U.S. FOOD & DRUG ADMINISTRATION

FEDERAL WATERS:

SAN PEDRO SHELF, CA

2024 SANITARY SURVEY REPORT

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EXECUTIVE SUMMARY

The U.S. Food and Drug Administration (FDA) has completed an updated sanitary survey of the San Pedro Shelf federal waters area and has determined that it currently does not meet the requirements for an approved shellfish growing area in the open status.

In 2017, the FDA conducted a sanitary survey of a shellfish farm in the federal waters off the San Pedro Shelf near Los Angeles, California and determined that the area met the standards for an approved shellfish growing area in the open status. The FDA has now completed an updated sanitary survey of the area, expanding the review to cover the entire federal waters portion of the San Pedro Shelf to account for newly identified potential pollution sources and reported interest in expanding or adding new farm sites in the surrounding area.

The updated sanitary survey found that pollution sources impacting water quality conditions in the San Pedro Shelf area have changed since 2017. Based on new data and analysis, the FDA has determined that this area — including the existing shellfish farm site — does not currently meet the requirements for an approved shellfish growing area in the open status.

INTRODUCTION

The FDA has authority to regulate the safety of bivalve molluscan shellfish (shellfish) under the Federal Food, Drug, and Cosmetic Act (FD&C Act); the Public Health Service Act; and FDA regulations, including 21 Code of Federal Regulations (CFR) part 123 Fish and Fisheries Products.

The National Shellfish Sanitation Program (NSSP) is a Federal-State cooperative program whose participants include federal agencies (FDA, National Oceanographic Atmospheric Administration (NOAA), Environmental Protection Agency (EPA)), state agencies, foreign competent authorities, and the shellfish industry. The NSSP provides a broad framework of raw molluscan shellfish sanitation standards through its Guide for the Control of Molluscan Shellfish (NSSP Guide). The NSSP Guide includes a model ordinance (MO) that participating states either adopt directly into law or use as the basis for developing equivalent state regulations, but it is not itself a federal regulation. The NSSP Guide incorporates federal regulations specific to fish and fishery products, which are found at 21 CFR Part 123 and 21 CFR 1240.60. The NSSP, which governs how U.S. growing areas are managed and classified for shellfish harvest, is implemented and enforced by states, with FDA providing oversight of the entire system. The NSSP contains within it all relevant federal requirements concerning, among other things, current good manufacturing practices, hazard analysis and Hazard Analysis Critical Control Point (HACCP) plans, recordkeeping, sanitation control procedures, and the restriction of interstate transport of shellfish in an insanitary manner. The full text of the NSSP Guide, including the MO, is available at FDA.gov.

The NSSP Guide defines federal waters as those waters that fall outside of state and local jurisdiction but within U.S. sovereignty (typically 3 to 200 nautical miles offshore, equivalent to 3.5 to 230 statute miles). Federal waters include the

territorial sea and exclusive economic zone. Shellfish harvested from federal waters and landed at a state-certified shellfish dealer is considered interstate commerce. Each state's Shellfish Control Authority (Authority) oversees shellfish growing areas and harvest in state waters, while the FDA and NOAA have authority over such operations in federal waters.

Per the NSSP, shellfish growing areas are classified as approved, conditionally approved, restricted, conditionally restricted, prohibited, or unclassified. Shellfish growing area classification is based on the findings of the sanitary survey, which is the evaluation of all environmental factors and actual and potential pollution sources, which have a bearing on water quality in a shellfish growing area. The sanitary survey includes the data and results of a shoreline survey; a survey of the microbiological quality of the water; an evaluation of the effect of any meteorological, hydrodynamic, and geographic characteristics on the shellfish growing area; and a determination of the appropriate growing area classification.

In addition to the classification of a shellfish growing area, a growing area is assigned a status for the harvesting of shellfish, which is separate and distinct from its classification. The growing area's status may be "open," "closed," "controlled access," or "remote." Any growing area in the "open" status, except for an area that is classified as prohibited or unclassified, is open for the harvest of shellfish, subject to any conditions or restrictions of its classification. A growing area can be placed in the "closed" status due to changing conditions, such as an emergency condition, the presence of marine toxins in concentrations of public health significance, or where pollution conditions have changed beyond the original data used to classify an area or conditions stipulated in the conditional area management plan of conditionally approved or conditionally restricted areas.

FDA conducts sanitary surveys of federal waters in accordance with the NSSP MO Chapter IV. @.01 in order to assess the classification and status of a shellfish growing area. A sanitary survey is required for each shellfish aquaculture farm site located in federal waters to confirm that the area meets the NSSP approved growing area classification and open status criteria.

In 2017, FDA conducted an initial sanitary survey of the San Pedro Shelf Aquaculture (SPSAQ) farm site, a 100-acre shellfish aquaculture operation located approximately 7 miles off the southern California coast in federal waters. At that time, the site met the criteria for an approved classification in open status.

This report presents an updated sanitary survey, which reviews previously collected data alongside new information and expands the geographic scope to cover the entire federal waters portion of the San Pedro Shelf area due to interest in farm expansion and new permit applications in the surrounding area.

Based on updated data and analysis, FDA has determined that the federal waters portion of the San Pedro Shelf area, including the SPSAQ farm site, currently does not meet NSSP requirements for an approved shellfish growing area classification in the open status.

DESCRIPTION OF GROWING AREA

AQUACULTURE SITE AND SAN PEDRO SHELF AREA

The San Pedro Shelf is a broad, shallow, and relatively flat submarine area off Los Angeles, California, known for its complex geological structures. It transitions into the deep San Pedro Basin via steep slopes and canyons, with sediment composition ranging from fine sand and mud to exposed bedrock of Miocene and Pliocene ages.

The shelf extends seaward 3 to 12 miles and is relatively broad, flat, and shallow, with much of it less than 50 meters deep. It is bordered by a steep escarpment that leads into the deep San Pedro Basin. The area also contains the San Pedro Sea Valley and San Gabriel Canyon, which incise the shelf and slope.

The seafloor is characterized primarily by muddy sand and sand. Outcrops of Miocene and Pliocene bedrock are also present along the Palos Verdes Fault Zone. The area includes San Pedro Bay, home to the ports of Los Angeles and Long Beach, which serve as the primary entry point for a significant portion of U.S. containerized imports.

The SPSAQ is a 100-acre shellfish aquaculture farm lease located in U.S. federal waters approximately seven (7) miles off the coast of southern California, in the waters of the Pacific Ocean (Figure 1).

The aquaculture gear currently permitted by the USACE consists of a grid of horizontal lines held in place underwater at an approximate depth of 20-feet by a series of surface floats, sub-surface floats, and seafloor helical anchors. Mediterranean mussels (*Mytilus galloprovincialis*) were previously cultivated at the site and grown suspended from vertical lines that hang down from the horizontal lines (Figure 2).

Figure 1. San Pedro Shelf Aquaculture site (SPSAQ) and surrounding San Pedro Shelf area located off the coast of California in the Pacific Ocean.



The footprint of the operation on the ocean surface is limited to the surface floats and buoys within the 100-acre area occupied by the aquaculture farm site (Catalina Sea Ranch, 2016). The footprint on the seafloor is limited to a combined area of approximately 90 square feet needed for helical screw anchors that hold the facility's long lines and corner buoys in place (Catalina Sea Ranch, 2016). The gear was permitted at the aquaculture site under USACE Permit SPL-2012-00042-DPS issued June 5, 2014 (Figure 2 and Figure 3).

Figure 2. Gear diagram from original USACE Permit SPL-2012-00042-DPS issued June 5, 2014.

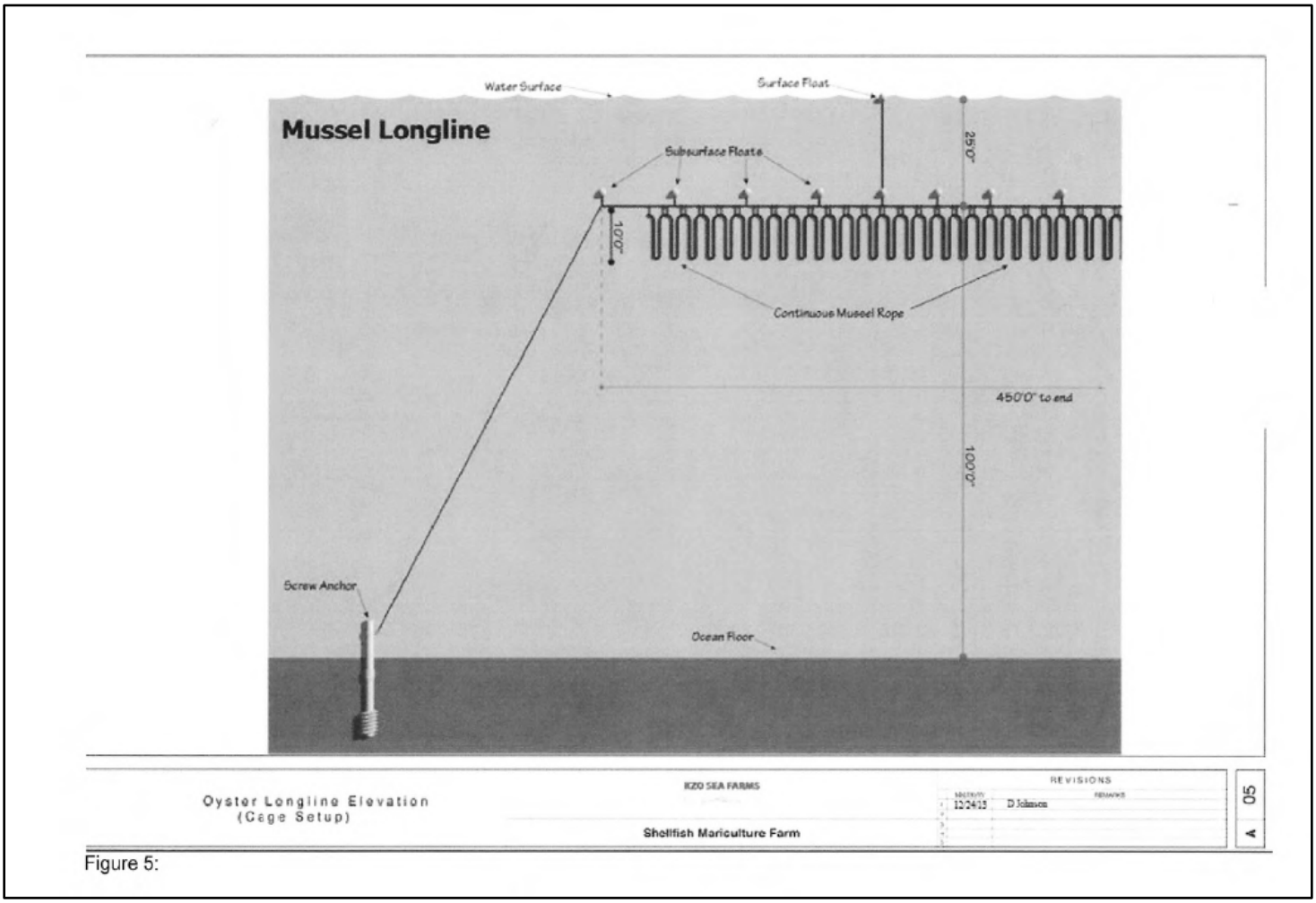
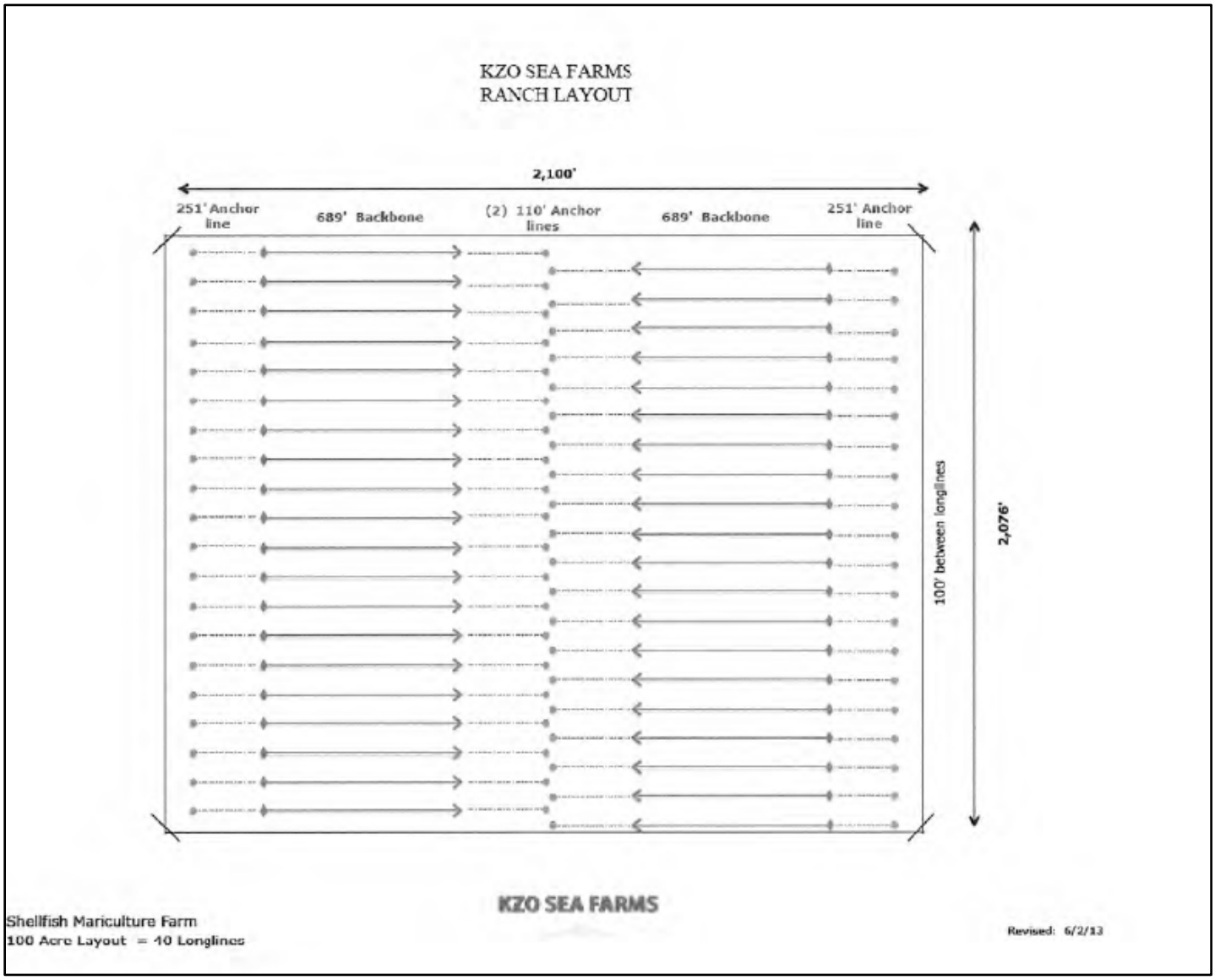


Figure 5:

Figure 3. Longline diagram from original USACE Permit SPL-2012-00042-DPS issued June 5, 2014.



HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

TIDES AND CURRENTS

The SPSAQ site is located in the Pacific Ocean, in federal waters, seven (7) miles from Huntington Beach, and 14 miles from the outlet of the Los Angeles River within the San Pedro Shelf area. Tides in this region are mixed semi-diurnal in nature, having two (2) high and two (2) low tides of different size each lunar day. Each tidal cycle is approximately 12 hours and 25 minutes in length. The tidal range at NOAA tidal station 9410660 Los Angeles, CA (the NOAA station nearest to the San Pedro Shelf area and the SPSAQ farm site that records water level information) measured between 6.77 to 9.06 feet during 2021.

Based on the California Current System (CCS), water circulation within the San Pedro Shelf area is a predominately equatorward flow. Prevailing ocean currents are a large-scale eddy of the Southern California Countercurrent found

between Catalina Island and the mainland, with smaller scale local currents. The nearshore flow movement direction is predominantly along the coast (down-coast or up-coast running primarily parallel to shore) (Orange County Sanitation District, 2009).

RAINFALL

Rainfall data for this report was retrieved from NOAA National Centers for Environmental Information (NCEI) for the Los Angeles International Airport (USW00023174) and the Santa Ana John Wayne Airport (USW00093184) (National Oceanic and Atmospheric Administration, 2022).

Rainfall during the months of December through March is generally the greatest and contributed most of the annual rainfall during the 2018 through 2021 period (Table 1 and Table 2).

Rainfall in Orange County influences flows in the Los Angeles, San Gabriel, and Santa Ana Rivers, as well as infiltration and inflow into the Orange County Sanitation District (OCSD) collection system and contributes to sanitary sewer overflow (SSO) events which can flow into and have a potential impact on water quality in the San Pedro Shelf growing area. The wettest months (December-March) correspond to the period of highest historical flow average and maximum flow recorded in the San Gabriel and Santa Ana Rivers as described further in Section D. below.

Table 1. Monthly Rainfall Totals at Los Angeles Airport, California – 2017 to 2022. Quantity is measured in inches. T = Trace amount. No data = ------. (National Oceanic and Atmospheric Administration, 2022)

Season Years	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season Total
2021-2022	0.12	0.02	T	0.46	T	8.24	0.09	0.04	---	---	---	---	8.97
2020-2021	0	0	0	0	0.1	1.65	1.91	0.02	1.32	T	T	T	5
2019-2020	0.05	T	T	0	1.43	4.42	0.38	T	4.11	2.68	0.12	T	13.19
2018-2019	0	0	0	0.58	2.09	1.45	5.52	4.42	2.1	0.05	0.73	T	16.94
2017-2018	0	T	0.08	T	0.1	0.01	1.4	0.1	2.07	0.05	0.06	T	3.87

Table 2. Monthly Rainfall Totals at Santa Ana (John Wayne, Orange County Airport), California 2017 to 2022. Quantity is measured in inches. T = Trace amount. No data = -------. (National Oceanic and Atmospheric Administration, 2022)

Season Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season Total
2021-2022	0.04	0.03	0.10	0.32	0.00	4.79	0.06	0.11	0.43	---	---	---	5.88
2020-2021	0.00	0.00	0.00	0.00	0.02	1.07	1.76	0.03	0.16	0.02	0.15	0.00	3.21
2019-2020	0.03	0.00	0.03	0.00	0.95	3.90	0.15	0.38	2.93	2.19	0.01	0.01	10.58

Season Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season Total
2018-2019	0.00	0.00	0.00	0.84	1.18	3.51	4.33	6.19	0.83	0.03	0.50	0.01	17.42
2017-2018	0.00	0.00	0.00	0.00	0.00	0.01	0.37	0.32	0.00	0.05	0.08	0.00	0.83

WINDS

Winds along the Southern California coast vary seasonally in speed and direction. The Angel's Gate, Long Beach weather station is located at the entrance to the Port of Los Angeles (Figure 4). Windfinder.com (Windfinder, 2022) reports detailed wind statistics data for this station based on observations taken between August 2008 and July 2022. During the winter months of November through March, the most persistent direction winds are west-southwest (WSW); for the remainder of the year, the most persistent winds are southwest (SW) winds (Figure 5). Wind speed is typically highest during the summer months, when winds average approximately 10 to 11 mph (Figure 6).

Wind is likely not a dominant factor affecting pollutant transport in the San Pedro Shelf coastal waters, based upon a review of the wind statistics for this area when compared to pollutant transport associated with river flows, tides, and currents in the area. However, wind may play a role in the transport of pollution sources that are buoyant and closer to the surface. Likely sources that might be affected include raw sewage discharges from the Los Angeles River, OCSD WWTP, and moored and moving vessels that are located in the WSW direction from the SPSAQ site and surrounding San Pedro Shelf area. Vessel discharges have a great likelihood of surfacing given the lighter freshwater density of wastewater compared to that of seawater.

Figure 4. Windfinder.com Angels Gate/Long Beach weather station location (Windfinder, 2022).

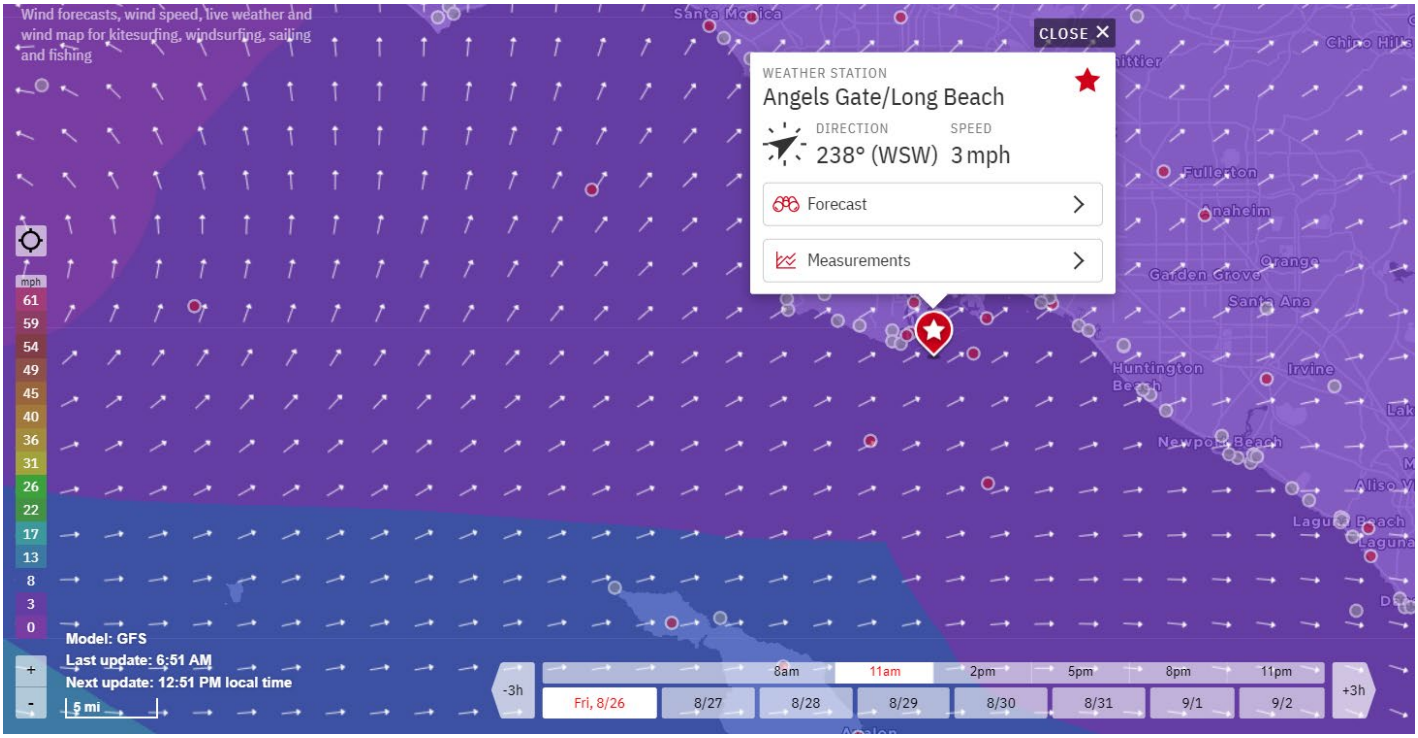


Figure 5. Monthly wind direction and strength distribution. Figure published on Windfinder.com (Windfinder, 2022).

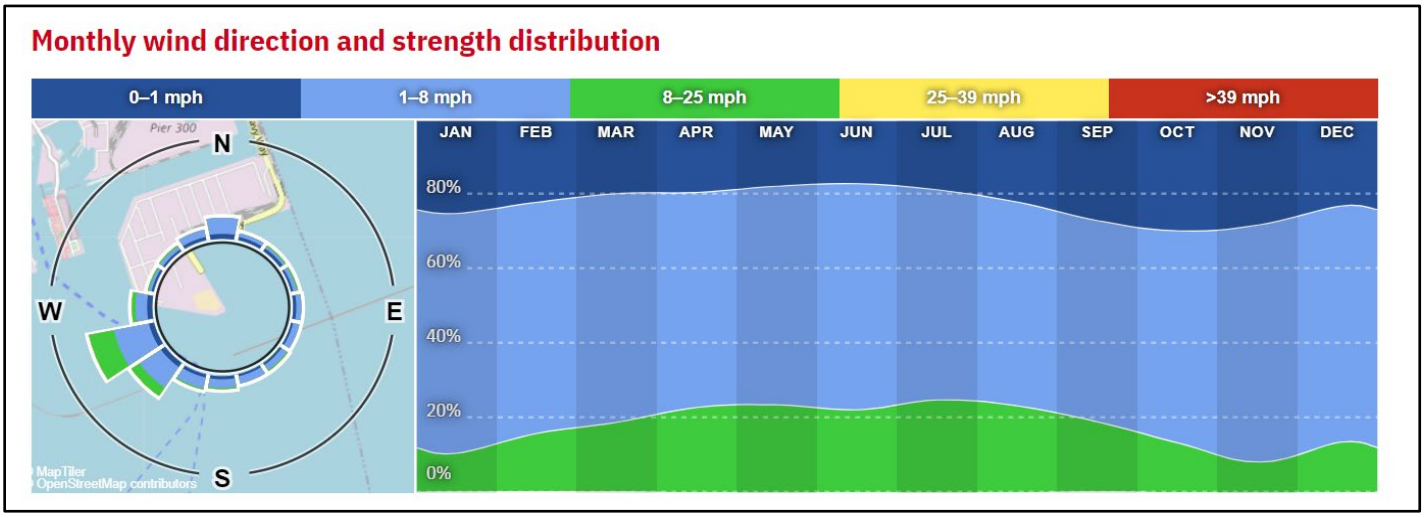
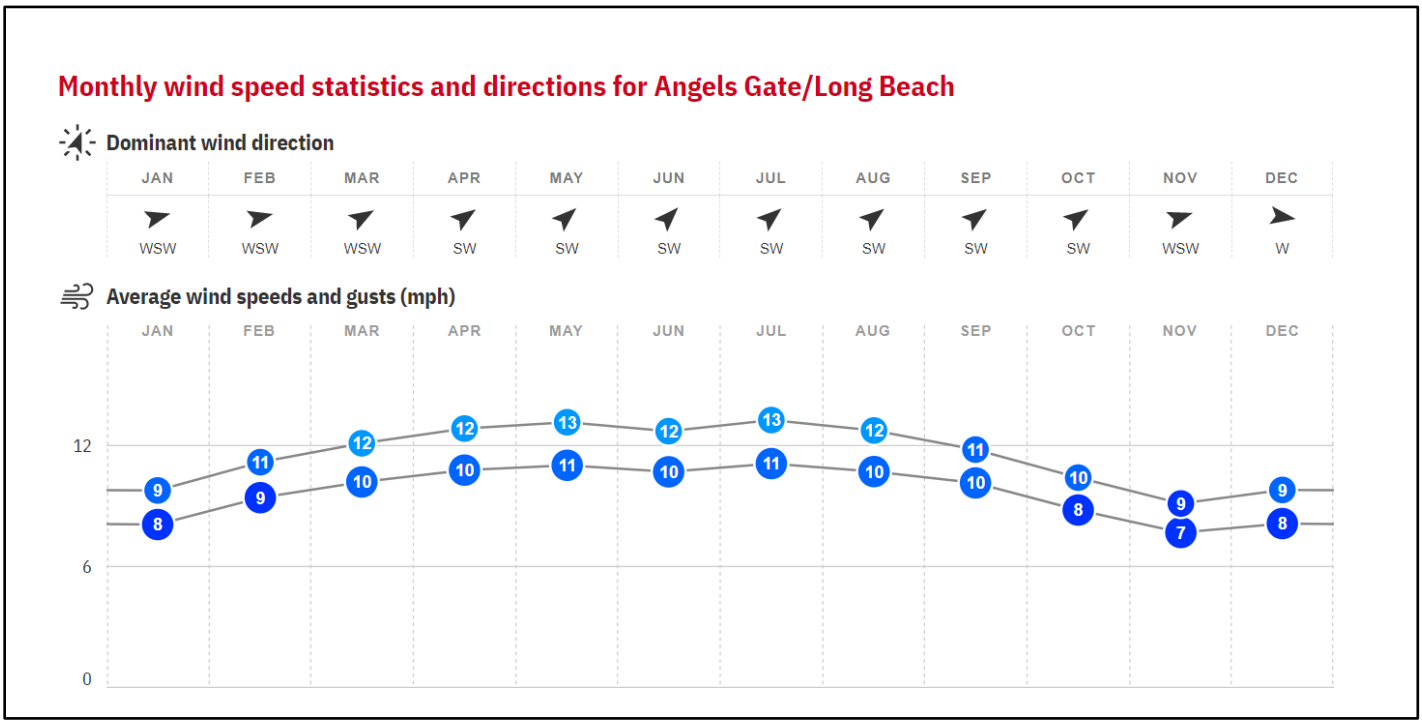


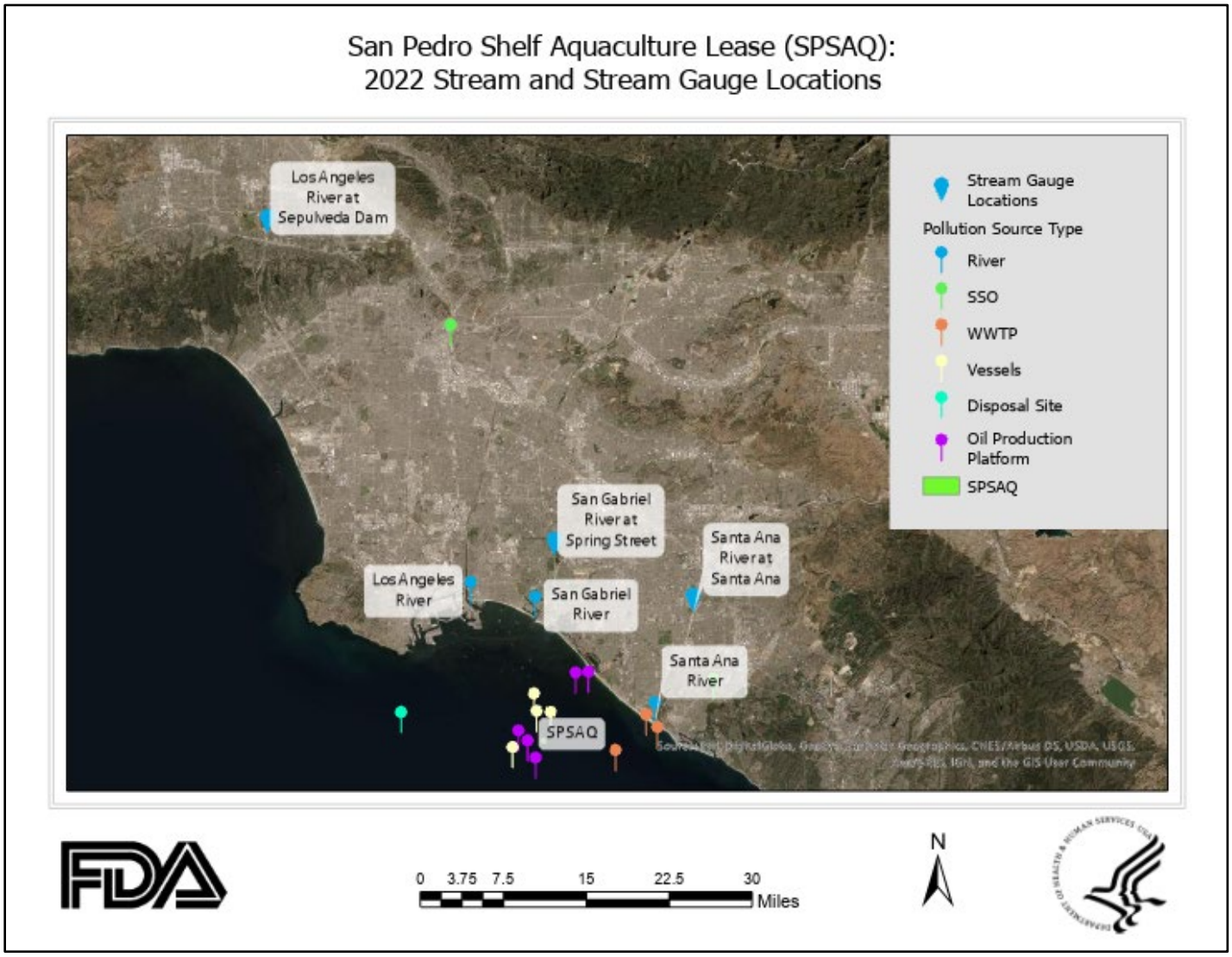
Figure 6. Monthly wind speed statistics and directions for the Angels Gate/Long Beach weather station. Figure published on Windfinder.com (Windfinder, 2022).



