PROPOSED CORRECTIONAL DEVELOPMENT FACILITY AT CALIFORNIA CITY

WATER SUPPLY ASSESSMENT

November 2017

Prepared for:
CITY OF CALIFORNIA CITY

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ABBREVIATIONS/ACRONYMS

AF	acre-feet
AFD	acre-feet per day
AFY	acre feet per year
AVEK	Antelope Valley-East Kern Water Agency
AVGB	Antelope Valley Groundwater Basin
AWWA	American Water Works Association
BDCP	Bay Delta Conservation Plan/California Water Fix
CCA	Corrections Corporation of America
CCCF	California City Correctional Facility
CCSB	California City Sub-Basin
CEQA	California Environmental Quality Act
CVP	Central Valley Project
DAWN	Domestic Agricultural Water Network
DCR	Delivery Capability Report
DU	Dwelling Unit
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELT	Early Long Term
ET_o	evapotranspiration
FVGB	Freemont Valley Groundwater Basin
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
IRWMG	Integrated Regional Water Management Group
IRWMP	Integrated Regional Water Management Plan
IWA	International Water Association
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
MGY	million gallons per year
SB	Senate Bill
SBx7-7	Water Conservation Act of 2009
sf	square feet
SGMA	Sustainable Groundwater Management Act of 2014
SNIP	South North Intertie Pipeline and Pump Station/Turnout Project
SWP	State Water Project
TDS	Total dissolved solids
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
WSA	Water Supply Assessment
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Correctional Development Facility at California City Project proposed by CoreCivic (Proposed Project) involves the construction and operation of two separate but adjacent correctional facilities with a total of 3,024 beds in California City (City). The Proposed Project encompasses approximately 215 acres of an existing 320-acre property that currently contains the existing California City Correctional Facility (CCCF). A 39.6-acre area south of the existing CCCF has been approved for a 2,200-bed correctional center and is not part of this Project.

The purpose of this Water Supply Assessment (WSA) is to provide information to verify that the City water supply is sufficient to provide for the water demands of the Proposed Project in addition to all other City service area demands, now and into the future. The water demand for the Proposed Project was included in demand projections in the City's 2015 Urban Water Management Plan (UWMP) dated April 2017 and approved by the City Council on April 11, 2017. As such, the City's 2015 UWMP was used as a basis to evaluate City supplies to meet service area demands for the years 2020 through 2040, which is the planning period for this WSA.

City water demands were projected in the City's 2015 UWMP assuming an annual decrease in per capita water use of 2.0 gallons per capita per day (gpcd) (resulting from continued water conservation), and a 1.5-percent annual population increase. Water demands for the Proposed Project were included in the demand projections in the UWMP. The water demand estimated for the Proposed Project of 146 million gallons per year (MGY) including water loss is 6.6 percent of the total water demand projected for the City in 2040 (2,201 MGY).

Historically, the City has obtained a majority of its potable water from groundwater pumped from the California City sub-basin (CCSB) of the Fremont Valley Groundwater Sub-basin (FVGB) via City-owned and operated wells (approximately 75 percent). Thus, reliability of the City water supply is primarily determined by its groundwater supply. The City's groundwater rights are 3.9 times greater than its existing well-pumping capacity and will be 3.3 times greater than its projected year 2020 pumping capacity. Thus, additional wells could be drilled and equipped to utilize unused water rights if needed in the future.

The City also has an agreement to purchase imported water from the Antelope Valley - East Kern Water Agency (AVEK), which has developed and invested in significant redundant supply sources to help ensure supply availability and reliability for its retail water agencies. AVEK has projected supply surpluses under normal supply/demand conditions but has projected supply deficits for single dry-year and multiple dry-year conditions. However, the projected City well-pumping capacity of 3,127 MGY is much greater than the projected demands for the City through the planning period so the City does not need to rely on AVEK supply during dry years.

Assuming that 80 percent of the City's projected well-pumping capacity of 3,127 MGY would be available at all times (2,502 MGY), and including AVEK supply reductions during dry conditions, the City has supply surpluses in meeting all normal-year and dry-year demand conditions through the planning period. As such, a sufficient and reliable water supply is identified for the City, now and into the future, including a sufficient water supply for the Proposed Project. These supplies are also sufficient to provide for overall City-wide growth at the rate projected in the City's 2015 UWMP.

1 INTRODUCTION

1.1 Proposed Project

The Correctional Development Facility at California City (City) Project proposed by CoreCivic (Proposed Project) involves the construction and operation of two separate but adjacent correctional facilities with a total of 3,024 beds. The Proposed Project encompasses approximately 215 acres of an existing 320-acre property that currently contains the existing California City Correctional Facility (CCCF). A 39.6-acre area south of the existing CCCF has been approved for a 2,200-bed correctional center and is not part of this Project.

1.2 WSA Purpose

The purpose of this Water Supply Assessment (WSA) is to provide information to verify that City water supply is sufficient to provide for the water demands of the Proposed Project in addition to all other City service area demands, now and into the future. Per City Public Works Department staff, the water demand for the Proposed Project was included in demand projections in the City's 2015 Urban Water Management Plan (UWMP). As such, the City's 2015 UWMP was used as a basis to evaluate City supplies to meet service area demands for the years 2020 through 2040, which is the planning period for this WSA.

2 LEGISLATION

According to the *Guidebook for Implementation of Senate Bill (SB) 610* and *SB 221 Water Code* Section 10912, a "Project" requiring a WSA is defined by any of the following criteria:

1. A proposed residential development of more than 500 dwelling units (DU)
2. A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet (sf) of floor space
3. A proposed commercial office building employing more than 1,000 persons or having more than 250,000 sf of floor space
4. A proposed hotel or motel, or both, having more than 500 rooms
5. A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 sf of floor space
6. A mixed-use project that includes one or more of the projects specified in this subdivision
7. A project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500-DU project
8. If the public water system has fewer than 5,000 service connections, a project means a proposed residential, business, commercial, hotel or motel, or industrial development that would account for an increase of 10 percent or more in the number of the public water system's existing service connections; or a mixed-use project that would demand an amount of water equivalent to, or greater than, the amount of water required by a residential development that would represent an increase of 10 percent or more in the number of the public water system's existing service connections

The Proposed Project entails the construction of two separate but adjacent correctional facilities with a total of 3,024 beds (inmates) on approximately 215 acres of land and, per Criteria No. 5 above, necessitates the preparation of a WSA following the requirements of SB 610.

2.1 SB 610 – Costa – Water Supply Planning

SB 610 was chaptered into law on October 9, 2001. It mandates that a city or county approving certain projects subject to CEQA (i) identify any public water system that may supply water for the project, and (ii) request those public water systems to prepare a project-specific water supply assessment. The assessment is to include the following:

1. A discussion of whether the public water system's total projected water supplies available during normal, single dry and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing
2. The identification of existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project and water received in prior years pursuant to those entitlements, rights, and contracts

3. A description of the quantities of water received in prior years by the public water system under the existing water supply entitlements, water rights, or water service contracts
4. A demonstration of water supply entitlements, water rights, or water service contracts by the following means:
   a. Written contracts or other proof of entitlement to an identified water supply
   b. Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system
   c. Federal, state, and local permits for construction of necessary infrastructure associated with delivering the water supply
   d. Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply
5. The identification of other public water systems or water service contract holders that receive a water supply or have existing water supply entitlements, water rights, or water service contracts, to the same source of water as the public water system
6. If groundwater is included for the supply for a proposed project, the following additional information is required:
   a. Review of any information contained in the Urban Water Management Plan (UWMP) relevant to the identified water supply for the proposed project
   b. Description of any groundwater basin(s) from which the proposed project will be supplied. Adjudicated basins must have a copy of the court order or decree adopted and a description of the amount of groundwater the public water system has the legal right to pump. For non-adjudicated basins, information on whether the California Department of Water Resources (DWR) has identified the basin as over-drafted or has projected that the basin will become over-drafted if present management conditions continue, in the most current bulletin of DWR that characterizes the condition of the basin, and a detailed description of the efforts being undertaken in the basin to eliminate the long-term overdraft condition
   c. Description and analysis of the amount and location of groundwater pumped by the public water system for the past five years from any groundwater basin which the proposed project will be supplied. Analysis should be based on information that is reasonably available, including, but not limited to, historic use records.
   d. Description and analysis of the amount and location of groundwater projected to be pumped by the public water system from any groundwater basin by which the proposed project will be supplied. Analysis should be based on information that is reasonably available, including, but not limited to, historic use records.
   e. Analysis of the sufficiency of the groundwater from the basin(s) from which the proposed project will be supplied

The WSA shall be included in the environmental document prepared for the project. A determination shall be made whether the projected water supplies will be sufficient to satisfy the demands of the project, in addition to existing and planned future uses.

Additionally, SB 610 requires new information to be included as part of a UWMP if groundwater is identified as a source of water available to the supplier. Information must include a description of all water supply projects and programs that may be undertaken to meet total projected water use. SB 610 prohibits eligibility for funds from specified bond acts until the plan is submitted to the State.

2.2 SB 1262 – Sustainable Groundwater Management Act

State Senate Bill 1262 adopted in September 2016 amends Section 66473.7 of the *Government Code* to require WSAs to address certain elements regarding groundwater sustainability if the project relies in whole or in part on groundwater as a source of supply.

The underlying groundwater basin (California City sub-basin of the Fremont Valley Groundwater Sub-basin) is not designated as a high- or medium-priority basin by the DWR. As such, for this WSA, the portions of SB 1262 that are applicable are as follows:

If a proposed development project will obtain water from a basin that is designated as low- or very low-priority under the *Sustainable Groundwater Management Act* of 2014 (SGMA), the following must be included in the WSA:

- Information as to whether DWR has identified the basin as being overdrafted or projected that the basin will become overdrafted if present management conditions continue

3 PROPOSED PROJECT

3.1 Proposed Project Location and Environmental Setting

The Proposed Project is located in California City in Kern County, California (see Figure 1, Project Location). The Proposed Project encompasses approximately 215 acres of the 320-acre property owned by CoreCivic that currently contains the existing California City Correctional Center.

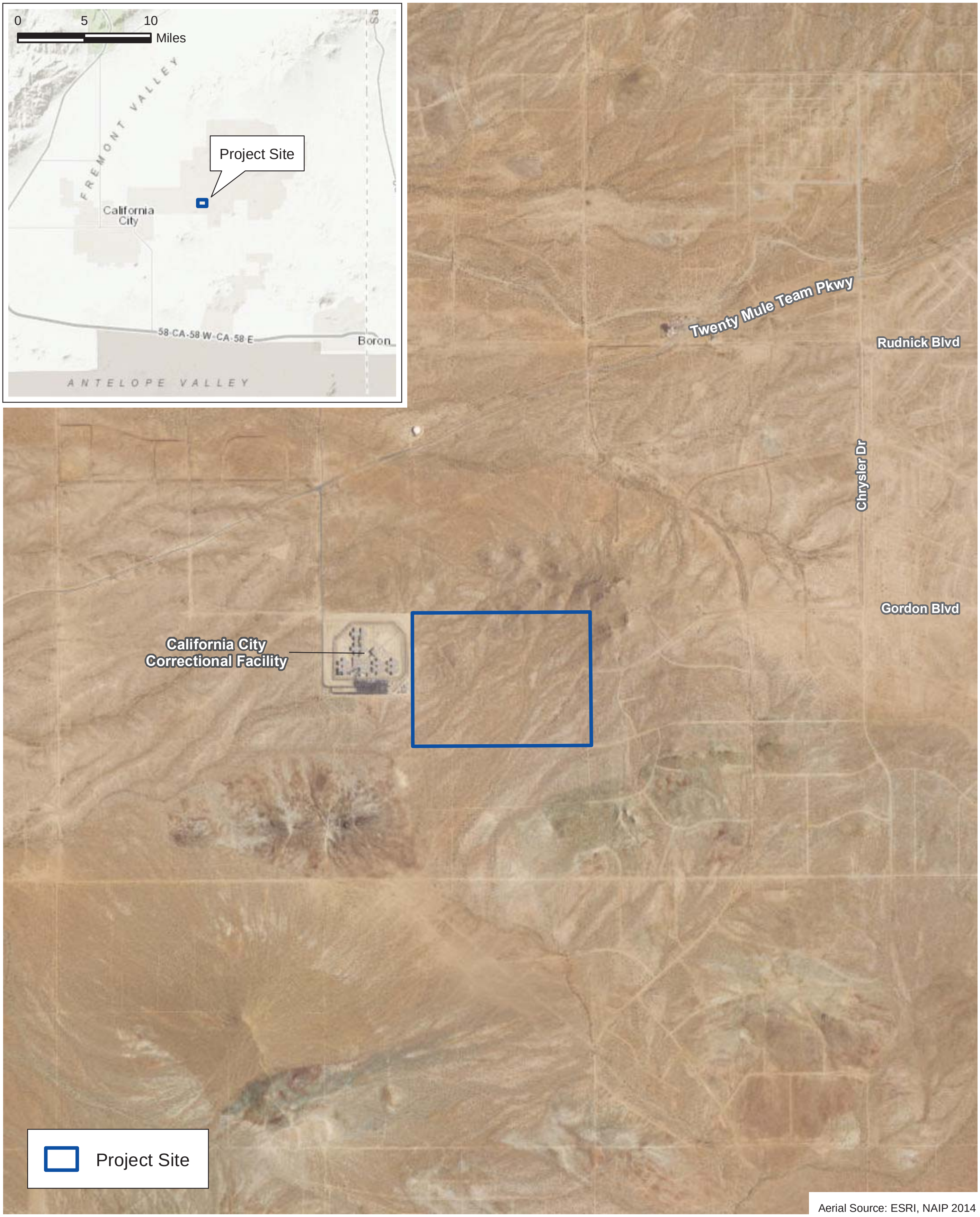
The Proposed Project is located in the Fremont Valley portion of the Western Mojave subregion of the California Desert Province. The majority of land in this portion of the Mojave Desert is privately owned or part of Edwards Air Force Base. The Mojave Desert is a wedge-shaped basin that experiences precipitation primarily in the winter, with occasional summer thunderstorms. The average annual precipitation in the vicinity of the proposed Project is 6.67 inches with approximately half of this falling in the winter. Temperatures in this region average 80.6 degrees Fahrenheit (°F) in the summer and 46.1°F in the winter (Arguez et al. 2010).

The 215-acre site is crossed by a network of small, off-highway vehicle roads. The existing California City Correctional Center is located along the western boundary of the Project site; undeveloped open land and dirt roads are located to the north, east, and south.

3.2 Project Purpose and Description

The Proposed Project is the construction and operation of two separate but adjacent correctional facilities with a total of 3,024 beds on approximately 215 acres of an existing 320-acre property located south of the alignment of Gordon Boulevard, east of Virginia Boulevard, and north of Lindberg Boulevard. The Proposed Project will employ approximately 800 to 1,000 persons that will work in three shifts: Shift 1 is 6:00 AM to 2:00 PM; Shift 2 is 2:00 PM to 10:00 PM; and Shift 3 is 10:00 PM to 6:00 AM. At full occupancy, the Proposed Project will accommodate 3,024 inmates.

As shown on Figure 2, Project Site Plan, the Project would include a one-level, 1,512-bed correctional facility on the northern portion of the site and an identical 1,512-bed correctional facility on the southern portion of the site. Each facility will contain seven secure housing structures in a semi-circular arrangement around a central open area with indoor and outdoor recreational facilities and open fields. West of the secure housing buildings and recreational area would be a central building for various inmate services and programs, such as intake, food service, medical care, education, maintenance, laundry, chaplain, library, visitation, and other support areas. A shared staff and visitor surfaced parking area would be located west of the proposed correctional facilities; and a series of five drainage retention basins would be located farther west, with an administration building and warehouse building near the access road in the northwest portion of the Project site.



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Project Location

Figure 1

Correctional Development Facility Project

PSOMAS

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SCALE 1" = 100'–0"

DECEMBER 14, 2017

Figure 2 - Project Site Plan

(2) 1,512 BED CORRECTIONAL FACILITIES
TOTAL 3,024 BEDS

CoreCivic

CALIFORNIA CITY, CALIFORNIA

TOTAL SITE AREA = +/– 215 ACRES

0 50' 100' 200' 400'

TRUE NORTH

3.3 Proposed Water Infrastructure

As part of the Proposed Project, upgrades to existing water infrastructure would be required to accommodate increased water demands at the site. The existing water line in Virginia Boulevard would be extended east along the proposed access road to serve the Proposed Project. Water lines would then extend to individual buildings on the site. A new municipal water pump would be installed at an existing pump station located adjacent to a 2.5-million-gallon (MG) water tank on the north side of Twenty Mule Team Parkway, approximately 1 mile north of the Project site. These water system improvements are detailed in a separate Water Capacity Analysis that was prepared in 2017 to identify the needed system improvements.

3.4 Estimated Project Demands

Construction of the two 1,512-bed correctional facilities will be phased between 2021 and 2025. Full occupancy would entail 3,024 inmates. A unit water demand of 101 gallons per day (gpd) per inmate is estimated based on water meter data for the existing CCCF and demand data from similar CoreCivic correctional facilities in the region. Build-out, full-occupancy water demand for the Proposed Project is estimated at 342 acre-feet (AF) per year (AFY) or 111 million gallons per year (MGY), not including system water loss, as shown in Table 3.1

Table 3.1
Supply to Meet Normal Demands

	Inmates	Unit Factor (gpd/inmate)	Demand (gpd)	Demand (AFY)	Demand (MGY)
Proposed Project	3,024	101	305,424	342	111

gpd: gallons per day; AFY: acre-feet per year; MGY: millions of gallons per year

4 CITY WATER SYSTEM

4.1 City Water System Characteristics

The City's water service area consists of the entire 203.4 square miles (130,200 acres) within the City limits. The single largest land use in the City is open space/undeveloped land at 63.3 percent (82,426 acres) of the total land area, followed by single-family residential and industrial land uses with 22.6 percent (29,392 acres) and 8.6 percent (11,217 acres), respectively.

Most of the City's residents live in the "First Community," which contains about 9,600 acres and most of the multi-family and smaller single-family residential lots. The "Second Community," which is located to the east of the center of California City, consists of larger lots and is currently sparsely populated. Sewer service is available in portions of the "First Community"; all other areas, except for the existing CCCF, which is connected to the sewer system, are served by septic tanks with on-site subsurface disposal.

