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Memorandum

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Subject	**Addendum 2 – New Desalter Site Assessment**
Project Name	Regional Brackish Water Reclamation Program Feasibility Study
Date	March 2021

1. Introduction and Purpose

The Water Replenishment District of Southern California (WRD) has identified a new potential location for the Centralized Regional Brackish Water Desalter near the intersection of W 208th Street and Crenshaw Boulevard in the City of Torrance. This technical memorandum presents and describes treatment equipment layouts for a 16,000 or 20,000 acre-feet per year (AFY) (feed water) desalter on this new potential plant site on the western parcel, adjacent to a new transit facility property. Also provided herein is a preliminary pipe sizing analysis for the yard piping from the desalter through 208th Street, just north of the property.

1.1 Background

WRD is responsible for managing and replenishing both the West Coast and Central groundwater basins. In the West Coast Basin, a significant saline plume of groundwater with elevated total dissolved solids has been trapped in the Gage, Silverado, Lynwood, and Lower San Pedro (equivalent to Sunnyside) aquifers because of historical seawater intrusion and the subsequent implementation of two injection barriers. To more fully utilize the West Coast Basin, WRD has initiated a Regional Brackish Water Reclamation Program (Program) to evaluate ways to use this impaired water supply. Program goals include treating the plume to produce potable water, and to discharge waste streams generated in the treatment process (which consists mostly of high-salinity brine or concentrate).

2. Site Overview and Benefits to the Program

In 2020, after completion of the Program's Draft Feasibility Study Report, the City of Torrance identified an alternative property for the centralized treatment facility on 208th Street, adjacent to the Torrance Transit Park and Ride Regional Terminal facility that is currently under construction. The alternative site, hereafter referred to as the 208th Street property, is 2.61 acres and is located approximately 1,500 feet directly to the north of the Elm and Faysmith site, which was evaluated in the Feasibility Study. Figure 2-1 shows the 208th Street property.