River Discharges

There are three (3) major freshwater river systems that flow into the Pacific Ocean near the SPSAQ site and may influence water quality in federal waters in the San Pedro Shelf area: the Los Angeles River, the Santa Ana River, and the San Gabriel River (Figure 7). The Los Angeles River flows from the Santa Monica Mountains to Long Beach and San Pedro Bay where it discharges into the ocean. The Santa Ana River flows from the San Bernardino Mountains through the Santa Ana Mountains, then through Orange County until it discharges into the Pacific Ocean. The San Gabriel River flows from the San Gabriel Mountains through San Gabriel Valley and part of the Los Angeles coastal plain before it discharges into the Pacific Ocean.

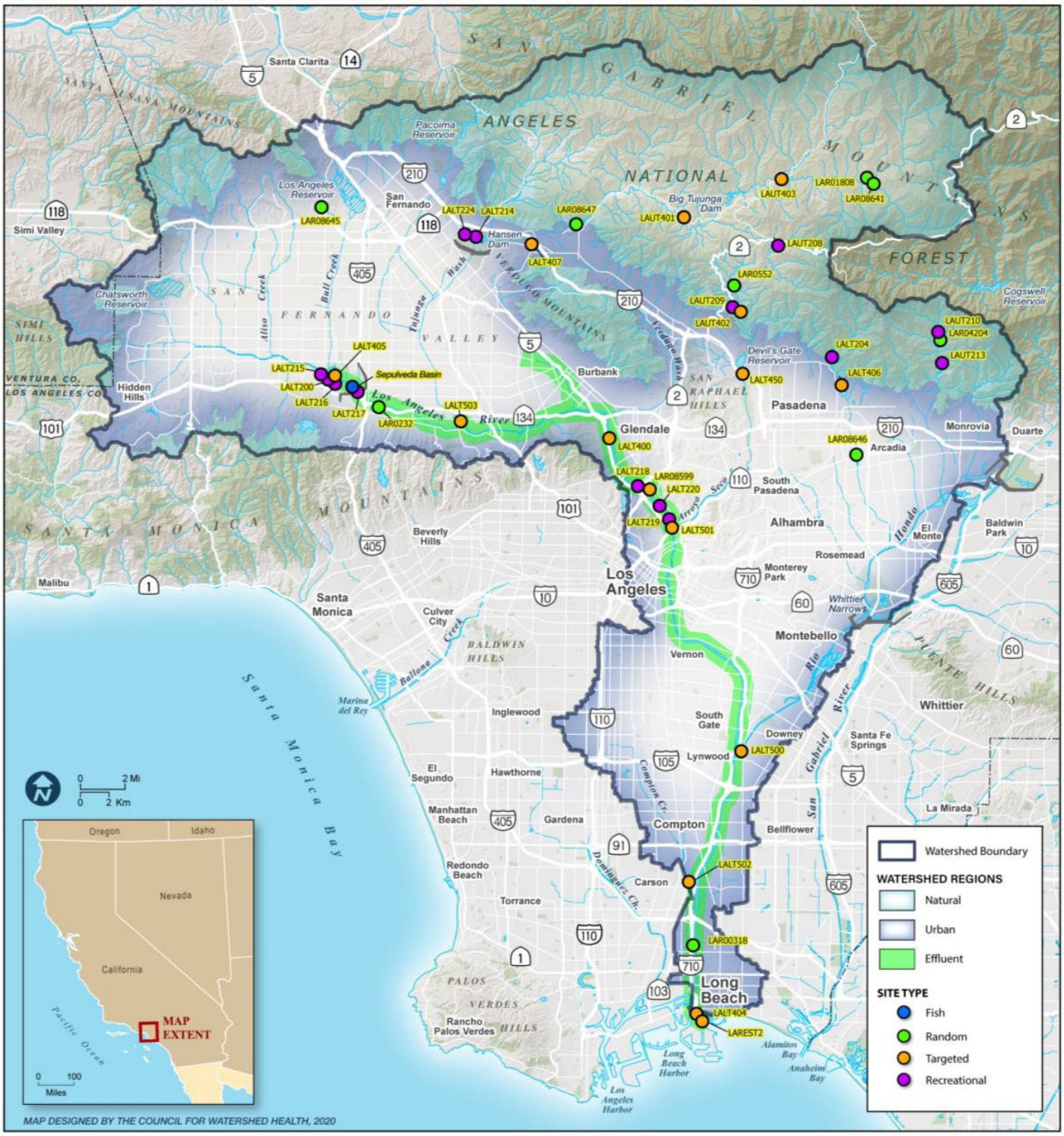
Figure 7. Major river discharges potentially impacting San Pedro Shelf area including the SPSAQ farm site with locations of USGS stream gauges in the area.



Los Angeles River

The Los Angeles River watershed covers 824 square miles of drainage area (Figure 8). The river is 51 miles long and is comprised primarily of concrete-lined mainstem channels. The river extends from the Santa Monica Mountains to Long Beach, eventually discharging into the Pacific Ocean through Queensway Bay. Los Angeles River carries the largest storm flow of all rivers in southern California and receives significant pollutant inputs. According to the US Geological Survey (USGS), Los Angeles River flows have been regulated since December 1941 by the Sepulveda Flood-Control Reservoir, having a capacity of 17,400 acre-ft (United States Geological Service, 2022). Since 1998, most of the base flow at this station represents releases of treated effluent from the city of Los Angeles Donald C. Tillman Water Reclamation Plant, located upstream of Sepulveda Dam (United States Geological Service, 2022).

Figure 8. Sampling sites in the Los Angeles River Watershed from the California River Watershed Monitoring Program Annual Report 2020.



Based on a review of historical flow data (Table 3), discharges are highest during the winter with January and February having the highest mean flows of 143 ft^3/sec and 157 ft^3/sec, respectively (United States Geological Service, 2022). Seasonal high river flows are typically observed during the months of December through March; however, there is significant interannual variability. For the most recent water year on record, the annual mean discharge in 2021 was 56.4 ft^3/sec, as compared to the 1940 – 2021 annual mean of 65.4 ft^3/sec (United States Geological Service, 2022). The highest

monthly maximum peak flow during the 2018 through 2021 assessment period was observed in February 2019, when flows reached a high of 10,600 ft^3/sec (Table 4). (United States Geological Service, 2022).

Table 3. Los Angeles River (USGS 11092450) monthly mean, maximum and minimum flows (f3/s). Records for Water Years 1940 – 2021 (United States Geological Service, 2022)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	35.1	63.4	89.3	143	157	103	51.6	32.7	27.4	28.2	29.7	30.4
Max	295	491	492	890	1,040	739	218	163	88.0	92.2	84.9	109
Water Year	2005	1966	2005	2005	2005	1978	2020	2003	2005	2005	2003	2007
Min	1.44	1.67	3.76	4.65	4.19	4.27	3.94	3.17	2.87	2.22	2.23	1.93
Water Year	1978	1978	1954	1976	1951	1951	1977	1951	1951	1951	1951	1951

The seasonal trends can be seen in the 2017-2021 hydrograph from the Los Angeles River USGS gauge 11092450 (Figure 9). River flows can rise quickly from baseline to peak flow, as seen in Figure 10. This graph shows river height just prior to and following an extreme rain event in 2017. On February 17, 2017, baseline gauge height at 09:15 am was 0.85 ft, the river rose to 13.24 ft by 4:30 pm, then took approximately 24 hours to return to baseline.

Table 4. Los Angeles River (USGS 11092450) Maximum Peak Flow and Monthly Mean Flow (f^3/s) Records (January 2018 – December 2021) (United States Geological Service, 2022)

Year	Discharge ft3/s	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	Max	163	46	269	35	36	43	42	47	45	50	96	185
2018	Mean	9710	815	7930	61	57	60	75	82	88	1120	4400	10100
2019	Max	445	519	188	41	61	49	37	45	44	38	88	187
2019	Mean	9150	10600	6200	90	1670	80	67	168	83	85	5620	10400
2020	Max	59	60	257	217	47	38	32	39	48	49	47	94
2020	Mean	1710	921	9860	12200	727	67	66	79	136	86	79	6020
2021	Max	104	43	92	30	37	28	30	49	65	77	59	495
2021	Mean	5660	105	2270	70	78	58	84	87	138	5150	108	10500

Figure 9. Los Angeles River USGS station 11092450 located at Sepulveda Dam. Data presented in cubic feet per second, January 2017 through December 2021. Figure published by USGS. (United States Geological Service, 2022)

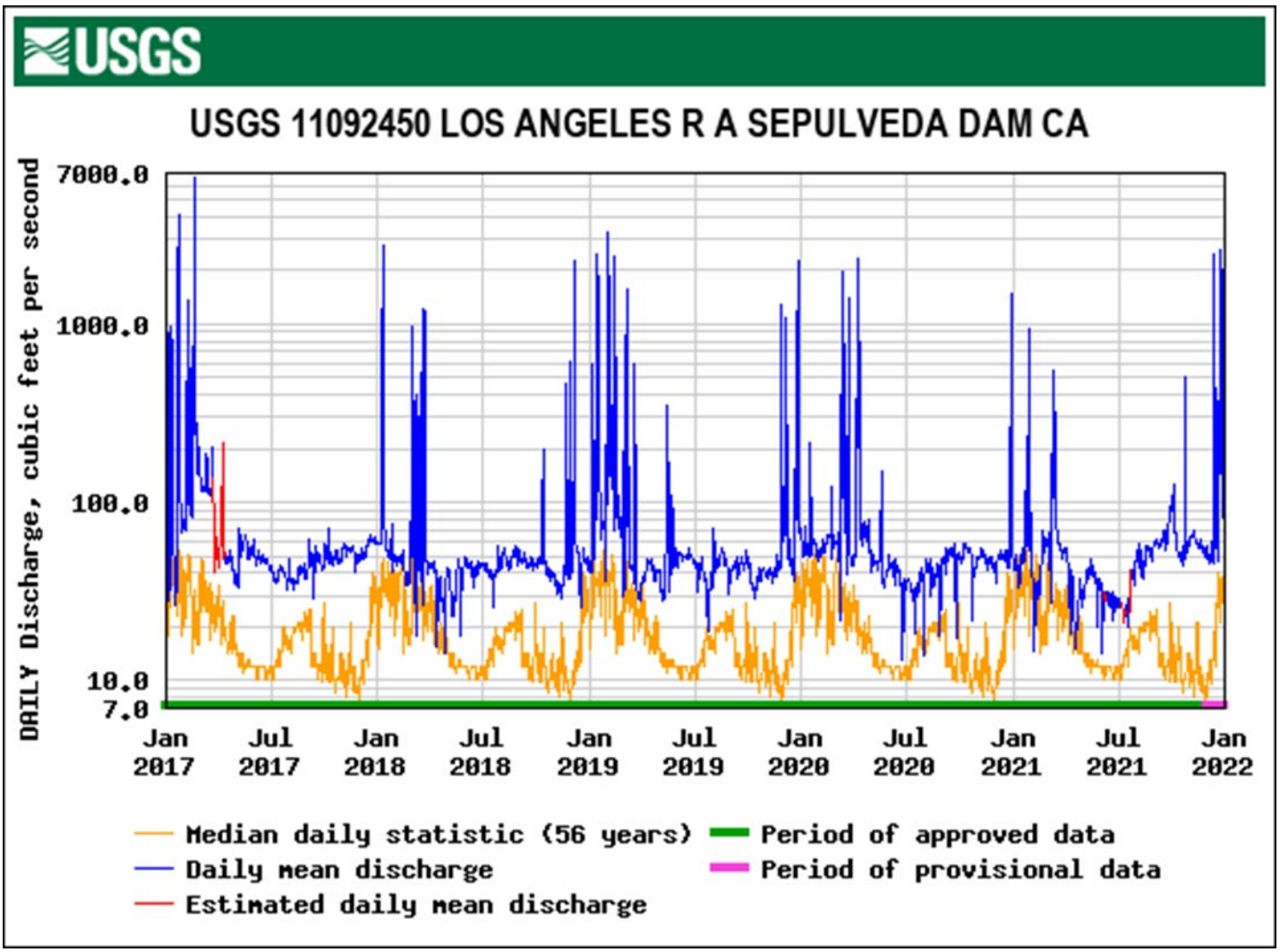
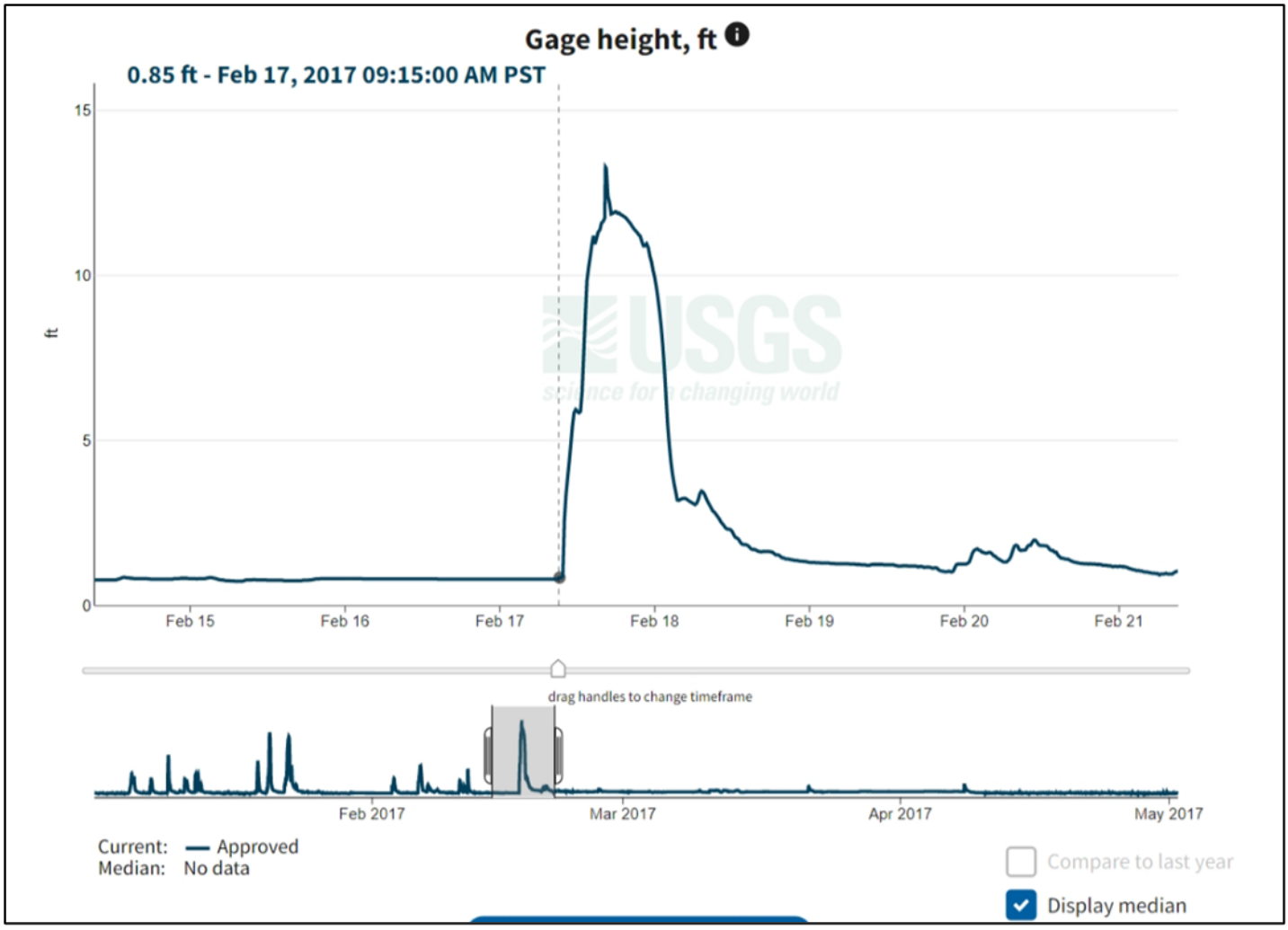


Figure 10. Los Angeles river (USGS station 11092450) gauge height in feet during February 17, 2017, event. Figure published by USGS. (United States Geological Service, 2022).



Santa Ana River

The Santa Ana River watershed drainage area is approximately 2,650 square miles. The total length of the Santa Ana River is approximately 96 miles, as it flows from the San Bernardino Mountains to the mouth of the river, where it discharges into the Pacific Ocean at Huntington Beach.

River flow in the watershed exhibits seasonal variation, with higher flows occurring between December and March due to precipitation and snowmelt. With a large river flow discharging into the ocean and in proximity to OCSD WWTP discharge points, the Santa Ana River is considered a significant freshwater input. USGS operates several gauges along the Santa Ana River. Stream gauge station USGS 11078000 in Santa Ana, CA, which is the closest to the river outlet, has provided flow discharge records since 1923.

Based on a review of historical flow data (Table 5), discharges are highest during the winter with January, February and March, having the highest mean flows of 222, 288 and 210 ft^3/sec, respectively (United States Geological Service, 2022). For the most recent water year on record, the annual mean discharge in 2021 was 2.92 ft^3/sec, as compared to the highest 1940 – 2021 annual mean of 676.2 ft^3/sec (Table 6). According to USGS water year summary (Water Years 1940-2021), the

annual mean discharge at this gauge location is 73.7 ft^3/sec, with the historical highest daily mean flow of 12,600 ft^3/sec recorded on January 11, 2005 (United States Geological Service, 2022). The highest monthly maximum peak flow during the 2018 through 2021 assessment period was recorded in February 2019 (Table 6), when flows reached a maximum peak of 9910 ft^3/sec (United States Geological Service, 2022).

The seasonal trends and extreme flow conditions in February 2019 can be seen in the 2018-2021 hydrograph from the Santa Ana River (USGS gauge 11078000) in Figure 11 (United States Geological Service, 2022).

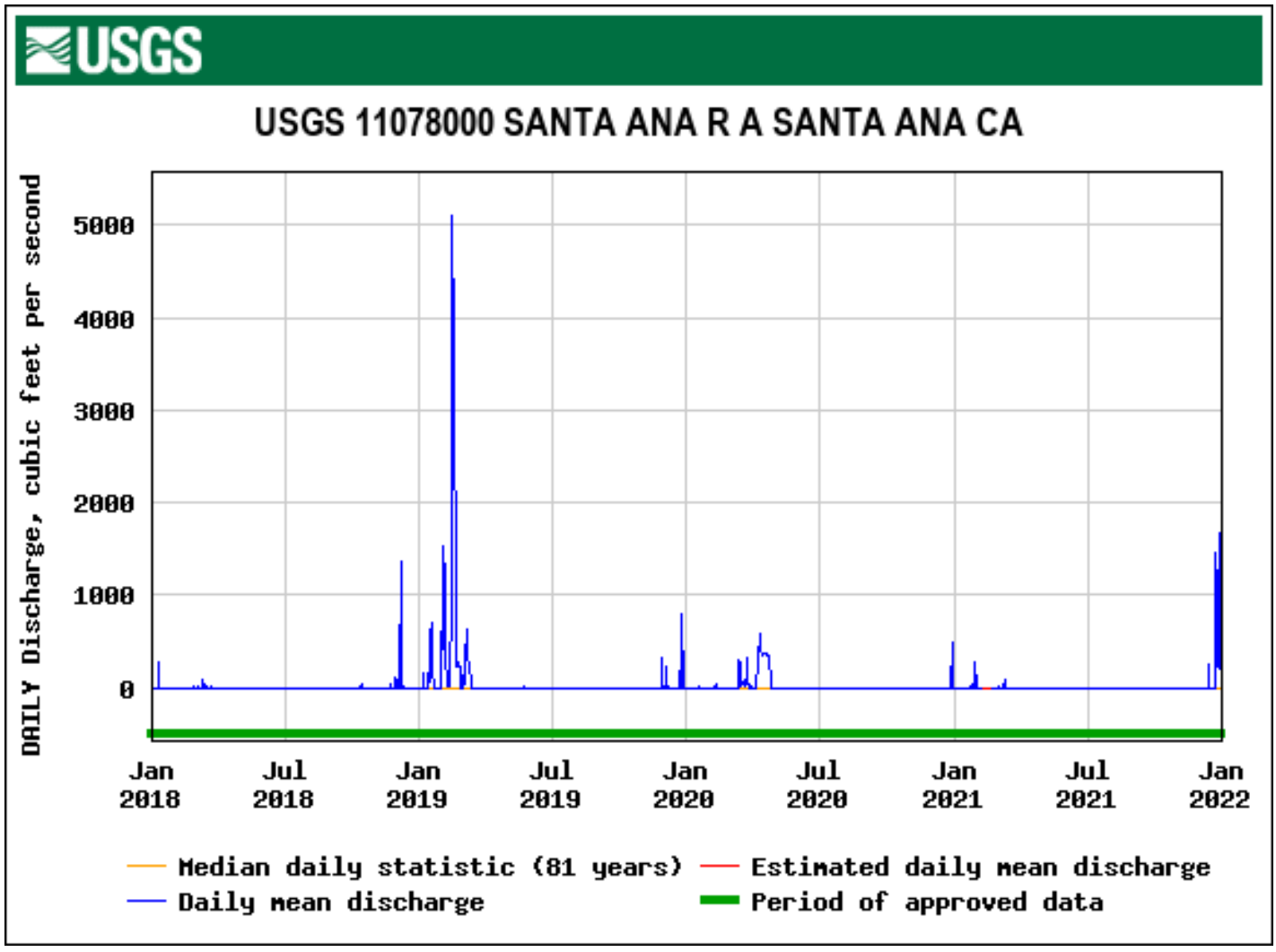
Table 5. The Santa Ana River (USGS 11078000) Maximum mean and maximum flows (f3/s) Records WATER YEARS 1940 – 2021, BY WATER YEAR (WY) (United States Geological Service, 2022).

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	11.9	11.9	57.2	222	288	210	63.0	22.8	6.42	0.76	1.42	1.19
Max	680	154	1,484	3,962	3,014	2,342	889	686	433	31.0	102	40.6
Year	2005	1984	2011	1993	1980	1969	1980	1998	1983	1998	1983	1986
Min	0	0	0	0	0	0	0	0	0	0	0	0
Year	1940	1940	1940	1976	1949	1949	1949	1940	1940	1940	1940	1940

Table 6. The Santa Ana River (USGS 11078000) Maximum Peak Flow and Monthly Mean Flow (f3/s) Records (January 2018 – December 2021) (United States Geological Service, 2022).

Year	Discharge, ft3/s	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	Max	1160	107	225	0	0	0	0	1	0	213	259	7160
2018	Mean	10	1	5	0	0	0	0	0	0	2	7	49
2019	Max	3430	9910	1440	3	200	10	0	0	2	9	1360	4260
2019	Mean	113	1078	88	0	1	0	0	0	0	0.4	13	41
2020	Max	35	246	2050	1340	7	2	8	0	1	0	56	3940
2020	Mean	0.3	2	49	228	0.1	0	0	0	0	0	0.1	17
2021	Max	1680	4	267	2	5	1	1	0	0	100	0	5400
2021	Mean	11	0	6	0	0	0	0	0	0	0.2	0	227

Figure 11. USGS 11078000 Santa Ana River 2018-2021. Figure published by USGS. (United States Geological Service, 2022).



San Gabriel River

The San Gabriel River consists of 689 square miles of drainage area from eastern Los Angeles County having a wide diversity of land use. In the middle and lower parts of the watershed where there are primarily urban land uses, residential and commercial activities.

The nearest USGS gauge location to the coast (Station F42B - San Gabriel River Above Spring Street) is managed by the Los Angeles County Public Works (Los Angeles County Public Works, 2022). Flow data is reported as daily mean discharge in ft^3/second and is plotted by the monthly mean and maximum discharge.

The highest maximum peak flow during the 2018 through 2021 assessment period was recorded in December 2021, when flows reached a maximum peak flow of 1,380 ft^3/sec (Table 7). The historic USGS water year summary for the San Gabriel River gauge is not available.

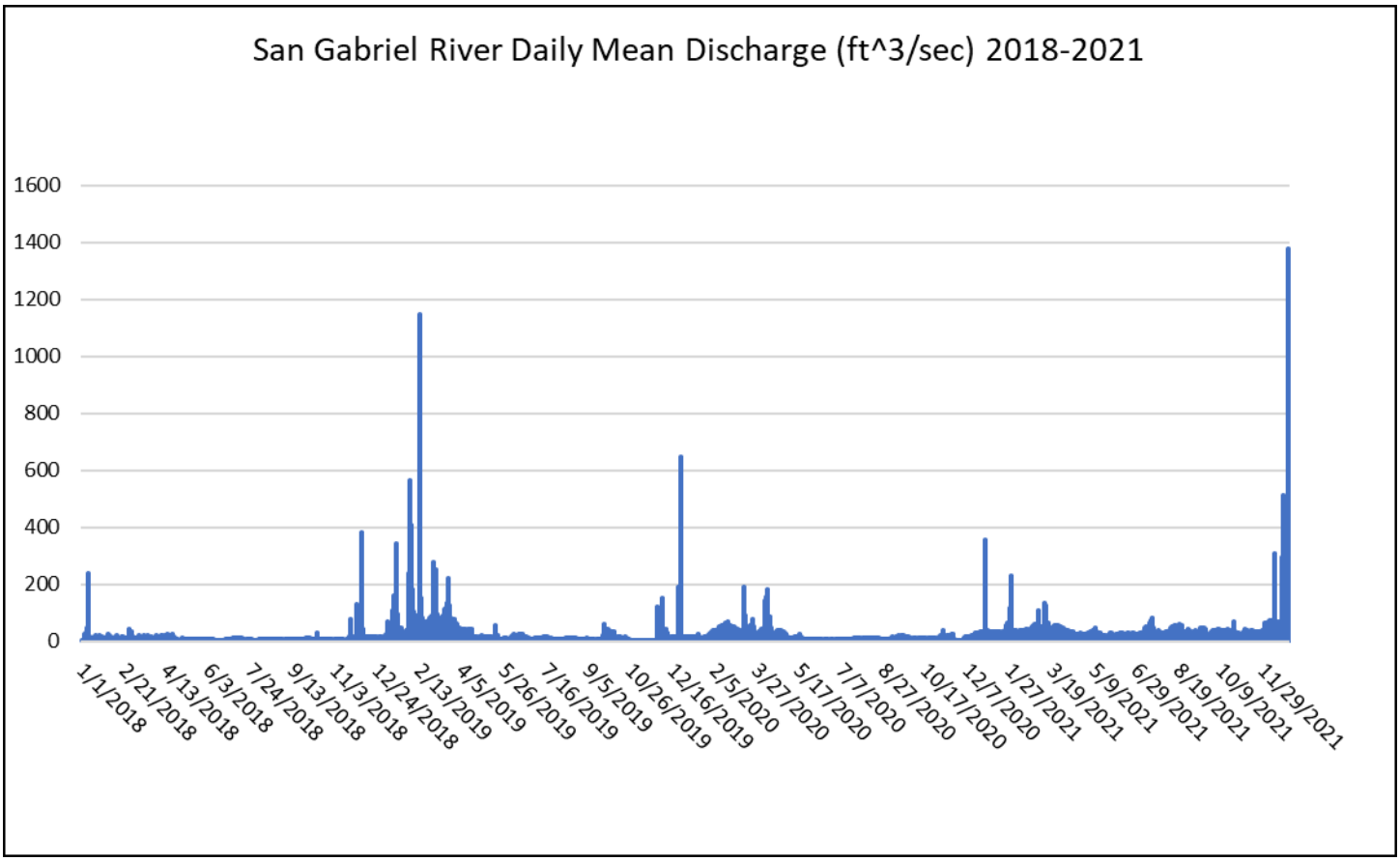
Seasonal high river flows are typically observed during the months of December through March; however, there is significant interannual variability. The seasonal trends and extreme flow conditions in February 2019 and December 2021

can be seen in the 2018-2021 chart showing the mean daily flows recorded at the station in Figure 12 (Los Angeles County Public Works, 2022).

