Appendix G

Revised Water and Wastewater System Reports

Water System Approval and Reports

State Water Resources Control Board
Division of Drinking Water

December 1, 2022

Ms. Lisa Pezzino, P.E.
SRT Consultants
Via email: lisa@srtconsultants.com

Dear Ms. Pezzino:

Re: Preliminary Technical Report – Alameda Co. (APN # 85-1200-1-16)

On October 12, 2022, the State Water Resources Control Board- Division of Drinking Water (Division) received a preliminary technical report for your proposed public water system located at 17015 Cull Canyon Road in Castro Valley, California (APN 85-1200-1-16). The report was developed and submitted for compliance with California Health and Safety Code (CHSC) *§116527.*

The Division has reviewed the preliminary technical report and that it contains all the necessary information required by *CHSC §116527,* and is therefore considered complete. Based on the findings in your report, the Division has determined that the proposed water system is eligible for a permit application review as an independent public water system. The Division's review and acceptance of this preliminary technical report shall not be deemed approval of project plans or a complete permit application. Pursuant to *CHSC §§116525 & 11654*0, and *Title 22 §§64552 & 64560 of the California Code of Regulations*, you are required to submit a complete permit application to the Division for approved operation of the proposed public water system.

For further assistance through the permit application process, please contact Sara Glade at (510) 620-3472 or Sara.Glade@waterboards.ca.gov or me at (510) 620-3454.

Sincerely,

Marco Pacheco, PE
Sr. Water Resource Control Engineer
San Francisco District

cc: Brian Lowe, COO
The Mosaic Project
Via Email: Brian@mosaicproject.org
478 Santa Clara Avenue, Suite 200
Oakland, CA 94610

Balance Hydrologics
800 Bancroft Way • Suite 101 • Berkeley, CA 94710 • (510) 704-1000
931 Mission Street • Santa Cruz, CA 95060 • (831) 457-9900
12020 Donner Pass Road • Unit B1 • Truckee, CA 96161 • (530) 550-9776
www.balancehydro.com • email: office@balancehydro.com

July 7, 2023

Alameda County Planning Department
399 Elmhurst St #140
Hayward, CA 94544

RE: Water System Conceptual Design Report for The Mosaic Project APN 85-1200-1-16

Dear Alameda County Planning Department:

Balance Hydrologics (Balance) led the effort to site, install, and test two (2) new wells – Well 20-1 and Well 17-1 – on a 37-acre parcel (APN 85-1200-1-16) at 17015 Cull Canyon Road, Castro Valley, CA. The well drilling and yield testing work was conducted under California Professional Geologist and Certified Hydrogeologist license held by Barry Hecht, PG 3664 and CHg 50. The installation of the wells and the evaluation source capacity of each well were in conformance with Title 22 of the California Code of Regulations (CCR §64554) and State and County standards. We have reviewed the report "The Mosaic Project - Water System Conceptual Design Report, March 2022" by SRT Consultants and can confirm that the data they used in Section 1.2 Supply Sources are correctly reported from our findings and analysis of the two new wells.

Sincerely,

BALANCE HYDROLOGICS, INC.

Mark Woyshner, M.Sc.Eng
Principal Hydrologist / Hydrogeologist

Barry Hecht, PG, CHg 50
Senior Principal

CERTIFIED HYDROGEOLOGIST
BARRY HECHT
No. 50
STATE OF CALIFORNIA

The proposed Mosaic camp requires the development of a new public water system (PWS), permitted through the State Water Resources Control Board (SWRCB or State) Division of Drinking Water (DDW). The new water system will include a water supply and delivery system that provides potable water year-round to the new facilities, in compliance with the requirements of the DDW, as well applicable Alameda County regulations. The following summary details the supply and demand analysis that has been approved by DDW and the conceptual design plan for the new facilities.

1.1. Water Demands

The following section details the water system demand estimate and the methodology and assumptions used to develop the average day demand (ADD) and maximum day demand (MDD) of the system. The methodology and values presented have been reviewed and preliminarily approved by DDW; final approval is anticipated with the submittal of the first major deliverable to the State. The water demand analysis included below is specific to potable water usage at the site, which will be supplied by the groundwater sources identified in Section 1.2. Any irrigation water demands will be supplied exclusively by greywater and rainwater sources and are not included in the following analysis.

1.1.1. Demand Methodology

With approval from DDW, Mosaic has estimated water demands using conservative assumptions that are specific to their proposed operations in order to provide an accurate baseline for water supply planning. Additionally, the Alameda County permitting process and the specific site constraints have dictated clear onsite usage patterns related to the proposed onsite wastewater treatment system, therefore providing relevant demand data for the potable water system. Representative per capita water use values are applied to the projected peak number of people present on site on a daily basis to determine the average and maximum daily demands of the system.

1.1.2. Water Demand Estimate Assumptions

The per capita water demand estimates are aligned with the analysis conducted by Northstar Engineering (Northstar) for the sizing and design of the onsite wastewater treatment infrastructure. The values used to size the wastewater facilities were developed to accurately estimate the projected water demands at the site, based on the detailed programming prepared by Mosaic staff and in compliance with Alameda County Environmental Health (ACEH) standards.

The per capita water use is estimated based on the anticipated types of water users on site, including:

- The campers, counselors, and teachers that will be on-site for week-long stays during the planned outdoor and summer camp programs, and over the weekend programs throughout the year;

- The caretaker house, which will be the property caretaker's residence and has a total of 3 bedrooms; and
- The family dwelling that will serve as Mosaic staff's permanent home, with a total of 8 bedrooms.

As shown in Table 1, the daily water usage estimates are expressed per capita for temporary stays (campers and counselors), coupled with the maximum site occupancy for planned camp sessions based on the County-approved peak design values for the onsite wastewater system. In accordance with ACEH standards, the water usage estimates for residents are expressed in terms of water usage per bedroom, rather than the expected per capita. The per-bedroom usage provides a conservative water usage estimate and assumes that all of the bedrooms in the residence will be occupied throughout the year, which may not be the case depending on staffing and camp programming.

Table 1 Water Demand Assumptions

Water Demand Type	Per Capita Water Demand Estimate	Demand Type	Peak Occupancy
Campers & Counselors	25 gpd per person [1]	Temporary Stay	108 persons
Facility Type	**Daily Water Demand Per Bedroom**	**Demand Type**	**No. of Bedrooms**
Caretaker House	150 gpd per bedroom [2]	No. of Bedrooms	3 Bedrooms
Permanent Dwelling Residence (up to 3 Bedrooms)	150 gpd per bedroom [2]	No. of Bedrooms	3 Bedrooms
Permanent Dwelling Residence (any additional bedroom, for up to 5 additional bedrooms)	75 gpd per bedroom [3]	No. of additional Bedrooms	5 additional bedrooms

1. The daily water usage estimate for campers and counselors is a conservative estimate based on a previous estimate conducted by Northstar for similar camp operations, and the EPA's Onsite Wastewater Treatment Systems Manual recommended values for camps.
2. The daily water usage estimate for the caretaker house provides a conservative estimate of 150 gpd per bedroom for the 3-bedroom house, based on the ACEH standards for dwellings.
3. The daily water usage estimate for all additional bedrooms over 3 bedrooms is based on ACEH design standards for dwellings.

Mosaic leadership has developed a detailed schedule of their programs and activities, which provides a basis for the anticipated number of people occupying the site throughout the year. The camp programming will involve 12 (twelve) weekend programs throughout the year, 18 week-long outdoor project sessions (10 during the Winter & Spring and 8 in the Fall), and 5 week-long summer camps.

The week-long camps will be 5-day/4-night programs that will run from 11am on Monday to 1:30pm on Friday. Based on the planned daily activities, the water demand estimates consider

½-day water demand on Mondays and ¼-day water demand on Fridays for the campers and counselors.[1] The Summer Sessions will run from June to August, while the week-long Outdoor Programs will run in the fall (September - October) and in the spring (April - May). The weekend programs are scheduled throughout the year, but will not run concurrently with the weekly sessions.[2] The programs will also be spaced out so that there would never be more than two (2) consecutive 5-day/4-night programs. The peak daily water demands for each type of programming was estimated by combining the per capita water use and planned occupancy, as shown in Table 1. In total, it is estimated that the camp will be in session approximately 140 days a year, and water demands on the remaining days will be based on the usage of full-time residents (qualified below as "Baseline Use").

Table 2 Peak Daily Water Demands Scenarios

Water Usage Scenario	Peak Water Demands
	Gallons per day
Baseline Use	1,275
Outdoor Programs	3,975
Outdoor Programs - First day	3,075
Outdoor Programs - Last day	2,400
Summer Programs	3,975
Summer Programs - First day	3,075
Summer Programs - Last day	2,400
Weekend Program	3,975

The daily water demand scenarios presented in Table 2 were applied to the annual programming prepared by Mosaic staff. The total annual potable water demand is estimated to be approximately 786,000 gallons.

The ADD was calculated as the daily average of the total annual water demand, for an estimate of 2,155 gallons per day (gpd), or 1.50 gallons per minute (gpm). This value actually represents the average daily use under maximum conditions, given that the maximum occupancy is utilized in calculating water use onsite during all the camp sessions. As shown in Table 3, the anticipated

[1] These values were estimated based on the following programming experience: (1) students will not use the showers on the first and last day of camp, and dinner will not be served on the last day (breakfast/lunch service has light water usage relative to dinner).
[2] A week-long program will never be held on the same week of a weekend program.

MDD is 3,975 gpd, which corresponds to the peak daily water usage during a Summer or Outdoor Program. Table 3 provides a summary of the system's projected water demands.

Table 3 Water Demand Summary

Demand Scenario	Water Demand Estimate
ADD	2,155 gpd or 1.50 gpm
MDD	3,975 gpd or 2.76 gpm

1.2. Supply Sources

Mosaic retained Balance Hydrologics (Balance) to conduct groundwater exploration on the site and identify potential supply sources for the new PWS. Four (4) groundwater wells were drilled and two (2) groundwater wells have been identified as potential production sources for the Mosaic water system. Both wells draw water from consolidated sedimentary bedrock and were constructed according to Title 22 of the California Code of Regulations (CCR Title 22). Table 4 presents the main characteristics of the two (2) new production wells.

Table 4 Production Wells Parameters

	Well 20-1	Well 17-1
Depth	135 ft	200 ft
Screen Depth	95 - 135 ft	70 - 90 ft and 130 - 190 ft
Aquifer Characteristics	Confined to Semi-Confined Bedrock Aquifer	
Static Depth to Water	52.9 ft	74.4 ft
Rated Capacity	4.7	3.0

Based on data from 10-day pumping tests and the source capacity analysis conducted in accordance with CCR Title 22, the two (2) identified groundwater sources have a combined rated capacity of 7.7 gpm, as shown in Table 5, below. The test results also indicated that neither well draws on groundwater under the direct influence of surface water. The methodology and conclusions of the supply evaluation have been reviewed and accepted by DDW; formal approval is anticipated with the submittal of the first major deliverable to the State.

Table 5 Rated Capacity of Mosaic Supply Sources

Supply Sources	Rated Capacity
Well 17-1 Rated Capacity	3.0 gpm
Well 20-1 Rated Capacity	4.7 gpm
Total System Rated Capacity	7.7 gpm

1.3. Supply and Demand Comparison

Based on the well sources identified and demand calculation presented in Section 1.1 above, it is concluded that the proposed Mosaic water system has sufficient supply for the projected peak water demands. Table 6, below, summarizes the critical supply and demand values for the proposed Mosaic system.

Table 6 Water Demand & Supply Summary

	Demand Projection
Average Daily Demand (ADD)	1.47 gpm
Maximum Daily Demand (MDD)	2.76 gpm
	Supply Capacity
Total System Rated Capacity	7.7 gpm

2. Recommended Conceptual Design

The proposed Mosaic water system will include new water system facilities to provide a sufficient, safe and sustainable water supply to Mosaic's future residents and camp activities. The proposed facilities include:

- Two (2) new groundwater sources developed as production wells and approximately 1,100 linear feet of transmission piping to supply water to the system's connections;
- One (1) 15,000-gallon plastic raw water storage tank;
- A new 15-foot by 30-foot water treatment plant (WTP), which will be supplied by the raw water tank and will include the treatment processes required to produce high quality drinking water,
- Two (2) 5,000-gallon plastic potable water storage tanks that will gravity-feed the distribution system,

- One (1) 20,000-gallon waste tank that will hold the treatment processes' spent backwash and process water,
- One (1) hydropneumatic tank and booster pump that will be supplied by water from the potable water storage tanks and will pressurize the distribution system to ensure adequate pressures at all water connections, and
- Approximately 1,300 linear feet of 4-inch distribution piping network to the identified water connections throughout the site.

2.1. Facilities Siting

Through the conceptual design process, several alternatives were considered for the siting of the facilities and the required treatment facility. The evaluation of potential sites for the new water system facilities took into consideration various factors, including available footprint, the layout of the proposed buildings, elevation requirements for water facilities, and the property's designated contiguous 2-acre envelope for the new development.

2.1.1. Facilities Siting Alternatives

Based on the site visit and discussions with the Mosaic team, seven (7) sites were identified to host the anticipated treatment and storage facilities. The proposed water system facilities could be located throughout the property on the specific locations identified in Figure 1.

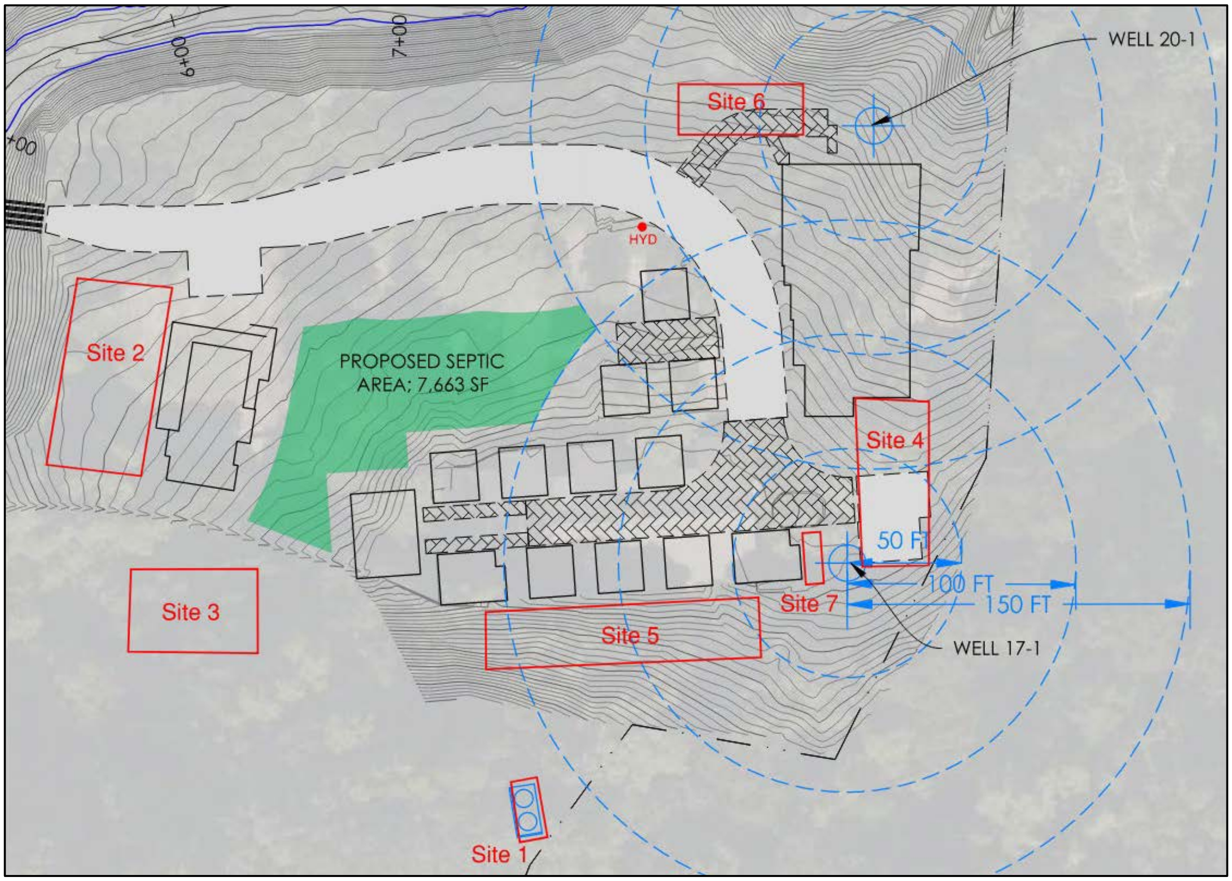

Figure 1 Siting Alternatives

- **Site 1** holds two (2) existing 5,000-gallon potable water tanks that have historically provided fire supply to the property. The two (2) tanks are located on an existing 9' by 11' concrete pad on a hill on the southwest side of the property and are accessed by a set of stairs. The main advantage of this site is the elevation it provides and its ability to gravity-feed the distribution system. The possibility of expanding the footprint of the site has been assessed and was deemed infeasible due to the topography.

- **Site 2** is a vacant, relatively flat open area. The site would require minimal grading and provide easy vehicular access. Multiple rainwater and greywater tanks are currently planned to be built on this site, however, it is under consideration for additional water storage facilities. The site is further from the proposed groundwater supply sources and would therefore involve more transmission piping.

- **Site 3** is behind the planned Staff House and currently houses a concrete pad that is approximately 10' x 10'. The site would require grading and removal of a nearby tree, and can only be accessed on foot. The site is further from the proposed groundwater supply sources and would therefore involve more transmission piping.

- **Site 4** will hold a deck adjacent to the main hall and parking spaces. A rainwater storage tank is currently planned for this site, and an additional small water storage tank could possibly be co-located here, providing easy vehicular access.

- **Site 5** is located close to the existing fire storage tanks, and is large enough to co-locate multiple water system facilities, but is not directly accessible to motorized vehicles. This location falls outside the 2-acre development envelope, and adjustments to the existing development plan will need to be made to accommodate its use.

- **Site 6** will be graded as part of the proposed site development and includes a total potential footprint of 20’ by 50’ for new water facilities. The site is easily accessible and is large enough to co-locate multiple water system facilities.

- **Site 7** is adjacent to Well 17-1, and is mainly being considered as the site for a hydro-pneumatic tank. The use of this site would require the grading of the area to install a concrete pad.

2.1.2. Proposed Facilities Siting

The evaluation of the identified sites revealed that Sites 1, 2, 6, and 7 would be most appropriate for the proposed new water system facilities. In order to optimize the space available and minimize pumping and power use requirements, the raw water storage tank will be co-located with the WTP and the existing elevated tank site will be utilized for potable water storage. The waste storage tank will be located near the staff house and will be accessible for vehicles. The hydro-pneumatic tank will be located at Site 7. Figure 2 shows the proposed locations of the new water facilities.

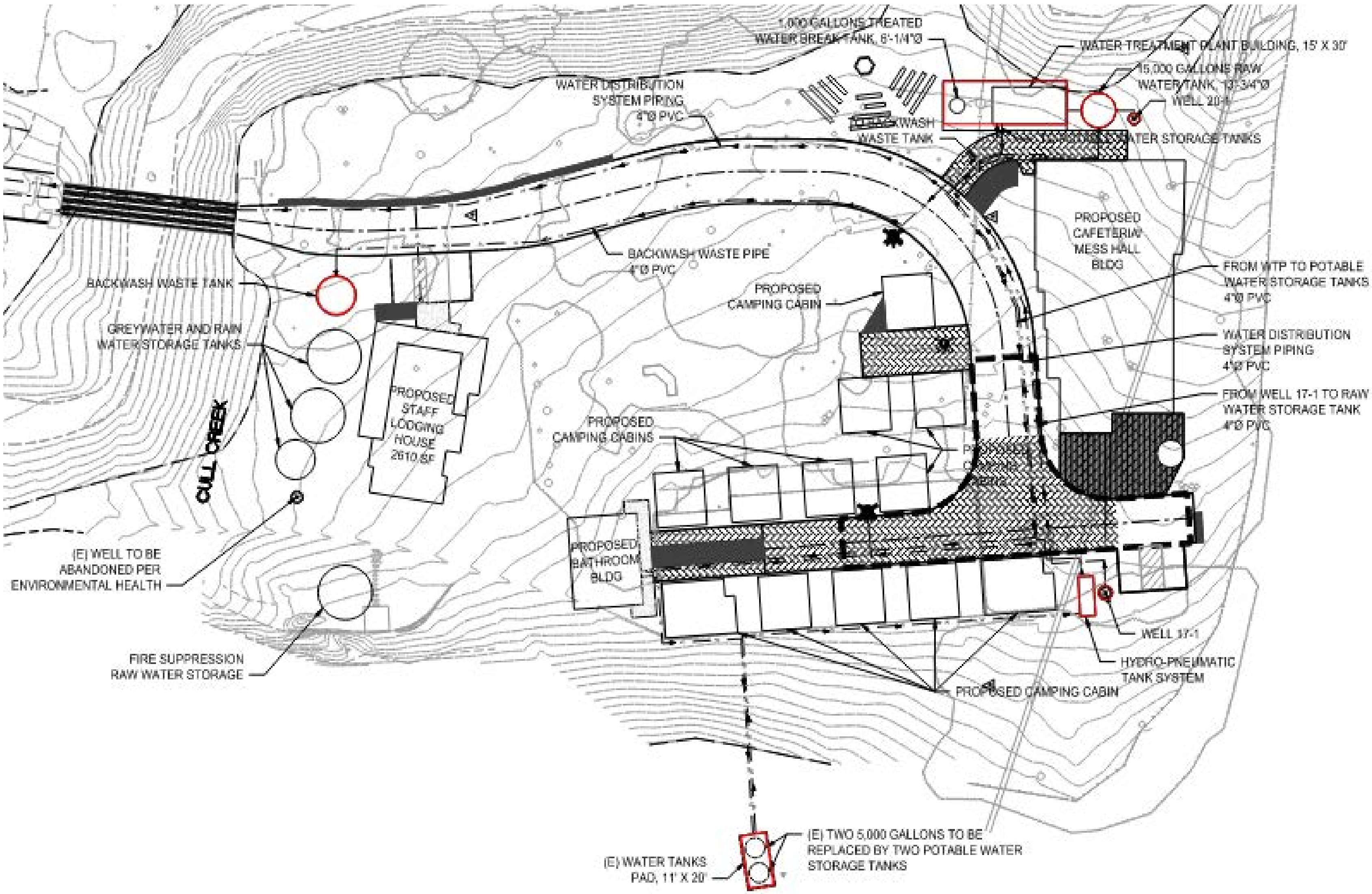

Figure 2 Water System Facilities Proposed Locations

2.2. Raw Water Supply Facilities & Transmission System

Based on the production values and water quality of each well, it was determined that Well 20-1 will operate as the main supply source while Well 17-1 would be used as a backup supply source, to be used to supplement Well 20-1 and maintain supply during Well 20-1 maintenance activities, as needed.

Both wells will have dedicated transmission mains that will transfer water directly to the new 15,000-gallon raw water tank located at the WTP site. The transmission mains will be 4-inch buried PVC pipes, and will include approximately 265 linear feet of pipe from Well 17-1 to the raw water tank and approximately 10 linear feet from Well 20-1 to the same raw water tank.

The 50-foot radius control zones around the supply sources have been assessed and deemed secured from potential contamination sources. Both wellheads will have an enclosure, which will be locked to protect the wells and prevent access from unauthorized personnel. Flow meters will be installed at each well to monitor the wells' respective source production, in compliance with CCR Title 22.

2.3. Proposed Water Treatment System

The water treatment facility was developed based on the wells' raw water quality, suppliers' recommendations, and CCR Title 22. The following section details the proposed treatment processes and general operational requirements.

The proposed treatment process includes a 15-gpm RO unit and has a total flow rate capacity of 15 to 23 gpm - depending on the blending ratio - to efficiently produce a safe drinking water supply to serve the Mosaic camp's demands. The proposed water treatment process includes three (3) pressure vessels, two (2) chemical injection steps and an RO unit in series, as follows:

- **Sodium Hypochlorite Dosing:** This chlorine injection process serves as the oxidizing step to precipitate key contaminants present in the groundwater.
- **Multi-Media Filter:** The multi-media pressure filter includes layers of anthracite, sand, and gravel and handles turbidity removal.
- **Greensand Filter:** The greensand filter targets the removal of iron and manganese precipitates.
- **Activated Carbon Filter:** The activated carbon vessel removes organics, taste and odor compounds, and excess chlorine from the oxidation step.
- **Antiscalant Dosing:** An antiscalant chemical is injected into the pipe to inhibit the formation of mineral scales that would cause membrane fouling. The antiscalant dosing also helps optimize membranes' operation and longevity.
- **RO System:** The RO system is highly efficient at removing salts, minerals and pathogens.

- **Disinfection Process:** A disinfection process will most likely be implemented based on the Groundwater Rule requirements. A sodium hypochlorite injection system located at the outlet of the potable water break tank at the treatment plant would set the proper chlorine residual for the distribution system.

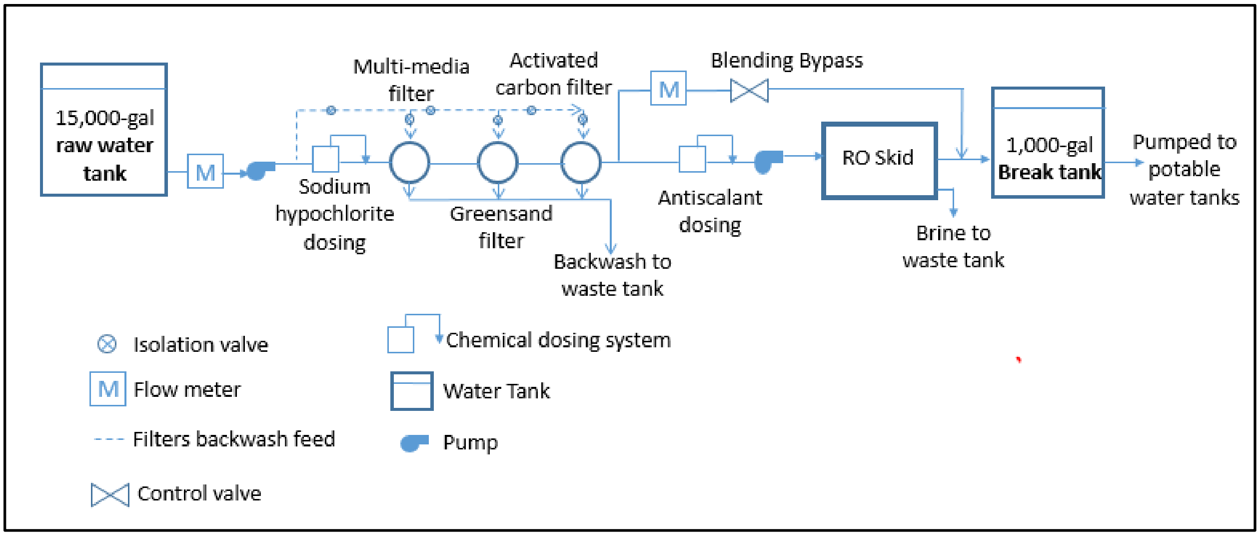

Figure 3 Treatment Process PFD

2.4. Distribution System

The distribution system will be supplied by the two (2) 5,000-gallon tanks at high elevation and a 1,000-gallon hydro-pneumatic system located at Site 7. With the potable water tanks located at 162 feet of elevation, the anticipated pressure range throughout the distribution system is approximately 19 psi to 58 psi. A hydropneumatic tank and booster pump setup will be implemented to ensure pressures between 40 and 80 psi at all connections, in compliance with CCR Title 22.

The distribution system mains will be 4-inch NSF-61 certified PVC pipes buried in trenches and backfilled with proper fill material. The distribution system will include approximately 1,300 linear feet of water mains to supply six (6) confirmed water connections throughout the Mosaic site, including:

- The main hall
- The bathroom building
- The staff house
- The caretaker house
- A minimum of two (2) water spigots (exact locations TBD)

Isolation valves will be installed throughout the distribution system to provide operational flexibility and facilitate the detection and containment of leaks within the distribution system. A flow meter will be installed at the outlet of the potable water tank feeding the distribution system to monitor the system's water demand, in compliance with CCR Title 22.

2.5. Waste Handling Facilities

The brine produced by the RO treatment unit and backwash waste from the pre-treatment processes will not be disposed of onsite and will instead be sent to a dedicated waste storage tank. The content of the waste tank will be hauled off-site by an approved waste hauler on a regular basis to ensure that treatment operations are not disrupted. Table 7 below shows the anticipated wastewater volume produced by the treatment processes for the maximum waste production scenario, which is based on two (2) consecutive week-long camp sessions.

The treatment waste volumes estimated include the anticipated spent backwash from the pre-treatment pressure vessels and the brine produced by the RO membranes, calculated as follows:

- The pre-treatment spent backwash is calculated using the approximate backwash cycle flow rate, duration, and frequency, and is directly dependent on the duration of treatment operation. Since the pre-treatment vessels are backwashed approximately once a day when in operation, the backwash waste is calculated based on the estimated number of days of operation over the 2-week period. It is anticipated that the treatment train will produce potable water in batches and be able to run every two (2) to three (3) days, for an estimate of five (5) days of operations over a 2-week period.
- Brine waste is calculated based on the recovery setting of the RO unit and the volume of water pushed through the membrane unit. The anticipated brine volume is therefore calculated using the expected volume of water produced over the 2-week period.

Table 7 High-Demand Scenario Treatment Waste Volume Calculations

Pre-Treatment Backwash Waste: 2-Week Cycle					
Treatment Trains	**Backwash Flow Rate**	**Backwash Duration**	**Cycle Frequency**	**No. of Days of Operations**	**Backwash Volume**
	gpm	*min*		*days*	*gallons*
Multimedia Filter	36.2	20	1/day	5	3,620
Greensand Filter	37.7	20	1/day	5	3,770
Activated Carbon	37.7	20	1/week	5	754
Total					8,144
RO Brine : 2-Week Cycle					
	2-Week Treated Water	**RO Flow Split**	**2-Week Water Treated by**	**Recovery**	**RO Brine Volume**

	Volume		**RO**		
	gallons		*gallons*		*gallons*
	39,900	65%	25,935	55%	11,671
Total 2-Week Backwash + RO Brine Volume					**19,815**

Based on the calculation included in Table 7, the installation of a 20,000-gallon waste tank onsite is recommended. The waste storage tank is proposed to be sited at a location near the Staff House that can easily be accessed by the vacuum truck.

In accordance with the East Bay Municipal Utility District (EBMUD) wastewater ordinance and discharge limits, the RO brine and backwash waste will be accepted and can be hauled by one of EBMUD's approved haulers. Based on information provided by local liquid waste haulers, the maximum size of the tanker trucks is 5,000 gallons of capacity. For the peak scenario detailed above, the anticipated hauling frequency of liquid waste would involve four (4) trucks every two (2) weeks.

the mosaic project

PRELIMINARY TECHNICAL REPORT

FOR A NEW PUBLIC WATER SYSTEM

April 2022

Prepared By:

SRT consultants

TABLE OF CONTENTS

1. INTRODUCTION AND BACKGROUND

This Preliminary Technical Report has been developed as part of the application process for a new non-transient non-community water system operated by The Mosaic Project (Mosaic) in Castro Valley. The proposed Mosaic camp requires the development of a new public water system (PWS), permitted through the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW).

1.1. Project Background

Mosaic is a non-profit organization currently based out of Oakland, California, and is in the process of developing a permanent camp and education center for youth programming on property located at 17015 Cull Canyon Road in Castro Valley, California (APN 85-1200-1-16). Mosaic's mission is to unite 4th- and 5th-grade children from markedly different backgrounds and provide them with essential community building skills, a close experience with nature, and empowering peacemaking tools.

The Castro Valley property is 37 acres and will include new facilities to host weekend and week-long camp programs. The new water system will include a water supply and delivery system that provides potable water year-round to the new facilities, in compliance with the requirements of the DDW, as well applicable Alameda County regulations.

This Preliminary Technical Report has been prepared in compliance with CCR Title 22 and SB 1263 requirements for the establishment of a new domestic water supply permit for Mosaic's camp facility. The Report includes a brief overview of the existing facilities, the consolidation assessment conducted, the system's demand and supply analysis showing adequate water supply, a detailed description of the proposed facilities and their operations strategy, a regulatory compliance summary, and detailed cost estimate.

1.2. Existing Facilities

The property was previously used as a temporary residence by a private party and the water infrastructure on site is limited. Two (2) existing wells were identified at the site, and only one (1) of them is operational and feeds the existing distribution system directly. The property holds two (2) existing 5,000-gallon plastic tanks for fire-fighting purposes.

1.3. Consolidation Study

A consolidation evaluation was conducted to assess the feasibility of consolidating with a nearby existing water system to supply the Mosaic property. The assessment included all of the community water systems located within a 3-mile radius of the Mosaic site, in compliance with SB 1263 requirements.

The only community system located within the area of interest is the Norris Canyon Property Owner Association (NCPOA), which is a community water system relying on groundwater and serving 19 residential connections. The assessment also revealed that a property located within the 3-mile radius is supplied by East Bay Municipal Utility District (EBMUD). Figure 2 shows a map of the water systems identified.

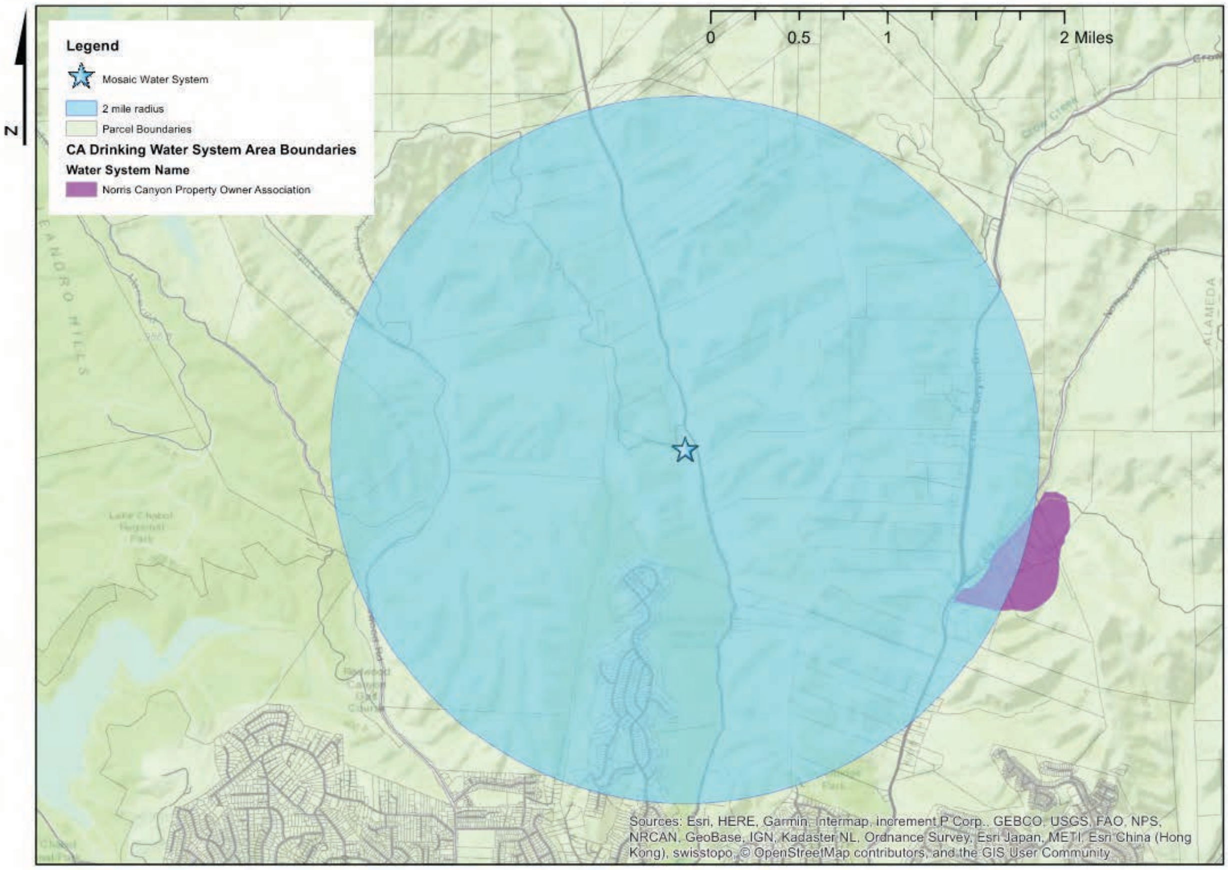

Figure 1 Mosaic Consolidation Assessment Map

The physical consolidation with the NCPOA community water system would require the installation of approximately 1.5 miles of transmission mains along County roads, which represents significant financial and construction barriers. Additionally, the water system serves a defined homeowner's association and therefore does not have an expandable boundary or supply capacity.

EBMUD's New Service Connections department was contacted to assess the feasibility of connecting the Mosaic site to EBMUD's distribution network. As detailed in the feasibility letter provided by EBMUD (See Attachment 1), EBMUD staff deemed this consolidation alternative infeasible based on the several barriers identified:

- Since the property currently falls outside of EBMUD's service area, the process of annexation would require an application to LAFCO to update their service area.
- The annexation process would also require the addition of the area into EBMUD's Central Valley Project (CVP) contractor area by the United States Bureau of Reclamation (USBR).
- The physical consolidation would require a main extension of over two (2) miles, which is financially prohibitive and operationally unfeasible. The length of the main extension and

the small water demand at the Mosaic site would cause potential water quality issues, pressure concerns and constructability challenges.

The consolidation evaluation indicated that physical or managerial consolidation is not a feasible option for Mosaic, based on constructability, administrative and financial drawbacks.

Table 1 Consolidation Evaluation Summary

	NCPOA	EBMUD
Mainline Extension Required (miles)	> 2 miles	>1.5 miles
Approximate Construction Cost[1]	> $3M	> $10M[2]
Additional Challenges	Small water system with low supply and limited operational and managerial capacity	Significant administrative challenges, annexation deemed infeasible by EBMUD

2. WATER SYSTEM DEMAND

The following section details the water system demand estimate and the methodology and assumptions used to develop the average day demand (ADD) and maximum day demand (MDD) of the system.

2.1. Water Demand Design Criteria

The water demands presented focus on the potable water usage at the site, which will be supplied by the groundwater sources identified in Section 3. Any irrigation water demands will be supplied exclusively by greywater and rainwater sources and are not included in the following analysis.

2.2. Demand Methodology

Based on Title 22 Code of Regulations (CCR) §64554, a water system shall develop water demand estimates using historical daily or monthly water usage data, if available. Since the Mosaic activities were not previously held at a specific location where consistent, long-term operational water demands could be monitored, historical data was not available to determine the projected water demand estimates.

[1] The approximate construction cost is based on an estimate of the piping necessary to physically connect to the water system.
[2] EBMUD representatives indicated that in the event that they were to serve the Mosaic property - which they were not willing to do - the process to connect would cost over $10M.

When historical records are not available, the CCR recommends the use of metering records from water systems similar in size, elevation, climate, demography, and residential property size to determine the average water usage per service connection of the proposed system. However, due to Mosaic's unique mission and specific camp programming, a facility with similar water demands and high-quality water usage data could not be identified for the purposes of the water demand estimates.

Mosaic has therefore elected to estimate water demands using conservative assumptions that are specific to their proposed operations in order to provide an accurate baseline for water supply planning. Additionally, the Alameda County permitting process and the specific site constraints have dictated clear onsite usage patterns related to the proposed onsite wastewater treatment system, therefore providing relevant demand data for the potable water system. Representative per capita water use values are applied to the projected peak number of people present on site on a daily basis to determine the ADD and MDD.

2.3. Water Demand Estimate Assumptions

The per capita water demand estimates are aligned with the analysis conducted by Northstar Engineering (Northstar) for the sizing and design of the onsite wastewater treatment infrastructure. The values used to size the wastewater facilities were developed to accurately estimate the projected water demands at the site, based on the detailed programming prepared by Mosaic staff and in compliance with Alameda County Environmental Health (ACEH) standards. The per capita water use is estimated based on the anticipated types of water users on site, including:

- The campers and counselors that will be onsite for week-long stays during the planned outdoor and summer camp programs, and over the weekend programs throughout the year;
- The caretaker house, which will be the property caretaker's residence and has a total of 3 bedrooms; and
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As shown in Table 2, the daily water usage estimates are expressed per capita for temporary stays (campers and counselors), coupled with the maximum site occupancy for planned camp sessions based on the County-approved peak design values for the onsite wastewater system. In accordance with ACEH standards, the water usage estimates for residents are expressed in terms of water usage per bedroom, rather than the expected per capita. The per-bedroom usage provides a conservative water usage estimate and assumes that all of the bedrooms in the residence will be occupied throughout the year, which may not be the case depending on staffing and camp programming.

Table 2 Water Demand Assumptions

Water Demand Type	Per Capita Water Demand Estimate	Demand Type	Peak Occupancy
Campers & Counselors	25 gpd per person[1]	Temporary Stay	108 persons
Facility Type	**Daily Water Demand Per Bedroom**	**Demand Type**	**No. of Bedrooms**
Caretaker House	150 gpd per bedroom[2]	No. of Bedrooms	3 Bedrooms
Permanent Dwelling Residence (Up to 2 Bedrooms)	150 gpd per bedroom[2]	No. of Bedrooms	3 Bedrooms
Permanent Dwelling Residence (any additional bedroom, for up to 5 additional bedrooms)	75 gpd per bedroom[3]	No. of additional bedrooms	additional bedrooms

1. The daily water usage estimate for campers and counselors is a conservative estimate based on a previous estimate conducted by Northstar for similar camp operations, and the EPA's Onsite Wastewater Treatment Systems Manual recommended values for camps.
2. The daily water usage estimate for the caretaker house provides a conservative estimate of 150 gpd per bedroom for the 3-bedroom house, based on the ACEH standards for dwellings.
3. The daily water usage estimate for all additional bedrooms over 3 bedrooms is based on ACEH design standards for dwellings.

Mosaic leadership has developed a detailed schedule of their programs and activities, which provides a basis for the anticipated number of people occupying the site throughout the year. The camp programming will involve 12 weekend programs throughout the year, 18 week-long outdoor project sessions (10 during the Winter & Spring and 8 in the Fall), and 5 week-long summer camps.

The week-long camps will be 5-day/4-night programs that will run from 11am on Monday to 1:30pm on Friday. Based on the planned daily activities, the water demand estimates consider ½-day water demand on Mondays and ¼-day water demand on Fridays for the campers and counselors.[3] The Summer Sessions will run from June to August, while the week-long Outdoor Programs will run in the fall (September - October) and in the spring (April - May). The weekend programs are scheduled throughout the year, but will not run concurrently with the weekly sessions.[4] The programs will also be spaced out so that there would never be more than two (2) consecutive 5-day/4-night programs. The peak daily water demands for each type of programming was estimated by combining the per capita water use and planned occupancy, as

[3] These values were estimated based on the following programming experience: (1) students will not use the showers on the first and last day of camp, and dinner will not be served on the last day (breakfast/lunch service has light water usage relative to dinner).
[4] A week-long program will never be held on the same week of a weekend program.

shown in Table 2. In total, it is estimated that the camp will be in session approximately 140 days a year, and water demands on the remaining days will be based on the usage of full-time residents (qualified below as "Baseline Use"). Table 3 defines the estimated daily demand scenarios at the Mosaic site.

Table 3 Peak Daily Water Demands Scenarios

Water Usage Scenario	Peak Water Demands
	Gallons Per Day
Baseline Use	1,275
Outdoor Programs	3,975
Outdoor Programs - First Day	3,075
Outdoor Programs - Last Day	2,400
Summer Programs	3,975
Summer Programs - First Day	3,075
Summer Programs - Last Day	2,400
Weekend Program	3,975

The daily water demand scenarios presented in Table 3 were applied to the annual programming prepared by Mosaic staff. Figure 1 shows the daily anticipated water demands over one year, based on the planned camp programming. The total annual potable water demand is estimated to be approximately 786,000 gallons.

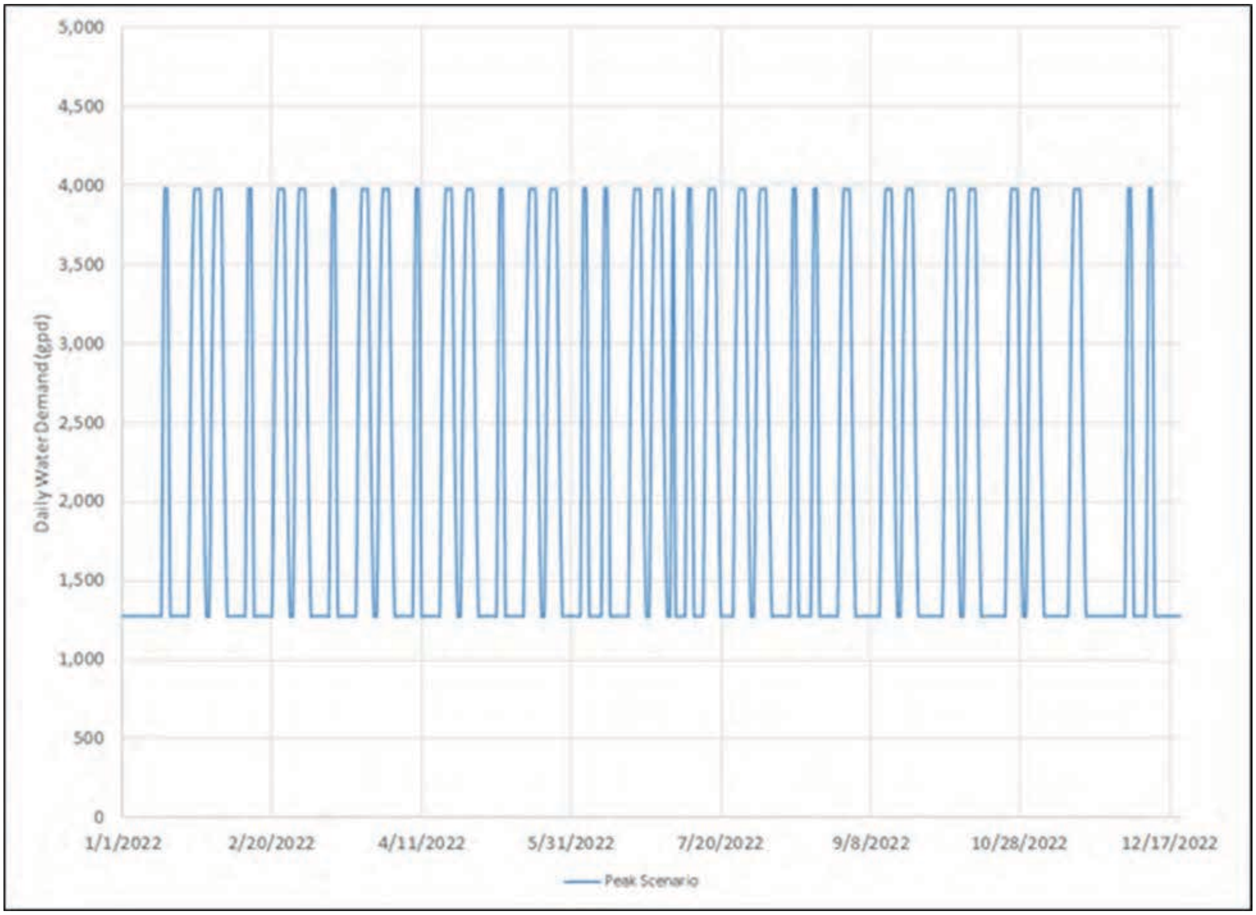

Figure 2 Daily Water Demands Estimates

2.4. Water Demand Scenarios

The ADD was calculated as the daily average of the total annual water demand, for an estimate of 2,155 gpd, or 1.50 gpm. This value actually represents the average daily use under maximum conditions, given that the maximum occupancy is utilized in calculating water use onsite during all the camp sessions. As shown in Table 4, the anticipated MDD is 3,975 gpd, which corresponds to the peak daily water usage during a Summer or Outdoor Program. A peaking factor of 1.5 was applied to the calculated MDD to determine the system's peak hourly demand (PHD), in compliance with Title 22 CCR §64554. Table 4 provides a summary of the system's water demands estimate.

Table 4 Water Demand Summary

Demand Scenario	Water Demand Estimate
ADD	2,155 gpd or 1.50 gpm
MDD	3,975 gpd or 2.76 gpm
PHD	248 gph or 4.14 gpm

Figure 3 provides an overview of the anticipated seasonal variation in water demands, showing the totalized monthly water demands, and the average daily water demands for each month. Based on the planned programming, the months of March and October are anticipated to have the largest water usage, with a maximum of approximately 75,000 gallons per month, or 1.74 gpm.

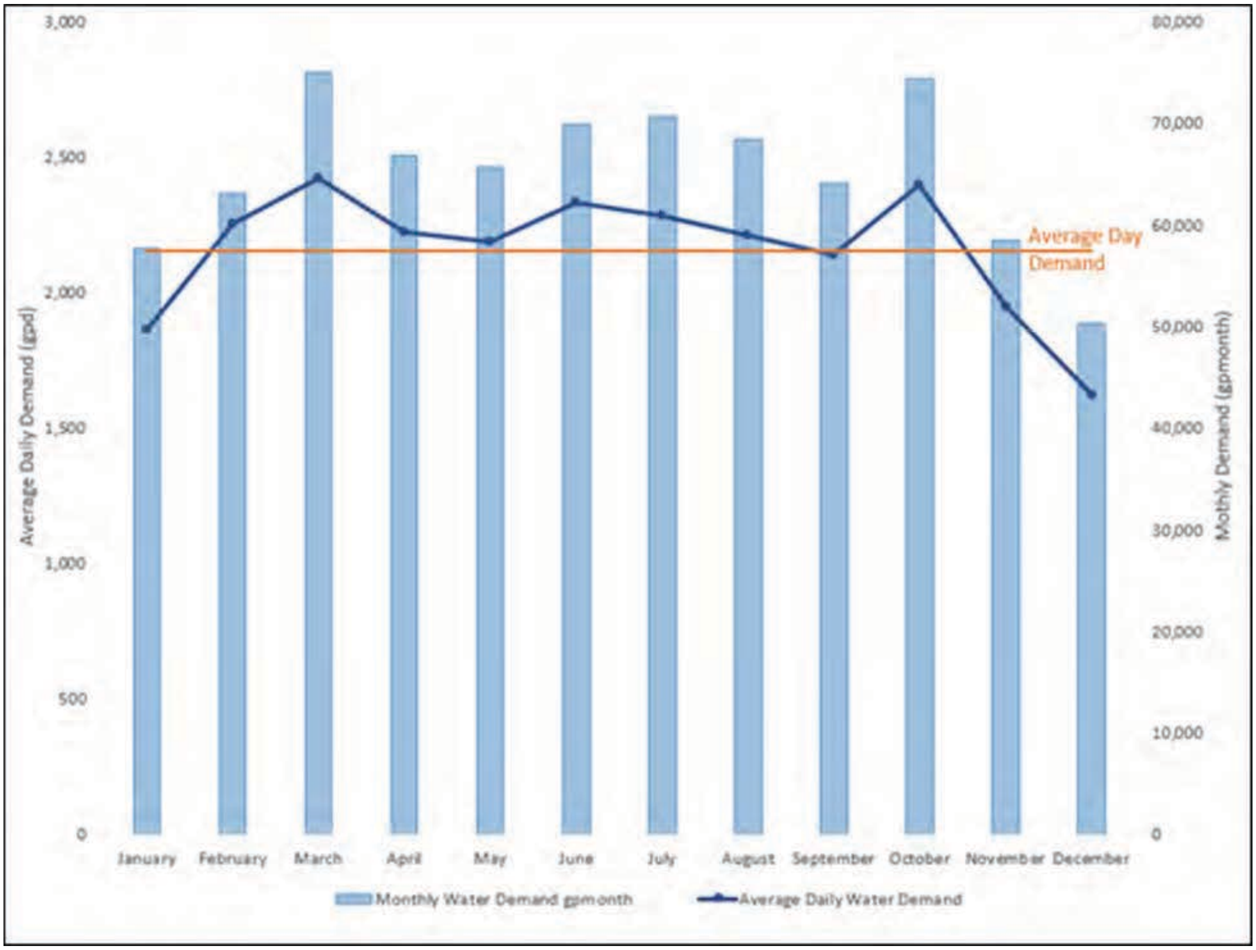

Figure 3 Average Daily & Monthly Water Demands

Based on the planned future activities at the site, the system's water demands are not projected to increase in the future.

3. WATER SUPPLY SOURCES

Mosaic retained Balance Hydrologics (Balance) to conduct groundwater exploration on the site and identify potential supply sources for the new PWS. Four (4) groundwater wells were drilled and two (2) groundwater wells have been identified as potential production sources for the Mosaic water system.

3.1. Proposed Groundwater Sources

Balance developed a hydrogeologic background of the property and identified several potential well sites that were anticipated to produce adequate supply. Based on the study conducted, Balance coordinated with Maggiora Bros. Drilling Co. to drill four (4) test wells during 2019 and 2020. Two (2) of the test wells were deemed unfit for development based on initial pumping (air-lift) and water quality tests. Two (2) test wells - Well 20-1 and Well 17-1 - were established as viable potential sources and were therefore further developed and subjected to 10-day constant-rate pump and recovery tests in November 2020. Title 22 CCR §64554 requires that the well capacity tests are conducted between August and October. Since water year 2020 was especially dry, with a prolonged dry season, DDW gave approval to extend the capacity testing season into November, given lack of rain. Wells 20-1 and 17-1 have been identified as production sources for the Mosaic water system, with Well 20-1 being considered the primary source due to production and water quality, as discussed below.

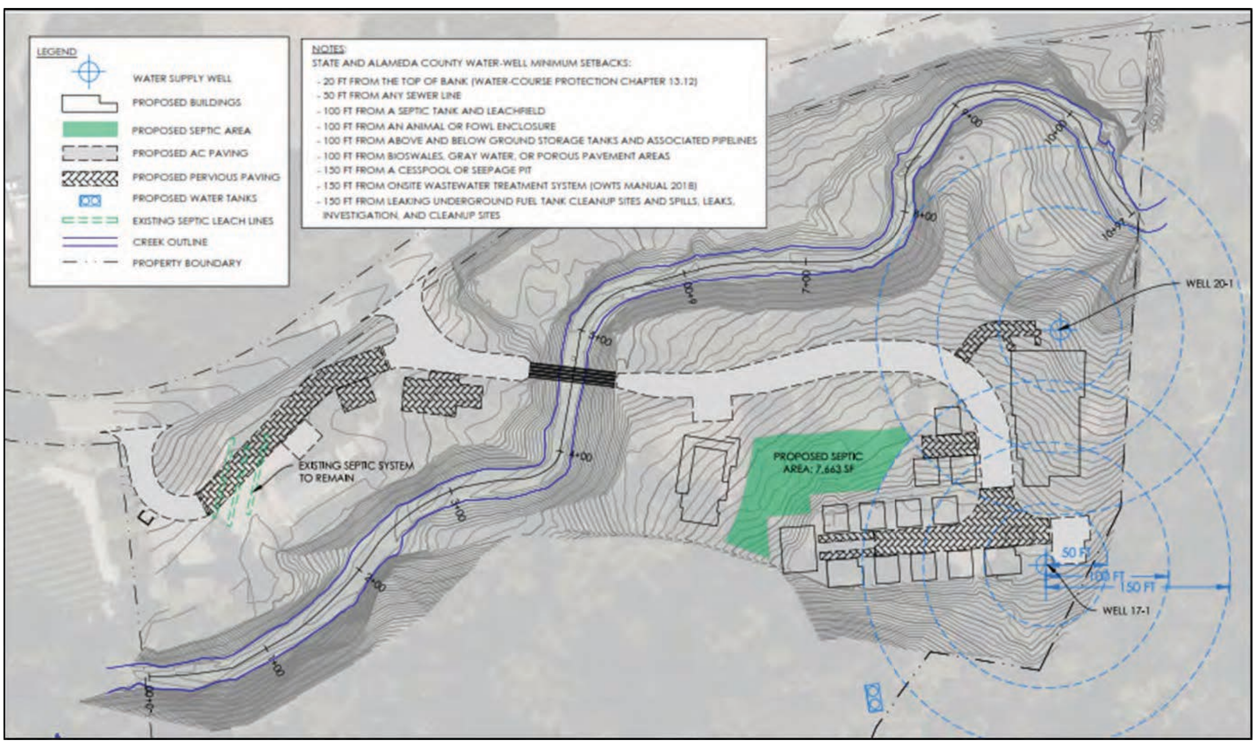

Figure 4 Location of Groundwater Supply Sources

3.2. Raw Water Quality

A full Title 22 water quality panel was conducted at Wells 20-1 and 17-1, and the raw water quality results of contaminants of concern are presented in Table 5. The table includes averages of water quality testing conducted from 2018 to 2020 for contaminants that were considered in the design of the treatment; highlighted cells show concentrations that are above the maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL). The full laboratory reports from the water quality tests are included as Attachment 2.

Table 5 Raw Water Quality Summary

Analyte	Average Concentration	
	Well 17-1	**Well 20-1**
Total Alkalinity	864	365
Hardness	21	466
Silica	42 mg/L	29 mg/L
Calcium	4.2 mg/L	108 mg/L
Sodium	541 mg/L	58 mg/L
Total Dissolved Solids	1,427 mg/L	659 mg/L
Arsenic	18 ug/L	ND
Iron	94 ug/L	365 ug/L
Manganese	9 ug/L	102 ug/L
pH	7.9	7.7
Specific Conductance	2200 umhos/cm	1038 umhos/cm
Dissolved Organic Carbon	2.4	ND
Nitrate	0.1 mg/L	ND
Langelier Index	0.99	1.01

1. Highlighted cells show concentrations that are above MCL or SMCL, as stipulated in Title 22 CCR articles §64431 and §64449.

3.3. Source Capacity

The pumping tests were conducted in compliance with Title 22 CCR §64554 to determine the rated source capacity of both wells. Both wells draw groundwater from fractured consolidated sedimentary bedrock and were constructed with a cement seal exceeding the required 50 feet from ground surface within a three-inch annulus. The sanitary seal at both wells was designed based on Alameda County and California Department of Water Resources (DWR)[5] requirements and was poured under the supervision of Alameda County staff, as specified in the County well ordinance.

In accordance with Title 22 CCR §64554, a 10-day pump test of a bedrock well provides a rated capacity of no more than 50-percent of the test pumping rate. Well 20-1 was successfully pumped at 9.35 gpm, achieving a rated capacity of 4.7 gpm, and well 17-1 was pumped at 6.05 gpm, for a rated capacity of 3.0 gpm. The Title 22 CCR §64554 requirements stipulate that the water-level recovery in the well shall be within two (2) feet of the static water level measured at the beginning of the test, or to a minimum of 95% of the total drawdown measured during the test, whichever is more stringent. The drawdown in Well 20-1 recovered to 2 feet from the static water level at 9.5 days into the 10-day recovery period, and met the standard. The drawdown in Well 17-1 reached the 95% of total drawdown recovery criteria within 12.66 days, shortly after the 10-day recovery period. Based on the pumping test results, Balance recommends a rated capacity of 4.7 gpm for Well 20-1 and 3.0 gpm for Well 17-1. The test results and water quality results also indicated that neither well draws on groundwater under the direct influence of surface water. The Source Capacity Results Technical Memorandum prepared by Balance is included in Attachment 3.

Table 6 Pump Tests Results Summary

	Well 20-1	Well 17-1
Pumping Rate	9.35 gpm	6.05 gpm
Depth of Well	135 ft	200 ft
Rated Capacity	4.7 gpm	3.0 gpm

The ion activity measured in the two (2) wells' water samples indicated that the wells draw groundwater from separate fractured bedrock aquifers, which is consistent with the interpreted geologic framework of the aquifers. Drawdown interference was also not detected in the water level monitoring records during the 10-day pumping tests.

3.4. 20-Year Evaluation of Normal, Single Dry-Year & Multiple Dry Year Analysis

In compliance with SB 1263, Balance Hydrologics conducted an analysis to assess the availability of the identified water supplies during normal, single dry or multiple dry water years during a 20-year projection. The analysis involved a basin-wide review of gaged baseflow or groundwater discharge of US Geological Survey (USGS) data from a streamflow station on Cull Creek located 1.67 miles downstream of the Mosaic site. The analysis also involved an

[5] Based on Bulletin 74-81 and Bulletin 74-90 developed by DWR

assessment of the monitored recovery process of Wells 20-1 and 17-1 throughout the extreme dry year 2021. The full report is included in Attachment 4.

Wells 20-1 and 17-1 were initially developed and tested during the extreme dry year 2020 and their recharge was monitored during extreme dry year 2020 and extreme dry year 2021, which provides first-hand insights on their pumping and recovery ability during single and multiple dry year scenarios. The analysis indicated that groundwater conditions within the watershed during multiple dry years and an extreme dry year are anticipated to be depleted, based on the basin-wide analysis of gaged groundwater contribution at the nearby USGS station.

The monitored recharge data revealed that Well 20-1 has recharge abilities in extreme dry year conditions based on its full recovery after a 10 day pump test. Well 17-1 also recovered substantially after a 10 day pump test during extreme dry year conditions, however it is more likely to be impacted by multi dry year and extreme dry year scenarios than Well 20-1. This analysis informs the operations of the groundwater sources, as discussed in Section 5.2.

With limited data available for analysis, an adaptive management pumping and monitoring plan is recommended for the Mosaic Water System. will help develop a deeper understanding of the upper use limits of the wells with recharge during normal and wet years.

4. WATER DEMAND & SUPPLY ANALYSIS

Based on data from 10-day pumping tests and the source capacity analysis conducted in accordance with Title 22 CCR 64554, the two (2) identified groundwater sources provide sufficient supply for the projected MDD of the Mosaic water system. Table 7, below, summarizes the critical supply and demand values for the proposed Mosaic system.

Table 7 Water Demand & Supply Summary

Demand	**Supply Capacity**
Average Daily Demand (ADD)	1.47 gpm
Maximum Daily Demand (MDD)	2.76 gpm
Supply	
Well 17-1 Rated Capacity	3.0 gpm
Well 20-1 Rated Capacity	4.7 gpm
Total System Rated Capacity	7.7 gpm
Rated Capacity with the Largest Supply Source Offline	3.0 gpm

5. NEW WATER SYSTEM FACILITIES

The proposed Mosaic water system will include new water system facilities to provide a sufficient, safe, and sustainable water supply to Mosaic's future residents and camp activities. Through the conceptual design process, several alternatives were considered for the siting of the facilities and the required treatment facility. The proposed facilities include:

- Two (2) new groundwater sources developed as production wells and approximately 1,100 linear feet of transmission piping;
- One (1) 15,000-gallon plastic raw water storage tank;
- A new 15-foot by 30-foot water treatment plant (WTP), which will be supplied by the raw water tank and will include the treatment processes required to address the wells' water quality issues,
- Two (2) 5,000-gallon plastic potable water storage tanks that will gravity-feed the distribution system,
- One (1) 20,000-gallon waste tank that will hold the treatment processes' spent backwash and process water and approximately 300 linear feet of piping from the WTP to the backwash waste tank,
- One (1) hydropneumatic tank and booster pump will be supplied by water pumped from the potable water storage tanks and will pressurize the distribution system to ensure adequate pressures at all water connections, and
- Approximately 1,300 linear feet of 4-inch distribution piping network to the identified water connections throughout the site.

Figure 5 shows a preliminary process flow diagram of the proposed new water system.

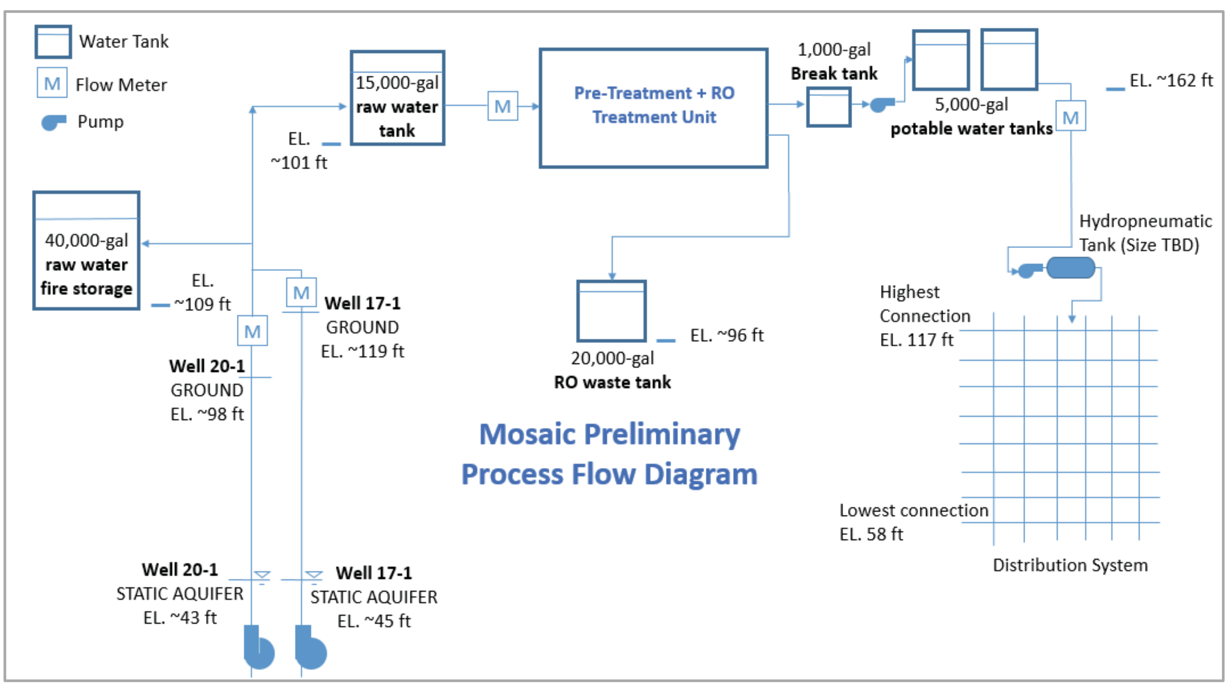

Figure 5 Proposed Water System Process Flow Diagram

5.1. General Layout

Multiple potential sites were evaluated to identify the most appropriate locations for the proposed new water system facilities. In order to optimize the space available and minimize pumping requirements, the raw water storage tank will be co-located with the WTP and the existing elevated tank site will be utilized for potable water storage. The waste storage tank will be located closer to the site entrance, near the staff house, to accommodate accessibility for vehicles. The hydro-pneumatic tank will be located near Well 17-1, in proximity to the majority of the distribution system connections. Figure 5 shows the proposed locations of the new water facilities, and Attachment 5 includes a full site plan.

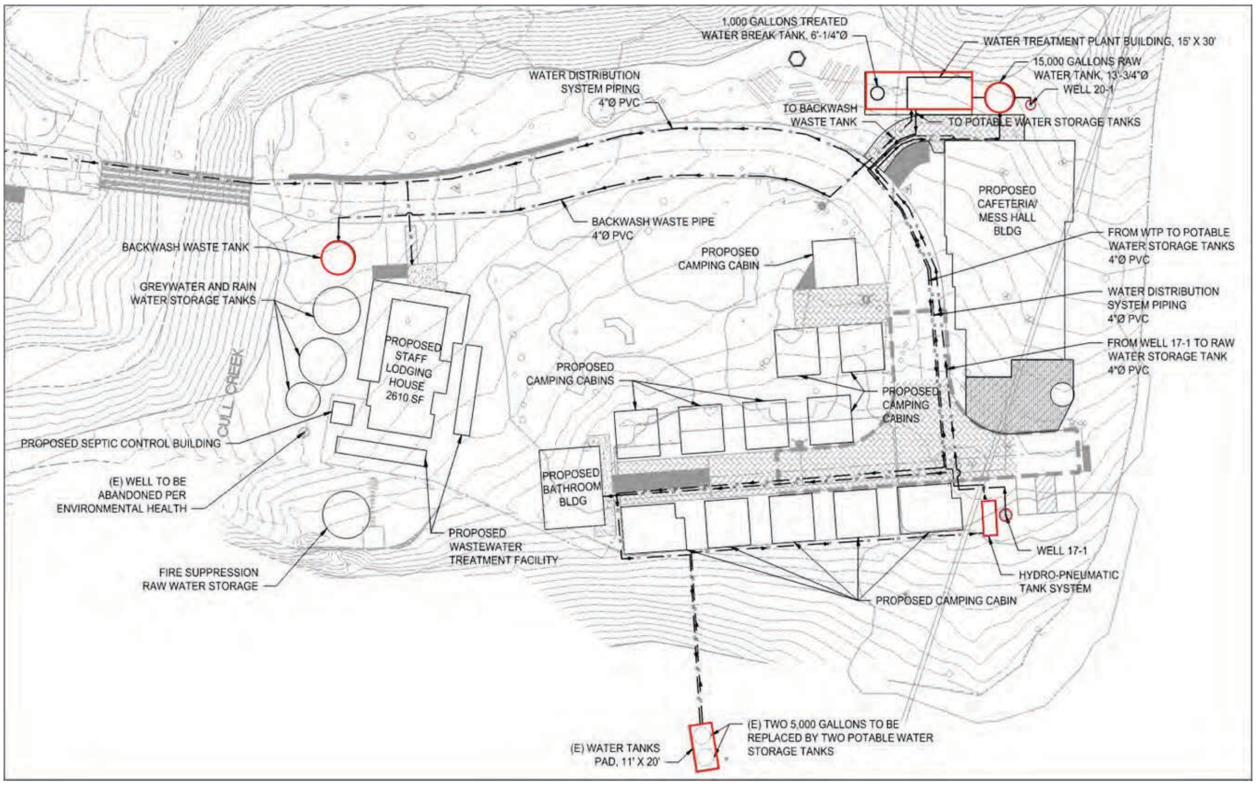

Figure 6 **Water System Facilities Proposed Locations**

5.2. Water Supply Sources

The two (2) new groundwater wells, Well 20-1 and Well 17-1, draw water from consolidated sedimentary bedrock and are rated to produce 4.7 gpm and 3.0 gpm, respectively. Both wells were constructed with an adequate sanitary seal and in compliance with Title 22 CCR §64554 and §64560. Table 8 presents the main characteristics of the two (2) new production wells and the well completion reports are included in Attachment 6.

Table 8 Production Wells Parameters

	Well 20-1	Well 17-1
Depth	135 ft	200 ft
Screen Depth	95 - 135 ft	70 - 90 ft and 130 - 190 ft
Aquifer Characteristics	Confined to Semi-Confined Bedrock Aquifer	
Static Depth to Water	52.9 ft	74.4 ft
Rated Capacity	4.7	3.0

Based on the water quality and supply resilience of each well, it was determined that Well 20-1 will operate as the main supply source while Well 17-1 would be used as a backup supply source, supplementing Well 20-1 and maintaining supply during Well 20-1 maintenance activities, as needed.

Both wells will have dedicated transmission mains that will transfer water directly to the new 15,000-gallon raw water tank located at the WTP site. The transmission mains will be 4-inch buried PVC pipes, and will include approximately 265 linear feet of pipe from Well 17-1 to the raw water tank and approximately 10 linear feet from Well 20-1 to the same raw water tank.

The 50-foot radius control zones around the supply sources have been assessed and deemed secured from potential contamination sources. Both wellheads will have an enclosure, which will be locked to protect the wells and prevent access from unauthorized personnel. Flow meters will be installed at each well to monitor the wells' respective source production, in compliance with CCR Title 22 §64161. A sediment filter at the wellhead will be installed as an initial preliminary screening of large particles.

5.3. Water Treatment System Design

The water treatment facility was developed based on the wells' raw water quality, suppliers' recommendations, and the CCR. The following sections detail the proposed treatment processes and general operational requirements.

5.3.1. Effluent Water Quality Regulatory Requirements

A treatment system will be implemented to target the constituents of concern present in the raw water and comply with disinfection requirements, ensuring a safe and sustainable water supply for the Mosaic water system. Constituents that are above regulatory limits in Wells 20-1 and 17-1 are included in Table 9. Additionally, as shown in Table 5, some constituents that do not have an MCL are also reported at high concentrations, including: sodium in Well 17-1 and calcium in Well 20-1[6].

[6] Sodium and calcium are included as part of the TDS concentrations.

