FINAL REPORT

BIOREMEDIATION AND INFILTRATION OF URBAN RUNOFF TO LAS VIRGENES CREEK

SWRCB CONTRACT NO. 01-231-550-3

CBI #3_306

CITY OF CALABASAS

March 27, 2008

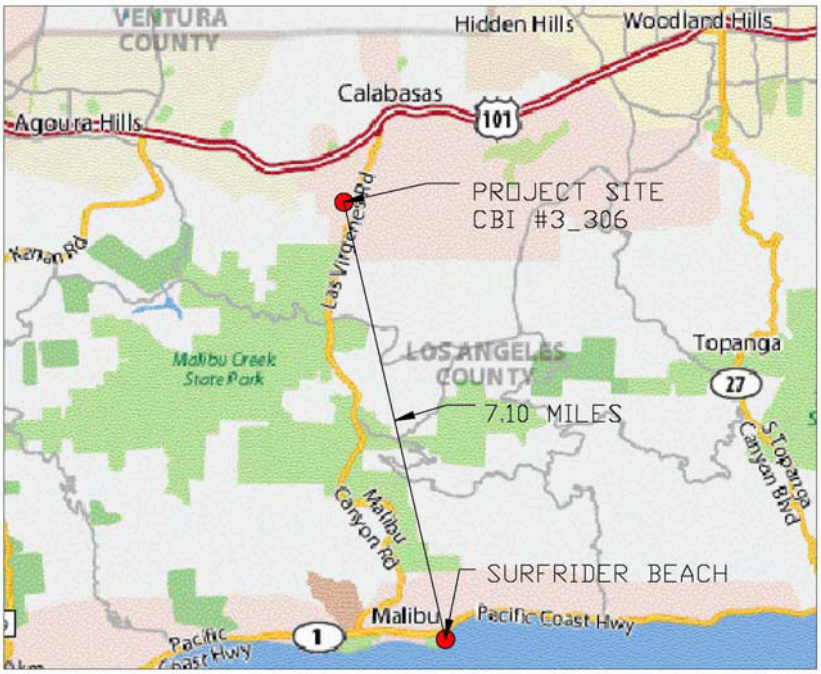
Disclosure:
Funding for this project has been provided in full or in part through a contract with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto for the implementation of California's Nonpoint Source Pollution Control Program. The contents of this document do not necessarily reflect the views and policies of the SWRCB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.
(Gov. Code 7550, 40 CFR 31.20)

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

In response to the poor water quality and dramatic number of postings and closures revealed by the mandated monitoring at California's beaches, the State of California established the Clean Beaches Initiative (CBI) Grant Program. The Budget Act of 2001 appropriated $32,298,000 from Proposition 13, (the Costa-Machado Water Act of 2000), to implement projects at 38 specific beaches, including Surfrider Beach in Malibu. The major goal of the CBI Grant Program is to reduce health risks through improved water quality at California's beaches. CBI grant funds are being used to 1) improve, upgrade, or convert existing sewer collection or septic systems to reduce or eliminate sewage spills, 2) implement urban runoff pollution reduction and prevention programs, and 3) implement management practices to eliminate upstream sources of bacterial contamination for the restoration and protection of coastal water quality.

The City of Calabasas applied for and obtained CBI grant funds for the purpose of implementing urban runoff pollution reduction and best management practices to eliminate sources of bacterial contamination for the restoration and protection of coastal water quality at Surfrider Beach in Malibu, California. This project is a demonstration project that will lead the way for additional projects throughout the Malibu Creek Watershed as we goal toward overall elimination of beach closures and vastly enhanced and improved habitats through widespread, incremental successes in reducing nonpoint source pollution. The project site is approximately seven miles from Surfrider Beach, as shown in the vicinity map in Figure 1 below.



VICINITY MAP FIGURE 1

The project began as a contract to conduct preliminary investigation necessary to determine the measures necessary to reduce or eliminate unhealthy bacterial concentrations and other urban pollutants of concern in Las Virgenes Creek, tributary to Surfrider Beach via Malibu Creek and Lagoon. Upon completion of the Preliminary Planning phase, the scope of

the contract was amended to incorporate implementation of the identified project alternative that would achieve the project goals stated above. The Implementation phase included design, permitting, construction, and documentation of the installation of a treatment train incorporating a passive filtration device (StormScreen unit) and infiltration device (StomChambers system) for diversion and treatment of dry weather flows from a 102" LA County Storm Drain (PD 1851).

PHOTOS OF COUNTY STORMDRAIN OUTFALL FOR PD 1851

The treatment system installed includes a low flow diversion from PD 1851 inside a manhole upstream of the outfall, a StormScreen gross solids removal unit, and then a double row of StormChambers units forming an infiltration bed 160' long by 14' wide. The StormScreen unit is over 20 feet deep, allowing for gravity flow from the diversion through the filters in the unit. However, it was determined to be cost prohibitive to install the infiltration bed at that depth and so a pump is required to move the filtered water up into the StormChambers. There is a gravity overflow from the pump chamber back to PD 1851 for instances when the pump shuts off. The system is designed to divert, filter and infiltrate up to 1350 gallons per minute (3 cfs), which is about ten times the observed dry weather flow rates during the 2003 study period. Therefore, the system will divert and capture small rain events in addition to dry weather flow. The entire system is underground, within the planted median area in Lost Hills Road just north of Cold Springs Street in the City of Calabasas.

This project has successfully met the criteria established by the Costa-Machado Water Act of 2000 through the installation of an operational urban runoff filtration and infiltration system that cleans-up and reduces dry season urban runoff into Las Virgenes Creek. The treatment system will be on-goingly maintained by the City of Calabasas for decades to come. By reducing the pollution load from entering the creek, and reducing the quantity of urban runoff to the creek, the City is incrementally improving beach health and appearance.

For questions regarding this project please contact the City of Calabasas Environmental Services Manager, Alex Farassati, at (818) 878-4225, x307. Another contact is the design engineer, Roxanne Hughes, at (805) 653-6597.

II. PROBLEM STATEMENT AND RELEVANT ISSUES

In response to the poor water quality and dramatic number of postings and closures revealed by the mandated monitoring at California's beaches, the State of California established the Clean Beaches Initiative (CBI) Grant Program. The Budget Act of 2001 appropriated $32,298,000 from Proposition 13, (the Costa-Machado Water Act of 2000), to implement projects at 38 specific beaches, including Surfrider Beach in Malibu.

The storm drain outfall located behind A.E. Wright Middle School in the City of Calabasas (PD 1851) is a documented pollution contributor to the Las Virgenes Creek, located in the upper reaches of the Malibu Creek Watershed, which dishcarges into Malibu Lagoon and Surfrider Beach. The land uses associated with the PD 1851 storm drain outfall include single and multi-family dwellings, construction sites, commercial buildings, a section of the 101 Freeway and the Calabasas landfill. The outfall contributes dry weather urban runoff at a rate of approximately 3 cubic feet per second (CFS) to the creek system and ultimately the Lagoon. The City completed water quality monitoring during the summer/fall of 2002 that documented chronic trash and litter problems, intermittent fecal coliform levels that exceed contact and non-contact recreation levels, and high nutrient loadings during these dry weather months. The proposed project will not only remove pollutants, but also actually reduce the quantity of dry weather urban runoff going to Malibu Lagoon thereby reducing frequency of beach closures at Surfrider Beach caused by lagoon breaches. The following quotation taken from Heal the Bay's 14th Annual Beach Report Card (2003/04) sums up the relevant issues to be addressed: "Surfrider Beach's water quality was very poor again this past year. The renowned beach, located at the outlet of Malibu Creek and Lagoon, received both a dry weather and AB411 time-period grade of F. This year, Surfrider Beach was able to wrestle away the title of Los Angeles County's most polluted beach from Cabrillo Beach, harborside. Please be aware that if the Malibu Lagoon sand-bar is breached, water contact at Surfrider Beach is likely to cause illness, and should be avoided."

The following table summarizes the number of AB411 beach postings and closures at Surfrider Beach as presented in the State Water Resource Control Boards Beach Watch database. BMDs are beach-mile days. Years 2002 through 2006 are all pre-project and year 2007 is post-project.

