ATTACHMENT 2-2

COASTAL STORM DRAIN MONITORING PROGRAM REVIEW

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The Coastal Storm Drain Monitoring Program met the overall monitoring program goals by complying with San Diego Regional Water Quality Control Board Order No. R9-2007-0001 (Permit), characterizing urban runoff discharges, identifying sources of bacteria, and helping to detect and eliminate illegal discharges. The Coastal Storm Drain Monitoring Program provided information that is intended to primarily answer the core management questions addressing urban runoff discharges, particularly core management question 3 and question 4 from the Permit, which are as follows:

3. What is the relative urban runoff contribution to the receiving water problem(s)?
4. What are the sources of urban runoff that contribute to receiving water problem(s)?

The Permit requires monitoring of indicator bacteria levels in urban runoff from coastal storm drain outfalls. Through a paired sampling design of the flowing coastal storm drain that reaches the ocean or bay and the nearby AB411 ocean or bay station, this program evaluates the relationship between coastal storm drain discharges and exceedances of bacteriological water quality standards in the coastal receiving waters.

An evaluation of the CSDM Program was conducted to answer the following question:

What is the impact of dry weather discharges from the coastal storm drains on the REC-1 beneficial use the adjacent coastal beach?

Evaluation of the results of the CSDM Program found that:

- The CSDM Program has demonstrated that coastal storm drain flows cause few ocean or bay bacterial exceedances during dry weather. Less than 2 percent of paired receiving water and coastal storm drain samples collected from 2007-2010 indicate a "linkage", where elevated storm drain concentrations correlate with observed receiving water exceedance of AB 411 bacterial criteria. Of 1,647 individual receiving water bacteria indicator samples analyzed, only 32 corresponded with coastal storm drain outfall discharges (0.9% of Total coliform, 1.5% of Fecal coliform, and 3.4% of *Enterococcus* paired samples). In addition to the low incidence of linked coastal storm drain outfall discharge and receiving water AB411 exceedances, the number of coastal storm drain discharges that reach receiving waters has decreased during the past eight years from 73 percent to 23 percent. The decrease in discharge reaching the receiving waters demonstrates a lower risk of a linkage occurring between coastal storm drains and receiving waters.
- Results of the CSDM Program indicate that few storm drains contribute discharges that are linked to the AB411 exceedances in receiving waters. Only 4 of the 227 (1.7 percent) coastal storm drains monitored over the past three years corresponded more than once to a nearby AB411 exceedance in the ocean or bay. These four coastal storm drains have ongoing source abatement programs. An additional six coastal storm drains over the past three years each corresponded only once with an elevated coastal storm drain discharge to a nearby AB 411 exceedance in the ocean or bay.

- Of the ten coastal storm drain outfalls over the past three years linked to AB411 exceedances in the ocean or bay, five will be included in the implementation plans for the Revised Total Maximum Daily Loads for Indicator Bacteria Project – I Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek Bacteria TMDL). The Bacteria TMDL will cover the following hydrologic areas: San Luis Rey River HU 903.00, San Marcos HA 904.50, San Dieguito HU 905.00, Miramar Reservoir HA 906.10, Scripps HA 906.30, Tecolote HA 906.50, San Diego River HU 907.00, and Chollas HSA 908.22. These areas cover much of the coastline and will result in a duplication of effort between the CSDM Program and the Bacteria TMDL monitoring program.

Conclusions

The conclusion of this evaluation is that the CSDM Program should be discontinued, as it has shown that the correspondence between elevated coastal storm drain outfall discharges and AB411 exceedances in the receiving water is minimal (1.9 percent). In addition, upcoming Bacteria TMDL monitoring will overlap with CSDM Program requirements. The TMDL will require an implementation plan to assess and prioritize receiving water exceedances caused by outfall discharges. The very few stations that exhibit a link to AB411 indicator bacterial exceedances in the bay or ocean are addressed by special programs at those stations.

Supporting Documentation

Background

The CSDM Program has been implemented since 2001, and includes the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar, San Diego, and the San Diego Unified Port District. The cities of Coronado and Imperial Beach do not currently participate in the program because Coronado participates in a weekly bacteria beach monitoring program, and Imperial Beach coastal storm drains do not flow during dry weather.

Order 2007-0001 require the Copermittees to identify all coastal storm drains and sample those that are flowing on a monthly basis. Current active sites for each jurisdiction were selected based on the following considerations:

- Accessibility
- Safety for samplers
- Outfall conveys urban runoff from the Copermittees' MS4.

Samples were collected from all locations meeting the site selection criteria above, in the manner described below:

1. Samples will be collected at all flowing storm drain outlets, even if the discharge does not come into direct contact with the receiving water.
2. Storm drain outlet samples will be collected if the storm drain discharge infiltrates into the sand before reaching the receiving water.
3. Storm drain outlet samples will be collected if the flowing storm drain results in ponding between the drain and the receiving water.

4. Paired samples (both storm drain sample and receiving water sample) will be collected when storm drain flows are observed to reach the receiving water.

Monthly samples are collected at all flowing coastal storm drain outfalls, and paired samples are collected in the receiving water if the coastal storm drain discharge reaches the receiving water. A total of 471 unpaired samples were collected at coastal storm drain outfalls from 2007-2010, and a total of 549 paired samples were collected during the same timeframe (2007-2008, 2008-2009, and 2009-2010 Coastal Storm Drain Monitoring Program Annual Reports). In total, 1,569 samples were analyzed for *Enterococcus*, Fecal Coliform, and Total Coliform (4,707 analyses total).

