

**FINAL PROJECT REPORT FOR THE
MANHATTAN BEACH PUMP PLANT
LOW-FLOW DIVERSION PROJECT**

**Clean Beaches Initiative Project No. 11
Agreement Number: 01-081-550-3
Project No. 552**

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Prepared for

**California State Water
Resources Control Board**

Prepared By

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

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2. Introduction

Problem Statement: In an effort to meet the requirements of the Dry Weather Santa Monica Bay Beaches Bacteria (SMBBB) Total Maximum Daily Load (TMDL), the Los Angeles County Flood Control District (LACFCD) proposed to construct a low-flow diversion (LFD) structure at the Manhattan Beach Pump Plant within Polliwog Park (referred to hereinafter as the Manhattan Beach Pump Plant). This low-flow diversion system was constructed to divert the upstream urban dry weather runoff to the sanitary sewer and reduce discharges to the receiving water body. However, this project only addresses the urban runoff from the upper most portion of the watershed, and it does not treat the additional urban runoff that enters the storm drain downstream of the subject project. In order to address this need, the LACFCD constructed a second diversion facility at the downstream end of this watershed to account for the additional urban dry-weather flow.

Urban dry weather runoff may contribute to elevated bacterial levels in the Santa Monica Bay. Consequently, this project was undertaken to reduce the levels of bacteria in the bay in an effort to comply with the Dry-Weather SMBBB TMDL. Below, in figure 1, is a map of the nearby shoreline monitoring sites for the Manhattan Beach Pump Plant per the Los Angeles County Department of Public Health.

As seen in this map, the monitoring site closest to the project is labeled DHS 113. However, it should be noted that the Los Angeles Regional Water Quality Control Board (Regional Board) has relocated this monitoring site from the storm drain outfall to point zero (wave wash), and it is now designated/labeled as SMB 5-2.



Post construction bacterial monitoring has been conducted, and the results are provided in Appendix A of this report. Also discussed in this report, is an assessment of the effectiveness of this project in diverting bacteria to the sanitary sewer, the changes in the quality of the receiving waters near the beach, lessons learned, and the construction and maintenance of the project. Additional project background and related information can be found in the Monitoring Plan, Quality Assurance Project Plan, Project Questionnaire, additional photos and maps for the project and/or the Grant Agreement in Appendix D. Table 1 provides a project schedule with completion dates.

Funding for this project has been provided in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) for the implementation of California's Nonpoint Source Pollution Control Program.

TABLE 1				
Task	Deliverable by Subtask #	Due Date	% of Work Complete	Date Submitted
1 Project Management			100%	
	1.2 Quarterly Progress Report	Ongoing through 2007	100%	01/10/08
	1.5 Contract Summary Form	01/04/2003	100%	09/18/03
	1.6 Subcontractor Documentation	09/20/2003	100%	09/18/03
	1.7 Project Survey Form (Attachment B)	12/31/2007	100%	12/31/07
2 CEQA/NEPA/Permits			100%	
	2.1 Categorical Exemption	09/20/2003	100%	09/18/03
	2.2 Required Permits	09/20/2003	100%	09/18/03
3 QAPP			100%	
	3.1 QAPP	09/20/2003	100%	01/22/04
4 Project Design			100%	
	4.1 Contract with DC (if applicable)	Not applicable	Not applicable	Not applicable
	4.2 100% design and specs submittal	09/20/2003	100%	09/18/03
	4.3 Proof of approved plans and specs, addenda, evidence of contract award	09/20/2003	100%	09/18/03
5 Project Implementation			100%	
	5.1 Selection of Construction Contractor	09/20/2003	100%	09/18/03
	5.3 Completed. project indicated by pre and post photos and as built drawings	03/15/2004	100%	08/25/04
	5.4 Notice of Completion and formal acceptance of project	3/31/06	100%	07/31/07
6 Monitoring and Reporting Plan			100%	
	6.1 Water Quality Sampling and Monitoring Plan	Ongoing through 04/30/2005	100%	10/27/04
	6.2 Quarterly Sampling and Monitoring Reports	Ongoing through 12/31/2007	100%	01/10/08
7 Reporting			100%	
	7.1 Draft Final Report	12/31/2007	100%	1/31/08
	7.2 Final Report	03/31/2008	100%	03/31/08