Agency Name	Beach Name	AB411 2007 Year		AB411 2006 Year		AB411 2005 Year		AB411 2004 Year		AB411 2003 Year		AB411 2002 Year	
		BMDs	Days	BMDs	Days	BMDs	Days	BMDs	Days	BMDs	Days	BMDs	Days
Los Angeles County	Surfrider Beach	0.91	17.00	8.15	97.00	8.35	120.00	8.27	84.00	93.22	103.00	1.02	9.00

(http://beachwatch.waterboards.ca.gov/BeachWatch/cla_common/BmdComparedCriteria.jsp)

III. PROJECT GOALS

The major goal of the CBI Grant Program is to reduce health risks through improved water quality at California's beaches. CBI grant funds are being used to 1) improve, upgrade, or convert existing sewer collection or septic systems to reduce or eliminate sewage spills, 2) implement urban runoff pollution reduction and prevention programs, and 3) implement management practices to eliminate upstream sources of bacterial contamination for the restoration and protection of coastal water quality.

This project is a demonstration project that will lead the way for additional projects throughout the Malibu Creek Watershed as we goal toward overall elimination of beach closures and vastly enhanced and improved habitats through widespread, incremental successes in reducing nonpoint source pollution. This project will prevent trash, excessive nutrients, sediment, and other pollutants from the drainage area for PD 1851 from reaching the creeks and beaches, and reduce the quantity of urban runoff discharging to Las Virgenes Creek. Through these efforts, the City hopes to achieve higher water quality standards, which promote beneficial uses and restore habitat for wildlife. By reducing the pollution load from entering the creek, and reducing the quantity of urban runoff to the creek, the City is incrementally improving beach health and appearance.

IV. PROJECT DESCRIPTION

This urban runoff pollution reduction and prevention project includes two primary phases. The project began as a contract to conduct preliminary investigation necessary to determine the measures necessary to reduce or eliminate unhealthy bacterial concentrations and other urban pollutants of concern in Las Virgenes Creek, tributary to Surfrider Beach via Malibu Creek and Lagoon. Upon completion of the Preliminary Planning phase, the scope of the contract was amended to incorporate implementation of the identified project alternative that would achieve the project goals stated above. The Implementation phase includes design, permitting, construction, and documentation of the installation of a treatment train incorporating a passive filtration device (StormScreen unit) and infiltration device (StomChambers system).

The total project cost is $605,000. Of the total project budget, the Clean Beaches Grant Program funded $495,000 and the remaining $110,000 is funded by the City of Calabasas, along with on-going maintenance and operational costs. Of the $495,000 grant funding, $385,000 was through Prop 13 and $110,000 was later added through Prop 40. The primary cost factor, and the reason for the addition of the Prop 40 funding, was the construction of the actual filtration and infiltration devices, which accounts for $435,000 of the project expenses.

The following outlines the project timeline, with original schedule of due dates versus revised timeline per contract amendments and the final completion dates.

Task	Deliverable by Subtask #	Original Contract Due Date	Amended Due Date	Date Submitted
1. Project Management	1.2 Quarterly Progress Report	12/30/02 and quarterly thereafter	n/a	2/04/03 4/16/03 9/04/03 2/03/04 10/26/04 1/10/05 4/28/05 9/30/05 11/29/05 3/16/07 3/19/07 9/7/07

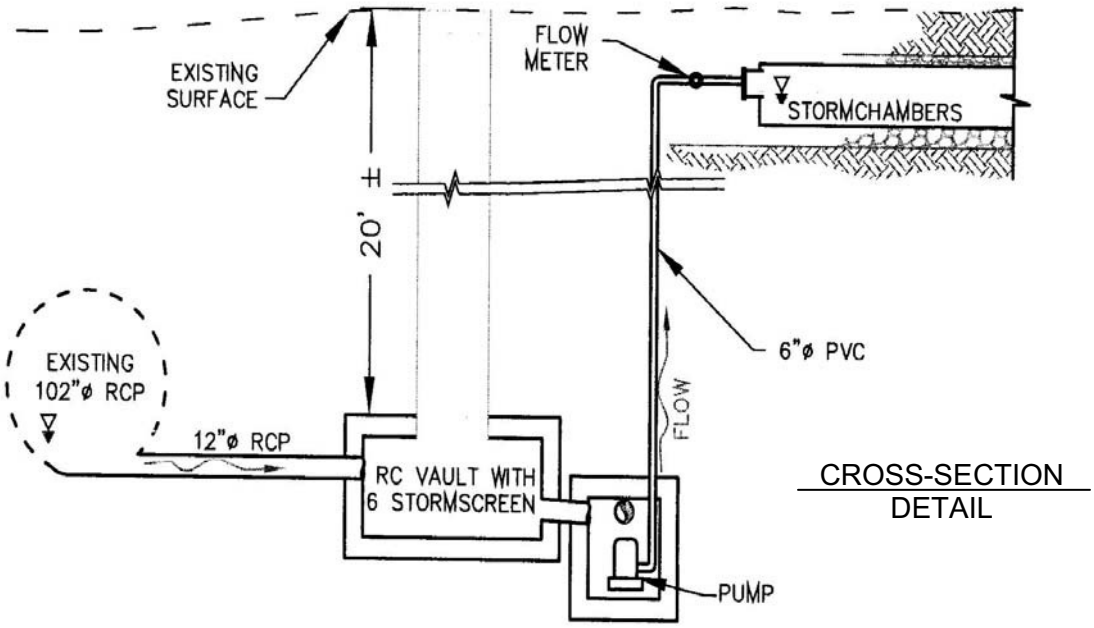
Task	Deliverable by Subtask #	Original Contract Due Date	Amended Due Date	Date Submitted
	1.5 Contract Summary form	11/30/02	n/a	2/18/03
	1.7 Project Survey Form	2/04/03	2/5/08	
2. CEQA Documents and Permits	2.1 CEQA Documentation	3/31/04	n/a	9/30/05
	2.2 Storm Drain Connection Permit	10/15/04	n/a	9/30/05
3. Quality Assurance Project Plan	3.1 QAPP	11/30/02	n/a	12/16/03
	3.2 Monitoring and Reporting Plan	10/15/04	7/03/06	3/19/07
4. Las Virgenes Creek Drainage Sub-Areas Study	4.1 Storm Drain Outfalls	11/19/02	n/a	02/04/03
	4.2 Tabular Outfall Conditions Documentation	12/16/02	n/a	12/31/03
	4.3 Sub-Area Maps With Land Use Statistics	12/30/02	n/a	2/18/04
	4.4 Water Quality and Flow Rate Data	02/04/03	n/a	2/18/04
	4.5 Outfall Specific Study Reports	03/02/03	n/a	2/18/04
	4.6 List of Proposed Projects and Design Criteria	03/02/03	n/a	2/18/04
5. Project Design	5.1 Stakeholder Meeting Minutes	07/30/04	9/30/05	1/12/06
	5.2 Approved PS&E	10/15/04	n/a	9/30/05
6. Project Construction	6.2 Photo Documentation	03/31/05	10/25/06	3/19/07
	6.3 “As-Built” Drawings	03/31/05	3/31/07	3/19/07
7. Public Outreach	7.1 Copy of City Enews Article and Website Page	03/31/05	3/31/07	3/19/07
	7.2 Photo of Project Information Signs	03/31/05	10/25/06	3/19/07
	7.3 Documentary Film	n/a	3/30/08	3/30/08
8. Reporting	8.1 Draft Final Report	03/31/05	1/08/08	2/04/08
	8.2 Final Report	03/31/05	3/30/08	3/30/08

The first phase of this project consisted of a drainage area study and preliminary planning for identification and scoping of project alternatives to prevent nonpoint source pollution from entering Las Virgenes Creek, with a focus on reduction of bacteria, trash and sediment loading to Surfrider Beach. The Study Report for the Infiltration and Bioremediation of Urban Runoff to Las Virgenes Creek is attached as Appendix A to this report. The study included identification of all major storm drain outfalls to Las Virgenes Creek within the Calabasas City Limits, documentation of dry weather flows from all eight identified drains, and monitoring of quantity and quality of dry weather flows from the two drains that were found to have consistent urban runoff contributions to the creek and beach. The monitoring results

documented significant total and fecal coliform loadings, trash and debris, elevated levels of Selenium and presence of scum/foam, particularly in PD 1851. Dry season flow from PD 1851 averaged 50 gpm with a peak measured flow rate of 100 gpm based on the August through September 2003 study period. Three project alternatives were presented for addressing identified pollutant loadings. The Study's Project Alternative #1 was recommended and subsequently selected for implementation.

