

THE COST TO WEST COAST COMMUNITIES OF DEALING WITH TRASH, REDUCING MARINE DEBRIS



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'just because you can't see it doesn't mean it isn't there'

Cover artwork courtesy of Ferdi Rizkiyanto

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The Cost to West Coast Communities of Dealing with Trash, Reducing Marine Debris

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EXECUTIVE SUMMARY

Under contract to the United States Environmental Protection Agency (EPA) the Kier Associates team contacted a random sample of U.S. West Coast communities in California, Oregon and Washington located in watersheds which drain into the Pacific Ocean. The team included, as well, data from 15 California cities collected in a separate, initial study begun at EPA in 2011.¹

From the data received from these 90 different communities, which ranged in size from just over 200 residents (Ukiah, Oregon) to over 4 million residents (Los Angeles, California), the team determined that, regardless of the distance from the ocean or the number of residents, West Coast communities are spending approximately \$13 per resident a year to combat and clean up trash, much of which would otherwise end up as marine debris.

Cost information was sought for six different activities related to trash management, namely:

- Beach and waterway cleanup
- Street sweeping
- Installation of storm-water capture devices
- Storm drain cleaning and maintenance
- Manual cleanup of litter
- Public anti-littering campaigns

According to the 2010 Census nearly fifty million people live in California, Oregon and Washington. If 85 percent of this population lives in coastal communities and along rivers leading to the Pacific Ocean – a percentage the team suggests is conservative – then these West Coast communities are spending more than \$520,000,000 – over one half billion dollars - each year to combat litter and curtail marine debris.

Such costs, in the view of the project team, make a compelling argument for accelerating the search for ways and means of reducing trash streams contributing to marine debris.



Figure 1: Pico Kenter storm drain in Santa Monica, CA. Image: Haan-Fawn Chau (<http://www.epa.gov/region9/water/npdes/stormwater-feature.html>.)

¹ Timothy Degan Kelly, "Draft - Economic Analysis of Marine Debris," edited by Saskia van Gendt, August 5, 2011.

INTRODUCTION

Purpose

This study aims to quantify the overall costs incurred by a robust number of randomly-selected West Coast communities for all levels of managing trash which is, or could otherwise become, marine debris in order to provide local governments and concerned citizens with another tool with which to work toward greater trash source reduction. Cost data was gathered and analyzed from cities with populations ranging from just over 200 residents (Ukiah, Oregon) to almost four million residents (Los Angeles, California). The research team's findings have been organized to present estimates of the average cost for managing potential marine debris by city size, as follows:

City Size	Population Range	Range of Annual Costs	Average Annual Cost
Largest	250,000 or more	\$2,877,400 - \$20,672,266	\$10,054,805
Larger	75,000 – 249,999	\$342,000 - \$2,057,500	\$1,211,522
Mid-Sized	15,000-74,999	\$37,500 - \$2,330,000	\$557,597
Smaller	0-14,999	\$0 - \$890,000	\$95,345

For detail see Appendix B: Data Tables

The data provide a basis for comparing such costs for cities that have implemented source reduction programs to those which are in the initial stages of such programs.

Out of sight, out of mind.

In 1975 the National Academy of Sciences determined that approximately 1.4 billion pounds of trash and other persistent solid material was being tossed into the world's oceans each year, where it becomes *marine debris*, much of it ending up on beaches.² No more current estimate can be found, but it appears that debris accumulations on beaches and in the ocean have increased in the years since. The disturbing rate at which debris such



² National Oceanic and Atmospheric Administration (NOAA), "Marine Debris: Frequently Asked Questions," 10 August 2012, <http://marinedebris.noaa.gov/info/faqs.html>, #1.

as plastics, polystyrene, metal, glass and rubber is accumulating in our oceans is becoming increasingly well documented.³

Debris is known to threaten sensitive marine and coastal habitats, harm hundreds of species of marine fauna, to interfere with navigation, degrade ocean habitats, cost millions of dollars in lost fishing and tourism revenue, and threaten human health and safety.⁴ Further, it has been noted there is a “constant influx of debris into the ocean every day, [and] if we can't stop that from happening, *clean up* will never have the necessary impact to protect marine organisms and ecosystems.”⁵ Until clean up is feasible and the flow of debris into the oceans is

³ Aimee A. Keller, et al., "Distribution and Abundance of Anthropogenic Marine Debris along the Shelf and Slope of the US West Coast," *Marine Pollution Bulletin* 60 (2010): 692-700; Evan A. Howell, et al., "On North Pacific Circulation and Associated Marine Debris Concentration," *Marine Pollution Bulletin* 65 (2012): 19-20. Shelly L. Moore and M. James Allen, "Distribution of Anthropogenic and Natural Debris on the Mainland Shelf of the Southern California Bight," *Marine Pollution Bulletin* 40, no. 1 (2000): 83-88; Stephanie Avery-Gomm, et al., "Northern Fulmars as Biological Monitors of Trends of Plastic Pollution in the Eastern North Pacific," *Marine Pollution Bulletin*, June 2012 (In Press): 5; Moore, "Synthetic Polymers in the Marine Environment," 134. In 2010, researchers in the Northwest Hawaiian Islands recovered two buoys lost during the 2007-08 Oregon Dungeness crab fishery, a coastal fishery. The buoys were found on different days in different locations, and help demonstrate the oceanic drift path of debris originating along the U.S. Pacific Coast. Further, the fact that the fishery takes place in nearshore waters demonstrates how land-based pollution from the U.S. west coast can impact distant places. Curtis C. Ebbesmeyer, et al., "Marine Debris from the Oregon Dungeness Crab Fishery Recovered in the Northwestern Hawaiian Islands: Identification and Oceanic Drift Paths," *Marine Pollution Bulletin* 65 (2012): 69-70, 74.

⁴ NOAA, "Interagency Report on Marine Debris Sources, Impacts, Strategies & Recommendations," Congressional Report Developed by Interagency Marine Debris Coordinating Committee. 2008. *U.S. Government*, 30 Jul 2012 http://water.epa.gov/type/oceb/marinedebris/upload/2008_imdcc_marine_debris_rpt.pdf, 12. Moore, "Synthetic Polymers in the Marine Environment," 133. Further, “ingested debris” has been recovered during necropsies of marine mammals, birds, fish, turtles and squid. In 1987, researcher David Laist documented over 100 different species of seabirds that either ingested plastic fragments or become entangled in debris. National Research Council, Committee on the Effectiveness of International and National Measures to Prevent and Reduce Marine Debris and Its Impacts, *Tackling Marine Debris in the 21st Century* (Washington, DC: National Academies Press, 2008), 1; D.W. Laist, "Impacts of Marine Debris: Entanglement of Marine Life in Marine Debris Including a Comprehensive List of Species with Entanglement and Ingestion Records," in *Marine Debris - Sources, Impacts and Solutions*, ed. M. Coe and D.B. Rogers (New York: Springer-Verlag, 1997), 99-139. Carcasses of northern fulmars recently recovered on beaches in Oregon and Washington State reveal the seabirds lacking in muscle and fat reserves; over 90% ingested plastic particles at some time prior to death from drowning. Further, the results provided “strong evidence” of increasing ingestion of plastic by fulmars, most likely paralleling an increase in the amount of plastic available for them to ingest. Avery-Gomm, et al., "Northern Fulmars as Biological Monitors of Trends of Plastic Pollution in the Eastern North Pacific," 2, 4. The ingestion of plastic debris by animals can provide an avenue for other organic pollutants, including DDT and PCBs, to enter the food chain. Almira Van, et al., "Persistent Organic Pollutants in Plastic Marine Debris Found on Beaches in San Diego, California," *Chemosphere* 86 (2012): 258, 260. In addition, researchers have expressed concern about estrogenic compounds found in plastics possibly causing endocrine disruptions in marine animals. Moore, "Synthetic Polymers in the Marine Environment," 135.

