chapter 2

COMPLIANCE DETERMINATIONS

Chapter 2
COMPLIANCE DETERMINATIONS

INTRODUCTION

This chapter provides compliance results for the 2013-14 monitoring year for the Orange County Sanitation District's (District) Ocean Monitoring Program (OMP). The program includes sample collection, analysis, and data interpretation to evaluate potential impacts of wastewater discharge on the following receiving water characteristics:

- Bacterial
- Physical
- Chemical
- Biological
- Radioactivity

Each of these characteristics have specific criteria (Table 2-1) for which permit compliance must be determined each monitoring year. Compliance determinations were made by comparing OMP findings to the criteria specified in the District's NPDES permit (Order No. R8-2012-0035; NPDES Permit No. CA0110604).

The OMP sampling locations typically include 28 regional nearshore (surfzone) stations for monitoring fecal indicator bacteria (no compliance criteria), 28 offshore water quality stations, 68 benthic stations (39 annual; 29 semi-annual) to assess sediment chemistry and bottom-dwelling communities, 15 trawl stations (eight annual; six semi-annual; one historical) to evaluate fish and macroinvertebrate communities, and two rig fishing zones for assessing human health risk from the consumption of sport fishes (Figures 2-1 and 2-2, Table A-1). However, sampling at the annual benthic and trawl stations was not conducted in 2013-14, as the District was given regulatory relief in order to participate in the Bight'13 regional sampling program. Monitoring frequencies varied by component, and ranged from 2–5 days per week for surfzone water quality to annual assessments of fish health and tissue analyses.

Table 2-1. Listing of compliance criteria from NPDES ocean discharge permit (Order No. R8-2012-0035, Permit # CA0110604) and compliance status for each criterion in 2013-14.

Orange County Sanitation District, California.

Criteria	Criteria Met
Bacterial Characteristics	
V.A.1.a. For the Ocean Plan Water-Contact Standards, total coliform density shall not exceed a 30-day Geometric Mean of 1,000 per 100 mL nor a single sample maximum of 10,000 per 100 mL. The total coliform density shall not exceed 1,000 per 100 mL when the single sample maximum fecal coliform/total coliform ratio exceeds 0.1.	Yes
V.A.1.a. For the Ocean Plan Water-Contact Standards, fecal coliform density shall not exceed a 30-day Geometric Mean of 200 per 100 mL nor a single sample maximum of 400 per 100 mL.	Yes
V.A.1.a. For the Ocean Plan Water-Contact Standards, *Enterococcus* density shall not exceed a 30-day Geometric Mean of 35 per 100 mL nor a single sample maximum of 104 per 100 mL.	Yes
V.A.1.b. For the USEPA Primary Recreation Criteria in Federal Waters, *Enterococcus* density shall not exceed a 30 day Geometric Mean (per 100 mL) of 35 nor a single sample maximum (per 100 mL) of 104 for designated bathing beach, 158 for moderate use, 276 for light use, and 501 for infrequent use.	NA
V.A.1.c. For the Ocean Plan Shellfish Harvesting Standards, the median total coliform density shall not exceed 70 per 100 mL, and not more than 10 percent of the samples shall exceed 230 per 100 mL.	NA
Physical Characteristics	
V.A.2.a. Floating particulates and grease and oil shall not be visible.	Yes
V.A.2.b. The discharge of waste shall not cause aesthetically undesirable discoloration of the ocean surface.	Yes
V.A.2.c. Natural light shall not be significantly reduced at any point outside the initial dilution zone as a result of the discharge of waste.	Yes
V.A.2.d. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.	Yes
Chemical Characteristics	
V.A.3.a. The dissolved oxygen concentration shall not at any time be depressed more than 10 percent from that which occurs naturally, as the result of the discharge of oxygen demanding waste materials.	Yes
V.A.3.b. The pH shall not be changed at any time more than 0.2 units from that which occurs naturally.	Yes
V.A.3.c. The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions.	Yes
V.A.3.d. The concentration of substances, set forth in Chapter II, Table B of the Ocean Plan, in marine sediments shall not be increased to levels which would degrade indigenous biota.	Yes
V.A.3.e. The concentration of organic materials in marine sediments shall not be increased to levels which would degrade marine life.	Yes
V.A.3.f. Nutrient materials shall not cause objectionable aquatic growths or degrade indigenous biota.	Yes
V.A.3.g. The concentrations of substances, set forth in Chapter II, Table B of the Ocean Plan, shall not be exceeded in the area within the waste field where initial dilution is completed.	Yes
Biological Characteristics	
V.A.4.a. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded.	Yes
V.A.4.b. The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered.	Yes
V.A.4.c. The concentration of organic materials in fish, shellfish, or other marine resources used for human consumption shall not bioaccumulate to levels that are harmful to human health.	Yes
V.A.5. Discharge of radioactive waste shall not degrade marine life.	Yes

NA = Not Applicable.

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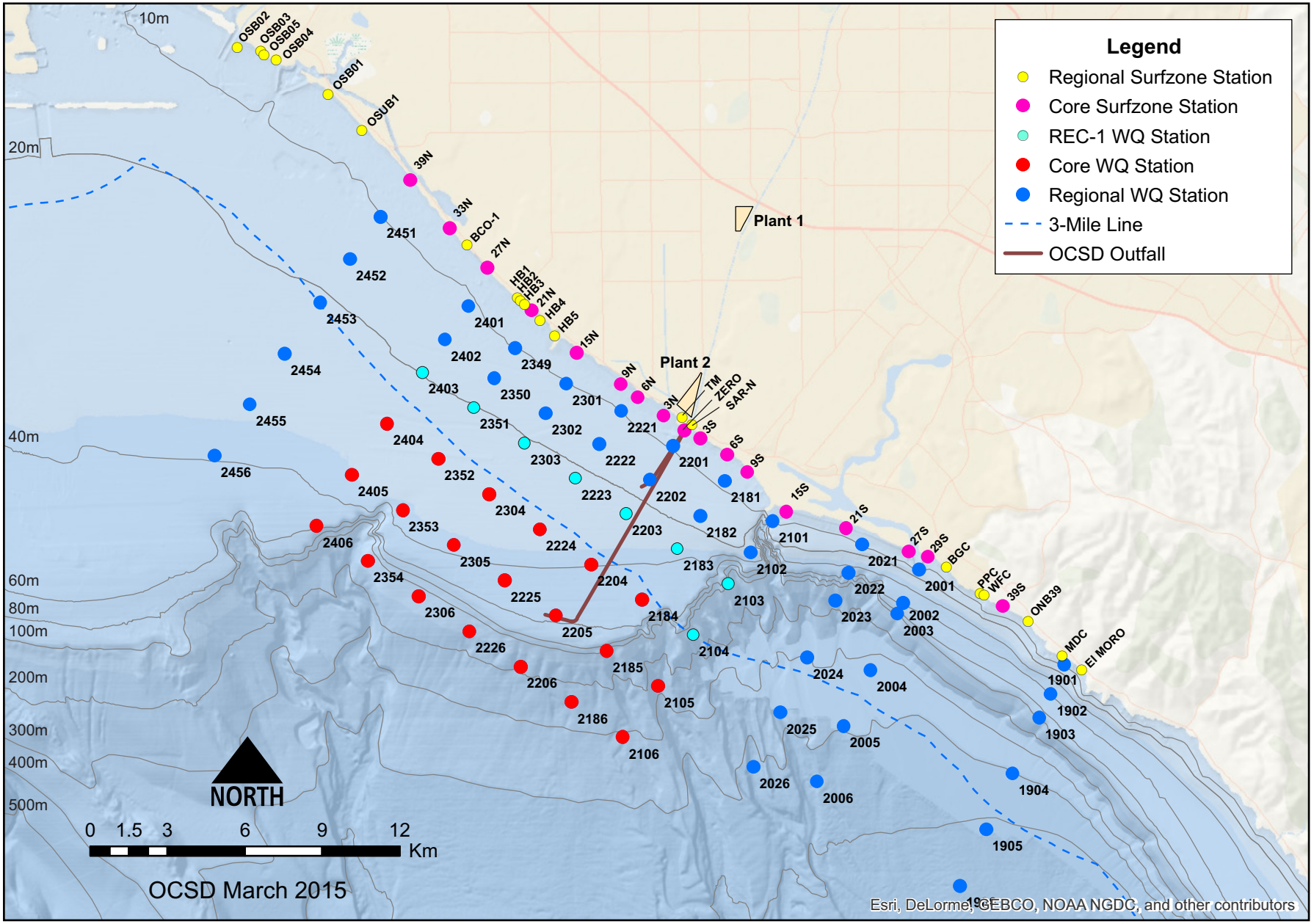

Figure 2-1. Offshore and surfzone water quality monitoring stations for 2013-14.

Orange County Sanitation District, California.

