Protecting Alameda County Creeks, Wetlands & the Bay

cleanwater PROGRAM

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Hayward, CA
94544
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MEMBER AGENCIES:
Alameda
Albany
Berkeley
Dublin
Emeryville
Fremont
Hayward
Livermore
Newark
Oakland
Piedmont
Pleasanton
San Leandro
Union City
County of Alameda
Alameda County Flood Control and Water Conservation District
Zone 7 Water Agency

September 13, 2013

Mr. Bruce Wolfe
Executive Officer
Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland CA 94612

Dear Bruce:

SUBJECT: **SUBMITTAL OF FY 2012-2013 CLEAN WATER PROGRAM AND BASMAA REPORTS PURSUANT TO PROVISION C.16**

As you know, various submission and reporting provisions of the Municipal Regional Stormwater Permit (MRP) authorize Permittee implementation and compliance through coordination of the countywide stormwater program or in a regional collaborative effort. The member agency Permittees of the Alameda Countywide Clean Water Program (Clean Water Program) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with submission of their Annual Reports pursuant to Provision C.16.

Therefore with this letter, I am submitting this Clean Water Program Annual Report along with three Bay Area Stormwater Management Agencies Association regional collaborative reports attached as appendices on behalf of and for the benefit of the Clean Water Program member agency Permittees. By signing this letter on behalf of the Clean Water Program, I certify under penalty of law that these documents and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine imprisonment of knowing violations. [40 CFR 122.22(d)].

Sincerely,

James Scanlin
Program Manager

Attachment: Clean Water Program FY 2012/13 Annual Report

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM FISCAL YEAR 2012/2013 ANNUAL REPORT

MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

Credits

This report is being submitted by the participating agencies in the Alameda Countywide Clean Water Program.

City of Alameda
City of Berkeley
City of Emeryville
City of Hayward
City of Newark
City of Piedmont
City of San Leandro
Alameda County

City of Albany
City of Dublin
City of Fremont
City of Livermore
City of Oakland
City of Pleasanton
City of Union City

Alameda County Flood Control and Water Conservation District
Zone 7 Water Agency

Implementation of the Program coordinated by:

Alameda County Flood Control and Water Conservation District
399 Elmhurst Street, Hayward, California 94544

Report Prepared by:

Clean Water Program Staff
Jim Scanlin, Program Manager
Arleen Feng

and

EOA, Inc.
1410 Jackson Street
Oakland, California 94612

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- BASMAA Regional Supplement: Green Street Pilot Projects Summary Report

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- Construction Site Inspection Tracking Spreadsheet Template
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- BASMAA Regional Supplement for Training and Outreach FY 2012-2013 (including Be the Street Report, BASMAA Media Relations Campaign Final Report and IPM Advocates for Retail Stores Final Report)
- Our Waterful World Insert
- CWP Survey Report
- CWP Press Releases (two)
- Bay Friendly Garden Tours 2013 Final Report
- Bringing Back the Natives Garden Tours Final Report
- Kids for the Bay – "Storm Drain Rangers" Program Final Report
- Caterpillar Puppets – "Watershed Babies Go the Water School" Program Final Report
- ZunZun – "The Musical Watershed" Program Final Report
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Glossary of Abbreviations and Acronyms

ACPWA:	Alameda County Public Works Agency
BAHM:	Bay Area Hydrology Model
BAMBI:	Bay Area Macroinvertebrate Bioassessment Information
BASMAA:	Bay Area Stormwater Management Agencies Association
BMP(s):	Best Management Practices
BOD:	Board of Directors
C.3:	Provision C.3 of MRP- New & Redevelopment
CASQA:	California Stormwater Quality Association
CSG:	Community Stewardship Grant
CW4CB:	Clean Watersheds for a Clean Bay
CWP:	Clean Water Program
DPR:	California Department of Pesticide Regulation
EBMUD:	East Bay Municipal Utility District
EOA:	Eisenberg, Olivieri, & Associates
EPA	Environmental Protection Agency
FY:	Fiscal year (July through June)
I&IDC:	Industrial and Illicit Discharge Control
IPM:	Integrated Pest Management
LID:	Low Impact Development
MRP:	Municipal Regional Stormwater Permit
NDS:	New Development Subcommittee
NPDES:	National Pollutant Discharge Elimination System
PCBs:	Polychlorinated Biphenyls
OWOW:	Our Water Our World
PBDE:	Polybrominated Diphenyl Ethers
PIP:	Public Information and Participation
POC:	Pollutant of Concern
POTW:	Publicly Owned Treatment Works
PSA:	Public Service Announcement
RFP:	Request for Proposal
RMC:	Regional Monitoring Coalition
RMP:	Regional Monitoring Program for Water Quality in the San Francisco Estuary
SAGE:	Sustainable Agriculture Education
SCVURPPP:	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFEI:	San Francisco Estuary Institute
SFEP:	San Francisco Estuary Partnership
SMCWPPP:	San Mateo Countywide Water Pollution Prevention Program
STLS:	Small Tributaries Loading Strategy
SWAMP:	Surface Water Ambient Monitoring Program

Glossary of Abbreviations and Acronyms

WAMS:	Watershed Assessment and Monitoring/Special Studies
Water Board:	San Francisco Bay Regional Water Quality Control Board

1

Executive Summary

Introduction

This report describes the Alameda Countywide Clean Water Program's (Clean Water Program) stormwater pollution prevention and control activities in FY 2012/13 and its activities conducted to assist the Clean Water Program's member agencies to comply with the municipal regional stormwater permit (MRP) adopted in October 2009.

Clean Water Program accomplishments are listed for each of the MRP's Provisions from Provision C.2 through C.15. Similar to previous years, a summary of the technical studies and informational, educational, and promotional products developed during FY 2012/13 is provided in Table 1-1. Table 1-2 briefly describes each component's work in progress. Lastly, Table 1-3 summarizes each agency's participation in the Management Committee and its subcommittees.

The Executive Summary is organized by MRP Provision from C.2 through C.10 and C.15; the Regional Pollutants of Concern section covers Provisions C.11, C.12 and C.14, as well as parts of Provisions C.9, C.10 and C.13.

Summary of MRP Provision Implementation

Provision C.2 Municipal Operations

Most MRP Provision C.2 tasks need to be implemented by each of the Clean Water Program's member agencies. The Clean Water Program helps member agency staff understand the MRP's requirements, and it develops various tools needed to effectively plan, implement, and report on the activities completed.

During this reporting period the Maintenance Subcommittee held a workshop focusing on trash reduction efforts. A training session, *Stormwater Trash Capture Workshop:*

Operations & Maintenance Lessons Learned, was held on October 30, 2012.

Provision C.3 New Development and Redevelopment

The Clean Water Program assists member agencies comply with MRP Provision C.3, New Development and Redevelopment, via meetings and activities of its New Development Subcommittee. Bimonthly meetings of the Subcommittee provide opportunities for member agencies to communicate their needs to the Program and obtain information and tools they need for MRP compliance. The Subcommittee forms work groups for focused effort on specific work products and sponsors training sessions for municipal agency staffs.

In FY 2012/13, the Program focused on assisting the member agencies in complying with Provision C.3.i of the MRP, site design requirements for small projects, which took effect December 1, 2012. Under these requirements, projects that create and/or replace 2,500 to 10,000 square feet of impervious surface and detached single-family home projects which create and/or replace 2,500 square feet or more of impervious surface must install one or more site design measures. These measures include directing runoff into landscaping, capturing and using rainwater in cisterns or rain barrels, or adding pervious paving.

Provision C.3 accomplishments of the Program are summarized below:

- Completed a comprehensive Stormwater Requirements Checklist that incorporates several existing checklists related to C.3/C.6 applicability, LID feasibility/infeasibility, identification of site design and source control measures, treatment measure selection and sizing, and hydromodification management measure selection and sizing into one form;
- Created a Stormwater Checklist for Small Projects to assist municipalities in complying with C.3.i and selecting appropriate site design, source control and construction-phase control measures for small and single family home projects;
- Updated the Model List of Source Control Measures to include example conditions of approval related to labeling of storm drain inlets on private streets, covering fueling areas with sufficient canopy, and BMPs related to copper architectural features;
- Completed a major update to the C.3 Technical Guidance manual (now Version 4.0) to add information related to hydraulic sizing of treatment measures, improved design details for treatment measures, and the new site design requirements for small projects;
- Updated a builder outreach flyer entitled "2012 Update: Stormwater Quality Control Requirements";
- Provided information to and review of the BASMAA regional submittal "Green Street Pilot Projects Summary Report"; and

- Funded (jointly with the Santa Clara and San Mateo stormwater programs) a major update of the Bay Area Hydrology Model to incorporate improved LID treatment measure simulation and other features.

Provision C.4 Industrial and Commercial Site Controls

This section of the report describes the countywide activities conducted to implement the MRP's Provision C.4 Industrial and Commercial Site Controls. Activities summarized in this section were implemented jointly for the benefit of the Clean Water Program's member agencies. The Clean Water Program's role is to help agency staff to develop and use various tools, templates, reporting forms, and other MRP compliance support materials and participate in countywide inspector training workshops.

During this reporting period, the following activities were completed with input and assistance from the Industrial & Illicit Discharge Control (I&IDC) Subcommittee.

- Facilitated regular I&IDC Subcommittee Meetings
- Conducted a training workshop that provided opportunities for classroom and hands on business inspection.

Provision C.5 Illicit Discharge Detection and Elimination

This section of the report describes the countywide activities conducted to help the Clean Water Program's member agencies to implement the MRP's Provision C.5 Illicit Discharge Detection and Elimination. The Clean Water Program's role is to help agency staff to develop and use MRP compliance support materials. This includes acting as a liaison with BASMAA on its continued development of a mobile business educational outreach program and enforcement strategy.

During this reporting period, the following materials and activities were completed with input and assistance from the I&IDC Subcommittee.

- Developed best practices tip sheets for Pools, Spas and Fountains, and Mobile Businesses
- Began developing BMPs for fire sprinkler test water and reviewed the BMP brochure developed by BASMAA on this topic. Worked with fire sprinkler testing companies to evaluate existing BMPs. Additional information is being collected to determine which discharges are suitable for landscape and which discharges need to be directed to the sanitary sewer.
- Continued to track the progress of BASMAA's Maintenance Operations Committee's expansion of BASMAA's surface cleaner training and recognition program to include fleet washers and carpet cleaners.
- Shared information at I&IDC Subcommittee meetings about illicit discharge incidents that provide useful case study type of information.

Provision C.6 Construction Site Control

This section summarizes the accomplishments of the Clean Water Program in helping its member agencies comply with MRP Provision C.6, Construction Site Control. The primary role of the Program in implementing Provision C.6 during FY 2012/13 was to provide a forum at the New Development Subcommittee meetings for agency representatives from throughout the County to share information and discuss issues related to construction site compliance. A workgroup of the Subcommittee also helped to plan the 2013 Construction Stormwater C.6 Training.

Provision C.6 accomplishments of the Program during FY 2012/13 are summarized below:

- Provided a Construction Stormwater C.6. Training on June 11, 2013 to 110 municipal agency representatives;
- Provided a revised Inspection Tracking Spreadsheet Template.

Provision C.7 Public Information and Outreach

Stormwater pollution results from the collective and incremental activities of each person within Alameda County. Thousands of routine, seemingly inconsequential decisions result in the unintended and unanticipated generation of stormwater pollutants. Public Information and Participation (PIP) is essential to minimizing stormwater pollution.

The Provision C.7 implementation actions performed by the Clean Water Program during FY 2012/13 are summarized below:

- Through the BASMAA Regional Media Relations project, conducted six pitches – Pesticides: Exterior Spraying, Don't Burn Holiday Gift Wrap, Single-use grocery bag bans, joint pitch with EPA on the new Greener Pesticides for Cleaner Waterways grant project, Car Washing PSAs, and Green Streets. In all, the six pitches resulted in 50 media placements: 22 on the radio; 27 online (this included radio station and newspaper websites), and one on TV.
- Ordered the following outreach and promotional items for distribution at public outreach events in FY 2012/13:
    - 5,000 "Slappy & Quackers" and the "Protect our Water & Wildlife" activity booklets
    - 15,000 mood pencils with Program logo
    - 5,000 seed packets of drought tolerant plants
    - 10,000 CWP reusable bags
    - 6,000 labels featuring "less-toxic" pest control recipes for spray bottles

- Hosted booths at the Alameda County Fair that was held from June 19, 2013 to July 7, 2013 in Pleasanton.
- Hosted three outreach events to promote the "Be the Street" anti-littering campaign.
- Promoted Watershed Stewardship Collaborative Efforts by awarding funds totaling $5,000 to the Bay Friendly Gardening Tours and the Bringing Back the Natives Garden Tours through the Event Partnership program.
- Promoted Citizen Involvement Events by awarding grants to fund five projects in the amount of $20,024.
- Promoted outreach to school age children by providing $100,000 to five educational programs.

Provision C.8 Water Quality Monitoring

Provision C.8 of the MRP requires Permittees to conduct water quality monitoring and associated projects during the permit term. All water quality monitoring activities required by Provision C.8 are coordinated regionally through the Regional Monitoring Coalition (RMC), a collaborative effort of MRP Permittees under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA). In 2010 Clean Water Program member agencies notified the Water Board in writing of their agreement to participate in the RMC, and that water quality data collection conducted through the RMC would commence by October 2011. The RMC 's comprehensive monitoring plan and regional activities for its implementation were described in BASMAA RMC Regional Monitoring Status Reports provided to the Water Board in March and September of 2011 and 2012.

As required by Provision C.8.g of the MRP, the Program's monitoring activities and results for the first quarter of FY 2012/13 were reported in the Urban Creeks Monitoring Report for Water Year 2012, which was submitted to the Water Board by BASMAA on behalf of the RMC participants in March 2013. The Program's monitoring activities and results for the last three quarters of FY 2012/13 will be reported in the Integrated Monitoring Report (IMR) Part A, which will be submitted by March 15, 2014 in lieu of the Urban Creeks Monitoring Report for Water Year 2012-13 as described in MRP Provision C.8.g.v.

In FY 2012/13, the Program continued Creek Status Monitoring in coordination with the RMC monitoring plan and guidance and submitted data electronically for the previous Water Year 2012 ending on September 30, 2012. The Program also continued Pollutants of Concern (POC) Loads Monitoring at the watershed station on San Leandro Creek selected through the Small Tributaries Loading Strategy as part of an ongoing collaboration between the RMC and the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP).

The Program also continued active participation in the RMP and represented BASMAA in several RMP Work Groups. Additional General Program accomplishments achieved during this reporting period include staff and consultant participation in events organized through the RMC to: 1) ensure consistency among RMC and SWAMP field teams when collecting bioassessment samples and associated habitat measurements, and 2) train staff and consultants of stormwater programs in screening of candidate monitoring sites and data management procedures using the RMC-developed database tools.

Regional Pollutants of Concern

MRP Provisions C.9 through C.14 address pollutants that have been identified as being of regulatory concern for San Francisco Bay and/or local waterbodies. Most of Provisions C.11, C.12 and C.14, as well as parts of C.9, C.10 and C.13, are implemented through BASMAA Regional Projects that are reported in the *BASMAA Regional Pollutants of Concern Report for FY 2012-2013* included in Appendix G.

Provision C.9 Pesticides Toxicity Control

Provisions in C.9 reflect the implementation actions incorporated in the Basin Plan through the Total Maximum Daily Load and Water Quality Attainment Strategy for diazinon and pesticide–related toxicity in urban creeks throughout the Bay Area.

Program accomplishments in FY 2012/13 related to Provision C.9 include the following:

- The Program set up an exhibit at the Alameda County Fair that promoted integrated pest management, including: potential impacts of pesticides on water quality; less-toxic methods of pest control; and, information on the *Our Water Our World* program.
- The Clean Water Program's contractor, Anne Joseph Consulting, implemented the region-wide *Our Water Our World* (OWOW) Integrated Pest Management (IPM) Store Partnership Program in over 30 stores in Alameda County.

Provision C.10 Trash Load Reduction

In FY 2012/13, the Program assisted the member agencies in complying with Provision C.10 of the MRP. This assistance included:

- Through participation in the BASMAA Trash Committee, the Program assisted in the development of a revised baseline trash generation rates model.
- Single-Use Carryout Bag Policy: A Countywide Single-Use Bag Ban was adopted by Alameda County Waste Management Authority (Stopwaste) and went into effect January 2013. As of January 1, 2013, grocery stores and other stores in

Alameda County that sell alcohol or four items, milk, bread, packaged food and soda, can no longer provide single-use plastic carryout bags.

- Be the Street: The Program is participating in the regional Be the Street anti-litter campaign. The effort targets youth (ages 14-24). There has been an enthusiastic response including over 50 submittals to a video contest. The Program has contracted independently with movie theaters in Alameda County to run one of the submitted videos. The video will run on 133 screens in nine theaters during July and August 2013.
- During FY 2012/13, Program staff has worked with Permittees from around the Bay Area and Water Board staff to devise an approach and framework for developing the Long-Term Trash Reduction Plans that are due to the Water Board in February 2014.

Provisions C.11, C.12, C.13, and C.14 Mercury, PCBs, Copper, and Legacy Pollutants

The following highlights accomplishments achieved during this reporting period with active participation by Clean Water Program staff:

- Program staff participated in regional Project Team meetings to implement and monitor pilot projects for controlling mercury and PCB discharges to stormwater from a variety of sources (Provisions C.11/12.c,d,e,f and i).
- Program staff represented BASMAA at meetings of RMP Work Groups planning and conducting studies to address the requirements of Provisions C.11.h, C.12.h and C.13.e.
- The Program conducted monitoring at the Ettie Street Pump Station and initiated an engineering feasibility study for larger scale pretreatment and storage facilities near the Ettie Street Pump Station, and discussed with the East Bay Municipal Utility District (EBMUD) potential plans for a diversion conveyance from the pump station to EBMUD's treatment plant. Program staff also coordinated production of BASMAA reports describing control measures and /or management practices to eliminate or reduce discharges for each of the three pollutant categories as required by Provisions C.14.a.vi-vii.

Provision C.15 Exempted and Conditionally Exempted Discharges

This section of the report describes the countywide activities conducted to help the Clean Water Program's member agencies to implement the requirements of the MRP's Provision C.15 Exempted and Conditionally Exempted Discharges. The Clean Water Program's role is to help agency staff to understand the MRP's requirements and to make available for their use various MRP compliance support materials.

The MRP describes a variety of different types of non-stormwater discharges that may be conditionally exempted. The most extensive tracking, monitoring, and reporting requirements are for planned and unplanned potable water discharges by water purveyors. The only Clean Water Program's member agencies that are water purveyors are the Cities of Hayward, Livermore, and Pleasanton and the Zone 7 Water Agency. Because there are so few water purveyors covered by the MRP, this MRP provision has had a low priority for countywide implementation.

Information about each agency's activities to comply with this MRP provision is contained in the agencies' reports.

TABLE 1-1. CLEAN WATER PROGRAM PROJECTS COMPLETED, TRAINING EVENTS, AND INFORMATIONAL/EDUCATIONAL/PROMOTIONAL PRODUCTS PRODUCED DURING FY 2012/13

Component	Product/Event	Intended Audience	Contact for Obtaining Additional Copies/ Items/Information
Provision C.2	2012 Trash Capture Workshop: The workshop focused on the new MRP trash requirements.	Agency staff	Appendix A
Provision C.3	Stormwater Requirements Checklist	Project applicants and Agency staff	Jill Bicknell, EOA, Inc. (408) 720-8811ext. 1
	Stormwater Checklist for Small Projects	Project applicants and Agency staff	Jill Bicknell, EOA, Inc. (408) 720-8811 ext. 1
	Updated Model Source Control List	Project applicants and Agency staff	Jill Bicknell, EOA, Inc. (408) 720-8811 ext. 1
	Update of C.3 Technical Guidance	Project applicants and Agency staff	Jill Bicknell, EOA, Inc. (408) 720-8811 ext. 1
	Builders C.3 Outreach Flyer – "2012 Update: Stormwater Quality Control Requirements"	Project applicants and Agency staff	Jill Bicknell, EOA, Inc. (408) 720-8811 ext. 1
Provision C.4	November 15, 2012 Annual I&IDC Training	Agency staff	Appendix C
Provision C.5	Mobile Businesses Best Practices Tip Sheet	Automobile detailing and washing, power washing and steam cleaning activities providers.	Lori Pettegrew, EOA, Inc. (510) 832-2852 x112
	Pools, Spas and Fountains Best Practices Tip Sheet	Pool Service Companies	Lori Pettegrew, EOA, Inc. (510) 832-2852 x112
Provision C.6	June 11, 2013 Construction Stormwater C.6 Training	Agency staff	Appendix D
	Updated Inspection Tracking Spreadsheet Template	Agency staff	Jill Bicknell, EOA, Inc. (408) 720-8811 ext. 1
Provision C.7	Promotional Items (pencils, erasers, seed packets, labels, and fact sheets)	Kids, General Public	Jim Scanlin, Clean Water Program Program Manager (510) 670-6548
	Awarded $100,000 in educational services contracts	Students K-12	Jim Scanlin, Clean Water Program Program Manager (510) 670-6548

Component	Product/Event	Intended Audience	Contact for Obtaining Additional Copies/ Items/Information
	Funded five Community Stewardship projects for a total of $20,024	Educators, friends groups, and other community groups	Jim Scanlin, Clean Water Program Program Manager (510) 670-6548
	Awarded $5,000 for Event Partnerships	Educators, friends groups, and other community groups	Jim Scanlin, Clean Water Program Program Manager (510) 670-6548
Provision C.8 Monitoring	Jointly produced BASMAA Regional Monitoring Coalition Urban Creeks Monitoring Report, 3/15/13. (posted on Water Board website).	Water Board staff, Agency monitoring staff, general public	Chris Sommers EOA, Inc (510) 832-2852
	ACCWP Electronic Data Submittal, 1/15/13.	Water Board SWAMP staff, Agency watershed monitoring staff, general public	Arleen Feng ACPWA (510) 670-5575
	2013 SWAMP Bioassessment Field Teams Intercalibration Workshop. (provided location and planning support for)	Program watershed monitoring staff and contractors who will conduct in-stream bioassessment sampling	Chris Sommers EOA, Inc (510) 832-2852
Provision C.9	IPM training workshops for store employees.	Employees of stores participating in the OWOW program.	Appendix E
	IPM tabling events held at garden centers in Alameda County.	Customers of stores participating in the OWOW program.	Appendix E

TABLE 1-2. GENERAL PROGRAM WORK IN PROGRESS AS OF JULY 2013

Component	Project Name	Status
Provision C.3	Additional updates to C.3 Technical Guidance, and forms/checklists as needed	Will complete per direction of New Development Subcommittee
	Participate in BASMAA process to prepare regional "Status Report on Application of Feasibility and Infeasibility Criteria"	In progress – will complete by MRP required submittal date of December 1, 2013.
	2013 New Development Workshop	Scheduled for Fall 2013.
Provision C.7	Educational Services Program	Awarded $100,000 (through RFP process) to fund five educational services programs during FY 2013/14. In FY 2009/10, the Program issued a RFP and selected five organizations for conducting school outreach programs from 2010/11 through 2013/14.
	Event Services Program	Approved awarding $5,000 to fund Bringing Back the Natives Garden Tours and Bay Friendly Gardening Tours during FY 2013/14.
	Community Services Grants	Sent out RFP for FY 2013/14 CSGs. Contracts expected to be awarded in November 2013.
Provision C.8	Regional Monitoring Coalition	Will continue participating in coordination of ongoing monitoring activities and updates to standards and guidance for monitoring, tools for data management.
	Integrated Monitoring Report	Will continue collaborating with other BASMAA agencies on preparation of C.8 portions of Integrated Monitoring Report for submittal by March 15, 2014.
	Creek Status Monitoring	Will complete Year 2 Creek Status Monitoring using Regional Monitoring Coalition guidance and standards, and initiate site evaluation and sampling plans for Year 3 monitoring.

Component	Project Name	Status
	Monitoring Projects	Will continue site-specific studies for three Stressor-Source Identification Projects to follow up on Creek Status trigger results from Water Year 2012.
	Small Tributaries Loading Strategy	Will continue collaborating with RMP in planning and implementation of POC Loads Monitoring, and interpretation of monitoring results.
	POC Loads Monitoring	Will continue operation of monitoring station in San Leandro Creek.
Provision C.10	Trash Load Reduction	Work through BASMAA to continue to develop the Long-Term Trash Reduction Plan approach and assessment methodology
Provision C.11/C.12 Regional Mercury and PCB projects	Clean Watersheds for a Clean Bay (C.11/12.c,d,e,i)	Will continue participating in BASMAA grant project, including planning and implementation of treatment retrofit and sediment removal pilot projects in the Ettie Street Pump Station.
	Pilot Diversion to POTWs (C.11/12.f)	Will continue participating in regional BASMAA coordination and discussions with EBMUD to implement pilot project at the Ettie Street Pump Station.
Provision C.11/C.12 Regional Mercury and PCB projects evaluation and reporting.	Integrated Monitoring Report Parts B and C	Will continue collaborating with other BASMAA agencies on planning and drafting of portions of Integrated Monitoring Report for submittal by March 15, 2014.

TABLE 1-3. MANAGEMENT COMMITTEE AND SUBCOMMITTEE PARTICIPATION[1]

Agency (No. of Meetings)	Management Committee (8)	Policy Level (8)	PIP (6)	Maintenance (1)	New Development (6)	I&IDC (5)	WAMS (2)
Alameda	7	7	6	1	5	1	2
Albany	8	8	1	0	3	0	0
Berkeley	7	7	4	1	4	4	1
Dublin	7	7	5	1	5	5	2
Emeryville	4	4	5	1	5	3	0
Fremont	7	7	5	1	6	2	2
Hayward	8	8	6	0	6	4	2
Livermore	5	5	4	0	6	3	0
Newark	8	8	5	0	5	2	0
Oakland	7	7	6	1	3	3	1
Piedmont	4	4	4	1	2	1	0
Pleasanton	7	7	2	1	6	0	1
San Leandro	8	8	2	1	5	5	0
Union City	8	8	5	0	3	5	0
Unincorporated Alameda County	6	6	6	1	4	5	0
Flood Control District	6	6	0	0	4	5	0
Zone 7	6	6	5	0	0	0	0

Notes:
[1]Total number of meetings for the Management Committee and each subcommittee is indicated in parentheses in the column headings.
Key: PIP Public Information Participation
I&IDC Industrial & Illicit Discharge Control
WAMS Watershed Assessment and Monitoring/Special Studies

2

Provision C.2 Municipal Operations

Introduction

Most MRP-required maintenance tasks need to be implemented by each of the Program's member agencies. The Program helps municipal staff understand the MRP's requirements through Municipal Maintenance Subcommittee meetings and workshops, and develops various tools, such as templates, reporting forms, and other materials needed to effectively plan, implement, and report on the activities completed.

Implementation

The Maintenance Subcommittee accomplishments for FY 2012/13 included a Stormwater Trash Capture Workshop and a Subcommittee Meeting. These accomplishments are described in more detail below.

Trash Capture Workshop

A training session, *Stormwater Trash Capture Workshop: Operations & Maintenance Lessons Learned*, was held on October 30, 2012. The workshop covered several topics, including:

- Lessons Learned from Trash Device Operations and Maintenance: Presentation of experience with large and small devices, how maintenance is handled, effectiveness, and flooding/siting issues.
- Homeless Debris Cleanup Panel: Discussion of mechanisms for cleanup and recommendations for cost and time efficiencies.
- Fremont's Litter and Trash Business Enforcement: Presentation of lessons learned and tools to help keep businesses in compliance.

A total number of 66 maintenance staff members participated in the workshop. Of these, approximately 55 staff members (83%) submitted surveys and evaluations. The average

percent of questions answered correctly increased from 58% pre-workshop to 68% post-workshop. The survey results indicated that the workshop was effective in communicating specific information to this portion of the target audience. Note that percent improvement is dependent upon the difficulty of the survey, as well as the knowledge that staff had prior to participating in the training. The greatest improvements were for questions regarding which land uses have the highest trash loading rate (29% increase) and the frequency of trash capture device maintenance needed (20% increase). The workshop agenda, evaluation summary and survey results are included in Appendix A.

Facilitate Maintenance Subcommittee Meeting

A Maintenance Subcommittee Meeting was held on May 2, 2013, and a total of 13 people attended. Topics covered included the following:

- Updates from BASMAA Municipal Operations Subcommittee
- Long-Term Trash Load Reduction Plans
- Revisions to the Annual Report Requirements
- Annual Workshop (Road Maintenance Training)
- Clean Water Program Website – Materials for Posting
- Priorities for 2013-2014
- Look Ahead to Next Permit Term
- Proposed Schedule for 2013-2014

In FY 2013/14, planned activities include a one-day Road Construction and Maintenance Workshop in the fall, a field trip in the fall or winter, and the annual subcommittee meeting (May 2014).

An attendance list and meeting agenda are included in Appendix A.

BASMAA Participation

Program staff participated in the BASMAA Municipal Operations Committee.

Future Actions

1. The Annual Municipal Maintenance Subcommittee Workshop is scheduled for October 2013.
2. Improve member agencies' staff understanding and provide staff training and guidance materials where needed regarding:
    - Road Construction and Maintenance BMPs

3

Provision C.3 New Development & Redevelopment

Introduction

In FY 2012/13, the Program assisted the member agencies in complying with Provision C.3 of the MRP, with a focus on the December 1, 2012 implementation of the new Provision C.3.i site design requirements for small projects. Under these requirements, projects that create and/or replace 2,500 to 10,000 square feet of impervious surface and detached single-family home projects which create and/or replace 2,500 square feet or more of impervious surface must install one or more site design measures. These site design measures include directing runoff into landscaping, capturing and using rainwater in cisterns or rain barrels, or adding pervious paving.

This assistance has been provided through the New Development Subcommittee, which was chaired by Jim Barse, City of Alameda, from January 2011 through December 2012. Shannan Young, City of Fremont, began serving as Chair in January 2013. Through this Subcommittee, the Program has conducted tasks such as providing training, convening countywide discussion of compliance issues, and updating and preparing new development-related model documents and guidance for member agency use. This chapter describes the Provision C.3 implementation actions during FY 2012/13, as well as planned future actions.

Implementation

The primary accomplishments of the Program related to Provision C.3 implementation during the past fiscal year are listed below, according to applicable MRP provision numbers. These included Program staff's participation in BASMAA's Development Committee to work on regional tasks to assist the Program and its member agencies in meeting the specific requirements of Provision C.3 described below.

Provision C.3.a New Development & Redevelopment Performance Standard Implementation

Update of Existing Forms and Guidance

The Clean Water Program maintains various forms intended to assist member agencies in complying with the Provision C.3.a.i.(2) requirement of having adequate development review and permitting procedures to implement Provision C.3. During FY 2012/13, the Program completed a comprehensive Stormwater Requirements Checklist that incorporates several existing checklists related to C.3/C.6 applicability, LID feasibility/infeasibility, identification of site design and source control measures, treatment measure selection and sizing, and hydromodification management measure selection and sizing into one form. The Program also created a Stormwater Checklist for Small Projects to assist municipalities in complying with C.3.i and selecting appropriate site design, source control and construction-phase control measures for small and single family home projects. The forms were provided to the Program's member agencies to customize for their use in reviewing development project applications. The updated forms are included in Appendix B.

The Program maintains a Model List of Source Control Measures to assist agencies in selecting appropriate source controls for specific projects, based on identified sources of pollutants on a development site. In FY 2012/13, the Model List was updated to include the following example conditions of approval related to source control measures:

- Verifying labeling of storm drain inlets for projects with newly developed, privately maintained streets;
- Covering fueling areas with a canopy that extends a minimum of ten feet or the length of the fueling hose, whichever is greater; and
- Structural and operational best management practices for projects installing and maintaining copper architectural features.

The updated Model List of Source Control Measures (showing the revised or added conditions of approval in tracked changes) is provided in Appendix B.

C.3 Technical Guidance Manual Update

The C.3 Technical Guidance Manual is another important tool to help member agencies meet the C.3.a.i.(2) requirement of having adequate development review and permitting procedures to implement Provision C.3. In FY 2012/13, the Program completed a major update (Version 4.0) of the C.3 Technical Guidance manual to assist applicants and agency staff with implementing the new MRP requirements for small projects and improving implementation of current requirements. The following revisions were included in Version 4.0:

- Chapter 2–Background/Regulatory Requirements: Provided updates and clarifications to the definition of and requirements for regulated projects, and added site design requirements for small projects;

- Chapter 3–Preparing Permit Application Submittals: Updated to be consistent with the new Stormwater Requirements Checklist;
- Chapter 4–Site Design Measures: Added site design requirements for small projects;
- Chapter 5–General Technical Guidance for Treatment Measures: Updated description of methodologies for hydraulic sizing of treatment measures;
- Chapter 6–Technical Guidance for Specific Treatment Measures: Added technical guidance on subsurface infiltration systems, deleted guidance on vegetated buffer strips, and updated guidance for all other treatment measures;
- Chapter 7–Hydromodification Management Measures: Added a section on review of hydromodification control submittals and a hydromodification control plan checklist;
- Appendix C-Example Scenarios and Hydraulic Sizing Worksheets: Added new hydraulic sizing examples and sizing worksheets;
- Appendix J-Feasibility Evaluation: Updated the description of the feasibility analysis for infiltration and rainwater harvesting and use, and included the new Flow Chart of Feasibility and Infeasibility Evaluation Process;
- Appendix K-Special Projects: Added a section describing how to calculate and apply the LID treatment reduction credits for a project.
- Appendix M-Site Design Requirements for Small Projects: Describes the requirements of Provision C.3.i for small projects and single family homes which took effect on December 1, 2012.

The updated C.3 Technical Guidance is available on the Clean Water Program's website at http://www.cleanwaterprogram.org/c3-guidance-table.html?view=item. The table of contents is included in Appendix B.

Outreach Materials

The Program updated its Provision C.3 Builders Outreach piece entitled *2012 Update: Stormwater Quality Control Requirements*, to assist member agencies in complying with the Provision C.3.a.i.(5) requirement of providing educational materials to municipal staff, developers, contractors, and others. The update was needed to provide information about the new requirements for small projects and single family homes that were due to take effect on December 1, 2012. The flyer can be found on the Clean Water Program's website at http://www.cleanwaterprogram.org/resources/resources-development.html and in Appendix B.

Provision C.3.b Regulated Projects

Green Street Pilot Projects

Provision C.3.b.iii requires the completion, by December 1, 2014, of 10 green street pilot projects throughout the Bay region that incorporate LID site design and treatment techniques, and at least two must be located within Alameda County. The following three projects within Alameda County have been identified to meet this requirement:

- The Park and Hollis Stormwater Curb Extension (Emeryville) – A bioretention area constructed in 2010 as part of new corner plaza area in a private project;
- Codornices Creek Restoration Project (Albany) – Four rain garden/bioretention areas constructed in 2011 that treat runoff prior to discharge to Codornices Creek; and
- Stanley Boulevard Safety and Streetscape Improvement Project (unincorporated Alameda County) --LID features to convert three miles of industrial corridor to more rural parkway setting.

The permit also requires that a Green Street Pilot Projects Summary Report describing the ten pilot projects be prepared and submitted by September 15, 2013. The report must also describe the results of the water quality monitoring or modeling performed for each project to determine the estimated reduction in pollutant loading achieved by the project. The report was funded by the Clean Water Program and other stormwater programs through the Bay Area Stormwater Management Agencies Association (BASMAA) as a regional submittal and prepared by BASMAA's contractor, Geosyntec Consultants. Clean Water Program staff reviewed and commented on the pilot project reporting forms and data collection procedures, submitted information on green street projects (with assistance from Emeryville, Albany, and Alameda County staff), and reviewed the draft and final draft reports. The final report was submitted to the Water Board as part of the BASMAA Annual Report FY 2012/13, Regional Supplement for New Development and Redevelopment, by September 15, 2013 and is included in Appendix B of this report.

Provision C.3.c Low Impact Development (LID)

Preparation of the LID Feasibility Status Report

Program staff participated in the initial planning process of the Status Report on Application of Feasibility and Infeasibility Criteria, which is required by Provision C.3.c.iii.(2) and due to the Water Board by December 1, 2013. The outline for the report was submitted with the FY 2011/12 Annual Report (in the BASMAA FY 2011/12 Regional Supplement for New Development and Redevelopment). The report development is still in progress and will be completed in the fall of 2013 prior to the submittal deadline.

Provision C.3.g Hydromodification Management

Bay Area Hydrology Model Support and Update

In 2006, the Clean Water Program collaborated with the Santa Clara and San Mateo countywide stormwater programs to fund the development of the Bay Area Hydrology Model (BAHM), a tool for simulating pre- and post-project runoff conditions and sizing hydromodification control measures to meet permit requirements. During FY 2012/13, the Program continued to maintain the website for the Bay Area Hydrology Model (BAHM) software and guidance, and to give responses or referrals to users' questions.

The original BAHM included simplified methods to simulate the effect of LID treatment measures on runoff hydrology but did not explicitly model the movement of runoff through these measures. During FY 2012/13, the three countywide programs contracted with the BAHM developer, Clear Creek Solutions, to update the BAHM to a Windows 7 platform and to explicitly model LID treatment measures including bioretention, planter boxes, pervious pavement, infiltration basins and trenches, and dry wells. In addition, enhancements were made to the data management, plotting, and reporting features of the BAHM. The updated model and draft User Manual have been provided to the programs for review and will likely be available for use in September 2013. Trainings on the updated model are planned for the fall of 2013.

Provision C.3.i Site Design Measures for Small Projects

C.3.i Checklist

On December 1, 2012, the site design requirements for small projects and single family homes went into effect. As described under C.3.a above, the Program created a Stormwater Checklist for Small Projects to assist municipalities in complying with C.3.i and selecting appropriate site design, source control and construction-phase control measures for small and single family home projects. The form was provided to the Program's member agencies to customize for their use in reviewing development project applications. The form is provided in Appendix B.

Future Actions

The following C.3 implementation actions are anticipated in FY 2013/14:

1. Provision C.3.a: Forms, Guidance, and Training

   The Program plans to update the following forms and guidance:

   - Update the C.3 Technical Guidance to include a new section about green streets, and updated hydraulic sizing worksheets.
   - Update forms and checklists as needed.

The Program will also conduct a New Development Workshop for agency staff in Fall 2013.

2. Provision C.3.b: Green Street Pilot Projects

   Program staff and representatives of agencies developing green streets will continue working with BASMAA to submit the Green Street Pilot Projects Summary Report and respond to any comments from Water Board staff.

3. Provision C.3.c: Feasibility Status Report

   Program staff will participate in the BASMAA process to prepare the regional "Status Report on Application of Feasibility and Infeasibility Criteria" required by Provision C.3.c.iii.(2), which is due to the Water Board on December 1, 2013.

4. Provision C.3.g: Bay Area Hydrology Model (BAHM) Update

   The Program will coordinate with SCVURPPP and SMCWPPP to host trainings on the updated BAHM, as well as conduct a refresher training on the basic concepts of hydromodification management prior to the BAHM trainings.

4

Provision C.4 Industrial & Commercial Site Controls

Introduction

This section of the report describes the Clean Water Program's activities conducted to implement the MRP's Provision C.4 Industrial and Commercial Site Controls. Activities summarized in this section were implemented jointly for the benefit of the Clean Water Program's member agencies. The Clean Water Program's role is to help municipal staff to receive training and to develop and use various tools, templates, reporting forms, and other MRP compliance support materials and participate in countywide inspector training workshops.

Information about each agency's business inspection and educational outreach efforts is contained in the agencies' reports.

During this reporting period the following activities were completed with input and assistance from the Industrial & Illicit Discharge Control (I&IDC) Subcommittee:

- Facilitated regular I&IDC Subcommittee Meetings
- Conducted a training workshop that provided opportunities for classroom and hands on business inspection.

Implementation

The Clean Water Program's primary Provision C.4-related accomplishments during the past fiscal year include the following:

Facilitated Industrial & Illicit Discharge Control Subcommittee Meetings

The I&IDC Subcommittee assists municipalities to implement the MRP's Provision C.4 Industrial and Commercial Site Controls requirements. Martha Aja with the City of Dublin, began chairing the I&IDC Subcommittee in March 2013.

Table 1-3 within Section 1 summarizes agencies' participation during FY2012/13 in the I&IDC Subcommittee. Most agencies regularly attended I&IDC Subcommittee meetings. Representatives from the following 14 agencies attended the majority of the FY 2012/13 subcommittee meetings: Alameda, Berkeley, Dublin, Fremont, Emeryville, Hayward, Livermore, Newark, Oakland, San Leandro, Union City, Union Sanitary District, Alameda County unincorporated (Alameda County Environmental Health) and Alameda County Flood Control and Water Conservation District, and Union Sanitary District (see Appendix C).

The I&IDC Subcommittee meetings provide an opportunity for member agencies to share information useful to implementing the industrial and commercial requirements of the MRP. Highlights from the I&IDC Subcommittee meetings included the following:

- Annual Update to the Green Business Program.
- Presentation on parking garage cleaning from Crystal Cleaning Company. The presentation raised awareness about large garage cleaning operations and the potential volumes of water and waste generated during this activity. Only a few agencies have large parking structures and the wastewater generated from this type of operation is suitable for the sanitary sewer.
- Update on developing Long Term Trash Plans and the applicability to the I&IDC Subcommittee.
- Presentation on the current draft Industrial General Permit (IGP) highlighting significant changes to the IGP. Potential impacts of the revised IGP to agency owned facilities and to the industrial inspection program were discussed.

Staff Training

In order to meet the MRP's requirements for annual training of municipal stormwater inspection staff, the I&IDC Subcommittee held an inspector training workshop on November 15, 2012 titled *Recognizing and Responding to Illicit Discharges* (see Appendix C). The trainers included knowledgeable local agency and consultant staff.

The training was attended by 71 staff and participants that completed an evaluation reported that the workshop met their expectations. The training included presentations about recognizing illicit discharges at commercial and industrial facilities and coordinating with the District Attorney for illicit discharge enforcement cases. The

workshop also provided information on inspecting food trucks and food service facilities. Lunch was catered by a mobile food truck to further allow for instruction on specific inspection procedures covered in the classroom.

Future Actions

The Clean Water Program's activities scheduled for FY 2013/14 include the following:

1. Facilitate the availability of training needed to comply with the MRP's requirements.
2. Participate through BASMAA's Municipal Operations Committee in collaborative activities.

5

Provision C.5 Illicit Discharge Detection & Elimination

Introduction

This section of the report describes the countywide activities conducted to help the Clean Water Program's member agencies to implement the MRP's Provision C.5 Illicit Discharge Detection and Elimination. The Clean Water Program's role is to help municipal staff to develop and use MRP compliance support materials. This includes acting as a liaison with BASMAA on its continued development of a mobile business educational outreach program and enforcement strategy.

Information about each agency's illicit discharge detection and elimination activities is contained in the agencies' reports. During this reporting period the following activities were completed with input and assistance from the I&IDC Subcommittee:

- Developed best practices tip sheets for Pools, Spas and Fountains, and Mobile Businesses
- Began developing BMPs for fire sprinkler test water and reviewed the BMP brochure developed by BASMAA on this topic. Worked with fire sprinkler testing companies to evaluate existing BMPs. Additional information is being collected to determine which discharges are suitable for landscape and which discharges need to be directed to the sanitary sewer.
- Continued to track the progress of BASMAA's Maintenance Operations Committee's expansion of BASMAA's surface cleaner training and recognition program to include fleet washers and carpet cleaners.
- Shared information at I&IDC Subcommittee meetings about illicit discharge incidents that provide useful case study type of information.

Implementation

The primary Provision C.5-related accomplishments of the Clean Water Program during the past fiscal year include the following:

Control of Mobile Sources

During FY 2012/13, the Program developed best practices tip sheets targeting the following to mobile businesses:

- Mobile Businesses: automobile detailing and washing, power washing and steam cleaning activities.
- Pools, Spas and Fountains

These one-page tip sheets provide best practices for proper disposal of wastewater generated during these activities. Stormwater inspectors will use these tip sheets to educate businesses about storm drain protection and proper methods for disposing of wastewaters. Local stormwater agency contacts are also provided on the tip sheets. The tip sheets are available on the Program's Website (www.cleanwaterprogram.org).

The Clean Water Program continued to participate in BASMAA's Municipal Operations Committee and its work to expand the surface cleaner recognition program to include fleet washers and carpet cleaners. A project update is provided in the BASMAA Training and Outreach for FY 2012/13 Regional Supplement included in Appendix E.

Tracking and Case Follow-up

The I&IDC Subcommittee continues to track information about illicit discharge cases that have broad applicability to the group. Some issues discussed during this reporting period included sharing the types of codes and citations used by agencies to enforce stormwater regulations at marinas. The subcommittee also discussed common issues generally found with grease interceptors located in tallow storage areas.

Future Actions

The Countywide Program's activities scheduled for FY 2013/14 include the following:

1. Continue to work with BASMAA's Municipal Operations Committee on its mobile cleaners program. This will include providing input on the BMP outreach and other materials developed as part of the current phase of expansion of BASMAA's surface cleaner training and recognition program.
2. Facilitate the availability of illicit discharge detection and elimination training needed to comply with the MRP's requirements.

6

Provision C.6 Construction Site Controls

Introduction

During the past fiscal year, the New Development Subcommittee continued to support the member agencies in meeting the requirements of Provision C.6, Construction Site Controls. This Subcommittee also assists with implementing Provision C.3, New Development and Redevelopment. More information about the Subcommittee is provided in Chapter 3. The following sections describe the FY 2012/13 actions to assist the member agencies with Provision C.6 compliance and plans for future actions.

Implementation

The primary role of the Program in implementing Provision C.6 during FY 2012/13 was to provide a forum at the New Development Subcommittee meetings for agency representatives from throughout the County to bring issues related to construction site compliance for information sharing, discussion, brainstorming and problem solving. A workgroup of the Subcommittee also helped to plan the 2013 Construction Stormwater C.6 Training. Key accomplishments regarding the implementation of Provision C.6 are described below.

Provision C.6.e Inspections

Revised Inspection Tracking Spreadsheet Template

During FY2012/13, the Subcommittee revised the Construction Site Inspection Tracking Spreadsheet Template to better assist municipalities in tracking data required for the Annual Report and to make the template more user-friendly. Revisions were made the calculated summary formats. The revised template is provided in Appendix D.

Provision C.6.f Staff Training

Construction Stormwater C.6 Training

To assist member agencies in complying with the Provision C.6.f requirement of providing staff training at least every other year on conducting construction stormwater inspections, the Program held a Construction Stormwater C.6 Training workshop on June 11, 2013 at the City of Hayward City Hall. The workshop included information on Provision C.6 requirements, the Statewide Construction General Permit, best management practices for construction sites, inspection tools, and enforcement options. A total of 110 municipal staff and two private consultants attended the workshop. The announcement flyer, agenda, attendance list, and evaluation summary for workshops are included in Appendix D.

To evaluate the effectiveness of the workshop, a pre-workshop survey and post-workshop survey was conducted to measure the change in participants' knowledge as a result of receiving information at the workshop. The eight survey questions covered such topics as inspection frequency, proper BMPs, enforcement actions and defining violations. The percentage of correct answers increased from 61% before the workshop to 88% after the workshop. The detailed survey results are presented in Appendix D.

Future Actions

New Development Subcommittee meetings will continue to serve as a vital countywide forum for information sharing and problem solving regarding Provision C.6 implementation. Additional training or updates to outreach materials may be provided as budget allows.

7

Provision C.7 Public Information & Outreach

Introduction

Stormwater pollution results from the collective and incremental activities of each person within Alameda County. Thousands of routine, seemingly inconsequential decisions result in the unintended and unanticipated generation of stormwater pollutants. Public Information and Participation (PIP) is essential to minimizing stormwater pollution. The Program assists the members in complying with Provision C.7 through the PIP Subcommittee, which was chaired by Patrizia Guccione, City of Alameda in FY 2012/13. The PIP Subcommittee met six times in FY 2012/13 (see Table 1-3 in Section 1 for attendance).

The Chair is responsible for running the Subcommittee's meetings and working with the PIP Coordinator to implement the Subcommittee's decisions. In addition, work groups, consisting of Subcommittee members, help to implement tasks for this provision.

To assist with the implementation of this provision's tasks, PIP Subcommittee members participated in the following work groups during FY 2012/13:

- Educational/Promotional Materials
- Community Stewardship Grants
- Alameda County Fair
- PIP Budget
- Media
- Public Opinion Survey
- Litter Outreach

Table 7-1 at the end of this section provides a brief description of work group tasks and lists participating members.

This chapter describes Provision C.7 implementation actions during FY 2012/13, as well as planned future actions.

Implementation

Provision C.7.b Advertising Campaign

BASMAA Regional Advertising Campaign

During FY 2012/13, the BASMAA Public Information / Participation (PI/P) Committee worked with SGA (consultants) to implement the "Be the Street" anti-litter Youth Outreach Campaign. Be the Street takes a Community Based Social Marketing approach to encourage youth to keep their community clean. The intent of the campaign is to make "no-littering" the norm among the target audience (youth between the ages of 14 and 24).

The Be the Street campaign is using online social marketing tools to conduct outreach. Activities in FY 2012/13 included maintaining the website, Facebook page, and Instagram account. A video contest asking participants to submit their best anti-litter video was also conducted. The Be the Street campaign received 52 entries in response to the contest. The winning video was promoted on television, Pandora (online music site), YouTube, Google, and Facebook. Additional details are provided in the Be the Street Report (an attachment to the BASMAA Training and Outreach for FY 2012/13 Regional Supplement included in Appendix E).

Our Waterful World Newspaper Insert and Online Media Campaign

The Program developed a 4-page insert entitled "Our Waterful World" for Bay Area Newspaper Group papers. The insert promoted the value of clean water and the CWP to the community. The content was designed as a "travelogue" of day-hikes or trips to local areas where water features are essential to the beauty. The insert was combined with an online ad campaign on the Bay Area News Group website, Yahoo.com and Ad Taxi. The insert was included in following Bay Area Newspaper Group papers on June 20, 2013:

- Oakland Tribune
- Fremont Argus
- Hayward Daily Review

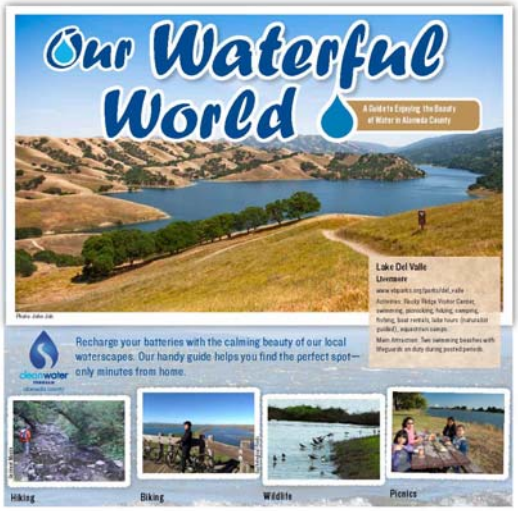

Figure. 7.1. Cover of "Our Waterful World" insert sent out in the Bay Area Newspaper Group papers.

- Piedmonter
- Tri-Valley Herald
- Alameda Times Star

The insert was sent out to 87,000 households. A map of all the places of interest featured in the insert was posted on the Program's website.

Traffic on the Program's website increased by 130% over the previous month as a result of the newspaper insert and online ad campaign. The website received approximately 64% new visitors compared to 56% in the previous month. In addition, a Facebook post about the insert received 2,706 views.

A copy of the insert is included in Appendix E.

Public Opinion Survey

The Program conducted a telephone survey late November and early December of 2012 with 600 residents of Alameda County to determine baseline data on awareness and behaviors related to storm water pollution. Highlights of the survey results are below:

- Approximately 50% of respondents are not aware of local agencies that work to protect local creeks and the Bay. Of respondents that are aware, approximately 5.3% could recall the Clean Water Program.
- 80% of the respondents could recall the "No Dumping Flows to Bay" tagline.
- 64% are aware that storm drains flow to local creeks and the Bay.
- 69% are willing to pay $20/year to support a program that protects local creeks and the Bay.
- Air pollution is considered the most serious environmental issue, followed by water pollution and litter.

A copy of the survey is included in Appendix E.

Provision C.7.c Media Relations

Local Media Relations

The Program worked with outreach consultant, Gigantic Idea Studios (GIS), to conduct the following three pitches (news releases/stories) of local interest in FY 2012/13:

Pick Up a Free Reusable Bag and a New Habit, January 15, 2013 - Using six reusable bag give-away events to create newsworthiness and local interest, the press release highlighted the negative effects of litter, and disposable plastic bags in particular, on local waterways. The release was sent as an e-blast to the Program's contact database (about 260 contacts), and individual pitches were made to specific groups and local media outlets, especially in cities with a scheduled give-away event. The release was positively received and generated good coverage including, but not limited to:

- Livermore Patch (http://livermore.patch.com/articles/free-reusable-bags-for-alameda-county-residents)

- Tri-Valley Times (http://www.contracostatimes.com/tri-valley-times/ci_22420376/free-reusable-bags-be-given-away-dublin-tuesday)
- Around Dublin (http://www.arounddublinblog.com/2013/01/dublin-ca-reusable-bag-giveaway/)
- Secret News (http://www.thesecretnewsonline.com/?p=3035)
- Oakland Local (http://oaklandlocal.com/posts/2013/01/get-free-reusable-bag-pac-n'-save-friday-feb-1)
- City of Emeryville e-newsletter 2/13/13 cover story with photo (no link available)
- Dublin Patch (http://dublin.patch.com/groups/editors-picks/p/free-reusable-bags-for-alameda-county-residents)
- Castro Valley Patch (http://castrovalley.patch.com/groups/events/p/ev--pick-up-a-free-reusable-bag-and-a-new-habit-ef6f07f8)
- Post on City of Oakland's Facebook page with link to CWP Facebook page

Clean Water Program Now Accepting Grant Applications, March 12, 2013 – This press release announced the availability of the 2013 Community Stewardship Grants, provided eligibility criteria and link to the online application. The release also summarized sample projects funded in the past. The release was sent as an e-blast to the Program's contact database, and individual pitches were made to specific groups (e.g., creek groups, neighborhood groups and non-profits working on conservation/water issues), and local media outlets. Coverage included, but was not limited to:

- Facebook post shared by several public library Facebook pages in Alameda county
- Facebook post on the Bay-Friendly Coalition's page
- Around Dublin (http://www.arounddublinblog.com/2013/03/dublin-ca-clean-water-program-community-stewardship-grant/)
- The Alamedan Blog (http://thealamedan.org/blog/community-corner-new-cutter-commander-clean-water-grants)
- Castro Valley Forum (no link available)
- Piedmont Civic Association (http://www.piedmontcivic.org/2013/03/13/grants-available-for-community-based-clean-water-projects/)
- Castro Valley Patch (http://castrovalley.patch.com/groups/announcements/p/an--clean-water-program-now-accepting-grant-applications)
- Shared/forwarded by various organizations including Save The Bay, The Watershed Project, Friends of Sausal Creek, Glenview Neighbors, Estudillo Homes, Bay-Friendly Coalition, Ecology Center, and Merritt College Environmental among others.
- Shared on the following Patch sites: Alameda, Albany, Berkely, Dublin, Fremont, Newark, Piedmont, Pleasanton, Rockbridge, San Leandro, and Union City.

Copies of the press releases are included in Appendix E.

BASMAA Media Relations

In FY 2012/13, BASMAA Media Relations conducted seven pitches on the following topics:

- Pesticides: Exterior Spraying
- IPM Advocates
- Don't Burn Holiday Gift Wrap
- Single-use grocery bag bans
- Be the Street Video Contest
- Car Washing PSAs
- Green Streets

The pitches resulted in 50 media placements: twenty two on the radio; twenty seven online (this included radio station and newspaper websites), and one on TV. Details are provided in the BASMAA Media Relations Annual Report (an attachment to the BASMAA Training and Outreach for FY 2012/13 Regional Supplement included in Appendix E).

Exterior Spraying

O'Rorke (BASMAA Media Relations consultant) used a two-pronged approach for this pitch: radio PSAs and a press release announcing the new regulations. A local press release was also developed. O'Rorke coordinated with the California Department of Pesticide Regulation on the copy/materials and pitch timing. The effort was successful: PSAs aired on two stations; Geoff Brosseau (Executive Directory, BASMAA) was interviewed by KBLX-FM; and SFGate.com, the San Jose Mercury News, the Marin Independent Journal and San Carlos Patch all ran stories.

IPM Advocates

This press release publicized the new trained IPM advocates in stores. Promoted as a boon to consumers, this pitch did well with stories running on both Rockridge and Piedmont Patch. A local release was also developed. KATD, A Spanish language radio station, interviewed Riccardo Barajas of San Jose and copy from the release was carried in PSA format by KCBS and KDIA.

Holiday Pitch

O'Rorke developed a press release dealing with various holiday water pollution prevention issues, including not burning gift wrap and setting out trees for post-Christmas recycling without flocking. A local release was also developed. This pitch took off with the help of photos and was carried by twelve Bay Area Patch.com sites, SFGate.com, Claycord.com, KMKY (Radio Disney), KOIT, KBLX, KFOX and news powerhouse, KCBS.

Bag Ban
This pitch focused on new and recent bag bans in cities around the region, including San Francisco's upgrade to including more stores in its ban. The pitch featured a press release and courtesy photos. A local release was also developed. Information ran on KBAY, KCBS and on eight Bay Area Patch.com sites.

Be the Street
Coordinating with SGA, O'Rorke pitched the online awards ceremony and looked at potentially promoting Bay Area contest award winners. O'Rokre developed a media advisory for the online awards and made pitch calls to all major Bay Area media; a lack of local award winners curbed interest. No coverage was secured.

Car Washing PSAs
These PSAs encouraged use of car washes as a way to prevention stormwater pollution. O'Rorke also developed a press release for use by local programs. The PSAs were aired by eleven radio stations, including the immensely popular KLLC, KCBS and KITS.

Green Streets
This pitch was focused on reaching out to select media: architecture, urban planning and some environmental reporters. No press release was issued, but a detailed pitch letter was sent along with photos highlighting Green Streets as an emerging trend in the Bay Area. As of this writing, no coverage had been secured yet. Additional follow-up is planned.

Provision C.7.d Stormwater Point of Contact

This provision requires Permittees to individually or collectively create and maintain a point of contact (e.g., phone number or website) to provide the public with information on watershed characteristics and stormwater pollution prevention alternatives.

Program Website

The Program continued to maintain its website (www.cleanwaterprogram.org) in FY 2012/13. The Program's website was published in the "Our Waterful World" newspaper insert that went out to 87,000 homes in Alameda County. The website was also promoted in online ads that ran on the BANG website, Yahoo.com and Ad Taxi. It is also published on most promotional materials and giveaways (e.g., pencils, reusable totes, seed packets, etc.).

Social Networking
The Program's Facebook page launched in Sep 2012 with multiple posts and photos about member agencies' Coastal Cleanup Day activities. Facebook offers a new avenue for the Program to share information with Alameda County residents. The Facebook page currently has 117 followers.

Provision C.7.e Public Outreach Efforts

Outreach Materials

The Program ordered the following outreach and promotional items for distribution at public outreach events in FY 2012/13:

- 5,000 "Slappy & Quackers" and the "Protect our Water & Wildlife" coloring booklets
- 15,000 mood pencils
- 5,000 seed packets
- 10,000 CWP reusable bags
- 6,000 labels featuring "less-toxic" pest control recipes for spray bottles

Figure. 7.2. Clean Water Program's Reusable Bag

In addition, the Program purchased two Be the Street photo booths (backdrop and stand).

Litter-themed Outreach Materials

The Program developed materials for a litter-themed outreach booth. The outreach materials included the following: pledge poster, outreach activity poster, and two games ("True…or Rubbish" and "What's in Our Water?"). Local agencies used these materials at fall outreach events to raise awareness about the impact of litter on local water bodies.

The PIP Subcommittee also formed a Litter Outreach work group to plan enhanced outreach on litter for implementation in FY 2013/14.

Earth Day 2013 Frog-Themed Outreach Materials

The Program developed new "frog-themed" outreach materials for use at local agency Earth Day outreach events. The materials aimed to show the impact of stormwater pollution on frogs and what the public can do to prevent it. The materials included the following:

- Games for kids – "Frog-quently asked questions" (a multiple choice quiz), "Fact of Frog-Tale" (True of False quiz), and an interactive game where kids will identify and remove pollutants from a creek background.
- Crafts – Build an origami frog and build a frog visor
- Informational poster and handouts

Be the Street Outreach Events

The Program conducted three Be the Street events in October 2012. The primary goal of the events was to invite youth aged 14-24 to take photos in front of the "Be The Street" banner/backdrop, and to interact with the campaign's Facebook page once the photos were uploaded, by liking the page, and by tagging, liking, commenting on and sharing

individual photos. A secondary goal was to promote the video contest and gather signups for the campaign's e-newsletter.

The events were conducted at the First Friday event in Oakland, a high school football game in Hayward, and a Teen Improv Theatre event in Pleasanton. The events were well attended and led to increased interactions on the Be the Street Facebook page.

Alameda County Fair

The Program hosted a booth at the Alameda County Fair held from June 19, 2013 to July 7, 2013 in Pleasanton. Approximately 391,426 fairgoers attended the fair this year. Cynthia Butler from Alameda County was instrumental in making sure the booth was well maintained and well stocked with promotional and educational items.

The Program worked with Gigantic Ideas Studios to update the booth. The booth was updated to include more interactive signs and an updated scavenger hunt game that included a contest. The concept was to show booth visitors how their pest control choices impact wildlife and water quality. The booth received the following prizes:

- Overall – 1st Place
- Best of Class Invitational Exhibit – 1st Place
- Educational Value Invitational Exhibit – 1st Place
- Appearance Invitational Exhibit – 2nd Place
- Adherence to Theme Invitational Exhibit – 2nd Place

Figure 7.3- Program's booth at the 2013 Alameda County Fair

Several city representatives staffed the booth on Fridays and weekends and disseminated stormwater pollution prevention messages by interacting with booth visitors and distributing promotional items and educational materials such as IPM fact sheets, and other stormwater related educational materials.

The County Fair, with its large and diverse audience, continues to be an effective way for the Program to get its message across to a wide variety of people and not just those who are already savvy to environmental issues.

Our Water Our World Store Partnership Program

The Program is an active participant in the Regional Our Water Our World (OWOW) Store Partnership Program. Thirty three nurseries and retail stores in Alameda County participate in the OWOW Program. The Program provides less-toxic pest management fact sheets to these stores for distributing to customers. In addition, store shelves are tagged with shelf tags that identity less-toxic pest control products.

In FY 2012/13, the Program continued to contract with Ms. Annie Joseph (IPM Consultant) to provide training to store employees on integrated pest management techniques and available less-toxic pest control products. Ms. Joseph conducted trainings for 147 employees representing 18 stores. An additional 150 employees were trained at a Home Depot Livermore Road Show. Additional information on these trainings is included in Section 9 of the FY 2012/13 Annual Report.

Provision C.7.f Watershed Stewardship Collaborative Efforts

Event Partnership Program

The Clean Water Program promoted Watershed Stewardship Collaborative Efforts by awarding funds for FY 2012/13 through its Event Partnership program. The Clean Water Program awarded grants in the amount of $5,000 to the following events:

- Bringing Back the Natives Garden Tour held on May 5, 2013. The tour showcases pesticide-free, water-conserving gardens that reduce solid waste, provide habitat for wildlife and contain 50% or more native plants.
- Alameda County Waste Management Authority (StopWaste) for Bay-Friendly Gardening Tour showcases private residential gardens that demonstrate gardening techniques appropriate for local conditions. The tour was held on April 28, 2013.

Table 7-4 at the end of this section provides a summary including event descriptions and number of participants reached. Copies of the final reports for the above listed programs are included in Appendix E.

The Bay-Friendly Gardening Tours attracted approximately 1,300 people. It featured 24 host gardens in Alameda County.

A post tour e-news and survey was sent to the 515 participants who provided email addresses. The survey response rate was nearly 20% with 93 completed surveys. Overall,

results indicate a high level of satisfaction with the tour and a continued interest in learning about Bay-Friendly practices:

- 99% would recommend the tour to a friend, neighbor or fellow gardener.
- 95% rated the quality of the gardens as excellent or good.
- 77% were more interested in adopting Bay-Friendly practices at home after the tour.
- 71% were most interested in learning about conserving water, 67% were looking for general inspiration, and 64% were interested in natural gardening techniques.
- 83% were most interested in visiting native plant gardens; followed by 77% for drought tolerant gardens and 53% for edible gardens.

The Bringing Back the Natives Gardening Tours final report contains an extensive effectiveness evaluation component. Some highlights of the tour are provided below:

- Estimated overall attendance at the event was 5,773 registrants.
- 2,245 registrants were from cities located in Alameda County.
- 12,831 garden visits were made on the day of the tour
- Evaluations of repeat registrants from the 2013 tour showed that after attending a prior Bringing Back the Natives Garden Tour: 19% of respondents incorporated natives into their gardens (thereby reducing herbicide use and conserving water); 13% were encouraging wildlife with plant choices; 14% grouped plants by water needs and incorporated drought-resistant plants into their gardens; 10% increased the density of plantings to out-compete weeds (reducing herbicide use and conserving water); 10% were tolerating some insect damage; 8% had begun mulching; 10% had amended their soil; 8% had reduced the size of their lawn; 6% had reduced or eliminated pesticide use; 10% had installed efficient irrigation; 3% were grasscycling; 3% were composting; and 4% had reduced the amount of hardscape in their gardens.

Provision C.7.g Citizen Involvement Events

<u>Community Stewardship Grant (CSG) Program</u>

The FY 2012/13 Community Stewardship Grant Program chose five projects for funding in August 2012 for a total of $20,024 in small grants. These projects are:

- Christensen Middle School - Coastal Clean-Up Day, Adopt A Creek Spot Event
- Friends of Leona Canyon - Friends of Leona Canyon and Lion Creek Pollution Abatement Program
- Cycles of Change - Green Cleaning in the Oakland Unified School District

- Sustainable Agriculture Education (SAGE) and the Sunol Ag Park - Youth Bridging Nature and Agriculture: Growing Hedgerows at the Sunol Ag Park
- The Watershed Project - The Watershed Project's Riparian Lab

The Clean Water Program has incorporated an evaluation component into all its funded programs. To be eligible for funding through the Community Stewardship Grant program, applicants have to demonstrate how they plan to evaluate the effectiveness of their project. Table 7-4 includes a summary of the projects funded in FY 2012/13. The final FY 2012/13 Community Stewardship Grant Program reports will be available in November 2013.

Provision C.7.h School-Age Children Outreach

Educational Services Program

One of the Clean Water Program's major accomplishments is the education of students and teachers about their local creeks, storm drain systems, and watersheds, as well as the encouragement of stormwater pollution prevention and watershed stewardship. In FY 2009/10, the Program issued a RFP and selected the following five organizations for conducting school outreach programs from 2010/11 through 2013/14:

- Kids for the Bay - "Storm Drain Rangers"
- Caterpillar Puppets - "Watershed Babies Go the Water School"
- ZunZun - "The Musical Watershed"
- Livermore Area Recreation and Park District - "Watershed Education"
- Golden Gate Audubon Society - "Eco-Oakland"

Table 7-3 at the end of this section provides a concise summary including brief program descriptions, targeted audience, and number students/teachers reached. In addition, copies of the final reports for the school outreach programs are included in Appendix E.

Highlights of the effectiveness evaluation conducted by these organizations are provided below.

- The "Storm Drain Rangers" conducted programs at eight schools this year. Four hundred and five students received the program along with fifteen teachers.
- Joe and Ronna Leon of Caterpillar Puppets presented 75 classroom assemblies in FY 2012/13 and offered the following quotes from teachers:
    - "Perfect. My kids really enjoyed it." Teacher, Hesperian Elementary
    - "Very informative and creative." Teacher, E. Oakland Leadership Academy
    - "I like puppets too. And I tell my parents to not waste that much water every day." Student, Jonathan Elementary.

  - "Wonderful presentation." Teacher, Ardenwood Elementary.
- ZunZun performed 32 assemblies at 22 schools reaching approximately 10,360 students. They offered the following quotes from teachers via electronic evaluations about the "The Musical Watershed" assembly:
  - This was one of the most enjoyable, entertaining, and educational assemblies I've seen. Thank you so much for presenting this to our school. My students were humming/singing the songs for several days afterwards.
  - I think it was the best program I've seen yet on this topic, and I've seen several. They really got the point across about the storm drains in a more personal, action way. They gave the children great suggestions
- The Golden Gate Audubon Society reported that 92% of the students surveyed at the end of the year-long program knew ways to help keep the environment clean, and 87% of the students correctly identified storm drains as the main point of entry for trash entering the San Francisco Bay. The Program reached 1,370 students and 13 teachers in six schools. They also provided the following quote from a teacher: "This program is absolutely wonderful and instills such important environmental stewardship within our children and family members by providing them with opportunities to which they may have never had access. I can see the obvious changes in my students' attitudes toward the environment. I feel fortunate to be a part of this program."

Future Actions

The following actions are anticipated in FY 2013/14:

1. Continue to hold PIP Subcommittee meetings;
2. Continue the Educational Services Grant Program;
3. Continue the Event Partnership Program;
4. Continue the Community Stewardship Grant Program; and
5. Continue to update and create new outreach and educational materials.

TABLE 7-1. PIP WORK GROUP PARTICIPATION IN FY 2012/13

Type of Work Group	Work Group Accomplishments	PIP Representatives	Agencies
Educational /Promotional Materials	Determined types and quantities of educational materials to order and distribute during the year. Assisted with the design and content of promotional and educational materials.	Kristin Hathaway	Oakland
		Martha Aja	Dublin
		Patrizia Guccione	Alameda
		Barbara Silva	Fremont
		Barbara Kusha	Zone 7 Water
Alameda County Fair	Worked with consultant to determine changes to the County Fair Booth.	Barbara Kusha	Zone 7 Water
		Martha Aja	Dublin
		Cynthia Butler	Alameda County
		Jim Scanlin	CWP
		Patrizia Guccione	Alameda
		Corinne Ferreyra	Hayward
FY 2013/14 PIP budget	Developed FY 2013/14 PIP Budget.	Kristin Hathaway	Oakland
		Barbara Silva	Fremont
		Jim Scanlin	CWP
		Patrizia Guccione	Alameda
Community Stewardship Grants	Selected five community projects for funding in FY 2012/13.	Kristin Hathaway	Oakland
		Barbara Silva	Fremont
		Martha Aja	Dublin
		Lynna Allen	Livermore
		Jim Scanlin	CWP
		Corinne Ferreyra	Hayward
		Danile Akagi	Berkeley

Type of Work Group	Work Group Accomplishments	PIP Representatives	Agencies
Media	Reviewed press releases for pitching to local media outlets.	Barbara Silva	Fremont
		Barbara Kusha	Zone 7 Water
		Patrizia Guccione	Alameda
		Jim Scanlin	CWP
Public Opinion Survey	Developed the FY 2013/14 Baseline Public Opinion Survey	Cynthia Butler	Alameda County
		Barbara Silva	Fremont
		Martha Aja	Dublin
		Cynthia Butler	Alameda County
		Barbara Silva	Fremont
Litter Outreach	Planned enhanced litter outreach activities for implementation in FY 2013/14	Kristin Hathaway	Oakland
		Jim Scanlin	CWP
		Patrizia Guccione	Alameda
		Corinne Ferreyra	Hayward
		Martha Aja	Dublin
		Lynna Allen	Livermore

TABLE 7-2. EVENT PARTNERSHIP PROGRAM FY 2012/13

Name of Project Group	Name of Event	Brief Event Description	Participants
Kathy Kramer Consulting	Bringing Back the Natives Garden Tours	Showcase pesticide-free, water-conserving gardens that reduce solid waste, provide habitat for wildlife and contain 50% or more native plants. The tour included 18 gardens in Alameda County.	5,773 registrants
StopWaste	Bay-Friendly Gardening Tours	Self-guided tour of private residential gardens that demonstrate gardening techniques appropriate for local conditions. Includes stops for buying locally grown plants, neighborhood garden clusters, and noontime talks.	1,300 people

TABLE 7-3. EDUCATIONAL SERVICES PROGRAMS FY 2012/13

Name of Program (*Name of Organization*)	Type of Program	Brief Program Description	Target Audience	Approximate Number of Students/Teachers[1]
Eco-Oakland *(Golden Gate Audubon Society)*	In-Class Presentations and Field Trip	Eco-Oakland is an education program consisting of the following components: 1) Introduction to Watershed/Stormwater Pollution (in-class); 2) Schoolyard Ecology (in-class); 3) California Native (in-class); 4) Local Creek Field Trip; and 5) Arrowhead Marsh Field Trip.	Educators Grades 3-5	Approximately 1,375 students and 13 teachers

[1] Numbers of students/teachers reached were taken from the final report provided by each individual educational program.

Name of Program (*Name of Organization*)	**Type of Program**	**Brief Program Description**	**Target Audience**	**Approximate Number of Students/Teachers**[1]
Storm Drain Rangers *(Kids for the Bay)*	In-Class Presentations	To educate Alameda County students about watersheds, stormwater pollution, and stormwater pollution prevention, the Storm Drain Rangers program consists of the following three lessons: 1) Our Watershed; 2) Taking Action for a Healthy Watershed; and 3) Becoming a Storm Drain Ranger.	Educators Grades 3-5	15 educators and 405 students
The Musical Watershed (*ZunZun*)	Assembly	Musical assembly that educates students and their teachers on watersheds and urban runoff pollution through audience participation. All assemblies are performed in English and Spanish, with a greater emphasis on Spanish whenever needed.	Grades K-5	Approximately 10,360 students
Watershed Education (*Livermore Area Recreation and Park District*)	In-Class Presentations	A series consisting of the following three watershed education programs for 4th and 5th grade students in Livermore, Pleasanton, and Dublin: 1) Water Flows: A look at Watersheds - Students learn about watersheds; 2) Stream Life I - A program to prepare students for a field trip to a local creek; and 3) Stream Life II - Students explore a local stream and get a hands-on experience assessing stream health by testing the water and catching and recording numbers of aquatic animals.	Grades 4-5	2,463 students

Name of Program (*Name of Organization*)	Type of Program	Brief Program Description	Target Audience	Approximate Number of Students/Teachers[1]
Watershed Workout , Froggy to the Rescue *(Caterpillar Puppets)*	Assembly	Engaging puppet shows that introduce students to watersheds and stormwater pollution and ways they can help to prevent it.	Grades 1-3	6,396 students

TABLE 7-4. COMMUNITY STEWARDSHIP GRANTS FY 2012/13

Project Group/School	Project Title	Brief Project Description
Christensen Middle School	Coastal Clean-Up Day, Adopt A Creek Spot Event	The primary goals of this project are to provide water quality education and creek stewardship opportunities for community members in the Tri-Valley area through the new Adopt A Creek Spot (AACS) program. The new AACS website (funded by the grant) and other coordinating activities by the Educational Program Work Group (a collaborative group of agency staff, creek group volunteers and educators) will provide support for the 1st Coastal Cleanup Day event to be held on September 15, 2012 at several AACS sites in Livermore. The day will include an initial orientation event, volunteers working at several cleanup sites, a specific education activity at each site, and a concluding event for tallying of trash collected. Those attending the Coastal Cleanup Day will be encouraged to continue their efforts by adopting spots and continuing to volunteer in succeeding workdays. Permanent signage for the AACS sites will be created and installed using grant funds. 75 local students are expected to volunteer for the Coastal Cleanup Day event, with an expected total of 200 volunteers- both individuals and groups.

Project Group/School	Project Title	Brief Project Description
Cycles of Change	Green Cleaning in the Oakland Unified School District	A storm water pollution prevention curriculum will be developed by Cycles of Change staff in close coordination with Oakland's Castlemont High School teachers. The curriculum will be implemented through hands-on projects, field trips and lessons taught to Castlemont students.
Friends of Leona Canyon	Friends of Leona Canyon and Lion Creek Pollution Abatement Program	This project will include installation and maintenance of sturdy trash cans, with appropriate signage, at the Leona mural wall at the Campus Drive overcrossing of Leona Creek near Merritt College in order to encourage graffiti artists to leave their spray paint cans in the trash cans rather than in the creek. The group will identify the types of heavy duty trash cans that would work best, and the can installation will be done with input from the city. The Friends group will empty the trash cans and place the bags of waste material along the street for pickup from the city.
The Watershed Project	The Watershed Project's Riparian Lab	The Riparian Lab is a free 16-week after-school environmental education program at Lincoln Elementary School in Oakland's Chinatown that provides children who have few opportunities (and whose schools are faced with budget cuts) to experience nature and learn the joy of being proud environmental stewards of their watershed. It will be run with the Oakland Asian Student Education Services LEAP program at Lincoln Elementary, and will be part of a science-based enrichment class during their after-school program. The program will involve field trips to creeks and other watershed resources, hands-on activities, games and projects.

Project Group/School	Project Title	Brief Project Description
Sustainable Agriculture Education (SAGE) & the Sunol Ag Park	Youth Help Bridge Nature and Agriculture: Growing Hedgegrows at the Sunol AgPark	Area high school students will work as a team to learn about, design and build a functional hedgerow of native vegetation at SAGE's Sunol Ag Park, giving them the opportunity for hands-on experience and discovery of enduring lessons about watershed ecology and sustainable agriculture. Participants will make at least four visits to the farm for learning and work, and over time will enjoy the satisfaction of seeing their own efforts transform an underutilized strip of farmland into a vital ecological feature of the Ag Park and its surrounding watersheds.

8

Provision C.8 Water Quality Monitoring

Introduction

Provision C.8 of the MRP requires Permittees to conduct water quality monitoring and associated projects during the permit term. All water quality monitoring activities required by Provision C.8 are coordinated regionally through the Regional Monitoring Coalition (RMC), a collaborative effort of MRP Permittees under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA). Many of the tasks for compliance with provisions in C.8 are conducted as BASMAA Regional Projects, with scopes and budgets approved by the BASMAA Board of Directors (BOD) and implemented through the BASMAA Monitoring and Pollutants of Concern Committee (MPC) and RMC Work Group.

Implementation

As required by Provision C.8.g of the MRP, all Monitoring efforts and results are to be documented in a separate report submitted March 15th of each year, which covers all data collected during the Water Year ending on September 30th of the previous year. Therefore the Program's monitoring activities for the first quarter of FY 2012/13 were reported in the Urban Creeks Monitoring Report for Water Year 2012, which was submitted by BASMAA on behalf of the RMC participants in March 2013, and is available at http://www.swrcb.ca.gov/rwqcb2/water_issues/programs/stormwater/UC_Monitoring_Report_2012.pdf.

The Program's monitoring activities for the last three quarters of FY 2012/13 will be reported in the Integrated Monitoring Report (IMR) Part A, which will be submitted by March 15, 2014 in lieu of the Urban Creeks Monitoring Report for Water Year 2012-13 as described in MRP Provision C.8.g.v.

Provision C.8.a Compliance Options

Provision C.8.a of the MRP allows Permittees to address monitoring requirements through a "regional collaborative effort". In a November 2, 2010 letter to Permittees, the Water Board's Assistant Executive Officer (Thomas Mumley) acknowledged that all MRP Permittees have opted to conduct monitoring required by the MRP through the RMC. The letter noted that monitoring coordinated through the RMC must begin by October 2011, with the first Urban Creeks Monitoring Report due in March 2013.

In response to the Assistant Executive Officer's request, the BASMAA RMC provided BASMAA RMC Regional Monitoring Status Reports in March and September of 2011 and 2012 which described the RMC Work Plan and regional activities for its implementation. In FY 2012/13 Representatives of the Clean Water Program and other programs continued to coordinate RMC activities through the RMC Work Group and the MPC.

Provision C.8.b San Francisco Estuary Receiving Water Monitoring

The Program fulfilled this provision by continuing its fair-share annual contributions to the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) in 2011 and 2012 (see Table 1 of the Urban Creeks Monitoring Report). The Program participated in stakeholder oversight of the RMP through BASMAA representation on the Steering and Technical Review Committees. Program staff actively participated as a BASMAA representative to the following RMP work groups:

- Sources, Pathways and Loadings Work Group;
- Contaminant Fate Workgroup; and
- Exposure and Effects Work Group.

Provision C.8.c Creek Status Monitoring

The Program's active participation in RMC activities for this provision during the reporting period included:

- Program staff and consultants implemented Creek Status Monitoring in coordination with other RMC programs and according to the seasonal requirements in MRP Table 8.1.
- Program staff participated in monthly meetings of the RMC Work Group to discuss monitoring results and coordination issues.
- Program staff and consultants participated in an RMC-sponsored intercalibration workshop to ensure consistency among RMC and SWAMP field teams in the interpretation of field procedures for collection of bioassessment samples and associated habitat measurements.

- Program staff and consultants participated in periodic meetings to coordinate screening and evaluation of candidate monitoring sites provided by the regional monitoring design and to train consultant staff in data entry and management procedures using the database and quality assurance tools developed through the RMC.

Provision C.8.d Monitoring Projects

Provision C.8.d of the MRP requires three types of monitoring projects:

1) Stressor/Source Identification Projects (C.8.d.i);
2) BMP Effectiveness Investigations (C.8.d.ii); and,
3) Geomorphic Projects (C.8.d.iii).

Based on MRP compliance schedules for these provisions, FY 2012/13 efforts by the Program and the RMC focused on selecting and scoping Stressor/Source Identification (SSID) Projects to follow up on Water Year 2012 monitoring results that reached "trigger" thresholds defined in MRP Table 8.1.

Per MRP Provision C.8.d.i, the initial step in the SSID process is a stepwise site-specific evaluation to identify the cause(s) of the observed trigger; this step shall be initiated as soon as possible and must begin no later than the second fiscal year following the sampling event that triggered the project. To ensure a coordinated approach to conducting the SSID studies, the RMC developed a joint process for evaluating trigger results and selecting priority sites for up to 10 SSID projects throughout the region. The Program's FY 2012/13 activities for this provision included:

- Program staff and consultants participated in the regional selection process which prioritized three follow-up SSID projects at Alameda County sites, and began planning and implementation of follow-up monitoring in conjunction with applicable Permittees:
    - 204CRW030 on Crow Creek was triggered by low dissolved oxygen during September 2012. The Program's monitoring plan developed for FY 2013/14 includes initial assessment of dissolved oxygen at several locations within the creek and tributaries, as well as water quality monitoring to assess nutrient inputs.
    - 204R00084 on Dublin Creek was triggered by a combination of "very Poor" biological community quality, as indicated by Index of Biological Integrity (IBI) scoring, and elevated sediment concentrations of multiple chemicals that could produce toxicity, although no significant toxicity was observed. The Program's FY 2013/14 monitoring plan focuses on analyzing sediment chemistry at sites with varying levels of urban influence in the watershed. Bioassessment data collected at two

additional sites in spring 2013 will test the hypothesis that habitat quality of engineered channels is the main determinant of low IBI scores.

  - 204R00047 on Castro Valley Creek was also triggered by a combination of "very Poor" IBI score and elevated sediment chemical concentrations. The Program's FY 2013/14 monitoring plan focuses on analyzing sediment chemistry at sites with varying levels of urban influence in the watershed.

- Staff from the Clean Water Program and other RMC stormwater programs actively participated in clarifying the scope for a regional project to develop guidance for design of site-specific studies for Stressor/Source Identification.

The Program's approach to monitoring projects required by Provisions C.8.d.ii and iii builds on collaboration with other regional initiatives. The Program's FY 2012/13 activities for these provisions included:

- Program staff and consultants conducted limited monitoring at the Ettie Street Pump Station as described for Provision C.11.f while coordinating with the Clean Watersheds for a Clean Bay (CW4CB) development of a monitoring study design for evaluating the effectiveness of treatment retrofit projects in accordance with Provisions C.11/12.e. The Program will fulfill the requirements of Provision C.8.d.ii by augmenting the planned FY 2013/14 CW4CB monitoring with laboratory analyses to include the range of pollutants found in urban runoff at the POC monitoring stations.
- Program staff and consultants obtained GIS shapefiles for the 2011 Green Solution Project, which fulfills the requirement for Provision C.8.d.iii(2) by providing an inventory of potential Alameda County locations for retrofit measures to mitigate stormwater pollution or hydrologic impacts. The Program will use these data for a more specific presentation of potential sites for decentralized landscape-based stormwater retention retrofits within the San Lorenzo Creek watershed. This presentation will also incorporate any insights or formatting recommendations from the initial phases of the San Francisco Estuary Partnership's Proposition 84-funded development of tools to support Green Infrastructure Master Planning processes,

Provision C.8.e Pollutants of Concern Monitoring

In a regional collaboration with the RMP, the Program and other Permittees are pursuing an alternative approach to answering the information needs identified in MRP Provision C.8.e, as allowed by the MRP. In FY 2012/13, the Program actively participated in this collaborative process in the following ways:

- Program staff participated in the Small Tributaries Loading Strategy (STLS) Work Group, in which BASMAA, Water Board staff and scientists from San Francisco Estuary Institute (SFEI) coordinate an alternative monitoring approach to the locations and methods for POC Loads Monitoring described in Provision C.8.e.

- The Program continued POC Loads Monitoring at a watershed station on San Leandro Creek, which was set up and operated by SFEI in the previous Water Year 2012.
- Program staff coordinated a 2012 update to the STLS Multi-Year Plan, which describes the planned monitoring approach as well as other elements in the overall STLS approach to load estimation, evaluation of trends and data analysis.
- Program staff oversaw planning and development of a sediment sub-model component to the Regional Watershed Spreadsheet Model element of the Small Tributaries Loading Strategy. The sediment sub-model is designed to provide a robust sediment delivery estimate/sediment budget from local tributaries and urban drainages as required by Provision C.8.e.vi while supporting the larger STLS objectives of estimating regional loadings of sediment-associated POCs including PCBs and mercury.

Provision C.8.f Citizen Monitoring

In FY 2012/13, the Program's efforts to encourage citizen and stakeholder observations and reporting of waterbody conditions included:

- As follow-up to its deployment of temperature loggers in the Sausal Creek watershed during the dry season of 2013, Program staff continued its collaboration with the Friends of Sausal Creek (FOSC) by providing the temperature monitoring data for presentation at the FOSC's annual membership meeting on the "State of the Creek" by a member of the FOSC Board of Directors. FOSC volunteers plan to continue temperature monitoring at selected sites during the summer of 2013.
- Program staff received telephone calls or emails in response to letters sent to homeowners and residents of creekside properties in advance of conducting the Unified Stream Assessment in aboveground sections of the Castro Valley and San Lorenzo creek systems. Most of these observations concerned channel maintenance issues that were referred directly to Alameda County or ACFCWCD for follow-up, but Program staff and consultants are continuing to work with one resident whose observations are relevant to the Crow Creek SSID project.

Provision C.8.g Reporting

The Program's FY 2012/13 reporting activities for C.8 included:

- The Program submitted its Electronic Status Monitoring Data Report to the Water Board for Water Year 2012 Creek Status data on January 15, 2013. As shown in Appendix F, the transmittal included data for the previous Water Year in SWAMP-comparable format and highlighted exceedances of Water Quality Objectives where they occurred within the data. By authorizing upload of these data by SFEI to the California Environmental Data Exchange Network (CEDEN), the Program

also fulfilled the requirement in Provision C.8.g.vii for data accessibility through a regional data center.

- Program staff collaborated with other RMC participants to prepare and submit the Urban Creeks Monitoring Report (UCMR) for Water Year 2012 as required by Provision C.8.g.iii. In addition to regionally prepared portions of the UCMR that discussed results for monitoring parameters collected under the Creek Status regional probabilistic design or the Small Tributaries Loading Strategy, Program staff and consultants prepared a Local Urban Creek Status Monitoring Report appendix that reported on results for targeted monitoring parameters.

Provision C.8.h Monitoring Protocols and Data Quality

Regional collaborations ensure SWAMP-comparable methods and procedures for Creek Status Monitoring and POC Loads Monitoring. Program's FY 2012/13 activities related to this provision included:

- Program staff participated in regional review of minor updates to the RMC Quality Assurance Project Plan and Standard Operating Procedures for Creek Status Monitoring, which were previously provided to the Water Board in a final draft version.
- Program staff worked with RMC participants to scope tasks for finalizing the STLS Quality Assurance Project Plan and Field Manual to document methods and quality assurance procedures for POC Loads Monitoring.

Future Actions

The Program will continue participation in RMC and RMP coordination of status monitoring in creeks and San Francisco Bay, and ongoing implementation of Creek Status Monitoring and Stressor/Source ID Projects in accordance with the RMC guidance documents and data management system. Additional chemical or data analyses will be conducted for the BMP Effectiveness and Geomorphic monitoring projects as described above.

The Program also will continue oversight of the STLS monitoring station at San Leandro Creek and support ongoing BASMAA contracting with SFEI for laboratory analyses and data management, as part of the alternative approach for monitoring to comply with C.8.e.i and iii. Program staff will continue participating in the STLS Team, for coordinated review and reporting of data from all STLS monitoring stations and finalization of the Field Manual and Quality Assurance Project Plan.

9

Provision C.9 Pesticides Toxicity Control

Introduction

This section summarizes the Program's efforts to comply with Provision C.9, Pesticides Toxicity Control, to prevent the impairment of urban streams by pesticide-related toxicity. Provisions in C.9 reflect the implementation actions incorporated in the Basin Plan through the Total Maximum Daily Load and Water Quality Attainment Strategy for diazinon and pesticide–related toxicity in urban creeks throughout the Bay Area.

Implementation

Provision C.9.e Track and Participate in Relevant Regulatory Processes

Provision C.9.e is being implemented as a BASMAA Regional Project. A report on the implementation of this provision is included in the *BASMAA Regional Supplement for Training and Outreach* (see Appendix E).

Provision C.9.f Interface with County Agricultural Commissioner

Program staff communicated with the County Agricultural Commission's Integrated Pest Management (IPM) Coordinator and discussed the implementation of the new restrictions on the perimeter spray of pyrethroids and other issues.

The County Agricultural Department's Commission's IPM Coordinator stated that the implementation of the CA Department of Pesticide Regulation's new restriction on structural pest control perimeter spray application of pyrethroids was going smoothly. There appears to be two things that help support the changes. First, as pesticides become more expensive, applicators are looking to reduce their use in order to cut costs. Second, public concern regarding possible negative side effects of pesticides has caused applicators to reduce application rates in order to prevent complaints from neighbors.

There was one report of a potentially inappropriate activity by a pesticide applicator from a public agency. The Santa Clara County Agricultural Commission reported an activity of a licensed applicator to the Alameda County Agricultural Commission. The County of Alameda Agricultural Commission staff followed up with the applicator to provide training. There were also several reports from the public that were investigated. There were no known reports from public agencies within Alameda County.

Provision C.9.g Evaluate Source Control Actions

Program efforts have focused primarily on two source control efforts: (1) Working with US EPA and the California Department of Pesticide Regulation (CA DPR) to revise pesticide application requirements to better protect the water quality of urban streams; and (2) working through the Our Water Our World program to promote the retail sale of less toxic alternative pesticides. Both of these efforts have made significant achievements.

Pesticide Regulations: The Program has worked directly and supported the efforts of BASMAA and CASQA to work with US EPA and CA DPR to revise pesticide regulations to better protect water quality in urban streams. This significant effort over many years is having a tremendous impact. Most significantly, CA DPR recently adopted water quality regulations that significantly restrict the use of pyrethroids for structural pest control applications. Structural pest control applications are the most significant source of pesticides to urban streams. A University of California Davis study suggests that these new regulations will reduce the amount of pyrethroid insecticides in urban stormwater by 80-90%.[1]

Point-of-Purchase: The Program is working through the Our Water Our World (OWOW) program to reduce the retail sale and use of pesticides causing water quality problems. OWOW has been going on for many years and is having more and more success. For many years, most of the participating stores were small independent hardware stores and nurseries along with Orchard Supply Hardware. Recently, Home Depot has become very supportive of OWOW. Home Depot has a huge share of the retail pesticide market. Having Home Depot participating in the OWOW program will have a significant impact on the retail sales of less toxic pesticides versus pesticides that have been impacting urban streams in the Bay Area. Sales of OWOW recommended products at Home Depot increase by an estimated 22-25% (personal communication with Annie Joseph). See the BASMAA Regional Supplement in Appendix E for additional details on the Region wide OWOW efforts.

There has been two years of sediment and water chemistry and toxicity testing

[1] Jorgenson, B. C. (2011). Off-Target Transport of Pyrethroid Insecticides in the Urban Environment: An Investigation into Factors Contributing to Washoff and Opportunities for Mitigation. Agricultural and Environmental Chemistry. Davis, CA, University of California Davis. Ph.D. thesis.

conducted under Provision C.8 of the MRP. Occasional moderate toxicity has been found that may be due to pesticides. Additional testing will be conducted over the next two years.

The Program along with BASMAA and CASQA will continue their efforts to push for improvements to pesticide regulations to better protect urban streams, and to promote retail sales of less toxic pesticides. Together, these efforts should significantly reduce and hopefully eliminate pesticide associated water quality impacts to urban streams. No additional actions are recommended at this time.

Provision C.9.h.i and ii Point-of-Purchase Outreach

The Program continued contracting with Annie Joseph to implement the Our Water Our World program in 33 stores throughout Alameda County. A summary of the FY 2012/13 effort is included in Section 7 and Appendix E.

BASMAA Our Water Our World (OWOW) Integrated Pest Management (IPM) Program

A report of BASMAA's activities and accomplishments of the regional *Our Water, Our World* program for FY 2012/13 is included in the *BASMAA Regional Supplement for Training and Outreach* (see Appendix E).

C.9.h.i. and ii. Public Outreach

C.9.h.i. (1) and (3): The Program continued contracting with Annie Joseph to implement the Our Water Our World program in 33 stores throughout Alameda County. A summary of the FY 2012/13 effort is included in Section 7 and Appendix E. Sales of OWOW recommended products at Home Depot increased by an estimated 22-25% (personal communication with Annie Joseph).

C.9.h.i. (1): The Program provided targeted outreach on proper pesticide use and disposal through its website, the OWOW program, and the County Fair exhibit.

C.9.h.iii. and iv. Pest Control Contracting Outreach

The Program set up an exhibit at the Alameda County Fair that promoted integrated pest management, including: potential impacts of pesticides on water quality; less-toxic methods of pest control; and, information on the *Our Water Our World* program. The total number of attendees at the Fair this year was over 391,000. The exhibit earned first-place awards for educational value and best of class. Program staff also met with staff from Alameda County Waste Management Authority (Stopwaste) to begin developing a program to conduct outreach to facilitate appropriate pesticide waste disposal.

Figure 9.1- Program's booth at the 2013 Alameda County Fair

C.9.h.v. and vi. Outreach to Pest Control Operators

Program staff has been working with DPR and UC-IPM through the San Francisco Estuary Partnership's *Got Ants?* grant outreach campaign. The campaign will encourage residents to contract with IPM-certified pest control companies.

Future Actions

The Program will continue its communications with the County Agricultural Commissioner and its support of BASMAA and CASQA efforts to participate in regulatory processes. It will continue to contract with Annie Joseph for implementation of the *Our Water Our World* Point of Purchase IPM outreach**.**

10

Provision C.10 Trash Load Reduction

Introduction

This chapter describes the Program's Provision C.10 implementation actions during FY 2012/13, as well as planned future actions.

Implementation

Provision C.10.a.ii Baseline Trash Load and Trash Load Reduction Tracking Method

Through participation in BASMAA the Program supported the development of a revised baseline trash generation rate model to provide member agencies with a preliminary estimate of trash loading per unit area from various land use types.

Provision C.10.a.iii Minimum Full Trash Capture

Program staff worked with San Francisco Estuary Partnership (SFEP) staff to facilitate the implementation of SFEP's $5 million grant to fund Permittee purchase and installation of full-capture trash devices.

Provision C.10.c Long-Term Trash Load Reduction

During FY 2012/13 Program staff has worked with Permittees from around the Bay Area and Water Board staff to devise an approach and framework for developing the Long-Term Trash Reduction Plans that are due to the Water Board in February 2014.

Provision C.10.d Summary of Trash Reduction Actions

Single-Use Carryout Bag Policy (Post MRP Action): A Countywide Single-Use Bag Ban was adopted by Alameda County Waste Management Authority (Stopwaste) and went

into effect January 2013. As of January 1, 2013, grocery stores and other stores in Alameda County that sell alcohol or four items, milk, bread, packaged food and soda, can no longer provide single-use plastic carryout bags, nor can they distribute paper bags or reusable bags for free at checkout. Stopwaste conducted an intensive outreach effort to inform the affected stores. Stopwaste has also implemented an inspection and enforcement program. Compliance rates appear to be very high. The Program will work with Stopwaste during FY 2013/14 to conduct a study to see if there is a reduction in the number of plastic bags found in storm drains compared to what was found during the baseline loading study conducted during FY 2011/12.

Public Outreach: Educations Services Program (Continued Pre-MRP Action): The Program contracts with four environmental education programs to conduct classroom, field trip, and assembly stormwater education. There is an anti-litter component to all of the programs and for some (for example, the Storm Drain Ranger Program) there is a very intensive focus on preventing and picking up litter. (See Section 7 (Public Outreach) for a detailed description of the programs.) FY 2013/14 is the last year of four-year contracts for these programs. The Program intends to release an RFP in FY 2013/14 for new education service contracts that will be implemented in FY 2014/15. The RFP will include a very heavy litter prevention emphasis.

Public Outreach: Be the Street (Post MRP Action): The Program is participating in the regional Be the Street anti-litter campaign. The effort targets youth (ages 14-24). There has been an enthusiastic response including over 50 submittals to a video contest. The Program has contracted independently with movie theaters in Alameda County to run one of the submitted videos. The video will run on 133 screens in nine theaters during July and August 2013.

Future Actions

The Program will continue to assist with the implementation of trash reduction efforts including: (1) Work with the BASMAA Trash Committee and Program member agencies to develop the Long-Term Trash Load Reduction Plans; (2) The Program intends to release an RFP in FY 2013/14 for new education service contracts that will include a very heavy litter prevention emphasis; (3) Place a Be the Street video contest submittal in movie theaters throughout Alameda County; (4) The Program will work with Stopwaste during FY 2013/14 to conduct a study to see if there is a reduction in the number of plastic bags found in storm drains compared to what was found during the baseline loading study conducted during FY 2011/12; and (5) Continue to participate in the Be the Street campaign.

11

Provision C.11 Mercury Controls

Introduction

Provisions in C.11 reflect the implementation plan incorporated in the Basin Plan through the Total Maximum Daily Load for mercury in San Francisco Bay. For mercury, polychlorinated biphenyls (PCBs) and other sediment-bound pollutants, the Water Board has proposed to implement control measures primarily as pilot projects that are intended to reduce uncertainties about the sources, occurrence or effectiveness of control measures for these Pollutants of Concern (POCs).

Implementation

As required in the MRP, findings and recommendations for the following provisions will be reported in the Integrated Monitoring Report (IMR) which will be submitted by March 15, 2014. These provisions, most of which are being implemented as BASMAA Regional Projects, are briefly summarized in the *BASMAA Regional Pollutants of Concern Report for FY 2012-2013* (see Appendix G):

- C.11.b, Monitor Methylmercury;
- C.11.c, C.11.d, C.11.e, C.11.i (addressed as a group by BASMAA's Clean Watersheds for a Clean Bay (CW4CB) project);
- C.11.f, Diversion of Dry Weather and First Flush Flows to POTWs;
- C.11.g, Monitor Stormwater Pollutant Loads and Loads Reduced;
- C.11.h, Fate and Transport Study of Mercury in Urban Runoff; and
- C.11.j, Develop Allocation Sharing Scheme with Caltrans.

MRP Provisions C.11.c through Provision C.11.i for mercury are essentially identical to C.12.c through Provision C.12.i for PCBs. In addition to participation in Regional Projects through BASMAA, the Program's direct activities included:

- C.11.a, the member agencies participate in the collection and recycling of mercury containing devices and equipment through the Alameda County Household Hazardous Waste facilities. Use of these facilities is also promoted on the Program's website. Through the four household hazardous waste facilities within the County (including Fremont), 76,417 pounds of mercury containing fluorescent lamps and compact fluorescent bulbs were recycled during FY 12-13. This equates to 244,083 linear feet of fluorescent lamps (tubes, u-shapes, etc.) and 122,243 compact fluorescent lamps[1]. Provision C.11.a.ii requires MRP Permittees to include an estimate of the mass of mercury collected. The estimated mass of mercury collected is based on the total amount of mercury-containing devices and equipment collected and calculated using the best available information from manufacturers and trade organizations regarding the amount of mercury in devices and equipment of interest. The estimated mass of mercury collected by Alameda County Household Hazardous Waste facilities during FY 12-13 is 1.06 kilograms.
- For C.11.b, Program consultants conducted methylmercury sampling at the San Leandro Creek monitoring station in conjunction with other Pollutants of Concern monitoring to be reported regionally in the IMR.
- Program staff participated in Project Management Team meetings for the Clean Watersheds for a Clean Bay project and participated in the selection process for consultants to prepare and coordinate design of the elements monitoring elements for the project.
- Program staff continued working with BASMAA contractors on design and planning for the stormwater treatment retrofit pilot media filter to be installed at the Ettie Street Pump Station (C11/12.d).
- Program staff and consultants monitored turbidity and sampled stormwater during one wet weather event using the pilot diversion and pretreatment storage equipment installed at the Ettie Street Pump Station, and also provided particle distribution data requested by CW4CB consultants to inform monitoring plan design for the CW4CB Task 5 retrofits projects.
- Program staff initiated consultant development of an engineering feasibility study for larger scale pretreatment and storage facilities near the Ettie Street Pump Station in conjunction with discussions with staff of the East Bay Municipal Utility District (EBMUD) on plans for diversion conveyance from the pump station to EBMUD's treatment plant.

[1] Since fluorescent light bulbs come in different sizes, quantities are reported in terms of the total pounds. The conversion factor used by Alameda County HHW facilities is: 1 linear foot equals .125 lbs and 1 CFL equals .20lbs.

- Program staff represented BASMAA at meetings of RMP Work Groups conducting and planning studies of mercury fate and transport addressing the requirements of Provision C.11.h.

Future Actions

The Program will continue its active participation and support for regional activities as described in BASMAA Work Plans and Regional Project Profiles, including preparation of the Integrated Monitoring Report. The Program will also continue coordination with EBMUD on plans for a diversion system and facilitate construction by the Alameda County Flood Control and Water Conservation District of the pilot retrofit project at the Ettie Street Pump Station.

12

Provision C.12 Polychlorinated Biphenyls (PCBs) Controls

Introduction

Provisions in C.12 reflect the implementation plan incorporated in the Basin Plan through the Total Maximum Daily Load for PCBs in San Francisco Bay, and their requirements and implementation approach are mostly identical with provisions in C.11 as described in the previous chapter.

Implementation

As required in the MRP, findings and recommendations for the following provisions will be reported in the Integrated Monitoring Report (IMR) which will be submitted by March 15, 2014. These provisions, most of which are being implemented as BASMAA Regional Projects, are briefly summarized in the *BASMAA Regional Pollutants of Concern Report for FY 2012-2013* (see Appendix G):

- C.12.b, Conduct Pilot Projects to Evaluate Managing PCB-Containing Materials and Wastes during Building Demolition and Renovation (e.g., Window Replacement) Activities;
- C.12.c, C.12.d, C.12.e, C.12.i (addressed as a group by BASMAA's Clean Watersheds for a Clean Bay (CW4CB) project);
- C.12.f, Diversion of Dry Weather and First Flush Flows to POTWs,
- C.12.g, Monitor Stormwater Pollutant Loads and Loads Reduced, and
- C.12.h, Fate and Transport Study of PCBs in Urban Runoff.

In addition to participation in Regional Projects via BASMAA, the Program's direct activities included:

- Program staff participated in Project Management Team meetings for the CW4CB project and participated in the selection process for consultants to prepare and coordinate design of the monitoring elements for the project.
- Program staff and consultants provided in-kind assistance to the City of Oakland to develop a sampling plan for sediment monitoring in conjunction with CW4CB Task 3.
- Program staff participated in the development of a study design for evaluating enhanced techniques for sediment management in conjunction with CW4CB Task 4, and worked with CW4CB monitoring consultants to develop a sampling approach for initial data collection during a clean-out at the Ettie Street Pump Station.
- Program staff and consultants conducted monitoring at the Ettie Street Pump Station as described for Provision C.11. Program staff initiated consultant development of an engineering feasibility study for larger scale pretreatment and storage facilities near the Ettie Street Pump Station in conjunction with discussions with staff of the East Bay Municipal Utility District (EBMUD) on plans for diversion conveyance from the pump station to EBMUD's treatment plant.
- Program staff represented BASMAA at meetings of RMP Work Groups that are conducting and planning studies of PCB fate and transport (Provision C.12.h).
- Specific training on identifying sources of PCBs at industrial/commercial facilities was incorporated into the Program's Industrial and Illicit Discharge Control training workshops during previous fiscal years. The Program also distributed the BASMAA Pollutants of Concern training manual to member agencies for on-going in-house training of industrial/commercial facility inspectors.

Future Actions

The Program will continue its active participation and support for regional activities as described in BASMAA Work Plans and Regional Project Profiles, including preparation of the Integrated Monitoring Report. The Program will also continue coordination with EBMUD on plans for a diversion system and facilitate construction by the Alameda County Flood Control and Water Conservation District of the pilot retrofit project at the Ettie Street Pump Station.

13

Provision C.13 Copper Controls

Introduction

The requirements of Provision C.13 reflect the copper management strategy incorporated in the Basin Plan amendment for Site Specific Objectives for copper in San Francisco Bay.

Implementation

The following requirements are being implemented as BASMAA Regional Projects, and regional activities for these are reported in the BASMAA *Regional Pollutants of Concern Report* (see Appendix G):

- C.13.c, Vehicle Brake Pads; and
- C.13.e, Studies to Reduce Copper Pollutant Impact Uncertainties.

In addition to participation in Regional Projects via BASMAA, the Clean Water Program's direct activities included:

- C.13.a. Architectural Copper: The Program developed a fact sheet on the use of proper BMPs for maintaining architectural copper features. The fact sheet was distributed to attendees at the Program's C.6 Construction Inspection Workshop.
- C.13.c. Program staff prepared the regional report summary on the implementation status of 2010 legislation to phase out copper in vehicle brake pads, and the status of copper water quality issues associated with automobile brake pads.
- C.13.e. Program staff participated in the RMP Exposure and Effects Workgroup to oversee continuing or follow-up studies to address uncertainties in sources of toxicity to San Francisco Bay benthos and the olfactory systems of salmonids in varying conditions of salinity.

Future Actions

The Program will continue its active participation and support for regional activities as described in BASMAA Work Plans and Regional Project Profiles.

14

Provision C.14 Polybrominated Diphenyl Ethers (PBDE), Legacy Pesticides & Selenium

Introduction

This provision requires the Permittees to work with the other municipal stormwater management agencies in the Bay Region to identify, assess, and manage controllable sources of polybrominated diphenyl ethers (PBDEs), legacy pesticides, and selenium found in urban runoff. The Water Board recognizes that these three pollutants or pollutant groups are distinct in terms of origin and transport, but they have been grouped into this provision because the requirements are identical.

Implementation

The following provisions are being implemented as BASMAA Regional Projects, and regional activities for these are reported in the BASMAA *Regional Pollutants of Concern Report* (see Appendix G):

- C.14.a, Control Program for PBDEs, Legacy Pesticides, and Selenium.

Program staff oversaw planning and development of a Pollutant Profile for PBDEs, which describes inputs and model sub-architecture to the Regional Watershed Spreadsheet Model (RWSM) element of the Small Tributaries Loading Strategy, included as an internal attachment to Appendix G. These inputs will allow RWSM calculation of loads to San Francisco Bay from urban runoff conveyance systems as required by Provision C.14.a.iv.

Program staff also coordinated production of BASMAA reports describing control measures and /or management practices to eliminate or reduce discharges for each of the three pollutant categories as required by Provisions C.14.a.vi-vii. These reports

include documentation of the potential sources and other information required to compute loads to San Francisco Bay and are incorporated in Appendix G.

Future Actions

The Program will continue its active participation and support for the Small Tributaries Loading Strategy refinement of the Regional Watershed Spreadsheet Model to support estimation of pollutant loads to San Francisco Bay.

15

Provision C.15 Exempted & Conditionally Exempted Discharges

Introduction

This section of the report describes the countywide activities conducted to help the Clean Water Program's member agencies to implement the requirements of the MRP's Provision C.15 Exempted and Conditionally Exempted Discharges. The Clean Water Program's role is to help municipal staff to understand the MRP's requirements and to make available for their use various MRP compliance support materials.

The MRP describes a variety of different types of non-stormwater discharges that may be conditionally exempted. The most extensive tracking, monitoring, and reporting requirements are for planned and unplanned potable water discharges by water purveyors. The only Clean Water Program's member agencies that are water purveyors are the Cities of Hayward, Livermore, and Pleasanton and the Zone 7 Water Agency. Because there are so few water purveyors covered by the MRP, this MRP provision has had a low priority for countywide implementation.

Implementation

Information about each agency's activities to comply with this MRP provision is contained in the agencies' reports.

Future Actions

The Clean Water Program will work with BASMAA's Municipal Operations Committee to identify any conditionally exempted discharge requirements that may be implemented more efficiently on a regional basis.

Appendix A

Provision C.2 Municipal Operations

- Stormwater Trash Capture Workshop – October 30, 2012
    - Agenda
    - Evaluations Summary
    - Survey Results
- Maintenance Subcommittee Meeting – May 2, 2013

Stormwater Trash Capture Workshop:
Operation & Maintenance Lessons Learned

Date: Tuesday, October 30th

Time: 8:00 am – 1:30 pm

Location: Albert Dewitt Officer's Club (O'Club) – Trident Room
641 West Red Line Avenue
Alameda Point - Alameda, CA 94501

DRAFT Agenda

1.	Registration and Refreshments	8:00 – 8:30am	
2.	Welcome	8:30 – 8:40	Patrizia Guccione, City of Alameda, Municipal Maintenance Subcommittee
3.	Trash Device Operations and Maintenance - Lessons Learned *Experience with devices, how maintenance is handled, effectiveness, flooding/siting issues*	8:40 – 10:20	David Lonestar, City of Oakland (lg devices) Mark Lander, City of Dublin (lg devices) Rick Orta, City of San Leandro (sm devices)
4.	Break & Vendor Exhibitions	10:20 – 10:40	
5.	Homeless Debris Cleanup Panel *Mechanisms for cleanup, recommendations for cost and time efficiencies*	10:40 – 11:20	Kate Shonk, City of Fremont Ella Samonsky, City of San Jose
6.	Fremont's Litter and Trash Business Enforcement *Lessons learned and tools to help and keep businesses in compliance*	11:20 – 11:50	Val Blakely, City of Fremont
7.	Wrap-Up	11:50 – 11:55	Patrizia Guccione, City of Alameda, Municipal Maintenance Subcommittee
8.	Lunch & Vendors Exhibitions	11:55 – 1:30	Kevin McGillicuddy, Roscoe Moss Sue Lillo, Kristar Octavio Lugo, Advanced Solutions John Lewis, Contech Marcell Sloan, REM John Alvardo, G2 Construction

Stormwater Trash Capture Workshop - October 30, 2012

Survey Results

	Questions	Correct Answer	Pre-workshop % Correct	Post-workshop % Correct	Difference
Q1	Municipalities in Alameda County must reduce trash load by:	A	91%	94%	3%
Q2	Trash capture devices can include:	D	76%	73%	-3%
Q3	Typical maintenance requirements for trash capture devices includes:	F	61%	67%	6%
Q4	Maintenance of trash capture devices is typically required:	F	20%	40%	20%
Q5	In addition to trash capture devices, the following can also help to reduce trash loads:	E	89%	88%	0%
Q6	Land use with the highest trash loading rate:	B	32%	60%	29%
Q7	Personal property can be defined as:	A	77%	83%	7%
Q8	The following safety tips apply when searching a site:	D	66%	77%	11%
Q9	During business inspections key locations to inspect include:	F	53%	56%	3%
Q10	The following tips apply when inspecting businesses:	C	19%	35%	16%
	Totals				
	Respondent Percentage Correct		58%	68%	9%
	Number of 50% or above		67%	79%	12%
	Number of 49% or below		20%	13%	7%
	Number of Surveys Completed		54	52	2

* Total number answered does not include blanks IF the whole back side of the questionaire was not filled out.
Otherwise, IF certain questions are skipped, they are counted as incorrect because it is assumed the survey respondent did not know the answer.

Evaluation Summary

Question	Rating 1-5
The presentations were clear and easy to follow.	3.5
Overall, this was a very useful workshop.	3.4
Overall, the workshop materials and handouts were informative and useful.	3.4
I am confident that I will use the skills learned in the workshop today on the job.	3.2
The presenter(s) were knowledgeable in the subject matter.	3.6
Questions were encouraged throughout the workshop.	3.6
Presentations addressed current issues and concerns of the participants.	3.4
Total number of surveys	55

What was most valuable about today's training?

- Real impacts of installing drain collection devices
- Homeless camps, trash awareness
- All
- Homeless cleanup
- Val Blakely's Presentation
- Up to speed Topics - Topics where localized issues
- Trash Capture Devices
- Knowing the available resources
- Trash Reduction, Tree Well Filter
- Illegal Dumping Enclosures
- Trash Device Operation & Maint
- Homeless camp clean up
- Hearing practical in-field use of Trash Capture Devices
- Good discussions on inlet trash capture devices that many of the municipalities will be using. Overall the topics were interesting, relevant and well received.
- TCD's
- TCD
- CDS & Homeless
- Trash Capture Devices (PM)
- Information from different cities
- How other cities/agencies handle the same problem.
- Containment of trash in storm drains
- Variety of presenters
- All of the different ideas
- First hand account from people on the ground
- Trash device operations and maintenance - lessons learned. Homeless debris cleanup
- Actual experiences
- All
- Val was funny
- Hearing actual experience & tips from other cities use of screens
- Info on TCD and SW Mgmt
- Maintenance requirements on Trash Capture Devices
- Very interesting discussion on encamped clean up - pointed out need to eliminate problem before it takes toll

- Trash capture device experiences and maintenance practices
- All good
- Lessons learned in installing and maintaining trash capture devices. Resource load and cost estimates were also valuable.
- David Lonestar - Awesome start. Key points well presented.
- Trash Enforcement

What was least valuable about today's training?

- Show & tell of actual device in room without organized presentation.
- All was good to know
- All were important
- Somewhat repetitive
- Nothing
- The Alameda employee speaking about his issues with just 4 TDLs. Too much time, too little content.
- Homeless Debris Cleanup
- Homeless camp clean up was interesting but not my area of concern
- N/A
- Homeless cleanup
- Trash Enclosures
- Nothing
- N/A
- The vendors
- Homeless encampment valuables. Everything is trash!
- Homeless Encampments
- City of Oakland slides re #'s were too small & detailed.
- All useful
- City of Alameda Complaints
- Homeless encampments not quite on-point for this group. I would have reduced it to 1 presentation.
- Homeless Encampments
- Homeless Encampments
- Homeless encampments issues!
- Homeless probably less relevant to some attendees.
- Homeless encampments - because not in my scope of work. None-the-less, very good information.

Do you have any suggestions for improvement?

- Microphone and larger projector
- More indepth Training
- More food during topics so my tummy doesn't growl
- None
- No. I think this was very well done!
- More Videos
- Make managerial staff attendance mandatory
- N/A

- I saw some of the same speakers. If possible seek out other agencies who can make a presentation.
- Time Keeper
- Demonstrations on TCD
- N/A
- No
- Make a more specific appeal to Maintenance personnel
- All good
- N/A
- Nope. Great Job!!!
- Not really. Presentations were well prepared & informative!
- What's next? Permit, etc.
- Maybe get someone from the Regional Water Quality Control Board to speak & get their perspective of local agencies efforts.

What subjects would you like to see in future workshops?

- Graffiti Abatement
- What cities are doing for trash clean up - other than DI & Vortex.
- More Video Presentations
- More visual
- None
- MRP 101. A brief yet comprehensive overview of the MRP & the role of the organizations such as County Programs, BASMA, CASQA, Regional Board, etc.
- TCD Plugs, how to break plugs with TCD installed in SWI
- Trash capture debris separation - organic vs trash
- N/A
- As different municipalities are having different problems it would be helpful to see some new focus from different city or county perspective.
- Compliance w/ the FOG Element of the SSMP
- Continue to address TCD maintenance & requirements
- PM Programs/Data Collection
- The same as today
- Sanitary Sewer Workshop
- Human waste treatment in urban settings
- N/A
- Making street sweeping more effective. Use of data sheets or hand-helds to track information from maintenance staff on-site.
- More actual maintenance issues encountered. What works and what doesn't.
- Various ways agencies trouble shoot the organic material clogging the trash capture devices.
- Maintenance problem solving circles
- Long term trash capture device maintenance perspective from L.A.? What are agencies doing to reduce trash load reduction goals.

Clean Water Program
Maintenance Sub Committee
May 2, 2013

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Appendix B

Provision C.3 New Development & Redevelopment

- Stormwater Requirements Checklist for Development Projects
- Stormwater Requirements Checklist for Small Projects
- Model List of Source Control Measures
- C.3 Stormwater Technical Guidance – Table of Contents – May 14, 2013
- *2012 Update: Stormwater Quality Control Requirements* Builders Outreach Flyer
- BASMAA Regional Supplement: Green Street Pilot Projects Summary Report

Stormwater Requirements Checklist

Municipal Regional Stormwater Permit (MRP)
Stormwater Controls for Development Projects

INSERT CITY SPECIFIC INFO HERE
ADDRESS
PHONE
FAX
WEB (for those who allow download etc)

I. Applicability of C.3 and C.6 Stormwater Requirements

I.A. Enter Project Data *(For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report.)*

I.A.1 Project Name: _____

I.A.2 Project Address (include cross street): _____

I.A.3 Project APN: _____ I.A.4 Project Watershed: _____

I.A.5 Applicant Name: _____

I.A.6 Applicant Address: _____

I.A.7 Applicant Phone: _____ Applicant Email Address: _____

I.A.8 Development type: (check all that apply)

- ☐ Residential ☐ Commercial ☐ Industrial ☐ Mixed-Use ☐ Streets, Roads, etc.
- ☐ 'Redevelopment' as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred[1]
- ☐ 'Special land use categories' as defined by MRP: (1) auto service facilities[2], (2) retail gasoline outlets, (3) restaurants[2], (4) uncovered parking area (stand-alone or part of a larger project)

I.A.9 Project Description[3]: (Also note any past or future phases of the project.) _____

I.A.10 Total Area of Site: _____ acres

Total Area of land disturbed during construction (include clearing, grading, excavating and stockpile area:_____ acres.

I.B. Is the project a "C.3 Regulated Project" per MRP Provision C.3.b?

I.B.1 Enter the amount of impervious surface[4] created and/or replaced by the project (if the total amount is 5,000 sq.ft. or more):

Table of Impervious and Pervious Surfaces

	a	b	c	d
Type of Impervious Surface	Pre-Project Impervious Surface (sq.ft.)	Existing Impervious Surface to be Replaced[6] (sq.ft.)	New Impervious Surface to be Created[6] (sq.ft.)	Post-project landscaping (sq.ft.), if applicable
Roof area(s) – excluding any portion of the roof that is vegetated ("green roof")				N/A
Impervious[4] sidewalks, patios, paths, driveways				
Impervious[4] uncovered parking[5]				
Streets (public)				
Streets (private)				
Totals:				
Area of Existing Impervious Surface to remain in place		N/A		
Total New Impervious Surface *(sum of totals for columns b and c):*				

[1] Roadway projects that replace existing impervious surface are subject to C.3 requirements only if one or more lanes of travel are added.
[2] Standard Industrial Classification (SIC) codes are in Section 2.3 of the C.3 Technical Guidance (download at www.cleanwaterprogram.org)
[3] Project description examples: 5-story office building, industrial warehouse, residential with five 4-story buildings for 200 condominiums, etc.
[4] Per the MRP, pavement that meets the following definition of pervious pavement is NOT an impervious surface. Pervious pavement is defined as pavement that stores and infiltrates rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or that stores and infiltrates the rainfall runoff volume described in Provision C.3.d.
[5] Uncovered parking includes top level of a parking structure.
[6] "Replace" means to install new impervious surface where existing impervious surface is removed. "Create" means to install new impervious surface where there is currently no impervious surface.

I.B. Is the project a "C.3 Regulated Project" per MRP Provision C.3.b? (continued)

		Yes	No	NA
I.B.2	In Item I.B.1, does the Total New Impervious Surface equal 10,000 sq.ft. or more? *If YES, skip to Item I.B.5 and check "Yes." If NO, continue to Item I.B.3.*	☐	☐	☐
I.B.3	Does the Item I.B.1 Total New Impervious Surface equal 5,000 sq.ft. or more, but less than 10,000 sq.ft? *If YES, continue to Item I.B.4. If NO, skip to Item I.B.5 and check "No."*	☐	☐	☐
I.B.4	Is the project a "Special Land Use Category" per Item I.A.8? For uncovered parking, check YES only if there is 5,000 sq.ft or more uncovered parking. *If NO, go to Item I.B.5 and check "No." If YES, go to Item I.B.5 and check "Yes."*	☐	☐	☐
I.B.5	Is the project a C.3 Regulated Project? *If YES, skip to Item I.B.6; if NO, continue to Item I.C.*	☐	☐	☐
I.B.6	Does the total amount of Replaced impervious surface equal 50 percent or more of the Pre-Project Impervious Surface? *If YES, stormwater treatment requirements apply to the whole site; if NO, these requirements apply only to the impervious surface created and/or replaced.*	☐	☐	☐

I.C. Projects that are NOT C.3 Regulated Projects

If you answered NO to Item I.B.5, or the project creates/replaces less than 5,000 sq. ft. of impervious surface, then the project is NOT a C.3 Regulated Project, and stormwater treatment is not required, BUT the municipality may determine that source controls and site design measures are required. Skip to Section II.

I.D. Projects that ARE C.3 Regulated Projects

If you answered YES to Item I.B.5, then the project is a C.3 Regulated Project. The project must include appropriate site design measures and source controls AND hydraulically-sized stormwater treatment measures. Hydromodification management may also be required; refer to Section II to make this determination. If final discretionary approval was granted on or after **DECEMBER 1, 2011**, Low Impact Development (LID) requirements apply, except for "Special Projects." See Section II.

I.E. Identify C.6 Construction-Phase Stormwater Requirements

		Yes	No
I.E.1	Does the project disturb 1.0 acre (43,560 sq.ft.) or more of land? (See Item I.A.10). *If Yes, obtain coverage under the state's Construction General Permit at https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp. Submit to the municipality a copy of your Notice of Intent and Storm Water Pollution Prevention Plan (SWPPP) before a grading or building permit is issued.*	☐	☐
I.E.2	Is the site as a "High Priority Site" that disturbs less than 1.0 acre (43,560 sq.ft.) of land? (Municipal staff will make this determination.) ▪ "High Priority Sites" are sites that require a grading permit, are adjacent to a creek, or are otherwise high priority for stormwater protection during construction (see MRP Provision C.6.e.ii(2))	☐	☐

- NOTE TO APPLICANT: All projects require appropriate stormwater best management practices (BMPs) during construction. Refer to the Section II to identify appropriate construction BMPs.
- NOTE TO MUNICIPAL STAFF: If the answer is "Yes" to either question in Section E, refer this project to construction site inspection staff to be added to their list of projects that require stormwater inspections at least monthly during the wet season (October 1 through April 30).

II. Implementation of Stormwater Requirements

II.A. Complete the appropriate sections for the project. For non-C.3 Regulated Projects, Sections II.B, II.C, and II.D apply. For C.3 Regulated Projects, all sections of Section II apply.

II.B. Select Appropriate Site Design Measures

- *Required for C.3 Regulated Projects.*
- *Starting December 1, 2012, projects that create and/or replace 2,500 - 10,000 sq.ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface, must include one of Site Design Measures a through f.*[7]
- *All other projects are encouraged to implement site design measures, which may be required at municipality discretion.*
- *Consult with municipal staff about requirements for your project.*

II.B.1 Is the site design measure included in the project plans?

Yes	No	Plan Sheet No.	
☐	☐		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
☐	☐		b. Direct roof runoff onto vegetated areas.
☐	☐		c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
☐	☐		d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
☐	☐		e. Construct sidewalks, walkways, and/or patios with permeable surfaces.
☐	☐		f. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.
☐	☐		g. Minimize land disturbance and impervious surface (especially parking lots).
☐	☐		h. Maximize permeability by clustering development and preserving open space.
☐	☐		i. Use micro-detention, including distributed landscape-based detention.
☐	☐		j. Protect sensitive areas, including wetland and riparian areas, and minimize changes to the natural topography.
☐	☐		k. Self-treating area (see Section 4.1 of the C.3 Technical Guidance)
☐	☐		l. Self-retaining area (see Section 4.2 of the C.3 Technical Guidance)
☐	☐		m. Plant or preserve interceptor trees (Section 4.5, C.3 Technical Guidance)

[7] See MRP Provision C.3.a.i(6) for non-C.3 Regulated Projects, C.3.c.i(2)(a) for Regulated Projects, C.3.i for projects that create/replace 2,500 to 10,000 sq.ft. of impervious surface and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface.

II.C. Select appropriate source controls *(Applies to C.3 Regulated Projects; encouraged for other projects. Consult municipal staff.[8])*

Are these features in project?		Features that require source control measures	Source control measures (Refer to Local Source Control List for detailed requirements)	Is source control measure included in project plans?		
Yes	**No**			**Yes**	**No**	Plan Sheet No.
☐	☐	Storm Drain	Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.	☐	☐	
☐	☐	Floor Drains	Plumb interior floor drains to sanitary sewer[9] [or prohibit].	☐	☐	
☐	☐	Parking garage	Plumb interior parking garage floor drains to sanitary sewer.[9]	☐	☐	
☐	☐	Landscaping	▪ Retain existing vegetation as practicable. ▪ Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects. ▪ Minimize use of pesticides and quick-release fertilizers. ▪ Use efficient irrigation system; design to minimize runoff.	☐	☐	
☐	☐	Pool/Spa/Fountain	Provide connection to the sanitary sewer to facilitate draining.[9]	☐	☐	
☐	☐	Food Service Equipment (non-residential)	Provide sink or other area for equipment cleaning, which is: ▪ Connected to a grease interceptor prior to sanitary sewer discharge.[9] ▪ Large enough for the largest mat or piece of equipment to be cleaned. ▪ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.	☐	☐	
☐	☐	Refuse Areas	▪ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff. ▪ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.[9]	☐	☐	
☐	☐	Outdoor Process Activities [10]	Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer.[9]	☐	☐	
☐	☐	Outdoor Equipment/ Materials Storage	▪ Cover the area or design to avoid pollutant contact with stormwater runoff. ▪ Locate area only on paved and contained areas. ▪ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer[9], and contain by berms or similar.	☐	☐	
☐	☐	Vehicle/ Equipment Cleaning	▪ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer[9], and sign as a designated wash area. ▪ Commercial car wash facilities shall discharge to the sanitary sewer.[9]	☐	☐	
☐	☐	Vehicle/ Equipment Repair and Maintenance	▪ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas. ▪ No floor drains unless pretreated prior to discharge to the sanitary sewer.[9] ▪ Connect containers or sinks used for parts cleaning to the sanitary sewer.[9]	☐	☐	
☐	☐	Fuel Dispensing Areas	▪ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break. ▪ Canopy shall extend at least 10 ft in each direction from each pump and drain away from fueling area.	☐	☐	
☐	☐	Loading Docks	▪ Cover and/or grade to minimize run-on to and runoff from the loading area. ▪ Position downspouts to direct stormwater away from the loading area. ▪ Drain water from loading dock areas to the sanitary sewer.[9] ▪ Install door skirts between the trailers and the building.	☐	☐	
☐	☐	Fire Sprinklers	Design for discharge of fire sprinkler test water to landscape or sanitary sewer.[9]	☐	☐	
☐	☐	Miscellaneous Drain or Wash Water	▪ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.[9] ▪ Roof drains shall drain to unpaved area where practicable. ▪ Drain boiler drain lines, roof top equipment, all washwater to sanitary sewer[9].	☐	☐	
☐	☐	Architectural Copper	▪ Discharge rinse water to sanitary sewer[9], or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."	☐	☐	

[8] See MRP Provision C.3.a.i(7) for non-C.3 Regulated Projects and Provision C.3.c.i(1) for C.3 Regulated Projects.

[9] Any connection to the sanitary sewer system is subject to sanitary district approval.

[10] Businesses that may have outdoor process activities/equipment include machine shops, auto repair, industries with pretreatment facilities.

II.D. Implement construction Best Management Practices (BMPs) *(Applies to all projects).*

Yes	No	Best Management Practice (BMP)
☐	☐	Attach the municipality's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
☐	☐	Temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
☐	☐	Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
☐	☐	Provide notes, specifications, or attachments describing the following: ▪ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency; ▪ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material; ▪ Specifications for vegetative cover & mulch, include methods and schedules for planting and fertilization; ▪ Provisions for temporary and/or permanent irrigation.
☐	☐	Perform clearing and earth moving activities only during dry weather.
☐	☐	Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
☐	☐	Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
☐	☐	Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
☐	☐	Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
☐	☐	Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.
☐	☐	Limit construction access routes and stabilize designated access points.
☐	☐	No cleaning, fueling, or maintaining vehicles on-site, except in a designated area where washwater is contained and treated.
☐	☐	Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
☐	☐	Contractor shall train and provide instruction to all employees/subcontractors re: construction BMPs.
☐	☐	Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, washwater or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.

PROJECTS THAT ARE <u>NOT</u> C.3 REGULATED PROJECTS STOP HERE!

II.E. Feasibility/Infeasibility of Infiltration and Rainwater Harvesting/Use (Applies to C.3 Regulated Projects ONLY)

Except for some Special Projects, C.3 Regulated Projects must include low impact development (LID) treatment measures. LID treatment measures are rainwater harvesting, infiltration, evapotranspiration, and biotreatment (landscape-based treatment with special soils). Biotreatment is allowed ONLY if it is infeasible to treat the amount of runoff specified in Provision C.3.d with rainwater harvesting, infiltration, and evapotranspiration.

	Yes	No	N/A
II.E.1 Is this project a "Special Project"? (See Appendix K of the C.3 Technical Guidance for criteria.) ➢ *If No, continue to Item II.E.2.* ➢ *If Yes, or if there is potential that the project MAY be a Special Project, complete the Special Projects Worksheet.*	☐	☐	☐
II.E.2 Infiltration Potential. Based on site-specific soil report[11], do site soils either: a. Have a saturated hydraulic conductivity (Ksat) <u>less</u> than 1.6 inches/hour), or, if the Ksat rate is not available, b. Consist of Type C or D soils? ➢ *If Yes, infiltration of the C.3.d amount of runoff is infeasible. Continue to II.E.3.* ➢ *If No, complete the Infiltration Feasibility Worksheet. If infiltration of the C.3.d amount of runoff is found to be feasible, skip to II.E.8; if infiltration is found to be infeasible, continue to II.E.3.*	☐	☐	☐

[11] If no site-specific soil report is available, refer to soil hydraulic conductivity maps in C.3 Technical Guidance Appendix I.

II.E.3 Recycled Water. Check the box if the project is installing and using a recycled water plumbing system for non-potable water use.

☐ The project is installing a recycled water plumbing system, and the installation of a second non-potable water system for harvested rainwater is impractical, and considered infeasible due to cost considerations.

- *If you checked this box, there is no need for further evaluation of rainwater harvesting. Skip to II.E.9.*

II.E.4 Potential Rainwater Capture Area

a. Refer to the Table of Impervious and Pervious Surfaces in Section I, and enter the total square footage of impervious surface that will be replaced and/or created by the project. _____ Sq. ft.

b. If I.B.6 indicates that 50% or more of the existing impervious surface will be replaced with new impervious surface, then add any existing impervious surface that will remain in place to the amount in II.E.4.a. _____ Sq. ft.

c. Convert the amount in Item II.E.4.b from square feet to acres (divide by 43,560). If II.E.4.b is not applicable, convert the amount in II.E.4.a from square feet to acres. This is the project's Potential Rainwater Capture Area, in acres. _____ Acres

II.E.5 Landscape Irrigation: Feasibility of Rainwater Harvesting and Use

a. Enter area of onsite landscaping. _____ Acres

b. Multiply the Potential Rainwater Capture Area (the amount in II.E.4.c) times 2.5. _____ Acres

c. Is the amount in II.E.5.a (onsite landscaping) LESS than 2.5 times the size of the amount in II.E.5.b (the product of 2.5 times the size of the Potential Rainwater Capture Area)[12]? ☐ **Yes** ☐ **No**

- *If Yes, irrigation use of the C.3.d amount of runoff is infeasible. Continue to II.E.6.*
- *If No, it may be possible to meet the treatment requirements by directing runoff from impervious areas to self-retaining areas (see Section 4.2 of the C.3 Technical Guidance). If not, refer to Table 11 and the curves in Appendix F of the LID Feasibility Report to evaluate feasibility of harvesting and using the C.3.d amount of runoff for irrigation. If that analysis shows that it is feasible to harvest and use the C.3.d amount of runoff, complete Part 5 (Factors Other than Demand) of the Rainwater Harvesting/Use Feasibility Worksheet. Skip to II.E.7.*

II.E.6 Indoor Non-Potable Uses: Feasibility of Rainwater Harvesting and Use *(check the box for the applicable project type, then fill in the requested information and answer the question):*[13]

☐ a. Residential Project

i. Number of dwelling units (total post-project): _____ Units

ii. Divide amount in (i) by the amount in II.E.4.c (Potential Rainwater Capture Area): _____ Du/ac

iii. Is the amount in (ii) LESS than 100 dwelling units per acre of capture area? ☐ **Yes** ☐ **No**

☐ b. Commercial Project

i. Floor area (total interior post-project square footage): _____ Sq.ft.

ii. Divide amount in (i) by the amount in II.E.4.c (Potential Rainwater Capture Area): _____ Sq.ft./ac

iii. Is the amount in (ii) LESS than 70,000 square feet per acre of capture area? ☐ **Yes** ☐ **No**

☐ c. School Project

i. Floor area (total interior post-project square footage): _____ Sq.ft.

ii. Divide amount in (i) by the amount in II.E.4.c (Potential Rainwater Capture Area): _____ Sq.ft./ac

iii. Is the amount in (ii) LESS than 21,000 square feet per acre of capture area? ☐ **Yes** ☐ **No**

---

[12] Landscape areas must be contiguous and within the same Drainage Management Area to irrigate with harvested rainwater via gravity flow.
[13] Rainwater harvested for indoor use is typically used for toilet/urinal flushing, industrial processes, or other non-potable uses.

II.E.6 Indoor Non-Potable Uses: Feasibility of Rainwater Harvesting and Use (continued)

☐ d. Industrial Project

i. Estimated demand for non-potable water (gallons/day): _____ Gal.

ii. Is the amount in (i) LESS than 2,400? ☐ **Yes** ☐ **No**

If you checked "No", refer to the curves in Appendix F of the LID Feasibility Report to evaluate feasibility of harvesting and using the C.3.d amount of runoff for industrial use.