⁵ Zack Bradford, Ocean Policy Research Analyst, Monterey Bay Aquarium. "RE: [MarineDebris] Plastic Republic - UCL IGEM 2012." 30 Jul 2012. *MarineDebris Digest*, Vol. 132, Issue 1.

stemmed, it is essential that all practical measures be undertaken to reduce the amount of debris entering the ocean each year.⁶

Although it is impossible to precisely estimate the percentage, most marine debris originates from land-based sources such as littering, legal and illegal dumping, poor waste management practices, stormwater discharges and extreme natural events.⁷ Debris cleanup and prevention is expensive and complex, costing public agencies many millions of dollars every year.⁸ Most of the responsibility for managing waste falls on local government, thus most cities in the states of Washington, Oregon and California incur direct, significant expenses associated with preventing or reducing marine



Figure 3: "Keeping the beaches clean and safe is a full-time job." Los Angeles County Beach and Marina Clean-Up Crew loads a dump truck with debris from just one storm. Image: Los Angeles County Department of Beaches and Harbors. (http://beaches.lacounty.gov/wps/portal/dbh/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3hXAw MDd3-3YCMLEws3A08jDy8nvB_YwtDM_2CbEdFAPJm91kl/?WCM_GLOBAL_CONTEXT=/wps/wcm/connect/dbh/content/dbh/site/home/home+detail/beach+clean-up.)

⁶ "We've been cleaning up inland areas for almost as long as we've been organizing Coastal Cleanup Day," said Eben Schwartz, statewide outreach coordinator for the California Coastal Commission. "The data we've collected during the event over the years has shown that most of the trash we pick up starts in our inland and urban areas. So why not go straight to the source and stop that trash where it starts?" California Coastal Commission, *California Coastal Commission Announces the "58 for 58" Campaign* Press Release (4 Feb 2004). Beach clean-ups, generally conducted by volunteers, do help heighten civic awareness; however, as the annual necessity and increasing size of these volunteer clean-up efforts demonstrate, beach clean-ups are not the solution as they do not address sources of the debris. A.T. Williams, M. Gregory, and D.T. Tudor, "Marine Debris -- Onshore, Offshore, Seafloor Litter," in *Encyclopedia of Coastal Science*, ed. M. Schwartz (Dordrecht, The Netherlands: Springer, 2005), 626; Charles James Moore, "Synthetic Polymers in the Marine Environment: A Rapidly Increasing, Long-Term Threat," *Environmental Research* 108 (2008): 133. Nevertheless, while volunteer efforts can be utilized to clean beaches, at-sea debris can be large (e.g. multiple derelict fishing nets versus plastic bottles and cigarettes) and is often located at depths which necessitate involving trained vessel operators and other experts. NOAA, "Marine Debris Sources, Impacts, Etc.," 40.

⁷ GESAMP, *State of the Marine Environment*, IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution, Reports and Studies No. 39 (United Nations Environment Programme, 1990), 88; A.T. Williams, M. Gregory, and D.T. Tudor, "Marine Debris -- Onshore, Offshore, Seafloor Litter," 623; Miriam Gordon, *Eliminating Land-Based Discharges of Marine Debris in California: A Plan of Action from The Plastic Debris Project*, 2006, *California Coastal Commission: The Plastic Debris Project*, http://www.plasticdebris.org/CA_Action_Plan_2006.pdf: 3, 14; C.J. Moore, G.L. Lattin and A.F. Zellers, "Quantity and Type of Plastic Debris Flowing from Two Urban Rivers to Coastal Waters and Beaches of Southern California," *Journal of Integrated Coastal Zone Management* 11, no. 1 (2011): 65. Further, a 2012 survey of U.S. West Coast data from the National Marine Debris Monitoring Program for the years 1998 through 2007 reveals a consistent overall decline in marine-sourced debris (from ships, fishing, etc.) while the land base debris load remains unchanged. Christine A. Ribic, et al., "Trends in Marine Debris along the U.S. Pacific Coast and Hawai'i 1998-2007," *Marine Pollution Bulletin* 64 (2012): 994, 1001.

⁸ California Ocean Protection Council in Consultation with California Marine Debris Steering Committee and Gordon Environmental Consulting, "An Implementation Strategy for the California Ocean Protection Council: Resolution to Reduce and Prevent Ocean Litter," 20 Nov 2008, State of California, Ocean Protection Council, 30 Jul 2012, 4.

debris - regardless of their distance from the ocean. These local costs can be particularly high for coastal communities.

Current approaches

Local governments have the ability to lessen the flow of trash into the ocean by promoting land-based cleanup and source reduction; enacting ordinances to reduce single-use plastic bags and polystyrene (Styrofoam™) takeout packaging, and creating incentives for reuse.⁹ In May of 2012, for example, Hawaii enacted a statewide ban on plastic bags, to be implemented over three years.¹⁰ Plastic bag ordinances have been implemented in a number of cities and counties throughout California, Oregon and Washington.¹¹ A number of cities and counties have also banned polystyrene food packaging and expanded polystyrene (EPS) items.¹²

Local governments invest significant funds for land-based cleanup to reduce the amount of debris reaching waterways. The City of San Francisco spends an estimated \$6 million annually just cleaning up discarded cigarettes.¹³ Los Angeles County spends over \$18 million a year sweeping streets, clearing catch basins, cleaning up litter and educating the public in an

⁹ In California, for example, the Ocean Protection Council's 2008 Implementation Strategy for the reduction of marine debris focuses on three main objectives: "1) bans on specific products more likely to become marine debris for which there are available substitute materials; 2) fees on products likely to become marine debris for which there are no available substitute materials; and 3) extended producer responsibility policies, aimed at making producers of plastic products responsible for the entire lifecycle of their products." Ibid, 6; *The Honolulu Strategy: A global framework for prevention and management of marine debris*, developed in conjunction with the United Nations Environmental Programme (UNEP) and NOAA, expands broadly on these goals in Table ES-1. NOAA, "The Honolulu Strategy: A Global Framework for Prevention and Management of Marine Debris," n.d., 31 Jul 2012 <<http://marinedebris.noaa.gov/projects/pdfs/HonoluluStrategy.pdf>>. Jennie R. Romer and Shanna Foley, "A Wolf in Sheep's Clothing: The Plastic Industry's 'Public Interest' Role in Legislation and Litigation of Plastic Bag Laws in California," *Golden Gate University Environmental Law Journal* 58, no. 2 (12 Apr. 2012): 377-78; Jessica R. Coulter, "Note: A Sea Change to Change the Sea: Stopping the Spread of the Pacific Garbage Patch with Small-Scale Environmental Legislation," *William & Mary Law Review* 51 (Apr. 2010): 1961.

¹⁰ Miguel Llanos, "Hawaii First State to Ban Plastic Bags at Checkout," *U.S. News on NBCNEWS.Com*. 16 May 2012. NBC News. http://usnews.nbcnews.com/_news/2012/05/16/11720480-hawaii-first-state-to-ban-plastic-bags-at-checkout?lite. Accessed 29 Aug. 2012.

¹¹ Bennett Hall, "City Council Approves Ban on Plastic Bags," *Gazette-Times* (Corvallis), 19 Jun 2012; Californians against Waste. Plastic Litter and Waste Reduction Campaign: Plastic Bag Litter Pollution: Plastic Bags: Local Ordinances. 2012. http://www.cawrecycles.org/issues/plastic_campaign/plastic_bags/local. Accessed 28 Aug. 2012.

