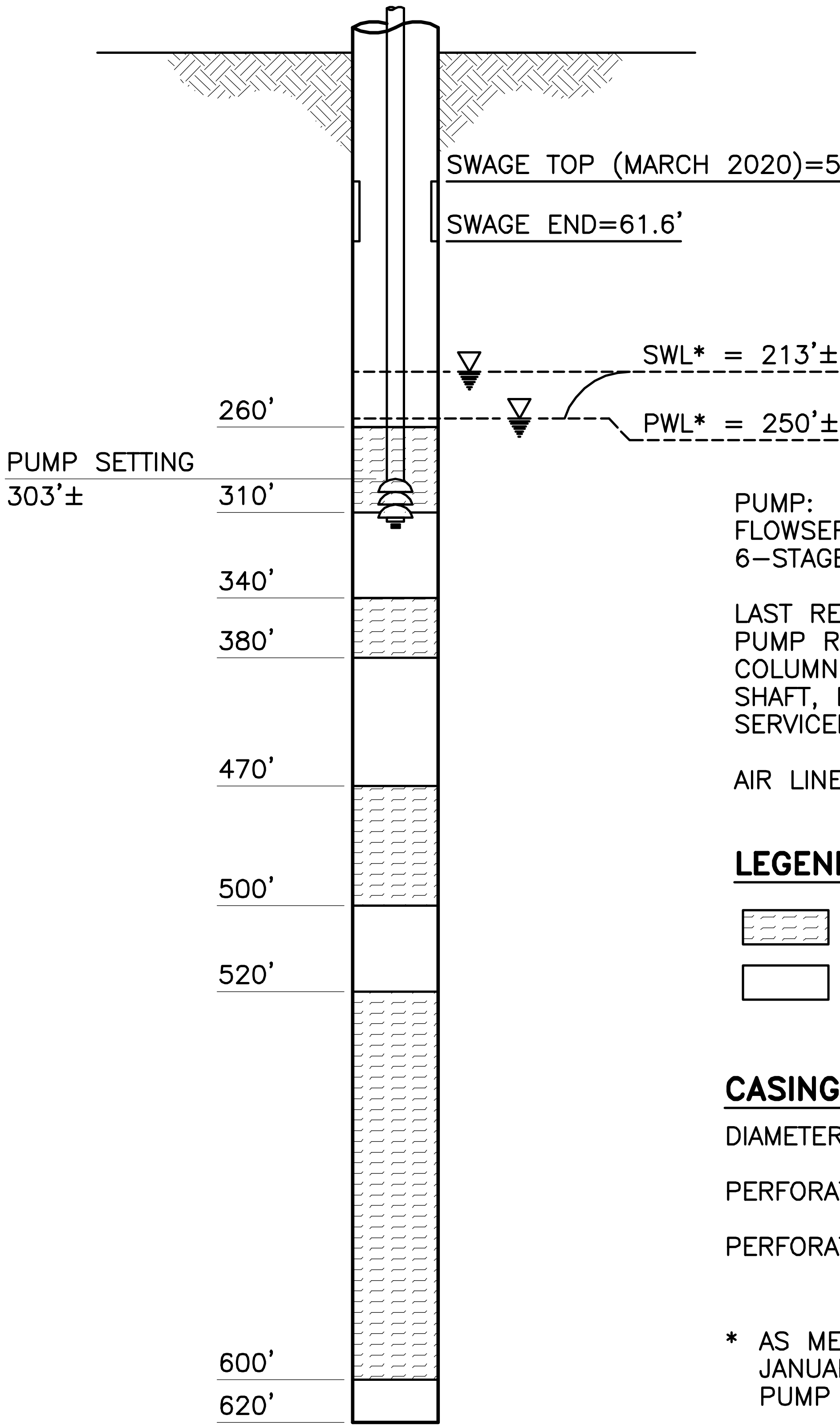
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.10
WELL SCHEMATIC

FIGURE
IV-2

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV2



PUMP:
FLOWSERVE 12 EMM
6–STAGE

LAST REHAB (MARCH 2020):
PUMP REBUILT, ALL NEW COLUMN PIPE, TUBE, AND SHAFT, NEW SUCTION, MOTOR SERVICED, NYLON BRUSH ONLY.

AIR LINE AT 303'

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 1/8"

PERFORATION TYPE: LOUVER (FUL–FLO)

* AS MEASURED DURING JANUARY 23, 2018 SCE PUMP PERFORMANCE TEST.

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INDIAN WELLS VALLEY WATER DISTRICT

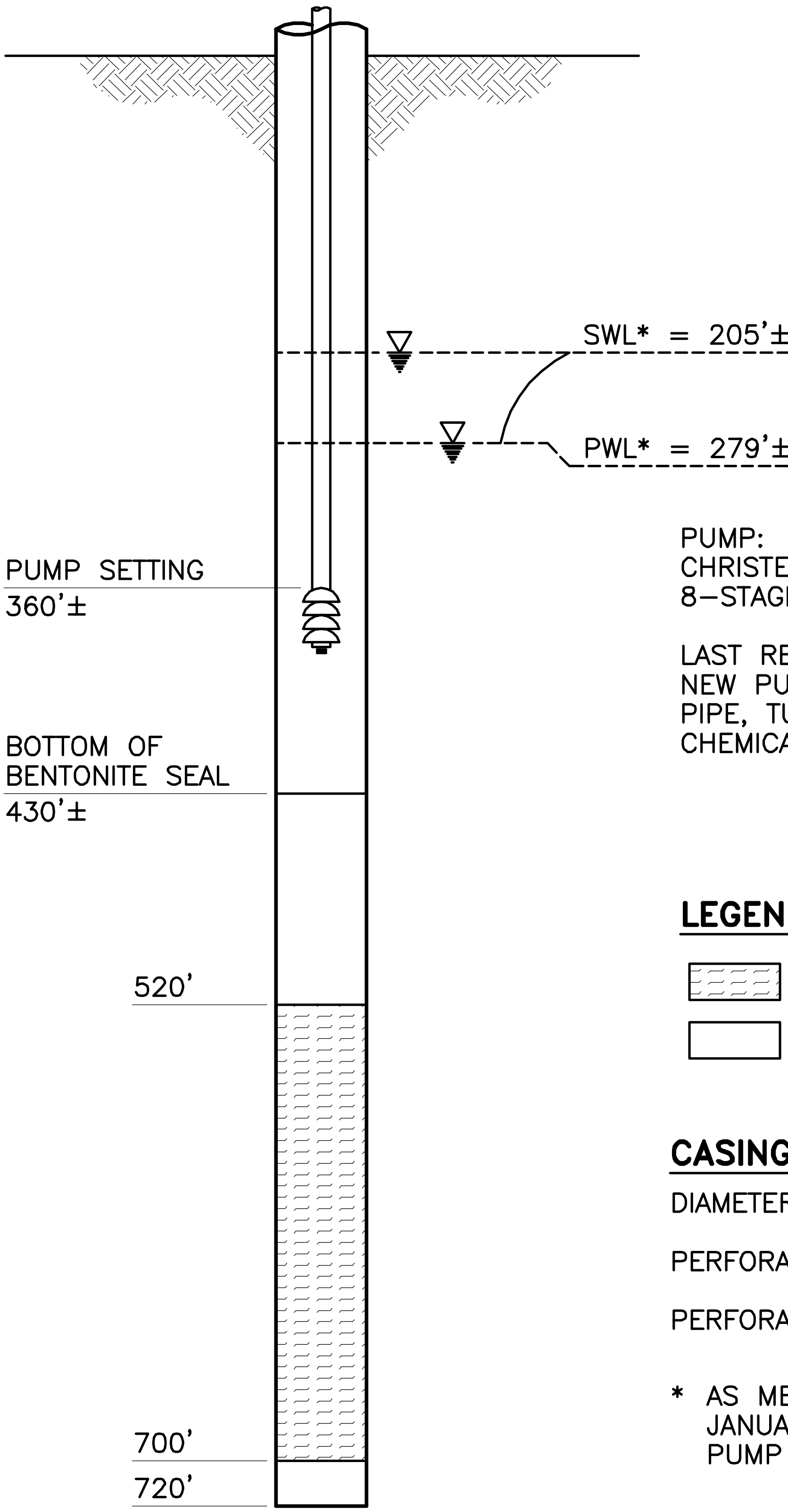
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.11
WELL SCHEMATIC

FIGURE IV-3

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178–148

178–148_f_IV3



PUMP:
CHRISTENSEN/GOULDS 12 RHJC
8–STAGE, 1,300 GPM

LAST REHAB (MARCH 2005):
NEW PUMP, SOME NEW COLUMN PIPE, TUBE, AND SHAFT, AND CHEMICAL CLEAN.

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 3/32"

PERFORATION TYPE: LOUVER

* AS MEASURED DURING JANUARY 23, 2018 SCE PUMP PERFORMANCE TEST.

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INDIAN WELLS VALLEY WATER DISTRICT

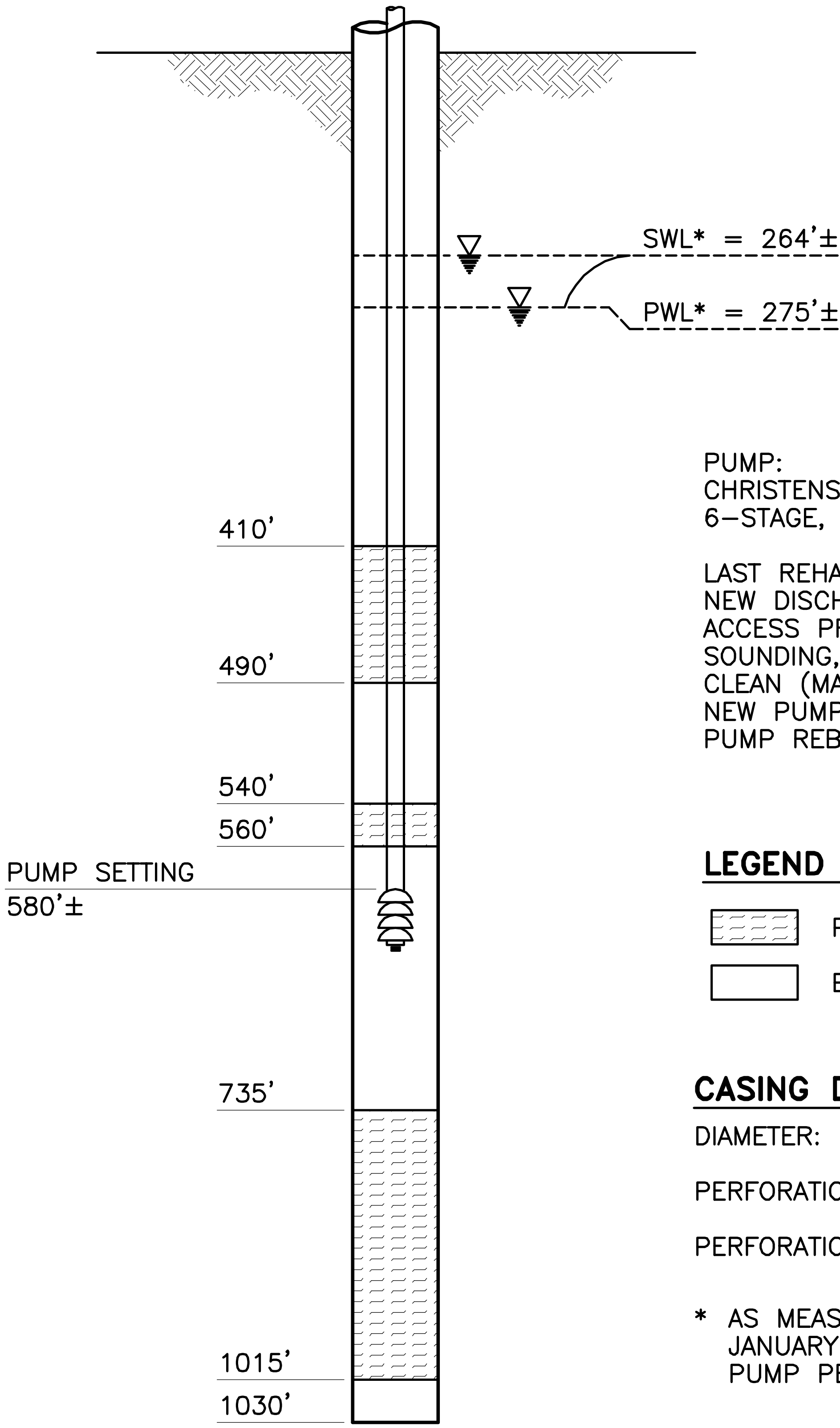
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.13
WELL SCHEMATIC

FIGURE IV-4

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178–148

178–148_f_IV4



PUMP:
CHRISTENSEN/GOULDS 12 CHC
6-STAGE, 1,250 GPM

LAST REHAB:
NEW DISCHARGE HEAD AND ACCESS PROVIDED FOR SOUNDING, AND CHEMICAL CLEAN (MAY 2007)
NEW PUMP (MAY 2008)
PUMP REBUILT (DECEMBER 2008)

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 50 SLOT

PERFORATION TYPE: WIRE WRAPPED SCREEN

* AS MEASURED DURING JANUARY 17, 2018 SCE PUMP PERFORMANCE TEST.

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INDIAN WELLS VALLEY WATER DISTRICT

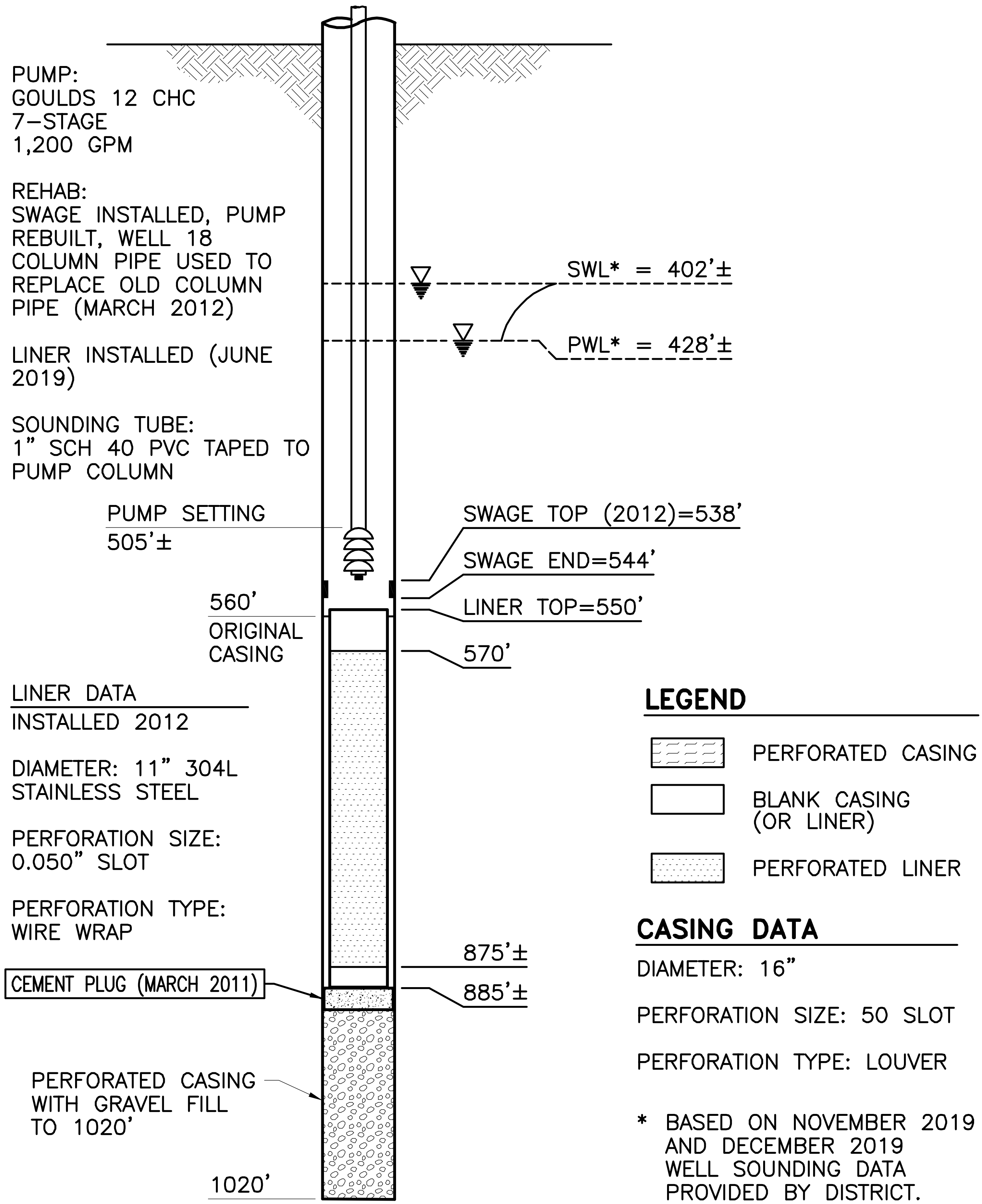
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.17
WELL SCHEMATIC