The City is located in the High Desert area of Southern California, with an elevation range of 2,300 to 4,000 feet above sea level. Rainfall for the area is less than 6 inches annually, with about 75 percent occurring from December through March. Due to extreme high temperatures (often exceeding 100 °F from May through September), very low humidity levels, and often windy conditions, the City has some of the highest pan evaporation and evapotranspiration (ETo) rates in the state.

City population decreased from 14,556 persons in 2008 to 13,466 persons in 2014 (a loss of 7.5 percent), but increased to 14,233 persons in 2015 (a gain of 5.7 percent) (DOF 2017). A conservative growth rate of 1.5 percent was assumed in the City's 2015 UWMP, projecting the population to increase to 22,247 persons in 2040.

The City's water supply currently consists of groundwater produced by six City-owned and operated wells and imported water purchased from Antelope Valley-East Kern Water Agency (AVEK). The six groundwater wells have a current combined production capacity of 5,100 gallons per minute (gpm). The groundwater is disinfected with sodium hypochlorite at the well sites and meets all drinking water quality standards set by federal and State health agencies. These existing wells are located in the First Community.

Approximately 313 miles of water mains comprise the City's water distribution system, ranging in size from 4 to 16 inches in diameter. The City has seven pressure zones to maintain service pressures between 50 and 100 pounds per square inch (psi). A 20-inch transmission line conveys water from the wells to five aboveground water storage reservoirs totaling 5.85 MG: Reservoir B1 (2.5 MG), Reservoir C2 (1 MG), Reservoir D3 (1 MG), Reservoir E4 (1 MG), and Rancho Reservoir (0.35 MG).

The California City Wastewater Treatment Facility produces Title 22 (*California Code of Regulations*, Department of Public Health, Regulation Related to Recycled Water) recycled water that is stored at the treatment plant and pumped to the City's Central Park Lake (as recreational, non-contact water) and then pumped to the Tierra Del Sol golf course, located adjacent to the lake, for landscape irrigation. In the winter months when effluent produced is more than the irrigation demand at the golf course, the recycled water is stored in ponds at the

City's treatment plant site for use in summer months when demand exceeds effluent production. Excess recycled water production that cannot be stored for later reuse is recharged to the groundwater basin or evaporated via eight percolation basins.

4.2 City Water Demands

4.2.1 City Potable Water Demands

Since the previous 2010 UWMP update, southern California's urban water demand has been largely shaped by efforts to comply with the *Water Conservation Act of 2009* (SBx7-7). This law requires all California retail urban water suppliers serving more than 3,000 AFY or 3,000 service connections to achieve a 20-percent water demand reduction (from a historical baseline) by 2020. The City has been actively engaged in efforts to reduce water use in its service area to meet the 2015 interim and the 2020 final water use targets. Meeting these targets is critical to ensure the City's eligibility to receive future State grants and loans.

City per-capita water use decreased from 452 gallons per capita per day (gpcd) in 2000 to 276 gpcd in 2010. After increasing to 287 gpcd in 2012, which is the year the recent severe drought in California started, City per-capita water use decreased to 226 gpcd in 2015, based on an annual water demand of 1,175 MGY and a population of 14,233. This was significantly less than the City's SBx7-7 2015 Target of 350 gpcd and is also significantly less than the City's 2020 Target water use of 311 gpcd.

The City's water demand of 1,175 MGY in 2015 included a water loss of 370 MGY, which was 31.5 percent of the water supply, as reported in the 2015 UWMP.

In the City's 2015 UWMP, the City's water demand is projected to be 1,741 MGY in 2020, based on an estimated per capita water use of 311 gpcd, which matches the City's SBx7-7 2020 Target water use, and a projected population of 15,333 arising from an estimated 1.5 percent annual population increase.

Water demands were projected for the years 2025 through 2040 (in five-year increments), assuming an annual decrease in per capita water use of 2.0 gpcd (resulting from continued water conservation) and a conservative 1.5 percent annual population increase (with the last five-year growth rate approximately doubled). Projected normal City water demands for the years 2020 through 2040 in five-year increments are shown in Table 4.1. The projected water demands for the Proposed Project were included in the demand projections in the City's 2015 UWMP but are shown as a separate line item in Table 4.1 for comparison. All water demands including those for the Proposed Project include a 31.5 percent water loss consistent with the 2015 UWMP.

Table 4.1
Projected Normal City Potable Water Demand (MGY)

Projected Normal Demand[(a)]	2020	2025	2030	2035	2040
Total City Demand without Proposed Project [(b)]	1,741	1,669	1,744	1,820	2,055
Additional Proposed Project Demand	0	146	146	146	146
Total Demand[(c)]	1,741	1,815	1,890	1,966	2,201

(a) All demands include estimated 31.5% water loss consistent with the 2015 UWMP
(b) Normal year demand as projected in the City's 2015 UWMP not including the Proposed Project demand, which was included in the 2015 UWMP projections, but is shown as a separate line item in this table for comparison
(c) Per Table 4.4-3 of the City's 2015 UWMP

The projected water demand for the Proposed Project of 146 MGY (including water loss) is 6.6 percent of the total water demand projected for the City in 2040 (2,201 MGY).

4.2.2 City Non-Potable Water Demands

The City also produces recycled water at its California City Wastewater Treatment Plant (WWTP) that provides irrigation water for the Tierra Del Sol golf course. The plant has a current rated treatment capacity of 1.0 and a current average wastewater flow to the plant of approximately 0.65 MGD. Approximately 19 percent of the City's potable water production historically becomes wastewater influent to the plant (approximately 220.0 MGY on average). All influent wastewater is converted to Title 22 recycled water at the plant.

The recycled water is stored in ponds at the treatment plant and pumped to Central Park Lake prior to delivery to the golf course; and, per the City's 2015 UWMP, approximately 24 percent of the recycled water is lost/evaporated (52.8 MGY on average). Also, according to the 2015 UWMP, approximately 75 percent of the recycled water production is delivered to the golf course for irrigation (165.0 MGY on average); and approximately 1 percent is sent to existing ponds in the winter for groundwater recharge via percolation. To accommodate both the approved 39.6-acre (2,200-bed) expansion of the existing California City Correctional Facility and the Proposed Project, approximately 0.5 MGD of additional treatment and disposal/storage and reuse capacity will be required at the City's WWTP.

Recycled water uses other than at the golf course were not projected in the City's 2015 UWMP due to high capital costs associated with constructing a recycled water transmission and distribution system. The recycled water supply to the golf course, which was 166.8 MGY in 2015, is projected to increase to 313.6 MGY by 2040, based on projections that wastewater flows to the plant will increase and that currently the City has to supplement demands at the golf course with potable water during the summer months. Recycled water discharge to the percolation ponds, which was 2.0 MGY in 2015 is projected to increase to 8.4 MGY in 2040.

Potentially, grants could be obtained in the future that would make an expansion of the recycled water system more economically feasible. Likewise, grants could potentially allow the City to connect more residences to the wastewater collection system. Currently, approximately 30 percent of the City is connected to the City's collection/treatment system with 70 percent connected to septic systems.

If the recycled water system could be expanded in the future, wastewater generated at the Proposed Project could be used to produce recycled water, which could offset the Project's potable water demand by allowing other areas near the Central portion or First Community area of the City to use recycled water instead of potable water for landscape irrigation.

4.3 City Water Supply

The City's primary source of potable water supply is groundwater produced from the Fremont Valley Groundwater Sub-basin (FVGB) of the South Lahontan Hydrologic Study Area via six City-owned and operated wells. The City's second source of potable water is imported surface water purchased from AVEK. As shown in Table 4.2, groundwater has accounted for 76 percent of the City's potable water supply since 2010, with water purchased from AVEK accounting for the balance.

The City's six wells have a combined rated supply capacity of 5,100 gpm (2,681 MGY). As shown in Table 4.2, the City has utilized only 36.1 percent of the well capacity on average since 2010. The groundwater, which meets all drinking water quality standards, is disinfected with sodium hypochlorite at the well sites prior to entering the distribution system.

As a supplement to the groundwater supply, the City also has an agreement to purchase water from AVEK. AVEK sells imported water from the DWR's California Aqueduct as part of the State Water Project (SWP). AVEK also developed groundwater banking programs to help increase the reliability of the Antelope Valley region's water supplies by storing excess water available from the SWP during wet periods and recovering it for delivery to customers during dry and high-demand periods or during a disruption in deliveries from the SWP. AVEK also began providing groundwater from wells within the Antelope Valley Groundwater Basin in 2014.

Table 4.2
Historical City Potable Water Supply (MGY)

	2010	2011	2012	2013	2014	2015	Average	% GW Capacity[(a)] Used
Groundwater	1,080	815	980	858	1,113	963	968	36.1%
Imported (AVEK)	344	480	421	396	12	212	311	-
Total	1,424	1,295	1,401	1,254	1,125	1,175	1,279	-
% of Average	111%	101%	110%	98%	88%	92%	-	-
% Groundwater	76%	63%	70%	69%	99%	82%	76%	-

(a) Capacity of City wells is 5,100 gpm = 2,681 MGY

The City also produces recycled water at the California City WWTP that provides irrigation water for the Tierra Del Sol golf course.

Non-revenue water (water loss) is defined by the International Water Association (IWA) and the American Water Works Association (AWWA) as the difference between distribution systems input (supply) volume and billed authorized consumption (demand). In essence, water loss is an extraneous demand on the water system. In the City's 2015 UWMP, non-revenue potable water was calculated at 31.5 percent of the potable water supplied into the City's distribution system in 2015, i.e., 370 of 1,175 MGY.

The City's water system contains a large percentage of steel water mains which were constructed in the 1960s. These water mains are susceptible to corrosion over time and are very prone to leakage. As recommended in the City's 2002 *Water Master Plan* (Quad Knopf 2002), the City will implement a water main replacement program to replace all steel mains, which is expected to substantially reduce the volume of water loss in the system.

4.3.1 Groundwater Supply

This section is intended to furnish the information required by Water Code section 10910(f).

The City lies within the Fremont Valley Groundwater Sub-basin (FVGB) of the South Lahontan Hydrologic Study Area. The FVGB is identified as sub-basin 6-46 in the Department of Water Resources Bulletin 118 (DWR 2003). The basin is 523 square miles (334,720 acres) of which 203 square miles (129,920 acres) is located under California City proper. The Muroc Fault traverses the sub-basin, dividing it into two smaller sub-basins, with California City on the north and Mojave on the south. The California City sub-basin (CCSB) contains approximately 142,451 acres (Stetson 2008) and has potentially 1,382,000 AF of storage capacity; however, estimates of the storage capacity vary greatly, with a high estimate of 5,700,000 AF in 1955, when the basin was considered full. Within the City boundary, the FVGB groundwater storage was estimated at approximately 1,980,000 AF in 1955 and 1,650,000 AF in 2007 (Stetson 2008).

The CCSB is hydraulically connected to the AVGB by the alluvial-filled narrows between the Castle Butte and the Twin Buttes; groundwater is able to move between the two valleys in this area. Several other faults in the sub-basin, including the Garlock Fault and El Paso Fault system, which run on the north and west side of the sub-basin, respectively, act as a restrictive groundwater barrier on the west and northwest sides of the sub-basin between the Tehachapi, Piute, and El Paso Mountains and the FVGB.

The CCSB has one area of depression, the now-dry Koehn Lake. According to Stetson, groundwater in the sub-basin flows from the alluvial fans along the mountains toward this depression. This flow stems in part from the AVGB, which contributes up to 2,570 AFY (Stetson 2008). The City, on average, pumps 3,300 AFY (1,075 MGY) from the aquifer, which provides the customers with approximately 75 percent of their potable water supply.

The City of California City purchased all water rights based on an agreement/contract dated March 21, 1960, between Boron Valley Water Development Company and Boron Valley Community Service District, which later became California City Service District. California City owns the water rights, stated as follows, "All water rights, all right, title and interest in and to all water in, on and underlying the surface of the land (herein referred to as “Water Rights”) within the boundaries of or which may subsequently flow into that area designated Area A (California City Proper 203 square miles). At that time, the water right was producing 32,000 AF (10,427 MG), which is 10.8 times greater the City’s 2015 groundwater extraction of 968 MG.

State Senate Bill 1262 adopted in September 2016 amends Section 66473.7 of the *California Government Code* to require WSAs to address certain elements regarding groundwater sustainability if the project relies in whole or in part on groundwater as a source of supply. Specifically, if a proposed development project will obtain water from a basin that is designated as medium- or high-priority under the SGMA, the following must be included in the WSA:

- Information as to whether DWR has identified the basin as being subject to critical conditions of overdraft
- A copy of the Groundwater Sustainability Plan or alternative plan, if a Groundwater Sustainability Agency has adopted such as plan

If a proposed development project will obtain water from a basin that is designated as low- or very low-priority under SGMA, the following must be included in the WSA:

- Information as to whether DWR has identified the basin as being overdrafted or projected that the basin will become overdrafted if present management conditions continue

The FVGB (Basin 6-46 as designated by DWR) has been designated as low-priority pursuant to Section 10722.4 of the Water Code. Furthermore, DWR has not identified the Basin as being overdrafted or becoming overdrafted if present management conditions continue.

California City, Mojave, and AVEK have now formed the FVGB Integrated Regional Water Management Group (IRWMG) and are working on the Integrated Regional Water Management Plan (IRWMP) for the basin to protect their water rights from outside influences.

Recharge in the California City sub-basin is derived from percolation of precipitation and runoff from surrounding watersheds. Additional recharge is realized from the subsurface flows from AVGB and Mojave sub-basin. The Muroc Fault acts as a partial barrier between the California City and Mojave sub-basins and CCSB, only allowing subsurface flow when the groundwater storage in the Mojave sub-basin is high enough to crest the top of the fault, approximately 2,420 feet above sea level.

The estimates of groundwater recharge have historically ranged greatly; however, Stetson reports an average between 1945 to 2007 of 13,100 AFY (4,269 MGY) including percolation of precipitation within the basin limits, percolation of runoff from other watersheds, and subsurface inflows from the Mojave sub-basin and AVGB (Stetson 2008).

In addition to the natural recharge, in the winter months the City sends treated Title 22 recycled water from their treatment plant to on-site percolation basins to help recharge the groundwater basin.

Existing and Projected Groundwater Pumping

The City has historically relied on groundwater pumping for a large portion (approximately 75 percent) of its water supply. As shown in Table 4.2, groundwater has accounted for 76 percent of the City's potable water supply since 2010. The City's six existing wells have a combined capacity of 5,100 gpm (2,691 MGY); and usage rates have averaged only 36.1 percent of this capacity since 2010, as shown in Table 4.2. The City is planning to construct two new wells (Well No. 1 and Well No. 11) and plans to have them operational by 2020, which will increase the City's combined well capacity to 5,950 gpm (3,127 MGY).

4.3.2 AVEK Supply

The AVEK service area encompasses nearly 2,400 square miles in northern Los Angeles and eastern Kern Counties, as well as a small portion of Ventura County. AVEK provides a supplemental imported water supply from the SWP to retail water suppliers in the Antelope Valley region including California City. This is a secondary water source for these suppliers and is used by these entities in lieu of or in addition to pumped groundwater. The bulk of AVEK's imported water is treated and distributed to customers throughout its service area. AVEK also provides delivery of untreated water from the California Aqueduct to local farmers and ranchers.

AVEK has played a major role in Antelope Valley's water system since it was granted a charter by the State Legislature in 1959. In 1962, the AVEK Board of Directors signed a water supply contract with the DWR for delivery of imported water supplies from the SWP to supplement Antelope Valley groundwater supplies. AVEK has the third largest allotment of the 29 SWP contractors, following the Metropolitan Water District and the Kern County Water Agency.

Purchased or Imported Water

AVEK sells imported water from DWR's California Aqueduct as part of the SWP. Currently, AVEK has an allocation for purchasing up to 144,844 AF of water per year (Table A) from the SWP. In order to maximize the use of its SWP supplies, AVEK has developed the Westside Water Bank within its service area and has entered into various exchange programs with other SWP contractors.

Through the Westside Water Bank facilities, AVEK can take delivery of SWP supplies in excess of its customers' demands for use as groundwater recharge (recharge capacity currently estimated to be approximately 36,000 AF per year) for future recovery in dry years. AVEK is also able to purchase additional SWP supplies from the DWR (such as Article 21 and turnback pool water) when available.

Projections for future deliveries of SWP water are estimated based on DWR's 2015 update of the *State Water Project Delivery Capability Report* (DCR), a biennial report prepared to assist SWP contractors and local planners in assessing the near and long-term availability of supplies from the SWP. In the 2015 update, DWR provides SWP supply estimates for SWP contractors to use in their planning efforts, including for use in their 2015 UWMPs. The 2015 DCR includes DWR's estimates of SWP water supply availability under both current and future conditions.

To evaluate SWP supply availability under future conditions, the 2015 DCR included four model studies. The first of the future-conditions studies, the Early Long Term (ELT) scenario, used all of the same model assumptions for current conditions, but reflected changes expected to occur from climate change, specifically, a 2025 emission level and a 15-centimeter sea level rise. The other three future-conditions include varying model assumptions related to the Bay Delta Conservation Plan/California Water Fix (BDCP), such as changes to facilities and/or regulatory and operational constraints.

In spring 2015, DWR announced that BDCP would move from a Section 10 permit to a Section 7 permit process under the Federal Endangered Species Act. As a practical matter, this split the project into two distinct parts known as Cal WaterFix (Alternative 4A), the conveyance portion, and Cal EcoRestore, the restoration portion. Cal WaterFix is Alternative 4A in the recirculated environmental document, and the preferred alternative. Alternative 4A is different than any of the future scenarios modeled by DWR in the DCR. While the BDCP/Cal WaterFix project has widespread support, it would be speculative at this time to assume the project will move forward. While there is significant support for BDCP, environmental review is ongoing; and several regulatory and legal requirements must be met prior to construction.

The average annual percentage of Table A allocation as shown in Table C.7 of the 2015 DCR is 59 percent. This results in an average allocation of about 85,460 AF per year for AVEK. Projections of future SWP deliveries are shown in Table 4.3.

