

**APPENDIX C: ECONOMIC CONSIDERATIONS FOR THE PROPOSED
FINAL AMENDMENTS TO THE STATEWIDE WATER QUALITY
CONTROL PLANS FOR THE OCEAN WATERS OF CALIFORNIA TO
CONTROL TRASH AND PART 1 TRASH PROVISIONS OF THE WATER
QUALITY CONTROL PLAN FOR INLAND SURFACE WATERS,
ENCLOSED BAYS, AND ESTUARIES OF CALIFORNIA TO CONTROL
TRASH**

CONTACT: Rafael Maestu, Economist
Office of Research, Planning and Performance
State Water Resources Control Board
Email: Rafael.Maestu@waterboards.ca.gov

Summary and Findings

California communities spend more than \$428 million annually to control trash from entering waters of the state, or \$10.71 per capita. This economic analysis estimates that between \$2.93 and \$7.77 more per resident might need to be spent each year for the next ten years to implement the proposed **final** Trash Amendments. The economic analysis also finds that communities in the Los Angeles Region implementing a trash and debris Total Maximum Daily Load (TMDL) are spending an average of \$5.3 per resident per year more than communities not implementing a trash or debris TMDL.

This economic analysis provides an estimate of the compliance costs and considers the incremental costs applicable National Pollutant Discharge Elimination System (NPDES) permitted storm water dischargers and other dischargers may need to incur based on the implementation provisions and time schedules in the proposed **final** Trash Amendments. The NPDES storm water permits addressed in this economic analysis include Municipal Separate Storm Sewer Systems (MS4s) Phase I and Phase II, Department of Transportation (Caltrans), Industrial General Permit (IGP), and the Construction General Permit (CGP).

Two basic methods²⁶ to estimate the incremental cost of compliance were used in this economic analysis. The first method is based on cost of compliance per capita, and the second method is based on land cover.

The estimated incremental annual cost to comply with the requirements of the proposed **final** Trash Amendments ranged from \$4²⁷ to \$10.67²⁸ per year per capita for MS4 Phase I NPDES permittees and from \$7.77²⁹ to \$7.91³⁰ per year per capita for smaller communities regulated

²⁶ The introduction includes a more detailed description of the methods used in this economic analysis.

²⁷ The estimated incremental cost of \$4.09 is based on a mixture of full capture systems and institutional controls. See Table 18 (\$67 M divided by a population of 16.4 M).

²⁸ The estimated cost is based on all capital expenditures occurring in one single year. See Table 13 (\$176 M divided by a population of 16.4 M).

²⁹ The estimated incremental cost of \$7.77 is based on a mixture of full capture systems and institutional controls. See Table 25 (\$32.9 M divided by a population of 4.2 M).

under MS4 Phase II NPDES permits. For IGP facilities, the estimated compliance cost is \$33.9 million or \$3,671³¹ per facility. Caltrans currently spends \$52 million on trash control³². To comply with the proposed final Trash Amendments, expenditures by Caltrans are estimated to increase by ~~\$37~~ \$34.5 million in total capital costs and ~~\$15~~ \$14.7 million per year for operation and maintenance of structural controls³³. A summary of the findings are presented in Table 1 with detailed discussion in body of the economic analysis.

In addition to employing trash control, permittees would need to prepare implementation plans and submit monitoring reports. Cost associated with implementation plans and monitoring and reports were not included in this analysis due to the uncertainty of the costs of implementing these new requirements.

This economic analysis fulfills the requirements of Water Code sections 13170 and 13241, subdivision (d) that require the State Water Board to consider economics when establishing water quality objectives. This economic analysis is not a cost-benefit analysis, but a consideration of potential costs of a suite of reasonably foreseeable measures to comply with the proposed final Trash Amendments.

³⁰ The estimated cost is based on all capital expenditures occurring in one single year. See Table 21 (\$33.5 M divided by a population of 4.2 M).

³¹ See Table 28 and Table 30. Total cost divided by number of facilities.

³² Caltrans Press Release, April 25, 2013. Available at: <http://www.dot.ca.gov/hq/paffairs/news/pressrel/13pr033.htm>
McGowen, Scott. California Department of Transportation. Letter to Diana Messina, State Water Resources Control Board. November 7, 2014

³³ See Table 30.

Table 1. Summary of Estimated Compliance Costs of the Proposed **Final** Trash Amendments for NPDES Storm Water Permits

NPDES Storm Water Permit	Number of Entities Accessed	Population /Size	Baseline of Current Trash Control Costs: Total and Per Capita Per Year	Estimated Incremental Cost for Track 1: Total and Per Capita Per Year	Estimated Incremental Cost for Track 2: Total and Per Capita Per Year (at Year 10)
MS4 Phase I (Based on per capita estimate approach)	193 communities	16,498,556	\$160 M Total (\$9.7 per capita) \$22 M for Full Capture System costs (\$1.36 per capita) \$138 M Institutional Controls (\$8.34 per capita)	Highest Annual Incremental Cost^a: \$65 M (total) \$3.95 (per capita) Total Capital Cost^b: \$123M (total) \$7.47 (per capita) Operation & Maintenance: \$52.8 M per year \$3.20 (per capita)	\$67,481,061 \$4.09 per capita
MS4 Phase II (Based on per capita estimate approach)	148 communities	4,310,345	\$49 M Total (\$11.53 per capita) \$6.8 M for Full Capture System (\$1.62 per capita) \$42 M Institutional Controls (\$9.91 per capita)	Highest Annual Incremental Cost^a: \$12.4 M (total) \$2.93 (per capita) Total Capital Cost^b: \$23.4M \$5.54 (per capita) Operation & Maintenance: \$10 M per year \$2.37 (per capita)	\$32,922,053 \$7.77 per capita
MS4 Phase I and Phase II (Based on Land Coverage Approach)	262,302 acres of developed, high intensity land coverage	20,736,141	\$209 M Total (\$10.1 per capita) \$29 M for Full Capture System (\$1.39 per capita) \$180 M Institutional Controls (\$8.68 per capita)	Highest Annual Incremental Cost^a: \$81 M (total) \$3.93 (per capita) Total Capital Cost^b: \$188.6 M (total) \$9.1 (per capita) Operation & Maintenance: \$80.8 M per year \$3.90 (per capita per year)	Not Estimated

Industrial General Permit	9,251 facilities	N/A	Unknown	\$33.9 M ^d \$3,671 per facility	
Construction General Permit	6,121 facilities	N/A	Unknown	No expected increase	No expected increase
Caltrans	N/A	55,000 miles 50,000 lane miles (15,000 centerline miles)	\$52 \$80 M per year	Total Capital Cost : \$37 \$34.5 M Operation & Maintenance: \$46 \$14.7 M per year	N/A

^a Annual cost at Year 10 (highest cost year) is assumed to be 10% of the total capital cost plus the total operation and maintenance cost for treatment controls.

^b Total capital costs are incremental total costs to achieve full compliance with the proposed final Trash Amendments.

^c Operation and maintenance costs are annual costs after full installation of all required treatment controls.

^d Since the current baseline costs are unknown, all trash control costs are conservatively assumed to be incremental.

Table of Contents

1. Introduction.....	C-6
a. Data Sources, Methodology and Assumptions, Limitations and Uncertainties	C-8
b. Organization of This Economic Analysis	C-11
2. Permittees Subject to the Proposed Trash Amendments.....	C-12
a. MS4 Phase I and Phase II Permits.....	C-12
b. California Department of Transportation	C-13
c. Permitted Storm Water Industrial and Construction Facilities	C-13
d. Other Facilities and Activities Subject to the Proposed Trash Amendments	C-14
3. Current Trash Control Expenditures	C-15
a. Summary of Existing Trash Control Studies	C-15
b. Use of Existing Studies in This Economic Analysis	C-17
c. Cost Information from Adopted Trash and Debris TMDLs.....	C-19
4. MS4 Phase I Permittees: Cost Per Capita Method	C-22
a. MS4 Phase I Statistics.....	C-22
b. Potential Compliance Options	C-23
i. Track 1: Full Capture Systems.....	C-23
ii. Track 2: Combination of Full Capture Systems, Other Treatment Controls, Institutional Controls, Multi-Benefit Projects	C-25
c. Compliance Schedules.....	C-30
d. Limitations and Uncertainties.....	C-32
5. MS4 Phase II Permittees: Cost Per Capita Method	C-33
a. MS4 Phase II Statistics.....	C-33
b. Potential Compliance Options	C-34
1. Track 1: Full Capture Systems.....	C-34
2. Track 2: Combination of Full Capture Systems, Other Treatment Controls, Institutional Controls, Multi-Benefit Projects	C-35
c. Compliance Schedules.....	C-38
6. MS4 Phase I and Phase II Permittees: Land Coverage Method	C-41
a. Costs Based on Land Coverage.....	C-41
b. Limitations and Uncertainties.....	C-44
7. Potential Costs for Industrial and Construction Permittees.....	C-48
a. Track 1: Full Capture Systems	C-48
b. Track 2: Combination of Full Capture Systems, Other Treatment Controls, Institutional Controls, Multi-Benefit Projects	C-49
c. Compliance Schedule.....	C-49
8. Potential Costs for Caltrans	C-50
a. Compliance with the Proposed Trash Amendments.....	C-50
b. Compliance Schedule.....	C-51
c. Limitations and Uncertainties.....	C-51
9. Potential Costs for Other Dischargers	C-54
10. Conclusion	C-54
11. References.....	C-55

1. INTRODUCTION

The presence of trash in surface waters, especially coastal and marine waters, is a serious issue in California. The State Water Resources Control Board (State Water Board) is proposing ~~Amendments to Statewide Water Quality Control Plans to Control Trash (Trash Amendments)~~ an Amendment to the Water Quality Control Plan for Ocean Waters of California to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. This economic analysis shall collectively refer to the amendment to control trash and Part 1 Trash Provisions as “Trash Amendments”.³⁴ The proposed final Trash Amendments would amend the Water Quality Control Plans for Ocean Waters of California (Ocean Plan) and be incorporated to the forthcoming Inland Surface Waters, Enclosed Bays, and Estuaries of California (ISWEBE Plan). The proposed final Trash Amendments aim to provide statewide consistency for the Water Boards’ regulatory approach to protect aquatic life and public health beneficial uses, and reduce environmental issues associated with trash in state waters, while focusing limited resources on high trash generating areas.

The proposed final Trash Amendments would apply to all surface waters of the state: ocean waters, enclosed bays, estuaries, and inland surface waters, with the exception of those waters within the jurisdiction of the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) with trash or debris TMDLs that are in effect prior to the effective date of the Trash Amendments. The provisions proposed in the final Trash Amendments include six elements: (1) water quality objective, (2) applicability, (23) prohibition of discharge, (34) implementation provisions, (45) time schedule, ~~(5) a time extension option for State Water Board consideration~~, and (6) monitoring and reporting requirements.

A central element of the proposed final Trash Amendments is a land-use based compliance approach to focus trash control to areas with high trash generation rates. Within this land-use based approach, a dual alternative compliance Track approach is proposed for permitted storm water dischargers (i.e., MS4 Phase I, MS4 Phase II, Caltrans, IGP, and CGP) to implement the prohibition of discharge for trash. Table 2 outlines the proposed alternative compliance Tracks for permitted storm water dischargers. Specifics of the proposed final Trash Amendments are described in Section 2 of the ~~Draft~~ proposed Final Staff Report.

³⁴ The State Water Board intends to amend the Water Quality Control Plan for Enclosed Bays and Estuaries of California to create the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California Plan (ISWEBE Plan). The State Water Board intends that the Part 1 Trash Provisions will be incorporated into the ISWEBE Plan, once it is adopted.

Table 2. Overview of Proposed Compliance Tracks for NPDES Storm Water Permits

	Track 1	Track 2
NPDES Storm Water Permit	MS4 Phase I and II IGP/CGP*	MS4 Phase I and II Caltrans IGP/CGP*
Plan of Implementation	Install, operate and maintain full capture systems in storm drains that capture runoff from one or more of the priority land uses/facility/site.	Implement a plan with a combination of full capture systems, multi-benefit projects, institutional controls, and/or other treatment controls to achieve full capture system equivalency, institutional controls, and/or multi-benefit projects with same performance results of Track 1 with the MS4 jurisdiction/significant trash generating areas/facility/site.
Time Schedule	10 years from first implementing permit but no later than 15 years from the effective date of the proposed Trash Amendments.**	10 years from first implementing permit but no later than 15 years from the effective date of the proposed Trash Amendments.**
Monitoring and Reporting	Demonstrate installation, operation, and maintenance of full capture systems and provide mapped location and drainage area served by of full capture systems.***	Develop and implement set of monitoring objectives that demonstrate mandated performance results, effectiveness of the selected combination of treatment and institutional controls, and compliance with full capture system equivalency the equivalency to Track 1. ***

* IGP/CGP permittees would first demonstrate inability to comply with the outright prohibition of discharge of trash.

** ~~Any new development within the MS4 permittee's jurisdiction must be built to immediately comply with Track 1 or Track 2. MS4 permittees designated after the effective date of the implementing permit would be in full compliance ten years after the date of designation. Where a permitting authority makes a determination that a specific land use or location generates a substantial amount of trash, the permitting authority has the discretion to determine a time schedule with a maximum of ten years.~~ IGP/CGP permittees would demonstrate full compliance with deadlines contained in the first implementing permit.

*** No trash monitoring requirements for IGP/CGP, however, IGP/CGP permittees would be required to report trash controls.

This economic analysis provides an estimate of the compliance costs and considers the incremental costs permitted storm water dischargers and other dischargers may need to incur based on the implementation provisions and time schedules proposed in the final Trash Amendments. The economic analysis was conducted under a set of assumptions identified in each section. All costs are expressed in February 2014 dollars, unless otherwise noted.

a. Data Sources, Methodology and Assumptions, Limitations and Uncertainties

This analysis applies general economic principles and generally accepted methods of economic analysis. This section provides an overview of the data sources, a description of the methodology used, the assumptions and the limitations of the analysis.

Data Sources

The data used in this analysis has been obtained from secondary sources and previous studies conducted by universities and other organizations. All data and reports used are publicly available.

Data has been obtained primarily from three sources:

- Cost Considerations conducted for trash and debris TMDLs by the Los Angeles Water Board.
- Studies and surveys conducted by:
 - Kier Associates. The Cost of West Coast Communities of Dealing with Trash, Reducing Marine Debris. September 2012. Prepared for United States Environmental Protection Agency (U.S. EPA).
 - Kier Associates. Waste in Our Water: The Annual Cost to California Communities of Reducing Litter that Pollutes Our Waterways. August 2013. Prepared for the National Resources Defense Council (NRDC).
 - Black & Veatch. Quantification Study of Institutional Measures for Trash TMDL Compliance. November 2012. Prepared for the City of Los Angeles.
- Office of Water Programs, California State University. NPDES Stormwater Cost Survey. January 2005. Prepared for State Water Board.

The economic analysis used Federal 2010 Census data for estimates of land use, population and median household income. For other social and economic information, we relied on the information publicly released by the Demographic Research Unit of the California Department of Finance³⁵.

We compiled the available cost data and analyzed it by categories of costs³⁶. Average and per capita costs were computed and tallied for each category based on the size of the communities. To control for anomalous spending patterns in communities, total annual expenditures were divided by total populations to yield weighted averages (within each population size group).

Methodology and Assumptions

This economic analysis provides a summary overview of the costs associated with reasonably foreseeable means of compliance permittees may select to be in compliance with the proposed **final** Trash Amendments. This economic analysis is conducted at the macro level to assess the estimated overall impact of the proposed **final** Trash Amendments. It does not specify the compliance cost for specific permittees. A more detailed analysis would be needed to estimate costs at the micro or project-specific level for each individual permittee.

³⁵ The Economic Research Unit prepares economic forecasts and analyses of various economic developments, advises state departments and local government agencies, and provides economic information to the public. Available at: http://www.dof.ca.gov/research/economic_research_unit/

³⁶ Categories of cost include, street sweeping, storm drain cleaning and maintenance, storm water capture devices, manual cleanup and public education.

With respect to MS4s Phase I and Phase II permittees, this economic analysis uses data gathered from individual municipalities regarding current trash control expenditures to establish the baseline of control costs. The economic analysis considers two potential methods to estimate compliance costs with the proposed [final](#) Trash Amendments. The first method estimates the current expenditures of trash control per capita and the per capita costs to comply with the proposed [final](#) Trash Amendments. The second method estimates the per acre cost for high intensity land cover, e.g., proxy for priority land uses.

The cost factors were used to estimate the potential cost of compliance with the proposed [final](#) Trash Amendments to MS4 Phase I and Phase II permittees based on respective population sizes and urban areas classified as high intensity. The estimated incremental compliance costs represent the cost of the additional level of trash control above and beyond the current level of costs incurred by MS4 Phase I or Phase II permittees subject to the proposed [final](#) Trash Amendments. To avoid the disproportionate influence on the overall average cost of large communities, compliance costs were estimated based on population size group.

For IGP permittees, we assumed that smaller facilities would choose to comply with the proposed [final](#) Trash Amendments implementing institutional controls rather than full capture systems. It is likely that only larger facilities would choose to install full capture systems. We identified two groups based on facility size. For Track 1 analysis, we estimated similar installation and annual operation and maintenance costs as the municipalities. For Track 2 analysis, we estimated the costs of institutional controls to include a \$500 initial training and an annual cost of \$300 in other measures. This approach is described in more detail in Section 7.

For Caltrans, the proposed [final](#) Trash Amendments focus trash control to significant trash generating areas within its jurisdiction. Currently, there is a lack of information about the specific locations where additional trash control will be implemented. Using a GIS analysis, we made the conservative assumption that significant trash generating areas could be approximated using a percentage of Caltrans facilities located within urban areas. We estimated similar installation and annual operation and maintenance costs as the municipalities. This approach is described in more detail in Section 8.