Summary of receiving water samples collected from 2007-2010

The geometric mean and range of receiving water results from 2007-2010 are presented in Figure 1 through Figure 3. Except for *Enterococcus*, the geometric mean for all stations and bacteria indicators is below the AB411 benchmark. Coast 36 and CSD010 are the only two stations with geometric means above the AB411 criteria for *Enterococcus* (although there are some single sample exceedances). Fecal coliform has a few single samples that are above the AB411 standard, but no geometric means. Total coliform also has no stations with geometric means above the benchmark, just a few single samples.

These results corroborate the findings of the receiving water and outfall discharge linkage analysis, which demonstrate that 19 Enterococcus, 8 Fecal Coliform, and 5 Total Coliform receiving water exceedances were likely caused by storm drain discharges. In those instances where receiving water results indicated higher concentrations of indicator bacteria than observed in storm drain runoff discharges, there was not a causal relationship demonstrated between storm drain discharge and the receiving water exceedance (see Table 1). Overall, there were more receiving water samples above the AB411 standard than presented in Table 1 because in some samples the receiving water result was much higher than the storm drain discharge concentration. For example, Station CSD021 exceeded the receiving water standard for *Enterococcus* and Fecal coliform on 12/1/2008 (804 MPN/100mL, and 460 MPN/100mL, respectively), but the storm drain concentrations were much lower than the receiving water results (280 MPN/100mL, and 9 MPN/100mL, respectively).

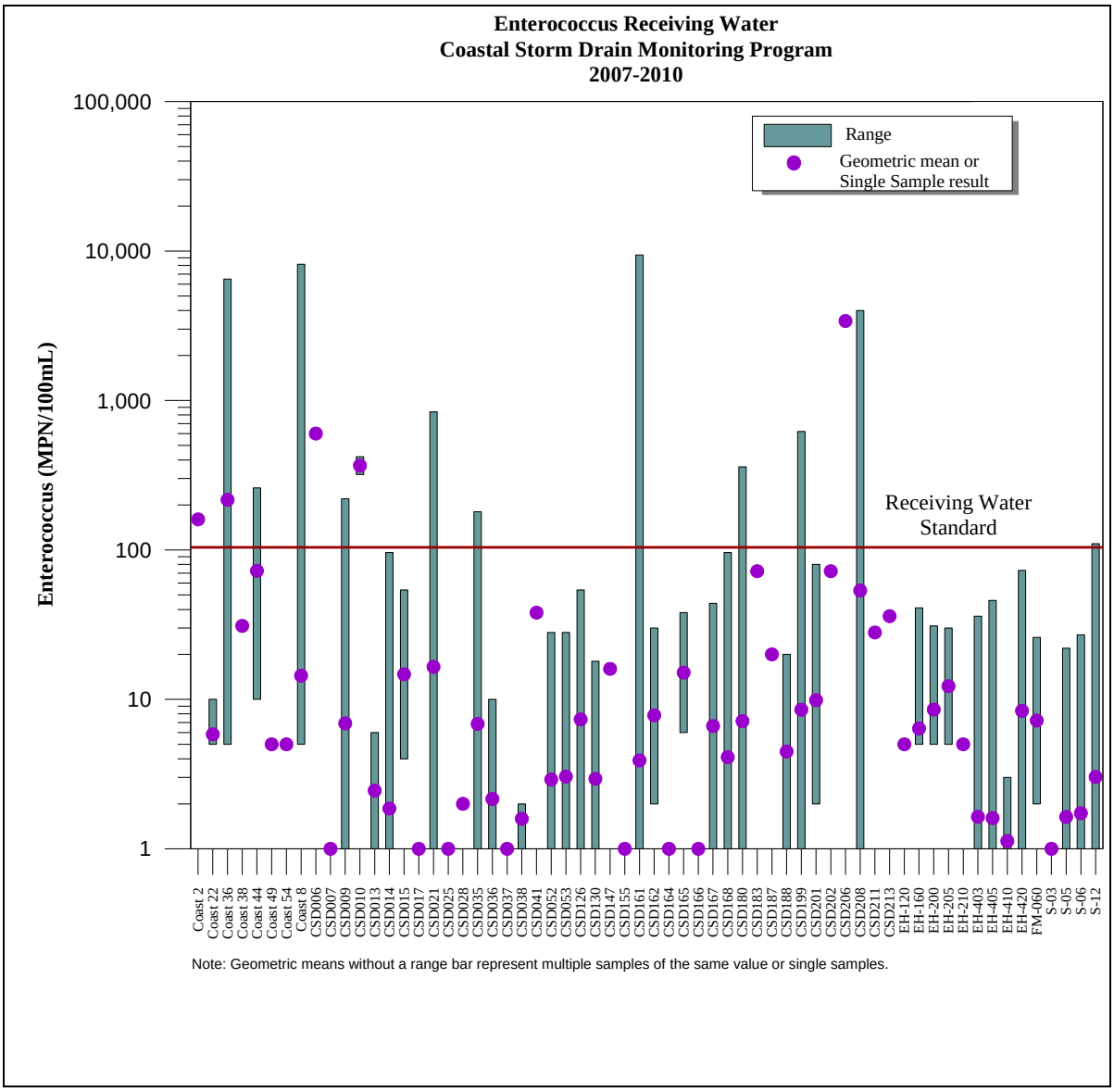

Figure 1. Summary of Coastal Storm Drain Monitoring Program Enterococcus Receiving Water Results 2007-2010

