Final Report

Clean Beaches Initiative – Proposition 13
City of Santa Monica's
Design & Implementation of BMPs for Santa Monica Pier

August, 2005

Prepared for the

State Water Resources Control Board
Agreement #01-075-550-0

Prepared by

The City of Santa Monica
Environmental Programs Division

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INTRODUCTION

Purpose

The Santa Monica Pier is one of the most popular attractions in Santa Monica Bay, and certainly in the City of Santa Monica. It receives about 3 million visitors a year, and the adjacent beaches attract some 10 million annually. Annual revenues generated by Pier businesses and visitors are over $15 million. A storm drain also runs under the Pier and empties into the Bay during the winter months, draining urban runoff from the downtown Promenade section, which is also a popular attraction for residents, businesses and visitors. The Promenade section is pedestrian friendly, attracting people to its shops, theaters, restaurants and mall. The weekly Farmers Market is also in this area.

The beach adjacent to the Pier also gets posted due to urban runoff pollution, whether from the storm drain or from activities on the Pier. Because of the popularity of the Pier and its beaches, the City is committed to reducing and preventing runoff pollution and to keeping the beaches clean and open. To date, the City has built the Santa Monica Urban Runoff Facility (SMURRF) to divert, treat and reuse urban runoff from the City's large Pico-Kenter storm drain and the smaller Pier storm drain. However, even with this facility, postings still occur. Generally, during the dry season, June-October, the Pier storm drain is sealed (around Memorial Day Weekend) and no runoff flows to the Bay. During the wet season after the first major storm "blows out" the sealed storm drain, wet weather only flows to the Bay. Dry periods during the wet season do not produce enough runoff to bypass the secondary diversion and reach the Bay.

Urban runoff pollution can result in elevated levels of bacteria, indictors of water quality problems and potential health impacts on people and marine life. When concentrations of these indictors exceed state standards, beaches have to be posted to alert visitors of potential health problems; in some cases when levels get too high, beaches must be closed, such as after a storm event. (State exceedances levels: Enterococcus over 104 organisms per 100 mL; Fecal Coliform over 400 organisms per 100 mL; and Total Coliform over 10,000 organisms per 100 mL.)

Non-point source water pollution, commonly know as urban runoff, is the single largest source of water pollution in the Bay. Whereas great strides have taken place to reduce point sources of water pollution, urban runoff has been largely ignored until recently. Urban runoff carries a variety of potential pollutants, including metals, organics, solids, nutrients and pathogens, to the receiving waters. For this project, pathogens are the pollutant of concern, which can cause direct health impacts to visitors of our beaches.

In an effort to reduce postings and infrequent closures, through the implementation of Best Management Practices (BMPs) at the Pier, the City applied for and received a Clean Beaches Initiative (CBI) grant to implement four additional BMP strategies on the Pier to decrease bacterial exceedances: new (offsite) solid waste management system, including new trash receptacles, inspection and repair of sanitary sewer line, installation of new fish cleaning sinks, and bird deterrence.

The waters of the Bay support many beneficial uses; however, due to excessive levels of 14 pollutants, this water body is classified as impaired for beneficial uses, such as swimming, fishing, and wildlife, and listed on the 303(d) list for TMDLs. A schedule

is in place to reduce these pollutants over the next 12 years. The Santa Monica Bay Restoration Project was implemented to deal, in part, with pollution from urban runoff, citing the need for Best Management Practices, BMPs, to reduce pollutants of concern found in urban runoff. The California Nonpoint Source Pollution Control Program also cites the major problem of urban runoff pollution and recommends a series of BMPs to curb this pollution source. The quality of urban runoff from urbanized areas, such as Santa Monica, has been found through numerous private, state and federal studies to contain these pollutants of concern at levels that negatively impact water quality and the beneficial uses dependent upon high water quality. These studies include those from the EPA's Office of Water and Oceans, the Santa Monica Bay Restoration Project, the State NPS program, and the Southern California Coastal Water Research Project. For this reason, this water body is listed on the 303(d) list of impairment. To better protect our marine resources and beach-goers, this project aimed to install BMPs to remove a specific pollutant of concern, that is, pathogens, to the maximum extent practicable.

The City of Santa Monica has an extensive urban runoff management program to curb and prevent urban runoff pollution. Numerous structural devices throughout the City have been installed in the City's storm drain system to remove gross solids and chemicals attached to the former. The City has been diverting its dry weather urban runoff flows from its Pier Storm Drain, which drains under the Pier and carries runoff from the Promenade or the City's downtown section, since the latter 1990s.

However, problems of water quality at the Pier remain due to urban runoff from the structure itself. The proposed project has four phases of BMPs to reduce the pathogen pollutants discharging from the Pier into the Bay.

A number of indicator bacteria are used by the State to gauge what pathogens might be in the water, putting humans at risk of health problems. Those indicator bacteria typically found in urban runoff are: Enterococci, E. coli or Fecal coliforms, and Total coliforms. These indicators are used to judge the likelihood of viral pathogens, over 100 are found in sewage and urban runoff, which cause a variety of symptoms and illnesses. The presence of these indicators, and thus pathogens, at certain levels triggers postings or closures. During the 2000 calendar year, the City had 64 beach postings due to higher levels of pathogens. No closures occurred.

Main sources of pathogens that appear to exist on and around the Pier:

- Sea gulls and pigeons attracted in large numbers to the Pier for nesting and feeding;
- Rodents attracted by food wastes found in the solid waste receptacles;
- Sewer pipe leaks, breaks and backups; and
- Food wastes in trash receptacles, which serve as a breeding substrate for pathogens

Project Scope & Description: BMP Systems

The project will be implemented on the Santa Monica Pier, located at the end of Colorado Boulevard in the City of Santa Monica. The project had four original components to be installed: under the Pier, for the bird-exclusion system and sewer upgrades; on the Pier, modified fish cleaning stations; and off the Pier, the solid waste compactor management system.

- Place exclusion nets or comparable bird exclusion system under the Pier to eliminate the roosting of birds, eliminating a major source of contamination from bird droppings.
- Plumb the fish cleaning sinks into the sanitary sewer instead of draining directly into the Bay, eliminating a food source for birds attracted to the Pier by fish wastes from fishers.
- Flush, inspect and upgrade the sewer lines under the Pier to eliminate any leaks of raw sewage.
- Replace the existing leaking trash bins and storage system serving Pier businesses with a sealed trash compactor and new plastic trash bins, eliminating a source of debris that attracts rodents and birds, and serves as a medium for pathogens.

These project goals were expected to eliminate most sources of pathogens that have been leading to the posting and closure of the beaches around the Pier.

Current-Existing City Efforts and Programs

The storm drains in the vicinity of the Pier have already been fitted with BMPs, that is, Continuous Deflective Separation units (CDSs) at both Pier and Pico-Kenter Storm Drains, removing trash and debris. In addition, dry weather runoff from these two drains is diverted (2001) to the Santa Monica Urban Runoff Recycling Facility (SMURRF) for treatment and reuse. Before 2001, the Pier storm drain was diverted since the late 1990s to the sanitary sewer via a small dry weather diversion structure under the beach walkway at the western end of the Pier.

To date, the City has implemented a bird-trapping program to trap birds on the Pier's superstructure for release at a distance offsite location. This strategy has been somewhat successful in reducing the Pier bird population somewhat. However, extraordinarily high concentrations of birds continue to plague the area, especially those able to rooster under the Pier. No alternative methods to date have been tried other than bird trapping.