Table 9 Effluent Water Quality Criteria Summary

	Average Well Concentrations	MCLs
Well 20-1		
Iron	365 ug/L	300 ug/L
Manganese	102 ug/L	50 ug/L
TDS	659 mg/L	500 mg/L
Constituents of Concern	Total alkalinity, silica, calcium	
Well 17-1		
Arsenic	18 ug/L	10 ug/L
TDS	1427 mg/L	500 mg/L
Constituents of Concern	Total alkalinity, hardness, silica, sodium	

Based on the CCR Title 22 §64430 and the Groundwater Rule, it is planned that the design will include disinfection equipment that can achieve at least 99.99 percent (4-log) reduction of viruses through filtration and disinfection.

5.3.2. Proposed Treatment Train

Based on the well's raw water quality presented in Section 2.1.2, industry knowledge, and communications with several vendors, reverse osmosis (RO) was identified as the most appropriate treatment technology for Mosaic's groundwater sources. RO uses high-pressure pumps to push water through the filtration membranes and is the most reliable treatment technology for handling water with elevated TDS and mineral concentrations. Additionally, RO is an effective treatment for arsenic, which is found in high concentrations in Well 17-1. Additional pretreatment steps are recommended to address all of the identified constituents of concern present in the raw water and to ensure the optimized operations of the RO unit. The design capacity of the RO unit and associated pre-treatment steps was evaluated with consideration of flexibility, run time, and efficiency. Two (2) main options were evaluated:

(1) Design Capacity of MDD (3-6 gpm): Designing the treatment system based on the MDD of the water system is a common practice and was investigated for the Mosaic system. It was established that RO units with lower flow rates tend to be designed for residential household applications and therefore don't hold the necessary NSF-61 certification. Additionally, the implementation of a 3 to 6 gpm RO unit would provide limited redundancy and flexibility, require long run times at the WTP, and lead to increased wear and tear and maintenance needs.

(2) Design Capacity higher than MDD (12 gpm): The implementation of an RO unit that can handle a flow rate of approximately 12 gpm would operate at a higher capacity than the wells' production rate and therefore require a larger raw water facility. A larger unit, however, would allow for shorter daily run times and provide additional operational flexibility. A higher production rate also provides the capacity to fill the potable water storage over a shorter amount of time and increases the reliability of the treatment system and its ability to respond to instantaneous, unexpected system demands.

Based on the evaluation of the two (2) above options, it was established that a larger RO would be required to meet NSF-61 requirements and allow for optimal flexibility for the water system. The proposed treatment process includes a 12-gpm RO unit and has a total flow rate capacity of up to 18.5 gpm - depending on the blending ratio - to efficiently produce a safe drinking water supply to serve the Mosaic's demands (see Section 5.3.3). The proposed water treatment process includes three (3) pressure vessels, three (3) chemical injection steps and an RO unit in series, as follows:

- **Sodium Hypochlorite Dosing:** This chlorine injection process serves as the oxidizing step to precipitate key contaminants present in the groundwater.
- **Low Pressure Feed Pump:** The supply pump is rated at approximately 50 pounds per square inch (psi) and pushes the water from the raw water tank through the pre-treatment filtration steps installed in series. The low-pressure supply pump is also used to backwash the pre-treatment filters.
- **Multi-Media Filter:** The 21-inch diameter multi-media pressure filter includes layers of anthracite, sand, and gravel and handles turbidity removal.
- **Greensand Filter:** The 24-inch diameter greensand filter targets the removal of iron and manganese precipitates.
- **Activated Carbon Filter:** The 24-inch diameter activated carbon vessel removes organics, taste and odor compounds, and excess chlorine from the oxidation step.
- **Antiscalant Dosing:** An antiscalant chemical is injected into the pipe to inhibit the formation of mineral scales that would cause membrane fouling. The antiscalant dosing is meant to specifically control and prevent the precipitation of silica to optimize membranes' operation and longevity.
- **High-Pressure Feed Pump:** The high-pressure pump provides up to 120 psi of pressure required for RO membrane operation.
- **RO System:** A commercial-sized brackish water RO unit provides the effective removal of the salts, minerals and pathogens present in the water. The RO unit is skid-mounted and includes a heavy duty sediment filter, 12 thin-film composite (TFC) 4-inch membranes held in individual fiber-reinforced plastic (FRP) pressure vessels and an integrated blending process to optimize the composition of the WTP effluent. A control panel ensures the proper operation of the RO treatment process and controls the necessary pumps, analyzers and internal setpoints.
- **Disinfection Process:** The system involves the installation of a disinfection process, based on the Groundwater Rule requirements. A sodium hypochlorite injection system located at the inlet of the potable water break tank at the treatment plant sets the proper chlorine residual for the distribution system.
- **WTP Control Panel:** A control panel facilitates the operation and supervision of the treatment process and allows the monitoring and updating of regulatory and operating setpoints of the water system.

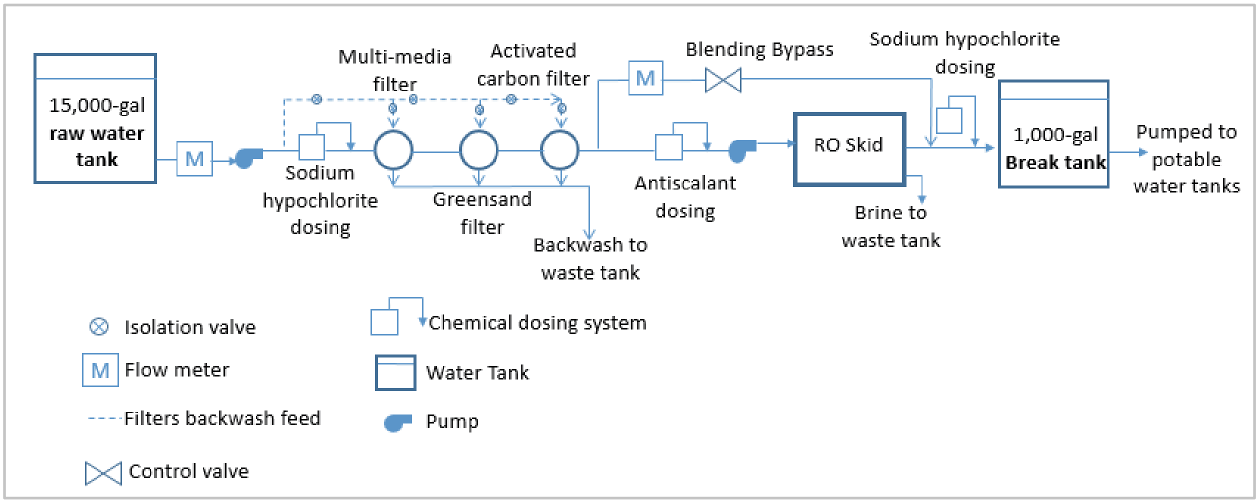

Figure 7 Treatment Process PFD

The effluent of the RO unit is sent to a 1,000-gallon treated water break tank located at the WTP site. A small booster pump will transfer water from the break tank to the potable water tanks located at a higher elevation.

5.3.3. Proposed RO Blending System

Based on RO treatment best practices, the new water treatment system will include a blending system in order to balance the mineral content in the finished water. This configuration will result in the blending of RO-treated water and water filtered through the pre-treatment in the 1,000-gallon break tank located downstream of the RO treatment process. The implementation of the blending process allows the presence of some mineral content in the finished water and mitigates the following disadvantages associated with the use of RO:

- Preliminary evidence shows that there may be adverse health effects associated with the consumption of completely demineralized water, which also commonly has poor taste.
- The demineralized RO-treated water is aggressive and can cause metals from distribution piping and appurtenances to leach into the water.
- The operations of a RO unit produces a significant amount of brine waste, with approximately 40 to 50% of the influent water sent to waste.

All of the water will flow through the pretreatment steps to ensure the maximum removal of iron and manganese, which are the main constituents of concern in Well 20-1. Based on the raw water quality in Well 17-1 - namely the presence of arsenic - the blending process will not be used whenever Well 17-1 is feeding the WTP. The blending of pre-treated water and RO-treated water will be used to balance the presence of TDS in the finished water, as shown in Table 7.

Preliminary calculations were conducted to determine the recommended RO blending ratio, based on the appropriate removal of TDS from the raw water from Well 20-1. This flow split scenario takes into account the maximum TDS concentration recorded at Well 20-1 and uses a conservative target TDS concentration of 300 mg/L.[7] Assuming a 90% removal based on estimates from RO vendors, the recommended flow split under normal operations would involve a minimum of 65% of the flow passing through the RO unit and 35% through the pre-treated blending flow, as presented in Table 10.[8]

Table 10 RO Blending Ratio Calculations (Well 20-1 Scenario)

Final TDS Concentration	300 mg/L
Raw Water TDS Concentration	682 mg/L
RO Achieved TDS Reduction	90%
RO Effluent TDS Concentration	68.2 mg/L
RO Flow %	**62.2%**
Blended Flow %	**37.8%**

Based on the 12-gpm capacity of the proposed RO unit, the total flow capacity of the plant would vary from 12 to 18.5 gpm, assuming conservative blending ratios of 65 to 100% of the water flowing through the RO unit. Based on the calculation shown in Table 10, potential operating scenarios were developed, as shown in Table 11. The blending line would be equipped with a motorized control valve, a manual isolation valve, a throttling valve, and a flow meter. The motorized control valve will open and close in sync with the treatment train and the throttling valve will be manually operated to set the appropriate flow ratio through the blending line. Before Well 17-1 is manually turned on, the valve on the blending line will be closed to ensure that 100% of the flow passes through the RO membranes.

Table 11 Potential Blending Scenarios

RO Flow	Blending Flow	Total Flow	Flow Split RO	Flow Split Blending
gpm	*gpm*	*gpm*	*%*	*%*
12	6.5	18.5	65	35
12	5.1	17.1	70	30
12	4	16	75	25
12	3	15	80	20
12	0	12	100	0

[7] The recommended secondary drinking water standard TDS limit is 500 mg/L.
[8] The feasibility of installing a real-time TDS analyzer located at the outlet of the 1,000-gallon break tank to provide confirmation of the proper blending ratio will also be assessed.

A water quality check has been conducted to identify the maximum acceptable TDS level in Well 20-1 that would ensure an effluent below the TDS MCL at a conservative blending ratio of 65/35 flow split. Assuming a 90% TDS removal by the RO unit, a 65/35 flow split between the RO unit and its blending, and a target effluent TDS concentration of 450 mg/L, the maximum acceptable influent TDS concentration would be 1,085 mg/L. Given that the average influent TDS concentration at Well 20-1 is recorded at 659 mg/L, there is an adequate factor of safety for the proposed blending plan.

5.3.4. Waste Handling Facilities

Due to the limited capacity of the new onsite septic system, the brine produced by the RO treatment unit and backwash waste from the pre-treatment processes will be sent to a dedicated waste tank. The content of the waste tank will be hauled off-site by an approved waste hauler on a regular basis to ensure that treatment operations are not disrupted. Table 12 below shows the anticipated wastewater volume produced by the treatment processes for a conservative scenario that involves two (2) consecutive week-long camp sessions.

The treatment waste volumes estimated include the anticipated spent backwash from the pre-treatment pressure vessels and the brine produced by the RO membranes, calculated as follows:

- The pre-treatment spent backwash is calculated using the approximate backwash cycle flow rate, duration, and frequency, and is directly dependent on the duration of treatment operation. Since the pre-treatment vessels get backwashed approximately once a day when in operation, the backwash waste is calculated based on the estimated number of days of operation over the 2-week period. It is anticipated that the treatment train will produce potable water in batches and be able to run every two (2) to three (3) days, for an estimate of five (5) days of operations over a 2-week period.
- Brine waste is calculated based on the recovery setting of the RO unit and the volume of water pushed through the membrane unit. The anticipated brine volume is therefore calculated using the expected volume of water produced over the 2-week period.

Table 12 High-Demand Scenario Treatment Waste Volume Calculations

Pre-Treatment Backwash						
Treatment Trains	**Backwash Flow Rate**	**Backwash Duration**	**Cycle Frequency**	**Operation Time**	**Backwash Volume**	**Anticipated Waste Composition**
	gpm	*min*		*days*	*gallons*	
Multimedia Filter	36.2	20	1/day	5	3,620	turbidity/ suspended solids
Greensand Filter	37.7	20	1/day	5	3,770	Iron and manganese
Activated Carbon	37.7	20	1/week	5	754	Organics, chlorine
				Total	8,144	

RO Brine						
	2-Week Treated Water Volume	**RO Flow Split**	**2-Week Water Treated by RO**	**Recovery**	**RO Brine Volume**	**Anticipated Waste Composition**
	gallons		*gallons*		*gallons*	
RO	39,900	65%	25,935	55%	11,671	TDS, pathogens, Salts, minerals arsenic
				Total 2-Week Backwash + RO Brine Volume	**19,815**	

Based on the high-demand scenario, the implementation of a 20,000-gallon backwash waste tank is recommended. The backwash waste tank is sited at a location near the Staff House that can easily be accessed by a vacuum truck. Based on the East Bay Municipal Utility District (EBMUD) wastewater ordinance and discharge limits, the RO brine and backwash waste will be accepted and can be hauled by one of EBMUD's approved haulers. Based on information provided by local liquid waste haulers, the size of the tanker trucks varies from 3,000 to 5,000 gallons of capacity. During the peak season, the anticipated hauling frequency of liquid waste would involve four (4) trucks every two (2) weeks. Additional options for disposing of pretreatment waste streams have been evaluated, however no solid alternatives for onsite disposal have been established at this time.

5.4. Storage Requirements

The storage facilities will include raw and potable water tanks that will store water from the water system's groundwater sources. The storage requirements for the Mosaic water system are based on CCR Title 22 §64554, as detailed in the following sections.

5.4.1. Raw Water Storage

The raw water storage capacity will hold raw water pumped from the groundwater supply sources identified to feed the water system. The main objectives of the implementation of raw water storage include additional supply reliability and operational flexibility for the water system. The raw water storage tank will be co-located with the treatment system to ensure that the treatment system process can be pressurized by a dedicated supply pump.

The installation of a 15,000-gallon raw water storage tank will provide approximately one (1) week of ADD supply and 3.7 days of MDD supply. Under normal conditions during the high season, the raw water storage tank will be kept full by Well 20-1 raw water supply. When both wells are in operation, the raw water tank will provide inherent blending of the two (2) water sources and provide limited settling of suspended particles, depending on the residence time inside the tank.

5.4.2. Treated Water Storage

The potable water storage capacity was determined based on the requirement stated in Title 22 CCR §64554(a)(2), which mandates "a storage capacity equal to or greater than MDD." Based on the estimated demand scenarios, a total of 10,000-gallon of potable water storage is recommended, which will provide up to four and a half (4.5) days of ADD and two and a half (2.5) days of MDD. The potable water tanks will supply the hydro-pneumatic tank before feeding the distribution system, as discussed in Section 5.5. The potable water storage capacity will provide flexibility of operations and supply reliability to the water system, while minimizing residence time to maintain water quality within the distribution system. Two (2) 5,000-gallon NSF-61 compliant plastic tanks will be installed at the site and will be hydraulically connected. The tanks will be equipped with pressure transducers to continuously monitor the water level inside the tanks.

5.5. Hydro-Pneumatic Tank & Distribution System

The distribution system will be supplied by the two (2) 5,000-gallon tanks at high elevation and a 1,000-gallon hydro-pneumatic system located by the bathroom building. With the potable water tanks located at 162 feet of elevation, the anticipated pressure range throughout the distribution system is approximately 19 psi to 58 psi. A hydropneumatic tank and booster pump setup will be implemented to ensure pressures between 40 and 80 psi at all connections, in compliance with CCR Title 22 §64602.

Based on a conservative estimate of maximum instantaneous demands and the recommended pump cycling process, the preliminary capacity of the hydro-pneumatic tank is 1,000 gallons. The hydro-pneumatic tank, of approximately 4-feet in diameter and 12 feet in length, would be located between the cabins and Well 17-1. The installation of a small enclosure around the booster pump that will pressurize the hydro-pneumatic tank will mitigate the anticipated noise levels.

The distribution system mains will be 4-inch NSF-61 certified PVC pipes buried in trenches and backfilled with proper fill material. The distribution system will include approximately 1,300 linear feet of water mains to supply six (6) confirmed water connections throughout the Mosaic site, including:

- The main hall
- The bathroom building
- The staff house
- The caretaker house
- A minimum of two (2) water spigots (exact locations TBD)

In accordance with CCR Title 22 §64572, the existing piping network will be removed and the new potable, sewer and greywater mains will be installed underground with the proper distance requirements. Isolation valves will be installed throughout the distribution system to provide operational flexibility and facilitate the detection and containment of leaks within the distribution system. A flow meter will be installed at the outlet of the potable water tank feeding the distribution system to monitor the system's water demand, in compliance with CCR Title 22 §64561.

5.6. Summary of Regulatory Compliance

The regulatory compliance requirements discussed in the previous section are summarized in Attachment 7.

5.7. Engineer's Opinion of Probable Cost

Based on the assessment of the proposed facilities described in this section, the engineer's opinion of probable capital cost for the implementation of the Mosaic new water system is approximately $1.02 M, as detailed in Table 13.

Table 13 Capital Construction Costs Estimate

	No.	Unit	Unit $	Total Cost
Groundwater Supply Sources				
20-1 submersible well pump	1	EA	$5,000	$5,000
17-1 submersible well pump	1	EA	$5,000	$5,000
Wellhead Appurtenances	2	EA	$5,000	$10,000
Flow Meter	2	EA	$2,300	$4,600
Transmission System				
4-inch PVC transmission piping	1100	LF	$120	$132,000
Storage Facilities				
15,000-gallon raw water tank	1	EA	$22,000	$22,000
20,000-gallon backwash waste tank	1	EA	$55,000	$55,000
Pressure Transducer	5	EA	$700	$3,500
10,000-gallon potable water tank	2	EA	$15,000	$30,000

Appurtenances and Misc. Piping	1	LS	$15,000	$15,000
Water Treatment Facility				
Pre-Chlorination Dosing System	1	EA	$756	$800
Pre-Treatment Supply Pump	1	EA	$4,120	$4,100
21" Multimedia Filter	1	EA	$3,288	$3,300
24" Greensand Filter	1	EA	$5,195	$5,200
24" Activated Carbon Filter	1	EA	$4,614	$4,600
Antiscalant Dosing System	1	EA	$1,031	$1,000
Reverse Osmosis Skid	1	EA	$22,334	$22,300
Control Panel & Instruments	1	EA	$16,950	$17,000
Skid Mounting	1	EA	$9,950	$10,000
Post chlorination dosing system	1	EA	$756	$800
1,000-gallon break tank	1	EA	$1,600	$1,600
Booster Pump	2	EA	$3,000	$6,000
Yard piping	150	LF	$100	$15,000
Flow meter	1	EA	$2,300	$2,300
WTP Enclosure	1	LS	$80,000	$80,000
Piping - Backwash waste to tank	300	LF	$120	$36,000
Distribution System				
4-inch PVC distribution piping	1300	LF	$120	$156,000
Appurtenances	1	LS	$10,000	$10,000
Hydro-pneumatic Tank & Pump	1	LS	$30,000	$30,000
Instrumentation & Controls	1	LS	$30,000	$30,000
TOTAL				$727,700
40% Contingency				$291,100
TOTAL + CONTINGENCY				$1,018,800

1. The cost estimates presented in this table do not include design engineering and permitting costs and represent the capital construction costs for the new proposed water system facilities.
2. The cost estimates presented in this table have been rounded to the nearest 100.
3. Electrical improvements have not been included in the cost estimate and will be handled as part of the general Mosaic development design and construction.

6. WATER SYSTEM OPERATION AND MAINTENANCE

The preliminary operational strategy that guides how the proposed facilities will operate to efficiently treat, store and convey the water throughout the system.

6.1. Preliminary Operation Strategy

The preliminary operational strategy for the new water system is based on maintaining effluent water quality and operational efficiency. Table 13 summarizes the general control strategy. The tank and treatment unit controls will be integrated into a control panel located at the WTP.

Table 13 Summary of Preliminary Operations Strategy

	Control Strategy
Wells 20-1, 17-1, and the Raw Water Tank	The 15,000-gallon raw water tank will be the supply source for the WTP and will be filled with groundwater supply directly from Wells 20-1 and Well 17-1. Since Well 20-1 is the main production source for the water system, the well pump will turn on and off based on the level in the raw water tank. The water level in the tank will be monitored with a pressure transducer placed inside the tank.
WTP Start-up and Pre-Treatment Feed Pump	The WTP will start-up based on the water level in the two (2) 5,000-gallon potable water tanks located at the elevated site on the hill. WTP start-up will be initiated by the pre-treatment pump turning on. The pre-treatment pump and WTP will turn off when the two (2) 5,000-gallon tanks have reached their high level setpoint. The water levels in the tanks will be monitored with pressure transducers placed inside each tank.
RO Feed Pump	The RO feed pump operation will be synced with the pre-treatment feed pump and they will turn on and off simultaneously, with the RO pumps operating on a slight delay to protect the pumps. Depending on the blending scenario, the RO feed pump and the pre-treatment feed pump may be operating at different flow rates.
Potable Water Break Tank	The RO-treated water and the water flowing through the blending line, when applicable, will blend in the 1,000-gallon break tank. The VFD-controlled transfer pump will send the treated water up to the two (2) 5,000-gallon potable water distribution tanks. The pump will vary its speed to match the variable permeate flow rate entering the tank from the WTP, maintaining a relatively stable preset level in the 1,000-gallon break tank.
Potable Water Distribution Tanks	The water level in the distribution water tank will call for the pre-treatment pump at the WTP to turn on and off and the water level in each tank will be monitored with a pressure transducer.

The annual O&M cost estimate is included in Attachment 8.

ATTACHMENT 1

EBMUD Notice of Feasibility of Water Main Extension

EAST BAY
MUNICIPAL UTILITY DISTRICT

December 30, 2021

Brian Lowe
Chief Operating Officer
The Mosaic Project
478 Santa Clara Avenue, Suite 200
Oakland, CA 94610

Subject: Feasibility of Obtaining East Bay Municipal Utility District Water Service for 17015 Cull Canyon Road, Castro Valley

Dear Mr. Lowe:

The property located at 17015 Cull Canyon Road, Castro Valley, APN 85-1200-1-16 (Property) is currently located outside of East Bay Municipal Utility District (District) Service Area as set by Alameda County Local Agency Formation Commission (LAFCO). The process for annexation into the District's service area starts with an application to LAFCO. After annexation into the District's service area addition by the United States Bureau of Reclamation (USBR) into the District's Central Valley Project (CVP) contractor's area will be required. This process typically takes 2-5 years and tens of thousands of dollars in costs.

After annexation into the District's service area through LAFCO and inclusion into the CVP contractor's area by the USBR, your project would be required to apply for a water service main extension. However, due to the length of a main extension required to provide water service (more than 2 miles) and the limited demand of the Mosaic Project there would be insufficient water usage to avoid potential issues in water quality. There may be additional concerns of pressure or additional hurdles due to the location of the project and the lack of District infrastructure in the immediate area. Currently, it is not feasible to obtain District water service at the Property.

You may contact me at (510) 287-1182 should you have any questions.

Sincerely,

Jack J. Flynn
Customer Services Manager of the New Business Office

375 ELEVENTH STREET . OAKLAND . CA 94607-4240 . TOLL FREE 1-866-40-EBMUD . (1-866-403-2683)

ATTACHMENT 2

Well 17-1 & Well 20-1 Water Quality Reports

Attachment 2A - Well 20-1 Water Quality Results
Attachment 2B - Well 17-1 Water Quality Results

ATTACHMENT 2A

Well 20-1 Water Quality Results

Balance Hydrologics, Inc.
Mark Woyshner/Gustavo Porras
800 Bancroft Way, Suite 101
Berkeley, CA 94710

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS (6227)
www.MBASinc.com
ELAP Certification Number: 2385

Wednesday, July 7, 2021

Lab Number: 210624_04-02 Sample Description: Mosaic Project, Well 20-1

Collection Date/Time: 6/23/2021 11:30 Sample Collector: Woyshner M Client Sample #:
Received Date/Time: 6/24/2021 9:47 System ID:

Analyte	Method	Unit	Result	Dilution	Qualifier	PQL	MCL	Analysis Date / Time		Analyst
Anion-Cation Balance	Calculation	%	0	1						
QC Anion Sum x 100	Calculation	%	111	1						
QC Cation Sum x 100	Calculation	%	112	1						
QC Ratio TDS/SEC	Calculation	NA	0.61	1						
Turbidity	EPA180.1	NTU	3.6	1		0.1	5	6/25/2021	8:45	KG
Boron	EPA200.7	mg/L	0.23	1		0.1		6/29/2021	17:46	MW
Calcium	EPA200.7	mg/L	111	1		1		6/29/2021	17:46	MW
Copper, Total	EPA200.7	µg/L	ND	1		20	1300	6/29/2021	17:46	MW
Iron, Dissolved	EPA200.7	µg/L	353	1		30	300	6/29/2021	17:49	MW
Iron, Total	EPA200.7	µg/L	358	1		30	300	6/29/2021	17:46	MW
Magnesium	EPA200.7	mg/L	43.8	1		0.5		6/29/2021	17:46	MW
Manganese, Dissolved	EPA200.7	µg/L	99	1		15	50	6/29/2021	17:49	MW
Manganese, Total	EPA200.7	µg/L	98	1		15	50	6/29/2021	17:46	MW
Potassium	EPA200.7	mg/L	1.5	1		0.5		6/29/2021	17:46	MW
Silica (SiO2), Total	EPA200.7	mg/L	27.3	1		1		6/29/2021	17:46	MW
Silica SiO2, Dissolved	EPA200.7	mg/L	27.1	1		1		6/29/2021	17:49	MW
Sodium	EPA200.7	mg/L	55	1		1		6/29/2021	17:46	MW
Zinc, Total	EPA200.7	µg/L	ND	1		30	5000	6/29/2021	17:46	MW
Arsenic, Total	EPA200.8	µg/L	ND	1		1	10	6/28/2021	16:52	MW
Cadmium, Total	EPA200.8	µg/L	ND	1		0.25	5	6/28/2021	16:52	MW
Chromium, Total	EPA200.8	µg/L	2.9	1		1	50	6/28/2021	16:52	MW
Lead, Total	EPA200.8	µg/L	ND	1		1	15	6/28/2021	16:52	MW
Bromide	EPA300.0	mg/L	0.2	1		0.1		6/25/2021	9:48	BS
Chloride	EPA300.0	mg/L	49.2	1		1	250	6/25/2021	9:48	BS
Fluoride	EPA300.0	mg/L	0.2	1		0.1	2	6/25/2021	9:48	BS
Nitrate as N	EPA300.0	mg/L	ND	1		0.1	10	6/25/2021	9:48	BS
Nitrite as N	EPA300.0	mg/L	ND	1		0.1	1	6/25/2021	9:48	BS
Orthophosphate as P	EPA300.0	mg/L	ND	1		0.06		6/25/2021	9:48	BS
Sulfate	EPA300.0	mg/L	138	1		1	250	6/25/2021	9:48	BS

Abbreviations/Definitions: mg/L: Milligrams per liter (=ppm) µg/L: Micrograms per liter (=ppb) MPN: Most Probable Number
MDL: Method Detection Limit PQL: Practical Quantitation Limit MCL: Maximum Contamination Level ND: Not Detected at the PQL (or MDL, if shown)
E: Analysis performed by External Laboratory; see Report attachments H: Analyzed outside of method hold time QC: Quality Control
J: Result is < PQL but ≥ MDL; the concentration is an approximate value.

Balance Hydrologics, Inc.
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Wednesday, July 7, 2021

Lab Number: 210624_04-02 Sample Description: Mosaic Project, Well 20-1

Collection Date/Time:	6/23/2021	11:30	Sample Collector: Woyshner M	Client Sample #:	
Received Date/Time:	6/24/2021	9:47	System ID:		

Analyte	Method	Unit	Result	Dilution	Qualifier	PQL	MCL	Analysis Date / Time		Analyst
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	363	1		10		6/24/2021	20:00	OW
Bicarbonate (as HCO3-)	SM2320B	mg/L	443	1		10				
Langelier Index, 15°C	SM2330B	NA	0.20	1						
Langelier Index, 60°C	SM2330B	NA	1.03	1						
Hardness (as CaCO3)	SM2340B/Calc	mg/L	458	1		5				
Specific Conductance (EC)	SM2510B	µmhos/cm	1038	1		3	900	6/24/2021	20:00	OW
Total Dissolved Solids	SM2540C	mg/L	638	1		10	500	6/25/2021	16:42	OW
pH (Laboratory)	SM4500-H+B	pH (H)	7.4	1		0.1	8.5	6/24/2021	20:00	OW
SAR (Sodium Absorption Ratio)	Suarez, 1981	NA	1.2	1						
SAR, Adjusted	Suarez, 1981	NA	1.5	1						

Abbreviations/Definitions:
mg/L: Milligrams per liter (=ppm)
µg/L: Micrograms per liter (=ppb)
MPN: Most Probable Number
MDL: Method Detection Limit
PQL: Practical Quantitation Limit
MCL: Maximum Contamination Level
ND: Not Detected at the PQL (or MDL, if shown)
E: Analysis performed by External Laboratory; see Report attachments
H: Analyzed outside of method hold time
QC: Quality Control
J: Result is < PQL but ≥ MDL; the concentration is an approximate value.

McCampbell Analytical, Inc.
"When Quality Counts"
1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E300.1
Date Prepared:	01/22/2021	**Analytical Method:**	E300.1
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Inorganic Anions by IC

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**IC4 01262175.D**	**213591**

Analytes	Result		RL	DF	Date Analyzed
Chloride	**49**		2.0	20	01/22/2021 16:21
Sulfate	**240**		20	200	01/22/2021 13:29

Surrogates	REC (%)	Qualifiers	Limits	Date Analyzed
Malonate	0	S	90-115	01/22/2021 16:21

Analyst(s): AO   Analytical Comments: c1

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**IC4 01262176.D**	**213591**

Analytes	Result		RL	DF	Date Analyzed
Chloride	**53**		5.0	50	01/22/2021 16:37
Sulfate	**140**		5.0	50	01/22/2021 16:37

Surrogates	REC (%)	Qualifiers	Limits	Date Analyzed
Malonate	0	S	90-115	01/22/2021 16:37

Analyst(s): AO   Analytical Comments: c1

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E314.0
Date Prepared:	01/25/2021	**Analytical Method:**	E314.0
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Perchlorate

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**IC1 21012515.CHW**	**213791**

Analytes	Result	RL	DF	Date Analyzed
Perchlorate	ND	1.0	2	01/25/2021 19:34

Analyst(s): AO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**IC1 21012516.CHW**	**213791**

Analytes	Result	RL	DF	Date Analyzed
Perchlorate	ND	0.50	1	01/25/2021 19:52

Analyst(s): AO

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SW8151A
Date Prepared:	01/22/2021	**Analytical Method:**	E515.3
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Chlorinated Herbicides

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001G	Water	01/21/2021 11:15	GC15A 01222112.D	213622

Analytes	Result	RL	DF	Date Analyzed
Bentazon	ND	1.0	1	01/22/2021 17:43
2,4-D (Dichlorophenoxyacetic acid)	ND	1.0	1	01/22/2021 17:43
2,4-DB	ND	1.0	1	01/22/2021 17:43
Dalapon	ND	1.0	1	01/22/2021 17:43
DCPA (mono & diacid)	ND	0.20	1	01/22/2021 17:43
Dicamba	ND	1.0	1	01/22/2021 17:43
Dinoseb (DNBP)	ND	1.0	1	01/22/2021 17:43
Pentachlorophenol (PCP)	ND	0.20	1	01/22/2021 17:43
Picloram	ND	1.0	1	01/22/2021 17:43
2,4,5-TP (Silvex)	ND	1.0	1	01/22/2021 17:43

Surrogates	REC (%)	Limits	
DCAA	81	70-130	01/22/2021 17:43

Analyst(s): DP

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002G	Water	01/21/2021 13:00	GC15A 01222113.D	213622

Analytes	Result	RL	DF	Date Analyzed
Bentazon	ND	1.0	1	01/22/2021 18:08
2,4-D (Dichlorophenoxyacetic acid)	ND	1.0	1	01/22/2021 18:08
2,4-DB	ND	1.0	1	01/22/2021 18:08
Dalapon	ND	1.0	1	01/22/2021 18:08
DCPA (mono & diacid)	ND	0.20	1	01/22/2021 18:08
Dicamba	ND	1.0	1	01/22/2021 18:08
Dinoseb (DNBP)	ND	1.0	1	01/22/2021 18:08
Pentachlorophenol (PCP)	ND	0.20	1	01/22/2021 18:08
Picloram	ND	1.0	1	01/22/2021 18:08
2,4,5-TP (Silvex)	ND	1.0	1	01/22/2021 18:08

Surrogates	REC (%)	Limits	
DCAA	81	70-130	01/22/2021 18:08

Analyst(s): DP

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http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E524.2
Date Prepared:	01/25/2021	**Analytical Method:**	E524.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002F	Water	01/21/2021 13:00	GC45 01232135.D	213766

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	40	1	01/25/2021 11:28
tert-Amyl Methyl Ether (TAME)	ND	0.50	1	01/25/2021 11:28
Benzene	ND	0.50	1	01/25/2021 11:28
Bromobenzene	ND	0.50	1	01/25/2021 11:28
Bromochloromethane	ND	0.50	1	01/25/2021 11:28
Bromodichloromethane	ND	0.50	1	01/25/2021 11:28
Bromoform	ND	0.50	1	01/25/2021 11:28
Bromomethane	ND	0.50	1	01/25/2021 11:28
2-Butanone (MEK)	ND	5.0	1	01/25/2021 11:28
t-Butyl alcohol (TBA)	ND	2.0	1	01/25/2021 11:28
n-Butyl benzene	ND	0.50	1	01/25/2021 11:28
sec-Butyl benzene	ND	0.50	1	01/25/2021 11:28
tert-Butyl benzene	ND	0.50	1	01/25/2021 11:28
Carbon disulfide	ND	0.50	1	01/25/2021 11:28
Carbon tetrachloride	ND	0.50	1	01/25/2021 11:28
Chlorobenzene	ND	0.50	1	01/25/2021 11:28
Chloroethane	ND	0.50	1	01/25/2021 11:28
Chloroform	ND	0.50	1	01/25/2021 11:28
Chloromethane	ND	0.50	1	01/25/2021 11:28
2-Chlorotoluene	ND	0.50	1	01/25/2021 11:28
4-Chlorotoluene	ND	0.50	1	01/25/2021 11:28
Dibromochloromethane	ND	0.50	1	01/25/2021 11:28
1,2-Dibromo-3-chloropropane	ND	0.20	1	01/25/2021 11:28
1,2-Dibromoethane (EDB)	ND	0.50	1	01/25/2021 11:28
Dibromomethane	ND	0.50	1	01/25/2021 11:28
1,2-Dichlorobenzene	ND	0.50	1	01/25/2021 11:28
1,3-Dichlorobenzene	ND	0.50	1	01/25/2021 11:28
1,4-Dichlorobenzene	ND	0.50	1	01/25/2021 11:28
Dichlorodifluoromethane	ND	0.50	1	01/25/2021 11:28
1,1-Dichloroethane	ND	0.50	1	01/25/2021 11:28
1,2-Dichloroethane (1,2-DCA)	ND	0.50	1	01/25/2021 11:28
1,1-Dichloroethene	ND	0.50	1	01/25/2021 11:28
cis-1,2-Dichloroethene	ND	0.50	1	01/25/2021 11:28
trans-1,2-Dichloroethene	ND	0.50	1	01/25/2021 11:28
1,2-Dichloropropane	ND	0.50	1	01/25/2021 11:28
1,3-Dichloropropane	ND	0.50	1	01/25/2021 11:28
2,2-Dichloropropane	ND	0.50	1	01/25/2021 11:28

(Cont.)

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E524.2
Date Prepared:	01/25/2021	**Analytical Method:**	E524.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002F	Water	01/21/2021 13:00	GC45 01232135.D	213766

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.50	1	01/25/2021 11:28
cis-1,3-Dichloropropene	ND	0.50	1	01/25/2021 11:28
trans-1,3-Dichloropropene	ND	0.50	1	01/25/2021 11:28
Diisopropyl ether (DIPE)	ND	0.50	1	01/25/2021 11:28
Ethylbenzene	ND	0.50	1	01/25/2021 11:28
Ethyl tert-butyl ether (ETBE)	ND	0.50	1	01/25/2021 11:28
Freon 113	ND	0.50	1	01/25/2021 11:28
Hexachlorobutadiene	ND	0.50	1	01/25/2021 11:28
2-Hexanone	ND	1.0	1	01/25/2021 11:28
Isopropylbenzene	ND	0.50	1	01/25/2021 11:28
4-Isopropyl toluene	ND	0.50	1	01/25/2021 11:28
Methyl-t-butyl ether (MTBE)	ND	0.50	1	01/25/2021 11:28
Methylene chloride	ND	0.50	1	01/25/2021 11:28
4-Methyl-2-pentanone (MIBK)	ND	0.50	1	01/25/2021 11:28
Naphthalene	ND	0.50	1	01/25/2021 11:28
n-Propyl benzene	ND	0.50	1	01/25/2021 11:28
Styrene	ND	0.50	1	01/25/2021 11:28
1,1,1,2-Tetrachloroethane	ND	0.50	1	01/25/2021 11:28
1,1,2,2-Tetrachloroethane	ND	0.50	1	01/25/2021 11:28
Tetrachloroethene	ND	0.50	1	01/25/2021 11:28
Toluene	ND	0.50	1	01/25/2021 11:28
1,2,3-Trichlorobenzene	ND	0.50	1	01/25/2021 11:28
1,2,4-Trichlorobenzene	ND	0.50	1	01/25/2021 11:28
1,1,1-Trichloroethane	ND	0.50	1	01/25/2021 11:28
1,1,2-Trichloroethane	ND	0.50	1	01/25/2021 11:28
Trichloroethene	ND	0.50	1	01/25/2021 11:28
Trichlorofluoromethane	ND	0.50	1	01/25/2021 11:28
1,2,4-Trimethylbenzene	ND	0.50	1	01/25/2021 11:28
1,3,5-Trimethylbenzene	ND	0.50	1	01/25/2021 11:28
Vinyl chloride	ND	0.50	1	01/25/2021 11:28
m,p-Xylene	ND	0.50	1	01/25/2021 11:28
o-Xylene	ND	0.50	1	01/25/2021 11:28
Xylenes, Total	ND	0.50	1	01/25/2021 11:28

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CA ELAP 1644

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E524.2
Date Prepared:	01/25/2021	**Analytical Method:**	E524.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002F	Water	01/21/2021 13:00	GC45 01232135.D	213766

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	97	70-130		01/25/2021 11:28
Toluene-d8	94	70-130		01/25/2021 11:28
4-BFB	96	70-130		01/25/2021 11:28

Analyst(s): KF

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E200.8
Date Prepared:	01/22/2021	**Analytical Method:**	E200.8
Project:	220172; The Mosaic Project	**Unit:**	µg/L

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002B**	**Water**	**01/21/2021 13:00**	**ICP-MS3 061SMPL.D**	**213611**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	6.0	1	01/27/2021 15:47
Arsenic	ND	2.0	1	01/27/2021 15:47
Barium	ND	100	1	01/27/2021 15:47
Beryllium	ND	1.0	1	01/27/2021 15:47
Cadmium	ND	1.0	1	01/27/2021 15:47
Chromium	**74**	10	1	01/27/2021 15:47
Cobalt	**1.0**	0.50	1	01/27/2021 15:47
Copper	**13**	10	1	01/27/2021 15:47
Lead	ND	0.50	1	01/27/2021 15:47
Mercury	ND	1.0	1	01/27/2021 15:47
Molybdenum	**2.9**	0.50	1	01/27/2021 15:47
Nickel	**36**	10	1	01/27/2021 15:47
Selenium	ND	5.0	1	01/27/2021 15:47
Silver	ND	10	1	01/27/2021 15:47
Thallium	ND	1.0	1	01/27/2021 15:47
Vanadium	ND	3.0	1	01/27/2021 15:47
Zinc	ND	50	1	01/27/2021 15:47

Analyst(s): JAG

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E525.2
Date Prepared:	02/01/2021	**Analytical Method:**	E525.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001H	Water	01/21/2021 11:15	GC42 02022117.D	214214

Analytes	Result	RL	DF	Date Analyzed
Benzo (a) pyrene	ND	0.043	1	02/02/2021 17:06
Bis (2-ethylhexyl) Adipate	ND	0.21	1	02/02/2021 17:06
Bis (2-ethylhexyl) Phthalate	ND	0.21	1	02/02/2021 17:06

Surrogates	REC (%)	Limits	Date Analyzed
Triphenyl phosphate	117	70-130	02/02/2021 17:06

Analyst(s): HD

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002H	Water	01/21/2021 13:00	GC42 02022118.D	214214

Analytes	Result	RL	DF	Date Analyzed
Benzo (a) pyrene	ND	0.043	1	02/02/2021 17:34
Bis (2-ethylhexyl) Adipate	ND	0.21	1	02/02/2021 17:34
Bis (2-ethylhexyl) Phthalate	ND	0.21	1	02/02/2021 17:34

Surrogates	REC (%)	Limits	Date Analyzed
Triphenyl phosphate	70	70-130	02/02/2021 17:34

Analyst(s): HD

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E531.1
Date Prepared:	01/22/2021	**Analytical Method:**	E531.1
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Carbamates by HPLC with Derivatization

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001I**	**Water**	**01/21/2021 11:15**	**HPLC1 01222113.D**	**213683**

Analytes	Result	RL	DF	Date Analyzed
3-Hydroxycarbofuran	ND	2.0	1	01/23/2021 04:26
Aldicarb (Temik)	ND	2.0	1	01/23/2021 04:26
Aldicarb sulfoxide	ND	2.0	1	01/23/2021 04:26
Aldoxycarb (Aldicarb Sulfone)	ND	2.0	1	01/23/2021 04:26
Carbaryl (Sevin)	ND	2.0	1	01/23/2021 04:26
Carbofuran (Furadan)	ND	2.0	1	01/23/2021 04:26
Methiocarb (Mesurol)	ND	2.0	1	01/23/2021 04:26
Methomyl (Lannate)	ND	2.0	1	01/23/2021 04:26
Oxamyl	ND	2.0	1	01/23/2021 04:26
Propoxur (Baygon)	ND	2.0	1	01/23/2021 04:26

Surrogates	REC (%)	Limits	
BDMC	80	65-135	01/23/2021 04:26

Analyst(s): ANL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002I**	**Water**	**01/21/2021 13:00**	**HPLC1 01222114.D**	**213683**

Analytes	Result	RL	DF	Date Analyzed
3-Hydroxycarbofuran	ND	2.0	1	01/23/2021 05:27
Aldicarb (Temik)	ND	2.0	1	01/23/2021 05:27
Aldicarb sulfoxide	ND	2.0	1	01/23/2021 05:27
Aldoxycarb (Aldicarb Sulfone)	ND	2.0	1	01/23/2021 05:27
Carbaryl (Sevin)	ND	2.0	1	01/23/2021 05:27
Carbofuran (Furadan)	ND	2.0	1	01/23/2021 05:27
Methiocarb (Mesurol)	ND	2.0	1	01/23/2021 05:27
Methomyl (Lannate)	ND	2.0	1	01/23/2021 05:27
Oxamyl	ND	2.0	1	01/23/2021 05:27
Propoxur (Baygon)	ND	2.0	1	01/23/2021 05:27

Surrogates	REC (%)	Limits	
BDMC	85	65-135	01/23/2021 05:27

Analyst(s): ANL

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E549.2
Date Prepared:	01/25/2021	**Analytical Method:**	E549.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Diquat and Paraquat

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001J**	**Water**	**01/21/2021 11:15**	**HPLC2 01252107.D**	**213762**

Analytes	Result	RL	DF	Date Analyzed
Diquat	ND	4.0	1	01/25/2021 18:47
Paraquat	ND	4.0	1	01/25/2021 18:47

Analyst(s): ANL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002J**	**Water**	**01/21/2021 13:00**	**HPLC2 01252108.D**	**213762**

Analytes	Result	RL	DF	Date Analyzed
Diquat	ND	4.0	1	01/25/2021 19:06
Paraquat	ND	4.0	1	01/25/2021 19:06

Analyst(s): ANL

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2320 B-1997
Date Prepared:	01/22/2021	**Analytical Method:**	SM2320 B
Project:	220172; The Mosaic Project	**Unit:**	mg $CaCO_3$/L

Total & Speciated Alkalinity as Calcium Carbonate

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**TITRINO F065689**	**213649**

Analytes	Result	RL	DF	Date Analyzed
Total Alkalinity	**858**	5.00	1	01/22/2021 12:09
Carbonate	ND	5.00	1	01/22/2021 12:09
Bicarbonate	**858**	5.00	1	01/22/2021 12:09
Hydroxide	ND	5.00	1	01/22/2021 12:09

Analyst(s): HN

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**TITRINO F065690**	**213649**

Analytes	Result	RL	DF	Date Analyzed
Total Alkalinity	**355**	5.00	1	01/22/2021 12:17
Carbonate	ND	5.00	1	01/22/2021 12:17
Bicarbonate	**355**	5.00	1	01/22/2021 12:17
Hydroxide	ND	5.00	1	01/22/2021 12:17

Analyst(s): HN

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2120 B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2120 B-2012
Project:	220172; The Mosaic Project	**Unit:**	Color Units

Apparent Color (Unfiltered)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001C**	**Water**	**01/21/2021 11:15**	**WetChem**	**213630**

Analytes	Result	RL	DF	Date Analyzed
Apparent Color	**4 @ pH 8.1**	2.0	1	01/22/2021 09:10

Analyst(s): PHU

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002C**	**Water**	**01/21/2021 13:00**	**WetChem**	**213630**

Analytes	Result	RL	DF	Date Analyzed
Apparent Color	**3 @ pH 7.7**	2.0	1	01/22/2021 09:20

Analyst(s): PHU

CA ELAP 1644

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SW5030B
Date Prepared:	01/22/2021	**Analytical Method:**	SW8021B/8015Bm
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001D	Water	01/21/2021 11:15	GC12 01222116.D	213580

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.050	1	01/22/2021 21:11
MTBE	---	0.0010	1	01/22/2021 21:11
Benzene	---	0.00050	1	01/22/2021 21:11
Toluene	---	0.00050	1	01/22/2021 21:11
Ethylbenzene	---	0.00050	1	01/22/2021 21:11
m,p-Xylene	---	0.0010	1	01/22/2021 21:11
o-Xylene	---	0.00050	1	01/22/2021 21:11
Xylenes	---	0.00050	1	01/22/2021 21:11

Surrogates	REC (%)	Limits	Date Analyzed
aaa-TFT	104	89-115	01/22/2021 21:11

Analyst(s): IA

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002D	Water	01/21/2021 13:00	GC12 01222120.D	213580

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.050	1	01/22/2021 23:29
MTBE	---	0.0010	1	01/22/2021 23:29
Benzene	---	0.00050	1	01/22/2021 23:29
Toluene	---	0.00050	1	01/22/2021 23:29
Ethylbenzene	---	0.00050	1	01/22/2021 23:29
m,p-Xylene	---	0.0010	1	01/22/2021 23:29
o-Xylene	---	0.00050	1	01/22/2021 23:29
Xylenes	---	0.00050	1	01/22/2021 23:29

Surrogates	REC (%)	Limits	Date Analyzed
aaa-TFT	103	89-115	01/22/2021 23:29

Analyst(s): IA

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM5540 C-2000
Date Prepared:	01/22/2021	**Analytical Method:**	SM5540 C-2000
Project:	220172; The Mosaic Project	**Unit:**	mg/L

MBAS / Anionic Surfactants as LAS

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001E	Water	01/21/2021 11:15	SPECTROPHOTOMETER	213629

Analytes	Result	RL	DF	Date Analyzed
MBAS	ND	0.025	1	01/22/2021 10:30

Analyst(s): PHU

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002E	Water	01/21/2021 13:00	SPECTROPHOTOMETER	213629

Analytes	Result	RL	DF	Date Analyzed
MBAS	ND	0.025	1	01/22/2021 10:40

Analyst(s): PHU

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E200.7
Date Prepared:	01/28/2021	**Analytical Method:**	E200.7
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001B**	**Water**	**01/21/2021 11:15**	**ICP-OES 14**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Boron	**1800**	20	1	01/28/2021 11:25
Calcium	**3500**	200	1	01/28/2021 11:25
Iron	ND	100	1	01/28/2021 11:25
Magnesium	**1700**	200	1	01/28/2021 11:25
Manganese	ND	20	1	01/28/2021 11:25
Potassium	**2600**	200	1	01/28/2021 11:25
Sodium	**520,000**	2000	10	01/28/2021 13:49

Analyst(s): DB

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002B**	**Water**	**01/21/2021 13:00**	**ICP-OES 15**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Boron	**270**	20	1	01/28/2021 11:28
Calcium	**100,000**	2000	10	01/28/2021 13:52
Iron	**370**	100	1	01/28/2021 11:28
Magnesium	**43,000**	200	1	01/28/2021 11:28
Manganese	**110**	20	1	01/28/2021 11:28
Potassium	**1600**	200	1	01/28/2021 11:28
Sodium	**57,000**	200	1	01/28/2021 11:28

Analyst(s): DB

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2150B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2150B
Project:	220172; The Mosaic Project	**Unit:**	TON @ 60°C

Threshold Odor Test

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001C	Water	01/21/2021 11:15	WetChem	213628

Analytes	Result	RL	DF	Date Analyzed
TON	ND	1.0	1	01/22/2021 10:15

Analyst(s): PHU

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002C	Water	01/21/2021 13:00	WetChem	213628

Analytes	Result	RL	DF	Date Analyzed
TON	ND	1.0	1	01/22/2021 10:45

Analyst(s): PHU

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM4500H+B-2000
Date Prepared:	01/22/2021	**Analytical Method:**	SM4500H+B
Project:	220172; The Mosaic Project	**Unit:**	pH units @ 25°C

pH

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**WetChem**	**213676**

Analytes	Result	Qualifiers	Accuracy	DF	Date Analyzed
pH	**7.10**	H	±0.05	1	01/22/2021 15:33

Analyst(s): NYG

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**WetChem**	**213676**

Analytes	Result	Qualifiers	Accuracy	DF	Date Analyzed
pH	**8.38**	H	±0.05	1	01/22/2021 15:35

Analyst(s): NYG

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2510 B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2510B
Project:	220172; The Mosaic Project	**Unit:**	µmhos/cm @ 25°C

Specific Conductivity at 25°C

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**WetChem**	**213663**

Analytes	Result	RL	DF	Date Analyzed
Specific Conductivity	**2190**	10.0	1	01/22/2021 13:10

Analyst(s): NYG

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**WetChem**	**213663**

Analytes	Result	RL	DF	Date Analyzed
Specific Conductivity	**1020**	10.0	1	01/22/2021 13:20

Analyst(s): NYG

ATTACHMENT 2B

Well 17-1 Water Quality Results

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E200.7
Date Prepared:	01/28/2021	**Analytical Method:**	E200.7
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Silica

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001B**	**Water**	**01/21/2021 11:15**	**ICP-OES 14A**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Silica	**43,000**	43	1	01/28/2021 11:25

Analyst(s): DB

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002B**	**Water**	**01/21/2021 13:00**	**ICP-OES 15A**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Silica	**30,000**	43	1	01/28/2021 11:28

Analyst(s): DB

CA ELAP 1644

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2540 C-1997
Date Prepared:	01/22/2021	**Analytical Method:**	SM2540 C-1997
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Total Dissolved Solids

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001A	Water	01/21/2021 11:15	WetChem	213701

Analytes	Result	RL	DF	Date Analyzed
Total Dissolved Solids	**1450**	10.0	1	01/25/2021 12:48

Analyst(s): HAD

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002A	Water	01/21/2021 13:00	WetChem	213701

Analytes	Result	RL	DF	Date Analyzed
Total Dissolved Solids	**658**	10.0	1	01/25/2021 12:50

Analyst(s): HAD

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SW3510C
Date Prepared:	01/21/2021	**Analytical Method:**	SW8015B
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001D**	**Water**	**01/21/2021 11:15**	**GC9a 01262110.D**	**213535**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	0.050	1	01/26/2021 11:56
TPH-Motor Oil (C18-C36)	ND	0.25	1	01/26/2021 11:56
TPH-Kerosene (C9-C18)	ND	0.050	1	01/26/2021 11:56

Surrogates	REC (%)	Limits		
C9	100	70-130		01/26/2021 11:56

Analyst(s): JIS

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002D**	**Water**	**01/21/2021 13:00**	**GC9a 01262112.D**	**213535**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	0.050	1	01/26/2021 12:35
TPH-Motor Oil (C18-C36)	ND	0.25	1	01/26/2021 12:35
TPH-Kerosene (C9-C18)	ND	0.050	1	01/26/2021 12:35

Surrogates	REC (%)	Limits		
C9	99	70-130		01/26/2021 12:35

Analyst(s): JIS

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2130 B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2130 B-2001
Project:	220172; The Mosaic Project	**Unit:**	NTU

Turbidity

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001C**	**Water**	**01/21/2021 11:15**	**WetChem**	**213673**

Analytes	Result	RL	DF	Date Analyzed
Turbidity	**0.68**	0.10	1	01/22/2021 13:42

Analyst(s): NYG

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002C**	**Water**	**01/21/2021 13:00**	**WetChem**	**213673**

Analytes	Result	RL	DF	Date Analyzed
Turbidity	**2.1**	0.10	1	01/22/2021 13:46

Analyst(s): NYG

Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E415.3
Date Prepared:	01/22/2021	**Analytical Method:**	E415.3
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Dissolved Organic Carbon (DOC)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001N**	**Water**	**01/21/2021 11:15**	**WC_CNS F012221-1_1027_61**	**213638**

Analytes	Result	RL	DF	Date Analyzed
Dissolved Organic Carbon	**2.4**	0.70	1	01/23/2021 00:59

Analyst(s): TD

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002N**	**Water**	**01/21/2021 13:00**	**WC_CNS F012221-1_1027_62**	**213638**

Analytes	Result	RL	DF	Date Analyzed
Dissolved Organic Carbon	ND	0.70	1	01/23/2021 01:13

Analyst(s): TD

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831.375.MBAS (6227)
www.MBASinc.com
ELAP Certification Number: 2385
Thursday, September 10, 2020

Lab Number: 200828_06-01 Sample Description: Mosaic Well 20-1

Collection Date/Time: 8/27/2020 15:25 Sample Collector: Porras G Client Sample #: 220172
Submittal Date/Time: 8/28/2020 10:33 System ID:

Analyte	Method	Unit	Result	Dil.	Qual	PQL	MCL	Analysis Date / Time		Analyst
Anion-Cation Balance	Calculation	%	2	1						
QC Anion Sum x 100	Calculation	%	116	1						
QC Cation Sum x 100	Calculation	%	121	1						
QC Ratio TDS/SEC	Calculation	NA	0.68	1						
Turbidity	EPA180.1	NTU	2.8	1		0.05	1	8/28/2020	10:36	IG
Boron	EPA200.7	mg/L	0.22	1		0.05		9/2/2020	11:40	MW
Calcium	EPA200.7	mg/L	112	1		1		9/2/2020	11:40	MW
Copper, Total	EPA200.7	µg/L	ND	1		10	1300	9/2/2020	11:40	MW
Iron, Total	EPA200.7	µg/L	[illegible]	1		10	300	9/2/2020	11:40	MW
Magnesium	EPA200.7	mg/L	47.2	1		0.5		9/2/2020	11:40	MW
Manganese, Total	EPA200.7	µg/L	[illegible]	1		10	50	9/2/2020	11:40	MW
Potassium	EPA200.7	mg/L	2.1	1		0.5		9/2/2020	11:40	MW
Sodium	EPA200.7	mg/L	61	1		1		9/2/2020	11:40	MW
Zinc, Total	EPA200.7	µg/L	ND	1		10	5000	9/9/2020	15:58	MW
Aluminum, Total *LO: MSD result unavailable. Acceptability based on LCS recovery.*	EPA200.8	µg/L	ND	1	LO	5	1000	9/2/2020	17:10	MW
Antimony, Total	EPA200.8	µg/L	ND	1	LO	0.5	6	9/2/2020	17:10	MW
Arsenic, Total	EPA200.8	µg/L	ND	1	LO	0.5	10	9/2/2020	17:10	MW
Barium, Total	EPA200.8	µg/L	74.3	1	LO	5	1000	9/2/2020	17:10	MW
Beryllium, Total	EPA200.8	µg/L	ND	1	LO	0.5	4	9/2/2020	17:10	MW
Cadmium, Total	EPA200.8	µg/L	ND	1	LO	0.25	5	9/2/2020	17:10	MW
Chromium, Total	EPA200.8	µg/L	1.8	1	LO	1	50	9/2/2020	17:10	MW
Lead, Total	EPA200.8	µg/L	ND	1	LO	1	15	9/2/2020	17:10	MW
Mercury, Total	EPA200.8	µg/L	ND	1	LO	0.2	2	9/2/2020	17:10	MW
Nickel, Total	EPA200.8	µg/L	ND	1	LO	5	100	9/2/2020	17:10	MW
Selenium, Total	EPA200.8	µg/L	ND	1	LO	1	50	9/2/2020	17:10	MW
Silver, Total	EPA200.8	µg/L	ND	1	LO	1	100	9/2/2020	17:10	MW
Thallium, Total	EPA200.8	µg/L	ND	1	LO	0.5	2	9/2/2020	17:10	MW
Bromide	EPA300.0	mg/L	0.1	1		0.1		8/28/2020	17:27	BS
Chloride	EPA300.0	mg/L	33.9	1		1	250	8/28/2020	17:27	BS

mg/L : Millgrams per liter (=ppm) µg/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance
MDL = Method Detection Limit J = Result is less than PQL ND = Non Detect

Monterey Bay Analytical Services

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ELAP Certification Number: 2385

Thursday, September 10, 2020

Lab Number: 200828_06-01 Sample Description: Mosaic Well 20-1

Collection Date/Time: 8/27/2020 15:25 Sample Collector: Porras G Client Sample #: 220172
Submittal Date/Time: 8/28/2020 10:33 System ID:

Analyte	Method	Unit	Result	Dil.	Qual	PQL	MCL	Analysis Date / Time		Analyst
Fluoride	EPA300.0	mg/L	0.3	1		0.1	2	8/28/2020	17:27	BS
Nitrate as N	EPA300.0	mg/L	ND	1		0.1	10	8/28/2020	17:27	BS
Nitrate+Nitrite as N	EPA300.0	mg/L	ND	1		0.1	10	8/28/2020	17:27	BS
Nitrite as N	EPA300.0	mg/L	ND	1		0.1	1	8/28/2020	17:27	BS
Orthophosphate as P	EPA300.0	mg/L	ND	1		0.1		8/28/2020	17:27	BS
Sulfate	EPA300.0	mg/L	153	1		1	250	8/28/2020	17:27	BS
Cyanide, Available	OIA-1677-09	µg/L	ND	1		2	150	9/1/2020	12:49	HC
Color, True	SM2120C	Color Units	ND	1		3	15	8/28/2020	10:56	IG
Odor Threshold at 60 C *Odor: ND*	SM2150B	TON	1	1		1	3	8/28/2020	14:06	IG
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	378	1		10		9/1/2020	16:37	OW
Bicarbonate (as HCO3-)	SM2320B	mg/L	461	1		10				
Carbonate as CaCO3	SM2320B	mg/L	ND	1		10		9/1/2020	16:37	OW
Hydroxide	SM2320B	mg/L	ND	1		10		9/1/2020	16:37	OW
Langlier Index, 15°C	SM2330B	NA	0.16	1						
Langlier Index, 60°C	SM2330B	NA	0.98	1						
Hardness (as CaCO3)	SM2340B/Calc	mg/L	474	1		10				
Specific Conductance (EC)	SM2510B	µmhos/cm	1005	1		1	900	8/31/2020	10:45	OW
Total Dissolved Solids	SM2540C	mg/L	682	1		10	500	9/1/2020	13:33	OW
pH (Laboratory)	SM4500-H+B	pH (H)	7.3	1		0.1	8.5	8/28/2020	16:56	OW
MBAS (Surfactants)	SM5540C	mg/L	ND	1		0.05		8/28/2020	15:17	OW

Report Approved by: David Holland, Laboratory Director

mg/L : Millgrams per liter (=ppm) µg/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance
MDL = Method Detection Limit J = Result is less than PQL ND = Non Detect

Report Amendments Date: 7/7/21 Initials: TP
This amended report supersedes any previous reports issued by the laboratory. Amendments to this report are as follows:
Dissolved Iron and Dissolved Manganese have been added to the results.

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ELAP Certification Number: 2385
Wednesday, July 7, 2021

Sample Results

Lab Number: 210624_04-01 Sample Description: Mosaic Project, Well 17-1

Collection Date/Time: 6/23/2021 11:30 Sample Collector: Woyshner M Client Sample #:
Received Date/Time: 6/24/2021 9:47 System ID:

Analyte	Method	Unit	Result	Dilution	Qualifier	PQL	MCL	Analysis Date / Time		Analyst
Anion-Cation Balance	Calculation	%	-2	1						
QC Anion Sum x 100	Calculation	%	112	1						
QC Cation Sum x 100	Calculation	%	107	1						
QC Ratio TDS/SEC	Calculation	NA	0.66	1						
Turbidity	EPA180.1	NTU	3.2	1		0.1	5	6/25/2021	8:45	KG
Boron	EPA200.7	mg/L	1.42	1		0.1		6/29/2021	17:40	MW
Calcium	EPA200.7	mg/L	4	1		1		6/29/2021	17:40	MW
Copper, Total	EPA200.7	µg/L	ND	1		20	1300	6/29/2021	17:40	MW
Iron, Dissolved	EPA200.7	µg/L	ND	1		30	300	6/29/2021	17:40	MW
Iron, Total	EPA200.7	µg/L	176	1		30	300	6/29/2021	17:40	MW
Magnesium	EPA200.7	mg/L	2.0	1		0.5		6/29/2021	17:40	MW
Manganese, Dissolved	EPA200.7	µg/L	16	1		15	50	6/29/2021	17:40	MW
Manganese, Total	EPA200.7	µg/L	18	1		15	50	6/29/2021	17:40	MW
Potassium	EPA200.7	mg/L	2.4	1		0.5		6/29/2021	17:40	MW
Silica (SiO2), Total	EPA200.7	mg/L	40.1	1		1		6/29/2021	17:40	MW
Silica SiO2, Dissolved	EPA200.7	mg/L	36.9	1		1		6/29/2021	17:43	MW
Sodium	EPA200.7	mg/L	533	1		1		6/29/2021	17:40	MW
Zinc, Total	EPA200.7	µg/L	ND	1		30	5000	6/29/2021	17:40	MW
Arsenic, Total	EPA200.8	µg/L	26.3	1		1	10	6/28/2021	16:49	MW
Cadmium, Total	EPA200.8	µg/L	ND	1		0.25	5	6/28/2021	16:49	MW
Chromium, Total	EPA200.8	µg/L	1.8	1		1	50	6/28/2021	16:49	MW
Lead, Total	EPA200.8	µg/L	ND	1		1	15	7/1/2021	10:00	MW
Molybdenum, Total	EPA200.8	µg/L	504	1		1.5		6/28/2021	16:49	MW
Chloride	EPA300.0	mg/L	42.0	1		1	250	6/25/2021	9:32	BS
Fluoride	EPA300.0	mg/L	0.7	1		0.1	2	6/25/2021	9:32	BS
Nitrate as N	EPA300.0	mg/L	0.1	1		0.1	10	6/25/2021	9:32	BS
Nitrite as N	EPA300.0	mg/L	ND	1		0.1	1	6/25/2021	9:32	BS
Orthophosphate as P	EPA300.0	mg/L	0.1	1		0.06		6/25/2021	9:32	BS
Sulfate	EPA300.0	mg/L	273	1		1	250	6/25/2021	9:32	BS
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	883	1		10		6/24/2021	19:52	OW

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ELAP Certification Number: 2385
Wednesday, July 7, 2021

Lab Number: 210624_04-01 Sample Description: Mosaic Project, Well 17-1

Collection Date/Time: 6/23/2021 11:30 Sample Collector: Woyshner M Client Sample #:
Received Date/Time: 6/24/2021 9:47 System ID:

Analyte	Method	Unit	Result	Dilution	Qualifier	PQL	MCL	Analysis Date / Time	Analyst
Bicarbonate (as HCO3-)	SM2320B	mg/L	1080	1		10			
Langelier Index, 15°C	SM2330B	NA	0.10	1					
Langelier Index, 60°C	SM2330B	NA	0.92	1					
Hardness (as CaCO3)	SM2340B/Calc	mg/L	19	1		5			
Specific Conductance (EC)	SM2510B	µmhos/cm	2200	1		3	900	6/24/2021 19:52	OW
Total Dissolved Solids	SM2540C	mg/L	1450	1		10	500	6/25/2021 16:42	OW
pH (Laboratory)	SM4500-H+B	pH (H)	8.3	1		0.1	8.5	6/24/2021 19:52	OW
SAR (Sodium Absorption Ratio)	Suarez, 1981	NA	55.5	1					
SAR, Adjusted	Suarez, 1981	NA	63.9	1					

Abbreviations/Definitions:
mg/L: Milligrams per liter (=ppm)
µg/L: Micrograms per liter (=ppb)
MPN: Most Probable Number
MDL: Method Detection Limit
PQL: Practical Quantitation Limit
MCL: Maximum Contamination Level
ND: Not Detected at the PQL (or MDL, if shown)
E: Analysis performed by External Laboratory; see Report attachments
H: Analyzed outside of method hold time
QC: Quality Control
J: Result is < PQL but ≥ MDL; the concentration is an approximate value.

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E300.1
Date Prepared:	01/22/2021	**Analytical Method:**	E300.1
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Inorganic Anions by IC

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**IC4 01262175.D**	**213591**

Analytes	Result		RL	DF	Date Analyzed
Chloride	**49**		2.0	20	01/22/2021 16:21
Sulfate	**240**		20	200	01/22/2021 13:29
Surrogates	**REC (%)**	**Qualifiers**	**Limits**		
Malonate	0	S	90-115		01/22/2021 16:21

Analyst(s): AO　　Analytical Comments: c1

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**IC4 01262176.D**	**213591**

Analytes	Result		RL	DF	Date Analyzed
Chloride	**53**		5.0	50	01/22/2021 16:37
Sulfate	**140**		5.0	50	01/22/2021 16:37
Surrogates	**REC (%)**	**Qualifiers**	**Limits**		
Malonate	0	S	90-115		01/22/2021 16:37

Analyst(s): AO　　Analytical Comments: c1

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E314.0
Date Prepared:	01/25/2021	**Analytical Method:**	E314.0
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Perchlorate

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001A	Water	01/21/2021 11:15	IC1 21012515.CHW	213791

Analytes	Result	RL	DF	Date Analyzed
Perchlorate	ND	1.0	2	01/25/2021 19:34

Analyst(s): AO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002A	Water	01/21/2021 13:00	IC1 21012516.CHW	213791

Analytes	Result	RL	DF	Date Analyzed
Perchlorate	ND	0.50	1	01/25/2021 19:52

Analyst(s): AO

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SW8151A
Date Prepared:	01/22/2021	**Analytical Method:**	E515.3
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Chlorinated Herbicides

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001G	Water	01/21/2021 11:15	GC15A 01222112.D	213622

Analytes	Result	RL	DF	Date Analyzed
Bentazon	ND	1.0	1	01/22/2021 17:43
2,4-D (Dichlorophenoxyacetic acid)	ND	1.0	1	01/22/2021 17:43
2,4-DB	ND	1.0	1	01/22/2021 17:43
Dalapon	ND	1.0	1	01/22/2021 17:43
DCPA (mono & diacid)	ND	0.20	1	01/22/2021 17:43
Dicamba	ND	1.0	1	01/22/2021 17:43
Dinoseb (DNBP)	ND	1.0	1	01/22/2021 17:43
Pentachlorophenol (PCP)	ND	0.20	1	01/22/2021 17:43
Picloram	ND	1.0	1	01/22/2021 17:43
2,4,5-TP (Silvex)	ND	1.0	1	01/22/2021 17:43

Surrogates	REC (%)	Limits	
DCAA	81	70-130	01/22/2021 17:43

Analyst(s): DP

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002G	Water	01/21/2021 13:00	GC15A 01222113.D	213622

Analytes	Result	RL	DF	Date Analyzed
Bentazon	ND	1.0	1	01/22/2021 18:08
2,4-D (Dichlorophenoxyacetic acid)	ND	1.0	1	01/22/2021 18:08
2,4-DB	ND	1.0	1	01/22/2021 18:08
Dalapon	ND	1.0	1	01/22/2021 18:08
DCPA (mono & diacid)	ND	0.20	1	01/22/2021 18:08
Dicamba	ND	1.0	1	01/22/2021 18:08
Dinoseb (DNBP)	ND	1.0	1	01/22/2021 18:08
Pentachlorophenol (PCP)	ND	0.20	1	01/22/2021 18:08
Picloram	ND	1.0	1	01/22/2021 18:08
2,4,5-TP (Silvex)	ND	1.0	1	01/22/2021 18:08

Surrogates	REC (%)	Limits	
DCAA	81	70-130	01/22/2021 18:08

Analyst(s): DP

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E524.2
Date Prepared:	01/25/2021	**Analytical Method:**	E524.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001F**	**Water**	**01/21/2021 11:15**	**GC45 01232134.D**	**213766**

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	40	1	01/25/2021 10:48
tert-Amyl Methyl Ether (TAME)	ND	0.50	1	01/25/2021 10:48
Benzene	ND	0.50	1	01/25/2021 10:48
Bromobenzene	ND	0.50	1	01/25/2021 10:48
Bromochloromethane	ND	0.50	1	01/25/2021 10:48
Bromodichloromethane	ND	0.50	1	01/25/2021 10:48
Bromoform	ND	0.50	1	01/25/2021 10:48
Bromomethane	ND	0.50	1	01/25/2021 10:48
2-Butanone (MEK)	ND	5.0	1	01/25/2021 10:48
t-Butyl alcohol (TBA)	ND	2.0	1	01/25/2021 10:48
n-Butyl benzene	ND	0.50	1	01/25/2021 10:48
sec-Butyl benzene	ND	0.50	1	01/25/2021 10:48
tert-Butyl benzene	ND	0.50	1	01/25/2021 10:48
Carbon disulfide	ND	0.50	1	01/25/2021 10:48
Carbon tetrachloride	ND	0.50	1	01/25/2021 10:48
Chlorobenzene	ND	0.50	1	01/25/2021 10:48
Chloroethane	ND	0.50	1	01/25/2021 10:48
Chloroform	ND	0.50	1	01/25/2021 10:48
Chloromethane	ND	0.50	1	01/25/2021 10:48
2-Chlorotoluene	ND	0.50	1	01/25/2021 10:48
4-Chlorotoluene	ND	0.50	1	01/25/2021 10:48
Dibromochloromethane	ND	0.50	1	01/25/2021 10:48
1,2-Dibromo-3-chloropropane	ND	0.20	1	01/25/2021 10:48
1,2-Dibromoethane (EDB)	ND	0.50	1	01/25/2021 10:48
Dibromomethane	ND	0.50	1	01/25/2021 10:48
1,2-Dichlorobenzene	ND	0.50	1	01/25/2021 10:48
1,3-Dichlorobenzene	ND	0.50	1	01/25/2021 10:48
1,4-Dichlorobenzene	ND	0.50	1	01/25/2021 10:48
Dichlorodifluoromethane	ND	0.50	1	01/25/2021 10:48
1,1-Dichloroethane	ND	0.50	1	01/25/2021 10:48
1,2-Dichloroethane (1,2-DCA)	ND	0.50	1	01/25/2021 10:48
1,1-Dichloroethene	ND	0.50	1	01/25/2021 10:48
cis-1,2-Dichloroethene	ND	0.50	1	01/25/2021 10:48
trans-1,2-Dichloroethene	ND	0.50	1	01/25/2021 10:48
1,2-Dichloropropane	ND	0.50	1	01/25/2021 10:48
1,3-Dichloropropane	ND	0.50	1	01/25/2021 10:48
2,2-Dichloropropane	ND	0.50	1	01/25/2021 10:48

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E524.2
Date Prepared:	01/25/2021	**Analytical Method:**	E524.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001F	Water	01/21/2021 11:15	GC45 01232134.D	213766

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.50	1	01/25/2021 10:48
cis-1,3-Dichloropropene	ND	0.50	1	01/25/2021 10:48
trans-1,3-Dichloropropene	ND	0.50	1	01/25/2021 10:48
Diisopropyl ether (DIPE)	ND	0.50	1	01/25/2021 10:48
Ethylbenzene	ND	0.50	1	01/25/2021 10:48
Ethyl tert-butyl ether (ETBE)	ND	0.50	1	01/25/2021 10:48
Freon 113	ND	0.50	1	01/25/2021 10:48
Hexachlorobutadiene	ND	0.50	1	01/25/2021 10:48
2-Hexanone	ND	1.0	1	01/25/2021 10:48
Isopropylbenzene	ND	0.50	1	01/25/2021 10:48
4-Isopropyl toluene	ND	0.50	1	01/25/2021 10:48
Methyl-t-butyl ether (MTBE)	ND	0.50	1	01/25/2021 10:48
Methylene chloride	ND	0.50	1	01/25/2021 10:48
4-Methyl-2-pentanone (MIBK)	ND	0.50	1	01/25/2021 10:48
Naphthalene	ND	0.50	1	01/25/2021 10:48
n-Propyl benzene	ND	0.50	1	01/25/2021 10:48
Styrene	ND	0.50	1	01/25/2021 10:48
1,1,1,2-Tetrachloroethane	ND	0.50	1	01/25/2021 10:48
1,1,2,2-Tetrachloroethane	ND	0.50	1	01/25/2021 10:48
Tetrachloroethene	ND	0.50	1	01/25/2021 10:48
Toluene	ND	0.50	1	01/25/2021 10:48
1,2,3-Trichlorobenzene	ND	0.50	1	01/25/2021 10:48
1,2,4-Trichlorobenzene	ND	0.50	1	01/25/2021 10:48
1,1,1-Trichloroethane	ND	0.50	1	01/25/2021 10:48
1,1,2-Trichloroethane	ND	0.50	1	01/25/2021 10:48
Trichloroethene	ND	0.50	1	01/25/2021 10:48
Trichlorofluoromethane	ND	0.50	1	01/25/2021 10:48
1,2,4-Trimethylbenzene	ND	0.50	1	01/25/2021 10:48
1,3,5-Trimethylbenzene	ND	0.50	1	01/25/2021 10:48
Vinyl chloride	ND	0.50	1	01/25/2021 10:48
m,p-Xylene	ND	0.50	1	01/25/2021 10:48
o-Xylene	ND	0.50	1	01/25/2021 10:48
Xylenes, Total	ND	0.50	1	01/25/2021 10:48

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E524.2
Date Prepared:	01/25/2021	**Analytical Method:**	E524.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001F**	**Water**	**01/21/2021 11:15**	**GC45 01232134.D**	**213766**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	98	70-130		01/25/2021 10:48
Toluene-d8	98	70-130		01/25/2021 10:48
4-BFB	94	70-130		01/25/2021 10:48

Analyst(s): KF

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E200.8
Date Prepared:	01/22/2021	**Analytical Method:**	E200.8
Project:	220172; The Mosaic Project	**Unit:**	µg/L

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001B**	**Water**	**01/21/2021 11:15**	**ICP-MS3 050SMPL.D**	**213611**

Analytes	Result	RL	DF	Date Analyzed
Antimony	ND	6.0	1	01/27/2021 14:54
Arsenic	**12**	2.0	1	01/27/2021 14:54
Barium	ND	100	1	01/27/2021 14:54
Beryllium	ND	1.0	1	01/27/2021 14:54
Cadmium	ND	1.0	1	01/27/2021 14:54
Chromium	ND	10	1	01/27/2021 14:54
Cobalt	ND	0.50	1	01/27/2021 14:54
Copper	ND	10	1	01/27/2021 14:54
Lead	ND	0.50	1	01/27/2021 14:54
Mercury	ND	1.0	1	01/27/2021 14:54
Molybdenum	**130**	0.50	1	01/27/2021 14:54
Nickel	ND	10	1	01/27/2021 14:54
Selenium	ND	5.0	1	01/27/2021 14:54
Silver	ND	10	1	01/27/2021 14:54
Thallium	ND	1.0	1	01/27/2021 14:54
Vanadium	ND	3.0	1	01/27/2021 14:54
Zinc	ND	50	1	01/27/2021 14:54

Analyst(s): JAG

(Cont.)