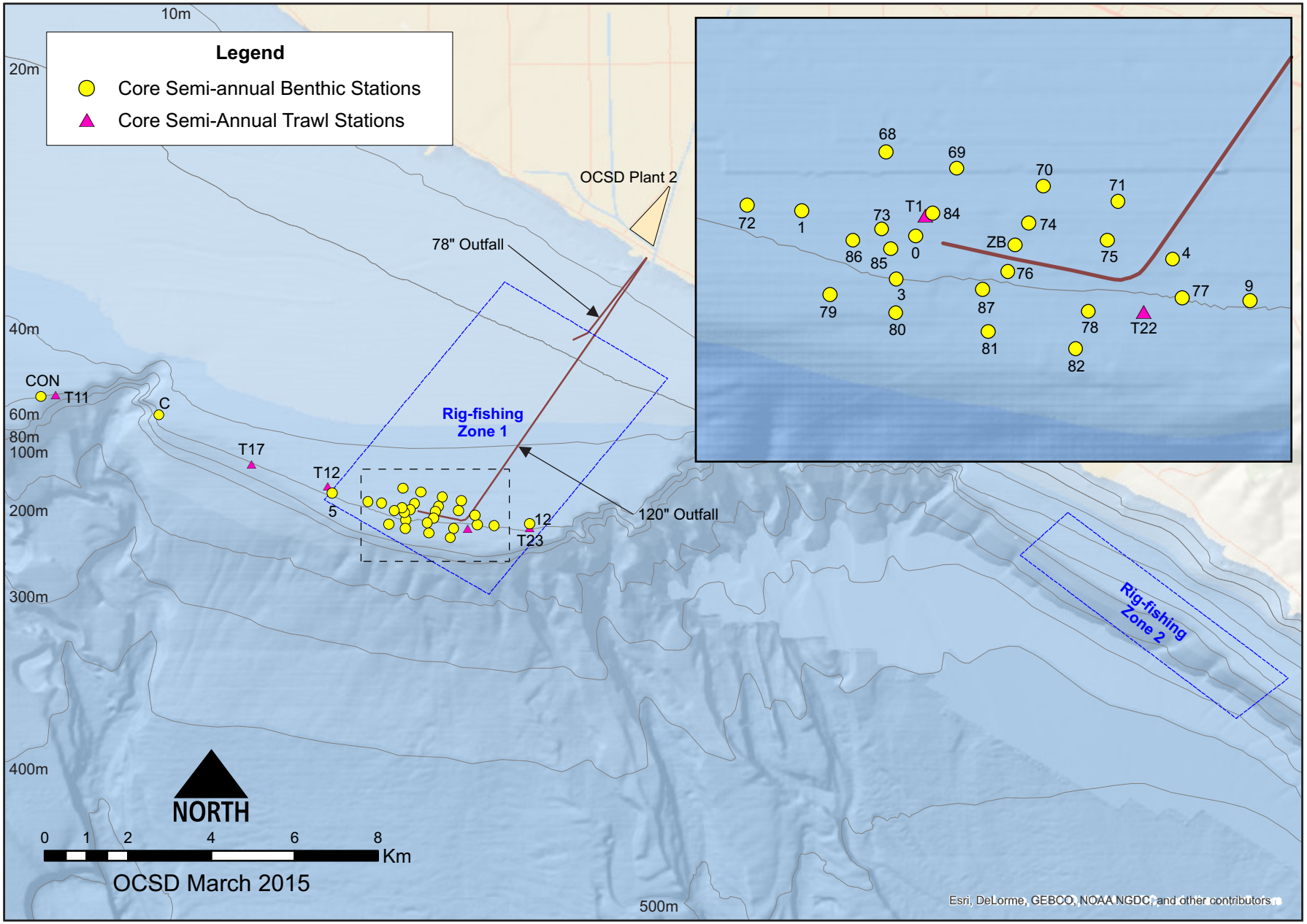

Figure 2-2. Benthic and trawl monitoring stations, as well as rig-fishing locations, for 2013-14.

WATER QUALITY

Nearshore Bacterial Criteria

Core Stations
Similar to previous years, the bacteria counts at core nearshore stations varied by season, location along the coast, and by indicator bacteria type (Table B-2). A general spatial pattern was associated with the mouth of the Santa Ana River. Seasonal geomeans and the percent of samples exceeding geomean and single sample standards all peaked near the river mouth and then tapered off upcoast and downcoast. Collectively, exceedance of the state single sample standard (AB411) was low, with less than 1% by total coliforms, less than 2% by fecal coliforms, and less than 3% by enterococci.

Regional Stations
Indicator bacteria density for regional nearshore stations are not described in this report, but can be found in Orange County Health Agency's Annual Ocean and Bay Water Quality Report (www.ocbeachinfo.com).

Offshore Bacterial Criteria

State water contact criteria have bacterial standards that need to be sustained. Criteria V.A.1.a and V.A.1.b require that the discharge not cause exceedences to offshore water contact standards for total coliform, fecal coliform, and enterococci bacteria. Total coliform bacteria standards include a 30-day geometric mean of <1,000/100 mL and single sample of <10,000/100 mL and <1,000 per 100 mL when FC:TC ratio >0.1. Fecal coliform bacteria limits comprise a 30-day geometric mean of <200/100 mL and a single sample of <400/100 mL. Enterococci limits contain a 30-day geometric mean of <35/100 mL and a single sample of <104/100 mL. Federal water contact criteria have bacterial standards for *Enterococcus* that need to be sustained as well. *Enterococcus* limits include a 30-day geometric mean of <35/100 mL and a single sample standard based on usage ranging from designated bathing beaches (<104/100 mL) to infrequent use (<501/100 mL). The District does not sample offshore waters for bacteria outside of state waters.

The majority (89–96%; n=780) of fecal indicator bacteria (FIB) counts were near or below the method detection limit of ≤10 MPN per 100mL at REC-1 stations (Tables B-3–B-5). Higher FIB densities were, however, observed near the outfall. The highest density observed for any single sample for total coliform, fecal coliform, and enterococci were 1553, 282, and 96 MPN per 100mL, respectively. Nevertheless, compliance for total, fecal, and enterococci bacteria was achieved 100% at the REC-1 stations, indicating no impact of bacteria to offshore receiving waters.

Physical Criteria

The criteria (V.A.2.a–d) for determining compliance with physical characteristics are narrative and apply to the discharge of floatable material, substances that could alter the color or transparency of the water, and/or contaminate sediments and degrade biological communities.

Floating Particulates and Oil and Grease

Criterion V.A.2.a states that "Floating particulates and oil and grease shall not be visible." There were no observations of oils and grease at any offshore or nearshore station in 2013-14 (Tables B-6 and B-7). Therefore, compliance was achieved 100% for this criterion.

Ocean Discoloration and Transparency

Criterion V.A.2.b specifies that "The discharge of waste shall not cause aesthetically undesirable discoloration of the ocean surface" and criterion V.A.2.c states that "Natural light shall not be significantly reduced at any point outside the initial dilution zone as a result of the discharge waste."

The lowest surface water clarity was at stations closer to shore and near the Newport Canyon, with progressively clearer water with distance offshore. The lower water clarity at the shallower stations typically reflects higher natural turbidity due to runoff and resuspension of sediment due to wave activity. Photosynthetically active radiation (PAR) results further confirmed the lack of an outfall signal for surface water clarity. There were no impacts from the wastewater discharge relative to ocean discoloration at any offshore station.

Water clarity standards were met 100% of the time for both Zone A and B station groups (Table 2-2). Compliance shows a slight increase from the previous year's value of 99.8% and within the range seen since 1998 (82.7–100%). All transmissivity values were within natural ranges of variability to which marine organisms are exposed (OCSD 1996a). Additionally, no discharge related patterns were observed for PAR.

Chemical Criteria

Criteria V.A.3.a–g include limits to the water column and sediments. With the exception of dissolved oxygen (DO) and acidity (pH), all of the criteria are narrative.

Dissolved Oxygen

Criterion V.A.3.a states that "The dissolved oxygen concentration outside the zone of initial dilution shall not at any time be depressed more than 10 percent from that which occurs naturally, as the result of the discharge of wastes." In 2013-14, compliance with this standard was met 96.8% and 98.1% of the time for Zone A and B station groups, respectively. Overall compliance was met 97.4% of the time for all stations combined (Table 2-2). This represents a decrease in compliance of about 0.3% from the 2012-13 monitoring year (Figure 2-3), but continues to remain in the upper end of the range seen since 1998 (86.1–98.2%). The DO values were well within the range of long-term monitoring results (OCSD 1996b, 2004b). No environmentally significant effects to DO from the wastewater discharge were observed.

Acidity (pH)

Criterion V.A.3.b specifies that "The pH shall not be changed at any time more than 0.2 units from that which occurs naturally." Overall compliance was met 99.2% and 99.8% of the time for Zone A and B station groups, respectively. Overall compliance was met 99.5% of the time for all stations combined (Table 2-2). Compliance shows a slight decrease from previous year's value of 100%, but is within the range seen since 1998 (95–100%). The measured pH values were within the range to which marine organisms are naturally

Table 2-2. Summary of offshore water quality compliance testing results for dissolved oxygen, pH, and transmissivity for 2013-14.

Orange County Sanitation District, California.

Parameter	Number of Observations	Number of Out-of-Range Occurrences	Percent of Out-of-Range Occurrences	Number Out-of-Compliance	Percent Out-of-Compliance
Zone A Stations					
Dissolved Oxygen	494	30	6.1	16	3.2
pH	494	18	3.6	4	0.8
%Transmissivity	494	241	48.8	0	0.0
Zone B Stations					
Dissolved Oxygen	468	51	10.9	9	1.9
pH	468	14	3.0	1	0.2
%Transmissivity	468	94	20.1	0	0.0
Total (Zone A and Zone B Stations Combined)					
Dissolved Oxygen	962	81	8.4	25	2.6
pH	962	32	3.3	5	0.5
%Transmissivity	962	335	34.8	0	0.0