The second phase of the project included the design, permitting, construction and documentation of a storm water treatment facility following the design criteria outlined as Project Alternative #1 in the above-described Study. The facility treats dry season runoff from an approximately 670 acre watershed of mixed urban (including landfill and freeway uses) and open space areas that flows through an existing 102" diameter storm drain (PD1851) into Las Virgenes Creek, ultimately entering Surfrider Beach via Malibu Creek and Lagoon. CEQA was completed in March of 2004 with filing of the Notice of Exemption for a Categorical Exemption per State of California CEQA Guidelines Sections 15301 and 15302. The design of a two-stage filtration and infiltration system was completed in June 2005, with construction contract awarded at the City Council meeting of July 11, 2005. LA County Flood Control District issued a construction permit authorizing the required modifications to PD1851 in August 2005 and construction began shortly thereafter. The system was installed in a landscaped median in the middle of Lost Hills Road, just south of Malibu Hills Road in the City of Calabasas.

The first stage of treatment includes gross solids removal through the use of a StormScreen unit furnished by Stormwater Management, Inc. (recently acquired by Contech Stormwater Solutions website link: www.contech-cpi.com/stormwater/products/14) The StormScreen is a 12-ft diameter circular concrete vault that houses six (6) screen assemblies with a total filtering capacity of 3 cfs of water. This will filter 100% of the average dry weather flow observed in the storm drain and will retain all solid pollutant larger than 0.25 inches in diameter. A pump unit is integrated with this filter system to bring the filtered water upwards several feet to the sub-surface level where the second stage of the system begins.



The second stage is an infiltration bed utilizing a perforated HDPE dome pipe system known as StormChambers furnished by HydroLogic Solutions, Inc. (also recently acquired by

Contech Stormwater Solutions). Filtered water from the first stage of treatment is pumped to this infiltration unit, and is monitored by a flow meter placed at the pump discharge line. Water in the infiltration unit (StormChambers) percolates into the ground using an area of about 2,400 sq. ft. When the StormChambers are full, the pump turns off automatically, and the filtered flow bypasses the infiltration bed and is returned to the 102" pipe through a connection upstream of the outfall to the creek. When operating at full optimization, this system will infiltrate the majority of dry weather flows, thus reducing the quantity of urban runoff into the creek and lagoon. Even when infiltration capacity is exceeded intermittently, the system will always maintain filtration of 100% of the dry weather flow, thus removing most if not all gross pollutants from entering the creek through this outfall.

The system passed functional testing and was brought on-line in November 2006. Immediately following system implementation, the dry weather flow into Las Virgenes Creek from PD1851 ceased completely. All of the urban runoff was successfully diverted into the StormScreen, filtered, and the clean water was pumped into the StormChambers for percolation. 100% filtration and 100% reduction in flow rate was accomplished. However, the Monitoring and Reporting Plan was still being drafted for approval at this time, so no formal monitoring was conducted until May 2007. Post-construction monitoring was conducted in compliance with the Monitoring and Reporting Plan from May 2007 through November 2007. During this period, it was documented that the flow meters were not operational, and the pump was also malfunctioning so that the filtered water was being returned to Las Virgenes Creek instead of infiltrated through the StormChambers. The system was cleaned out in February 2008 and the contractor and manufacturer worked with the City staff to identify and resolve these problems. At that time it was discovered that the diversion structure inside PD 1851 was capturing a much higher volume of storm flow than the Stormscreen could handle, causing an overflow of sediment into the pump chamber during high rains. In addition, the sediment level in the Stormscreen unit was up to six feet in depth and was partially obstructing inflow from the diversion pipe. This caused a stagnation of flow in the diversion trough, which filled the trough with sediment and severely reduced the amount of dry weather flow into the treatment system.

In March of 2008, the City worked with a contractor to reconstruct the diversion to function as originally intended in order limit the capture of storm flows while still capturing dry weather flows. In addition, In April 2008 the City will restore functionality of the pump and will continue to maintain the electrical systems through an on-call contract with an outside contractor. The flow meters require more head than is available in the system and will not be functional. Therefore, flow monitoring will need to continue at the end of pipe in the outfall.

PROJECT LOCATION AND SITE MAP

V. MONITORING AND REPORTING

The pre-project monitoring was conducted as a part of the Study Report in the initial phase of this project. The Study Report is attached as Appendix A to this report, without it's technical appendix. The full technical appendix to the Study Report is very voluminous and is on file at the SWRCB. The Quality Assurance Project Plan (QAPP) was prepared based largely on an existing QAPP that was in place for another monitoring project that the City had under way through a 391h Grant that used volunteer water quality monitoring. The sampling sites included locations at the end of pipe for each of the two storm drain outfalls included in the study, and in the creek itself just below the outfalls. See page 9 of the Study Report for a summary of the pre-project outfall monitory plan. This plan was designed and executed prior to project design, as a part of the initial study to identify project opportunities. The data was collected during dry weather in August and September 2003. An excerpt of the pre-project water quality data from the Study Report's technical appendix is included in Appendix B of this report, as pertains to PD1851.

The post-project monitoring data was based on a Monitoring and Reporting Plan prepared and approved as the project was actually coming on line. This plan included three

monitoring sites in the vicinity of the project, as shown in the project location and site map above. The two curb opening catch basins were added to post project monitoring in order to document the only alternative source of flow into PD 1851 downstream of the low flow diversion. These monitoring sites were consistently dry throughout the observation period. The data was collected in May through November of 2007. The data is included in Appendix B of this report. As noted above in the project description section, the water quality observations documented during post-construction monitoring are representative of a semi-functioning system that is a mixture of unfiltered dry weather flow recombined with post-filtered dry weather flow that has gone through the StormScreen and returned to the storm drain above the outfall.

Four years elapsed between collection of the pre-project data and the post-project data. Staff turnover at the City resulted in a different set of persons responsible for collection of the post-project data than the pre-project. As a result, much of the data was collected differently. The sampling times are not consistent, descriptions of observation data are not consistent, the location of the observations are not consistent, only the sample point at end-of-pipe is really in tact. For example, the data sets include observation of algae and color. In the pre-project data, the observer recorded the percent cover of algae within the creek adjacent to the outfall and the color of the water collected from the end of pipe. In the post-project data, the observer recorded only the color of the algae and the color of the water flowing across the concrete apron between the pipe and the creek. Given the changes that can occur in a watershed over a four-year period and the differences in field data collection and observation that occurred between pre- and post-project monitoring, it is not plausible to draw any direct conclusions from these data sets.

A review of the preconstruction data versus the post construction data collected indicates that there is a reduction in trash and debris in the vicinity of the outfall (greater than 50 pieces pre-project and between 10-30 pieces post), but it also appears that Ammonia and Nitrate has increased slightly. Comparison of the pre-project and post project data must take into account that there was virtually no rain in August to September of 2003, but three rain events during the same time frame in 2007, classifying the post project data into a category of dry season, wet weather flow. This, coupled with the malfunction of the treatment system, may explain the apparent increase in the coliforms between pre-project and post project data sets.

When the treatment system is optimized, it can and will achieve 100% filtration and infiltration of dry weather flows from PD 1851 the same as when it was initially brought online. This will eliminate coliform loading to the creek during dry weather altogether, along with the other pollutants of concern.

VI. LESSONS LEARNED

There are several lessons that were learned through this project process: 1) Learn and use the contract amendment and time extension processes so that decisions are not deadline driven; 2) The design engineer must review all changes made during construction 3) plan on staff turnover.