The SWP Contracts entered into in the 1960s had initial 75-year terms, which will begin to expire in 2035. While the SWP Contracts provide for continued water service to the contractors beyond the initial term, efforts are currently underway to extend the SWP Contracts to improve financing for the SWP. It is anticipated that the term of the SWP Contracts will be extended to December 31, 2085. The Contracts and associated amendments are scheduled to be finalized during 2017.

Table 4.3
Projected Normal AVEK Potable Water Supply

Supply Source	Projected Water Supply (AFY)			
	2020	**2025**	**2030**	**2035**
Purchased or Imported Water[(a)]	85,460	85,460	85,460	85,460
Groundwater[(b)]	3,550	3,550	3,550	3,550
Total	89,010	89,010	89,010	89,010

(a) SWP Allocation at 59% of Table A
(b) AVEK's annual overlying production right of 3,550AF

Groundwater

AVEK's groundwater wells are located within the AVGB, which is a large, topographically closed, alluvial basin with an estimated total storage capacity of about 68 to 70 million AF, according to DWR's most recent Bulletin 118 (2004). It consists of two primary aquifers: the upper unconfined aquifer, which is the main source of groundwater for the area, and a lower aquifer that is considered to be confined.

According to U.S. Geological Survey (USGS) *Water Resources Investigation Report 03-4016 (Simulation of Ground-Water Flow and Land Subsidence in the Antelope Valley Ground-Water Basin, California),* groundwater levels declined more than 200 feet in some parts of the basin, resulting in increased pumping lifts, reduced well efficiency, and land subsidence of more than 6 feet in some areas. The aquifers consist of gravel, sand, silt, and clay alluvial deposits and clay and silty clay lacustrine deposits.

Groundwater quality in the upper aquifer is generally suitable for domestic, agricultural, and industrial use. Total dissolved solids (TDS) concentrations are in the range of 200 to 800 milligrams per liter (mg/L). The deep aquifer typically has higher TDS concentrations. Hardness levels range from 50 to 200 mg/L. High fluoride, boron, nitrates, hexavalent chromium, and arsenic are found in some areas of the basin.

The Antelope Valley IRWMP was designed to serve as the Groundwater Management Plan for the AVGB and includes all the relevant components related to Groundwater Management Plans in the Water Code (Part 2.75, Section 10753), as well as the components recommended in DWR's Bulletin 118 (2004). The Antelope Valley IRWMP notes that nothing in that document will supersede or interfere with the pending adjudication of the basin, which has been completed as described below.

A Stipulated Judgment (Judgment) was approved in December 2015 for the Antelope Valley Groundwater Adjudication. According to the Judgment, AVEK has an overlying pre-rampdown production right of 4,000 AFYand an overlying production right of 3,550 AFY at the end of the seven-year production rampdown period, which began January 1, 2016. In addition to the overlying production right, AVEK has the right to produce an amount of imported water return flows in any year equal to the applicable percentage (34 percent for agricultural imported water use and 39 percent for municipal and industrial imported water use) multiplied by the average amount of imported water used by AVEK within the basin, and outside the AVGB but within the watershed of the basin (as approved by the Watermaster), in the preceding five-year period.

AVEK also has the rights to all imported water return flows from water imported through AVEK and not allocated to other parties identified in the Judgment. Carryover of unused production rights and imported water return flows are allowed for a period of up to ten years (or longer if a Storage Agreement is entered into with the Watermaster). The Watermaster appointed as a part of the Judgment is a five-member board: one representative each from AVEK and Los Angeles County Waterworks District 40, one other Public Water Supplier representative, and two landowner representatives.

AVEK customers also having overlying groundwater production rights per the Judgment have a total pre-rampdown production right of 38,000 AFY. The final overlying production right of these customers will be 19,300 AFY, indicating a reduced groundwater production right of 18,700 AF after the end of the seven-year rampdown period.

The Judgment does not limit or modify the operation of AVEK's preexisting banking projects or the performance of its preexisting exchange agreements. AVEK operates its groundwater banking programs to help increase the reliability of the Antelope Valley region's water supplies. Excess water available from the SWP is stored during wet periods and recovered for delivery to customers during dry and high-demand periods or during a disruption in deliveries from the

SWP. The maximum recharge volume for the Westside Water Bank is estimated to be approximately 36,000 AFY. The maximum recovery volume is proposed to be about 36,000 AFY. A 10-percent loss factor is applied to groundwater recharged for the Westside Water Bank to account for evapotranspiration and other losses during recharge and conveyance as well as typical metering accuracy.

AVEK also has groundwater recovery capacity from wells located at the Eastside Water Bank (5,700 AFY total estimated capacity). Additionally, AVEK constructed three potable groundwater wells in 2015 along Avenue H between 70th and 80th Street West (Bench Ranch Well Field) with a total capacity of about 3,700 AFY. These wells convey water to AVEK's Los Angeles County Waterworks District turnout at the intersection of 80th Sttreet West and Avenue H.

AVEK began pumping groundwater during 2014. Prior to 2014, AVEK did not utilize groundwater as a source of supply and did not have production groundwater wells. AVEK's available groundwater supplies are governed by the groundwater adjudication for the AVGB and by the amount of groundwater stored in its groundwater bank accounts. Groundwater supplies for normal years are assumed to be AVEK's overlying groundwater production right of 3,550 AFY. Because of the adjudication, it is anticipated that the groundwater basin will be stabilized; and its allocated groundwater supplies will be available to AVEK in every year. Groundwater quality issues may result in the need for treatment facilities or drilling of additional wells. This is not anticipated to result in a reduction in the quantity of groundwater available to AVEK. Projections of future groundwater production are shown in Table 4.4.

Existing and Projected AVEK Water Supply

As shown in Table 4.2, supply from AVEK has accounted for 24 percent of the City's water supply since 2010 with an annual average of 311 MG. Per their agreement with AVEK, the City can increase or decrease the supply from AVEK under normal supply circumstances, i.e., in non-drought years, with no restraints on the SWP supply, etc. AVEK projected normal supplies to their member retail water suppliers in their 2015 UWMP and projected an annual supply to California City ranging from 1,070 AF (349 MG) in 2020 to 1,240 AF (404 MG) in 2035.

4.3.3 Projected City Water Supply

Projected City supply by source to meet normal–year, i.e., non-dry-year, potable water demands through the year 2040 is shown in Table 4.4. All demands include a 31.5-percent water loss. Based on the normal AVEK supplies to the City reported in AVEK's 2015 UWMP (with the year 2040 supply assumed equal to the 2035 supply as AVEK's supply projections end in 2035), and projected normal City water demands, the groundwater supply needed to meet demands for the planning period 2020 through 2040 is shown in Table 4.4.

Table 4.4
Supply to Meet Normal Demands (MGY)

	2020	2025	2030	2035	2040
Normal Demand[(a)]					
Total City Demand without Proposed Project	1,741	1,669	1,744	1,820	2,055
Additional Proposed Project Demand	0	146	146	146	146
Normal Demand	1,741	1,815	1,890	1,966	2,201
Supply					
AVEK	349	365	385	404	404
City Wells	1,392	1,450	1,505	1,562	1,797
Total	1,741	1,815	1,890	1,966	2,201
City Well Capacity[(b)]	3,127	3,127	3,127	3,127	3,127
City Well Supply Surplus	1,735	1,677	1,622	1,565	1,330
% City Well Supply Surplus	125%	116%	107%	100%	74%

(a) All demands include 31.5% water loss
(b) Capacity of City Wells projected to be 5,950 gpm = 3,127 MGY

Based on the projected well supply capacity of 3,127 MGY (with the start-up of Well Nos. 1 and 11), the City will have a well supply surplus ranging from 125 to 74 percent for the planning period. The projected well capacity of 3,127 MGY utilizes only 30 percent of the City's groundwater rights of 10,427 MG (32,000 AF).

5 RELIABILITY OF WATER SUPPLIES

This section provides information on the availability and reliability of City, as well as AVEK, potable water supplies during normal, single dry-year, and multiple dry-year conditions for the planning period 2020 through 2040.

5.1 AVEK Supply Reliability

As a supplement to their groundwater supply, the City has an agreement to purchase water from AVEK. AVEK sells imported water from the DWR California Aqueduct as part of the SWP, and also began providing groundwater from wells within the Antelope Valley Groundwater Basin in 2014. Supply from AVEK has accounted for 24 percent of the City's water supply since 2010 with an annual average of 311 MG.

AVEK developed groundwater banking programs to help increase the reliability of the Antelope Valley region's water supplies by storing excess water available from the SWP during wet periods and recovering it for delivery to customers during dry and high-demand periods or during a disruption in deliveries from the SWP.

The Water Supply Stabilization Project No. 2 (Westside Water Bank) started operations in 2010 and currently includes approximately 400 acres of groundwater recharge basins and nine groundwater recovery wells. Up to 20 new wells may be constructed as a part of the Westside Water Bank project. Five irrigation wells existing on the property at the time of development may also be used in the program. AVEK meters the deliveries and recovery for the program and will not recover more than 90 percent of the amount recharged to account for evapotranspiration and other losses during recharge and conveyance as well as typical metering accuracy.

AVEK added the Eastside Water Banking and Blending Project, which started operations in 2016. Three 2-acre recharge basins and three groundwater wells have been constructed as a part of the project. The project allows for recharge of raw water which is later recovered and blended for delivery to the Eastside Water Treatment Plant.

The South North Intertie Pipeline and Pump Station/Turnout Project (SNIP) was constructed in 2011 to connect the existing Rosamond Water Treatment Plant and the Quartz Hill Water Treatment Plant by utilizing the ability to move water through Los Angeles County Waterworks District pipelines. The SNIP Turnout is capable of moving water to and from the Los Angeles County Waterworks District at the rate of about 28 million gallons per day (MGD). The SNIP pipeline also provides flexibility in the method of return of water banked in the Westside Water Bank (direct delivery or transfer).

In 2012 AVEK entered into an agreement with Palmdale Water District for the exchange of up to 4 MGD of treated water in return for surface water to serve the Acton Water Treatment Plant's service area customers. This project improves the reliability of AVEK's water supply as it allows AVEK to serve customers potable water meeting current water quality standards even in times when the Acton Water Treatment Plant is not in operation.

Financed by a $71-million bond issue, AVEK constructed the Domestic Agricultural Water Network (DAWN), which consists of four water treatment plants with clear water storage and more than 100 miles of pipelines. Four 8- MG water storage reservoirs near Mojave and one 3-MG reservoir at Vincent Hill complete the DAWN facilities.

Other facility improvements to allow for better distribution of water since the DAWN Project Improvements include the Parallel South Feeder and the addition of 9-MG of storage at the Quartz Hill Water Treatment Plant.

The Quartz Hill Water Treatment Plant is capable of producing 90 MGD (270 AF per day [AFD]) of treated aqueduct water. The Eastside Water Treatment Plant is capable of producing 10 MGD (30 AFD). The Rosamond Water Treatment plant can produce 14 MGD (42 AFD), and the Acton Water Treatment Plant can produce 4 MGD (12 AFD) of treated water.

Potential future projects to enhance AVEK supply availability and reliability include the Westside Water Bank Expansion and the Enterprise Bank Project. The potential Westside Water Bank Expansion is the construction of a new turnout to the California Aqueduct, and a parallel pipeline to the West Feeder to increase the groundwater recharge capacity of the Westside Water Bank. The increase in water supply is estimated at 40,000 AF based on the assumption that one-third of total banking capacity of 120,000 AF is available for recovery in dry years.

The potential Enterprise Bank Project is the development of a new groundwater recharge and recovery facility. Construction would include recharge basins and pipelines, groundwater recovery wells, well collection system, and transmission and pumping facilities to deliver water from the bank to the Aqueduct for delivery to AVEK's banking partners. The increase in water supply is estimated at 83,300 AF. The first phase includes a groundwater banking capacity of 250,000 AF with dry-year recovery estimated to be one-third of bank capacity. Ultimate capacity of the Enterprise Bank is proposed to be up to 1 million AF.

5.1.1 Bay Delta Conservation Plan/California Water Fix (BDCP)

An ongoing planning effort to increase long-term supply reliability for both the SWP and the Central Valley Project (CVP) is taking place through the BDCP process. The co-equal goals of the BDCP are to improve water supply reliability and restore the Sacramento River Delta (Delta) ecosystem. The BDCP is being prepared through a collaboration of State, federal, and local water agencies, State and federal fish agencies, environmental organizations, and other interested parties.

Several "isolated conveyance system" alternatives are being considered in the plan that would divert water from the north Delta to the south Delta where water is pumped into the south-of-Delta stretches of the SWP and CVP. The new conveyance facilities would allow for greater flexibility in balancing the needs of the estuary with the reliability of water supplies. The plan would also provide other benefits, such as reducing the risk of long outages from Delta levee failures.

The BDCP has been in development since 2006 and is currently undergoing extensive environmental review. The Draft BDCP and its associated Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) were released for public review in December 2013. In response to public comments, the BDCP was reevaluated, and in April 2015 the lead agencies announced a modified alternative which effectively split the project into two parts: the conveyance portion (known as Cal WaterFix), and the restoration portion (known as

EcoRestore). The Cal WaterFix alternative is evaluated in a partially recirculated draft environmental document (Recirculated Draft EIR/Supplemental Draft EIS) that was released for public review in July 2015 and certified by DWR in July 2017.

5.1.2 Normal Year, Single Dry-Year and Multiple Dry-Year Supply Reliability

The normal year SWP water supply for AVEK, based on the results of the DWR's 2015 DCR ELT scenario, is estimated to be 59 percent of its Table A amount of 144,844 AFY, or approximately 85,460 AFY (AVEK 2015 UWMP). Groundwater supplies for normal years are assumed to be AVEK's overlying groundwater production right of 3,550 AFY. It is anticipated that the groundwater basin will be stabilized and its allocated groundwater supplies will be available to AVEK in every year because of the adjudication. Normal year AVEK demand and supply as estimated in their 2015 UWMP is shown in Table 5.1. A supply surplus ranging from 3.2 to 6.4 percent is estimated.

Table 5.1
AVEK Normal Year Supply and Demand Comparison (AFY)

Description	2020	2025	2030	2035
Supply	89,010	89,010	89,010	89,010
Demand	83,670	85,620	85,920	86,250
Supply Surplus	5,340	3,390	3,090	2,760
Supply Surplus %	6.4%	4.0%	3.6%	3.2%

The single dry-year SWP water supply for AVEK is estimated to be 5 percent of its Table A allocation, or approximately 7,200 AFY, which is a worst-case scenario based on the historically low Table A allocation in 2014 (AVEK 2015 UWMP). Groundwater supplies for dry years are assumed to include AVEK's overlying groundwater production right of 3,550 AFY with recovery from groundwater bank accounts estimated to be 36,000 AFY. This provides a total supply of 46,750 AFY. Single dry-year AVEK demand and supply as estimated in their 2015 UWMP is shown in Table 5.2. A supply deficit ranging from 44.1 to 45.8 percent is estimated.

Table 5.2
AVEK Single-Dry Year Supply and Demand Comparison (AFY)

Description	2020	2025	2030	2035
Supply	46,750	46,750	46,750	46,750
Demand	83,670	85,620	85,920	86,250
Supply Deficit	(36,920)	(38,870)	(39,170)	(39,500)
Supply Deficit %	(44.1%)	(45.4%)	(45.6%)	(45.8%)

The multiple dry-year period of 1990 through 1992 was selected for analysis based on the ELT-forecasted SWP allocations of 12 percent, 16 percent, and 24 percent of AVEK's Table A amounts. Total supply is then increased by the overlying groundwater production right of 3,550 AFY and recovery from groundwater bank accounts of 36,000 AFY, as above. Multiple dry-year AVEK demand and supply as estimated in their 2015 UWMP is shown in Table 5.3. A supply deficit ranging from 11.1 to 34.0 percent is estimated.

Table 5.3
AVEK Multiple Dry-Year Supply and Demand Comparison (AFY)

escription		2020	2025	2030	2035
First year	Supply	56,950	56,950	56,950	56,950
	Demand	83,670	85,620	85,920	86,250
	Supply Deficit	(26,720)	(28,670)	(28,970)	(29,300)
	Supply Deficit %	(31.9%)	(33.5%)	(33.7%)	(34.0%)
Second year	Supply	62,750	62,750	62,750	62,750
	Demand	83,670	85,620	85,920	86,250
	Supply Deficit	(20,920)	(22,870)	(23,170)	(23,500)
	Supply Deficit %	(25.0%)	(26.7%)	(27.0%)	(27.3%)
Third year	Supply	74,350	74,350	74,350	74,350
	Demand	83,670	85,620	85,920	86,250
	Supply Deficit	(9,320)	(11,270)	(11,570)	(11,900)
	Supply Deficit %	(11.1%)	(13.2%)	(13.5%)	(13.8%)

5.2 City Supply Reliability

Historically, the City has obtained a majority of their potable water supply from groundwater pumped from the (CCSB of the FVGB via City-owned and operated wells. Since 2010, approximately 75 percent of the City's supply came from their wells, with water purchased from AVEK accounting for the balance. Thus, City water supply reliability is primarily determined by their groundwater supply.

The FVGB and CCSB are reported to be in good hydrogeologic condition in the City's 2015 UWMP. DWR has designated the FVGB a low-priority basin regarding the need to conduct groundwater level monitoring and has deemed the basin not to be in an overdraft condition. Currently, California City, Mojave, and Cantil are the only major water agencies pumping significant groundwater from the CCSB, with California City being by far the largest pumper. In 2016, California City pumped 1,180 MG (3,620 AF); Mojave pumped 152 MG (467 AF); and Cantil pumped 2.4 MG (7 AF), which totals 1,334.5 MG (4,095 AF). Stetson reports an average recharge to the CCSB between 1945 to 2007 of 13,100 AFY (4,269 MGY) including percolation of precipitation within the basin limits, percolation of runoff from other watersheds, and subsurface inflows from the Mojave sub-basin and AVGB (Stetson 2008). Additionally, the City helps to recharge the basin by sending recycled water produced at their wastewater treatment plant to on-site basins for percolation primarily during the winter months. It is concluded in the City's 2015 UWMP that the current CCSB pumping rate does not exceed the rate of basin recharge.