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E525.2
Date Prepared:	02/01/2021	**Analytical Method:**	E525.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001H	Water	01/21/2021 11:15	GC42 02022117.D	214214

Analytes	Result	RL	DF	Date Analyzed
Benzo (a) pyrene	ND	0.043	1	02/02/2021 17:06
Bis (2-ethylhexyl) Adipate	ND	0.21	1	02/02/2021 17:06
Bis (2-ethylhexyl) Phthalate	ND	0.21	1	02/02/2021 17:06

Surrogates	REC (%)	Limits		
Triphenyl phosphate	117	70-130		02/02/2021 17:06

Analyst(s): HD

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002H	Water	01/21/2021 13:00	GC42 02022118.D	214214

Analytes	Result	RL	DF	Date Analyzed
Benzo (a) pyrene	ND	0.043	1	02/02/2021 17:34
Bis (2-ethylhexyl) Adipate	ND	0.21	1	02/02/2021 17:34
Bis (2-ethylhexyl) Phthalate	ND	0.21	1	02/02/2021 17:34

Surrogates	REC (%)	Limits		
Triphenyl phosphate	70	70-130		02/02/2021 17:34

Analyst(s): HD

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E531.1
Date Prepared:	01/22/2021	**Analytical Method:**	E531.1
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Carbamates by HPLC with Derivatization

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001I	Water	01/21/2021 11:15	HPLC1 01222113.D	213683

Analytes	Result	RL	DF	Date Analyzed
3-Hydroxycarbofuran	ND	2.0	1	01/23/2021 04:26
Aldicarb (Temik)	ND	2.0	1	01/23/2021 04:26
Aldicarb sulfoxide	ND	2.0	1	01/23/2021 04:26
Aldoxycarb (Aldicarb Sulfone)	ND	2.0	1	01/23/2021 04:26
Carbaryl (Sevin)	ND	2.0	1	01/23/2021 04:26
Carbofuran (Furadan)	ND	2.0	1	01/23/2021 04:26
Methiocarb (Mesurol)	ND	2.0	1	01/23/2021 04:26
Methomyl (Lannate)	ND	2.0	1	01/23/2021 04:26
Oxamyl	ND	2.0	1	01/23/2021 04:26
Propoxur (Baygon)	ND	2.0	1	01/23/2021 04:26

Surrogates	REC (%)	Limits	
BDMC	80	65-135	01/23/2021 04:26

Analyst(s): ANL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002I	Water	01/21/2021 13:00	HPLC1 01222114.D	213683

Analytes	Result	RL	DF	Date Analyzed
3-Hydroxycarbofuran	ND	2.0	1	01/23/2021 05:27
Aldicarb (Temik)	ND	2.0	1	01/23/2021 05:27
Aldicarb sulfoxide	ND	2.0	1	01/23/2021 05:27
Aldoxycarb (Aldicarb Sulfone)	ND	2.0	1	01/23/2021 05:27
Carbaryl (Sevin)	ND	2.0	1	01/23/2021 05:27
Carbofuran (Furadan)	ND	2.0	1	01/23/2021 05:27
Methiocarb (Mesurol)	ND	2.0	1	01/23/2021 05:27
Methomyl (Lannate)	ND	2.0	1	01/23/2021 05:27
Oxamyl	ND	2.0	1	01/23/2021 05:27
Propoxur (Baygon)	ND	2.0	1	01/23/2021 05:27

Surrogates	REC (%)	Limits	
BDMC	85	65-135	01/23/2021 05:27

Analyst(s): ANL

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E549.2
Date Prepared:	01/25/2021	**Analytical Method:**	E549.2
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Diquat and Paraquat

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001J	Water	01/21/2021 11:15	HPLC2 01252107.D	213762

Analytes	Result	RL	DF	Date Analyzed
Diquat	ND	4.0	1	01/25/2021 18:47
Paraquat	ND	4.0	1	01/25/2021 18:47

Analyst(s): ANL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002J	Water	01/21/2021 13:00	HPLC2 01252108.D	213762

Analytes	Result	RL	DF	Date Analyzed
Diquat	ND	4.0	1	01/25/2021 19:06
Paraquat	ND	4.0	1	01/25/2021 19:06

Analyst(s): ANL

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2320 B-1997
Date Prepared:	01/22/2021	**Analytical Method:**	SM2320 B
Project:	220172; The Mosaic Project	**Unit:**	mg $CaCO_3$/L

Total & Speciated Alkalinity as Calcium Carbonate

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**TITRINO F065689**	**213649**

Analytes	Result	RL	DF	Date Analyzed
Total Alkalinity	**858**	5.00	1	01/22/2021 12:09
Carbonate	ND	5.00	1	01/22/2021 12:09
Bicarbonate	**858**	5.00	1	01/22/2021 12:09
Hydroxide	ND	5.00	1	01/22/2021 12:09

Analyst(s): HN

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**TITRINO F065690**	**213649**

Analytes	Result	RL	DF	Date Analyzed
Total Alkalinity	**355**	5.00	1	01/22/2021 12:17
Carbonate	ND	5.00	1	01/22/2021 12:17
Bicarbonate	**355**	5.00	1	01/22/2021 12:17
Hydroxide	ND	5.00	1	01/22/2021 12:17

Analyst(s): HN

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2120 B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2120 B-2012
Project:	220172; The Mosaic Project	**Unit:**	Color Units

Apparent Color (Unfiltered)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001C**	**Water**	**01/21/2021 11:15**	**WetChem**	**213630**

Analytes	Result	RL	DF	Date Analyzed
Apparent Color	**4 @ pH 8.1**	2.0	1	01/22/2021 09:10

Analyst(s): PHU

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002C**	**Water**	**01/21/2021 13:00**	**WetChem**	**213630**

Analytes	Result	RL	DF	Date Analyzed
Apparent Color	**3 @ pH 7.7**	2.0	1	01/22/2021 09:20

Analyst(s): PHU

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SW5030B
Date Prepared:	01/22/2021	**Analytical Method:**	SW8021B/8015Bm
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001D	Water	01/21/2021 11:15	GC12 01222116.D	213580

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.050	1	01/22/2021 21:11
MTBE	---	0.0010	1	01/22/2021 21:11
Benzene	---	0.00050	1	01/22/2021 21:11
Toluene	---	0.00050	1	01/22/2021 21:11
Ethylbenzene	---	0.00050	1	01/22/2021 21:11
m,p-Xylene	---	0.0010	1	01/22/2021 21:11
o-Xylene	---	0.00050	1	01/22/2021 21:11
Xylenes	---	0.00050	1	01/22/2021 21:11

Surrogates	REC (%)	Limits	
aaa-TFT	104	89-115	01/22/2021 21:11

Analyst(s): IA

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002D	Water	01/21/2021 13:00	GC12 01222120.D	213580

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	0.050	1	01/22/2021 23:29
MTBE	---	0.0010	1	01/22/2021 23:29
Benzene	---	0.00050	1	01/22/2021 23:29
Toluene	---	0.00050	1	01/22/2021 23:29
Ethylbenzene	---	0.00050	1	01/22/2021 23:29
m,p-Xylene	---	0.0010	1	01/22/2021 23:29
o-Xylene	---	0.00050	1	01/22/2021 23:29
Xylenes	---	0.00050	1	01/22/2021 23:29

Surrogates	REC (%)	Limits	
aaa-TFT	103	89-115	01/22/2021 23:29

Analyst(s): IA

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM5540 C-2000
Date Prepared:	01/22/2021	**Analytical Method:**	SM5540 C-2000
Project:	220172; The Mosaic Project	**Unit:**	mg/L

MBAS / Anionic Surfactants as LAS

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001E	Water	01/21/2021 11:15	SPECTROPHOTOMETER	213629

Analytes	Result	RL	DF	Date Analyzed
MBAS	ND	0.025	1	01/22/2021 10:30

Analyst(s): PHU

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002E	Water	01/21/2021 13:00	SPECTROPHOTOMETER	213629

Analytes	Result	RL	DF	Date Analyzed
MBAS	ND	0.025	1	01/22/2021 10:40

Analyst(s): PHU

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E200.7
Date Prepared:	01/28/2021	**Analytical Method:**	E200.7
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001B**	**Water**	**01/21/2021 11:15**	**ICP-OES 14**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Boron	**1800**	20	1	01/28/2021 11:25
Calcium	**3500**	200	1	01/28/2021 11:25
Iron	ND	100	1	01/28/2021 11:25
Magnesium	**1700**	200	1	01/28/2021 11:25
Manganese	ND	20	1	01/28/2021 11:25
Potassium	**2600**	200	1	01/28/2021 11:25
Sodium	**520,000**	2000	10	01/28/2021 13:49

Analyst(s): DB

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002B**	**Water**	**01/21/2021 13:00**	**ICP-OES 15**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Boron	**270**	20	1	01/28/2021 11:28
Calcium	**100,000**	2000	10	01/28/2021 13:52
Iron	**370**	100	1	01/28/2021 11:28
Magnesium	**43,000**	200	1	01/28/2021 11:28
Manganese	**110**	20	1	01/28/2021 11:28
Potassium	**1600**	200	1	01/28/2021 11:28
Sodium	**57,000**	200	1	01/28/2021 11:28

Analyst(s): DB

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2150B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2150B
Project:	220172; The Mosaic Project	**Unit:**	TON @ 60°C

Threshold Odor Test

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001C**	**Water**	**01/21/2021 11:15**	**WetChem**	**213628**

Analytes	Result	RL	DF	Date Analyzed
TON	ND	1.0	1	01/22/2021 10:15

Analyst(s): PHU

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002C**	**Water**	**01/21/2021 13:00**	**WetChem**	**213628**

Analytes	Result	RL	DF	Date Analyzed
TON	ND	1.0	1	01/22/2021 10:45

Analyst(s): PHU

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM4500H+B-2000
Date Prepared:	01/22/2021	**Analytical Method:**	SM4500H+B
Project:	220172; The Mosaic Project	**Unit:**	pH units @ 25°C

pH

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**WetChem**	**213676**

Analytes	Result	Qualifiers	Accuracy	DF	Date Analyzed
pH	**7.10**	H	±0.05	1	01/22/2021 15:33

Analyst(s): NYG

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**WetChem**	**213676**

Analytes	Result	Qualifiers	Accuracy	DF	Date Analyzed
pH	**8.38**	H	±0.05	1	01/22/2021 15:35

Analyst(s): NYG

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2510 B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2510B
Project:	220172; The Mosaic Project	**Unit:**	µmhos/cm @ 25°C

Specific Conductivity at 25°C

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**WetChem**	**213663**

Analytes	Result	RL	DF	Date Analyzed
Specific Conductivity	**2190**	10.0	1	01/22/2021 13:10

Analyst(s): NYG

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**WetChem**	**213663**

Analytes	Result	RL	DF	Date Analyzed
Specific Conductivity	**1020**	10.0	1	01/22/2021 13:20

Analyst(s): NYG

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E200.7
Date Prepared:	01/28/2021	**Analytical Method:**	E200.7
Project:	220172; The Mosaic Project	**Unit:**	µg/L

Silica

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001B**	**Water**	**01/21/2021 11:15**	**ICP-OES 14A**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Silica	**43,000**	43	1	01/28/2021 11:25

Analyst(s): DB

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002B**	**Water**	**01/21/2021 13:00**	**ICP-OES 15A**	**214029**

Analytes	Result	RL	DF	Date Analyzed
Silica	**30,000**	43	1	01/28/2021 11:28

Analyst(s): DB

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2540 C-1997
Date Prepared:	01/22/2021	**Analytical Method:**	SM2540 C-1997
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Total Dissolved Solids

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001A**	**Water**	**01/21/2021 11:15**	**WetChem**	**213701**

Analytes	Result	RL	DF	Date Analyzed
Total Dissolved Solids	**1450**	10.0	1	01/25/2021 12:48

Analyst(s): HAD

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002A**	**Water**	**01/21/2021 13:00**	**WetChem**	**213701**

Analytes	Result	RL	DF	Date Analyzed
Total Dissolved Solids	**658**	10.0	1	01/25/2021 12:50

Analyst(s): HAD

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SW3510C
Date Prepared:	01/21/2021	**Analytical Method:**	SW8015B
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	2101980-001D	Water	01/21/2021 11:15	GC9a 01262110.D	213535

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	0.050	1	01/26/2021 11:56
TPH-Motor Oil (C18-C36)	ND	0.25	1	01/26/2021 11:56
TPH-Kerosene (C9-C18)	ND	0.050	1	01/26/2021 11:56

Surrogates	REC (%)	Limits	
C9	100	70-130	01/26/2021 11:56

Analyst(s): JIS

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	2101980-002D	Water	01/21/2021 13:00	GC9a 01262112.D	213535

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	0.050	1	01/26/2021 12:35
TPH-Motor Oil (C18-C36)	ND	0.25	1	01/26/2021 12:35
TPH-Kerosene (C9-C18)	ND	0.050	1	01/26/2021 12:35

Surrogates	REC (%)	Limits	
C9	99	70-130	01/26/2021 12:35

Analyst(s): JIS

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	SM2130 B
Date Prepared:	01/22/2021	**Analytical Method:**	SM2130 B-2001
Project:	220172; The Mosaic Project	**Unit:**	NTU

Turbidity

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001C**	**Water**	**01/21/2021 11:15**	**WetChem**	**213673**

Analytes	Result	RL	DF	Date Analyzed
Turbidity	**0.68**	0.10	1	01/22/2021 13:42

Analyst(s): NYG

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002C**	**Water**	**01/21/2021 13:00**	**WetChem**	**213673**

Analytes	Result	RL	DF	Date Analyzed
Turbidity	**2.1**	0.10	1	01/22/2021 13:46

Analyst(s): NYG

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Analytical Report

Client:	Balance Hydrologics	**WorkOrder:**	2101980
Date Received:	01/21/2021 14:40	**Extraction Method:**	E415.3
Date Prepared:	01/22/2021	**Analytical Method:**	E415.3
Project:	220172; The Mosaic Project	**Unit:**	mg/L

Dissolved Organic Carbon (DOC)

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 17-1	**2101980-001N**	**Water**	**01/21/2021 11:15**	**WC_CNS F012221-1_1027_61**	**213638**

Analytes	Result	RL	DF	Date Analyzed
Dissolved Organic Carbon	**2.4**	0.70	1	01/23/2021 00:59

Analyst(s): TD

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
Castro Valley/ Well 20-1	**2101980-002N**	**Water**	**01/21/2021 13:00**	**WC_CNS F012221-1_1027_62**	**213638**

Analytes	Result	RL	DF	Date Analyzed
Dissolved Organic Carbon	ND	0.70	1	01/23/2021 01:13

Analyst(s): TD

Well 17-1

Monterey Bay Analytical Services

Balance Hydrologics
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ELAP Certification Number: 2385

Friday, January 12, 2018

Lab Number: 180105_07-01

Collection Date/Time: 1/4/2018 14:00 Sample Collector: Porras G Client Sample #:

Submittal Date/Time: 1/5/2018 14:05 Sample ID:

Sample Description: Mosaic Well 17-01

Analyte	Method	Unit	Result	Dil.	Qual	PQL	MCL	Anal. Date	Anal. Time	Analyst
QC Anion Sum x 100	Calculation	%	112	1						
QC Cation Sum x 100	Calculation	%	124	1						
Anion-Cation Balance	Calculation	%	5	1						
QC Ratio TDS/SEC	Calculation	NA	0.67	1				1/5/2018	15:15	LM
Turbidity	EPA180.1	NTU	0.60	1		0.05	1	1/5/2018	15:43	LM
Boron	EPA200.7	mg/L	1.51	1		0.05		1/11/2018	13:05	HM
Calcium	EPA200.7	mg/L	5	1		1		1/11/2018	13:05	HM
Iron, Total	EPA200.7	µg/L	12	1		10	300	1/11/2018	13:05	HM
Magnesium	EPA200.7	mg/L	2	1		1		1/11/2018	13:05	HM
Manganese, Total	EPA200.7	µg/L	ND	1		10	50	1/11/2018	13:05	HM
Potassium	EPA200.7	mg/L	2.6	1		1		1/11/2018	13:05	HM
Sodium	EPA200.7	mg/L	571	1		1		1/11/2018	13:05	HM
Zinc, Total	EPA200.7	µg/L	ND	1		10	5000	1/11/2018	13:05	HM
Aluminum, Total	EPA200.8	µg/L	10	1		5	1000	1/12/2018	10:29	MW
Antimony, Total	EPA200.8	µg/L	1	1		0.5	6	1/12/2018	10:29	MW
Arsenic, Total	EPA200.8	µg/L	2	1		1	10	1/12/2018	10:29	MW
Barium, Total	EPA200.8	µg/L	25	1		5	1000	1/12/2018	10:29	MW
Beryllium, Total	EPA200.8	µg/L	ND	1		0.1	4	1/12/2018	10:29	MW
Cadmium, Total	EPA200.8	µg/L	ND	1		0.2	5	1/12/2018	10:29	MW
Chromium, Total	EPA200.8	µg/L	8	1		1	50	1/12/2018	10:29	MW
Copper, Total	EPA200.8	µg/L	139	1		2	1300	1/12/2018	10:29	MW
Lead, Total	EPA200.8	µg/L	ND	1		1	15	1/12/2018	10:29	MW
Mercury, Total	EPA200.8	µg/L	ND	1		0.5	2	1/12/2018	10:29	MW
Nickel, Total	EPA200.8	µg/L	1	1		1	100	1/12/2018	10:29	MW

mg/L : Millgrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level

H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance

MDL = Method Detection Limit J = Result is less than PQL LN: MS and/or MSD below acceptance limits. LR: LCS recovery below method control limits.

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ELAP Certification Number: 2385

Friday, January 12, 2018

Selenium, Total	EPA200.8	µg/L	ND	1		1	50	1/12/2018	10:29	MW
Silver, Total	EPA200.8	µg/L	ND	1		1	100	1/12/2018	10:29	MW
Thallium, Total	EPA200.8	µg/L	ND	1		0.5	2	1/12/2018	10:29	MW
Bromide	EPA300.0	mg/L	ND	1		0.1		1/5/2018	17:44	HM
Chloride	EPA300.0	mg/L	41	1		1		1/5/2018	17:44	HM
Fluoride	EPA300.0	mg/L	0.9	1		0.1	2	1/5/2018	17:44	HM
Nitrate as N	EPA300.0	mg/L	ND	1		0.1	10	1/5/2018	17:44	HM
Nitrite as N	EPA300.0	mg/L	0.7	1		0.1	1	1/5/2018	17:44	HM
Orthophosphate as P	EPA300.0	mg/L	ND	1	LN, LR	0.1		1/5/2018	17:44	HM
Sulfate	EPA300.0	mg/L	233	1		1		1/5/2018	17:44	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	0.7	1		0.1		1/5/2018	17:44	HM
Cyanide, Available	OIA-1677-09	µg/L	ND	1		3	150	1/11/2018	10:08	BS
Color, Apparent (Unfiltered)	SM2120B	Color Units	5	1		3	15	1/5/2018	16:04	LM
Odor Threshold at 60 C	SM2150B	TON	1	1		1	3	1/5/2018	15:57	LM
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	850	1		10		1/8/2018	9:32	LM
Langlier Index, 15°C	SM2330B	NA	0.22	1						
Langlier Index, 60°C	SM2330B	NA	1.05	1						
Hardness (as CaCO3)	SM2340B/Calc	mg/L	22	1		10				
Specific Conductance (EC)	SM2510B	µmhos/cm	2049	1		1	900	1/5/2018	15:15	HM
Total Dissolved Solids	SM2540C	mg/L	1380	1		10	500	1/5/2018	15:00	LM
pH (Laboratory)	SM4500-H+B	pH (H)	8.4	1		0.1	10	1/5/2018	16:53	LM
MBAS (Surfactants)	SM5540C	mg/L	ND	1		0.05		1/5/2018	14:05	HM

Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L : Millgrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit MCL : Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See Report attachments T = Temperature Exceedance
MDL = Method Detection Limit J = Result is less than PQL LN: MS and/or MSD below acceptance limits. LR: LCS recovery below method control limits.

ATTACHMENT 3

Wells 17-1 & 20-1 Source Capacity Results
Technical Memorandum
By Balance Hydrologics

TECHNICAL MEMORANDUM

To: Brian Lowe, Chief Operating Officer, The Mosaic Project
From: Mark Woyshner, Barry Hecht, CHg50, and Gustavo Porras
cc: Lisa Pezzino, P.E., SRT Consultants
Date: April 5, 2020

Subject: Mosaic Project Wells 17-1 and 20-1: Source Capacity Test Results

Summary and Conclusions

The Mosaic Project ("Mosaic") is in the design phase of their proposed group camp project located on a 33.8-acre parcel (APN 85-1200-1-16) at 17015 Cull Canyon Road, Castro Valley, CA (**Figure 1**). Mosaic is in the process of establishing on-site water sources for a proposed public water system to supply the camp with potable water. Balance Hydrologics ("Balance") conducted hydrogeologic backgrounding, sited several potential well sites on the property, and worked with Maggiora Bros. Drilling Co. ("Maggiora") to install two new wells – Well 20-1 and Well 17-1. Balance then coordinated with Mosaic staff to test their yields. The well drilling and yield testing work was conducted under California Professional Geologist license held by Barry Hecht, PG 3664 and CHg 50.

A 10-day constant-rate pumping and recovery test was conducted sequentially at each of the wells in November 2020. The objective of the test was to evaluate the source capacity of the wells in conformance with the California Code of Regulations (CCR §64554). Both wells draw groundwater from fractured consolidated sedimentary bedrock and were constructed with a cement seal exceeding the required 50 feet from ground surface within a three-inch annulus. For a bedrock well, CCR §64554 requires ether a 72-hour or 10-day test, and for a 10-day test, no more than 50 percent of the pumping rate is assigned as the well's capacity. Well 20-1 was successfully pumped at 9.35 gallons per minute (gpm), achieving a capacity of 4.7 gpm. Well 17-1 was successfully pumped at 6.05 gpm, achieving a capacity of 3.0 gpm.

CCR §64554 requires a water-level recovery in the well "…to within two feet of the static water level measured at the beginning of the well capacity test or to a minimum of ninety-five percent of the total drawdown measured during the test, whichever is more stringent." Drawdown in Well 20-1 recovered to 2-ft from static water level at 9.5 days into the recovery, thus satisfying this standard. It also reached 95 percent recovery at 12.66 days after pumping stopped. The source capacity test at Well 17-1 did not satisfying the recovery standards.

CCR §64554 requires the well capacity test to be conducted during the months of August, September, or October. Water year 2020 was a dry year with a prolonged dry season. The California Department of Drinking Water (DDW) gave approval to extend the capacity testing season into November, given lack of rain.

- At the start of the pumping test at Well 17-1 on November 8, 2020, cumulative rainfall totaled 0.04 inches since September 1, 2020. During the 10-day pumping test, 0.75 inches of rain were measured at regional rain stations, and an additional 0.11 inches fell at the beginning of the recovery period. Cumulative rainfall totaled 0.90 inches at the end of the recovery at Well 17-1 on November 28, 2020. Given the dry soil conditions and that no effects were detected in the water-level monitoring records, the rainfall is considered negligible for the results of the test.
- No rain fell during the pumping and recovery test at Well 20-1.

Major ion activity measured in water samples collected from the two wells indicated that the wells draw groundwater from separate fractured bedrock aquifers, which is consistent with the interpreted geologic framework of the aquifers. Drawdown interference was also not detected in the water-level monitoring records during the 10-day pumping tests.

Several independent lines of reasoning – including the drawdown test results and evidence of confined aquifer conditions – indicated that neither well draws on groundwater under the direct influence of surface water. Well 20-1, in addition, showed a slight artesian pressure. Groundwater sampled from Well 20-1 was broadly similar to the in ionic composition of baseflow sampled in Cull Creek, suggesting a similar groundwater source.

Using the pumping and recovery data, we calculated a bulk transmissivity of 190 gpd/ft and a hydraulic conductivity of 2.3 gpd/ft^2 (or 1.1 x 10^{-4} cm/s) for the fractured aquifer supplying Well 20-1. At Well 17-1, bulk transmissivity was 28 gpd/ft and a hydraulic conductivity of 1.1 gpd/ft^2 (or 5.2 x 10^{-5} cm/s).

Introduction

The Project site is situated within Cull Creek canyon about three miles north from Interstate 580 at 17015 Cull Canyon Road, Castro Valley, CA. Wells 20-1 and 17-1 are located at the southeasternmost portion of the Project 33.8-acre parcel (APN 85-1200-1-16) (**Figure 2**). Three other wells on the property – 19-1, 19-2, and the old shallow homestead well – are not suitable to be used as a source to the proposed potable water system and are currently proposed to be destroyed per State and County protocols.

Well 20-1 was drilled and completed by Maggiora in August 2020 to a total depth of 135 feet and screened from 95 to 135 feet (**Figures 3 and 4**). The well was equipped with a Grundfos 5HP pump set at a depth of 95 feet. Well 17-1 was drilled and completed by Maggiora in December 2017 to a total depth of 200 feet and screened from 70 to 90 feet and from 130 to 190 feet (**Figure 5**). A Grundfos model ½ HP pump (Model No. 5S05-13) was installed in Well 17-1 at a depth of 180 feet. Following the completion of Well 17-1, Balance prepared a comprehensive report (Porras and Hecht, 2019) which included results of preliminary yield and water-quality testing of that well.

This memo documents activities, conditions, and results of a 10-day constant-rate pumping and recovery test conducted at each well. The objective of the tests was to evaluate the source capacity of the wells in conformance with the California Code of Regulations (CCR §64554). In addition, aquifer properties of transmissivity and hydraulic conductivity were calculated for relative comparative purposes, and any obvious permeability and/or recharge boundaries were noted.

Description Wells and Aquifer

The Project property is situated near the axis of a tightly folded northwest-plunging anticline, and underlain primarily by fractured, consolidated sedimentary rocks comprising vertical to high-angle dipping beds of siltstone and siliceous shale, with Quaternary alluvial deposits along Cull Creek (**Figure 6**; cf., Graymer, 2000; Graymer and others, 1994; Dibblee and Minch, 2005; Dibblee, 1980; Crane, 1988). Except for the nearly flat stream terraces along Cull Canyon Road, where existing structures, wells, and road access are sited, topography across nearly all the property at large is hilly with 30 to 70 percent slopes, and accessible only by foot. Rainfall at the site averages about 24 to 26 inches per year (Alameda County, 1980; Sa'ad and Nahn, 1989).

Monterey Formation bedrock of Mio-Pliocene age (Tm and Tmc on **Figure 6**) underlying the terrace alluvium is exposed along Cull Creek and its tributaries, and at road cuts along Cull Canyon Road, on-site service roads, and the ridge trail. Underlying the Monterey Formation is late-Cretaceous age, Great Valley Complex rock types (Kr on **Figure 6**). These siltstone and siliceous shales rock types are often unfavorable sources for groundwater supply, except possibly where fractured. A northwest-trending trace of a normal fault has been mapped by agency geologists (Graymer, 2000; Graymer and others, 1994), which intersects the property along its southern border, shown on USGS maps with evidence of Quaternary activity (roughly speaking, during the past 2,000,000 years). Another fault is mapped along the axes of Cull Creek canyon and intersecting with the property along its eastern border (Crane, 1988, with geology by Dibblee, 1980).

Wells 20-1 and 17-2 were drilled into the underlying, confined to semi-confined aquifer system within the folded bedrock and designed to draw groundwater from the bedrock fractures. Both wells were situated within proximity to the USGS-delineated Quaternary normal fault. Both wells were also situated between this regionally primary thrust fault and a parallel fault locally delineating the boundary of bedrock thrusted onto the Great Valley Complex. Generally, faults in such rocks make for attractive targets for groundwater exploration since they often serve as conduits for groundwater and its storage, or as barriers concentrating flow in preferred directions. Past movements along the fault have potentially fractured neighboring rock, creating voids which provide storage of groundwater.

At Well 20-1, we drilled through 50 feet of terrace deposits (likely of Pleistocene age) comprising brown to dark yellowish brown silty clay with sand and gravels. Underlying the terrace deposits, a greenish gray, well consolidated, very fined-grained sandstone was identified to a depth of 135 feet (the bottom of the well), likely corresponding to the mid-Miocene age, Oursan Sandstone locally delineated on the Graymer and others (USGS) geology map (**Figure 6**). At 120 to 125 feet, sandstone and chert gravels up to 1-inch diameter were identified, which was the source of abundant yield during drilling. Well 20-1 was constructed with 5-inch diameter SDR21 PVC casing to a total depth of 135 feet with a stick-up of 2 feet above ground surface. The well was sealed within a 3-inch annulus around casing with 10.3 sack cement mix to a depth of 60 feet from ground surface, about 10 feet beyond the bottom of the terrace deposits. Casing perforations were from 95 to 135 feet and a Monterey #3 sand pack was placed from 135 feet to 60 feet prior to tremie-pouring the seal. Following completion and air-lift development of Well 20-1, static water level in the well settled about 14 feet above first water found at 55 during drilling. This slight artesian pressure and the noted chemically reduced gley color of the sandstone suggests confining conditions of the bedrock aquifer.

At Well 17-1, a brown silty clay and shale was encountered to a depth of 60 feet (possibly mid-Miocene Claremont shale), and from 60 feet bgs to 220 feet (the bottom of the drill hole) a dark blue-gray shale (likely late-Cretaceous Great Valley Complex). First water was encountered at a depth of 50 feet below ground surface. Well 17-1 was constructed with 5-inch diameter SDR21 PVC casing to a total depth of 200 feet with a stick-up of 2 feet above ground surface. Slotted casing was installed between 70 and 90 feet and between 130 and 190 feet. Sand (8x16) was poured in the annulus around the casing from the bottom of the drill hole up to a depth of 60 feet bgs. The sanitary seal was tremie-poured from a depth of 60 feet bgs to ground surface with 10.3 sack cement mix. Following completion and air-lift development of Well 17-1 static water level was 40 feet below ground surface, a rise of about 10 feet from first water. Like at Well 20-1, the slight artesian pressure and noted dark blue-gray color of the shale suggests confining conditions of the bedrock aquifer at Well 17-1.

Pouring of sanitary seal at both wells was witnessed by Alameda County staff, as specified in the County well ordinance.

As a commonly used method to characterize (or ‘fingerprint’) water from different sources for comparison, major ion activity results of groundwater samples collect from all five wells on the Project property were plotted in a Piper diagram[1] (**Figure 7**) along with samples collected from Cull Creek. Based on these results, Wells 20-1 and 17-1 draw groundwater from separate fractured bedrock aquifers, which is consistent with the interpreted geologic framework of the aquifers described above. Water sampled from Well 17-1 is characterized as a sodium bicarbonate groundwater, while water sampled from Well 20-1 is a calcium to neutral bicarbonate groundwater and similar to baseflow sampled in Cull Creek and groundwater from the shallow Old Homestead Well. The samples from 20-1 differ slightly in their higher proportion of sulfate activity (best seen on the “Anion” component of the Piper plot), a significant doubling of sulfate replicated in two separate samples separated by a winter recharge cycle. Wells 19-1 and 19-2 (proposed to be destroyed) are low yielding, completed deeper in poorly fractured shales, and have sodium chloride signature. The wide range of separate groundwater source types on site illustrates the unique geologic complexity of high-angle bedding of faulted marine sandstones, gravels, and shales at various degrees of fracturing. Groundwater under these geologic conditions tend to exhibit characteristics of a confined (or semi-confined) aquifer.

Pumping Test Conducted and Results

Mosaic staff carried out the 10-day constant-rate pumping tests at Wells 20-1 and 17-1 with Gustavo Porras from Balance assisting with planning, permitting, and executing the test. A “Dole” valve was installed in-line at the well head to regulate the pumped flow at a constant rate

[1] Piper diagrams (Piper, 1944) show the relative concentration of major cations and anions, in milliequivalents per liter, to the total content major ions of the water. Groups of samples generally relate to a common source, flow path, or chemical process (such as mixing, mineral precipitation, or ion exchange).

and hand measurements of flow were conducted periodically using a 5-gallon bucket and stopwatch. We installed a Van Essen Instruments Micro-Diver M50 water-level logger in the sounding tube of each well, which was programed to record the water level at a 5-minute interval. To calibrate the automated water-level records, hand measurements of depth-to-water were carried out across the water-level range during pumping and recovery using an electronic water level sounder within the sounding tube. The frequency of hand depth-to-water measurements followed the recommended schedule per California Code of Regulations (CCR §64554). The details and results of the tests are summarized in **Table 1**.

A 10-day constant-rate pumping test was performed at Well 20-1 from November 20 to November 30, 2020, with a 10-day recovery continuing after pumping to December 10, 2020 (**Figure 8**). Well 20-1 was successfully pumped at 9.35 gallons per minute (gpm), achieving a credited source capacity of 4.7 gpm.[2] Drawdown in Well 20-1 recovered to 2-ft from static water level at 9.5 days into the recovery, thus satisfying this standard.[3] It also reached 95 percent recovery at 12.66 days after pumping stopped (**Figure 9**).

At Well 17-1, the 10-day constant-rate pumping test was performed from November 8 to November 18, 2020, with a 10-day recovery to November 28, 2020 (**Figure 10**). Well 17-1 was successfully pumped at 6.05 gpm, achieving a credited source capacity of 3.0 gpm. The source capacity test at Well 17-1 did not satisfying the recovery standards (**Figure 11**).

No rain fell during the pumping and recovery test at Well 20-1. At the start of the pumping test at Well 17-1 on November 8, 2020, cumulative rainfall totaled 0.04 inches since September 1, 2020.[4] During the 10-day pumping test, 0.75 inches of rain were measured at regional rain stations, and an additional 0.11 inches fell at the beginning of the recovery period. Cumulative rainfall totaled 0.90 inches at the end of the recovery at Well 17-1 on November 28, 2020.

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[2] 22CCR §64554(g)(2)(D). Following completion of a 72-hour or 10-day well capacity test, the well shall be assigned a capacity no more than: 1. For a 72-hour test, 25 percent of the pumping rate at the end of a completed test's pumping. 2. For a 10-day test, 50 percent of the pumping rate at the end a completed test's pumping.

[3] 22CCR §64554(g)(2)(C). To complete either the 72-hour or 10-day well capacity test the well shall demonstrate that, within a length of time not exceeding the duration of the pumping time of the well capacity test, the water level has recovered to within two feet of the static water level measured at the beginning of the well capacity test or to a minimum of ninety-five percent of the total drawdown measured during the test, whichever is more stringent. If the well recovery does not meet these criteria, the well capacity cannot be determined pursuant to subsection (g)(2) using the proposed pump rate.

[4] Average of rainfall measured at two RAWS stations: South Oakland station https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCOKS and Las Trampas station https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCTRA

Given the dry soil conditions and that no effects were detected in the water-level monitoring records, the rainfall is considered negligible for the results of the test.

Aquifer Properties

The fractured bedrock supplying Well 20-1 is considerably more permeable than at Well 17-1. Total drawdown in Well 20-1 at the end of 10 days of pumping at 9.35 gpm was 15.8 feet (**Figure 12**). Based on these results, the calculated specific capacity (Cs) for the well is 0.59 gpm per foot of drawdown (**Table 2**).[5] At Well 17-1, drawdown was 86.1 feet with 10 days of pumping at 6.05 gpm (**Figure 13**), which yields a Cs of 0.07 gpm/ft.

Transmissivity (T) is a common aquifer coefficient that characterizes how easily water moves through the aquifer (a measure of bulk permeability) and can be used to quantify groundwater flow. Transmissivity can be initially estimated with a relationship to Cs but is more accurately estimated using the pumping test data (**Figures 12 and 13**) and recovery data (**Figures 14 and 15**).[6] The data were analyzed using the modified nonequilibrium equation graphical method (Cooper and Jacob, 1946) to estimate transmissivity (T). This method (and other similar methods) is commonly applied to alluvial aquifers but is also useful for fractured bedrock aquifers as a general comparative metric.[7] Hydraulic conductivity (K, also known as permeability) was estimated by dividing T by the aquifer thickness (b), which was estimated as the total depth of the well minus the depth to static water level. Results of the T and K calculations are summarized in **Table 2**.

Boundary Effects

When a well is pumped it, introduces a stress to the aquifer and lowers hydraulic pressures and water levels in the vicinity of the well. With continued pumping, this effect propagates outward from the well, and the expanding zone of influence can be conceptually represented generally as

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[5] Specific capacity (Cs) is well function describing the quantity of water that a well can produce per unit drawdown of water level in the well. It is the pumping rate divided by the water level drawdown in the well, in gpm per foot drawdown. To estimate aquifer transmissivity (T) with Cs see Appendix 16.D of Driscoll (1983) or p. 128 of DWR Bulletin No. 118-2 (June 1974).

[6] Calculations of T using recovery data is generally regarded as more accurate because the data are not affected by pump fluctuations and vibrations, and various other possibilities for error related to pumping.

[7] Method assumes (a) full penetration of the aquifer, and perhaps more importantly, (b) the hydraulic conductivity ("permeability") of the shallow and deeper zones are similar (homogeneous conditions), and (c) the hydraulic conductivity is the same in all directions (isotropic conditions). Although the assumptions are never strictly met in any natural aquifer system, they are commonly suitable to roughly estimate bulk aquifer properties. Results seem reasonable for comparative purposes despite marked geologic differences.

a "cone of depression", though largely distorted and confined under the geologic conditions on the Project property and vicinity. As it propagates outward, drawdown at the well is influenced by changes in aquifer permeability and by recharge within the zone of influence. An inflection in the drawdown curve can be interred to represent a boundary of the cone of depression in the aquifer from which the well draws water.

- A recharge boundary results in reduced drawdown after the cone of depression encounters a stream, a lake, a high-yielding open fracture or joint, or leakage from overlying perched groundwater. Recharge boundaries were not encountered during the 10-day pumping tests of both Wells 20-1 and 17-1.

- A no-flow or low-permeability boundary result in increased drawdown after the cone of depression encounters a zone of lower permeability due to causes such as a change in lithology or a low-permeability fault. No-flow or low-permeability boundaries were not encountered during the 10-day pumping tests of both Wells 20-1 and 17-1.

Limitations

This memorandum was prepared for The Mosaic Project as a field results level assessment of groundwater conditions for planning and permitting purposes of their Wells 20-1 and 17-1 proposed a water supply source for a proposed public water system. Mosaic is the only intended beneficiary of this document. No other party should communicate the information presented herein without the consent of Mosaic. Considering the intrinsic variability of geologic materials, particularly in this setting, if additional information or detail is required or alternative uses or applications envisioned, then consultation should commence with Balance Hydrologics for site-specific exploration and interpretations. The findings, recommendations, specifications, and professional opinions are presented within the limits of the proposed work for the client in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.

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Enclosures

TABLES

Table 1. Water well source capacity test results, conducted during late dry season 2020, The Mosaic Project, Alameda County, CA

Well No.	Pumping Results [1]										Recovery Results [2]						Cumulative Rain Since 9/1/2020 (approx.) [3]		
	Pumping Duration (days)	Start Pumping (date time PST)	End Pumping (date time PST)	Static Depth to Water (ft)	End Pumping DTW (ft)	Total Drawdown (ft)	Volume of Water Extracted (ac-ft)	Pumping Rate (gpm)	Title 22 Assigned Capacity (gpm)	Specific Capacity gpm/ft	End Recovery Period (date time PST)	Recovery Duration (days)	End Recovery DTW (ft)	End Recovery Residual Drawdown (ft)	Percent Recovery (%)	95 Percent Recovery Duration (days)	Start of Pumping (inches)	End of Pumping (inches)	End of Recovery (inches)
Well 17-1 (WCR2017-006156)	10.0	11/8/2020 11:00	11/18/2020 11:00	74.43	160.48	86.05	0.27	6.05	3.0	0.070	11/28/2020 11:10	10.0	102.68	28.25	67.2%	no record	0.04	0.79	0.90
Well 20-1 (WCR2020-011582)	10.1	11/20/2020 8:15	11/30/2020 10:00	52.92	68.67	15.75	0.42	9.35	4.7	0.59	12/10/2020 11:45	10.1	54.74	1.82	88.4%	12.7	0.90	0.90	0.90

Notes:

[1] 22CCR §64554(g)(2)(D). Following completion of a 72-hour or 10-day well capacity test, the well shall be assigned a capacity no more than: 1. For a 72-hour test, 25 percent of the pumping rate at the end of a completed test's pumping. 2. For a 10-day test, 50 percent of the pumping rate at the end a completed test's pumping.

[2] 22CCR §64554(g)(2)(C). To complete either the 72-hour or 10-day well capacity test the well shall demonstrate that, within a length of time not exceeding the duration of the pumping time of the well capacity test, the water level has recovered to within two feet of the static water level measured at the beginning of the well capacity test or to a minimum of ninety-five percent of the total drawdown measured during the test, whichever is more stringent. If the well recovery does not meet these criteria, the well capacity cannot be determined pursuant to subsection (g)(2) using the proposed pump rate.

[3] Average of rainfall measured at two RAWS stations: South Oakland station (https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCOKS) and Las Trampas station (https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCTRA).

Table 2. Summary of yield test results at Wells 20-1 and 17-1, The Mosaic Project, Alameda County, CA

	Well 20-1 (pumping)	**Well 20-1** (recovery)	**Well 17-1** (pumping)	**Well 17-1** (recovery)
Total depth of well (feet)	135	135	100	100
Static water level at start of test, (feet)	52.9	--	74.4	--
Pumping duration (hours)	242	--	240	--
Pumping rate, Q (gpm)	9.35	--	6.05	--
Drawdown at end of pumping, s (feet)	15.8	--	86.1	--
Recovery (ft)	--	13.9	--	57.8
Percent recovery	--	88%	--	67%
Specific capacity, Cs=Q/s (gpm/ft)	0.59	--	0.070	--
Transmissivity based on Cs (gpm/ft) [2]	890	--	105	--
Drawdown slope, s	11	16	40	100
Transmissivity, T (gpd/ft) [1]	224	154	40	16
Aquifer thickness, b (ft) [3]	82	82	26	26
Hydraulic conductivity, K=T/b (gpd/ft^2)	2.73	1.88	1.56	0.62
Hydraulic conductivity, K (cm/s)	1.3E-04	8.9E-05	7.4E-05	2.9E-05

Notes:

1. Cooper and Jacob (1946) method assumes (a) full penetration of the aquifer, and perhaps more importantly, (b) the hydraulic conductivity ("permeability") of the shallow and deeper zones are similar (homogeneous conditions), and (c) the hydraulic conductivity is the same in all directions (isotropic conditions). Although the assumptions are never strictly met in any natural aquifer system, they are commonly suitable to roughly estimate bulk aquifer properties.

2. The relationship of aquifer transmissivity (T) to specific capacity (Cs) is found in Appendix 16.D of Driscoll (1983) or p. 128 of DWR Bulletin No. 118-2 (June 1974).

3. Aquifer thickness, b = well depth - static water level

4. Yield test performed by Mosaic Project staff.

FIGURES

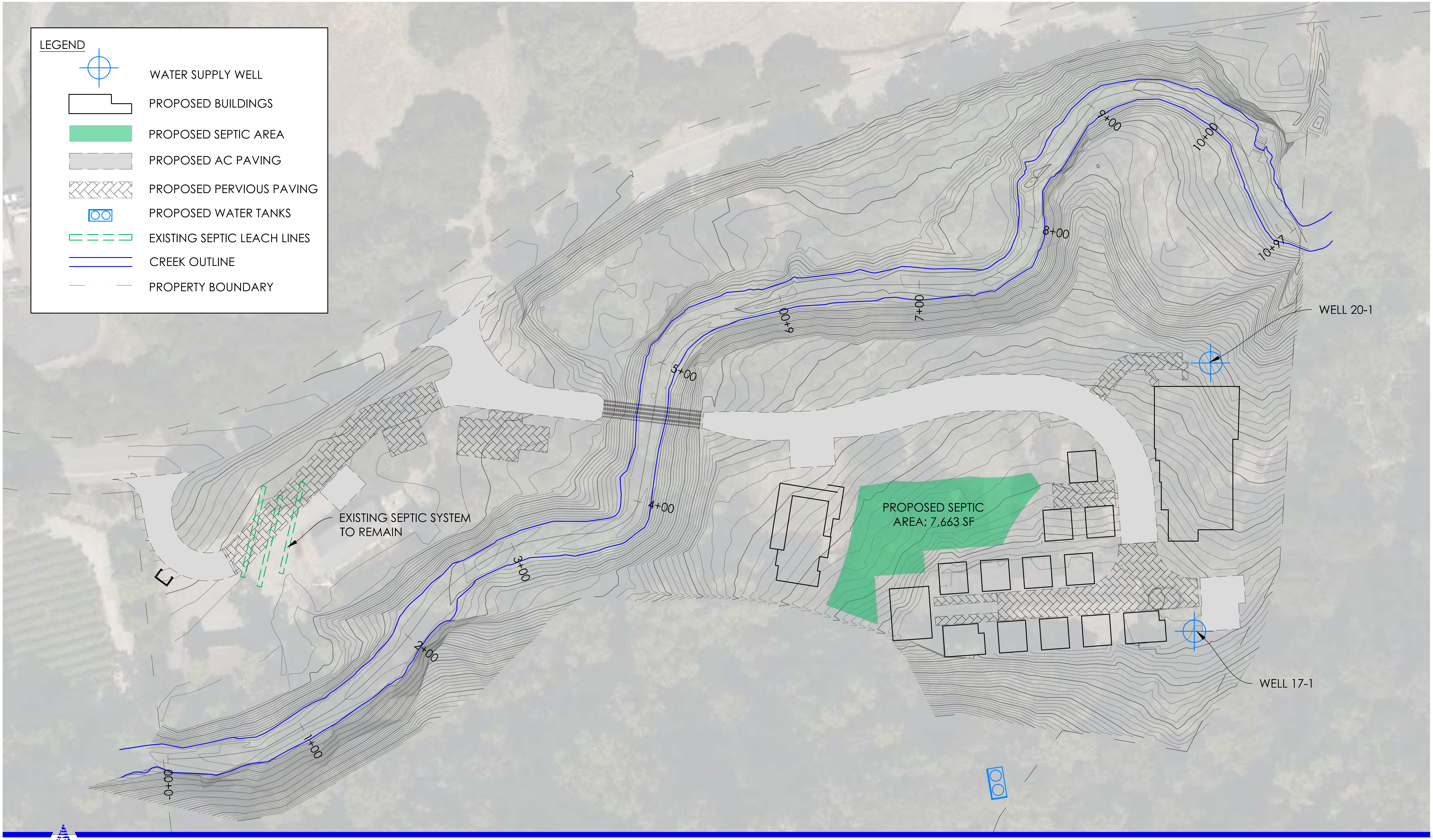


Figure 1. TENTATIVE SITE PLAN, THE MOSAIC PROJECT, ALAMEDA COUNTY, CA.

NOTE: DATA PROVIDED BY NORTHSTAR ENG. ON MARCH 24, 2021.
SURVEYOR: GREENWOOD & MOORE, INC. DATA NOT GEOREFERENCED

Balance Hydrologics, Inc.

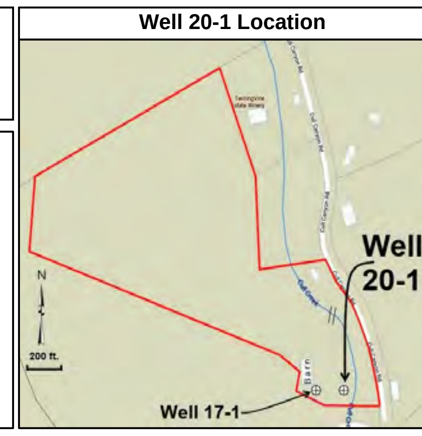
Figure 2. Location of source wells on site, The Mosaic Project, Alameda County, CA.
APN 85-1200-1-16 is a 33.8-acre parcel at 17015 Cull Canyon Road, Castro Valley, CA. Except for the nearly flat stream terraces along Cull Canyon Road, where existing structures, wells, and road access are sited, topography across nearly all the property at large is hilly with 30 to 70 percent slopes. Rainfall at the site averages about 24 to 26 inches per year.

Preliminary Data Subject To Revision

Balance Hydrologics, Inc.

Figure 3. Geologic log for well 20-1, 17015 Cull Canyon Road, Castro Valley, CA 94552

Well 20-1 Location



Owner:	The Mosaic Project
Well location:	17015 Cull Canyon Road, Castro Valley, CA 94552
APN:	85-1200-1-16
Latitude, Longitude:	N 37°44'28.10", W 122° 3'16.80"
Ground surface elevation:	447 feet WGS84
Start drilling date:	August 12, 2020
Well completion date:	August 18, 2020
Borehole geologist:	Gustavo Porras
Supervisory geologist:	Barry Hecht, CHg #50
Drilling company:	Maggiora Bros. Drilling
Driller:	Joel Garcia
Drilling rig:	Rotary Ingersoll-Rand TH-60, No. 6655
Driling bits:	Surface to 60 feet = 12¼ inches; 60 feet to 135 feet = 10 inches
Depth of borehole:	135 feet
Depth of casing:	135 feet
Diameter of casing:	5-inch PVC
Drilling method:	Drilled with air-rotary, only

Depth (feet)	Lithology	Hydrology	Well Construction	Remarks
0	Brown (10YR 4/3 and 4/2) Silty clay with some sand and gravels up to 1/4 inch			0 to 135 ft: drilled pilot hole with 8¾-inch bit; driller used air-rotary drilling; cuttings samples were collected every 5 feet
5	Silty clay, massive. Dries brick hard. Almost no coarse sand or gravel (5YR 6/3). Abrupt transition			0 to 60 ft: reamed with 12¼-inch bit 0 to 95 ft: 5-inch blank SDR21 well casing Silty clays may be a ponded deposit. 5 to 20 ft: driller added water to lubricate borehole No significant drill chattering, wall caving or odors encountered during drilling.
25	Dark yellowish brown (10YR 3/4) silty clay with some subrounded, mixed lithology, well sorted gravels up to 1/4 inch; dry.			
35	Olive brown (2.5Y 4/4) sandy silty clay with some gravels up to 1/2 inch, dry. Rich in cherts and Oursan sandstones.			
40	Dark yellowish brown (10YR 4/4) sandy silty clay with abundant coarse sand and small gravels, dry	41.25 ft: Static water level on 8/26/20		0 to 60 ft: Sanitary seal tremmied with cement slurry; observed by Alameda County inspector Eneyew Amberber
50	Greenish gray (Gley 1 5/10Y) poorly consolidated, very fined grained sandstone; fragments up to 1/4 inch; moist. Many more volcanics and grey shales in gravels (7.5YR 6/0).	55 ft: first water during drilling on 8/13/20		55 to 60 ft: Bentonite plug
60	Greenish gray (Gley 1 5/10Y) semi consolidated, very fined grained sandstone; fragments up to 1 inch; moist. Gravels are mainly gray shales and volcanics, subordinate sandstone.	60 ft: 865 uS/cm@25°C and estimated 1 gpm; water temperature 28.8°C 80 ft: 681 uS/cm@25°C; water temperature 25.1°C		60 to 135 ft: Sand pack: Monterey sand #3
90	Greenish gray (Gley 1 5/10Y) well consolidated, very fined grained sandstone and mudstone; fragments up to 1/2 inch; wet	90 ft: 605 uS/cm@25°C; water temperature 26.6°C 100 ft: 598 uS/cm@25°C and measured 0.5 gpm; water temperature 24.8°C 115 ft: 704 uS/cm@25°C and measured 54 gpm; water temperature 19.6°C		95 to 135 ft: 5-inch screened 0.032-inch slot SDR21 well casing
120	Greenish gray (Gley 1 5/10Y) gravels up to 1 inch made up of broken rounded to sub-rounded pieces of very fined grained sandstone, chert fragments up to 1/4 inch, wet			
127	Greenish gray (Gley 1 5/10Y) well consolidated, very fined grained sandstone; wet	125 ft: 618 uS/cm@25°C and measured 80 gpm; water temperature 21.3°C		Bottom of well capped

Figure 4. Driller's well completion report for Well 20-1, The Mosaic Project, Alameda County, CA.

State of California

Well Completion Report

Form DWR 188 Auto-Completed 11/2/2020

WCR2020-011582

Owner's Well Number D00611 Date Work Began Date Work Ended 08/17/2020

Local Permit Agency Alameda County Public Works Agency, Water Resources Section

Secondary Permit Agency Permit Number W2020-0534 Permit Date

Well Owner (must remain confidential pursuant to Water Code 13752)

Name THE MOSAIC PROJECT,

Mailing Address 478 SANTA CLARA AVE.

City OAKLAND State CA Zip 94610

Planned Use and Activity

Activity New Well

Planned Use Water Supply Domestic

Well Location

Address 17015 CULL CANYON RD

City CASTRO VALLEY Zip 94552 County Alameda

Latitude 37 (Deg.) 44 (Min.) 29.5954 (Sec.) N Longitude -122 (Deg.) 3 (Min.) 17.249 (Sec.) W

Dec. Lat. 37.7415543 Dec. Long. -122.0547914

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN 085-120-001

Township 02 S

Range 02 W

Section 23

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Direct Rotary Drilling Fluid Air

Total Depth of Boring 135 Feet

Total Depth of Completed Well 135 Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured 08/17/2020

Estimated Yield* 80 (GPM) Test Type Air Lift

Test Length 1 (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	10	Top soil
10	40	Brn. clay
40	55	Brn. shale
55	80	Green shale
80	115	Sandstone
115	135	Sandstone

Figure 4. (continued)

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	95	Blank	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563			
1	95	135	Screen	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563	Milled Slots	0.04	

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	55	Cement	10.3 Sack Mix		
55	60	Bentonite	High Solids		
60	135	Filter Pack	8 x 16		

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	135	10

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name MAGGIORA BROS DRILLING INC
Person, Firm or Corporation

595 AIRPORT BLVD	WATSONVILLE	CA	95076
Address	City	State	Zip

Signed *electronic signature received* — C-57 Licensed Water Well Contractor
08/28/2020 — Date Signed
249957 — C-57 License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

N
Latitude Deg/Min/Sec

W
Longitude Deg/Min/Sec

TRS:

APN:

Figure 5. Driller's well completion report for Well 17-1, The Mosaic Project, Alameda County, CA.

State of California

Well Completion Report

Form DWR 188 Auto-Completed 2/26/2018

WCR2017-006156

Owner's Well Number: D00379 | Date Work Began: 12/07/2017 | Date Work Ended: 12/13/2017

Local Permit Agency: Alameda County Public Works Agency, Water Resources Section

Secondary Permit Agency: | Permit Number: W2017-0834 | Permit Date: 11/15/2017

Well Owner (must remain confidential pursuant to Water Code 13752)

Name: Marcus Maita

Mailing Address: 2004 Camino Ramon

City: Danville | State: CA | Zip: 94526

Planned Use and Activity

Activity: New Well

Planned Use: Water Supply Domestic

Well Location

Address: 17015 Cull Canyon RD

City: Castro Valley | Zip: 94552 | County: Alameda

Latitude: ___ Deg. ___ Min. ___ Sec. N | Longitude: ___ Deg. ___ Min. ___ Sec. W

Dec. Lat.: 37.7411710 | Dec. Long.: -122.0555243

Vertical Datum: | Horizontal Datum: WGS84

Location Accuracy: | Location Determination Method:

APN: 85-1200-1-16

Township: 02 S

Range: 02 W

Section: 23

Baseline Meridian: Mount Diablo

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

Borehole Information

Orientation: Vertical | Specify:

Drilling Method: Direct Rotary | Drilling Fluid: Air

Total Depth of Boring: 220 Feet

Total Depth of Completed Well: 200 Feet

Water Level and Yield of Completed Well

Depth to first water: ___ (Feet below surface)

Depth to Static Water Level: 40 (Feet) | Date Measured: 12/13/2017

Estimated Yield*: 35 (GPM) | Test Type: Air Lift

Test Length: 3 (Hours) | Total Drawdown: ___ (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	5	Top soil
5	20	Brn clay
20	38	Brn. silty clay
38	60	Brn. silty clay & shale
60	80	Black shale
80	100	Black shale
100	120	Black shale
120	140	Black shale & white shale
140	160	White shale & black shale
160	180	Brn. & black shale
180	200	Brn. & black shale
200	220	Black shale

Figure 5. (continued)

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	70	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	70	90	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	
1	90	130	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	130	190	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	
1	190	200	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	60	Cement	10.3 Sack Mix		
60	220	Filter Pack	8 x 16		

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	60	11
60	220	9

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: MAGGIORA BROS DRILLING INC
Person, Firm or Corporation

595 AIRPORT BLVD	WATSONVILLE	CA	95076
Address	City	State	Zip

Signed

electronic signature received	12/22/2017	249957
C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only

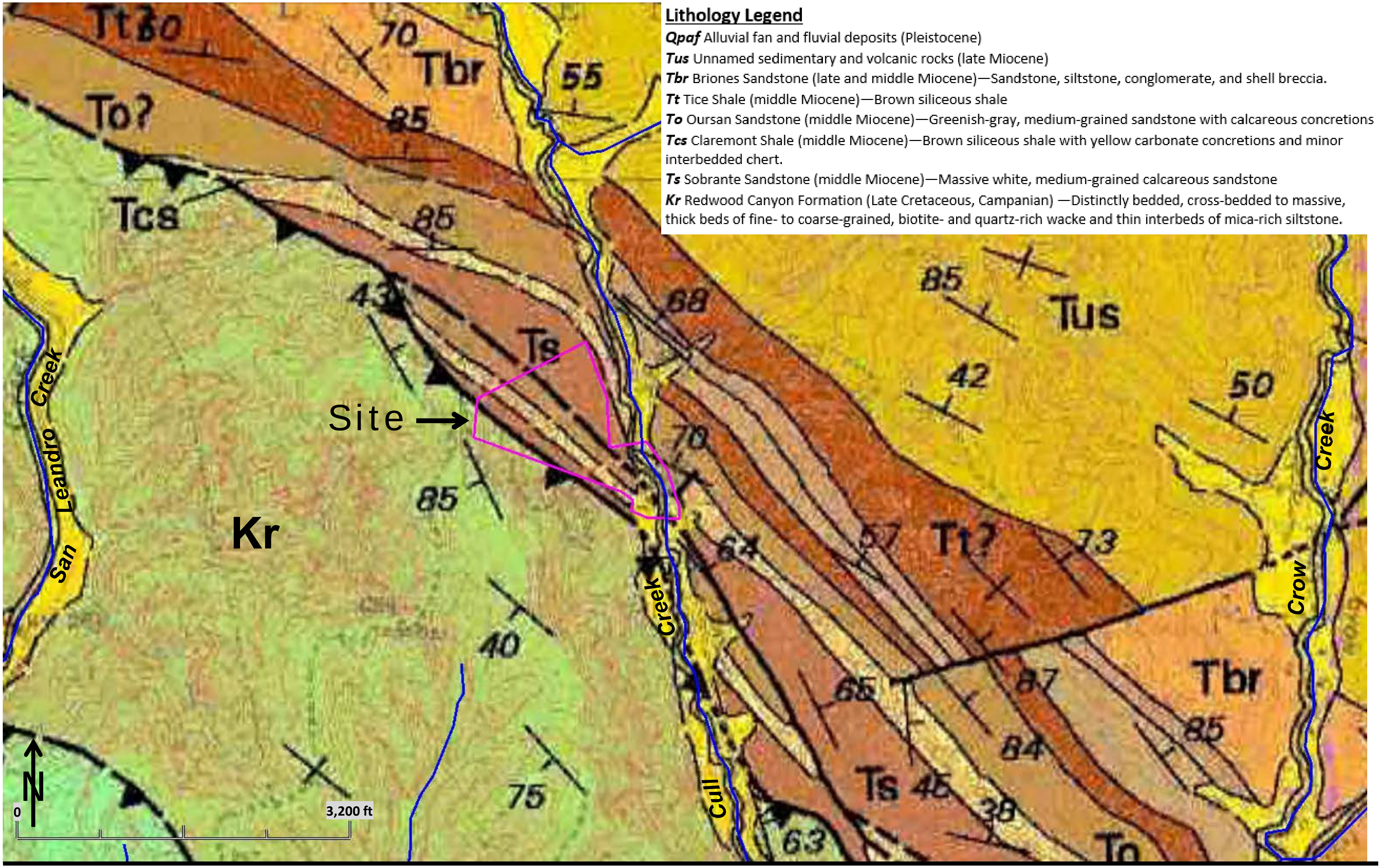
CSG #	State Well Number	Site Code	Local Well Number

N Latitude Deg/Min/Sec

W Longitude Deg/Min/Sec

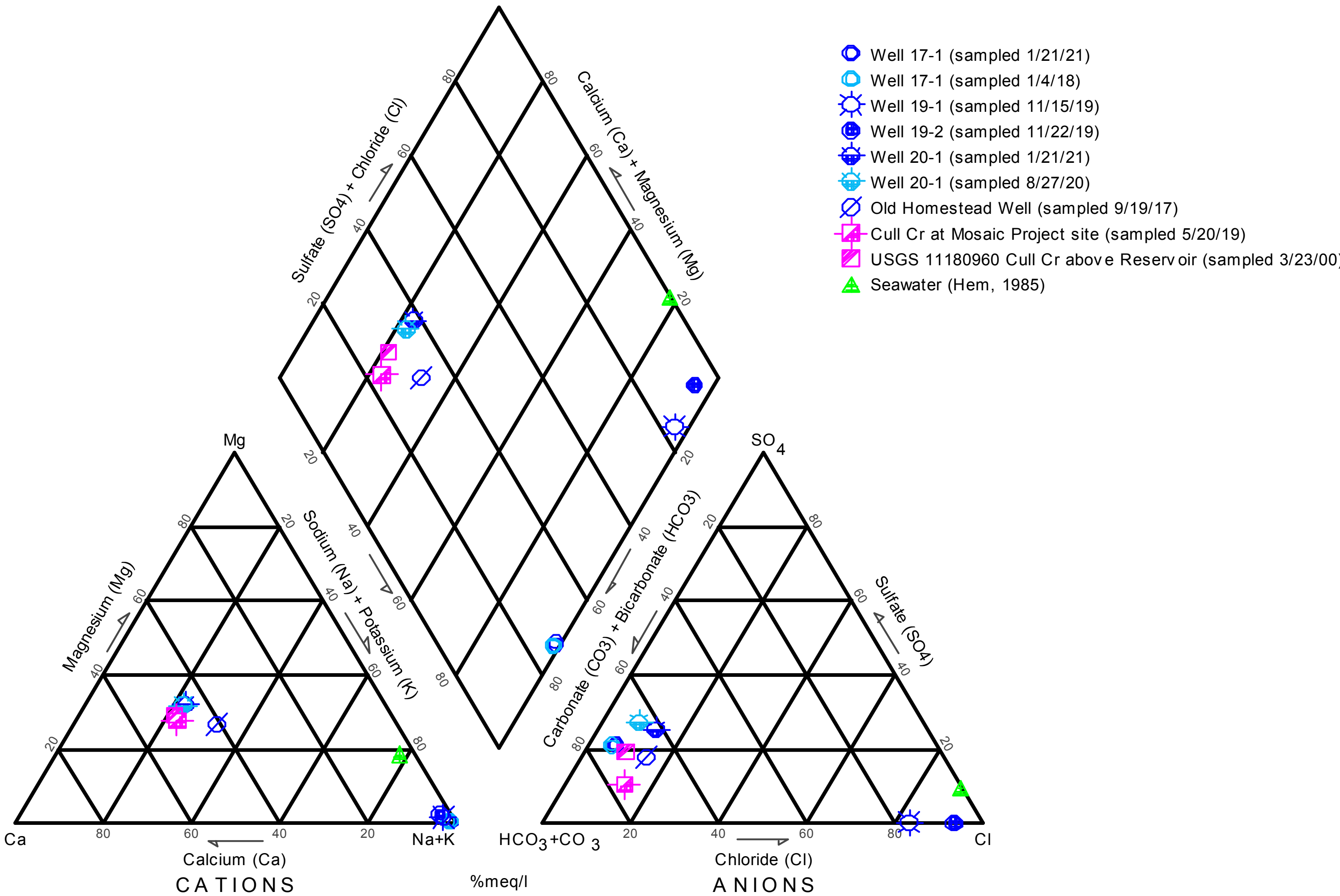
TRS:

APN:



Balance Hydrologics

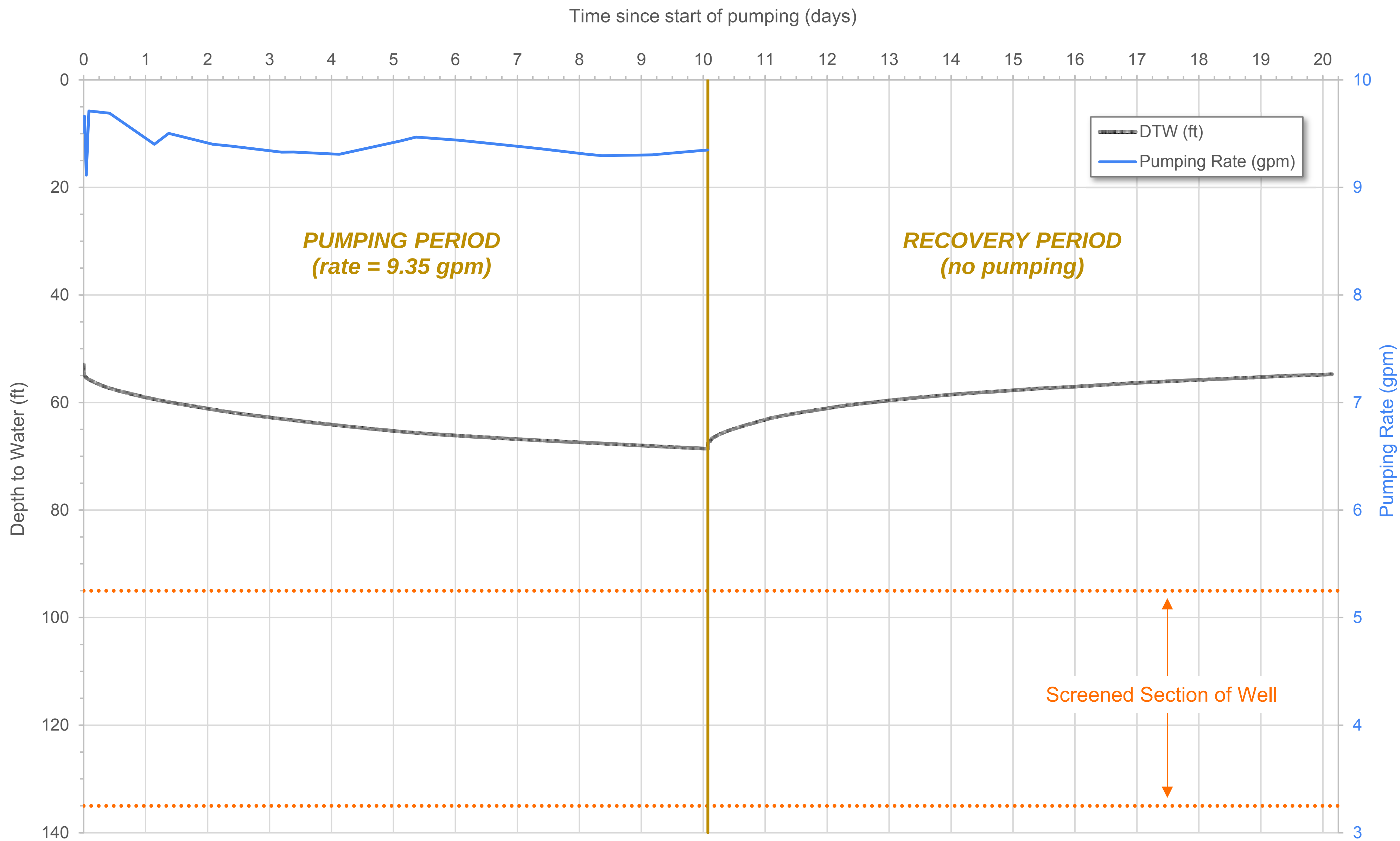
Figure 6. Site geology and vicinity, The Mosaic Project, Alameda County, CA.
Geology source: Graymer, R.W., 2000, Geologic map and map database of the Oakland metropolitan area, Alameda, Contra Costa, and San Francisco Counties, California: U.S. Geological Survey Miscellaneous Field Studies MF–2342, scale 1:50,000. (Available at https://pubs.usgs.gov/mf/2000/2342/.)