Table 1 SWRCB CBI Grant Schedule of tasks to be completed

3. Data

Samples were collected and analyzed in compliance with the approved Monitoring Report. Data is presented below in graphical form. Tabulated monitoring data, Chains of Custody and the Field Data Sheets can be found in Appendices A and B.

Flow data was collected during monitoring. An estimate of the total volume of water diverted to the sanitary sewer and an approximate bacterial load is presented below.

Beach Mile Days data was downloaded from the Beachwatch Website (<http://beachwatch.waterboards.ca.gov>) and analyzed to determine trends in shoreline water quality.

Summer Beach Report Cards were downloaded from Heal the Bay (www.healthebay.org), and the grades for 27th Street and the two adjacent monitoring sites are tabulated in Table 4.

During the year 2007, shoreline monitoring data from the SMB 5-2 monitoring site near the Manhattan Beach Pump Plant storm drain outlet was obtained from the Los Angeles County Department of Health Services, and this data was used to plot the graphs shown in Figures 4 through 6.

3.1 Low Flow Diversion Monitoring Data

As required by the Catch Basins Inserts (CBI) Grant, one year of monitoring of the LFD was conducted after construction was complete. The samples were collected directly upstream of the diversion and analyzed for bacteria (total coliform, fecal coliform, and fecal enterococcus). For the summer-dry period (April 1 to October 31), samples were collected during three monitoring events on April 26, July 10, and October 2, 2007. The Los Angeles County Sanitation District (LACSD) allows the LACFCD to divert urban runoff low flows from this LFD year round under the dry weather conditions. Consequently, this LFD was sampled four times during 2007. A fourth sample was collected on November 5, 2007. Bacterial data results from these four monitoring events were then plotted and graphed, as shown in Figures 1 through 3. As shown in the figures below, bacteria concentrations tend to exceed the Assembly Bill 411 (AB 411) standards with higher exceedances seen later in the year. Geometric averages of the bacterial loads that were diverted to the sewer can be found in Table 2 below.

During the monitoring, water samples were collected from the storm drain just upstream of the diversion structure. Samples were collected in a prerinsed bucket and then transferred to sterile bottles containing sodium thiosulfate. Sodium thiosulfate dechlorinates the sample so that unwanted bacteria die off does not occur. Sample bottles were then transported on ice and under Chain of Custody to the laboratory within the required six hour holding time.