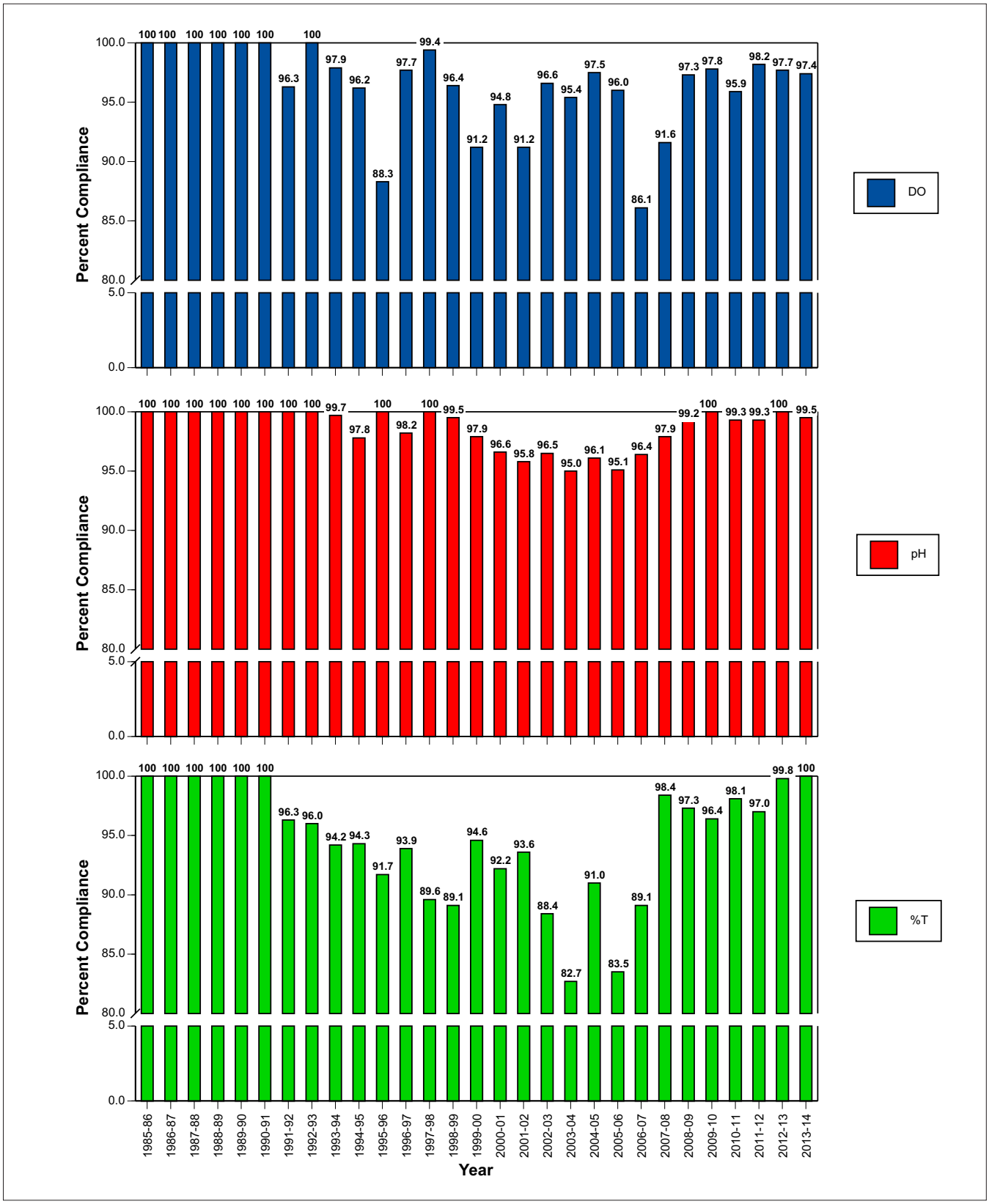

Figure 2-3. Summary of mean percent compliance for dissolved oxygen (DO), pH, and light transmissivity (%T) for all compliance stations compared to reference stations, 1985–2014.

Orange County Sanitation District, California.

exposed. Therefore, there were no environmentally significant effects to pH from the wastewater discharge.

Nutrients

Criterion V.A.3.f specifies, "Nutrient materials shall not cause objectionable aquatic growths or degrade indigenous biota." The District determines compliance with this criterion using ammonium concentrations in the water column. During 2013-14, 86% (n=1,656) of the samples contained ammonium concentrations that were below the detection limit. Detectable ammonium concentrations ranged from 0.02 to 0.24 mg/L, with 98% (n=226) of the detected values collected from samples taken below 15 m. Plume-related changes in ammonium were not considered environmentally significant as maximum values were 20 to 30 times less than, respectively, California Ocean Plan receiving water objectives for chronic (4 mg/L) and acute (6 mg/L) toxicity to marine organisms (OCSD 2004a). Average values at all depths and for all seasons were two orders of magnitude lower than the chronic objective. In addition, there were no detectable plankton associated impacts (i.e., excessive plankton blooms caused by the discharge).

Organics in the Water Column

Criterion V.A.3.g states that "The concentrations of substances set forth in Chapter II, Table B of the California Ocean Plan, shall not be exceeded in the area within the waste field where initial dilution is completed." Only eight constituents from Table B of the Ocean Plan have effluent limitations established in the District's NPDES permit. During the period from July 2013 through June 2014, none of these constituents exceeded the effluent limitations established in the permit.

Radioactivity

Criterion V.A.5 states that the "Discharge of radioactive wastes shall not degrade marine life." The District measures the effluent for radioactivity, but not the receiving waters. The results of the effluent analyses during 2013-14 collectively indicated that both state and federal standards were consistently met and are published in the District's Discharge Monitoring Reports (DMR). As fish and invertebrate communities are generally diverse and healthy, compliance with this criterion is considered to be met.

Overall, results from the District's 2013-14 water quality monitoring program detected minor changes in measured water quality parameters related to the discharge of wastewater to the coastal ocean (Table B-1), which is consistent with previously reported results (e.g., OCSD 2014). Plume-related changes in temperature, salinity, dissolved oxygen (DO), pH, and transmissivity were measurable beyond the initial mixing zone during some surveys, but usually extended only into the nearfield stations, typically <2 km away from the outfall as what has been seen in the past. None of these changes were determined to be environmentally significant since they fell within natural ranges to which marine organisms are exposed (OCSD 1996a, 2004b; Wilber and Clarke 2001, Chavez *et al*. 2002, Jarvis *et al*. 2004, Allen *et al*. 2005, Hsieh *et al*. 2005). Overall, the measured environmental and public health effects to the receiving water continue to be small, with all values within the ranges of natural variability for the study area, and reflected seasonal and yearly changes of large-scale regional influences. The limited observable plume effects occurred primarily at depth, even during the winter when stratification was weakest. In summary, staff concluded that the discharge is not greatly affecting the receiving water environment and

that beneficial uses were protected and maintained based on the 2013-14 water quality monitoring results.

SEDIMENT CHEMISTRY

Physical Criteria

Criterion V.A.2.d states that "The rate of deposition and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded." No effects on sediments from effluent solids discharge were evident from the sediment characteristics or marine community data (see below).

Chemical Criteria

Three narrative compliance criteria are specified for marine sediments: (1) “The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions" (V.A.3.c); (2) " The concentration of substances, set forth in Chapter II, Table B of the Ocean Plan, in marine sediments shall not be increased to levels which would degrade indigenous biota " (V.A.3.d); and (3) “The concentration of organic materials in marine sediments shall not be increased to levels which would degrade marine life” (V.A.3.e).

Sediment geochemistry analyses (Tables 2-3–2-6) and sediment toxicity test (Table 2-7) results indicate minimal changes in sediment quality from the effluent discharge. Means and ranges of sediment parameter values were generally low and comparable for within-ZID and non-ZID station groups. Sediment geochemistry results were below levels of biological concern (ERM values), except for (1) mercury at within-ZID Station 0 and non-ZID Station 73 and (2) total dichlorodipheynltrichloroethane (tDDT) at non-ZID Station 87 in Summer 2013. However, whole sediment toxicity tests showed no measureable toxicity at neither Station 0 nor 73, indicating that the mercury was either not bioavailable or was not sufficient to elicit a toxic response. The high tDDT value at Station 87 is considered an artefact of the pre-1970s POTW discharge of this contaminant, as tDDT values were well below the ERM at all other stations in Summer 2013 and at all stations (including 87) in Winter 2014.

Historically, the District has used the sewage marker total linear alkylbenzenes (tLAB) concentrations as a measure of the outfall chemical footprint. While the Summer 2013 mean tLAB concentration at within-ZID stations is almost double that of the non-ZID stations, it is 10-fold (an order of magnitude) lower than before the onset of full secondary treatment, indicating a decrease in the outfall chemical footprint with the additional treatment.

Sediment geochemistry results from the 2013-14 monitoring year were consistent with those of previous years suggesting generally good sediment quality in the monitoring area. This was corroborated by the absence of sediment toxicity in laboratory tests and the presence of healthy fish and invertebrate communities both near and away from the outfall. Therefore, permit criteria V.A.3.c–e were met for 2013-14.

Table 2-3. Physical properties and organic contaminant concentrations of sediment samples collected at the District's semi-annual stations in Summer 2013 compared to Effects Range–Low (ERL) and Effects Range–Median (ERM) values and regional measurements of sediment physical characteristics.

Orange County Sanitation District, California

Station	Depth (m)	Total LAB (µg/kg)	Median Phi	Fines (%)	TOC (%)	Sulfides (mg/kg)	Total P (mg/kg)	Total N (mg/kg)	Total PAH (µg/kg)	Total DDT (µg/kg)	Total Pest (µg/kg)	Total PCB (µg/kg)
Middle shelf Zone 2, non-ZID (52-65 meters)												
1	56	51.5	3.55	38.9	0.34	7.86	680	340	176	2.12	0.69	4.40
3	60	44.5	3.54	32.0	0.28	4.12	520	230	143	2.28	0.72	4.47
5	59	41.0	3.76	50.4	0.32	2.70	580	320	69.8	2.79	1.04	4.12
9	59	17.4	3.36	31.8	0.31	2.91	600	260	24.1	1.82	0.35	2.08
12	58	18.3	3.30	34.0	0.31	4.37	500	250	19.5	1.78	ND	2.19
68	52	44.9	3.75	54.1	0.35	6.73	550	270	41.7	2.25	0.06	3.54
69	52	43.6	3.61	41.5	0.34	21.0	570	290	40.4	2.57	0.47	4.07
70	52	43.0	3.55	36.9	0.31	3.06	680	270	86.5	2.03	0.06	3.15
71	52	31.1	3.37	27.1	0.33	1.46	580	230	19.4	1.85	0.41	2.29
72	55	39.0	3.65	39.1	0.35	3.44	560	260	130	2.02	0.56	3.75
73	55	106	3.39	25.0	0.38	6.56	880	390	72.5	15.0	0.85	20.7
74	57	42.0	3.46	33.9	0.32	7.46	540	310	267	2.54	0.09	4.11
75	60	41.6	3.45	34.8	0.36	6.25	570	250	32.7	2.16	0.09	1.94
77	60	20.1	3.39	34.0	0.32	5.35	570	280	27.5	1.42	ND	0.40
78	63	19.5	3.42	29.8	0.29	4.15	520	ND	25.0	1.19	0.55	0.71
79	65	32.1	3.65	40.8	0.36	4.99	520	310	32.1	1.97	ND	2.05
80	65	22.3	3.67	50.7	0.33	2.46	610	260	34.8	1.38	0.25	0.81
81	65	19.9	3.52	32.4	0.25	3.92	550	180	17.9	1.02	ND	1.00
82	65	18.2	3.38	34.4	0.31	7.71	530	ND	19.6	1.61	0.41	0.49
84	54	81.3	3.49	34.7	0.38	25.6	600	300	62.8	2.75	0.07	4.02
85	57	161	3.35	22.3	0.34	9.99	700	380	194	3.15	0.13	12.7
86	57	79.8	3.46	33.8	0.36	7.36	580	320	79.5	3.04	0.10	5.73
87	60	45.9	3.47	36.6	0.31	47.0	550	300	33.3	**52.9**	ND	3.67
C	56	10.2	3.49	44.0	0.33	2.39	650	310	40.7	1.78	9.17	0.54
CON	59	41.6	3.57	46.6	0.30	ND	560	300	39.5	5.07	ND	0.60
	Mean	**44.6**	**3.50**	**36.8**	**0.33**	**7.95**	**590**	**264**	**69.2**	**4.74**	**0.64**	**3.74**
Middle shelf Zone 2, within-ZID (56-58 meters)												
0	56	124	3.37	19.2	0.34	3.89	750	480	319	2.12	2.73	7.77
4	56	40.7	3.39	25.6	0.34	5.17	490	250	51.3	1.59	0.43	2.77
76	58	39.1	3.41	33.1	0.31	1.95	600	260	32.1	1.20	ND	7.44
ZB	56	82.2	3.37	28.2	0.29	1.08	600	280	26.1	1.25	ND	1.91
	Mean	**71.5**	**3.39**	**26.5**	**0.32**	**3.02**	**610**	**318**	**107**	**1.54**	**0.79**	**4.97**
SEDIMENT QUALITY GUIDELINES AND REGIONAL REFERENCE VALUES												
[1] ERL		NA	NA	NA	NA	NA	NA	NA	4,022	1.58	NA	22.7
[1] ERM		NA	NA	NA	NA	NA	NA	NA	44,792	46.1	NA	180
[2] Bight'08 AWM Mid-shelf		NA	NA	46.8	1.0	NA	NA	NA	179.0	16.0	NA	13.0

