Mission Bay WMA

9.1 Monitoring Site Descriptions

The Mission Bay watershed management area includes three hydrologic areas: Scripps (HA 906.30), Miramar (HA 906.40) and Tecolote (HA 906.50). Mission Bay drains both Rose and Tecolote Creeks. It was converted from a coastal marshland in the 1940s and now functions as a 4000-acre aquatic park. This watershed management area covers over 43,200 acres (Figure 9-1). The entire watershed management area lies within the City of San Diego. Land use within the watershed is primarily parks (26%) and residential (26%). Total population for the watershed in 2000 was more than 215,100.

Urban runoff, sewage spills, and bacterial contamination have been reported as impairing water quality within the Mission Bay watershed management area. Restricted tidal flow within Mission Bay is limiting pollutant transport to the Pacific Ocean. This watershed management area supports a variety of ecosystems and provides many beneficial uses (Table 9-1). Major impacts to the Mission Bay watershed management area include surface water quality degradation, beach closures, sedimentation, habitat degradation and loss, invasive species, and eutrophication. Table 9-2 presents the water bodies that have been placed on the SWRCB 2002 303(d) list.

Annual rainfall over the watershed ranges from 10.5 inches near the coast to 13.5 inches over the eastern portion of the watershed (Figure 9-1).

The Tecolote Creek (TC, SD5) mass loading station is located along a trapezoidal, concrete-lined open channel on the east side of Morena Boulevard in San Diego. The contributing runoff area covers over 5,992 acres, which is approximately 14% of the Mission Bay watershed management area. The primary land uses within the contributing runoff area are residential (43%), and transportation (21%).

Stream bioassessment monitoring in the Mission Bay WMA has occurred at sites in Rose Creek and Tecolote Creek. The Rose Creek site is located just downstream of the Highway 52 overcrossing. The stream bed and riparian zone have remained relatively undisturbed, although freeway and railroad development are in close proximity. The in-stream habitat of the riffles consists of moderately stable, smooth cobble and has perennial water flow. Tecolote Creek monitoring has occurred at two reaches. The upper reach is at Mt. Acadia Blvd. and the lower reach is upstream of Cross St., just above the beginning of the channelized portion of the creek. Both reaches are within the Tecolote Canyon Natural Park, and the stream bed and riparian zones are mostly undisturbed. The riffle substrate in Tecolote Creek is primarily unconsolidated gravel, but there is moderate treefall and roots within the streambed that add stability. Flow in the creek is year-round at the lower reach, but is generally quite low in the dry season.

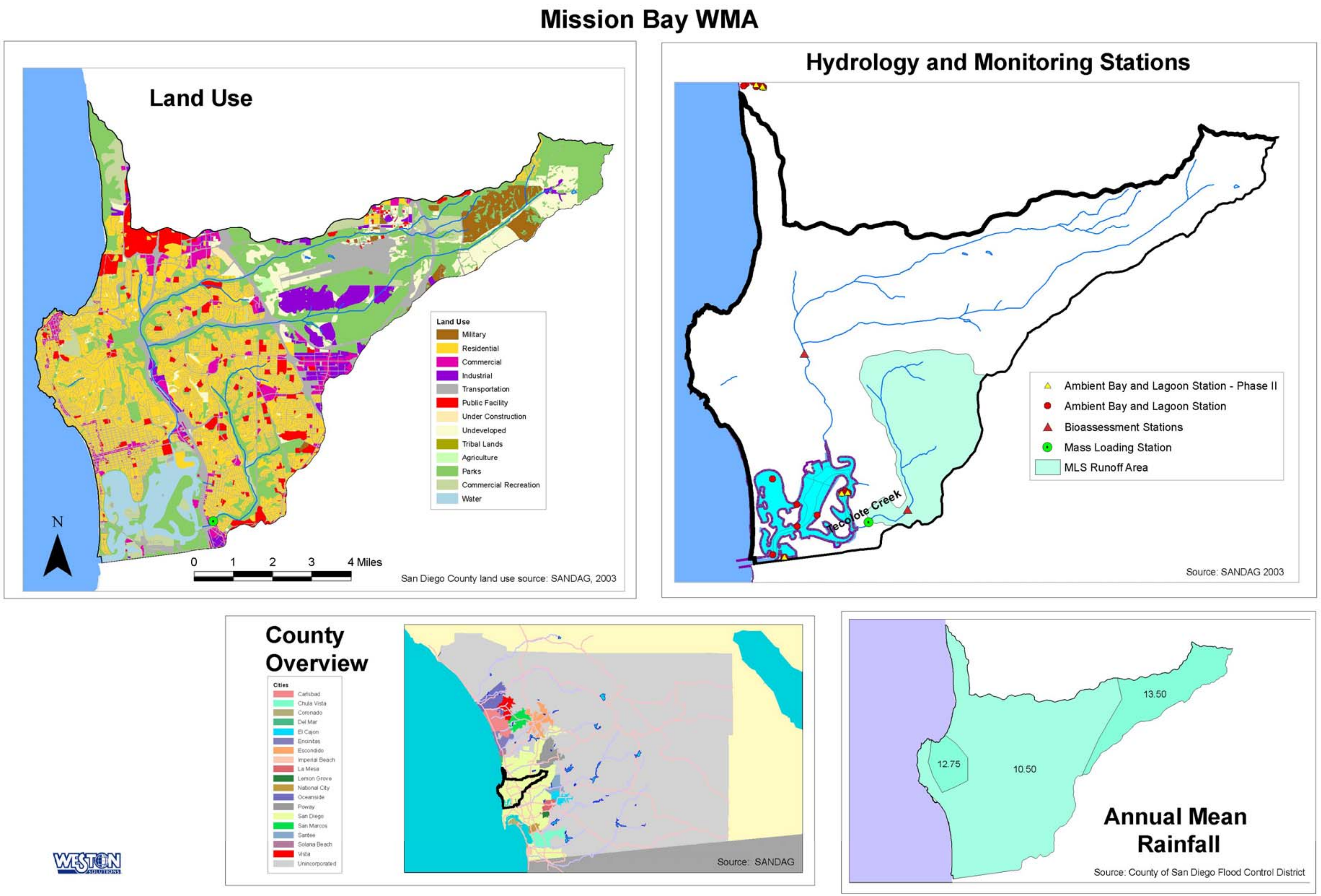

Figure 9-1. Mission Bay Watershed Management Area.

Table 9-1. Beneficial uses within the Mission Bay watershed (Rose and Tecolote Creeks).

Beneficial Uses	Inland Surface Waters [(a)]	Coastal Waters [(b)]	Ground Waters
Municipal and Domestic Supply			
Agricultural Supply			
Industrial Service Supply	O	●	
Industrial Process Supply			
Ground Water Recharge			
Navigation			
Contact Water Recreation	●	●	
Non-Contact Water Recreation	●	●	
Commercial and Sport Fishing		●	
Warm Freshwater Habitat	●		
Cold Freshwater Habitat	●		
Biological Habitats of Special Significance			
Estuarine Habitat		●	
Wildlife Habitat	●	●	
Rare, Threatened, or Endangered Species	●	●	
Marine Habitat		●	
Migration of Aquatic Organisms		●	
Shellfish Harvesting		●	
Aquaculture			
Spawning, Reproduction and/or Early Development			

● = Existing
O = Potential
[(a)] Rose Canyon and Tecolote
[(b)] Mission Bay

Source: Basin Plan September 8, 1994 (Tables 2-2, 2-3, 2-4, 2-5)

Table 9-2. Water bodies on the SWRCB 303(d) List in the Mission Bay watershed.

Water Body Name	Hydrologic Sub Area (HSA)	HSA #	Pollutant/Stressor
Pacific Ocean Shoreline	Scripps	906.30	Bacteria Indicators
Mission Bay	Miramar	906.40	Bacteria Indicators, Eutrophic, Lead
Tecolote Creek	Tecolote	906.50	Bacterial Indicators, Cadmium, Copper, Lead, Toxicity, Zinc

Source: SWRCB 2003

The primary receiving water body for Tecolote Creek is Mission Bay, located within the City of San Diego. Mission Bay is a large man-made coastal embayment that encompasses an area of over 4,000 acres and 27 miles of shoreline. The Bay consists of numerous smaller bays, coves, inlets, and large stretches of open water. The three Ambient Bay and Lagoon monitoring sites in Mission Bay were located in the northeastern portion between the mouths of Rose Creek and Tecolote Creek (Figure 9-1). These creeks provide the majority of the freshwater input to Mission Bay, but the Bay is also influenced by over 100 storm drains. Rose and Tecolote Creeks and the majority of the storm drains that discharge to the Bay are connected to a diversion system that diverts dry weather flow to the sanitary sewer. The diversion system is not operational during wet weather. Mission Bay is connected to the ocean through a large rip-rapped channel on the Bay's southwest corner. Tidal flushing is thought to be fairly good near the channel, but circulation is restricted in the eastern portion of the Bay, particularly near the mouth of Tecolote Creek. Mission Bay was created through extensive dredging and filling operations from the mid-1940s through the mid-1960s. An area in the southeast corner of the Bay was used as a municipal landfill during the 1950s. Currently, Mission Bay is surrounded by residential and commercial uses and Interstate 5 parallels the Bay's eastern border. Mission Bay is listed on the SWRCB 2002 303(d) list for bacterial indicators, eutrophic conditions, and lead (Table 9-2).

9.2 Storm Water Monitoring Summary

9.2.1 2004-2005 Results

The Tecolote Creek mass loading station has been monitored since 1993 for a total of 35 storms. For the 2004-2005 wet season, monitoring occurred on October 27, 2004 and February 11 and 18, 2005. The results for last 35 storms were compared to water quality objectives (WQO) to identify potential water quality concerns during storm flow (Table 9-3).

Fecal coliform, total suspended solids (TSS), and turbidity levels exceeded WQOs during all three storm events monitored in 2004-2005. During the October 27, 2004 storm event, the WQO for chemical oxygen demand (COD), total phosphorus, copper, and zinc were also exceeded (Table 9-3). Concentrations of Diazinon were detected during the February 11, 2005 storm event, however concentrations did not exceed the water quality objectives during 2004-2005.

No toxicity to *Hyalella*, *Selenastrum, or Ceriodaphnia* was observed in any of the Tecolote Creek samples collected in 2004-2005 (See Section 3.1.6.2 for details on toxicity testing).

Table 9-3. Analytes measured at the Tecolote Creek mass loading station.