Timing is everything with a construction contract. The City bid the construction of the Stormscreen/Stormchambers Installation project during the summer of 2005. The Engineer's cost estimate was $275K. The City received only two bids – one for $388K and the other for $493K. Faced with the decision to allocate additional funds in order to award and stay on

schedule versus rejecting all bids and re-advertising, taking additional steps to obtain additional competition and reduce the final bid price, the City proceeded with the former. The primary decision factor was to avoid needing to file a grant contract amendment in order to change the project schedule to allow for time to re-advertise the project, as it was thought that this process would take several months and cause the project to lose funding altogether. Later into the project, it was discovered that there is a time extension process available that could extend schedule without requiring a formal (and often lengthy) contract amendment process. Given this understanding, the City may have re-bid the project rather than award immediately.

During construction, the contractor and the City Inspector worked together to form a design solution regarding connection of the twelve inch diversion pipe to the manhole in PD 1851. Since the design engineer was not involved in this solution, the end result caused the diversion to capture flows that exceed the capacity of the treatment system. This fatally flawed the system from performing as intended, until the problem was identified and resolved. All construction changes must include a shop drawing review by the design engineer to avoid this type of difficulty. Only the design team understood the system well enough to develop or approve a design solution.

This project spans five years. It began in 2002/03 with the initiation of the Study Report and concluded in 2008 with final reporting on the in-place treatment system. Through this time, the project saw four different project managers on the City side and three on the State side. Project staffing on the City side also changed, which dramatically affected monitoring and reporting processes. In retrospect, it is clear that steps need to be taken at the outset to prepare a project for staffing transitions. There should be a “white paper” describing the key issues that must transfer between staff. New project personnel should meet with former to go over the white paper and discuss the goals and intent of the project along with schedule of deliverables.

VII. PUBLIC OUTREACH

The City of Calabasas has utilized several different publications to advertise this project to the local community. An article about the project has been posted on the City’s website at: http://www.cityofcalabasas.com/departments/environmental.html#watershed for the duration of the project. The project was also heralded through the email subscription service called Calabasas Enews, which is distributed to approximately 800 subscribers. The Enews article is available at http://www.cityofcalabasas.com/enews/2005/december2005.html#RUNOFF. A similar article was also published in the January 2006 issue of the local weekly newspaper, the Las Virgenes-Conejo Valley edition of the Acorn. In March 2006, the project was presented to the City’s Environmental Commission, which is televised on the City’s public channel, CTV. A project information sign was erected and maintained at the project site throughout the construction period. The City has also prepared a video documentary about the project that is included as a DVD insert in Appendix C, which contains copies of the foregoing articles.

VIII. CONCLUSIONS

This project has successfully met the criteria established by the Costa-Machado Water Act of 2000 through the installation of an operational urban runoff filtration and infiltration system that will clean-up and reduce dry season urban runoff into Las Virgenes Creek. The treatment system will be on-goingly maintained by the City of Calabasas for decades to come. By reducing the pollution load from entering the creek, and reducing the quantity of urban runoff to the creek, the City is incrementally improving beach health and appearance. Removal of this urban runoff from Las Virgenes Creek ultimately reduces dry season flow into Malilbu Lagoon, thereby reducing the probability of dry season lagoon breaches that result in beach closures at Surfrider Beach. It must be acknowledged that beach closures are caused not only by anthropogenic sources of bacteria, but also natural sources are a known contributor. This project focuses on reduction of anthropogenic sources and overall reduction of dry weather flow to prevent lagoon breaching during summer months when beach usage is at its peak.

Although this project accomplishes only an incremental reduction in urban flows, it is a demonstration project that leads the way for replication of similarly goaled projects throughout the Malibu Creek Watershed. After all, the widespread dry season urban runoff sources that ultimately accumulate at the Malibu Lagoon did not appear overnight. The removal and reduction of these sources is a long term commitment that must be undertaken project by project, escalating over time to meet the intended goal of excellent beach water quality for generations to come.

IX. APPENDICES

A. Study Report: Infiltration and Bioremediation of Urban Runoff To Las Virgenes Creek

B. Pre- and Post-project Monitoring Data Summary

C. Public Outreach Materials

APPENDIX A

Study Report
Infiltration and Bioremediation of Urban Runoff to
Las Virgenes Creek

STUDY REPORT
Infiltration and Bioremediation of Urban Runoff to Las Virgenes Creek

Clean Beaches Initiative Grant Program
SWRCB Agreement No. 01-231-550-0

Prepared By:
Roxanne C. Hughes, P.E.
Environmental Service Manager
City of Calabasas
(800) 491-1720

Disclosure:
Funding for this project has been provided in full or in part through a contract with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto for the implementation of California's Nonpoint Source Pollution Control Program. The contents of this document do not necessarily reflect the views and policies of the SWRCB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use." (Gov. Code 7550, 40 CFR 31.20)

Introduction

The goal of this study is to identify opportunities for projects that will improve water quality through application of infiltration/ bioremediation technologies at storm drain outfalls that contribute significant pollutant loading and dry weather flows to the portion of Las Virgenes Creek that lies within the boundaries of the City of Calabasas. Reducing the pollutant load and the volume of dry weather flow that enters the creek is expected to improve water quality at Surfrider Beach.

From reviewing LA County stormdrain maps and walking Las Virgenes Creek between the 101 Freeway and the Lost Hills/Las Virgenes Road intersection, eight major storm drains were identified. These eight storm drain outfalls were further investigated to determine which drains contribute significant dry weather flows to Las Virgenes Creek. Of the eight identified storm drains, two were observed to have consistent dry weather flows into Las Virgenes Creek. Los Angeles County Public Works owns and maintains these two continuously flowing storm drains, identified on County As-Built drawings as Private Drain (P.D.) No. 1851 (A.E. Wright Site) and P.D. No. 2055 (Cold Springs Site). These two storm drain outfalls are shown in Figure 1, Outfall Site Map.

A map of the drainage sub-areas for each of these outfalls is presented in Figure 2, Watershed Boundaries. The land use area statistics for the sub-watersheds associated with each storm drain are shown in Table 1, Watershed Land Use Calculations.

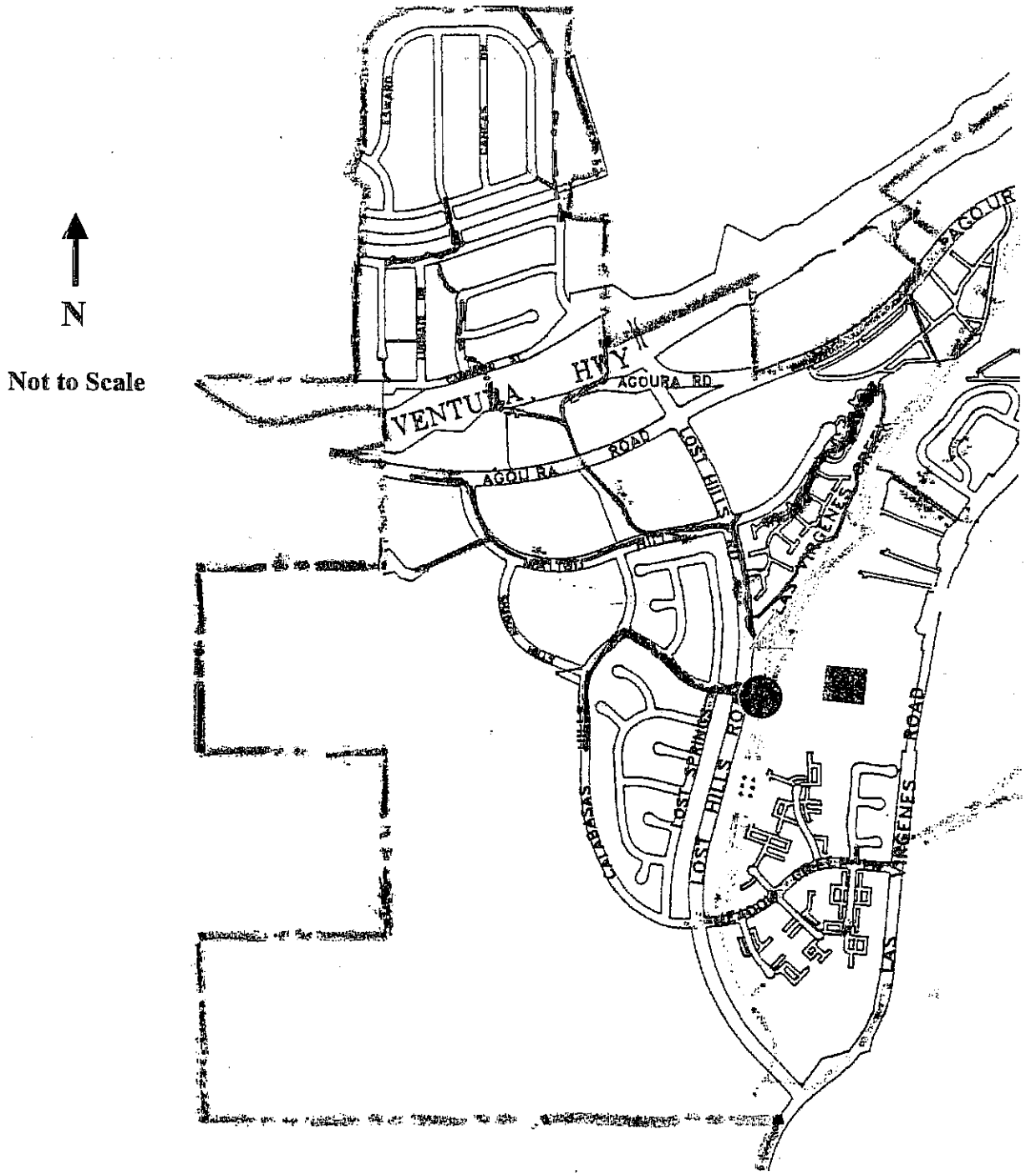
Water quality and flow monitoring was conducted on dry weather flows from these two outfalls from August through September 2003. This report summarizes the identified opportunities and constraints and a proposed projects list that was developed based on the resulting water quality data presented in Appendix A.