Bolded station value indicates ERM exceedance.

AWM = Area Weighted Mean, ND = Not Detected, NA = Not Applicable.

All stations n=1.

[1] Long *et al*. (1995).

[2] Schiff *et al*. (2011).

Table 2-4. Concentrations of sediment metals (mg/kg) at the District's semi-annual stations in Summer 2013 compared with Effects Range–Low (ERL) and Effects Range–Median (ERM) values and regional measurements of sediment physical characteristics.

Orange County Sanitation District, California.

Station	Depth (m)	Sb	As	Ba	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag	Zn
Middle shelf Zone 2, non-ZID (52-65 meters)														
1	56	ND	1.94	30.1	0.24	0.32	21.6	16.3	8.19	0.06	9.50	0.23	0.28	44.3
3	60	ND	2.03	32.3	0.30	0.29	22.2	12.5	7.54	0.02	10.4	0.28	0.24	50.7
5	59	ND	2.26	42.3	0.29	0.32	22.5	13.9	6.20	0.03	11.0	0.29	0.29	47.6
9	59	0.14	2.21	28.4	0.28	0.22	19.4	8.66	5.06	0.01	9.10	0.29	0.24	41.4
12	58	ND	1.96	26.3	0.25	0.30	20.8	8.99	7.84	0.02	9.41	0.26	0.26	40.9
68	52	ND	2.26	37.6	0.27	0.31	21.9	11.6	6.05	0.02	10.1	0.32	0.23	44.5
69	52	ND	2.03	32.5	0.28	0.31	21.0	11.6	5.76	0.02	10.1	0.25	0.30	44.9
70	52	ND	2.20	32.3	0.26	0.38	20.6	10.1	5.32	0.03	9.72	0.25	0.19	45.8
71	52	ND	2.46	33.1	0.26	0.36	19.2	8.90	4.84	0.03	9.12	0.31	0.20	43.8
72	55	0.11	2.34	31.3	0.25	0.27	20.2	10.9	7.15	0.08	9.11	0.29	0.21	41.8
73	55	ND	2.39	29.9	0.24	0.65	22.3	15.2	9.15	**1.23**	9.22	0.29	0.38	49.8
74	57	ND	2.56	35.1	0.27	0.40	20.9	9.95	5.06	0.01	9.80	0.28	0.16	44.8
75	60	ND	2.72	33.1	0.26	0.35	19.3	8.36	5.48	0.03	9.06	0.26	0.13	44.6
77	60	ND	1.76	27.2	0.28	0.20	20.4	9.44	5.01	0.02	9.40	0.21	0.19	43.2
78	63	ND	1.64	28.3	0.26	0.20	19.6	9.04	4.60	0.02	9.30	0.23	0.17	42.6
79	65	ND	1.92	34.7	0.29	0.34	22.5	11.9	7.15	0.02	10.7	0.32	0.22	48.7
80	65	ND	2.47	37.1	0.35	0.21	22.1	12.2	8.43	0.02	11.3	0.25	0.26	50.1
81	65	ND	1.70	32.1	0.32	0.19	19.5	8.89	4.48	0.02	9.54	0.20	0.16	43.7
82	65	0.10	2.15	32.4	0.30	0.20	21.0	9.87	4.99	0.03	10.4	0.29	0.21	46.2
84	54	ND	2.42	33.8	0.25	0.49	22.4	13.5	6.76	0.03	10.1	0.32	0.24	47.9
85	57	0.10	2.84	34.3	0.28	0.77	25.7	14.4	9.08	0.03	9.58	0.38	0.39	51.1
86	57	ND	2.09	32.4	0.27	0.53	22.3	14.1	6.67	0.02	9.69	0.30	0.28	48.6
87	60	ND	2.17	34.3	0.30	0.38	22.0	10.8	6.51	0.02	10.2	0.34	0.21	47.0
C	56	ND	2.12	29.4	0.26	0.16	21.7	9.05	12.1	0.02	9.12	0.21	0.25	38.9
CON	59	ND	2.45	45.0	0.28	0.21	21.8	9.90	6.44	0.02	10.5	0.29	0.16	44.1
	Mean	**0.02**	**2.20**	**33.0**	**0.28**	**0.33**	**21.3**	**11.2**	**6.63**	**0.07**	**9.82**	**0.28**	**0.23**	**45.5**
Middle shelf Zone 2, within-ZID (56-58 meters)														
0	56	ND	2.90	29.9	0.27	0.78	21.5	42.6	6.38	**1.14**	9.24	0.35	0.26	56.4
4	56	ND	2.38	25.7	0.25	0.26	21.1	8.95	7.62	0.02	8.96	0.24	0.15	41.8
76	58	ND	2.17	33.9	0.30	0.25	19.9	10.7	4.42	0.02	10.3	0.25	0.23	47.5
ZB	56	ND	2.44	31.8	0.28	0.35	19.2	10.2	4.45	0.01	9.30	0.29	0.21	45.1
	Mean	**ND**	**2.47**	**30.3**	**0.28**	**0.41**	**20.4**	**18.1**	**5.72**	**0.30**	**9.45**	**0.28**	**0.21**	**47.7**
SEDIMENT QUALITY GUIDELINES AND REGIONAL REFERENCE VALUES														
[1] ERL		NA	8.20	NA	NA	1.20	81.0	34.0	46.7	0.15	20.9	NA	1.00	150
[1] ERM		NA	70.0	NA	NA	9.60	370	270	218	0.70	51.6	NA	3.70	410
[2] Bight '08 AWM Mid-shelf		NA	6.1	NA	0.3	0.32	31.0	10.7	7.8	0.05	12.0	0.72	0.24	46.0

Bolded station value indicates ERM exceedance.

AWM = Area Weighted Mean, ND = Not Detected, NA = Not Applicable.

All stations n=1.

[1] Long *et al*. (1995).

[2] Schiff *et al*. (2011).

Table 2-5. Physical properties and organic contaminant concentrations of sediment samples collected at the District's semi-annual stations in Winter 2014 compared to Effects Range–Low (ERL) and Effects Range–Median (ERM) values and regional measurements of sediment physical characteristics.