The City installed educational signs, fish-cleaning sink stations and trashcans to encourage fishers to keep fish wastes out of the Bay. This program has not been as effective as anticipated.

City Pier staff inspect the Pier's sanitary sewer lines each week; however, this staff does not have the resources to give the sanitary system a thorough inspection and retrofit. Problems of leaks and breaks continue.

The four methods of the project goals listed above are the methods suggested some years ago to help reduce beach postings and closures, but funding has not been available to implement them until the CBI grant became available.

Project Timetable

The table below identifies the schedule of major activities associated with this project.

Project Schedule

Activity	Date
Install BMPs	Beginning summer, 2003; End date projection December 15, 2003
Gather Beach Water Quality Data	Beginning summer, 2003 through April 2005
Prepare draft/final report	February, 2004
Review data with technical advisors	Ongoing after final report submitted, 2004

ORIGINAL SCHEDULE OF COMPLETION DATES

Task		Product	Completion Date
1.0		***Project Management and Administration***	
	1.2	Quarterly Progress Reports	June 02, and quarterly until done
	1.5	Contract Summary Form	May 02
2.0		***State, and Local Permitting***	
	2.1	CEQA documentation	December 20, 2001
3.0		***Quality Assurance Project Plan***	
	3.1	*QAPP*	November 19, 2003
4.0		***Project Engineering***	
	4.1	Project Review	April 30, 2002
	4.2	Field Survey	April, 2002
	4.3	Preparation of Contract Documents	June 15, 2002
5.0		***Project Implementation***	
	5.1	Select Subcontractor	If necessary, will update the Project Manager
	5.2	Construction Methods & Construction	June 30, 2002
6.0		***Monitoring/Reporting***	
	6.1	Monitoring and Reporting Plan	July 15, 2002
	6.2	Draft Final Report	November 30, 2002 (assuming all four components are completed before the rainy season)
	6.3	Final Report	February 15, 2003

Task 1: Project Management & Administration

The project's engineering and design work were completed by City engineers and project manager. Reporting activities focused on construction activities, or the installation of the BMPs. The project manager and project administrator met and spoke weekly to go over the project schedule, delays and completions. Delays were experienced in the evaluation of the bird deterrence system, the fish sink selection and locations and the sewer line inspection.

Task 2: State & Local Permitting

The project received CEQA categorical exemption. No other permits were required.

Task 3: Quality Assurance Project Plan

The QAPP was approved by the State the end of 2003. The QAPP discussed the use of beach water quality data and beach exceedances days (i.e. postings) as a way to

monitor the effectiveness of the project, comparing beach postings (or exceedances of the three indicators) before the project to beach postings after the project. Results are discussed below in the Results section and shown in Appendices A & B.

Task 4. Project Engineering

The City's project manager oversaw the hiring of sub-contractors to install the new solid waste management component, check and update the sanitary sewer line and install the fish sinks. The project administrator oversaw the bird deterrence effort. No significant engineering designs were required other than for the fish sinks locations and the trash compactor, which required the approval of the Pier Restoration Group and Resources Management. Copies of the available engineering plans or "as-builts" are included in Appendix F.

Task 5 – Project Implementation

Project construction was completed in the fall 2003. Additional work for educational signage, some regular bird deterrence efforts and monitoring will continue into 2006, at the City's expense.

Task 6 – Monitoring, and Draft and Final Report

The Project's data will include the number of days of beach postings and levels of exceedances after the Project's completion and to compare this data with past similar data to observe any noticeable decreases in beach postings. This data assessment will be useful in providing information about BMP effectiveness of the pollution prevention measures for bacterial pollution sources. The data will be made available to the public for purposes of watershed education and to the regulatory and resource management agencies to supplement their existing data collection efforts.

Data will be compiled and maintained at the City of Santa Monica Environmental Programs Division, 200 Santa Monica Pier, Suite K, Santa Monica 90401. The information will be shared with the State Water Resources Control Board, the Los Angeles Regional Water Quality Control Board, and upon request to other state, federal, and local agencies and organizations.

6.1. General Overview of Monitoring

The City of Los Angeles' Bureau of Sanitation Environmental Monitoring Division (LA BSEMD) at Hyperion monitors water quality of water samples taken from the Santa Monica Pier, Station 5, part of its regular daily activities and in compliance with the Bacterial TMDL for the Bay. Table 6.1 summarizes the monitoring design, including the physical, chemical and biological parameters to be measured, whether the samples will be analyzed by the monitoring group or sampled for later analysis by a professional lab, and the frequency of measurement.

Table 6.1 Summary of Monitoring Design

Parameter	Type of monitoring	Frequency of monitoring
Indicator Bacteria	L	D (W)

Codes for Table 6.1: Type: F: field analysis, L: in-house lab analysis, P: sample only, send to outside professional lab; **Frequency**: M: monthly, S: seasonal, D: daily (twice), W: weekly, will switch to this frequency to comply with new Bacterial TMDL Monitoring Plan for Santa Monica Bay

This QA plan only addresses data quality objectives for the following parameters:

Total Coliform Bacteria
E. coli (Fecal Coliform) Bacteria
Enterococci Bacteria

Bacterial parameters will be monitored using protocols of the LA BSEMD at Hyperion; a copy of the sampling program was included in the Project's QAPP.

6.2. Data Collected

Data was obtained from the City of Los Angeles Bureau of Sanitation for years 1994-2005 (April) on water quality sampling for the Pier station, including data for the three indicators mentioned above. The data was analyzed for a number of criteria, including days of exceedances (beach postings) and various concentrations during the year, including dry and wet seasons. Tables 1 A, B and C summarize the data from years 1994-05 for each indicator; see Appendix B. Charts 1-6 highlight the data from the tables in a more visual manner; each indicator has a chart for changes in days and changes in concentration. The data is recorded in an Excel spreadsheet at the City of Santa Monica, Environmental Programs Division.

The data includes data before the project and after the project, in order to compare pre and post data, as a strategy to measure effectiveness in reducing bacterial loading from the Pier superstructure.

RESULTS

Water Quality Results

Before describing the results, this report notes that the City installed a diversion to the sanitary sewer in the mid-1990s, allowing low flows, i.e. during non-storm periods, to pass into the sanitary sewer instead of flowing in the Pier storm drain pipe under the Pier. In additional, the Santa Monica Urban Runoff Recycling Facility (SMURRF) was construction in 1999-2000 and came online February 2001. The SMURRF diverts from the Pier storm drain line dry weather runoff to the facility, preventing it from flowing to the beach under the Pier. During storm events, the facility shuts down.

Data for the Pier monitoring station, S5, was obtained from the City of Los Angeles for years 1994 (July) through 2005 (April). The data was analyzed, separating dry weather

months from wet weather months, and averaging concentrations of each of the three indicators. Total days of exceedances, which triggers posting, were also compiled for dry and wet months. For both concentrations and days of exceedances, annual totals were compiled. Appendices A and B contain the Excel spreadsheet summary of data for each indicator over time and graphs showing (visually) the data for concentrations and exceedances by year.

Enterococcus

Graphs 1 and 2 show variations in concentrations and days of exceedances over time. A noticeable decline in concentration occurs in the late 1990s perhaps due to the new diversion of runoff to the sanitary sewer. However, spikes and increases occur after 1999. The SMURRF may have had a positive impact in days only, not concentration. The dramatic increase in 2004 and 2005 may be due to the heavy rains of 2004-05 as well as the new sampling procedures, going to daily samples instead of weekly.