Background

The State Water Resources Control Board has determined that the Malibu Lagoon and Surfrider Beach are suffering from excess dry weather flows and high pollution levels due to accumulated urban runoff from the Malibu Creek Watershed. Las Virgenes Creek is located at the headwaters of the Malibu Creek Watershed, flowing south from Calabasas and joining Malibu Creek approximately 6 river-miles upstream of Malibu Lagoon. Las Virgenes Creek is currently on the 2002 Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments due to high coliform count, nutrients, organic enrichment/low dissolve oxygen, scum/foam-unnatural, sedimentation/siltation, selenium and trash – all from nonpoint sources. In addition, the City of Calabasas has been conducting citizen monitoring of water quality parameters through the Adopt-A-Creek Program at several locations along Las Virgenes Creek over the past two years. The resulting monitoring data further documents the presence of typical urban runoff pollutants such as nutrients, algae, trash, fecal coliform, and metals.

In 1999 the City of Calabasas identified a need to improve the quality of water entering the Las Virgenes Creek via a specific storm drain outlet located behind A.E. Wright

Figure 1
Outfall Site Map



Legend	
PD 2055 Outfall #5	
PD 1851 Outfall #3	
A.E. Wright Middle School	
City Limits	

Middle School. Pursuant to seeking funding to build a treatment facility at this location, the scope of work was expanded to include an infiltration/bioremediation feasibility study for all outfalls that contribute significant dry-weather flows to the portion of Las Virgenes Creek located within City limits (approx. 1 river-mile).

Drainage Sub-Areas Study

Data was compiled from existing storm drain plans, current aerial photos, USGS Topography Maps, field reviews and information presented in the recently completed Las Virgenes, McCoy and Dry Canyon Creeks Master Plan to delineate the watershed sub-areas that drain into P.D. No. 1851 and P.D. No. 2055. The two watershed areas were then divided into land use sub-areas identified from aerial photos and field reviews. The resulting watershed boundaries and land use statistics are depicted in Figure 2 and tabulated as follows:

Table 1: Watershed Land Use Calculations

	Area ID*	Area (ft^2)	Area (AC)	Land Use	% of Total Watershed
Watershed 1 (A.E. Wright Site, P.D. 1851)	1A	5,574,377	128	Residential	19%
	1B	4,033,903	93	Commercial	14%
	1C	8,776,476	201	Open Space	30%
	1D	10,394,735	239	Landfill	36%
	1E	408,320	9	Freeway	1%
	1	29,187,811	670	Watershed Total	100%
Watershed 2 (Cold Springs Site P.D. 2055)	2A	1,626,206	37	Residential	100%
	2	1,626,206	37	Watershed Total	100%

*See Figure 2 for mapped Area IDs


1D
239 ACRES
Watershed 1
670 ACRES
1C
201 ACRES
1C
201 ACRES
1A
128 ACRES
1E
9 ACRES
1B
93 ACRES
1C
201 ACRES
Watershed 1
670 ACRES
1A
128 ACRES
2A
37 ACRES
1A
128 ACRES
Watershed 2
37 ACRES

The primary land uses associated with our drainage sub-areas are mixed residential, light commercial/industrial, open space and landfill. Table 2 shows the typical concentrations of pollutants of concern associated with these land uses. This table was prepare in May, 2003 by the LA County Department of Public Works using monitoring information gathered during their on-going NPDES Monitoring Program. According to this data source, the most prominent pollutant of concern for the identified land uses in our sub-area drainages is bacteria.

TABLE 2 : TYPICAL CONCENTRATIONS OF POLLUTANTS OF CONCERN

Constituent	Standard[1]	Retail/ Commercial	General Light Industrial	Transportation	High Density Single Family Residential	Mixed Residential
Man-Made Trash	No man-made trash by 2012.	Land use data for trash accumulation is currently being compiled under the trash TMDL regulations		Caltrans assumes 10 cubic feet of trash per year per acre of drainage area and applies a "factor of safety" of 2.	Land use data for trash accumulation is currently being compiled under the trash TMDL regulations	
Bacterial Indicators						
Coliform, Total, mpn/100ml						
Wet Weather (instantaneous)	10,000	1,200,000	160,000	600,000	1,600,000	a
Coliform, Fecal, mpn/100ml						
Wet Weather (instantaneous)	400	90,000	30,000	205,000	900,000	a
Enterococcus, Fecal, mpn/100ml						
Wet Weather (instantaneous)	104	40,000	160,000	32,000	140,000	
TSS, mg/l	n/n	53	129	50	61	40
Turbidity, NTU (30 day average)	75	24	55	22	19	15
Oil and Grease, mg/l (30 day average)	25	2.9	1.4	2.8	1.2	a
Nutrients						
Phosphorus (P), Total, mg/l	n/n	0.28	0.3	0.32	0.32	0.18

	Ammonia Nitrogen (NH3-N), mg/l	2.4, 2.7	0.25	0.26	0.14	0.25	0.33
	Nitrate Nitrogen (NO3-N), mg/l	5.0, 10	0.43	0.52	0.4	0.46	0.44
	Nitrite Nitrogen (NO4-N), mg/l	1.0, 5.0	0.07	0.06	0.06	0.05	0.06
	Total Kjeldahl Nitrogen (TKN), mg/l	n/n	2.2	2.3	1.3	2	1.7
Metals							
	Aluminum (Al), Total, ug/l	1000	50	470	107	287	271
	Copper (Cu), Dissolved, ug/l	3.1, 9.0	11	14	27	6.7	8
	Copper (Cu), Total, ug/l	12	22	21	39	11	13
	Lead (Pb), Dissolved, ug/l	2.5, 8.1	a	a	a	a	a
	Lead (Pb), Total, ug/l	8	2.5	5.1	2.5	5.4	2.5
	Nickel (Ni), Dissolved, ug/l	8.2, 52	a	2.5	2.5	a	a
	Nickel (Ni), Total, ug/l	20, 100	2.5	6	2.5	a	a
	Zinc (Zn), Dissolved, ug/l	81, 120	130	303	152	25	89
	Zinc (Zn), Total, ug/l	80	192	366	218	66	125
Polyaromatic Hydrocarbons (sum)		15					
	Phenanthrene, ug/l		a	a	a	0.025	0.24
	Pyrene, ug/l		a	a	a	0.37	0.3

Notes:

a = Unknown

n/n = no numeric standard

[1]Numeric standards taken from the California Ocean Plan, the Los Angeles Region Basin Plan, AB411, the California Toxics Rule (fresh water), and the California Toxics Rule (salt water). Except for indicator bacteria and TMDL limitations, there are no numerical water quality standards that apply to stormwater or "non-point source" discharges. Current federal and state numerical standards apply only to "point source" discharge, such as sewage and industrial dishcarges. Water quality standards described in the 1995 Los Angeles Region Basin Plan or the 1997 California Ocean Plan do not apply to stormwater runoff, and any exceedance of values should not indicate violation nor noncompliance with the plans. Furthermore, a direct comparison of any sampling results with the Ocean Plan standards cannot be made since the results presented in the table are detected values before dilution, a factor allowed by the Ocean Plan.