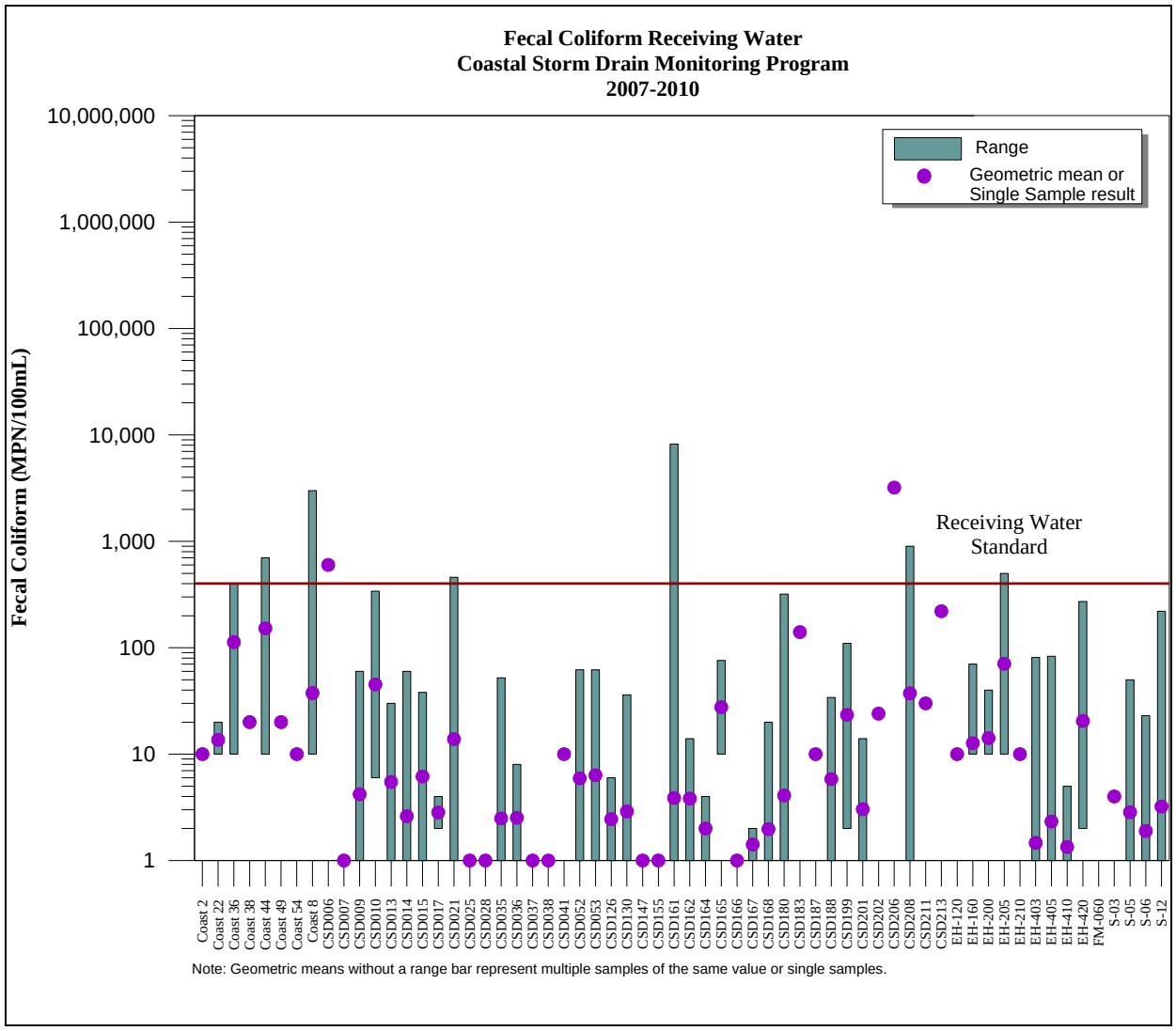

Figure 2. Summary of Coastal Storm Drain Monitoring Program Enterococcus Receiving Water Results 2007-2010