☐ e. Mixed-Use Residential/Commercial Project[14]

	Residential	*Commercial*
i. Number of residential dwelling units and square footage of commercial floor area:	_____ Units	_____ Sq.ft.
ii. Percentage of total interior post-project floor area serving each activity:	_____ %	_____ %
iii. Prorated Potential Rainwater Capture Area per activity (multiply amount in II.E.4.c by the percentages in [ii]):	_____ Acres	_____ Acres
iv. Prorated project demand per acre of Potential Rainwater Capture Area (divide the amounts in [i] by the amounts in [iii]):	_____ Du/ac	_____ Sq.ft/ac

v. Is the amount in (iv) in the residential column <u>less</u> than 100 dwelling units per acre of capture area, AND is the amount in the commercial column <u>less</u> than 70,000 square feet per acre of capture area? ☐ **Yes** ☐ **No**

- *If you checked "Yes" for the above question for the applicable project type, rainwater harvesting for indoor use is considered <u>infeasible</u>, unless the project includes one or more buildings that each have an individual roof area of 10,000 sq. ft. or more, in which case further analysis is needed. Complete Sections II.E.5 and II.E.6 of this form for each such building, then continue to II.E.7.*
- *If you checked "No" for the question applicable to the type of project, rainwater harvesting for indoor use may be <u>feasible</u>. Complete the Rainwater Harvesting Feasibility Worksheet, and then continue to II.E.7.*

II.E.7 Identify and Attach Additional Feasibility Analyses

If further analysis is conducted based on results in II.E.1, II.E.2, II.E.5, or II.E.6, indicate the analysis that is conducted and attach the applicable form or other documentation (check all that apply):

☐ Special Projects Worksheet (if required in II.E.1)

☐ Infiltration Feasibility Worksheet (if required in II.E.2)

☐ Rainwater Harvesting and Use Feasibility Worksheet (if required in II.E.5 or II.E.6), completed for:

- ☐ The entire project
- ☐ Individual building(s), if applicable, describe:_____

☐ Evaluation of the feasibility of harvesting and using the C.3.d amount of runoff for irrigation, based on Table 11 and the curves in Appendix F of the LID Feasibility Report (if required in II.E.5).

☐ Evaluation of the feasibility of harvesting and using the C.3.d amount of runoff for non-potable industrial use, based on the curves in Appendix F of the LID Feasibility Report (if required in II.E.6.d).

II.E.8 Finding of Infiltration Feasibility/Infeasibility

Infiltration of the C.3.d amount of runoff is <u>infeasible</u> if any of the following conditions apply (check all that apply):

☐ The "Yes" box was checked for Item II.E.2.

☐ Completion of the Infiltration Feasibility Worksheet resulted in a finding that infiltration of the C.3.d amount of runoff is infeasible.

- *Based on the above evaluation, infiltration of the C.3.d amount of runoff is (check one):*

☐ Infeasible ☐ Feasible

[14] For a mixed-use project involving activities other than residential and commercial activities, follow the steps for residential/commercial mixed-use projects. Prorate the Potential Rainwater Capture Area for each activity based on the percentage of the project serving each activity.

II.E.9 Finding of Rainwater Harvesting and Use Feasibility/Infeasibility

Harvesting and use of the C.3.d amount of runoff is infeasible if any of the following apply (check all that apply):

- ☐ The project will have a recycled water system for non-potable use (II.E.3).
- ☐ Only the "Yes" boxes were checked for Items II.E.5 and II.E.6.
- ☐ Completion of the Rainwater Harvesting and Use Feasibility Worksheet resulted in a finding that harvesting and use of the C.3.d amount of runoff is infeasible.
- ☐ Evaluation of the feasibility of harvesting and using the C.3.d amount of runoff for irrigation, based on Table 11 and the curves in Appendix F of the LID Feasibility Report, resulted in a finding of infeasibility.
- ☐ Evaluation of the feasibility of harvesting and using the C.3.d amount of runoff for non-potable industrial use, based on the curves in Appendix F of the LID Feasibility Report, resulted in a finding of infeasibility.
  - ➢ *Based on the above evaluation, harvesting and using the C.3.d amount of runoff is (check one):*

    ☐ Infeasible ☐ Feasible

II.E.10. Use of Biotreatment

If findings of infeasibility are made in both II.E.8 (Infiltration) and II.E.9 (Rainwater Harvesting and Use), then the applicant may use appropriately designed bioretention facilities for compliance with C.3 treatment requirements.

- ➢ *Applicants using biotreatment are encouraged to maximize infiltration of stormwater if site conditions allow.*

Continue to Section II.F on the next page.

II.F. Stormwater Treatment Measures (Applies to C.3 Regulated Projects)

II.F.1 Check the applicable box and indicate the treatment measures to be included in the project.

Yes	No	
☐	☐	Is the project a **Special Project**? If yes, consult with municipal staff about the need to prepare a discussion of the feasibility and infeasibility of 100% LID treatment. Indicate the type of non-LID treatment to be used, the hydraulic sizing method*, and percentage of the amount of runoff specified in Provision C.3.d that is treated: Non-LID Treatment — Hydraulic sizing method — % of C.3.d amount of runoff treated ☐ Media filter ☐ Tree well filter
☐	☐	Is it **infeasible** to treat the C.3.d amount of runoff using either infiltration or rainwater harvesting/use (see II.E.8 and II.E.9)? If yes, indicate the biotreatment measures to be used, and the hydraulic sizing method: Biotreatment Measures — Hydraulic sizing method ☐ Bioretention area ☐ Flow-through planter ☐ Other (specify):
☐	☐	Is it **feasible** to treat the C.3.d amount of runoff using either infiltration or rainwater harvesting/use (see II.E.8 and II.E.9)? If yes, indicate the non-biotreatment LID measures to be used, and hydraulic sizing method: LID Treatment Measure (non-biotreatment) — Hydraulic sizing method ☐ Rainwater harvesting and use ☐ Bioinfiltration[15] ☐ Infiltration trench ☐ Other (specify):_____

*** Hydraulic Sizing Method:** Indicate which of the following Provision C.3.d.i hydraulic sizing methods were used:

1. Volume based approaches – Refer to Provision C.3.d.i.(1):
   1(a) Urban Runoff Quality Management approach, or
   1(b) 80% capture approach (recommended volume-based approach).

2. Flow-based approaches – Refer to Provision C.3.d.i.(2):
   2(a) 10% of 50-year peak flow approach,
   2(b) Percentile rainfall intensity approach, or
   2(c) 0.2-Inch-per-hour intensity approach (this is recommended flow-based approach AND the basis for the 4% rule of thumb described in Section 5.1 of the C.3 Technical Guidance).

3. Combination hydraulic sizing approach -- Refer to Provision C.3.d.i.(3):
   If a combination flow and volume design basis was used, indicate which flow-based and volume-based criteria were used.

II.G. Is the project a Hydromodification Management[16] (HM) Project? (Complete this section for C.3 Regulated Projects)

II.G.1 Does the project create and/or replace 1 acre (43,560 sq. ft.) or more of impervious surface? (Refer to Item I.B.1.)

☐ Yes. *Continue to Item II.G.2.*

☐ No. *The project is NOT required to incorporate HM measures. Skip to Item II.G.6 and check "No."*

II.G.2 Is the total impervious area increased over the pre-project condition? (Refer to Item I.B.1.)

☐ Yes. *Continue to Item II.G.3.*

☐ No. *The project is NOT required to incorporate HM measures. Skip to Item II.G.6 and check "No."*

[15] See Section 6.1 of the C.3 Technical Guidance for conditions in which bioretention areas provide bioinfiltration.

[16] Hydromodification is the modification of a stream's hydrograph, caused in general by increases in flows and durations that result when land is developed (made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding. Hydromodification management control measures are designed to reduce these effects.

II.G.3 Is the site located in a tidally influenced/depositional area, or in the extreme eastern portion of the county that is not subject to HM requirements? *(See HMP Susceptibility Map in Appendix I of the C.3 Technical Guidance.)*

- ☐ Yes. *Project is exempt from HM requirements. Attach map indicating project location. Skip to II.G.6 and check "No".*
- ☐ No. *Continue to II.G.4.*

II.G.4 Is the site located in a high slope zone or special consideration watershed, as shown on the HMP Susceptibility Map?

- ☐ Yes. *Project is subject to HM requirements. Attach map indicating project location. Skip to II.G.6 and check "Yes."*
- ☐ No. *Continue to II.G.5.*

II.G.5 For sites located in a white area on the HMP Susceptibility Map, has an engineer or qualified environmental professional determined that runoff from the project flows only through a hardened channel or enclosed pipe along its entire length before emptying into a waterway in the exempt area?

- ☐ Yes. *Project is exempt from HM requirements. Attach signed statement by qualified professional. Go to II.G.6 and check "No."*
- ☐ No. *Project is subject to HM requirements. Attach map indicating project location. Go to Item G.6 and check "Yes."*

II.G.6 Is the project a Hydromodification Management Project?

- ☐ Yes. *The project is subject to HM requirements in Provision C.3.g of the Municipal Regional Stormwater Permit.*
- ☐ No. *The project is EXEMPT from HM requirements.*
- ☐ HM requirements are impracticable. *(Attach documentation needed to comply with the impracticability provision in MRP Attachment B.)*

➢ *If the project is subject to the HM requirements, incorporate in the project flow duration stormwater control measures designed such that post-project stormwater discharge rates and durations match pre-project discharge rates and durations. The Bay Area Hydrology Model (BAHM) has been developed to size flow duration controls. See www.bayareahydrologymodel.org. Guidance is provided in Chapter 7 of the C.3 Technical Guidance.*

II.H Stormwater Treatment Measure and/HM Control Owner or Operator's Information:

Name:_____

Address:_____

Phone:_____ Email:_____

➢ *Applicant must call for inspection and receive inspection within 45 days of installation of treatment measures and/or hydromodification management controls.*

Name of applicant completing the form:_____

Signature:_____ Date:_____

III. For Completion By Municipal Staff

III.1 Alternative Certification: Was the treatment system sizing and design reviewed by a qualified third-party professional that is not a member of the project team or agency staff?

☐ Yes ☐ No Name of Reviewer _____

III.2. Confirm Operations and Maintenance (O&M) Submittal:

The following questions apply to C.3 Regulated Projects and Hydromodification Management Projects.

		Yes	No	N/A
III.2.a	Was maintenance plan submitted?	☐	☐	☐
III.2.b	Was maintenance plan approved?	☐	☐	☐
III.2.c	Was maintenance agreement submitted? (Date executed:_____)	☐	☐	☐

➢ *Attach the executed maintenance agreement as an appendix to this checklist.*

III.3 Incorporate HM Controls (if required)

Are the applicable items for HM compliance included in the plan submittal?

Yes	No	NA	Documentation for HM Compliance
☐	☐	☐	Site plans with pre- and post-project impervious surface areas, surface flow directions of entire site, locations of flow duration controls and site design measures per HM site design requirement
☐	☐	☐	Soils report or other site-specific document showing soil types at all parts of site
☐	☐	☐	If project uses the Bay Area Hydrology Model (BAHM), a list of model inputs.
☐	☐	☐	If project uses custom modeling, a summary of the modeling calculations with corresponding graph showing curve matching (existing, post-project, and post-project with HM controls curves), goodness of fit, and (allowable) low flow rate.
☐	☐	☐	If project uses the Impracticability Provision, a listing of all applicable costs and a brief description of the alternative HM project (name, location, date of start up, entity responsible for maintenance).
☐	☐	☐	If the project uses alternatives to the default BAHM approach or settings, a written description and rationale.

- *Municipal staff: Refer to the "Flow Duration Control Review Worksheet for HM Submittals" to review the documentation submitted for HM compliance.*

III.4 Annual Operations and Maintenance (O&M) Submittals:

For C.3 Regulated Projects and Hydromodification Management Projects, indicate the dates on which the Applicant submitted annual reports for project O&M: _____

_____

III.5 Comments:

_____

_____

_____

_____

III.6 Notes:

Section I Notes:_____

Section II Notes:_____

Section III Notes:_____

III.7 Project Close-Out:

III.7.a	Were final Conditions of Approval met?	☐	☐	
III.7.b	Was initial inspection of the completed treatment/HM measure(s) conducted? (Date of inspection:_____)	☐	☐	☐
III.7.c	Was maintenance plan submitted? (Date executed:_____)	☐	☐	☐
III.7.d	Was project information provided to staff responsible for O&M verification inspections? (Date provided to inspection staff:_____)	☐	☐	☐

Name of staff confirming project is closed out:_____

Signature:_____ Date:_____

Name of O&M staff receiving information:_____

Signature:_____ Date:_____

Appendices

Appendix A: O&M Agreement
Appendix B: O&M Annual Report Form

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Stormwater Checklist for Small Projects

Municipal Regional Stormwater Permit (MRP)
Order No. R2-2009-0074 ; Order No. R2-2011-0083
NPDES No. CAS612008

INSERT CITY SPECIFIC INFO HERE
ADDRESS
PHONE
FAX
WEB (for those who allow download etc)

Complete this form for individual single family home projects of any size, other projects that create and/or replace less than 10,000 square feet of impervious surface, and projects in the following categories that create and/or replace less than 5,000 square feet of impervious surface: restaurants, retail gasoline outlets, auto service facilities[1], and parking lots (stand-alone or part of another use).

A. Project Information

A.1 Project Name: _____

A.2 Project Address: _____

A.3 Project APN: _____

B. Select Appropriate Site Design Measures

B.1 Does the project create and/or replace 2,500 square feet or more of impervious surface[2]? ☐ Yes ☐ No

- *If yes, and the project will receive final discretionary approval on or after December 1, 2012, the project must include one of Site Design Measures a through f.[3] Fact sheets regarding site design measures a through f may be downloaded at http://www.flowstobay.org/bs_new_development.php#flyers.*
- *If no, or the project will receive final discretionary approval before December 1, 2012, the project is encouraged to implement site design measures[4], which may be required at municipality discretion. Consult with municipal staff about requirements for your project.*

B.2 Is the site design measure included in the project plans?

Yes	No	Plan Sheet No.	
☐	☐		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
☐	☐		b. Direct roof runoff onto vegetated areas.
☐	☐		c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
☐	☐		d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
☐	☐		e. Construct sidewalks, walkways, and/or patios with permeable surfaces.
☐	☐		f. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.
☐	☐		g. Minimize land disturbance and impervious surface (especially parking lots).
☐	☐		h. Maximize permeability by clustering development and preserving open space.
☐	☐		i. Use micro-detention, including distributed landscape-based detention.
☐	☐		j. Protect sensitive areas, including wetland and riparian areas, and minimize changes to the natural topography.
☐	☐		k. Self-treating area (see Section 4.2 of the C.3 Technical Guidance)
☐	☐		l. Self-retaining area (see Section 4.3 of the C.3 Technical Guidance)
☐	☐		m. Plant or preserve interceptor trees (Section 4.1, C.3 Technical Guidance)

[1] See Standard Industrial Classification (SIC) codes here.
[2] Complete the C.3/C.6 Development Review Checklist if the project is not an individual single family home, and it creates and/or replaces 10,000 square feet or more of impervious surface; or if it is a restaurant, retail gasoline outlet, auto service facility, or parking lot project that creates and/or replaces 5,000 square feet or more of impervious surface.
[3] See MRP Provision C.3.i.
[4] See MRP Provision C.3.a.i.(6).

Approved December 4, 2012

C. Select appropriate source controls *(Encouraged for all projects; may be required at municipal discretion. Consult municipal staff.[5])*

Are these features in project? Yes	No	Features that require source control measures	Source control measures (Refer to Local Source Control List for detailed requirements)	Is source control measure included in project plans? Yes	No	Plan Sheet No.
☐	☐	Storm Drain	▪ Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.	☐	☐	
☐	☐	Floor Drains	▪ Plumb interior floor drains to sanitary sewer [or prohibit].	☐	☐	
☐	☐	Parking garage	▪ Plumb interior parking garage floor drains to sanitary sewer.[6]	☐	☐	
☐	☐	Landscaping	▪ Retain existing vegetation as practicable. ▪ Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects. ▪ Minimize use of pesticides and quick-release fertilizers. ▪ Use efficient irrigation system; design to minimize runoff.	☐	☐	
☐	☐	Pool/Spa/Fountain	▪ Provide connection to the sanitary sewer to facilitate draining.[6]	☐	☐	
☐	☐	Food Service Equipment (non-residential)	Provide sink or other area for equipment cleaning, which is: ▪ Connected to a grease interceptor prior to sanitary sewer discharge.[6] ▪ Large enough for the largest mat or piece of equipment to be cleaned. ▪ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.	☐	☐	
☐	☐	Refuse Areas	▪ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff. ▪ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.[6]	☐	☐	
☐	☐	Outdoor Process Activities [7]	▪ Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer.[6]	☐	☐	
☐	☐	Outdoor Equipment/ Materials Storage	▪ Cover the area or design to avoid pollutant contact with stormwater runoff. ▪ Locate area only on paved and contained areas. ▪ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer[6], and contain by berms or similar.	☐	☐	
☐	☐	Vehicle/ Equipment Cleaning	▪ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer[6], and sign as a designated wash area. ▪ Commercial car wash facilities shall discharge to the sanitary sewer.[6]	☐	☐	
☐	☐	Vehicle/ Equipment Repair and Maintenance	▪ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas. ▪ No floor drains unless pretreated prior to discharge to the sanitary sewer. [6] ▪ Connect containers or sinks used for parts cleaning to the sanitary sewer. [6]	☐	☐	
☐	☐	Fuel Dispensing Areas	▪ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break. ▪ Canopy shall extend at least 10 ft in each direction from each pump and drain away from fueling area.	☐	☐	
☐	☐	Loading Docks	▪ Cover and/or grade to minimize run-on to and runoff from the loading area. ▪ Position downspouts to direct stormwater away from the loading area. ▪ Drain water from loading dock areas to the sanitary sewer.[6] ▪ Install door skirts between the trailers and the building.	☐	☐	
☐	☐	Fire Sprinklers	▪ Design for discharge of fire sprinkler test water to landscape or sanitary sewer[6]	☐	☐	
☐	☐	Miscellaneous Drain or Wash Water	▪ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.[6] ▪ Roof drains shall drain to unpaved area where practicable. ▪ Drain boiler drain lines, roof top equipment, all washwater to sanitary sewer [6].	☐	☐	
☐	☐	Architectural Copper	▪ Drain rinse water to landscaping, discharge to sanitary sewer [6], or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."	☐	☐	

[5] See MRP Provision C.3.a.i(7).

[6] Any connection to the sanitary sewer system is subject to sanitary district approval.

[7] Businesses that may have outdoor process activities/equipment include machine shops, auto repair, industries with pretreatment facilities.

D. Implement construction Best Management Practices (BMPs) *(Required for all projects.)*

D.1 Is the site a "High Priority Site"? (*Municipal staff will make this determination; if the answer is yes, the project will be referred to construction site inspection staff for monthly stormwater inspections during the wet season, October 1 through April 30.*) Yes ☐ No ☐

- "High Priority Sites" are sites that require a grading permit, are adjacent to a creek, or are otherwise high priority for stormwater protection during construction per MRP Provision C.6.e.ii(2).

D.2 All projects require appropriate stormwater BMPs during construction, indicate which BMPs are included in the project, below.

Yes	No	Best Management Practice (BMP)
☐	☐	Attach the San Mateo Countywide Water Pollution Prevention Program's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
☐	☐	Temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
☐	☐	Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
☐	☐	Provide notes, specifications, or attachments describing the following: ▪ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency; ▪ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material; ▪ Specifications for vegetative cover & mulch, include methods and schedules for planting and fertilization; ▪ Provisions for temporary and/or permanent irrigation.
☐	☐	Perform clearing and earth moving activities only during dry weather.
☐	☐	Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
☐	☐	Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
☐	☐	Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
☐	☐	Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
☐	☐	Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.
☐	☐	Limit construction access routes and stabilize designated access points.
☐	☐	No cleaning, fueling, or maintaining vehicles on-site, except in a designated area where washwater is contained and treated.
☐	☐	Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
☐	☐	Contractor shall train and provide instruction to all employees/subcontractors re: construction BMPs.
☐	☐	Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, washwater or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.

Name of applicant completing the form:_____

Signature:_____ Date:_____

E. Comments (for municipal staff use only):

_____

_____

_____

F. NOTES (for municipal staff use only):

Section A Notes:_____

Section B Notes:_____

Section C Notes:_____

Section D Notes:_____

MODEL LIST OF SOURCE CONTROL MEASURES

The following list contains measures to control sources of stormwater pollutants associated with the post-construction phase of new development and redevelopment projects. Each identified source of pollutants may have one or more appropriate control measures. The model list is intended to be a menu from which agencies may select appropriate measures to apply to specific projects. Agency discretion is reserved to consider constraints such as municipal sewer system capacity and allocation restrictions and storm drain system infrastructure and design features/limitations. Phrases in brackets represent alternative or optional wording. An asterisk is used to indicate which source control measures on the Model List are also included in, or similar to conditions included in, the New Development Subcommittee's COAs, dated April 1999.

I. STRUCTURAL CONTROL MEASURES

I.A. Illegal Dumping to Storm Drain Inlets and Waterways

* On-site storm drain inlets shall be clearly marked with the words "No Dumping! Flows to Bay," or equivalent, using methods approved by the [Agency]. For projects with newly-developed, privately-maintained streets, agency staff will verify that storm drain inlets have been marked before the final sign-off on the project's building permit or encroachment permit.

I.B. Interior Floor Drains

Interior floor drains shall be plumbed to the sanitary sewer system and shall not be connected to storm drains [or interior floor drains are prohibited]. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of plumbing interior floor drains, consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

I.C. Parking Garages

Interior level parking garage floor drains [receiving non-stormwater discharges] shall be connected to [a water treatment device approved by the (Agency) prior to discharging to] the sanitary sewer system. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [Or – If a municipality determines that connecting to a sanitary sewer system is not practicable, the applicant may propose an alternative method of plumbing interior parking garage floor drains or addressing runoff consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff].

I.D. Pesticide/Fertilizer Application and Irrigation

1) * Landscaping shall be designed to minimize irrigation and runoff, promote surface infiltration where possible, minimize the use of fertilizers and pesticides that can contribute to stormwater pollution, and incorporate appropriate Bay-Friendly Landscaping principles.

2) Structures shall be designed to discourage the occurrence and entry of pests into buildings, thus minimizing the need for pesticides. For example, dumpster areas should be located away from occupied buildings, and building foundation vents shall be covered with screens.

3) If a landscaping plan is required as part of a development project application, the plan shall meet the following conditions related to reduction of pesticide use on the project site:

   a. * Where feasible, landscaping shall be designed and operated to treat stormwater runoff by incorporating elements that collect, detain, and infiltrate runoff. In areas that provide detention of water, plants that are tolerant of saturated soil conditions and prolonged exposure to water shall be specified.

   b. Plant materials selected shall be appropriate to site specific characteristics such as soil type, topography, climate, amount and timing of sunlight, prevailing winds, rainfall, air movement, patterns of land use, ecological consistency and plant interactions to ensure successful establishment.

   c. Existing native trees, shrubs, and ground cover shall be retained and incorporated into the landscape plan to the maximum extent practicable.

   d. Proper maintenance of landscaping, with minimal pesticide use, shall be the responsibility of the property owner.

   e. Integrated pest management (IPM) principles and techniques shall be encouraged as part of the landscaping design. Examples of IPM principles and techniques include:

      1. Select plants that are well adapted to soil conditions at the site.
      2. Select plants that are well adapted to sun and shade conditions at the site. Consider future conditions when plants reach maturity. Consider seasonal changes and time of day.
      3. Provide irrigation appropriate to the water requirements of the selected plants.
      4. Select pest- and disease-resistant plants.
      5. Plant a diversity of species to prevent a potential pest infestation from affecting the entire landscaping plan.

6. Use “insectary” plants in the landscaping to attract and keep beneficial insects.

4) * Landscaping shall also comply with [Agency’s] “water efficient landscape ordinance” or equivalent.

5) An efficient irrigation system shall be installed in areas requiring irrigation. An example of an efficient irrigation system is one that includes a weather-based (automatic, self-adjusting) irrigation controller with a moisture and/or rain sensor shutoff, and in which sprinkler and spray heads are not permitted in areas less than 8 feet wide.

I.E. Pool, Spa, and Fountain Discharges

1) New or rebuilt swimming pools, hot tubs, spas and fountains must have a connection to the sanitary sewer to facilitate draining. This connection could be a drain in the pool to the sanitary sewer or a cleanout located close enough to the pool so that a hose can readily direct the pool discharge into the sanitary sewer cleanout. [Agency with permitting authority shall coordinate with local sanitary sewer agencies to determine the standards and requirements necessary for the installation of a sanitary sewer discharge location to allow draining with the proper permits from the local sanitary sewer agency.]

2) Subject to local requirements, when draining is necessary, a hose or other temporary system shall be directed into a sanitary sewer clean out, or vegetated areas that are large enough to accommodate the volume without allowing the discharged water to flow to the storm drain system or receiving water body. For discharges to the sanitary sewer, the applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific discharge requirements.

3) [If there are no other feasible disposal alternatives (e.g. disposal to sanitary sewer or landscaped areas), swimming pool, spa and fountain water may be allowed to discharge to the storm drains if the water has been properly dechlorinated to non-detectable levels of chlorine consistent with water quality standards, the water is within ambient temperature, and no copper-based algae control projects have been added to the water.]

I.F. Food Service Equipment Cleaning

* Food service facilities (including restaurants and grocery stores) shall have a sink or other container or area for cleaning floor mats, equipment, and hood filters, which is connected to a grease interceptor prior to discharging to the sanitary sewer system. The cleaning area shall be large enough to clean the largest mat or piece of equipment to be cleaned. The cleaning area shall be indoors or in a roofed area outdoors; both areas must be plumbed to the sanitary sewer. Outdoor cleaning areas shall be designed to prevent stormwater run-on from entering the sanitary sewer and to prevent stormwater run-off from carrying pollutants to the storm drain. Signs shall be

posted indicating that all food service equipment washing activities shall be conducted in this area. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of plumbing interior or roofed floor drains that is consistent with the Municipal Regional Stormwater Permit and, subject to approval by Agency staff.]

I.G. Refuse Areas

1) * New or redevelopment projects [such as food service facilities, recycling facilities and/or multi-family residential complexes or subdivisions or similar facilities] [or - such as food service facilities, recycling facilities or similar facilities] shall provide a roofed and enclosed area for dumpsters, recycling containers, compactors, and food waste containers. The area shall be designed to prevent water run-on to the area and runoff from the area and to contain litter and trash, so that it is not dispersed by the wind or runoff during waste removal. Dumpster drips from covered trash and food compactor enclosures shall drain to the sanitary sewer, subject to the local sanitary sewer agency's authority and standards.

2) * Runoff from food service areas, trash enclosures, recycling areas, and/or food compactor enclosures or similar facilities shall not discharge to the storm drain system. Trash enclosure areas shall be designed to avoid run-on to the trash enclosure area. Any drains installed in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities shall be connected [to a grease removal device and/or treatment devices prior to discharging] to the sanitary sewer. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of providing for drainage from the trash enclosure area that is consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

I.H. Outdoor Process Activities/Equipment[1]

1) Process activities shall be performed either indoors or in roofed outdoor areas. If performed outdoors, the area shall be designed to prevent run-on to and runoff from the area with process activities.

2) * Process equipment areas shall drain to the sanitary sewer system. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of providing for drainage of process

[1] Examples of businesses that may have outdoor process activities and equipment include machine shops and auto repair shops, and industries that have pretreatment facilities.

equipment areas that is consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

I.I. Outdoor Equipment/Materials Storage

1) * All outdoor equipment and materials storage areas shall be covered [and bermed], or shall be designed with BMPs to limit the potential for runoff to contact pollutants

2) Storage areas containing non-hazardous liquids shall be covered by a roof and drain to the sanitary sewer system, and be contained by berms, dikes, liners, vaults or similar spill containment devices. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [Or – Storage areas containing non-hazardous liquids shall be covered by a roof and contained by berms, dikes, liners, vaults or similar spill containment devices.]

3) All on-site hazardous materials and wastes, as defined and/or regulated by the California Public Health Code and the local Certified Unified Program Agency (CUPA) [, i.e., Alameda County Environmental Health Department], must be used and managed in compliance with the applicable CUPA program regulations and the facility hazardous materials management plan approved by the CUPA authority.

I.J. Vehicle/Equipment and Commercial/Industrial Cleaning

1) Wastewater from vehicle and equipment washing operations shall not be discharged to the storm drain system. [However, for car dealerships, if water only (without soap or other cleaning agent) is used for a minimal amount of rinsing of vehicle exterior surfaces for appearances purposes, the runoff may be discharged to the storm drain system.]

2) * Commercial/industrial facilities having vehicle/equipment cleaning needs [and new residential complexes of 25 units or greater] shall either provide a roofed, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs (faucets) and installing signs prohibiting such uses. Vehicle/equipment washing areas shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. A sign shall be posted indicating the location and allowed uses in the designated wash area. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of providing for drainage of the vehicle/equipment washing area that is consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

3) * Commercial car wash facilities shall be designed and operated such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer [or a wastewater reclamation system shall be installed and the wastewater reused with no

discharges to the storm drain]. The applicant shall contact the local permitting authority [or sanitary district with jurisdiction] for specific connection and discharge requirements.

I.K. Vehicle/Equipment Repair and Maintenance

1) Vehicle/equipment repair and maintenance shall be performed in a designated area indoors, or if such services must be performed outdoors, in an area designed to prevent the run-on and runoff of stormwater.

2) Secondary containment shall be provided for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.

3) Vehicle service facilities shall not contain floor drains [unless the floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer, for which an industrial waste discharge permit has been obtained. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements.]

4) Tanks, containers or sinks used for parts cleaning or rinsing shall not be connected to the storm drain system. Tanks, containers or sinks used for such purposes may only be connected to the sanitary sewer system if allowed by an industrial waste discharge permit. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of providing for drainage of tanks, containers or sinks used for parts cleaning or rinsing that is consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

I.L. Fuel Dispensing Areas

1) * Fueling areas[2] shall have impermeable surfaces (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.

2) * Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump or the length at which the fuel hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater. [Alternative: The fueling area must be roofed and the roof's minimum dimensions must be equal to or greater than the area within

[2] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

the grade break or fuel dispensing area, as defined below.[2]] The canopy [or roof] shall not drain onto the fueling area.

I.M. Loading Docks

1) * Loading docks shall be graded to minimize run-on to and runoff from the loading area [and/or be covered]. Roof downspouts shall be positioned to direct stormwater away from the loading area. Stormwater runoff from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. [Or – Stormwater runoff from loading dock areas shall be connected to a post-construction stormwater treatment measure(s) prior to discharge to the storm drain system]. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements.

2) Door skirts between the trailers and the building shall be installed to prevent exposure of loading activities to rain, unless one of the following conditions apply:: the loading dock is covered, or the applicant demonstrates that rainfall will not result in an untreated discharge to the storm drain system.

I.N. Fire Sprinkler Test Water

Provisions shall be made in the project design and construction to allow for the discharge of fire sprinkler test water to an onsite vegetated area. If this is not feasible, provide for discharge to the sanitary sewer subject to approval from the local permitting authority and/or sanitary district with jurisdiction.

I.O. Miscellaneous Drain or Wash Water

1) Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of providing for boiler drain lines that is consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

2) For small air conditioning units, air conditioning condensate should be directed to landscaped areas as a minimum BMP. For large air conditioning units, in new developments or significant redevelopments, the preferred alternatives are for condensate lines to be directed to landscaped areas, or alternatively connected to the sanitary sewer system after obtaining permission from the sanitary sewer's owner. As with smaller units, any anti-algal or descaling agents must be properly disposed of. Any air conditioning condensate that discharges to land without flowing to a storm drain may be subject to the requirements of the State Water Resources Control Board's (SWRCB) Statewide General Waste Discharge Requirements (WDRs) for Discharges to Land with a Low Threat to Water Quality. [Or – Air conditioning condensate lines may discharge to the storm drain system provided they are not a source of pollutants].

3) Roof drains shall discharge and drain away from the building foundation to an unpaved area wherever practicable.

4) Roof top equipment [other than that producing air conditioning condensate] [or including that producing air conditioning condensate] shall drain to the sanitary sewer [or be covered and have no discharge to the storm drain]. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements.

5) * Most washing and/or steam cleaning must be done at an appropriately equipped facility that drains to the sanitary sewer. Any outdoor washing or pressure washing must be managed in such a way that there is no discharge of soaps or other pollutants to the storm drain. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements. [These conditions shall be required for automotive related businesses]. [In the event that the sanitary district does not approve the connection, the applicant may propose an alternative method of providing for drainage of the washing or steam cleaning facility that is consistent with the Municipal Regional Stormwater Permit and subject to approval by Agency staff.]

I.P. Architectural Copper Installation

1) Projects with architectural copper should, if possible, purchase copper materials that have been pre-patinated at the factory. Whether patination is done offsite or onsite, applicant should consider coating the copper materials with an impervious coating that prevents further corrosion and runoff. If patination is done on-site, implement one or both of the following:
   - Collect rinse water in a tank and pump to the sanitary sewer. Contact your local sanitary sewer agency before discharging to the sanitary sewer.
   - Collect the rinse water in a tank and haul off-site for proper disposal.

II. OPERATIONAL BMPS

This section describes Operational best management practices (BMPs) that rely on private property owners to implement following construction of projects. Responsibility for implementation of these BMPs clearly rests with the property owners. Because some of these Operational BMPs may be difficult to implement, the municipalities may consider some of these Operational BMPs as reasonable goals to achieve. The municipalities have certain limited responsibilities for verification of property owner implementation. [The municipality will check on a property owner/operator's implementation of required Operational BMPs only during industrial and commercial business inspections, if any, and/or any inspections to verify the operation and maintenance of stormwater treatment measures, and/or may require the property owners to submit technical reports to verify the effective implementation of the Operational BMPs.]

II.A. Paved Sidewalks and Parking Lots

* Sidewalks and parking lots shall be swept regularly to minimize the accumulation of litter and debris. Debris resulting from pressure washing shall be trapped and collected to prevent entry into the storm drain system. Washwater containing any soap, cleaning agent or degreaser shall not be discharged to the storm drain [and shall be collected and discharged to the sanitary sewer] [or collected and treated prior to being lawfully disposed]. The applicant shall contact the local permitting authority [and/or sanitary district with jurisdiction] for specific connection and discharge requirements.

II.B. Private Streets, Utilities and Common Areas

1) The owner of private streets and storm drains shall prepare and implement a plan for street sweeping of paved private roads and cleaning of all storm drain inlets.

2) * For residential developments, where other maintenance mechanisms are not applicable or otherwise in place a property owners association, architectural committee, or similar organization [or a maintenance assessment district, special assessment district, or similar arrangement] shall be created and shall be responsible for maintaining all private streets and private utilities and other privately owned common areas and facilities on the site including landscaping. These maintenance responsibilities shall include implementing and maintaining stormwater BMPs associated with improvements and landscaping [and will include the maintenance responsibilities described in the maintenance plan, which is included as an attachment to the stormwater treatment measure O&M agreement for the subject property]. [CC&R's creating the association shall be reviewed and approved by the City or County Attorney prior to the recordation of the Final Map and recorded prior to the sale of the first residential unit.] The CC&R's [or special assessment district] shall describe how the stormwater BMPs associated with privately owned improvements and landscaping shall be maintained by the association [or the special assessment district].

II.C. Vehicle/Equipment Repair and Maintenance

1) No person shall dispose of, nor permit the disposal, directly or indirectly, of vehicle fluids, hazardous materials, or rinsewater from parts cleaning operations into storm drains.

2) No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.

3) No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area that

cannot discharge to the storm drain, such as an area with secondary containment.

II.D. Fueling Areas

The property owner shall dry sweep the fueling area and spot clean leaks and drips routinely. Fueling areas shall not be washed down with water unless the wash water is collected and disposed of properly (i.e., not in the storm drain).

II.E. Loading Docks

* The property owner shall ensure that BMPs are implemented to prevent potential stormwater pollution. These BMPs shall include, but are not limited to, a regular program of sweeping, litter control and spill clean-up.

II.F. On-site Storm Drains

* All on-site storm drains must be cleaned [or inspected and, if necessary, cleaned] at least once a year immediately prior to the rainy season. Additional cleaning may be required by the [Agency].

II.G. Architectural Copper Cleaning, Treating or Washing

1) When cleaning, treating or washing architectural copper features, implement one or both of the following:
   - Collect rinse water in a tank and pump to the sanitary sewer. Contact your local sanitary sewer agency before discharging to the sanitary sewer.
   - Collect the rinse water in a tank and haul off-site for proper disposal.

cleanwater PROGRAM

MEMBER AGENCIES:

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County of Alameda
Alameda County Flood Control and Water Conservation District
Zone 7 Water Agency

C.3 Stormwater Technical Guidance

May 14, 2013

A handbook for developers, builders and project applicants

Version 4.0

Protecting Alameda County Creeks, Wetlands & the Bay

Local Contacts

Please contact the local agency with any questions regarding requirements specific to the local jurisdiction, using contact information provided below.

Alameda (City of): Public Works Department, 510.747.7930

Alameda County Flood Control and Water Conservation District: 510.670.5543

339 Elmhurst Street, 1st Floor, Permit Center, Hayward, CA 94544

Albany: Community Development and Environmental Resources Department 1000 San Pablo Avenue, Albany, CA 94706. 510.528.5760, www.albanyca.org/index.aspx?page=132

Berkeley: 510.981.6421

Dublin: 925.833.6650

Emeryville: Civic Center, 1333 Park Ave, Emeryville, CA 94608

510.596.3728, www.ci.emeryville.ca.us/planning/stormwater.html

Fremont: Environmental Services Division, 39550 Liberty Street, Fremont CA 94538, 510.494.4570, www.fremont.gov/stormwaterdevelopment

Hayward: Engineering and Transportation Division, 510.583.4785

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Oakland: Permit Center, 250 Frank H. Ogawa Plaza, 2nd Floor, Oakland, CA 94612

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Credits

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2012 Update: Stormwater Quality Control Requirements

Information for Developers, Builders and Project Applicants

September 2012

Why Are New Requirements Needed?

Stormwater runoff from urbanized areas remains the largest source of pollution to San Francisco Bay. Local agencies in urbanized portions of the Bay Area are responsible for controlling stormwater pollution by complying with the Municipal Regional Stormwater Permit, issued by the State Regional Water Quality Control Board (Water Board) in October 2009.

Rainwater is harvested and used to flush toilets in Oakland.

Overview of Stormwater Requirements

During development review, local agencies require projects to include stormwater controls, depending on project type and size, including:

- Site design measures,
- Source controls,
- Low Impact Development (LID) treatment measures,
- Hydromodification management,
- Construction BMPs.

The newest requirements are described in the sidebar at right.

Site Design for Water Quality

Site design measures to reduce water quality impacts include:

- Reduce impervious surfaces.
- Direct runoff from impervious surfaces to vegetated areas.

New site design requirements are described in the sidebar.

Source Controls

Source controls prevent potential pollutant sources from contacting rainfall and stormwater. Examples include:

- Roofed trash enclosures.
- Pest-resistant landscaping.
- Sanitary sewer drains for vehicle wash areas (with sewer district approval).

Contact the city where your project is located for its Local Source Control Measures List (see Contact Info on page 2).

Low Impact Development (LID) StormwaterTreatment

The goal of low impact development (LID) is to reduce stormwater runoff and mimic a site's predevelopment hydrology. LID treatment consists of:

- Infiltration,
- Harvesting and using rainwater,
- Evapotranspiration (evaporating stormwater into the air directly or through plant transpiration), or
- Biotreatment (filtering water through vegetation and engineered soil before it reaches the storm drain).

New 2012 Requirement

Beginning December 1, 2012, a new requirement applies to:

- *Projects that create and/or replace at least 2,500 square feet, but less than 10,000 square feet, of impervious surface, and*
- *Individual single family homes that create and/or replace 2,500 square feet or more of impervious surface.*

These projects must include at least one of the following site design measures:

- *Direct roof runoff*
  - *Into cisterns or rain barrels for use, or*
  - *Onto vegetated areas.*
- *Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.*
- *Direct runoff from driveways/uncovered parking lots onto vegetated areas.*
- *Construct sidewalks, walkways, and/or patios with permeable surfaces.*
- *Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.*

Biotreatment is allowed only if it is infeasible to treat the amount of stormwater specified in Provision C.3.d of the MRP with infiltration, rainwater harvesting and use, or evapotranspiration. LID treatment is required for projects that create and/or replace 10,000 square feet or more of impervious surface. The following project categories require LID if they create and/or replace

5,000 square feet, or more, of impervious surface:

- Uncovered parking areas (stand-alone or part of another use),
- Restaurants,
- Auto service facilities[1],
- Retail gasoline outlets.

A Stormwater Requirements Checklist (available from municipal staff) walks you through a process to evaluate:

- Whether the site soils are sufficiently permeable to infiltrate the amount of runoff specified in Provision C.3.d of the MRP, and
- Whether the project may have sufficient demand for non-potable water to harvest and use the C.3.d amount of runoff.

Evapotranspiration was addressed in the model used to develop checklist questions. For more information on evaluating feasibility, see Appendix J of the Clean Water Program's C.3 Technical Guidance (available on the Program's website).

The use of vault-based systems is restricted to projects that meet the Special Projects criteria described in Appendix K of the C.3 Technical Guidance.

A bioretention area in Fremont provides biotreatment and some infiltration of stormwater runoff.

Hydromodification Management (HM)

When land is covered with buildings and pavement, runoff enters creeks at higher rates and volumes, resulting in channel erosion, flooding and habitat loss. These changes to waterways are known as hydromodification. Hydromodification management (HM) measures are detention and/or infiltration facilities that are constructed with special discharge structures to match pre-project runoff patterns. HM requirements are different from flood control requirements.

If a project creates and/or replaces one acre or more of impervious surface, AND is located in a susceptible area, HM requirements apply. You can view a map of susceptible areas and flyer on HM requirements in the HM section of the Clean Water Program's New Development webpage (see Contact Information).

Maintaining Treatment and HM Measures

LID treatment measures and HM measures need ongoing maintenance to keep working properly. Applicants must prepare a maintenance plan and sign, with the applicable local agency, a maintenance agreement that runs with the land.

Construction Site Controls

Project sites are required to use construction BMPs, such as:

- Prepare and use sediment and erosion control plans.
- Minimize exposed soil by stabilizing slopes.

Projects disturbing one acre or more must comply with the Statewide Construction NPDES General Permit. For more information, visit www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml.

What is Required for My Project?

Check with the city where your project is located for specific application requirements.

Flow-through planters provide biotreatment of runoff in Emeryville.

Contact Information

- Clean Water Program: 510/670-5543, www.cleanwaterprogram.org/development
- Water Board staff: 510/622-2300 (request Alameda County storm-water program manager)
- For contact info for new development representatives at local agencies, go to the weblink listed above.

---

[1] Standard Industrial Classification (SIC) Codes for auto service facilities include:

- Wholesale distributors (SIC Codes 5013 and 5014);
- Gasoline service stations (SIC Code 5541);
- Auto repair facilities (SIC Codes 7532, 7533, 7534, 7536, 7537, 7538, 7539).

Alameda Countywide
Clean Water Program

Contra Costa
Clean Water Program

Fairfield-Suisun
Urban Runoff
Management Program

Marin County
Stormwater Pollution
Prevention Program

Napa County
Stormwater Pollution
Prevention Program

San Mateo Countywide
Water Pollution
Prevention Program

Santa Clara Valley
Urban Runoff Pollution
Prevention Program

Sonoma County
Water Agency

Vallejo Sanitation
and Flood
Control District

B A S M A A

September 16, 2013

Bruce Wolfe, Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Green Street Pilot Projects Summary Report - MRP Provisions C.3.b.iii and C.3.b.v.(2)(c)

Dear Mr. Wolfe:

This letter and attachment are submitted on behalf of all 76 municipalities subject to the requirements of the Municipal Regional Stormwater NPDES Permit (MRP).

MRP Provision C.3.b.iii states:

> The Permittees shall cumulatively complete ten pilot green street projects that incorporate LID techniques for site design and treatment in accordance with Provision C.3.c and that provide stormwater treatment sized in accordance with Provision C.3.d. It is also desirable that they meet or exceed the Bay-Friendly Landscape Scorecard minimum requirements (see www.BayFriendly.org).
>
> (1) Parking lot projects that provide LID treatment in accordance with Provisions C.3.c and Provision C.3.d. for stormwater runoff from the parking lot and street may be considered pilot green street projects.
> (2) A Regulated Project (as defined in Provision C.3.b.ii) may not be counted as one of the ten pilot green street projects.
> (3) At least two pilot green street projects must be located in each of the following counties: Alameda, Contra Costa, San Mateo, and Santa Clara.
> (4) The Permittees shall construct the ten pilot green street projects in such a manner that they, as a whole:
> (a) Are representative of the various types of streets: arterial, collector, and local; and
> (b) Contain the following key elements:
> (i) Stormwater storage for landscaping reuse or stormwater treatment and/or infiltration for groundwater replenishment through the use of natural feature systems;
> (ii) Creation of attractive streetscapes that enhance neighborhood livability by enhancing the pedestrian environment and introducing park-like elements into neighborhoods;
> (iii) Service as an urban greenway segment that connects neighborhoods, parks, recreation facilities, schools, mainstreets, and wildlife habitats;

Bay Area

Stormwater Management

Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

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(iv) Parking management that includes maximum parking space requirements as opposed to minimum parking space requirements, parking requirement credits for subsidized transit or shuttle service, parking structures, shared parking, car sharing, or on-street diagonal parking;
(v) Meets broader community goals by providing pedestrian and, where appropriate, bicycle access; and
(vi) Located in a Priority Development Area as designated under the Association of Bay Area Government's and Metropolitan Transportation Commission's FOCUS4 program.

(5) The Permittees shall conduct appropriate monitoring of these projects to document the water quality benefits achieved. Appropriate monitoring may include modeling using the design specifications and specific site conditions

Due Date – All green street projects shall be completed by December 1, 2014.

Provision C.3.b.v.(2)(c) requires the Permittees to submit a report as follows:

(c) The 2013 Annual Report shall contain a summary of all green street projects completed by January 1, 2013. The summary shall include for each completed project the following information:

(i) Location of project

(ii) Size of project, including total impervious surface treated

(iii Map(s) of project showing areas where stormwater runoff will be treated by LID measures

(iv) Specific type(s) of LID treatment measures included

(v) Total and specific costs of project

(vi) Specific funding sources for project and breakdown of percentage paid by each funding source

(vii) Lessons learned, including recommendations to facilitate funding and building of future projects

(viii) Identification of responsible party and funding source for operation and maintenance.

Through the Bay Area Stormwater Management Agencies Association (BASMAA), the Permittees collaboratively developed the attached Green Street Pilot Projects Summary Report. Although monitoring is a component of more than half of the green street projects, a limited body of monitoring data is available as of the due date for this report; therefore, the report includes model-based estimates of pollutant removal by the projects.

Based on the information in this report and experience to date in the Bay Area, we would like to share the following observations and conclusions:

- Provision C.3.b.iii required the implementation of 10 green street pilot projects throughout the region. However, more than 20 such projects have been developed or are being developed during the term of the MRP (see Table A3 of the report for information regarding ten "additional" projects). For most of the projects, proponents indicated the project was initiated prior to adoption of the MRP, due to factors such as available funding, opportunity, and community goals and interests.
- Of the 20 projects, most projects were or will be at least partially funded by grants, and many received funding from multiple sources. (One project was funded solely by the local municipality, two projects were associated with private development projects, and one project was partially funded by private entities.). This further demonstrates the importance of the availability of additional sources of funding and opportunities for collaboration with other agencies beyond the local municipality in the success of a green street project.
- Although it is not explicitly stated in the report, among the most substantive lessons learned is that it is only possible to implement green street projects in developed areas when a fortuitous set of characteristics coincide. These include locations with favorable topography, adequate space within the right-of-way, an absence of irreconcilable utility conflicts, and a storm drain sufficiently close and deep to allow tie-in of treatment facility underdrains (if needed). Sites with this combination of features are limited.

As the parties initiating, constructing, and maintaining green streets projects, the Permittees conclude that implementation of green streets (or "green infrastructure") can best be furthered not through permit provisions requiring development of green streets, but rather by facilitating grant funding, providing appropriate incentives in related sections of permits, and perhaps most importantly, working collaboratively with Permittees, transportation agencies, and state and federal agencies that provide water quality-related funding to better integrate green street objectives with transportation programs. Green street projects are most likely to occur in situations where a transportation project is already planned. Trying to acquire supplemental funding for green street features through grant solicitations that are not in sync with transportation funding programs and calendars is extremely challenging, at best.

We look forward to discussing with you and your staff the green street pilot projects, lessons learned thus far, and potential strategies to facilitate green streets projects on a larger scale. An informational slide show has been developed along with this report, and we would welcome the opportunity to share that presentation with you and your Board.

We certify under penalty of law that this document was prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James Scanlin, Alameda Countywide Clean Water Program

Tom Dalziel, Contra Costa Clean Water Program

Kevin Cullen, Fairfield-Suisun Urban Runoff Management Program

Matt Fabry, San Mateo Countywide Water Pollution Prevention Program

Adam Olivieri, Santa Clara Valley Urban Runoff Pollution Prevention Program

Lance Barnett, Vallejo Sanitation and Flood Control District

Attachment: Green Street Pilot Projects Summary Report

cc: Tom Mumley, Regional Water Board
Shin-Roei Lee, Regional Water Board
Dale Bowyer, Regional Water Board
Sue Ma, Regional Water Board
BASMAA Board of Directors

Prepared for

Bay Area Stormwater Management Agencies Association (BASMAA)
P.O. Box 2385
Menlo Park, CA 94026

FINAL

Green Street Pilot Projects

Summary Report

Municipal Regional Permit
Provision C.3.b.iii. and C.3.b.v.(2)(c).

Prepared by

Geosyntec consultants

engineers | scientists | innovators

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7 August 2013

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1. EXECUTIVE SUMMARY

Municipal Regional Permit[1] (MRP) Provision C.3.b.iii requires that Permittees cumulatively complete ten green street pilot retrofit projects (Projects) that incorporate low impact development (LID) techniques for site design and treatment in accordance with Provision C.3.c and provide stormwater treatment sized in accordance with Provision C.3.d. At least two projects must be located in each of the following counties: Alameda, Contra Costa, San Mateo, and Santa Clara. Additionally, MRP Provision C.3.b.iii. (5) requires that the Permittees conduct appropriate monitoring of these projects to document the water quality benefits achieved. Appropriate monitoring may include modeling using design specifications and specific site conditions. The 2013 Annual Report, due to the Regional Water Board on September 15, 2013, must contain a summary of all green street pilot projects completed by January 1, 2013.

In fulfillment of MRP Provision C.3.b.v.(2)(c), this report, which is to be included with the 2013 Annual Report, provides project descriptions that include the locations of the ten selected green street pilot projects, the proposed treatment measures, drainage catchment information, project designs, construction activities, cost estimates, funding sources, and identification of parties responsible for operation and maintenance. The ten selected projects are in various stages of design and construction and will be completed within a few months of the report filing date. More than ten additional green street projects are in the planning and/or design phases throughout the San Francisco Bay Area, which are beyond the requirements of the MRP. In Appendix A, Tables A1 and A2 provide Project status tables that summarize key project information for the ten selected green street pilot projects. Table A3 provides available data on all of the reported twenty green street projects throughout the San Francisco Bay. The data indicate that most projects were at least partially funded by grants, and many received funding from multiple sources. (One project was funded solely by the local municipality, two projects were associated with private development projects, and one project was partially funded by private entities.)

For the selected projects with complete designs (i.e., the Codornices Creek Restoration Project and the Park and Hollis Stormwater Curb Extension Project), project design

[1] Municipal Regional Stormwater NPDES (National Pollutant Discharge Elimination System) Permit, Order R2-2009-0074, NPDES Permit No. CAS612008, issued by the California Regional Water Quality Control Board, San Francisco Bay Region.

drawings are provided in Appendix C. For the selected projects in the design stage (i.e., the Bransten Road Green Streets Project and the City of Richmond's San Pablo Avenue Green Spine Project), treatment measure conceptual plans are provided.

In fulfillment of MRP Provision C.3.b.iii.(5), a simple spreadsheet model was developed for the ten selected green street pilot projects using design specifications and site-specific considerations, including tributary area and land uses, rainfall, best management practices (BMP[2]) categorization, and runoff and effluent water quality. The list of potential pollutants of concerns (POCs) that were modeled included copper, zinc, total suspended solids (TSS), total mercury, and polychlorinated biphenyls (PCBs). Additionally, monitoring information is reported for those Projects where monitoring was conducted or is planned. Of the ten selected green street projects, one has been monitored and four others will be monitored following completion. Overall, more than half of the 20 reported green street projects have or will be monitored.

The ten green street pilot projects provide valuable lessons for the planning, design and construction of future green street projects. In general, constructing green street projects within an existing transportation corridor present major challenges. Right-of-ways generally contain electrical utilities, gas lines, water lines, and other infrastructure. Treatment facilities need adequate space within the right-of-way to operate effectively but cannot conflict with existing utilities and transportation needs, and must be located at a lower elevation than the tributary impervious surface for which treatment is desired. These factors require a comprehensive evaluation of the existing site and its functionality with accurate mapping and information prior to construction. In addition to technical considerations, factors such as availability of funding, opportunity for integration into other planned projects, and community support are key for the success of a green street project.

2. INTRODUCTION

MRP Provision C.3.b.iii. requires Permittees to cumulatively complete ten green street pilot projects (Projects) that incorporate LID techniques for site design and treatment in accordance with Provision C.3.c., and provide stormwater treatment sized in accordance

[2] The term "BMP" used throughout this report refers to a post-construction stormwater treatment measure.

with Provision C.3.d. At least projects must be located in each of the following counties: Alameda, Contra Costa, San Mateo, and Santa Clara.

The ten selected projects are representative of various types of streets, including arterial, collector, and local, as well as parking lots. As a whole, the Projects contain the following key elements as specified in Provision C.3.b.iii:

(i) Stormwater storage for landscape reuse or stormwater treatment and/or infiltration for groundwater replenishment through the use of natural feature systems;
(ii) Creation of attractive streetscapes that enhance neighborhood livability by enhancing the pedestrian environment and introducing park-like elements into neighborhoods;
(iii) Service as an urban greenway segment that connects neighborhoods, parks, recreation facilities, schools, main streets, and wildlife habitats;
(iv) Parking management that includes maximum parking space requirements as opposed to minimum parking space requirements, parking requirement credits for subsidized transit or shuttle service, parking structures, shared parking, car sharing, or on-street diagonal parking;
(v) Meets broader community goals by providing pedestrian, and where appropriate, bicycle access; and
(vi) Located in a Priority Development Area as designated under the Association of Bay Area Governments and Metropolitan Transportation Commission's FOCUS program.

This report fulfills the MRP requirements to provide the status of the ten green street pilot projects, as specified in Provision C.3.b.v. (2). This report contains a summary of all the projects completed by January 1, 2013, as well as those projects in the design phase that will be constructed by or near the end of the permit term. For each completed project, the summary includes the following information:

(i) The location of the project;
(ii) The size of the project, including the total impervious surface treated;
(iii) Map(s) of the project showing areas where stormwater runoff will be treated by LID measures;
(iv) Specific type(s) of LID treatment measures included;
(v) Total and specific costs of project;

(vi) Specific funding sources for project and breakdown of percentage paid by each funding source;
(vii) Lessons learned, including recommendations to facilitate finding and building of future projects; and
(viii) Identification of responsible party and funding source for operation and maintenance.

This report also documents the modeling methodology that was used to evaluate the potential water quality benefits achieved or proposed to be achieved by each of the ten green street pilot projects, as required in Provision C.3.b.iii.(5). The water quality benefits, in terms of potential removal of pollutants of concern (POCs), were estimated using a spreadsheet model and are described in Section 4 of this report. In general, the spreadsheet model errs on the side of conservatism in terms of inputs and assumptions and is not intended to evaluate actual BMP performance. The modeling results will be supplemented by more site-specific monitoring data for some projects (monitoring is planned for more than half of the twenty projects being implemented).

3. PROJECT DESCRIPTIONS

The project descriptions include available information on the locations of the green street pilot projects, the proposed treatment measures, drainage catchment information, project designs, construction activities, cost estimates, funding sources, and identification of parties responsible for operations and maintenance.

The ten selected projects are in various stages of design. For those projects with complete designs (i.e., the Codornices Creek Restoration Project and the Park and Hollis Stormwater Curb Extension Project), project design drawings are provided in Appendix C. For projects in the design stage (i.e., the Bransten Road Green Streets Project and the City of Richmond's San Pablo Avenue Green Spine Project), treatment measure conceptual plans are provided in Appendix C. In some cases, such as Bransten Road and Stanley Boulevard, the design plans are quite extensive, so a sample of bioretention cross-sections and plans showing treatment measure locations are provided, rather than including the entire design package. Figure 1 shows the locations of the ten selected green streets pilot projects and Appendix A provides Project status tables that summarize key Project information.

3.1 Park and Hollis Stormwater Curb Extension

The Park and Hollis Stormwater Curb Extension Project is located in the City of Emeryville (Alameda County), at the northeast corner of Park Avenue and Hollis Street. The project is classified as a landscaped curb extension along a collector street. The project was required by the City of Emeryville as part of an expansion project by Pixar Animation Studios. The project was completed in 2010 and is currently rated as a Bay-Friendly landscape (no score provided).

Project Catchment

The total drainage area to the Project is 0.19 acres. The Project is located in a commercially developed area and is entirely in the public right-of-way. Prior to construction, the tributary area was 100% impervious; following the installation of the curb extension, the tributary area became 93% impervious.

Treatment Measure Concept

The curb extension (bioretention facility) is 650 square feet in area and consists of an on-street planted rain garden with an underdrain. The underlying native soil is clay, so infiltration as the sole means of treatment was determined to be infeasible. Biofiltration media was added above the clay layer and an underdrain was installed to convey treated runoff to the public storm drain. The Alameda Countywide Clean Water Program's C.3 Stormwater Technical Guidance[3], which was used to size the treatment measure requires treatment measures to be a minimum of 4% of the tributary area.

Project Design and Construction Schedule

The Park and Hollis Stormwater Curb Extension Project was completed in 2010. Operation and maintenance activities are ongoing.

Project Funding and Costs

This project was entirely funded by Pixar Animation Studios as part of their expansion project. A request was submitted for detailed expense information for the green street portion of the project, but this data was not available at the time of reporting. The property on which the green street project is located is owned by the City of Emeryville.

---

[3] The ACCWP C3 Technical Guidance Manual can be found at http://www.cleanwaterprogram.org/c3-guidance-table.html?view=item

Project Outcomes and Lessons Learned

The Park and Hollis Stormwater Curb Extension Project was considered a success as a green street pilot project due to a reduction in localized flooding and the addition of vegetation that aesthetically enhanced the plaza area. A notable lesson learned from this project is that choosing streets with standard crowns, rather than those with steeper cross slopes, allows for more effective green streets due to the reduced cross slope and they allows for greater available treatment area. The project team recommended that green streets components should be a condition of approval for projects in Emeryville whenever possible.

Operation and Maintenance

Pixar Animation Studios is responsible for the project's operation and maintenance, and has signed a standard stormwater O&M agreement with the City of Emeryville.

3.2 Codornices Creek Restoration Project

The Codornices Creek Restoration Project is located in the City of Albany (Alameda County), and is a joint project between the City of Berkeley, City of Albany, and the University of California; the primary purpose of the project is to restore lower Codornices Creek between the Union Pacific Railroad Tracks to the west and San Pablo Avenue to the east. As part of the overall restoration project, a series of rain gardens (bioretention facilities) were installed to treat stormwater runoff prior to entering Codornices Creek, which are described below.

Project Catchment

The total drainage area tributary to the project is 1.93 acres of impervious area (developed on top of clay soils). The area, which will remain 100% impervious following the restoration, is commercial and residential in land use with 60% of the area in the public right-of-way.

Treatment Measure Concept

The four rain gardens (bioretention facilities) have surface areas of 180 ft^2, 260 ft^2, 224 ft^2, and 425 ft^2. The facilities have an underdrain placed near the top of a 1-foot gravel drainage layer, which may allow for some incidental infiltration through the system. There are two treatment areas located on each side of the 6th Street, which are separated by a sidewalk providing access to the street. Facility sizing was based on the Alameda

Countywide Clean Water Program's C3 Stormwater Technical Guidance, but two of the four basins were restricted in size by site conditions, including driveway access requirements for semi-truck trailers, an existing shallow culvert crossing, and design parameters for improved pedestrian crossing.

Project Design and Construction Schedule

The planning phase for the Project took approximately 1 year, the design phase was approximately 6 months, and the actual construction took approximately 1 year, with the rain garden portion taking approximately 3 months to construct.

Project Funding and Costs

The Codornices Creek Restoration Project was funded entirely by a Proposition 50 River Parkways Grant that was awarded to the City of Albany. The $2.2 million dollar grant was intended for the restoration of the Creek between 6th Street and 8th Street. The cost of the four rain gardens was included within this grant and was estimated to be approximately $175,000 in total. The design phase cost approximately $35,000, and the construction cost approximately $140,000. The project required permitting from the Department of Fish and Game and the San Francisco Bay Regional Water Quality Control Board, but this did not add any additional costs.

Table 1. Costs for Codornices Creek Restoration Project

Project Phase	Description	Cost ($)	Notes
Design	Labor	35,000	Rain garden cost estimated as a part of the overall grant for the Creek Restoration Project.
Construction	Materials	140,000	
Total Cost	**Total**	**175,000**	

Project Outcomes and Lessons Learned

The Codornices Creek Restoration Project incorporated rain gardens in curb extensions that provided the added benefit of traffic calming in the creek crossing area. Overall, the comments received from the public have been very positive. However, the dense growth of planting on the southern rain garden cells caused water to back-up on the outer wall of the cells, which caused ponding in the gutter during larger storms. Outside of the undersized southwestern rain garden, the ponding extended into the driveway area of an adjacent business. To address this problem, the original plantings in the southwestern

rain garden were removed and replaced with other species. Additionally, a duct was placed beneath the sidewalk on the western side of Sixth Street, allowing for a connection between southwestern and northwestern rain gardens. Finally, and unfortunately, the overflow of the northwestern rain garden was lowered, substantially reducing the effective area and effective reservoir volume of the two western rain gardens. (Dan Cloak, Personal Communication, 2013)

Operation and Maintenance

The maintenance of the improvements related to the Codornices Creek Restoration Project is shared among the City of Albany, the City of Berkeley, and UC Berkeley through a Memorandum of Understanding (MOU). The bioretention areas were included in the MOU prior to construction, with the costs split among the agencies. The first year of maintenance for the four rain gardens was estimated to cost approximately $2,000; the total annual cost per year to maintain the restoration area is approximately $20,000 per year. The project includes a mandatory 5-year landscape-monitoring plan.

3.3 Stanley Boulevard Safety and Streetscape Improvement

The Stanley Boulevard Safety and Streetscape Improvement Project is located in Unincorporated Alameda County along a 3-mile stretch of Stanley Boulevard between the city limits of Pleasanton and Livermore. The Alameda County Public Works Agency is converting a 4-lane, high volume arterial street, which is currently a primarily industrial corridor, to a rural parkway setting. The overall project uses a variety of sustainable design concepts and improves the safety and aesthetics along Stanley Boulevard. The project is rated as a Bay-Friendly landscape with a score of 98. The project is currently under construction.

Project Catchment

The total drainage area to the project is approximately 33 acres, 90% of which is in the public right-of-way. The pre- and post-project tributary area imperviousness values are 80% and 78%, respectively. Exploratory borings identified the underlying soils as being generally alluvium consisting of silty sand with gravel and clayey sand with gravel.

Treatment Measure Concept

Two treatment measures will be constructed along Stanley Boulevard: (1) an infiltration trench and (2) a bioswale (bioretention facility). The infiltration trench is located on the northern side of Stanley Boulevard and is approximately 13,895 feet long and 4 feet

wide, with a 1-foot depth of backfilled gravel. The infiltration trench is designed to infiltrate all runoff from the water quality design storm. The bioswale is located on the south side of Stanley Boulevard and is approximately 13,895 linear feet long and 3 feet wide. The bioswale has a maximum of 18 inches of sandy loam media and a raised overflow structure that is 4 inches above grade. The Caltrans standards and Alameda Countywide Clean Water Program's C.3 Stormwater Technical Guidance were used to size the treatment measures.

Project Design and Construction Schedule

The duration of the Stanley Boulevard Safety and Streetscape Improvement Project was projected to be from September 2008 to September 2012. The project is currently in the construction phase and the construction of the two treatment measures has not yet started.

Project Funding and Costs

The total cost of the project is estimated to be $14,500,000 and was funded by a variety of sources. State Prop 1B and local funds are contributing 64.3% of the project costs, CEMEX and Vulcan Materials Companies are contributing 34.5%, the Bay Area Air Quality Management District Transportation for Clean Air Grant Funds are contributing 0.008%, and the StopWaste.org Bay Friendly Grant Funds are contributing 0.002%. A breakdown of the design and construction costs for the stormwater treatment measures was not available at the time of reporting.

Project Outcomes and Lessons Learned

The construction of the Stanley Boulevard and Streetscape Improvement Project is still in progress, so it is not yet possible to assess treatment performance and project execution. However, the anticipated ancillary benefits of the project include improved drainage and stormwater treatment; the conservation of energy and water associated with stormwater runoff; the introduction of native plant species and diversification of wildlife habitats; and the improvement of public safety for motorists, bicyclists, and pedestrians (including compliance with the Americans with Disabilities Act (ADA) requirements). Interpretive signage will be located throughout the project site to promote and educate the public about sustainability concepts.

An important lesson learned through the project planning phase and design phase is that roadway projects that incorporate treatment features should be located on relatively flat

terrain and have ample public right-of-way. Where there is limited right-of-way within a developed or urban area, treatment options become limited in type and size, resulting in reduced treatment effectiveness and higher project costs.

Operation and Maintenance

The Alameda County Public Works Maintenance & Operations Division will be responsible for the operation and maintenance of the project site.

3.4 El Cerrito Green Streets Project

The El Cerrito Green Streets Project is located in the City of El Cerrito (Contra Costa County). The project includes facilities at two locations along the major arterial of San Pablo Avenue: (1) the Eureka Rain Gardens at 10200 San Pablo Avenue and (2) the Madison Rain Gardens at 11048 San Pablo Avenue. This project was conceived as part of the larger San Pablo Avenue Streetscape Project, which adds low impact development (LID) elements to the pedestrian, bicycle, transit, and beautification improvements. The project is located inside the El Cerrito San Pablo Priority Development Area, as designated by the ABAG/MTC FOCUS program. The project was completed in 2010.

Project Catchment

The drainage area to the project is 1.33 acres, only including the area within the public right-of-way. The tributary area to the Madison Rain Garden is 0.39 acres and the tributary area to the Eureka Rain Gardens is 0.94 acres. There may be some additional runoff from adjacent properties, but this area was not included in the analysis. The tributary area is classified as 100% commercial, with approximately 99% imperviousness in the pre-project and post-project scenarios.

Treatment Measure Concept

The Eureka Rain Garden consists of a series of 12 individual rain gardens and the Madison Rain Gardens consists of a series of seven individual rain gardens. The individual rain gardens (bioretention facilities) are separated from each other to provide access between curbside parking and the sidewalk. The gardens collect street runoff through a series of depressed troughs that run from the street gutters into the gardens and convey water through a series of curb cuts. There are two curb cuts for each of the individual rain gardens, which are composed of a gutter depression of 0.10 feet and a

flow-through trough set at 90 degrees to the gutter that falls 0.10 feet along a 2.5-foot rain garden length.

Water that enters the gardens is stored in a shallow depression and may leave the structure through one of three pathways. The first pathway is via percolation through approximately 18 inches of sandy loam filter media to the underdrain connected to the public storm drain system. The second pathway is to exit the storage area through one of the curb cuts located at the down gradient end of the rain garden and flow into the adjacent rain garden structure. The third pathway occurs when stormwater in the rain garden storage area exceeds the elevation of the overflow outlets and is conveyed directly to the storm drain. The water that enters the overflow catch basin or exits a downstream curb cut without being treated in a subsequent rain garden is considered untreated bypass flow.

The Madison Rain Garden was designed to capture 0.38 acres of the overall tributary area (0.39 acres). The Eureka Rain Garden was sized to treat 0.64 acres of the overall tributary area (0.94 acres).

Project Design and Construction Schedule

The design phase occurred from 2008 through the end of 2009 and was a portion of the larger San Pablo Avenue Streetscape Project. The construction of the El Cerrito Green Streets Project was completed in August of 2010.

Project Funding and Costs

Approximately 78% of this project was funded by a federal American Recovery and Reinvestment Act (ARRA) grant administered through the State Water Resources Control Board that amounted to $392,000. Funds from the ARRA grant were split between the design/construction phase and the monitoring phase. The design/ construction phase of the grant totaled $215,295 and was provided to the City of El Cerrito as a sub-grantee. The monitoring funds were managed by the San Francisco Estuary Institute (SFEI) and results from that monitoring were reported by SFEI (2012).[4] Additional funding for the project was provided by the El Cerrito Redevelopment Agency and amounted to $108,832, which is 22% of the overall funding.

[4] Monitoring and Results for El Cerrito Rain Gardens, Gilbreath, Pearce, and McKee (2012).

The total design costs specific to the green streets portion of the project are unknown because the design was completed in conjunction with the larger San Pablo Avenue Streetscape Project. An estimate for the total construction cost is $324,127, which includes estimated construction management costs of $26,300, but does not include an estimated annual operation and maintenance (O&M) cost of $5,000. The total monitoring costs are estimated at $176,705.

Table 2. Costs for El Cerrito Green Streets Project

Project Phase	Description	Individual Cost ($)	Total Cost ($)	Notes
Design	Total	Unknown	Unknown	Completed as part of larger San Pablo Ave Streetscape Project.
Construction	Management	26,300	324,127	
	Other	297,827		
O&M	Annual	5,000	5,000	
Monitoring	Total	176,705	176,705	Through SFEI
Total Cost	**Total**	**500,832**	**500,832**	The total estimated cost does not include the annual O&M costs.

Project Outcomes and Lessons Learned

The El Cerrito Green Streets Project has been considered an overall success and has been well received by the local community, particularly the businesses that are adjacent to the project. Many members of the community appreciate the aesthetic component of the rain gardens; some have noted that they appreciate the scale of the treatment facilities and their impact on stormwater management.

One design issue that arose during the monitoring analysis was that some of the curb cuts did not convey water into the rain gardens very well. This is attributed, in part, to the location of the plantings in the rain garden with respect to the placement of the curb cuts. Following construction, additional soil mix was placed in a portion of each of the rain gardens. This raised the top of soil above the design elevation so that the functional area and reservoir volume of each rain garden were reduced by between one-third to one-half (Dan Cloak, Personal Communication, 2013). This, in addition to other factors, could have led to significant bypass, which, although not measured, was observed (A. Gilbreath, SFEI, Personal Communication, 2012).

Overall, the project design and construction was completed with few major issues or setbacks due to the thorough planning process and cooperation of the community at large. One major change order was needed after a 16-inch water line was discovered within the rain garden area due to a mapping error. This was resolved quickly with East Bay Municipal Utility District (EBMUD), with a cost of implementing protective measures of $16,000. The only other additional change that was not in the original scope was the incorporation of a concrete pad for mounting a water quality sampler that cost $5,600.

Operation and Maintenance

The City of El Cerrito is responsible for the operations and maintenance of the project and the estimated additional cost per year is approximately $5,000. The entire maintenance staff received training on the filter media and the Bay Friendly planting scheme.

3.5 San Pablo Avenue Green Spine – Richmond

The portion of the San Pablo Avenue Green Spine Project within the City of Richmond (Contra Costa County) is located along the major arterial of San Pablo Avenue, between McBryde Avenue and Andrade Avenue. The project is currently at 30% design and the City is committed to incorporating Bay-Friendly landscape into the design. The project is located inside a Priority Development Area, as designated by the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) FOCUS program.

Project Catchment

The total drainage area is approximately 2.22 acres. Additional Project catchment information is unknown at this time.

Treatment Measure Concept

The proposed treatment measures consist of six bioretention areas consisting of three rain gardens and three curb extensions. The six bioretention areas have a total surface area of 4,625 ft^2. All six of the facilities will be located on the western side of San Pablo Avenue. Three facilities are located on the northwestern side of the intersection of McBryde Ave and San Pablo Ave. One facility is located on the southern side of Andrade Ave where it meets San Pablo Ave, and two facilities are located on the

northern side of the intersection. Further specifications for the treatment measures are not yet available because the project is currently in the 30% design phase.

Project Design and Construction Schedule

The San Pablo Avenue Green Spine Project is currently in the 30% design phase. The designs are anticipated to be completed by late summer 2013 and construction to begin in late summer/fall 2013. The design and construction cost estimates are not available at this time.

Project Funding and Costs

The Project is being funded entirely through a water quality grant administered by the San Francisco Estuary Partnership (SFEP). The construction portion of the funding is provided by the California Department of Transportation (Caltrans) (42.6%). The Project is supported by grants from USEPA's San Francisco Bay Water Quality Improvement Fund (7.2%) and the State of California's Integrated Regional Water Management Program (50.2%). The exact amount and breakdown of costs by phase have not been determined yet.

Project Outcomes and Lessons Learned

The Project is still in the design phase and has not reached a stage to evaluate outcomes or lessons learned at this time.

Operation and Maintenance

The City of Richmond will ultimately be responsible for the operation and maintenance of the project.

3.6 Sustainable Streets and Parking Lot Demonstration Project

The Sustainable Green Streets and Parking Lots Demonstration Project is in the City of Burlingame (San Mateo County) on Donnelly Ave between Primrose Road and Bellevue Avenue. The project incorporated stormwater treatment into the Public Parking Lot C Project by the City of Burlingame. This project was also intended to improve traffic circulation and add disabled accessible stalls, while maintaining the number of parking stalls. The project was completed in January 2011.

Project Catchment

The total drainage area to the project is 1.32 acres and consists of an existing parking lot, adjacent roadway, and building roofs. The pre-project imperviousness was 95%. The runoff from this area is routed into a rain garden, which adds 0.06 acres of landscaped area and results in a post-project imperviousness of 90%. The soil underlying the project is a mix of clayey loam, sandy loam, fine sand, and gravel.

Treatment Measure Concept

The proposed treatment measures consist of a 0.06 acre rain garden and a 0.01 acre planter box (curb extension, both of which function as bioretention facilities). Because the project location is not served by a storm drain system, the bioretention areas were constructed without an underdrain. A trench was included underneath the bioretention areas to detain runoff to increase the volume that infiltrates into the underlying soils.

The facilities were sized based on flow-based criteria to capture 0.2 inches per hour of rainfall intensity and to have a surface area of at least 4% of the tributary impervious area. The rain garden and curb extension are sized to handle a 0.2 in/hr rainfall intensity through the two facilities. The infiltration rate of the bioretention media is estimated to be 10 inches per hour.

Project Design and Construction Schedule

The Sustainable Streets and Parking Lots Demonstration Project was completed in January 2011. The planning and design phase for the project took approximately 9 months, which was followed by 4 to 5 months of construction.

Project Funding and Costs

The San Mateo Countywide Water Pollution Prevention Program, which is administered by the San Mateo County/City Association of Governments, provided $250,000 of funding for the project. The City of Burlingame also contributed to the Capital Improvement Project through the General Fund. The total cost of the project was approximately $270,000, which included $55,000 for project design and $215,000 for construction costs. It is estimated that roughly $6,500 per year will be needed for routine operations and maintenance costs.

Table 3. Costs for Sustainable Streets and Parking Lot Demonstration Project

Project Phase	Description	Cost ($)	Notes
Design	Total	55,000	The total estimated cost does not include the annual O&M costs.
Construction	Total	215,000	
O&M	Annual	6,500	
Total Cost	**Total**	**270,000**	

Project Outcomes and Lessons Learned

The Sustainable Streets and Parking Lots Demonstration Project achieved stormwater treatment and improved the drainage problems that had previously been an issue in the parking lot. The project also resulted in enhanced pedestrian and vehicle safety, and can be considered a successful integration of green street features into an existing development. There were some initial concerns by property owners about the project, but since its completion, the responses have been solely positive, including those from the City Council. The project will continue to engage the public through educational signage in the visible downtown location.

Some important lessons learned through the project design and construction phase are the following:

1. A 1-foot rock strip is beneficial to deter erosion along the rain garden;
2. A maintenance period following construction should be incorporated into the schedule;
3. Simple irrigation systems should be provided for vegetated treatment measures, where needed;
4. Facilities should be sited where storm drain systems currently exist or where underdrains can be extended to connect to the current system. If this is not feasible, incorporate overflow mechanisms, such as storm drain overflow piping where possible;
5. Prior to construction, the availability of the planned landscaped plantings should be verified;
6. Contractor qualifications should always be included in the specifications.

7. Project proponents should attempt to acquire sufficient funding for storm drain overflow piping and monitoring as part of the project.

Operation and Maintenance

The City of Burlingame is responsible for operation and maintenance of the project, which will be funded through the General Fund at a cost of approximately $6,500 per year.

3.7 Bransten Road Green Street

The Bransten Road Green Street Project is located in the City of San Carlos (San Mateo County) along Bransten Road, between Old Country Road and Industrial Road. The project is along a local street, in a location where elevated levels of PCBs have been identified through sediment monitoring. To the extent feasible, the proposed treatment measures will be sited at locations where the elevated concentrations were identified. The final design of the project was completed in February 2013 and construction is anticipated to begin in the summer of 2013.

Project Catchment

The drainage area to the Project is 0.54 acres (only including the impervious roadway surface areas draining to the bioretention facilities). Unidentified tributary areas may include drainage from other impervious sources, such as private properties, adjacent sidewalks, rooftops, or parking lots; these may contribute additional runoff to the facilities but are not incorporated into the calculation of facility size. The surrounding area is primarily industrial in land use and the imperviousness in the area prior to construction is approximately 95%. The project is underlain by a combination of fill and Holocene-age alluvial fan deposits. The soil type is hydrologic soil group (HSG) D, which is characterized by low infiltration rates and high runoff potential.

Treatment Measure Concept

The proposed treatment measures are nine bioretention areas that will be constructed in newly created curb extensions of various lengths. The San Mateo Countywide Water

Pollution Prevention Program (SMCWPPP) guidelines[5] were used, where feasible, for designing the bioretention areas.

Certain aspects of some of the bioretention facilities' designs deviate from the SMCWPPP guidelines due to utility conflicts and site restrictions. The SMCWPPP guidelines state that there should be an underdrain system in place where HSG D soils are present for bioretention areas. However, five of the bioretention areas are designed without underdrains either due to their location along a stretch of Bransten Road with no existing storm drain system (and no feasible addition or extension of the storm drain) or due to the depth of the existing storm drain system being too shallow to connect to the underdrain invert. These five bioretention areas also have soil depths of 12 inches, which deviate from the SMCWPPP guidance (minimum soil layer depth of 18 inches) due to utility conflicts. These areas without underdrains are designed to infiltrate through the biotreatment soil media and into the underlying soils.

The four remaining bioretention areas have underdrains with elevated orifices to allow for infiltration of the water that collects in the bottom of the rock layer. It should be noted that the design of Bioretention Area 7 includes an underdrain system that is routed around the existing drainage inlet and through Bioretention Areas 8 and 9, so that it can discharge to a storm drain with an invert that is low enough to connect to the underdrain. This was incorporated because Bioretention Area 7 is identified with elevated levels of PCBs, so additional efforts were necessary to attain a typical bioretention design in order to address the pollution reduction goal of the Project.

The "Simplified Sizing Method" from the SMCWPPP was used to determine whether the bioretention areas satisfy C.3 guidelines. This method requires that a bioretention area is at least 4% of the impervious surface area draining to that facility. All of the proposed facilities satisfy this criterion, and some have added capacity to handle additional runoff (where sources in addition to the roadway areas were identified).

Project Design and Construction Schedule

The Bransten Road Green Street Project completed its final design in March of 2013. Construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.

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[5] The SMCWPPP C.3 Technical Guidance Manual can be found at: http://www.flowstobay.org/bs_new_development.php#c3

Project Funding and Costs

Funding for the project comes from three sources: (1) 59% from grant funding through USEPA's San Francisco Bay Water Quality Improvement Fund; (2) 40% from grant funding through the San Mateo Countywide Water Pollution Prevention Program's Sustainable Green Streets and Parking Lots Program; and (3) 1% from a match from the Countywide Program. The 100% design cost estimate provides for a total project cost of approximately $535,600, with the design cost estimated at $156,000 and the construction costs estimated at $379,600. The design cost were high due to potholing to verify utility locations, redesign due to utility conflicts and challenges with PCB levels.

Table 4. Costs for Bransten Road Green Street Project

Project Phase	Description	Cost ($)	Notes
Design	Total	156,000	Anticipated O&M costs are unknown at this time.
Construction	Total	379,600	
Total Cost	**Total**	**535,600**	

Project Outcomes and Lessons Learned

The project is at the 100% design phase, but has not reached a stage to evaluate outcomes or lessons learned at this time.

Operation and Maintenance

The City of San Carlos will be responsible for the operation and maintenance of the project following completion. The costs of these activities are not yet determined.

3.8 Packard Foundation Green Street

The David and Lucile Packard Foundation Green Street is located in the City of Los Altos (Santa Clara County) on Second Street between Lyell Street and Whitney Street. The green street features were constructed in 2012 as part of the Packard Foundation's development of its new office building at 343 Second Street. (The runoff from the building and associated hardscape and parking lots is captured and treated by other stormwater treatment measures.) The green street portion of the project incorporates curbside flow-through rain gardens and corner bulb-outs to capture, treat and infiltrate runoff from adjacent impervious surfaces.

Project Catchment

The total drainage area to the rain gardens is 0.59 acres of impervious road and sidewalk areas. The project reduced the area of imperviousness from 100% to approximately 89%. The underlying soil type of the tributary area is sandy lean clay to clayey sand.

Treatment Measure Concept

The treatment measures consist of 20 rain gardens (bioretention facilities) along the north and south sides of Second Street and at the corners of Whitney Street and Second Street. The rain gardens along Second Street fit within the park strip between the sidewalk and the street, and range in size from 3.5 to 6.5 feet wide and 8 to 27.5 feet long, separated by street trees and sidewalk or driveway entrances. Their surface areas range from 30 to 164 square feet. They receive sidewalk runoff via sheet flow and street runoff through curb cuts. The two rain gardens at the corners of Whitney Street are shaped like bulb-outs from the curb and have a surface area of 110 square feet. The total surface area of the 20 rain gardens is 1834 square feet.

The rain gardens were designed based on the Santa Clara County Urban Runoff Pollution Prevention Program (SCVURPPP) C.3 Stormwater Handbook, using a design infiltration rate of 2 inches/hour. However, rain garden sizes were primarily determined by the available space within the public right of way.

Project Design and Construction Schedule

The project was constructed in 2012.

Project Funding and Costs

The funding and cost breakdown of the project is not known at this time.

Project Outcomes and Lessons Learned

The project was constructed in 2012, but the outcomes or lessons learned are not known at this time.

Operation and Maintenance

The Packard Foundation is responsible for operation and maintenance of the project.

3.9 Hacienda Avenue Green Streets

The Hacienda Avenue Green Street Project is located in the City of Campbell (Santa Clara County) on a segment of Hacienda Avenue that connects the San Tomas Area Neighborhood to Winchester Boulevard. The City is redeveloping Hacienda Avenue as a green street with proposed improvements including the installation of a new sidewalk, bike lanes, street trees; and bioinfiltration areas; narrowing the existing development area; and encouraging infiltration in open areas. The project will incorporate Bay-Friendly Landscape Design guidelines. The project is currently in the final design phase, with final design anticipated in September 2013.

Project Catchment

The total drainage area to the project is 22.7 acres and has an imperviousness of 74% prior to the green street improvements. The reduction of the width of the roadway by the project will reduce the imperviousness to 71%. The land use of the catchment is primarily residential. The underlying soils are fine sandy silt, silty sand, and gravely sand.

Treatment Measure Concept

The treatment measures to be implemented along Hacienda Avenue include the installation of approximately 80 bioinfiltration areas (bioretention with no underdrain) along both sides of the street, which will be landscaped with drought tolerant, native plants. They range in width from 5 to 20 feet, with an average length of 60 feet. The total surface area of the bioinfiltration areas is roughly 26,000 square feet. The infiltration rate of the underlying soil (3 feet below existing grade) is approximately 4 inches per hour. The treatment measures were designed using the combination flow and volume method as described in the SCVURPPP C.3 Stormwater Handbook.

Project Design and Construction Schedule

The project is currently in the final design phase (anticipated final design in September 2013), with construction set to begin in the summer of 2014.

Project Funding and Costs

The project received $2,000,000 in funding from the Bay Area Integrated Regional Water Management Plan (IRWMP), and $500,000 in funding from Caltrans (in the form of a Federal Grant under Community Development Transportation Program, with funds

originating from Federal Transportation Enhancement Fund). The total budget for the project is approximately $4,635,000. The City of Campbell is providing the remaining funds for this project.

Project Outcomes and Lessons Learned

The project is still in the design phase and has not reached a stage to evaluate outcomes or lessons learned at this time.

Operation and Maintenance

The City of Campbell will be responsible for the operation and maintenance of the project following completion. The costs of these activities are not yet determined.

3.10 Southgate Neighborhood Green Streets

The Southgate Neighborhood Green Streets Project is located within the Southgate neighborhood in the City of Palo Alto (Santa Clara County). This is a residential neighborhood consisting of single-family homes. The subdivision was developed in the 1920s with storm water runoff directed via surface gutter flow to a single drainage inlet connected to a piped storm drain system. Due to problems with street ponding in the neighborhood that arose over time as a result of the deterioration of gutter grades, the City of Palo Alto decided to retrofit the neighborhood to improve surface drainage and incorporate green street elements to improve water quality.

Project Catchment

The total area for the site is approximately 41.4 acres. Catchment delineation to each treatment measure is still being refined as part of final design.

Treatment Measure Concept

The proposed treatment measures include bioretention and biofiltration planters, porous pavement crosswalks, and a porous pavement “paseo” (pedestrian walkway connecting two streets). The bioretention planters will be incorporated into the street right-of-way and existing parkway strips (vegetated areas between the sidewalks and the streets). The project includes installation of 19 bioretention areas. The bioretention areas will be sited in locations that optimize the amount of tributary area draining to each system. The size and configuration of each bioretention area vary based on various constraints in the neighborhood, including physical conflicts with mature street trees, driveways, and

utility infrastructure. Bioretention facility surface areas will range from 5 to 9 feet in width and from 6 to 45 feet in length. The total surface areas of the bioretention areas is 3,524 square feet.

Porous pavers will be incorporated into crosswalks at four intersections in the neighborhood. The pavers will connect each adjacent corner with a 10-foot-wide crosswalk, creating nearly 8,712 square feet of pervious walkway as a part of the project.

Project Design and Construction Schedule

The project is currently in the final design phase, with construction set to begin in the fall of 2013.

Project Funding and Costs

The project is being funded entirely by the City of Palo Alto. The preliminary cost estimate for the design and construction of the project, including the bioretention planters, pervious paseo, pervious crosswalks, and approximately 475 linear feet of new storm drain, is $1.1 million (approximately $300,000 for design and $800,000 for construction). The actual costs are not available at this time.

Project Outcomes and Lessons Learned

The project is currently in the design phase and therefore has not yet reached a stage to conduct a post-implementation evaluation of outcomes or lessons learned at this time. However, some of the lessons learned in the design phase include: (1) soils and utilities should be researched early in the project schedule in order to understand site constraints; and (2) the project team should coordinate with residents in the neighborhood not only for their approval, but also to educate them, understand their concerns, and obtain feedback.

Operation and Maintenance

The City of Palo Alto will be responsible for the operation and maintenance of the project following completion. The cost of these activities is not yet determined.

3.11 Additional Green Street Projects

In addition to the ten selected green streets pilot projects described above, there are currently more than ten additional green streets projects in the planning or design

phases in the MRP Permittee area throughout the San Francisco Bay. These additional green street projects are beyond the requirements of the MRP and are being constructed based on the initiative of the municipality or funding agency. These additional projects are summarized in Table 5 below and Table A3 in Appendix A provides the available data on all of the reported twenty green street projects throughout the San Francisco Bay.

Table 5. Additional Ten Green Street Projects

Project Name	Project Location
1. Martha Gardens – Green Alleys Pilot Project	Alley between 2nd & 3rd St; Virginia & Martha St, San Jose, 95110
2. Nevin Avenue Improvements Green Streets	Nevin Avenue from 19th St to 27th St, Richmond CA 94804
3. Park Avenue – Green Avenue Pilot Project	Park Ave between Meridian Ave & Sunol St, San Jose, 95126
4. PG&E Substation	South 1st Street & Cutting Blvd, Richmond 94804
5. San Pablo Avenue Green Spine – Albany	San Pablo Ave & Monroe St, Albany 94706
6. San Pablo Avenue Green Spine – Berkeley	San Pablo Ave & Codornices Creek, Berkeley 94706
7. San Pablo Avenue Green Spine – El Cerrito (2 Project locations)	San Pablo Ave & Stockton Ave, El Cerrito 94530 San Pablo Ave & Moeser Ave, El Cerrito 94530
8. San Pablo Avenue Green Spine – Emeryville	San Pablo Ave & W MacArthur Blvd, Emeryville 94608
9. San Pablo Avenue Green Spine – Oakland	San Pablo Ave & 17th Street, Oakland, 94612
10. San Pablo Avenue Green Spine – San Pablo	13613 San Pablo Ave, San Pablo 94806

4. WATER QUALITY MODELING

MRP Provision C.3.b.iii requires that the Permittees conduct appropriate monitoring of the green street pilot projects to document the water quality benefits achieved.

Appropriate monitoring may include modeling using the design specifications and specific site conditions of the projects. The water quality modeling approach described below was selected to meet this requirement. The list of potential pollutants of concern to be modeled consisted of: copper, zinc, total suspended solids (TSS), total mercury and polychlorinated biphenyls (PCBs). In general, the spreadsheet model airs on the side of conservatism in terms of inputs and assumptions and is not intended to evaluate actual BMP performance. The modeling results are meant as placeholders until more site-specific monitoring data is collected.

Monitoring has been conducted at one green street project, the El Cerrito Green Street Project and is described in Section 5. Monitoring is planned as part of four other selected green street projects (additional projects will be added in the future), as part of grant requirements.

4.1 Facility Sizing Methodology

The treatment measures were sized using a simplified flow-based methodology in which the surface area of the BMP is sized to be 4% of the tributary impervious area. This sizing factor (0.04) is based on the ratio of the design rainfall intensity (0.2 inches per hour) to the design percolation rate of the biotreatment soil media (5 inches per hour, as required by Provision C.3.c.i.(2)(b)(iv)).

The planned BMP surface area and actual sizing factor (BMP surface area divided by tributary impervious drainage area to BMP) are presented in Table 6. The sizing factor for a few of the green street pilot projects was less than 0.04, because the projects are retrofit projects and had to work with space available for the BMPs.. However, due to the conservatism of treatment facility design built into the 4% sizing method (i.e. the method does not account for surface ponding, actual treatment soil infiltration rates, etc.), project facilities with a sizing factor of less than 0.04 may nonetheless capture and treat the C.3.d amount of runoff. Existing site constraints such as land availability and utility conflicts are examples of confining parameters, which affect the size and placement of water quality treatment measures.

Table 6. Planned BMP Size and Sizing Factor

Project Name	Planned BMP Surface Area (acre)	Sizing Factor[1,2] --
San Pablo Avenue Green Spine - Richmond	0.106	0.049
El Cerrito Green Streets	0.025	0.019
Codornices Creek Restoration	0.025	0.013
Park and Hollis Stormwater Curb Extension	0.015	0.084
Stanley Boulevard Safety and Streetscape Improvement	2.23	0.087
Sustainable & Parking Lots Demonstration	0.072	0.056
Bransten Road Green Street	0.104	0.203
Southgate Neighborhood Green Streets	0.010	0.002[3]
Packard Foundation	0.042	0.071
Hacienda Avenue Green Streets	0.596	0.026

Notes:

1 The sizing factor is the planned BMP surface area divided by the total tributary impervious area.

2 Available project tributary area delineations may not include all surfaces draining to the BMP, such as the adjacent paved surfaces or roofs; the sizing factors were based on the reported project information.

3 Tributary area information available for Southgate Neighborhood Green Streets includes all areas within the neighborhood, not just those delineated to drain onto green streets.

4.2 Modeling Methodology for TSS and Metals

The reductions in pollutant loads of total suspended solids (TSS) and metals that may be achieved by green street pilot projects stormwater treatment facilities, were modeled using a simple spreadsheet-based model.

The reduction in pollutant loads in a BMP is based on a combination of two factors: (1) the amount of water that is treated by the BMP and (2) the level of treatment received. The amount of water that is treated is commonly referred to as “captured” and the percent of mean annual flow that is treated is commonly referred to as “percent captured”. When the capacity of the BMP to accept inflow is met, water will flow around the unit and is said to be “bypassed”.

The amount captured by a bioretention facility depends on a number of factors including the catchment area and tributary imperviousness, the surface area of the infiltration bed, surface ponding volume, the media infiltration rate, void space in the underdrain layer, native soils infiltration rates, and evapotranspiration rates. The percent capture also depends on the precipitation patterns and runoff rates, and the time that is

required for the BMP to drain (or draw down) and regain capacity to capture runoff in anticipation of the next event. All other factors being equal, BMPs located in areas receiving more intense rainfall and rainfall with short inter-event separation times will achieve lower percent capture.

One of the primary factors affecting percent capture is the surface area of the bioretention unit. As indicated in Table 6, the unit sizes for the green street pilot projects vary substantially in terms of sizing factor, including three units that have sizing factors below 0.04 (the nominal sizing factor used in the Bay Area for new development projects). These smaller units will achieve a lower percent capture than those units with sizing factors over 0.04 will. In general, bioretention facilities that are properly designed and sized using the 0.04 sizing factor, should achieve percent capture in excess of 80%. However, given the substantially lower sizing factors for some of the facilities due to their design as retrofit projects, it was conservatively assumed that all of the facilities would achieve a 70% percent capture rate. It should be noted that the facilities might be sized in accordance to C.3.d. with the 70% capture rate due to the overall conservative nature of the treatment facility design in the guidance documents.

The influent pollutant load estimates were based on land use specific concentrations from the San Francisco Bay Area Stormwater Runoff Monitoring Data Analysis 1988-1995 (BASMAA, 1996). The industrial land use concentrations were an average of the available “Light Industrial” and “Heavy Industrial” land use categories, and the transportation concentrations were used for projects with tributary areas designated as within the public right-of-way.

The concentration used for total copper for “Residential” land uses was assumed to be a weighted estimate based on 25% of the area producing runoff concentrations similar to “Urban” land use and 75% of the area producing runoff concentrations similar to “Open Space” land use, as those were the only two categories with concentrations provided for total copper. A summary of the assumed land use specific concentrations is presented in Table 7.

Table 7. Land Use Specific Influent Concentrations

Land Use	Total Cu (µg/L)	Total Zn (µg/L)	Total TSS (mg/L)
Residential	19.5	188	85.9
Commercial	45	397	97.5
Industrial	45	365	135
Transportation	45	279	192

Each of the analyses assumed that the facilities would achieve 70% capture of the runoff volume, and scaled the removal of pollutants accordingly. Within the facilities, a range was used to estimate the pollutant reductions due to incidental infiltration and/or evapotranspiration of the captured volume (25%, 50%, and 75%) to account for variability in design and infiltration rates beneath the facilities. Similar assumptions were made in the LID Feasibility/Infeasibility Report prepared for BASMAA in 2011 (Geosyntec, 2011b), which noted that incidental infiltration in biotreatment measures was analyzed in a publication by Strecker, Quigley, Urbonas, and Jones (Strecker et. al., 2004). That study observed as much as 40 percent volume reduction through incidental infiltration. The Sustainable Green Streets and Parking Lot Demonstration Project (City of Burlingame) was also modeled to have 80% and 100% infiltration of the captured volume due to the specification in the project description that the BMP was designed to infiltrate. For all projects, the remaining pollutant loads associated with the volume that was not modeled as being infiltrated, were used as the influent loads being treated within the BMPs.

The 2012 International Stormwater BMP Database Summaries were used to evaluate the effluent event mean concentrations (EMCs) of TSS and total metals (copper and zinc) for bioretention facilities and bioswales (See Table 8). The bioretention facilities in the database are mostly characterized as bioretention cells that are not associated with flood conveyance, and all but 8 of the facilities have underdrains. Bioswales in the database are typically dry grassy swales (wetland swales are analyzed in the wetland channel BMP category).

The Database is generally quite robust in terms of the number and quality of data. For example, fourteen studies consisting of a total of 193 measurements of effluent TSS EMCs from bioretention facilities were considered when estimating the mean effluent

concentration. Similarly, a total of 354 individual measurements from 23 studies were analyzed to estimate the mean for bioswales.

The information from the Database was not filtered by location or climate of the facilities (i.e., in order to isolate facilities in semi-arid climates). Monitoring data for bioretention facilities includes facilities located in Delaware, Massachusetts, North Carolina, New Hampshire, Oregon, Pennsylvania, Virginia, Washington and Wisconsin; monitored bioswales were located in California, Florida, North Carolina, New Hampshire, Oregon, Texas, Virginia, Washington, and Wisconsin. In order to evaluate the representativeness of this data for application in California, a comparison of the effluent TSS EMCs with local monitoring data from the El Cerrito Project was conducted, and the comparison was quite good. Therefore, the application of the Database for bioretention BMPs in semi-arid climates, such as California, was deemed appropriate until data that is more representative becomes available.

Table 8. Estimated Mean Effluent Concentrations in Bioretention and Bioswales

Constituent	BMP Type	Effluent Concentration
TSS (mg/L)	Bioretention	17.70
	Bioswale	27.00
Total Cu (µg/L)	Bioretention	9.72
	Bioswale	10.10
Total Zn (µg/L)	Bioretention	27.70
	Bioswale	36.20

With the exception of the Stanley Boulevard Safety and Streetscape Improvement Project, the pollutant reductions due to treatment were calculated for the overall tributary area and design BMP volume for bioretention facilities. The Stanley Boulevard Safety and Streetscape Improvement Project specifies that 43% of the BMP area is a bioswale, so the effluent concentrations were estimated as partially attributed to bioretention and partially attributed to bioswales.

The total estimated removal from incidental infiltration and treatment is summarized for each of the projects in Appendix B.

4.3 Model Methodology for PCBs and Mercury

The approximate removal of PCBs and mercury could not be estimated using the same methodology as TSS and total metals because the International Stormwater BMP Database does not contain sufficient information on removal efficiencies for bioswales and bioretention facilities for those contaminants. In lieu of that information, a correlation was used between influent and effluent TSS concentrations to represent the treatment and removal of PCBs and mercury. This correlation is based upon a study conducted by the San Francisco Estuary Institute (SFEI) that looked at the contaminants and loadings of trace contaminants in an urbanized tributary in Hayward, California called Zone 4 Line A (Z4LA) (McKee et. al., 2011).

The water quality concentrations of the influent to the BMPs were estimated using land use particle-based event mean concentrations (EMCs), which were developed as part of a calibration and verification effort of the Regional Watershed Spreadsheet Model (RSWM) that was conducted by SFEI (SFEI, 2012). The approach uses pollutant of concern (POC) loads monitoring data that was collected from 21 mass emission stations in the Bay Area and uses statistical analyses and reverse optimization to estimate the concentrations of PCBs and total mercury (HgT) that originate within the different land uses in the upstream watersheds (McKee et. al., 2011).

The land use categories used for HgT include 1) old urban areas, 2) newer urban areas, and 3) undeveloped land (agriculture and open space). Urban areas are broken into two categories based on age of development because legacy pollutants, such as PCBs, depend on age of land use as well as land use type. For PCBs, two different land use category breakdowns were used to identify if a statistically significant relationship exists between PCBs and land use for the watersheds analyzed. The land uses common to both breakdowns include: 1) old (pre-1954) industrial areas, 2) old urban areas, 3) newer urban areas, and 4) undeveloped land (agriculture/open space). The land use categorizations were based upon available GIS layers and a previous study conducted by Greenfield et. al. that demonstrated a positive correlation between old industrual (before 1954) areas and PCBs and HgT (Greenfield et. al., 2010). Railroads were also analyzed for one set of model iterations as a specialized PCBs-associated land use. However, the inclusion of the railroad land use category did not generally improve the fit of the esimated concentrations and was inconsistent across watersheds, so the mean concentrations for the scenario without railroads is used. One watershed (Santa Fe Channel) was removed from the PCB concentration analysis after a skew towards high concentrations was observed. The optimization particle ratios for HgT and PCBs are presented in Table 9.

Table 9. Optimized Mean Particle Ratios for PCBs and HgT

Land Use Type	PCBs (µg/kg)[1]	HgT (mg/kg)[2]
Old Urban	150	0.63
New Urban	0.87	0.16
Old Industrial	2800	N/A
Agriculture/Open Space	20	0.14

Notes:

1. For PCBs, the four land use categories used from the RWSM EMC analysis include: 1) old (pre-1954) industrial areas, 2) old urban areas, 3) newer urban areas, and 4) undeveloped land (agriculture/open space).
2. For HgT, the three land use categories used from the RWSM EMC analysis include: 1) old urban areas, 2) newer urban areas, and 3) undeveloped land (agriculture/open space).

Limitations of Methodology

The particle ratios indicated in Table 9 were applied to convert influent solids concentrations to PCB concentrations. Since each project catchment contained a mix of land uses, a "catchment land use weighted" estimate of the particle ratio was applied to the effluent TSS to predict the effluent PCB concentration. It was assumed then that the effluent particle ratio was equal to the composite influent particle ratio, based on the reasoning that most of removals of PCBs would be in proportion to the removal of solids. Loading reduction estimates contained in this report reflect this assumption.

However, particle ratio data collected by SFEI at the El Cerrito Rain Gardens (Gilbreath et al, 2012) indicate that the mean effluent particle ratio at the inlet was 1.16 mg/kg, and only 0.13 mg/kg at the outlet. This suggests that PCBs are treated more effectively than solids (perhaps because of adsorption) or that the source of solids in the effluent may reflect mobilizing of solids from the media. Data from the Daly City Library Monitoring Study show a similar pattern; namely the post-installation PCB – SSC correlation is lower than that for the pre-installation data (David et al, 2011).

The implication for this report is that estimates of load reductions based on equality of particle ratios may result in lower estimates of load reduction (by as much as 10%), especially in those catchments where much of the land use is categorized by older industrial.

4.4 Summary of Modeling Results

The total estimated removal from incidental infiltration and treatment is summarized for each of the projects in Appendix B. Table B1 presents the results for the scenario with 25% incidental infiltration of the captured runoff volume, which was intended to be representative of systems designed with an underdrain and/or located on soils with poor infiltration capacity. The percent of the influent loads that is removed is between 55-62% for TSS, 55-64% for PCBs, 55-62% for HgT, and 18% for both copper and zinc. Table B2 presents the modeling results for the median case of 50% incidental infiltration. The percent of the influent loads that are removed is between 60-65% for TSS, 60-66% for PCBs, 60-65% for HgT, and is 35% for both copper and zinc. Table B3 presents the results for the scenario with 75% incidental infiltration of the captured runoff volume, which was intended to be representative of systems designed without an underdrain and located on soils with high infiltration rates. The percent of the influent loads that are removed for 75% incidental infiltration is between 65-67% for TSS, 65-68% for PCBs, 65-67% for HgT, and 53% for both copper and zinc. The modeling indicates that a higher degree of infiltration increases the removal of influent metal loads significantly, while only marginally increasing the removal of TSS, PCBs and HgT.

5. MONITORING

At the time of this report, monitoring had only occurred at the El Cerrito Green Streets Project. Qualitative observational monitoring was conducted during water years (WY) 2010 and 2011 to observe the construction of the project and the performance in the first year following implementation. Water Quality monitoring data collected by SFEI during WY 2012 were limited to 4 storm events and indicated that the percent reduction in concentrations (or treatment effectiveness) achieved varied depending on constituent, but was approximately 79% for suspended sediment concentration (SSC), 87% for polychlorinated biphenyls (PCBs), and 69% for total copper. Reductions in mercury were less consistent and the reduction for total Hg was indicated as -17%. This estimate was heavily driven by one sample, without which, the effectiveness would have been 32%. A summary table of the estimated load reductions is presented in Table 10.

Table 10. El Cerrito Green Streets - Estimated Load Reductions

	Average Change in Concentration (Inlet-Outlet)	Load Reduction if Volume Reduced by:		
		25%	50%	75%
SSC (n=4)	79%	84%	90%	95%
HgT (n=4) [1]	-17%	12%	42%	71%
HgT (excluding Storm 2; n=3) [1]	32%	49%	66%	83%
Total Copper (n=4)	69%	77%	85%	92%
PCBs (n=4)	87%	90%	94%	97%

Notes:

1. HgT is presented, both including all the data, as well as excluding the anomalous Storm 2 data point.

Monitoring is planned for the Codornices Creek Restoration Project, the San Pablo Avenue Green Spine Project, the Bransten Road Green Street Project, and the Hacienda Avenue Green Streets Project. A monitoring plan has been developed for the City of Richmond's San Pablo Avenue Green Spine Project and the Hacienda Avenue Green Streets Project as part of the Green Infrastructure Capacity Building Project, managed by the San Francisco Estuary Partnership (SFEP). The San Francisco Estuary Institute (SFEI) will conduct pollutant and flow monitoring to determine the effectiveness of the stormwater treatment measures to meet the green infrastructure implementation goals.

The San Pablo Avenue Green Spine project includes seven locations, one of which is the selected green streets pilot project located in the City of Richmond. The seven planned project locations will be assessed to determine the three locations most appropriate for monitoring with respect to site logistics, land use characteristics, and green infrastructure type. Baseline conditions will be established using land use characteristics in the drainage areas for each delineated project site and inlet monitoring prior to the stormwater reaching the treatment mechanisms for three storm events. The outlet of the facilities will also be monitored to provide an estimate of the level of treatment achieved. The preliminary analyte list includes PCBs, PAHs, mercury (total and dissolved), copper (total and dissolved), nutrients, and SSC.

The Hacienda Avenue Project will be monitored to evaluate its water budget by measuring the rainfall, stormwater bypass, and the water level within the treatment facility. This will allow for an estimation of infiltration to determine whether the facility is functioning as designed.

Finally, the Bransten Road Green Street Project will be monitored as part of Clean Watersheds for a Clean Bay (CW4CB) Task 5 grant in two phases: a screening phase to support monitoring design (2012-13 wet season) and a BMP assessment phase (2013-14 wet season). A maximum of 19 stormwater samples will be collected. A lesser number may be collected depending on the number of storms that are monitored during the 2012-2013 wet season. Grab samples will be collected for the following pollutants of concern: PCBs, dissolved PCBs, total mercury, particle size distribution, volatile suspended solids (VSS), suspended sediment concentration (SSC), turbidity, and settleable solids.

6. SUMMARY OF LESSONS LEARNED

The ten green street pilot projects provide valuable lessons for the design and construction of future green street projects. In general, constructing green street projects within an existing transportation corridor present major challenges. Right-of-ways generally contain electrical utilities, gas lines, water lines, and other infrastructure. Treatment facilities need adequate space within the right-of-way to operate effectively but cannot conflict with existing utilities and transportation needs, and must be located at a lower elevation than the tributary impervious surface for which treatment is desired. These factors require a comprehensive evaluation of the existing site and its functionality with accurate mapping and information prior to construction.

Additionally, runoff from areas outside of the delineated tributary area, such as adjacent properties, rooftops, sidewalks, and parking lots, may drain to green street project treatment measures even though they are not sized to treat the additional flows. Unanticipated treatment benefits from treating the additional runoff will be achieved even if the areas outside of the right-of-way are not designed to be tributary to the treatment measures.

Additional design and construction lessons learned include: (1) special attention should be made to design the curb cuts so that significant bypass does not occur; (2) Standard crown slopes allow for more effective implementation of green streets due to the reduced cross slope and greater available treatment area; (3) Monitoring of the facility should be considered during the design phase so that the appropriate infrastructure can be built; (4) the project team should coordinate with residents in the neighborhood not only for their approval, but also to educate them, understand their concerns, and obtain

feedback; and (5) A maintenance period following construction should be incorporated into the schedule.

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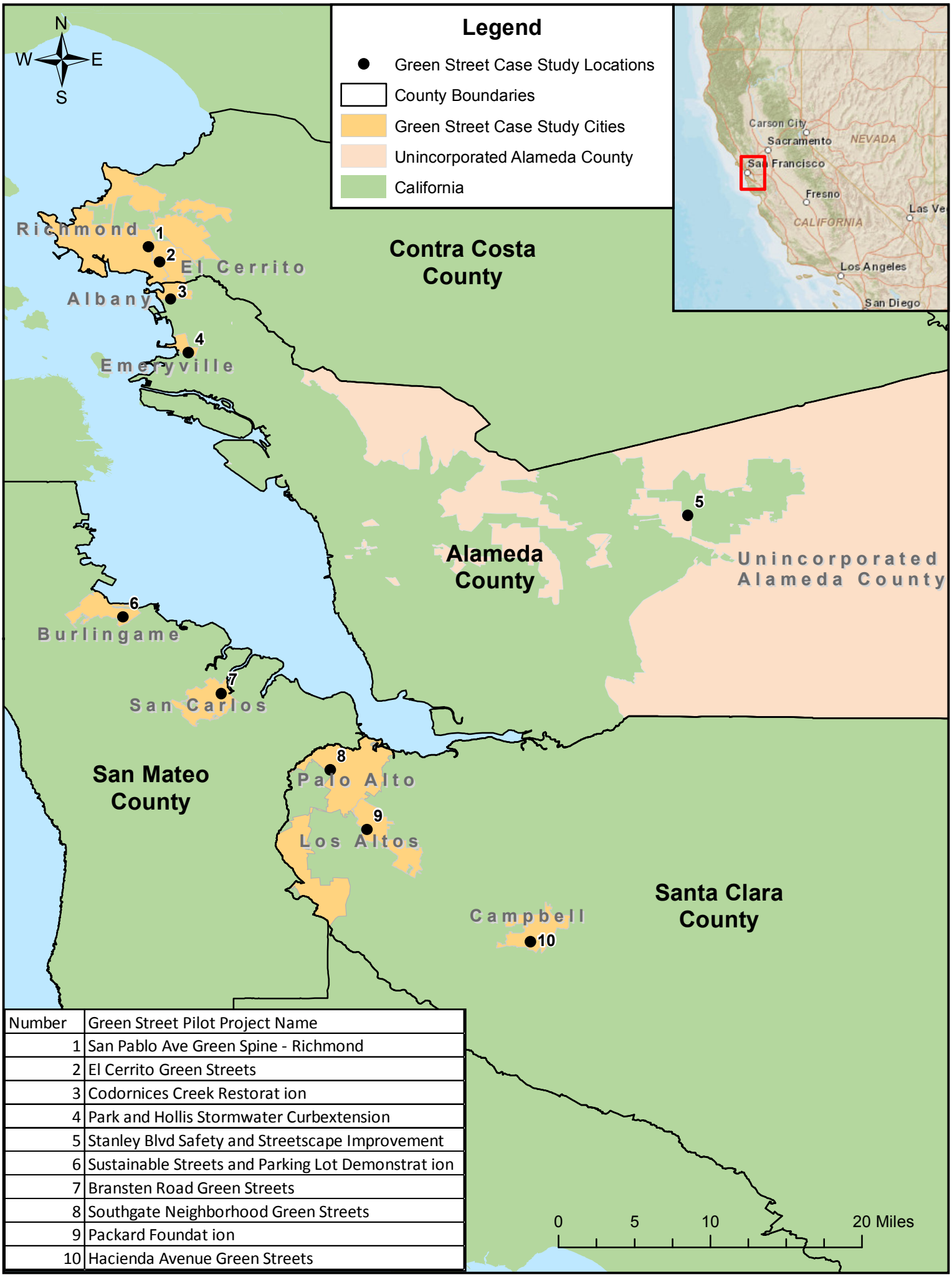
Geosyntec consultants

FIGURES



Number	Green Street Pilot Project Name
1	San Pablo Ave Green Spine - Richmond
2	El Cerrito Green Streets
3	Codornices Creek Restorat ion
4	Park and Hollis Stormwater Curbextension
5	Stanley Blvd Safety and Streetscape Improvement
6	Sustainable Streets and Parking Lot Demonstrat ion
7	Bransten Road Green Streets
8	Southgate Neighborhood Green Streets
9	Packard Foundat ion
10	Hacienda Avenue Green Streets

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APPENDIX A

Green Street Pilot Projects Status Tables

Table A1. Project Information for 10 Selected Green Street Pilot Projects

Program	County	No.	Project Name	Owner/ Municipality	Project Location	Project Type (check all that apply)					Project Description	Project Attributes (check all that apply)									Project Status	Project Contact	Estimated Date of Comple-tion	Monitor-ing	Modeling	Project Status
						Arterial	Collector	Local	Parking Lot	Other (*specify*)		Bay-Friendly Landscaping	Stormwater Storage/Use	Stormwater Infiltration	Stormwater Treatment	Enhance Pedestrian and /or bicycle environment	Park-like elements	Connect residential, recreation, schools,	Parking Management	ABAG/MTC- designated Priority Development						
ACCWP	Alameda	1	Park and Hollis Stormwater Curb Extension	Emeryville	Northeast Corner of Park Ave and Hollis Street		X				Planted stormwater curbextension constructed in 2010 as part of new corner plaza area.	X	X			X	X			X	Constructed	Peter Schultze-Allen (Emeryville)	2010	None planned	Yes	Project completed. Pixar Animation Studios responsible, cost information not broken down or available.
		2	Codornices Creek Restoration Project	Berkeley, Albany, University of California	San Pablo Avenue at 6th Street			X			4 Rain Gardens/Bioretention areas with underdrains with discharge to Codornices Creek	X		X	X	X	X	X			Constructed	Jim Scanlin (ACPWA)	2011	Yes 5-Year Plan	Yes	Maintenance of all the improvements made on Codornices Creek is divided among the three agencies (Albany, Berkeley, and UC Berkeley) through a Memorandum of Understanding (MOU). The bioretention facilities were included in this MOU by an amendment before acceptance of construction.The Creek Project requires 5 years of monitoring.
		3	Stanley Boulevard Safety and Streetscape Improvement Project	Unincor-porated Alameda County	Stanley Boulevard Safety and Streetscape Improvement Project	X					Improving 3 miles of roadway, incorporating LID to convert industrial corridor to more rural parkway setting.	98		X	X	X	X	X			Contruction Phase	Justin Laurence (ACCWP)	September 2012	None planned	Yes	Construction is currently in progress. The BMPs have not yet begun construction.
CCCWP	Contra Costa	4	El Cerrito Green Streets	El Cerrito	10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	X					2 Rain Gardens (bioretention with underdrains)	X			X	X	X			X	Constructed	Stephen Pree (El Cerrito)	August 2010	Yes Conducted	Yes	The project was completed in August 2010 and completed water quality monitoring through WY 2012.
		5	San Pablo Avenue Greenspine Project	Richmond	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	X					5 Bioretention facilities, including infiltration			X		X	X	X			Preliminary Design Phase	Josh Brandt (SFEP)	Fall 2013	Planned	No	The project is currently in the 30% design phase. Design anticipated to be completed by late summer 2013 and construction to begin in late summer/fall 2013.
SMCWPPP	San Mateo	6	Sustainable Streets and Parking Lots Demonstration Project	Burlingame	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300			X	X		Rain Garden (bioretention without underdrain) and curb extention	X		X	X						Constructed	Jane Gomery (Burlingame)	January 2011	No	Yes	The project was completed in January 2011.
		7	Bransten Road Green Street	San Carlos	Bransten Road between Old County Road and Industrial Road			X			Bioretention areas in newly constructed curb extensions				X	X	X		X		100% Design Phase	Ray Chan (San Carlos)	December2014	CW4CB Task 5 Planned	Yes	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.
SCVURPPP	Santa Clara	8	Packard Foundation Project	Los Altos	343 Second Street, between Whitney and Lyell			X			Flow-through rain gardens in park strip along street and at an intersection; conversion of impervious to pervious area			X	X	X					Constructed	Jill Bicknell (SCVURPPP)	July 2012	None planned	Yes	Construction completed July 2012.
		9	Hacienda Avenue Green Street	Campbell	Hacienda Avenue, between South San Tomas Aquino Rd & Winchester Blvd	X					Improving 1 mile of roadway. Adding bike lanes, sidewalk infill, narrowing roadway width to install bioretention swales and bulbouts	X		X		X	X	X	X		Final Design Phase	Fred Ho (Campbell)	Late 2014/early 2015	Yes (water balance only)	Yes	Conceptual designs approved by City Council. Construction to begin in summer 2014.
		10	Southgate Neighborhood Green Street	Palo Alto	Various streets centered around Miramonte and Castilleja Avenues			X			Adding bioretention and biofiltration planters and pervious pavement throughout a residential neighborhood	X		X	X	X	X	X			Final Design Phase	Jill Bicknell (SCVURPPP)	Early 2014	None planned	Yes	Design received approval from city architectural review design staff. Construction to begin in fall 2013.

Updated August 7, 2013

Table A2. Project Cost Information for 10 Selected Green Street Pilot Projects

Program	County	No.	Project Name	Owner/ Municipality	Project Location	Project Cost Estimate				Project Status	Project Contact	Funding (include Percentages)
						Construction Costs	Design Costs	Annual O&M Costs	Total Estimated Costs without Annual O&M			
ACCWP	Alameda	1	Park and Hollis Stormwater Curbextension	Emeryville	Northeast Corner of Park Ave and Hollis Street	Not Available	Not Available	Not Available	Not Available	Constructed	Peter Schultze-Allen (Emeryville)	Pixar Animation Studios
		2	Codornices Creek Restoration Project	Berkeley, Albany, University of California	San Pablo Avenue at 6th Street	$140,000	$35,000	$3,000	$175,000	Constructed	Jim Scanlin (ACPWA)	100% Funded by Prop 50 River Parkways Grant that was awarded to the City of Albany.
		3	Stanley Boulevard Safety and Streetscape Improvement Project	Unincorporated Alameda County	Stanley Boulevard Safety and Streetscape Improvement Project	Not Available	Not Available	Alameda County Public Works Maintenance & Operations Local Funds	$14,500,000	Contruction Phase	Justin Laurence (ACCWP)	State Prop 1B & Local funds (64.3%), CEMEX and Vulcan Materials Companies (34.5%), Bay Area Air Quality Management District – Transportation for Clean Air Grant Funds (0.008%), StopWaste.org Bay Friendly Grant Funds (0.002%)
CCCWP	Contra Costa	4	El Cerrito Green Streets Project	El Cerrito	10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	$324,127	Unknown	$5,000	$324,127	Constructed	Stephen Pree (El Cerrito)	This project was funded in large part through a federal ARRA grant through the State Water Resources Control Board ($392,000). This grant was split between the design/construction phase and the monitoring phase. The construction portion of that grant ($215,295) went to the City of El Cerrito as subgrantees. Other funding was from the El Cerrito Redevelopment Agency ($108,832).
		5	San Pablo Avenue Greenspine Project	Richmond	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	Not Available	Not Available	City of Richmond responsible	Not Available	Preliminary Design Phase	Josh Brandt (SFEP)	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
SMCWPPP	San Mateo	6	Sustainable Streets and Parking Lots Demonstration Project	Burlingame	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300	$215,000	$55,000	$65,000	$270,000	Constructed	Jane Gomery (Burlingame)	The San Mateo Countywide Water Pollution Prevention Program provided $250,000 of the funding. The City of Burlingame also contributed to the Capital Improvement Project from its General Fund.
		7	Bransten Road Green Street	San Carlos	Bransten Road between Old County Road and Industrial Road	$379,600	$156,000	Not Available	$535,600	100% Design Phase	Ray Chan (San Carlos)	EPA's San Francisco Bay Water Quality Improvement Fund (59%), San Mateo Countywide Water Pollution Prevention Program's Sustainable Creen Streets and Parking Lots Program (40%), Match from San Mateo Countywide Water Pollution Prevention Program (1%).
SCVURPPP	Santa Clara	8	Packard Foundation Project	Los Altos	343 Second Street, between Whitney and Lyell	Not Available - part of larger project	Not Available - part of larger project	Not Available	Not Available	Constructed	Jill Bicknell (SCVURPPP)	Funding was provided entirely by the David & Lucile Packard Foundation as part of construction of its headquarters office building. The Packard Foundation is responsible for operation and maintenance of the project.
		9	Hacienda Avenue Green Street	Campbell	Hacienda Avenue, between South San Tomas Aquino Rd & Winchester Blvd	Not Available	Not Available	Not Available	$4,635,000	Final Design Phase	Fred Ho (Campbell)	Received $2 million grant from State's IRWM program (43%) and $0.5 million in Federal funding via Caltrans (11%). City is providing the remainder of the funding (46%)."
		10	Southgate Neighborhood Green Street	Palo Alto	Various streets centered around Miramonte and Castilleja Avenues	$800,000 (estimate)	$300,000	Not Available	$1,100,000	Final Design Phase	Jill Bicknell (SCVURPPP)	The project is being funded entirely by the City of Palo Alto. The preliminary cost includes about 475 linear feet of new storm drain.

Updated August 7, 2013

Table A3. Project Information for All Reported Bay Area Green Street Projects

Pro-gram	County	No.	Project Name	Owner/ Municipality	Project Location	Project Type (check all that apply)					Project Description	Project Attributes (check all that apply)									Project Status	Project Contact	Estimated Date of Comple-tion	WQ Monitor-ing	Modelling	Project Schedule, Funding, and Other Information
						Arterial	Collector	Local	Parking Lot	Other (*specify*)		Bay-Friendly Landscaping	Stormwater Storage/Use	Stormwater Infiltration	Stormwater Treatment	Enhance Pedestrian and /or bicycle environment	Park-like elements	Connect residential, recreation, schools,	Parking Management	ABAG/MTC- designated Priority Development						
ACCWP	Alameda	A1	**Park and Hollis Stormwater Curb Extension**	**Emeryville**	Northeast Corner of Park Ave and Hollis Street		X				Planted stormwater curbextension constructed in 2010 as part of new corner plaza area.	X	X			X	X			X	Constructed	Peter Schultze-Allen (Emeryville)	2010	None planned	Yes	Project completed. Pixar Animation Studios responsible, cost information not broken down or available.
		A2	**Codornices Creek Restoration Project**	**Berkeley, Albany, University of California**	San Pablo Avenue at 6th Street			X			4 Rain Gardens/Bioretention areas with underdrains with discharge to Codornices Creek	X		X	X	X	X	X			Constructed	Jim Scanlin (ACPWA)	2011	Yes 5-Year Plan	Yes	Maintenance is divided among 3 agencies (Albany, Berkeley, and UC Berkeley) through a Memorandum of Understanding (MOU) for entire project. The Creek Project requires 5 years of monitoring.
		A3	**Stanley Boulevard Safety and Streetscape Improvement Project**	**Unincor-porated Alameda County**	Stanley Boulevard Safety and Streetscape Improvement Project	X					Improving 3 miles of roadway, incorporating LID to convert industrial corridor to more rural parkway setting.	98		X	X	X	X	X			Contruction Phase	Justin Laurence (ACCWP)	September 2012	None planned	Yes	Construction is currently in progress. The BMPs have not yet begun construction. State Prop 1B & Local funds (64.3%), CEMEX and Vulcan Materials Companies (34.5%), Bay Area Air Quality Management District – Transportation for Clean Air Grant Funds (0.008%), StopWaste.org Bay Friendly Grant Funds (0.002%)
		A4	**San Pablo Avenue Greenspine Project**	**Albany**	San Pablo Ave & Monroe St, Albany 94706	X					3 Stormwater Curb Extensions and Sidewalk Planters	X			X		X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		A5	**San Pablo Avenue Greenspine Project**	**Berkeley**	San Pablo Ave & Cordornices Creek, Berkeley 94708	X					5 Stormwater Curb Extensions	X			X		X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		A6	**San Pablo Avenue Greenspine Project**	**Emeryville**	San Pablo Ave & W MacArthur Blvd, Emeryville 94608	X					3 Rain Gardens	X			X	X	X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		A7	**San Pablo Avenue Greenspine Project**	**Oakland**	San Pablo Ave & 17th Street, Oakland, 94612	X					Stormwater Planters and Street Trees	X		X	X		X		X		60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
CCCWP	Contra Costa	CC1	**El Cerrito Green Streets**	**El Cerrito**	10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	X					2 Rain Gardens (bioretention with underdrains)	X			X	X	X			X	Constructed	Stephen Pree (El Cerrito)	August 2010	Yes Conducted	Yes	Funded through a federal ARRA Grant and by the El Cerrito Redevelopment Agency and administered through the State Water Resources Control Board via SFEP.
		CC2	**San Pablo Avenue Greenspine Project**	**El Cerrito**	San Pablo Ave & Stockton Ave; San Pablo Ave & Moeser Ave, El Cerrito 94530; El Cerrito 94530	X					Stormwater Curb Extensions, Rain Gardens, and Sidewalk Planters	X		X	X		X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		CC3	**San Pablo Avenue Greenspine Project**	**Richmond**	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	X					5 Bioretention Facilities, including Infiltration	X		X		X	X	X			60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		CC4	**San Pablo Avenue Greenspine Project**	**San Pablo**	13613 San Pablo Ave, San Pablo 94806	X					Stormwater Planters	X					X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		CC5	**Nevine Avenue Improvements Green Streets**	**Richmond**	Nevin Avenue from 19th St to 27th St			X			Rain gardens (bioretention w/underdrain) curb extensions, permeable pavement			X	X	X	X				100% Design Phase	Lynn Scarpa (Richmond)	March 2014	Planned as part of CW4CB Task 5	No	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.

Table A3. Project Information for All Reported Bay Area Green Streets Projects

Pro-gram	County	No.	Project Name	Owner/ Municipality	Project Location	Project Type (check all that apply)					Project Description	Project Attributes (check all that apply)									Project Status	Project Contact	Estimated Date of Comple-tion	WQ Monitor-ing	Modelling	Project Status
						Arterial	Collector	Local	Parking Lot	Other (*specify*)		Bay-Friendly Landscaping	Stormwater Storage/Use	Stormwater Infiltration	Stormwater Treatment	Enhance Pedestrian /or bicycle environment	Park-like elements	Connect residential, recreation, schools, streets,	Parking Management	ABAG/MTC- designated Priority Development Area						
		CC6	**PG&E Substation at 1st & Cutting**	**Richmond**	South 1st Street & Cutting Blvd, Richmond 94804		X				4 Bioretention areas (2 w/underdrains; 2 w/o underdrains)			X	X						100% Design Phase	Lynn Scarpa (Richmond)	October 2013	Planned as part of CW4CB Task 5	No	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.
SMCW PPP	**San Mateo**	**SM1**	**Sustainable Streets and Parking Lots Demonstration Project**	**Burlingame**	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300			X	X		Rain Garden (bioretention without underdrain) and curb extention	X		X	X						Constructed	Jane Gomery (Burlingame)	January 2011	No		Funding for the projects come from a countywide vehicle registration fee under Assembly Bill (AB) 1546, which went into effect on July 1, 2005, and was subsequently extended to 2012 through Senate Bill (SB) 348.
		SM2	**Bransten Road Green Street**	**San Carlos**	Bransten Road between Old County Road and Industrial Road			X			Bioretention areas in newly constructed curb extensions				X	X	X		X		100% Design Phase	Ray Chan (San Carlos)	December2014	Planned as part of CW4CB Task 5	Yes	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.
SCVUR PPP	**Santa Clara**	**SC1**	**Packard Foundation Project**	**Los Altos**	343 Second Street, between Whitney and Lyell			X			Flow-through rain gardens in park strip along street and at an intersection; conversion of impervious to pervious area			X	X	X					Constructed	Jill Bicknell (SCVURPPP)	July 2012	None planned	Yes	Construction completed July 2012. Funding was provided entirely by the David & Lucile Packard Foundation as part of construction of its headquarters office building.
		SC2	**Hacienda Avenue Green Street**	**Campbell**	Hacienda Avenue, between South San Tomas Aquino Rd & Winchester Blvd	X					Improving 1 mile of roadway. Adding bike lanes, sidewalk infill, narrowing roadway width to install bioretention swales and bulbouts	X		X		X	X	X	X		Final Design Phase	Fred Ho (Campbell)	Late 2014/early 2015	Yes (Water balance only)	Yes	Conceptual designs approved by City Council. Construction to begin in summer 2014. Funding assistance provided by $2 million grant from State's IRWM program (43%) and $0.5 million in Federal funding via Caltrans (11%). City is providing the remainder of the funding (46%).
		SC3	**Southgate Neighborhood Green Street**	**Palo Alto**	Various streets centered around Castilleja &Miramonte Aveunes			X			Adding bioretention and biofiltration planters and pervious pavement throughout a residential neighborhood	X		X	X	X	X	X			Final Design Phase	Jill Bicknell (SCVURPPP)	Early 2014	None planned	Yes	Design received approval from city architectural review design staff. Construction to begin in fall 2013. The project is being funded entirely by the City of Palo Alto.
		SC4	**Martha Gardens Green Alleys Pilot Project**	**San Jose**	Alley between Second and Third Street; Virginia and Martha Strret					x	"Green" concrete sloped to permeable pavers draining to below-grade infiltration galleries.			x	x	x					Project Design Phase	Jill Bicknell (SCVURPPP)	Late 2013	Pre and post-project sediment analysis	No	Project was selected for Prop 84 Stormwater Implementation Grant funding.
		SC5	**Park Avenue: Green Avenue Pilot Project**	**San Jose**	Park Avenue between Meridian Ave. and Sunol St.		x				Bioretention areas constructed at existing curb and at new curb extensions, and permeable paver median.			x	x	x					Preliminary Design Phase	Jill Bicknell (SCVURPPP)	Late 2014	Pre and post project pollutant analysis, flow reduction.	No	Project was selected for Prop 84 Stormwater Implementation Grant funding.

Table A4. Modeling Information for 10 Selected Green Street Pilot Projects

GREEN STREET PILOT PROJECTS										
	Park and Hollis Stormwater Curb Extension	**Codornices Creek Restoration**	**Stanley Boulevard Safety and Streetscape Improvement**	**El Cerrito Green Streets**	**San Pablo Avenue Green Spine - Richmond**	**Sustainable Green Streets and Parking Lots Demonstration**	**Bransten Road Green Streets**	**Southgate Neighborhood Green Streets Project**	**Packard Foundation Green Streets**	**Hacienda Avenue**
General Info										
County	Alameda	Alameda	Alameda	Contra Costa	Contra Costa	San Mateo	San Mateo	Santa Clara	Santa Clara	Santa Clara
City	Emeryville	Albany	Unincorporated Alameda County	El Cerrito	Richmond	Burlingame	San Carlos	Palo Alto	Los Altos	Campbell
Location	Northeast Corner of Park Ave and Hollis Street	San Pablo Avenue at 6th Street	3 mile stretch of Stanley Blvd between City Limits of Pleasanton and Livermore in Unincorporated Alameda County	Two Locations: 10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300	Bransten Road between Old County Road and Industrial Road	Various streets centered around Castilleja Avenue and Miramonte Avenue	Second Street from Lyell Street to Whitney Street	Hacienda Avenue between S. Winchester Boulevard and Burrows Road/San Tomas Aquino Road
Design Complete	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No. Expected completion September 2013.
Constructed	Yes	Yes	In Progress	Yes	No	Yes	No	No	Yes	No
Map/Plans	GIS	CADD (PDF)	CADD (PDF)	CADD (PDF)	CADD (PDF)	CADD (PDF)	CADD (PDF)	PDF	CADD (PDF)	Available
Drainage Area Size/Characteristics										
Drainage area (acre)	0.19 (8,470 sq-ft)	1.93	33	1.33	2.22	1.32	0.54	41.4	0.59	22.7
Ability to measure area	GIS	CADD (PDF)	CADD	CADD	GIS	CADD	CADD	AutoCAD	Building Plans	GIS
Pre-Construction % Imp	100	100	80	99	Not Known At This Time	95	95	67	100	74
Post-Construction % Imp	93	100	78	99	Not Known At This Time	90	95	66	89	71
Underlying Soil Type	Clay	Clay	Alluvium with silty sand (SM) with gravel and clayey sand (SC) with gravel	D	Not Known At This Time	Clayey Loam	Fill and Holocene-age alluvial fan deposits; HSG D	Lean clay with sand; clayey sand with gravel at 5-10 feet below grade	Sandy lean clay to clayey sand	Fine sandy silt, silty sand, gravelly sand
Infiltration Rate	Infeasible	Low impermeability	In-situ Percolation testing and site sampling PDF available	Low impermeability	Not Known At This Time	Yes, rate (0.1 in/hr, 0.17 in/hr)	Low impermeability	0.15-0.5 in/hr (at 5-10 feet below grade)	2 inches/hour	4 in/hr
Land Use	Commerical	Commercial, Residential, 60% in ROW	90% Public ROW, 10% Private	Commerical	Commercial	Commerical	Industrial	Residential	Commercial	Residential
LID Features										
BMP Type	Planted stormwater curb extension or on-street rain garden.	Rain garden/bioretention areas with underdrains	Linear treatment measure(bioswales on plans), infiltration trench (filter strips on plans)	Bioretention with underdrain	Bioretention with underdrain	Bioretention area and curb extension	Bioretention swales in curb extensions-Detailed plans available, some infiltrate	Bioretention and biofiltration planters, and pervious pavers	Curbside rain gardens and bulb-outs	Bioinfiltration
Number of BMPS	1	4	2	2	6	2	9	21	20	~80
Infiltration	Bioretention facilities lined with impermeable liner and has underdrains; No infiltration.	Bioretention facilities not lined; incidental infiltration from ponding beneath underdrain which drains to Creek.	Bioswale and filter strip not lined; Both have overflows and are connected to public storm drain; Incidental infiltration due to ponding.	Bioretention facilities not lined; incidental infiltration from ponding beneath underdrain	Not Known At This Time	Bioretention facilities not lined; No underdrain and not connected to public storm drains; designed to infiltrate onsite	Bioretention facilities not lined; incidental infiltration from ponding beneath underdrain and in bioretential facilities without underdrains	Bioretention facilities are not lined and most have no underdrains	Bioretention facilities are not lined and have no underdrains	Bioinfiltration units not lined, will not have underdrain but will have overflow outlet/drain
BMP Sizing	650 sq-ft	Facilities sized with surface areas of 180 sq-ft, 260 sq-ft, 224 sq-ft, and 425 sq-ft	Trench (13,895' long, 4' wide), LTM (13,895' long, 3' wide)	Madison Rain Gardens (7 individual gardens) sized to treat 0.38 ac w/tributary area 0.39 ac. Eureka Rain Gardens (12 individual gardens) sized to treat 0.64 ac w/tributary area 0.94 ac.	4,625 sq ft of proposed treatment area, primarily through central rain garden and 5 curb extension planters.	0.06 acre bioretention (rain garden-infiltrates), 0.01 acre planter box (curb extension)	0.10 acres (from WRECO Memo, Feb 2013)	Bioretention with underdrains = 906 sq. ft.; bioretention without underdrains = 2,618 sq. ft.; pervious pavers = 8,712 sq. ft.	1834 sq. ft. (0.042 acres) total surface area	~26,000 sq. ft. (0.6 acres) total surface area
Stormwater Design Criteria	Volume Hydraulic Design Basis, 4% of catchment area method	Alameda County Sizing Criteria	Volume Hydraulic Design Basis. Stormwater Quality Handbook recommends a bioswale area that is 4% the size of the impervious area. 4% will adequately be able to capture and treat 0.2 in/hr of rainfall. The storm drain pipes are sized to handle a 2.0 in/hr storm.	Volume Hydraulic Design Basis	At this stage of planning, still using Contra Costa Countywide Clean Water Program c.3 sizing criteria of 4% of tributary area.	Flow Hydraulic Design Basis, 0.2" per hour of rainfall intensity	Volume Hydraulic Design Basis, 4% of catchment area method	Volume-based (85th percentile storm event)	Volume basis; actual size based on space available	Not Known At This Time
Design Specifications/Resources	Countywide Program C3 Design Manual	C3 Guidelines used as basis	Alameda County Design Guidelines, (State) Caltrans Standard Plans and Specifications, AASHTO and the Roadside Design Guide Policies, Cities of Livermore and Pleasanton design standards/requirements, Bay Friendly Guidelines, Various Utilities (PG&E, AT&T, Comcast), Railroad (UPRR), and (EBRPD) Park District requirements, and C3 Stormwater Technical Guidance.	C3 Guidelines	Not Known At This Time	San Mateo Countywide Program, C3 Stormwater Technical Guidance	San Mateo Countywide Program, C3 Stormwater Technical Guidance	Santa Clara County Drainage Manual and Los Angeles County Hydrology Manual	SCVURPPP C.3 Stormwater Handbook	SCVURPPP C.3 Stormwater Handbook

Table A4. Modeling Information for 10 Selected Green Street Pilot Projects

GREEN STREET PILOT PROJECTS										
	Park and Hollis Stormwater Curb Extension	**Codornices Creek Restoration**	**Stanley Boulevard Safety and Streetscape Improvement**	**El Cerrito Green Streets**	**San Pablo Avenue Green Spine - Richmond**	**Sustainable Green Streets and Parking Lots Demonstration**	**Bransten Road Green Streets**	**Southgate Neighborhood Green Streets Project**	**Packard Foundation Green Streets**	**Hacienda Avenue**
Water Quality Data										
Pre-Construction WQ Data	None Available	None Available	None Available	None Available	Not Known At This Time	None Available	None Available	None Available	None Available	None Available
Mean Annual Precip	Pull from rainfall record	20	Pull from rainfall record	Pull from rainfall record	Pull from rainfall record	18.77 inches of rainfall.	Pull from rainfall record	18 inches	18 inches	19 inches
WQ Monitoring	None planned	None planned	None planned	Conducted 2011-2012	Planned (SFEI)	None planned	CW4CB Task 5 planned	Not Known At This Time	None planned	None planned

Geosyntec consultants

APPENDIX B

Spreadsheet Model Results

Table B1. Modeling Results for Green Street Pilot Projects with 25% Incidental Infiltration

Project Name	Average Annual Runoff (cu-ft)	Total Effluent Volume[1] (cu-ft)	Average Annual Influent Loads					Average Annual Load Reduction				
			TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)	TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)
Bransten Road Green Street Project	24134	19911	77679	24944	216295	103	39	48025	4365	37852	66	24
Codornices Creek Restoration Project	113904	93971	366620	117727	1020838	488	184	226662	20602	178647	312	115
El Cerrito Green Streets Project	78935	65122	254068	81585	707441	338	128	157077	14277	123802	216	80
Packard Foundation Project	24703	20380	64355	22559	204609	5	16	38549	3948	35806	3	15
Park and Hollis Stormwater Curbextension	10593	8739	34096	10949	94938	45	17	21080	1916	16614	29	11
Stanley Blvd Safety and Streetscape Improvement Project	771549	636528	2009999	704592	6390485	152	794	1203978	123304	1118335	91	476
Sustainable Streets and Parking Lots Demonstration Project	60547	49951	157733	55292	501488	12	62	94481	9676	87760	7	37
San Pablo Avenue Green Spine Project (City of Richmond segment)	71813	59246	187084	65581	594807	14	74	112063	11477	104091	8	44
Hacienda Avenue Green Streets	758221	625532	1975276	692420	6280090	149	780	1183180	121174	1099016	89	467
Southgate Neighborhood Green Streets Project	1285452	1060498	3348790	11738790	10646968	253	1323	2005907	205432	1863219	151	792

Notes:

[1] Total Effluent Volume refers to the sum of the effluent volume from the BMPs and the bypassed volume.