Estimates Based on Costs per Capita

Humans are the only source of trash as defined in the proposed [final](#) Trash Amendments. It is reasonable to assume that the amount of trash generated is directly proportional to the population of each community. Areas with high trash generation rates are influenced by land use type and population density. Factors to take into consideration when evaluating cost of compliance are the size of the community, population density and land use types³⁷.

To estimate the potential incremental costs of compliance with the proposed [final](#) Trash Amendments for MS4 Phase I and Phase II permittees not included in the Los Angeles Region, the average annual per capita cost of implementing full capture systems (Track 1) is estimated using the current average per capita annual cost of areas that are already in compliance with the trash and debris TMDLs within the Los Angeles Region. Per capita cost factors were applied to the entire population in each MS4 Phase I and Phase II. By using this method, the potential cost of compliance with the proposed [final](#) Trash Amendments is likely overestimated since not all members of the population would be living in high trash generating areas. At the same time, this method is more accurate at estimating the cost of complying with institutional controls that are proportional to the population size group. To address this potential source of error, we developed specific cost estimates for each MS4 Phase I and Phase II by population size group.

³⁷ Available land coverage data was used in proxy of land use information. See Section 6 of the Economic Analysis.

This should mitigate for potential variability, such as an observed proportional relationship between high trash generating land uses and MS4 Phase I and Phase II population size groups³⁸.

Estimates Based on Land Uses

Trash generation rates can vary by land use, therefore a second method was used to estimate the compliance cost of a full capture system based on land coverage³⁹. The number of storm drains per acre varies, depending on the type of land use (e.g., high density residential, commercial, mixed urban, and public transportation stations).

Land coverage data was used to calculate the number of storm drains within each segmented road and land cover. Information on land coverage specific for each specific community regulated under an MS4 Phase I and Phase II permit is not readily available. A total statewide number is estimated based on land coverage of high intensity⁴⁰.

This method is the most accurate method to estimate the cost of implementing full capture systems (Track 1)⁴¹. Using land coverage to estimate the total cost of compliance focuses on the actual priority land use area that would be impacted and excludes other low density populated areas. This methodological approach may reduce the error generated when using per capita estimates on large communities with large populations and proportionally low developed density. This method, however, may overestimate costs by including high intensity land coverage that is not part of an MS4. Since the proposed **final** Trash Amendments define priority land uses based on the different types of land uses, using land coverage for the analysis may be underestimating the area subject to trash controls.

Limitations and Uncertainties

The economic analysis estimates the potential cost of compliance following two methodologies. The two selected methods have advantages and limitations. The first method is based on average cost per capita and may overestimate the total cost of compliance by assuming that all populations in each community will bear the cost of implementing full capture systems. The second method is based on area defined as developed, high-intensity land coverage, which is assumed to be a proxy for priority land uses as defined in the proposed **final** Trash Amendments. The analysis, based on cost per capita, would provide best estimates for small and medium size communities with a smaller ratio of resident per acre of high density residential; however this may inflate the total cost for large communities with a small acreage of low density residential areas or communities with an even acreage range of low to high density residential areas. This method is more accurate to estimate the cost of complying with institutional controls that are proportional to the population size group, but this method is less accurate to estimate the cost of implementing full capture systems. Using both methods of analysis would help minimize the potential error in the estimates inherent to each method individually.

³⁸ See Section 4(b)(i) for a discussion of high density residential areas in proportion to population.

³⁹ Land cover data was utilized as a proxy to predictively identify priority land uses subject to the proposed **final** Trash Amendments. The analysis assumes that priority land uses correlates with land cover information. This assumption may underestimate the total area subject to compliance with the proposed **final** Trash Amendments.

⁴⁰ USGS Multi-Resolution Land Characteristics Consortium Land Cover Data 2006. Available at: http://www.mrlc.gov/nlcd06_leg.php

⁴¹ It would be less accurate when estimating the cost of implementing Track 2, because means of compliance through Track 2 has high diversity with available trash controls. Some institutional trash control options, such as education, are not simply relatable to land use area in contrast to locations of full capture systems.

Assumption Regarding Compliance Schedules

The proposed **final** Trash Amendments provide ten years from the first implementing permit for certain permittees to achieve full compliance⁴². Cost estimates for compliance in this economic analysis include the operational costs of treatment and institutional controls. These cost estimates assume a 10% per year expenditure of capital cost in order to achieve full implementation in ten years.

b. Organization of This Economic Analysis

The economic analysis is organized as follows. Sections 1, 2, and 3 describe the permitted storm water dischargers subject to the proposed **final** Trash Amendments and their current trash control expenditures that are used as the baseline for the remainder of the economic analysis. Sections 4 and 5 estimate the potential incremental costs for MS4 Phase I and II permittees based on cost per capita. Section 6 estimates the potential incremental costs of compliance based on land coverage for MS4 Phase I and II permittees implementing full capture systems. Section 7 estimates the potential costs for facilities regulated under the IGP. Section 8 estimates the potential costs for Caltrans. Finally, Section 9 includes information on other dischargers subject to the proposed **final** Trash Amendments. A summary of the conclusions reached in each section is stated at the outset of each section, for the convenience of the reader.

⁴² The proposed **final** Trash Amendments include a 15-year cap, so if a Water Board delays in adopting or reissuing, permittees may not have the full ten years to comply.

2. PERMITTEES SUBJECT TO THE PROPOSED **FINAL** TRASH AMENDMENTS

One of the main transport mechanisms of trash to receiving waters is through the storm water system. The proposed **final** Trash Amendments therefore focus on trash control by requiring that NPDES storm water permits, specifically the MS4 Phase I and Phase II Permits, Caltrans Permit, the CGP, and the IGP, to contain implementation provisions that require permittees to comply with the prohibition of discharge. These provisions focus on trash control in the locations with high trash generation rates, in order to maximize the value of limited resources spent on addressing the discharge of trash into state waters.

As of August 6, 2013, the Water Boards reported⁴³ 16,996 storm water facilities regulated under the Storm Water Construction Facilities, Storm Water Industrial Facilities, and Storm Water Municipal NPDES Permits (Table 3).

Table 3. Facilities and Municipalities Regulated Under the Storm Water **Permitting** Program

Regional Water Board	Construction	Industrial	Municipal (Phase I and Phase II)	Total
1	179	337	14	538
2	1,069	1,316	109	2,494
3	457	401	45	903
4	1,193	2,683	100	3,976
5F	554	453	25	1,032
5R	173	198	3	374
5S	887	1,094	67	2,048
5 all.	1,614	1,745	95	3,454
6A	72	40	5	117
6B	307	190	5	502
6 all.	379	230	10	619
7	253	172	19	444
8	1,136	1,583	62	2,781
9	924	784	79	1,787
TOTAL	7,204	9,251	532	16,996

a. MS4 Phase I and Phase II Permits

The State Water Resources Control Board and Regional Water Quality Control Board's (collectively, the Water Boards) Municipal Storm Water Permitting Program regulates storm water discharges from MS4s. Storm water is runoff from rain or snow melt that runs off surfaces such as rooftops, paved streets, highways or parking lots and can carry with it trash. The runoff

⁴³ Water Boards' Fiscal Year 2012-2013 Performance Report released on September 2013. Available at: http://www.waterboards.ca.gov/about_us/performance_report_1213/regulate/21200_npdes_sw_facilities.shtml

with trash can then drain directly into a local stream, lake or bay. The MS4⁴⁴ permits are issued in two categories or phases: MS4 Phase I and MS4 Phase II.

Some permittees have provisions specific to the control of trash. For example, the San Francisco Bay Municipal Regional Stormwater Permit requires discharges to meet water quality objectives and ensure the protection of the beneficial uses of receiving waters and their associated habitats. Permittees must demonstrate compliance with trash-related receiving water limitations through implementation of structural controls and institutional controls to reduce trash loads from MS4s. The San Francisco Bay Water Board set load reductions for trash from storm water discharges at 40% by 2014.

In the Los Angeles Region, fifteen TMDLs were adopted for trash and debris by either the Los Angeles Water Board or U.S. EPA. The Los Angeles Water Board's trash and debris TMDLs set the numeric target for trash in the applicable water bodies to zero, as derived from the water quality objective in the basin plans. The TMDLs have all also defined trash to be "man-made litter," as defined by the California Government Code (§ 68055.1(g)). Implementation plans vary slightly but are mostly based on phased percent reduction goals that can be achieved through discharge permits, best management practices (BMPs), and structural controls.

In this economic analysis, the communities regulated under the MS4 NPDES program have been grouped based on factors such as size, land use zones, and population.

b. California Department of Transportation

Caltrans is responsible for the design, construction, management, and maintenance of the state highway system, including freeways, bridges, tunnels, Caltrans' facilities, and related properties. Caltrans is subject to the permitting requirements of CWA section 402(p). Caltrans' discharges consist of storm water and non-storm water discharges from state owned rights-of-way.

Before July 1999, discharges from Caltrans' MS4 were regulated by individual NPDES permits issued by the Regional Water Boards. On July 15, 1999, the State Water Board issued a statewide permit (Order No. 99-06-DWQ) which regulated all discharges from Caltrans MS4s, maintenance facilities and construction activities. On September 19, 2012, the Caltrans' permit was re-issued (Order No. 2012-0011-DWQ) and became effective on July 1, 2013.

Caltrans' System-Wide Management Program describes the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters. A revised System-Wide Management Program must be submitted to the State Water Board for approval by July 1, 2014.

c. Permitted Storm Water Industrial and Construction Facilities

Under the industrial program, the State Water Board issues an NPDES Industrial General Permit to 9,200 dischargers associated with ten broad categories of industrial activities (Order No. 97-03-DWQ). The permit also requires that dischargers develop a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. Through the SWPPP, dischargers are

⁴⁴ **Municipal Stormwater Phase I Facilities:** The Municipal Storm Water Permits regulate storm water discharges from MS4s. Under Phase I, which began in 1990, the Water Boards have issued NPDES MS4 permits to permittees serving populations greater than 100,000 people. Many of these permits are issued to a group of co-permittees encompassing an entire metropolitan area. These permits are reissued as the permits expire.

Municipal Stormwater Phase II Facilities: Under Phase II, the State Water Board adopted a General Permit for the Discharge of Storm Water from Small MS4s (WQ Order No. 2003-0005-DWQ) to provide permit coverage for smaller municipalities (10,000 to 100,000 people), including non-traditional small MS4s which are governmental facilities such as military bases, public campuses, prisons and hospital complexes.

required to identify sources of pollutants, and describe the means to manage the sources to reduce storm water pollution. For the monitoring plan, facility operators may participate in group monitoring programs to reduce costs and resources. The regulated industrial sites by regional water board are presented in Table 4.

Table 4: Facilities Regulated under the Storm Water Industrial and Construction Program (as of June 30, 2013)

Regional Water Board	Industrial Storm Water Facilities	Construction Storm Water Facilities
1	334	134
2	1,319	922
3	396	391
4	2,689	1,072
5	1,721	1,341
6	227	313
7	172	219
8	1,573	892
9	770	835
TOTAL	9,201	6,121

CGP permittees are already required to comply with a prohibition of debris discharge from construction sites⁴⁵. Although current costs for trash control by CGP permittees are unknown, there is no expected increase of costs as a result of the proposed **final** Trash Amendments.

d. Other Facilities and Activities Subject to the Proposed Trash Amendments

The proposed **final** Trash Amendments include a prohibition of discharge for discharges not regulated under NPDES permits, Waste Discharge Requirements (WDRs) or ~~W~~waivers of WDRs. The prohibition also applies to the discharge of preproduction plastic by manufacturers of preproduction plastics, transporters and users of preproduction plastics to surface waters of the state.

Also, the proposed **final** Trash Amendments include a provision allowing the Water Boards to require trash controls in areas or facilities that may generate trash, such as high usage campgrounds, picnic areas, beach recreation areas, or marinas.

Due to the uncertainty surrounding the activities and facilities potentially subject to these requirements, these groups were not included in the economic analysis.

⁴⁵ State Board Action 2009-0009-DWQ amended by 2010-0014-DWQ & 2012-0006-DWQ. Prohibition III. D. page 21. Available at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo2009_0009_dwq.pdf
Debris is defined as "Litter, rubble, discarded refuse, and remains of destroyed inorganic anthropogenic waste."

3. CURRENT TRASH CONTROL EXPENDITURES

Communities in California spend approximately \$428 million per year to combat and cleanup trash, which is \$10.71 per resident⁴⁶. Communities within the jurisdiction of the Los Angeles Water Board are already complying with trash and debris TMDLs, and they are currently spending⁴⁷ \$15.04 on average per resident per year to do so. This is 55% higher than the communities not implementing trash or debris TMDLs⁴⁸.

Caltrans spends approximately ~~\$52~~ ~~\$80~~ million a year on “litter removal” (i.e., trash control), or approximately ~~\$1,040~~ ~~\$1,600~~ per lane-mile⁴⁹.

Specific information about the current costs that IGP permittees incur to control trash is unknown. CGP permittees are already required to comply with a prohibition of debris discharge from construction sites⁵⁰, so though current costs for trash control by CGP permittees are unknown, they are not expected to increase as a result of the proposed Trash Amendments.

a. Summary of Existing Trash Control Studies

In 2012, Kier Associates published a study⁵¹ for U.S. EPA to quantify the overall costs of managing trash. The study found that, on average, small and medium West Coast communities (in California, Oregon and Washington) spend at least \$14 per year per resident in trash management and marine debris reduction efforts. The study concluded that the largest cities did not enjoy much in the way of “economies of scale”. The largest cities are spending, conservatively, \$13 per year per resident on trash management and marine debris reduction efforts.

In August 2013, NRDC released another study⁵² (NRDC Study) assessing the annual cost to California communities of reducing litter that pollutes waterways. The NRDC Study is based on a direct survey of 221 randomly selected communities. The NRDC Study found that California communities spend \$428,400,000 each year to combat and clean up litter and to prevent it from ending up in the state’s rivers, lakes, canals and oceans. The NRDC Study indicated a large disparity in the annual average compliance cost per capita ranging between \$8.94 and \$18.33 per resident to manage litter (Table 5). The annual average statewide spending was \$10.71 per resident (Figure 1). The highest reported expenditure was the City of Del Mar in San Diego County with an average of \$71 per resident.

⁴⁶ Kier Associates. 2013. Waste in Our Water: The Annual Cost to California Communities of Reducing Litter That Pollutes Our Waterways. Prepared for NRDC. Available at: http://docs.nrdc.org/oceans/files/oce_13082701a.pdf, page 19.

⁴⁷ Not including costs associated with beach cleanups specific to coastal communities.

⁴⁸ Communities not implementing trash or debris TMDL are spending an average of \$9.68 per resident per year.

⁴⁹ See fn. 2832, ante.

⁵⁰ State Board Action 2009-0009-DWQ amended by 2010-0014-DWQ & 2012-0006-DWQ. Prohibition III. D. page 21. Available at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo2009_0009_dwq.pdf. Debris is defined as “Litter, rubble, discarded refuse, and remains of destroyed inorganic anthropogenic waste.”

⁵¹ Kier Associates. 2012. The Cost to West Coast Communities of Dealing with Trash, Reducing Marine Debris. Prepared for U.S. EPA, Region 9. Available at: <http://www.epa.gov/region9/marine-debris/cost-w-coast-debris.html#report>

⁵² Kier Associates. 2013. Waste in Our Water: The Annual Cost to California Communities of Reducing Litter That Pollutes Our Waterways. Prepared for NRDC. Available at: http://docs.nrdc.org/oceans/files/oce_13082701a.pdf

The NRDC Study collected information from 95 communities ranging from 700 residents (Etna in Siskiyou County) to more than 4 million residents (the City of Los Angeles) regarding six categories of litter management:

- Waterway and beach cleanup
- Street sweeping
- Installation of storm water capture devices
- Storm drain cleaning and maintenance
- Manual cleanup of litter
- Public education

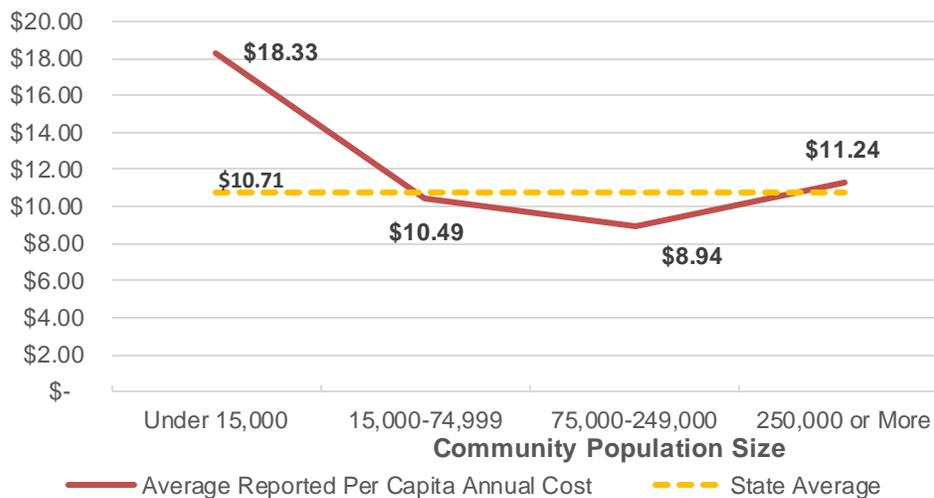
Table 5 and Figure 1 summarize the findings of the NRDC Study.