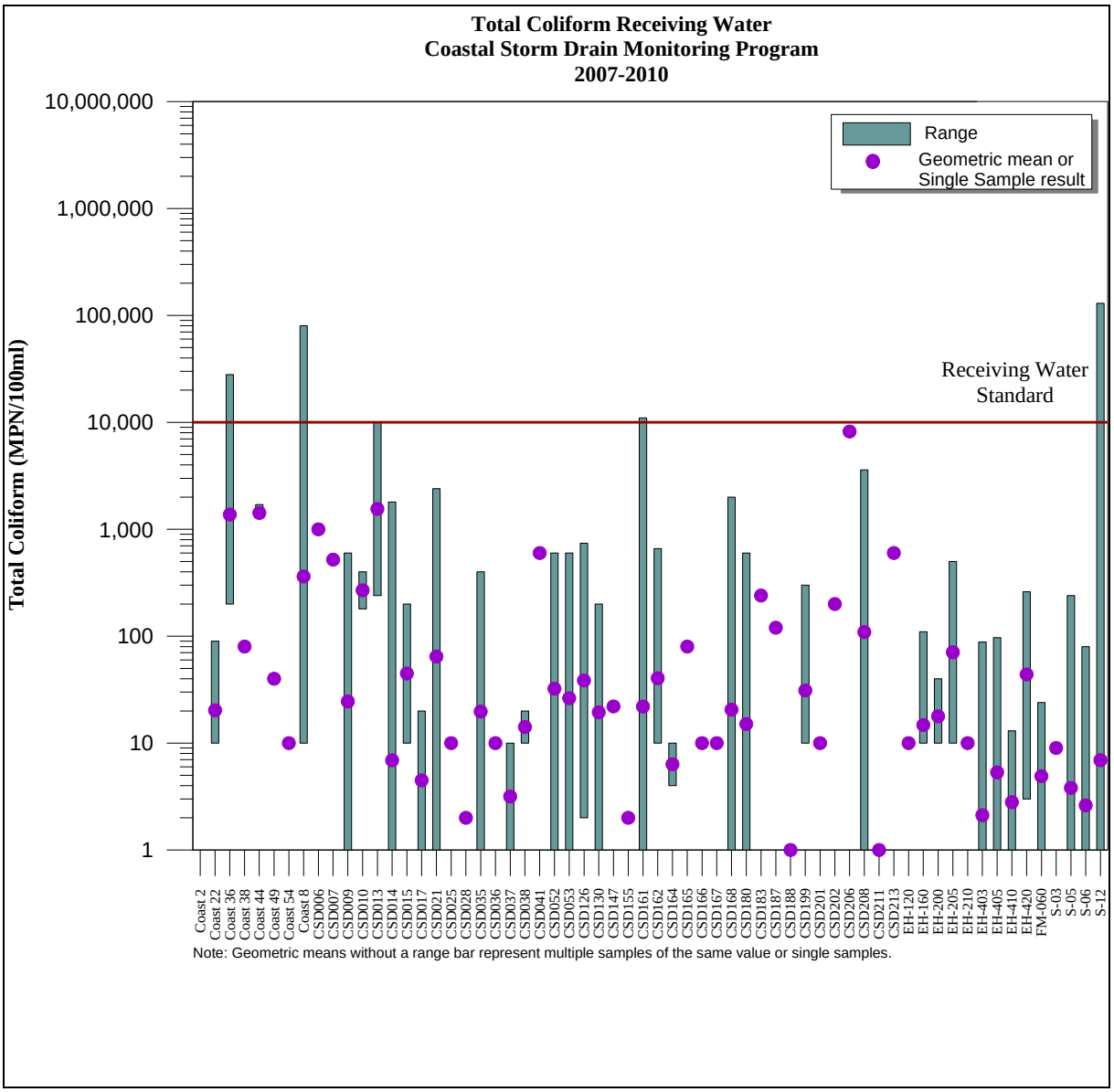

Figure 3. Summary of Coastal Storm Drain Monitoring Program Enterococcus Receiving Water Results 2007-2010

Coastal Storm Drain Outfall Discharge and Receiving Water Linkage Analysis

Sampling of the receiving water occurs when coastal storm drain outfall discharges reach the receiving waters. During the past three years of monitoring (2007-2010) 549 paired samples were collected. A paired sample consisted of one sample from the coastal storm drain outfall discharge and one from the receiving water. Of the 549 paired samples, 1.9 percent showed a link between storm drain outfalls and the receiving water (Table 1).

Table 1. Summary of Coastal Storm Drain Outfall and Receiving Water Linkages

Analyte	Number of Linked Samples	Total Number of Paired Samples	Percent Storm Drain Caused Receiving Water Exceedance
Enterococcus	19	549	3.5%
Fecal Coliform	8	549	1.5%
Total Coliform	5	549	0.9%
Total	**32**	**1,647**	**1.9%**

To further illustrate the relationships between receiving water and storm drain bacteria levels, and receiving water and storm drain action levels, a series of scatter plots referred to as adaptive monitoring diagrams were developed. The adaptive monitoring diagrams stratified the paired sampling data into categories, or quadrants and are essential tools in the implementation of understanding how storm drain flows can impact receiving waters. Figure 4 through Figure 6 summarize the results of Total Coliform, Fecal Coliform, and *Enterococcus* paired samples for 2007-2010.

The scatter plots are divided into five quadrants that are formed by superimposing a line of slope = 1 and two perpendicular lines that delineate the AB411 standard for the indicator of interest. For example, the five quadrants in Figure 1 through Figure 3 are formed by the 1:1 slope line and two lines delineating the AB411 standard line for Total Coliform (10,000 MPN/ 100mL). Receiving water bacteria levels in samples falling within quadrants above the 1:1 slope line (Quadrants II and III, and the upper part of Quadrant I) are higher in bacteria than the corresponding storm drain sample and are therefore, likely influenced by sources in addition to the storm drain discharge. Possible sources include birds, other marine wildlife, discharges from watercraft, and ocean bathers. Quadrant IV of the scatter plots includes the paired samples where elevated storm drain bacteria are likely to have caused or contributed significantly to the AB411 exceedance. Quadrant V includes the elevated storm drain samples that did not result in an AB411 exceedance. Table 2 describes the relationships associated with paired sample data falling into each quadrant.

Table 2. Adaptive Monitoring Description, Recreated from Coastal Storm Drain Monitoring Program 2009-2010 Annual Report

Quadrant	Area	Relationship/Possible Action
Lower Left	I	Storm drain and receiving water levels are below receiving water standards. The receiving waters support beneficial uses
Lower Right	I-A	Storm drain concentration is above receiving water criteria but below 95th percentile action level, receiving water is below receiving water criteria. No action necessary
	V	Storm drain concentration is above 95th percentile action level while receiving water concentration is below receiving water criteria. Highly elevated storm drain concentration does not cause receiving water exceedance, however, the magnitude of the exceedance warrants follow-up and possible investigation.
Upper Left	II	Storm drain less than receiving water standards, while criteria are exceeded in receiving water sample. It does not appear that storm drain flow is responsible for the receiving water exceedance.

Quadrant	Area	Relationship/Possible Action
Upper Right	III	Storm drain and receiving water samples are above receiving water criteria, and storm drain concentration is less than receiving water concentration. Storm drain contamination may contribute to receiving water exceedance, but other sources are also likely.
	IV	Storm drain and receiving water samples are above receiving water criteria, and storm drain concentration is greater than the receiving water concentration. Elevated storm drain concentration likely to have caused receiving water exceedance.