ANALYTE	UNITS	WQO	SOURCE	1993-94		1994-95				1995-96			1996-97		1997-98			1998-99			1999-00		
				12/11/1993	1/25/1994	11/10/1994	12/25/1994	1/11/1995	2/14/1995	11/1/1995	1/22/1996	1/31/1996	10/30/1996	11/21/1996	11/10/1997	12/6/1997	3/25/1998	11/8/1998	1/25/1999	3/15/1999	2/12/2000	3/5/2000	4/17/2000
General / Physical / Organic																							
Electrical Conductivity	umhos/cm					3220	393	414	185	1040	989		2220	53.5	1130	1690	726	6070	629	542	746	823	792
Oil And Grease	mg/L	15	USEPA Multi-Sector General Permit	1.96	3.1	1.2	1.28	0.82	1.55	11.4	2.4		2.5	2.4	3.6	1.6	0.6	0.7	<0.5	<0.5	4.16	1.56	2.96
pH	pH Units	6.5-8.5	Basin Plan			7.4	7.4	7.4	9.1		7.8												
Bacteriological																							
Enterococci	MPN/100 mL																						
Fecal Coliform	MPN/100 mL	4,000	Basin Plan	2,400	<30	**11,000**	**17,000**	**>160,000**	**160,000**	**>16,000**	**16,000**		**8,000**	**16,000**	**160,000**	3,640	**8,850**	1,600	1,600	1,600	<2	1,600	<2
Total Coliform	MPN/100 mL			240,000	240,000	50,000	>160,000	>160,000	>160,000	>16,000			160,000	24,000	160,000	20,000	20,000	241,900	125,900	613,000	240	1,600	900
Wet Chemistry																							
Ammonia As Nitrogen	mg/L				1.1	1.2	0.3	0.3	0.4	0.41	<0.2	<0.2	0.44	0.32	0.56	0.57	0.6	0.6	0.57	0.51	1.57	<0.1	<0.1
Un-ionized Ammonia as N	µg/L	25 (a)	Basin Plan																				
Biological Oxygen Demand	mg/L	30	USEPA Multi-Sector General Permit		20	20	23.3	<3	9.5	12.8	<5	<5	13.4	12.9	**33**	**43**	22	30	5	9	11.7	2.38	5.7
Chemical Oxygen Demand	mg/L	120	USEPA Multi-Sector General Permit		**280**	100	**150**	91	74	**126**	**132**	69	56	35	89	20	22	61	33	33	74	60	36
Dissolved Organic Carbon	mg/L																						
Dissolved Phosphorus	mg/L	2	USEPA Multi-Sector General Permit		0.2	0.4	<0.05	0.5	0.3	0.1	0.8	0.4	0.2	0.2	<0.1	0.1	0.12	0.52	0.15	0.1	<0.1	0.13	<0.1
Nitrate Nitrogen As N	mg/L	10	Basin Plan		4.2	<0.1	0.8	0.8	0.8				1.1	1	1.7	0.54	0.5	0.52	0.7	0.53	3.3	0.6	2.3
Nitrite Nitrogen As N	mg/L	1	Basin Plan		0.15	<0.05	<0.05	<0.05	<0.05							0.06	0.05	0.1	<0.05	0.05	0.065	<0.05	<0.05
Surfactants (MBAS)	mg/L	0.5	Basin Plan		0.31	**0.77**	**0.52**	0.23	0.17	0.26	0.14	<0.1	<0.1	<0.1	<0.1	0.05	0.2	**0.51**	0.08	<0.05	0.48	0.24	0.2
Total Dissolved Solids	mg/L	1500	Basin Plan by watershed	400	750	2300	260	370	680	1270	842	256	546	362	1730	447	318	1492	563	660	279	304	302
Total Kjeldahl Nitrogen	mg/L				10	3.7	3.7	2.3	3.6	3.9	2.6	0.89	2.9	2.7	1.6	<1	1.1	0.12	2.93	1.85	2.1	0.77	1.83
Total Organic Carbon	mg/L																						
Total Phosphorus	mg/L	2	USEPA Multi-Sector General Permit		0.3	0.5	<0.05	1.1	0.4	0.5	<0.2	<0.2	0.8	0.5	0.7	0.12	0.23	0.61	0.16	0.16	0.21	0.34	0.4
Total Suspended Solids	mg/L	100	USEPA Multi-Sector General Permit	**880**	**1500**	**140**	**300**	76	**130**	**140**	**244**	92	**348**	**104**	**410**	**503**	**2024**	**913**	**540**	55	**478**	80	87
Turbidity (NTU)	NTU	20	Basin Plan		8	**36**	**43**	**66**	**39**	**79.6**	17.4	12.1	**120**	**131**	**160**	**27**	**96**	**84**	**45**	17	17	**63**	**60**
Pesticides																							
Chlorpyrifos	µg/L	0.02	CA Dept. of Fish & Game															<0.05*		<0.5*	<0.5*	<0.5*	<0.5*
Diazinon	µg/L	0.08	CA Dept. of Fish & Game															**0.4**	**0.28**	**0.41**	<0.5*	<0.5*	**0.18**
Malathion	µg/L	0.43	CA Dept. of Fish & Game																				
Hardness																							
Total Hardness	mg CaCO3/L			210	550	1100	140	120	340	547	363	111	268	253	694	186	124	148	218	277	216	126	105
Total Metals																							
Antimony	mg/L	0.006	Basin Plan	0.0014	0.0012	0.0019	<0.001	<0.001	0.0012	<0.0015			<0.003	0.003	<0.0015	<32*	<32*	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Arsenic	mg/L	0.34/0.05	40 CFR 131/ Basin Plan	0.0069	0.013	<0.005	0.0089	<0.005	<0.005	0.008			0.009	0.007	0.001	<0.053*	<0.053*	0.004	0.0015	0.002	<0.001	0.006	0.009
Cadmium	mg/L	(b)	40 CFR 131	0.0023	0.0027	0.0003	0.0008	0.0003	0.0003	0.0009			0.0016	0.0019	<0.00025	<0.004	<0.004	0.004	<0.00025	<0.00025	<0.00025	0.001	<0.00025
Chromium	mg/L	(b)	CTR (Cr VI)	0.0017	0.006	0.0028	0.0019	0.0028	0.0051	<0.005			0.010	<0.010	<0.005	<0.007	0.019	<0.005	0.009	0.056	<0.005	<0.005	<0.005
Copper	mg/L	(b)	40 CFR 131	0.030	0.054	0.0068	**0.025**	0.010	0.012	0.033			**0.050**	0.020	0.009	**0.056**	**0.146**	<0.005	<0.005	<0.005	**0.036**	0.017	<0.005
Lead	mg/L	(b)	40 CFR 131	0.140	0.200	0.003	0.035	0.019	0.013	0.0173			0.050	0.026	<0.001	<0.042	<0.042	0.040	0.003	0.023	0.027	<0.001	<0.001
Nickel	mg/L	(b)/0.1	40 CFR 131/ Basin Plan	0.022	0.018	0.016	0.0065	<0.005	0.005	0.014			<0.010	<0.010	<0.005	<0.015	<0.015	0.020	<0.005	0.009	<0.005	<0.005	<0.005
Selenium	mg/L	0.02	40 CFR 131	<0.0005	0.0006	<0.0005	0.0012	0.0006	0.0005	0.0023			0.002	0.003	<0.001	<0.075	<0.075	0.004	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	(b)	40 CFR 131	**0.780**	0.490	0.034	0.170	0.059	0.062	**0.137**			0.230	0.120	0.069	0.068	0.130	<0.025	<0.025	0.071	0.160	0.012	0.050
Dissolved Metals																							
Antimony	mg/L	(e)	40 CFR 131			0.0019	0.001	<0.001	<0.001		<0.0015	<0.0015	<0.003	<0.003							<0.0015	<0.0015	<0.0015
Arsenic	mg/L	0.34 (c)	40 CFR 131			<0.005	<0.005	<0.005	<0.005		0.005	0.003	0.002	0.002							<0.001	<0.001	<0.001
Cadmium	mg/L	(b)	40 CFR 131			0.0003	<0.0002	<0.0002	<0.0002		<0.00025	<0.00025	<0.0005	0.0005							<0.00025	<0.00025	<0.00025
Chromium	mg/L	(b)	40 CFR 131			0.0019	<0.001	0.0014	<0.001		<0.005	<0.005	<0.010	<0.010							<0.005	<0.005	<0.005
Copper	mg/L	(b)	40 CFR 131			0.0059	<0.005	0.005	0.0059		<0.008	0.006	0.010	<0.010							<0.005	<0.005	<0.005
Lead	mg/L	(b)	40 CFR 131			0.0015	<0.001	<0.001	0.0019		0.002	<0.001	<0.002	<0.002							<0.005	<0.001	<0.001
Nickel	mg/L	(b)	40 CFR 131			0.0150	<0.005	<0.005	<0.005		<0.005	<0.005	<0.010	<0.010							<0.005	<0.005	<0.005
Selenium	mg/L	0.02 (d)	40 CFR 131			<0.0005	<0.0005	<0.0005	<0.0005		<0.001	<0.001	<0.002	<0.003							<0.001	<0.001	<0.001
Zinc	mg/L	(b)	40 CFR 131			0.039	0.013	0.017	0.016		0.026	<0.025	0.230	<0.050							0.016	0.012	<0.001
Toxicity																							
Ceriodaphnia 96-hr	LC50 (%)	100																					
Ceriodaphnia 7-day survival	NOEC (%)	100																					
Ceriodaphnia 7-day reproduction	NOEC (%)	100																					
Hyalella 96-hr	NOEC (%)	100																					
Selenastrum 96-hr	NOEC (%)	100																					

See last page for footnotes and source references

Table 9-3. Analytes measured at the Tecolote Creek mass loading station.