Fecal Coliform-E. Coli

Graphs 3 and 4 show some variation, though less dramatic than for Enterococcus. For concentration, exceedances levels went down in 2002 but jumped up the since than, during the Project period. The last two years could be due to rainfall. For non-exceedances levels, the same reduction to 2002 occurred and then rose to the present. Graph 4 shows a downward trend in days of exceedances, despite the high rain amounts the last year. There was a significant decline in 2003, the year of this Project. Concentration declined dramatically in 2002, perhaps due to a dry winter season.

Total Coliform

Graphs 5 and 6 show results for this indicator. For concentration criteria, exceedances levels seem to be trend downward, though for dry season in 2003 it went up while wet season and annual daily average for exceedances went down. And it appears the high rainfall did not impact this trend. For days of exceedances, wide fluctuations occurred. The number of days increased in 2003 and especially in 2004 and 2005, perhaps due to the high rainfall. Dry season exceedances went down in 2005 due probably to limited data, the month of April only; six months of samples are still to come.

Total Coliform, concentrations only, seems to show a parallel to the Project and overall urban runoff improvements to the Pier since the mid-1990s, sanitary diversion, SMURRF and Pier BMP Project.

Rainfall Results

Appendices C and D show annual calendar year rainfall for 1994-2005 (April). Appendix D shows rainfall versus annual days of exceedances for the same time periods. Note that exceedances follow close rainfall, indicating that exceedances increase when rainfall increases and visa versa. One might draw a conclusion that the best way to reduce exceedances is to reduce the quantity of runoff to the Bay through various Best Management Practices, such as infiltration pits or cisterns, instead of trying to treat and release it.

BMP Components Installation Results

Solid Waste Management Component

The original trash management program was a trash enclosure (no photos available) at the mid-section of the Pier over the water, with metal dumpsters that leaked and attracted rodents and birds. This old system has been completely removed. Now, new green plastic seamless trash receptacles (see Appendix E photo) for Pier businesses are wheeled to the new trash compactor. A City trash vehicle replaces the compactor dumpster on a regular basis, over land; previously, a City trash vehicle had to drive onto the Pier to retrieve trash, in which trash could escape from the containers during the transfer process. The new system has eliminated this problem.

The City has also replaced most of the old trash receptacles used by visitors. The old ones dumped their contents frequently on windy days as they did not have tops; the change in air pressure due to high wind speeds caused the plastic trash bags to blow out, throwing trash onto the Pier. The wide openings also attracted birds to scavenge. The new ones have tops with narrow openings and eliminate wind-blown trash from these receptacles. The City also installed cigarette receptacles for smokers to dispose safely of butts. Not all new visitor receptacles have been installed as the City must replace many pylons to strengthen the western Pier structure. This problem has prevented a truck to drive onto the western end of the Pier to replace receptacles. See photos in Appendix E.

Sanitary Sewer Component

Through a RFP process, the City had a contractor check all sanitary sewer lines for leaks and corrosion. The pipes were found to be in good order, though many pipe hangers that support the pipes to give them the proper grade (preventing sagging and breaks) were found to be missing or broken. These hangers were repaired, replaced or added where missing.

Fish Cleaning Sinks Component

The City had existing fish cleaning stations (photos of Appendix E), which allowed fishers to clean their catch. However, the sinks emptied directly into the Bay, attracting birds, which would then take up living under the Pier and contributing to higher bacterial counts. New fish sinks have garbage disposals to grind fish materials and send this material directly into the sanitary sewer, preventing debris from entering the Bay and preventing bird attraction. Three sinks were installed at strategic fishing locations: north, south and west locations. The City has encounter problems with fishers accidentally or intentionally loosing knives and metal fishing gear in the disposals, causing damage. This problem has been an ongoing issue. The City intends to add signage to promote proper use of the sinks.

Bird Deterrence Component

The final strategy was bird deterrence. Initially, the City was going to use netting on the sides of the Pier understructure to keep birds from inhabiting under the Pier. But the initial cost, long-term maintenance costs and aesthetic (seeing a net around the Pier) issues persuaded the City to seek an integrated pest management strategy. Also,

obtaining a permit from the State was felt to be a significant and drawn out process, and one which was not guaranteed. Moreover, the net would have been a major change in appearance, which would require various approvals. The City felt that removing nests and breeding opportunities was a more effective strategy given the limited funds and time.

The City hired a falconer, with expertise in bird deterrence, to work under the Pier to remove birds' nests and birds. The City had intended to fly a falcon above the Pier to deter birds, but this strategy would be a short-term solution. Instead, the City chose to remove nests under the Pier, which attract birds to inhabit the Pier area, resting at night under the Pier and foraging on the Pier during the day. The falconer came twice and removed almost 200 birds and nests from under the Pier, both over water and over land. City staff has also sealed gaps in fencing around the Pier to prevent birds from entering and establishing nests.

PROBLEMS & RECOMMENDATIONS

This Project has proven successful in three of the four components in preventing releases and discharges of urban-generated pollutants from individual trash receptacles and business trash containers, and from sanitary sewer lines into the Bay, thereby improving water quality and reducing some health risk to swimmers.

Bird deterrence efforts were not fully realized due to the complex nature of human-bird relationships. People like to feed birds; there are many food businesses on the Pier; fishing activities attract birds; the Pier structure attracts birds; more aggressive bird deterrence efforts, i.e. poisoning and harvesting them, are unacceptable in this political climate though the best options. Enforcing existing laws prohibiting bird feeding is another option. Water quality analyses are suggested to determine whether bacteria are from humans or animals, i.e. birds, dogs and cats. There is a strong belief that the high bacterial counts are due to birds. But until the proper tests are run to examine the genetic composition, one cannot say with certainty.

The fish sinks are somewhat effective but the selected products are not holding up well to the elements and abuse inflicted upon the sinks by people. People lose or intentionally put into the sinks and grinder objects that destroy the grinders. A better product would have been a sink with a drain cover that only allows "appropriate" objects to go into the grinder and prevents knives and other metal objects from entering the grinder (Redondo Pier example, though each sink costs significantly more than this grant had). The start buttons on the sinks also do not hold up well to continual use.

The solid waste management component is working very well, with business trash being kept in more leak-proof containers, and the centralized location for all trash off the Pier. The new trash receptacles keep trash in the containers and do not allow the loss of trash during windy days.

An unknown factor is the Pier storm drain under the Pier, which empties onto the sand and into the Bay. The storm drain pipe is in poor condition and has a reverse grade,

meaning that for low flows that bypass the SMURRF and the existing sanitary diversion runoff flow back toward land, and settle and sit in the pipe under the Pier. Often there is a small lake of water under the Pier. Each year, this pipe is closed off with sand and plywood and does not flow during the summer months; the ponded water is pumped from under the Pier and into the sanitary sewer in the late spring before closing the storm drain. The storm drain is open during the winter months after the first big storm opens the pipe. One does not expect water quality issues during the summer for this reason. One costly suggestion is to replace the pipe and move it from under the Pier so that repairs and maintenance are easier.

CONCLUSIONS

Most of the components of the Project are working well, trash management, fish sinks, and sanitary sewer lines. The bird deterrence component cannot be judged a total success, though the City continues to enlist the services of a bird consultant to periodically remove bird nests from the Pier understructure as a way to deter birds. However, the continued presence of tourists, fishers and food will continue to attract birds. Determining the type of bacteria, that is, performing genetic analyses to determine if human or non-human bacteria, found in the water, and thus, potential sources of such bacteria, would help guide future endeavors of urban runoff pollution mitigation.