It is reported in the City's 2015 UWMP that per a contract/agreement dated March 21, 1960, between Boron Valley Water Development Company and Boron Valley Community Service District, which later became California City Service District, the City owns water rights totaling 32,000 AF (10,428 MG). These water rights are over 10 times greater than the City's pumping rate of 968 MG averaged between 2010 and 2015.

The City currently has six wells with a combined pumping capacity of 5,100 gpm (2,680 MGY). The wells and pumps are monitored closely, well-maintained, and rehabilitated on a regular basis to preserve and extend service life. Each well is sounded regularly to detect any drops in the water table. The City is planning to construct two new wells (Well No. 1 and Well No. 11), and plans to have them operational by 2020, which will increase the City's combined well capacity to 5,950 gpm (3,127 MGY). The City's groundwater rights are 3.9 times greater than their existing well-pumping capacity and will be 3.3 times greater than their projected year 2020 pumping capacity. Thus, additional wells could be drilled and equipped to utilize unused water rights if needed in the future.

As discussed in Section 4, AVEK has developed and invested in significant redundant water supply sources to help ensure supply availability and reliability for its retail water agencies. AVEK has projected supply surpluses under normal supply/demand conditions but has projected supply deficits for single dry-year and multiple dry-year conditions. As will be demonstrated below, the projected well-pumping capacity of 3,127 MGY is much greater than the projected demands for the City through the planning period and do not depend on the AVEK supply.

A comparison of projected City demand, including the demands of the Proposed Project and projected supply under normal year supply/demand conditions, is shown in Table 5.4. It is estimated in the City's 2015 UWMP that 80 percent of the City's well-pumping capacity of 3,127 MGY would be available at all times (2,502 MGY). The AVEK supplies to the City are as reported in their 2015 UWMP under normal supply/demand conditions. As shown in Table 5.1, the City can supply all projected demands with a supply surplus ranging from 64 to 32 percent for the planning period.

Table 5.5 shows projected City demand, including the demands of the Proposed Project, compared with projected supply under single dry-year supply/demand conditions. Again, it is estimated that 80 percent of the City's well-pumping capacity of 3,127 MGY would be available. The AVEK supplies to the City are reduced by 55.9 percent, 54.6 percent, 54.4 percent, 54.2 percent, and 54.2 percent, for 2020, 2025, 2030, 2035, and 2040 consistent with the reductions estimated in the AVEK 2015 UWMP under single dry-year supply/demand conditions. As shown in Table 5.5, the City can still supply all projected demands with a supply surplus ranging from 55 to 24 percent for the planning period.

Projected City demand and supply for multiple dry-year conditions through the planning period is shown in Table 5.6. The AVEK supply is reduced by percentages consistent with the reductions shown in Table 5.3, and the City's groundwater supply is estimated at 80 percent of well-pumping capacity. As shown in Table 5.6, the City can still supply all projected demands with a supply surplus ranging from 62 to 29 percent for the planning period.

Table 5.4
Comparison of Normal Year City Demand and Supply (MGY)

Description	2020	2025	2030	2035	2040
Normal Year Demand[(a)]					
Total City Demand without Proposed Project	1,741	1,669	1,744	1,820	2,055
Additional Proposed Project Demand	0	146	146	146	146
Total	1,741	1,815	1,890	1,966	2,201
Available Supply					
AVEK	349	365	385	404	404
Wells @ 80% Capacity[(b)]	2,502	2,502	2,502	2,502	2,502
Total	2,851	2,867	2,887	2,906	2,906
Supply Surplus	1,110	1,052	997	940	705
% Supply Surplus	64%	58%	53%	48%	32%

(a) All demands include 31.5% water loss
(b) Capacity of City wells projected to be 5,950 gpm = 3,127 MGY

Table 5.5
Comparison of Single Dry-Year City Demand and Supply (MGY)

Description	2020	2025	2030	2035	2040
Single-Dry Year Demand[(a)]					
Total City Demand without Proposed Project	1,741	1,669	1,744	1,820	2,055
Additional Proposed Project Demand	0	146	146	146	146
Total	1,741	1,815	1,890	1,966	2,201
Available Supply					
AVEK	195	199	209	219	219
Wells @ 80% Capacity[(b)]	2,502	2,502	2,502	2,502	2,502
Total	2,697	2,701	2,711	2,721	2,721
Supply Surplus	956	886	821	755	520
% Supply Surplus	55%	49%	43%	38%	24%

(a) All demands include 31.5% water loss
(b) Capacity of City wells projected to be 5,950 gpm = 3,127 MGY

Table 5.6
AVEK Multiple Dry-Year Supply and Demand Comparison (MGY)

escription		2020	2025	2030	2035	2040
First Year	Demand w/o Project	1,741	1,669	1,744	1,820	2,055
	Proposed Project	0	146	146	146	146
	Total Demand	1,741	1,815	1,890	1,966	2,201
	AVEK	237	243	255	267	267
	Wells @ 80% Capacity	2,502	2,502	2,502	2,502	2,502
	Total Supply	2,739	2,745	2,757	2,769	2,769
	Supply Surplus	998	930	867	803	568
	Supply Surplus %	57%	51%	46%	41%	26%
Second Year	Demand w/o Project	1,741	1,669	1,744	1,820	2,055
	Proposed Project	0	146	146	146	146
	Total Demand	1,741	1,815	1,890	1,966	2,201
	AVEK	262	268	281	294	294
	Wells @ 80% Capacity	2,502	2,502	2,502	2,502	2,502
	Total Supply	2,764	2,770	2,783	2,796	2,796
	Supply Surplus	1,023	955	893	830	595
	Supply Surplus %	59%	53%	47%	42%	27%
Third Year	Demand w/o Project	1,741	1,669	1,744	1,820	2,055
	Proposed Project	0	146	146	146	146
	Total Demand	1,741	1,815	1,890	1,966	2,201
	AVEK	310	317	333	348	348
	Wells @ 80% Capacity	2,502	2,502	2,502	2,502	2,502
	Total Supply	2,812	2,819	2,835	2,850	2,850
	Supply Surplus	1,071	1,004	945	884	649
	Supply Surplus %	62%	55%	50%	45%	29%

6 CONCLUSION

City water demands were projected in the City's 2015 UWMP, assuming an annual decrease in per capita water use of 2.0 gpcd (resulting from continued water conservation), and a 1.5-percent annual population increase, and approximately double that in the 2036-2040 period. Per City Public Works Department staff, water demands for the Proposed Project were included in the demand projections in the UWMP. The water demand estimated for the Proposed Project of 146 MGY (including water loss) is 6.6 percent of the total water demand projected for the City in 2040 (2,201 MGY).

Historically, the City has obtained a majority of their potable water supply from groundwater pumped from the California City sub-basin of the FVGB via City-owned and operated wells (approximately 75 percent). Thus, the City's water supply reliability is primarily determined by its groundwater supply. The City's groundwater rights are 3.9 times greater than its existing well- pumping capacity and will be 3.3 times greater than its projected year 2020 pumping capacity. Thus, additional wells could be drilled and equipped to utilize unused water rights if needed in the future.

The City purchases imported water from AVEK to supplement its groundwater supply. AVEK has developed and invested in significant redundant supply sources to help ensure supply availability and reliability for its retail water agencies. AVEK has projected supply surpluses under normal supply/demand conditions but has projected supply deficits for single dry-year and multiple -dry-year conditions. However, the projected City well- pumping capacity of 3,127 MGY is much greater than the projected demands for the City through the 2040 planning period and is not dependent on AVEK supply. The groundwater resources available to the City is more than enough to meet the total demands in the City without imported supply during single and multiple dry periods.

Assuming that 80 percent of the City's projected well-pumping capacity of 3,127 MGY would be available at all times (2,502 MGY), and including AVEK supply reductions during dry conditions, the City has supply surpluses and can meet all normal-year and dry-year demand conditions through the planning period.

The information included in this WSA identifies a sufficient and reliable water supply for the City, now and into the future, including a sufficient water supply for the Proposed Project. These supplies are also sufficient to provide for overall City-wide growth at the rate projected in the City's 2015 UWMP.

7 REFERENCES

The following documents were used in preparing this water supply assessment:

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CORECIVIC CALIFORNIA CITY CORRECTIONAL FACILITY

WATER CAPACITY ANALYSIS

June 26, 2017

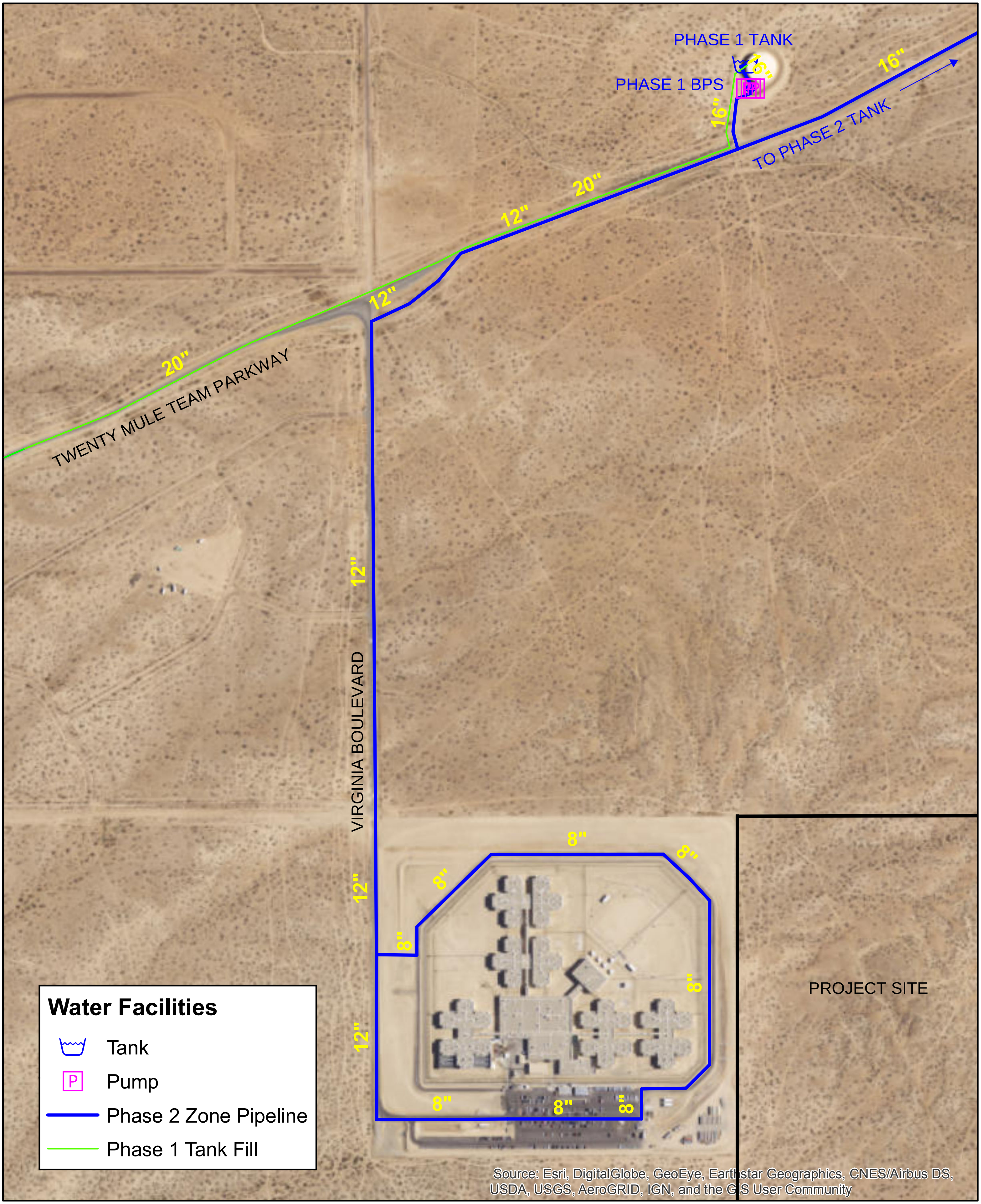
Existing Water System

The CoreCivic project (Project) site is within the California City water system pressure zone served off of the Phase 1 Booster Pump Station (BPS), located at the Phase 1 Tank approximately 0.7 miles north of the Project, and the 1 million gallon (MG) Phase 2 Tank. For discussion purposes this pressure zone is referred to as the Phase 2 pressure zone. The existing California City Correctional Facility (CCCF) is served by a 12-inch pipeline which extends north along Virginia Boulevard for approximately 4,000 feet from the CCCF site to Twenty Mule Team Parkway. This 12-inch pipeline continues northeasterly along Twenty Mule Team Parkway for approximately 2,000 feet and connects to a 16-inch pipeline which is the discharge pipeline from the Phase 1 BPS. The Phase 1 BPS takes suction from the adjacent 2.5 million gallon (MG) Phase 1 Tank and discharges into the 16-inch pipeline which feeds the 12-inch pipeline serving the CCCF and also continues northeasterly approximately 5 miles to the Phase 2 Tank. A schematic map of the existing Phase 2 pressure zone system is illustrated on Figure 1.

The California City Phase 1, Phase 2, Phase 3, and Phase 4 storage tanks are all located northeast of the primary residential area of the City. Water is delivered to the Phase 1 Tank through the main distribution system from the City's well sources or AVEK supply. From the Phase 1 Tank, water either flows back by gravity to the main distribution system or is boosted to the upper pressure zones through the series of subsequent storage tanks and booster stations. The Phase 1 BPS supplies all the upper zones by pumping water from the Phase 1 Tank to supply the Phase 2 Tank. Water from the Phase 2 Tank is then pumped via the Phase 2 BPS to supply the Phase 3 Tank, and water from the Phase 3 Tank is pumped via the Phase 3 BPS to supply the Phase 4 Tank. These upper pressure zones serve two primary water customers, the CCCF located in the Phase 2 pressure zone and the Silver Saddle Ranch served off of the Phase 4 Tank.

Water Demands

Water demand for the Project was developed based on metered water use data for the existing CCCF. Water meter data for the existing facility was provided by the City for the years 2015 and 2016. Due to meter change-out and partial inaccuracies in the 2016 data, the 2015 data was utilized to develop monthly water use at the existing CCCF shown in Table 1 in cubic feet and gallons per minute (gpm). The 2015 total consumption equaled 11,376,800 cubic feet (85.1 MG). With a total of 2,304 beds at the correctional facility, the per inmate water use equates to 101 gallons per day (gpd) per bed.



PSOMAS

FIGURE 1
Existing Water Facilities

Table 1
Existing CCCF Metered Water Use

2015	Metered Use (cubic feet)			Average gpm*
	Meter 1	Meter 2	Total	
JAN	290,700	604,610	895,310	150
FEB	295,600	657,740	953,340	177
MAR	289,900	725,760	1,015,660	170
APR	167,400	435,930	603,330	104
MAY	267,800	679,380	947,180	159
JUN	319,500	656,560	976,060	169
JUL	331,800	617,780	949,580	159
AUG	382,900	715,780	1,098,680	184
SEP	358,500	684,650	1,043,150	181
OCT	374,900	685,760	1,060,660	178
NOV	303,600	599,170	902,770	156
DEC	295,900	635,180	931,080	156
TOTAL	**3,678,500**	**7,698,300**	**11,376,800**	**162**
*** gpm = gallons per minute**				

New designs for facilities operated by CoreCivic incorporate best management practices and are able to achieve a water use of 94 gpd/bed. The existing CCCF is operated by the State with different operating protocols which may contribute to the higher usage. The future operators of the new facilities are not currently known, therefore the 2015 data was utilized to project demands for the Project using the more conservative water demand of estimate of 101 gpd/bed. In addition, this same conservative factor was used to project demands for the previously approved 2,200-bed correctional center located on an adjacent 39.6-acre area to be included in this water capacity analysis.

The average water demand for the existing correctional facility based on meter data described above, and projected demand for the proposed Project and previously approved 2,200-bed correctional center are summarized in Table 2.

Table 2
Projected Water Demand

CoreCivic	Operating Capacity (beds)	Unit Factor (gpd/bed)	Average Water Demand	
			gpd	gpm
Existing CCCF	2,304	101	232,704	162
Approved correctional center on adjacent 39.6-acre area	2,200	101	222,200	154
Proposed 215-Acre Correctional Development	3,024	101	305,424	212
Total	**7,28**	**101**	**760,328**	**528**

Capacity Analysis

Pump Station Capacity

The Phase 1 BPS consists of two 50 horsepower pumps, each with a design flow of 500 gallons per minute (gpm) and a total dynamic head (TDH) of 300 feet for a combined capacity of 1,000 gpm. As discussed above, the station pumps potable water to the exiting CCCF as well as the Phase 2 Tank. The Phase 1 BPS has a constructed building, concrete pad and empty pump can that is capable of accommodating a new pump with no grading or earthwork required. Two additional booster pump stations, the Phase 2 BPS and Phase 3 BPS, provide potable water from the Phase 2 Tank to the Silver Saddle Ranch community approximately 7.2 miles northeast of the Project site. Monthly pump production data was provided by the City for the Phase 1, Phase 2, and Phase 3 booster pump stations for the period from January 2016 to April 2017. The monthly production data provided is summarized in Table 3 along with the average and peak month production. Data for the months of November 2016 through January 2017 was not available. Because the missing data is for winter months, the peak demand on these pump stations can still be evaluated.