Table 5. Estimated Current Annual Costs of Trash Control

Community Size	Population Range	Range of Annual Reported Cost	Average Reported Annual Costs	Average Reported Per Capita Cost
Largest	250,000 or more	\$2,877,400-\$36,360,669	\$13,929,284	\$11.24
Large	75,000-249,000	\$350,158-\$2,379,746	\$1,131,156	\$8.94
Midsize	15,000-74,999	\$44,100-2,278,877	\$457,001	\$10.49
Small	Under 15,000	\$300-\$890,000	\$144,469	\$18.33

Source: NRDC Study 2013

Figure 1. Trash Annual Control Costs Per Capita by Community Population Size Group



b. Use of Existing Studies in This Economic Analysis

The proposed [final](#) Trash Amendments include an exception for waters of the state where existing trash and debris TMDLs adopted by the Los Angeles Water Board or U.S. EPA are in effect prior to the proposed [final](#) Trash Amendments. This may result in some limitations in extrapolating statewide costs directly from the studies described above. To address this limitation, we combined the data in the NRDC Study and the Kier Associates’ U.S. EPA Study to calculate a baseline of current costs. The costs were stratified based on community type and size. The summary of the average annual cost per capita for communities outside of the Los Angeles Water Board boundaries by type of trash control type are presented in Table 6.

Table 6. Estimated Current Annual Average Cost Per Capita by Type of Trash Control and by Community Size of MS4 Phase I and Phase II (Not Including Communities within the Los Angeles Region)

MS4 Communities by Population Size (Not Including Los Angeles Communities)	Street Sweeping	Storm Drain Cleaning & Maint.	Storm Water Capture Devices	Manual Cleanup	Public Education	Total Annual Cost Per Capita
>500,000	\$4.19	\$3.28	\$1.19	\$1.27	\$0.65	\$10.41
100,000-500,000	\$3.73	\$2.24	\$1.18	\$0.51	\$0.55	\$7.64
75,000-100,000	\$5.65	\$1.07	\$0.93	\$1.89	\$0.51	\$9.15
50,000-75,000	\$5.33	\$3.15	\$1.53	\$1.57	\$0.42	\$10.20
25,000-50,000	\$3.94	\$2.75	\$1.90	\$1.86	\$0.37	\$9.73
10,000-25,000	\$3.61	\$1.21	\$3.26	\$2.21	\$0.50	\$10.09
0-10,000	\$9.26	\$2.31	\$1.25	\$2.32	\$1.69	\$15.34
All MS4 Communities	\$4.38	\$2.79	\$1.29	\$1.28	\$0.58	\$9.68

Source: NRDC Study 2013

In comparison, the average cost per capita in communities within Los Angeles Water Board boundaries are presented in Table 7.

Table 7. Estimated Current Annual Average Cost Per Capita by Type of Trash Control and by Community Size within the Los Angeles Region

Los Angeles Region MS4 Communities by Population Size	Street Sweeping	Storm Drain Cleaning & Maint.	Storm Water Capture Devices	Manual Cleanup	Public Education	Total Annual Average Cost Per Capita
>500,000	\$6.52	\$1.23	\$2.64	\$4.16	\$1.21	\$15.76
100,000-500,000	\$5.22	\$2.26	\$1.57	\$0.05	\$0.15	\$9.22
75,000-100,000	\$7.62	\$0.26	\$7.92	\$1.19	\$0.39	\$16.79
50,000-75,000	\$6.57	\$0.50	\$6.42	\$1.81	\$0.22	\$14.46
25,000-50,000	\$5.28	\$1.52	\$0.75	\$1.20	\$0.46	\$7.79
10,000-25,000	\$10.58	\$4.62	\$16.00	\$4.10	\$0.85	\$29.84
0-10,000						
All Los Angeles MS4 Communities	\$6.72	\$1.87	\$6.54	\$2.25	\$0.48	\$15.04

Source: NRDC Study 2013

On average, the annual expenditures per capita in communities in the Los Angeles Region are 55% greater than the average cost in the rest of California. The data was collected in 2011 and 2012; as such not all communities were in full compliance with the Los Angeles Water Board's existing trash and debris TMDLs.

Table 8 compares the total estimated annual current expenditures (including those in the Los Angeles Region) for trash control with economic factors such as State Domestic Product, per capita income, and other economic indicators. For example, the City of Los Angeles budget for FY 13-14⁵³ is \$7.69 billion. The City of Los Angeles' annual total expenditures related to trash control identified in the NRDC Study are \$36,360,669⁵⁴ which represents 0.473% of its annual budget. The City of San Diego⁵⁵ spends 0.51%⁵⁶ of its annual budget on trash control. At the other end of the spectrum, the City of San Anselmo, with a population of 12,336, expends \$161,000 in trash controls or approximately 1.3% of its annual budget of \$12.4 million⁵⁷.

Caltrans annually spends **\$52 \$80** million⁵⁸ on litter removal. This is approximately **0.41% 6.7%** of their **\$12.7 \$1.2** billion **maintenance** budget for FY 13-14. Caltrans manages over 50,000 lane-miles of roadways; owns and operates 265 state highways; and owns and manages

⁵³ City of Los Angeles Budget for FY 13-14. Available at: <http://cao.lacity.org/budget/summary/2013-14BudgetSummaryBooklet.pdf>

⁵⁴ Kier Associates. Waste in Our Water. Appendix A, page XVI, Table 13.

⁵⁵ City of San Diego. Proposed 2014 Budget. Available at: <http://www.sandiego.gov/fm/proposed/pdf/2014/vol1/v1executivesummary.pdf>

⁵⁶ Calculated from Kier Associates-WASTE IN OUR WATER, Appendix B, page ii, Table 9 and City of San Diego's Proposed 2014 Budget.

⁵⁷ City of San Anselmo. 2012 Budget. Available at: http://www.marinij.com/ci_21546177/san-anselmo-council-approves-2012-budget

⁵⁸ See fn. **2832**, ante.

12,300 bridges and 665 buildings and other structures. Caltrans spends an average of ~~\$1,040~~ **\$1,600** per lane-mile on litter removal.

Table 8. Existing Trash Control Expenditures in Perspective

Statistic	Budget/Value	Annual Expenditures on Trash Control	Conclusion
California 2012 Gross State Domestic Product	\$2.0035 trillion	\$428 ⁵⁹ million	Californians spend 0.02% of the State Domestic Product in trash controls.
California 2013 average income per capita	\$28,341	\$10.71	Californians spend 0.03% of their average income per capita in trash controls.
California State Budget for FY 2013-14	\$145.3 billion	\$428 million	The California State budget is 7.25% of the California State Domestic product. The cost of trash controls is approximately 0.3% of the State Budget.
The City of Los Angeles Budget for FY 13-14	\$7.69 billion	\$36.3 million	The City of Los Angeles spends 0.47% of their annual budget on trash control.
City of San Diego Budget for FY 2014	\$2.75 billion	\$14 ⁶⁰ million	The City of San Diego spends 0.51% of their annual budget on trash control.
City of San Anselmo Budget (population of 12,336)	\$12.4 million	\$161,000 ⁶¹	The City of San Anselmo spends 1.31% of their annual budget on trash control.
Caltrans Division of Maintenance	\$12.7 billion \$1.2 billion	\$52 million-\$80 million	Caltrans spends 0.41% 6.7% of their annual maintenance budget on litter removal (approximately \$1,040 \$1,600 per lane-mile).

c. Cost Information from Adopted Trash and Debris TMDLs

In the Los Angeles Region, fifteen TMDLs were adopted for trash and debris by either the Los Angeles Water Board or U.S. EPA. Six of the fifteen trash and debris TMDLs include cost considerations that identify the least expensive method of compliance to be catch basin inserts (CBI), which is a type of full capture system (Table 9). The six trash TMDLs were selected as a representative baseline for the cost of adopted trash TMDLs to provide a cost comparison to the proposed Trash Amendments. The existing trash and debris TMDLs are assumed an installation cost factor for a CBI unit of \$800 and annual operations and maintenance cost of \$342⁶² per unit. Catch basin inserts must be monitored frequently and must be used in conjunction with frequent street sweeping. Based on the six trash TMDLs, the annual costs to install and operate

⁵⁹ Kier Associates. 2013. Waste in Our Water: The Annual Cost to California Communities of Reducing Litter That Pollutes Our Waterways. Prepared for NRDC. Available at: http://docs.nrdc.org/oceans/files/oce_13082701a.pdf, page 19.

⁶⁰ Kier Associates. Waste in Our Water. Appendix A, page XVII, Table 13.

⁶¹ Kier Associates. Waste in Our Water. Appendix A, page XIX, Table 14.

⁶² Los Angeles Water Board. 2007. Trash TMDL for Los Angeles River Watershed Final Staff Report dated August 9, 2007. Available at: http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/2007-012/09_0723/L.%20A.%20River%20Trash%20TMDL_Final%20%20Staff%20Report_August%209.%202007.pdf Section VIII. Cost Considerations. Subsection B. Cost of Implementing Trash TMDL. Subdivision 1. Catch Basin Inserts. Paragraph 1. Page 38. The annual operations and maintenance of \$342 is estimated based on the information provided in the Trash TMDL and is the result of dividing the \$51.3 million required in servicing and capital costs (see Table 9 on page 38 of the Los Angeles River Trash TMDL) by the 150,000 catch basins that would need to be retrofitted with inserts to cover 574 square miles of the watershed. See paragraph 1 on page 38 of Los Angeles River 2007 trash TMDL.

full capture systems range between \$5 per capita to \$22.95 per capita, with an average of \$14.33 cost per capita (Table 9).

Table 9. Costs Identified in Trash and Debris TMDLs Adopted by the Los Angeles Water Board

TMDL	Adoption Date	Population/ Household	Total Area and Developed, High Intensity Areas (in acres)	Capital Cost	Operations and Maintenance Annual Cost	Total Annualized Cost	Total Annual Cost Per Capita	Annual Cost Per Acre “Developed, High Intensity”
Los Angeles River Watershed 2007-012	Sept. 23, 2008	4,414,748 1,367,890 households	531,612 (42,730)	\$120 million	\$51.3 million	\$63.3 million	\$14.33	\$1,481
Ventura River Estuary 2007-008	Mar. 6, 2008	15,630 4,867 households	26,176 (58)	\$607,200	\$303,600	\$425,000	\$27.19	\$7,350
Malibu Creek 2008-007	July 7, 2009	59,461 21,794 households	48,438 (29)	\$1,600,000	\$785,000	\$1,099,800	\$18.5	\$38,040
Ballona Creek 2004-023	Aug. 11, 2005	1,501,881 597,311 households	81,972 (16,264)	\$25 million	\$12.5 million	\$15 million	\$10	\$922
Dominguez Channel 2007-006	Mar. 6, 2008	245,000 82,000 households	13,452 (7,680)	\$1,805,000	\$902,000	\$1,082,500	\$4.41	\$141
Calleguas Creek 2007-007	Mar. 6, 2008	65,000 21,000 households	32,326 (505)	\$1,200,000	\$596,000	\$835,000	\$12.88	\$1,653

Assumptions used in the TMDLs’ cost considerations: Capital costs are fully spent in ten years. Operations and maintenance cost is based on full implementation. After ten years, full capture systems need to be fully replaced (10% a year). Total cost is estimated after implementation. Average of three persons per household. CBIs are considered the lowest cost method of compliance.

As part of the economic analysis, we analyzed the potential compliance costs for MS4 communities within the Los Angeles Water Board’s jurisdiction implementing trash TMDLs as if they have to comply with the proposed **final** Trash Amendments instead of full compliance with their current trash TMDLs.

The most significant difference between the Los Angeles Region trash and debris TMDLs and the proposed **final** Trash Amendments is the focus on trash control in high trash generating areas. We estimated the compliance cost with Track 1 or the installation of full capture systems in “developed, high intensity” land coverage in Los Angeles Region, and compared the results with the current compliance costs.

The current annualized cost of compliance (Table 10) for the selected trash and debris TMDLs in the Los Angeles Region is calculated to be \$81.7 million (\$12.97 per capita). The estimated cost for the same communities if complying with only the proposed **final** Trash Amendments would be \$28.4 (\$4.5 per capita); therefore those communities would have saved approximately \$53 million a year (\$8.47 per capita) if they had to comply only with the proposed **final** Trash Amendments.

Table 10. Compliance Costs for Municipalities Complying with Select⁶³ Trash TMDLs Compared to Estimated Compliance Costs for the Proposed **Final** Trash Amendments

Trash TMDL	Population	Area “Developed, High Intensity” (acres)	Estimated Total Capital Cost (to comply with Trash Amendment s only)	Estimated Cost Per Capita (to comply with Trash Amendme nts only)	Estimated O&M Annual Cost (to comply with Trash Amendme nts only)	Estimated Annualized Cost (to comply with Trash Amendme nts only)	<i>Current Annualized Costs of Compliance with trash TMDLs</i>	<i>Current Cost Per Capita</i>
Los Angeles River 2007-012	4,414,748	42,730	\$34,184,000	\$4.08	\$14,613,660	\$18,032,060	\$63,300,000	\$14.33
Ventura River 2007-008	15,630	58	\$46,400	\$1.57	\$19,836	\$24,476	\$425,000	\$27.19
Malibu Creek 2008-007	59,461	29	\$23,200	\$0.21	\$9,918	\$12,238	\$1,099,800	\$18.50
Ballona Creek 2004-023	1,501,881	16,264	\$13,011,200	\$4.57	\$5,562,288	\$6,863,408	\$15,000,000	\$10.00
Dominguez Channel 2007-006	245,000	7,680	\$6,144,000	\$13.23	\$2,626,560	\$3,240,960	\$1,082,500	\$4.41
Calleguas Creek 2007-007	65,000	505	\$404,000	\$3.28	\$172,710	\$213,110	\$835,000	\$12.88
TOTAL	6,301,720	67,266	\$53,812,800	\$4.50	\$23,004,972	\$28,386,252	\$81,742,300	\$12.97

⁶³ The six presented trash TMDLs in Table are the most representative trash TMDL that cover areas similar to the high trash generating areas of the proposed **final** Trash Amendments.

4. MS4 PHASE I PERMITTEES: COST PER CAPITA METHOD

a. MS4 Phase I Statistics

Data was obtained for MS4 Phase I permittees using the California Integrated Water Quality System (CIWQS). MS4 Phase I permittees were then grouped by population size. Of the 376 MS4 Phase I permittees, the permittees associated with Caltrans and those records that did not have complete information necessary for the analysis, such as population, were removed from the analysis. The remaining 289 MS4 permittees were used in this analysis (Table 11).

Table 11. MS4 Phase I Permittees by Regional Water Board

Number of MS4 Phase I Communities by Population Size	Regional Water Board									Grand Total
	1	2	3	4	5	6	7	8	9	
>500,000		1		2	1				1	5
100,000-500,000		11	1	16	4			17	4	53
75,000-100,000		5		10	2			6	5	28
50,000-75,000		12		13	4			15	6	50
25,000-75,000		20		24	3		6	8	9	70
10,000-25,000		12		22	3	1	3	9	5	55
0-10,000		8		10	1	2	1	4	2	28
Grand Total		69	1	97⁶⁴	18	3	10	59	32	289

Out of the 289 MS4 Phase I permittees identified for the economic analysis, 192⁶⁵ are located outside the Los Angeles Water Board boundaries and would be subject to the proposed [final](#) Trash Amendments. Table 12 shows the population living in locations regulated under a Phase I MS4 permit.

⁶⁴ The 97 facilities are subject to an existing trash and debris TMDLs and thus removed from this economic analysis.

⁶⁵ Of the 193 MS4 Phase I permittees outside the Los Angeles Region, one was a duplicate in the database and removed from the analysis.

Table 12. Population Regulated Under MS4 Phase I Permits

MS4 Phase I Communities by Population Size	Regional Water Board									Grand Total
	1	2	3	4	5	6	7	8	9	
>500,000		894,943		4,917,745	799,407				1,223,400	7,835,495
100,000- 500,000		1,715,218	150,441	2,380,622	1,498,871			3,191,801	911,063	9,848,016
75,000- 100,000		407,979		865,587	175,603			523,614	411,052	2,383,835
50,000- 75,000		749,499		785,896	234,054			889,346	339,605	2,998,400
25,000- 75,000		658,814		904,866	112,580		233,462	323,637	356,748	2,590,107
10,000- 25,000		201,038		385,651	62,781	23,609	59,535	157,235	104,895	994,744
0-10,000		40,063		36,533	1,420	8,890	3,816	28,528	5,609	124,859
Grand Total		4,667,554	150,441	10,276,900	2,884,716	32,499	296,813	5,114,161	3,352,372	26,775,456

The number of MS4 Phase I permittees considered in this economic analysis is limited to 289, which represents a total population of 26,775,456 or 72% of the population of California (37,253,959⁶⁶). The 192 MS4 Phase I permittees outside the Los Angeles Region have a total population of 16,498,556 or 45% of California population.

b. Potential Compliance Options

The **final** Trash Amendments propose a dual alternative Track approach for compliance with the prohibition of discharge of trash.

i. Track 1: Full Capture Systems

To determine the incremental cost of compliance, we needed to establish the baseline cost for the MS4 Phase I permittees in this analysis using available cost data from the NRDC (Table 6). For those permittees without the NRDC Study cost data, the average NRDC Study cost factors were applied for each permittee size group (assuming a similar level of current expenditures). Based on that data, the 192 MS4 Phase I permittees are spending \$22,412,501 (\$1.36 per capita) per year to install, operate and maintain full capture systems.