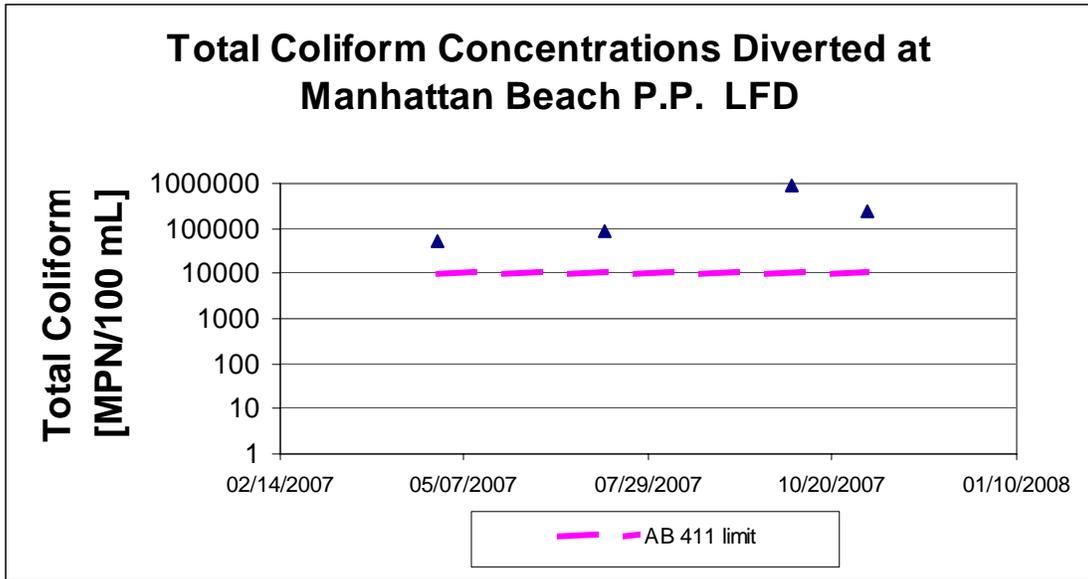


Figure 1 Total Coliform Concentrations Diverted to Sewer at Manhattan Beach Pump Plant

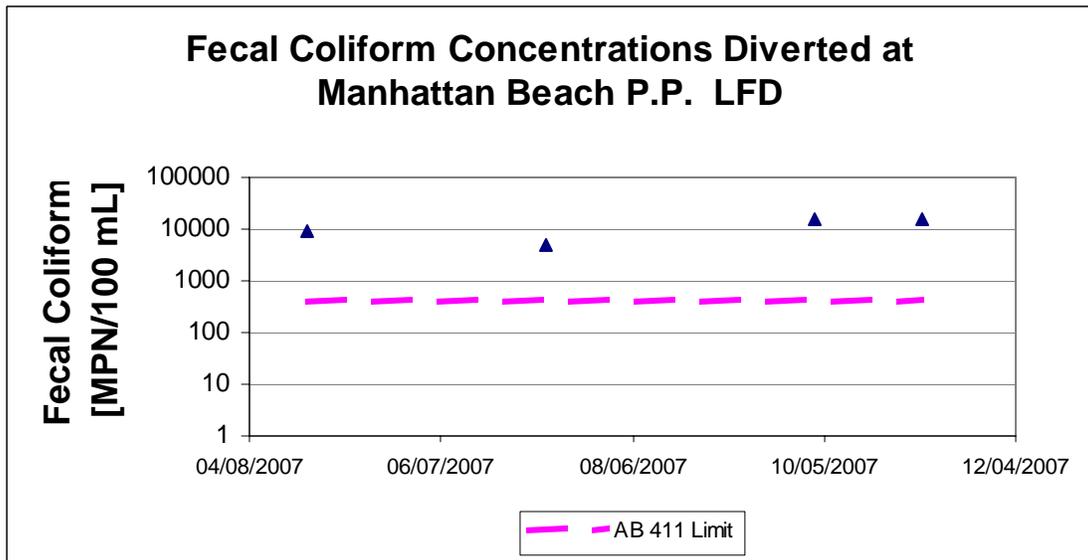


Figure 2 Fecal Coliform Concentrations Diverted to Sewer at Manhattan Beach Pump Plant

