Appendix P Water Systems Analysis

Appendices

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PSOMAS

TECHNICAL MEMORANDUM

To: Elizabeth Kim

From: Kim Alexander

Date: March 3, 2022

Subject: Draft Brea 265 Water System Analysis

Proposed Project

The Brea 265 Specific Plan (Project) consists of the redevelopment of the project area by Aera Energy from active oil operations into a proposed master-planned residential community. The Project will provide for a mix of housing, parks and recreational uses, and open space that are compatible with the existing neighborhoods in the area. The Brea 265 Specific Plan provides a maximum of 1,100 dwelling units within two residential land use categories, designated as Low Density Residential (LDR) and Medium Density Residential (MDR). The Land Use Summary is shown in Table 1 based on the October 14, 2021 Draft Specific Plan.

Table 1
Land Use Summary

Land Use	AC	DU's
Residential		
Low Density Residential (LDR)*	134.6	450
Medium Density Residential (MDR)	62.9	650
Non-Residential		
Parks/Recreation (PR)	15.1	N/A
Open Space (OS)	47.0	N/A
Right-of-Way (ROW)	2.0	N/A
Total	**262.1**	**1,100**

*Includes 1-acre public safety/civic uses

City Water Demand

City water demands were developed and projected in the City's 2020 Urban Water Management Plan (UWMP) based on projections prepared by CDM Smith as part of the 2021 OC Water Demand Forecast for Municipal Water District of Orange County (MWDOC) and Orange County Water District (OCWD). The demand projections were made for the Orange County region as a whole and also provided retail agency specific demands based on collaboration with MWDOC and OCWD member agencies.

The CDM Smith forecast methodology began with a retail water agency survey that asked for FY 2017-18, FY 2018-19, and FY 2019-20 water use by major sector, including number of accounts. Given that FY 2017-18 was a slightly above-normal demand year (warmer/drier than average) and FY 2018-19 was a slightly below-normal demand year (cooler/wetter than average), water use from these two years were averaged to represent an average-year base water demand.

For the residential sectors (single-family and multifamily) the base year water demand was divided by households in order to get a total per unit water use (gallons per home per day). In order to split household water use into indoor and outdoor uses, three sources of information were used: (1) the Residential End Uses of Water (Water Research Foundation, 2016); (2) California's plumbing codes and landscape ordinances; and (3) California Department of Water Resources (DWR) Model Water Efficient Landscape Ordinance (MWELO) calculator.

Three different periods of residential end uses of water were analyzed as follows:

- Pre-2010 efficiency levels – Has an average indoor water use that is considered to be moderately efficient, also does not include the most recent requirements for MWELO.
- High-efficiency levels – Includes the most recent plumbing codes that are considered to be highly efficient, and also includes the most recent requirements for MWELO.
- Current average efficiency levels – Represents the weighted average between pre-2010 efficiency and high efficiency levels, based on average age of homes for each retail water agency.

For outdoor residential water use, the indoor per capita total was multiplied by each member agency-specific persons per household in order to get an indoor residential household water use (gallons per day per home), and then was subtracted from the base year total household water use for single-family and multifamily for each agency based on actual water use as reported by the agency surveys.

For existing residential homes, the current average indoor and outdoor water use for each member agency were used for the year 2020. It was assumed that indoor water uses would reach the high efficiency level by 2040. Based on current age of homes, replacement/remodeling rates, and water utility rebate programs it is believed this assumption is very achievable. It was also assumed that current outdoor water use would be reduced by 5% by 2050.

For new homes, the indoor high efficiency level was assumed for the years 2025 through 2050. Outdoor uses for new homes were assumed to be 25% and 30% lower than current household water use for single-family and multifamily homes, respectively. The resulting residential water demand projections utilized in the City's 2020 UWMP are shown in Table 2.