¹² California Ocean Protection Council, "Resolution to Reduce and Prevent Ocean Litter," 13; City News Service, "LAUSD to Ban Styrofoam Food Trays at All School Campuses," *Los Angeles Daily News*. 23 Aug. 2012. http://www.dailynews.com/education/ci_21387420/lausd-ban-styrofoam-food-trays-at-all-school. Accessed 30 Aug. 2012.

¹³ J.E. Schneider, et al., "Estimates of the Costs of Tobacco Litter in San Francisco and Calculations of Maximum Permissible Per-Pack Fees" (Health Economics Consulting Group LLC, 2009), 19.

attempt to reduce debris.¹⁴ Throughout the survey area, cities and counties are also addressing the problem through the implementation of Total Maximum Daily Load (TMDL) plans for trash and implementation of Municipal Separate Storm Sewer System – MS4 – permit requirements, working with the states to steadily limit trash discharges into West Coast waterbodies. The Los Angeles County TMDL, for example, requires “Southern California cities discharging into the river to reduce their trash contribution to these water bodies by 10% each year for a period of 10 years with the goal of zero trash in the two waterways by 2015.”¹⁵

While such cleanup efforts do reduce the amount of trash reaching the ocean, their cost has not been well studied until now. This report strives to address that unknown-cost issue.



¹⁴ County of Los Angeles Staff, *An Overview of Carryout Bags in Los Angeles County*, a staff report to the Los Angeles County Board of Supervisors (Los Angeles: Los Angeles County Department of Public Works, Environmental Programs Division, August 2007), 4.

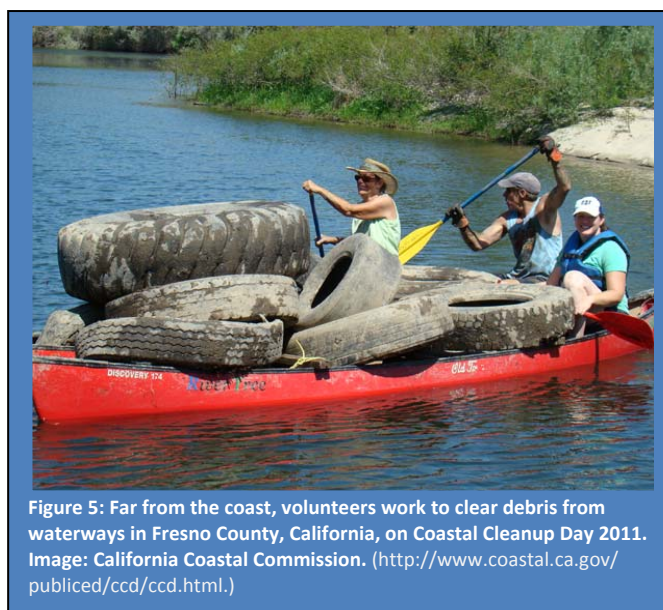
¹⁵ "Total Maximum Daily Loads (TMDLs) for Los Angeles." *City of Los Angeles Stormwater Program*. City of Los Angeles Stormwater Program. 25 July 2011. http://www.lastormwater.org/Siteorg/program/TMDLs/tmdl_lariver_trash.htm. "Devices to capture plastic debris before it reaches rivers and oceans are being installed at urban catch basins, storm drains and pumping stations, and debris booms are being placed across rivers draining urban areas. Containment structures cover only a small percentage of debris conduits, and during heavy storms, these devices break or overflow, and release debris. Nevertheless, these devices are being relied upon by municipalities required to reduce trash input to urban waterways by regulations called total maximum daily loads (TMDLs), used by Water Resource Control Boards to regulate pollutants entering urban waterways. Structural controls typically capture macro-debris (45mm) only, as the legal definition of trash under the TMDL is anthropogenic debris that can be trapped by a 5mm mesh screen (California Regional Water Quality Control Board, Los Angeles Region). Based on a study of the Los Angeles watershed, 90% of plastic debris by count, and 13% by weight are micro-debris <5mm." Moore, "Synthetic Polymers in the Marine Environment," 136.

METHODOLOGY

This study expands on data from 15 California cities that was collected for EPA in 2011 by Timothy Degan Kelly.¹⁶

A random list of all U.S. West Coast cities on watersheds that ultimately drain into the Pacific Ocean was generated and the top 80 cities were contacted (see Appendix D: Cities Randomly Selected and Contacted by Kier Associates). Cost data came from a variety of sources including MS4 permits, annual budgets and reports and phone and email follow-up with city hall staffs, public works field managers and knowledgeable NGOs. The data came from an array of program areas – city budget personnel, clean water program managers, watershed management programs, parks and recreation departments and more. There was no one reliable source common among the cities – the survey team persisted until it found an information source, city by city (See Appendix C: Respondents, Participating Cities).

Including the initial 15 cities contacted by Mr. Kelly, over 90 cities and municipal agencies were contacted. Of those more than 50 were able to provide cost data relating to some, if not all of the six categories.



Thus, the study consisted primarily of the initial request from information from the cities, followed by a great deal of follow-up effort to get the costs from the cities of the six selected categories of trash management (See Appendix A: Request for Information):

- Beach and waterway cleanup
- Street sweeping
- Installation of stormwater capture devices
- Storm drain cleaning and maintenance
- Manual cleanup of litter
- Public education

The resulting figures provide the average annual cost incurred by the cities to manage trash capable of becoming marine debris.

The following cities participated in this study, grouped according to size:

¹⁶ Kelly, "Draft - Economic Analysis of Marine Debris."

City, State	Population
Largest	Over 250,000
Los Angeles, CA	3,831,868
San Diego, CA	1,301,617
San Jose, CA	964,695
Seattle, WA	608,660
Portland, OR	583,776
Sacramento, CA	466,488
Long Beach, CA	462,604
Oakland, CA	409,184
Larger	75,000-249,999
Chula Vista, CA	243,916
Glendale, CA	196,847
Sunnyvale, CA	133,963
Inglewood, CA	112,241
Everett, WA	103,019
South Gate, CA	94,300
Kent, WA	92,411
Hawthorne, CA	83,945
Livermore, CA	80,968
Mid-Sized	15,000-74,999
Mountain View, CA	74,066
Redondo Beach, CA	66,748
Wasco, CA	64,173
Gardena, CA	58,829
Huntington Park, CA	58,100
Diamond Bar, CA	55,544
Fountain Valley, CA	55,313
Paramount, CA	55,018
Glendora, CA	49,737
Azusa, CA	46,361
San Gabriel, CA	39,718
West Hollywood, CA	34,399
Laguna Hills, CA	30,344
Walnut, CA	29,172
San Pablo, CA	29,139

City, State	Population
SeaTac, WA	26,909
Sanger, CA	24,270
Mercer Island, WA	22,699
Oak Harbor, WA	22,075
Arvin, CA	19,304
Laguna Woods, CA	16,192
Smaller	Under 15,000
The Dalles, OR	13,620
Auburn, CA	13,330
Commerce, CA	12,823
Port Orchard, WA	11,144
Signal Hill, CA	10,834
Capitola, CA	9,918
Monmouth, OR	9,534
Ione, CA	7,918
Sutherlin, OR	7,810
Orland, CA	7,291
Hughson, CA	6,640
Winters, CA	6,624
Del Mar, CA	4,151
Angels Camp, CA	3,836
Medina, WA	2,969
Chewelah, WA	2,607
Omak, WA	2,552
Cle Elum, WA	1,872
Winlock, WA	1,339
Millersburg, OR	1,329
Blue Lake, CA	1,253
Malin, OR	805
Etna, CA	737
Bingen, WA	712
Dufur, OR	604
Mosier, OR	433
Detroit, OR	202
Ukiah, OR	186

The available cost data was compiled and analyzed by category. Average and per capita costs were then computed for each category and have been tallied as between smaller, mid-sized, larger and largest cities.¹⁷ In calculating averages and per capita data, responses of “N/A” and/or “0” were assumed to indicate that a city spent nothing for that category. The team is aware that this is a conservative approach – it was clear in many cases that cities were spending in these categories, they just couldn’t break out the costs.