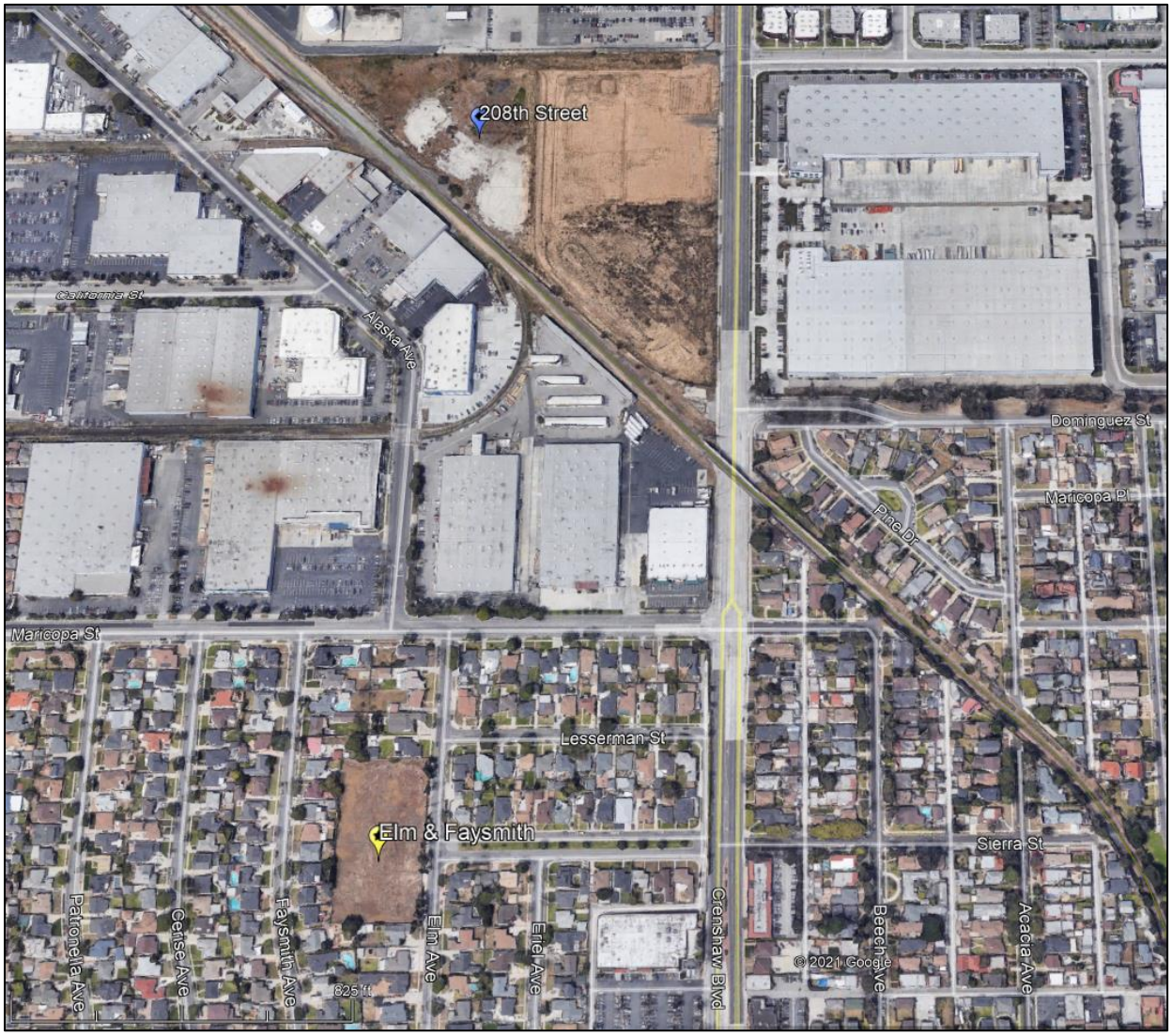

Figure 2-1. 208th Street Property Location and Proximity to the Elm and Faysmith Property

The 208th Street property possesses the same project benefits that were previously identified for the Elm and Faysmith property, including proximity to the Torrance potable distribution system and location along the leading edge of the plume. In addition, the 208th Street property is in a commercial area and therefore provides the added benefit of a reduced impact on neighboring residents during construction. For this reason, WRD and the City of Torrance have established the 208th Street property as the preferred location for the centralized desalter in place of the Elm and Faysmith site. The following is a summary of the site benefits relative to the Elm and Faysmith site:

- Since, unlike the Elm and Faysmith site, the 208th Street property is not located in a residential area:
  - Zoning of the 208th Street property will not need to be changed since is currently designated as heavy industrial.
  - There will be a lower impact to neighbors during construction and operations.
- The 208th Street site is a larger site than the Elm and Faysmith property. Thus, space is available for future expansion, less excavation would be required, and space is available for granular activated carbon (GAC) or other treatment alternatives upstream of reverse osmosis (RO).

- As is the case with the Elm and Faysmith site, the 208th Street site is close to potable distribution system, located along the leading edge of the plume, and is owned by a Program stakeholder.

2.1 Implications for the Completed Feasibility Study

Due to the close proximity and many similarities between the two alternative sites, the evaluations and recommendations that were presented in the Feasibility Study Report can be applied to implementation of the Program at either site. Minor adjustments or updated analyses will need to be completed as the Program moves forward in development, primarily related to modifications in the length of conveyance infrastructure that will be required and the desalter site layouts on this larger property. The following is a summary of the updates that will be performed in future detailed Program development:

- New treatment layouts
- Modified conveyance routes and cost estimates for:
  - Source water
  - Product water
  - Brine disposal

3. Area and Layout Details

Figure 3-1 displays a Google Earth image of the area (including, and around, the available parcel). The parcel is in the City of Torrance, is shaped like the state of Nevada, and will have road access only on the north side via 208th Street. 208th Street will therefore be the source and/or destination for chemical delivery trucks, as well as utilities, including power and pipelines for well water feed, product water, and brine waste flow.

Figure 3-1. Parcel Location

Figures 3-2 through 3-5 provide four potential desalter layouts that represent two different treatment capacities (treatment of 16,000 and 20,000 AFY of brackish groundwater) and two different clearwell configurations (above grade and below grade).