Table 2
Unit Water Use Factors from Brea 2020 UWMP

	2025	2030	2035	2040	2045
Residential Dwelling Units	**17,053**	**17,068**	**17,068**	**17,265**	**17,476**
Single-Family	9,579	9,594	9,594	9,622	9,628
Multi-Family	7,474	7,474	7,474	7,643	7,848
Residential Demand (AFY)	**4,797**	**4,724**	**4,646**	**4,603**	**4,622**
Single-Family	3,692	3,640	3,583	3,535	3,522
Multi-Family	1,105	1,084	1,063	1,068	1,100
Residential Unit Demand (gpd/du)					
Single-Family	344	339	333	328	327
Multi-Family	132	129	127	125	125
Population	*45,883*	*46,615*	*47,697*	*48,155*	*48,236*
Per-capita Residential Use	*93.3*	*90.5*	*87.0*	*85.3*	*85.5*
Source: City of Brea 2020 UWMP and Center for Demographic Research at California State University, Fullerton, 2020					

Existing and projected population, single-family and multifamily households for each retail water agency were provided by the Center for Demographic Research at California State University Fullerton (CDR) under contract by MWDOC and OCWD. CDR provides historical and future demographics by census tracts for all of Orange County. Census tract data is then clipped to retail water agency service boundaries in order to produce historical and projected demographic data by agency.

The projected number of residential dwelling units and the calculated per dwelling unit demand for single-family and multi-family homes is shown in Table 2. The best representation for water use in water efficient homes is given by years 2040 and 2045. It was assumed in the demand projections that existing home indoor use would reach high efficiency levels by 2040 and new homes would start off as efficient. This results in water efficient residential use factors of 327 gpd/du for single-family homes and 125 gpd/du for multi-family homes shown for 2040 in Table 2. These factors are slightly higher than what a new home factor would be because outdoor use for existing homes was only reduced by 5% by 2050 when compared to existing outdoor use while for new homes it was reduced by 25% for single-family and 30% for multi-family homes when compared to existing outdoor use.

The City identified water demands from anticipated new development in the 2020 UWMP and the 2021 Water Master Plan (WMP), including Brea 265. The estimated water demand for Brea 265 of 545.9 AFY is documented in Table 3-4 of the UWMP and Table 4-14 of the WMP. This demand quantity was calculated in the WMP using a single water demand factor, for single-family residential use, applied to the entire project acreage. The various demand factors in the WMP were generated on a per-acre basis using billed water use data for 2019 divided by the corresponding land use acreage from GIS. The year 2019 was chosen as a representative year most closely matching the five-year average water use from 2015 through 2019. A per-acre factor was developed for residential uses, rather than a per dwelling unit factor, because the

City's GIS data did not include the number of dwelling units. The resulting demand factors for single-family and multi-family uses in the WMP combine many different densities and ages of housing products. This is an appropriate approach to estimating system-wide future water demands for the WMP as a high-level planning document. A separate and more detailed demand projection for the Proposed Project is presented below based on Specific Plan land use data, metered water use for similar housing products, and estimated irrigation water use.

Proposed Project Demand Factors

Domestic Demand

The Project area will contain all new construction with mandated water conservation measures in place. The City provided 2018 water use data for newer developments within their service area that have residential densities similar to the Proposed Project. The year 2018 was selected because it had the highest metered water use since 2015 and would provide conservative results for modeling purposes. The developments provided were Olinda Ranch, Blackstone, and La Floresta. The average calculated densities and average water demand per dwelling unit (du) for these developments are summarized in Table 3.

Table 3
2018 Average Water Use by Residential Development

Development	Land Use	AC	DU's	Average Density (du/ac)	Average Use (gpd/du)
Olinda Ranch	Very Low Density	41	63	1.5	762
PA 6 Blackstone	SFD	33	93	2.8	407
PA 5 Blackstone	SFD	25	100	4.0	352
PA 8 La Floresta	Zero Lot Line SFD	16	77	6.0	218
PA 3 Blackstone	SFD Cluster	49	261	6.5	145
PA 3 La Floresta	SFD Cluster	12	89	8.5	144
PA 7 La Floresta	Townhomes			15.0	122

The residential land use data for the Project was split into the area west of Valencia Avenue and the area east of Valencia Avenue to account for the lower density product to the east. The Project's residential land use types and densities were compared with the water use data in Table 3 to estimate Project water demand factors on a per dwelling unit basis. The proposed demand factors also take into account estimated sewer flow generation factors that were calculated using September 2019 sewer flow monitoring data collected as part of this Project and documented in the Draft Brea 265 Sewer System Analysis dated February 2, 2022. Sewer flow represents indoor water use with the remainder of the water demand attributed to outdoor (irrigation) use. The recommended residential water demand factors for the Proposed Project are shown in Table 4 along with the resulting average water demand. The residential water use factors for the Project are conservatively higher than those used in the City's 2020 UWMP for new residential development.

