Appendix H
Preliminary Hydrologic and Stormwater Analysis

Memorandum

April 14, 2021

To:	Marianne Naess, Executive Vice President of Nordic Aquafarms	Ref. No.:	11207226
From:	Patrick Tortora, PE; Nathan Sanger, PE	Tel:	(707) 443-8330
cc:	John Ford, Humboldt County Planning Department		
Subject:	**Nordic Aquafarms Preliminary Hydrologic and Stormwater Analyses, Rev. 3**		

1. Introduction

1.1 Purpose

Nordic Aquafarms Inc (NAF) is proposing to build an entirely land-based aquaculture project at the former Louisiana Pulp Mill in Samoa, California. The project will be sited at the approximately 36-acre lease area and will likely be developed in two to three phases. The total facility building footprint is currently estimated at approximately 767,000 square feet (~17.6 acres) for the 5 buildings and 22,000 square feet (~0.5 acres) for the oxygen generation yard.

A hydrologic and stormwater study was performed to evaluate the impacts of the proposed construction on pre-developed stormwater characteristics and to analyze the measures proposed to mitigate those impacts. This document presents the information, methods, and results generated from that study.

1.2 Methodologies and Assumptions

The methodologies used in conducting the hydrologic and stormwater analyses were generated from a variety of sources including existing maps, field data, computer programs, standards, and reference manuals.

The hydrologic analyses were performed using the SCS Dimensionless Unit Hydrograph method with a 24-hour NRCS Type IA synthetic rainfall distribution. This method was used to generate site runoff hydrographs, determine peak flows, and perform infiltration pond routing analysis. The pond routing utilized the software package PondPack V8i to determine the peak flows and pond stages at various storm events. Table 1 below outlines the site-specific design parameters that were used for modeling the site hydrology.

Table 1 Design Parameters

Coefficent	Value
Runoff Coefficient (CN): impervious[1]	98
Time of Concentration (Tc)[2]	5 minutes
Infiltration Rate	13 inches/hour
Design Infiltration Rate[3]	6 inches/hour

1: The curve number for the preliminary calculations was 98, in order to provide conservative estimates for the site runoff and potentially account for any minor design modifications as the project progresses. The final calculations will utilize composite curve numbers based on the landscape, roof top, and pavement areas.
2: The time of concentration was assumed to be 5 minutes to provide a conservative estimate of potential stormwater discharge and potentially account for any minor design modifications as the project progresses.
3: Infiltration rate was determined by the NCRS soil survey. See data in Appendix A. A design infiltration rate of 6 inches/hour was used as a conservative value to account for future sedimentation and potential reduced infiltration rates over the life of the project.

1.3 Agency Stormwater Criteria

This project lies within the County of Humboldt's jurisdiction but is outside the regulated Municipal Separate Storm Sewer System (MS4) permit boundaries. Thus, MS4 stormwater criteria do not apply to the project. This project, therefore, will follow the stormwater regulations that conform to the State Water Recourses Control Board's (SWRCB) Construction General Permit (CGP) post-construction requirements.

The CGP post-construction standards require that the proposed project capture and treat the stormwater generated from the 85th percentile 24-hour storm event. In order to minimize the potential for movement of contaminants offsite and ensure no impacts to receiving waters, the NAF facility will exceed the capture requirement for the CGP standards by designing its stormwater treatment system to provide onsite stormwater capture and infiltration up to the 100-year 24-hour storm event. The overall proposed design for the NAF facility will include stormwater treatment for the volume of water generated by the 85th percentile 24-hour rain fall event (See Table 2 below), and stormwater volume capture for the volume of water associated with the 100-year 24-hour storm event (Table 2).

1.4 Rainfall Intensity Data

The 24-hour rainfall depths used in this study were obtained from the NOAA Atlas 14, Volume 6, Version 2 Eureka WFO Woodley Island Station 04-2910 (Appendix A). Rainfall depths are summarized in Table 2 below.

Table 2 24-Hour Rainfall Depths

Design Storm	24-Hour Rainfall (inches)
85th Percentile	0.65
2 Year	2.66

Table 2 24-Hour Rainfall Depths

Design Storm	24-Hour Rainfall (inches)
5 Year	3.53
10 Year	4.12
25 Year	4.92
100 Year	6.19

2. Existing Storm Drainage Conditions

This existing site is generally flat, sloping from west to east. Most of the site is situated at an elevation of approximately 22 feet (NAVD88), with an elevation range of approximately 20-25 feet throughout the area to be developed (Appendix B, Figure B-1). Stormwater generated on the western side of the site currently drains to an existing pipe system that discharges to the ocean outfall, and stormwater generated on the eastern side of the site currently discharges to Humboldt Bay (Figure B-1).

The Humboldt Bay tidal conditions in the vicinity of the site are listed in Table 3 below. NOAA historical tidal data is included in Appendix C.

Table 3 Datum's and Observed Tides (Humboldt Bay North Spit Buoy)

Datum	Value (ft, NAVD88)
Mean Higher High Water	6.51
Mean High Water	5.80
Mean Tide Level	3.36
Mean Sea Level	3.36
Mean Low Water	0.91
Mean Lower Low Water	-0.34
Highest Tide Observed	9.54

3. Proposed Drainage Conditions

The existing industrial buildings and surrounding hardscape areas will be demolished as a part of this project except for the two existing warehouse buildings that are nearest the bay (Figure B-2). Much of the existing stormwater piping located on the interior of the site will also be removed, with the remaining portion along the northern border of the site being used as emergency overflow piping for major storm events that produce stormwater volumes that exceed the capacity of the stormwater treatment system. For storm events up to the 100-year 24 hour storm the site has been designed to have no offsite discharge to ensure no stormwater impacts to receiving waters.

The proposed facility will result in an increase of impervious surface area from 18.8 acres to 25.9 acres (as part of a total lease area of 35.6 acres), which results in a 20% net increase of impervious surface area compared to existing site conditions.

This project is proposing three vegetated bioretention/infiltration ponds and a series of Low Impact Development (LID) facilities to manage the stormwater generated from the five separate drainage basins of the site (Figure B-2), with the goal of capturing and infiltrating all onsite stormwater up to the 100-year, 24 hour storm event. Typical cross sections of the proposed bioretention/infiltration ponds and LID facilities are included as Appendix D. Figure B-3 depicts the preliminary site grades and proposed stormwater drainage flow pathways throughout the facility.

Drainage basins 1 through 3 will utilize vegetated bioretention/infiltration ponds, and drainage basin 4 will employ a series of LID stormwater facilities in combination with infiltration trenches to provide volume capacity for storm events up to the 100-year storm event. The bioretention/infiltration ponds and trenches will be up to maximum 4' deep, with bottom elevations ranging from 16 to 18 feet (NAVD 88), which is above typical tidal elevations in the vicinity.

An 18-inch layer of topsoil will provide stormwater treatment, for the 85th percentile storm event or greater, in both the bioretention/infiltration ponds and LID stormwater facilities (Appendix D). The 18-inch layer of topsoil has been selected to be in conformance with the Humboldt County Low Impact Development Guidelines (Humboldt County 2016), which require a minimum depth of Bioretention Soil Media (BSM) based on national studies.

Drainage basin 5 includes the gravel fire access road located immediately south of building 2. The fire access road has been designed to match the existing topography in the area to minimize the potential for stormwater runoff from the road. The fire access road has also been located and graded such that stormwater runoff in this basin will not impact the area within a minimum of 10 feet offset from any identified high quality dune mats.

Pond routing models have been completed for Ponds 1-3 and their performance under various storm events are summarized in Table 4 below. For the pond routing models, the site was subdivided into sub basins that correspond to the treatment ponds. Figure B-2 depicts the ponds and LIDs, sub basins, and sub basin areas for the site. Figure B-3 shows preliminary site grades and stormwater flow paths. Stormwater modeling output data is included as Appendix E.

Table 4 Infiltration Pond Performance Summary

Facility	Storm Event	Peak Inflow (cfs)	Surface Water Elevation (ft) (NAVD 88)	Required Storage (cf)	Proposed Pond Storage (cf)
Pond 1	85th Percentile	1.0	18.2	2,443	60,150
	2 Year	5.4	18.9	14,925	
	5 Year	7.3	19.2	20,864	
	10 Year	8.5	19.5	25,726	
	25 Year	10.2	19.8	33,146	
	100 Year	12.9	20.4	45,479	
Pond 2	85th Percentile	0.6	18.4	1,046	29,099
	2 Year	3.0	19.9	8,625	
	5 Year	4.0	20.4	12,721	
	10 Year	4.7	20.8	15,978	
	25 Year	5.7	21.2	20,761	
	100 Year	7.2	21.9	28,279	
Pond 3	85th Percentile	0.6	18.2	1,436	30,250
	2 Year	3.2	19.1	8,957	
	5 Year	4.3	19.5	13,007	
	10 Year	5.1	19.8	16,248	
	25 Year	6.1	20.2	20,761	
	100 Year	7.7	20.9	28,951	

Tables 5 and 6 provide a summary of the basin 4 infiltration trench performance and size. The lengths shown in Table 6 account for the total length required to capture and treat the 100-year, 24-hour storm event. The total length of the trench can be broken up in sub-trenches (sized accordingly) to align with the proposed LIDs shown in Figure B-2.

Table 5 Basin 4 100-Year Storm Event Infiltration Trench Performance Summary

Facility	Peak Inflow (cfs)	Design Trench Outflow Rate (cfs)	Required Storage Volume (cf)	Proposed Trench Storage (cf)
Infiltration Trench	13.3	2.85	39,093	43,374

Table 6 Basin 4 Infiltration Trench Size Summary

Facility	Length (ft)	Width (ft)	Depth (ft)	Perforated Pipe
Infiltration Trench	1400	12	4	4 – 30 inch dia.

Tables 7 and 8 provide a summary of the stormwater discharge and subsurface infiltration of stormwater associated with basin 5. For the purposes of this analysis a 2.25 foot wide existing sand surface buffer along

the entire length of the south side of the gravel road was modeled to demonstrate infiltration of stormwater runoff associated with the 100-year storm event. The gravel access road and 2.25 foot wide buffer are located a minimum of 12 feet offset from any identified high quality dune mats.

Table 7 Basin 5 100-Year Storm Event Infiltration Buffer Performance Summary

Facility	Peak Inflow (cfs)	Design Infiltration Buffer Outflow Rate (cfs)	Required Storage Volume (cf)	Modeled Infiltration Buffer Storage (cf)
Infiltration Buffer	1.0	0.46	737	846

Table 8 Basin 5 Infiltration Buffer Size Summary

Facility	Length (ft)	Width (ft)	Depth (ft)
Infiltration Buffer	1140	2.25	1

The above hydrologic analysis demonstrates that the stormwater treatment ponds and LID infiltration trench facilities proposed for the site provide stormwater treatment and volume capacity that exceeds the 100-year storm event for each of the site's stormwater basins. As such, the proposed stormwater treatment for the site meets and exceeds the post-construction stormwater management criteria of the CGP. The above analysis also demonstrates that the high-quality dune mat area located to the south of building 2 will not be impacted by the anticipated stormwater runoff from the gravel fire access road at the site.

3.1 Infiltration Basin Design Considerations

The design of the storm water infiltration basins is complex and must consider several factors that influence the infiltration rate and overall ability of the basin to adequately function. These factors include near-surface soil characteristics, subsurface geology, groundwater conditions and infiltration pond configuration. Massman et al (Massman, 2003) developed an infiltration pond design manual that outlines a step by step process for infiltration basin design. The steps include:

1. Estimation of stormwater runoff that is routed to the infiltration pond,
2. Selection of pond configuration and depth,
3. Subsurface site characterization and data collection,
4. Determination of the saturated hydraulic conductivity (K_s),
5. Determination of the hydraulic gradient, and
6. Estimation of the infiltration pond effective infiltration rate

Storm Water Runoff

The storm water runoff for the entire site was calculated using the SCS Dimensionless Unit Hydrograph method with a 24-hour NRCS Type IA synthetic rainfall distribution and is presented in Appendix E. The resulting runoff hydrograph for the 100-year, 24-hour storm event had a peak flow of approximately 13.3

cubic feet per second (cfs) (at basin 4) and a total volume of 623,092 cubic feet (4,661,052 gallons). The volume of stormwater listed above doesn't include discharge from basin 5. Since basin 5 is relatively small and model analysis demonstrates that stormwater from this basin will be infiltrated by the existing sand surface buffer immediately south of the gravel fire access road, it has been excluded from the following infiltration design analysis.

Pond Configuration and Depth

The detention and infiltration features include 3 detention/infiltration ponds and one infiltration trench. The area and depth of the features are summarized in Table 9.

Table 9 Basin Infiltration Size Summary

Facility	Max Depth BGS (ft)	Area (ft^2)
Pond 1	3	21,500
Pond 2	4	10,200
Pond 3	3	13,188
Trench	6	16,800

Subsurface Site Characterization

The subsurface site characterization was performed by SHN Consulting Engineers and Geologists and is summarized in the Preliminary Geotechnical Investigation Report, June 2020. Field work consisted of 13 geotechnical test borings and 6 Seismic Cone Penetrometer tests (CPT). An excerpt from the report characterizes the site as:

"*Data from the borings and SCPT probes indicates the upper 130 feet of the subsurface profile to be consistent across the project site. A thin veneer of loose surficial sandy fill overlies most of the project site. Below the fill, the subsurface profile can be divided into four primary depositional units consisting of:*

1. *loose to mostly medium dense recent and older dune deposits,*
2. *dense to very dense beach and shallow marine deposits,*
3. *medium stiff bay mud, and*
4. *very dense Hookton Formation sand and sand with silt.*

The dune deposits are composed of clean fine sand and are present to a maximum depth of about 50 feet below existing site grades (approximate elevation of -25 feet relative to sea level). The dune deposits are in turn underlain by beach and shallow marine deposits from a depth of 40 or 50 (±) feet and continuing to 90 (±) feet. The beach and shallow marine deposits are composed of medium to coarse grained sand with occasional thin layers of subrounded fine gravel. The transition from the dune to beach deposits is readily identifiable by the sudden occurrence of medium to coarse sand and the presence of fine gravel, shell fragments and woody debris, and marked increase in the sampler penetration resistance. Underlying the beach and shallow marine deposits are much older finegrained bay deposits and granular deposits of the

Hookton Formation (Ogle, 1953). The depths to the varying stratums and relative densities of the materials were observed to be relatively uniform across the site." (SHN 2020)

The infiltration basins are located in the upper stratums consisting of sand fill and recent to older dune deposits. A number of soil samples, representative of the site, were collected and grain size sieve analyses were performed. Soil sample location maps are included in Appendix F, which show that the borings were collected in areas that correspond with the "Urban land-Anthraltic" NRCS soil map units (Appendix A). The results of the sieve analysis are included in Geotechnical Report (SHN 2020).

Depth to groundwater was measured at multiple locations throughout the site and was found to be between 12 to 16 feet below the ground surface. The groundwater surface is relatively flat with very little gradient. Measurements throughout the year indicate a seasonal variation of 1 to 3 feet (SHN, 2020).

Estimation of Saturated Hydraulic Conductivity (K_s)

In 1997 aquifer tests were conducted at the site (SHN, 2011). An excerpt from SHN's 2011 site conceptual model is as follows:

"In 1997, aquifer tests were conducted on monitoring wells MW-4 and MW-10 in order to determine the hydraulic conductivity of the screened portion of the aquifer (first encountered groundwater), and to gain a better understanding of site aquifer characteristics. For the aquifer test conducted on monitoring well MW-4, two piezometers were installed 5 feet and 15 feet away from the pumping well, and used as water level observation points. For the aquifer pump test conducted on monitoring well MW-10, the piezometers were installed 10 feet and 20 feet away from the pumping well, and used as water level observation points. A submersible pump was installed in the pumping well prior to the start of each pump test. For each test, the pump was started, and each piezometer and the pumping well were monitored for depth to water at pre-selected time intervals. The pumping rate for the duration of each test was approximately 12 gallons per minute. Upon completion of each test, the pump was turned off, and each piezometer and the pumping well were monitored for water level recovery. Each test, including recovery monitoring, lasted approximately 12 hours.

Based on the results of both aquifer pump tests, it appears that the information collected from piezometers PZ-1 and PZ-3 is the most representative data, and was used to evaluate the site aquifer hydraulic characteristics. Hydraulic conductivity (K) in these two piezometers ranged from 570 feet per day (ft/day) in piezometer PZ-3, to 915 ft/day in piezometer PZ-1." (SHN 2011)

For this analysis, a value of 743 ft/day (the average of the two most representative hydraulic conductivity values at PZ-1 and PZ-2) was used. Maps showing the locations of MW-4 and MW-10, located in the north and central portions of the facility, respectively, are included in Appendix F.

The selected value used for hydraulic conductivity is more than one order of magnitude greater than the NRCS estimated K_s for soil unit 155 shown in Appendix A. Since the K_s estimates from the aquifer pump tests were generated using site specific data, they will be used in this analysis.

Estimation of Hydraulic Gradient

The hydraulic gradient describes the driving force that causes the storm water in a pond or infiltration trench to infiltrate into the soil. The primary force causing the infiltration is gravity and capillary suction. At this site, the effects of capillary suction are minimal due to the observed grain sizes and uniform grain size distribution. Massmann et al. developed an equation to estimate the hydraulic gradient for sites with shallow groundwater and sandy soil, similar to this site. In this estimation, the effects due to the capillary suction are incorporated in the constant (138.62 or 78) and a value is not explicitly used. For sands with minimal amounts of fines capillary suction has a very minor effect upon the wetting front. They used computer simulations and regression analysis to determine an effective gradient under steady-state conditions and is calculated as:

$$gradient \approx \frac{D_{wt} + D_{pon}}{138.62(K^{0.1})}$$

Where:
K is hydraulic conductivity in ft/day
D_{tw} is the depth in feet from the base of the infiltration pond to the water table
D_{pond} is the depth of the storm water in the pond

A similar process for infiltration trenches was used to develop the following equation:

$$gradient \approx \frac{D_{wt} + D_{trenchj}}{78(K^{0.05})}$$

Where:
K is hydraulic conductivity in ft/day
D_{tw} is the depth in feet from the base of the infiltration trench to the water table
D_{trench} is the depth of the storm water in the trench

It should be noted that the Massmann et al. gradient estimation uses a basin size correction factor for ponds with bottom areas between 0.6 and 6 acres in size. For small ponds, ponds with area equal to 2/3 acre, the correction factor is equal to 1.0. All of the pond and trench areas are less than 2/3 acre, and a correction factor of 1.0 was used.