This diagram shows cations in the ternary graph on the left and anions on the right graph. The diamond graph in the center illustrates both cations and anions. Hardness dominated water plots to the left and top on the diamond graph, soft monovalent-salt dominated water to the right, and soft alkaline water towards the bottom. The radius of circle around the plotted points

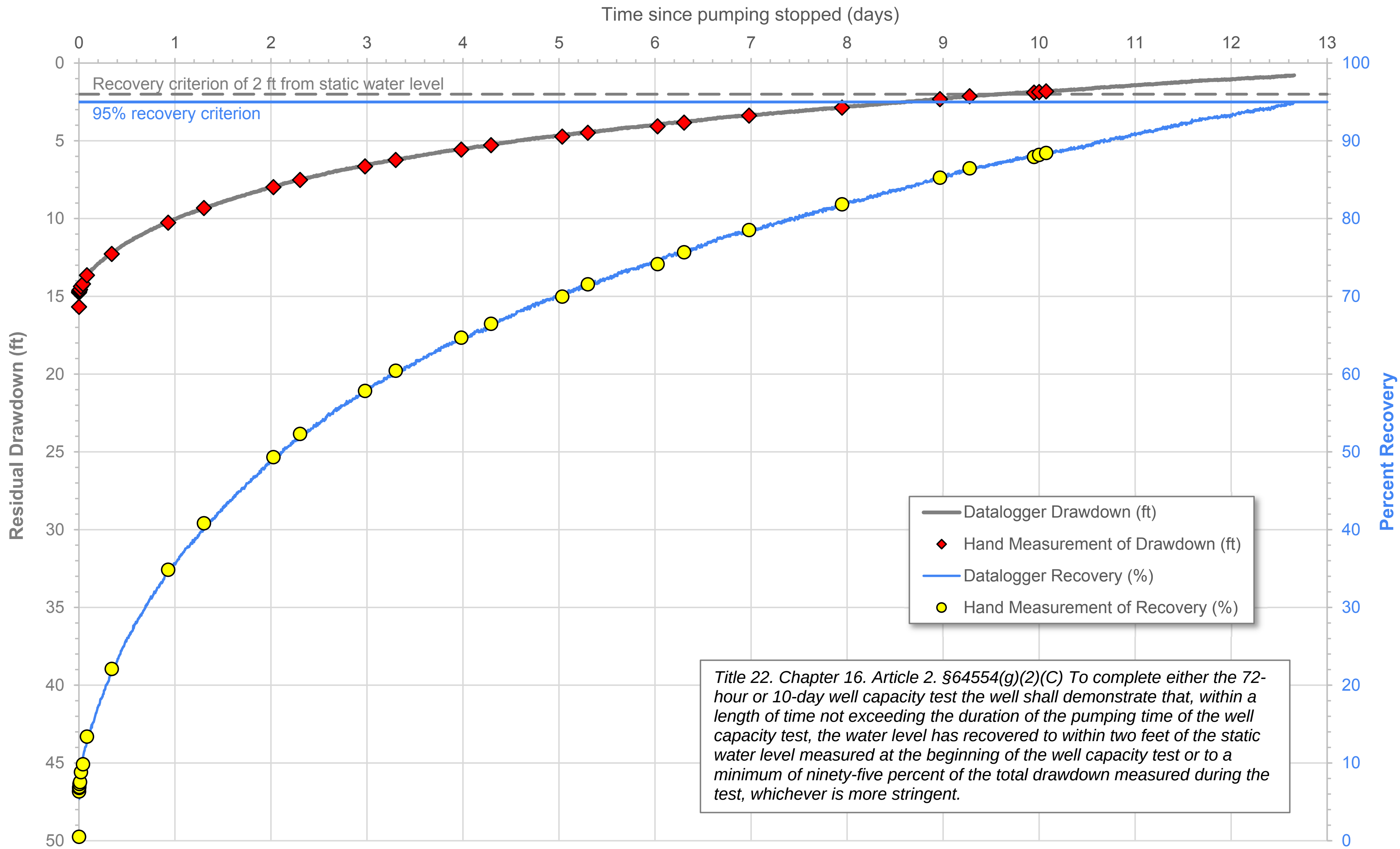
Balance Hydrologics

Figure 7. **Relative ratios of major ion activity ("Piper Diagram") in source water samples collected at The Mosaic Project site, Alameda County, CA**



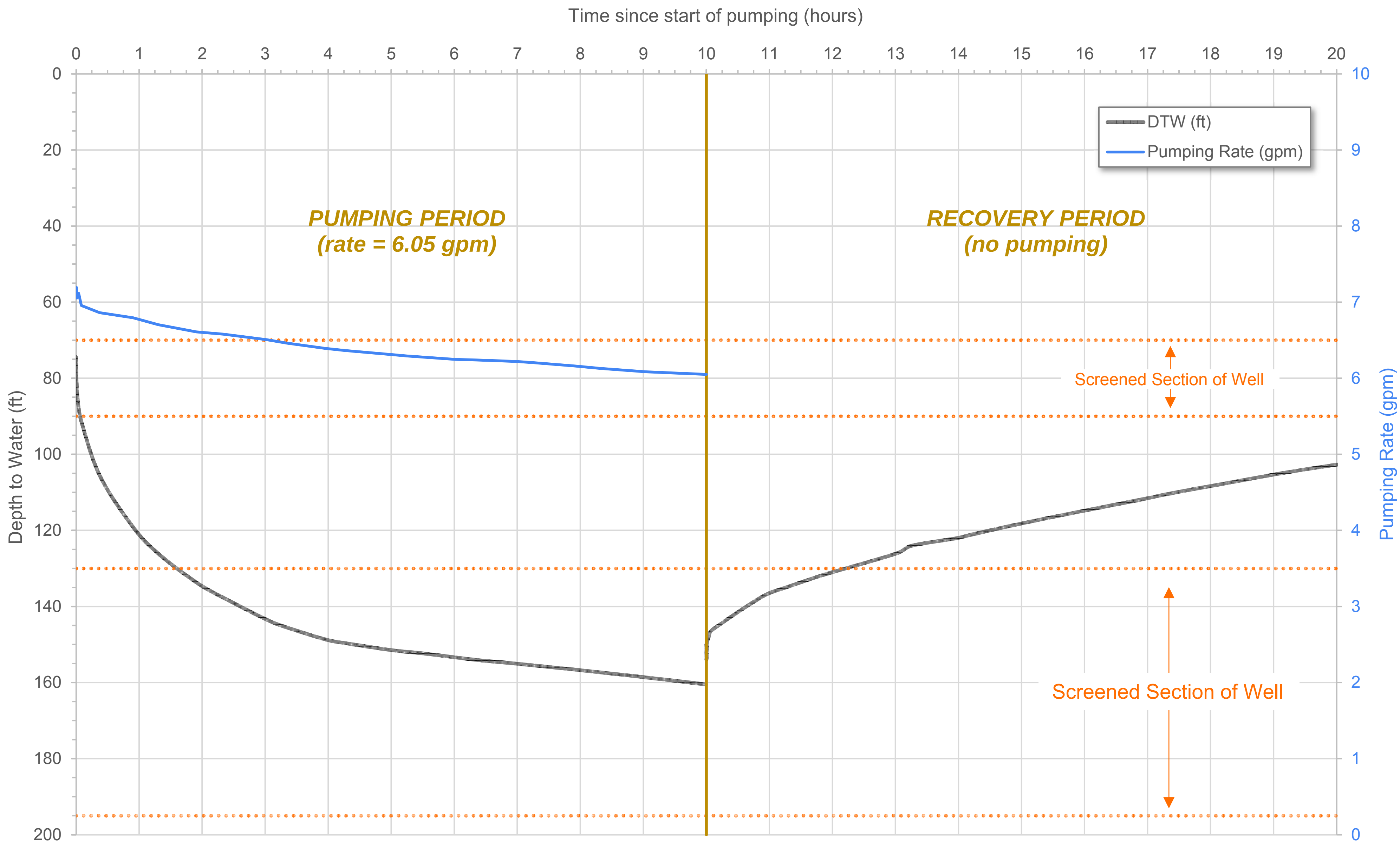
Balance Hydrologics

Figure 8. Drawdown and recovery hydrograph of 10-day source capacity test at Well 20-1 during late dry season 2020, The Mosaic Project, Alameda County, CA. Data source: Hand measurements.
Depth of well = 135 ft; Depth to top of well screens = 95 ft; Static depth to water = 52.92 ft;
Pumping period = 11/20 to 11/30/2020; Pumping rate = 9.35 gpm; Recovery = 88% and 1.82 ft residual drawdown.



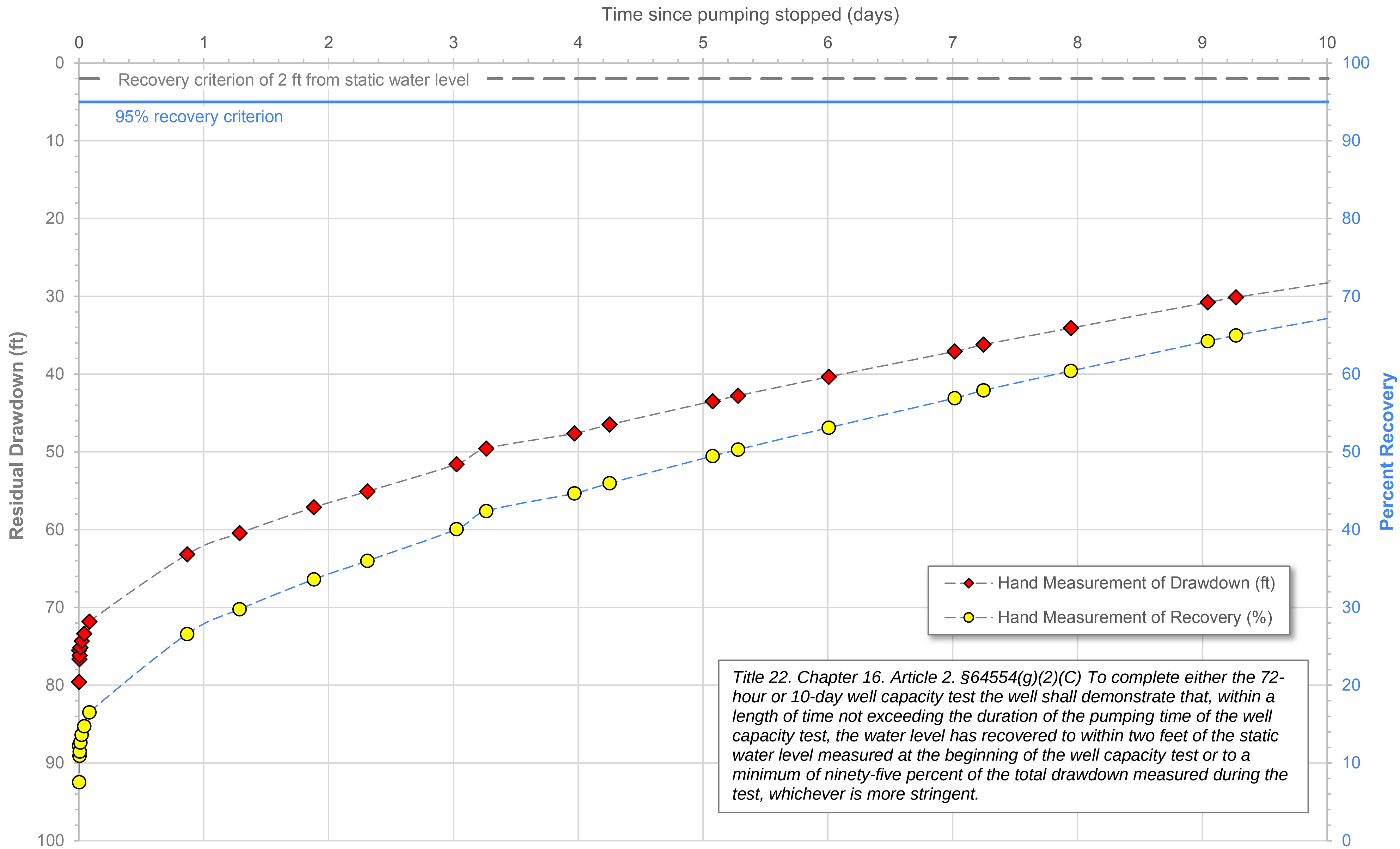
Balance Hydrologics

Figure 9. Water-level recovery in Well 20-1 following 10 days of pumping at 9.35 gpm, The Mosaic Project, Alameda County, CA. Data source: Hand measurements and Diver M50 datalogger 5-minute interval measurements. Depth of well = 135 ft; Depth to top of well screens = 95 ft; Static depth to water = 52.92 ft; Pumping period = 11/20 to 11/30/2020; Pumping rate = 9.35 gpm; Recovery = 88% and 1.82 ft residual drawdown.



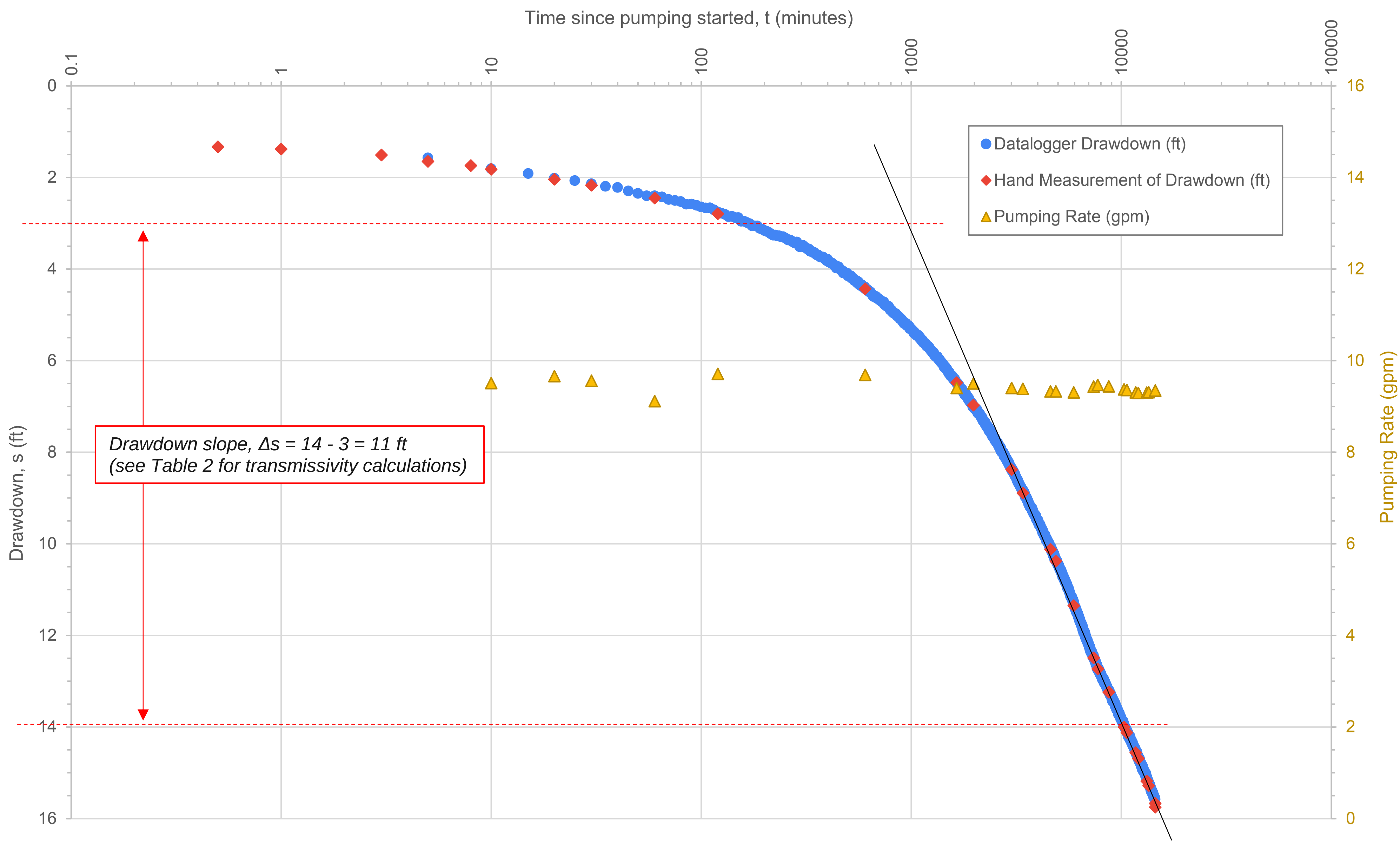
Balance Hydrologics

Figure 10. Drawdown and recovery hydrograph of 10-day source capacity test at Well 17-1 during late dry season 2020, The Mosaic Project, Alameda County, CA Data source: Hand measurements.
Depth of well = 200 ft; Depth to top of well screens = 70 ft and 130 ft; Static depth to water = 74.43 ft;
Pumping period = 11/8 to 11/18/2020; Pumping rate at 6.05 gpm; Recovery = 67% and 28 ft residual drawdown.



Balance Hydrologics

Figure 11. Water-level recovery in Well 17-1 following 10 days of pumping at 6.05 gpm, The Mosaic Project, Alameda County, CA. Data source: Hand measurements.
Depth of well = 200 ft; Depth to top of well screens = 70 ft and 130 ft; Static depth to water = 74.43 ft;
Pumping period = 11/8 to 11/18/2020; Pumping rate at 6.05 gpm; Recovery = 67% and 28 ft residual drawdown.



Balance Hydrologics

Figure 12. Time-drawdown analysis of source capacity test at Well 20-1 during late dry season 2020, The Mosaic Project, Alameda County, CA. Data source: Hand measurements and Diver M50 datalogger 5-minute interval measurements. Depth of well = 135 ft; Depth to top of well screens = 95 ft; Static depth to water = 52.92 ft; Pumping period = 11/20 to 11/30/2020; Pumping rate = 9.35 gpm; Recovery = 88% and 1.82 ft residual drawdown.

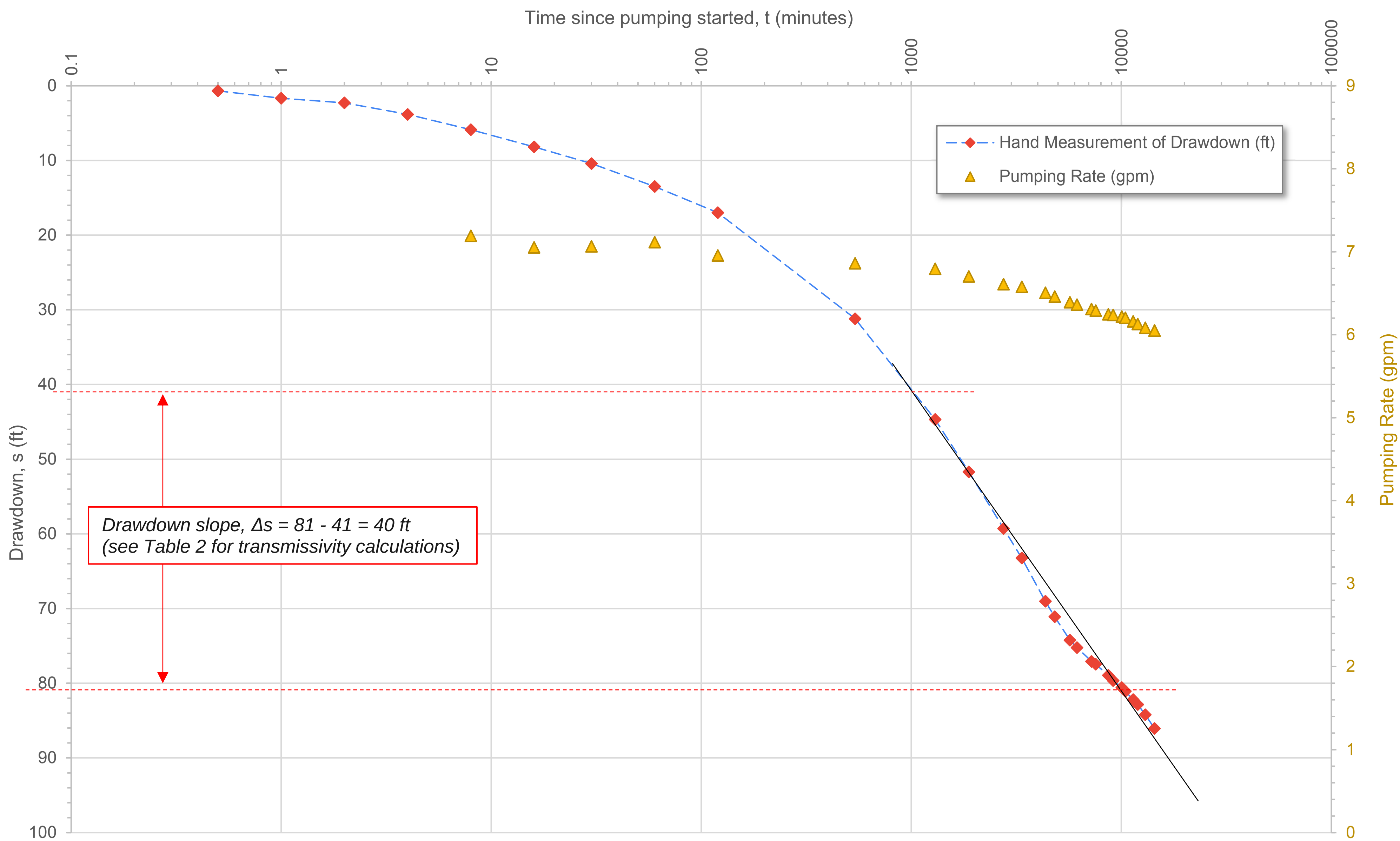
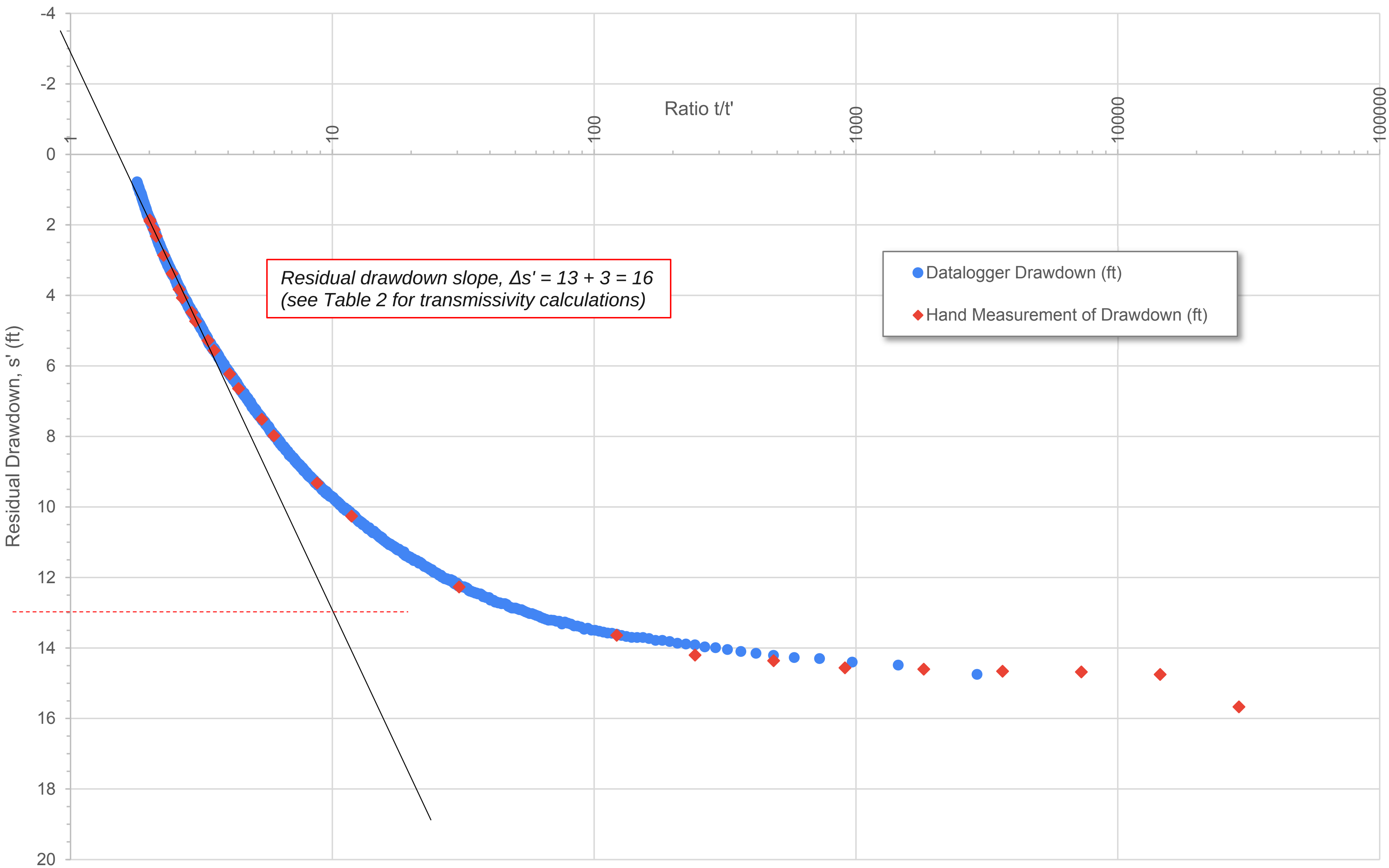
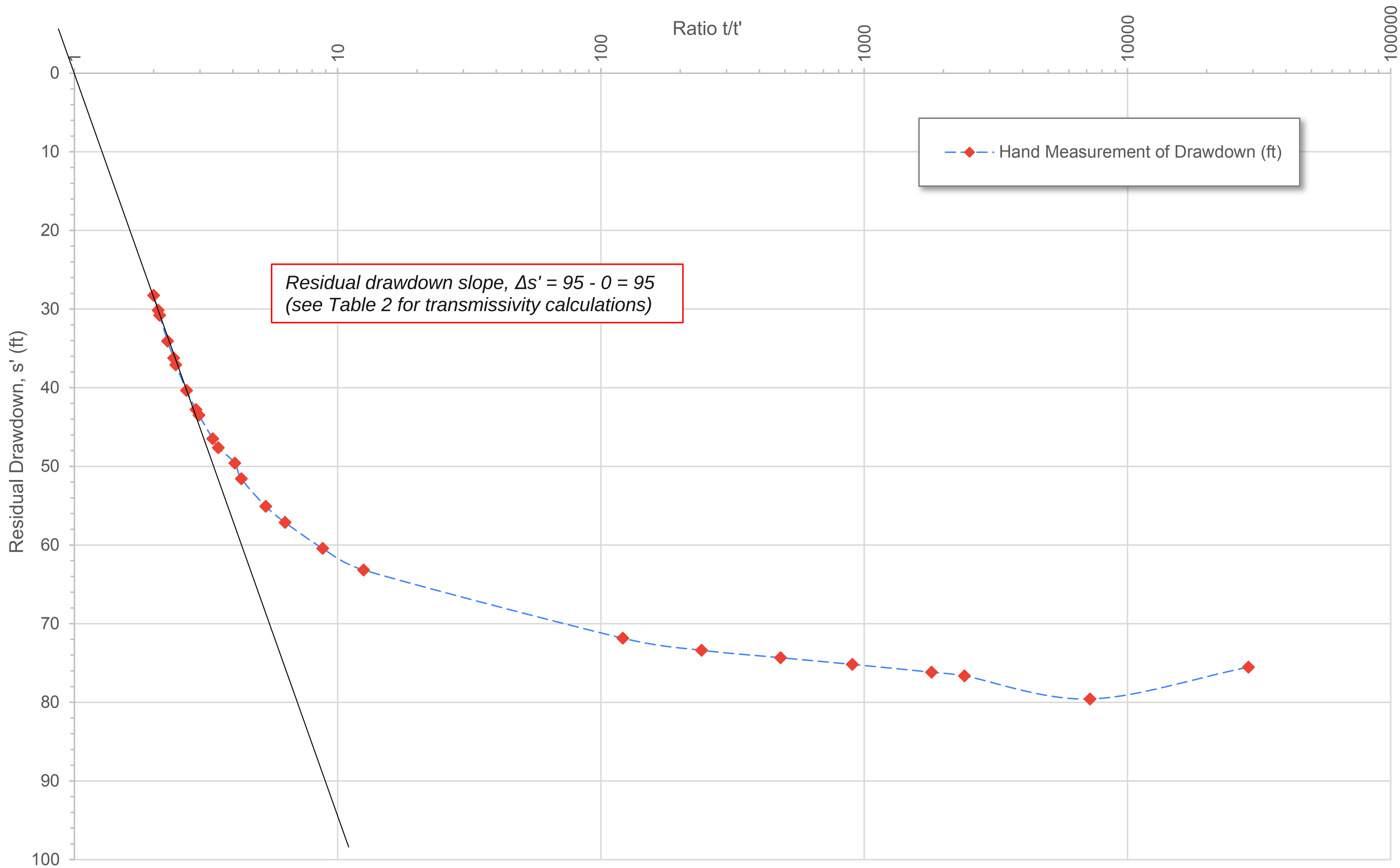


Figure 13. Time-drawdown analysis of source capacity test at Well 17-1 during late dry season 2020, The Mosaic Project, Alameda County, CA. Data source: Hand measurements.
Depth of well = 200 ft; Depth to top of well screens = 70 ft and 130 ft; Static depth to water = 74.43 ft;
Pumping period = 11/8 to 11/18/2020; Pumping rate at 6.05 gpm; Recovery = 67% and 28 ft residual drawdown.



Balance Hydrologics

Figure 14. Residual drawdown analysis, Well 20-1 following 10 days of pumping at 9.35 gpm, The Mosaic Project, Alameda County, CA. Data source: Hand measurements and Diver M50 datalogger 5-minute interval measurements. Depth of well = 135 ft; Depth to top of well screens = 95 ft; Static depth to water = 52.92 ft; Pumping period = 11/20 to 11/30/2020; Pumping rate = 9.35 gpm; Recovery = 88% and 1.82 ft residual drawdown.



Balance Hydrologics

Figure 15. Residual drawdown analysis, Well 17-1 following 10 days of pumping at 6.05 gpm, The Mosaic Project, Alameda County, CA. Data source: Hand measurements.
Depth of well = 200 ft; Depth to top of well screens = 70 ft and 130 ft; Static depth to water = 74.43 ft;
Pumping period = 11/8 to 11/18/2020; Pumping rate at 6.05 gpm; Recovery = 67% and 28 ft residual drawdown.

ATTACHMENT 4

Wells 17-1 & 20-1 20-Year Projection Analysis
By Balance Hydrologics

MEMORANDUM *** CLIENT REVIEW DRAFT ***

To: Brian Lowe, Chief Operating Officer, The Mosaic Project
From: Mark Woyshner and Barry Hecht, CHg50
cc: Lisa Pezzino, P.E., SRT Consultants
Date: January 4, 2022

Subject: Mosaic Project Wells 17-1 and 20-1: Dry Year Analysis

Purpose

The Mosaic Project ("Mosaic") is in the design phase of their proposed group camp project located on a 33.8-acre parcel (APN 85-1200-1-16) at 17015 Cull Canyon Road, Castro Valley, CA (**Figure 1**). The Project site is situated within Cull Creek canyon about three miles north from Interstate 580 in unincorporated Alameda County with no water and sewer connections available to property owners. Mosaic is in the process of establishing a new public water system to supply the camp with potable water. Two new source wells have been installed on the property – Well 20-1 and Well 17-1 – and source capacity tests have been completed at each well during dry-season 2020 in conformance with the California Code of Regulations (CCR §64554). Results of the capacity tests (10-day constant-rate pumping and recovery tests) are presented in the Balance Hydrologics' memo dated April 5, 2021 (Woyshner and others, 2021) which includes a description of the wells and aquifers. Well 20-1 was successfully pumped at 9.35 gallons per minute (gpm), achieving a "CCR capacity" of 4.7 gpm (50% of the 10-day test), and Well 17-1 was successfully pumped at 6.05 gpm, achieving a capacity of 3.0 gpm. Tested during late dry-season of the extreme dry year 2020, Well 20-1 satisfied drawdown recovery standards but Well 17-1 did not.

Senate Bill No. 1263, approved by the Governor and filed with Secretary of State on September 29, 2016, is based on the legislative conclusion that "it is the policy of the state to discourage the establishment of new, unsustainable public water systems when there is a feasible alternative." The intent of SB1263 is to direct the State Water Board to approve new public water systems with "the necessary technical, managerial, or financial capacity to be sustainable in the long term in view of water supply uncertainties." SB1263 added Section 116527 to the Health and Safety Code requiring a preliminary technical report prior to applying for a permit for a proposed new public water system. Based primarily on the findings of the preliminary technical report, the

State Water Board shall issue or deny a new public water system permit and may impose permit conditions. The preliminary technical report shall include "an analysis of whether a proposed new public water system's total projected water supplies available during normal, single dry, or multiple dry water years during a 20-year projection will meet the projected water demand for the service area" per Section 116527(b)(8) of SB1263.

The new public water system proposed for The Mosaic Project is supplied by two new wells drawing groundwater from bedrock aquifers. It is commonly understood in coastal California for bedrock wells to recharge during the wet season and if not fully recharged, they can yield less groundwater during dry years. Thus, after estimating its CCR capacity, the long-term viability of pumping a new well completed in bedrock is best evaluated with use across a cycle of years of major recharge and of drought years – for example, from years of peak recharge, through drought years, and then completing the cycle with a return to a peak recharge. In accordance with this supply condition, Mosaic has a 20-year no-growth projection and as a camp supplied by a transient non-community water system, they can modify their use of the site each year and thus the water demand as they further understand the production limitations of their new water wells.

Balance Hydrologics was asked to assist Mosaic with an analysis of dry-year supply estimates to comply with SB1263. This memo presents the following analyses of groundwater capacity:

a) A basin-wide analysis of gaged baseflow (groundwater discharge) at the U.S. Geological Survey (USGS) streamflow station number 11180960 located 1.67 miles downstream from the Project wells on Cull Creek above Cull Creek Reservoir, near Castro Valley, CA; and

b) Monitored recovery of the two Project wells during extreme dry year 2021 following pumping during dry season 2020.

As set forth below, our analysis concludes that although depleted alluvial storage and soil-moisture capacity is sufficient to support riparian habitat through the dry season, groundwater conditions within the watershed during multiple dry years and an extreme dry year are also likely depleted, which would primarily limit the use of Project Well 17-1. The gaging record shows that groundwater recharge during wet years restores higher baseflows and would thus by analogy, also restore well yields. Project Well 20-1 appears to completely recharge about two acre-feet of pumping during extreme dry year 2021 and thus could be pumped more during normal and wet years. Given that the wells were tested and initially used during the extreme dry year 2020 and their recharge monitored during extreme dry year 2021, an adaptive management pumping monitoring plan would be beneficial to understand the upper use limits of the wells with recharge during normal and wet years.

Hydrogeologic Conditions at the Site

The Project property is situated near the axis of a tightly folded northwest-plunging anticline, and underlain primarily by fractured, consolidated sedimentary rocks comprising vertical to high-angle dipping beds of siltstone and siliceous shale, with Quaternary alluvial terrace deposits along Cull Creek (**Figure 2**; c.f., Graymer, 2000; Graymer and others, 1994; Dibblee and Minch, 2005; Dibblee, 1980; Crane, 1988). Wells 20-1 and 17-2 were drilled into the underlying, confined to semi-confined aquifer system within the folded bedrock and designed to draw groundwater from the bedrock fractures. A bulk transmissivity of 190 gpd/ft and a hydraulic conductivity of 2.3 gpd/ft^2 (or 1.1 x 10^{-4} cm/s) was calculated for the fractured aquifer supplying Well 20-1, and at Well 17-1, bulk transmissivity was 28 gpd/ft and hydraulic conductivity was 1.1 gpd/ft^2 (or 5.2 x 10^{-5} cm/s) (Woyshner and others, 2020).

Major ion activity measured in water samples collected from the two wells indicated that the wells draw groundwater from separate fractured bedrock aquifers, which is consistent with the interpreted geologic framework of the aquifers. Drawdown interference was not detected in the water-level monitoring records during several 10-day pumping tests conducted during dry-season 2020. Several independent lines of reasoning – including the drawdown test results and evidence of confined aquifer conditions – also indicated that neither well draws on groundwater under the direct influence of surface water, particularly Well 17-1. Groundwater sampled from Well 20-1 was similar in ionic composition to baseflow sampled in Cull Creek, suggesting a common groundwater source. Well 20-1, in addition, showed a slight artesian pressure. For further details of the wells and aquifers at the site, refer to Woyshner and others, 2021.

Analysis of Baseflow Gaging in Cull Creek

The USGS has gaged streamflow on Cull Creek since October 1978 to the current year. The gaging station is located at latitude 37° 43' 04" N longitude 122° 03' 12" W (NAD27) on left bank, 0.9 mi upstream from Cull Creek Dam, and 1.67 miles downstream from the Mosaic Project wells (**Figure 2**). In the gage background data, no storage or diversions are listed by USGS upstream from this station, although we suspect that a number of smaller irrigators, equestrian and domestic uses are met from the stream or connected shallower aquifers. The maximum discharge for the period of record is 1,690 cubic feet per second (cfs) on Jan. 5, 1982, with a gage height of 8.71 feet. No flow is reported for many days each year.

Table 1 summarizes the monthly mean flow for the 43-year period of record. The driest month is generally September when zero monthly mean flow was recorded 74 percent of the years. Even some very wet years have recorded zero mean flow in September (such as 2017 and 1993), reflecting dry antecedent conditions and depleted groundwater storage during multi-year droughts. Though the gaging station is at a bedrock constriction in the canyon, it is situated at the downstream end of an alluvial reach (**Figure 2**), where depleted alluvial storage and consumptive use by riparian vegetation contribute to no flow conditions at the gage. Given these station conditions, the gaged groundwater contributions to baseflow would be somewhat less than that represented at bedrock reaches such as at the Mosaic Project site, and therefore considered a conservative estimate for conditions at the Project site.

The driest year of the gaged record was water year 2021, followed by 1990. The four driest consecutive years of record were 1988 through 1991. Baseflow recession into the dry season during these years are plotted in **Figure 3**. The daily mean baseflow during the 2021 extreme dry year was less than 0.01 cfs (4.5 gpm) starting at the end of March, flow during April averaged less than half a gallon per minute, then no flow was measured starting in May and continued through the dry season. Cull Creek was also noted to be dry at the Mosaic Project site roughly during this time, but observations were not recorded. The 50th percentile (median) baseflow receded below 0.01 cfs by the end of July, and muti-dry years 1988 through 1992 receded to a level within the 5^{th} to 25^{th} percentiles and had no flow from the end of June through October. During very wet year 1998, gaged groundwater contributions to baseflow persisted through the entire dry season but not during very wet year 2017 (as discussed above). These gaging data suggest that although alluvial storage and soil-moisture capacity is sufficient to support riparian habitat, groundwater contributions to Cull Creek flow appear depleted within the watershed during multiple dry years and an extreme dry year, manifesting in lower water levels in wells.

The gaging data shows that baseflows recover to higher flow rates following additional recharge to groundwater during wet years, as seen in **Figure 4** which compares the specific baseflow with annual rainfall. Specific baseflow is the total flow from June through September divided by the annual rainfall, which characterizes the antecedent conditions and year-to-year carryover. For example, following a series of wet years, water year 1999 had considerably more baseflow than during water year 2016, a year with similar near normal annual rainfall, but following a series of dry years (these data are also summarized in **Table 1**). Prolonged higher baseflows rates during wet years implies more recharge to groundwater and potentially higher well yields.

Observed Recharge during Extreme Dry Year 2021

During the late dry-season of 2020, Wells 20-1 and 17-1 were pumped for various purposes including to test the yields and to collect samples for water quality analyses. Test-pumping during dry-season 2020 concluded with a 10-day pumping test at each well. In total, approximately 1.4 acre-feet was pumped from Well 20-1 and 0.9 acre-feet from Well 17-1 (**Table 2**). The static groundwater level prior to the final 10-day pumping test was lower than the initial (before testing) static level, indicating more extraction than recovery during the dry season. After the final 10-day test was completed, the water level in the wells was monitored through the following wet season.

Water year 2021 was an extreme dry year with about 11 inches of cumulative rainfall by April 1, 2021 based on rainfall recorded at two regional rain gages.[1] After pumping a total of 1.4 acre-feet from Well 20-1, groundwater at the well recovered to its initial static level with 6.5 inches of cumulative rain by the end of January, then recharged an additional 4.2 feet with the wet-season total of 11 inches of rain (**Table 2 and Figure 5**). Thus, rainfall during extreme dry year 2021 could have completely recharged additional pumping from Well 20-1 (perhaps 50 to 100 percent more pumping based on the observed recovery). Well 17-1, however, did not recover to its initial static level after pumping a total of 0.93 acre-feet from the well (**Table 2 and Figure 5**). It is possible that a similar pumping capacity test if conducted during a wet year would recover to CCR standards.

Conclusions

To comply with SB 1263, "an analysis of whether a proposed new public water system's total projected water supplies available during normal, single dry, or multiple dry water years during a 20-year projection will meet the projected water demand for the service area." Mosaic has a 20-year no-growth projection and can modify its use of the site and thus its water demand.

Our basin-wide analysis of gaged groundwater contribution at the USGS station on Cull Creek located 1.67 miles downstream from the Project, suggests that although depleted alluvial storage and soil-moisture capacity is sufficient to support riparian habitat through the dry season, groundwater conditions within the watershed during multiple dry years and an extreme dry year are also depleted, which would likely manifest in lower water levels in wells. Long-term

[1] Average of rainfall measured at two RAWS stations: South Oakland station and Las Trampas station.

groundwater monitoring data are not available to confirm this interpretation of the stream gaging data. However, observed recharge at Project wells 20-1 and 17-1 during extreme dry year 2021 indicated that, rainfall completely recharged the 1.4 acre-feet pumped from Well 20-1 prior to the wet season, and suggests additional pumping (perhaps 50 to 100 percent more pumping) would have also been recharged during this extreme dry year. Well 17-1, however, did not completely recover and thus would likely provide limited source water production for Project use during an extreme dry year and consecutive dry years. Given that the wells were tested during the extreme dry year 2020 and their recharge monitored during extreme dry year 2021, an adaptive management pumping monitoring program would be beneficial to understand the upper use limits of the wells with recharge during normal and wet years.

Limitations

This memorandum was prepared for The Mosaic Project as an assessment of groundwater conditions for planning and permitting purposes of their Wells 20-1 and 17-1 proposed a water supply source for a proposed public water system. Mosaic is the only intended beneficiary and owner of this document. No other party should communicate the information presented herein without the consent of Mosaic. Considering the intrinsic variability of geologic materials, particularly in this setting, if additional information or detail is required or alternative uses or applications envisioned, then consultation should commence with Balance Hydrologics for site-specific exploration and interpretations. The findings, recommendations, specifications, and professional opinions are presented within the limits of the proposed work for the client in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.

References Cited

Crane, R.C., and Cassa, R.C., 1988, Northern California Geological Society field trip guide to the geology of the San Ramon valley and environs

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Hayward quadrangle, Contra Costa and Alameda Counties, California: Dibblee Foundation Map DF-163, scale 1:24,000

Dibblee, T.W., 1980, Preliminary geologic map of the Hayward quadrangle, Alameda and Contra Costa Counties, California: U.S. Geological Survey, Open-File Report OF-80-540, scale 1:24,000.

Graymer, R.W., 2000, Geologic map and map database of the Oakland metropolitan area, Alameda, Contra Costa, and San Francisco Counties, California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-2342, scale 1:50,000.

Graymer, R. W., Jones, D.L. and Brabb E.E., 1994, Preliminary geologic map emphasizing bedrock formations in Contra Costa County, California: A digital database, U.S. Geological Survey Open-file Report 94-622.

Sa'ad, A.D., and Nahn, C.E., 1989, Santa Clara Valley Water District mean annual precipitation map for Santa Clara and adjacent counties: Hydrology Open File Report, 7 p. + map at 1:125,000.

Woyshner, M., Hecht, B., and Porras G., 2021, Mosaic Project Wells 17-1 and 20-1: Source capacity test results: A Balance Hydrologics technical memorandum to Brian Lowe, Chief Operating Officer of The Mosaic Project, April 5, 2021, 9 pp. + tables and figures

Enclosures

Table 1. Monthly mean flow in Cull Creek above Cull Creek Reservoir
Table 2. Dry-season 2020 pumping at The Mosaic Project site
Figure 1. Tentative site plan
Figure 2. Location of USGS gaging station on Cull Creek above Cull Creek Reservoir
Figure 3. Baseflow recession at the USGS gage on Cull Creek above Cull Creek Reservoir
Figure 4. Dry-season specific baseflow compared to annual rainfall
Figure 5. Recharge and recovery at Wells 20-1 and 17-1

Table 1. Monthly mean flow in Cull Creek above Cull Creek Reservoir, near Castro Valley, Alameda County, CA.

The driest year of record was WY2021 (highlighted yellow), followed by 1990. The driest consecutive years of record was 1988 through 1991 (highlighted yellow). Specific baseflow (the total flow from June through September divided by the annual rainfall) characterizes the antecedent conditions and carryover. For example, following a series of wet years, WY1999 had notably more baseflow than WY2016, a year with similar annual rainfall (near normal) but following a series of dry years (highlighted green).

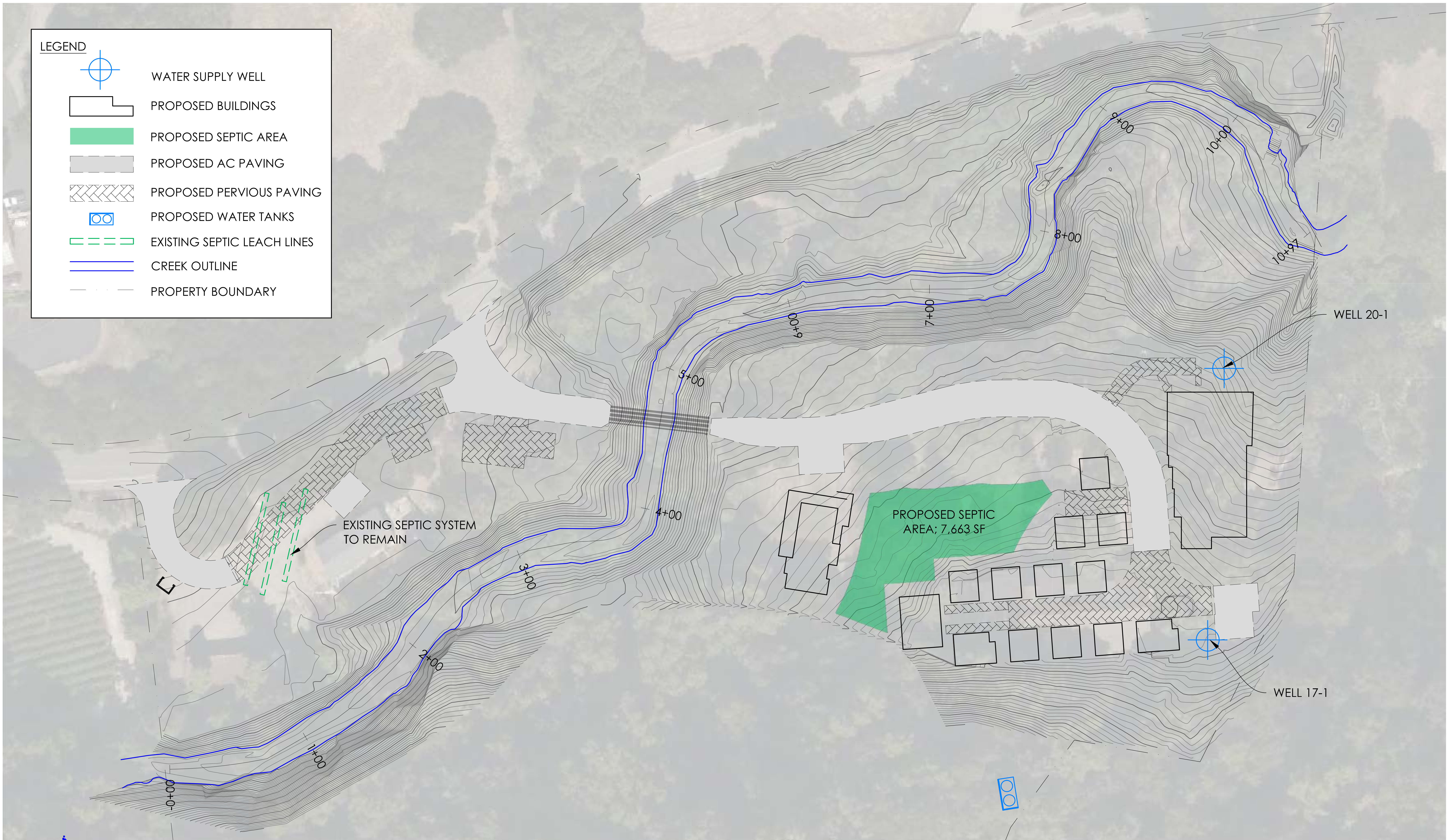
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Mean Flow [1]			4-yr Mean Annual [1]		Total Baseflow [1] (June through Sept)			Annual Rainfall [2] (Average of Oakland S and Las Trampas)			Specific Baseflow
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(% of normal)	(rank, dry to wet)	(cfs)	(rank, dry to wet)	(cfs)	(% of mean)	(rank, dry to wet)	(inches)	(% of mean)	(rank, dry to wet)	(cfs/inch of rain)
1979	0	0.043	0.155	5.83	14	7.12	2.77	0.921	0.265	0.116	0	0	2.53	88%	25	--	--	11.62	107%	28	--	--	--	--
1980	0.118	0.513	2.97	17.6	23.4	9.51	2.23	0.73	0.298	0.16	0.006	0	4.74	165%	36	--	--	14.14	130%	26	--	--	--	--
1981	0.028	0.018	0.252	1.81	0.835	3.88	0.795	0.277	0.028	0	0	0	0.665	23%	12	--	--	0.95	9%	15	--	--	--	--
1982	0.001	1.66	9.99	35.5	39.7	19	16.8	1.8	0.734	0.246	0.038	0.002	10.3	359%	42	4.56	33	30.91	285%	37	--	--	--	--
1983	0.45	5.09	8.55	14.7	29.2	54.3	7.93	3.56	0.948	0.187	0.123	0.079	10.3	359%	43	6.50	40	40.42	372%	43	--	--	--	--
1984	0.093	6	14	4.68	4.76	3.44	1.34	0.59	0.222	0.036	0.001	0	2.93	102%	26	6.05	38	7.86	72%	24	--	--	--	--
1985	0.05	1.84	1.73	0.806	4.75	2.95	1.11	0.298	0.051	0.006	0	0	1.11	39%	17	6.16	39	1.80	17%	16	--	--	--	--
1986	0.001	0.052	0.233	1.73	39.2	14.2	2.42	0.972	0.321	0.042	0.004	0.004	4.7	164%	35	4.76	34	11.20	103%	30	--	--	--	--
1987	0.001	0	0.064	0.383	3.37	1.34	0.446	0.138	0.019	0	0	0	0.461	16%	8	2.30	18	0.67	6%	8	--	--	--	--
1988	0	0.005	0.121	1.23	0.328	0.132	0.096	0.016	0.007	0	0	0	0.162	5.6%	5	1.61	11	0.31	2.8%	3	--	--	--	--
1989	0	0.009	0.123	0.216	0.344	2.57	0.652	0.212	0.012	0	0	0	0.346	12%	6	1.42	8	0.45	4%	12	--	--	--	--
1990	0.009	0.007	0.001	0.047	0.316	0.148	0.055	0.074	0.015	0	0	0	0.054	1.9%	2	0.26	2	0.54	5%	7	--	--	--	--
1991	0	0	0.012	0	0.045	3.1	0.912	0.267	0.013	0.001	0	0	0.366	13%	7	0.23	1	0.52	5%	14	--	--	--	--
1992	0.103	0	0.017	0.071	4.53	3.14	0.688	0.137	0.025	0.002	0	0	0.711	25%	13	0.37	3	0.91	8%	9	--	--	--	--
1993	0.002	0	2.01	31.6	10.2	6.72	2.8	0.698	0.222	0.019	0	0	4.52	157%	34	1.41	7	7.34	68%	25	--	--	--	--
1994	0.009	0.017	0.304	0.225	4.12	0.741	0.446	0.297	0.052	0.012	0	0	0.493	17%	9	1.52	10	2.00	18%	17	--	--	--	--
1995	0	0.202	0.212	17.7	4.29	26	7.01	2.13	0.772	0.243	0.031	0.001	4.91	171%	37	2.66	22	31.69	292%	40	37.81	147%	26	0.84
1996	0	0	1.06	10.6	22.7	13.3	2.96	1.16	0.409	0.036	0	0	4.29	149%	33	3.55	27	13.46	124%	31	30.19	118%	19	0.45
1997	0	0.568	13.9	43.7	4.68	1.46	0.839	0.37	0.106	0.023	0.008	0	5.53	193%	38	3.81	29	4.19	39%	21	32.76	128%	22	0.13
1998	0.001	0.159	1.18	26	58.9	12	8.37	2.67	1.27	0.495	0.133	0.05	8.93	311%	40	5.92	37	59.19	545%	42	44.91	175%	27	1.32
1999	0.067	0.456	0.392	3.37	26.3	10.8	4.01	1.17	0.502	0.161	0.075	0.028	3.79	132%	30	5.64	36	23.21	214%	33	26.18	102%	16	0.89
2000	0.005	0.111	0.12	4.23	23	9.89	1.94	0.943	0.296	0.081	0.008	0.001	3.31	115%	28	5.39	35	11.70	108%	29	27.23	106%	17	0.43
2001	0.029	0.035	0.099	0.236	3.84	2.55	0.812	0.187	0.007	0	0	0	0.628	22%	11	4.16	31	0.32	3%	11	18.39	72%	6	0.02
2002	0.005	0.264	9.73	5.11	2.95	4.89	1.41	0.566	0.166	0.047	0.01	0	2.11	74%	22	2.46	19	6.82	63%	23	22.96	90%	11	0.30
2003	0	0.968	12.3	3.73	1.54	1.04	2.76	2.51	0.324	0.028	0.005	0	2.11	74%	23	2.04	16	10.81	100%	38	24.45	95%	12	0.44
2004	0	0	0.785	4.91	15.7	3.41	0.888	0.318	0.05	0	0	0	2.12	74%	24	1.74	13	1.60	15%	18	21.06	82%	9	0.08
2005	0.055	0.112	2.3	9.19	6.86	15.9	5.99	1.99	0.674	0.195	0.034	0.002	3.6	125%	29	2.49	20	27.40	252%	39	37.54	146%	25	0.73
2006	0	0.043	15.3	13.1	6.9	30	23.6	2.85	0.877	0.177	0.034	0.015	7.77	271%	39	3.90	30	33.32	307%	41	36.07	141%	24	0.92
2007	0.02	0.062	0.396	0.201	3.67	1.61	0.534	0.182	0.047	0.007	0	0	0.539	19%	10	3.51	25	1.71	16%	13	13.39	52%	2	0.13
2008	0.004	0.012	0.254	6.3	8.08	1.47	0.568	0.165	0.025	0	0	0	1.38	48%	19	3.32	23	0.84	8%	10	15.46	60%	4	0.05
2009	0	0.005	0.133	0.094	3.37	4.75	0.575	0.395	0.055	0.004	0	0	0.767	27%	14	2.61	21	1.85	17%	19	21.62	84%	10	0.09
2010	0.326	0.033	0.523	7.09	4.03	5.32	5.01	1.43	0.505	0.111	0.005	0	2.02	70%	21	1.18	5	18.79	173%	34	28.03	109%	18	0.67
2011	0.001	0.127	7.92	2.98	7.71	20.5	4.75	1.38	0.851	0.241	0.055	0.016	3.88	135%	32	2.01	15	35.21	324%	36	32.37	126%	21	1.09
2012	0.012	0.047	0.042	0.516	0.126	5.6	7.53	0.94	0.242	0.062	0.003	0	1.26	44%	18	1.98	14	9.30	86%	27	25.50	99%	14	0.36
2013	0	1.09	13.6	2.69	1.24	0.502	0.284	0.051	0.003	0	0	0	1.64	57%	20	2.20	17	0.20	1.8%	5	24.75	97%	13	0.01
2014	0	0	0	0	0.523	0.45	0.635	0.045	0	0	0	0	0.134	4.7%	4	1.73	12	0.12	1.1%	4	16.35	64%	5	0.01
2015	0	0.003	7.18	0.653	1.97	0.38	0.23	0.051	0.005	0	0	0	0.872	30%	16	0.98	4	0.27	2.5%	6	19.23	75%	7	0.01
2016	0	0	1.63	11	1.83	21.4	1.8	0.518	0.114	0.005	0	0	3.23	113%	27	1.47	9	3.66	34%	22	26.11	102%	15	0.14
2017	0.169	0.07	4.57	38.7	55.9	9.33	5.26	1.26	0.404	0.1	0.018	0	9.36	326%	41	3.40	24	15.82	146%	32	34.49	135%	23	0.46
2018	0	0.101	0.048	0.624	0.186	3.07	4.96	0.391	0.09	0.008	0	0	0.789	27%	15	3.56	28	3.02	28%	20	20.33	79%	8	0.15
2019	0	0.064	0.156	6.32	23.7	11.7	3.32	1.54	0.512	0.135	0.018	0.003	3.83	133%	31	4.30	32	20.23	186%	35	30.48	119%	20	0.66
2020	0	0.015	0.164	0.184	0.108	0.173	0.244	0.019	0	0	0	0	0.076	2.6%	3	3.51	26	0.12	1.1%	2	13.41	52%	3	0.01
2021	0	0	0.001	0.092	0.049	0.059	0.001	0	0	0	0	0	0.017	0.6%	1	1.18	6	0.12	1.1%	1	11.30	44%	1	0.01
Mean	0.036	0.46	3.13	7.81	10.9	8.14	3.2	0.84	0.27	0.07	0.014	0.005	2.87	--	--	2.95	--	10.85	--	--	25.64	--	--	0.38
Years	19	9	1	2	0	0	0	1	3	12	24	32	--	--	--	--	--	--	--	--	--	--	--	--
w/o Flow	44%	21%	2.3%	4.7%	0%	0%	0%	2.3%	7.0%	28%	56%	74%	--	--	--	--	--	--	--	--	--	--	--	--

Data source: [1] USGS gaging station 11180960; Lat 37°43'04", Long 122°03'12" NAD27; drainage area 5.79 square miles; gage datum 450 feet above NGVD29.
[2] Western Regional Climate Center, Remote Automatic Weather Stations (RAWS), Oakland South station and Las Trampas station rainfall daily totals.

Table 2. Dry-season 2020 pumping at Mosaic Project site, Alameda County, CA

After pumping a total of 1.43 acre-feet from Well 20-1, groundwater at the well recovered to its initial static level then recharged an additional 4.2 feet with the wet-season total of 11 inches of rain. Thus rainfall during extreme dry year 2021 could have completely recharged additional pumping from Well 20-1. Well 17-1, however, did not recover to its initial static level after pumping a total of 0.93 acre-feet from the well.

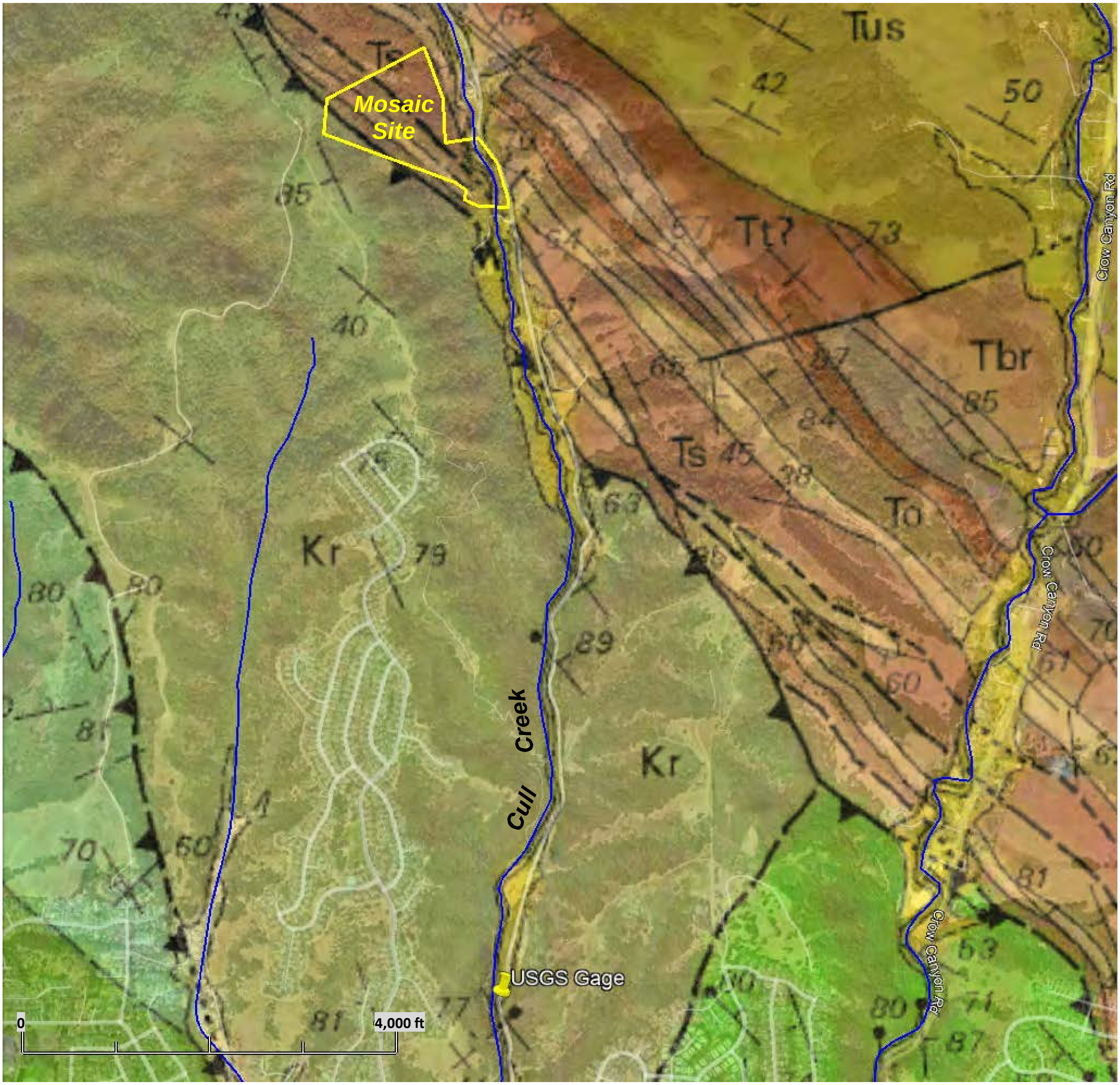
Well No.	Start of Dry Season Pumping (date)	Initial Static Depth to Water (ft)	End of Dry Season Pumping (date)	Volume of Water Extracted (ac-ft)	Cumulative Rain on April 1, 2021 (inches)	Static Depth to Water on April 1, 2021 (ft)	Change from Initial Static Level (ft)
Well 20-1	9/1/2020	45.0	11/28/2020	1.43	11	40.8	4.2
Well 17-1	9/20/2020	33.1	12/10/2020	0.93	11	62.2	-29.1



Balance Hydrologics, Inc.

Figure 1. TENTATIVE SITE PLAN, THE MOSAIC PROJECT, ALAMEDA COUNTY, CA.

NOTE: DATA PROVIDED BY NORTHSTAR ENG. ON MARCH 24, 2021.
SURVEYOR: GREENWOOD & MOORE, INC. DATA NOT GEOREFERENCED



Lithology Legend

Qpaf Alluvial fan and fluvial deposits (Pleistocene)

Tus Unnamed sedimentary and volcanic rocks (late Miocene)

Tbr Briones Sandstone (late and middle Miocene)—Sandstone, siltstone, conglomerate, and shell breccia.

Tt Tice Shale (middle Miocene)—Brown siliceous shale.

To Oursan Sandstone (middle Miocene)—Greenish-gray, medium-grained sandstone with calcareous concretions.

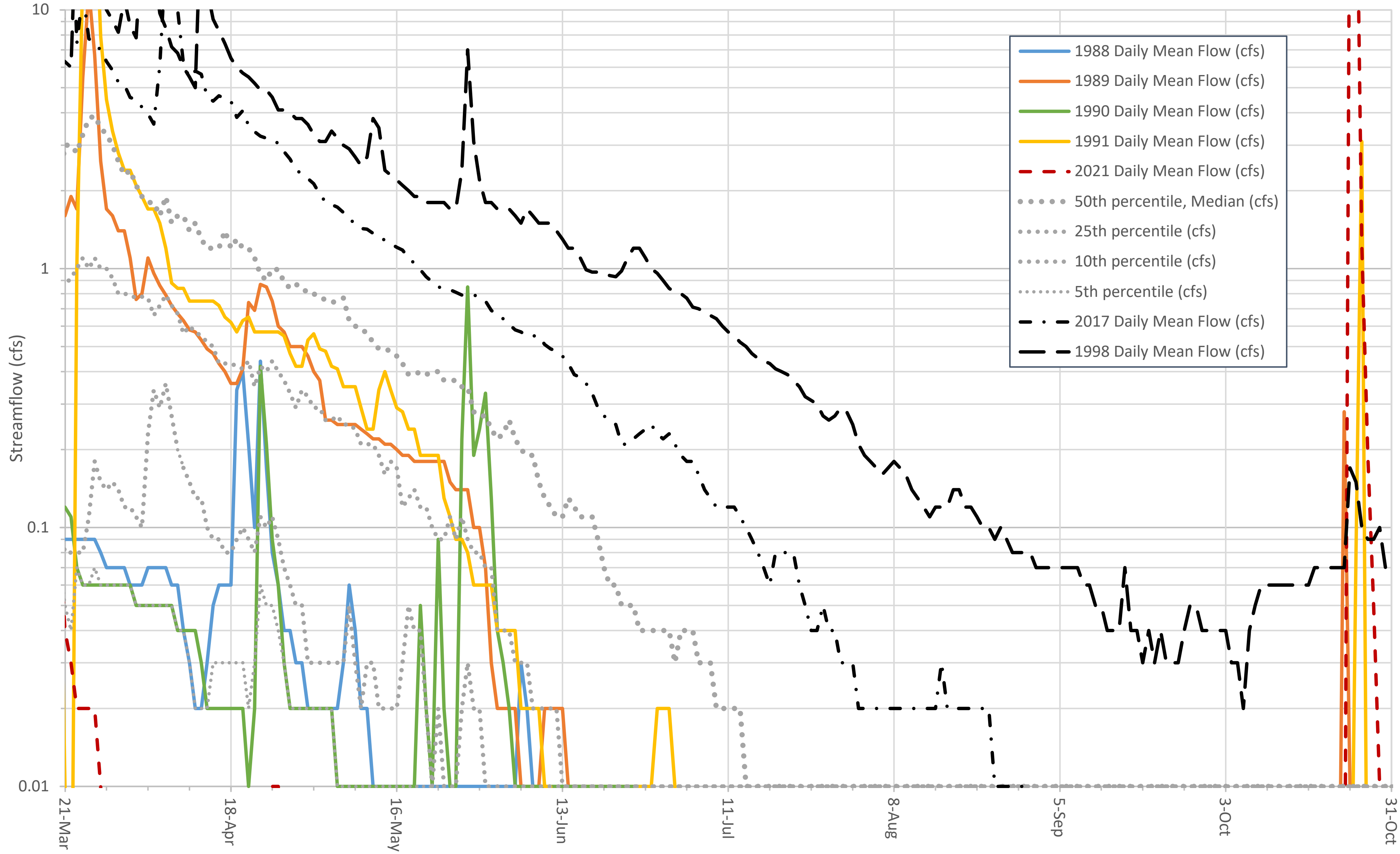
Tcs Claremont Shale (middle Miocene)—Brown siliceous shale with yellow carbonate concretions and minor interbedded chert.

Ts Sobrante Sandstone (middle Miocene)—Massive white, medium-grained calcareous sandstone.

Kr Redwood Canyon Formation (Late Cretaceous, Campanian) — Cross-bedded to massive, biotite- and quartz-rich wacke and thin interbeds of mica-rich siltstone.

Balance Hydrologics

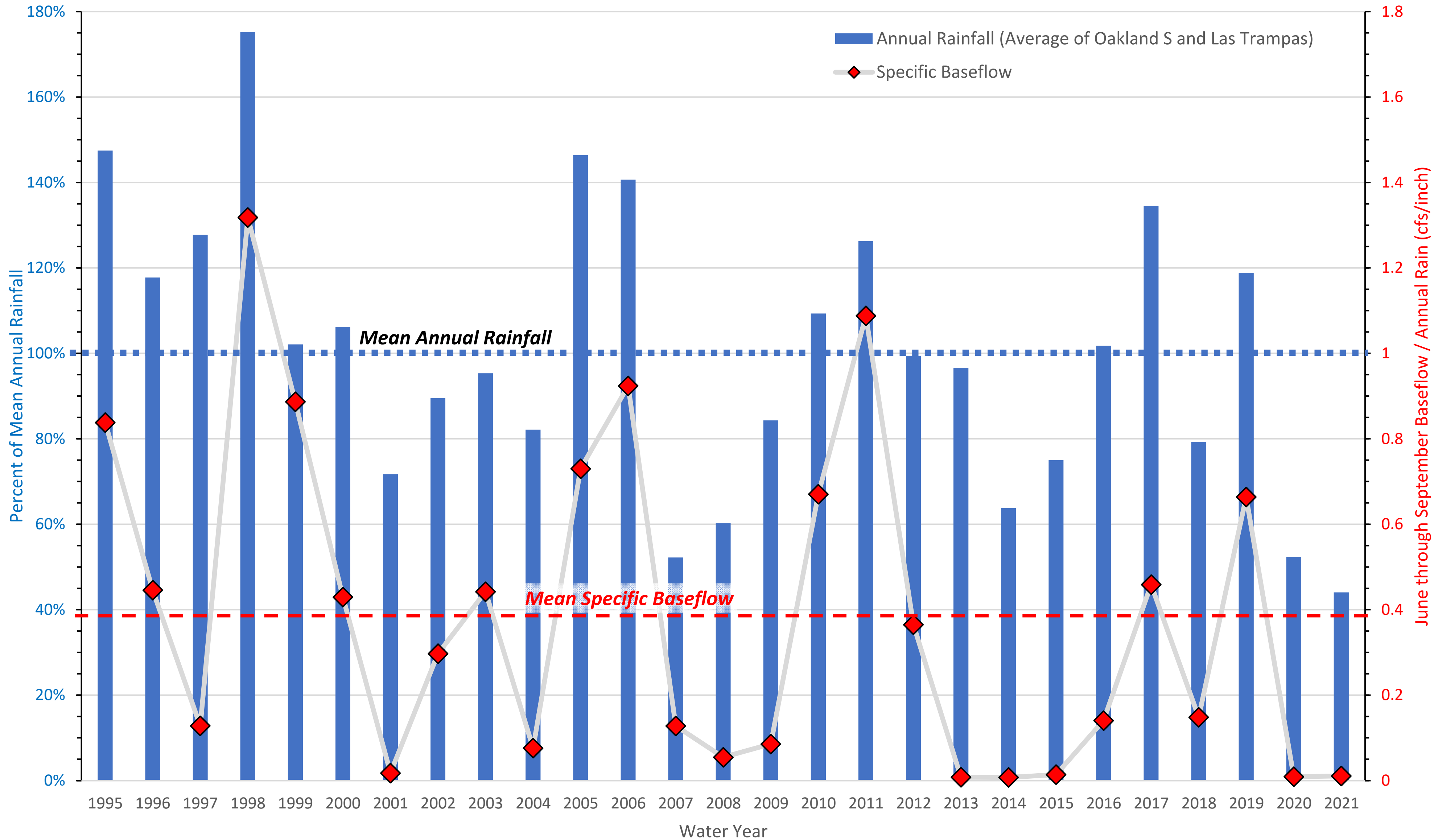
Figure 2. Location of USGS gaging station on Cull Creek above Cull Creek Reservoir, near Castro Valley, Alameda County, CA.
Geology base: Graymer, R.W., 2000, U.S. Geological Survey Miscellaneous Field Studies MF–2342, scale 1:50,000.