Because of the large number of variables - local weather conditions, distance of the city from waterways and from the coast, population, equipment expenditures, etc. - no data extrapolations were made. *Thus actual averages and per capita expenses are, for the most part, most likely higher than those reported in this study.*

COST ESTIMATES

Direct costs are costs that can be clearly traced to a specific service for managing potential marine debris.

Beach and waterway cleanup includes the cost to clean trash from beaches and waterways within the city. Not all cities conduct beach and waterway cleanups, and in general coastal communities incur larger expenses for beach cleanups than do inland communities. In addition, cities without waterways do not participate in cleanups, and inland cities with streams or rivers sometimes do not even recognize the connection between their inland waterway and potential ocean debris.¹⁸

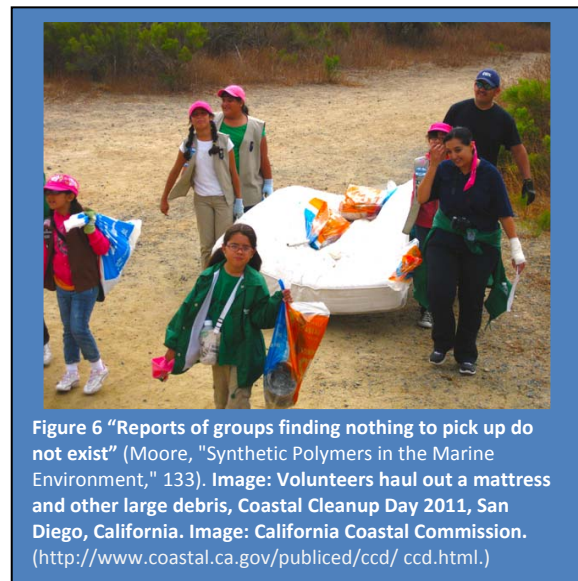


Figure 6 “Reports of groups finding nothing to pick up do not exist” (Moore, “Synthetic Polymers in the Marine Environment,” 133). Image: Volunteers haul out a mattress and other large debris, Coastal Cleanup Day 2011, San Diego, California. Image: California Coastal Commission. (<http://www.coastal.ca.gov/publiced/ccd/ccd.html>.)

¹⁷ For comparison purposes, a table of only those cities which provided costs for all categories (excluding beach/waterway cleanup) was also prepared and has been attached as Table 12 in Appendix B: Data Tables.

¹⁸ For example, Lakeview, Oregon responded: “this is just for Municipalities that have water ways that run to the ocean. The Town of Lakeview is 300 miles from the ocean. We do not have any water ways that go to the ocean. We have no big rivers in our area. All water ways are used for local irrigation.” Lakeview drains into Goose Lake, situated on the Northern California/Oregon border. While extensive agricultural diversions led the USGS to recently reclassify Goose Lake as a “closed basin,” historically the North Fork of the Pit River originated at Goose Lake, and the Lake does still, on rare occasions, spill into the Pit River. The Pit River is part of the Sacramento River system, which does flow into the Pacific. In another instance, the City of Mercer Island responded that their closed community, situated on Lake Washington, did not litter. After noting that Lake Washington was connected to

The cost for cleanups generally does not reflect the entire cost for the event, including disposal, material and labor. Often beach and waterway cleanups are conducted by a county or regional group (e.g., Los Angeles County or organized by the California Coastal Commission), making the data difficult to retrieve and attribute to a particular city.¹⁹ Nonetheless the responses to our Request for Information disclose that, often in conjunction with either a county or regional group, West Coast cities spend on average \$56,688 a year on beach and waterway cleanups (See Appendix B: Data Tables).

Table 1: Annual Cost for Beach and Waterway Cleanups²⁰

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest	Over 250,000	\$0 - \$1,837,398	\$422,185	\$0.83
Larger*	75,000-249,999	\$0 - \$17,500	\$3,329	\$0.03
Mid-Sized	15,000-74,999	\$0 - \$112,459	\$12,746	\$0.28
Smaller	Under 15,000	\$0 - \$114,005	\$6,418	\$1.28

*None of the “Larger” cities responding were located on the coast.

For detail see Appendix B: Data Tables

Street sweeping includes the cost for cities to clean their streets using truck powered street sweepers and—unless otherwise noted—includes the cost of equipment, labor, and litter disposal.²¹ Not only does street sweeping help keep streets and communities free of trash, it

Puget Sound and that we were interested in their costs for *not* littering the city did provide data for our study detailing costs that average \$102.50 per resident. See Appendix B, Table 10: Cost Data for Mid-Sized Cities (Population Range 15,000 – 75,000).

¹⁹ On the most recent International Coastal Cleanup Day, 598,076 volunteers collected some 9,184,428 pounds of trash from 20,776 miles of beaches. Eighty percent of the debris collected was comprised of the top ten items found (in descending order: cigarettes; caps/lids; plastic beverage bottles; plastic bags; food wrappers/containers; cups, plates, forks, knives, spoons; glass beverage bottles; straws, stirrers; beverage cans; and paper bags). Ocean Conservancy. "International Coastal Cleanup: 2012 Data Release." 2012. <http://www.oceanconservancy.org/our-work/marine-debris/2012-data-release.html>. Accessed 8 Aug. 2012.

²⁰ Plastics, including pre-production pellets, discarded fishing gear, scrubbers, and fragments of once larger plastic items, are reported to make up between 50% and 80% of the debris found along shorelines. Volunteer efforts result in most of the bulkier debris being removed; however, not all debris is even visible to the naked eye—fragments and microscopic debris are routinely left behind in large quantities. Van, et al., "Persistent Organic Pollutants," 258; Patricia L. Corcoran, Mark C. Biesinger, and Meriem Grifi, "Plastics and Beaches: A Degrading Relationship," *Marine Pollution Bulletin* 58 (2009): 80.

²¹ While most cities are able to provide a cost figure for street sweeping, in some areas sweeping is the responsibility of the state roads department and thus not a budgeted item.

also removes sediment and associated contaminants that would otherwise enter waterways via storm water collection systems. Street sweeping was a readily available cost figure for most cities to provide because most street sweeping is contracted out and the cost is a single fee to the contractor. Overall, responses to our Request for Information disclose that West Coast cities spend on average \$664,580 a year sweeping their streets. (See Appendix B: Data Tables).



Table 2: Annual Cost for Street Sweeping

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest	Over 250,000	\$245,000 - \$8,104,857	\$4,084,492	\$5.36
Larger	75,000-249,999	\$180,000-\$1,224,210	\$641,298	\$5.58
Mid-Sized	15,000-74,999	\$25,685-\$1,300,000	\$272,715	\$7.06
Smaller	Under 15,000	\$0 - \$160,301	\$36,314	\$5.48

For detail see Appendix B: Data Tables

Stormwater capture devices include costs for purchasing and installing catchments to trap trash in the storm drain system. The cost of these devices varies depending on how much progress cities have made in their litter reduction program and the type of device(s) installed. Some cities have yet to install any devices and others have already installed several devices. The capture devices can range from a simple insert placed into the storm drain for as little as

\$400 to complex vortex separators costing upwards of \$40,000 or more.²² Which device is used depends in part on the amount of trash normally entering the storm drain - more trash requires a more complex device. Costs for stormwater capture devices also depend on each city's proximity to a waterbody. In addition to installing devices on storm drains, many cities also install devices directly in streams to capture trash from storm events, littering, etc. Devices include netting systems that catch combined sewer system overflows that can range in cost from \$75,000 to \$300,000 (See Figure 9).²³ Overall, responses to our Request for Information suggest that West Coast cities spend on average \$165,811 a year on stormwater capture devices (See Appendix B: Data Tables).