The hydraulic conductivity used in the estimation is the saturated hydraulic conductivity.

The infiltration gradients at the site were calculated for a range of depths (Table 10). With the depth to groundwater ranging from 12 to 16 feet at the site and the trench being 6 feet deep, the resulting depth to groundwater under the infiltration facility would range from 6 to 10 feet during dry periods and would decrease to 3 to 7 feet during the wet season.

Table 10 Estimated Facility Infiltration Gradients

Season	Distance from bottom of feature to Groundwater (ft)	Gradient (ft/ft)			
		3 ft depth in pond	4 ft depth in pond	3 ft depth in trench	4 ft depth in trench
Dry	6	0.034	0.037	0.083	0.092
Dry	10	0.048	0.052	0.120	0.129
Wet	3	0.022	0.026	0.055	0.064
Wet	7	0.037	0.041	0.092	0.101

Estimation of Infiltration Rate

The infiltration rate for the facility may be estimated using Darcy's law, which is calculated by multiplying the saturated hydraulic conductivity with the hydraulic gradient. This infiltration rate is for the ideal conditions and assumes that conditions will remain constant with what was originally measured at the site. However, with use the infiltration rates may be significantly reduced due to siltation and biofouling. Siltation occurs with fine sediments are washed into the infiltration facility with the storm water runoff and biofouling occurs when vegetation and other debris wash into the facility and promotes the growth of other plants. To account for the decrease in efficiency a correction factor is applied to the Darcy's law calculation. Correction factors for biofouling and siltation were taken from Massmann et al. (Massmann, 2003) and the Federal Highway Administration Urban Design Drainage Manual and ranged from 0.2 to 0.9 for ponds and 0.6 to 0.9 for trenches. For this analysis, a value of 0.55 was selected for ponds and 0.75 for the trench. Selection of the correction factor considered the potential for biofouling/sedimentation based on observed site conditions and a moderate maintenance effort.

The infiltration rates for each detention/infiltration feature were calculated and are summarized in Table 11. In calculating the infiltration rates the most conservative values for each parameter were used. The gradient calculation used the wet season depths with the least separation between the bottom of the feature and groundwater elevation. The total maximum infiltration rate per day for each facility exceeds the stormwater expected for a 100-year event.

Table 11 Maximum Daily Infiltration Rate by Detention/Infiltration Feature

Facility	Max Depth (ft)	Ks (ft/day)	Gradient (ft/ft)	Correction Factor	Infiltration q (ft/day)	Area (ft^2)	Infiltration Q (ft^3/day)	100-Year Event Rainfall Q (ft^3/day)
Pond 1	3	743	0.022	0.55	9.1	21,500	196,343	190,681
Pond 2	4	743	0.026	0.55	10.7	10,200	108,674	106,127
Pond 3	3	743	0.022	0.55	9.1	13,188	120,436	113,908
Trench	4	743	0.055	0.75	30.8	16,800	517,448	212,376

3.2 Groundwater Mounding Considerations

Groundwater mounding has the potential to occur beneath stormwater management structures designed to infiltrate stormwater runoff. Concentrating recharge in a small area can cause groundwater mounding that

affects the local water table by altering flow directions or causing groundwater to reach the surface (Colorado School of Mines, 2005). Groundwater mounding typically occurs in subsurface soils with low hydraulic conductivity.

Colorado School of Mines' guidance (2005) for assessing the potential for groundwater mounding recommends that groundwater mounding is not a concern where:

- Site soils are more permeable than fine sand
- The seasonal depth to groundwater is less than 40 feet below grade, and
- There are not any laterally continuous restrictive layers within 20 feet of the ground surface.

Historical site-specific investigations at the NAF Project Site demonstrate that the subsurface soils are extremely transmissive, fine-grained dune sands and that groundwater is unconfined and tidally influenced (SHN, 2011), with a minimum depth to groundwater of approximately 12 feet below ground surface.

Based our review of the historical data for the site in comparison to groundwater mounding assessment guidance and the infiltration assessment (Section 3.1), the site appears to have sufficient capacity to assimilate additional stormwater in excess of natural infiltration and groundwater mounding is not anticipated to occur.

3.3 Historical Site Contamination Considerations

The NAF Project Site was historically developed as a pulp mill in 1964, which operated until late 2008 when the pulp mill was permanently shut down. The property is currently a Brownfields site with the North Coast Regional Water Quality Control Board (RWQCB) acting as the lead agency for the ongoing investigations and cleanup of historical contamination, and overseeing the current groundwater monitoring for the site.

In this section, we look at the potential effect of the proposed stormwater management system on the residual soil and groundwater impacts at the site. For this effort, GHD reviewed the Interim Measures Work Plan (IMWP) recently developed for the site (SHN, 2020) which presents the site history and a discussion of the remaining chemicals of potential concern (COPCs) in site soils and groundwater. Figures 4 and 5 of the IMWP depict the approximate areas of residual contaminants in soil and groundwater, respectively, and also show the locations of the proposed NAF Project buildings (Appendix F).

With the exception of a small section of the LID stormwater facilities located between buildings 3 and 4 (Figure B-3), all of the stormwater basins, LID facilities, and infiltration trenches for the NAF Project are positioned outside the footprints of the COPCs in soil and groundwater as depicted on Figures 4 and 5 of the IMWP. Thus, based on the location of the vast majority of the stormwater management structures being outside of the primary areas of known contamination, and the discussions provided in Sections 3.1 and 3.2, above, the Project is anticipated to have little to no significant impact on the residual soil and groundwater plumes at this site.

4. References

Colorado School of Mines. (January 2005). “Guidance for Evaluation of Potential Groundwater Mounding Associated with Cluster and High-Density Wastewater Soil Absorption Systems.” St. Louis, MO:National Decentralized Water Resources Capacity Development Project.

Department of Toxic Substances Control. (April 2020). “Response to Comments on McNamara and Peepe Lumber Mill Monitoring.” Sacramento, CA:DTSC.

Federal Highway Administration. (1996). Urban Design Drainage Manual, Hydrologic Engineering Circular No. 22, Washington D.C.

Humboldt County. (June 2016). “Humboldt Low Impact Development Stormwater Manual.” Eureka, CA: Humboldt County

Massman, J. (October 2003), “A Design Manual for Sizing Infiltration Ponds”, Mercer Island, WA, Washington State Department of Transportation and U.S Department of Transportation Federal Highway Administration.

Massman, J. and Butchart, C. (March 2000), “Infiltration Characteristics, Performance, and Design of Storm Water Facilities”. University of Washington, Seattle WA, Washington State Department of Transportation.

SHN Consulting Engineers & Geologists, Inc. (January 2011). “Conceptual Site Model, Evergreen Pulp Mill Incorporated, One TCF Drive, Samoa California, Case No. 1NHU892.” Eureka, CA:SHN

---. (September 2013). “First Half 2013 Groundwater Monitoring Report and Updated Conceptual Site Model, Evergreen Pulp Mill Incorporated, One TCF Drive, Samoa California, Case No. 1NHU892.” Eureka, CA:SHN

---. (March 2020). “First Quarter 2020 Groundwater Monitoring Report, Evergreen Pulp Mill Incorporated, One TCF Drive, Samoa California, Case No. 1NHU892.” Eureka, CA:SHN

---. (June 2020). “Preliminary Geotechnical Investigation Report, Proposed Nordic Aquafarms California Facility, Redwood Marin Terminal II, 364 Vance Avenue, Samoa Peninsula, Humboldt County, CA.” Eureka, CA:SHN

---. (October 2020). “Interim Measures Work Plan, Former Evergreen Pulp Mill, Samoa California, Case No. 1NHU892.” Eureka, CA:SHN

Appendix A - Precipitation Frequency Data and NCRS Soil Survey Data

NOAA Atlas 14, Volume 6, Version 2 EUREKA WFO
WOODLEY IS
Station ID: 04-2910
Location name: Eureka, California, USA*
Latitude: 40.8097°, Longitude: -124.1603°
Elevation:
Elevation (station metadata): 20 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	0.144 (0.126-0.165)	0.211 (0.184-0.243)	0.258 (0.223-0.301)	0.323 (0.269-0.393)	0.377 (0.306-0.469)	0.434 (0.343-0.556)	0.496 (0.380-0.656)	0.586 (0.427-0.812)	0.660 (0.463-0.951)
10-min	0.206 (0.180-0.237)	0.302 (0.264-0.349)	0.370 (0.320-0.431)	0.464 (0.386-0.563)	0.540 (0.439-0.672)	0.623 (0.492-0.797)	0.712 (0.544-0.940)	0.840 (0.613-1.16)	0.947 (0.664-1.36)
15-min	0.249 (0.218-0.287)	0.365 (0.319-0.422)	0.447 (0.387-0.521)	0.561 (0.467-0.680)	0.653 (0.531-0.813)	0.753 (0.595-0.963)	0.861 (0.658-1.14)	1.02 (0.741-1.41)	1.15 (0.803-1.65)
30-min	0.339 (0.298-0.391)	0.498 (0.435-0.576)	0.610 (0.528-0.711)	0.765 (0.637-0.928)	0.892 (0.724-1.11)	1.03 (0.811-1.32)	1.17 (0.898-1.55)	1.39 (1.01-1.92)	1.56 (1.10-2.25)
60-min	0.479 (0.419-0.552)	0.702 (0.614-0.812)	0.860 (0.745-1.00)	1.08 (0.898-1.31)	1.26 (1.02-1.56)	1.45 (1.14-1.85)	1.66 (1.27-2.19)	1.95 (1.43-2.71)	2.20 (1.54-3.17)
2-hr	0.736 (0.645-0.849)	1.04 (0.906-1.20)	1.25 (1.08-1.46)	1.55 (1.29-1.88)	1.79 (1.46-2.23)	2.05 (1.62-2.63)	2.34 (1.79-3.09)	2.76 (2.01-3.82)	3.10 (2.17-4.47)
3-hr	0.938 (0.822-1.08)	1.30 (1.13-1.50)	1.55 (1.34-1.81)	1.91 (1.59-2.32)	2.20 (1.79-2.74)	2.52 (1.99-3.22)	2.86 (2.18-3.77)	3.35 (2.44-4.64)	3.77 (2.64-5.43)
6-hr	1.36 (1.19-1.56)	1.83 (1.60-2.12)	2.17 (1.88-2.53)	2.64 (2.20-3.20)	3.02 (2.45-3.75)	3.43 (2.71-4.39)	3.87 (2.96-5.11)	4.51 (3.29-6.24)	5.04 (3.53-7.25)
12-hr	1.93 (1.69-2.22)	2.57 (2.25-2.97)	3.02 (2.61-3.52)	3.63 (3.02-4.40)	4.12 (3.34-5.12)	4.64 (3.66-5.93)	5.19 (3.97-6.85)	5.98 (4.36-8.28)	6.62 (4.64-9.53)
24-hr	2.66 (2.38-3.03)	3.53 (3.15-4.04)	4.12 (3.66-4.75)	4.92 (4.23-5.84)	5.54 (4.67-6.71)	6.19 (5.11-7.67)	6.88 (5.53-8.73)	7.84 (6.07-10.3)	8.61 (6.45-11.7)
2-day	3.45 (3.09-3.94)	4.62 (4.13-5.29)	5.40 (4.79-6.21)	6.42 (5.52-7.62)	7.21 (6.08-8.72)	8.02 (6.62-9.93)	8.86 (7.13-11.3)	10.0 (7.76-13.2)	10.9 (8.20-14.9)
3-day	3.89 (3.48-4.43)	5.24 (4.68-5.99)	6.13 (5.43-7.05)	7.29 (6.26-8.65)	8.17 (6.89-9.89)	9.07 (7.48-11.2)	10.0 (8.04-12.7)	11.3 (8.72-14.8)	12.2 (9.18-16.7)
4-day	4.27 (3.82-4.87)	5.79 (5.17-6.62)	6.77 (6.00-7.79)	8.05 (6.92-9.55)	9.02 (7.60-10.9)	10.00 (8.24-12.4)	11.0 (8.84-14.0)	12.4 (9.56-16.3)	13.4 (10.1-18.2)
7-day	5.42 (4.85-6.18)	7.44 (6.64-8.51)	8.73 (7.74-10.0)	10.4 (8.91-12.3)	11.6 (9.78-14.0)	12.8 (10.6-15.9)	14.1 (11.3-17.9)	15.7 (12.2-20.7)	17.0 (12.8-23.1)
10-day	6.36 (5.69-7.25)	8.78 (7.84-10.0)	10.3 (9.13-11.9)	12.2 (10.5-14.5)	13.7 (11.5-16.5)	15.1 (12.4-18.7)	16.5 (13.3-21.0)	18.4 (14.2-24.2)	19.8 (14.9-27.0)
20-day	8.88 (7.95-10.1)	12.3 (10.9-14.0)	14.3 (12.7-16.5)	16.9 (14.5-20.1)	18.8 (15.8-22.7)	20.6 (17.0-25.5)	22.4 (18.0-28.5)	24.8 (19.2-32.7)	26.6 (19.9-36.1)
30-day	11.0 (9.88-12.6)	15.1 (13.5-17.3)	17.6 (15.6-20.3)	20.7 (17.8-24.6)	22.9 (19.3-27.7)	25.1 (20.7-31.0)	27.2 (21.8-34.5)	29.9 (23.1-39.4)	31.9 (23.9-43.3)
45-day	14.3 (12.8-16.3)	19.4 (17.4-22.2)	22.5 (20.0-25.9)	26.3 (22.6-31.2)	28.9 (24.4-35.0)	31.5 (26.0-39.0)	34.0 (27.3-43.2)	37.2 (28.8-49.0)	39.5 (29.6-53.8)
60-day	16.9 (15.1-19.3)	22.8 (20.3-26.0)	26.2 (23.2-30.2)	30.4 (26.1-36.1)	33.4 (28.2-40.4)	36.3 (29.9-44.9)	39.0 (31.4-49.5)	42.5 (32.9-56.0)	45.0 (33.8-61.3)

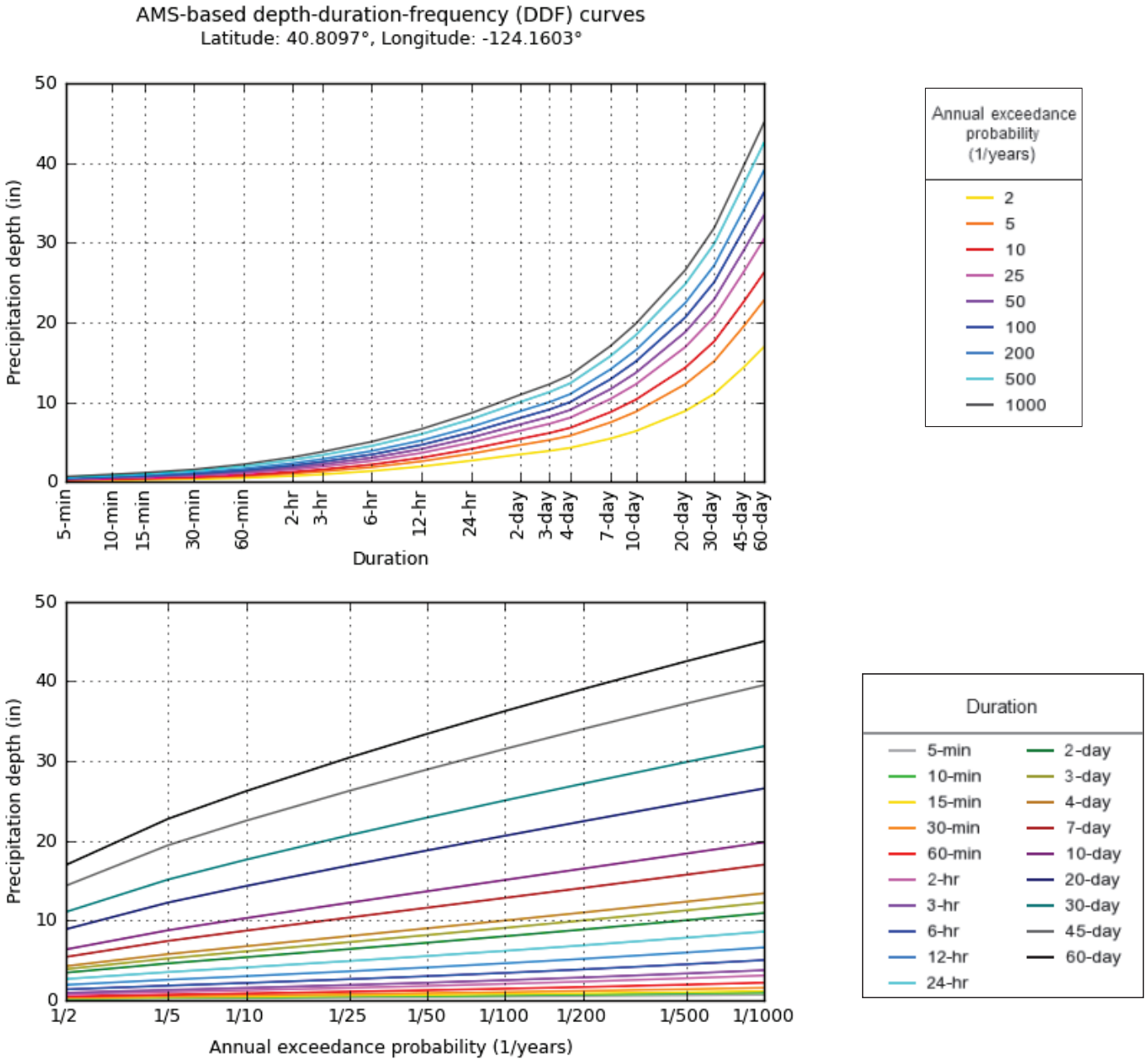
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