Table B2. Modeling Results for Green Streets Pilot Projects with 50% Incidental Infiltration

Project Name	Average Annual Runoff (cu-ft)	Total Effluent Volume[1] (cu-ft)	Average Annual Influent Loads					Average Annual Load Reduction				
			TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)	TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)
Bransten Road Green Street Project	24134	15687	77679	24944	216295	103	39	50142	8730	75703	68	25
Codornices Creek Restoration Project	113904	74038	366620	117727	1020838	488	184	236653	41204	357293	322	120
El Cerrito Green Streets Project	78935	51308	254068	81585	707441	338	128	164000	28555	247604	223	83
Packard Foundation Project	24703	16057	64355	22559	204609	5	25	40715	7896	71613	3	16
Park and Hollis Stormwater Curbextension	10593	6885	34096	10949	94938	45	17	22009	3832	33228	30	11
Stanley Blvd Safety and Streetscape Improvement Project	771549	501507	2009999	704592	6390485	152	794	1271652	246607	2236670	96	502
Sustainable Streets and Parking Lots Demonstration Project	60547	39355	157733	55292	501488	12	62	99792	19352	175521	8	39
San Pablo Avenue Green Spine Project (City of Richmond segment)	71813	46679	187084	65581	594807	14	74	118361	22953	208182	9	47
Hacienda Avenue Green Streets	758221	492844	1975276	692420	6280090	149	780	1249684	242347	2198032	94	494
Southgate Neighborhood Green Streets Project	1285452	835544	3348790	1173896	10646968	253	1323	2118656	410864	3726439	160	837

Notes:

[1] Total Effluent Volume refers to the sum of the effluent volume from the BMPs and the bypassed volume.

Table B3. Modeling Results for Green Streets Pilot Projects with 75% Incidental Infiltration

Project Name	Average Annual Runoff (cu-ft)	Total Effluent Volume[1] (cu-ft)	Average Annual Influent Loads					Average Annual Load Reduction				
			TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)	TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)
Bransten Road Green Street Project	24134	11464	77679	24944	216295	103	39	52259	13096	113555	70	26
Codornices Creek Restoration Project	113904	54104	366620	117727	1020838	488	184	246643	61807	535940	331	124
El Cerrito Green Streets Project	78935	37494	254068	81585	707441	338	128	170924	42832	371406	230	86
Packard Foundation Project	24703	11734	64355	22559	204609	5	25	42882	11844	107419	3	17
Park and Hollis Stormwater Curbextension	10593	5032	34096	10949	94938	45	17	22938	5748	49842	31	12
Stanley Blvd Safety and Streetscape Improvement Project	771549	366486	2009999	704592	6390485	152	794	1339325	369911	3355004	101	529
Sustainable Streets and Parking Lots Demonstration Project	60547	28760	157733	55292	501488	12	62	105102	29028	263281	8	42
San Pablo Avenue Green Spine Project (City of Richmond segment)	71813	34111	187084	65581	594807	14	74	124660	34430	312273	9	49
Hacienda Avenue Green Streets	758221	360155	1975276	692420	6280090	149	780	1316189	363521	3297047	99	520
Southgate Neighborhood Green Streets Project	1285452	610590	3348790	1173896	10646968	253	1323	2231404	616296	5589658	168	881

Notes:

[1] Total Effluent Volume refers to the sum of the effluent volume from the BMPs and the bypassed volume.

Geosyntec consultants

APPENDIX C

Green Street Pilot Projects Design Plans

NOTE: FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

INDEX OF SHEETS:

Sheet No.	Description	
1	Title Sheet	
2–5	Demolition Plan	DM–1/4
6–9	Layout	L–1/4
10–13	Grading Plan	GR–1/4
14–17	Utility & Storm Drain Plan	U–1/4
18–19	Construction Details	C–1/2
20	Notes and Legend	HP1.1
21	Planting Notes and Legend	HP1.2
22–25	Landscape Layout Plan	HP2.1/2.4
26–29	Planting Plan	HP3.1/3.4
30–33	Irrigation Plan	HP4.1/4.4
34	Irrigation Notes and Legend	HP4.5
35–37	Irrigation Details	HP4.6/4.8
38–39	Landscape Details	HP5.1/5.2

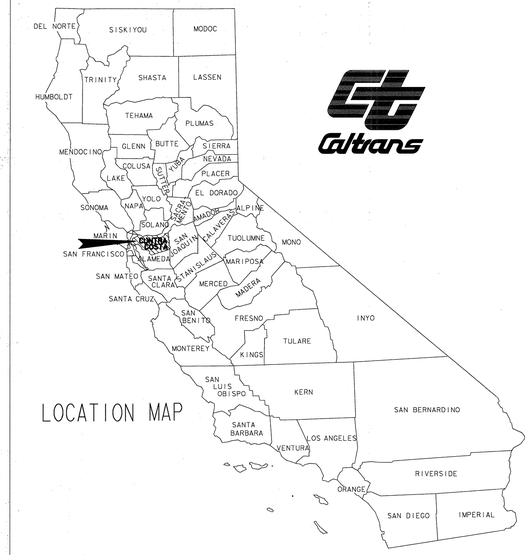
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN CONTRA COSTA COUNTY
IN EL CERRITO
AT SAN PABLO AVENUE (SR 123)

To be supplemented by Standard Plans dated May 2006

San Pablo Avenue Rain Garden Project

DST	COUNTY	ROUTE	MILES POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	123	0.0/2.1	1	39



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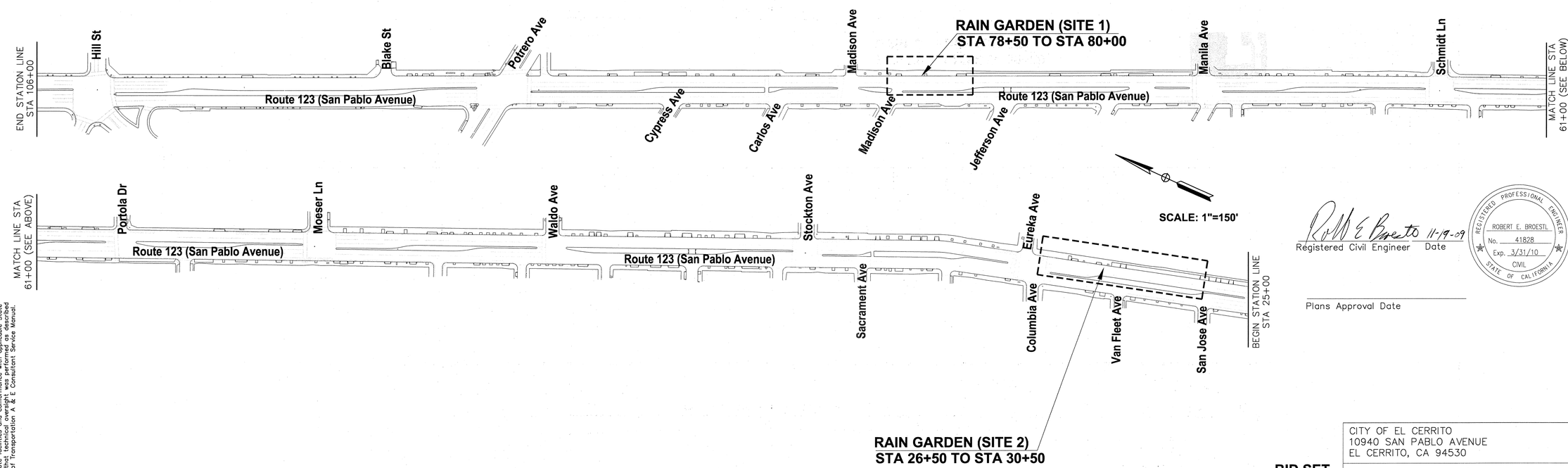


Registered Civil Engineer Date 11-19-09

REGISTERED PROFESSIONAL ENGINEER
ROBERT E. BROESTL
No. 41828
Exp. 3/31/10
CIVIL
STATE OF CALIFORNIA

Plans Approval Date

BID SET

November 19, 2009

CITY OF EL CERRITO
10940 SAN PABLO AVENUE
EL CERRITO, CA 94530

GATES AND ASSOCIATES
2671 CROW CANYON ROAD
SAN RAMON, CA 94583

BELLECCI & ASSOCIATES, INC.
2290 DIAMOND BOULEVARD, SUITE #100
CONCORD, CA 94520

City Contract No. C4016

LAST REVISION 00-00-00 DATE PLOTED=> TIME PLOTED=>

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHINICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER | CALTRANS DESIGN OVERSIGHT APPROVAL | REGISTRATION NO. | LICENSE EXP. DATE | DATE SIGNED

Approved as to impact on State facilities and conformance with applicable State standards and practices and that technical oversight was performed as described in the California Department of Transportation A & E Consultant Service Manual.

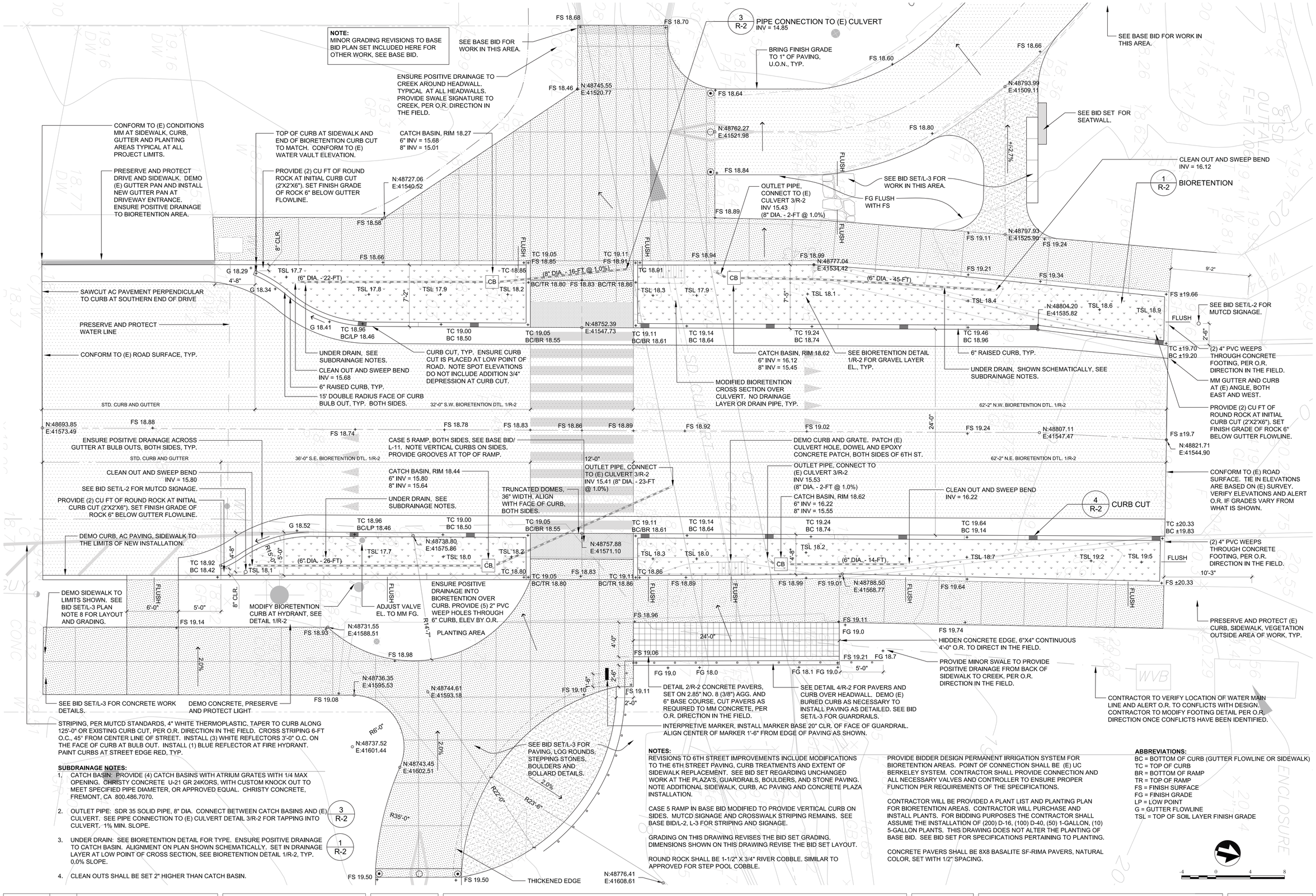
The Contractor shall possess the Class (or Classes) of license as specified in the "Notice to Contractors".

FOR REDUCED PLANS ORIGINAL SCALE IN INCHES 0 100 200 300 400 500

CITY CONTRACT NO.: C4016
DGN FILE=> DG TITLE_PHASE 2

CU 04275

EA 4A5604



SUBDRAINAGE NOTES:

1. CATCH BASIN: PROVIDE (4) CATCH BASINS WITH ATRIUM GRATES WITH 1/4 MAX OPENING. CHRISTY CONCRETE U-21 GR 24KORS, WITH CUSTOM KNOCK OUT TO MEET SPECIFIED PIPE DIAMETER, OR APPROVED EQUAL. CHRISTY CONCRETE, FREMONT, CA 800.486.7070.
2. OUTLET PIPE: SDR 35 SOLID PIPE, 8" DIA. CONNECT BETWEEN CATCH BASINS AND (E) CULVERT. SEE PIPE CONNECTION TO (E) CULVERT DETAIL 3/R-2 FOR TAPPING INTO CULVERT. 1% MIN. SLOPE. (3 / R-2)
3. UNDER DRAIN: SEE BIORETENTION DETAIL FOR TYPE. ENSURE POSITIVE DRAINAGE TO CATCH BASIN. ALIGNMENT ON PLAN SHOWN SCHEMATICALLY. SET IN DRAINAGE LAYER AT LOW POINT OF CROSS SECTION, SEE BIORETENTION DETAIL 1/R-2, TYP. 0.0% SLOPE. (1 / R-2)
4. CLEAN OUTS SHALL BE SET 2" HIGHER THAN CATCH BASIN.

NOTES:

REVISIONS TO 6TH STREET IMPROVEMENTS INCLUDE MODIFICATIONS TO THE 6TH STREET PAVING, CURB TREATMENTS AND EXTENT OF SIDEWALK REPLACEMENT. SEE BID SET REGARDING UNCHANGED WORK AT THE PLAZA'S, GUARDRAILS, BOULDERS, AND STONE PAVING. NOTE ADDITIONAL SIDEWALK, CURB, AC PAVING AND CONCRETE PLAZA INSTALLATION.

CASE 5 RAMP IN BASE BID MODIFIED TO PROVIDE VERTICAL CURB ON SIDES. MUTCD SIGNAGE AND CROSSWALK STRIPING REMAINS. SEE BASE BID/L-2, L-3 FOR STRIPING AND SIGNAGE.

GRADING ON THIS DRAWING REVISES THE BID SET GRADING. DIMENSIONS SHOWN ON THIS DRAWING REVISE THE BID SET LAYOUT.

ROUND ROCK SHALL BE 1-1/2" X 3/4" RIVER COBBLE. SIMILAR TO APPROVED FOR STEP POOL COBBLE.

PROVIDE BIDDER DESIGN PERMANENT IRRIGATION SYSTEM FOR BIORETENTION AREAS. POINT OF CONNECTION SHALL BE (E) UC BERKELEY SYSTEM. CONTRACTOR SHALL PROVIDE CONNECTION AND ALL NECESSARY VALVES AND CONTROLLER TO ENSURE PROPER FUNCTION PER REQUIREMENTS OF THE SPECIFICATIONS.

CONTRACTOR WILL BE PROVIDED A PLANT LIST AND PLANTING PLAN FOR BIORETENTION AREAS. CONTRACTOR WILL PURCHASE AND INSTALL PLANTS. FOR BIDDING PURPOSES THE CONTRACTOR SHALL ASSUME THE INSTALLATION OF (200) D-16, (100) D-40, (50) 1-GALLON, (10) 5-GALLON PLANTS. THIS DRAWING DOES NOT ALTER THE PLANTING OF BASE BID. SEE BID SET FOR SPECIFICATIONS PERTAINING TO PLANTING.

CONCRETE PAVERS SHALL BE 8X8 BASALITE SF-RIMA PAVERS, NATURAL COLOR, SET WITH 1/2" SPACING.

ABBREVIATIONS:

BC = BOTTOM OF CURB (GUTTER FLOWLINE OR SIDEWALK)
TC = TOP OF CURB
BR = BOTTOM OF RAMP
TR = TOP OF RAMP
FS = FINISH SURFACE
FG = FINISH GRADE
LP = LOW POINT
G = GUTTER FLOWLINE
TSL = TOP OF SOIL LAYER FINISH GRADE

DATE	NO.	REVISIONS
10.22.10	1	CONCRETE PAVERS / DIMENSIONING
11.24.10	2	REMOVED SPEED TABLE / GRADING / BULB OUT
11.30.10	3	RESOLVE WATER LINE / DRAIN PIPE CONFLICTS

Restoration Design Group, LLC
2612b Eighth Street
Berkeley, CA 94710
T 510.644.2798 F 510.644.2799
www.restorationdesigngroup.com

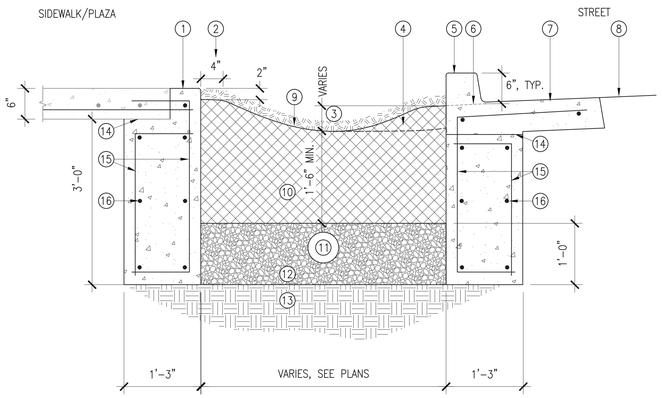
LOWER CODORNICES CREEK - PHASE III
CREEK RESTORATION & SITE IMPROVEMENTS PLAN
CITY OF ALBANY / CITY OF BERKELEY / UNIVERSITY OF CALIFORNIA BERKELEY

CONSTRUCTION SET
NOVEMBER 30, 2010

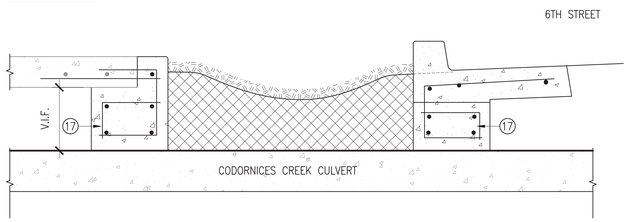
REVISED 6TH STREET PLAN

SHEET
R-1

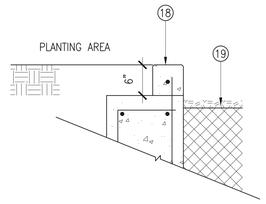
S:\PROJECTS\LOWER CODORNICES CREEK_PHASE III\7 AUTOCAD\6TH ST BIORETENTION\L-REVISED 6TH STREET PLAN - BIORETENTION.DWG
PLOTTED ON: 12/3/2010



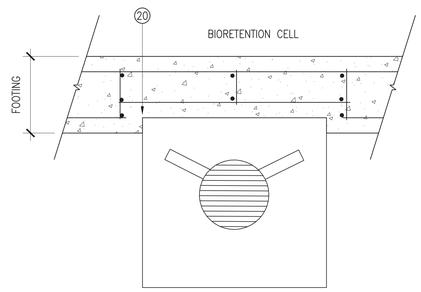
TYPICAL CONDITION



AT CODORNICES CREEK CULVERT



BIORETENTION CONCRETE CURB AND FOOTING WHEN ADJACENT TO PLANTING AREAS

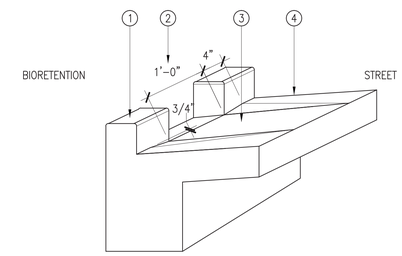


BIORETENTION CURB AND FOOTING MODIFICATIONS AT FIRE HYDRANT: PLAN VIEW

1. SIDEWALK/PLAZA SEE BASE BID AND REVISED 6TH STREET PLAN. SEE R-1 FOR ELEVATIONS. NO THICKENED EDGE AT BIORETENTION. POUR 6" CURB MONOLITHIC WITH FOOTING.
2. MOUND TOP OF SOIL (TSL) TO WITHIN 2" OF SIDEWALK/PLAZA PER O.R. DIRECTION IN THE FIELD. HOLD BOTH SIDES LEVEL 4" AT EQUAL ELEVATION.
3. TSL AT BIORETENTION LOW POINT. ELEVATIONS NOTED ON PLANS INDICATE BIORETENTION LOW POINT.
4. INLET DEPRESSION, DEPRESS FINISH GRADE OF SOIL AT CURB CUTS 4"-6" BELOW GUTTER FLOWLINE, PER O.R. DIRECTION. SEE NOTES ON PLAN FOR (3) LOCATIONS TO RECEIVE COBBLE AT INLET DEPRESSION.
5. CONCRETE CURB, SEE BERKELEY STD. DETAILS. ENSURE POSITIVE DRAINAGE OVER CURB. SEE R-1 FOR ELEVATIONS.
6. CURB CUT, SEE DETAIL 2/R-2.
7. GUTTER PAN, SEE BERKELEY STANDARD DETAIL.
8. AC PAVING, SEE BASE BID.
9. MULCH, 2" DEPTH ABOVE TSL. SEE BID SET SPECS.
10. SOIL LAYER, SEE CONTRA COSTA CLEAN WATER PROGRAM STORMWATER C.3 GUIDEBOOK APPENDIX B FOR SPEC.
11. UNDER DRAIN, 6" DIA. PVC SDR 35 OR EQUIVALENT, PERFORATED WITH HOLES FACING DOWN. BED NEAR TOP OF GRAVEL LAYER. SEE PLANS FOR EXTENT. PROVIDE SWEEP BEND AND CLEANOUT AT END. CLEANOUT ELEVATION 2" ABOVE OVERFLOW ELEV.
12. DRAINAGE LAYER, CLASS II PERMEABLE. OMIT WHERE DIRECTLY ABOVE 6TH STREET CULVERT.
13. SUBGRADE
14. COLD JOINT, CLEAN AND ROUGH
15. #4 REBAR @12" O.C. HOOK TOP AND BOTTOM AS SHOWN, 3" CLR TYP.
16. CONCRETE FOOTING WITH (6) #4 REBAR AS SHOWN.
17. TRUNCATE BOTTOM OF CONCRETE FOOTING AT CULVERT. MODIFY REBAR AS REQUIRED TO ENSURE 3" CLR. VERIFY IN FIELD BY O.R.
18. CURB, 6" WIDTH, INSTALL (1) #4 REBAR CONTINOUS.
19. HOLD TSL LEVEL TO BIORETENTION CURB AT THE S.E. BIORETENTION AREA ONLY, WHEN ADJACENT TO PLANTING AREA, AS SHOWN,
20. MODIFY CONCRET FOOTING THICKNESS TO ACCOMMODATE FIRE HYDRANT. MODIFY REBAR TO ENSURE 3" CLR AS SHOWN.

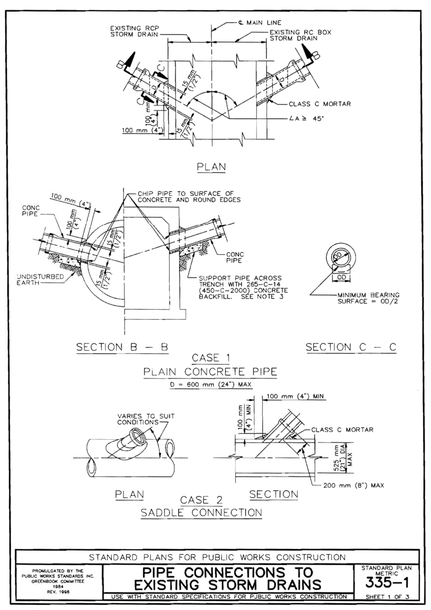
NOTE:
- CONTINUE TRUNCATED FOOTING AND SOIL PROFILE ON SOUTHERN SIDE OF CULVERT @ THE NW BIORETENTION CELL.

1 BIORETENTION
SCALE: NTS



1. CURB, SEE PLANS AND BIORETENTION DETAIL 1/R-1.
2. CURB CUT, 1'-0" WIDE, CONTINUE GUTTER PAN SLOPE DOWN CURB CUT INTO BIORETENTION AREA. ENSURE POSITIVE DRAINAGE INTO BIORETENTION AREA
3. CURB CUT DEPRESSION. DEPRESS GUTTER PAN 3/4" ACROSS 4" ON BOTH SIDES OF CURB CUT AS SHOWN.
4. GUTTER PAN, SEE BERKELEY STD. DETAILS.

2 CURB CUT
SCALE: NTS



NOTES

CASE 1 AND CASE 3

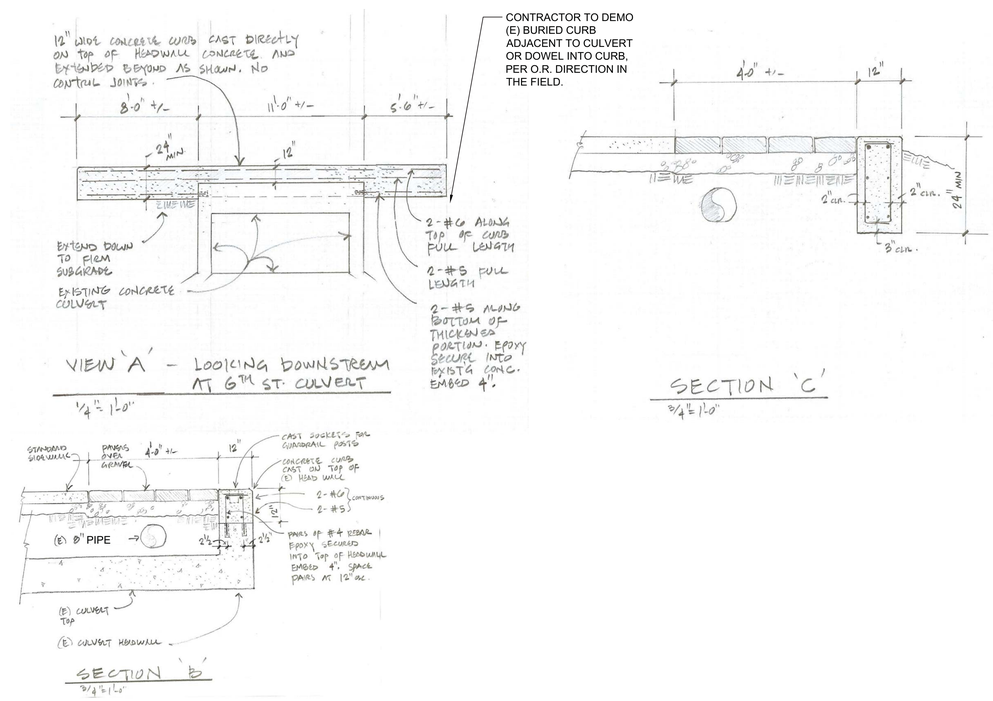
1. OUTSIDE DIAMETER OF THE CONNECTOR PIPE SHALL NOT BE GREATER THAN 1/2 THE INSIDE DIAMETER OF THE RCP MAIN LINE.
2. INSIDE DIAMETER D OF THE CONNECTOR PIPE SHALL NOT BE GREATER THAN 600 mm (24").
3. THE MINIMUM OPENING INTO THE EXISTING STORM DRAIN SHALL BE THE OUTSIDE DIAMETER OF THE CONNECTING PIPE PLUS 30 mm (1"). THE CONCRETE BACKFILL SUPPORTING THE CONNECTING PIPE MAY BE OMITTED IF THE PIPE IS LAID ON UNDISTURBED EARTH TO STORM DRAIN WALL.
4. ALL CSP AND FITTINGS SHALL BE GALVANIZED. BAND CONNECTORS MAY BE 2 GAGES LIGHTER THAN THE PIPE, BUT WITH A MINIMUM GAGE OF 16. THEY SHALL BE CONNECTED AT THE ENDS BY ANGLES HAVING MINIMUM DIMENSIONS OF 50 mm x 50 mm x 5 mm (2"x2"x3/16") AND 140 mm (5 1/2") BOLTS.
5. WHEN JOINING A RCP CONNECTOR PIPE TO A CSP CONNECTOR PIPE, THE INSIDE DIAMETER D OF THE CSP SHALL BE AT LEAST EQUAL TO BUT NOT MORE THAN 75 mm (3") GREATER THAN THAT OF THE RCP.
6. CONNECTOR PIPES SHALL BE NOT MORE THAN 1.5 m (5') ABOVE THE INVERT.
7. CONNECTOR PIPES SHALL ENTER MAIN LINE RCP RADIALLY.
8. WHEN CONNECTING TO A RCB, SPPWC 333 SHALL BE USED IF THE TOP OF THE CONNECTOR PIPE IS LESS THAN 300 mm (12") BELOW THE SOFFIT OF THE RCB OR THE FLOW LINE OF THE PIPE IS LESS THAN 330 mm (13") ABOVE THE FLOOR OF THE RCB AT THE INSIDE FACE.

CASE 2

9. SADDLE CONNECTIONS SHALL BE USED WHEN CONNECTING TO PIPES 525 mm (21") OR LESS IN DIAMETER WITHOUT THE USE OF JUNCTION STRUCTURES OR PRECAST Y BRANCHES.
10. TRIM OR CUT SADDLE TO FIT SNUGLY OVER THE OUTSIDE OF THE MAIN PIPE SO ITS AXIS WILL BE ON THE LINE AND GRADE OF THE CONNECTING PIPE.
11. THE OPENING INTO THE PIPE SHALL BE CUT AND TRIMMED TO FIT THE SADDLE SO THAT NO PART WILL PROJECT WITHIN THE BORE OF THE SADDLE PIPE.
12. THE CONNECTOR PIPE SHALL BE SUPPORTED AS SHOWN IN CASE 1 AND CASE 3.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
PIPE CONNECTIONS TO EXISTING STORM DRAINS
STANDARD PLAN METRIC 335-1
SHEET 2 OF 3

3 PIPE CONNECTION TO (E) CULVERT
SCALE: NTS



4 PAVERS AT SIXTH STREET EAST HEADWALL
SCALE: NTS

DATE	NO.	REVISIONS
10.22.10	1	CONCRETE PAVERS / DIMENSIONING
11.24.10	2	REMOVED SPEED TABLE / GRADING / BULB OUT
11.30.10	3	RESOLVE WATER LINE / DRAIN PIPE CONFLICTS

RDG
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LOWER CODORNICES CREEK - PHASE III
CREEK RESTORATION & SITE IMPROVEMENTS PLAN
CITY OF ALBANY / CITY OF BERKELEY / UNIVERSITY OF CALIFORNIA BERKELEY

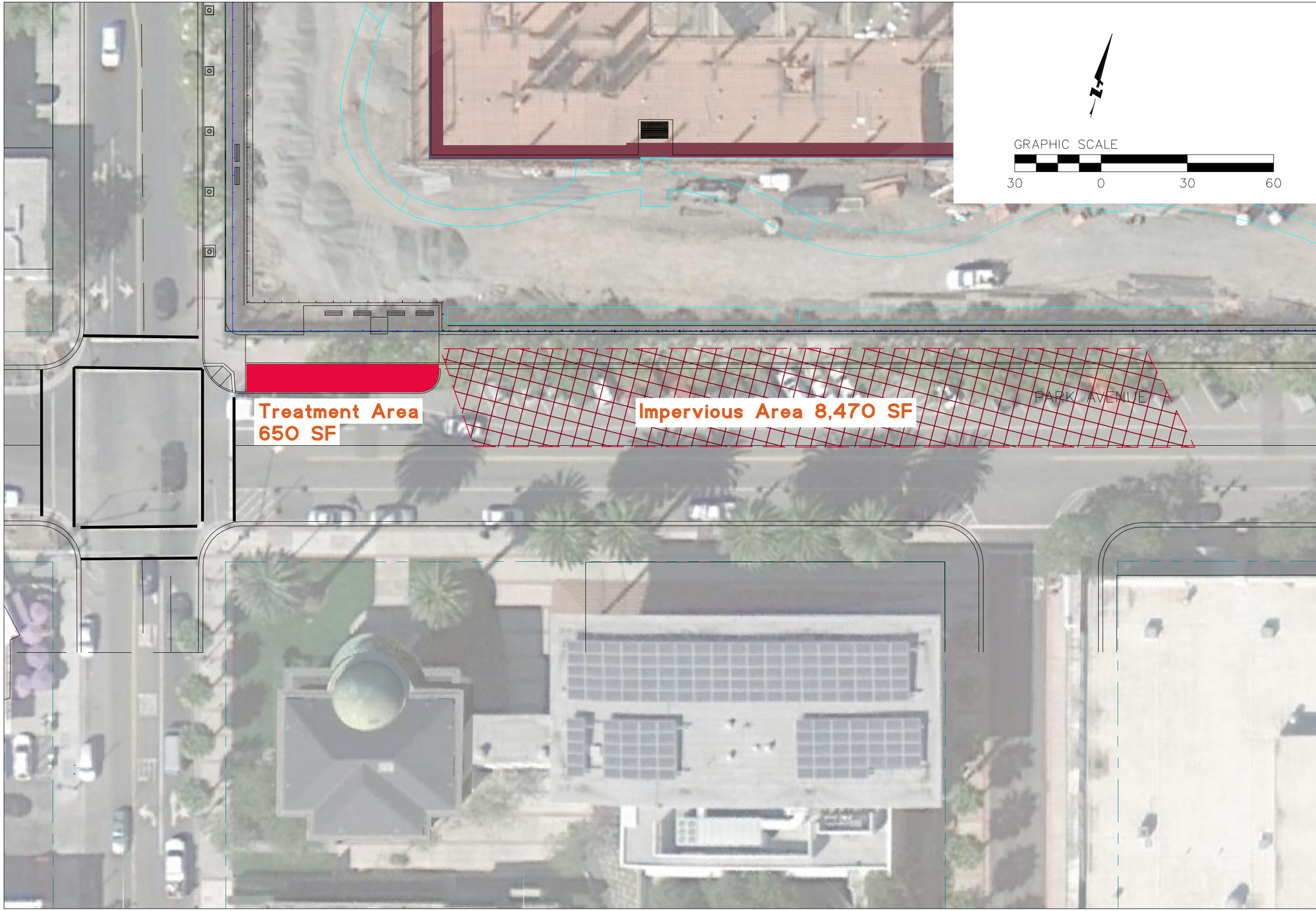
CONSTRUCTION SET
NOVEMBER 30, 2010

REVISED 6TH STREET DETAILS

SHEET
R-2

S:\PROJECTS\LOWER CODORNICES CREEK_PHASE III\7 AUTOCAD\6TH ST BIORETENTION\S-REVISED 6TH STREET PLAN - BIORETENTION.DWG
PLOTTED ON: 12/3/2010

©BKF Engineers



BKF
ENGINEERS/SURVEYORS/PLANNERS
255 SHORELINE DRIVE, STE 200
REDWOOD CITY, CA 94065
650/482-6300
650/482-6399 (FAX)

PIXAR PHASE II
STORMWATER QUALITY EXHIBIT
PARK AND HOLLIS STORMWATER CURB EXTENSION

EMERYVILLE
ALAMEDA COUNTY
CALIFORNIA

No.	Revisions

Date	09/01/11
Scale	1"=30'
Design	SOM
Drawn	SOM
Approved	
Job No	070128

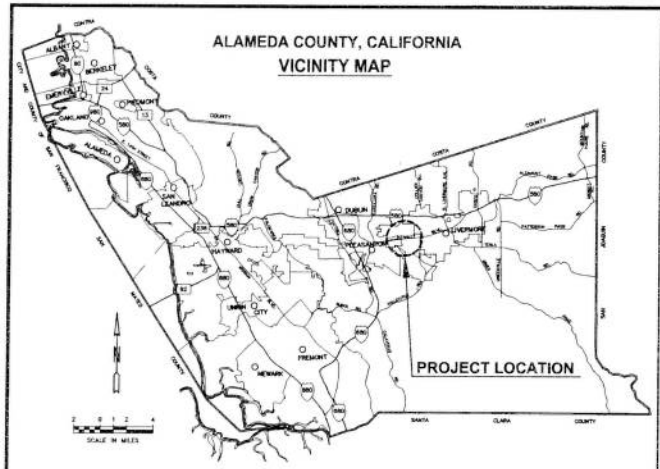
Sheet Number:

1 OF 1

DRAWING NAME: K:\Eng07\070128\DWG\SWPPP\Treatment Areas\Park and Hollis Exhibit.dwg
PLOT DATE: 09-01-11 PLOTTED BY: som

REVIEWED BY:	DATE:	REVIEWED BY:	DATE:
CONSTRUCTION		SURVEY	
MAINTENANCE		TRAFFIC	
REAL ESTATE		ENVIRONMENTAL	

ALAMEDA COUNTY, CALIFORNIA
VICINITY MAP



ALAMEDA COUNTY
PUBLIC WORKS AGENCY

MAY 2010

STANLEY BOULEVARD

SAFETY & STREETSCAPE IMPROVEMENT PROJECT BETWEEN THE CITY LIMITS OF PLEASANTON & LIVERMORE

MURRAY TOWNSHIP
ALAMEDA COUNTY, CALIFORNIA

INDEX OF SHEETS

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1.02	POLLUTION PREVENTION SHEET
1.03	NOTES AND ABBREVIATIONS
2.01 – 2.06	TYPICAL SECTIONS AND DETAILS
3.01	PLAN INDEX SHEET
4.01 – 4.12	LAYOUT PLAN
5.01 – 5.13	ROADWAY AND PATHWAY PLAN
6.01 – 6.02	WALL DETAILS
6.03 – 6.04	WALL ELEVATIONS
7.01 – 7.27	DRAINAGE AND GRADING PLANS AND DETAILS
8.01	TRAFFIC SIGNAL PLAN – SHADOW CLIFFS ENTRANCE
8.02	TRAFFIC SIGNAL EQUIPMENT SCHEDULE – SHADOW CLIFFS ENTRANCE
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11.27	IRRIGATION NOTES AND LEGEND
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12.27 – 12.30	LANDSCAPING AND AMENITIES – NOTES AND DETAILS
13.01 – 13.02	RECYCLED WATER CONNECTION AT ISABEL AVENUE
14.01 – 14.14	UTILITY PLAN
15.01 – 15.05	SECTIONS
16.01	JOINT TRENCH PLAN – GENERAL NOTES AND SECTIONS
16.02 – 16.07	JOINT TRENCH PLAN – JOINT TRENCH COMPOSITE
16.08 – 16.13	JOINT TRENCH PLAN – ELECTRICAL SCHEMATIC
16.14 – 16.19	JOINT TRENCH PLAN – TELEPHONE SCHEMATIC
16.20 – 16.25	JOINT TRENCH PLAN – CABLE TV SCHEMATIC
16.26	UNDERGROUND UTILITY RAILROAD CROSSINGS – PLAN AND PROFILE

CONVENTIONAL SYMBOLS

PROPERTY, RIGHT OF WAY AND EASEMENT LINES OTHER THAN THOSE FOR PROJECT
PROJECT RIGHT OF WAY AND EASEMENT LINES
CONSTRUCTION CENTER LINE 10 11
TRAVERSE OR SURVEY LINE AND MONUMENT
CENTER LINE
CENTER LINE OF CHANNEL, CREEK, OR DITCH
TOE OF FILL OR SLOPE
TOP OF CUT OR BANK
CONCRETE CHANNEL
ROAD
EDGE OF PAVEMENT EP
PCC EXTRUDED CURB OR AC BERM
PCC SIDEWALK, CURB GUTTER & DRIVEWAY
GUARD RAIL OR BARRICADE
FENCE (SPECIFY TYPE) X
CHAIN-LINK FENCE
RAILROAD
BUILDING
SHRUBBERY
MAIL BOX
TREE
TREE TO BE REMOVED
CHANNEL SLOPE

EXISTING UTILITIES:
WATER W
GAS G
SANITARY SEWER SS
OIL
GASOLINE GS
STORM DRAIN SD
ELECTRICAL E
ELECTRICAL UNDERGROUND EUG
TELEPHONE T
TELEPHONE UNDERGROUND TUG
FIBER OPTIC UNDERGROUND FOUG
CABLE TV CATV
CABLE TV UNDERGROUND CATVUG
TRANSMISSION LINE AND TOWER TL
DROP INLET DI
ELECTROLIER
FIRE HYDRANT
MANHOLE MH
MONUMENT EXISTING PROPOSED
UTILITY POLES:
JOINT POLE JP
POWER POLE PP
TELEPHONE POLE TP
GUY POLE GP
RIGHT OF WAY MARKER
ROADWAY SIGN
STREET NAME SIGN
WATER METER WM
WATER VALVE WV

LOCATION MAP
NO SCALE

- THE CONTRACTOR SHALL POSSESS A CLASS A LICENSE AT THE TIME THIS CONTRACT IS AWARDED.

CONSTRUCTION AREA SIGNS

TYPE	QUANTITY	DESCRIPTION	DIMENSION (in)
C20-2	2	END ROAD WORK	60 x 24
W20-1	2	ROAD WORK	48 x 48
C30 (CA)	2 (MIN.)	LANE CLOSED	36 x 36

DANIEL WOLDESENBET, Ph.D., P.E.
COUNTY ENGINEER
CIVIL ENGINEER CERTIFICATE NO. 60306
EXPIRATION JUNE 30, 2010

REGISTERED PROFESSIONAL ENGINEER DANIEL WOLDESENBET No. 60306 Exp. 6/30/2010 CIVIL STATE OF CALIFORNIA

6/2/10
PLAN APPROVAL DATE

REVISIONS

NO.	DESCRIPTION	BY	DATE	APPV'D

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

TITLE SHEET

SCALE	AS SHOWN
DATE	MAY 2010
WORK ORDER NO.	R32064
SPECIFICATION NO.	2125
SHEET NO.	1.01 OF 194
FILE NO.	U-324-12

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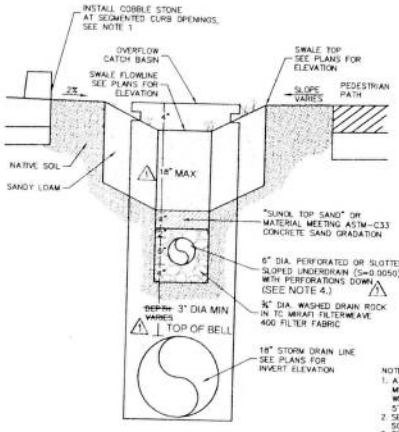
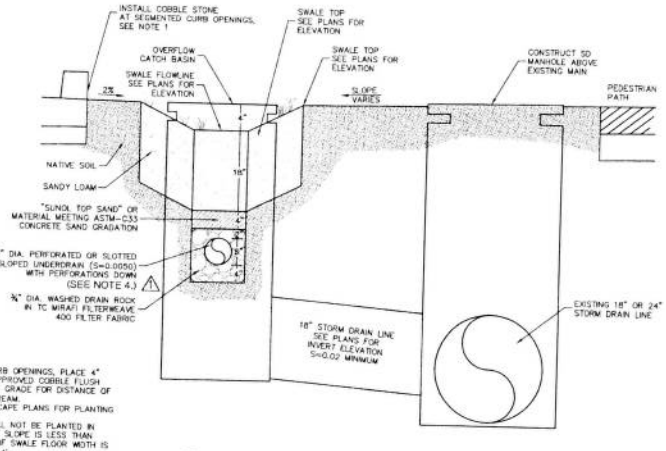
FOR REDUCED ENGLISH PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

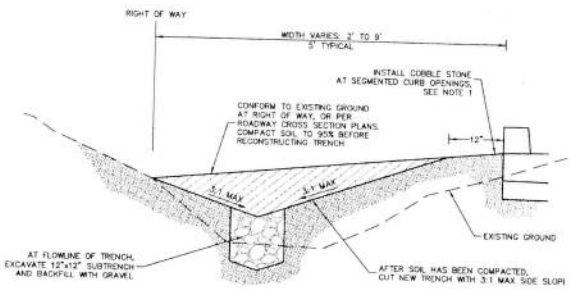


1 **BIO RETENTION SECTION**
SOUTHSIDE – ABOVE MAINLINE
NTS

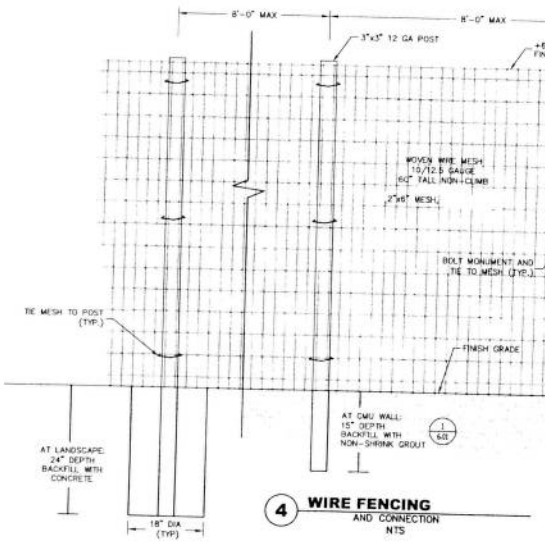
NOTES:
1. AT ALL CURB OPENINGS, PLACE 4" MIN DIA. APPROVED COBBLE FLUSH WITH FINISH GRADE FOR DISTANCE OF 5' DOWNSTREAM.
2. SEE LANDSCAPE PLANS FOR PLANTING SCHEDULE.
3. TREES SHALL NOT BE PLANTED IN FLOWLINE IF SLOPE IS LESS THAN 0.0020 OR IF SWALE FLOOR WIDTH IS LESS THAN 4'.
4. PERFORATED PIPE SHALL BE ALIGNED CENTERED WITH SWALE.



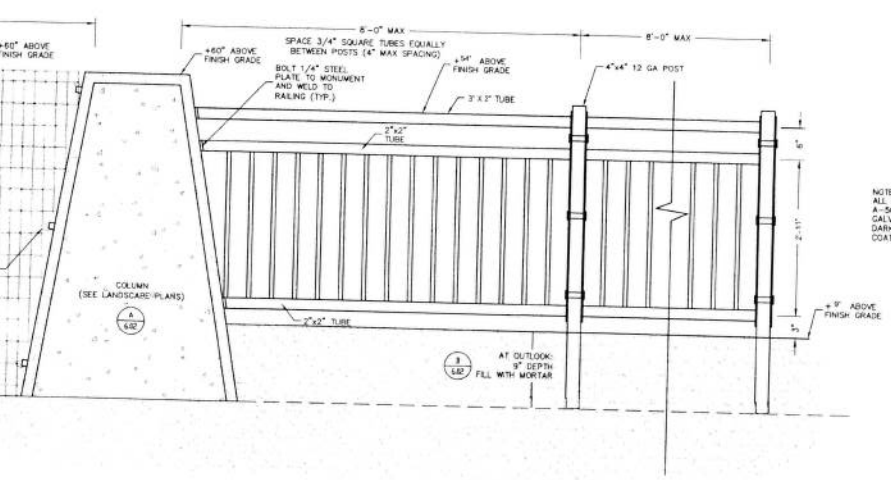
2 **BIO RETENTION SECTION**
SOUTHSIDE – OFFSET MAINLINE
NTS



3 **TRENCH SECTION**
NORTHSIDE
NTS



4 **WIRE FENCING**
AND CONNECTION
NTS



NOTE:
ALL MATERIALS TO BE ASTM A-500 GRADE-B HOT DIPPED GALVANIZED 14-GAUGE STEEL. DARK BROWN, FLAT POWDER COAT FINISH.

5 **METAL RAILING**
AND CONNECTION – AT OVERLOOK
NTS

REVISIONS			
NO.	DESCRIPTION	BY	DATE
1	REVISION TO BIO RETENTION SECTION 1	BN	8/22/11

CONSTRUCTION	REVIEWED BY:	DATE:	SURVEY	REVIEWED BY:	DATE:
MAINTENANCE			TRAFFIC		
REAL ESTATE			ENVIRONMENTAL		

BKF
2700 Willow Road, Suite 200
Pleasanton, California 94588
(925) 396-7750
Fax (925) 396-7799

DESIGNED: ANTHONY N. WEED
CHECKED: ROBERT C. STEVENS
APPROVED: JUNE 2011

COUNTY OF ALAMEDA PUBLIC WORKS AGENCY
STANLEY BOULEVARD
SAFETY & STREETSCAPE IMPROVEMENT PROJECT
BETWEEN THE CITY LIMITS OF PLEASANTON & LIVERMORE
DRAINAGE AND GRADING PLAN AND DETAILS

WORK ORDER NO. R32064
SPECIFICATION NO. 2125
SHEET NO. 7.27 OF 194
FILE NO. U-324-12

FOR REDUCED ENGLISH PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

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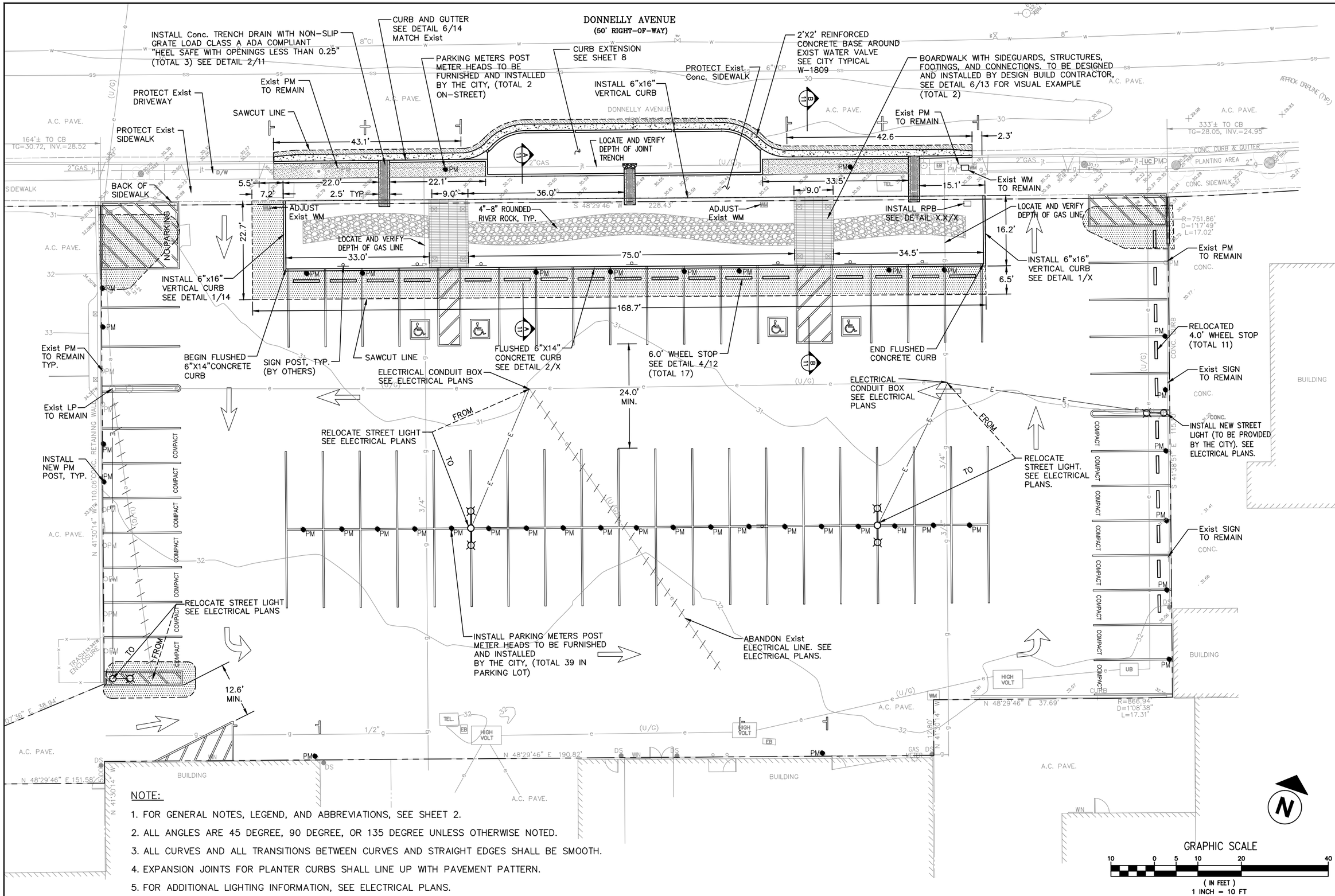


NOTE:

1. FOR GENERAL NOTES, LEGEND, AND ABBREVIATIONS, SEE SHEET 2.
2. ALL ANGLES ARE 45 DEGREE, 90 DEGREE, OR 135 DEGREE UNLESS OTHERWISE NOTED.
3. ALL CURVES AND ALL TRANSITIONS BETWEEN CURVES AND STRAIGHT EDGES SHALL BE SMOOTH.
4. EXPANSION JOINTS FOR PLANTER CURBS SHALL LINE UP WITH PAVEMENT PATTERN.
5. FOR ADDITIONAL LIGHTING INFORMATION, SEE ELECTRICAL PLANS.

CITY OF BURLINGAME
PUBLIC WORKS
501 PRIMROSE ROAD
BURLINGAME, CA 94010
650.558.7230
650.685.9310 (FAX)

DONNELLY AVENUE – PARKING LOT C
STORMWATER GARDEN

BURLINGAME SAN MATEO COUNTY CALIFORNIA

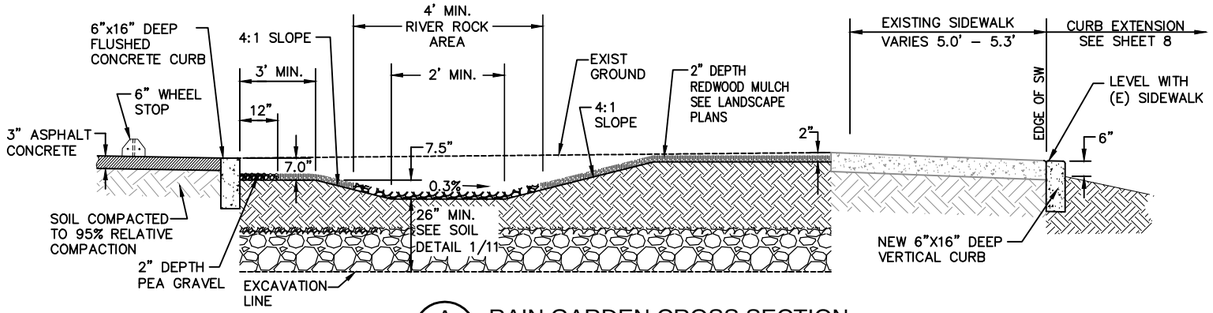
Revisions

No.	

Date:	11/17/09
Scale:	1"=10'
Design By:	
Drawn By:	LM
Checked By:	JG
Project No.:	82340

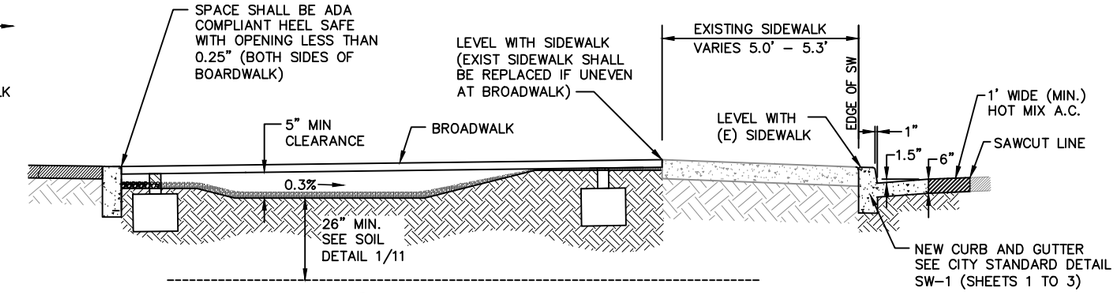
DRAWING TITLE: LAYOUT

Drawing Number: 5 OF 16



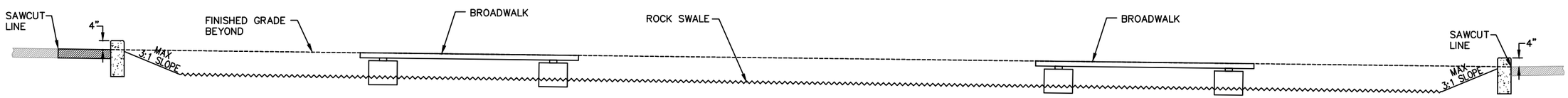
A/11 RAIN GARDEN CROSS SECTION

NOT TO SCALE



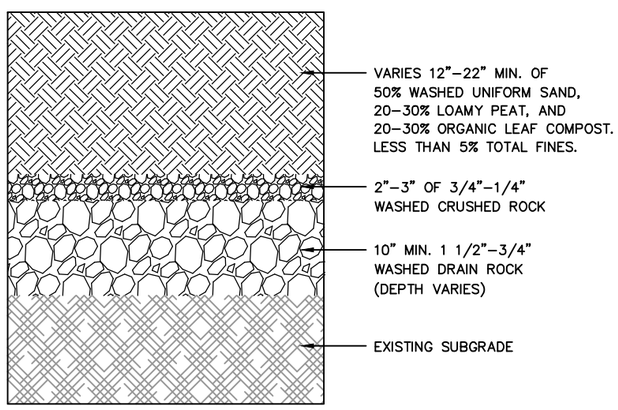
B/11 RAIN GARDEN CROSS SECTION

NOT TO SCALE



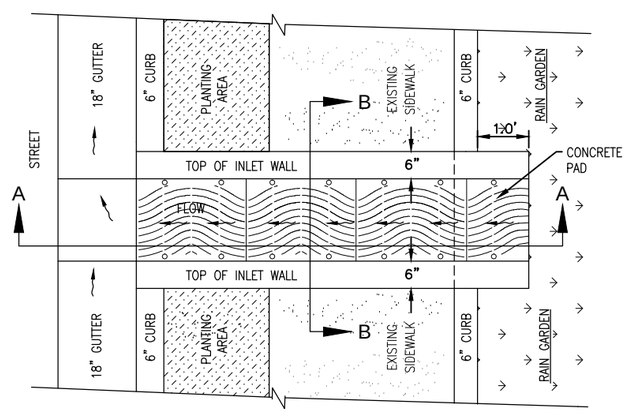
C/10 RAIN GARDEN CROSS SECTION

NOT TO SCALE

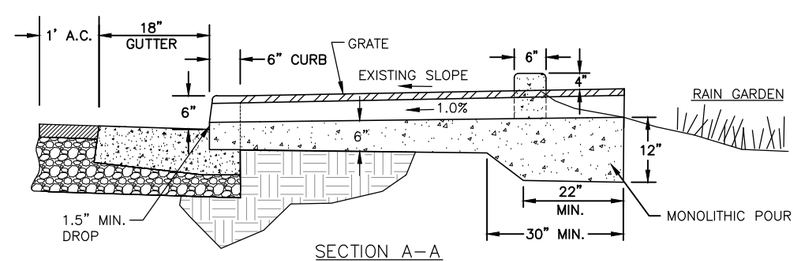


1/10 SOIL PROFILE

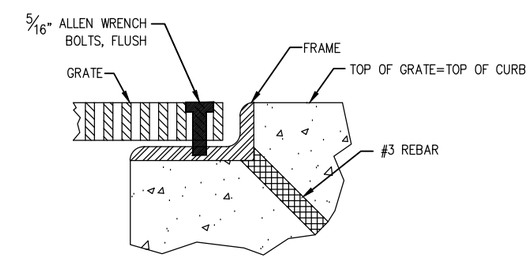
NOT TO SCALE



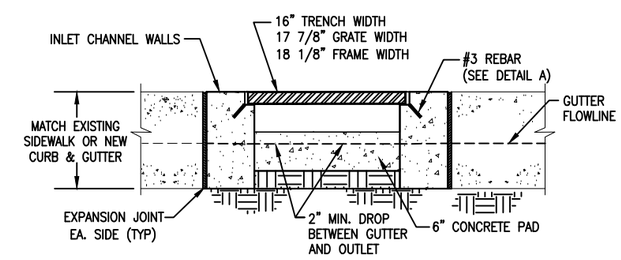
PLAN VIEW



SECTION A–A



DETAIL A



NOTE: MAXIMUM GRATE HOLE WIDTH (OPEN) 1/4 INCH. GRATE SIZE 18"X24". CAST IRON URBAN ACCESSORIES TRENCH GRATE AND FRAME. TITLE WAVE MODEL OR APPROVED EQUAL.

SECTION B–B

2/10 CONCRETE OUTLET

NOT TO SCALE

CITY OF BURLINGAME
PUBLIC WORKS
501 PRIMROSE ROAD
BURLINGAME, CA 94010
650.558.7230
650.685.9310 (FAX)

DONNELLY AVENUE – PARKING LOT C
STORMWATER GARDEN
BURLINGAME SAN MATEO COUNTY CALIFORNIA

Revisions

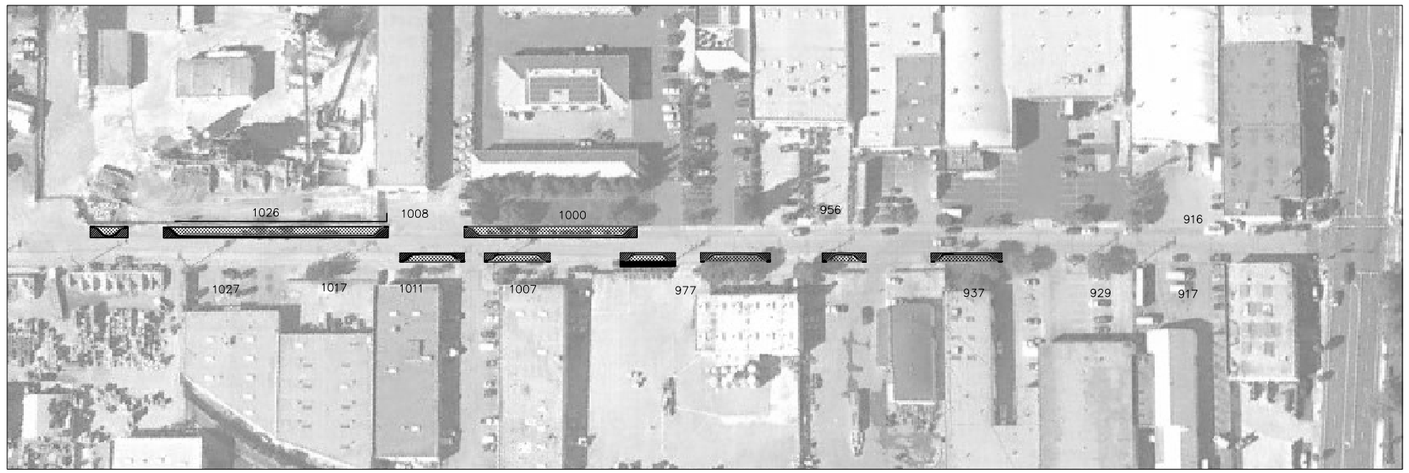
No.	

Date:	11/19/09
Scale:	AS SHOWNS
Design By:	
Drawn By:	
Checked By:	
Project No.:	82340

DRAWING TITLE: DETAILS

Drawing Number: 11 OF 16

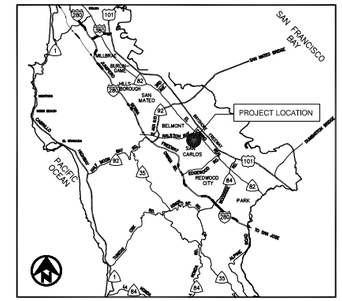
BRANSTEN ROAD
CURB EXTENSION AND STORWATER TREATMENT
SAN CARLOS, CA



LIMITS OF WORK

LOCATION MAP

NOT TO SCALE



VICINITY MAP

NOT TO SCALE

INDEX OF DRAWINGS

SHEET NO.	SHEET ID	PLAN & TITLE
1	T	TITLE SHEET, LOCATION MAP AND GENERAL NOTES
2	X	TYPICAL SECTIONS
3 - 6	L	LAYOUT PLAN
7 - 10	D	DRAINAGE PLAN
11 - 19	C	CONSTRUCTION DETAILS
20 - 22	I	IRRIGATION PLAN, NOTES AND DETAILS
23 - 25	P	IPLANTING PLAN, NOTES AND DETAILS

GENERAL NOTES:

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CITY OF SAN CARLOS STANDARD SPECIFICATIONS 2008 EDITION.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE INTENT OF THESE PLANS AND SHALL REPORT ANY DISCREPANCIES FOUND IN THEM TO THE ENGINEER PRIOR TO CONSTRUCTION.
3. IT IS CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES WITH THE APPROPRIATE UTILITY AGENCIES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. CONTRACTOR SHALL NOTIFY ALL PUBLIC AND PRIVATE UTILITY OWNERS 48 HOURS PRIOR TO COMMENCEMENT OF WORK ADJACENT TO THE UTILITY. CONTACT SERVICE ALERT (USA) AT 800-642-2444.

SURVEY CONTROL:

BENCHMARK IS THE CENTER OF THE FIRE HYDRANT AT THE SOUTHEAST CORNER OF BRANSTEN ROAD AND INDUSTRIAL ROAD STATION 19.703' RT "BRN" LINE 14+42.00 LATITUDE 37°30'26.53" LONGTITUDE -122°15'06.75" TOP OF HYDRANT ELEVATION + 9.82; CITY OF SAN CARLOS DATUM.

ADDITIONAL REFERENCE POINT:

EXISTING DRAINAGE INLET AT 18.033' LT "BRN" LINE 7+27.74, GRATE ELEVATION +7.68.

LINE 14+42.00 LATITUDE 37°30'26.53" LONGTITUDE -122°15'06.75" TOP OF HYDRANT ELEVATION + 9.82; CITY OF SAN CARLOS DATUM.

JAY WALTER, P.E.
PUBLIC WORKS DIRECTOR/CITY ENGINEER
PUBLIC WORKS DEPARTMENT

AUTHORIZED FOR CONSTRUCTION: _____

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE
1	08/22/12	AC/AO	65%
2	10/19/12	AC/AO	95%
3	03/04/13	AC/AO	100%

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

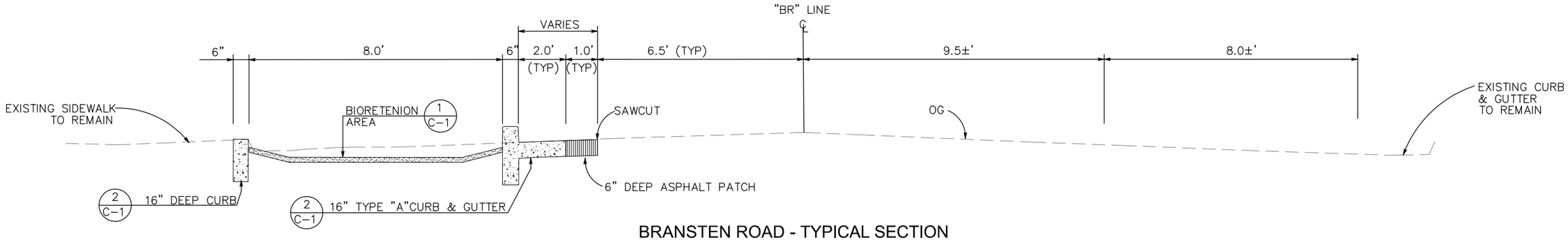
CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/04/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA
TITLE SHEET, LOCATION MAP, AND GENERAL NOTES

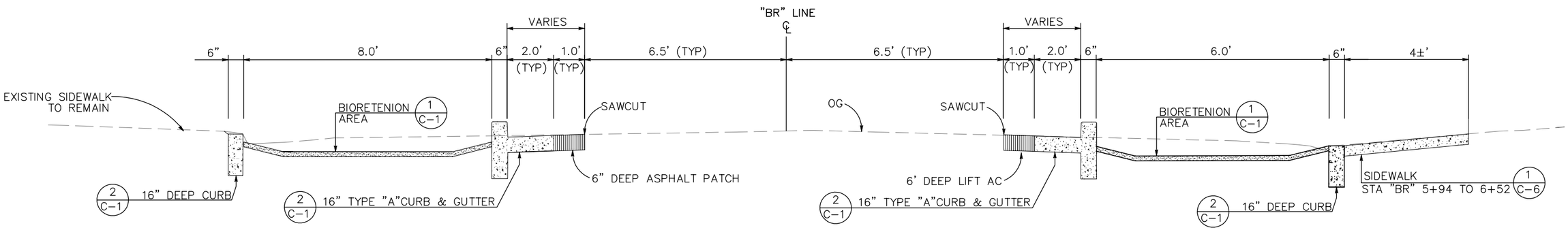
T-1

SHEET NO. 1 OF 25



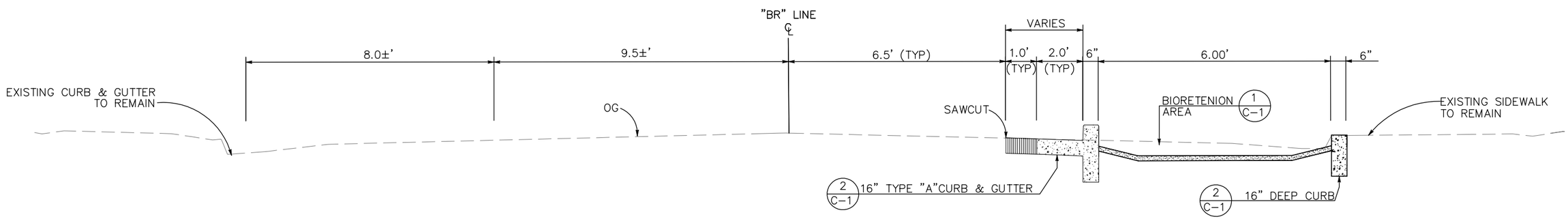
BRANSTEN ROAD - TYPICAL SECTION

STA "BR" 0+40 TO 3+60



BRANSTEN ROAD - TYPICAL SECTION

STA "BR" 3+60 TO 6+55



BRANSTEN ROAD - TYPICAL SECTION

STA "BR" 6+55 TO 10+00

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE
1	08/22/12	AC/AO	65%
2	10/19/12	AC/AO	95%
3	03/04/13	AC/AO	100%

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
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DRAWN BY VP

REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/04/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

TYPICAL SECTIONS

X-1

SHEET NO. 2 OF 25

PROJECT TITLE

NOTES:

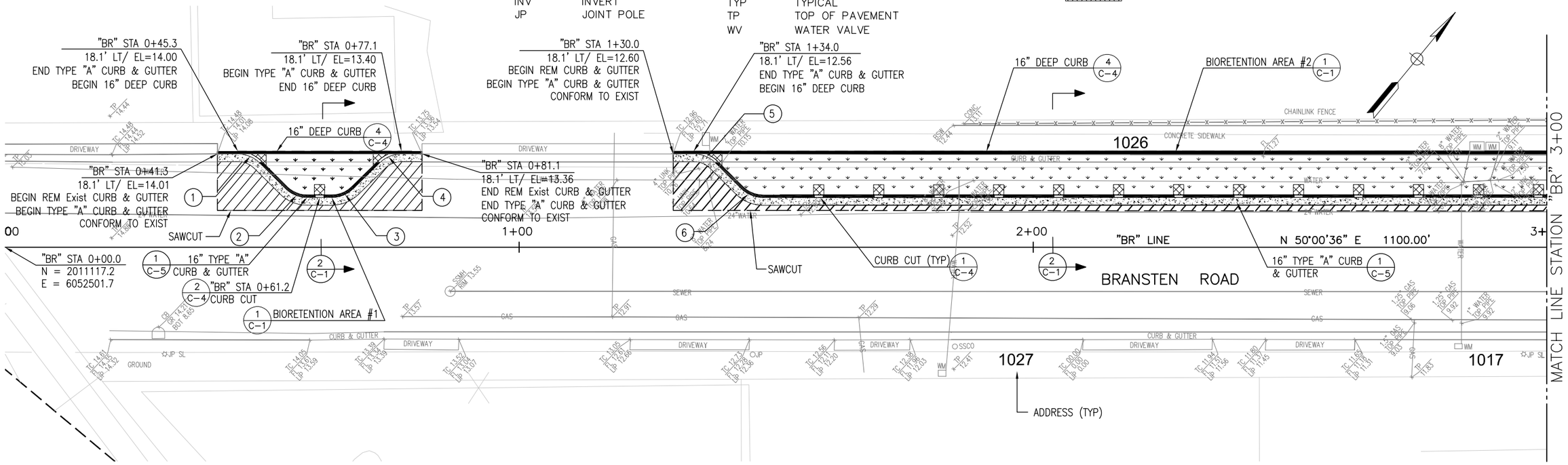
1. ELEVATIONS ON THE PLANS ARE FLOWLINES AT THE FACE OF CURBS.
2. CONTRACTOR TO COORDINATE WITH CITY ENGINEER FOR ALLOWABLE STAGING LOCATIONS.
3. CONSTRUCT ONE SIDE OF BRANSTEN ROAD AT A TIME TO ALLOW FOR ONE-WAY TRAFFIC CONTROL.
4. CONTRACTOR TO ALLOW DRIVEWAY ACCESS AT ALL TIMES DURING CONSTRUCTION.
5. CURVE DATA IS MEASURED FROM OUTSIDE FACE OF CURB.

ABBREVIATIONS:

AB	AGGREGATE BASE	LF	LINEAR FEET
AC	ASPHALT CONCRETE	MAX	MAXIMUM
BC	BEGIN CURVE	MIN	MINIMUM
BFP	BACKFLOW PREVENTION	MOD	MODIFIED
BOT	BOTTOM	OG	ORIGINAL GRADE
BSW	BACK OF SIDEWALK	PCC	PORTLAND CEMENT CONCRETE
CL	CLASS	REM	REMOVE
CONC	CONCRETE	SW	SIDEWALK
EC	END CURVE	SD	STORM DRAIN
ELEV	ELEVATION	SL	STREET LIGHT
FG	FINISHED GRADE	STA	STATION
FL	FLOWLINE ELEVATION	STD	CITY OF SAN CARLOS STANDARD
GR	GRATE	TC	TOP OF CURB
INV	INVERT	TYP	TYPICAL
JP	JOINT POLE	TP	TOP OF PAVEMENT
		WV	WATER VALVE

LEGEND:

- SAWCUT LINE
- TYPE "A" CURB OR 16" DEEP CURB
- CURB CUT
- TYPE "A" CURB GUTTER
- NEW ROADWAY PAVEMENT 6" AC (TYPE B), 12" CL 2 AB
- CONCRETE FOREBAY
- BIORETENTION AREA
- SIDEWALK



PLAN

SCALE: 1" = 10'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
1	0+45.3	0+49.6	6.0'	45°00'00"	4.7'	2.5'
2	0+54.5	0+58.8	6.0'	45°00'00"	4.7'	2.5'
3	0+63.6	0+67.7	6.0'	45°00'00"	4.7'	2.5'
4	0+72.9	0+77.1	6.0'	45°00'00"	4.7'	2.5'
5	1+34.0	1+38.2	6.0'	45°00'00"	4.7'	2.5'
6	1+43.2	1+47.4	6.0'	45°00'00"	4.7'	2.5'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

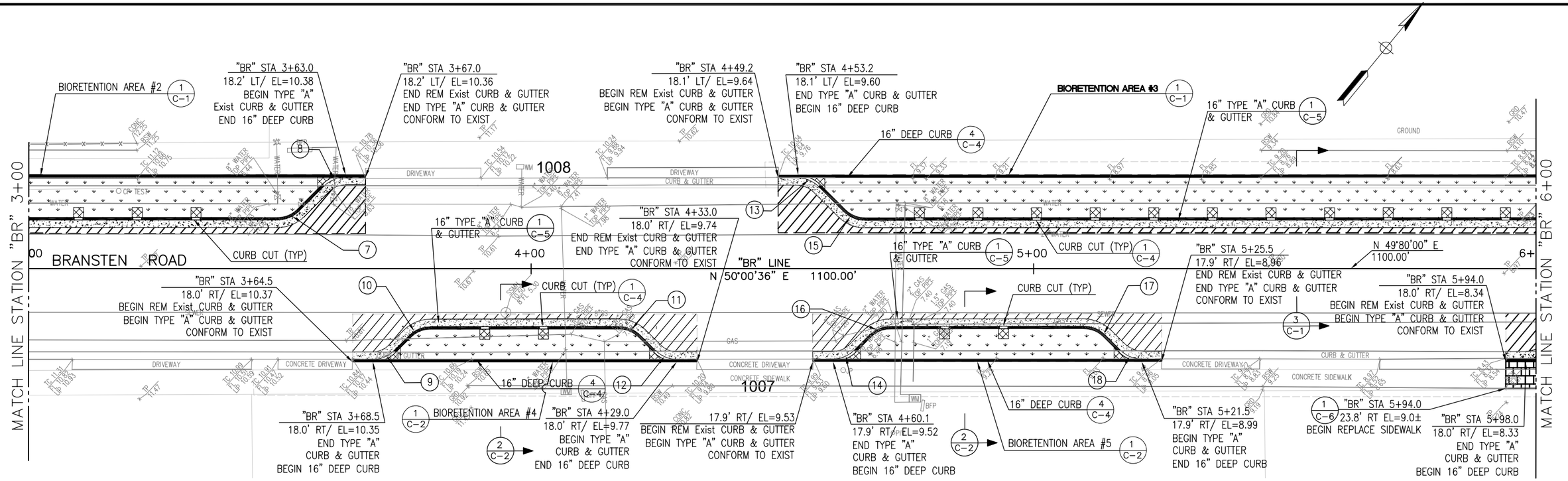
REGISTERED PROFESSIONAL ENGINEER ANNALETTE A. OCHOA No. 55279 Exp. 12/31/14 CIVIL STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-1

SHEET NO. 3 OF 25



CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
7	3+49.5	3+53.8	6.0'	45°00'00"	4.7'	2.5'
8	3+58.8	3+63.0	6.0'	45°00'00"	4.7'	2.5'
9	3+68.5	3+72.7	6.0'	45°00'00"	4.7'	2.5'
10	3+75.7	3+79.9	6.0'	45°00'00"	4.7'	2.5'
11	4+13.4	4+21.4	6.0'	45°00'00"	4.7'	2.5'
12	4+24.8	4+29.0	6.0'	45°00'00"	4.7'	2.5'
13	4+53.2	4+57.2	6.0'	45°00'00"	4.7'	2.5'
14	4+60.1	4+64.3	6.0'	45°00'00"	4.7'	2.5'
15	4+62.2	4+66.4	6.0'	45°00'00"	4.7'	2.5'
16	4+67.2	4+71.5	6.0'	45°00'00"	4.7'	2.5'
17	5+10.0	5+14.3	6.0'	45°00'00"	4.7'	2.5'
18	5+17.3	5+21.5	6.0'	45°00'00"	4.7'	2.5'

PLAN

SCALE: 1" = 10'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

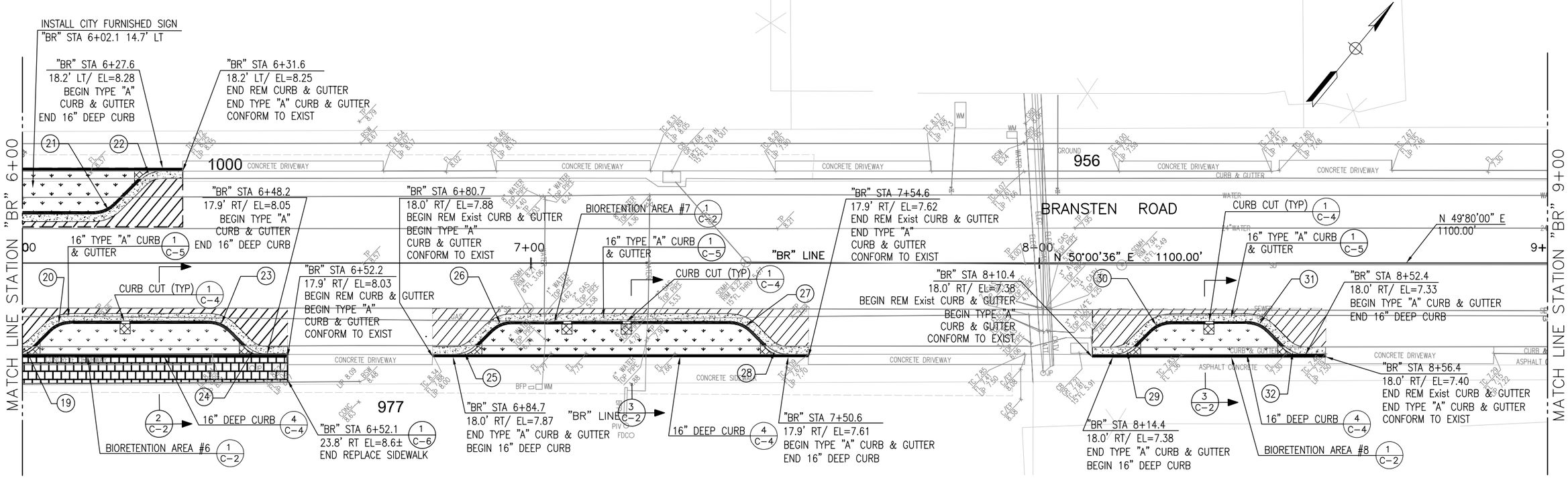
REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-2

SHEET NO. 4 OF 25



PLAN

SCALE: 1" = 10'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
19	5+98.0	6+02.2	6.0'	45°00'00"	4.7'	2.5'
20	6+05.2	6+09.5	6.0'	45°00'00"	4.7'	2.5'
21	6+14.1	6+18.3	6.0'	45°00'00"	4.7'	2.5'
22	6+23.3	6+27.5	6.0'	45°00'00"	4.7'	2.5'
23	6+36.1	6+40.9	6.0'	45°00'00"	4.7'	2.5'
24	6+43.9	6+48.1	6.0'	45°00'00"	4.7'	2.5'
25	6+84.9	6+89.1	6.0'	45°00'00"	4.7'	2.5'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
26	6+92.1	6+96.3	6.0'	45°00'00"	4.7'	2.5'
27	7+39.1	7+43.4	6.0'	45°00'00"	4.7'	2.5'
28	7+46.4	7+50.6	6.0'	45°00'00"	4.7'	2.5'
29	8+14.5	8+18.7	6.0'	45°00'00"	4.7'	2.5'
30	8+21.7	8+25.9	6.0'	45°00'00"	4.7'	2.5'
31	8+40.9	8+45.1	6.0'	45°00'00"	4.7'	2.5'
32	8+48.1	8+2.4	6.0'	45°00'00"	4.7'	2.5'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

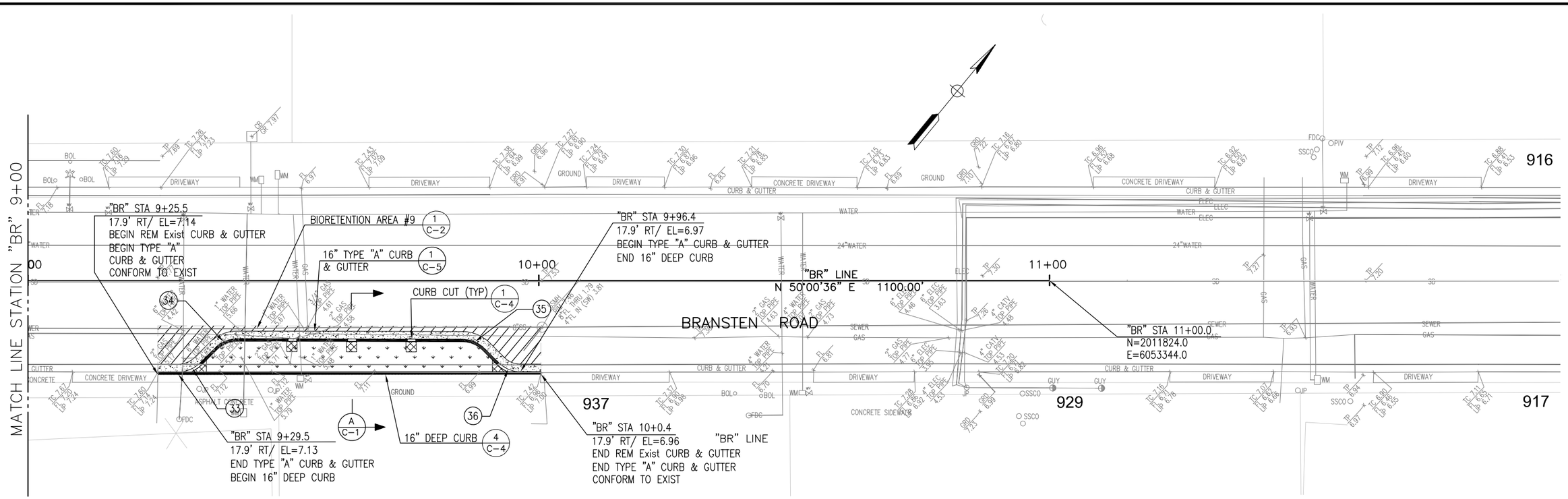
REGISTERED PROFESSIONAL ENGINEER
ANALETTE A OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-3

SHEET NO. 5 OF 25



PLAN

SCALE: 1" = 10'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
33	9+29.5	9+33.7	6.0'	45°00'00"	4.7'	2.5'
34	9+36.7	9+40.9	6.0'	45°00'00"	4.7'	2.5'
35	9+84.9	9+89.2	6.0'	45°00'00"	4.7'	2.5'
36	9+92.2	9+96.4	6.0'	45°00'00"	4.7'	2.5'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

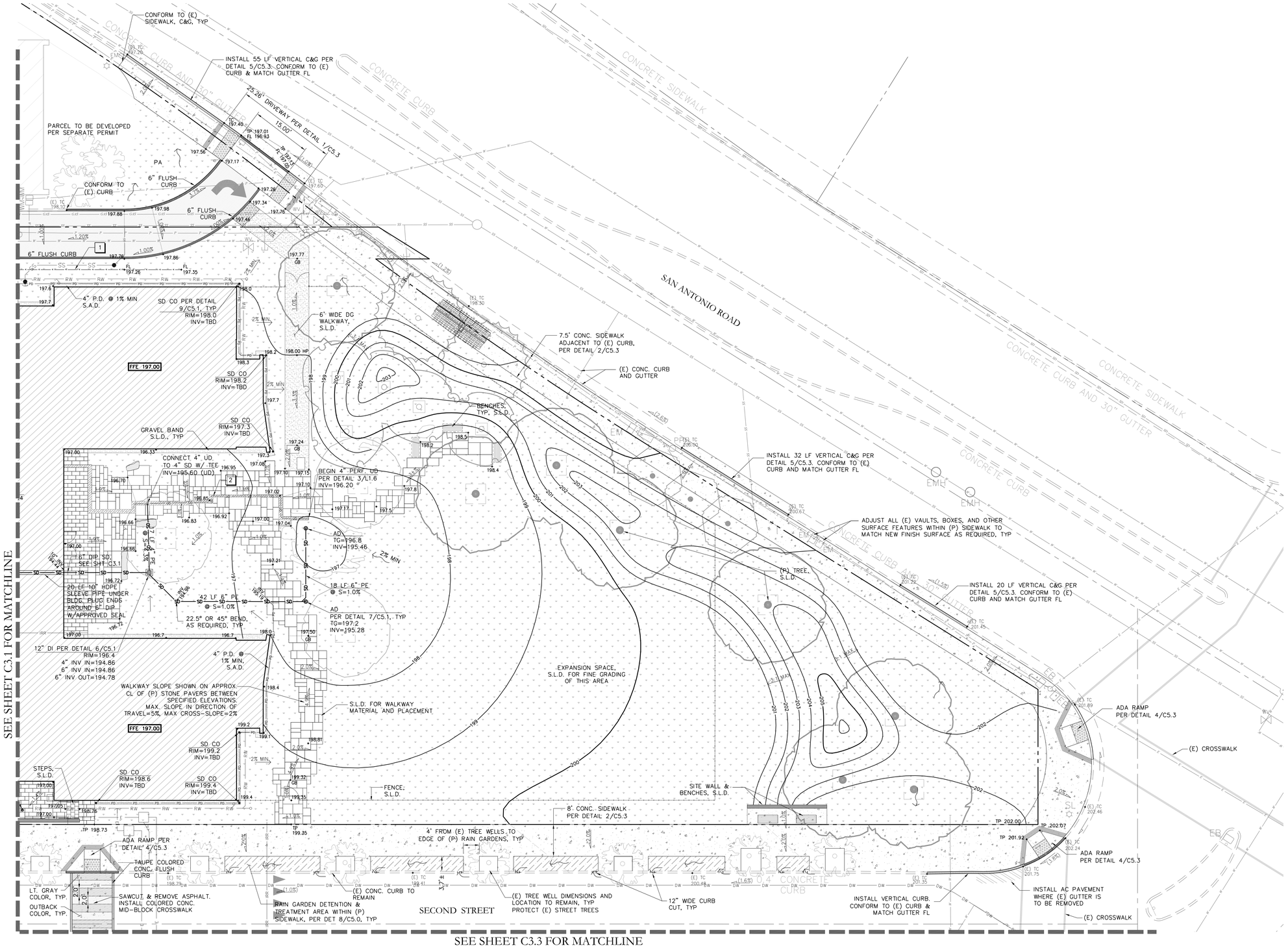
REGISTERED PROFESSIONAL ENGINEER ANALETTE A. OCHOA No. 55279 Exp. 12/31/14 CIVIL STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-4

SHEET NO. 6 OF 25



PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

LEGEND

	EXISTING	PROPOSED
EASEMENT		
LIMITS OF WORK		
MAJOR CONTOUR	100	890
MINOR CONTOUR		
PROPERTY LINE		
TOP OF PAVEMENT ELEVATION	(E) EP 198.95	EP 196.78
TOP OF CURB ELEVATION	(E) TC 198.95	TC 196.78
FLOWLINE ELEVATION	(E) FL 198.95	FL 196.78
GRADE BREAK		
ROAD CENTERLINE		
STORM DRAIN	SD	SD
AREA DRAIN		
CLEANOUT		
DROP INLET		
FINISH FLOOR ELEVATION		FFE197.00
FLOW DIRECTION		
SLOPE DIRECTION SOFTSCAPE	2.0%	2.0%
SLOPE DIRECTION HARDSCAPE	2.0%	2.0%
SPOT GRADE ELEVATION		71.3
STORM DRAIN MANHOLE		
TRENCH DRAIN		
PERFORATED UNDER DRAIN		UD
VEGETATED SWALE		
CONCRETE VALLEY GUTTER		
FOUNDATION PERIMETER DRAIN		PD
UTILITY SLEEVE		

SURFACING LEGEND

- BUILDING FOOTPRINT (1ST FLOOR)
- ASPHALT PAVEMENT (PER DETAIL 3/C5.0)
- ASPHALT OVERLAY (PER SPECS)
- CONCRETE PAVING (PER DETAIL 4/C5.0)
- CONCRETE PAVERS (PER DETAIL 1/C5.0)
- PLANTED AREAS (S.L.D.)
- RAIN GARDEN (PER DETAIL 8/C5.0)
- DETECTABLE WARNING SURFACE (SEE NOTE 3 THIS SHEET)
- VERTICAL CURB (PER DETAIL 2/C5.0)
- FLUSH CURB (PER DETAIL 5/C5.0)

DRAINAGE KEYNOTES

1. 230 LF (TOTAL) VEGETATED SWALE, S=1.0% MIN PER DET 9/C5.0, SWALE #1
2. STONE DRAIN OVER INFILTRATION TRENCH. SLOPE 4" PERF UD @ 1% MIN. S.L.D. SHT L1.6 FOR TRENCH WIDTH AND ALIGNMENT.

NOTES:

1. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
2. SEE LANDSCAPE DRAWINGS FOR SURFACING MATERIALS AND SOIL PREPARATION WITHIN ALL PLANTED AREAS, THE COURTYARD, BUILDING ENTRIES, AND PATIOS.
3. PER CITY REQUIREMENTS, DETECTABLE WARNING SURFACES SHALL BE INSTALLED AT NEW CONCRETE CURB RAMPS AND SHALL BE CAST-IN-PLACE IRON WITH BAKED-ON OIL FINISH, 18"X24", MANUFACTURED BY EAST JORDAN IRON WORKS AS INDICATED IN THE CONTRACT PLANS, DETAILS AND THE TECHNICAL PROVISIONS.

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Consultant:
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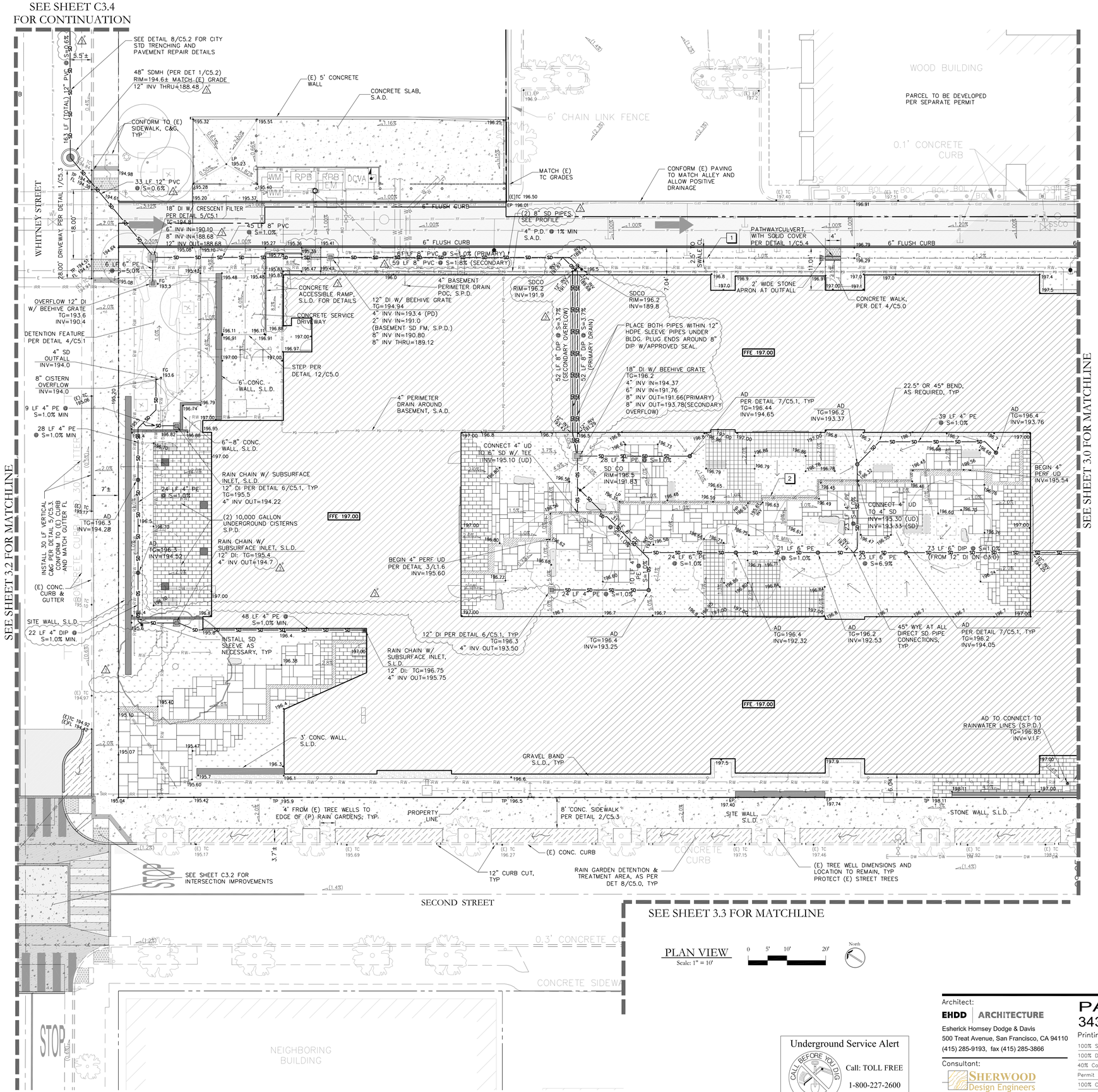
Sheet Title:
GRADING & DRAINAGE PLAN
EXPANSION AREA

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.:
C3.0



DRAINAGE KEYNOTES

1. 230 LF (TOTAL) VEGETATED SWALE, S=1.0% MIN PER DET 9/C5.0, SWALE #1
2. SIDEWALK UNDERDRAIN (3"x12.5" RECTANGULAR CAST IRON PIPE) PER DETAIL 1/C5.1. CONNECT 12" DI TO UNDERDRAIN W/ 5 LF 6" DUCTILE IRON PIPE AND PIPE ADAPTOR.

NOTES:

1. SEE SHEET C3.0 FOR LEGEND.
2. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
3. SEE LANDSCAPE DRAWINGS FOR SURFACING MATERIALS AND SOIL PREPARATION WITHIN ALL PLANTED AREAS, THE COURTYARD, BUILDING ENTRIES, AND PATIOS.
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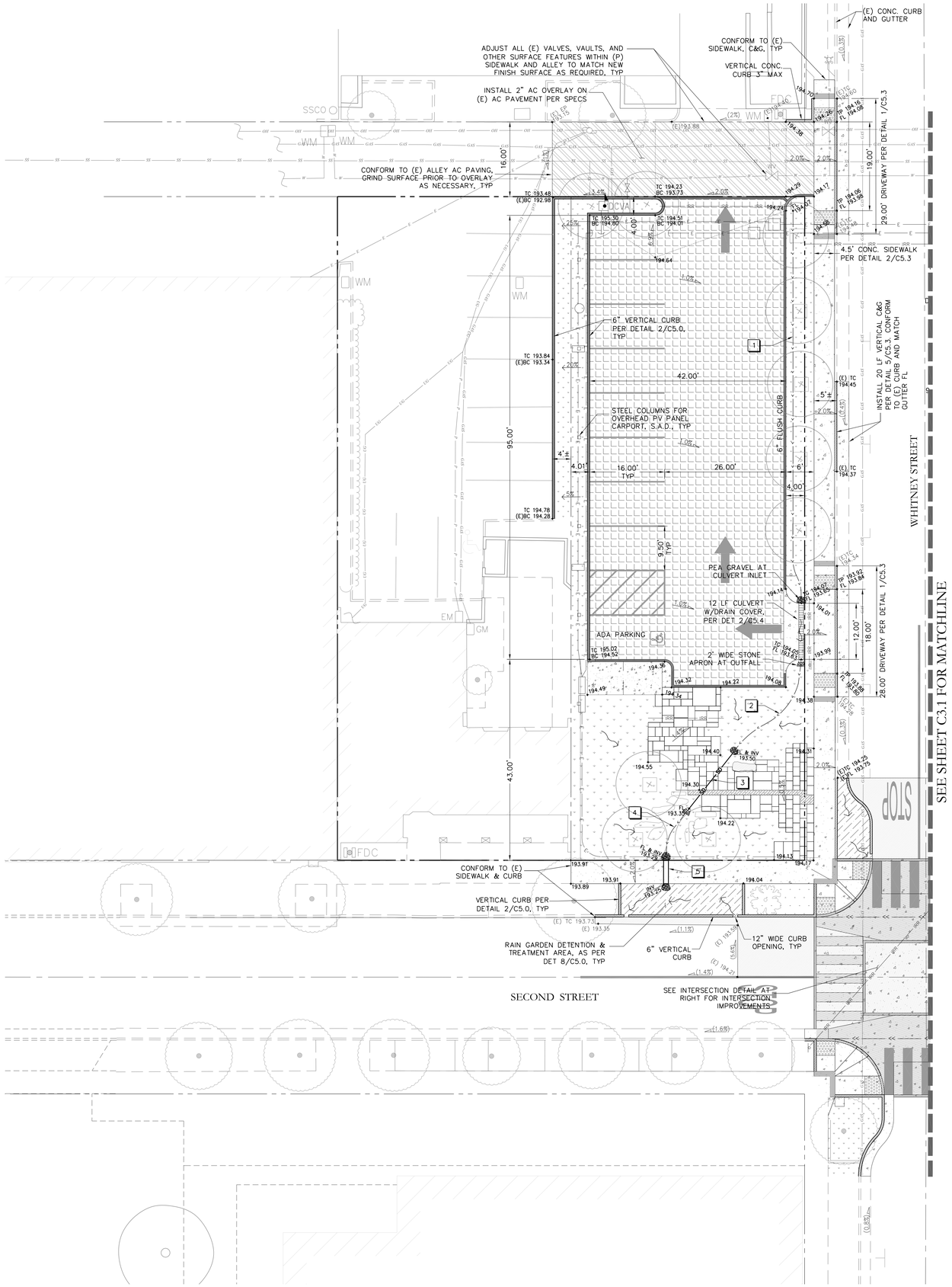
Sheet Title:
GRADING & DRAINAGE PLAN
BUILDING SITE

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.:
C3.1



PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

DRAINAGE KEYNOTES

1. 85 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #2
2. 26 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #2
3. 15 LF 4" PE SD, S=1.0% W/ PEA GRAVEL AT INLET AND 2' STONE APRON AT OUTFALL
4. 12 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #2
5. SIDEWALK UNDERDRAIN (3"x12.5" RECTANGULAR CAST IRON PIPE) @ S=0.5%, PER DETAIL 1/C5.1. W/ PEA GRAVEL AT INLET AND OUTLET

NOTES:

1. SEE SHEET C3.0 FOR LEGEND.
2. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
3. SEE LANDSCAPE DRAWINGS FOR SURFACING MATERIALS AND SOIL PREPARATION WITHIN ALL PLANTED AREAS, THE COURTYARD, BUILDING ENTRIES, AND PATIOS.
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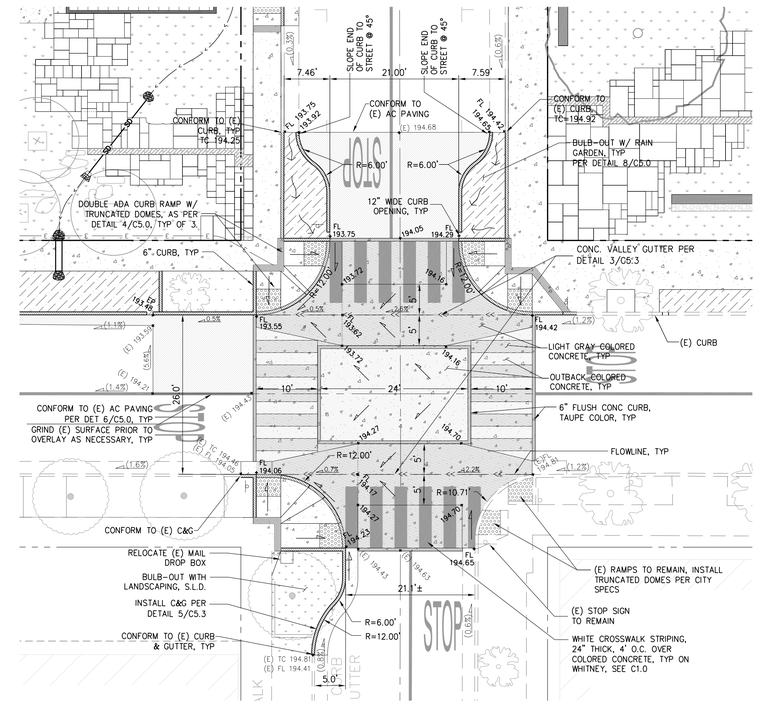

PLAN VIEW - INTERSECTION
Scale: 1" = 10'

NOTE: DESIGN APPROVAL OF INTERSECTION DESIGN DEFERRED AND SUBJECT TO A FINAL APPROVAL BY THE CITY OF LOS ALTOS.

INTERSECTION NOTES:

1. CENTER OF INTERSECTION TO BE PAVED WITH CONC. PAVERS PER SPECS.
2. VALLEY GUTTER AND CROSSWALKS SHALL BE COLORED PER CONCRETE SPECS.
3. SEE SHEET C1.0 FOR STRIPING & SIGNAGE INFORMATION.
4. SEE LANDSCAPE DRAWINGS FOR SOIL PREPARATION AND PLANTING WITHIN BULB-OUT RAIN GARDENS.

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Sheet Title:
GRADING & DRAINAGE PLAN
VISITOR PARKING

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.: C3.2

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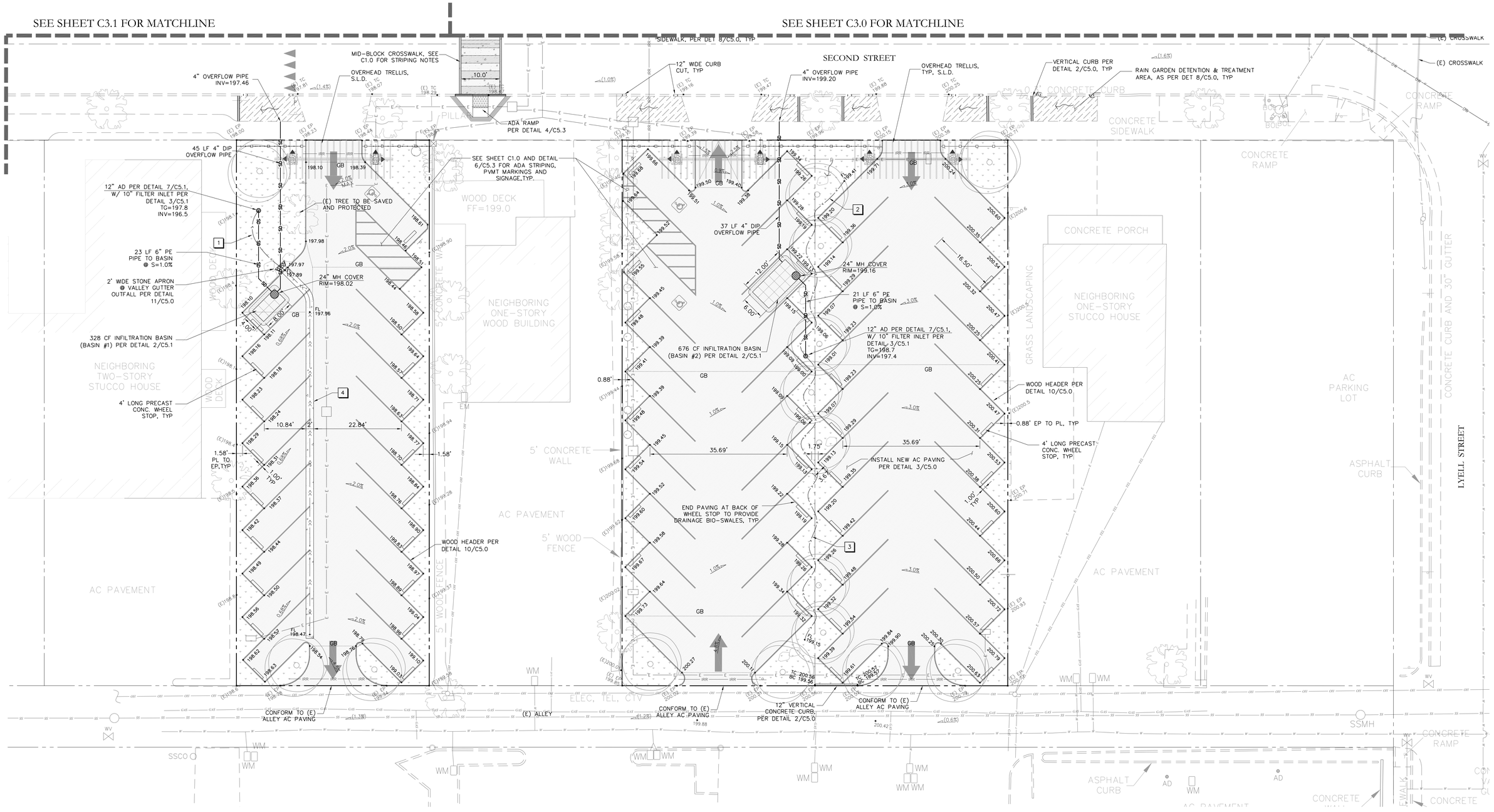

PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

DRAINAGE KEYNOTES

1. 20 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #3
2. 52 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #4
3. 83 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #4
4. CONCRETE VALLEY GUTTER, S=0.6% MIN. PER DETAIL 7/C5.0

NOTES:

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2. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
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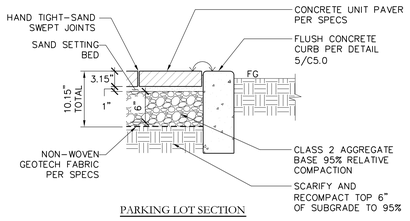
Sheet Title:
GRADING & DRAINAGE PLAN
SECOND ST. PARKING

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.:
C3.3

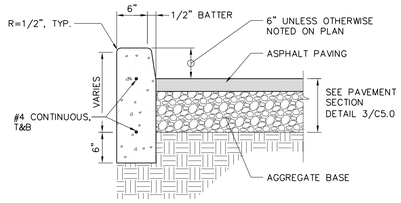
p:\2007\07-821_Packard_Second_St\04 Design\Sheetfiles_1Phase1\01_CD & Permit Set\Final CD's\C3.0 Grading & Drainage Plan.dwg, C3.3,Herve Wilson,12/7/2010 11:7:46 PM,Precision paper size: 19.00 x 42.00 inches,1:1



PARKING LOT SECTION

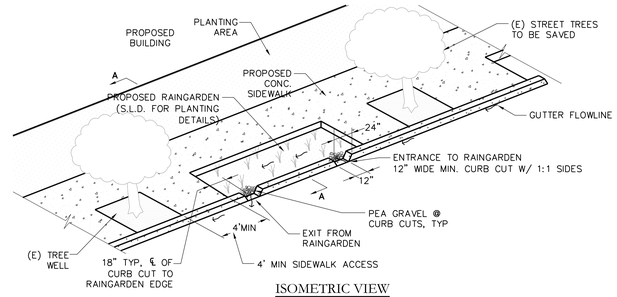
1 / C5.0 CONCRETE PAVER SECTION

SCALE: NTS

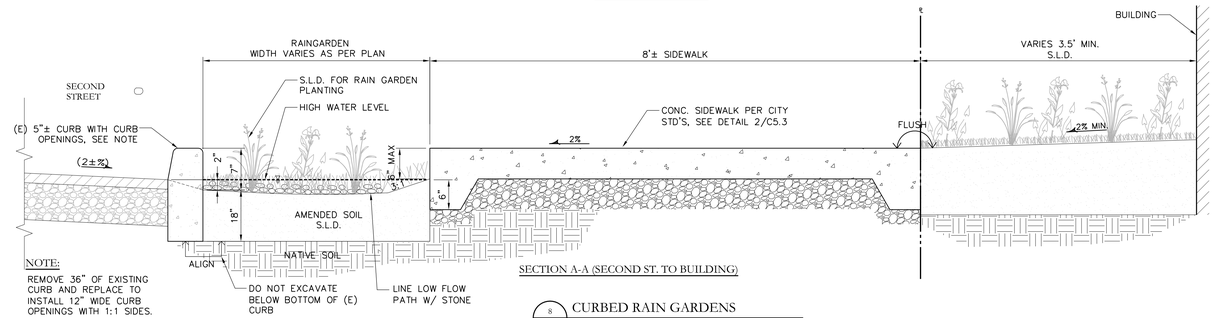


2 / C5.0 VERTICAL CONCRETE CURB

SCALE: NTS



ISOMETRIC VIEW



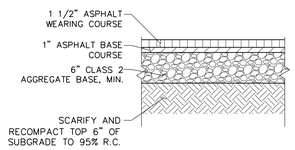
NOTE:

REMOVE 36" OF EXISTING CURB AND REPLACE TO INSTALL 12" WIDE CURB OPENINGS WITH 1:1 SIDES.

SECTION A-A (SECOND ST. TO BUILDING)

8 / C5.0 CURBED RAIN GARDENS

SCALE: NTS



NOTE:

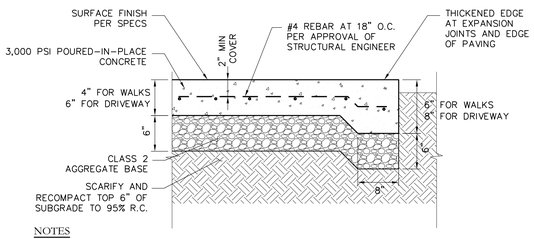
3" AC ON 9" AB FOR THE ALLEY EAST OF THE BUILDING AND PUBLIC STREET REPAIR.

ADD ALT NO. 1:

INSTALL 1/16" TO 1/8" THICK POLYMER COMPOSITE MICRO-OVERLAY IN LIGHT GRAY COLOR OVER ASPHALT COURSE WITHIN ALL SECOND STREET PARKING LOTS AND ALLEY EAST OF BUILDING. REFER TO SPECS FOR MORE INFORMATION.

3 / C5.0 ASPHALT SECTION

SCALE: NTS

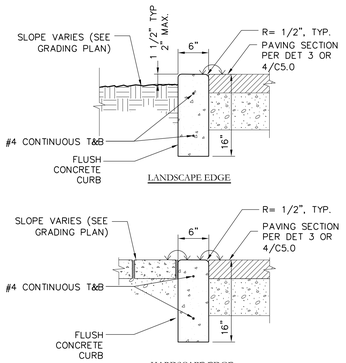


NOTES

1. WHERE (E) SUBGRADE IS DETERMINED TO BE UNSUITABLE BY GEOTECHNICAL ENGINEER, INSTALL GEOTECH FABRIC BEFORE PLACING AB.
2. REFER TO THE SPECS FOR JOINTING AND INSTALLATION INFORMATION.

4 / C5.0 CONCRETE SECTION

SCALE: NTS

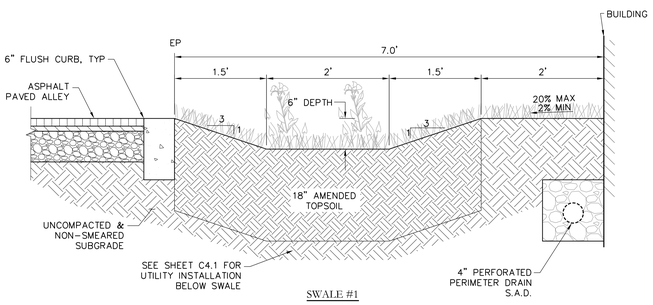


NOTES:

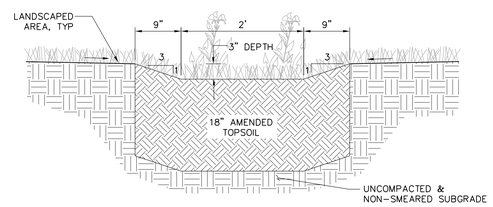
1. INSTALL CONTROL JOINT EVERY 15 FT, MIN.
2. INSTALL EXPANSION JOINT EVERY 45 FT, MIN.

5 / C5.0 FLUSH CONCRETE CURB

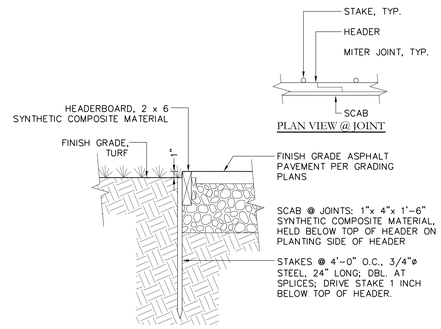
SCALE: NTS



SWALE #1



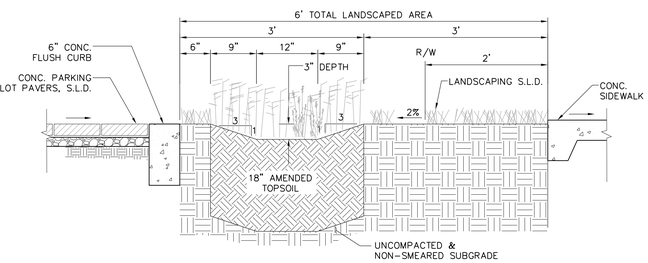
SWALE #3



SECTION

10 / C5.0 HEADER BOARD

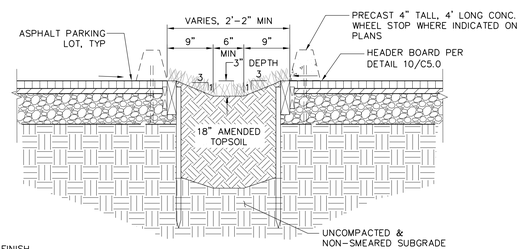
SCALE: NTS



SWALE #2

NOTE:

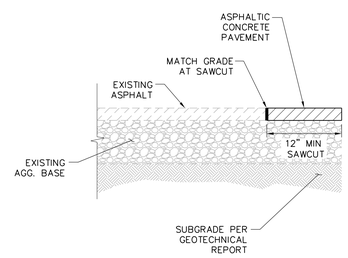
TOP OF SOIL SHOULD BE 2" BELOW FINISH GRADE TO ALLOW FOR MULCH LAYER. S.L.D. FOR MULCH PLACEMENT.



SWALE #4

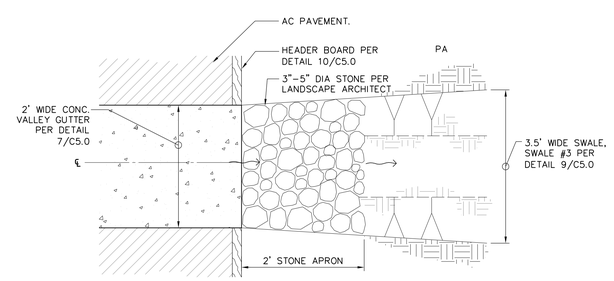
9 / C5.0 VEGETATED SWALES

SCALE: NTS



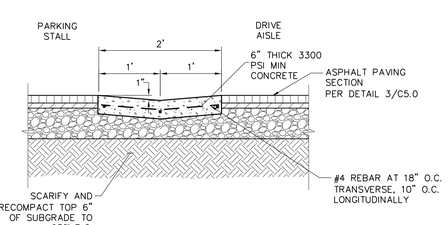
6 / C5.0 PAVEMENT CONFORM

SCALE: NTS



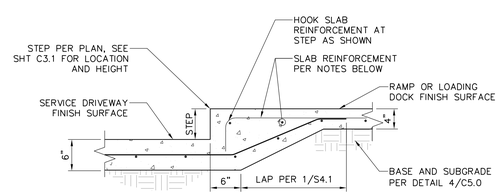
11 / C5.0 STONE APRON

SCALE: NTS



7 / C5.0 PARKING LOT VALLEY GUTTER

SCALE: NTS



NOTE:

1. PROVIDE REINFORCEMENT PER THE FOLLOWING:
   DRIVEWAY AND LOADING DOCK: #4 @ 12" O.C. BOTH WAYS.
   PED RAMP: #4 @ 18" O.C. BOTH WAYS.
2. SEE SPEC 02751 FOR ALL OTHER CONCRETE REQUIREMENTS

12 / C5.0 STEP AT SLAB-ON-GRADE

SCALE: NTS

Architect:

EHDD | ARCHITECTURE

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SITE AND DRAINAGE DETAILS

EHDD Job No.: 07023

Sheet No.:

File Location:

Drawn By: BW, IV

Scale: NTS

C5.0

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Appendix C

Provision C.4 Industrial & Commercial Site Controls

- Industrial & Illicit Discharge Control Subcommittee Meetings – Attendance List – FY 2012/13
- Recognizing and Responding to Illicit Discharges November 15, 2012 Workshop
    - Agenda
    - Evaluations Summary
    - Survey Results

Industrial & Illicit Discharge Control Subcommittee - FY 2012/13

Name (e-mail)	Phone/Fax	Agency	12-Jul	13-Sep	17-Jan	14-Mar	9-May
Jim Barse JBarse@ci.alameda.ca.us	510/749-5857	Alameda				√	
James Jorgensen jjorgensen@albanyca.org	510/528-5728	Albany					
Carrie Estadt cestadt@ci.berkeley.ca.us	510/981-7469 510/981-7470	Berkeley					
Geoff Fiedler gfiedler@ci.berkeley.ca.us	510/981-7467		√	√	√	√	
Karl Busche kbusche@cityofberkeley.info	510/981-7466						
Martha Aja Martha.Aja@ci.dublin.ca.us	925-452-2152	Dublin	√	√	√	√	√
Peter Schultze-Allen pschultze-allen@ci.emeryville.ca.us	510/596-3728 510/596-4389	Emeryville	√	√	√		
Marie Kulka mkulka@ebmud.com	510/287-1727 510/287-0621	EBMUD	√				
John Schroeter jschroeter@ebmud.com							
Tim Berger tberger@ci.fremont.ca.us	510/494-4587 510/494-4752	Fremont	√				
Val Blakely vblakely@fremont.gov	510/494-4577			√			
Debra Kunisawa Debra.Kunisawa@hayward-ca.gov	510/881-7960 510/881-7903	Hayward	√				
Alejandro Perez Alejandro.Perez@hayward-ca.gov	510/881-7993				√	√	√
Lynna Allen lgrijalva@ci.livermore.ca.us	925/960-8143 925/960-8105	Livermore					
Steve Aguiar smaguiar@ci.livermore.ca.us	925/960-8126				√	√	√
Blaine Drewes bdrewes@cityoflivermore.net							
Michael Carmen Michel.Carmen@Newark.org	510/578-4320	Newark	√				√
Craig Pon cpon@oaklandnet.com	510/238-6544 510/238-7286	Oakland	√		√		√
Sheryl Skillern sskillern@oaklandnet.com	510/238-7253				√		√
Mark Feldkamp mfeldkamp@ci.piedmont.ca.us		Piedmont				√	
Brian Lorimer blorimer@ci.pleasanton.ca.us	925/931-5511 925-931-5595	Pleasanton					
Scott Walker swalker@ci.pleasanton.ca.us							
John Camp jcamp@ci.san-leandro.ca.us	510/577-6029 510/577-6019	San Leandro	√	√	√	√	√
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Johnny Hubbs Jhubbs@unioncity.org	510/675-5302						
Faroq Azim						√	√
Emily Hoe emilyH@unioncity.org	510/675-5367		√	√	√		
Scott Seery scott.seery@acgov.org	510/567-6783	Alameda County		√	√		
Barney Chan barney.chan@acgov.org	510/567-6765		√	√	√	√	√
Jim Scanlin jims@acpwa.org	510/670-6548	ACCWP	√	√	√	√	√
Arleen Feng arleen@acpwa.org	510/670-5575						
Lori Pettegrew lap@eoainc.com	510/832-2852x112		√	√	√	√	√
Joe Mendoza joseph_mendoz@unionsanitary.com	510/477-3638	USD	√				
Jose Soto jose_soto@unionsanitary.com	510/477-7630			√	√	√	√
Sandy Mathews SandyM@lwa.com	510/625-1580	LWA		√	√		

F:\Al1x 2011-12\AL12IDC\MTGS\2012-13\[Attendance Roster12-13.xls]Sheet1

Stormwater Business Inspectors Workshop: Recognizing and Responding to Illicit Discharges

Thursday, November 15, 2012
8:30 a.m. to 2:00 p.m.

951 Turner Court, Hayward CAConference Room 230

Topic	Speaker	Time
Check in/Knowledge Survey	-	8:30-9:00
1.Welcome	Jim Scanlin Clean Water Program	9:00-9:15
2. MRP Illicit Discharge Requirements / Why We Care About Non-Stormwater Discharges	Sandy Mathews Larry Walker Associates	9:15-9:30
3. Recognizing Illicit Discharge at Commercial and Industrial Facilities	Jim Barse City of Alameda	9:30-10:00
4. Less Obvious Sources of PCBs	Mark Johnson San Francisco Bay Regional Water Board	10:00-10:30
Break		10:30-10:45
5. Coordinating with the District Attorney on Illicit Discharge Enforcement Cases	Mike Oppido, Alameda County District Attorney's Office Scott Seery, Alameda County Department of Environmental Health	10:45-11:30
6. Mobile Food Trucks Inspections	Scott Seery Alameda County Department of Environmental Health	11:30-11:45
7. Lunch and Mobile Food Truck Look See	Whole Foods	11:45-12:45
8. Update on the State Industrial General Permit	Sandy Mathews Larry Walker Associates	12:45-1:00
9. Food Service Inspections	Scott Seery Alameda County Department of Environmental Health	1:00-1:45
10. Wrap Up / Post Workshop Knowledge Survey and Evaluations	Jim Scanlin Clean Water Program	1:45-2:00

I&IDC Workshop on November 15, 2013

Summary of Evaluation Forms

	Overall Total	Inspectors	Supervise Inspectors	SW Staff/Manager	Other
The presentations were clear and easy to follow.	3.80	3.79	4.00	3.75	3.86
Overall, the order/progression of the presentations was appropriate.	3.73	3.74	4.00	3.50	3.86
Overall, the workshop materials and handouts were informative and useful.	3.67	3.62	4.00	3.63	3.86
I will use the skills learned in the workshop today on the job.	3.75	3.71	4.00	3.88	3.71
The presenter(s) were knowledgeable in the subject matter.	3.83	3.74	4.00	4.00	4.00
The presenter(s) encouraged questions.	3.70	3.64	4.00	3.75	3.86
Total number of surveys	50	33	2	8	7

What was most valuable about today's training?

- Practical inspection procedures/tips
- Update on the MRP
- Everything
- Restaurant inspection coverage
- Pictures from inspections are really valuable
- Good slides, visuals
- MRP Illicit Discharge Requirements
- Learned who to contact for investigative help when needed
- Greate refresher w/ new info
- Pictures
- Overhead pictures
- Much thanks for a great lunch
- PCB
- PCB presentation, Using picture to demonstrate stormwater knowledge
- Update on industrial generatl permit
- Lunch and mobile food truck info
- Working with DA
- Food truck presentation
- Hearing examples on field & how to handle enforcement
- Good examples of various business types & what to look for. Handouts of each slide presentation. Loved the Whole Foods truck lunch! Thx.
- All info was good. Food trucks "new" so very helpful
- Photos in presentations, w/ discussion & Q/A
- MRP Changes, Photos
- Examples were valuable. Some photographs were unclear.
- PCBs, DA court cases
- Good day today informatively

- Update on Industrial Permit
- I'm new, so the basics/BMPs were most helpful.
- Information about IGP
- PCB presentation, restaurant inspection, food facilities, lunch from Whole Foods
- New regulations, State permit
- Items 2, 4-8; Great lunch!
- All aspects of the training. I like the recognition of illicit discharge and coordinating wiwth the DA
- Good photos, good examples

What was least valuable about today's training?

- Food facilities because I'm not a food inspector
- Nothing
- NIO Training. Good overall but non-aapplicable to inspectors of cities w/ no NIO businesses
- PCB presentation
- Larger text on handouts/slides, if possible
- PCB's
- Nothing
- Restaurant
- Lack of understanding of gray water definition. Gray water includes: Handwashing sink water, shower water, bathroom basin water and clothes washing machines with some conditions.
- They were all valuable
- Nothing
- PCB
- PCBs (put last)
- Update on State Industrial Permit
- Restaurant Inspection. Lots of repition about dumpster drainage
- None
- Food truck inspections
- The policy/regulatory presentation was lacking in details, but still a good update to include.
- MRP Updates
- What is a illicit discharge
- Nothing

Do you have any suggestions for improvement?

- Very all inclusive. Well done.
- Nope
- Explain abbreviations for terms so people not in the exact line of work can better understand terminology 'QSE' 'NAC' 'NOI' etc - Some of us have not hear these terms
- Bring back inspection component using teams of 4-5 people to make observations of scenarios at the site.
- Identify acronyms MRP? Etc
- Longer more time for Q & A
- Have Scott not talk

- It will be nice if there is activity that can invole everybody practically rather than looking at a power point presentation at all times. It is important to take pictures of these places that are in compliance so that we see the contrast. Learning is about the bad & good.
- Some practical exercise of evaluating a hypothetical real world situation
- Continue to use pictures
- Talk from Regional Board. When will they have staff to implement their own program?
- More regular coffee, Less Decaf
- Presenters contact information or websites could be provided on each powerpoint presentation
- Always get to hear directly from the DA. Btw, Scott did a nice job.
- Big issue- - go through the inspection form and get audience input on photos - who rates this as BMP 0? 1? 2? 3?
- Sampling methods & results. What typical discharges have in terms of contaminants, What chemicals or Ph to look for (E.g., wash water cleaning solvents, paint shops)
- None
- Best presentation since attending CWP Trainings
- More caffeinated coffee
- I would include more time for each of the subjects

What subjects would you like to see in future workshops?