FIGURE
IV-5

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV5



178–148_f_IV6

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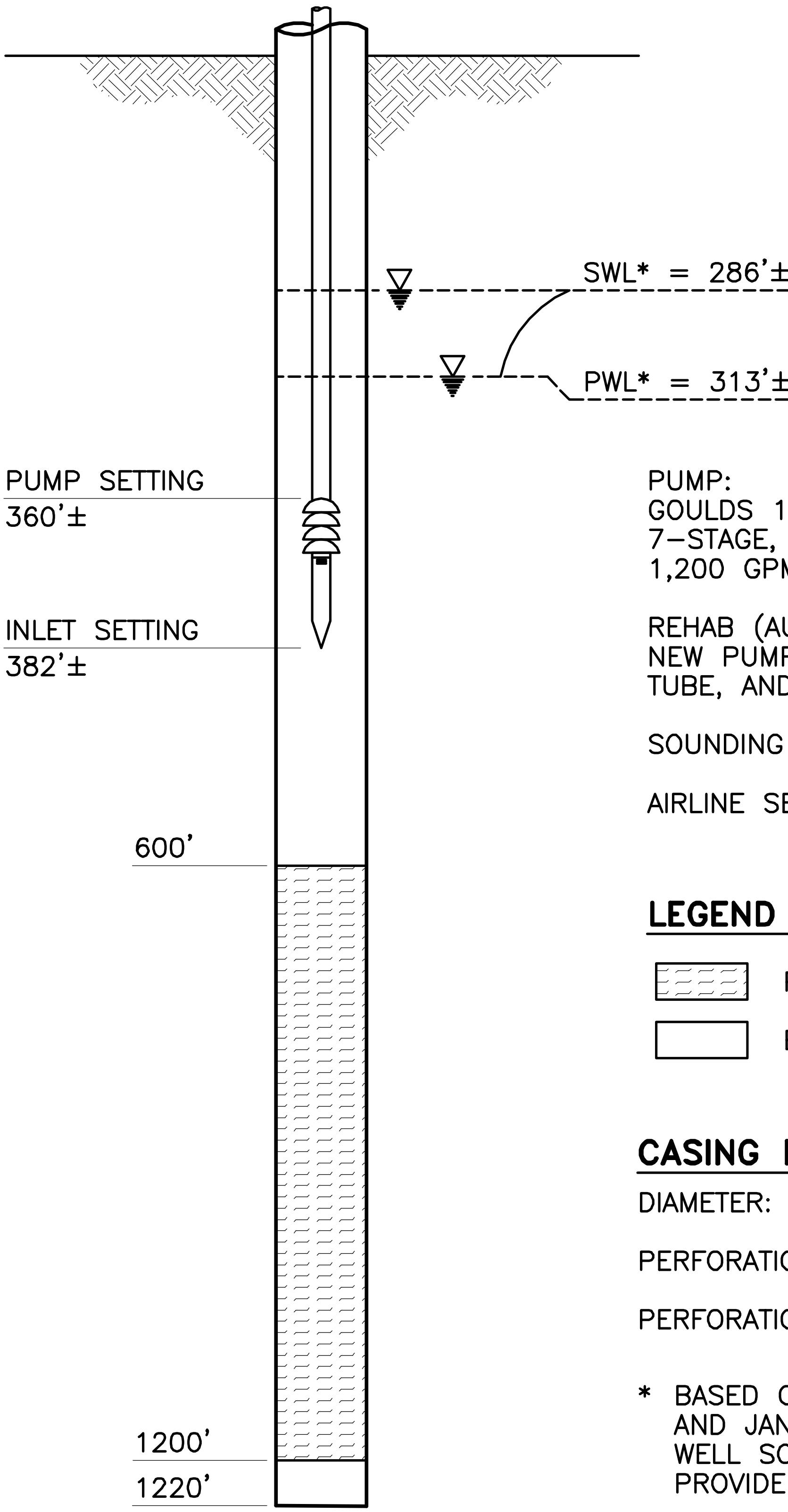
INDIAN WELLS VALLEY WATER DISTRICT

2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.18
WELL SCHEMATIC

FIGURE
IV-6

SCALE: N.T.S. DATE: 04/20/22 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178–148



PUMP:
GOULDS 12 CHC
7-STAGE,
1,200 GPM

REHAB (AUGUST 2019):
NEW PUMP, MOTOR, COLUMN, TUBE, AND SFAFT

SOUNDING TUBE: 799'

AIRLINE SETTING: 359'

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 50 SLOT

PERFORATION TYPE: WIRE WRAPPED SCREEN

* BASED ON DECEMBER 2019 AND JANUARY 2020 WELL SOUNDING DATA PROVIDED BY DISTRICT.

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INDIAN WELLS VALLEY WATER DISTRICT

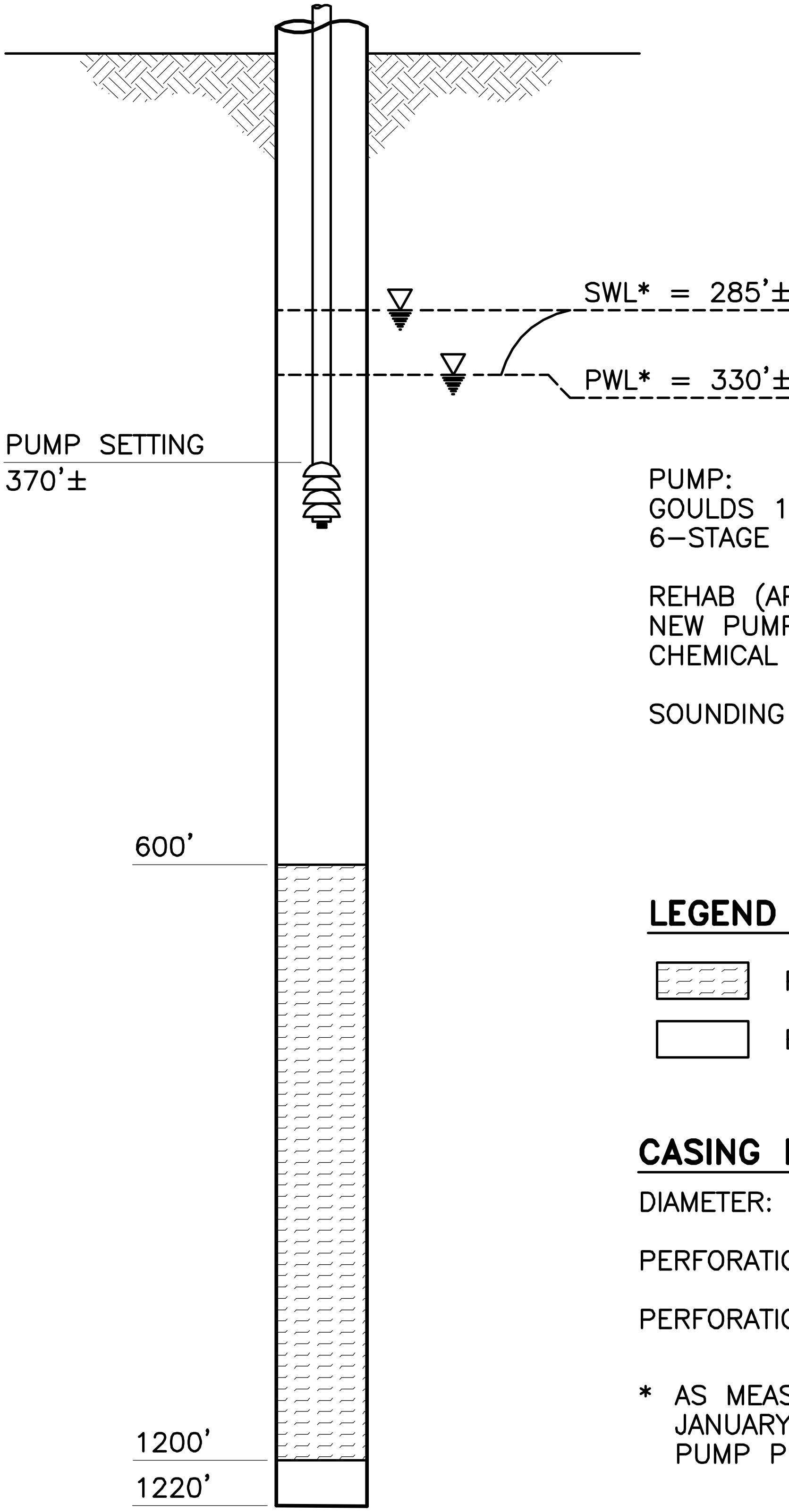
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.30
WELL SCHEMATIC

FIGURE IV-7

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV7



PUMP:
GOULDS 12 RHJC
6-STAGE

REHAB (APRIL 2008):
NEW PUMP, MOTOR SERVICED,
CHEMICAL CLEAN.

SOUNDING TUBE: 799'

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 16"

PERFORATION SIZE: 0.032" SLOT

PERFORATION TYPE: WIRE WRAPPED SCREEN

* AS MEASURED DURING JANUARY 17, 2020 SCE PUMP PERFORMANCE TEST.

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INDIAN WELLS VALLEY WATER DISTRICT

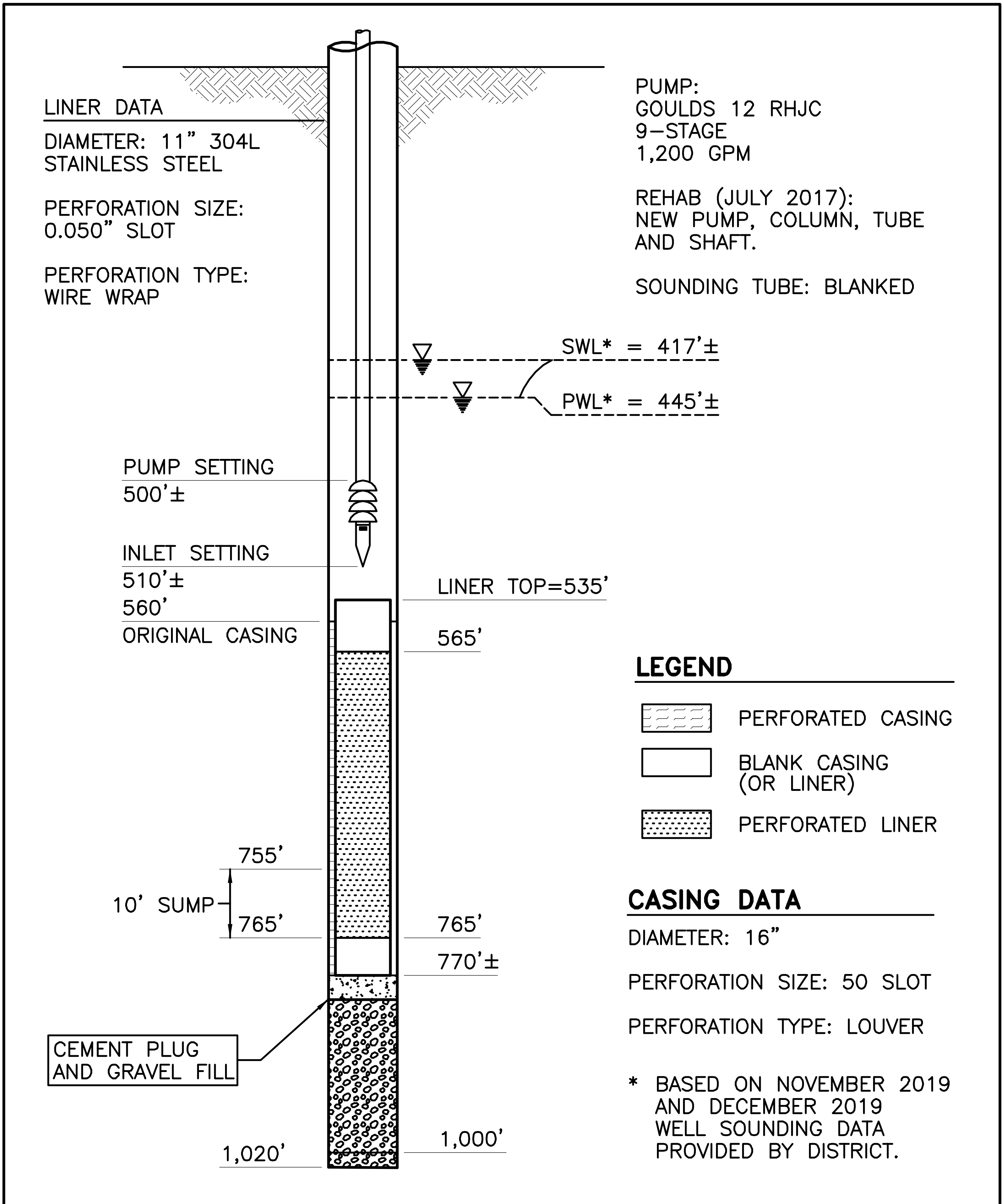
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.31
WELL SCHEMATIC

FIGURE IV-8

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV8



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INDIAN WELLS VALLEY WATER DISTRICT

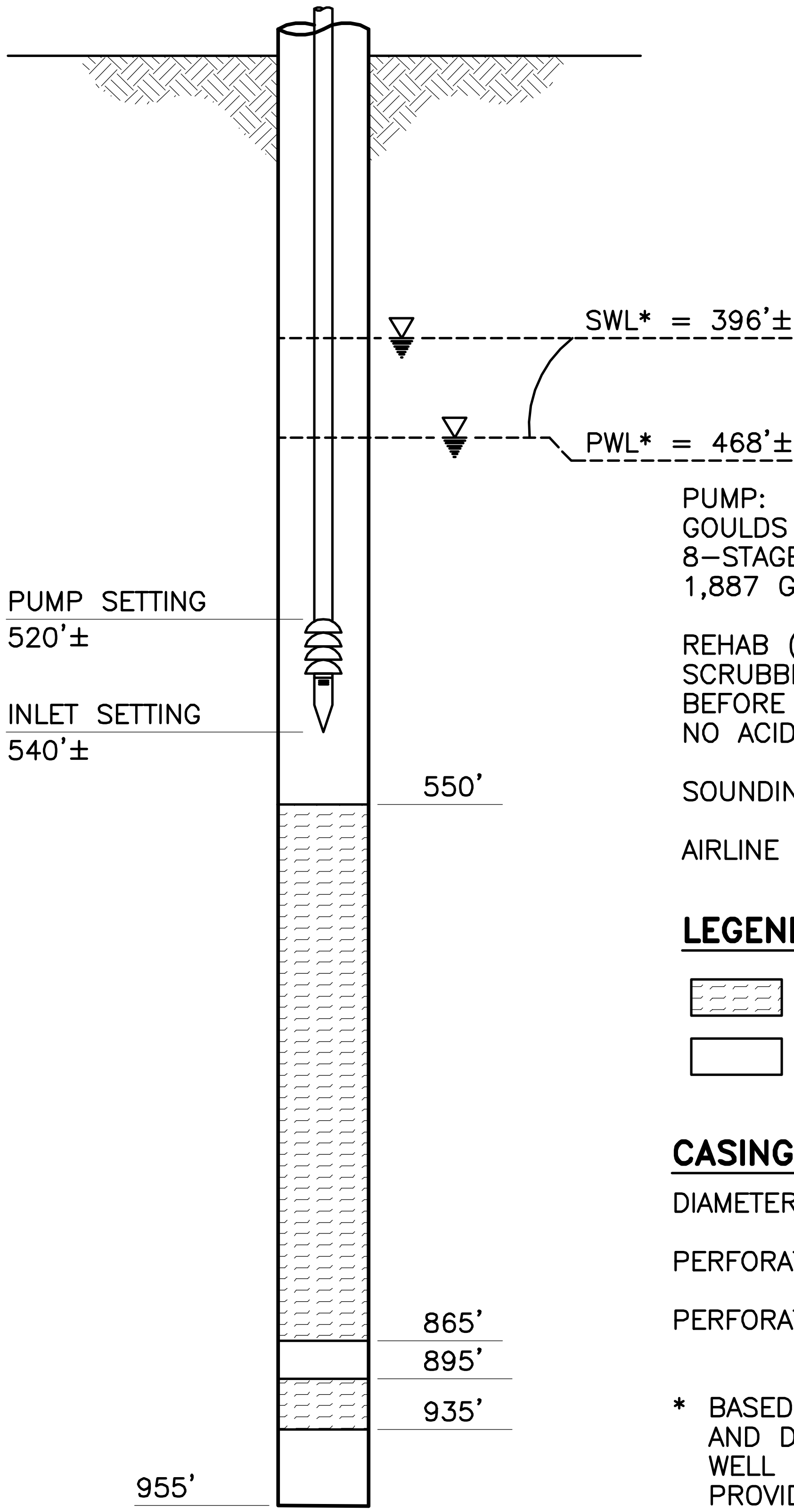
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.33
WELL SCHEMATIC

FIGURE
IV-9

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178–148

178–148_f_IV9



PUMP:
GOULDS 14 RJMC
8-STAGE
1,887 GPM

REHAB (MARCH 2018):
SCRUBBED AND BAILED
BEFORE NEW PUMP INSTALLED.
NO ACID USED

SOUNDING TUBE: 545' AND 550'

AIRLINE SETTING: 510'

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 20"

PERFORATION SIZE: 55 SLOT

PERFORATION TYPE: LOUVER (FUL-FLO)

* BASED ON SEPTEMBER 2019 AND DECEMBER 2019 WELL SOUNDING DATA PROVIDED BY DISTRICT.