Orange County Sanitation District, California

Station	Depth (m)	Total LAB (µg/kg)	Median Phi	Fines (%)	TOC (%)	Sulfides (mg/kg)	Total P (mg/kg)	Total N (mg/kg)	Total PAH (µg/kg)	Total DDT (µg/kg)	Total Pest (µg/kg)	Total PCB (ug/kg)
Middle shelf Zone 2, non-ZID (52-65 meters)												
1	56	NS	3.50	34.8	0.35	5.39	640	250	278	3.88	0.96	21.3
3	60	NS	3.57	37.0	0.36	7.01	600	380	40.9	1.50	ND	17.3
5	59	NS	3.78	52.7	0.38	7.66	650	320	48.9	2.97	ND	3.30
9	59	NS	3.38	33.3	0.34	8.72	560	290	49.9	1.53	ND	0.86
12	58	NS	3.31	31.8	0.36	9.91	580	320	48.7	1.27	ND	0.32
68	52	NS	3.63	36.0	0.43	10.6	650	280	80.8	3.13	ND	4.76
69	52	NS	3.67	43.8	0.42	10.1	710	310	59.6	2.10	0.09	5.37
70	52	NS	3.55	39.2	0.45	13.3	600	300	78.0	1.93	ND	1.81
71	52	NS	3.43	34.3	0.36	10.4	640	250	30.7	1.20	ND	0.53
72	55	NS	3.61	41.7	0.35	10.1	570	260	60.8	2.09	ND	12.6
73	55	NS	3.37	20.2	0.48	5.99	920	350	132	2.43	0.06	7.69
74	57	NS	3.44	40.4	0.37	3.92	600	310	82.1	1.53	ND	2.89
75	60	NS	3.39	28.7	0.33	11.0	590	290	41.7	1.26	ND	1.99
77	60	NS	3.41	31.8	0.36	12.6	540	280	66.1	1.20	ND	0.62
78	63	NS	3.43	33.5	0.42	5.66	660	450	47.5	1.93	ND	7.12
79	65	NS	3.61	38.3	0.41	10.9	590	260	48.1	2.00	ND	4.64
80	65	NS	3.67	51.9	0.32	7.91	690	270	17.4	1.33	ND	1.13
81	65	NS	3.48	37.3	0.31	8.75	740	270	21.3	1.39	ND	1.09
82	65	NS	3.44	39.6	0.32	4.92	610	260	21.6	1.31	ND	0.31
84	54	NS	3.44	29.1	0.45	6.92	820	350	88.9	1.86	ND	7.70
85	57	NS	3.35	22.0	0.52	11.9	1100	380	116	2.68	ND	13.8
86	57	NS	3.42	28.1	0.47	9.49	830	310	63.5	2.03	0.05	9.06
87	60	NS	3.51	37.6	0.39	5.44	630	290	36.2	1.29	ND	2.22
C	56	NS	3.44	35.9	0.32	7.89	700	310	35.9	3.46	ND	2.85
CON	59	NS	3.58	47.1	0.41	9.78	680	290	36.3	3.38	ND	0.57
	Mean	**NS**	**3.50**	**36.2**	**0.39**	**8.65**	**676**	**305**	**65.2**	**2.03**	**0.05**	**5.27**
Middle shelf Zone 2, within-ZID (56-58 meters)												
0	56	NS	3.23	18.7	0.59	19.0	2200	470	63.8	2.71	ND	4.01
4	56	NS	3.32	25.5	0.38	7.37	570	330	37.3	1.42	ND	1.17
76	58	NS	3.44	32.4	0.35	4.60	510	230	57.3	1.34	ND	2.31
ZB	56	NS	3.44	32.3	0.33	5.77	530	300	82.2	1.32	ND	4.00
	Mean	**NS**	**3.36**	**27.2**	**0.41**	**9.20**	**953**	**333**	**60.2**	**1.70**	**ND**	**2.87**
SEDIMENT QUALITY GUIDELINES AND REGIONAL REFERENCE VALUES												
[1] ERL		NA	NA	NA	NA	NA	NA	NA	4,022	1.58	NA	22.7
[1] ERM		NA	NA	NA	NA	NA	NA	NA	44,792	46.1	NA	180
[2] Bight'08 AWM Mid-shelf		NA	NA	46.8	1.0	NA	NA	NA	179.0	16.0	NA	13.0

AWM = Area Weighted Mean, ND = Not Detected, NS = Not Sampled, NA = Not Applicable.

All stations n=1.

[1] Long *et al*. (1995).

[2] Schiff *et al*. (2011).

Table 2-6. Concentrations of sediment metals (mg/kg) at the District's semi-annual stations in Winter 2014 compared with Effects Range–Low (ERL) and Effects Range–Median (ERM) values and regional measurements of sediment physical characteristics.

Orange County Sanitation District, California.

Station	Depth (m)	Sb	As	Ba	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag	Zn
Middle shelf Zone 2, non-ZID (52-65 meters)														
1	56	ND	2.68	33.8	0.23	0.34	19.5	11.3	5.68	0.02	8.77	0.36	0.40	42.1
3	60	ND	2.31	32.0	0.25	0.30	21.7	11.6	9.44	0.02	9.30	0.35	0.19	44.7
5	59	ND	2.65	38.8	0.26	0.29	21.4	11.6	5.78	0.02	10.3	0.33	0.22	42.6
9	59	ND	2.33	27.4	0.22	0.20	17.3	7.92	4.44	0.01	8.09	0.40	0.12	35.9
12	58	0.10	2.65	27.8	0.25	0.21	17.8	7.77	4.59	0.01	8.47	0.35	0.11	37.3
68	52	0.11	3.06	36.2	0.26	0.28	21.4	10.7	11.1	0.02	9.47	0.33	0.19	40.2
69	52	0.11	2.94	33.7	0.24	0.32	19.6	11.2	5.30	0.02	9.39	0.33	0.20	40.6
70	52	0.11	3.04	37.5	0.23	0.31	18.9	10.3	5.23	0.02	9.30	0.33	0.18	40.8
71	52	ND	2.61	29.0	0.22	0.31	17.3	8.24	4.16	0.02	8.27	0.31	0.12	38.5
72	55	0.10	2.93	29.9	0.25	0.60	22.1	13.4	6.72	0.02	9.28	0.34	1.28	45.5
73	55	ND	2.82	31.5	0.23	0.62	21.6	13.8	6.89	0.02	8.97	0.36	0.24	45.7
74	57	ND	2.91	31.5	0.23	0.29	17.2	9.50	4.22	0.02	8.66	0.43	0.15	42.9
75	60	ND	2.89	29.9	0.25	0.31	17.2	8.30	3.95	0.01	8.47	0.34	0.12	39.6
77	60	ND	2.13	30.3	0.24	0.23	18.6	9.26	4.55	0.01	8.88	0.30	0.13	38.8
78	63	ND	2.50	28.7	0.26	0.21	18.4	8.49	4.24	0.01	8.77	0.30	0.11	38.4
79	65	0.10	2.26	35.2	0.26	0.24	20.2	10.8	5.00	0.01	9.63	0.34	0.17	42.9
80	65	0.13	3.22	37.6	0.32	0.20	19.4	10.8	5.19	0.01	10.7	0.36	0.12	46.9
81	65	ND	2.11	35.0	0.26	0.20	18.1	8.63	4.29	0.01	9.11	0.32	0.13	38.8
82	65	ND	1.89	30.5	0.26	0.18	19.1	8.76	4.84	0.01	9.62	0.45	0.11	40.8
84	54	0.27	2.57	31.9	0.23	0.49	21.7	12.3	5.91	0.02	9.78	0.33	0.19	44.0
85	57	ND	3.19	30.5	0.26	0.66	23.9	19.5	6.02	0.02	9.00	0.36	0.22	48.3
86	57	ND	2.41	31.0	0.24	0.46	21.3	12.2	5.43	0.02	9.18	0.39	0.21	43.5
87	60	ND	2.37	30.5	0.26	0.17	19.0	9.46	4.83	0.01	9.11	0.70	0.14	40.9
C	56	0.10	2.49	32.6	0.22	0.20	18.6	7.89	5.54	0.01	8.31	0.34	0.12	34.4
CON	59	0.11	2.50	47.0	0.24	0.18	20.5	9.60	5.60	0.01	10.3	0.35	0.13	42.4
	Mean	**0.12**	**2.62**	**32.8**	**0.25**	**0.31**	**19.7**	**10.5**	**5.56**	**0.02**	**9.17**	**0.36**	**0.21**	**41.5**
Middle shelf Zone 2, within-ZID (56-58 meters)														
0	56	0.13	4.32	30.0	0.23	0.88	23.8	40.8	6.89	0.07	9.78	0.45	0.53	55.7
4	56	0.11	2.59	30.0	0.24	0.32	18.8	8.71	4.43	0.02	8.49	0.34	0.16	37.0
76	58	ND	2.21	29.3	0.26	0.25	18.7	9.61	4.01	0.01	9.09	0.32	0.12	41.1
ZB	56	ND	2.98	30.3	0.25	0.35	17.8	9.38	3.90	0.02	8.82	0.32	0.14	42.2
	Mean	**0.06**	**3.03**	**29.9**	**0.24**	**0.45**	**19.8**	**17.1**	**4.81**	**0.03**	**9.05**	**0.36**	**0.24**	**44**
SEDIMENT QUALITY GUIDELINES AND REGIONAL REFERENCE VALUES														
[1] ERL		NA	8.20	NA	NA	1.20	81.0	34.0	46.7	0.15	20.9	NA	1.00	150
[1] ERM		NA	70.0	NA	NA	9.60	370	270	218	0.70	51.6	NA	3.70	410
[2] Bight '08 AWM Mid-shelf		NA	6.1	NA	0.3	0.32	31.0	10.7	7.8	0.05	12.0	0.72	0.24	46.0

AWM = Area Weighted Mean, ND = Not Detected, NA = Not Applicable.

All stations n=1.

[1] Long *et al*. (1995).

[2] Schiff *et al*. (2011).

Table 2-7. Whole-sediment *Eohaustorius estuarius* (amphipod) toxicity test results for January 2014. Test results given as the percent difference in amphipod survival between test vs. home sediments.

Orange County Sanitation District, California.

Station	% Survival	% of Home	% Difference from Home	p-Value*	Determination
Home	97	NA	NA	NA	NA
0	98	101	-1	0.71	Not Toxic
1	98	101	-1	0.71	Not Toxic
4	88	91	9	0.08	Not Toxic
72	98	101	-1	0.71	Not Toxic
73	98	101	-1	0.71	Not Toxic
76	95	97	2	0.18	Not Toxic
77	97	100	0	0.53	Not Toxic
CON	99	102	-2	0.88	Not Toxic
ZB	97	100	0	0.53	Not Toxic

* T-test for difference from home sediment, significance at $p \leq 0.05$.

NA = Not Applicable.

BENTHIC INFAUNA

Biological Criteria

Three narrative compliance criteria are specified in the NPDES permit for biological communities: (1) “Marine communities, including vertebrates, invertebrates, and plant species, shall not be degraded" (V.A.4.a); (2) "The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered" (V.A.4.b); and (3) “The concentration of organic materials in fish, shellfish, or other marine resources used for human consumption shall not bioaccumulate to levels that are harmful to human health” (V.A.4.c). The concept of a degraded community implies a loss of diversity or a significant change and/or loss of community function.

Macrobenthic Invertebrate Communities

A total of 545 invertebrate taxa comprising 27,924 individuals were collected in the 2013-14 monitoring year. As with previous monitoring surveys, the Polychaeta was the most speciose and numerically abundant taxonomic group at within- and non-ZID stations. Most importantly, the infaunal communities within the monitoring area were not affected by the outfall discharge based on the following evidence:

1. The mean species richness, abundance, H′, and SDI values for the infauna were comparable between within- and non-ZID stations in both surveys (Tables 2-8 and 2-9).

2. The infaunal communities at within- and non-ZID station groups can be classified as reference condition based on their low (<25) mean BRI values and high (>60) mean ITI values in both surveys (Tables 2-8 and 2-9).