Generally, larger communities have a larger proportion of developed, high intensity in proportion to their population. To compensate for this, a Geographic Information Systems (GIS) analysis was used to determine the ratio of high intensity land coverage for each permittee population size group. We estimated separate per capita cost for each community size based on existing land coverage data for permittees outside the Los Angeles Region. The areas of San Francisco and Sacramento serviced by a combined sewer system were excluded. We used the actual land

⁶⁶ U.S. Census Bureau. 2010.

coverage area classified as high intensity to estimate, for each community size, the number of acres that would need to install full capture systems. The estimated capital cost for each full capture system were assumed as \$800, the annual operations and maintenance is \$342, and an average of one full capture system per acre. The cost estimate assumes all costs are incurred in the same year (Year 10).

The increased cost of implementing full capture systems is estimated to be \$176 million or \$10.67 more on average per capita per year, assuming all full capture systems are installed in a year. This estimate includes the operation and maintenance of the full capture systems (Table 13). This incremental cost per capita varies based on the size of the permittee. For example, some permittees may have an increase of \$13.76 per capita per year, while others may only see an increase of \$5.61 on average per capita per year.

Table 13. Incremental Cost of Compliance for MS4 Phase I Communities Using Full Capture Systems by Community Size

MS4 Phase I Community Size	MS4 Phase I Communities	Total Population (A)	Current Cost (baseline)	Current Cost Per Capita (baseline B)	Estimated Annual Cost Per Capita (After Full Implementation in Year 10) (C+D)	Estimated Total Capital Costs Per Capita (C)	Estimated Annual O&M Per Capita (in Year 10) (D)	Total Estimated Incremental Cost Of Compliance (C+D-B) X A
>500,000	3	2,917,750	\$2,451,409	\$0.84	\$14.60	\$10.22	\$4.38	\$40,077,769
100,000-500,000	37	7,467,394	\$10,469,051	\$1.40	\$12.80	\$8.96	\$3.84	\$85,245,951
75,000-100,000	18	1,518,248	\$1,293,517	\$0.85	\$10.50	\$7.35	\$3.15	\$14,646,291
50,000-75,000	37	2,212,504	\$3,059,738	\$1.38	\$11.00	\$7.70	\$3.30	\$21,335,016
25,000-75,000	46	1,685,241	\$3,033,531	\$1.80	\$8.70	\$6.09	\$2.61	\$11,629,598
10,000-25,000	33	609,093	\$2,028,291	\$3.33	\$7.70	\$5.39	\$2.31	\$2,675,719
0-10,000	18	88,326	\$78,965	\$0.89	\$6.50	\$4.55	\$1.95	\$490,845
Total	192	16,498,556	\$22,414,501	\$1.36	\$12.03	\$8.42	\$3.61	\$176,101,189

In summary, the 192 MS4 Phase I permittees analyzed are currently spending approximately \$22.4 million annually to install and operate full capture systems⁶⁷. To comply with Track 1 of the proposed Trash Amendments, an estimated additional cost of \$176 million or an additional \$10.67 (\$12.03 – \$1.36) per capita on the year that full compliance is achieved. The total capital costs are estimated at \$8.42 per capita or \$139 million. Once the full capture systems are installed (capital costs), the annual operations and maintenance costs are estimated at \$3.2 per capita or \$52.8 million. Assuming permittees install 10% of the structural controls each year, the incremental capital, operation and maintenance costs in Year 10 (highest cost year) would be \$65 million for all affected permittees (\$3.95 per capita).

⁶⁷ The NRDC data does not break down the costs into capital and operation and maintenance.

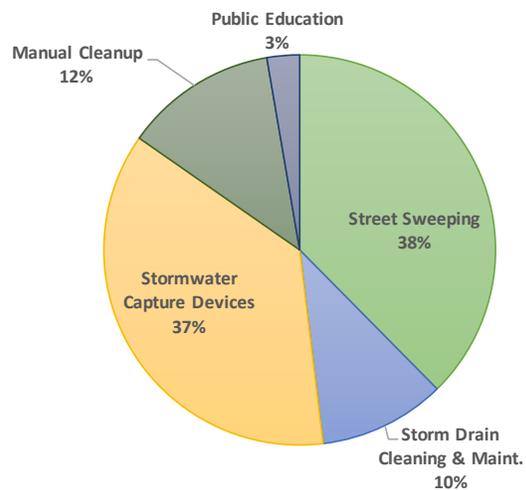
ii. Track 2: Combination of Full Capture Systems, Other Treatment Controls, Institutional Controls, Multi-Benefit Projects

A 2012 study⁶⁸ conducted by the California Coastal Commission and the Algalita Marine Research Institute and partially funded by the State Water Board concluded that:

“There is no one method for completely controlling trash in stormwater. Institutional controls may provide the best long-term solution, especially those focused on prevention. However, depending on the magnitude of the problem, institutional controls may be inadequate. Focusing on enforcement of litter laws is considered by many to provide the most “bang for the buck”. However, most urban municipalities will have to do more to physically capture and control trash in urban waterways or to prevent it from reaching the waterway.”

Previous studies have demonstrated that mixed institutional controls and full capture systems provide a high level of performance/compliance. For example, the City of Los Angeles has implemented a comprehensive trash prevention program involving both structural and institutional measures. The Los Angeles’ program has included the installation of full capture and partial capture systems in catch basins, as well as ongoing efforts to implement institutional measures such as public outreach, street sweeping and catch basin cleaning.

Figure 2. Percentage of Expenditures by Trash Control Category in the Los Angeles Region (Source: NRDC Study)



The proposed **final** Trash Amendments specify that Track 2 must be implemented to achieve the equivalent level of performance to the exclusive use of full capture systems (Track 1) in the priority land uses.

On November 6, 2012, a study⁶⁹ prepared for the City of Los Angeles by Black & Veatch, assessed the effectiveness of institutional measures for trash TMDL compliance. The study conducted in Los Angeles show that institutional measures can be effective in medium and low trash-generating areas but may not achieve the same level of compliance in high trash-generating areas. The results show a 12.5% trash reduction in 2012 from the 2007 baseline in medium and low trash generating areas.

The question that remains is what ideal mixture of institutional controls, other treatment controls, multi-benefit projects and full capture systems permitted dischargers might choose to comply with the proposed **final** Trash Amendments at a minimum cost.

⁶⁸ Gordon, Miriam, and Ruth Zamist. "Municipal Best Management Practices for Controlling Trash and Debris in Stormwater and Urban Runoff." n.d. California Coastal Commission; Algalita Marine Research Foundation. 31 Jul 2012 <http://plasticdebris.org/Trash_BMPs_for_Munis.pdf>.

⁶⁹ Black & Veatch. 2012. Quantification Study of Institutional Measures for Trash TMDL Compliance.

Based on the data provided in the NRDC Study, permittees in the Los Angeles Region are currently⁷⁰ spending approximately 37% of trash control expenditures in implementing full capture systems (Figure 2). This percentage varies significantly depending on the size of the permittee’s jurisdiction, population density, and area of priority land uses. Larger sized permittees dedicate 17% of trash control expenditures to full capture systems, and smaller sized permittees dedicate 46% of trash control expenditures to full capture systems (Table 14 and Figure 3).

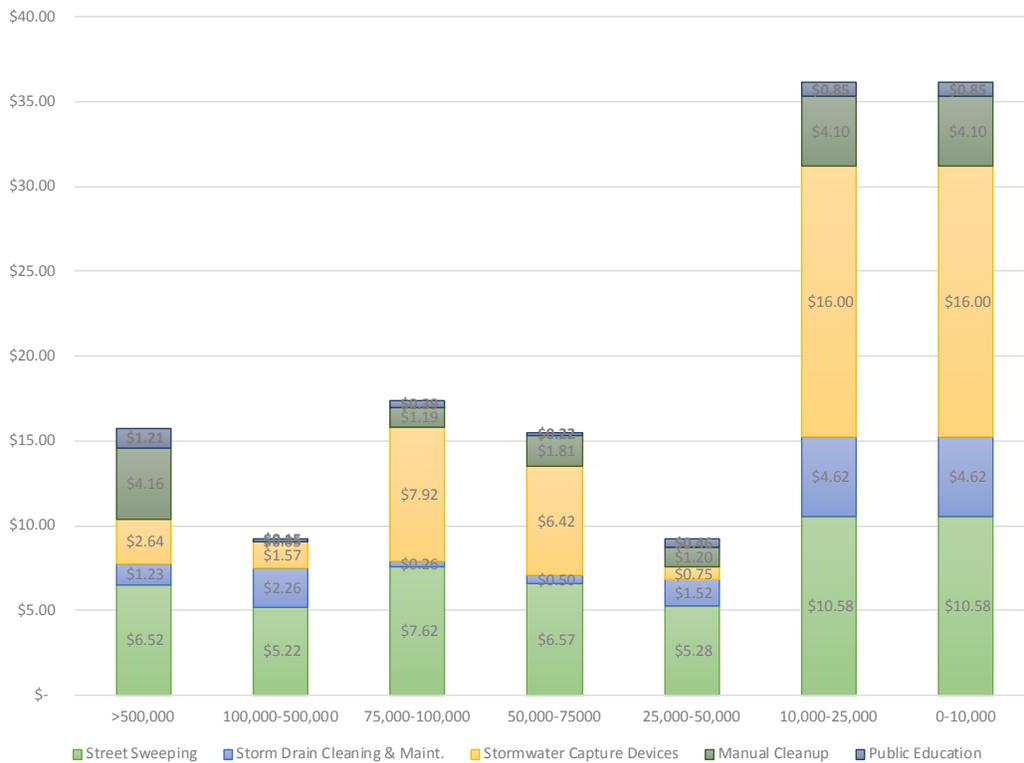
Table 14. Current Expenditures in Trash Control by Category in the Los Angeles Region

Los Angeles Region MS4 By Population Size	Street Sweeping	Storm Drain Cleaning & Maint.	Stormwater Capture Devices	Manual Cleanup	Public Education	Total Annual Average Cost Per Capita
>500,000	\$ 6.52	\$ 1.23	\$ 2.64	\$ 4.16	\$ 1.21	\$ 15.76
100,000-500,000	\$ 5.22	\$ 2.26	\$ 1.57	\$ 0.05	\$ 0.15	\$ 9.22
75,000-100,000	\$ 7.62	\$ 0.26	\$ 7.92	\$ 1.19	\$ 0.39	\$ 16.79
50,000-75,000	\$ 6.57	\$ 0.50	\$ 6.42	\$ 1.81	\$ 0.22	\$ 14.46
25,000-50,000	\$ 5.28	\$ 1.52	\$ 0.75	\$ 1.20	\$ 0.46	\$ 7.79
10,000-25,000	\$ 10.58	\$ 4.62	\$ 16.00	\$ 4.10	\$ 0.85	\$ 29.84
0-10,000						
Grand Total	\$ 6.72	\$ 1.87	\$ 6.54	\$ 2.25	\$ 0.48	\$ 15.04

Source: NRDC Study 2013

⁷⁰ Current expenditures in Los Angeles Region are not necessarily the total amount of expenditures needed to comply with the proposed [final](#) Trash Amendments since the communities in Los Angeles Region were not scheduled to be in full compliance with their TMDLs as of the date that NRDC collected the data. This information is only illustrative to estimate the adequate distribution of full capture and institutional control expenditures.

Figure 3. Current Trash Controls Per Capita by Permittee Size in the Los Angeles Region



Source: NRDC Study 2013

The data shows that permittees in Los Angeles Region are already implementing full capture systems in combination with institutional controls.

In comparison, the data collected for MS4 Phase I permittees outside the Los Angeles Region have a substantially different cost structure of trash control related to the use of institutional controls, regardless of the size of the permittee’s jurisdiction.

Permittees outside the Los Angeles Region dedicate 13% of their trash-control resources to full capture systems. This percentage varies significantly depending on size (population density and land use area). For example, larger sized communities dedicate 11% to 14% of trash control resources to full capture systems, and smaller sized communities dedicate a larger percentage (up to 30%) to full capture systems (Figure 4 and Table 15).

Figure 4. Percentage of Expenditures by Trash Control Category Outside the Los Angeles Region (Source: NRDC Study 2013)

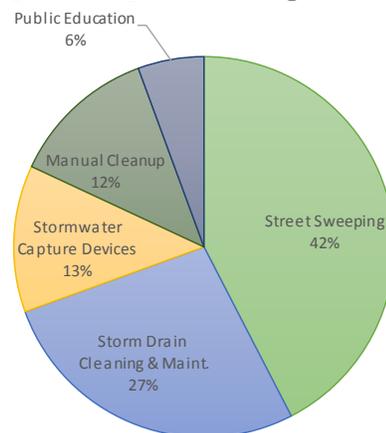


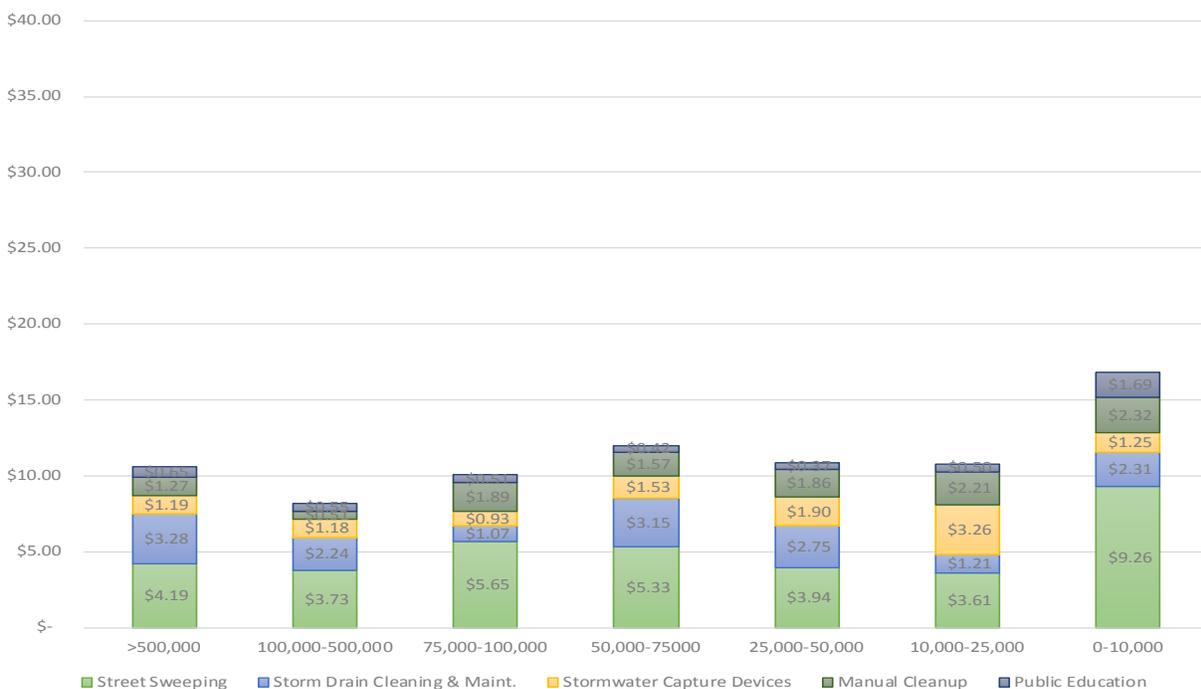
Table 15. Current Annual Per Capita Expenditures in Trash Control by Category Outside the Los Angeles Region

MS4 By Population Size	Street Sweeping	Storm Drain Cleaning & Maint.	Stormwater Capture Devices	Manual Cleanup	Public Education	Total Annual Cost Per Capita
>500,000	\$ 4.19	\$ 3.28	\$ 1.19	\$ 1.27	\$ 0.65	\$ 10.41
100,000-500,000	\$ 3.73	\$ 2.24	\$ 1.18	\$ 0.51	\$ 0.55	\$ 7.64
75,000-100,000	\$ 5.65	\$ 1.07	\$ 0.93	\$ 1.89	\$ 0.51	\$ 9.15
50,000-75000	\$ 5.33	\$ 3.15	\$ 1.53	\$ 1.57	\$ 0.42	\$ 10.20
25,000-50,000	\$ 3.94	\$ 2.75	\$ 1.90	\$ 1.86	\$ 0.37	\$ 9.73
10,000-25,000	\$ 3.61	\$ 1.21	\$ 3.26	\$ 2.21	\$ 0.50	\$ 10.09
0-10,000	\$ 9.26	\$ 2.31	\$ 1.25	\$ 2.32	\$ 1.69	\$ 15.34
Grand Total	\$ 4.38	\$ 2.79	\$ 1.29	\$ 1.28	\$ 0.58	\$ 9.68

Source: NRDC Study 2013

This information is represented in Figure 5.

Figure 5. Current Trash Controls Per Capita by MS4 Phase I Permittee Size Outside the Los Angeles Region



Source: NRDC Study 2013

We determined the baseline costs for current use of institutional controls using cost factors obtained using data from the NRDC Study. The cost factors were applied to the population within each population size group. Table 16 summarizes the current estimated expenditures for MS4 Phase I permittees.

Table 16. Estimated Current Total Annual Expenditures in Trash Control by Category in MS4 Phase I Permittees Outside the Los Angeles Region

Baseline Expenditures. MS4 By Population Size	Street Sweeping	Storm Drain Cleaning & Maint.	Stormwater Capture Devices	Manual Cleanup	Public Education	Total Annual Cost
>500,000	\$ 12,239,133	\$ 9,577,468	\$ 3,468,147	\$ 3,703,492	\$ 1,895,704	\$ 30,369,032
100,000-500,000	\$ 27,841,905	\$ 16,706,970	\$ 8,801,453	\$ 3,775,087	\$ 4,132,958	\$ 57,066,650
75,000-100,000	\$ 8,572,112	\$ 1,629,968	\$ 1,412,616	\$ 2,870,335	\$ 770,787	\$ 13,890,738
50,000-75,000	\$ 11,788,359	\$ 6,971,166	\$ 3,388,229	\$ 3,473,392	\$ 928,365	\$ 22,558,015
25,000-50,000	\$ 6,648,246	\$ 4,634,900	\$ 3,197,960	\$ 3,135,473	\$ 629,481	\$ 16,405,397
10,000-25,000	\$ 2,198,389	\$ 736,123	\$ 1,987,132	\$ 1,346,130	\$ 305,923	\$ 6,143,977
0-10,000	\$ 817,704	\$ 203,876	\$ 110,750	\$ 205,061	\$ 148,889	\$ 1,355,031
Grand Total	\$ 72,188,075	\$ 46,050,511	\$ 21,225,758	\$ 21,193,701	\$ 9,542,549	\$ 159,741,928

No studies identified the mix of institutional control measures and full capture systems that would be used by any given community to comply with Track 2, as the most effective means of controlling trash are highly dependent on the particular site conditions, types of trash, and the available resources for maintenance and operation.