The data results, tables and graphics also indicate that there are most likely other factors that have not been examined that are influencing exceedances. Fluctuations in rainfall over time, upstream (of the Pier) bacterial inputs that pass by the sampling station at the time of sampling, and homeless encampments in the area especially under the Pier near the surf zone are some other considerations for future work. Pier maintenance staff frequently find signs of homeless in the area of the sampling station.

Future work for the Project includes completion of signage at the Pier to point out new urban runoff prevention strategies due to this grant and to encourage visitors to not feed birds nor throw trash into the Bay.

APPENDIX A
Table 1 A, B, and C. Summary Water Quality Data for Station S5 – Santa Monica Pier

Criteria | **Pathogen Type**

Table 1A. Enterococcus

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Exceedence Days	3	11	9	4	6	0	3	6	5	4	23	23
Exceedence Days - Dry Season	0	3	3	1	1	0	1	2	2	1	3	4
Exceedence Days - Wet Season	3	8	6	3	5	0	2	4	3	3	20	19
Ave. Annual Concentration Non-Exceedences	26	24	30	28	23	24	25	20	20	20	23	31
Ave. Annual Concentration Exceedences	1300	1085	794	273	435	0	947	307	1090	210	846	1144
Total Ann Ave Conc	142	209	143	44	64	24	72	49	111	33	207	289

Table 1B. Fecal Coliform/E. Coli

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Annual Exceedence Days	45	122	107	107	125	97	52	60	83	42	50	44
Exceedence Days - Dry Season	35	76	62	65	65	56	20	31	30	20	28	7
Exceedence Days - Wet Season	10	46	45	42	60	41	32	29	53	22	22	37
Ave. Concentration Non-Exc. Days - Dry Season	355	396	414	366	351	282	157	173	154	164	231	408
Ave. Concentration Exc Days - Dry Season	890	852	1104	867	861	776	837	732	569	749	1113	1140
Ave. Concentration Non-Exc. Days - Wet Season	252	465	426	346	507	352	339	290	219	278	307	612
Ave. Concentration Exc Days - Wet Season	894	1150	1026	778	962	869	1072	1015	683	1025	1208	1038
Ave. Daily Concentration - Non-Exceedence Days	133	153	149	160	155	124	158	94	107	122	115	144
Ave. Daily Concentration - Exceedence Days	891	964	1071	832	909	815	982	854	619	893	1155	1054
Ave. Daily Total Concentration - Annual	320	425	419	493	417	430	232	221	181	212	262	561

Table 1C. Total Coliform

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Annual Exceedence Days	3	15	12	8	10	2	6	13	2	7	17	19
Exceedence Days - Dry Season	1	4	2	3	5	2	1	4	0	2	11	3
Exceedence Days - Wet Season	2	11	10	5	5	0	5	9	2	5	6	16
Ave. Concentration Non-Exc. Days - Dry Season	637	659	726	731	534	536	246	354	326	311	310	641
Ave. Concentration Exc Days - Dry Season	130000	20500	13000	33000	30000	45500	3700	12500	0	20500	12818	13000
Ave. Concentration Non-Exc. Days - Wet Season	889	1053	681	890	1004	548	558	644	451	791	773	1235
Ave. Concentration Exc Days - Wet Season	23000	24273	27300	37200	51200	0	33000	28889	30500	23200	12833	12875
Ave. Daily Concentration - Non-Exceedence Days	721	817	708	1107	730	541	517	471	377	509	495	2785
Ave. Daily Concentration - Exceedence Days	58667	23267	24917	35625	40600	45500	33667	23846	30500	22429	12824	12895
Ave. Daily Total Concentration - Annual	1692	1742	1501	1561	1837	791	920	1304	543	934	1086	3313

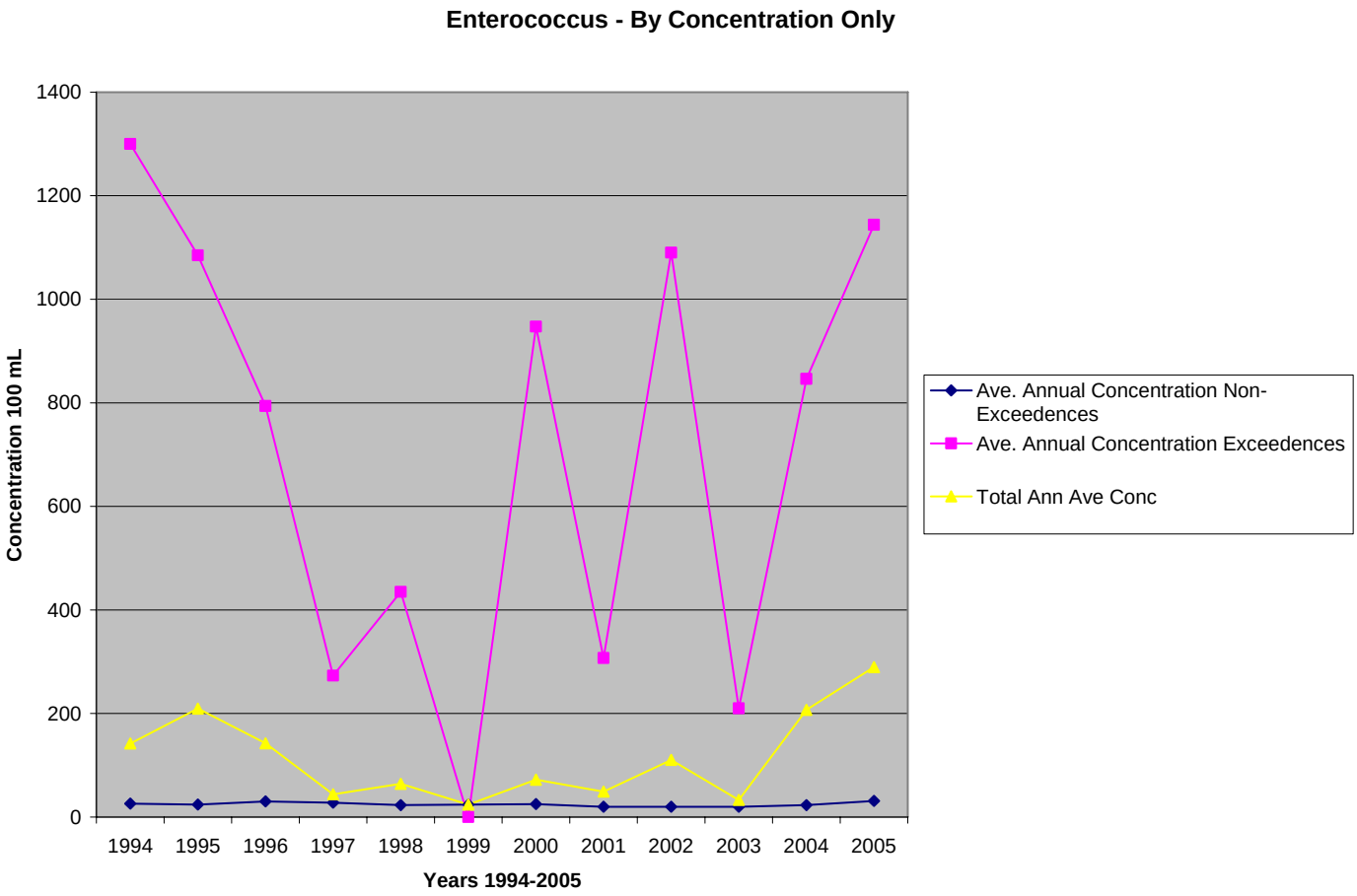
Change in sampling November 2004 to daily from weekly
Above normal wet season 2004-05, late storms in April, May
2005 January-April data; 1994 July-Decmber data
Pier BMP Project completed mid-2003
2001 February SMURRF online
1996 diversions at Pier working