Table 3
Monthly Booster Pump Station Water Production Data

	Phase 1 BPS		Phase 2 BPS		Phase 3 BPS	
Month	gpd	gpm	gpd	gpm	gpd	gpm
JAN 2016	319,097	222	53,129	37	59,065	41
FEB	333,714	232	62,536	43	61,357	43
MAR	454,323	316	180,774	126	181,000	126
APR	550,200	382	266,867	185	273,333	190
MAY	632,677	439	381,710	265	388,323	270
JUN	695,600	483	443,800	308	455,667	316
JUL	738,387	513	488,129	339	491,903	342
AUG	726,742	505	462,194	321	474,129	329
SEP	671,067	466	437,800	304	458,400	318
OCT	439,484	305	214,774	149	214,645	149
FEB 2017	309,000	215	44,839	31	43,065	30
MAR	404,929	281	64,143	45	62,143	43
APR	441,903	307	141,806	98	136,129	95
AVG	**516,702**	**359**	**224,162**	**156**	**253,781**	**176**
MAX	**738,387**	**513**	**488,129**	**339**	**491,903**	**342**

The Phase 1 BPS has an average production rate of 359 gpm and a maximum month production of 513 gpm. As discussed above, the Phase 1 pump supplies the correctional facility site and the Phase 2 Tank. The Phase 2 and Phase 3 pump stations primarily supply the Silver Saddle Ranch community served off of the Phase 4 Tank. The production at the Phase 1 BPS minus the production at the Phase 3 BPS is assumed to be utilized within the Phase 2 pressure zone as a combination of water demand and system losses within that zone. Phase 3 BPS production is a combination of use by the Silver Saddle Ranch community and system losses. The water use within these two service pressure zones is summarized in Table 4. As shown in Table 4, water use in the Phase 2 pressure zone shows very little seasonal variation, which is consistent with the meter read data for the existing CCCF.

Table 4
Monthly Water Use by Zone

	PHASE 2 ZONE		SILVER SADDLE	
Month	**gpd**	**gpm**	**gpm**	**gpm**
JAN 2016	260,032	181	59,065	41
FEB	272,357	189	61,357	43
MAR	273,323	190	181,000	126
APR	276,867	192	273,333	190
MAY	244,355	170	388,323	270
JUN	239,933	167	455,667	316
JUL	246,484	171	491,903	342
AUG	252,613	175	474,129	329
SEP	212,667	148	458,400	318
OCT	224,839	156	214,645	149
FEB 2017	265,935	185	43,065	30
MAR	342,786	238	62,143	43
APR	305,774	212	136,129	95
AVG	**262,920**	**183**	**253,781**	**176**
MAX	**342,786**	**238**	**491,903**	**342**

The Phase 1 BPS which serves the CCCF must have sufficient capacity to meet maximum daily demands with hourly peaks served off of available storage in the Phase 2 Tank. Based on the production data, the maximum month demand within the Phase 2 pressure zone is approximately 500 gpm. Assuming a 20% increase from maximum month to maximum day demand, the pump station should have capacity to supply approximately 600 gpm for a maximum day. The pump station currently has a pumping capacity of 1,000 gpm with both pumps operating. The production data indicates that during summer months at least one pump must operate continuously to meet daily demand. This was confirmed by City staff.

The proposed Project and the approved 2,200-bed correctional center , together, will add an average daily demand of approximately 366 gpm to the Phase 2 zone served off of the Phase 1 BPS. As discussed above, there is no significant variation seasonally in correctional facility water use. This is attributed to the operating protocols of the facilities and the lack of outdoor water use. To be conservative, a 20 percent increase was assumed to estimate the required production capacity at the BPS for the Project and approved expansion. This results in an additional production capacity of 440 gpm to meet maximum day demand. The required maximum day capacity for the Phase 1 BPS to serve exiting CCCF use plus the proposed Project and approved 2,200-bed correctional center equates to approximately 1,040 gpm. To meet these future production demands, an additional pump is required at the Phase 1 BPS. It is recommended that a new pump be added to the existing pump station with a capacity of approximately 550 gpm and a TDH of 300 feet to match the head on the existing pumps and meet maximum day demand within the pressure zone. The additional pump will allow for the operation of two out of the three pumps to meet maximum day demand, with one serving as backup. These three pumps could then rotate operation as lead, lag, and backup.

Water Storage Capacity

As described above, the upper pressure zones which serve the CCCF and the Silver Saddle Ranch community contain three storage tanks (Phase 2, Phase 3, and Phase 4) that are supplied through the Phase 1 BPS from the Phase 1 Tank. These storage facilities are summarized in Table 5 below.

Table 5
Water Storage Facilities

Reservoir Name	High Water Level (ft)	Capacity (MG)
Phase 1	2,600	2.5
Phase 2	2,900	1.0
Phase 3	3,050	1.0
Phase 4	3,200	1.0

Based on the City's Engineering Report, February 1995, the total storage capacity should be equal to or greater than the average daily demand. The City's 2002 Water Master Plan recommends a storage criteria of 1.25 times the maximum day demand for operational and emergency storage plus the volume required for fire storage. This is based on operational storage equal to 25 percent of a maximum day demand and emergency storage equal to the volume of one maximum day demand.

The Phase 2 pressure zone which serves the proposed Project has a projected average demand of approximately 760,300 gpd (from Table 2) with minimal peaking based on monthly meter and production data. To conservatively estimate maximum day demand, the average demand was peaked by a factor of 1.2 for a maximum day demand of approximately 912,400 gpd. The Silver Saddle Ranch community fed from the Phase 4 Tank has a maximum monthly demand of 491,900 gpd (from Table 4). This demand was peaked by a factor of 1.2 for a maximum day demand of approximately 590,300 gpd. Table 6 shows the recommended storage requirement for the upper pressure zones based on estimated maximum day demands and the City's Water Master Plan recommended criteria.

Table 6
Recommended Water Storage Volume

Upper Pressure Zones	Storage (MG)
Phase 2 Pressure Zone	
Maximum Day Demand	*0.91*
Operational Storage (0.25xMDD)	0.23
Emergency Storage (1.0xMDD)	0.91
Fire Storage (1500 gpm/2 HRS)	0.18
Total Storage	1.32
Silver Saddle Ranch	
Maximum Day Demand	*0.59*
Operational Storage (0.25xMDD)	0.15
Emergency Storage (1.0xMDD)	0.59
Fire Storage (1500 gpm/2 HRS)	0.18
Total Storage	0.92
Required Storage Capacity	2.23
Total Available Storage	3.00

The combined storage of the upper zones is equal to 3.0 million gallons (MG) with a total required storage capacity of 2.23 MG. Silver Saddle Ranch is served off of the Phase 4 tank which must have sufficient capacity to serve that community as there is no higher elevation tank able to gravity feed into that zone. The 1.0 MG capacity in the Phase 4 Tank is sufficient to meet the storage requirement of 0.92 MG for the Silver Saddle Ranch zone. All three upper zone tanks are able to gravity feed into the Phase 2 pressure zone. Making the conservative assumption that the Phase 4 Tank is dedicated to serve the Silver Saddle Ranch community, both the Phase 2 and Phase 3 tanks hold storage capacity that can serve the Phase 2 zone. The total recommended storage volume for the Phase 2 zone is equal to 1.32 MG as shown in Table 6. With a combined storage capacity of 2.0 MG, the Phase 2 and Phase 3 tanks have sufficient capacity to serve that requirement and no additional storage volume is needed.

With 1 MG storage in the Phase 2 Tank and the ability to supply the zone from the 1 MG Phase 3 Tank, sufficient storage capacity (0.68 MG surplus) is in place to serve the existing and approved use within the CCCF pressure zone along with the approved 2,200-bed correctional center, and proposed Project.

<u>Pipeline Capacity</u>
A hydraulic model of the Phase 2 pressure zone water supply facilities was developed in InfoWater software to evaluate the capacity of the existing pipeline facilities and proposed pump station expansion to serve the proposed Project during peak hour and fire flow conditions. Demands were added to the model for the existing CCCF, the approved 2,200-bed correctional center, and the proposed Project. A peak hour factor of 2 times the average day demand was assumed for the peak hour simulation. The fire flow analysis assumed maximum day demand

conditions plus a fire flow of 1,500 gpm. Model output for both peak hour demand and maximum day demand plus fire flow are attached along with the corresponding junction diagram of the existing and proposed pipeline facilities. The existing 12-inch pipeline in Virginia Boulevard and Twenty Mule Team Parkway which serves the CCCF site from the Phase 1 BPS has sufficient capacity to meet the demand of the existing CCCF, the approved 2,200-bed correctional center, and the proposed Project. A 12-inch pipeline is recommended from Virginia Boulevard extending east to the Project site to supply sufficient fire flow and pressure. The proposed alignment of this pipeline would be within the Project access road along the northern boundary of the existing CCCF site as shown on Figure 2. An 8-inch diameter onsite loop was assumed within the Project boundary to simulate Project demands and fire flow locations.

SCALE 1" = 100'–0"

DECEMBER 14, 2017

Figure 2 - Pipeline Improvements

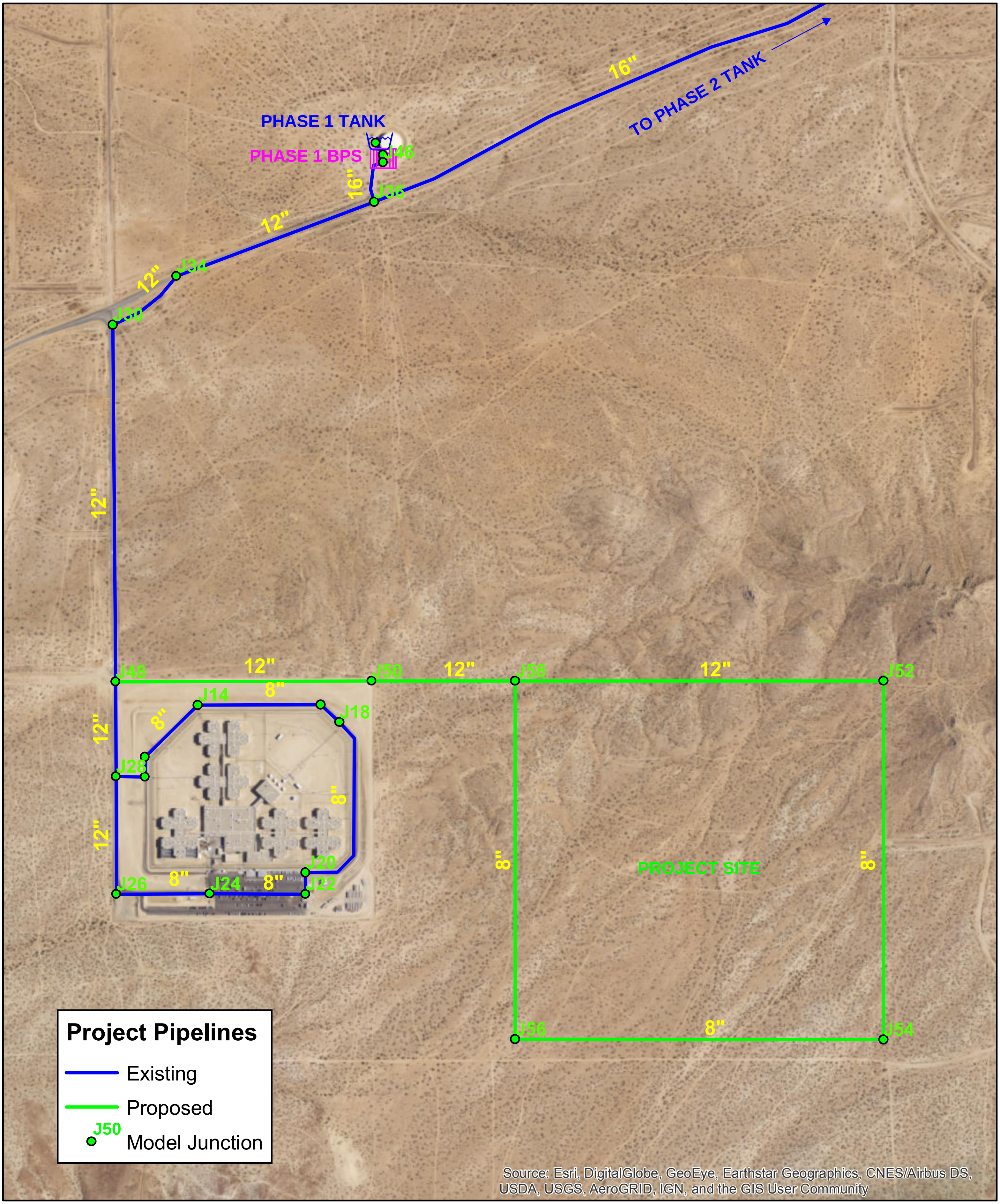
(2) 1,512 BED CORRECTIONAL FACILITIES
TOTAL 3,024 BEDS

CoreCivic

CALIFORNIA CITY, CALIFORNIA
TOTAL SITE AREA = +/– 215 ACRES

0 50' 100' 200' 400'

TRUE NORTH


PHASE 1 TANK
PHASE 1 BPS
TO PHASE 2 TANK
16"
12"
J46
J36
J34
J30
J48
J50
J58
J52
J14
J18
J28
J20
J22
J24
J26
J56
J54
8"
PROJECT SITE
Project Pipelines
Existing
Proposed
J50
Model Junction
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

WATER SYSTEM ANALYSIS
MODEL OUTPUT

JUNCTION REPORT - MDD PLUS FIRE FLOW

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J10	48.5	2,545.0	2,806.8	113.4
J12	0.0	2,550.0	2,806.7	111.2
J14	48.5	2,555.0	2,806.3	108.9
J16	0.0	2,570.0	2,806.0	102.3
J18	48.5	2,570.0	2,806.0	102.3
J20	48.5	2,553.0	2,805.9	109.6
J22	0.0	2,553.0	2,805.9	109.6
J24	185.0	2,551.0	2,805.9	110.5
J26	0.0	2,544.0	2,806.9	113.9
J28	0.0	2,548.0	2,807.0	112.2
J30	0.0	2,548.0	2,848.1	130.1
J34	0.0	2,561.0	2,857.4	128.4
J36	0.0	2,562.0	2,881.5	138.4
J38	0.0	2,570.0	2,591.9	9.5
J42	0.0	2,885.0	2,890.0	2.2
J44	0.0	2,570.0	2,591.7	9.4
J46	0.0	2,570.0	2,882.3	135.3
J48	0.0	2,540.0	2,807.5	115.9
J50	0.0	2,580.0	2,787.2	89.8
J52	63.3	2,615.0	2,765.9	65.4
J54	1,563.3	2,600.0	2,704.2	45.1
J56	63.3	2,590.0	2,737.3	63.8
J58	63.3	2,600.0	2,775.8	76.2

PIPE REPORT - MDD PLUS FIRE FLOW

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
P11	J10	J12	120.0	8.0	100.0	135.2	0.9	0.1	0.7
P13	J12	J14	495.0	8.0	100.0	135.2	0.9	0.4	0.7
P15	J14	J16	870.0	8.0	100.0	86.7	0.6	0.3	0.3
P17	J16	J18	170.0	8.0	100.0	86.7	0.6	0.1	0.3
P19	J18	J20	1,350.0	8.0	100.0	38.2	0.2	0.1	0.1
P23	J20	J22	160.0	8.0	100.0	-10.3	0.1	0.0	0.0
P25	J22	J24	630.0	8.0	100.0	-10.3	0.1	0.0	0.0
P27	J24	J26	681.0	8.0	100.0	-195.3	1.3	1.0	1.4
P29	J26	J28	821.0	12.0	100.0	-195.3	0.6	0.2	0.2
P31	J28	J10	212.0	8.0	100.0	183.7	1.2	0.3	1.3
P33	J28	J48	647.0	12.0	100.0	-379.0	1.1	0.4	0.7
P35	J30	J34	554.8	12.0	100.0	-2,132.0	6.1	9.3	16.7
P37	J34	J36	1,436.9	12.0	100.0	-2,132.0	6.1	24.1	16.7
P39	J36	J46	322.9	16.0	100.0	-1,620.8	2.6	0.8	2.5
P41	J38	RES9000	25.8	16.0	100.0	-1,620.8	2.6	0.1	2.5
P43	RES9002	J42	81.3	16.0	100.0	511.2	0.8	0.0	0.3
P45	J42	J36	29,016.7	16.0	100.0	511.2	0.8	8.5	0.3
P47	J38	J44	96.1	16.0	100.0	1,620.8	2.6	0.2	2.5
P49	J44	U7002	21.6	12.0	100.0	522.9	1.5	0.0	1.3
P51	U7002	J46	26.0	12.0	100.0	522.9	1.5	0.0	1.2
P53	J44	U7004	30.0	12.0	100.0	522.8	1.5	0.0	1.2
P55	U7004	J46	31.7	12.0	100.0	522.8	1.5	0.0	1.2
P57	J44	U7000	30.3	12.0	100.0	575.1	1.6	0.0	1.5
P59	U7000	J46	34.6	12.0	100.0	575.1	1.6	0.1	1.5
P61	J48	J30	2,427.8	12.0	100.0	-2,132.0	6.1	40.7	16.7
P63	J48	J50	1,743.1	12.0	100.0	1,753.0	5.0	20.3	11.7
P65	J50	J58	975.6	12.0	100.0	1,753.0	5.0	11.4	11.7
P67	J52	J54	2,450.0	8.0	100.0	915.1	5.8	61.7	25.2
P69	J54	J56	2,490.0	8.0	100.0	-648.1	4.1	33.1	13.3
P71	J58	J52	2,506.3	12.0	100.0	978.4	2.8	9.9	4.0
P73	J56	J58	2,438.2	8.0	100.0	-711.4	4.5	38.5	15.8

PUMP REPORT - MDD PLUS FIRE FLOW

ID	Elevation (ft)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (gpm)	Head Gain (ft)
U7000	2,570.0	9.4	135.3	575.1	290.7
U7002	2,570.0	9.4	135.3	522.9	290.6
U7004	2,570.0	9.4	135.3	522.8	290.7

TANK REPORT - MDD PLUS FIRE FLOW

ID	Flow (gpm)	Head (ft)
RES9000	-1,620.8	2,592.0
RES9002	-511.2	2,890.0

JUNCTION REPORT - PEAK HOUR DEMAND

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J10	81.0	2,545.0	2,867.9	139.9
J12	0.0	2,550.0	2,867.7	137.7
J14	81.0	2,555.0	2,866.8	135.1
J16	0.0	2,570.0	2,866.0	128.3
J18	81.0	2,570.0	2,865.9	128.2
J20	81.0	2,553.0	2,865.7	135.5
J22	0.0	2,553.0	2,865.7	135.5
J24	309.0	2,551.0	2,865.7	136.4
J26	0.0	2,544.0	2,868.2	140.5
J28	0.0	2,548.0	2,868.6	138.9
J30	0.0	2,548.0	2,880.8	144.2
J34	0.0	2,561.0	2,883.4	139.7
J36	0.0	2,562.0	2,889.9	142.1
J38	0.0	2,570.0	2,592.0	9.5
J42	0.0	2,885.0	2,890.0	2.2
J44	0.0	2,570.0	2,591.9	9.5
J46	0.0	2,570.0	2,890.2	138.8
J48	0.0	2,540.0	2,869.8	142.9
J50	0.0	2,580.0	2,868.3	124.9
J52	105.6	2,615.0	2,867.0	109.2
J54	105.6	2,600.0	2,866.1	115.3
J56	105.6	2,590.0	2,866.1	119.6
J58	105.6	2,600.0	2,867.5	115.9