Monitoring Summary

A Quality Assurance Project Plan (QAPP) was prepared for implementation of a monitoring plan designed to measure pollutants of concern associated with known impairments in Las Virgenes Creek and downstream receiving waters per the CWA Section 303(d) list, which includes bacteria. A summary of the monitoring plan is present in Table 3 below. In addition, depth of flow measurements were taken inside the storm drain pipe and used to approximate the pipe flow based on Manning's Equation for pipes flowing partially full. The complete set of water quality and flow rate data is presented in Appendix A.

Table 3 Summary of Outfall Monitoring Plan

Parameter	Type of monitoring	Frequency of monitoring
Total Suspended Solids	Sample and send to Lab	3 times/Month
Temperature	Field analysis	3 times/Month
Dissolved Oxygen	Field analysis	3 times/Month
pH	Field analysis	3 times/Month
Total and Fecal Coliform	Sample and send to Lab	3 times/Month
Ammonia	Sample and send to Lab	3 times/Month
Nitrate	Sample and send to Lab	3 times/Month
Ortho-Phosphate	Sample and send to Lab	3 times/Month
Selenium	Sample and send to Lab	3 times/Month
Foam/scum	Field observation	3 times/Month
Visual observation of algae	Field observation	3 times/Month
Visual observation of trash	Field observation	3 times/Month
Odor	Field observation	3 times/Month
Flow	Field observation	3 times/Month
Photo document	Field documentation	3 times/Month

An analysis of the data presented in Appendix A yielded the following conclusions:

1. The water quality testing and observations for Total Suspended Solids (TSS), Temperature, Dissolved Oxygen (DO), pH, Ammonia, Nitrate, Ortho-Phosphate and Odor generally do not appear to be of concern. The TSS levels were reported below detection limits for over 75% of the samples. Temperature, pH, and DO readings were almost entirely within acceptable creek standards to support beneficial uses, even though the readings were taken in the pipe. Lab results for Ammonia and Nitrate also generally stayed within creek water quality standards as well.
2. Selenium levels appear to be of concern only in P.D. No. 1851, corresponding to Watershed 1 in Figure 2.
3. Both outfalls studied definitely have significant loadings of total and fecal coliforms. As foreshadowed by the land use study, bacteria is a primary pollutant of concern for these drainage sub-areas.
4. Both outfalls have significant loadings of trash. Although the trash observations were recorded as "dense" for every sampling event at both

outfalls, it should be noted that existing trash was not picked up between observations. Therefore, the "more than fifty pieces" of trash readings do not represent only new trash from the outfall, but accumulated debris over time with noticeable new pieces turning up throughout the observation period.

5. The algae observations reported correspond to algae in the creek segments below the studied outfalls. The P.D. 2055 observations describe heavy algae in a small pond below the outfall that is separated from the main creek, whereas the P.D 1851 observations describe heavy algae in the main creek segment directly below the outfall. It should also be noted that, in general, this entire reach of Las Virgenes Creek in the vicinity of these two outfalls has heavy algae growth. Because algae growth is affected by multiple variables, it is not credible to draw any specific conclusions about the outfall discharges from these observations.
6. The foam/scum observations indicate moderate levels of this pollutant coming out of P.D. 1851, with much lower levels at P.D. 2055.
7. The calculated flow rate for P.D. 1851 is generally between 30 to 60 gallons per minute (gpm), with a peak flow of 100 gpm corresponding to an observation made at 7:35 AM on a weekday morning. Mid-morning readings around 10 AM averaged 50 gpm while late afternoon readings around 5 PM were near 30 gpm.
8. The calculated flow rate for P.D. 2055 is generally between 60 to 140 gallons per minute (gpm), with a peak flow of 187 gpm corresponding to an observation made at 9:30 AM on a weekday morning. Flow generally appeared higher in the AM versus PM readings.

Opportunities and Constraints

Based on the foregoing findings, both outfalls present an opportunity for water quality improvements and dry weather flow reduction. It is recommended to set P.D. 1851 as a higher priority over P.D. 2055 for the following reasons:

1. P.D. 1851 has more water quality concerns over P.D 2055 because of the elevated levels of Selenium and foam and also the industrial/commercial and landfill uses in the sub-area drainages tributary to P.D. 1851.
2. The P.D. 1851 outfall is located immediately adjacent to a proposed footbridge that is currently being designed for implementation as part of the City's Safe Routes to School program. The children in the residential neighborhoods to the west of the creek already cross through the creek at the outfall location to access A.E. Wright school on foot. The footbridge will serve as dual purpose to protect the creek and provide safe passage for the school children. The footbridge project presents an opportunity to easily showcase a water quality improvement project implemented at P.D. 1851 to the local youth.
3. There is an area of land just north of the P.D. 1851 outfall and east of an existing catch basin a lateral to P.D. 1851 that could potentially be used to install a structural BMP for diversion, treatment and infiltration of dry weather

flow from P.D. 1851. Steeple Chase Home Owners Association (HOA) currently owns this property. The City is already in negotiations with the HOA to obtain easements for installation of the footbridge discussed above. It is feasible that the easement rights could be expanded to allow installation and maintenance of a stormwater BMP at this location. In this case the project would be well sited for easy advertisement to pedestrians utilizing the new footbridge.

4. The potential P.D. 1851 project site is at street level, above and outside of the creek bed. This provides an opportunity for installation of an infiltration well to return the dry weather flows to ground water.
5. P.D. 2055 is constrained within the creek bed, with no nearby land available for project siting. Stormwater BMP choices are thereby limited to installation of in-line storm drain filtration style devices, without opportunity for infiltration or bioremediation.

Project List

The following list of proposed project locations and associated design criteria has been developed based on the opportunities and constraints presented above:

PROJECT ALTERNATIVE #1 – P.D. 1851 (A.E. WRIGHT)

Project Description: Install in-line low flow diversion weir to divert dry weather runoff into a treatment train including gross solids removal chamber, biofiltration module and infiltration well for groundwater recharge prior to discharge of filtered water in excess of soil percolation capacity.

Proposed Location: North of outfall, on Steeple Chase HOA property between Lost Hills Road and Las Virgenes Creek

Design Criteria:

1) Install dry weather flow diversion from main 102" storm drain that will bypass during high flow conditions. Permitting and maintenance approvals from Los Angeles County Public Works will be required.
2) Install gross solids removal device that will not result in standing water. (See Appendix B StormScreen for example)
3) Install sand filter, or other similar biological filtration unit, downstream of gross solids removal device. Alternatively, infiltration media may be incorporated as a component of the gross solids removal device (See StormFilter and StormTreat Systems example products in Appendix B).
4) Install a gravel pit style infiltration well downstream of the bio-filter.
5) Design the infiltration system to discharge directly to Las Virgenes Creek when saturation occurs.
6) Include incoming and outgoing flow monitoring devices at entrance and exit points to treatment train.

PROJECT ALTERNATIVE #2A – P.D. 2055 (COLD SPRINGS SITE)
Project Description: Replace 48" RCP storm drain with a stormwater chamber system designed for exfiltration of storm flows for groundwater recharge. (See StormChamber example product).

Proposed Location: Underneath Cold Springs Street and Lost Hills Road in the public street right-of-way along the existing storm drain alignment.