ANALYTE	UNITS	WQO	SOURCE	2000-01			2001-02			2002-03			2003-04			2004-05			Frequency Above WQO	Mean Ratio to WQO
				10/27/2000	1/8/2001	2/13/2001	11/29/2001	2/17/2002	3/8/2002	11/8/2002	12/16/2002	2/11/2003	11/1/2003	11/12/2003	2/3/2004	10/27/04	02/11/05	02/18/05		
General / Physical / Organic																				
Electrical Conductivity	umhos/cm			2950	2350	338	3300	5090	3650	1694	311	322	4740	4490	850	167	473	199		
Oil And Grease	mg/L	15	USEPA Multi-Sector General Permit	4	1	1	<1	<1	2	2.00	1.69	3.16	1.05	<1	<1	<1	1.32	<1	0%	0.12
pH	pH Units	6.5-8.5	Basin Plan				7.7	7.4	7.7	6.67	7.61	7.55	7.67	7.73	6.85	6.78	6.90	7.14	3%	0.03
Bacteriological																				
Enterococci	MPN/100 mL			9,000	17,000	5,000	7,000	7,000	3,000	35,000	23,000	14,000	11,000	8,000	80,000	300,000	50,000	30,000		
Fecal Coliform	MPN/100 mL	4,000	Basin Plan	**50,000**	**21,000**	1,300	3,000	**5,000**	**7,000**	**110,000**	**13,000**	2,200	**50,000**	**17,000**	**13,000**	**70,000**	**13,000**	**17,000**	57%	5.73
Total Coliform	MPN/100 mL			170,000	220,000	8,000	5,000	22,000	11,000	300,000	50,000	30,000	230,000	50,000	50,000	800,000	130,000	130,000		
Wet Chemistry																				
Ammonia As Nitrogen	mg/L			0.91	0.5	0.4	0.9	0.19	0.28	0.44	0.34	0.26	0.38	<0.1	0.14	0.39	0.35	<0.1		
Un-ionized Ammonia as N	µg/L	25 (a)	Basin Plan							0.64	3.79	2.4	5.19	0.79	0.24	0.6	0.1	0.5	0%	0.02
Biological Oxygen Demand	mg/L	30	USEPA Multi-Sector General Permit	14	13.2	<2	3.6	4.5	4.6	6.75	22.4	25.4	22.9	4.19	**68.4**	7.45	7.75	3.65	9%	0.47
Chemical Oxygen Demand	mg/L	120	USEPA Multi-Sector General Permit	**122**	118	88	60	**155**	57	79	67	**125**	**211**	99	**148**	**173**	88	25	29%	0.75
Dissolved Organic Carbon	mg/L									8.3	13.2	15.9	26.1	20.5	6.46	34	7.8	4.44		
Dissolved Phosphorus	mg/L	2	USEPA Multi-Sector General Permit	0.14	0.28	0.27	0.11	0.4	0.13	0.16	0.32	0.82	0.47	0.27	0.06	0.89	0.46	<0.05	0%	0.13
Nitrate Nitrogen As N	mg/L	10	Basin Plan	1	0.7	0.6	0.4	0.5	0.4	0.81	0.84	0.90	1.84	0.95	0.55	0.53	0.5	0.42	0%	0.09
Nitrite Nitrogen As N	mg/L	1	Basin Plan	0.09	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.06	0.07	0.06	<0.05	<0.05	<0.05	<0.05	0%	0.04
Surfactants (MBAS)	mg/L	0.5	Basin Plan	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	9%	0.43
Total Dissolved Solids	mg/L	1500	Basin Plan by watershed	440	2320	250	1890	2200	2490	757	220	373	2660	1070	1190	174	627	285		
Total Kjeldahl Nitrogen	mg/L			2.15	6.5	0.67	2.2	2	0.39	2.1	1.4	3.7	3	1.8	3.4	6	1	6.2		
Total Organic Carbon	mg/L									21.9	27.0	15.4	35.5	20	18.8	36.4	12.1	8.27		
Total Phosphorus	mg/L	2	USEPA Multi-Sector General Permit	0.5	0.32	0.38	0.24	0.65	0.22	0.6	1.84	1.03	1.14	0.34	0.58	**2.87**	0.47	0.5	3%	0.27
Total Suspended Solids	mg/L	100	USEPA Multi-Sector General Permit	**103**	75	**179**	34	68	33	**158**	**346**	**301**	**102**	<20	<20	**2180**	**229**	**245**	69%	3.75
Turbidity (NTU)	NTU	20	Basin Plan	**73.8**	**63**	**85**	**21.3**	8.99	10.7	**102**	**200**	**200**	**34.7**	13.5	**201**	**540**	**44.7**	**67.4**	74%	3.98
Pesticides																				
Chlorpyrifos	µg/L	0.02	CA Dept. of Fish & Game	<0.05*	<0.5*	**0.03**	<0.03*	<0.03*	<0.03*	<0.03*	**0.087**	<0.03*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	23%	2.14
Diazinon	µg/L	0.08	CA Dept. of Fish & Game	**0.47**	<0.5	**0.16**	**0.22**	**0.19**	**0.09**	**0.185**	**0.095**	**0.155**	**0.116**	0.073	0.053	<0.01	0.051	<0.01	46%	1.39
Malathion	µg/L	0.43	CA Dept. of Fish & Game	**1.8**	<0.5*	<0.1				<0.10	<0.10	**0.87**	<0.01	0.269	0.085	<0.01	0.063	<0.01	13%	0.54
Hardness																				
Total Hardness	mg CaCO3/L			209	1070	107	962	1180	1350	344	245	298	1470	1300	591	126	330	152		
Total Metals																				
Antimony	mg/L	0.006	Basin Plan	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.006	**0.009**	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005	6%	0.30
Arsenic	mg/L	0.34/0.05	40 CFR 131/ Basin Plan	0.007	0.007	0.005	0.001	0.004	0.004	0.008	0.015	0.013	0.009	0.006	0.016	0.006	0.009	<0.002	0%	0.15
Cadmium	mg/L	(b)	40 CFR 131	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0%	0.08
Chromium	mg/L	(b)	CTR (Cr VI)	0.006	<0.005	0.006	0.006	0.006	<0.005	<0.005	0.02	0.018	0.005	<0.005	0.015	<0.005	<0.005	<0.005	0%	0.00
Copper	mg/L	(b)	40 CFR 131	0.023	0.012	**0.016**	0.008	0.009	0.009	0.03	**0.050**	0.038	0.011	0.009	0.044	**0.038**	0.018	0.010	27%	0.89
Lead	mg/L	(b)	40 CFR 131	0.015	0.008	0.018	0.004	0.004	<0.002	0.018	0.052	0.040	0.006	0.003	0.034	0.065	0.019	0.011		
Nickel	mg/L	(b)/0.1	40 CFR 131/ Basin Plan	0.011	0.009	0.005	0.005	0.006	0.006	0.008	0.011	0.012	0.007	0.005	0.012	0.012	0.005	0.003	0%	0.01
Selenium	mg/L	0.02	40 CFR 131	<0.002	0.006	<0.002	<0.002	0.003	0.002	<0.004	<0.004	<0.004	<0.004	<0.005	<0.005	<0.005	<0.005	<0.005	6%	0.19
Zinc	mg/L	(b)	40 CFR 131	0.080	0.040	0.080	0.022	0.028	0.034	0.096	0.208	0.235	0.047	0.033	0.206	**0.237**	0.086	0.065	9%	0.49
Dissolved Metals																				
Antimony	mg/L	(e)	40 CFR 131	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.002	0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		
Arsenic	mg/L	0.34 (c)	40 CFR 131	0.003	0.003	0.002	0.001	0.001	0.002	0.003	0.004	0.003	0.004	0.003	0.003	<0.002	<0.002	<0.002	0%	0.01
Cadmium	mg/L	(b)	40 CFR 131	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0%	0.02
Chromium	mg/L	(b)	40 CFR 131	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0%	0.00
Copper	mg/L	(b)	40 CFR 131	0.010	0.006	<0.005	0.006	<0.005	<0.005	0.008	0.006	**0.042**	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	4%	0.18
Lead	mg/L	(b)	40 CFR 131	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0%	0.01
Nickel	mg/L	(b)	40 CFR 131	0.009	0.008	0.002	0.004	0.005	0.005	0.004	<0.002	0.003	0.005	0.003	0.003	<0.002	0.003	<0.002	0%	0.00
Selenium	mg/L	0.02 (d)	40 CFR 131	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	<0.004	<0.004	<0.004	<0.004	<0.005	<0.005	<0.005	<0.005	<0.005	0%	0.07
Zinc	mg/L	(b)	40 CFR 131	0.050	0.030	<0.020	<0.020	0.029	<0.020	0.021	0.039	0.144	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0%	0.11
Toxicity																				
Ceriodaphnia 96-hr	LC50 (%)	100		**25**	100	100	>100	>100	>100	>100	>100	**70.71**	>100	>100	>100	>100	>100	>100	13%	0.36
Ceriodaphnia 7-day survival	NOEC (%)	100		**12.5**	**50**	100	**50**	100	100	100	100	**50**	100	100	100	100	100	100	27%	0.93
Ceriodaphnia 7-day reproduction	NOEC (%)	100					**50**	100	100	100	100	**50**	**50**	100	100	100	100	100	25%	0.50
Hyalella 96-hr	NOEC (%)	100		100	**25**	**12.5**	100	100	100	100	100	100	100	100	100	100	100	100	13%	0.80
Selenastrum 96-hr	NOEC (%)	100					100	**25**	100	100	100	100	100	100	100	100	100	100	8%	0.33

See last page for footnotes and source references

Table 9-3. Analytes measured at the Tecolote Creek mass loading station.

Blank spaces have been verified and no data is available due to changes in the monitoring program.

(a) Un-ionized Ammonia is a calculated value, non-detectable values calculated at the detection limit. Basin Plan WQO is 0.025 mg/L; values shown here have been converted to μg/L.
(b) Water Quality Objective for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(c) Water Quality Objectives for dissolved metal fractions are based on water effects ratios (WER) and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Objective is based on the total recoverable form as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(e) USEPA has not published an aquatic life criterion value.

Shaded text – exceeds water quality objective.

* Indicates detection limit exceeds water quality objective.

Sources
USEPA National Pollutant Discharge Elimination System (NPDES) Storm Water Multi-Sector General Permit for Industrial Activities, 65 Federal Register (FR) 64746, Final Reissuance, October 30, 2000. Table 3 - Parameter benchmark values.
Siepmann and Finlayson 2000.
Basin Plan, September 8, 1994.
Assembly Bill 411 - Title 17 of the California Code of Regulations, Section 7958.
USEPA Federal Register Document 40 CFR Part 131, May 18, 2000.