PIPE REPORT - PEAK HOUR DEMAND

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
P11	J10	J12	120.0	8.0	100.0	225.9	1.4	0.2	1.9
P13	J12	J14	495.0	8.0	100.0	225.9	1.4	0.9	1.9
P15	J14	J16	870.0	8.0	100.0	144.9	0.9	0.7	0.8
P17	J16	J18	170.0	8.0	100.0	144.9	0.9	0.1	0.8
P19	J18	J20	1,350.0	8.0	100.0	63.9	0.4	0.3	0.2
P23	J20	J22	160.0	8.0	100.0	-17.1	0.1	0.0	0.0
P25	J22	J24	630.0	8.0	100.0	-17.1	0.1	0.0	0.0
P27	J24	J26	681.0	8.0	100.0	-326.1	2.1	2.5	3.7
P29	J26	J28	821.0	12.0	100.0	-326.1	0.9	0.4	0.5
P31	J28	J10	212.0	8.0	100.0	306.9	2.0	0.7	3.3
P33	J28	J48	647.0	12.0	100.0	-632.9	1.8	1.1	1.8
P35	J30	J34	554.8	12.0	100.0	-1,055.4	3.0	2.5	4.6
P37	J34	J36	1,436.9	12.0	100.0	-1,055.4	3.0	6.5	4.6
P39	J36	J46	322.9	16.0	100.0	-1,007.9	1.6	0.3	1.0
P41	J38	RES9000	25.8	16.0	100.0	-1,007.9	1.6	0.0	1.0
P43	RES9002	J42	81.3	16.0	100.0	47.6	0.1	0.0	0.0
P45	J42	J36	29,016.7	16.0	100.0	47.6	0.1	0.1	0.0
P47	J38	J44	96.1	16.0	100.0	1,007.9	1.6	0.1	1.0
P49	J44	U7002	21.6	12.0	100.0	504.0	1.4	0.0	1.2
P51	U7002	J46	26.0	12.0	100.0	504.0	1.4	0.0	1.2
P53	J44	U7004	30.0	12.0	100.0	503.9	1.4	0.0	1.2
P55	U7004	J46	31.7	12.0	100.0	503.9	1.4	0.0	1.2
P57	J44	U7000	30.3	12.0	100.0	0.0	0.0	0.0	0.0
P59	U7000	J46	34.6	12.0	100.0	0.0	0.0	0.0	0.0
P61	J48	J30	2,427.8	12.0	100.0	-1,055.4	3.0	11.1	4.6
P63	J48	J50	1,743.1	12.0	100.0	422.5	1.2	1.5	0.8
P65	J50	J58	975.6	12.0	100.0	422.5	1.2	0.8	0.8
P67	J52	J54	2,450.0	8.0	100.0	93.0	0.6	0.9	0.4
P69	J54	J56	2,490.0	8.0	100.0	-12.6	0.1	0.0	0.0
P71	J58	J52	2,506.3	12.0	100.0	198.6	0.6	0.5	0.2
P73	J56	J58	2,438.2	8.0	100.0	-118.3	0.8	1.4	0.6

PUMP REPORT - PEAK HOUR DEMAND

ID	Elevation (ft)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (gpm)	Head Gain (ft)
U7000	2,570.0	9.5	138.8	0.0	0.0
U7002	2,570.0	9.5	138.8	504.0	298.4
U7004	2,570.0	9.5	138.8	503.9	298.4

TANK REPORT - PEAK HOUR DEMAND

ID	Flow (gpm)	Head (ft)
RES9000	-1,007.9	2,592.0
RES9002	-47.6	2,890.0

CORECIVIC CALIFORNIA CITY CORRECTIONAL DEVELOPMENT

SEWER CAPACITY ANALYSIS

August 18, 2017

Existing Sewer System

The City of California City's sewer system serves the existing CCCF which discharges from the correctional facility into a 12-inch sewer pipeline within the parking lot located in the southern end of the property. The sewage is run through an onsite grinder initially and then transmitted through approximately 8,500 feet of 12-inch pipeline into an 18-inch sewer pipeline in Twenty Mule Team Parkway at 145th Street. The 12-inch pipeline alignment from the CCCF extends westerly from the existing CCCF parking lot to Virginia Boulevard, then north along Virginia Boulevard to Gordon Boulevard, west along Gordon Boulevard to 145th Street and north on 145th Street to connect with the sewer pipe in Twenty Mule Team Parkway. According to the as-built drawings provided by CH2M, the minimum slope along the existing 12-inch diameter pipeline is approximately 0.2 percent. The existing facilities from the CCCF site to Twenty Mule Team Parkway are illustrated on Figure 1.

The 18-inch pipeline in Twenty Mule Team Parkway extends southwesterly approximately 2 miles then increases in diameter to 24-inches. The 24-inch pipeline continues southwesterly along Twenty Mule Team Parkway another 1.4 miles to near the intersection with Randsburg Mojave Road. At this point the pipeline turns westerly and increases in diameter to 27-inches where it continues to the City's wastewater treatment plant (WWTP) on Nelson Drive (at the northeastern section of the City's central core).

The City's WWTP has a permitted capacity of 1.0 million gallons per day (MGD). According to City staff, the treatment facility is currently operating at approximately 0.65 MGD and has reached its effective maximum operating capacity. Treated effluent is stored in ponds at the WWTP and percolated or delivered to the City golf course for irrigation purposes. Historically the ponds remain full from approximately December through March when irrigation demands are low.

Sewage Generation

Sewage generation for the Project was developed based on metered water use data for the existing CCCF. The majority of water use within the CCCF will generate sewage. Based on CoreCivic's infrastructure guide, average sewer flow generation is approximately 93% of facility water demand.

Water meter data for the existing facility was provided by the City for the years 2015 and 2016. Due to meter change-out and reported partial inaccuracies in the 2016 data, the 2015 data for the CCCF was utilized to develop monthly water use at the existing CCCF shown in Table 1. The 2015 total consumption equaled 11,376,800 cubic feet (85.1 MG). With a total of 2,304 beds at the correctional facility, the per inmate water use equates to 101 gallons per day (gpd) per bed. The resulting sewage generation rate is 93 gpd/bed using 93% of the metered water use.

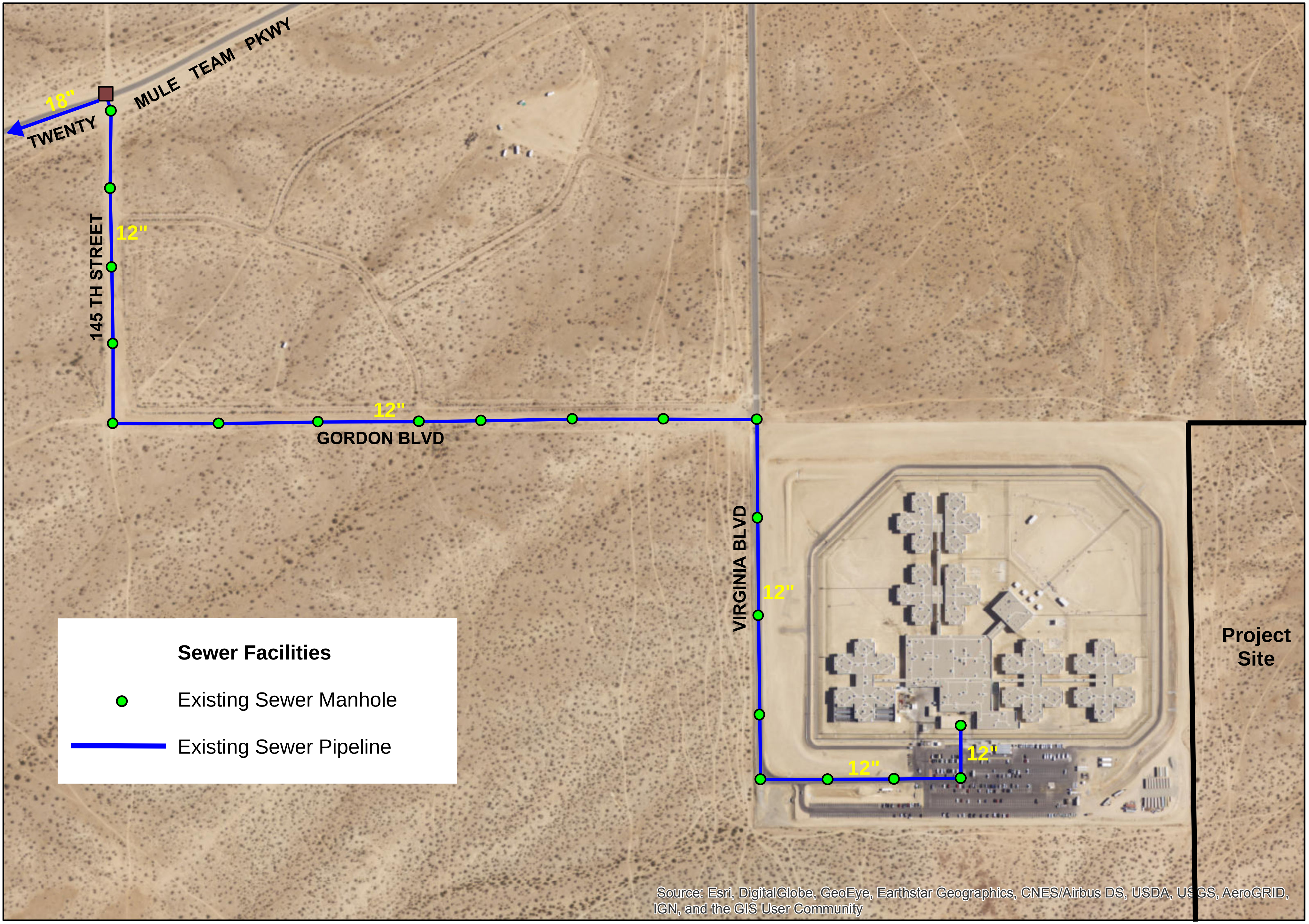


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FIGURE 1
Existing Sewer Facilities

Table 1
Existing CCCF Metered Water Use

2015	Metered Use (cubic feet)			Average
	Meter 1	Meter 2	Total	gpm*
JAN	290,700	604,610	895,310	150
FEB	295,600	657,740	953,340	177
MAR	289,900	725,760	1,015,660	170
APR	167,400	435,930	603,330	104
MAY	267,800	679,380	947,180	159
JUN	319,500	656,560	976,060	169
JUL	331,800	617,780	949,580	159
AUG	382,900	715,780	1,098,680	184
SEP	358,500	684,650	1,043,150	181
OCT	374,900	685,760	1,060,660	178
NOV	303,600	599,170	902,770	156
DEC	295,900	635,180	931,080	156
TOTAL	**3,678,500**	**7,698,300**	**11,376,800**	**162**
* gpm – gallons per minute				

New designs for facilities operated by CoreCivic incorporate best management practices and are able to achieve a water use of 94 gpd/bed which would result in a sewage generation factor of 87 gpd/bed. The existing CCCF is operated by the State with different operating protocols which may contribute to the higher usage. The future operators of the proposed facilities are not known, therefore the more conservative 2015 data was utilized to project water demands and the resulting sewage generation for the Project is 93 gpd/bed. This same factor was used to estimate sewage discharge for the previously approved 2,200-bed correctional center located on an adjacent 39.6-acre area to be included in this sewer capacity analysis. The factor is based on the most recent data available and is closer to current performance expectations than previous planning numbers used for that site.

The average sewage flow for the existing correctional facility based on meter data described above, and projected flow for the proposed Project and previously approved 39.6-acre expansion are summarized in Table 2.

Table 2
Projected Sewage Flow

CoreCivic	Operating Capacity (beds)	Unit Factor (gpd/bed)	Average Sewage Generation gpd	gpm
Existing CCCF	2,304	93	214,272	149
Approved 2,200-Bed Correctional Center on Adjacent 39.6-acre Area	2,200	93	204,600	142
Proposed 215-Acre Correctional Development	3,024	93	281,232	195
Total	**7,528**	**93**	**700,104**	**486**

Capacity Analysis

The existing sewage collection system was modeled using InfoSewer modeling software. Pipeline facilities from the CCCF site to Twenty Mule Team Parkway were input into the model based on system design/as-built plans and details. Scenarios were run for existing CCCF flows plus the approved 2,200-bed correctional center on the adjacent 39.6 acres, and for the existing and approved flows plus the proposed Project. Sewer flow was peaked by a factor of 2.0 to simulate peak hour conditions. Typical design criteria for 12-inch and smaller pipelines set a maximum flow depth of 50% full for dry weather flow. Slightly higher depths may be allowed up to approximately two-thirds full for existing pipeline facilities prior to additional pipe capacity being recommended. Due to the very low rainfall in the project vicinity and little potential for infiltration, it is assumed that the existing 12-inch pipelines serving the CCCF have a maximum allowable depth of two-thirds full. Criteria for pipelines larger than 12-inches allow for a maximum capacity of 75% full.

The model output and the corresponding manhole junction diagram are attached. Results indicate that the existing 12-inch sewer pipeline from the CCCF site to Twenty Mule Team Parkway has pipeline reaches with depths up to two-thirds full during peak sewer loads from the existing CCCF plus the approved 2,200-bed correctional center. Adding peak flows from the proposed Project cause the 12-inch pipeline to flow full for most of the reaches which is not an acceptable operating condition.

The pipeline within Twenty Mule Team Parkway to the WWTP were evaluated using an Excel spreadsheet model for the most critical reach which is the smallest diameter reach with the shallowest slope. The spreadsheet model results are attached along with the InfoSewer model output. The combined peak flow from the existing CCCF, approved 2,200-bed correctional center, and the proposed Project was used to determine a depth of flow within the 18-inch diameter critical reach equal to only 49% of its diameter. This projected flow is well within the design criteria of 75% full for an 18-inch pipeline, and all sewer reaches in Twenty Mule Team Parkway with larger diameters and/or steeper slopes would experience even lower depths than this maximum of 49% full.

Proposed Sewer Improvements

Pipeline Improvements

Based on the hydraulic analysis, additional pipeline capacity is required to convey sewage from the proposed Project site to the 18-inch pipeline in Twenty Mule Team Parkway. The Project can be served by two alternative sewer alignments which would transmit sewage from the site to the pipeline in Virginia Boulevard. One alternative alignment would be extended west from the northwest corner of the Project site to Virginia Boulevard within the proposed access road traversing the northern boundary of the existing CCCF site. This alternative would require an onsite sewer lift station and force main. The second alternative alignment would extend west along the southern boundary of the existing CCCF site to the existing sewer system in Virginia Boulevard. Both these alignments are illustrated on Figure 2.

It was assumed that the onsite sewer lines would extend to individual buildings within the proposed Project and collect sewage to the southwest corner of the site, as the developed building pad will slope to the southwest, at which point the collected sewage will be run through an onsite grinder. Sewage could potentially be collected to a location further north, thus reducing pipeline length, but this would involve deeper gravity sewer pipelines. Design of the onsite sewer system should consider the optimum location for this collection point taking into account the depth of gravity sewer collection pipelines versus the lengths of these pipelines and force mains. From this point, for Option 2, the sewage will be pumped to the northwest corner of the property to connect to the easterly sewer extension in Gordon Boulevard along the access road or it will gravity flow, for Option 1, (without pumping) to the west to the existing 12-inch pipeline within Virginia Boulevard.

The sewer pipelines within Virginia Boulevard, Gordon Boulevard, and 145th Street do not have sufficient capacity to collect peak flows from the Project, and thus parallel 12-inch diameter pipelines are recommended along the alignment of the above-mentioned existing sewer pipelines to transmit the Project sewage to the pipe in Twenty Mule Team Parkway. The Option 2 alignment could potentially utilize a force main to connect to the 18-inch pipeline in Twenty Mule Team Parkway rather than a parallel gravity line. All options will be evaluated during the design phase of the Project to determine the preferred alternative. The capacity any parallel gravity pipelines will be shared by the Project and the approved 2,200-bed correctional center project. Based on the estimated bed count for each site, the Project would be responsible for approximately 58% of the parallel gravity pipeline improvements. As an alternative to installing parallel pipelines to meet peak flow capacity, an approximate 28,000 gallon holding tank could be constructed onsite, along with the sewer lift station and force main for Option 2, in order to pump and discharge sewage from the site during off-peak periods.

SCALE 1" = 100'–0"

DECEMBER 14, 2017

CoreCivic

Figure 2 - Alternative Sewer Line Alignments

(2) 1,512 BED CORRECTIONAL FACILITIES

TOTAL 3,024 BEDS

CALIFORNIA CITY, CALIFORNIA

TOTAL SITE AREA = +/– 215 ACRES

0 50' 100' 200' 400'

TRUE NORTH

The pipeline within Twenty Mule Team Parkway has sufficient capacity to serve the proposed Project, including the existing CCCF and approved 2,200-bed correctional center project, and transmit flows to the wastewater treatment plant on Nelson Drive. Proposed offsite pipeline improvements are illustrated on Figure 3.