This economic analysis therefore considers several compliance options using the data from the NRDC Study. We have applied the current mixture of institutional controls and full capture systems from communities implementing trash and debris TMDLs in the Los Angeles Region, and compared this information with the information obtained from MS4 Phase I permittees located outside the Los Angeles Region. We then calculated the difference in the level of expenditures for each community group based on population size. The differences were used to estimate the total incremental cost for MS4 Phase I permittees located outside the Los Angeles Region (Table 17).

The data collected on institutional control expenditures show that the average expenditures by Los Angeles Water Board MS4 Phase I permittees are greater than non-Los Angeles Water Board MS4 Phase I permittees, not just for full capture systems but also for expenditures on several types of institutional controls (Table 17).

Table 17. Institutional Control Expenditures Per Capita in the Los Angeles Region and by Other Phase I MS4 Permittees

Average Trash Controls Cost	Los Angeles Region	Other Communities	Difference
Stormwater Capture Devices	\$ 6.54	\$ 1.29	\$ 5.25
Street Sweeping	\$ 6.72	\$ 4.38	\$ 2.34
Storm Drain Cleaning & Maint.	\$ 1.87	\$ 2.79	\$ (0.92)
Manual Cleanup	\$ 2.25	\$ 1.28	\$ 0.97
Public Education	\$ 0.48	\$ 0.58	\$ (0.10)
Total Current Annual (True) Average Cost Per Capita	\$ 15.04	\$ 9.68	\$ 5.36

The data in Table 17 suggests that for the more that is spent on full capture systems means that less needs to be spent on institutional controls, such as storm drain cleaning, maintenance and public education.

In some cases, the estimated per capita costs in categories such as full capture systems, manual cleanup and public education, for permittees outside of the Los Angeles Region is already greater than for permittees implementing trash and debris TMDLs. For those cases, the current level of expenditures was applied and no incremental costs would be necessary to comply with the proposed [final](#) Trash Amendments.

Table 18 presents the estimated annual incremental cost if all MS4 Phase I permittees select Track 2. The total annual cost is estimated to be approximately \$67 million (\$4.09 per capita) in the year when full compliance is achieved. Therefore on average, the cost of compliance with Track 2 would be lower than complying with Track 1 (i.e., only using full capture systems).

Table 18. Estimated Incremental Costs of Compliance with Track 2 for MS4 Phase I Permittees Outside the Los Angeles Region

Estimated Increase in Total Trash								
Controls Cost by Population	100,000-	75,000-	50,000-	25,000-	10,000-			
Community Size Group	>500,000	500,000	100,000	75000	50,000	25,000	0-10,000	Total
Stormwater Capture Devices	\$4,234,713	\$2,922,356	\$10,611,908	\$10,816,046	\$0	\$7,758,356	\$1,302,809	\$37,646,188
Street Sweeping	\$6,784,597	\$11,137,892	\$2,996,938	\$2,747,793	\$2,249,827	\$4,245,815	\$116,590	\$30,279,451
Storm Drain Cleaning & Maint.	(\$5,988,636)	\$169,341	(\$1,235,224)	(\$5,864,914)	(\$2,073,334)	\$2,077,887	\$204,033	(\$12,710,847)
Manual Cleanup	\$8,434,348	\$0	\$0	\$531,240	\$0	\$1,151,151	\$157,220	\$10,273,959
Public Education	\$1,634,774	\$0	\$0	\$0	\$145,730	\$211,806	\$0	\$1,992,310
Total Incremental Cost	\$15,099,795	\$14,229,588	\$12,373,622	\$8,230,165	\$322,223	\$15,445,015	\$1,780,652	\$67,481,061

Other Compliance Costs

In addition to compliance tracks, the proposed [final](#) Trash Amendments includes monitoring, evaluation and reporting requirements. These would potentially increase the cost of compliance with the proposed [final](#) Trash Amendments. This economic analysis does not include an estimate of those potential costs. These costs are expected to be negligible relative to capital and operation and maintenance costs.

c. Compliance Schedules

The [final](#) Trash Amendments propose a time schedule for permittees to comply ten years from the effective date of the first implementing permit.⁷¹ One potential compliance schedule is 10% completion of controls per year. We have estimated the average annual cost to comply with Track 1 and Track 2 once the permittees have achieved full implementation. Capital costs were distributed evenly in order to achieve full compliance within ten years (10% each year).

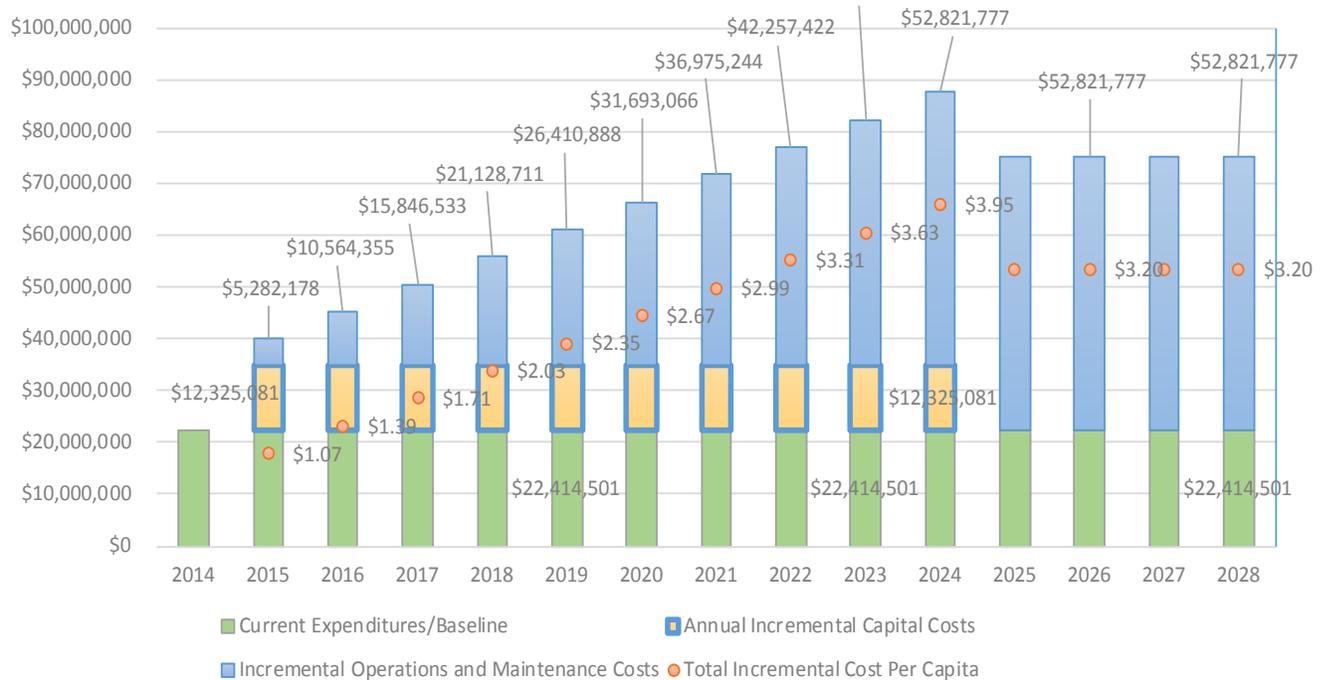
To estimate the annual incremental cost of compliance, the following cost factors and assumptions are used:

- Compliance starts in January 2015.
- The installation of a full capture system is \$800 per unit.

⁷¹ See fn. [3742](#), *ante*.

- The annual cost of operations and maintenance for a full capture system is \$342 per unit install.
- The total cost to install, operate and maintain a full capture system in Year 1 is \$1,142.
- Full capture systems were installed in 10% increments over ten years.
- Maintenance cost for each year includes the cost of operating and maintaining each full capture system. For example, the operations and maintenance cost in Year 2 is the sum of the 10% full capture systems installed in Year 1 plus the 10% installed in Year 2.

Figure 6. Compliance Schedule with Track 1 for MS4 Phase I Permittees Estimated Total Costs 2014-2024



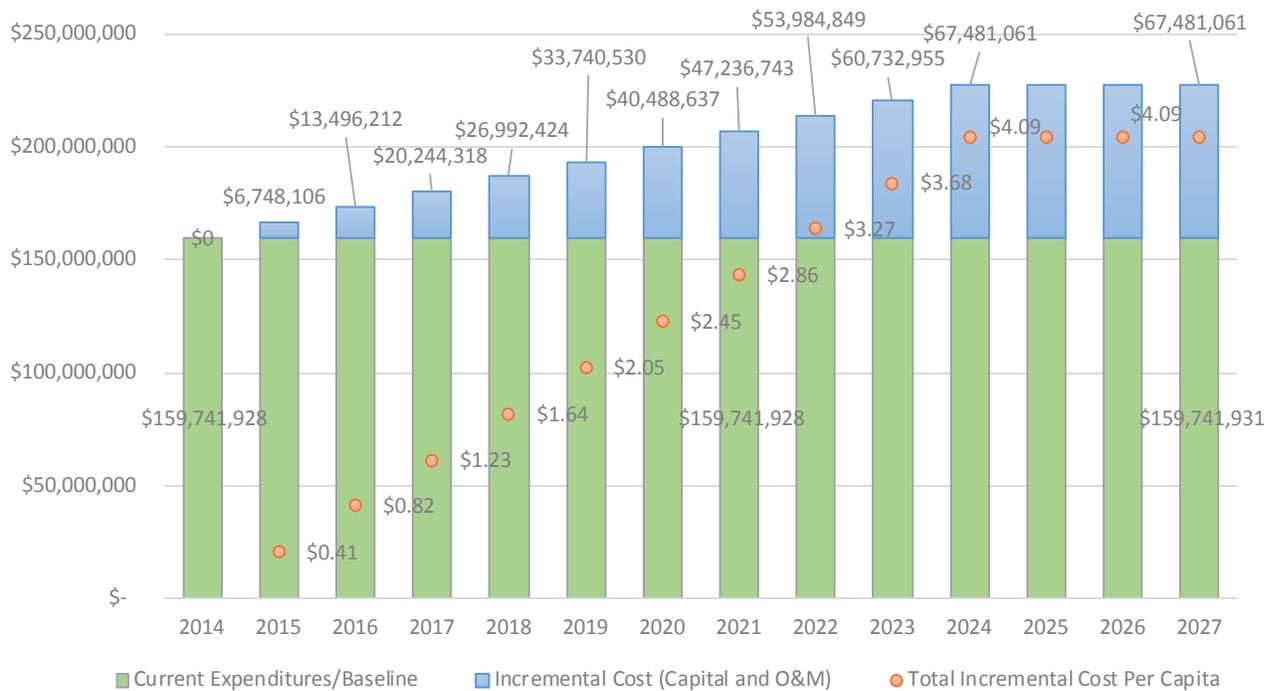
Assuming communities install 10% of the structural controls each year, the capital, operation and maintenance costs in Year 10 (highest cost year) would be \$65 million for all Phase 1 affected permittees (\$3.95 per capita). The total cost of installing (capital costs) full capture systems in MS4 Phase I permittees is estimated at \$8.42 per capita or approximately \$123 million. Spread out over ten years equally is approximately \$12.3 million per year. Operations and maintenance of the installed full capture systems increases based on the accumulated installed units (capital costs). As a result, operations and maintenance cost per capita fluctuates from \$0.32 in Year 1 to \$3.2 in Year 10.

Compliance Schedule with Track 2

The incremental cost in the year of full compliance with the proposed **final** Trash Amendments is approximately \$67.5 million or \$4 per capita⁷² (Figure 7).

⁷² After Year 10 the incremental cost is assumed to remain constant at \$67.48 million per year.

Figure 7. Compliance Schedule with Track 2 for MS4 Phase I Permittees



d. Limitations and Uncertainties

Current cost of trash controls implemented through MS4 permits in California ranged from \$3 per person a year for municipalities with a population of 500,000 or more to up to \$60 per year for small municipalities. The selection of the method of compliance with the proposed final Trash Amendments will highly depend on the site specific conditions of every permittee, such as:

- Compliance alternatives
- Costs of controls
- Types of trash
- Site characteristics
- Compliance schedules
- Current compliance rates (for establishing the baseline)
- Other economic factors, technology, inflation, risks, regulatory framework

5. MS4 PHASE II PERMITTEES: COST PER CAPITA METHOD

a. MS4 Phase II Statistics

Data for MS4 Phase II permittees was obtained using CIWQS and grouped by population size. Of the 156 MS4 Phase II listed permittees, eight were removed due to incomplete information necessary for the analysis⁷³. 148 MS4 Phase II permittees were identified for the analysis (Table 19).

Table 19. MS4 Phase II Permittees by Regional Water Board

Number of MS4 Phase II Population Size	Regional Board											Grand Total	
	1	2	3	4	5F	5R	5S	6A	6B	7	8		9
>500,000													
100,000-500,000			1				1						2
75,000-100,000			2		2	1	2						7
50,000-75,000		4	4		1	1	6		3				19
25,000-50,000	2	4	11		5		9			3			34
10,000-25,000	6	2	12		5	1	14	1		2			43
0-10,000	4	15	8		3		11	1	1				43
Grand Total	12	25	38		16	3	43	2	4	5			148

There are no permittees listed in CIWQS under Phase II in the jurisdiction of the Los Angeles Water Board, Santa Ana Water Board, and San Diego Water Board⁷⁴. Table 20 shows the population living in municipalities regulated under the MS4 Phase II permit.

⁷³ Additionally, the City of Avalon and other non-traditional Phase II permittees in the Los Angeles Region are new enrollees to MS4 Phase II permit and lack data on CIWQS. Thus, the new enrollees were not included in the analysis.

⁷⁴ There are ten MS4 Phase II permittees in Los Angeles Region, eleven MS4 Phase II permittees in the Santa Ana Region and nine MS4 Phase II permittees in the San Diego Region that are tracked in the Storm Water Multiple Application and Report Tracking System (SMARTS) database but were not included in the CIWQS database at the time of the economic analysis.

Table 20. Population for Municipalities Regulated Under MS4 Phase II Permits

Number of MS4 Phase I Municipalities by Population Size	Regional Water Board									Grand Total	
	1	2	3	4	5	6	7	8	9		
>500,000											
100,000-500,000			144,000		112,581						256,581
75,000-100,000			190,053		410,070						600,123
50,000-75,000		254,276	219,526		492,190	194,000					1,159,992
25,000-75,000	66,832	145,456	361,578		558,983		126,005				1,258,854
10,000-25,000	96,229	22,785	201,976		304,542	13,000	35,334				673,866
0-10,000	31,371	100,176	49,676		95,346	11,600					288,169
Grand Total	194,432	522,693	1,166,809		1,973,712	218,600	161,339				4,237,585

In summary, 148 municipalities regulated under Phase II of the MS4 program with a total population of 4,237,585, representing 11.5% of California population (2010 Census) are considered in this analysis.

Using the information provided in the referenced studies, a baseline of current costs was created based on municipality type and size. The NRDC Study was relied upon for the data obtained from a direct survey of 221 California municipalities. The summary of the current average annual cost per capita by category of trash control is presented in Table 6. This methodology as previously described for MS4 Phase I permittees was replicated for the MS4 Phase II permittees.

b. Potential Compliance Options

1. Track 1: Full Capture Systems

An analysis of the increased annual average cost for the 148 MS4 Phase II permittees shows that the total potential incremental cost for all Phase II MS4s is \$33 million (Table 21).

Table 21. Incremental Cost of Compliance for MS4 Phase II Communities Using Full Capture Systems by Municipality Size

MS4 Phase II Municipality Size	MS4 Phase II	Total Population (A)	Current Cost (baseline)	Current Cost Per Capita (baseline B)	Estimated Annual Cost Per Capita (After Full Implementation in Year 10) (C+D)	Estimated Total Capital Costs Per Capita (C)	Estimated Annual O&M Per Capita (in Year 10) (D)	Total Estimated Incremental Cost Of Compliance (C+D-B) X A
>500,000								
100,000-500,000	2	256,581	\$321,137	\$1.25	\$12.82	\$8.96	\$3.84	\$2,967,648
75,000-100,000	7	600,123	\$533,630	\$0.89	\$10.50	\$7.35	\$3.15	\$5,766,952
50,000-75,000	19	1,159,992	\$1,462,858	\$1.26	\$11.03	\$7.70	\$3.30	\$11,327,048
25,000-75,000	34	1,258,854	\$2,084,477	\$1.66	\$8.70	\$6.09	\$2.61	\$8,868,698
10,000-25,000	43	673,866	\$2,156,399	\$3.20	\$7.72	\$5.39	\$2.31	\$3,047,851
0-10,000	43	288,169	\$300,253	\$1.04	\$6.45	\$4.55	\$1.95	\$1,558,787
Total	148	4,237,585	\$6,858,754	\$1.62	\$9.53	\$6.67	\$2.86	\$33,536,983

In summary, the 148 MS4 Phase II communities analyzed are currently spending \$6.8 million per year to install and operate full capture systems. To comply with Track 1 in one year is estimated to be an additional cost of \$33.5 million or an additional \$7.91 (difference between \$9.53 and \$1.62) per capita in the year that full compliance is achieved. The incremental total capital costs are estimated at \$5.54⁷⁵ per capita or \$23.4 million. Once full capture systems are installed (capital costs), the annual operation and maintenance costs are estimated at \$2.37⁷⁶ per capita or \$10 million. Assuming permittees install 10% of the structural controls each year, the capital, operation and maintenance costs in Year 10 (highest cost year) would be \$12 million (\$2.93 per capita) (Figure 9).