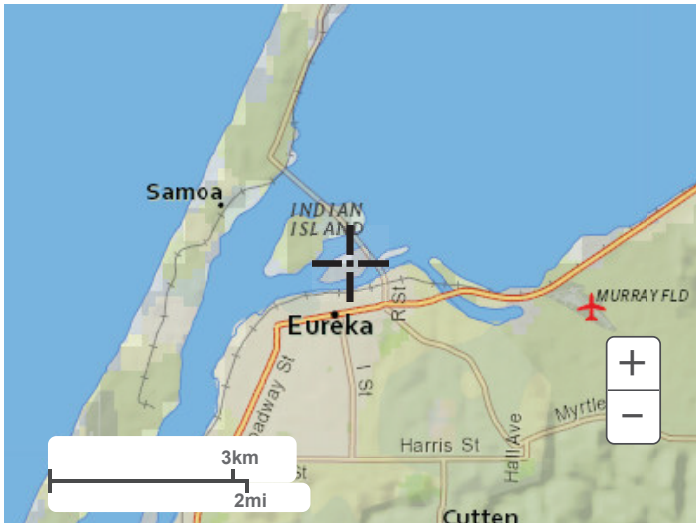
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Jun 29 21:35:59 2020

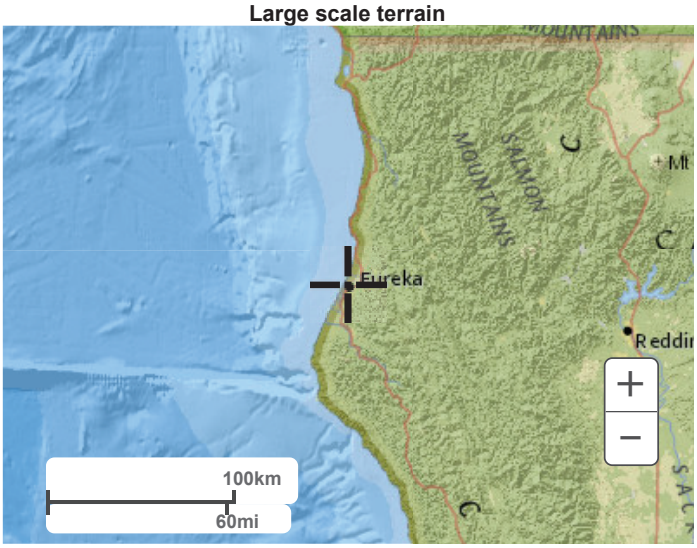
Back to Top

Maps & aerials

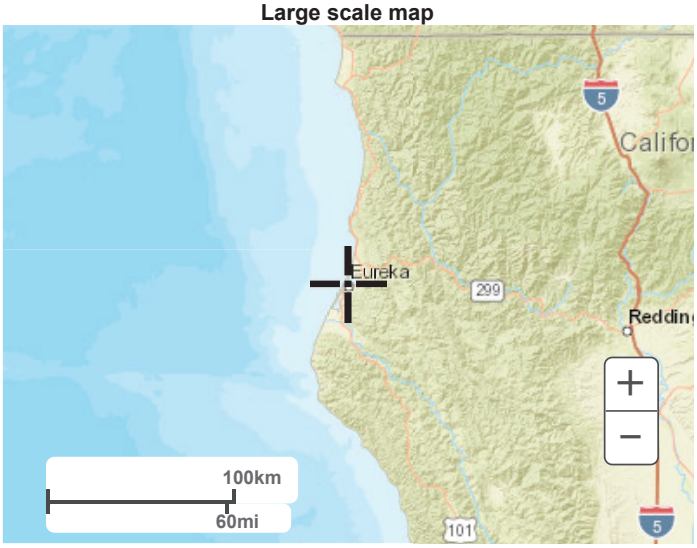
Small scale terrain



Large scale terrain

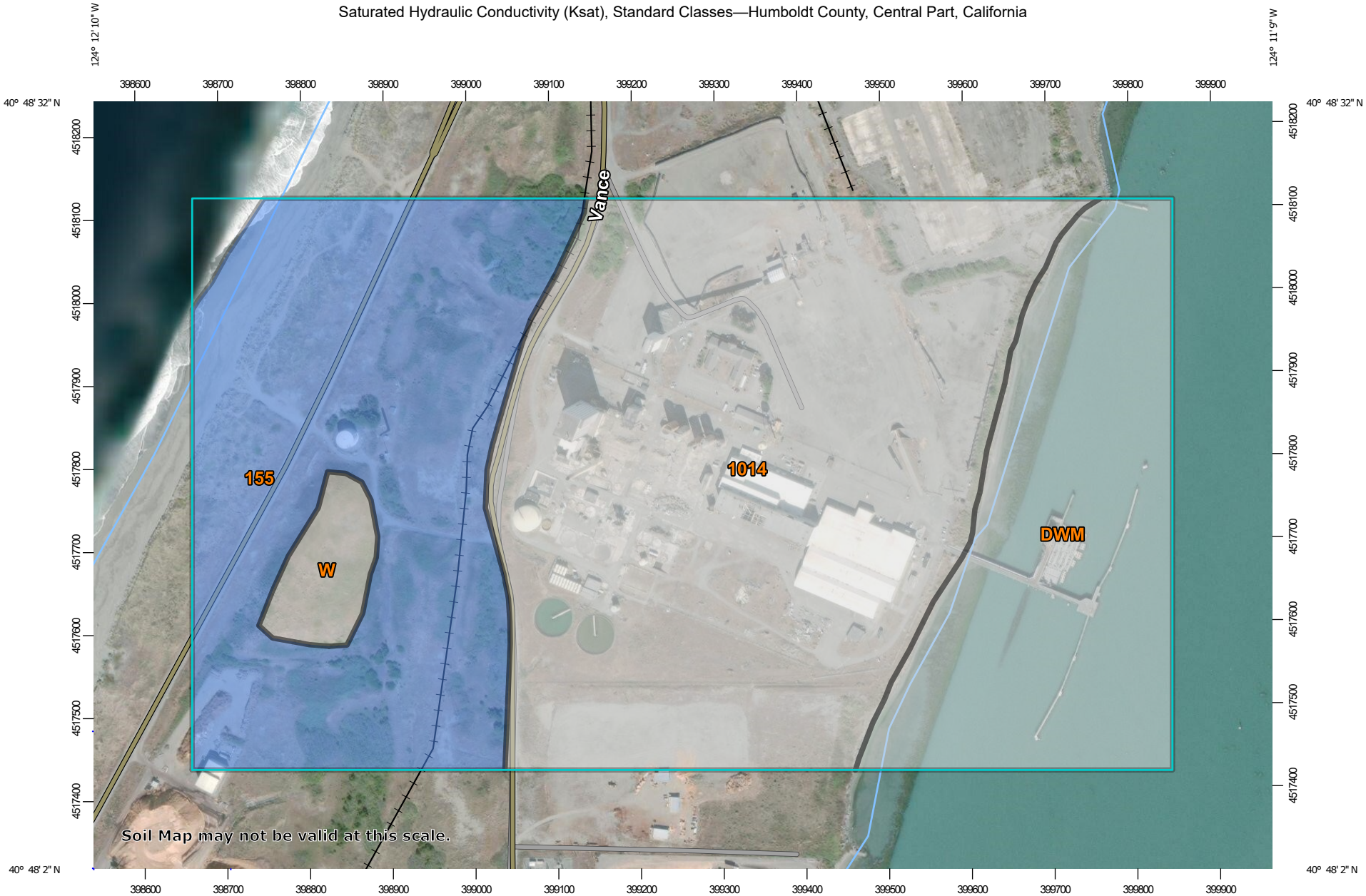


Large scale map



Large scale aerial

Saturated Hydraulic Conductivity (Ksat), Standard Classes—Humboldt County, Central Part, California



Map Scale: 1:6,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

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 Rating Polygons

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Lines

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Points

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

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 1:24,000.

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: Humboldt County, Central Part, California
Survey Area Data: Version 5, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 11, 2017

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.

Saturated Hydraulic Conductivity (Ksat), Standard Classes

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
155	Samoa-Clambeach complex, 0 to 50 percent slopes	92.0000	60.8	30.0%
1014	Urban land-Anthraltic Xerorthents association, 0 to 2 percent slopes		94.1	46.5%
DWM	Water, marine		41.5	20.5%
W	Water		4.7	2.3%
Totals for Area of Interest			**202.5**	**100.0%**

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 12

Bottom Depth: 60

Units of Measure: Inches

Appendix B – Site Maps

N

0 10' 20' 40'

GHD

NORDIC AQUAFARMS AQUACULTURE FACILITY

FIGURE B-1
EXISTING SITE MAP

Project No.: **11207226**
Date: **4/14/2021**
REV-3

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Prelim Storm Basins.dwg
Plot Date: 16 April 2021 - 3:41 PM

EXISTING OUTFALL TO OCEAN

POND 1
3' DEEP

BASIN 1
AREA=384,230 SF

BUILDING 1

BASIN 2
AREA=213,740 SF

BUILDING 5

OXYGEN GENERATION

POND 2
4' DEEP

BUILDING 4

BASIN 3
AREA=229,410 SF

BUILDING 3

POND 3
3' DEEP

LEASE LINE, TYP

EXISTING OUTFALL TO THE BAY

BASIN 4
AREA=428,400 SF

BUILDING 2

PROPERTY LINE, TYP

BASIN 5
AREA=27,900 SF

LEGEND

POND

LOW IMPACT DEVELOPMENT (LID)

N

0 10' 20' 40'

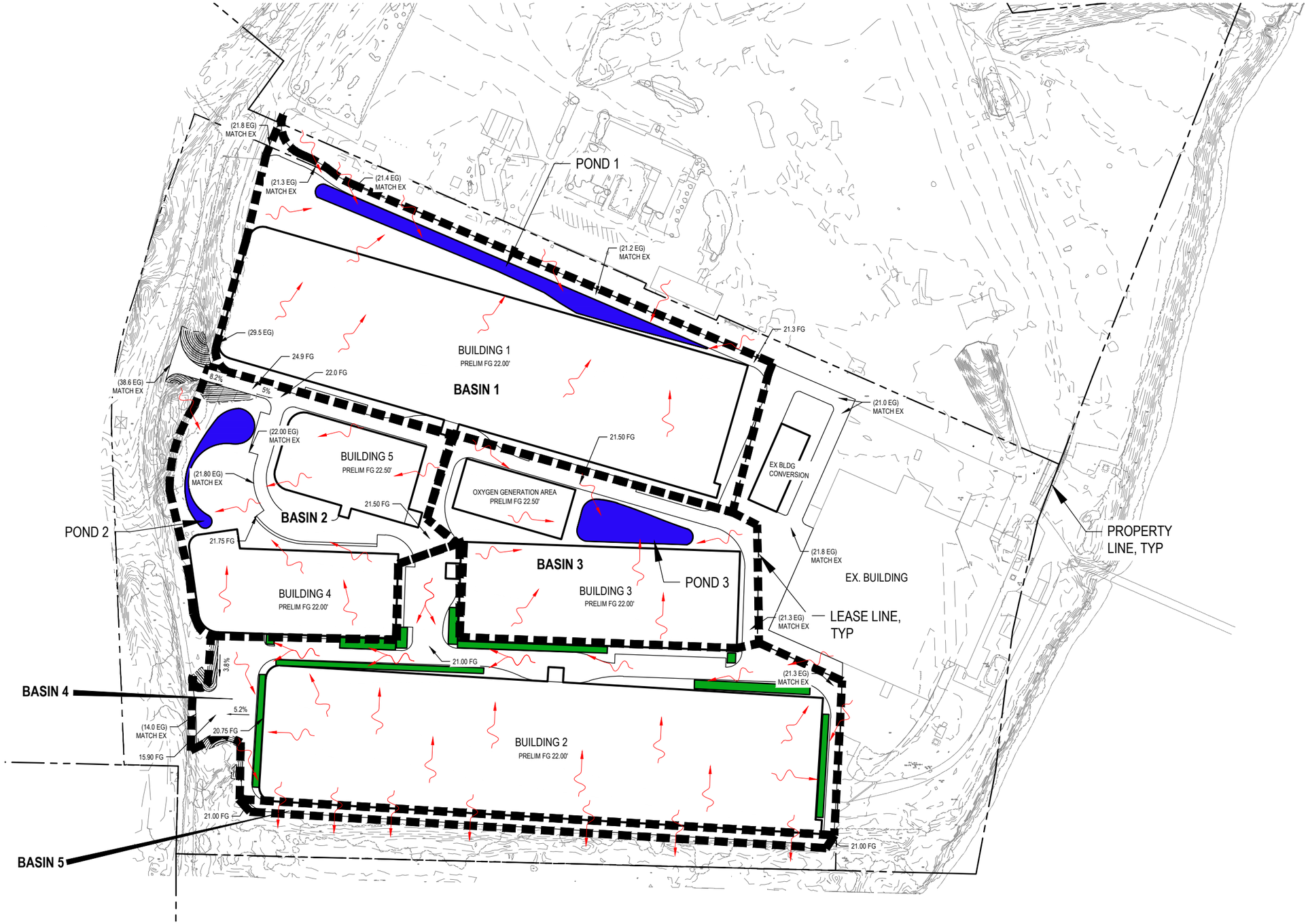
GHD

NORDIC AQUAFARMS
AQUACULTURE FACILITY

FIGURE B-2
PRELIMINARY STORM DRAINAGE BASIN MAP

Project No.: **11207226**
Date: **4/14/2021**
REV-3

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Prelim Storm Basins.dwg
Plot Date: 15 April 2021 - 9:58 AM



NORDIC AQUAFARMS
AQUACULTURE FACILITY

FIGURE B-3
PRELIMINARY SITE GRADING

Project No.: 11207226
Date: 4/14/2021
REV-3

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Prelim Storm Basins.dwg
Plot Date: 16 April 2021 - 4:07 PM

Appendix C - NOAA Historical Tides Elevations

Datums for 9418767, North Spit CA

NOTICE: All data values are relative to the NAVD88.

Elevations on NAVD88

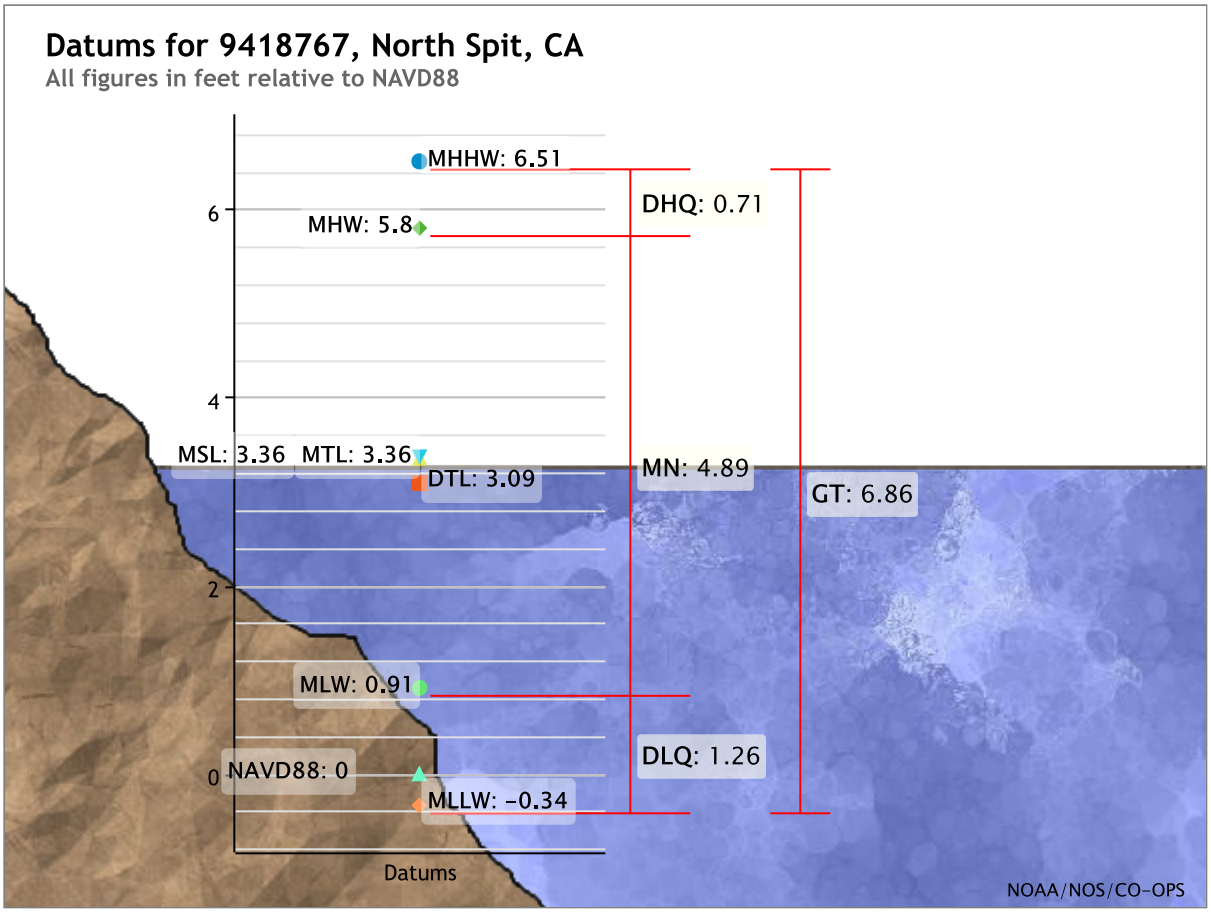
Station: 9418767, North Spit, CA
Status: Accepted (Sep 30 2011)
Units: Feet
Control Station:
T.M.: 0
Epoch: (/datum_options.html#NTDE) 1983-2001
Datum: NAVD88

Datum	Value	Description
MHHW (/datum_options.html#MHHW)	6.51	Mean Higher-High Water
MHW (/datum_options.html#MHW)	5.80	Mean High Water
MTL (/datum_options.html#MTL)	3.36	Mean Tide Level
MSL (/datum_options.html#MSL)	3.36	Mean Sea Level
DTL (/datum_options.html#DTL)	3.09	Mean Diurnal Tide Level
MLW (/datum_options.html#MLW)	0.91	Mean Low Water
MLLW (/datum_options.html#MLLW)	-0.34	Mean Lower-Low Water
NAVD88 (/datum_options.html)	0.00	North American Vertical Datum of 1988
STND (/datum_options.html#STND)	-14.89	Station Datum
GT (/datum_options.html#GT)	6.86	Great Diurnal Range
MN (/datum_options.html#MN)	4.89	Mean Range of Tide
DHQ (/datum_options.html#DHQ)	0.71	Mean Diurnal High Water Inequality