- Case studies were very informative
- Enforcement practices, examples of Nov letters, sharing of cases to help inspectors w/ knowledge of issues
- on site inspection
- NOV's, Citation, and Enforcement practices
- Have Scott stop talking
- More training on waste water technology and returning water technology.
- More on BMP's. Examples
- Letter of the Law vs Intent of the Law
- More on the stormwater general permit
- Maybe Dept of Fish & Game could present on what they do when an illicit discharge impacts streams & creeks
- The 10-day f/u reg for violations: How are agencies administration? Has it been resource intensive and if so, how is that managed?
- You gotta do this one - compare different inspectors ratings of the inspection form.
- No bottled water (Whole Foods) - Coolers w/ cups
- Case development for enforcement
- More BMPs & cast studies - very helpful!
- What is better Education vs Enforcement
- Anything dealing with the CWP & illicit discharges

I&IDC Workshop on November 15, 2013

Survey Responses

	Question	Correct Answer	Pre-workshop % Correct	Post-workshop % Correct	Difference
Q1	Local agencies have the authority to control non-stormwater discharges at industrial sites under which provision(s) of the MRP:	**C**	**82%**	**96%**	**14%**
Q2	THE MRP considers timely correction of an illicit discharge to be:	**B**	**60%**	**98%**	**38%**
Q3	A significant change of the upcoming reissuance of the State's Industrial General Permit is:	**B**	**67%**	**94%**	**27%**
Q4	During an inspection of industrial facilities a likely source of PCBs is:	**A**	**83%**	**98%**	**15%**
Q6	Contact District Attorney (DA) Investigators when:	**D**	**90%**	**91%**	**1%**
Q7	The discharge of food preparation waste water from mobile food trucks is allowed, provided they do it while they are traveling on state highways (such as Interstate 880):	**B**	**97%**	**100%**	**3%**
	Totals				
	Respondent Percentage Correct		**80%**	**96%**	**16%**
	Percent with 4 or more answers correct		**85%**	**100%**	**15%**
	Percent with 3 or fewer questions correct		**15%**	**0%**	**-15%**
	Number of Surveys Completed		**60**	**53**	**7**

Appendix D

Provision C.6 Construction Site Controls

- Construction Site Inspection Tracking Spreadsheet Template
- Construction Stormwater C.6 Training June 11, 2013
    - Agenda
    - Evaluations Summary
    - Survey Results

Construction Site Inspections Tracking Spreadsheet

[Enter Agency Name]

Instructions: *Obtain data from the Inspection Checklist for Construction Stormwater Controls completed during inspection. Enter data from one inspection per row. Column 7 should be answered yes or no for only the first inspection at any site. For sites disturbing 1 acre or more and high priority sites, there should be at least 1 inspection per month from October 1 to April 30. Beginning April 1, 2010, Enforcement Response Level (Columns 20 - 24) should correspond with the agency's Enforcement Response Plan. Enter "1" for yes. Leave blank, or enter "0" for a "no" response. No matter how many problems per site in a single category (for example, Erosion Control) enter only 1. No matter how many problems at the site, enter only 1 in Column 16 when all problems are fixed, and enter only 1 in column 25 or 26 to indicate how long it took to correct all problems.*

Purpose: *Municipal Regional Permit Provision C.6.e.ii(4) requires agencies to track information identified in this spreadsheet. Agencies will need to summarize data from this spreadsheet in annual report forms. This spreadsheet is not submitted with the Annual Report.*

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
								Problems (Refs 13-19)								Resolution (Ref 21)				Enforcement Response Level (Ref 21)					Violation Corrected? (Ref 21)	
Enter 1 per inspection	Enter 1 for each site	Site Name	Inspectn Date	Weather During Inspectn	Rain with Runoff Since Prev. Inspectn? Y/N	ANSWER ONCE PER SITE: Project Disturbs 1 acre or more? (Y/N/See Previous Entry)[1]		Erosion Control	Sediment Control	Run-on & Runoff	Active Treatmt	Site Mgt.	Non Stormwtr Mgt	Illicit Discharge	Specific Problem(s) (Ref 13-19)	Problem Fixed	Needs More Time	Escalate Enforcement	Comments (including rationales for longer compliance times) (Ref 21)	Verbal Warning	Written Warning/ Notice of Vioation	Notice to Comply/ Stop Work Order	Notice to Comply with $ penalty	Legal Action	Within 10 Business Days	NOT corrected within 30 days
1	1	**EXAMPLE:** Nirvana Estates	**EXAMPLE:** 12/12/09	**EXAMPLE:** Light Rain	**EXAMPLE:** Yes	1	**EXAMPLE:** Yes	1	1	1	1	1	1	1	**EXAMPLE:** Hydroseed washout, Straw wattles/silt fence not working, Excessive run-on from upslope, Active treatment daily log not kept, Soil stockpile not covered, concrete washwater in storm drain		1		**EXAMPLE:** Superintendent began corrections. Follow up inspection in 1 week.		1					
1	0	**EXAMPLE:** Nirvana Estates	**EXAMPLE:** 12/19/09	**EXAMPLE:** Clear	**EXAMPLE:** No	0	**EXAMPLE:** See previous entry								**EXAMPLE:** All problems observed on 12/12/09 were fixed	1			**EXAMPLE:** No problems identified.						1	
1	1	**EXAMPLE:** Serenity Subdivision	**EXAMPLE:** 12/13/2009	**EXAMPLE:** Clear	**EXAMPLE:** No	0	**EXAMPLE:** No							1	**EXAMPLE:** Sawcutting slurry in stormdrain.		1		**EXAMPLE:** Follow up inspection in 1 week.	1						
1	0	**EXAMPLE:** Serenity Subdivision	**EXAMPLE:** 12/20/2009	**EXAMPLE:** Heavy rain	**EXAMPLE:** Yes	0	**EXAMPLE:** See previous entry								**EXAMPLE:** No problem	1			**EXAMPLE:** No problems identified.						1	

Total # Inspections	Total # Sites
4	2

No. of sites disturbing ≥ 1 acre: 1

No. of sites disturbing < 1 acre: 1

Summary of violations in 6 BMP categories

	Erosion control	Sed. Control	Runoon/runoff	Active Treatmt	Site Mgt	NonStormwater
	1	1	1	1	1	1
Total violations:	6					
Percentage by category:	17%	17%	17%	17%	17%	17%

Total Illicit discharges 2

Total sites with problems fixed 2

Summary of Enforcement Actions					Timeframe of corrections	
Verbal warn.	Written warn./ Notice of Viol.	Stop work/ Notce. to comply	Notce.to comply with $ penalty	Legal action	Total corrected within 10 business days	Total NOT corrected within 30 days
1	1	0	0	0	2	0
Total enforcement actions					% of sites corrected w/in 10 bus. Days	Percentage NOT corrected in 30 days
2						
% within enforcement category						
50%	50%	0%	0%	0%	100%	0%

[1] Answer Yes or No only once for each site. 1 = Yes. 0 = No.

[2] The references (for example "Ref 13") refer to the applicable item number on the Inspection Checklist for Construction Stormwater Controls

Construction Stormwater C.6 Training

Tuesday, June 11, 2013
8:30 a.m. to 12:30 p.m.
City of Hayward City Hall
Council Chambers, 2nd Floor
777 B Street, Hayward CA
(Take BART to the Downtown Hayward Station)

This training will provide inspectors with an understanding of the Municipal Regional Permit (MRP) C.6 requirements and Best Management Practices (BMPs) to help them implement the stormwater program requirements during inspections. During the training participants will:

See the Attached Tentative Agenda

- **Review the MRP Provision C.6 Requirements**
- **Learn how the Statewide Construction Stormwater General Permit relates to the MRP**
- **Gain knowledge of the MRP C.6 BMPs and how they are used**
- **Learn how to use inspection tools**
- **Gain understanding of enforcement options and how inspection results are reported to the Regional Board**
- **Hear from fellow inspectors on challenges and successes**

Morning refreshments will be provided.

There is no fee for the workshop
Please pass this flyer to appropriate staff in your organization.

NOTE: Clean Water Program agency staff will receive first priority for registration.
If space is available, developers, builders, and consultants may also attend.

Name:_____

Title:_____

Agency/Company:_____

Phone:_____ **Email:**_____

Registering several staff from the same agency? Use the form on the reverse side.
Please complete and email to Mashon [*mashonJ@lwa.com*] **No later than June 4th**
Questions? Call or email Mashon or Sandy [*sandyM@lwa.com*] at (510-625-1580)

Tentative Construction Stormwater (C.6) Workshop Agenda

June 11, 2013 8:30-12:30
Hayward City Hall,
Council Chambers, 2nd Floor
777 B Street, Hayward CA

Workshop Agenda

Check-in and Refreshments		8:30-9:00
1. Welcome	Shannan Young, City of Fremont	9:00-9:10
2. Overview of MRP Provision C.6 Requirements and relationship to the State Construction General Permit	Jim Barse, City of Alameda	9:10-9:40
3. Review of C.6 BMPs	Sandy Mathews, Larry Walker Associates	9:40-10:10
Break		10:10-10:30
4. Inspection Tools	Tim Berger, City of Fremont	10:30-11:15
5. Enforcement Options and Reporting	Laura Prickett, EOA	11:15-11:45
6. Inspector Panel	Moderated by Pam Lung, City of Livermore	11:45-12:15
Wrap Up	Shannan Young, City of Fremont	12:15-12:30

cleanwater PROGRAM

Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency	Signature
Boyd	Rod	AEC Consultants	
Brathwaite	Sam	Alameda Co, Ground Zone	
Jones	Tony	Alameda Co, Ground Zone	
Batin	Rahman	Alameda Co, GSA-TSD	
Cadrecha	Michael	Alameda Co, GSA-TSD	
Freitag	Rod	Alameda Co, GSA-TSD	
Garrison	Jason	Alameda Co, GSA-TSD	
Laczko	Brian	Alameda Co, GSA-TSD	
Loeper	Jerry	Alameda Co, GSA-TSD	
Fung	Stanley	Alameda Co, PWA	
Grimm	Chris	Alameda Co, PWA	
Scanlin	Jim	Alameda County (PM)	
Barse	James	City of Alameda (Speaker)	
Smith	Erin	City of Albany	
BERNARDES	ANA	abernardes@albanyca.org.	
Savellano	David	Alameda Co GSA	
Johnson	Howard	howard.johnson@acgov.org	

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Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency	Signature
Aikenhead	Diana	City of Berkeley	
Akagi	Danny	City of Berkeley	
Andreetta	Colleen	City of Berkeley candreetta@cityofberk.	
Brovold	Greg	City of Berkeley	
Cevasco	John	City of Berkeley	
Chen	Vincent	City of Berkeley	
Emmons	Patrick	City of Berkeley	
Heidenreich	Greg	City of Berkeley	
Irby	Donald	City of Berkeley	
Johnson	Pamela	City of Berkeley	
Lancelot	Michael	City of Berkeley	
Lopez	David	City of Berkeley	
Mendez	Leslie	City of Berkeley	
Merry	Adrian	City of Berkeley	

amerry@cityofberkeley.info

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Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency		Signature
Messinger	Steve	City of Berkeley		
Nelson	Brent	City of Berkeley		
Roshal	Michael	City of Berkeley		
Rudolph	Brad	City of Berkeley		
Rushing	Roger	City of Berkeley		
Suan	Harold	City of Berkeley		
Barreras	Roehl	City of Dublin		
Bucknam	Jeff	City of Dublin		
Imai	Jayson	City of Dublin		
Schultz-Allen	Peter	City of Emeryville		
Mayes	Andrew	City of Fremont	amayes@fremont.gov	
Mennucci	Mark	City of Fremont		
Ravenstad	Roger	City of Fremont		
Young	Shannon	City of Fremont (Chair)		
Berger	Tim	City of Fremont (Speaker)		
MATLOCK	DANIEL	CITY OF FREMONT		

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Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency	Signature
Ali	Mir	City of Hayward	
Del Rio	Miguel	City of Hayward	
Fanuncio	Jim	City of Hayward	
Koo	Michelle	City of Hayward	
Lear	James	City of Hayward	
Leuterio	Hector	City of Hayward	
Nguyen	John	City of Hayward	
Owusu	Yaw	City of Hayward	
Pulu	Paulo	City of Hayward	
Samayoa	Luis	City of Hayward	
Taha	Mustafa	City of Hayward	
Titus	Geoff	City of Hayward	
Torres	Dave	City of Hayward	
Whipple	Jason	City of Hayward	
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FLOOD,	John	CITY of UNION CITY jflood@unioncity.org	

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Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency	Signature
Inthavong	Hamm	City of Livermore	
Lee	Scott	City of Livermore	
Follenfant ~~Manning~~	Bob ~~Mike~~	City of Livermore	
Martin	Doug	City of Livermore	
Pato	Mike	City of Livermore	
Tingley	Robert	City of Livermore	
Lung	Pam	City of Livermore (Moderator)	Pamela Lung
Herschel	John	City of Newark	John Herschel
Carmen	Michael	City of Newark PW	
Kelly	Laura	City of Newark PW	
Kreutzer	Karl	City of Newark PW	
Tucker	Jim	City of Newark PW	
BALLOU	JEFF	CITY OF PLEASANTON	jballou@cityofpleasantonca.gov
PETERSEN	SCOTT	CITY OF PLEASANTON	rravalin@cityofpleasantonca.gov
RAVALIN	RYAN	CITY OF PLEASANTON	spetersen@cityofpleasantonca.gov ~~spet~~

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Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency	Signature
Banks	Dana	City of Oakland PWA	
Chan	Alan	City of Oakland PWA	
Chiang	Alan	City of Oakland PWA	
Choi	Henry	City of Oakland PWA	
Fermanian	Joseph	City of Oakland PWA	
Fung	Phillip	City of Oakland PWA	
Lau	Danny	City of Oakland PWA	
Lewis	Chris	City of Oakland PWA	
Lin	Jing	City of Oakland PWA	
Louie	Denise	City of Oakland PWA	
Mach	Randy	City of Oakland PWA	
McGee	James	City of Oakland PWA	
Millian	Mario	City of Oakland PWA	
Montoya	Moises	City of Oakland PWA	
Myles	Wezlon	City of Oakland PWA	Wezlon Myles
Pon	Craig	City of Oakland PWA	
GRIFFIN	CRAIG	CITY OF PIEDMONT	cgriffin@ci.piedmont.ca.us

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Construction Stormwater
C.6 Training
June 11, 2013

Last Name	First Name	Agency		Signature
Schwarz	Ali	City of Oakland PWA		
Sibley	Carl	City of Oakland PWA		
Tanios	Joseph	City of Oakland PWA		
Tannenwald	Diane	City of Oakland PWA		
Tran	Paul	City of Oakland PWA		
Tuden	Rebecca	City of Oakland PWA		
White	Lee	City of Oakland PWA		
Wong	Jing	City of Oakland PWA		
Akiyama	Robert	City of Piedmont		
Brian	Curtis	City of San Leandro		
Brooks	Kip	City of San Leandro		
Osakwe	Austine	City of San Leandro		
Titsworth	Michael	City of San Leandro		
Kerr	Kristin	EOA (Speaker)		
Olmsted	Mona	Zone 7		
ELLIS	STEVEN	ZONE 7	sellis@zone7water.com	
~~Brooks~~	~~Kip~~ Jogie	~~City of San Leandro~~		
Watson	Athena	Zone 7	awatson@zone7water.com	

athenawatson

Construction Stormwater C.6 Training - June 11, 2013

		Correct Answer	Pre-workshop % Correct	Post-workshop % Correct	Difference
Q1	What is the primary purpose of the pre-rainy season notification?	**C**	**90%**	**88%**	**-2%**
Q2	How frequently must active high priority sites be inspected by the local agency?	**C**	**53%**	**97%**	**44%**
Q3	The purpose of erosion control BMPs is to?	**A**	**51%**	**74%**	**23%**
Q4	When must a re-inspection occur if violations are documented at a site?	**C**	**40%**	**98%**	**58%**
Q5	Projects regulated by the Municipal Regional Permit are never subject to the State Construction General Permit.	**B**	**97%**	**91%**	**-6%**
Q6	Which should an inspector use to determine appropriate enforcement actions?	**C**	**47%**	**86%**	**39%**
Q7	Which of the following is an example of progressive enforcement?	**B**	**69%**	**97%**	**28%**
Q8	How many violations are documented for the Annual Report if the following is noted in the inspection, 3 failed silt fences, 2 areas without erosion controls, and a leaking can of paint?	**B**	**40%**	**69%**	**29%**
	Totals				
	Respondent Percentage Correct		**61%**	**88%**	**27%**
	Number of 50% or above		**80%**	**98%**	**18%**
	Number of 49% or below		**19%**	**2%**	**17%**
	Number of Surveys Completed		**70**	**58**	**12**

Summary of Construction Stormwater C.6 Workshop Evaluation Forms
June 11, 2013

Evaluation Question	Rating Scale 1-4
The presentations were clear and easy to follow	3.5
Overall the order/progression of the presentations was appropriate	3.5
Overall, the workshop materials and handouts were informative and useful	3.3
I will use the skills learned in the workshop today on the job	3.4
The presenter(s) were knowledgeable in the subject matter	3.7
The presenter(s) encouraged questions	3.5
Total number of surveys	64

What was most valuable about today's training?

- Case Examples
- MRP, ERP, Enforcement Reporting
- Good overview for non-inspector types
- Checklist & slides of violations and compliant conditions
- Consistent awareness
- Explanations of what is expected based on the MRP & how inspectors should enforce actions. The examples were helpful as well.
- Very good overview and intro to C.6
- Everything
- "Real" site conditions / photos
- All was good
- Examples of violations & what to do
- Examples of what's been seen in the field
- What to watch out for in the field. Inspection escalation procedures. Documentation of violations.
- Handouts
- Obtaining a better understanding of the difference between the MRP & CGP programs.
- Having inspectors here and taking info back to use.
- Getting a good review & refresher on BMPs & general requirements. Getting CWEA credit hours.
- Very clear on the procedures and examples.
- The panel and Tim's presentation.
- The actions an inspector can take when a violation is made.
- Knowledgeable presenters w/ field experience
- Seeing the value of SW management practices and the problems that poor plans can create.
- Asking the question within our own agency - who is responsible for implementing program? Where is our ERP?
- Enforcement & inspection guidance and reporting. Showing experiences.
- Enlightening me of the Regs which the City didn't inform me of very well. Basically understanding MRP vs. CGP and C6 in general.
- Always good to review this topic.
- Clear overview of the processes w/ background.
- Clearer understanding of program
- Panel at end
- Worksheet examples
- Questionnaire to determine knowledge & see how much was learned
- Raising awareness of BMP's, potential hazards & enforcement.
- Laying out a practical plan or action
- Example photographs
- Providing experience and discussion of steps followed during inspection/enforcement

- Reporting requirements, consistent following of ERP
- Kristin Kerr's presentation
- Understanding the value of SW and its prevention.
- SWPPP Overview
- Refreshed my memory
- Clearly informed what we are to look for, how to report and what to expect without getting bogged down on the details.
- Basic review & explanations helpful
- MRP →CGP distinction
- All is important
- Introduction to this area

What was least valuable about today's training?

- Slide docs too small
- All very valuable
- Can't think of any
- Very dry (no pun intended). The presentation needs to be energized up a bit
- Everything was valuable & necessary to provide a complete picture
- N/A
- None
- Specific person's experiences. Not always relevant.
- All the information was constructive and useful.
- Decaf coffee
- Silt fence. Should be reclassified as a dam.
- Annual reporting.
- Difficult for all staff to attend when work load is so busy in June.
- Inspectors panel
- Reporting
- None
- Nothing. All information was valuable.
- Dry
- Pastries
- Review of regulations (always difficult to do)
- Inspection panel
- The power point handouts were very hard to read when showing forms.
- None

Do you have any suggestions for improvement?

- More examples of conditions of violations.
- No
- More examples of compliant & non-compliant conditions
- More real life examples & step-by-step procedures would be helpful, particularly of projects/plans that do not work well.
- No
- Common solutions to common problems- eg, tracking where sites are small and do not allow an "on site" cleaning/wash area. eg. Hillsides vs. flat lands.
- Still unclear when things are required (i.e., site disturbance less than 1 acre, etc.)
- None
- More actual enforcement instances. Those presented are too generic.
- More examples of BMP deficiencies - example of photographs
- I like the ½-day only format. Keep it short & focused.
- Walk through an inspection and how to fill out the form with examples of verbal writings & violations.

- Eliminate the formal steps & state actual events & actions that were taken.
- The handouts, though filled with lots of information, are a bit difficult to read.
- Resources for CGP training.
- More sessions available. Make sessions available during slow times of construction - vs. June.
- Condense
- On training announcement 1) Make it clear if this is a refresher or if there are major regulatory changes (since the last training) that are being covered; 2) Suggest attendees (e.g. Inspectors, PM's); 3) Bring hardcopies of the various references mentioned (permits, SM manuals). Seeing them might jog people's memory of whether they have that or need to obtain it; 4) Provide parking info w/ registration form.
- Training more often and also not so rushed. Not enough time for presentations.
- Yes, better worksheet examples.
- Room where drinks are allowed
- Fruit
- Small breaks or quick overview between presentations. We were going back to back presentations
- How do you make the material more interesting? I don't know it's just hard stuff to go over.
- The "Double" Screen display was a distraction
- Hand out the sample completed forms w/ power point presentation.
- Engineers' note must expand beyond recommending hydroseeding as erosion control measure, but that hydroseeding is a **temporary** erosion and sediment control measure and shall only be done with sterile seeds that will not invade beyond the applied areas until permanent landscape gets implemented. The distinction will provide much needed clarifications to my landscape architect colleagues and development communities.

What subjects would you like to see in future workshops?

- BMPs
- N/A
- Implementing the CGP, developing & implementing a successful SWPPP. Effective communication between inspectors & contractor.
- Most factual cases from start (warning) to finish (citation/fine/court)
- Same as above
- None
- MRP incentives. Actual MRP goals and whether goals are being reached.
- The ERP process.
- Construction-site inspections of stormwater treatment measure.
- Have Jurisdictions bring ERPs to share.
- Verbal warnings vs. violations
- More events or story like actions which were taken.
- Examples of written & photographed documentation and backup. More graphic examples of creative solutions to difficult SW management events and circumstances.
- More photos & examples. As a novice inspector, learning from past experiences is very helpful.
- Examples of notice of violations or notice to comply from various agencies.
- SW controls on municipalities' own maintenance yards and activities
- The actual types of methods for sites.
- CGP reporting
- Tips on reporting what board comment on and how to improve annual report completion.
- Utility companies that access manholes who discharges the water that's been sitting in the vaults into the storm drains. How do you treat or prevent it?
- They mentioned "significant" and "no significant" violation. Please define "significant".
- Able to have my coffee in the room.
- Expanding on slope protection measures for erosion and sediment control on steep slopes with expansive soil or extremely porous soil. In the future Stormwater Workshops for public agencies,

engineers, landscape architects and other professionals regarding engineers' one of the standard recommendations for erosion/sediment control measures on BMP plans, hydroseeding.

Other Comments

- Nice facility

Appendix E

Provision C.7 Public Information & Outreach

- BASMAA Regional Supplement for Training and Outreach FY 2012-2013 (including Be the Street Report, BASMAA Media Relations Campaign Final Report and IPM Advocates for Retail Stores Final Report)
- Our Waterful World Insert
- CWP Survey Report
- CWP Press Releases (two)
- Bay Friendly Garden Tours 2013 Final Report
- Bringing Back the Natives Garden Tours Final Report
- Kids for the Bay – "Storm Drain Rangers" Program Final Report
- Caterpillar Puppets – "Watershed Babies Go the Water School" Program Final Report
- ZunZun – "The Musical Watershed" Program Final Report
- Golden Gate Audubon Society – "Eco-Oakland" Program Final Report
- Livermore Area Recreation and Park District – "Watershed Education" Program Final Report

Annual Reporting for FY 2012-2013

Regional Supplement for Training and Outreach

San Francisco Bay Area Municipal Regional Stormwater Permit

B A S M A A

Bay Area Stormwater Management Agencies Association

September 2013

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LIST OF ATTACHMENTS:

C.7.b. Advertising Campaign

Be the Street Report

C.7.c. Media Relations – Use of Free Media

BASMAA Media Relations Campaign Final Report

C.9.h.i. Point of Purchase Outreach

Photos of *Our Water, Our World* displays at major chains
Photos of training at major chains
Copies of *Our Water, Our World* advertisements
IPM Advocates for Retail Stores Final Report

INTRODUCTION

This Regional Supplement has been prepared to report on regionally implemented activities complying with portions of the Municipal Regional Stormwater Permit (MRP), issued to 76 municipalities and special districts (Permittees) by the San Francisco Bay Regional Water Quality Control Board (Water Board). The Regional Supplement covers training and outreach activities related to the following MRP provisions:

- Provision C.5.d., Control of Mobile Sources,
- Provision C.7.b., Advertising Campaign,
- Provision C.7.c., Media Relations – Use of Free Media,
- Provision C.7.d., Stormwater Point of Contact, and
- Provision C.9.h.i., Point of Purchase Outreach.

These regionally implemented activities are conducted under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA), a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Most of the 2012-2013 annual reporting requirements of the specific MRP Provisions covered in this Supplement are completely met by BASMAA Regional Project activities, except where otherwise noted herein or by Permittees in their reports. Scopes, budgets and contracting or in-kind project implementation mechanisms for BASMAA Regional Projects follow BASMAA's Operational Policies and Procedures as approved by the BASMAA Board of Directors. MRP Permittees, through their program representatives on the Board of Directors and its committees, collaboratively authorize and participate in BASMAA Regional Projects or Regional Tasks. Depending on the Regional Project or Task, either all BASMAA members or Phase I programs that are subject to the MRP share regional costs.

Training

C.5.d. Control of Mobile Sources

This provision requires Permittees to develop and implement a program to reduce the discharge of pollutants from mobile businesses, including development and implementation of minimum standards and BMPs, and outreach to mobile businesses. BASMAA's long-standing Surface Cleaner Training and Recognition program addresses these aspects of the provision by focusing on the most common type of outdoor cleaning – cleaning of flat surfaces like sidewalks, plazas, parking areas, and buildings. Individual Permittees address the inspection and enforcement aspects of the provision.

Previously, BASMAA, the Regional Water Board, and mobile businesses jointly developed best management practices. The BMPs were packaged and delivered in training materials (e.g., *Pollution from Surface Cleaning* folder), and via workshops and training videos. The folder and the training video have since been translated into Spanish. Cleaners that take the training and a self-quiz are designated by BASMAA as Recognized Surface Cleaners. BASMAA also created and provides marketing materials for use by Recognized Surface Cleaners. Previously, BASMAA converted the delivery mechanism to being online so that mobile businesses would have on-demand access

to the materials and the training. BASMAA continues to maintain the Surface Cleaner Training and Recognition program. Cleaners can use the website to get trained and recognized for the first time or renew their training and recognition, as required annually. Recognized cleaners can also download marketing materials from the website. Potential customers, including Permittees can use the site to verify the recognition status of any cleaner, as can municipal inspectors.

Subsequent to the development and implementation of the existing program, BASMAA and the Permittees scoped and budgeted for a new project to enhance the existing Surface Cleaner Training and Recognition program in the following ways.

1. Expand the existing Surface Cleaner Training and Recognition Program to include two new mobile business categories - automotive washing and carpet cleaning;
2. Utilize existing resources that are available to complete the necessary tasks;
3. Develop marketing materials, training videos and self-test applications for the new categories;
4. Create Spanish tracks of the information; and
5. Create a web-based application to share information about mobile businesses.

A consultant team with expertise in best management practices and commercial training programs, videography, graphic design, web design, and translation has initiated work on the enhancements. The project will be fully implemented in FY 13-14.

Public Information and Outreach

C.7.b. Advertising Campaign

This provision requires Permittees to participate in or contribute to advertising campaigns on trash/litter in waterways and pesticides with the goal of significantly increasing overall awareness of stormwater runoff pollution prevention messages and behavior changes in target audience. Through the BASMAA Public Information / Participation (PI/P) Committee, Permittees previously decided to take a broader view of some of its regional tasks (e.g., Regional Advertising Campaign, Regional Media Relations, *Our Water, Our World* program) to ensure that work on individual MRP provisions was coordinated and part of an overall strategy.

In FY 10-11, working with SGA, Inc., BASMAA developed broader Regional Strategic Outreach Plans – one for litter and one for pesticides – that include audiences related to the MRP provisions and ways of reaching them regarding trash/litter and pesticides (e.g., advertising, media relations, schools outreach, events). Although the scopes of the strategies are broad, the level of stormwater agency (regional, areawide program, city) implementing each part varies (i.e., each part is not implemented via BASMAA). The strategies are multi-year and also include recommendations for creative, media placement, media relations, partnerships, and evaluation.

In FY 11-12, BASMAA, again working with SGA, Inc., finished developing an Implementation Plan for the litter strategic plan, which provides more detailed tasks and budgets for the multi-year project. Implementation of the "*Be the Street*" anti-litter

Youth Outreach Campaign also began in FY 11-12. *Be the Street* takes a Community Based Social Marketing approach to encourage youth to keep their community clean. The intent of the campaign is to make "no-littering" the norm among the target audience (youth between the ages of 14 and 24). The *Be the Street* Campaign is using online social marketing tools to conduct outreach.

Activities in FY 12-13 included: maintaining a website, Facebook page, and YouTube Channel; issuing an e-newsletter; creating an Instagram account; conducting an "anti-littering" video contest and live streaming online awards show; and advertising the winning video on Pandora, YouTube, Google, Facebook, and KTVU (see attached *Be the Street* Report for details).

C.7.c. Media Relations – Use of Free Media

This provision requires Permittees to participate in or contribute to a media relations campaign, maximize use of free media/media coverage with the objective of significantly increasing the overall awareness of stormwater pollution prevention messages and associated behavior change in target audiences, and to achieve public goals. The Annual Reporting requirement includes providing the details of each media pitch, such as the medium, date, and content of the pitch. BASMAA has conducted a Regional Media Relations project since FY 96-97 that assists Permittees in complying with this type of provision. The FY 12-13 BASMAA Regional Media Relations project made seven pitches (see attached Media Relations Program Report for details):

- Pesticides: Exterior Spraying press release and PSAs,
- IPM Advocates press release,
- Holiday press release,
- Plastic bag bans press release,
- Be the Street press release,
- Car Washing PSAs, and
- Green Streets press release.

C.7.d. Stormwater Point of Contact

This provision requires Permittees to individually or collectively create and maintain a point of contact, e.g., phone number or website, to provide the public with information on watershed characteristics and stormwater pollution prevention alternatives. The Annual Reporting requirement states that any change in the contact be reported in annual reports subsequent to FY 09-10 annual report. There was no change in FY 12-13 to the point of contact provided by BASMAA. BASMAA assists with this provision by using the regional website: BayWise.org to list or link to member programs' lists of points of contact and contact information for the stormwater agencies in the Bay Area.

Pesticides Toxicity Control

C.9.h.i. Point of Purchase Outreach

This provision requires Permittees to:

- Conduct outreach to consumers at the point of purchase;
- Provide targeted information on proper pesticide use and disposal, potential

adverse impacts on water quality, and less toxic methods of pest prevention and control; and
- Participate in and provide resources for the "Our Water, Our World" program or a functionally equivalent pesticide use reduction outreach program.

The Annual Reporting requirement allows Permittees who participate in a regional effort to comply with C.9.h.i. to reference a report that summarizes these actions. Below is a report of activities and accomplishments of the *Our Water, Our World* program for FY 12-13.

- Coordinated program implementation with major chains Home Depot, Orchard Supply Hardware (OSH), and Ace Hardware National. Corporate office of OSH (San Jose) and Home Depot (Atlanta) directed support of the program with their stores. Work with these major chains resulted in year-to-year increases in sales of less-toxic products of:
  - +29% in retail sales – OSH
  - +22-25% - Home Depot

  Our qualitative assessment suggests the following factors (in no particular order) behind these relatively large increases:
  - Early dry spring
  - Improved economy
  - Increased consumer interest and demand in organic and green products
  - Increased selection and higher visibility of less toxic products due to better displays and OWOW participation in end-cap displays
  - Increased participation of OWOW at these retailers (more call frequency as a whole)
  - Increased participation of OWOW with IPM Advocates (see below) at regional road shows and district kick-off meetings where we met with hundreds of employees we never have before reached in such numbers
  - Increased trainings of Home Depot and OSH employees at OWOW stores
  - Increased tablings at these two retailers

- Coordinated master print run of the following: fact sheets, shelf talkers, literature rack signage, beneficial bug brochure, magnet, Pest or Pal activity guide for kids, pocket guide, and Pests Bugging You? booklet.

- Updated less-toxic Product Lists: OSH and Home Depot-specific lists/labels.

- Maintained *Our Water, Our World* website.

- Provided Ask-the-Expert service—which provides 24-hour turnaround on answers to pest management questions.

- Provided and staffed exhibitor booths.
  - Excel Gardens Dealer Show, Las Vegas (August 2012)
  - L&L Dealer Show, Reno (October 2012)
  - NorCal trade show (February 2013)

- Provided on-call assistance (e.g., display set-up, training, IPM materials review) to specific stores (e.g., OSH, Home Depots) (see photo attached).

- Worked with pesticide manufacturers to set up eco-friendly displays of less-toxic pesticides in 31 Home Depots (see photo attached).

- Provided print advertising and articles – Chinook Coupon Book (see ad attached) and distributed about 500 books that also had the *Our Water, Our World* label on the front cover at the BART Blue Sky Festival and San Francisco Earth Day (see ad attached).

- Provided print and web advertising – Bay Nature magazine (see ad attached); Bringing Back the Natives Garden Tour's garden guide (see ad attached).

Additionally, BASMAA, in partnership with the UC IPM Program, finished developing and implementing a Pest Management Alliance grant from the Department of Pesticide Regulation (DPR) for the *IPM Advocates for Retail Stores* project. The project's purpose was to develop and implement a program that recruited, trained, and mentored individuals to help retail stores implement the *Our Water, Our World* program. The *IPM Advocates for Retail Stores* project kicked off in December 2010. In FY 12-13, the project team:

- through the Advocates, continued to work with the stores to set up displays and conduct trainings of store employees;
- sustained an IPM Advocates web page with links to online information and materials from UC IPM and *Our Water, Our World* that provides one-stop shopping for store employees, store managers, and IPM Advocates interested in keeping up with the latest IPM and product-related developments;
- evaluated the project; and
- identifed ways to sustain IPM Advocates after the grant expired (spring 2013).

(see attached IPM Advocates for Retail Stores report for details)

Additionally in FY 12-13, BASMAA initiated work on two other projects related to *Our Water, Our World*:

Got Ants – This DPR funded grant project is being led by the San Francisco Estuary Partnership and BASMAA is a sub-recipient of a small portion of the grant funds. The project is a social marketing outreach campaign designed to provide easy-to-use information on ant control methods that do not harm water quality and shift users' behavior to integrated pest management (see Got Ants? Get SERIOUS website for more information).

Greener Pesticides for Cleaner Waterways – This EPA funded grant project is being led by the San Francisco Estuary Partnership. The project is implementing pesticide pollution prevention through engaging residential pesticide users to use less toxic products. Part of the project involves doing so through the *Our Water, Our World* program using the IPM Advocates, the former managed and the latter qualified by BASMAA. (see Greener Pesticides for Cleaner Waterways for more details).

ATTACHMENTS

C.7.b. Advertising Campaign

Be the Street FY 2012-2013 Summary. Revised Report including SCVURPPP and ACCWP Program Staff Comments

Be the Street FY 2012-2013 Summary

Be the Street Facebook Page

The Be the Street Facebook page (https://www.facebook.com/BetheSt) was maintained throughout the year to engage the target audience, Bay Area youth ages 14-24 years old, with interesting content and event photos. The focus was on clean streets and community ownership as a social norm. The page allows fans to connect with Be the Street, get the latest program updates such as the PSA video contest news and winners announcement, share thoughts and photos and ask questions. Other outreach components such as the Be the Street website (www.BetheStreet.org), YouTube channel (http://www.youtube.com/bethestreet) and Instagram account (http://instagram.com/bethestreet) are linked on the page. The following are Facebook statistics from the year:

- 268 published posts;
- 1,062 new fans, resulting in a total of 1,468 fans;
- 2,048 total interactions (includes likes, comments, shares and responses to poll questions); and
- 115,513 total post views.

In addition, this year we created and integrated a customized Be the Street Instagram app (https://www.facebook.com/BetheSt/app_148296625321468) on the Facebook page to highlight our Be the Street Instagram account feed. It allows fans to easily connect with this additional social media channel. As well, fans can easily see and engage with a gallery of Be the Street photos.

eNewsletter

While we had originally planned on creating a quarterly eNewsletter, our analysis indicated that the readership of the eNewsletter was much lower than our interaction rates on social media outlets. This led to the discontinuation of this tactic in favor augmenting both the social media and video contest components

1. 2 eNewsletters released
2. 23% open rate
3. 13% click through rate

Be the Street YouTube Channel

The Be the Street YouTube channel (http://www.youtube.com/bethestreet) was maintained throughout the year to present clean street and pollution prevention related videos online. The channel hosted the PSA video entries, promotional videos and award show. The Be the Street YouTube channel allows for a positive visual association with the program and attracts new interest. Similar to other social media

channels, it offers an opportunity for viewers to comment or give feedback. It also offers quick access to links to easily share and embed these videos. Other outreach components such as the Be the Street website (www.BetheStreet.org), Facebook page (https://www.facebook.com/BetheSt) and Instagram account (http://instagram.com/bethestreet) are linked on the channel. The following are YouTube statistics from the year:

- 54 videos uploaded;
- 16 subscribers;
- 21 total interactions (includes likes/dislikes, comments and shares); and
- 15,506 video views.

Be the Street Instagram Account

The Be the Street Instagram account (http://instagram.com/bethestreet) was created and launched in November 2012 to build awareness and engagement with Bay Area youth ages 14-24 years old through photos. The value of this social media channel is that it combines mobile and photo sharing. The Instagram account allows Bay Area youth to follow the program's photos, comment on photos, like photos, tag themselves and tag the program @BetheStreet/#BetheStreet in their own photos. The photos tell the story of how the program and youth are inspiring others to take pride in clean streets and community ownership. It includes a link to the Be the Street Facebook page (https://www.facebook.com/BetheSt). The following are Instagram statistics from the year:

- 68 posted photos;
- 67 followers; and
- 729 total interactions (likes, comments and #BetheSteet).

Website

The Be the Street website (www.bethestreet.org) usage statistics are reported below. It should be noted that mobile visitors are underreported below as they are difficult for Google Analytics to accurately track right now. We hope that this issue is solved soon but we are unable to compensate for this tracking inadequacy for the time being.

1. Total Visits: 15,431
2. Unique Visitors: 10,040
3. Visit Duration: 2:19. We should highlight that this is a tremendously high average duration number. This has everything to do with our content rich work stemming from the video contest.

4. Page Views: 37,135

5. *Popup click through results: 39 (ran from 5/1/13-6/30/13 where Unique Visitors during that period were 3,171. This resulted in a 1.2% conversion.)

Video Contest

As its major effort of the Fiscal year, Be the Street conducted a video contest asking participants to submit their best anti-litter video. The contest was designed not only to render a crowd-sourced video advertisement which Be the Street subsequently put use to, but also to drive traffic to various Be the Street outlets (most notably the website and social media). As a whole, the video contest was a tremendous success, yielding dozens of local entries and exponentially increasing our traffic across the targeted outlets. Additionally, we allowed for voting and commenting on videos on our website. Finally, we conducted a live streaming online awards show to act as a lightning rod moment; something to get our audience in one place at one time.

1. 283 organizations reached out to
2. 52 video entries received
3. 4,844 votes cast (every IP address was only allowed to vote once to ensure real voters)
4. 593 unique views of the 25 minute Awards Show. This number represents more than 530 views as many people presumably watched the show in groups
5. 359 user comments on videos
6. While we are unable to track the exact number here, since each video was given a dedicated profile page on the website, we were able to track at least fourteen instances of filmmakers promoting their own page through their own social media channels.
7. More than fifteen users live commenting during our awards show

Ads

With our winning video, Be the Street launched a regional ad buy using Pandora, YouTube, Google, Facebook, and KTVU.

1. 3.82% click through rate on Pandora ad (against industry standard of 1.2)
2. Approximately 6.5 million impressions from target demographic of 14-24 year olds in the Bay Area
3. $7,800 in pro-bono donations gained with more coming in FY 13-14 based on media outlets' availability

C.7.b. Advertising Campaign
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Revised Report including SCVURPPP and ACCWP Program Staff Comments

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7. More than fifteen users live commenting during our awards show

Media Advertising

With our winning video, Be the Street launched a regional ad buy using Pandora, Facebook, and KTVU, resulting in approximately 6.5 million impressions from target demographic of 14-24 year olds in the Bay Area. Below is a summary of media advertising:

1. TV advertising on KTVU Fox - The winning video ran 12 times in June and July 2013, and received 35,000 impressions in the 12-24 years age group. The video also ran on KTVU online 273 times.

2. Facebook ads - Advertisements promoting the Be the Street Facebook page were placed in August 2012, September 2012, March 2013, May 2013, and June 2013. Overall, the advertisements received 5,733,573 impressions and 2,173 click-throughs . The ads also resulted in 917 additional likes on the Be the Street Facebook page.

3. Pandora The placement of the winning video on Pandora resulted in 371,919 impressions and 13,143 "click-throughs". The 3.82% click through rate on Pandora ad on is significantly above the industry standard of 1.2%.

The media buys also resulted in $7,800 in pro-bono donations gained with more coming in FY 13-14 based on media outlets' availability

Be the Street Outreach Events

Permittees conducted the following community outreach events to promote the BE the Street Campaign to Bay Area youth:

Alameda Countywide Clean Water Program:

- First Friday at Uptown, Oakland, October 5, 2012
- Hayward High School Football Game, Hayward, October 19, 2012
- Creatures of Impulse - Teen Improv Troupe Show, Pleasanton, October 26, 2012
- Alameda County Clean Water Program Earth Day Event, Alameda County

Santa Clara Valley Urban Runoff Pollution Prevention Program:

- Twilight Opening AMC 16 Vallco Shopping Mall, Cupertino, November 15, 2012
- Twilight Century Cinemas 16, Mountain View, November 15, 2012
- Christmas in the Park, San Jose, December 8, 2012
- Mission College Eco Fair, Santa Clara, April 18, 2013

San Mateo Countywide Water Pollution Prevention Program:

- Jefferson High School's Environmental Club, Daly City March 2013
- Belmont Earth Day, Belmont, April 20, 2013
- Skyline College's Green Fair, San Bruno, April 24, 2013
- Portola Valley Earth Fair, Portola Valley, April 27, 2013
- San Mateo BE the Street TPumps Event, San Mateo
- San Mateo County Fair, San Mateo, June 8, 2013
- San Mateo County Fair, San Mateo, June 12, 2013
- East Palo Alto Anniversary, East Palo Alto, June 29, 2013

ATTACHMENT

C.7.c. Media Relations – Use of Free Media

BASMAA Media Relations Campaign Final Report

BASMAA
Media Relations Campaign
Final Report FY 2012-2013

Submitted by O'Rorke Inc
June 26, 2013

During the fiscal year 2012-2013, O'Rorke Inc. continued to serve as BASMAA's media relations contractor.

Early in the year, O'Rorke worked directly with project manager Sharon Gosselin and the BASMAA PIP committee to brainstorm pitch topics. As a result, O'Rorke developed and implemented an annual workplan that included seven planned pitches, including press releases, radio and online public service announcements, and/or Editorial Letters on key stormwater issues (addressed below), ; on-call time for monitoring of breaking news opportunities; the creation of a photo library; and localized templates of many of the press releases developed for the regional campaign as a way to assist local programs with their own media efforts.

In FY 2012-13 seven pitches were done that resulted in fifty total media placements (stories and PSAs). The report that follows gives a synopsis of each pitch and the number and type of placements each garnered. A coverage report for the year is attached.

Exterior Spraying
O'Rorke used a two-pronged approach for this pitch: we used radio PSAs and a press release announcing the new regulations. A local press release was also developed. O'Rorke coordinated with the California Department of Pesticide Regulation on the copy/materials and pitch timing. The effort was successful: PSAs aired on two stations; Geoff Brosseau was interviewed by KBLX-FM; and SFGate.com, the San Jose Mercury News, the Marin Independent Journal and San Carlos Patch all ran stories.

IPM Advocates
O'Rorke worked with the IPM committee to issue a press release regarding new trained advocates in stores. Promoted as a boon to consumers, this pitch did well with stories running on both Rockridge and Piedmont Patch. A local release was also developed. KATD, A Spanish language radio station, interviewed Riccardo Barajas of San Jose and copy from the release was carried in PSA format by KCBS and KDIA.

Holiday Pitch

O'Rorke wrote a press release dealing with various holiday water pollution prevention issues, including not burning gift wrap and setting out tress for post-Christmas recycling sans flocking. A local release was also developed.

This pitch took off with the help of photos and was carried by twelve Bay Area Patch.com sites, SFGate.com, Claycord.com, KMKY (Radio Disney), KOIT, KBLX, KFOX and news powerhouse, KCBS.

Bag Ban
This pitch focused on new and recent bag bans in cities around the region, including San Francisco's upgrade to including more stores in its ban. The pitch featured a press release and courtesy photos. A local release was also developed.

Information ran on KBAY, KCBS and on eight Bay Area Patch.com sites.

Be the Street
Coordinating with SGA, O'Rorke pitched the online awards ceremony and looked at potentially promoting Bay Area contest award winners. O'Rokre developed a media advisory for the online awards and made pitch calls to all major Bay Area media; a lack of local award winners curbed interest. No coverage was secured.

Car Washing PSAs
These PSAs encouraged use of car washes as a way to prevention stormwater pollution. O'Rorke also developed a press release for use by local programs.

The PSAs were aired by eleven radio stations, including the immensely popular KLLC, KCBS and KITS.

Green Streets
This pitch was focused on reaching out to select media—architecture, urban planning and some environmental reporters. No press release was issued, but a detailed pitch letter was sent along with photos highlighting Green Streets as an emerging trend in the Bay Area.

As of this writing, no coverage had been secured yet. But O'Rorke plans additional follow-up for July.

Recommendations for FY 2013-2014

- Continue to look to new local/regional studies as a jumping off point for pitching. The Green Streets report, due in September, represents an excellent opportunity.

- Continue to pitch FM radio stations and seek out public affairs coverage via PSAs or direct pitches. Public affairs directors have been receptive to BASMAA messages.

- Continue to pitch Patch sites; these were an important source of coverage in FY 13-14.

- Utilize BayWise.org in pitches as a resource; have homepage and content updated as needed to keep site relevant to media relations efforts.

- Pitch the upcoming Our Water, Our World/IPM app and new look; together these happenings could be a major pitch for FY 13-14.

ATTACHMENTS

C.9.h.i. Point of Purchase Outreach

Photos of *Our Water, Our World* displays at major chains

Photos of training at major chains

Copies of *Our Water, Our World* advertisements

IPM Advocates for Retail Stores Final Report

Got Bugs? Get Answers!
Choose less toxic products for a healthy home and garden
visit www.ourwaterourworld.org
our water our world
Look for this symbol before you buy
AMEND GARDEN SOIL
PATIO Plus
CAN CRUSHER
$9.96

Answers to your

Avoid Pesticides to Help Protect the Bay

Wondering how to prevent pesky insects without using toxic chemicals?

Most consumers are willing to try less-toxic option for managing household and garden pests. They just need to know that alternatives do exist, and which ones they should use.

Look for this tag before you buy

Fortunately, help is available. In the Bay Area more than 170 local nurseries and hardware stores have partnered with local government to help educate consumers about less-toxic options. These retailers place tags on store shelves in front of less-toxic products, and carry fact sheets with tried and true ways to control common household and garden pests.

Visit www.OurWaterOurWorld.org to find out:

- which insects actually benefit your garden
- how to cultivate a lawn that deters weeds and other pests
- which less-toxic products can replace conventional pesticides
- how to dispose of leftover pesticides safely so they won't end up in our creeks, Bay, and Ocean
- what questions to ask before hiring a pest control company

You can even submit a question about your pest problem, and get a free personalized online response in less than 24 hours!

www.OurWaterOurWorld.org

2013

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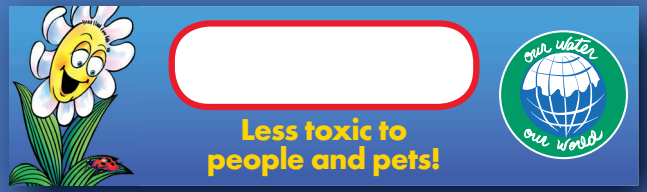
Everything we ♥ about the San Francisco Bay Area & Santa Cruz

Sustainable Local Coupons

Healthy Gardening for People, Pets, and Our Environment!

Choose less toxic products for a healthy home and garden

Look for this tag before you buy



www.OurWaterOurWorld.org

Brought to you by Bay Area Water Pollution Prevention Agencies

Leaves of three: The rash success of poison oak

Poison oak is one native plant people love to hate. But it does have a good side, feeding birds and other wildlife. For people, the best thing is to learn to recognize it, and step aside.

Current Issue

Jul-Sep 2013

Bay Nature joins this year's celebration of "The Year of the Bay" with the publication of "Baylands Reborn: Restoration and Renewal on San Francisco Bay." We also head to Butano State Park, take a close look at poison oak, and more!

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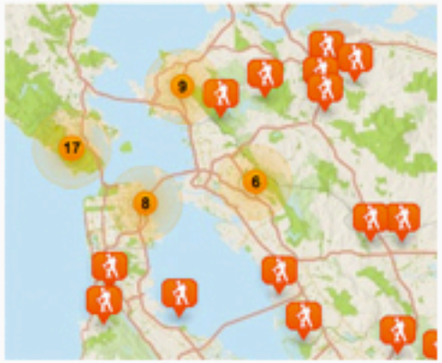
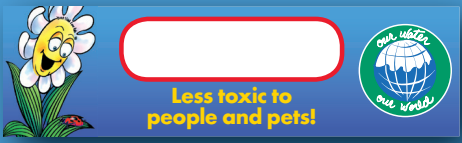


Let the Trailfinder be your guide. Over 420 local parks, 320 trails!
Explore the Trailfinder now.

Advertise with BayNature

Choose less toxic products for a healthy home and garden!

Look for this tag before you buy



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IPM Advocates for Retail Stores

DPR Grant No. 10–PML–G001

Written by
Annie Joseph, Ann Joseph Consulting
for
Geoff Brosseau, Principal Investigator

May 8, 2013

Bay Area Stormwater Management Agencies Association
Our Water Our World
UC Statewide IPM Program

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Funding for this project has been provided in full or in part through a grant awarded by the Department of Pesticide Regulation (DPR). The contents of this document do not necessarily reflect the views and policies of DPR, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

A note about use of the term *less-toxic pesticide*: Throughout this document, we define less-toxic pesticides as those that don't pollute waterways and minimize exposure to people, pets, or wildlife. Occasionally, we substitute the terms *environmentally friendly* and *green*. Whenever possible, IPM Advocates emphasize cultural and mechanical solutions to pest problems instead of chemical ones—for example, promoting the use of traps and tools.

IPM Advocates for Retail Stores

INTRODUCTION

Large retail stores and independent garden centers sell an assortment of less-toxic pesticides, traps, and tools. Despite a growing number of consumers interested in purchasing these products, store employees frequently direct consumers toward aerosol sprays, foggers, do-it-yourself perimeter sprays, and combination pesticide–fertilizers for lawns. Consumers purchase these, often using them without reading label directions, and risk exposure to excessive amounts of pesticides. Many of the products contain pyrethroids, which can run off into storm drains and contaminate surface water.

Since 1997, the successful Our Water, Our World program (OWOW)—an outreach arm of the Bay Area Stormwater Management Agencies Association (BASMAA)—has involved over 200 retail nurseries and garden centers in Northern California in programs that educate store employees and consumers about less-toxic management practices. By 2003, OWOW program consultant Annie Joseph was working with stores single-handedly, traveling to different locations daily to conduct employee-training workshops, hold tabling events for customers, and design endcap displays featuring environmentally friendly products. At the same time, more and more stores were requesting OWOW services.

Meanwhile, the UC Integrated Pest Management Program (UC IPM) was developing educational materials and online training for store employees, and lending touch-screen kiosks to cooperating retailers.

In assessing the situation, it was determined that a corps of "IPM Advocates" would help expand these components and respond to stores' needs for assistance with inventory selection, marketing, and employee training. To fill this need, this Pest Management Alliance project combined OWOW's retail expertise with UC IPM's wealth of technical information and resources to complement this collaborative outreach and training program.

The goal of the project was to improve delivery of IPM information at retail stores through education of employees and customers. In addressing this goal, this project helped address two fundamental issues: (1) environmental and health problems resulting from improper or overuse of pesticides sold to consumers and (2) the lack of knowledge by retailers and customers of safe IPM alternatives that reduce or avoid these problems.

Project investigators developed an IPM Advocate profile, wrote a curriculum, identified trainees, conducted the Advocate training and certificate program, and created a mentoring program. All ten IPM Advocates successfully completed the program and spent over a year assisting 30 stores with inventory selection, built over 60 in-store displays, trained 321 employees at 31 workshops, and reached out to over 2,000 customers through 60 tabling events. All ten Advocates continue to work with stores, subsidized by local government pollution prevention programs.

As a result of this project, 23 of 30 (77%) store managers surveyed reported greater sales of less-toxic products from 2011 to 2012, even with a depressed economy. Over 96% of the managers say their employees now have more confidence when identifying pest problems. More than 70% of the stores increased their shelf space for less-toxic products in 2012. The store managers directly attribute these changes to the impact of the IPM Advocate Program.

SCOPE OF WORK

OBJECTIVE 1. Develop a profile of what trainees should know to qualify as IPM Advocates (learning objectives)

TASK 1.1. Information needed for Advocates. Identify the key information and skills the IPM Advocates need to know when delivering IPM information to retailers. This information will serve as the learning objectives for the IPM Advocate training program. Discuss at initial meeting (Task 10.1).

The Management Team held its initial meeting on December 16, 2010 to develop learning objectives for the IPM Advocates, how to recruit candidates, and discuss logistical issues.

TASK 1.2. Survey. Carry out a survey of 30 Bay Area and Sacramento retail nursery and garden center stores about enlisting an IPM Advocate for their store. If Advocate services were available, what should that person know and how could they help? Tabulate and summarize survey responses.

PRELIMINARY STORE SURVEY

From December 17, 2010 to January 30, 2011, Annie Joseph surveyed 30 owners, managers, and product buyers of retail stores in the Bay Area and Sacramento about services an IPM Advocate should offer. She then summarized and discussed the results with the Management Team (**Table 1**).

Stores surveyed included: Alden Lane Nursery; Almaden Valley Nursery; Capital Nursery, Sacramento; Emigh Hardware, Carmichael; Green Acres Nursery, Sacramento; Orchard Supply Hardware's Corporate Office; Golden Nursery, San Mateo; Westbrae Nursery, Berkeley; Grand Lake Ace Hardware, Oakland; Yamagami's Nursery, Cupertino; SummerWinds Nursery, Cupertino; Orchard Nursery, Lafayette; Prickett's Nursery, Santa Rosa; Friedman's Home Improvement, Santa Rosa; Fairfax Lumber, Fairfax; Goodman Ace Nursery, Mill Valley; Sloat Garden Center's Corporate Office; Van Winden's Garden Center, Napa; Wegman's Nursery, Redwood City; Regan Nursery, Fremont; Evergreen Nursery, San Leandro; Navlet's Garden Centers, Concord; SummerWinds Nursery's Corporate Office; Palo Alto Ace Hardware, Palo Alto; Bill's Ace Hardware, Martinez; Flowercraft Garden Center, San Francisco; East Bay Nursery, Berkeley; Davis Ace Hardware, Davis; Bayside Gardens, Tiburon.

Table 1. Store survey: what should IPM Advocates know and how can they help stores?[*]

	If Advocate services were available, what should Advocates know?
76%	Know about local insect pests, diseases, beneficial insects, and how to identify these. Advocates should present this information on a seasonal basis or when pests appear.
73%	Have a background gardening, farming, landscaping, or working in a nursery.
63%	Have good communication skills so they can relate to employees and customers.
57%	Have retail experience or know how to handle themselves in a retail setting.
50%	Understand principles of IPM.
	If Advocate services were available, how could Advocates help your store?
97%	Conduct employee training on a yearly basis so employees keep current on invasive pests and plants and less-toxic ways to manage them. Advocates should have excellent public speaking skills so they can easily engage and inspire employees and customers.
73%	Inform buyers about new products coming to the market.
73%	Hold outreach events at their stores highlighting IPM practices, including use of beneficial insects, companion planting, insect pest and disease identification for customers. Share resources.
67%	Provide stores with marketing and display ideas and help build displays.
47%	Replenish shelf talkers and keep literature racks well stocked.
47%	Serve as a conduit for additional resources not found in stores.
37%	Gain familiarity with most of the staff, their positions, which less-toxic products their store carries, and how these can be recommended.

[*] *Survey of store owners, managers, and product buyers, n = 30.*

ADDITIONAL MISCELLANEOUS REQUESTS

Store owners, managers, and product buyers advised that Advocates should not be pushy. Advocates should know about pesticide regulations, which products might be going off the market, and less-toxic replacements. The following include other suggestions: be a good listener and willing to learn from us, be respectful of our knowledge base, know your audience, and don't talk over our heads. Know about the damage that pesticides can do to beneficial insects and wildlife, whether toxic or less toxic. Be able to tell us limitations of certain less-toxic pesticides, be able to think on your feet, know the effects of pesticides on pets and humans, know that changing to more environmentally friendly practices is a process that will take time. Be enthusiastic and passionate about your program—it will draw others to you. Don't be afraid to make suggestions even if you get rejected. Look at this from a business perspective—we're in the business of making money and this needs to be profitable partnership for us.

TASK 1.3. Learning objectives meeting. Assemble a group of Alliance partners, including representatives of stores, California Association of Nurseries and Garden Centers (CANGC), and product distributors to develop learning objectives. The survey responses, along with discussion at the initial meeting, data from a recent survey of stores by UC IPM, and past experience of Alliance members will form the starting point for this discussion.

On February 7 and 28, 2011, the Management Team met to develop learning objectives using the profiles proposed by the stores (**Appendix 1**). Attending this meeting were Geoff Brosseau, BASMAA; Annie Joseph, OWOW; Mary Lou Flint and Karey Windbiel-Rojas, UC IPM; Gina Purin, Marin County Stormwater Pollution Prevention Program; Nita Davidson, DPR; Chris Zanobini, CANGC; and Alan Borem, Central Garden & Pet, whose company distributes products to stores.

The learning objectives included detailed sessions on IPM, emphasizing hands-on activities with pests, diagnostics, tools and products, actual pesticide packages, and practice using the UC IPM web retail portal site. Another portion included information about specific categories of pesticides—insecticides, fungicides, herbicides, and rodenticides—and their target pests. Alternatives to pesticides were emphasized: physical or mechanical tools available in stores such as traps, barriers, and mulches. The classes would also cover cultural practices, resistant cultivars, pest-resistant plants, and biological control.

The learning objectives also included a component on communication with a practice presentation and role-playing exercises. The Advocates would need to know how to communicate with different store employees and customers, deal with conflict, and train store employees. Within the store, employees would need to know how to set up displays and understand how stores conduct business. They would also learn how to incorporate seasonal pests, new pests, and new products into a changing marketing program.

OBJECTIVE 2. Develop a training curriculum and certificate exam.

TASK 2.1. Curriculum development. Incorporate the learning objectives into a lesson plan and training curriculum.

TASK 2.2. Review of curriculum. Review the draft curriculum, involving team members and Alliance partners before finalization.

From April through June, 2011, Mary Lou Flint, Karey Windbiel-Rojas, Annie Joseph, Nita Davidson, and Gina Purin developed the curriculum and exams and submitted them to a review by Alliance partners. See Task 4.2 for a summary of the lesson plan and **Appendix 2** for the detailed training curriculum.

TASK 2.3. Exit exam development. Develop an exit exam for the course (to earn certification) based on the learning objectives and content.

See **Appendix 3** for the exit exam.

OBJECTIVE 3. Recruit, interview, and identify up to ten IPM Advocate trainees.

TASK 3.1. Carry out a selective recruitment process through active, targeted advertisement to find individuals who are well suited to the IPM Advocate job.

TASK 3.2. Review candidate applications and curriculum vitæ.

We actively recruited IPM Advocate candidates to interview through local retail nurseries and hardware stores, pesticide distributors, CANGC, UC Master Gardeners, the Northern California Spring Trade Show, California Landscape Contractors Association, Bay Friendly Landscapers, and through public agencies that participate in the Our Water, Our World program. Annie Joseph, Nita Davidson, Mary Lou Flint, Karey Windbiel-Rojas, and Gina Purin reviewed 27 applications and chose 20 people to interview in Sacramento, Martinez, and San Rafael. Annie, Karey, and Nita interviewed candidates on March 28–29 at Cal/EPA Headquarters, Sacramento; April 4 and 7 at Contra Costa County Public Works Department, Martinez; and April 11 and 15 at Marin County Civic Center, San Rafael.

See **Appendix 4** for interview questions posed to the applicants.

We chose 11 Advocate trainees for the program, all residing in Northern California: Suzanne Bontempo, San Francisco; Lisa Graves, El Cerrito; Steve Griffin, Brentwood; Teresa Lavell, Fairfield; Daniel Levy, Sebastopol; David Perkins, San Francisco; Anne Rogers, Sausalito; David Rosen, Woodland; Maris Sidenstecker, Seaside; Debi Tidd, Walnut Creek; and Steve Zien, Citrus Heights. David Rosen attended two classes, but had to leave the program for health reasons.

OBJECTIVE 4. Conduct a training program for up to ten IPM Advocate trainees. Trainees who successfully complete the curriculum and pass an exit exam will receive a joint certificate from UC IPM and BASMAA and will be designated IPM Advocates.

TASK 4.1. Conduct at least seven hands-on, interactive classes for candidates.

TASK 4.2. Assign homework and provide a library of resources to use during training and in future work as IPM Advocates.

Ten Advocate trainees participated in a 7-week training course during June and July, 2011. Formal training took place at weekly 3-hour classes in Oakland that featured lectures from Mary Lou Flint and Karey Windbiel-Rojas of University of California, Nita Davidson of DPR, and Annie Joseph of OWOW, and industry experts as well as hands-on activities and student presentations. Participants were expected to spend at least an additional 3 hours each week completing reading assignments and homework. Each participant was given a binder and additional resources that included books, Quick Tip cards, flyers, and web site references.

See **Appendix 2** for the lesson plan and training curriculum, homework assignments, and the library of resources.

The following is a summary of the classes:

WEEK 1, June 6. Overview of IPM Advocates training program and resources

Overview of IPM Advocate Program; introduction of trainees; review of class outline, books, and other resources; what is IPM?; introduction to pests, the importance of pest identification, pest detection, prevention, cultural or good gardening practices, biological control, mechanical and physical control, and pesticides; learning to use the UC IPM Retail Portal, UC IPM web site, OWOW web site, and other online resources to get pest information and solve problems.

WEEK 2, June 13. Introduction to pesticides and pest identification

What are pesticides—the different types, their environmental and health concerns, secondary pest outbreak, pesticide resistance, how pesticides get into water and how people are exposed, how to read a label including signal words; introduction to less-toxic pesticides; introduction to identification of arthropods and plant diseases

WEEK 3, June 20. Managing insects, mites, spiders, mollusks, and plant pathogens

Introduction to insect and disease pests and abiotic disorders of plants; pest identification practicum; indoor and nuisance arthropod pests and their management; management tools for arthropods, mollusks, and plant pathogens

WEEK 4, June 27. Managing weeds and vertebrate pests
Types of weeds and management practices and tools; designing weeds out of landscapes with mulches; resources for weed identification; vertebrate pests

WEEK 5, July 11. Communication: Working with stores, fostering teamwork, avoiding conflict, training store employees
Developing relationships with different types of stores, effective communication with store employees and team building, helping employees with customer expectations about products, tailoring an educational program to the customers and employees of each store based on the store's product mix, how to identify the less-toxic products each store carries, training methods used at the store level, and dealing with conflict

WEEK 6, July 18. Displays and Marketing: Understanding the business end of retail stores
Defining the retail store model and each Advocate's place in that setting; understanding pesticide manufacturers and suppliers, how to display information and products, improving exposure of less-toxic products

WEEK 7, July 25. Presentations, wrap-up, and mentoring (Figure 1)
Presentations by Advocates on observations in the field regarding displays; what will happen next with the mentoring component of this program; store assignments, expectations, duration; take-home exam distributed

TASK 4.3. Give exit exam based on curriculum.

After Week 7, Advocates were given a take-home exam covering class material, resources, and learning objectives (see **Appendix 3**). Questions were short answer or essay style and examinees were expected to use provided resources to research the answers. All ten Advocates passed the exam with grades above 84%. This allowed them to transition to internships, during which they were mentored in stores. Full certification was not awarded until the 11-month mentoring portion was completed and recognized by a graduation on June 1, 2012.

Figure 1. The ten IPM Advocates after their seventh class, July 2011.

OBJECTIVE 5. Develop and implement IPM Advocate coordination and mentoring program by identifying needs of individual stores and matching IPM Advocates to those stores. Mentor IPM Advocates as they work with stores.

TASK 5.1. Identify 20–30 stores in Sacramento and the Bay Area interested in working with Advocates.

Annie met with store managers of 40 stores in the Bay Area and Sacramento to see if they were interested in working with an Advocate and identified 30 stores in 12 counties (**Table 2**).

Table 2. Stores interested in working with IPM Advocates.

Alameda County	1. Orchard Supply Hardware, Berkeley; 2. Orchard Supply Hardware, Dublin; 3. Westbrae Nursery, Berkeley
Contra Costa County	4. Annie's Annuals, Richmond; 5. Bill's Ace, Martinez; 6. Navlet's Garden Centers, Concord; 7. Orchard Nursery, Lafayette; 8. Urban Farmer, Richmond
Marin County	9. Orchard Supply Hardware, San Rafael; 10. Pini Hardware, Novato; 11. Sloat Garden Center, Blithedale Ave., Mill Valley
Monterey County	12. Home Depot, Seaside; 13. Orchard Supply Hardware, Sand City
Napa County	14. Van Winden's Garden Center, Napa
Sacramento County	15. Capital Nursery, Citrus Heights; 16. Capital Nursery, Sacramento; 17. Emigh Ace Hardware, Sacramento; 18. Orchard Supply Hardware, Antelope
San Francisco County	19. Cole Hardware, San Francisco; 20. Flowercraft Garden Center, San Francisco
San Mateo County	21. Home Depot, Colma; 22. Orchard Supply Hardware, South San Francisco
Santa Clara County	23. Orchard Supply Hardware, Mountain View; 24. SummerWinds Nursery, Campbell; 25. Yamagami's Nursery, Cupertino
Santa Cruz County	26. Orchard Supply Hardware, Capitola
Solano County	27. Home Depot, Vallejo; 28. Orchard Supply Hardware, Fairfield
Sonoma County	29. Friedman's Home Improvement, Santa Rosa; 30. Prickett's Nursery, Santa Rosa

TASK 5.2. Match each IPM Advocate with two to three stores introducing each Advocate to store managers and key employees, and discuss expectations as well as specific concerns.

Table 3. Store assignments.

Anne Rogers: Sloat Gardens, Mill Valley; Orchard Supply Hardware (OSH), San Rafael; Cole Hardware, San Francisco
Daniel Levy: Friedman's Home Improvement, Santa Rosa; Prickett's Nursery, Santa Rosa; Pini Hardware, Novato
David Perkins: SummerWinds Nursery, Campbell; Yamagami's Nursery, Cupertino; OSH, Mountain View
Debi Tidd: Orchard Nursery, Lafayette; Westbrae Nursery, Berkeley
Lisa Graves: Urban Farmer Store, Richmond; Annie's Annuals, Richmond; OSH, Berkeley
Maris Sidenstecker: OSH, Sand City; Home Depot, Seaside; OSH Capitola
Steven Griffin: Navlet's Garden Centers, Concord; OSH, Dublin; Ace, Martinez
Steve Zien: Capital Nursery, Citrus Heights and Sacramento; OSH, Antelope; Emigh Hardware, Sacramento
Suzanne Bontempo: Flowercraft Nursery, San Francisco; Home Depot, Daly City; OSH, South San Francisco
Teresa Lavell: Home Depot, Vallejo; OSH, Fairfield; Van Winden's Garden Center, Napa

ADVOCATES IN STORES: INTRODUCTION TO THE RETAIL LIFE

In August 2011, Annie Joseph matched Advocates to two or three stores and introduced them to store managers and key employees (**Table 3**). The Advocates discussed goals, expectations, and concerns with store managers, including ideas for endcaps, training employees, displaying materials, incorporating online training from UC IPM, bringing in IPM kiosks, and setting up regional training in Oakland by UC IPM.

Annie Joseph coordinated schedules and staff and Advocates contacted before visits. Annie worked one on one with the Advocates, teaching them how to conduct training sessions and assemble displays.

The following is a log of Advocate activities during the first months of their mentorship. It highlights how Advocates became acquainted with their stores and the progress they made.

2011

August 8. Anne Rogers met Sloat Garden Center's buyer Scott Peterson for an annual review of products to add and delete in their ten stores. This was an opportunity for Anne to see how a regional chain store operates. She realized that her participation influenced product selection for the coming year; this affected ten stores in three counties and more than 70,000 consumers.

August 11. David Perkins met José, the store manager of SummerWinds Nursery, Campbell and key staff. He also met Aaron, the manager and key staff of OSH, Mountain View, and product buyer Amy Root of Yamagami's Nursery, Cupertino (see Figure 6). At Yamagami's, David placed literature racks in more visible areas. He experienced a store that's a member of a small regional chain store, SummerWinds Nursery; a large regional chain, Orchard Supply Hardware; and an independent nursery, Yamagami's Nursery.

August 15. Steve Griffin met Navlet's Garden Centers, Concord manager and key staff, distributor representative Wayne Booth, plant buyer George Wharton, and built a small display of mosquito dunks at the register. This was an opportunity for Steve to see how a small regional store chain such as Navlet's works. He met the plant buyer, a pesticide distributor representative, and asked for shelf space, which resulted in the mosquito dunks being placed in a high-traffic area.

September 2. Debi Tidd met Orchard Nursery, Lafayette managers and staff, and Westbrae Nursery staff in Berkeley. These are both independent nurseries that Debi will work with over the next year.

September 8. Steve Zien met Capital Nursery, Sunrise manager Mike; Capital Nursery, Sacramento manager Seth, and OSH, Antelope manager Ed. Steve's stores combined a small regional chain, Capital Nursery, and a large regional chain, OSH. At OSH, Antelope, Steve met the district manager, store manager, and the pesticide distributor representative from a nursery distributor, the Commerce Corporation. This gave Steve a chance to discuss building endcaps (see Figure 5).

September 9. Daniel Levy met David and Denise at Prickett's Nursery, Santa Rosa; Ed Casey at Friedman's Home Improvement, Santa Rosa; and Jim Stark at Pini Hardware, Novato. Daniel discussed training opportunities and the UC IPM Kiosk display opportunities.

September 12. Anne Rogers met Bill Selk at OSH, San Rafael and discussed moving the literature rack to an area with more traffic.

September 13. Anne Rogers met Molly, the manager at Sloat Garden Center, Blithedale Ave., Mill Valley and discussed training and displays.

September 14. Teresa Lavell met Van Winden's Garden Center, Napa and OSH, Fairfield managers and staff. This was an opportunity for Teresa to see how three different business models worked—an independent nursery, Van Winden's; a regional chain, OSH; and a large chain, Home Depot.

September 15. Lisa Graves met managers and key staff at OSH, Berkeley and Annie's Annuals, Richmond. (She started working at the Urban Farmer store in October.) Lisa worked with a small independent store, Annie's Annuals; a small regional chain, Urban Farmer; and a large regional chain, OSH.

September 16. Suzanne Bontempo met department manager Wendy and assistant manager Mo at OSH, South San Francisco. Later that day she met Tito at Home Depot, Colma, and Hazel, manager at Flowercraft Garden Center in San Francisco. Suzanne worked with the small independent Flowercraft, large regional chain OSH, and large chain, Home Depot.

September 28. Daniel attached shelf talker labels (**Figure 2**) at Friedman's Home Improvement, Santa Rosa with Annie Joseph.

September 29. Suzanne accompanied Annie to the San Francisco Public Utilities Commission office to get supplies and meet Meg Gale. She also met Tim Swillinger from San Mateo County Environmental Health when retrieving supplies for OSH and Home Depot.

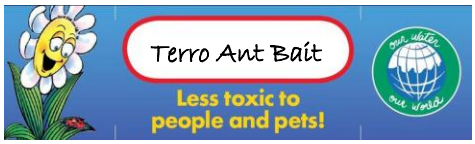

Figure 2. Shelf talker label.

TASK 5.3. Encourage regular communication between IPM Advocate and consultant [Annie Joseph] to discuss the Advocates' progress with each store and address issues that come up.

TASK 5.4. Stay in contact with store managers to get feedback about the program.

ADVOCATES IN STORES: OFFERING TRAINING WORKSHOPS, BUILDING DISPLAYS, AND GETTING FEEDBACK

Annie Joseph helped conduct training workshops and create displays with Advocates.

2011

October 7. Annie introduced Steve Griffin to Judy Macaluso at OSH, Dublin. They discussed outreach, training, and display ideas. Annie showed Steve how OSH shelf talkers are attached to shelves. They also discussed building an endcap for dormant sprays and how Steve could work with Judy, the store manager, to place orders for the products. Steve met Ace, Martinez manager Tom and they discussed an endcap display idea for fall and winter pests. Steve met Lisa, who's in charge of the endcap areas. They also refreshed shelf talkers and fact sheets.

October 12. Annie and Maris met the garden manager of Home Depot, secured the literature rack, displayed shelf talkers, and discussed training for October 26. They also met with the OSH, Sand City manager and attached shelf talkers and filled literature racks. They discussed outreach, potential training dates, and got feedback on Maris's progress.

October 18. Annie talked to the manager at Urban Farmer and worked out a date for Lisa to meet with staff.

October 20. Steve Zien and Annie met with Randy from Emigh Hardware. They discussed a training date for January, outreach for customers, and display ideas.

October 25. Lisa Graves met with Urban Farmer manager Kim and assistant manager Tom in Richmond and discussed display ideas and future training dates, probably in spring.

October 25. Annie and Geoff Brosseau met with OSH's Corporate Office in San José to discuss the IPM Advocate Program in OSH stores.

November 1. Anne and Annie met with Rick Cunningham at Cole Hardware in San Francisco to introduce Anne and schedule training and outreach. Later that day, Annie, Teresa Lavell, and Jennifer Kaiser met at Home Depot, Vallejo to discuss future partnership, put up shelf talkers, and meet staff.

2012

January 3–6. Annie worked with Daniel Levy and Gina Purin on a rat and mouse flier for stores in Marin and Sonoma counties.

January 6. Annie visited stores in Contra Costa and Alameda counties: Westbrae Nursery; Navlet's Garden Centers, Concord; Orchard Nursery, Lafayette; and Ace Hardware, Martinez to get feedback on Steve Griffin and Debi Tidd.

January 9. Annie visited Steve Zien's stores in Sacramento County to get feedback on his work.

January 10. Annie visited Anne Rogers's stores in San Francisco and San Rafael to get feedback.

January 13. Annie visited Prickett's Nursery and Friedman's in Santa Rosa to get feedback on Advocate Daniel Levy.

Figure 3. Lisa greeting customers at OSH, Berkeley.

January 18. Annie met Teresa at Home Depot, Vallejo. Together, they secured the literature rack and refreshed the shelf talkers. They then met the district manager, spoke with staff about the program, and discussed future training and outreach.

January 19. Annie and Daniel Levy conducted an outreach event at Friedman's, Santa Rosa.

January 24. Annie visited OSH stores in Berkeley, Dublin, and Mountain View; Yamagami's Nursery, Cupertino; and SummerWinds Nursery, Campbell to get feedback on Advocates Steve Griffin, Lisa Graves, and David Perkins.

February 2. Annie joined a Home Depot event with Teresa and Kevin Cullen from the Fairfield–Suisun Sewer District. Annie met with Bay Area stores to promote Home Depot's environmentally friendly products.

February 12. Annie helped David Perkins with tabling at SummerWinds Nursery, Campbell.

February 16. Annie staffed a booth at the Nor Cal Trade Show with Teresa Lavell, Steve Zien, and Anne Rogers. They were joined by Mae from the San Mateo County Department of Environmental Health. The Advocates met store employees, product distributors, and pesticide manufacturers.

February 17. Teresa Lavell and Annie secured a new area for literature rack placement at Home Depot, Vallejo. The store was reset, so shelf talkers needed updating.

February 21. Annie, Anne Rogers, and 100 employees participated in a special store event at Sloat's, Kentfield.

March 11. Annie attended a no-tax event at OSH, Berkeley with Lisa Graves (**Figure 3**).

March 24. Annie tabled with Teresa Lavell at Home Depot, Vallejo.

April 2. Annie visited Home Depot in Vallejo and with Teresa Lavell arranged for staff training on April 19.

April 4. Annie visited Friedman's and Prickett's Nursery in Santa Rosa and Pini Hardware in Novato to get feedback on the work of Daniel Levy.

April 5. Annie visited Navlet's Garden Centers, Concord; Ace, Martinez; and OSH, Dublin to get feedback on Steve Griffin's work.

April 9. Annie visited Yamagami's Nursery, Cupertino; OSH, Mountain View; and SummerWinds Nursery, Campbell to gather information on David Perkins's progress.

April 11. Annie visited Annie's Annuals and the Urban Farmer Store in Richmond and OSH, Berkeley to get feedback on Lisa Graves.

April 12. Annie met with Scott Peterson, a buyer from Sloat Garden Center, Mill Valley to get feedback on Anne Rogers and to discuss endcap ideas and possible store promotions.

April 14. Annie visited OSH, Fairfield and Van Winden's Garden Center, Napa to get feedback on the work of Teresa Lavell.

April 16. Annie visited Cole Hardware and Flowercraft Garden Center in San Francisco and Home Depot in Colma to get feedback the work of Suzanne Bontempo and Anne Rogers.

Figure 4. Debi (left) stocking the literature rack with Scott and Madeline at Orchard Nursery, Lafayette.

April 26. Annie visited Orchard Nursery, Lafayette and Westbrae Nursery to get feedback on Debi Tidd's work (**Figure 4**).

May 7. Annie met with the manager at OSH, Fairfield to discuss movement of less-toxic products this season and to get feedback on Teresa Lavell.

May 9. Annie visited OSH, Antelope and Emigh Hardware, Sacramento to get feedback from store managers and staff on Steve Zien.

May 19. Annie visited Capital Nursery in Sacramento and Citrus Heights to get feedback on Steve Zien.

May 30. Annie visited Sloat Garden Center, Mill Valley to get feedback on Anne Rogers and see how the less-toxic weed endcap was going.

June 11. Annie worked with Steve Griffin to set up a new Home Depot store in Roseville.

OBJECTIVE 6. IPM Advocates work with individual stores to help stores promote IPM practices and less-toxic products to their customers.

TASK 6.1. Advocates develop a relationship with employees and management of each store (20–30 stores), possibly advising on inventory selection, in-store displays, and marketing approaches that can inform customers about less-toxic products.

Figure 5. Steve Zien and Debbie, a product distributor from the Commerce Corporation, at OSH, Antelope presenting their new endcap display.

The IPM Advocates developed relationships with employees and managers of each store. Annie gave them procedural guides and checklists explaining how to call on the stores, whether independent nursery, hardware store, Orchard Supply Hardware, or Home Depot. Advocates also interacted with sales representatives and pesticide manufacturers **(Figure 5)**. These relationships grew as they worked together to make sure products were ordered for the displays they made.

Advocates suggested to store managers and buyers which less-toxic products to carry. They also advised on marketing approaches that informed customers about less-toxic products. Advocates frequently communicated with Annie Joseph during the year-long mentoring period. They suggested ideas and built over 60 displays in 93% of the stores. Highlights of the promotions from September 2011 through April 2012 include:

- **Van Winden's Garden Center**, Napa and **Sloat Garden Center**, Mill Valley. Created signage to promote the use of plants that attract beneficial insects.
- **Sloat Garden Center**, Mill Valley and **Orchard Nursery**, Lafayette. Focused on less-toxic options for weed management and more than doubled the sales of those products over the previous year.
- **Home Depot**, Seaside. Maris Sidenstecker created a display for less-toxic products. (This marks the first time Home Depot stores have promoted less-toxic products in off-the-shelf displays.)
- **Home Depot**, Vallejo. Added floor displays for less-toxic products in cooperation with Scott's Miracle-Gro merchandisers.

Figure 6. David with buyer Amy at Yamagami's Nursery, Cupertino showing off their new display.

TASK 6.2. Advocates carry out in-store training workshops for 100–150 store employees. The workshops will provide information about products sold, pesticide safety and environmental protection, common pest problems and IPM solutions, pest identification, and other topics.

Advocates held 31 training workshops in 30 stores, training a total of 321 store employees (**Table 4**). This more than doubled the projected goal of 150 store employees projected for training. Workshops were held in training rooms before or after hours so customers did not disturb participants. Annie Joseph attended as support for all but four of the workshops. Some of the workshops were attended by all store employees, including cashiers. This approach worked well, creating a sense of camaraderie. Employees eagerly attended the workshops, were actively engaged, and some came in to attend on their day off.

Table 4. In-store training workshops.

Store and location	Advocate Trainer	Date	# Trained
Annie's Annuals, Richmond	Lisa Graves	11/17/11	11
Bill's Ace, Martinez	Steve Griffin	3/16/12	10
Capital Nursery, Citrus Heights	Steve Zien	10/15/11	11
Capital Nursery, Sacramento	Steve Zien	10/22/11	6
Cole Hardware, Cole Street, San Francisco	Anne Rogers	11/15/11	3
Emigh Ace Hardware, Sacramento	Steve Zien	1/26/12	6
Flowercraft Garden Center, San Francisco	Suzanne Bontempo	1/7/12	4
Friedman's Home Improvement, Santa Rosa	Daniel Levy	12/7/11	7
Home Depot, Colma	Suzanne Bontempo	12/22/11	15
Home Depot, Seaside	Maris Sidenstecker	10/26/11	20
Home Depot, Vallejo	Teresa Lavell	4/19/12	11
Navlet's Garden Centers, Concord	Steve Griffin	9/28/11	9
Orchard Nursery, Lafayette	Debi Tidd	3/13/12	10
Orchard Supply Hardware, Antelope	Steve Zien	4/16/12	6
Orchard Supply Hardware, Berkeley	Lisa Graves	12/14/11	13
Orchard Supply Hardware, Capitola	Maris Sidenstecker	5/31/12	1
Orchard Supply Hardware, Dublin	Debi Tidd	2/12/12	38
Orchard Supply Hardware, Fairfield	Teresa Lavell	5/17/12	11
Orchard Supply Hardware, Mountain View	David Perkins	11/17/11	4
Orchard Supply Hardware, Sand City	Maris Sidenstecker	5/17/12	12
Orchard Supply Hardware, San Rafael	Anne Rogers	10/14/11	11
Orchard Supply Hardware, South San Francisco	Suzanne Bontempo	12/09/11	8
Pini Hardware, Novato	Daniel Levy	1/13/12	18
Prickett's Nursery, Santa Rosa	Daniel Levy	11/16/11	10
Sloat Garden Center, Blithedale Ave., Mill Valley	Anne Rogers	10/13/11	15
SummerWinds Nursery, Campbell	David Perkins	9/19/11	9
Urban Farmer Store, Richmond	Lisa Graves	12/20/11	5
Van Winden's Garden Center, Napa	Teresa Lavell	10/10/11	16
Westbrae Nursery Berkeley	Debi Tidd	11/18/11	4
Yamagami's Nursery, Cupertino	David Perkins	1/24/12	17
		Total store employees trained	321

TASK 6.3. Advocates consult on pest management issues specific to each store, and carry out informal employee training on selected topics as needed.

Advocates used the OWOW "Ask the Expert Feature" and the Collaborative Tools web site set up by UC IPM (see Task 7.1 below) to inquire about unfamiliar plant diseases and pests. Advocates trained the store employees how to use the UC IPM web site to diagnose plant diseases and pests, and also consulted on selected topics as needed.

TASK 6.4. Promote online pesticide safety and IPM training program.

Advocates encouraged the stores to use the UC IPM web site and training modules on pesticide safety and IPM for retailers. UC IPM "Meet the Beneficials" poster was handed out to each store and displayed in a prominent area. UC IPM also donated a set of the UC IPM Landscape Pest ID cards and a pest wheel for each store.

OBJECTIVE 7. Create a web page with links to online information and materials that will provide one-stop shopping for store employees, store managers, and IPM Advocates interested in keeping up with the latest IPM and product-related developments.

TASK 7.1. Set up a web page with links to information identified by Alliance Partners. Target audiences: retail nurseries, garden centers and IPM Advocates.

UC IPM created two web sites and a web-based communication tool for IPM Advocates and expects to maintain all three sites into the indefinite future to support the IPM Advocates and retail nursery and garden center industry.

The IPM Advocates web site, www.ipmadvocates.com, is the official site for the project. This site was used to recruit IPM Advocate applicants and promote their activities to the public. It includes a summary of the program, contact information for each of the IPM Advocates, and links to resources of interest to retailers or IPM Advocates. Each IPM Advocate was also given an "@ipmadvocate.com" e-mail address.

The IPM Advocates Collaborative Tools site is a web-based communication tool (maintained by the University of California ANR Communications Services unit) that allows the IPM Advocates to share their experiences and ask questions. This is a closed system that includes not only the Advocates and the team managers but also several University of California pest experts who are able to answer technical questions. For instance, IPM Advocates may send in a photo of a damaged plant or pest and request help with identification or advice on appropriate management. Collaborative conversations on over 100 different topics have been initiated since the site was opened in late 2011.

TASK 7.2. UC IPM update this new web page with educational materials related to pest problems, invasive pests and new products identified by Alliance Partners, IPM Advocates, or stores as being of special interest to retailers.

TASK 7.3. UC IPM modify existing information on its web site for better accessibility and usefulness for the above audiences.

The Retail Nursery & Garden Center Portal on the UC IPM web page, www.ipm.ucdavis.edu/RETAIL, provides in-depth information about pests and pest management tools tailored to help retail employees quickly find the information they need to answer customer questions. The site includes links to a quarterly newsletter for retail nurseries and garden centers, online training courses, upcoming in-person training workshops, as well as information on pesticides and their alternatives.

OBJECTIVE 8. Evaluate the program through feedback from stores, agency partners, IPM Advocates, and results of training.

TASK 8.1. IPM Advocates give pre- and post-surveys

The Advocates assessed the value of the in-store training workshops for store employees by having those attending take pre- and post-surveys. Annie compiled the results for all 30 stores (**Table 5**).

Table 5. Store employee responses before and after training.

Question (correct answer)	% Correct	
	Before Training	After Training
When water enters a sewer, where does it go? (To a treatment facility where it's cleaned of contaminants.)	53%	71%
When water enters a storm drain, where does it go? (Directly to the nearest body of water without treatment.)	82%	100%
What do you do when you have left over pesticide after you finish spraying? *(Follow the disposal directions on the label.)*	50%	100%
Where can you dispose of left over pesticides? (Take unused pesticides to a household-hazardous waste facility.)	58%	100%

After training store employees, Advocates conducted surveys of the training itself. Most employees found the training workshops enlightening and expected the information to help them do their jobs competently (see **Appendix 5**. Store Employee Evaluation of the Training Workshops).

TASK 8.2. IPM Advocates work with partner store to get data on sales

Annie worked with each partner store to get data on changes in the types of products available and changes in sales of less-toxic products. This required store visits, phone calls, and e-mail communication with store managers and department managers. Obtaining sales data is an involved process as stores have to get information from different vendors.

As a result of this project, 16 of the 30 (53%) stores reported an increase in sales of less-toxic products from 2011 to 2012, even with a depressed economy. Not all 30 stores had the capability to track sales, so 53% may be an underestimate as confirmed by the less formal survey of store managers in Task 8.3, in which 77% attributed increased sales of less-toxic products to the presence of IPM Advocates in their stores.

TASK 8.3. Each store [manager] participates in a follow-up survey to assess how the IPM Advocate program helped them better provide IPM information to their customers.

The Management Team created a survey to assess effectiveness of the IPM Advocates. Annie interviewed store managers in late 2012 in each of the 30 stores where IPM Advocates worked during their mentoring program. Results of the surveys are summarized below in **Table 6**. Some of the important findings managers attribute to the IPM Advocate Program included:

- Over 96% of stores reported increased employee confidence in identifying pest problems
- Over 76% of stores increased sales of green (less-toxic) products
- Over 70% of stores increased shelf space for green products
- Over 76% used the University of California web site for identifying pests or solving problems
- Over 66% said they would be increasing shelf space for green products in 2013.

Table 6. Store manager responses about effectiveness of the IPM Advocate program.

1	The following questions are about elements of the IPM Advocate Program and how these have affected your store. (n = 30 store managers)	Agree (%)	Somewhat agree (%)	Not sure (%)	Somewhat disagree	Disagree (%)	Does not apply (%)
a	Training employees helps them more confidently identify pests or diagnose plant diseases.	97%	3%	0%	0%	0%	0%
b	Training employees helps them more confidently recommend products.	93%	7%	0%	0%	0%	0%
c	Training employees has helped improve their morale.	77%	20%	3%	0%	0%	0%
d	Sales of green products have increased since introduction of the IPM Advocate Program.	77%	13%	10%	0%	0%	0%
e	Attaching shelf talkers helps increase sales of green products	73%	13%	10%	0%	3%	0%
f	As a result of this program, shelf or display space for green products has increased.	70%	23%	3%	0%	0%	3%
g	Customers have given positive feedback.	87%	10%	3%	0%	0%	0%

2	Which of the following resources have you or your employees used in response to Advocate presence in stores?	% total stores (n = 30)
a	UC IPM web site for identifying pests or finding management information	77%
b	Online retail training courses from the UC IPM web site	23%
c	*Meet the Beneficials* poster (posted in the store)	80%
d	Subscribed to UC IPM *Retail Nursery & Garden Center News*	33%
3	**Has the IPM Advocate Program influenced the type of pest management products your store will sell next year?**	**% total stores (n = 30)**
a	Will increase shelf or display space for green products	67%
b	Will keep shelf or display space for green products the same	7%
c	Will reduce shelf or display space for green products	0%
d	Haven't decided yet	3%
e	I don't make decisions on shelf or display space allocation.	23%

OBJECTIVE 9. Identify a way to maintain the IPM Advocates after the end of the grant and establish a continuing education requirement.

TASK 9.1. Identify a way to maintain IPM Advocates after the grant.

During the mentoring program, Annie introduced each Advocate to key representatives of sponsoring agencies in the area where they worked. This would enable Advocates to contract with local pollution-prevention agencies, have public speaking opportunities, and attend special events. Annie also promoted the Advocates at monthly BASMAA meetings by giving updates on their activities. With continued support by local agencies, the Advocates would still work in stores when the mentoring program ended in October 2012.

Annie helped the Advocates prepare to work in the field on their own, teaching them how to invoice, compile a scope of work, and acquire insurance.

This Alliance Grant showed how valuable the Advocates are to stores by improving employee morale and sales of less-toxic products. Based in part on this reputation, the U.S. EPA provided funding in October 2012 to support the work of eight Advocates in 14 additional stores through its San Francisco Bay Water Quality Improvement Fund. The project, Greener Pesticides for Cleaner Waterways, will also provide advertising, training for retail store employees, events, and a mobile phone app to help connect customers to less-toxic products for pest problems.

WHERE ARE THEY NOW?

As of April 2013, all ten Advocates were gainfully employed.

1. **Suzanne Bontempo** represents OWOW in stores and works on separate outreach activities with the San Mateo County Department of Environmental Health. She's part of U.S. EPA's Greener Pesticides Grant and contracts with the San Francisco Public Utilities Commission partnership with OWOW.
2. **Lisa Graves** subcontracts with Annie in OWOW stores for the Alameda Countywide Clean Water Program. She's also part of the U.S. EPA Greener Pesticides Grant and Annie is working with Debi Tidd to find opportunities in west Contra Costa County stores.
3. **Steve Griffin** works with the City of Roseville, the County of Alameda Clean Water Program, and the Santa Clara Valley Urban Runoff Pollution Prevention Program. He's also part of the U.S. EPA Greener Pesticides Grant and subcontracts with Debi Tidd for the Contra Costa Clean Water Program.
4. **Teresa Lavell** subcontracts with Annie in the Alameda Countywide Clean Water Program, Santa Clara Valley Urban Runoff Pollution Prevention Program, Napa County Flood Control and Water Conservation District, and Fairfield Suisun Sewer District. She's also a part of the U.S. EPA Greener Pesticides Grant.
5. **Daniel Levy** works with Annie in Santa Rosa and with the U.S. EPA Greener Pesticides Grant.
6. **David Perkins** is part of the U.S. EPA Greener Pesticides Grant.
7. **Anne Rogers** is part of the U.S. EPA Greener Pesticides Grant and works in two stores.
8. **Maris Sidenstecker** contracts with the Monterey Peninsula Stormwater Pollution Prevention Program.
9. **Debi Tidd** subcontracts with Annie on OWOW activities in the Santa Clara Valley Urban Runoff Pollution Prevention Program and Alameda Countywide Clean Water Program. She's also part of the U.S. EPA Greener Pesticides Grant and contracts with the Contra Costa Countywide Clean Water Program.
10. **Steve Zien** subcontracts with Annie in stores associated with the Sacramento County Storm Water Program.

TASK 9.2. Aligning the Advocates with a professional organization.

At the beginning of the project, BASMAA approached the CANGC about being an advisor to the project and CANGC accepted that role. CANGC was involved in helping with Task 1.3, establishing learning objectives, and also mentioned the project in its February 2011 e-Newsletter for members.

Now that the grant-funded portion of the project is ending, CANGC has agreed to include an article about the project and its results in an e-Newsletter in 2013. BASMAA is also approaching the Master Nursery Garden Centers about working with them to promote less-toxic products. Master Nursery Garden Centers is a national member-owned buying cooperative for independent garden centers with more than 700 members. They run discount programs, including a graduated green goods discount that allows members to earn an 18% discount from green goods growers.

TASK 9.3. Offer continuing education for IPM Advocates.

We held our first continuing education class for IPM Advocates on October 22, 2012 at the Benicia Community Center. Annie Joseph hosted the class, which focused on new products and changes in the marketplace. Mary Lou Flint, Andrew Sutherland, Steven Griffin, Steve Zien, Suzanne Bontempo, Lisa Graves, Teresa Lavell, and Debi Tidd attended.

Annie reviewed changes coming to the marketplace in 2013. For example, Home Depot planned to abandon support of the Elementals line of Scott's Miracle-Gro. The Bayer Company would offer its Natria line of pesticides in Home Depot. Orchard Supply Hardware would support Dr. Earth organic fertilizers and pesticides. OSH would reset its fertilizer aisle to showcase organic fertilizers prominently in front of the main pesticide aisle. Corry's planned to discontinue its snail and slug bait with metaldehyde and would package a new active ingredient, FeEDTA, an iron salt that is less toxic than metaldehyde.

On January 28, 2013, UC IPM conducted a continuing education class for the IPM Advocates on seasonal pests. IPM Advocates received information binders and PowerPoint presentations to use in their educational programs for retail stores. UC IPM will continue to conduct continuing education classes to keep Advocates up to date.

UC IPM will continue to maintain its IPM Advocates Collaborative Tools site to allow private and archived communication among Advocates, project team managers, and select affiliates, including UC pest experts to answer specific pest and plant problems, discuss issues common to the IPM Advocates, enhance communication, and send announcements of upcoming events or new publications of interest.

UC IPM created and printed brochures and posters "The IPM Advocates' Seasonal Guide to Home & Garden Pests in California" for the Advocates to use to publicize their programs and educate store employees. UC IPM also provides Advocates with copies of educational materials to distribute to their stores including copies of the quarterly retail *IPM News* newsletter, posters, Quick Tip collections on rings, bookmarks, and pest wheels.

OBJECTIVE 10. Grant administration meetings and reports

We held our initial meeting on December 16, 2010 in Davis at the UC IPM offices to develop learning objectives for the IPM Advocates. Annie met with Nita at DPR twice to discuss updates and transfer photos on November 3, 2011 and May 29, 2012. The Management Team communicated frequently through conference calls and in-person meetings.

CONCLUSIONS

Ten IPM Advocates volunteered more than 30 hours every month for a year at stores while holding down full-time jobs. Many traveled over 100 miles each week to attend the seven 3-hour classes that covered a wealth of material from pest management, water pollution prevention, store-relationship building, and marketing ideas for less-toxic products.

Over the course of the year they met with store owners, managers, pesticide buyers, and manufacturers. They placed displays of less-toxic products in prominent areas of the stores and made sure the products were properly tagged with shelf talkers so customers and employees could easily find them.

- Advocates trained a total of 321 store employees in 31 training workshops. This more than doubled the projected goal of 150 store employees we originally proposed to train.
- Each Advocate participated in two tabling events for all three of their stores, totaling 60 outreach events. During these tabling events they contacted over 2,000 customers.
- The Advocates spent time researching pest problems for their stores and made sure the employees knew how to find the information on their own using the OWOW Ask the Expert feature and the UC IPM web sites.

At the end of the year, many store managers recognized that the Advocates had improved sales and asked if Advocates could call on their stores all the time. Representatives from the pesticide industry mentioned the displays of less-toxic products they built with the expertise of the Advocates. Everyone who worked with the Advocates was excited about the support they received from the "experts." The bonds forged were lasting, and store managers and employees are still fondly recalling their year with the Advocates.

ACKNOWLEDGMENTS

Thank you to the following:

- **Geoff Brosseau**, Executive Director of BASMAA, who forged the path to make sure that the IPM Advocates Alliance Grant was supported by the public agencies from its infancy to fruition.
- **Gina Purin**, Education and Outreach Director for MCSTOPP. Her input for our classroom training and her steady support to keep us focused on the less-toxic message was felt throughout the project.
- **Mary Louise Flint**, Associate Director of Urban and Community IPM and Extension Entomologist, UC Davis, for bringing her ideas as well as UC IPM's resources, both of which sustained the project throughout its duration. **Karey Windbiel-Rojas**, Urban IPM Educator at UC IPM, for the knowledge and energy she brought to the classroom. Mary Lou and Karey provided the Advocates with tools for plant pest and disease diagnosis and donated UC IPM "Meet the Beneficials" posters, which were displayed in each store, in addition to pest wheels, UC IPM Landscape Pest ID cards, and several other publications. Their support also provided a forum for the Advocates and team members to discuss plant diseases and pests on Collaborative Tools.
- Our grant manager, **Nita Davidson** of DPR, whose vision championed the unique IPM Advocates Alliance. Her dedication motivated her to organize a session focused on this project at the Seventh International IPM Symposium in Memphis, Tennessee, and to participate in several outreach events, store training workshops, and trade shows on her own time.
- **Dan Joseph** and **Jenna Tidd**, for their support.
- And finally, our enthusiastic and committed IPM Advocates—**Suzanne Bontempo**, **Lisa Graves**, **Steve Griffin**, **Teresa Lavell**, **Daniel Levy**, **David Perkins**, **Anne Rogers**, **Maris Sidenstecker**, **Debi Tidd**, and **Steve Zien**.

Figure 7. Suzanne and employees at the end of a training class at Home Depot, Colma.

Figure 8. Securing the literature rack at Home Depot, Seaside from rogue forklifts.

APPENDICES

Appendix 1. Learning Objectives for the IPM Advocate Curriculum

The seven classes for IPM Advocates were based on these learning objectives:

1. Technical IPM

These sessions will include hands-on activities with pests, diagnostics, tools and products, actual pesticide packages, and practice using the UC IPM web retail portal site:

a. Pest and problem identification—How to identify and diagnose common home (including indoor pests) and garden pest problems including arthropods, weeds, plant disease, vertebrate pests, nematodes and abiotic disorders
b. What is IPM?
   i. The importance of preventing pest problems
   ii. Integrating multiple management tools
c. General pesticide information including hazards, safety, and labeling
   i. How to read a label including signal words
   ii. Pesticide regulations as they related to consumer products in California
   iii. Environmental and human health concerns,
   iv. How pesticides get into the environment
   v. How people get exposed to pesticides
   vi. Pesticide mitigation measures—how applications can be made safer,
   vii. Protective equipment and clothing—what is sold in store. When to use it
   viii. Application equipment—what is sold in stores. Basics of mixing and calibration
   ix. Safe storage and disposal practices
d. Information about *specific* insecticides, fungicides, herbicides, and rodenticides on the market
   i. Which pests they manage
   ii. How and when they must be applied
   iii. How and why they work
   iv. What are the advantages and disadvantages of different formulations and packaging (e.g., foggers, aerosols, granules, ready-to-use)
   v. Impacts on people, beneficials, and wildlife
   vi. Least-toxic pesticides—what they are, specific active ingredients, what they're effective against, and how to use them
e. Alternatives to pesticides
   i. Physical or mechanical tools—e.g., traps, barriers, mulches, hoses
   ii. Cultural practices including good plant care, how irrigation and fertilization practices impact pest problems and details on how products sold in stores can enhance good plant care and protect plants from pests
   iii. Resistant cultivars and pest-resistant plants—what these are, how and when to advise customers to purchase these. Includes UCD Arboretum All-Stars.
   iv. Biological control—naturally occurring and commercially available species. How to recognize them and encourage their activities.
f. How to research information related to pests and managing pests with least-toxic IPM practices. Gain familiarity with resources.

2. Communication

This session will include a practice presentation and role-playing exercises

a. Developing relationships with stores
b. Effectively communicating with different store employees
c. How to ask questions of customers to effectively solve their problems
d. Addressing customer expectations about products
e. How to match your education program to a store's products and customer base. How to know the products your store carries
f. Effective teaching methods

   g. Dealing with conflict
   h. Problem solving
   i. Training at the store level
2. Displays and Marketing—includes going to stores and observing displays
   a. Understand the business end of the retail stores
   b. Relationships with suppliers—how to best work with vendors
   c. How to display materials and information in the store to promote safer products
   d. How to incorporate seasonal pests, new pests, and new products into a changing market

Appendix 2. Lesson Plan and Training Curriculum

WEEK/DAY 1—June 6, 2011

OVERVIEW OF IPM ADVOCATES TRAINING PROGRAM AND RESOURCES

1. A. Introduction and Overview of the Program

- Overview of IPM Advocate Program—15 minutes (Geoff Brosseau, BASMAA and introduction of trainers (MLF, KWR, AJ, NAD))
- Introductions—30 minutes (trainees)
- Class outline, what to expect, introduction to books and other resources—15 minutes (MLF)

1. B. What is IPM?

Introduction to pests, the importance of pest ID, pest detection, prevention, cultural or good gardening practices, biological control, mechanical and physical control, and pesticides. Covers indoor and outdoor pests. 45 minutes (PowerPoint presentation—MLF)

Break—10 minutes

1. C. Hands-on Activity

Learning to use the UC IPM Retail Portal, UC IPM web site, and OWOW web pages, and other online resources to get pest information and solve problems. Trainees use their own laptop and Wi-Fi to follow along and look up information—1 Hour (KWR)

Homework

- Take the two online courses, *Introduction to Pesticides* and *Moving Beyond Pesticides* on the UC IPM web site, and get certificates
- Read pages 3-48 in *Pests of Landscape Trees and Shrubs* and review pages 3–35 in *Pests of the Garden and Small Farm*. Answer multiple-choice questions (handout given in class).
- Read Chapters 4 and 6 from *Lawn and Residential Landscape Pest Control* (copies in binder). Answer review questions at end of the chapter. (Optional: View online training course for Maintenance Gardeners chapters 4, 5, 6)

Information included in binder for Week 1

1. Name and contact information for IPM Advocates trainees and instructors
2. Information about the partners: UC IPM annual report; UC IPM Retail newsletter; OWOW brochure/info; Trainer bios; partner program info
3. Information about IPM Advocate Program
4. Class outline: Training schedule for 7 training sessions
5. List of books and other resources each trainee is being given
6. PowerPoint for "What is IPM?" presentation
7. Web demonstration handouts:
   a. Instructions for using UC IPM web site
   b. Web exercises
   c. Illustrated UC IPM web handout
8. Homework assignment and instructions.

9. Reading assignment questions.
10. Copies of Chapters 4 ("Pesticides and Their Hazards") and 6 ("Selection and Use of Pesticide Application Equipment") from *Lawn and Residential Landscape Pest Control*. (for homework reading)

Resources provided to each IPM Advocate on first day

1. A binder for training materials (will be added to each week)—bring to each class
2. UC IPM Quick Tip collection on a key ring
3. *Pests of Garden and Small Farm*, UC ANR publication 3332
4. *Pests of Landscape Trees and Shrubs*, UCANR Publication 3359
5. *Landscape Pest Identification Cards*, UC ANR publication 3513
6. *Natural Enemies Handbook*, UC ANR publication 3386
7. *Wildlife Pest Control Around Gardens and Homes*, UC ANR Publication 21385
8. *Retail Garden Center Manual*, UC ANR Publication 3492
9. Laminated Natural Enemies poster
10. *Watershed map*
11. Hand lens and UC IPM lanyard
12. OWOW Fact Sheets
13. OWOW Booklet
14. Mac's Field Guide
15. Top 10 Most Wanted

WEEK/DAY 2—June 13

PESTICIDES AND INTRODUCTION TO PEST IDENTIFICATION

2. A. Introduction to Pesticides—60 minutes (PowerPoint, MLF)

- What are pesticides, different types
- Environmental and health concerns, acute and chronic toxicity
- Secondary pest outbreak, pesticide resistance
- How pesticides get into water and how people are exposed
- How to read a label including signal words
- Laws and regulations related to consumer pesticides in California
- Pesticide formulations and packaging including advantages and disadvantages of each (e.g., ready-to-use, aerosols, liquid concentrates, granules, foggers, baits)
- Protective equipment and clothing with an emphasis on what is sold in stores
- Pesticide application equipment sold in stores, how it works
- Storage and disposal
- Introduction to less-toxic pesticides. Organic pesticides. What they are; how they work.
- Resources for pesticide information

Break—10 minutes

2. B. Hands-on Activity Related to Pesticides—75 minutes (MLF and KWR)

We will have a range of pesticide products, application equipment and safety equipment that is sold in stores. A very brief introduction to what is on display will be given. Then IPM Advocate trainees will be broken into 3 groups of 3 or 4. Each group will have 30 minutes to study the items in their section and prepare a 15-minute presentation for the group based on their research. They can use their laptops to search the Internet. Groups will listen to presentations, ask questions and discuss related issues.

Group 1—Pesticide Labels

Group will be provided with 15 product containers. They should do the following:

a. Find the key parts of the label—trade name, active ingredient, formulation, signal word, manufacturer, U.S. EPA number, precautionary statements including hazards, direction for use. How do the labels differ in the way they present the material? Which labels are most helpful? Which are the least helpful? Discuss examples of information that you thought might be confusing for consumers.
b. For each pesticide, determine what the formulation is. How does the formulation affect how it would be used?

c. Go on the internet and find MSDS sheets for some of these products. What information do the MSDS sheets have that labels don't have?

Group 2—Application Equipment and Personal Safety Equipment

Included will be a backpack sprayer, a compressed sprayer, a squirt bottle, a hose end sprayer, aerosol can, a drop spreader. Also goggles, gloves, boots, plastic hat, cloth baseball cap. Measuring equipment for mixing up pesticides. We will also have a pesticide to mix up (This will actually be colored water).

Group will explain or demonstrate:

a. What each type of equipment is and what it is used for, when it should be used, and what are advantages and disadvantages of each.

b. How to mix up a pesticide following label directions in the backpack or compressed air sprayer. Use the measuring equipment and colored "pesticide" water. Be sure to put on appropriate protective equipment.
c. Once you are finished applying the pesticide, what will you do with any left over in the tank? What about the material remaining in the pesticide container? How do you handle the clothing you wore when you applied the pesticide?

Group 3—Organic Pesticides and Exempt (25b) Pesticides

- Examples of the following pesticides will be presented (2 or more trade names if possible).
  Bacillus *thuringiensis* var. *kurstaki*
- *Bacillus thuringiensis* var. *israelensis*
- *Bacillus subtilis* (Serenade, Bayer Advanced Natria)
- Codling moth granulosis virus (Cyd-X)
- Borate-based baits (including Gourmet liquid ant bait)
- Insecticidal soap
- Spinosad
- Pyrethrin (without piperonyl butoxide—PBO)
- Azadiractin
- Horticultural oil
- Neem oil
- D-Limonene oil
- Canola oil
- Rosemary, clove, cinnamon, phenylethyl proprionate (derived from peanuts) and other 25b oils
- Copper ammonium complex (Kop-R-Spray)
- Copper soaps
- Iron phosphate
- Plant-based herbicide oils (Greenmatch EX, Matran)
- Acetic acid (vinegar) (Ecosharp Weed and Grass Killer)

a. Group will review definition of organic pesticide, identify what OMRI on the label means, and identify what a 25b pesticide is. What are inert ingredients?

b. Group will introduce each product, explain what pests it is used against, what plants and sites can be treated, and any known problems or advantages. Consult the UC IPM web page for help.

2. C. Introduction to Arthropod and Plant Pathogen Identification

Will introduce insect orders (and common pest groups) and major groups of plant pathogens. Will also review resources for pest identification in preparation for Week 3.—Last 30 minutes (PowerPoint, MLF)

Homework

- Research how and where to dispose of home use pesticides in your county.
- Read introductory parts of chapters on insect and pathogen pests from *Pests of Landscape Trees and Shrubs*. Answer homework questions.
- View narrated biological control presentation (24 minutes).

- View 20-minute video, *Managing Argentine Ants Around the Home*.

Week 2 binder materials

1. DPR hand-outs
   - What is a pesticide?
   - Read the Label First!
   - Buy less, lock it away, and dispose with care
   - Emergency! What to do when accidents happen
2. UC IPM handout: "Choosing Less-Toxic Insecticides and Fungicides for Use in Landscapes and Gardens"
3. UC IPM handout: "Some Organically Acceptable Pesticides Used in Landscapes"
4. OWOW Pesticide list
5. Pest Note: *Pesticides: Safe and Effective Use in the Home and Landscape*
6. Pesticide label illustration from page 17 of *Lawn and Residential Landscape Pest Control*.
7. Printed PowerPoint for "Introduction to Pesticides" presentation
8. Printed PowerPoint for "Introduction to Arthropod and Plant Pathogen Identification"
9. Assigned reading questions for homework

WEEK/DAY 3—June 20

MANAGING INSECTS, MITES, SPIDERS, MOLLUSKS, AND PLANT PATHOGENS

3. A. Introduction to Insect and Disease Pests and Abiotic Disorders of Plants

An introduction to the pest ID cards, including general management approaches for pest groups. 30 minutes (Mary Lou)

3. B. Pest Identification Practicum

Hands-on ID with 75 samples of arthropod pests and pathogen damage and natural enemies. Each IPM Advocate will have a list of pests and damage symptoms on display so they can check off the pests as they view them and identify them using the Landscape Pest ID cards.—35 minutes (MLF and KWR)

3. C. Indoor and Nuisance Arthropod Pests and Their Management

Introduction to managing spiders, bed bugs, mosquitoes, roaches, fleas, yellowjackets, and kitchen pests; when customers should consider hiring a professional to solve their pest problems. PowerPoint presentation—30 minutes (NAD) (*Note: Ants are covered in online video homework, so were not covered in detail here*.)

Break—15 minutes

3. D. Management Tools for Arthropods/Mollusks and Plant Pathogens

A brief introduction to tools on display (see attached list of tools) and directions for hands-on activity.—10 minutes (MLF and KWR)

3. E. Hands-on Activity:

IPM Advocates work in teams of twos and identify several examples of less-toxic tools from the products on display (see attached list—Products and Tools for Week 3) that they would suggest for managing each pest on their lists. (See pest lists). Also consult UC IPM web site—Pest Notes for help and OWOW lists. 20 minutes for research, then 40 for reports and discussion (each group gets 6 minutes)—Total 60 minutes)

Homework

- Read *Weeds in Lawns* and *Weeds in Landscapes* Pest Notes plus some sections of *Managing Wildlife Around Homes*.
- Bring three samples of insect of pathogen pests or pest damage to share with the group in Week 4. Use print and online resources to identify them, research solutions, and be prepared to show them to the group. Prepare them using guidelines
- Bring in three weeds to be used in identification exercise for Week 4.

Week 3 binder materials

1. Handout on how to prepare a pest ID sample
2. List of pests on display
3. List of products on display
4. Pest Notes for spiders, fleas, bed bugs, cockroaches, mosquitoes, pantry pests

5. Pest Notes for *Weeds in Lawns* and *Weeds in Landscapes*
6. Printed copies of PowerPoint presentations
7. The 10 Most Wanted Bugs in Your Garden (OWOW brochure)
8. List of common insectary plants that provide food for natural enemies (OWOW fact sheet, *Healthy Garden to Manage Pests Naturally*

WEEK/DAY 4—June 27

MANAGING WEEDS AND VERTEBRATE PESTS

Beginning of class: Advocates lay out homework specimens for others to view

4. A. Management Tools for Weeds—30 minutes (PowerPoint, Mary Lou)

Brief intro to weeds—broadleaf, grass, sedge; annual, perennial, biannual; summer and winter weeds.

- Environments favoring weeds
- Cultural practices
- Irrigation practices
- Solarization
- Mulches
- Hand weeding and cultivation tools
- Keeping weeds out of planting beds with barriers
- Designing weeds out of landscapes
- Herbicides

4. B. Weed Management Tool Display and Time for Viewing—10 minutes

Brief introduction to activity (Mary Lou)

Tools

- Fabric mulches
- Organic mulches—various sizes of bark chips and other organic mulches, rocks
- Plastic for solarization
- Drip irrigation?
- Barriers to keep lawn weeds out of planting beds
- Dandelion removal tools
- Hand cultivation tools
- Weed whacker
- Herbicides
  - Traditional products—Glyphosate, weed & feed product, trifluralin, benefin, dithiopyr, dicamba, 2,4-D, fluazifop
  - Organic products: plant oils: clove, lemongrass, eugenol; acetic acid, soaps, corn gluten meal

4. C. Resources for Identifying Weeds—5 minutes (Karey)

UC IPM web site, books

4. D. Hands-on Activity (Karey)

Advocates work in pairs. Each pair is given 3 weeds (from selections brought in by Advocates). For each weed, they must use web resources to fill out a form with the information below.

- Common and scientific name
- Annual or perennial?
- How does it reproduce?
- What environmental conditions favor its growth and spread?
- What are some nonchemical management practices?
- What herbicides manage it?

Advocates will be given 20 minutes to fill out their forms. Then everyone will report on what their weeds were and how to manage them. (5 minutes per pair = 30 minutes)

Break—10 minutes

4. E. Vertebrate Pests

Overview of management of rodents with focus on rats, mice, pocket gophers, ground squirrels, squirrels and some information on deer, skunks, raccoons and moles—45 minutes (PowerPoint, Roger Baldwin, Wildlife IPM Specialist, UC Statewide IPM Program)

4. F. Display and Discussion of Rodent Management Tools Sold in Stores—30 min. (Roger Baldwin)

- Various repellents for deer and rabbits
- Screens for rodent-proofing houses
- Clippers for removing ivy
- Barriers to keep squirrels out of trees?
- Ultrasonic devices, vibrating stakes, pinwheels
- Netting (especially for birds)
- Fencing, trunk guards,
- Gopher baskets
- Traps—live traps
  - Traps for gophers: box, Macabee, Gophinator, Cinch
  - Traps for moles: harpoon, scissor-jaw, mole worm bait?
  - Traps for rats and mice: snap traps, glue traps, electrocution (zapper) traps
  - Bait stations
- Repellents such as castor oil for moles and gophers
- Rodenticides: Labels of common materials. Note that second-generation anticoagulant rodenticides will be removed from consumer market June 30, 2011. Emphasize problem with nontarget predators.
- Probe (with or without bait dispenser)
- Smoke or gas cartridges and explosives
- Other items (shovel, boards, stakes)

Homework

UC guide to healthy turf; how to exclude rodents around your home and landscape

Week 4 binder materials

1. List of items on display for weed management
2. List of items on display for rodent management
3. Pest Note: *Weeds in Lawns*
4. Pest Note: *Weeds in Landscapes*
5. Printed copies of PowerPoint presentations

WEEK/DAY 5—July 11

COMMUNICATION

All presentations and activities led by Annie unless otherwise noted

5.A Developing Relationships with Different Types of Stores—1 Hour (PowerPoint)

- Independent Nursery
- Franchise: Ace, Do It Best, True Value Hardware
- Small Regional Chain: e.g., SummerWinds Nursery, Sloat Garden Center, Cole Hardware
- Large Regional Chain: Orchard Supply Hardware
- Big Box Store: Home Depot, Lowe's

5.B Effective Communication with Store Employees and Team Building—30 minutes

- How to identify key players in a store and understand the store hierarchy
- Learn who makes recommendations for pest management and who makes decisions for purchasing
- Know which employees can influence purchasing

Break—10 Minutes

5.C Helping Employees with Customer Expectations About Products—30 minutes

- Preparing the customer with the right expectations so they don't abandon less-toxic practices
- Hands-on activity with less-toxic products, and how they work: Advocates will break up into groups and present alternative strategies for pest management, defining how the products work, and how this information will be communicated to the stores

5.D. Tailoring Your Educational Program to the Customers and Employees of Each Store, Based on the Store's Product Mix—30 minutes

5.E. How to Identify the Less-toxic Products Each Store Carries—15 minutes

5.F. Training Methods Used at the Store Level—10 minutes

- PowerPoint presentations
- Hands-on activities
- Flip Charts

5.G. Dealing with Conflict—20 minutes

- Learn about different challenges and how to handle them
- Three case studies

Homework

- Make a list of the services your local Mosquito and Vector Control offers your community.
- Locate a creek in your area (you may have to consult a street map if the creek is well hidden). Draw a section of the creek and imagine that there is an outfall pipe that brings in water from storm drains. Look around the nearest street and describe—pictorially or in words—how contaminated water would move from houses (or if you are in a commercial area, from a potential spraying site) to the storm drain. What features such as surface substrate, slope, and sprinkler placement may contribute to runoff into the storm drain?

Week 5 binder materials

1. List of stores and type of chain of command
2. Conflict reading info
3. Team building reading info
4. Importance of key contacts in areas: County Agricultural Department, Mosquito and Vector Control, Household Hazardous Waste, Cooperative Extension, local Stormwater Pollution Prevention group, Green Waste.
5. Local Creek Information (how to access locations)

WEEK/Day 6—July 18

DISPLAYS AND MARKETING: UNDERSTANDING THE BUSINESS END OF RETAIL STORES

6.A. Define the Retail Store Model and Our Place in That Setting—30 minutes

6.B. Learn about pesticide manufacturers and suppliers, the roles they play in the stores, and how you can work best with them.—45 minutes

Break—10 Minutes

6.C. How to Display Information and Products—30 minutes

- Learn how to get additional display space and improve the exposure of the less-toxic products.
- Learn how to encourage more ad space for products in the store's advertising.

6.D. Learn How to Incorporate Seasonal Pests, New Pests, and New Products Into Your Store's Marketing Program—1 hour (ppt)

Guest Speakers on Displays and Marketing: SummerWinds Nursery Management Team—45 minutes

Homework

- Prepare a 10-minute presentation for Week 7
- For presentation, present your observations on store placement of less-toxic products and what could be done to improve their promotion

Week 6 binder materials

1. List of vendors that call on stores
2. List of seasonal pests and display ideas for stores
3. PowerPoint presentation handouts
4. Homework assignment and instructions

WEEK/Day 7—July 25

PRESENTATIONS, WRAP UP, AND MENTORING

7.A. Presentations

Each advocate gives a 10-minute presentation on what they observed in the field, regarding displays: What works, what doesn't, and why. Followed by questions.

(11 presenters x 10 minutes: 110 minutes)

Break—10 minutes

7.B. Mentoring—1 hour

- What will happen next with the mentoring component of this program
- Store assignments, expectations, duration

7.C. Take-home exam distributed

Appendix 3. Exit Exam for IPM Advocates

When answering these questions, consult the resources used in the IPM Advocate training program. Refer to the UC IPM resources (e.g., books, web site, Pest Notes, Quick Tips, online training), the OWOW resources, the posted presenters' PowerPoint presentations, the binder, and your class notes. Resources from other states and organizations may not have correct or appropriate information for California, and your answer may be marked incorrect.

Work on the exam on your own—do not consult or collaborate with others in the class.

If you need clarification about a question, email Karey at kwindbiel@ucanr.edu and one of the instructors will address the question**. Do not post your query on Collaborative Tools.**

E-mail your final answers as an attachment directly to Karey no later than 5:00 p.m. on August 8. DO NOT POST YOUR ANSWERS ON COLLABORATIVE TOOLS.

1. Define the critical features of an integrated pest management program. (3)

2. It's June and a customer comes in complaining about volcano-shaped piles of soil in their turf, which is tall fescue. (6)

   a. Where on the UC IPM web site could you go to diagnose a problem on turf? (cut and paste the URL)

   b. What "pests" might be causing this problem? How would you distinguish between the symptoms of the different pests that might leave these mounds in a lawn?

   c. What would you tell the customer to do? What products do many garden centers sell that can help reduce each of these problems?

3. Attached are 3 home-use pesticide labels. Answer the following questions for **each** product (15):

   a. What is the trade name and what is the active ingredient?

   b. On what sites, plants or situations can it be used?

   c. What is the formulation? What equipment (including safety equipment) do you need to apply it?

   d. Go to the UC IPM web site home-use pesticide database and note the active ingredient's:

      1. Water quality rating
      2. Impact on natural enemies

3. Impact on honey bees
4. Acute toxicity to people
5. Names of some other home-use pesticide products that contain this active ingredient

4. Use the UC IPM web page to identify this weed (8).

a. What is its scientific name, common name, and any other names it is sometimes called?

b. Use the UC IPM Pest Note as a resource. What are some nonchemical control products sold in stores that can be used to manage this weed?

c. What herbicides are suggested by UC IPM to manage this pest? Are any of these products on the OWOW list?

d. What are 25b products? Are there any 25b products suggested for managing this weed? What are the benefits and drawbacks of this (these) product(s)?

e. What are pre-emergent herbicides? Are there pre-emergent herbicides suggested for this weed?

5. One of your stores is stocking "ladybugs" (convergent lady beetles). What advice would you give them about how to properly handle lady beetles in the store and what to recommend to customers who purchase them? (Research the UC IPM web site for this information and note where you found it.) (3)

6. A customer brings you the insect pictured below that she found in her kitchen. It's a little under ½ inch long. (9)

a. What is its common name and species name? What is its preferred habitat?

b. What would you suggest she buy to determine the **extent** of her problem?

c. What are some nonchemical tools and products she might find in her local hardware store to help limit the problem?

d. Fill out first 3 columns in the table below with the following: What types of pesticide formulations are recommended in the Pest Note for use against this pest? How is each formulation used? For each type, list active ingredients (a.i.s) that can be found in that formulation.

e. For the fourth column, go to the Sortable Less-toxic Product List (version 3) on the IPM Advocates Collaborative Tools web site (which is a modification of the OWOW product list in a sortable and expanded format).

List trade names for each for the formulation/active ingredient combinations you listed in **d** above. (This Pest Note is not up to date on product names.)

Example Table for Question 6—add additional lines or reformat as needed.

Formulation type	How Used	Active Ingredients	Product Names	Found in Store?

f. Go to a well-stocked hardware or big box store and note which of these products and active ingredients found there (last column). What store did you visit?
g. At the store, you will find other pesticide formulations are available for management of this pest. What are these? Are there situations when these types of pesticides should be recommended?
7. A customer brings you the plant sample and damage pictured below. (9)

a. What is the plant? What is the common name of the problem indicated by the symptoms? What organism caused it?
b. Where can you find information on the UC IPM web site about managing this problem? (list URL)
c. What are some nonchemical controls for this problem?
d. Might your store sell varieties of this plant that resist this problem? If so, name some of the varieties? Are there other ornamentals that don't get this problem?
e. List less-toxic active ingredients that can be used to manage this problem.

f. For each active ingredient, include product names available in stores. What are 3 different resources you can use to find this information? (You should have used all 3 sources in this training.)
g. What is a synthetic product that is effective against this problem?
h. Use the "Active Ingredient/Compare Risks" button at the bottom of the Pest Note to determine which product has the highest risk to water quality, the highest risk to natural enemies, and which may pose a long-term risk to people. List these here.

9. A store manager asks your advice about how he can quickly get his new employees up to speed regarding pesticides and alternatives to pesticides. What free training resources would you recommend? (3)

10. What are the steps you follow when diagnosing an insect or disease problem on a plant? How do you distinguish a biotic disorder from an abiotic one? (Include resources you would use and how you would use them. Also note what information you need to make a good diagnosis.) (6)

11. What problems occur when pyrethroid insecticides such as bifenthrin run off into storm drains? Why should we care? (3)

12. In some stores (e.g., Home Depot, OSH, Ace) you may find some nonpesticidal pest management items located in the cleaning, appliance, or paint departments. (3)

For each of the pests in the table below, list one nonpesticidal tool ideal for managing this pest. Refer to resources such as handouts and PowerPoint presentations—you don't have to go to the store to answer this question.

TARGET PEST	ITEM
Spiders	
Drain flies	
Ants (and other pests)	

13. A customer complains that he has so many moths flying out of his kitchen cupboard that he can't keep up with them. He sees them fluttering in his kitchen every night, collecting on the walls and ceiling. He thinks these moths had their start breeding in dog kibbles that he keeps in a kitchen cupboard. They've now spread to dried fruit and rice he stores in plastic zip bags in the same cupboard. He's looking for a spray to kill the moths in his cupboard and on the kitchen ceiling. You try to dissuade him from spraying. (8)

a. List two things he can do to clean up the infestation. b. List two ways he can prevent future infestations.
c. List a product he can purchase to detect the moths. d. What's the common name of the moth in his kitchen cupboard?

He is also concerned that some of the moths have moved to a closet and are now devouring his woolen clothes. You explain that the moth in his kitchen and those in his closet are two distinct types of moth (and actually the larvae or caterpillars are the culprits).

e. What are the common names of the two possible moths in his closet? f. Should he buy some moth balls? What are two things he can do reduce future infestations?

14. From what sources do Ace Hardware stores get pesticides? What are the advantages of each? (3)

15. Define the role of the following individuals and how they influence the sales of pesticides in Home Depot and OSH: (6)

A. Department lead
B. Merchandiser from pesticide manufacturer or distributor
C. Sales staff in garden section
D. Shelf stocker employed by store
E. Nursery staff

16. Describe a conflicting situation you may come across with an employee in a store and how you'd resolve it. (3)

17. What is the main goal of a retail business? (3)
18. Why would it be important for you to know about the local Household Hazardous Waste Facility and Mosquito and Vector Control Agencies that are in your store area? (3)
19. What are four of the most important things to remember when you're training store employees on IPM? (3)
20. What do you do when store employees ask you about a pest or pest control product you are not familiar with? (3)

Appendix 4. Recruitment of IPM Advocates

INTERVIEW QUESTIONS

1. Describe your knowledge and experience with horticulture as it relates to gardening, the retail sector, or landscaping.
2. Describe any training or experience you've had in pest management including pest identification and use of pesticides. Any classes? Special workshops?
3. What experience do you have working with retail nurseries and garden centers?
4. What are your thoughts on the use of pesticides as part of an IPM program? (This includes conventional, organic, and less-toxic products).
5. Tell us how you might go about researching a pest-related question asked by a store or customer. How would you find management solutions?
6. How would you describe your people skills?
7. Have you been involved in any activities where you had to advocate for a new program or a new way of doing something? Were you successful? Why or why not? How might you change the process if you were to do it over again?
8. Give an example of a situation in which you've dealt with conflict or a challenging person. How did you handle the situation?
9. What experience have you had giving presentations, lectures, or training classes? Have you had experience explaining technical or scientific terms to the general public?
10. Describe your experience working with people from diverse socioeconomic and ethnic backgrounds.
11. Why are you interested in becoming an IPM Advocate?
12. What are your short-term career goals? Long-term goals?
13. Are you currently employed? (no | yes—full-time/part-time)
14. Explain any conflicts that may arise from working as an IPM Advocate.

    Would the time commitment interfere with your current job or business?

    What, if any, are your time constraints?
15. Approximately how many hours during the week can you devote to IPM Advocate training and homework? What about mentoring?
16. We anticipate that many IPM Advocates will work as self-employed consultants like Annie does.

    Do you have any experience working on your own in a business or other activity?
17. If selected as an IPM Advocate, how will you feel about traveling using your personal vehicle as part of the training and mentoring portions, and for future work in this field?
18. As an IPM Advocate, you'd have to establish a working relationship with new people. Describe how you'd go about doing this.

Appendix 5. Store Employee Evaluation of the Training Workshops

Survey question (number of responses)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The training workshop was well organized and interesting. (n = 245)	67%	28%	4%	1%	0%
My training manual will be a useful resource in the future. (n = 248)	68%	24%	7%	1%	0%
The information will help me recommend and sell less-toxic products. (n = 219)	76%	20%	4%	1%	0%
The instructor was responsive to questions. (n = 251)	80%	16%	3%	0%	0%
The level of detail was appropriate. (n = 239)	69%	27%	3%	1%	0%
Visual aids were effective. (n = 237)	68%	27%	4%	1%	0%
Written materials were effective. (n = 232)	68%	25%	6%	1%	0%
I would recommend the training to my co-workers. (n = 246)	74%	17%	8%	0%	0%
I'd like to learn more about IPM practices and certification. (n = 219)	50%	27%	21%	1%	0%

TRAINING WORKSHOPS FOR STORE EMPLOYEES

LEFT: Teresa Lavell training employees at OSH, Fairfield

RIGHT Annie Joseph and Anne Rogers training employees at Sloat Garden Center, Mill Valley

THE IPM ADVOCATES—CHANGING HOW STORES SELL PESTICIDES

Left to right, top to bottom: ❶ Suzanne Bontempo attaching shelf talkers with Tito, lead for the garden department at Home Depot, Colma ❷ A display of less-toxic products at Home Depot, Sacramento set up for the 2012 season ❸ Steve Griffin after setting up an endcap display at Navlet's Garden Center, Concord with Marsha, the store manager ❹ Display of traps and tools and other less-toxic products at Cole Hardware, San Francisco ❺ Maris at OSH, Sand City presenting a fact sheet about rodent exclusion ❻ Daniel Levy with Ed Casey, a buyer for Friedman's Home Improvement, Santa Rosa

Our Waterful World

A Guide to Enjoying the Beauty of Water in Alameda County

Photo: John Joh

Lake Del Valle

Livermore

www.ebparks.org/parks/del_valle

Activities: Rocky Ridge Visitor Center, swimming, picnicking, hiking, camping, fishing, boat rentals, lake tours (naturalist guided), equestrian camps.

Main Attraction: Two swimming beaches with lifeguards on duty during posted periods.

cleanwater PROGRAM alameda county

Recharge your batteries with the calming beauty of our local waterscapes. Our handy guide helps you find the perfect spot—only minutes from home.

Gurmeet Manku

Hiking

Garbological Finds

Biking

Wildlife

Picnics

Enjoy the aquatic beauty in our own backyard!

Alameda County is home to some beautiful waterscapes. The Clean Water Program is excited to share some of our favorite spots for enjoying creeks, wetlands, lakes and the Bay. There's something for everyone—from active hikes to easy strolls, to scenic spots for picnics, and biking, boating & fishing.

Please visit the website for each location to verify access, hours and services. Information compiled in May 2013.

Alberto Fox

Sausal Creek Watershed

El Centro Avenue at Dimond Park, Oakland

www.sausalcreek.org

Activities: Download a map and pick your trail! Trails range from easy to more adventurous, and include creek crossings over rocks and small waterfalls.

Pictured at left: Sausal Creek in Dimond Canyon.

Main Attraction: Experience the urban-creek connection. This creek begins in the Oakland Hills and flows through the city, discharging into the tidal canal that separates the island of Alameda from Oakland; the creek ultimately flows into San Francisco Bay.

Insider Tip: visit www.cleanwaterprogram.org/parks for details on one of our favorite Sausal Creek hikes!

Kas Neteler

Warmest spot to enjoy a walk by the Bay!

Crown Memorial State Beach

Eighth Street and Otis Drive, Alameda

East Bay Regional Park District (EBRPD)

www.ebparks.org/parks/crown_beach

Parking fee: $5 per vehicle when kiosk is attended; $4 per trailered vehicle.

Activities: Swimming, boardspoarts, picnicking, biking, strolling, sandcastle-building

Main Attraction: The showpiece of the park is its 2.5-mile beach, with sand dunes bordering a bicycle trail.

Patti Cole

Sycamore Grove Park

1051 Wetmore Road or 5211 Arroyo Road, Livermore

Livermore Area Recreation and Park District (LARPD)

www.larpd.dst.ca.us/open_space/sycamore.html

Parking fee: $5 per vehicle or by annual permit

Activities: Hiking, bicycle and horse trails; barbecue grills at Arroyo Road entrance. Reservable picnic area.

Main Attraction: Several picturesque footbridges crisscross the waterways. Creekside areas boast frogs, pond turtles, dragonflies, ducks and muskrats.

The San Francisco Bay Trail

Berkeley to Emeryville

The San Francisco Bay Trail Project

www.baytrail.org

Activities: Walking, jogging, biking, bird watching. Picnicking and kite flying at Cesar Chavez Park.

Main Attraction: Part of the 330 mile-long San Francisco Bay Trail, the stretch between Emeryville and Berkeley offers an easy, family-friendly paved path for biking and walking, along with stunning views of the Bay and opportunities for shorebird observation. Additional bird watching at adjacent Aquatic Park.

Map: www.baytrail.org/Maps/East_Bay.pdf

cleanwater PROGRAM

Paige O'Neill

Bike the Alameda Creek Trail from Old Canyon Road to Coyote Hills Regional Park

Niles Staging Area, Fremont

East Bay Regional Park District (EBRPD)

www.ebparks.org/parks/trails/alameda_creek#activities

Parking fee: None at Niles Staging Area at Old Canyon Road

Activities : Bike along the creek and experience firsthand how creeks flow through our landscape to wetlands, and finally to the Bay at Coyote Hills Regional Park (see below).

Main Attraction: Alameda Creek Regional Trail follows the banks of Alameda Creek from the mouth of Niles Canyon westward to San Francisco Bay - a distance of 12 miles. Alameda Creek is Alameda County's largest, and is home to a host of birds and other wildlife.

Gabriela Quiros, KQED QUEST

rbnicholson

Other Waterful Areas to Enjoy

North/Central Alameda County

Lakeside Park (Lake Merritt), Oakland
www2.oaklandnet.com/Government/o/opr/s/LakeMerritt/index.htm

A great urban oasis, the lake is also home to all kinds of impressive water fowl, including egrets, cormorants, herons and geese.

Strawberry Creek, Berkeley

http://strawberrycreek.berkeley.edu

A self-guided walking tour of the creek offers spots to relax and observe, as well as glimpses into ongoing restoration work.

Codornices Creek, Albany/Berkeley
www.codornicescreekwatershed.org

One of the most free-flowing creeks of the East Bay, Codornices Creek boasts native steelhead trout, among other wildlife.

Lake Chabot Regional Park, Oakland/Castro Valley
www.ebparks.org/parks/lake_chabot

Fishing, boating, hiking/biking trails make this park a great way to enjoy the water.

South/East Alameda County

Alamo Creek Park, Dublin
http://www.dublin.ca.gov/index.aspx?NID=481

See a natural creek in a family-friendly park that includes basketball courts, picnic area, play equipment, and walkways/trails.

Arroyo Del Valle Trail, Pleasanton
www.ci.pleasanton.ca.us/pdf/trails-map-080908.pdf

Stroll or bike along this urban creek path before or after visiting downtown shops or restaurants.

Eden Landing Ecological Reserve, Hayward/Union City
http://rhorii.com/EdenLanding/BayTrail.html

A 2.75 mile trail runs on levees along former salt ponds that are now being restored.

Garin/Dry Creek Pioneer Regional Parks, Hayward
www.ebparks.org/parks/garin

Hiking, horseback riding, picnicking, fishing, and the two-acre Dry Creek Garden, which showcases nearly 200 native and exotic plants.

Hayward Regional Shoreline
www.ebparks.org/parks/hayward

1,811 acres of salt, fresh, and brackish water marshes, seasonal wetlands and public trails.

Shadow Cliffs Regional Recreation Area, Pleasanton
www.ebparks.org/parks/shadow_cliffs

A former gravel quarry, Shadow Cliffs boasts an 80-acre lake with swimming, fishing, boating, picnicking and birdwatching.

ONLINE INSIDER TIPS!

Visit www.cleanwaterprogram.org/parks for more details, including special insider tips for these waterful parks!

Coyote Hills Regional Park

8000 Patterson Ranch Road, Fremont

East Bay Regional Park District (EBRPD)

www.ebparks.org/parks/coyote_hills

Parking fee: $5 per vehicle; $4 per trailered vehicle.

Activities: Bicycling, walking, bird watching, jogging, nature exploration, and picnicking. Coyote Hills Visitor Center & Nectar Garden, open Wed.-Sun. 10-4

Main Attraction: The rich wetland is preserved, along with 2,000-year old Tuibun Ohlone Indian shellmound sites. Marsh Boardwalk and 3.5-mile Bay View Trail.

See what your neighbors are doing to protect "Waterful" Alameda County…

Rosi H. and family, Berkeley

"I feel so lucky to live near the Bay and such beautiful parks. We always make sure we don't leave any garbage behind after our picnics. Sometimes the park garbage cans are far away or sometimes they are full. So I always bring a bag to take garbage home, just in case."

Jocelyn G. & Kalin P., Oakland

"First we photograph and then we pick up litter we find. It's part of an instagram project #litterati. You should check it out! Plus it makes our neighborhood a nice place to live."