Figure 8: Trash traps installed in a creek will capture bulky debris, as long as they are serviced regularly. Image courtesy of Riverlink.Org. (<http://theriverwhisperer.blogspot.com/2011/01/lo-tech-hi-performance-approach-to.html>.)

Table 3: Cost for Stormwater Capture Devices

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest	Over 250,000	\$0 - \$2,508,000	\$630,755	\$1.32
Larger	75,000-249,999	\$0 - \$640,000	\$223,105	\$2.04
Mid-Sized	15,000-74,999	\$0 - \$1,100,000	\$164,499	\$4.12
Smaller	Under 15,000	\$0 - \$560,000	\$27,382	\$2.21

For detail see Appendix B: Data Tables

²² Miriam Gordon 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>.

²³ Ibid, 30-31.



Storm drain cleaning and maintenance includes the cost to clean and maintain storm drains and stormwater catchment devices so they will operate effectively. The cost for storm drain cleaning and maintenance is a very elastic figure; cities yet to install any stormwater devices have minimal costs while cities with stormwater devices in place naturally have higher costs. In addition, maintenance costs vary widely depending on local weather conditions. Communities that experience more rainfall have to clean storm drains more often, resulting in greater costs. Cities with less rainfall generally only clean storm drains before and after storm events. Overall, responses to our Request for Information indicate that West Coast cities spend on average \$294,935 annually on storm drain cleaning and maintenance (See Appendix B: Data Tables).

Table 4: Annual Cost for Storm Drain Cleaning and Maintenance

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest	Over 250,000	\$0 - \$6,400,000	\$1,943,260	\$1.85
Larger	75,000-249,999	\$0 - \$1,098,000	\$261,449	\$1.73
Mid-Sized	15,000-74,999	\$0 - \$538,778	\$47,320	\$1.07
Smaller	Under 15,000	\$0 - \$85,000	\$10,533	\$2.32

For detail see Appendix B: Data Tables

Manual cleanup refers to the cost of manually cleaning up litter from streets, parks and roadsides. Manual cleanup programs include complaint response and parks maintenance. Some cities do not have a formal litter collection program. For some, volunteers do the cleaning up. In some cases, cities with manual litter cleanup programs spread the responsibility among multiple departments. Cost may be spread, for example, between parks and recreation and public works agencies. In most cases the percentage of employee time devoted to picking up litter is simply an estimate made by the respondent. Overall, responses to our Request for Information suggest that West Coast cities spend on average \$304,545 annually on manual litter cleanup (See Appendix B: Data Tables).

**Table 5: Annual Cost for Manual Cleanup**

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest	Over 250,000	\$48,000 - \$7,000,000	\$2,371,903	\$2.58
Larger	75,000-249,999	\$0 - \$150,000	\$50,141	\$0.48
Mid-Sized	15,000-74,999	\$0 - 200,000	\$46,188	\$1.09
Smaller	Under 15,000	\$0 - \$81,000	\$11,166	\$2.11

For detail see Appendix B: Data Tables

Public Education includes the costs to cities of informing the public about how littering and improper disposal of other waste affects stormwater management. This is done through the Internet, billboards, public transit posters, school programs and television. Many cities invest in multiple education and outreach efforts where marine debris and litter prevention are but a part of a larger public education program. Overall, responses to our Request for Information indicate that West Coast cities spend on average \$80,927 annually on public education relating to litter and waste disposal (See Appendix B: Data Tables).

Table 6: Annual Cost for Public Education

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest	Over 250,000	\$0 - \$1,945,531	\$602,208	\$0.59
Larger	75,000-249,999	\$5,000 - \$72,000	\$32,200	\$0.29
Mid-Sized	15,000-74,999	\$0 - \$80,000	\$14,127	\$0.35
Smaller	Under 15,000	\$0 - \$25,000	\$3,532	\$0.46

For detail see Appendix B: Data Tables

Indirect Costs are more difficult to quantify – and their quantification was not attempted in this study - because they often require attributing a cost to an action or an impact that has no clearly-defined dollar value. In the case of marine debris, cities appear poorly prepared to quantify indirect costs, including losses to tourism and industry.

Loss to tourism consists of tourism revenue lost from the impacts of marine debris on the environment. Tourism is affected by beach closures, littered rivers and beaches, and stormwater overflows. During large rain events, many storm drain systems are designed to overflow and discharge stormwater directly into nearby water bodies without treatment. This water can include litter that has been accumulating in storm drains and along streets. Once discharged into the water body, the debris can wash ashore, causing both physical and health risks to beachgoers, and can close beaches entirely. Impacts vary, however tourism losses have been estimated at \$5.4 billion after medical debris



Figure 11: Beach closure sign—a common. Image: Serge Dedina, Wildcoast ([http:// sergededina.com/ category/coronado/.](http://sergededina.com/category/coronado/))

washed up on New Jersey shores in 1987 and again at Long Island, New York, in 1988.²⁴

Marine debris can also cause losses to tourism by killing marine animals and degrading habitats. Many West Coast communities depend on whale- and bird watching as a means of bringing in revenue. The impacts of marine debris on the health of animals and their habitat can significantly reduce tourism attraction.



Figure12: Baby sea otter caught in plastic bag, Moss Landing (mom was able to eventually remove the bag). Image: Terry McCormac
(<http://saveourshores.org/what-we-do/banning-plastic-bags.php>.)

Loss to industry consists of revenue lost because of vessel or equipment damage and losses of marine animals from *ghost fishing*. Costs include loss or damage to fishing gear, as well as costs incurred by entangling propellers, clogging intake valves and sinking vessels. Lost fishing gear can endanger other fishing operations and has the potential to entangle marine animals. Further, in cases where fishing gear is lost, not only is there the cost to industry of the lost gear, but the gear can ghost fish, reducing catches for other fishing vessels. A 2007 study of derelict fishing gear in Puget Sound found derelict crab pots could be contributing to the mortality of some 372,000 crabs annually, worth an estimated ex-vessel value of \$1.2 million. With regard to lost fishing nets, the same study found “live or dead entangled animals having recreational or commercial value in the 604 derelict nets recovered to date” and an annual ex-vessel loss per net of approximately \$1,760. Although it is difficult to estimate the number of derelict nets still in Puget Sound or the length of time each net has been in place, there were indications that some of the recovered nets had been ghost-fishing for over 30 years.²⁵

The cost of marine debris to a city’s tourism and industry sectors can be a large hidden cost to beach and waterfront communities. Data needs to be gathered in these areas to accurately quantify the total cost of marine debris to cities.

²⁴ Moore, "Synthetic Polymers in the Marine Environment," 134. National Research Council, *Tackling Marine Debris*, 1. By 2011, New Jersey was reported to have some of the cleanest beaches in the nation. Tony Barboza, "Beach Pollution at Third-Highest Level in 22 Years: California Registered a Slight Increase in Beach Closures and Advisories in 2011 While the Rest of the United States Saw a 3% Drop, the Natural Resources Council Finds." *Los Angeles Times*, 27 June 2012, <http://articles.latimes.com/2012/jun/27/local/la-me-beach-report-20120627>, News.

²⁵ Natural Resources Consultants, Inc. "A Cost-Benefit Analysis of Derelict Fishing Gear Removal in Puget Sound, Washington." Prepared for the Northwest Straits Foundation. 29 Sept. 2007, 8-9. <http://www.nwstraits.org/uploads/pdf/Derelict%20Gear%20Cost-Benefit%20Analysis%202007.pdf>. Accessed 7 Aug. 2012.

Overall costs include the cost to cities for beach and waterway cleanups, street sweeping, storm drain cleaning and maintenance, manual cleanup, storm water capture devices and public education. The full-cost picture cannot be presented, however, because of the unavailability of the indirect cost of beach litter and other forms of marine debris.