Datum	Value	Description
DLQ (/datum_options.html#DLQ)	1.26	Mean Diurnal Low Water Inequality
HWI (/datum_options.html#HWI)	7.63	Greenwich High Water Interval (in hours)
LWI (/datum_options.html#LWI)	1.18	Greenwich Low Water Interval (in hours)
Max Tide (/datum_options.html#MAXTIDE)	9.54	Highest Observed Tide
Max Tide Date & Time (/datum_options.html#MAXTIDEDT)	12/31/2005 18:54	Highest Observed Tide Date & Time
Min Tide (/datum_options.html#MINTIDE)	-3.24	Lowest Observed Tide
Min Tide Date & Time (/datum_options.html#MINTIDEDT)	01/20/1988 02:18	Lowest Observed Tide Date & Time
HAT (/datum_options.html#HAT)	8.52	Highest Astronomical Tide
HAT Date & Time	12/31/1986 19:00	HAT Date and Time
LAT (/datum_options.html#LAT)	-2.73	Lowest Astronomical Tide
LAT Date & Time	05/25/1990 14:12	LAT Date and Time

Tidal Datum Analysis Periods

01/01/1983 - 12/31/2001



Showing datums for

9418767 North Spit, CA

Datum

NAVD88

Data Units
- (●) Feet
- ( ) Meters

Epoch
- (●) Present (1983-2001)
- ( ) Superseded (1960-1978)

Submit

Show nearby stations

Products available at 9418767 North Spit, CA

TIDES/WATER LEVELS

Water Levels (/waterlevels.html?id=9418767)

NOAA Tide Predictions (/noaatidepredictions.html?id=9418767)

Harmonic Constituents (/harcon.html?id=9418767)

Sea Level Trends (/sltrends/sltrends_station.shtml?id=9418767)

Datums (/datums.html?id=9418767)

Bench Mark Sheets (/benchmarks.html?id=9418767)

Extreme Water Levels

Reports (/reports.html?id=9418767)

METEOROLOGICAL/OTHER

Meteorological Observations (/met.html?id=9418767)

Water Temp/Conductivity

PORTS®

Humboldt Bay PORTS® (/ports/index.html?port=hb)

PORTS® product page for North Spit (/ports/ports.html?id=9418767)

OPERATIONAL FORECAST SYSTEMS

This station is not a member of OFS

INFORMATION

Station Home Page (/stationhome.html?id=9418767)

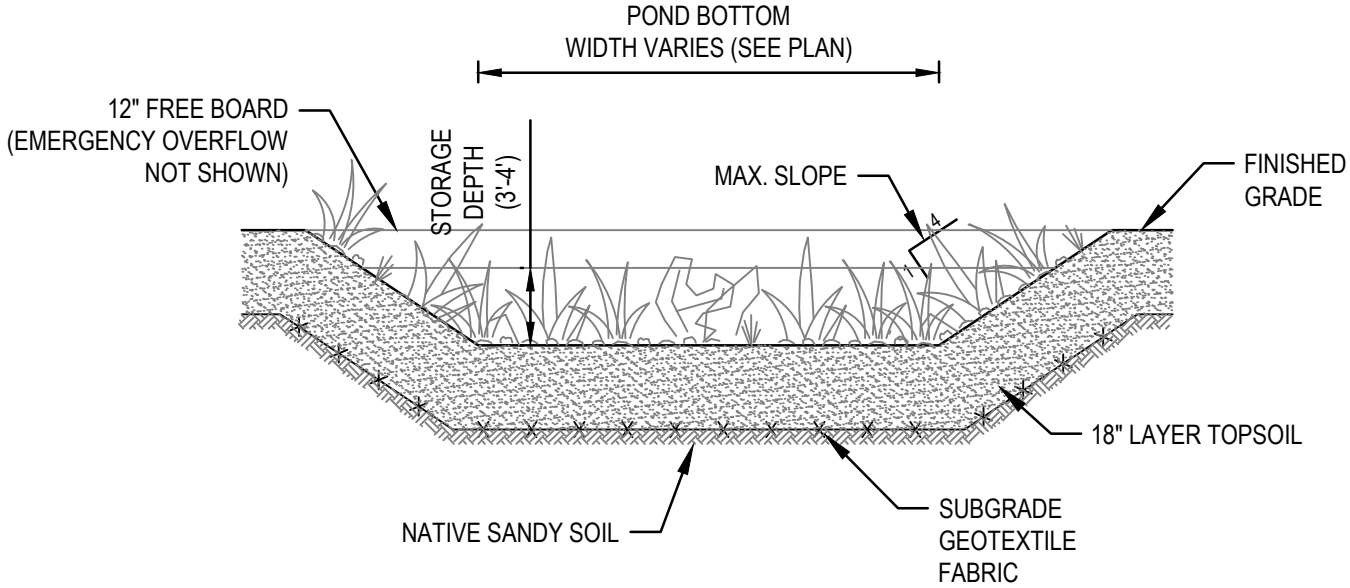
Data Inventory (/inventory.html?id=9418767)

Measurement Specifications (/measure.html)

Website Owner: Center for Operational Oceanographic Products and Services

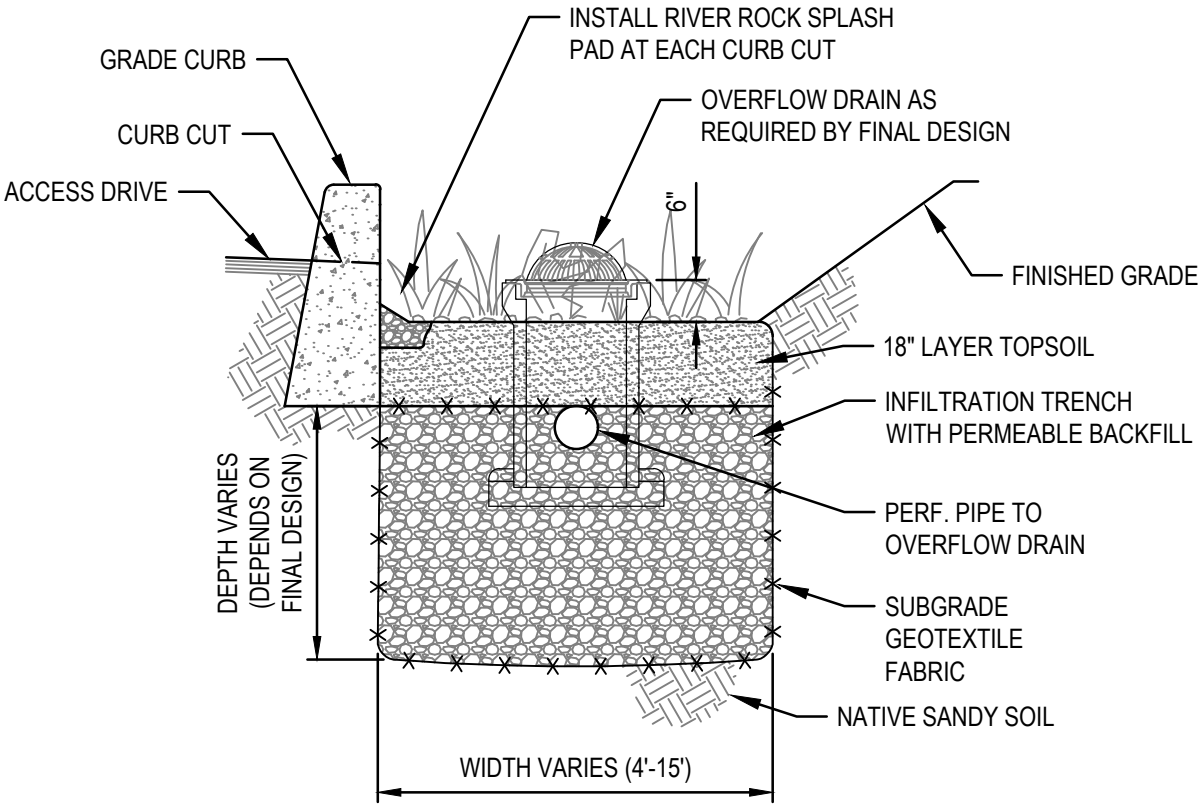
National Oceanic and Atmospheric Administration (http://www.noaa.gov)
National Ocean Service (http://oceanservice.noaa.gov)
Privacy Policy (/privacy.html)
Disclaimer (/disclaimers.html)
Take Our Survey (/survey.html)
Freedom of Information Act (https://www.noaa.gov/foia-freedom-of-information-act)
Contact Us (/contact.html)

Appendix D - Typical Pond and LID Cross Sections



1 TYPICAL VEGETATED INFILTRATION POND SECTON

N.T.S.



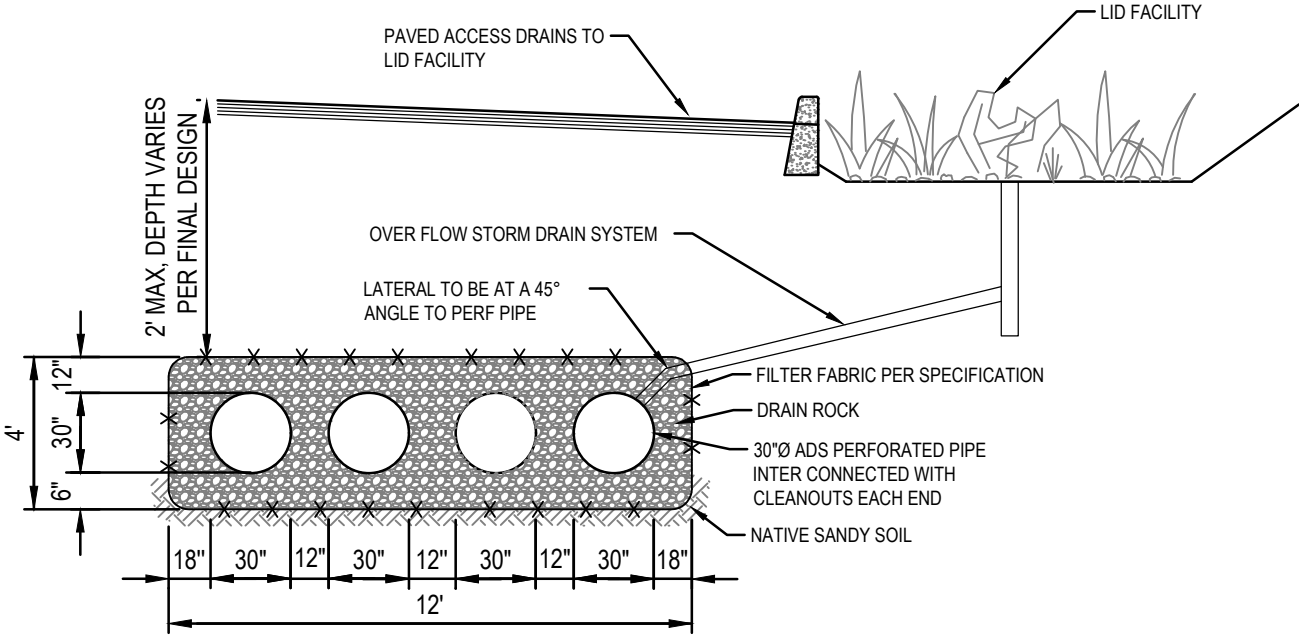
2 TYPICAL LID SECTION

N.T.S.

NORDIC AQUAFARMS
AQUACULTURE FACILITY

FIGURE D-1
PRELIMINARY TYPICAL STORM WATER POND
AND BIORETENTION FACILITY CROSS SECTIONS

Project No. **11207226**
Report No. **REV-3**
Date **4/14/2021**



3 OVER FLOW INFILTRATION TRENCH

N.T.S.

NORDIC AQUAFARMS
AQUACULTURE FACILITY

FIGURE D-2
PRELIMINARY TYPICAL STORM WATER
OVERFLOW INFILTRATION TRENCH
CROSS SECTION

Project No. **11207226**
Report No. **REV-3**
Date **4/14/2021**

Filename: N:\US\Eureka\Projects\561\11207226\Digital_Design\ACAD 2020\Figures\11207226_Fig_D_1_2_Typ Pond Cross Sections.dwg
Plot Date: 18 April 2021 - 8:03 AM

Source:

Appendix E – Stormwater Modeling Data

Scenario Calculation Summary

Scenario Summary	
ID	50
Label	85th Percentile
Notes	
Active Topology	Base-Active Topology
Hydrology	Base-Scssbuh Runoff
Rainfall Runoff	Humboldt 85th
Physical	Base-Volume
Initial Condition	Base Initial Condition
Boundary Condition	Base-Boundary Conditions
Infiltration and Inflow	Base-Infiltration
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Nordic 2 yr

Output Summary			
Output Increment	0.050 hours	Duration	35.000 hours

Rainfall Summary			
Return Event Tag	1	Rainfall Type	Time-Depth Curve
Total Depth	0.7 in	Storm Event	85th Percentile

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin 1	85th Percentile	1	None	14,748.00	7.950	1.0260	(N/A)	(N/A)
Basin 2	85th Percentile	1	None	8,270.00	7.950	0.5707	(N/A)	(N/A)
Basin 3	85th Percentile	1	None	8,876.00	7.950	0.6126	(N/A)	(N/A)
Pond-1 (IN)	85th Percentile	1	None	14,748.00	7.950	1.0260	(N/A)	(N/A)
Pond-1 (OUT)	85th Percentile	1	None	0.00	0.000	0.0000	18.16	2,443.00
Pond-2 (IN)	85th Percentile	1	None	8,270.00	7.950	0.5707	(N/A)	(N/A)
Pond-2 (OUT)	85th Percentile	1	None	0.00	0.000	0.0000	18.38	1,046.00
Pond-3 (IN)	85th Percentile	1	None	8,876.00	7.950	0.6126	(N/A)	(N/A)
Pond-3 (OUT)	85th Percentile	1	None	0.00	0.000	0.0000	18.19	1,436.00

Scenario Calculation Summary

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Scenario Calculation Summary

Scenario Summary	
ID	27
Label	Humboldt 2 yr
Notes	
Active Topology	Base-Active Topology
Hydrology	Base-Scssbuh Runoff
Rainfall Runoff	Humboldt 2 yr
Physical	Base-Volume
Initial Condition	Base Initial Condition
Boundary Condition	Base-Boundary Conditions
Infiltration and Inflow	Base-Infiltration
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Nordic 2 yr

Output Summary			
Output Increment	0.050 hours	Duration	35.000 hours

Rainfall Summary			
Return Event Tag	2	Rainfall Type	Time-Depth Curve
Total Depth	2.7 in	Storm Event	TypeIA 24hr (2 yr)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin 1	Humboldt 2 yr	2	None	77,893.00	7.900	5.4177	(N/A)	(N/A)
Basin 2	Humboldt 2 yr	2	None	43,374.00	7.900	3.0138	(N/A)	(N/A)
Basin 3	Humboldt 2 yr	2	None	46,554.00	7.900	3.2347	(N/A)	(N/A)
Pond-1 (IN)	Humboldt 2 yr	2	None	77,893.00	7.900	5.4177	(N/A)	(N/A)
Pond-1 (OUT)	Humboldt 2 yr	2	None	0.00	0.000	0.0000	18.91	14,925.00
Pond-2 (IN)	Humboldt 2 yr	2	None	43,374.00	7.900	3.0138	(N/A)	(N/A)
Pond-2 (OUT)	Humboldt 2 yr	2	None	0.00	0.000	0.0000	19.88	8,625.00
Pond-3 (IN)	Humboldt 2 yr	2	None	46,554.00	7.900	3.2347	(N/A)	(N/A)
Pond-3 (OUT)	Humboldt 2 yr	2	None	0.00	0.000	0.0000	19.08	8,957.00

Scenario Calculation Summary

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Scenario Calculation Summary

Scenario Summary	
ID	37
Label	Humboldt 5 yr
Notes	
Active Topology	Base-Active Topology
Hydrology	Base-Scssbuh Runoff
Rainfall Runoff	Humboldt 5 yr
Physical	Base-Volume
Initial Condition	Base Initial Condition
Boundary Condition	Base-Boundary Conditions
Infiltration and Inflow	Base-Infiltration
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Nordic 5 yr

Output Summary			
Output Increment	0.050 hours	Duration	35.000 hours

Rainfall Summary			
Return Event Tag	5	Rainfall Type	Time-Depth Curve
Total Depth	3.5 in	Storm Event	TypeIA 24hr (5 yr)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin 1	Humboldt 5 yr	5	None	105,669.00	7.900	7.2792	(N/A)	(N/A)
Basin 2	Humboldt 5 yr	5	None	58,840.00	7.900	4.0493	(N/A)	(N/A)
Basin 3	Humboldt 5 yr	5	None	63,154.00	7.900	4.3461	(N/A)	(N/A)
Pond-1 (IN)	Humboldt 5 yr	5	None	105,669.00	7.900	7.2792	(N/A)	(N/A)
Pond-1 (OUT)	Humboldt 5 yr	5	None	0.00	0.000	0.0000	19.23	20,864.00
Pond-2 (IN)	Humboldt 5 yr	5	None	58,840.00	7.900	4.0493	(N/A)	(N/A)
Pond-2 (OUT)	Humboldt 5 yr	5	None	0.00	0.000	0.0000	20.42	12,721.00
Pond-3 (IN)	Humboldt 5 yr	5	None	63,154.00	7.900	4.3461	(N/A)	(N/A)
Pond-3 (OUT)	Humboldt 5 yr	5	None	0.00	0.000	0.0000	19.50	13,007.00

Scenario Calculation Summary

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Scenario Calculation Summary

Scenario Summary	
ID	40
Label	Humboldt 10 yr
Notes	
Active Topology	Base-Active Topology
Hydrology	Base-Scssbuh Runoff
Rainfall Runoff	Humboldt 10 yr
Physical	Base-Volume
Initial Condition	Base Initial Condition
Boundary Condition	Base-Boundary Conditions
Infiltration and Inflow	Base-Infiltration
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Nordic 10 yr