Exceedence Levels (exceedence equals beach posting)
Total coliform leel exceeds 10,000 organisms per 100 mL
Fecal coliform (E. Coli) level exceeds 400 organisms per 100 mL
Enterococcus level exceeds 104 organisms per 100 mL

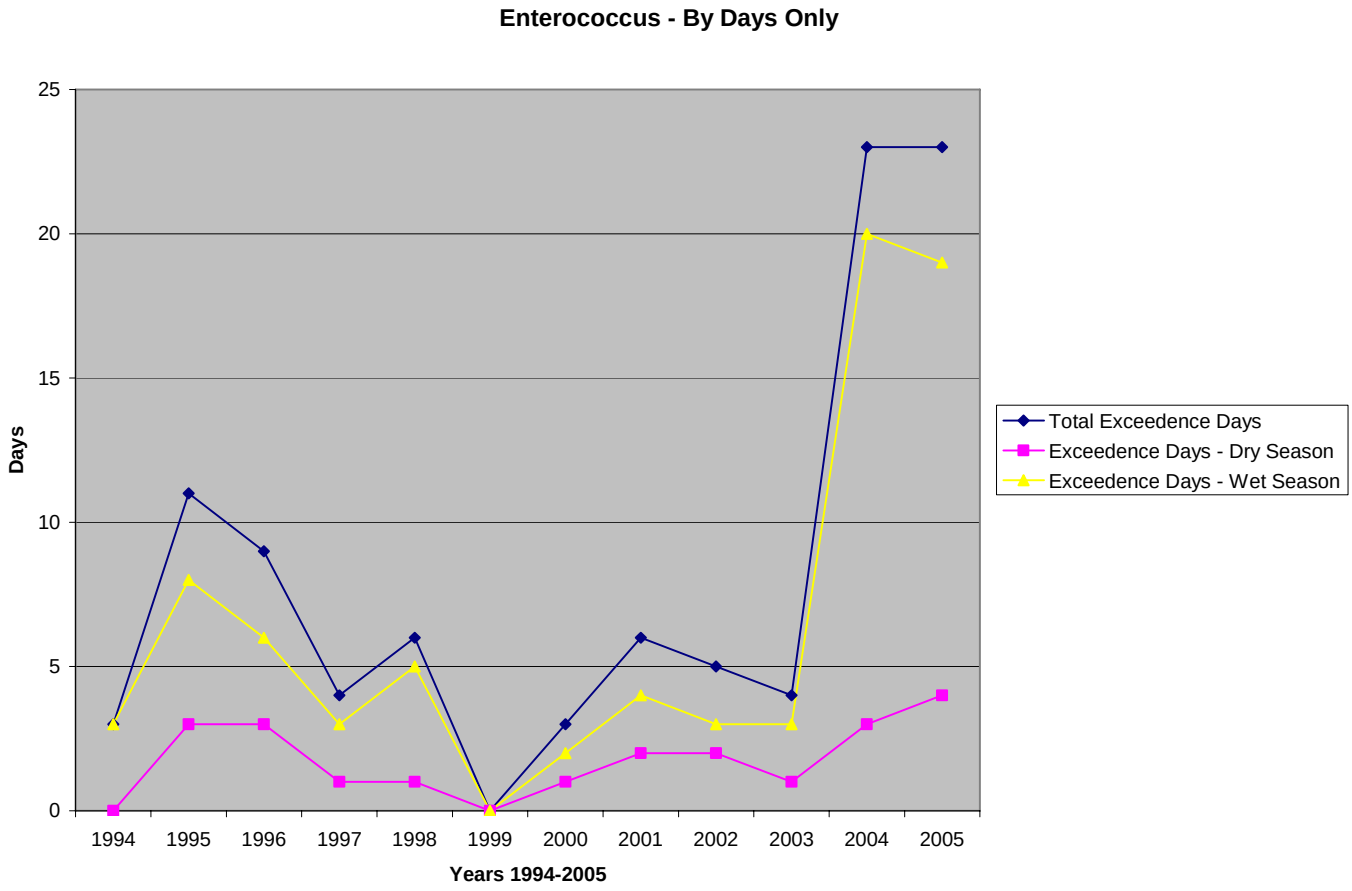
Dry season April 1-Oct 31

Table 1 A, B, C. Summary of Exceedence Days & Indicator Conc.

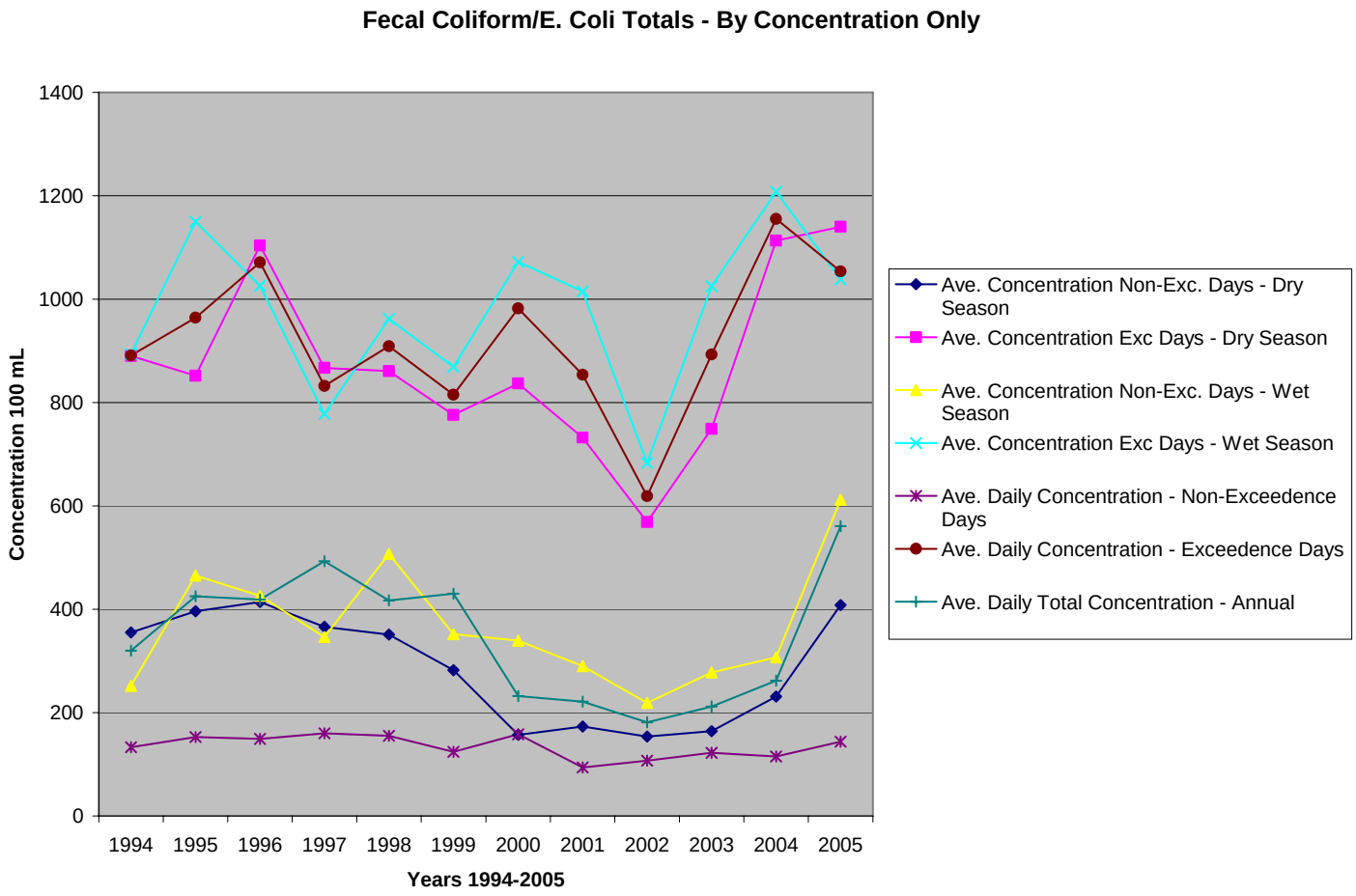
APPENDIX B
Graphs 1-6. Water Quality Data, by Concentration and Days of Exceedences (Postings)
Enterococcus, Fecal Coliform and Total Coliform