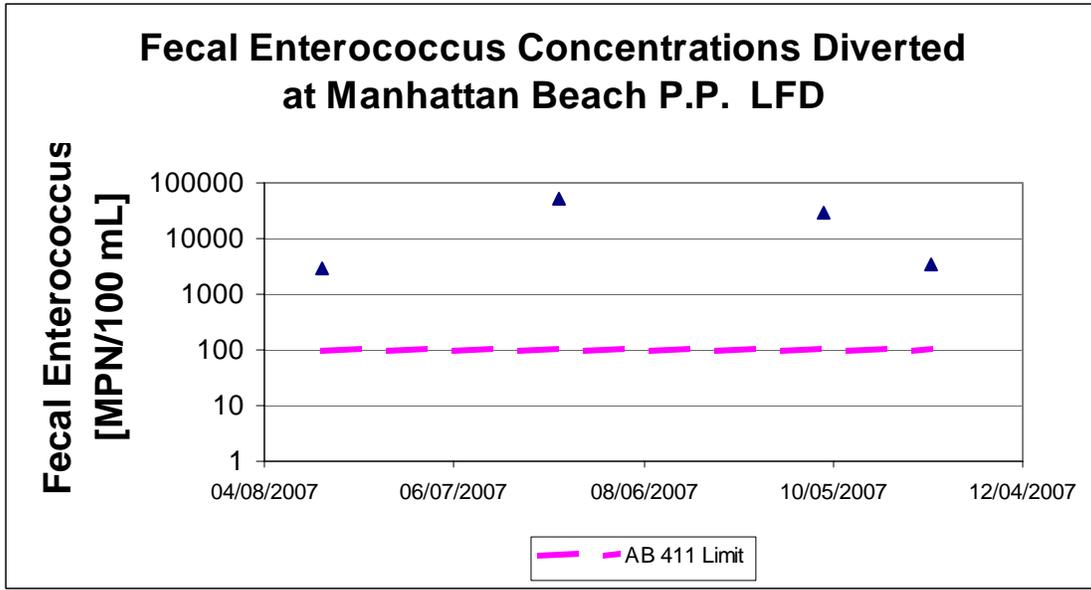


Figure 3 Fecal Enterococcus Concentrations Diverted to Sewer at Manhattan Beach Pump Plant

Monitoring results taken at the same time are generally within an order of magnitude of each other, but do exhibit some variation. It may be helpful for future monitoring efforts to collect multiple samples in order to minimize variations in exceedences and/or the risk of missing an exceedence due to natural variation in the concentrations. In this manner, the health of the beach going public and other portions of the environment can be protected most economically. The tabulated data used to create figures 1 to 3 and Table 2 can be found in Appendix A.

3.2 Flow Data and Estimated Loading

Approximately 2.8 million gallons of flow were diverted to the sanitary sewer at the Manhattan Beach Pump Plant low-flow diversion between April 15 and November 5, 2007. Table 2 shows the geometric average concentrations of the diverted bacteria and an estimated diverted load. For bacteria, geometric averages were calculated by multiplying all four individual sample values and then taking the fourth root of the product. This was done for each reported category of bacteria (Total Coliform, Fecal Coliform and Enterococcus). Flow volume was calculated by determining the flow that occurred between July 10 and November 5, 2007, based upon the cumulative flow gage, then prorating this value to include the time period between April 15 and November 5, 2007. Estimated Bacteria Loads were calculated by multiplying the flow volume by the geometric averages. Visual inspections of flow bypass were made during the sampling events and no flow was observed bypassing the diversion structure. All upstream urban runoff is

stored in the Pump Plant sump. Table 2 shows the geometric average concentrations of the diverted bacteria and an estimated diverted load. Bacteria can exhibit rapid changes in population size, so these estimated loads should not be relied upon when determining bacterial concentrations in receiving waters.

Geometric Bacteria Concentrations (MPN/100 mL)		Flow (Gallons)	Flow (mL)	Estimated Bacteria Loads (MPN)
Total Coliform	159,399	2.4E+06	9.1E+09	1.4E+13
Fecal Coliform	8,963		9.1E+09	8.1E+11
Enterococcus	16,510		9.1E+09	1.5E+12

Table 2 Flow Volume and Estimated Bacterial Loads to Sanitary Sewer

3.3 Beach Mile Days

Beach Mile Day data was downloaded from the BeachWatch website (<http://beachwater.waterboards.ca.gov>). A Beach Mile Day is a measure of shoreline water quality that takes into account both the geographical and temporal extent of water quality fluctuation and concerns. These tabulated results were generated from the shoreline monitoring data for the compliance monitoring sites/stations located at or near the storm drain outfall (Project No. 286) for the LFD at the Manhattan Beach Pump Plant. These compliance monitoring sites are in the City of Manhattan Beach, and they are located at 27th Street and the Strand, 40th Street and the Strand, and the Manhattan Beach Pier. The tabulated Beach Mile Days for these three compliance sites are presented below in Table 3.