Output Summary			
Output Increment	0.050 hours	Duration	35.000 hours

Rainfall Summary			
Return Event Tag	10	Rainfall Type	Time-Depth Curve
Total Depth	4.1 in	Storm Event	TypeIA 24hr (10 yr)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin 1	Humboldt 10 yr	10	None	124,531.00	7.900	8.5346	(N/A)	(N/A)
Basin 2	Humboldt 10 yr	10	None	69,342.00	7.900	4.7476	(N/A)	(N/A)
Basin 3	Humboldt 10 yr	10	None	74,426.00	7.900	5.0957	(N/A)	(N/A)
Pond-1 (IN)	Humboldt 10 yr	10	None	124,531.00	7.900	8.5346	(N/A)	(N/A)
Pond-1 (OUT)	Humboldt 10 yr	10	None	0.00	0.000	0.0000	19.47	25,726.00
Pond-2 (IN)	Humboldt 10 yr	10	None	69,342.00	7.900	4.7476	(N/A)	(N/A)
Pond-2 (OUT)	Humboldt 10 yr	10	None	0.00	0.000	0.0000	20.79	15,978.00
Pond-3 (IN)	Humboldt 10 yr	10	None	74,426.00	7.900	5.0957	(N/A)	(N/A)
Pond-3 (OUT)	Humboldt 10 yr	10	None	0.00	0.000	0.0000	19.81	16,248.00

Scenario Calculation Summary

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Scenario Calculation Summary

Scenario Summary	
ID	43
Label	Humboldt 25 yr
Notes	
Active Topology	Base-Active Topology
Hydrology	Base-Scssbuh Runoff
Rainfall Runoff	Humboldt 25 yr
Physical	Base-Volume
Initial Condition	Base Initial Condition
Boundary Condition	Base-Boundary Conditions
Infiltration and Inflow	Base-Infiltration
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Nordic 25 yr

Output Summary			
Output Increment	0.050 hours	Duration	35.000 hours

Rainfall Summary			
Return Event Tag	25	Rainfall Type	Time-Depth Curve
Total Depth	4.9 in	Storm Event	TypeIA 24hr (25 yr)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin 1	Humboldt 25 yr	25	None	150,046.00	7.900	10.2328	(N/A)	(N/A)
Basin 2	Humboldt 25 yr	25	None	83,511.00	7.900	5.6923	(N/A)	(N/A)
Basin 3	Humboldt 25 yr	25	None	89,634.00	7.900	6.1096	(N/A)	(N/A)
Pond-1 (IN)	Humboldt 25 yr	25	None	150,046.00	7.900	10.2328	(N/A)	(N/A)
Pond-1 (OUT)	Humboldt 25 yr	25	None	0.00	0.000	0.0000	19.84	33,146.00
Pond-2 (IN)	Humboldt 25 yr	25	None	83,511.00	7.900	5.6923	(N/A)	(N/A)
Pond-2 (OUT)	Humboldt 25 yr	25	None	0.00	0.000	0.0000	21.24	20,474.00
Pond-3 (IN)	Humboldt 25 yr	25	None	89,634.00	7.900	6.1096	(N/A)	(N/A)
Pond-3 (OUT)	Humboldt 25 yr	25	None	0.00	0.000	0.0000	20.22	20,761.00

Scenario Calculation Summary

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Scenario Calculation Summary

Scenario Summary	
ID	46
Label	Humboldt 100 yr
Notes	
Active Topology	Base-Active Topology
Hydrology	Base-Scssbuh Runoff
Rainfall Runoff	Humboldt 100 yr
Physical	Base-Volume
Initial Condition	Base Initial Condition
Boundary Condition	Base-Boundary Conditions
Infiltration and Inflow	Base-Infiltration
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Nordic 100 yr

Output Summary			
Output Increment	0.050 hours	Duration	35.000 hours

Rainfall Summary			
Return Event Tag	100	Rainfall Type	Time-Depth Curve
Total Depth	6.2 in	Storm Event	TypeIA 24hr (100 yr)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
Basin 1	Humboldt 100 yr	100	None	190,681.00	7.900	12.9198	(N/A)	(N/A)
Basin 2	Humboldt 100 yr	100	None	106,127.00	7.900	7.1871	(N/A)	(N/A)
Basin 3	Humboldt 100 yr	100	None	113,908.00	7.900	7.7140	(N/A)	(N/A)
Pond-1 (IN)	Humboldt 100 yr	100	None	190,681.00	7.900	12.9198	(N/A)	(N/A)
Pond-1 (OUT)	Humboldt 100 yr	100	None	0.00	0.000	0.0000	20.39	45,479.00
Pond-2 (IN)	Humboldt 100 yr	100	None	106,127.00	7.900	7.1871	(N/A)	(N/A)
Pond-2 (OUT)	Humboldt 100 yr	100	None	0.00	0.000	0.0000	21.92	28,279.00
Pond-3 (IN)	Humboldt 100 yr	100	None	113,908.00	7.900	7.7140	(N/A)	(N/A)
Pond-3 (OUT)	Humboldt 100 yr	100	None	0.00	0.000	0.0000	20.89	28,951.00

Scenario Calculation Summary

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

100 YEAR STORMWATER CALCULATION MATRIX - SANTA BARBARA HYDROGRAPGH METHOD

Date: **4/14/2021**

Given: **Project =** **NORDIC AQUAFARMS AQUACULTURE FACILITY**

Area = 9.83 acres

Pt = 6.2 inches **100-Year / 24 Hour Storm**

dt = 10 min.

Tc = 5 min. (Post-Developed Site Conditions)

PERVIOUS Parcel			**IMPERVIOUS Parcel**		
Area =	0	acres	**Area =**	9.83	acres
CN =	49		**CN =**	98	
S =	10.41		**S =**	0.20	
0.2S =	2.08		**0.2S =**	0.04	

Compute Developed Conditions Runoff hydrograph

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Col. (3) x Pt = 10 year - 24 Hour Hyetograph at this location.
Column (5) = Accumulated Sum of Col. (4)
Column (6) = [If P <= 0.2S] = 0; Note, use PERVIOUS Area "S" value.
[If P > 0.2S] = (Col.(5) - 0.2S)^2/(Col.(5) + 0.8S); Using the PERVIOUS Area "S" value.
Column (7) = Col.(6) of Present Time Step - Col.(6) of Previous Time Step
Column (8) = Same method as for Col.(6), except use the IMPERVIOUS Area "S" value.
Column (9) = Col.(8) of the present time step - Col.(8) of the previous time step.
Column (10) = ((PERVIOUS area / Total area) x Col.(7)) + ((IMPERVIOUS area / Total area) x Col.(9))
Column (11) = (60.5 x Col.(10) x Total Area) / 10 (dt = 10 minutes)
Routing Constant, w = dt / (2Tc + dt) = 0.5000
Column (12) = Col.(12) of Previous Time Step + (w x [Col.(11) of Previous Time Step
+ Col.(11) of Present Time Step - (2 x Col.(12) of Previous Time Step)])

					Pervious Area		Impervious Area				
(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution % of Pt	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	(6) Accumu-lated Runoff in.	(7) Incre-mental Runoff in.	(8) Accumu-lated Runoff in.	(9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs
1	10	0.0040	0.0248	0.0248	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.000
2	20	0.0040	0.0248	0.0496	0.0000	0.0000	0.0004	0.0000	0.0000	0.0	0.000
3	30	0.0040	0.0248	0.0744	0.0000	0.0000	0.0047	0.0044	0.0044	0.3	0.130
4	40	0.0040	0.0248	0.0992	0.0000	0.0000	0.0130	0.0082	0.0082	0.5	0.376
5	50	0.0040	0.0248	0.1240	0.0000	0.0000	0.0241	0.0111	0.0111	0.7	0.575
6	60	0.0040	0.0248	0.1488	0.0000	0.0000	0.0374	0.0133	0.0133	0.8	0.725
7	70	0.0040	0.0248	0.1736	0.0000	0.0000	0.0523	0.0150	0.0150	0.9	0.841
8	80	0.0040	0.0248	0.1984	0.0000	0.0000	0.0687	0.0163	0.0163	1.0	0.931
9	90	0.0040	0.0248	0.2232	0.0000	0.0000	0.0861	0.0174	0.0174	1.0	1.004
10	100	0.0040	0.0248	0.2480	0.0000	0.0000	0.1044	0.0183	0.0183	1.1	1.062
11	110	0.0050	0.0310	0.2790	0.0000	0.0000	0.1283	0.0239	0.0239	1.4	1.256
12	120	0.0050	0.0310	0.3100	0.0000	0.0000	0.1531	0.0248	0.0248	1.5	1.450
13	130	0.0050	0.0310	0.3410	0.0000	0.0000	0.1787	0.0256	0.0256	1.5	1.500
14	140	0.0050	0.0310	0.3720	0.0000	0.0000	0.2049	0.0262	0.0262	1.6	1.541
15	150	0.0050	0.0310	0.4030	0.0000	0.0000	0.2317	0.0267	0.0267	1.6	1.575
16	160	0.0050	0.0310	0.4340	0.0000	0.0000	0.2588	0.0272	0.0272	1.6	1.604
17	170	0.0060	0.0372	0.4712	0.0000	0.0000	0.2919	0.0331	0.0331	2.0	1.794
18	180	0.0060	0.0372	0.5084	0.0000	0.0000	0.3255	0.0336	0.0336	2.0	1.984
19	190	0.0060	0.0372	0.5456	0.0000	0.0000	0.3595	0.0339	0.0339	2.0	2.008
20	200	0.0060	0.0372	0.5828	0.0000	0.0000	0.3937	0.0343	0.0343	2.0	2.029
21	210	0.0060	0.0372	0.6200	0.0000	0.0000	0.4283	0.0345	0.0345	2.1	2.047
22	220	0.0060	0.0372	0.6572	0.0000	0.0000	0.4631	0.0348	0.0348	2.1	2.063
23	230	0.0070	0.0434	0.7006	0.0000	0.0000	0.5039	0.0408	0.0408	2.4	2.250
24	240	0.0070	0.0434	0.7440	0.0000	0.0000	0.5450	0.0411	0.0411	2.4	2.438
25	250	0.0070	0.0434	0.7874	0.0000	0.0000	0.5863	0.0413	0.0413	2.5	2.451
26	260	0.0070	0.0434	0.8308	0.0000	0.0000	0.6278	0.0415	0.0415	2.5	2.463
27	270	0.0070	0.0434	0.8742	0.0000	0.0000	0.6694	0.0416	0.0416	2.5	2.473

(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	Pervious Area (6) Accumu-lated Runoff in.	(7) Incre-mental Runoff in.	Impervious Area (8) Accumu-lated Runoff in.	(9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs	design hydro-graph less Q infill cfs
28	280	0.0070	0.0434	0.9176	0.0000	0.0000	0.7112	0.0418	0.0418	2.5	2.482	
29	290	0.0082	0.0508	0.9684	0.0000	0.0000	0.7603	0.0491	0.0491	2.9	2.704	
30	300	0.0082	0.0508	1.0193	0.0000	0.0000	0.8096	0.0493	0.0493	2.9	2.926	
31	310	0.0082	0.0508	1.0701	0.0000	0.0000	0.8590	0.0494	0.0494	2.9	2.935	
32	320	0.0082	0.0508	1.1210	0.0000	0.0000	0.9085	0.0495	0.0495	2.9	2.942	
33	330	0.0082	0.0508	1.1718	0.0000	0.0000	0.9581	0.0496	0.0496	3.0	2.948	
34	340	0.0082	0.0508	1.2226	0.0000	0.0000	1.0078	0.0497	0.0497	3.0	2.954	
35	350	0.0095	0.0589	1.2815	0.0000	0.0000	1.0655	0.0577	0.0577	3.4	3.194	0.343
36	360	0.0095	0.0589	1.3404	0.0000	0.0000	1.1232	0.0578	0.0578	3.4	3.435	0.583
37	370	0.0095	0.0589	1.3993	0.0000	0.0000	1.1811	0.0579	0.0579	3.4	3.440	0.589
38	380	0.0095	0.0589	1.4582	0.0000	0.0000	1.2390	0.0579	0.0579	3.4	3.445	0.594
39	390	0.0095	0.0589	1.5171	0.0000	0.0000	1.2970	0.0580	0.0580	3.5	3.449	0.598
40	400	0.0095	0.0589	1.5760	0.0000	0.0000	1.3551	0.0581	0.0581	3.5	3.453	0.602
41	410	0.0134	0.0831	1.6591	0.0000	0.0000	1.4371	0.0820	0.0820	4.9	4.166	1.315
42	420	0.0134	0.0831	1.7422	0.0000	0.0000	1.5192	0.0821	0.0821	4.9	4.881	2.030
43	430	0.0134	0.0831	1.8253	0.0000	0.0000	1.6013	0.0822	0.0822	4.9	4.886	2.035
44	440	0.0180	0.1116	1.9369	0.0000	0.0000	1.7118	0.1105	0.1105	6.6	5.731	2.880
45	450	0.0180	0.1116	2.0485	0.0000	0.0000	1.8224	0.1106	0.1106	6.6	6.577	3.726
46	460	0.0340	0.2108	2.2593	0.0030	0.0030	2.0316	0.2092	0.2092	12.4	9.513	6.662
47	470	0.0540	0.3348	2.5941	0.0240	0.0211	2.3643	0.3327	0.3327	19.8	16.121	13.270
48	480	0.0270	0.1674	2.7615	0.0417	0.0176	2.5308	0.1665	0.1665	9.9	14.853	12.002
49	490	0.0180	0.1116	2.8731	0.0559	0.0142	2.6419	0.1111	0.1111	6.6	8.259	5.408
50	500	0.0134	0.0831	2.9562	0.0678	0.0119	2.7246	0.0827	0.0827	4.9	5.765	2.914
51	510	0.0134	0.0831	3.0392	0.0807	0.0129	2.8073	0.0827	0.0827	4.9	4.922	2.071
52	520	0.0134	0.0831	3.1223	0.0946	0.0139	2.8901	0.0828	0.0828	4.9	4.923	2.072
53	530	0.0088	0.0546	3.1769	0.1043	0.0097	2.9445	0.0544	0.0544	3.2	4.079	1.228
54	540	0.0088	0.0546	3.2314	0.1144	0.0101	2.9988	0.0544	0.0544	3.2	3.234	0.383
55	550	0.0088	0.0546	3.2860	0.1249	0.0105	3.0532	0.0544	0.0544	3.2	3.235	0.384
56	560	0.0088	0.0546	3.3406	0.1358	0.0109	3.1075	0.0544	0.0544	3.2	3.235	0.384
57	570	0.0088	0.0546	3.3951	0.1472	0.0113	3.1619	0.0544	0.0544	3.2	3.235	0.384
58	580	0.0088	0.0546	3.4497	0.1589	0.0117	3.2163	0.0544	0.0544	3.2	3.236	0.385
59	590	0.0088	0.0546	3.5042	0.1711	0.0121	3.2707	0.0544	0.0544	3.2	3.236	0.385
60	600	0.0088	0.0546	3.5588	0.1836	0.0125	3.3251	0.0544	0.0544	3.2	3.236	0.385
61	610	0.0088	0.0546	3.6134	0.1965	0.0129	3.3795	0.0544	0.0544	3.2	3.237	0.385
62	620	0.0088	0.0546	3.6679	0.2098	0.0133	3.4339	0.0544	0.0544	3.2	3.237	0.386
63	630	0.0088	0.0546	3.7225	0.2235	0.0137	3.4883	0.0544	0.0544	3.2	3.237	0.386
64	640	0.0088	0.0546	3.7770	0.2375	0.0140	3.5427	0.0544	0.0544	3.2	3.237	0.386
65	650	0.0072	0.0446	3.8217	0.2492	0.0118	3.5872	0.0445	0.0445	2.6	2.943	
66	660	0.0072	0.0446	3.8663	0.2612	0.0120	3.6318	0.0445	0.0445	2.6	2.649	
67	670	0.0072	0.0446	3.9110	0.2735	0.0122	3.6763	0.0445	0.0445	2.6	2.649	
68	680	0.0072	0.0446	3.9556	0.2859	0.0125	3.7208	0.0445	0.0445	2.6	2.649	
69	690	0.0072	0.0446	4.0002	0.2986	0.0127	3.7653	0.0445	0.0445	2.6	2.650	
70	700	0.0072	0.0446	4.0449	0.3116	0.0129	3.8099	0.0445	0.0445	2.6	2.650	
71	710	0.0072	0.0446	4.0895	0.3247	0.0132	3.8544	0.0445	0.0445	2.6	2.650	
72	720	0.0072	0.0446	4.1342	0.3381	0.0134	3.8990	0.0445	0.0445	2.7	2.650	
73	730	0.0072	0.0446	4.1788	0.3517	0.0136	3.9435	0.0445	0.0445	2.7	2.650	
74	740	0.0072	0.0446	4.2234	0.3655	0.0138	3.9880	0.0445	0.0445	2.7	2.650	
75	750	0.0072	0.0446	4.2681	0.3796	0.0140	4.0326	0.0445	0.0445	2.7	2.650	
76	760	0.0072	0.0446	4.3127	0.3938	0.0143	4.0771	0.0445	0.0445	2.7	2.650	
77	770	0.0057	0.0353	4.3481	0.4053	0.0114	4.1124	0.0353	0.0353	2.1	2.374	
78	780	0.0057	0.0353	4.3834	0.4168	0.0116	4.1477	0.0353	0.0353	2.1	2.098	
79	790	0.0057	0.0353	4.4187	0.4286	0.0117	4.1829	0.0353	0.0353	2.1	2.098	
80	800	0.0057	0.0353	4.4541	0.4404	0.0118	4.2182	0.0353	0.0353	2.1	2.099	
81	810	0.0057	0.0353	4.4894	0.4524	0.0120	4.2535	0.0353	0.0353	2.1	2.099	