Design Criteria:

1) Size stormwater chamber system for maximum infiltration of documented dry weather runoff flows. Permitting and maintenance approvals from Los Angeles County Department of Public Works will be required.
2) Include incoming and outgoing flow monitoring devices at entrance and exit points to treatment train.

PROJECT ALTERNATIVE #2B – P.D. 2055 (COLD SPRINGS SITE)
Project Description: Reduce bacteria loading to the creek through implementation of a storm drain disinfection program to cleanse the main 48" RCP storm drain of any bacteria that may be proliferating within the drain itself.

Proposed Location: Use existing manholes to access storm drain line.

Design Criteria:

1) Implement a storm drain disinfection project to cleanse the main drain of any bacteria that may be proliferating within the drain itself.
2) Use a bladder to plug the discharge pipe from the nearest manhole upstream of the outfall to capture the cleaning product to be introduced at the manholes at the upstream end points of the storm drain system.
3) Pump the captured disinfecting waters through a portable filtration system and return cleaned water to a water truck to re-introduce into the storm drain system repeatedly.
4) Continue rinsing storm drain with clean water until water quality testing shows captured cleansing water to be clear for discharge back to the creek.
5) Monitor water quality at the outfall to determine fecal and total coliform loading for comparison to pre-project loadings documented in this report. If a dramatic decrease of coliform levels is evident, continue monitoring to determine an appropriate cleansing cycle to keep the drain free of bacteria.

APPENDIX B

Pre- and Post-Project Monitoring Data

Pre-project Monitoring Data for PD 1851
(Outfall #3)

Total Suspended Solids at Outfall #3, PD 1851 AE Wright

Date	Time	MG/L		
8/8/2003	8:50 AM	ND	0	
8/8/2003	1:55 PM	ND	0	
8/13/2003	10:00 AM	17	0	
8/13/2003	5:35 PM	ND	0	
8/18/2003	10:20 AM	13	0	
8/18/2003	5:10 PM	ND	0	
8/20/2003	10:15 AM	ND	0	
8/20/2003	5:15 PM	ND	17	
9/5/2003	10:10 AM	ND	13	
9/5/2003	2:15 PM	ND	29	Standard Deviation
9/12/2003	10:15 AM	ND	0	8.269807
9/12/2003	3:00 PM	ND	0	
9/16/2003	7:25 AM	29	0	
9/16/2003	12:47 PM	ND	0	
9/16/2003	5:30 PM	ND	0	
9/26/2003	8:30 AM	ND	0	
9/26/2003	12:20 PM	ND	0	
			3.470588	

ND= Nondetectable

Total Suspended Solids (TSS) Standard
Water Quality Control Plans (Basin Plans)

Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.

Ammonia at Outfall #3, PD 1851 AE Wright

Date	Time	MG/L	pH	Temp. °C	Standard		
8/8/2003	8:50 AM	0.134	8.1	19.2	1.47		0.134
8/8/2003	1:55 PM	0.357	8.2	19.6	1.26		0.357
8/13/2003	10:00 AM	0.073	7.9	19.5	1.96		0.073
8/13/2003	5:35 PM	ND	8.3	18.5	1.22		0
8/18/2003	10:20 AM	0.053	8.1	20.8	1.47		0.053
8/18/2003	5:10 PM	1.29	8.2	19.9	1.26	!	1.29
8/20/2003	10:15 AM	0.212	8.1	20.3	1.47		0.212
8/20/2003	5:15 PM	0.187	8.2	19.8	1.26		0.187
9/5/2003	10:10 AM	0.099	8.1	20.7	1.47		0.099
9/5/2003	2:15 PM	0.26	8.2	N/A	N/A		0.26
9/12/2003	10:15 AM	ND	8	19.7	1.71		0
9/12/2003	3:00 PM	0.053	8.2	N/A	N/A		0.053
9/16/2003	7:25 AM	ND	8.1	18.8	1.68		0
9/16/2003	12:47 PM	ND	8.1	20.3	1.47		0.158
9/16/2003	5:30 PM	0.158	8	20.4	1.71		0
9/26/2003	8:30 AM	ND	8	N/A	N/A		0.403
9/26/2003	12:20 PM	0.403	8.2	N/A	N/A		0.19288

Standard Deviation
0.3095

ND= Nondetectable
N/A= Not Available
"!" indicates exceedance of water quality standards

USEPA National Recommended Water Quality Criteria to Protect Freshwater Aquatic Life
Total Ammonia Nitrogen
Continuous Concentration, 30-day Average (mg N/L)
Fish Early Life Stages Present

	Temperature, °C									
pH	0	14	16	18	20	22	24	26	28	30
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.8	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.5	3.07	2.7	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.24	3	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.3	3.78	3.32	2.92	2.57	2.25
7	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.5	3.08	2.7	2.38	2.09
7.2	5.39	5.39	4.9	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.3	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.9	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.5	1.32
7.8	3.1	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.8	2.8	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8	2.43	2.43	2.21	1.94	1.71	1.5	1.32	1.16	1.02	0.897
8.1	2.1	2.1	1.91	1.68	1.47	1.29	1.14	1	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.7	0.615	0.541	0.475
8.5	1.09	1.09	0.99	0.87	0.765	0.672	0.591	0.52	0.45	0.401
8.6	0.92	0.92	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.48	0.422	0.371	0.326	0.287
8.8	0.661	0.661	0.601	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9	0.486	0.486	0.442	0.389	0.342	0.3	0.264	0.232	0.204	0.179

Orthophosphate at Outfall #3, PD 1851 AE Wright

Date	Time	MG/L
8/8/2003	8:50 AM	0.984
8/8/2003	1:55 PM	0.732
8/13/2003	10:00 AM	0.639
8/13/2003	5:35 PM	0.589
8/18/2003	10:20 AM	1.03
8/18/2003	5:10 PM	1.64
8/20/2003	10:15 AM	0.737
8/20/2003	5:15 PM	0.46
9/5/2003	10:10 AM	1
9/5/2003	2:15 PM	1.23
9/12/2003	10:15 AM	0.775
9/12/2003	3:00 PM	0.789
9/16/2003	7:25 AM	1
9/16/2003	12:47 PM	0.466
9/16/2003	5:30 PM	0.447
9/26/2003	8:30 AM	0.886
9/26/2003	12:20 PM	0.648
		0.826588

Standard Deviation
0.306929

ND= Nondetectable

Nitrate (Nitrate-N) at Outfall #3, PD 1851 A.E. Wright

Date	Time	MG/L			
8/8/2003	8:50 AM	4.78		4.78	
8/8/2003	1:55 PM	4.44		4.44	
8/13/2003	10:00 AM	2.07		2.07	
8/13/2003	5:35 PM	13.6	!	13.6	
8/18/2003	10:20 AM	6.44		6.44	
8/18/2003	5:10 PM	2.93		2.93	
8/20/2003	10:15 AM	8.01		8.01	
8/20/2003	5:15 PM	2.25		2.25	
9/5/2003	10:10 AM	4.8		4.8	
9/5/2003	2:15 PM	4.6		4.6	
9/12/2003	10:15 AM	4.7		4.7	
9/12/2003	3:00 PM	3.6		3.6	3.027449
9/16/2003	7:25 AM	5.9		5.9	
9/16/2003	12:47 PM	1.5		1.5	
9/16/2003	5:30 PM	ND		0	
9/26/2003	8:30 AM	3.3		3.3	
9/26/2003	12:20 PM	3.7		3.7	
				4.507059	

ND= Nondetectable
"!" indicates exceedance of water quality standards

Nitrate (Nitrate as Nitrogen) Standard
Water Quality Control Plans (Basin Plans)

Parameter	Single Sample
Nitrate as Nitrogen	10 mg/L

Selenium at Outfall #3, PD 1851 AE Wright

Date	Time	UG/L	MRL	
8/8/2003	8:50 AM	ND	10	?
8/8/2003	1:55 PM	ND	200	?
8/13/2003	10:00 AM	ND	10	?
8/13/2003	5:35 PM	ND	50	?
8/18/2003	10:20 AM	11	5	!
8/18/2003	5:10 PM	23	5	!
8/20/2003	10:15 AM	ND	10	?
8/20/2003	5:15 PM	ND	25	?
9/5/2003	10:10 AM	8.2	5	!
9/5/2003	2:15 PM	8.9	5	!
9/12/2003	10:15 AM	ND	10	?
9/12/2003	3:00 PM	ND	20	?
9/16/2003	7:25 AM	ND	10	?
9/16/2003	12:47 PM	ND	20	?
9/16/2003	5:30 PM	ND	20	?
9/26/2003	8:30 AM	ND	10	?
9/26/2003	12:20 PM	13	5	!