Ramona M., Livermore

"I like the DIY car washes the best. It's more thorough than washing it in my driveway, and I know the dirty water doesn't end up polluting anything. These car washes have special drains."

Peggy R., Hayward

"I don't use chemicals to fight garden pests* but instead rely on birds and good bugs to eat the bad bugs! I occasionally spray a heavy stream of water on my roses to get rid of aphids."

Editor's Note: There are commercially available products that are less toxic than others. Learn more at www.ourwaterourworld.org

Penny the Dog & owner Ener C., Oakland

"Picking up after our dog helps to keep our neighborhood beautiful, our shoes free of stinky messes, and our waterways clean. It also ensures that parks and cities continue to have dog friendly policies."

Dan W., San Leandro

"I sweep my driveway now, because I found out that using a water hose to clean it will wash pollution into the storm drain. Those drains empty into creeks…I had thought the water was treated."

cleanwater PROGRAM alameda county

Your local government is working to protect our shared water resources.

All the cities in Alameda County, along with the Flood Control & Water Conservation District and Zone 7 Water Agency, participate in the Clean Water Program. The Clean Water program facilitates compliance with Federal Clean Water Act for its member agencies in Alameda County. It also empowers Alameda County residents to join the efforts of local government and protect our waterways. Using less-toxic alternatives for auto care, properly disposing of auto chemicals and used oil, washing your car properly and preventing spills and leaks are all things you can do to support our shared mission and prevent pollution.

Protecting Alameda County Creeks, Wetlands & the Bay

To learn more, visit www.cleanwaterprogram.org/parks

www.facebook.com/CleanWaterProgram

Member Agencies: Cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, Union City; the County of Alameda, the Alameda County Flood Control and Water Conservation District, and Zone 7 Water Agency

Alameda County Clean Water Program

Survey of County Residents

Prepared for Gigantic Idea Studio

3/19/2013

action research

Research • Social Marketing • Results

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Background and Method

A telephone survey was conducted in late November and early December of 2012 with 600 residents of Alameda County to determine baseline data on awareness and behaviors related to storm water pollution.

The survey was based, in part, on a 2006 survey of Alameda County residents and covered the following topics:

- **Environmental Issues**: Respondents were asked to name, without prompting, what they thought was the more important environmental issue facing Alameda County.
- **Storm Water Knowledge**: Respondents were asked to describe what they thought happens to water that runs off the street and into storm drains. This was followed by a list of behaviors and sources that might result in pollution of creeks and the Bay which respondents were asked to rate as potential problems.
- **Environmental Attitudes and Behaviors:** This section of the survey presented respondents with a series of statements describing attitudes toward environmental responsibility and behaviors which they might or might not engage in. Behaviors included using recycled or reusable products, using toxic chemicals for pest control, and littering. They were asked to rate their level of agreement with the attitude or action described in each statement.
- **Program Recognition:** This section began by asking respondents to rate the importance of a program to protect creeks and the Bay and to state whether or not they would be willing to provide some financial support to such a program. Respondents were then asked whether they had heard of the Clean Water Program (CWP), first as an open-ended and then as a prompted question. This section also contained items aimed at assessing how many respondents had been exposed to a CWP message that was run in movie theaters during the survey timeframe.
- **Lawn Care:** This section assessed baseline levels of self-reported use of pesticides on lawns and gardens.

A dual-frame random-digit dialing (RDD) sampling procedure was used, including 80% landlines and 20% cell phones. Typically, women and older individuals are more likely to agree to complete telephone surveys than are men and younger individuals. In order to obtain a more gender- and age-balanced sample, interviewers asked to speak to the person in the household over 18 who had the next birthday. See Appendix A for the full text of the survey.

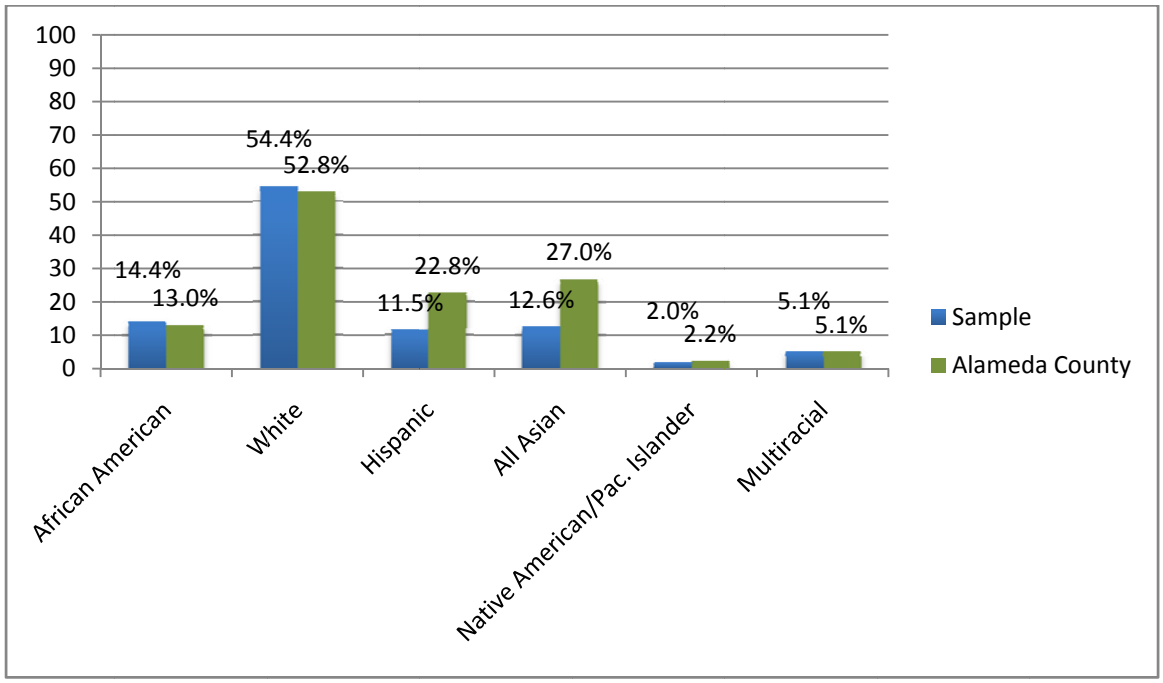
Sample Demographics

The final sample included 59.2% women (N=355) and 40.8% men (N=245.) The average respondent was 51.7 years old (SD=16.9), and had lived in Alameda County for an average of 26.2 years (SD=19.6).

Figure 1shows a comparison of respondents' self-classification by racial/ethnic background with the 2011 census data for Alameda County. For the purposes of analysis, the survey response categories of Vietnamese (0.9%), Chinese (3.0%), Korean (0.5%), Filipino (1.8%) and Other Asian (5.8%) have been

combined.The percent of respondents in the telephone sample who were African American, White, Native American/Pacific Islander, or multiracial corresponded closely to the census figures for the County. However, a smaller proportion of respondents identified themselves as Hispanic or Asian than is reflected in the census. The reason for these differences is unknown. It may be that the lower response rate for Asians was due to a language barrier. The survey was offered in Spanish as well as English, but only a total of 20 (3.4%) surveys were conducted in Spanish.

Figure 1. Sample breakdown by racial/ethnic group

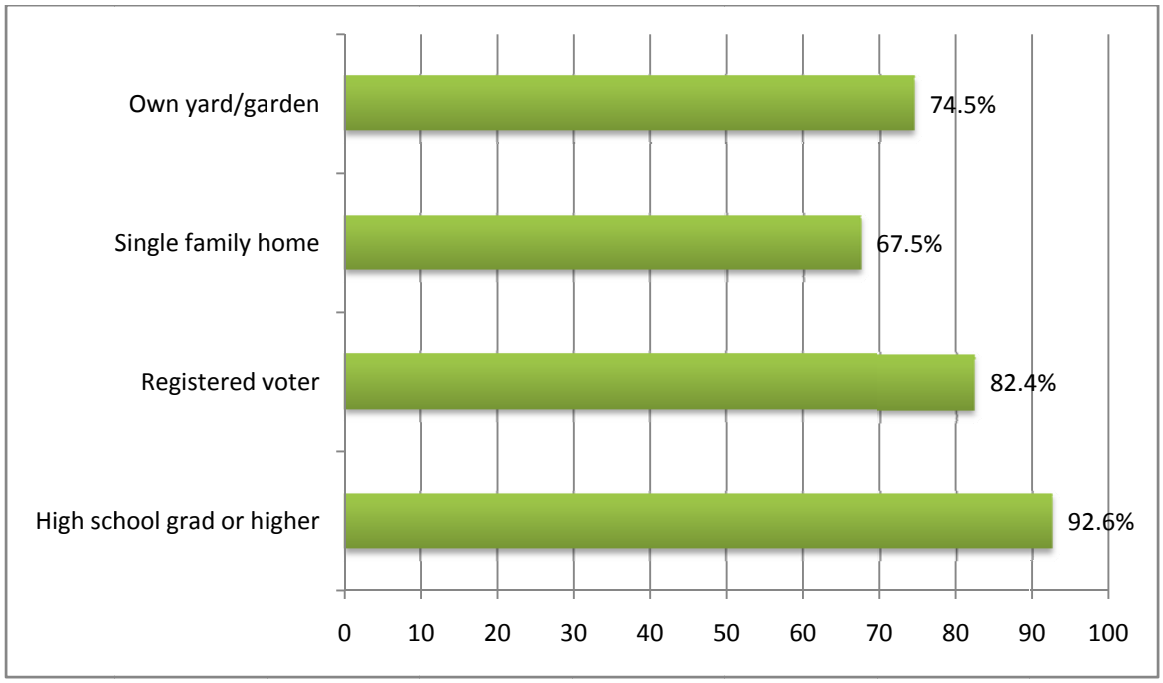


Respondents were also asked a few other questions to help characterize them on factors which might be related to survey topics. Analysis revealed that most respondents had at least a high school education. Over thirty percent (32.2%) had graduated from college. The majority of respondents live in a single family home (67.5%). Most (82%) reported being registered voters, of those, 94% reported having voted in the November 2012 election.

Approximately three quarters (74.5%) of respondents reported having a yard or garden and most of those (76.1%) said that they or a family member cared for it. Just over 22% used a professional service. Only a minority (17.7%) of those with a lawn or garden reported that they used pesticides[1]. See Figure 2.

[1] Self-reported rates of pesticide use are variable. An Environmental Protection Agency summary report found rates ranging from 17% to 87%. (Source: http://cfpub.epa.gov/npdes/stormwater/menuofbmps)

Figure 2. Selected sample demographics



*Percentage of registered voters.

Environmental Issues

The survey began by asking respondents to name what they believed was the most important environmental issue currently facing Alameda County. Approximately 35% (N=212) did not know or did not provide an answer to this item. Among those who answered the open-ended question, air pollution was seen as the most important issue, followed by water pollution and litter or garbage. See Table 1.

Table 1. Perceptions of most important environmental issue for Alameda County

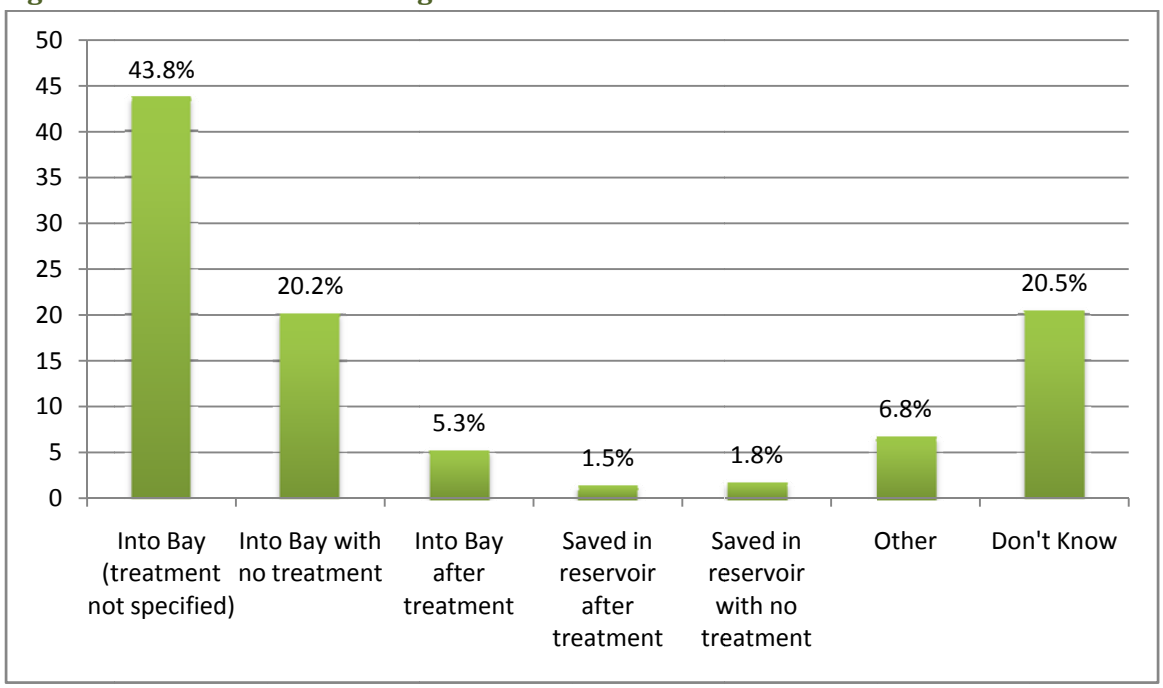
Environmental Issue	Percent Rating as Most Important
Air Pollution	33.2%
Water Pollution	10.6%
Litter/Garbage	10.6%
Global Warming	10.3%
Recycling	5.7%
Hazardous/Toxic Waste	4.6%
Overdevelopment/Overpopulation	4.6%
Fossil Fuel Dependency	2.8%
Cars Leaking Oil or Other Fluids	2.6%
Drought/Water Conservation	2.3%
Running Out of Landfill/Dump Sites	1.8%
Pesticides or Other Chemicals on Food	0.8%
Infrastructure/Sewer Maintenance	0.8%
Other	7.2%

If the respondent chose "Water Pollution" as the most important issue, interviewers probed for a more detailed response. Of the 41 respondents who were asked to specify the type of water pollution, 16 (39%) mentioned pollution or trash going into the Bay, creeks, wetlands, storm water, groundwater or runoff. The second most commonly mentioned concern was pollution of drinking water (14%). There were no consistent patterns in the issues that respondents introduced in the "Other" category.

Storm Water Knowledge

To assess respondents' baseline knowledge of storm water outcome, they were asked to state, in an open-ended item, what they though happens to water that runs off the street and into storm drains. Over half of respondents (64%) stated that the water runs directly into creeks or the Bay, with about 20% specifying that it did so with no treatment.However, over 20% of respondents stated that they did not know what happens to water running off the streets. See Figure 3.

Figure 3. Storm water knowledge

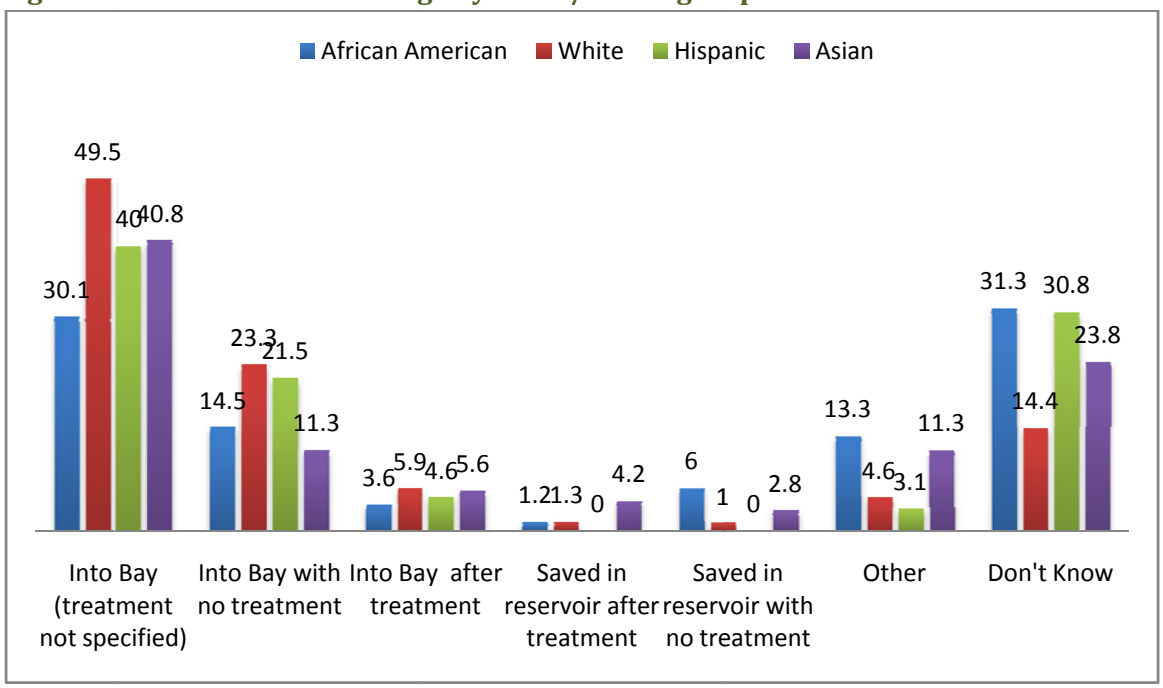


Chi-square analysis showed no difference between men and women in the pattern of their responses to the storm water knowledge item ($p>.05$). Similarly, a one-way analysis of variance (ANOVA) showed no significant relationship between age and storm water knowledge response categories ($p>.05$).

There was a significant relationship between storm water knowledge responses and racial/ethnic category ($p<.01$). Figure 4shows the percentage of responses in each category by ethnic group. (Note that some groups did not represent a large enough subsample to include in the analysis).

White respondents were significantly more likely to state that run-off from the street goes directly into the Bay or creeks, particularly in comparison with African American respondents. African Americanand Hispanic respondents were more likely to say that they did not know what happened to run-off from the streets.

Figure 4. Storm water knowledge by racial/ethnic group



There was trend for those with at least a least a high school education to be more likely to say that run-off from the street goes directly into the Bay, but it was not statistically significant (p>.05).

Respondents who lived in single family units and those who reported having their own yard or garden were significantly more likely to say that storm water runs directly into the Bay or creeks.SeeFigure 5 and Figure 6.

Figure 5. Storm water knowledge by lawn or garden status

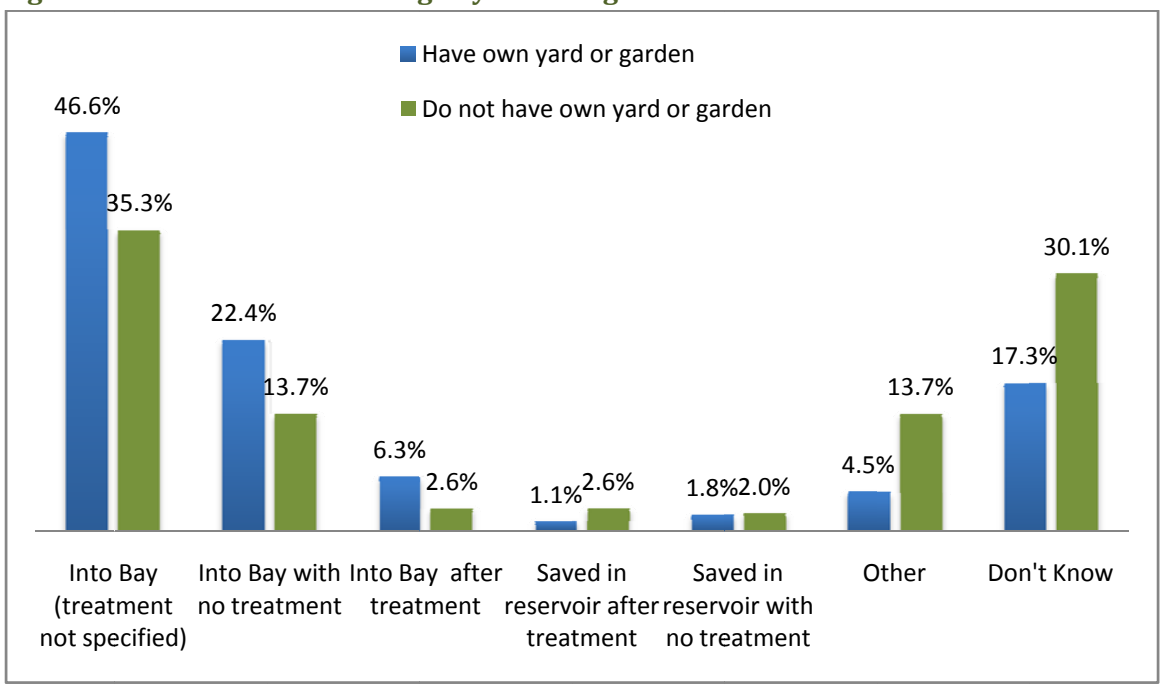
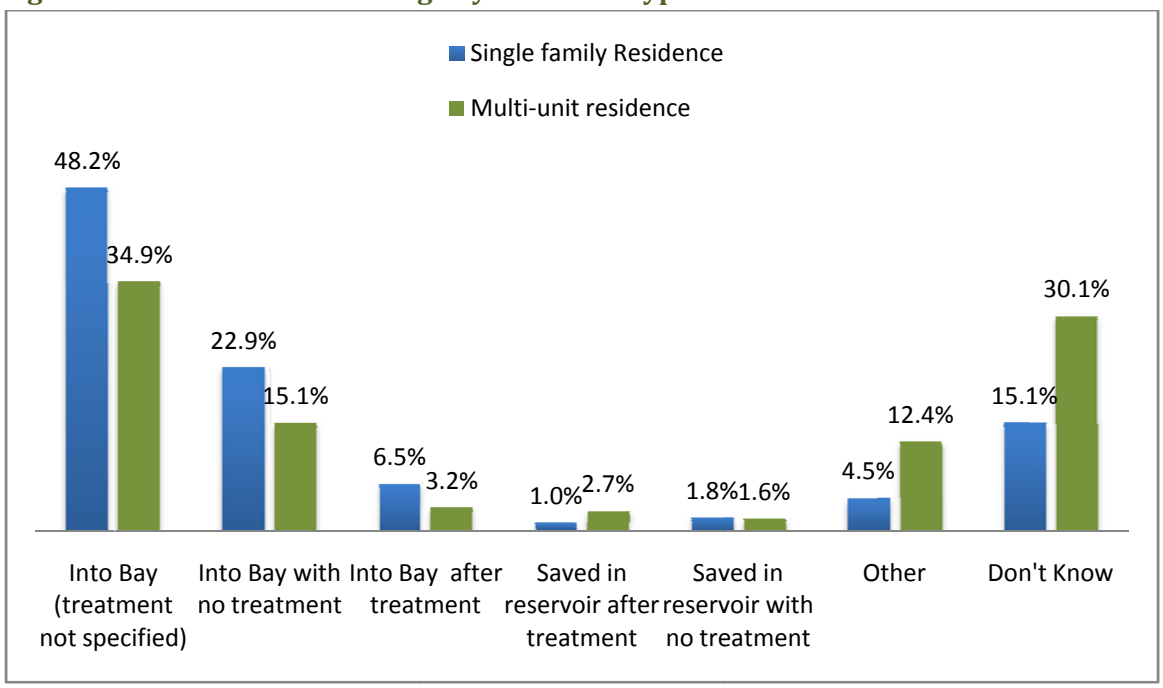


Figure 6. Storm water knowledge by residence type



These responses suggest that those who are more familiar with caring for lawns, gardens, driveways and sidewalks may be more aware of or knowledgeable about storm water pollution issues.

In addition to the open-ended item about storm water, respondents were asked to rate their perception of the seriousness of a list of behaviors which could potentially affect storm water pollution. Problems were rated on a 4-point scale where “1” indicated a “Very serious problem” and “ 4” indicated that the

issue was perceived as "Not a problem at all." In order to keep the survey within time limits, each respondent asked a random selection of four of the items.

Table 2. Mean responses to polluting behavior items

Survey Item	Mean	SD
Washing your car in the street or driveway	2.62	.92
Trash in the street	1.78	.82
Pesticides, weed killers and fertilizers used in and around the home	1.58	.83
Fluorescent light bulbs put in the garbage can	1.90	.91
Oil leaking from cars	1.59	.81
Rinsing paint brushes, pans, and rollers in the sink	1.97	.98
Hosing down your driveway	2.73	.97
Driving a car	2.33	.99
Factories and other industry	1.78	.92
Illegal dumping of large items such as tires, furniture or appliances	1.54	.80
Cigarette butts on streets, sidewalks and parking lots	1.90	.87
Accidental litter such as items falling from vehicles	2.06	.89

Respondents rated those actions that had the most obvious and direct relationship to water run-off("Washing your car in the street or driveway" and "Hosing down your driveway")asless of a problem thanother potentially polluting behaviors. These two behaviors had a mean rating in the top half of the scale and a median rating of "3," indicating that half of the sample rated them as a "Not too serious" or a "Not a problems at all" problem. The third least seriously-rated behavior was "Driving a car." It is possible, though, that driving was being rated on its overall environmental impact, rather than for its specific relation to storm-water pollution, since "oil leaking from cars" was rated as a more serious problem. All other behaviors were given an average rating of "2" or below, indicating that they were perceived as significant problems for creeks and the Bay. See Table 2.

Demographic Differences

Analyses were performed to assess whether demographic variables were related to perceptions of the importance of potentially polluting behaviors. Racial/ethnic groups differed on only two items: "Trash in the street" and "Cigarette butts on streets, sidewalks and parking lots". For both of these items, White respondents rated the problem as less serious in comparison with other groups (M= 1.99, and M=2.05, respectively, *p's*< 05). Those living in single family units were also more likely than others to see the same two behaviors as less serious (M= 1.87, and M=2.01, respectively, *p's*< 05). Similarly, registered voters were more likely to rate those two items as less serious, (M= 1.85, and M=1.95, respectively, *p's*< 05), as well as "Accidental litter such as items falling from vehicles" (M=2.11, *p*<.05).

Women rated each of the problems as more serious than did men. In the case of 6 behaviors, this difference reached statistical significance (*p*<.05). See Table 3.

Table 3. Mean polluting behavior ratings by gender

Survey Item	Men	Women
Washing your car in the street or driveway	2.79	2.51
Rinsing paint brushes, pans, and rollers in the sink	2.15	1.85
Driving a car	2.49	2.22
Factories and other industry	1.98	1.65
Cigarette butts on streets, sidewalks and parking lots	2.15	1.73
Accidental litter such as items falling from vehicles	2.27	1.91

There was no significant relationship between respondents' age and any of the potentially polluting behaviors in the list.

Environmental Attitudes and Behaviors

In order to assess general attitudes about how their own everyday behaviors impact the environment, respondents were asked to indicate their level of agreement with a series of statements including littering, reusable beverage containers and overall level of environmental responsibility. Responses were given on a 10-point scale where "1" was "strongly disagree" and "10" was "strongly agree."

Table 4. Mean responses to environmental attitude and behavior items

Survey Item	Mean	SD	Median
My actions directly impact water quality in local creeks and the Bay.	7.44	3.08	9.00
I consider the environmental impact of everything I do.	7.25	2.52	8.00
I only buy recycled or environmentally friendly products.	5.98	2.59	6.00
Being environmentally responsible is too expensive.	3.88	3.04	3.00
Being environmentally responsible is too inconvenient.	3.40	3.00	2.00
I can control pests in and around my home without toxic chemicals.	6.98	2.99	8.00
I never throw trash on the ground.	8.25	2.99	10.00
Litter makes a neighborhood look bad.	9.15	2.19	10.00
I always use reusable water bottles and coffee mugs.	6.92	3.11	8.00
It is okay to throw apple cores and other food scraps on the ground.	4.01	3.25	3.00
I have thrown trash on the ground in parks and public areas where I know it will be picked up.	2.50	2.91	1.00

In general, respondents agreed that their actions had a direct impact on water quality. Half of respondents rated this item at "9" or above. They were also strongly in agreement that litter makes a neighborhood look bad, and most indicated that they did not throw trash on the ground, even in areas where it would be picked up. They were less in agreement about whether it was acceptable to discard food scraps on the ground.

Respondents generally disagreed that being environmentally responsible was too expensive or inconvenient, and they tended to agree that they take the environment into consideration in their actions.

However, agreement was only moderate in the case of more specific behaviors such as controlling household pests without chemicals, buying environmentally friendly products and using reusable beverage containers. See Table 4.

Demographic Differences

Racial/Ethnic Groups

Differences across racial and ethnic groups were noted for several of the Environmental Attitude and Behavior items. Specifically:

- African American respondents were less in agreement that their actions directly impact water quality (M=6.26)
- African Americans were also less in agreement with regard to buying environmentally friendly products (M=5.12) and using reusable beverage containers (M=5.78).
- Asian respondents were more likely than other groups to agree that being environmentally responsible is too expensive, although their mean response was still not high in agreement (M=5.03)
- White respondents were stronger in their agreement that they never throw trash on the ground (M=8.77) and, correspondingly, in their disagreement that they have thrown trash on the ground in public areas (M=1.93).

Gender

Mean responses also differed for men and women on some of the Attitude and Behavior items:

- Women were more likely to agree that they only by recycled and environmentally friendly products (M=6.18) and were more likely to disagree that being environmentally responsible is too expensive (M=3.67).
- Women were also more likely to agree that they never throw trash on the ground (M=8.51) and that litter makes a neighborhood look bad (M=9.30).

Own Yard or Garden

Those respondents who said that they have their own yard or garden also differed significantly from those who did not on a few of the Attitude and Behavior items:

- Those who did not have their own yard or garden were less likely to feel that their actions directly impact water quality (M=6.83). They were also more likely to feel that being environmentally responsible is too inconvenient (M=3.86), although this mean still fell in the range of disagreement on the 10-point scale.
- Those who had their own yard or garden were more likely to agree that they buy recycled or environmentally friendly products (M=6.11) and but were also more likely to agree that is it okay to throw food scraps on the ground (M=4.31).

There were no significant differences on the Attitude and Behavior items between those who reported living in a single family home and those who lived in multi-unit homes.

Education Level

There were a few significant differences on Attitude and Behavior items related to participants' level of education:

- Those with a college education or some graduate school were less likely to feel that being environmentally responsible is too expensive (M=3.76 and M=3.35 vs. M=4.95 for other categories combined). Similarly, they were less likely to feel that it was too inconvenient (M=3.04 and M=2.98 vs. M=4.39 for other categories combined).
- This with a graduate school or professional school experience were less likely to agree that they had thrown trash on the ground in public areas (M=1.73).

Voter Registration Status

Finally, those who indicated that they were not registered voters differed from those who were on several of the Attitude and Behavior items.

- Respondents who were not registered voters were more likely to agree that being environmentally responsible is too expensive (M=4.61) or inconvenient (M=4.32).
- Registered voters more strongly agreed that litter makes a neighborhood look bad (M=9.28).
- Non-registered respondents were less likely to agree that they never thrown trash on the ground (M=7.60) and somewhat more likely to agree that they had littered in public areas (M=2.99)

Program Recognition

Importance of having a program or agency to protect creeks and the Bay

To begin the section of the survey on Program Recognition, participants were asked to ratehow important it was to have a program or agency that protects local creeks and the Bay, where "1" was "not at all important" and "10" was "extremely important". **Overall, respondents rated having such a program or agency as extremely important: The mean response was 8.56, and half of respondents gave this question the highest rating on the 10-point scale.**

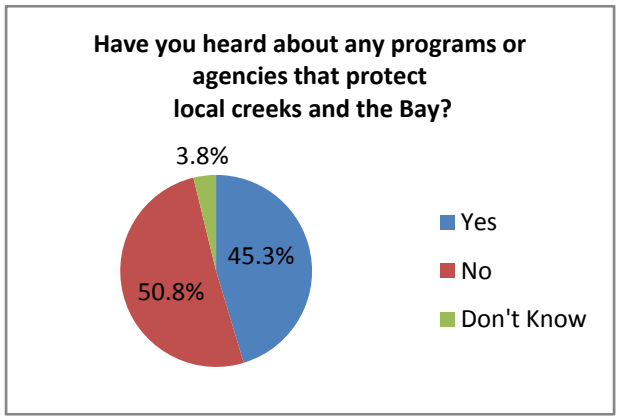
There were no significant differences in ratings on the question of program importance across gender, race/ethnicity, or education categories. Those who were registered voters (M=8.47) and those who live in single-family homes (M=8.42) rated program importance some what lower than others (*p's* <.05), but their ratings were still at the high end of the scale.

As a follow-up, respondents were asked whether or not they would be willing to pay $20 per year to support such a program. The majority (68.6%) of survey respondents were willing to do so. There were no significant differences across demographic groups on this item with one exception: Respondentswho had some graduate or professional school were more willing, as a group, to pay for a program (87.4%).

Program awareness

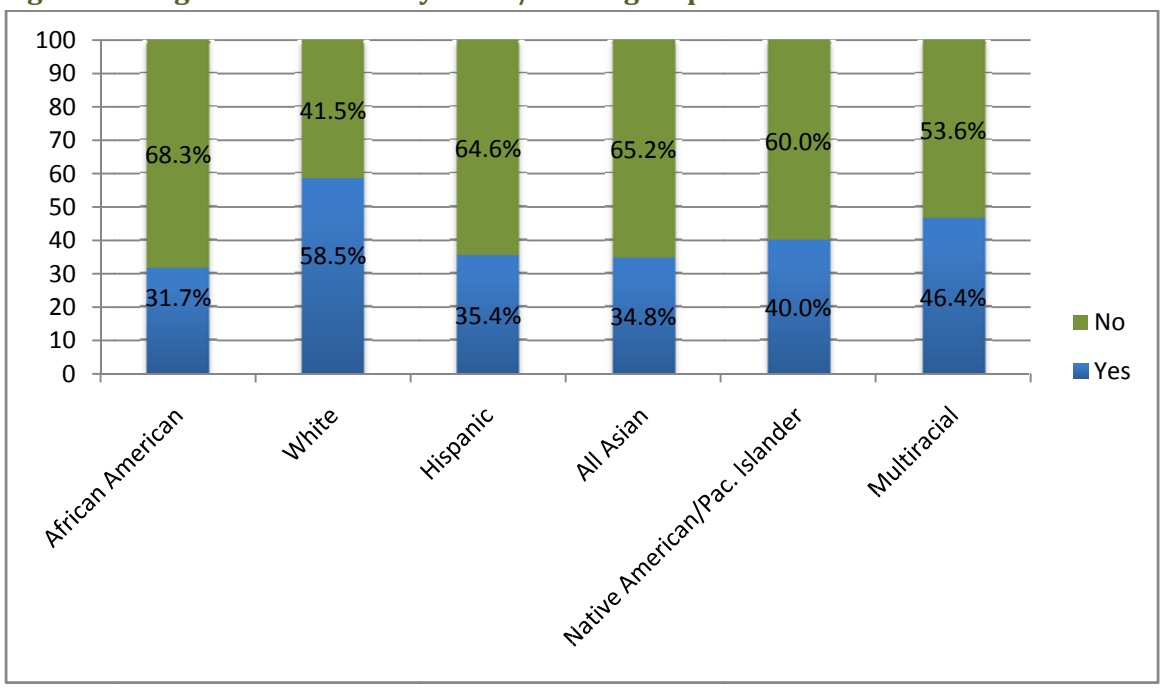
Respondents were split on whether they had heard of a program that protects local creeks and the Bay. Just over half stated that they were not aware of any such programs or agencies, while about 45% said that they were aware of a program or agency. SeeFigure 7.

Figure 7. Awareness of water protection programs or agencies



An analysis by racial/ethnic group showed that White respondents were most likely to say that they were currently aware of a program or agency to protect local waterways and African American, Hispanic and Asian respondents were less likely to say that they were aware of such a program or agency (p<.001). See Figure 8.

Figure 8. Program awareness by racial/ethnic group



Those respondents with a college education or higher, were also significantly more likely to report program awareness (see Figure 9.)

Figure 9. Program awareness by education level

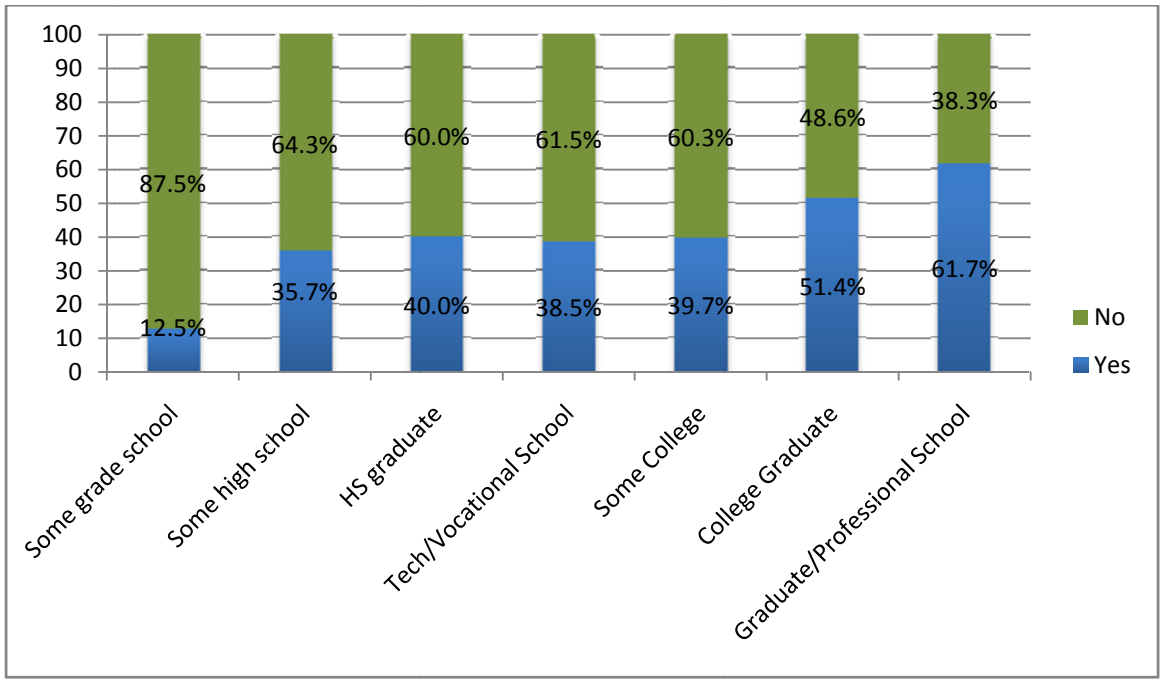
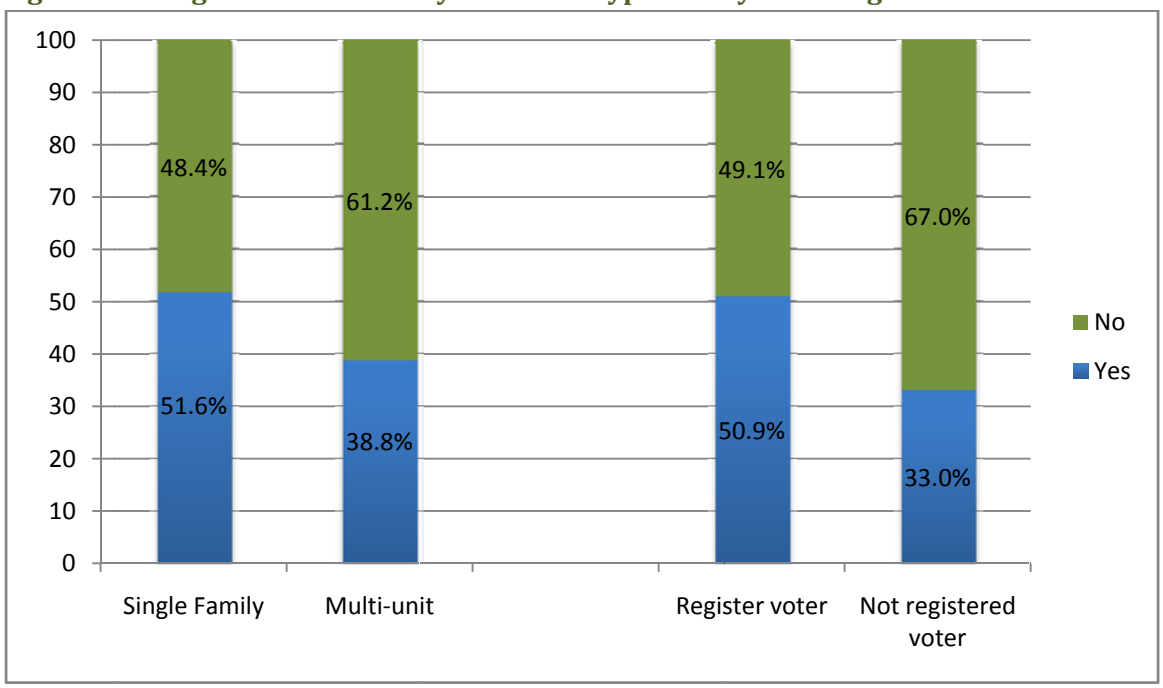


Figure 10. Program awareness by residence type and by voter registration status



Three other demographic variables were related to program awareness: First those who live in single-family residences were more likely to say that they were aware of a program or agency, as were those who were registered voters (*p's*<.05). See Figure 10. Finally, respondents who confirmed program awareness were older, on average, than those who did not (M=53.7 vs. M=50.0, *p*<.05).

Recall for Program Name and Message

Interviewers asked survey respondents whether or not they could name any program or agency that protected local creeks and the Bay.**Error! Reference source not found.** shows the percentage of respondents who mentioned each of the listed programs or agencies. Without prompting, approximately 5% (N=7) of respondents cited the Clean Water Program of Alameda County.Table 5 shows the percentages of respondents naming each specific program, among those who provided a response.

Table 5. Program name recall

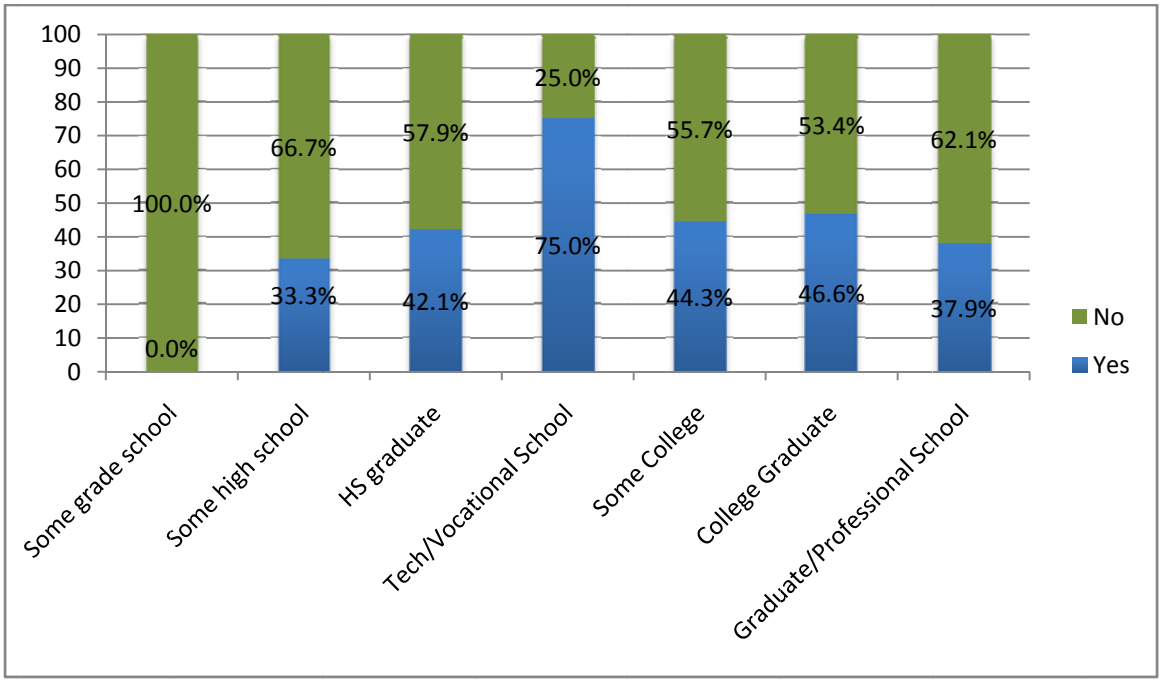
Program Name	Percent Recalling (N=131)
Our Water Our World	0.8%
Save the Bay	22.9%
BASMAA	0.8%
Bay Conservation and Development Commission	3.1%
Regional Water Quality Control Board	3.8%
California Coastal Commission	3.8%
Clean Water Program of Alameda County	5.3%
Other	59.5%

However, when asked directly if they had heard of the Clean Water Program (CWP), 42.9% of all respondents said "Yes."Note that the following comparisons exclude those respondents who said "Don't Know" or declined to respond.

Analysis of key demographics found:

- Those who had heard of the CWP were older, on average, than those who had not (M=55.48, SD=16.58 vs. 48.36, SD=16.32), *p*<.001.
- There were significant differences across education level categories on program name recognition, but the pattern does not show a clear trend. SeeFigure 11.

Figure 11. Program name recognition by education level



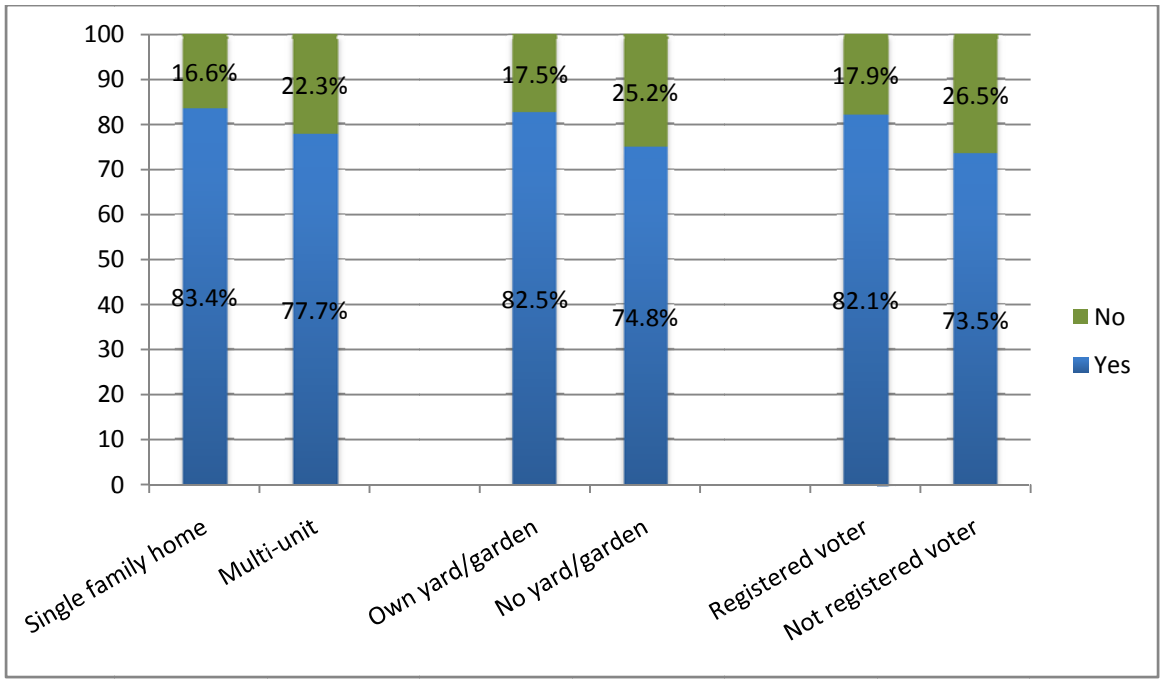
- Registered voters were more likely to have heard of the CWP than were those who were not registered (46.7% vs. 29.3%).
- There were no significant differences in program name recognition found across racial/ethnic groups.
- There were no significant differences found between those living in single family residences and multi-unit buildings on this question.

Numerous other programs and organizations were mentioned in response to the open-ended question. Those mentioned 3 or more times were: Friends of Sausal Creek (10),the Environmental Protection Agency (4), andBaykeeper (3). See Appendix B for a complete list of responses to this item.

Message recall

At the end of the survey respondents were asked if they had heard or seen the specific phrase "No dumping, drains to Bay." The majority of respondents (80.4%) did recall hearing the phrase. There were no differences in rates of recall for this message by gender or racial/ethnic group. However there were significant differences in recall for the phrase across other demographic categories. Respondents who lived in a single-family residence, had their own yard or garden or were a registered voter were more likely to say that they recalled the phrase (*p's*< .05). See Figure 12.

Figure 12. Demographic variables showing significant differences in message recall



Message exposure

Finally, respondents were asked if they had viewed a movie in a theater in the two weeks prior to the survey. About 31% had done so. These individuals were then asked if they recalled seeing any messages about clean water during the previews. Less than 10% were able to recall such a message (9.7%, N=17). Of those that recalled a message, four respondents were able to describe specific content for the interviewer. These four individuals stated that the message was to be careful what was put into the water and/or to avoid dumping trash on the ground because it drains into the Bay. Ten out of 17 (59%) did not recall any specific message content. The remaining three recalled a general message: "Be as green as possible," "Don't pollute creeks," "Do not pollute."

Conclusions

Storm Water Knowledge

Overall, the results of the survey indicate that residents of Alameda County are aware of storm water pollution as a serious environmental issue affecting their local waterways. Water pollution was one of the top three issues cited spontaneously by respondents. The majority were also able to state without prompting that water runoff from storm drains enters local creeks and the Bay. However, there is room for improvement: 36% of respondents were mistaken in their impression of what happens to storm water runoff or did not know.

When asked about specific polluting behaviors with the potential to impact waterways, such as littering and disposal of toxic substances, respondents generally recognized them as problems. However, responses indicate that many may still not be aware of the pollution caused by washing cars in the street or driveway or hosing down their driveways. Information on these issues may also be most profitably targeted to men, who seemed less generally convinced of their importance than women.

Environmental Attitudes and Behaviors

Respondents as a group expressed high levels of agreement that their behaviors have a direct impact on the environment. They tended to express positive attitudes about using environmentally friendly products and negative attitudes about littering.

Analysis of demographic variables suggested that more outreach might be needed to some groups on these issues. These included residents of multi-family units, African-Americans, and Asians, who may be less inclined to feel that their actions have a direct impact or that being environmentally responsible is economically feasible.

Program Recognition

Survey respondents felt strongly that it was important to have a program or agency to protect local creeks and the bay, but less than half (45%) said they had heard of any such program. Program awareness was even lower (30-40%) for non-White residents and those with lower education levels.

However, when specifically prompted, about 43% of respondents had heard of the Clean Water Program. There was also high rate of recognition for the phrase “No dumping, drains to Bay,” with over 80% of respondents indicating that they had seen or heard it.These results suggestthat this particular message is becoming a familiar one in Alameda County. One respondent who was not able to name a specific program did mention “the one that paints the fish symbol on the storm drains.” Older residents and registered voters were most likely to say that they had heard of the Clean Water Program, but there were no ethnic differences in recognition for the CWP.

More research is needed on the impact of program messages as they are being distributed in movie theaters. The current survey showed that only a minority of those who had been to a movie in the survey’s timeframe could recall having seen such a message and only a few of those were able to cite specific content.

Appendix A: Survey

INTRO 1. Hello, my name is _____ and I am conducting a survey to find out how people in Alameda County feel about some local issues. We are not selling anything and your responses will be completely confidential. The survey will take about 10 minutes. For the survey, may I speak to the person in the household who has the next birthday and is at least 18 years of age? Would that be you?

1. YES
2. NO [ASK FOR HOUSEHOLD MEMBER AT LEAST 18 YEARS OF AGE WITH NEXT BIRTHDAY]

CELL PHONE SAMPLE ONLY: ASK INTRO2, ELSE SKIP TO INTRO5.

INTRO2. This sounds like a cell phone. Are you in a place where you can safely talk on your cell phone?

1. YES, SAFE PLACE [SKIP TO INTRO4]
2. NO, NOT A SAFE PLACE [SET UP A CALLBACK]
3. NO, NOT A CELL PHONE

INTRO3. Okay, did you forward your cell phone number to this phone, or is this not a cell phone number that I called you on?

1. FORWARDED FROM CELL PHONE
2. NOT A CELL PHONE [TERMINATE]
3. OTHER [TERMINATE]
4. DON'T KNOW/REFUSED [TERMINATE]

INTRO4. When you are at home, do you get personal calls on a regular phone as well as this cell phone, or do you get all your personal calls on this cell phone, or do you use this phone only for business calls?

1. GET CALLS ON REGULAR PHONE AND THIS CELL PHONE
2. GET CALLS ON THIS CELL PHONE ONLY
3. GET ONLY BUSINESS CALLS ON THIS CELL PHONE [TERMINATE]
8. DON'T KNOW [TERMINATE]
9. REFUSED [TERMINATE]

INTRO5. To verify that I'm calling the right area, what is your zip code?

1. ZIP CODE IS ON LIST
2. ZIP CODE IS NOT ON LIST [THANK AND TERMINATE]
8. DON'T KNOW [TERMINATE]
9. REFUSED [TERMINATE]

ENVIRONMENTAL ISSUES

Q1. What do you think is the most important environmental issue facing Alameda County today? [INTERVIEWER, DO NOT READ RESPONSE ITEMS. RESPONSES THAT ARE NOT LISTED WILL BE PLACED IN *OTHER* AND CODED.]

Q1_1. RECYCLING
Q1_2. LITTER/GARBAGE
Q1_3. HAZARDOUS/TOXIC WASTE
Q1_4. CARS LEAKING OIL/OTHER FLUIDS
Q1_5. RUNNING OUT OF LANDFILL/DUMP SITES
Q1_6. DESTRUCTION OF HABITAT/OPEN SPACE
Q1_7. DEVELOPMENT/OVERPOPULATION
Q1_8. INFRASTRUCTURE MAINTENANCE OF SEWERS
Q1_9. PESTICIDES OR OTHER CHEMICALS ON FOOD
Q1_10. FOSSIL FUEL DEPENDENCE/ENERGY USE ISSUES
Q1_11. GLOBAL WARMING
Q1_12. DROUGHT/WATER CONSERVATION
Q1_13. AIR POLLUTION
Q1_14. WATER POLLUTION
Q1_15. OTHER
Q1_98. DON'T KNOW
Q1_99. REFUSED

[SHOW Q1_14A ONLY IF Q1_14 IS CHOSEN]

Q1_14A. Could you be more specific? What type of water pollution do you mean? [RECORD VERBATIM]
_____

[SHOW Q1_15_OTH ONLY IF Q1_15 IS CHOSEN]

Q1_15_OTH. _____
[RECORD *OTHER* RESPONSE VERBATIM]

STORM WATER KNOWLEDGE

Q2. When it rains, what would you say happens to the water that runs off the street into the storm drains? [INTERVIEWER, DO NOT READ RESPONSES.]

1. RUNS DIRECTLY INTO CREEKS OR THE BAY (NO MENTION OF WHETHER TREATED OR NOT)
2. RUNS DIRECTLY INTO CREEKS OR THE BAY WITH NO TREATMENT
3. TREATED FIRST, THEN GOES INTO CREEKS OR BAY
4. TREATED FIRST, THEN SAVED IN A RESERVOIR
5. NOT TREATED, SAVED IN A RESERVOIR
6. OTHER
8. DON'T KNOW
9. REFUSED

[SHOW Q2_OTH ONLY IF RESPONSE TO Q2 IS *OTHER*]

Q2_OTH._____
_____[RECORD *OTHER* RESPONSE VERBATIM]

T1. I am going to read you a list of things that might or might not be harmful to our creeks and the Bay. For each one I read, please tell me if you think it is a very serious problem, a somewhat serious problem, not too serious a problem, or not a problem at all.

[RANDOMIZE Q4-Q15, ASK ONLY FIRST 4 STATEMENTS THAT APPEAR]

Q4. Washing your car in the street or driveway

Q5. Trash in the street

Q6. Pesticides, weed killers and fertilizers used in and around the home

Q7. Fluorescent light bulbs put in the garbage can

Q8. Oil leaking from cars

Q9. Rinsing paint brushes, pans, and rollers in the sink

Q10. Hosing down your driveway

Q11. Driving a car

Q12. Factories and other industry

Q13. Illegal dumping of large items such as tires, furniture or appliances

Q14. Cigarette butts on streets, sidewalks, and parking lots.

Q15. Accidental litter such as items falling from vehicles.

[RESPONSES FOR Q4-Q15]

1. Very serious problem
2. Somewhat serious problem
3. Not too serious a problem
4. Not a problem at all
8. DON'T KNOW
9. REFUSED

ENVIRONMENTAL ATTITUDES AND BEHAVIORS

T3. I am going to read you a list of statements. For each, please tell me if you agree or disagree with the statement, using a scale of 1 to 10, where 1 means you **strongly disagree** with the statement and 10 means you **strongly agree** with the statement

[RANDOMIZE Q21-Q31]

Q21.	My actions directly impact water quality in local creeks and the Bay. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q22.	I consider the environmental impact of everything I do. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q23.	I only buy recycled or environmentally friendly products. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q24.	Being environmentally responsible is too expensive. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q25.	Being environmentally responsible is too inconvenient. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q26.	I can control pests in and around my home without toxic chemicals. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q27.	I never throw trash on the ground. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q28.	Litter makes a neighborhood look bad. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q29.	I always use reusable water bottles and coffee mugs. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q30.	It is okay to throw apple cores and other food scraps on the ground. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF
Q31.	I have thrown trash on the ground in parks and public areas where I know it will be picked up. 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF

PROGRAM RECOGNITION

T4. Now I have a few questions to ask about local issues.

Q32. Using a scale from 1 to 10 where 1 means ***not at all*** important and 10 means ***extremely*** important, how important is it to have a program or agency that protects local creeks and the Bay?

1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 - - - 9 - - - 10 - - 98 DK - 99 REF

Q33. Would you be willing to pay $20 per year to support such a program?

1. YES
2. NO
8. DON'T KNOW
9. REFUSED

Q34. Have you heard about any programs or agencies that protect local creeks and the Bay?

1. YES
2. NO [SKIP TO Q36]
8. DON'T KNOW [SKIP TO Q36]
9. REFUSE[SKIP TO Q36]

Q35. Can you name the program? [INTERVIEWER, DO NOT READ RESPONSE CHOICES, PROBE FOR SPECIFICS. IF PROGRAM IS NOT ON THE LIST, CHOOSE *OTHER* AND RECORD RESPONSE VERBATIM]

Q35_1. OUR WATER OUR WORLD [program/campaign]
Q35_2. SAVE THE BAY [non-profit]
Q35_3. BASMAA [regional agency]
Q35_4. BAY CONSERVATION & DEVELOPMENT COMMISSION(BCDC)[regional agency]
Q35_5. REGIONAL WATER QUALITY CONTROL BOARD [state agency w/local district]
Q35_6. CALIFORNIA COASTAL COMMISSION [state agency]
Q35_7. THANK YOU OCEAN [campaign of the CCC]
Q35_8. CLEAN WATER PROGRAM OF ALAMEDA COUNTY [**SKIP TO Q37**]
Q35_9. OTHER
Q35_98. DON'T KNOW
Q35_99. REFUSED

[SHOW Q35_9_OTH ONLY IF Q35_9 IS CHOSEN]

Q35_9_OTH. _____[RECORD *OTHER* RESPONSE VERBATIM]

Q36. Have you ever heard of the Clean Water Program?

1. YES
2. NO [SKIP TO Q38]
8. DON'T KNOW [SKIP TO Q38]
9. REFUSED [SKIP TO Q38]

T5. Thinking of things you may have heard or seen over the past year,

Q38. Have you heard or seen the phrase “No dumping, drains to Bay?”

1. YES
2. NO
8. DON’T KNOW
9. REFUSED

Q42. In the past week or two have you gone to a movie in a theater?

1. YES
2. NO [SKIP TO Q46]
8. DON’T KNOW [SKIP TO Q46]
9. REFUSED [SKIP TO Q46]

Q43. In what city was the theater where you saw the movie?
_____

Q44. During the previews and messages before the movie, do you recall seeing any messages about clean water?

1. YES
2. NO [SKIP TO Q46]
8. DON’T KNOW [SKIP TO Q46]
9. REFUSED [SKIP TO Q46]

Q45. What was the message? [INTERVIEWER, PROBE FOR SPECIFICS, RECORD VERBATIM]
_____

OTHER ENVIRONMENTAL BEHAVIORS

Q50. Do you have your own yard or garden?
1. Yes
2. No [SKIP TO T6]
98. DK [SKIP TO T6]
99. REF [SKIP TO T6]

Q51. Who cares for your yard or garden?
1. Self or other family member
2. Professional service
3. Other_____
98. DK
99. REF

[SHOW Q51_3_OTH ONLY IF Q51_3 IS CHOSEN]

Q51_3_OTH. _____[RECORD *OTHER* RESPONSE VERBATIM]

Q52. Do you use pesticides on your lawn or garden?

1. YES
2. NO
98. DK
99. REF

DEMOGRAPHICS

T6. We are almost finished. Now I'd like to ask you a few questions for statistical purposes only.

Q60. What is the highest level you completed in school?

1. Some grade school
2. Some high school
3. Graduated from High School
4. Technical/Vocational school
5. Some College
6. Graduated from College
7. Graduate or Professional School
8. Other
98. DON'T KNOW
99. REFUSED

[SHOW Q60_OTH ONLY IF RESPONSE TO Q60 IS *OTHER*]

Q60_OTH. _____[RECORD *OTHER* RESPONSE VERBATIM]

Q62. Do you live in a detached single family residence or a multi-unit building?

1. Single family
2. Multi-unit
3. Other
8. DON'T KNOW
9. REFUSED

[SHOW Q62_OTH ONLY IF RESPONSE TO Q62 IS *OTHER*]

Q62_OTH. _____[RECORD *OTHER* RESPONSE VERBATIM]

Q63. Are you a registered voter?

1. Yes
2. No [SKIP TO Q65]
8. DON'T KNOW [SKIP TO Q65]

9. REFUSED [SKIP TO Q65]

Q64. Did you vote in the most recent election?

1. Yes
2. No
8. DON'T KNOW
9. REFUSED

Q65. How long have you lived in Alameda County?

_____

Q66. In what year were you born?

_____

Q67. Would you classify yourself as [READ RESPONSE CHOICES, CHOOSE ALL THAT APPLY]

Q67_1. African-American/Black
Q67_2. White
Q67_3. Hispanic/Latino
Q67_4. Vietnamese
Q67_5. Chinese
Q67_6. Korean
Q67_7. Filipino
Q67_8. Other Asian
Q67_9. Native American/Pacific Islander
Q67_10. Multiracial
Q67_11. Other
Q67_98. DON'T KNOW
Q67_99. REFUSED

[SHOW Q67_11_OTH ONLY IF Q67_11 IS CHOSEN]

Q67_11_OTH. _____[RECORD *OTHER* RESPONSE VERBATIM]

THOSE ARE ALL THE QUESTIONS I HAVE. THANK YOU FOR PARTICIPATING IN OUR SURVEY!

INTERVIEWER ONLY:

IC1.RECORD GENDER

1. MALE
2. FEMALE
9. DON'T KNOW

IC2. HOW WELL DID THE RESPONDENT UNDERSTAND THE QUESTIONS?

1. VERY WELL
2. SOMEWHAT WELL
3. NOT WELL

IC3. HOW ATTENTIVE WAS THE RESPONDENT?

1. VERY ATTENTIVE
2. SOMEWHAT ATTENTIVE
3. NOT AT ALL ATTENTIVE

IC4. HOW COOPERATIVE WAS THE RESPONDENT?

1. VERY COOPERATIVE
2. SOMEWHAT COOPERATIVE
3. NOT AT ALL COOPERATIVE

Appendix B: Other Programs and Agencies Named

Respondents were asked if they had heard of any programs or agencies that protect local creeks and the Bay. Below is a list of agencies and programs cited in response to the open-ended item "Can you name the program?" Numbers in parentheses indicate those which were mentioned by multiple respondents.

Alameda County Water Agency

Alameda County Watershed

Alameda Creek Alliance (2)

Alameda Parks and Recreation

Arbor Day

Bay Area Air Quality

Bay Area Water District

Bay Area Watershed Alliance

Baykeeper (3)

Baywatch

Biointegral Research Center for Non-Toxic Test Solutions (BIRC)

California Water

CEEQUAL

Church of Christ Boys to Men Youth Group

Clean Bay

Cleaning the Creeks Program

Clean up the Creek Day

Coyote Hills or Coyote Point

Democratic Party

East Bay Creek Restoration Project

East Bay Municipal Pickup

East Bay Municipal Utility District (2)

East Bay Pollution Control

East Bay Water Control

East Bay Regional Parks

Environmental Justice Coalition on Water

Environmental Protection Agency (4)

Flood Control

Friends of Five Creeks

Friends of Fossil Creek

Friends of San Lorenzo Creek

Friends of Sausal Creek (10)

Mosquito Abatement

Oro Loma Sanitary District

Piedmont Pines Neighborhood Association

Public Works

Riverkeeper

Strawberry Creek Association

Surf Rider

Sierra Club

Trout Unlimited

Waste Management

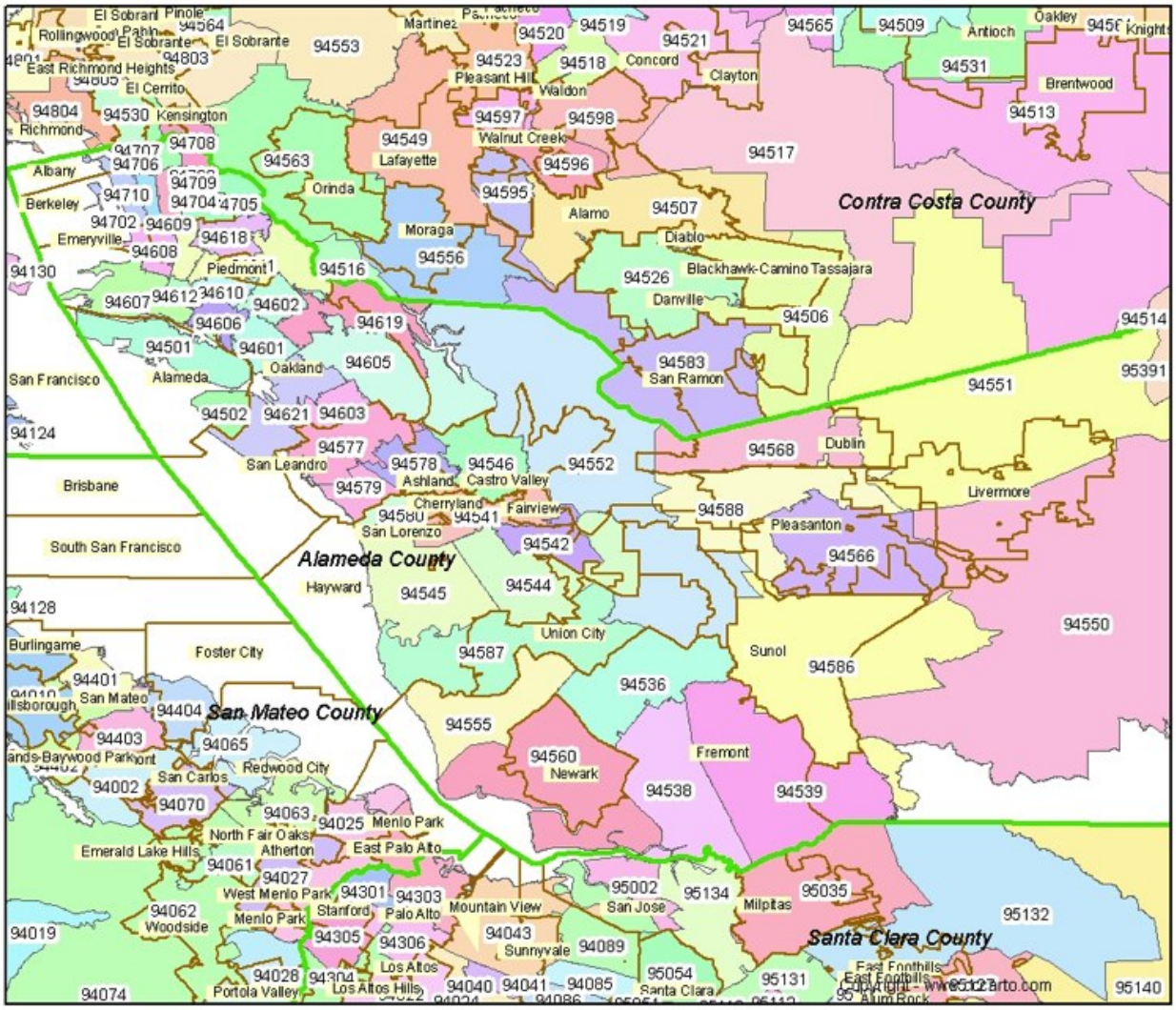
Water Board

Zone 7 (2)

Appendix C: Sample Distribution by Zip Code

Zip Code	Frequency	Percent	Valid Percent	Cumulative Percent
94501	23	3.8	3.8	3.8
94502	5	.8	.8	4.7
94536	26	4.3	4.3	9.0
94538	17	2.8	2.8	11.8
94539	12	2.0	2.0	13.8
94540	1	.2	.2	14.0
94541	30	5.0	5.0	19.0
94542	9	1.5	1.5	20.5
94544	15	2.5	2.5	23.0
94545	16	2.7	2.7	25.7
94546	20	3.3	3.3	29.0
94550	30	5.0	5.0	34.0
94551	20	3.3	3.3	37.3
94552	8	1.3	1.3	38.7
94555	5	.8	.8	39.5
94560	15	2.5	2.5	42.0
94566	24	4.0	4.0	46.0
94568	19	3.2	3.2	49.2
94577	22	3.7	3.7	52.8
94578	12	2.0	2.0	54.8
94579	9	1.5	1.5	56.3
94580	7	1.2	1.2	57.5
94586	4	.7	.7	58.2
94587	17	2.8	2.8	61.0
94588	12	2.0	2.0	63.0
94601	16	2.7	2.7	65.7
94602	20	3.3	3.3	69.0
94603	7	1.2	1.2	70.2
94605	14	2.3	2.3	72.5
94606	9	1.5	1.5	74.0
94607	7	1.2	1.2	75.2

94608	19	3.2	3.2	78.3
94609	9	1.5	1.5	79.8
94610	9	1.5	1.5	81.3
94611	20	3.3	3.3	84.7
94612	3	.5	.5	85.2
94613	1	.2	.2	85.3
94618	8	1.3	1.3	86.7
94619	12	2.0	2.0	88.7
94621	5	.8	.8	89.5
94662	1	.2	.2	89.7
94702	7	1.2	1.2	90.8
94703	14	2.3	2.3	93.2
94704	2	.3	.3	93.5
94705	2	.3	.3	93.8
94706	13	2.2	2.2	96.0
94707	11	1.8	1.8	97.8
94708	6	1.0	1.0	98.8
94709	2	.3	.3	99.2
94710	4	.7	.7	99.8
94720	1	.2	.2	100.0
Total	600	100.0	100.0	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San Francisco
Brisbane
South San Francisco
Burlingame
Foster City
San Mateo
Redwood City
San Carlos
Menlo Park
North Fair Oaks
Atherton
East Palo Alto
Emerald Lake Hills
West Menlo Park
Stanford
Palo Alto
Mountain View
Woodside
Portola Valley
Los Altos
Los Altos Hills
Sunnyvale
San Jose
Santa Clara
Milpitas
East Foothills
Alum Rock
Martinez
Pleasant Hill
Concord
Clayton
Walnut Creek
Lafayette
Orinda
Moraga
Alamo
Diablo
Blackhawk-Camino Tassajara
Danville
San Ramon
Dublin
Livermore
Pleasanton
Castro Valley
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Cherryland
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San Lorenzo
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FOR IMMEDIATE RELEASE
March 12, 2013

CONTACT
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(510) 670-6548

To view this release online visit www.cleanwaterprogram.org/members-news/item/clean-water-program-now-accepting-grant-applications.html

Clean Water Program Now Accepting Grant Applications

Funding Available for Projects That Help Protect Creeks, Wetlands and the Bay

Alameda County, CA—The Clean Water Program is inviting applications for its 2013 Community Stewardship Grant Program, designed to encourage and facilitate community-based actions that enhance and protect the health of local waterways. Proposed projects must be aimed at storm water pollution prevention in Alameda County and contain a community or public outreach element. Funding requests between $1,000 and $5,000 per project will be considered, for a total 2013 grant budget of $20,000. Eligible applicants include teacher and student groups, youth organizations, homeowners associations, community groups, environmental groups and other non-profit organizations. Deadline for submissions is April 18, 2013.

"Projects funded by the grants help us reach out to people in Alameda County about the importance of clean and healthy waterways and what we can all do to protect our creeks, wetlands and the Bay," explained Clean Water Program Manager Jim Scanlin."The grants provide financial support to local groups and organizations aligned with this mission, and in turn their expertise, creativity and networks on the community level help us expand our reach," he added.

Since its beginnings over 15 years ago, the annual grants program has funded almost 100 grassroots projects.Activities range from creek restoration, wildlife habitat improvement and rainwater harvestingtooutreach and education. Projects focused on outreach typically address practices to prevent storm water pollution such as proper household hazardous waste disposal, litter prevention, Integrated Pest Management, etc. Outreach methods include art projects, events, trainings, videos and printed materials, among others.

Sample projects funded in recent years:

- Park Day School in Oakland installeda rainwater garden and cistern as part of the school'slearning gardenprogram, developed educational signage and provided tours of the garden and catchment system to outside visitors at several school events.
- Cycles of Change in Oakland trained high school students as "watershed ambassadors" who led groups of 3rd through 8th grader to educate small businesses near Lake Merritt about their sharedwatershed and how to prevent storm water pollution.
- The Alameda Creek Alliance recruited and trainedvolunteersto monitor, clean up and restore creek habitat, and reach out to creek-side residents through theStreamKeeper Program,aimed at the restoration of salmon and steelhead trout to Alameda Creek.

For more information about the Clean Water Program Community Stewardship Grants and projects funded in the past, and to download an application packet please visit www.cleanwaterprogram.org/grants.

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FOR IMMEDIATE RELEASE
January 15, 2013

CONTACT
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(510) 670-6548

Pick Up a Free Reusable Bag and a New Habit

Clean Water Program Giveaways Raise Awareness about Plastic Bag Pollution

Alameda County, CA—Between January 22 and February 2, 2013, member agencies of the Clean Water Program will be holding reusable bag giveaway events, in support of the countywide reusable bag ordinance that went into effect on January 1. The ordinanceprohibits stores that sell packaged food or alcohol from giving away single-use bags at checkout, and requires them to charge a minimum of 10 cents per paper or reusable bag, as an incentive for shoppers to bring their own reusable bags to the store.

The following reusable bag giveaways are scheduled, while supplies last. All events are free to the public.
Dublin: Tue, Jan 22, 3-5PM, lobby of the Dublin library, 200 Civic Plaza, Dublin
San Leandro: Fri, Jan 25, 10AM-12PM, Pac N Save supermarket, 555 Floresta Blvd.
Emeryville: Fri, Feb 1, 3-5PM, Pac N Save supermarket, San Pablo Ave at 40th St.
Hayward: Sat, Feb 2, 9AM-12PM, Hayward Farmers Market, 777 B Street (City Plaza)
Oakland: Sat, Feb 2, 9-11AM, Fruitvale Plaza, Avenida de la Fuente

"We want to raise awareness about the harm disposable plastic bags pose to the health of our local creeks and San Francisco Bay, and encourage residents to get into the habit of using reusable bags," explained Clean Water Program Manager Jim Scanlin, "Each year, the equivalent of 100,000 kitchen garbage bags worth of litter end up in our local waterways, including an estimated 1 million disposable plastic bags," he added.

In Alameda County storm water does not pass through a water treatment plant. This means that litter and other pollutants carried into the storm drain system by wind and water flow directly into creeks and the Bay, where they harm fish, marine mammals and birds. Plastic bags and other lightweight plastic litter don't biodegrade and are particularly hazardous because they float, entangling and poisoning marine wildlife that mistakes the items for food.

In addition to its environmental impacts, litter is also an eyesore and puts a heavy financial burden on communities. Alameda County jurisdictions spend approximately $24 million every year on litter and storm drain cleanup.

Under the Federal Clean Water Act, cities in the Bay Area are required to reduce or eliminate storm water pollution in order to comply with the Municipal Regional Stormwater Permit, issued by the San Francisco Bay Regional Water Quality Board. Under the current permit, Alameda County must reduce trash discharge from storm drains by 40% by 2014, and by 70% by 2017. The ban is expected to go along way toward reaching those goals.

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(For background on the Clean Water Program, please see next page.)

About the Clean Water Program

Made up of agencies from around Alameda County, the Clean Water Program has been working since 1991 to facilitate local compliance with the Federal Clean Water Act. Member agencies include the cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro and Union City, the County of Alameda, the Alameda County Flood Control and Water Conservation District, and the Zone 7 Water Agency.

The Program reaches out to residents and businesses throughout the county, helping people understand why having clean and healthy waterways is important to our daily lives, and what role each of us plays in protecting local creeks, wetlands and the Bay. Fostering an appreciation of the local environment, the Program inspires residents to do their part to prevent water pollution during everyday activities like gardening, household cleaning, and keeping their cars in good shape. The Program's free publications and consultations help business owners and managers understand water pollution prevention regulations that affect them, and adopt best practices to stay in compliance.

For more information about the Clean Water Program visit www.cleanwaterprogram.org.

2013

Bay-Friendly Garden Tour

Executive Tour Summary

Bay-Friendly Coalition

June 2013

Executive Tour Summary | 2013 Bay-Friendly Garden Tour

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Introduction

For the 3rd year the Bay-Friendly Coalition partnered with local agencies to organize the Bay-Friendly Garden Tour. Tours were held on two separate dates in two counties and four city clusters:

- Sunday, April 28, Alameda County
  - Dublin/Pleasanton/Livermore
  - Castro Valley/San Leandro
  - Oakland
- Sunday, May 5, Napa County
  - Napa

The tour continues to inspire residents with real-life examples of Bay-Friendly gardens and provides an opportunity for the public to learn more about Bay-Friendly programs and practices. The tour supports Bay-Friendly Qualified Professionals by showcasing their personal or client's gardens and provides an opportunity to promote sponsors, nurseries and landscaping suppliers.

Accomplishments of the 2013 Tour include:

- Further development of a successful sponsorship package for businesses and organizations.
- Increased public engagement via social media.
- Continued press coverage of the tour and Bay-Friendly, including features in the San Francisco Chronicle and Napa Valley Register.
- Continued positive feedback from tour participants, host gardeners and volunteers.
- Continued project delivery on budget.

2013 Tour Numbers at a Glance

- **1300** Tour Participants
- **334** New Email Contacts
- **65** Registered Volunteers
- **35** Host Gardens
- **23** Memberships
- **9** Regional & Local Sponsors
- **7** Participating Bay-Friendly Qualified Professionals
- **4** Local Host Agencies

Roles and Funding

The 2013 tour was organized and funded on three levels.

1. **The Bay-Friendly Coalition** served as the umbrella organization for regional tour planning and implementation. The Coalition collaborated with and supported the local organizing agencies.
2. **Local Organizing Agencies** coordinated and implemented the tour in their service areas with support from the Coalition.
3. **Sponsors** contributed funds to the Coalition to support the tour.

This year's **local organizing agencies** were the City of Napa, Napa County, Napa County Resource Conservation District and StopWaste.Org

This year's **sponsors** included:

- Alameda Countywide Clean Water Program
- Cagwin & Dorward
- East Bay Municipal Utility District
- Evergreen Nursery
- Ploughshares Nursery
- The Urban Farmer Store
- Western Garden Nursery
- WM EarthCare
- Zone 7 Water Agency

Tour Promotion

Tour promotions were primarily geared towards encouraging registration, but also raised public awareness of Bay-Friendly programs and practices. Promotions were conducted both regionally and locally. Sponsors provided raffle items, including the EBMUD book "Plants and Landscapes for Summer-Dry Climates" and a BYOB picnic pack from Cagwin & Dorward, as incentives for tour participation. The Coalition developed a tour poster and postcard that were provided to organizers and sponsors for local distribution. The tour was listed in both print and online media calendars. Promotional efforts included:

Print Media Highlights

- San Francisco Chronicle, Sunday, April 21, *Garden Tours in the Bay Area*
- Napa Valley Register, Saturday, April 27, *Going on a Garden Tour: Bay-Friendly Tours Inspire Transformations*
- Castro Valley Forum, Wednesday, April 17, *No Rain? No Problem with Bay-Friendly Landscaping*

Online Platforms

- The Coalition's tour web page **generated over 6500 page views** from March through April. Local agencies included tour information on their websites.
- The Coalition's monthly e-newsletter was sent to a list of over 10,000 people and featured the tour in the March and April issues.
- The Bay-Friendly Blog featured tour related posts from March through April. Tour host gardeners, including a Bay-Friendly Qualified Professional, submitted posts that promoted the tour. During this time the blog received nearly **5000 page views,** the most traffic it has received to date.
- The Bay-Friendly Facebook page was used extensively to promote the tour and had the highest level of engagement to date. During March and April Facebook received **99 new likes** (a 13% increase).
- Local community websites listed the tour including Patch sites in Livermore, Fremont, Castro Valley, and San Leandro.

Paid Marketing

- Online advertisements were placed on Google and Facebook, and together **generated 1576 clicks**. The campaign's impact was limited by its budget, not by interest in the advertisements.
- An advertisement was placed in the East Bay Express Urban Homestead Guide and tour information was included in their e-blast.

Tour Participants

More than 1300 people participated in this year's tours and 632 guidebooks were sold. Participation is tracked through the number of guidebooks sold and the number of guests sharing a guidebook. Print guidebooks included 36 entrance tickets and digital guidebooks included two entrance passes. Each adult turned in a ticket at every garden visited or presented their entrance pass. Compared to the 2012 Tour, average garden attendance increased in Napa from 141 to 166 and in Alameda County from 166 to 175.

Host Gardeners

The tour featured **35 host gardens** located in four city clusters. They represented the many different styles of Bay-Friendly, showcasing urban homesteads with chickens and vegetables, hillside native habitat gardens, and landscapes watered by rainwater catchment systems. **Seven Bay-Friendly Qualified Professionals** participated and showcased seven gardens on the tour, including personal home gardens as well as client's gardens.

Volunteers

Volunteers staffed welcome tables at each of the host gardens—**65 individuals registered to volunteer**. After the tour a survey was sent to volunteers asking for feedback about their experience. Of the 27

volunteers who completed surveys, **69% indicated that they were motivated to volunteer because they wanted to "support Bay-Friendly".**

Participant Feedback

A post tour e-news and survey was sent to the 515 participants who provided email addresses. The survey response rate was nearly 20% with **93 completed surveys**. Overall, results indicate a high level of satisfaction with the tour and a continued interest in learning about Bay-Friendly practices:

- 99% would recommend the tour to a friend, neighbor or fellow gardener.
- 95% rated the quality of the gardens as excellent or good.
- 77% were more interested in adopting Bay-Friendly practices at home after the tour.
- 71% were most interested in learning about conserving water, 67% were looking for general inspiration, and 64% were interested in natural gardening techniques.
- 83% were most interested in visiting native plant gardens; followed by 77% for drought tolerant gardens and 53% for edible gardens.
- 60% rate their level of personal gardening experience as intermediate; 22% as beginner and 18% as experienced.

Program Improvements

Recommended changes from the 2012 Tour were incorporated into the 2013 Tour. These improvements included:

- **Optimize guidebook production, content and distribution.** The guidebook was offered in both print and digital format. Guidebook printing and mailing has been one of the program's most expensive hard costs. This year fewer guidebooks were printed to help reduce the printing and mailing costs, and digital guidebooks were relied upon for supplemental distribution. Less than 5% of the print guidebooks were remaining after the tour. Print guidebooks accounted for 41% of total guidebooks distributed; digital accounted for 59%.
- **Expand into more counties.** The San Mateo County Resource Conservation District secured local funding to join the 2013 tour but was unable to identify enough host gardens to feature on a tour. The San Francisco PUC and Garden for the Environment were approached as potential host agencies but funding was not available for 2013. The Marin Municipal Water District opted to organize a free Marin-Friendly Garden Tour with local funding for 2013. Santa Clara County decided not to participate in the 2013 tour but remains open to collaborating on future tours.
- **Increase participation.** Total participation was less than the 2012 Tour largely because fewer counties participated; however, per garden visitation was up. Alameda County gardens received an average of 175 visitors this year as compared to 166 in 2012; Napa gardens received 166 compared to 141. One strategy for increasing participation that the Coalition has yet to try is offering the tour for free. The Coalition took the first step toward a free tour in 2013 Tour by offering a digital guidebook. Relying more

heavily on digital guidebooks could help reduce hard costs and allow the tour to be offered for free in the future.

- **Streamline local organizer's role and better highlight host agencies.** The Coalition continued to support the local organizing agencies; the average time local organizers spent per garden was reduced from 18 hours in 2012 to 16 hours in 2013. Tools provided to the local organizers were further developed and included a host agency overview, marketing plan, key milestones matrix, guidebook style guide and volunteer assignment spreadsheet. Local organizing agencies were presented as partners rather than sponsors in promotional collateral and were included in the welcome letter in the front of the tour guidebook. Each host garden received a sign listing local organizing agencies (as well as sponsors) that was displayed on welcome tables on tour day.

Moving Forward

The Coalition has decided not to hold a tour in 2014 and will be evaluating the current tour model for cost-effectiveness, strategic fit and market reach. The Coalition is also interested in exploring opportunities for collaboration with other garden tours and community organizations.

Bringing Back the Natives Garden Tour
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San Pablo CA 94806
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mailto:Kathy@KathyKramerConsulting.net

http://www.BringingBackTheNatives.net

Final Report

Why a Native Plant Garden Tour?
The spring 2013 Bringing Back the Natives Garden Tour was held in order to showcase pesticide-free, water-conserving gardens that reduce solid waste, provide habitat for wildlife, and contain 60% or more native plants.

The tour enlists local residents to demonstrate by example that seasoned and novice gardeners can garden with good results without the use of synthetic chemicals, and with minimal supplemental water, while providing food, shelter, and nesting areas for wildlife. The gardens on this tour show that it is possible to implement sustainable garden practices and still have beautiful places for people to relax in and enjoy. The goals of the Bringing Back the Natives Garden Tour are to motivate attendees to eliminate pesticide use, reduce water use, generate less solid waste, and provide habitat for wildlife in their own gardens.

Why California natives? Once established in the garden setting, California native plants need little or no summer water, as they survive naturally with only fall-to-spring rainfall. In addition to being water-conserving, California natives are hardy, and they do not require the use of pesticides and fertilizers, as many non-natives do. Native plants need less pruning than many non-natives, such as lawn, ivy, or cotoneaster, thus generating less green waste. Natives also provide the best habitat for birds, butterflies, beneficial insects, and other forms of wildlife.

A four-year study of water use, green waste generation, maintenance hours, and maintenance labor costs between a traditional garden and a California native plant garden was conducted by the City of Santa Monica. (See http://www.smgov.net/Departments/OSE/Categories/Landscape/Garden-Garden.aspx). The results of this study showed that the native garden used one tenth of the water that the traditional garden did; generated 40% of the green waste; took 20% of the time to maintain; and cost 75% less to maintain than the traditional garden.

Bringing Back the Natives Garden Tour gardens contain minimal or no lawn. This is of particular value since the majority of the chemicals purchased by homeowners support lawn care, and the majority of water used in home gardens is applied to lawns. According to the U.S. Fish and Wildlife Service's Division of Environmental Contaminants publication, "Homeowner's Guide to Protecting Frogs—Lawn and Garden Care," homeowners use up to ten times more chemical pesticides per acre on their lawns than farmers use on crops. In addition, half of

the water used by the average household is applied to the landscape—with most of that water being applied to keep turf green. Only 4 of the gardens included on the tour had any lawn at all, and these were reduced in size to 10% of the gardened area.

Award
This year Tour organizer Kathy Kramer received the Jefferson Award for the Bringing Back the Natives Garden Tour. Right before the Tour, this piece was shown on CBS three times, and the Tour and award were promoted on KQED twice:
http://sanfrancisco.cbslocal.com/2013/05/01/jefferson-award-winner-teaches-others-the-values-of-native-plants/

2013 Bringing Back the Natives Garden Tour events: Spring Tour and Native Plant Sale Extravaganza; Fall Native Plant Sale Extravaganza; and Select Tours

In 2013 the Bringing Back the Natives Garden Tour expanded its offerings to include not only the spring Tour and Native Plant Sale Extravaganza, but also a Fall Extravaganza, and a series of Select Tours. These are described below.

Ninth Annual Bringing Back the Natives Garden Tour and Native Plant Sale Extravaganza
The Ninth Annual Bringing Back the Natives Garden Tour, which took place on Sunday, May 5, 2013, showcased forty three gardens and nurseries located in fifteen cities and unincorporated areas in Alameda and Contra Costa counties (Berkeley, Concord, El Cerrito, El Sobrante, Fremont, Hayward, Livermore, Martinez, Moraga, Oakland, Orinda, Pleasanton, Richmond, San Lorenzo, and Walnut Creek).

A variety of gardens were featured on the tour. The gardens ranged from Al Kyte's forty year old wildlife habitat to a number of gardens that had been recently installed, and from very large lots to small front gardens in the flats. Tour gardens contained everything from local native plants to the horticulturally available suite of natives from throughout California. A quarter of the gardens were designed and installed by owners, and the rest were designed and installed by professionals. Almost all of the gardens were landscaped with between 70% to 100% native plants. Twenty-five percent of the gardens on this year's tour were offered by former registrants who had attended a previous Bringing Back the Natives Garden Tour and become inspired to transform their own garden.

Spring Native Plant Sale Extravaganza
In additional to the May 5, 2013 tour day, on which forty three gardens and nurseries were open for viewing, the spring Native Plant Sale Extravaganza took place throughout the week-end of May 4 and 5, 2013.

During the spring Native Plant Sale Extravaganza a number of native plant nurseries—some not normally open to the public, and others normally open only for limited hours—were open from 10:00–5:00. Bringing Back the Natives Garden Tour registrants took advantage of this opportunity to shop for unique

or hard-to-find native plants that are not normally available in most nurseries. This year nine nurseries took part in the Extravaganza, and more than $10,000 worth of natives were sold over the course of the week-end.

Number of registrants, volunteers, and garden visits
The tour received overwhelming interest from the public; this year there were 5,773 registrants. The bulk of the registrants (5,580) registered for the tour in advance, and on-line. On the day of the tour an additional 193 people visited the same day walk-in registration sites, which were set up in Berkeley, Concord, El Cerrito, Hayward, Livermore, Martinez, Moraga, and Oakland.

This year 12,831 garden visits were made on the day of the tour. See the end of this report for a list of the number of visitors counted at each garden.

Nearly 200 volunteers either worked at gardens for a half-day shift on the day of the tour, or helped with tour preparation and clean-up, contributing more than 800 hours of time to the tour. The 43 hosts put in countless hours preparing for the tour, and more than 300 hours on the day of the event.

Garden Talks
More than 40 garden talks and demonstrations were given throughout the day on a plethora of subjects. Talk topics included how to: retain stormwater on-site; remove a lawn; select, plant, and care for natives in general, and select natives for specific areas; design a simple, low-maintenance native plant garden; how to attract bees; choose appropriate natives; design and install a native plant garden; create a low-maintenance native plant garden; garden on hillsides; purchase native plants; control weeds without using herbicides; water efficiently; maintain a native plant garden; design and install a native garden yourself; garden for wildlife in general, and native bees and butterflies in particular; and how to control erosion, among other topics.

The website
The website contains numerous photographs of all of the gardens that have ever been on the tour (information on prior tours remains accessible on the website for reference), extensive garden descriptions, plant lists for each garden, and some garden-specific bird, butterfly, mammal, reptile, and amphibian lists, as well as resource information on how to garden with California natives. The resource information includes contact information for landscaper designers with gardens on the tour, a list of Easy-to-Grow East Bay Natives, lists of nurseries that carry native plants, lists of reference books, "How I got started gardening with native plants" essays by a number of the host gardeners, and more.

In order to attract hosts and volunteers, and to thank them for their time, two Garden Soirees—free, private tours of native plant gardens—were held in 2013. Garden Soirees offer host gardeners and volunteers the opportunity to see tour gardens that they would otherwise miss. They also create a feeling of camaraderie between hosts and volunteers, and provide a venue for people who are both knowledgeable and passionate about gardening with natives to meet and exchange information.

Misc. details
Eighteen of the gardens were at least partially wheelchair accessible. Eighteen of the gardens were also certified by the National Wildlife Federation as Backyard Wildlife Habitat Gardens.

Fall Native Plant Sale Extravaganza
In the fall of 2012 a Native Plant Sale Extravaganza was held. Nearly $11,000 worth of native plants were sold at eight locations. These included three private gardens (in Moraga, Orinda, and San Pablo), San Lorenzo High School in San Lorenzo, the U.C. Botanic Garden in Berkeley, East Bay Wilds in Oakland, and Markham Arboretum in Concord.

Select Tours
In the fall of 2012 and the spring of 2013 a series of Select Tours (small, private tours with themes) were coordinated. These included a tour of a garden with an extensive graywater / rainwater catchment system; three "Meet the Designer" tours (with noted designers Michael Thilgen, Kelly Marshall, and Liz Simpson); three hands-on sheet-mulching workshops; one hands-on Netafim installation workshop; a tour of a large organic garden that stored 10,000 gallons of rainwater on-site, had chickens, and had extensive native and edible gardened areas; and a Meet-the-Do-It-Yourselfers tour of three gardens designed and installed by homeowners.

Tour Partnerships
The Bringing Back the Natives Garden Tour created partnerships with a variety of organizations that share common values—that chemical-free and water conserving gardening preserves water quality and quantity, and creates wildlife habitat. The list of major sponsors and supporters of this year's tour includes a flood control district, two county stormwater programs, three water districts, four cities, an unincorporated area, and a private foundation. The list of tour sponsors is provided below.

Sponsors of the 2013 tour

$15,000
Alameda County Flood Control and Water Conservation District

$10,000
Contra Costa Clean Water Program

$5,000
Jiji Foundation

$4,000
Contra Costa Water District

$2,500
County Clean Water Program (Alameda)

Contra Costa Watershed Program

$2,000
Bay Area Water Supply and Conservation Agency
City of Richmond

$1,600
California Native Plant Society (East Bay Chapter)

$1,500
City of El Cerrito

$1,000
City of Antioch
City of Pittsburg
Zone 7 Water Agency

$500
Alameda County Water Agency
City of Walnut Creek

Host Gardeners
The gardens selected to take part in the tour are chemical-free and water-conserving landscapes that provide habitat for wildlife. Hosts were chosen because of their willingness to be on site on the day of the tour to explain first-hand the techniques they use in their gardens, and their enthusiasm for, and commitment to, educating others about how to garden in environmentally sensitive ways.

Host gardener recruitment began in the spring of 2012 for the 2013 tour. Potential candidates completed an application, and applicants who met the criteria received a site visit. Host criteria were as follows:

- Gardener must reside in Alameda or Contra Costa County.
- Gardener must use organic and/or natural techniques for pest control rather than synthetic pesticides.
- Garden must demonstrate water conservation techniques. Examples include mulches, groundcover plants, drip or soaker hose irrigation, and the use of plants that do not require excessive watering during the dry part of the growing season.
- Gardener must be a good ambassador for chemical-free, water-conserving gardening: enjoy educating the public; and have the knowledge base to employ natural gardening techniques and share this information with the public.
- Garden must provide food, shelter and nesting areas for wildlife.

- Garden must contain 60% or more California native plants.
- No invasive plants are found in the garden.

Host's gardening experience ranged from native plant novices to professional landscape designers. All of the host gardeners were good ambassadors for natural gardening techniques.

Host Comments from the 2013 evaluations:

- The greeters that you lined up for us were a great help. The garden guests were pleasant, asked good questions, and many of them thanked me for opening our garden to them. I recognized several of the guests from two years ago, when we first placed our garden on the tour; one of them told me that our garden had inspired her and that she removed her lawn and now has a native garden of her own. It was a great day overall!
- Thank you so much for all the years of wonderful tours. I've been so impressed with how it has really made a difference educating people about native plants and sustainable garden design. I no longer have people ask me 'why natives'. Instead they know why, are excited, and have more specific questions as to how to create a drought tolerant earth-friendly garden. I love that the tour is free - anyone can attend and donate at the level that works for them. I love how inclusive and open the tour is for everyone.
- Many people learn from and are inspired by the tour.
- As usual, excellent up-front organization and communication from Kathy Kramer to hosts. Good catalog, and good media coverage. Awesome job, as always.
- The Tour was well advertised, and the visitors were very appreciative and friendly. It was very well organized, making it easy to be a host.
- I've had my garden on one different type of garden tour before. What I found very interesting and unique about this tour was how interested the visitors were in learning how to create this type of garden. I had questions about the process of removing the grass, design, irrigation, plants, and more. This tour was much more than just coming to look at the pretty flowers.
- This year I added photos of some of the more spectacular blooming plants (which were not in bloom at this point). I printed out the pictures on regular printer paper, put them in plastic sleeves and hung them from the relevant plant with fishing line. People seemed to really enjoy seeing them. The volunteers were all outstanding and enthusiastic. Thanks so much for all you do, Kathy! And congratulations on your recent award! I think this tour has done so much to increase awareness of use of native plants in the garden. I also noticed greater diversity among the visitors.

- What a lovely day! People streaming into my garden and telling me how much they liked it, who wouldn't love that!? Thank you so much putting on this event. It is exciting to see people becoming interested in something so good for our environment and community.

- The guests' obvious enjoyment of and appreciation for my garden was very gratifying.

- Lots of very interested and friendly folks visited our garden. I thought the level of expertise shown in the questions about my garden was a higher than in previous years. If so, it's a sign that more people are becoming more informed about native plant gardening.

- The website and tour guide are beautifully done and very valuable. The Tour is popular, and well-attended. Many people learn from and are inspired by the tour.

Volunteer Comments from the 2013 evaluations:

- This Tour is really bringing about important change! My compliments for and admiration of Kathy for smoothly coordinating such a major event each year. The concept of gardening without pesticides, and for nature, is reaching so many different people in so many different ways and at different levels...to the benefit of us all.

- Keep doing what you're doing. The Bringing Back the Natives Garden Tour is an amazing contribution to bettering our environment; I love that instead of just wringing our hands, it shows ordinary people a beautiful way to act on behalf of all of us.

- The Bringing Back the Natives Garden Tour makes a difference for our planet!

- The volunteer experience was marvelous. The organization was like no other garden tour in the Bay Area. I knew exactly what to anticipate and prepare for; this contributed to a wonderful lasting impression on all garden spectators.

- Wonderful program, excellent ideas, lots of really inspirational people -- I volunteered at Glen Schneider's, and found him to be delightful and informative.

- The Garden Guide was an invaluable informational and well-crafted tool; it helped me to find the information needed efficiently, and the design was beautiful. I enjoyed being a volunteer. Thank you.

- Over 300 happy people came to the garden where I volunteered! A lot of people are interested in bringing back the natives and seeing how others are doing it.

- I think you do a FANTASTIC job!!!! It's astounding how well you put such an elaborate set of gardens and impressive booklet together.

- I am always impressed by the thoroughness of the printed tour guide and the website, as well as the enthusiasm and helpfulness of everyone involved.

- The tour is awesome just the way it is. The fact that it is free is so wonderful. So many people can become educated about native plants.

- The ease of the maps, the descriptions, the photos on the website; all were well-done. Everything was SUPER well-organized.

Tour Survey and Evaluation
Two surveys were offered to the tour's pre-registered participants. The first was available as part of the registration process. Below are some statistics taken from this survey.

The 2013 tour attendees were highly motivated to learn new gardening techniques. When asked what they would like to learn from the tour the majority of respondents (83%) wanted to learn how to select native plants; 58% wanted to learn how to conserve water; 56% wanted to learn how to garden for wildlife; 33% percent wanted to learn how to reduce pesticide use; 33% wanted to learn how to remove their lawns; and 23% wished to learn about composting.

What do you want to learn from the tour?	**2012 Responses**	**2013 Responses**
How to select native plants	72%	83%
How to reduce water use	51%	58%
How to garden for wildlife	51%	56%
How to reduce or eliminate pesticide use	30%	33%
How to replace a lawn with a garden	30%	33%
How to compost	19%	23%

Evaluations

There was a return of 475 registrant evaluations. 98% of those filling out the evaluations rated the tour "Excellent" or "Very Good."

This year 70% of the registrants were repeat visitors, and 30% were attending the tour for the first time.

Motivation and Behavior Change
The registrant evaluations were split up into two groups—those who had attended the tour before, and those who had not. The data for Repeat Registrants and First-Time Registrants was tabulated separately. Both of these categories are discussed below.

Repeat Registrants
72% of registrants who had attended a previous Bringing Back the Natives Garden Tour, and who filled out the evaluation form, said they had changed their gardening practices because of their participation in the Bringing Back the Natives Garden Tour.

The first column below shows the percentages of the repeat registrants who changed their gardening behaviors after attending the Bringing Back the Natives Garden Tour. The second column shows the percentage of repeat registrants who plan to change their gardening behaviors.

Evaluations of repeat registrants from the 2013 tour showed that after attending a prior Bringing Back the Natives Garden Tour: 19% of respondents had incorporated natives into their gardens (thereby reducing herbicide use and conserving water); 13% were encouraging wildlife with plant choices; 14% had grouped plants by water needs and incorporated drought-resistant plants into their gardens; 10% had increased the density of plantings to out-compete weeds (reducing herbicide use and conserving water); 10% were tolerating some insect damage; 8% had begun mulching; 10% had amended their soil; 8% had reduced the size of their lawn; 6% had reduced or eliminated pesticide use; 10% had installed efficient irrigation; 3% were grasscycling; 3% were composting; and 4% had reduced the amount of hardscape in their gardens.

Repeat visitors were highly motivated to make changes in their gardens. When asked what they planned to do: 38% planned to increase the density of plantings to out-compete weeds; 29% to group plants of similar water needs; 25% to install efficient irrigation; 20% to encourage wildlife; 21% to reduce the size of their lawn; 18% to incorporate native plants into their gardens; 18% to mulch; 11% to minimize hardscapes; 12% to compost; 16% to amend their soil with compost; 13% to tolerate some insect damage to plants; 8% to grasscycle; and 6% to reduce or eliminate pesticide use.

How do you manage your garden? (This information was taken from evaluations filled out by repeat registrants.)

ITEM	Began after participation in a	Plan to do this

	previous BBTN Tour	
1. Reduce/eliminate insecticide/ herbicide use.	6%	6%
2. Increase the density of plantings to out-compete weeds.	10%	38%
3. Encourage birds, butterflies, etc. with plant choices, food, shelter, and water.	13%	20%
4. Tolerate some insect damage to plants.	10%	13%
5. Incorporate native plants into our garden.	19%	18%
6. Group plants of similar water needs.	14%	29%
7. Incorporate drought-resistant plants into our garden.	13%	18%
8. Install efficient irrigation (such as drip, timers, soaker hoses).	10%	25%
9. Grasscycle (leave grass clippings on the lawn).	3%	8%
10. Reduce the size of our lawn.	8%	21%
11. Mulch with leaves, grass, wood chips, etc.	8%	18%
12. Amend soil with compost.	10%	16%
13. Minimize hardscapes (patios, decks).	4%	11%
14. Compost yard waste and kitchen scraps at home.	3%	12%

First-time registrants

The tour was highly motivating to the first time registrants who completed the evaluation. 58% planned to incorporate native plants into their gardens; 58% of first-time registrants responded that they planned to increase the density of plants, thus helping to out-compete weeds and reduce water use; 50% of first time registrants planned to group plants by water needs; 43%planned to encourage wildlife; 42% planned to incorporate drought-resistant plants into their gardens; 32% planned to reduce the size of their lawns; 35% to install efficient irrigation;

31% planned to mulch; and 32% to amend their soils; 16% to compost kitchen scraps and yard waste; 19% planned to tolerate some insect damage; 15% planned to reduce or eliminate pesticide use; and 14% planned to reduce the amount of hardscape in their gardens.

How do you manage your garden? (These are responses from first-time registrants.)

ITEM	Plan to
1. Reduce/eliminate insecticide/herbicide use.	15
2. Increase the density of plantings to out-compete weeds.	58
3. Encourage birds, butterflies, etc. with plant choices, food, shelter, and water.	43
4. Tolerate some insect damage to plants.	19
5. Incorporate native plants into our garden.	47
6. Group plants of similar water needs.	50
7. Incorporate drought-resistant plants into our garden.	42
8. Install efficient irrigation (such as drip, timers, soaker hoses).	35
9. Grasscycle (leave grass clippings on the lawn).	15
10. Reduce the size of our lawn.	32
11. Mulch with leaves, grass, wood chips, etc.	31
12. Amend soil with compost.	32
13. Minimize hardscapes (patios, decks).	14
14. Compost yard waste and kitchen scraps at home.	16

Number of visitors at each garden, and total number of garden visits made

	# AM visitors	# PM visitors	Total Visitors
BAYSIDE CITIES			
Berkeley			
California Native Bee Garden			373
Mary Ford and Rob Lewis	190	219	409
Mardi and Jeff Mertens	175	158	333
Christine Meuris	175	204	379

Margaret Norman and Geoff Holton	197	275	472
Glen Schneider	189	198	387
El Cerrito			
Donna Bodine	138	96	234
Irene Kiebert and Michael Fischer	118	98	216
Nancy Warfield and David Gray	169	187	356
El Sobrante			
Nita Stull	68	32	100
Fremont			
Kathleen McCabe-Martin	43	37	80
Hayward			
Natalie Forrest and Douglas Sprague	81	89	170
Brenda Senturia	69	83	152
Christine Wiseman	54	108	162
Oakland			
Kate and Harry Dobbins	93	173	266
Sue Duckles and Cherie Donahue	138	168	306
Joan Lohman and Jenn Biehn	291	215	506
Tai Moses and Michael Kerner	182	270	461
Richmond/Point Richmond			
Tom and Shirley Butt	129	159	288
Jocelyn and Peter Rohan	83	78	161
San Lorenzo			
San Lorenzo High School			100
INLAND CITIES			
Concord			
Debby and John Butterworth	208	181	389
Roy and Rosadelia Detwiler	199	161	360
Lafayette			

Claire and William Gilbert	306	423	729
Mary Jennings and Michael Jennings	303	305	608
Livermore			
Hannah and George Farquar	111	101	212
Darcy Horne	125	51	176
Bryan and Donna Weber	99	93	192
Martinez			
Web and Sue Beadle			257
Chris and Marianne Dundon	122	102	224
Nancy Salsig	118	94	212
Moraga			
Bill and Linda Dick	163	242	405
Al Kyte	205	197	402
Orinda			
Barbara Leitner	124	166	290
Susan and Willy Mautner	164	182	346
Elizabeth O'Shea and Richard Howard			370
Bob and Stephanie Sorenson	279	304	583
Pleasanton			
Beth Clark	80	77	157
Walnut Creek			
Meg McShannic and David Wallace	248	227	475
Nancy Wenninger	244	289	533
TOTAL	5680	6042	12,831

* The number of morning and afternoon visits does not equal the number of total visits, as some gardens reported only total visits; not the breakdown.

When planning for a year, plant corn. When planning for a decade, plant trees.

When planning for life, train and educate people.
(Chinese proverb)

Below are comments from garden tour attendees, either taken from registrant evaluation forms, or received via e-mail.

- The tour was really superb, as usual.
- I love the El Cerrito yard on Everett; last year this yard inspired me to sheet mulch my lawn, and now I am offering my own garden for the 2014 Tour!!
- The Bringing Back the Natives Garden Tour was excellent in every way.
- This is the most organized garden event of the year anywhere, hands down! The book is invaluable! I refer to each years book throughout the year when reflecting on the gardens I visited and each time I look back at the description or my notes in the margins, I remember something that's new to me.
- I have a tiny front lawn (400 square feet) and the grass is not doing well, no matter what I do to it. Attending the garden show really got me thinking about replacing the grass with a tiny native garden rather than resodding. Thank you.
- The guide book is very well thought out and extremely useful.
- Volunteers were knowledgeable and friendly, the signage was helpful and the directions were clear. This was my first garden tour, so I don't have anything to compare it to. Nice job!
- The tour is wonderful. What an asset to this area to have something so worthwhile and yet be free.
- I was really impressed with how nicely this event is organized, and really appreciated that the plants all had identifying markers.
- Thanks for this wonderful event. We particularly liked having a chance to meet the landscape designer at one of the gardens!
- The Tour was well-organized and well-run. Thank you for the gift you have given us all!
- I look forward to this event every year - lots of new ideas, and plants to try.
- I think you do a wonderful job and I appreciate the enthusiasm you are generating for more sustainable landscaping.
- The Tour is super-organized, interesting, educational, and a must-do spring event for anyone who has a garden, wants one, or appreciates them, and the gardeners who create them.
- The booklet was very well done – it had all of the information I needed. Signing up was easy and efficient. Volunteers were friendly, helpful. A great job!
- Excellent job. I am always impressed with the organizational skills of the people putting this tour together, and the very detailed Tour booklet. The volunteers at the sites are always very pleasant and very knowledgeable about the plants. A+! Thank you for a great day.
- This tour is such a good service toward educating people on the variety and practical uses of native plants. Thank you so much for Bringing Back the Natives!
- Thank you very much for organizing this outstanding event.

- I always look forward to attending this yearly tour to see if I can incorporate any ideas into my garden.
- I LOVE the tour! Really, it is so amazing. The gardens are very inspirational, the owners who volunteer their time and gardens and allow so many people to traipse through them and ask questions - are kind, generous and gracious with their time and property, and the volunteers and landscapers present are very helpful and kind. My friend had never been on the Bringing Back the Natives Tour and was very inspired by what she saw. She took lots of photos of plants and their botanical names, to be able to review and consider for her garden. Thanks so much for another GREAT tour!
- Another excellent Tour. Thank you and all the volunteers for all your hard work.
- The booklet was a goldmine of information.
- Thank you very much! It's obvious that so much passion and hard work went into the whole enterprise. Kudos to the organizers and volunteers, both the gardener/hosts and the "docents". The Tour was really well organized, including the easy-to-follow online description of the gardens as well as the tour booklet.
- I look forward to this tour all year! Everyone is very friendly and knowledgable and willing to share expertise and encouragement.
- Great job! I look forward to this again next year.
- Great hosts and volunteers, very knowledgeable and friendly.
- The book was very helpful. I really enjoyed the places I visited and will be back again next year.
- Everyone was helpful, friendly and there were lots of volunteers at each location. It was really nice to have folks throughout the garden to answer questions.
- Sue Duckles' talk was very helpful. She told it like it was but was very encouraging. She gave wonderful suggestions on how to get started (and how to not get overwhelmed) by breaking down the work that needs to be done. I have a lot of ivy to remove but I feel like I can get it done!
- Loved it. Keep up the good work.
- This tour opened up a whole new world of possibilities for my garden.
- The garden volunteers and owners were all so gracious.
- Well done! Enthusiastic volunteers at every house!
- The tour was so inspiring! Thank you to the hosts and volunteers.
- Another amazing tour!
- What a tremendous amount of work. It was phenomenal.
- Please continue all the hard work that it takes to do this event. It is so enjoyable and such a good opportunity to learn more about California natives. Thank you for all you do.
- Very organized and friendly people. Enjoyed the tour immensely.
- THANKS for all of the work to put this on. I always learn so much on the tour and find things, even if in tiny steps, to apply to our garden.
- Thank you for your efforts in pulling this together!
- Excellent; you provide a great service to the Bay Area.
- I like that you can talk with the owners of the gardens who are happy to share their knowledge.

- The owners and volunteers were extremely helpful, approachable and knowledgeable.
- I thought it was wonderful! I learned soooo much; all the gardens I visited had such knowledgeable people, who were so willing to answer questions. What you are doing by making this information available will help us move in a more conscious direction.
- I appreciate the various homeowners opening up their gardens to the public. It is a wonderful and educational tour.
- The garden owners are very generous and gracious in opening up their gardens to outsiders. The Bringing Back the Natives Tour is a wonderful way both introduce and reinforce native planting practices to the community. The volunteers involved in the Tour -- from the garden owners to those helping to collect tickets -- are helpful, knowledgeable, and definitely passionate about a more sustainable approach to gardening.
- A great thing being done and bit by bit converting people to better practices. As water becomes more scarce, expect more folks looking at this.
- Appreciated the labeling of plants. The brochure is beautiful. All the gardens I visited were beautiful and had very friendly, helpful hosts and hostesses. First rate tour.
- We deeply appreciate the effort that goes into making the tour happen, as well as the gardeners who graciously allow us to tramp through their gardens and all the helpful volunteers. It's a wonderful event - thank you!
- What a beautiful offering Kathy Kramer, the volunteers, and the hosts make to the community. Inspiring, beautiful, and helpful! Thank you to all!
- Really love it! Helps me get ideas, see mature plants, and learn about plants I haven't seen before. A really enjoyable day!
- The tour is very well organized and a wonderful opportunity to learn, enjoy and admire. I appreciate that native plants are receiving the attention they deserve. Thank you so much.
- I look forward to the tour every year, and recommend it to people I meet during my docent duties at the U.C. Botanical Garden. The tour compliments the U.C. garden because it shows practical applications of native plants.
- Kudos on an extremely-well organized event and a very informative website!
- Wonderfully organized tour. Well staffed. Great variety of gardens and habitats.
- Thanks for continuing to produce this garden tour. It is a wonderful & educational event!
- I really enjoyed the tour. Loved being able to buy plants that I knew I wanted to incorporate.
- Well organized tour! Nice t-shirts on the volunteers! It was a pleasure to attend again.
- Volunteers very friendly, hosts very eager to answer questions. Well thought out and great planning.
- This is such a wonderful opportunity to become inspired by fellow native plant enthusiasts. I look forward to this tour every year!
- Fabulous job once again. I want to compliment the booklet organization & detail. In planning my day I spend a great deal of time checking the maps & gardens at a glance as well as the details in the write ups. Thanks again for all your hard work that I so enjoy and appreciate. I even enjoy reading the details

later after the tour day is over.

EDUCATIONAL SERVICES End-of-Year REPORT FORM Fiscal Year 2012/13

A) PROGRAM INFORMATION

Organization Name: KIDS for the BAY

Mailing Address: 1771 Alcatraz Avenue (Street) Berkeley (City) CA (State) 94703 (Zip Code)

Program Director: Mandi Billinge

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Name of Person Completing the Report: Kimberly Aguilar

Phone: 510-985-1602 **E-mail:** kimberly@kidsforthebay.org

Date of Report: July 15, 2013 **Reporting Period:** **From** Jan. 16, 2013 **to** Jul. 15, 2013

Program Scope:

The Storm Drain Rangers (SDR) Program is designed to educate third, fourth, and fifth grade students in Alameda County about storm water pollution reduction. Students learn about watersheds, storm water pollution and pollution prevention strategies in a program that consists of three classroom lessons:

1. Our Watersheds
2. Taking Action for a Healthy Watershed
3. Becoming a Storm Drain Ranger

(** For a more detailed description of the lesson activities and objectives, please refer to the SDR Program Lessons Overview sent with the previous report.)

Fifteen SDR Programs have been delivered during the 2012-13 school year. Four hundred and five students received the program along with fifteen teachers.

In the SDR Follow-Up Program, nine teachers who participated in the SDR program in previous years implemented the SDR curriculum on their own this school year. Over 200 students have been reached and educated in storm water pollution prevention through the Follow-Up Program.

A total of over 600 students and twenty-four teachers participated in the SDR Program in the 2012-13 school year. The following are highlights from the SDR Program classroom lessons completed during this reporting period:

Satellite Map Activity:
Students used a satellite map of the San Francisco Bay to identify and learn about bay geography and the San Francisco Bay watershed.

At Le Conte Elementary School in Berkeley, KIDS for the BAY Instructor Bhavana Mody modeled to students

how to identify various features on the satellite map. Students were especially excited to find Berkeley, Oakland, the Bay Bridge, and Treasure Island, amongst other local landmarks on the satellite map. “I found everything!” proudly shared one student, Nadia. A third grade student from Ruby Bridges Elementary School in Alameda, Mya, remarked, “I can identify Alameda, and it is an island and a city!” At Bay Elementary School in Ms. Danielle Covay’s fourth grade class students prided themselves on locating various sites on the satellite map. Njiri, a fourth grade student in Ms. Covay’s class, proudly spoke for her group, “We found San Lorenzo and San Francisco and the Golden Gate Bridge!” Students at Palma Ceia Elementary School in Hayward were excited to explore an actual picture of the San Francisco Bay Area. Palma Ceia Elementary School fourth grader, Macrina, said, “If the satellite would have zoomed in even closer when it took this picture I could have found Palma Ceia and my house in the city of Hayward!” Fourth grade teacher, Mr. David Ellison, at Tom Kitayama Elementary School shared, “This map is great! This lesson is perfect; it ties in so well with our geography standards and gives students a chance to learn local geography which we do not cover. I am definitely going to get my own satellite map for my classroom.”

Bay Model Activity:

Students were thrilled to apply what they had learned during the satellite map activity to build their very own replica of the San Francisco Bay Estuary.

Third grade students at Le Conte Elementary School in Berkeley were excited to watch the clear “fresh” water and blue “salt” water combine to form their San Francisco Bay Estuary. “We got to see the water combining,” stated third grader, Sindhu.

KIDS for the BAY Instructor Bhavana Mody explained to students at Bay Elementary School in San Lorenzo that all of the water is connected in the bay. Ms. Mody explained that storm drains lead to nearby creeks which then lead to the San Francisco Bay and the Pacific Ocean. Students were incredibly excited to build their models using their new knowledge. After finishing his model with his group, fourth grader Ruben exclaimed, “Look at how perfect our estuary is!” Ms. Mody asked all the students to take note of how clean the water is and said, “Now let’s pretend, my car leaked oil into a storm drain near San Lorenzo!” The students gasped as Ms. Mody poured a drop of red dye in the bay models and watched the “pollution” spread. “Oh no!” cried Alex, “The pollution is ruining the whole bay!” A student, Jennat, shared, “We made a beautiful estuary, and it was cool to see the colors mixing. But it was sad when the pollution spread everywhere.” Jada, a student at Ruby Bridges Elementary School, wrote, “When we did the clay models, it taught me that one drop of pollution can make the whole ocean polluted and can affect the world!”

Third grade teacher at Ruby Bridges Elementary School, Ms. Ingrid Dickerson, commented to Ms. Mody after the lesson, “The kids really loved learning about the environment today. I think this lesson will have a big impact on them.” Ms. Danielle Covay, fourth grade teacher at Bay Elementary School, shared after the lesson, “That was so amazing to watch - the kids were really affected by the pollution.”

Fresh Water Conservation:

Students were inspired to reduce their water usage after learning about the amount of available fresh water on the planet.

Students in Ms. Eileen Farnan’s class at Tom Kitayama Elementary School were shocked to learn about our limited fresh water supplies. The following lesson, KIDS for the BAY Instructor Kimberly Aguilar was so impressed that students remembered that only 0.33 percent is the percentage of fresh water accessible in creeks, lakes, and wells on Earth.

Students took home a water use log to record their daily water consumption and brainstorm pledges to conserve water. When asked what she learned from recording the water she uses in one day, Aaliyah from Ardenwood Elementary in Fremont shared, "I learned that we need to conserve water a lot more after the shocking number 119.85 gallons appeared in front of my eyes on my water log worksheet." Melanie, a student at Palma Ceia Elementary, pledged to conserve water. "I pledge to tell my mom when she washes my hair to turn off the water before she starts," shared Melanie. When asked how awareness and behavior has changed amongst her class, Ms. Curlette Logan from Palma Ceia Elementary School in Hayward commented, "I've noticed that when students wash their hands they don't leave the water running anymore." A parent of fourth grader Emily from Tom Kitayama Elementary School shared, "My daughter is really enjoying the KIDS for the BAY lessons. Yesterday she suggested I take shorter showers because of the scarce amount of fresh water available."
The Storm Drain Rangers lesson on conserving fresh water leaves an impact on students, changing behaviors that will ultimately save a lot of water for future generations.

Urban Run-Off Pollution and Neighborhood Clean-Up
Lesson Two of the Storm Drain Rangers program focused on reducing pollution and our storm drains.

Students discussed the differences between storm drains and sewer systems. When asked to summarize what they had learned, Jessica, a fourth grader at Bay Elementary School in San Lorenzo, stated, " In storm drains, the water is not cleaned and in sewers, the water is cleaned."

KIDS for the BAY Instructors challenged students to think about what made something "pollution." A student, Jude, at Le Conte Elementary School offered, "Pollution is something like gas and smoke that's bad for the environment." Students at Tom Kitayama Elementary were so concerned about storm drain pollution they began to brainstorm ways that may help minimize the amount of litter that leads to the creek, bay, and ocean. Destiny shared, "What if we attached nets to the storm drains and like the mail man someone can be paid to clean all of them." Following that suggestion Pedro shared, "Why don't people just do it for free?" KIDS for the BAY Instructor Kimberly Aguilar congratulated them all on their inquisitive ideas. Ms. Kim shared with Pedro that it was very honorable of him to suggest people help clean storm drains and that it is possible to help clean a storm drain near their homes with a parent guardian. A student at Le Conte Elementary School, Alex, suggested, "We could do a clean-up so that pollution doesn't get into the water." KIDS for the BAY Instructor Bhavana Mody announced to Alex and his class that a clean-up is exactly what they would be doing to help prevent litter from reaching the storm drains!

Students were shown pictures of marine wildlife affected by marine debris. The students were profoundly affected and had many thoughts to share. "I think it's so bad that people's litter hurts these animals," said Sosi, a fourth grader at Bay Elementary School. Another student at Bay Elementary School, Loy, shared, "It's too sad that all those birds die because of litter." When asked why it is important to keep storm drains free of litter fourth grader Lizzette gave a very thoughtful answer, "Many of the fish eat the oil or garbage then we eat the fish." Angel, a student at Sobrante Park Elementary School shared, "I have littered but I didn't know it could do this to animals. I won't be littering anymore." Students were inspired to make a difference in their environment.

During the Neighborhood Survey and Clean-Up activity, students at Le Conte Elementary carefully spotted and recorded many nearby storm drains, and collected hundreds of pieces of trash before they could travel into the storm drains. "We are collecting a lot of plastic," commented one group of students at Le Conte Elementary School while cleaning up around the school's playground area. During the garbage clean-up at Bay Elementary School, students passionately collected garbage and each time they deposited the garbage, they exclaimed, "Another animal we saved!" Students at Ruby Bridges Elementary School excitedly ran to pick up chip bags,

straw wrappers, and tiny pieces of paper. While picking up a plastic bag, third grader from Ruby Bridges Elementary, Nebiyu, remarked, “See! We’re saving sea turtles by doing this!” Many students excitedly looked around for trash, making tallys to record data on the types of trash found. Hannah, a fourth grader at Tom Kitayama Elementary School, shared, “We are finding so much plastic today it isn’t even funny!” Another student, Kai, from Tom Kitayama Elementary School shared, “Look at all the trash we have found. This isn’t going in the storm drain today!”

After the activity, students at Le Conte Elementary School cheered loudly when they learned they picked up over 700 pieces of trash. Bay Elementary School students’ efforts resulted in a total of 674 pieces of garbage collected! Students in both classes at Ruby Bridges Elementary collectively picked up 1,386 pieces of trash. The students from Ruby Bridges Elementary were so proud of the work they had done and even continued to pick up trash during their recess. One student, Donye, proudly shared, “Some of us picked up more garbage at recess so we could help save the environment.” Third grade teacher at Le Conte Elementary School, Ms Charity Johnston, shared, “They loved going outside and picking up trash because they got to actually make a difference in their environment.” Ms. Rica, a teacher’s aide at Bay Elementary School, said to Ms. Mody, “I am so glad this message is being taught to our kids. I hope the environmentalist spirit stays with them for a long time!” Third grade teacher at Ruby Bridges Elementary School, Ms. Elizabeth Escalante, commented that she was very impressed by how the students had taken initiative on their own to help marine wildlife. Fourth grade teacher Mr. David Ellison was impressed by his students’ motivation to clean the environment, saying “I have been cleaning up after them all year and now it’s surprising how much motivation they have to clean up after themselves and others when they realize the impact that it makes on the environment.”

At Ardenwood Elementary Ms. Janelle Logazino had her class write letters to reflect on the impact of the clean-up. Third grader Aaliayh wrote, “All the students with the clipboards were always trying to keep up with their partner’s continuous reports of picked up trash. I felt proud that we were helping nature so much!”

Students all over Alameda County were so thrilled to have helped the environment by preventing thousands of pieces of litter from reaching the storm drains.

Take-Home Education

Many students felt so empowered by what they had been learning as Storm Drain Rangers, that they were inspired to share it with their friends and families.

One student, Amadi, from Le Conte Elementary School, shared, “I educated my parents about how there is enough plastic garbage to make a big island in the ocean, and that we should not put any plastic on the ground.” Another student, Devonay, also from Le Conte Elementary School, shared, “I told my mom that we should pick up the garbage near our house and rescue animals.” Bay Elementary School students had told their families about plastic garbage, car washing near storm drains, and fixing car oil leaks. One student, Sosi, from Bay Elementary School, shared that she and her father had gone out and collected garbage on their own street. “I really don’t want the animals to get hurt so I told my dad and we went around and picked up garbage so now it won’t go down into the storm drains,” Sosi shared. Another student, Alex, also from Bay Elementary School, described how he asked his family to take their car to the car wash. “I told them to go to the car wash because it’s not as poisonous to the animals,” shared Alex. Students from Ruby Bridges Elementary School went home and shared information about storm drain prevention to their families too. One student pledged “to pick up garbage on the ground whenever she sees it and to help keep the environment clean.” Another student, Taisa, shared, “I told my mom about how she should not throw cigarette butts on the ground because they’ll go into the storm drains.” Kyle shared, “I told my family how to cut six-pack rings and how to keep trash out of storm drains.” Third grader Sukraj, a student from Ardenwood Elementary School, read the pledge he made with his

Mother out loud to the class. “We pledge to stop pollution from making animals die, so we won’t dispose chemicals in the wrong place,” read Sukraj.

Because students are so inspired by the messages learned from the Storm Drain Rangers Program, many people outside the program are educated, resulting in a wide spread environmental impact.

Pesticides in Our Waterways

Many students were shocked when they learned that pesticides and herbicides could go into storm drains and hurt the environment.

Students at Le Conte Elementary School were very interested in discussing alternatives to pesticides. One student, Riley, from Le Conte Elementary School, asked, “Is there any way to get rid of the bugs that hurt the environment by spraying something that doesn’t have toxic chemicals in it?” KIDS for the BAY Instructor Bhavana Mody shared a recipe for organic environmentally friendly pesticides using garlic and jalapenos. Several students jotted the recipe down. One student at Bay Elementary School shared, “I want to make my parents stop using RAID and use this instead so that the water stays clean.”

Students learned how pesticides and herbicides can seep into ground water and nearby creeks when building their Pesticide Models. Third grader Devin from Ruby Bridges was so engaged in building his pesticide model he exclaimed “Oh no! The pesticides are creeping into our beautiful creek! It’s going to kill all the animals!”

Students at Tom Kitayama Elementary expressed great concern about the use of pesticides. The engaging and interactive story KIDS for the BAY Instructor Kimberly Aguilar told about Cesar Chavez and his struggles really got the students thinking about the effects of pesticides on the environment, and especially on people. “Why would farmers spray their foods with pesticides if they know its bad for people to eat and bad for the environment?” asked Tom Kitayama Elementary School fourth grader Jashinder. Justin, a student at Tom Kitayama Elementary School, shared, “So just like Cesar Chavez told everyone to stop buying food from pesticide farms, we need to tell our moms and dads to buy organic food so the farmers change their ways.” Third grader, Jude, from Le Conte Elementary School shared, “My mom works at the farmers’ market and it’s good to go there because the fruits and vegetables don’t have pesticides on them.” One student, Emily, from Le Conte Elementary School shared, “I’m going to educate my family about how we should buy organic food.”

Students were actively engaged in discussions about pesticide and herbicide usage and its effects on the environment after witnessing the impact it can make in our local watersheds using their Pesticide Models. They were inspired to talk to their families about organic foods.

The SDR Follow-Up Program

Codel Frydendahl and Lisa Gilbert are two third grade teachers at Niles Elementary School in Fremont who have partnered with KIDS for the BAY to teach students how to better care for their environment. Ms. Frydendahl and Ms. Gilbert’s remarkable dedication to environmental education and their partnership with KIDS for the BAY has helped them deliver the SDR Program to over 200 students in Fremont! This year will be their fourth year implementing the KIDS for the BAY curriculum in their classrooms and they are thrilled to have been gifted a KIDS for the BAY equipment kit.

Four years ago, Ms. Frydendahl and Ms. Gilbert first participated in the Storm Drain Rangers Program with a KIDS for the BAY Instructor. The lesson was modeled for both teachers in hopes that Ms. Frydendahl and Ms. Gilbert would independently teach the program for future classes. That year Ms. Frydendahl and Ms. Gilbert described the program as being exciting and well presented. Ms. Frydendahl and Ms. Gilbert have taught the

program every year since then and KIDS for the BAY has helped by equipping them with materials and guidance as needed. Ms. Frydendahl describes the support as, "Wonderful. KIDS for the BAY is easy to contact and obtain materials from. We really appreciate having our own kit so we can work around our crazy schedules."

Ms. Frydendahl and Ms. Gilbert work as a team to make the learning experience exciting and memorable for their students. While teaching the program, both teachers collaborate by meeting before and after a lesson to discuss what worked well and to remind each other what not to forget for the following lesson. Their favorite component of the curriculum is the building of the San Francisco Bay Estuary. Ms. Frydendahl appreciates the activity because it allows students to witness how salt water and fresh water flow together in an estuary. Through their teaching Ms. Frydendahl and Ms. Gilbert make certain to emphasize the importance of keeping the environment litter-free. Every year Ms. Frydendahl and Ms. Gilbert have their students take action to reduce storm drain pollution by conducting a clean-up around Perk Ponds at Niles Elementary.

Ms. Frydendahl and Ms. Gilbert reported that their students love the program and feel inspired by it. Both teachers will continue to use the SDR curriculum and equipment kit so they can continue teaching the program year after year.

Another group of teachers at Hesparian Elementary School in San Lorenzo have taken on teaching the Storm Drain Rangers program for two years now. Fifth grade teachers Mary Burke, Elaine Weissman, and Denise Fitzgerald are very happy to have the materials provided and teach the program because of the impact the curriculum makes on their students. Ms. Weissman shared that she had noticed a change in awareness in her students after discussing water conservation and sending home the water logs. Many students had shared with her that they had decreased their water usage and it had shown on their second water use log. Ms. Fitzgerald shared how the pesticide activity made an impact on her students, "My class found it an eye-opening experience, and saw how pollution can so easily spread when we used the terrarium to demonstrate water flowing through the watershed. The water use chart was another eye-opener. Thank you for providing this wonderful learning experience, once again!" Hesparian Elementary School's fifth grade team of teachers have done a wonderful job teaching storm drain pollution prevention to their students for the past two years.

The Follow-Up Program enables devoted educators to continue teaching the Storm Drain Rangers program in their classrooms year after year; thereby creating a lasting impact in their communities for many years to come.

Quotes:

"Awareness is everything. The kids learn, but most importantly, take their knowledge home to parents."
-Codel Frydendahl, Fifth Grade Teacher, Niles Elementary School, Fremont

"The program brought motivation towards science to my students. Also, hands on programs give the opportunity for children to, in a tangible way, understand any subject better. For me as a hands on teacher, it gave me the chance to observe the instructor, and learn other teaching strategies. The program provided an ongoing process of critical thinking among my students."
- Lamberto Roque, Fourth Grade Teacher, Palma Ceia Elementary School, Hayward

"The program promoted healthy discussions in class and at home. Also, I believe it instilled a sense of power and responsibility. All the lessons involving hands-on teamwork resulted in real enthusiasm, 100% on-task behavior and 100% fun. The kids couldn't wait for KIDS for the BAY to return."
- David Ellison, Fourth Grade Teacher, Tom Kitayama Elementary School, Union City

"I really appreciate the tools I have been given to teach these lessons in the future, and the foundation my

students have for further discussion. The class is really on board with what it means to be a Storm Drain Ranger!"
- Sahsa Tyshler, Third Grade Teacher, Le Conte Elementary School, Berkeley

"Many of my students have shared with me that they have taken what they learned from The Storm Drain Rangers Program, and applied it to their own lives outside of school. For example, a few students report that they now always cut apart the plastic that holds drinks together. They do not want animals to become entwined in the plastic. Many students report that they no longer litter, and that they don't let their friends litter either. The students all have a better understanding of our local water system, and why it's important to keep it healthy."
- Elizabeth Escalante, Third Grade Teacher, Ruby Bridges Elementary School, Alameda

"Use your brain to not pollute the storm drain!"
- Amy Kuo, Third Grade Student, Ardenwood Elementary School, Fremont

"My family pledges not to litter and keep the storm drains clean in front of our house."
- Alyssa Gonzalez, Fourth Grade Student, Palma Ceia Elementary, Hayward

"I admit that before the Storm Drain Rangers Program I used to litter. But now that I know how much it hurts animals and the environment I will never ever litter again!"
- Hannah Jefferson, Fourth Grade Student, Tom Kitayama Elementary School, Union City

B) PROGRAM UPDATE

1. List the school programs completed during this reporting period into table provided below (sorted by city):

City	School/Teacher	Lessons/Activities	Dates of Lessons	# of Students reached
Alameda County Unincorporated	Bay Elementary School/ Kathy Brancheau	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Nov. 26** **Dec. 3** **Dec. 10**	28 Students
Fremont	Ardenwood Elementary School/ Jill Eleizer	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Nov. 29** **Dec. 6** **Dec. 13**	30 students
Fremont	Ardenwood Elementary School/ Janelle Logazino	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Jan. 7** **Jan. 14** **Jan. 28**	30 students
Hayward	Palma Ceia Elementary School/ Lamberto Roque	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Jan. 11** **Jan. 18** **Jan. 25**	23 students

Hayward	Palma Ceia Elementary School/ Collette Logan	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Jan. 11** **Jan. 18** **Jan. 25**	31 students
San Lorenzo	Bay Elementary School/ Danielle Covay	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Jan. 10** **Jan. 17** **Jan. 24**	31 students
Oakland	Sobrante Park Elementary School/ Marley Wertheimer	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Feb. 19** **Feb. 26** **Mar. 5**	27 students
Alameda	Ruby Bridges Elementary School/ Elizabeth Escalante	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Feb. 22** **Mar. 1** **Mar. 8**	24 students
Alameda	Ruby Bridges Elementary School/ Ingrid Dickerson	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Feb. 22** **Mar. 1** **Mar. 8**	23 students
Oakland	Sobrante Park Elementary School/ Monique Armstrong	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Feb. 27** **Mar. 6** **Mar. 13**	29 students
Berkeley	Le Conte Elementary School/ Charity Johnston	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Mar. 4** **Mar. 11** **Mar. 18**	18 students
Berkeley	Le Conte Elementary School/ Alexandra Tyshler	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**Mar. 4** **Mar. 11** **Mar. 18**	18 students
Union City	Tom Kitayama Elementary School/ Eileen Farnan	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**May. 9** **May. 10** **May. 17**	31 students
Union City	Tom Kitayama Elementary School/ David Ellison	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**May. 9** **May. 10** **May. 17**	32 students

Hayward	Palma Ceia Elementary School/ Jade Duong	**Lesson 1** Our Watershed **Lesson 2** Taking Action for a Healthy Watershed **Lesson 3** Becoming a Storm Drain Ranger	**May. 21** **May. 30** **Jun. 4**	30 students

*If your program consists of multiple class lessons/activities, please list the name of the lesson(s) and/or activity(ies) implemented for **each class** during the reporting period.