Table 7. San Gabriel River (Station F42B - San Gabriel River Above Spring Street) Maximum Peak Flow and Monthly Mean Flow (f3/s) Records (January 2018 – December 2021) (Los Angeles County Public Works, 2022)

Year	Discharge, ft3/s	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	Max	239	42	36	26	12	11	13	9	12	31	132	382
2018	Mean	24	15	12	17	10	7	9	8	9	9	17	29
2019	Max	343	1150	277	46	58	27	17	15	60	40	120	650
2019	Mean	61	156	106	32	15	17	12	11	18	16	7	51
2020	Max	28	70	190	183	27	10	12	15	22	14	39	359
2020	Mean	18	50	42	52	14	8	10	12	15	12	15	36
2021	Max	230	61	137	48	47	32	84	62	50	69	45	1380
2021	Mean	46	42	58	32	29	27	40	42	33	38	33	165

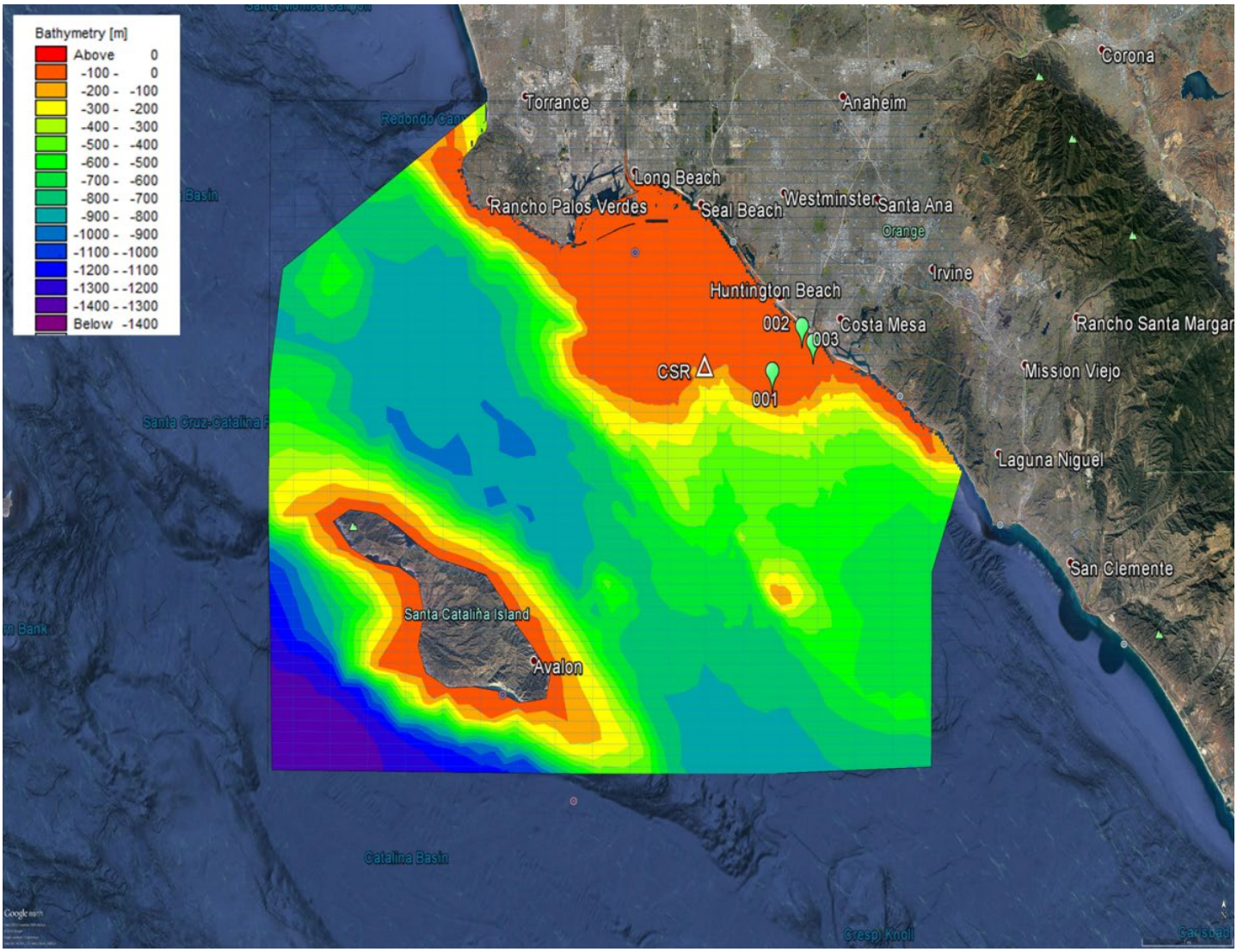
Figure 12. The San Gabriel River (Station F42B - San Gabriel River Above Spring Street) Daily Mean Discharge (f3/s) Records (January 2018 – December 2021) (Los Angeles County Public Works, 2022).



BATHYMETRY

The bathymetry used in the MIKE 21 hydrodynamic model (Figure 13) is based on the NOAA digital elevation models (DEMs) of Santa Monica, California. The original DEM area from NOAA covers between Point Mugu (north) and Newport Beach (south) and extends to the Pacific Ocean extending past Santa Catalina Island to the southeast. It is a 1/3 arc-second Mean High Water (MHW) DEM referenced to World Geodetic System of 1984 (WGS 84) (NOAA, 2011).

Figure 13. Bathymetry data (depth in meters) in the San Pedro Shelf area and SPSAQ farm site used in MIKE hydrodynamic models.



The impact of pollution discharges (for instance, sewage discharges from WWTP, SSO discharge, or oil spills) depends largely on bathymetry and hydrological characteristics. Based on the bathymetry data, water depth in the San Pedro Shelf area and in the vicinity of the SPSAQ site is between 100 and 200 meters relative to MHW. (United States Environmental Protection Agency and State of California, 2021)

STRATIFICATION

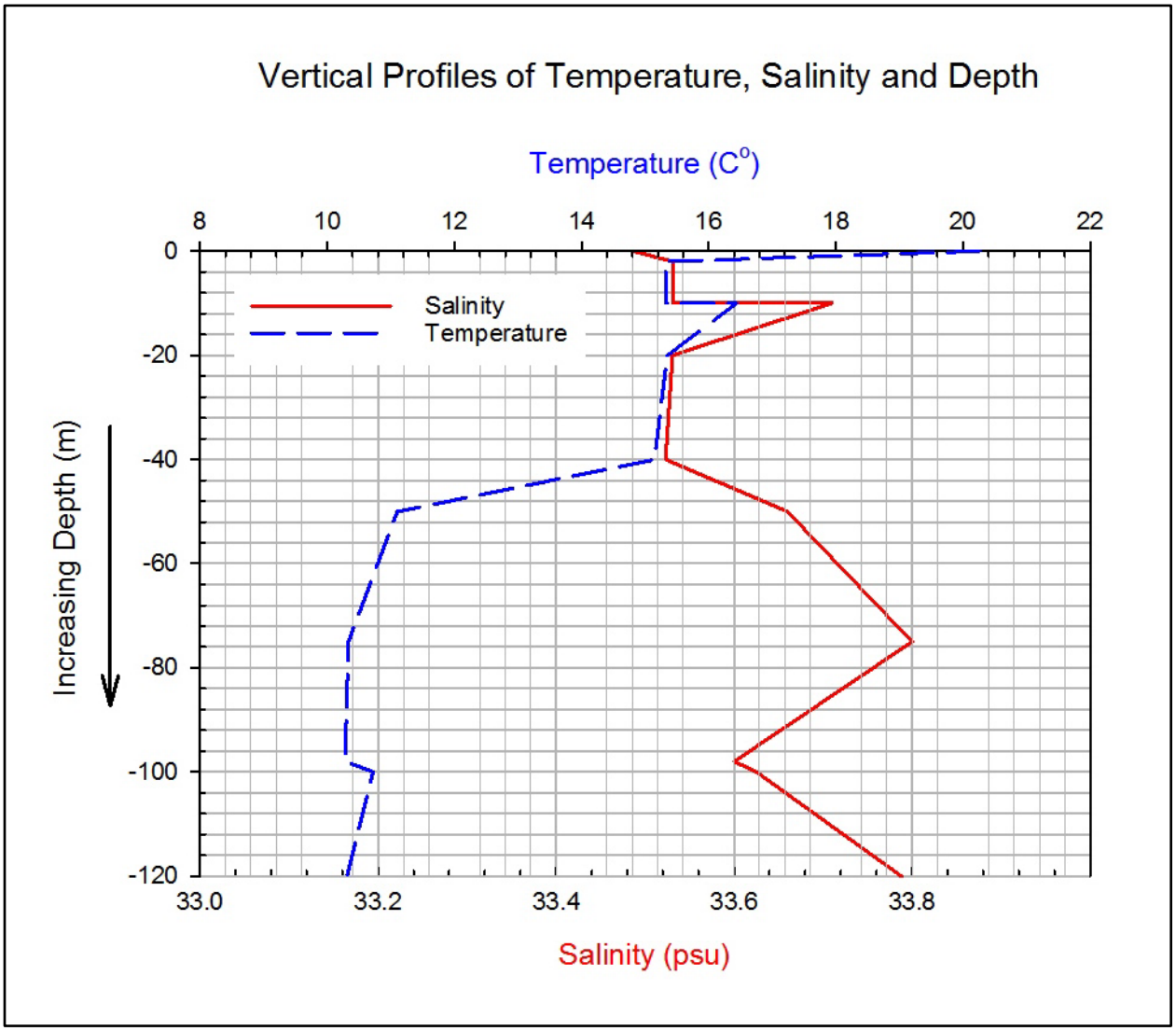
Stratification caused by salinity and temperature differences is an important factor influencing pollutant transport and diffusion process in the vertical direction (depth). Stratification in the water column may be impacted by the ambient water depth, bathymetry, tide, currents, wind, and distance from freshwater input. Unlike variations of salinity typically found in estuaries, salinity in the open ocean is relatively stable; however, temperatures can vary from the surface to bottom. The mixed layer (surface) dynamics can be complicated due to these factors.

Currently, water column data (temperature, salinity, and depth) at the specific SPSAQ site location is not readily available. Considering the distance of freshwater input to the San Pedro Shelf and SPSAQ site is relatively far, the freshwater plume and associated thermohaline is not likely to contribute to stratification in this area. The National Centers for Environmental Information of NOAA provides conductivity (as a measure of salinity), temperature and depth data in the world ocean database (NOAA, 2013). Where salinity is not measured directly, conductivity can be converted to salinity. The salinity and temperature data of five (5) locations within the San Pedro Shelf and in the vicinity of the SPSAQ site were selected and extracted from the database. The data demonstrates a well-mixed water column with minimal salinity changes (between 33.5 psu and 33.8 psu) from the surface (0 meters) to the depth of 120 meters (Table 8). The vertical gradient in temperature indicates a thermocline occurs at approximately 40 meters, indicating a vertical temperature stratification (Figure 14).

Table 8. Vertical Profiles of Temperature, Salinity and Depth at Selected Locations from NOAA (NOAA, 2013).

Data Station Location in Latitude and Longitude Degree Decimal Minutes	**Depth (m)**	**Temperature (C°)**	**Salinity (psu)**	**Temperature difference (C°)**	**Salinity difference (psu)**
33.422° N 117.893° W	0	20.26	33.486	--	--
33.42° N 117.902° W	2	15.32	33.531	-4.94	0.045
33.42° N 117.902° W	10	15.34	33.532	-4.92	0.046
33.392° N 117.908° W	10	16.44	33.710	-3.82	0.224
33.42° N 117.902° W	20	15.35	33.531	-4.91	0.045
33.42° N 117.902° W	40	15.15	33.523	-5.11	0.037
33.4° N 117.87° W	50	11.10	33.660	-9.16	0.174
33.4° N 117.87° W	75	10.33	33.800	-9.93	0.314
33.425° N 117.92° W	98	10.28	33.600	-9.98	0.114
33.42° N 117.902° W	100	10.72	33.625	-9.54	0.139
33.42° N 117.902° W	120	10.31	33.788	-9.95	0.302

Figure 14. Temperature, Salinity and Depth at 5 Selected Locations Adjacent to SPSAQ (NOAA, 2013).



IDENTIFICATION OF SIGNIFICANT POLLUTION SOURCES

DETERMINATION OF ACTUAL AND POTENTIAL POLLUTION SOURCES – INITIAL EMPIRICAL ANALYSIS

A component of the sanitary survey is a shoreline survey. The traditional shoreline survey performed by the Authority in state waters may include an in-field investigation to identify actual and potential sources that could impact the shellfish growing waters. Given the unique characteristics in federal waters and the location of the San Pedro Shelf and SPSAQ farm site, many of the pollution sources encountered on an in-field investigation may not have a bearing on the sanitary quality of shellfish waters due to the large distance separating the sources from the growing area and the large degree of tidal mixing and volume of water available for dilution. Thus, in federal waters, FDA performed an empirical screening analysis as an initial screening tool to determine which pollution sources (in terms of flow rate) could potentially impact the San Pedro Shelf area, assuming a worst-case scenario of 1.4×10^6 FC/100 ml discharge – a level recommended in the NSSP Section IV. Guidance Documents Chapter IV (United States Food and Drug Administration, 2023) when assessing point sources with limited data. Pollution sources that were screened and showed to have a potential impact to the San

Pedro Shelf area were assessed further through the application of a hydrodynamic computer model as discussed in Section VII.

Image 1: The following equation was used to calculate a theoretical flow rate that would produce a pollutant loading that could potentially impact the San Pedro Shelf and SPSAQ site:

Equation Used to Calculate the Theoretical Flow Rate That Would Produce a Pollutant Loading That Could Potentially Impact the San Pedro Shelf and SPSAQ Site

$$A = \frac{V}{D} = \frac{\left(\frac{L}{G}\right)}{D} = \frac{\left(\frac{(F)(C)}{G}\right)}{D}$$

Where:

A = Area of Buffer Zone

V = Volume Impacted by Source

D = Depth of Water

L = Pollutant Load

G = Desired Water Quality Goal

F = Flow Rate of Source

The empirical pollution source screening analysis results show that the greatest potential for pollution sources located along the shore to impact the San Pedro Shelf area are from the OCSD WWTP discharge, the OCSD SSOs and the Los Angeles, San Gabriel, and Santa Ana Rivers. Additionally, other sources of pollution within the San Pedro Shelf area and closer to the SPSAQ site, including sewage discharges from vessels may also result in a potential impact. Based on the assumptions above, any single land-based pollution source having a flow rate greater than 2,330,000 gal/day (2.33 MGD) has the potential to impact the classification of the San Pedro Shelf area which includes the SPSAQ site.

The OCSD WWTP and SSOs, and the Los Angeles and San Gabriel Rivers can discharge a flow rate greater than 2,330,000 gal/day. As indicated by the screening analysis, these pollution sources may impact the San Pedro Shelf area and the SPSAQ site. In addition, anchored and transient commercial vessels in close proximity to the SPSAQ site and surrounding federal waters portion of the San Pedro Shelf area may result in a potential impact. An in-depth analysis of these potential pollution sources is presented in Section VII.

DETERMINATION OF ACTUAL AND POTENTIAL SOURCES – HYDRODYNAMIC MODELING

For those pollution sources that were identified in the initial pollution source screening empirical analysis as having the potential to specifically impact the San Pedro Shelf and SPSAQ site, hydrodynamic models, MIKE 21 (DHI, 2022b) and MIKE 3 (DHI, 2022a) were applied to more accurately determine:

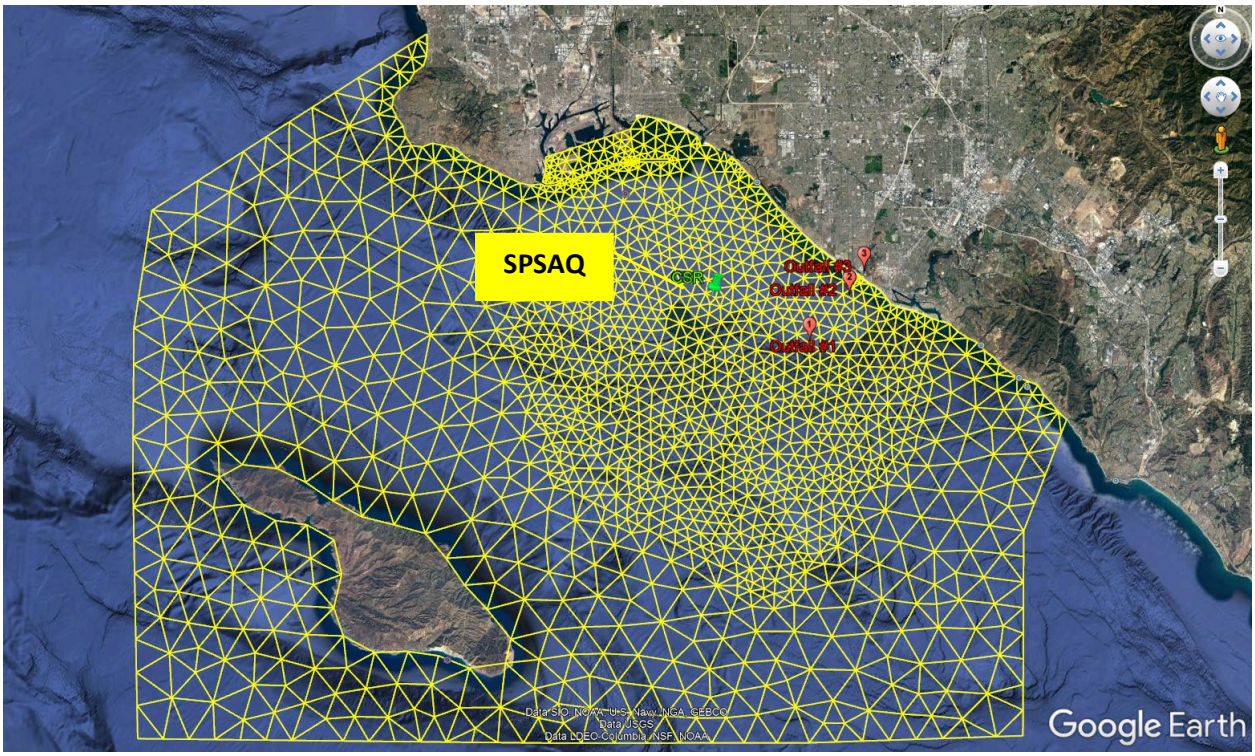
- The time it may take for pollution sources to reach the enter the San Pedro Shelf area and SPSAQ site;
- dispersion, dilution, and area impacted by the pollution source;
- potential build-up and residence time of the pollutant; and
- pollution source impacts under various conditions.

The hydrodynamic model, MIKE 21, was initially used to run various pollution event scenarios due to shorter simulation runs times and less time for initial model setup. MIKE 21 is a two-dimensional (2D) model used to simulate pollutant transport in coastal or marine environments. These models represent variations in two (2) dimensions, usually in the x-y (surface) direction and may assume complete and uniform mixing in the z-direction (depth). However, for pollutant event scenarios shown to impact the San Pedro Shelf area and SPSAQ site, the MIKE 3 model was also used considering the documented temperature stratification at approximately 40 meters deep and deeper water oceanographic circulation. The MIKE 3 is a three-dimensional (3D) model representing variations in all three (x-y-z) directions, providing higher resolution of results in the vertical (depth) direction.

To carry out the modeled simulation, a flexible triangular grid was developed for the area between Point Mugu, Newport Beach (North-South) and extending beyond Santa Catalina Island (Southwest) which covers the San Pedro Shelf and SPSAQ site with a sufficiently large area (Figure 15). For the modeling assessment, all significant water inputs to the study area were established as distinct sources. The following data were collected for model development:

- Bathymetry
- Freshwater flow (San Gabriel River, Santa Ana River, and Los Angeles River)
- Water level (tidal)
- Historical OCSD WWTP effluent flow and water quality
- Historical SSO events
- Aerial photos

Figure 15. Flexible grid and boundary conditions used in the numerical model of the San Pedro Shelf area including the SPSAQ site.



A detailed description of the bathymetry data is in Section VI.E. To accurately represent bathymetry, additional manual adjustment of the NOAA data was required. In addition, satellite imagery was used to adjust features (such as, coastline banks, channels, harbors, barriers, and the entrance to the ocean) before generating the bathymetric mesh.

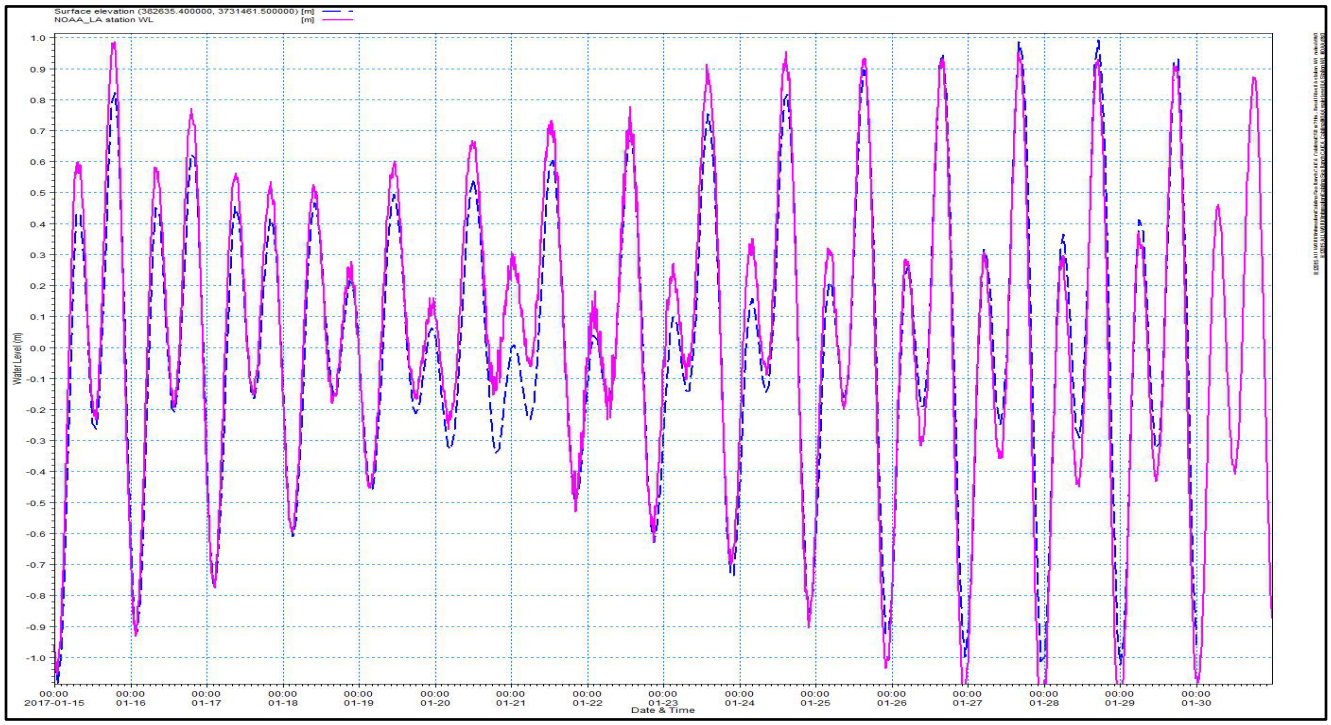
The San Gabriel, Santa Ana, and Los Angeles Rivers provide freshwater inflow to the study area. Freshwater inputs and OCSD WWTP Outfall #1 were considered as continuously discharging sources. The locations of freshwater river discharges were placed within the extremities of flexible grid (Figure 15). Historical flow rates for these various sources and bacterial levels were included in the model.

To calibrate the hydrodynamic model, the simulated water levels from the model were compared to measured water levels at the NOAA Los Angeles tidal station (Figure 16; Station ID 9410660) (National Oceanic and Atmospheric Administration, 2016). The comparison between measured and simulated water level results indicates a good fit between the model output and actual measurements (Figure 17).

Figure 16. NOAA Los Angeles tidal station (Station ID 9410660).



Figure 17. Semi-diurnal tides at NOAA Los Angeles tidal station (Station ID 9410660). Actual tide data in blue, modeled data in pink.



UPDATED MAJOR POLLUTION SOURCES

A summary of all pollution sources that have been identified as well as the NSSP required documentation is included in Table 9 and mapped on Figure 18. Each pollution source in Table 11 has been identified with a Map ID that corresponds to the location of the source on Figure 18. Information about each pollution source includes the name of the pollution source, the type of pollution source, the distance in miles from source to growing area, the latitude and longitude of the pollution source, and the impact of the pollution source on the growing area, noted as being either "direct" or "indirect." In general, a pollution source is determined to have a direct impact on a shellfish growing area if the discharge enters the shellfish growing area directly. These may be point sources of pollution, such as a municipal wastewater treatment plant outfall that discharges directly into a shellfish growing area, or non-point sources of pollution, such as stormwater runoff or agriculture runoff that reach the growing area indirectly. In the case of offshore federal waters, a pollution source has been identified as a "direct discharge" if a pollutant has the potential to be discharged directly into the growing area. Since point sources with the potential to impact the San Pedro Shelf area including the SPSAQ site (such as the WWTPs) do not discharge directly into the San Pedro Shelf area and must travel a distance prior to reaching the SPSAQ site, these have been identified as "indirect" discharges. Alternatively, ships have the potential to discharge human sewage directly into the San Pedro Shelf area and waters in close proximity to the within the San Pedro Shelf and SPSAQ site and may impact these waters either "directly" or "indirectly." Oil production platforms and associated pipelines have been identified as having the potential to rupture and impact the San Pedro Shelf area and SPSAQ site "directly" or "indirectly" as oil pipelines intersect the SPSAQ site.

Figure 18. Actual and Potential Major Pollution Sources Determined through Empirical Analysis

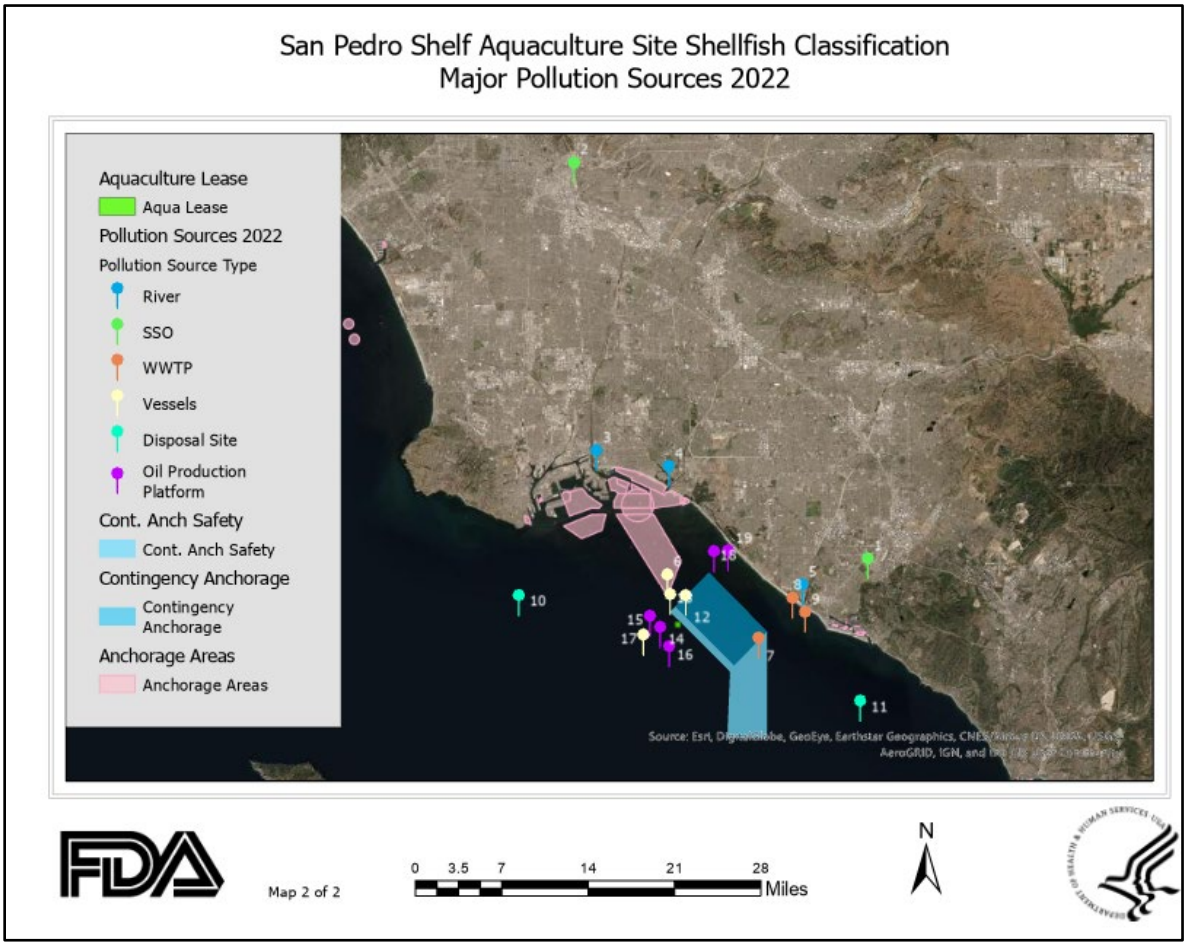


Table 9. 2022 Table of Actual and Potential Pollution Sources.

Map ID	Name	Pollution Source Type	Distance to Growing Area (Miles)	Latitude Degree Decimal Minutes	Longitude Degree Decimal Minutes	Impact
1	Costa Mesa	SSO	15.63	33° 39.24000002’ N	117° 52.91999999’ W	Indirect
2	LA SSO	SSO	31.1	34° 02.34000002’ N	118° 13.56000002’ W	Indirect
3	Los Angeles River	River	13.7	33° 45.57156397’ N	118° 11.99395603’ W	Indirect
4	San Gabriel River	River	10.87	33° 44.63218903’ N	118° 06.90923220’ W	Indirect
5	Santa Ana River	River	10.01	33° 37.72663824’ N	117° 57.51558887’ W	Indirect
6	Anchorage Area	Vessels	2.14	33° 38.29973854’ N	118° 07.00804548' W	Direct/ Indirect
7	Outfall #1	WWTP	6.81	33° 34.60000003' N	118° 00.59999997' W	Indirect
8	Outfall #2	WWTP	9.07	33° 36.93333335' N	117° 58.21666670' W	Indirect
9	Outfall #3	WWTP	10.08	33° 36.10000003' N	117° 57.33333333' W	Indirect
10	LA-2	Disposal Site	20.4	33° 37.08934044' N	118° 17.45319797' W	Indirect
11	LA-3	Disposal Site	26.5	33° 30.91527539' N	117° 53.45721496' W	Indirect
12	Contingency Anchorage	Vessels	8.9	33° 37.08690919' N	118° 05.71231158' W	Direct/ Indirect
13	Production Platform Channel	Vessels	1.0	33° 37.15443178' N	118° 06.81245934' W	Direct/ Indirect
14	Production Platform Elly	Oil Production Platform	3.4	33° 35.22959590' N	118° 07.51638018' W	Direct/ Indirect
15	Production Platform Edith	Oil Production Platform	3.5	33° 35.88281548' N	118° 08.23296220' W	Direct/ Indirect
16	Production Platform Eureka	Oil Production Platform	5.3	33° 34.10456987' N	118° 06.88387828' W	Direct/ Indirect
17	San Pedro Navigational Channel	Vessels	5.6	33° 34.77946960' N	118° 08.69474247' W	Direct/ Indirect
18	Production Platform Eva	Oil Production Platform	8.73	33° 39.65932110' N	118° 03.73084161' W	Direct/ Indirect
19	Production Platform Emmy	Oil Production Platform	9.3	33° 39.71251070' N	118° 02.74320702' W	Direct/ Indirect

The Role of Indicator Bacteria and Decay Rates

As a result of the oyster-borne typhoid bacterial infections and outbreaks that occurred in the U.S. during the winter of 1924-25 (Lumsden, 1925), the National Shellfish Certification Program was initiated by the states, the U.S. Public Health Service, and the shellfish industry (Frost, 1925). The 1925 program criteria adopted in the U.S. for safe growing areas were stated as: (1) the area is sufficiently removed from major sources of pollution so that the shellfish would not be subjected to fecal contamination in quantities which might be dangerous to the public health, (2) the area is free from pollution by even small quantities of fresh sewage, and (3) bacteriological examination does not ordinarily show the presence of the coli-aerogenes group of bacteria in 1 cc dilutions of the growing area water. These criteria were known as the sanitary survey, which, collectively, were used to determine if an area was safe for shellfish harvesting for human consumption. Use of bacteriological indicators to measure the variability in water quality, in conjunction with sanitary surveys and source assessment, hydrographic and meteorological considerations, and patrol of closed harvest areas have generally proven effective in preventing major outbreaks of disease transmitted by the fecal-oral route and form the backbone of today's National Shellfish Sanitation Program (NSSP). A complete history of the NSSP is documented. (Clem, 1994).