3. The pollution-tolerant polychaete species *Capitella capitata* Complex was absent at non-ZID stations and present in extremely low numbers (1–20 individuals) at within-ZID stations. In addition, the abundances of the pollution-sensitive amphipod species remained high at within-ZID stations, with an annual mean of 97 individuals.

4. Multivariate analyses (cluster and nMDS) of the July 2013 infaunal species and abundance data showed that within-ZID Stations 0 and ZB were grouped with non-ZID Stations 73, 75 and 85, whereas within-ZID Stations 4 and 76 were both nested within a larger group containing nearly all other non-ZID stations (Figure 2-4). This suggests that the outfall discharge had an overall negligible effect on the benthic community structure within the monitoring area.

We conclude, therefore, that the biota outside the ZID was not degraded by the outfall discharge, and as such, permit criterion V.A.4.a was met for 2013-14.

Table 2-8. Summary statistics of infaunal community measures for all stations during the Summer 2013 survey, sorted by depth.

Orange County Sanitation District, California.

Station	Depth (m)	Total Number of Species	Total Abundance	Shannon-Wiener Diversity Index (H')	Swartz's 75% Dominance Index	Infaunal Trophic Index (ITI)	Benthic Response Index (BRI)
Middle shelf Zone 2, within-ZID (51–90 m)							
0	56	127	720	3.85	27	70	27
4	56	86	403	3.75	25	83	13
76	58	138	782	3.86	26	74	20
ZB	56	105	635	3.69	25	71	23
	Mean	**114**	**635**	**3.79**	**26**	**71**	**21**
Middle shelf Zone 2, non-ZID (51–90 m)							
1	56	93	432	3.37	21	74	16
3	60	116	680	3.46	22	73	17
5	59	88	482	3.25	18	73	17
9	59	117	480	4.03	35	76	16
12	58	119	448	4.13	37	83	14
68	52	122	722	3.69	27	77	16
69	52	142	785	4.01	37	76	18
70	52	134	669	4.01	33	78	16
71	52	87	524	3.47	20	74	21
72	55	103	539	3.33	22	73	18
73	55	109	675	3.32	18	71	25
74	57	111	582	3.57	22	76	18
75	60	94	462	3.71	23	85	20
77	60	102	417	3.83	30	79	16
78	63	105	515	3.74	27	76	19
79	65	98	594	3.21	19	75	17
80	65	87	570	3.39	17	79	18
81	65	77	520	2.99	14	72	18
82	65	102	543	3.50	23	74	20
84	54	116	719	3.63	24	76	19
85	57	98	760	3.24	15	72	21
86	57	99	695	3.34	17	73	22
87	60	135	671	3.73	28	76	21
C	56	102	378	3.92	36	81	13
CON	59	103	407	4.08	35	83	16
	Mean	**106**	**571**	**3.60**	**25**	**82**	**18**

ZID = Zone of Initial Dilution.

Table 2-9. Summary statistics of infaunal community measures for all stations during the Winter 2014 survey, sorted by depth.

Orange County Sanitation District, California.

Station	Depth (m)	Total Number of Species	Total Abundance	Shannon-Wiener Diversity Index (H')	Swartz's 75% Dominance Index	Infaunal Trophic Index (ITI)	Benthic Response Index (BRI)
Middle shelf Zone 2, within-ZID (51–90 m)							
0	56	85	556	3.15	14	64	28
4	56	99	305	3.91	33	78	20
76	58	98	393	3.87	28	75	19
ZB	56	83	452	3.43	23	69	23
	Mean	**91**	**427**	**3.59**	**25**	**69**	**23**
Middle shelf Zone 2, non-ZID (51–90 m)							
1	56	87	379	3.24	21	76	19
3	60	90	333	3.80	32	75	13
5	59	83	358	3.32	24	72	15
9	59	96	385	3.87	29	80	20
12	58	75	294	3.68	25	81	19
68	52	88	361	3.68	28	83	13
69	52	88	345	3.56	24	80	17
70	52	110	361	3.99	39	79	15
71	52	96	433	3.57	26	77	19
72	55	73	363	3.02	16	76	19
73	55	94	483	3.47	19	74	22
74	57	85	398	3.34	19	75	21
75	60	80	331	3.51	22	75	21
77	60	79	357	3.66	24	83	17
78	63	76	328	3.51	23	77	16
79	65	86	463	3.37	21	75	16
80	65	92	480	3.34	20	80	14
81	65	73	331	3.36	21	78	18
82	65	99	447	3.72	25	77	17
84	54	95	426	3.49	27	73	22
85	57	75	412	3.02	15	71	23
86	57	81	364	3.32	21	71	21
87	60	68	320	3.30	16	75	22
C	56	86	309	3.74	28	84	18
CON	59	95	352	3.93	32	82	12
	Mean	**86**	**377**	**3.51**	**24**	**83**	**18**

ZID = Zone of Initial Dilution.

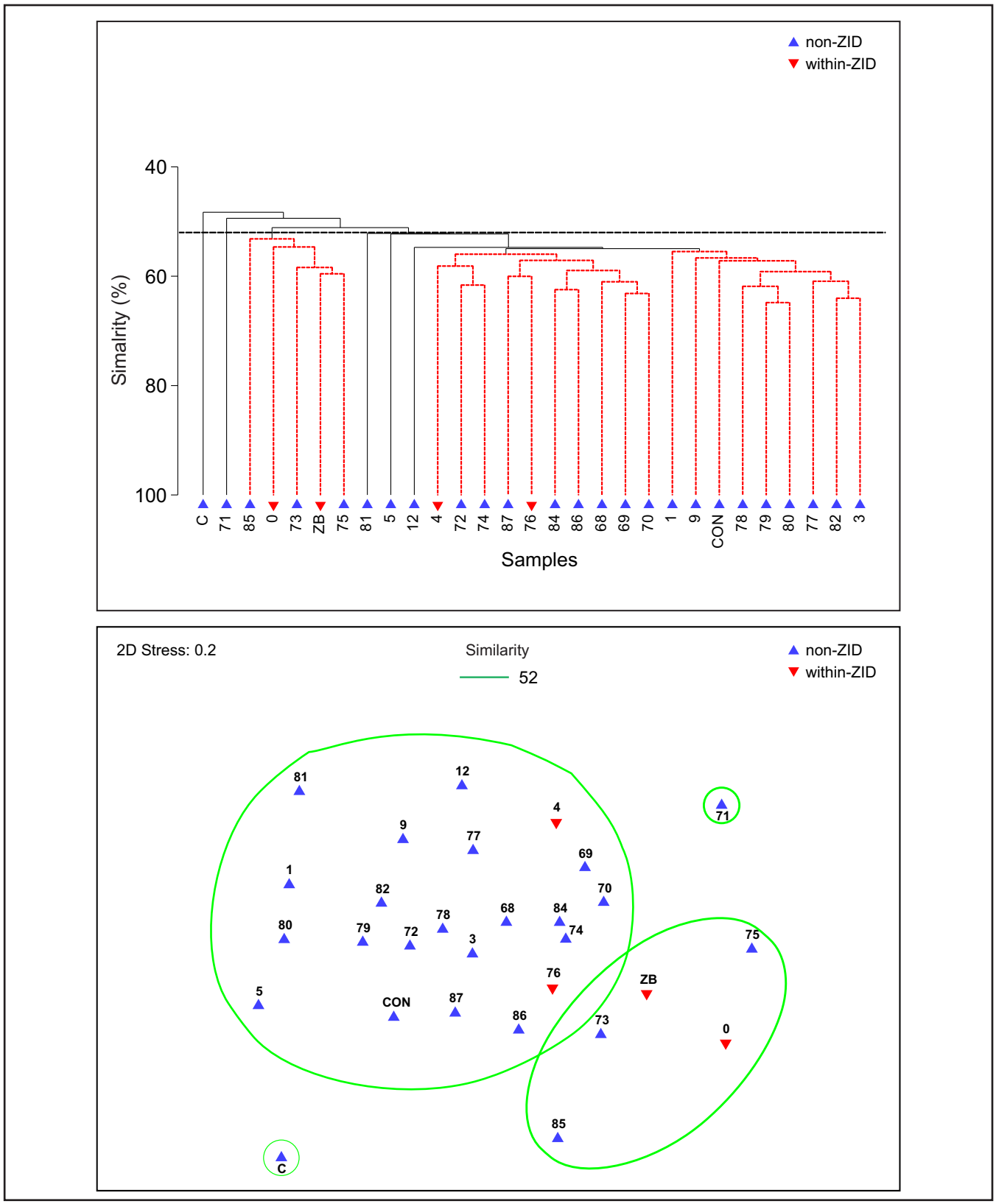

Figure 2-4. **Dendrogram (top panel) and non-metric Multidimensional Scaling (MDS) plot (bottom panel) of the infauna collected at within- and non-ZID stations for the Summer 2013 OCSD monitoring survey.**

Stations connected by red dashed lines in the dendrogram are not significantly differentiated by the SIMPROF test. The four clusters formed at a 52% similarity level on the dendrogram are superimposed on the MDS plot.

Orange County Sanitation District, California.

TRAWL COMMUNITIES

Epibenthic Macroinvertebrate Communities

A total of 27 epibenthic macroinvertebrate (EMI) taxa, comprising 3,214 individuals and a total weight of 13.9 kg, were collected in the monitoring area during trawls conducted in the 2013-14 period (Tables B-8 and B-9). The mean species richness, H′ and SDI values of EMIs were comparable between outfall and non-outfall stations in both surveys (Table 2-10). By contrast, the mean abundance and biomass values of EMIs differed, particularly in the winter survey, between outfall and non-outfall stations. This incongruity can be attributed to the capture of dramatically higher number of individuals of the sea urchin *Lytechinus pictus* at non-outfall Stations T11 (n_{summer}=330; n_{winter}=741) and T23 (n_{summer}=450; n_{winter}=480) as compared to outfall Stations T1 (n_{summer}=185; n_{winter}=1) and T22 (n_{summer}=60; n_{winter}=56). This is not cause for concern as (1) the total abundance of *Lytechinus pictus* was higher at outfall Stations T1 and T22 than non-outfall Stations T12 and T17 (Table B-8) and (2) the abundance of *Lytechinus pictus* has occasionally varied from year to year at outfall Station T1 versus non-outfall Station T11 (OCSD 2014). Furthermore, multivariate analyses (cluster and nMDS) of the EMI species and abundance data showed that the EMI communities at the outfall and non-outfall stations were generally similar (Figure 2-5). This suggests that the outfall discharge had an overall negligible effect on the EMI community structure within the monitoring area. We conclude that the EMI communities within the monitoring area were not degraded by the outfall discharge, and consequently, permit criterion V.A.4.a was met for 2013-14.