Balance Hydrologics

Figure 3. Baseflow recession at the USGS gage on Cull Creek above Cull Creek Reservoir, near Castro Valley, Alameda County, CA. Baseflow during the 2021 extreme dry year was less than 0.01 cfs (4.5 gpm) starting at the end of March and no flow starting in May. The stream was also dry at the Mosaic Project site. The 50th percentile (median) baseflow receded below 0.01 cfs by the end of July, and muti-dry years 1988 through 1992 receded to a level within the 5th and 25th percentiles and had no flow July through October. During very wet years 2017 and 1998 flow persisted through the dry season suggesting groundwater effluent contributions to baseflow at the gaging station. About 25% of years had flow through the dry season.

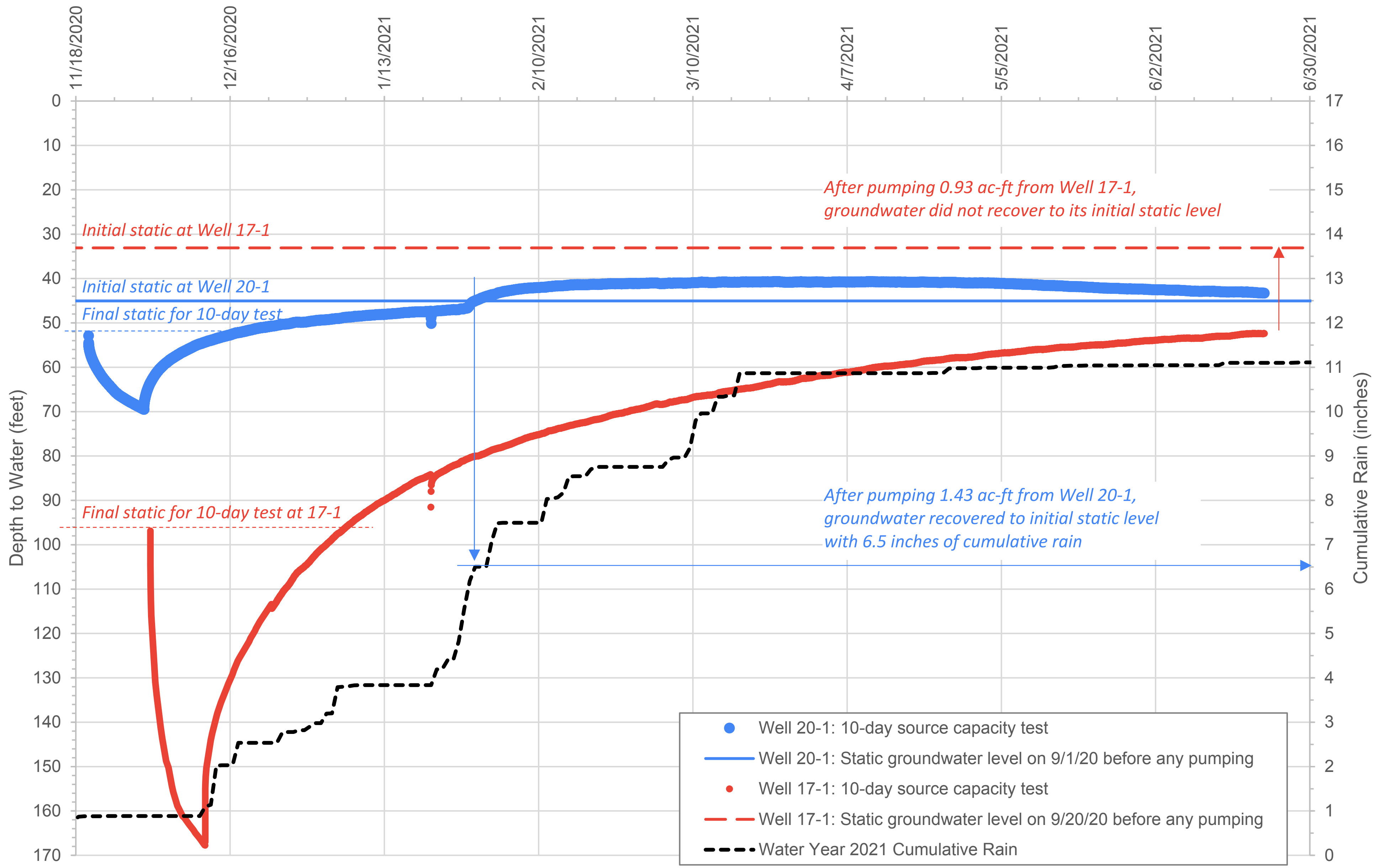
220172 cull cr flow record.xlsx, Cull Cr recession chart



Balance Hydrologics

Figure 4. Dry-season specific baseflow compared to annual rainfall, Cull Creek watershed, Alameda County, CA. Baseflow is higher following additional recharge to groundwater during wet years. Data sources: Western Regional Climate Center, Remote Automatic Weather Stations (RAWS), Oakland South station and Las Trampas station rainfall daily totals. USGS gaging station on Cull Creek above Cull Creek Reservoir, near Castro Valley, station number 11180960.

220172 cull cr flow record.xlsx, baseflow vs rainfall

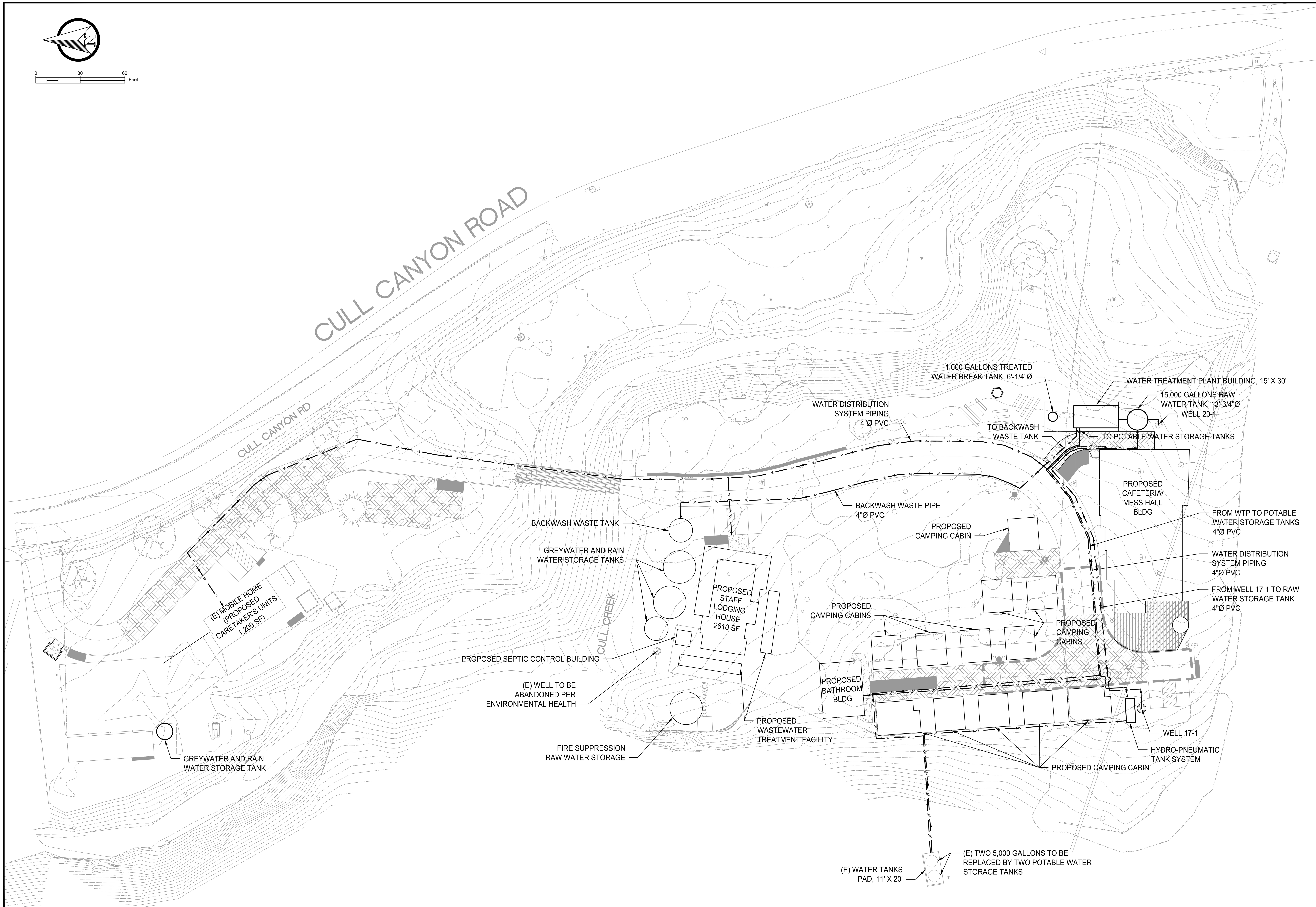


Balance Hydrologics

Figure 5. Recharge and recovery at Wells 20-1 and 17-1, Mosaic Project, Alameda County, CA. Pumping groundwater from each well started in September 2020. The final static groundwater level for each 10-day pumping test was lower than the initial static level, indicating more extraction than recovery during the dry season. Subsequent rainfall during extreme dry year 2021 was sufficient to recharge total pumping at Well 20-1 but not at Well 17-1.

ATTACHMENT 5

Mosaic Water System Site Plan



SYM.	DESCRIPTION	DATE	APPROVED
--	--	--	

REVISIONS

NOT FOR CONSTRUCTION

S R T consultants
90 New Montgomery Street, Suite 905
San Francisco, CA 94105
Ph 415.776.5800
Fx 415.776.5200

THE MOSAIC PROJECT
17015 Cull Canyon Road
Castro Valley, California 94552

MOSAIC NEW WATER SUPPLY AND TREATMENT SYSTEM

WATER SYSTEM SITE PLAN

DATE	NOV 2021
SCALE	AS SHOWN
DESIGN	LEM/LP
DRAWN	NM
CHECK	T. YUROVSKY
SHEET	01 of 03

C-01

DRAWING NAME: \\fileserver\srt\01_PROJECTS\Mosaic\02_TASKS\CAD\Design Package\SitePlan_Rev0.dwg
PLOT DATE: Jan 26, 2022 – 4:26pm PLOTTED BY: Christine

ATTACHMENT 6

Wells 17-1 & 20-1 Completion Reports

Figure 4. Driller's well completion report for Well 20-1, The Mosaic Project, Alameda County, CA.

State of California

Well Completion Report

Form DWR 188 Auto-Completed 11/2/2020

WCR2020-011582

Owner's Well Number D00611 | Date Work Began | Date Work Ended 08/17/2020

Local Permit Agency Alameda County Public Works Agency, Water Resources Section

Secondary Permit Agency | Permit Number W2020-0534 | Permit Date

Well Owner (must remain confidential pursuant to Water Code 13752)

Name THE MOSAIC PROJECT,

Mailing Address 478 SANTA CLARA AVE.

City OAKLAND State CA Zip 94610

Planned Use and Activity

Activity New Well

Planned Use Water Supply Domestic

Well Location

Address 17015 CULL CANYON RD

City CASTRO VALLEY Zip 94552 County Alameda

Latitude 37 Deg. 44 Min. 29.5954 Sec. N

Longitude -122 Deg. 3 Min. 17.249 Sec. W

Dec. Lat. 37.7415543 Dec. Long. -122.0547914

Vertical Datum | Horizontal Datum WGS84

Location Accuracy | Location Determination Method

APN 085-120-001

Township 02 S

Range 02 W

Section 23

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Direct Rotary Drilling Fluid Air

Total Depth of Boring 135 Feet

Total Depth of Completed Well 135 Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured 08/17/2020

Estimated Yield* 80 (GPM) Test Type Air Lift

Test Length 1 (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	10	Top soil
10	40	Brn. clay
40	55	Brn. shale
55	80	Green shale
80	115	Sandstone
115	135	Sandstone

Figure 4. (continued)

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	95	Blank	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563			
1	95	135	Screen	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563	Milled Slots	0.04	

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	55	Cement	10.3 Sack Mix		
55	60	Bentonite	High Solids		
60	135	Filter Pack	8 x 16		

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	135	10

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name MAGGIORA BROS DRILLING INC
Person, Firm or Corporation

595 AIRPORT BLVD	WATSONVILLE	CA	95076
Address	City	State	Zip

Signed

electronic signature received	08/28/2020	249957
C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

			N					W

Latitude Deg/Min/Sec — Longitude Deg/Min/Sec

TRS:

APN:

Figure 5. Driller's well completion report for Well 17-1, The Mosaic Project, Alameda County, CA.

State of California

Well Completion Report

Form DWR 188 Auto-Completed 2/26/2018

WCR2017-006156

Owner's Well Number D00379 Date Work Began 12/07/2017 Date Work Ended 12/13/2017

Local Permit Agency Alameda County Public Works Agency, Water Resources Section

Secondary Permit Agency Permit Number W2017-0834 Permit Date 11/15/2017

Well Owner (must remain confidential pursuant to Water Code 13752)

Name Marcus Maita

Mailing Address 2004 Camino Ramon

City Danville State CA Zip 94526

Planned Use and Activity

Activity New Well

Planned Use Water Supply Domestic

Well Location

Address 17015 Cull Canyon RD

City Castro Valley Zip 94552 County Alameda

Latitude ___ ___ ___ N Longitude ___ ___ ___ W

Deg. Min. Sec. Deg. Min. Sec.

Dec. Lat. 37.7411710 Dec. Long. -122.0555243

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN 85-1200-1-16

Township 02 S

Range 02 W

Section 23

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Direct Rotary Drilling Fluid Air

Total Depth of Boring 220 Feet

Total Depth of Completed Well 200 Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static

Water Level 40 (Feet) Date Measured 12/13/2017

Estimated Yield* 35 (GPM) Test Type Air Lift

Test Length 3 (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	5	Top soil
5	20	Brn clay
20	38	Brn. silty clay
38	60	Brn. silty clay & shale
60	80	Black shale
80	100	Black shale
100	120	Black shale
120	140	Black shale & white shale
140	160	White shale & black shale
160	180	Brn. & black shale
180	200	Brn. & black shale
200	220	Black shale

Figure 5. (continued)

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	70	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	70	90	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	
1	90	130	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	130	190	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	
1	190	200	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	60	Cement	10.3 Sack Mix		
60	220	Filter Pack	8 x 16		

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	60	11
60	220	9

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: MAGGIORA BROS DRILLING INC
Person, Firm or Corporation

595 AIRPORT BLVD	WATSONVILLE	CA	95076
Address	City	State	Zip

Signed

electronic signature received	12/22/2017	249957
C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

N

Latitude Deg/Min/Sec

W

Longitude Deg/Min/Sec

TRS:

APN:

ATTACHMENT 7

Mosaic Water System Regulatory Compliance Summary

Mosaic Water System Regulatory Compliance Summary

CCR §64554 New & Existing Source Capacity	
(a)At all times, a public water system's water source(s) shall have the capacity to meet the system's maximum day demand (MDD)	The Mosaic water system sources will have a total rated capacity of 7.7 gpm. Wells 17-1 and 20-1 provide redundancy and together are able to supply more than twice the system's MDD.
(b)A system shall estimate MDD and PHD for the water system as a whole (total source capacity and number of service connections) and for each pressure zone within the system (total water supply available from the water sources and interzonal transfers directly supplying the zone and number of service connections within the zone)	The MDD has been estimated at 2.76 gpm and the PHD has been estimated at 4.14 gpm. There will be only one (1) pressure zone in the Mosaic system.
(c) Community water systems using only groundwater shall have a minimum of two approved sources before being granted an initial permit.	20-1 and 17-1 are both viable groundwater sources for the system.
(c) The system shall be capable of meeting MDD with the highest capacity source off-line.	Should the largest supply source, Well 20-1, be out of service, Well 17-1, with a rated capacity of 3.0 gpm, would still be able to feed the system's MDD of 2.76 gpm.
(d) A public water system shall determine the total capacity of its groundwater sources by summing the capacity of its individual active sources. If a source is influenced by concurrent operation of another source, the total capacity shall be reduced to account for such influence.	The total capacity of the groundwater sources is 7.7 gpm. Well 20-1 and 17-1 draw from separate fractured bedrock aquifers and drawdown interference was not detected in the water level monitoring records during the 10-day pumping tests.
(g) The capacity of a well whose primary production is from a bedrock formation, such that the water produced is yielded by secondary permeability features (e.g., fractures or cracks), shall be determined pursuant to either paragraph (1) or (2) below.	The well test was conducted by Balance Hydrologics in accordance with paragraph (g)(2).
§64560. New Well Siting, Construction, and Permit Application.	
(a) To receive a new or amended domestic water supply permit for a proposed well, the water system shall provide the following information to the Department in the technical report as part of its permit application: (1) A source water assessment as defined in Section 63000.84 for the proposed site;	A source water assessment will be provided for the wells as attachment to the Technical Report.
(2) Documentation demonstrating that a well site control zone with a 50-foot radius around the site can be established for protecting the source from vandalism, tampering, or other threats at the site by water system ownership, easement, zoning, lease, or an alternative approach approved by the Department based on its potential effectiveness in providing protection of the source from contamination;	There is a 50-foot control zone radius around wells 17-1 and 20-1. Previous communication with DDW addressed potential compliance issues with Well 20-1, and the alternative approach was approved by the Division (email dated May 21, 2020).
(3) Design plans and specifications for the well; and	Design plans and specifications will be submitted as attachment to the Technical Report.
(4) Documentation required for compliance with the California Environmental Quality Act (CEQA).	Mosaic is under contract with an environmental firm to complete CEQA for the whole project, including the wells. The approved CEQA document will be provided to the Division upon completion.
(b) After the Department has provided written or oral approval of the initial permit amendment application and the water system has constructed the well, the water system shall submit the following additional materials for its permit application: (1) A copy of the well construction permit if required by the county or local agency; (2) Department of Water Resources well completion report; (3) A copy of any pump tests required by the Department; (4) Results of all required water quality analyses; and (5) As-built plans.	The pump test report (b)(3) is included as attachment. All other elements of §64560 (b) will be met in future stages of the project.
(c) Each new public water supply well shall: (1) As a minimum, be constructed in accordance with the community water system well requirements in California Department of Water Resources Bulletins 74-81 and 74-90, which are hereby incorporated by reference; (2) Be constructed in accordance with American Water Works Association (AWWA) Standard A100-06 (Water Wells), which is hereby incorporated by reference; (3) Be installed such that: (A) All equipment is accessible for operation, maintenance, and removal; (B) Protection is provided against flooding; (C) The wellhead terminates a minimum of 18 inches above the finished grade; (D) Wellhead and electrical controls are not installed in vaults; (E) The well is equipped with: 1. Fittings and electrical connections to enable chlorination facilities to be readily installed; 2. A non-threaded down-turned sampling tap located on the discharge line between the wellhead and the check valve. Sampling taps used for obtaining samples for bacteriological analysis shall not have a screen, aerator, or other such appurtenance; (F) Provisions are made to allow the well to be pumped to waste with a waste discharge line that is protected against backflow.	Wells 20-1 and 17-1 have been constructed in accordance with (c)(1) and (c)(2). All other elements of §64560 (c) will be met in future stages of the project.
CCR §64531 Source Flow Meters	
Each water system shall: (a) Except for inactive sources, install a flow meter at a location between each water source and the entry point to the distribution system; (b) Meter the quantity of water flow from each source, and record the total monthly production each month.	Flow meters will be installed at the wellhead of Wells 17-11 and 20-1.
CCR §64572 Water Main Separation	
(a) New water mains and new supply lines shall not be installed in the same trench as, and shall be at least 10 feet horizontally from and one foot vertically above, any parallel pipeline conveying: (1) untreated sewage (2) Primary or secondary treated sewage, (3) Disinfected secondary-2.2 recycled water (defined in section 60301.220), (4) Disinfected secondary-23 recycled water (defined in section 60301.225), and (5) Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.	The existing piping network will be removed and the new potable, sewer and greywater mains will be installed underground with the proper distance requirements.
(c) New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.	
(e) The vertical separation specified in subsections (a), (b), and (c) is required only when the horizontal distance between a water main and pipeline is less than ten feet.	
(f) New water mains shall not be installed within 100 horizontal feet of the nearest edge of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 horizontal feet of the nearest edge of any cesspool, septic tank, sewage leach field, seepage pit, underground hazardous material storage tank, or groundwater recharge project site.	
CCR §64602 Minimum Pressure	
(a) Each distribution system shall be operated in a manner to assure that the minimum operating pressure in the water main at the user service line connection throughout the distribution system is not less than 20 pounds per square inch at all times.	The distribution system will be pressurized by a hydro-pneumatic tank to ensure that the pressures within the distribution system do not go below 40 psi.
(b) Each new distribution system that expands the existing system service connections by more than 20 percent or that may otherwise adversely affect the distribution system pressure shall be designed to provide a minimum operating pressure throughout the new distribution system of not less than 40 pounds per square inch at all times excluding fire flow.	

ATTACHMENT 8

Mosaic Water System O&M Cost Estimate

Mosaic Preliminary Engineering Report Cost Estimate

Operations & Maintenance Costs

	Cost	Unit/ Frequency	Total Cost	Notes
Staff - Water System Maintenance				
Certified Operator	$45,000	Annual	$45,000	O&M activities will be shared between certified in-house Mosaic staff and a contracted certified operator. Work includes routine treatment and distribution system O&M, water quality sampling and monitoring, monthly DDW reports, valve exercising, main flushing, cross-connection testing, backflow prevention devices maintenance etc.
Operations				
Water monitoring sampling and laboratory analysis	$10,000	Annual	$10,000	including raw water chemical, bacteriological for treated and untreated water, lead and copper, disinfection byproducts
Electricity costs for pumps and other utilities	N.A	Annual	N.A	Water system electricy consumption will be supplied by on-site production of renewable energy and expenses are associated with general Mosaic operations.
Water Treatment Media & Chemicals				
Sodium Hypochlorite	$250	$5/gal	$250	Water treatment chemical costs and equipment for distribution monitoring of chemical treatment
Multi-Media Replacement	$475	Every 4 years	$119	
Greensand Media Replacement	$1,950	Every 4 years	$488	
GAC Media Replacement	$1,370	Annual	$1,370	
Antiscalant	$275	$55/gal	$2,750	
As-Needed Engineering Support	$5,000		$5,000	Annual deliverables and reports will developed in-house and engineering support will be provided as needed, including consumer Confidence report preparation, Annual report preparation, Maintenance of written procedures for system maintenance, Annual capital improvement plan and records of estimated life of main facilities, Source capacity planning studies, permit amendments for any additional growth, As-built maps
Emergency Reserve	$7,000		$7,000	Emergency reserve costs for drought, regulatory changes, public notice of bacteriological or chemical failures, etc.
Total			$71,976	
Contingency			20%	
Total + Contingency			**$86,372**	

Fire Flow Calculations

The Mosaic Project – Cull Canyon Road

Fire Flow Basis for Design : NFPA 1142 Water Supplies for Rural Firefighting (See Exhibit A)

Building: Multi-Use Building (Worst case Scenario)

Size: 9,380 sf - 117,222 cf

11425 Water Supplies for Suburban and Rural Fire Fighting (See Exhibit B)
Chapter 4
4.1.5 For the purpose of calculating minimum water supply requirement, a structure shall be considered an exposure hazard under the following conditions:
(1) It is 100 sf or larger and is within 50 ft of another structure
4.3 Structures with Exposure Hazards
4.3.1 For structures with unattached structural exposure hazards, the minimum water supple, in gallons, shall be determined by calculating the total enclosed volume, in cubic feet, of the structure, dividing by the occupancy hazard classification number as determined from Chapter 5, multiple by the construction classification number as determined from Chapter 6, and multiplying by 1.5 as follows :

$$WS_{min} = \frac{V_{tot}}{OHC}(CC) * 1.5$$

Where
WS_{min}=minimum water supply in gallons
VS_{tot}= total volume of structures in ft^3 = 117,222 ft^3
OHC = occupancy hazard classification number= 6 (5.2.4.2 – (20) Municipal Buildings)
CC = construction classification number = Type V-B = 1.5 (Table 6.2.1 Construction Classification Number)

$$WS_{min} = \frac{117{,}222}{6}(1.5) * 1.5 = 43{,}958.25 \text{ or } 43{,}960 \text{ gallons}$$

4.6 Water Delivery Rate to the Fire Scene
4.6.1 The minimum water rate supply is determined using Sections 4.2 through 4.5 and shall be delivered in accordance with Table 4.6.1.

Table 4.6.1 Water Delivery Rate

Total Water Supply Required		Water Delivery Rate	
gal	L	gpm	L/min
<2,500	9,459	250	950
2,500–9,999	9,460–37,849	500	1,900
10,000–19,999	37,850–75,699	750	2,850
≥20,000	≥75,700	1,000	3,800

For 43,960 gallons the Water Delivery Rate is 1,000 gpm.

Alameda County Fire Department

Fire Prevention Bureau

Plan Review Comments

6363 Clark Ave, Dublin California 94568 Phone (925) 833-3473 Fax (925) 875-9387

February 10, 2021

Alameda County
Community Development Agency
Planning Department
224 West Winton Ave., Room 111
Hayward, California 94544

To	Sonia Urzua	**PLN#**	2020-00093 (2019-00151)
Address	17015 & 17031 Cull Canyon		
Job Description	Use and Improvements to Create an Outdoor Recreation Camp for Grade School Children with associated Caretaker Unit		
Reviewed By	Rian Evitt-Deputy Fire Marshal		

Review of Planning referrals are usually based on information and plans that lacking details for specific comments. The primary focus of our review is to assure fire access to the site. Specific fire and building code issues will be addressed during the regular building permit submittal and review process.

Conditions of Approval

The following conditions shall be met prior the issuance of a building permit and fire clearance for occupancy.

Note: The fire department does not recognize any structures as being existing on this site. This site will be a "C" camp overall. However, the individual structures will be "R" or "B" occupancy. None of the structures will be a "C" occupancy.

1. This project is located in SRA. As such the project must comply with current state building and fire Code requirements in affect at time of submittal including Title 14.
2. [redacted]
3. Fire department access will need to be installed and meet the requirements of Title 14. This aspect of the project will require improvement plans to be reviewed and approved by fire staff.
4. All structures on the site will require the installation of fire sprinklers.
5. A fire alarm system shall be installed in any multiple residential occupancy as required by the fire code.
6. All building materials and construction must comply with the requirements set forth in Chapter 7A of the building code.

EXHIBIT B

3.3.13 Lift. The vertical height that water must be raised during a drafting operation, measured from the surface of a static source of water to the centerline of the pump intake. [**1911**, 2012]

3.3.14 Minimum Water Supply. The quantity of water required for fire control and extinguishment.

3.3.15 Mobile Water Supply Apparatus (Tanker, Tender). A vehicle designed primarily for transporting (pickup, transporting, and delivering) water to fire emergency scenes to be applied by other vehicles or pumping equipment. [**1901**, 2016]

3.3.16 Municipal-Type Water System. A system having water pipes servicing fire hydrants and designed to furnish, over and above domestic consumption, a minimum of 250 gpm (950 L/min) at 20 psi (138 kPa) residual pressure for a 2-hour duration. [**1141**, 2017]

3.3.17* Mutual Aid/Assistance Agreement. A prearranged agreement between two or more entities to share resources in response to an incident. [**1600**, 2016]

3.3.18 Occupancy Hazard Classification Number. A series of numbers from 3 through 7 that are mathematical factors used in a formula to determine total water supply requirements.

3.3.19 Reducer. A fitting used to connect a small hose line or pipe to a larger hose line or pipe.

3.3.20 Rural. Those areas that are not unsettled wilderness or uninhabitable territory but are sparsely populated with densities below 500 persons per square mile.

3.3.21 Structure. That which is built or constructed; an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

3.3.22* Suburb or Suburban. Those moderately inhabited areas with population densities of at least 500 persons per square mile but less than 1000 persons per square mile.

3.3.23 Water Delivery Rate. The minimum amount of water per minute (in gpm or L/min), required by this standard or the AHJ, to be delivered to the fire scene via mobile water supply apparatus, hose lines, or a combination of both.

3.3.24* Water Supply Officer (WSO). The fire department officer or designee responsible for providing water for firefighting purposes.

[redacted]

4.1 General.

4.1.1 Prior to calculating the minimum water supply for a structure, the structure shall be surveyed to obtain the following information:

(1) Occupancy hazard
(2) Type of construction
(3) Structure dimensions (length, width, and height)
(4) Exposures, if any

4.1.1.1 For new construction, plans shall be submitted to the fire department or the AHJ for determination of the minimum water supply required before construction is started.

4.1.1.2 Changes made in the structural design, dimensions, occupancy, or contents of a planned or existing structure that affect the occupancy hazard or the construction type shall require that the structure be resurveyed to determine if changes are necessary in the minimum water supply required.

4.1.1.3 If there are changes in automatic fire suppression systems in a structure that would affect the protection afforded, the property owner(s) shall notify the AHJ in writing of such changes, including temporary impairment.

4.1.2* The methodology in this chapter shall be used to calculate the required minimum water supply necessary for structural fire-fighting purposes.

4.1.3* The minimum requirements shall be subject to increase by the AHJ to compensate for particular conditions such as the following:

(1) Limited fire department resources
(2) Extended fire department response time or distance
(3) Potential for delayed discovery of the fire
(4) Limited access
(5) Hazardous vegetation
(6) Structural attachments, such as decks and porches
(7) Unusual terrain
(8) Special uses and unusual occupancies

4.1.4 The AHJ shall be permitted to specify how the water supplies required in this document are provided, giving consideration to local conditions and need.

[redacted]

(2) The structure, regardless of size, is of occupancy hazard classification 3 or 4 as determined in Chapter 5 and is within 50 ft (15.24 m) of another structure.

4.2 Structures Without Exposure Hazards.

4.2.1* For structures with no exposure hazards, the minimum water supply, in gallons (liters), shall be determined by calculating the total enclosed volume, in cubic feet (cubic meters), of the structure, including any attached structures, dividing by the occupancy hazard classification number as determined from Chapter 5, and multiplying by the construction classification number as determined from Chapter 6 as follows:

$$WS_{min} = \frac{VS_{tot}}{OHC}(CC) \qquad [4.2.1]$$

where:

WS_{min} = minimum water supply in gal (For results in L, multiply by 3.785.)
VS_{tot} = total volume of structure in ft^3 (If volume is measured in m^3, multiply by 35.3.)
OHC = occupancy hazard classification number
CC = construction classification number

4.2.2 The minimum water supply required for any structure without exposure hazards shall not be less than 2000 gal (7600 L).

[redacted]

[redacted]

[redacted]

[redacted]

4.3.2 The minimum water supply required for a structure with exposure hazards shall not be less than 3000 gal (11,355 L).

4.4* Structures with Automatic Sprinkler Protection.

4.4.1 The AHJ shall be permitted to reduce the water supply required by this standard for manual fire-fighting purposes when a structure is protected by an automatic sprinkler system that fully meets the requirements of NFPA 13, NFPA 13D, or NFPA 13R. *(See Annex F.)*

4.4.2 If a sprinkler system protecting a building does not fully meet the requirements of NFPA 13, NFPA 13D, or NFPA 13R, a water supply shall be provided in accordance with this standard.

4.5 Structures with Other Automatic Fire Suppression Systems. For any structure fully or partially protected by an automatic fire suppression system other than as specified in Section 4.4, the AHJ shall determine the minimum water supply required for fire-fighting purposes.

4.6 Water Delivery Rate to the Fire Scene.

4.6.1 The minimum water supply is determined using Sections 4.2 through 4.5 and shall be delivered in accordance with Table 4.6.1.

4.6.2 The AHJ shall be permitted to adjust the water delivery rate, giving consideration to local conditions and need.

[redacted]

Total Water Supply Required		[redacted]	
[redacted]	L	[redacted]	L/min
<2,500	9,459	250	950
2,500–9,999	9,460–37,849	500	1,900
10,000—19,999	37,850–75,699	750	2,850
[redacted]	≥75,700	[redacted]	3,800

4.6.3 The minimum water delivery rate shall not be less than 250 gpm (950 L/min).

4.7 Other Uses. Water supplies developed to meet this standard shall be permitted to be used for fighting fires in other than structures or for use during other emergency activities.

Chapter 5 Classification of Occupancy Hazard

5.1 General.

5.1.1 This chapter shall be used to determine the occupancy hazard classification number used in the calculation of water supply requirements in Chapter 4.

5.1.2 Where more than one occupancy is present in a structure, the occupancy hazard classification number for each occupancy shall be determined separately, and the classification number for the most hazardous occupancy shall be used for the entire structure.

5.2* Occupancy Hazard Classification Number.

5.2.1 Occupancy Hazard Classification Number 3.

5.2.1.1* Occupancy hazard classification number 3 shall be used for severe hazard occupancies.

5.2.1.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 3:

(1) Cereal or flour mills
(2) Combustible hydraulics
(3) Cotton picking and opening operations
(4) Die casting
(5) Explosives and pyrotechnics manufacturing and storage
(6) Feed and gristmills
(7) Flammable liquid spraying
(8) Flow coating/dipping
(9) Linseed oil mills
(10) Manufactured homes/modular building assembly
(11) Metal extruding
(12) Plastic processing
(13) Plywood and particleboard manufacturing
(14) Printing using flammable inks
(15) Rubber reclaiming
(16) Sawmills
(17) Solvent extracting
(18) Straw or hay in bales
(19) Textile picking
(20) Upholstering with plastic foams

5.2.2 Occupancy Hazard Classification Number 4.

5.2.2.1* Occupancy hazard classification number 4 shall be used for high hazard occupancies.

5.2.2.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 4:

(1) Barns and stables (commercial)
(2) Building materials supply storage
(3) Department stores
(4) Exhibition halls, auditoriums, and theaters
(5) Feed stores (without processing)
(6) Freight terminals
(7) Mercantiles
(8) Paper and pulp mills

(9) Paper processing plants
(10) Piers and wharves
(11) Repair garages
(12) Rubber products manufacturing and storage
(13) Warehouses, such as those used for furniture, general storage, paint, paper, and woodworking industries

5.2.3 Occupancy Hazard Classification Number 5.

5.2.3.1 Occupancy hazard classification number 5 shall be used for moderate hazard occupancies, in which the quantity or combustibility of contents is expected to develop moderate rates of spread and heat release. The storage of combustibles shall not exceed 12 ft (3.66 m) in height.

5.2.3.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 5:

(1) Amusement occupancies
(2) Clothing manufacturing plants
(3) Cold storage warehouses
(4) Confectionery product warehouses
(5) Farm storage buildings, such as corn cribs, dairy barns, equipment sheds, and hatcheries
(6) Laundries
(7) Leather goods manufacturing plants
(8) Libraries (with large stockroom areas)
(9) Lithography shops
(10) Machine shops
(11) Metalworking shops
(12) Nurseries (plant)
(13) Pharmaceutical manufacturing plants
(14) Printing and publishing plants
(15) Restaurants
(16) Rope and twine manufacturing plants
(17) Sugar refineries
(18) Tanneries
(19) Textile manufacturing plants
(20) Tobacco barns
(21) Unoccupied buildings

5.2.4 Occupancy Hazard Classification Number 6.

5.2.4.1 Occupancy hazard classification number 6 shall be used for low hazard occupancies, in which the quantity or combustibility of contents is expected to develop relatively low rates of spread and heat release.

[redacted]

(1) Armories
(2) Automobile parking garages
(3) Bakeries
(4) Barber or beauty shops
(5) Beverage manufacturing plants/breweries
(6) Boiler houses
(7) Brick, tile, and clay product manufacturing plants
(8) Canneries
(9) Cement plants
(10) Churches and similar religious structures
(11) Dairy products manufacturing and processing plants
(12) Doctors' offices
(13) Electronics plants
(14) Foundries
(15) Fur processing plants
(16) Gasoline service stations
(17) Glass and glass products manufacturing plants
(18) Horse stables
(19) Mortuaries
[redacted]
(21) Post offices
(22) Slaughterhouses
(23) Telephone exchanges
(24) Tobacco manufacturing plants
(25) Watch and jewelry manufacturing plants
(26) Wineries

5.2.5 Occupancy Hazard Classification Number 7.

5.2.5.1 Occupancy hazard classification number 7 shall be used for light hazard occupancies, in which the quantity or combustibility of contents is expected to develop relatively light rates of spread and heat release.

5.2.5.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 7:

(1) Apartments
(2) Colleges and universities
(3) Clubs
(4) Dormitories
(5) Dwellings
(6) Fire stations
(7) Fraternity or sorority houses
(8) Hospitals
(9) Hotels and motels
(10) Libraries (except large stockroom areas)
(11) Museums
(12) Nursing and convalescent homes
(13) Offices (including data processing)
(14) Police stations
(15) Prisons
(16) Schools
(17) Theaters without stages

Chapter 6 Classification of Construction

6.1 General.

6.1.1 This chapter shall be used to determine the construction classification number used in the calculation of water supply requirements in Chapter 4.

6.1.2 Where more than one type of construction is present in a structure, the classification number for each type of construction shall be determined separately, and the higher construction classification number shall be used for the entire structure.

6.2* Construction Classification Number.

6.2.1 The construction classification number shall be as shown in Table 6.2.1 based on the construction of the structure as determined in accordance with Section 6.3.

6.2.2 For dwellings, the maximum construction classification number shall be 1.0.

6.3 Classification of Types of Building Construction.

6.3.1* Classification of types of building construction shall be in accordance with 6.3.3 through 6.3.7 and Table 6.3.1.

[illegible]

[illegible]	[illegible]
Type I (442 or 332)	0.5
Type II (222, 111, or 000)	0.75
Type III (211 or 200)	1.0
Type IV (2HH)	0.75
[illegible]	[illegible]

6.3.2 If the type of construction of the structure has been determined using NFPA 220 that type of construction shall be permitted to be used in lieu of determining the type of construction in accordance with 6.3.3 through 6.3.7.

6.3.3 Type I (442 or 332) Construction.

6.3.3.1 Type I (442 or 332) construction shall be those types in which the fire walls, structural elements, walls, arches, floors, and roofs are of approved noncombustible or limited-combustible materials.

6.3.3.2 Structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

6.3.4 Type II (222, 111, or 000) Construction.

6.3.4.1 Type II (222, 111, or 000) construction shall be those types not qualifying as Type I construction in which the fire walls, structural elements, walls, arches, floors, and roofs are of approved noncombustible or limited-combustible materials.

6.3.4.2 Structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

6.3.5 Type III (211 or 200) Construction.

6.3.5.1 Type III (211 or 200) construction shall be that type in which exterior walls and structural members that are portions of exterior walls are of approved noncombustible or limited-combustible materials.

6.3.5.2 Fire walls, interior structural elements, walls, arches, floors, and roofs shall be permitted to be entirely or partially constructed of wood of smaller dimensions than required for Type IV construction or of approved noncombustible, limited-combustible, or other approved combustible materials.

6.3.5.3 In addition, structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

Table 6.3.1 Fire Resistance Ratings for Type I through Type V Construction (hr)

	Type I		Type II			Type III		Type IV	Type V	
	442	332	222	111	000	211	200	2HH	111	000
Exterior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	2	2	2	1	0
Supporting one floor only	4	3	2	1	0	2	2	2	1	0
Supporting a roof only	4	3	1	1	0	2	2	2	1	0
Interior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	2	1	0
Supporting one floor only	3	2	2	1	0	1	0	1	1	0
Supporting roofs only	3	2	1	1	0	1	0	1	1	0
Columns										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	H*	1	0
Supporting one floor only	3	2	2	1	0	1	0	H*	1	0
Supporting roofs only	3	2	1	1	0	1	0	H*	1	0
Beams, Girders, Trusses, and Arches										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	H*	1	0
Supporting one floor only	2	2	2	1	0	1	0	H*	1	0
Supporting roofs only	2	2	1	1	0	1	0	H*	1	0
Floor Construction	2	2	2	1	0	1	0	H*	1	0
Roof Construction	2	1½	1	1	0	1	0	H*	1	0
Interior Nonbearing Walls	0	0	0	0	0	0	0	0	0	0
Exterior Nonbearing Walls †	0	0	0	0	0	0	0	0	0	0

Note: Shaded columns indicate those members that are permitted to be of approved combustible material.
*"H" indicates heavy timber members; see 6.3.6 for requirements.
†Exterior nonbearing walls meeting the conditions of acceptance of NFPA 285 are permitted to be used.

WASTEWATER SYSTEM APPROVAL AND REPORTS

Ronald Browder
Director

Dilan Roe
Chief, Land & Water Protection Division

Paresh Khatri
Manager, Local Oversight Program

1131 Harbor Bay Parkway
Alameda, CA 94502

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Health.AlamedaCountyCA.gov/ACEHD

Environmental Health Department
Alameda County Health

June 18, 2025

Cull Canyon Properties LLC
c/o Brian Lowe
Owner(s)
17015 Cull Canyon Road, Castro Valley
(Sent via E-mail to: brian@mosaicproject.org)

Subject: Feasibility Study Approval for an Onsite Wastewater System
Property Address: 17015 (17031) Cull Canyon Road, Castro Valley
Assessor's Parcel No.: 85-1200-1-16

Dear Applicant,
Alameda County Environmental Health Department's (ACEHD) Onsite Wastewater System (OWS) Program has received a Preliminary OWS Design Plan set for the proposed land uses at the subject property identified below:

Residential Use	Commercial Use
☐ Single Family Residence	☐ Winery
☒ Caretaker Units	☐ Breweries
☐ Mobile Homes	☐ Cannabis
	☐ Dog Kennels
	☒ Other: Camp Facility

The Preliminary OWS Design evaluates the feasibility of the onsite wastewater systems for all wastewater generated at the subject property. The Preliminary OWS Design Plans are titled *Mosaic Project*, prepared by NorthStar Designing Solutions, dated June 3, 2025, and submitted along with a Basis of Design Report (subject line reading *Basis of Design Report for Mosaic Project – 17015 Cull Canyon Road Project Site (APN 85-1200-1-16, County File No. PLN2020-00093))*. Wastewater systems proposed at the subject property include the following:

OWCU	Existing	Proposed	OWTS	Existing	Proposed
Holding Tank	☐	☐	Septic Tanks	☒	☒
Portable Toilet	☐	☐	Pump Tanks	☐	☒
Vault Toilets	☐	☐	Flow Equalization Tanks	☐	☒
			Treatment Units	☐	☒
			Grease Interceptors	☐	☒
			Dispersal Field Area	☒	☒

Note: OWCU = Onsite Wastewater Containment Unit
OWTS = Onsite Wastewater Treatment System

Environmental Health Department
Alameda County Health

Based on our review of the Preliminary OWS Design documents, ACEHD has determined that wastewater generated at the site can be managed using onsite wastewater systems. ACEHD is providing feasibility approval of the Preliminary OWS Design for the proposed new campsite facility and existing OWS for the 3-bedroom caretaker dwelling at the subject property. ACEHD is also providing clearance for the Conditional Use Permit for the proposed new campsite facility at this site (**PLN2020-00093**) by means of this letter.

<u>Conditions of Final Approval</u>

ACEHD's final approval of the onsite wastewater system for the subject property will be based upon the Alameda County OWTS Ordinance and Manual in effect at that time and will be conditioned upon approval of the onsite wastewater system design documents and receipt of copies of associated project permits/approvals by other agencies, as identified below:

<u>ACEHD</u>

☐ Performance evaluation of existing onsite wastewater system that demonstrate the systems are adequately functioning or provide recommendations to repair, modify or replace.

☐ Design documents for proposed repairs, modifications, or replacements of existing onsite wastewater systems.

☒ Final OWTS Design documents for proposed new onsite wastewater systems.

<u>Planning Departments</u>

☒ Final Project Approval from the Planning Department

☒ Landscaping Requirements and Plans

<u>Groundwater Basin Managers</u>

☐ Zone 7 Water Agency (Commercial Land Use with OWTS Approval)

<u>Public Water Supply Permitting Agencies</u>

☐ State Water Resources Control Board Public Water Supply Permit

☐ ACEHD Public Water Supply Permit

<u>Building Departments</u>

☒ Building Permit Plans

<u>State Agencies</u>

☐ San Francisco Regional Water Quality Control Board (Waste Discharge Requirements for Process or Industrial Wastewater)

☐ San Francisco Regional Water Quality Control Board (Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities)

☐ California Department of Fish and Wildlife (Streambed Alteration Permits)

Environmental Health Department
Alameda County Health

Should you have any questions or concerns regarding this correspondence, please call me at (510) 567 – 6723 or send me an electronic mail message at natali.colom@acgov.org.

Sincerely,

Natali Colom Cruz

Natali Colom Cruz
Senior Hazardous Material Specialist, OWS Program

cc: Dilan Roe, Chief of Land Water Division, *(Sent via E-mail to:* Dilan.Roe@acgov.org*)*
Joshua Barbosa, Hazardous Material Specialist, OWS Program, (*Sent via E-mail to:* josh.barbosa@acgov.org*)*
Muhammed Khan, Senior HMS, OWS Program, (*Sent via E-mail to:* muhammed.khan@acgov.org*)*
Nick Weigel, OWS Designer (*Sent via E-mail to:* nick@weigelhome.com)
Nicole Ledford, OWS Designer - NorthStar Design Solutions (*Sent via E-mail to:* nledford@northstarae.com)
Albert Lopez, Alameda County Planning Department (*Sent via E-mail to:* albert.lopez@acgov.org)

June 3, 2025

Natali Colom Cruz
Engineering Technician – Hazardous Material Specialist
Alameda County Department of Environmental Health
Land Use Program
1131 Harbor Bay Parkway
Alameda, CA 94502

Subject: Basis of Design Report for The Mosaic Project - 17015 Cull Canyon Road Project Site (APN 85-1200-1-16, County File No. PLN2020-00093)

Dear Natali,

The following is an updated Basis of Design Analysis for The Mosaic Project. This updated Basis od Design is prepared in response to the comments from ACDEH received on March 10, 2025 and follows the Alameda County *Onsite Wastewater Treatment System Manual June 2018* (Manual.)

PROJECT LOCATION

The Mosaic Project (Project) is located on an approximately 37-acre site, at 17015 Cull Canyon Road in the unincorporated portion of Alameda County, California, approximately 3 miles North of Interstate 580 (I-580). The site is bounded by Cull Canyon Road to the east, Twining Vine Winery to the north, Cull Canyon Regional Recreational Area to the west, and residential property to the south.

The site is centered at about 37°44'33.83"N latitude and 122° 3'18.85"W longitude, and is located in Section 23, Range 02W, Township 2S, Hayward USGS 7.5' Quad.

PROJECT OBJECTIVES

The Mosaic Project's mission is to work toward a peaceful future by uniting children of diverse backgrounds, providing them with essential community building skills, and empowering them to become peacemakers.

The primary program is the Outdoor Project which brings together 4th and 5th grade classes from markedly different backgrounds for a profound weeklong experience in nature.

PROJECT DESCRIPTION

The Outdoor Project consists of three classes of 4th or 5th grade students (approximately 75-95 students) who are bussed to the site for a 5-day, 4-night camp program. Students arrive at 11:00 Monday morning and depart at 1:30 Friday afternoon.

The Outdoor Project operates seasonally during the school year with six consecutive camp sessions in the fall [September-October] and six consecutive camp sessions in the spring [April-May]. We are expanding to operate year-round, including summer sessions and occasional weekend programs. The programs would be such that there would never be more than two consecutive 5-day, 4-night programs in a row. Likewise, weekend programs would never fall next to a weekday program. This will allow for the following:

- 18 Outdoor Project 5-day/4-night sessions (10 in the winter/spring and 8 in the fall)
- Four (4) 5-day/4-night summer sessions
- 12 weekend programs

NEW CENTRAL CAMP WASTEWATER SYSTEM

Central Camp Wastewater Source and Flow Analysis

The uses below at the camp will generate wastewater. Wastewater predictions are based on a per person design flow assumption in terms of gallons per day. Predicted Wastewater Flows can be found in Table 1.

Central Meeting & Dining Hall: This 8,500 sqft. multi-purpose building would be constructed southeast of the cabins. It will be used for camp indoor activities and would contain restrooms, a medic room, kitchen, pantry, dining area, meeting space, laundry, restrooms, showers, and offices.

Restroom/Shower Building: A 1,025 sqft. restroom/shower building would be constructed near the camping cabins.

Family Dwelling: A 2,636 sqft. staff dwelling would be constructed to serve as Mosaic staff's permanent home.

Camping Cabins: Twelve 400 sqft. non-permanent camping cabins would be placed on the project site. Cabins will be simple, light-footprint construction with no plumbing features in the b. Campers will be served by the Central Meeting and Dining Hall and the Restroom/Shower Building.

Table 1 – Predicted Wastewater Flows

Occupant Type	Maximum Daily Occupants/Use	Flow/per Person (gpd)*	GPD
Cabin Occupants 9 campers plus 1 staff per cabin	120*	25	3,000
Day Staff	8	25	200
Family Dwelling Residence	6 Bedroom	N/A	675
		Total	**3,875**

* See Discussion on flow rate for details

Flow Rate Determination: The flow rate of 25gpd/person is based on multiple factors.

- Comparative Flow Analysis – a design flow per person of 25gpd/person was determined for this project based on our experience in designing similar systems and the below factors:
    - Water use was measured via the water system flow meter at the current camp facility in the Spring of 2018. During a ten-day period with 124 staff and campers on site, the average water use recorded at 19 gallons per day per person. It should be noted this

facility has an aging water infrastructure, which may have resulted in higher calculated water use than actual use by campers and staff.

- Review of EPA Onsite Wastewater Treatment Systems Manual (February 2002) Table 3-6. Typical wastewater flow rates from recreational facilities shows typical values for camps. Typical values for "Pioneer Camps" and "Children's Camps" are 25gpd and 45gpd respectively, with the average of these two flows at 35pgd/person. The way The Mosaic Project camp is operated is in line with a Pioneer Camp. Table 3-10, *Comparison of flow rates and flush volumes before and after U.S. Energy Policy Act* shows a reduction of flow for water saving fixtures at approximately 50% potential reduction in water used. This is consistent with what we see across the state in residential and school settings. Accounting for this, a 50% reduction in design flows for modern fixtures results in a predicted average water use per person at under 20gpd/person.

- Total Design Flow Determination – The total design flow determination of 3,875gpd will be used for the sizing of the septic tanks, treatment system and dispersal field. Blackwater flow reductions as a result of any proposed or future greywater use for landscape irrigation are not subtracted from the design flow except in analyzing the impacts on secondary treatment sizing illustrated in the scenarios below.
  - The total number of campers will vary between 75 and 95 children, fewer than the potential maximum occupancy.
  - Additional/flexible bed spaces are needed to accommodate various distribution of genders in each camp session.

Central Camp Wastewater Treatment System Sizing

Wastewater treatment infrastructure design is governed by the wastewater generated (both flow and waste strength), the soil resource, and the type of dispersal system used.

In this conceptual phase of the project, primary and secondary treatment of effluent is assumed. This will require, at a minimum, grease interceptor tanks, septic tanks, and secondary treatment equipment and surge/dosing tanks with pumps and controls to move wastewater evenly and consistently to dispersal zones on the site.

Secondary wastewater treatment will be accomplished with Orenco Advantex textile filtration with an AXMax treatment unit. The determination of secondary treatment equipment will be made as part of final design of the site and infrastructure.

Secondary treatment systems are sized for both hydraulic and organic loading. For hydraulic loading, peak flow (design flow) and average flow conditions are reviewed. Average flows are assumed as 80% of the design.

Organic loading sizing must also be reviewed again at peak and average flow conditions.

Pursuant to Chapter 15 of the plumbing code, greywater systems have a diverter valve to allow the user to divert from the greywater system to the sewer/septic system. Because of the potential for the greywater system to be turned off, two scenarios for treatment sizing must be analyzed;

- Scenario 1 – Full blackwater flow, with no greywater diversion. This scenario models when a greywater system is not active, primarily when regulations limit the use of greywater in high precipitation conditions.

- Scenario 2 – Reduced blackwater flow, with greywater diversion. This scenario models if a greywater system is active, lowering the daily flow and potentially increasing the organic loading. Scenario 2 also demonstrates the treatment system design requirements if a greywater system is not installed.

A summary of the conceptual treatment sizing can be found below. Supporting calculations are attached.

Table 2 – Treatment System Sizing		
Component	**Size**	**Notes:**
Septic Tank(s)	20,000 gallons	○ May be multiple tanks at various locations
Secondary Treatment	225 s.f. of filter area	○ Scenario 2 Average Flow Organic Loading Governs ○ May be reduced with pretreatment conditioning in final design phase.
Time Dosed Dosing Tank	6,000 gallons	○ In conjunction with 2,200 gallons of capacity in AX Treatment System.

Dispersal System Approach and Sizing

The dispersal concept includes applying secondary treated effluent to pressure dosed chambered trenches in the area identified on the attached concept site plan.

Soil profiles revealed loam/clay loam and silty clay loam soils with profiles typical to Yolo loam and Danville silty clay loam. NRCS mapping predicts Yolo loam in the vicinity of the proposed project with Danville silty clay loam appearing across Cull Canyon Road. Groundwater was not encountered during the soil profiling activities.

Initial percolation tests (P5, P6, P7 and P8) in the area of the proposed dispersal system for the camp was conducted by Salvador Ruiz REHS, and ranged from 10 to 192 min/in. (average percolation rate of 18 min/in.) The 192 minute per inch test (P8) is considered an outlier and additional percolation tests were conducted to confirm this. Additional percolation tests (P9, P10, and P11 were conducted in the vicinity and as directed by ACDEH. The results of these tests were (25, 15, and 12 minutes per inch) Based on these additional results, the 192 minute per inch test (P8) is confirmed as an outlier and not used in the average. These results are also in the ranges outline in Table 8-4 - *Soil Types & Associated Percolation Rate Guidelines* in the Manual.

Mr. Ruiz's data is summarized below.

HOLE NUMBER	ADJUSTED STABILIZED RATE (MPI)
P5	19
P6	10
P7	26
~~P8~~	~~192~~
P9	25
P10	15
P11	12

The conceptual design is based on a peak design flow of 3,875gpd and a soil application rate of 1.2gpd/sf (18min./in.) and 6.6sf of infiltrative area per lineal foot. With secondary treated effluent and other condition met, the final design may incorporate up to 8.0sf/lf of infiltrative area in the final design. With these conservative assumptions, the total lineal footage required for the original dispersal field is approximately 489 lineal feet of pressure dosed trenches. The conceptual design shows 639 lineal feet which is 30 percent (161 lineal feet) larger than required.

The replacement area would be in the spacing between the proposed pressure dosed trenches. This would use the same configuration as the original dispersal system, with 630 lineal feet of pressure dosed trenches which is more than 25 percent (150 lineal feet) larger than required.

Soil profile and percolation test results are provided in the attached report from Salvador Ruiz, REHS.

Table 3 – Conceptual Dispersal System Sizing

Dispersal Method	Application Rate:	Size:	Notes:
Pressure Dosed Trenches	1.20gpd/sf @6.6sf/lf	489 minimum lf	o Application rate using enhanced application rates and infiltrative surface area. Per Table 25-2 this is 1.20 gpd/sf. o Proposed Original Field 639lf o Proposed Replacement Field 650lf

Cumulative Impact Assessment

The project was analyzed for applicability under Chapter 10 of the Manual. The project is classified as Nonresidential with a Design Wastewater Flow of over 2,500gpd outside the Upper Alameda Creek Watershed above Niles (Impaired Area.) Based on Table 10-1 - *Projects Requiring Cumulative Impact Assessment* in the Manual, Groundwater Mounding Analysis and Nitrogen Loading Analysis are required.

- Assumptions and Data Sources:
  - Climatic Data
    - Precipitation was assumed at 22 inches per year based on Alameda County Hydrology & Hydraulics Manual from the Alameda County Flood Control District https://www.cleanwaterprogram.org/images/uploads/C3TG_v6_Oct_2017_Appendix_D_Rainfall_Map.pdf
    - Evapotranspiration was not used in any calculations keeping the calculations conservative in nature.
  - Background Groundwater Quality Data.
    - Because this project is not located in an area identified in Chapter 10.4.C.2 of the Manual as an Area of Concern (AOC) background data is not required for nitrogen

loading calculations. A background nitrate concentration in rainfall was assumed as 2.0mg/l.

- Soil Profile Data
  - Soil Profile Sheets and percolation test results are attached.
  - NRCS Soil Data is attached

- Wastewater Characteristics
  - Flow – Predicted design flow is calculated at 3,375gpd and an average daily flow predicted at 80% of design flow or 2,700gpd
  - Biochemical Oxygen Demand (BOD) - BOD is assumed as less the 300mg/l with a peak of 500mg/l from potential greywater diversion. The is consistent with data seen by Orenco systems and the waste strength range listed in the Manual for campgrounds and professional experience. See attached Orenco letter.
  - Nitrogen - Nitrogen is assumed to be similar to residential strength at 70mg/l from Table 10-2. The is consistent with data seen by Orenco systems. See attached letter.

Groundwater Mounding Analysis – Groundwater mounding was calculated using the Hantush Method (Case 2 in the attached methodology) and Bower Method (Case 4 in the attached methodology.) Based on these calculated methods, groundwater could mound up to 18.7 feet and come within 8.3 feet of the bottom of the proposed dispersal trenches, which is over 5 feet greater than the 3 feet of separation found in Case 2 of Table 5-2 - Pressure-Dosed Trench Dispersal Systems Configurations & Siting Criteria in the Manual for percolation rates between 6 to 120 min/in. and enhanced percolation rates.

Table 4 is a summary of these results. Calculations are attached.

It should be noted that actual groundwater was not encountered during soil profiling activities and represents a theoretical potential for groundwater under the trenches as a result of concurrent wastewater loading and hypothetical shallow groundwater conditions. This modeling shows

Table 4 – Summary of Mounding Analysis Results

Scenario	**Calculated Localized Mound Height**	**Calculated Depth to Saturated Zone Below Dispersal**	**Notes:**
Case 2 – Design Flow	5.8 ft	21.2 ft.	○ Conservative with design flow occurring 365 days per year.
Case 2 – Average Flow	4.8 ft	22.2 ft.	
Case 4 – Design Flow	18.7 ft	8.3 ft.	○ Conservative with design flow occurring 365 days per year.
Case 4 – Average Flow	15.0 ft	12.0 ft.	

- Nitrogen Loading Analysis
  - Nitrogen Loading was calculated using the Hantzsche-Finnemore equation and the nitrogen limits listed in Table 10-4 - *Minimum Cumulative Nitrogen Loading Criteria from Proposed OWTS* in the manual. This calculation was used to determine nitrogen removal rate from the proposed secondary treatment system. The methodology used was to set the calculated average concentration of nitrate nitrogen entering the groundwater at 7.0mg/l and solve for the percent removal from the treatment system. Table 5 is a summary of these results. Calculations are attached.
  - For conservancy, no plant uptake or soil denitrification was assumed, leaving the nitrogen removal to the proposed secondary treatment system.

Table 5 – Summary of Nitrogen Loading Results

Scenario	Nitrogen Concentration Assumed	Calculated Percent Removal Required	Notes:
Design Flow – Predicted	70 mg/l	34.0%	
Design Flow – High	105 mg/l	56.0%	1.5 x Predicted concentration
Average Flow – Predicted	70 mg/l	10.0%	
Design Flow – High	140 mg/l	60.0%	2.0 x Predicted concentration

  - Table 5 shows that less than 34% nitrogen reduction is needed from the treatment system to satisfy the requirement of 7.0 mg/l groundwater nitrate concentration. Additionally, nitrogen concentrations ranging between 1.5 and 2.0 times higher than residential strength nitrogen would require approximately 60% reduction. This is well within a standard Orenco Advantex system capability without additional denitrification enhancements.

CARETAKER'S UNIT SEPTIC SYSTEM OVERVIEW
An existing 1,200 sq ft. structure will remain as a caretaker's dwelling and will continue to be served by the existing septic system for the structure. The existing system consists of a 1,200-gallon septic tank with a pump that pumps septic tank effluent to distribution boxes, and 150 lf of rock filled gravity dispersal leach field.

Although not a part of the proposed onsite wastewater system for the camp facility, the existing caretaker facility was evaluated by Salvador Ruiz, REHS at the request of ACDEH. The request was made out of concern that the final site plan may impact the existing dispersal system serving the caretakers' system. Also, in the event of a future failure of the existing caretaker's unit septic system or changes to the final site plan, these options could also serve the caretaker's unit as a repair.
The caretaker unit is functioning in its current state. A replacement system is not proposed for the caretaker facility at this time.

It should be noted that roots were found during an in-depth evaluation were found in a distribution box. This is a common occurrence in many septic systems. The roots were removed at the time of the site evaluation. See Sal' Ruiz's report attached.

CARETAKER'S UNIT FUTURE UPGRADES
As part of this project, trench piezometers will be added to the ends of the dispersal trenches to monitor the status of the trenches. This may help provide early indications of system failure allow time for a repair to be designed permitted and installed before a catastrophic failure of the dispersal system.

CARETAKER'S UNIT FUTURE REPLACEMENT
There are multiple options and configurations of a replacement system by using dispersal trenches of various lengths, widths and depths, sand filters, bottomless filters, mounds, drip dispersal, etc. This includes the use of advanced treatment as a part of the option set. Since the final project configuration and conditions of approval are not known at this time, two options for the replacement of the caretaker's system are provided. The options presented here are to demonstrate two viable replacement solutions.

Option 1 - Textile Filter Treatment to Raised Sand Bed

Option 2 - Textile Filter Treatment to Pressure Dosed Trenches

Caretaker's Unit Wastewater Design Flow
The caretaker's unit is an existing three-bedroom residence is proposed to remain as is with no changes to occupancy. Based on the bedroom count and Table 14-1 the Design Flow for this residence is 450gpd.

Caretaker's Unit Treatment System Sizing

Option 1 & 2 – Textile Filter Treatment
Secondary wastewater treatment will be accomplished with Orenco Advantex textile filtration with an AXRT treatment device. The AX RT is rated for residential wastewater flows up to a 6-bedroom residence.

Caretaker's Unit Dispersal System Approaches and Sizing

Additional soil profiling and percolation testing was conducted in the area of the existing caretakers' residence dispersal area. These values can be found in the report by Salvador Ruiz.

Option 1 - Textile Filter Treatment to Raised Sand Bed

Percolation tests results and soil profiles indicate that the raised sand filter bed can be used as a dispersal component following supplemental treatment. The raised sand filter bed would be designed to take advantage of the silty clay loam horizon described by Mr. Ruiz in his report attached.

This option takes advantage of its ability to use the upper horizons of soil if required. The sand filter bed would be sized based on the percolation rate of the soil in the vicinity using the average percolation rates from tests 3 and 4. An application rate of 1.2gpd/sf could be used to size the dispersal area.

This would require 375 square feet of dispersal area under the filter. The area outside the existing dispersal field has sufficient area to accommodate this dispersal method. For reference, 450sf of area is shown in the concept plan. Additionally, there is over 450sf of area over and between the existing dispersal trenches that could be used as a part of a final design. This equates to more than two times the calculated area needed for a replacement system.

No sizing modifications are given for timed dosing of the dispersal system.

The size of this filter bed would be between 375 to 450 square feet depending on the final location and configuration. See Option 1 Wastewater calculations attached.

Option 2 - Textile Filter Treatment to Subsurface Dispersal Trenches

This option uses the same concept and location as the existing trench design for a replacement.

Using the existing system data and 450gpd design flow for a 3-bedroom residence, a design application rate of 0.45gpd/sf was calculated. See Option 2 Wastewater calculations attached.

Using the existing system design application rate of 0.45gpd/sf, (equated a percolation rate of 69min/in. from Table 25-2 in the ACDEH Wastewater manual) a 3-foot wide pressure dosed trench and the existing system rock depth under pipe of 28 inches (see Sal Ruiz REHS's Report), 130 lineal feet of pressure dosed trench would be required to serve the caretaker's unit.

No sizing modifications are used for timed dosing of the dispersal system.

SEPTIC SYSTEM PROPOSAL SUMMARY

NEW CENTRAL CAMP WASTEWATER SYSTEM

Based on soil testing, conceptual sizing of treatment system components, and cumulative impact assessment calculations, the project can be supported by an onsite wastewater treatment and dispersal system. The system would be sized to accommodate 3,875gpd design flow (3,100gpd average daily flow), domestic strength waste (BOD between 300mg/l and 500mg/l), nitrogen input ranging from 70mg/l to 140 mg/l. At a minimum, system components would include:

1. Septic Tank Volume totaling 20,000 gallons.
2. An Orenco AX MAX textile filter system with 225 square feet of media and associated recirculation volume providing 30 mg/l BOD and 30 mg/l TSS and 50% nitrogen removal.
3. A 6,000-gallon dosing tank with the capacity to hold 1.5 days of design flow and delivery of secondary treated effluent to a subsurface dispersal field.
4. 489 lineal feet of 36-inch wide x 24-inch deep pressure dosed dispersal trenches. Current Design shows 639 lineal feet for the original field.

CARETAKER'S UNIT FUTURE REPLACMENT SYSTEM

The caretaker unit is functioning in its current state. A replacement system is not proposed for the caretaker facility at this time.

It should be noted that roots were found during an in-depth evaluation were found in a distribution box. This is a common occurrence in many septic systems. The roots were removed at the time of the site evaluation. See Sal' Ruiz's report attached.

System Upgrades

As part of this project, trench piezometers will be added to the ends of the dispersal trenches to monitor the status of the trenches. This may help provide early indications of system failure allow time for a repair to be designed permitted and installed before a catastrophic failure of the dispersal system.

Future Replacement System

At such time where the existing system may need to be upgraded or replaced, the following is proposed.

Based on the current Manual, a new system would be sized to accommodate 450gpd design flow domestic strength wastewater. System components would include:

1. Septic Tank Volume totaling 1,500 gallons.
2. An Orenco AX RT textile filter system with 20 square feet of media.
3. Based on future soil profiling and percolation testing as part of a formal replacement system design, there are various options for a potential future repair. Two representative options are shown here.
    a. Option 1 – 375 to 450 square foot sand filter bed for final dispersal. 450 square foot footprint is shown on the exhibits.
    b. Option 2 – 130 lineal feet of 36-inch wide x 28-inch deep pressure dosed dispersal trenches. This width and depth are consistent with the trenches currently in use without supplemental treatment. The concept shows 140 lineal feet.

I am happy to discuss any of the assumptions, calculations, and/or proposed treatment technologies with you at your convenience.

Best regards,
NorthStar

Dominickus J. Weigel III RCE 66282
Senior Engineer

Enclosures:

- Design Calculations
- Mounding Calculations
- Nitrogen Loading Calculations
- Conceptual Future Caretaker Repair Replacement Wastewater System Sizing
- Wastewater Dispersal Area Exhibit
- Mounding Analysis Exhibit

- Conceptual Dispersal Field Layout Exhibit
- NRCS Soil Map and Soil Unit Descriptions
- Orenco Preliminary Design Review Letter
- Alameda County Flood Control District Mean Annual Precipitation Map
- Excerpts from Methodologies for Assessment of Cumulative Impacts (Mounding Methodology Hantush and Bower)
- EPA Onsite Wastewater Treatment Systems Manual (February 2002) Table 3-6. *Typical wastewater flow rates from recreational facilities shows typical values for camps.*
- EPA Onsite Wastewater Treatment Systems Manual (February 2002) Table 3-10. *Comparison of flow rates and flush volumes before and after U.S. Energy Policy Act*
- System Evaluation for the Two Existing Systems and Percolation Test and Soil Profile Information for Canyon Creek Ranch, Alameda County APN: 085-12000-1-16 17015 Cull Canyon Road, Castro Valley, CA 94552, Salvador Ruiz, REHS.

Wastewater System Design Calculations - Treatment System

The Mosaic Project
Alameda County CA

Wastewater Design Flow

	Number	Flow Per Person	BOD	Peak Design Flow
Campers/Counselors	120	25 gpd	<300mg/l	3,000 gpd
Day Staff	8	25 gpd	<300mg/l	200 gpd
Family Dwelling Residence (3-Bedroom)	3	150 gpd	<300mg/l	450 gpd
Family Dwelling Residence (+ Bedrooms)	3	75 gpd	<300mg/l	225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Septic Tank Sizing

Septic Tank Size	Detention (Days) Minimum	5	19,375 gal

Use 20,000 Gallon Septic Tank

Recirculation Tank Volume

Recirc Tank	Detention (Days)	1	3,875 gal

Included in AX Max Treatment System

Secondary Treatment System (Advantex)

Design Flow		Hydraulic Loading	Square Footage Required
Peak	3,875 gpd	50 gpd/sf	78 sf
Average	3,100 gpd	25 gpd/sf	124 sf
Waste Strength			
Peak	500 mg/l	50 gpd/sf	
Average	300 mg/l	25 gpd/sf	
Cumulative Pounds of BOD5 at Design Flow	16.16	lb BOD$_5$/day	
Cumulative Pounds of BOD5 at Average Flow	7.76	lb BOD$_5$/day	
Design Flow Loading Rate	0.08	lb BOD$_{5/day/sf}$	202 sf
Average Flow Loading Rate	0.04	lb BOD$_{5/day/sf}$	194 sf

A Miimum of 202 square feet of textile is required

Use AX-225 Unit Which has 225 Square Feet of Textlle Media

Dosing Tank Sizing

		Required (Days)	Volume
Dosing Tank Volumw Required	Detention Average Flow (Days)	2.0	6,200 gal
Use 6,000 Gallon Dosing Tank			6,000 gal
AX Max 225 Reserve Capacity			2,200 gal
	Total Reserve Capacity		8,200 gal

Use 6,000 Gallon Dosing Tank in conjunction 25% of total tank volume provided by AX-225 Treatment System to Exceed Minimum of 6,200 gallons

Wastewater System Design Calculations - Dispersal Field

Dispersal Trenches With Chambers in Main Campus Area

The Mosaic Project
Alameda County CA

Wastewater Design Flow

	Number	Flow Per Person		Peak Design Flow
Campers/Counselors	120	25 gpd		3,000 gpd
Day Staff	8	25 gpd		200 gpd
Family Dwelling Residence (3-Bedroom)	3	150 gpd		450 gpd
Family Dwelling Residence (+ Bedrooms)	3	75 gpd		225 gpd
			Total Flow	3,875 gpd

Minimum Dispersal Field Sizing Trenches

Required Capacity		3,875 gpd
Application Rate	Average Percolation Rate 18 minutes/in.	1.20 gpd/sf
Dispersal Area (Using 36" wide and 22" below orifice shield)		6.60 sf/lf
Standard Dispersal Trench Length Required		489 lf

Use 639 Lineal Feet of 36-inch wide x 24-inch deep pressure dosed dispersal trenches for Original Field.

Wastewater System Design Calculations - Mounding Analysis Case 2 Design Flow

The Mosaic Project
Alameda County CA

Mounding Analysis as listed in Chapter 10 OWTS Manual - Design Flow

Wastewater Design Flow

	Number	Flow Per Person		Peak Design Flow
Campers/Counselors	120	25 gpd		3,000 gpd
Day Staff	8	25 gpd		200 gpd
Care Taker/Security Residence (Bed 1-3)	3	150 gpd		450 gpd
Care Taker/Security Residence (Bed 4+)	3	75 gpd		225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Localized Mounding Using Case 2

Width of Absorption Field Area (Feet) W		100
Length of Absorption Field (Feet) L		200
Wastewater Flow (GPD) Qw		3,875 gpd
Wastewater Application Rate (Ft/Day) I		0.025902406
Soil Pore Space (Cu Ft/Cu Ft) V		0.3
Horizontal Hydraulic Conductivity of Soil (Ft/Day) K		2.77
Depth to Saturated Zone From Bottom of Disposal Trench (Feet) H		27
Assumed Initial Depth of Saturated Zone (Feet) hi		5
Duration of Wastewater Application (Days) t		365.00
Assumed Maximum Depth of Saturated Zone (Feet) hm		10.83
b (Feet)		7.92
Vo	500	73.08
alpha	300	0.31
beta		0.15
Value of Function from Table 1		0.19
Calculated Maximum Depth of Saturated Zone (Feet) hm (Note: This value should equal the a		10.83
Calculated Maximum Height of Localized Mounding (Feet) hm-hi		5.83
Calculated Depth to Saturated Zone from Bottom of Disposal Trench (Feet) z		**21.17**

Ksat from NRCS Yolo Loam 0.57 to 2.2 in/hr. =1.14 to 4.4 Used Average for Calculations

H assumed as difference of lowest elevations of dispersal field (105 contour) - creek bed (75 contour) - assumed dispersal trench depth of 3 feet.