Bivalve molluscan shellfish filter feed on algae from the surrounding water, and during this feeding process each animal can filter out and retain microorganisms from between 20 and 90 liters of water per day. This ability to accumulate microorganisms results in the levels of bacteria and viruses in shellfish being much greater than those found in overlying waters. When disease causing microorganisms are present, shellfish may contain levels 3 to 1,000 times greater than found in overlying water, depending on species of shellfish, type of microorganism, environmental conditions, and season (Burkhardt & Calci, 2000a, Burkhardt et al., 1992, Metcalf et al., 1979, Bedford et al., 1978, Enriquez et al., 1992). However, it has been widely recognized that coliform bacteria do not reliably reflect the presence or absence of viral pathogens such as norovirus and Hepatitis A virus (HAV) (Sobsey et al., 1987, Richards, 1988, Goyal et al., 1987).

FDA has been providing technical assistance to domestic and foreign shellfish programs for over 50 years through the classification of growing areas in proximity to pollution sources through hydrographic dye studies. The objective of this assistance for classifying and managing shellfish growing areas is to minimize the risk posed by sources of anthropogenic pollution, and since 1925, this has been most reliably and uniformly achieved by adequate dilution of the bacterial and viral pathogens intermittently present in fecal waste and treated wastewater. Based on studies conducted collaboratively between FDA, states, and industry, various dilution ratios have been established to size prohibited buffer zones encompassing sewage sources (United States Food and Drug Administration, 2023). As stated in the NSSP Guidance, "it is imperative that the Shellfish Control Authority assess the wastewater dispersal and dilution and the time of transport to the area where shellstock may be harvested." The time of travel from sewage sources to shellfish growing areas in state waters can be short (several hours or less). Therefore, indicator organism bacterial decay values have not historically been factored into previous FDA-led state shellfish program technical assistance hydrographic dye studies.

The magnitude of the pollution sources evaluated with the San Pedro Shelf Sanitary Survey are significantly large and the time of travel to the area including the SPSAQ site in federal waters may be long (in some cases several days). Therefore, the rate of bacterial decay was considered for this sanitary survey in federal waters. A bacterial decay value of 0.25 per day was used in all model simulations consistent with the calibrated models reported in Hellweger & Masopust, 2008 as well as supported by the conservative end of the range of in-situ decay values reported in Bowie et al., 1985 (Hellweger & Masopust, 2008), (Bowie, 1985).

DESCRIPTION OF POLLUTION SOURCES

PERMITTED WASTEWATER TREATMENT PLANTS (WWTP)

The OCSD owns and operates a regional collection system, wastewater treatment facilities, and outfalls and is permitted to discharge under a National Pollutant Discharge Elimination System (NPDES) Permit (No. CA0110604) ((United States Environmental Protection Agency and State of California, 2021).). The NPDES permit allows OCSD to discharge disinfected secondary treated wastewater from Reclamation Plant No. 1 (in Fountain Valley) and Treatment Plant No. 2 (in Huntington Beach). The OCSD serves approximately 471 square miles of central and northern Orange County, California, and accepts domestic, commercial, and industrial wastewater within this service area. Additional untreated wastewater is contributed by the Santa Ana Watershed Project Authority, Irvine Ranch Water District, and Stringfellow Superfund Site (EPA ID #CAT080012826). The OCSD also accepts small volumes (less than 5 MGD) of dry weather urban runoff during dry weather conditions.

The Orange County Water District (OCWD), located adjacent to Reclamation Plant No. 1, owns, and operates the Groundwater Replenishment System (GWRS), a major regional wastewater reclamation project, that can divert up to 100 MGD of the OCSD's secondary treated wastewater for advanced treatment and reuse with plans underway to increase the diversion up to 131 MGD. The OCWD's advanced treatment process can generate filter backwash concentrates high in salts, ammonia nitrogen, and trace metals, which are returned to OCSD for treatment and ocean disposal. The Green Acres Project (GAP), also located adjacent to Reclamation Plant No. 1 and owned and operated by the OCWD, can divert up to 10 MGD of the OCSD's secondary treated wastewater for tertiary treatment, disinfection, and reuse. The GAP also generates filter backwash that is returned to OCSD for treatment and ocean disposal.

According to the OCSD NPDES permit (CA0110604 issued June 23, 2021), raw wastewater entering both facilities pass through metering and diversion structures and continues to headworks facilities for preliminary treatment, which includes grit and screenings removal (United States Environmental Protection Agency and State of California, 2021). Primary treatment occurs in primary sedimentation facilities and the primary effluent is routed to trickling filters and activated sludge facilities for secondary treatment, or for ocean discharge. Secondary treated effluent is either delivered from the facilities to Reclamation Plant No. 1 for further treatment and reclamation or discharged to the ocean. OCWD's concentrated waste streams are recycled back into OCSD's treatment facilities, except for the brine created by the reverse osmosis backwash which is blended with other treated waste streams in the interplant lines and the final effluent stream prior to ocean discharge.

The effluent is discharged through an ocean outfall system consisting of three (3) discharge points. The primary discharge point (001) is through a 120" outfall extending approximately 4.5 miles offshore from the mouth of the Santa Ana River fitted with a multi-port diffuser at a depth of about 195 feet (60 meters). An emergency discharge point (002) is located approximately 1 mile offshore from the mouth of the Santa Ana River, also fitted with a multi-port diffuser at a depth of about 65 feet (20 meters). Discharge Point 002 becomes the primary discharge point during periods of maintenance of the Outfall 001. Discharge point (003) discharges to the Santa Ana River Reach 1 through overflow weirs and would only be used during an extreme emergency.
Per the OCSD NPDES permit, the discharge of wastewater from any location other than Discharge Point 001 is prohibited, except during the following situations:

- Emergency discharge of disinfected secondary effluent and reverse osmosis (RO) concentrate to Discharge Point 002 when the flow rate exceeds the hydraulic capacity of Discharge Point 001, provided that discharges through Discharge

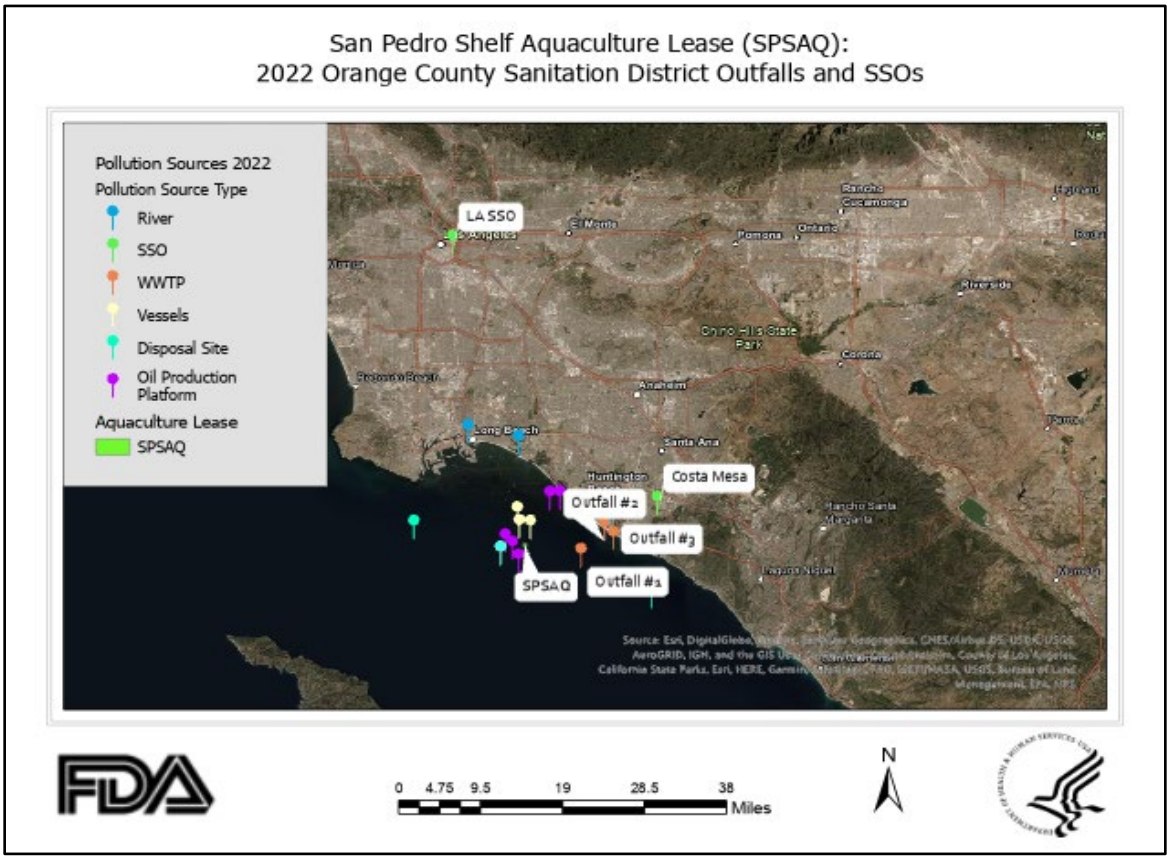
Point 001 and discharges to OCWDs water recycling facilities are maximized to a functional capacity that is necessary to prevent infrastructure or equipment damage before wastewater is discharged through Discharge Point 002;

- Emergency discharge of disinfected secondary effluent and RO concentrate to Discharge Point 003 (Santa Ana River overflow weirs) in the event of an extreme emergency (such as, tsunami, earthquake, flood, and acts of war or terrorism) that precludes discharging all wastewater to Discharge Points 001 and 002, provided that discharges through Discharge Points 001 and 002 are maximized before wastewater is discharged through Discharge Point 003; or
- Discharge of disinfected secondary effluent and RO concentrate to Discharge Point 002 during planned essential maintenance or capital improvement projects to assure efficient operation of Discharge Point 001 when there is no other feasible alternative.

PERMITTED SANITARY SEWER OVERFLOWS (SSOS)

Per the NPDES Permit for the OCSD, the State Water Board issued the "Statewide General Waste Discharge Requirements for Sanitary Sewer Systems" (U.S. ENVIRONMENTAL PROTECTION AGENCY and CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, 2021), requiring public agencies that own or operate sanitary sewer systems with greater than one (1) mile of pipes or sewer lines to enroll for coverage under the General Order. Pursuant to the General Order, agencies must: 1) develop sanitary sewer management plans and report all sanitary sewer overflows (SSOs), among other requirements and prohibitions; 2) adhere to requirements regarding operation and maintenance of collection systems, and for reporting and mitigating SSOs; and 3) consider that the Discharger's collection system is part of the publicly owned treatment works that is subject to the Order/Permit (California State Water Resources Control Board, 2006). Under the service area of the OCSD there are two SSOs that have shown a recent history of discharge which may potentially have a bearing on the sanitary quality of the rivers entering coastal waters. These are Los Angeles and the Costa Vista SSOs which discharge to the Los Angeles and the Santa Ana Rivers, respectively (Figure 19).

Figure 19. Permitted OCSD SSO and Outfall Locations.



Vessel Navigation and Potential Discharges

The Clean Water Act (CWA) Section 312 (33 U.S.C. 1322) lays out the regulatory framework for sewage discharges from vessels into the U.S. navigable waters. These regulatory requirements generally apply to "waters of the U.S." as defined in 40 CFR 122.2, and which may not include the federal waters portion of the San Pedro Shelf area or the SPSAQ site.

The San Pedro Shelf area including the SPSAQ site are located in federal waters, which may fall outside the waters subject to the CWA. Therefore, vessel sewage discharges may occur with limited oversight and regulation in the federal waters portion of the San Pedro Shelf area and SPSAQ site.

Observations of georeferenced navigational tracks show vessels navigating throughout the San Pedro Shelf and within 3,000 feet of the SPSAQ site during 2017 and in 2020 (Figure 20 and Figure 22). The density of tracks between platforms are visible in both vessel density maps. Tracks in yellow indicate vessel density between 101 and 250 vessels per year.

Geospatial analysis was performed by creating a 1-mile buffer specifically around the SPSAQ site. This buffer was then used to extract a count of all vessels tracked in the Automatic Identification System (AIS) that navigated within one (1) mile of the SPSAQ site. Results indicate that 510 passenger vessels, 142 pleasure vessels, 48 tow vessels, 15 commercial fishing vessels, and 193 vessels classified as "other" navigated within the one (1) mile buffer around the SPSAQ site during 2017 (Figure 21). An update of the geospatial analysis with 2021 AIS vessel data indicates that 293 passenger vessels, 300 pleasure vessels, 90 tow vessels, 43 commercial fishing vessels, and 126 vessels classified as "other" navigated within the 1-mile buffer around the SPSAQ site (Figure 22). The most significant change noted between 2017 and 2021 is the

significant increase in cargo vessels (188) and tanker vessels (46) navigating within one (1) mile of the SPSAQ site during 2021, compared to none of these types during 2017. The total number of vessels navigating in the vicinity of the SPSAQ site increased from 908 to 1,133 between 2017 and 2021, a 25% increase in vessel traffic navigating within 1 mile of the SPSAQ site.

Figure 20. 2017 AIS Vessel Track Density within One Mile of Aquaculture Site

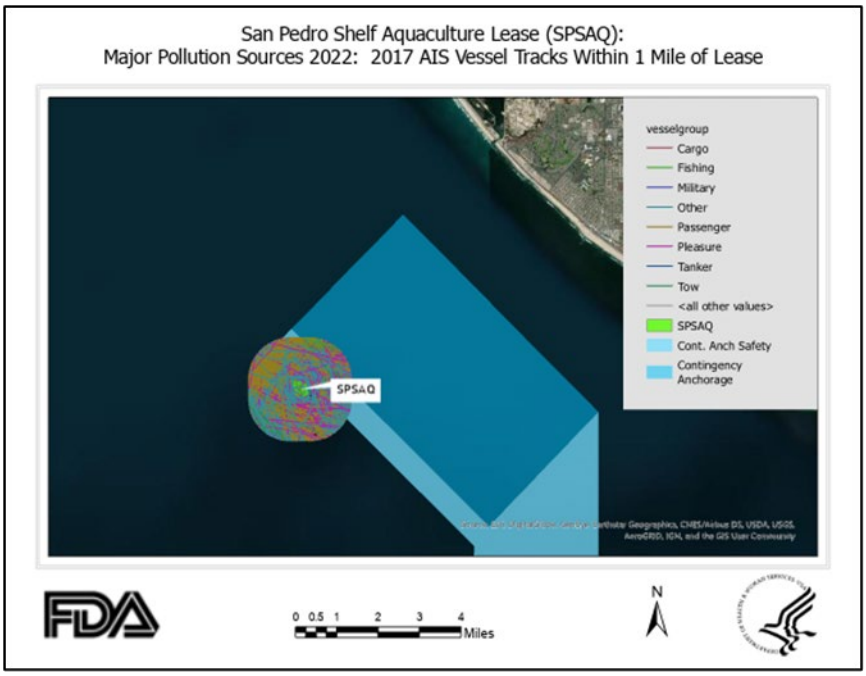


Figure 21. 2017 AIS Vessel Density within One Mile of Aquaculture Site

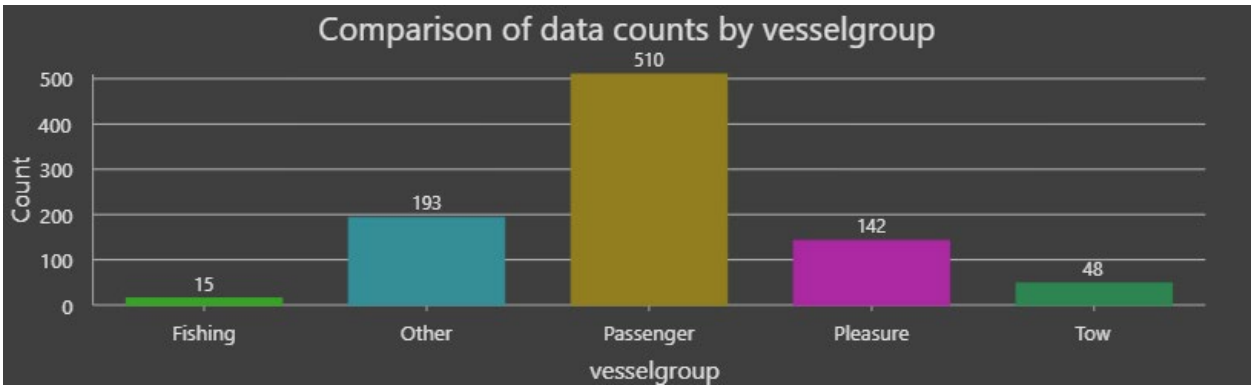


Figure 22. 2021 AIS Vessel Track Density within One Mile of Aquaculture Site

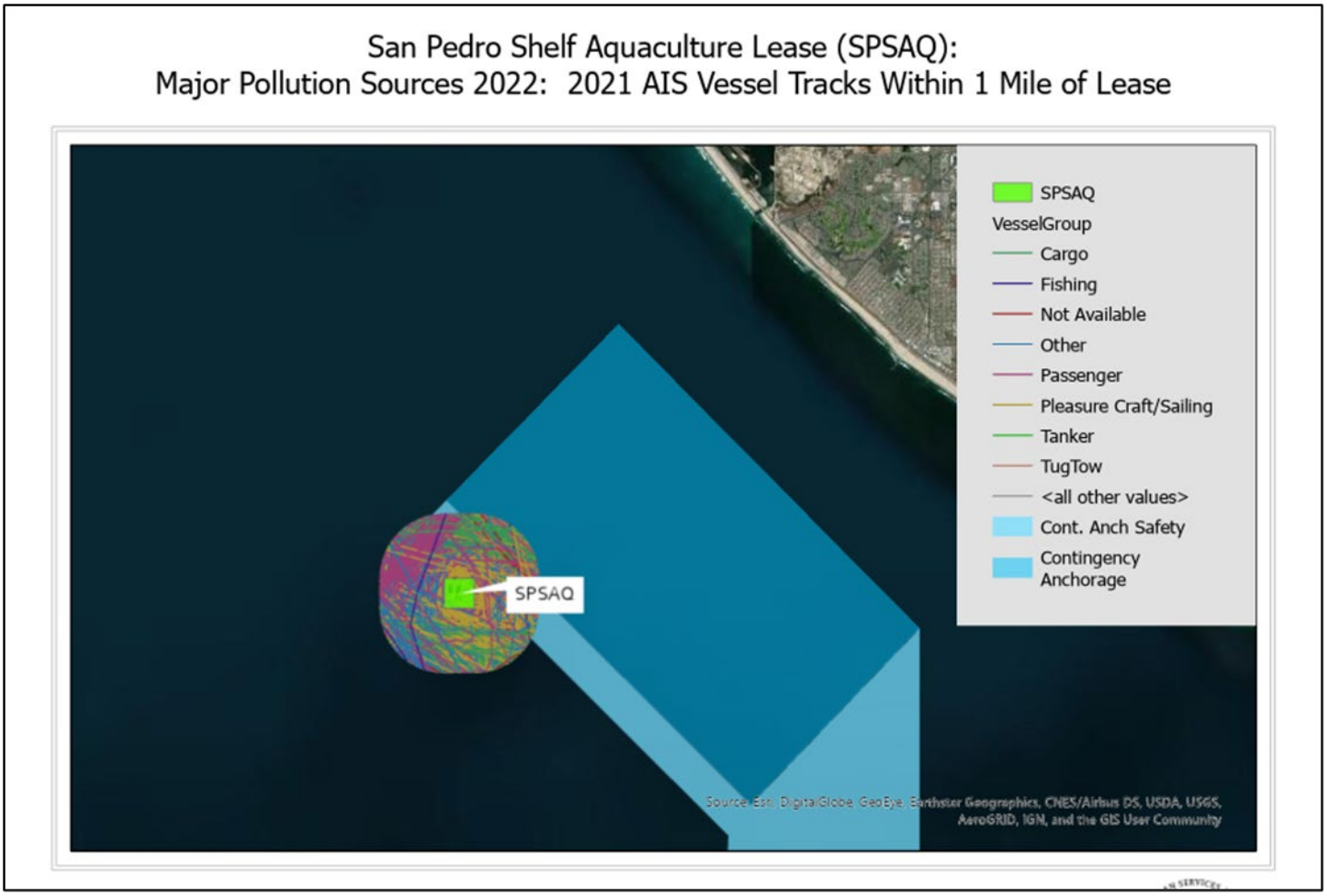
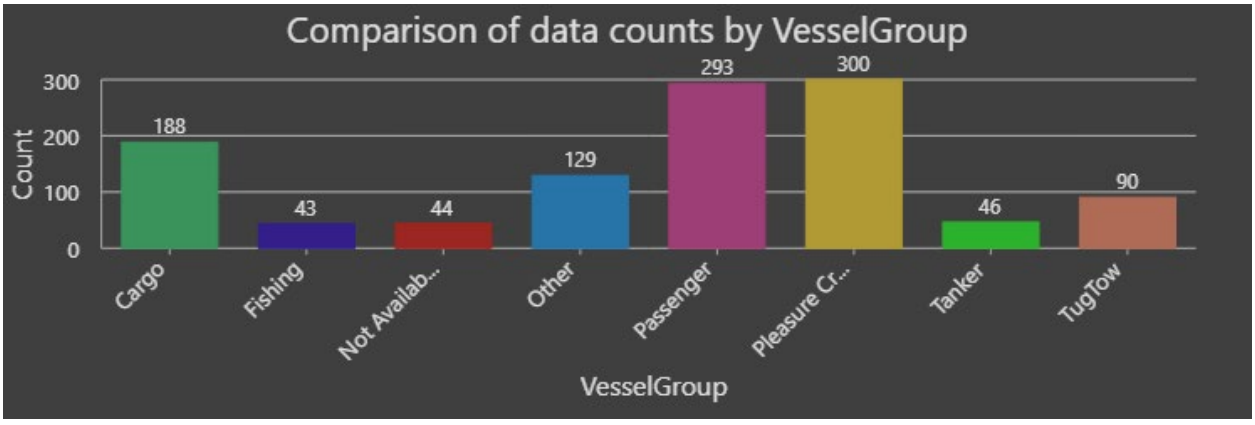


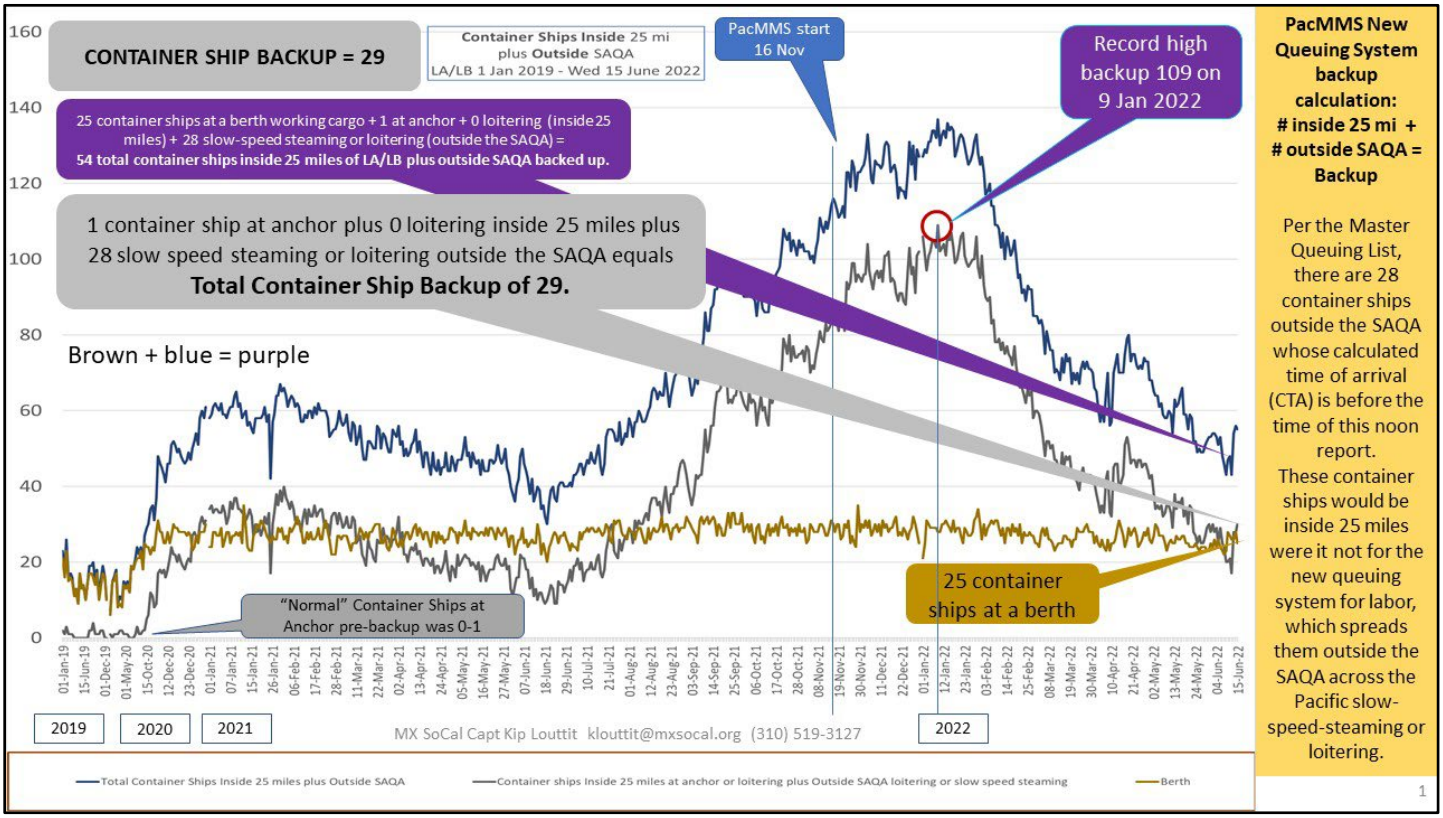
Figure 23. 2021 AIS Vessel Density within One Mile of Aquaculture Site



Due to conditions and restrictions associated with the COVID pandemic, commercial shipping activity and anchorage holding times in the San Pedro Shelf area increased significantly beginning in February 2020, reaching peaks during November 2021 and January 2022 (Figure 24).

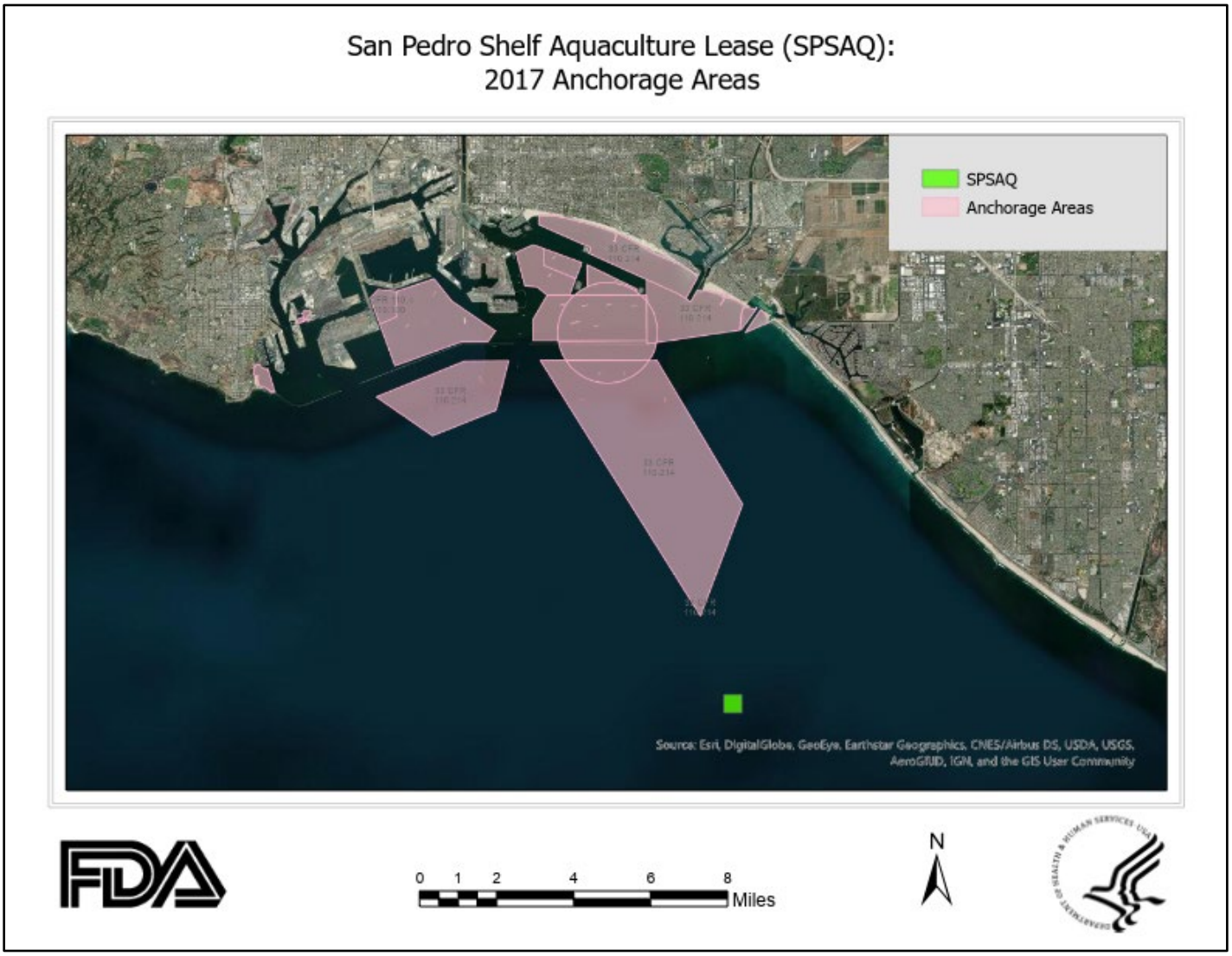
The vessel congestion associated with the container backlog increased steadily from June 2021 through January 2022, and since that time has been decreasing. At the time of the writing of this report (June 2022), the backlog is near pre-COVID baseline levels, with fewer vessels now anchored outside of the port (in blue). However, the total number of vessels in port (yellow) and at berths (green) remains elevated above pre-COVID levels. Despite the commercial shipping backlog being managed, it is likely that the volume of commercial shipping vessels will remain increased above pre-COVID levels, and contingency anchorages will continue to be utilized (Loutit, 2022).