ND= Nondetectable
"!" indicates exceedance of water quality standards
"?" indicates that it is unknown* if the water quality standard was exceeded
*Since the Minimum Reporting Limit (MRL) varies from 5 to 200, some results do not have the sensitivity that is required to determine exceedances of the standard (5 ug/L).

Selenium Standard
California Toxics Rule Criteria (USEPA)
Inland Surface Waters: Freshwater Aquatic Life Protection

Parameter	Continuous Concentration (4-day Average)
Selenium	5 ug/L

Fecal Coliform at Outfall #3, PD 1851 AE Wright

Date	Time	MPNM	
8/8/2003	8:50 AM	28,000	!
8/8/2003	1:55 PM	2,400	!
8/13/2003	10:00 AM	13,000	!
8/13/2003	5:35 PM	300	
8/18/2003	10:20 AM	5,000	!
8/18/2003	5:10 PM	3,000	!
8/20/2003	10:15 AM	50,000	!
8/20/2003	5:15 PM	25,000	!
9/5/2003	10:10 AM	13,000	!
9/5/2003	2:15 PM	17,000	!
9/12/2003	10:15 AM	5,000	!
9/12/2003	3:00 PM	7,500	!
9/16/2003	7:25 AM	8,000	!
9/16/2003	12:47 PM	14,000	!
9/16/2003	5:30 PM	1,700	!
9/26/2003	8:30 AM	50,000	!
9/26/2003	12:20 PM	700	!

ND= Nondetectable
"!" indicates exceedance of water quality standards

Bacteria Standard
Draft Total Maximum Daily Loads for Bacteria
Malibu Creek Watershed
California Regional Water Quality Control Board Los Angeles

Parameter	30-Day Geometric Mean	Single Sample
Fecal Coliform	200	400

Total Coliform at Outfall #3, PD 1851 AE Wright

Date	Time	MPNM
8/8/2003	8:50 AM	>1,600,000
8/8/2003	1:55 PM	50,000
8/13/2003	10:00 AM	>1,600,000
8/13/2003	5:35 PM	24,000
8/18/2003	10:20 AM	50,000
8/18/2003	5:10 PM	50,000
8/20/2003	10:15 AM	>1,600,000
8/20/2003	5:15 PM	>1,600,000
9/5/2003	10:10 AM	300,000
9/5/2003	2:15 PM	500,000
9/12/2003	10:15 AM	50,000
9/12/2003	3:00 PM	240,000
9/16/2003	7:25 AM	500,000
9/16/2003	12:47 PM	90,000
9/16/2003	5:30 PM	35,000
9/26/2003	8:30 AM	160,000
9/26/2003	12:20 PM	50,000

ND= Nondetectable

Odor at Outfall #3, PD 1851 AE Wright

Date	Time	Odor
8/8/2003	8:50 AM	None
8/8/2003	1:55 PM	None
8/13/2003	10:00 AM	None
8/13/2003	5:35 PM	None
8/18/2003	10:20 AM	None
8/18/2003	5:10 PM	None
8/20/2003	10:15 AM	None
8/20/2003	5:15 PM	None
9/5/2003	10:10 AM	None
9/5/2003	2:15 PM	None
9/12/2003	10:15 AM	None
9/12/2003	3:00 PM	None
9/16/2003	7:25 AM	None
9/16/2003	12:47 PM	None
9/16/2003	5:30 PM	None
9/26/2003	8:30 AM	None
9/26/2003	12:20 PM	None

Odor
0. None
1. Feces (sewage)
2. Fishy
3. Musty
4. Decay (dead organisms)
5. Ammonia
6. Petoleum
7. Sulfide (rotten egg)
8. Chlorine
9. Other (describe)

Odor Standard
Water Quality Control Plans (Basin Plans)

Undesirable odors in water are an aesthetic nuisance, can impact recreational and other uses, and can indicate the presence of other pollutants.

Waters shall not contain odor-producing substances in concentrations that impart undesirable odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses.

Color at Outfall #3, PD 1851 AE Wright

Date	Time	Color
8/8/2003	8:50 AM	None
8/8/2003	1:55 PM	None
8/13/2003	10:00 AM	None
8/13/2003	5:35 PM	None
8/18/2003	10:20 AM	None
8/18/2003	5:10 PM	Yellow
8/20/2003	10:15 AM	None
8/20/2003	5:15 PM	None
9/5/2003	10:10 AM	None
9/5/2003	2:15 PM	None
9/12/2003	10:15 AM	None
9/12/2003	3:00 PM	None
9/16/2003	7:25 AM	None
9/16/2003	12:47 PM	None
9/16/2003	5:30 PM	None
9/26/2003	8:30 AM	None
9/26/2003	12:20 PM	None

Color
1. None
2. Brown or tan
3. Black
4. White
5. Other (describe)

Color Standard
Water Quality Control Plans (Basin Plans)

Color is primarily an aesthetic consideration, although extremely dark colored water can limit light penetration and cause additional water quality problems.

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Foam at Outfall #3, PD 1851 AE Wright

Date	Time	Foam
8/8/2003	8:50 AM	High
8/8/2003	1:55 PM	Moderate
8/13/2003	10:00 AM	Moderate
8/13/2003	5:35 PM	Moderate
8/18/2003	10:20 AM	Moderate
8/18/2003	5:10 PM	Moderate
8/20/2003	10:15 AM	Moderate
8/20/2003	5:15 PM	High
9/5/2003	10:10 AM	Separated bubbles
9/5/2003	2:15 PM	Moderate
9/12/2003	10:15 AM	Moderate
9/12/2003	3:00 PM	Separated bubbles
9/16/2003	7:25 AM	Separated bubbles
9/16/2003	12:47 PM	None
9/16/2003	5:30 PM	Moderate
9/26/2003	8:30 AM	None
9/26/2003	12:20 PM	Separated bubbles

Foam

0. None
1. Separated bubbles (not greater than 3 inches in diameter)
2. Moderate (more than 3 inches in diameter, less than 1 inch in height)
3. High (1 or more inches in height, diameter is greater than one foot)

Floating Material Standard
Water Quality Control Plans (Basin Plans)

Floating materials can be an aesthetic nuisance as well as provide substrate for undesirable bacterial and algal growth and insect vectors.

Waters shall not contrain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Algae at Outfall #3, PD 1851 A.E. Wright

Date	Time	Algae
8/8/2003	8:50 AM	Dense
8/8/2003	1:55 PM	Dense
8/13/2003	10:00 AM	Dense
8/13/2003	5:35 PM	Dense
8/18/2003	10:20 AM	Dense
8/18/2003	5:10 PM	Dense
8/20/2003	10:15 AM	Dense
8/20/2003	5:15 PM	Dense
9/5/2003	10:10 AM	Dense
9/5/2003	2:15 PM	Dense
9/12/2003	10:15 AM	Dense
9/12/2003	3:00 PM	Dense
9/16/2003	7:25 AM	High
9/16/2003	12:47 PM	High
9/16/2003	5:30 PM	High
9/26/2003	8:30 AM	High
9/26/2003	12:20 PM	High

Percent Cover of Algae:
0. None
1.Light (< 5%)
2. Moderate (5-25%)
3. High (26-50%)
4. Dense (> 50%)

Algae Standard
Draft Total Maximum Daily Loads for Nutrients
Malibu Creek Watershed
US EPA Region 9

Parameter	Algae (% coverage)
Algae	*30

*Thirty percent cover (with greater than 10% frequency) is an indicator for evaluating exessive nuisance algae in creeks.