Wastewater System Design Calculations - Mounding Analysis Case 2 Average Flow

Mounding Analysis as listed in Chapter 10 OWTS Manual - Average Flow

The Mosaic Project
Alameda County CA

Wastewater Design Flow

	Number	Flow Per Person		Peak Design Flow
Campers/Counselors	120	25 gpd		3,000 gpd
Day Staff	8	25 gpd		200 gpd
Care Taker/Security Residence (Bed 1-3)	3	150 gpd		450 gpd
Care Taker/Security Residence (Bed 4+)	3	75 gpd		225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Localized Mounding Using Case 2

Width of Absorption Field Area (Feet) W		100
Length of Absorption Field (Feet) L		200
Wastewater Flow (GPD) Qw		3,100 gpd
Wastewater Application Rate (Ft/Day) I		0.020721925
Soil Pore Space (Cu Ft/Cu Ft) V		0.3
Horizontal Hydraulic Conductivity of Soil (Ft/Day) K		2.77
Depth to Saturated Zone From Bottom of Disposal Trench (Feet) H		27
Assumed Initial Depth of Saturated Zone (Feet) hi		5
Duration of Wastewater Application (Days) t		365.00
Assumed Maximum Depth of Saturated Zone (Feet) hm		9.83
b (Feet)		7.42
Vo	500	68.47
alpha	300	0.32
beta		0.16
Value of Function from Table 1		0.19
Calculated Maximum Depth of Saturated Zone (Feet) hm (Note: This value should equal the a		9.83
Calculated Maximum Height of Localized Mounding (Feet) hm-hi		4.8
Calculated Depth to Saturated Zone from Bottom of Disposal Trench (Feet) z		**22.2**

Ksat from NRCS Yolo Loam 0.57 to 2.2 in/hr =1.14 to 4.4 Used Average for Calculations

H assumed as difference of lowest elevations of dispersal field (105 contour) - creek bed (75 contour) - assumed dispersal trench depth of 3 feet.
Length and Width of Absorption Field Based on Proposed Field Layout See Sheet WW4.

Wastewater System Design Calculations - Mounding Analysis Case 4 Design Flow

The Mosaic Project
Alameda County CA

Mounding Analysis as listed in Chapter 10 OWTS Manual - Design Flow

Wastewater Design Flow

	Number	Flow Per Person		Peak Design Flow
Campers/Counselors	120	25 gpd		3,000 gpd
Day Staff	8	25 gpd		200 gpd
Care Taker/Security Residence (Bed 1-3)	3	150 gpd		450 gpd
Care Taker/Security Residence (Bed 4+)	3	75 gpd		225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Localized Mounding Using Case 4

Width of Absorption Field Area (Feet) W	100
Length of Absorption Field (Feet) L	200
Wastewater Flow (GPD) Qw	3,875 gpd
Wastewater Application Rate (Ft/Day) I	0.025902406
Horizontal Hydraulic Conductivity of Soil (Ft/Day) K	2.77
Average Thickness of Saturated Zone Perpendicular to Flow (D)	20
Lateral Flow Distance from Disposal Field to Discharge Point (feet) d	200
Height of Dispersal Point Above Downslope Outlet (feet) H	27.00
Calculated Maximum Groundwater Depth Above Outlet (feet) h	18.7
Calculated Effective Separation Distance (feet) z	**8.3**

Ksat from NRCS Yolo Loam 0.57 to 2.2 in/hr =1.1 **500**

H assumed as difference of lowest elevations of dispersal field (105 contour) - creek bed (75 contour) - assumed dispersal trench depth of 3 feet.

Wastewater System Design Calculations - Mounding Analysis Case 4 Average Flow

Mounding Analysis as listed in Chapter 10 OWTS Manual - Average Flow

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Alameda County CA

Wastewater Design Flow

	Number	Flow Per Person		Peak Design Flow
Campers/Counselors	120	25 gpd		3,000 gpd
Day Staff	8	25 gpd		200 gpd
Care Taker/Security Residence (Bed 1-3)	3	150 gpd		450 gpd
Care Taker/Security Residence (Bed 4+)	3	75 gpd		225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Localized Mounding Using Case 4

Width of Absorption Field Area (Feet) W	100
Length of Absorption Field (Feet) L	200
Wastewater Flow (GPD) Qw	3,100 gpd
Wastewater Application Rate (Ft/Day) I	0.020721925
Horizontal Hydraulic Conductivity of Soil (Ft/Day) K	2.77
Average Thickness of Saturated Zone Perpendicular to Flow (D)	20
Lateral Flow Distance from Disposal Field to Discharge Point (feet) d	200
Height of Dispersal Point Above Downslope Outlet (feet) H	27.00
Calculated Maximum Groundwater Depth Above Outlet (feet) h	15.0
Calculated Effective Separation Distance (feet) z	**12.0**

Ksat from NRCS Yolo Loam 0.57 to 2.2 in/hr =1.1 **500**

H assumed as difference of lowest elevations of dispersal field (105 contour) - creek bed (75 contour) - assumed dispersal trench depth of 3 feet.

Wastewater System Design Calculations - Nitrogen Analysis Design Flow

Nitrogen Loading Mass Balance as listed in Chapter 10 OWTS Manual - Design Flow

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Alameda County CA

Wastewater Design Flow

	Number	Flow Per Person	Nitrogen	Peak Design Flow
Campers/Counselors	120	25 gpd	<70mg/l	3,000 gpd
Day Staff	8	25 gpd	<70mg/l	200 gpd
Care Taker/Security Residence (Bed 1-3)	3	150 gpd	<70mg/l	450 gpd
Care Taker/Security Residence (Bed 4+)	3	75 gpd	<70mg/l	225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Nitrogen Loading Analysis Design Flow High

Daily Wastewater Flow (Gallons per Day) W	3,875 gpd	
Total Surface Area (Acres)	37.0 acres	
Duration of Wastewater Application (Days) t	365	
Calculated Volume of Wastewater Entering Soil (Inches per Year) I	1.41	
Total Nitrogen Concentration in Wastewater Entering System (mg/l) nw	70	
Percent of Nitrate-Nitrogen loss due to Soil Denitrification d	0	
Average Rainfall Recharge Rate (50% of Annual Rainfall Assumed) (Inches per Year) R	11	
Background Nitrate-Nitrogen[1] Concentration in Rainfall Recharge (mg/l) nb	2	
Percent Nitrogen Removal Required From Treatment System Tr	**34%**	
Calculated Average Concentration of Nitrate-Nitrogen (mg/l) nr	**7.00**	

Ref: HANTZSCHE-FINNEMORE EQUATION 500

Nitrogen Loading Analysis Design Flow High Concentration Assumption

Daily Wastewater Flow (Gallons per Day) W	3,875 gpd	
Total Surface Area (Acres)	37.0 acres	
Duration of Wastewater Application (Days) t	365	
Calculated Volume of Wastewater Entering Soil (Inches per Year) I	1.41	
Total Nitrogen Concentration in Wastewater Entering System (mg/l) nw	105	**1.5X of anticipated**
Percent of Nitrate-Nitrogen loss due to Soil Denitrification d	0	
Average Rainfall Recharge Rate[1] (50% of Annual Rainfall Assumed) (Inches per Year) R	11	
Background Nitrate-Nitrogen Concentration in Rainfall Recharge (mg/l) nb	2	
Percent Nitrogen Removal Required From Treatment System Tr	**56%**	
Calculated Average Concentration of Nitrate-Nitrogen (mg/l) nr	**7.00**	

Ref: HANTZSCHE-FINNEMORE EQUATION

1 From Attachment 6 of the Alameda County Hydrology & Hydraulics Manual and may be downloaded as a GIS file from the Alameda County Flood Control District website
https://www.cleanwaterprogram.org/images/uploads/C3TG_v6_Oct_2017_Appendix_D_Rainfall_Map.pdf

Castro Valley 22-24 inches (22 used)

Wastewater System Design Calculations - Nitrogen Analysis Average Flow

Nitrogen Loading Mass Balance as listed in Chapter 10 OWTS Manual - Average Flow

The Mosaic Project
Alameda County CA

Wastewater Design Flow

	Number	Flow Per Person	Nitrogen	Peak Design Flow
Campers/Counselors	120	25 gpd	<70mg/l	3,000 gpd
Day Staff	8	25 gpd	<70mg/l	200 gpd
Care Taker/Security Residence (Bed 1-3)	3	150 gpd	<70mg/l	450 gpd
Care Taker/Security Residence (Bed 4+)	3	75 gpd	<70mg/l	225 gpd
			Total Flow	3,875 gpd
			Average Flow	3,100 gpd

Nitrogen Loading Analysis Design Flow High

Daily Wastewater Flow (Gallons per Day) W	3,100 gpd
Total Surface Area (Acres)	37.0 acres
Duration of Wastewater Application (Days) t	365
Calculated Volume of Wastewater Entering Soil (Inches per Year) I	1.13
Total Nitrogen Concentration in Wastewater Entering System (mg/l) nw	70
Percent of Nitrate-Nitrogen loss due to Soil Denitrification d	0
Average Rainfall Recharge Rate (50% of Annual Rainfall Assumed) (Inches per Year) R	11
Background Nitrate-Nitrogen Concentration in Rainfall Recharge (mg/l) nb	2
Percent Nitrogen Removal Required From Treatment System Tr	**20%**
Calculated Average Concentration of Nitrate-Nitrogen (mg/l) nr	**7.00**

Ref: HANTZSCHE-FINNEMORE EQUATION 500

Nitrogen Loading Analysis Design Flow High Concentration Assumption

Daily Wastewater Flow (Gallons per Day) W	3,100 gpd	
Total Surface Area (Acres)	37.0 acres	
Duration of Wastewater Application (Days) t	365	
Calculated Volume of Wastewater Entering Soil (Inches per Year) I	1.13	
Total Nitrogen Concentration in Wastewater Entering System (mg/l) nw	140	**2X of anticipated**
Percent of Nitrate-Nitrogen loss due to Soil Denitrification d	0	
Average Rainfall Recharge Rate (50% of Annual Rainfall Assumed) (Inches per Year) R	11	
Background Nitrate-Nitrogen Concentration in Rainfall Recharge (mg/l) nb	2	
Percent Nitrogen Removal Required From Treatment System Tr	**60%**	
Calculated Average Concentration of Nitrate-Nitrogen (mg/l) nr	**7.00**	

Ref: HANTZSCHE-FINNEMORE EQUATION

1 From Attachment 6 of the Alameda County Hydrology & Hydraulics Manual and may be downloaded as a GIS file from the Alameda County Flood Control District website
https://www.cleanwaterprogram.org/images/uploads/C3TG_v6_Oct_2017_Appendix_D_Rainfall_Map.pdf

Castro Valley 22-24 inches (22 used)

Future Caretaker System Repair/Replacement Conceptual Wastewater System - Option 1 - Supplemental Treatment to Bottomless Sand Filter

Future Caretaker System Repair/Replacement

The Mosaic Project
Alameda County CA

Wastewater Design Flow

Care Taker/Security Residence (Bedroom)	3	150 gpd	<300mg/l	450 gpd
			Total Flow	450 gpd

Septic Tank Sizing

Septic Tank Size	Detention (Days)	3	1,350 gal

Use 1,500 Gallon Septic Tank

Secondary Treatment System (Advantex)

Design Flow		Hydraulic Loading	Square Footage Required
Peak	450 gpd	50 gpd/sf	9 sf
Average	360 gpd	25 gpd/sf	15 sf
Waste Strength			
Peak	300 mg/l	50 gpd/sf	
Average	200 mg/l	25 gpd/sf	
Cumulative Pounds of BOD5 at Design Flow	1.13 gpd/sf	lb BOD_5/day	
Cumulative Pounds of BOD5 at Average Flow	0.60 gpd/sf	lb BOD_5/day	
Design Flow Loading Rate	0.08 gpd/sf	lb $BOD_{5/day/sf}$	14 sf
Average Flow Loading Rate	0.04 gpd/sf	lb $BOD_{5/day/sf}$	15 sf

Use AXRT Treatment System with 20sf of Textile Media

Dosing Tank Sizing

Dosing Tank	Detention (Days)	1.5	675 gal

Use AXRT Treatment System Peak and Septic Tank Reserve Capacity

Minimum Dispersal Field Sizing Bottomless Sand Filter Bed

Required Capacity	450 gpd
Application Rate	1.20 gpd/sf
Bottomless Sand Filter Square Footage Required	375 sf

Uses 1.20 gpd/sf per Table 25-2 (Percolation Test Data at bottom of Filter (16 inches) is 16 min/in.

Required Capacity	450 gpd
Application Rate	1.00 gpd/sf
Bottomless Sand Filter Square Footage Required	450 sf

Assumes per 1.0 gpd/sf Table 25-2

These calculations are to demonstrate sizing for caretaker system in the event of future repair or replacement.

Option 1 - Treatment to Bottomless Sand Filter Requires 375sf to 450sf area.

Assumes per 1.20 gpd/sf Table 25-2 (Percolation Test Data at bottom of Filter (16 inches) is 16 min/in. Perc Test 3 (15 min/in.) and 4 (17min./in.)

Future Caretaker System Repair/Replacement Conceptual Wastewater System Option 2 - Treatment with 3 Foot Pressure Dosed Trenches Between Existing Trenches

Future Caretaker System Repair/Replacement

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Alameda County CA

Wastewater Design Flow

Care Taker/Security Residence (Bedroom)	3	150 gpd	<300mg/l	450 gpd
			Total Flow	450 gpd

Septic Tank Sizing

Septic Tank Size	Detention (Days)	3	1,350 gal

Use 1,500 Gallon Septic Tank

Secondary Treatment System (Advantex)

Design Flow		Hydraulic Loading	Square Footage Required
Peak	450 gpd	50 gpd/sf	9 sf
Average	360 gpd	25 gpd/sf	15 sf
Waste Strength			
Peak	300 mg/l	50 gpd/sf	
Average	200 mg/l	25 gpd/sf	
Cumulative Pounds of BOD5 at Design Flow	1.13 gpd/sf	lb BOD_5/day	
Cumulative Pounds of BOD5 at Average Flow	0.60 gpd/sf	lb BOD_5/day	
Design Flow Loading Rate	0.08 gpd/sf	lb $BOD_{5/day/sf}$	14 sf
Average Flow Loading Rate	0.04 gpd/sf	lb $BOD_{5/day/sf}$	15 sf

Use AXRT Treatment System with 20sf of Textile Media

Dosing Tank Sizing

Dosing Tank	Detention (Days)	1.5	675 gal

Use AXRT Treatment System Peak and Septic Tank Reserve Capacity

Minimum Dispersal Field Sizing Trenches

Required Capacity	450 gpd
Existing System Calculated Application Rate (see below)	0.45 gpd/sf
Dispersal Area (Using 36" wide and 28" below invert of pipe)	7.67 sf/lf
Standard Dispersal Trench Length Required	130 lf

Uses 0.45 gpd/sf per calculation of existing system sizing shown below

These calculations are to demonstrate sizing for caretaker system in the event of future repair or replacement.

Option 2 - Treatment to Pressure Dosed Trenches Requires 130 lf of 36" foot wide by 28" rock depth below pipe. 140 Lienal Feet Shown

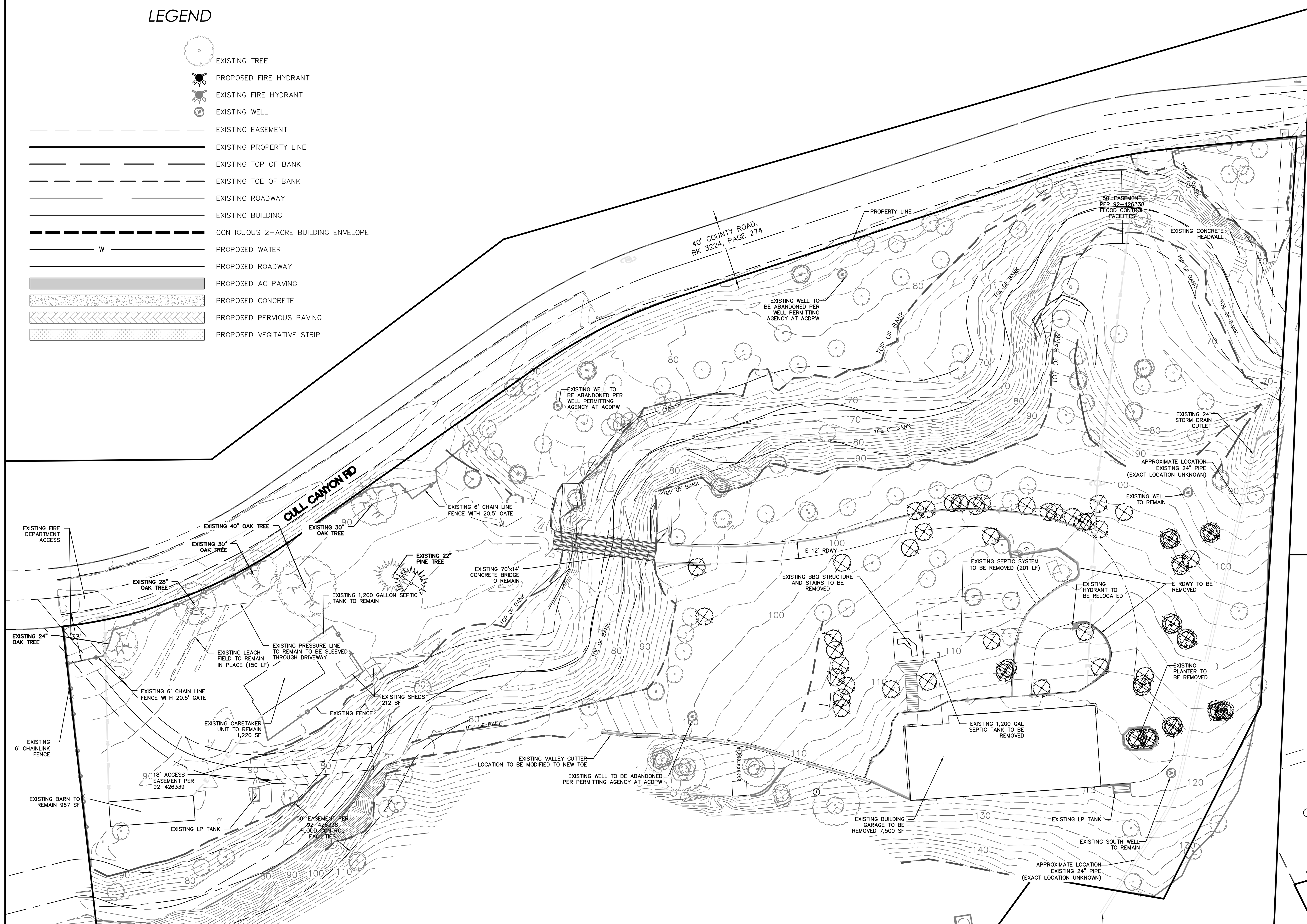
Existing System Calculated Application

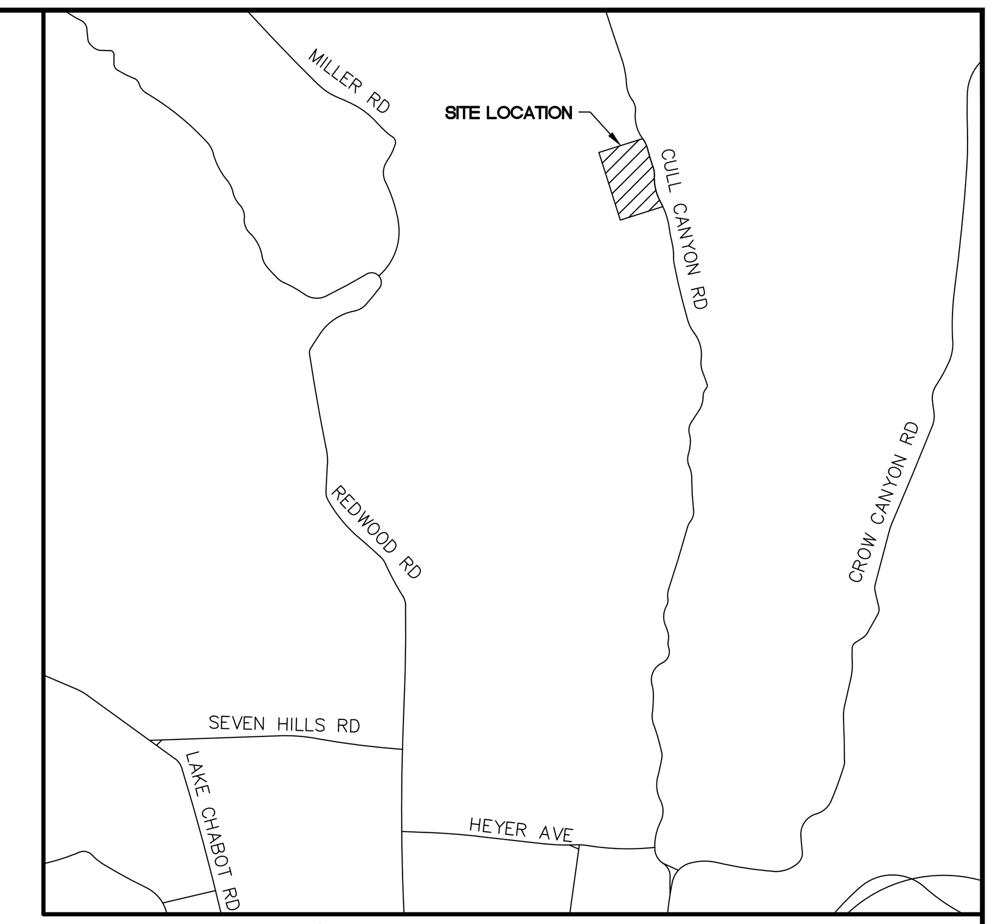
Existing Trench Data		
Total Length	150	feet
Trench Width	24	inches
Rock Depth Below Pipe	28	inches
Absorption Area per Lineal Foot	6.67	sf/lf
Total Absorption Area	1,000	sf
Design Flow	450	Gallons/day
Calculated Design Application Rate	**0.45**	**gpd/sf**

NOTE: 0.45gpd/sf equated to a percolation rate of 45 minutes per inch using Standard application rates from Table 25-1 and 69 minutes per inch for Enhanced Application Rates from Table 25-2.

LEGEND

- EXISTING TREE
- PROPOSED FIRE HYDRANT
- EXISTING FIRE HYDRANT
- EXISTING WELL
- EXISTING EASEMENT
- EXISTING PROPERTY LINE
- EXISTING TOP OF BANK
- EXISTING TOE OF BANK
- EXISTING ROADWAY
- EXISTING BUILDING
- CONTIGUOUS 2-ACRE BUILDING ENVELOPE
- PROPOSED WATER
- PROPOSED ROADWAY
- PROPOSED AC PAVING
- PROPOSED CONCRETE
- PROPOSED PERVIOUS PAVING
- PROPOSED VEGITATIVE STRIP





LOCATION MAP NTS

NOTE

THE TOPOGRAPHIC SURVEY WAS PREPARED BY GREENWOOD AND MOORE, INC, DATED NOVEMBER 05, 2019. NO LIABILITY IS ASSUMED BY NORTHSTAR FOR FEATURES THAT MAY EXIST, BUT ARE NOT SHOWN ON SAID TOPOGRAPHIC SURVEY.

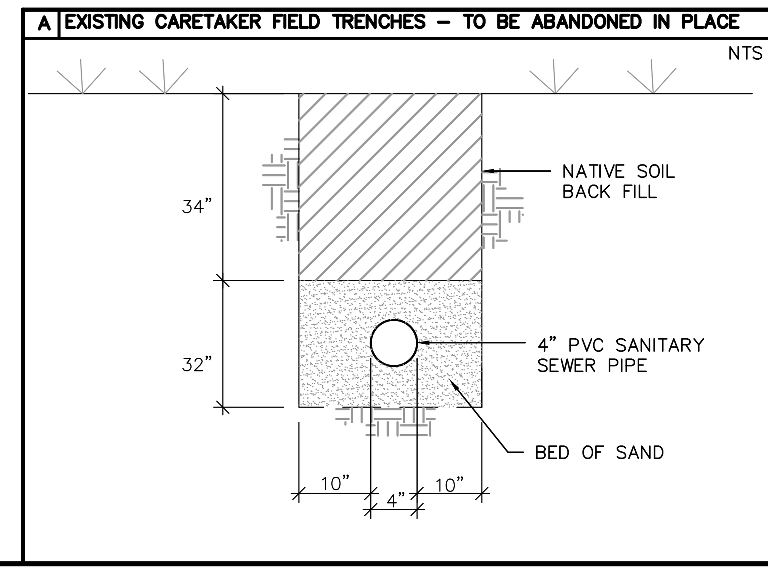
ABBREVIATIONS

BUILDING	BLDG
EXISTING	E
LIQUID PROPANE	LP
LANDSCAPE	L/S
ROADWAY	RDWY
TOP OF BANK	TOB
TEMPORARY BENCHMARK	TBM

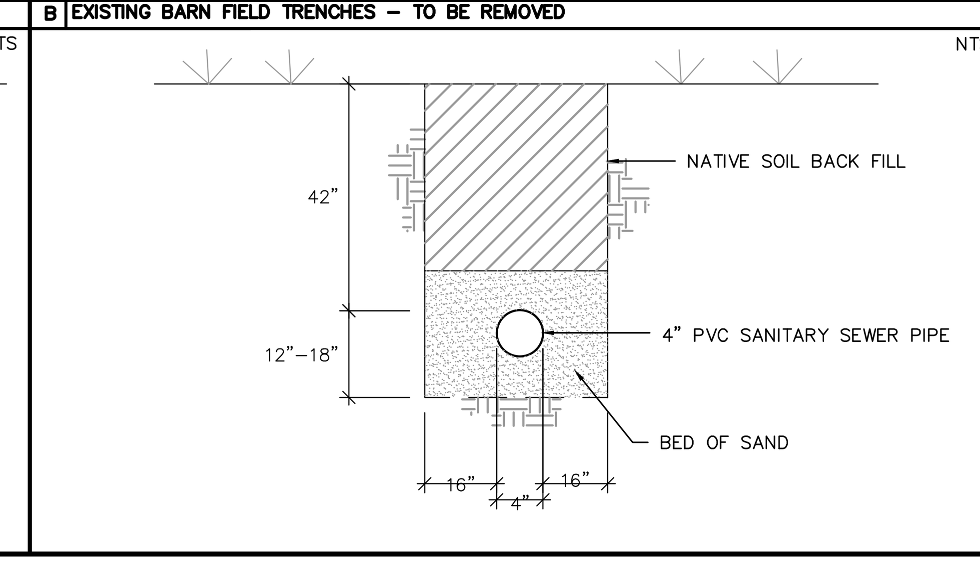
EXISTING SITE INFORMATION		
	SF	ACRE
EXISTING CARETAKER UNIT AND SHEDS (BUILDING AREA)	1432	0.03
EXISTING DISPLAY GARAGE (BUILDING AREA)	7500	0.17
EXISTING BARN (BUILDING AREA)	967	0.02
EXISTING IMPERVIOUS (NON–BUILDING AREA)	16,956	0.39
TOTAL	26,857	0.61

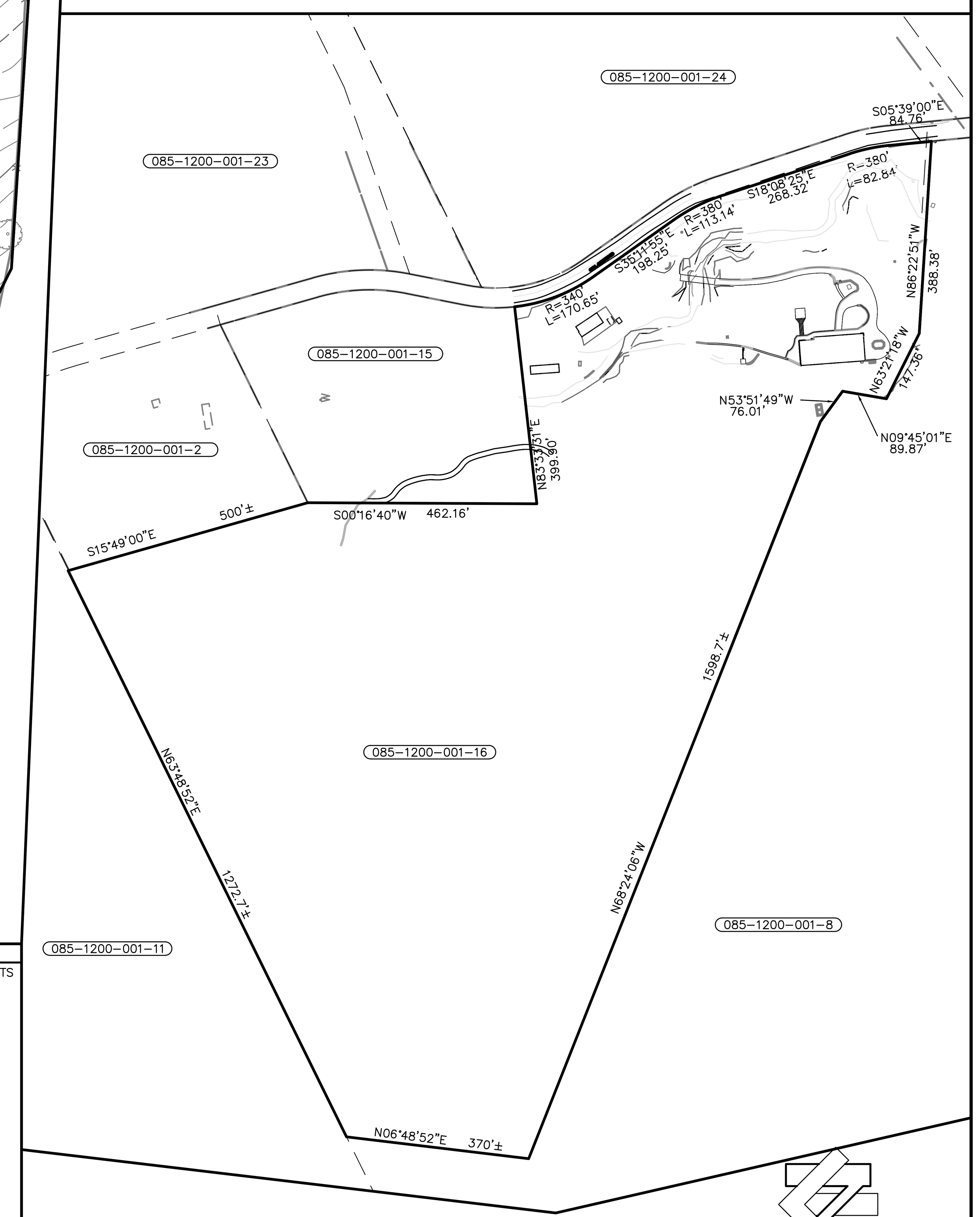
40 0 40 80

A EXISTING CARETAKER FIELD TRENCHES – TO BE ABANDONED IN PLACE



B EXISTING BARN FIELD TRENCHES – TO BE REMOVED





OVERALL PROPERTY VIEW

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Mosaic Project

Cull Canyon Rd, Castro Valley, California

Rev. Delta	Revision Description	Date

Sheet Title:	EXISTING SITE LAYOUT
Scale:	1"=40'
Status:	CUP DOCUMENTS
Drawn By:	MNL
Checked By:	MNL
Date Issued:	04/22/2024
Project No.	17-231
Sheet No.	WW1

LEGEND

- EXISTING TREE
- PROPOSED FIRE HYDRANT
- EXISTING FIRE HYDRANT
- EXISTING WELL
- EXISTING EASEMENT
- EXISTING PROPERTY LINE
- EXISTING TOP OF BANK
- EXISTING TOE OF BANK
- EXISTING ROADWAY
- EXISTING BUILDING
- CONTIGUOUS 2-ACRE BUILDING ENVELOPE
- PROPOSED 25' SETBACK
- PROPOSED 50' SETBACK
- PROPOSED 100' SETBACK
- PROPOSED 150' SETBACK
- W PROPOSED WATER
- PROPOSED ROADWAY
- PROPOSED AC PAVING
- PROPOSED CONCRETE
- PROPOSED PERVIOUS PAVING
- PROPOSED VEGITATIVE STRIP
- PROPOSED DECK

NOTE

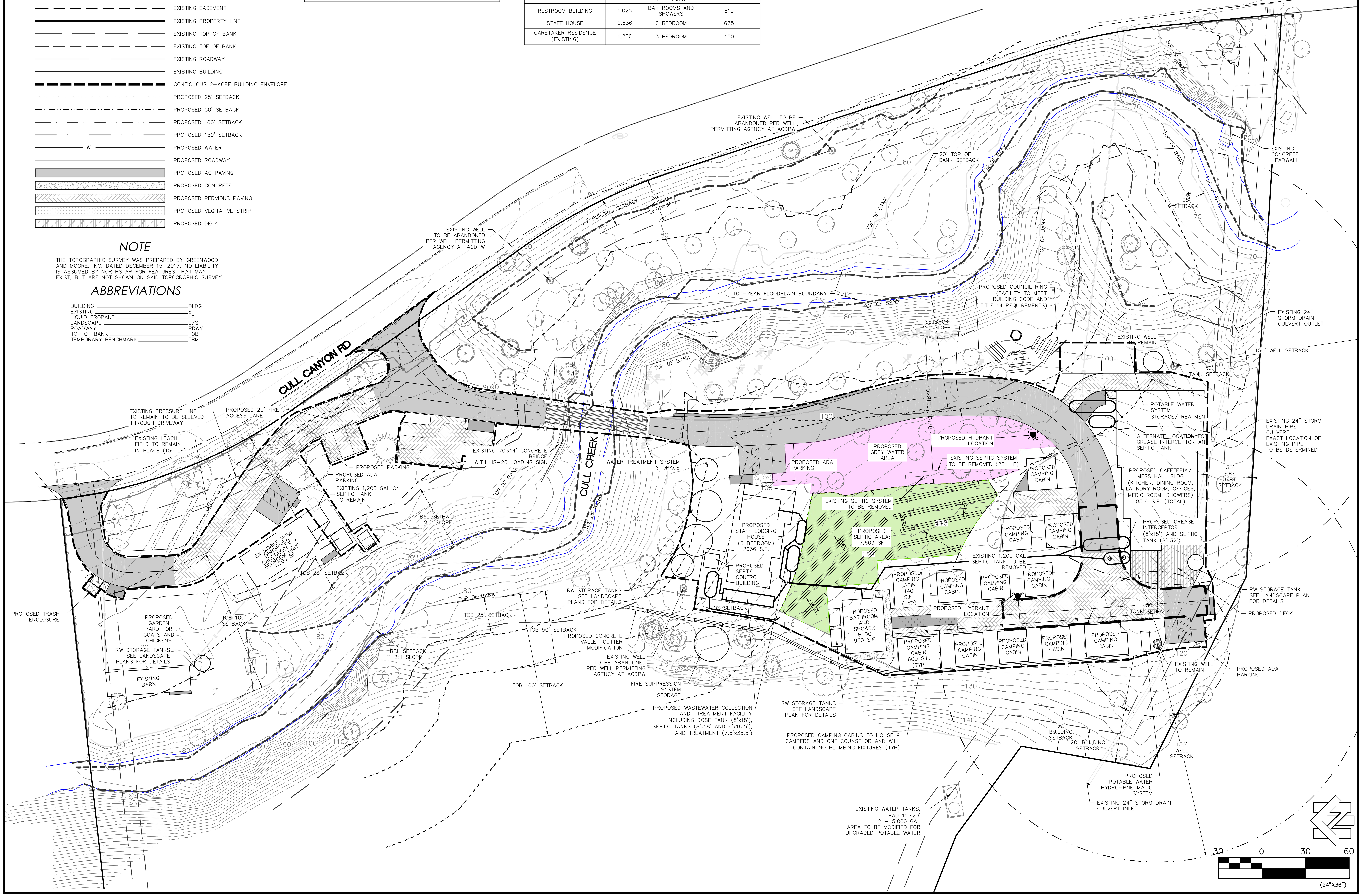
THE TOPOGRAPHIC SURVEY WAS PREPARED BY GREENWOOD AND MOORE, INC, DATED DECEMBER 15, 2017. NO LIABILITY IS ASSUMED BY NORTHSTAR FOR FEATURES THAT MAY EXIST, BUT ARE NOT SHOWN ON SAID TOPOGRAPHIC SURVEY.

ABBREVIATIONS

BUILDING	BLDG
EXISTING	E
LIQUID PROPANE	LP
LANDSCAPE	L/S
ROADWAY	RDWY
TOP OF BANK	TOB
TEMPORARY BENCHMARK	TBM

PROPOSED IMPERVIOUS AREA		
	SF	ACRE
TOTAL BUILDING AREA (PROPOSED INCLUDING CARETAKER)	18,173	0.42
TOTAL IMPERVIOUS AREA (PROPOSED)	47,503	1.09
2-ACRE BUILDING ENVELOPE	85,113	1.95

PROPOSED BUILDINGS			
	SF	BUILDING DETAILS	
		USE	MAX DAILY FLOW (GPD)
MULTI-USE BUILDING	8,506	KITCHEN AND BATHROOMS	1,890
CABINS (12@400 sf)	4,800	12 – 10 PERSONS PER CABIN	0
RESTROOM BUILDING	1,025	BATHROOMS AND SHOWERS	810
STAFF HOUSE	2,636	6 BEDROOM	675
CARETAKER RESIDENCE (EXISTING)	1,206	3 BEDROOM	450



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Mosaic Project

Cull Canyon Rd, Castro Valley, California

Rev. Delta	Revision Description	Date

Sheet Title: PROPOSED SITE LAYOUT

Scale: 1"=30'

Status: CUP DOCUMENTS

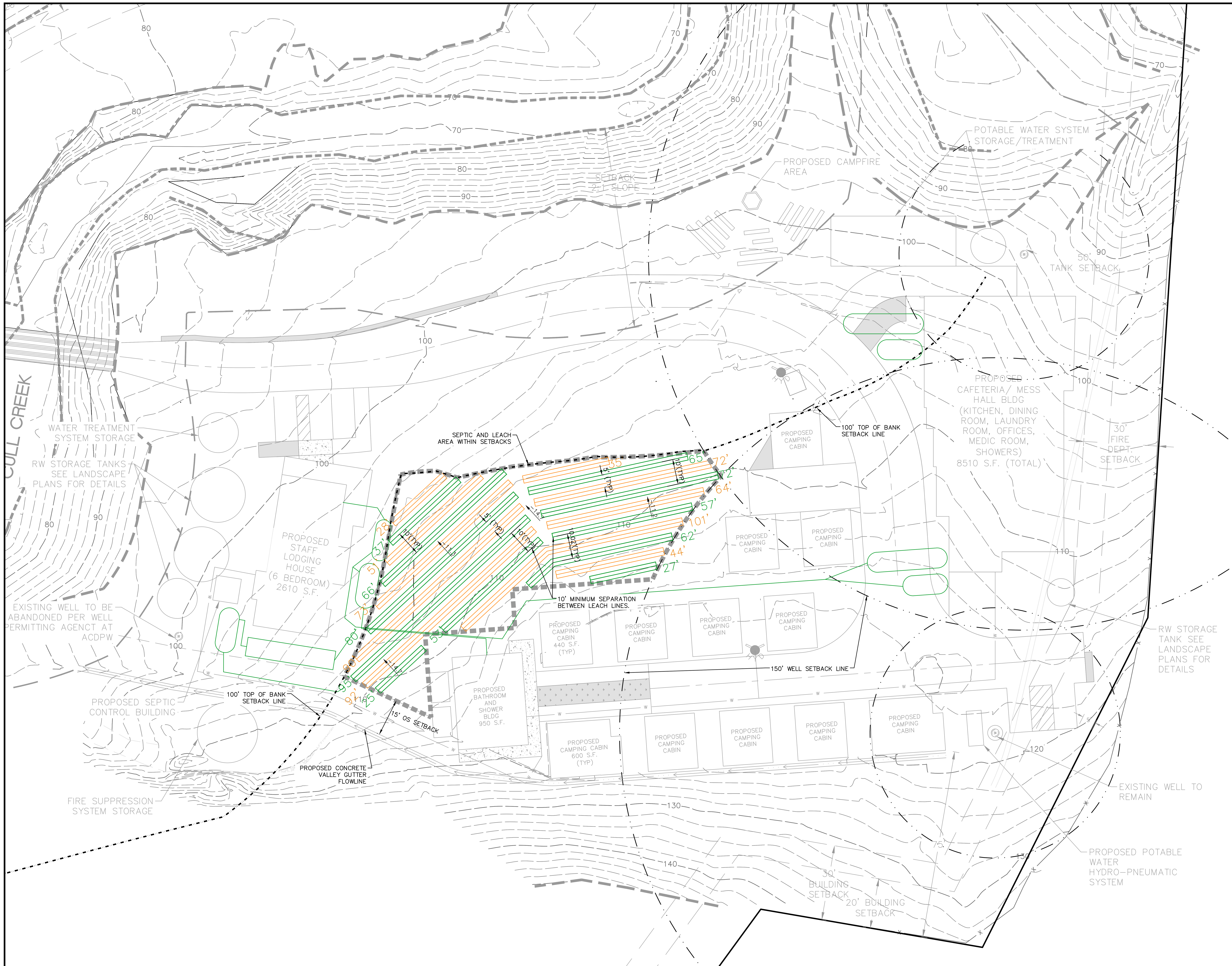
Drawn By: MNL

Checked By: MNL

Date Issued: 04/22/2024

Project No. 17-231

Sheet No. WW2

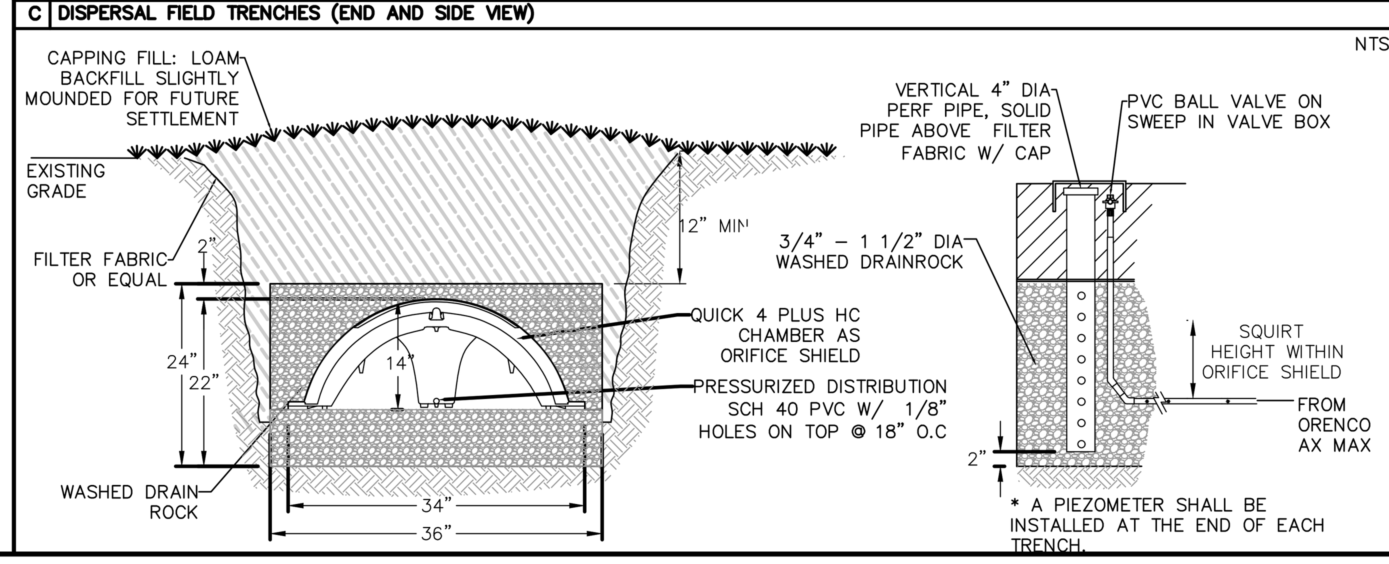


LEGEND

- EXISTING WELL
- SOIL PROFILE LOCATION
- REHS PERC. TESTING LOCATION
- 100' TOP OF BANK SETBACK
- 150' WELL SETBACK
- SEPTIC AND LEACH AREAS WITHIN SETBACKS
- PROPOSED DISPERSAL FIELD
- PROPOSED REPLACEMENT FIELD

C | DISPERSAL FIELD TRENCHES (END AND SIDE VIEW)

NTS



* A PIEZOMETER SHALL BE INSTALLED AT THE END OF EACH TRENCH.

ORIGINAL FIELD – 639 LINEAL FEET
REPLACEMENT FIELD – 650 LINEAL FEET
REQUIRED LINEAL FOOTAGE – 489 LINEAL FEET

20 0 20 40

(24"X36")

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Rev. Delta	Revision Description	Date

Sheet Title:
PROPOSED DISPERSAL LAYOUT

Scale: 1"=30'

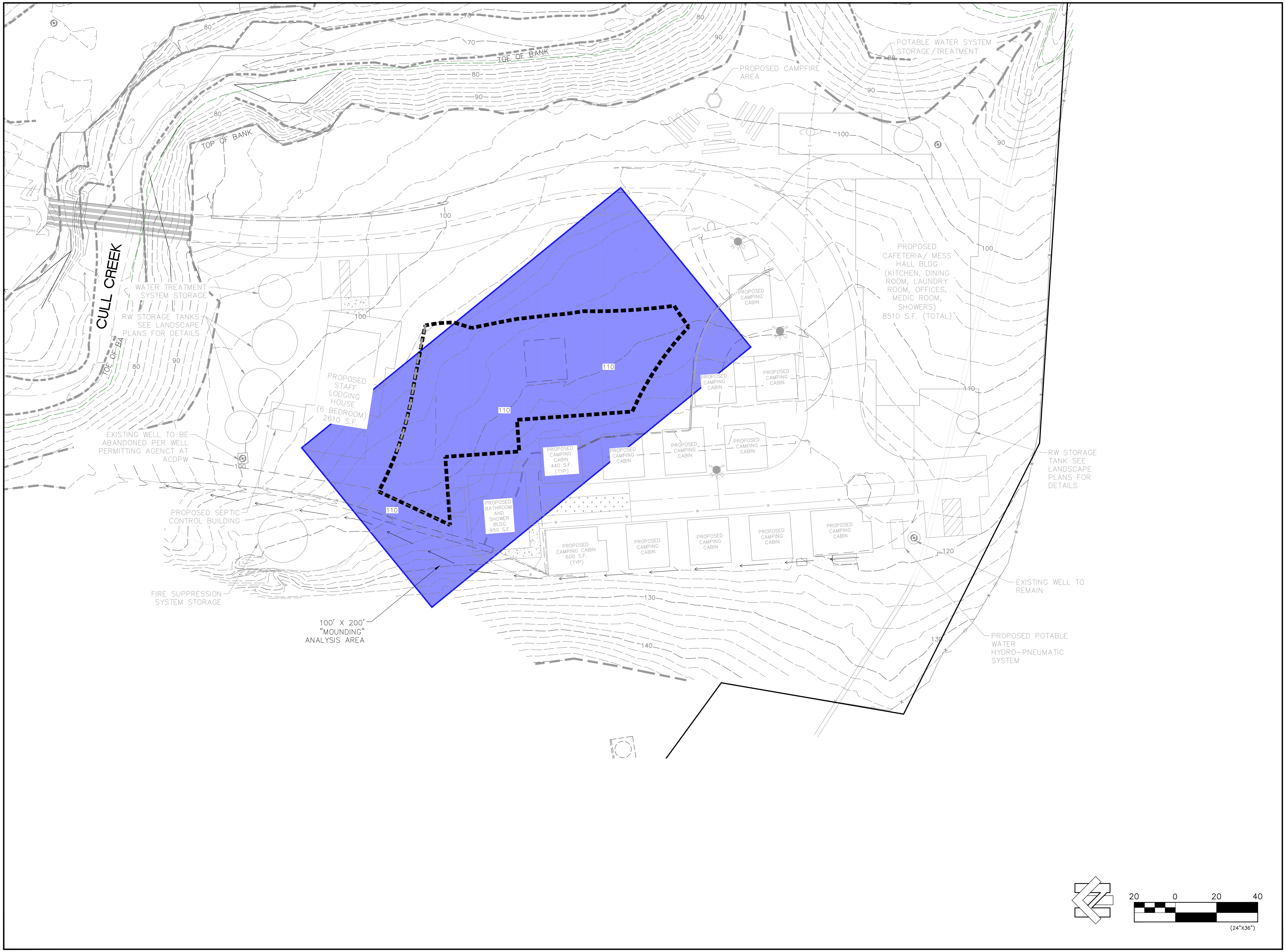
Status:
CUP DOCUMENTS

Drawn By: MNL
Checked By: MNL

Date Issued: 04/22/2024

Project No. 17-231

Sheet No.
WW3



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Rev. Delta	Revision Description	Date

Sheet Title: MOUNDING ANALYSIS EXHIBIT

Scale: 1"=20'

Status: CUP DOCUMENTS

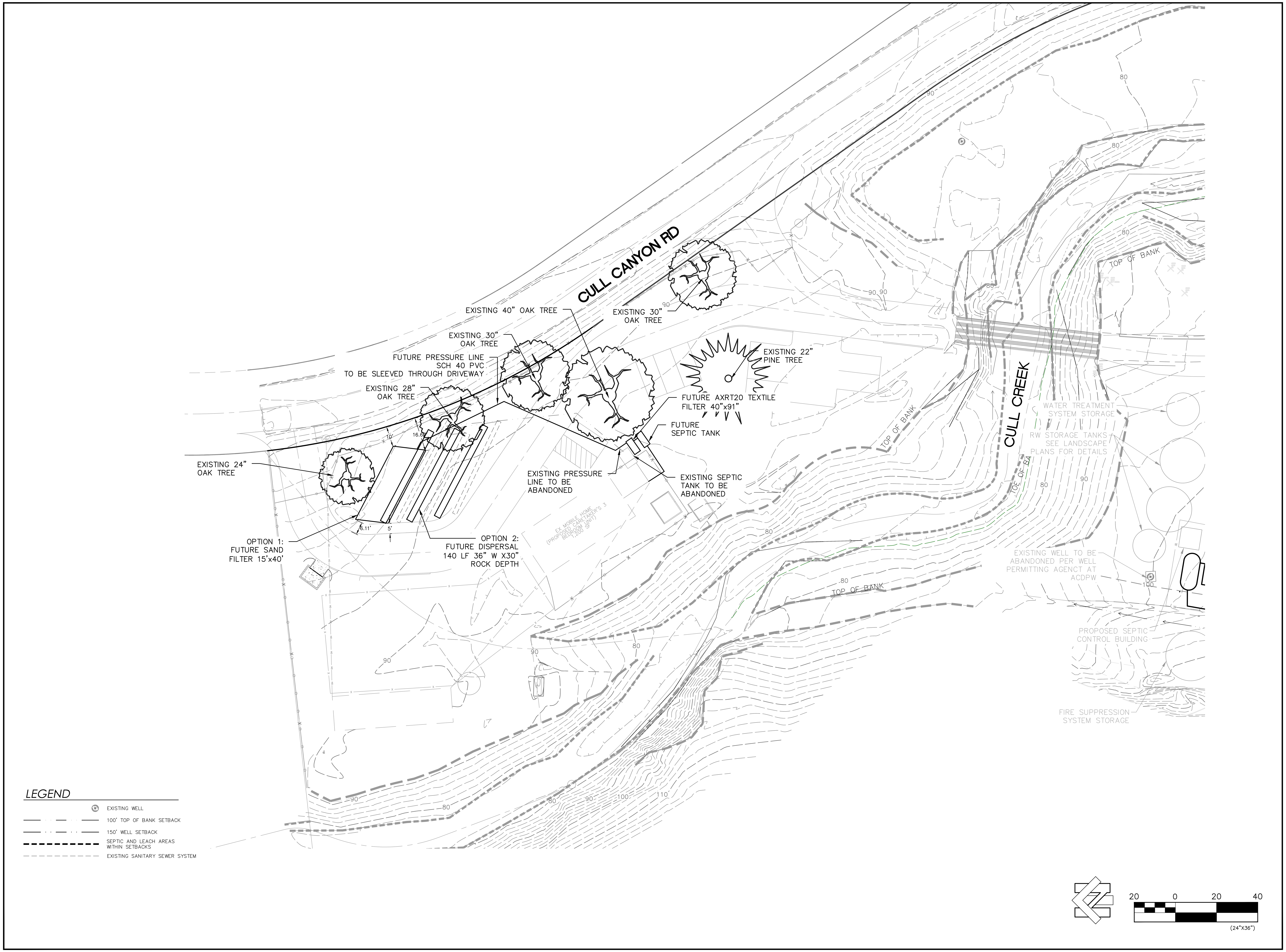
Drawn By: MNL

Checked By: MNL

Date Issued: 04/22/2024

Project No. 17-231

Sheet No. WW4



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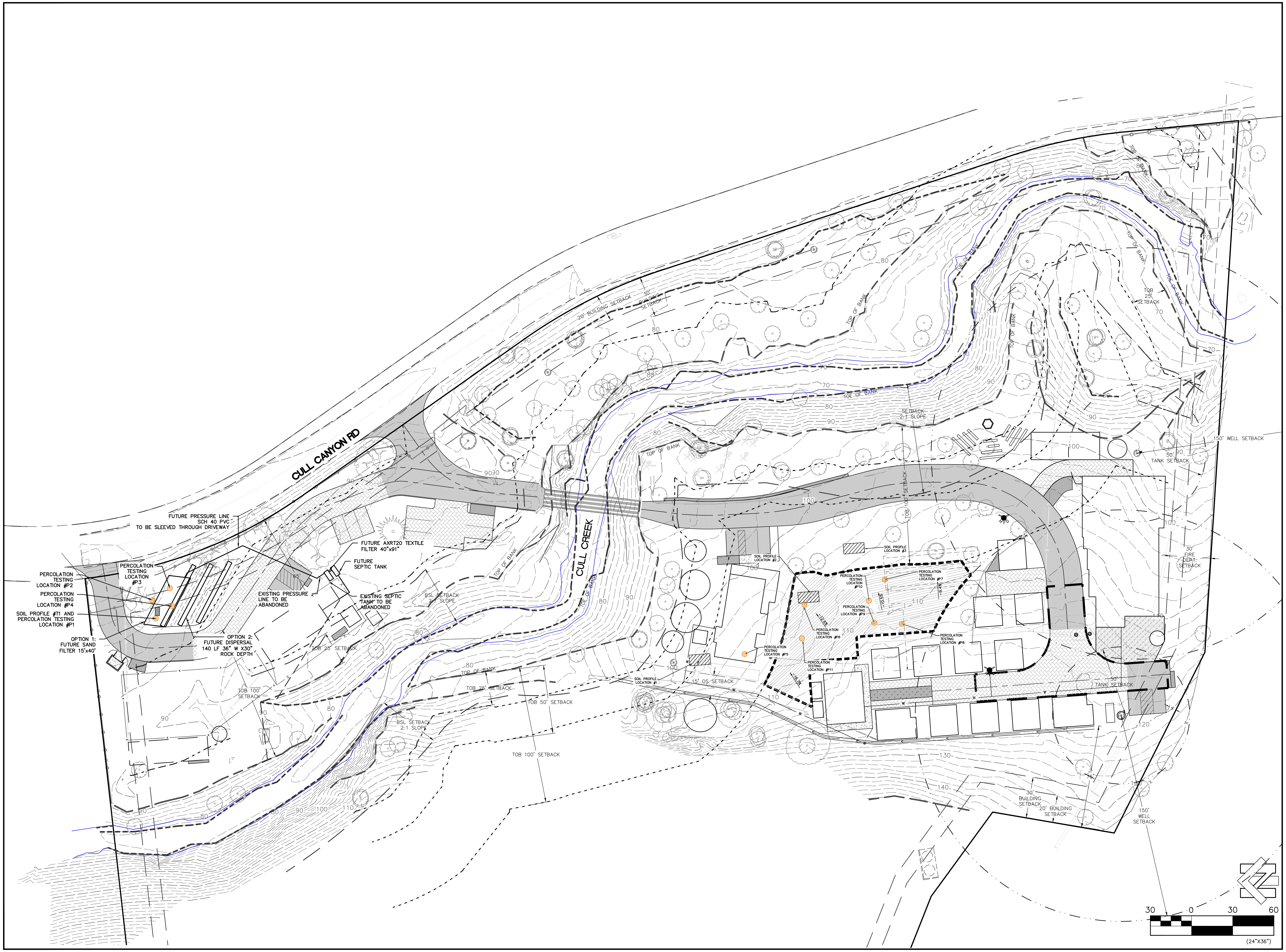
PRELIMINARY
LICENSE STAMP

Mosaic Project
Cull Canyon Rd, Castro Valley, California

Rev. Delta	Revision Description	Date

Sheet Title: FUTURE CARETAKER EXHIBIT
Scale: 1"=20'
Status: CUP DOCUMENTS
Drawn By: MNL
Checked By: MNL
Date Issued: 04/22/2024
Project No. 17-231
Sheet No. WW5



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Mosaic Project
Cull Canyon Rd, Castro Valley, California

Rev. Delta	Revision Description	Date

Sheet Title:	OVERALL SEPTIC SHEET
Scale:	1"=30'
Status:	CUP DOCUMENTS
Drawn By:	MNL
Checked By:	MNL
Date Issued:	04/22/2024
Project No.	17-231
Sheet No.	WW6

Orenco® PROTECTING THE WORLD'S WATER

May 15th, 2025

Nick Weigel
Northstar Engineering
111 Mission Ranch Blvd, Suite 100
Chico, CA 95926

Subject: Final Design Review of the Mosaic Project

Orenco Systems, Inc. ("Orenco") has received the Plans with all required fields completed (attached to this letter), a copy of the plan set showing the designed site layout and configuration plans, and other documents that comprise the Final Design for the Mosaic project. Orenco staff reviews the Final Design of all wastewater collection and treatment systems for commercial applications to ensure that the design is compliant with the most current version of the system's applicable design criteria published by Orenco for the specified parameters provided by the system's designer in the Plans. The findings and conclusions of my review of this Final Design are as follows:

Design Basis

The system has been designed for a Type 2, Campground application. Influent flow and constituent concentrations and effluent constituent concentration requirements have been provided by the system's designer on the attached Plans and were used in my review of the Final Design.

The influent flow on the Plans were not extrapolated from the metered flows from the subject site, but in our experience, they are consistent with influent flows from other, similar Campground systems that Orenco has previously observed. As such, I have no reason to doubt the accuracy of the designer's findings and assumptions as to the influent flow, and find that it was reasonable for the designer to use them as the design basis for the system.

System Design

The proposed Final Design of the system consists of the following:

Primary Treatment: (1) 20,000 U.S. Gallon Septic Tank
Secondary Treatment: (1) AX-Max225-35
Disposal: Subsurface Pressure Drainfield

Design Criteria

The applicable design criteria for this system, which I used to conduct the review of its Final Design, is revision 11.0 of document NDA-ATX-1, titled *Orenco® AdvanTex® Design Criteria, Commercial Treatment Systems*, which was published by Orenco in May 2023. A copy of the design criteria can be downloaded from Orenco's online document library at www.orenco.com/corporate/doclibrary.cfm.

Findings

The findings of my review as to whether the Final Design complies with Orenco's design criteria for treating wastewater to the effluent constituent concentration requirements are as follows:

Primary Treatment
Orenco always recommends the use of a pre-anoxic return tank and requires them on all projects that require significant nitrogen reduction. This pre-anoxic tank should be sized equal to one day at maximum day design flow and is considered part of the overall primary tank volume. The Final Design specifies the use of (1) 20,000 U.S. Gallon Primary tank for primary treatment. Using the flow data specified on the Plans the hydraulic retention times for grease capture and primary treatment calculate as follows:

Primary Tank(s) Hydraulic Retention Time (HRT)[1]				
Design Average Flow (gpd)	Design Maximum Day Flow (gpd)	Effective Combined Primary Tankage (gpd)	Avg HRT (days)	Max Day HRT (days)
3,100	3,875	20,000	6.5	5.2

[1] Design Max Day Flow is the maximum daily flow a facility is expected to receive no more than one day within any week's time.

The Primary Tank Sizing Recommendations states that the recommended primary tankage for a Campground treatment system should be sized to a minimum of 3 days of hydraulic retention time at the Design Max Day Flow. Therefore, the configuration and specifications of the primary treatment tanks in the Final Design satisfy Orenco's recommendation for primary tankage for this Campground application. The pre-anoxic tank volume is less than recommended and tank configuration should be reviewed.

Recirculation Tank — Standard Stage
The Final Design further specifies the use of an AX-Max Treatment System for recirculation and blending of the AdvanTex-treated effluent with primary tank effluent. The recirculation volume in the AX-Max System satisfies the requirement for recirculation tank volume.

Hydraulic Load — Standard Stage
The Final Design specifies the use of AX-MAX225-35, which contains a nominal surface area of 225 square feet of treatment media. Using the flow data specified on the Plans the hydraulic loading rate for the system calculates as follows:

Hydraulic Loading Rate (HLR) — Standard Stage				
Design Average Flow (gpd)	Design Maximum Day Flow (gpd)	Nominal Textile Area (sq. ft.)	Average HLR (gal. per day/sq. ft.)	Peak HLR (gal. per day/sq. ft.)
3,100	3,875	225	13.8	17.2

According to the AdvanTex System Loading Chart in the applicable design criteria, the standard AdvanTex treatment system (Stage 1) should not be hydraulically loaded more than 25 gpd/square foot at Design Average Flow or 50 gpd/square foot at Design Max Day Flow. Therefore, the specified type and number of AdvanTex units in the Final Design satisfy Orenco's design criteria to achieve the effluent quality listed in the design criteria at a 95% confidence level for this Type 2, Campground application.

Organic Load — Standard Stage
The following influent characteristics provided on the Plans were estimated and not derived from direct sampling. Even though the influent characteristics were not derived from direct sampling, the values provided are consistent with values we have seen in other, similar Type 2, Campground applications.

Influent (Primary Tank Effluent) Characteristics — Loading to Textile			
Average BOD_5 (mg/L)	Max BOD_5 (mg/L)	Average TSS (mg/L)	Max FOG (mg/L)
300	500	300	25

Based on the average influent biochemical oxygen demand (BOD5) concentration and flow data specified on the Plans, the system will receive approximately 7.8 pounds of BOD5 per day at Design Average Flow, and 16.2 pounds of BOD5 per day at Maximum Day Design Flow. Using this information, the organic loading rate of the system calculates as:

Organic Loading Rate (OLR) — Standard Stage				
Average Organic Load (lbs/day)	Maximum Organic Load (lbs/day)	Nominal Treatment Area (sq. ft.)	Average OLR (lbs BOD/sq. ft./day)	Maximum OLR (lbs BOD/sq. ft./day)
7.8	16.2	225	0.03	0.07

According to the Organic Load Requirements in the applicable design criteria, an AdvanTex Treatment System should not be organically loaded more than 0.04 pounds BOD5/square foot at Design Average Flow or 0.08 pounds BOD5/square foot at Design Peak Flow. Therefore, the specified type and number of AdvanTex units in the final design satisfy Orenco's design criteria to achieve the effluent quality listed in the design criteria at a 95% confidence level for this Type 2, Campground application.

Nitrogen Reduction — Standard Stage

According to the Nitrogen Reduction Standards in the applicable design criteria, the standard configuration of a single-stage AdvanTex Treatment System will typically achieve 50% reduction of Total Nitrogen, depending on wastewater strength and other characteristics such as BOD5, grease and oils, pH, and alkalinity concentrations, primary treatment hydraulic retention time, or temperature.

Total Nitrogen Reduction		
Total Kjeldahl Nitrogen (mg/L)	Reduction Percentage	Effluent Total Nitrogen Concentration (mg/L)
70	50%	35

Based on the average influent Total Kjeldahl Nitrogen (mg/L) concentrations and other influent constituent concentrations and flow data specified on the Plans the nitrogen loading for the standard stage calculates as follows:

Total Nitrogen Loading Rate — Standard Stage		
Total Kjeldahl Nitrogen (mg/L)	Average Nitrogen Load (lbs/day)	Total Nitrogen Loading Rate (lbs/day/square foot)
70	1.81	0.008

Conclusions

I have reviewed the Final Design of the Mosaic wastewater treatment system and have found that the design is compliant with the most current version of the system's applicable design criteria published by Orenco for the specified parameters provided by the system's designer in the Plans. In addition, I noted no anomalies in the site layout or configuration of the system during my review.

Compliance Table — Meets Minimum Design Standards	Standard Stage
Recirc Tank Size	Yes
Hydraulic Load	Yes
Organic Load	Yes
Nitrogen Load	Yes

As such, the system as designed satisfactorily complies with Orenco's design criteria to meet the following effluent limits specified in the Plans at a 95% confidence level, provided that all influent flows and constituent concentrations specified in the Plans are not exceeded:

Expected Effluent Quality	
Constituent	**Average (mg/L)**
BOD5	30
TSS	30
Total Nitrogen	50% Reduction

It is important to note that even though the AdvanTex Treatment System has the capability to meet or exceed the required treatment parameters, there is no way that Orenco can guarantee that a particular system will be operated or maintained in a manner consistent with the Final Design reviewed. Once the facility is placed into operation, the influent flows and constituent concentrations to the facility should be monitored, and if flow or any of the influent constituent concentrations exceed those listed in the Plans, measures should be taken to reduce the flow or constituent concentration to those listed. However, if additional treatment capacity becomes necessary, the system is designed to have the capability to expand to account for the new flow or constituent concentration.

Proper air ventilation is a critical feature of all commercial AdvanTex Treatment Systems, and as such, adequate active ventilation is required for all systems. In addition, please note that disposing of toxics or chemicals into the system is strictly prohibited. Examples of toxics include restaurant degreasers, cleansers, wax strippers for linoleum, carpet shampoo, waste products, or any other toxins. Furthermore, water softener brine discharge is prohibited from being discharged into the AdvanTex Treatment System. Failure to adhere to these policies will void Orenco's limited product warranties.

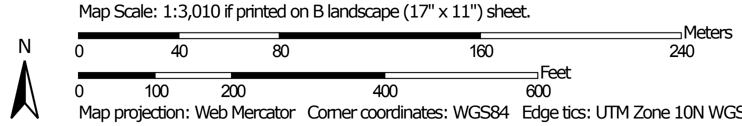
If you have any questions about my review process, findings, or conclusions, please feel free to call or e-mail me.