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INDIAN WELLS VALLEY WATER DISTRICT

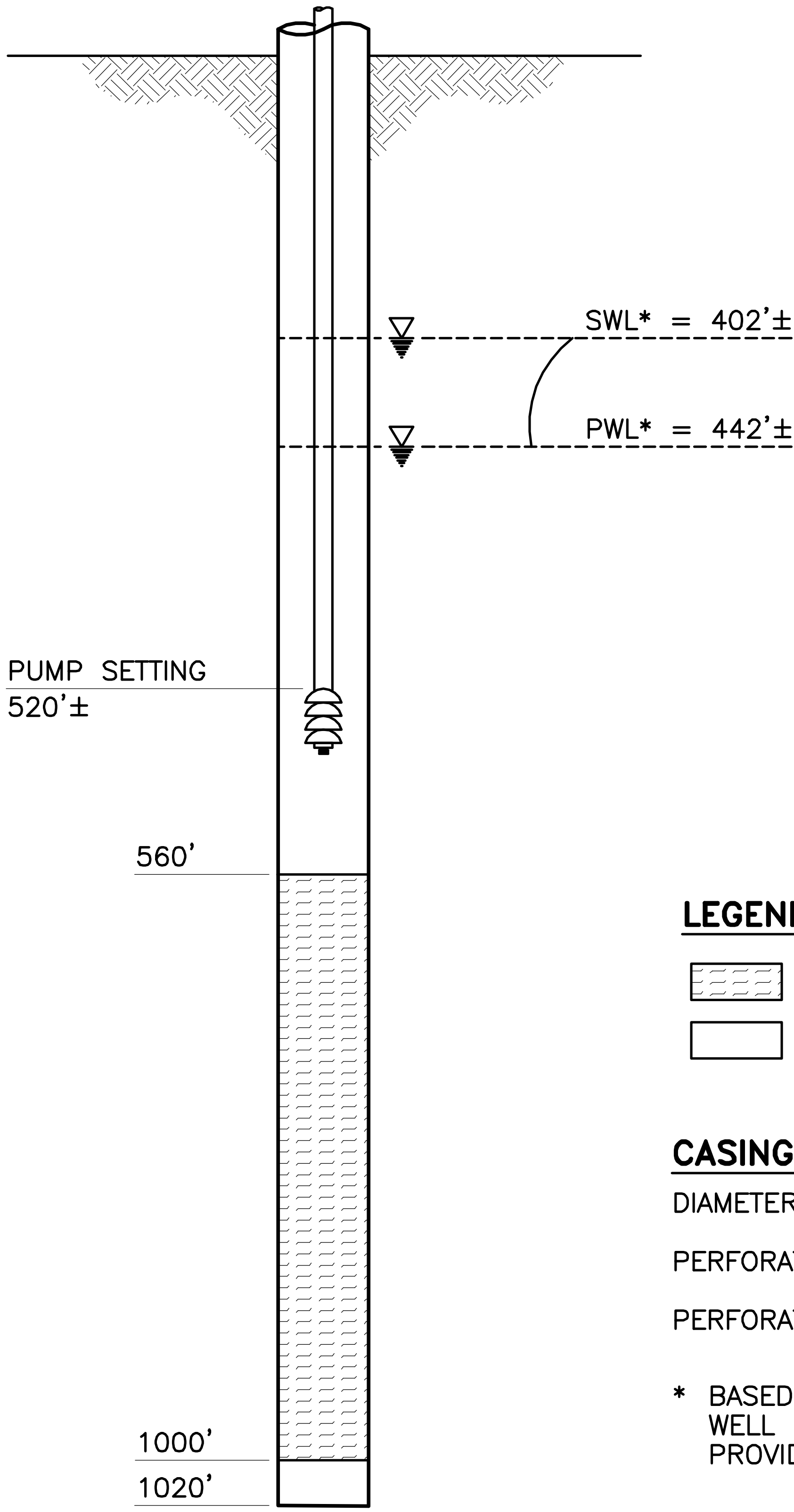
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.34
WELL SCHEMATIC

FIGURE IV-10

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV10



LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 20"

PERFORATION SIZE: 55 SLOT

PERFORATION TYPE: LOUVER

* BASED ON MARCH 2021 WELL STARTUP DATA PROVIDED BY DISTRICT.

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INDIAN WELLS VALLEY WATER DISTRICT

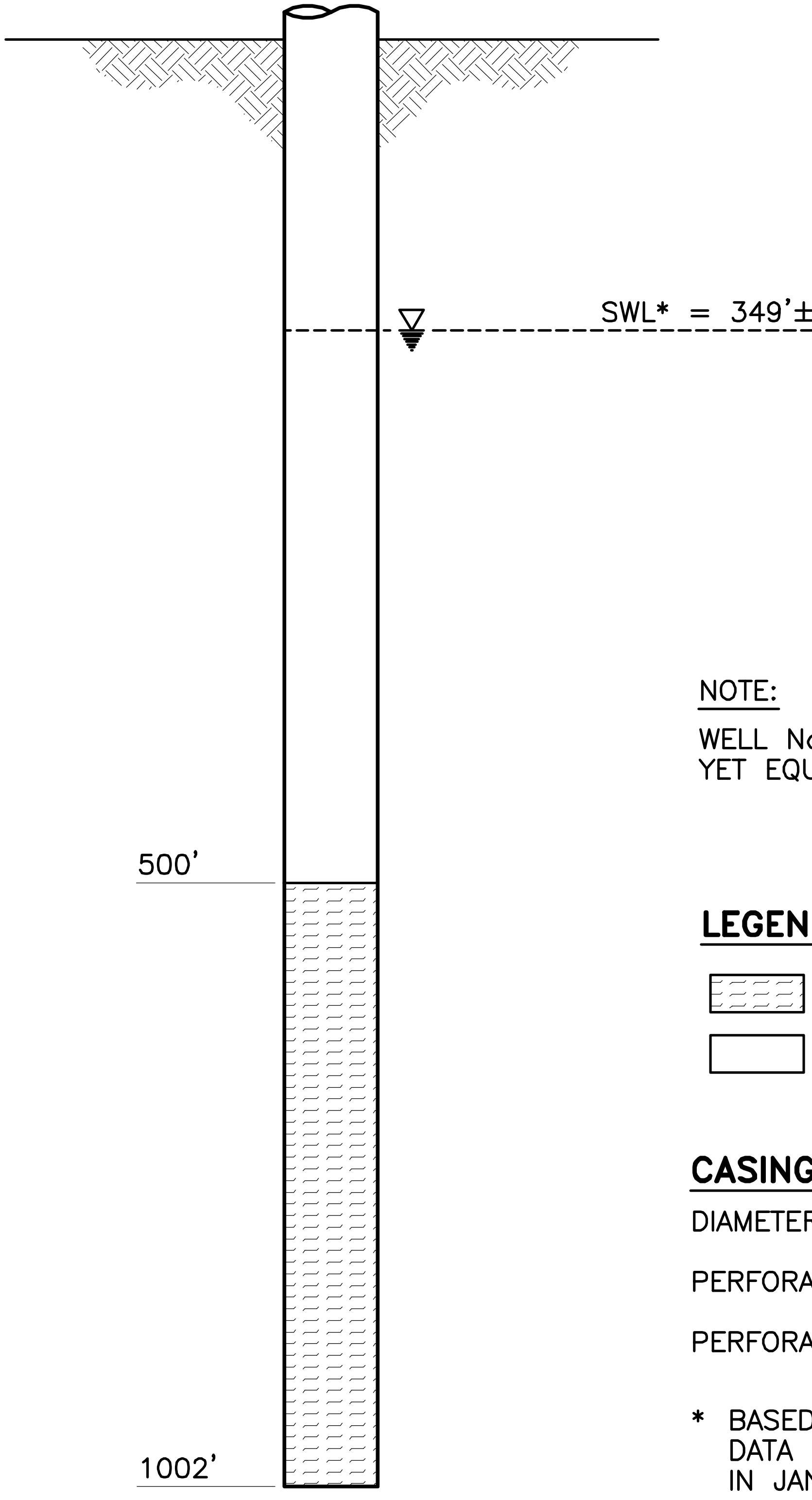
2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.35
WELL SCHEMATIC

FIGURE IV-11

SCALE: N.T.S. DATE: 12/21/21 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV11



NOTE:

WELL No.36 IS NOT YET EQUIPPED.

LEGEND

PERFORATED CASING

BLANK CASING

CASING DATA

DIAMETER: 18"

PERFORATION SIZE: 0.070"

PERFORATION TYPE: MILLED SLOT

* BASED ON WELL SOUNDING DATA PROVIDED BY DISTRICT IN JANUARY 2022.

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INDIAN WELLS VALLEY WATER DISTRICT

2020 WATER GENERAL PLAN UPDATE

DISTRICT WELL No.36
WELL SCHEMATIC

FIGURE IV-12

SCALE: N.T.S. DATE: 02/01/22 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_f_IV12

TABLE IV-1
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
EXISTING PRESSURE ZONES

PRESSURE ZONE NAME	HWL ELEVATION RESERVOIR	APPROXIMATE RANGE OF ELEVATIONS SERVED (FEET)	APPROXIMATE STATIC PRESSURE RANGE (PSI)
2,455 A-ZONE	2,455	2,250-2,380	30-90
2,555 B-ZONE	2,555	2,320-2,460	40-100
2,660 C-ZONE	2,661	2,430-2,560	40-100
2,775 D-ZONE	2,772	2,540-2,700	30-100
2,885 E-ZONE	2,883	2,640-2,760	50-110

TABLE IV-2
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELLS ABANDONED/DESTROYED SINCE 1985

WELL		APPROXIMATE PRODUCTION CAPACITY (GPM)
1.	Ridgecrest Heights Water Company 1	1,000
2.	Ridgecrest Heights Water Company 2	200
3.	Ridgecrest Heights Water Company 3	200
4.	Ridgecrest Heights Water Company 4	200
5.	Ridgecrest Heights Water Company 7	200
6.	Ridgecrest Heights Water Company 9	200
7.	Ridgecrest Heights Water Company 10	200
8.	Ridgecrest Heights Water Company 15	200
9.	Ridgecrest Highlands Water Company 1	200
10.	Ridgecrest Highlands Water Company 2	200
11.	HLM Water Company 1	200
12.	HLM Water Company 2	200
13.	HLM Water Company 3	200
14.	HLM Water Company 4	200
15.	China Lake Acres (Antelope Valley Water Company) 1	1,000
16.	Lane Acres (Ridgecrest Heights Water Company) 1	200
17.	Lane Acres (Ridgecrest Heights Water Company) 2	200
18.	Lane Acres (Ridgecrest Heights Water Company) 3	200
19.	J&F Building Supplies	200
20.	Indian Wells Valley Water District 14	200
21.	Indian Wells Valley Water District 8	2,000
22.	Indian Wells Valley Water District 9	1,000
23.	Indian Wells Valley Water District 16	500
24.	Indian Wells Valley Water District 19	500
	Total:	9,600

TABLE IV-3
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WATER WELL DATA
(DISTRICT WELLS)

NUMBER	COMPLETION DATE	CASING DIMENSIONS			PERFORATION DATA					DRILLERS LOG	WELL STATUS
		DEPTH (FT)	DIAMETER (IN)	THICKNESS	SIZE (IN)	TYPE	INTERVAL FROM (FT)	INTERVAL TO (FT)	LENGTH (FT)		
7	1963	304	16	Dbl 8 Gauge	5/32	Slot	169	290	75	Yes	Abandoned
8	1964	730	16	1/4"	1/8	Slot	310	740	220	Yes	Abandoned
9	1968	760	16	1/4"	5/32	Slot	220	760	410	No	Abandoned
9A	2003	1020	16	1/4"	1/8	Louvers	300	796	356	Yes	Active
10	1974	800	16	5/16"	5/32	Slot	250	800	550	Yes	Active
11	1977	620	16	1/4"	1/8	Louvers	260	600	200	Yes	Active
12	1983	720	16	1/4"	3/32	Louvers	580	700	120	Yes	Abandoned
13	1983	720	16	1/4"	3/32	Louvers	520	700	180	Yes	Active
16 (China Lake Acres)*										No	Monitoring
17	1989	1,030	16	1/4"	0.05	Screen	410	1,015	380	Yes	Active
18 (Southwest Well Field)	1989	1,020	16	1/4"	0.05	Louvers	560	1,000	440	Yes	Active
19 (Navy Well)*										No	Abandoned
30	1992	1,220	16	1/4"	0.05	Screen	600	1,200	600	Yes	Active
31	1992	1,220	16	1/4"	0.05	Screen	600	1,200	600	Yes	Active
33	1999	1,020	16	1/4"	0.05	Louvers	560	1,000	440	Yes	Active
34	2006	955	20	5/16"	0.05	Louvers	550	935	355	Yes	Active
35	2021	1,020	20	5/16"	0.05	Louvers	560	1,000	440	Yes	Active
36	2013	1,010	18	3/8"	0.07	Slot	500	1,002	502	No	Not Equipped

Source: IWVWD Records
* Data Unavailable

TABLE IV-4
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL STATIC WATER LEVEL
DEPTH FROM GROUND SURFACE (FEET)

YEAR	WELL 7	WELL 9A	WELL 10	WELL 11	WELL 12	WELL 13	WELL 17	WELL 18 (1)	WELL 30	WELL 31	WELL 33 (1)	WELL 34 (1)
Original	146	236	185	183	258	184	255	---	235	268	382	375
1976	158	---	202	---	---	---	---	---	---	---	---	---
1977	---	---	---	---	---	---	---	---	---	---	---	---
1978	---	---	---	---	---	---	---	---	---	---	---	---
1979	162	---	213	196	---	---	---	---	---	---	---	---
1980	179	---	223	192	---	---	---	---	---	---	---	---
1981	---	---	---	---	---	---	---	---	---	---	---	---
1982	164	---	214	188	---	---	---	---	---	---	---	---
1983	162	---	205	196	---	---	---	---	---	---	---	---
1984	166	---	212	188	260	177	---	---	---	---	---	---
1985	---	---	211	188	271	179	---	---	---	---	---	---
1986	---	---	---	198	---	---	---	---	---	---	---	---
1987	---	---	118	203	269	187	---	---	---	---	---	---
1988	---	---	237	216	281	214	---	---	---	---	---	---
1989	---	---	263	233	305	233	255	---	---	---	---	---
1990	---	---	---	---	---	---	---	---	---	---	---	---
1991	---	---	237	216	285	205	257	138	---	---	---	---
1992	---	---	263	218	293	218	273	---	---	---	---	---
1993	---	---	---	224	292	229	270	---	272	295	---	---
1994	---	---	---	---	---	---	---	---	---	---	---	---
1995	189	---	255	232	316	221	269	147	270	294	---	---
1996	194	---	272	224	316	229	274	150	273	297	---	---
1997	194	---	249	234	306	238	287	153	274	297	---	---

(1) Southwest Well Field

Note: Well specific capacity factors determined subsequent to original data are based on water levels measured by Southern California Edison Company pump tester during pumping tests. Measured static water levels and well specific capacity factors may not reflect actual conditions if pumping unit had not been idle for at least 24 hours prior to pump performance test.

TABLE IV-4
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL STATIC WATER LEVEL
DEPTH FROM GROUND SURFACE (FEET)

YEAR	WELL 7	WELL 9A	WELL 10	WELL 11	WELL 12	WELL 13	WELL 17	WELL 18 (1)	WELL 30	WELL 31	WELL 33 (1)	WELL 34 (1)
1998	---	---	---	---	---	---	---	---	---	---	---	---
1999	---	---	---	---	---	---	---	---	---	---	---	---
2000	---	---	---	---	---	---	---	---	---	---	---	---
2001	---	---	---	---	---	---	---	---	---	---	---	---
2002	---	---	---	---	---	---	---	---	---	---	---	---
2003	---	---	---	---	---	---	---	---	---	---	---	---
2004	---	---	---	---	---	---	---	---	---	---	---	---
2005	---	---	---	---	---	---	---	---	---	---	---	---
2006	---	---	---	---	---	---	---	---	---	---	---	---
2007	---	255	250	231	---	227	282	405	278	304	403	---
2008	---	245	---	228	---	221	---	406	288	314	404	387
2009	---	246	242	227	---	231	270	407	278	313	406	385
2010	---	237	234	220	---	---	276	409	292	318	409	385
2011	---	---	---	---	---	---	---	---	---	---	---	---
2012	---	235	231	220	---	211	267	414	293	329	408	388
2013	---	---	---	---	---	---	---	---	---	---	---	---
2014	---	---	---	---	---	---	---	---	---	---	---	---
2015	---	229	237	---	---	207	---	414	299	---	408	391
2016	---	---	---	---	---	---	---	---	---	---	---	---
2017	---	---	---	---	---	---	---	---	---	---	---	---
2018	---	225	225	213	---	205	264	---	285	285	412	---
2019	---	---	---	---	---	---	---	---	---	---	---	---

(1) Southwest Well Field

Note: Well specific capacity factors determined subsequent to original data are based on water levels measured by Southern California Edison Company pump tester during pumping tests. Measured static water levels and well specific capacity factors may not reflect actual conditions if pumping unit had not been idle for at least 24 hours prior to pump performance test.