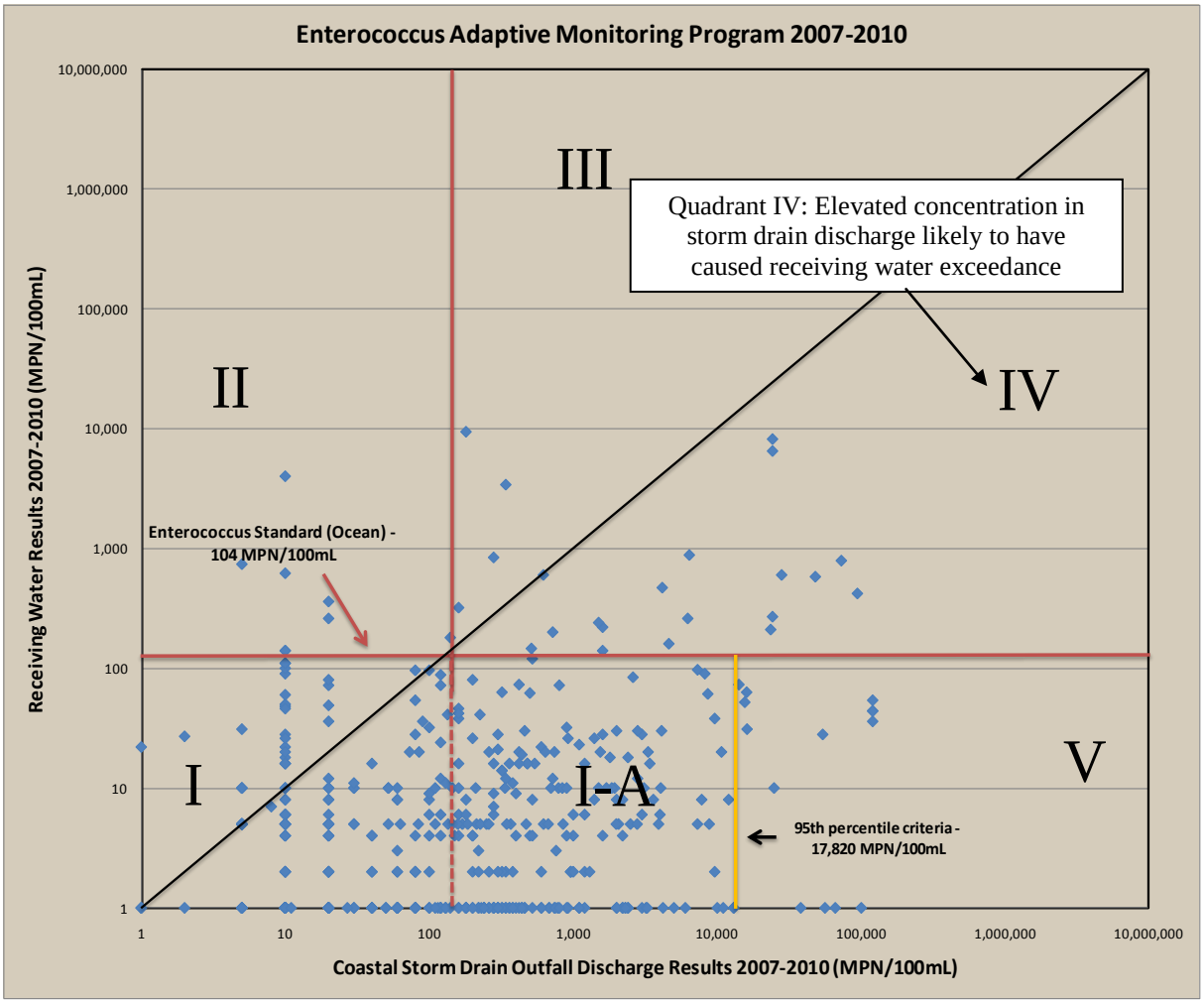

Figure 4. *Enterococcus* Adaptive Monitoring Results 2007-2010

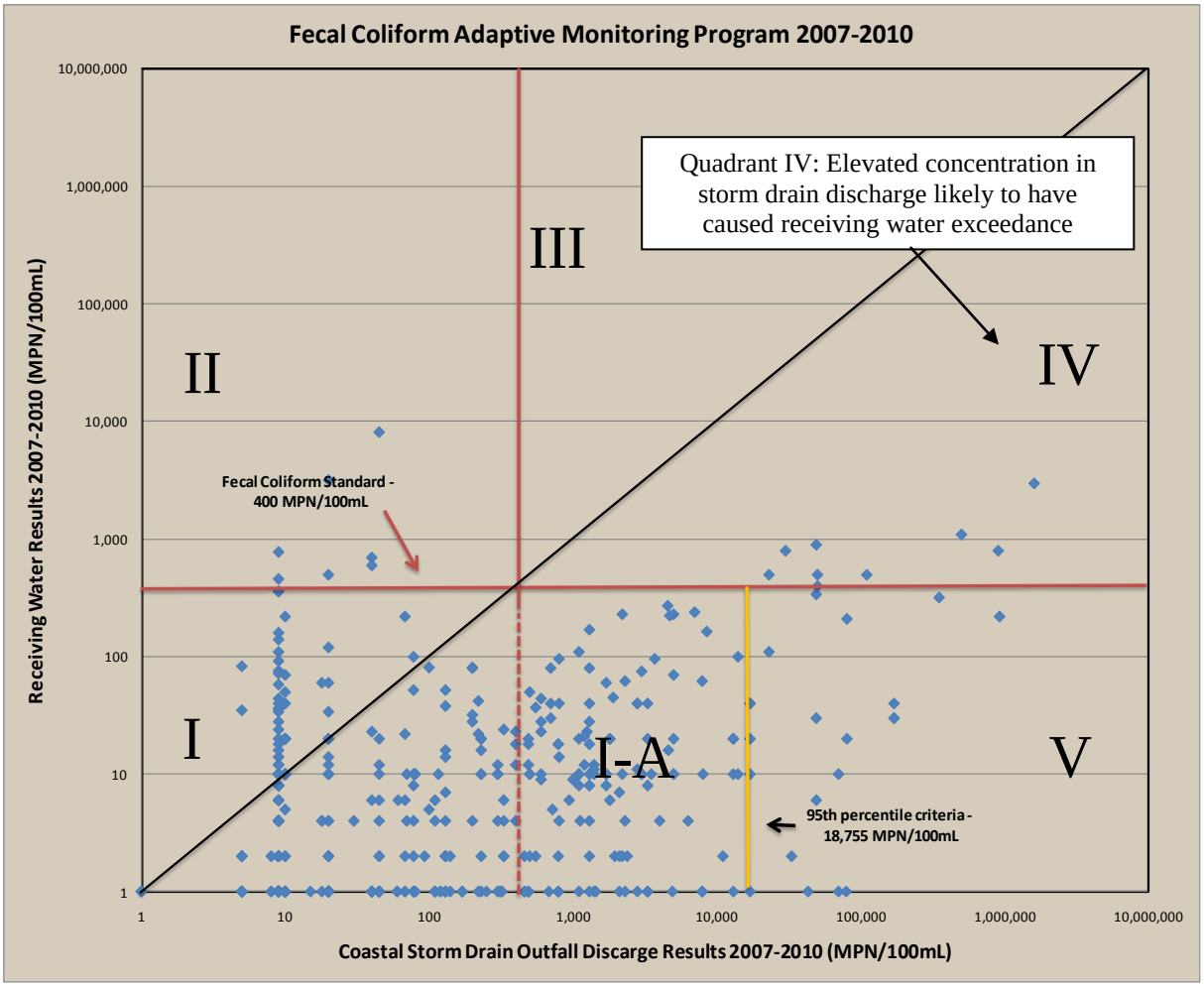

Figure 5. Fecal Coliform Adaptive Monitoring Results 2007-2010

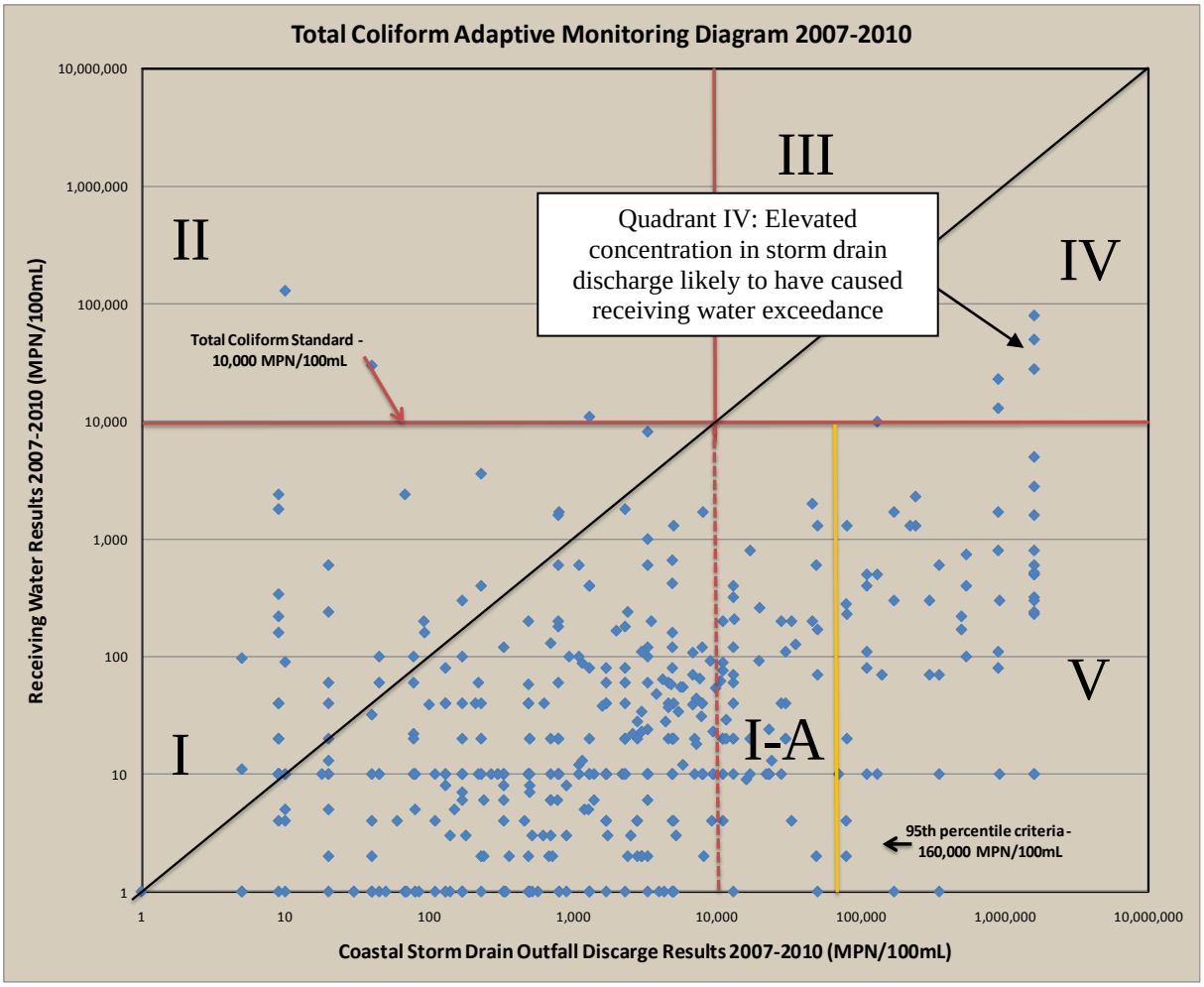

Figure 6. Total Coliform Adaptive Monitoring Results 2007-2010

The samples that fall into Quadrant IV in Figure 4 through Figure 6 are summarized in Table 5, which presents a seasonal breakdown of the coastal storm drain discharge and receiving water results where linkages are present. The majority of linked samples occurred during the winter months (11 of 19 *Enterococcus* samples, 4 of 7 Fecal Coliform, and 4 of 5 Total Coliform).