City Wastewater Treatment Plant

The City's WWTP has an approved capacity of 1.0 MGD. According to City staff, the treatment facility is currently operating at approximately 0.65 MGD and has reached its effective maximum operating capacity, without factoring the future wastewater flow of approximately 0.20 MGD from the approved but not yet constructed 2,200-bed correctional center facility and other planned/permitted projects in the City. Therefore, in order to accommodate the proposed Project's estimated sewage flows of 0.28 MGD, additional treatment and disposal/storage capacity will be required at the City's WWTP, including increased seasonal storage and/or percolation pond capacity to accommodate the projected Project's sewage flow. To accommodate both the approved 2,200-bed correctional center and the proposed Project, approximately 0.5 MGD of additional treatment and disposal/storage and reuse capacity will be required at the City's WWTP. City staff indicated that the onsite storage and percolation ponds are typically full from December through March. Using the average daily inflow from the Project of 0.28 MGD, approximately 100 acre-feet of additional percolation/seasonal storage and reuse capacity may be required to accommodate the entire four months of daily inflow from the Project during this lower irrigation demand period. The approved 2,200-bed correctional center project's estimated flow of 0.20 MGD may require an additional approximately 75 acre-feet of percolation/seasonal storage and reuse capacity resulting in a combined total of approximately 175 acre-feet of percolation/storage capacity for both projects. Plant and pond operational enhancements could substantially reduce this need for additional disposal/storage capacity. Potential improvements and operational enhancements (methods) could include the following:

- Deepening some or all of the existing ponds
- Removing some of the interior berms to create more storage volume
- Constructing additional storage capacity within the City's WWTP boundary
- Increased frequency of silt removal and surface scarification to improve percolation rates
- Increasing the surface area covered by water during more months of the year to increase percolation and evaporation

The City's WWTP site is depicted on Figure 4, which shows the boundary of the plant, the percolation/seasonal storage ponds and other facilities in aerial view. Based on input from City staff, necessary improvement are anticipated to be within the current operating boundaries of the developed WWTP site and would not encroach into adjacent property.

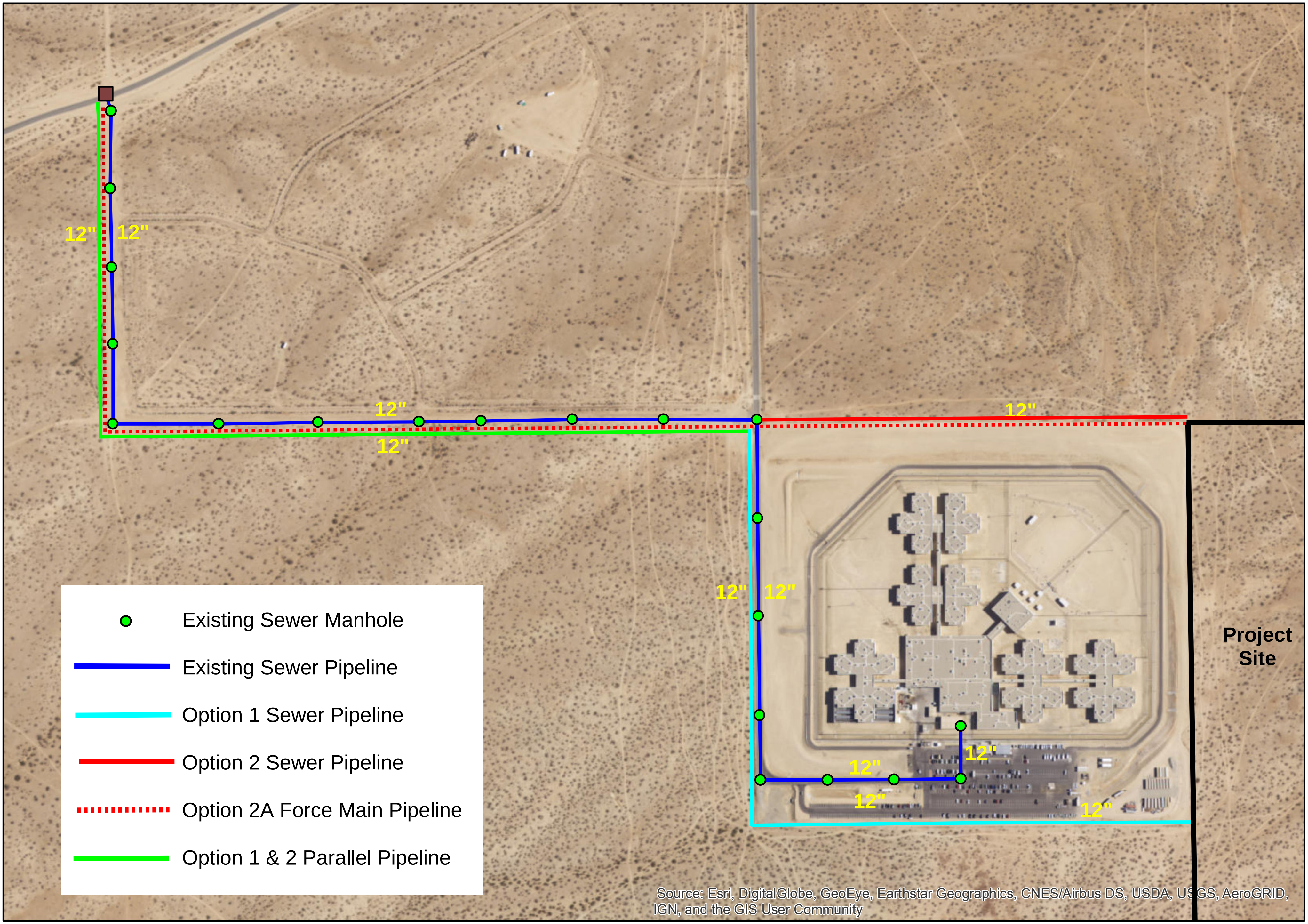

FIGURE 3
Offsite Sewer Improvements

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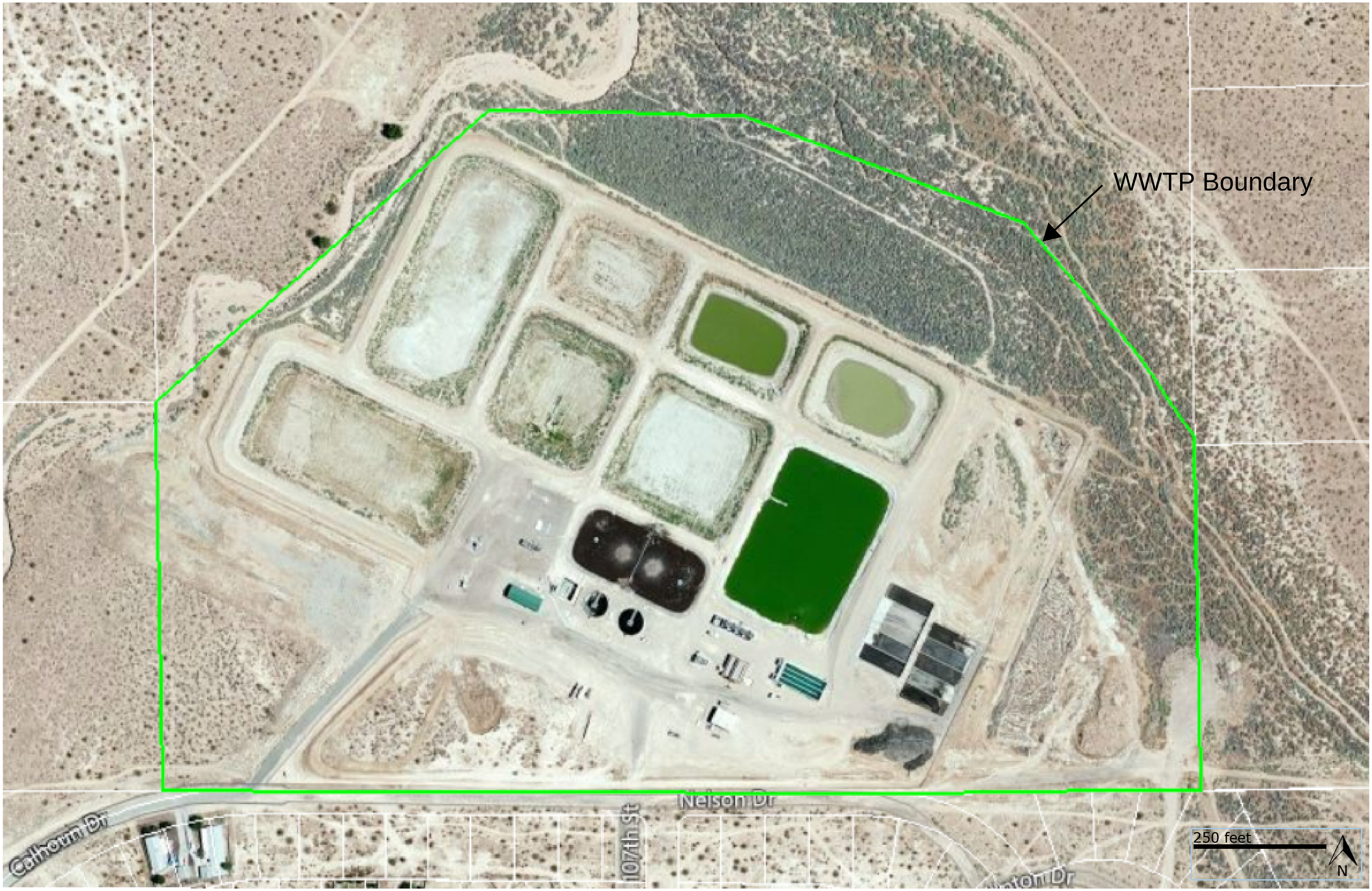


FIGURE 4
Existing WWTP Site Plan

PSOMAS

Based on preliminary discussions with City staff, in order to handle additional capacity the processes of the WWTP requiring upgrades considering equipment condition and/or capacity constraints would be the headworks equipment (most likely requiring a new, larger unit with built-in redundancy), solids handling equipment (most likely a new, larger belt filter press), additional tertiary treatment and disinfection capacity (most likely an additional skid-mounted package treatment unit and additional chlorine contact chambers) and a larger capacity pump station to boost additional recycled water to the golf course lake during peak irrigation season. Importantly, the Project would contribute approximately 0.28 MGD of new flow to the City's WWTP operation. As such, although this Draft EIR is assessing the totality of upgrades at the City's WWTP potentially needed for cumulative development, the proposed Project would be responsible for only its pro rata share of impacts related to WWTP improvements based on the anticipated sewage flow of 0.28 MGD.

Hazen *Technical Memorandum*

May 10, 2019

To: Psomas

From: Ian Mackenzie, P.E.
Derya Dursun, P.E.
Dave Jones, P.E.

Re: California City Wastewater Treatment Plant

Condition Assessment

Introduction

This memo reports on the existing condition of the California City Wastewater Treatment Plant and provides planning level recommendations for potential improvements that would allow the plant to continue to treat its current influent flow to meet permit requirements. This report is based on observations from a site visit conducted on October 17, 2018 as well as information provided by plant staff.

20124-000

Table of Contents

1. Condition Assessment

1.1 Headworks:

The headworks includes an inlet pump station, mechanically-raked bar screen, screenings compactor and Parshall flume for flow measurement. No grit removal facilities are provided.

All units of the headworks were in working order and plant staff did not report any significant mechanical problems. It was noted that the Parshall flume is located downstream of the internal drainage return flows which means that it is impossible to identify how much of the measured flow is actual influent. It was also noted that influent pumps station is a submersible type which the plant staff have difficulty in maintaining.

1.2 Aeration Basins

There are two aeration basins, each equipped with two floating mechanical mixers. The plant staff reported that the mixers were in good condition although they require frequent cleaning. Cracks were observed in the asphalt lining of the basins above the water line and it appeared that these cracks continued below the water line.

1.3 Secondary Clarifiers

One of the two secondary clarifiers is running; however the effluent weirs appear to be in need of adjustment. The second clarifier is non-functional due to failure of the scraper mechanism. Maintenance of the operating clarifier is not possible until the non-functional clarifier can be returned to service. In the event that the single functioning clarifier ceases to operate, the plant would no longer be able to effectively treat wastewater.

1.4 Tertiary Filtration System

It was observed that plastics and other floatable solids were passing through the tertiary filters to the chlorine contact basin. The backwash return flows from the tertiary filters to headworks were also significantly higher than expected. The plant staff reported that these problems with the tertiary filtration system have been ongoing for a long time and that they had been unable to correct them.

1.5 Disinfection System

The plant staff reported that the existing gas chlorine disinfection system was maintained and tested on a regular basis by a third party and that performance was consistently satisfactory. However, they also noted that special training was required to work with the gaseous chlorine and that given the plant's isolated location and the small number of staff on-site, there is a danger that an accident during the changeout of the gas cylinders could lead to a serious incident.

The chlorine contact basin was in good condition, however it contained floating materials that had not been removed by the tertiary filtration system.

1.6 Sludge Handling System

The sludge drying beds were not in use. Plant staff reported that the beds have been ineffective in draining water from sludge, so they have been replaced by the centrifuge. The centrifuge was operating correctly, however plant staff reported that there were problems with freezing during cold weather. The centrifuge was being fed thin sludge directly from the Return Activated Sludge (RAS) System which reduced its capacity.

1.7 Electrical System

The plant staff reported that the plant electrical system had been performing well. Switchgear appeared visually to be in good condition. The standby generator was regularly maintained and tested and had performed reliably.

1.8 Effluent Box

No issues were noted or reported with the plant effluent box.

1.9 Percolation Ponds

The plant staff reported that the performance of the percolation ponds had deteriorated and that removal of deposited materials from the surface of the beds had not been successful in restoring their performance. Performance of the percolation ponds was a limitation on plant capacity during periods when effluent could not be discharged for reuse.

2. Preliminary Recommended Improvements

It was concluded from the site visit that the plant was in need of significant improvements to allow it to perform reliably per its original design. These improvements can be subdivided into two categories:

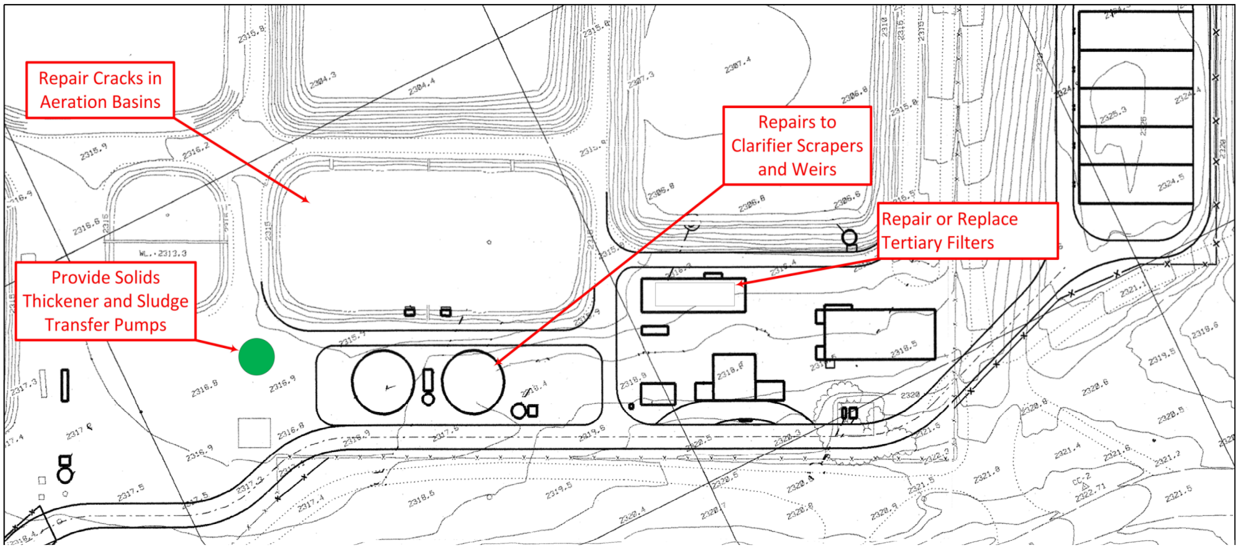
- Facilities that are not functioning and require immediate replacement to restore the desired level of plant performance (Functional Improvements);
- Facilities that are currently functioning but are in imminent danger of failure and should be replaced to maintain the security of plant performance (Reliability Improvements).

The facilities in these two categories and the required improvements associated with them are described in the following sections.

2.1 Functional Improvements

Functional Improvements are features that are severely underperforming or not functioning and require immediate replacement to restore the plant to its original capacity. The functional improvements are identified in Figure 1 (green indicates a completely new facility or system) and described in the following paragraphs.

Figure 1 – Location of Functional Improvements



2.1.1 Aeration Basins

The presence of underwater cracks in the aeration basins should be confirmed and any identified cracks repaired to eliminate the possibility of partially treated wastewater seeping into the ground. The basins will need to be drained, one at a time, to allow cracks to be identified and repairs to be carried out. It is impossible to confirm the presence of cracks and the extent of repairs required until the basins are drained. Grit and other residuals that may have accumulated in the basins should also be removed when the basins are drained to allow for inspection and any necessary crack repair. The removal of a basin from service to allow for crack repair will place a significant strain on the treatment capabilities of the plant. If it is planned to add aeration basin capacity to cope with future flows, it would be desirable to add the additional capacity before taking the existing basins off line. If the basin repair work is carried out before a capacity expansion, it may be necessary to provide some temporary treatment capacity while the basins are being repaired.

2.1.2 Clarifiers

Clarifier No. 1 is operating although the weir needs adjustment and the scraper mechanism needs maintenance. Clarifier No. 2 is not in operation because the scraper mechanism is not working. Repairs to the scraper mechanism and adjustment of weirs in Clarifier No. 2 should be carried out first. This work can be carried out while Clarifier 1 remains in service. After Clarifier 2 returns to service, Clarifier 1 can be temporarily taken out of service to allow the weirs in this clarifier to be adjusted and maintenance to be carried out on the scraper mechanism.

2.1.3 Tertiary Filtration System

This system is non-functional and needs to be replaced. There are a number of options for this including a very extensive overhaul of the existing system, replacement by a similar system or replacement by a cloth media filtration system. Selection of a final system will require additional analysis and discussion with the City and the operations team. For cost estimating purposes, it has been assumed that the existing system will be replaced by a cloth media system. In addition to the cloth filters system, the associated chemical dosing system and backwash handling facilities will be needed.