Figure 24. Container ships anchored within 25 miles of Los Angeles and Long Beach 01/01/2019 through 06/15/2022. Data provided by the Marine Exchange of Southern California courtesy of Captain Kip Loutit (Loutit, 2022) .



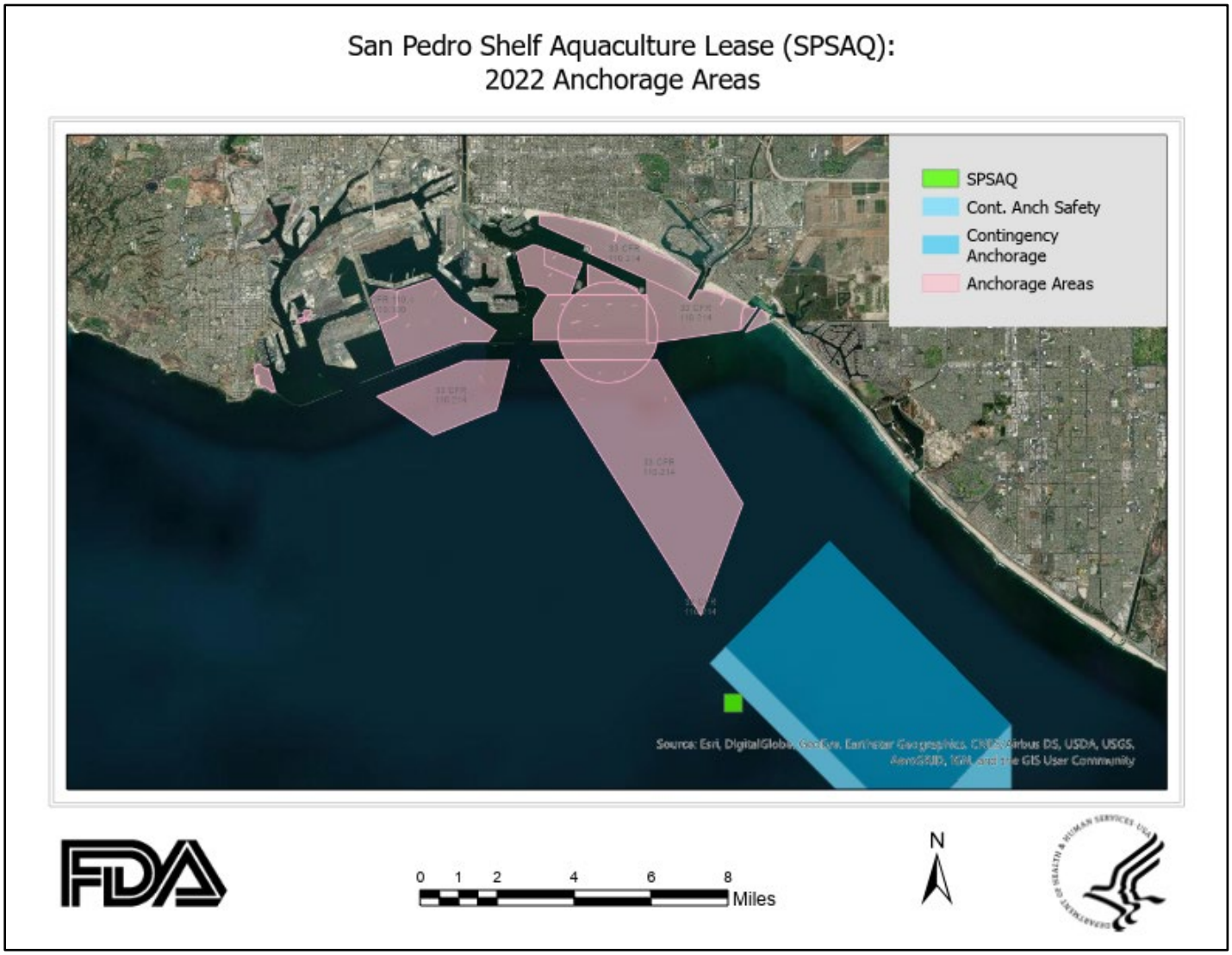
Prior to 2021, most commercial shipping vessel activity was restricted to the established shipping lanes and anchorages located within the San Pedro Shelf area but, greater than two (2) miles from the SPSAQ site. At that time, due to the distance, commercial shipping activity was considered as having a minimal impact to the SPSAQ site. There were two (2) main ship anchorages that were utilized prior to the COVID pandemic, the nearest boundary of which was 2.13 miles from the SPSAQ site (Figure 25).

Figure 25. Port of Los Angeles Federal Anchorages active in 2017.



As commercial shipping activity increased and wait times for landing at the Los Angeles Port increased, a significant backlog of ships filled the available anchorages and then expanded outside the established anchorage boundaries. In response, a previously not identified contingency anchorage was reinstated, placing vessels at anchor closer to the SPSAQ site (Figure 26). NOAA has since designated this contingency anchorage as a permanent anchorage area to accommodate the increased number of commercial shipping vessels in the San Pedro Shelf area. The boundary of this contingency anchorage is 2,909 feet (~0.5 miles) from the nearest corner of the SPSAQ site, and the additional contingency anchorage safety area that is required for safe navigation of vessels in the area overlaps the boundary of the SPSAQ site.

Figure 26. Contingency anchorage in proximity to aquaculture site in 2022.



As previously discussed, given that these sewage discharges from vessels may occur with relatively limited oversight and regulation, vessels may discharge untreated or partially treated sewage in proximity to the SPSAQ farm site and surrounding federal waters portion of the San Pedro Shelf area. Additionally, literature research into the volume, rate, and microbiological quality of vessel discharges has been performed and hydrodynamic dilution modeling was applied to quantify the impact of vessel discharges on the SPSAQ site and San Pedro Shelf area (section 7.3).

Marine Disposal Sites

The Marine Protection, Research, and Sanctuaries Act (MPRSA, also known as the Ocean Dumping Act) prohibits the dumping of material into the ocean that could unreasonably degrade or endanger human health or the marine environment. The EPA issues general permits under MPRSA for the transportation and disposition (dumping) of certain materials. The USACE issues permits for dredged material using EPA's environmental criteria and permits are subject to EPA's concurrence, while for all other materials, EPA is the permitting agency. EPA is also responsible for designating recommended ocean dumping sites for all types of materials.

There are three (3) ocean disposal sites off the southern California coast that are managed by EPA: LA-2 off the ports of Los Angeles and Long Beach, LA-3 off Newport Beach, and LA-5 off San Diego Bay. Given the location to the San Pedro Shelf area, only LA-2 and LA-3 are pertinent to this assessment. Disposal at these sites is coordinated jointly by EPA (Region IX) and USACE (Los Angeles District) as reported in the Site Management & Monitoring Plan (SMMP) developed by EPA with USACE (January 2011). The compliance and enforcement provisions of the MPRSA regulations for the LA-2 and LA-3 sites are outlined in the January 2011 SMMP.

The LA-2 and LA-3 sites have been in use since the mid-1970s. However, the LA-2 site was officially designated as a permanent disposal site in 1991, the LA-3 site was officially designated as a permanent site in 2005 (and adjusted its location slightly), and the LA-5 site was designated a permanent site in 1992. Prior to the official designation as permanent sites, these three (3) locations were designated as interim sites. All three (3) sites are addressed under one Site Management and Monitoring Plan (SMMP) to minimize confusion for dredgers and permit writers, and because the site use conditions are virtually identical among the three sites.

Site monitoring is a requirement for use of both the LA-2 and LA-3 disposal sites; routine monitoring surveys at both sites occur at least every five (5) years, or more frequently, as determined by EPA. The primary purpose of the environmental monitoring plan is to verify that: 1) only acceptable dredged material is disposed of at the site, 2) no substantial amounts of dredged material will go outside the site, 3) no substantial amount of bioaccumulation is occurring inside the site, and 4) no adverse effects are occurring to biological resources outside the site.

Oil Production

According to the California State Lands Commission, in the Pacific Outer Continental Shelf Region, there are 23 oil and gas production facilities installed in federal waters (California State Lands Commission, 2022). In waters of the San Pedro Shelf, there are three platforms located in federal waters: Platforms Ellen, Elly, and Eureka operated by the Beta Operating Company, LLC (California State Lands Commission, 2022). In California state waters, Platforms Eva and Emmy are operated off Huntington Beach, and Platform Esther off Seal Beach (California State Lands Commission, 2022).

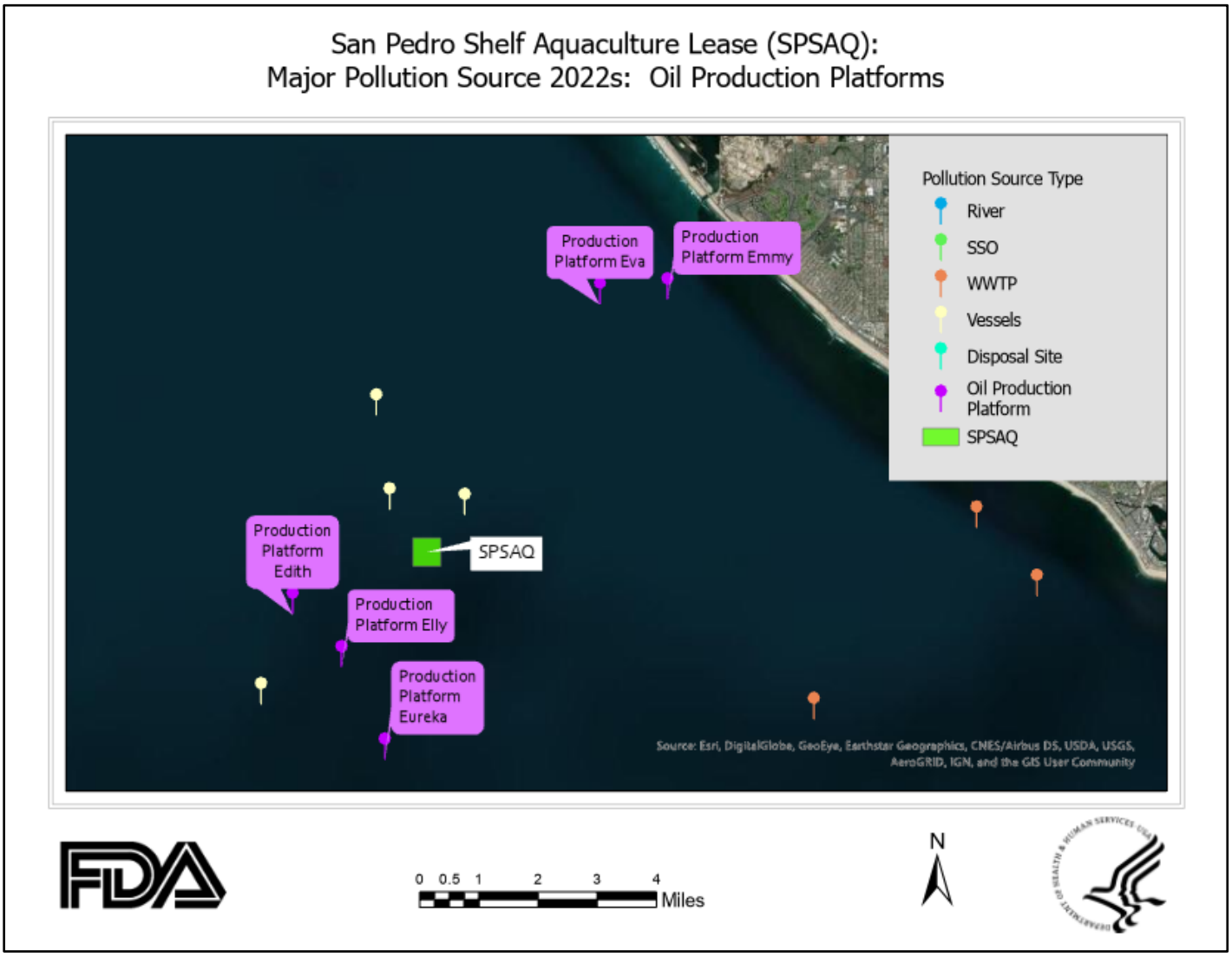
On October 2, 2021, there was a crude oil spill from an offshore pipeline leak originating at Production Platform Elly, offshore of Huntington Beach, CA. According to the Associated Press (AP), the amount of crude oil was believed to be close to 25,000 gallons, or approximately 588 barrels, according to Coast Guard officials (Associated Press, 2021). Production Platform Elly is within the San Pedro Shelf and 2.45 miles to the northeast of the SPSAQ site (Figure 27). The SPSAQ site is located between the source of the spill and Huntington Beach, and directly within the zone of impact of the oil spill.

Risks to seafood safety following an oil spill may result from polycyclic aromatic hydrocarbon (PAH) exposures and metals, as well as from dispersants, and these exposures may depend on a variety of factors (Gohkle, 2011). The Gohkle review concluded that contamination following a spill is determined by multiple factors, including the following (Gohkle, 2011):

- type and quality of the oil,
- the proximity of the spill to fishing grounds,
- ambient temperature and weather conditions, and
- species- and ecosystem-specific parameters that determine metabolism and the potential for bioaccumulation at different levels of the food chain.

Following the October 2, 2021, spill, all commercial and recreational fisheries in the area were closed until November 30, 2021, and were reopened following extensive testing by state and federal authorities (Southern California Spill Reponse, 2022). At the time of this oil spill, shellfish were not present at the SPSAQ site but, a full assessment would have been conducted and the San Pedro Shelf area including the SPSAQ site may have been included in the closure if shellfish were present.

Figure 27. Oil production platforms within the San Pedro Shelf area and within the vicinity of SPSAQ site.



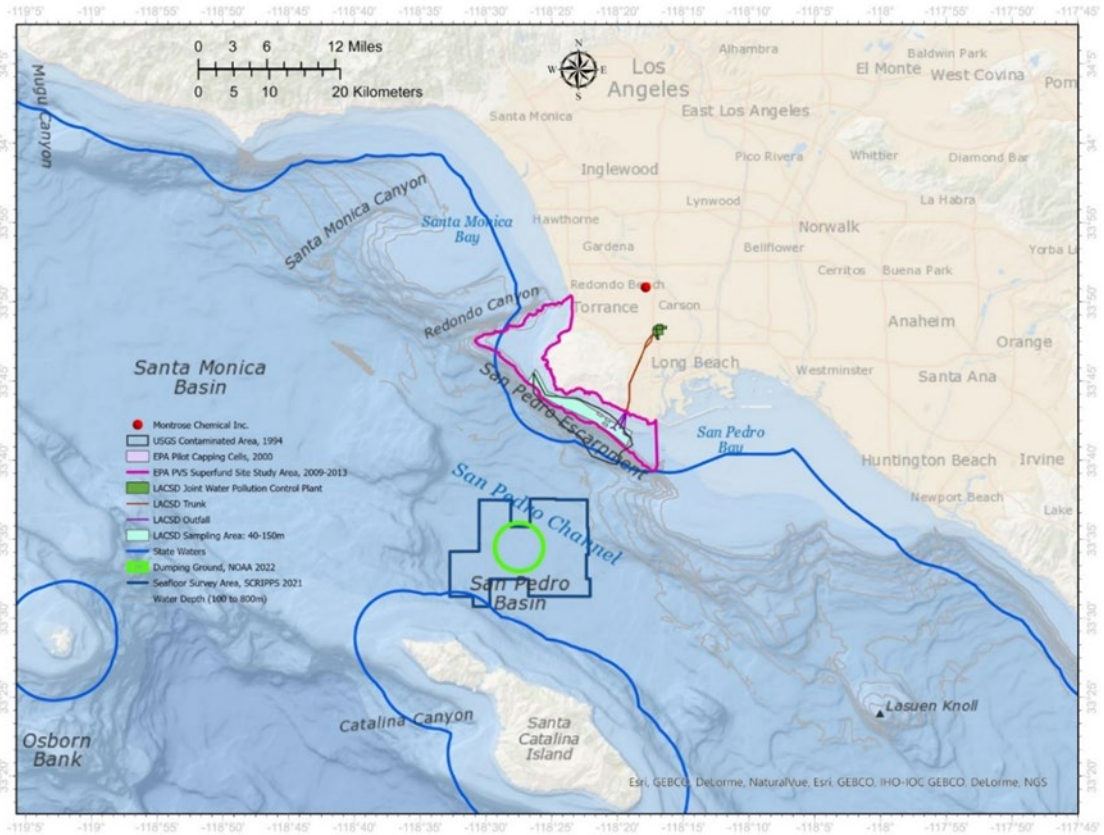
Coast Guard officials reported that the source of the oil spill was a leak in a pipeline owned by Houston-based Amplify Energy Corp. that shuttles crude from offshore platforms to the coast (Associated Press, 2021). Officials said “the cause of the leak remains under investigation, but the pipeline was likely damaged by a ship’s anchor several months to a year before it ruptured” (Associated Press, 2021).

The Platform Elly spill is discussed in this report as an example of a documented contamination event that may have presented a risk to shellfish aquaculture in the San Pedro Shelf area if active cultivation was occurring at the SPSAQ site at the time. Due to the number of oil production platforms in the area, and reported aging infrastructure, there is a potential risk of future oil spills that may impact shellfish aquaculture operations in the San Pedro Shelf area.

POISONOUS AND DELETERIOUS SUBSTANCES

In 2020, NOAA identified a deep trough off the southern California coast where it is estimated that approximately 250,000 drums possibly full of dichlorodiphenyltricholorethane (DDT) and other waste were dumped between 1940 and the mid-1970s (Los Angeles Times, 2021). This previously unidentified dump site is located approximately 13 NM (15 statute miles) adjacent to the San Pedro Shelf area and SPSAQ site in federal waters (Figure 28) (United States Environmental Protection Agency, 2022). Poisonous or deleterious substance (P&DS) has a specific definition in the NSSP MO, and means a toxic substance occurring naturally or added to the environment for which a regulatory tolerance limit or action level has been established in shellfish to protect public health (United States Food and Drug Administration, 2023). DDT is listed as a P&DS and has a regulatory tolerance limit or action level established by the FDA, which for DDT and metabolites is 5.0 ppm (µg/mg) (United States Food and Drug Adminstration, 2000). In coordination with NOAA SIP and SPSAQ site personnel, FDA developed a plan to collect Mediterranean mussel samples from the SPSAQ site to be analyzed for DDT and metabolites by the FDA pesticides laboratory.

Figure 28. Location of dumping ground in the San Pedro Shelf.



*The boundary of Dump Site #2 is based on NOAA navigation chart.

Dichlorodiphenyldichloroethane (DDD) and DDT levels in shellfish tissues analyzed by the FDA pesticides laboratory were found to be below the limit of detection for the analysis (Table 10). Dichlorodiphenyldichloroethylene (DDE) is a breakdown component of DDT, and 2,4'-DDE was found at levels ranging from 0.28 to 4.46 µg/kg (ppb), while 4,4'-DDE was found at levels between 2.29 to 3.78 µg/kg (ppb). Converted to µg/mg (ppm) used in action levels, 2,4'-DDE ranged from 0.00028 to 0.00446 µg/mg (ppm) and 4,4'-DDE ranged from 0.00229 to 0.00378 µg/mg (ppm). These levels do not exceed existing FDA action levels for DDD, DDE, or DDT of 5.0 ppm.

Table 10. Mediterranean mussel tissue: DDD, DDE, and DDT results as reported by USFDA Bioanalytical Methods Branch.

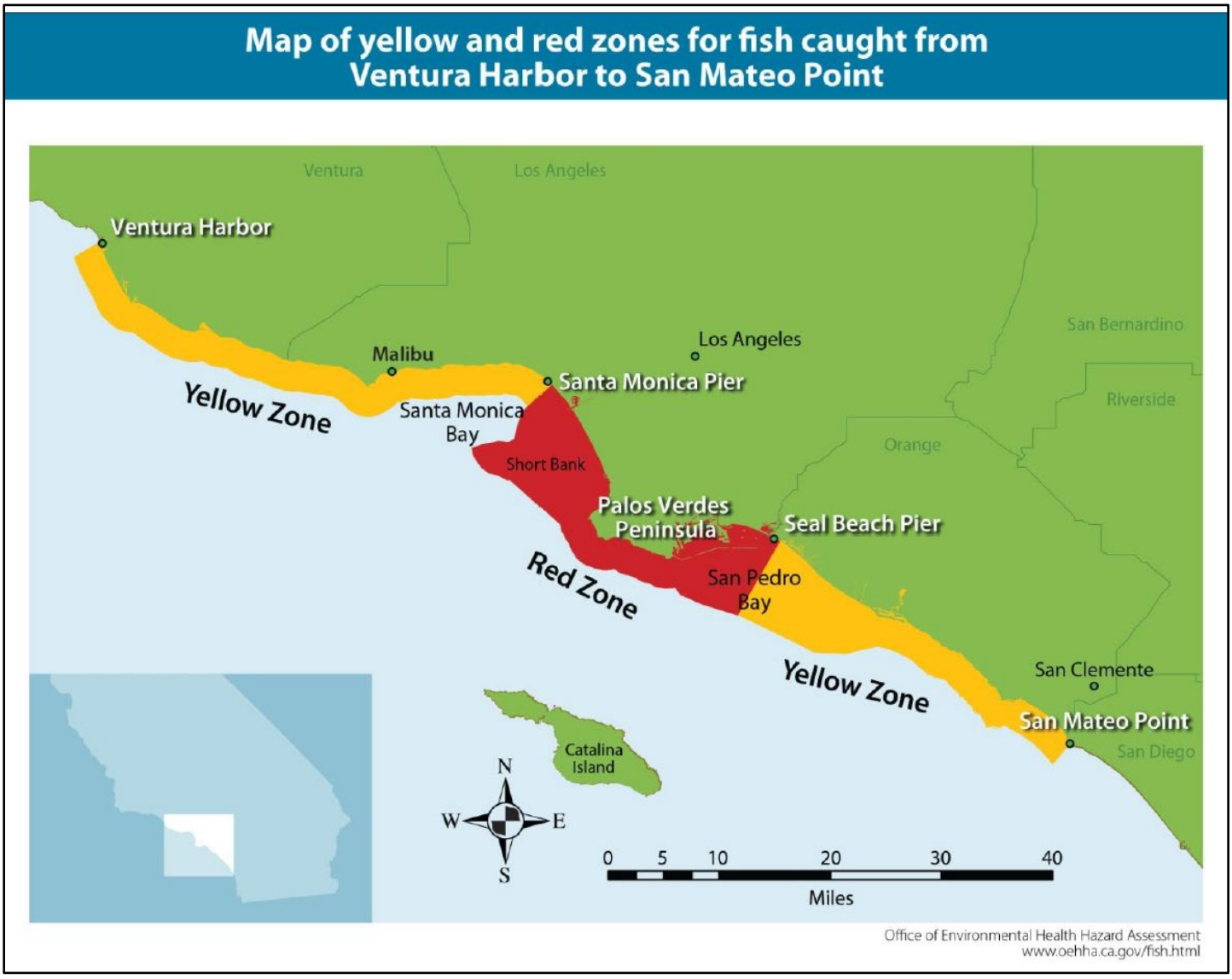
	Amount found (µg/kg), Average (Standard Deviation), $n = 4$*					
	2,4'-DDD	4,4'-DDD	2,4'-DDE	4,4'-DDE	2,4'-DDT	4,4'-DDT
Sample 1	nd**	nd	0.46 (0.03)	3.78 (0.07)	nd	nd
Sample 2	nd	nd	0.31 (0.03)	2.66 (0.19)	nd	nd
Sample 3	nd	nd	0.28 (0.03)	2.39 (0.16)	nd	nd
Sample 4	nd	nd	0.37 (0.02)	3.12 (0.13)	nd	nd
Sample 5	nd	nd	0.34 (0.03)	2.86 (0.12)	nd	nd
Sample 6	nd	nd	0.27 (0.03)	2.29 (0.07)	nd	nd
Sample 7	nd	nd	0.35 (0.03)	3.00 (0.05)	nd	nd
Sample 8	nd	nd	0.34 (0.01)	2.87 (0.25)	nd	nd

*sample measured is an average of triplicates determined over four days
** nd, not detected < lowest calibration level without identification: approximately 50 pg/mL (0.2 µg/kg in sample) for 2,4'-DDD, 2,4'-DDE, and 4,4'-DDE; 100 pg/mL (0.4 µg/kg in sample) for 4,4'-DDD and 2,4'-DDT; 200 pg/mL (0.80 µg/kg in sample) for 4,4'-DDT

The southern California coast has a documented history of chemical contamination of water, sediments, and seafood originating from multiple industrial, urban, and agricultural sources (California Environmental Protection Agency Office of Environmental Health Hazard Assessment, 2009). Millions of pounds of hazardous chemicals, including chlorinated hydrocarbons dichlorodiphenyltrichloroethane and its metabolites (DDTs) and polychlorinated biphenyls (PCBs), were deposited onto the ocean floor for at least 20 years until the 1970s via the Los Angeles sewer system and water pollution control plant ocean outfalls (California Environmental Protection Agency Office of Environmental Health Hazard Assessment, 2009). Following extensive fish tissue testing conducted between 2002 and 2004 via funding provided by the Montrose Settlements Restoration Program (MSRP), the Office of Environmental Health Hazard Assessment developed species and area-specific fish advisories based upon the levels of contaminants identified.

The San Pedro Shelf area and SPSAQ site is located in waters just offshore of the advisory areas shown in Figure 29. DDT and PCBs in sediments remain a significant risk to the marine environment via mobilization into the water column through biological and physical processes and may pose some level of risk for shellfish aquaculture in the San Pedro Shelf area. At the time of testing, the DDT and metabolite levels in the mussels from the SPSAQ site did not exceed the existing NSSP and FDA action levels for DDD, DDE, and DDT.

Figure 29. Map of yellow and red fish advisory zones for Ventura Harbor to San Mateo Point (California Environmental Protection Agency Office of Environmental Health Hazard Assessment, 2009).



POLLUTION SOURCE ASSESSMENT

PERMITTED WASTEWATER TREATMENT PLANT DISCHARGES AND SANITARY SEWER OVERFLOWS

National Shellfish Sanitation Program Model Ordinance and Guidance

The 2023 NSSP MO, Section II, Chapter IV.@.03E.(5) (Prohibited Classification – Wastewater Discharges), states that determination of the size of a prohibited zone around a WWTP outfall shall include "the wastewater's dispersion and dilution, and the time of waste transport to the growing area where shellstock may be harvested." The NSSP has the following guidance to state shellfish control authorities to size prohibited zones around WWTP outfalls according to the following scenarios (United States Food and Drug Administration, 2023):

Scenario 1: In consideration of effluent discharged from a WWTP under **failure conditions** (such as a loss of disinfection or bypass), the prohibited zone should provide a sufficient amount of dilution such that the effluent discharged under failure conditions is diluted to the fecal coliform (FC) standard of 14 FC/100 mL within the harvest area.

OR

Scenario 2: In order to reduce the size of the prohibited zone, a conditionally approved zone may be operated **if** a factor of at least a 1000:1 dilution of effluent from a secondary treatment facility operating within its design parameters is achieved within the prohibited area to mitigate the impact of viruses, **and** there is a sufficient amount of time to close the conditional area to the harvesting of shellfish **before** the effluent discharged at the onset of a failure can travel to the boundaries of the prohibited zone.

Note: the additional area beyond the prohibited zone to be closed under WWTP failure conditions should provide a volume sufficient to dilute the effluent discharged under failure conditions to the FC standard of 14 FC/100 mL within the closed (due to failure) zone (consistent with Scenario 1).

Utilizing a minimum 1000:1 dilution significantly reduces the risk of impacts from enteric viral pathogens when the WWTP is operating within normal operating conditions (NSSP Section IV. Guidance Documents, Chapter IV). In addition to minimum dilution within the prohibited area, adequate detection and response time is needed when any malfunction occurs to ensure that all harvesting ceases and closures are enforced, so that contaminated product does not reach the market (or the depuration facility). "Normal" is defined in the Guidance as: "operating fully within the plant's design specifications, including design flows; treatment stages; disinfection; as well as compliance with all permit conditions that relate to the WWTPs effectiveness in reducing enteric viruses in sewage."

When classifying shellfish growing areas using a traditional hydrographic dye dilution methodology, areas having a dilution equivalent to FC concentrations greater than 88 FC/100 mL indicate microbial water quality consistent with that established for a prohibited classification under the NSSP MO. Areas having a dilution equivalent to FC concentrations ranging from 14 to 88 MPN/100ml indicate water quality consistent with a restricted classification. Typically, shellfish harvested from areas classified as restricted would be utilized for controlled depuration or relay according to the NSSP MO. Shellfish harvested from waters classified as restricted would require relay to an approved or conditionally approved growing area (in open status) prior to harvest, to allow shellfish to naturally eliminate bacteria and viruses. Another option would be to transfer shellfish to a land-based facility for controlled depuration. Areas having a dilution equivalent to FC concentrations less than 14 FC/100 mL indicate microbial water quality consistent with that established for the approved classification under the NSSP MO, suitable for direct harvest of shellfish with no additional depuration process required.

ASSESSMENT OF PERMITTED WASTEWATER TREATMENT PLANTS (WWTP)

According to the EPA Enforcement and Compliance Online (ECHO) monitoring data download for 2013 to 2022, FC in the OCSD outfall #1 effluent ranged from 1.5×10^5 – 5.4×10^6 FC/100 mL (Table 11). Although the OCSD routinely operates within the conditions of the NPDES permit, the level of FC discharged from outfall #1 is consistent with wastewater that receive little to no disinfection. Currently, the OCSD does not implement a FC discharge limit for outfall #1. During 2018, FC values reached a maximum of 5.4×10^6 MPN/100mL (Table 11). This FC concentration was reported in both August and November of 2018 and represents a 54.3% increase over the previously reported 2015 maximum value of 3.5×10^6

MPN/100mL. The 2018 maximum FC value was applied to updated hydrodynamic modeling during the 2024 sanitary survey analysis and is discussed in Section VII. C. Scenario 5.

During 2019, OCSD flows reached a maximum value of 222.09 MGD (Table 12). This maximum flow value was observed in February of 2019 and represents an 8.9% increase over the previously reported 2013 maximum of 203.91 MGD used by FDA when conducting the sanitary survey in 2017.