WRD has indicated a desire for the facility to include an educational center, and this has been placed on the north end of the property, closest to the street, for accessibility. The treatment process has been documented in Appendix A of the Feasibility Study Report (Conceptual System Design and Program Requirements), as well as other project documents, such as the potential for possible GAC as pretreatment to RO[1]. The incoming well water would, under well pump pressure, be directed to the GAC filters on the east (longest) side of the property. GAC filtrate would then be directed west, inside the treatment building to the cartridge filters, followed by the RO trains, then exit the building on the south, enter the air strippers, and then be collected in the clearwell after remineralization chemical addition. Two options have been provided for finished water storage, including either a belowgrade rectangular, or abovegrade circular, clearwell tank. The latter of these options would require an additional pump station between the air stripper sump and the circular clearwell. Clearwell water would be pressurized by a distribution pump station and directed northward to 208th Street to enter the Torrance distribution system. Distribution may also include a dedicated finished water pipeline for water distribution to the Los Angeles Department of Water and Power (LADWP).

Chemical storage is located inside the treatment building on the west side of the property. A 35-foot wide asphalt road area has been allocated between the treatment plant equipment/treatment building and the perimeter of the property for truck access. Delivery trucks would enter from 208th Street and drive south along the west side of the treatment building, where they would stop to make their deliveries. After delivery, they would drive counterclockwise around the treatment building to exit the property. Bollards would be placed at the perimeter of the clearwell and appropriate process equipment areas to direct the delivery trucks.

An RO clean-in-place and neutralization system has been included inside the process building. In addition, the process building includes an area of 25 by 125 feet, which is allocated for the control room, administration, the electrical room, and the laboratory. Roll up doors for equipment maintenance access would be located on the east wall of the treatment building and the south wall of the treatment building on the west side.

The GAC system includes a backwash pump station and a backwash water storage sink or collection point before sewering via gravity. The GAC system would be located outside, under a protective canopy.

[1] Jacobs Engineering Group Inc. 2020. *Performance Assessment and Pretreatment Recommendation*. November 25.