9.2.2 Relationships/Analyses

Water quality monitoring in Tecolote Creek has been conducted since 1993, thus, it is possible to assess storm water runoff over a longer temporal scale than the other sites in San Diego County with mass loading stations. A review of the data from Tecolote Creek suggests that there are four parameters that are consistently problematic in storm water runoff, including fecal coliform bacteria, TSS, turbidity, and Diazinon. Fecal coliform bacteria originate from the feces of all warm blooded animals. Thus, its presence in the environment can be indicative of natural sources (e.g., birds, rodents, cattle, etc.) as well as human sewage. Fecal coliform bacteria are ubiquitous in the environment and are frequently found in high densities in urban runoff. In Tecolote Creek, the wet weather water quality objective for fecal coliform (4,000 MPN/100 ml) has been exceeded in 22 of the 34 (65%) storm events where it has been analyzed since 1993. Densities have been uniformly high in nearly all the samples collected and there is no apparent temporal trend for this COC during storm events.

Total suspended solids are solid materials suspended in water than can be trapped by a filter. It can include a variety of material such as sand, silt, and clay, decaying plant and animal material, industrial waste, and sewage. High TSS levels can cause many problems for aquatic life in a stream, including the macroinvertebrate community. In addition, high TSS levels can be related to elevated levels of bacteria, nutrients, pesticides, and metals, as these constituents often adhere to particles in the water associated with TSS. Turbidity is a measure of water clarity and is determined by the extent to which particles suspended in a water sample scatter a beam of light. Thus, TSS and turbidity are often co-related. In Tecolote Creek, the water quality objective for TSS (100 mg/L) has been exceeded in 71% (24 of the 34) of the storm water samples collected since 1993 and the objective for turbidity has been exceeded in 74% (26 out of 35) of the samples.

Diazinon is an organophosphate insecticide. Like all pesticides in this chemical family, it kills insects and other organisms through its effect on the nervous system. It inhibits an enzyme, acetylcholinesterase, which breaks down choline. Choline is used to transmit nervous impulses across junctions between nerve cells. In the presence of organophosphates, choline builds up in the junction, resulting in incoordination, convulsions, and ultimately death. Diazinon and other organophosphate pesticides can have a profound impact on the macroinvertebrate population of a stream. In Tecolote Creek, Diazinon has been monitored at the mass loading station during 21 storm events since 1998. Of these, it has exceeded the water quality objective (0.08 μg/L) 13 times (62%), with concentrations ranging from 0.095 to 0.47 μg/L. Review of the data suggests that there is a significant decreasing trend in Diazinon concentrations (R^2=0.30).

In addition to the wet weather monitoring results discussed above, concentrations of MBAS (R^2=0.15), Ammonia as N (R^2=0.14), total cadmium (R^2=0.14), and total lead (R^2=0.17) have shown statistically significant decreasing trends from 1993 through 2005. Increasing trends have been observed for total phosphorus (R^2=0.13) and enterococcus bacteria (R^2=0.46). While these are significant trends, those for the metals and nutrients have low R^2 values which indicate large variability of the data.

Toxicity testing has been performed on storm water from the Tecolote Creek MLS for the past five years or 15 events (See Section 3.1.6.2 for details on toxicity testing). During the first two years, significant toxicity to the test organisms was observed (Table 9-3); however, during the last three years toxicity was only observed to *Ceriodaphnia* and it appears to be related to a specific storm event rather than a persistent problem.

In order to illustrate the magnitude of the water quality exceedances for 2004-2005, the ratio of water quality results to the WQOs were plotted for several of the most common constituents of concern. The results are shown in Figure 9-2. The largest single exceedance was for turbidity, which exceeded the WQO by 27 times during the October 27, 2004 storm. There were also noticeable single exceedances for TSS (22 times the WQO) and for fecal coliform (17.5 times the WQO) during the October 27, 2004 storm. The average magnitude of water quality exceedances was also determined for each constituent by calculating the mean ratio of water quality results to the WQOs from all storm events from October 2001 through April 2004. Mean ratios are illustrated in Figure 9-2. The largest average exceedance for the period of record was for fecal coliform (6.1 times the WQO). The second largest average exceedance was for turbidity, which exceeded the WQO by 4.4 times.

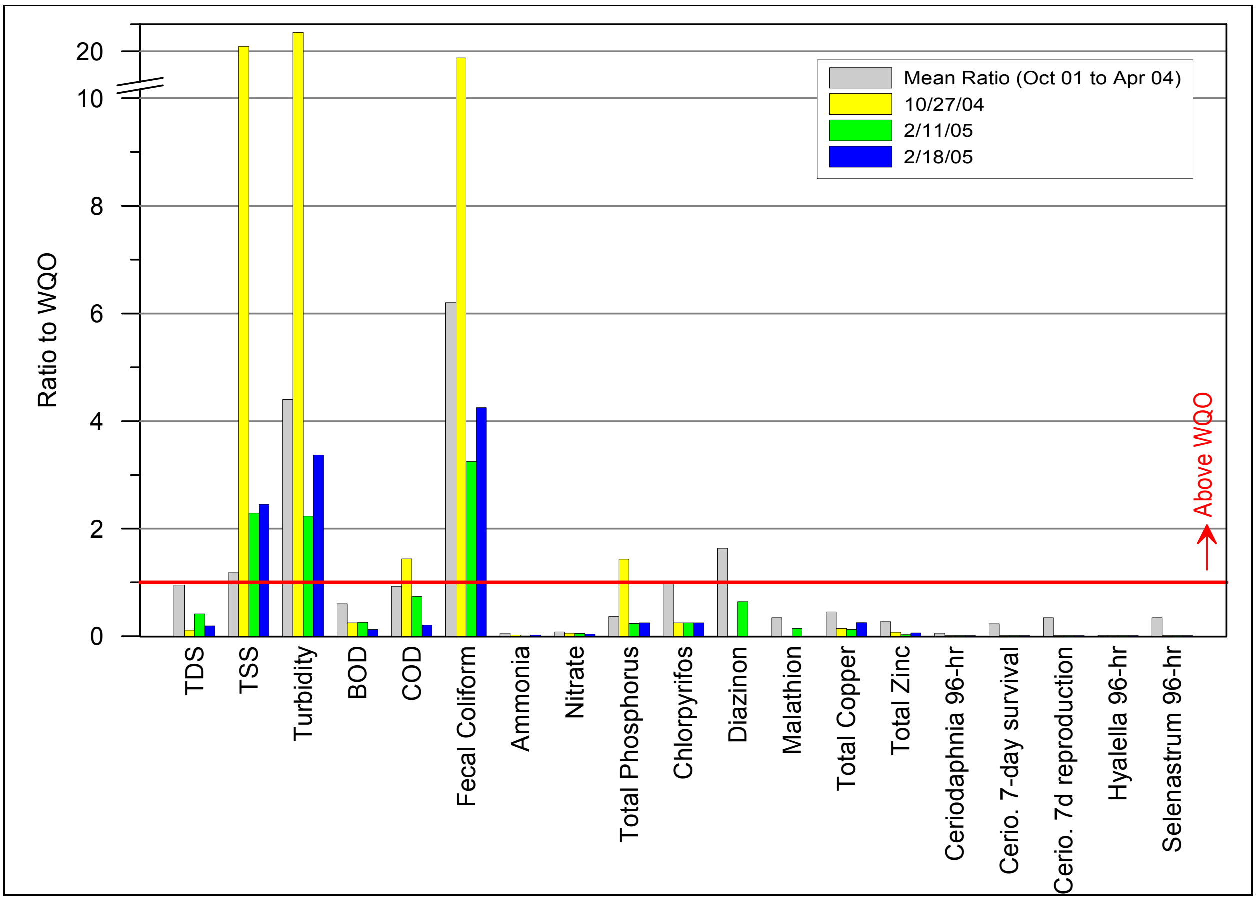

Figure 9-2. Tecolote Creek water quality ratios.

In addition to the wet weather monitoring discussed above, there are 16 sites in the Mission Bay WMA where water quality is monitored during dry weather. Of these, five are located upstream of the mass loading station on Tecolote Creek. The dry weather data for this site is useful, but it is important to remember that it represents only one year of monitoring (See Section 3.4 for details on dry weather sampling).

Table 9-4 shows exceedances of water quality objectives and the average ratio of exceedance for COC that were measured during the 2004 dry weather monitoring program. During dry weather sampling, there were exceedances of action levels at the monitoring sites located above the mass loading station for pH, turbidity, phosphorus, total coliform, and enterococcus. Of these, only turbidity had an average ratio of exceedance greater than one. A map for the WMA showing DWS exceedances is found in Figure 9-3. Pie symbols appear at dry weather stations that have had water quality exceedances. The colored slices of the pie show the different constituent groups that contributed to the exceedances. The constituents that had exceedances during both the dry and wet weather monitoring in 2004-2005 include total phosphorus and turbidity.

Table 9-4. Mission Bay WMA 2004 Dry Weather Exceedance Matrix.

Constituent	Number of Exceedances	Number of Samples Collected	Average Ratio of Exceedance*	St. Dev. Ratio of Exceedance
pH	1	5	0.23	0.45
Turbidity	2	5	1.43	1.92
Phosphorus	1	5	0.79	0.61
Total Coliform	1	5	1.44	2.58
Enterococcus	1	5	0.69	0.58

* Average ratio of exceedance is equal to the average concentration for all samples collected divided by the Water Quality Objective.

9.2.3 Third Party Data

Third party data was collected from two locations in 2002 within the Mission Bay watershed under the Surface Water Ambient Monitoring Program (SWAMP) and was provided by the San Diego Regional Water Quality Control Board. The sampling sites were located on Tecolote Creek near the mass loading station and on Rose Canyon Creek. Grab samples were collected from each station during dry weather once in March, April, June and September, 2002 for Rose Canyon Creek and in March, April and June for Tecolote Creek. The site was dry in September, therefore samples were not collected. Results are presented in Table H-2 in Appendix H. Data collected from Tecolote Creek were compared to the mass loading station and dry weather data results to provide qualitative assessments with current wet and dry weather results. The Rose Canyon Creek station was too spatially disconnected from the MLS to correlate the data with any of the wet and dry weather monitoring results, however, exceedances were noted.

There were water quality objective exceedances for sulfate, manganese and toxicity at the Tecolote Creek station. Sulfate and manganese exceeded objectives during all three sampling events. Toxicity at Tecolote Creek was evident for *Selenastrum* growth during all three sampling events and for *Ceriodaphnia dubia* survival and reproduction during two sampling events. All other constituents were below their respective water quality objectives. Comparing the third party data with wet weather MLS data and dry weather data collected upstream of the MLS, the only common exceedance was for toxicity during wet weather. Toxicity to *Ceriodaphnia* survival has been observed in 4 out of 15 storm events; *Ceriodaphnia* reproduction has been affected in 3 out of 15 storm events; toxicity to *Hyalella* has been observed in 2 out of 15 storm events and toxicity to *Selenastrum* has been observed 1 out of 12 storm events.