Sincerely,

Torrey Menne
Systems Engineer
Orenco Water
814 Airway Avenue
Sutherlin, OR 97479
P: (800) 348-9843
tmenne@orenco.com

Soil Map—Alameda Area, California
(The Mosaic Project)

Map Scale: 1:3,010 if printed on B landscape (17" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Alameda Area, California
Survey Area Data: Version 14, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 31, 2019—Jun 6, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaB	Danville silty clay loam, 3 to 10 percent slopes	8.8	13.0%
HnF2	Henneke rocky loam, eroded	5.2	7.7%
LpF2	Los Gatos-Los Osos complex, 30 to 75 percent slopes, eroded, MLRA 15	31.5	46.6%
LtD	Los Osos silty clay loam, 7 to 30 percent slopes	0.4	0.7%
LtE2	Los Osos silty clay loam, 30 to 45 percent slopes, eroded	2.4	3.5%
LtF2	Los Osos silty clay loam, 45 to 75 percent slopes, eroded	14.6	21.5%
YmB	Yolo loam, 0 to 8 percent slopes, MLRA 15	4.8	7.0%
Totals for Area of Interest		**67.6**	**100.0%**

Alameda Area, California

YmB—Yolo loam, 0 to 8 percent slopes, MLRA 15

Map Unit Setting

National map unit symbol: 2w89h
Elevation: 70 to 2,530 feet
Mean annual precipitation: 16 to 29 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 360 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Yolo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yolo

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from metamorphic and sedimentary rock

Typical profile

Ap - 0 to 8 inches: loam
A - 8 to 16 inches: loam
C1 - 16 to 24 inches: very fine sandy loam
C2 - 24 to 46 inches: fine sandy loam
C3 - 46 to 60 inches: loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.3 to 0.5 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Livermore

Percent of map unit: 5 percent
Hydric soil rating: No

Sycamore

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Alameda Area, California
Survey Area Data: Version 11, Sep 13, 2017

Alameda Area, California

DaB—Danville silty clay loam, 3 to 10 percent slopes

Map Unit Setting

National map unit symbol: hb35
Elevation: 100 to 2,500 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 240 to 360 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Danville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Danville

Setting

Landform: Fan terraces, fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone and shale

Typical profile

H1 - 0 to 21 inches: silty clay loam
H2 - 21 to 53 inches: silty clay
H3 - 53 to 80 inches: clay loam

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Los osos

Percent of map unit: 10 percent
Hydric soil rating: No

Los gatos

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Alameda Area, California
Survey Area Data: Version 14, May 29, 2020

Property Owner: THE MOSAIC PROJECT Location: 17015 Mill Canyon Rd Job #: 17-231
AP#: 85-200-1-16 Date: 10/9/2020 Weather/Lighting/Temp: OVERCAST 65

Test Pit #: #1

- Horizon Depth: 0 – 24"
- Color Chip: 7.5YR 3/2
- Rock: **0-15%** 15-35% 35-50% 50%-75% %
- Texture: LOAM
- Structure:
  - Grade: structureless weak **moderate** strong
  - Shape: platy prismatic columnar **blocky** (angular/**subanglar**) granular single grain sandy texture massive
- Sand Size: very fine **fine** medium coarse very coarse
- Consistence:
  - Dry: loose soft **slight-hard hard** very-hard Ex-hard
  - **Moist**: loose V-friable friable firm V-firm Ex-firm
  - Sticky: not s **slight s** s very s
  - Plasticity: not p **slight p** p very p
- Roots: very fine 1mm | fine 1-2mm | medium 2-5mm | coarse 5-10mm
  - Few: <10 <10 <1 <1
  - Common: 10-100 10-100 1-10 1-5
  - **Many: >100 >100 >10 >5**
- Pores: very fine .1-.5mm | fine .5-2mm | medium 2-5mm | coarse 5-10mm
  - Few: <25 <10 <1 <1
  - Common: 25-200 10-50 1-5 1-5
  - **Many: >200 >50 >5 >25**
- Boundary: abrupt <1 in | clear 1-2.5 in | **gradual 2.5-5 in** | diffuse >5 in
- Mottles: yes **no**
  - Size: fine <5mm medium 5-15mm large >15mm
  - Quantity: few 2% common 2-20% many <20%
  - Contrast: faint distinct prominent
  - Shape: streaks bands spots
- Redoximorphic Characteristics yes **no**
- Redox concen: ____nodules ____concretions ____masses ____Pore linings
- Redox depletions: iron/clay Depth to: obs/ind water
- Soil Water: Dry **Moist** Sat. Groundwater/Seepage: Yes No
- Comments: WELL PUMP TEST WATER DISCHARGE IN AREA

Test Pit #: #1

- Horizon Depth: 72" – 84"
- Color Chip: 2.5YR2/3/2
- Rock: **0-15%** 15-35% 35-50% 50%-75% %
- Texture: Silty clay loam
- Structure:
  - Grade: structureless weak moderate strong
  - Shape: platy prismatic columnar **blocky** (angular/**subanglar**) granular single grain sandy texture massive
- Sand Size: **very fine** fine medium coarse very coarse
- Consistence:
  - **Dry**: loose soft slight-hard hard **very-hard** Ex-hard
  - Moist: loose V-friable friable firm V-firm Ex-firm
  - Sticky: not s slight s **s** very s
  - Plasticity: not p slight p **p** very p
- Roots: very fine 1mm | fine 1-2mm | medium 2-5mm | coarse 5-10mm
  - **Few: <10 <10 <1 <1**
  - Common: 10-100 10-100 1-10 1-5
  - Many: >100 >100 >10 >5
- Pores: very fine .1-.5mm | fine .5-2mm | medium 2-5mm | coarse 5-10mm
  - Few: <25 **<10 <1 <1**
  - Common: **25-200** 10-50 1-5 1-5
  - Many: **>200** >50 >5 >25
- Boundary: abrupt <1 in | clear 1-2.5 in | gradual 2.5-5 in | diffuse >5 in
- Mottles: yes **no**
  - Size: fine <5mm medium 5-15mm large >15mm
  - Quantity: few 2% common 2-20% many <20%
  - Contrast: faint distinct prominent
  - Shape: streaks bands spots
- Redoximorphic Characteristics yes no Possible
- Redox concen: X nodules ____concretions ____masses ____Pore linings
- Redox depletions: **iron/clay** Depth to: obs/ind water
- Soil Water: **Dry** Moist Sat. Groundwater/Seepage: Yes No
- Comments:

Test Pit #:

- Horizon Depth: 24" – 72"
- Color Chip: 2.5YR 3/2
- Rock: **0-15%** 15-35% 35-50% 50%-75% %
- Texture: Silty clay loam
- Structure:
  - Grade: structureless weak **moderate** strong
  - Shape: platy prismatic columnar **blocky** (angular/**subanglar**) granular single grain sandy texture massive
- Sand Size: very fine **fine** medium coarse very coarse
- Consistence:
  - Dry: loose soft slight-hard **hard very-hard** Ex-hard
  - **Moist**: loose V-friable friable firm V-firm Ex-firm
  - Sticky: not s slight s **s** very s
  - Plasticity: not p slight p **p** very p
- Roots: very fine 1mm | fine 1-2mm | medium 2-5mm | coarse 5-10mm
  - Few: <10 <10 <1 <1
  - **Common: 10-100 10-100 1-10 1-5**
  - Many: >100 >100 >10 >5
- Pores: very fine .1-.5mm | fine .5-2mm | medium 2-5mm | coarse 5-10mm
  - Few: <25 <10 **<1 <1**
  - Common: 25-200 **10-50** 1-5 1-5
  - Many: **>200** >50 >5 >25
- Boundary: abrupt <1 in | clear 1-2.5 in | gradual 2.5-5 in | diffuse >5 in
- Mottles: yes **no**
  - Size: fine <5mm medium 5-15mm large >15mm
  - Quantity: few 2% common 2-20% many <20%
  - Contrast: faint distinct prominent
  - Shape: streaks bands spots
- Redoximorphic Characteristics yes **no**
- Redox concen: ____nodules ____concretions ____masses ____Pore linings
- Redox depletions: iron/clay Depth to: obs/ind water
- Soil Water: Dry ~~Moist~~ Sat. Groundwater/Seepage: Yes No
- Comments:

Test Pit #:

- Horizon Depth: #1 84" – 121"
- Color Chip:
- Rock: **0-15%** 15-35% 35-50% 50%-75% %
- Texture: Silty clay loam
- Structure:
  - Grade: structureless weak moderate strong
  - Shape: platy prismatic columnar **blocky** (angular/**subanglar**) granular single grain sandy texture massive
- Sand Size: very fine **fine** medium coarse very coarse
- Consistence:
  - Dry: loose soft slight-hard **hard very-hard** Ex-hard
  - Moist: loose V-friable friable firm V-firm Ex-firm
  - Sticky: not s slight s **s** very s
  - Plasticity: not p slight p **p** very p
- Roots: very fine 1mm | fine 1-2mm | medium 2-5mm | coarse 5-10mm
  - **Few: <10 <10 <1 <1**
  - Common: 10-100 10-100 1-10 1-5
  - Many: >100 >100 >10 >5
- Pores: very fine .1-.5mm | fine .5-2mm | medium 2-5mm | coarse 5-10mm
  - **Few: <25 <10 <1 <1**
  - Common: 25-200 10-50 1-5 1-5
  - Many: >200 >50 >5 >25
- Boundary: abrupt <1 in | clear 1-2.5 in | gradual 2.5-5 in | **diffuse >5 in**
- Mottles: yes **no**
  - Size: fine <5mm medium 5-15mm large >15mm
  - Quantity: few 2% common 2-20% many <20%
  - Contrast: faint distinct prominent
  - Shape: streaks bands spots
- Redoximorphic Characteristics yes no Possible
- Redox concen: X nodules ____concretions ____masses ____Pore linings
- Redox depletions: **iron/clay** Depth to: obs/ind water
- Soil Water: **Dry** Moist Sat. Groundwater/Seepage: Yes No
- Comments:

Property Owner: THE MOSAIC PROJECT Location: 17015 Cull Canyon Rd Job #: 17-231
AP#: 85-1200-1-16 Date: 10/9/2020 Weather/Lighting/Temp: OVERCAST / 65

Test Pit #: #1

Horizon Depth: 0-48"
Color Chip: 7.5YR 3/3
Rock: **0-15%** 15-35% 35-50% 50%-75% %
Texture: CLAY LOAM
Structure:
Grade: structureless weak **moderate** strong
Shape: platy prismatic columnar
blocky (angular/**subanglar**) granular single grain
sandy texture massive
Sand Size: very fine **fine** medium coarse very coarse
Consistence:
Dry: loose soft **slight-hard** **hard** very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s **slight s** s very s
Plasticity: not p **slight p** p very p

Roots:	very fine 1mm	fine 1-2mm	medium 2-5mm	coarse 5-10mm
Few:	<10	<10	<1	<1
Common:	**10-100**	**10-100**	**1-10**	**1-5**
Many:	**>100**	**>100**	**>10**	**>5**

Pores:	very fine .1-.5mm	fine .5-2mm	medium 2-5mm	coarse 5-10mm
Few:	**<25**	**<10**	**<1**	**<1**
Common:	**25-200**	**10-50**	**1-5**	**1-5**
Many:	>200	>50	>5	>25

Boundary: abrupt <1 in clear 1-2.5 in gradual 2.5-5 in **diffuse >5 in**
Mottles: yes **no**
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no Possible localized @48"+
Redox concen: X nodules ___ concretions ___ masses ___ Pore linings
Redox depletions: **iron/clay** Depth to: obs/ind ___ water
Soil Water: **Dry** Moist Sat. Groundwater/Seepage: Yes No
Comments:

Test Pit #: #2

Horizon Depth: 48"-111"
Color Chip: 7.5YR 3/2
Rock: **0-15%** 15-35% 35-50% 50%-75% %
Texture: silty clay loam
Structure:
Grade: structureless weak **moderate** strong
Shape: platy prismatic columnar
blocky (**angular/subanglar**) granular single grain
sandy texture massive
Sand Size: very fine **fine** medium coarse very coarse
Consistence:
Dry: loose soft slight-hard **hard** **very-hard** Ex-hard
Moist: loose V-friable friable **firm** **V-firm** Ex-firm
Sticky: not s slight s **s** very s
Plasticity: not p slight p **p** very p

Roots:	very fine 1mm	fine 1-2mm	medium 2-5mm	coarse 5-10mm
Few:	**<10**	**<10**	**<1**	**<1**
Common:	**10-100**	**10-100**	**1-10**	**1-5**
Many:	>100	>100	>10	>5

Pores:	very fine .1-.5mm	fine .5-2mm	medium 2-5mm	coarse 5-10mm
Few:	**<25**	**<10**	**<1**	**<1**
Common:	**25-200**	**10-50**	**1-5**	**1-5**
Many:	>200	>50	>5	>25

Boundary: abrupt <1 in clear 1-2.5 in gradual 2.5-5 in **diffuse >5 in**
Mottles: yes **no**
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no Possible localized
Redox concen: X nodules ___ concretions ___ masses ___ Pore linings
Redox depletions: **iron/clay** Depth to: obs/ind ___ water
Soil Water: Dry **Moist** Sat. Groundwater/Seepage: Yes No
Comments:

Test Pit #: 2

Horizon Depth:
Color Chip:
Rock: 0-15% 15-35% 35-50% 50%-75% %
Texture:
Structure:
Grade: structureless weak moderate strong
Shape: platy prismatic columnar
blocky (angular/subanglar) granular single grain
sandy texture massive
Sand Size: very fine fine medium coarse very coarse
Consistence:
Dry: loose soft slight-hard hard very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s slight s s very s
Plasticity: not p slight p p very p

Roots:	very fine 1mm	fine 1-2mm	medium 2-5mm	coarse 5-10mm
Few:	<10	<10	<1	<1
Common:	10-100	10-100	1-10	1-5
Many:	>100	>100	>10	>5

Pores:	very fine .1-.5mm	fine .5-2mm	medium 2-5mm	coarse 5-10mm
Few:	<25	<10	<1	<1
Common:	25-200	10-50	1-5	1-5
Many:	>200	>50	>5	>25

Boundary: abrupt <1 in clear 1-2.5 in gradual 2.5-5 in diffuse >5 in
Mottles: yes no
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no
Redox concen: ___ nodules ___ concretions ___ masses ___ Pore linings
Redox depletions: iron/clay Depth to: obs/ind ___ water
Soil Water: Dry Moist Sat. Groundwater/Seepage: Yes No
Comments:

Test Pit #: 2

Horizon Depth:
Color Chip:
Rock: 0-15% 15-35% 35-50% 50%-75% %
Texture:
Structure:
Grade: structureless weak moderate strong
Shape: platy prismatic columnar
blocky (angular/subanglar) granular single grain
sandy texture massive
Sand Size: very fine fine medium coarse very coarse
Consistence:
Dry: loose soft slight-hard hard very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s slight s s very s
Plasticity: not p slight p p very p

Roots:	very fine 1mm	fine 1-2mm	medium 2-5mm	coarse 5-10mm
Few:	<10	<10	<1	<1
Common:	10-100	10-100	1-10	1-5
Many:	>100	>100	>10	>5

Pores:	very fine .1-.5mm	fine .5-2mm	medium 2-5mm	coarse 5-10mm
Few:	<25	<10	<1	<1
Common:	25-200	10-50	1-5	1-5
Many:	>200	>50	>5	>25

Boundary: abrupt <1 in clear 1-2.5 in gradual 2.5-5 in diffuse >5 in
Mottles: yes no
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no
Redox concen: ___ nodules ___ concretions ___ masses ___ Pore linings
Redox depletions: iron/clay Depth to: obs/ind ___ water
Soil Water: Dry Moist Sat. Groundwater/Seepage: Yes No
Comments:

Property Owner: THE MOSAIC PROJECT Location: 17015 Cull Canyon Rd Job #: 17-231
AP#: 85-1290-1-16 Date: 10/9/2020 Weather/Lighting/Temp: Overcast 65

Test Pit #: 3
Horizon Depth: 0-18"
Color Chip: 7.5YR 3/2
Rock: 0-15% 15-35% 35-50% 50% -75% %
Texture: Loam
Structure:
Grade: structureless weak moderate strong
Shape: platy prismatic columnar
blocky (angular/subanglar) granular single grain
sandy texture massive
Sand Size: very fine fine medium coarse very coarse
Consistence:
Dry: loose soft slight-hard hard very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s slight s s very s
Plasticity: not p slight p p very p

Roots:	very fine	fine	medium	coarse
	1mm	1-2mm	2-5mm	5-10mm
Few:	<10	<10	<1	<1
Common:	10-100	10-100	1-10	1-5
Many:	>100	>100	>10	>5

Pores:	very fine	fine	medium	coarse
	.1-.5mm	.5-2mm	2-5mm	5-10mm
Few:	<25	<10	<1	<1
Common:	25-200	10-50	1-5	1-5
Many:	>200	>50	>5	>25

Boundary:	abrupt	clear	gradual	diffuse
	<1 in	1-2.5 in	2.5-5 in	>5 in

Mottles: yes no
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no
Redox concen: ____nodules____concretions____masses____Pore linings
Redox depletions: iron/clay Depth to: obs/ind ____ water ____
Soil Water: Dry Moist Sat. Groundwater/Seepage: Yes No
Comments:

Test Pit #: 3
Horizon Depth: #3 24"-86"
Color Chip: 2.5YR 3/2
Rock: 0-15% 15-35% 35-50% 50% -75% %
Texture: Silty clay loam
Structure:
Grade: structureless weak moderate strong
Shape: platy prismatic columnar
blocky (angular/subanglar) granular single grain
sandy texture massive
Sand Size: very fine fine medium coarse very coarse
Consistence:
Dry: loose soft slight-hard hard very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s slight s s very s
Plasticity: not p slight p p very p

Roots:	very fine	fine	medium	coarse
	1mm	1-2mm	2-5mm	5-10mm
Few:	<10	<10	<1	<1
Common:	10-100	10-100	1-10	1-5
Many:	>100	>100	>10	>5

Pores:	very fine	fine	medium	coarse
	.1-.5mm	.5-2mm	2-5mm	5-10mm
Few:	<25	<10	<1	<1
Common:	25-200	10-50	1-5	1-5
Many:	>200	>50	>5	>25

Boundary:	abrupt	clear	gradual	diffuse
	<1 in	1-2.5 in	2.5-5 in	>5 in

Mottles: yes no
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no Possible
Redox concen: ✓ nodules____concretions____masses____Pore linings
Redox depletions: iron/clay Depth to: obs/ind 76" water —
Soil Water: Dry Moist Sat. Groundwater/Seepage: Yes No
Comments:

Test Pit #: 3
Horizon Depth: 18"-24"
Color Chip: 7.5YR 3/2
Rock: 0-15% 15-35% 35-50% 50% -75% %
Texture: Silty clay loam
Structure:
Grade: structureless weak moderate strong
Shape: platy prismatic columnar
blocky (angular/subanglar) granular single grain
sandy texture massive
Sand Size: very fine fine medium coarse very coarse
Consistence:
Dry: loose soft slight-hard hard very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s slight s s very s
Plasticity: not p slight p p very p

Roots:	very fine	fine	medium	coarse
	1mm	1-2mm	2-5mm	5-10mm
Few:	<10	<10	<1	<1
Common:	10-100	10-100	1-10	1-5
Many:	>100	>100	>10	>5

Pores:	very fine	fine	medium	coarse
	.1-.5mm	.5-2mm	2-5mm	5-10mm
Few:	<25	<10	<1	<1
Common:	25-200	10-50	1-5	1-5
Many:	>200	>50	>5	>25

Boundary:	abrupt	clear	gradual	diffuse
	<1 in	1-2.5 in	2.5-5 in	>5 in

Mottles: yes no
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics ? yes no
Redox concen: ____nodules____concretions____masses____Pore linings
Redox depletions: iron/clay Depth to: obs/ind ____ water ____
Soil Water: Dry Moist Sat. Groundwater/Seepage: Yes No
Comments:

Test Pit #:
Horizon Depth:
Color Chip:
Rock: 0-15% 15-35% 35-50% 50% -75% %
Texture:
Structure:
Grade: structureless weak moderate strong
Shape: platy prismatic columnar
blocky (angular/subanglar) granular single grain
sandy texture massive
Sand Size: very fine fine medium coarse very coarse
Consistence:
Dry: loose soft slight-hard hard very-hard Ex-hard
Moist: loose V-friable friable firm V-firm Ex-firm
Sticky: not s slight s s very s
Plasticity: not p slight p p very p

Roots:	very fine	fine	medium	coarse
	1mm	1-2mm	2-5mm	5-10mm
Few:	<10	<10	<1	<1
Common:	10-100	10-100	1-10	1-5
Many:	>100	>100	>10	>5

Pores:	very fine	fine	medium	coarse
	.1-.5mm	.5-2mm	2-5mm	5-10mm
Few:	<25	<10	<1	<1
Common:	25-200	10-50	1-5	1-5
Many:	>200	>50	>5	>25

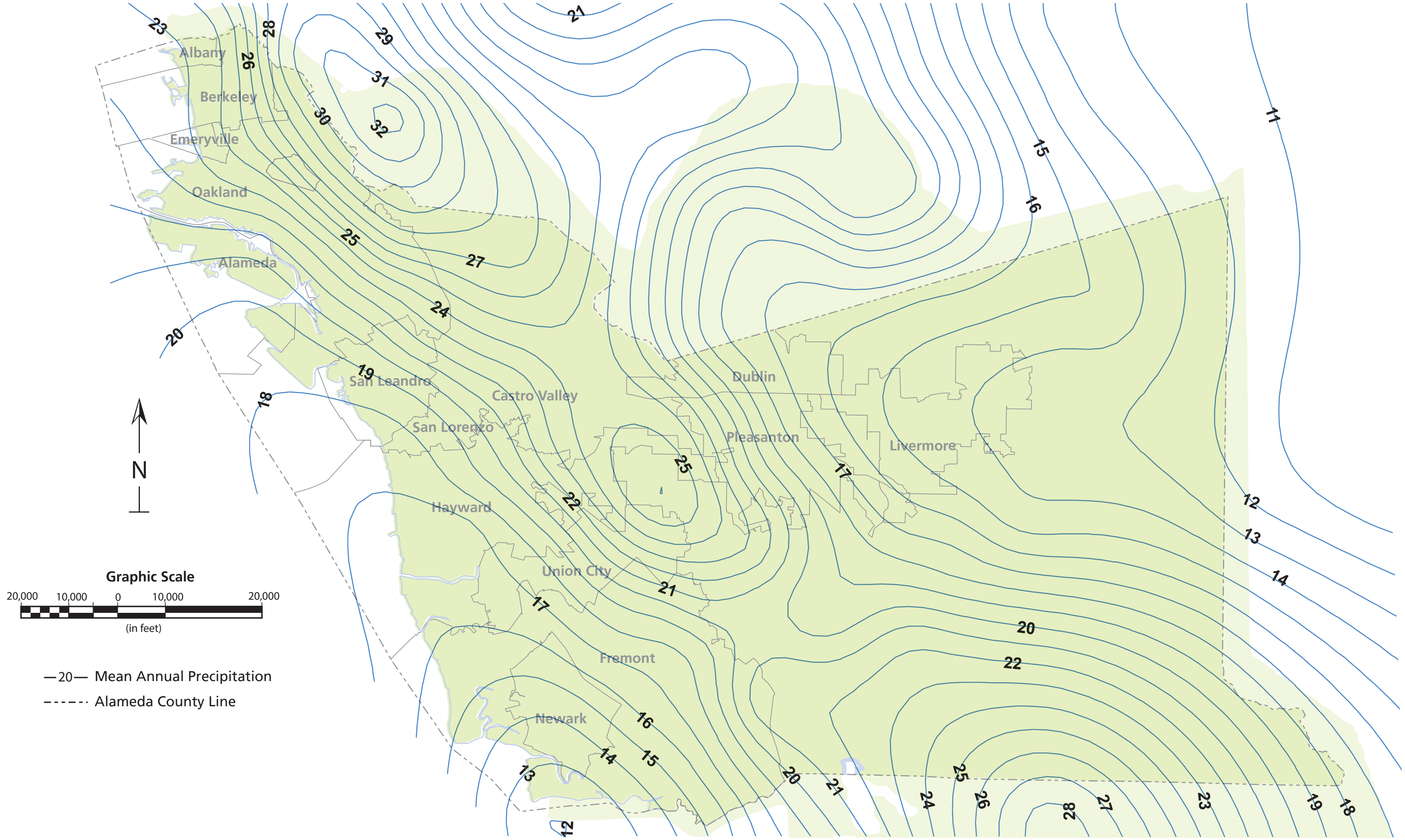
Boundary:	abrupt	clear	gradual	diffuse
	<1 in	1-2.5 in	2.5-5 in	>5 in

Mottles: yes no
Size: fine <5mm medium 5-15mm large >15mm
Quantity: few 2% common 2-20% many <20%
Contrast: faint distinct prominent
Shape: streaks bands spots
Redoximorphic Characteristics yes no
Redox concen: ____nodules____concretions____masses____Pore linings
Redox depletions: iron/clay Depth to: obs/ind ____ water ____
Soil Water: Dry Moist Sat. Groundwater/Seepage: Yes No
Comments:

Appendix

D

Mean Annual Precipitation Map: Alameda County



This map is Attachment 6 of the Alameda County Hydrology & Hydraulics Manual and may be downloaded as a GIS file from the Alameda County Flood Control District website.

(District 2011)

Alameda County Flood Control & Water Conservation District

Mean Annual Precipitation

North Coast RWQCB

SECTION III

METHODOLOGIES FOR ASSESSMENT OF CUMULATIVE IMPACTS

Standard siting and design criteria for on-site sewage disposal systems are mainly for the purpose of protecting water supplies and public health from the standpoint of bacterial contamination and disease transmission. The primary objective is to assure that inadequately treated sewage effluent does not discharge to the surface of the ground or enter useable groundwaters. Individual septic tank/soil absorption systems are generally evaluated independently of one another. The effects of many systems in a concentrated area are not directly taken into account. The purpose of this section is to propose various procedures and criteria that can be utilized to examine the potential cumulative impacts of on-site sewage disposal practices.

The methodologies presented in this section are aimed at providing simplified, yet technically sound, assessment tools for use by the Regional Board and local health and planning officials in their review of land use plans and specific development proposals. While the results of these analyses may influence the siting or design of systems for individual residences, it is not anticipated that they would be exercised by local health departments in the routine review and permitting of sewage disposal systems for single family dwellings. The main usefulness is likely to be in reviewing and setting standards for major subdivisions, large common on-site systems, and zoning and land use plans.

The presentation is divided into several sections addressing the following cumulative impact issues:

- *Groundwater Hydraulics;*
- *Salt Accumulation in Groundwater;*
- *Nitrate Accumulation in Groundwater;*
- *Nutrient Additions to Surface Waters;*
- *Bacteriological-Public Health Impacts.*

The main focus of the assessment methodologies is on the projection of areawide water quality and public health effects, which is the overall objective of this study. Where appropriate, additional techniques for examining localized impacts are presented as an indication of more site-specific analyses that may be required in certain instances.

It should be recognized further that the procedures and criteria presented here are of a general nature. They do not attempt to cover the many special considerations relative to hydrology, geology, water quality, etc., that may need to be addressed in follow-up detailed studies of individual impact areas. The methodologies are offered as initial guidelines, with the expectation that alternative analytical approaches and refinements may evolve as additional experience is gained. At this time, they may be most useful in establishing an orderly review process and reducing the need for individual and repititious research with each new development proposal or land use decision.

GROUNDWATER HYDRAULICS

Problem Overview

The introduction of wastewater into the soil by means of on-site systems has a surcharging effect on the groundwater system which is not necessarily addressed by standard siting and design criteria. The occurrence of long-term groundwater hydraulic problems in any particular instance depends upon the ability of the soil and groundwater system to accept and disperse the added wastewater loading. The specific areawide and localized concerns are briefly as follows:

(1) The potential areawide problem is that of an overall rise in groundwater levels in a particular area due to the hydraulic loading from large numbers of systems. A general rise of the water table occurring over all or portions of a development area would effectively reduce the amount of unsaturated soil available for wastewater renovation.

(2) The potential localized problem is that of hydraulic mounding immediately beneath the disposal field. The rise of the groundwater table in response to wastewater loading will reduce the effective "depth to groundwater" and likewise the filtering potential of the soil. In the extreme case, mounding of groundwater may reach as high as the leaching trenches, (a) resulting in direct introduction of sewage effluent into groundwater, and (b) promoting anaerobic soil conditions, clogging of infiltrative surfaces and premature system failure.

An additional consideration in regard to groundwater hydraulics is the relative proportion of wastewater loading in comparison with normal background amounts of rainfall percolation (recharge) in the project area. As will be discussed later, this determines the effective initial dilution ratio, and, in the case of conservative substances, controls the quality of combined wastewater-rainfall percolate eventually reaching groundwaters.

In developing workable assessment approaches to these problems it must be recognized that the soil and groundwater conditions at any particular site will be extremely complex and differ markedly from one site to the next. A highly accurate scientific analysis cannot be made for each site without investing significant time and money, and even then all uncertainties will not necessarily be eliminated. The approaches outlined here are aimed at defining general types of conditions likely to be encountered, and providing simplifying assumptions and analytical tools to make reliable assessments needed for regulatory, planning and design decisions.

Areawide Groundwater Effects

Evaluation of potential areawide influences on groundwater from on-site systems should focus on the water balance and comparison of wastewater additions with natural inputs to the groundwater system. Figure 1 provides a schematic summary of the steps and typical computations involved. Discussion of the various elements and the key assumptions and data needs is provided below.

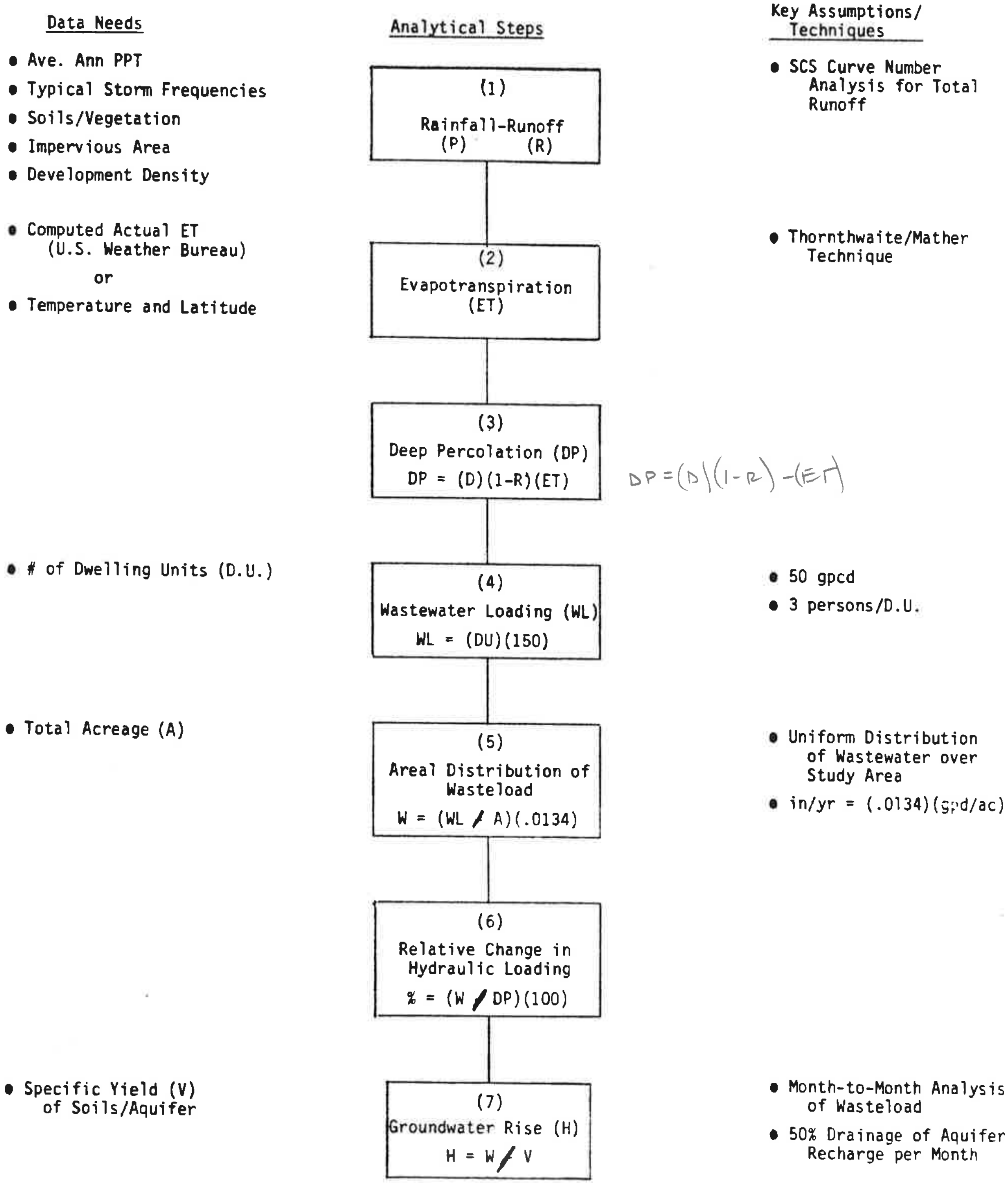
Step 1: Rainfall-Runoff

The first step in evaluating the water balance is determining rainfall and runoff amounts for the project area. Average yearly rainfall should be estimated from long-term weather data. Various methods are available to estimate runoff amounts. A convenient and reliable method is that developed and used widely by the USDA Soil Conservation Service (U.S. SCS, 1964). The method involves (1) assigning "curve numbers" for the wateshed area according to type of hydrologic soil-cover complex, and then (2) computing total runoff amounts for individual storms using established rainfall-runoff plots.

In assessing impacts from on-site systems, the main interest is in determining yearly or seasonal rainfall-runoff amounts. This may be done by computing and summing runoff from actual or statistical series of storm events over the period of a year. The resulting runoff computation

Figure 1

Areawide Groundwater Hydraulics Analysis



can be compared to total rainfall to estimate the runoff percentage.

Step 2: Evapotranspiration

Losses due to plant uptake and evaporation can be estimated on the basis of "actual evapotranspiration" (ET). This is defined as the "computed amount of water loss under existing conditions of temperature and precipitation" (Elford and McDonough, 1963). Computations may be made following the water balance techniques developed by Thornthwaite & Mather (1957). Actual ET values have been computed by the U.S. Weather Bureau for a number of locations in the North Coast Region (Elford and McDonough, 1963-1966). For typical computations it is assumed that the soil in the root zone is capable of storing 4 inches of plant-available moisture. Available moisture (i.e., rainfall) in excess of this is assumed to runoff or percolate to underlying soils and groundwater, beyond the reach of plant roots. It is also assumed that plants use stored moisture at the full, or "potential" rate until all stored moisture has been used.

For purposes of cumulative impact assessment, actual ET values may be estimated from existing U.S. Weather Bureau computations or developed individually for specific sites using the basic methodology outlined by Thornthwaite and Mather.

Step 3: Deep Percolation of Rainfall

Computation of the amount of deep percolation (recharge) of rainfall may be made from the preceding estimates of rainfall, runoff and actual ET. The average yearly deep percolation is computed as follows:

$$(DP) = (P)(1-R) - (ET)$$

where:

DP = Average deep percolation of rainfall (in/yr);
P = Average precipitation (in/yr);
R = Runoff percentage;
ET = Actual evapotranspiration (in/yr).

Step 4: Wastewater Loading

Wastewater discharges through subsurface disposal systems will generally be beneath the root zone, resulting in complete percolation to groundwater. The long-term hydraulic loading can be computed on the basis of average wastewater flow over the area under study. For typical residential on-site systems the following assumptions are appropriate:

(1) 50 gpcd
(2) 3 persons/dwelling unit.

These are consistent with reported literature values and planning studies (NEHA, 1979; EPA, 1980). Maximum wastewater flow estimates (e.g., 150 gpd per bedroom) are suitable for designing individual systems, but do not adequately represent average long-term loading characteristics which are of chief concern in assessing cumulative effects.

Step 5: Areal Distribution of Wasteload

The next step is the determination of the areal distribution of wastewater loading. This is expressed as waste flow per unit area (e.g., gpd/acre). It may be approximated by dividing the total wastewater flow by the total acreage under study. Conversion can then be made to in/yr as follows:

$$(in/yr) = (gpd/acre)(0.0134)$$

Step 6: Relative Change in Hydraulic Loading

Hydraulic impacts due to wastewater additions can be assessed by determining the relative change in hydraulic loading. This is done simply by computing wastewater loading as a percentage of average background deep percolation. The results are a useful indicator of the amount of natural dilution normally available on-site. Additionally, projected changes in salt and nitrate loadings may conveniently be expressed as a function of the amount of wastewater loading relative to deep percolation (see following sections dealing with salts and nitrates).

Step 7: Groundwater Rise

Potential areawide increases in groundwater levels can be approximated by dividing the wastewater hydraulic loading by the specific yield of the underlying soils or aquifer. Specific yield varies among soils and water bearing formations, and normally falls between about 5 and 30%. The potential for change in natural water table levels should be examined on a month-to-month and seasonal basis. In the water balance method of Thornthwaite and Mather (1957), 50 percent of the surplus waters percolating to groundwater are assumed to discharge to surface streams each month. This is based on studies of watersheds in the Eastern United States. Month-to-month accumulation of wastewater should be reduced by a similar amount.

Whether or not long-term (yearly) accumulation occurs depends upon the natural fluctuations and drainage characteristics of the groundwater system. To assess the potential impacts specifically requires more detailed characterization of aquifer properties and groundwater movement. In many instances it is likely that natural fluctuations from year-to-year will far outweigh the effects from wastewater additions. Also, a detailed analysis should account for related land use and development activities which may contribute to changes in groundwater levels, e.g., groundwater withdrawals, irrigation, and alteration of natural recharge areas. These effects may further negate impacts from on-site sewage disposal systems.

Localized Hydraulic Mounding

The growth and decay of groundwater mounds in response to percolation and recharge of surface water has been studied by a number of investigators (Glover, 1966; Hantush, 1967; Bianchi, 1970; Bouwer, 1976; DeCoster, 1976). Various predictive equations have been developed and tested. While derived specifically for the purpose of assessing groundwater recharge operations, many of the techniques are equally applicable to the case of subsurface effluent disposal systems.

These analytical methods can be applied by defining four typical situations which characterize the conditions under which on-site systems are generally employed. These are:

- *Case 1* - Relatively level topography with underlying unconfined shallow aquifer of greater than 50' thickness and of effectively "infinite" lateral extent;
- *Case 2* - Relatively level topography with underlying unconfined shallow aquifer of less than 50' thickness (includes perched water) and of effectively "infinite" lateral extent;
- *Case 3* - Level to moderately sloping topography, with shallow groundwater having a defined lateral seepage or discharge point near the disposal field;
- *Case 4* - Sloping terrain with perched groundwater and/or a clearly defined impermeable substrata.

Assessment techniques applicable to each of these situations are described below.

Case 1. The case of percolation to an aquifer of relatively large thickness is illustrated in Figure 2. Analysis can follow a method developed by Glover (1966). It allows prediction of the shape and maximum rise of the water table beneath square and rectangular recharge plots under different loading rates and soil-groundwater conditions. The maximum rise is of most concern with on-site sewage disposal systems.

1. Data Needs

Computation of the height at the center of the groundwater mound requires the following input data:

- W = Width of the disposal field (ft);
- L = Length of the disposal field (ft);
- I = Wastewater application rate (ft/day);
- V = Specific yield or fillable pore space of the soil (ft^3/ft^3);
- K = Horizontal hydraulic conductivity of the aquifer (ft/day);
- D = Saturated thickness of the aquifer (ft);
- H = Depth to groundwater from bottom of the disposal trenches (ft);
- t = Duration of wastewater application (days).

The parameters W, L and I are readily obtainable from the design and layout of the disposal system. Soil and aquifer characteristics, V,K,D and H, may be obtained from prior groundwater studies or site-specific field investigations. A useful reference on this topic is the EPA Land Treatment Design Manual (1977). The duration of wastewater application, t, corresponds to the period for mound height analysis during which a given background water table level is sustained. For seasonally fluctuating water tables (common to most of the North Coast) the most critical time for analysis would likely be for periods of 30 to 180 days during the wet weather season. The selected value should be based upon observed or estimated characteristics of the aquifer.

2. Analysis

The maximum groundwater rise may be estimated with the following 3-step procedure:

Step 1: Compute the following quantities:

(1) $\alpha = \frac{KD}{V}$

(2) $R = \frac{I}{V}$

(3) $\frac{W}{\sqrt{4\quad t}}$

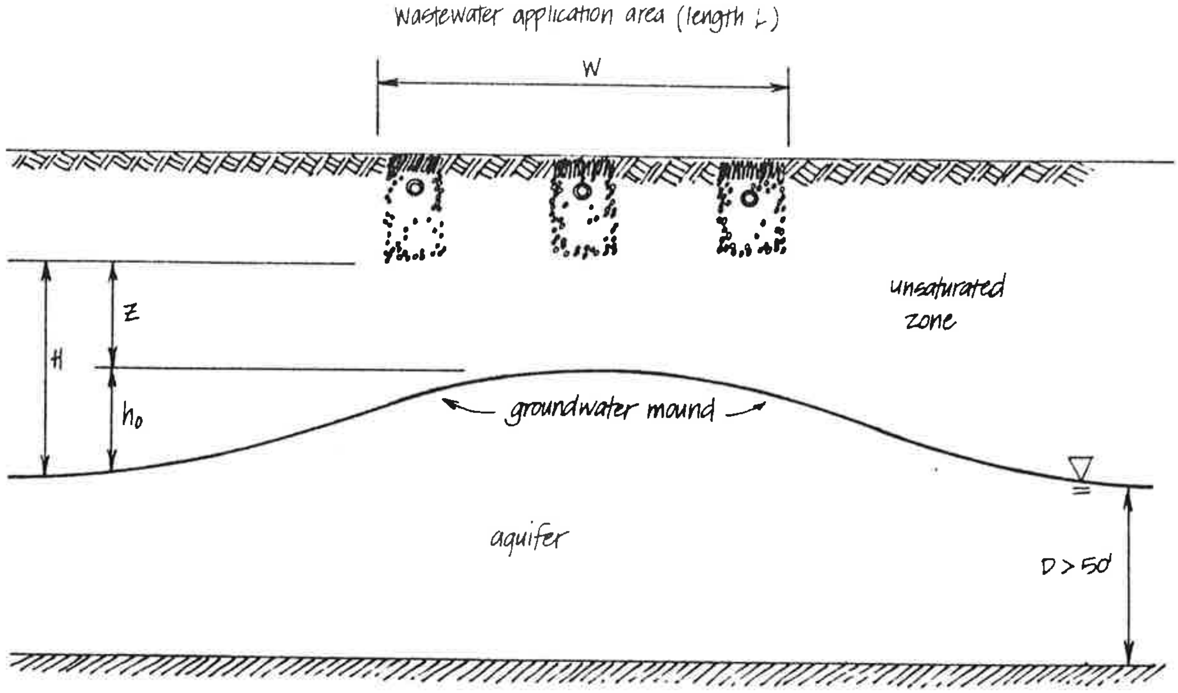


Fig. 2. Groundwater Mounding for Case 1 - Aquifer of Relatively Large Thickness

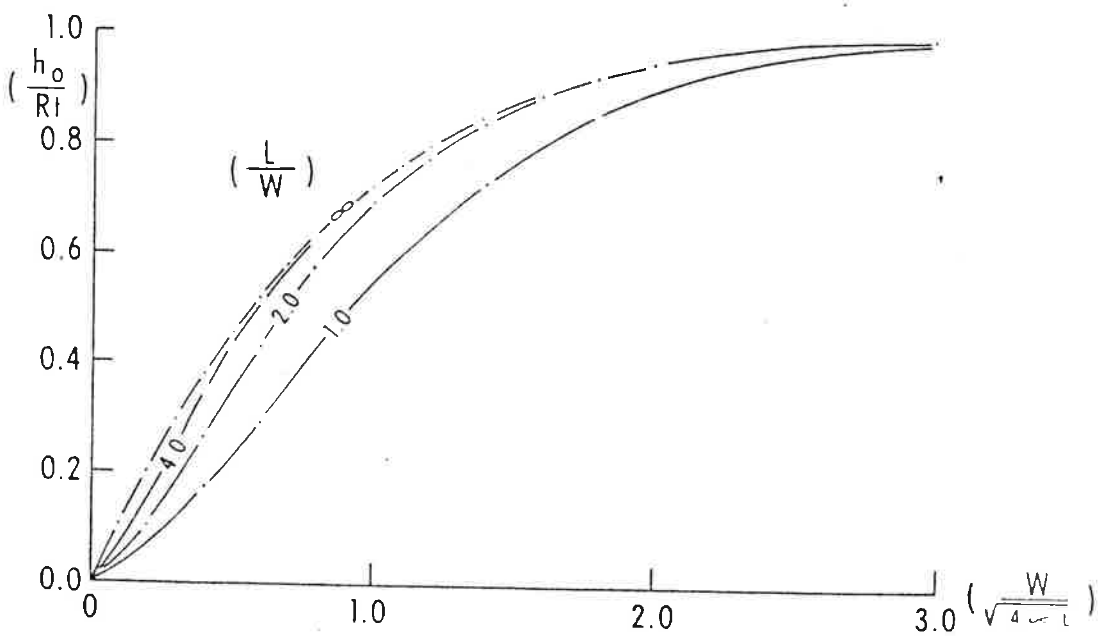


Fig. 3. Dimensionless Plot of the Rise at the Center (h_0) of the Mound Beneath a Rectangular Recharge Area for Different Ratios of Length to Width (Glover,1966)

Step 2: Obtain values of $\frac{h_o}{Rt}$ from Figure 3; from these compute the maximum mound height h_o.

Step 3: Compute the effective separation distance (z) between the disposal point and the maximum groundwater height:

$$z = H - h_o$$

Case 2. The case of a relatively thin aquifer is illustrated in Figure 4. A method developed by Hantush (1967) provides a suitable means for estimating groundwater mounding. The approach is similar to that previously described for the case of a thick aquifer. The estimation method has been shown to provide fairly accurate estimates when the rise of the water table relative to the initial depth of saturation does not exceed about 50%.

1. Data Needs

Computation of maximum mound height requires the following input data:

W = Width of disposal field (ft);
L = Length of disposal field (ft);
I = Wastewater application rate (ft/day);
V = Specific yield or fillable pore space of the soil (ft^3/ft^3);
K = Horizontal hydraulic conductivity of the aquifer (ft/day);
H = Depth to groundwater from point of disposal (ft);
h_i = Initial water table height (ft);
t = Duration of wastewater application (days).

As discussed for Case 1, these data are readily obtainable or can be reasonably estimated in most instances.

2. Analysis

The maximum mound height (h_m) is determined by the following 4-step procedure:

Step 1: Compute the following:

(1) $\bar{b} = 0.5\ (h_i + h_m)$*

(2) $V_o = \frac{K\bar{b}}{V}$

(3) $\alpha = \frac{L}{4\sqrt{V_o t}}$

*Estimated value of h_m is assumed initially and final solution derived by method of successive approximation.

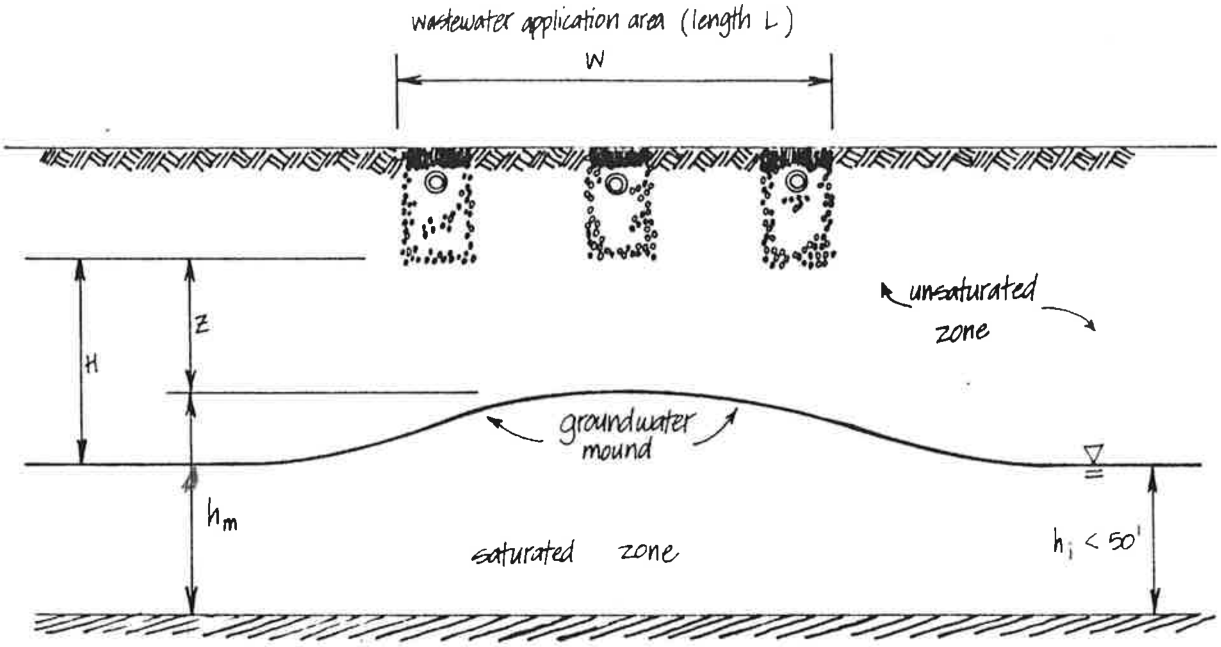


Fig. 4. Groundwater Mounding for Case 2 - Relatively Thin Groundwater Zone

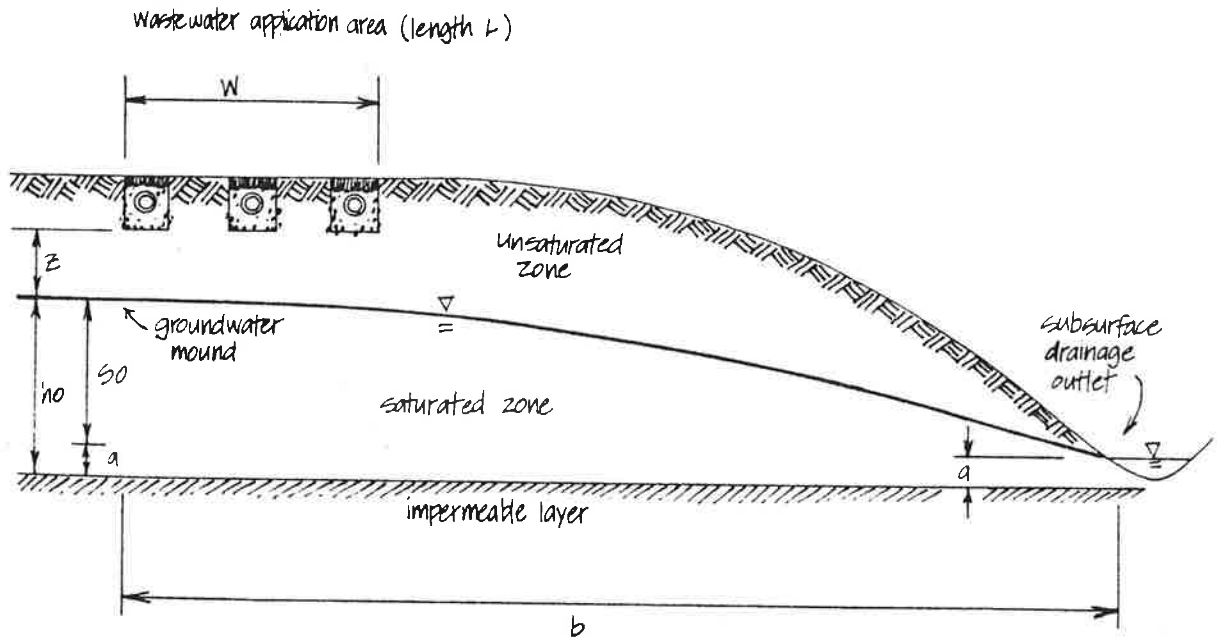


Fig. 5. Groundwater Mounding for Case 3 - Flow to Lateral Seepage Outlet

TABLE 1. Numerical Solutions for Groundwater Mounding Analysis

Values of the function $S^{x}(\alpha,\beta) = \int_0^1 \operatorname{erf}(\frac{\alpha}{\sqrt{\tau}}) \operatorname{erf}(\frac{\beta}{\sqrt{\tau}})\, d\tau$

α \ β	0.02	0.04	0.06	0.08	0.10	0.14	0.18	0.22	0.26	0.30	0.34	0.38	0.42	0.46	0.50	0.54	0.58	0.62
0.02	0.0041	0.0073	0.0101	0.0125	0.0146	0.0184	0.0215	0.0243	0.0267	0.0288	0.0306	0.0322	0.0337	0.0349	0.0361	0.0371	0.0380	0.0387
0.04	0.0073	0.0135	0.0188	0.0236	0.0278	0.0353	0.0415	0.0470	0.0518	0.0559	0.0596	0.0628	0.0657	0.0683	0.0705	0.0725	0.0743	0.0759
0.06	0.0101	0.0188	0.0265	0.0335	0.0398	0.0509	0.0602	0.0684	0.0751	0.0817	0.0871	0.0920	0.0963	0.1001	0.1035	0.1065	0.1091	0.1115
0.08	0.0125	0.0236	0.0335	0.0425	0.0508	0.0652	0.0776	0.0884	0.0978	0.1060	0.1133	0.1197	0.1254	0.1305	0.1350	0.1389	0.1425	0.1456
0.10	0.0146	0.0278	0.0398	0.0508	0.0605	0.0786	0.0939	0.1072	0.1183	0.1290	0.1381	0.1461	0.1532	0.1595	0.1650	0.1700	0.1744	0.1783
0.14	0.0184	0.0353	0.0509	0.0652	0.0786	0.1025	0.1232	0.1414	0.1573	0.1714	0.1839	0.1949	0.2048	0.2135	0.2212	0.2281	0.2343	0.2397
0.18	0.0216	0.0416	0.0602	0.0776	0.0939	0.1232	0.1490	0.1716	0.1916	0.2094	0.2251	0.2391	0.2515	0.2626	0.2724	0.2812	0.2890	0.2959
0.22	0.0243	0.0470	0.0684	0.0884	0.1072	0.1414	0.1716	0.1984	0.2222	0.2433	0.2621	0.2789	0.2938	0.3071	0.3189	0.3295	0.3389	0.3472
0.26	0.0267	0.0518	0.0754	0.0978	0.1188	0.1573	0.1916	0.2222	0.2494	0.2737	0.2954	0.3147	0.3320	0.3474	0.3612	0.3735	0.3844	0.3941
0.30	0.0288	0.0559	0.0817	0.1060	0.1290	0.1714	0.2094	0.2433	0.2737	0.3009	0.3252	0.3470	0.3665	0.3839	0.3995	0.4134	0.4257	0.4368
0.34	0.0306	0.0596	0.0871	0.1133	0.1381	0.1839	0.2251	0.2621	0.2954	0.3252	0.3520	0.3761	0.3976	0.4169	0.4341	0.4495	0.4633	0.4756
0.38	0.0322	0.0628	0.0920	0.1197	0.1461	0.1949	0.2391	0.2789	0.3147	0.3470	0.3761	0.4022	0.4256	0.4466	0.4654	0.4823	0.4973	0.5108
0.42	0.0337	0.0657	0.0963	0.1254	0.1532	0.2048	0.2515	0.2938	0.3320	0.3665	0.3976	0.4256	0.4508	0.4734	0.4937	0.5119	0.5281	0.5427
0.46	0.0349	0.0683	0.1001	0.1305	0.1595	0.2135	0.2626	0.3071	0.3474	0.3839	0.4169	0.4466	0.4734	0.4975	0.5191	0.5385	0.5559	0.5715
0.50	0.0361	0.0705	0.1035	0.1350	0.1650	0.2212	0.2724	0.3189	0.3612	0.3995	0.4341	0.4654	0.4937	0.5191	0.5420	0.5626	0.5810	0.5975
0.54	0.0371	0.0725	0.1065	0.1389	0.1700	0.2281	0.2812	0.3295	0.3735	0.4134	0.4495	0.4823	0.5119	0.5385	0.5626	0.5842	0.6036	0.6209
0.58	0.0380	0.0743	0.1091	0.1425	0.1744	0.2343	0.2890	0.3389	0.3844	0.4257	0.4633	0.4973	0.5281	0.5559	0.5810	0.6036	0.6238	0.6420
0.62	0.0387	0.0759	0.1115	0.1456	0.1783	0.2397	0.2959	0.3472	0.3941	0.4368	0.4756	0.5108	0.5427	0.5715	0.5975	0.6209	0.6420	0.6609
0.66	0.0394	0.0773	0.1136	0.1484	0.1815	0.2445	0.3022	0.3547	0.4027	0.4466	0.4865	0.5227	0.5556	0.5854	0.6122	0.6364	0.6582	0.6778
0.70	0.0401	0.0785	0.1154	0.1509	0.1849	0.2488	0.3075	0.3612	0.4104	0.4553	0.4962	0.5334	0.5672	0.5977	0.6254	0.6503	0.6728	0.6929
0.74	0.0406	0.0796	0.1171	0.1531	0.1876	0.2526	0.3123	0.3671	0.4172	0.4630	0.5048	0.5429	0.5774	0.6087	0.6371	0.6627	0.6857	0.7064
0.78	0.0411	0.0806	0.1185	0.1550	0.1900	0.2559	0.3165	0.3722	0.4232	0.4699	0.5125	0.5513	0.5865	0.6185	0.6475	0.6736	0.6972	0.7184
0.82	0.0415	0.0814	0.1198	0.1567	0.1921	0.2589	0.3203	0.3765	0.4286	0.4760	0.5192	0.5587	0.5946	0.6272	0.6567	0.6834	0.7074	0.7291
0.86	0.0419	0.0822	0.1209	0.1582	0.1940	0.2615	0.3237	0.3808	0.4333	0.4813	0.5252	0.5653	0.6017	0.6348	0.6648	0.6920	0.7165	0.7386
0.90	0.0422	0.0828	0.1219	0.1595	0.1957	0.2638	0.3265	0.3844	0.4374	0.4860	0.5305	0.5711	0.6080	0.6416	0.6721	0.6996	0.7245	0.7469
0.94	0.0425	0.0834	0.1228	0.1607	0.1971	0.2658	0.3292	0.3875	0.4411	0.4902	0.5351	0.5762	0.6136	0.6476	0.6784	0.7063	0.7316	0.7543
0.98	0.0428	0.0839	0.1236	0.1617	0.1984	0.2676	0.3314	0.3902	0.4442	0.4938	0.5392	0.5807	0.6184	0.6528	0.6840	0.7123	0.7378	0.7608
1.00	0.0429	0.0842	0.1239	0.1622	0.1990	0.2684	0.3324	0.3914	0.4457	0.4955	0.5410	0.5827	0.6206	0.6552	0.6865	0.7150	0.7406	0.7638
1.20	0.0437	0.0858	0.1263	0.1654	0.2030	0.2740	0.3395	0.4001	0.4558	0.5070	0.5540	0.5969	0.6362	0.6719	0.7044	0.7339	0.7605	0.7846
1.40	0.0441	0.0866	0.1275	0.1669	0.2049	0.2767	0.3431	0.4043	0.4608	0.5127	0.5603	0.6039	0.6438	0.6801	0.7132	0.7432	0.7704	0.7949
1.80	0.0444	0.0871	0.1283	0.1680	0.2062	0.2785	0.3454	0.4071	0.4641	0.5165	0.5645	0.6086	0.6489	0.6856	0.7190	0.7494	0.7769	0.8018
2.00	0.0444	0.0871	0.1284	0.1681	0.2064	0.2787	0.3457	0.4075	0.4645	0.5169	0.5651	0.6092	0.6495	0.6863	0.7198	0.7502	0.7778	0.8027
2.20	0.0444	0.0872	0.1284	0.1682	0.2065	0.2788	0.3458	0.4076	0.4646	0.5171	0.5653	0.6094	0.6497	0.6865	0.7200	0.7505	0.7781	0.8030
2.50	0.0444	0.0872	0.1284	0.1682	0.2065	0.2789	0.3458	0.4077	0.4647	0.5172	0.5653	0.6095	0.6498	0.6867	0.7202	0.7506	0.7782	0.8032
3.00	0.0444	0.0872	0.1284	0.1682	0.2065	0.2789	0.3458	0.4077	0.4647	0.5172	0.5654	0.6095	0.6499	0.6867	0.7202	0.7506	0.7782	0.8032

Source: (Hantush, 1967)

TABLE 2. (cont.)

α \ β	0.62	0.66	0.70	0.74	0.78	0.82	0.86	0.90	0.94	0.98	1.00	1.20	1.40	1.80	2.00	2.20	2.50	3.00
0.02	0.0387	0.0394	0.0401	0.0406	0.0411	0.0415	0.0419	0.0422	0.0425	0.0428	0.0429	0.0437	0.0441	0.0444	0.0444	0.0444	0.0444	0.0444
0.04	0.0759	0.0773	0.0785	0.0796	0.0806	0.0814	0.0822	0.0828	0.0834	0.0839	0.0842	0.0855	0.0866	0.0871	0.0871	0.0872	0.0872	0.0872
0.06	0.1115	0.1136	0.1154	0.1171	0.1185	0.1198	0.1209	0.1219	0.1228	0.1236	0.1239	0.1263	0.1275	0.1283	0.1284	0.1284	0.1284	0.1284
0.08	0.1456	0.1484	0.1509	0.1531	0.1550	0.1567	0.1582	0.1595	0.1607	0.1617	0.1622	0.1654	0.1669	0.1680	0.1681	0.1682	0.1682	0.1682
0.10	0.1783	0.1818	0.1849	0.1876	0.1900	0.1921	0.1940	0.1957	0.1971	0.1984	0.1990	0.2030	0.2049	0.2062	0.2064	0.2065	0.2065	0.2065
0.14	0.2397	0.2445	0.2488	0.2526	0.2559	0.2589	0.2615	0.2638	0.2658	0.2676	0.2684	0.2740	0.2767	0.2785	0.2787	0.2788	0.2788	0.2789
0.18	0.2959	0.3020	0.3075	0.3123	0.3166	0.3203	0.3237	0.3266	0.3292	0.3314	0.3324	0.3396	0.3431	0.3454	0.3457	0.3458	0.3458	0.3458
0.22	0.3472	0.3547	0.3612	0.3671	0.3722	0.3768	0.3808	0.3844	0.3875	0.3902	0.3914	0.4001	0.4043	0.4071	0.4075	0.4076	0.4077	0.4077
0.26	0.3941	0.4027	0.4104	0.4172	0.4232	0.4285	0.4333	0.4374	0.4411	0.4442	0.4457	0.4558	0.4608	0.4641	0.4645	0.4646	0.4647	0.4647
0.30	0.4368	0.4465	0.4553	0.4630	0.4699	0.4760	0.4813	0.4860	0.4902	0.4938	0.4955	0.5070	0.5127	0.5165	0.5169	0.5171	0.5172	0.5172
0.34	0.4756	0.4865	0.4962	0.5048	0.5125	0.5192	0.5252	0.5305	0.5351	0.5392	0.5410	0.5540	0.5603	0.5645	0.5651	0.5653	0.5653	0.5654
0.38	0.5108	0.5227	0.5334	0.5429	0.5513	0.5587	0.5653	0.5711	0.5762	0.5807	0.5827	0.5969	0.6039	0.6086	0.6092	0.6094	0.6095	0.6095
0.42	0.5427	0.5556	0.5672	0.5774	0.5865	0.5946	0.6017	0.6080	0.6136	0.6184	0.6206	0.6362	0.6438	0.6489	0.6495	0.6497	0.6498	0.6499
0.46	0.5715	0.5854	0.5977	0.6087	0.6185	0.6272	0.6348	0.6416	0.6476	0.6528	0.6552	0.6719	0.6801	0.6856	0.6863	0.6865	0.6867	0.6867
0.50	0.5975	0.6122	0.6254	0.6371	0.6475	0.6567	0.6648	0.6721	0.6784	0.6842	0.6865	0.7044	0.7132	0.7190	0.7198	0.7200	0.7202	0.7202
0.54	0.6209	0.6364	0.6503	0.6627	0.6736	0.6834	0.6920	0.6996	0.7063	0.7123	0.7150	0.7339	0.7432	0.7494	0.7502	0.7505	0.7506	0.7506
0.58	0.6420	0.6582	0.6728	0.6857	0.6972	0.7074	0.7165	0.7245	0.7316	0.7378	0.7406	0.7605	0.7704	0.7769	0.7778	0.7781	0.7782	0.7782
0.62	0.6609	0.6779	0.6932	0.7064	0.7184	0.7291	0.7386	0.7469	0.7543	0.7608	0.7638	0.7846	0.7949	0.8018	0.8027	0.8030	0.8032	0.8032
0.66	0.6778	0.6953	0.7110	0.7250	0.7375	0.7485	0.7584	0.7671	0.7748	0.7816	0.7846	0.8064	0.8171	0.8243	0.8252	0.8255	0.8257	0.8257
0.70	0.6929	0.7110	0.7272	0.7417	0.7546	0.7660	0.7762	0.7852	0.7932	0.8002	0.8034	0.8259	0.8370	0.8445	0.8454	0.8458	0.8460	0.8460
0.74	0.7064	0.7250	0.7417	0.7566	0.7698	0.7816	0.7921	0.8014	0.8096	0.8168	0.8201	0.8434	0.8549	0.8627	0.8636	0.8640	0.8642	0.8642
0.78	0.7184	0.7375	0.7546	0.7698	0.7834	0.7956	0.8063	0.8159	0.8243	0.8317	0.8351	0.8591	0.8710	0.8789	0.8799	0.8803	0.8805	0.8805
0.82	0.7291	0.7486	0.7660	0.7816	0.7956	0.8080	0.8190	0.8288	0.8374	0.8450	0.8485	0.8731	0.8853	0.8935	0.8945	0.8949	0.8951	0.8951
0.86	0.7386	0.7584	0.7762	0.7921	0.8063	0.8190	0.8302	0.8402	0.8491	0.8569	0.8604	0.8855	0.8980	0.9065	0.9075	0.9079	0.9081	0.9081
0.90	0.7469	0.7671	0.7852	0.8014	0.8159	0.8288	0.8402	0.8504	0.8594	0.8674	0.8710	0.8966	0.9094	0.9180	0.9191	0.9195	0.9197	0.9197
0.94	0.7543	0.7748	0.7932	0.8096	0.8243	0.8374	0.8491	0.8594	0.8686	0.8767	0.8803	0.9064	0.9195	0.9282	0.9294	0.9298	0.9300	0.9300
0.98	0.7608	0.7816	0.8002	0.8168	0.8317	0.8450	0.8569	0.8674	0.8767	0.8849	0.8886	0.9151	0.9281	0.9373	0.9384	0.9389	0.9391	0.9391
1.00	0.7638	0.7846	0.8034	0.8201	0.8351	0.8485	0.8604	0.8710	0.8803	0.8886	0.8924	0.9191	0.9324	0.9414	0.9426	0.9430	0.9432	0.9433
1.20	0.7846	0.8064	0.8259	0.8434	0.8591	0.8731	0.8855	0.8966	0.9064	0.9151	0.9191	0.9472	0.9614	0.9709	0.9722	0.9726	0.9728	0.9729
1.40	0.7949	0.8171	0.8370	0.8549	0.8710	0.8853	0.8980	0.9094	0.9195	0.9284	0.9324	0.9614	0.9759	0.9858	0.9871	0.9875	0.9878	0.9878
1.60	0.8018	0.8243	0.8445	0.8627	0.8789	0.8935	0.9065	0.9180	0.9282	0.9373	0.9414	0.9709	0.9858	0.9959	0.9972	0.9977	0.9979	0.9980
2.00	0.8027	0.8252	0.8454	0.8636	0.8799	0.8945	0.9075	0.9191	0.9294	0.9384	0.9426	0.9722	0.9871	0.9972	0.9985	0.9990	0.9992	0.9993
2.20	0.8030	0.8255	0.8458	0.8640	0.8803	0.8949	0.9079	0.9195	0.9298	0.9389	0.9430	0.9726	0.9875	0.9977	0.9990	0.9995	0.9997	0.9998
2.50	0.8032	0.8257	0.8460	0.8642	0.8805	0.8951	0.9081	0.9197	0.9300	0.9391	0.9432	0.9728	0.9878	0.9979	0.9992	0.9997	1.0000	1.0000
3.00	0.8032	0.8257	0.8460	0.8642	0.8805	0.8951	0.9081	0.9197	0.9300	0.9391	0.9433	0.9729	0.9878	0.9980	0.9993	0.9998	1.0000	1.0000

Source: Hantush (1967)

(4) $\beta = \dfrac{W}{4\sqrt{V_o t}}$

Step 2: Using Table 1, obtain values for the function $S^*(\alpha,\beta)$.

Step 3: Compute the maximum mound height (h_m) from the following formula:

$$h_m = \sqrt{(2I/K)V_o t S^*(\alpha,\beta) + h_i^2}$$

Case 3. The situation where lateral drainage of groundwater is influenced by an adjacent road cut, underdrain, rock out-cropping, etc., is illustrated in Figure 5. Groundwater mounding can be estimated using a method developed by Decoster (1976). Based upon the Dupuit-Forcheimer approximation and Darcy's law, Decoster developed an equation describing the shape of the phreatic surface extending from the disposal field to the drainage outlet. The equation which gives the maximum height of groundwater beneath the disposal field is:

$$\frac{h_o}{W} = \left[\frac{P_o}{K}\left(\frac{2b}{W} - 1\right) + \left(\frac{a}{W}\right)^2\right]^{\frac{1}{2}}$$

where parameters are as shown in Figure 5 and are described in data needs below.

1. Data Needs

The following input data are required for this analysis:

W = Width of disposal field (ft);
P_o = Wastewater application rate (ft/day);
K = Horizontal hydraulic conductivity of the soil (ft/day);
d = Depth to impervious layer below point of disposal (ft);
a = Height of water at the drainage outlet (ft);
b = Lateral distance from far edge of disposal field to drainage outlet (ft).

2. Analysis

Estimation of the maximum rise of the water table (h_o) is determined by the following 4-step procedure:

Step 1: Compute the following two non-dimensional quantities:

(1) $A = \frac{a}{W}\sqrt{\frac{K}{P_o}}$

(2) $B = \frac{W}{b}$

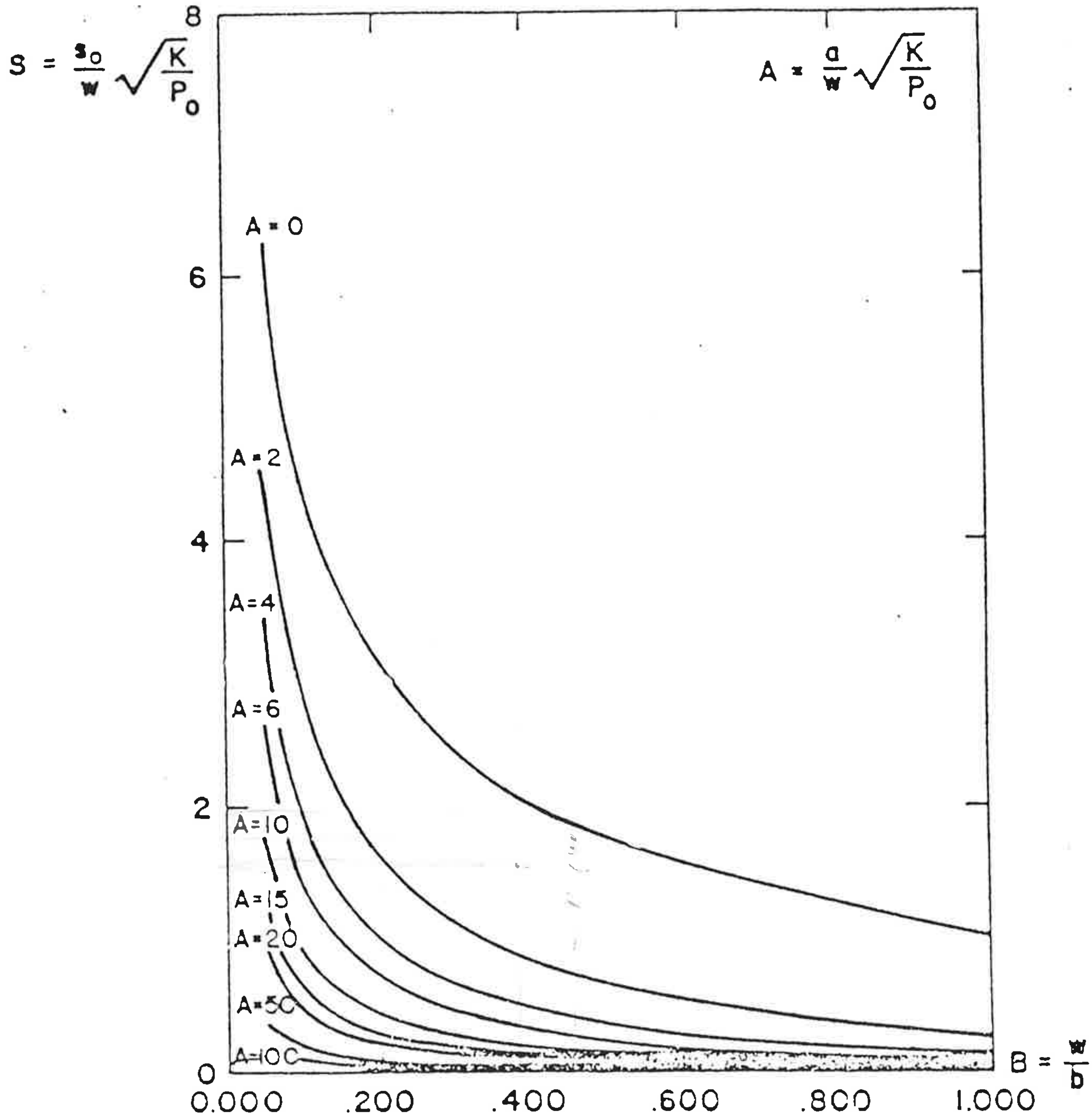


Figure 6. Subsurface drainage design graph.

Source: Small Scale Waste Management Project, 1978

Step 2: With values for A and B, graphically determine the non-dimensional quantity S using Figure 6.

Step 3: Calculate the rise of the groundwater mound (s_0) above the control level (a) as follows:

$$s_o = SW\sqrt{\frac{P_o}{K}}$$

Step 4: Compute the effective separation distance (z) between the disposal point and the maximum groundwater height:

$$z = d - a - s_o$$

This analysis has certain limitations which should be recognized:

(1) Accuracy is expected to be within about 15% (subject to data reliability);

(2) Groundwater movement is projected only in two dimensions. Therefore, the analysis becomes increasingly conservative as the length:width ratio of the disposal field decreases;

(3) Estimates are likely to be conservative where subsurface drainage is to a single lateral boundary outlet. This difficulty can be overcome by solving for lateral flow opposite to the drain using the method described for Case 2. An imaginary line can be constructed through the disposal field as shown in Figure 7. By successively adjusting and computing mound heights at the division line, the combined analyses will converge to an estimate of the position and height of maximum groundwater rise.

Case 4. The case of perched, laterally moving groundwater in sloping terrain is illustrated in Figure 8. A method developed by Bouwer (1976) can be used to roughly approximate groundwater mounding under such conditions.