2. Estimated percent of program completed:

100% of SDR program completed

3. Have all the planned lessons/activities been implemented by the end of the 2011-12 school year? Yes

If no, please explain:

C) PROGRAM EVALUATION

4. Evaluation data for SDR Programs in the 2012-13 school year was collected through meetings with and written evaluation forms from teachers, samples of student work, and through observations and written reports from KftB Instructors. This anecdotal information was incorporated into our reports to the ACCWP. Please see the enclosed sample teacher evaluation form and samples of student work.

During the 2012-13 school year KIDS for the BAY also administered pre-surveys and post-surveys to students participating in the Storm Drain Rangers Program. We gave a survey with ten questions about storm drain pollution and assessed a change in knowledge before and after the program was delivered. The data for the student surveys will be submitted separately to the ACCWP.

Teachers also completed a survey after the completion of the program to asses the impact of the program and teachers' level of satisfaction. Results from the teacher post-program survey are in the following table.

Table 1. N = 8

Statement	Post Program Survey Response				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Participation in the Storm Drain Rangers Program has increased my students' awareness of the storm drain system.				1 12%	7 88%
The curriculum guide provided to me is helpful in teaching the Storm Drain Rangers Program next year.				1 12%	7 88%
The in-class modeling of the Storm Drain Rangers Program increases my confidence in teaching the program myself.				2 25%	6 75%
Having access to program equipment will enable me to teach the Storm Drain Rangers Program next year.				2 25%	6 75%
I would recommend the Storm Drain Rangers Program to other classroom teachers.					8 100%

One hundred percent of teachers who submitted a post-program evaluation form either "Agreed" or "Strongly Agreed" to all survey statements, showing a high level of satisfaction for the program and a strong positive impact on teachers and students.
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D) BUDGET UPDATE

1. **Funds awarded (as per agreement):** $29,970.00 ($666.00 x 45 lessons)
2. **Costs invoiced during this reporting period:** $25,974.00
3. **Costs invoiced to date:** $25,974.00
4. **Funds remaining:** $0.00

E) PUBLICATIONS

1. **Attach copies of any press releases, newsletters, articles, and/or other program marketing materials produced during this reporting period.**

Please email an electronic copy of this report to Jim Scanlin (jims@acpwa.org) and Vishakha Atre (vatre@eoainc.com).

Signature of Program Director
Mandi Billinge

Date

EDUCATIONAL SERVICES FINAL REPORT Fiscal Year 2012/2013

A) PROJECT INFORMATION

Organization Name: Joe Leon, Caterpillar Puppets **Mailing Address:** 2060 Casa Grande Benicia CA 94510
Street
City State
Fax Number: (925) 543-3042 **Project Director:** Joe Leon **Phone:** 707 746-5597 cell 707 334-1380 **E-mail:** caterpillarpuppets@mac.com
Name of Person Completing the Report: Ronna Leon **Phone:** 707 746-5597 **E-mail:**CATERPILLARPUPPETS@MAC.COM **Date of Report 6/3/2013**
Reporting Period: From 9/12/2012 **to** 6/3/2013
Project Scope:
Educational outreach puppet show assembly for grades K-3. 100 Students per assembly program. Teaches what is a watershed, what is a storm drain. How can we keep our watershed clean? What causes watershed pollution?

B) PROJECT UPDATE

1. Sorted by City, list the school programs* completed during this reporting period into table provided below:

EMERYVILLE 2/2

Nov 30 Ana Yates Elementary 2x 9:15& 10:00 210 Students
1070 41st. Emeryville, Contact: Mary McGruder

CASTRO VALLEY, SAN LORENZO, SUNOL 11/14

Dec 12 Stanton Elementary 3x 1:00, 1:45 and 2:15 300 students
2644 Somerset Ave, Castro Valley Contact: Jennifer Tomita (corrected date)

Feb 13 Hesperian Elementary 3x 8:30, 9:15 and 9:45 280 students
620 Drew,San Lorenzo, Contact: Principal Wendy Garner

Feb 7 Palomares Elementary 1x 10:20 100 students
6395 Palo Verde Rd., Castro Valley Contact: Sharon Pipkins

March 21 Del Rey Elementary 4x 8:50 and 9:30 each day 370 students
March 28 1510 Via Sonya, San Lorenzo , Contact Robert Patrick

PIEDMONT 1 /2

April 11 Zion Lutheran School 1x 10:15 45 students
5201 Park Blvd., Piedmont, Contact: Karen Hebel

BERKELEY 8/ 6

Dec 17 Berkeley Arts Magnet 3x 9:30, 10:15 and 11:00 320 students
2015 Virginia St, Berkeley C0ntact Kristin Collins

March 15 Escole Bilingue 2x 2:25 and 3:05 200 students
1009 Heinz Ave. Berkeley Contact: Mirza Kopelman

EDUCATIONAL SERVICES FINAL REPORT Fiscal Year 2012/2013

January 22 Shureh International School 1x 2:15
1333 University Ave, Berkeley Contact Patricia Pope

April 10 Walden School 1x 1:15 60 students
2446 McKinley Ave Berkeley, Contact: Carolyn

Feb. 22 Escole Bilingue 1x 10:00 30 students
1009 Heinz Ave. Berkeley Contact: Mirza Kopelman

SAN LEANDRO 8/10

Sept 26 The Principled Academy 1x 11:15 90 students
2305A Washington Ave, San Leandro Contact: Nancy Asmeyeden

Sept 25 Assumption School 2x10:50 and 11:30
1851 136th Ave., San Leandro Contact: Marilyn Doman

Oct 5 Hillside Elementary 4x 8:15, 8:50, 9:20, 10:00 400 students
15980 Marcella St, San Leandro Contact Miss Cythia, Secretary

Oct 23 James Baldwin Academy 1x 10:00 40 students
2275 Arlington Dr.,San Leandro Contact: Cate Sula

FREMONT 22/19

Sept 19 Blacow Elementary 3x 8:30, 9:15, 10:15 300 students
40404 Sundale Dr., Fremont Contact: Gina Shelley

Oct 2 Peralta Campus Montessori School 2x 10:00 and 10:40 160 students
4511 Peralta Blvd., Fremont Contact: Kate, Director

Oct 3 Montessori School 1x 10:00 65 students
37220 Maple St, Fremont Contact: Desiree Samora

Oct 18 Our Lady of Guadalupe 1x 111 students
40374 Fremont Blvd., Fremont, Contact Lorrie Keltie

December 10 Peace Terrace Academy 1x 2:30 50 students
33330 Peace Terrace Academy Fremont, Contact: Muneiza Ahsan

Nov 5 James Leitch Elementary 6x 8:45, 9;30, 1:00 each day 670 students
and Nov 7 47100 Fernald St, Fremont Contact: Mrs. Lee, Principal

Feb 21 Mission Valley Elementary 4x 9:30 and 10:30 370 students
March 27 41700 Denise St. Fremont, Contact: Jessica Santona

June 3 Stratford School 1x 10:00 and 10:45 175 students
5301 Curtis St. Fremont, Contact: E. Tariverdi

April 17 Ardenwood School 2x 8:30 and 9:15 240 students
33955 Emilia Ln, Fremont Contact: Mrs. Jamie Shimomura

EDUCATIONAL SERVICES FINAL REPORT Fiscal Year 2012/2013

OAKLAND 6/ 6

Sept 20 East Oakland Leadership Academy 1x 9:30 60 students
2614 Foothill Blvd. Oakland Contact: Jeralyn
Sept 26 Achieve Academy Resource Center 1x 3:45 120 students
1700 28th Ave, Oakland Contact Alicia Ramirez
Nov. 16 St Theresa Elementary 9:30 1x 115 students
4850 Clarewood, Oakland, Contact: Martha Lindorfer
Nov 2 St Martin De Pores 1x 9:30 75 students
675 41st street, Oakland Contact: Nubia Giles
March 13 Kaiser Elementary 2x 9:30 and 10:15 200 students
25 South Hill Ct. Oakland, Contact Christine Kizziar

HAYWARD 14/ 13

Sept 18 Colonial Acres 1x 9:30 90 students
17115 Meekland Ave., Hayward, Contact Michelle Barragan
April 24 St Clement School 2x 9:45 and 10:30 140 students
790 Calhoun St, Hayward Contact: Nichole Garcia
Jan 18 Treeview School 2x 1:00 and 1:50 150 students
30565 Treeview St. Hayward Contact: Sue Eckles
Jan18 Bidwell School 2x 9:40 and 10:40 150 students
175 Fairway St Hayward contact: Sue
Dec 13 Tyrrell Elementary 3x 9:30, 10:15, and 11:00 350 students
2700 Tyrell Ave, Hayward Contact: Clair Horhoger
April 23 Lea's Christian School 1x 2:45 75 students
26236 Adrian Ave, Hayward, Contact: Terri Jackel
Feb 20 Eden Garden School 3x 9:00, 9:40, 1015
2184 Thayer Ave. Hayward, Contact: Gary Dobbs

NEWARK 4/2

March 19 Milani Elementary 3x 12:30,1:15 and 1:55 290 students
37490 Birch, Newark Contact:Sharon Blattel, Teacher

April 8 Milani Elementary 1x 9 AM 70 students
37490 Birch, Newark Contact:Michelle Leipelt, Teache

75 confirmed of 75 as of March 13, 2013

*If your program consists of multiple class visits, please list the name of the lesson(s) and/or activity(ies) implemented
during the reporting period for **each class**. **2. Estimate percent of programs completed:100%**

3. How did activities implemented during this reporting period enhance students' understanding about stormwater pollution prevention and watershed awareness:

EDUCATIONAL SERVICES FINAL REPORT Fiscal Year 2012/2013

The assembly teaches WHAT IS A WATERSHED, WHAT CAUSES STORM WATER POLLUTION. It involves students in thinking about and problem solving watershed issues. It involves them emotionally with characters associated with the creek, bay and ocean systems: frogs, ducks, raccoons, seals, fish and the effect that watershed pollution has on them and their habitats.

4. Were all the workshops implemented by the end of the 2010/11 school year? If not, please explain: Yes. As in other years of this program some areas and districts were more receptive to having outside programs then others. We believe this does not reflect on the quality of the program as much as on the culture of a particular school district. **C)**

PROGRAM EVALUATION

Attached to mailed copy in full Sample: "Perfect. My kids really enjoyed it." Herperian Elementary "Very informative and creative." E. Oakland Leadership Academy "You were wonderful. This had "all" the elements of the best lesson plan and more!" "I like puppets too. And I tell my parints to not waste that much water everyday." student, Jonathan. "Wonderful presentation." Ardenwood.

1. Funds awarded (as per agreement): $22,500
2. Costs invoiced during this reporting period: $22,500 **3. Costs invoiced to date:** $22,500(Final 2 Invoices payments not received yet for$2,400 May 7 and $300 as of June 3) **4. Funds remaining:** none

E) PUBLICATIONS 1. Attach copies of any press releases, newsletter articles, or other publicity materials regarding the program produced during last quarter. Materials, brochure, evaluation form, pre-class activity sheet, follow-up coloring page are the same as submitted in report 1. Nothing new added.

All reports submitted to the Alameda Countywide Clean Water Program must contain the following certification
statement, and be signed and dated by the Project Director. "I hereby certify that the above and attached statements are true and accurate."

_____ _____ Signature of Project Director Date

NOTE: An **electronic copy** (unsigned) of this final report must be emailed to jims@acpwa.org, **AND** as per agreement, a **signed hard copy** of this electronic report including a summary of evaluations, and copies of the receipts (indirect costs) must be submitted to the following address: Jim Scanlin Alameda Countywide Clean Water Program 951 Turner Court, Room 300 Hayward, CA 94545 **EDUCATIONAL SERVICES FINAL REPORT FORM Fiscal Year 2010/2011**

ZunZun Assembly Programs for Alameda County Clean Water Program FINAL REPORT 2012-2013 School Year July 5, 2013

ZunZun performed "The Musical Watershed" in Clean Water Program's (CWP) service area in the 2012-2013 school year. ZunZun performed 32 assemblies at 22 schools for 10,360 students. In all, we saw approximately 10,360 young people and 520 educators this year to share information about the Alameda County watershed—what it is, where students are in their watershed, how to keep it clean, and how to protect the watershed. The assemblies were in Spanish and English, depending on the language spoken by audience members.
All assemblies included California State Education standards in Science, Math, History-Social Science, Language Arts and English Language Development, and Fine Arts so that they easily tied into classroom curriculum. . All assemblies had lots of student participation. All of the information was geared to be solid, hands-on ideas that students could take home and share with their families to prevent watershed pollution. Also, we sent every school a newsletter article they could put in their school newsletter to help parents and families learn the concepts and know about the ACCWP sponsored assemblies.

Included in this final report are the following:

- Outreach
- Supplemental Materials
- State Standards
- Performances
- Evaluations
- Possibilities for Next Year
- Final Performance Schedule

Enclosed with this report, please find:

- Sample of Flyer Advertising Assembly
- Sample Newsletter Article
- Pre and Post Assembly Activities
- Print Out of Electronic Evaluations and Evaluation Comments

OUTREACH

Creating a list of target schools within the parameters provided by CWP, ZunZun advertised this year's program to the principals and assembly coordinators at eligible elementary schools. ZunZun faxed or emailed a flyer to the school contact person and then followed up to answer questions and book assemblies. Schools booked directly with ZunZun and performance updates were sent to Jim Scanlin and Vishakha Atre on a regular basis.

One month before each school's scheduled assembly, we emailed a confirmation letter and sent the vocabulary lists and a newsletter article to the school contact person. One week before the scheduled performance, we called the school to confirm show times.

SUPPLEMENTAL MATERIALS

Supplemental materials to aid in retention of the assembly information were emailed to each school one month prior to the assembly. Post assembly activities were distributed to teachers at the assembly for use after the performances. A newsletter article about the performance was also emailed to help inform students' families of the presentation and to encourage parents to ask questions about what the students learned about watershed pollution prevention. The activities and newsletter facilitate discussions at home about CWP's message and the ZunZun show.

STATE STANDARDS

In addition to being extremely fun, ZunZun assemblies cover a large number of California State Content Standards for grades K-6. Because we use music and musical instruments, they meet many **Visual and Performing Arts Standards.** As the assemblies are about water issues, they cover **Science Content Standards.** Students are learning new vocabulary and words, so they are meeting many **Language Arts and English Language Development Standards.** We introduce instruments from around the world, which meets many standards in **History- Social Science Standards.** Finally, we use both Spanish and English which meets **English Language Development Standards** and **World Language Content Standards.**

A few specific examples of State Content Standards in **Science, Language Arts, and Visual and Performing Arts** met in our shows are as follows:

Science: Water education for all grade levels is included in every assembly. (ie: Grade 3 physical science 1.e, 1.f.; Grade 5, earth sciences 3a, 3b, 3c) Education standards regarding water on earth, evaporation, water present in the form of salt water, etc.

Language Arts: Use of rhythm and rhyme to remember a concept. Learning new words such as "runoff" and seeing/ hearing a description while repeating a rhyme that reiterates the definition. (See CA Content Standards, Reading Standards- Craft and Structure, Key Ideas and Details Integration and Knowledge of Ideas. Also Speaking and Listening Standards for grades K-6).

Visual and Performing Arts: As students sing and perform with us in the assembly, they are not only hearing music (All grades, Music Standards 1.1-1.5), but performing it (Grade 2, Music Standards, 2.1, 2.2 for example).

Because all students learn differently, ZunZun strives to use as many different types of learning tools as possible in our assemblies, so they are learning *visually*, *musically*, *physically*, *scientifically*, *mathematically*, *verbally*. Students are thinking things through, moving and singing throughout. In summary, so many standards are contained in the assemblies, it would be a very long list to include them all here.

PERFORMANCES

We design our assembly segments to be interactive and to appeal to the many learning styles of the students. Always included are the following elements: visuals, call and response, movement, comedy, and lots of fun informative facts. Some schools included their 6-8th graders, for whom we change the content to be more age-appropriate. All assemblies are performed in English and Spanish, with a greater emphasis on Spanish whenever needed. Each assembly is 45 minutes in length and introduces students to the topic of watershed and watershed pollution prevention. Performance segments included in this year's program are as follows:

Watershed Instruments from Around the World

The segment begins by introducing water instruments from around the world that represent watershed sounds, while we explain how important and precious clean, safe water is all over the world. We show instruments from North and South America, Africa, and Asia that represent the sounds of rain, storms, water in rivers and streams, and finally the ocean. This "water music" segment serves as a great jumping off point to explain the importance of the watershed and to show how cultures worldwide depend on their watersheds. Also we use the segment to define watershed as land and water draining through the land, and explain that everywhere outside in part of the watershed.

Watershed Saving Dances

This segment was designed to inspire the whole audience (including the teachers!) to dance. After hearing all of the instruments representing a watershed, we introduce the watershed dances. The music played is performed on berimbau and students sing, "Doing the water dance! Protect the water when you've got the chance!" The dances we do are "the jellyfish", "the car wash", and "the rainbow".

We use "the jellyfish" to discuss plastic bags entering the watershed and ways to prevent this (mainly **bring your own bag**, reuse plastic bags, tie used and dirty bags in a knot before throwing away so they cannot fly).

The second dance is "the car wash," during which students pretend to wash a car. This segment shows the audience the difference between a storm drain and the sewer. We show a sink and then explain how a sewer system works and how it is different than a storm drain. Many students live with adults who do not know the difference between a sewer drain and a storm drain, and this simple explanation can help a whole family learn the difference, and keep soap and other toxins out of the storm drain. We explain that it is best to wash vehicles at a commercial car wash because they use less water and the dirty water drains to "the sewer", to treatment facilities that remove pollutants. If students must wash their vehicles at home, the first thing they should do is use a rag to wipe brake dust off of wheels. Then, use a hose with a nozzle to conserve water and to wash over a lawn, dirt or gravel so that the dirty water will not run to the storm drain. When washing is done, dirty soapy water should be dumped into the toilet or onto landscaping. We say soap is a thumbs up inside, it gets us clean, but outside, soap is thumbs down- it is no longer clean, it is pollution.

We use "the rainbow" to invite teachers to dance (always a highlight!) and then to remind students about oil from cars going down the storm drain when the rains come. After the dance, we explain that we love seeing rainbows in the sky, but when you see a rainbow on top of water, it is usually oil that has leaked from a car. Then we go on to help audience members to think of ways to prevent oil from going into the watershed.

Fish Flies to Audience

After explaining how pollutants go into storm drains and go through our watershed, we reinforce the lesson with our flying fish activity. We pretend to dump oil down the storm drain on the backdrop and then ask audience members to remind themselves of the path that oil would take (from the storm drain to a creek, then a river, then the bay, and then the ocean). We specify the particular path based on the local geography. A black blob of oil enters into the ocean section of the backdrop and (from backstage) fish begin flying out of the water, unhappy to be in the oil. We repeat the same steps with paint and garbage, see the paint and garbage travel to the ocean, and this time the fish not only flies up into the air, but out into the audience. This segment is perhaps the most memorable

part of our assembly! Kids love it! We refer to this activity in our parent newsletter to help students with recall and to give parents a chance to hear about assembly content.

Dirty Water

This is a call and response song during which we invite students to come up front while the audience sings the call and response. The whole audience sings
"Dirty water, down the storm drain, goes to a creek which reaches the sea where the fish are swimming. They start to feel sick, the poor, poor fish, it makes you think."
The song is repeated three times as the students dance faster and faster.

"Hour After Hour", 2,500,000 Bottles

The next activity is the "so many bottles thrown away" segment. We show how many plastic water bottles are thrown away every hour in the U.S. using a place value activity. Initially, three students join us in performance area and hold the numbers 2, 5 and 0 (two hundred and fifty). We say, "Is that it? No, there is more! We need another volunteer!" By adding a zero each time another child joins in, the number grows and grows until we reach 2,500,000. This is the number of bottles estimated to be thrown away, not recycled, every hour in the U.S. We use this segment to reiterate the importance of keeping the watershed clean (not throwing the bottles away, recycling them) and also to encourage families to use tap water. We explained how tap water is clean and safe to drink, and that it costs fractions of what people pay for bottled water. This activity is appropriate for older grades, 3rd and up, who have studied or are studying place value.

High Tide/ Low Tide Limbo

Using steelpan and marimbula, two instruments from the Caribbean made from recycled things, we celebrate our bay getting cleaner because of the actions of the audience. This segment allows us to define the San Francisco Bay as an estuary where fresh water drains from our towns and cities and mixes with salty water from the Pacific Ocean. We teach students that there are two high tides and two low tides per day. During low tide, mudflats, which are a rich habitat and space where egrets, herons, and other animals find food, are exposed. Students then come up front for the limbo and act as though they are fish under a high tide with lots of water and under a low tide. This piece is a celebration of student action because students and kids like them can help our watershed to become cleaner through their own efforts.

EVALUATIONS

We implemented electronic evaluations as they complement our earth-friendly program. During the week of each assembly, the contact person at each school is emailed a brief description and link to an online survey, which they are asked to distribute via email to staff. Recipients can click on the link and complete online in about two minutes. This year we received 50 evaluations. A summary of the evaluation responses is included with the hard copy of this final report. Of the surveys collected, 100% would like to see the

assembly return. All evaluations reflected high ratings for the content and quality of the assemblies. We received constructive ideas, and also received an evaluation asking for follow up activities, which we do provide both electronically and with hard copies at the end of the assemblies.

Onsite and online feedback was very positive this year. Schools are very appreciative of a free assembly program, especially one that incorporates music since Arts programs have been cut or reduced from so many school budgets.

The following is a taste of the feedback we received via electronic evaluations:

This was one of the most enjoyable, entertaining, and educational assemblies I've seen. Thank you so much for presenting this to our school. My students were humming/singing the songs for several days afterwards.
9/17/2012 7:17 PMView Responses

I think it was the best program I've seen yet on this topic, and I've seen several. They really got the point across about the storm drains in a more personal, action way. They gave the children great suggestions.
9/17/2012 9:18 AMView Responses

Sometimes the programs we get for this particular topic are not very good. This one was wonderful, and especially great in that we value an arts-rich and culturally-diverse curriculum. This fit the bill and also educated the kids (and adults!) about our watersheds. Thank you!
9/13/2012 10:44 AMView Responses

It was perfect!!! My kids loved it and retained info from the assembly. Very fun!
9/8/2012 3:32 PMView Responses

It was great becuase we are learning about water in Science right now, So it went hand in hand with what we have been reading and learning about.
9/7/2012 11:17 AMView Responses

Absoluetley AMAZING!!!! My students LOVED IT!!!! Thank you!!!
9/6/2012 8:56 PMView Responses

Loved loved loved it!!!!! VERY talented performers who were also great with our students. Thank you for coming to our school today!!!
9/6/2012 8:26 PMView Responses

This was our second year implementing electronic evaluations instead of paper forms. There are benefits to both modes. There has been a higher return rate for the paper forms than for the electronic evaluations. If CWP is looking for a larger number of total responses, we may want to revert to paper. Although electronic evaluations have a lower return rate, they still provide valuable information and a good understanding of the

effectiveness of ZunZun assembly programs; they are easier to distribute to schools, faster for teachers to complete and they also meld with our environmental message. We look forward to a meeting to decide what will work best for next year's program. Also, Alameda County Clean Water Program received more electronic evaluations back thank any other agency we work for.

POSSIBILITIES FOR NEXT YEAR

We look forward to working with Clean Water Program again in the 2013-2014 school year! Thank you for your continued support of our assembly programs.

Common Core Curriculum: As California begins to adopt the Common Core Standards for classroom curriculum, we will make the use of the standards apparent to teachers and educators while performing the assemblies. We will compare the assembly content to the Common Core guidelines and make the standards we use available to educators. California plans to implement Common Core by the 2014-15 school year.

Paper Evaluations or Electronic? We are seeing far fewer evaluations returning with the electronic evaluations than we did when we handed out paper ones. There seems to be a *psychology* involved with *seeing* the paper in front of you to do the evaluation verses going to the computer to type one up.

San Francisco Bay Estuary and Watershed Birds - A song about the diversity of bird life in the San Francisco Bay Estuary watershed and how they are affected by storm drain runoff. We would like to expand the watershed pollution prevention message for next year's assembly.

Garbage Percussion: We create instruments out of common trash (plastic bottles, bags and cups) and have students play them while we discuss recycling and sustainable practices (reusable bags, bottles and containers). We are considering using this segment next year.

School Staff Outreach: If CWP is interested, we would be happy to hand out information about storm drain pollution prevention to the janitorial staff at each school or program we visit.

PROGRAM EVALUATION SUMMARY

Survey respondents were given the following instructions: Rate the following by circling the most appropriate score, with 7 being the highest or best rating and 1 being the lowest rating.

1. Number of evaluations completed: 50

2.Rate the educational value of this program.

48% awarded the highest value, with a total of 96% awarding 5 or higher.

3.Rate the program's ability to stimulate student discussion.

41% awarded the highest value, with a total of 88% awarding 5 or higher.

4.Rate the likelihood that students will retain the material covered.

31% awarded the highest value, with a total of 82% awarding 5 or higher.

5.Rate how well the program promoted storm water pollution prevention and watershed awareness.

54% awarded the highest value, with a total of 98% awarding 5 or higher.

6.Rate the effectiveness of the musical elements of the program in communicating the educational message.

63% awarded the highest value, with a total of 98% awarding 5 or higher.

7.Rate the effectiveness of the audience participation activities in keeping the students' attention and reinforcing the educational message.

66% awarded the highest value, with a total of 100% awarding 5 or higher.

8.Rate the ability of live presentations such as this one to increase the students' capacity for retaining the educational message.

61% awarded the highest value, with a total of 100% awarding 5 or higher.

9.Rate the actors' professional and courteous manner.

88% awarded the highest value, with a total of 100% awarding 5 or higher.

10.Would you like to see Clean Water Program continue with this or a similar program in the future? Yes or No

100% answered "Yes" to this question.

ZunZun Assembly FINAL PERFORMANCE SCHEDULE 2012-13

Date	School	Contact	# of Shows	Times	# of stud.	City
8/31	Bowman	DiShawn Givens	2	9:00 & 10:05	545	Hayward
9/6	Chabot	Sue Israel	2	9:30 & 10:30	450	Castro Vly
9/12	Kaiser	Christine Kizziah	1	1:00	280	Oakland
9/25	Vannoy	Elise Tewell	1	9:25	380	Castro Vly.
9/26	Bay	Diana Tavares	2	9:00 & 10:00	650	San Lorenzo
10/2	Our Lady of Guad.	Lorie Keltie	1	1:15	225	Fremont
10/3	Hillview Crest	John Hazatone	1	9:30	715	Hayward
10/5	Glassbrook	G. Castro-Lopez	2	1:30 & 2:30	475	Hayward
10/10	Kennedy	Sue Zelt	1	9:15	380	Newark
10/11	Mission San Jose	Chuck Graves	2	8:20 & 9:50	630	Fremont
10/25	Del Rey	Robert Patrick	2	8:50 & 9:50	570	San Lorenzo
11/13	Thornhill	Dana Stern	1	9:30	390	Oakland
11/14	Mission Valley	Sheri Carlson	2	8:45 & 9:45	780	Fremont
12/4	Oliveira	Anne Damron	2	9:00 & 10:15	680	Fremont
12/4	Nea CLC	Kelly Keefer	1	12:30	230	Alameda
12/6	Lorenzo Manor	Greg Sahakian	2	9:00 & 10:00	675	Hayward
1/24	Vallejo Mill	Minnie Ransom	2	9:00 & 10:00	530	Fremont
1/24	Sobrante Park	Nicole Pierce	1	12:45	250	Oakland
3/12	Treeview	Sue Eckles	1	9:00	325	Hayward
4/17	Cragmont	Lorraine Mahley	1	1:40	420	Berkeley
4/18	Paden	Karin Chin	1	1:55	430	Alameda
6/11	Beach	Heidi Sawicki	1	1:00	350	Piedmont
	TOTAL SCHOOLS		**22**	**TOTAL STUDENTS**	**10,387**	

EDUCATIONAL SERVICES FINAL REPORT

A) PROGRAM INFORMATION

Organization Name: Golden Gate Audubon Society

Mailing Address: 2530 San Pablo Avenue, Ste. G (Street) Berkeley (City) CA (State) 94702 (Zip Code)

Program Director: Anthony DeCicco

Phone: 510-843-2222 **E-mail:** adecicco@goldengateaudubon.org

Name of Person Completing the Report: Anthony DeCicco

Phone: 843-2222 **E-mail:** adecicco@goldengateaudubon.org

Date of Report: July 15, 2013 **Reporting Period:** **From** July 1, 2012 to June 30, 2013

Program Scope:

1. Provide elementary classroom sessions in at least 5 separate public elementary schools with an environmental education program.
   * Lesson 1 Schoolyard Ecology
   * Lesson 2 Effects of Pollution and Habitat Loss on Bay Food Chain
   * Lesson 3 We All Live in a Shared Watershed
   * Lesson 4 Program Review and Eco-Stewardship Practices

2. Involve these same classrooms in a field trip that engages students in hands-on discovery, restoration and stormwater pollution prevention activities at local water resource sites: Arrowhead Marsh at Martin Luther King Jr. Regional Park, Lion Creek, Arroyo Viejo Creek or Sausal Creek.

**Please note: Although not listed in the GGAS/ACCWWP contract, each Eco-Oakland Program class was offered a family marine stewardship-themed trip to the Pacific Ocean. Participants explored the inter-tidal zone at low-tide along Muir Beach, hiked the Marin Headlands and learned strategies to reduce stormwater contaminants. We made a total of 4 trips.

3. Conduct pre- and post- program evaluations assessing students' knowledge and retention of key watershed and stormwater pollution prevention concepts.

4. Prepare and submit a mid-year progress report and an Annual Report to the DISTRICT.
The Annual Report will provide at a minimum an activity summary, the total number of lessons delivered, the total number of students involved, an overall evaluation of the learning of the educational messages, and any recommendations for improving the program in subsequent years. The Annual Report will be submitted by July 15th of each year of the contract.

EDUCATIONAL SERVICES QUARTERLY REPORT FORM Fiscal Year 2012-2013

B) PROGRAM UPDATE

1. List the school programs* completed during this reporting period into table provided below (sorted by city):

City	School/Teacher	Lessons/Activities	Lesson/Activity Date	# of Students reached
Ex: Fremont	*Warwick/S. Peters*	*Fieldtrip to Arrowhead Marsh*	*10/24/06*	*35 Students*
Oakland	Korematsu/N. Pal	Lesson 1 (Schoolyard Ecology)	12/07/12	20
Oakland	Korematsu/D. Rodriguez	Lesson 1	12/07/12	20
Oakland	Korematsu/R. McAtee	Lesson 1	12/07/12	20
Oakland	Intnl. Cmty. School./P. Long	Lesson 1	11/09/12	20
Oakland	Intnl. Cmty. School/I. Wheeler	Lesson 1	11/09/12	20
Oakland	Sobrante Park/A. Klazkin	Lesson 1	12/05/12	35
Oakland	Melrose/R. Kurshan-Emmer	Lesson 1	10/09/12	25
Oakland	Melrose/J. Jung	Lesson 1	10/09/12	25
Oakland	Esperanza/M. Lara	Lesson 1	10/29/12	20
Oakland	Esperanza/G. Reardon	Lesson 1	10/29/12	20
Oakland	Esperanza/C. Segura	Lesson 1	10/29/12	20
Oakland	ICS/P. Long	Field trip to Arrowhead Marsh	12/06/12	20
Oakland	ICS/I. Wheeler	Field trip to Arrowhead Marsh	12/04/12	20
Oakland	Korematsu/N. Pal	Field trip to Arrowhead Marsh	2/04/13	20
Oakland	Korematsu/R. McAtee	Field trip to Arrowhead Marsh	2/08/13	20
Oakland	Korematsu/D. Rodriguez	Field trip to Arrowhead Marsh	2/19/13	20
Oakland	Sobrante Park/A. Klazkin	Field trip to Arrowhead Marsh	12/20/12	35
Oakland	Melrose/J. Jung	Field trip to Arrowhead Marsh	10/19/12	25
Oakland	Melrose/R. Kurshan – Emmer	Field trip to Arrowhead Marsh	10/3012	25
Oakland	Esperanza/C. Segura	Field trip to Arrowhead Marsh	11/07/12	20
Oakland	Esperanza/M. Lara	Field trip to Arrowhead Marsh	11/06/12	20
Oakland	Esperanza/G. Reardon	Field trip to Arrowhead Marsh	11/08/12	20
Oakland	ICS/P. Long	Lesson 2 (Effects of Pollution and Habitat Loss on Bay Food Chains)	12/14/12	20
Oakland	ICS/I. Wheeler	Lesson 2	12/14/12	20
Oakland	Sobrante Park/A. Klazkin	Lesson 2	2/12/13	35
Oakland	Melrose/J. Jung	Lesson 2	11/13/12	25
Oakland	Melrose/R. Kurshan – Emmer	Lesson 2	11/13/12	25
Oakland	Korematsu/N. Pal	Lesson 2	2/27/13	20
Oakland	Korematsu/R. McAtee	Lesson 2	2/27/13	20
Oakland	Esperanza/M. Lara	Lesson 2	2/27/13	20
Oakland	Esperanza/G. Reardon	Lesson 2	12/03/12	20
Oakland	Esperanza/C. Segura	Lesson 2	12/03/12	20
Oakland	Korematsu/D. Rodriguez	Lesson 2	2/27/13	20
Oakland	ICS/P. Long	Lesson 3	3/04/13	20
Oakland	ICS/I. Wheeler	Lesson 3	3/04/13	20
Oakland	Esperanza/M. Lara	Lesson 3	2/11/13	20
Oakland	Esperanza/G. Reardon	Lesson 3	2/11/13	20
Oakland	Esperanza/C. Segura	Lesson 3	2/11/13	20
Oakland	Sobrante Park/A. Klazkin	Lesson 3	3/05/13	35
Oakland	Korematsu/N. Pal	Lesson 3	3/13/13	20
Oakland	Korematsu/R. McAtee	Lesson 3	3/13/13	20
Oakland	Korematsu/D. Rodriguez	Lesson 3	3/19/13	20
Oakland	Melrose/J. Jung	Lesson 3	3/28/13	25
Oakland	Melrose/R. Kurshan – Emmer	Lesson 3	3/28/13	25
Oakland	ICS/P. Long	Creek Field Trip	3/08/13	20
Oakland	ICS/I. Wheeler	Creek Field Trip	3/15/13	20
Oakland	Esperanza/M. Lara	Creek Field Trip	3/20/13	20
Oakland	Esperanza/G. Reardon	Creek Field Trip	3/19/13	20
Oakland	Esperanza/C. Segura	Creek Field Trip	3/21/13	20
Oakland	Sobrante Park/A. Klazkin	Creek Field Trip	4/11/13	35
Oakland	Korematsu/N. Pal	Creek Field Trip	4/16/13	20
Oakland	Korematsu/R. McAtee	Creek Field Trip	4/19/13	20
Oakland	Korematsu/D. Rodriguez	Creek Field Trip	4/18/13	20
Oakland	Melrose/J. Jung	Creek Field Trip	3/14/13	25
Oakland	Melrose/R. Kurshan – Emmer	Creek Field Trip	4/04/13	25
Oakland	ICS/P. Long	Lesson 4	5/31/13	20
Oakland	ICS/I. Wheeler	Lesson 4	5/31/13	20
Oakland	Esperanza/M. Lara	Lesson 4	5/06/13	20
Oakland	Esperanza/G. Reardon	Lesson 4	5/06/13	20

Oakland	Esperanza/C. Segura	Lesson 4	5/06/13	20
Oakland	Sobrante Park/A. Klazkin	Lesson 4	4/30/13	35
Oakland	Korematsu/N. Pal	Lesson 4	6/11/13	20
Oakland	Korematsu/R. McAtee	Lesson 4	6/11/13	20
Oakland	Korematsu/D. Rodriguez	Lesson 4	6/11/13	20
Oakland	Melrose/J. Jung	Lesson 4	6/10/13	25
Oakland	Melronse/R. Kurshan – Emmer	Lesson 4	6/10/13	25

*If your program consists of multiple class lessons/activities, please list the name of the lesson(s) and/or activity(ies) implemented for **each class** during the reporting period.

2. **Estimated percent of program completed:** 100 %

3. **Will all the planned lessons/activities be implemented by the end of the 2013? school year?** X **Yes** No **If no, please explain:**

4. **Attach an activity schedule planned for the next quarter (sorted by city). Schedules need to include city, school, name of teacher, date, and time of scheduled programs. If your program consists of multiple class lessons/activities, list lesson(s) and activity(ies) for each class.**

No scheduling for the fall 2013-2014 has occurred yet. We will begin outreach an initial planning with Eco-Oakland Program teachers in Late August/early September.

C) PROGRAM EVALUATION

1. **Attach a summary of evaluations received.**

Matching pre-program and post-programs surveys were administered to a significant number of classes at the initial portion of the 2012- 2013 academic year. 10 of the 11 classes were given the post-program surveys.

Attached is an evaluation report from our 2011- 2012 evaluation process. Analysis of the 2012 – 2013 surveys will be available by the end of this summer.

D) BUDGET UPDATE

1. **Funds awarded (as per agreement):** $ 10,000.00 each year; 2011 – 2014.
2. **Costs invoiced during this reporting period:** $ 10,000.00
3. **Costs invoiced to date:** $ 20,000.00
4. **Funds remaining:** $10,000.00

E) PUBLICATIONS

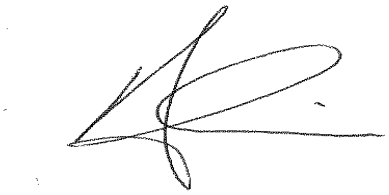
1. **Attach copies of any press releases, newsletters, articles, and/or other program marketing materials produced during this reporting period.**

An article in our newsletter, The Gull, which features the Eco-Education Program (attached with this report as well)

http://www.goldengateaudubon.org/wp-content/uploads/Gull_Sept-Oct-2012.pdf

Please email an electronic copy of this quarterly report to Jim Scanlin (jims@acpwa.org) and Christina Hovland (chovland@eoainc.com).

EDUCATIONAL SERVICES QUARTERLY REPORT FORM Fiscal Year 2012-2013



July 15, 2013

Signature of Program Director

Date

cleanwater
PROGRAM

EDUCATIONAL SERVICES YEAR END PROGRESS REPORT

A) PROGRAM INFORMATION

Organization Name: Livermore Area Recreation and Park District

Mailing Address: 4444 East Avenue (Street) Livermore (City) CA (State) 94550 (Zip Code)

Program Director: Pat Sotelo

Phone: (925) 960-2400 **E-mail:** psotelo@larpd.dst.ca.us

Name of Person Completing the Report: Peggy Simi

Phone: (925) 960-2400 **E-mail:** psimi@larpd.dst.ca.us

Date of Report: 07/03/13 **Reporting Period:** **From 6/13/2012 to 8/22/2013**

Program Scope: A series of water education programs for 4th & 5th Grade students in the Tri-Valley

B) PROGRAM UPDATE

1. List the school programs* completed during this reporting period into table provided below (sorted by city):

City	School/Teacher	Lessons/Activities	Lesson/Activity Date	# of Students reached
Dublin	Kolb/Howard	Water Flows	01/14/13	30
Dublin	Kolb/Russo-O'Carrol	Water Flows	01/14/13	30
Dublin	Kolb/Freschi	Water Flows	01/15/13	30
Dublin	Kolb/Mognaga	Water Flows	01/15/13	30
Livermore	Our Saviors/Neal-Joslin	Water Flows	09/21/12	20
Livermore	Altamont Creek/Loftus	Water Flows	11/06/12	33
Livermore	Altamont Creek/Becker	Water Flows	11/06/12	33
Livermore	Altamont Creek/Dugger	Water Flows	11/07/13	33
Livermore	Rancho/Romero	Water Flows	12/12/12	26
Livermore	Rancho/Mitchell	Water Flows	12/12/12	26
Livermore	Rancho/Swanson	Water Flows	12/14/12	26
Livermore	Rancho/Swenson	Water Flows	12/14/12	18
Pleasanton	Valley View/Muniz	Water Flows	02/07/13	33
Pleasanton	Valley View/Perez	Water Flows	02/07/13	33
Pleasanton	Valley View/Smith	Water Flows	02/08/13	33
Pleasanton	Valley View/Howell	Water Flows	02/08/13	33
Pleasanton	Hearst/Mitchell/Cara	Water Flows	09/11/12	33
Pleasanton	Hearst/O'Brien	Water Flows	09/11/12	33
Pleasanton	Hearst/Morrell	Water Flows	09/12/12	33
Pleasanton	Hearst/Evans	Water Flows	09/12/12	33
Pleasanton	Vintage Hills/Delema	Water Flows	02/15/13	33
Pleasanton	Vintage Hills/Jara	Water Flows	02/15/13	33
Pleasanton	Vintage Hills/Cease	Water Flows	03/01/13	33
Pleasanton	Vintage Hills/Kidd	Water Flows	03/01/13	33

EDUCATIONAL SERVICES YEAR END REPORT FORM Fiscal Year 2012/2013

Pleasanton	**Donlon/Weaver**	Water Flows	*09/25/12*	33
Pleasanton	**Donlon/Mahoney**	Water Flows	*09/25/12*	33
Pleasanton	**Donlon/Robinson**	Water Flows	*09/27/12*	33
Pleasanton	**Donlon/Rice**	Water Flows	*09/27/12*	33
Dublin	**Kolb/Howard**	Stream Life I	*01/17/13*	30
Dublin	**Kolb/Russo-O'Carrol**	Stream Life I	*01/17/13*	30
Dublin	**Kolb/Freschi**	Stream Life I	*01/18/13*	30
Dublin	**Kolb/Mognaga**	Stream Life I	*01/18/13*	30
Livermore	**Our Saviors/Neal-Joslin**	Stream Life I	*10/05/12*	20
Livermore	**Altamont Creek/Loftus**	Stream Life I	*02/11/13*	33
Livermore	**Altamont Creek/Becker**	Stream Life I	*01/25/13*	33
Livermore	**Altamont Creek/Dugger**	Stream Life I	*1/25/13*	33
Livermore	**Rancho/Romero**	Stream Life I	*12/19/12*	26
Livermore	**Rancho/Mitchell**	Stream Life I	*12/19/12*	26
Livermore	**Rancho/Swanson**	Stream Life I	*12/21/12*	26
Livermore	**Rancho/Swenson**	Stream Life I	*12/21/12*	18
Pleasanton	**Valley View/Muniz**	Stream Life I	*02/21/13*	33
Pleasanton	**Valley View/Perez**	Stream Life I	*02/21/13*	33
Pleasanton	**Valley View/Smith**	Stream Life I	*02/22/13*	33
Pleasanton	**Valley View/Howell**	Stream Life I	*02/22/13*	33
Pleasanton	**Hearst/Mitchell/Cara**	Stream Life I	*09/18/12*	33
Pleasanton	**Hearst/O'Brien**	Stream Life I	*09/18/13*	33
Pleasanton	**Hearst/Morrell**	Stream Life I	*09/19/13*	33
Pleasanton	**Hearst/Evans**	Stream Life I	*09/19/13*	33
Pleasanton	**Vintage Hills/Delema**	Stream Life I	*04/15/13*	33
Pleasanton	**Vintage Hills/Jara**	Stream Life I	*04/15/13*	33
Pleasanton	**Vintage Hills/Cease**	Stream Life I	*04/08/13*	33
Pleasanton	**Vintage Hills/Kidd**	Stream Life I	*04/08/13*	33
Pleasanton	**Donlon/Weaver**	Stream Life I	*10/04/12*	33
Pleasanton	**Donlon/Mahoney**	Stream Life I	*10/04/12*	33
Plesanton	**Donlon/Robinson**	Stream Life I	*10/15/12*	33
Pleasanton	**Donlon/Rice**	Stream Life I	*10/15/12*	33
Dublin	**Kolb/Howard**	Stream Life II	*04/11/13*	30
Dublin	**Kob/Freshi**	Stream Life II	*04/11/13*	30
Livermore	**Our Saviors/Neal-Joslin**	Stream Life II	*10/19/12*	20
Livermore	**Altamont Creek/Loftus**	Stream Life II	*06/06/13*	33
Livermore	**Altamont Creek/Becker**	Stream Life II	*06/07/13*	33
Livermore	**Altamont Creek/Dugger**	Stream Life II	*06/06/13*	33
Livermore	**Rancho/Romero**	Stream Life II	*05/07/13*	26
Livermore	**Rancho/Mitchell**	Stream Life II	*05/07/13*	26
Livermore	**Rancho/Swanson**	Stream Life II	*05/14/13*	26
Livermore	**Rancho/Swenson**	Stream Life II	*05/14/13*	18
Pleasanton	**Valley View/Smith**	Stream Life II	*05/10/13*	33
Pleasanton	**Valley View/Howell**	Stream Life II	*05/10/13*	33
Pleasanton	**Hearst/Mitchell/Cara**	Stream Life II	*10/22/13*	33
Pleasanton	**Hearst/O'Brien**	Stream Life II	*10/22/13*	33
Pleasanton	**Hearst/Morrell**	Stream Life II	*10/23/12*	33
Pleasanton	**Hearst/Evans**	Stream Life II	*10/23/12*	33
Pleasanton	**Vintage Hills/Delema**	Stream Life II	*05/28/13*	33
Pleasanton	**Vintage Hills/Jara**	Stream Life II	*05/28/13*	33
Pleasanton	**Vintage Hills/Cease**	Stream Life II	*05/30/13*	33
Pleasanton	**Vintage Hills/Kidd**	Stream Life II	*05/21/13*	33
Pleasanton	**Donlon/Weaver**	Stream Life II	*04/16/13*	33
Pleasanton	**Donlon/Mahoney**	Stream Life II	*04/16/13*	33
Pleasanton	**Donlon/Robinson**	Stream Life II	*04/19/13*	33
Pleasanton	**Donlon/Rice**	Stream Life II	*04/19/13*	33

*If your program consists of multiple class lessons/activities, please list the name of the lesson(s) and/or activity(ies) implemented for **each class** during the reporting period.

2. **Estimated percent of program completed:** 86%

EDUCATIONAL SERVICES YEAR END REPORT FORM Fiscal Year 2012/2013

3. **Will all the planned lessons/activities be implemented by the end of the 2012-13? school year?** ☒ **Yes** ☐ **No** **If no, please explain:**

4. **Attach an activity schedule planned for the next quarter (sorted by city). Schedules need to include city, school, name of teacher, date, and time of scheduled programs. If your program consists of multiple class lessons/activities, list lesson(s) and activity(ies) for each class. Not applicable**

C) PROGRAM EVALUATION

1. **Attach a summary of evaluations received.**

D) BUDGET UPDATE

1. **Funds awarded (as per agreement):** $10,000.00
2. **Costs invoiced during this reporting period:** $11,520.00
3. **Costs invoiced to date:** $11,520.00
4. **Funds remaining:** $0

E) PUBLICATIONS

1. **Attach copies of any press releases, newsletters, articles, and/or other program marketing materials produced during this reporting period.**

   Nature program booklet provided

Please email an **electronic copy** of this quarterly report to Jim Scanlin (jims@acpwa.org) and Christina Hovland (chovland@eoainc.com).

Signature of Program Director

7/03/2013
Date

Appendix F

Provision C.8 Water Quality Monitoring

- Electronic Status Monitoring Data Report to the Water Board for Water Year 2012 Creek Status Data January 15, 2013 transmittal letter

cleanwater
PROGRAM

Protecting Alameda County Creeks, Wetlands & the Bay

399 Elmhurst St.
Hayward, CA
94544
p. 510-670-5543

MEMBER AGENCIES:
Alameda
Albany
Berkeley
Dublin
Emeryville
Fremont
Hayward
Livermore
Newark
Oakland
Piedmont
Pleasanton
San Leandro
Union City
County of Alameda
Alameda County Flood Control and Water Conservation District
Zone 7 Water Agency

January 15, 2013

Bruce Wolfe
Executive Officer
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: Electronic Data Submittal - ACCWP Creek Status Monitoring from October 2011through September 2012 Pursuant to Provision C.8.g

Dear Mr. Wolfe:

The member agency Permittees of the Alameda Countywide Clean Water Program (Program) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with Monitoring requirements of the Municipal Regional Stormwater NPDES Permit (MRP, Order No. R2-2009-0074, CAS612008).

With this letter I am submitting a CD-ROM containing the Program's Creek Status Monitoring data collected between October 1, 2011 and September 30, 2012 pursuant to Provision C.8.c of the MRP. These data are provided in Microsoft Excel files listed in Attachment A, which are formatted according to templates compatible with data management requirements of the Surface Water Ambient Monitoring Program (SWAMP). The Program is submitting these data to the Regional Water Board by January 15, 2013 as specified in Provision C.8.g.ii of the MRP. Other data addressing the requirements of MRP Provision C.8.e, but not through the efforts of the Program, will be submitted through the entities responsible for Quality Assurance in a time schedule consistent with the Provisions of the MRP[1].

By signing this letter on behalf of the program, I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. [40CFR 122.22(d)].

[1] Data collection in Alameda County, and data management and Quality Assurance for all sites, of the alternative approach to Pollutants of Concern Loads Monitoring were performed by the San Francisco Estuary Institute through a collaboration between BASMAA and the RMP. Data collection and reporting for Long Term Trends Monitoring are the responsibility of the SWAMP Sediment Pollution Trends (SPoT) program.

The quality of all Creek Status Monitoring data was evaluated through data collection and evaluation methods consistent with the Standard Operating Procedures and Quality Assurance Project Plan developed through the BASMAA Regional Monitoring Coalition (RMC), a regional collaborative that includes all ACCWP member Permittees. These documents have been reviewed by Region 2 SWAMP staff for SWAMP-comparability where applicable, as provided in MRP C.8.h,

In conformance with MRP Provision C.8.g.ii, the Program has participated in the RMC's development of a regional information management system that supports electronic transfer of data to the Regional Data Center of the California Environmental Data Exchange Network (CEDEN). As requested by Water Board staff on August 5, 2011, concurrent with this submission the Program is transferring the subject monitoring data directly to CEDEN. As required in MRP Provision C.8.g.vii, the Program will notify stakeholders and members of the public of the availability of electronically submitted data and monitoring reports through its website and via other communications as appropriate.

We are in the process of identifying potential persistent water quality issues that would warrant a programmatic response as required by the MRP. Attachment A presents preliminary highlights of some of these issues. It should be emphasized that this water quality data review is preliminary and does not constitute a determination of whether water quality objectives were exceeded and/or if stormwater runoff or dry weather discharges are or may be causing or contributing to exceedances, if any. The Program is in the process of determining whether these data represent persistent exceedances in receiving waters; if it is determined that discharges under this permit are causing or contributing to persistent exceedances of the applicable water quality objectives, the Permittees will follow up as required by MRP Provision C.1. Where results meet trigger criteria for individual parameters as noted in Table 8.1 or Attachment H of the MRP, the Program will implement follow up Monitoring Project actions pursuant to MRP Provision C.8.d.

Please contact me if you have any questions or comments.

Sincerely,

James Scanlin
Program Manager

Attachment: CD ROM
Attachment A: list of datafiles on CD-ROM

Copy via email: Alameda Countywide Clean Water Program Management Committee Representatives

Attachment A

Data files for ACCWP Creek Status Monitoring
October 1, 2011-September 30, 2012

Sources of templates for data files (see file ACCWP-EDS_ToC_WY2012.xlsx for details):
SWAMP v2.5 Database references at http://swamp.mpsl.mlml.calstate.edu/
Kevin Lunde, SFRWQCB SWAMP Program (Continuous Monitoring)
EOA, Inc. (Stream Survey using Urban Streams Assessment)

Sample Purpose	Filename, including site ID	Evaluation of Water Quality[a]
WaterChem	SWAMP_WQ_ACCWP_205R00535_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_205R00430_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_205R00110_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00647_WET_chem.xls	6/18/12 Dissolved Oxygen was less than 5 mg/L for WARM Beneficial Use
WaterChem	SWAMP_WQ_ACCWP_204R00639_WET_chem.xls	6/19/12 pH exceeded 8.0 and electrical conductivity exceeded 900 us/cm for MUN Beneficial Use
WaterChem	SWAMP_WQ_ACCWP_204R00596_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00583_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00455_WET_chem.xls	6/13/12 Dissolved Oxygen was less than 5 mg/L for WARM Beneficial Use
WaterChem	SWAMP_WQ_ACCWP_204R00391_WET_chem.xls	6/6/12 Dissolved Oxygen was kess than 5 mg/L
WaterChem	SWAMP_WQ_ACCWP_204R00383_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00367_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00356_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00068_WET_chem.xls	6/4/12 total residual chloride exceeded 250 mg/L for MUN Beneficial Use
WaterChem	SWAMP_WQ_ACCWP_204R00340_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00319_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00303_WET_chem.xls	6/14/12 Dissolved Oxygen was less than 7 mg/L for COLD Beneficial Use
WaterChem	SWAMP_WQ_ACCWP_204R00191_WET_chem.xls	5/29/12 Dissolved Oxygen was less than 7 mg/L for COLD Beneficial Use
WaterChem	SWAMP_WQ_ACCWP_204R00100_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00084_WET_chem.xls	No exceedance
WaterChem	SWAMP_WQ_ACCWP_204R00047_WET_chem.xls	6/6/12 Dissolved Oxygen was less than 7 mg/L and pH exceeded 8.5 for COLD Beneficial Use

Sample Purpose	Filename, including site ID	Evaluation of Water Quality[a]
WaterTox	SWAMP_WQ_ACCWP_204R00100_WET_tox.xls	No significant toxicity
WaterTox	SWAMP_WQ_ACCWP_204R00084_WET_tox.xls	No significant toxicity
WaterTox	SWAMP_WQ_ACCWP_204R00047_WET_tox.xls	3/14/12 *Hyallela azteca* survival was less than 50% of Control (No re-sample/re-test was performed in spring)
SedChem	SWAMP_WQ_ACCWP_204R00100_DRY_chem.xls	No significant toxicity
SedChem	SWAMP_WQ_ACCWP_204R00084_DRY_chem.xls	No significant toxicity
SedChem	SWAMP_WQ_ACCWP_204R00047_DRY_chem.xls	No significant toxicity
WaterTox, SedTox	SWAMP_WQ_ACCWP_204R00047_DRY_tox.xls	No significant toxicity
WaterTox, SedTox	SWAMP_WQ_ACCWP_204R00100_DRY_tox.xls	No significant toxicity
WaterTox, SedTox	SWAMP_WQ_ACCWP_204R00084_DRY_tox.xls	No significant toxicity
WaterChem (Pathogens)	SWAMP_WQ_ACCWP_CVY150_DRY_pathogens.xls	No significant toxicity
WaterChem (Pathogens)	SWAMP_WQ_ACCWP_CVY140_DRY_pathogens.xls	7/11/12 *E. coli* exceeded Basin Plan Table 3.2 criterion for infrequently used area in REC-1 Beneficial Use
WaterChem (Pathogens)	SWAMP_WQ_ACCWP_CVY120_DRY_pathogens.xls	7/11/12 *E. coli* exceeded Basin Plan Table 3.2 criterion for moderately used area in REC-1 Beneficial Use.
WaterChem (Pathogens)	SWAMP_WQ_ACCWP_CVY080_DRY_pathogens.xls	7/11/12 *E. coli* exceeded Basin Plan Table 3.2 criterion for moderately used area in REC-1 Beneficial Use.
WaterChem (Pathogens)	SWAMP_WQ_ACCWP_CVY020_DRY_pathogens.xls	7/11/12 *E. coli* exceeded Basin Plan Table 3.2 criterion for moderately used area in REC-1 Beneficial Use.
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00391_merged_rev.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00596_merged_rev.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00191_merged_rev.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00583_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00340_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00319_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00303_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00100_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00084_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00068_merged.xls	No exceedance

Data files for ACCWP Creek Status Monitoring October 1, 2011-September 30, 2012

Sample Purpose	Filename, including site ID	Evaluation of Water Quality[a]
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00047_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00356_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00367_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00383_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00455_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00639_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_204R00647_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_205R00110_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_205R00430_merged.xls	No exceedance
Benthics, Algae, FieldMeasure, Habitat	SWAMP_BA_ACCWP_205R00535_merged.xls	No exceedance
ContinuousMonitoring (GenWQ)	CM_ACCWP_YSI_CRW030_2012_dry.xls	September 2012 Dissolved Oxygen concentrations were below the 7 mg/L level for COLD Beneficial Use for a majority of readings.
ContinuousMonitoring (GenWQ)	CM_ACCWP_YSI_CRW030_2012_wet.xls	No exceedance
ContinuousMonitoring (GenWQ)	CM_ACCWP_YSI_CVY005_2012_dry.xls	No exceedance
ContinuousMonitoring (GenWQ)	CM_ACCWP_YSI_CVY005_2012_wet.xls	No exceedance
ContinuousMonitoring (GenWQ)	CM_ACCWP_YSI_SLO065_2012_dry.xls	No exceedance
ContinuousMonitoring (GenWQ)	CM_ACCWP_YSI_SLO065_2012_wet.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_CRW030_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_CRW050_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_SAU035_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_SAU070_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_SAU0090_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_SAU0100_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_SAU0110_2012.xls	No exceedance
ContinuousMonitoring (Temp)	CM_ACCWP_Hobo_SAU0200_2012.xls	No exceedance

Data files for ACCWP Creek Status Monitoring October 1, 2011-September 30, 2012

Sample Purpose	Filename, including site ID	Evaluation of Water Quality[a]
StreamSurvey	USA_ACCWP_Chabot_2012.xls	N/A
StreamSurvey	USA_ACCWP_CVC_2012.xls	N/A
StreamSurvey	USA_ACCWP_SLZ_2012.xls	N/A

[a] Based on preliminary review of water quality standards; these notes do not constitute a determination of whether water quality objectives were exceeded and/or if stormwater runoff or dry weather discharges are or may be causing or contributing to exceedances, Numeric water quality objectives for most data parameters have not been adopted to-date.

Appendix G

BASMAA Regional Pollutants of Concern Report

- BASMAA Regional Pollutants of Concern Report for FY 2012/13

Alameda Countywide
Clean Water Program

Contra Costa
Clean Water Program

Fairfield-Suisun
Urban Runoff
Management Program

Marin County
Stormwater Pollution
Prevention Program

Napa County
Stormwater Pollution
Prevention Program

San Mateo Countywide
Water Pollution
Prevention Program

Santa Clara Valley
Urban Runoff Pollution
Prevention Program

Sonoma County
Water Agency

Vallejo Sanitation
and Flood
Control District

B A S M A A

Regional Pollutants of Concern Report for FY 2012-2013

September 12, 2013

Bay Area

Stormwater Management

Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

510.622.2326

info@basmaa.org

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Table 2. Revised Implementation Schedule for Pilot Stormwater Diversion Projects (September 2013).

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Appendix 2. Legacy Pesticides Sub-Report - Chlordanes, DDTs and Dieldrin

Appendix 3. Selenium Sub-Report - Urban Runoff Characterization and Control Measures Plan

INTRODUCTION

This document (Regional POC Report)summarizes the status of regionally-implemented activities that were conducted on behalf of all 76 municipalities and special districts (Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP, Order R2009-0074) issued by the San Francisco Regional Water Quality Control Board (Water Board). The Regional POC Report covers annual reporting requirements for portions of MRP Provisions C.9, C.11, C.12, C.13 and C.14, and also reports on the status of regional activities implemented in compliance with Provision C.10.a. The Regional POC Report complements separately submitted Annual Reports prepared by Permittees individually or by their respective countywide stormwater programs.

In two previous Fiscal Years, the Regional POC Report was accompanied by semi-annual Monitoring Status Reports that provided updates on activities related to MRP Provision C.8 (Water Quality Monitoring) prior to the submittal of the first Urban Creeks Monitoring Report in March 2013. Monitoring activities starting October 1, 2011 are now reported separately from the Regional POC Report as prescribed by MRP Provision C.8.g.

Regionally-implemented activities to address Pollutants of Concern (POCs) are conducted under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA), a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Most of the MRP requirements pertinent to activities discussed in the Regional POC Report are met entirely by BASMAA regional projects, except where otherwise noted. Scopes, budgets, and contracting or in-kind project implementation mechanisms for BASMAA regional projects follow BASMAA's *Operational Policies and Procedures,* approved by the BASMAA Board of Directors (BOD). MRP Permittees, through their stormwater program representatives on the BOD and its subcommittees, collaboratively authorize and participate in BASMAA regional projects or tasks. Regional project costs are shared by either all BASMAA members or among those Phase I municipal stormwater programs that are subject to the MRP[1]. To conduct monitoring for the MRP as a regional collaborative, the BASMAA Regional Monitoring Coalition (RMC) was established in July 2010 to coordinate monitoring activities among BASMAA members and with other related monitoring initiatives.

[1] The BASMAA programs supporting MRP Regional Projects include all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities.

POLLUTANTS OF CONCERN OVERVIEW

Provisions C.9 through C.14 of the MRP address pollutants that are identified as being of regulatory concern for San Francisco Bay or other local water bodies. For some, regulatory water quality attainment strategies, such as Total Maximum Daily Loads (TMDLs), have been adopted or are currently under development. For mercury, PCBs and other sediment-bound pollutants, the Water Board has proposed to require implementation of stormwater-related control measures in the following modes:

1. Full-scale implementation throughout the region.
2. Focused implementation in areas where benefits are most likely to accrue.
3. Pilot-testing in a few specific locations.
4. Other: This may refer to experimental control measures, Research and Development, desktop analysis, laboratory studies, and/or literature review.

Many regional tasks currently being implemented by BASMAA agencies focus on MRP provisions relating to modes 3 and 4, which require studies or pilot projects intended to reduce uncertainties about the sources, occurrence or effectiveness of control measures for POCs. Other tasks are being implemented through participation in regional or state-wide collaboratives, such as:

- The Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP); and
- initiatives to control sources of specific pollutants.

PESTICIDES TOXICITY CONTROL (C.9)

C.9.e. Track and Participate in Relevant Regulatory Processes

The essential requirements of this provision are to track U.S. Environmental Protection Agency (USEPA) and California Department of Pesticide Regulation (DPR) actions related to urban-uses of pesticides and actively participate in the shaping of regulatory efforts currently underway. This provision allows for cooperation among Permittees through the California Stormwater Quality Association (CASQA), BASMAA and/or the Urban Pesticide Pollution Prevention Project (UP3 Project). Recognizing that this approach is the most likely to result in meaningful changes in the regulatory environment, Permittees elected to continue on this course in FY 2012-13 to achieve compliance with this provision. Oversight of this provision is the purview of the BASMAA Board of Directors.

Summary of participation efforts

The actual work of tracking and participating in the ongoing regulatory efforts related to pesticides was accomplished through CASQA. CASQA conducted its activities on behalf of members and coordinated funding contributions and activities through its Pesticides Subcommittee, a group of stormwater quality agencies affected by pesticides or pesticides-related toxicity listings, TMDLs, or permit requirements, as well as others knowledgeable about pesticide-related stormwater issues. One of the Subcommittee's two co-chairs is Jamison Crosby, Program Manager of the Napa County Stormwater Pollution Prevention Program.

With funding collected from numerous California urban runoff programs and municipal wastewater treatment plant organizations, CASQA conducts the following activities:

- Track pesticide-related regulatory activities by USEPA, DPR, and other agencies that have significant potential to affect municipal wastewater treatment plants, municipal urban runoff programs, and surface water quality.
- Maintain open lines of communication with pesticide regulators, water board and other allies, pesticide manufacturers, professional pesticide applicators, and other key stakeholders.
- Identify highest priority pesticides-related regulatory activities.
- Obtain and review relevant new scientific information.
- Identify anticipated effect on urban runoff programs and surface water quality.
- For priority items, analyze regulatory documents like environmental risk assessments, obtain related scientific information, and hold meeting and/or write comment letters regarding proposed actions and CASQA and the clean water community's concerns.
- As necessary, develop and analyze background information, such as pesticide use information, identification of priority pesticides, or data summaries on new pesticides, to inform management decisions or to document the scientific basis for a requested regulatory action.

Information Submitted and How Regulatory Actions Were Affected

FY 2012-13 was another productive year. Table 1 summarizes information submitted and how regulatory actions were affected. The participation efforts listed above produced outcomes at Outcome Level 3: Target Audience Actions (formerly Behavior Change) in the CASQA Effectiveness Assessment system.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13.

Outcome in 2012-13	CASQA Participation Actions*
Adoption of California regulations, "Surface Water Protection in Outdoor Nonagricultural Settings." Regulations were completed in June 2012 and became effective July 19, 2012. The regulations reduce the quantities of pyrethroids applied on outdoor impervious surfaces by professional applicators, thus reducing the quantity of pyrethroids that can be washed directly into gutters and storm drains when it rains or when water like irrigation overflow runs across treated surfaces. Together, the regulations and new bifenthrin labeling (see below) are anticipated to reduce the amount of pyrethroid insecticides in urban stormwater runoff by 80-90%.[2] UP3 Project analysis—based on pyrethroid monitoring data, pyrethroid use data, and urban runoff modeling by U.C. Davis—suggests that the regulations (in combination with label changes described below) will largely, but not completely, end widespread water and sediment toxicity from pyrethroids in San Francisco Bay Area urban watersheds. In some watersheds, lower levels of toxicity may continue. In a larger number of watersheds, pyrethroid concentrations will continue to exceed aquatic life protection benchmarks such as the values developed by U.C. Davis with funding from the Central Valley Water Board. In September and October 2012, the Pyrethroid Working Group (a pesticide industry group) placed videos that provide instruction to the pest management industry on how to comply with the new California DPR Surface Water Regulations on YouTube (see https://www.youtube.com/user/PWG2PMP?feature=mhee).	Commendation letter and award to DPR 9/13/12** Since the early-2000s, multiple meetings, letters, and ongoing communications with California DPR.

*The San Francisco Bay Regional Water Quality Control Board also participated in almost all of these regulatory processes, providing input that paralleled CASQA's. The State Water Resources Control Board, the Central Valley Regional Water Quality Control Board, and California municipal wastewater treatment plants also joined CASQA and the San Francisco Bay Water Board in participating in many of these processes. Outcomes should be attributed to the combined communications of all participants.
**The table lists FY 2012/13 actions and summarizes past actions that relate directly to the outcome.

[2] Jorgenson, B. C. (2011). Off-Target Transport of Pyrethroid Insecticides in the Urban Environment: An Investigation into Factors Contributing to Washoff and Opportunities for Mitigation. Ph.D. Thesis, University of California, Davis.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions*
California Professional Bifenthrin Product Application Limitations Implemented through Product Label Changes. DPR agreed with water quality agencies that additional reductions in outdoor bifenthrin use—beyond what is required in the surface water regulations—are warranted because of bifenthrin's significant contribution to aquatic toxicity. At manufacturers' request, DPR allowed bifenthrin-specific restrictions to be implemented through label changes on bifenthrin professional product labels rather than through bifenthrin-specific regulations. For professional applicators, restrictions on pesticide labels are enforceable. New bifenthrin labels will prohibit applications to any exposed horizontal impervious surface and any building wall that abuts impervious surfaces that drain to storm drains. In fall 2011, bifenthrin manufacturers set out a relatively rapid schedule for bringing the newly labeled products to the California marketplace by summer 2012. Manufacturers jointly committed to the label changes and the aggressive implementation schedule in a Memorandum of Agreement (MOA), which was signed by all manufacturers of bifenthrin professional products. In a letter concurring with the MOA, DPR promised not to include special bifenthrin restrictions in its regulations if the MOA is implemented as promised. Available evidence indicates that the label changes are occurring as promised in the MOA. For example, in May 2012, FMC, the manufacturer of one of the most popular professional bifenthrin products announced that it was shipping products reflecting the new labeling.	Since the mid 2000s, multiple meetings and ongoing communications with California DPR about bifenthrin water pollution.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions*
Water Quality Protection Label Changes for All Types of Pyrethroid Products—Including Consumer Products—Start to Appear on Product Shelves But Are Being Implemented Slowly. In 2009, EPA began working with pyrethroid manufacturers to modify pyrethroid product labels with instructions that provide additional water quality protections. The instructions direct users to apply only spot or "crack and crevice" treatments on impervious surfaces and contain other recommendations, such as to avoid applications when rain is forecast in the next 24 hours. EPA required these changes for pyrethroids that went through re-registration (cypermethrin, permethrin, resmethrin, tetramethrin, sumithrin, and allethrins). For all other pyrethroids (e.g., bifenthrin, cyfluthrin, esfenvalerate), the changes are voluntary until Registration Reviews are completed late this decade. EPA's initial goal was to achieve 100% voluntary label changes and to approve both voluntary and mandatory label changes in 2010. The reality has fallen short of this goal. The first modified consumer product labels began appearing on retail shelves in fall 2011. In spring 2012, manufacturers started to ship professional products with the new labels. In May 2012, EPA admitted that there is no current target implementation date for the new labels and that not all manufacturers are voluntarily making the label changes. On January 10, 2013, in response to requests from pesticide users and regulators facing pest problems not present in California, EPA modified label language designed to minimize water pollution to allow additional types of applications on buildings by professional applications under limited circumstances. EPA's language changes clarify the legality of California's regulatory exception allowing treatments under building eaves in areas full sheltered from rain. Otherwise, these changes should not affect California because DPR's surface water protection regulations do not include the new exceptions. EPA has only required this language be placed on labels for the pyrethroids that were reviewed in EPA's last review cycle, re-registration (cypermethrin, permethrin, allethrins, tau-fluvalinate, resmethrin, sumithrin, and tetramethrin). For all other pyrethroids (bifenthrin, cyhalothrin, cyhalothrin, cyfluthrin, tralomethrin, deltamethrin, esfenvalerate, etofenprox) the language is voluntary.	Since the mid 2000s, multiple meetings and ongoing communications with California DPR and EPA about pyrethroid insecticide water pollution and specific early mitigation actions, including product label language improvements. The label change process was initiated by DPR in response to October 2007 letters from CASQA and the Water Boards requesting early mitigation actions for pyrethroids in urban runoff.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
(continued) DPR's adoption of the Surface Water Protection regulations was partially motivated by the delays and limited adoption of these product labels. Since DPR regulations can only address professional applicators, the EPA label change program is the only effort underway to reduce pyrethroid water pollution from non-professional (consumer) products. For most of the pyrethroids linked to water pollution, non-professional use is relatively small. The exception is bifenthrin, for which non-professional use comprises about 20% of the market.[3]	
DPR Incorporated Surface Water Into Registration Process for Most New Pesticide Chemicals Intended for Use Outdoors in Urban Areas. On September 16, 2011, DPR announced a formal procedure to ensure that pesticides with potential to pollute surface water will be identified when they enter DPR's registration process and will be routed to DPR's Surface Water Program for review. Past DPR registration process shortcomings have allowed at least one problem pesticide (fipronil) to slip through and have constrained the quality of DPR's evaluations. DPR's new procedure should identify most pesticides likely to be water quality problems (however, there are a few critical gaps in the program, such as swimming pool chemicals). When registration is approved, DPR will have the necessary scientific basis to require appropriate mitigation measures. In parallel, DPR has established procedures to create a surface water quality "watch list," to require analytical methods when it registers pesticides on this watch list, and to track usage and annually reevaluate its monitoring program to respond to changes in use of watch list pesticides. In July 2011, just as DPR was finalizing its procedure, DPR demonstrated how the new process would work when it denied the application to register a product called Abtech Smart Sponge. The "Smart Sponge" is designed to kill bacteria in storm drains with a biocide that may also be toxic to aquatic organisms. Although EPA's Antimicrobials Division gave minimal review of water quality implications when approving this product, DPR (in an early implementation of its new procedure) ensured that the product was fully reviewed by DPR's Surface Water Program. Because DPR Surface Water Program reviewers determined that there was insufficient information available to determine if the product would adversely impact water quality, DPR denied the registration application.	Letter to DPR 11/15/12 Since the early 2000s, multiple meetings, letters, and ongoing communications with California DPR.

[3] TDC Environmental (2010). Pesticides in Urban Runoff, Wastewater, and Surface Water: Annual Urban Pesticide Use Data Report 2010. Prepared for the San Francisco Estuary Partnership.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
(continued) In February 2013, based on CASQA, BACWA, and Water Board comments, DPR was challenged by the need to make a decision about registering a silver-based biocide designed to be impregnated into paint and other products. Treated products, like paint, are not regulated as pesticides, so DPR has no control of these products in commerce. DPR ultimately determined to register the silver biocide to avoid disadvantaging California manufacturers. However, it determined to start working with EPA on the exemption for treated products and on the gaps in EPA's environmental risk assessments for silver and other biocides that are widely used in these products. In its "Notice of Proposed and Final Decisions and Public Reports" DPR noted its commitment to working with EPA on silver: "…DPR is still concerned about the potential impact of silver pesticides on California POTWs and surface water quality. DPR has initiated discussions with the U.S. Environmental Protection Agency on this particular issue."	
DPR and EPA to Improve Ability to Model Pesticides in Urban Runoff. California input to EPA and DPR has long encouraged development of modeling methods that EPA and DPR can use to evaluate water quality risks associated with pesticide use in urban areas. In 2011, U.S. EPA formalized plans to modify its pesticide runoff model (PRSM/EXAMS) to account for both pervious and impervious surfaces, to use washoff data, and to develop multiple urban modeling scenarios. In late 2011, DPR initiated a project to fill a key gap in urban runoff modeling by developing a computational model for pesticide wash-off from impervious surfaces. In June 2012, DPR provided funding to U.C. Davis to extend an existing pesticide environmental fate and transport model (HYDRUS 2/3D) to address urban runoff. Developing these improved models will help protect water quality because DPR and EPA will be better able to predict water pollution before it occurs. In a February 2013 letter to EPA on the chlorinated isocyanurates registration review, CASQA recognized the improved examination of surface water quality risks done by EPA for that registration review. CASQA noted EPA developed conceptual models that appropriately identified pathways for transport of chlorinated isocyanurates through urban storm drainage systems to surface waters. Also noting that identifying all pathways by which antimicrobials may flow into and through urban storm drainage is a critical first step in a thorough ecological risk assessment.	Letter to EPA on improved examination of surface water quality risks and chlorinated isocyanurates registration review, 2/12/13 Since the early-2000s, multiple meetings, letters, and ongoing communications with EPA and DPR about the need for predictive modeling tools to inform pesticide registration decisions.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
EPA Proposed Special Regulation of Nanoparticle Pesticides. In fall 2011, EPA proposed a policy for regulating nanoparticle pesticides based on a rebuttable presumption that nanoparticles are different than the non-nanoparticle versions of the same pesticide. Requiring separate registration of nanoparticle pesticides would provide EPA with the ability to obtain data to characterize their potential water quality impacts. EPA is currently considering public comments on the proposed policy, but signaled its intent to regulate nanoparticle pesticides separately through product-specific decisions on nanosilver pesticides. In September 2012, CASQA commented on the registration review of nanosilver pesticides. The input to EPA included information about nanosilver pesticides sources and pathways to urban runoff and surface waters; an explanation of the regulatory consequences and costs of pesticide water pollution; and specific recommendations: of questions to address as a result of a nanosilver disinfectant case study; of uses to evaluate for their potential environmental exposures; to develop a more robust and informative assessment plan for nanosilver; to require the registrants to develop water, soil and sediment chemical analysis methods for nanosilver with appropriate method detection limits; and to investigate cumulative impacts.	Letter to EPA 9/10/12
EPA Proposed to Restructure the Pesticide Registration Review Process. EPA is proposing to slightly restructure the pesticide Registration Review process in response to problems that have been encountered with pesticide Endangered Species Act (ESA) Consultations, which are required for nearly every pesticide in Registration Review. This restructured process would apply to all pesticide registration reviews. Water quality agencies have significant concerns about the main element of the restructuring proposal – closed-door kick-off meetings with pesticide manufacturers – based on very negative experience with similar meetings during re-registration. There is also concern about the proposal for early communications, which would only give manufacturers and farmers input into EPA's decisions. Despite these concerns, this is a significant opportunity. If the structure were slightly revised to provide stormwater quality and other experts and interested parties opportunity for early input, the change would strengthen the Registration Review process.	Letter to EPA 10/16/12

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
Application to Register Potential Pyrethroid Substitute Cyantraniliprole – Based on the limited information in EPA's and DPR's registration application public notices, it appears that cyantraniliprole could substitute for pyrethroids, and thereby could potentially see widespread use in urban areas if EPA and DPR register it. Although there are no publicly available aquatic toxicity data for cyantraniliprole, a related chemical, (chlorantraniliprole) is very highly toxic to aquatic invertebrates and has multiple stable (and similarly toxic) degradates. Comments requested a careful evaluation of the potential water quality risks associated with all proposed urban uses of this new insecticide. Both EPA and DPR are currently reviewing the registration application. In comments developed in late FY 2012-13 (submitted 7/6/13), CASQA commented on the registration review of cyantraniliprole urban products. The input to EPA focused on only one use – broadcast applications on urban impervious surfaces (e.g., building perimeter sprays to control ants). EPA's modeling predicts that such applications could cause toxicity to aquatic invertebrates. EPA's risk managers proposed mitigation measures that address toxicity in agricultural areas, but do not work in the urban setting. The letter proposes alternative measures, similar to those that California Department of Pesticide Regulation adopted for the pyrethroid insecticides (which were agreeable to the industry).	Letter to EPA 7/6/13

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
Other Comments Were Submitted and Are Awaiting Responses. EPA is currently considering public comments for: • Acetamiprid (a very highly toxic to aquatic organisms potential substitute for pyrethroids) • Dichlobenil (highly toxic root control product that could potentially be mis-applied in storm drains) • Hydramethylnon (a very highly toxic to aquatic organisms pesticide appearing in "uncontainerized baits," which are granules intended for broadcast distribution) • MGK-264 (a synergist commonly used with pyrethroids as well as other pesticides) • Polyhexamethylenebiguanide (PHMB) (registered uses as a swimming pool fungicide, algaecide and sanitizer can result in discharges to the storm drain system and ultimately surface waters) • Prallethrin (a pyrethroid that does not currently have a lot of use, but that could potentially become a substitute for the common pyrethroids) • Resmethrin (a pyrethroid that will in the future be used primarily for mosquito abatement (other uses are being phased out)) • Triclosan (a biocide incorporated into many personal care products and a wide range of other consumer products – mainly those made of plastic materials – that can receive outdoor exposure, which could contribute Triclosan to urban storm drain systems via leaching or degradation of the impregnated products)	Five Letters to EPA on 9/10/12; Letter to EPA 11/26/12; Letter to EPA 2/12/13; Letter to EPA 5/28/13

<u>*Below is a list of 15 comment letters developed by CASQA's Pesticides Subcommittee in FY 2012-13</u>

September 10 – Comments to EPA on Dichlobenil Registration Review
September 10 – Comments to EPA on MGK-264 Registration Review
September 10 – Comments to EPA on Nanosilver Registration Review
September 10 – Comments to EPA on Polyhexamethylenebiguanide (PHMB) Registration Review
September 10 – Comments to EPA on Prallethrin Registration Review
September 10 – Comments to EPA on Resmethrin Registration Review
October 16 – Comments to EPA on ESA Consultation & Enhanced Stakeholder Input
November 15 – Comments on DPR Proposed Decision to Register Bactiblock 101 S.1.19
November 26 – Comments to EPA on Acetamiprid Registration Review

February 12 – Comments to EPA on Improved Examination of Surface Water Quality Risks and Chlorinated Isocyanurates Registration Review
February 12 – Comments to EPA on Hydramethylnon Registration Review
February 27 – Comments to Water Board on Coordinated Pesticides Monitoring in Urban Watersheds
March 28 – Comments to Central Coast Regional Water Board on Proposed TMDL for Toxicity and Pesticides in the Santa Maria Watershed
May 28 – Comments to EPA on Triclosan Registration Review
July 6 – Comments to EPA on Proposed Registration – Cyantraniliprole Urban Products

TRASH LOAD REDUCTION (C.10)

The goal of MRP Provision C.10 (Trash Load Reduction) is to implement control measures and other actions to significantly reduce trash loads to local urban creeks by the end of the term of the MRP, which will set the course for additional load reductions in future years. To achieve this goal, Permittees are required to develop and implement a Short-Term Trash Loading Reduction Plan, which includes the installation and maintenance of trash full-capture devices, designed to treat a mandatory minimum level of land area, and the implementation of other control measures and best management practices to prevent or remove trash loads. To address longer-term goals of trash reduction, Permittees are required to develop a Long-Term Trash Loading Reduction Plan by February 1, 2014 in preparation for the next permit.

Activities associated with Provision C.10 requirements were conducted in FY 2012-13 directly by Permittees, and at the countywide stormwater program and regional levels on behalf of Permittees. Actions implemented by Permittees are documented in section C.10 of each Permittee's Annual Report Form. Regional projects are coordinated through the BASMAA Trash Committee, which includes participation by Bay Area stormwater program and Permittee staff, Water Board staff and other stakeholders (e.g., Save the Bay, Clean Water Action and USEPA Region 9). All regional project deliverables are developed under that direction of the BASMAA Trash Committee and are approved by the BASMAA Board of Directors (BOD) prior to finalization. A status summary for BASMAA regional projects implemented on behalf of Permittees in compliance with Provision C.10 of the MRP is included in this section.

Trash Generation Rates Project

MRP Provision C.10.a.ii requires Permittees to develop and report on baseline trash loads from their MS4s by February 1, 2012. On February 1, 2011, BASMAA submitted a progress report to the Water Board on behalf of all towns, cities, and counties (i.e., Permittees) subject to this provision of the MRP. Through the submittal of this progress report, all MRP Permittees agreed to use methods developed collaboratively through BASMAA to develop their baseline trash load. These methods are fully described in the *Baseline Trash Loading Rates Literature Review and Methodology – Technical Memorandum* and the *Baseline Trash Loading Rates Sampling and Analysis Plan*.

Preliminary baseline trash loading estimates were developed and submitted by each Permittee in Section 2.0 of their Short-Term Plans. Preliminary baseline loads were developed consistent with the *Preliminary Baseline Trash Generation Rates* developed via a BASMAA regional project. Preliminary generation rates were developed by monitoring trash at 159 sites located in four Bay Area counties (Alameda, Contra Costa, San Mateo and Santa Clara). Each site was a storm drain inlet that was equipped with Water Board recognized trash full capture device. Monitoring sites were selected to test

the effect that land use and other factors (e.g., economic profile and population density) may have on trash generation.

The results from two monitoring events (May and September 2011) were used to develop the preliminary baseline generation rates submitted by BASMAA to the Water Board on February 1, 2012. These rates were used by each Permittee to develop preliminary baseline trash loads, which are specific to the jurisdictional areas for each Permittee and incorporate the effectiveness of baseline street sweeping and stormwater conveyance system maintenance programs.

Following the development of preliminary trash generation rates, two additional monitoring events were conducted in January and April 2012 at project monitoring sites. The results of these events were combined with the first two events and a variety of analyses were conducted to refine trash generation rates. Additionally, two hydrodynamic separators (HDS) devices were monitored to assist in comparisons to refined trash generation rates based on all four monitoring events. The HDS devices receive runoff from catchments that are larger and have more heterogeneous land uses and income categories. The HDS units are located in the cities of San Jose and Dublin.

A final technical report on the generation rates is currently being finalized by BASMAA and will be completed in late 2013. The final technical report describes all methods used and analyses conducted to develop final trash generation rates that are being used by Permittees as a starting point for developing Long-Term Trash Load Reduction Plans due to the Water Board by February 1, 2014.

Long-Term Plan Framework and Guidance

Provision C.10.c of the MRP requires each Permittee to submit a *Long-Term Trash Load Reduction Plan* (Long-Term Plan) by February 1, 2014. The Long-Term Plans must describe control measures that are currently being implemented, including the level of implementation, and additional control measures that will be implemented and/or increased level of implementation designed to attain a 70% trash load reduction by July 1, 2017, and 100% (i.e., "No Visual Impact") by July 1, 2022.

A work group of MRP Permittee, SMCWPPP and other Bay Area countywide stormwater program staff, and Regional Water Board staff met between October 2012 and March 2013 to better define the process for developing Long-Term Trash Reduction Plans, methods for assessing progress toward reduction goals, and tracking and reporting requirements. Through these discussions, a framework for developing and implementing Long-Term Plans was developed and agreed upon by Permittee and Water Board staff. The Long-term Plan framework is comprised of the following tasks:

1. Identify and map very high, high, moderate, and low trash generating areas based on land use and other factors that affect the level of trash discharged from the MS4 from each area.

2. As needed, identify trash sources in high and moderate generation areas to assist in focused control measure implementation.
3. Identify and prioritize trash management areas and the types of trash problems that need to be addressed within those areas.
4. Identify control measures for reducing trash in prioritized areas and minimizing problems associated with trash.
5. Define the assessment methods(s) that will be used to demonstrate progress and success.
6. Select and implement trash control measures to reduce trash in prioritized areas and minimizing problems associated with trash.
7. Evaluate and document progress towards goals using defined assessment methods.
8. Modify trash generating area designations and reprioritize areas and control measures as needed.

A foundational task in the framework is the identification of very high, high, moderate, and low trash generating areas within each Permittees jurisdictional areas (i.e., Task #1). In FY 2012-13, final trash generation rates developed through the BASMAA Trash Generation Rates Study were used by Permittees as a starting point for differentiating and delineating land areas with varying levels of trash generation. Permittees then used local knowledge and field and/or desktop assessments to confirm/refine the level of trash generation for specific areas. Permittees then began delineating and prioritizing preliminary trash management areas. Final draft trash generation maps and preliminary management area maps are included in each Permittee's FY 2012-13 Annual Report. Delineations of land areas treated by full trash capture devices conducted to-date and locations of all devices installed/constructed to-date are also included in the trash generation maps.

A BASMAA regional project to develop a general outline and further guidance for developing Long-term Plans is also currently underway. The guidance and outline is intended to assist Permittees with developing their plans. This project is scheduled for completion in the fall of 2013.

JOINT MERCURY AND POLYCHLORINATED BIPHENYLS (PCBS) CONTROLS

Provisions C.11.c through Provision C.11.g for mercury are written identically to C.12.c through Provision C.12.g for PCBs. This reflects similarities between the respective TMDLs for these pollutants, based on the legacy and sediment-associated nature of their occurrence. For Provisions C.11/12.c through Provision C.11/12.f, MRP requirements focus on pilot studies. Sites for these pilots were primarily chosen on the basis of the potential for reducing PCB loads, but consideration was given to mercury removal. Provisions C.11.i and C.12.i are also written identically, since the primary San Francisco Bay beneficial use impairment for both mercury and PCBs is associated with consumption of fish containing these pollutants.

Mercury and PCB Pilot Projects

Provisions C.11/12.c through Provision C.11/12.f require pilot studies to test methods to reduce urban runoff loadings of PCBs and mercury to San Francisco Bay. These provisions require that Permittees pilot-test a variety of potential methods, including site remediation, enhancements of municipal operation and maintenance activities to remove sediments with pollutants, stormwater treatment retrofitting, and diversion of stormwater to existing Publicly-Owned Treatment Works (POTWs). Most projects are located in the older industrial regions in the Bay Area where past studies have found elevated PCB and mercury concentrations in sediments collected from street and storm drain infrastructure. Thus the pilot projects appear representative of the known types of potentially effective control measures and the geographic area of potential wider implementation in the future.

Clean Watersheds for a Clean Bay (CW4CB) is a grant-funded project that is anticipated to result in Permittee compliance with the following MRP Provisions that jointly address PCBs and mercury:

- C.11/12.c (CW4CB Tasks 2 and 3) - Pilot Projects to Investigate and Abate Mercury/PCB Sources;
- C.11/12.d (CW4CB Task 4) - Pilot Projects to Evaluate Enhanced Municipal Operations and Maintenance Practices;
- C.11/12.e. (CW4CB Task 5) - Pilot Projects to Evaluate On-Site Stormwater Treatment via Retrofit; and,
- C.11/12.i (CW4CB Task 6) - Development of a Risk Reduction Program Implemented throughout the Region.

These provisions implement priority urban runoff-related actions called for by the San Francisco Bay PCBs and mercury TMDL water quality restoration programs. CW4CB is helping implement these TMDLs by developing and pilot-testing a variety of potential methods to reduce urban runoff loading of PCBs and mercury to the Bay. For the most recent status of the CW4CB pilot projects please refer to the semi-annual progress report dated April 30, 2013 that was submitted to USEPA.

Integrated Monitoring Report

The MRP requires Permittees to submit an Integrated Monitoring Report (IMR) by March 14, 2014 that summarizes water quality monitoring activities and provides conclusions with regard to provisions C.8 and most of the C.11/12 pilot studies. The results and status of all MRP C.11/12 pilot projects will be documented in the IMR, including a number of pilot projects not required to be reported on in the 2013 Annual Report (e.g., CW4CB projects). BASMAA will assist Permittees in developing and submitting the IMR. In addition to synthesizing the water quality monitoring conducted per Provision C.8, the IMR will provide a synthesis of data and information developed through the implementation of PCB and mercury control pilot studies (MRP provisions C.11 and C.12) and PCB and mercury specific monitoring studies conducted via the RMP. The IMR will also incorporate information gained through pollutant loading station monitoring conducted per provision C.8.e. The IMR will address:

- Lessons learned,
- Pilot programs and BMP cost-effectiveness,
- Load reductions, and
- Recommendations on steps and criteria to identify opportunities for future implementation.

C.11/12.f. Pilot Stormwater Diversion Projects

This status report summarizes activities by Permittees to implement actions required under provisions C.11.f and C.12.f of the MRP. These are nearly identical provisions for control of mercury and polychlorinated biphenyls (PCBs) that require the evaluation of pilot diversions of dry weather and/or first flush events to publically owned treatment works (POTWs). The pilot projects are being evaluated in parallel with other BMP pilot implementation projects. The results of pilot studies will inform decisions regarding future permit requirements for these (and possibly other) pollutants. Results of a feasibility evaluation, coordinated through a BASMAA regional project, were included in the Regional Pollutants of Concern and Monitoring Supplement to the FY 2009-10 Annual Report. The evaluation included selection criteria for potential diversion projects, and identified candidate projects in each of the five counties regulated under the MRP. Based on input from the Water Board, a revised Feasibility Evaluation Report was submitted in December 2010. A total of five diversion projects were selected by Permittees based on the criteria included in the revised report. One project is located each of the five MRP-associated counties.

Work plans for each project were submitted to the Water Board in May 2012. Work plans identified project objectives, equipment and infrastructure requirements, water quality monitoring (including analytical methods), a general framework for identifying

costs, benefits and operation challenges associated with the diversions, and a time schedule for monitoring, evaluation and reporting.

In FY 2012-13, Permittees implemented diversion projects consistent with the project work plans. The following pages provide a brief overview and current status for each of the pilot diversion project, including modifications to the work plan that were necessary during FY 2012-13. Table 1 includes an updated implementation schedule for each project.

Ettie Street Pump Station (Alameda County)

The Alameda County pilot project is at the Ettie Street Pump Station (ESPS), located in the City of Oakland and operated by the Alameda County Flood Control and Water Conservation District (ACFCWCD). The pump station was selected based on elevated PCB and mercury concentrations found in previous studies of sediment in the pump station and its catchment area, and the geographical proximity to the East Bay Municipal Utilities District (EBMUD) conveyance and wastewater treatment systems. The diversion project is designed to further evaluate the potential benefits of diversions from the pump station to EBMUD.

The ESPS pilot project consists of two elements. The initial pilot phase installed a pilot test diversion to evaluate the feasibility of using a continuous turbidity sensor to direct selective pumping of stormwater from the ESPS wet well to a storage tank for detention and pretreatment. Water from the storage tank can be directed either to an existing sanitary sewer line or to a 2-bed media filter treatment system to be installed in fall 2013 as one of the CW4CB retrofit pilot projects.

Monitoring focuses on sampling the diverted water for PCBs and mercury to relate the concentrations of these sediment-associated pollutants to the turbidity data to help optimize their captured during diversion pumping. Based on comments by Water Board staff on the May 2012 work plan, the monitoring design was revised to leverage the CW4CB monitoring efforts planned for FY 2013-14. ACCWP monitored turbidity during the FY 2012-13 wet season and sampled stormwater from a November 2012 storm event, which was analyzed to provide particle distribution data requested by CW4CB consultants to inform monitoring plan design for the CW4CB Task 5 retrofits. However recurrent data quality problems were observed with the turbidity probe output showing a bias toward lower readings, which were attributed to fouling of the sensor glass and wiper. The probe mount was redesigned to permit regular wet season maintenance without confined space entry, and additional monitoring is planned for FY 2013-14 that will be coordinated with parallel monitoring of the retrofit media filters.

The redesign of the monitoring also permitted reallocation of resources to evaluation of costs and benefits associated with the second phase of the study, a larger scale diversion concept similarly based on detention of wetweather diversions, An engineering feasibility study of larger-scale diversion will be completed in fall 2013 and include the following elements:

- Larger pretreatment storage facilities constructed on adjacent land underneath the MacArthur Freeway if feasible through either acquisition of easement rights granted by the State of California to ACFCWCD or a Common Use Agreement between the State and ACFCWCD.
- Permanent diversion conveyance from the pump station to the pretreatment facility.
- Permanent diversion conveyance from pretreatment to sanitary sewer to be implemented by EBMUD and sized to carry typical dry weather flows from the ESPS (approximately 1000 gallons per minute). This conveyance, now in the initial planning stage, will be available in non-peak flow periods for transfer of pretreated stormwater from the ESPS. ACCWP will qualitatively review challenges in obtaining easements for a new larger-scale conveyance across existing freeways and railroads, in reference to the alternatives being considered by EBMUD for connection to existing conveyance lines owned by EBMUD or the City of Oakland.
- Wet weather diversion from pump station to pretreatment to be triggered by elevated turbidity during storm events. Multiple scenarios of diversion timing and volume will be developed in consideration of alternative turbidity thresholds and the characteristics and constraints of facility capacity and conveyance design.
- Estimated construction and operating costs for facilities and equipment for pumping, controls and monitoring, maintenance, sediment disposal and security for all facilities.
- Outlining terms of agreement with EBMUD for ongoing sharing of costs and TMDL load allocations for PCBs and mercury associated with the amounts transferred through stormwater diversion.

All information available to-date about the project will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

North Richmond Stormwater Pump Station (Contra Costa County)

The Contra Costa Clean Water Program (CCCWP) is facilitating implementation of a stormwater diversion pilot project to divert urban runoff from the North Richmond Stormwater Pump Station (North Richmond Station) to the West County Wastewater District (WCWD). The North Richmond Station is designed to control stormwater flooding conditions for the unincorporated area of North Richmond. The station receives water from a network of stormwater collection sewers which drain into the wet well of the pump station. Stormwater is then pumped into the discharge channel of the pump station which drains by gravity into a 78-inch discharge pipeline.

To assist with the pilot project, the County sought and obtained grant funding administered by the San Francisco Estuary Project through the United States Environmental Protection Agency (USEPA) San Francisco Bay Area Water Quality Improvement Fund. The Project is one of several in the "Estuary 2100 Phase 2: Building

Partnerships for Resilient Watersheds" program. The grant provides $496,649 in USEPA funds, matched by $165,550 from the County to plan, design, construct, and monitor an engineered diversion into WCWD.

Baseline water quality monitoring was performed per the scope of the grant between 2010 and 2012. WCWD staff had substantial input on the monitoring parameters for that baseline study. The baseline study was completed and reported in 2012. The water quality characterizations from the North Richmond Station, along with assessments of sediments in the associated drainage area, indicate that mercury and PCB concentrations in sediments are high enough to provide potentially significant benefits for stormwater management in that area. Additionally, based on the results of a stormwater runoff characterization study conducted for the Small Tributaries Loading Strategy (STLS) of the Regional Monitoring Program (RMP), mercury to suspended sediment ratios are the third highest of twenty-two Bay Area watersheds characterized by SFEI in 2011. PCB to suspended sediment ratios are the fifth highest of Bay Area watersheds assessed in that same study.

A probable construction cost estimate and preliminary schedule for the Project was developed by Brown and Caldwell in December 2012. The estimated construction cost, $764,000, exceeds the original grant assumption. Design costs for the diversion are approximately $100,000, in addition to the construction cost. The construction costs reflect not only the diversion, but also much needed infrastructure rehabilitation at the North Richmond Station. The diversion construction costs represent a moderate (i.e., approximately $50,000 - $100,000) in additional design and construction costs added to the costs of the infrastructure rehabilitation necessary to meet flood control needs.

The current recommended approach is a "hard-piped" diversion, with flows routed into the nearest sanitary sewer collections system. One main pump and one back-up low flow pump (0.4 mgd) would be installed in the North Richmond Station wet well. The pumps would be connected to and controlled by a supervisory control and data acquisition system (SCADA). Water level sensors in the outlet of the conveyance pipe would allow the pumps to be shut down via the SCADA system if the conveyance was reaching its capacity. In addition, the SCADA system would be connected to continuous water quality probes that could detect petroleum or other spills and trigger pump shut-down.

Some of the more substantial costs of the diversion pilot are related to planning, monitoring, and risk management. The initial pre-diversion monitoring cost was approximately $180,000. Planning support by CCCWP consultants has cost $80,000 to date, and continues to accrue. Although pre-diversion monitoring has been completed, concerns raised by WCWD may require additional monitoring. As of June 2013, the need for additional monitoring to support the Project is being discussed by the CCCWP Monitoring Committee.

Between January and April 2013, CCCWP staff, along with County and Richmond staff, engaged directly with WCWD staff. In those discussions technical concerns about

conveyance capacity, toxicity to activated sludge microorganisms, effluent quality, bio-solids quality and spills and illicit discharges were fleshed out by WCWD.

CCCWP is currently developing a technical memorandum addressing the above concerns expressed by WCWD. Concurrently, the County is moving forward with procurement of a design consultant to develop biddable plans, specifications, and cost estimates for the Project. The County continues to negotiate with WCWD over the terms and conditions of a permit to discharge dry weather urban runoff and first flush into the WCWD collection system. A significant challenge to obtaining that permit is regulatory relief from consequences should the diversion cause a sewage treatment system upset, a sanitary sewer overflow, or exceedance of an effluent limit.

At present, it is anticipated that construction of the Project would commence in the dry season of 2014, to be ready for a diversion pilot in wet season 2014 – 2015. The proposed approach is for late dry season flows to continue to be diverted to the flood control channel, per normal operations. Weather reports would be monitored, and when there is a significant probability of a storm (e.g., greater than 75 percent chance of at least 0.5 inches of rain in a 24 hour period), the WCWD would be notified and the pump station valving changed to redirect flows to the WCWD. Diversions would continue until level sensors determined that pipeline capacity was less than 0.5 mgd.

The diversion would resume after capacity was restored. This pattern of weather tracking, notification, and diversion would continue for one month. Approximately six months after the first flush diversion was implemented and evaluated, a dry weather diversion would be implemented. The dry weather diversion would be conducted for a summer season (e.g., June through August).

All information available to-date about the project will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

Pulgas Creek Pump Station (San Mateo County)

The San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) pilot diversion project evaluated the diversion of dry weather runoff and first flush flows of stormwater from near the Pulgas Creek Pump Station to the sanitary sewer collection system served by the South Bayside System Authority's (SBSA) regional wastewater treatment plant. SMCWPPP selected the City of San Carlos' Pulgas Creek Pump Station watershed for the pilot diversion project and other CW4CB studies because of the relatively high concentrations of PCBs found in pump station and storm drain sediments. The approximately 330-acre watershed draining to the Pulgas Creek Pump Station is comprised of current and historic industrial land uses.

As part of a stormwater runoff characterization study conducted for the Small Tributaries Loading Strategy (STLS) of the Regional Monitoring Program (RMP), analyses of PCBs and mercury were performed on stormwater samples from the two storm drain lines that flow to the Pulgas Creek Pump Station. Results indicated that stormwater

flowing into the pump station contained between about 19,000 and 84,500 picograms per liter (pg/L) of total PCBs. These concentrations are relatively elevated compared to the 886 pg/L Event Mean Concentration (EMC) of total PCBs calculated by SFEI from stormwater runoff sampling with similar methods from a parking lot and recreation area in Daly City. The data also show that the concentrations of total PCBs from the north Pulgas Creek storm drain line were generally higher than those found in the south storm drain line.

In early FY 2012-13, Countywide Program staff worked with SBSA and City of San Carlos staff to obtain a wastewater discharge permit for the City of San Carlos. The permit authorizes the diversion of a limited volume of dry weather urban runoff and stormwater. The permit describes discharge, monitoring, and reporting requirements. The discharge permit is subject to revision at any time for the purposes of protecting the sanitary sewerage facilities and workers and to accommodate new regulations and NPDES permit requirements that may be imposed on SBSA.

As outlined in the May 2012 project work plan, wet and dry weather pilot scale diversions of urban runoff from the north Pulgas Creek storm drain line were scheduled to occur during FY 2012-2013. In preparation for monitoring, initial installation of the continuous monitoring equipment (data loggers, flow and turbidity meters, and batteries) in the north drain line was accomplished in October 2012. A rainfall gauge was also installed on the roof of the Pulgas Creek Pump Station. At a follow-up maintenance visit in November, however, technical problems were discovered with the flow/turbidity data logger which prevented logging of continuous turbidity measurements, although continuous flow measurements were being made. The data logger and turbidity sensors were removed and taken to the laboratory for troubleshooting. After several weeks of unsuccessful attempts to resolve the issues, replacement equipment was procured and installed at the site in December 2012. Due to the equipment malfunctions, no turbidity measurements were recorded, and only limited flow measurements (between the initial installation in October and removal of the data logger in November) were recorded.

Following the December installation, regular maintenance events were conducted throughout the remainder of the rainy season (approximately every two weeks through the end of April) in order to download data and assure proper operation of all equipment. From December 2012 through May 2013, continuous flow, turbidity and rainfall data were measured at the site. Additionally, one dry weather diversion event was conducted in November 2012. Immediately prior to the diversion, water samples were collected from the north storm drain line according to the methods and procedures described in the work plan. Using a portable, submersible pump, approximately 500 gallons of water were pumped out of the North Pulgas storm drain line through flexible conduit into a stainless steel tank. The City of San Carlos maintenance staff removed the water from the tank using their Vactor truck. The water was taken to the City's corporation yard and discharged into the sanitary sewer line, per the SBSA permit.

One storm diversion event was also conducted in March 2013. Samples were collected from the north storm drain line during the storm event according to the methods and procedures described in the work plan. Stormwater was diverted from the storm drain line using the submersible pump/conduit system used for the dry weather diversion into the same stainless steel tank. Following the storm (during dry weather), the City of San Carlos maintenance staff removed the water from the tank using their Vactor truck and discharged the stormwater into the sanitary sewer line, per the SBSA permit. Samples of the water were collected as it was discharged into the sanitary sewer line and analyzed according to the SBSA permit requirements.

The site was demobilized for the season in May 2013. Due to the equipment issues [4] at the beginning of the 2012 wet season and the lack of storms during the remainder of the rainy season, only one storm was monitored and only one wet weather diversion was completed in FY 2012-13. During the demobilization, water samples were collected from the Pulgas North storm drain line to provide additional data on concentrations of POCs during dry weather, but no water was diverted to the sanitary sewer.

To complete the remaining monitoring outlined in the work plan, this project will continue into the 2013-2014 wet weather season. Weather permitting, three wet weather diversion events will be conducted at this site between October 2013 and April 2014. SMCWPPP is coordinating with SBSA to obtain an extension of the SBSA discharge permit for San Carlos through June 30, 2014. All information available to-date for the project will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

Palo Alto Diversion Structure (Santa Clara County)

The pilot diversion project in Santa Clara County is currently being implemented by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), in cooperation with the City of Palo Alto. The project is an evaluation of an existing dry and wet weather diversion structure located in the City of Palo Alto. The diversion structure was constructed in 1993 to divert a limited volume of urban runoff from the stormwater conveyance system to the Palo Alto Regional Water Quality Control Plant. The area draining to the diversion structure is roughly 50 acres and is bound by Hamilton Avenue, Bryant Street, Channing Avenue and Alma Street. The site was originally selected by the City of Palo Alto because of the land use in the drainage area (commercial, light industrial, multi-family residential), proximity of the 27" sewer trunk line to the storm drain line, and because the sewer trunk line had excess capacity. The structure was designed to divert urban runoff flows into the sanitary sewer at no more than 0.5 million gallons per day (MGD).

A work plan that describes the methods used to evaluate the effectiveness of the Palo Alto diversion structure and to fulfill the objectives of the project was provided to the Water Board in May 2012. The work plan was designed to guide monitoring and data

[4] Significant communication issues between the data loggers and samplers/probes deployed at the site caused monitoring to be postponed. Communication issues have been subsequently addressed.

collection activities over Fiscal Year 2012-13. Work plan tasks included: (1) project planning; (2) water quality monitoring; (3) evaluation of diversion costs and operational challenges; (4) cost and benefit analysis; and (5) reporting. Monitoring activities outlined in the work plan include continuous monitoring of the volume and turbidity of urban runoff flowing into and through the diversion structure. Water quality sampling includes suspended sediment concentrations, particle size distribution, and mercury and PCB concentrations during two dry weather events and three wet weather events. These data will be used to calculate loads removed from urban runoff due to operation of the diversion structure.

Targeted storm diversion events for FY 2012-13 included the first rain event of the season that generated runoff at the site and additional storm diversion events selected to represent the range of expected flow conditions at the site. The schedule of the project, however, was delayed in FY 2012-13 due to technical problems with the flow/turbidity data logger that prevented logging of continuous turbidity measurements. Initial installation of the continuous monitoring equipment (data loggers, flow and turbidity meters, and batteries) at the Bryant/Channing diversion structure in Palo Alto, CA was completed in January 2013. Following the January installation, regular maintenance events were conducted throughout the remainder of the rainy season (approximately monthly through the end of April) in order to download data and assure proper operation of all equipment. Between January and May 2013, continuous flow was measured at both locations and turbidity was measured at the upstream location only. Rainfall data were collected from nearby existing rain gauges during the same timeframe.

In FY 2012-13, three diversion monitoring events, including two dry weather events and one wet weather event, were conducted at the Palo Alto diversion structure. The two dry weather urban runoff diversion monitoring events were conducted in January and May 2013, and the wet weather event in March 2013. Samples were collected and analyzed according to the methods and procedures described in the May 2012 work plan. The site was demobilized in May 2013 for the season, but will be remobilized and continue during the 2013-14 wet weather season in order to monitoring during two additional wet weather events between October 2013 and April 2014. All information available to-date will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

State Street Pump Station (Solano County)

The Solano County pilot diversion project is being implemented by the Fairfield Suisun Urban Runoff Program (FSURMP) and Fairfield-Suisun Sewer District (FSSD). The project involves changes to the operation of an existing pump station so as to divert stormwater from the station to the FSSD wastewater treatment plant. The State Street pump station is located in the City of Fairfield just upstream of Suisun City. It serves a watershed area of approximately six acres. The contributing area is commercial, of which a significant portion is automotive repair.

Normal discharges from the State Street Pump Station were terminated in mid-June 2012. The contents of the pump station's wet well (approximately 825 gallons) were subsequently removed by FSSD staff using a Vactor truck. Prior to removal, the discharge pumps were operated to mix the contents and to collect a representative sample. This June 18, 2012 sample was analyzed for PCBs, mercury, total organic carbon, total metals, and suspended sediment concentration. The contents were trucked and discharged to the FSSD treatment plant. As an "in-house" pilot project, there were no formal agreements needed for treatment plant's acceptance of the discharge.

There was minimal subsequent dry weather runoff accumulation in the pump station. FSURMP and FSSD removed approximately 1200 gallons on September 20, 2012, and analyzed a sample for the same suite of constituents as the June sample. Following collection of this sample, the pump station was returned to normal wet season operation. Flows into the pump station were also monitored during summer 2013. All information available to-date will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

Table 2. Revised Implementation Schedule for Pilot Stormwater Diversion Projects (September 2013).

Project Name, Location / Operating partner	Tasks	2012				2013				2014			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Alameda County Ettie St. Pump Station City of Oakland / ACFCWCD	1. Pre-project wet and/or dry season monitoring and analysis		■	■									
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation	■	■	■			■						
	3.a Large scale scenario development				■	■	■	■					
	4. Post installation/construction monitoring and analysis			■	■	■	■		■	■			
	5. Data analysis and interpretation and project reporting			■	■		■	■	■	■			
Contra Costa County North Richmond Pump Station City of Richmond/CC County	1. Pre-project wet and/or dry season monitoring and analysis	■											
	2. Detailed planning and work plan development		■	■	■	■	■						
	3. Equipment installation/construction and implementation							■	■				
	4. Post installation/construction monitoring and analysis									■			
	5. Data analysis and interpretation and project reporting										■		
San Mateo County Pulgas Creek Pump Station City of San Carlos	1. Pre-project wet and/or dry season monitoring and analysis	NA											
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation			■	■								
	4. Post installation/construction monitoring and analysis				■	■	■	■	■	■			
	5. Data analysis and interpretation and project reporting						■	■	■	■	■		
Santa Clara County Passive MS4 Diversion Structure City of Palo Alto	1. Pre-project wet and/or dry season monitoring and analysis	NA											
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation		■	■									
	4. Post installation/construction monitoring and analysis				■	■	■	■	■	■			
	5. Data analysis and interpretation and project reporting						■	■	■	■	■		
Solano County State Street Pump Station City of Fairfield/FSSD	1. Pre-project wet and/or dry season monitoring and analysis	■											
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation			■									
	4. Post installation/construction monitoring and analysis			■	■	■	■	■					
	5. Data analysis and interpretation and project reporting						■	■	■				

MERCURY CONTROLS

As described above, the results and status of most MRP provisions for C.11 are not required to be reported on in the 2013 Annual Report, and will be presented in the Integrated Monitoring Report to be submitted in March 2014.

C.11.b. Monitor Methylmercury

MRP Provision C.11.b duplicates the requirement in C.8.g to report results of methylmercury monitoring required in Provision C.8.e. Per the schedule for commencement of POC monitoring described in previously submitted Monitoring Status Reports, methylmercury monitoring began in FY 2011-12 with annual reporting of results in the Urban Creeks Monitoring Report or Integrated Monitoring Report submitted by March 15 of each year beginning in March 2013.

PCB CONTROLS

As described above, the results and status of MRP provisions for C.12 are not required to be reported on in the 2013 Annual Report, and will be presented in the Integrated Monitoring Report to be submitted in March 2014.

COPPER CONTROLS

C.13.c. Vehicle Brake Pads

This MRP provision requires Permittees to engage in efforts to reduce the copper discharged from automobile brake pads to surface waters via urban runoff. Provision C.13.c.iii requires that the Permittees report annually on legislation development and implementation status, and also in the 2013 Annual Report to assess the status of copper water quality issues associated with automobile brake pads and recommend brake pad-related actions for inclusion in subsequent permits if needed.

Permittee compliance is achieved through continued participation in a process originally initiated by the Brake Pad Partnership (BPP) that achieved the 2010 passage of Senate Bill 346 which will phase out copper and other heavy metals in brake pads over the next 15-20 years (see Table 2)[5].

Permittees continue to track and support implementation of SB 346through participation in CASQA, which has engaged in the development of regulations for SB 346 by the Department of Toxic Substances Control (DTSC) and also by Washington

[5] full text of the legislation was submitted with the FY2010-11 Regional POC Report

Department of Ecology for that state's Better Brakes Law, which is similar to SB 346 in many respects[6].

Key implementation milestones for brake pad regulation were reached in FY 2012-13 with the participation of CASQA and other stakeholders:

- Marking and packaging standards for brake pads (manufactured after 2014) to identify which products contain <0.5% copper,
- A compliance verification system for third party testing of brake pads to certify their percentage content of substances regulated by the laws.
- Identification of two certification organizations to collect baseline reporting information regarding copper, nickel, zinc, and antimony content in brake pads, required from manufacturers by January 2013 under the Washington law.

Washington Ecology also provided CASQA representatives with a preliminary summary of baseline data received from manufacturers by January 2013, which represent only a portion of the total friction materials available for sale in the U.S. in 2011. These initial data generally supported the assumptions used by the BPP concerning the copper content of brake pads in the current population of U.S. automobiles, suggesting agreement with earlier estimates of SB 346's effect on copper loads to California water bodies.

When the full baseline dataset becomes available it may also be used to update load reduction estimates prepared for southern California stormwater programs to show that SB 346 will help them meet the copper load reductions required by TMDLs for local streams. Ongoing CASQA participation in SB 346 implementation and evaluation of progress toward reducing discharges of brake-related copper are likely to continue without additional intervention by MRP Permittees during the next MRP permit term.

[6] SB 346 includes a requirement that California regulations must be consistent with those of other states concerning compliance markings and certification. Washington's brake pad law required adoption of implementing regulations by December 2012, which was ahead of DTSC's timeline for preparing regulations for SB 346. Washington Department of Ecology adopted final Better Brakes Rules in October 2012; available at http://www.ecy.wa.gov/programs/hwtr/betterbrakes.html

Table 3. Implementation Timeline for SB 346 Regulation of Vehicle Brake Pads..

Year	SB 346 Key Milestones or Provisions
2011	SB 346 becomes effective January 1. When reformulating brake pads, manufacturers must select alternatives to copper that pose less potential hazard to public health and the environment.
2012	Target date - finalization for certification and marking criteria.
2014	Limits on cadmium, chromium, lead, mercury and asbestos take effect January 1. (Non-compliant pads can be sold solely for inventory depletion until 2024) Compliance certification must be marked on pads and listed on the Internet.
2018	Cal-EPA Secretary appoints extension application advisory committee.
2019	Manufacturers may apply for extensions to the 2025 0.5% copper limit beginning January 1.
2021	5% copper limit takes effect January 1. (No extensions allowed, but non-compliant pads for pre-2021 vehicles may continue to be sold indefinitely)
2023	State Water Board & DTSC report to legislature on brake pad copper reductions and copper TMDL implementation progress. (The report can make recommendations for any additional brake pad copper controls needed to achieve TMDLs)
2025	0.5% copper limit takes effect January 1.
2032	Final end date for all light duty vehicle compliance extensions. (Non-compliant replacement pads for pre-2025 vehicles may continue to be sold indefinitely)

C.13.e. Studies to Reduce Copper Pollutant Impact Uncertainties

This MRP provision requires Permittees to conduct or cause to be conducted technical studies to investigate possible copper sediment toxicity and technical studies to investigate sub-lethal effects on salmonids. These uncertainties regarding copper effects in the Bay are described in the amended Basin Plan's implementation program for copper site-specific objectives. Compliance with this provision has been achieved through continued participation in the RMP, whose Multi-year planning process addresses these gaps through studies overseen by the Exposure and Effects Workgroup. While the MRP requires no reporting for this provision in FY2012-13, the RMP continued efforts to address these uncertainties:

- A study of the olfactory effects of copper on seawater-phase salmonids was completed in 2012 and found inhibition of the olfactory nerves of young (smolt

stage) Chinook salmon in salt water was induced at higher copper concentrations than in previous freshwater studies. The study concluded that existing regulatory thresholds for copper in San Francisco Bay are likely to be protective for salmonids. A final summary of the study results is available at http://www.sfei.org/sites/default/files/SeawaterEOG2012report12202012_final.pdf

In 2013 additional external funding was provided to the RMP for further evaluation of the copper olfactory effects at intermediate salinities. Due to the effect of federal budget cuts on study facilities, the additional tests will be conducted with coho salmon instead of Chinook salmon used in previous tests, resulting in extension of the project timeline into 2014.

- Ongoing exploration of the causes of moderate sediment toxicity in San Francisco Bay included an expert workshop in November 2012, the second in a series of discussions on stressor identification. Workshop participants identified a number of possible chemical and non-chemical stressors that could affect the laboratory organisms used for the toxicity tests (the amphipod *Eohaustorius estuarius*), and a follow-up proposal to test the effects of sediment particle size and shape was recommended for 2014 pilot/special studies funding

PBDES, LEGACY PESTICIDES, AND SELENIUM

C.14.a. Control Program for PBDEs, Legacy Pesticides, and Selenium.

This provision requires the Permittees to work with the other municipal stormwater management agencies in the Bay Region to identify, assess, and manage controllable sources of poly-brominated diphenyl ethers (PBDEs), legacy pesticides, and selenium found in urban runoff. Previous reporting for this provision focused on characterizing the representative distribution of these pollutants or pollutant groups in the urban landscape and in urban runoff. The reporting requirement for 2013 is to report on the results of the following MRP implementation objectives:

- Provide information to allow calculation of loads to San Francisco Bay of PBDEs, legacy pesticides, and selenium from urban runoff conveyance systems throughout the Bay.
- Identify control measures and/or management practices to eliminate or reduce discharges of PBDEs, legacy pesticides, or selenium conveyed by urban runoff conveyance systems.

Water Board staff recognized that these three pollutants or pollutant groups are distinct in terms of origin and transport, but grouped them into this provision because the requirements are identical. The original purpose of this provision was to gather concentration and loading information on pollutants of concern for which TMDLs were planned or in the early stages of development, and inform development of TMDL

implementation plans. However regulatory priorities have altered in response to newer information regarding trends of PBDEs and legacy pesticides; as described in Appendices 1 and 2, these POC groups are both declining in the biota of San Francisco Bay, and are unlikely to be causing impairment to beneficial uses. For selenium, the Regional Board is developing separate TMDLs to address 303(d) listing of the North and Central/South portions of San Francisco Bay.

through separate regulation strategies

The Permittees' compliance approach for the characterization and load calculation requirements of this provision is based on the Regional Watershed Spreadsheet Model (RWSM) developed for the Small Tributaries Loading Strategy, a collaboration between the RMP and BASMAA that uses a combination of monitoring and modeling to address questions listed in MRP Provision C.8.e concerning POC contributions from local watersheds to San Francisco Bay. The RWSM provides a framework and user interface that can be used as the basis for various pollutant-specific sub-models to estimate overall loads from local watersheds. Pollutant profiles containing the information needed to construct sub-models for load estimation of PBDEs and legacy pesticides are attached to Appendices 1 and 2, respectively. Preliminary recommendations for selenium sub-model development were included in the Year 2 progress report for the RWSM, included in the FY 2011-12 Regional POC Report as part of Appendix B4b.

To comply with Provisions C.14.a.v and C.14.a.vii BASMAA developed a regional project to prepare separate sub-reports describing control measures and /or management practices to eliminate or reduce discharges for each of the three pollutant categories (included in this Regional POC Report as Appendices 1, 2 and 3). Each report follows a similar format and includes the following information:

- A review of basic information on the pollutant or pollutant group, including chemical qualities, known adverse effect concentrations and applicable water quality objectives.
- A summary of uses, sources and pathways based on available information. Where possible this relies on POC fact sheets and Conceptual Model reports developed for the Bay Area by the RMP and other regional initiatives.
- An overview of the status of water quality regulations and policies associated with the POC, including Bay Area 303(d) listing basis and TMDL schedule where applicable.
- A summary of the MRP requirements in Provision C.14.
- A summary of characterization information for the pollutant or pollutant group, integrating available data sources including some that were provided in previous reporting for Provision C.14.a.
- A description of control measures that may be applicable to reducing loads for the pollutant or pollutant group, whether implemented in current or previous permit periods, or planned by MRP Permittees and other related agencies. For some POCs applicable control measures can include those that are being pilot tested or implemented for PCBs and/or mercury. Potential enhancements to

existing or planned control measures are discussed where there is a strong likelihood of improvement to water quality in return for reasonable effort.

These sub-reports identify many existing control measures that are serving to reduce loads of these POCs to San Francisco Bay, both through MRP provisions and also the construction and industrial general stormwater permits. Pilot or focused implementation of additional management measures aimed at reducing PCBs and mercury will also help reduce a wide range of other POCs, particularly those associated with sediment including PBDEs and Legacy Pesticides. Considering the regulatory status of PBDEs, legacy pesticides, and selenium the existing control programs described in the subreports provide sufficient reductions of these POCs in urban runoff.

APPENDICES

Control Program for PBDEs, Legacy Pesticides, and Selenium

Appendix 1. Poly-brominated diphenyl ethers (PBDEs) Sub-Report

Appendix 2. Legacy Pesticides Sub-Report - Chlordanes, DDTs and Dieldrin

Appendix 3. Selenium Sub-Report - Urban Runoff Characterization and Control Measures Plan

SEPTEMBER 13, 2013

Polybrominated Diphenyl Ethers (PBDEs) Sub-Report

Submitted on behalf of all Permittees in Compliance with Provision C.14.a of Order R2-2009-0074 to:

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN FRANCISCO BAY REGION

prepared for:

Bay Area Stormwater Management Agencies Association

prepared by:

LARRY WALKER ASSOCIATES

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ATTACHMENTS

Attachment A: Hunt JA, Gilbreath AN, McKee LJ. 2013. PBDEs Pollutant Profile. San Francisco Estuary Institute, Richmond, California.

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GLOSSARY OF ACRONYMS

ADC	Alternate Daily Cover
ASW	Automobile Shredder Waste
BEARHFTI	California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation
BMP	Best Management Practice
CWA	Clean Water Act
DNQ	Detected, but not quantified
DTSC	California Department of Toxic Substances Control
LC50	Concentration that is lethal to 50% of test species
MCL	Maximum Contaminant Level
mg/L	Milligrams per liter (concentration)
mL	Milliliter (volume)
MS4	Municipal Separate Stormwater Sewer System
ND	Non-Detect
ng/L	Nanograms per liter (concentration)
NPDES	National Pollutant Discharge Elimination System
OEHHA	California Office of Environmental Health Hazard Assessment
PBDE	Polybrominated Diphenyl Ether
POC	Pollutant of Concern
QAPP	Stormwater Program Quality Assurance Project Plan
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
TMDL	Total maximum Daily Load
USEPA	United States Environmental Protection Agency
WDR	Waste Discharge Requirements
WQO	Water Quality Objectives

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1 Introduction and Purpose of Sub-Report

The Municipal Regional Stormwater NPDES Permit (MRP), adopted by the San Francisco Regional Water Quality Control Board (Regional Water Board) on October 14, 2009, authorizes stormwater discharges from 77 Permittees comprised of municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, and the cities of Fairfield, Suisun City, and Vallejo.

Provision C.14 of the MRP specifies requirements for polybrominated diphenyl ethers (PBDEs), legacy (organochlorine) pesticides and selenium. Provisions C.14.a.i. through a.vii. require Permittees to characterize the representative distribution of these three pollutant groups in urban areas and provide information to allow a calculation of loads to San Francisco Bay from urban runoff conveyance systems. Provision C.14.a also requires Permittees to determine if there are potential sources or source areas that may contribute to discharges in urban runoff and to identify control measures and/or management practices to eliminate or reduce these discharges. C.14.a.i. through C.14.a.v. requirements regarding characterization and load estimation in the Bay have been addressed through a Regional Watershed Spreadsheet Model developed through a separate collaborative effort as described in Attachment A. C.14.a.vi. and C.14.a.vii. requirements are addressed through three separate sub-reports on PBDEs, legacy pesticides, and selenium.

This sub-report addresses all C.14 requirements with respect to PBDEs. It summarizes urban runoff characterization information compiled through other sources and also identifies control measures and/or management practices to eliminate or reduce their discharges from urban runoff conveyance systems.

2 Introduction to PBDEs

PBDEs are semi-volatile, diphenyl ethers with one to ten bromine atoms attached. **Figure 1** displays the structure of a diphenyl ether, as well as the structure for one of the 209 PBDE congeners that could possibly exist. Although 209 congeners are possible, only some of these congeners are manufactured or result as degradation products. In this document, PBDE congeners are denoted by PBDE-X or BDE-X, where X denotes the specific congener being referenced. BDE-47 and BDE-209 are the two most widely referenced congeners in literature studies and appear to be the two most widely monitored PBDE congeners. The three commercial mixtures of PBDEs, each named for the average bromination level of its components, are PentaBDE, OctaBDE, and DecaBDE. PBDEs have low water solubilities. Congener vapor pressures vary with bromination level, which affects their movement into and within environmental media (USEPA 2010). For example, at air temperatures of 25°C, more than 98%of the single, double, and triple brominated congeners may be found in air in the vapor phase. Congeners with four or five bromines begin to partition to atmospheric particles, such that BDE-47 (four bromines) is 10% particle phase, and BDE-99 (five bromines) is 39%particle phase. Congeners with six or seven bromines are 87-99% particle phase, while the fully brominated BDE-209 is expected to be 99% associated with airborne particles (Sutton et al. 2013). Physical properties of the commercial mixtures were summarized in European Union risk assessment reports (European Chemicals Bureau 2000, 2002, 2003, 2004; **Table 1**).Differences in the physical properties listed in **Table 1** have important implications for the transport of PBDE congeners through urban runoff conveyance systems, as referenced in **Section 3.3**.

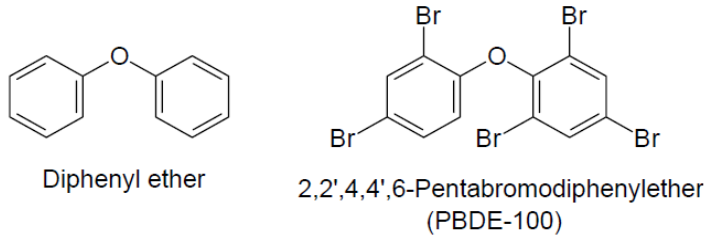

Figure 1. Diphenyl ether structure and structure of BDE-100 (Cal/EPA 2006).

Table 1. Physical properties of commercial PBDEs (European Chemicals Bureau 2000, 2002, 2003, 2004)

Property	PentaBDE	OctaBDE	DecaBDE
Physical state at 20°C and 1,013 hPa	Amber, viscous liquid or semi-solid	Off-white powder or flaked material	Fine crystalline powder
Melting point	-7 to -3°C	Varying by specific commercial product	300-310°C
Boiling point	Decomposes at >200°C	Decomposes at >330°C	Decomposes at 320°C
Vapor pressure	4.69x10-5 Pa at 21°C	6.69x10-5 Pa at 21°C	4.63x10-6 Pa at 21°C
Water solubility	13.3 µg/L at 25°C	0.5 µg/L at 25°C	<0.1 µg/L at 25°C
Log octanol-water partition coefficient	6.57	6.29	6.27
Estimated atmospheric half-life	12.6 days	76 days	94 days

Once higher-brominated PBDEs (e.g. BDE-209) enter the environment, they may undergo transformation via microbial, metabolic, or photolytic processes (reviewed by USEPA2010). This transformation is referred to as debromination. Debromination is the transformation of a higher-brominated compound into a lower-brominated compound. Relative to the fully brominated BDE-209, many lower-brominated congeners (e.g., BDE-47) are considered more toxic and certainly more bioaccumulative, causing biota and humans to be more at risk (Darnerud 2003). Other lower-brominated products of debromination are not found in commercial mixtures and have not been subjected to toxicity tests (Sutton et al. 2013).

There is concern over human exposure to PBDEs, especially for young children receiving higher exposures through ingestion of PBDE-laden indoor dust due to high amounts of hand-to-mouth activity (Sutton et al. 2013).Studies on mice and rats have shown that exposure to PBDEs cause neuro-developmental toxicity, weight loss, toxicity to the kidney, thyroid, and liver, and dermal disorders (ATSDR 2004; Birnbaum and Staskal 2004; De Wit 2002). Studies on animals and human beings have shown that some PBDEs can act as endocrine system disruptors and also tend to deposit in human adipose tissue (ATSDR 2004; Birnbaum and Staskal 2004; He et al. 2006; McDonald 2002). A study has indicated that OctaBDE may be a potential teratogen; exposure to OctaBDE may affect fetal development and lead to birth defects or developmental malformations (He et al. 2006). According to USEPA, DecaBDE is described as possessing "suggestive evidence of carcinogenic potential" (USEPA 2008).

Sutton et al. (2013) cited several studies that have documented the susceptibility of wildlife to the toxicological effect of PBDEs. For example, in birds, PBDEs have been associated with various reproductive effects in American Kestrels (McKernan et al. 2009) and Ospreys (Henny et al. 2009) at concentrations within the range of those found in San Francisco Bay tern eggs (She et al. 2008). Laboratory studies probing the effects of a PBDE-laden diet on fish suggest that juvenile Chinook salmon become more susceptible to infection (Arkoosh et al. 2010) and juvenile zebrafish display altered locomotion behavior (Chou et al. 2010).

The European Union risk assessments developed predicted environmental concentrations of PBDEs from water, sediments, air, and biota and predicted no effect concentrations at which no effect would be expected (European Chemicals Bureau, 2000, 2002, 2003). With similar or lower levels than have been observed in San Francisco Bay (Werme et al. 2007), the European Union risk assessments suggested that concentrations of PBDEs were high enough to pose possible local risks to aquatic life in the sediments and possible risk to top predators from PentaBDE. Lower risk was expected from OctaBDE except when the hexabrominated component was considered, in which case there were possible risks to predators, and probably low risks from DecaBDE except if it underwent debromination.

As discussed in **Section 4.1**, production and use of certain PBDEs in California has been banned, although these actions did not result specifically or solely because of concerns for beneficial uses of the San Francisco Bay (Werme et al. 2007).

3 PBDE Uses, Sources, and Transport Pathways

This section provides an overview of the existing literature regarding PBDE uses, sources, and transport pathways.

3.1 PBDE USES

PBDEs are added to some plastics, electrical and electronic equipment, upholstered furniture, non-clothing textiles, and foam products for use as a flame retardant. These materials are found in products in many applications, including within homes, offices, automobiles, and airplanes (Sutton et al. 2013).Household products that may contain PBDEs include curtains, carpet padding, furniture cushions, mattress pads, and pillows. Because PBDEs are added to the products rather than chemically bound into them, they can be slowly and continuously released from the products during their manufacture, while in use, or after their disposal. **Table 2** lists the predominant usage for the three commercial mixtures of PBDEs (PentaBDE, OctaBDE, and DecaBDE). Further information is available in the PBDEs Pollutant Profile included herein as Attachment A.

Table 2. Commercial mixtures of PBDE flame retardants, congeners comprising each mixture, and the predominant usage of each mixture (see also Attachment A)

Commercial Mixture	Congeners present, listed in order of dominant composition (greatest to least)[a]	Predominant usage
PentaBDE (commercially known as DE-71 and Bromkal 70-5DE)	BDE 99 (35-50%), 47 (25-37%), 100, 153, 154 and possibly minor amounts of 17, 28, 66, 85, 138 and 183	Approximately 95% used in polyurethane foam in furniture cushions, automobile seats and head rests, and mattresses; approximately 5% used in foam-based packaging and carpet padding
OctaBDE (commercially known as DE-79)	BDE 183 (40%), 197 (21%), 203 (5-35%), 196, 208, 207, 153 and 154.	Approximately 95% used in Acrylonitrile Butadiene Styrene (ABS) resins; approximately 5% used in other plastics for computers and kitchen appliances
DecaBDE (commercially known as DE-83R and Saytex 102E)	BDE 209 (97.5%), 206, 207 and 208.	General purpose flame retardant used in virtually any type of polymer, including thermoplastics, textiles, and back-coatings of consumer electronics, the backs of television sets, wire insulations, upholstery, electrical boxes, and high impact polystyrene plastic

[a](Alaee et al. 2003, USEPA 2010)

As shown in **Table 3**, there is very little data regarding market demand statistics for PBDEs. Total self-reported environmental releases of DecaBDE in the United States peaked in 1999 (53.9 metric tons), and stayed at similar levels through 2002 (Attachment A). There has since been a steady decline down to 21.1 metric tons in 2007 and 8.4 metric tons in 2011 (Attachment A), likely due to the imminent ban on production and usage, which is further discussed in **Section** 4. Detailed information is also available in the PBDEs Pollutant Profile included herein as Attachment A.

Table 3. Market demand statistics for PBDEs reported in the literature (see also to Attachment A). Data in metric tons.

	1991	1999[a]			2001[b]			2003[c]
	PentaBDE	PentaBDE	OctaBDE	DecaBDE	PentaBDE	OctaBDE	DecaBDE	All PBDEs
Americas	4,000	8,290	1,375	24,300	7,100	1,500	24,500	not reported
Europe	unknown	210	450	7,500	150	610	7,600	not reported
Asia	unknown	---	2,000	23,000	150	1,500	23,000	not reported
Rest of world	unknown	unknown	unknown	unknown	100	180	1,050	not reported
Total	4,000	8,500	3,825	54,800	7,500	3,790	56,100	56,418

[a]Watanabe and Sakai 2003
[b]USDHHS 2004
[c]USEPA 2010

3.2 PBDE SOURCES

PBDEs have been widely used as a flame retardant in textiles, plastics, and polyurethane foam products since the 1970's and are now both ubiquitous in the urban environment and also possibly being redistributed to the rural environment through application of biosolids and atmospheric deposition. In the San Francisco Bay Area, SFEI made a preliminary categorization of potential source areas for PBDEs (Attachment A) from urban and non-urban categories in the Bay Area:

- Areas surrounding manufacturing facilities that have previously reported air emission releases of PBDEs. Legacy contamination may exist; the USEPA Toxic Release Inventory includes two business locations within the Bay Area that self-report on- and off-site releases of decaBDE. Both locations are in the Peninsula region and are associated with Tyco Thermal Controls.
- Lands where application of treated biosolids may cause them to be sources of PBDEs in runoff. Although the total volume of biosolids applied within the San Francisco Bay Area is unknown, Solano County reported an approximate average of 10,000 tons being land applied annually between 2002 and 2011 (County of Solano 2012). The same application volumes have not been reported from other less-agricultural counties in the Bay Area.
- PBDEs were added as fire retardants in the plastics and foam within automobiles and thus automobile shredding facilities (autoshredders) produce particulate autoshredder waste (ASW) which may contain PBDEs. There are two autoshredder facilities in the Bay Area which generate an estimated 300,000 tons of waste (including millable components of automobiles, refrigerators, and ovens) each year (California Department of Toxic Substances Control (DTSC) 2002). ASW consists of mostly non-metallic materials: glass, fiber, rubber, automobile fluids, dirt and plastics found in automobiles and household appliances that remain after the recyclable metals have been removed (DTSC 2002). ASW materials are treated with inorganic binders to reduce their potential to leach heavy metals, for example in ultimate disposal as alternative daily cover (ADC) at landfills. While usage as ADC in lined landfills is not expected to release PBDEs into the environment (U.S. Department of Health and Human Services 2004) such that it would be available for transport to the Bay, production or transportation of ASW or "auto fluff" may involve release to the environment and storm drain conveyances. Ambient air monitoring taken by the California Air Resources Board showed PBDE levels in urban

areas increased ten-fold in the vicinity of e-waste recycling and autoshredder facilities (Charles et al. 2005)

- Other source areas noted in Attachment A are: carpet/foam recycling facilities and plastics, electronics, cars and textiles manufacturers; however few data are available on these sources or from areas surrounding these types of facilities.

3.3 PBDE TRANSPORT PATHWAYS

The pathways by which PBDEs get from a source into the physical environment are not fully understood (Alcock et al., 2003), and the pathways to the San Francisco Bay are even less known. Conceptually, release can occur during initial synthesis, during incorporation into commercial products, during wear or degradation of products, or during disposal and recycling (Hale et al., 2003). PBDEs are not manufactured in the San Francisco Bay Area; however, manufacturing of PBDE-containing products and/or use of PBDE-containing products is widespread. The release of PBDEs from PDBE-containing products has been quantified in few studies (Palm et al. 2002; Alcock et al. 2003), and no comprehensive survey has been done in California (Werme et al. 2007).