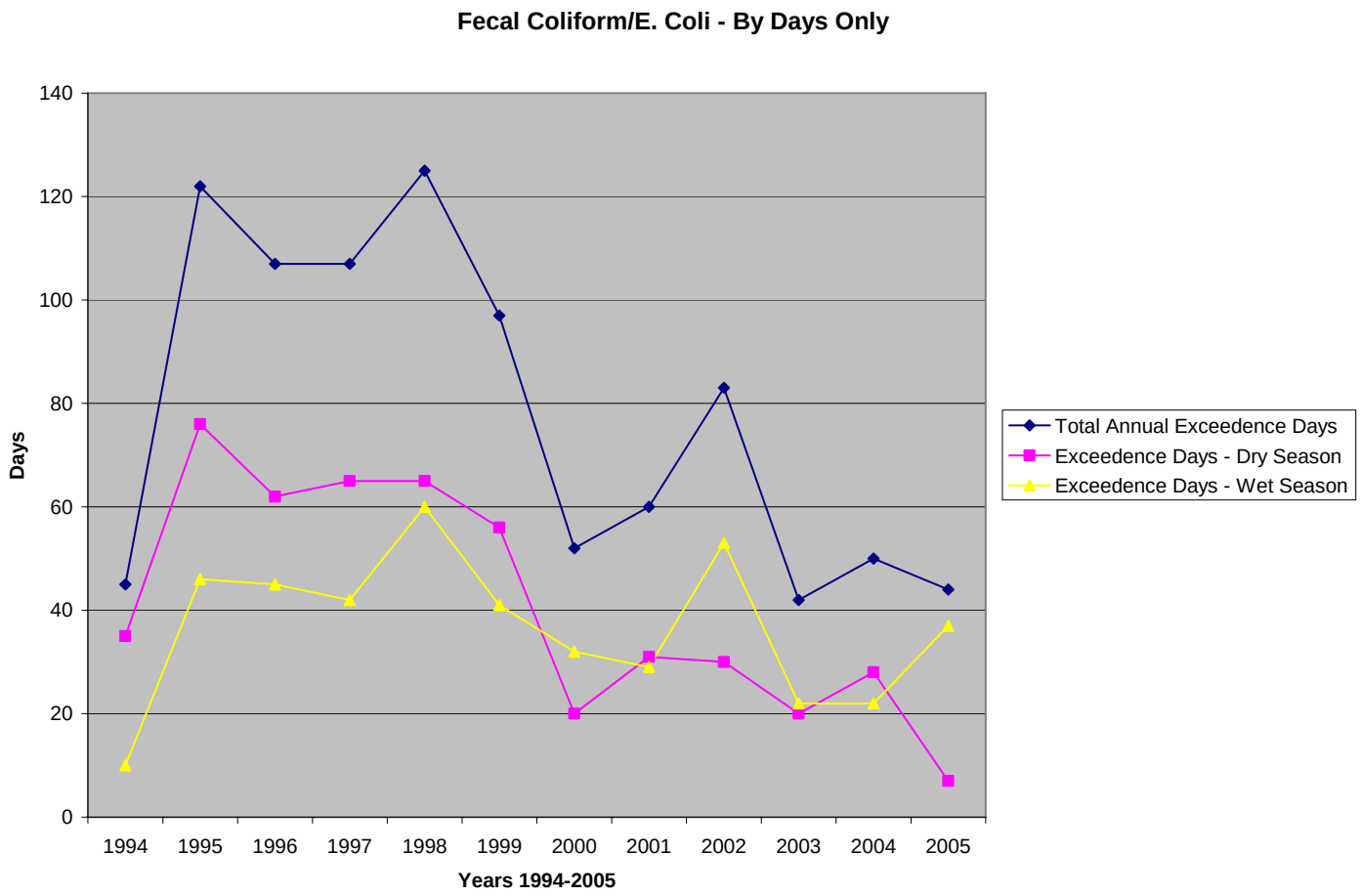
Graph 1. Enterococcus Concentrations.



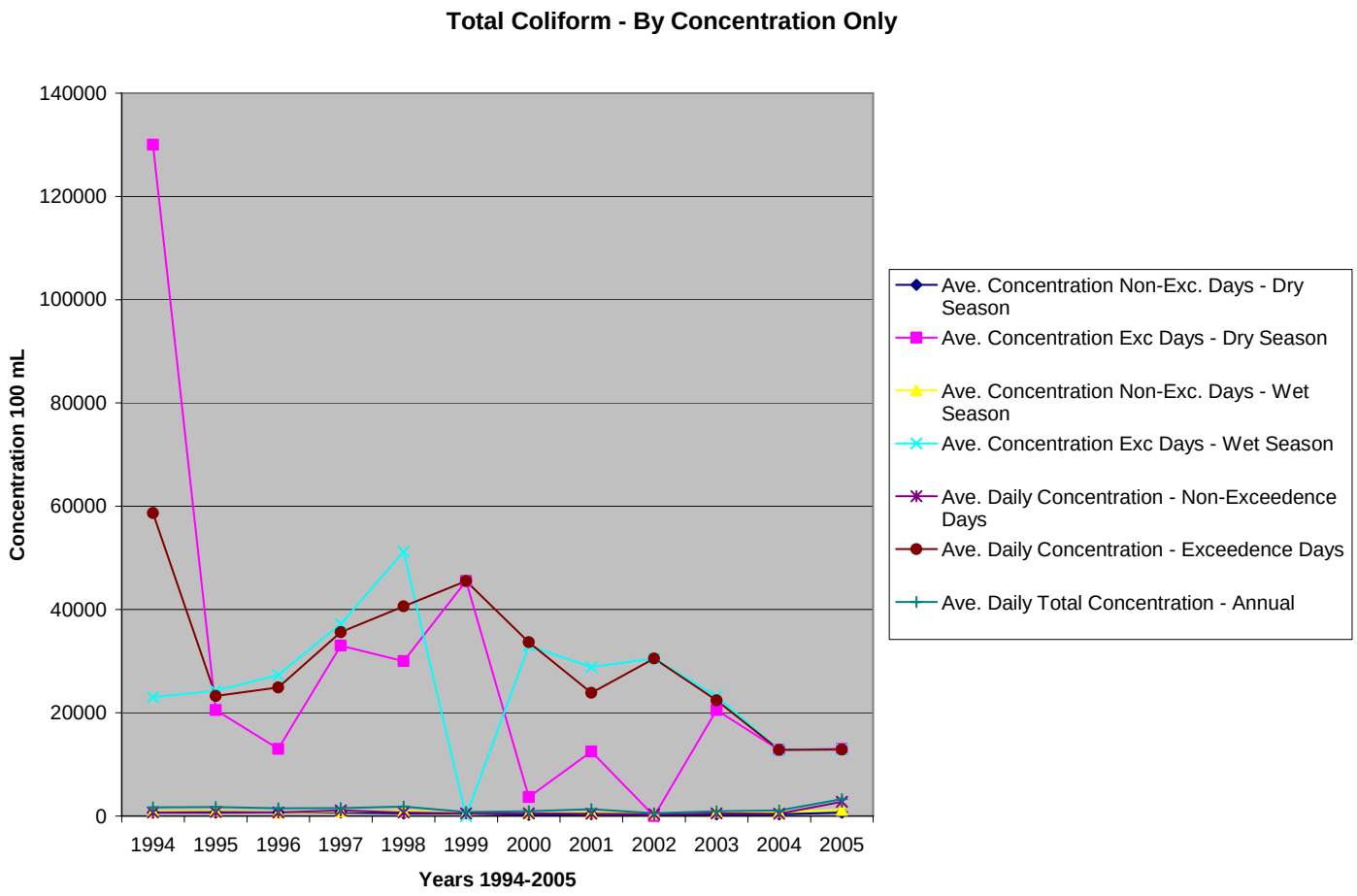
Graph 2. Enterococcus Exceedance Days.