TABLE IV-5
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL SPECIFIC CAPACITY
(PRODUCTION IN GPM/FT OF DRAWDOWN)

YEAR	WELL 7	WELL 9A	WELL 10	WELL 11	WELL 12	WELL 13	WELL 17	WELL 18 (1)	WELL 30	WELL 31	WELL 33 (1)	WELL 34 (1)
Original	11	---	---	---	---	---	41	81	54	64	25	27
1976	11	---	60	---	---	---	---	---	---	---	---	---
1977	---	---	---	---	---	---	---	---	---	---	---	---
1978	---	---	---	---	---	---	---	---	---	---	---	---
1979	11	---	61	36	---	---	---	---	---	---	---	---
1980	14	---	62	37	---	---	---	---	---	---	---	---
1981	---	---	---	---	---	---	---	---	---	---	---	---
1982	12	---	62	35	---	---	---	---	---	---	---	---
1983	12	---	65	38	---	---	---	---	---	---	---	---
1984	12	---	60	35	9	17	---	---	---	---	---	---
1985	---	---	59	37	10	17	---	---	---	---	---	---
1986	---	---	---	36	---	---	---	---	---	---	---	---
1987	---	---	11	37	9	19	---	---	---	---	---	---
1988	---	---	56	37	9	21	---	---	---	---	---	---
1989	---	---	53	37	9	26	41	81	---	---	---	---
1990	---	---	---	---	---	---	---	---	---	---	---	---
1991	---	---	57	34	8	25	60	---	---	---	---	---
1992	---	---	52	32	9	25	45	---	---	---	---	---
1993	---	---	---	29	9	27	52	---	57	67	---	---
1994	---	---	---	---	---	---	---	---	---	---	---	---
1995	9	---	50	38	9	25	58	---	62	65	---	---
1996	10	---	48	22	---	25	55	---	65	75	---	---
1997	10	--- *	1180 *	29	10	20	47	---	78	78	---	---

(1) Southwest Well Field

* Data considered inaccurate (specific capacity too high).

Note: Well specific capacities subsequent to original data are based on water levels measured by Southern California Edison Company pump tester during pumping tests. Measured static water levels and well specific capacities may not reflect actual conditions if pumping unit had not been idle for at least 24 hours prior to pump performance test.

TABLE IV-5
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL SPECIFIC CAPACITY
(PRODUCTION IN GPM/FT OF DRAWDOWN)

YEAR	WELL 7	WELL 9A	WELL 10	WELL 11	WELL 12	WELL 13	WELL 17	WELL 18 (1)	WELL 30	WELL 31	WELL 33 (1)	WELL 34 (1)
1998	---	---	---	---	---	---	---	---	---	---	---	---
1999	---	---	---	---	---	---	---	---	---	---	---	---
2000	---	---	---	---	---	---	---	---	---	---	---	---
2001	---	---	---	---	---	---	---	---	---	---	---	---
2002	---	---	---	---	---	---	---	---	---	---	---	---
2003	---	---	---	---	---	---	---	---	---	---	---	---
2004	---	---	---	---	---	---	---	---	---	---	---	---
2005	---	---	---	---	---	---	---	---	---	---	---	---
2006	---	---	---	---	---	---	---	---	---	---	---	---
2007	---	42	42	25	---	17	61	87	62	63	59	---
2008	---	37	---	26	---	15	---	97	56	40	55	39
2009	---	32	41	23	---	15	57	85	56	42	52	36
2010	---	31	37	23	---	---	63	90	61	47	53	36
2011	---	---	---	---	---	---	---	---	---	---	---	---
2012	---	29	39	23	---	15	56	75	60	51	46	34
2013	---	---	---	---	---	---	---	---	---	---	---	---
2014	---	---	---	---	---	---	---	---	---	---	---	---
2015	---	26	36	---	---	16	---	93	61	---	45	35
2016	---	---	---	---	---	---	---	---	---	---	---	---
2017	---	---	---	---	---	---	---	---	---	---	---	---
2018	---	23	39	29	---	19	112 *	---	66	26	41	---
2019	---	---	---	---	---	---	---	---	---	---	---	---

(1) Southwest Well Field
* Data considered inaccurate (specific capacity too high).
Note: Well specific capacities subsequent to original data are based on water levels measured by Southern California Edison Company pump tester during pumping tests. Measured static water levels and well specific capacities may not reflect actual conditions if pumping unit had not been idle for at least 24 hours prior to pump performance test.

TABLE IV-6
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL SPECIFIC CAPACITY FACTOR
(SPECIFIC CAPACITY/FOOT OF PERFORATED INTERVAL)

YEAR	WELL 7	WELL 9A	WELL 10	WELL 11	WELL 12	WELL 13	WELL 17	WELL 18 (2)	WELL 30	WELL 31	WELL 33 (2)	WELL 34 (2)
Total Perforation Length (FT)	78	356	515	200	120	180	380	440	600	600	440	355
Original	0.14	---	---	---	---	---	0.11	0.18	0.10	0.11	---	---
1976	0.14	---	0.12	---	---	---	---	---	---	---	---	---
1977	---	---	---	---	---	---	---	---	---	---	---	---
1978	---	---	---	---	---	---	---	---	---	---	---	---
1979	0.14	---	0.12	0.18	---	---	---	---	---	---	---	---
1980	0.18	---	0.12	0.19	---	---	---	---	---	---	---	---
1981	---	---	---	---	---	---	---	---	---	---	---	---
1982	0.15	---	0.12	0.18	---	---	---	---	---	---	---	---
1983	0.15	---	0.13	0.19	---	---	---	---	---	---	---	---
1984	0.15	---	0.12	0.18	0.08	0.09	---	---	---	---	---	---
1985	---	---	0.11	0.19	0.08	0.09	---	---	---	---	---	---
1986	---	---	---	0.18	---	---	---	---	---	---	---	---
1987	---	---	0.02	0.19	0.08	0.11	---	---	---	---	---	---
1988	---	---	0.11	0.19	0.08	0.12	---	---	---	---	---	---
1989	---	---	0.10	0.19	0.08	0.14	0.11	0.18	---	---	---	---
1990	---	---	---	---	---	---	---	---	---	---	---	---
1991	---	---	0.11	0.17	0.07	0.14	0.16	---	---	---	---	---
1992	---	---	0.10	0.16	0.08	0.14	0.12	---	---	---	---	---
1993	---	---	---	0.15	0.08	0.15	0.14	---	0.10	0.11	---	---
1994	---	---	---	---	---	---	---	---	---	---	---	---
1995	0.12	---	0.10	0.19	0.08	0.14	0.15	---	0.10	0.11	---	---
1996	0.13	---	0.09	0.11	---	0.14	0.14	---	0.11	0.13	---	---
1997	0.13	---	2.29 *	0.15	0.08	0.11	0.12	---	0.13	0.13	---	---

(1) China Lake Acres
(2) Southwest Well Field
(3) Navy Well
* Data considered inaccurate (specific capacity factor too high).

Note: Well specific capacity factors determined subsequent to original data are based on water levels measured by Southern California Edison Company pump tester during pumping tests. Measured static water levels and well specific capacity factors may not reflect actual conditions if pumping unit had not been idle for at least 24 hours prior to pump performance test. Well specific capacity factors are partially based on total perforation length, and therefore cannot be determined for Wells 16 and 19, for which construction data is not available.

TABLE IV-6
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL SPECIFIC CAPACITY FACTOR
(SPECIFIC CAPACITY/FOOT OF PERFORATED INTERVAL)

YEAR	WELL 7	WELL 9A	WELL 10	WELL 11	WELL 12	WELL 13	WELL 17	WELL 18 (2)	WELL 30	WELL 31	WELL 33 (2)	WELL 34 (2)
1998	---	---	---	---	---	---	---	---	---	---	---	---
1999	---	---	---	---	---	---	---	---	---	---	---	---
2000	---	---	---	---	---	---	---	---	---	---	---	---
2001	---	---	---	---	---	---	---	---	---	---	---	---
2002	---	---	---	---	---	---	---	---	---	---	---	---
2003	---	---	---	---	---	---	---	---	---	---	---	---
2004	---	---	---	---	---	---	---	---	---	---	---	---
2005	---	---	---	---	---	---	---	---	---	---	---	---
2006	---	---	---	---	---	---	---	---	---	---	---	---
2007	---	0.12	0.08	0.13	---	0.09	0.16	0.20	0.10	0.11	0.13	---
2008	---	0.10	---	0.13	---	0.08	---	0.17	0.10	0.09	0.10	0.10
2009	---	0.09	0.08	0.12	---	0.08	0.15	0.19	0.09	0.07	0.12	0.10
2010	---	0.09	0.07	0.12	---		0.17	0.20	0.10	0.08	0.12	0.10
2011	---	---	---	---	---	---	---	---	---	---	---	---
2012	---	0.08	0.08	0.12	---	0.08	0.15	0.17	0.10	0.09	0.10	0.10
2013	---	---	---	---	---	---	---	---	---	---	---	---
2014	---	---	---	---	---	---	---	---	---	---	---	---
2015	---	0.07	0.07	---	---	0.09	---	0.21	0.10	---	0.10	0.10
2016	---	---	---	---	---	---	---	---	---	---	---	---
2017	---	---	---	---	---	---	---	---	---	---	---	---
2018	---	0.06	0.08	0.15	---	0.11	0.29	---	0.11	0.04	0.09	---
2019	---	---	---	---	---	---	---	---	---	---	---	---

(1) China Lake Acres
(2) Southwest Well Field
(3) Navy Well
* Data considered inaccurate (specific capacity factor too high).

Note: Well specific capacity factors determined subsequent to original data are based on water levels measured by Southern California Edison Company pump tester during pumping tests. Measured static water levels and well specific capacity factors may not reflect actual conditions if pumping unit had not been idle for at least 24 hours prior to pump performance test. Well specific capacity factors are partially based on total perforation length, and therefore cannot be determined for Wells 16 and 19, for which construction data is not available.

TABLE IV-7
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
EXISTING WELL PUMPING PLANTS PERFORMANCE DATA
CAPACITY, EFFICIENCY, ENERGY

		2010			2012			2015			2018		
WELL	HP	gpm	EFF	KWH/AF	gpm	EFF	KWH/AF	gpm	EFF	KWH/AF	gpm	EFF	KWH/AF
9A	150	1,066	63	625	1,034	63	631	1,045	62	616	1,001	61	633
10	150	1,096	66	583	1,142	70	543	1,120	66	587	1,157	69	538
11	150	990	68	580	978	68	579	983	---	604	1,175	66	462
13	150	---	---	---	1,177	69	617	1,177	69	609	1,301	67	539
17	200	1,218	65	585	1,201	61	607	1,287	---	516	1,266	61	581
18 (1)(4)	200	964	57	783	1,190	67	683	1,079	68	680	1,200 (6)	---	---
30	200	1,405	65	555	1,405	65	563	1,385	67	557	1,394	65	551
31	200	1,168	67	553	1,163	67	566	1,170	---	574	1,190	60	592
33 (2)(4)	200	1,115	64	708	1,087	64	726	1,056	66	703	1,146	60	785
34 (3)(4)	250	1,204	65	684	1,182	63	704	1,144	66	696	2,000 (6)	---	---
35 (4)	250	---	---	---	---	---	---	---	---	---	1,200 (6)	---	---
36 (5)	---	---	---	---	---	---	---	---	---	---	---	---	---
	Total GPM:	10,226			11,559			11,446			14,030		

(1) 200 hp pumping unit replaced by XXX hp pumping unit in 20XX
(2) 200 hp pumping unit replaced by XXX hp pumping unit in 20XX
(3) 250 hp pumping unit replaced by XXX hp pumping unit in 20XX
(4) Southwest Well Field
(5) Not yet equipped
(6) Estimated
HP: Break Horsepower
GPM: Gallons Per Minute
EFF: Efficiency in Percent
KWH/AF: Kilo-Watt-Hours per Acre-Foot

TABLE IV-8
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
EXISTING BOOSTER PUMPING PLANTS PERFORMANCE DATA
CAPACITY, EFFICIENCY, ENERGY

BOOSTER	UNIT NO.	HP	2009 (1)			2012 (1)			2015 (1)			2018 (2)		
			GPM	EFF	KWH/AF	GPM	EFF	KWH/AF	GPM	EFF	KWH/AF	GPM	EFF	KWH/AF
College (C-Zone)	1	50	662	76	341	654	66	396	662	76	345	634	---	384
	2	50	616	74	354	637	73	359	648	76	344	623	---	399
Gateway (3)	1	50	684	67	300	699	65	294	667	65	312	---	---	---
	2	50	779	64	316	804	66	294	771	65	317	---	---	---
Salisbury (3)	1	20	271	68	359	286	66	359	292	67	359	---	---	---
	2	20	273	66	367	291	61	381	283	64	373	---	---	---
Sunland	1	50	1,193	60	220	1,205	61	218	1,222	63	222	1,325	---	183
	2	50	1,289	54	245	1,272	53	288	1,307	65	211	1,400	---	178
Vulcan	1	40	1,199	63	193	---	---	---	1,112	83	157	1,101	---	163
	2	40	953	56	216	---	---	---	969	70	175	790	---	217
Ridgecrest Heights	1	40	880	53	230	852	54	245	793	57	229	762	---	236
	2	20	407	36	305	367	36	296	254	35	321	378	---	239
	3	20	474	36	294	449	36	298	249	33	330	333	---	264

(1) Data from SCE tests
(2) Data from District tests
(3) In construction, to be replaced

HP: Break Horsepower
GPM: Gallons Per Minute
EFF: Efficiency in Percent
KWH/AF: Kilo-Watt-Hours per Acre-Foot

TABLE IV-9
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
EXISTING WATER STORAGE RESERVOIRS
DESCRIPTIVE DATA

RESERVOIR NAME	DATE CONSTRUCTED	TYPE OF CONSTRUCTION	PRESSURE ZONE SERVED	DIMENSIONS (DIA X H)	HIGH WATER ELEVATION (FT)	BOTTOM ELEVATION (FT)	NOMINAL STORAGE CAPACITY (MG)
Bowman No. 1	1980	Welded Steel	2455 (A)	120 X 24	2455	2431	2.00
Bowman No. 2	1993	Welded Steel	2455 (A)	197 X 24	2455	2431	5.00
Kendall	1978	Welded Steel	2455 (A)	120 X 24	2455	2431	2.00
Gateway	1973	Welded Steel	2555 (B)	66 X 23	2555.9	2532.9	0.55
Ridgecrest Heights	1992	Welded Steel	2555 (B)	153 X 23	2555.9	2532.9	3.00
Springer	2009	Welded Steel	2555 (B)	125 X 23	2555.9	2532.9	2.00
C-Zone No. 1 (1)	1960	Bolted Steel	2660 (C)	55 X 23	2661.36	2638.36	0.40
C-Zone No. 2	2009	Welded Steel	2660 (C)	87 X 23	2661.36	2638.36	1.00
D-Zone No. 1 (1)	1973	Bolted Steel	2775 (D)	27 X 23.69	2772.09	2748.4	0.10
D-Zone No. 2	2011	Welded Steel	2775 (D)	56 X 24.09	2772.09	2748	0.40
College	1973	Welded Steel	2885 (E)	66 X 24	2883	2859	0.55
Well Field	1973	Welded Steel	Abandoned	86 X 24	2365	2341	---
China Lake Acres	---	Bolted Steel	Abandoned	---	---	---	---
						Total:	16.50

CHAPTER V

RECOMMENDED WATER SYSTEM IMPROVEMENTS

CHAPTER V
RECOMMENDED WATER SYSTEM IMPROVEMENTS

As a result of the significant improvements constructed by the District between 1997 and 2021, the decrease in water use per capita since 2010 and of the limited growth expected to occur over the next 15 to 25 years, the improvements recommended in this chapter are relatively limited. Nevertheless, there are a number of improvements that the District needs to construct, particularly transmission pipelines and storage facilities. The water system improvements presented in this chapter are intended to enable the District to meet existing and anticipated water demands over the next 15 to 25 years.

The District's highest priority is the construction of pipeline improvements to (a) enable full use of the Southwest Wellfield pumping plants, and (b) to eliminate the lag between the water levels in the Kendall and Bowman reservoirs.

The District's telemetry system will be expanded as water system improvements are constructed. As ground water issues become more critical, real time water level measurements and modeling of monitoring and production wells may become desirable or necessary, at which time the telemetry system will be further expanded and improved.

A. IMPROVEMENT CRITERIA

The recommended improvements are based on the following design criteria:

- Well pumping plants should have sufficient combined capacity to meet maximum day demands with the largest well pumping plant out of service.
- New District production wells should have a minimum casing diameter of 20 inches and (where possible) should be equipped to produce approximately 1,200 gpm (plus or minus 300 gpm). The depth of new well casings and location of perforations should be designed to take into consideration the local water quality and risk of corrosion.
- Booster pumping plants should be capable of meeting maximum day demands, and each plant should have at least two pumping units. In booster pumping plants with only two units, each unit should be capable of meeting maximum day demands.

- Pumping units should be automatically controlled through telemetered reservoir levels. Pumping unit controls should be capable of being operated manually or automatically.
- Pipelines should have sufficient capacity to meet peak demands and maximum day demands with simultaneous fire flows, and without excessive flow velocities or headlosses.
- Pipelines 12 inches or larger should be interspersed at 1/2 mile intervals. In the absence of specified diameters, pipelines serving industrial zones will be 12 inch diameter minimum and pipelines serving commercial and residential zones will be 8 inch diameter minimum.
- Storage reservoirs should be capable of providing at least the minimum (and preferably optimum) equalizing storage, fire storage, and emergency storage capacity requirements. Depending on capacity, storage reservoirs may also be capable of providing OPPR storage.
- Pressure reducing or pressure regulating valves should be used to supplement A-Zone with water from the Southwest Area, and to supplement A-Zone storage with surplus B-Zone storage, and elsewhere only when absolutely necessary (e.g. for emergency service).
- Hydropneumatic booster pumping installations should be avoided because of their relatively limited capacity, high operating cost, and limited service capability.