Table 7: Total Annual Direct Cost of Marine Debris Management, West Coast Cities

City Size	Population Range	Range of Annual Costs Reported	Average Annual Cost	Average Per Capita Cost
Largest*	Over 250,000	\$2,877,400 - \$20,672,266	\$10,054,805	\$12.54
Larger	75,000-249,999	\$342,000 - \$2,057,500	\$1,211,522	\$10.15
Mid-Sized	15,000-74,999	\$37,500 - \$2,330,000	\$557,596	\$13.97
Smaller	Under 15,000	\$0 - \$890,000	\$95,345	\$13.85

For detail see Appendix B: Data Tables



Figure 13: "Every year, thousands of helium-filled balloons are released into the atmosphere. Some of these balloons are released accidentally, while others are released in large numbers during weddings, mall openings, and other kinds of celebrations.... Although the floating balloons seem to disappear, they ultimately lose their helium and fall back to earth. Some of these balloons come down on the ocean, where they can become a harmful form of marine debris. Some marine animals, especially sea turtles, have been known to ingest balloons. It is believed that they mistake balloons for jellyfish, their natural prey. The swallowed balloons can block air passages, causing the animals to suffocate, or may lodge in intestinal tracts, where they may disrupt digestion. (NOAA Marine Debris Program. "Turning the Tide of Trash: A Learning Guide on Marine Debris: Marine Debris 101," 9.) Image: Algalita Marine Research Institute (<http://www.algalita.org/blog/?cat=6>).

CONCLUSION

This study presents the costs reported by a random sample of West Coast communities concerning their management of trash, their efforts to reduce marine debris.

The objective of the study is to contribute to the information available to decision-makers and others responsible for considering further steps with which to reduce the waste streams contributing to marine debris.

The cities provided the study team with costs concerning beach and waterway cleanup; street sweeping; the cost of stormwater capture devices; storm drain cleaning and maintenance; manual litter cleanup and public anti-littering campaigns.

The study team found that on average small and medium-sized West Coast communities spend at least \$14 per year per resident in these trash management and marine debris reduction efforts. 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 for these same trash management and marine debris reduction efforts.

West Coast communities may not be able to control the influx of debris into the marine environment during natural disasters, but we certainly can control what flows into the ocean during normal events.

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Appendix A: Request for Information



Dear Municipal Manager

As part of an all-out West Coast campaign against marine debris the U.S. Environmental Protection Agency has asked us to help them collect data on the costs to local governments of preventing and cleaning up litter that could otherwise reach rivers running to the ocean and the ocean itself.

We would appreciate it enormously if you could furnish us the information below within a very few days. It's our hope that these numbers can be lifted directly from your line-item budget, plunked into the spaces below and returned to us as an attached file.

Activity	Cost in annual \$\$
1. Beach and waterway cleanup – your costs to clean litter from beaches and waterways, including your cost of participating in local or regional volunteer cleanups.	
2. Street sweeping – your cost of running power street sweepers - and, if you have it, the cost of disposing of the litter swept up	
3. Storm drain grate cleaning and maintenance	
4. Stormwater capture devices – the cost of 1- buying and installing stormwater trash capture devices, and 2- the annual cost of cleaning these devices – two dollar figures if you have them, thanks	
5. Manual litter cleanup – your costs of picking up litter from streets, parks and roadsides to the extent you didn't already report it in the lines above	
6. Public education – your costs of public campaigning against littering and improper disposal of other wastes impacting stormwater management through internet, billboard, public transit, and television (if part of larger public education campaign, can you break out that related to litter?)	

If you have questions or would prefer to complete the survey by telephone, please contact Kalla Hirschbein at 415-561-3474, extension 222, or khirschbein@ifrfish.org.

Thank you for your good help!

KIER ASSOCIATES, FISHERIES AND WATERSHED PROFESSIONALS
P.O BOX 915, BLUE LAKE, CA 95525 - (707) 668-1822 - www.kierassociates.net

Appendix B: Data Tables

Table 8: Cost Data for Largest Cities (Population ≥ 250,000)

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita ²	Storm Drain Cleaning & Maintenance	Per Capita ³	Manual Cleanup	Per Capita ⁴	Stormwater Capture Devices	Per Capita ⁵	Public Education ¹	Per Capita ⁶	Total	Per Capita ⁷
Los Angeles, CA	3,831,868	\$0.00	\$0.00	\$8,104,857	\$2.12	\$3,621,878	\$0.95	\$7,000,000 ²	\$1.83	\$0.00	\$0.00	\$1,945,531	\$0.51	\$20,672,266	\$5.39
San Diego, CA	1,301,617	\$342,165 ³	\$0.26	\$4,800,000	\$3.69	\$6,400,000 ⁴	\$4.92	\$809,505 ⁵	\$0.62	\$555,922 ⁶	\$0.43	\$1,200,969 ⁷	\$0.92	\$14,108,561	\$10.84
San Jose, CA	964,695	\$126,619	\$0.13	\$3,534,731 ⁸	\$3.66	\$1,784,924 ⁹	\$1.85	\$3,066,882 ¹⁰	\$3.18	\$116,273	\$0.12	\$247,124	\$0.26	\$8,876,553	\$9.20
Seattle, WA	608,660	\$0.00 ¹¹	\$0.00	\$1,380,000 ¹²	\$2.27	\$935,000 ¹³	\$1.54	\$3,961,000 ¹⁴	\$6.51	\$0.00 ¹⁵	\$0.00	\$0.00 ¹⁶	\$0.00	\$6,276,000	\$10.31
Portland, OR	583,776	\$0.00	\$0.00	\$4,956,464 ¹⁷	\$8.49	\$1,098,680 ¹⁸	\$1.88	\$1,024,113 ¹⁹	\$1.75	\$371,169 ²⁰	\$0.64	\$19,498 ²¹	\$0.03	\$7,469,924	\$12.80
Sacramento, CA	466,488	\$1,057,300	\$2.27	\$245,000	\$0.53	\$1,005,600	\$2.16	\$48,000	\$0.10	\$0.00	\$0.00	\$521,500	\$1.12	\$2,877,400	\$6.17
Long Beach, CA	462,604	\$1,837,39 ²²	\$3.97	\$5,054,886 ²³	\$10.93	\$700,000 ²⁴	\$1.51	\$3,002,002 ²⁵	\$6.49	\$1,494,679 ²⁶	\$3.23	\$883,042	\$1.91	\$12,972,007	\$28.04
Oakland, CA	409,184	\$14,000 ²⁷	\$0.03	\$4,600,000 ²⁸	\$11.24	\$0.00	\$0.00	\$63,725	\$0.16	\$2,508,000 ²⁹	\$6.13	\$0.00	\$0.00	\$7,185,725	\$17.56
Totals	8,628,892	\$3,377,482	\$6.67	\$32,675,938	\$42.92	\$15,546,082	\$14.80	\$18,975,227	\$20.64	\$5,046,043	\$10.54	\$4,817,664	\$4.75	\$80,438,436	\$100.31
Averages	1,078,612	\$422,185	\$0.83	\$4,084,492	\$5.36	\$1,943,260	\$1.85	\$2,371,903	\$2.58	\$630,755	\$1.32	\$602,208	\$0.59	\$10,054,805	\$12.54

Table 9: Cost Data for Larger Cities (Population Range 75,000 – 249,999)