2. Track 2: Combination of Full Capture Systems, Other Treatment Controls, Institutional Controls, Multi-Benefit Projects

Track 2 of the proposed [final](#) Trash Amendments focuses on permittees installing, operating, and maintaining any combination of full capture systems, other treatment controls, institutional controls, and/or multi-benefit projects. The combinations of trash controls must achieve the same performance results as Track 1.

MS4 Phase II permittees are already spending resources in full capture systems and institutional controls. Table 22 shows the average annual cost per capita for each type of trash control.

⁷⁵ Costs are estimated based on a full capture system at \$800 per unit (capital costs) and \$342 annual cost of operations and maintenance per unit. Therefore, capital costs are estimated to be 70% of the costs if all full capture systems are installed in one year and operations and maintenance cost are estimated to be 30% of the total costs. The capital costs incremental cost is calculated by multiplying \$7.91 (the difference between \$9.53 and \$1.62) by 70% (i.e., \$7.91 X 0.7 = \$5.54).

⁷⁶The operations and maintenance incremental cost is calculated by multiplying \$7.91 (the difference between \$9.53 and \$1.62) by 30% (i.e., \$7.91 X 0.3 = \$2.37).

Table 22. Current Average Annual Expenditures Per Capita by Trash Control Category by Population Size Group (MS4 Phase II Permittees)

MS4 PHASE II By Population Size	Street Sweeping	Storm Drain Cleaning & Maint.	Stormwater Capture Devices	Manual Cleanup	Public Education	Total Annual Cost Per Capita
>500,000						
100,000-500,000	\$ 4.08	\$ 2.12	\$ 1.25	\$ 0.56	\$ 0.58	\$ 8.59
75,000-100,000	\$ 6.98	\$ 1.34	\$ 0.86	\$ 2.13	\$ 0.52	\$ 11.84
50,000-75000	\$ 5.85	\$ 3.31	\$ 1.25	\$ 1.41	\$ 0.40	\$ 12.24
25,000-50,000	\$ 3.92	\$ 3.06	\$ 1.62	\$ 1.96	\$ 0.40	\$ 10.95
10,000-25,000	\$ 3.99	\$ 1.23	\$ 3.13	\$ 2.07	\$ 0.48	\$ 10.90
0-10,000	\$ 4.68	\$ 2.64	\$ 1.03	\$ 2.48	\$ 1.57	\$ 12.41
Grand Total	\$ 4.96	\$ 2.50	\$ 1.59	\$ 1.81	\$ 0.52	\$ 11.38

Source: NRDC Study 2013

The actual cost of trash controls by category is presented in Table 23 and Figure 8. The total estimated population regulated under a MS4 Phase II permit is 4,310,345.

Table 23. Current Expenditures in Annual Trash Control Category by Population Size Group (MS4 Phase II Permittees)

MS4 PHASE II By Population Size	Street Sweeping	Storm Drain Cleaning & Maint.	Stormwater Capture Devices	Manual Cleanup	Public Education	Total Annual Cost	Population
>500,000							
100,000-500,000	\$ 1,045,952	\$ 545,074	\$ 321,137	\$ 143,258	\$ 148,913	\$ 2,204,334	256,581
75,000-100,000	\$ 4,329,764	\$ 833,308	\$ 533,630	\$ 1,323,013	\$ 321,491	\$ 7,341,206	620,156
50,000-75000	\$ 6,835,786	\$ 3,870,160	\$ 1,462,858	\$ 1,650,517	\$ 468,274	\$ 14,287,595	1,167,639
25,000-50,000	\$ 5,043,383	\$ 3,930,905	\$ 2,084,477	\$ 2,515,101	\$ 508,387	\$ 14,082,253	1,286,248
10,000-25,000	\$ 2,750,042	\$ 846,592	\$ 2,156,399	\$ 1,427,361	\$ 329,857	\$ 7,510,251	689,112
0-10,000	\$ 1,359,397	\$ 768,567	\$ 300,253	\$ 722,072	\$ 457,452	\$ 3,607,742	290,609
Grand Total	\$ 21,364,325	\$ 10,794,607	\$ 6,858,754	\$ 7,781,321	\$ 2,234,375	\$ 49,033,382	4,310,345

Source: NRDC Study 2013

Figure 8. Current Annual Trash Control Per Capita for MS4 Phase II Communities

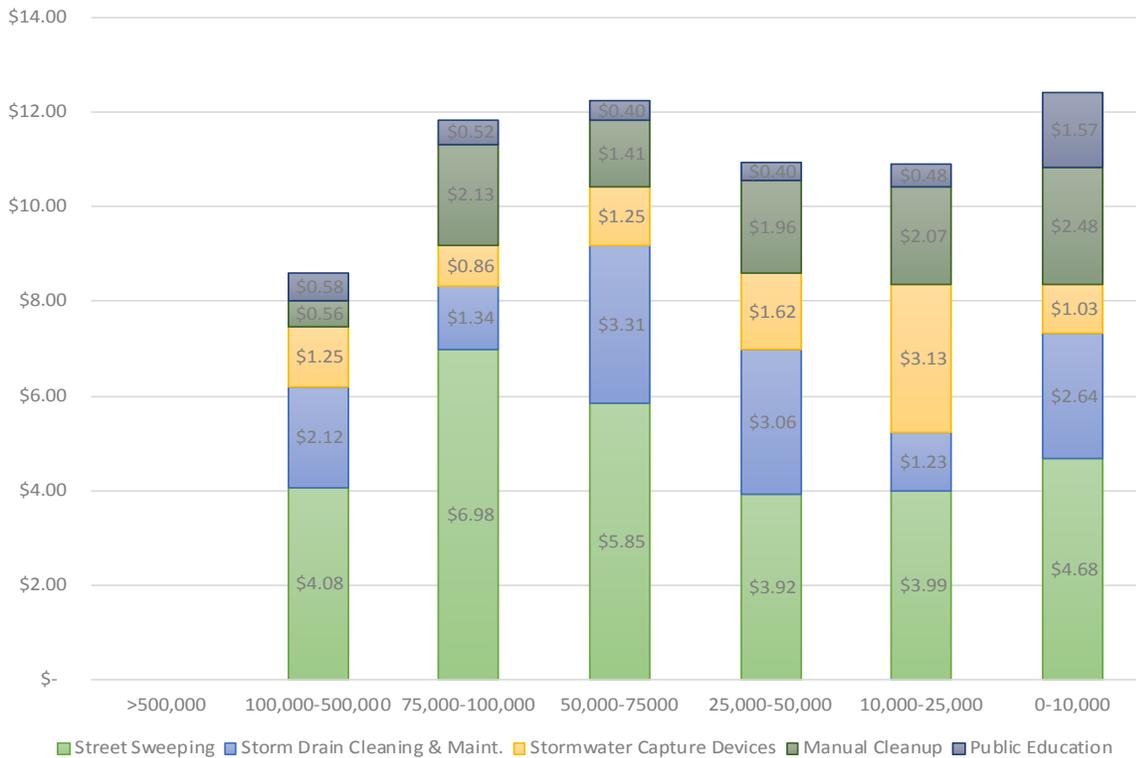


Table 24 highlights the main differences of annual trash control expenditures per capita between the permittees inside and outside the Los Angeles Region.

Table 24. Average Annual Trash Control Expenditures Per Capita in the Los Angeles Region and MS4 Phase II Communities

Average Trash Controls Cost	Los Angeles Region	Phase II Communities	Difference
Stormwater			
Capture Devices	\$ 6.54	\$ 1.59	\$ 4.95
Street Sweeping	\$ 6.72	\$ 4.96	\$ 1.76
Storm Drain			
Cleaning & Maint.	\$ 1.87	\$ 2.50	\$ (0.63)
Manual Cleanup	\$ 2.25	\$ 1.81	\$ 0.44
Public Education	\$ 0.48	\$ 0.52	\$ (0.04)
Total Current Annual (True) Average Cost Per Capita	\$ 15.04	\$ 11.38	\$ 3.66

Table 25 summarizes the estimated annual incremental cost of trash controls choosing a combination of institutional controls and full capture systems. MS4 Phase II permittees would

spend an additional \$32 million a year once full implementation is achieved⁷⁷, an additional \$7.77⁷⁸ per capita per year if compliance is completed in one year.

Table 25. Estimated Annual Incremental Costs of Compliance with Track 2 for MS4 Phase II Permittees Outside the Los Angeles Water Region

Estimated Increase in Total Trash Controls Cost by Population Community Size Group									
Group	>500,000	100,000-500,000	75,000-100,000	50,000-75,000	25,000-50,000	10,000-25,000	0-10,000	Total	
Stormwater Capture Devices		\$ 81,695	\$4,378,006	\$6,033,384		\$0	\$8,869,393	\$4,349,491	\$23,711,968
Street Sweeping		\$293,400	\$395,824	\$835,602	\$1,748,006	\$4,540,763	\$1,715,246	\$9,528,842	
Storm Drain Cleaning & Maint.		\$34,799	(\$672,068)	(\$3,286,340)	(\$1,975,808)	\$2,337,105	\$574,046	(\$2,988,266)	
Manual Cleanup		\$0	\$0	\$462,910	\$0	\$1,397,998	\$469,425	\$2,330,333	
Public Education		\$0	\$0	\$0	\$83,287	\$255,888	\$0	\$339,175	
Total Incremental Cost		\$409,895	\$4,101,762	\$4,045,556	(\$144,515)	\$17,401,148	\$7,108,208	\$32,922,053	

c. Compliance Schedules

Compliance schedules for MS4 Phase II permittees is ten years of the effective date of the first implementing permit⁷⁹. The analysis uses the same methodology as previously described for MS4 Phase I permittees.

Compliance Schedule with Track 1

Total incremental cost in the year of full compliance with the proposed final Trash Amendments is estimated to be \$12.3 million or \$2.93 per capita. After Year 10, the incremental cost of operating and maintaining the full capture systems the cost may be \$10 million per year⁸⁰ (\$2.37 per capita) (Figure 9).

⁷⁷ This estimated annual incremental cost is assuming that all necessary expenditures are conducted in one single year and the operations and maintenance associated with those specific expenditures. See compliance schedule for an analysis of incremental cost of compliance over a 10 year period.

⁷⁸ \$7.77 is the result of dividing the total annual cost presented in Table (\$32,922,053) by the population of the 148 communities selected (4,237,585) (i.e., \$32,922,053 / 4,237,585 = \$7.77).

⁷⁹ See fn. 3742, ante.

⁸⁰ Operations and maintenance costs are estimated at \$342 per year for every full capture system installed. Therefore for every \$800 of full capture system installed, \$342 (or 42.75% of capital costs) would be spent annually in operations and maintenance. After 10 years of installation of full capture systems, MS4 Phase II communities would have spent \$23,463,510 on full capture systems. To maintain and operate \$23,463,510 full capture systems, the permittees would need to spend \$10 million annually (i.e., \$23,463,510 X 0.4275 = \$10,030,650).

Figure 9. Compliance Schedule with Track I for MS4 Phase II Permittees with Estimated Total Costs



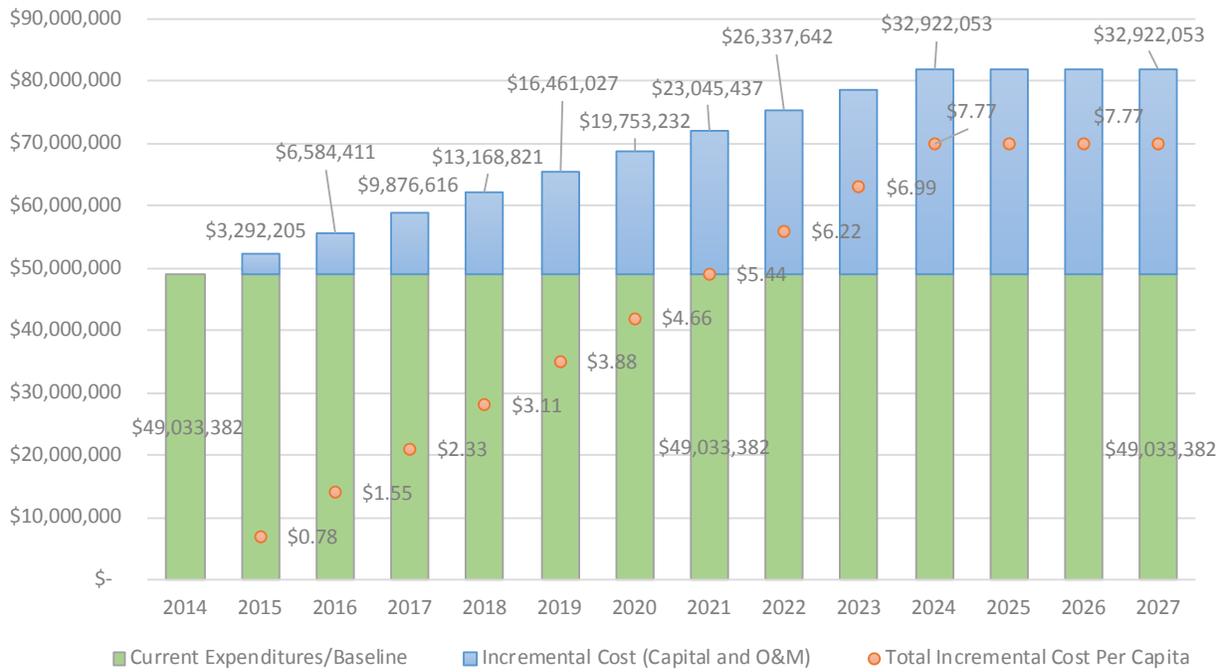
Assuming installation of 10% of the structural controls each year, the capital, operation and maintenance incremental costs in Year 10 (highest cost year) would be \$12.3 million for affected MS4 Phase II permittees (\$2.93 per capita). The total cost of installing (capital costs) full capture systems in MS4 Phase II permittees is estimated at \$5.54 per capita or approximately \$23.4 million. This total amount spread out in ten years equally is approximately \$2.3 million per year. Operations and maintenance of the installed full capture systems increases based on the accumulated installed units (capital costs). As a result, operations and maintenance cost per capita fluctuates from \$0.24 in Year 1 to \$2.37 in Year 10.

Compliance Schedule with Track 2

The incremental cost in the year of full compliance with the proposed final Trash Amendments is \$32.9 million or \$7.77⁸¹ per capita (Figure 10).

⁸¹ \$7.77 is the result of dividing the total annual cost presented in Table (\$32,922,053) by the population of the 148 communities selected (4,237,585) (i.e., \$32,922,053 / 4,237,585 = \$7.77).

Figure 10. Compliance Schedule with Track 2 for MS4 Phase II Permittees



6. MS4 PHASE I AND PHASE II PERMITTEES: LAND COVERAGE METHOD

a. Costs Based on Land Coverage

Trash generation rates vary by land use. Sections 4 and 5 were used methodology to estimate compliance costs for Track 1 and Track 2. This section uses a second method of cost analysis to estimate the compliance cost of a full capture system based on land coverage. The number of storm drains within a linear road mile is based on land coverage. Since counties do not have a uniform classification of land cover codes or divisions, the data was collated from USGS Multi-Resolution Land Characteristics Consortium Land Cover Data 2006. The data can be accessed at: <http://www.mrlc.gov/nlcd2006.php>. The categories identified were the following:

- Land Use (LU) 22 or “Developed, Low Intensity”. This is defined as developed low intensity includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.
- Land Use (LU) 23 or “Developed, Medium Intensity”. This is defined as developed medium intensity includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
- Land Use (LU) 24 or “Developed, High Intensity”. This is defined as developed high intensity includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80-100 percent total cover.