Table 11. Summary OCSD outfall #1 effluent data 2013 to 2021 daily maximum fecal coliform (FC) in MPN/100mL. Data downloaded from EPA ECHO (United States Environmental Protection Agency, 2022). FC equals fecal coliform. MPN stands for Most Probable Number and is an estimate of the number of fecal coliform organisms per 100 milliliters.

Year	FC Max of DMR Value (MPN/100mL)	FC Average of DMR Value (MPN/100mL)
2013	1.60×10^6	2.15×10^5
2014	9.20×10^5	2.28×10^5
2015	3.50×10^6	3.68×10^5
2016	1.30E+06	2.47×10^5
2017	2.40E+06	6.64×10^5
2018	**5.40×10^6**	1.26×10^6
2019	3.50×10^6	9.40×10^5
2020	3.50×10^6	7.62×10^5
2021	3.50×10^6	9.68×10^5

Table 12. Summary OCSD outfall #1 effluent data 2013 to 2021 daily maximum flow in MGD. Data downloaded from EPA ECHO (United States Environmental Protection Agency, 2022)

Flow, in conduit or thru treatment plant	Max of DMR Value (MGD)	Average of DMR Value (MGD)
2013	203.16	115.71
2014	202.65	116.98
2015	177.22	102.54
2016	185.22	99.07
2017	203.91	104.79
2018	193.49	101.22
2019	**222.09**	107.66
2020	200.25	103.58
2021	196.87	98.78

NPDES permit # CA0110604 compliance history for January 1, 2018, through June 22, 2022, was assessed using the EPA ECHO system. According to the data, there were no compliance violations during the period of review for any of the permit criteria. All parameters monitored were assessed; however, only FC and flow are presented here (Table 13), as these are the most critical parameters to be evaluated for impacts to shellfish growing waters.

Table 13. OCSD effluent compliance history 2018 to 2022 for flow and fecal coliform (FC) data. Data downloaded from EPA ECHO (United States Environmental Protection Agency, 2022)

NPDES ID	Start Date	End Date	Outfall Number	Parameter Desc	Max Violation Status	Compliance Status
CA0110604	1/1/2018	6/10/2022	1	Flow, in conduit or thru treatment plant	No Violation Identified	No Violation Identified
CA0110604	1/1/2018	6/10/2022	1	Coliform, fecal general	No Violation Identified	No Violation Identified
CA0110604	1/1/2018	6/10/2022	2	Flow, in conduit or thru treatment plant	No Violation Identified	No Violation Identified
CA0110604	1/1/2018	6/10/2022	2	Coliform, fecal general	No Violation Identified	No Violation Identified
CA0110604	1/1/2018	6/10/2022	INF1	Flow, in conduit or thru treatment plant	No Violation Identified	No Violation Identified
CA0110604	1/1/2018	6/10/2022	INF2	Flow, in conduit or thru treatment plant	No Violation Identified	No Violation Identified

Based on the 2022 review of the OCSD discharge monitoring and compliance data, there was a decline in the microbiological water quality of the OCSD discharge since the 2017 sanitary survey. The OCSD discharge remains a pollution source, and hydrodynamic models were updated for this review based upon the most recent monitoring data. Modeled impacts from the OCSD collection system and outfall are discussed in section 7.3.3.

Hydrodynamic Modeling of Pollution Event Impacts to San Pedro Shelf and SPSAQ Site

Various pollution event scenarios were modeled using DHI's MIKE 21 hydrodynamic modeling software with inputs based on OCSD NPDES permit records, California State Water Resources Control Board (CSWRCB) historical data, USGS river gauge data, and white-paper and peer-reviewed literature values for vessel discharge FC levels and discharge rates. The objectives of hydrodynamic modeling were to:

- Quantitively predict FC concentrations in the study area considering various concentrations in the discharged effluent and duration of discharge events from OCSD WWTP outfall #1;
- Quantitively predict FC concentrations in the study area based on available water quality data from the Los Angeles River;
- Quantitively predict FC concentrations in the study area based on data from available literature for cargo ships, oil tankers, and cruise ship discharges; and
- Assess the impacts of modeled pollution events on the SPSAQ site and San Pedro Shelf area according to NSSP MO FC criteria for shellfish growing areas in the approved classification.

FC and flow rate data reported for the OCSD WWTP outfall #1 was utilized for hydrodynamic modeling inputs, including arithmetic mean, geometric mean, and 90th percentile FC concentrations and flow rates (United States Environmental Protection Agency, 2022). Summary statistics were calculated and presented in Table 14.

Table 14. FC Concentration and Flow from OCSD Outfall #1 (MPA = Most Probable Number; GM = geometric mean; MGD = millions of gallons per day). (United States Environmental Protection Agency, 2022).

Parameter	Arithmetic Mean	GM	90th Percentile	Max. value
Flow Rate (MGD)	102.84	100.37	130.89	203.91 (2017)
FC (MPN/100ml)	106,165	33,039	230,000	3,500,000 (2015) 5,400,000 (2018)

Currently, there are no FC permit limits established for the OCSD WWTP outfall #1 effluent (only for outfall #2 which is closer to shore), and the level of FC discharged from outfall #1 is consistent with wastewater discharges that receive little to no disinfection. Thus, instead of applying a 1000:1 dilution criteria (which assumes complete and effective disinfection) to assess the impact of the WWTP OCSD discharge to the SPSAQ site and surrounding San Pedro Shelf area, actual FC and flow records were used in conjunction with the NSSP water quality standards for shellfish growing area classifications. FC concentrations and flow rates used in the computer modeled scenarios were based on a review of historical OCSD WWTP monitoring records (Table 11 and Table 12).

Six (6) scenarios were modeled for this sanitary survey report. Values applied in models were selected from a combination of environmental data, microbiological data, and literature values (Table 17) and represent realistic adverse conditions for the San Pedro Shelf waters. The simulation period for the modeled scenarios was 15 days. A decay rate of K = 0.25 per day was applied to all modeled scenarios (Hellweger & Masopust, 2008). See Section 5.4 of this report for additional information on decay rates.

Scenario 1: Anchored Cargo Vessel Discharge

The impacts of a stationary cargo vessel sewage discharge were modeled in Scenario 1. A literature review of cargo vessel sewage discharges was performed to identify typical FC levels, holding tank sizes, and flow rates associated with cargo vessels. Geospatial analysis was performed utilizing the November 16, 2021, AIS vessel data. This date was chosen as it was the time of maximum capacity utilization of the contingency anchorages (Loutit, 2022). The AIS data was used to visually determine the vessel tracks and locations of moored vessels and to identify the closest moored vessel to the SPSAQ site (Figure 30). Vessel labeled 22 was determined to be the closest moored vessel on that day, located 3,396 meters (1.8 NM) from the northeast corner of the SPSAQ site in the San Pedro Shelf area, and the vessel latitude and longitude was used for the location of the discharge in the hydrodynamic model.

The discharge rate used in the hydrodynamic model was 8 m^3/hour, based on the 2013 Alaska Vessel Wastewater Discharge General Permit documentation (Alaska Department of Environmental Conservation, 2013). The maximum sewage holding tank size for a cargo vessel was 47.9 m^3 (Holmberg, 2021). The duration of the modeled release was six (6) hours, calculated using maximum tank size of 48 m^3 divided by the discharge rate of 8 m^3/hour, which equals six (6) hours. The FC concentration used was 52,000,000 FC/100 mL, the maximum FC concentration for cargo vessel discharges reported in Holmberg, 2021.

Under modeled Scenario 1, the SPSAQ site and surrounding San Pedro Shelf area is at risk of being impacted by stationary cargo vessel sewage discharge (Figure 31). The SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (35.53 FC/100 mL) exceed the approved shellfish growing area criteria of 14 FC/100 mL. The described discharge will travel through the San Pedro Shelf area and may reach the SPSAQ site in approximately four (4) hours, reaching a peak concentration approximately seven (7) hours after the discharge event

begins under the modeled conditions. A two-log decrease in FC concentration occurs two (2) days and 13.5 hours after the simulated discharge event ends (Figure 32).

Figure 30. Scenario 1. Cargo vessel AIS tracks used in moored vessel modeling. Vessel 22 is the closest vessel to SPSAQ moored in the contingency anchorage on November 16, 2021.

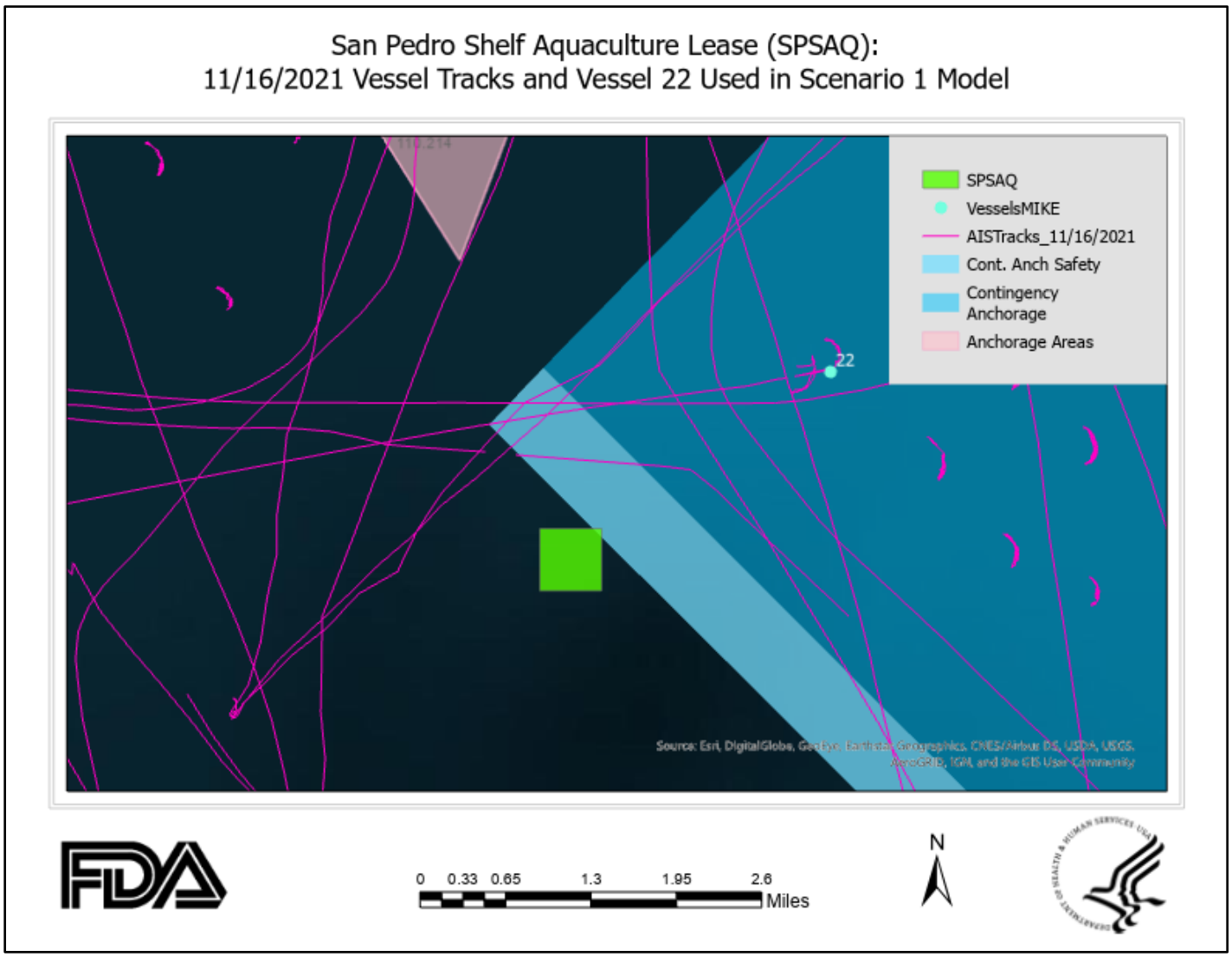


Figure 31. Scenario 1. Impact of the discharge from an anchored cargo vessel on SPSAQ utilizing a maximum FC concentration over a 6-hour pollution event

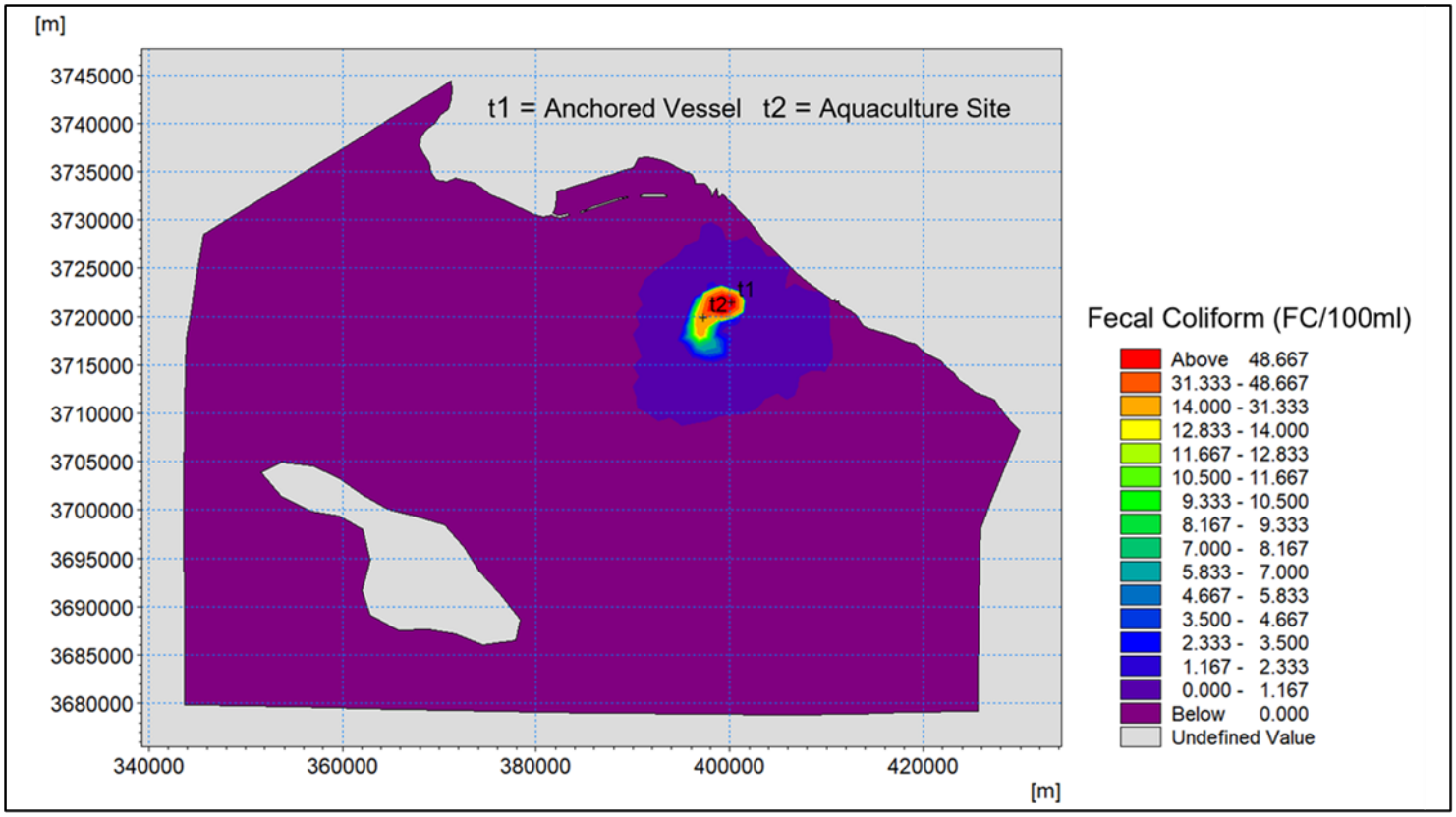
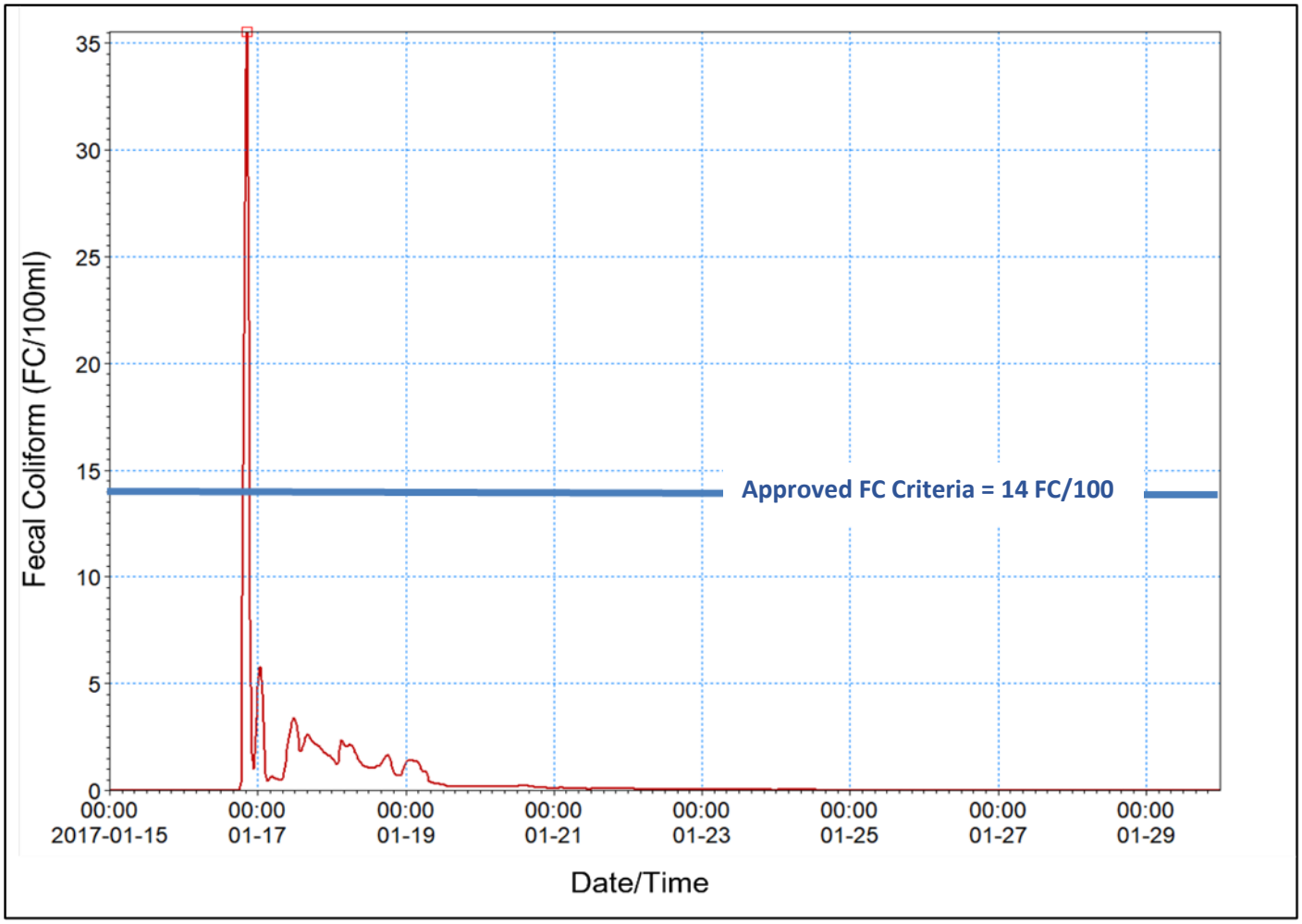


Figure 32. Scenario 1. Impact of an Anchored Cargo Vessel Discharge on Aquaculture Lease with Maximum FC Concentration During a 6-hr Pollution Event



Scenario 2: Moving Cruise Ship Discharge

The impact of a moving cruise ship vessel sewage discharge was modeled in Scenario 2. A literature review of cruise ship sewage discharges was performed to identify typical FC levels and flow rates associated with cruise ships. Geospatial analysis was performed by first extracting cruise ship data from an AIS data set from January 2020. AIS data was used to determine the average speed that a cruise ship would be traveling when coming into harbor (8.89 m/s). A single representative cruise ship track (Figure 33) in the navigational channel within the San Pedro Shelf area closest to the SPSAQ site was selected for modeling (ID IMO9087489 on January 27, 2020). The vessel path was used to extract a series of latitude and longitude points at a distance (0.54 km) that would result in 1-minute, evenly spaced intervals to simulate a discharge occurring while the vessel was moving (Table 15).

Figure 33. Scenario 2. Cruise ship AIS tracks for vessel IMO9087489 from January 27, 2020, applied in moving cruise ship discharge hydrodynamic model.

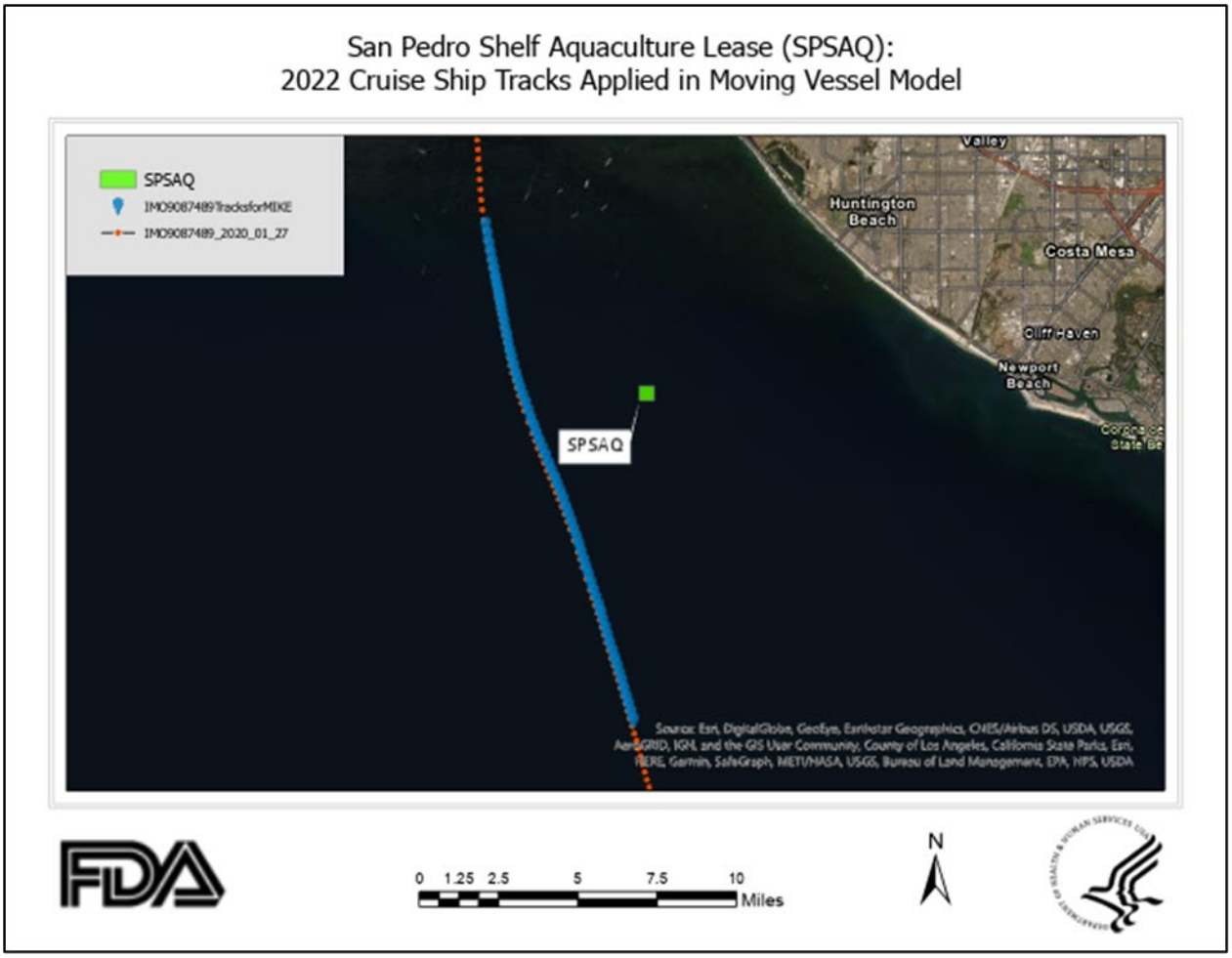


Table 15. Calculations used to develop data points for Scenario 2 moving cruise ship discharge.

Mean Speed Over Ground m/s	Conversion to m/hr	km/hr	Distance Between Points in km for 1 Minute Interval
8.98	32328	32.328	0.54

The discharge rate used in calculations was 50 m^3/hour, based on reference values provided in the 2013 Alaska Vessel Wastewater Discharge General Permit documentation for a large cruise ship (Alaska Department of Environmental Conservation, 2013). The duration of the modeled release was one (1) hour, with the total discharge released at 60 points along the path of the moving vessel. Th FC concentration used in the modeled scenario was 170,000,000 FC/100 mL, the maximum FC concentration for cruise ship discharges reported in Holmberg, 2021.

Under Modeled Scenario 2, the SPSAQ site and surrounding San Pedro Shelf area is at risk of being impacted by sewage discharge from a moving cruise ship vessel Figure 34). The SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (18.11 FC/100 mL) exceed the approved shellfish growing area criteria of 14 FC/100 mL. The described discharge will travel through the San Pedro Shelf area and may reach the SPSAQ site in approximately 10 hours, reaching a peak concentration approximately 21 hours after the discharge event under the

modeled conditions (Figure 35). A two-log decrease in FC concentration occurs 9.46 days after the discharge event ends (Figure 36).

Figure 34. Scenario 2. Impacts of a cruise ship discharge on SPSAQ with maximum literature value for FC concentration while underway during a modeled 1-hour discharge event. Map indicates the elapsed time 00:00 – 01:00 (period of modeled release).

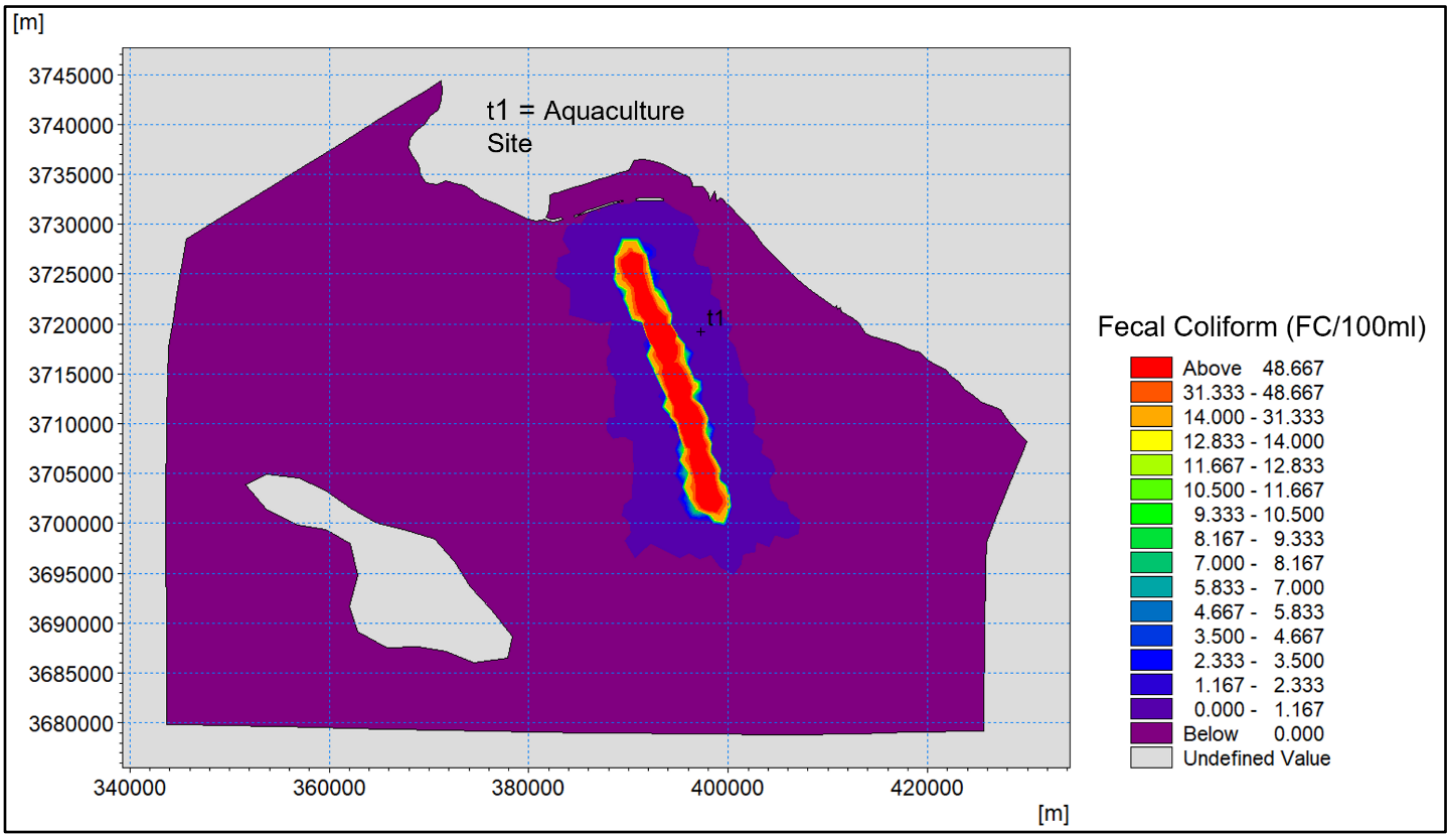


Figure 35. Impact of a Cruise Vessel Discharge on Aquaculture Lease with Maximum FC Concentration During a 1-hr Pollution Event While in Transit. Map Shows Maximum Concentration Reached at Aquaculture Lease 27 hours After Onset of Discharge.