Table 4
Proposed Project Water Demand Factors for Residential Use

Proposed Land Use	Acres	du/ac	DU's	Factor (gpd/du)	Average Demand (gpd)
WEST LOW DENSITY RESIDENTIAL					
Low Density Residential (LDR)	25.2	4.2	105	380	39,900
Public Safety/Civic(1)					330
Medium Density Residential (MDR)	49.0	10.3	507	160	81,120
Subtotal	**74.2**	**8.2**	**612**	**198**	**121,350**
EAST HILLSIDE RESIDENTIAL					
Low Density Residential (LDR)	109.4	3.1	345	420	144,900
Medium Density Residential (MDR)	13.9	10.0	143	160	22,880
Subtotal	**123.3**	**4.0**	**488**	**344**	**167,780**
Total Domestic	**197.5**	**5.6**	**1,100**		**289,130**

(1) Included in LDR land use in Specific Plan (PA 11). Average flow assumes 6 personnel and 55 gpcd.

The Specific Plan breaks down residential use into Low Density Residential (LDR) and Medium Density Residential (MDR) as opposed to the Single-Family and Multi-Family Residential categories used in the 2020 UWMP. The LDR category provides for detached and attached single-family homes. The MDR products provides for detached and attached single-family homes, townhomes, condominiums, and duplexes. Both residential categories are classified based on residential density shown in Table 4. The LDR demand factor for the western Project area of 380 gpd/du is based on the average water use for Blackstone Planning Area (PA) 5 and PA 6 shown in Table 3. The factor is conservatively high given the lower density of these existing housing products. It also correlates with the sewer generation factor of 230 gpd/du, assuming that approximately 60 percent of the water demand will be indoor use (sewer flow) and 40 percent outdoor use for irrigation. The LDR factor for the eastern Project area of 420 gpd/du is based on the lower density Blackstone PA 6 development. This factor also correlates with the sewer flow factor used for this product of 250 gpd/du, assuming the same 60/40 indoor/outdoor ratio.

A factor of 160 gpd/du is assumed for MDR homes in both the eastern and western Project areas based on the Blackstone and La Floresta Cluster homes and La Floresta zero lot line detached homes. This is conservative given the higher density product within the Project areas compared to the Blackstone and La Floresta homes. The MDR product correlates with the estimated sewer flow by assuming 80 percent indoor use (sewer flow) and 20 percent outdoor use. The lower outdoor use is anticipated for the MDR homes due to limited yard/landscape areas within these products. Water demand for the common area landscaping is accounted for separately and is described below.

In addition to the residential land uses, the Specific Plan provides for a reserved site for public safety/civic uses within PA 11 which is designated in the LDR category. Water demand for this public use was calculated using and estimated 6 personnel on duty at any one time and a demand of 55 gallons per capita per day (gpcd). The estimate of personnel on duty was provided by City staff.

Landscape Irrigation Demand

The parks and recreation area within the Project includes a 13-acre sports park to the west of Valencia Avenue and a 2.1-acre park to the east of Rose Drive. State mandated water conservation measures require an outdoor water budget that is consistent with the Department of Water Resources Model Water Efficient Landscape Ordinance (MWELO) adopted by the State Water Resources Board in 2015. The MWELO requires the calculation of a maximum applied water allowance (MAWA) for outdoor water use that is no more than 55% of the reference evapotranspiration (ETo) rate for residential landscaping and 45% for commercial landscaping. A landscape irrigation factor of 2,040 gpd/acre was calculated for the Project residential areas based on the MAWA using the ETo data for Monrovia, CA, obtained from California Irrigation Management Information System (CIMIS) and an ETo adjustment factor (ETAF) of 0.55 (55% of the ETo) for residential areas. The Monrovia CIMIS station is the closest station to the Project site and the ETo for that station was 49.85 inches per year. The resulting common area irrigation water demand estimate for the Project is shown in Table 5. The irrigated acreage for the residential common areas was provided by the developer's engineer, Hunsaker & Associates, and the park area is included in the Project Specific Plan. As a cross-check, the irrigation demand for the sports park was calculated using the proposed site plan along with the ETo and estimated plant factor and irrigation efficiency. The result was an estimated 31 AFY for the parks and recreation area compared to 35 AFY derived using the MAWA calculation.