Exceedances observed at Rose Canyon Creek included sulfate, manganese, turbidity, pH, Diazinon and toxicity. Sulfate concentrations exceeded objectives during all four sampling events; manganese, turbidity and Diazinon exceeded objectives during two sampling events and pH exceeded objectives during one event. Toxicity to at least one test organism was evident during all sampling events.

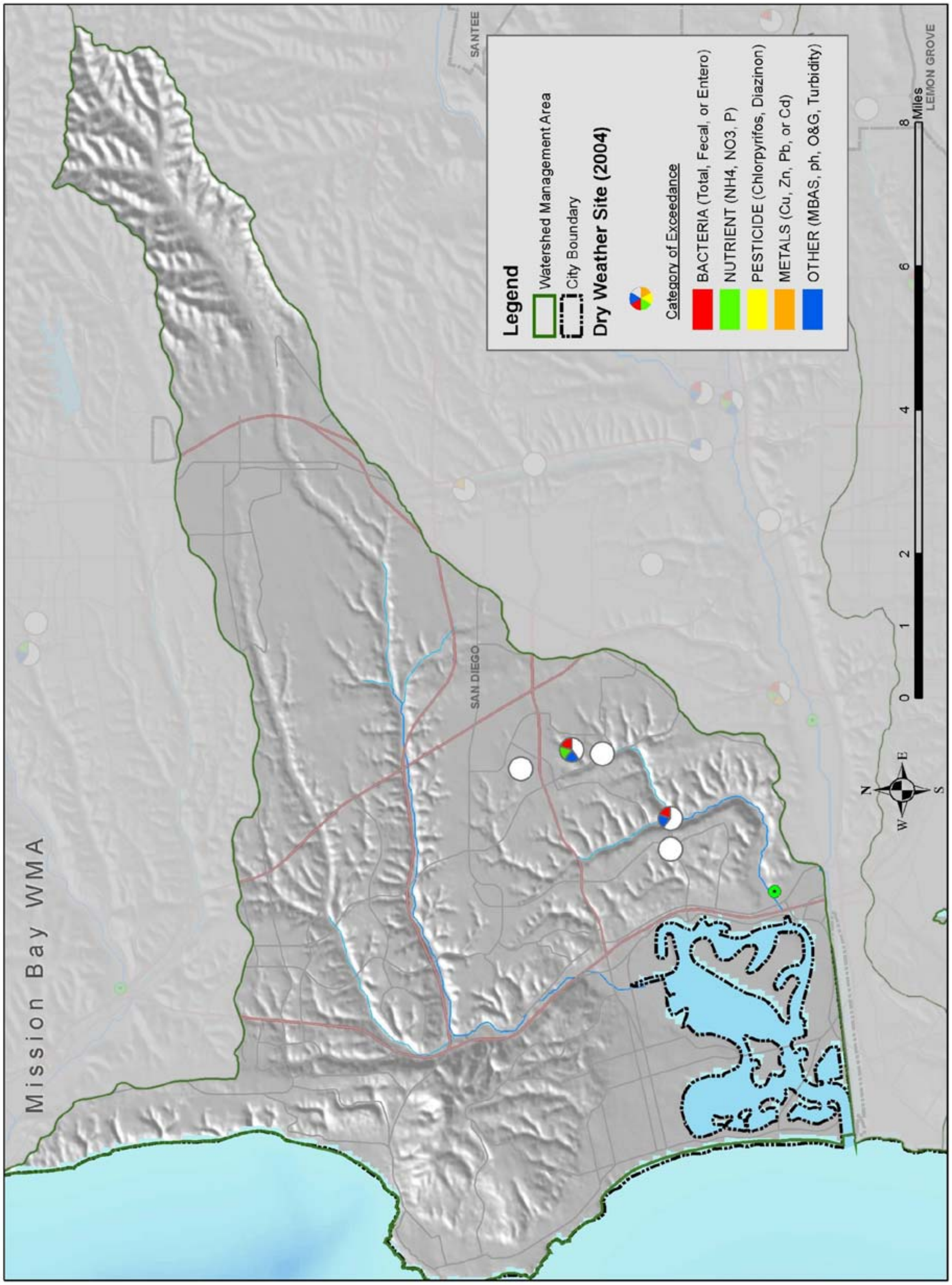

Figure 9-3. Mission Bay WMA dry weather exceedance map.

9.2.4 TIEs

TIE testing was not performed on Tecolote Creek samples. This mass loading station has not been identified as a TIE candidate site based upon the Triad Decision Matrix.

9.2.5 Summary and Conclusions

Four parameters appear to be consistently problematic in storm water runoff at the Tecolote Creek MLS: fecal coliform bacteria, TSS, turbidity, and Diazinon. High levels of other constituents occur occasionally, but do not appear to be consistently problematic. Diazinon, MBAS, ammonia, total cadmium, and total lead appear to be decreasing over time, while enterococcus and total phosphorus concentrations appear to be increasing. There were five dry weather monitoring sites located upstream of the mass loading station that were monitored in 2004-2005. The data from these sites suggested that the water quality objectives for turbidity and total phosphorus were exceeded in both dry and wet weather. Although there has been toxicity associated with storm water in previous monitoring years, it appears to be related to specific storm events rather than a persistent pattern. Third party data collected in 2002 indicated that sulfate, manganese and toxicity were consistent problems at the Tecolote Creek monitoring station.

9.3 Stream Bioassessment

Stream bioassessment in the Mission Bay WMA included two urban affected monitoring sites representing two different watersheds. One site was in Rose Creek, downstream of the confluence with San Clemente Canyon Creek and downstream of Highway 52. The other site was in Tecolote Creek in Tecolote Canyon Natural Park, near the downstream border of the Park.

9.3.1 Results and Discussion

Rose Creek near Highway 52: MB-RC

The Rose Creek monitoring site had a benthic macroinvertebrate community with an Index of Biotic Integrity rating of Poor for the October 2004 survey, and Very Poor for the May 2005 survey (Table 9-5) (See Section 3.2 for details on the sampling approach). Taxa richness was fair to low, with 23 and 9 unique taxa collected, and with 0 and 3 EPT taxa in October 2004 and May 2005, respectively. There were no organisms collected that are highly intolerant to impairment, and the percent tolerant taxa comprised 12% of the community in October and 11% of the community in May.

The physical habitat of the reach was nearly optimal, with a substrate of large cobble, tree roots, and emergent vegetation providing a variety of stable niche space for macroinvertebrate colonization. The live oak and sycamore riparian zone was mostly undisturbed, and the stream had good canopy cover. Water quality was somewhat impaired, with high specific conductance values of 3.651 mS/cm in October 2004 and 3.196 mS/cm in May 2005 (Table 9-5). Values for pH were 8.1 and 7.7 for the October and May surveys, respectively.

The benthic community was seasonally variable. In October 2004, the site was dominated by the snail, *Fossaria*, and Oligochaete earthworms (Table 9-6). In May, the site was dominated by the minnow mayfly, *Baetis*, the black fly, *Simulium*, and Chironomid midges. The increased taxa richness in the May survey was most likely due to increased numbers of Dipteran taxa (true flies).

Table 9-5. Selected Biological Metrics and Physical Measures of the Mission Bay WMA.

Mission Bay Watershed Management Area	Rose Creek near Highway 52 (MB-RC)		Tecolote Creek in Tecolote Canyon Natural Park (TC-TCNP)	
Survey	**Oct-04**	**May-05**	**Oct-04**	**May-05**
Index of Biotic Integrity/ Qualitative Rating	**21** **Poor**	**10** **Very Poor**	**20** **Poor**	**2** **Very Poor**
Metrics				
Taxa Richness	23	9	18	13
EPT Taxa (mayflies, stoneflies, and caddisflies)	0	3	1	2
% Intolerant Taxa	0%	0%	0%	0%
% Tolerant Taxa	12%	11%	32%	9%
Average Tolerance Value	6	5.8	6.8	6.2
% Collector Filterers +Collector Gatherers	24%	98%	73%	97%
Physical Measures				
Elevation	65		55	
Physical Habitat Score	146	160	140	151
Riffle Velocity (ft/sec)	0.9	1.3	0.9	1.4
Substrate Composition				
Silt			5%	
Sand	3%	10%	2%	17%
Gravel	20%	7%	16%	25%
Cobble	74%	72%	50%	58%
Boulder		3%		
Roots			27%	
Bedrock/solid		8%		
Water Quality				
Temperature °C	19.8	15.3	18.4	18.5
pH	8.1	7.7	7.44	7.8
Specific Conductance (ms/cm)	3.651	3.196	7.992	3.594
Relative Chlorophyll (μg/L)	5.7	2.9	2.3	3.4

Table 9-6. Mission Bay WMA Community Summary.

		Taxon	Common Name	Percent Composition	Tolerance Value	Functional Feeding Group
Rose Creek near Highway 52 (MB-RC)	Oct-04	***Fossaria***	**snail**	**53%**	**8**	**Scraper**
		Oligochaeta	earth worm	20%	5	Collector Gatherer
		Physa	aquatic snail	10%	8	Scraper
		Ceratopogonidae	biting midges	5%	6	Predator
		Muscidae	common fly	2%	6	Predator
	May-05	***Baetis***	**minnow mayfly**	**32%**	**5**	**Collector Gatherer**
		Simulium	black fly	24%	6	Collector Filterer
		Chironomidae	non-biting midges	22%	6	Collector Gatherer/Filterer
		Ostracoda	seed shrimp	10%	8	Collector Gatherer
		Oligochaeta	earth worm	10%	5	Collector Gatherer
Tecolote Creek in Tecolote Canyon Natural Park (TC-TCNP)	Oct-04	***Hyalella***	**amphipod**	**22%**	**8**	**Collector Gatherer**
		Dasyhelea	biting midge	20%	6	Collector Gatherer
		Chironomidae	non-biting midges	19%	6	Collector Gatherer/Filterer
		Argia	dancer damselfly	14%	7	Predator
		Ostracoda	seed shrimp	9%	8	Collector Gatherer
	May-05	**Chironomidae**	**non-biting midges**	**51%**	**6**	**Collector Gatherer/Filterer**
		Simulium	black fly	36%	6	Collector Filterer
		Ostracoda	seed shrimp	6%	8	Collector Gatherer
		Physa	aquatic snail	2%	8	Scraper
		Baetis	minnow mayfly	1%	5	Collector Gatherer

The Mission Bay mass loading station sampled runoff from a separate drainage from Rose Creek, therefore storm water information could not be correlated with the bioassessment site.