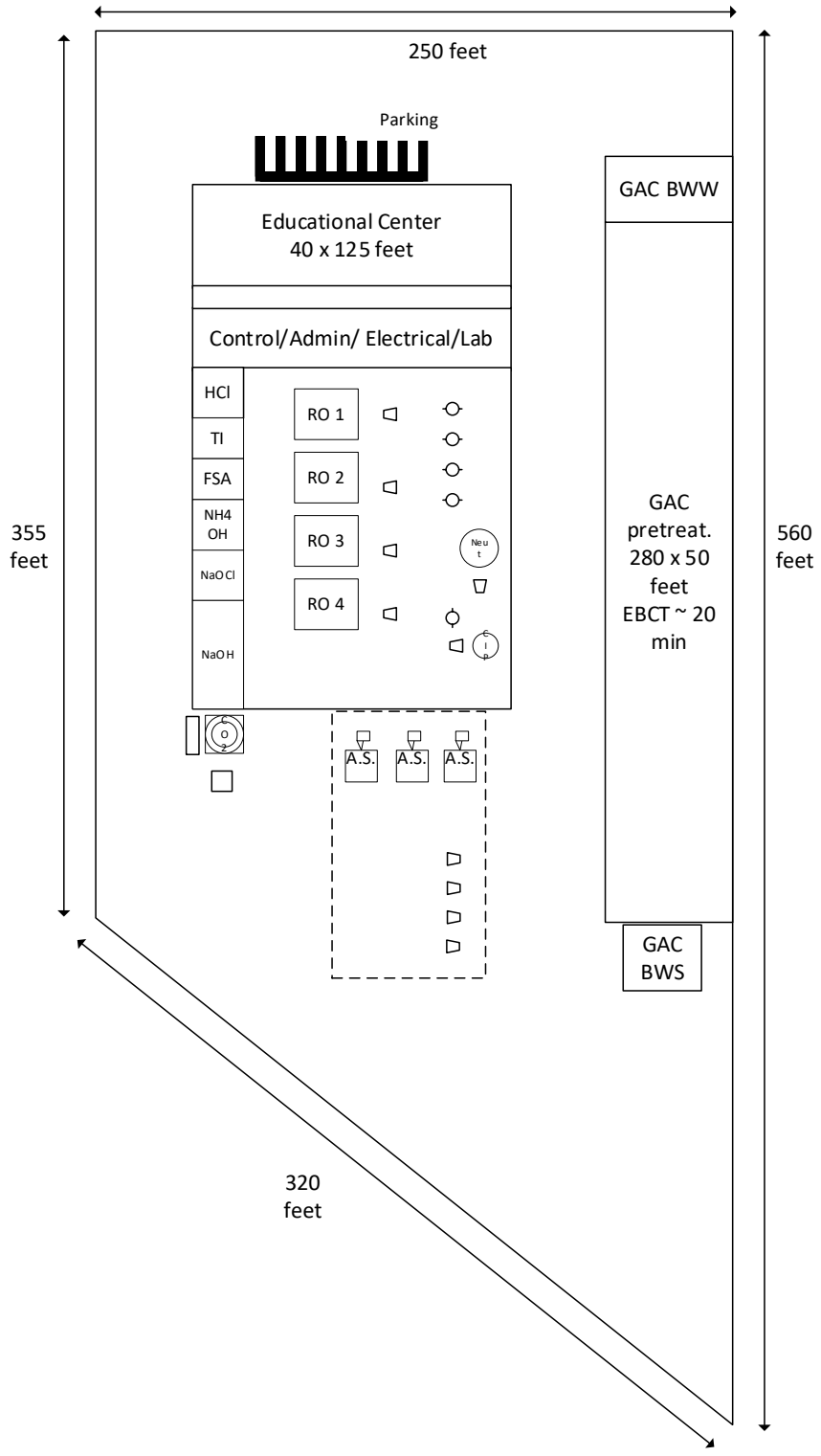

Figure 3-2. 16,000 AFY Desalter with Belowgrade (Rectangular-dashed) Clearwell

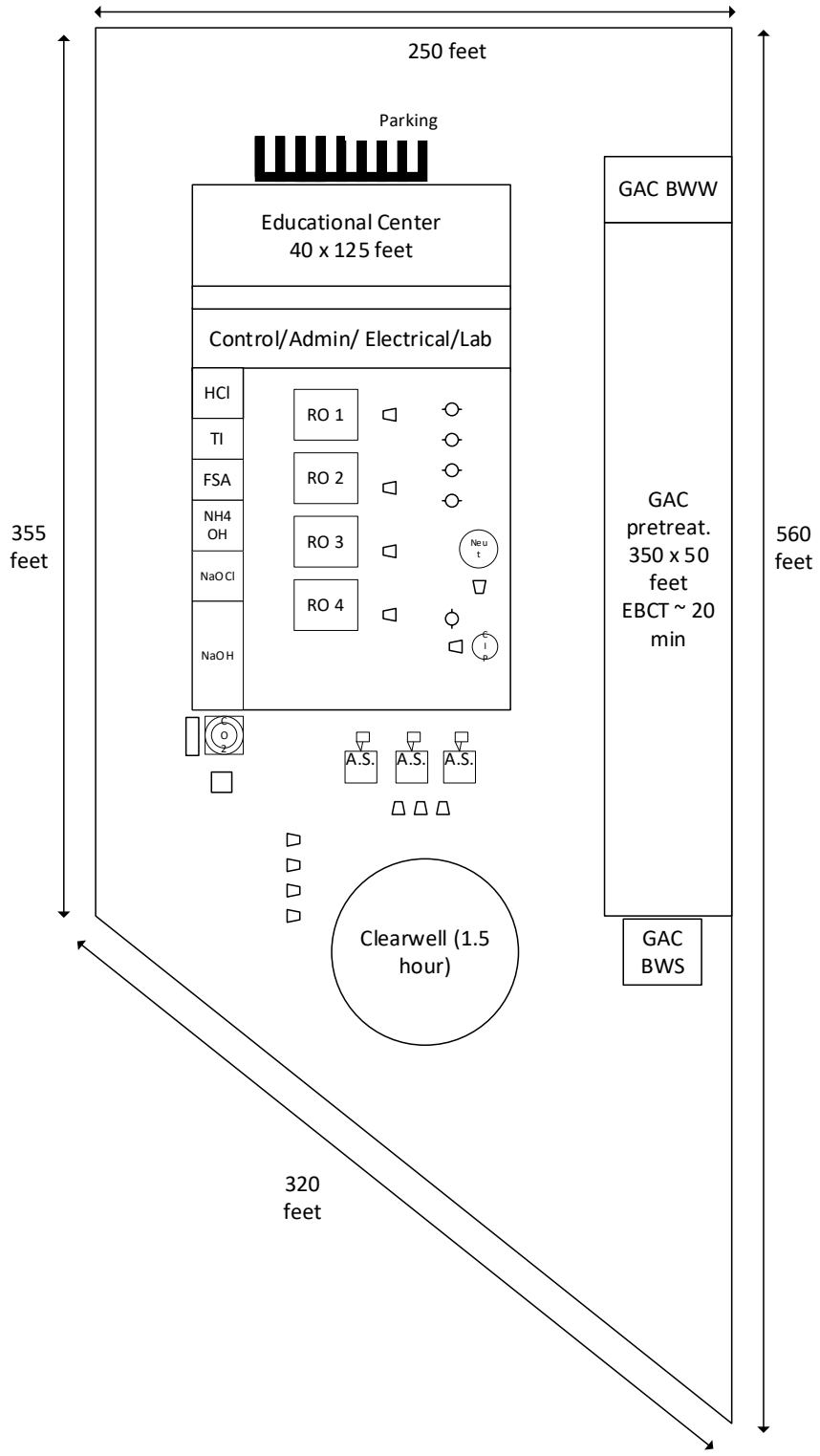

Figure 3-3. 16,000 AFY Desalter with Abovegrade Circular Clearwell

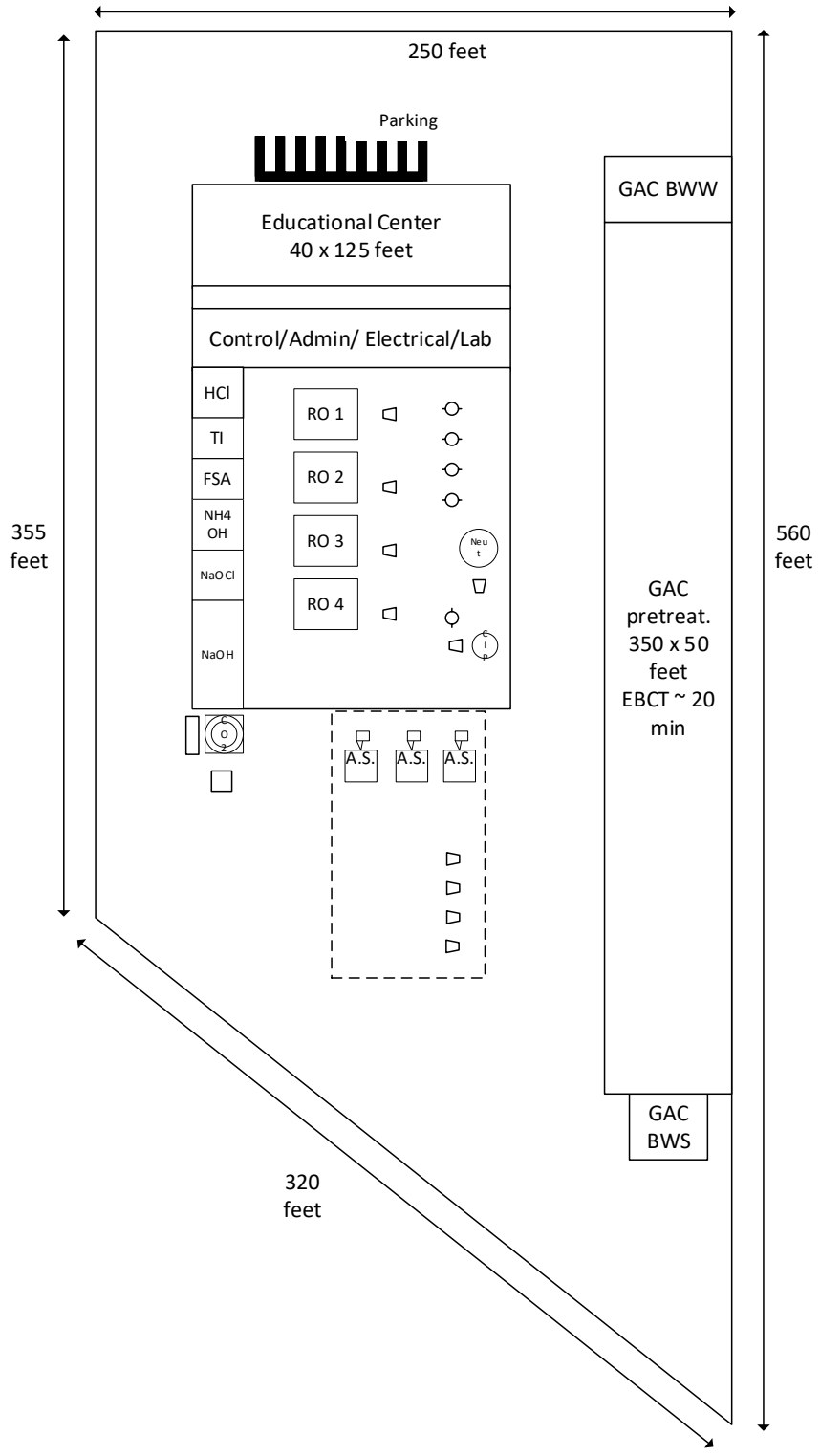

Figure 3-4. 20,000 AFY Desalter with Belowgrade (Rectangular-dashed) Clearwell

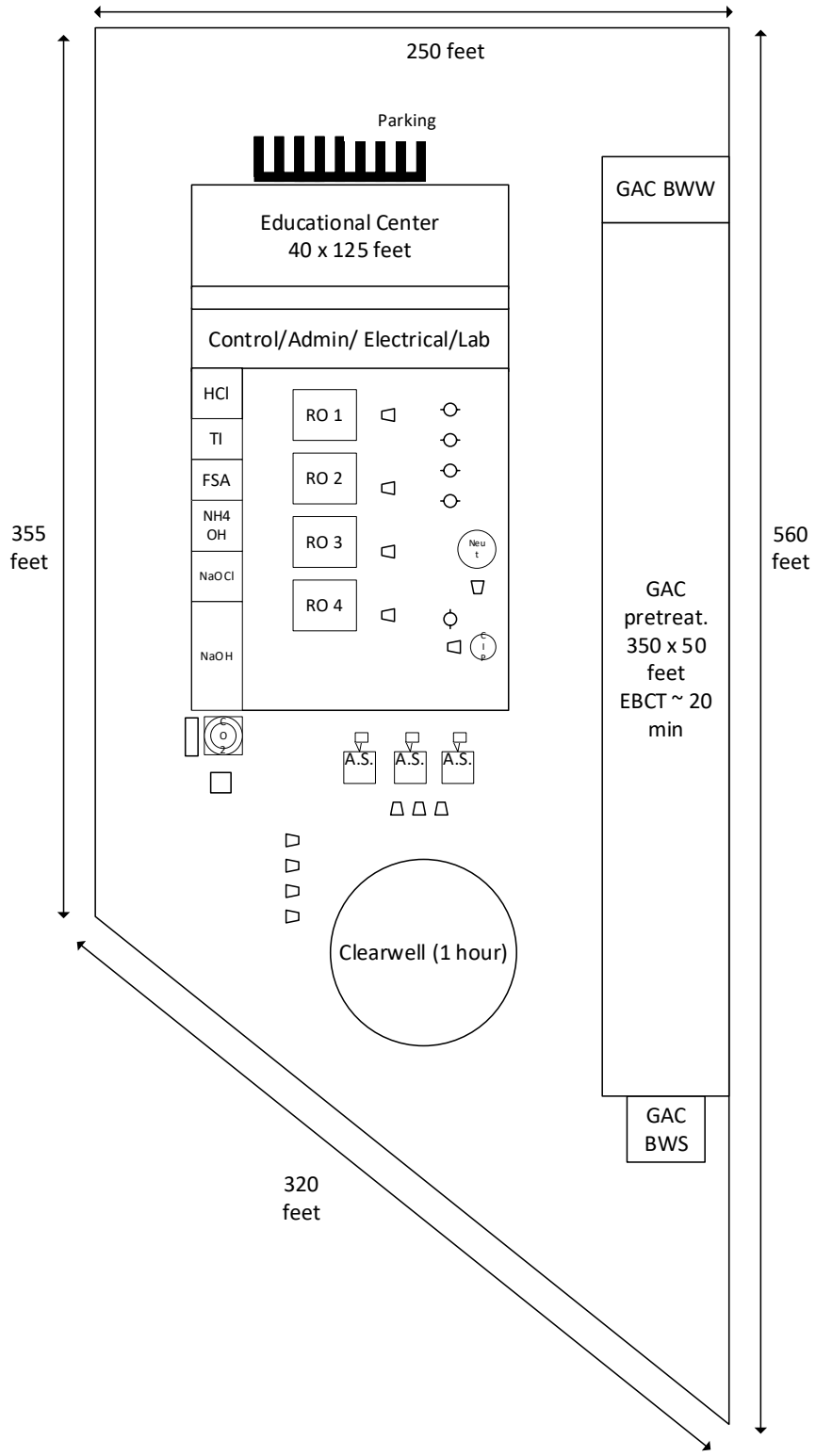

Figure 3-5. 20,000 AFY Desalter with Abovegrade Circular Clearwell

4. Pipe Sizing

Construction of 208th Street to serve the Transit Terminal property will commence in May 2021. The piping from the desalter treatment site for conveyance of the source water, product water, and brine will run underneath the newly constructed street and, thus, needs to be designed and constructed before it is paved. A pipe sizing analysis has been conducted to identify pipe