Table 5
Proposed Irrigation Demand Factors

Land Use	Acres	Factor (gpd/ac)	GPD
Irrigated Common Areas	65.00	2,040	132,602
Parks/Recreation	15.10	2,040	30,805
Total	**80.10**		**163,407**
Monrovia ETo (in/yr)	49.85		

Total Demand

New developments are required to comply with current water conservation standards and are expected to have lower than average demand when compared to current City-wide use. As such, the recommended factors utilized in this analysis are sufficiently conservative and appropriate for planning purposes. The projected water demand for the Project, utilizing the factors described above, is summarized in Table 6. The required water supply for the Project would take into account water losses through the system. Using a 5 percent water loss, consistent with the 2020 UWMP, the total supply requirement equals 532 AFY.

Table 6
Water Demand Summary

Water Use	gpd	AFY
Residential	289,130	323.9
Irrigation	163,407	183.0
Total Water Demand	**452,537**	**507**

The population for the proposed Project is estimated using the factors utilized in the Project Environmental Impact Report (EIR) of 2.82 persons per du. The resulting population estimate is 3,102 for the Project. Using this population estimate and the calculated Project residential demand, the resulting residential per capita water use is equal to 93 gpd. In comparison, using data from the 2020 UWMP for year 2045 (water efficient homes), the residential per capita water use is equal to 86 gpd, again showing that Project water demand estimates used in this analysis are conservative, but reasonable.

Model Analysis

Water service will be provided to the proposed Project by the City of Brea from two pressure zones. For the Project area west of Valencia Avenue, at least two connections will be made to the City's 790 Zone to form a looped system. It is recommended that two connections are made to the City's 790 Zone pipeline in Valencia Avenue with a potential third connection point to the City pipeline in Lambert Road. Pressures will be reduced from the 790 Zone, through pressure reducing valves (PRVs), to a hydraulic grade line (HGL) of approximately 655 feet, providing static service pressures between approximately 60 and 80 psi. East of Valencia Avenue, the northern portion of the Project area will have at least two connections to the City's 790 Zone pipeline in Valencia Avenue with pressures reduced through PRVs, similar to the western project area, with a HGL of approximately 655 feet. The southern portion of the eastern Project area will have at least two looped connections to the City's 605 Zone pipeline along Rose Avenue. This service area does not require PRVs.

Onsite Water System

The onsite service pressures and fire flow were modeled utilizing the City's existing hydraulic model in InfoWater software by Innovyze. The conceptual backbone water system was incorporated into the model based on preliminary Project grading. The model junction map is included in Appendix A.
The system was evaluated using the following design criteria based on the City's 2021 Water System Master Plan Update (2021 WMP):

- Minimum service pressure of 40 psi during peak hour
- Maximum static service pressure of 80 psi, above which individual pressure regulators are required

- Minimum fire pressure of 20 psi during maximum day demand conditions
- Assumed fire flow of 1,500 gpm for single family residential and 2,500 gpm for multi-family residential use with actual flows to be determined by the local fire authority
- Pipeline velocity below 7 fps for non-fire flow conditions and below 15 fps for fire flow conditions

Maximum day and peak hour demands were estimated using the Project demand calculations above for average day and the peaking factors documented in the 2021 WMP as shown in Table 7. Maximum day demand is calculated using a peaking factor of 1.59 times the average demand and peak hour demand is calculated using a peaking factor of 3.00 times the average day demand.

Table 7
Water Demand Peaking

Water Demand	Factor	gpm
Average Day Demand	1.00	314
Maximum Day Demand	1.59	500
Peak Hour Demand	3.00	943

Model simulations indicate that the City's existing water system can supply sufficient service pressure and fire flow to the Project area to meet the above design criteria. Model output for peak hour and maximum day demand plus fire flow conditions is included in Appendix A for the conceptual, onsite water system. The final system must be designed appropriately based on the required fire flow as stipulated by the local fire authority but based on all new residential developments requiring fire sprinkler systems the assumptions used in the model should be conservative.