Fish Community

A total of 29 fish taxa, comprising 5,301 individuals and a total weight of 146.8 kg, were collected in the monitoring area during the 2013-14 trawling effort (Tables B-10 and B-11). The mean species richness, abundance, biomass, H′, and SDI values of demersal fishes were comparable between outfall and non-outfall stations in both surveys (Table 2-11). More importantly, the fish communities at outfall and non-outfall station groups can be classified as reference condition based on their low (<45) mean FRI values in both surveys. Multivariate analyses (cluster and nMDS) of the demersal fish species and abundance data further demonstrated that the fish communities at the outfall and non-outfall stations were similar (Figure 2-6). These results unequivocally indicate that the outfall discharge had no effect on the demersal fish community structure within the monitoring area. We conclude that the demersal fish communities within the monitoring area were not degraded by the outfall discharge, and thus, permit criterion V.A.4.a was met for 2013-14.

Demersal Fish Tissue Chemistry

In the 2013-14 survey period, muscle and liver tissue contaminant concentrations in the target species (Hornyhead Turbot and English Sole) were generally similar between outfall and farfield stations and were well below federal and state human consumption guidelines (Table 2-12). Nevertheless, the mean values of tDDT and tPCB were noticeably high in the liver of both target species. This was not unexpected as high interannual and interspecies variability of certain contaminants, including tDDT and tPCB, have been documented in OCSD's monitoring area since July 2004 (OCSD 2014). Furthermore, DDT and PCB are legacy contaminants found in marine sediments throughout the SCB due to historical POTW discharges that occurred until the early 1970s (Schiff 2000). Spatial comparisons of fish tissue contaminants are complicated by the transitory nature of fishes, because we assume that the location of capture is also the location of exposure. However, demersal

Table 2-10. Summary statistics of the epibenthic macroinvertebrate community measures for Summer 2013 and Winter 2014 trawl surveys.

Orange County Sanitation District, California

Season	Station Group	Station	Depth (m)	Total Number of Species	Total Abundance	Biomass (kg)	Shannon-Wiener Diversity Index (H')	Swartz's 75% Dominance Index
Summer	Non-outfall	T11	60	12	418	1.44	0.9	1
		T12	57	14	222	1.85	1.2	2
		T17	60	9	92	1.03	2.0	4
		T23	58	13	543	2.27	0.8	1
		Mean	**59**	**12**	**319**	**1.65**	**1.2**	**2**
	Outfall	T1	55	12	248	2.39	1.1	2
		T22	60	13	121	0.80	1.5	2
		Mean	**58**	**13**	**185**	**1.59**	**1.3**	**2**
Winter	Non-outfall	T11	60	8	818	1.80	0.4	1
		T12	57	5	24	0.37	1.4	3
		T17	60	5	18	0.26	1.2	2
		T23	58	7	529	1.28	0.4	1
		Mean	**59**	**6**	**347**	**0.93**	**0.9**	**2**
	Outfall	T1	55	10	55	0.31	1.3	2
		T22	60	9	126	0.08	1.6	4
		Mean	**58**	**10**	**91**	**0.19**	**1.5**	**3**

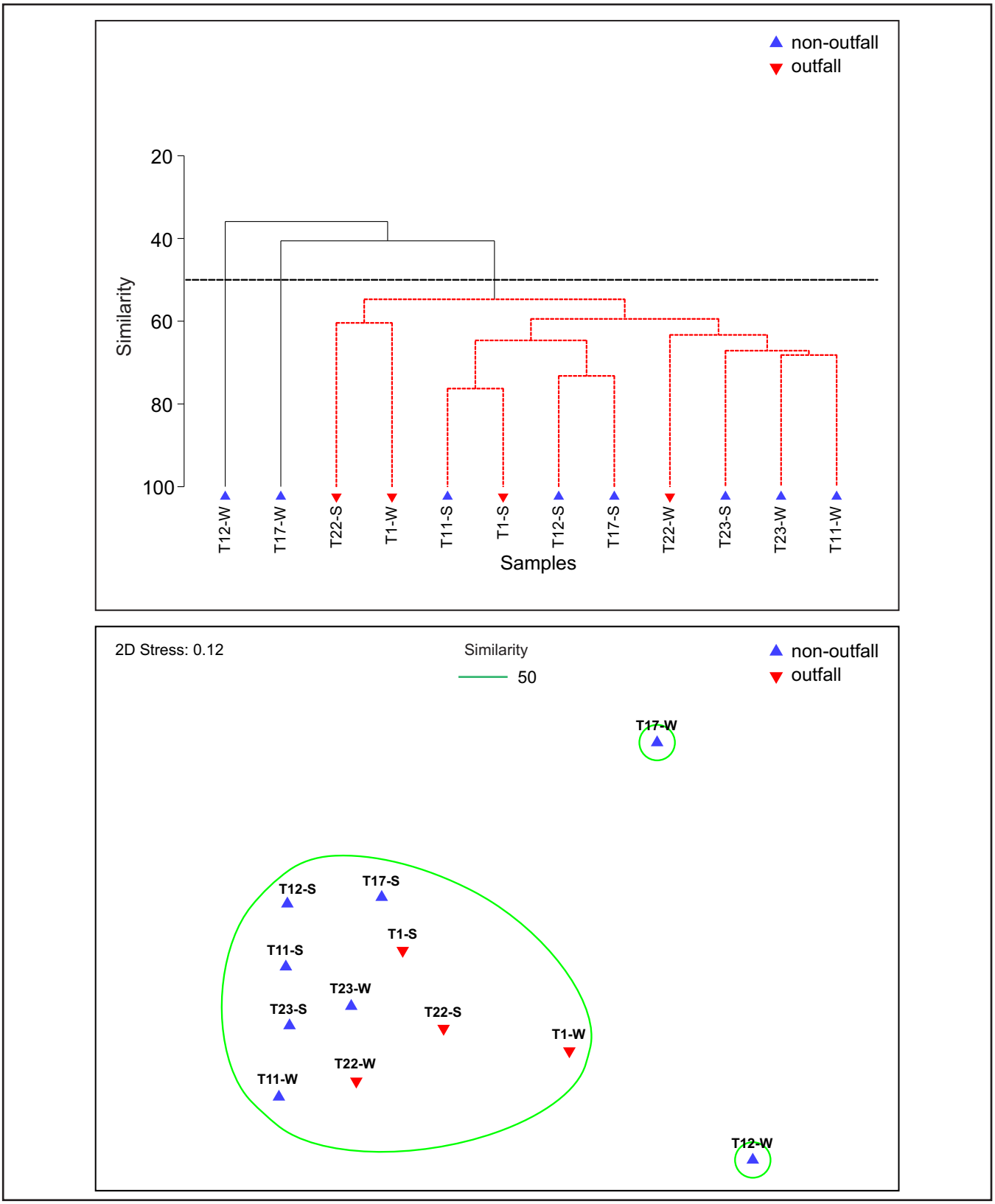

Figure 2-5. **Dendrogram (top panel) and non-metric Multidimensional Scaling (MDS) plot (bottom panel) of the epibenthic macroinvertebrates collected at outfall and non-outfall stations for the Summer 2013 (S) and Winter 2014 (W) OCSD monitoring surveys.**
Stations connected by red dashed lines in the dendrogram are not significantly differentiated by the SIMPROF test. The three clusters formed at a 50% similarity level on the dendrogram are superimposed on the MDS plot.

Orange County Sanitation District, California.

Table 2-11. Summary statistics of demersal fish community measures for Summer 2013 and Winter 2014 trawl surveys.

Orange County Sanitation District, California

Season	Station Group	Station	Depth (m)	Total Number of Species	Total Abundance	Biomass (kg)	Shannon-Wiener Diversity Index (H')	Swartz's 75% Dominance Index	Fish Response Index (FRI)
Summer	Non-outfall	T11	60	11	544	6.70	1.2	2	22
		T12	57	16	732	9.59	1.4	3	22
		T17	60	15	625	8.95	1.5	3	26
		T23	58	17	842	25.57	1.5	2	27
		Mean	**59**	**15**	**686**	**12.70**	**1.4**	**3**	**24**
	Outfall	T1	55	15	583	13.54	1.5	3	23
		T22	60	13	254	8.59	1.5	2	24
		Mean	**58**	**14**	**419**	**11.06**	**1.5**	**3**	**24**
Winter	Non-outfall	T11	60	15	445	17.56	2.1	5	24
		T12	57	18	236	8.15	2.1	4	21
		T17	60	15	368	12.18	1.8	3	19
		T23	58	13	155	6.68	2.1	5	18
		Mean	**59**	**15**	**301**	**11.14**	**2.0**	**4**	**21**
	Outfall	T1	55	12	291	16.75	1.9	5	18
		T22	60	14	226	12.56	2.1	5	20
		Mean	**58**	**13**	**259**	**14.65**	**2.0**	**5**	**19**