B. PRESSURE ZONES

The District's water system will continue to comprise five pressure zones, namely: A-Zone, B-Zone, C-Zone, D-Zone, and E-Zone. The pressure zones are shown on **Maps 1 through 4**. Development within the pressure zones is expected to primarily occur in the A-Zone. Development will be monitored and plans altered accordingly, especially in the C-Zone, D-Zone, and E-Zone where large developments would significantly impact the requirement for additional facilities.

Pressure zone data (such as approximate range of elevations served and approximate range of static pressures) is set forth in **Chapter IV, Table IV-1**. Pressure zone intervals are generally consistent from one service area to another, because the District has adopted a uniform pressure zone elevation difference of approximately 100 feet.

Within the A-Zone, the District historically and currently has difficulty filling the Kendall Reservoir, and currently utilizes the Springer Flow Control Valve (FCV) set at a constant rate to help fill the tank. However, doing so is not sufficient to eliminate the lag between the water levels in the Kendall and Bowman reservoirs. As demands grow, storage issues in the A-Zone will become exacerbated without additional system improvements, since the Kendall reservoir is unable to completely fill under high demand conditions. Proposed pipeline improvements (at minimum, 24-inch Bowman Road from Brady St. to China Lake Blvd.) and the conversion of the Springer FCV to a pressure reducing valve (PRV) will eliminate this issue by allowing more flow through the valve during periods of high demand.

Within the B-Zone, use of the Southwest Well Field to fill the Gateway and Springer reservoirs creates pressure spikes in the vicinity of Downs Street and Upjohn Avenue that could potentially damage District pipelines in that vicinity. Consequently, the production of the SWWF wells cannot be fully utilized. The District currently utilizes the Bowman PRV to partially relieve these pressure spikes. Proposed pipeline improvements (24 inch Springer Ave. from Mahan St. to College Heights Blvd. and 24 inch Gateway Blvd. from Springer Ave. to Gateway Reservoirs) will completely eliminate these pressure spikes, after which the Bowman PRV can be used solely to supplement A-Zone supply and storage requirements.

The D-Zone and E-Zone currently have small booster, reservoir, and distribution systems. Due to terrain, it is impractical to interconnect these two zones (i.e. to boost from the D-Zone to the E-Zone).

C. WATER SUPPLY FACILITIES

Although importing water and improved water conservation efforts may offer some help in meeting demands, the District's water supply is likely to be derived from ground water for at least the next ten years.

1. Imported Water Facilities

As discussed in **Chapter III**, imported water may be required for groundwater replenishment to allow the District and other groundwater producers to continue to produce sufficient groundwater to satisfy current and projected demands while not exceeding the IWVGB's safe yield.

Since the District does not currently have agreements for future importation, transmission facility requirements are unknown, and estimated project costs and construction schedules cannot presently be established. The feasibility of various water importation alternatives is currently being investigated by the District and the IWVGA.

2. Recycled Water Facilities

The District does not currently distribute reclaimed water; and use of recycled water for landscape irrigation within the City of Ridgecrest is currently deemed unlikely. However, the use of recycled water for groundwater replenishment is currently being evaluated by the District and the IWVGA. See **Chapter VI** herein for additional information.

3. Well Pumping Plants

Presently, the District's production capacity meets its projected water requirements for normal operation (see **Table V-2A**). **Table V-2D** sets forth the proposed well replacement schedule based on a 50 year service life.

To meet projected water requirements to take advantage of OPPR, if desired, one additional well pumping plant would need to be constructed by 2030 and a second well pumping plant constructed by 2045 (see **Table V-2B**). Under such conditions, the well pumping plants would be needed to provide the production capacity necessary to meet maximum day OPPR demands with the largest well out of service. For both operating conditions (normal and OPPR), an assumption has been made that excess supply in B-Zone is used to supplement A-Zone. **Table V-2C** sets forth the proposed well construction schedule for the span of this Water General Plan.

While OPPR would enable the District to take advantage of off-peak energy cost savings, said savings would not be sufficient to justify the cost of constructing and maintaining the required production, pipeline, storage, and pumping facilities. Therefore, we are not recommending implementation of OPPR utilization in this Plan (see **Section I herein**).

A recommended well replacement program, based on a 50-year service life, is set forth in **Table V-2D.**

4. Southwest Well Field

The District's Southwest Well Field water supply system consists of the SWWF well pumping plants and transmission pipelines, which will help supply water primarily to the B-Zone and all higher elevation zones, with some flow being supplied (through pressure reducers) to the A-Zone. The SWWF produces approximately 5,500 gpm; however, once the Ridgecrest Heights Reservoir fills, high velocities through the existing 16 inch pipeline in Springer Avenue result in the District being able to utilize only approximately 2,400 gpm of this capacity without creating pressure spikes in the northwest portion of the B-Zone.

Hydraulic analyses and field tests indicate that undersized transmission mains linking the SWWF to the Springer and Gateway reservoirs are the cause of the pressure spikes. Once recommended pipeline improvements are constructed in B-Zone (see **Tables V-3A, V-3B, V-3C, and V-4D**) the District will be able to fully utilize the production in the SWWF.

D. BOOSTER PUMPING FACILITIES

Booster pumping capacity within the system is adequate, provided certain operating requirements are followed. Additional booster pumping plants would be required to serve any significant system expansion in the C-Zone, the D-Zone, or the E-Zone. Any future booster pumping plants will contain multiple pumping units for boosting and reserve capacity. In order to permit the use of OPPR, future booster pumping plants would need to be capable of filling the reservoir in the next highest zone in 18 hours.

While OPPR would enable the District to take advantage of off-peak energy cost savings, said savings would not be sufficient to justify the cost of constructing and maintaining the required production, pipeline, storage, and pumping facilities. Therefore, we are not recommending implementation of OPPR utilization in this Plan (see **Section I**).

E. WATER STORAGE FACILITIES

Proposed storage reservoirs are set forth in **Tables V-1A through V-1H**, and are shown on **Maps 3 and 4**. Required storage consists of the following four components:

- equalization storage, which is equal to approximately 20% of maximum day demand;
- fire storage, which equals the volume required for a specified fire flow and flow duration as determined by the Fire Marshall;
- emergency storage, which provides continuous storage during periods when production has been interrupted and is equal to either 24 hours of average day demand (minimum volume; see **Tables V-1A and V-1C**) or 24 hours of maximum day demand (optimum volume; see **Tables V-1B and V-1D**); and
- OPPR storage, which allows pumping plant equipment (e.g. well and booster pumping plants) to be shut off during peak energy demand and is equal to the volume of six hours of maximum day demand.

Due to the large amount of emergency storage in the B- Zone, equalization storage in that zone is taken to be 5 feet of storage rather than 20% of maximum day demand, in order to allow booster pump and well controls to operate properly.

Presently, the District's storage capacity meets its minimum equalization, fire, and emergency storage requirements (see **Table V-1A**) in all zones except the E-Zone. However, storage in the A-Zone is inadequate to provide optimum emergency storage and/or OPPR storage requirements (see **Table V-1C**).

After the 2019 Ridgecrest Earthquake, which damaged several District reservoirs, the District began design of additional storage facilities in all pressure zones except the A-Zone, to replace damaged facilities and provide additional emergency storage. After receiving the bid results for the 0.1 MG D-Zone replacement reservoir, the District decided not to move forward with replacement of said reservoir at this time due to high cost for a relatively small storage increase. The remaining additional storage reservoirs in the other three pressure zones, now in the initial stages of construction, will add a total of 2.15 MG of new storage capacity to the system as follows:

- **B-Zone**: 1.0 MG Gateway Reservoir--1.0 MG new capacity

- **C-Zone**: 1.0 MG C-Zone Reservoir--0.6 MG net increase in capacity
- **E-Zone**: 0.55 MG College Reservoir--0.55 MG new capacity

After completion of these reservoir projects, storage deficiencies in the E-Zone will be eliminated. Construction of all the proposed facilities listed in **Tables V-1E, V-1F, V-1G and V-1H, and V-4D** (including the reservoirs in initial stages of construction, and including the proposed A-4 Reservoir), and the utilization of B-Zone storage facilities to supplement A-Zone storage, would enable the District to achieve optimum emergency storage capacity objectives (as set forth in **Tables V-1A through V-1D**).

While OPPR would enable the District to take advantage of off-peak energy cost savings, said savings would not be sufficient to justify the cost of constructing and maintaining the required production, pipeline, storage, and pumping facilities. Therefore, we are not recommending implementation of OPPR utilization in this Plan (see **Section I** herein).

If and when the District's finances permit, construction of facilities capable of achieving optimum emergency storage under normal operating conditions is recommended. The advantage of optimum emergency storage is that it would permit a closer approximation to normal service during supply outages, even during seasonal high-demand periods.

However, such facilities include the A-4 reservoir and Bowman Road (24 inch from China Lake Blvd. to A-4 Reservoir) pipeline facilities. The significant costs of constructing said facilities can be deferred until the District's finances permit if the supplemental storage in the B-Zone is utilized to supplement the storage in the A-Zone, after construction of the 1.0 MG Gateway reservoir (which is one of the reservoirs currently in the initial stages of construction). Under said scenario, 19 hours of maximum day demand storage would be available in A-Zone and B-Zone combined, as shown on **Figure V-1**. As mentioned previously, the supplemental emergency storage in the B-Zone could be utilized in the A-Zone by constructing the recommended pipeline improvements, converting the Springer FCV Station to a PRV Station, and making adjustments to the Bowman PRV Station. Although this would fall short of full optimum emergency storage objectives, as an interim measure, it would be a significant improvement over the minimum emergency storage of 12 hours of maximum day demand (equivalent to 24 hours of average day demand).

F. TRANSMISSION AND DISTRIBUTION FACILITIES

Recommended pipeline improvements are set forth in **Tables V-3A, V-3B, V-3C, and V-4D**, and shown on **Maps 3 and 4**.

At minimum, we recommend the following pipeline improvements as set forth in **Table V-3A**:

- 30 inch Bowman Road from Brady St. to China Lake Blvd.
- 24 inch Springer Ave. from Mahan St. to College Heights Blvd.
- 24 inch Gateway Blvd. from Springer Ave. to Gateway Reservoirs

These improvements are suitable for eliminating the lag between the water levels in the Kendall and Bowman reservoirs, eliminating pressure spikes in the B-Zone, and providing minimum emergency storage in the A-Zone without OPPR utilization.

The recommended improvements are scheduled to accommodate recommended production and storage facilities when completed and to meet distribution demands. Pipeline locations are based on the District's policy of avoiding parallel pipelines and placing pipelines in defined rights-of-way.

In addition, the District currently requires new pipelines to be at least 8 inches in diameter, and should replace pipelines smaller than 8 inches in diameter from its inventory as budget permits, in order to improve operating conditions and increase fire flow capability.

The recommended pipelines are based on hydraulic network analyses performed for the 1997 Water General Plan and for this 2020 Water General Plan. The pipeline systems were analyzed using a hydraulic network model that was developed for this General Plan to reflect current conditions. The hydraulic network model was used to analyze existing conditions as well as future conditions at scheduled intervals.

The hydraulic network model systematically searches for a solution to a set of simultaneous equations which describe the physical system. The parameters required for the analysis include pipe diameters, pipe lengths, pipe friction factors, node (pipe junction) point demands (approximating actual inflows and outflows), node ground surface elevations, hydraulic and power characteristics of pumping plants, and reservoir high and low water levels.

Evaluation of the water system required comparing analyses with specific design guidelines indicative of a properly sized, efficient water system. Pressure, headloss, and velocity data generated under different demand conditions were compared with design criteria to identify system deficiencies.

The design criteria listed below and the demand criteria listed in **Chapter III** were used to develop requirements for water production facilities, storage facilities, pipelines, and other facilities to meet current and future demands.

Design Pipeline Velocity	=	5 fps
Maximum Pipeline Velocity	=	10 fps
Maximum Nodal Pressure (Normal)	=	95 psi
Minimum Nodal Pressure (Normal)	=	40 psi
Residual Nodal Pressure (Fire)	=	20 psi

Water demands were allocated among the nodes throughout the transmission system. The system was analyzed for maximum day demand, minimum hour demand, and peak hour maximum day demand for existing and future demand conditions. Fire flow requirements were imposed at various locations within the system with the entire system under maximum day demand to evaluate fire flow conditions.

G. WATER TREATMENT FACILITIES

USEPA and DDW are constantly evaluating new contaminants for regulation. New regulations for PFAS are currently resulting in the installation of new treatment facilities at many water agencies. The District may need to respond if monitoring indicates noncompliance with emerging regulations.

H. ANNEXATIONS

DDW has requested that the District consider annexing Inyokern CSD along with nine small water systems in the Inyokern area and five small water systems in the China Lake area. The District may be required to annex some of these small water systems under the terms of the forthcoming Shallow Well Mitigation Plan being developed under the provisions of the Groundwater Sustainability Plan, if they are impacted by declining water levels. Costs for each annexation will vary according to condition of individual facilities. For planning purposes, we have assumed that annexations will take place when state funding is available.

I. UTILIZATION OF OFF-PEAK POWER RATES (OPPR)

Electrical usage history for a 12-month period was reviewed to determine if the District could benefit from cost savings that could be realized if the District's pumping units were only operated during off-peak hours. During the 12-month period, the District paid approximately $460,000 for all electrical use (which included approximately $420,000 for pumping unit electrical costs).

The District is on a rate structure that takes advantage of the solar panels to power nearby pumping plants during on-peak time periods. During the 12-month review period, the solar panels that have been installed by the District generated approximately $150,000 worth of electricity that was used to power the pumping plants where solar panels are installed.

Our analysis of the current rate structure showed that that the District would be able to realize a savings of approximately $60,000 per year if all District pumping units were not operated between the hours of 12 PM and 6 PM. However, in order to realize this savings, the District would need to construct additional storage facilities well pumping plants, and booster pumping facilities, as well as larger transmission pipelines. To construct said facilities would cost an additional $8 million for minimum emergency storage or $14 million for optimum emergency storage. The cost of constructing and maintaining these additional facilities would not be recouped within their operating life. Therefore, we are not recommending implementation of OPPR utilization in this Plan.

J. ESTIMATED COSTS AND PROPOSED SCHEDULE

Estimated current project costs and related construction schedules for the proposed water system facilities are set forth in **Tables V-5A through V-5D**. Estimated project costs include a 10% allowance for construction contingencies and a 20% allowance for administrative, legal, and engineering costs. The estimated project costs are based on recent construction costs for similar projects. Proposed facilities consist, essentially, of existing system reinforcements and proposed system expansions, and are shown on **Maps 2, 3, and 4**. The facilities shown on the figures correlate with those set forth in **Tables V-5A through V-5D**, which is based on estimated projected water demands and production requirements as set forth in **Chapter II**. The District will revise the schedule of construction based on actual changes in demand.

No distinction has been made between facilities which will be financed by the District or facilities that will be financed by developers or users. Facilities have been scheduled for construction herein based on water production, transmission, storage, and distribution needs.