In the San Francisco Bay Area, PBDEs follow the following pathways (Werme et al. 2007):

- Direct input from activities in ports and other entities operating in close proximity to the estuary.
- Discharge of municipal and industrial wastewater.
- Atmospheric deposition.
- Runoff from local watersheds.
- Transport from the Sacramento and San Joaquin rivers.

This sub-report specifically addresses the runoff from the local watersheds pathway. The runoff from the local watersheds pathway represents a particularly important pathway for the particle-bound, higher-brominated PBDEs like BDE-209 to move from the terrestrial landscape to the Bay. **Figure 2** presents a conceptual model of how sources are released and transported through this pathway.

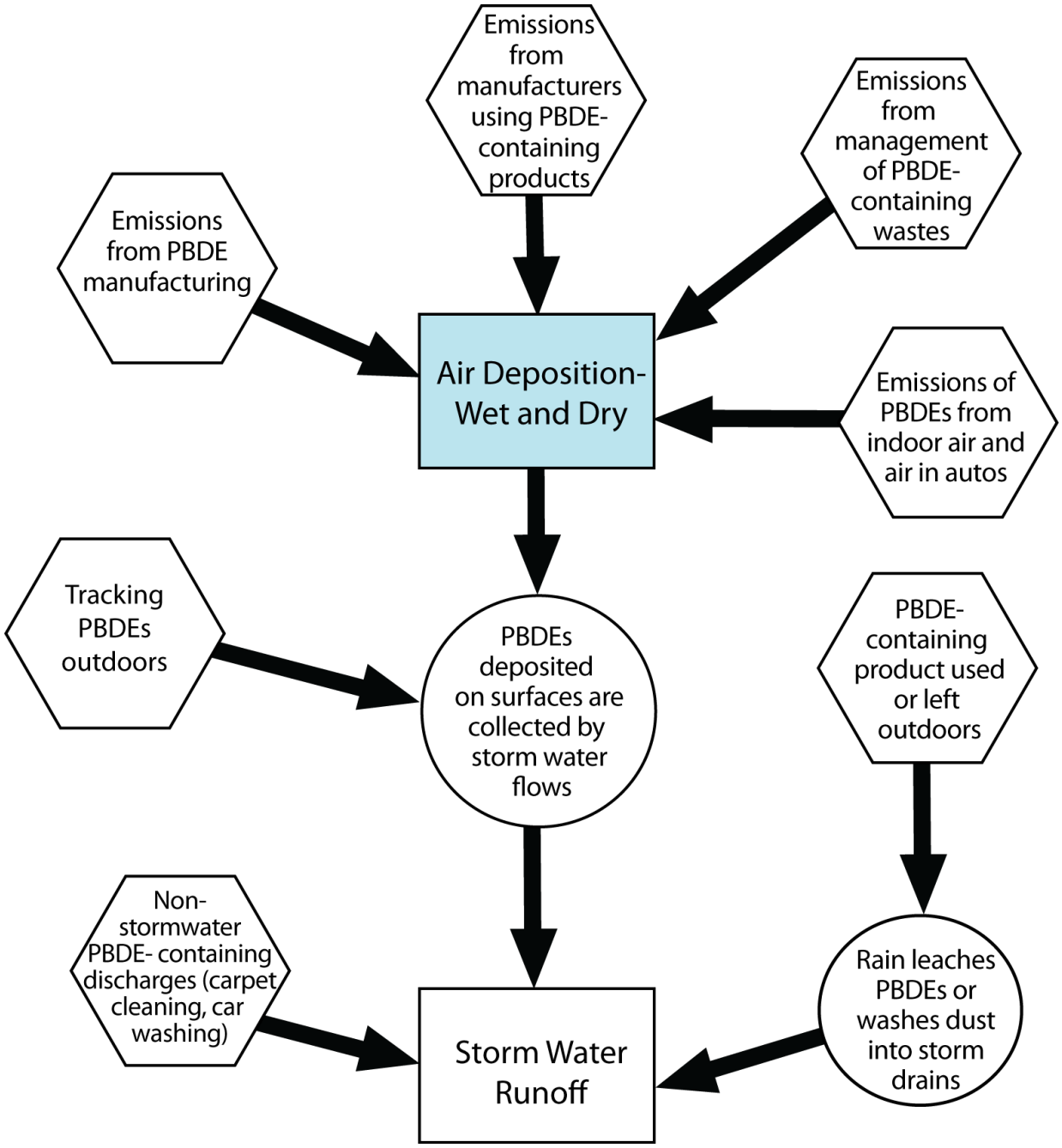

Figure 2. Sources and pathways of PBDEs that enter the San Francisco Bay in stormwater runoff (Werme et al. 2007)

4 Regulatory Status of PBDEs

Over the last 60 years, concurrent with increasing applications of petroleum-based polymers, usage of flame retardants also increased as regulations led to their integration into the polymers to meet fire safety expectations (Attachment A). The following section discusses regulations aimed at decreasing the use of PBDEs as flame retardants, proposed revisions to the standards that resulted in the use of PBDEs as flame retardants, and existing assessments of whether water bodies within the San Francisco Bay Area are impaired due to PBDEs.

4.1 REGULATIONS AND POLICIES BANNING PBDES PRODUCTION AND USE

Governments have responded to the rising environmental and health concerns over PBDEs with bans on production and usage. Due to the greater evidence of bioconcentration by lower-brominated congeners, PentaBDE and OctaBDE were banned in most places prior to DecaBDE (**Table 4**). As indicated in **Table 4** and further detailed in Attachment A, Europe phased out PBDEs faster than the U.S. In 2003, California passed Assembly Bill 302, becoming the first U.S. state to prohibit the manufacture, distribution, and processing of products containing PentaBDE and OctaBDE. This phase-out was originally scheduled for 2008, although the Legislature later accelerated that timeframe for phase-out to begin as of June 1, 2006 (Attachment A). Also, USEPA has issued a Significant New Use Rule to phase out the PentaBDE and OctaBDE homologs (USEPA 2013). According to this rule, no new manufacture or import of these two homologs has been allowed since January 1, 2005, without a 90-day notification to USEPA for evaluation (USEPA 2013). As a result, the major manufacturers of PentaBDE and OctaBDE ceased production of these compounds at the end of 2004.

USEPA has also supported and encouraged the voluntary phase-out of manufacturing and importation of DecaBDE. USEPA received commitments from the principal manufacturers and importers of DecaBDE to initiate reductions in the manufacture, import, and sales of DecaBDE starting in 2010, with all sales to cease by December 31, 2013. The USEPA intends to encourage other importers of DecaBDE to join this initiative. As part of this encouragement, the USEPA intends to develop "Design for the Environment and Green Chemistry Alternatives Assessment" for DecaBDE to aid users in selecting suitable alternatives (USEPA 2013).

Table 4. Years when bans on PBDEs went into effect in various parts of the world (see also Attachment A)

Location	PentaBDE	OctaBDE	DecaBDE
California	2006	2006	2013
European Union	2004	2004	2008
Sweden	1999	unknown	2007
Australia	2007	2007	unknown
China	2006	2006	unknown

4.2 ADDITONAL PBDE REGULATIONS

The Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (BEARHFTI), through their promulgation n 1975 of strict fire-resistance standards for upholstery, furniture, carpets, and other consumer products, is the State of California agency that is largely responsible for the widespread use of PBDEs and other chemical flame retardants. The

BEARHFTI has proposed revised flammability standards that could eliminate the incentive to incorporate these substances into upholstered furniture and many items for infants and young children (BEARHFTI 2013a).The BEARHFTI has determined that the 1975standarddoes not "adequately address the flammability performance of the upholstery cover fabric and its interactions with underlying filling," and has proposed a new standard that is designed to better address fires caused by smoldering materials, the predominant source causing upholstered furniture fire deaths. The new standard will be implemented starting July 1, 2014, but will allow products manufactured prior to this date to continue to be offered for sale without a sell by date. Nevertheless after July 2014, chemical fire retardants would disappear from a variety of newly produced consumer goods (BEARHFTI 2013b). It is anticipated that after current PBDEs-containing products have reached their useful life, the concentration of PBDEs in California's environment will see significant reductions.

4.3 IMPAIRMENT ASSESSMENT

There are no local, state, or federal criteria, standards, or screening levels for PBDEs in water, sediment, fish, or wildlife tissues. USEPA continues to evaluate and assess the risks posed by PBDEs (USEPA 2013). No federal cleanup standards or guidelines have been set for PBDEs (ATSDR 2004; USEPA 2013). Although numeric objectives have not been set for PBDEs, the following narrative objectives from the San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)[1] could be interpreted to evaluate whether urban runoff loads of PBDEs are contributing to an impairment of beneficial uses:

> "Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish or other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered."
>
> "Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life."

Without defined standards, it is not possible to definitively state that PBDEs are impairing water bodies located within the San Francisco Bay Area. During the 2006 and 2010 303(d) listing cycle, the Regional Water Board made the decision not to place the San Francisco Bay on the 303(d) list as impaired by PBDEs because, without a numeric guideline or objective, it could not be determined if the pollutant is likely to cause or contribute to -adverse effects on biota.

Sutton et al. (2013) cited several studies that have assessed whether San Francisco Bay PBDE concentrations are impairing beneficial uses related to wildlife. PBDE contamination of the San Francisco Bay does not impair the commercial and sport fishing (COMM) beneficial use based on comparison to thresholds developed by the Office of Environmental Health Hazard Assessment (OEHHA) (Klasing and Brodberg 2011). PBDE concentrations are also unlikely to impair reproduction and development of San Francisco Bay birds, according to a recent study of the toxicity of PentaBDE to tern eggs (Rattner et al. 2011). An analysis of whether current concentrations of PBDEs in the San Francisco Bay impair the health of harbor seals has been inconclusive (Neale et al. 2005) and further research would be necessary to evaluate this risk.

[1] http://www.waterboards.ca.gov/rwqcb2/basin_planning.shtml

5 MRP Requirements (C.14)

Provisions C.14.a.i. through vii. of the MRP ask Permittees to undertake efforts to determine if urban runoff is a conveyance mechanism associated with the possible impairment of San Francisco Bay for PBDEs, legacy pesticides (such as DDT, dieldrin, and chlordane), and selenium. The provisions specify actions that MRP Permittees must take regarding PBDEs. The C.14.a. provisions and actions undertaken by Permittees to comply with the provisions, in regards to PBDEs, are summarized as follows:

- Characterize the representative distribution of PBDEs in the urban areas of the San Francisco Bay Region (a.ii. and a.iii.). The Permittees developed the Regional Watershed Spreadsheet Model Profile to comply with this requirement.
- Provide information to allow calculation of PBDE loads to San Francisco Bay from urban runoff conveyance systems (a.iv. and a.v.). San Francisco Estuary Institute (SFEI) is developing a report "PBDEs in San Francisco Bay", cited herein as Sutton et al. (2013). The Report is based on environmental and biota data from the Regional Monitoring Program for Water Quality in the San Francisco Bay (RMP) and will be finalized for submittal with the MRP 2013 Annual Report. Many of the preliminary findings are summarized in Section 6 of this Report.
- Identify control measures and/or management practices to eliminate or reduce discharges of PBDEs conveyed by urban runoff conveyance systems (a.vi. and a.vii.). The document herein satisfies this requirement.

6 Pollutant of Concern Characterization Summary

As part of the RMP, SFEI has undertaken a series of monitoring and research projects to investigate the effects of PBDEs on the San Francisco Bay (Sutton et al. 2013). The following sections include summary text, tables and figures of the distributions of PBDEs found via urban San Francisco Bay area monitoring data and PBDE concentrations that have been measured in runoff from local watersheds within the San Francisco Bay Area.

6.1 PBDE DISTRIBUTIONS DERIVED FROM URBAN SAN FRANCISCO BAY AREA MONITORING DATA

Sutton et al. (2013) found that PBDEs are widely detected in San Francisco Bay matrices including water and sediment, in small and large tributaries to the Bay, and wildlife in the area. **Figure 3** and **Figure 4** illustrates a spatial distribution of PBDE concentrations in water and sediment, respectively, in the Bay Area while **Figure 5** shows a comparison of average concentrations found in shiner surfperch (Sutton et al.2013).

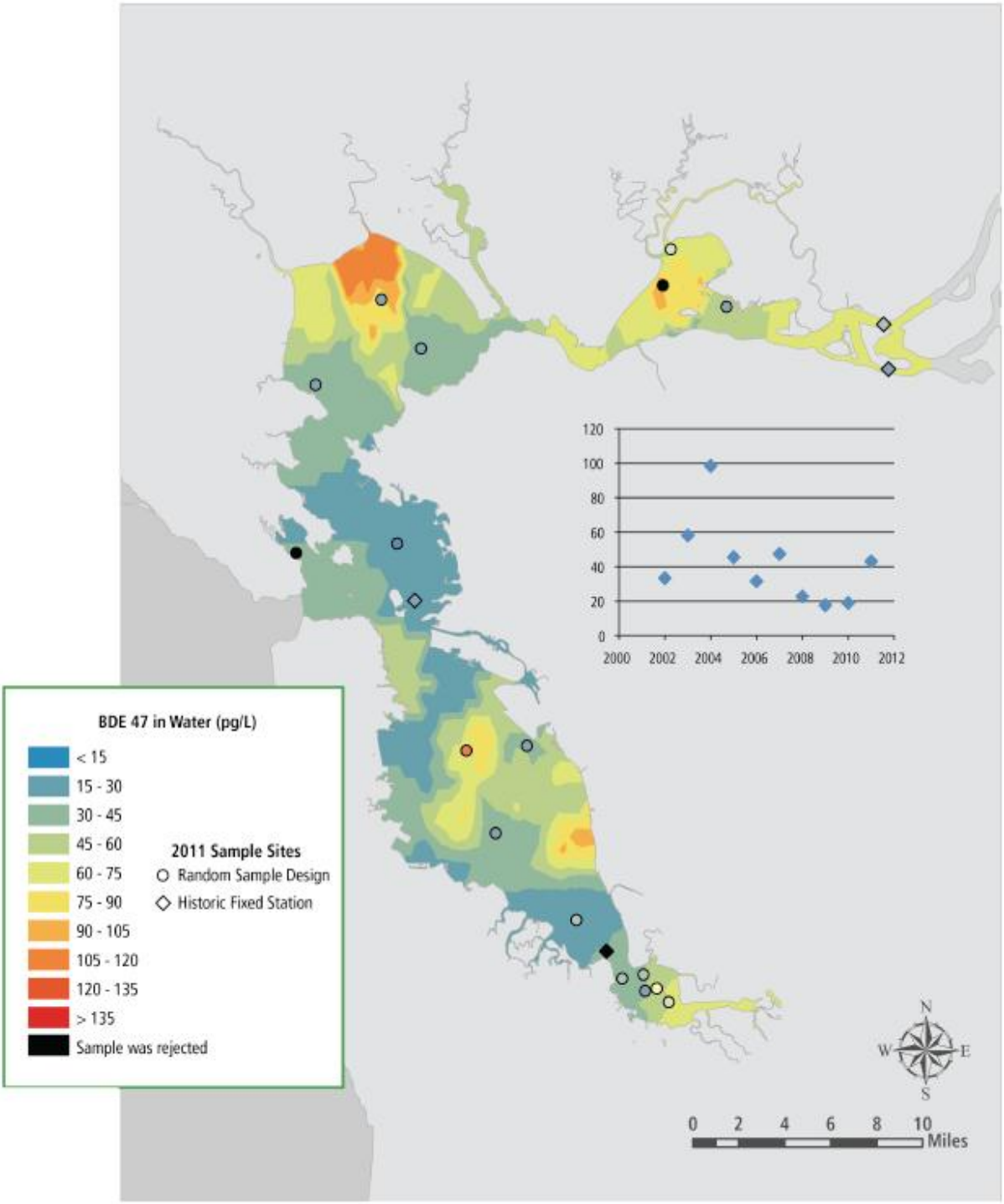

Figure 3. Concentrations of BDE-47 in water in San Francisco Bay (pg/L) (Sutton et al. 2013). Map plot based on 206 RMP data points from 2002-2011. Trend plot shows annual Bay-wide averages. Colored symbols on map show results for samples collected in 2010: circles represent random sites, and diamonds represent historic fixed stations.

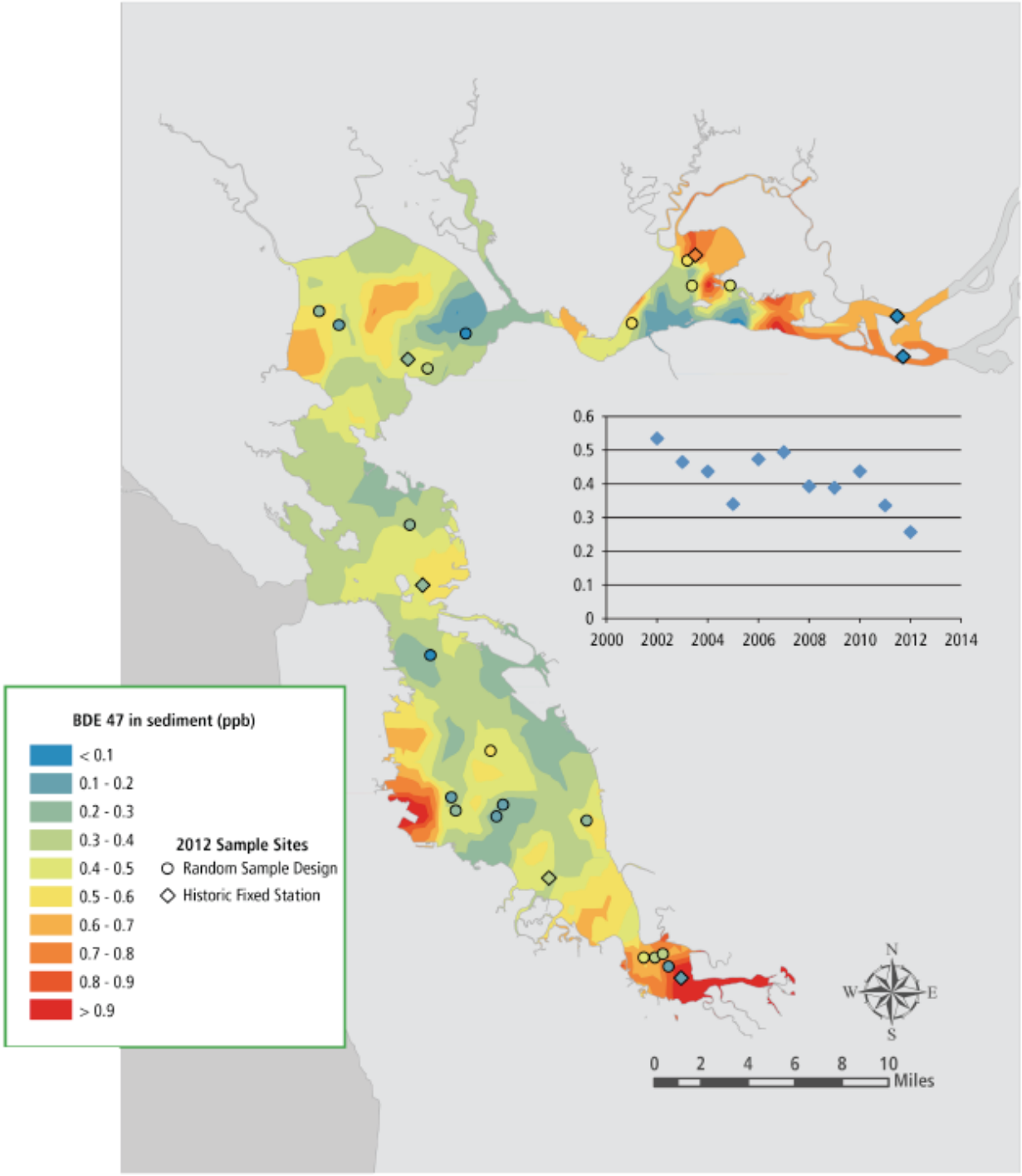

Figure 4.Concentrations of BDE-47 in sediment in San Francisco Bay (ng/g dry weight) (Sutton et al. 2013). Contour plot based on 338 RMP data points from 2002–2009 and 2011. Trend plot shows annual Bay-wide averages. Colored symbols on map show results for samples collected during the wet season (April) in 2012. Circles represent random sites. Diamonds represent historic fixed stations. Red circle on trend plot indicates a wet season sample; other samples were dry season.

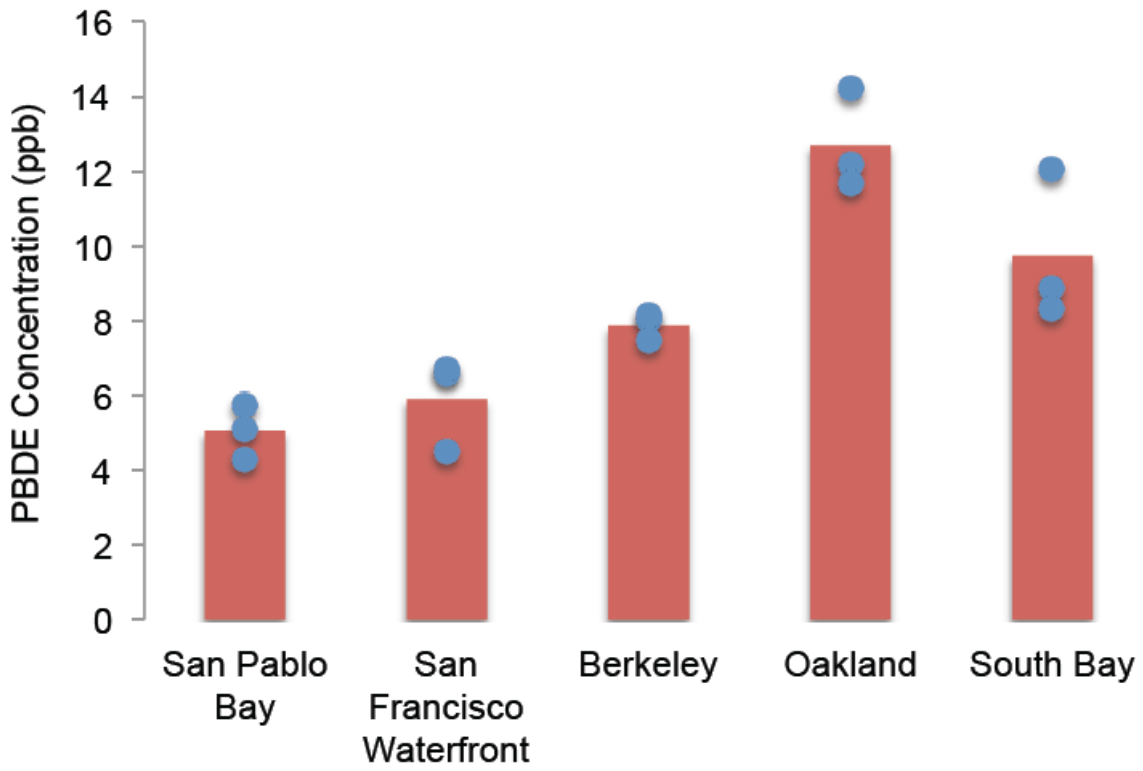

Figure 5. PBDE concentrations (ppb) in shiner surfperch in San Francisco Bay, 2009 (Sutton et al. 2013). Bars indicate average concentrations. Points represent composite samples.

Likely in response to the regulatory actions and policies banning production and use of PBDEs described in **Section 4.1**, Sutton et al. (2013) indicated a decline in contaminant levels for all San Francisco Bay organisms under study (**Figure 6**, **Figure 7**, **Figure 8**, **Table 5**, and **Table 6**). PBDEs are one success story, where a ban and phase-out in 2004 appear to have caused a marked decline in concentration in the San Francisco Bay food web (Mumley et al. *in progress*). This decline is expected to continue and should diminish any potential impacts of PBDEs on San Francisco Bay biota (Sutton et al. 2013). Sutton et al. (2013) developed a PBDE mass budget model that indicates rapid recovery is possible with reduced contaminant loads expected as these compounds are removed from the market.

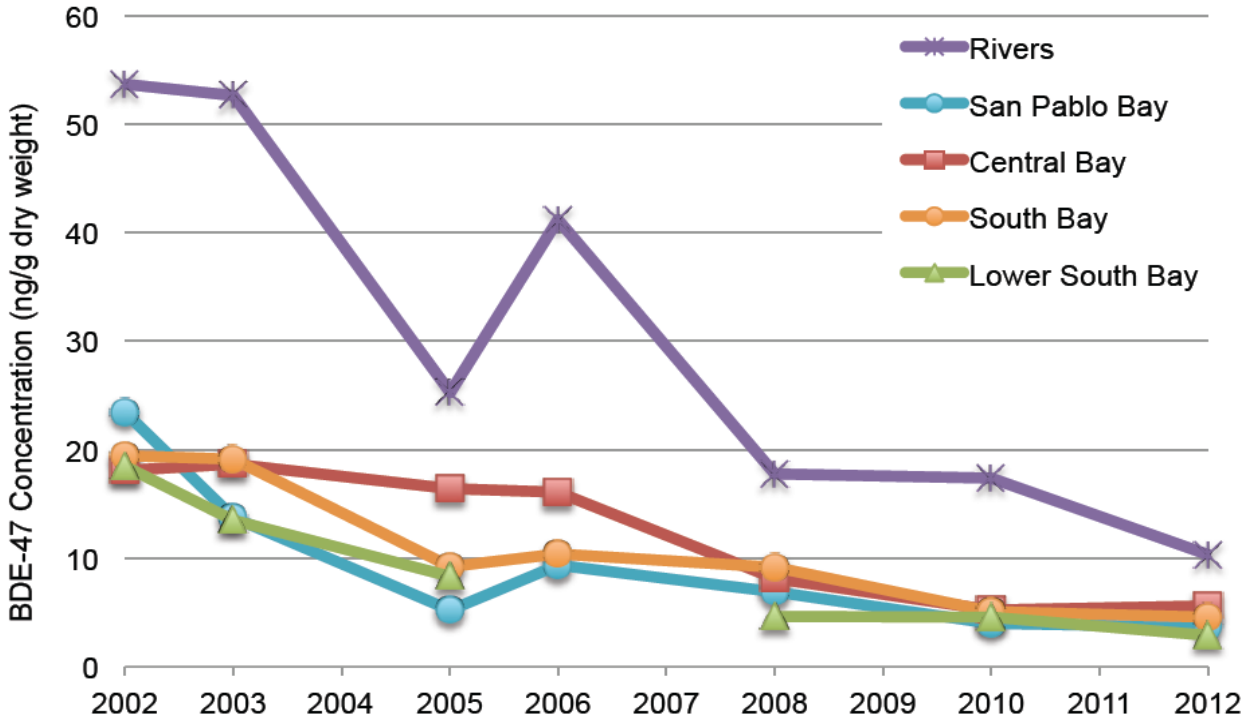

Figure 6. Concentrations of BDE-47 in bivalves (ng/g dry weight) (Sutton et al. 2013)

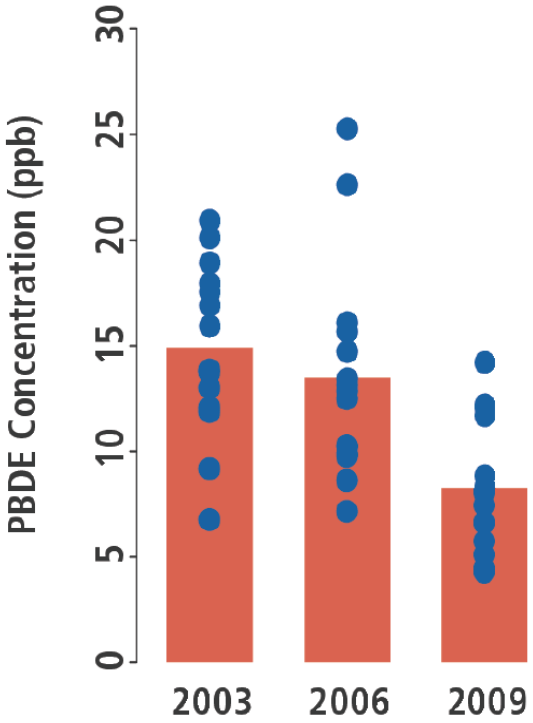

Figure 7. PBDE concentrations (ppb) in shiner surfperch in San Francisco Bay, 2003-2009 (Sutton et al. 2013). Bars indicate average concentrations. Points represent composite samples.

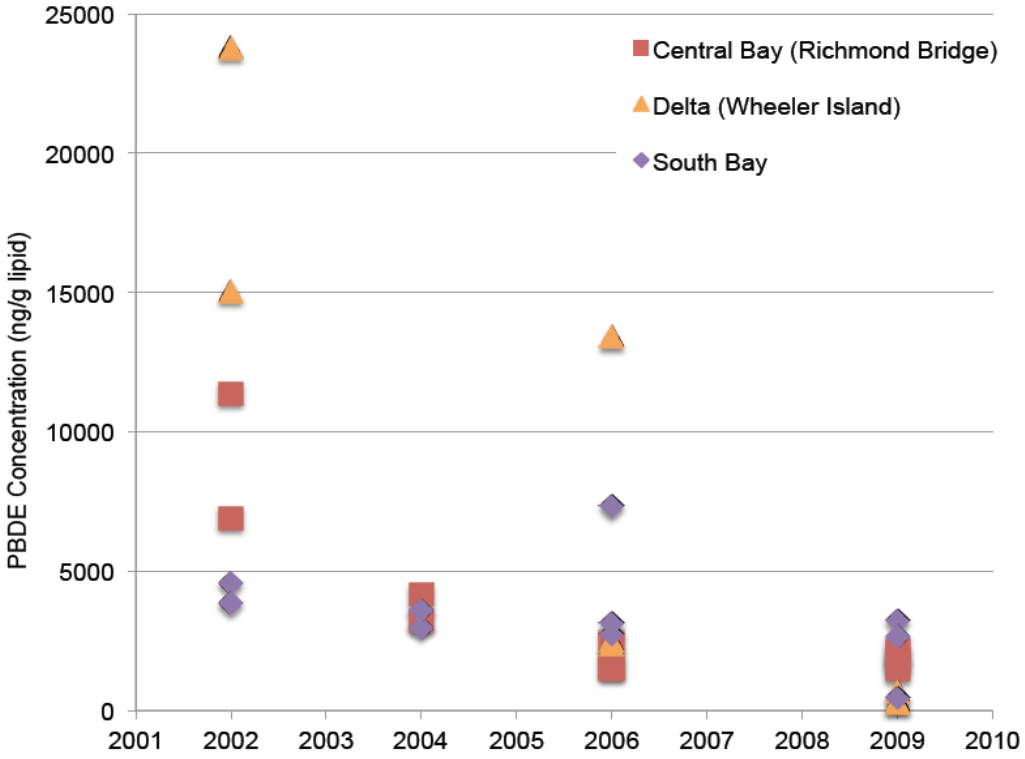

Figure 8. Concentrations of total PBDEs in cormorant eggs (ng/g lipid) (Sutton et al. 2013)

Table 5. Total PBDE concentrations in Forster's tern eggs from San Francisco Bay (ng/g lipid) (Sutton et al. 2013)

Year	2000[1]	2001[1]	2002[1]	2003[1]	2009[2]
Samples (n)	5	29	20	22	18
Maximum (ng/g lipid)	3560	62400	63300	26000	2350
Minimum (ng/g lipid)	1080	1460	2590	666	668
Mean (ng/g lipid)	2160	7610	9420	5610	1440
Median (ng/g lipid)	1820	4380	5460	3600	1450
SD (ng/g lipid)	1010	11400	13400	5540	495

[1] Values from She et al. 2008
[2] Values measured by the RMP

Table 6. Recently collected total PBDE measurements in Bay harbor seals (Sutton et al. 2013)

Year	1998[1]	2006[2]	2007-2008[3]	2007-2008[4]
Samples (n)	2	2	9	5
Maximum (ng/g lipid)	8325	1600	11000	5076
Minimum (ng/g lipid)	2985	550	300	530
Geometric mean (ng/g lipid)	4985	940	970	1076

[1] She et al. 2002
[2] The RMP
[3] Greig et al. 2011; seals from central California, including regions outside San Francisco Bay
[4] Klosterhaus et al. 2012

Despite the decline in contaminant levels for all San Francisco Bay organisms under study, Sutton et al. (2013) documented that San Francisco Bay water and sediment concentrations have shown fewer clear temporal trends. San Francisco Bay-wide averages of the dominant congener in water, PentaBDE component BDE-47, suggest that this congener has disappeared from most locations in the San Francisco Bay with the exception of the Lower South Bay (**Figure 9**). In contrast, San Francisco Bay-wide averages of BDE-47 and the dominant congener in sediment, DecaBDE component BDE-209, show little change (Sutton et al. 2013). Because the phase-out of DecaBDE is still ongoing (**Section 4.1**), and because natural mixing and sample compositing may cloud any signal of recent changes to sediment contaminant loads, it may be some time before a clear trend emerges from study of this matrix (Sutton et al. 2013).

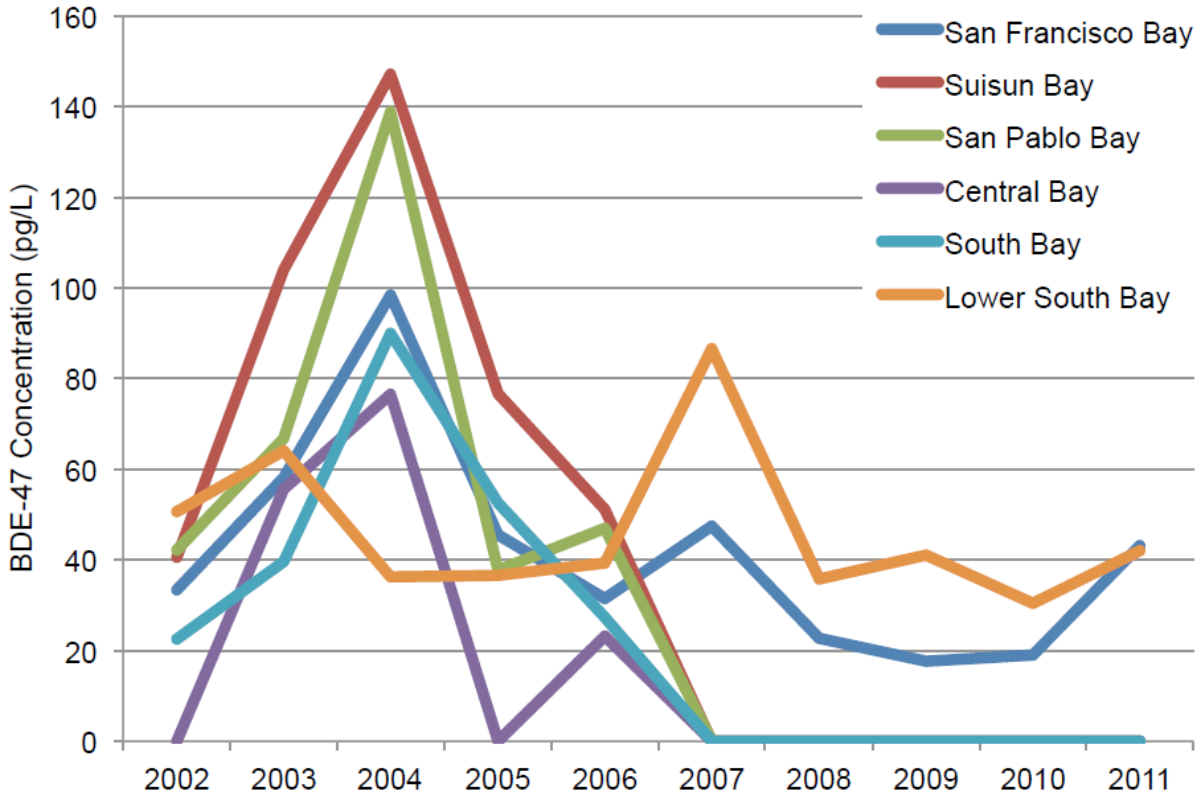

Figure 9. Regional distribution of BDE-47 in San Francisco Bay water over time (pg/L) (Sutton et al. 2013)

6.2 PBDE CONCENTRATIONS IN RUNOFF FROM LOCAL WATERSHEDS

Little data exist in the world literature on PBDE concentrations in stormwater, and where PBDEs have been sampled in stormwater, it has been done in mixed-use urban areas (Attachment A). Through funding from the RMP, SFEI has sampled 10 mixed-use watersheds around the San Francisco Bay Area for PBDEs in stormwater runoff. **Table 7** presents summary statistics for this monitoring effort. As noted in the table, most of these watersheds have only been studied at a pilot level, with fewer than 10 samples collected. One Alameda County watershed (Zone 4 Line A in Hayward) had 38 sample points with mean and median concentrations of 47 ng/L and 27 ng/L, respectively.

Table 7. PBDE concentrations in runoff from local watersheds based on locally collected data by the RMP. All watersheds include mixed-urban land uses (see also Attachment A)

Specific Location	N	PBDE concentrations (ng/L)				Reference
		Min	Max	Mean	Median	
Borel Ck, Peninsula Bay Area, CA	3	9	20	14	12	McKee et al. 2012
Coyote Ck, Santa Clara County, CA	7	7	36	15	13	SFEI unpublished
Guadalupe River, San Jose, CA	13	15	369	88	38	SFEI unpublished (WY 2012); McKee et al. 2006
Lower Marsh Ck, Brentwood, CA	1	20	20	20	20	SFEI unpublished
Lower Penetencia Ck, Milpitas, CA	4	13	22	18	19	McKee et al. 2012
San Leandro Ck, San Leandro, CA	3	41	80	57	50	SFEI unpublished
Santa Fe Channel, Richmond, CA	2	24	30	27	27	McKee et al. 2012
Sunnyvale East Channel, Sunnyvale, CA	6	5	100	48	42	McKee et al. 2012; SFEI unpublished (WY 2012)
Zone 4 Line A, Hayward, CA	38	0	430	47	27	Gilbreath et al. 2012
Zone 5 Line M, Union City, CA	4	34	128	75	69	McKee et al. 2012

6.2.1 Results of Investigation of Local Watershed with Anomalous Elevated PBDE Concentrations

Although the stormwater data for the San Francisco Bay Area does not exist for homogenous land uses, SFEI preliminarily explored correlations between PBDE concentrations in the San Francisco Bay Area watersheds and the land uses in those watersheds (Attachment A). This exploration yielded strong correlations with the combined sum of High Residential and Open Compacted spaces (**Figure 10**). However, the linear trend line in **Figure 10** excludes the Zone 5 Line M watershed in Union City because it does not follow this correlation. The Zone 5 Line M watershed land uses are approximately 31% residential, 11% transportation, 36% open, 15% commercial, and 7 % industrial (Attachment A). SFEI conducted a cursory review of the current industrial sector of this small watershed using Google Maps and Google Earth. This cursory review revealed several parcels that may be contributing to the elevated PBDE concentrations. These parcels included two custom plastics manufacturers, and a furniture distribution warehouse plus possible small-scale furniture recycling at this location. Given the anomalous results obtained from this watershed, SFEI suggested that these parcels may warrant local or site-

specific control measures after further investigation. Past uses as industrial facilities (e.g. Pacific States Steel clean-up site) may also pose legacy issues in this watershed.

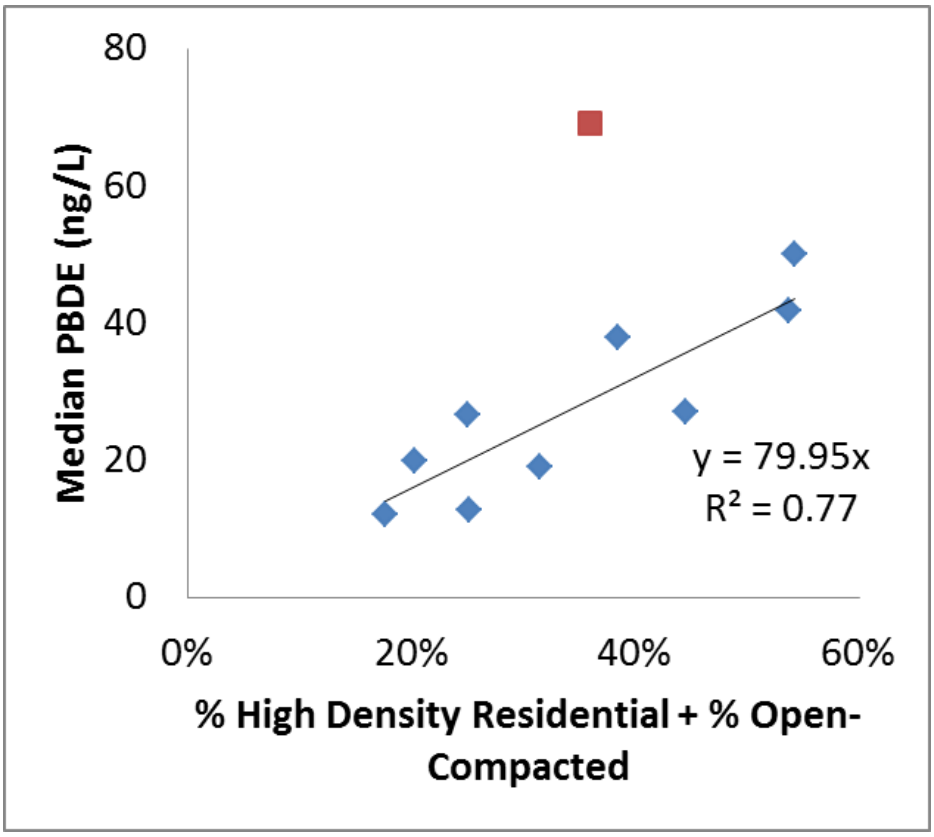

Figure 10. Median PBDE concentrations in relation to the percentage of high density residential development (< 0.333 acres/unit) and percentage compacted open space in nine Bay Area watersheds (see also Attachment A). The linear trend line is related only to the nine watersheds represented by blue markers; the red marker is Zone 5 Line M.

6.2.2 Correlation between Elevated PBDE Concentrations and Other POCs

SFEI also regressed local PBDEs in stormwater data with total mercury (HgT) and PCBs (sum of 40 congeners) to provide preliminary evidence if, at a regional average scale, targeting the clean-up of either of these high priority POCs would result in multiple benefits for management of PBDEs (Attachment A). In water, median PBDE concentrations correlated fairly well with HgT, but not with PCBs (**Figure 11**). When normalized to suspended sediment concentration, PBDEs did not correlate well with either HgT or PCBs (**Figure 12**). This data suggests that, on a spatial scale, control measures aimed at reducing HgT loads in water may be coordinated with control measures aimed at reducing PBDE loads in this media. However, control measures aimed at reducing PCBs in water and sediment or HgT in sediment may not be beneficial for reducing corresponding PBDE loads in those media.

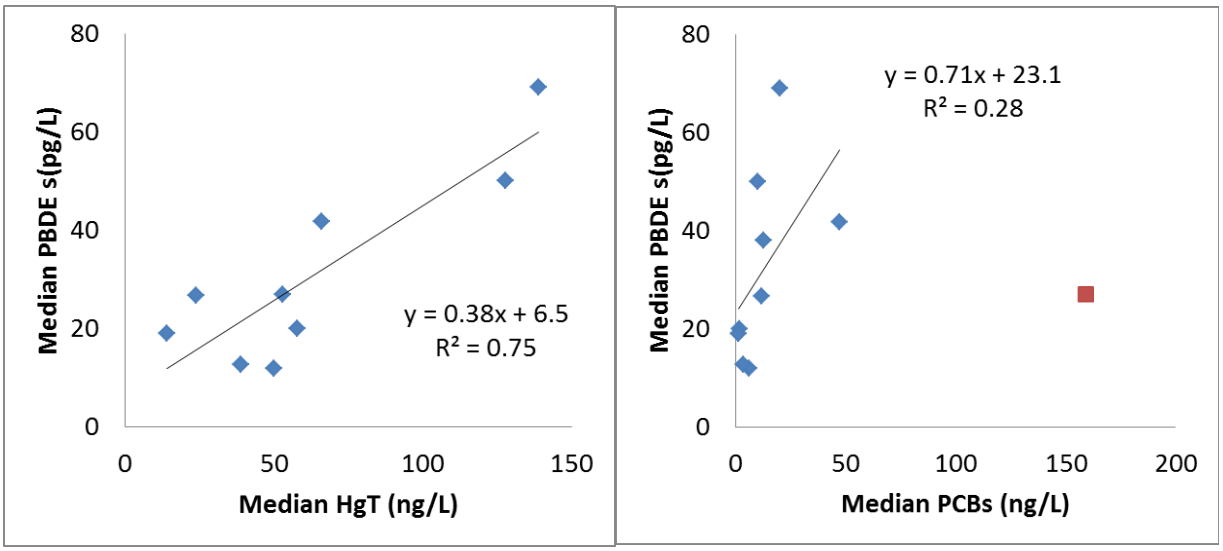

Figure 11. Median PBDE concentrations in relation to median HgT and median PCB concentrations in San Francisco Bay area watersheds (Attachment A). The Guadalupe River watershed data is excluded as anomalous from the regression with median HgT due to Hg mining influence in this watershed. The outlier data point in red for median PCBs is the PCB hot spot watershed, Santa Fe Channel.

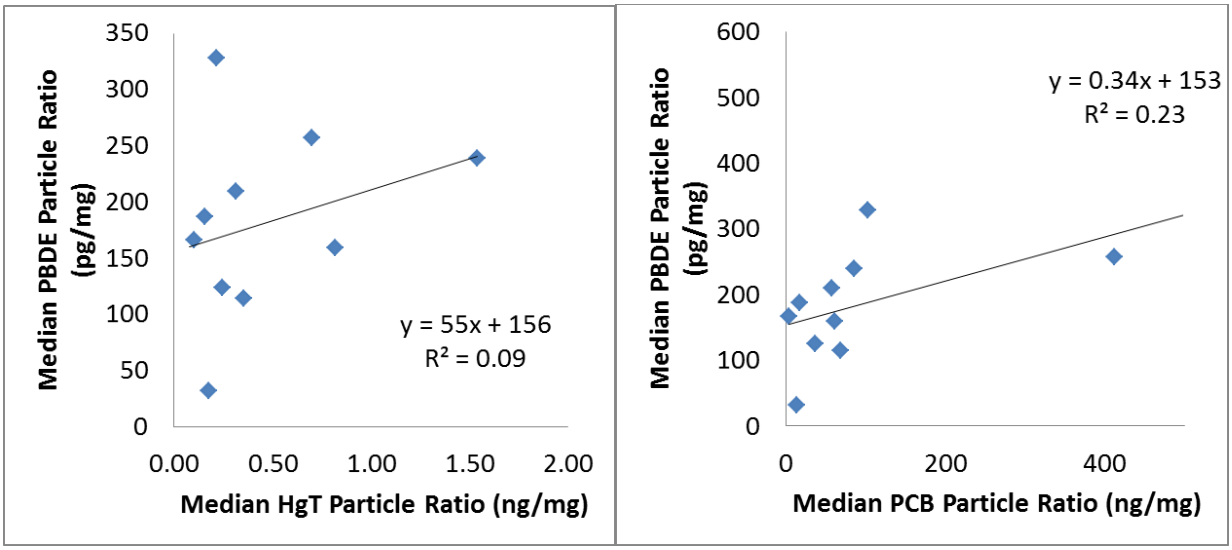

Figure 12. Relationships of median PBDE particle ratios with HgT and PCB particle ratios in San Francisco Bay Area watersheds (Attachment A)

7 Current and Planned Control Measures

This section provides a summary of control measures implemented by Permittees to control the discharge of PBDEs from municipal stormwater to the San Francisco Bay.

Under the MRP, and through many other efforts, Permittees are currently implementing a series of control measures to improve the quality of stormwater runoff into the Bay. These measures, though not directly aimed at controlling PBDEs, have the effect of reducing all Pollutant of Concern loads conveyed through stormwater into the Bay. The evidence of declining PBDE levels in San Francisco Bay biota and the outcome of the RMP's modeling suggest that existing management actions to eliminate production and use of PBDEs should be sufficient to address the potential impacts of contamination of San Francisco Bay (Sutton et al. 2013). Therefore new PBDE-specific control measures for municipal stormwater Permittees in the Bay Area are not included in the list below or planned for the future. The implementation of pilot and new control measures that are focused on other high priority sediment-associated pollutants (e.g., PCBs and mercury) will also have reduction benefits for PBDEs.

7.1 MEASURES TO PREVENT AND REDUCE PBDE DISCHARGES

Many existing activities in the MRP serve to reduce discharges of PBDEs.

- Best Management Practices (BMPs) at municipal operations sites: Provision C.2 requires development and implementation of appropriate BMPs by all Permittees to control and reduce non-stormwater discharges and polluted stormwater to storm drains and watercourses during operation, inspection, and, routine repair and maintenance activities of municipal facilities and infrastructure. Requirements such as development of site-specific BMPs and implementation of Stormwater Pollution Prevention Plans at corporate yards can reduce sediment and runoff discharges into the stormwater conveyance systems ultimately reducing the POC loadings (including PBDEs) into the Bay.

- Source control, site design, stormwater treatment, and low impact development for land development projects: Practices required under Provision C.3 are ultimately aimed at retaining or infiltrating stormwater on site and reducing runoff volumes to the Bay. Increases in runoff may cause excess erosion in stream channels, releasing potentially contaminated sediments, including those with elevated PBDE concentration.

- Industrial and Commercial Site Controls: Provision C.4 of the MRP requires Permittees to implement an industrial and commercial site inspection and control program at all sites that could reasonably be considered to cause or contribute pollutants to urban runoff. Follow-up and enforcement actions consistent with local Enforcement Response Plans (ERPs) to prevent discharges of pollutants and impacts on beneficial uses of receiving waters are implemented as needed. Inspections are carried out to ensure that the facilities have implemented adequate and appropriate control measures. The ERP provision allows for future incorporation of information-gathering at specific types of facilities if regulatory priorities for PBDEs change in the future. Facilities covered under the new statewide Industrial General Permit would also be subject similar self-reporting standards.

  Enhancing stormwater pollution prevention plans at industrial and commercial sites can be beneficial for reducing PBDEs and other contaminants in their stormwater. If PBDE

loading reductions increase in priority, local agencies may choose to identify electronics and carpet/foam recycling facilities, as well as manufacturers of plastics, electronics, cars, and textilesas potential sources which could be prioritized for higher frequency inspections. In one recent case, USEPA conducted several inspections and noted evidence of non-compliance with the Federal Clean Water Act at Sims Metal, an autoshredder in Redwood City. Under an EPA-issued Order, Sims Metal is now required to sample storm water discharges more frequently throughout the rainy season, to revise their stormwater pollution prevention plan to update monitoring and sampling, and to develop and implement stormwater pollution control measures for all areas of activity (USEPA2011). As further noted in Section 7.3, DTSC has initiated a review of current technical data and information on treatment processes at these facilities and it is re-evaluating the non-hazardous waste classification of autoshredder waste. A decision is expected late 2014.

- Construction Site Control: Provision C.6 of the MRP requires Permittees to implement a construction site inspection and control program at all construction sites. Permittees conduct inspections to determine compliance and effectiveness of the construction site measures, and require timely correction if violations are found. Permittees require all construction sites to have site-specific and seasonally- and phase-appropriate control measures such as:
    - Erosion and sediment control;
    - Good site management;
    - Run-on and Run-off control;
    - Non-urban runoff management; and
    - Active treatment systems (as necessary).

  Erosion and sediment control approaches are helpful in preventing mobilization of sediment that may have been enriched by PBDEs from legacy uses.

- Urban Runoff Treatment Retrofits: Storm drain inlet inserts, flow through separation devices (e.g., hydrodynamic separators), vegetated filtration systems (grassy swales), infiltration trenches/basins, media filtration, detention basins, wet ponds and constructed wetlands can intercept sediments in the urban runoff conveyance system and may reduce the load of POCs, including PBDEs, to the Bay. These urban runoff treatment structures may be installed by municipalities on public and capital improvement projects or as retrofits projects targeting pollutants of concern. Through pilot studies conducted in compliance with provisions C.11/12.e of the MRP, Permittees are currently evaluating the effectiveness of urban runoff treatment retrofits and assessing the costs of implementing these actions. The focus of these studies is PCBs and mercury, however, all pollutants in urban runoff, including PBDEs will likely benefit from the information being collected. Although sources and pathways differ between PBDEs and other POCs, potential focused implementation of enhanced urban runoff system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of PBDEs to the Bay from urban runoff.

- Solid and Household Hazardous Waste Disposal. Permittees also operate, promote, coordinate or otherwise facilitate programs for collection of household hazardous waste or electronic waste, and recycling or collection of furniture and other bulky waste. These

efforts are driven primarily by targets for solid waste reduction but also have the effect of reducing PBDE release from improper disposal of various consumer goods.

7.2 BAY AND WATERSHED MONITORING

Through their participation in the RMP, the MRP Permittees have supported status and trends monitoring of PBDEs in San Francisco Bay water and sediment since 2002 (reviewed in Sutton et al. 2013). The RMP has also supported research into PBDE effects on biota through funding from the Pilot/Studies and Special Studies program. While these data show that regulatory bans and phase-outs have already led to declines in PBDE contamination in Bay biota over the last decade, there may be increasing occurrence in the Bay of alternative (non-PBDE) flame retardants substituted in consumer products by manufacturers; thus Sutton et al. (2013) propose that continuing RMP monitoring and research on PBDEs be combined with additional investigation of the most likely alternative chemicals. Future RMP planning will consider these recommendations and allocate resources for monitoring and special studies according to the management priorities and information needs for PBDEs or alternative flame retardants.

The Small Tributaries Loading Strategy (STLS) is a collaboration of Permittees and the RMP that addresses the MRP Provision C.8.e requirement to conduct Pollutants of Concern (POC) monitoring to assess inputs of priority POCs to the San Francisco Bay from local tributaries and urban runoff, and also provide stormwater monitoring data for POCs with lower regulatory priority including PBDEs. The STLS Multi-Year Plan*[2] documents monitoring methods and design, as well as the complementary development of a Regional Watershed Spreadsheet Model (Lent and McKee 2011, Lent et al. 2012) and guidance for articulating the model for specific POCs (e.g. Attachment A for PBDEs).

Due to limited data, the contribution of specific potential sources identified in Attachment A to PBDE releases into the Bay is unclear. It is also unknown what portions of those releases are conveyed through stormwater. Many of the sources may release PBDEs through air emissions which ultimately accumulate into the Bay through air depositions. Any such releases are beyond the scope of the stormwater controls.

7.3 RELATED REGULATORY CHANGES

The types of facilities identified as potential PBDE sources (autoshredders, electronics and carpet/foam recyclers, and plastics, electronics, cars, and textiles manufacturers) are also considered industrial operations under the Federal Clean Water Act and are subject to the State's Industrial General Stormwater Permit. This permit is in the process of being reissued by the State Water Resources Control Board (State Water Board); increased monitoring, more stringent BMPs, and increased self-inspections are proposed in the draft permit[3] (State Water Board draft 2013). In addition, these facilities are regulated directly by the Regional Water Board and USEPA can enforce the Federal Clean Water Act.

As previously mentioned, autoshredders generate considerable amounts of non-metallic waste from materials found in automobiles and household appliances that remain after the recyclable

[2] STLS Multi-Year Plan included as Appendix D-1 of the Urban Creeks Monitoring Report available at www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/UC_Monitoring_Report_2012.pdf

[3] The anticipated effective date of the reissued permit is January 1, 2015.

metals are removed. These waste materials are treated with inorganic binders to reduce their potential to leach heavy metals in their ultimate disposal as ADC at landfills. In 2012, the Altamont Landfill in Livermore used a total of 131,700 tons of autoshredder waste (ASW) for ADC (CalRecycle 2012). In recent years ASW has come under scrutiny from DTSC as the Department is concerned that the concentrations of heavy metals in this waste may ultimately pose environmental risks (DTSC 2013). The treated waste is currently subject to an exemption from hazardous waste designation; the exemption allows the facilities to treat their waste on-site without a DTSC permit, and allows for the treated ASW to be disposed as nonhazardous waste (hence its disposal as ADC in municipal landfills).According to DTSC, the exemption was granted in the late 1980s and it is based on scientific evidence available at that time (DTSC 2013). To account for advances in testing and analytical methods, DTSC has initiated a review of current technical data and information on ASW treatment processes and it is re-evaluating the non-hazardous waste classification of ASW. Because DTSC is involving many stakeholders not only from the industry but also from affected state and local agencies (CalRecycle, State Water Board, local air quality management districts, etc.), the re-evaluation process is expected to last until late 2014. DTSC will announce its decision at that time and then develop a course of action based on the findings of this process (DTSC 2013).

Ultimately, a potential classification of ASW as hazardous waste may not necessarily affect the release of PBDEs from autoshredding sites, but would prevent the PBDE-containing ASW from being disposed in municipal landfills and from potentially being released back into the environment from these sites. This type of wide-reaching regulatory decisions can have significant impact in controlling PBDE releases into the environment. Overall, source-control activities taken at the local level have limited effectiveness for PBDEs; the most effective form of source control is legislation to ban the use and importation of PBDEs as flame retardants.

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ATTACHMENT **A**

PBDEs Pollutant Profile (Hunt et al. 2013)

PBDEs Pollutant Profile

Introduction and Purpose of Document

This profile was prepared by SFEI as one of a series supporting development of the Regional Watershed Spreadsheet Model (RWSM) for estimating pollutant loads to the San Francisco Bay per the joint RMP-BASMAA Small Tributaries Loading Strategy. The RWSM will be used to generate pollutant-specific sub-models using spatial datasets that define input runoff coefficients for local land use types and also pollutant-specific "source areas". The first step for each pollutant-specific sub-model is to review what is known locally and/or internationally about the sources or use characteristics and processes of release and transport of the San Francisco Bay. This information is then put together with what is known about available GIS layers on the proposed most important sources and a model structure and generalized work plan is recommended. This information for Polybrominated Diphenyl Ethers (PBDEs) is compiled into this profile. BASMAA funded the preparation of this document to assist in fulfilling C.14 MRP requirements, but the profile's focus is on all potential sources to Bay, as well as conveyance by stormwater and local tributaries from the SF Bay watershed.

PBDEs: description, historical usage, and behavior in environment

Polybrominated diphenyl ethers (PBDEs) are a group of flame retardant additives used in thermoplastics, polyurethane foam, and textiles. These materials are found in products within clothing, homes, offices, automobiles and airplanes. PBDEs are diphenyl ethers with one to ten bromine atoms attached (Figure 1) and although 209 congeners are possible, only some of the congeners are manufactured or result as degradation products.

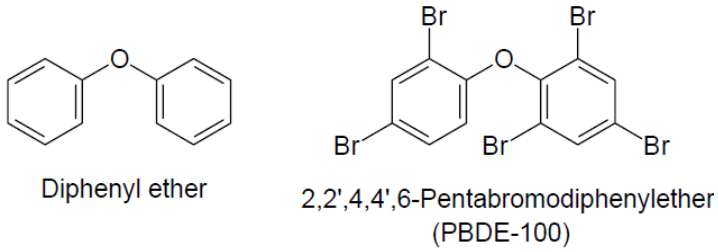

Figure 1. Diphenyl ether structure and structure of BDE-100 (illustration from California Environmental Protection Agency, 2006).

Over the last 60 years, concurrent with increasing applications of petroleum-based polymers, usage of flame retardants also increased as regulations led to their integration into the polymers to meet fire safety expectations. Organobromine compounds are the most effective of the halogenated organic flame retardants, and widespread usage and commercial production of PBDEs as a flame retardant began in the 1970s. There are

three commercial mixtures of PBDEs, each named for the average bromination level of the various congeners that comprise the mixture ("penta-", "octa-", and "deca-BDE"; Table 1).

Table 1. Commercial mixtures of PBDE flame retardants, congeners comprising each mixture, and the predominant usage of each mixture.

Commercial Mixture	Congeners present, listed in order of dominant composition (greatest to least)[a]	Predominant usage
pentaBDE[b] (commercially known as DE-71 and Bromkal 70-5DE)	BDE 99 (35-50%), 47 (25-37%), 100, 153, 154 and possibly minor amounts of 17, 28, 66, 85, 138 and 183	Approx 95% used in polyurethane foam in furniture cushions, automobile seats and head rests, and mattresses; Approx 5% used in foam-based packaging and carpet padding
octaBDE[b] (commercially known as DE-79)	BDE 183 (40%), 197 (21%), 203 (5-35%), 196, 208, 207, 153 and 154.	Approx 95% used in ABS resins; Approx 5% used in other plastics for computers and kitchen appliances
decaBDE[b] (commercially known as DE-83R and Saytex 102E)	BDE 209 (97.5%), 206, 207 and 208.	General purpose flame retardant used in virtually any type of polymer, including thermoplastics, textiles, and back-coatings of consumer electronics, the backs of television sets, wire insulations, upholstery, electrical boxes, and high impact polystyrene (HIPS) plastic

[a]Congener composition information from Alaee et al. 2003 and U. S. Environmental Protection Agency 2010.
[b]For this report, "pentaBDE", "octaBDE", and "decaBDE" will refer to the commercial mixtures and not the homologue group.

Scarce data on market demand for PBDEs is available (Table 2). The period of peak usage of each formulation is not well-known and likely varies across regions of the world. As described in a review by Hale et al. (2006), sediment core data from Europe and Japan show peaks in the early to mid-1990's, suggesting that peak market demand and usage occurred sometime prior given the time required for PBDEs to cycle from their products into sediments where they would be observed in sediment core data. In contrast, total self-reported environmental releases of decaBDE in the United States (U.S.) peaked in 1999 (53.9 metric tons (metric t)), and stayed at similar levels through 2002 (Toxic Release Inventory, accessed January 2013). There has since been a steady decline down to 21.1 metric t in 2007 and 8.4 metric t in 2011, likely due to the imminent ban on production and usage (in 2013, discussed later). If the US market tracks self-reported releases by US production/processing entities, this may suggest concentrations in the U.S. environment may not be expected to peak until post-2002, although it is unclear whether or not environmental peaks have yet occur ed. Indeed, core data from two out of three wetland areas in the San Francisco (SF) Bay collected in 2005-2006 showed increasing trends in PBDE concentrations without any sign of plateau (Yee et al., 2011). On the other hand, in a recent review of PBDEs in the SF Bay, Sutton et al., (in prep) reported that concentrations in water and sediment over the ten year period of record have not shown distinct trends, while concentrations in Bay wildlife are trending downward.

Table 2. Market demand statistics for PBDEs. Data in metric tons (metric t).

	1991	1999[a]			2001[b]			2003[c]
	PentaBDE	**PentaBDE**	**OctaBDE**	**DecaBDE**	**PentaBDE**	**OctaBDE**	**DecaBDE**	**All PBDEs**
Americas	4,000	8,290	1,375	24,300	7,100	1,500	24,500	not reported
Europe	unknown	210	450	7,500	150	610	7,600	not reported
Asia	unknown	---	2,000	23,000	150	1,500	23,000	not reported
Rest of world	unknown	unknown	unknown	unknown	100	180	1,050	not reported
Total	4,000	8,500	3,825	54,800	7,500	3,790	56,100	56,418

[a] = Watanabe and Sakai, 2003
[b] = U.S. Department of Health and Human Services, 2004
[c] = U.S. Environmental Protection Agency, 2010

Recent History of Environmental Concerns and Regulatory Response:

Studies of PBDEs in laboratory animals have suggested potential concerns about liver toxicity, thyroid toxicity, developmental and reproductive toxicity, and developmental neurotoxicity (reviewed in U.S. Environmental Protection Agency, 2010). There is concern over human exposure to PBDEs, especially in children given the typical exposure mechanism being indoor dust coupled with the increased hand-to-mouth frequency for children. Studies of human blood, breastmilk and adipose tissue samples indicated rapidly increasing concentrations of PBDEs over the last two decades, with concentrations in North Americans generally several times higher than those seen in Europeans (U.S. Environmental Protection Agency, 2010). Although the most recent findings suggest that concentrations in SF Bay biota are decreasing (Sutton et al., 2013), PBDEs measured in humans and wildlife in the SF Bay Area are amongst the highest concentrations reported anywhere in the world (She et al., 2007; reviewed in Shaw and Kannan, 2009). One hypothesis for these elevated concentrations is the existence of California Technical Bulletin 117 (Zota et al., 2008) first passed in 1975, which requires a stricter degree of flame retardation in upholstered furniture than fire safety regulations elsewhere. Until phase-out in 2006, pentaBDE was the predominant flame retardant used to comply with TB 117.

Governments have responded to the rising environmental concerns over PBDEs with bans on production and usage (Table 3). The earliest bans went into effect in parts of Europe, and focused on the penta- and octa-BDE formulations due to the evidence that lower-brominated congeners bioconcentrate more readily than the higher-brominated congeners. Nevertheless, bans on deca-BDE have followed in some locations. In 2003, California passed Assembly Bill 302, becoming the first U.S. state to prohibit the manufacture, distribution, and processing of products containing the penta- and octaBDE formulations. This phase-out was originally scheduled for 2008, although the Legislature later accelerated that timeframe for phase-out to begin as of June 1, 2006. The United Stated Environmental Protection Agency (USEPA) has now negotiated with the two major U.S. manufacturers to end production, importation, and sales of decaBDE for most uses by December 31, 2012, and to end all uses by late 2013 (U.S. Environmental Protection Agency, 2010). The USEPA has also encouraged the other minor importers of decaBDE to join this initiative, although the ban does not prevent decaBDE importation.

Table 3. Years when bans on PBDEs went into effect in various parts of the world.

	Year of Ban		
Location	**pentaBDE**	**octaBDE**	**decaBDE**
California	2006	2006	2013[1]
European Union	2004	2004	2008
Sweden	1999	unknown	2007
Australia	2007	2007	unknown
China	2006	2006	unknown

How do PBDEs behave in the environment?

PBDEs enter our surface waters primarily from stormwater runoff and sewage treatment plant discharges, as well as in minor amounts from rainfall and direct atmospheric deposition. PBDEs in the terrestrial landscape are primarily atmospherically deposited after emissions from production, use, and disposal/recycling. PBDEs are semivolatile organic compounds and have low water solubilities, however their vapor pressures differ enough from one another to affect their movement into and within various media of the environment. At air temperatures of 25°C, > 98% of the mono-, di-, triBDE (homologue group) congeners may be present in the vapor phase, tetra- and pentaBDE (homologue group) congeners begin to distribute more to atmospheric particles (e.g. BDE-47 is 10% particle phase, BDE-99 is 39% particle phase), hexa- and hepta- congeners are 87 - 99% particle phase, and 99% of BDE-209 is expected to be associated with airborne particles. This vapor versus particle phase distribution has important implications for how and where different BDEs move and settle in the environment.

Air: Lower-brominated homologs (e.g., tri- and tetraBDE) are volatile and persistent enough to permit long-range transport. In fact, the tetra-brominated BDE-47 has even been detected in environmental samples in remote regions of the world such as the Arctic and Tibetan Plateau (de Wit et al., 2006; Wang et al., 2009a). Higher-brominated congeners (e.g. BDE-209) may also be found in air samples, but are more likely to deposit closer to their sources as they are more prone to wet and dry atmospheric deposition. For example, in a study of atmospheric concentrations of PBDEs in urban and rural areas of the Great Lakes region, Strandberg et al. (2001) found that the dominant congeners in air samples were BDE-47, -99, and -100, while BDE-209 was only detected in the Chicago area, likely near to point sources. Ambient and near source air monitoring has been conducted by the California Air Resources Board (CARB) in California urban areas and near automobile shredders and electronics recycling facilities. While all urban areas contained background levels, the near source areas were highly elevated in comparison (results discussed in greater detail later).

[1] As described in the text above Table 3, this "ban" is actually a negotiation between the U.S. EPA and the two major U.S. manufacturers to end production, importation, and sales of all decaBDE by the end of 2013. This does not effectively ban importation of decaBDE by smaller importers.

Soil/Sediment: Adsorption of PBDEs increases with bromination and organic carbon content of soil and sediment. PBDEs in soils across the landscape are therefore expected to be in greater concentrations nearest to point sources – urban areas, and source areas within the urban environment. In particular, decaBDE (predominantly BDE-209) is expected to deposit near its source and not be particularly mobile in the environment. DecaBDE will transport however, via the particle it is bound to as that particle is mobilized through the environment (e.g. in stormwater runoff).

Water: In water, greater proportions of the lower-brominated homologs will remain suspended in the water column as compared to the higher-brominated homologs that are more likely to settle out on sediment particles. In the SF Bay, BDE-47 is the congener found in the highest concentrations in the water column, whereas BDE-209 is the dominant congener in the Bay's surficial sediment samples (Klosterhaus et al., 2012).

Stormwater: Stormwater represents an important pathway particularly for the particle-bound higher-brominated PBDEs (e.g. BDE-209) to move from the terrestrial landscape to the Bay. Stormwater concentrations in Zone 4 Line A, a 100% urban tributary in Hayward, showed a strong correlation with turbidity, for both the sum of PBDEs as well as the individual congeners BDE-47 and BDE-209 (r^2 = 0.88, 0.9, and 0.86, respectively; Gilbreath et al., 2012). In this watershed, an estimated 99.3% of the total PBDE load was transported during storm flow conditions and 58% of the total load was BDE-209 and 6% was BDE-47 thus the majority of PBDEs in stormwater are accounted for with these two BDEs alone. BDE-99, 206, 207 and 208 contributed another 5-10% of the load. These observations are consistent with other local urbanized tributaries in the SF Bay Area well (Oram et al., 2008).

Debromination and Transformation: Lower-brominated PBDEs are more lipophilic, and hence more likely to accumulate in aquatic organisms, than their higher-brominated counterparts. However, studies suggest that transformation of higher-brominated congeners to more bioaccumulative forms may occur through microbial degradation, metabolic debromination, photodegradation, and possibly reaction with the hydroxyl radical (reviewed in U.S. Environmental Protection Agency, 2010).

Release Mechanisms to the Environment and Possible Pollutant Source Areas

Environmental sediment core data from numerous studies generally show increases in PBDEs beginning in the late 1960's or early 70's (Qiu et al., 2010; Zegers et al., 2003), concurrent with the beginnings of commercial production. Although in California the penta- and octa- formulations were banned in 2006, and production, importation, and sales of decaBDE by the two major US manufacturers will end for all uses by the end of 2013, the volume of PBDEs still in use in products manufactured prior to these bans is enormous. Steadily over the next several years to decades, this standing stock will be disposed of or recycled, creating still further opportunities for PBDEs to enter the environment. Releases of PBDEs to the environment can occur during initial synthesis of

the compounds, during its incorporation into polymers, during the usage of products containing PBDEs, and as the result of disposal, recycling or incineration of PBDE-containing products. These pathways of release into the SF Bay Area environment are explored in this section.

Initial Synthesis: There are no locations of manufacture of PBDEs in the SF Bay Area. PBDEs were historically manufactured within the U.S. only in Arkansas and will no longer be manufactured at all in the U.S. after 2013.

Releases from Incorporation Processes into Polymers: Given the recent bans on usage in consumer products, sites of PBDE incorporation into polymers should not be a continuing mechanism of release into the environment. However, legacy contamination may exist around areas where such manufacture occurred in the past. While not an exhaustive list of decaBDE sources as only certain emitters are required to self-report, the USEPA Toxic Release Inventory (TRI) includes two business locations within the Bay Area that self-report on- and off-site releases of decaBDE. Both locations are in the Peninsula region (Redwood City and Menlo Park) and are associated with Tyco Thermal Controls. While the majority of decaBDE disposal from these businesses has been done through landfilling and recycling, air emission releases have also been reported. At the Redwood City location for nearly the entire period between 1991 and 2005, Tyco self-reported air emission releases of 113 kg of decaBDE each year. This is a significant load in relation to the previously estimated annual load to the SF Bay of 33-52 kg (BDEs 47+209; Oram et al., 2008). Other business types that may be important source areas include manufacturers of electronics equipment, plastics, cars, carpet and furniture.

During Product Usage: Degradation of in-use products containing PBDEs is an important mechanism of exposure for humans and release particularly to the indoor environment. PBDEs are additive flame retardants, meaning they are simply blended into polymers rather than chemically bonded, enabling them to readily leach out of products. As a result, indoor dust represents the primary exposure pathway for most humans. Some of this dust migrates outside, some goes down our drains to sewage treatment plants, and some goes into the garbage can (e.g. through disposal of waste from vacuum cleaners) for disposal at a landfill. In addition, clothing is both a source as well as a filter for air and thus dryer lint is enriched with PBDEs (Stapleton et al., 2005), which is usually partially trapped in the dryer lint trap and disposed of in the garbage and partially vented to an outside wall of each house. In the outdoor environment, PBDEs are found ubiquitously, with more densely populated urban areas generally containing higher concentrations of PBDEs than agricultural and rural areas (with the exception of sewage sludge-applied lands (e.g. Strandberg et al., 2001)).

Source areas of in-use products that may have concentrations of PBDEs greater than the general urban signal might include:

- Carpet, upholstery and furniture manufacturers and warehouses
- Electronics manufacturers and distribution warehouses
- Foam manufacturers and distributors

Due to recent bans on PBDEs, these source areas are not expected to continue to release PBDEs at the same rates in the future, however, the immediate surrounding landscapes of the above-listed areas may have elevated PBDE concentrations due to a legacy build-up of leached PBDEs.

Disposal and Recycling: The most important remaining pathway for PBDE release into the environment is in the process of disposal – into landfills, recycling, or in sewage sludge. Landfill disposal is not expected to result in significant environmental releases because of the US laws for municipal solid waste landfills aimed at creating conditions to prevent such releases (liners, treated leachate[2]) (U.S. Environmental Protection Agency, 2010). However, environmental releases are expected or have been shown to result for all of the following source areas:

- E-waste recycling facilities
- Automobile shredding and recycling facilities or "Autoshredders"
- Carpet and foam recycling facilities
- Sewage Sludge application to rural lands
- Publicly Owned Treatment Works (POTW) sewage sludge incinerators

California e-waste is estimated at 1200 metric t/yr (Petreas and Oros, 2009) and comprises the largest proportion of PBDEs in the California waste stream. E-waste today is reflective of the magnitude of electronics sold in previous years, which increased (by weight, see Figure 2) steadily in the 1980's, and sharply in the 1990's to a peak of nearly 3 million short tons (2.92 M metric t) in 2000, and has since plateaued (U.S. Environmental Protection Agency, 2011). The USEPA estimates the average lifespan of most electronic products to range between 5 and 15 years, depending on the product. Therefore, despite the recent PBDE bans in California, we would expect PBDEs to remain in the e-waste stream for many years to come, and BDE-209 is expected to dominate the congener profile for these products. E-wastes are usually recycled, landfilled or incinerated, and a large proportion of e-wastes are exported to China. Elevated PBDE concentrations in runoff from e-waste recycling facilities may be expected, however the only studies to report sample data near such facilities are from China (see Table 4) where e-waste recycling practices may differ from practices in the U.S.

Autoshredders may pose as another important source area for PBDE releases given that PBDEs have been used in the plastics and foam within automobiles. Seven autoshredder facilities in California, two of which are in the SF Bay Area (Sims Metal Recycling in Redwood City and Schnitzer Steel in Oakland), generate an estimated 300,000 tons of waste (including millable components of automobiles, refrigerators, and ovens) each year (Department of Toxic Substances Control, 2002) primarily to be used as alternative daily cover (ADC; material other than soil placed on the surface of municipal solid-waste

[2] Untreated leachate has been found to contain PBDEs, however in the one study that addressed PBDE concentrations in treated leachate, no PBDEs were detected (reviewed in U.S. Environmental Protection Agency, 2010).

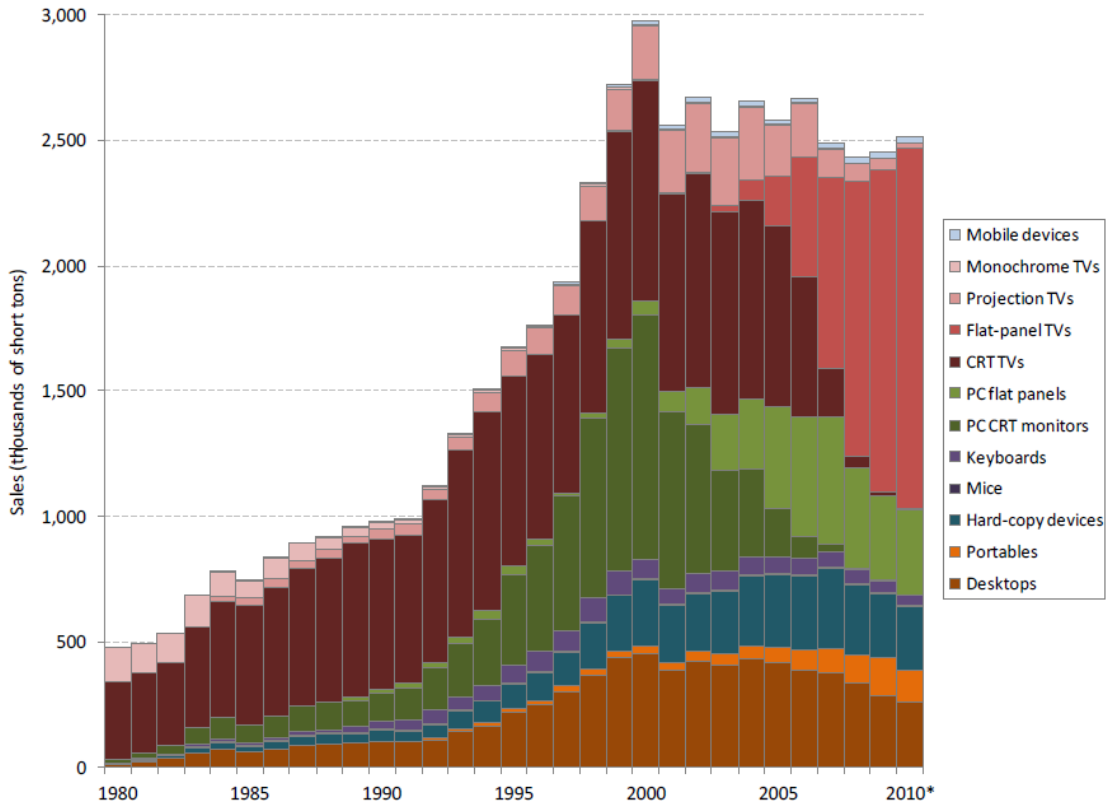

Figure 2. Annual sales of electronic products (in thousands of short tons) (from U.S. Environmental Protection Agency, 2011, without permission). PBDEs in these products range up to 30% by weight (Hale et al., 2003).

landfills at the end of each operating day). Shredder waste consists of glass, fiber, rubber, automobile fluids, dirt and plastics found in automobiles and household appliances that remain after the recyclable metals have been removed (Department of Toxic Substances Control, 2002). Autoshredder waste sampled in the SF Bay Area contained approximately 50,000 ng/g of total PBDEs (Petreas and Oros, 2009), though higher levels have been reported elsewhere (310,000 ng/g in Japan, Sakai et al., 2006). While usage as ADC in lined landfills is not expected to release PBDEs into the environment (U.S. Department of Health and Human Services, 2004) such that it would be available for transport to surface waters, autoshredder facilities can be an important local source when wind blows shredder residue or "auto fluff" onto surface waters or surrounding areas).

The CARB conducted ambient air monitoring in urban areas of California and near e-waste recycling and autoshredder facilities. BDE-209 near an electronics recycling facility measured up to 11,000 pg/m^3 and up to 1,900 pg/m^3 near an auto-shredding facility (Charles et al., 2005). These elevated near-source concentrations contrast sharply with ambient urban concentrations averaging 25 pg/m^3 of BDE-209 in six SF Bay Area

and Southern California cities (average of 160 pg/m^3 for the sum of PBDEs in 2004 monitoring; CARB website http://www.arb.ca.gov/app/dioxin/cadamp.php).

No data could be found on water or soil concentrations of PBDEs in or around carpet, carpet padding and foam recycling facilities. However, exposure to these sources has been shown to cause significantly elevated blood serum levels of PBDEs in humans (Stapleton et al., 2008) and thus areas surrounding these facilities may have elevated concentrations due to PBDE releases through the crumbling of this material at the end of its life and as it is being physically manipulated for disposal. A simple hypothetical scenario (inclusive of numerous untested assumptions) illustrates the potential magnitude of PBDEs that may be released into the environment from this source. An estimated 175,000 metric t of carpet and carpet padding was discarded to landfills and recycling in California in 2011 (CARE, http://www.carpetrecovery.org/, accessed Jan.2013). Assuming carpet padding represents approximately one quarter of the total discarded mass by weight, PBDEs in the carpet padding equal approximately 0.3% by weight (based on studies overseen by Dr. Robert Hale and reported by the Carpet Cushion Council, http://www.carpetcushion.org/bonded-cushion.cfm), 0.5%[3] of the PBDEs in that material are released to the environment during the disposal or recycling process, and then weighting the resulting load by the percentage of the California population living in the Bay Area (19%), then 125 kg of PBDEs would be released annually from discarded carpet padding. Again, this is a significant load in relation to the previously estimated annual load to the SF Bay of 33-52 kg (BDEs 47+209; Oram et al., 2008).

PBDEs have been found in high concentrations in sewage sludge. Land application of biosolids is generally viewed as beneficial (e.g. the U.S. EPA: http://water.epa.gov/polwaste/wastewater/treatment/biosolids/genqa.cfm), however, it also is a mechanism of redistribution of PBDEs out into the rural environment. Hale et al. (2001) tested 11 sludge samples from four different states and found that the sum concentrations of the -47, -99, -100, -153, and -154 congeners were relatively consistent regardless of location of pre-treatment, ranging from 1,100 to 2,290 ng/g. This exceeds some European sludge concentrations of these congeners by 10 to 100-fold (Hale et al., 2001; reviewed in de Wit, 2002). Concentrations of BDE-209 in the Hale et al. (2001) samples varied more greatly between 84.8–4,890 ng/g. Measurements of PBDEs in sewage sludge of the SF Bay Area are within a similar range: one POTW sampled in 2002 (North, 2004) and three others sampled in 2005 (Petreas and Oros, 2009) contained average total PBDE concentrations of 2,600 ng/g, and biosolids measured from two SF Bay Area treatment plants were 2,917 and 3,651 ng/g (County of Solano, 2012).

A report commissioned by the Bay Area Clean Water Agencies noted that the SF Bay Area produced 158,000 metric t of sewage sludge in 2007, and this number is projected to rise with increasing population (Mitchell, 2009). Of this, 19% (~30,000 metric t) was land applied (Figure 3; Mitchell, 2009). At an average concentration of 2,800 ng/g, an estimated total of 84 kg of PBDEs are annually released through sewage sludge land application. Although it is unknown how much of this load is applied within the Region 2

[3] It is unknown how realistic this assumption is.

boundary, Solano County reported an approximate average of 10,000 tons being land applied annually between 2002 and 2011 (County of Solano, 2012), so at least approximately 25-30 kg of PBDEs are being land applied within Solano County. Again, as compared with the previously estimated annual loads to the SF Bay, this back-of-the-envelope calculation shows that sewage sludge land application may have a significant role in PBDE loading to the Bay from at least certain small tributaries. Note however, that Solano has a higher proportion of crop agricultural land than most other Bay Area counties thus Solano is not necessarily typical.

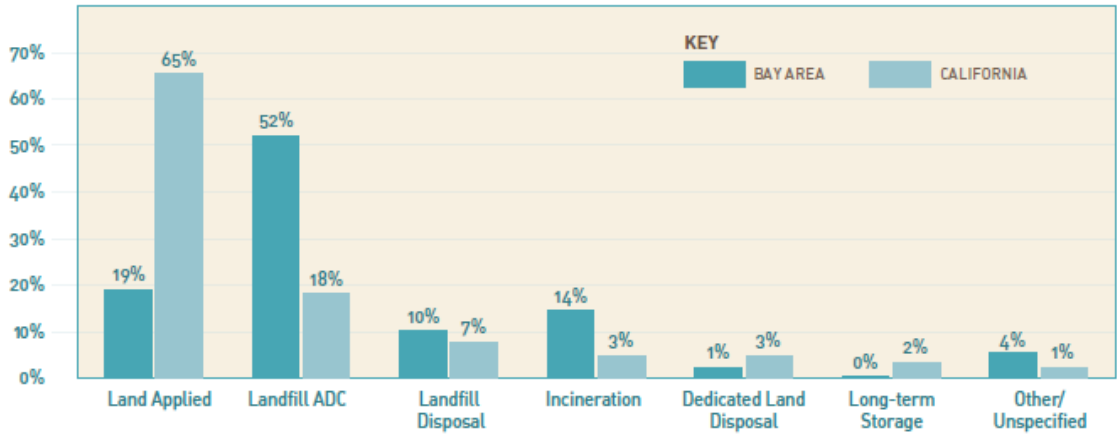

Figure 3. Bay Area and California biosolids management practices in 2007 (figure from Mitchell, 2009 without permission).

Landfilling of sewage sludge (as ADC) is not expected to result in environmental release, but incineration may. Only two POTWs in California incinerate biosolids, both of which are located in the SF Bay Area, explaining why a much greater portion of biosolids in the SF Bay Area are incinerated as compared to California as a whole (Figure 3). In a 2004 study in which stack emissions from a SF Bay Area POTW incineration facility were analyzed for brominated dioxins and furans, North noted that PBDEs were not measured because it was assumed all PBDEs would be transformed to dioxins during the process. Given that this study reported 96% of the PBDEs entering the POTW were trapped within the sludge, a follow-up study to verify that assumption may be warranted. Areas surrounding the two POTW incinerators located in the cities of Palo Alto and Concord may therefore represent source areas, however this hypothesis has not been studied.

Source Areas and Pollutant Concentrations in Soils

Soils data from a survey of the world literature supports the hypothesis that higher PBDE concentrations are generally found in the urban environment relative to the rural environment. The world literature on PBDE concentrations in soils is dominated by studies conducted in Europe (UK, Sweden, Norway, France) and China. Few studies have reported soils concentrations in the U.S. and to our knowledge, no soils data is available

for the SF Bay Area. In the following tables, we report statistics on soils data collected in individual studies (Table 4), as well as summarize this data into land use classes (Table 5) that may be considered for our regional modeling efforts.

The ordering scheme was chosen because most of the studies reported mean concentration data, whereas fewer studies reported medians (Table 5). The ordering would be very similar if the classes had instead been organized by maximum concentrations measured in each class, though the "urban" category would have moved farther down the list. This general ordering matches the conceptual model of PBDEs as a relatively ubiquitous urban contaminant, with a few important source areas. However, there is much deviation within this scheme when considering the individual studies (Table 4), and in part this is due to the variable definitions for land use terms. For example, Duan et al. (2010) looked at PBDE concentrations on a small island in China where the mean concentrations sampled amongst the various rural land uses there (5.5-14 ng/g) are elevated above some urban areas in France, the UK, and even other locations in China (Muresan et al., 2010; Harrad, 2006; Jiang et al., 2010). Likely, these more elevated concentrations are the result of Chongming Island's proximity to a very urban landscape (Chongming Island is part of the Shanghai municipal area and includes modern shipbuilding, port machinery and communications equipment manufacturing, and biopharmaceutical manufacturing). Other agricultural areas in China also indicate more elevated concentrations (e.g., Luo et al., 2009; Zou et al., 2007) and again, this may be due to the proximity to urban centers, or in the case of agriculture, it may be due to practices in biosolids application. With this in mind, there may be good justification to create a new land use category that describes open spaces that are in close proximity to urban (e.g. "rural with urban influence"), and to recognize that agricultural lands may have widely varying concentrations depending on biosolids application practices.

The very elevated levels of PBDEs in sludge applied lands are striking in that it provides further support for the hypothesis that PBDE distributions in soils are not isolated to the urban environment alone and PDBEs are being redistributed at high concentrations into portions of the rural environment. Commensurate with usage and market demand statistics, PBDE concentrations in sewage sludge tend to be higher in the U.S. than in Europe (Hale et al., 2001; Andrade et al., 2010), and therefore sludge applied lands in and near the SF Bay Area may have concentrations elevated beyond those reported outside the US. Ironically, of the studies reported here, the U.S. sludge applied lands return some of the lower concentrations. Complicating the understanding of PBDE concentrations in sludge applied lands, Andrade et al. (2010) demonstrated that multiple applications over the years leads to greater PBDE concentrations in the soil, and Gorgy et al. (2013) found that PBDE concentrations decrease exponentially with time following the application of biosolids with part of the losses attributed to downward migration of the PBDEs into the soil and hypothesizing that a large proportion of the PBDEs degrade. One might also hypothesize that some of the losses may be attributed to mobilization in stormwater runoff or irrigation runoff. Further additional factors such as the tonnage of biosolids applied per acre or differences in crop practices that enhance local degradation, resuspension, or wash-off of PBDEs may alter PBDE mass that may find its way into stormwater and result in elevated concentrations from sewage applied lands.

Table 4. PBDE concentrations in soils data from a search of world literature.

Class	Description	Specific Location	PBDE concentrations (ng/g)				Reference
			Min	Max	Mean	Median	
Background	Arctic	Russian Arctic	0.16	0.23	0.20[a]		de Wit et al., 2006
	Reference soils	Sweden	0.03	1.9	0.15	0.61	Sellström et al., 2005
	Upland soils	Tibetan Plateau, China	0.004	0.04	0.0111		Wang et al., 2009a
Open Space	Woodland	Chongming Island, China	7.0	16	12		Duan et al., 2010
	Woodland	France	0.23	5.1	1.2	0.59	Muresan et al., 2010
	Woodland	UK	0.11	12	6.1[a]	2.5	Hassanin et al., 2003
	Woodland	Norway	0.13	3.0	1.6[a]	0.97	Hassanin et al., 2003
	Grassland	Chongming Island, China	0.48	9.5	5.5		Duan et al., 2010
	Grassland	UK	0.07	6.0	3.0[a]	0.61	Hassanin et al., 2003
Agriculture	Agriculture	Pearl River Delta, China			15		Zou et al., 2007
	Agriculture	USA	< MDL	11	2.2	< MDL	Andrade et al., 2010
	Agriculture	USA			0.5		Rieck, 2004
	Agriculture	Canada			0.3		Gorgy et al., 2013
	Agriculture	France	0.24	44	1.9	0.66	Muresan et al., 2010
	Agriculture	Sweden	0.03	0.10	0.066	0.06	Matscheko et al., 2002
	Agriculture	Surabaya, Indonesia	0.08	0.35	0.23		Ilyas et al., 2010
	Agriculture (near urbanized area)	Chongming Island, China	0.32	37	14		Duan et al., 2010
	Agriculture (rural)	Qingyuan,China	5.3	29	20		Luo et al., 2009
	Agriculture near an electric and electronic manufacturing zone	Qingyuan,China	50	81	64		Luo et al., 2009
Rural	Rural	UK	0.07	0.29	0.22	0.24	Harrad, 2006
	Road - Rural (near urbanized area)	Chongming Island, China	5.7	26	14		Duan et al., 2010
Urban	Suburban	UK	0.24	0.40	0.32	0.32	Harrad, 2006
	Urban	Taiyuan city, China	0.02	211	26	2.1	Li et al., 2008
	Urban	France	0.32	18	2.2	1.1	Muresan et al., 2010
	Urban	UK	0.54	3.9	1.8	0.84	Harrad, 2006
	Urban	Shanghai, China	0.02	3.8	0.74		Jiang et al., 2010
	Urban	Harbin, China	0.002	0.06	0.026		Wang et al., 2009b
	Urban	Ningbo, China	1.0	20	11[a]	10	Wang et al., 2011

[a] The mean reported here was calculated as the average of the minimum and maximum concentrations reported in each reference.

Table 4 (cont). PBDE concentrations in soils data from a search of world literature.

Class	Description	Specific Location	PBDE concentrations (ng/g)				Reference
			Min	Max	Mean	Median	
Urban (cont.)	Urban roads	Surabaya, Indonesia	1	22	10		Ilyas et al., 2010
	Urban sewer sediments	Hochiminh city	55	119	82	83	Minh et al., 2010
	Urban	15 states in USA	0.09	1200	82	5.3	Offenberg et al., 2006 *in* U.S. Environmental Protection Agency, 2010
	Mixed urban/rural: Floodplain soils	Shiawassee R, Michigan	0.94	55	14		Yun et al., 2008
	Mixed urban/rural: Floodplain soils	Saginaw R, Michigan	0.09	19	3.0		Yun et al., 2008
Industrial	Industrial	Taiyuan city, China	6.0	144	46	28	Li et al., 2008
	Urban/Low-voltage electrical industrial area	Liushi, China	1.0	155	78[a]	30	Wang et al., 2011
Sludge Applied Lands	Sludge Applied Lands (1x application)	USA	0.51	34	14	11	Andrade et al., 2010
	Sludge Applied Lands (2x applications)	USA	8.5	140	58	55	Andrade et al., 2010
	Sludge Applied Lands	Sweden	0.06	3900	608	1.2	Sellström et al., 2005
	Sludge Applied Lands	Spain	30	689	266	184	Eljarrat et al., 2008
	Sludge Applied Lands	USA	140	7600	3870[a]		Rieck, 2004
	Sludge Applied Lands	Canada	30	600	315[a]		Gorgy et al., 2013
At and Near E-waste Centers	E-waste site soils	China	858	991	940	961	Cai and Jiang, 2006
	E-waste site soils (acid leaching and printer-roller dump site)	Guiyu, China	1440	3570	2505		Leung et al., 2007
	Near E-waste site soils	Pearl River Delta, China	28	122	79	86	Zou et al., 2007
	Road soils of e-waste recycling area	Qingyuan, China	191	9156	2689		Luo et al., 2009
	Urban/E-waste heavy area	Fengjiang, China	95	220	158[a]	140	Wang et al., 2011
	Ag soils near e-waste recycling area	Qingyuan, China	5.0	207	42		Luo et al., 2009
Near Polyurethane Foam (PUF) Plant	Near PUF manufacturing plant	USA	ND	76	30	14	Hale et al., 2002

[a] The mean reported here was calculated as the average of the minimum and maximum concentrations reported in each reference.

Table 5. Summary of PBDE concentrations by class and organized from least to greatest by the mean of the mean[4] concentrations within each class.

Class	N studies	PBDE concentrations (ng/g)		
		Minimum	Maximum	Mean of Means
Background	3	0.004	1.9	0.12
Open Space	6	0.065	16.2	4.9
Rural	2	0.073	26.0	7.3
Agriculture	10	ND	81.2	12
Urban	12	0.002	1200	20
Near PUF Plant	1	ND	76.0	30
Industrial	2	1.00	155	62
Sludge Applied Lands	6	0.063	7600	855
At and Near E-waste Centers	6	5.00	9156	1250

Given the differences in usage of PBDEs between the U.S. and Europe (see market demand in Table 2), and the differences in end-use disposal practices between the U.S. and China (the U.S. typically exporting large quantities of e-waste to China), extrapolation from the world literature to the SF Bay should be done with caution. Although magnitude of use may be elevated in California relative to European countries, the use categories should be the same perhaps leading to generally similar land use relationships.

It should be noted that the PBDE concentrations presented in these two tables are generally much less than seen in the SF Bay Area for PCBs in soils and sediments (e.g. Yee and McKee, 2010). For example, the open space and urban soil concentrations for PCBs are approximately 0.02 mg/kg and 0.06 mg/kg or 20 ng/g and 60 ng/g respectively. Given we generally see higher concentrations and loads of PBDEs relative to PCBs in our mixed land use urban areas, it is a little surprising that PBDE soil concentrations are not at least as high if not higher than the PCB concentrations. If PBDEs are not in the soils at the same magnitude as PCBs and yet they are in urban stormwater at 2-3 times the concentrations of PCBs, they must be coming from real source areas that are specific to PBDEs or from atmospheric fallout onto impervious surfaces such as roadways and rooftops and being washed off during storm events and particulate phase. At this time we cannot be certain of the pathways and processes.

Pollutant Concentrations in Stormwater

Little data exist in the world literature on PBDE concentrations in stormwater, and where PBDEs have been sampled in stormwater, it has been done in mixed-use urban areas

[4] This includes central tendency figures calculated by averaging the minimum and maximum concentrations provided by each reference for those cases in which no average concentration was reported.

(Table 6). Only two studies from outside of the SF Bay Area were found to report on concentrations in small tributaries in Washington and Oregon. Through funding from the RMP, SFEI has sampled 10 mixed-use watersheds around the SF Bay Area for PBDEs in stormwater runoff. Most of the SF Bay Area watersheds have only been studied at a pilot level, with <8 samples collected. In two of these watersheds, more concentration and loading information exists (Guadalupe and Zone 4 Line A).

Table 6. PBDE concentrations in stormwater based on review of peer-reviewed literature and locally collected data by the RMP. All watersheds include mixed-urban land uses. White and light gray highlighted data are from studies outside of the SF Bay Area, and dark gray highlighted data are from local small tributaries.

Specific Location	N	PBDE concentrations (ng/L)				Reference
		Min	Max	Mean	Median	
Spokane River, WA	14			7	5	Lubliner, 2009
Columbia River Basin	16	ND	53	9	0.2	Morace, 2012
Borel Ck, Peninsula Bay Area, CA	3	9	20	14	12	McKee et al., 2012
Coyote Ck, Santa Clara County, CA	7	7	36	15	13	SFEI unpublished
Guadalupe River, San Jose, CA	13	15	369	88	38	SFEI unpublished (WY 2012); McKee et al., 2006
Lower Marsh Ck, Brentwood, CA	1	20	20	20	20	SFEI unpublished
Lower Penetencia Ck, Milpitas, CA	4	13	22	18	19	McKee et al., 2012
San Leandro Ck, San Leandro, CA	3	41	80	57	50	SFEI unpublished
Santa Fe Channel, Richmond, CA	2	24	30	27	27	McKee et al., 2012
Sunnyvale East Channel, Sunnyvale, CA	6	5	100	48	42	McKee et al., 2012; SFEI unpublished (WY 2012)
Zone 4 Line A, Hayward, CA	38	0	430	47	27	Gilbreath et al., 2012
Zone 5 Line M, Union City, CA	4	34	128	75	69	McKee et al., 2012

Table 7. Summary table of PBDE concentrations in SF Bay Area stormwater runoff data.

	Bay Area Data (N=10)
Minimum of dataset (all watersheds, all samples) (ng/L)	**0.4**
Maximum of dataset (all watersheds, all samples) (ng/L)	**430**
Mean of the Means (ng/L)	**41**
Mean of the Means % BDE-47	**8**
Mean of the Means % BDE-209	**58**
Mean of the Means Ratio BDE-209:BDE-47	**10**

Although stormwater data does not exist for homogenous land uses, we preliminarily explore concentrations in the SF Bay Area watersheds with the land use in those watersheds. This exploration yielded strong correlations with the combined sum of High Residential and Open Compacted spaces (Figure 4). The linear trendline in these graphs excludes the one high outlier watershed, Zone 5 Line M in Union City. Zone 5 Line M also had elevated median concentrations, particularly for total mercury (HgT) and to a lesser degree PCBs relative to other watersheds sampled in WY 2011 reconnaissance study (McKee et al., 2012). Although Zone 5 Line M represents an anomaly relative to the other nine Bay Area watersheds with PBDE data, it also represents an opportunity to investigate possible sources. The watershed land uses are approximately 31% residential, 11% transportation, 36% open, 15% commercial, and 7 % industrial. The watershed includes former industrial areas that have been re-zoned and are being redeveloped into a mixed-use transit village. Additionally, a cursory review of the current industrial sector of this small watershed using Google Maps and Google Earth revealed several parcels that may be contributing to the PBDEs or HgT concentrations. These parcels included two custom plastics manufacturers, and a furniture distribution warehouse plus possible small-scale furniture recycling at this location. The most elevated sample concentration at this location was unlike the other samples collected in the same watershed and unlike the rest of the Bay Area samples in that the ratio BDE-209:BDE-47 was 38, as opposed to the SF Bay Area average ratio of 10, and 90% of the sample was comprised of BDEs 206-209, indicating that decaBDE was the dominant source. Further investigation could be done in this watershed to identify important source areas for the regional modeling effort. Particle ratios of PBDEs to suspended sediment concentration (SSC) in local stormwater data was also analyzed for relationships to land uses. No strong correlation was noted. The relationship to percent high density residential was only R^2=0.05. The strongest relationship was to industrial land use (R^2=0.42).

For perspective, Oram et al. (2008) completed a first effort at estimating PBDE loads into SF Bay from various sources. In this study, Oram and colleagues estimated that the small tributaries contributed 11-27% of the BDE-47 load to SF Bay, and 74% of the BDE-209 load. In contrast, effluent from POTWs has concentrations similar to stormwater runoff in the SF Bay Area (mean 29 ng/L; North, 2004) but is dominated by BDE-47 and other pentaBDE congeners (North, 2004). POTW effluent contributes an estimated 36-75% of the BDE-47 load to the Bay, and only 9% of the BDE-209 load (Oram et al., 2008). Presumably most of the BDE-209 load into POTWs is settled out in the sewage sludge. These concentrations in effluent from POTWs and stormwater runoff from small tributaries are about 3 orders of magnitude greater than concentrations sampled in SF Bay waters (Werme et al., 2007).

Local PBDEs in stormwater data was regressed with total mercury (HgT) and PCBs (sum of 40 congeners) to provide preliminary evidence if, at a regional average scale, targeting the clean-up of either of these high priority pollutants of concern would result in multiple benefits for management of PBDEs. On a water concentration basis, PBDEs were correlated with HgT, but not with PCBs (Figure 5). When normalized to suspended sediment concentration, PBDEs did not correlate well with either HgT or PCBs, nor did HgT and PCBs correlate well with one another (Figure 6). The relationship between

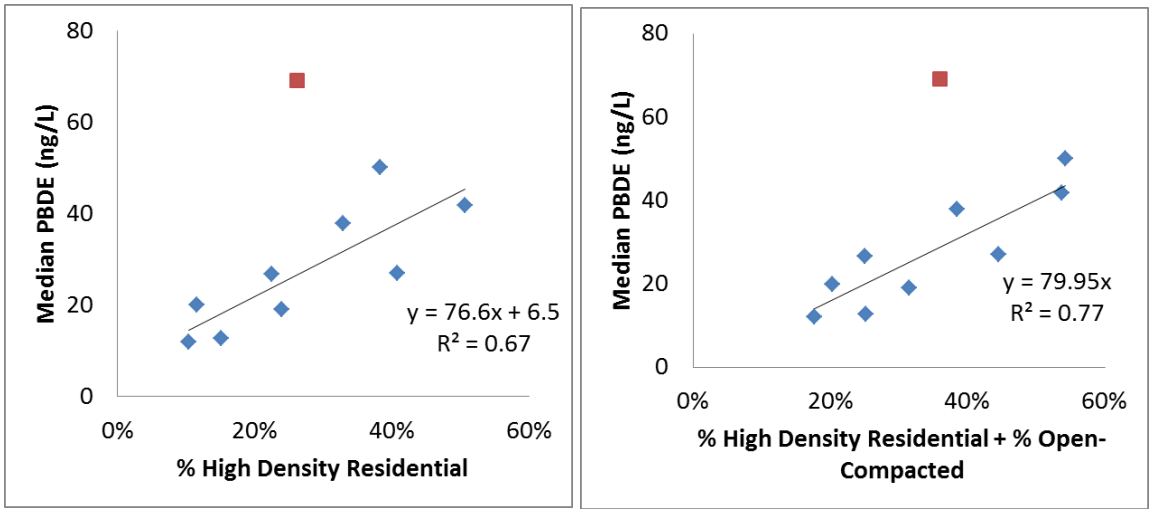

Figure 4. Median PBDE concentrations in relation to the % high density residential (< 0.333 acres/unit) and % compacted open space in nine Bay Area watersheds. The linear trendline is related only to the nine watersheds represented by blue markers; the red marker is Zone 5 Line M.

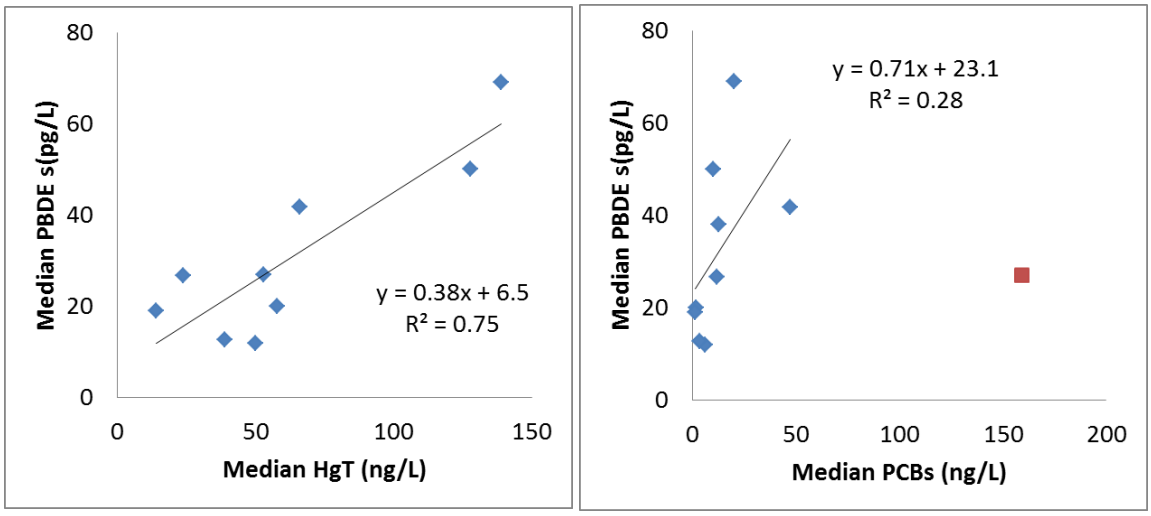

Figure 5. Median PBDE concentrations in relation to median HgT and median PCB concentrations in Bay Area watersheds. The Guadalupe River watershed data is excluded as anomalous from the regression with median HgT due to Hg mining influence in this watershed. The outlier datapoint in red for median PCBs is the PCB hot spot watershed, Santa Fe Channel.

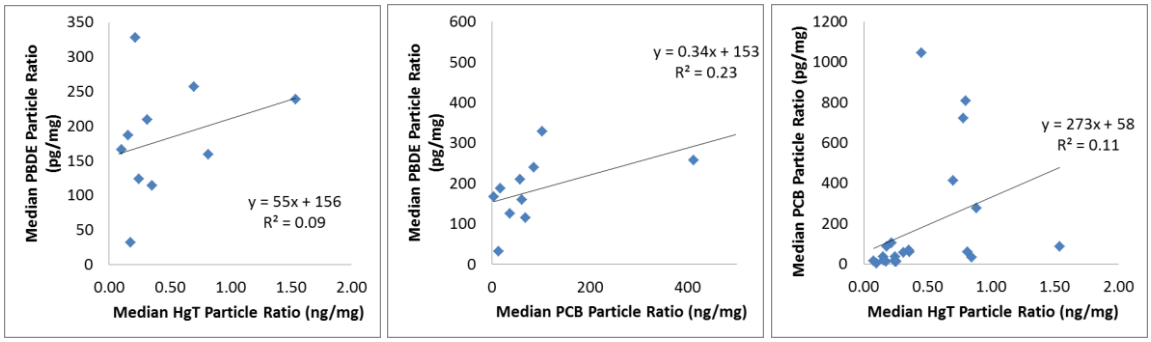

Figure 6. Relationships of median PBDE, HgT and PCB particle ratios in Bay Area watersheds.

median particle ratios for PBDEs and PCBs (Figure 6, center graph) is improved when removing the high PCB outlier (Santa Fe Channel) on the far right of the graph, in which the R^2 raises to 0.45 and the equation line is y = 1.64x + 92.4. No relationship could be found between land use and the ratio of PCBs to PBDEs (median particle ratios), nor between HgT and PBDEs (median particle ratios), for local watersheds. This data suggests that management of PBDEs may coordinate with management of HgT, but not with PCBs. This matches our conceptual models of HgT as being a largely ubiquitous, atmospherically derived source versus PCBs being very much associated with very specific source areas. This is further corroborated by regression of the ratio of median PBDE:PCB water concentrations in stormwater and landscape characteristics (imperviousness, open space, and residential land use) (Figure 7). If we accept the standing hypothesis that PCBs are associated most strongly with sources and source areas in older industrial settings, these relationships appear to suggest that PBDEs are not strongly associated with local old industrial sources/source areas. Instead, more ubiquitous urban use and atmospheric deposition play a stronger role in PBDE concentrations observed in SF Bay Area stormwater.

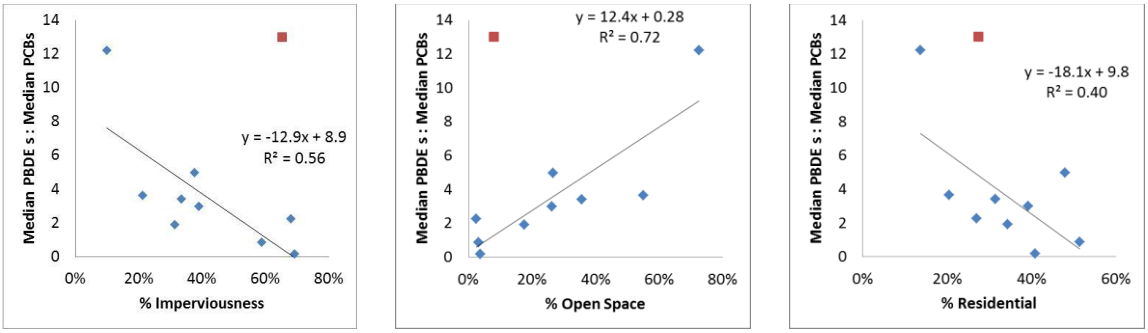

Figure 7. Relationships between landscape characteristics and median PBDE:PCB concentrations in stormwater during rain storms in Bay Area watersheds. The outlier in red is Lower Penetencia Creek.

Summary and Options for Event Mean Concentration (EMC) Development for Pollutant

PBDEs have been widely used as a flame retardant in textiles, plastics, and polyurethane foam products since the 1970's and are now both ubiquitous in the urban environment and also possibly being redistributed to the rural environment through application of biosolids and atmospheric deposition. PBDE loads to SF Bay have been previously estimated (Oram et al., 2008). However, since that time, more local empirical data has been collected for input, calibration, and verification for an improved estimate of loads from the small tributaries, and through the development of this contaminant profile, at least two important sources (sludge applied lands and areas surrounding Tyco Thermal Controls in the Peninsula) have been identified that were not previously captured by the input data into the previous estimate.

To model loads of PBDEs in stormwater runoff from the small tributaries to the SF Bay, unique PBDE concentration/loadings factors could be applied to select land use and source area classes. The systematic review of synthesis, product incorporation and uses, disposal processes, and soil and water concentration data supports a general distinction in PBDE concentrations between urban and rural areas, as well as select source areas. A strong correlation exists between PBDE concentrations in stormwater runoff from nine SF Bay watersheds and the percentage of high residential and compacted open spaces in those watersheds. This correlation alone may provide a good basis for an improved estimation of regional loads, however the one high outlier watershed (Zone 5 Line M) highlights the potential importance of adding in source areas to the PBDE model, to be weighed against the effort needed to identify and obtain reliable data for each type of source area. The potential source areas of most interest for PBDEs and the estimated magnitude of emission factor for each category is presented in Table 8.

Table 8. Proposed land use / source area categories for PBDE based on our present conceptual model generated through this review.

<table>
<tr><th>Land use / source areas</th><th>Estimate emission factor[1]</th><th>GIS layer created?[2]</th><th>Particle concentration data? [2]</th><th>Water concentration data? [2]</th></tr>
<tr><td>All industrial</td><td>M/H</td><td>Y</td><td>Y</td><td rowspan="15">N</td></tr>
<tr><td>Plastics, Electronics, Cars and Textiles Manufacturers</td><td rowspan="5">H</td><td rowspan="5">N</td><td rowspan="4">N</td></tr>
<tr><td>Autoshredders</td></tr>
<tr><td>Carpet/Foam Recycling Facilities</td></tr>
<tr><td>Electronics Recycling Facilities</td><td>Y</td></tr>
<tr><td>Area surrounding Tyco Thermal Controls</td><td rowspan="4">N</td></tr>
<tr><td>Auto recycling/ refurbishing</td><td>M/H</td><td>Y</td></tr>
<tr><td>Landfills that use auto-shredder fluff as daily alternative cover</td><td rowspan="4">M</td><td>N</td></tr>
<tr><td>All transportation</td><td rowspan="7">Y</td></tr>
<tr><td>Urban (except industrial)</td><td>Y</td></tr>
<tr><td>Commercial</td><td rowspan="3">N</td></tr>
<tr><td>High density residential</td><td>M/H</td></tr>
<tr><td>Low density residential</td><td>L/M</td></tr>
<tr><td>All nonurban (except sludge applied lands)</td><td>L</td><td rowspan="2">Y</td></tr>
<tr><td>Sludge Applied Lands</td><td>H</td><td>N</td></tr>
</table>

[1] Estimated magnitude of emission factor: High (H); Medium (M); Low (L).
[2] Indication of current availability of GIS shapefile and concentration data for each source area category: Yes (Y); No (N). An "N" indicates additional effort is needed to integrate this category into the RWSM.

To support the development of a regional PBDE loads model, GIS databases and shapefiles of the above listed source areas could be developed, and average soils, suspended particulate matter, or stormwater concentrations in those areas would need to be defined. Differences in usage patterns between the U.S. and elsewhere, and even California versus the rest of the U.S., confounds the usage of concentration data from outside areas but the general pattern of more highly versus less contaminated areas might hold true for the SF Bay Area more than the magnitude of concentrations. Therefore, to the extent possible, we recommend the use of local data as a starting point and data from the rest of the U.S. and outside of the U.S. for making decisions about the relative order magnitude of EMCs or concentration factors. Where necessary, data from outside the SF Bay Area can be used to augment the local dataset with the expectation that initial model runs might indicate the need for development of local data for input into the model. Options for developing the SF Bay Area specific EMC estimates needed for input into the spreadsheet model include:

A. Back calculating the EMCs for both land uses and source areas from the current local stormwater datasets. This method has shown promise for the Hg and PCB versions of the RWSM, however the success of this method is in part dependent on the source area classes being present in the watersheds with empirical data and the size of the data set (number of locations sampled assuming a robust number of samples per location – at least 4 but ideally 6-8 samples collected during storm flow conditions).

B. Conduct empirical studies of PBDEs in runoff or soils from the above listed source areas. Such studies may have added benefit for sampling of other priority analytes in similar source area classes (e.g. metals near autoshredders). These source area EMCs could potentially be added to the more generalized urban versus rural land use model, or a model that applies concentrations based on high residential and compacted open spaces.

C. Use air monitoring data and assumptions regarding particle settlement and air deposition of PBDEs to estimate EMCs for source areas where air sampling has occurred (near autoshredders, e-waste recyclers, etc.) assuming storage and runoff characteristics of the local landscape (e.g. perhaps scaling for the runoff coefficient).

Preliminary Recommendations for Pollutant RWSM development

Most studies reporting environmental concentrations of PBDEs are for soils. Unfortunately no local soils data have been collected for comparison to measurements from other parts of the world, and given differences in use and recycling practices, we suggest using the soils data in combination with a sediment model only as a line of basic QA. Fewer stormwater studies have been conducted and none for homogenous land use types, but we do have 10 local watershed datasets and preliminary analysis of this data shows concentrations correlate fairly strongly with some identified land uses. As a result,

we suggest estimating regional loads of PBDEs based on the application of our local stormwater concentration data to the volume results of the hydrology model. In short, we recommend a land-use based volume-concentration model. This approach appears to be supported by the correlations with mercury and the lack of correlations with PCBs. Given that concentrations of PBDEs in stormwater are expected to be continually trending downward due to the effects of the recent bans on PBDEs, such modeling should be considered to represent baseline conditions and not to predict future loads.

To develop a baseline model of the regional PBDE load, we suggest the following steps:

1) Further explore land use correlations between the SF Bay Area specific stormwater runoff data and the >150 ABAG defined land use classes. This may be the simplest approach towards reaching a calibrated model with a level of uncertainty we can feel comfortable with in this first version of the PBDE model. This approach would allow us to utilize the already-developed land-use based volume-concentration model that was used for the test case copper model.

2) If the above approach does not produce strong enough results, develop GIS layers for some or all of the source areas identified and apply effort towards developing EMCs for those source areas (further updated literature review focused on recent studies to account for the expected downward trend in PBDE concentrations due to the effects of recent bans on PBDEs, back calculation, or – as a last resort – empirical field data collection). This type of model would also be a land-use based volume-concentration model; however it would require integration of the source areas into the land use layer as was done for the Hg and PCB models.

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Legacy Pesticides Sub-Report

Chlordanes, DDTs and Dieldrin

Submitted on behalf of all Permittees in Compliance with Provision C.14.a of Order R2-2009-0074

Prepared as a Regional Project for:

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LIST OF ABBREVIATIONS

303(d) list	United States Clean Water Act 303(d) list
ATSDR	Agency for Toxic Substances and Disease Registry
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CEP	Clean Estuary Partnership
CM/IA	Conceptual Model/Impairment Assessment
CTR	California Toxics Rule
CD3	Contaminant Data Display & Download
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
ERL	Effects Range - Low
ERM	Effects Range - Median
MRP	Municipal Regional Stormwater NPDES Permit (Order R2-2009-0074)
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
POC	Pollutants of Concern
POTW	Publicly Owned Treatment Works
RMP	Regional Monitoring Program
SFEI	San Francisco Estuary Institute
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1.0 INTRODUCTION

This *Legacy Pesticides Sub-Report* was prepared for the Bay Area Stormwater Management Agencies Association (BASMAA) representing all towns, cities, counties and flood control agencies (i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP, Order R2-2009-0074) issued by the San Francisco Regional Water Quality Control Board (Water Board) on October 14, 2009. This report addresses the requirements of MRP Provisions C.14.a.iii-vii for characterizing legacy pesticide concentrations in urban stormwater and identifying control measures and/or management practices to eliminate or reduce discharges of legacy pesticides discharged by urban runoff conveyances systems.

Requirements associated with legacy pesticides are included in the MRP because regulatory agencies have previously identified legacy pesticides as impairing beneficial uses in the San Francisco Bay, and determined that urban stormwater is a likely or potential cause or contributor to the impairment (SFRWQCB 2009). In 1994, the Water Board conducted a study to measure the level of chemical contaminants in sport fish in the San Francisco Bay. The study found levels of PCBs, mercury, dioxins, and legacy pesticides (chlordanes, DDTs and dieldrin) in fish exceed potential levels of concern (OEHHA 2007). Based on the findings of the study, the California Office of Environmental Health Hazard Assessment (OEHHA) confirmed the potential health risk and issued an interim advisory directed at consumption of sport fish from the Bay (OEHHA 2007). As a result of the advisory, the United States Environmental Protection Agency (USEPA) added the San Francisco Bay to the 1998 United States Clean Water Act 303(d) list as impaired by legacy pesticides. Currently, the San Francisco Bay is on the most recent 303(d) list as impaired by legacy pollutants (SWRCB 2011) and the sport fish advisory is still in place (OEHHA 2007).

Provision C.14 of the MRP includes the same requirements for legacy pollutants, polybrominated diphenyl ethers (PBDEs), and selenium (hereinafter C.14 pollutants) in urban runoff. Total Maximum Daily Loads (TMDLs) and reevaluations of impairments are planned or are in the early stages of development for each of the C.14 pollutants. Provision C.14 serves as an interim step between impairment listings and TMDL development or delisting. In particular, the MRP provisions require Permittees to implement a plan that characterizes the representative distribution of C.14 pollutants in the urban areas of the San Francisco Bay Region to answer the following questions:

- Are C.14 pollutants present in urban runoff?
- Are C.14 pollutants (relatively) uniformly distributed in urban areas?
- Are storm drains or other surface drainage pathways sources of C.14 in themselves?
- Are there specific locations within the urban watershed where prior or current uses result in land sources contributing to discharge of C.14 pollutants to the Bay via urban runoff conveyance systems?

Permittees are also required to provide information to allow for the calculation of C.14 pollutant loadings to San Francisco Bay from urban runoff conveyance systems and identify control measures and/or management practices to eliminate or reduce discharges from these systems.

This report addresses all questions and requirements regarding legacy pesticides that are included in the MRP. With regard to urban runoff characterization data, results of monitoring studies implemented prior to and during MRP implementation are described. Pre-MRP monitoring data described include those collected via the Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs and Organochlorine Pesticides (KLI and EOA 2002), which sampled storm drain sediments and included legacy (organochlorine) pesticides in the analyses. Monitoring data collected in compliance with

Provision C.8 of the MRP, including fine-grained bedded sediments sampled from receiving waters (i.e., creeks) in 2012 and described in the Water Year 2012 Regional Urban Creek Monitoring Report are also summarized.

2.0 BACKGROUND

During the mid-20th Century, organochlorine pesticides were used as insecticides for agriculture, pest control and mosquito abatement. Though their use was discontinued in the late 1980s, these pesticides have persisted in the environment and presently remain a concern to water quality regulators and managers. Because of their persistence, these pesticides are known as legacy pesticides. In the San Francisco Bay, the main legacy pesticides of concern are chlordanes, dichlorodiphenyltrichloroethane (DDTs), and dieldrin. These organochlorine pesticides are especially problematic because they are lipophilic and bioaccumulate in fish and wildlife (Connor et al. 2004, Connor 2007). Due to their hydrophobic properties, legacy pesticides also associated with both bedded and suspended sediments in the Bay and its tributaries.

2.1. Chlordanes

Chlordanes are a toxic, bioaccumulative (USEPA 2011a) synthetic chemical mixture of many related chemicals including pure chlordane and the following (Connor et al. 2004):

- alpha-chlordane
- gamma-chlordane
- cis-nonachlor
- trans-nonachlor
- oxychlordane
- heptachlor
- heptachlor epoxide
- oxychlordane

Chlordane was first used in the United States in 1948 as a pesticide on agricultural crops, lawns, and as a fumigating agent. Thirty years later in 1978, the EPA banned its use on food crops and phased out other above-ground uses over the next five years. Its use as an underground termite control was still allowed until 1988, when all uses of chlordane were banned (USEPA 2011a).

Exposure to chlordane can harm the endocrine, nervous, and digestive systems and the liver. It is a likely carcinogen, and may cause liver cancer. Additionally, it may cause behavioral disorders in children if their mother has ingested contaminated fish or shellfish and chlordane is transmitted through their mother's blood stream or breast milk. Chlordane has been found to be toxic to many aquatic species at concentrations ranging from 0.2 to 2.0 µg/L (USEPA 2000), including the fathead minnow (*Pimephales promelas*), rainbow trout (*Oncorhynchus mykiss*) and aquatic invertebrates.

2.2. DDTs

Like chlordanes, DDTs are a synthetic chemicals that are bioaccumulative. DDT will break down in the environment due to microorganisms (ATSDR 2002b), but its breakdown products – dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD) – are also persistent, toxic and bioaccumulative (ATSDR 2002b). DDT is degraded to DDE under aerobic conditions and to DDD in anoxic systems (USEPA 2000). For purposes of this plan, the term DDTs includes both DDE and DDD.

DDT is a pesticide whose usage was widespread in the United States. Beginning in 1939, it was used for mosquito abatement and residential and agricultural applications (Connor et al. 2004). In 1963, the

State of California restricted its use (Connor et al. 2004), and in 1972, the federal government banned its use except for public health emergencies (ATSDR 2002b).

DDTs are probable carcinogens that damage the liver and may cause liver cancer (USEPA 2011b, ATSDR 2002b). It can also damage the reproduction system and temporarily damage the nervous system. DDT is also highly toxic to many aquatic invertebrate species at varying concentrations and can cause problems for wildlife, including eggshell thinning, estrogenic properties, antiandrogenic sexual development feminization of males (CCCWP 2004), embryo mortality, and decreased hatchling survival (USEPA 2000).

Invertebrate species are generally more sensitive than fish to DDT in the water column (USEPA 2000), and sediments contaminated with DDT have been shown to affect benthic communities at low concentrations (USEPA 2000). Field and laboratory studies found that chronic effects from DDT occur at concentrations greater than 2 µg/kg in sediments (USEPA 2000). For both freshwater and saltwater fish, short-term exposure to concentrations less than 1 µg/L have led to toxic responses (USEPA 2000). DDT may be transferred to embryos, and concentrations of 1.1 to 2.4 mg/kg have been associated with fry mortality (USPEA 2000).

2.3. Dieldrin

Dieldrin is the breakdown product of aldrin, a synthetic compound that was used in the United States between 1948 and 1987 as a pesticide on corn, cotton, and citrus crops, for control of termites and other soil dwelling insects; as a wood preservative; and for moth-proofing clothing and carpets (Connor et al 2007, Connor et al. 2004). The United States Department of Agriculture cancelled all uses in 1970, but in 1972, the USEPA approved its use for termite control. Dieldrin was used for termite control until 1987, when the manufacturer voluntarily canceled its registration for termite control (ATSDR 2002a).

Unlike aldrin, dieldrin degrades very slowly in water or soil. Dieldrin sorbs tightly to soil and sediment, particularly if substantial amounts of organic carbon are present (USEPA 2000). Dieldrin is toxic to aquatic organisms, birds, and mammals and is capable of producing carcinogenic, teratogenic (e.g., cleft palate, webbed feet, skeletal anomalies), and reproductive effects (USEPA 2000). Dieldrin is a probable human carcinogen (ATSDR 2002a) that can damage the nervous system, immune system, and kidneys (USEPA 2011c). It may also increase infant mortality and cause birth defects (USEPA 2011c).

In fish, dieldrin produces adverse enzymatic and hormonal changes that lead to impaired reproductive ability (CCCWP 2004). The LC50s for freshwater and saltwater aquatic invertebrates exposed to sediment spiked with dieldrin in the laboratory have been shown to range from 0.0041 to 386 µg/g dry weight (USEPA 2000). For wildlife, mammals appear to be more sensitive to dieldrin poisoning than birds. Brain concentrations in mammals of 5 mg/kg are associated with lethality. Concentrations as low as 1 mg/kg in the brain might trigger irreversible starvation in some birds and concentrations of 10 mg/kg are associated with lethality (USEPA 2000).

3.0 REGULATORY STATUS

3.1. Water Quality Criteria and Sediment Objectives/Guidelines

Aquatic life and human health water quality criteria for legacy pesticides were included in the 2000 California Toxics Rule (CTR), and are shown in Table 3-1. Human health criteria are much lower than those for aquatic life. In 2002, the USEPA updated the human health criteria for legacy pesticides for the protection of human health, but California has not adopted the new criteria. Compared to the CTR criteria, the USEPA revised human health criteria (Table 3-2) are higher for chlordane, but lower for DDT and dieldrin (USEPA 2002).

Table 3-1. California Toxics Rule water quality criteria for legacy pesticides in µg/L (CTR 2000)

Parameter	Aquatic Life				Human Health	
	Fresh Water		Salt Water		Fresh Water	Salt & Fresh Water
	1-hour	4-day	1-hour	4-day	Water & Organisms	Organisms Only
p,p'-DDD (4,4'-DDD)	-	-	-	-	0.00083	0.00084
p,p'-DDE (4,4'-DDE)	-	-	-	-	0.00059	0.00059
p,p'-DDT (4,4'-DDT)	1.1	0.001	0.13	0.001	0.00059	0.00059
Chlordane	2.4	0.0043	0.09	0.004	0.00057	0.00059
Dieldrin	0.24	0.056	0.71	0.0019	0.00014	0.00014

Table 3-2. USEPA water quality criteria for legacy pesticides in µg/L (USEPA 2002)

Parameter	Fresh Water	Salt & Fresh Water
	Water & Organisms	Organisms Only
p,p'-DDD (4,4'-DDD)	0.00031	0.00031
p,p'-DDE (4,4'-DDE)	0.00022	0.00022
p,p'-DDT (4,4'-DDT)	0.00022	0.00022
Chlordane	0.00080	0.00081
Dieldrin	0.000052	0.000054

3.2. Sediment Quality Guidelines and Objectives

While there are no numeric standards for legacy pesticides in the San Francisco Bay sediments, the State Water Resources Control Board (SWRCB) adopted narrative sediment quality objectives in 2011 in order to comply with Section 13393 of the California Water Code (SWRCB 2011). The narrative objectives for Aquatic Life, Human Health, and Wildlife and Resident Finfish are shown in Table 3-3. The Aquatic Life narrative objective will be implemented using multiple lines of evidence – sediment toxicity, benthic

community condition, and sediment chemistry (SWRCB 2011). The Human Health and Wildlife and Resident Finfish narrative objectives will be implemented on a case-by-case basis, based on a human health risk assessment and ecological risk assessment, respectively (SWRCB 2011).

Table 3-3. Proposed California Sediment Quality Objectives (SWRCB 2011)

Parameter	Sediment Quality Objective
Aquatic Life – Benthic Community Protection	Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California.
Human Health	Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health in bays and estuaries of California.
Wildlife and Resident Finfish.	Pollutants shall not be present in sediment at levels that alone or in combination are toxic to wildlife and resident finfish by direct exposure or bioaccumulate in aquatic life at levels that are harmful to wildlife or resident finfish by indirect exposure in bays and estuaries of California.

In addition to the narrative sediment quality objectives, the National Oceanic and Atmospheric Administration (NOAA) has developed numeric sediment quality guidelines that can be used as screening tools (Buchman 2008). There are two thresholds – the Effects Range-Low (ERL), which is the tenth percentile of pollutant concentrations in sediments determined to be toxic, and the Effects Range-Median (ERM), which is the median pollutant concentration in sediments determined to be toxic to aquatic life (Buchman 2008). The ERL and ERM for legacy pesticides are shown in Table 3-4.

Table 3-4. Effects Range-Low (ERL) and Effects Range-Median (ERM) for legacy pesticides in µg/kg (Buchman 2008).

Parameter	ERL	ERM
DDT	1	7
DDE	2.2	27
DDD	2	20
Chlordanes	0.5	6
Dieldrin	0.02	8

3.3. Beneficial Use Impairment and Trends

The Clean Water Act 303(d) list of water quality limited segments (i.e., impaired segments) is updated typically every 2 years. The 303(d) in California was last updated in 2010. A description of the five beneficial uses in the San Francisco Bay that could be impaired by legacy pesticides is provided in Table **3-5**. On the current list, the beneficial use of sport fishing is listed as impaired by legacy pollutants for all sections of San Francisco Bay (SWRCB 2011).

Table 3-5. Beneficial uses in the San Francisco Bay that could be impaired by legacy pesticides (SFBRWQCB 2011).

Beneficial Use	Description
Sport Fishing (COMM)	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
Preservation of Rare and Endangered Species (RARE)	Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.
Fish Spawning (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
Wildlife Habitat (WILD)	Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.
Estuarine Habitat (EST)	Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.

In 2004, the Clean Estuary Partnership (CEP) assessed the level of impairment of beneficial uses in the San Francisco Bay, utilizing the following five levels of impairment (Connor et al. 2004):

- **No impairment:** The available data demonstrate no negative effect on beneficial uses of the Bay, and there is sufficient information to make the finding.
- **Impairment unlikely:** The data indicate that legacy pesticides cause no impairment to the Bay. However, there is some uncertainty, due to lack of sufficient information or disagreement about how to interpret the data.
- **Possible impairment:** There is some suggestion of impairment, but the uncertainties preclude making a definitive judgment.
- **Definite impairment:** The data clearly demonstrate a negative effect on the beneficial uses of the Bay.
- **Unable to determine impairment:** There is insufficient information to make any determination.

A summary of their findings is shown in Table 3-6. The assessment found that the Bay may be impaired by legacy pesticides, particularly for fishing and fish consumption, but other environmental beneficial uses (preservation of rare and endangered species, fish spawning, wildlife and estuarine habitat) are less likely to be impaired (Connor et al. 2004). While insightful, this assessment has no regulatory standing and may not reflect the true impairment in the Bay as it was based on fish tissue from only six locations in the Bay and was based on two types of fish (white croaker and shiner surfperch) which are consumed by relatively few anglers (Connor et al. 2004). Additionally, dieldrin concentrations were below detection limits (Connor et al. 2004), which severely limits the conclusions that can be made about impairment due to dieldrin.

Table 3-6. Estimated San Francisco Bay impairments by legacy pesticides (Connor et al. 2004).

Matrix	DDTs	Chlordanes	Dieldrin
Fish	Possible impairment of COMM	Impairment unlikely	Possible impairment of COMM
Water	Possible impairment of COMM	Impairment unlikely	Possible impairment of COMM
Sediments	Impairment unlikely	Possible impairment of RARE, SPWN, WILD, or EST	Impairment unlikely
Wildlife	Impairment unlikely	Impairment unlikely	Impairment unlikely

Since the impairment assessment conducted by the CEP in 2004, additional water, sediment and sport fish monitoring data for legacy pesticides have been collected by the Regional Monitoring Program for the San Francisco Bay (RMP). Water and sediment data collected between 2002 and 2011 by the RMP are presented in Figures 3-1 and 3-2, respectively. Legacy pesticide concentrations in Bay water are compared to water quality criteria presented in Tables 3-1 and 3-2. Bay sediment concentrations of legacy pesticides are compared to sediment quality guidelines developed by NOAA (Buchman 2008).

As illustrated in Figures 3-1 and 3-2, concentrations of legacy pesticides in water and sediment in the Bay are consistently below levels of concern. Both water quality objectives and sediment quality guidelines for legacy pesticides in the San Francisco Bay have been consistently met in recent years (CEDEN 2013). Fish tissue concentrations also appear to be below adverse thresholds (SFEI 2012a). As a result, the Water Board is considering removing the San Francisco Bay from the next 303(d) list for legacy pesticides impairment (SFEI 2012a).