Off-site Water System

The City's water system was evaluated to determine impacts of Project demands on the existing distribution system and the potential for off-site improvement requirements. The City's water system model was updated as part of the 2021 WMP. Additionally, potential capital improvement projects were identified related to both existing and buildout conditions (including Brea 265). The City has experienced difficulty filling Valencia Reservoir during peak demand months. Because the Project area is in the vicinity of and would be supplied from the Valencia Reservoir, Project demands would aggravate the already strained conditions. This water supply analysis uses the existing model to evaluate specific offsite pump station and pipeline improvements needed to serve the increased demand from the Project while also providing sufficient supply capacity to Valencia Reservoir and the areas it serves.

Increased pumping capacity at Berry Street Booster Pump Station (BPS) was identified in the WMP as an improvement to meet existing system deficiencies. The existing high-pressure pumps (790 Zone) do not have enough capacity to supply maximum day demand with the largest pump out of service as required under primary booster pump design criteria. As such, the WMP recommended an additional high-pressure pump at Berry Street BPS. A minimum capacity of 1,191 gpm was identified to meet existing deficiencies and a minimum capacity of 1,778 gpm to meet future demands including the Project. The WMP also identified pipeline improvements along Valencia Avenue, between Birch Street and Lambert Road and from the Valencia Reservoir inlet/outlet line to Sandpiper Way, to eliminate bottlenecks in the system that supplies Valencia Reservoir and meet pipeline velocity design criteria. These pipelines are to be upsized from 12-inch to 24-inch in diameter which will match the diameter of the exiting 24-inch pipeline between these two segments along Valencia Avenue between Lambert Road to Sandpiper Way. The locations of the proposed pipeline improvements are illustrated in Appendix B. These capital improvement projects increase both pumping and pipeline capacities available to supply Valencia Reservoir, though they were not specifically evaluated for that purpose. Additionally, the pipeline improvements would reduce friction losses to the reservoir, thus requiring less added head at the pump station and ultimately lower energy costs.

The existing WMP model was updated to run extended period simulations (EPS) to better evaluate the emptying and filling of Valencia Reservoir under existing and proposed improved conditions. City staff provided hourly reservoir levels for a peak summer period from August 29 through September 2, 2021. Valencia Reservoir levels dropped from a high of about 24 feet (60 % full) down to about 16 feet in two days and then fluctuated between 16 (40 % full) and 19 feet (48 % full) during the peak period while the other reservoirs were able to maintain water levels. Valencia Reservoir is filled directly from Berry Street BPS and is located farthest from this primary source of water supply to the City. The remaining reservoirs are either at lower elevations and filled through altitude valves or at higher elevations and filled through and intermediate booster pump stations. Both of these controls allow for the other reservoirs to be easily filled.

Hourly imported water supply rates from California Domestic Water Company (CDWC) at Berry Street BPS and the calculated hourly volume change at the City's reservoirs were used to estimate the City's demand peaking. The average hourly volume of water entering the distribution system was divided by the average demand for the entire period to develop a universal demand peaking curve for input into the EPS model. City staff provided control data for Berry Street BPS (used to fill Valencia Reservoir), Tonner BPS (used to fill Tonner Reservoir), and the altitude valves that are used to fill Westside and Eastside Reservoirs (also from Berry Street BPS). This data was also incorporated into the EPS model. Simulations for consecutive maximum day demands over a 72-hour period demonstrate the existing conditions, with Valencia Reservoir emptying and then remaining at low levels while the other reservoirs maintain water levels. This is due to the combination of pipeline friction losses to Valencia Reservoir and the lower discharge head at Berry Street BPS during high flow rates simulated along the existing pump curves.

The proposed pipeline improvements along Valencia Avenue and up to the Reservoir were incorporated into the model for proposed conditions and simulations were conducted to evaluate the proposed increased pumping capacity to the 790 Zone at Berry Street BPS. The pipeline improvements alone increase flow to Valencia Reservoir but do not provide sufficient supply to maintain water levels. Results indicate that increasing the discharge pressure at Berry Street BPS does allow water levels to be maintained. The City did not have SCADA data available for Berry Street BPS but the control data provided indicates a discharge pressure range between 170 and 197 psi at the pumps. The pumps operate along pump curves which supply higher flow rates at a lower discharge pressure or lower flow rates at a higher discharge pressure. To fill the reservoir, increasingly higher head is needed as water levels in the reservoir increase.