FIGURE V-1
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
EMERGENCY STORAGE AVAIBILITY IN A-ZONE AND B-ZONE FOR ULTIMATE CONDITIONS
(HOURS)

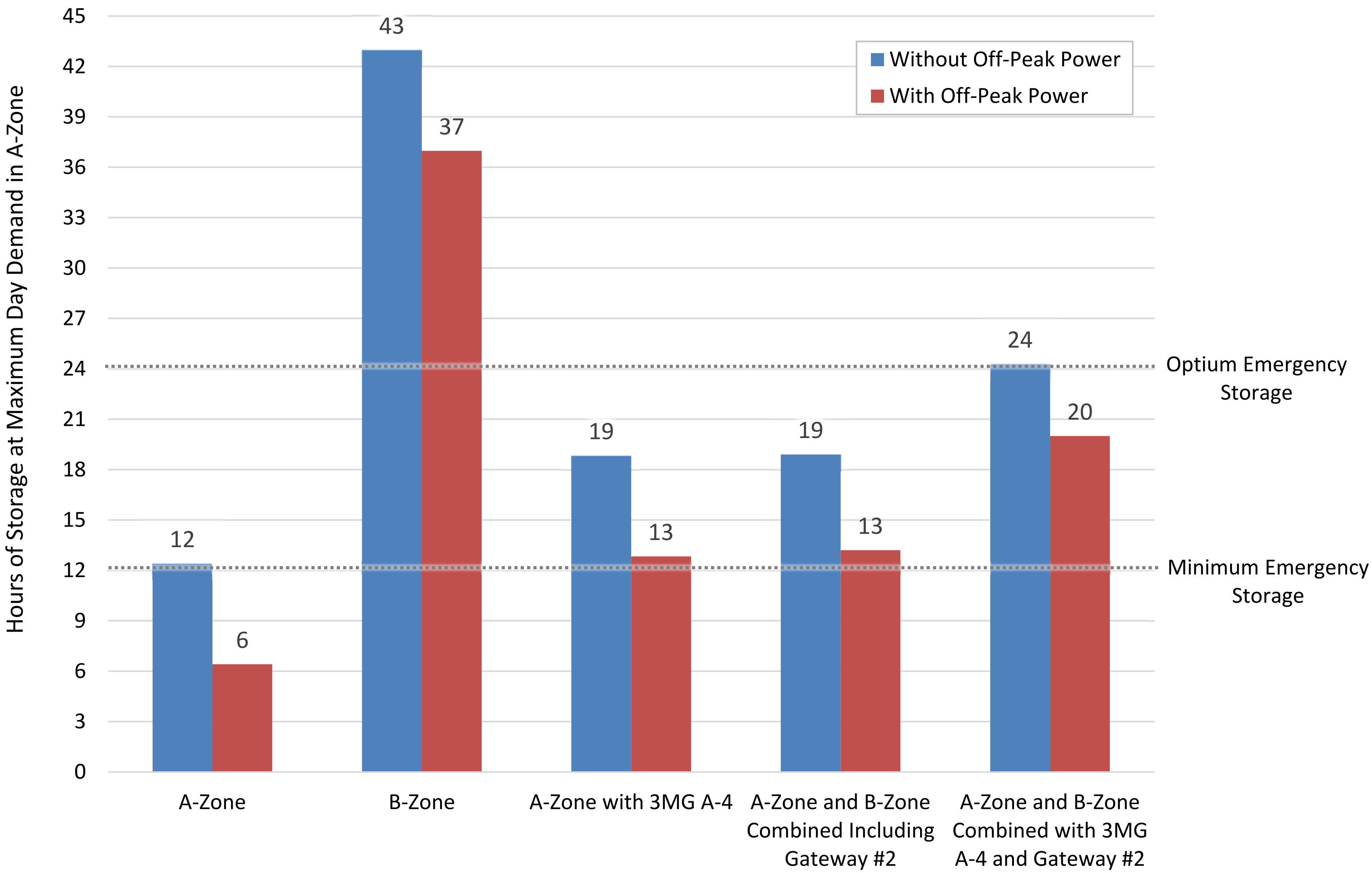


TABLE V-1A
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE FACILITY REQUIREMENTS BY PRESSURE ZONE
IN MILLION GALLONS (MG)
(MINIMUM ALLOWABLE EMERGENCY STORAGE, NORMAL OPERATION)

Zone	Storage Component	Required Storage						Existing	Required Storage Increase					
		2018	2025	2030	2035	2040	2045	Storage[3]	2018	2025	2030	2035	2040	2045
A-Zone	Operational	1.79	1.85	1.93	2.00	2.12	2.24							
(2455)	Fire	0.96	0.96	0.96	0.96	0.96	0.96							
	Emergency[1]	4.48	4.63	4.81	5.00	5.30	5.61							
	Total	7.23	7.45	7.70	7.96	8.38	8.81	9.00	0.00	0.00	0.00	0.00	0.00	0.00
B-Zone	Operational[2]	1.21	1.21	1.21	1.21	1.21	1.21							
(2555)	Fire	0.48	0.48	0.48	0.48	0.48	0.48							
	Emergency[1]	1.06	1.07	1.07	1.07	1.07	1.08							
	Total	2.75	2.75	2.76	2.76	2.76	2.77	5.55	0.00	0.00	0.00	0.00	0.00	0.00
C-Zone	Operational	0.12	0.12	0.12	0.12	0.12	0.12							
(2660)	Fire	0.24	0.24	0.24	0.24	0.24	0.24							
	Emergency[1]	0.29	0.29	0.29	0.29	0.29	0.29							
	Total	0.64	0.64	0.64	0.64	0.64	0.64	1.40	0.00	0.00	0.00	0.00	0.00	0.00
D-Zone	Operational	0.02	0.02	0.02	0.02	0.02	0.02							
(2775)	Fire	0.18	0.18	0.18	0.18	0.18	0.18							
	Emergency[1]	0.06	0.06	0.06	0.06	0.06	0.06							
	Total	0.27	0.27	0.27	0.27	0.27	0.27	0.50	0.00	0.00	0.00	0.00	0.00	0.00
E-Zone	Operational	0.06	0.06	0.06	0.06	0.06	0.06							
(2885)	Fire	0.54	0.54	0.54	0.54	0.54	0.54							
	Emergency[1]	0.14	0.14	0.14	0.14	0.14	0.14							
	Total	0.74	0.74	0.74	0.74	0.74	0.74	0.55	0.19	0.19	0.19	0.19	0.19	0.19
Totals	Operational	3.20	3.26	3.33	3.40	3.52	3.65							
	Fire	2.40	2.40	2.40	2.40	2.40	2.40							
	Emergency	6.04	6.19	6.38	6.56	6.87	7.18							
	TOTAL	11.64	11.85	12.11	12.37	12.79	13.22	17.00	0.19	0.19	0.19	0.19	0.19	0.19

Notes: (1) Emergency Storage = 24 hours of ADD

(2) Operational Storage in B-Zone is equal to the greater of 20% of MDD or the top 5 feet of storage

(3) Does not include storage from proposed Gateway, C-Zone, D-Zone and College Tanks

TABLE V-1B
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE FACILITY REQUIREMENTS BY PRESSURE ZONE
IN MILLION GALLONS (MG)
(OPTIMUM EMERGENCY STORAGE, NORMAL OPERATION)

Zone	Storage Component	Required Storage						Existing	Required Storage Increase					
		2018	2025	2030	2035	2040	2045	Storage(3)	2018	2025	2030	2035	2040	2045
A-Zone	Operational	1.79	1.85	1.93	2.00	2.12	2.24							
(2455)	Fire	0.96	0.96	0.96	0.96	0.96	0.96							
	Emergency(1)	8.96	9.27	9.63	10.00	10.60	11.21							
	Total	11.72	12.08	12.51	12.96	13.68	14.41	9.00	2.72	3.08	3.51	3.96	4.68	5.41
B-Zone	Operational(2)	1.21	1.21	1.21	1.21	1.21	1.21							
(2555)	Fire	0.48	0.48	0.48	0.48	0.48	0.48							
	Emergency(1)	2.13	2.14	2.14	2.15	2.15	2.16							
	Total	3.82	3.82	3.83	3.83	3.84	3.84	5.55	0.00	0.00	0.00	0.00	0.00	0.00
C-Zone	Operational	0.12	0.12	0.12	0.12	0.12	0.12							
(2660)	Fire	0.24	0.24	0.24	0.24	0.24	0.24							
	Emergency(1)	0.58	0.58	0.58	0.58	0.58	0.58							
	Total	0.93	0.93	0.93	0.93	0.93	0.93	1.40	0.00	0.00	0.00	0.00	0.00	0.00
D-Zone	Operational	0.02	0.02	0.02	0.02	0.02	0.02							
(2775)	Fire	0.18	0.18	0.18	0.18	0.18	0.18							
	Emergency(1)	0.12	0.12	0.12	0.12	0.12	0.12							
	Total	0.33	0.33	0.33	0.33	0.33	0.33	0.50	0.00	0.00	0.00	0.00	0.00	0.00
E-Zone	Operational	0.06	0.06	0.06	0.06	0.06	0.06							
(2885)	Fire	0.54	0.54	0.54	0.54	0.54	0.54							
	Emergency(1)	0.28	0.28	0.28	0.28	0.28	0.28							
	Total	0.88	0.88	0.88	0.88	0.88	0.88	0.55	0.33	0.33	0.33	0.33	0.33	0.33
Totals	Operational	3.20	3.26	3.33	3.40	3.52	3.65							
	Fire	2.40	2.40	2.40	2.40	2.40	2.40							
	Emergency	12.08	12.39	12.76	13.13	13.73	14.36							
	TOTAL	17.68	18.04	18.49	18.93	19.66	20.40	17.00	3.05	3.41	3.84	4.29	5.01	5.74

Notes: (1) Emergency Storage = 24 hours of MDD

(2) Operational Storage in B-Zone is equal to the greater of 20% of MDD or the top 5 feet of storage

(3) Does not include storage from proposed Gateway, C-Zone, D-Zone and College Tanks

TABLE V-1C
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE FACILITY REQUIREMENTS BY PRESSURE ZONE
IN MILLION GALLONS (MG)
(MINIMUM ALLOWABLE EMERGENCY STORAGE, OFF PEAK POWER)

Zone	Storage Component	Required Storage						Existing	Required Storage Increase					
		2018	2025	2030	2035	2040	2045	Storage[3]	2018	2025	2030	2035	2040	2045
A-Zone	Operational	1.79	1.85	1.93	2.00	2.12	2.24							
(2455)	Fire	0.96	0.96	0.96	0.96	0.96	0.96							
	OPP	2.24	2.32	2.41	2.50	2.65	2.80							
	Emergency[1]	4.48	4.63	4.81	5.00	5.30	5.61							
	Total	9.48	9.76	10.11	10.46	11.03	11.61	9.00	0.48	0.76	1.11	1.46	2.03	2.61
B-Zone	Operational[2]	1.21	1.21	1.21	1.21	1.21	1.21							
(2555)	Fire	0.48	0.48	0.48	0.48	0.48	0.48							
	OPP	0.53	0.53	0.54	0.54	0.54	0.54							
	Emergency[1]	1.06	1.07	1.07	1.07	1.07	1.08							
	Total	3.28	3.29	3.29	3.30	3.30	3.30	5.55	0.00	0.00	0.00	0.00	0.00	0.00
C-Zone	Operational	0.12	0.12	0.12	0.12	0.12	0.12							
(2660)	Fire	0.24	0.24	0.24	0.24	0.24	0.24							
	OPP	0.14	0.14	0.14	0.14	0.14	0.14							
	Emergency[1]	0.29	0.29	0.29	0.29	0.29	0.29							
	Total	0.79	0.79	0.79	0.79	0.79	0.79	1.40	0.00	0.00	0.00	0.00	0.00	0.00
D-Zone	Operational	0.02	0.02	0.02	0.02	0.02	0.02							
(2775)	Fire	0.18	0.18	0.18	0.18	0.18	0.18							
	OPP	0.03	0.03	0.03	0.03	0.03	0.03							
	Emergency[1]	0.06	0.06	0.06	0.06	0.06	0.06							
	Total	0.30	0.30	0.30	0.30	0.30	0.30	0.50	0.00	0.00	0.00	0.00	0.00	0.00
E-Zone	Operational	0.06	0.06	0.06	0.06	0.06	0.06							
(2885)	Fire	0.54	0.54	0.54	0.54	0.54	0.54							
	OPP	0.07	0.07	0.07	0.07	0.07	0.07							
	Emergency[1]	0.14	0.14	0.14	0.14	0.14	0.14							
	Total	0.81	0.81	0.81	0.81	0.81	0.81	0.55	0.26	0.26	0.26	0.26	0.26	0.26
Totals	Operational	3.20	3.26	3.33	3.40	3.52	3.65							
	Fire	2.40	2.40	2.40	2.40	2.40	2.40							
	OPP	3.02	3.10	3.19	3.28	3.43	3.59							
	Emergency	6.04	6.19	6.38	6.56	6.87	7.18							
	TOTAL	14.66	14.95	15.30	15.65	16.22	16.81	17.00	0.74	1.02	1.37	1.72	2.29	2.87

Notes: (1) Emergency Storage = 24 hours of ADD

(2) Operational Storage in B-Zone is equal to the greater of 20% of MDD or the top 5 feet of storage

(3) Does not include storage from proposed Gateway, C-Zone, D-Zone and College Tanks

TABLE V-1D
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE FACILITY REQUIREMENTS BY PRESSURE ZONE
IN MILLION GALLONS (MG)
(OPTIMUM EMERGENCY STORAGE, OFF PEAK POWER)

		Required Storage						Existing	Required Storage Increase					
Zone	Storage Component	2018	2025	2030	2035	2040	2045	Storage[3]	2018	2025	2030	2035	2040	2045
A-Zone	Operational	1.79	1.85	1.93	2.00	2.12	2.24							
(2455)	Fire	0.96	0.96	0.96	0.96	0.96	0.96							
	OPP	2.24	2.32	2.41	2.50	2.65	2.80							
	Emergency[1]	8.96	9.27	9.63	10.00	10.60	11.21							
	Total	13.96	14.39	14.92	15.46	16.33	17.22	9.00	4.96	5.39	5.92	6.46	7.33	8.22
B-Zone	Operational[2]	1.21	1.21	1.21	1.21	1.21	1.21							
(2555)	Fire	0.48	0.48	0.48	0.48	0.48	0.48							
	OPP	0.53	0.53	0.54	0.54	0.54	0.54							
	Emergency[1]	2.13	2.14	2.14	2.15	2.15	2.16							
	Total	4.35	4.36	4.36	4.37	4.37	4.38	5.55	0.00	0.00	0.00	0.00	0.00	0.00
C-Zone	Operational	0.12	0.12	0.12	0.12	0.12	0.12							
(2660)	Fire	0.24	0.24	0.24	0.24	0.24	0.24							
	OPP	0.14	0.14	0.14	0.14	0.14	0.14							
	Emergency[1]	0.58	0.58	0.58	0.58	0.58	0.58							
	Total	1.08	1.08	1.08	1.08	1.08	1.08	1.40	0.00	0.00	0.00	0.00	0.00	0.00
D-Zone	Operational	0.02	0.02	0.02	0.02	0.02	0.02							
(2775)	Fire	0.18	0.18	0.18	0.18	0.18	0.18							
	OPP	0.03	0.03	0.03	0.03	0.03	0.03							
	Emergency[1]	0.12	0.12	0.12	0.12	0.12	0.12							
	Total	0.36	0.36	0.36	0.36	0.36	0.36	0.50	0.00	0.00	0.00	0.00	0.00	0.00
E-Zone	Operational	0.06	0.06	0.06	0.06	0.06	0.06							
(2885)	Fire	0.54	0.54	0.54	0.54	0.54	0.54							
	OPP	0.07	0.07	0.07	0.07	0.07	0.07							
	Emergency[1]	0.28	0.28	0.28	0.28	0.28	0.28							
	Total	0.95	0.95	0.95	0.95	0.95	0.95	0.55	0.40	0.40	0.40	0.40	0.40	0.40
Totals	Operational	3.20	3.26	3.33	3.40	3.52	3.65							
	Fire	2.40	2.40	2.40	2.40	2.40	2.40							
	OPP	3.02	3.10	3.19	3.28	3.43	3.59							
	Emergency	12.08	12.39	12.76	13.13	13.73	14.36							
	TOTAL	20.70	21.14	21.68	22.21	23.09	23.99	17.00	5.36	5.79	6.32	6.86	7.73	8.62

Notes: (1) Emergency Storage = 24 hours of MDD

(2) Operational Storage in B-Zone is equal to the greater of 20% of MDD or the top 5 feet of storage

(3) Does not include storage from proposed Gateway, C-Zone, D-Zone and College Tanks

TABLE V-1E
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE RESERVOIR
PROJECT COSTS (MINIMUM ALLOWABLE EMERGENCY STORAGE, NORMAL OPERATION)
(2021 DOLLARS)

Storage Reservoir	Capacity (MG)	2021	2022	2023	2024	2025	2035	2040	2045
B-Zone									
Gateway No. 2	1.0		$1,700,000						
C-Zone									
C-Zone	1.0		$1,600,000						
D-Zone									
D-Zone	0.1								$900,000
E-Zone									
College	0.55		$1,460,000						
TOTAL:	**2.7**	**$0**	**$4,760,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$900,000**

TABLE V-1F
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE RESERVOIR
PROJECT COSTS (OPTIMUM EMERGENCY STORAGE, NORMAL OPERATION)
(2021 DOLLARS)

Storage Reservoir	Capacity (MG)	2021	2022	2023	2024	2025	2035	2040	2045
A-Zone [1]									
A-4	3.0					$5,000,000			
B-Zone									
Gateway No. 2	1.0		$1,700,000						
C-Zone									
C-Zone	1.0		$1,600,000						
D-Zone									
D-Zone	0.1								$900,000
E-Zone									
College	0.55		$1,460,000						
TOTAL (excluding A-4):	**2.7**	**$0**	**$4,760,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$900,000**
TOTAL:	**5.7**	**$0**	**$4,760,000**	**$0**	**$0**	**$5,000,000**	**$0**	**$0**	**$900,000**

Notes:
[1] Additional 2.5 MG supplied by B-Zone

TABLE V-1G
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE RESERVOIR
PROJECT COSTS (MINIMUM ALLOWABLE EMERGENCY STORAGE, OFF PEAK POWER)
(2021 DOLLARS)

Storage Reservoir	Capacity (MG)	2021	2022	2023	2024	2025	2035	2040	2045
B-Zone									
Gateway No. 2	1.0		$1,700,000						
C-Zone									
C-Zone	1.0		$1,600,000						
D-Zone									
D-Zone	0.1								$900,000
E-Zone									
College	0.55		$1,460,000						
TOTAL:	**2.7**	**$0**	**$4,760,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$900,000**

TABLE V-1H
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
STORAGE RESERVOIR
PROJECT COSTS (OPTIMUM EMERGENCY STORAGE, OFF PEAK POWER)
(2021 DOLLARS)

Storage Reservoir	Capacity (MG)	2021	2022	2023	2024	2025	2035	2040	2045
A-Zone [1]									
A-4	4.0					$6,600,000			
A-5	2.5							$4,100,000	
B-Zone									
Gateway No. 2	1.0		$1,700,000						
C-Zone									
C-Zone	1.0		$1,600,000						
D-Zone									
D-Zone	0.1								$900,000
E-Zone									
College	0.55		$1,460,000						
TOTAL:	**9.2**	**$0**	**$4,760,000**	**$0**	**$0**	**$6,600,000**	**$0**	**$4,100,000**	**$900,000**

Notes:
[1] Additional 2.0 MG supplied by B-Zone

TABLE V-2A
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PRODUCTION FACILITY REQUIREMENTS BY PRESSURE ZONE
IN GALLONS PER MINUTE (GPM)
(NORMAL OPERATION)