Tecolote Creek in Tecolote Canyon Natural Park: TC-TCNP

The Tecolote Creek monitoring site had a benthic macroinvertebrate community with an Index of Biotic Integrity rating of Poor for the October 2004 survey, and Very Poor for the May 2005 survey (Table 9-5). As in past surveys, the IBI scores varied considerably, ranging from 20 in October to 2 in May. Taxa richness was fair to low, with 18 and 13 unique taxa collected, and with 1 and 2 EPT taxa collected in October and May, respectively. There were no organisms collected that are highly intolerant to impairment, and the percent tolerant taxa comprised 32% and 9% of the community in October 2004 and May 2005, respectively.

The physical habitat of the reach was near optimal, with a substrate primarily of unconsolidated gravel and small cobble, with emergent vegetation and tree roots providing additional niche space. The riparian zone was mostly undisturbed live oak, and the stream had good canopy cover. Water quality was poor, with the highest specific conductance value of any site in the San Diego County program during the October survey. Values were 7.992 ms/cm in October and 3.594 ms/cm in May. Values for pH were 7.4 and 7.8 for the October and May surveys, respectively.

The benthic community was seasonally variable. The October survey was dominated by the amphipod, *Hyalella*; the biting midge, *Dasyhelea*; Chironomid midges, and the damselfly, *Argia* (Table 9-6). The May survey was dominated by Chironomid midges and the black fly, *Simulium*.

The Tecolote Creek mass loading station was located several thousand feet downstream of the bioassessment station, and water quality measures may be correlated with the site although some urban runoff would have entered the stream below the bioassessment site. Constituents of concern identified during storm water sampling that would have a negative impact on the biological community included total suspended solids and turbidity (Table 9-3). Exceedances in total dissolved solids, pesticides, and toxicity to *Ceriodaphnia* and *Hyalella* have occurred historically, but were not evident in 2004-2005. Total metals, including copper, lead, and zinc were detected at levels that would prevent the colonization of highly sensitive organisms.

9.3.2 Summary and Conclusions

The Mission Bay WMA was sampled at two sites. One site was in Rose Creek, downstream of Highway 52, and the other site was in Tecolote Creek in Tecolote Canyon Natural Park. The macroinvertebrate community of both sites had Index of Biotic Integrity ratings of Poor in October and Very Poor in May, with substantial seasonal variation in the total IBI scores.

9.4 Ambient Bay and Lagoon Monitoring

9.4.1 Results and Discussion

9.4.1.1 Phase I Results and Discussion

Phase I sediment samples were collected in Mission Bay for the ABLM Program on June 2, 2004 (See Section 3.3 for details on the sampling approach). Mission Bay was treated as a single water body representing the receiving waters of both Rose Creek, which discharges to the northeast end of the Bay, and Tecolote Creek, which discharges to the southeast end of the Bay. The sampling locations are shown in Figure 9-4. The median grain size of the nine sites sampled in Mission Bay was extremely variable, ranging from 2.37 μm at Site 3L-1 in the inner stratum to 261 μm at Site 2M-1 in the middle stratum (Table 9-7). Sand was the dominant constituent in the outer and middle strata sites, with sediments in the inner stratum of Mission Bay, nearest the mouths of Rose and Tecolote Creeks, being much smaller grained. TOC concentrations also tended to be lower in the middle areas

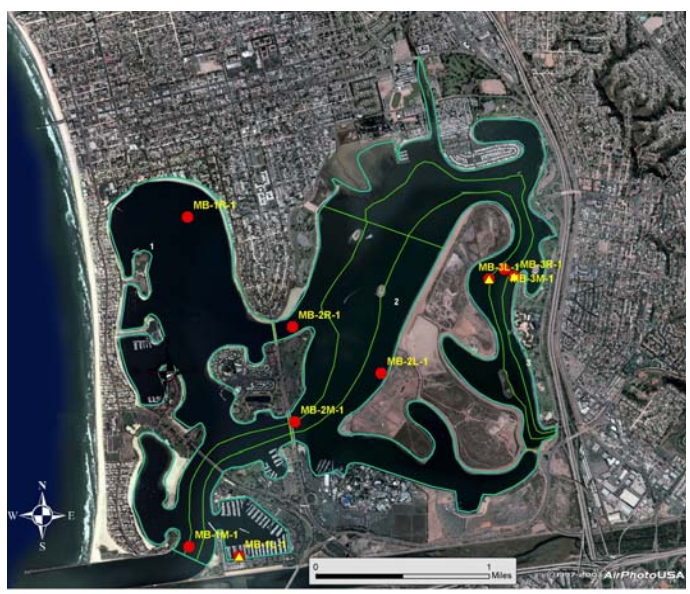

Figure 9-4. Map of Phase I site locations in Mission Bay. Sites with yellow triangles were selected for Phase II assessment.

of Mission Bay compared to the inner and outer stratums. The one exception to these patterns was Site 1L-1 in the outer stratum, which had similar sediment characteristics to inner stratum sites.

Due to the high fine grain size and high TOC levels found in sediments in the inner stratum of Mission Bay, two inner stratum sites (3L-1 and 3R-1) and one outer stratum site (1L-1) were selected for Phase II assessment (Table 9-7).

Table 9-7. Results of Phase I sediment analyses and subsequent ranking for Phase II site selection at Rose Creek and Tecolote Creek outfalls in Mission Bay.

Sampling Site	TOC and Grain Size Distribution in Phase I								Ranking for Phase II				
	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Median (µm)	Mean (µm)	Fines (%)	TOC (%)	Fines Rank	TOC Rank	Rank Sum	Highest Rank	Phase II
MB-1L-1	0.00	17.2	37.63	45.19	5	8	82.82	2.38	7	7	14	*	Yes
MB-1M-1	0.05	92.0	3.92	4.06	181	187	7.98	0.55	2	2	4		
MB-1R-1	1.52	33.4	41.1	23.9	27.8	11.7	65.07	2.17	5	6	11		
MB-2L-1	0.03	66.3	23.77	9.88	87	54	33.65	0.96	4	4	8		
MB-2M-1	0.20	95.3	2.0	2.43	261.0	242.8	4.47	0.25	1	1	2		
MB-2R-1	0.34	84.7	7.3	7.6	109.3	103.43	14.93	0.59	3	3	6		
MB-3L-1	1.69	5.74	36.7	55.9	2.37	NC	92.58	2.52	9	9	18	*	Yes
MB-3M-1	0.62	14.1	41.1	44.2	6.65	NC	85.27	1.72	8	5	13		
MB-3R-1	1.31	17.3	32.1	49.3	4.19	NC	81.43	2.49	6	8	14	*	Yes
Mean of all Sites	0.64	47.34	25.08	26.94	76.04	101.15	52.02	1.51					
St. Dev.	0.68	36.90	16.41	21.70	93.03	96.27	36.48	0.93					

NC = Not calculable (%silt + %clay > 84%)

9.4.1.2 *Phase II Results and Discussion*

The three sites selected in Mission Bay as part of Phase I were sampled in Phase II on July 13, 2004. Sediments from Sites 1L-1, 3L-1 and 3R-1 were composited and analyzed for chemistry, toxicity, and benthic community structure. The results are summarized in Table 9-8.

Sediment Chemistry. Sediments from each of the 12 coastal embayments in the ABLM Program were analyzed for four basic constituents: metals, PCBs, PAHs, and pesticides. Of these, seven metals were detected above the detection limit in Mission Bay: arsenic, chromium, copper, lead, nickel, selenium, and zinc (Table 9-8). All of these metals except selenium were also found in all the other embayments assessed in the ABLM Program.

Concentrations of metals were relatively high, with arsenic, copper, lead and zinc exceeding their respective ERL, but none exceeded their respective ERM value. During the 2003 ABLM program the same seven metals were detected with the exception being cadmium detected instead of selenium. Concentrations of the 2003 metals were low and none exceeded their respective ERM value. However, concentrations of arsenic, copper, and lead exceeded their respective ERL values in 2003. There were no PAHs, PCBs, or pesticides found above the detection limit in Mission Bay during the 2004 program.

The mean ERM quotient, which is a measure of the cumulative effects of the COC for which ERMs are available, was 0.299. This value exceeded the threshold of 0.10 and was the highest in the ABLM

Program. Sediments with mean ERM-Q values above this threshold have a higher probability of producing adverse biological effects than those with mean ERM-Qs below the threshold (Long et al. 1998). During the 2003 ABLM program the threshold was also exceeded with a mean ERM quotient of 0.199.

Toxicity. The percent survival of *E. estuarius* exposed to Mission Bay sediments in a 10-day acute toxicity test was 81 % which was not significantly different from that of the Control (99%) (Table 9-8). This suggests that the Mission Bay sediments were not toxic to the test organisms. This is similar to the results from the 2003 ABLM program where no toxicity was observed.

Table 9-8. Summary of chemistry, toxicity, and benthic community structure in Mission Bay.

CHEMISTRY*					TOXICITY*	BENTHIC COMMUNITY						
Analyte	**ERL**	**ERM**	**Result**	**ERM-Q**	**Percent Survival**	**Index**	**1L-1**	**3L-1**	**3R-1**	**Mean**	**St. Dev.**	**Total**
METALS (mg/kg)					**81%** Not significantly Different from Control	Abundance	672	453	1433	853	514	2558
Antimony	NA	NA	<1.74	NA		Richness	41	33	56	43.3	11.7	87
Arsenic	8.2	70	**12.7**	0.181		Diversity	2.44	2.54	2.90	2.62	0.24	NA
Cadmium	1.2	9.6	<0.174	NA		Evenness	0.66	0.73	0.72	0.70	0.04	NA
Chromium	81	370	43.2	0.117		Dominance	6	6	9	7.0	1.73	NA
Copper	34	270	**148**	0.548								
Lead	46.7	218	**50.4**	0.231								
Nickel	20.9	51.6	12.9	0.250								
Selenium	NA	NA	1.96	NA								
Zinc	150	410	**191**	0.466								
Mean ERM-Q				**0.299**								

* Analysis performed on composite samples from the three sites.
NA-Not applicable
Bold – exceeds ERL or ERM value

Benthic Community Structure. A total of 2558 organisms were collected from Mission Bay, representing 87 taxa (Table 9-8). During the 2003 ABLM program a total of 2,932 organisms were collected, representing 69 taxa. Site 3R-1 in the inner stratum had greater taxa abundance, richness, dominance and diversity than Sites 1L-1 and 3L-1. However, evenness was greatest at Site 3L-1, in the inner stratum. Based on these indices, the benthic community structure in Mission Bay had a rank of 1 where 1 represents the healthiest community with the lowest combined index score and 12 the least-healthy community.