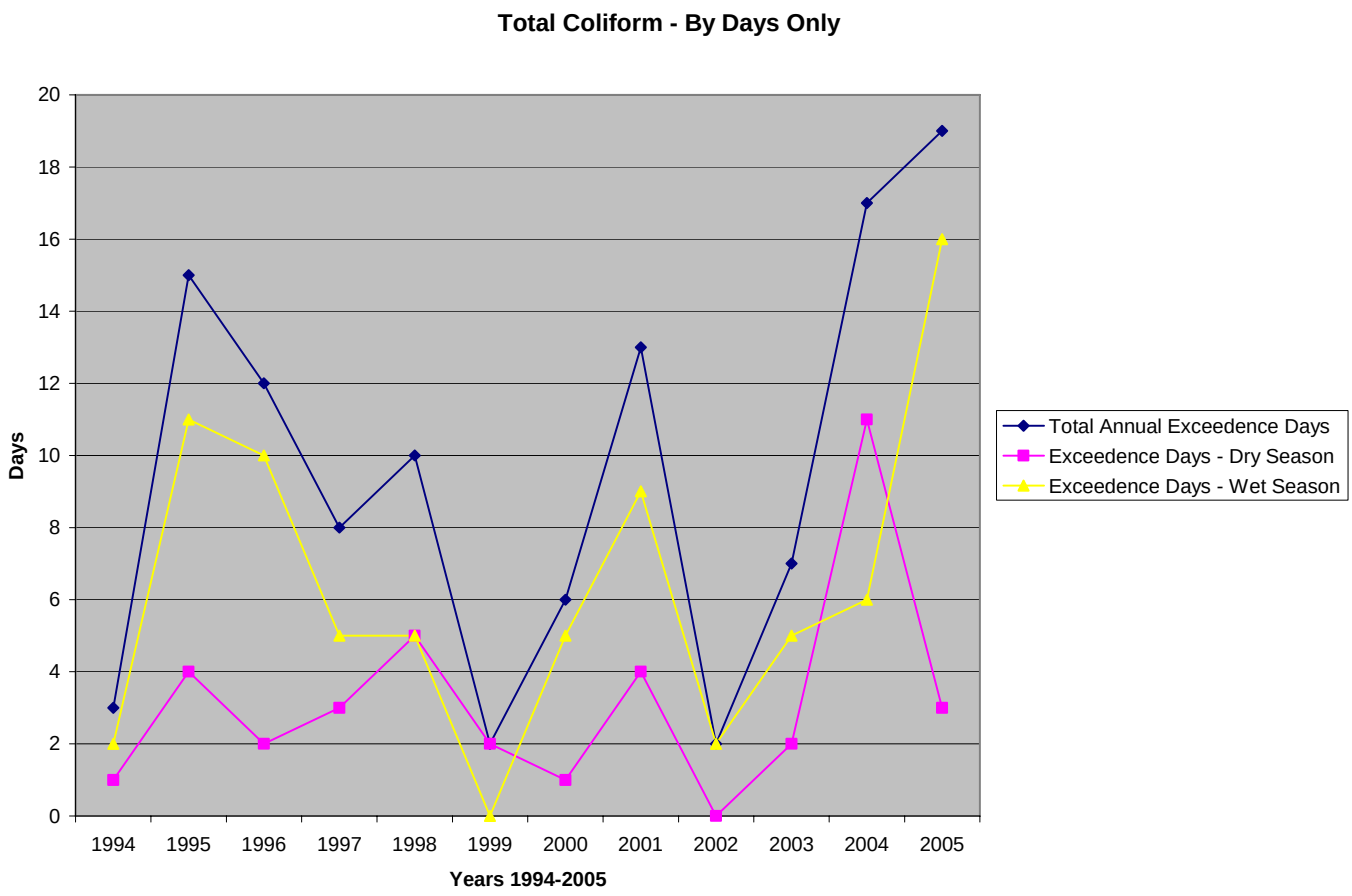
Graph 3. Fecal Coliform (E. Coli) Concentrations.



Graph 4. Fecal Coliform (E. Coli) Exceedance Days.