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
Chula Vista, CA	243,916	\$1,000 ³⁰	\$0.00	\$257,000 ³¹	\$1.05	\$1,098,000 ³²	\$4.50	\$77,000 ³³	\$0.32	\$200,000 ³⁴	\$0.82	\$72,000 ³⁵	\$0.30	\$1,705,000	\$6.990
Glendale, CA	196,847	\$0.00	\$0.00	\$1,224,210	\$6.22	\$156,676	\$0.80	\$10,000 ³⁶	\$0.05	\$40,000 ³⁷	\$0.20	\$5,000	\$0.03	\$1,435,886	\$7.294
Sunnyvale, CA	133,963	\$11,457 ³⁸	\$0.09	\$495,745 ³⁹	\$3.70	\$112,579 ⁴⁰	\$0.84	\$4,170 ⁴¹	\$0.03	\$121,703 ⁴²	\$0.91	\$10,000	\$0.07	\$755,654	\$5.641
Inglewood, CA	112,241	\$0.00	\$0.00	\$702,631 ⁴³	\$6.26	\$462,720 ⁴⁴	\$4.12	\$0.00	\$0.00	\$500,000 ⁴⁵	\$4.45	\$30,000 ⁴⁶	\$0.27	\$1,695,351	\$15.105
Everett, WA	103,019	\$0.00	\$0.00	\$1,093,100	\$10.61	\$400,100	\$3.88	\$110,100	\$1.07	\$395,200 ⁴⁷	\$3.84	\$59,000 ⁴⁸	\$0.57	\$2,057,500	\$19.972
South Gate, CA	94,300	\$0.00	\$0.00	\$1,100,000	\$11.66	\$40,000	\$0.42	\$0.00	\$0.00	\$640,000 ⁴⁹	\$6.79	\$6,800	\$0.07	\$1,786,800	\$18.948
Kent, WA	92,411	\$0.00 ⁵⁰	\$0.00	\$180,000 ⁵¹	\$1.95	\$0.00	\$0.00	\$150,000 ⁵²	\$1.62	\$0.00	\$0.00	\$12,000 ⁵³	\$0.13	\$342,000	\$3.701
Hawthorne, CA	83,945	\$0.00	\$0.00	\$300,000	\$3.57	\$8,000	\$0.10	\$100,000	\$1.19	\$0.00	\$0.00	\$60,000	\$0.71	\$468,000	\$5.575

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
Livermore, CA	80,968	\$17,500	\$0.22	\$419,000	\$5.17	\$74,969	\$0.93	\$0.00	\$0.00	\$111,042 ⁵⁴	\$1.37	\$35,000 ⁵⁵	\$0.43	\$657,511	\$8.121
Totals	1,141,610	\$29,957	\$0.31	\$5,771,686	\$50.21	\$2,353,044	\$15.59	\$451,270	\$4.28	\$2,007,945	\$18.38	\$289,800	\$2.58	\$10,903,702	\$91.347
Averages	126,846	\$3,329	\$0.03	\$641,298	\$5.58	\$261,449	\$1.73	\$50,141	\$0.48	\$223,105	\$2.04	\$32,200	\$0.29	\$1,211,522	\$10.150

Table 10: Cost Data for Mid-Sized Cities (Population Range 15,000 – 75,000)

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
Mountain View, CA	74,066	\$0.00	\$0.00	\$348,000	\$4.70	\$20,000	\$0.27	\$68,000	\$0.92	\$276,000 ⁵⁶	\$3.73	\$18,000	\$0.24	\$730,000	\$9.86
Redondo Beach, CA	66,748	\$112,459	\$1.68	\$850,000	\$12.73	\$71,000 ⁵⁷	\$1.06	\$0.00	\$0.00	\$1,100,000 ⁵⁸	\$16.48	\$15,000	\$0.22	\$2,148,459	\$32.19
Wasco, CA	64,173	\$0.00	\$0.00	\$120,000	\$1.87	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$120,000	\$1.87
Gardena, CA	58,829	\$0.00	\$0.00	\$235,400 ⁵⁹	\$4.00	\$10,000 ⁶⁰	\$0.17	\$200,000	\$3.40	\$400,000 ⁶¹	\$6.80	\$4,748	\$0.08	\$850,148	\$14.45
Huntington Park, CA	58,100	\$0.00	\$0.00	\$700,000	\$12.05	\$25,000	\$0.43	\$50,000	\$0.86	\$250,000 ⁶²	\$4.30	\$8,000	\$0.14	\$1,033,000	\$17.78
Diamond Bar, CA	55,544	\$0.00	\$0.00	\$205,000	\$3.69	\$15,000	\$0.27	\$50,000	\$0.90	\$0.00	\$0.00	\$42,100	\$0.76	\$312,100	\$5.62
Fountain Valley, CA	55,313	\$68,127	\$1.23	\$368,050	\$6.65	\$538,778	\$9.74	\$104,956	\$1.90	\$103,613 ⁶³	\$1.87	\$42,163	\$0.76	\$1,225,687	\$22.16
Paramount, CA	55,018	\$0.00	\$0.00	\$204,000	\$3.71	\$0.00	\$0.00	\$105,000	\$1.91	\$131,400	\$2.39	\$3,500	\$0.06	\$443,900	\$8.07
Glendora, CA	49,737	\$0.00	\$0.00	\$310,000	\$6.23	\$20,000	\$0.40	\$28,000	\$0.56	\$0.00	\$0.00	\$80,000	\$1.61	\$438,000	\$8.81
Azusa, CA	46,361	\$0.00	\$0.00	\$60,000	\$1.29	\$9,500	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$69,500	\$1.50
San Gabriel, CA	39,718	\$0.00	\$0.00	\$200,000	\$5.04	\$0.00 ⁶⁴	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$200,000	\$5.04
West Hollywood, CA	34,399	\$0.00	\$0.00	\$275,000	\$7.99	\$25,000	\$0.73	\$101,000	\$2.94	\$45,000 ⁶⁵	\$1.31	\$10,000	\$0.29	\$456,000	\$13.26
Laguna Hills, CA	30,344	\$20,000	\$0.66	\$128,000	\$4.22	\$50,000	\$1.65	\$10,000 ⁶⁶	\$0.33	\$65,000 ⁶⁷	\$2.14	\$0.00 ⁶⁸	\$0.00	\$273,000	\$9.00
Walnut, CA	29,172	\$800 ⁶⁹	\$0.03	\$104,000 ⁷⁰	\$3.57	\$100,000 ⁷¹	\$3.43	\$10,000 ⁷²	\$0.34	\$4,000 ⁷³	\$0.14	\$10,000	\$0.34	\$228,800	\$7.84
San Pablo, CA	29,139	\$63,617	\$2.18	\$67,011	\$2.30	\$10,288	\$0.35	\$136,396	\$4.68	\$30,000 ⁷⁴	\$1.03	\$15,650	\$0.54	\$322,962	\$11.08
SeaTac, WA	26,909	\$1,560 ⁷⁵	\$0.06	\$92,000	\$3.42	\$90,000	\$3.34	\$91,000 ⁷⁶	\$3.38	\$11,000 ⁷⁷	\$0.41	\$5,000	\$0.19	\$290,560	\$10.80
Sanger, CA	24,270	\$0.00	\$0.00	\$72,000	\$2.97	\$1,200	\$0.05	\$5,000	\$0.21	\$1,000	\$0.04	\$250	\$0.01	\$79,450	\$3.27
Mercer Island, WA	22,699	\$0.00 ⁷⁸	\$0.00	\$1,300,00 ⁷⁹	\$57.27	\$0.00 ⁸⁰	\$0.00	\$0.00 ⁸¹	\$0.00	\$1,030,000 ⁸²	\$45.38	\$0.00 ⁸³	\$0.00	\$2,330,000	\$102.65