As in 2003, the barley snail, *Barleeia* sp., was the most common species of the benthic community in Mission Bay during the 2004 program, accounting for 8.6% (32.1% in 2003) of all the animals collected (Table 9-9). The second most abundant species was the Polychaete, *Exogone lourei*, that accounted for 8.5% of the benthic community. Another polychaete worm, *Aphelochaeta* sp., was the third most abundant, accounting for 7.9% of the total abundance.

Table 9-9. Dominant infaunal species found in the Mission Bay during the 2004 ABLM Program.

Embayment	Taxa (Species)	Higher Taxa	Abundance	Percent Composition
SRE	*Barleeia sp*	Mollusca	221	8.6
	Exogone lourei	Polychaeta	218	8.5
	Aphelochaeta sp.	Polychaeta	203	7.9

* Values were calculated from the total of all sites assessed.

Relative Ranking. The results of the chemistry, toxicity, and benthic community assessments for Mission Bay were ranked against the same parameters for the other embayments monitored in the ABLM Program (see Section 3.3.5 for a complete discussion). For chemistry, a rank of 1 represents the lowest ERM-Q and 12 represents the highest. For toxicity, a rank of 1 represents the highest percent survival of test organisms and 12 represents the lowest. For benthos, a rank of 1 represents the highest species diversity, abundance and richness and a rank of 12 represents the lowest species diversity, abundance and richness. The results are presented in Figure 9-5. For Mission Bay, the relative ranks were 11 for chemistry, 8 for toxicity, and 1 for benthic community structure.

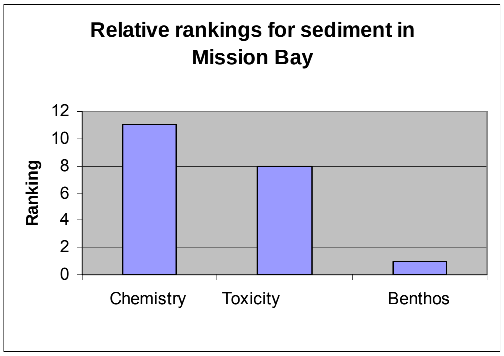

Figure 9-5. Relative rankings for sediment in Mission Bay.

9.4.1.3 Summary and Conclusions

Sediments in Mission Bay were monitored as part of the 2004 ABLM Program to assess the potential for adverse effects from the watershed and to compare sediment quality with other coastal embayments in San Diego County. In Phase I, a stratified random approach was used to identify the three sites where COC were most likely to be found (i.e., those with the highest TOC and smallest grains size): Site 1L-1 in the outer Stratum, and sites 3R-1 and 3L-1 in the inner stratum. These sites were sampled in Phase II of the assessment and analyzed for sediment chemistry, toxicity, and benthic community structure. The results of the chemistry assessment indicated that seven of the nine metals assessed were found in Mission Bay sediments. Of these, arsenic, copper, lead and zinc all exceeded their ERLs. The mean ERM-Q for Mission Bay was the highest of any embayment assessed in the ABLM Program. No ERMs were exceeded. There were no PAHs, PCBs, or pesticides found above the detection limit in Mission Bay during the 2004 program. In contrast to the sediment chemistry results, the percent survival of the test organisms exposed to Mission Bay sediments was not significantly different from that of the Control, suggesting that the sediments were not toxic to the test organisms. The benthic community indices suggested that the biotic community in the Mission Bay had a rank of 1 (where1 represents the lowest combined index score and 12 the highest). The infaunal community was dominated by a genus of barley snail, and polychaete worms. The relative ranks for Mission Bay compared to the other embayments of the ABLM Program were 11 for chemistry, 8 for toxicity and 1 for benthic community structure. Compared to the other embayments in the 2004 ABLM program, Mission Bay had an overall rank of eight. During the 2003 ABLM program the Lagoon had an overall rank of five. An increase in overall ranking indicates a decrease in relative quality compared with last year's ranking. More data will need to be collected before any definitive trends can be identified.

9.5 WMA Assessment

The Mission Bay watershed management area was assessed using data from both dry and wet weather monitoring efforts. One mass loading station located on Tecolote Creek collected chemistry and toxicity data during storm events. Chemistry data was collected from five dry weather monitoring sites upstream of the MLS. Two bioassessment sites were evaluated and scored on the Index of Biotic Integrity. The watershed management area assessment methods presented in Section 3.4 of this report were applied to these data to determine constituents of concern (COC) and develop a water quality objective (WQO) exceedance frequency for each of these COC. Water quality objective exceedances in wet and dry weather and the IBI scores of the bioassessment sites are summarized in Table 9-10. Using the evaluation criteria discussed in Section 3, constituents were assigned zero, one, two, or three diamonds depending on their frequency of occurrence. Data from this table were evaluated for this watershed using the triad decision matrix (Table 9-11).

Four constituents had a high frequency of occurrence and received three diamonds. These constituents include:

- Turbidity,
- Fecal Coliform,
- Total Coliform, and
- Enterococcus,

Fecal coliform received three diamonds based on Criterion No. 1 because WQO were exceeded in 83% of wet weather samples. Total coliform received three diamonds based on Criterion No. 2 because six of the last consecutive storm samples exceeded WQOs, and turbidity and enterococcus received three diamonds based on Criterion No. 3, as both had wet weather exceedances between 50 and 80% plus a dry weather exceedance in the last year. No constituents received three diamonds during the 2003-2004 monitoring year.

Two constituents were identified as having a medium frequency of occurrence and received two diamonds based on Criterion No. 5. These constituents include:

- Total suspended solids
- Diazinon

Although Diazinon had zero wet or dry weather exceedances in the 2004-2005 sampling season, it still received two diamonds (medium frequency of occurrence) due to its cumulative exceedance frequency of 58% during wet weather. Diazinon received the same ranking the previous year. Total suspended solids increased to two diamonds during the 2004-2005 monitoring year due to its 58% MLS exceedance frequency. During the 2003-2004 monitoring year, total suspended solids received a one diamond ranking due to wet weather exceedances.

Three constituents had a low frequency of occurrence and received one diamond. These constituents include:

- pH
- COD
- Orthophosphate

Table 9-10. Constituent exceedances in the Mission Bay WMA.

Constituents With Any Wet Weather (MLS) WQO Or Dry Weather Action Level Exceedance	MLS (Wet Weather) Results										Dry Weather Results *		Frequency of Occurrence	Criterion No.
	2001/2002		2002/2003		2003/2004		2004/2005		CUMULATIVE		2004			
	#/3	%	#/3	%	#/3	%	#/3	%	#/12	%	#	%		
Conventional Parameters														
pH	0	0	0	0	0	0	0	0	0	0	1	20	♦	8
BOD	0	0	0	0	1	33	0	0	1	8	NA	NA	-	-
COD	1	33	1	33	2	67	1	33	5	42	NA	NA	♦	9
Total Suspended Solids	0	0	3	100	1	33	3	100	7	58	NA	NA	♦♦	5
Turbidity	1	33	3	100	2	67	3	100	9	75	2	40	♦♦♦	3
Nutrients														
Orthophosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	20	♦	8
Total Phosphorus	0	0	0	0	0	0	1	33	1	8	NA	NA	-	-
Bacteriological														
Total Coliform	0	0	2	67	3	100	3	100	8	67	1	20	♦♦♦	2
Fecal Coliform	2	67	2	67	3	100	3	100	10	83	0	0	♦♦♦	1
Enterococcus	0	0	3	100	2	67	3	100	8	67	1	20	♦♦♦	3
Pesticides														
Chlorpyrifos	0	0	1	33	0	0	0	0	1	8	0	0	-	-
Diazinon	3	100	3	100	1	33	0	0	7	58	0	0	♦♦	5
Malathion	NA	NA	1	33	0	0	0	0	1	8	NA	NA	-	-
Total Metals														
Antimony	0	0	1	33	1	33	0	0	0	0	NA	NA	-	-
Copper	0	0	1	33	0	0	1	33	2	17	NA	NA	-	-
Zinc	0	0	0	0	0	0	1	33	1	8	NA	NA	-	-
Dissolved Metals														
Copper	0	0	1	33	0	0	0	0	1	8	0	0	-	-
Toxicity													**EVIDENCE OF PERSISTENT TOXICITY?**	
Ceriodaphnia 96-hour	0	0	1	33	0	0	0	0	1	8	NA	NA	No	
Ceriodaphnia 7-day survival	1	33	1	33	0	0	0	0	2	17	NA	NA	No	
Ceriodaphnia 7-day reproduction	1	33	1	33	1	33	0	0	3	25	NA	NA	No	
Selenastrum 96-hour	1	33	0	0	0	0	0	0	1	8	NA	NA	No	
Bioassessment	IBI Rating												**EVIDENCE OF BENTHIC ALTERATION?**	
Rose Creek (DS)	NA		Very Poor		Poor		Poor		Poor		NA		Yes	
Tecolote Creek (DS)	Very Poor		Poor		Very Poor		Very Poor		Very Poor		NA			

* = Total number of observations varied among constituents.
NA = Not assessed
- = Constituent results are below the defined requirements for a Low Frequency of Occurrence rating.
♦ = Low Frequency of Occurrence rating.
♦♦ = Medium Frequency of Occurrence rating.
♦♦♦ = High Frequency of Occurrence rating.
DS = Downstream of MLS

Both orthophosphate and pH had a criterion ranking of eight due to dry weather exceedances. Neither constituent was ranked the previous year or had ever been found to exceed WQOs in wet weather. COD received one diamond based on Criterion No. 9 for wet weather exceedances between 25 and 50%, as it did the previous year.

In addition to the constituents listed in Table 9-10, several other constituents have been identified as concerns in the Mission Bay watershed because they are listed on the SWRCB 303(d) List. These include indicator bacteria, eutrophication, and lead in Mission Bay, and cadmium, copper, lead, zinc and toxicity in Tecolote Creek.

There was no evidence of persistent toxicity associated with wet weather runoff at the MLS. The cumulative IBI ratings for Rose Creek and Tecolote Creek were poor and very poor, suggesting evidence of benthic alteration within the Mission Bay watershed.