(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	Pervious Area (6) Accumu-lated Runoff in.	(7) Incre-mental Runoff in.	Impervious Area (8) Accumu-lated Runoff in.	(9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs
82	820	0.0057	0.0353	4.5248	0.4645	0.0121	4.2887	0.0353	0.0353	2.1	2.099
83	830	0.0057	0.0353	4.5601	0.4767	0.0122	4.3240	0.0353	0.0353	2.1	2.099
84	840	0.0057	0.0353	4.5954	0.4890	0.0123	4.3593	0.0353	0.0353	2.1	2.099
85	850	0.0057	0.0353	4.6308	0.5015	0.0125	4.3946	0.0353	0.0353	2.1	2.099
86	860	0.0057	0.0353	4.6661	0.5141	0.0126	4.4298	0.0353	0.0353	2.1	2.099
87	870	0.0057	0.0353	4.7015	0.5268	0.0127	4.4651	0.0353	0.0353	2.1	2.099
88	880	0.0057	0.0353	4.7368	0.5397	0.0128	4.5004	0.0353	0.0353	2.1	2.099
89	890	0.0050	0.0310	4.7678	0.5510	0.0114	4.5313	0.0309	0.0309	1.8	1.970
90	900	0.0050	0.0310	4.7988	0.5625	0.0115	4.5623	0.0309	0.0309	1.8	1.841
91	910	0.0050	0.0310	4.8298	0.5741	0.0116	4.5932	0.0309	0.0309	1.8	1.841
92	920	0.0050	0.0310	4.8608	0.5857	0.0116	4.6242	0.0309	0.0309	1.8	1.841
93	930	0.0050	0.0310	4.8918	0.5974	0.0117	4.6551	0.0309	0.0309	1.8	1.841
94	940	0.0050	0.0310	4.9228	0.6093	0.0118	4.6861	0.0309	0.0309	1.8	1.841
95	950	0.0050	0.0310	4.9538	0.6212	0.0119	4.7170	0.0310	0.0310	1.8	1.842
96	960	0.0050	0.0310	4.9848	0.6332	0.0120	4.7480	0.0310	0.0310	1.8	1.842
97	970	0.0050	0.0310	5.0158	0.6453	0.0121	4.7789	0.0310	0.0310	1.8	1.842
98	980	0.0050	0.0310	5.0468	0.6574	0.0122	4.8099	0.0310	0.0310	1.8	1.842
99	990	0.0050	0.0310	5.0778	0.6697	0.0123	4.8408	0.0310	0.0310	1.8	1.842
100	1000	0.0050	0.0310	5.1088	0.6821	0.0124	4.8718	0.0310	0.0310	1.8	1.842
101	1010	0.0040	0.0248	5.1336	0.6920	0.0099	4.8966	0.0248	0.0248	1.5	1.658
102	1020	0.0040	0.0248	5.1584	0.7020	0.0100	4.9213	0.0248	0.0248	1.5	1.473
103	1030	0.0040	0.0248	5.1832	0.7121	0.0101	4.9461	0.0248	0.0248	1.5	1.473
104	1040	0.0040	0.0248	5.2080	0.7222	0.0101	4.9709	0.0248	0.0248	1.5	1.473
105	1050	0.0040	0.0248	5.2328	0.7323	0.0102	4.9956	0.0248	0.0248	1.5	1.473
106	1060	0.0040	0.0248	5.2576	0.7425	0.0102	5.0204	0.0248	0.0248	1.5	1.473
107	1070	0.0040	0.0248	5.2824	0.7528	0.0103	5.0452	0.0248	0.0248	1.5	1.474
108	1080	0.0040	0.0248	5.3072	0.7631	0.0103	5.0699	0.0248	0.0248	1.5	1.474
109	1090	0.0040	0.0248	5.3320	0.7735	0.0104	5.0947	0.0248	0.0248	1.5	1.474
110	1100	0.0040	0.0248	5.3568	0.7839	0.0104	5.1194	0.0248	0.0248	1.5	1.474
111	1110	0.0040	0.0248	5.3816	0.7944	0.0105	5.1442	0.0248	0.0248	1.5	1.474
112	1120	0.0040	0.0248	5.4064	0.8049	0.0105	5.1690	0.0248	0.0248	1.5	1.474
113	1130	0.0040	0.0248	5.4312	0.8155	0.0106	5.1937	0.0248	0.0248	1.5	1.474
114	1140	0.0040	0.0248	5.4560	0.8261	0.0106	5.2185	0.0248	0.0248	1.5	1.474
115	1150	0.0040	0.0248	5.4808	0.8368	0.0107	5.2433	0.0248	0.0248	1.5	1.474
116	1160	0.0040	0.0248	5.5056	0.8476	0.0107	5.2680	0.0248	0.0248	1.5	1.474
117	1170	0.0040	0.0248	5.5304	0.8583	0.0108	5.2928	0.0248	0.0248	1.5	1.474
118	1180	0.0040	0.0248	5.5552	0.8692	0.0108	5.3176	0.0248	0.0248	1.5	1.474
119	1190	0.0040	0.0248	5.5800	0.8801	0.0109	5.3424	0.0248	0.0248	1.5	1.474
120	1200	0.0040	0.0248	5.6048	0.8910	0.0109	5.3671	0.0248	0.0248	1.5	1.474
121	1210	0.0040	0.0248	5.6296	0.9020	0.0110	5.3919	0.0248	0.0248	1.5	1.474
122	1220	0.0040	0.0248	5.6544	0.9130	0.0110	5.4167	0.0248	0.0248	1.5	1.474
123	1230	0.0040	0.0248	5.6792	0.9241	0.0111	5.4414	0.0248	0.0248	1.5	1.474
124	1240	0.0040	0.0248	5.7040	0.9352	0.0111	5.4662	0.0248	0.0248	1.5	1.474
125	1250	0.0040	0.0248	5.7288	0.9464	0.0112	5.4910	0.0248	0.0248	1.5	1.474
126	1260	0.0040	0.0248	5.7536	0.9576	0.0112	5.5157	0.0248	0.0248	1.5	1.474
127	1270	0.0040	0.0248	5.7784	0.9689	0.0113	5.5405	0.0248	0.0248	1.5	1.474
128	1280	0.0040	0.0248	5.8032	0.9802	0.0113	5.5653	0.0248	0.0248	1.5	1.474
129	1290	0.0040	0.0248	5.8280	0.9916	0.0114	5.5901	0.0248	0.0248	1.5	1.474
130	1300	0.0040	0.0248	5.8528	1.0030	0.0114	5.6148	0.0248	0.0248	1.5	1.474
131	1310	0.0040	0.0248	5.8776	1.0144	0.0115	5.6396	0.0248	0.0248	1.5	1.474
132	1320	0.0040	0.0248	5.9024	1.0260	0.0115	5.6644	0.0248	0.0248	1.5	1.474
133	1330	0.0040	0.0248	5.9272	1.0375	0.0116	5.6891	0.0248	0.0248	1.5	1.474
134	1340	0.0040	0.0248	5.9520	1.0491	0.0116	5.7139	0.0248	0.0248	1.5	1.474

(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	Pervious Area (6) Accumu-lated Runoff in.	(7) Incre-mental Runoff in.	Impervious Area (8) Accumu-lated Runoff in.	(9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs
135	1350	0.0040	0.0248	5.9768	1.0608	0.0116	5.7387	0.0248	0.0248	1.5	1.474
136	1360	0.0040	0.0248	6.0016	1.0724	0.0117	5.7635	0.0248	0.0248	1.5	1.474
137	1370	0.0040	0.0248	6.0264	1.0842	0.0117	5.7882	0.0248	0.0248	1.5	1.474
138	1380	0.0040	0.0248	6.0512	1.0960	0.0118	5.8130	0.0248	0.0248	1.5	1.474
139	1390	0.0040	0.0248	6.0760	1.1078	0.0118	5.8378	0.0248	0.0248	1.5	1.474
140	1400	0.0040	0.0248	6.1008	1.1197	0.0119	5.8626	0.0248	0.0248	1.5	1.474
141	1410	0.0040	0.0248	6.1256	1.1316	0.0119	5.8873	0.0248	0.0248	1.5	1.474
142	1420	0.0040	0.0248	6.1504	1.1435	0.0120	5.9121	0.0248	0.0248	1.5	1.474
143	1430	0.0040	0.0248	6.1752	1.1555	0.0120	5.9369	0.0248	0.0248	1.5	1.474
144	1440	0.0040	0.0248	6.2000	1.1676	0.0120	5.9616	0.0248	0.0248	1.5	1.474

Total Volume of Runoff = 212375.647 cu. ft.

(Found by summing this column and multiplying by 600. 600 is the conversion required to convert SUM(Q) in cfs to total volume in cubic feet as follows:
V = SUM(Q) x dt
(cu.ft.) = (cu.ft/s) x (10 min.) x (60 s/min.)

INFILTRATION TRENCH BASIN 4 SIZING CALCULATIONS (100 YEAR STORM EVENT)

FLOW RATES AND VOLUMES:

k=	6.00	in/hr	=	0.000139 ft/sec

Sum of Incremental Flow Rates =	65.16	cfs
Required Storage Volume =	39093	cf

TRENCH SIZING:

L =	1400	ft			
W =	12	ft			
H =	4	ft			
Wetted Area =	20527.68	sf			
Q trench=	2.851	cfs	(outflow from trench)		
VOID RATIO =	0.60				
TRENCH VOL =	**40594**	**cf**	>	39093 CF	**OK**

EQUIVALENT VOID RATIO:

Pipe Size =	30	in		
No. of Pipes =	4			
Void Ration Pipe =	1.00		=	100%
Void Ratio Rock =	0.33		=	33.0%
A pipe =	19.64	sf	(cross sectional)	
A rock =	28.36	sf	(cross sectional)	
A total =	48	sf	(cross sectional)	
Volume pipe =	27489.9	cf		
Volume rock =	39,710	cf		
Volume total =	67,200	cf		
Equivalent Void Ratio =	**0.60**		**=**	**60%**

SUMMARY:

Trench:	**L =**	**1400**	**ft**	
	W =	**12**	**ft**	
	H =	**4**	**ft**	
	No. of Pipes =	**4**	**30**	**inch dia pipe**

100 YEAR STORMWATER CALCULATION MATRIX - SANTA BARBARA HYDROGRAPGH METHOD

Date: **4/14/2021**

Given: **Project =** **NORDIC AQUAFARMS AQUACULTURE FACILITY**

Area = 0.62 acres

Pt = 6.2 inches **100-Year / 24 Hour Storm**

dt = 10 min.

Tc = 5 min. (Post-Developed Site Conditions)

PERVIOUS Parcel			**IMPERVIOUS Parcel**		
Area =	0	acres	**Area =**	0.62	acres
CN =	49		**CN =**	98	
S =	10.41		**S =**	0.20	
0.2S =	2.08		**0.2S =**	0.04	

Compute Developed Conditions Runoff hydrograph

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Col. (3) x Pt = 10 year - 24 Hour Hyetograph at this location.
Column (5) = Accumulated Sum of Col. (4)
Column (6) = [If P <= 0.2S] = 0; Note, use PERVIOUS Area "S" value.
[If P > 0.2S] = (Col.(5) - 0.2S)^2/(Col.(5) + 0.8S); Using the PERVIOUS Area "S" value.
Column (7) = Col.(6) of Present Time Step - Col.(6) of Previous Time Step
Column (8) = Same method as for Col.(6), except use the IMPERVIOUS Area "S" value.
Column (9) = Col.(8) of the present time step - Col.(8) of the previous time step.
Column (10) = ((PERVIOUS area / Total area) x Col.(7)) + ((IMPERVIOUS area / Total area) x Col.(9))
Column (11) = (60.5 x Col.(10) x Total Area) / 10 (dt = 10 minutes)
Routing Constant, w = dt / (2Tc + dt) = 0.5000
Column (12) = Col.(12) of Previous Time Step + (w x [Col.(11) of Previous Time Step
+ Col.(11) of Present Time Step - (2 x Col.(12) of Previous Time Step)])

					Pervious Area		Impervious Area				
(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution % of Pt	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	(6) Accumu-lated Runoff in.	(7) Incre-mental Runoff in.	(8) Accumu-lated Runoff in.	(9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs
1	10	0.0040	0.0248	0.0248	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.000
2	20	0.0040	0.0248	0.0496	0.0000	0.0000	0.0004	0.0000	0.0000	0.0	0.000
3	30	0.0040	0.0248	0.0744	0.0000	0.0000	0.0047	0.0044	0.0044	0.0	0.008
4	40	0.0040	0.0248	0.0992	0.0000	0.0000	0.0130	0.0082	0.0082	0.0	0.024
5	50	0.0040	0.0248	0.1240	0.0000	0.0000	0.0241	0.0111	0.0111	0.0	0.036
6	60	0.0040	0.0248	0.1488	0.0000	0.0000	0.0374	0.0133	0.0133	0.0	0.046
7	70	0.0040	0.0248	0.1736	0.0000	0.0000	0.0523	0.0150	0.0150	0.1	0.053
8	80	0.0040	0.0248	0.1984	0.0000	0.0000	0.0687	0.0163	0.0163	0.1	0.059
9	90	0.0040	0.0248	0.2232	0.0000	0.0000	0.0861	0.0174	0.0174	0.1	0.063
10	100	0.0040	0.0248	0.2480	0.0000	0.0000	0.1044	0.0183	0.0183	0.1	0.067
11	110	0.0050	0.0310	0.2790	0.0000	0.0000	0.1283	0.0239	0.0239	0.1	0.079
12	120	0.0050	0.0310	0.3100	0.0000	0.0000	0.1531	0.0248	0.0248	0.1	0.091
13	130	0.0050	0.0310	0.3410	0.0000	0.0000	0.1787	0.0256	0.0256	0.1	0.095
14	140	0.0050	0.0310	0.3720	0.0000	0.0000	0.2049	0.0262	0.0262	0.1	0.097
15	150	0.0050	0.0310	0.4030	0.0000	0.0000	0.2317	0.0267	0.0267	0.1	0.099
16	160	0.0050	0.0310	0.4340	0.0000	0.0000	0.2588	0.0272	0.0272	0.1	0.101
17	170	0.0060	0.0372	0.4712	0.0000	0.0000	0.2919	0.0331	0.0331	0.1	0.113
18	180	0.0060	0.0372	0.5084	0.0000	0.0000	0.3255	0.0336	0.0336	0.1	0.125
19	190	0.0060	0.0372	0.5456	0.0000	0.0000	0.3595	0.0339	0.0339	0.1	0.127
20	200	0.0060	0.0372	0.5828	0.0000	0.0000	0.3937	0.0343	0.0343	0.1	0.128
21	210	0.0060	0.0372	0.6200	0.0000	0.0000	0.4283	0.0345	0.0345	0.1	0.129
22	220	0.0060	0.0372	0.6572	0.0000	0.0000	0.4631	0.0348	0.0348	0.1	0.130
23	230	0.0070	0.0434	0.7006	0.0000	0.0000	0.5039	0.0408	0.0408	0.2	0.142
24	240	0.0070	0.0434	0.7440	0.0000	0.0000	0.5450	0.0411	0.0411	0.2	0.154
25	250	0.0070	0.0434	0.7874	0.0000	0.0000	0.5863	0.0413	0.0413	0.2	0.154
26	260	0.0070	0.0434	0.8308	0.0000	0.0000	0.6278	0.0415	0.0415	0.2	0.155
27	270	0.0070	0.0434	0.8742	0.0000	0.0000	0.6694	0.0416	0.0416	0.2	0.156