Year	BMD (all year)	BMD (AB 411 year April - October)	BMD (all year)	BMD (AB 411 year April - October)
	40th Street extended		Manhattan Beach Pier	
2002	0	0	0	0
2003	0	0	0	0
2004	1.05	0.85	1.43	0.22
2005	0.75	0.75	0.77	0.66
2006	0	0	0	0
2007	0	0	0.77	0.77
	27th Street extended			
2003	2.02	1.85		
2004	0.65	0.6		
2005	1.8	1.7		
2006	27.38	1.4		
2007	0.55	0.1		

Table 3 Beach Mile Days

An analysis of the Beach Mile Days for these monitoring compliance sites/stations indicates that water quality in the bay varied widely from year to year, over the past five years. It seems that the water quality initially improved at all three sampling sites, but decreased again in latter years. Although the results at the 27th Street compliance site are slightly above the AB 411 limit, the water quality was the best there in 2007. However, with only five years of data, it is difficult to establish a definite trend. Other variations, such as rainfall totals make it difficult to definitively assert that any single Low-Flow Diversion project significantly affected water quality in Santa Monica Bay.

3.4 Summer Beach Report Card Grades

Another widely used and publicly available measure of shoreline water quality is Heal the Bay's Report Card. Table 4 shows the grades from the summer report card for the LFD at Manhattan Beach Pump Plant Storm Drain and the two adjacent monitoring compliance sites/stations. Appendix C contains the data that was used to generate these weekly Beach Report Cards.

	Manhattan Beach Pier Drain	Manhattan Beach at 28th St. Drain	Manhattan Beach Projection of 40th St.
2007	A+	A	A+
2006	A+	D	A+
2005	A	A	A+
2004	A+	D	A+
2003	A+	B	A+

Table 4 Heal The Bay Summer Dry Beach Report Card Grades

An analysis of these report card grades indicate that this beach generally has very good water quality during summer-dry weather but, occasionally exhibits bacterial exceedences, near the 28th Street Drain. These poor grades do not seem to be influenced by the grades at the adjacent stations. Water quality at the Manhattan Beach Pier and at 40th Street was consistently good, while the 28th Street water quality repeatedly oscillated back and forth between good and poor. Since no definite trend exists, the changes in the 28th Street Storm Drain outfall do not appear to be directly related to the LFD. The LFD was not fully operational until October 2006 and since then, it seems that the LFD is working effectively. The water quality of Manhattan Beach Pier Storm Drain and the 40th Street Drain does not seem to have significantly changed since the installation of the Low-Flow Diversion. Overall the water quality of all three beach sites has improved or remained stable in 2007. Since a second LFD was recently constructed in December 2006 at 28th Street and the Strand which is downstream of this LFD project, there is a cumulative effect on water quality with both of these LFDs diverting dry weather flows to the sewer system.

3.5 Shoreline Bacteria Monitoring

In accordance with Assembly Bill 411 (AB 411) and the Santa Monica Bay Beaches Bacterial TMDL, coordinated shoreline bacteria monitoring is conducted along the shore of Santa Monica Bay. These monitoring results are used to determine whether beaches should be posted or closed to protect the health of the public depending on the concentrations of fecal indicator bacteria. This project diverts urban runoff low flows away from the bay. Otherwise, it would enter the bay via the downstream Manhattan Beach Pump Plant Storm Drain outlet (Project No. 286), near the SMB 5-2 monitoring compliance site. The 2007 monitoring results for this year's AB 411 season are presented graphically below in Figures 4 through 6. Tabulated Data can be found in Appendix E.