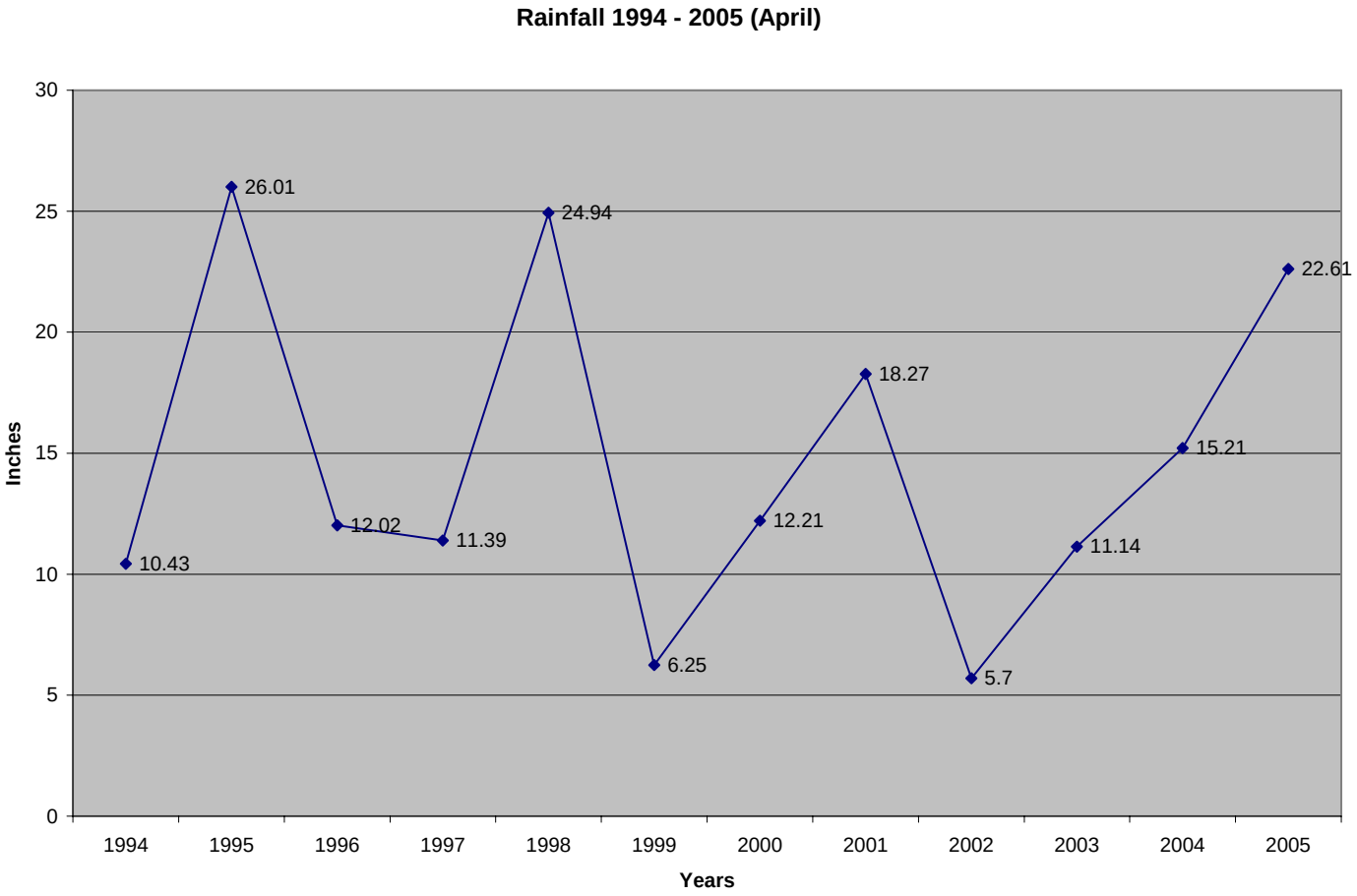


Graph 5. Total Coliform Concentration.

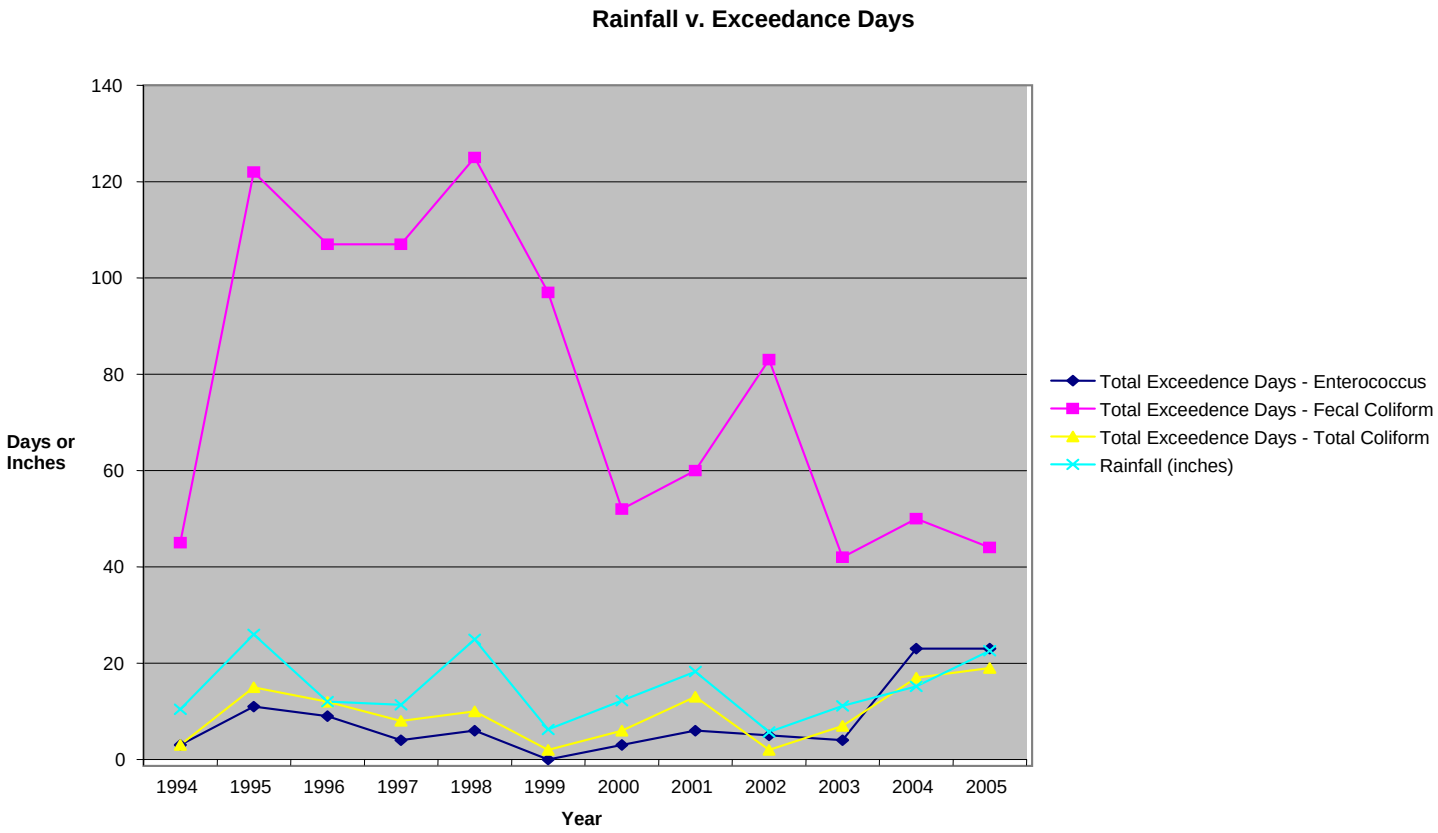


Graph 6. Total Coliform Exceedance Days.

APPENDIX C
RAINFALL YEARS 1994-2005, Pier Station



APPENDIX D
RAINFALL v. EXCEEDANCES



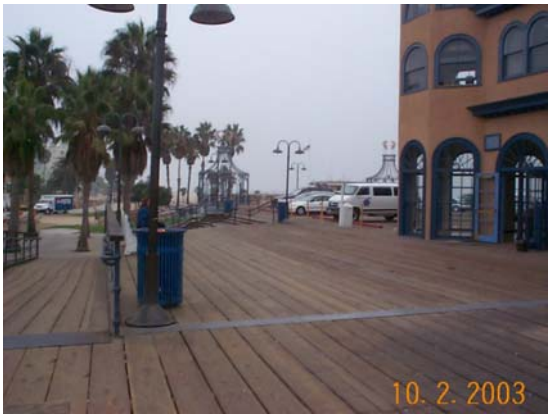
APPENDIX E
PHOTOS OF PROJECT IMPROVEMENTS

Old Fish Sink

New Fish Sink (3 total) – North Side

New Fish Sink – West End of Pier

New Cigarette Trash Receptacle



Old Trash Receptacle next to light pole.

New Trash Receptacle

New Trash Compactor under the Pier Ramp, east end of Pier

New compactor under Pier with new business trash containers and vehicle that tows them off the Pier to the compactor and back onto the Pier.

APPENDIX F
ENGINEERING DESIGN PLANS
(see attached hard copies)