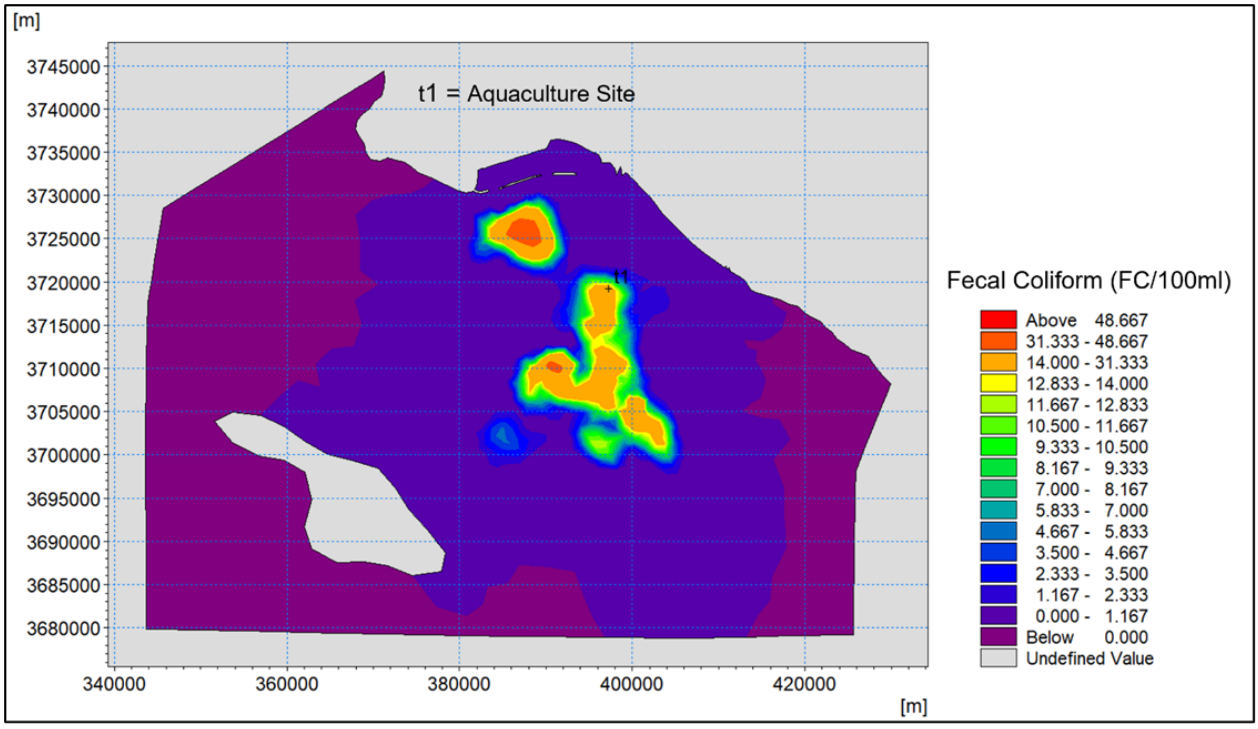
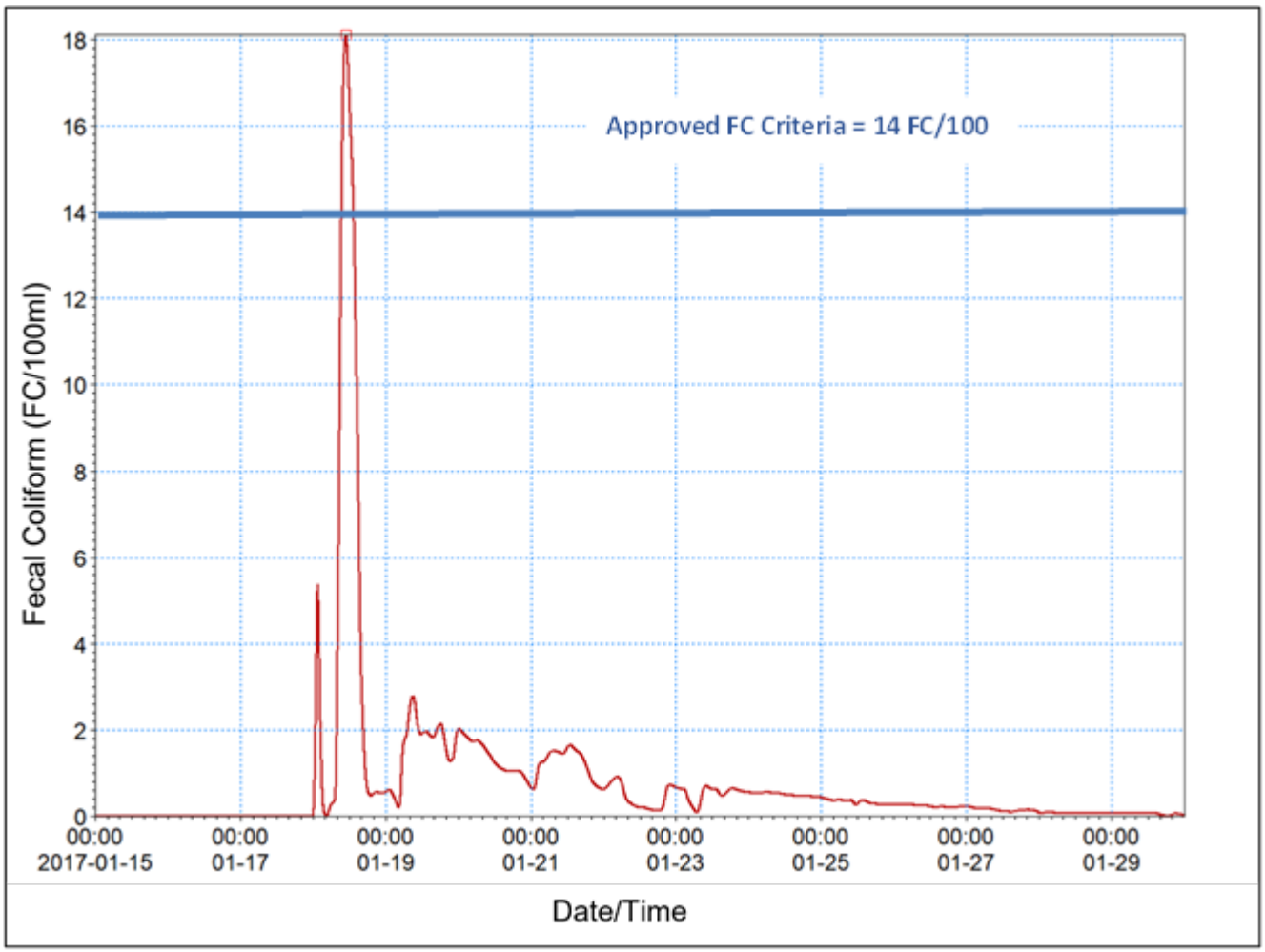


Figure 36. Scenario 2. Impact of a Cruise Vessel Discharge on Aquaculture Lease with Maximum FC Concentration During a 1-hr Pollution Event While in Transit.

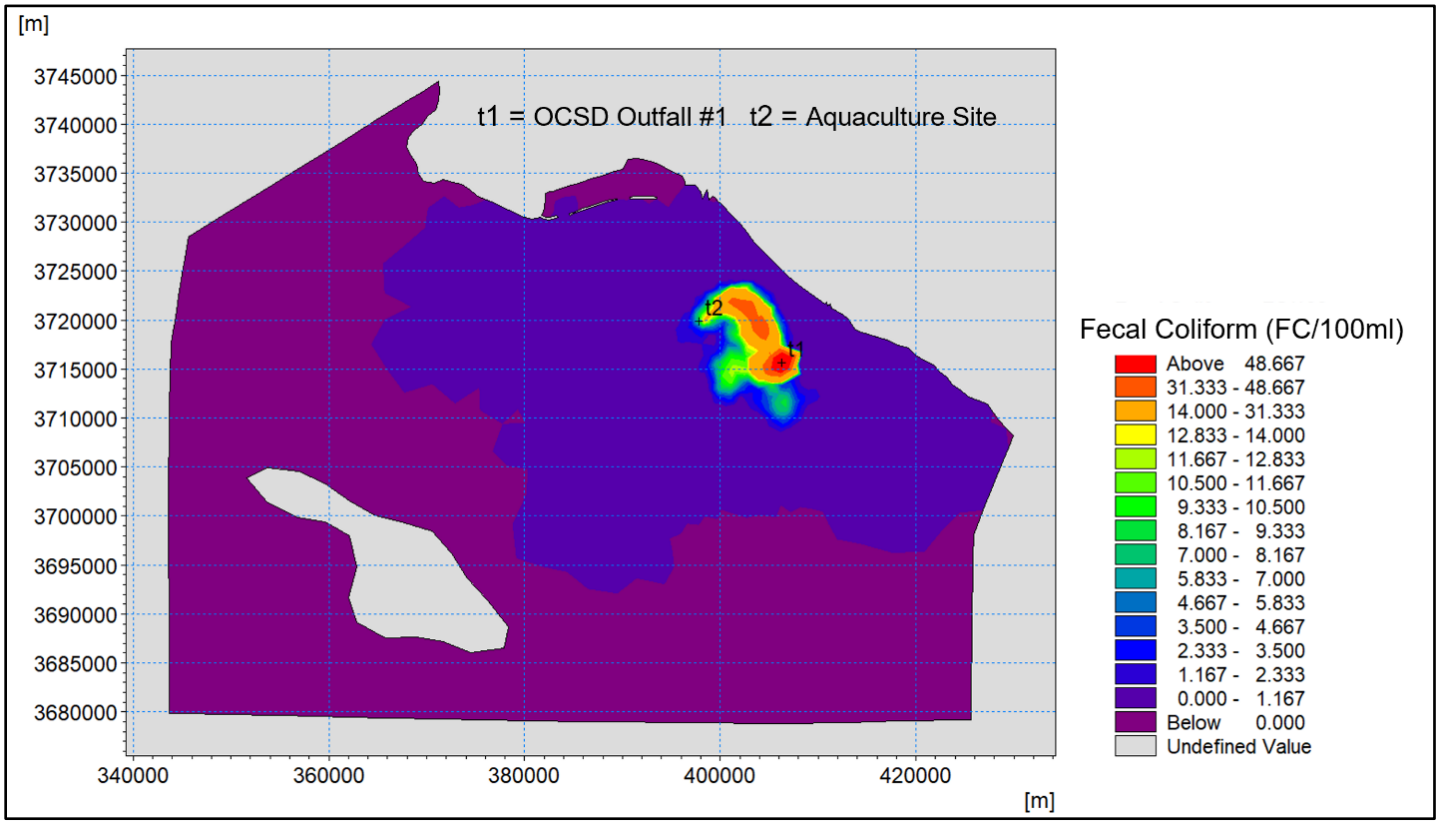


Scenario 3: OCSD WWTP Discharge Pollution Event 1 – 90th Percentile FC and Maximum Daily Flow for 24 Hours

The 90th percentile historical FC concentration (230,000 MPN/100ml) and maximum daily flow (203.91 MGD which occurred on January 22, 2017) from OCSD WWTP outfall #1 was simulated using MIKE 21, applying a bacterial decay rate of K = 0.25 per day (Hellweger & Masopust, 2008), assuming degraded WWTP treatment efficiency over a pollution event duration of 24 hours. The model simulation was run with the 90th percentile FC concentration and maximum flow during the first 24 hours of the simulation, followed by a return to normal operating conditions, applying the geometric mean FC concentration (33,039 MPN/100ml) and geometric mean flow (100.37 MGD) over the remaining 14 days of the 15-day simulation period. Under this scenario, all effluent was assumed to be discharged via outfall #1.

Under this scenario, the SPSAQ site and a portion of the federal waters San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (15.58 FC/100 mL) exceed NSSP approved shellfish growing area criteria of 14 FC/100 mL (Figure 37). A 24-hour pollution event may reach the SPSAQ site and surrounding San Pedro Shelf area in approximately 10 hours, reaching a peak concentration approximately 15 hours after onset of release under modeled conditions (Figure 38).

Figure 37. Impact of an OCSD Discharge on Aquaculture Lease with Maximum Daily Flow and 90th Percentile FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.



Due to model constraints, the residence time of the pollutant relative to the SPSAQ site and San Pedro Shelf occurs at a time later than the modeled 14-day scenario; a two-log decrease in FC concentration occurs at some point beyond 14 days after onset of release under modeled conditions (Figure 39).

These results indicate that OCSD pollution events have the potential to result in microbiological water quality impacts to the SPSAQ site and surrounding San Pedro Shelf area which would result in exceedance of the NSSP standards established for the approved shellfish growing area classification.

Scenario 4: OCSD WWTP Discharge Pollution Event 2 – Maximum FC and Maximum Daily Flow for 24 Hours

The maximum historical FC concentration from 2017 (3,500,000 MPN/100ml) and maximum daily flow (203.91 MGD which occurred on January 22, 2017) from OCSD WWTP outfall #1 was simulated using MIKE 21, applying a bacterial decay rate of K = 0.25 per day (Hellweger & Masopust, 2008), assuming degraded WWTP treatment efficiency over a pollution event duration of 24 hours. The model simulation was run with the maximum FC concentration and maximum flow during the first 24 hours of the simulation, followed by a return to normal operating conditions, applying the geometric mean FC concentration (33,039 MPN/100ml) and geometric mean flow (100.37 MGD) over the remaining 14 days of the 15-day simulation period. Under this scenario, all effluent was assumed to be discharged via outfall #1.

Under the conditions modeled under Scenario 4, the SPSAQ site and surrounding San Pedro Shelf area is at risk of being impacted by OSCD discharge (Figure 39). The SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone

where modeled FC concentrations (160.64 FC/100 mL) exceed approved shellfish growing area criteria of 14 FC/100 mL (Figure 39). A 24-hour pollution event may reach the SPSAQ site and surrounding federal waters portion of the San Pedro Shelf area in approximately 13 hours, reaching a peak concentration approximately 44 hours after onset of release under modeled conditions (Figure 40). A two-log drop in FC concentration occurs approximately 11 days after the end of the pollution event under the modeled conditions.

Figure 38. Impact of an OCSD Discharge on Aquaculture Lease with Maximum Daily Flow and 90th Percentile FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.

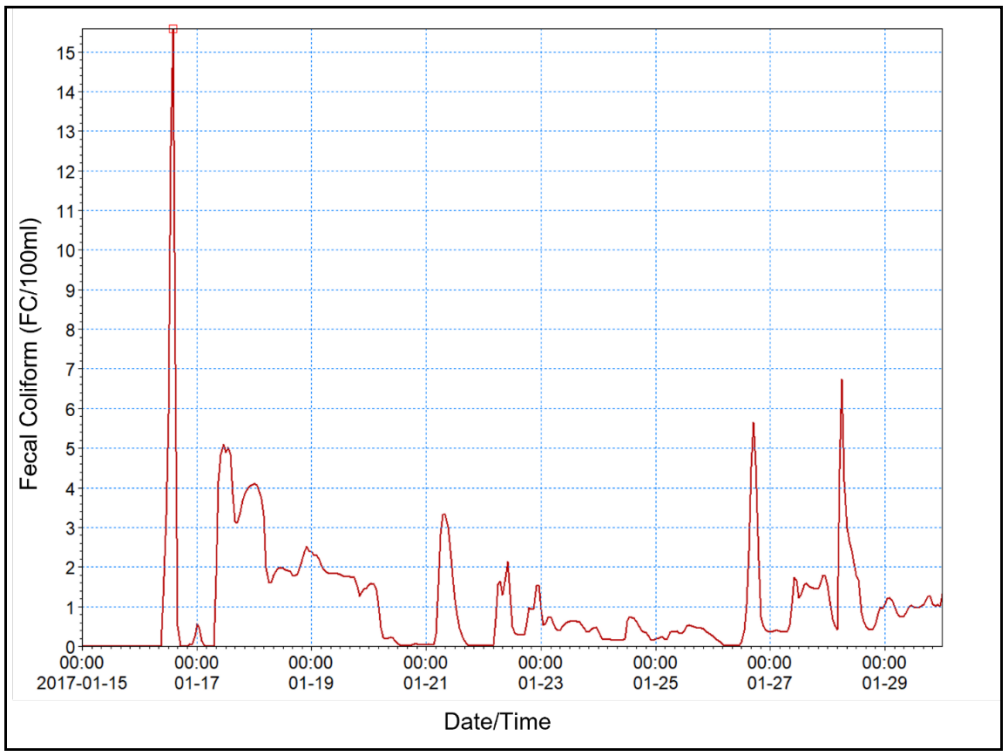


Figure 39. Scenario 4. Impact of an OCSD Discharge on Aquaculture Lease with Maximum Daily Flow and Maximum FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.

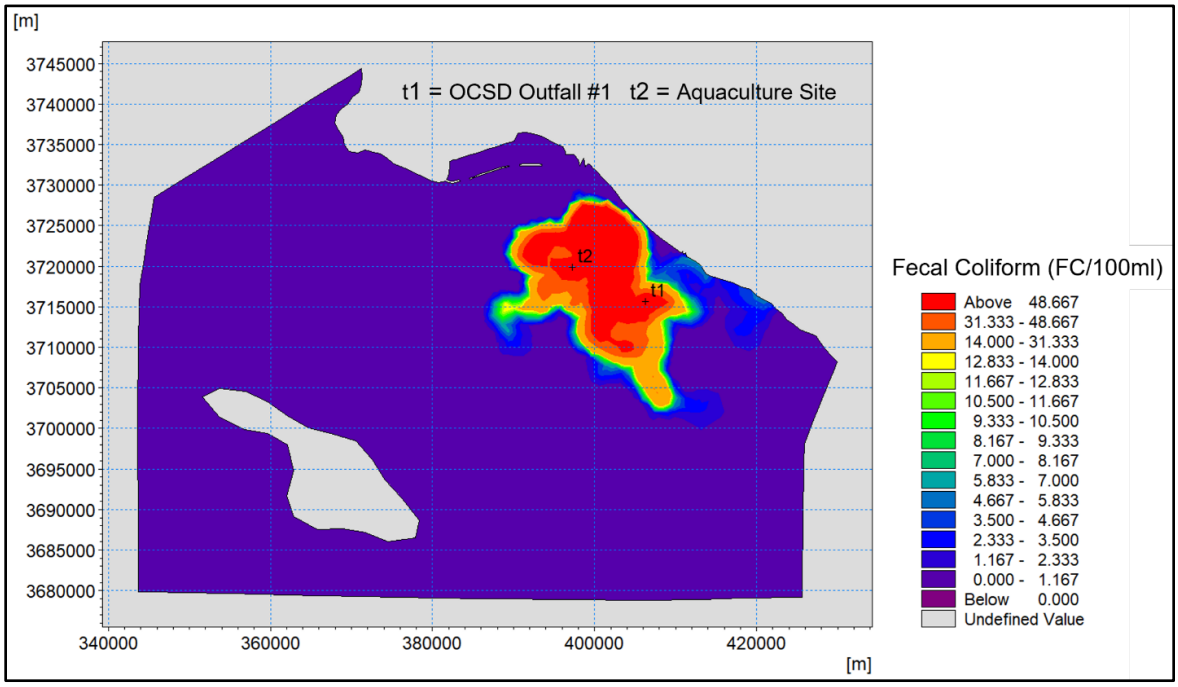
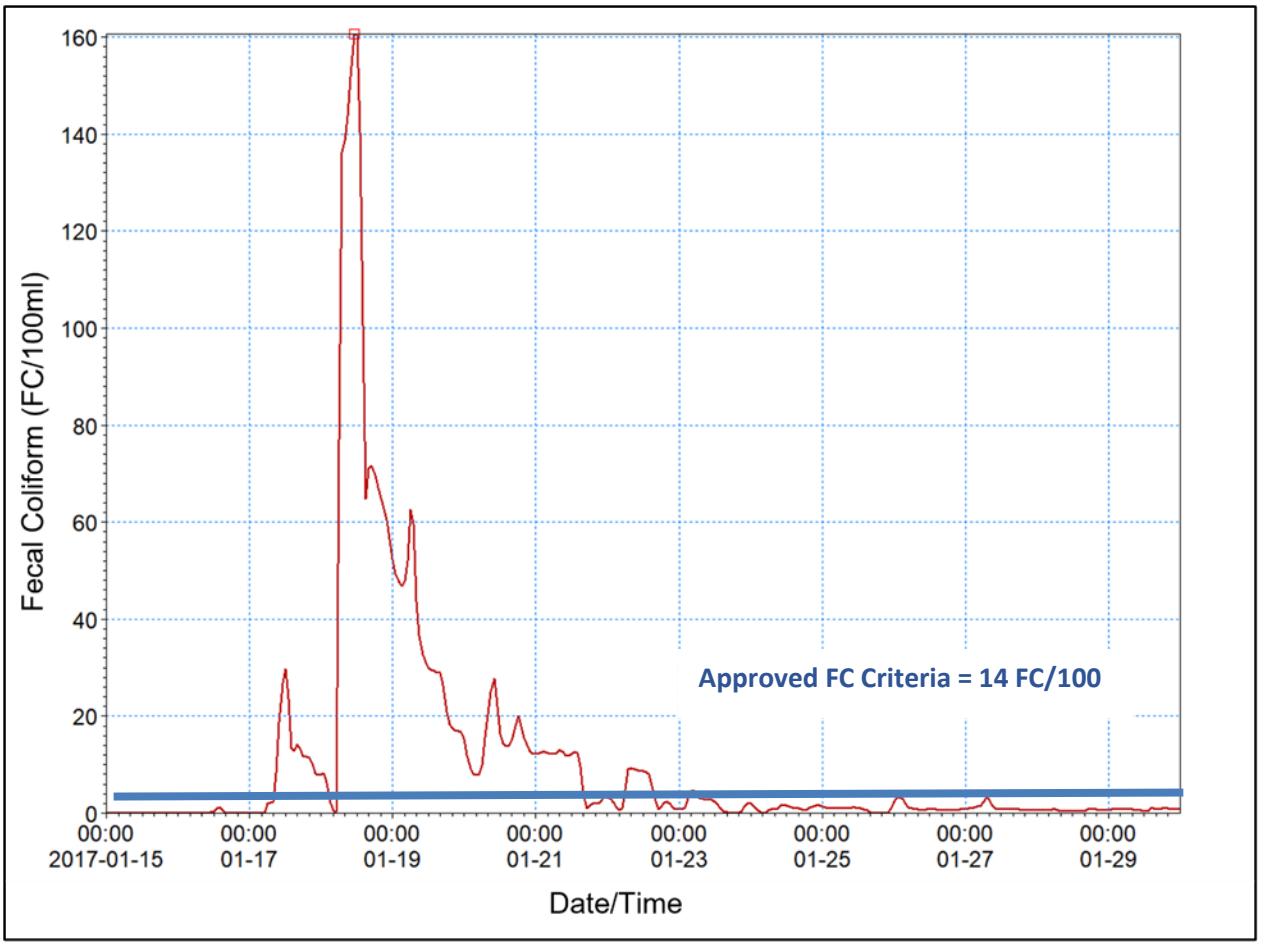


Figure 40. Scenario 4. Impact of an OCSD Discharge on Aquaculture Lease with Maximum Daily Flow and Maximum FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.



These results indicate that OCSD WWTP effluent discharge pollution events may result in microbiological water quality impacts to the SPSAQ site and surrounding San Pedro Shelf area which would result in exceedance of the NSSP standards established for the approved shellfish growing area classification.

Scenario 5: OCSD WWTP Discharge Pollution Event 3 – Maximum 2018 FC and Maximum Daily Flow for 24 hours

The maximum historical FC concentration in 2018 (5,400,000 MPN/100ml) and maximum daily flow (203.91 MGD which occurred on January 22, 2017) from OCSD WWTP outfall #1 was simulated using MIKE 21, applying a bacterial decay rate of K = 0.25 per day (Hellweger & Masopust, 2008), assuming degraded WWTP treatment efficiency over a pollution event duration of 24-hours. The model simulation was run with the maximum FC concentration and maximum flow during the first 24-hours of the simulation, followed by a return to normal operating conditions, applying the geometric mean FC concentration (33,039 MPN/100ml) and geometric mean flow (100.37 MGD) over the remaining 14 days of the 15-day simulation period. Under this scenario, all effluent was assumed to be discharged via outfall #1.

Under the conditions modeled under Scenario 5, the SPSAQ site and the surrounding federal waters portion of the San Pedro Shelf area is at risk of being impacted by OCSD discharge. The SPSAQ site and surrounding area falls within a dilution zone where modeled FC concentrations (173.27 FC/100 mL) exceed approved shellfish growing area criteria of 14 FC/100 mL (Figure 41). A 24-hour pollution event may reach the SPSAQ site in approximately 18 hours, reaching a peak

concentration approximately 23 hours after onset of release under modeled conditions (Figure 42). A two-log decrease in FC concentration occurs approximately 12.25 hours after the end of the pollution event under the modeled conditions.

These results indicate that OCSD pollution events may result in microbiological water quality impacts to the SPSAQ site and surrounding San Pedro Shelf area which would result in exceedance of the NSSP standards established for the approved shellfish growing area classification.

Figure 41. Scenario 5. Impact of an OCSD Discharge on Aquaculture Lease with Maximum Daily Flow and Maximum FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.

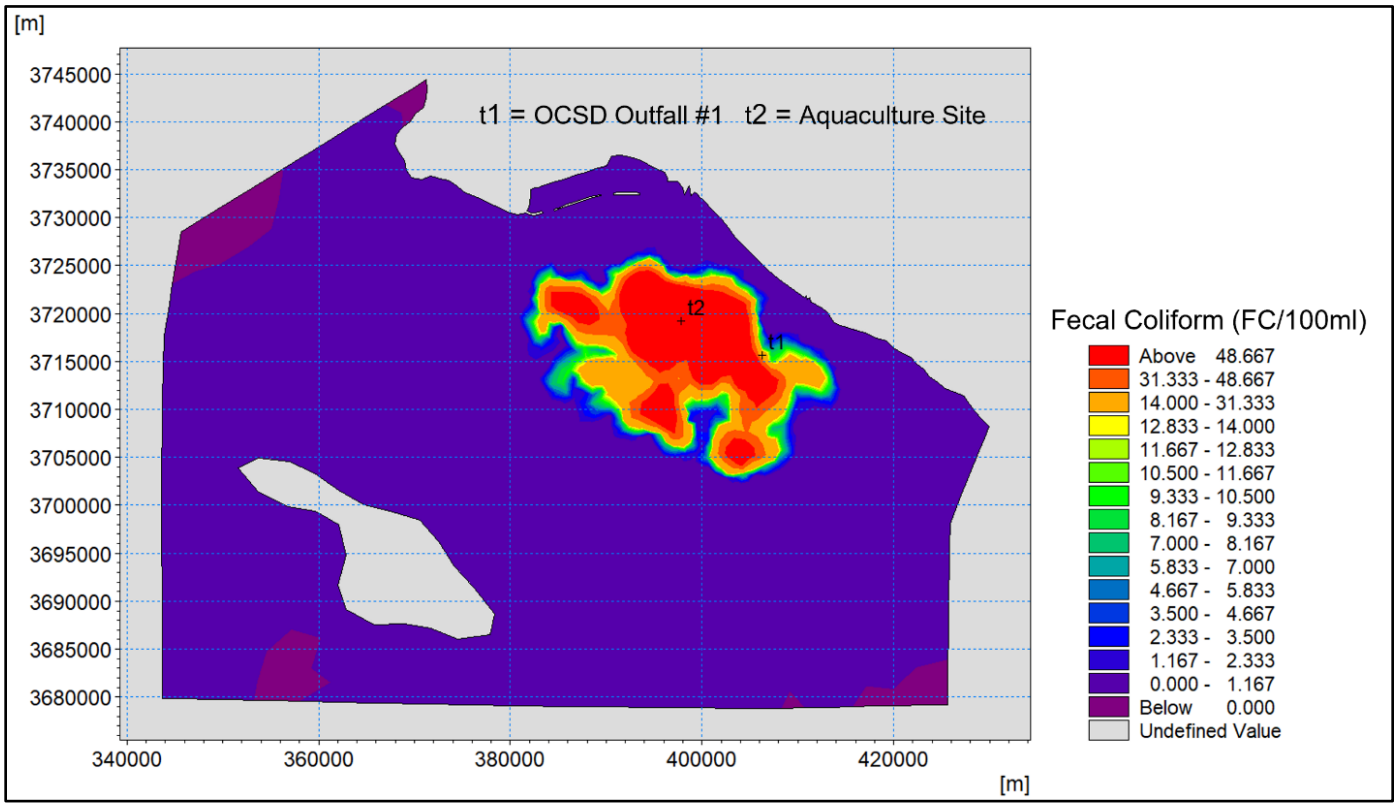
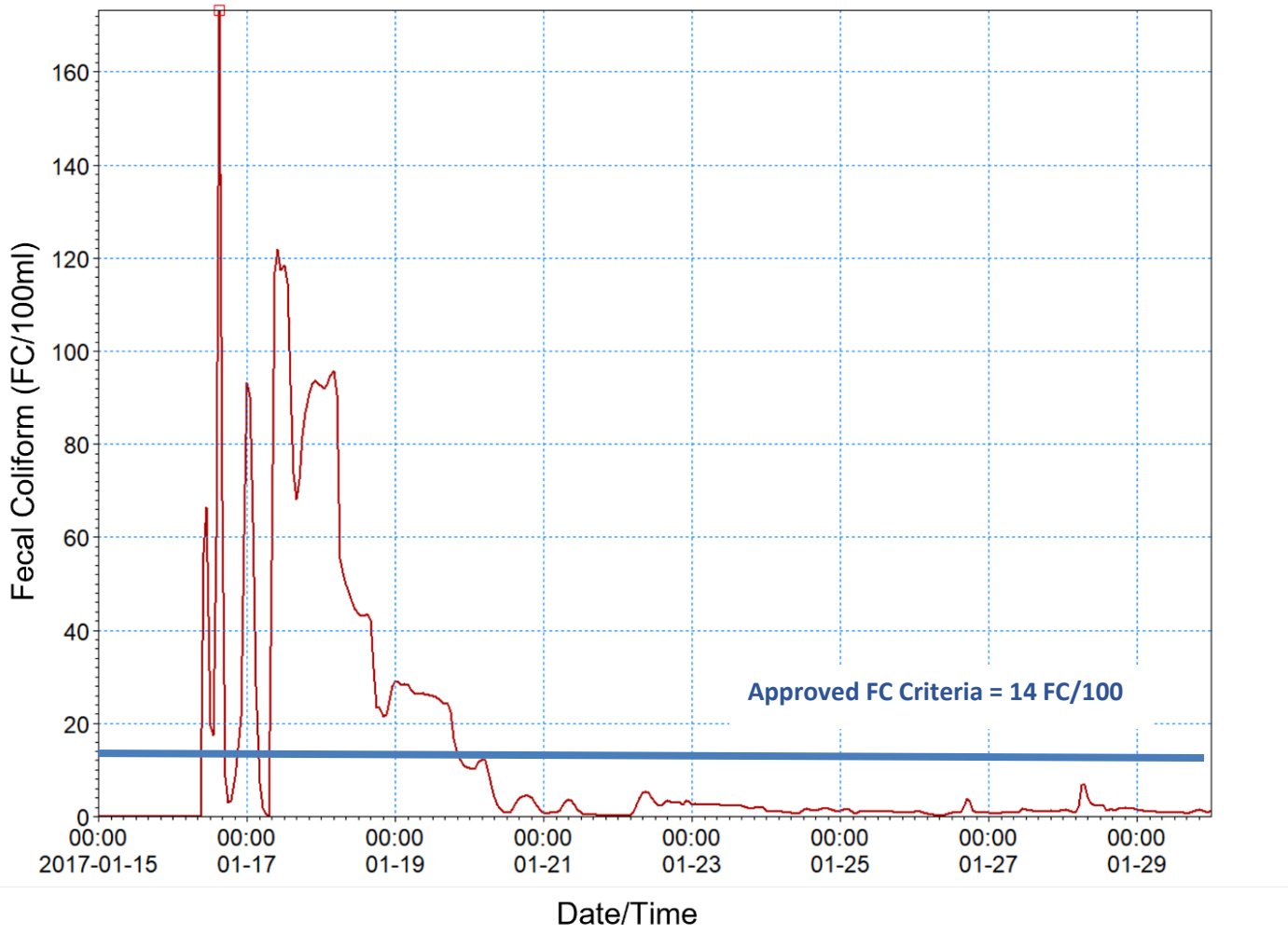


Figure 42. Scenario 5. Impact of an OCSD Discharge on Aquaculture Lease with Maximum Daily Flow and Maximum FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.