The existing pumps provide a total dynamic head (TDH) of approximately 409 feet at peak flows. During maximum day demand EPS simulations, the resulting discharge pressure fluctuates between approximately 170 and 175 psi. Simulated average day demand indicates discharge pressures of approximately 180 psi at the BPS. Increasing the TDH at the BPS to approximate 425 feet at peak flow rates results in a discharge pressure of approximately 182 psi and allows Valencia Reservoir to maintain water levels over consecutive maximum days. This required discharge pressure is well within the existing discharge pressure range at the pump station and would not over pressurize the system. The proposed pump could be utilized during peak flow conditions to allow for higher flow rates at a higher discharge pressure without over pressurizing the system. Proposed Project demands were also added to the improved system with similar results. Modeled water levels at Valencia Reservoir both before and after the proposed improvements are included in Appendix B. These simulations include only water supply from CDWC through Berry Street BPS with no imported water from MWD.

The ability to fill Valencia Reservoir with the high-pressure pumps at Berry Street BPS is limited by the capacity of the I-Line from CDWC that supplies the Berry Street Reservoir on the suction side of the pump station. The existing maximum day demand of approximately 8,600 gpm, documented in the WMP, is already approaching the maximum capacity of the I-Line documented as 20 cfs (9,000 gpm) in Table 2-7 of the City's WMP. The current combined capacity of the Berry Street BPS for both the low-pressure (515 Zone) and high-pressure (790 Zone) pumps is 10,500 gpm, exceeding the capacity of the supply line. Higher pumping rates, above the capacity of the I-Line, can only be maintained for a limited period by utilizing storage at Berry Street Reservoir. With projected demand increases documented herein and in the Brea 265 Water Supply Assessment, including the Project, supplemental supply will be needed from MWD to meet demands and maintain water levels in storage tanks, including Valencia Reservoir.

Conclusion

Onsite water service and fire flow for the Project can be provided by the City's existing water distribution system within the required design criteria. The Project areas located east and west of Valencia Avenue will be served off of the City's 790 Zone through PRV's. The Project area located east of Rose Drive will be served directly off of the City's 605 Zone. The City's 605 Zone is also served off of the 790 Zone through PRVs.

The Project adds an average day demand of approximately 300 gpm and a maximum day demand of approximately 500 gpm, supplied primarily through the combination of Valencia Reservoir and the Berry Street high-pressure pumps (790 Zone). This system is already strained during peak demand conditions and the City is unable to maintain water levels in Valencia Reservoir. There is also an existing pumping deficiency in the 790 Zone. Added demands from the Project would exasperate these issues.