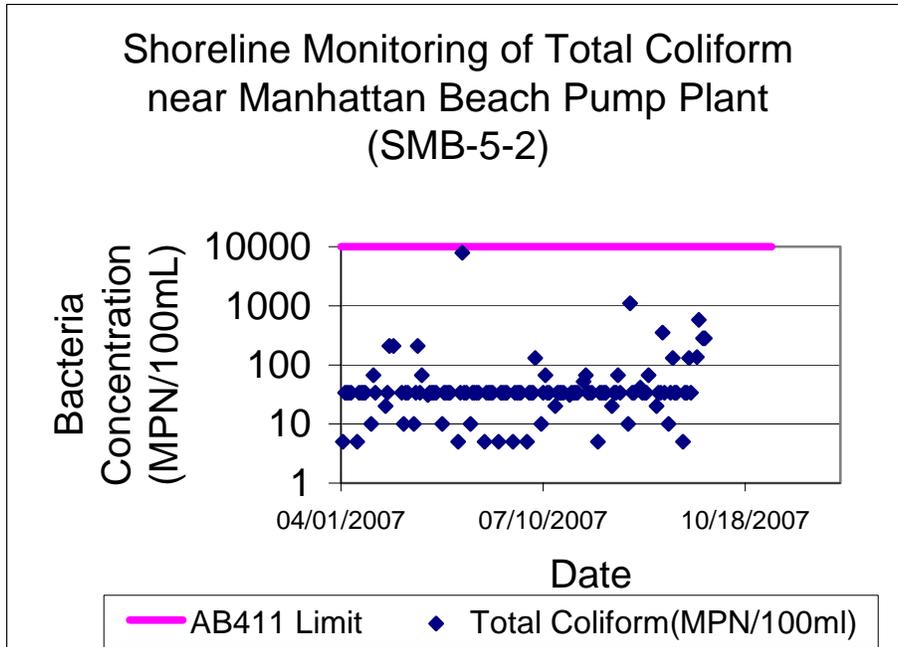


Figure 4 Shoreline Monitoring of Total Coliform at Manhattan Beach Pump Plant Storm Drain outlet

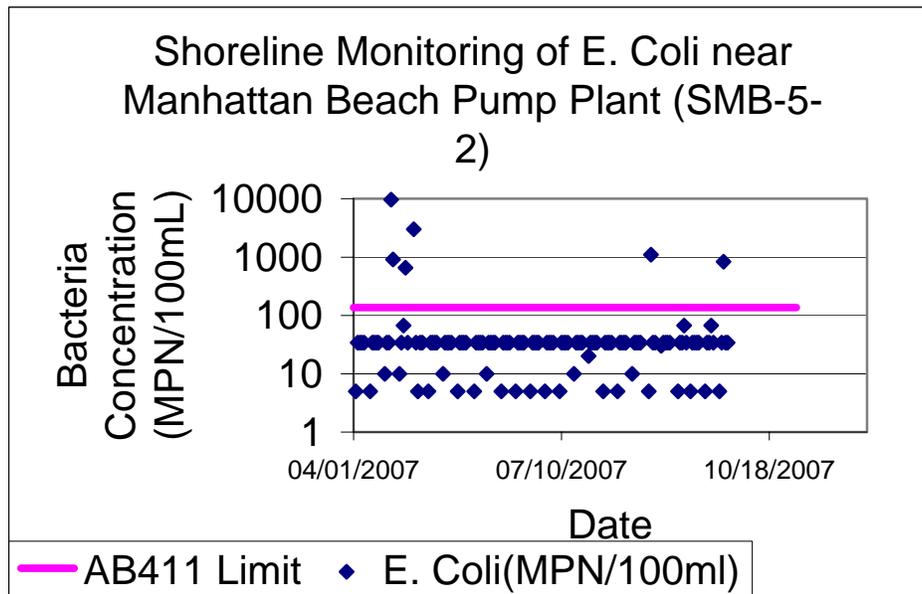


Figure 5 Shoreline Monitoring of E. Coli at Manhattan Beach Pump Plant Storm Drain outlet