Figure 9-6 summarizes the average number of water quality exceedances (including constituents that had no exceedances) for six categories of constituents and displays how water quality concerns are changing over time. This stacked bar chart groups constituents as either conventionals, nutrients, bacteria, pesticides, metals, or toxicity. It uses the number of MLS exceedances from values in Table 9-10.

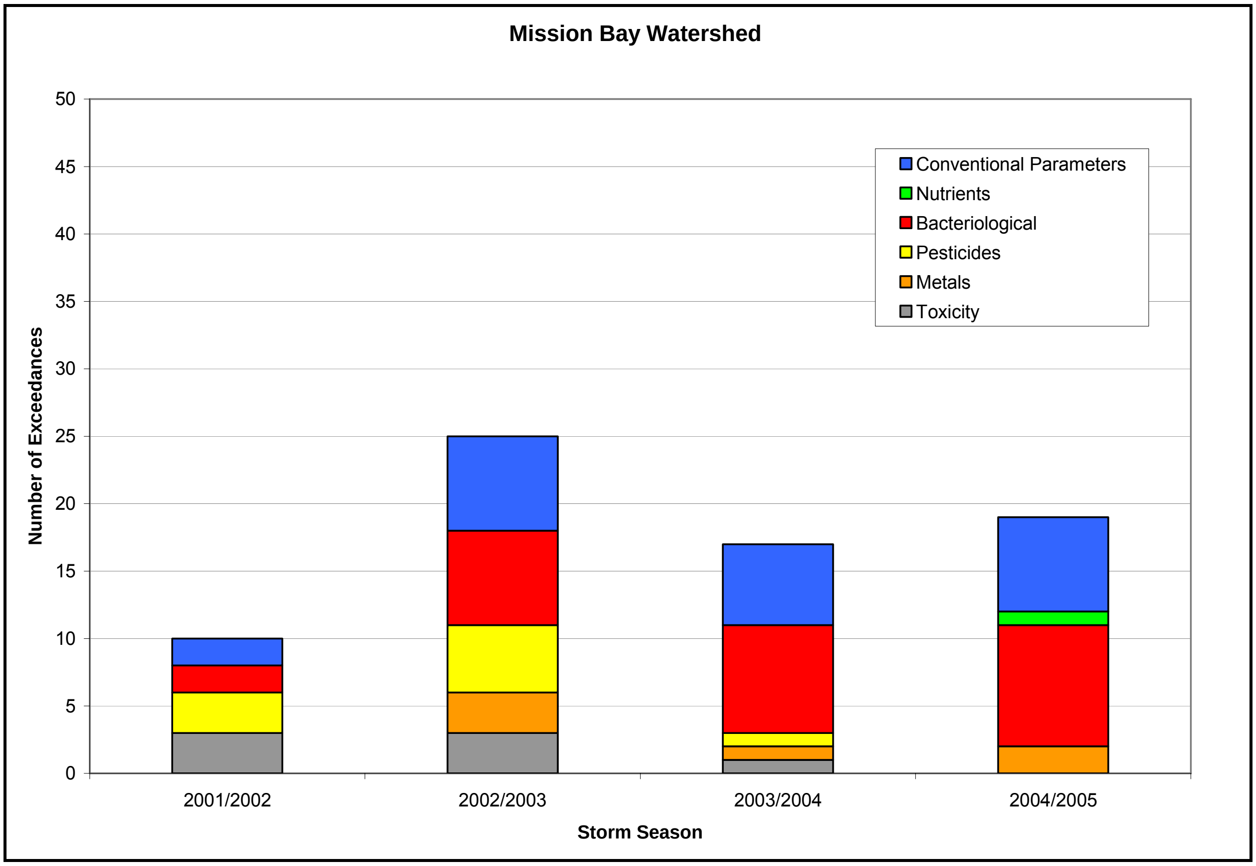

Figure 9-6. Stacked bar chart of the number of wet weather exceedances of constituent groups in Mission Bay WMA.

For the Tecolote Creek MLS, the overall frequency of WQO exceedances during 2004-2005 was dominated by conventional and bacteriological parameters, with some exceedances of metals and nutrients. The previous three sampling seasons had similar influences, however 2004-2005 was the first year in four years without any pesticide or toxicity exceedances, however it was the first year with nutrient exceedances.

Triad Decision Matrix

The triad decision matrix combines the occurrence of COC with the toxicity and bioassessment results to draw potential conclusions about the watershed and provide possible actions for future monitoring or assessment. Table 9-11 summarizes the results and lists possible conclusions and actions.

Table 9-11. Decision matrix results for the Mission Bay WMA.

Chemistry	Toxicity	Benthic Alteration	Possible Conclusion(s)	Possible Actions or Decisions
Persistent exceedances of water quality objectives (high frequency COC identified)	No evidence of persistent toxicity	Indications of alteration	Benthic impact due to habitat disturbance, not toxicity. Test organisms not sensitive to problem pollutants.	1) Continue monitoring to gather long-term trend information. 2) Evaluate upstream source identification as a high priority. 3) Consider whether different test organisms should be evaluated. 4) Consider potential role of physical habitat disturbance. 5) TIE would not provide useful information with no evidence of toxicity.

Based on the results discussed above, the recommended action within this watershed is to continue to monitor for all elements of the program to gather additional data for assessment and long-term trend analysis and to initiate upstream source identification to determine sources of constituents of concern.

Although bacteria parameters are not considered in the triad decision matrix because they are not believed to influence toxicity responses in bioassay test organisms, bacteria should be considered a high priority COC due to its persistence over the last three sampling years.

Baseline Long-Term Effectiveness Assessment (BLTEA) Ratings for the Mission Bay WMA

The water quality priority ratings presented in Table 9-12 are based on the methodology presented in the BLTEA report (WESTON, MOE, & LWA 2005) and are presented in the Methods Section 3.4. Constituent groups and stressor groups are given a ranking from A to D with A being the highest priority rating and D the lowest priority rating. Items ranked with a D indicate that the constituent group or stressor is a low priority or does not have sufficient data to support a higher ranking. The ratings were based on current results presented in this 2004-2005 annual report and data from the following programs:

- Storm water Mass Loading Monitoring (MLS) – Wet Weather Data
- Co-permittee Dry Weather Data Monitoring
- Ambient Bay, Lagoon, and Coastal Receiving Water Monitoring (ABLM)
- Urban Stream Bioassessment Monitoring
- Triad Assessment – Toxicity Testing of Storm water
- 303d Listing

Table 9-12. Baseline Long-Term Effectiveness Assessment (BLTEA) Ratings for the Mission Bay WMA

Watersheds/Sub-watersheds	Percentage of Total Area	Priority Ratings*									
		Constituent Groups								Stressor Groups	
		Heavy Metals	Organics	Oil and Grease	Sediments	Pesticides	Nutrients	Gross Pollutants	Bacteria/ Pathogens	Benthic Alterations	Toxicity
Mission Bay WMA	**100%**	**A**	**D**	**D**	**B**	**C**	**B**	**C**	**A**	**B**	**C**
Scripps HA (906.30)	15%	B	D	D	B	C	D	C	A	A	D
Miramar HA (906.4)	64%	A	D	D	B	C	A	C	A	B	D
Tecolote HA (906.5)	21%	A	D	D	A	B	D	C	A	B	A

Notes:
**** = Rating Calculated Based on Area Weighted Averages of Score Value from the sub-watershed areas.***
***** = Priority Level (Highest-A to Lowest-D)***

The purpose of the BLTEA ratings is to identify water quality priorities within a watershed based on weighted averages of the sub-watershed ratings. Because it is a weighted average, larger sub-watersheds will have a greater influence in the overall watershed rating.

Heavy metals and bacteria were the highest priority (A rated) constituents for the Mission Bay WMA followed by sediments, nutrients, and benthic alterations which were given B ratings. All other constituents were given either a C or D rating.

The Scripps sub-watershed, which accounts for 15% of the Mission Bay WMA, had high priority (A) ratings for bacteria and benthic alteration. The Miramar sub-watershed, which accounts for 64% of the Mission Bay WMA, had high priority (A) ratings for heavy metals, nutrients, and bacteria. The Tecolote sub-watershed, which accounts for 21% of the Mission Bay WMA, had high priority (A) ratings for heavy metals, sediments, bacteria, and toxicity.

A regional evaluation and description of the BLTEA is presented in the Regional Assessment Section 13. The complete tables used to calculate the ratings are presented in Appendix G.

9.6 Conclusions and Recommendations

For the Tecolote Creek sub-watershed, which accounts for approximately 14% of the Mission Bay watershed management area, the primary land uses within the contributing runoff area are residential (43%), and transportation (21%). For the Mission Bay WMA, turbidity, and all three bacterial indicators were identified as high frequency of occurrence COC, TSS and Diazinon were identified as medium frequency of occurrence COC, and ph, COD, and orthophosphate were identified as low frequency of occurrence COC. Third party data collected in 2002 under SWAMP indicated that sulfate, manganese, and toxicity were consistent problems at the Tecolote Creek monitoring station. There was no evidence of persistent toxicity associated with samples collected from the Tecolote Creek MLS. However, the in-stream benthic community was ranked as poor and very poor, suggesting evidence of benthic alteration. In Mission Bay, the final receiving waters for Tecolote Creek, relative rankings were 11 for chemistry, 8 for toxicity and 1 for benthic community structure. Overall, Mission Bay received a ranking of eight compared to other embayments within San Diego County. Mission Bay experienced a decrease in relative quality compared with the 2003 ABLM program.

In addition to the WMA assessment findings, the BLTEA ratings found heavy metals and bacteria were the highest priority (A rated) constituents for the Mission Bay WMA followed by sediments, nutrients, and bacteria which were given B ratings. The heavy metals priority rating found in the BLTEA rating was primarily due to the 303(d) listings for metals in the Miramar and Tecolote sub-watersheds even though the WMA assessment did not indicate metals were an overall priority.

The information provided from the triad matrix results used in conjunction with the BLTEA ratings can assist the jurisdictions in making informed decisions in developing their WURMP programs. The two reports also allow for an evaluation of where data gaps exist and where efforts should be targeted.

Utilizing the BLTEA rating methods for future data evaluations would also allow for long-term BMP effectiveness assessment. Incorporation of additional useable data from other third party sources such as POTWs and non-profit organizations would also help to increase the confidence of the BLTEA ratings and overall WMA assessments.

The recommendations for the Mission Bay watershed are to continue monitoring to gather additional data for assessment and long-term trend analysis and to initiate upstream source identification to determine sources of constituents of concern.