1. Data Needs

The following input data are required:

W = Width of disposal field in direction of groundwater flow (ft);
I = Wastewater application rate (ft/day);
D = Average thickness of groundwater perpendicular to direction of flow (ft);

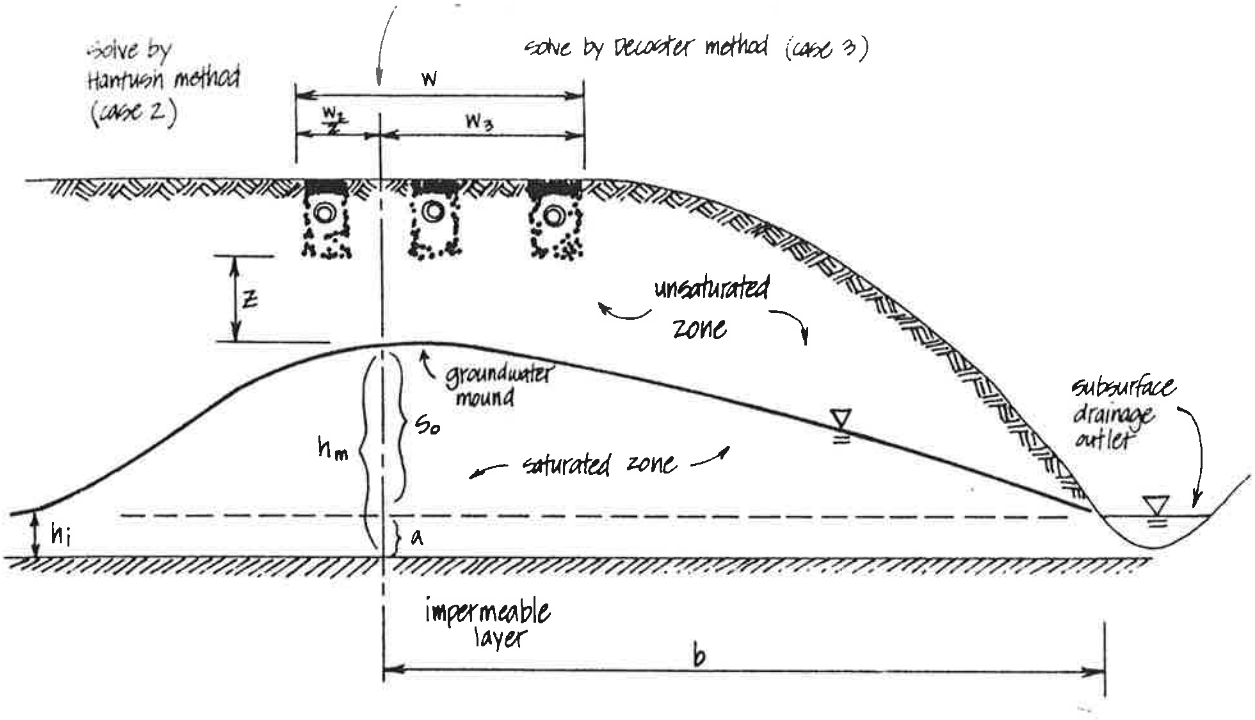


Fig. 7. Combined Application of Case 2 and Case 3 Methodologies

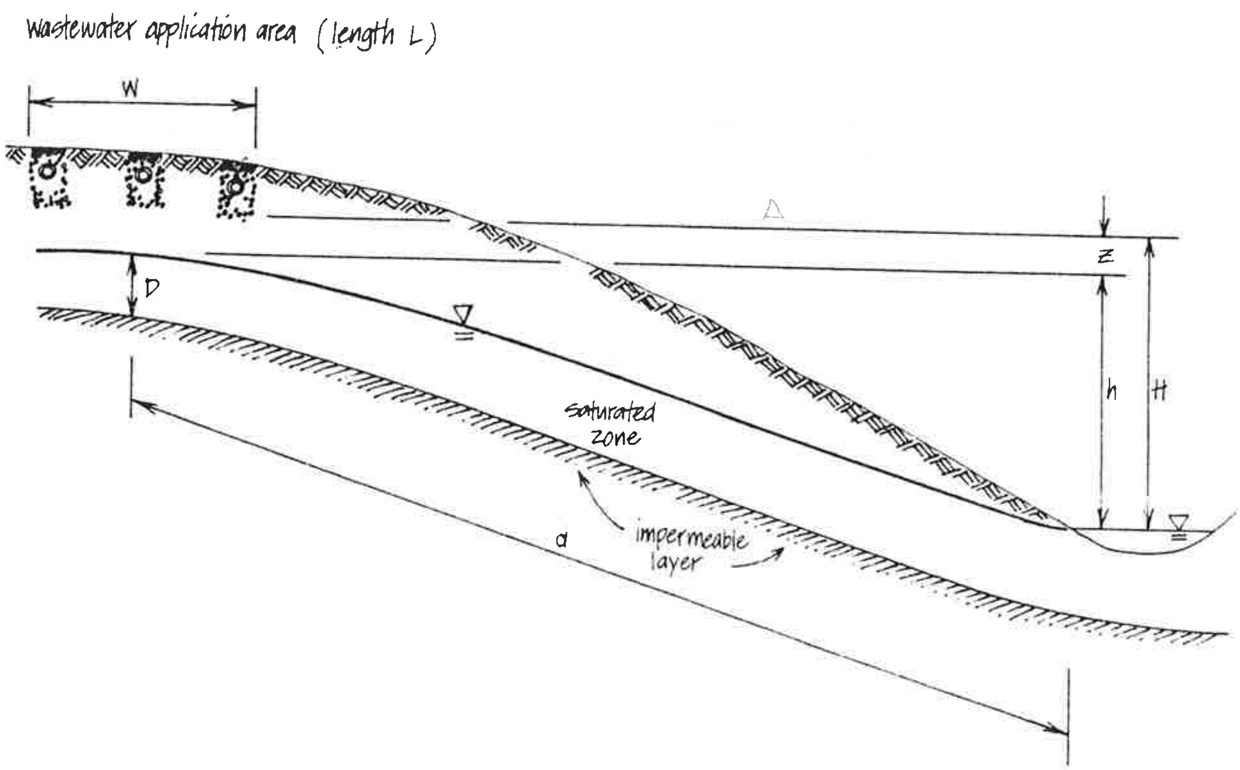


Fig. 8. Groundwater Mounding for Case 4 - Perched Water in Sloping Terrain

d = Lateral flow distance from disposal field to seepage or discharge point (ft);
K = Horizontal hydraulic conductivity (ft/day);
H = Height of the disposal point above the downslope outlet (ft).

2. Analysis

Groundwater mounding is determined by the following 2-step procedure:

Step 1: Compute the maximum groundwater depth (H) above the outlet from the formula:

$$h = \frac{WdI}{KD}$$

Step 2: Compute the effective separation distance (z) between the disposal point and the maximum groundwater height:

$$z = H - h$$

SALT ACCUMULATION

Problem Overview

The accumulation of salts (dissolved solids) in ground and surface waters is a result of (a) leaching of minerals from soils and geologic formations (b) evaporative processes and (c) inputs from waste disposal and other cultural practices. While high salt concentrations are not generally recognized as a widespread water quality problem in the North Coast Region, there are areas where background total dissolved solids (TDS) concentrations in groundwaters are in the range of 400-600 mg/L. In these situations, the added long-term effect from on-site sewage disposal practices may be of concern. In addition, water supplies in many parts of the Region are obtained from relatively small groundwater basins, particularly in the coastal areas. These groundwaters, which rely extensively on local recharge, are affected by changes in watershed conditions, and may be particularly sensitive to waste inputs from on-site sewage disposal practices.

The potential problems from on-site systems are directly related to:

(1) the concentration of salts in domestic wastewaters, and

(2) the fact that dissolved solids are essentially conservative substances, the concentration of which may be reduced only by means of dilution.

Table 3-6. Typical wastewater flow rates from recreational facilities[a]

Facility	Unit	Flow, gallons/unit/day		Flow, liters/unit/day	
		Range	Typical	Range	Typical
Apartment, resort	Person	50–70	60	190–260	230
Bowling alley	Alley	150–250	200	570–950	760
Cabin, resort	Person	8–50	40	30–190	150
Cafeteria	Customer	1–3	2	4–11	8
	Employee	8–12	10	30–45	38
Camps:					
Pioneer type	Person	15–30	25	57–110	95
Children's, with central toilet/bath	Person	35–50	45	130–190	170
Day, with meals	Person	10–20	15	38–76	57
Day, without meals	Person	10–15	13	38–57	49
Luxury, private bath	Person	75–100	90	280–380	340
Trailer camp	Trailer	75–150	125	280–570	470
Campground-developed	Person	20–40	30	76–150	110
Cocktail lounge	Seat	12–25	20	45–95	76
Coffee Shop	Customer	4–8	6	15–30	23
	Employee	8–12	10	30–45	38
Country club	Guests onsite	60–130	100	230–490	380
	Employee	10–15	13	38–57	49
Dining hall	Meal served	4–10	7	15–38	26
Dormitory/bunkhouse	Person	20–50	40	76–190	150
Fairground	Visitor	1–2	2	4–8	8
Hotel, resort	Person	40–60	50	150–230	190
Picnic park, flush toilets	Visitor	5–10	8	19–38	30
Store, resort	Customer	1–4	3	4–15	11
	Employee	8–12	10	30–45	38
Swimming pool	Customer	5–12	10	19–45	38
	Employee	8–12	10	30–45	38
Theater	Seat	2–4	3	8–15	11
Visitor center	Visitor	4–8	5	15–30	19

[a] Some systems serving more than 20 people might be regulated under USEPA's Class V UIC Program.

Source: Crites and Tchobanoglous, 1998.

pollutants, the strength of residential wastewater fluctuates throughout the day (University of Wisconsin, 1978). For nonresidential establishments, wastewater quality can vary significantly among different types of establishments because of differences in waste-generating sources present, water usage rates, and other factors. There is currently a dearth of useful data on nonresidential wastewater organic strength, which can create a large degree of uncertainty in design if facility-specific data are not available. Some older data (Goldstein and Moberg, 1973; Vogulis, 1978) and some new information exists, but modern organic strengths need to be verified before design given the importance of this aspect of capacity determination.

Wastewater flow and the type of waste generated affect wastewater quality. For typical residential sources peak flows and peak pollutant loading rates do not occur at the same time (Tchobanoglous and Burton, 1991). Though the fluctuation in wastewater quality (see figure 3-5) is similar to the water use patterns illustrated in figure 3-3, the fluctuations in wastewater quality for an individual home are likely to be considerably greater than the multiple-home averages shown in figure 3-5.

Table 3-10. Comparison of flow rates and flush volumes before and after U.S. Energy Policy Act

Fixture	Fixtures installed prior to 1994 in gallons/minute (liters/second)	EPACT requirements (effective January, 1994)	Potential reduction in water used (%)
Kitchen faucet	3.0 gpm (0.19 L/s)	2.5 gpm (0.16 L/s)	16
Lavatory faucets	3.0 gpm (0.19 L/s)	2.5 gpm (0.16 L/s)	16
Showerheads	3.5 gpm (0.22 L/s)	2.5 gpm (0.16 L/s)	28
Toilet (tank type)	3.5 gal (13.2 L)	1.6 gal (6.1 L)	54
Toilet (valve type)	3.5 gal (13.2 L)	1.6 gal[a] (6.1 L)	54
Urinal	3.0 gal (11.4 L)	1.0 gal (3.8 L)	50

Source: Konen, 1995.

Table 3-11. Wastewater flow reduction: water-carriage toilets and systems [a]

Generic type	Description	Application considerations	Operation & maintenance	Water use per event gal (L)	Total flow reduction in gpcd (Lpcd); % of use [b]
Toilets with tank inserts	Displacement devices placed into storage tank of conventional toilet to reduce volume but not height of stored water. Varieties: Plastic bottles, flexible panels, drums, or plastic bags	Device must be compatible with existing toilet and not interfere with flush mechanism Installation by owner Reliability low; failure can result in large flow increase	Frequent post-installation inspections to ensure proper positioning	3.3–3.8 (12.5–14.4)	1.8–3.5 (6.8–13.2) 4%–8%
Water-saving toilets	Variation of conventional flush toilet fixture; similar in appearance and operation. Redesigned flushing rim and priming jet to initiate siphon flush in smaller trapway with less water.	Interchangeable with conventional fixture	Essentially the same as for a conventional unit	1.0–1.6 (3.8–13.2)	5.3–13 (12.1–49.2) 6%–20%
Washdown flush toilets	Flushing uses only water, but substantially less due to washdown flush Varieties: Few Note: Water usage may increase due to multiple flushings	Rough-in for unit may be nonstandard Drain-line slope and lateral-run restrictions Plumber installation advisable	Similar to conventional toilet Cleaning possible	0.8–1.6 (3.0–6.1) (but more frequent flushings possible)	9.4–12.2 (35.6–46.2) 21%–27%
Pressurized-tank toilets	Specially designed toilet tank to pressurize air contained in toilet tank. Upon flushing, compressed air propels water into bowl at increased velocity Varieties: Few	Compatible with most conventional toilet units Increased noise level Water supply pressure of 35–120 psi (180–620 cm Hg) required	Periodic maintenance of compressed air source	2.0–2.5 (7.6–9.5)	6.3–8.0 (23.8–30.3) 14%–18%

[a] Adapted from USEPA, 1992. Compared to conventional toilet usage (4.3 gallons/flush [16.3 liters/flush], 3.5 uses per person per day, and a total daily flow of 45 gallons/person/day [170 liters/person/day]).

[b] gpcd = gallons per capita (person) per day; Lpcd = liters per capita (person) per day.

May 16, 2025

Ms. Natali Colom
Alameda County Environmental Health
1131 Harbor Bay Parkway
Alameda, CA 94550

Re: Onsite Wastewater Treatment Systems
Canyon Creek Ranch, Alameda County APN: 085-12000-1-16
17015 Cull Canyon Road, Castro Valley, CA 94552

Dear Ms. Colom:

Per your request, I have prepared an as-built plan and conducted an evaluation of the existing on-site wastewater systems (OWSs) at 17015 Cull Canyon Road, Castro Valley. The subject parcel consists of approximately 37 acres with a residential 3-bedroom mobile home and a Barn Building with restroom facilities. The Barn Building is currently not in use.

This evaluation includes the OWSs serving the existing 3-bedroom caretaker mobile home (OWS 1) and the OWS serving the Barn Building (OWS 2). Also, this evaluation report incorporates records from Alameda County Department of Environmental Health, my findings during a physical inspection of the existing OWSs, and the as-built OWS plans.

Per Alameda County Department of Environmental Health (ACDEH) records, the OWS 2 (Barn Building) has been approved. While there are records of approval of the building plan for the caretaker mobile home, it is not clear if the OWS 1 was approved by ACDEH.

- OWS 1 records indicate that the caretaker mobile home plan was approved by Alameda County Building Inspection Division on March 7, 1997. The OWS records did not have a stamp from ACDEH. (See ACDEH records, Appendix 1)

- OWS 2 was approved on 10/10/1996 to serve the Barn Building restrooms located at the west side of Cull Canyon Creek. (See ACDEH records Appendix 2.)

OWSs Locations and Evaluations:

On September 5, 2023, with the assistance of William Sanitary Services the onsite wastewater systems discovery was conducted in which portions of the two existing OWSs were exposed. On November 13, 2023, a soil profile was conducted at location adjacent to the OWS 1, (see soil profile log in Appendix 3) and on November 14, 2023, percolation tests were conducted in the vicinity of each of the two existing OWSs, (see percolation tests results in Appendix 4).

OWS 1

This system serves the caretaker residence (3-bedroom mobile home) and is located in the same area as shown in the ACDEH septic system records Appendix 1. The OWS 1 is located by the entrance to the property, between the front property line, the front of the existing caretaker mobile home, and the shop building. (See Caretaker House OWS Site Plan, Sheet OWTS-2).

This system consists of a two-compartment concrete septic tank. Only the second compartment is equipped with a manhole access riser that extends to finish grade. The septic tank second compartment is also fitted with a biotube, effluent filter and an effluent pump. **No evidence of high wastewater levels or surface water intrusion was observed in the second compartment access riser.**

A distribution box (D-box) and the dispersal field were exposed by excavating the backfill cover. The solid pipes connecting the D-box to the distribution lateral pipes, as well as the distribution lateral pipes, were located with a tracer and eventually excavated. The effluent is pumped from the septic tank to a concrete D-box which has three 4-inch diameter outlet pipes. The effluent from the D-box flows via gravity to the dispersal field trenches. **When the D-box was uncovered, it was full of roots which grew a couple of feet into the distribution lateral pipes.** The total length of each of the three trenches measured approximately 50 feet. **Portions of the 4-inch diameter distribution lateral PVC pipes were clogged with roots.** The trenches are 2 feet wide by approximately 50 feet long and 5.5 feet deep, with a separation distance of 13 feet center to center. The first drain rock was observed 32 inches below ground surface, the top of the 4-inch diameter distribution lateral pipe was observed at 34 inches below ground surface, and the bottom of the drain rock under the PVC pipe was observed at 66 inches below ground surface. **No evidence of high wastewater level was observed above the drain rock, but when the distribution lateral pipe was perforated to introduce the tracer, effluent surfaced from the drain pipe due to the root growth in the drain pipe.** (See Caretaker House OWS 1, Sheet OWTS-2 and photos #1, 2 and 3)

OWS 2
This system serves the restroom located inside the Barn Building, **which is not in use**. The septic tank is located east to the Barn Building, adjacent to the existing BBQ structure. The dispersal field is located south of the BBQ structure, in the same area as shown in the ACDEH records of the OWS Barn Building. (See Barn OWS 2, Sheet OWTS-2)

The system consists of a two-compartment concrete septic tank with the following exterior dimensions: length 9.3 feet x width 5.0 feet and inside height of 5.5 feet with an approximate operational volume capacity of 1,200 gallons.

The septic tank **is not equipped with access risers. Roots from the redwood trees next to the septic tank have intruded into the tank.** The tank is equipped with inlet and outlet ABS pipe sanitary tees. A three outlet D-box was located at 12.5 east to the septic tank. **Redwood tree roots were observed in the D-box and the D-box was dry.** The dispersal field trenches were located by excavating the backfill cover at the beginning and ends of each trench. The dispersal field trenches' dimensions are: 3 feet wide by 54 to 60 inches deep and 67 feet long, with separation distances of 11.5 feet and 13.0 feet center to center. The first drain rock was observed at 36 to 42 inches below ground surface, the top of the 4-inch diameter HDPE pipe was observed at 38 to 44 inches below ground surface, and the bottom of the drain rock under the 4-inch diameter HDPE pipe was observed at 60 inches below ground surface. **No evidence of high wastewater level was observed.** (See Barn Building As-Built OWS Plan, Sheet OWTS-2 and Photos 4 and 5)

<u>OWSs Capacity Adequacy Evaluation</u>:

OWS 1 serves the caretaker house (3-bedroom mobile home). Per ACDEH OWTS Manual, the total minimum daily wastewater flow from the 3-bedroom house is 450 gallons (based on 150 gpd per bedroom). Per ACDEH OWTS Manual, Table 17-1 Minimum Septic Tank Capacity Criteria for Residential Facilities, **the existing 1,200-gallon septic tank (per ACDEH records) meets the minimum septic tank capacity criteria for the 3-bedroom house, however, the pump should be in a separate tank to provide emergency storage capacity.**

Per the observed dispersal field trench dimensions during the OWS discovery on September 5, 2023, each trench provides a total of 333.5 square feet of infiltrated surface, based on a 6.67 square feet per lineal foot of infiltrated surface, which equals a total of 1,000 square feet of infiltrated surface. **No evidence of foul odors, wastewater ponding, wastewater surfacing, or wet soil was observed over the dispersal field or surrounding areas, but it seems that the roots growth in the dispersal trench distribution pipe is obstructing the dispersal of the wastewater/effluent.**

OWS 2 serves the Barn Building's restroom. Per ACDEH OWTS Manual, Section 17.2 A.3. Multi-Unit Residential and Non-Residential Facilities, *a. The minimum capacity of septic tanks for non-residential facilities shall be one thousand five hundred (1,500) gallons or three times the wastewater design flow for the facility served, whichever is greater*. **The existing two compartment concrete septic tank only has a 1,200-gallon volume capacity. Therefore, the septic tank does not meet the requirements for a non-residential operation. In addition, intrusion of roots into the septic tank was observed.**

During the OWS discovery, it was confirmed that the dispersal field has a similar configuration as the ACDEH records of the OWS plan approved on October 10, 1996. Based on the observed dispersal field trench dimensions, each trench provides a total of 335 square feet of infiltrated area, based on a 5.0 square feet per lineal foot of infiltrated surface, which equals a total of 1,005 square feet of infiltrated surface. **No evidence of foul odors, wastewater ponding, wastewater surfacing, or soil saturation was observed over the dispersal field or surrounding areas.**

TABLE 1 – OWSs INFORMATION SUMMARY

OWS Number	1	2
Buildings or Operations Served	Caretaker Mobile Home	Barn Building
Number of Bedrooms	3	N/A
Number of Bathrooms	2	2
Laundry Room	Washer and Dryer	N/A
Number of Occupants	1 to 2 people (Caretaker's Family)	Unknown
Wastewater Flow Based on No. of Bedrooms	450 gpd	N/A
Wastewater Flow Based on No. of Occupants	N/A	Unknown
Septic Tank Size	1,200 Gallons	1,200 Gallons

Approximate Total Dispersal Field Length	150 feet (Primary Dispersal Field Only)	201 feet (Primary Dispersal Field only)
Dispersal Field Trench Width	2 ft	3 ft
Trench Gravel Depth	2.3 ft	1 ft
Infiltrated Surface Area/ Linear Foot	6.6 ft^2	5 ft^2

OWS 1 - The percol*a*tion tests from November 14, 2023, were not conducted at the infiltrative surface depth of the existing dispersal field trenches since the percolation tests were conducted for a dispersal field replacement; therefore, the percolation test results should not be used to determine if the existing dispersal field is suitable for the wastewater flow from the existing caretaker 3-bedroom mobile home. However, the percolation test results from test holes P1 through P4 may be used to design a new dispersal field for the caretaker mobile home. Only 4 percolation tests were performed due to the limited space in the area adjacent to the existing dispersal field. See table below for percolation test results.

OWS 1 PERCOLATION TEST DATA – SUMMARY RESULTS

HOLE DEPTH (INCHES)	36”			
HOLE NUMBER	P1	P2	P3	P4
ADJUSTED STABILIZED RATE (MPI)	384	341	15	17
AVERAGE RATE (MPI)	189			

OWS 1 PERCOLATION TEST RESULTS DICREPANCIES: The significant difference in percolation rates between test holes P1 and P2 from P3 and P4 has to do with the location of the tests holes. P1 and P2 are set in the silty clay horizon which has a hard consistency, a few fine size pores and a few very fine size roots. P3 and P4 are located in a silty clay loam horizon which has a semi-hard consistency, many pores of fine, medium, and coarse size, as well as many roots of very fine, fine, medium and coarse size. While preparing the percolation test holes P3 and P4, it was noticed that the silty clay loam horizon extends deeper, 30 to 36 inches below ground surface, at that location.

BARN OWS 2:

OWS 2 PERCOLATION TEST DATA, NOVEMBER 14, 2023
SUMMARY RESULTS

HOLE DEPTH (INCHES)	36”			
HOLE NUMBER	P5	P6	P7	P8
ADJUSTED STABILIZED RATE (MPI)	19	10	26	192
AVERAGE RATE (MPI)	62			

At the request of ACDEH during the March 20, 2025, meeting, additional percolation tests were required at a specific location proposed by ACDEH (see Sheet OWTS-2, Barn OWS 2, Rev. 01, 03-30-25). Additional percolation test results below:

OWS 2 PERCOLATION TEST DATA, MARCH 27, 2025
SUMMARY RESULTS

HOLE DEPTH (INCHES)	36”		
HOLE NUMBER	P9	P10	P11
ADJUSTED STABILIZED RATE (MPI)	25	15	12
AVERAGE RATE (MPI)	17		

OWS 2 PERCOLATION TEST RESULTS DICREPANCIES: The significant difference in percolation rates between test hole P8 vs. P5, P6, P7, P9, P10 and P11 shows that percolation test hole P8 should be considered an outlier result and should not be used in calculating the average percolation rate. Therefore, the average rate should be 18 minutes per inch.

CONCLUSION:

OWS 1 – Since the existing dispersal field is within 10 feet from one of the large oak trees and roots have intruded into the D-box and distribution laterals and the existing driveway encroaches into portion of the dispersal field trenches, it is recommended to monitor the distribution box for root growth and have the driveway relocated away from the existing dispersal field trenches. In addition, install observation wells and monitor the dispersal field trenches for possible system failure. If the system shows signs of failure, the entire septic system will need to be replaced. Since percolation rates in test holes P1 and P2 exceed the allowed percolation rates, I recommend to conduct additional percolation tests at a shallow depth of 24 inches or less below ground surface. If acceptable rates are obtained, the tested area could be suitable for a drip dispersal field or a sand filter with a maximum depth of 24 inches below ground surface.

OWS 2 – Only the septic tank was evaluated. A new septic tank that meets the requirements for the new development must be proposed. The percolation tests were conducted for a new onsite wastewater dispersal field.

If you have any questions, please let me know.

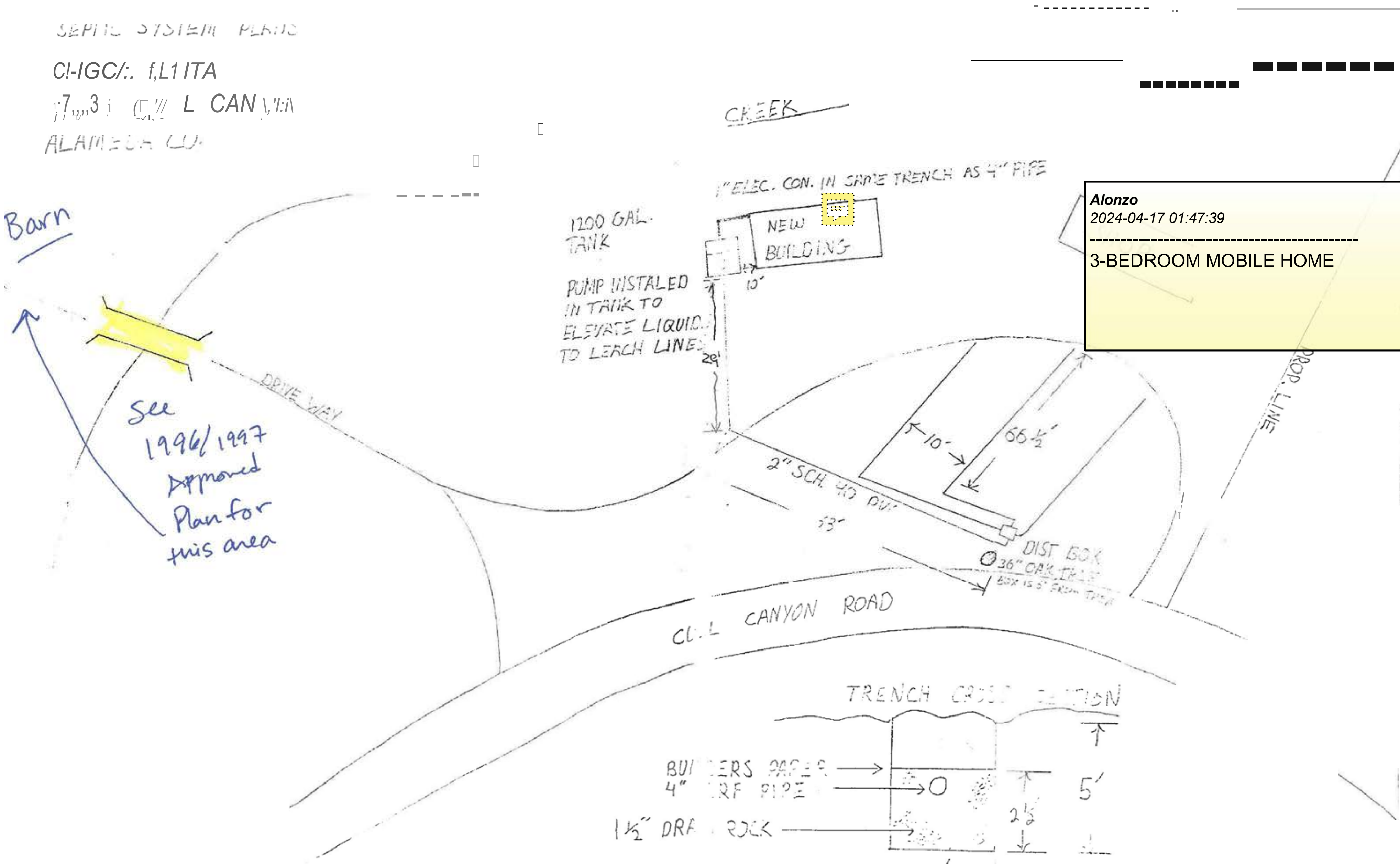
Regards,

Salvador M. Ruiz

Salvador M. Ruiz, REHS
State of California Registration Number: 5940
Expiration Date: December 31, 2026

APPENDIX 1

OWS 1 Records



Alonzo
2024-04-17 01:47:39
3-BEDROOM MOBILE HOME

BID. COPY

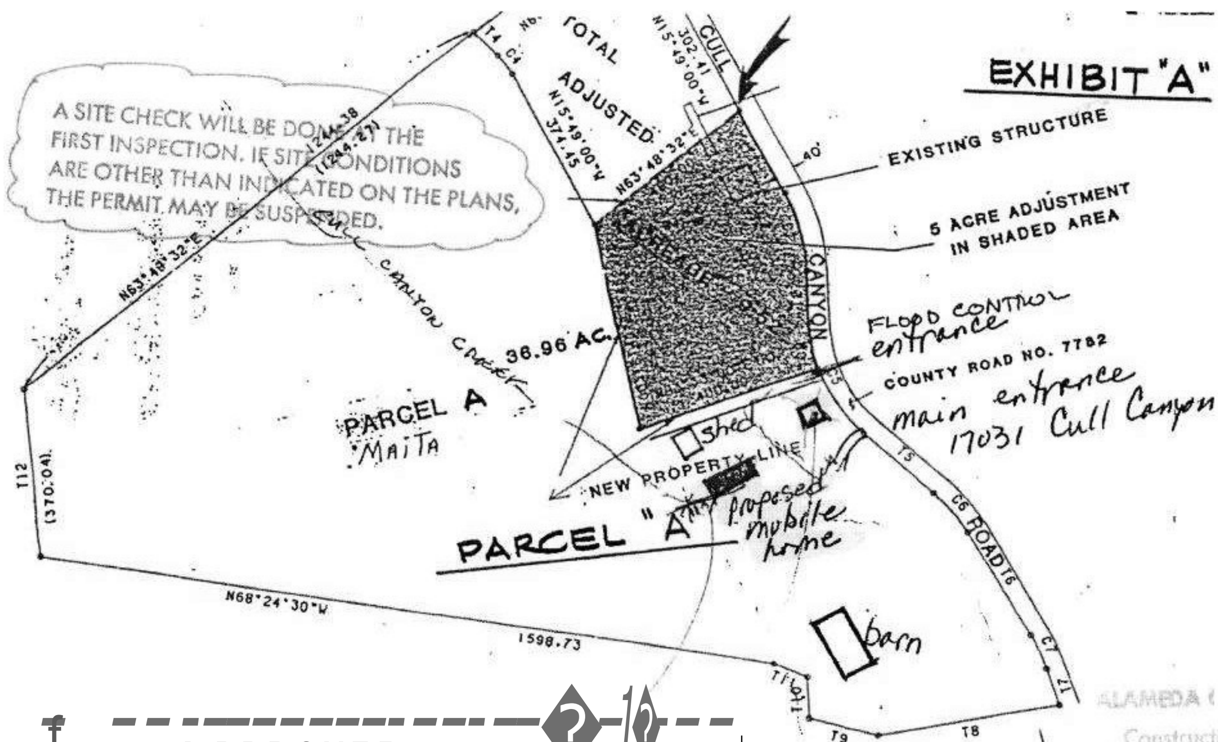
APPROVED
ALAMEDA COUNTY BUILDING INSPECTION DIVISION

Construction shall not be changed from what is shown on this plan unless authorized by the Building Official.

This plan shall be kept at the building site for use by the Building Inspector. Do not mark or alter.

This approval shall not be interpreted to be approval to violate or omit any provisions of the Building Code

Date 3-7-97



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Alameda Co Planning

MOBILEHOME INSTALLATION I.NFORMATION

PARK NA"1E ______________ I.O. UCI. ______________ SPACE _______

TENAm' .'iAME ______________ PARK ADDRESS ______________

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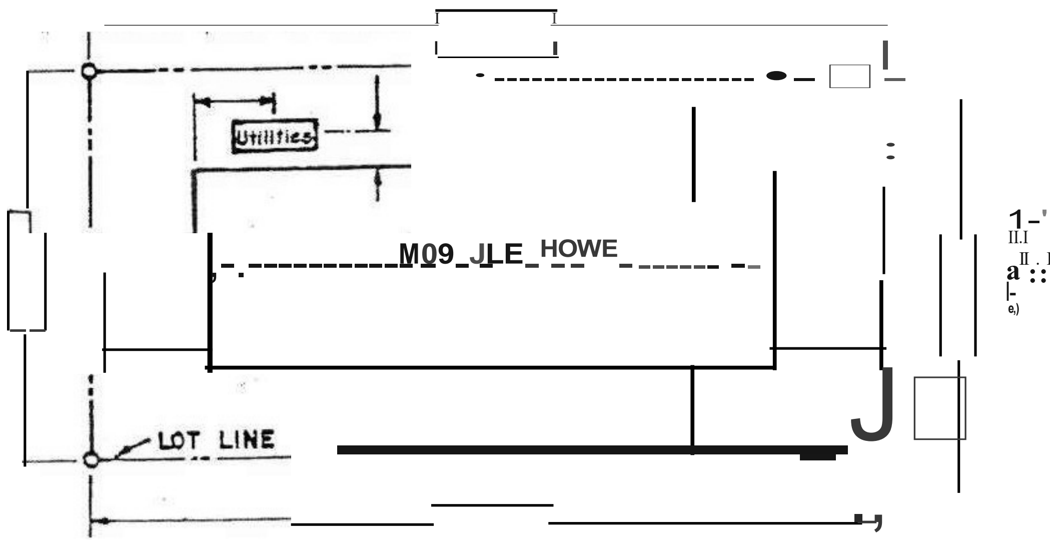

PLOT PLAN

LOT UTILITY SERVICES

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CIRCUIT BREAKER RATING . / o o (amps)

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MOBILEHOME DATA

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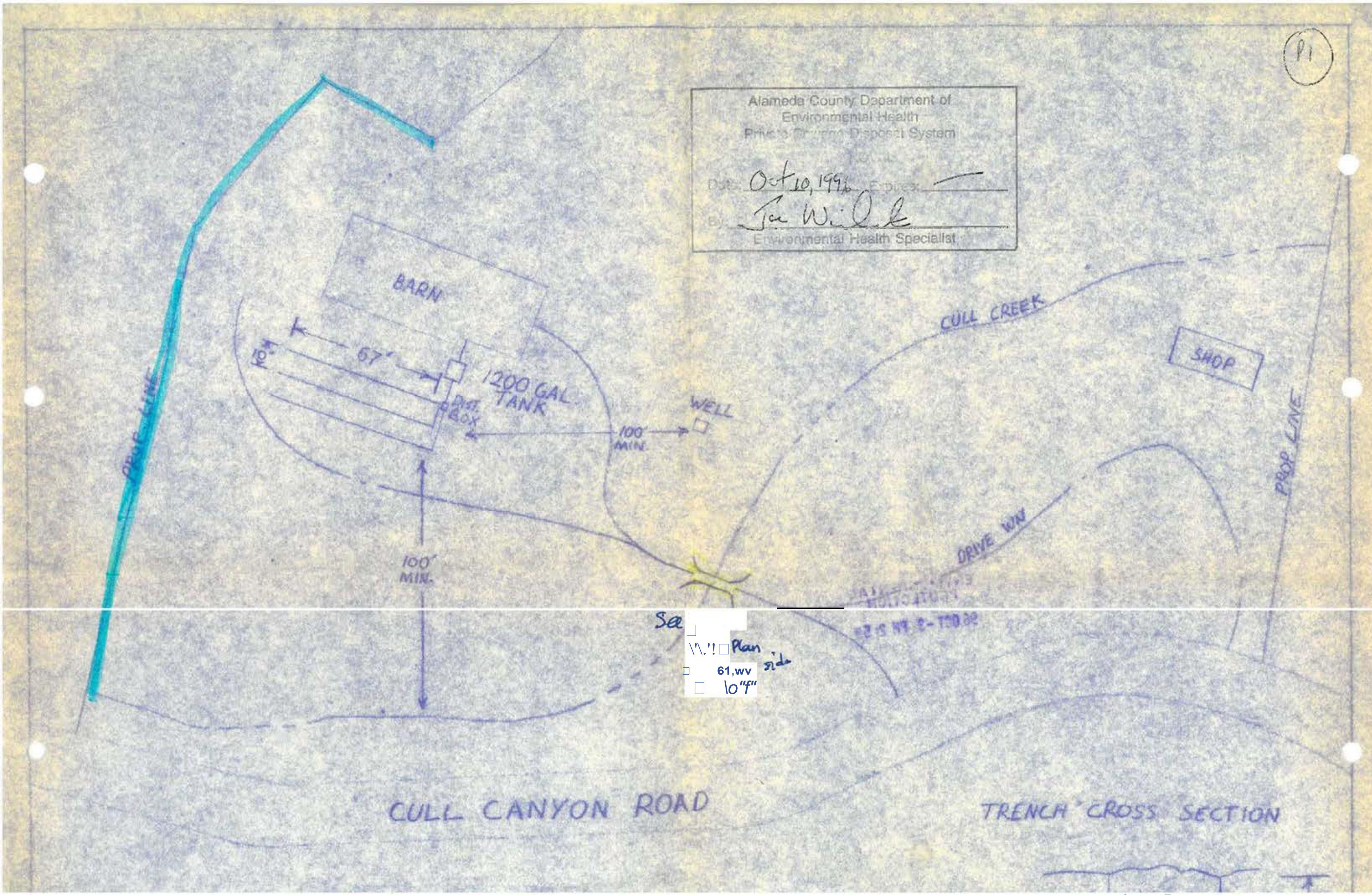
APPENDIX 2

OWS 2 Records


P1
Alameda County Department of
Environmental Health
Private Sewage Disposal System
Date: Oct 10, 1996
Environmental Health Specialist
BARN
67'
10'
1200 GAL TANK
DIST. BOX
100' MIN.
WELL
CULL CREEK
SHOP
PROP LINE
DRIVE WAY
100' MIN.
PROP LINE
CULL CANYON ROAD
TRENCH CROSS SECTION

APPENDIX 3

SOIL PROFILE

Soil Profile Report for On-Site Wastewater Disposal System
17015 Cull Canyon Road, Castro Valley, CA
APN: 085-1200-1-16

Qualified Professional: Salvador M. Ruiz, REHS

A soil profile was completed on November 13, 2023, within the proposed percolation test holes area at 17015 Cull Canyon, Castro Valley, California, Alameda County, Assessor's Parcel Number 085-1200-1-16, to determine the soils depth and characteristics for an onsite wastewater system suitability.

The following soil texture characteristics were observed at the soil profile test pit:

TEST PIT T1:

First Horizon

- **Depth -** Ground surface to 23 inches below ground surface (BGS)
- **Wetness** - dry
- **Rock Content –** less than 5% of pea gravel and cobbles
- **Color –** olive brown
- **Texture –** silty clay loam
- **Ribbon** - 0.25 inch
- **Structure –** subangular blocky
- **Grade -** strong
- **Plasticity** – slightly plastic
- **Stickiness –** slightly sticky
- **Consistency** – slightly hard
- **Pores** - many of fine, medium and coarse size
- **Roots** – many of very fine, fine, medium and coarse size
- **Other –** no mottles observed

Second Horizon

- **Depth -** 23 inches to 60 inches BGS
- **Wetness** – moist
- **Rock Content -** 0%
- **Color –** dark brown
- **Texture –** silty clay
- **Ribbon** - 0.75 inch
- **Structure –** subangular blocky
- **Grade -** moderate
- **Plasticity** – very plastic
- **Stickiness –** very sticky
- **Consistency** – hard
- **Pores** – few of fine size
- **Roots** – few of very fine size
- **Other –** low permeability

Total depth observed: 60 inches

APPENDIX 4

PERCOLATION TEST RESULTS

Percolation Test Data Form __________OWS 1

Date: 11-14-2023 **Address:** 17015 Cull Canyon Road, Castro Valley**APN:** 085-1200-1-16 **Conducted by:**

Salvador M. Ruiz**,** REHS **Inspected By:** Caroline Hoskins, ACDEH

Type of Test Hole: Alternative

Test Hole No: P1 **Float measurement from top of gravel:** 13.125 in.

Depth of Gravel:	**2**	in	Hole Diameter (d):	**6**	in	Pipe Length above ground (L_1):	0 in
Pipe Diameter (d_1):	**4**	in	Test Hole Depth (D):	**40**	in	Pipe Length (L):	**24** in

Test Interval	Time (min)			Waste Level (inches)			Percolation Rate		Test Termination Criteria
	Start (T_0)	End (T_1)	Interval (ΔT)	Initial (X_0)	Final (X_1)	Difference (ΔX)	(mpi)	Adjusted mpi (*1.6)	Percent Difference (≤10%)
1	7:30	8:00	0:30	19.0000	18.9375	0.0625	480	768	
2	8:00	8:30	0:30	18.9375	18.8750	0.0625	480	768	
3	8:30	9:00	0:30	19.2500	19.0625	0.1875	160	256	66.67%
4	9:00	9:30	0:30	19.2500	19.1250	0.1250	240	384	50.00%
5	9:30	10:00	0:30	19.2500	19.1250	0.1250	240	384	0.00%
6	10:00	10:30	0:30	19.1250	19.0000	0.1250	240	384	0.00%
7	10:30	11:00	0:30	19.3750	19.2500	0.1250	240	384	0.00%
8	11:00	11:30	0:30	19.2500	19.2500	0	0	0	0

(Average last 3 readings) Adjusted Percolation Rate (mpi): 384.00

Test Hole No: P2 **Float measurement from top of gravel:** 12.375 in.

Depth of Gravel:	**2**	in	Hole Diameter (d):	**6**	in	Pipe Length above ground (L_1):	0 in
Pipe Diameter (d_1):	**4**	in	Test Hole Depth (D):	**36**	in	Pipe Length (L):	**24** in

Test Interval	Time (min)			Waste Level (inches)			Percolation Rate		Test Termination Criteria
	Start (T_0)	End (T_1)	Interval (ΔT)	Initial (X_0)	Final (X_1)	Difference (ΔX)	(mpi)	Adjusted mpi (*1.6)	Percent Difference (≤10%)
1	7:31	8:01	0:30	18.5000	18.2500	0.25	120	192	
2	8:01	8:31	0:30	18.2500	18.1250	0.13	240	384	
2	8:31	9:01	0:30	18.2500	18.1250	0.13	240	384	100.00%
3	9:01	9:31	0:30	18.6250	18.4375	0.19	160	256	33.33%
4	9:31	10:01	0:30	18.4375	18.2500	0.19	160	256	0.00%
5	10:01	10:31	0:30	18.2500	18.1250	0.13	240	384	50.00%
6	10:31	11:01	0:30	18.4375	18.3125	0.13	240	384	0.00%
7	11:01	11:31	0:30	18.3125	18.1250	0.19	160	256	33.33%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 341.33

Test Hole No: P3 **Float measurement from top of gravel:** 12.75 in.

Depth of Gravel:	**2**	in	Hole Diameter (d):	**6**	in	Pipe Length above ground (L_1):	0 in
Pipe Diameter (d_1):	**4**	in	Test Hole Depth (D):	**36**	in	Pipe Length (L):	24 in

Test Interval	Time (min)			Waste Level (inches)			Percolation Rate		Test Termination Criteria
	Start (T_0)	End (T_1)	Interval (ΔT)	Initial (X_0)	Final (X_1)	Difference (ΔX)	(mpi)	Adjusted mpi (*1.6)	Percent Difference (≤10%)
1	7:32	8:02	0:30	20.5000	dry	unknown			
1	8:02	8:32	0:30	19.2500	13.7500	5.50	5.4545	8.7273	
2	8:32	9:02	0:30	18.8750	14.4375	4.44	6.7606	10.8169	23.94%
3	9:02	9:32	0:30	18.7500	14.6875	4.06	7.3846	11.8154	9.23%
4	9:32	10:02	0:30	18.5000	14.8750	3.63	8.2759	13.2414	12.07%
5	10:02	10:32	0:30	18.5000	15.1250	3.38	8.8889	14.2222	7.41%
6	10:32	11:02	0:30	18.5000	15.3750	3.13	9.6000	15.3600	8.00%
7	11:02	11:32	0:30	18.6875	15.5625	3.13	9.6000	15.3600	0.00%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 14.98

Test Hole No: P4 **Float measurement from top of gravel: 12.5** in.

Depth of Gravel:	**2**	in	Hole Diameter (d):	**6**	in	Pipe Length above ground (L_1):		0	in
Pipe Diameter (d_1):	**4**	in	Test Hole Depth (D):	**36**	in	Pipe Length (L):		**24**	in

Test Interval	**Time (min)**			**Waste Level (inches)**			**Percolation Rate**		**Test Termination Criteria**
	Start (T_0)	**End (T_1)**	**Interval (ΔT)**	**Initial (X_0)**	**Final (X_1)**	**Difference (ΔX)**	**(mpi)**	**Adjusted mpi (*1.6)**	**Percent Difference (≤10%)**
1	7:33	8:03	0:30	18.5000	12.7500	5.7500	5.2174	8.3478	
2	8:03	8:33	0:30	18.3750	14.2500	4.1250	7.2727	11.6364	39.39%
3	8:33	9:03	0:30	18.3750	14.7500	3.6250	8.2759	13.2414	13.79%
4	9:03	9:33	0:30	18.6250	15.0000	3.6250	8.2759	13.2414	0.00%
5	9:33	10:03	0:30	18.5625	15.3750	3.1875	9.4118	15.0588	13.73%
6	10:03	10:33	0:30	18.5625	15.6250	2.9375	10.2128	16.3404	8.51%
7	10:33	11:03	0:30	18.5000	15.7500	2.7500	10.9091	17.4545	6.82%
8	11:03	11:33	0:30	18.6250	16.0000	2.6250	11.4286	18.2857	4.76%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 17.36

Percolation Test Data - Summary Results

Test Hole. No.	Depth (inches)	Adjusted Percolation
P1	36	384
P2	36	341
P3	36	15
P4	36	17

Design Percolation Rate (mpi): 189

Alameda County Department of Environmental Health – Onsite Wastewater System Program
1131 Harbor Bay Pkwy, Alameda, CA 94502
Phone: (510) 567-6700 • Fax: (510) 337-9335 • Web: https://deh.acgov.org/landwater/owts.page

Percolation Test Data Form

OWS 2

Date: 11-14-2023 **Address:** 17015 Cull Canyon Road, Castro Valley **APN:** 085-1200-1-16 **Conducted by:**

Salvador M. Ruiz, REHS **Inspected By:** Caroline Hoskins, ACDEH

Type of Test Hole: Alternative

Test Hole No: P5 **Float measurement from top of gravel:** 12.125 in.

Depth of Gravel:	2	in	Hole Diameter (d):	6	in	Pipe Length above ground (L_1):	0	in	
Pipe Diameter (d_1):	4	in	Test Hole Depth (D):	36	in	Pipe Length (L):	24	in	
Test Interval	Time (min)			Waste Level (inches)			Percolation Rate		Test Termination Criteria
	Start (T_0)	End (T_1)	Interval (ΔT)	Initial (X_0)	Final (X_1)	Difference (ΔX)	(mpi)	Adjusted mpi (*1.6)	Percent Difference (≤10%)
1	9:45	10:15	0:30	18.2500	14.2500	4.0000	7.5000	12.0000	
2	10:15	10:45	0:30	18.3750	15.3750	3.0000	10.0000	16.0000	33.33%
3	10:45	11:15	0:30	18.1250	15.3750	2.7500	10.9091	17.4545	9.09%
4	11:15	11:45	0:30	18.1875	15.5000	2.6875	11.1628	17.8605	2.33%
5	11:45	12:15	0:30	18.1875	15.6250	2.5625	11.7073	18.7317	4.88%
6	12:15	12:45	0:30	18.1250	15.5000	2.6250	11.4286	18.2857	2.38%
7	12:45	13:15	0:30	18.1250	15.6875	2.4375	12.3077	19.6923	7.69%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 18.90

Test Hole No: P6 Float measurement from top of gravel: 12.625 in.

Depth of Gravel:	2	in	Hole Diameter (d):	6	in	Pipe Length above ground (L_1):	0	in	
Pipe Diameter (d_1):	4	in	Test Hole Depth (D):	36	in	Pipe Length (L):	24	in	
Test Interval	Time (min)			Waste Level (inches)			Percolation Rate		Test Termination Criteria
	Start (T_0)	End (T_1)	Interval (ΔT)	Initial (X_0)	Final (X_1)	Difference (ΔX)	(mpi)	Adjusted mpi (*1.6)	Percent Difference (≤10%)
1	9:46	10:16	0:30	18.6250	13.1250	5.5000	5.4545	8.7273	
2	10:16	10:46	0:30	18.6250	13.0000	5.6250	5.3333	8.5333	2.22%
3	10:46	11:16	0:30	18.6250	13.4375	5.1875	5.7831	9.2530	8.43%
4	11:16	11:46	0:30	18.5000	13.7500	4.7500	6.3158	10.1053	9.21%
5	11:46	12:16	0:30	18.6250	13.9375	4.6875	6.4000	10.2400	1.33%
6	12:16	12:46	0:30	19.1250	14.1250	5.0000	6.0000	9.6000	6.25%
7	12:46	13:16	0:30	18.6250	14.0625	4.5625	6.5753	10.5205	9.59%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 10.12

Test Hole No: P7 Float measurement from top of gravel: 13.375 in.

Depth of Gravel:	2	in	Hole Diameter (d):	6	in	Pipe Length above ground (L_1):	0	in	
Pipe Diameter (d_1):	4	in	Test Hole Depth (D):	36	in	Pipe Length (L):	24	in	
Test Interval	Time (min)			Waste Level (inches)			Percolation Rate		Test Termination Criteria
	Start (T_0)	End (T_1)	Interval (ΔT)	Initial (X_0)	Final (X_1)	Difference (ΔX)	(mpi)	Adjusted mpi (*1.6)	Percent Difference (≤10%)
1	9:47	10:17	0:30	19.5000	16.3750	3.1250	9.6000	15.3600	
2	10:17	10:47	0:30	19.2500	17.2500	2.0000	15.0000	24.0000	56.25%
3	10:47	11:17	0:30	19.2500	17.2500	2.0000	15.0000	24.0000	0.00%
4	11:17	11:47	0:30	19.2500	17.5000	1.7500	17.1429	27.4286	14.29%
5	11:47	12:17	0:30	19.3125	17.5000	1.8125	16.5517	26.4828	3.45%
6	12:17	12:47	0:30	19.3750	17.6250	1.7500	17.1429	27.4286	3.57%
7	12:47	13:17	0:30	19.3750	17.5000	1.8750	16.0000	25.6000	6.67%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 26.50

Test Hole No: P8 Float measurement from top of gravel: 11.625 in.

Depth of Gravel:	**2**	in	Hole Diameter (d):	**6**	in	Pipe Length above ground (L_1):	0 in
Pipe Diameter (d_1):	**4**	in	Test Hole Depth (D):	36	in	Pipe Length (L):	24 in

Test Interval	**Time (min)**			**Waste Level (inches)**			**Percolation Rate**		**Test Termination Criteria**
	Start (T_0)	**End (T_1)**	**Interval (ΔT)**	**Initial (X_0)**	**Final (X_1)**	**Difference (ΔX)**	**(mpi)**	**Adjusted mpi (*1.6)**	**Percent Difference (≤10%)**
1	9:47	10:18	0:31	17.625	17.125	0.5000	60.0000	96.0000	
2	10:18	10:48	0:30	17.625	17.3125	0.3125	96.0000	153.6000	60.00%
3	10:48	11:18	0:30	17.625	17.3125	0.3125	96.0000	153.6000	0.00%
4	11:18	11:48	0:30	17.625	17.375	0.2500	120.0000	192.0000	25.00%
5	11:48	12:18	0:30	17.625	17.375	0.2500	120.0000	192.0000	0.00%
6	12:18	12:48	0:30	17.625	17.375	0.2500	120.0000	192.0000	0.00%
7	12:48	13:18	0:30	17.625	17.375	0.2500	120.0000	192.0000	0.00%

(Average last 3 readings) Adjusted Percolation Rate (mpi): 192.00

Percolation Test Data - Summary Results

Test Hole. No.	Depth (inches)	Adjusted Percolation
P5	36	19
P6	36	10
P7	36	26
P8	36	192

Design Percolation Rate (mpi): 62

Alameda County Department of Environmental Health – Onsite Wastewater System Program
1131 Harbor Bay Pkwy, Alameda, CA 94502
Phone: (510) 567-6700 • Fax: (510) 337-9335 • Web: https://deh.acgov.org/landwater/owts.page

Percolation Test Data Form

17015 Cull Canyon Rd., Castro Valley   APN: 99-1150-30

Date: 3-27-25   Conducted by: Salvador M. Ruiz, REHS

Test Hole No: P9   Measurements Reference Point: 12.5 in   Inspected by: Not required by ACDEH

Depth of Gravel:	**2**	in		Hole Diameter (d):	**6**	in			Pipe Length above ground (L_1):	10	in
Pipe Diameter (d_1):	**4**	in		Test Hole Depth (D):	36	in			Pipe Length (L):	24	in
Test Interval	**Time (min)**			**Waste Level (inches)**			**Percolation Rate**		**Test Termination Crietria**		
	Start (T_0)	**End (T_1)**	**Interval (ΔT)**	**Initial (X_0)**	**Final (X_1)**	**Difference (ΔX)**	**(mpi)**	**Adjusted mpi (*1.6)**	**Percent Difference (≤10%)**		
1	2:00	2:30	0:30	18.6875	15.3750	3.3125	9.06	14.49			
2	2:30	3:00	0:30	18.6250	16.7500	1.8750	16.00	25.60		76.67%	
3	3:00	3:30	0:30	18.5000	16.8750	1.6250	18.46	29.54		15.38%	
4	3:30	4:00	0:30	18.5000	16.5625	1.9375	15.48	24.77		16.13%	
5	4:00	4:30	0:30	18.6250	16.7500	1.8750	16.00	25.60		3.33%	
6	4:30	5:00	0:30	18.5000	16.6250	1.8750	16.00	25.60		0.00%	
7	5:00	5:30	0:30	18.6250	16.6875	1.9375	15.48	24.77		3.23%	
13											
14											
15											

(Average last 3 readings)   Adjusted Percolation Rate (mpi): 25

Test Hole No: P10   Measurement Reference Point: 11.875 in

Depth of Gravel:	**2**	in		Hole Diameter (d):	**6**	in			Pipe Length above ground (L_1):	10	in
Pipe Diameter (d_1):	**4**	in		Test Hole Depth (D):	36	in			Pipe Length (L):	24	in
Test Interval	**Time (min)**			**Waste Level (inches)**			**Percolation Rate**		**Test Termination Crietria**		
	Start (T_0)	**End (T_1)**	**Interval (ΔT)**	**Initial (X_0)**	**Final (X_1)**	**Difference (ΔX)**	**(mpi)**	**Adjusted mpi (*1.6)**	**Percent Difference (≤10%)**		
1	2:01	2:31	0:30	17.7500	dry			-			
2	2:31	3:01	0:30	18.1250	12.0625	6.0625	4.95	7.92			
3	3:01	3:31	0:30	18.0000	13.0000	5.0000	6.00	9.60		21.25%	
4	3:31	4:01	0:30	17.7500	13.8750	3.8750	7.74	12.39		29.03%	
5	4:01	4:31	0:30	17.8750	14.3125	3.5625	8.42	13.47		8.77%	
6	4:31	5:01	0:30	17.8750	14.6250	3.2500	9.23	14.77		9.62%	
7	5:01	5:31	0:30	17.7500	14.7500	3.0000	10.00	16.00		8.33%	
13											
14											
15											

(Average last 3 readings)   Adjusted Percolation Rate (mpi): 15

Test Hole No: P11   Measurement Refernce Point: 12.375 in

Depth of Gravel:	**2**	in		Hole Diameter (d):	**6**	in			Pipe Length above ground (L_1):	10	in
Pipe Diameter (d_1):	**4**	in		Test Hole Depth (D):	36	in			Pipe Length (L):	24	in
Test Interval	**Time (min)**			**Waste Level (inches)**			**Percolation Rate**		**Test Termination Crietria**		
	Start (T_0)	**End (T_1)**	**Interval (ΔT)**	**Initial (X_0)**	**Final (X_1)**	**Difference (ΔX)**	**(mpi)**	**Adjusted mpi (*1.6)**	**Percent Difference (≤10%)**		
1	2:02	2:32	0:30	18.0625	dry			-			
2	2:32	3:02	0:30	18.5625	12.7500	5.8125	5.16	8.26			
3	3:02	3:32	0:30	18.2500	12.9375	5.3125	5.65	9.04		9.41%	
4	3:32	4:02	0:30	18.1250	13.6875	4.4375	6.76	10.82		19.72%	
5	4:02	4:32	0:30	18.3125	14.0000	4.3125	6.96	11.13		2.90%	
6	4:32	5:02	0:30	18.2500	14.2500	4.0000	7.50	12.00		7.81%	
7	5:02	5:32	0:30	18.2500	14.3125	3.9375	7.62	12.19		1.59%	
13											
14											
15											

(Average last 3 readings)   Adjusted Percolation Rate (mpi): 12

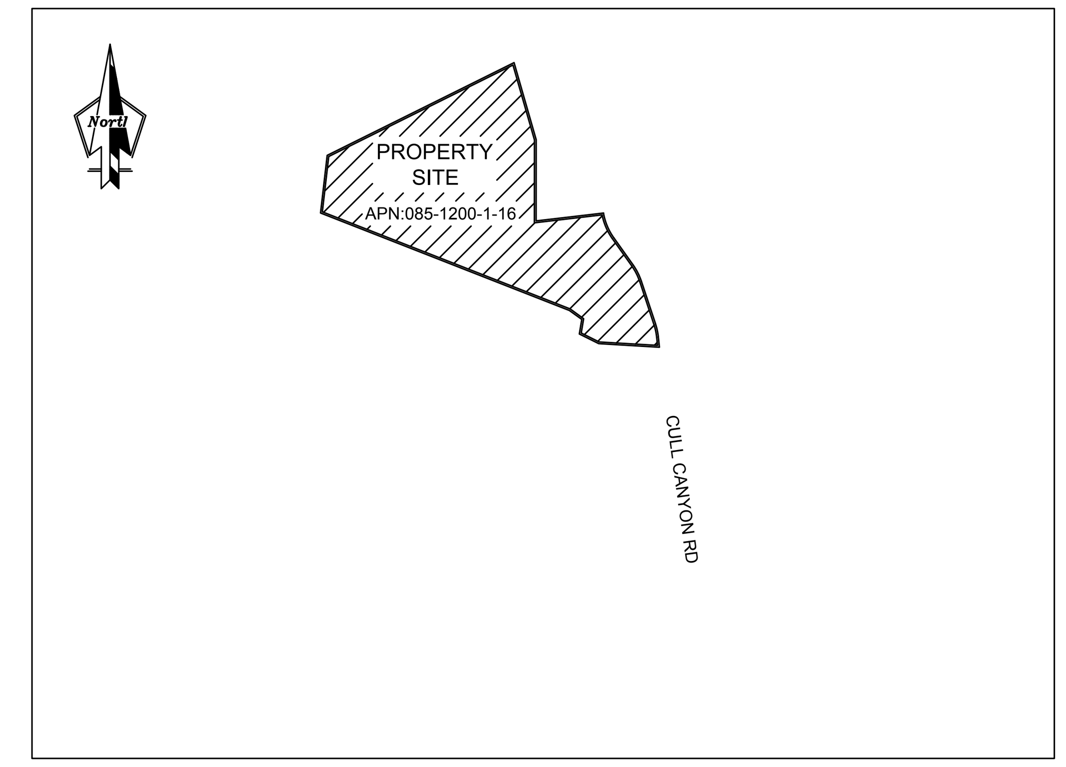
BASE SITE PLAN MAP PROVIDED BY
NORTHSTAR DESIGNING SOLUTIONS
111 MISSION RANCH BLVD, SUITE 100
CHICO, CA 95926
(530) 893-1600

SITE LAYOUT

SCALE: 1" = 100'

SCALE 1" = 100'

0 100 200 400



VICINITY MAP

SCALE: N.T.S.

THIS SITE MAP WAS PREPARED SOLELY FOR THE PURPOSE OF THE OWTS LOCATION AND SHOULD NOT BE CONSTRUED AS A BOUNDARY SURVEY OR FOR OTHER PURPOSES. LOCATIONS ARE APPROXIMATE, ALL INFORMATION SHOWN ON THE DRAWING HAS BEEN PROVIDED BY THE PROPERTY OWNER AND MEASUREMENTS TAKEN IN THE FIELD.

SHEET
OWTS-1

DATE: 04/16/24
SCALE: 1" = 100'
DRAWN: ADR
CHECKED BY: SMR
REV. 01 (05/16/25)

SITE LOCATION:
17015 CULL CANYON RD
CASTRO VALLEY, CA 94552
APN: 085-1200-1-16

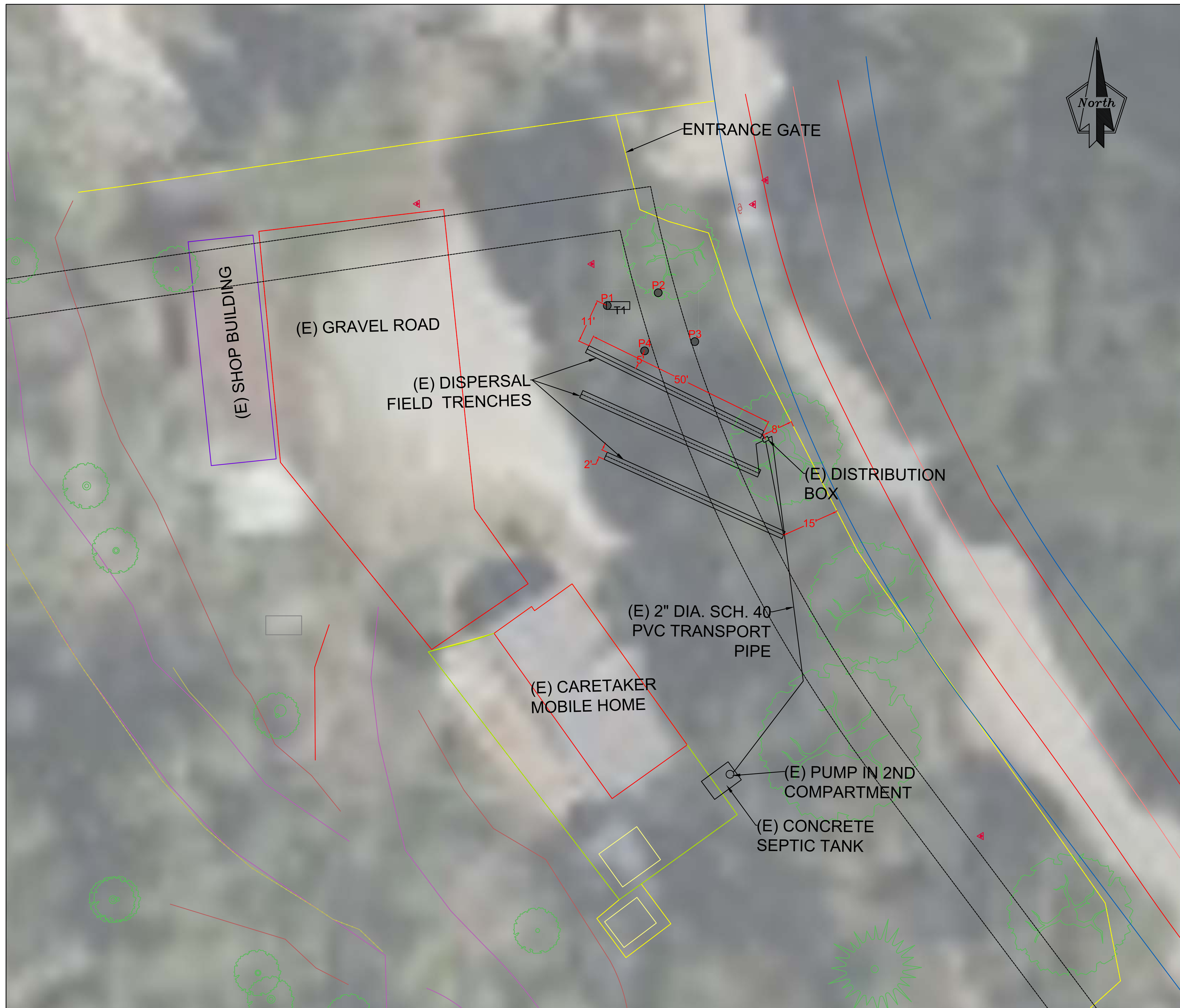
AS-BUILT ONSITE
WASTEWATER SYSTEM FOR:

THE MOSAIC PROJECT
17015 CULL CANYON RD
CASTRO VALLEY, CA 94552

SALVADOR M. RUIZ
REGISTERED ENVIRONMENTAL
HEALTH SPECIALIST
STATE OF CALIFORNIA
REGISTRATION NUMBER:5940
EXPIRES: 12-31-26

X_________ DATE:05/16/25

SALVADOR M. RUIZ, R.E.H.S
3941 PARK DRIVE STE. 20744
EL DORADO HILLS, CA 95762
PHONE: (925) 212-9168
EMAIL: sruizehs@yahoo.com



KEY NOTES

(E) EXISTING

(P) PROPOSED

PERCOLATION TEST HOLE

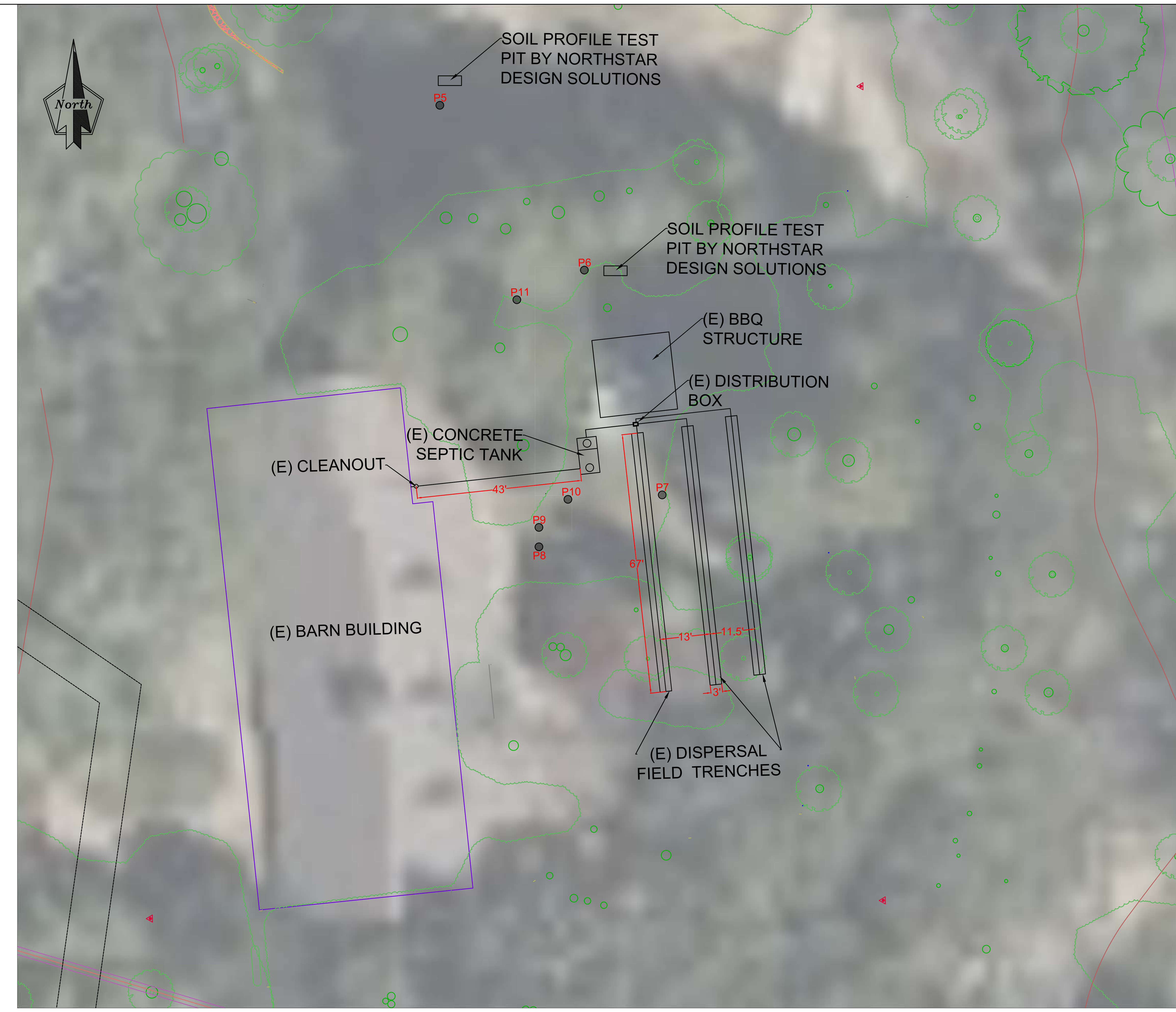
SOIL PROFILE TEST PIT

CARETAKER HOUSE OWS 1

SCALE: 1" = 20'

SCALE 1" = 20'

0 20 40 80



KEY NOTES

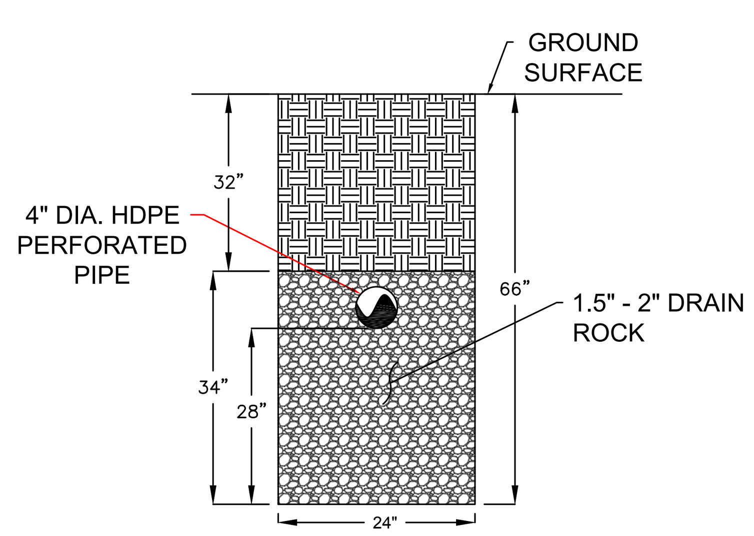
(E) EXISTING

BARN OWS 2

SCALE: 1" = 20'

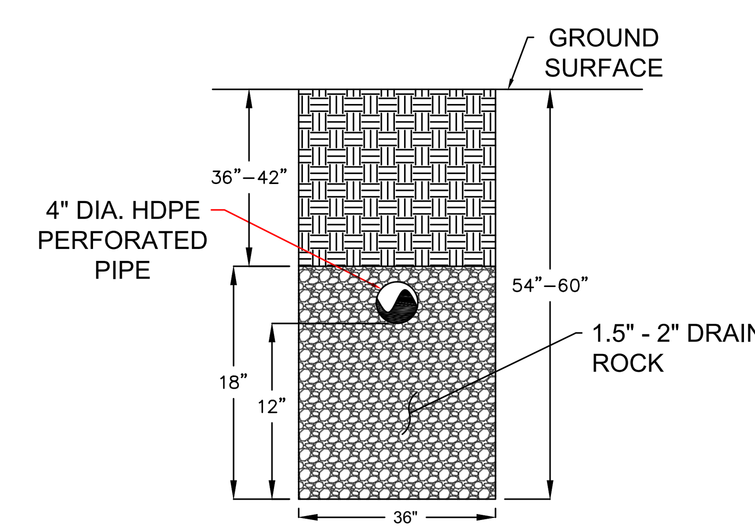
SCALE 1" = 20'

0 20 40 80



CARETAKER HOUSE OWS DISPERSAL FIELD TRENCH CROSS SECTION

SCALE: NOT TO SCALE



BARN OWS DISPERSAL FIELD TRENCH CROSS SECTION

SCALE: NOT TO SCALE

SHEET

OWTS-2

DATE: 04/16/24
SCALE: 1" = 20'
DRAWN: ADR
CHECKED BY: SMR
REV. 01 (05/16/25)

SITE LOCATION:
17015 CULL CANYON RD
CASTRO VALLEY, CA 94552
APN: 085-1200-1-16

AS-BUILT ONSITE
WASTEWATER SYSTEM FOR:
THE MOSAIC PROJECT
17015 CULL CANYON RD
CASTRO VALLEY, CA 94552

SALVADOR M. RUIZ
REGISTERED ENVIRONMENTAL
HEALTH SPECIALIST
STATE OF CALIFORNIA
REGISTRATION NUMBER:5940
EXPIRES: 12-31-26

X DATE:05/16/25

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3941 PARK DRIVE STE. 20744
EL DORADO HILLS, CA 95762
PHONE: (925) 212-9168
EMAIL: sruizehs@yahoo.com

PHOTOS
Existing Onsite Wastewater Systems
17015 Cull Canyon Road, Castro Valley, CA

Photo 1: OWS 1 Uncovered Distribution Box

PHOTOS
Existing Onsite Wastewater Systems
17015 Cull Canyon Road, Castro Valley, CA

Photo 2: <u>OWS 1 Roots Removed from Distribution Box and Distribution Laterals</u>

PHOTOS
Existing Onsite Wastewater Systems
17015 Cull Canyon Road, Castro Valley, CA

Photo 3: OWS 1 Wastewater Flowing Out after the Distribution Lateral Pipe was Perforated to Introduce the Tracer

PHOTOS
Existing Onsite Wastewater Systems
17015 Cull Canyon Road, Castro Valley, CA

Photo 4: OWS 2 Septic Tank Second Compartment Outlet Sanitary Tee and Roots Intrusion

PHOTOS
Existing Onsite Wastewater Systems
17015 Cull Canyon Road, Castro Valley, CA

Photo 5: OWS 2 Distribution Box with Redwood Tree Roots Intrusion