Scenario 6: Sanitary Sewer Overflows Into Los Angeles River

The impacts of the Los Angeles River on the SPSAQ site and surrounding federal waters portion of the San Pedro Shelf were modeled in Scenario 6. As the SSOs discharge into the Los Angeles River and not directly into the ocean, in this scenario, MIKE 21 was applied to simulate potential bacteriological impacts to the SPSAQ site and San Pedro Shelf from the Los Angeles River as described: applying 90th percentile FC concentration for 24 hours (2,200,000 FC/100 mL) and the geometric mean FC for the remaining 14 days (240,000 FC/100 mL) and applying a bacterial decay rate of K = 0.25 per day (Hellweger & Masopust, 2008). The Los Angeles River flow modeled was the 15-day period as recorded at the Los Angeles River USGS gauge (USGS 11092450 Los Angeles River at the Sepulveda Dam), where modeled flow rates ranged from 2.39 to 475 m^3/s (United States Geological Service, 2022), which includes the highest flow rate that occurred during the model time frame constraints. FC data was obtained from the Los Angeles River TMDL (1997-2007) (California Regional Water Quality Control Board Los Angeles Region, 2010). This older TMDL data set was the most complete record of observations available for FC data, which is why the data was used for the analysis.

Under modeled Scenario 6, the growing area FC criteria for the approved area classification is exceeded. The SPSAQ site and federal waters portion of the San Pedro Shelf falls within a dilution zone where modeled FC concentrations (4659.81

FC/100 mL) exceed approved shellfish growing area criteria of 14 FC/100 mL. (Figure 43). The maximum FC concentration of 4659.81 FC/100 ml is reached at the site approximately 3 days and 16 hours after the modeled discharge event (Figure 44). A 2-log decrease in FC concentration occurs approximately 9 days 15 hours after onset of the discharge, and a 3-log decrease occurs longer than 14 days after the onset of the discharge.

Due to model constraints, the residence time of the pollutant relative to the SPSAQ site and surrounding area could not be simulated under the 14-day scenario. In the future, constraining the model to 21 or 30 days would better define the total residence time of the pollutant at the SPSAQ site and surrounding area.

Table 16. Los Angeles River Dry and Wet Weather Data from TMDL (1997-2007). Scenario 6 modeled FC levels are highlighted.

Parameter	Dry Mean	Dry GM	Dry 90%	Dry 75%	Dry Max	Wet Mean	Wet GM	Wet 90%	Wet 75%	Wet Max
Flow Rate (MGD)	244	87	626	118	1719	1923	1090	4957	2571	8883
FC (MPN/100ml)	1,201,070	5,700	240,000	50,000	24,000,000	1,065,503	240,000	2,200,000	650,000	3,000,000

Figure 43. Scenario 6. Impact of an LA River Discharge on Aquaculture Lease with Pollution Event Flow and 90th Percentile FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.

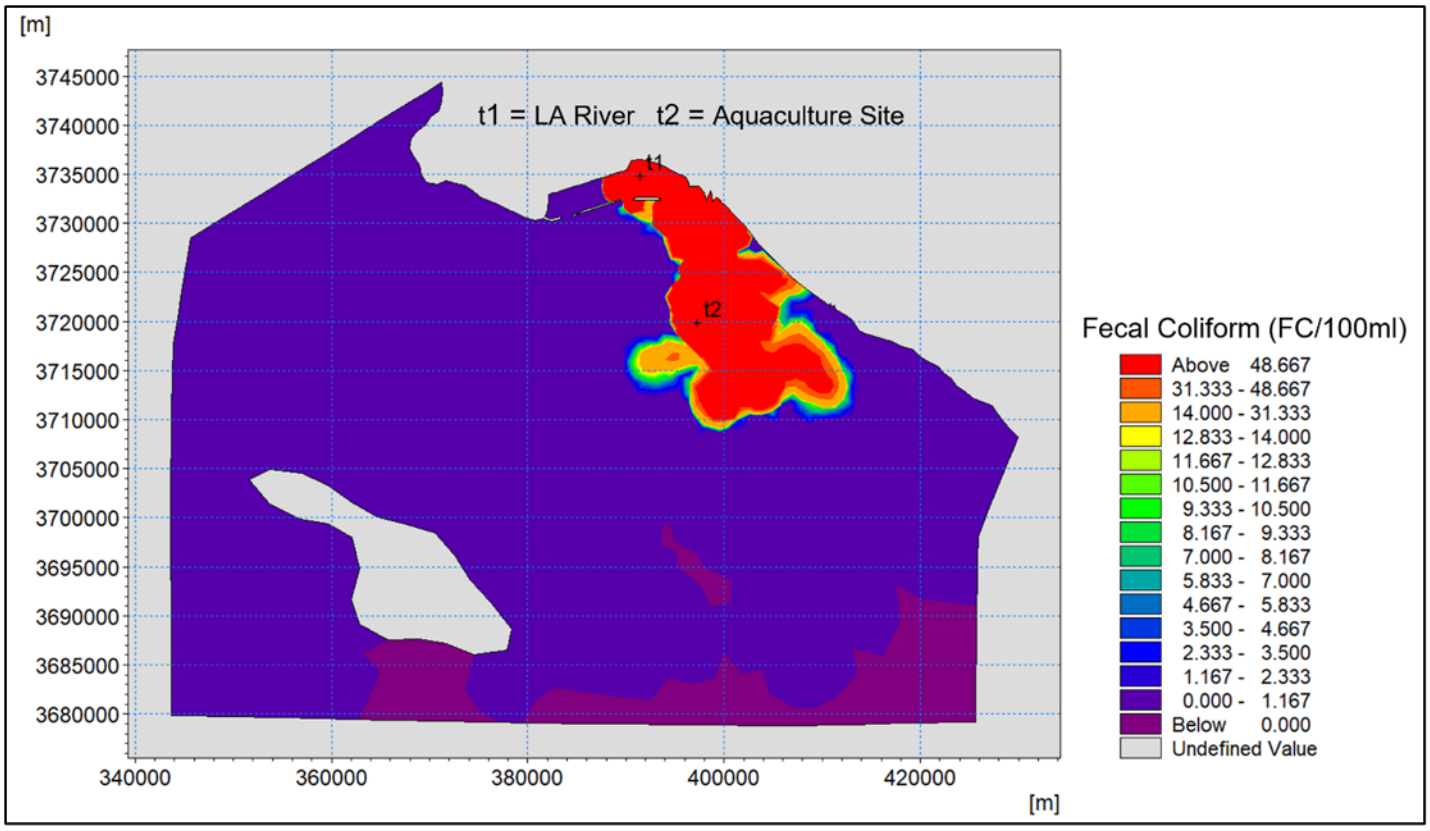


Figure 44. Scenario 6. Impact of an LA River Discharge on Aquaculture Lease with Pollution Event Flow and 90th Percentile FC Concentration During a 24-hr Pollution Event and Geometric Mean Flow and FC Concentration for Remaining Simulation Period.

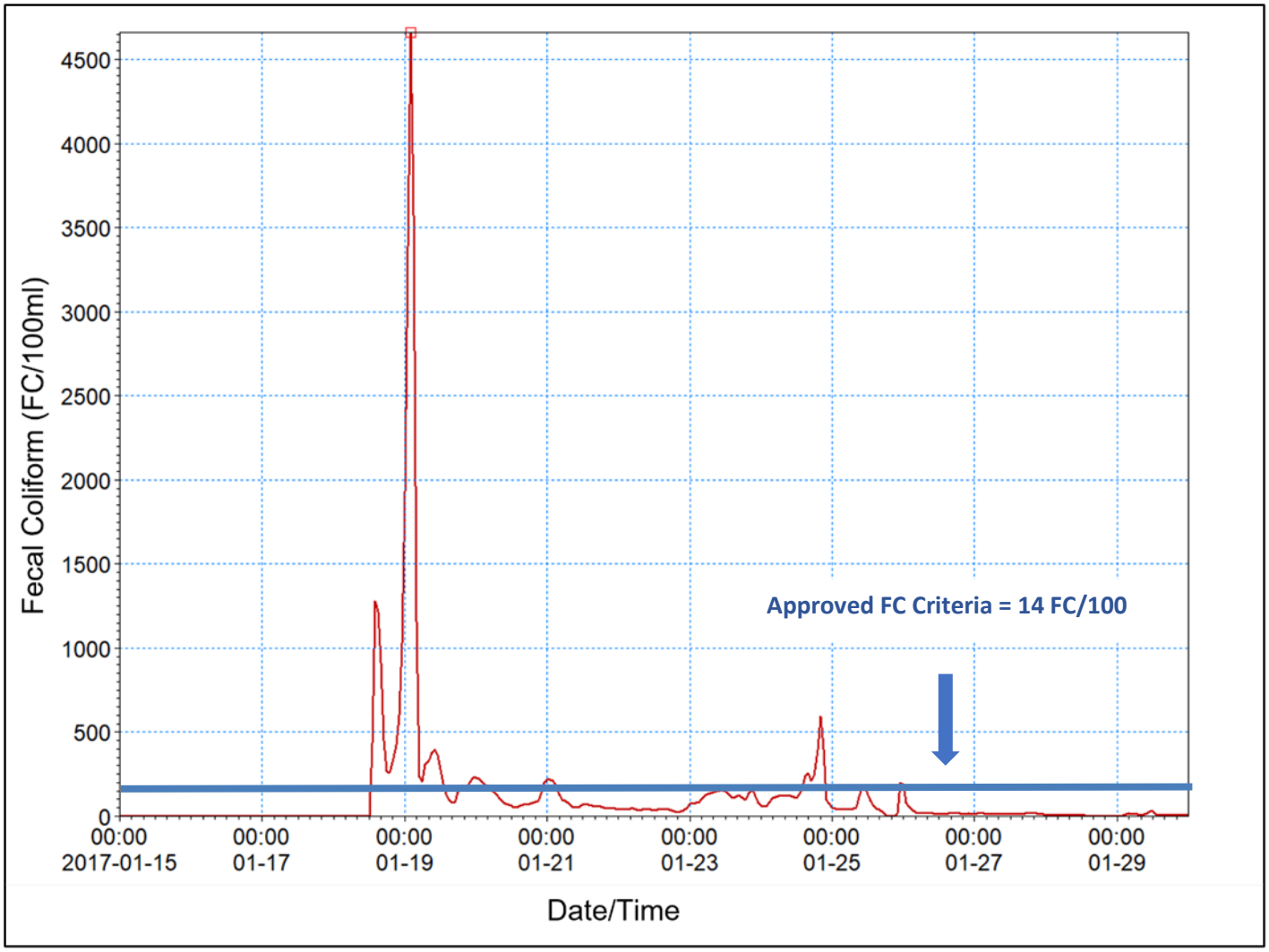


Table 17. Summary of Modeled Scenarios (GM = geometric mean; FC = fecal coliform; MGD = millions of gallons per day).

Scenarios	Modeled Event	FC Concentration (MPN/100ml)	Modeled Flow/Discharge Rate	Decay (K per day)	Modeled FC Concentration at Site FC/100mL	Modeled FC concentration meets Approved criteria of 14 FC/100mL?
1	**Anchored Cargo Vessel**	Highest Cargo Ship FC Sample on Record for 6 hours = 52,000,000	Typical Discharge Rate for 6 hours = 8 m^3/hr	K = 0.25	35.53 FC/100 mL	NO
2	**Moving Cruise Ship**	Highest Cruise Ship FC Sample on Record for 1 hour = 170,000,000	Typical Discharge Rate for 1 hour = 50 m^3/hr	K = 0.25	18.11 FC/100 mL	NO
3	**OCSD Pollution Event**	90th Percentile FC for 24 Hours = 230,000; Geometric Mean for Remaining = 33,039	2017 Maximum Daily Flow for 24 Hours = 203.91 MGD; Geometric Mean for Remaining = 100.37 MGD	K = 0.25	15.58 FC/100 mL	NO

Scenarios	Modeled Event	FC Concentration (MPN/100ml)	Modeled Flow/Discharge Rate	Decay (K per day)	Modeled FC Concentration at Site FC/100mL	Modeled FC concentration meets Approved criteria of 14 FC/100mL?
4	**OCSD Pollution Event 1**	Maximum 2017 FC for 24 Hours = 3,500,000; Geometric Mean for Remaining = 33,039	2017 Maximum Daily Flow for 24 Hours = 203.91 MGD: Geometric Mean for Remaining = 100.37 MGD	K = 0.25	160.64 FC/100 mL	NO
5	**OCSD Pollution Event 3**	Maximum 2018 FC Sample on Record for 24 Hours = 5,400,000; Geometric Mean for Remaining = 33,039	2017 Maximum Daily Flow for 24 Hours = 203.91 MGD; Geometric Mean for Remaining = 100.37 MGD	K = 0.25	173.27 FC/100 mL	NO
6	**LA River Pollution Event**	90th Percentile FC for 24 Hours = 2,200,000; Geometric Mean for Remaining = 240,000	Highest Flow Event Range Within 15 Day Dataset = 2.39-475 m^3/s	K = 0.25	4659.81 FC/100 ml	NO

INTERPRETATION OF DATA IN DETERMINING AREA CLASSIFICATION

Oil Production Platforms

The 2021 Platform Elly oil spill is discussed in this report as an example of a documented contamination event that may have presented a significant risk to shellfish aquaculture in the San Pedro Shelf area had there been active production at the site at the time of the spill. The oil production platforms and infrastructure in this area pose a potential risk and concern for shellfish safety. Due to the number of production platforms in the area, and reported aging infrastructure of these facilities, an unknown but elevated risk of future oil spills has the potential to impact shellfish aquaculture operations in the San Pedro Shelf area. Oil spills impacting the San Pedro Shelf area would need to be managed on a case-by-case basis; however, extended site closures while the situation is being assessed and the investigation of the spill by authorities is completed would be required. Following the investigation and assessment of the spill, a recall and destruction of shellfish product may be required. Extensive confirmatory testing of shellfish tissues for a range of potential contaminants associated with the oil spill would be required to establish the safety of shellfish prior to harvest.

Vessel Navigation and Potential Discharges

Based on the 2022 evaluation of vessel discharges impacting the San Pedro Shelf area, there have been significant increases in the number of vessels between 2017 and 2021, a transition to a greater number of cargo and tanker vessels, and an addition of a permanent overflow anchorage in proximity to the SPSAQ site and throughout the San Pedro Shelf area. These pollution sources adjacent to the SPSAQ site and surrounding San Pedro Shelf area have the potential to impact water quality and impact the classification and/or status of the shellfish growing area.

Updated GIS analysis and hydrodynamic modeling indicate that discharges from both stationary and moving vessels have the potential to impact water quality in the area, and modeled results indicate FC concentrations following a discharge

event would exceed the FC criteria for an approved shellfish growing area. Discharges from vessels are not known or predictable and thus cannot be reasonably managed.

The number of vessels navigating through the San Pedro Shelf area and in within 1 mile of the SPSAQ site increased from 908 to 1,133 between 2017 and 2021, a 25% increase in vessel traffic within 1 mile of the SPSAQ site. The number of cargo vessels navigating within 1 mile of the SPSAQ site increased from 0 in 2017 to 188 during 2021. The number of tanker vessels navigating within 1 mile of the SPSAQ site increased from 0 in 2017 to 46 during 2021.

Hydrodynamic modeling indicates that human waste discharges from both stationary and moving vessels have the potential to impact microbiological water quality throughout the federal waters portion of the San Pedro Shelf area. Results from this modeling exercise indicate that FC concentrations following a discharge event would result in an exceedance of the NSSP FC standards established for the approved shellfish growing area classification.

- When a discharge from a stationary cargo vessel is modeled, the SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (35.53 FC/100 mL) exceed the approved shellfish growing area criteria of 14 FC/100 mL.
- When a discharge from a moving cruise ship is modeled, the SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (18.11 FC/100 mL) exceed the approved shellfish growing area criteria of 14 FC/100 mL.

Human waste discharges from vessels in federal waters are not monitored or predictable and cannot be safely managed. Due to the potential unpredictable direct discharge of human waste from vessels into the SPSAQ site and surrounding San Pedro Shelf area in federal waters, the area does not meet the NSSP requirements for an approved shellfish growing area classification criteria in the open status.

WASTEWATER TREATMENT PLANTS (WWTP)

Based on permit data from the OCSD WWTP effluent, including both outfalls #1 and #2, the OCSD WWTP does not effectively reduce FC indicator bacteria in the final effluent.

Monthly Operating Report permit data from 01/2013 through 12/31/2021 indicates that FC in the OCSD WWTP effluent ranges from 150,000 to 5,400,000 FC/100 mL. Although the OCSD routinely operates within the conditions of the NPDES permit, the level of FC discharged from OCSD WWTP outfall #1 is consistent with wastewater discharges that receive little to no disinfection. Presence of high FC in the final effluent could be an indication that enteric viruses in the final effluent are also high; however, viral indicator data is not available for the WWTP.

Several pollution events from OCSD WWTP outfall #1 were modeled in 2017 and updated for this 2024 sanitary survey assessment. Both the 2017 Scenario 1A and 2022 Scenario 3, 4, and 5 models indicate that the SPSAQ site and surrounding federal waters portion of the San Pedro Shelf would be impacted under the representative pollution events described.

- For the 2017 model, Scenario 1A represented a “worst case” pollution event, modeled using the maximum FC (3,500,000 FC/100 mL) record for 24 hours followed by a return to baseline geometric mean FC (33,039 FC/100mL) for the remaining 14 days of the model. A maximum flow rate of 203.91 MGD was modeled for the entire 15-day model period. No decay rate was applied in the 2017 Scenario 1A.

- For the 2022 model, Scenario 3 represents a comparable but less extreme, less conservative scenario to approximate a pollution event that could occur more routinely. The 2022 Scenario 3 was modeled using the 90th percentile historical FC concentration for 24 hours (230,000 FC/100 mL) rather than the maximum, followed by a return to the geometric mean FC (33,039 FC/10 mL) for the remaining 14 days of the model. The maximum flow rate of 203.91 MGD was run for 24 hours, followed by a return to the geometric mean 100.37 MGD for the remaining 14 days of the model run. In addition, a decay rate of K = 0.25 per day was applied in 2022. Based on the Scenario 3 hydrodynamic modeling result for the OCSD outfall #1 discharge, the SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (15.58 FC/100 mL) exceed approved shellfish growing area criteria of 14 FC/100 mL.
- Scenario 4 was modeled using the maximum historical FC concentration from 2017 (3,500,000 MPN/100ml) and maximum daily flow (203.91 MGD which occurred on 01/22/2017) from the OCSD outfall #1, applying a bacterial decay rate of K = 0.25 per day (Hellweger & Masopust, 2008), and assuming degraded WWTP treatment efficiency over a pollution event duration of 24 hours. The model simulation was run with the maximum FC concentration and maximum flow during the first 24 hours of the simulation, followed by a return to normal operating conditions, applying the geometric mean FC concentration (33,039 MPN/100ml) and geometric mean flow (100.37 MGD) over the remaining 14 days of the 15-day simulation period. Under this scenario, all effluent was assumed to be discharged via outfall #1. Under these modeled conditions, the SPSAQ site and surrounding San Pedro Shelf area is at risk of being impacted by OSCD discharge. The SPSAQ site and surrounding San Pedro Shelf area falls within a dilution zone where modeled FC concentrations (160.64 FC/100 mL) exceed approved shellfish growing area criteria of 14 FC/100 mL.
- Scenario 5 was modeled using the maximum historical FC concentration in 2018 (5,400,000 MPN/100ml) and maximum daily flow (203.91 MGD which occurred on January 22, 2017) from the OCSD outfall #1 applying a bacterial decay rate of K = 0.25 per day (Hellweger & Masopust, 2008), and assuming degraded WWTP treatment efficiency over a pollution event duration of 24-hours. The model simulation was run with the maximum FC concentration and maximum flow during the first 24-hours of the simulation, followed by a return to normal operating conditions, applying the geometric mean FC concentration (33,039 MPN/100ml) and geometric mean flow (100.37 MGD) over the remaining 14 days of the 15-day simulation period. Under this modeled scenario, all effluent was assumed to be discharged via outfall #1. Under the conditions modeled, the SPSAQ site and surrounding San Pedro Shelf area is at risk of being impacted by the OCSD discharge. The SPSAQ site and surrounding area falls within a dilution zone where modeled FC concentrations (173.27 FC/100 mL) exceed approved shellfish growing area criteria of 14 FC/100 mL. A 24-hour pollution event traveling through the San Pedro Shelf area may reach the SPSAQ site in approximately 18 hours, reaching a peak concentration approximately 23 hours after onset of release under modeled conditions. A two-log decrease in FC concentration occurs approximately 12.25 hours after the end of the pollution event under the modeled conditions. These results indicate that OCSD pollution events may result in microbiological water quality impacts to the SPSAQ site and surrounding San Pedro Shelf area which would result in exceedance of the standards established for the approved classification.

These results indicate that OCSD pollution events have the potential to result in microbiological water quality impacts to the SPSAQ site and surrounding federal waters portion of the San Pedro Shelf which would result in exceedance of the NSSP standards established for the approved shellfish growing area classification. These events require additional investigation and assessment to identify appropriate management triggers for the area.

Los Angeles River and Sanitary Sewer Overflows

The largest pollutant load in the San Pedro Shelf area is from the Los Angeles River, which is listed as impaired due to bacteria. During the winter months, rainfall significantly increases the flow in the Los Angeles River, which for comparison,

is several orders of magnitude larger than the WWTP effluent. Data obtained from the Los Angeles River Bacteria TMDL indicate consistently elevated FC levels, primarily during December through March. Reported FC levels in the river have been consistent with those observed in raw sewage.

During the winter months, prevailing winds (NNW) favor pushing river flows entering coastal waters towards the SPSAQ site and federal waters portion of the San Pedro Shelf. The combination of higher river flows, elevated bacterial levels, lower water temperatures, and a generally higher prevalence of norovirus present in the community indicate a higher potential risk for enteric virus contamination of the SPSAQ site and federal waters portion of the San Pedro Shelf area during this period.

Several pollution events from the Los Angeles River and OCSD WWTP outfall #1 were modeled in 2017 and updated for this 2024 sanitary survey assessment.

- 2017 Scenario 5B included the following modeled parameters: OCSD #1 geometric mean FC (33,039 FC/100 mL) and geometric mean flow (100.37) were modeled simultaneously with a Los Angeles River SSO event applying the 90th percentile FC (2,200,000 FC/100 mL) and a 90th percentile flow (3010 MGD); a K = 5 per day was applied in the 2017 Scenario 5B.
- For 2022 Scenario 5, all OCSD #1 parameters were the same as the 2017 Scenario 5B. The Los Angeles River SSO event parameters also applied the same 90th percentile FC (2,200,000 FC/100 mL), however data from an actual high flow river event was modeled using Los Angeles USGS stream gauge data. The 15-day event that was modeled included river flow data ranging from 2.39 to 475 m3/s; adjusting the K = 5 per day decay rate used in the 2017 modeling, a K = 0.25 per day was applied in the 2022 modeling.
- Following a review of the scientific literature, a 0.25 per day decay rate was determined to be appropriate for the pollution sources impacting the San Pedro Shelf growing area, taking into consideration factors including water temperatures, depth of shellfish resources, location of WWTP outfall at 195-foot depth, and the effect of sunlight on viral decay.

The 2022 hydrodynamic modeling indicates that when historical flow and FC data for the Los Angeles River is considered and a decay rate of K = 0.25 per day is applied, the FC criteria for the approved shellfish growing area classification is exceeded at the SPSAQ site and a large federal waters portion of the San Pedro Shelf. The time of travel for pollution from the modeled discharge to reach the SPSAQ site and surrounding area is approximately 3 days and 2 hours. The maximum FC concentration of 4659.81 FC/100 ml is reached at the site approximately 3 days and 16 hours after the modeled discharge.

A representative pollution event originating from the Los Angeles River would result in a maximum FC concentration exceeding the NSSP established FC criteria for the approved growing area classification under the modeled conditions.

CONCLUSIONS AND RECOMMENDATIONS FOR IMPROVEMENT OF SANITARY SURVEY

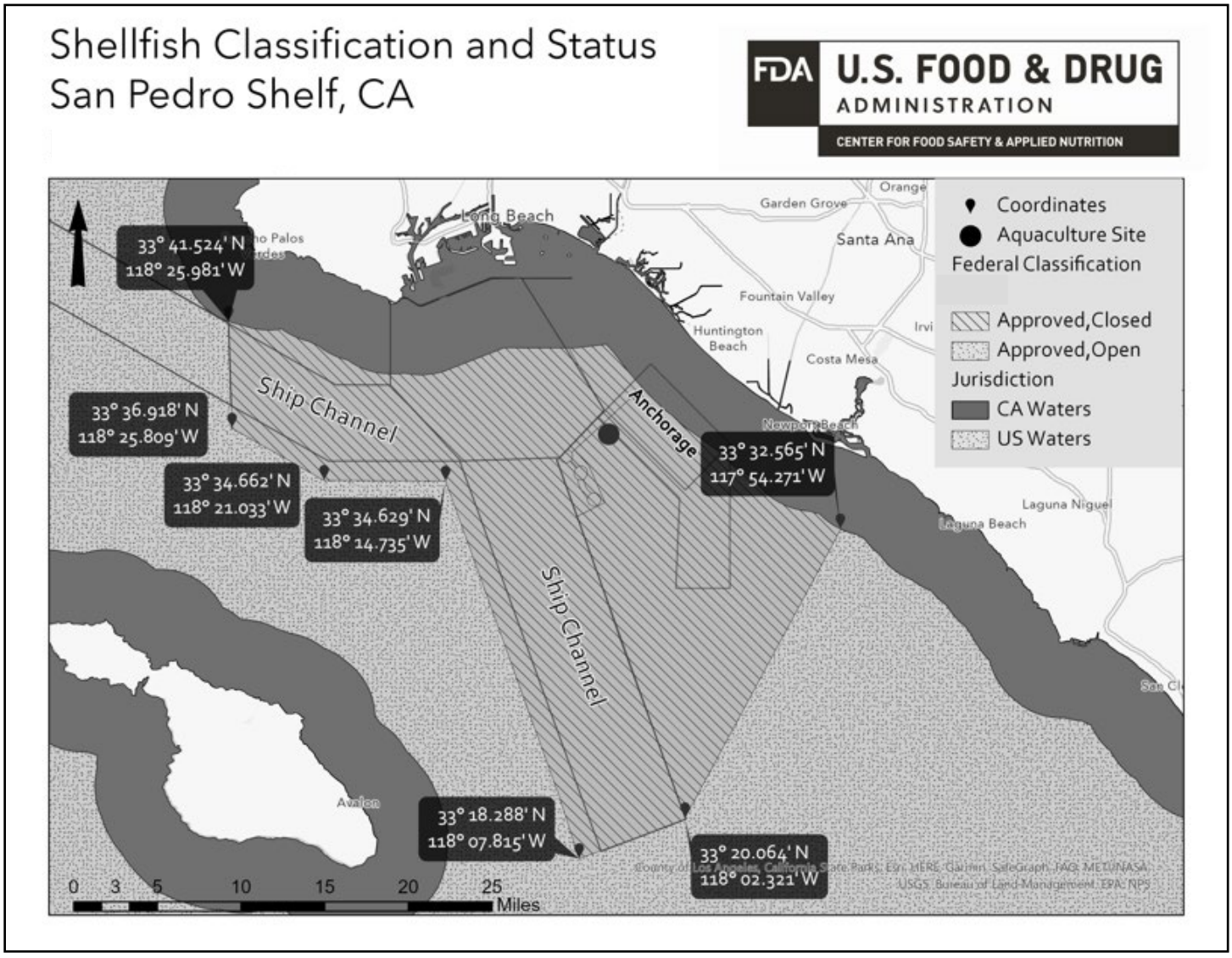
In conclusion, some pollution sources and conditions of the San Pedro shelf area have changed since FDA surveyed the SPSAQ site in 2017. The most significant of these pollution conditions that have changed is the new permanent anchorage located in federal waters off the coast of Huntington Beach and the associated increased commercial shipping activities outside of the shipping channel throughout the San Pedro Shelf area and in proximity to the SPSAQ site. Effective November 16, 2021, the Pacific Maritime Management Services (PacMMS) implemented a new vessel queuing system to increase safety and mitigate air quality impacts given the increased container shipping traffic in the vicinity of the Ports of Los Angeles (LA), and Long Beach (LB) (Pacific Maritime Management Services (PacMMS), 2021). Per discussion with the PacMMS, the utilization of the new Huntington Beach anchorage (located within the San Pedro Shelf area and 0.5 miles from the SPSAQ site) has been permanently incorporated into the queuing system operations. The anchorage will therefore continue to be utilized going forward, as a result, transient and moored vessels will be traveling through the San Pedro Shelf area and in close proximity to the SPSAQ site in federal waters.

Large commercial shipping vessels are not prohibited by regulations from discharging untreated or partially treated human sewage into federal waters. These vessels transiting to and mooring in the Huntington Beach anchorage, therefore have the potential to unpredictably discharge untreated or partially treated human sewage throughout the San Pedro Shelf area and in close proximity to the SPSAQ farm site. There is no manageable mechanism available to predict the potential impact from a vessel sewage discharge and, therefore, allow for the safe harvest of shellfish from these waters.

This updated sanitary survey expanded the area of consideration for the cumulative impact of all the pollution sources such as the large OCSD WWTP outfall, Los Angeles River input, ship channels and potential human waste discharges, oil platforms, and dump sites (as identified in Figure 18 and Table 11) to the entire federal waters portion of the San Pedro Shelf area.

As a result, due to the new anchorage and associated ship traffic and the cumulative impact of multiple pollution sources, it is the finding of this sanitary survey report that the approved shellfish growing area classification in the open status is not appropriate for the federal waters portion of the San Pedro Shelf area, including the SPSAQ farm site. Based on the geographic scope of this sanitary survey and in accordance with the NSSP guidelines, the map illustrated in Figure 45 defines the area for closure to the harvest of commercial shellfish.

Figure 45. San Pedro Shelf Federal Waters proposed classification and harvest status map for federal waters, including those offshore of Santa Monica, Los Angeles, Long Beach, Huntington Beach, and San Clemente



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