(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	Pervious Area (6) Accumu-lated Runoff in.	Pervious Area (7) Incre-mental Runoff in.	Impervious Area (8) Accumu-lated Runoff in.	Impervious Area (9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs	design hydro-graph less Q infill cfs
28	280	0.0070	0.0434	0.9176	0.0000	0.0000	0.7112	0.0418	0.0418	0.2	0.156	
29	290	0.0082	0.0508	0.9684	0.0000	0.0000	0.7603	0.0491	0.0491	0.2	0.170	
30	300	0.0082	0.0508	1.0193	0.0000	0.0000	0.8096	0.0493	0.0493	0.2	0.184	
31	310	0.0082	0.0508	1.0701	0.0000	0.0000	0.8590	0.0494	0.0494	0.2	0.185	
32	320	0.0082	0.0508	1.1210	0.0000	0.0000	0.9085	0.0495	0.0495	0.2	0.185	
33	330	0.0082	0.0508	1.1718	0.0000	0.0000	0.9581	0.0496	0.0496	0.2	0.186	
34	340	0.0082	0.0508	1.2226	0.0000	0.0000	1.0078	0.0497	0.0497	0.2	0.186	
35	350	0.0095	0.0589	1.2815	0.0000	0.0000	1.0655	0.0577	0.0577	0.2	0.201	
36	360	0.0095	0.0589	1.3404	0.0000	0.0000	1.1232	0.0578	0.0578	0.2	0.216	
37	370	0.0095	0.0589	1.3993	0.0000	0.0000	1.1811	0.0579	0.0579	0.2	0.217	
38	380	0.0095	0.0589	1.4582	0.0000	0.0000	1.2390	0.0579	0.0579	0.2	0.217	
39	390	0.0095	0.0589	1.5171	0.0000	0.0000	1.2970	0.0580	0.0580	0.2	0.217	
40	400	0.0095	0.0589	1.5760	0.0000	0.0000	1.3551	0.0581	0.0581	0.2	0.218	
41	410	0.0134	0.0831	1.6591	0.0000	0.0000	1.4371	0.0820	0.0820	0.3	0.263	
42	420	0.0134	0.0831	1.7422	0.0000	0.0000	1.5192	0.0821	0.0821	0.3	0.308	
43	430	0.0134	0.0831	1.8253	0.0000	0.0000	1.6013	0.0822	0.0822	0.3	0.308	
44	440	0.0180	0.1116	1.9369	0.0000	0.0000	1.7118	0.1105	0.1105	0.4	0.361	
45	450	0.0180	0.1116	2.0485	0.0000	0.0000	1.8224	0.1106	0.1106	0.4	0.415	
46	460	0.0340	0.2108	2.2593	0.0030	0.0030	2.0316	0.2092	0.2092	0.8	0.600	0.139
47	470	0.0540	0.3348	2.5941	0.0240	0.0211	2.3643	0.3327	0.3327	1.2	1.016	0.555
48	480	0.0270	0.1674	2.7615	0.0417	0.0176	2.5308	0.1665	0.1665	0.6	0.936	0.475
49	490	0.0180	0.1116	2.8731	0.0559	0.0142	2.6419	0.1111	0.1111	0.4	0.521	0.060
50	500	0.0134	0.0831	2.9562	0.0678	0.0119	2.7246	0.0827	0.0827	0.3	0.363	
51	510	0.0134	0.0831	3.0392	0.0807	0.0129	2.8073	0.0827	0.0827	0.3	0.310	
52	520	0.0134	0.0831	3.1223	0.0946	0.0139	2.8901	0.0828	0.0828	0.3	0.310	
53	530	0.0088	0.0546	3.1769	0.1043	0.0097	2.9445	0.0544	0.0544	0.2	0.257	
54	540	0.0088	0.0546	3.2314	0.1144	0.0101	2.9988	0.0544	0.0544	0.2	0.204	
55	550	0.0088	0.0546	3.2860	0.1249	0.0105	3.0532	0.0544	0.0544	0.2	0.204	
56	560	0.0088	0.0546	3.3406	0.1358	0.0109	3.1075	0.0544	0.0544	0.2	0.204	
57	570	0.0088	0.0546	3.3951	0.1472	0.0113	3.1619	0.0544	0.0544	0.2	0.204	
58	580	0.0088	0.0546	3.4497	0.1589	0.0117	3.2163	0.0544	0.0544	0.2	0.204	
59	590	0.0088	0.0546	3.5042	0.1711	0.0121	3.2707	0.0544	0.0544	0.2	0.204	
60	600	0.0088	0.0546	3.5588	0.1836	0.0125	3.3251	0.0544	0.0544	0.2	0.204	
61	610	0.0088	0.0546	3.6134	0.1965	0.0129	3.3795	0.0544	0.0544	0.2	0.204	
62	620	0.0088	0.0546	3.6679	0.2098	0.0133	3.4339	0.0544	0.0544	0.2	0.204	
63	630	0.0088	0.0546	3.7225	0.2235	0.0137	3.4883	0.0544	0.0544	0.2	0.204	
64	640	0.0088	0.0546	3.7770	0.2375	0.0140	3.5427	0.0544	0.0544	0.2	0.204	
65	650	0.0072	0.0446	3.8217	0.2492	0.0118	3.5872	0.0445	0.0445	0.2	0.185	
66	660	0.0072	0.0446	3.8663	0.2612	0.0120	3.6318	0.0445	0.0445	0.2	0.167	
67	670	0.0072	0.0446	3.9110	0.2735	0.0122	3.6763	0.0445	0.0445	0.2	0.167	
68	680	0.0072	0.0446	3.9556	0.2859	0.0125	3.7208	0.0445	0.0445	0.2	0.167	
69	690	0.0072	0.0446	4.0002	0.2986	0.0127	3.7653	0.0445	0.0445	0.2	0.167	
70	700	0.0072	0.0446	4.0449	0.3116	0.0129	3.8099	0.0445	0.0445	0.2	0.167	
71	710	0.0072	0.0446	4.0895	0.3247	0.0132	3.8544	0.0445	0.0445	0.2	0.167	
72	720	0.0072	0.0446	4.1342	0.3381	0.0134	3.8990	0.0445	0.0445	0.2	0.167	
73	730	0.0072	0.0446	4.1788	0.3517	0.0136	3.9435	0.0445	0.0445	0.2	0.167	
74	740	0.0072	0.0446	4.2234	0.3655	0.0138	3.9880	0.0445	0.0445	0.2	0.167	
75	750	0.0072	0.0446	4.2681	0.3796	0.0140	4.0326	0.0445	0.0445	0.2	0.167	
76	760	0.0072	0.0446	4.3127	0.3938	0.0143	4.0771	0.0445	0.0445	0.2	0.167	
77	770	0.0057	0.0353	4.3481	0.4053	0.0114	4.1124	0.0353	0.0353	0.1	0.150	
78	780	0.0057	0.0353	4.3834	0.4168	0.0116	4.1477	0.0353	0.0353	0.1	0.132	
79	790	0.0057	0.0353	4.4187	0.4286	0.0117	4.1829	0.0353	0.0353	0.1	0.132	
80	800	0.0057	0.0353	4.4541	0.4404	0.0118	4.2182	0.0353	0.0353	0.1	0.132	
81	810	0.0057	0.0353	4.4894	0.4524	0.0120	4.2535	0.0353	0.0353	0.1	0.132	

(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	Pervious Area (6) Accumu-lated Runoff in.	(7) Incre-mental Runoff in.	Impervious Area (8) Accumu-lated Runoff in.	(9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs
82	820	0.0057	0.0353	4.5248	0.4645	0.0121	4.2887	0.0353	0.0353	0.1	0.132
83	830	0.0057	0.0353	4.5601	0.4767	0.0122	4.3240	0.0353	0.0353	0.1	0.132
84	840	0.0057	0.0353	4.5954	0.4890	0.0123	4.3593	0.0353	0.0353	0.1	0.132
85	850	0.0057	0.0353	4.6308	0.5015	0.0125	4.3946	0.0353	0.0353	0.1	0.132
86	860	0.0057	0.0353	4.6661	0.5141	0.0126	4.4298	0.0353	0.0353	0.1	0.132
87	870	0.0057	0.0353	4.7015	0.5268	0.0127	4.4651	0.0353	0.0353	0.1	0.132
88	880	0.0057	0.0353	4.7368	0.5397	0.0128	4.5004	0.0353	0.0353	0.1	0.132
89	890	0.0050	0.0310	4.7678	0.5510	0.0114	4.5313	0.0309	0.0309	0.1	0.124
90	900	0.0050	0.0310	4.7988	0.5625	0.0115	4.5623	0.0309	0.0309	0.1	0.116
91	910	0.0050	0.0310	4.8298	0.5741	0.0116	4.5932	0.0309	0.0309	0.1	0.116
92	920	0.0050	0.0310	4.8608	0.5857	0.0116	4.6242	0.0309	0.0309	0.1	0.116
93	930	0.0050	0.0310	4.8918	0.5974	0.0117	4.6551	0.0309	0.0309	0.1	0.116
94	940	0.0050	0.0310	4.9228	0.6093	0.0118	4.6861	0.0309	0.0309	0.1	0.116
95	950	0.0050	0.0310	4.9538	0.6212	0.0119	4.7170	0.0310	0.0310	0.1	0.116
96	960	0.0050	0.0310	4.9848	0.6332	0.0120	4.7480	0.0310	0.0310	0.1	0.116
97	970	0.0050	0.0310	5.0158	0.6453	0.0121	4.7789	0.0310	0.0310	0.1	0.116
98	980	0.0050	0.0310	5.0468	0.6574	0.0122	4.8099	0.0310	0.0310	0.1	0.116
99	990	0.0050	0.0310	5.0778	0.6697	0.0123	4.8408	0.0310	0.0310	0.1	0.116
100	1000	0.0050	0.0310	5.1088	0.6821	0.0124	4.8718	0.0310	0.0310	0.1	0.116
101	1010	0.0040	0.0248	5.1336	0.6920	0.0099	4.8966	0.0248	0.0248	0.1	0.104
102	1020	0.0040	0.0248	5.1584	0.7020	0.0100	4.9213	0.0248	0.0248	0.1	0.093
103	1030	0.0040	0.0248	5.1832	0.7121	0.0101	4.9461	0.0248	0.0248	0.1	0.093
104	1040	0.0040	0.0248	5.2080	0.7222	0.0101	4.9709	0.0248	0.0248	0.1	0.093
105	1050	0.0040	0.0248	5.2328	0.7323	0.0102	4.9956	0.0248	0.0248	0.1	0.093
106	1060	0.0040	0.0248	5.2576	0.7425	0.0102	5.0204	0.0248	0.0248	0.1	0.093
107	1070	0.0040	0.0248	5.2824	0.7528	0.0103	5.0452	0.0248	0.0248	0.1	0.093
108	1080	0.0040	0.0248	5.3072	0.7631	0.0103	5.0699	0.0248	0.0248	0.1	0.093
109	1090	0.0040	0.0248	5.3320	0.7735	0.0104	5.0947	0.0248	0.0248	0.1	0.093
110	1100	0.0040	0.0248	5.3568	0.7839	0.0104	5.1194	0.0248	0.0248	0.1	0.093
111	1110	0.0040	0.0248	5.3816	0.7944	0.0105	5.1442	0.0248	0.0248	0.1	0.093
112	1120	0.0040	0.0248	5.4064	0.8049	0.0105	5.1690	0.0248	0.0248	0.1	0.093
113	1130	0.0040	0.0248	5.4312	0.8155	0.0106	5.1937	0.0248	0.0248	0.1	0.093
114	1140	0.0040	0.0248	5.4560	0.8261	0.0106	5.2185	0.0248	0.0248	0.1	0.093
115	1150	0.0040	0.0248	5.4808	0.8368	0.0107	5.2433	0.0248	0.0248	0.1	0.093
116	1160	0.0040	0.0248	5.5056	0.8476	0.0107	5.2680	0.0248	0.0248	0.1	0.093
117	1170	0.0040	0.0248	5.5304	0.8583	0.0108	5.2928	0.0248	0.0248	0.1	0.093
118	1180	0.0040	0.0248	5.5552	0.8692	0.0108	5.3176	0.0248	0.0248	0.1	0.093
119	1190	0.0040	0.0248	5.5800	0.8801	0.0109	5.3424	0.0248	0.0248	0.1	0.093
120	1200	0.0040	0.0248	5.6048	0.8910	0.0109	5.3671	0.0248	0.0248	0.1	0.093
121	1210	0.0040	0.0248	5.6296	0.9020	0.0110	5.3919	0.0248	0.0248	0.1	0.093
122	1220	0.0040	0.0248	5.6544	0.9130	0.0110	5.4167	0.0248	0.0248	0.1	0.093
123	1230	0.0040	0.0248	5.6792	0.9241	0.0111	5.4414	0.0248	0.0248	0.1	0.093
124	1240	0.0040	0.0248	5.7040	0.9352	0.0111	5.4662	0.0248	0.0248	0.1	0.093
125	1250	0.0040	0.0248	5.7288	0.9464	0.0112	5.4910	0.0248	0.0248	0.1	0.093
126	1260	0.0040	0.0248	5.7536	0.9576	0.0112	5.5157	0.0248	0.0248	0.1	0.093
127	1270	0.0040	0.0248	5.7784	0.9689	0.0113	5.5405	0.0248	0.0248	0.1	0.093
128	1280	0.0040	0.0248	5.8032	0.9802	0.0113	5.5653	0.0248	0.0248	0.1	0.093
129	1290	0.0040	0.0248	5.8280	0.9916	0.0114	5.5901	0.0248	0.0248	0.1	0.093
130	1300	0.0040	0.0248	5.8528	1.0030	0.0114	5.6148	0.0248	0.0248	0.1	0.093
131	1310	0.0040	0.0248	5.8776	1.0144	0.0115	5.6396	0.0248	0.0248	0.1	0.093
132	1320	0.0040	0.0248	5.9024	1.0260	0.0115	5.6644	0.0248	0.0248	0.1	0.093
133	1330	0.0040	0.0248	5.9272	1.0375	0.0116	5.6891	0.0248	0.0248	0.1	0.093
134	1340	0.0040	0.0248	5.9520	1.0491	0.0116	5.7139	0.0248	0.0248	0.1	0.093

(1) Time Increment	(2) Time min.	(3) Rainfall distri-bution	(4) Incre-mental Rainfall in.	(5) Accumu-lated Rainfall in.	Pervious Area (6) Accumu-lated Runoff in.	Pervious Area (7) Incre-mental Runoff in.	Impervious Area (8) Accumu-lated Runoff in.	Impervious Area (9) Incre-mental Runoff in.	(10) Total Runoff in.	(11) Instant hydro-graph cfs	(12) design hydro-graph cfs
135	1350	0.0040	0.0248	5.9768	1.0608	0.0116	5.7387	0.0248	0.0248	0.1	0.093
136	1360	0.0040	0.0248	6.0016	1.0724	0.0117	5.7635	0.0248	0.0248	0.1	0.093
137	1370	0.0040	0.0248	6.0264	1.0842	0.0117	5.7882	0.0248	0.0248	0.1	0.093
138	1380	0.0040	0.0248	6.0512	1.0960	0.0118	5.8130	0.0248	0.0248	0.1	0.093
139	1390	0.0040	0.0248	6.0760	1.1078	0.0118	5.8378	0.0248	0.0248	0.1	0.093
140	1400	0.0040	0.0248	6.1008	1.1197	0.0119	5.8626	0.0248	0.0248	0.1	0.093
141	1410	0.0040	0.0248	6.1256	1.1316	0.0119	5.8873	0.0248	0.0248	0.1	0.093
142	1420	0.0040	0.0248	6.1504	1.1435	0.0120	5.9121	0.0248	0.0248	0.1	0.093
143	1430	0.0040	0.0248	6.1752	1.1555	0.0120	5.9369	0.0248	0.0248	0.1	0.093
144	1440	0.0040	0.0248	6.2000	1.1676	0.0120	5.9616	0.0248	0.0248	0.1	0.093

Total Volume of Runoff = 13385.020 cu. ft.

(Found by summing this column and multiplying by 600. 600 is the conversion required to convert SUM(Q) in cfs to total volume in cubic feet as follows:
V = SUM(Q) x dt
(cu.ft.) = (cu.ft/s) x (10 min.) x (60 s/min.)

INFILTRATION TRENCH BASIN 5 SIZING CALCULATIONS (100 YEAR STORM EVENT)

FLOW RATES AND VOLUMES:

k=	6.00	in/hr	=	0.000139 ft/sec

Sum of Incremental Flow Rates =	1.23	cfs
Required Storage Volume =	737	cf

TRENCH SIZING:

L =	1140	ft	(length of roadway)
W =	2.25	ft	
H =	1	ft	
Wetted Area =	3318.89	sf	
Q trench=	0.461	cfs	(outflow from trench)
VOID RATIO =	0.33		
TRENCH VOL =	**846**	**cf**	> 737 CF **OK**

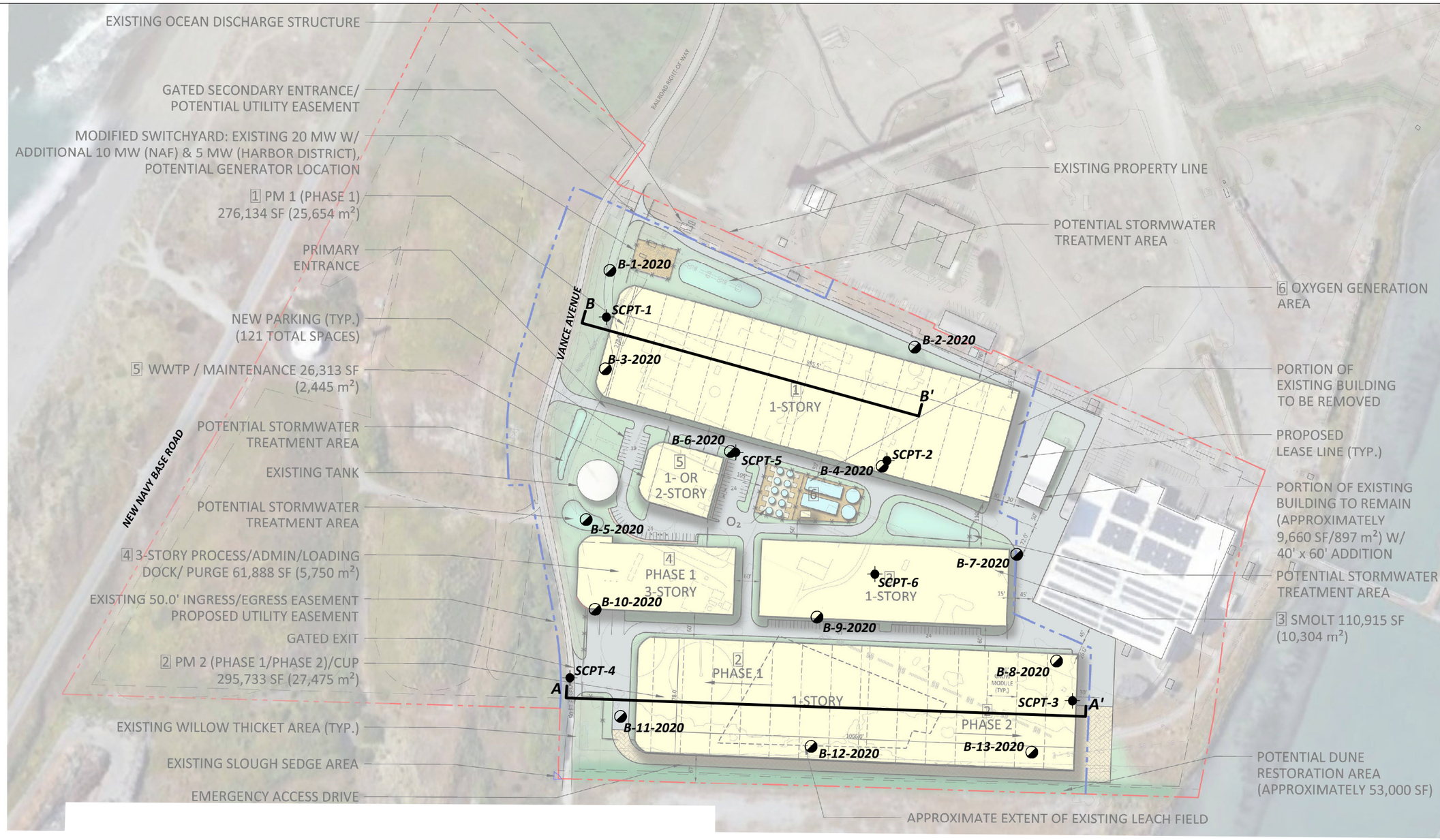
EQUIVALENT VOID RATIO:

Pipe Size =	0	in		
No. of Pipes =	0			
Void Ration Pipe =	1.00		=	100%
Void Ratio Rock =	0.33		=	33.0%
A pipe =	0.00	sf		(cross sectional)
A rock =	2.25	sf		(cross sectional)
A total =	2.25	sf		(cross sectional)
Volume pipe =	0.0	cf		
Volume rock =	2,565	cf		
Volume total =	2,565	cf		
Equivalent Void Ratio =	**0.33**		**=**	**33%**

SUMMARY:

Trench:	**L =**	**1140**	**ft**
	W =	**2.25**	**ft**
	H =	**1**	**ft**
No. of Pipes =		**0**	**0 inch dia pipe**