Zone	Production Demand	Required Production						Existing	Required Production Increase					
		2018	2025	2030	2035	2040	2045	Production[3]	2021	2025	2030	2035	2040	2045
A-Zone	Average Day	3,112	3,217	3,343	3,471	3,680	3,893							
(2455)	Maximum Day	6,225	6,434	6,686	6,942	7,361	7,786	6,900 [2]	0	0	0	42	461	886
		Wells Required @ 1,200 gpm							0	0	0	1	1	1
B-Zone	Average Day	739	742	744	745	746	749							
(2555)	Maximum Day	1,478	1,483	1,487	1,490	1,492	1,498	3,500 [2]						
C-Zone [1]	Average Day	201	201	201	201	201	201							
(2660)	Maximum Day	402	402	402	402	402	402							
D-Zone [1]	Average Day	43	43	43	43	43	43							
(2775)	Maximum Day	86	86	86	86	86	86							
E-Zone [1]	Average Day	99	99	99	99	99	99							
(2885)	Maximum Day	198	198	198	198	198	198							
Total	Average Day	1,082	1,084	1,086	1,088	1,089	1,092							
	Maximum Day	2,163	2,169	2,173	2,175	2,178	2,184	3,500 [2]	0	0	0	0	0	0
	Total	Wells Required @ 1,200 gpm							0	0	0	0	0	0
System Total	Average Day	4,194	4,301	4,429	4,559	4,769	4,985							
	Maximum Day	8,388	8,603	8,859	9,118	9,538	9,969	11,800 [2]	0	0	0	0	0	0
		Wells Required @ 1,200 gpm [4]							0	0	0	0	0	0

Notes: (1) C-, D- and E-Zones are served by B-Zone production facilities.
(2) Existing production with the largest well out of service.
(3) Not including Well 36.
(4) Additional wells required if B-Zone production is used to supplement A-Zone

TABLE V-2B
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PRODUCTION FACILITY REQUIREMENTS BY PRESSURE ZONE
IN GALLONS PER MINUTE (GPM)
(OFF PEAK POWER)

Zone	Production Demand	Required Production						Existing	Required Production Increase					
		2018	2025	2030	2035	2040	2045	Production [3]	2021	2025	2030	2035	2040	2045
A-Zone	Average Day	4,150	4,289	4,458	4,628	4,907	5,190							
(2455)	Maximum Day	8,300	8,579	8,915	9,256	9,814	10,381	6,900 [2]	1,400	1,679	2,015	2,356	2,914	3,481
								Wells Required @ 1,200 gpm	2	2	2	2	3	3
B-Zone	Average Day	986	989	992	993	995	999							
(2555)	Maximum Day	1,971	1,978	1,983	1,987	1,990	1,998	3,500 [2]						
C-Zone [1]	Average Day	268	268	268	268	268	268							
(2660)	Maximum Day	535	535	535	535	535	535							
D-Zone [1]	Average Day	57	57	57	57	57	57							
(2775)	Maximum Day	115	115	115	115	115	115							
E-Zone [1]	Average Day	132	132	132	132	132	132							
(2885)	Maximum Day	264	264	264	264	264	264							
Total	Average Day	1,442	1,446	1,448	1,450	1,452	1,456							
	Maximum Day	2,885	2,892	2,897	2,901	2,903	2,912	3,500 [2]	0	0	0	0	0	0
								Wells Required @ 1,200 gpm	0	0	0	0	0	0
System Total	Average Day	5,592	5,735	5,906	6,078	6,359	6,646							
	Maximum Day	11,184	11,470	11,812	12,157	12,717	13,293	11,800 [2]	0	0	12	357	917	1,493
								Wells Required @ 1,500 gpm [4]	0	0	1	1	1	1

Notes: (1) C-, D- and E-Zones are served by B-Zone production facilities.
(2) Existing production with the largest well out of service.
(3) Not including Well 36.
(4) Additional wells required if B-Zone production is used to supplement A-Zone

TABLE V-2C
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL PUMPING FACILITIES
PROJECT COSTS (OFF PEAK POWER)
(2021 DOLLARS)

Well Field	2021	2022	2023	2024	2025	2035	2040	2045
Southwest Well Field								
New Well 37							$2,500,000	
GRAND TOTAL:	$0	$0	$0	$0	$0	$0	$2,500,000	$0

TABLE V-2D
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
WELL PUMPING FACILITIES REPLACEMENTS
PROJECT COSTS
(2021 DOLLARS)

Well Field	2021	2022	2023	2024	2025	2035	2040	2045
Well 10				$1,750,000				
Well 11						$1,750,000		
Well 13							$1,750,000	
Well 17							$1,750,000	
Well 18							$1,750,000	
Well 30								$1,750,000
Well 31								$1,750,000
GRAND TOTAL:	$0	$0	$0	$1,750,000	$0	$1,750,000	$5,250,000	$3,500,000

TABLE V-3A
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PIPELINE PROJECT COSTS (MINIMUM ALLOWABLE EMERGENCY STORAGE, NORMAL OPERATION)
(2021 DOLLARS)

Distribution Pipelines	Length (LF)	2021	2022	2023	2024	2025	2035	2040	2045
A-Zone									
30" Bowman Road from Brady Street to China Lake Road	10,500						$5,381,000		
B-Zone									
24" Gateway Boulevard	5,700						$2,423,000		
24" Springer Avenue	8,000					$3,400,000			
Total:		**$0**	**$0**	**$0**	**$0**	**$3,400,000**	**$7,804,000**	**$0**	**$0**

TABLE V-3B
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PIPELINE PROJECT COSTS (OPTIMUM EMERGENCY STORAGE, NORMAL OPERATION)
(2021 DOLLARS)

Distribution Pipelines	Length (LF)	2021	2022	2023	2024	2025	2035	2040	2045
A-Zone									
24" Bowman Road from China Lake Road to A-4 Reservoir	14,500					$6,163,000			
30" Bowman Road from Brady Street to China Lake Road	10,500						$5,381,000		
B-Zone									
24" Gateway Boulevard	5,700						$2,423,000		
24" Springer Avenue	8,000					$3,400,000			
Total:		**$0**	**$0**	**$0**	**$0**	**$9,563,000**	**$7,804,000**	**$0**	**$0**

TABLE V-3C
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PIPELINE PROJECT COSTS (MINIMUM ALLOWABLE EMERGENCY STORAGE, OFF PEAK POWER)
(2021 DOLLARS)

Distribution Pipelines	Length (LF)	2021	2022	2023	2024	2025	2035	2040	2045
A-Zone									
30" Bowman Road from Brady Street to China Lake Road	10,500						$5,381,000		
24" College Heights Boulevard from Bowman Road to Springer Ave	5,900								$2,508,000
18" College Heights Boulevard from Springer Avenue to Kendal Tank	3,200							$1,200,000	
B-Zone									
24" Gateway Boulevard	5,700						$2,423,000		
24" Springer Avenue	8,000					$3,400,000			
Total:		**$0**	**$0**	**$0**	**$0**	**$3,400,000**	**$7,804,000**	**$1,200,000**	**$2,508,000**

TABLE V-4D
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PIPELINE PROJECT COSTS (OPTIMUM EMERGENCY STORAGE, OFF PEAK POWER)
(2021 DOLLARS)

Distribution Pipelines	Length (LF)	2021	2022	2023	2024	2025	2035	2040	2045
A-Zone									
30" Bowman Road from China Lake Road to A-4 Reservoir	14,500					$7,431,000			
30" Bowman Road from Brady Street to China Lake Road	10,500						$5,381,000		
24" College Heights Boulevard from Bowman Road to Springer Ave	5,900								$2,508,000
18" College Heights Boulevard from Springer Avenue to Kendal Tank	3,200							$1,200,000	
B-Zone									
24" Gateway Boulevard	5,700						$2,423,000		
24" Springer Avenue	8,000					$3,400,000			
Total:		**$0**	**$0**	**$0**	**$0**	**$10,831,000**	**$7,804,000**	**$1,200,000**	**$2,508,000**

TABLE V-5A
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECT COSTS (MINIMUM ALLOWABLE EMERGENCY STORAGE, NORMAL OPERATION)
SUMMARY
(2021 DOLLARS)

System Component	2021	2022	2023	2024	2025	2035	2040	2045
Well Pumping Facilities	$0	$0	$0	$1,750,000	$0	$1,750,000	$5,250,000	$3,500,000
Storage Reservoirs	$0	$4,760,000	$0	$0	$0	$0	$0	$900,000
Pressure Reducing Stations	$0	$0	$125,000	$0	$125,000	$0	$0	$0
Distribution Pipelines	$0	$0	$0	$0	$3,400,000	$7,804,000	$0	$0
TOTAL:	**$0**	**$4,760,000**	**$125,000**	**$1,750,000**	**$3,525,000**	**$9,554,000**	**$5,250,000**	**$4,400,000**

TABLE V-5B
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECT COSTS (OPTIMUM EMERGENCY STORAGE, NORMAL OPERATION)
SUMMARY
(2021 DOLLARS)

System Component	2021	2022	2023	2024	2025	2035	2040	2045
Well Pumping Facilities	$0	$0	$0	$1,750,000	$0	$1,750,000	$5,250,000	$3,500,000
Storage Reservoirs	$0	$4,760,000	$0	$0	$5,000,000	$0	$0	$900,000
Pressure Reducing Stations	$0	$0	$125,000	$0	$125,000	$0	$0	$0
Distribution Pipelines	$0	$0	$0	$0	$9,563,000	$7,804,000	$0	$0
TOTAL:	**$0**	**$4,760,000**	**$125,000**	**$1,750,000**	**$14,688,000**	**$9,554,000**	**$5,250,000**	**$4,400,000**

TABLE V-5C
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECT COSTS (MINIMUM ALLOWABLE EMERGENCY STORAGE, OFF PEAK POWER)
SUMMARY

System Component	2021	2022	2023	2024	2025	2035	2040	2045
Well Pumping Facilities	$0	$0	$0	$1,750,000	$0	$1,750,000	$7,750,000	$3,500,000
Storage Reservoirs	$0	$4,760,000	$0	$0	$0	$0	$0	$900,000
Pressure Reducing Stations	$0	$0	$125,000	$0	$125,000	$0	$0	$0
Distribution Pipelines	$0	$0	$0	$0	$9,563,000	$7,804,000	$0	$0
TOTAL:	**$0**	**$4,760,000**	**$125,000**	**$1,750,000**	**$9,688,000**	**$9,554,000**	**$7,750,000**	**$4,400,000**

TABLE V-5D
INDIAN WELLS VALLEY WATER DISTRICT
DOMESTIC WATER SYSTEM
PROJECT COSTS (OPTIMUM EMERGENCY STORAGE, OFF PEAK POWER)
SUMMARY
(2021 DOLLARS)

System Component	2021	2022	2023	2024	2025	2035	2040	2045
Well Pumping Facilities	$0	$0	$0	$1,750,000	$0	$1,750,000	$7,750,000	$3,500,000
Storage Reservoirs	$0	$4,760,000	$0	$0	$6,600,000	$0	$4,100,000	$900,000
Pressure Reducing Stations	$0	$0	$125,000	$0	$125,000	$0	$0	$0
Distribution Pipelines	$0	$0	$0	$0	$10,831,000	$7,804,000	$1,200,000	$2,508,000
TOTAL:	**$0**	**$4,760,000**	**$125,000**	**$1,750,000**	**$17,556,000**	**$9,554,000**	**$13,050,000**	**$6,908,000**

CHAPTER VI

RECYCLED WATER

CHAPTER VI
RECYCLED WATER

Section 13050(n) of the California Water Code defines "recycled water" as water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

There are currently two wastewater treatment facilities (WWTFs) within the IWVGB: The City of Ridgecrest WWTF, and a small WWTF operated by the Inyokern Community Services District. Residents within the IWVGB who do not contribute flow to either of these WWTFs dispose of wastewater using septic tanks.

A. WASTEWATER AVAILABLE FOR RECYCLING

The City WWTF has a capacity of 3.6 MGD. The facility is located on NAWS China Lake, approximately 3.5 miles northeast of the City center. Annual average day flows at the WWTF were approximately 2.44 MGD in 2017, or approximately 2,739 AF/Yr.

The small WWTF operated by Inyokern CSD has an approximate capacity of 0.035 MGD, or approximately 39 AF/Yr. The final effluent generated by the Inyokern WWTF is disposed of through evaporation/percolation ponds located at the Inyokern WWTF site, and is currently not of sufficient quality for recycling without additional treatment.

The City WWTF produces recycled water that is currently used by the City of Ridgecrest and the Navy, as described in the following paragraphs.

The City currently uses approximately 220 AF/Yr of secondary-treated effluent for irrigation of City-managed alfalfa fields. The City plans to discontinue irrigation of these alfalfa fields upon completion of new recycled water treatment facilities.

An agreement has been established between the City of Ridgecrest and the Navy for coordination of facilities in exchange for use of recycled water by the Navy. The City's agreement with the Navy allots the Navy 748 AF/Yr of secondary-treated effluent. After disinfecting the secondary-treated effluent with chlorine, the Navy uses the treated water to irrigate a golf course on Navy property.

Navy personnel have stated that they typically use their entire allotment for irrigation of the golf course, but Provost & Pritchard (2015) stated that only 500 AF/Yr are used.

The remaining secondary-treated wastewater generated at the City WWTF—approximately 1,767 AF/Yr—is discharged to evaporation and facultative ponds at the City WWTF site.

Currently, adequate quantities of water must remain in the evaporation ponds at all times in order to provide sufficient percolation to maintain water levels in the nearby Lark and G-1 Seeps, located north of the City WWTF, which serves as a refuge for the Mohave tui chub *(Gila bicolor mohavensis),* an endangered species of fish. It has been estimated that the annual water demands to maintain the habitat is approximately 805 AF/Yr. Discussions with the U.S. Fish & Wildlife Service have led to a tentative goal of relocating the Mohave tui chub in approximately 5 to 10 years.

If irrigation of the alfalfa fields is discontinued and irrigation of the NAWS golf course is limited to 500 AF/Yr, 1,435 AF/Yr of secondary effluent will be available for recycling. If, in addition, the Mohave tui chub is relocated, 2,239 AF/Yr of secondary effluent will be available for recycling.

The City is currently planning to upgrade and expand the existing City WWTF. The City plans to abandon and demolish the existing City WWTF for construction of a new oxidation ditch secondary treatment plant with new evaporation/percolation ponds and new solids handling facilities. The City has also evaluated constructing new tertiary recycled water treatment facilities, a new recycled water storage tank, a new recycled water pump station, and a new recycled water distribution system. The new recycled water facilities that the City plans to construct are projected to have a capacity of 1.8 MGD (2,016 AF/Yr).

Table VI-1 shows the quantities of secondary-treated effluent used during the period 2016 through 2020.

TABLE VI-1
HISTORICAL RECYCLED WATER USE[1]
(AF/Yr)

	2016	2017	2018	2019	2020
Navy	500	500	500	500	500
City of Ridgecrest[2]	1,215	1,428	1,215	1,171	1,159
Maintenance of Fish Refuge	805	805	805	805	805
IWVWD	0	0	0	0	0
Total	**2,520**	**2,733**	**2,520**	**2,476**	**2,464**

(1) All treatment plant effluent is either treated further and used for irrigation or is percolated into the ground to supply water to the Lark Seep.

(2) Alfalfa irrigation and percolation/evaporation

B. POTENTIAL RECYCLED WATER USES

The following potential recycled water uses are currently being evaluated jointly by IWVWD and the IWVGA:

1. Alternative 1: Indirect Potable Reuse (IPR), i.e. groundwater replenishment

    a. Surface (percolation ponds)

    b. Subsurface (direct injection)

2. Alternative 2: Landscape Irrigation (Community College, schools, parks, fairgrounds, sports complex, Navy) with Seasonal Storage (approximate demand of 930 AF/Yr)

3. Alternative 3: Combination of Landscape Irrigation and IPR

4. Alternative 5: Direct Potable Reuse

    The State is currently working on Direct Potable Reuse Regulatory Framework.

Each of the above uses would require a minimum of tertiary treatment and disinfection of the wastewater. In addition, Alternatives 1, 3, and 4 would require advanced treatment to reduce Total Dissolved Solids (TDS) and Total Nitrogen, and possibly other constituents.

Based on preliminary investigations and cost comparisons, IWVWD is emphasizing Alternative 1.b. (subsurface IPR) as the most feasible alternative, for the following reasons:

1. For Alternative 2 (landscape irrigation): demand for recycled water for landscape irrigation will diminish to essentially zero during the wet months, requiring wet-weather storage of essentially the entire discharge of the recycled water treatment facilities. In addition, due to economic factors, demands for landscape irrigation water by individual business customers will be unstable, and thus unreliable, in the long term.

2. For Alternative 3 (Combination of landscape irrigation with IPR): The IPR facilities would be required to accept the entire quantity of recycled water production during wet weather, and would, therefore, need to be designed to accommodate the entire discharge of the recycled water treatment facilities. The IPR facilities for Alternative 4 would need to be essentially the same as the IPR facilities for Alternative 1. Therefore, Alternative 1 would be simpler and considerably more cost-effective.