sizes that would accommodate the future, select desalter capacity, which is yet to be determined. In order to provide for the greatest flexibility in pipe sizing and end use, high-density polyethylene (HDPE) pipe material has been selected for all pipelines.

Two scenarios have been considered for the distribution of product water to LADWP and the City of Torrance. Scenario A assumes that the product water will be conveyed in a single pipeline to serve both LADWP and the City of Torrance. Scenario B assumes that the product water will be conveyed in two separate pipelines, where one pipeline will serve LADWP, and the other pipeline will serve the City of Torrance. The three plant capacities that were evaluated in the Feasibility Study have been assumed for both Scenarios A and B: 12,500, 16,000, and 20,000 AFY. Tables 4-1 and 4-2 detail the relative flows for source water, product water, and brine for each of the plant capacities in both Scenarios A and B. The following assumptions have been made for pipe sizing and development of a Class 5, order-of-magnitude cost estimate:

- Both Scenarios A and B:
  - The length of pipe is equal to the length of the new 208th Street roadway (that is, 800 feet).
  - Maximum flows for City of Torrance product water include the operation of the standby product water pump.
  - Average flow is equal to maximum flow, assuming that the plant operates at design capacity.
  - The diameters that have been indicated are not optimized in that there are other HDPE pipe sizes and pressure classes that may provide better overall velocities for each scenario or be more cost-effective (that is, smaller weight and thickness are associated with a lower HDPE pipe material cost).
  - The open-cut installation cost is very conservative. The unit cost of $11.03 per diameter inch per linear foot (per the LADWP [2019] Trunkline Design Manual) is consistent with previous cost estimates prepared for the Feasibility Study. However, this value assumes trenching of an existing roadway, which will not be required for the pipes installed under 208th Street.
  - The material unit cost varies by HDPE pipe weight; a unit cost of $1.89 per pound has been assumed based on a quote from an HDPE pipe supplier and recent construction bids.
- Scenario B:
  - LADWP receives the allocated flow (4,000 or 10,000 AFY) and City of Torrance receives the remainder under the average and maximum flow conditions.
  - There are two midsized (16,000 AFY) plant options, which assume that LADWP can receive either 4,000 or 10,000 AFY.