Table 3. Seasonal Summary of Coastal Storm Drain Discharge and Linked Receiving Water Samples

Month	*Enterococcus*	Fecal Coliform	Total Coliform	Season
May	1	0	0	Dry Season
June	1	1	0	
July	0	1	0	
August	3	1	0	
September	3	0	1	
Summer Total	**8**	**3**	**1**	
October	1	2	1	Wet Season
November	2	0	0	
December	1	0	0	
Jan	4	2	3	
Feb	2	0	0	
March	1	0	0	
April	0	0	0	
Winter Total	**11**	**4**	**4**	

Stations for which a linkage between coastal storm drain discharge and receiving water results has been observed are presented in Table 4. Of 227 stations included in the program, only four of the ten stations with a suspected linkage exhibit a chronic pattern of paired sample exceedances. These four stations represent 1.7 percent of the stations monitored within the CSDM Program. At two of these four stations, additional measures have already been taken to ensure the linkage between coastal storm drain discharges and receiving waters is eliminated. Effectiveness assessment of BMP implementation (Coast 8) is currently underway, and for CSD208 special monitoring is currently underway to understand and eliminate the source of bacteria. The sources of indicator bacteria exceedances at Coast 36 and Coast 44 have been identified. The outfall at Coast 36 is from Camp Pendleton and results have been forwarded to them for action. The two exceedances at Coast 44 were from commercial fishing activity and Oceanside Harbor Maintenance and Oceanside Code Enforcement have worked with the fisherman and the fish distributors to implement appropriate BMPs. The other six stations have exhibited a linkage between storm drain discharge and receiving water bacteria indicator results only once during the past three years. Four of the six stations will be monitored under the upcoming Bacteria TMDL. Therefore, additional special monitoring at these locations is not necessary.

Table 4. Summary of Coastal Storm Drain Outfall Monitoring Stations with Linkages to Receiving Water AB411 Exceedances

Station	Season Linkage Observed	Years Linkage Observed	HU	Water Body	Latitude	Longitude	Ongoing Actions
Coast 2	Winter (2008-2009)	1	902*	Oceanside Harbor	33.21303	-117.39474	Not an ongoing receiving water and storm drain outfall discharge linkage. No further action necessary.
Coast 36	Summer/Winter (2008-2010)	2	902*	Oceanside Harbor	33.21253	-117.39426	Source of flow identified. Results, photos, and details sent to Camp Pendleton for abatement.
Coast 44	Winter (2008-2010)	2	902*	Oceanside Harbor	33.20642	-117.38961	Source of flow identified. Oceanside Harbor Maintenance and Code Enforcement have implemented structural and administrative BMPs for the commercial fisherman and seafood transport and distribution companies.
Coast 8	Summer/Winter (2007-2010)	3	902*	Oceanside Harbor	33.20564	-117.3932	Effectiveness Assessment of BMP implementation ongoing
CSD006	Winter (2008-2009)	1	906	Vallecitos	32.85562	-117.25819	Included in Bacteria TMDL; Not an ongoing receiving water and storm drain outfall discharge linkage. No further action necessary.
CSD009	Winter (2008-2009)	1	906	Roseland Dr	32.852138	-117.26111	Included in Bacteria TMDL; Not an ongoing receiving water and storm drain outfall discharge linkage. No further action necessary.
CSD010	Summer (2008-2009)	1	906	Coast Blvd	32.850346	-117.27297	Included in Bacteria TMDL; Not an ongoing receiving water and storm drain outfall discharge linkage. No further action necessary.
CSD035	Winter (2007-2008)	1	906	Cortez Place	32.818586	-117.27428	Included in Bacteria TMDL; Not an ongoing receiving water and storm drain outfall discharge linkage. No further action necessary.
CSD208	Summer/Winter (2007-2010)	3	906	Cudahy	32.78679	-117.20791	Included in Bacteria TMDL, Special Monitoring through City of San Diego
EH-205	Summer (2008-2009)	1	908	Bessemer St	32.71803	-117.23344	Not an ongoing receiving water and storm drain outfall discharge linkage. No further action necessary.

* Hydrologic Unit designated as 902* is representative of stations in Oceanside Harbor. The harbor is listed as a coastal water body in Table 2-3 of the Water Quality Control Plan for the San Diego Basin (9). A Hydrologic Unit Basin Number has not been assigned to the harbor. According to SanGIS data, the stations fall into the 902 Hydrologic Unit, Santa Margarita.

The sample results shown in Quadrant IV of Figure 4 through Figure 6 are presented in Table 5.