3. For Alternative 5 (Direct Potable Reuse): The State has not yet completed its Direct Potable Reuse Regulatory Framework. The required level of treatment will be the highest of all alternatives, and stringent source control of sewer users will be required. A redundant alternative supply will be required. The State's criteria are tentatively scheduled to be adopted December 2023 for raw water augmentation (recycled water used to augment water treatment facility feed water). Criteria for treated water augmentation and reservoir augmentation have not yet been scheduled.

4. For Alternative 1.a. (surface IPR): Previous studies in the Indian Wells Valley have indicated that percolation basins are inefficient with respect to conveying water into the usable aquifer, due to both evaporation from the percolation ponds and geological factors.

Groundwater injection of recycled water requires a high level of treatment. In addition to tertiary treatment and disinfection, nitrogen and TDS removal would be required to comply with basin objectives (Title 22 standards for potable use to comply with MUN designation) and state anti-backsliding provisions. Advanced secondary treatment would be required for nitrogen removal; reverse osmosis (RO) or other desalting technology would be required for TDS removal.

C. FUTURE RECYCLED WATER AVAILABILITY

Because the City is planning construction of a new WWTF, it is possible that treatment plant effluent may be available from the City at some point in the future for use by the IWVGA and/or the District. The City has already committed approximately 2,000 AF/Yr of WWTF effluent to IWVGA for recycling purposes. However, at this time, there are no specific plans for effluent water allocations for District recycling use. Projected use of recycled secondary-treated effluent for the period 2025 through 2045 is shown in **Table VI-2**, assuming relocation of the Mohave tui chub.

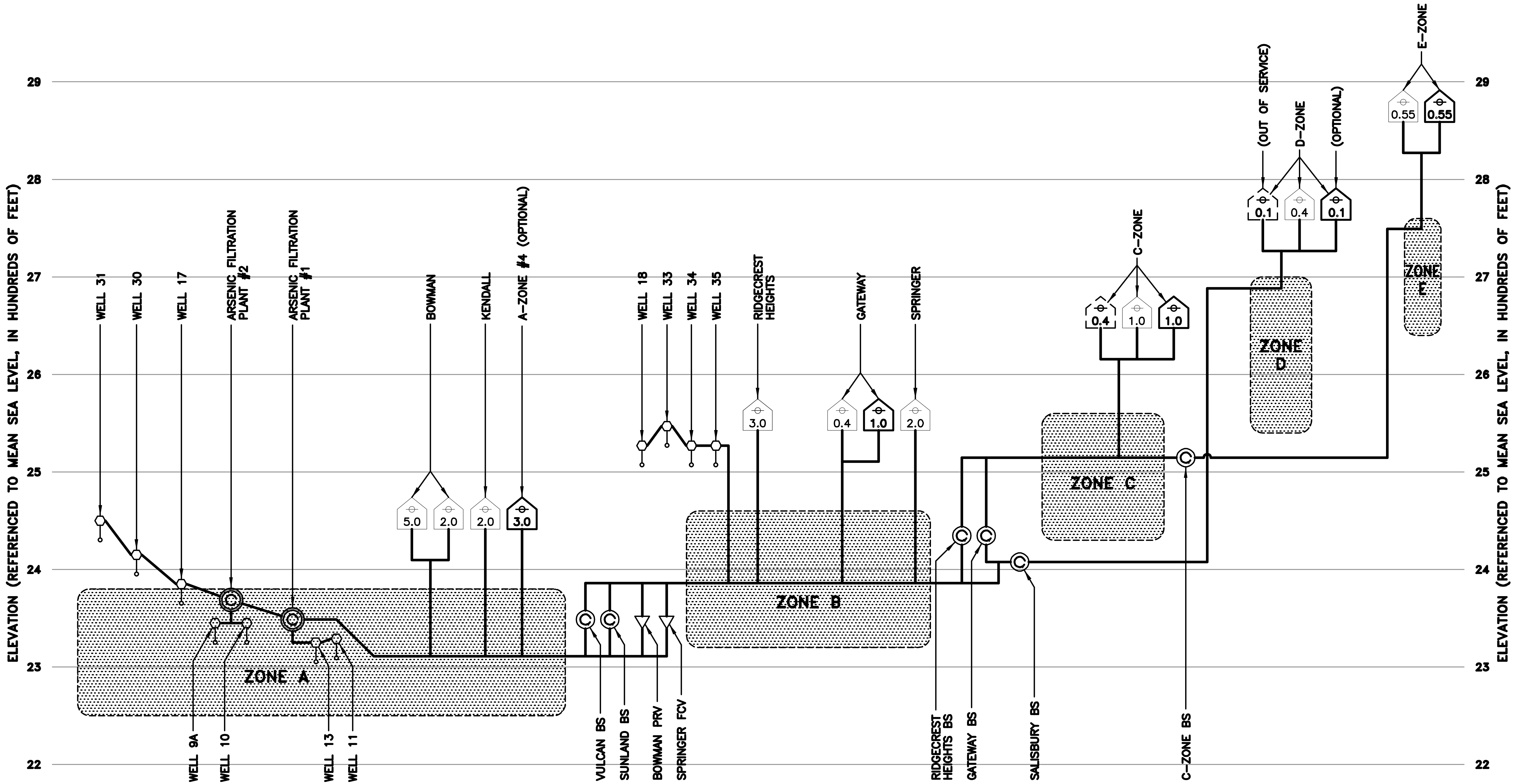
TABLE VI-2
PROJECTED RECYCLED WATER USE (AF/Yr)

	2025	2030	2035	2040	2045
Navy	500	500	500	500	500
City of Ridgecrest(1)	1,652	2,637	827	1,029	1,253
Maintenance of Fish Habitat	805	0	0	0	0
IWVGA, IWVWD	0	0	2,000	2,000	2,000
Total (2)	**2,957**	**3,137**	**3,327**	**3,529**	**3,753**

(1) Alfalfa irrigation and percolation/evaporation from disposal of excess wastewater. Alfalfa irrigation will be discontinued in 2035 +/-.

(2) Based on Provost & Pritchard Technical Memorandum: City of Ridgecrest -- Updated Flows and BOD loading. 7/10/21, for an annual growth factor of 1.2%.

MAPS



LEGEND

WELL PLANT (GPM/HP)	EXISTING STORAGE RESERVOIR (MIL.GAL.)
BOOSTER PLANT (GPM/HP)	PROPOSED STORAGE RESERVOIR (MIL.GAL.)
ARSENIC FILTRATION PLANT	STORAGE RESERVOIR (MIL.GAL.) TO BE REPLACED
SYSTEM VALVE	DISTRIBUTION SYSTEM

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INDIAN WELLS VALLEY WATER DISTRICT

DOMESTIC WATER SYSTEM GENERAL PLAN

EXISTING AND PROPOSED POTABLE WATER SYSTEM FACILITIES

MAP 1 OF 4

SCALE: N.T.S. DATE: 03/22/23 DRAWN BY: SPK/MWE CHECKED BY: NRW W.O.: 178-148

178-148_map1.dwg

VICTOR ST
CALVERT BLVD
HERBERT ST
JACKS RANCH RD
BRADY ST
DOWNS ST
CHINA LAKE RD
COUNTY LINE RD
INYOKERN RD
INYOKERN AIRPORT
NORTH KNOX RD
KNOX RD
LAURISTEN RD
WARD AVE
PILOT PLANT RD
RIDGECREST
RIDGECREST BLVD
UPJOHN AVE
BOWMAN RD
SPRINGER AVE
JAVIS AVE
REDROCK-INYOKERN RD
BROWN RD
KERN CO.
SAN BERNARDINO CO.
395
178
WELL No.30
200 HP, 1,400 GPM
WELL No.17
200 HP, 1,250 GPM
ARSENIC REMOVAL FACILITY
(WELLS 9A AND 10)
WELL 9A: 150 HP, 1,000 GPM
WELL 10: 150 HP, 1,150 GPM
WELL No.31
200 HP, 1,200 GPM
WELL No.36
(UNEQUIPPED)
ARSENIC REMOVAL FACILITY
(WELLS 11 AND 13)
WELL 11: 150 HP, 1,200 GPM
WELL 13: 150 HP, 1,300 GPM
BOWMAN 1
2.0MG TANK
BOWMAN 2
5.0MG TANK
BOWMAN PRV
WELL No.34
250 HP, 1,900 GPM
WELL No.35
250 HP, 1,200 GPM
WELL No.33
200 HP, 1,200 GPM
WELL No.18
200 HP, 1,200 GPM
VULCAN
BS
SUNLAND BS
SPRINGER
2MG TANK
SPRINGER
FCV
R/C HEIGHTS 3.0 MG
RIDGECREST HEIGHTS BS
KENDALL 2.0MG
TANK
GATEWAY
0.4MG TANK
C-ZONE BS
C-ZONE No.1
0.4MG TANK
C-ZONE No.2
1.0MG TANK
SALISBURY BS
GATEWAY BS
D-ZONE No.2
0.4MG TANK
D-ZONE No.1
0.1MG TANK
(OUT OF SERVICE)
COLLEGE TANK
0.6MG
EXISTING FACILITIES LEGEND
6" AND BELOW EXISTING PIPELINE
8" EXISTING PIPELINE
10" EXISTING PIPELINE
12" EXISTING PIPELINE
14" EXISTING PIPELINE
16" EXISTING PIPELINE
24" EXISTING PIPELINE
30" EXISTING PIPELINE
A/B ZONE-BREAK CONTOUR – 2350 FT
B/C ZONE-BREAK CONTOUR – 2450 FT
C/D ZONE-BREAK CONTOUR – 2560 FT
D/E ZONE-BREAK CONTOUR – 2680 FT
IWVWD BOUNDARY
EXISTING STORAGE RESERVOIR
EXISTING WELL
A ZONE
B ZONE
C ZONE
D ZONE
E ZONE
AIR INSTALLATION COMPATIBLE USE ZONE (AICUZ)
N
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY
KRIEGER & STEWART
Engineering Consultants
3602 University Avenue • Riverside, CA 92501
www.kriegerandstewart.com • 951-684-6900
INDIAN WELLS VALLEY WATER DISTRICT
2020 WATER GENERAL PLAN UPDATE
EXISTING FACILITIES
SCALE: 1"=2000'
DATE: 05/04/22
DRAWN BY: SPK/MWE
CHECKED BY: NRW
W.O.: 178-148
MAP
2
OF 4
DWG. NO.: 178-148_map2 FILE NO.: 178-148 UPDATE BY: SPK PROJ. ENG.: JRB PLOT DATE: 05/04/22 PLOT TIME: 4:32PM PLOT SCALE: 1=1

INYOKERN AIRPORT
REDROCK-INYOKERN RD
VICTOR ST
CALVERT BLVD
HERBERT ST
JACKS RANCH RD
BRADY ST
DOWNS ST
CHINA LAKE RD
COUNTY LINE RD
NORTH KNOX RD
KNOX RD
INYOKERN RD
LAURISTEN RD
WARD AVE
PILOT PLANT RD
RIDGECREST
RIDGECREST BLVD
UPJOHN AVE
BOWMAN RD
SPRINGER AVE
JAVIS AVE
BROWN RD
395
178
KERN CO.
SAN BERNARDINO CO.
WELL No.30
200 HP, 1,400 GPM
WELL No.17
200 HP, 1,250 GPM
ARSENIC REMOVAL FACILITY
(WELLS 9A AND 10)
WELL 9A: 150 HP, 1,000 GPM
WELL 10: 150 HP, 1,150 GPM
WELL No.31
200 HP, 1,200 GPM
WELL No.36
(UNEQUIPPED)
ARSENIC REMOVAL FACILITY
(WELLS 11 AND 13)
WELL 11: 150 HP, 1,200 GPM
WELL 13: 150 HP, 1,300 GPM
BOWMAN 1
2.0MG TANK
BOWMAN 2
5.0MG TANK
WELL No.34
250 HP, 1,900 GPM
WELL No.35
250 HP, 1,200 GPM
BOWMAN PRV
30"
24"
A-4
3MG
VULCAN BS
WELL No.33
200 HP, 1,200 GPM
WELL No.18
200 HP, 1,200 GPM
SUNLAND BS
SPRINGER PRV
SPRINGER 2MG TANK
R/C HEIGHTS 3.0 MG
RIDGECREST HEIGHTS BS
KENDALL 2.0MG TANK
GATEWAY 0.55MG TANK
GATEWAY 1.0MG TANK
C-ZONE BS
D-ZONE No.2
0.4MG TANK
C-ZONE No.1
1.0MG TANK
SALISBURY BS
GATEWAY BS
D-ZONE No.1
0.1MG TANK
(OPTIONAL)
C-ZONE No.2
1.0MG TANK
COLLEGE TANK No.2
0.55MG
COLLEGE TANK
0.55MG
EXISTING FACILITIES LEGEND
6" AND BELOW EXISTING PIPELINE
8" EXISTING PIPELINE
10" EXISTING PIPELINE
12" EXISTING PIPELINE
14" EXISTING PIPELINE
16" EXISTING PIPELINE
24" EXISTING PIPELINE
30" EXISTING PIPELINE
A/B ZONE-BREAK CONTOUR – 2350 FT
B/C ZONE-BREAK CONTOUR – 2450 FT
C/D ZONE-BREAK CONTOUR – 2560 FT
D/E ZONE-BREAK CONTOUR – 2680 FT
IWVWD BOUNDARY
EXISTING STORAGE RESERVOIR
EXISTING WELL
A ZONE
B ZONE
C ZONE
D ZONE
E ZONE
AIR INSTALLATION COMPATIBLE USE ZONE (AICUZ)
PROPOSED FACILITIES LEGEND
PROPOSED A ZONE PIPELINE
OPTIONAL PROPOSED A ZONE PIPELINE
PROPOSED B ZONE PIPELINE
PROPOSED STORAGE RESERVOIR
OPTIONAL PROPOSED STORAGE RESERVOIR
PROPOSED PRV STATION
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
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INDIAN WELLS VALLEY WATER DISTRICT
2020 WATER GENERAL PLAN UPDATE
PROPOSED FACILITIES
NORMAL OPERATION
MAP
3
OF 4
SCALE: 1"=2000'
DATE: 03/22/23
DRAWN BY: SPK/MWE
CHECKED BY: NRW
W.O.: 178-148
DWG. NO.: 178-148_map3 FILE NO.: 178-148 UPDATE BY: SPK PROJ. ENG.: JRB PLOT DATE: 03/22/23 PLOT TIME: 2:44PM PLOT SCALE: 1=1

INDIAN WELLS VALLEY WATER DISTRICT
2020 WATER GENERAL PLAN UPDATE
PROPOSED FACILITIES
OFF PEAK POWER (NOT RECOMMENDED)
MAP 4 OF 4
KRIEGER & STEWART Engineering Consultants
3602 University Avenue • Riverside, CA 92501
www.kriegerandstewart.com • 951-684-6900
SCALE: 1"=2000'
DATE: 03/22/23
DRAWN BY: SPK/MWE
CHECKED BY: NRW
W.O.: 178-148
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY
DWG. NO.: 178-148_map4 FILE NO.: 178-148 UPDATE BY: SPK PROJ. ENG.: JRB PLOT DATE: 03/22/23 PLOT TIME: 4:54PM PLOT SCALE: 1=1
EXISTING FACILITIES LEGEND
6" AND BELOW EXISTING PIPELINE
8" EXISTING PIPELINE
10" EXISTING PIPELINE
12" EXISTING PIPELINE
14" EXISTING PIPELINE
16" EXISTING PIPELINE
24" EXISTING PIPELINE
30" EXISTING PIPELINE
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D/E ZONE-BREAK CONTOUR - 2680 FT
IWVWD BOUNDARY
EXISTING STORAGE RESERVOIR
EXISTING WELL
A ZONE
B ZONE
C ZONE
D ZONE
E ZONE
AIR INSTALLATION COMPATIBLE USE ZONE (AICUZ)
PROPOSED FACILITIES LEGEND
PROPOSED A ZONE PIPELINE
OPTIONAL PROPOSED A ZONE PIPELINE
PROPOSED B ZONE PIPELINE
PROPOSED STORAGE RESERVOIR
OPTIONAL PROPOSED STORAGE RESERVOIR
PROPOSED PRV STATION
INYOKERN AIRPORT
REDROCK-INYOKERN RD
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CALVERT BLVD
HERBERT ST
JACKS RANCH RD
BRADY ST
DOWNS ST
CHINA LAKE RD
COUNTY LINE RD
NORTH KNOX RD
KNOX RD
LAURISTEN RD
INYOKERN RD
WARD AVE
PILOT PLANT RD
RIDGECREST
RIDGECREST BLVD
UPJOHN AVE
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250 HP, 1,900 GPM
WELL No.35
250 HP, 1,200 GPM
WELL No.33
200 HP, 1,200 GPM
WELL No.18
200 HP, 1,200 GPM
BOWMAN PRV
SPRINGER PRV
30"
30"
24"
24"
24"
18"
A-4, 4.0MG
A-5
2.5MG
VULCAN BS
SUNLAND BS
SPRINGER 2MG TANK
R/C HEIGHTS 3.0 MG
RIDGECREST HEIGHTS BS
KENDALL 2.0MG TANK
GATEWAY 0.55MG TANK
GATEWAY 1.0MG TANK
C-ZONE BS
C-ZONE No.1 1.0MG TANK
C-ZONE No.2 1.0MG TANK
SALISBURY BS
GATEWAY BS
D-ZONE No.2 0.4MG TANK
D-ZONE No.1 0.1MG TANK (OPTIONAL)
COLLEGE TANK No.2 0.55MG
COLLEGE TANK 0.55MG