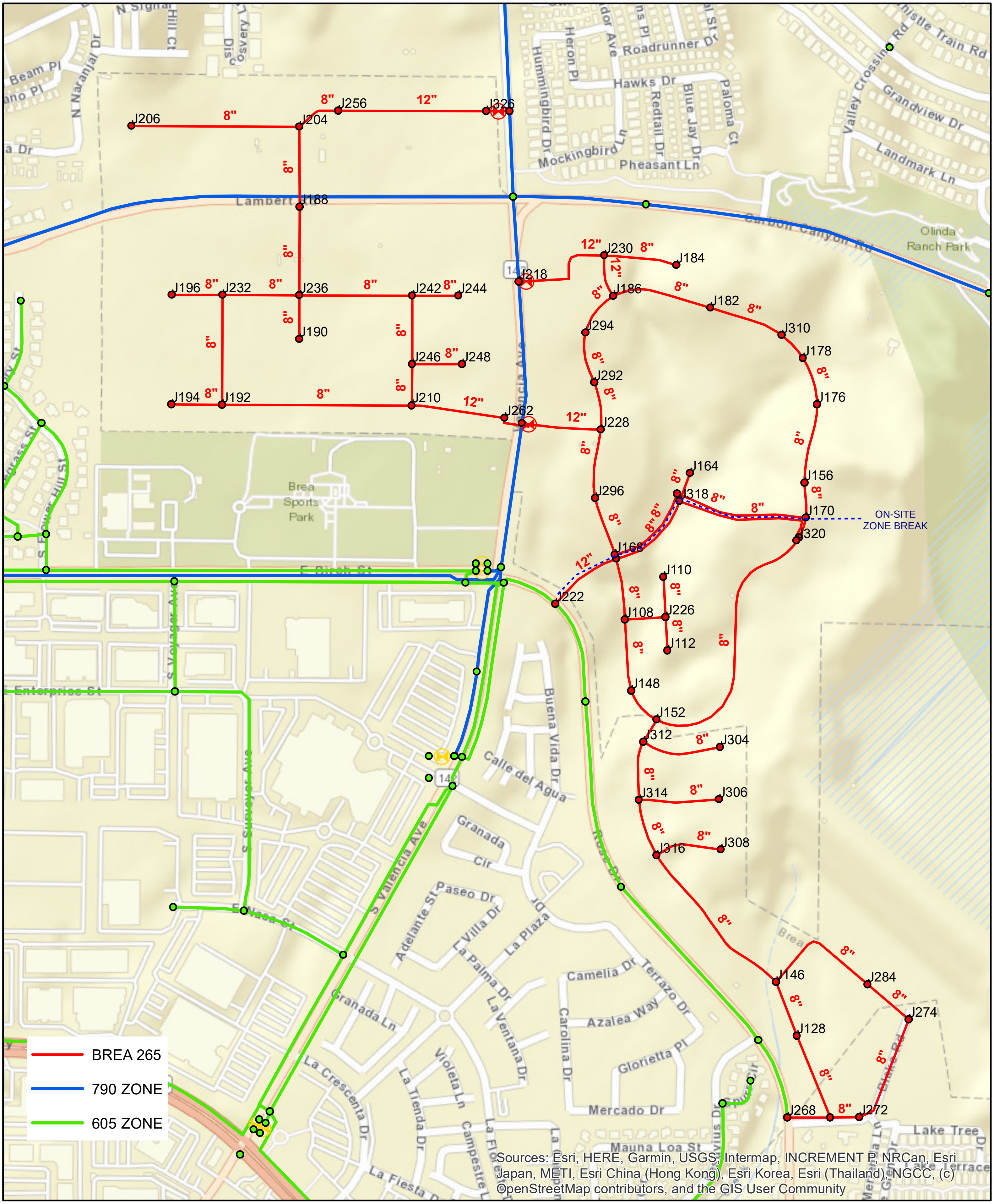
It is recommended to increase the capacity and discharge head to the 790 Zone at Berry Street BPS. There are three existing high-pressure pumps and a new fourth pump would be added to meet maximum day demands with one pump out of service. The capacity identified in the WMP of 2,000 gpm for the new pump is recommended. Additionally, the fourth pump may be utilized to increase discharge head during peak flow rates (approximately 7,000 gpm) by operating with the other three pumps to provide a TDH from the pump station of at least 425 feet. Prior to selecting a new pump and the future operation of the Berry Street BPS, it is recommended to collect SCADA data for pump station under existing conditions, including flow rates and discharge head/pressure, to confirm the existing operation of the system and the model results. The modeled flow rates for both the low-pressure (515 Zone) and high-pressure (790 Zone) pumps are impacted by many factors including the large number of PRV’s in the system and flow from the upper to the lower zone.

It is recommended that new 24-inch pipelines in Valencia Avenue be constructed to increase system capacity to fill Valencia Reservoir. This allows for a lower discharge head at Berry Street BPS and lower energy costs due to reduced friction losses. Approximately 1,270 LF of new 24-inch pipeline is recommended from the Reservoir inlet/outlet to Sandpiper Way, replacing existing 12-inch pipeline. Approximately 2,060 LF of new 24-inch pipeline is recommended from Lambert Road to Birch Street. The WMP noted that the existing 12-inch pipeline along Valencia Avenue, between Lambert Avenue and Birch Street, is in good condition and may be repurposed in the proposed reduced zone serving the Project once the new 24-inch pipeline improvement is constructed.