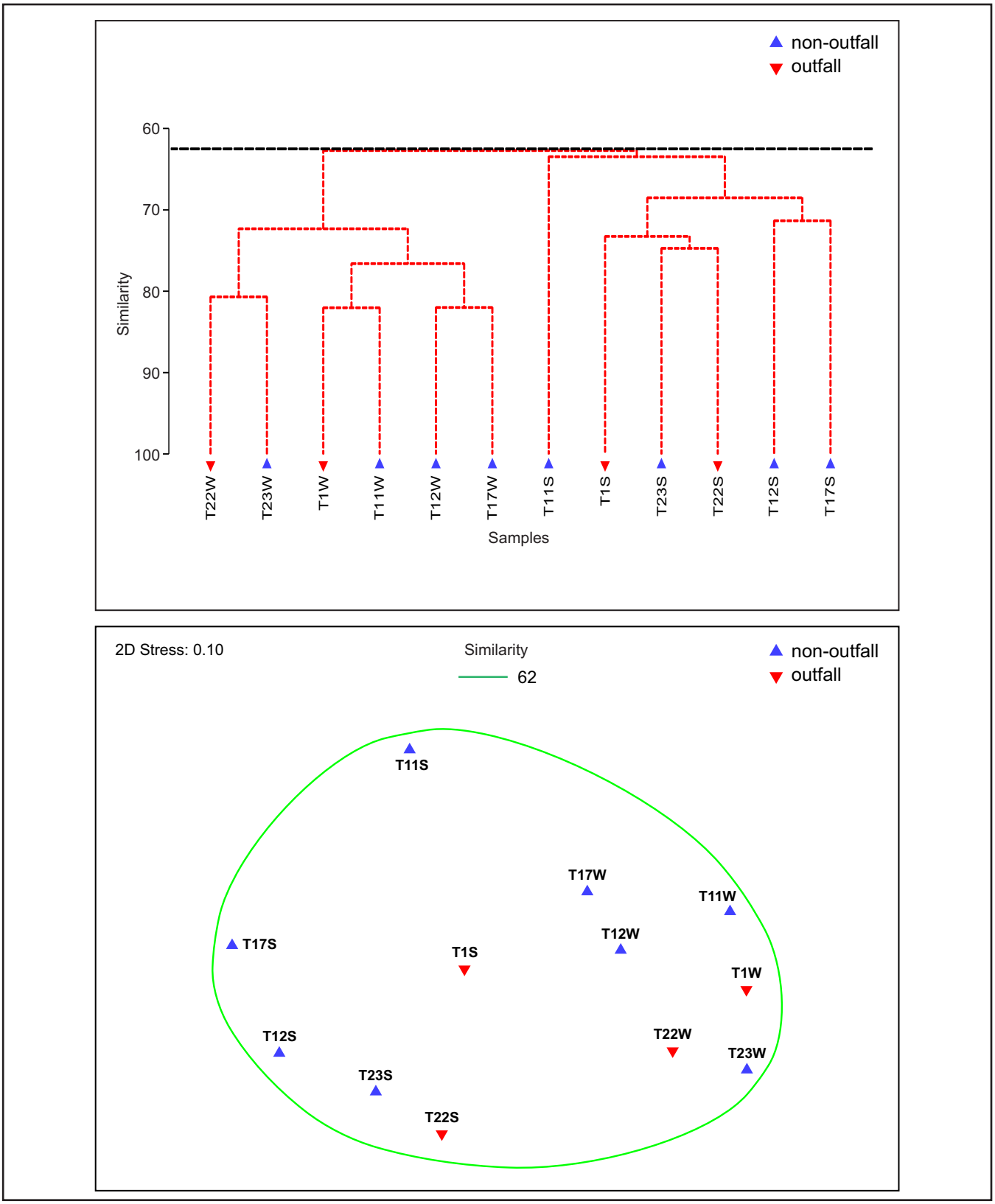

Figure 2-6. **Dendrogram (top panel) and non-metric Multidimensional Scaling (MDS) plot (bottom panel) of the demersal fishes collected at outfall and non-outfall stations for the Summer 2013 (S) and Winter 2014 (W) OCSD monitoring surveys.**
Stations connected by red dashed lines in the dendrogram are not significantly differentiated by the SIMPROF test. The single cluster formed at a 62% similarity level on the dendrogram is superimposed on the MDS plot.

Orange County Sanitation District, California.

Table 2-12. Summary statistics of tissue contaminant analyses of trawl fishes collected in January 2014 at outfall and farfield stations.

Orange County Sanitation District, California.

Species	Tissue	Station Group	n	Mean Standard Length (mm)	Percent Lipid	Mercury (mg/kg)	Total DDT (µg/kg)	Total PCB (µg/kg)	Total Chlordane (µg/kg)	Dieldrin (µg/kg)
Pleuronichthys verticalis (Hornyhead Turbot)	Muscle	T11 (Farfield)	10	159	0.14	0.06 (0.02-0.09)	18.73 (9.19-37.37)	2.88 (0-9.43)	ND	0.16 (0.16-0.16)
		T1 (Outfall)	10	164	0.15	0.09 (0.02-0.42)	13.00 (6.81-22.77)	3.40 (0.98-10.11)	ND	0.67 (0.16-5.31)
	Liver	T11 (Farfield)	10	159	5.8	0.20 (0.12-0.48)	561.15 (95-1022.50)	52.26 (0-187.42)	ND	0.78 (0.78-0.78)
		T1 (Outfall)	10	164	8.75	0.16 (0.02-0.53)	666.89 (109-1806.20)	73.58 (30.40-138.56)	ND	0.78 (0.78-0.78)
Parophrys vetulus (English Sole)	Muscle	T11 (Farfield)	10	181	0.89	0.05 (0.03-0.07)	130.93 (54.66-395.40)	10.12 (1.53-18.61)	ND	0.16 (0.16-0.16)
		T1 (Outfall)	10	178	1.57	0.06 (0.02-0.10)	200.65 (59.89-480)	48.79 (12.87-130.90)	ND	0.16 (0.16-0.16)
	Liver	T11 (Farfield)	10	181	9.8	0.04 (0.02-0.06)	373.30 (153.10-1004.04)	73.94 (22.59-144.02)	ND	0.78 (0.78-0.78)
		T1 (Outfall)	10	178	18.84	0.06 (0.03-0.12)	739.32 (262-1579.88)	116.83 (25.40-285.10)	ND	0.78 (0.78-0.78)
California No Consumption Advisory Tissue Level (ATL)						0.44	2100	120	560	46
FDA Action Level for edible tissue						1	5000	2000	300	300

ND = Not Detected.

fish with large ranges may be captured away from the primary location of exposure (Allen 2006). As the migratory patterns of the fish species used in OCSD's ocean monitoring program are unknown, immigration of fish into the monitoring area may account for the elevated levels of tDDT and tPCB recorded in fish liver tissue in this survey. Overall, there is no outfall-related trend of increasing contaminant levels in fish muscle or liver tissue. These results demonstrate that the outfall is not an epicenter of disease due to the bioaccumulation of contaminants in fish tissue.

Sport Fish Muscle Chemistry

Although the rig fishing sampling objective was not met at Zone 2 (n=3), all fish muscle tissue contaminant levels at this zone, as well as those at Zone 1, were well below federal and state human consumption guidelines (Table 2-13). These results, in tandem with the demersal fish tissue chemistry results, indicate there is little risk from consuming fish from the monitored areas and criterion V.A.4.c was achieved.

Fish Health

Fishes appeared normal in both color and odor in 2013-14, thus criterion V.A.4.b was met. Furthermore, less than 1% of all fishes collected showed evidence of irregularities. The most common irregularity was the presence of the eye parasite *Phrixocephalus cincinnatus* on the Pacific Sanddab (*Citharichthys sordidus*), which occurred in 1% of the examined fish. These results are comparable to background levels found within the SCB (Perkins and Gartman 1997) and do not indicate a degraded biota.

CONCLUSIONS

In 2013-14, the District achieved compliance for all permit criteria. The overall frequency of compliance for all monitoring parameters cannot be expressed as a single numerical value because many of the criteria are descriptive rather than numeric. In summary, California Ocean Plan criteria for water quality were met. Bacterial standards were consistently achieved at near- and offshore stations. Sediment quality was not degraded by excessive loading of measured chemical contaminants or by physical changes to the sediment from the discharge of wastewater solids. Normal infaunal communities were present throughout the monitoring area. Fish and trawl invertebrate communities in the monitoring area were healthy and diverse, and federal and state fish consumption guidelines were met with no outfall influence indicated. These results indicate that the receiving environment was not degraded by the discharge of the treated wastewater, all permit compliance criteria were met, and environmental and human health was protected.

Table 2-13. Summary statistics of muscle tissue contaminant analyses of rig-caught fishes collected in January 2014 at Zone 1 (outfall) and Zone 2 (farfield).

Orange County Sanitation District, California.

Zone	Species	n	Mean Standard Length (mm)	Lipids (%)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	Total DDT (µg/kg)	Total PCB (µg/kg)	Total Chlordane (µg/kg)	Dieldrin (µg/kg)
1 - Outfall	*Scorpaena guttata* (California Scorpionfish)	2	278	0.12	0.26 (0.13-0.40)	3.12 (1.41-4.83)	0.54 (0.50-0.58)	12.21 (6.32-18.09)	3.23 (2.76-3.70)	ND	ND
	Sebastes caurinus (Copper Rockfish)	9	279	0.15	0.12 (0.08-0.16)	1.55 (0.93-2.08)	0.86 (0.71-1.01)	11.66 (5.21-20.77)	3.52 (1.04-6.14)	ND	ND
	Sebastes dallii (Calico Rockfish)	3	128	0.27	0.09 (0.02-0.13)	0.63 (0.49-0.85)	0.98 (0.45-1.31)	18.27 (14.70-22.50)	3.38 (1.52-5.01)	2.63 (0-7.89)	ND
	Sebastes miniatus (Vermilion Rockfish)	14	235	0.47	0.05 (0.03-0.07)	1.61 (1.19-2.11)	0.66 (0.48-0.87)	9.36 (4.21-18.97)	2.46 (0.54-5.06)	0.63 (0-8.80)	ND
2 - Farfield	*Sebastes miniatus* (Vermilion Rockfish)	3	214	0.48	0.07 (0.06-0.08)	1.44 (1.37-1.48)	0.6 (0.48-0.79)	27.69 (2.76-66.90)	2.58 (0-4.67)	0.49 (0-1.47)	0.93 (0-2.78)
CA Advisory Tissue Level (ATL)			0.44	NA	15	2100	120	560	46	0.44	NA
Federal Action Level for edible tissue			1	NA	NA	5000	2000	300	300	1	NA

ND = Not Detected.

NA = Not Applicable.

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