5. References

Los Angeles Department of Water and Power (LADWP). 2019. *Trunk Line Design Group Design Manual: A Guide to the Management, Design and Construction Support of Trunk Line Design Projects.* April.

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Table 5-1. Scenario A – Product Water in Single Pipeline

	Flow (cfs)		Velocity (ft/s)		HDPE IPS Pipe Size			Unit Costs			Length	Total	
12,500-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	2.58	2.58	4.14	4.14	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water	14.67	15.58	4.03	4.28	32	25.83	DR 11 (200 psi)	$352.96	$220.11	$573.07	800	**$458,456**	**$641,838**
Source water	17.25	17.25	3.85	3.85	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**
16,000-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	3.31	3.31	5.30	5.30	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water	18.77	19.94	5.16	5.48	32	25.83	DR 11 (200 psi)	$352.96	$220.11	$573.07	800	**$458,456**	**$641,838**
Source water	22.08	22.08	4.93	4.93	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**
20,000-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	4.15	4.15	6.64	6.64	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water	23.47	24.93	6.45	6.85	32	25.83	DR 11 (200 psi)	$352.96	$220.11	$573.07	800	**$ 58,456**	**$641,838**
Source water	27.60	27.60	6.16	6.16	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**

Notes:
$/ft. = dollar(s) per foot
% = percent
cfs = cubic feet per second
ft. = feet
ft/s = feet per second
ID = inner diameter
in. = inch(es)
IPS = iron pipe size
psi = pound(s) per square inch

Table 5-2. Scenario B - Product Water in Two Pipelines (Los Angeles Department of Water and Power and Torrance)

	Flow (cfs)		Velocity (ft/s)		HDPE IPS Pipe Size			Unit Costs			Length	Total	
12,500-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft.)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	2.58	2.58	4.14	4.14	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water **(LADWP 4,000 AFY)**	5.57	5.57	3.01	3.01	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Product water (Torrance)	9.13	12.84	4.43	6.23	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Source water	17.25	17.25	3.85	3.85	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**
16,000-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft.)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	3.31	3.31	5.30	5.30	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water **(LADWP 4,000 AFY)**	5.57	5.57	3.01	3.01	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Product water (Torrance)	13.31	17.95	6.45	8.70	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Source water	22.08	22.08	4.93	4.93	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**
16,000-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft.)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	3.31	3.31	5.30	5.30	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water **(LADWP 10,000 AFY)**	13.77	13.77	7.45	7.45	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$ 26,656**	**$457,318**
Product water (Torrance)	4.95	9.75	2.40	4.73	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Source water	22.08	22.08	4.93	4.93	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**
20,000-AFY Plant	**Average**	**Maximum**	**Average**	**Maximum**	**Nominal (in.)**	**ID (in.)**	**Pressure Class**	**Open-cut Installation ($/ft.)**	**Material ($/ft)**	**Total ($/ft)**	**(ft.)**	**No Contingency**	**40% Contingency**
Brine	4.15	4.15	6.64	6.64	14	10.70	DR 9 (250 psi)	$154.42	$50.29	$204.71	800	**$163,768**	**$229,275**
Product water **(LADWP 10,000 AFY)**	13.77	13.77	7.45	7.45	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Product water (Torrance)	9.75	15.47	4.73	7.50	24	18.53	DR 9.3 (241 psi)	$264.72	$143.60	$408.32	800	**$326,656**	**$457,318**
Source water	27.60	27.60	6.16	6.16	34	28.66	DR 13.5 (160 psi)	$375.02	$206.50	$581.52	800	**$465,216**	**$651,302**