cc: Mike Swan, PSOMAS

APPENDIX A

Onsite Model Output



PSOMAS

Conceptual On-site Water System Model Junction Map

BREA 265 CONCEPTUAL ON-SITE WATER SYSTEM SIMULATIONS

PEAK HOUR DEMAND SIMULATION

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J326	34.6	530	656	54.8
J230	0.0	508	656	64.3
J184	20.1	514	656	61.7
J186	0.0	501	656	67.3
J294	20.1	495	656	69.9
J256	35.4	510	656	63.4
J292	20.1	486	656	73.8
J228	0.0	476	656	78.1
J182	21.0	513	656	62.1
J262	0.0	483	656	75.1
J296	29.0	461	656	84.6
J168	0.0	445	656	91.6
J162	0.0	458	656	85.9
J310	21.0	506	656	65.1
J154	0.0	472	656	79.8
J156	18.4	486	656	73.8
J170	12.0	477	656	77.7
J176	13.2	500	656	67.7
J178	21.0	529	656	55.1
J210	17.7	478	656	77.2
J204	36.2	506	656	65.1
J206	36.2	498	656	68.5
J246	21.1	484	656	74.6
J248	21.1	486	656	73.7
J188	23.4	505	656	65.5
J190	17.7	482	656	75.4
J192	29.7	467	656	81.9
J236	23.4	488	656	72.8
J242	41.4	489	656	72.4
J194	29.7	470	656	80.6
J232	29.7	482	656	75.4
J244	41.4	490	656	71.9
J196	29.7	477	656	77.6
J222	0.0	443	592	64.8
J106	0.0	445	592	63.9
J108	0.0	434	592	68.6
J318	0.0	456	592	59.3
J112	0.0	429	592	70.8
J164	32.8	459	592	57.8
J226	0.0	435	592	68.2
J268	0.0	402	592	82.5
J110	32.8	440	592	66.0

MDD PLUS FIRE FLOW SIMULATION

ID	Static Pressure (psi)	Static Head (ft)	Available Hydrant Flow at 20 psi (gpm)
J256	63	656	7,606
J294	70	656	6,918
J292	74	656	7,185
J162	86	656	4,482
J162	86	656	4,482
J168	92	656	5,390
J168	92	656	5,390
J296	85	656	6,059
J154	80	656	3,600
J170	78	656	3,891
J266	66	656	2,197
J188	66	656	5,352
J188	66	656	5,352
J246	75	656	6,441
J248	74	656	4,260
J190	76	656	4,295
J242	72	656	5,589
J192	82	656	5,103
J232	76	656	5,086
J244	72	656	3,919
J244	72	656	3,919
J222	69	603	3,576
J106	69	603	3,425
J108	73	603	3,228
J110	71	603	2,427
J112	76	603	2,575
J164	63	603	2,397
J318	64	603	2,657
J148	80	603	3,295
J268	87	603	3,495
J270	87	603	3,465
J272	86	603	3,329
J276	85	603	2,578
J278	85	603	2,682
J282	85	603	3,065
J320	57	603	2,234
J128	85	603	3,292
J146	84	603	3,236
J152	80	603	3,299
J274	84	603	3,221
J284	84	603	3,235
J312	81	603	3,224

BREA 265 CONCEPTUAL ON-SITE WATER SYSTEM SIMULATIONS

PEAK HOUR DEMAND SIMULATION

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J270	0.0	403	592	82.1
J272	0.0	404	592	81.6
J320	15.8	472	592	52.2
J148	0.0	419	592	75.1
J128	0.0	407	592	80.3
J152	0.0	419	592	75.1
J146	35.0	410	592	79.0
J274	35.0	409	592	79.4
J284	0.0	410	592	79.0
J312	0.0	417	592	76.0
J304	34.6	435	592	68.2
J314	0.0	412	592	78.1
J316	0.0	412	592	78.1
J306	34.6	430	592	70.3
J308	34.6	426	592	72.1

MDD PLUS FIRE FLOW SIMULATION

ID	Static Pressure (psi)	Static Head (ft)	Available Hydrant Flow at 20 psi (gpm)
J304	73	603	2,381
J306	75	603	2,362
J308	77	603	2,429
J316	83	603	3,047

APPENDIX B

Off-site System Improvements

2021 BREA WATER MASTER PLAN
Valencia Avenue Pipeline Improvements

MAXIMUM DAY DEMAND – SIMULATED AND OBSERVED WATER LEVELS