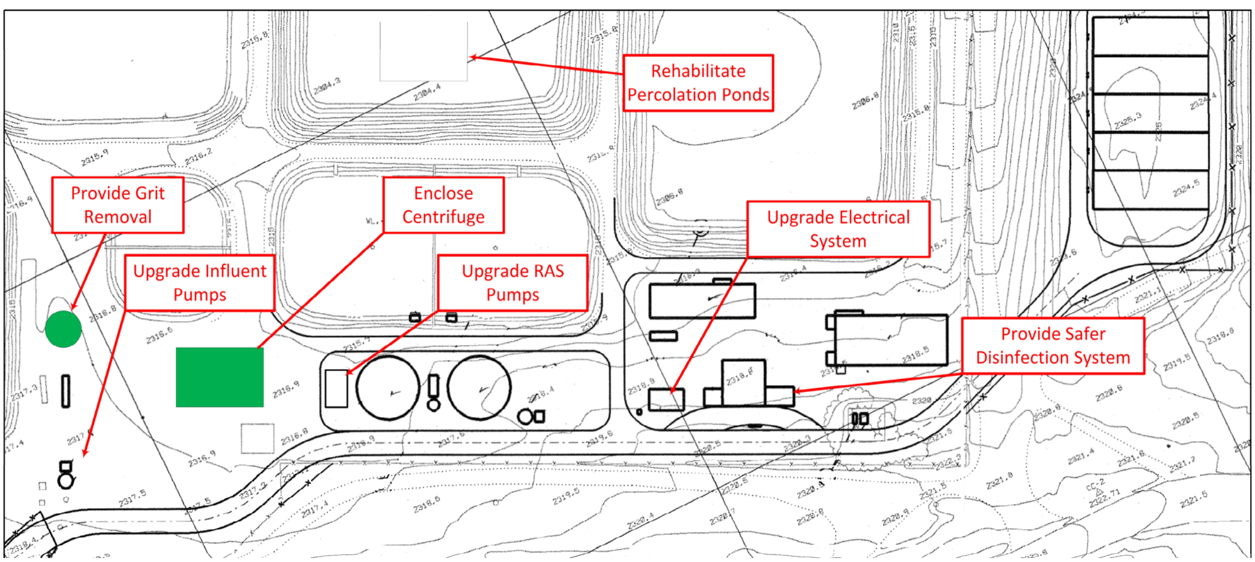
2.1.4 Sludge Dewatering

The existing centrifuge is functioning correctly but is being fed a very thin sludge which limits its capacity. A sludge thickening system should be added upstream of the centrifuge to improve performance. The sludge thickening system could be either mechanical or gravity system. For cost estimating purposes, it has been assumed that a gravity thickening system will be provided. A thickened sludge pump station will also be needed to transfer sludge from the thickeners to the centrifuge.

2.2 Reliability Improvements

Reliability improvements are identified as improvements to systems that are currently functional but are in imminent danger of failure and should be upgraded to maintain the security of plant capacity. These reliability improvements are identified in Figure 2 (green indicates a completely new facility or system) and described in the following paragraphs.

Figure 2 – Location of Reliability Improvements



2.2.1 Disinfection System

The existing disinfection system uses chlorine gas which is a hazardous chemical. Many wastewater facilities are phasing out the use of chlorine gas in favor of systems which present fewer hazards to staff and the general public. It is recommended that California City phase out the use of chlorine gas. Alternatives to replace chlorine gas include on-site generated sodium hypochlorite, bulk delivered sodium hypochlorite and UV disinfection. For cost estimating purposes it has been assumed that bulk delivered sodium hypochlorite will be utilized.

2.2.2 Grit Removal System

Grit is defined as inorganic settleable solids typically similar to sand particles in size. The plant at present has no facilities for the removal of grit. As a result, any grit entering the plant will tend to settle out in the aeration basins. Over time the buildup of grit in these basins reduces their capacity and impairs the effectiveness of the biological treatment process. To protect the aeration basins, it is recommended to install a grit removal facility between the inlet screening and the aeration basins. A variety of types of grit removal equipment are available. For cost estimating purposes it has been assumed that a vortex type grit removal system will be installed.

2.2.3 Electrical and Control Systems

The existing plant electrical systems were mostly installed in the early 1990s and are approaching the end of their normal service life. It is recommended that a more detailed evaluation of the condition of this equipment be performed to determine the best alternatives for upgrading this system. For cost estimating purposes, it has been assumed that the existing equipment will be replaced with new equipment of a similar type.

2.2.4 Pumping Systems

The existing influent pumps are submersible pumps and Return Activated Sludge (RAS) pumps have been in service since the early 1990s and are approaching the end of their service life. This equipment is essential to the operation of the plant and replacement is recommended to ensure continued reliable operation.

The RAS pumps can be replaced with equipment of similar types although sizing of the pumps should be checked against current and projected future design flows. The influent pumps are currently of submersible type and pose difficulties for maintenance. Replacement by dry well type pumps is recommended. The influent pumps may need to have their duty reevaluated if grit removal equipment is added.

2.2.5 Solids Dewatering System

The current centrifuge is performing satisfactorily, however in cold weather it is subject to freezing which impedes its operation. To provide for more reliable operation it is recommended to install the centrifuge in a new structure equipped with heating.

2.2.6 Percolation Ponds

The existing percolation ponds are underperforming. Further investigation is necessary to identify effective improvements to provide sufficient capacity. For cost estimating purposes the cost of additional geotechnical borings and analysis to complete the investigation has been included.

3. Cost Estimate

The probable project costs of the identified improvements are given in the table below. The estimate serves for feasibility/evaluation and is considered to be an AACE Class 4 level. Class 4 has a typical accuracy range of -30% on the low side and +50% on the high side. A 35% design contingency has been added to the estimate based on current status of the design documents, the nature of the project and the estimate classification. A detailed buildup of the estimate is given in Appendix A.

Table 3-1: Functionality Improvements

Element	Cost
Aeration basin repair	$240,000
Clarifier rehabilitation	$200,000
Chemical dosing	$160,000
Flocculation tank	$120,000
Tertiary filter	$1,170,000
Gravity thickener	$120,000
Thickened sludge pump station	$100,000
Site Work (Yard Piping, Ductbanks, Site Civil, etc.)	$250,000
Electrical and Instrumentation and Control	$700,000
Total	**$3,060,000**

Table 3-2: Reliability Improvements

Element	Cost
Replace existing gas chlorine system	$ 500,000
Replace electrical system	$ 1,660,000
Replace inlet works pumps	$ 420,000
Fine screens	$ 380,000
Grit removal	$ 360,000
Centrifuge enclosure	$ 10,000
Headworks enclosure	$ 20,000
Percolation ponds (geotechnical borings and analysis only)	$ 180,000
Site Work (Yard Piping, Ductbanks, Site Civil, etc.)	$ 790,000
Electrical and Instrumentation and Control	$ 800,000
Total	**$ 5,110,000**

4. Conclusion

The Wastewater Treatment Plant is currently not performing as designed due to the deterioration of many major components. Additional performance and reliability deterioration is likely in future as components continue to age. Rehabilitation or replacement of system components is recommended to address this decline in performance.

The proposed functional and reliability improvements will improve the performance of Wastewater Treatment Plant and should allow it to treat flows up to its current permitted capacity. However, the proposed prison capacity expansion and other potential population increase will require an increase in treatment capacity beyond current permit limits.

The next phase of this study will evaluate the improvements to the plant necessary to accommodate these proposed population and resulting flow increases. This evaluation will also consider potential economies of scale in addressing the functional and reliability improvements in parallel with capacity expansion.

Appendix A: Preliminary Cost Estimate

1. Introduction

This estimate is for miscellaneous upgrades to a wastewater treatment facility. The project work is to be performed in California City, Kern County, California. The general scope is listed below:

- Functionality Improvements
  - Aeration basin crack repair
  - Clarifier skimmer replacement
  - Chemical dosing system replacement
  - Flocculation tank replacement
  - Tertiary filter installation
  - Gravity thickener construction
  - Thickened sludge pump station construction
  - Associated civil, electrical and instrumentation and control work
- Reliability Improvements
  - Replace chlorine gas dosing system
  - Replace aging electrical system
  - Replace aging pumps (RAS, WAS, inlet pumps)
  - Install fine screen
  - Install grit removal
  - Centrifuge enclosure
  - Headworks enclosure
  - Percolation pond
  - Associated civil, electrical and instrumentation and control work

The estimate serves for feasibility/evaluation and is considered to be an AACE Class 4 level. Class 4 has a typical accuracy range of -30% on the low side and +50% on the high side. A 35% design contingency has been added to the estimate based on current status of the design documents, the nature of the project and the estimate classification.

2. Estimate Basis

Estimate costs are derived from the following:

1. Discussions with project team

3. Planning Basis

Base Assumptions are the following

1. The project is assumed to be procured as a single prime contract through a traditional design/bid/build process.

4. Cost Basis

1. Wage rates utilized are based on prevailing wages published for Kern County current to June 30, 2019.
2. A 40-hour work week is assumed, no overnight, shift, weekend or other premium time is provided.
3. Wherever possible, equipment rates are based on current published rental rates as listed in the AED Blue Book, supplemented by RS Mean's data, the AED Green Book and local rental suppliers.
4. Crews, equipment and productivity used for work items are based mostly on standards specific to each trade. Some information was supplemented by RS Mean's data modified where necessary by estimator judgment.

5. Itemized Estimate Notes

1. Estimated scope is as follows:
    - Functionality Improvements
        - Aeration Basin
            - 2 basin (100'x64'x9')
            - Drain and clean tank
            - Allow for miscellaneous crack repair
        - Clarifier rehabilitation
            - 1 clarifier (45-ft diameter)
            - Remove existing scum scraper and effluent baffle
            - Allow for miscellaneous concrete repair at removed baffle locations
            - Furnish/Install new scum scraper and effluent baffle (FRP)
        - Chemical dosing
            - Allow for demolition of existing system (Allow 2 cds)
            - Place concrete containment
            - Furnish/Install storage tank (assume 10,000 gal)
            - Furnish/Install 2 dosing pumps
            - Allow for miscellaneous piping within the containment area
        - Flocculation tank
            - Demolish existing flocculation tank (Allow 3 cds, assume similar size to new)
            - Place new CIP flocculation tank (10'x10'x9.5')
            - Allow for interior coating
            - Allow for 1-5hp mixer
            - Allow for railings/stair/etc.
        - Tertiary filter
            - Furnish/Install 2mgd peak cloth filter
        - Gravity thickener
            - Place CIP thickener tank (15' diameter x10')

- Allow for interior coating
- Allow for railings/stair/etc.

- Thickened sludge pump station
  - Allow for slab-on-grade (10'x15'), housekeeping pads
  - 2 progressive cavity pumps
  - Allow for misc. piping within the slab
- Sitework
  - Allow for yard piping, ductbanks, paving, grading and other ancillary work
  - Assume 8% of total cost
- Electrical and I&C
  - Allow for conduit/wire, MCC, lighting, instrumentations, integration and other ancillary work
  - Assume electrical is 15% and I&C 5% of total cost

- Reliability Improvements
  - Replace existing chlorine gas system
    - Demolition existing system (Allow 5cds)
    - Furnish/Install hypochlorite dosing system
      - Include storage tank, dosing pumps (2), allow for associated piping
      - Assume containment structure within a CMU building
  - Replace electrical system
    - Provide new ductbanks
      - 2,500lf power/control/signal
      - 980lf for site lighting
      - 1 electric manhole
      - 10 pull boxes
      - 9 site lights
      - Service switchboard
      - ATS (1000A)
      - MCC-1M (1000A, 480V, 8 sections)
      - Existing MCC (600A, 480V, 3 sections)
      - Influent pump MCC (225A, 480V, 1 section)
      - 4 lighting/distribution panels
      - Transformers (1-45kVA, 1-25kVA, 1-5kVA)
      - Allow for emergency generator (250kW)
      - Allow for termination, tagging and testing
  - Replace inlet works pumps
    - Excavate for new wet well
    - Place new CIP wet well (5'x5'x10')
    - Allow for hatch
    - Furnish/Install 2 pumps
    - Allow for misc. piping within the wet well and to common discharge header
    - Allow for dewatering

        - Allow for 2mgd bypass
    - Fine screens
        - Remove existing bar screen
        - Place dumpster slab (10’x5’)
        - Furnish/Install fine screen (2’x5’ channel) and washer-compactor
    - Grit removal
        - Construction new CIP channel (20’x2.5’x4’ – total length influent/effluent) and vortex chamber (4’x4’x15’)
        - Allow for hatch over chamber
        - Allow for railings/ladder
        - Furnish/Install vortex grit equipment (including grit pump and classifier)
    - Centrifuge enclosure
        - Assume prefab metal structure (10’x10’)
    - Headworks enclosure
        - Assume decking over existing channel (5’x10’)
    - Percolation ponds
        - Assume 7 borings and engineering hours to provide a report with recommendations for percolation
    - Sitework
        - Allow for yard piping, ductbanks, paving, grading and other ancillary work
        - Assume 8% of total cost
    - Electrical and I&C
        - Allow for conduit/wire, MCC, lighting, instrumentations, integration and other ancillary work
        - Assume electrical is 15% and I&C 5% of total cost (not including replacement of existing electrical distribution system)

6. Below the Line Adders

The following adders were used:

Below the Line Adders	
Item	**%**
General Conditions	15
Contractor Overhead	10
Contractor Profit	10
Insurance and Bonding	3
Contingency	35

These factors are generally in-line with recent estimated projects in this location and of this size and conform to the AACE Class of each scope.

7. Other Assumptions

Additional assumptions to the estimate include:

1. It is assumed that all process equipment to be demoed are not in operation and will be de-energized prior to being turned over to the Contractor unless otherwise noted.
2. Bypass at the inlet works will be provided, however all of the remaining work is assumed to be done without impacting plant's ability to meet effluent limits.
3. It is assumed that excavations will not be impacted by high groundwater.
4. An allowance has been made for sitework but it is assumed that connections to existing process and utility pipes are not overly difficult to match and no extensive site prep is required.

8. Exclusions

The following items are specifically excluded from the scope of this estimate:

1. Hazardous material abatement, removal or disposal
2. Dewatering, except as noted for the inlet works.
3. Temporary treatment
4. Temporary bypass, except as noted for the inlet works

9. Exceptions

None taken.

10. Risks and Opportunities

Some risk items and opportunities need to be considered in the process of reviewing estimated costs. These are the following:

1. When demolishing existing equipment and structures, there is the risk that the work will uncover hazardous materials. This would increase the cost and duration of the job.
2. Rehabilitating an existing structure carries the risk that demolition or modification to the existing structure will reveal defects or compliance issues that would increase the cost and duration of the work.
3. The current political situation with regards to tariffs and potential trade wars, makes forecasting future construction bids more uncertain. As a hedge the City may want to include specification language which provides relief to Contractors if material prices rise by tying escalation to government indices. This would reduce Contractor's risk and hopefully result in lower bids.
4. Whenever underground work is required there is the danger of delays resulting from unmarked utilities, cultural artifacts or other unforeseen conditions.

11. Estimate Quality Assurance

Estimate review has been ongoing. No second party review has been undertaken.

12. Estimating Team

Oversight to the estimating team is provided by Ian Mackenzie, PE and Derya Dursun, PE, PhD.

The principal or lead estimator is Chris Portner, P.E, CEP.

All estimate reviews have been internal reviews by the Design and Estimating Teams.

City of California City

Wastewater Treatment Plant Improvements

Functionality repairs

Item	Description		Raw Cost	Cost Including Markups and Contingencies (Rounded)
0	*General Conditions*	*15%*	*$236,769*	
1	*Aeration basin repair*		*$ 123,225*	*$ 240,000*
2	*Clarifier rehabilitation*		*$ 102,949*	*$200,000*
3	*Chemical dosing*		*$ 80,638*	*$ 160,000*
4	*Flocculation tank*		*$ 63,213*	*$ 120,000*
5	*Tertiary filter*		*$ 603,791*	*$ 1,170,000*
6	*Gravity thickener*		*$ 60,311*	*$ 120,000*
7	*Thickened sludge pump station*		*$ 49,982*	*$ 100,000*
8	*Site Work (Yard Piping, Ductbanks, Site Civil, etc)*		*$ 130,093*	*$ 250,000*
9	*Electrical and I&C*		*$ 364,261*	*$ 700,000*
		Subtotal:	**$ 1,815,233**	
	Contractor Overhead	*10%*	*$ 181,523*	
		Subtotal:	**$ 1,996,756**	
	Contractor Profit	*10%*	*$ 199,676*	
		Subtotal:	**$ 2,196,431**	
	Escalation at 3% annually		*$ -*	
		Subtotal:	**$ 2,196,431**	
	Bond and Insurance	*3%*	*$ 65,893*	
		Subtotal:	**$ 2,262,324**	
	Contingency	*35%*	*$ 791,814*	
		Probable Bid Cost:	**$ 3,054,000**	**$ 3,060,000**

City of California City
Wastewater Treatment Plant Improvements
Reliability repairs

Item	Description		Raw Cost	Cost Including Markups and Contingencies (Rounded)
0	*General Conditions*	*15%*	*$ 396,671*	
1	*Replace existing gas chlorine system*		*$ 257,334*	*$ 500,000*
2	*Replace electrical system*		*$ 855,791*	*$ 1,660,000*
3	*Replace inlet works pumps*		*$ 218,620*	*$ 420,000*
4	*Fine screens*		*$ 198,257*	*$ 380,000*
5	*Grit removal*		*$ 183,393*	*$ 350,000*
6	*Centrifuge enclosure*		*$ 5,000*	*$ 10,000*
7	*Headworks enclosure*		*$ 12,500*	*$ 20,000*
8	*Percolation ponds*		*$ 90,900*	*$ 180,000*
9	*Site Work (Yard Piping, Ductbanks, Site Civil, etc)*		*$ 409,904*	*$ 790,000*
10	*Electrical and I&C*		*$ 412,772*	*$ 800,000*
		Subtotal:	**$ 3,041,141**	
	Contractor Overhead	*10%*	*$ 304,114*	
		Subtotal:	**$ 3,345,255**	
	Contractor Profit	*10%*	*$ 334,526*	
		Subtotal:	**$ 3,679,781**	
	Escalation at 3% annually		-	
		Subtotal:	**$ 3,679,781**	
	Bond and Insurance	*3%*	*$ 110,393*	
		Subtotal:	**$ 3,790,174**	
	Contingency	*35%*	$ *1,326,561*	
		Probable Bid Cost:	**$ 5,117,000**	**$ 5,110,000**