Table 5. Coastal Storm Drain Discharge and Receiving Water Linkage Analysis Individual Results

Station	Date	Analyte	Months	Coastal Outfall Concentration (MPN/100 ml)	Coastal Receiving Water Concentration (MPN/100 ml)
Coast 2	2/4/2009	Enterococcus	Feb	4,611	160
Coast 36	9/2/2008	Enterococcus	Sept	24,196	6,488
Coast 36	6/1/2009	Enterococcus	June	4,150	470
Coast 36	11/9/2009	Enterococcus	Nov	23,500	210
Coast 36	9/1/2010	Enterococcus	Sept	72,700	790
Coast 44	3/10/2008	Enterococcus	March	512	146
Coast 44	1/11/2010	Enterococcus	Jan	6,240	260
Coast 8	1/17/2008	Enterococcus	Jan	24,196	8,164
Coast 8	5/12/2008	Enterococcus	May	24,196	269
CSD006	12/1/2008	Enterococcus	Dec	620	600
CSD009	11/10/2008	Enterococcus	Nov	1,600	220
CSD010	8/4/2008	Enterococcus	Aug	94,000	420
CSD035	1/14/2008	Enterococcus	Jan	1,600	140
CSD208	8/11/2008	Enterococcus	Aug	1,500	240
CSD208	8/5/2009	Enterococcus	Aug	28,000	600
CSD208	10/14/2009	Enterococcus	Oct	48,000	580
CSD208	1/13/2010	Enterococcus	Jan	6,400	880
CSD208	2/1/2010	Enterococcus	February	720	200
CSD208	9/7/2010	Enterococcus	Sept	520	120
Enterococcus: 19 Receiving Water Samples Likely Linked to Storm Drain Discharge					
Coast 44	1/11/2010	Fecal Coliform	Jan	50,000	500
Coast 8	10/8/2007	Fecal Coliform	Oct	500,000	1,100
Coast 8	1/17/2008	Fecal Coliform	Jan	30,000	800
Coast 8	6/2/2008	Fecal Coliform	June	110,000	500
Coast 8	10/21/2009	Fecal Coliform	Oct	1,600,000	3,000
Coast 8	2/15/2010	Fecal Coliform	February	900,000	800
CSD208	8/5/2009	Fecal Coliform	Aug	49,000	900
EH-205	7/23/2009	Fecal Coliform	July	23,000	500
Fecal Coliform: 8 Receiving Water Samples Likely Linked to Storm Drain Discharge					
Coast 36	9/2/2008	Total Coliform	Sept	1,600,000	23,000
Coast 8	1/17/2008	Total Coliform	Jan	1,600,000	50,000
Coast 8	1/31/2008	Total Coliform	Jan	90,000	23,000

Table 5. Coastal Storm Drain Discharge and Receiving Water Linkage Analysis Individual Results

Station	Date	Analyte	Months	Coastal Outfall Concentration (MPN/100 ml)	Coastal Receiving Water Concentration (MPN/100 ml)
Coast 8	1/12/2009	Total Coliform	Jan	90,000	13,000
Coast 8	10/21/2009	Total Coliform	Oct	1,600,000	80,000
Total Coliform: 5 Receiving Water Samples Likely Linked to Storm Drain Discharge					
In Total: 1.9 Percent (32 of 1,647) Receiving Water Samples Likely Linked to Storm Drain Discharge					

Coastal Storm Drain Discharge Frequency

During the time period of 2007-2010, coastal storm drain outfall discharges that reach the receiving water have decreased. Figure 7 illustrates the reduction of coastal storm drain outfall discharges, from approximately 73 percent of coastal storm drains discharging in 2002-2003 down to 23 percent discharging in 2009-2010. The reduced incidence of discharging outfalls translates to a reduced risk of beneficial use impairment in the coastal receiving waters.

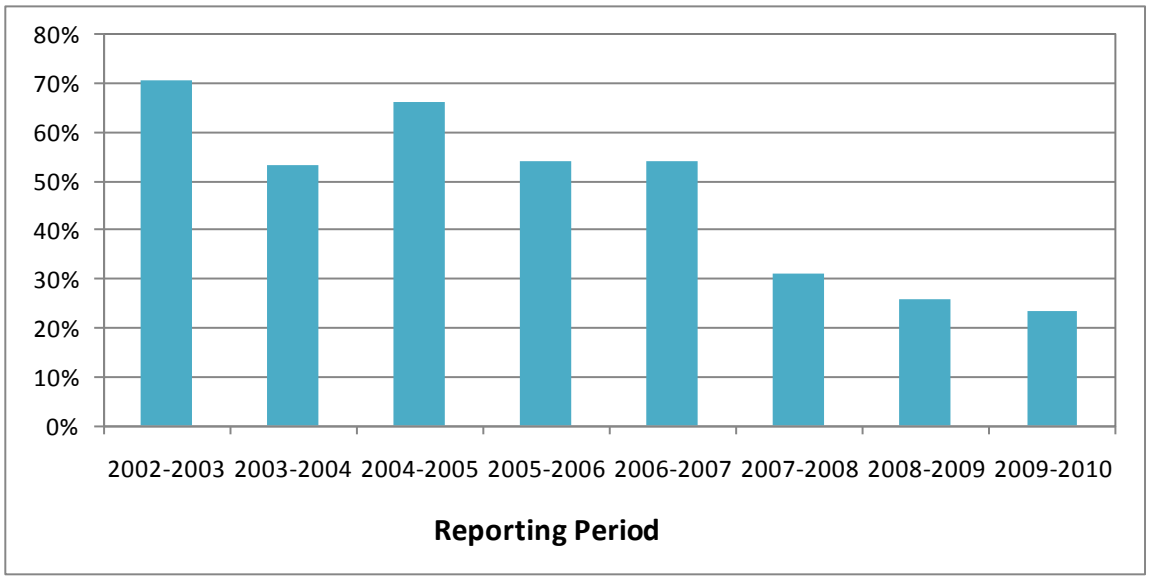

Figure 7. Proportion of Flowing Coastal Storm Drains, Reproduced from Figure 4-10 of Coastal Storm Drain Monitoring Program 2009-2010 Annual Report