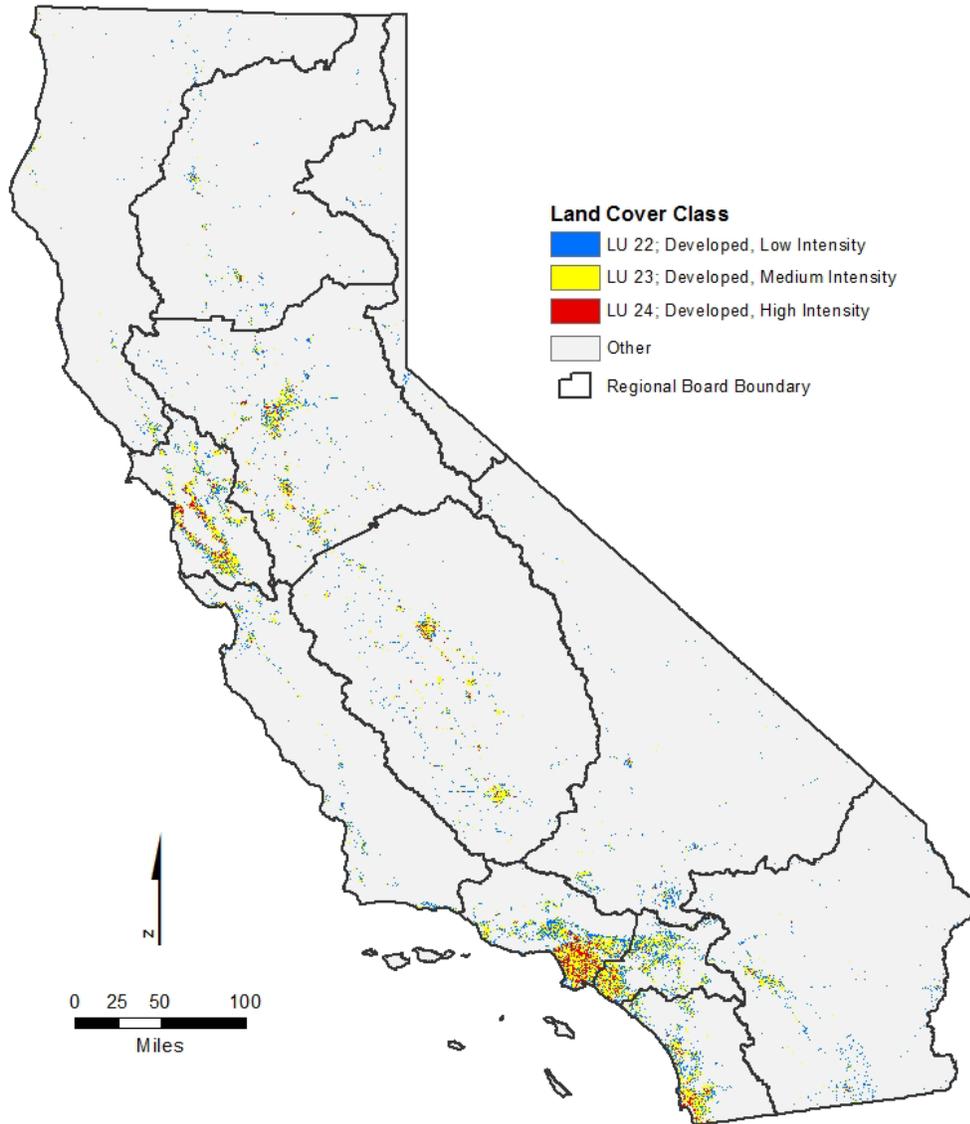
Land coverage was utilized to as a proxy to preliminarily identify priority land uses subject to the proposed **final** Trash Amendments. The analysis assumes that priority land uses, as defined in the proposed **final** Trash Amendments, correlate with land cover information for LU 24. Table 26 shows the land cover in acres by regional water board, and Figure 11 shows a map of developed areas by regional water board.

Table 26. Land Coverage by Regional Water Board.

Regional Water Board	Developed, High Intensity (acres) LU24	Developed, Medium Intensity (acres) LU23	Developed, Low Intensity (acres) LU22	Total (acres)
1	3,363.72	28,436.50	53,925.15	85,725.37
2	79,241.00	283,766.94	189,907.27	552,915.21
3	7,365.93	65,757.88	96,791.50	169,915.32
4	116,476.55	369,140.92	234,763.83	720,381.30
5	88,199.95	394,570.64	422,365.75	905,136.34
6	5,519.61	38,368.20	124,361.10	168,248.92
7	6,822.85	56,434.21	119,589.18	182,846.23
8	42,020.59	256,479.11	216,122.48	514,622.18
9	41,759.49	196,458.79	153,307.11	391,525.39
Total (acres)	390,769.69	1,689,413.19	1,611,133.37	3,691,316.26

Source: USGS Multi-Resolution Land Characteristics Consortium Land Cover Data 2006

Figure 11. Developed Land Cover Classes by Regional Water Board.



Compliance with Track 1 for MS4 permittees requires installing, operating and maintaining full capture systems for all storm drains that capture runoff from one or more of the priority land uses in their jurisdictions. Costs Considerations conducted for developing the TMDLs in the Los Angeles Region estimated that, in high intensity developed areas, an average of approximately one catch basin per acre is needed. Therefore, one full capture system per acre was used for the compliance cost estimates.

There are 390,769 acres classified as “Developed, High Intensity” in California. Los Angeles Water Board MS4 permittees are already implementing trash and debris TMDLs (116,476 acres) were subtracted from the total. The areas in City of San Francisco (10,830 acres of high density), and Sacramento (1,160 acres) served by combined sewer systems were subtracted from the total. Trash generated on areas served by combined sewer systems would be captured and removed at the regional wastewater treatment plant instead of being discharged through a conventional storm drain system. Therefore, the total high intensity land potential subject to the proposed [final](#) Trash Amendments is 262,302.3 acres. The population within this high intensity land cover is 20.7 million.

The average cost of installing a catch basin insert was estimated to be \$800 and the annual operation and maintenance was \$324. We estimated one catch basin per acre and one full capture system is needed per catch basin. Similar to the compliance schedule discussion in Sections 5 and 6, full capture systems were assumed to be installed at a rate of about 10% per year, with full build out in Year 10.

As described in previous sections, MS4 Phase I and Phase II permittees are spending \$29 million a year or \$1.41 per resident per year in operating and maintaining full capture systems⁸². Table 27 and Figure 12 shows the estimated total cost of compliance per year assuming a compliance period of ten years and that 10% of full capture systems are installed each year.

During the first ten years of the implementation of the proposed [final](#) Trash Amendments, permittees may incur an incremental average cost of \$41 million a year (\$2 per capita) to install, operate and maintain full capture systems in high density areas. The total incremental annual cost of operating and maintain all full capture systems installed after Year 10 is \$60 million or an average cost per resident per year of \$2.91. Table 27 shows the total estimated costs, the incremental cost and the cost per capita for each year starting in 2015 and ending in 2026.

b. Limitations and Uncertainties

The estimates based on land coverage are based on the following assumptions:

1. Land Coverage is a surrogate for land use designation. Priority land uses are correlated to land coverage.

Using land coverage to estimate the total cost of compliance focuses on the actual priority land uses that would be impacted. This may reduce the error that the estimates using per capita would have on large communities with large populations and low developed density. At the same time, it may overestimate the costs by including all high intensity land uses that are not part of an MS4. The proposed [final](#) Trash Amendments define priority land uses based on the different types of uses. By using land coverage instead of land use the analysis may be underestimating the area subject to compliance with the proposed [final](#) Trash Amendments.

2. The average cost of a full capture system is \$800 and the annual operations and maintenance is \$342.
A broad range of compliance options are available to the permittees subject to the proposed [final](#) Trash Amendments. The selection of the full capture system depends on many site specific factors and conditions. Capital cost per unit ranges from \$300 per catch basin inserts for installation (capital costs) and \$330 annual maintenance to \$80,000 per vortex separator system for installation (capital costs) and \$30,000 annual maintenance. Different methods may cover different areas, for example a drop inlet may only cover one acre, whereas a vortex separator system may cover many acres, therefore a normalized cost per acre was estimated at \$800 in capital cost and \$342 in annual operations and maintenance.
3. The analysis is highly sensitive to this assumption and more site specific estimates would be necessary to develop a more accurate estimate.

The number of full capture systems per acre in priority land uses is one full capture system per acre. There is no one size fits all assumption for storm drain inlet placing. High intensity blocks vary greatly in size depending on what city they are in and the local conditions

⁸² See Table 13 and Table for a description of the baseline of current costs. (\$22.4 million for MS4 Phase I permittees and \$6.8 for MS4 Phase II permittees)

(rainfall, slope, density, impervious surfaces, etc.). Rough estimates range from one catch basin in a three-acre urban area in the City of Los Angeles⁸³ (0.33 per acre) and up. For this analysis, one catch basin per acre was assumed. The analysis is highly sensitive to this assumption and more site specific estimates would be necessary to develop a more accurate estimate.

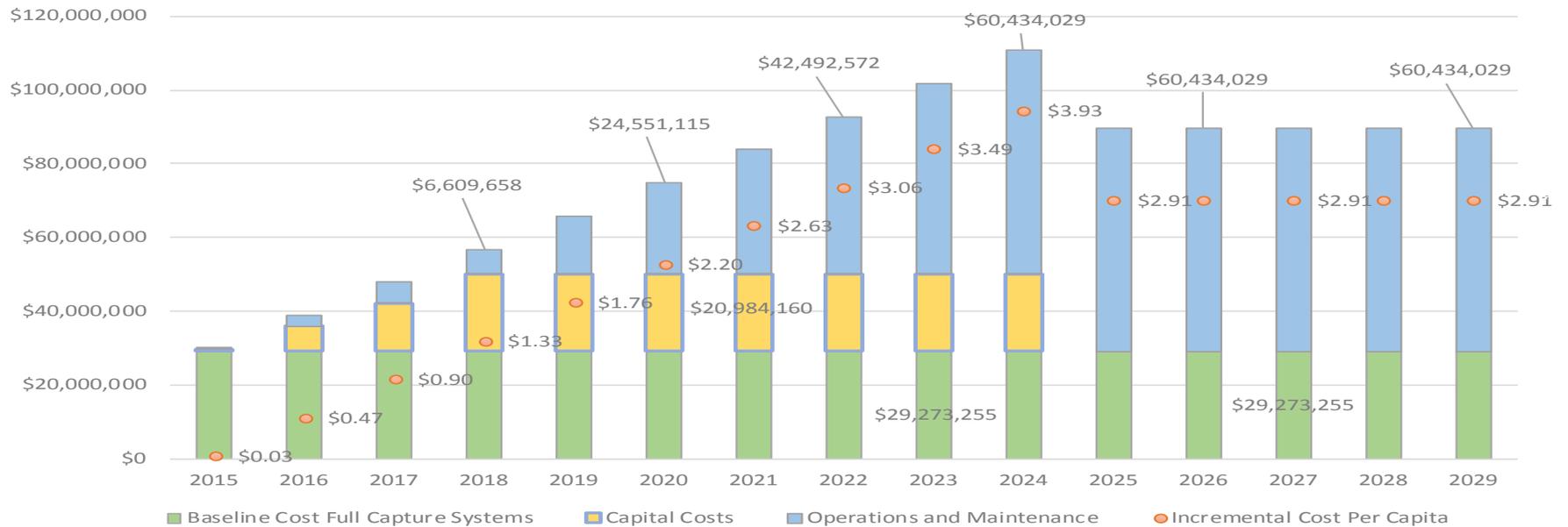
4. The land coverage analysis does not take into consideration institutional controls or other approved methods of compliance. Compliance with the proposed final Trash Amendments can be achieved with the installation of structural controls or a combination of structural controls and other methods including institutional controls. The land coverage analysis does not include an estimate of potential cost for a combination of institutional and structural controls per acre of priority land use. This approach would probably estimate the more reliable results. Further analysis would be necessary to estimate total costs of Track 2.

⁸³ City of Los Angeles Stormwater Management Division. 2002. High Trash-Generation Areas and Control Measures. http://www.lastormwater.org/wp-content/files_mf/trash_gen_study.pdf

Table 27. Cost of Compliance Schedule Based on High Intensity Land Cover

Cost Categories	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Capital Costs	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$20,984,160	\$0	\$0
Operations and Maintenance	\$8,970,728	\$17,941,457	\$26,912,185	\$35,882,914	\$44,853,642	\$53,824,370	\$62,795,099	\$71,765,827	\$80,736,556	\$89,707,284	\$89,707,284	\$89,707,284
Total Cost	\$29,954,888	\$38,925,617	\$47,896,345	\$56,867,074	\$65,837,802	\$74,808,530	\$83,779,259	\$92,749,987	\$101,720,716	\$110,691,444	\$89,707,284	\$89,707,284
Cost Per Capita	\$1.44	\$1.88	\$2.31	\$2.74	\$3.18	\$3.61	\$4.04	\$4.47	\$4.91	\$5.34	\$4.33	\$4.33
Baseline Cost Full Capture Systems	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255	\$29,273,255
Incremental Cost	\$681,633	\$9,652,361	\$18,623,090	\$27,593,818	\$36,564,547	\$45,535,275	\$54,506,003	\$63,476,732	\$72,447,460	\$81,418,189	\$60,434,029	\$60,434,029
Incremental Cost Per Capita	\$0.03	\$0.47	\$0.90	\$1.33	\$1.76	\$2.20	\$2.63	\$3.06	\$3.49	\$3.93	\$2.91	\$2.91

Figure 12 Compliance Schedule for Track 1 for MS4 Phase I and Phase II Permittees Based on High Intensity Land Coverage



7. POTENTIAL COSTS FOR INDUSTRIAL AND CONSTRUCTION PERMITTEES

There are 9,251 industrial facilities regulated under the Storm Water Industrial Program⁸⁴. The estimated compliance costs (**track 1**) with the proposed **final** Trash Amendments for the industrial facilities are \$33.9⁸⁵ million or \$3,671⁸⁶ per facility.

The number of full capture systems required to comply **with track 1** is directly proportional to the number of catch basins and storm drains in each industrial site. Information regarding the number of storm drains in each industrial site is not available in the SMARTS database⁸⁷.

Given the small size of many industrial permittees, we assumed that smaller facilities would choose to comply with the proposed **final** Trash Amendments implementing institutional controls rather than full capture systems. It is likely that only larger facilities would choose to install full capture systems. We identified two groups based on facility size. Out of the 9,251 industrial sites, 2,501 facilities with a size larger than 10 acres were assumed to comply by installing full capture systems and 6,750 facilities with a size of less than 10 acres, or without size information, would comply by implementing institutional controls such as training and manual cleanup.

In our calculations, the following assumptions⁸⁸ were made and used for the cost factors.

- Facilities larger than 10 acres would comply with Track 1.
- An average of 10 catch basins per facility for facilities greater than 10 acres.
- The cost of installation of each full capture system is estimated to be \$800 and the annual operation and maintenance to be \$342.
- Facilities smaller than 10 acres would implement institutional controls.
- Cost of institutional controls includes a \$500 initial training and an annual cost of \$300 in other measures.
- Industrial facilities are not implementing any trash control methods to comply with the proposed **final** Trash Amendments, therefore all costs are incremental.

a. Track 1: Full Capture Systems

The estimated cost of compliance for industrial dischargers larger than 10 acres selecting Track 1 (2,501 facilities) would be approximately \$28.5 million in a single year⁸⁹ and \$8.5 million

⁸⁴ CGP permittees are already required to comply with a prohibition to discharge debris and trash from construction sites. State Board Action 2009-0009-DWQ amended by 2010-0014-DWQ & 2012-0006-DWQ. Prohibition III. D. page 21. Available at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo2009_0009_dwq.pdf.

Debris is defined (footnote 4) as "Litter, rubble, discarded refuse, and remains of destroyed inorganic anthropogenic waste." Trash control costs are therefore not expected to increase for CGP permittees as a result of the proposed **final** Trash Amendments.

⁸⁵ The total cost of \$33.9 million is the sum of the cost for large industrial facilities calculated in Table (i.e., \$28.5 million) and Table (i.e., \$5.4 million).

⁸⁶ This is the result of dividing the total cost of \$33.9 million by the 9,251 industrial facilities.

⁸⁷ SMARTS is the main database used to manage the Storm Water program. Available at: [Stormwater Multi-Application, Reporting, and Tracking System \(SMARTS\)](#)

⁸⁸ Assumptions are necessary because of the limitations in the data available regarding the activities conducted at the industrial facilities, the number of workers in each facility, etc.

annually following initial implementation (Table 28). The average operation and maintenance annual cost per facility is estimated to be \$3,420 and the one time average installation cost of full capture systems per facility is estimated to be \$8,000.

Table 28. Estimated Cost of Compliance for Industrial Facilities Larger than 10 Acres

Size of Industrial Site	Number of Facilities	Number of Catch Basins @ 10 per Facility	Installation @ \$800	Operation @ \$342	Total Cost
>100 Acres	923	9,230	\$7,384,000	\$3,156,660	\$10,540,660
10-100 acres	1,578	15,780	\$12,624,000	\$5,396,760	\$18,020,760
Total	2,501	25,010	\$20,008,000	\$8,553,420	\$28,561,420

b. Track 2: Combination of Full Capture Systems, Other Treatment Controls, Institutional Controls, Multi-Benefit Projects

The estimated cost of compliance for industrial permittees smaller than 10 acres selecting Track 2 (6,750 facilities) would be approximately \$5.4 million in a single year and \$2 million annually following initial implementation (Table 29).

Table 29. Estimated Cost of Compliance for Industrial Facilities Smaller than 10 Acres

Size of Industrial Site	Number of Facilities	Training @ \$500	Operation @ \$300	Total Cost
<10 acres	3,571	\$1,785,500	\$1,071,300	\$2,856,800
No Size Data	3,179	\$1,589,500	\$953,700	\$2,543,200
Total	6,750	\$3,375,000	\$2,025,000	\$5,400,000

c. Compliance Schedule

Industrial permittees subject to the proposed [final](#) Trash Amendments must demonstrate full compliance with the deadlines of the first implementing NPDES permit (whether such permits are [modified re-opened](#), re-issued, or newly adopted). The deadlines cannot exceed the terms of the first implementing permit. With uncertain compliance timelines for these permittees, it is difficult to estimate and predict the schedule of the cost of complying with the proposed [final](#) Trash Amendments, which is why this analysis assumes a permittees' full compliance being achieved in a single year, rather than amortized over several years.

⁸⁹ No compliance schedule is estimated in this section for IGP permittees. Therefore all expenditures are estimated as if they were incurred in a single year.

8. POTENTIAL COSTS FOR CALTRANS

Caltrans' Division of Maintenance expenditures on "litter removal" are ~~\$80 million~~ ~~range from 41 million~~⁹⁰ ~~to 52 million~~ per year⁹¹. According to Caltrans, there are approximately ~~55,000~~ 50,000 (approximately 15,000 centerline miles) in California⁹². Therefore, the current cost of litter removal is, on average, ~~\$1,000~~ \$1,600 per lane mile per year.

a. Compliance with the Proposed Final Trash Amendments

Caltrans may comply with the proposed final Trash Amendments by installing, operating and maintaining any combination of full capture systems, other treatment controls, institutional controls and/or multi benefit projects for all storm drains that captures runoff from its significant trash generating areas.