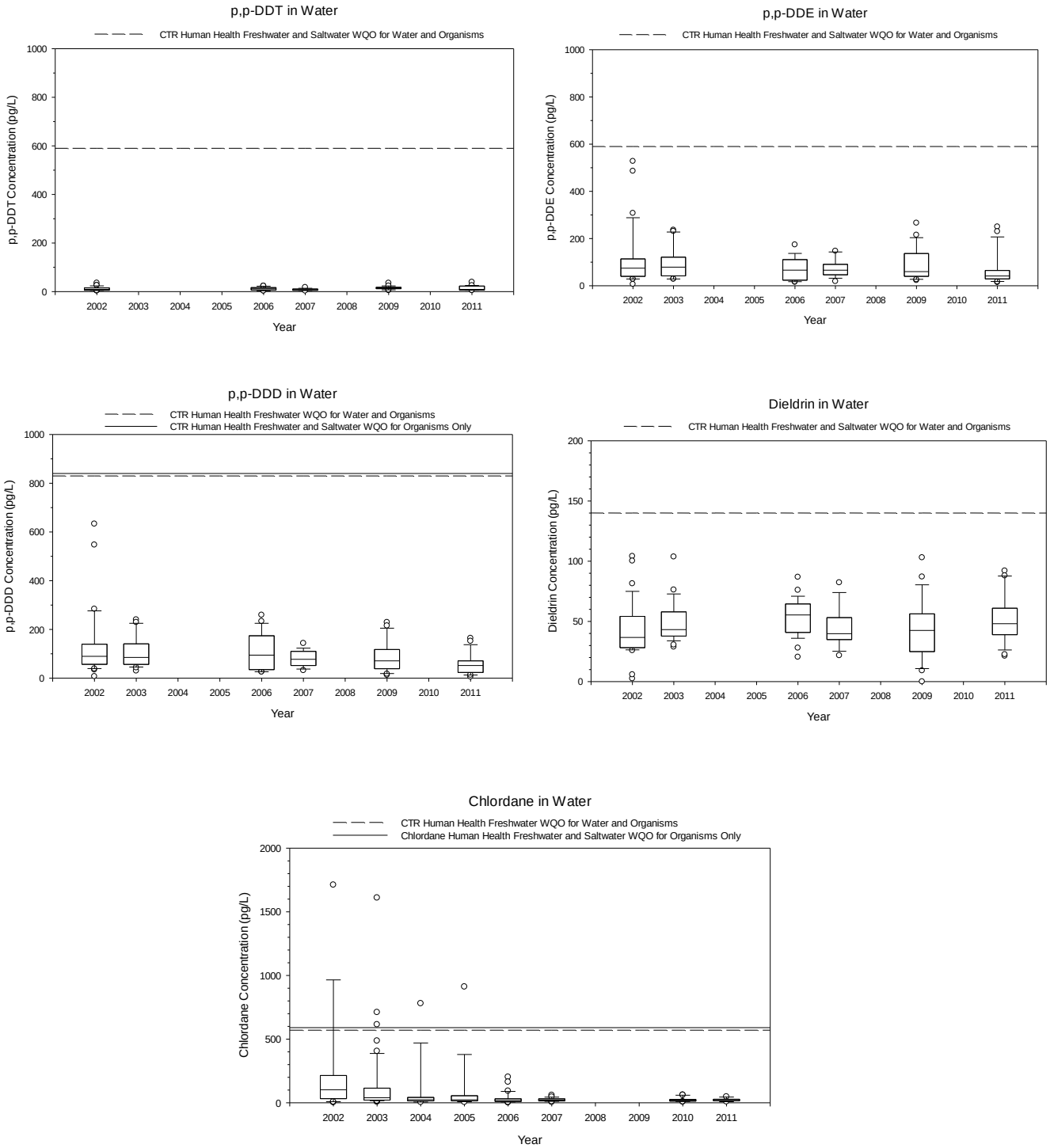

Figure 3-1. Water column concentrations of legacy pesticides in the San Francisco Bay between 2002 and 2011 (CEDEN 2013) compared to water quality objectives.

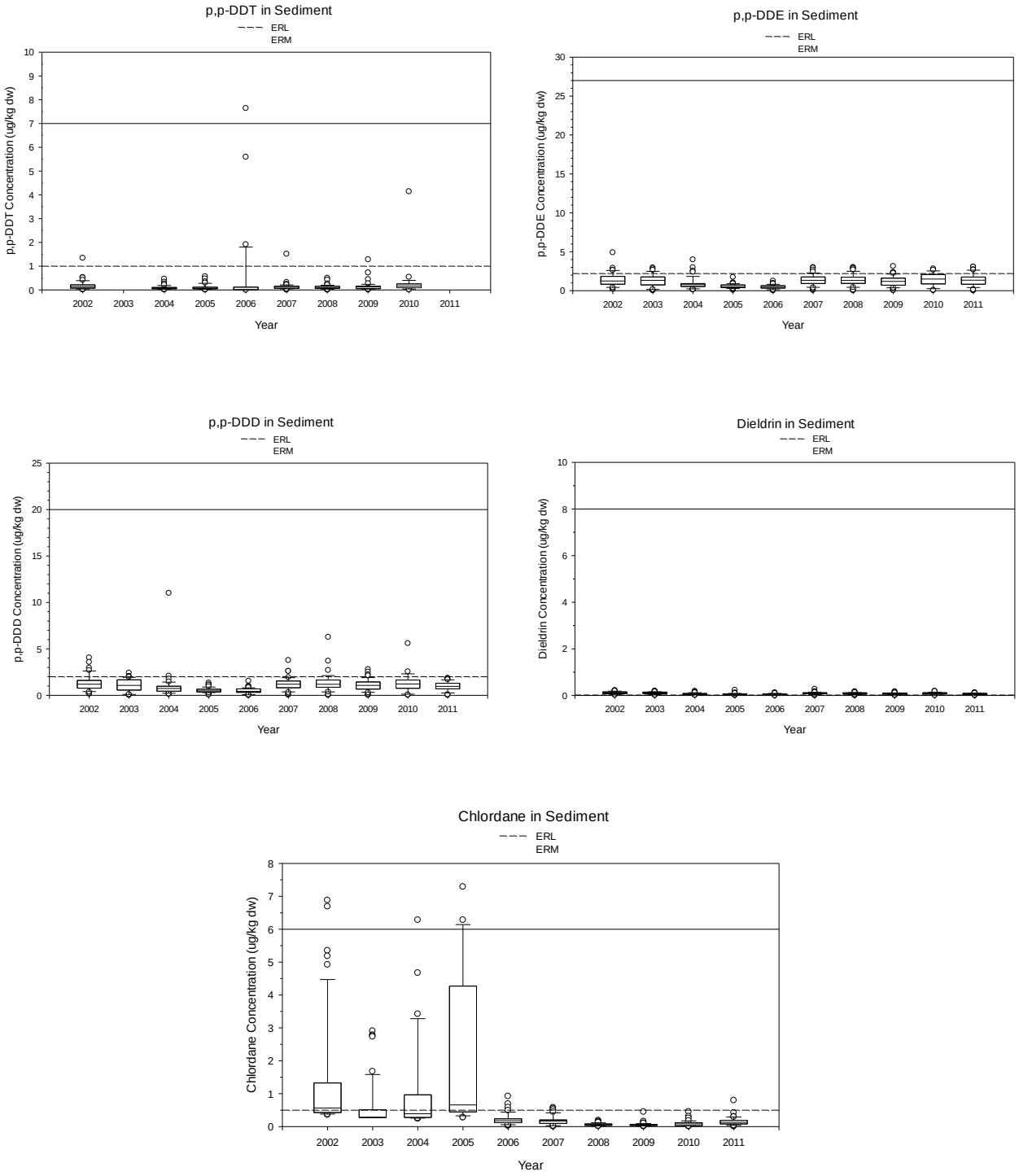

Figure 3-2. Bedded sediment concentrations of legacy pesticides in the San Francisco Bay between 2002 and 2011 (CEDEN 2013) compared to sediment quality guidelines.

4.0 SOURCES, PATHWAYS AND ENVIORNMENTAL FATES

4.1. Conceptual Model of Legacy Pesticide Sources and Pathways

In 2004, the Clean Estuary Partnership (CEP) developed a conceptual model (Figure 4-1) describing the current state of knowledge of legacy pesticides in the in the San Francisco Bay. The CM/IA computer model predicted that under a scenario in which no new legacy pesticides entered the Bay, the system would remove legacy pesticides within one to three decades. However, under scenarios of continued inputs to the Bay, recovery time would be considerably longer or not reached at all.

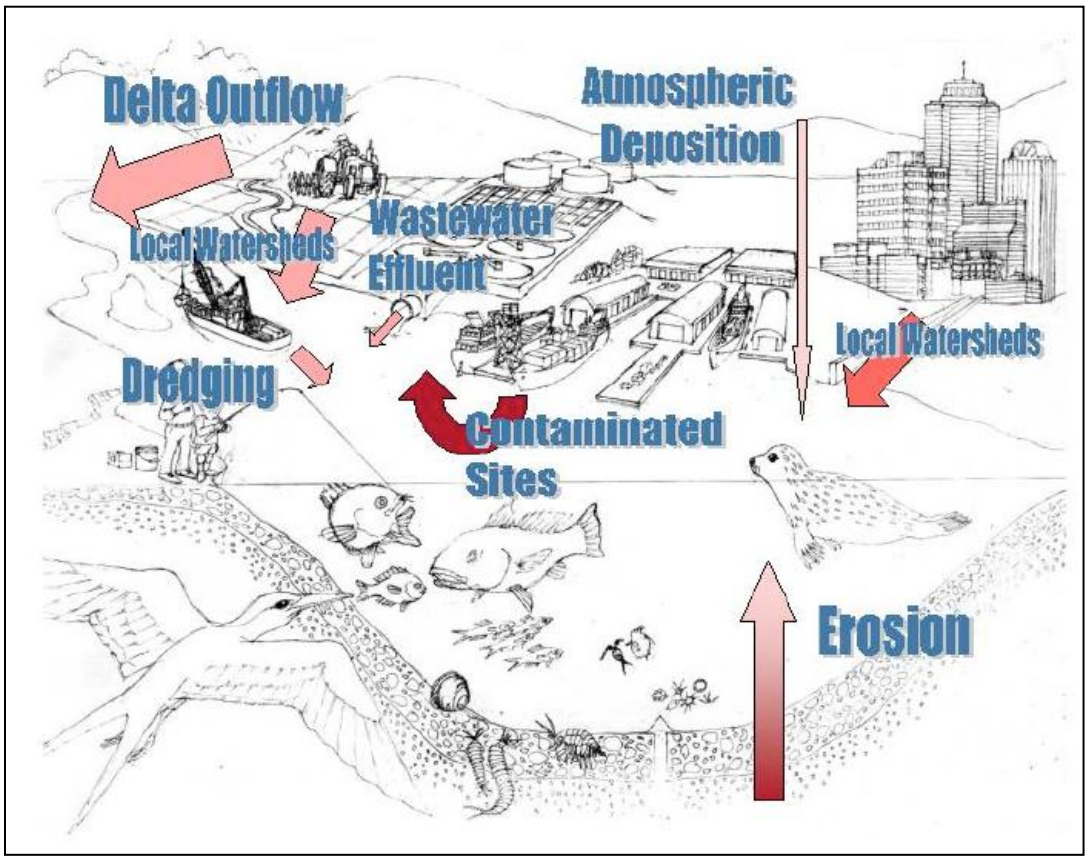

Figure 4-1. Sources and pathways of legacy pesticides to the San Francisco Bay (Connor et al. 2004)

4.2. Sources

Though legacy pesticides were banned over 25 years ago, they remain present in the watershed soils and sediments of floodplains, banks, and channel beds throughout California and the Bay Area (Connor et al. 2004). DDTs and dieldrin were primarily used in agricultural areas on crops, although urban uses did exist. Chlordanes were primarily used in urban areas for pest control. Historic, direct application on crops and soils is the main source of legacy pesticides today. Detectable concentrations can be found in the soils in agricultural areas, surrounding wooded structures, and other areas where applications occurred. Additionally, application, inappropriate disposal or leaks from unused stocks of legacy pesticides are another potential source to various transport pathways.

4.3. Transport Pathways

The San Francisco Bay is a dynamic system that is continually mixed due to rainfall, inflows, tides, winds, and human activities (e.g., dredging). As a result, legacy pesticides that would be buried deeply under new sediment layers in a quiescent system become re-mobilized and extend the timeframe needed for the Bay to recover from water quality impacts associated with these pollutants. The following sections provide a summary of pathways that may transport legacy pesticides to the Bay.

4.3.1. Urban and Agricultural Runoff

Both the Sacramento River and San Joaquin Rivers convey runoff to the Bay from most of the State of California. Surface runoff from Central Valley (via the Sacramento and San Joaquin Rivers) is responsible for the largest freshwater inflows and sediment transport to the Bay. Therefore, the northern portion of the Bay, which receives Central Valley runoff, is well-flushed. In contrast, the South Bay, which receives little freshwater inflows has a longer residence time for water, sediment, and associated pesticides. In addition, small tributaries draining local watersheds adjacent to the Bay also serve as important transport mechanisms. Specifically, DDT and chlordane concentrations in sediments in Bay Area watersheds are higher in urbanized regions than in non-urbanized, non-agricultural open spaces (Connor et al. 2004).

4.3.2. Municipal and Industrial Wastewater

An estimated 600 million gallons of municipal effluent is discharged to the Bay each day from Publicly Owned Treatment Works (POTWs) (Connor et al 2007). These POTWs receive legacy pesticides from human and food waste, stormwater runoff (i.e., combined sewer systems), landfill leachate, hazardous waste disposal and other sources. POTWs generally cannot effectively remove the legacy pesticides from their discharges and as a result are one transport pathway of legacy pesticides to the Bay. Due to the absence of current uses, industrial discharges are believed to be a much smaller pathways of legacy pesticides to the Bay that POTWs (Connor et al 2007).

4.3.3. Atmospheric Deposition

Though DDT was banned in 1972, it is still commonly used in other countries, including Mexico (ATSDR 2002) and therefore atmospheric deposition of DDTs from foreign sources may be important pathways to receiving waters in the U.S. (USEPA 2011b). Given the current limited sources of chlordanes or dieldrin (aldrin), atmospheric deposition is likely a much less important pathway for these pesticides. All legacy pesticides, however, may volatilize from contaminated water and soil and then redeposit back on land or water (ATSDR 2002).

4.3.4. Remobilization of Historic Sediment Deposits

Deep burial of legacy pesticides in the Bay sediments below the active sediment layer is responsible for a loss of pollutants from the water column. However, there has been net erosion of sediments from both the Northern portion (Suisun and San Pablo Bays) and the Southern portion of the Bay (South Bay) (Connor et al. 2007), which has remobilized historic deposits of sediment-bound organochlorine pesticides in the Bay water column.

Contaminated sediments may also become remobilized via tides and wind. The strongest tidal events occur during spring tides caused by new and full moons while the strongest winds occur during the spring and summer. Dredging also remobilizes sediments contaminated with legacy pesticides buried deeply in the Bay, but since more material is disposed of outside of the Bay, it is assumed that dredging results a net loss rather than net input of legacy pesticides in the Bay (Connor et al. 2007).

4.3.5. Estimated Loads from Transport Pathways

The CM/IA also estimated legacy pesticide loads from various pathways to the San Francisco Bay (Conner et al. 2004). The median and range (minimum and maximum) of legacy pesticide loads from each pathway are shown in Table 4-1. Total annual inputs of DDTs are greater than chlordanes, which are greater than dieldrin. The largest loads of all three pollutants are due to stormwater runoff from local watersheds. While local watersheds may currently be comprised of mostly urban land uses, historically there were substantial nonurban, agricultural regions (e.g., Santa Clara County and Eastern Alameda and Contra Costa County). Therefore, legacy pesticide loads from local watershed runoff is not likely attributable to urban land uses alone.

Table 4-1. Estimated median and range of annual legacy pesticide loads (kg/year) to the San Francisco Bay (Connor et al. 2004)

Pathways	DDTs	Chlordanes	Dieldrin
Runoff from Central Valley	15 (5 – 40)	2 (0.7 – 5)	5 (2 – 13)
Runoff from local watersheds	40 (9 – 190)	30 (7 – 160)	3 (0.7 – 15)
Municipal wastewater (POTWs)	0.2 (0.02 – 2)	0.1 (0.003 – 2)	0.06 (0.008 – 0.4)
Industrial discharges	< 0.2	< 0.1	< 0.06
Atmospheric deposition	1 (0.02 – 2)	0.9	1 (0.2 – 2)
Historic sediment deposits	9 (0.2 – 18)	2 (0 – 4)	0.2 (0 – 0.6)
Dredged Material	-2 (-3 – -0.03)	-0.3 (-0.6 – 0)	-0.03 (-0.1 – 0)
Total	**60 (10 – 250)**	**30 (10 – 170)**	**10 (3 – 30)**

As described in Appendix A - pollutant profile for legacy pesticides, legacy pesticides loading estimates are also under development through activities of the Small Tributaries Loading Strategy (STLS) work group, an RMP work group that includes representatives of BASMAA, the Water Board, SFEI, and technical advisors. To date, the STLS workgroup has developed a pollutant profile for legacy pesticides that is intended to assist in the modeling of loads of pollutants in urban runoff to the Bay.

4.4. Environmental Fates

The San Francisco Bay is a dynamic system that is able to slowly purge itself of legacy pesticides. Removal of legacy pesticides from the San Francisco Bay occurs, in relative order, through degradation in sediments, outflow through the Golden Gate Strait, and volatilization (Connor et al. 2007).

4.4.1. Transport through the Golden Gate

While the San Francisco Bay receives inputs from numerous sources, the Pacific Ocean is its only hydrologic output. The Bay is connected to the Pacific Ocean via the Golden Gate, and outflow through the Golden Gate is an important loss pathway for the legacy pesticides (Connor et al. 2007). Dieldrin is

more soluble in water than DDTs and chlordane, and as a result, flow out of the Golden Gate plays a larger role in its removal (Connor et al. 2004).

4.4.2. Losses in Sediment

Chlordane is persistent and has been known to remain in some soils for over 20 years. Its persistence is greater in heavy, clay or organic soils than in sandy soils where is can evaporate more quickly (ATSDR 1994). The evaporation rate of chlordane on soil surfaces is roughly two to three days (ATSDR 1994). Because it is hydrophobic, chlordane attaches to sediments and particles in the water column. It is unknown how much, if any, chlordane breaks down in water or sediment, but it does break down in the atmosphere by reacting with light and certain chemicals in the environment (ATSDR 1994). Connor et al. (2007) estimate that the half-life of chlordanes in the Bay sediments is 2.3 years assuming first-order decay.

DDT is very persistent and while it will degrade in the environment, degradation can take more than 15 years (USEPA 2011b). Degradation in soils is generally due to microorganisms, but depends on temperature, type of soil, and soil moisture (ATSDR 2002). In California, the half-life of DDT was calculated to be 7-13 years (Connor et al. 2007). DDT degradation increases with increasing moisture, suggesting that degradation rates would be higher in Bay sediments than in the watershed soils (Connor et al. 2007). Connor et al. (2007) estimate that the half-life of DDT is 9 years in the Bay sediments. DDT that has evaporated into the atmosphere or has attached to solids in the air has a much shorter half-life, calculated to be 1.5-3 days (ATSDR 2002).

While aldrin degrades readily to dieldrin due to sunlight and bacteria (ATSDR 2002), dieldrin is a very persistent organic chemical. Dieldrin is hydrophobic and adsorbs to soil where it remains unchanged for many years (ATSDR 2002). Connor et al. (2007) estimate that the half-life of dieldrin in Bay sediments is 2.8 years, assuming first-order decay. It can however, evaporate slowly into the atmosphere where it changes to photodieldrin within a few days (ATSDR 2002).

4.4.3. Degradation in Water

Reported degradation rates of legacy pesticides in the water column are higher than the rates in sediments (Leatherbarrow et al. 2006, Connor et al. 2007). However, sorption of DDTs to sediments can decrease the rate of photolysis, and turbidity can limit photolysis to the top few centimeters of the water column (Connor et al. 2007). Additionally, only a small portion of the mass of legacy pesticides is dissolved in the water column. Therefore any removal of legacy pesticides from the Bay through degradation in water is believed to be minor.

4.4.4. Volatilization

Volatilization is also a possible loss pathway of legacy pesticides, but there have been no data collected to study the air-water exchange of legacy pesticides within the Bay.

4.4.5. Consumption by Fish and Wildlife

The last loss pathway for legacy pesticides from the San Francisco Bay water column and sediments is through the integration into the food web. This occurs through uptake from sediment and water into aquatic flora and fauna, including fish. The RMP monitors contaminants in sport fish from the Bay every three years, and currently data are available on the RMP's website through 2009. No efforts to-date have been made to quantify this loss pathway, but it is believed to be minor.

5.0 URBAN RUNOFF CHARACTERIZATION SUMMARY

During 2000 and 2001, six stormwater agencies in the San Francisco Bay area conducted a study that sampled and analyzed storm drain sediments at 70 monitoring stations in residential/commercial, industrial, and mixed and open space (nonurban) land use areas in Alameda, Marin, San Mateo, Santa Clara, Contra Costa, and Solano Counties (KLI and EOA 2002). The first year focused on mercury and polychlorinated biphenyls (PCBs), while the second year also analyzed sediments for the organochlorine (legacy) pesticides chlordanes, dieldrin and DDTs.

Summary statistics of legacy pesticide concentrations observed during the study are presented in Table 5-1 by land use category. Box and whisker plots of DDT and chlordane concentrations by land use are shown in Figure 5-1. Dieldrin was detected in very few samples and was excluded from the box plots and analysis.

Table 5-1. Summary statistics for legacy pesticide concentrations in four land use categories. All data normalized to fine fraction (<62.5 µm) (KLI and EOA 2002).

Parameter	N	% Detected	Min Detected	Max Detected	Mean	SD	Percentile		
							25th	50th	75th
Industrial									
Chlordanes	45	77.8	1.7	24,296	1315	4,849	2.8	69.0	404
DDTs	45	68.9	19.1	24,541	881	4,915	16.4	97.9	426
Aldrin	45	2.2	11	11	0.2	-	-	-	-
Dieldrin	45	13.3	4.4	2.8	1.5	-	-	-	-
Residential									
Chlordanes	11	100	54.3	3,744	964	1,185	327	550	1633
DDTs	11	72.7	7.2	1,307	239	455	17.7	161	188
Aldrin	11	0	-	-	-	-	-	-	-
Dieldrin	11	36.4	6.6	70	11	-	-	-	-
Mixed									
Chlordanes	13	84.6	4.5	268	65	87	5.2	34	109
DDTs	13	84.6	14.1	734	123	240	17.1	39.8	98.0
Aldrin	13	0	-	-	-	-	-	-	-
Dieldrin	13	7.7	3.4	3.4	0.52	-	-	-	-
Open									
Chlordanes	4	75	0.72	4.0	1.6	2.2	-	-	3.3
DDTs	4	25	0.82	0.82	-	-	-	-	-
Aldrin	4	0	-	-	-	-	-	-	-
Dieldrin	4	0	-	-	-	-	-	-	-

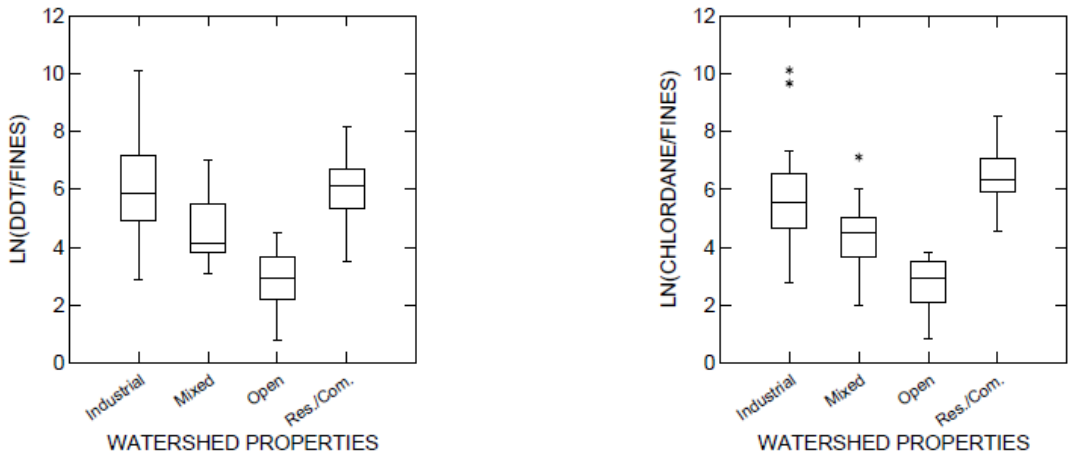

Figure 5-1. Comparison of DDT and chlordane concentrations in the fine fraction of storm drain sediments from four land use categories in the San Francisco Bay watershed[1].

Data from the study showed that chlordane and DDT concentrations were significantly different for urban and non-urban land use classifications. Moreover, chlordane concentrations at residential/commercial sites were significantly higher than at the three other land use categories monitored (KLI and EOA 2002). Summary statistics of legacy pesticide concentrations separated by urban and nonurban land use are shown Table 5-2, with corresponding box plots in Figure 5-2. The median concentration of chlordane in samples collected from urban sites were 40 times greater than the median for nonurban sites. Similarly, for DDTs the urban sites were 100 times greater (KLI and EOA 2002). However, it is important to note that nonurban sites were not adequately characterized, given that only four open space/nonurban sites were monitored.

Table 5-2. Summary statistics for legacy pesticide concentrations in urban and nonurban land use categories. All data normalized to fine fraction (<62.5 µm) (KLI and EOA 2002).

Parameter	N	% Detected	Min Detected	Max Detected	Mean	SD	Percentile		
							25th	50th	75th
Urban									
Chlordanes	69	82.6	1.7	24296	1023	3957	8.5	69	433
DDTs	69	72.5	7.2	24541	636	3966	13.5	78.9	353
Aldrin	69	1.4	11	11	0.16	-	-	-	-
Dieldrin	69	15.9	3.4	70	2.8	-	-	-	-
Nonurban									
Chlordanes	4	75	0.72	4.0	1.6	2.2	-	-	3.3
DDTs	4	25	0.82	0.82	-	-	-	-	-
Aldrin	4	0	-	-	-	-	-	-	-
Dieldrin	4	0	-	-	-	-	-	-	-

[1] Horizontal bar = Median; Top of upper box = 75th percentile; Bottom of lower box = 25th percentile; 75th percentile – 25th percentile = interquartile range; Upper whisker = 75th percentile + (1.5 x interquartile range); Lower whisker = 25th percentile – (1.5 x interquartile range); Dots = outliers.

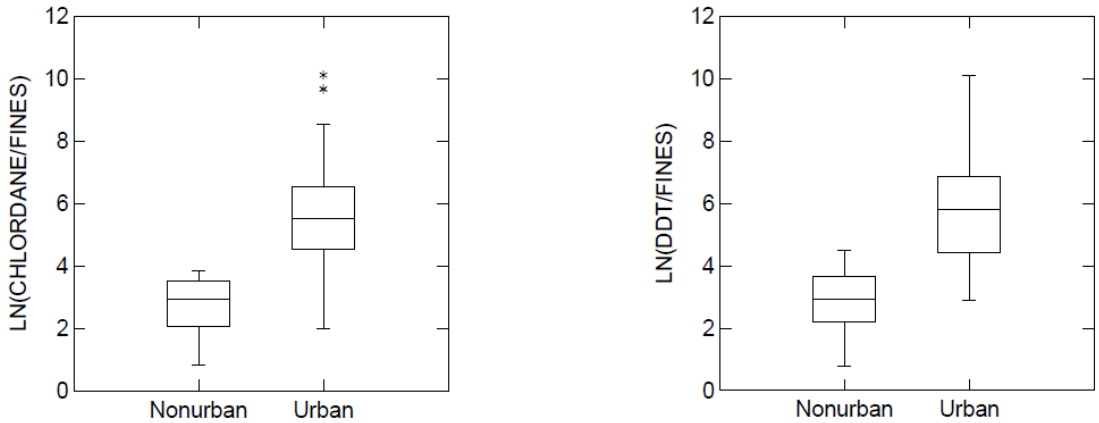

Figure 5-2. Comparison of chlordane and DDT concentrations in the fine fraction of storm drain sediments in urban and nonurban land use categories in the San Francisco Bay watershed.

Using data from the regional study, preliminary loading estimates of chlordane and DDT loads to the San Francisco Bay were developed by the authors. Two major assumptions were necessary to develop these loading estimates. The first assumption was that legacy pesticides in sediments collected from storm drains were associated with particles less than 62.5 µm. Secondly, it was assumed that this fine fraction of the bedded sediment was representative of the suspended material measured as Total Suspended Solids (TSS) in urban runoff from local watersheds. Estimates of chlordane and DDT loads from urban stormwater sources are shown in

Table 5-3, compared to 17 San Francisco Bay watersheds. Since dieldrin was detected in few samples, it was excluded from the calculation. The estimates indicate that the majority of the chlordane load and nearly the entire DDT load to the San Francisco Bay from local watersheds are from urban land areas.

Table 5-3. Median estimates of chlordane and DDT loads from stormwater to the San Francisco Bay from 17 watersheds and portions contributed by urban sources. Low (25th percentile) and high (75th percentile) estimates are included in parentheses (KLI and EOA 2002).

Parameter	San Francisco Bay Watersheds		Urban Sources	
	Pounds	Kilograms	Pounds	Kilograms
Chlordane	85 (48-261)	33 (19-103)	84 (48-260)	33 (19-102)
DDT	23 (2.3-51)	9.2 (0.9-20)	23 (2.3-50)	9.2 (0.9-20)

The pollutant profile included in Appendix A provides additional information on the concentrations of legacy pesticides in urban runoff. The profile is intended to assist Permittees in assessing whether legacy pesticides are present in urban runoff and distributed uniformly in urban areas.

6.0 CURRENT AND PLANNED CONTROL MEASURES

This section provides a summary of control measures implemented by Permittees to control the discharge of legacy pesticides from municipal stormwater to the San Francisco Bay. Control measures are implemented in compliance with the MRP. Given that recent monitoring data from San Francisco Bay (SFEI 2011, SFEI 2012a, CEDEN 2013) indicates that water quality standards for legacy pesticides are consistently achieved, new control measures for municipal stormwater Permittees in the Bay Area are currently not planned or included in this section. However, as discussed in this section the continued implementation current control measures associated with legacy pesticides, and the implementation of pilot and new control measures focused on other high priority sediment-associated pollutants (e.g., PCBs and mercury) will have reduction benefits for legacy pesticides in the future.

Stormwater control measures applicable to legacy pesticides focus on both preventing legacy pesticides from entering the environment and intercepting these pollutants once available for potential transport to the Bay via urban stormwater runoff. Since legacy pesticides are hydrophobic and have a strong association with sediments, most stormwater control measures described do not specifically target legacy pesticides, but instead aim to prevent sediments that may have elevated concentrations pesticides from entering the San Francisco Bay. Legacy pesticides are not the only pollutants of concern associated with sediments, and many of the control measures below are used to control other pollutants, such as polychlorinated biphenyls (PCBs) and mercury. In addition, many of the legacy pesticide control measures described are implemented in compliance with MRP provisions other than C.14. Control measures are described fall into three general categories: 1) Pollution Prevention, 2) Interception, and 3) Treatment.

6.1. Pollution Prevention Activities

6.1.1. Public Education and Outreach

The goal of public education and outreach is to identify and change behaviors that adversely affect water quality, and to increase the understanding and appreciation of streams and the Bay. Permittee approaches to pesticide management focus on the use of best management practices for source control and pollution prevention, including the following:

- Development and distribution of public education material on integrated pest management to highlight less-toxic methods of pest prevention and pest control;
- Promoting proper disposal of pesticides at household hazardous waste facilities or events;
- Outreach to landscape maintenance contractors; and
- Outreach to structural pest control operators.

6.1.2. Household Hazardous Waste Disposal

Permittees also successfully promote, coordinate and staff household hazardous waste (HHW) facilities collection events that result in the proper disposal of unused stocks of legacy pesticides. Data on the amounts of pesticides collected via HHW facilities events by Permittees and associated agencies are available via CalRecycle, the State agency that oversees HHW activities.

6.1.3. Commercial and Industrial Site Controls

Provision C.4 requires Permittees to implement an industrial and commercial site inspection and control program at all sites which could reasonably be considered to cause or contribute to pollution of

stormwater runoff, with follow-up and enforcement consistent with local Enforcement Response Plans (ERPs), to prevent discharges of pollutants and impacts on beneficial uses of receiving waters. These programs assist Permittees in preventing pollutants like legacy pesticides from entering stormwater conveyances.

6.1.4. Illicit Discharge Control Activities

Provision C.5 requires Permittees to implement an illicit discharge control program that includes an active surveillance component, a centralized complaint collection component, and a follow-up component to target illicit discharge and non-stormwater sources. Similar to commercial and industrial site inspection programs, illicit discharge control programs also assist Permittees in preventing pollutants such as legacy pesticides from entering stormwater conveyances.

6.1.5. Construction Site Inspection and Enforcement

Provision C.6 of the MRP requires Permittees to implement a construction site inspection and control program at all construction sites, with follow-up and enforcement. Permittees require all construction sites to have site-specific and seasonally- and phase-appropriate Best Management Practices (BMPs) that fall into the following six categories:

- Erosion control;
- Sediment control;
- Good site management; and
- Run-on and Run-off control;
- Non stormwater management.
- Active treatment systems (as necessary);

Permittees also conduct inspections to determine compliance and effectiveness of the construction site BMPs, and require timely correction if violations are found.

6.2. Activities to Intercept Sediment and Legacy Pesticides

6.2.1. Stormwater System Operation and Maintenance

Permittees currently remove sediment and organic materials through routine maintenance of their stormwater conveyance systems. Control measures include inlet/catch basin cleaning, street sweeping and channel desilting. Frequencies and efficiencies of these control measure vary widely due to site-specific conditions and different levels of implementation by Permittees. Through pilot studies conducted in compliance with provisions C.11/12.c of the MRP, Permittees are currently evaluating the effectiveness of enhanced operation and maintenance activities and assessing the costs of implementing enhanced actions. The focus of these studies is PCBs and mercury, however, all sediment bound pollutants, including legacy pesticides, will benefit from the information being collected. Although sources and pathways differ between legacy pesticides and other sediment-bound pollutants, potential focused implementation of enhanced stormwater system operation and maintenance for PCBs/mercury in the future will also assist Permittees in reducing the load of legacy pesticides to the Bay from urban runoff.

6.3. Stormwater Treatment and Diversions

6.3.1. New and Redevelopment Runoff Controls

Provision C.3 of the MRP requires Permittees to use their planning authority to require source control, site design, and stormwater treatment measures in new and redevelopment projects to prevent stormwater runoff pollutant discharges from and prevent increases in runoff from projects that create and/or replace more than 10,000 ft^3 of impervious surface area. Increases in runoff may cause excess erosion in stream channels, releasing potentially contaminated sediments, including those with elevated concentrations of legacy pesticides.

6.3.2. Stormwater Treatment Retrofits

Storm drain inlet inserts, flow through separation devices (e.g., hydrodynamic separators), vegetated filtration systems (grassy swales), infiltration trenches/basins, media filtration, detention basins, wet ponds and constructed wetlands can intercept sediments and legacy pesticides in the stormwater conveyance system and reduce the load of legacy pesticides to the Bay. These stormwater treatment structures may be installed by municipalities on public and capital improvement projects or as retrofits projects targeting pollutants of concern. Through pilot studies conducted in compliance with provisions C.11/12.e of the MRP, Permittees are currently evaluating the effectiveness of stormwater treatment retrofits and assessing the costs of implementing these actions. The focus of these studies is PCBs and mercury, however, all sediment bound pollutants, including legacy pesticides, will benefit from the information being collected. Although sources and pathways differ between legacy pesticides and other sediment-bound pollutants, potential focused implementation of enhanced stormwater system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of legacy pesticides to the Bay from urban runoff.

6.4. Bay and Watershed Monitoring

6.4.1. San Francisco Bay Status and Trends Monitoring

The RMP monitors contaminants, including legacy pesticides, in Bay water, sediments, and fish/wildlife tissue on an ongoing basis through its Status and Trends Program (SFEI 2012b). The status and trends program currently includes:

- Biennial water chemistry monitoring;
- Biennial sediment chemistry monitoring, alternating between wet and dry seasons;
- Biennial bivalve bioaccumulation monitoring;
- Sediment toxicity and benthic taxonomic classification;
- Suspended sediment dynamics (USGS);
- Hydrographic studies (USGS);
- Triennial bird egg monitoring (cormorant and tern); and
- Triennial sport fish monitoring.

The RMP is currently funded through Permittee and other discharger contributions. These contributions provide the adequate funding necessary to support water quality and beneficial uses assessments in the Bay.

6.4.2. Small Tributary POC Loads Monitoring/Modeling

Provision C.8 of the MRP prescribes water quality monitoring conducted by Permittees in tributaries to the Bay. Provision C.8.e of the MRP requires Permittees to conduct pollutants of concern (POC)

monitoring to assess inputs of POCs to the San Francisco Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. As a result, Permittees developed the Small Tributaries Loading Strategy Multi-Year Plan, which includes the following:

- Watershed modeling of runoff, pollutants, and sediment discharged to San Francisco Bay, using the Regional Watershed Spreadsheet Model, including legacy pesticides;
- Bay margins modeling;
- Source area runoff monitoring;
- Small tributaries monitoring in local watersheds.

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ATTACHMENT A

Legacy Organochlorine (OC) Pesticide Pollutant Profile (SFEI 2013)

Legacy Organochlorine (OC) Pesticide Pollutant Profile

Legacy Pesticides: description, historical usage, and behavior in the environment

Description and historical usage

The legacy pesticides are a subset of organochlorine pollutants that were heavily used as insecticides in California up until their respective regulatory bans. These pollutants are highly toxic to wildlife and humans and are part of the dirty dozen variously chlorinated pollutants (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, toxaphene, dioxins, furans, hexachlorobenzene, and PCBs) that were banned or heavily regulated in the 1970s and 1980s (Werner and Hitzfeld 2012). All are considered legacy since they are no longer in use yet they still exist in the environment and continue to enter the Bay from local drainages. To support Provision C.14. of the Municipal Regional Stormwater Permit (MRP) (SFBRWQCB 2009), this report focuses on three organochlorine pesticides: Dichlorodiphenyltrichloroethane(DDT), chlordane, and dieldrin.

The term DDT (Figure 1) is generally used to describe six isomers which are a combination of technical grade DDT as well as degradation products (Mischke *et al.* 1985). DDT was used widely in the landscape during its period of usage. It was initially used as an agricultural pesticide and for controlling disease carrying vectors but then usage in residential applications became commonplace (Mischke *et al.* 1985). The use of DDT in California began around 1944, was restricted in 1963 and banned in 1972 consistent with the national ban (Mischke *et al.* 1985). California recordkeeping on pesticide use did not start until 1971 therefore County or even State resolution use statistics on DDTs are not available. However there are records of production for the whole of the US. It appears that more than 600,000 tonnes (1.35 billion lbs) was applied in the U.S. before the 1972 ban. Usage apparently peaked in 1962 at about 82,000 tonnes per year, coincidentally around the time of the publication of Rachel Carson's book "Silent Spring". Scaled to the US population of the 1960s census (181 million), the Bay Area was 2% of the US population and the total use of DDT in the nine county Bay Area was therefore approximately 12,000 metric tonnes (26.5 million lbs).

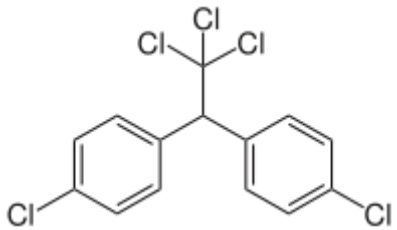

Figure 1 . Chemical structure of DDT.

The term Chlordane (Figure 2) also represents a pesticide category with multiple isomers. Chlordane was manufactured and sold in the United States from 1948 to 1988. In the Bay Area, this pesticide group had more structural (64%) applications than other legacy pesticides (Figure 3) and was primarily used in termite control. Early applications also included home/garden use (Dearth and Hites 1991). Over the period 1974-1980, Santa Clara County registered the highest Bay Area chlordane use accounting for about 30% of total use (Figure 4 and Figure 5). In the Bay Area, chlordane use declined from 117,000 pounds in 1975 to 53,000 pounds in 1980 – more than a 50% reduction in 5 years. Chlordane was restricted for use in California in 1975 and banned nationally in 1978 except for use in termite control (Dearth and Hites 1991; Kratzer 1999). The production of chlordane was ceased nationally in 1988.

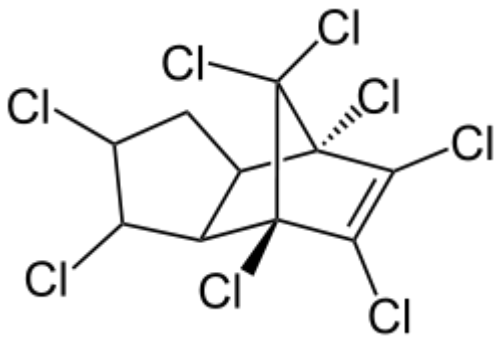

Figure 2. Chemical structure of chlordane.

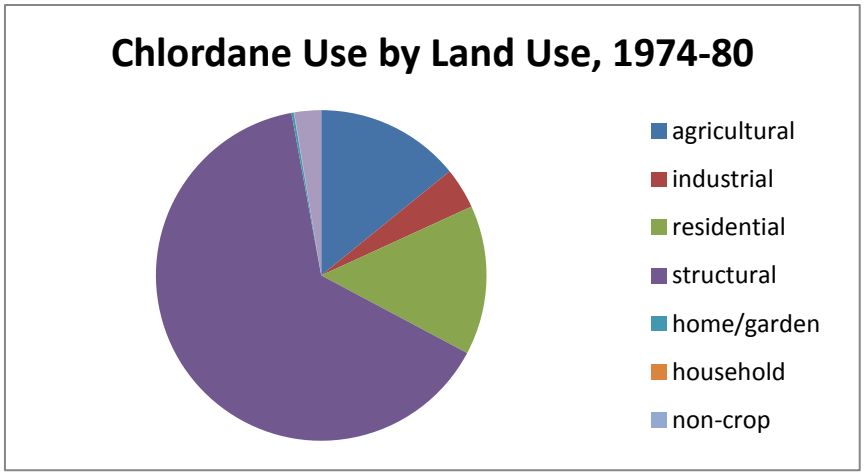

Figure 3. Bay Area chlordane usage (in pounds) by land use 1974-1980 (California Department of Pesticide Regulation data).

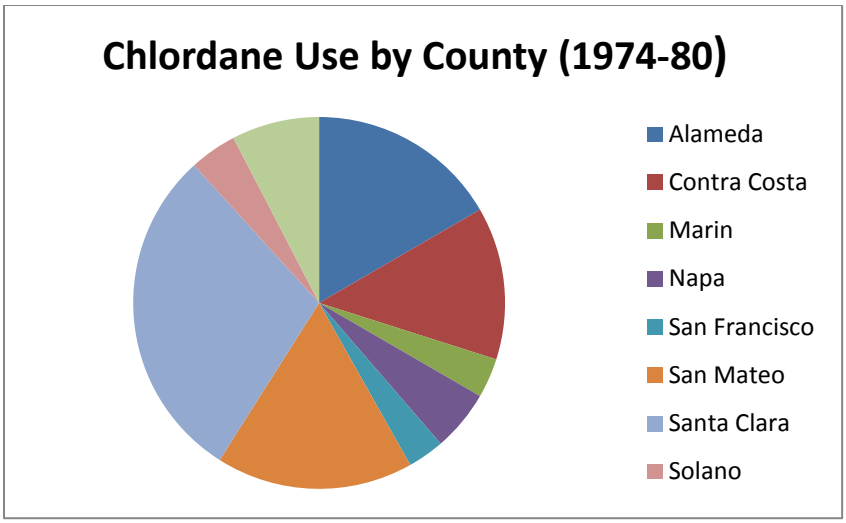

Figure 4. Bay Area chlordane usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

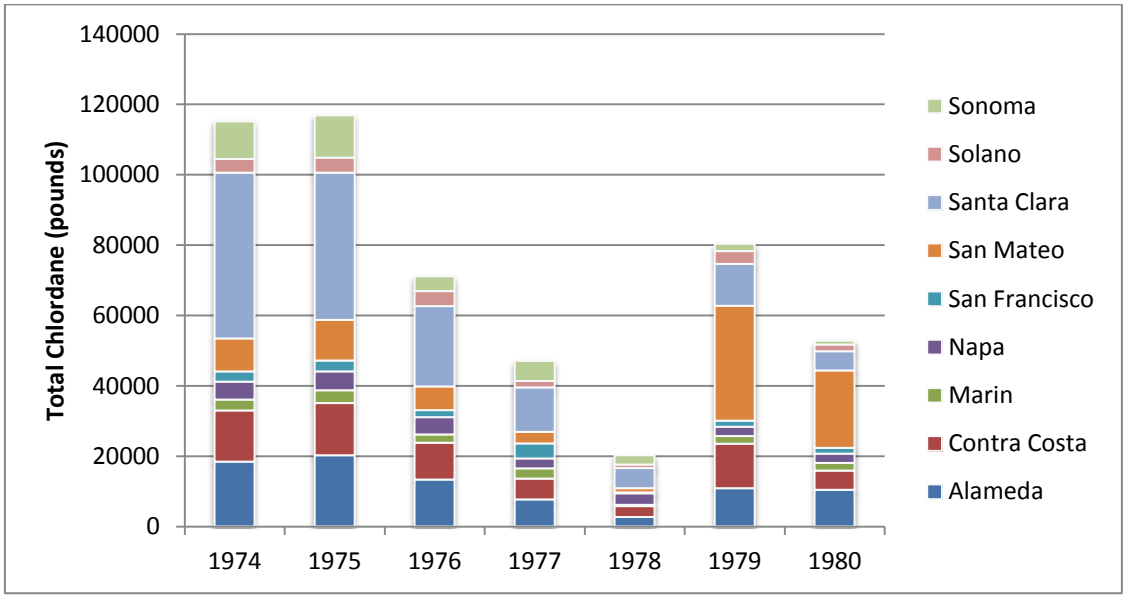

Figure 5. Bay Area chlordane usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

Dieldrin is a chlorinated hydrocarbon (Figure 6) originally produced in 1948 as an insecticide. Dieldrin is closely related to aldrin, which reacts further to form dieldrin. Aldrin is not toxic to insects; it is oxidized in the insect to form dieldrin which is the active compound. Both dieldrin and aldrin are named after the Diels-Alder reaction which is used to form aldrin from a mixture of norbornadiene and hexachlorocyclopentadiene. Dieldrin proved to be a highly effective insecticide and was very widely used during the 1950s to early1970s. Endrin is a stereoisomer of dieldrin. However, it is an extremely persistent organic pollutant; it does not easily break down.

Furthermore it tends to biomagnify as it is passed along the food chain. Long-term exposure has proven toxic to a very wide range of animals including humans, far greater than to the original insect targets. For this reason it is now banned in most of the world. It has been linked to health problems such as Parkinson's, breast cancer, and immune, reproductive, and nervous system damage.

Historically, dieldrin applications included termite control, wood preservation, and moth proofing, particularly by the textile industry (Meharg *et al.* 2000). Dieldrin use began in 1950 and, in the Bay Area, was primarily used in residential (47%), agriculture (29%), and commercial (24%) applications (Figure 7). Alameda and Solano counties (26% each) had the highest dieldrin use in the Bay Area over the period 1974-1980 (Figure 8 and Figure 9). The pesticide was restricted in 1974 and banned in 1985 except for underground termite control (Kratzer 1999). However, dieldrin use was effectively discontinued in the Bay Area in 1978 (Figure 9). A full national ban occurred in 1987.

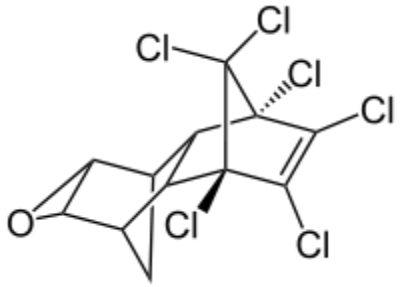

Figure 6. Chemical structure of dieldrin.

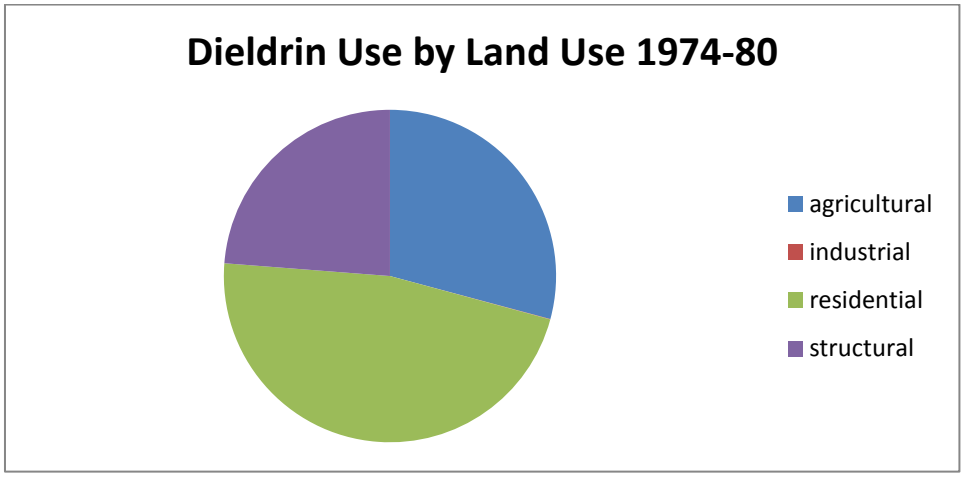

Figure 7. Dieldrin usage by land use 1974-1980 (California Department of Pesticide Regulation data).

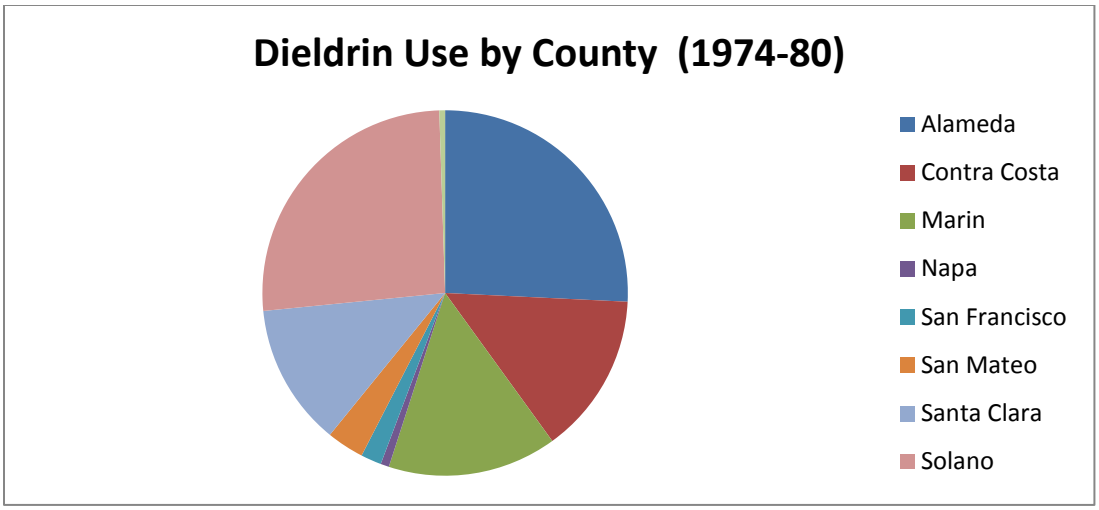

Figure 8. Bay Area dieldrin usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

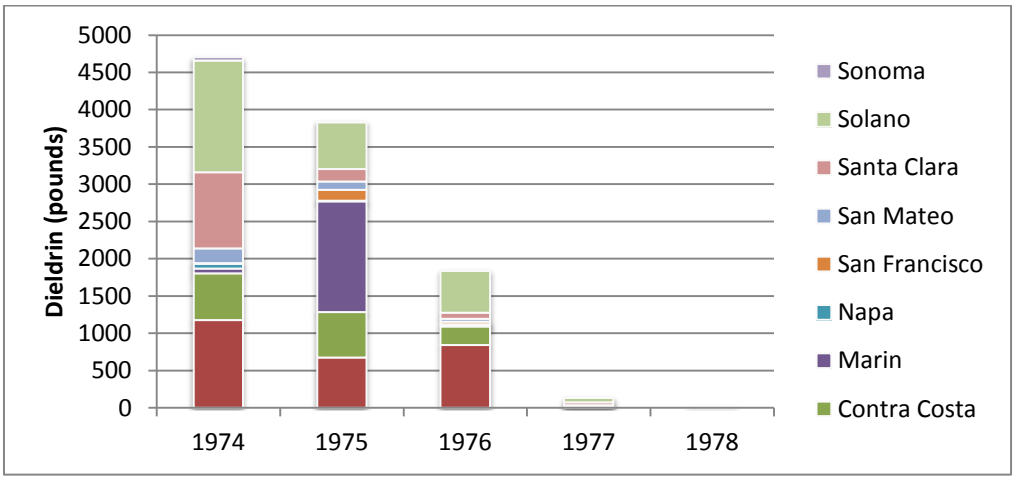

Figure 9. Bay Area dieldrin usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

How do legacy pesticides behave in the environment?

Technical grade DDT is a mixture of three DDT isomers, p,p'-DDT (85%) and lower percentages of o,p'-DDT and o,o'-DDT (Network). DDE is the primary degradation product in oxygenated soils (Guenzi and Beard 1976). DDT and degradation products are persistent in the environment and, once in aquatic environments, have bioaccumulative properties (Kratzer 1999; Nowell *et al.* 1999). Soil half-lives for DDT and degradation products range from 110 days - 5690 days (0.3 – 15.6 years) (Nowell *et al.* 1999). Additionally, soil conditions can greatly affect chemical degradation (Guenzi and Beard 1976; Hitch and Day 1992).

Technical grade chlordane consists of an estimated 147 structurally related compounds (Dearth and Hites 1991). The most dominant isomers in technical grade are the cis- and trans-chlordanes which are also racemic in the mixture (Dearth and Hites 1991; Bidleman *et al.* 2004). Both isomers show low solubility in water, high affinity to bind with organic carbon in soils and have a half-life of about 365 days (Nowell *et al.* 1999; Medina *et al.* 2009). Other isomers, such as oxychlordane, are more water-soluble and have lower affinities for soil binding (Nowell *et al.* 1999). Legacy contaminated US Air Force sites showed high chlordane soil concentrations (up to 20 ppm) 20-60 years post application. Volatilization from soils is one of the primary pathways of transport (Bidleman *et al.* 2004; Scholtz and Bidleman 2007; Medina *et al.* 2009).

Dieldrin is more soluble (particularly at higher temperatures) than the other organochlorine pesticides discussed and has a lower affinity for binding with soils (Eye 1968; Nowell *et al.* 1999). However, dieldrin has been shown to remain in soils with half-lives ranging from 2 to 7 years depending on soil type (as reviewed in (Eye 1968). Flood events can mobilize dieldrin contaminated sediment particles from land based sources. When these are in a micro-particulate form (experimentally <32 µm) they can be prone to desorption, resulting in aqueous transport of dieldrin (Smit *et al.* 2008).

As noted above, as a general rule, all three chlorinated pesticides (DDT, chlordane, and dieldrin) can remain in soils for long periods of time and can be released to the atmosphere from contaminated soils or, through erosional processes, release to rivers, creeks, and other drainage systems via stormwater (Foster *et al.* 2000; McKee *et al.* 2004). Connor et al (2004) reviewed legacy pesticide transport pathways to San Francisco Bay. At that time, the authors estimated that local tributaries accounted for an estimated 71% of DDT loads, 91% of chlordane loads, and 33% of dieldrin loads to the Bay, the single largest pathway (Table 1). Keeping in mind that the errors and biases in the loads estimates may have been relatively large due to a lack of spatially and temporally resolute data, loads from the Central Valley Rivers were also identified as a larger contribution compared to other sources such as direct atmospheric deposition or wastewater loads.

Table 1. Legacy pesticide loading estimates including upper and lower bounds (kg/year) for San Francisco Bay (reproduced from Connor et al., 2004).

Pathway	DDTs	Chlordanes	Dieldrin
Central Valley	15 (5–40)	2 (0.7–5)	5 (2–13)
Local Watershed	40 (9–190)	30 (7–160)	3 (0.7–15)
Municipal Wastewater	0.2 (0.02–2)	0.1 (0.003–2)	0.06 (0.008-0.4)
Industrial Wastewater	<0.2	<0.1	<0.06
Atmospheric Deposition	1 (0.02–2)	0.9	1 (0.02–2)
Erosion of Sediment deposits	9 (0.2 – 18)	2 (0 – 4)	0.2 (0 – 0.6)
Dredged material	-2 (-3 – -0.03)	-0.3 (-0.6 – 0)	-0.03 (-0.1-0)
Total best estimate	**60 (10 – 250)**	**30 (10-170)**	**10 (3-30)**

Release mechanisms to the environment and possible pollutant source areas

Conceptually, release of organochlorine pesticides into the environment could have occurred during initial synthesis (true sources), contamination of soils due to spillage during transportation to market, (by definition) during usage, and during disposal of contaminated storage containers, equipment, or unused product. These conceptual categories will be explored in this section.

Initial synthesis: That we are aware of, there are no legacy locations of manufacture of organochlorine pesticides in the Bay Area. United Heckathorn formulated, packaged, and shipped pesticides from a five acre site at the head of the Lauritzen and Parr channels of Richmond Harbor. No chemicals were manufactured on site. Heckathorn would receive technical grade pesticides from chemical manufacturers, grind them in air mills, mix them with other ingredients such as clays or solvents, and package them for final use in liquid or powder form. Although many pesticides were handled at United Heckathorn, DDT accounted for approximately 95% of the operations (EPA, 2013). We are not aware of any factories where mixing or alternative formulations were prepared. Thus, there are no true sources in the Bay Area.

Contamination of soils due to spillage during transportation to market: Given DDT use likely peaked in California in around 1962, the main transportation rout for DDT product would have been rail transport. Thus, historic rail yards and connected warehousing in older industrial areas could be considered legacy source areas. Production and use of chlordane and dieldrin occurred later but still within the same general period when rail transport was a strong component of Bay Area transport systems relative to today. Other legacy source areas may include wholesale and retail depots such as agricultural supply stores or supply depots for commercial pesticide applicators.

Use Area: Given the use history of DDT, chlordane, and dieldrin, organochlorine pesticides are likely relatively ubiquitous in soil residues across Bay Area watersheds. However, despite the ubiquitous application and wind and atmospheric dispersion of these pollutants, there are potential land uses that can be identified in local watersheds. For example, soils in plant and tree nurseries have been found to contain excessively high concentrations of organochlorine pesticides (Mangiafico *et al.* 2008). From the Bay Area pesticide use data available, chlordanes were primarily used in structural applications for termite control while dieldrin was primarily used as a residential pesticide. These applications are spatially disparate in watersheds making source area identification more difficult.

Disposal and recycling: Like many chemicals, both in modern use and historic use, bulk product was delivered in metal drums. Source areas therefore likely include drum recycling facilities and perhaps more generally metals recycling facilities. There may also be some legacy product still being discarded into landfills as packages containing pesticides, sometimes with obscured labels, are discarded from storage.

Source areas and pollutant concentrations in soils

Since no previous literature review was available on OC pesticides in soils for the Bay Area (the RMP nor and SFEI grant funded project competed such a review), we carried out a brief survey of peer-reviewed literature as well as reviewed data available locally based mainly on BASMAA studies carried out during 2000 and 2001.

Previous analyses of local DDT and chlordane storm drain sediment data found very limited statistical differences in chlordanes and DDTs by land use (KLI and Eisenberg 2002). In the following tables, concentrations and statistics on soils data collected in individual studies are shown (Table 2 - Table 4), as well as a summary based on simple land use classes (Table 5 -

Table 7) that may be considered for our regional modeling efforts. For chlordanes, soil and sediment concentrations from residential/commercial land use were statistically higher than other land uses (industrial, mixed, and open). Chlordane was used more extensively as a structural pesticide which may partly explain why concentrations were highest in residential/commercial areas. However, there were no apparent statistical differences for DDT soil/sediment concentrations in these same land uses suggesting widespread usage and dispersion of DDTs. It is also interesting to note that concentration data from the historic study by Law and Goerlitz (1974) shows a similar range of concentrations for both DDT and chlordane compounds perhaps indicating no trend. Unfortunately, it is not possible to separate out specific source areas such as depots, railway loading areas, or nurseries and other possible source areas. Soils data from a survey of the local literature and local studies supports the hypothesis that:

- Maximum DDT concentrations were highest in soil and sediments from industrial land uses and lowest from open space. Residential/commercial land uses had the intermediate concentrations,
- Maximum chlordane concentrations were also highest in soil and sediment from industrial land uses and lowest in open space. Residential/commercial land uses also had intermediate concentrations,
- Dieldrin soil and sediment concentrations are highest in residential/commercial areas and lowest in open space.

Pollutant concentrations in stormwater

Despite regulatory actions banning use of these chemicals, legacy pesticides are still being found in Bay Area stormwater (KLI and Eisenberg 2002; Salop *et al.* 2002; McKee *et al.* 2004; Hunt *et al.* 2012). DDT isomer percentage (DDT: DDD and DDT: DDE) greater than 5% may indicate fresh sources of DDT or lower soil degradation rates from DDT to DDE (J Davis, personal communication). Based on this conceptual model, local data suggest that fresh DDT is still being transported from some watersheds (Guadalupe River, Zone 4 Line A, Richmond Pump Station). Soil temperatures, oxygen levels, and other soil conditions can affect the degradation of DDT to DDE with higher temperatures resulting in higher degradation rates (Guenzi and Beard 1976; Hitch and Day 1992; Rinella *et al.* 1993). It is unclear if higher DDT isomer percentages, in stormwater, are a

result of ongoing illegal applications of private stockpiles or from soil conditions that hinder degradation to DDE in the watershed.

Table 2. Sediment and soil DDT concentrations, by land's use, from local studies and world literature. The fines fraction is <62.5 µm. For the tabulated data, DDT concentrations are comprised of p,p'-DDT, o,p'-DDT p,p'-DDD, o,p'-DDD, p,p'-DDE, and o,p'-DDE, unless otherwise noted. Zero (0) is entered for non-detect (ND) concentrations. Soil/sediment samples consist of grab and composite samples. Statistics are within study average, minimum, maximum, and median concentrations except where noted.

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum	Non-averaged result
Agricultural	Yolo Bypass	Central Valley California	Smalling et al., 2007	µg/kg	Creek bed	Sediment Concentration					263
Agricultural	Yolo Bypass	Central Valley California	Smalling et al., 2007	µg/kg	Soil	Sediment Concentration	355	786	374	11	
Industrial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	244	4037	74	10	
Industrial	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	881	24541		19	
Mixed	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	30	73	29	8	
Mixed	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	123	734		14	
Open	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	6	15	1	1	
Open	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	1	1		1	
Residential/commercial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	267	2157	41	6	
Residential/commercial	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	239	1307		7	
Unknown	Marin County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	60	155	40	6	
Unknown	San Mateo County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	75	264	52	12	
Urban	Ballona Creek	Arid West	Curren Et al. 2011	µg/kg	Storm drain	Particulate concentration		70		0	
Urban	Beijing China	World	Zhang et al., 2010	ng/g	Street dust	Sediment Concentration	20	59		1	
Urban/Rural	26 Bay Area creeks	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	63				
Urban/Rural	Alameda Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	18				
Urban/Rural	Alamitos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	60				
Urban/Rural	Arroyo Corte Madera del Persidio	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	69				
Urban/Rural	Arroyo de la Laguna	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	36				
Urban/Rural	Belmont Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	347				
Urban/Rural	Colma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	11				
Urban/Rural	Cordilleros Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	46				
Urban/Rural	Corte Madera Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	106				
Urban/Rural	Coyote Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	99				
Urban/Rural	Green Valley Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	5				
Urban/Rural	Guadalupe River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	8				
Urban/Rural	Los Gatos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	53				
Urban/Rural	Los Trancos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	22				
Urban/Rural	Miller Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	48				
Urban/Rural	Napa River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	58				
Urban/Rural	Navato Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	20				
Urban/Rural	Petaluma River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	20				
Urban/Rural	Redwood Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	42				
Urban/Rural	San Francisquito Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	193				
Urban/Rural	San Lorenzo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	16				
Urban/Rural	San Pablo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	11				
Urban/Rural	San Rafael Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	270				
Urban/Rural	Sanoma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	4				
Urban/Rural	Stevens Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	49				
Urban/Rural	Union Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	66				
Urban/Rural	Wildcat Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	29				

Table 3. Sediment and soil chlordane (sum of 6 isomers) concentrations by land use from local studies and world literature. Chlordane concentrations are comprised of Chlordane, cis-, Chlordane, trans-, Heptachlor, Nonachlor, cis-, Nonachlor, trans-, Oxychlordane, Heptachlor epoxide, unless otherwise noted. Zero (0) is entered for non-detect (ND) concentrations. Soil/sediment samples consist of grab and composite samples. Statistics are within study average, minimum, maximum, and median concentrations except where noted.

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Industrial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	388	11496	55	9
Industrial	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	1315	24296		2
Mixed	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	31	111	21	6
Mixed	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	65	268		5
Open	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	5	13	1	1
Open	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	2	4		1
Res/Com	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	363	2657	92	10
Residential/commercial	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	964	3744		54
Unknown	Marin County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	336	1125	106	7
Unknown	San Mateo County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	64	227	41	15
Urban	Ballona Creek	Arid West	Curren Et al. 2011	µg/kg	Storm drain	Particulate concentration		191		0
Urban/Rural	26 Bay Area creeks	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	122			
Urban/Rural	Alameda Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	33			
Urban/Rural	Alamitos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	46			
Urban/Rural	Arroyo Corte Madera del Persidio	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	140			
Urban/Rural	Arroyo de la Laguna	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	111			
Urban/Rural	Belmont Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	660			
Urban/Rural	Colma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	29			
Urban/Rural	Cordilleros Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	27			
Urban/Rural	Corte Madera Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	103			
Urban/Rural	Coyote Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	77			
Urban/Rural	Green Valley Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	0			
Urban/Rural	Guadalupe River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	13			
Urban/Rural	Los Gatos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	140			
Urban/Rural	Los Trancos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	21			
Urban/Rural	Miller Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	310			
Urban/Rural	Napa River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	36			
Urban/Rural	Navato Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	62			
Urban/Rural	Petaluma River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	130			
Urban/Rural	Redwood Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	40			
Urban/Rural	San Francisquito Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	339			
Urban/Rural	San Lorenzo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	15			
Urban/Rural	San Pablo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	65			
Urban/Rural	San Rafael Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	800			
Urban/Rural	Sanoma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	4			
Urban/Rural	Stevens Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	99			
Urban/Rural	Union Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	200			
Urban/Rural	Wildcat Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	66			

Table 4. Sediment and soil dieldrin concentrations by land use from local studies only. Zero (0) is entered for non-detect (ND) concentrations.

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Industrial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	25	570	7	1
Mixed	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	7	17	5	0
Open	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	6	14	3	0
Res/Com	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	118	1300	11	0
Unknown	Marin County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	8	14	6	0
Unknown	San Mateo County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	13	82	5	4

Table 5. Summary statistics for DDTs in sediment and soils by land use for local studies only.

Land Use Source Category	units	Count	Minimum	Maximum	Average
Industrial	µg/kg	4	10	4037	1091
Residential/commercial	µg/kg	4	6	2157	618
Urban/Rural	µg/kg	27	4	347	66
Unknown	µg/kg	8	6	264	83
Mixed	µg/kg	4	8	73	35
Open	µg/kg	4	1	15	6
Industrial	µg/kg fines	3	19	24,541	8480
Residential/commercial	µg/kg fines	3	7	1307	518
Mixed	µg/kg fines	3	14	734	290
Open	µg/kg fines	3	1	1	1

Table 6. Summary statistics for chlordane and sediment in soils by land use our local studies only. Zero (0) is entered for non-detect (ND) concentrations.

Land Use Source Category	units	Count	Minimum	Maximum	Average
Industrial	µg/kg	4	9	11496	2987
Residential/commercial	µg/kg	4	10	2657	781
Unknown	µg/kg	8	7	1125	240
Urban/Rural	µg/kg	27	0	800	137
Mixed	µg/kg	4	6	111	42
Open	µg/kg	4	1	13	5
Industrial	µg/kg fines	3	2	24296	8538
Residential/commercial	µg/kg fines	3	54	3744	1587
Mixed	µg/kg fines	3	5	268	113
Open	µg/kg fines	3	1	4	2

Table 7. Summary statistics for dieldrin in sediment and soils by land use for local studies only. Zero (0) is entered for non-detect (ND) concentrations.

Land Use Source Category	units	Count	Minimum	Maximum	Average
Residential/commercial	µg/kg	4	0	1300	357
Industrial	µg/kg	4	1	570	151
Unknown	µg/kg	8	0	82	16
Mixed	µg/kg	4	0	17	7
Open	µg/kg	4	0	14	6

OC pesticide data in stormwater are available from a number of Bay Area rivers, creeks, and stormdrains (Table 8-Table 11). However, since most of the sampling locations are at the downstream points of our systems, pollutant contributions from distinct land uses or source areas are not available. The local exception is the Heckathorn United Inc. Superfund site which can be considered a source area. Recent stormwater monitoring at this location, showed most stormwater samples below detection. But a storm event in May 2012 produced maximum stormwater concentrations for DDT (267 ng/L) and dieldrin (13 ng/L) (Services 2013). After this storm event, a cracked pipe in the stormwater collection system was found and believed to be the source of the pesticides in stormwater. As part of the Superfund remediation, the site has been engineered with a concrete cap covering the contaminated area as well as an extensive stormwater collection system. There is potential for additional leaking from the capped area if the engineered system becomes compromised.

There are also nonlocal pesticide findings that do provide some basis of pollutant contributions from land use/source areas, in particular from agricultural areas. DDT and dieldrin stormwater concentrations from plant nurseries in Southern California were elevated compared with local stormwater concentrations. Maximum DDT was measured at 620 ng/L and maximum dieldrin was measured at 20 ng/L (Mangiafico *et al.* 2009). An additional study at Southern California citrus/avocado groves also found elevated DDT concentrations of stormwater (136 ng/L) (Mangiafico *et al.* 2009). It is unclear why pesticide concentrations were elevated since property owners did not report using these pesticides. The papers hypothesized pollutants may be spray drift from adjacent properties or legacy contaminants that are continuing to be mobilized. No similar Bay Area studies were found. Therefore it is unclear if local nurseries and other agricultural areas are sources of organochlorine pesticides.

To explore possible regional scale variations in applications in relation to land use, the ratios of chlordane to dieldrin were computed for the local stormwater data as well as the available storm drain sediment data. No unequivocal patterns were isolated in relation to imperviousness or land use characteristics for the stormwater data except there appears to be an indication that older industrial areas exhibit less chlordane relative to dieldrin (Table 12). A better pattern may have been observed if the Richmond sampling location had more wet weather data (the data currently available is from the original Richmond pump station data set which was predominantly dry flow (Hunt et al., 2012)) or if data were available from more locations than just four. There appears to be a more robust pattern emerging from the bed sediment data (Table 13). Chlordane use in the Bay Area was mostly structural while dieldrin was residential. From the usage history, we might expect open spaces and residential/commercial land uses to have lower ratios and that does appear to bear out in the bed sediment data – although there are many structures in residential/commercial areas but perhaps dieldrin was used more in industrial applications - not in residential or commercial areas. This pattern appears to be directly opposite to the pattern seen in the stormwater data (although the n is small for the stormwater data).

Table 8. DDT concentrations in stormwater, by land use, from local studies and world literature

Analyte	Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
DDT-Sum	Agricultural	Orestimba Creek at River Road	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	316			
DDT-Sum	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Dry Season Runoff	Sediment Concentration	307	617	258	71
DDT-Sum	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	205	458	193	4.6
Sum p,p isomers	Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		267		0.0
DDT-Sum	Mixed	Guadalupe River at hwy 101	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	35	71	35	3.3
DDT-Sum	Mixed	Mallard Island	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.8	1.6	0.5	0.3
DDT-Sum	Mixed	Mallard Island	Central Valley	Bergamaschi et al., 2001	µg/kg	Stormwater	Particulate concentration	6.0	11		4.0
DDT-Sum	Mixed	Richmond Pumpstation	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	1.2	3.6	0.5	0.0
DDT-Sum	Mixed	Zone 4 Line A	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	20	59	10	7.4
DDT-Sum	Urban	Beijing China	World	Zhang et al., 2010	ng/L	Stormwater	EMC	12	1.3		1.3
Sum p,p isomers	Citrus/avocado grove	Ventura County	Arid West	Mangiafico et al., 2009	ng/L	Stormwater	Water Concentration		136		
Sum p,p isomers	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2008	ng/L	Stormwater	Water Concentration		374		
Sum p,p isomers	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2009	ng/L	Stormwater	Water Concentration		620		

Table 9. Chlordane concentrations in stormwater, by land use, from local studies and world literature

Analyte	Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Chlordane	Agricultural	Orestimba Creek at River Road	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	7			
Chlordane	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Dry Season Runoff	Sediment Concentration	11	31	6	0
Chlordane	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	12	43	5	0
Chlordane	Mixed	Guadalupe River at hwy 101	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	29	64	26	3.4
Chlordane	Mixed	Mallard Island	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.10	0.18	0.10	0.04
Chlordane	Mixed	Mallard Island	Central Valley	Bergamaschi et al., 2001	µg/kg	Stormwater	Particulate concentration	0			
Chlordane	Mixed	Richmond Pumpstation	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	1.8	5.6	0.73	0.27
Chlordane	Mixed	Zone 4 Line A	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	9.3	16	9.3	3.5
Heptachlor and trans chlordane	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2008	ng/L	Stormwater	Water Concentration		37		
Sum of cis,trans-chlordane, Heptachlor, heptachlor epoxide	Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		0		0
Technical chlordane	Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		0		0
Trans chlordane	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2009	ng/L	Stormwater	Water Concentration		12		

Table 10. Dieldrin concentrations in stormwater, by land use, from local studies and world literature

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Agricultural	England	England	Meharg et al., 2000	ng/L	Water	Water Concentration	3.0	13		0.16
Agricultural	Orestimba Creek at River Road	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentratio	4.6			
Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Dry Season Runoff	Sediment Concentration	4.8	7.9	5.3	0
Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentratio	3.0	8.8	2.0	0
Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		13		0
Industrial	England	England	Meharg et al., 2000	ng/L	Water	Water Concentration	3.0	13	0	0.16
Mixed	Guadalupe River at hwy 101	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	2.8	6.0	2.7	0.64
Mixed	Mallard Island	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.16	0.25	0.16	0.06
Mixed	Richmond Pumpstation	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.85	1.1	0.90	0.46
Mixed	Zone 4 Line A	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	1.5	4.6	0.85	0.71
Plant nursery	Ventura County	Arid West	Mangiafico et al., 2008	ng/L	Stormwater	Water Concentration		20		

Table 11. Summary statistics for DDT, dieldrin, chlordanes in stormwater by land use, from local studies. Sum of p,p isomers include DDT, DDD, and DDE.

Contaminant	Land Use Source Category	Units	Count of Sites	Maximum	Minimum	Average
Sum p,p isomers	Hekathorn Superfund Site	ng/L	2	267	0	134
DDT-Sum	Mixed	ng/L	48	71	0	10
Dieldrin	Hekathorn Superfund Site	ng/L	2	13	0	6.5
Dieldrin	Mixed	ng/L	48	6	0.06	1.1
Sum of cis,trans-chlordane, Heptachlor, heptachlor epoxide	Hekathorn Superfund Site	ng/L	2	0	0	0
Technical chlordane	Hekathorn Superfund Site	ng/L	2	0	0	0
Chlordane	Mixed	ng/L	48	64	0	7.1

Table 12. The ratio of chlordane to dieldrin based on stormwater loading studies in the Bay Area.

	Ratio of Chlordane/Dieldrin in Stormwater	% Impervious	% Old Industrial (1974)	% Res/Com
Guadalupe River at hwy 101	10	39	2	50
Zone 4 Line A	4.8	68	18	62
Richmond Pumpstation*	0.91	62	33	35
Mallard Island	0.73	-	-	-

*Based mostly on dry weather data.

Table 13. The ratio of chlordane to dieldrin based on bed sediment studies in the Bay Area (KLI and EOA, 2002).

	Ratio of Chlordane/Dieldrin in Stormdrain Sediment
Unknown	16
Industrial	15
Mixed	4.8
Res/Com	3.1
Open	0.93

Relationships with other Contaminants

Investigating local data can provide information that can be used to identify relationships between hydrophobic contaminants. These relationships do not necessarily identify source areas but they can identify contaminants that co-occur spatially or are transported during storm water runoff following similar release and transport processes. DDTs, chlordanes, and dieldrin stormwater and storm drain concentrations were found to be highly correlated with PCB concentrations in local watersheds (Zone 4 Line A, Guadalupe River, Richmond Pump Station, and various watersheds in KLI 2002) suggesting that land/stream based transport mechanisms for organic pollutants, in these watersheds, are similar (Table 14 and Table 15). These correlations suggest that management actions, designed to remove PCBs, may also be effective in removing DDTs, chlordanes, and dieldrin. They suggest that management of Hg will not be as effective for removal of other contaminants.

Table 14. Pearson correlation coefficients between legacy pesticides, PCBs, and Mercury for stormwater data from Zone 4 Line A, Guadalupe River, and Richmond Pump Station. Yellow highlights indicate well correlated data.

	Dieldrin	*Total Mercury*	*Sum of 40 PCBs (SFEI)*	*Sum of Chlordanes (SFEI)*	*Sum of DDTs (SFEI)*
Dieldrin	1				
Mercury	0.27	1			
Sum of 40 PCBs (SFEI)	0.87	0.28	1		
Sum of Chlordanes (SFEI)	0.86	0.26	0.87	1	
Sum of DDTs (SFEI)	0.84	0.23	0.88	0.95	1

Table 15. Pearson correlation coefficients between legacy pesticides, PCBs, and mercury for storm drain sediment data from KLI 2002 (utilizing data normalized to percent fines <62.5 µm). Yellow highlights indicate well correlated data.

	Chlordane	*Sum DDT*	*Sum PCB*	*Total Mercury*
Chlordane	1			
Sum DDT	0.87	1		
Sum PCB	0.96	0.97	1	
Total Mercury	0.70	0.27	0.50	1

Summary and Options to support Model development

The compilation of local and literature soil/sediment and stormwater organochlorine pesticide concentrations provides a starting point for identifying possible land use and/or source area contributions to pollutant loading. The soil/sediment data provide more classes of land use than the stormwater data. Additionally, these data (maximum concentrations) also span many orders of magnitude between the land uses (chlordane = 4; DDT and dieldrin = 3) which provides a range of pollutant contributions from high to low. However, much of the soil/sediment data are more than 10 years old and therefore may not be representative of current conditions. In contrast, the stormwater data span about 2 orders of magnitude but do have some empirical data on source areas (Superfund site, nurseries, agriculture). There were no identified organochlorine pesticide soil/sediment source area data sets.

Since there is limited specific legacy pesticide source area information, our current GIS land-use designations would be the most relevant spatial data set for attempting to model loading estimates. The newly revised old industrial land use data layer (old industrial areas pre-1968) will aid in identifying those areas that were polluted during the period of max organochlorine usage (1960s). Industrial areas showed the highest soil/sediment concentrations for DDTs and chlordanes. There would be some benefit to incorporating

stormwater source area data as well since this information could provide a finer spatial scale of pollutant sources in the landscape. However, using the source area stormwater data would require a hybrid model (a combination of the base sediment and the base hydrology spreadsheet models) or converting the stormwater concentrations to particulate concentrations (if feasible). As noted above, the soil/sediment database is more extensive and provides information on the land-use basis. Below is a summary of recommendations:

What is the proposed model architecture for integrating OP pesticides into the RWSM?

- Given there is more sediment data available, more variability in sediment data between land uses, sediment appear to be the optimal basis for modeling regional scale loads of OP pesticides (This assumes the successful development of a calibrated sediment model which was still in development at the writing of this report section)
- Could explore the hybrid model architecture that capitalizes on available soil/sediment as well as stormwater data
- Could consider development of a co-transport model based on the relationship between local empirical legacy pesticide and PCB data

What GIS layers are proposed for modeling OC pesticides using the suggested modeling architecture? What is the availability and quality of those GIS layers?

- Primary GIS layers include current land use (industrial, commercial, residential, agriculture, open space) data including the updated pre-1968 industrial data layer. Other GIS data layers already in existence to support source area resolution in the model include rail transport, and recycling for drums and metals more generally. These data layers are already developed and are of good quality but could be optimized to be a little more specific to OC pesticides; for example, splitting out warehousing or light industrial from “old industrial”.
- Consider development of GIS source area data layers for nurseries and wholesale/ retail agricultural and garden supply centers and wholesale for commercial pesticide applicators.

What are the proposed data to support the concentration inputs and calibration/validation for the suggested model?

- Local and world literature soil/sediment/stormwater empirical data have been collated to be used as input coefficients for each of the proposed model parameters. Additional exploration of other potential legacy pesticide source areas could provide more spatially resolute information on pollutant contributions.
- Calibration/verification data at the watershed scale are presently sparse.

What data could be developed to support the model, and what is the relative importance of each dataset suggested (e.g. how high of a priority and how much would it help the model outcome or reduction in uncertainty)?

- Consider selectively adding legacy pesticides to the pollutant list for influent data at monitoring sites associated with the BASMAA EPA grant funded "Clean Water for a Clean Bay project". Stormwater data are being collected at a number of sites and would provide information at finer spatial scales in industrial drainage areas.
- Consider adding legacy pesticides to existing stormwater monitoring projects at Bay Area LID sites being monitoring through grant projects especially in areas with high percent urban, industrial, or agricultural land use.
- Consider mining county records for legacy pesticide use and spatial application data during peak period of the 1960s in order to determine relative application of OC pesticides in the Bay Area.

What methods do we suggest for developing that data? – Back-calculation from existing data; monitoring specific sites?

- An option is to use the inverse optimization methodology (Lent, 2011) for estimating land use based input concentrations (EMCs) using local empirical sediment data.
- Could consider adding OC pesticides to the analytic list for source area monitoring (RMP funding) should it occur in relation to improving PCB and Hg information.

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Selenium Sub-Report

Urban Runoff Characterization and Control Measures Plan

Submitted on behalf of all Permittees in Compliance with Provision C.14.a of Order R2-2009-0074

Prepared as a Regional Project for:

Bay Area Stormwater Management Agencies Association

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ABBREVIATIONS

BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CRWQCB	California Regional Water Quality Control Board
CTR	California Toxics Rule
DL	Detection Limit
MRP	Municipal Regional Stormwater NPDES Permit
MS4s	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
POTW	Publicly Owned Treatment Works
RMP	Regional Monitoring Program
SCVURPPP	Santa Clara Valley Urban Runoff Pollutant Prevention Program
SFEI	San Francisco Estuary Institute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This *Selenium Control Measures Plan* was prepared for the Bay Area Stormwater Management Agencies Association (BASMAA) representing all towns, cities, counties and flood control agencies (i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP, Order R2-2009-0074) issued by the San Francisco Regional Water Quality Control Board (Regional Board) on October 14, 2009. This report addresses the requirements of MRP Provisions C.14.a.iii-vii for characterizing selenium concentrations in urban runoff and identifying control measures and/or management practices to eliminate or reduce discharges of selenium discharged by urban runoff conveyances systems.

Requirements associated with selenium are included in the MRP because regulatory agencies have previously identified selenium as impairing beneficial uses in the San Francisco Bay, and determined that urban runoff is a likely or potential cause or contributor to the impairment (SFRWQCB 2009). In 1986, a health advisory was issued to hunters against the consumption of San Francisco Bay Area diving ducks. After a Selenium Verification Study conducted from 1985 to 1990 showed potentially toxic concentrations of selenium in diving ducks, San Francisco Bay was listed as impaired by selenium in 1998 (SFBRWQCB 2011). The 303(d) listing has since been amended to specify inclusion of specific segments as described in Section 3 of this report. The requirement to characterize selenium concentrations in urban runoff and identify control measures is included in the MRP to assist with the development of Total Maximum Daily Loads (TMDLs) for segments of North and South San Francisco Bay in which elevated selenium levels in some fish and diving birds threaten beneficial uses.

Provision C.14 of the MRP includes the same requirements for legacy pollutants, polybrominated diphenyl ethers (PBDEs), and selenium (hereinafter C.14 pollutants) in urban runoff. TMDLs and reevaluations of impairments are planned or are in the early stages of development for each of the C.14 pollutants. Provision C.14 serves as an interim step between impairment listings and TMDL development or delisting. In particular, the MRP provisions require Permittees to implement a plan that characterizes the representative distribution of C.14 pollutants in the urban areas of the San Francisco Bay Region to answer the following questions:

- Are C.14 pollutants present in urban runoff?
- Are C.14 pollutants (relatively) uniformly distributed in urban areas?
- Are storm drains or other surface drainage pathways sources of C.14 pollutants in themselves?
- Are there specific locations within the urban watershed where prior or current uses result in land sources contributing to discharge of C.14 pollutants to the Bay via urban runoff conveyance systems?

Permittees are also required to provide information to allow for the calculation of C.14 pollutant loadings to San Francisco Bay from urban runoff conveyance systems and identify control measures and/or management practices to eliminate or reduce discharges from these systems. This report addresses all questions and requirements regarding selenium that are included in the MRP. With regard to urban runoff characterization data, results of monitoring studies implemented during the MRP via the Regional Monitoring Program for the San Francisco Bay's (RMP) Small Tributaries Loading Strategy (STLS) are also described.

2.0 BACKGROUND

Selenium is a naturally occurring trace element that can be found in sedimentary rocks, soils, and mineral deposits of marine origin throughout California. Average concentrations of total recoverable selenium (total selenium) found in sediments and soils usually range from 0.01 to 0.02 mg/kg with most seleniferous soils containing less than 2 mg/kg. In natural freshwater and estuarine ecosystems total selenium concentrations are typically low, ranging from 0.1 to 1 µg/L (SFBRWQCB 2011). Selenium is elementally similar to sulfur and is strongly associated with sulfur in nature.

Selenium is also an essential micronutrient for plants and animals that plays an important role in thyroid and immune system functions as well as the prevention of oxidative stress or inflammation. However, too much selenium can be harmful. In fact, the disparity between the selenium concentrations required for a healthy diet in plants, animals, and humans and the levels at which selenium becomes toxic or poisonous, is very small compared to other micronutrients (SFBRWQCB 2011).

2.1. Selenium Speciation

Selenium species found in San Francisco Bay include the following:

- Elemental selenium (Se^0);
- Selenide (Se^{2-});
- Selenite Se^{4+} (SeO_3^{2-}); and
- Selenate Se^{6+} (SeO_4^{2-})

Elemental selenium is insoluble and occurs in particulate form. In the Bay, elemental selenium is most common in bed sediments (SFBRWQCB 2011, Tetra Tech 2008a). The oxidized and more stable form, selenate, is more likely found suspended in the water column. The relatively reduced form, selenite, is the most readily bioavailable species. It readily sorbs to particulate matter and therefore is more likely found in suspended particulates. (SFBRWQCB 2011, Abu-Saba and Ogle 2005) In the Bay, as in most aerobic surface waters, selenate and selenite are the most soluble and most mobile forms of selenium (SFBRWQCB 2011).

Biological uptake of selenium species results in biological conversion to the most reduced species, selenide, which is incorporated into organic compounds called organoselenides (Abu-Saba and Ogle2005). This process is generally carried out by algal or bacterial species (Tetra Tech 2008a).

Although particulate selenium typically only accounts for 2-18% of the total selenium in the Bay, this portion is important to Bay food webs (Abu-Saba and Ogle 2005, SFBRWQCB 2011). Particulate selenium consumed by aquatic organisms is bioaccumulated into, and transformed and transported through the food web, thus increasing the potential for toxicity to organisms. Particulate selenium suspended in the water column of the Bay is likely a result of: 1) deposition from various non-point sources discharging into the Bay, 2) generation in situ (by phytoplankton uptake of dissolved selenium), or 3) erosion from the sediment bed (SFBRWQCB 2011). Riverine and non-point sources discharging into the Bay are the primary source of particulate selenium, with smaller contributions from generation and erosion (SFBRWQCB 2011). Table 2-1 provides further description of the four common selenium species, their key characteristics, and importance to selenium cycling.

Table 2-1. Selenium Speciation Information (Abu-Saba and Ogle 2005).

Oxidation State	Selenium Species	Key Characteristics	Importance to Selenium Cycling
Se +6	Selenate (SeO4+2)	Extremely soluble with a very low affinity for sorption to particulates. Thermodynamically most stable in oxic waters.	Principal form in minerals (e.g. marine shales), therefore dominant species in leached agricultural drainwaters. Very low bioaccumulation and/or biotransformation by algae. Uptake is inhibited by sulfate.
Se +4	Selenite (SeO3+2)	Extremely soluble with a much greater affinity for sorption to particulates than selenate. Thermodynamically less stable in oxic waters, but still common due to very slow oxidation rate.	Principal form of concern as it accumulates in phytoplankton ~10-fold more readily than selenate; Uptake is not inhibited by sulfate.
Se 0	Elemental Selenium	Insoluble precipitate, formed primarily from dissimilatory reduction of selenite in anoxic sediments.	Removal pathway from water bodies; conversion to particulate organoselenium is important bioaccumulation pathway for benthic invertebrates.
Se -2	Inorganic selenide (Se2-)	Highly reactive, forms insoluble precipitates with metals analogous to sulfide; Se2- often co-occurs with inorganic sulfide ores (e.g., cinnabar)	Formation of highly insoluble HgSe (cinnabar analogue) may explain mechanism of Hg detoxification by Se.
	Cellular (aka particulate) Organoselenium	Selenium that has been incorporated into phytoplankton/higher organisms. Selenium substitutes for sulfur in amino acids (e.g. selenomethionine)	Particulate organoselenium is major bioaccumulation pathway for benthic invertebrates (particularly for bivalves like *Corbula/Potamocorbula*)
	Dissolved Organoselenium (aka, organoselenide)	Dissolved organic compounds (e.g. selenomethionine) released from decaying cellular tissues.	Regenerative pool of selenium with uncertain bioavailability
	Dimethylselenide, Dimethydiselenide	Methylated selenium is produced by microbes, plants, and animals.	Provides gaseous escape from sediments and surface waters into the atmosphere.

2.2. Selenium Bioaccumulation

In the San Francisco Bay, Asian clams (*Corbula amurensis, formerly Potamocorbula amurensis*) play a notable role in the bioaccumulation of selenium. This non-native clam feeds on particles containing selenium. Studies show that this clam displays a rate constant for selenium loss that is 10 times slower compared to common crustaceans (SFBRWQCB 2011). Figure 2-1 depicts the process of bioaccumulation of selenium through the foodweb as observed in North San Francisco Bay.

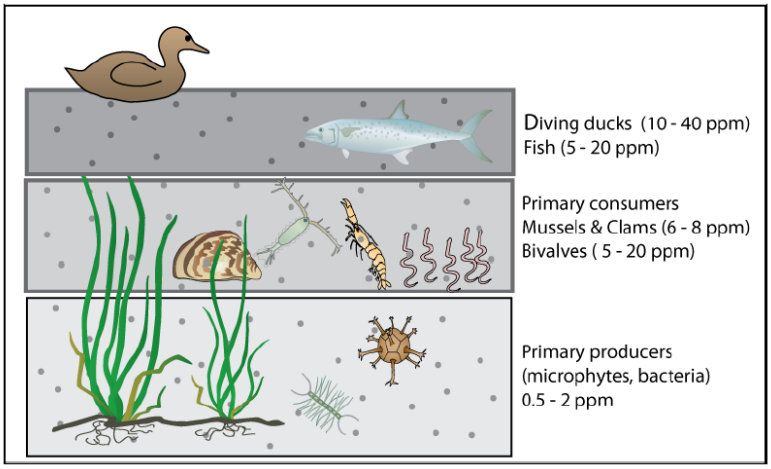

Figure 2-1. Conceptual representation of selenium biomagnification in the North San Francisco Bay. Concentrations (ppm) illustrate the range of selenium found in the North Bay species (SFBRWQCB 2011).

2.3. Selenium Thresholds

Selenium has been observed in San Francisco Bay in the tissues of diving birds and benthic-feeding fish at concentrations that are potentially toxic to aquatic life. Selenium toxicity is of greatest concern for higher trophic level species because, much like mercury, bioaccumulation magnifies the element's toxic effects. Selenium in excess can cause reproductive impacts, such as those observed in bird embryos and hatchlings in the Central Valley's Kesterson wildlife refuge in the early 1980s (Abu-Saba and Ogle2005). Selenium-rich agricultural drainage waters discharging into the refuge were determined to be the cause of these defects. The deformities and fish mortality at the site sparked concern over selenium pollution in California waters and the San Francisco Bay.

Potential declines in the reproduction of benthic-feeding species in the Bay are currently a concern to the Water Board (SFBRWQCB 2011). These include fish, such as white sturgeon and Sacramento splittail, and diving ducks, such as Greater Scaups and Surf Scoters. Existing ecological risk guidelines for selenium in fish and wildlife reported by Beckon et al. (2001) are presented Table 2-2. More stringent site-specific thresholds relevant to North San Francisco Bay are summarized by SFBRWQCB (2011) in the North Bay TMDL Preliminary Project Report. Site-specific thresholds are currently proposed for the North Bay by the Regional Board due to concerns of selenium toxicosis and reproductive impairment in diving ducks.

Table 2-2. Selenium Ecological Risk Guidelines for Fish and Wildlife (Beckon et al. 2001).

Matrix	Effect on	Ecological Risk Guidelines - µg/g-dw		
		No Effect	Concern	Toxicity
Warm Water Fish (Wholebody)	Fish growth/condition/survival	<4	4-9	>9
Vegetation (as diet)	Bird Reproduction	<3	3-7	>7
Invertebrates (as diet)	Bird Reproduction	<3	3-7	>7
Sediment	Fish and bird reproduction	<2	2-4	>4
Avian Eggs	Egg Hatchability	<6	6-10	>10

3.0 REGULATORY STATUS

The Federal Clean Water Act (CWA) requires that states develop water quality standards protective of human health and the aquatic environment. Section 303(d) of the CWA requires the development of a list of "impaired" water bodies that do not meet these standards. The State Water Resources Control Board (State Board) and its Regional Water Quality Control Boards are responsible for compiling and periodically updating the 303(d) list of impaired water bodies in California. The list is subject to approval by the United States Environmental Protection Agency (USEPA). The 303(d) list in California was last updated in 2010. TMDLs are a type of water quality obtainment strategy used in an effort to restore impaired water bodies.

3.1. Water Quality Objectives and Criteria

The USEPA promulgated numeric water quality criteria on behalf of the State of California in 2000 to protect and maintain freshwater and marine aquatic ecosystems (USEPA 2000). The California Toxics Rule (CTR) establishes water quality criteria for acute (1-hr) and chronic (4-day average) concentrations of potentially harmful pollutants. While the USEPA did approve criteria for total selenium through the promulgation of the CTR, the agency specified that for San Francisco Bay and Delta, more stringent criteria must apply due to the scientific evidence of selenium bioaccumulation in the Bay (SFBRWQCB 2011, USEPA 2000). Therefore, the USEPA promulgated the freshwater National Toxic Rule (NTR) criteria for selenium in San Francisco Bay and Delta. These applicable numeric criteria are listed in Table 3-1 and are also described in the Basin Plan (SFBRWQCB 2007).[1] At this time, no water quality objectives for the protection of human health have been adopted by the Regional Board, State Board, or the USEPA (USEPA 2000).

Table 3-1. Selenium Water Quality Criteria for protection of aquatic life in the San Francisco Bay. (USEPA 2000, SFBRWQCB 2007)

Water Quality Criteria	Fresh Water		Salt Water	
	1-hr	4-day	1-hr	4-day
California Toxics Rule (µg/L)	20	5	290	71
National Toxics Rule (µg/L)	20	5	20	5

3.2. Beneficial Use Impairment and Trends

In 1986, a health advisory was issued to hunters against the consumption of Bay area diving ducks (Greater Scaups and Surf Scoters) (SFBRWQCB 2011). In response to the advisory, and a subsequent second health advisory about diving duck consumption, a Selenium Verification Study was conducted from 1985 to 1990 by the Regional Board. The study showed that selenium levels in surf scoters were three times higher than thresholds determined by the US Fish and Wildlife Service (USFWS) to cause selenium toxicosis and reproductive impairment (SFBRWQCB 2011). The advisories and the observed presence of elevated selenium levels in wildlife led to the 303(d) listing of all segments of the San

[1] The USEPA is currently reevaluating the selenium criteria for the protection of semi-aquatic wildlife in the San Francisco Bay and Delta. Modeling of the fate and transport of selenium in San Francisco Bay conducted by the United State Geological Survey (USGS) serves as the basis for the reevaluation. When USEPA completes its reevaluation, it will formally request public comment on the USGS modeling report as well as draft revised selenium criteria for the San Francisco Bay and Delta (USEPA 2011).

Francisco Bay as impaired by selenium in 1998. Since that time, the 303(d) list has been amended to specify inclusion of specific Bay segments listed in Table 3-2. Figure 3-1 provides an illustration of all segments of the San Francisco Bay.

Table 3-2. San Francisco Bay segments listed as impaired by selenium on the in 2010 303(d) list (SFBRWQCB 2011).

San Francisco Bay Segment		Impairment Description	TMDL Under Development
North Bay	Sacramento-San Joaquin Delta	Hatchability in nesting diving birds; Health consumption advisory in effect for scaup and scoter (diving ducks)	Yes
	Suisun Bay		
	Carquinez Strait		
	San Pablo Bay		
	San Francisco Bay - Central		
Lower & South Bay	San Francisco Bay – Lower • Central Basin • Oakland Inner Harbor - Pacific Dry Dock (Part of Lower Bay)	Health consumption advisory in effect for benthic-feeding ducks	No
	• San Francisco Bay - South		

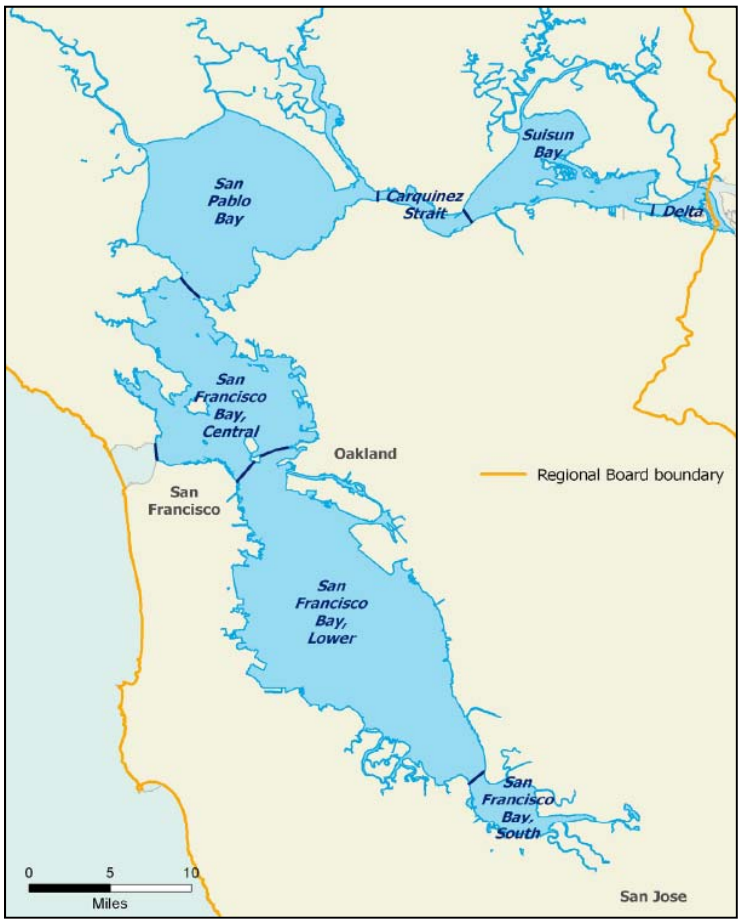

Figure 3-1. The San Francisco Bay system and specific segments.

Specific beneficial uses in North San Francisco Bay that are reported by the Water Board as threatened by selenium bioaccumulation include Estuarine Habitat (EST), Preservation of Rare and Endangered Species (RARE), and Ocean, Commercial and Sport Fishing (COMM) (SFBRWQCB 2011). Descriptions of each use are included in Table 3-3.

Table 3-3. Descriptions of North Bay beneficial uses potentially impaired by selenium (SFBRWQCB 2007; SFBRWQCB 2011).

Designated Beneficial Use	Description
Estuarine Habitat (EST)	Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g. estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.
Preservation of Rare and Endangered Species (RARE)	Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.
Ocean, Commercial and Sport Fishing (COMM)	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms in oceans, bays, and estuaries, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Although impairment listings for the northern and southern portion of the Bay are currently in place, concentrations of selenium in the water column of San Francisco Bay are well below numeric water quality criteria listed in Table 3-2 (SFEI 2011, SFBRWQCB 2011). Average concentrations of total selenium measured in water throughout the San Francisco Bay from 2002 through 2010 by the Regional Monitoring Program for the San Francisco Estuary (RMP) are shown in Figure 3-2. Bay-wide, the average concentration of selenium in water during this timeframe was 0.13 µg/L (SFEI 2011). The highest concentration was 1.15 µg/L, well below the 5 ug/L water quality criteria. As illustrated in Figure 3-1, Bay-wide average selenium concentrations post-2002 are relatively consistent.

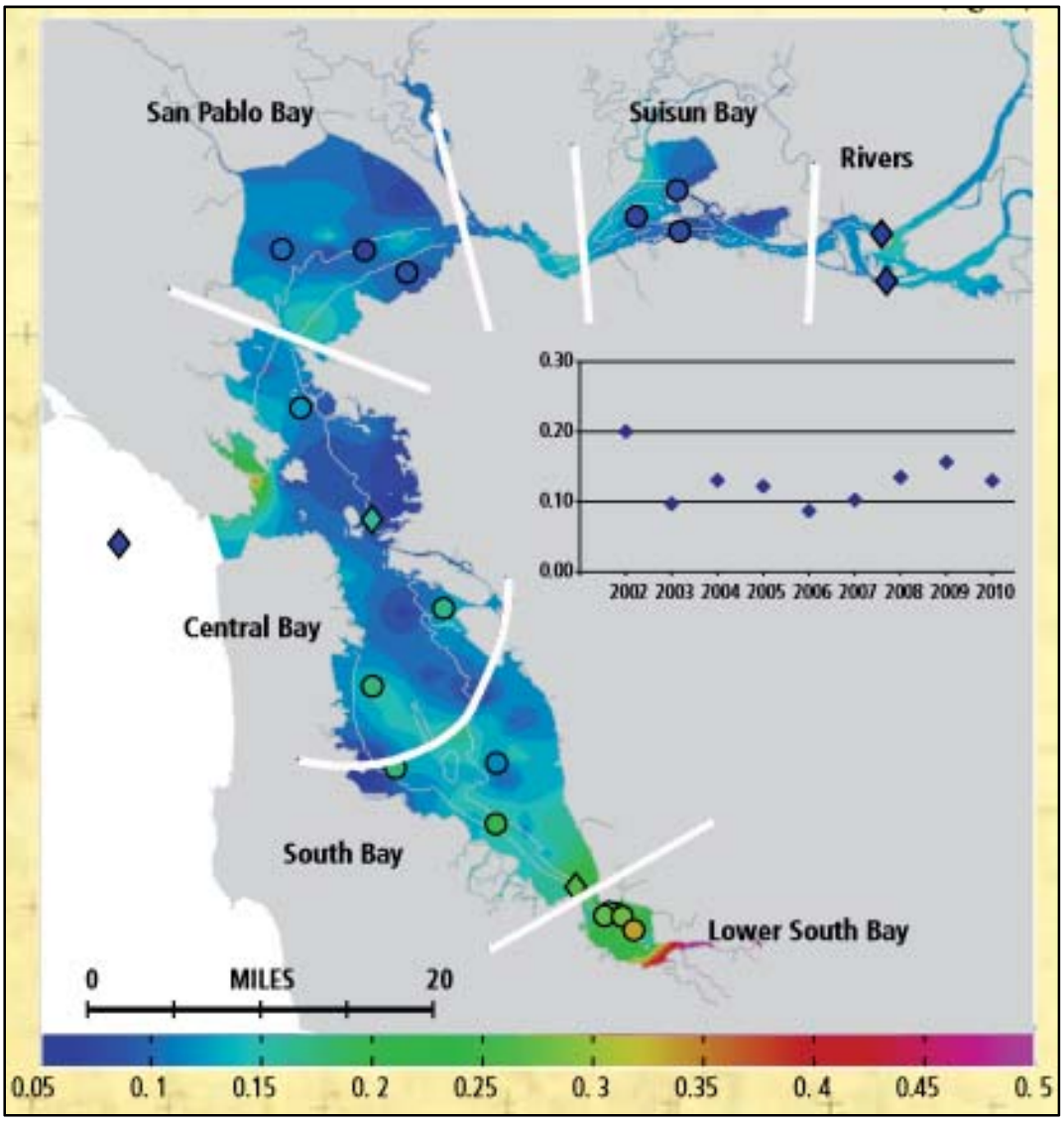

Figure 3-2. Selenium concentrations (ug/L) in the San Francisco Bay between 2002 and 2010 (SFEI 2011).

Triennially, the RMP also conducts monitoring of pollutants in sport fish tissue. The most recent monitoring was conducted in 2012, but data for this year are not yet available. As illustrated in Figure 3-2, concentrations of selenium in white sturgeon between 1997 and 2009 show no trend. Additionally, the RMP monitoring in 2009 indicates that selenium concentrations in multiple sport fish species are well below guidelines set by the Office or Environmental Health and Hazard Assessment (SFEI 2012). The OEHAA guideline for white sturgeon is 2.5 ppm (mg/kg – wet weight) (OEHAA 2011).

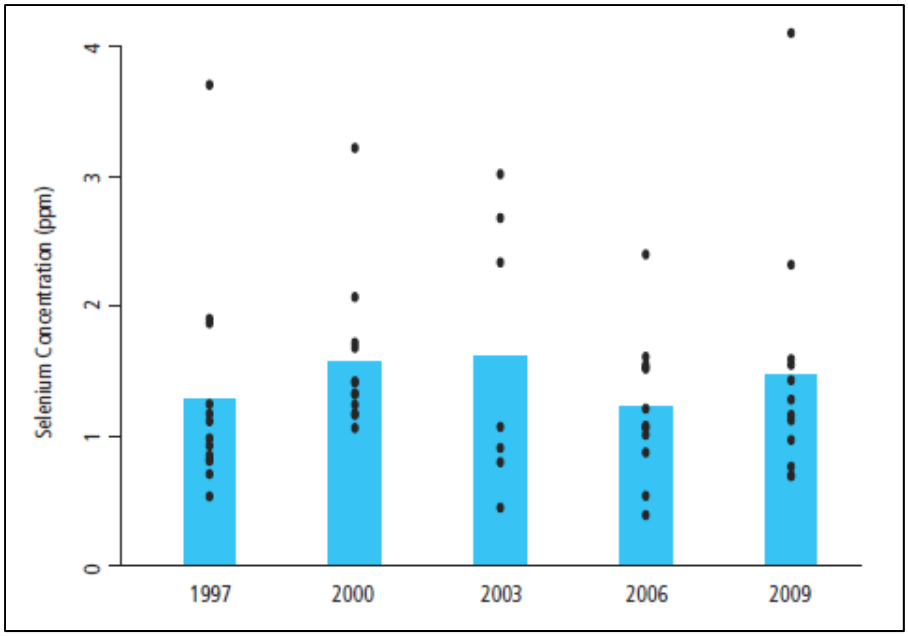

Figure 3-1. Selenium concentrations (ppm wet weight) in white sturgeon in San Francisco Bay between 1999 and 2009. Bars indicate average concentrations. Points represent individual samples (either composites or individual fish) (SFEI 2012).

3.3. Status of TMDL Development

The Regional Board is currently addressing 303(d) listing of the North and South San Francisco Bay through separate regulation strategies because of their differences in selenium sources (SFBRWQCB 2011). Primary sources for the North and South Bays are described in Section 4 of this report. The TMDL development process for all segments of North San Francisco Bay is currently underway with the goal of addressing the issue of selenium bioaccumulation in fish and birds. The North Bay Selenium TMDL Project was initiated by the Water Board in 2007 (SFBRWQCB 2011). After data collection and analysis in support of TMDL development, a Preliminary Project Report was released in 2011 summarizing findings and current knowledge regarding selenium impairment and relevant sources. As described in the report, a TMDL target based on fish tissue will likely be proposed for adoption instead of a water-based, total selenium target that is not directly representative of toxic effects to wildlife (SFBRWQCB 2011). The initial proposed fish tissue target for white sturgeon is 6.0 – 8.1 ug/g (dry weight).[2] The target is based on the proposed USEPA wildlife criterion for San Francisco Bay/California and represents the estimated selenium concentration in fish at which an effect is observed in 5 - 10% of the population (SFBRWQCB 2011). The North Bay TMDL is currently progressing and is scheduled for completion in 2014 or 2015.

The process for developing a selenium TMDL for Lower and South Bay segments has not formally begun. Based on the TMDL development schedules recently presented by Water Board staff, the process will begin within the next 2 to 5 years, unless other regulatory processes are implemented as alternatives to a TMDL.

[2] Concentrations of total selenium presented in Figure 3-1 should not be compared to the proposed fish tissue target due to the difference in units (wet v. dry weights).

4.0 USES, SOURCES, PATHWAYS AND FATES

Selenium uses, sources, transport pathways and environmental fates are described in this section. Additionally, conceptual models of these processes are presented. Sources and transport pathways differ geographically for North and South San Francisco Bay segments (SFBRWQCB 2011) and therefore these segments are discussed separately.

4.1. Selenium Uses

Selenium is a naturally occurring trace element that is widely distributed but dispersed in the environment. Selenium is used in a variety of applications, including those listed in Table 4-1. The vast majority of uses (~70% of the market share) are associated with the manufacturing of glass, metal, chemicals and pigments.

Table 4-1. Selenium uses and estimated market shares (SFBRWQCB 2011,Lent and McKee 2011, USGS 2004).

Selenium Use	Use Description	Market Share
Glass Manufacturing	• Combined with other chemicals to produce colored glass • Used as decolorizer in windows • Used in powdered glass applied to ceramic products	25%
Metal Manufacturing	• Additives to steel, copper and lead alloys	24%
Chemical and Pigment Manufacturing	• Catalyst and oxidizing agents in organic chemical production • Used as pigments in coloring of plastics	22%
Pharmaceutical, Cosmetic and Nutrition Industries	• Catalyst in pharmaceutical manufacturing • Feed additive for livestock • Dietary supplement • Antidandruff shampoos	19%
Electronics	• Photographic exposure meters • Xerographic copiers • Solar photocells	10%

4.2. Conceptual Model of Selenium Sources and Pathways

Primary sources and transport pathways for selenium in the Bay are listed in Table 4-2 and depicted in the conceptual model (Figure 4-1) developed via the Selenium Conceptual Model and Impairment Assessment (CM/IA) funded through the Clean Estuary Partnership (Abu-Saba and Ogle 2005). Due to the differences in sources and transport pathways for North and South San Francisco Bay are listed separately in Table 4-2 and described separately in the following sections.

Table 4-2. Selenium sources and transport pathways to North and South San Francisco Bay (SFBRWQCB 2011).

Bay Segment	Prominent Sources	Prominent Transport Pathways
North Bay	• Natural sources o Groundwater o Soils/sediment • Extracted petroleum	• Urban Runoff • Agricultural Runoff • Agricultural Drainwater • Petroleum Refinery Discharges • Municipal and Industrial Wastewater • Resuspension of sediments in Bay • Atmospheric Deposition
South/Lower South Bay	• Natural sources o Groundwater o Soils/sediment	• Urban Runoff • Pumped Groundwater • Municipal and Industrial Wastewater • Resuspension of sediments in Bay • Atmospheric Deposition

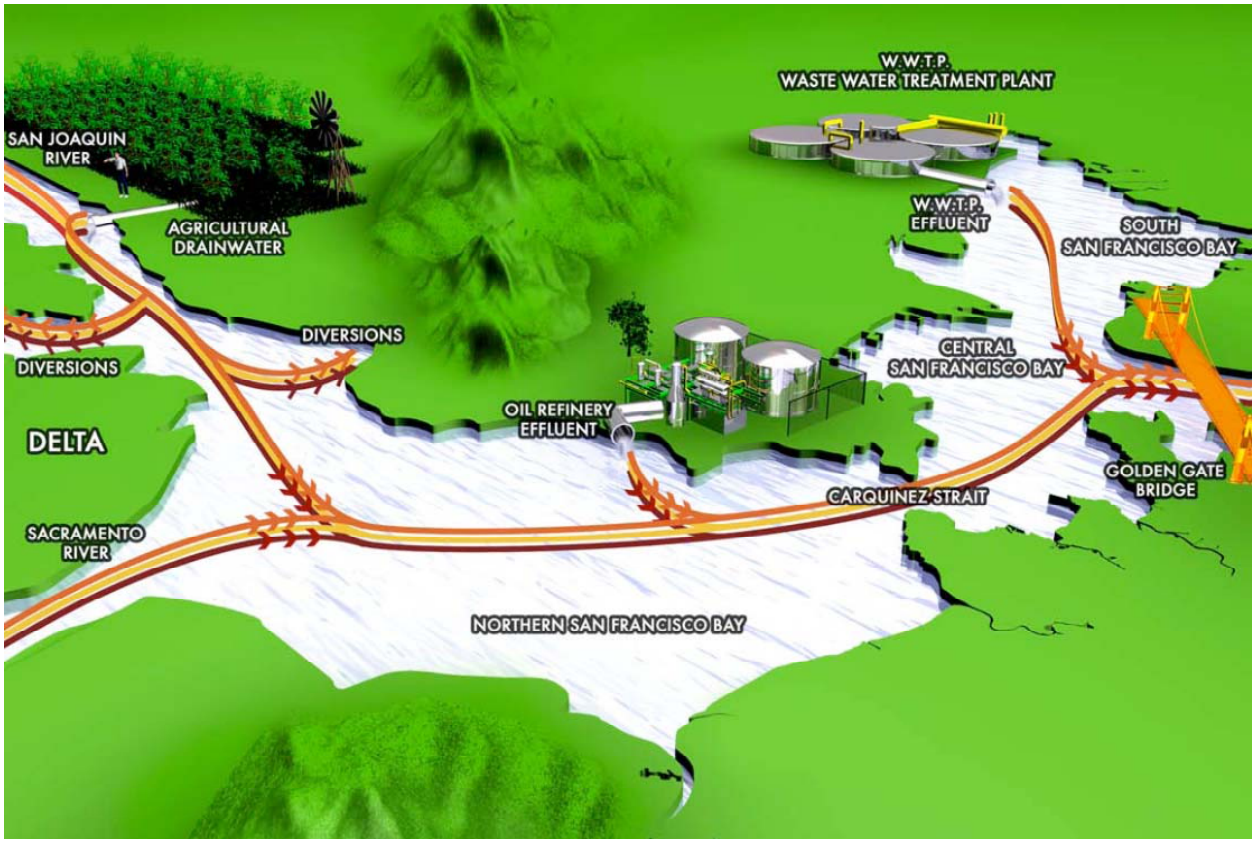

Figure 4-1. Generalized conceptual model of selenium sources and pathways in San Francisco Bay (Abu-Saba and Ogle 2005).

4.3. North Bay Sources, Transport Pathways and Loads

Information on major sources and pathways of selenium to the North Bay is included in North Bay Selenium TMDL – Preliminary Project Report (SFBRWQCB 2011). The primary source to the North Bay is naturally occurring selenium in soils, sediments and groundwater. Petroleum that is extracted and refined provides an additional source of selenium via discharges of refinery treatment plant effluent. Annual loading estimates for the primary source and pathways presented in the TMDL Project Report indicate that the Sacramento and San Joaquin Rivers provide the greatest load of both dissolved and particulate selenium to the North Bay. At roughly an order-of-magnitude less load than the two rivers, petroleum refineries, municipal and industrial wastewater discharges, and urban and non-urban run-off each provide roughly the same mass of total selenium to the North Bay. Atmospheric deposition is believed to contribute a relatively small load to the Bay. Loading estimates developed by the Water Board (SFBRWQCB 2011) for each selenium source and pathway are included in Table 4-3.

Table 4-3. Characteristics and loads of selenium sources and transport pathways to North San Francisco Bay (SFBRWQCB 2011).

Source/Transport Pathway		Description/Notes	Dominant Forms and Species	Estimated Load [kg] [a]
External	Municipal and Industrial wastewater	POTWs and industrial wastewater effluents	**Predominantly dissolved Se:** selenate (60%), selenite (25%), organic and elemental Se (15%)	**230**
	Petroleum Refineries	Refinery effluents	**Predominantly dissolved Se:** selenate (56-64%), organic selenide (~20%), selenite (15-22%)	**540**
	Central Valley watersheds via Delta inflow	Delta inflow consists of flow from the San Joaquin and Sacramento Rivers. Much of San Joaquin River flows are currently diverted before entering the Bay.	**Dissolved selenium:** Sacramento River - selenate (50-70%), selenite (10-20%), organic selenide (15-20%) San Joaquin River - selenate (60-70%), selenite (3-10%), organic selenide (15-20%)	**3940** (annual average) (1110 - >11000)
			Particulate selenium	**770** (part. Se annual average) (170 - 1660)
	Urban and non-urban runoff	Includes both agricultural and urban runoff.	Speciation not measured but assumed to be similar to Sacramento River	**350-840** (>1500)
	Atmospheric deposition	Includes both dry and wet deposition to the Bay water surface.	Wet deposition (selenite) Dry deposition	**20** (120) **<10** (130)
Internal	Erosion and sediment transport in the Bay	Can be either a source or sink of selenium.	**Particulate selenium**	**280**

[a]Unless noted, loads are expressed as total selenium. Values in bold represent the best estimate, values in parenthesis show the range and/or the highest estimate. Estimates are rounded to the nearest 10 kg

4.4. South Bay Sources, Transport Pathways and Loads

Sources and pathways of selenium to the South Bay (including Lower South Bay) are not well documented (Abu-Saba and Ogle 2005). Sources are likely natural and similar to the North Bay, with the exception of petroleum from refineries that are strictly located in the North Bay. Loading estimates for selenium sources to the South Bay have not yet been developed.

Compared to the North Bay, the South Bay receives much less freshwater inflow and is typically characterized by more localized occurrences of high selenium levels. Because selenium concentrations are primarily locally elevated in the South Bay, the widespread effects of bioaccumulation of selenium are less pronounced than in the North Bay (SFBRWQCB 2011). Data collected by the RMP in between 1989 and 2004 indicate that in sloughs at the outlet of tributaries to the South Bay, selenium concentrations are typically higher than average South Bay or Lower South Bay concentrations (Figure 4-2). Specifically, selenium concentrations in water in Alviso Slough during low-tides are substantially higher than high-tide concentrations (Watson et al. 1998), suggesting that freshwater sources of selenium may play an important role in the slough. Furthermore, based on surface water and groundwater studies conducted in the Guadalupe River watershed (Zawislanski 2003, SCVWD 1994), elevated concentrations in the slough may be attributable to the discharge of pumped groundwater from dewatering operations in the lower Guadalupe River. The relative magnitude of selenium load to the slough from this pathway is currently unknown.

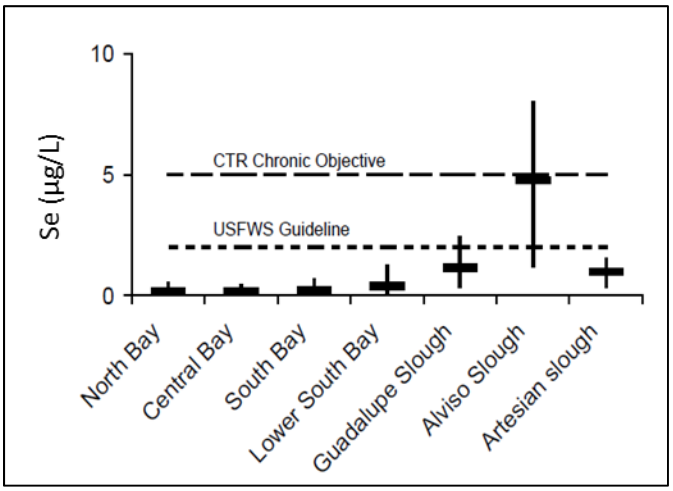

Figure 4-2. Selenium concentrations in segments and sloughs of the San Francisco Bay in 1986-2004.

4.5. Environmental Fate of Selenium

Cycling of selenium in the Bay is carried out through four main processes. Selenium can be:

- absorbed to or ingested by organisms,
- bound or complexed with particulate matter,
- free in solution, or
- released to the atmosphere through volatilization.

Selenium associated with particulate matter and embedded in sediment of the Bay will likely remain in the Bay longer than suspended or dissolved selenium in the water column. As shown in Figure 4-3, water borne selenium is cycled by water flows much more quickly than sediment-bound selenium (Abu-Saba and Ogle 2005). Therefore, even when dissolved selenium concentrations decrease, ecological effects may continue for a longer period of time due to the long residence time (T in Figure 4-4) of selenium in Bay sediments. This is especially important because low-trophic level organisms, consume particulate selenium in sediment, which facilitates the bioaccumulation, and thus the potential for toxicity associated with selenium.

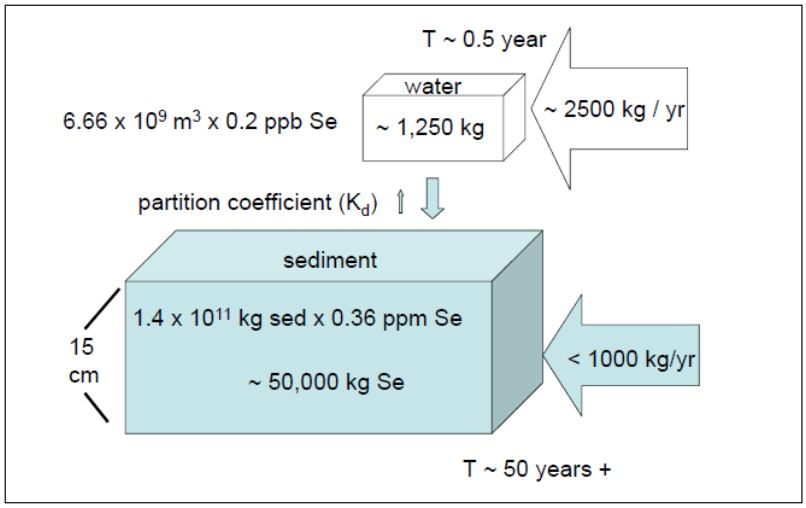

Figure 4-3. Mass balance for selenium in water and sediment of the San Francisco Bay. T = Residence time of selenium in water and sediments. (Abu-Saba and Ogle 2005).

5.0 URBAN RUNOFF AND TRIBUTARY CHARACTERIZATION

Permittees are required to provide information to allow for the calculation of selenium (dissolved and/or total) loadings to San Francisco Bay from urban runoff conveyance systems. To address this requirement, Permittees are conducting pollutants of concern (POC) monitoring and modeling of selenium from local tributaries and urban runoff. Watershed modeling and monitoring of urban runoff, pollutants and sediment discharged to San Francisco Bay are conducted through the RMP's Small Tributaries Loading Strategy (STLS). Information gained to-date through these efforts is summarized in this section, which includes data from urban runoff conveyances and within receiving water bodies (i.e., tributaries).

5.1. Selenium in Urban Runoff

Through a brief literature review, Lent and McKee (2011) summarized "central tendency" total selenium concentrations in urban runoff. Selenium concentrations are presented by land use in Table 5-1 and include values derived from studies in Southern California, Western Maryland and two cities of the San Francisco Bay Area. Based on the review, central tendency concentrations of total selenium in runoff from agricultural land uses are predicted to be an order-of-magnitude greater than runoff from other land use types (Lent and McKee 2011). Typical concentrations are intended to represent average annual concentrations that may be used as inputs to the regional watershed spreadsheet model currently under development through the STLS. Dissolved selenium concentrations or selenium species are currently unavailable for urban runoff.

Table 5-1. Total selenium concentrations in urban runoff by land use type (Lent and McKee 2011).

Land Use Category	Location	Minimum (µg/L)	Maximum (µg/L)	Central Tendency (µg/L)
Commercial	Southern CA	<MDL	13.2	0.1
Open	Southern CA	<MDL	13.9	0.1
Residential	Southern CA	<MDL	24	0.2
Industrial	Southern CA	<MDL	11.9	0.2
Agriculture	Southern CA	<MDL	5.6	1.6
Mixed urban	Hayward, CA	0.053	2.9	0.14
Open	Western Maryland	-	-	0.04
Open	Western Maryland	-	-	0.03
Industrial	Richmond, CA	0.342	7.5	-

MDL = Method Detection Limit

BASMAA also conducted studies in the late 1980's through the mid 1990's in efforts to characterize the concentrations of pollutants in urban runoff in the Bay area. Monitoring at stations representing light and heavy industrial, residential, commercial, transportation, and open space land uses were monitored for a variety of constituents, including total selenium. Although the compilation of the BASMAA data was not part of the scope for this report, the data are readily available and could be used to further assess the contributions of selenium to San Francisco Bay from urban runoff conveyance systems.

5.2. Selenium in Tributaries to the Bay

Given that selenium is present in groundwater that infiltrates to local tributaries independently from urban runoff conveyances, this section specifically discusses concentration of selenium measured in local small tributaries to the Bay.

Selenium in tributaries is mostly dissolved, but similar to urban runoff, little information is available about selenium speciation or bioavailability in Bay tributaries (Tetra Tech 2008c). Data that are available were collected through Pollutant of Concern (POC) monitoring conducted as part of the STLS by BASMAA member agencies and the RMP in fulfillment of Provision C.8.e of the MRP. The POC monitoring program was designed with the primary goal of addressing pollutants of concern in local tributaries and providing one mechanism to assess progress toward achieving waste load allocations (WLAs) for existing TMDLs (BASMAA 2013). While the primary goal of this study was to assess priority POCs, it also aimed to provide a limited characterization of additional lower priority analytes, including selenium. The results available to-date from four stations monitored as part of the STLS, and in compliance with the MRP are presented in Table 5-2. All data presented were collected during a combination of dry weather and storm flows. A report summarizing POC loads monitoring data collected in Water Year 2012 (October 2011 – September 2012) was submitted to the Water Board on March 15, 2013 as part of the *Water Year 2012 Urban Creeks Monitoring Report* (BASMAA 2013).

Table 5-2. Selenium concentrations in San Francisco Bay Area small tributaries monitored in Water Year 2012 (BASMAA 2013, McKee et al. 2013)

Site Location	Analyte	Mean (µg/L)	Min (µg/L)	Max (µg/L)
Marsh Creek	Total Se	0.72	0.65	0.78
	Dissolved Se	0.64	0.48	0.80
San Leandro Creek	Total Se	0.21	0.11	0.29
	Dissolved Se	0.13	0.07	0.20
Guadalupe River	Total Se	1.30	1.20	1.60
	Dissolved Se	1.04	0.77	1.32
Sunnyvale East Channel	Total Se	0.41	0.33	0.49
	Dissolved Se	0.32	0.31	0.33

As discussed in section 4.4, monitoring data collected in Water Year 2012 further illustrate that selenium concentrations in the Guadalupe River, while well below applicable water quality criteria, are notably higher than samples from other monitoring sites. The results are not surprising given that the region surrounding the Guadalupe River is known to have high concentrations of selenium in groundwater. The Santa Clara Valley Subbasin is shown to have concentrations typically ranging from 2.5 to 3.8 µg/L in the Principal Aquifer Zone and 0.4 to 2 µg/L in the Upper Aquifer Zone based on data from 1997 to 2000 (SCVWD 2001). Other studies have also found elevated concentrations in soils and groundwater samples from this area, ranging from less than the method detection limit to 12 µg/L (Alvarez et al. 1998, Anderson 1998).

6.0 CURRENT AND PLANNED CONTROL MEASURES

This section provides a summary of control measures implemented by Permittees to control the discharge of selenium from municipal urban runoff conveyance systems to the San Francisco Bay. Control measures are implemented in compliance with the MRP. Given that monitoring data and conceptual models indicate that urban runoff conveyances are not likely causing or contributing to exceedances of water quality standards for selenium (SFEI 2011, SFEI 2012, BASMAA 2013), new control measures for Permittees in the Bay Area are currently not planned or included in this section. However, as discussed, the continued implementation of current urban runoff control measures, and the implementation of pilot and new control measures focused on other high priority pollutants (e.g., PCBs and mercury) will likely have further reduction benefits for selenium in the future. Reduction benefits associated with some new control measures, however, may be limited for selenium due to fact that most selenium in urban runoff is dissolved and new controls are generally focusing on high priority sediment-bound POCs such as PCBs and mercury.

Applicable urban runoff control measures described in this section focus on both preventing selenium from entering the environment and intercepting selenium once available for transport to the Bay via urban runoff. Control measures fall into three general categories: 1) Pollution Prevention, 2) Interception, and 3) Treatment.

6.1. Pollution Prevention Activities

6.1.1. Industrial Facility Inspections

Provision C.4 of the MRP requires Permittees to implement an industrial and commercial site inspection and control program at all sites that could reasonably be considered to cause or contribute pollutants to urban runoff. Follow-up and enforcement actions consistent with local Enforcement Response Plans (ERPs) to prevent discharges of pollutants and impacts on beneficial uses of receiving waters are implemented as needed. Inspections are carried out to ensure that the facilities have implemented adequate and appropriate control measures. Facilities that may use equipment that contains selenium are inspected via this program and therefore may reduce the risk of selenium discharges to the urban runoff conveyance system.

6.1.2. Household Hazardous Waste Disposal

Permittees also successfully promote, coordinate and staff household hazardous waste (HHW) facilities and collection events that result in the proper disposal of items that contain selenium. Items that contain selenium that are collected at HHW facilities and events include:

- Electronics (selenium used in photocopying, photocells, light meters and solar cells, selenium rectifiers, DC power surge protectors, xeroradiography and in solid state, flat-panel x-ray cameras, blue and white LEDs);
- Print photography products (selenium used in toners, intensifiers, and extenders); and,
- Pharmaceuticals (selenium in small amounts in dietary supplements).

6.1.3. Commercial and Industrial Site Controls

Provision C.4 requires Permittees to implement an industrial and commercial site inspection and control program at all sites which could reasonably be considered to cause or contribute to pollution of urban runoff, with follow-up and enforcement consistent with local Enforcement Response Plans (ERPs), to

prevent discharges of pollutants and impacts on beneficial uses of receiving waters. These programs assist Permittees in preventing pollutants such as selenium from entering urban runoff conveyances.

6.1.4. Illicit Discharge Control Activities

Provision C.5 requires Permittees to implement an illicit discharge control program that includes an active surveillance component, a centralized complaint collection component, and a follow-up component to target illicit discharge and non-urban runoff sources. Similar to commercial and industrial site inspection programs, illicit discharge control programs also assist Permittees in preventing pollutants such as selenium from entering urban runoff conveyances.

6.1.5. Construction Site Inspection and Enforcement

Provision C.6 of the MRP requires Permittees to implement a construction site inspection and control program at all construction sites, with follow-up and enforcement. Permittees require all construction sites to have site-specific and seasonally- and phase-appropriate control measures that fall into the following six categories:

- Erosion control;
- Sediment control;
- Good site management; and
- Run-on and Run-off control;
- Non urban runoff management.
- Active treatment systems (as necessary);

Permittees also conduct inspections to determine compliance and effectiveness of the construction site measures, and require timely correction if violations are found.

6.2. Activities to Intercept Pollutants in Urban Runoff

6.2.1. Urban Runoff System Operation and Maintenance

Permittees currently remove sediment and organic materials through routine maintenance of their urban runoff conveyance systems. Control measures include inlet/catch basin cleaning, street sweeping and channel desilting. Frequencies and efficiencies of these control measure vary widely due to site-specific conditions and different levels of implementation by Permittees. Through pilot studies conducted in compliance with provisions C.11/12.c of the MRP, Permittees are currently evaluating the effectiveness of enhanced operation and maintenance activities and assessing the costs of implementing enhanced actions. The focus of these studies is PCBs and mercury, however, all pollutants, including selenium, will benefit from the information being collected. Although sources and pathways differ between selenium and other targeted pollutants, potential focused implementation of enhanced urban runoff system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of selenium to the Bay from urban runoff.

6.3. Urban Runoff Treatment and Diversions

6.3.1. New and Redevelopment Runoff Controls

Provision C.3 of the MRP requires Permittees to use their planning authority to require source control, site design, and urban runoff treatment measures in new and redevelopment projects to prevent urban runoff pollutant discharges from and prevent increases in runoff from projects that create and/or replace more than 10,000 ft^3 of impervious surface area. Increases in runoff may cause excess erosion

in stream channels, releasing potentially contaminated sediments, including those with elevated concentrations of selenium.

6.3.2. Urban Runoff Treatment Retrofits

Storm drain inlet inserts, flow through separation devices (e.g., hydrodynamic separators), vegetated filtration systems (grassy swales), infiltration trenches/basins, media filtration, detention basins, wet ponds and constructed wetlands can intercept sediments and selenium in the urban runoff conveyance system and may reduce the load of selenium to the Bay. These urban runoff treatment structures may be installed by municipalities on public and capital improvement projects or as retrofits projects targeting pollutants of concern. Through pilot studies conducted in compliance with provisions C.11/12.e of the MRP, Permittees are currently evaluating the effectiveness of urban runoff treatment retrofits and assessing the costs of implementing these actions. The focus of these studies is PCBs and mercury, however, all pollutants in urban runoff, including selenium will likely benefit from the information being collected. Although sources and pathways differ between selenium and other pollutants, potential focused implementation of enhanced urban runoff system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of selenium to the Bay from urban runoff.

6.3.3. Conditionally Exempt Groundwater Discharges

Control measures for groundwater discharges to the urban runoff conveyance system are described in Provision C.15 of the MRP, and may assist in reducing impacts associated with selenium. Uncontaminated pumped groundwater, foundation drains, crawl space pumps and footing drains from single family homes are exempted non-urban runoff discharges allowed by per MRP Provision C.15.a. For all other new discharges of uncontaminated pumped groundwater, foundation drains, crawl space pumps and footing drains that have flows less than 10,000 gallons per day, Permittees encourage discharge to landscape areas or bioretention facilities as a control measure. If the discharge is directed to the urban runoff conveyance system, proper control of the discharge is required by the MRP. New discharges of uncontaminated groundwater greater than 10,000 gallons per day are reported to the Water Board and may be subject to separate NPDES permitting requirements.

Permittees who use groundwater for drinking water must implement control measures when drinking water is discharged. Appropriate control measures may include filtration, settling, coagulant application with no residual coagulant discharge, minor odor or color removal with activated carbon, small-scale peroxide addition, or other minor treatment to remove total suspended solids and silt.

Groundwater discharged from dewatering activities at construction sites disturbing one acre or more of land are subject to the Statewide General Construction Stormwater Permit (Order No. 2009-0009-DWQ). These authorized non-stormwater discharges must have appropriate control measures in place and conduct monitoring, consistent with the General Permit.

6.4. Bay and Watershed Monitoring

6.4.1. San Francisco Bay Status and Trends Monitoring

The RMP monitors contaminants, including legacy pesticides, in Bay water, sediments, and fish/wildlife tissue on an ongoing basis through its Status and Trends Program (SFEI 2012b). The status and trends program currently includes:

- Biennial water chemistry monitoring;

- Biennial sediment chemistry monitoring, alternating between wet and dry seasons;
- Biennial bivalve bioaccumulation monitoring;
- Sediment toxicity and benthic taxonomic classification;
- Suspended sediment dynamics (USGS);
- Hydrographic studies (USGS);
- Triennial bird egg monitoring (cormorant and tern); and
- Triennial sport fish monitoring.

The RMP is currently funded through Permittee and other discharger contributions. These contributions provide the funding necessary to support water quality and beneficial uses assessments in the Bay.

6.4.2. Small Tributary POC Loads Monitoring/Modeling

Provision C.8 of the MRP prescribes water quality monitoring conducted by Permittees in tributaries to the Bay. Provision C.8.e of the MRP requires Permittees to conduct pollutants of concern (POC) monitoring to assess inputs of POCs to the San Francisco Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. As a result, Permittees developed the Small Tributaries Loading Strategy Multi-Year Plan, which includes the following:

- Watershed modeling of runoff, pollutants, and sediment discharged to San Francisco Bay, using the Regional Watershed Spreadsheet Model, including legacy pesticides;
- Bay margins modeling;
- Source area runoff monitoring;
- Small tributaries monitoring in local watersheds.

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