Appendix F – Additional Site Figures



EXPLANATION

- ● SEISMIC CONE PENETROMETER TEST LOCATIONS
- ◐ GEOTECHNICAL BORING LOCATIONS
- A — A' GEOLOGIC SECTION LINE

1"=250'±

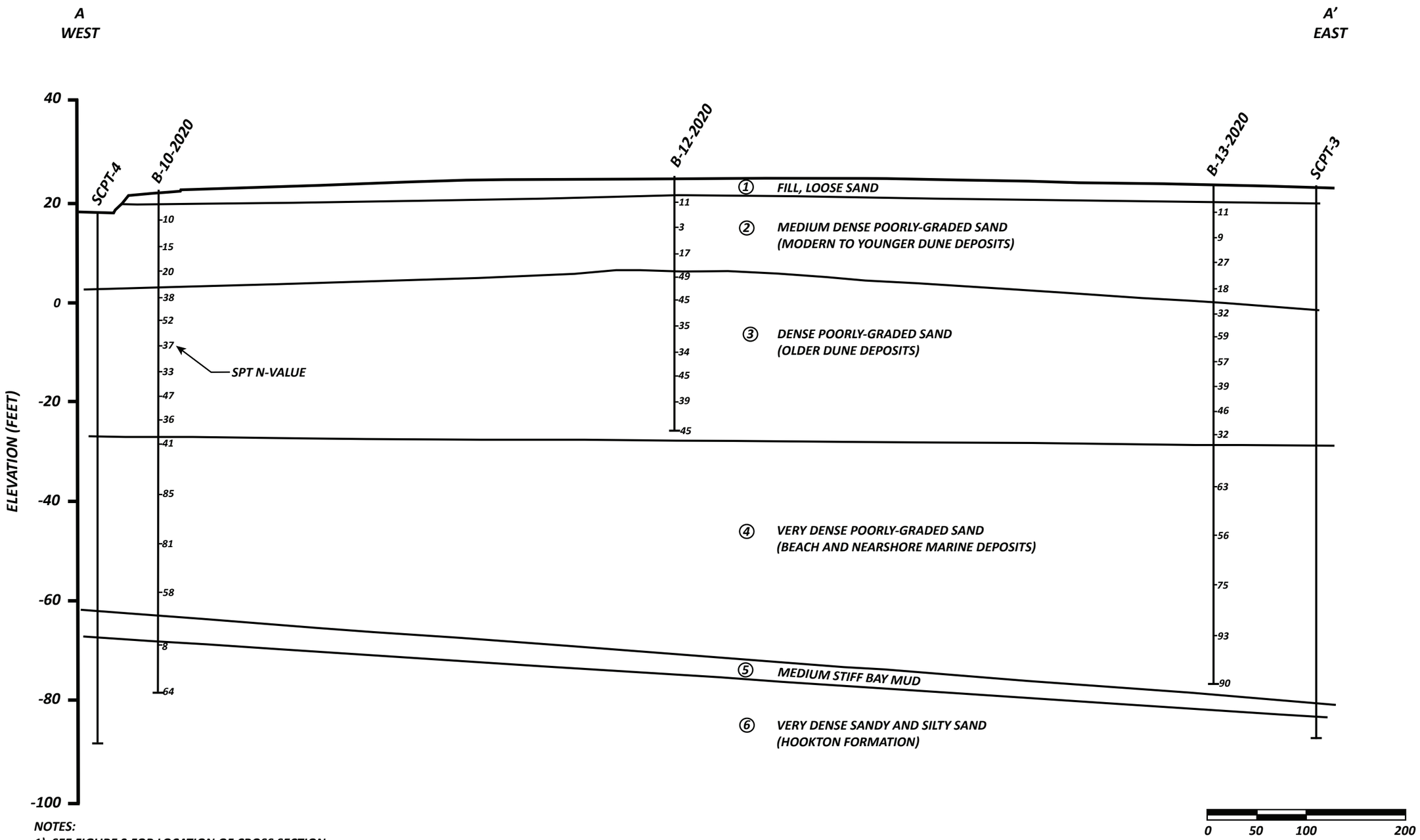
0 250 FEET

N

BASEMAP FROM NORDIC AQUAFRAMS, "CONCEPT SITE PLAN, NORDIC AQUAFARMS, SAMOA, CALIFORNIA", DATED JUNE 11, 2020

SHN	Nordic Aquafarms California, LLC. Geotechnical Investigation Report Samoa Peninsula, Humboldt County, California	**Proposed Building Locations with Geotechnical Exploration Locations** SHN 019146.010
	June 2020 / Figure3_BuildingLocations	**Figure 3**

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\010-Geotech-Inv\GIS\PROJ_MXD\Figure3_BuildingLocations.mxd User Name: psundberg DATE: 6/23/20, 4:15PM



NOTES:
1) SEE FIGURE 3 FOR LOCATION OF CROSS SECTION.
2) CROSS SECTION REPRESENTS IDEALIZED CONDITIONS BASED ON LIMITED SUBSURFACE DATA.
3) SEE APPENDICIES 2 & 3 FOR GEOTECHNICAL BORING & SCPT LOGS, RESPECTIVELY

HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

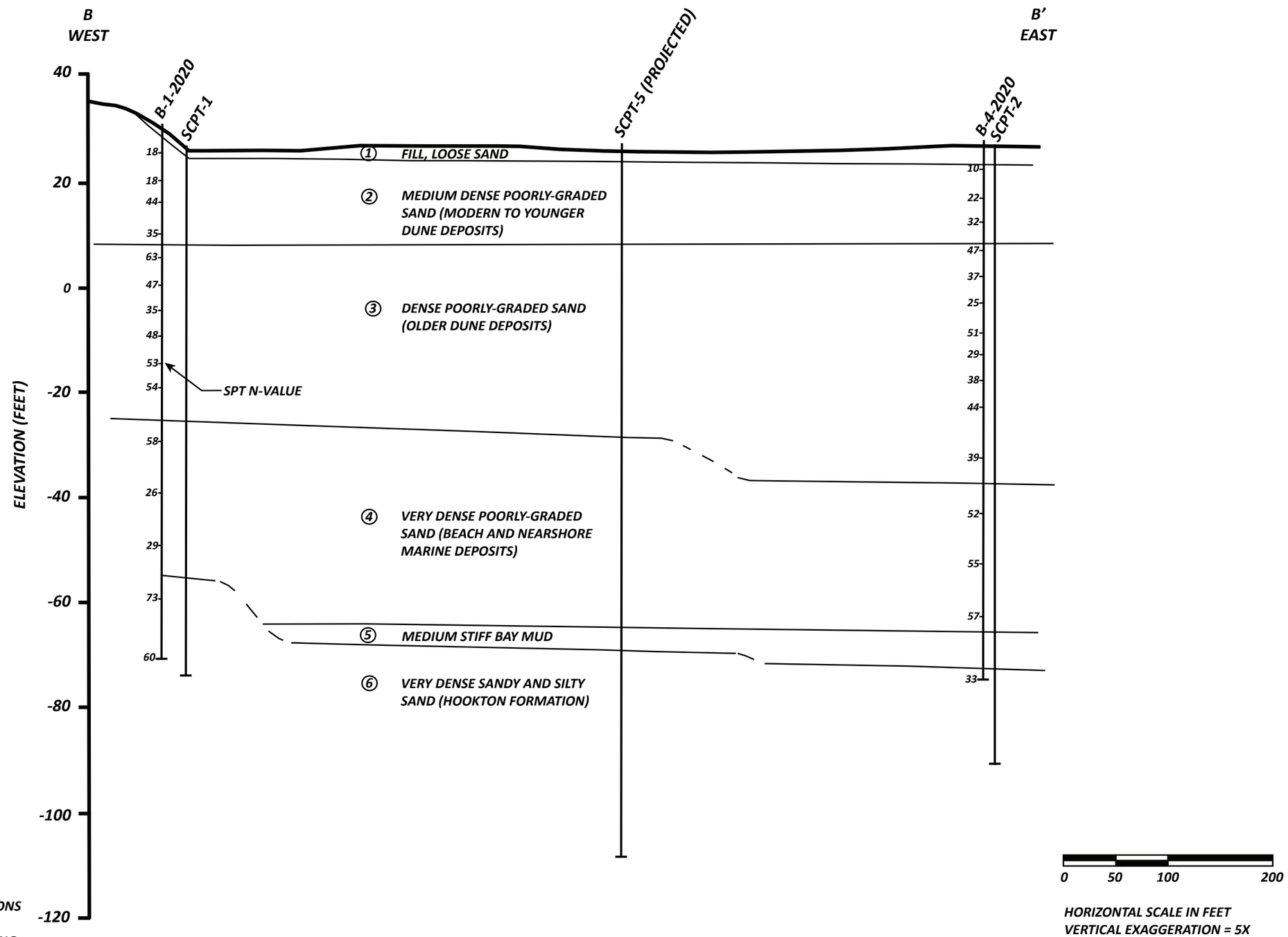
Nordic Aquafarms California, LLC.
Geotechnical Investigation Report
Samoa Peninsula, Humboldt County, California

Geologic Section A-A'

SHN 019146.010

May 2020 | Figure6_GeologicCrossSectionAA | **Figure 6**

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\010-Geotech-inv\GIS\FIGURES\Figure6_GeologicCrossSectionAA.ai User Name: psundberg DATE: 5/8/20, 1:30PM



NOTES:

1) SEE FIGURE 3 FOR LOCATION OF CROSS SECTION.
2) CROSS SECTION REPRESENTS IDEALIZED CONDITIONS BASED ON LIMITED SUBSURFACE DATA.
3) SEE APPENDICIES 2 & 3 FOR GEOTECHNICAL BORING & SCPT LOGS, RESPECTIVELY.

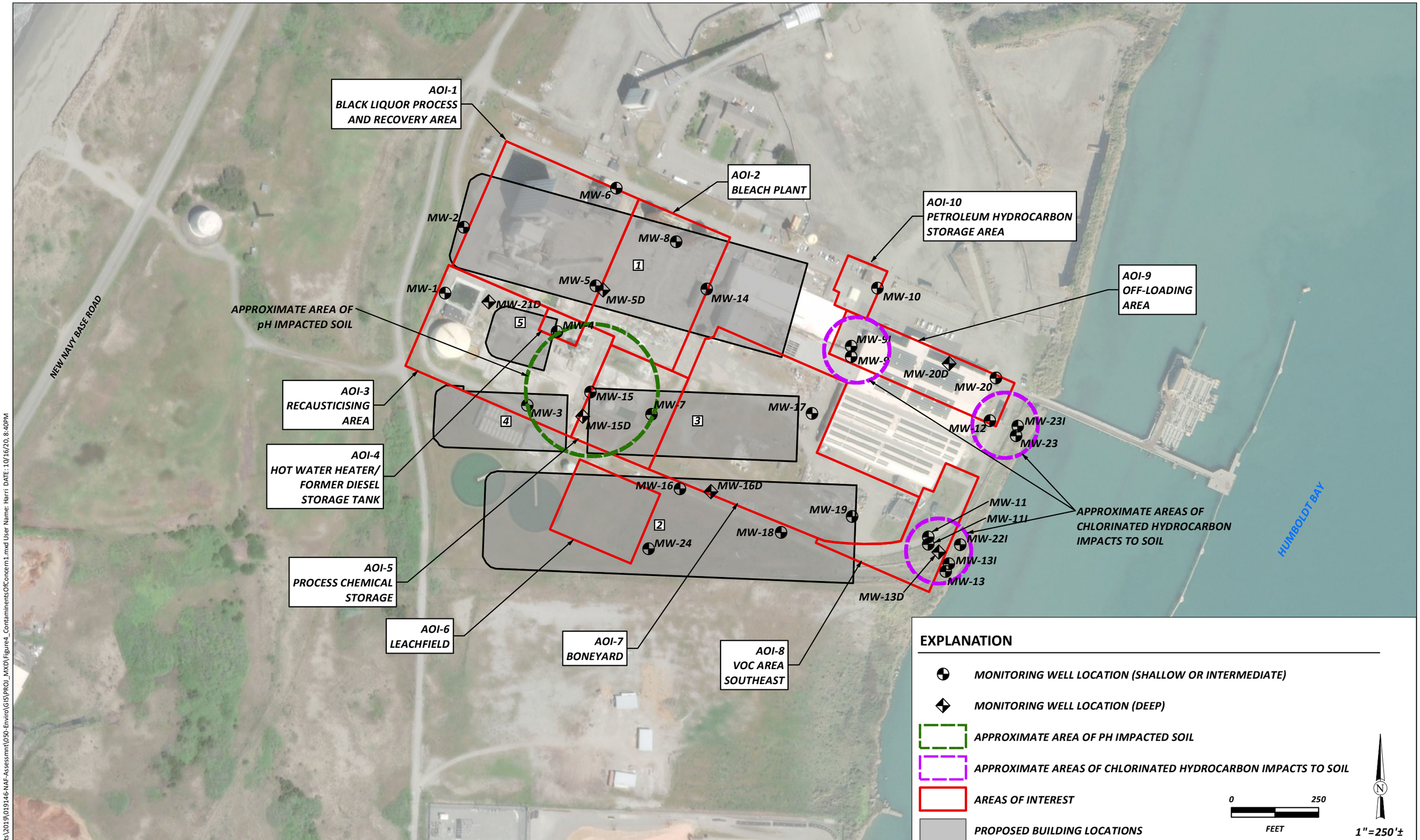
Nordic Aquafarms California, LLC.
Geotechnical Investigation Report
Samoa Peninsula, Humboldt County, California

Geologic Section B-B'

SHN 019146.010

May 2020 | Figure7_GeologicCrossSectionBB | **Figure 7**

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\010-Geotech-Inv\GIS\FIGURES\Figure7_GeologicCrossSectionBB.ai User Name: psundberg DATE: 5/22/20, 1:30PM



NOTE: ALL LOCATIONS ARE APPROXIMATE
SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

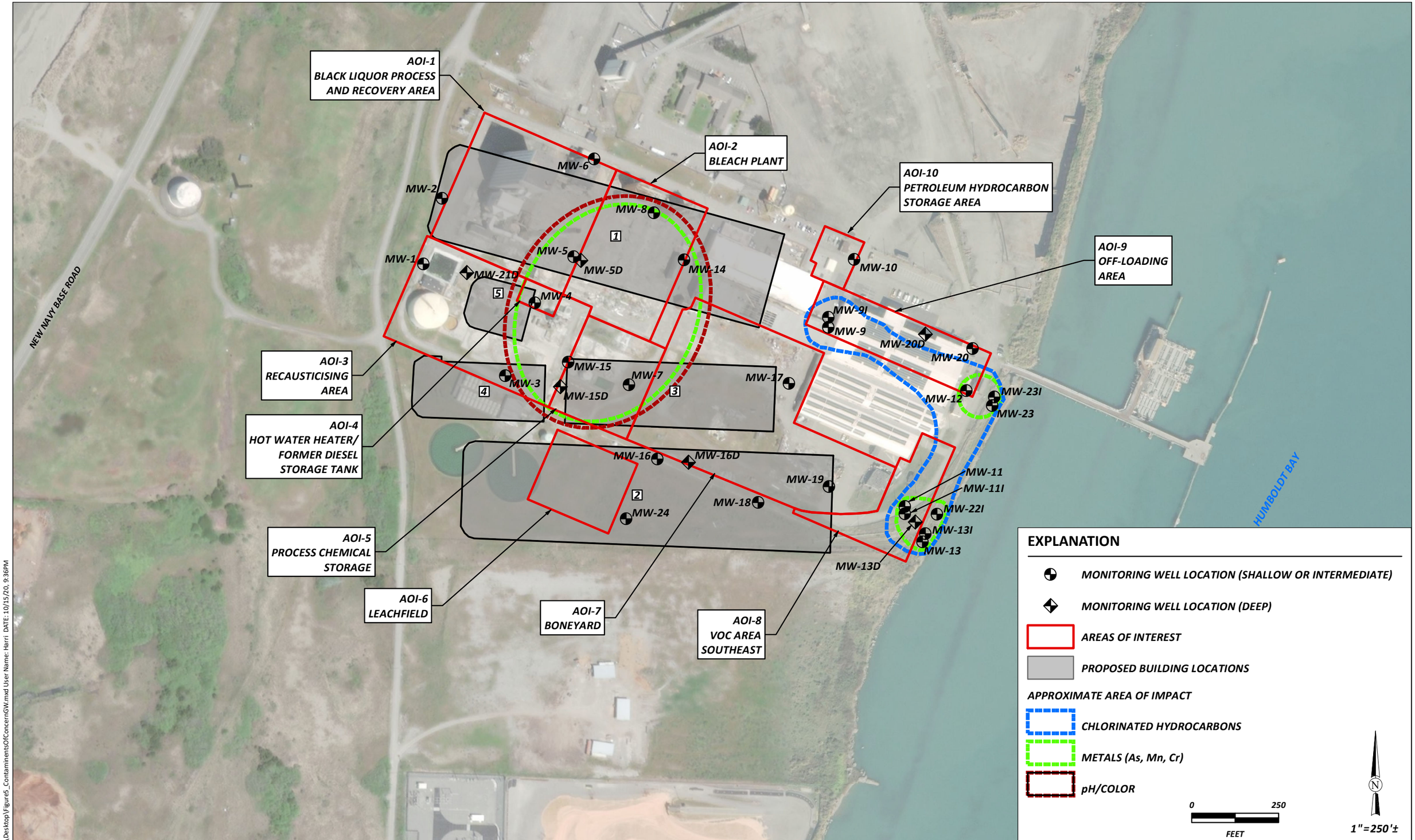
SHN

Nordic Aquafarms California, LLC.
Interim Measures Work Plan
Samoa Peninsula, Humboldt County, California

Contaminants of Potential Concern in Soil
SHN 019146.050

October 2020 | Figure4_ContaminentsOfConcern1 | Figure 4

Path: \\eureka\projects\2019\019146-NAF-Assessmnt\050-Enviro\GIS\PROJ_MXD\Figure4_ContaminentsOfConcern1.mxd User Name: Harri DATE: 10/16/20, 8:40PM



NOTE: ALL LOCATIONS ARE APPROXIMATE
SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Nordic Aquafarms California, LLC.
Interim Measures Work Plan
Samoa Peninsula, Humboldt County, California

Contaminants of Potential Concern in Groundwater
SHN 019146.050

October 2020 | Figure5_ContaminentsOfConcernGW | Figure 5

Path: C:\Users\Harri\Desktop\Figure5_ContaminentsOfConcernGW.mxd User Name: Harri DATE: 10/15/20, 9:36PM