Caltrans already implements a variety of institutional controls, including a statewide public outreach and education program (e.g., "Don't Trash California"). Caltrans also operates the Adopt-a-Highway program to clean up trash from its roadways. For this reason, and because of the many site-specific factors Caltrans will need to consider that are not available, we cannot identify with precision specific trash control that Caltrans may use. To determine the economic impact to Caltrans, we considered one possible approach that assumes no increase of institutional controls and some incremental level of structural controls to reduce trash loads to waters.

To estimate the location and relative extent of Caltrans' significant trash generating areas, we used a GIS analysis to determine the centerline miles of the state highway system. Areas already covered by existing trash and debris TMDLs and the areas of San Francisco and served by combined sewer systems⁹³ were excluded. Next, we identified urban boundaries using city, town and census defined places from the U.S. Census Bureau TIGER/LineR Shapefiles⁹⁴. Figure 13 provides a map of the resulting 5,990 urban centerline miles. We then assumed that 20% of the urban centerline miles would serve as a proxy for significant trash generating areas that that would require additional structural controls to comply with the proposed final Trash Amendments. Using this method, 1,198 centerline miles were identified that may need to be addressed using structural control.

For unit costs, we assumed the same installation (\$800) and annual operation and maintenance (~~\$324~~ \$342) costs as those used in Section 7. We estimated that there are approximately 18 catch basins per mile in rural areas and 36 catch basins per mile in urban areas. Because significant trash generating areas are more likely to be in urban areas, we used the higher estimate to calculate the number of catch basins needing full capture devices. Under these

⁹⁰ Litter removal costs are provided by Caltrans Maintenance Program. ~~For more about Litter Abatement.~~ Available at: <http://www.dot.ca.gov/docs/LitterAbatementPlan.pdf>

⁹¹ See fn. ~~2832~~, *ante*.

⁹² California State Transportation Agency. 2012. 2012 California Public Road Data, Table 1. Accessed May 2014. Available at: <http://www.dot.ca.gov/hq/tsip/hpms/datalibrary.php>

⁹³ Areas with a combined sewer system are not explicitly carved out by the proposed final Trash Amendments, but because all storm water in these areas is captured and treated, they are not considered significant trash generating areas and should not require additional trash controls. Therefore these areas were also excluded from Caltrans cost analysis.

⁹⁴ U. S. Census Bureau. 2012. 2012 TIGER Shapefiles for census tracts and census designated places. Accessed January 2014. Available at: <http://www.census.gov/geo/maps-data/data/tiger-line.html>

assumptions, estimated incremental capital costs for Caltrans would be approximately \$35 million and incremental annual operation would be approximately \$15 million (Table 30).

Table 30. Incremental Capital Costs and Operation and Maintenance Estimates for Caltrans

Factor	Estimates
Centerline Miles of Roadway	15,147
Centerline miles in Urban areas.	5,990
Percent of subject miles requiring structural controls	20%
Affected Miles	1,198
Drop inlets per mile	36
Total number of drop inlets	46534
Total Capital Cost (@ \$800 per drop inlet)	\$34,502,400
Annual Operation & Maintenance Cost (@ \$342 per drop inlet per year)	\$14,749,776

b. Compliance Schedule

Compliance with the water quality objective and implementing the prohibition of discharge will be demonstrated by Caltrans according to a time schedule set forth in the proposed [final](#) Trash Amendments. The compliance schedule will be contingent on the effective date of the first implementing permit. Caltrans must demonstrate full compliance within ten years of the effective date of the first implementing permitting permit⁹⁵. The State Water Board can set achievements of interim milestones for compliance within a specific permit. These interim milestones could be set as a percent reduction or percent installation per year or over several years. Assuming a 10% annual investment in structural controls, the annual capital cost would be approximately \$3.5 million.

Reaching full compliance with the prohibition of discharge will require extensive planning by Caltrans. To assist Caltrans with planning for full compliance, the State Water Board will issue a Water Code section 13267 or 13383 order within 18 months of the effective date of the proposed [final](#) Trash Amendments requesting an implementation plan. Requesting an implementation plan from Caltrans permittees prior to the will optimize compliance planning and implementation.

c. Limitations and Uncertainties

Due to the differences in the type, size and distribution of facilities, the construction, operation and maintenance of trash control systems on highways and roads managed by Caltrans districts will be extremely site specific, and may differ significantly from costs for municipalities. The calculations are sensitive to the assumptions used to estimate significant trash generating areas and the percentage of those areas that would require additional structural controls. For

⁹⁵ See fn. [3742](#), *ante*.

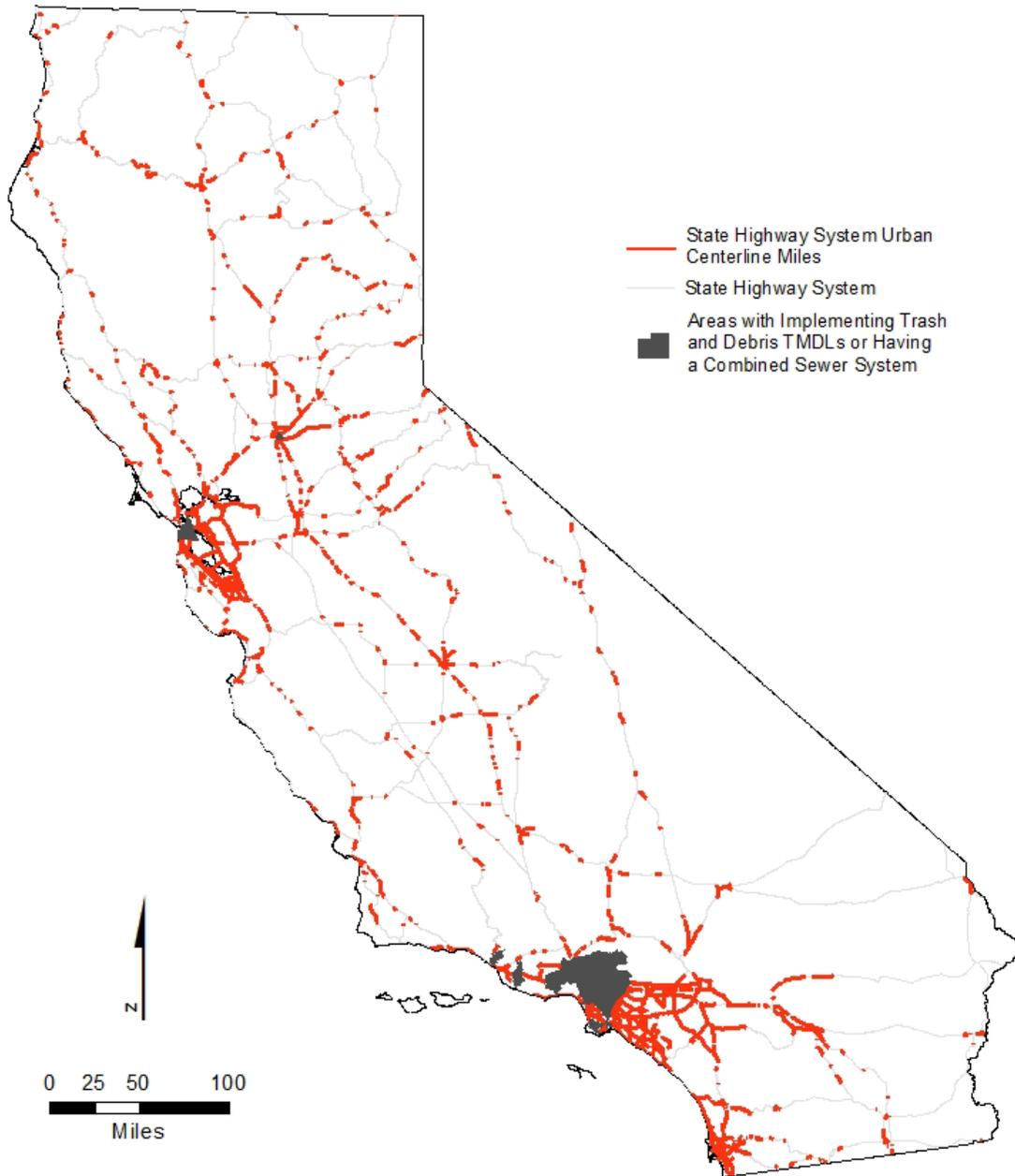
example, we based cost calculations on the assumption that significant trash generating areas will largely correspond to urban areas. However, this assumption may underestimate costs that some significant trash generating areas will occur in non-urban areas, such as rest stops. GIS data from Caltrans indicates there are currently 88 rest stop areas in California, seven of which are already accounted for in the calculation of urban centerline miles. If these rest areas are determined to be significant trash generating areas, the capital costs are expected to increase by less than \$1 million using the methodology described above. In addition, Caltrans has suggested that 40% is a more reasonable estimate of the Percent of subject miles requiring structural controls⁹⁶. However Caltrans did not provide justification for this estimate. If the calculations in Table 30 were revised to use Caltrans assumptions, the total estimated capital cost would increase to approximately \$69 million.

~~In addition~~ Finally, we anticipate that Caltrans likely will choose Gross Solids Removal Devices in many locations instead of catch basin inserts. Gross Solids Removal Devices are generally more expensive to install and maintain, but also cover larger areas. Without additional information on the specific location and site conditions where additional trash controls will be needed, we cannot determine whether on balance Gross Solids Removal Devices will be more or less expensive than catch basin inserts⁹⁷.

⁹⁶ Source: McGowen, Scott., California Department of Transportation. Letter to Diana Messina, California State Water Resources Control Board. November 7, 2014.

⁹⁷ During the comment period and subsequent correspondence and conversations with Caltrans, Caltrans provided a cost estimate of \$176,000 per treated acre as the total installation cost for gross solid removal devices. However, this estimate was developed to address TMDL compliance for multiple pollutants (Source: McGowen, Scott., California Department of Transportation. Letter to Diana Messina, California State Water Resources Control Board. November 7, 2014). Caltrans may indeed choose to install Gross Solids Removal Devices to address multiple pollutants, but cheaper alternatives exist for trash and therefore the full costs associated with Gross Solids Removal Devices may not be reasonably attributed to these amendments. In fact, to the extent that Gross Solids Removal Devices are already required under the Caltrans MS4 permit, costs to implement the Trash Amendments could be substantially less than estimated above. Please see the responses to comments document for additional information.

Figure 13. State Highway System Centerlines in Urban Areas



9. POTENTIAL COSTS FOR OTHER DISCHARGERS

The proposed final Trash Amendments include a provision that allows the Water Boards to require dischargers that are not subject to Section 3⁹⁸ of the proposed final Trash Amendments to implement trash controls in areas or facilities that may generate trash. Such areas or facilities may include (but are not limited to) high usage campgrounds, picnic areas, beach recreation areas, parks not subject to an MS4 permit, or marinas.

Because of the optional nature of this provision, no baseline figures are available with which to conduct an economic analysis. The absence of specific baseline figures, coupled with the variety of compliance options available, and the resulting wide range of costs related to this group of dischargers, no information is available to develop specific cost estimates for the incremental trash control costs associated with this category of dischargers at this point.

10. CONCLUSION

The presence of trash in surface waters, especially coastal and marine waters, is a serious issue in California. California communities are currently spending \$428 million annually to control trash from entering water of the states, which varies between the sizes of communities. With the proposed final Trash Amendments, the State Water Board's objective is to provide statewide consistency for the Water Boards' regulatory approach to protect aquatic life and public health beneficial uses, and reduce environmental issues associated with trash in state waters, while focusing limited resources on high trash generating areas.

To achieve this objective, a central element of the proposed final Trash Amendments is a land-use based compliance approach to focus trash control to areas with high trash generation rates. Within this land-use based approach, a dual alternative compliance Track approach is proposed for permitted storm water dischargers (i.e., MS4 Phase I, MS4 Phase II, Caltrans, IGP, and CGP) to implement the prohibition of discharge for trash.

Under the requirements of Water Code sections 13170 and 13241, subdivision (d) that require the State Water Board to consider economics when establishing water quality objectives. This economic analysis is not a cost-benefit analysis, but a consideration of potential costs of a suite of reasonably foreseeable measures to comply with the proposed final Trash Amendments. This economic analysis utilized two basic methods to estimate the incremental cost of compliance for permitted storm water discharge: the first method was based on cost of compliance per capita, and the second method was based on land cover.

This economic analysis estimated the incremental annual cost to comply with the requirements of the proposed final Trash Amendments ranged from \$4 to \$10.67 per year per capita for MS4 Phase I NPDES permittees and from \$7.77 to \$7.91 per year per capita for smaller communities regulated under MS4 Phase II permits. For IGP facilities, the estimated compliance cost is \$33.9 million or \$3,671 per facility. To comply with the proposed final Trash Amendments, expenditures by Caltrans are estimated to increase by ~~\$37~~ \$34.5 million in total capital costs and ~~\$45~~ \$14.7 million per year for operation and maintenance of structural controls.

⁹⁸ As proposed to the Ocean Plan Ch. III(L)(2). As proposed to the ISWEBE Plan Ch. IV(BA)(3).

11. REFERENCES

- Black & Veatch. 2012. Quantification Study of Institutional Measures for Trash TMDL Compliance. November, 2012. Prepared for City of Los Angeles.
- City of Los Angeles Stormwater Management Division. 2002. High Trash-Generation Areas and Control Measures. January 2002. Accessed January 2014. Available at: http://www.lastormwater.org/wp-content/files_mf/trash_gen_study.pdf
- California Department of Water Resources. 2008. Economic Analysis Guidebook. Accessed January 2014. Available at: http://www.water.ca.gov/pubs/planning/economic_analysis_guidebook/econguidebook.pdf
- California State Water Resources Control Board. 2014. California Integrated Water Quality System Database. Accessed January 2014. Available at: http://www.waterboards.ca.gov/water_issues/programs/ciwqs/
- Currier, B., J. Jones, G. Moeller. 2005. NPDES Stormwater Cost Survey. Office of Water Programs, California State University, Sacramento. January 2005. Accessed January 2014. Available at: https://www.owp.csus.edu/research/papers/papers/NPDES_Stormwater_costsurvey.pdf
- Fry, J., G. Xian, S. Jin, J. Dewitz, C. Homer, L. Yang, C. Barnes, N. Herold, and J. Wickham. 2011. [Completion of the 2006 National Land Cover Database for the Conterminous United States](#).
- Gordon, M. and R. Zamist. 2012. Municipal Best Management Practices for Controlling Trash and Debris in Stormwater and Urban Runoff. n.d. California Coastal Commission; Algalita Marine Research Foundation. Accessed January 2014. Available at: http://plasticdebris.org/Trash_BMPs_for_Munis.pdf
- Hildebrand, G. 2011. Trash TMDL: Achieving Compliance. County of Los Angeles Department of Public Works presentation to the Statewide Water Quality Control Plan for Trash Public Advisory Group. Accessed January 2014. Available at: http://www.waterboards.ca.gov/water_issues/programs/trash_control/pag/docs/la_trashtmdl_ghildebrand.pdf
- Los Angeles Regional Water Quality Control Board. 2007. Trash Total Maximum Daily Loads for the Los Angeles Regional Board. Accessed January 2014. Available at: http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/2007-012/09_0723/L.%20A.%20River%20Trash%20TMDL_Final%20%20Staff%20Report_August%209,%202007.pdf
- [McGowen, Scott, California Department of Transportation. Letter to State Water Board re Caltrans Treatment BMP Cost Estimates. January 16, 2014.](#)
- [McGowen, Scott., California Department of Transportation. Letter to Diana Messina, California State Water Resources Control Board. November 7, 2014.](#)
- Stickel, B. H., A. Jahn and W. Kier. 2012. The Cost to West Coast Communities of Dealing with Trash, Reducing Marine Debris. Prepared by Kier Associates for U.S. Environmental Protection Agency, Region 9. September 2012. Accessed January 2014. Available at: <http://www.epa.gov/region9/marine-debris/cost-w-coast-debris.html#report>

- Stickel, B. H., A. Jahn, and W. Kier. 2013. Waste in Our Water: The Annual Cost to California Communities of Reducing Litter that Pollutes our Waterways. Kier Associates. Accessed January 2014. Available at: http://docs.nrdc.org/oceans/files/oce_13082701a.pdf
- U.S. Census Bureau. 2012. American Community Survey, 5-year Estimates 2008-2012. Accessed January 2014. Available at: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>
- U. S. Census Bureau. 2012. 2012 TIGER Shapefiles for census tracts and census designated places. Accessed January 2014. Available at: <http://www.census.gov/geo/maps-data/data/tiger-line.html>
- U.S. Census Bureau. 2010. United States Census 2010. Accessed January 2014. Available at: <http://www.census.gov/2010census/>
- U.S. Department of Commerce. Bureau of Economic Analysis. 2013. California Municipal Statistical Areas. Accessed January 2014. Available at: <http://www.bea.gov/regional/docs/msalist.cfm#C>
- U.S. Environmental Protection Agency. 2010 National Center for Environmental Economics. Guidelines for Preparing Economic Analyses. Accessed January 2014. Available at: <http://yosemite.epa.gov/ee/epa/eed.nsf/pages/guidelines.html>
- U.S. Geographical Survey. 2006. Multi-Resolution Land Characteristics Consortium Land Cover Data 2006. Accessed January 2014. Available at: <http://www.mrlc.gov/nlcd2006.php>