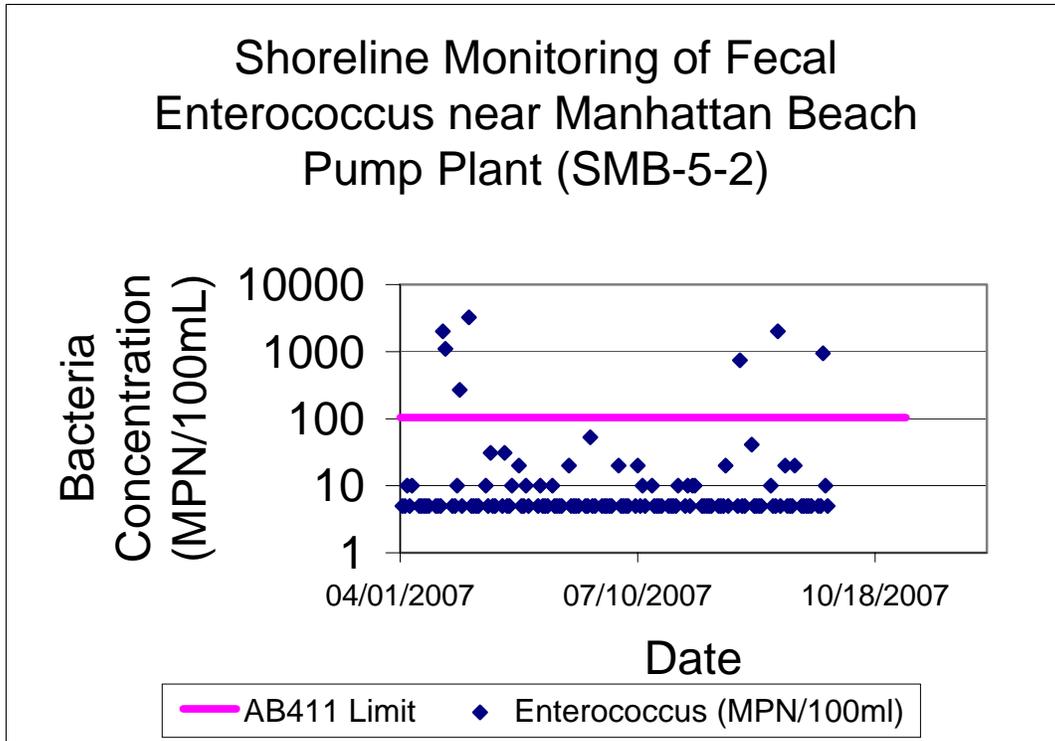


Figure 6 Shoreline Monitoring of Fecal Enterococcus at Manhattan Beach Pump Plant Storm Drain outlet

Figures 4 through 6 illustrate that bacteria samples taken at the outfall of the Manhattan Beach Pump Plant storm drain were generally below AB 411 single sample limits. Several exceedences are observed for E. coli and Enterococcus. Flow coming into the Low-Flow Diversion was diverted to the sanitary sewer during this time period, suggesting that runoff upstream of the diversion did not contribute to shoreline water quality, and that bacterial exceedences can occur even when a Low-Flow Diversion system is in place.

4. Conclusions and Recommendations

Although this Final Project Report is primarily focused on fecal indicator bacterial monitoring to assess the effectiveness of this LFD, some important conclusions and recommendations regarding other aspects of this Low-Flow Diversion project should be acknowledged. For the convenience of the reader these are presented in three sections, Bacteria and Flow Monitoring, Siting, and Design and Maintenance.

4.1 Bacteria and Flow Monitoring

This project successfully diverted 2.8 million gallons of water to the sanitary sewer for treatment. The geometric seasonal average concentrations of Total Coliform, Fecal Coliform, and Enterococcus in this water were all over the AB 411 single sample limit for contact recreation. These bacteria concentrations in the diverted water also exceeded AB 411 standards for contact recreation.

Water quality in Santa Monica Bay seems to have generally improved during the summer dry periods in the last five years. Water quality at the Manhattan Beach Pump Plant Storm Drain outlet also seems to have improved since the installation of the LFD, although occasionally exceedences of AB 411 limits occur. However, these exceedences can most likely be attributable to a change in the watershed which may be transitory due to construction activities, spills, tide borne fecal indicator bacteria of marine origin, etc.

Although This Low-Flow Diversion Project successfully diverts water that often contains bacteria in excess of public health standards into the sanitary sewer for treatment, it is difficult to determine if this has a significant effect on the water quality in Santa Monica Bay since the shoreline water quality near this project was not consistently poor before the project. Summer dry weather water quality near the Manhattan Beach Pump Plant Storm Drain has been good overall since the completion of this project. However, steps should still be taken to prevent the degradation of current conditions, including conducting source identification studies similar to the North Santa Monica Bay Source Identification Study conducted by the Los Angeles County Department of Public Works and in partnership with the Los Angeles County Department of Public Health, Heal the Bay, and the Southern California Coastal Waters Research Project (SCCWRP). Rapid identification of bacteria sources will allow quick assessment of a threat and proper remedial measures to be taken.

4.2 Siting

Due to the size of the watershed at 1473 acres and the large volume of flow encountered, it was necessary to construct two LFD structures in this watershed. One LFD was constructed upstream at the project site with the Manhattan Beach Pump Plant to capture the upstream flows and the other LFD was constructed at 28th Street and the Strand to capture the remaining downstream flows and divert them from entering the receiving waters.

This project is located in a grassy area adjacent to a parking lot within the Manhattan Beach Pump Plant. It is located within the Polliwog Park Recreation Area and is not within a Flood Control District channel right of way, which greatly facilitated maintenance and sampling. This is especially important since the project site is adjacent to Manhattan Beach Boulevard, a heavily traveled street in Manhattan Beach. Working in traffic poses risks and hardships to maintenance staff and the traveling public. These issues are avoided in this project.

The Manhattan Beach Pump Plant LFD project site is unique in that it is largely recreational in comparison with its immediate area, which is largely suburban. The nature of the watershed creates bacterial and sediment loads that are similar in characteristic to typical urban runoff. These all tie into conclusions about the bacterial monitoring and design and maintenance.

Although the water quality needs for this project are hard to determine, selecting the project site away from traffic and within a park yielded some important benefits.

4.3 Design and Maintenance

Although construction of this low-flow diversion was completed in May 2004, modifications to the sampling locations, diversion pump, and flow meter's electrical system delayed the operation of the LFD. To alleviate a problem with pine cones clogging the diversion pump and causing it to fail, a trash screen was installed around the pump. Due to these problems, the LFD was offline until September 2006. After equipment modifications, installation of a new pump, and electrical repairs were completed, the Low Flow Diversion became fully operational on October 15, 2006. This LFD currently operates year-round during dry weather conditions.

Presently, inspection of this LFD is performed on a weekly basis. Routine cleaning is done on an as needed basis to maintain the LFD. Storm drain and well water sampling is done during the dry season, on a weekly basis. Typical problems encountered by our maintenance staff include failure of telemetry and pumps, malfunction of electric control mechanisms, and broken equipment that must be replaced or repaired. Recalibration of LFD flow meters is also required on a regular basis.

5 Contact Information

For questions regarding the Manhattan Beach Pump Plant Low-Flow Diversion Project and monitoring report, please contact Ms. Angela George, Senior Civil Engineer of Los Angeles County Department of Public Works, at 626 458-4341 or ageorge@dpw.lacounty.gov.

6 References

BeachWatch Beach Mile Days Reports, <http://beachwatch.waterboards.ca.gov>, accessed 10/14/07

Heal the Bay Summer Report Cards, <http://healthebay.org/brc/summer/default.asp>, accessed 10/12/07

Appendix A
Bacterial Monitoring Data

Appendix B
Chains of Custody and Field Data Sheets

Appendix C
Beach Report Cards

Appendix D
Grant Documents and Project Photos

Appendix E

Shoreline Monitoring Results