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
Oak Harbor, WA	22,075	\$0.00	\$0.00	\$35,876 ⁸⁴	\$1.63	\$4,300	\$0.19	\$600	\$0.03	\$0.00	\$0.00	\$33,000	\$1.49	\$73,776	\$3.34
Arvin, CA	19,304	\$0.00	\$0.00	\$25,000	\$1.30	\$0.00 ⁸⁵	\$0.00	\$10,000 ⁸⁶	\$0.52	\$0.00 ⁸⁷	\$0.00	\$2,500 ⁸⁸	\$0.13	\$37,500	\$1.94
Laguna Woods, CA	16,192	\$1,100	\$0.07	\$27,685	\$1.71	\$3,661	\$0.23	\$0.00	\$0.00	\$7,472 ⁸⁹	\$0.46	\$6,750	\$0.42	\$46,668	\$2.88
Totals	878,110	\$267,663	\$5.91	\$5,727,022	\$148.33	\$993,727	\$22.52	\$969,952	\$22.87	\$3,454,485	\$86.47	\$296,661	\$7.29	\$11,709,510	\$293.40
Averages	41,815	\$12,746	\$0.28	\$272,715	\$7.06	\$47,320	\$1.07	\$46,188	\$1.09	\$164,499	\$4.12	\$14,127	\$0.35	\$557,596	\$13.97

Table 11: Cost Data for Smaller Cities (Population Range < 15,000)

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
The Dalles, OR	13,620	\$0.00	\$0.00	\$70,493	\$5.18	\$0.00	\$0.00	\$15,000	\$1.10	\$47,473 ⁹⁰	\$3.49	\$0.00	\$0.00	\$132,966	\$9.76
Auburn, CA	13,330	\$0.00	\$0.00	\$88,000	\$6.60	\$40,000	\$3.00	\$8,500	\$0.64	\$61,500 ⁹¹	\$4.61	\$5,000	\$0.38	\$203,000	\$15.23
Commerce, CA	12,823	\$0.00	\$0.00	\$150,000	\$11.70	\$85,000	\$6.63	\$70,000	\$5.46	\$560,000 ⁹²	\$43.67	\$25,000	\$1.95	\$890,000	\$69.41
Port Orchard, WA	11,144	\$0.00	\$0.00	\$50,000	\$4.49	\$1,000 ⁹³	\$0.09	\$0.00	\$0.00	\$200 ⁹⁴	\$0.02	\$20,000	\$1.79	\$71,200	\$6.39
Signal Hill, CA	10,834	\$0.00	\$0.00	\$150,400	\$13.88	\$1,000	\$0.09	\$81,000	\$7.48	\$64,000 ⁹⁵	\$5.91	\$7,500	\$0.69	\$303,900	\$28.05
Capitola, CA	9,918	\$15,000 ⁹⁶	\$1.51	\$100,00 ⁹⁷	\$10.08	\$25,000 ⁹⁸	\$2.52	\$30,000 ⁹⁹	\$3.02	\$22,000 ¹⁰⁰	\$2.22	\$25,00 ¹⁰¹	\$2.52	\$217,000	\$21.88
Monmouth, OR	9,534	\$1,200	\$0.13	\$85,600	\$8.98	\$25,000	\$2.62	\$7,900	\$0.83	\$0.00	\$0.00	\$7,000	\$0.73	\$126,700	\$13.29
Ione, CA	7,918	\$0.00	\$0.00	\$30,000 ¹⁰²	\$3.79	\$10,000 ¹⁰³	\$1.26	\$25,000 ¹⁰⁴	\$3.16	\$0.00	\$0.00	\$5,000 ¹⁰⁵	\$0.63	\$70,000	\$8.84
Sutherlin, OR	7,810	\$48,000	\$6.15	\$30,000	\$3.84	\$15,000	\$1.92	\$20,800	\$2.66	\$10,000 ¹⁰⁶	\$1.28	\$2,000	\$0.26	\$125,800	\$16.11
Orland, CA	7,291	\$0.00	\$0.00	\$0.00 ¹⁰⁷	\$0.00	\$1,680 ¹⁰⁸	\$0.23	\$0.00 ¹⁰⁹	\$0.00	\$0.00 ¹¹⁰	\$0.00	\$500 ¹¹¹	\$0.07	\$2,180	\$0.30
Hughson, CA	6,640	\$0.00	\$0.00	\$15,000	\$2.26	\$5,000	\$0.75	\$9,000	\$1.36	\$0.00	\$0.00	\$0.00	\$0.00	\$29,000	\$4.37
Winters, CA	6,624	\$0.00	\$0.00	\$0.00 ¹¹²	\$0.00	\$0.00	\$0.00	\$15,000	\$2.26	\$0.00 ¹¹³	\$0.00	\$0.00	\$0.00	\$15,000	\$2.26
Del Mar, CA	4,151	\$114,005	\$27.46	\$160,301	\$38.62	\$20,195	\$4.87	\$0.00	\$0.00	\$1,120 ¹¹⁴	\$0.27	\$0.00	\$0.00	\$295,621	\$71.22
Angels Camp, CA	3,836	\$0.00	\$0.00	\$0.00	\$0.00	\$10,920 ¹¹⁵	\$2.85	\$10,920 ¹¹⁶	\$2.85	\$0.00	\$0.00	\$0.00	\$0.00	\$21,840	\$5.69
Medina, WA	2,969	\$1,500	\$0.51	\$5,000	\$1.68	\$10,000	\$3.37	\$6,300	\$2.12	\$0.00	\$0.00	\$500	\$0.17	\$23,300	\$7.85
Chewelah, WA	2,607	\$0.00	\$0.00	\$18,300	\$7.02	\$1,140	\$0.44	\$820	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$20,260	\$7.77
Omak, WA	2,552	\$0.00	\$0.00	\$37,500	\$14.69	\$7,200	\$2.82	\$1,200	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$45,900	\$17.99

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
Cle Elum, WA	1,872	\$0.00	\$0.00	\$2,100	\$1.12	\$6,500	\$3.47	\$2,000	\$1.07	\$0.00	\$0.00	\$0.00	\$0.00	\$10,600	\$5.66
Winlock, WA	1,339	\$0.00	\$0.00	\$200 ¹¹⁷	\$0.15	\$4,000 ¹¹⁸	\$2.99	\$2,000 ¹¹⁹	\$1.49	\$0.00	\$0.00	\$0.00	\$0.00	\$6,200	\$4.63
Millersburg, OR	1,329	\$0.00	\$0.00	\$20,000 ¹²⁰	\$15.05	\$20,000	\$15.05	\$1,400 ¹²¹	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$41,400	\$31.15
Blue Lake, CA	1,253	\$0.00	\$0.00	\$3,000	\$2.39	\$4,800	\$3.83	\$1,300	\$1.04	\$400	\$0.32	\$500	\$0.40	\$10,000	\$7.98
Malin, OR	805	\$0.00	\$0.00	\$200	\$0.25	\$0.00	\$0.00	\$200	\$0.25	\$0.00	\$0.00	\$0.00	\$0.00	\$400	\$0.50
Etna, CA	737	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$300 ¹²²	\$0.41	\$300	\$0.41
Bingen, WA	712	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Dufur, OR	604	\$0.00	\$0.00	\$0.00 ¹²³	\$0.00	\$0.00 ¹²⁴	\$0.00	\$0.00 ¹²⁵	\$0.00	\$0.00 ¹²⁶	\$0.00	\$0.00 ¹²⁷	\$0.00	\$0.00	\$0.00
Mosier, OR	433	\$0.00	\$0.00	\$700 ¹²⁸	\$1.62	\$500 ¹²⁹	\$1.15	\$300 ¹³⁰	\$0.69	\$0.00	\$0.00	\$0.00 ¹³¹	\$0.00	\$1,500	\$3.46
Detroit, OR	202	\$0.00 ¹³²	\$0.00	\$0.00	\$0.00	\$1,000 ¹³³	\$4.95	\$4,000 ¹³⁴	\$19.80	\$0.00	\$0.00	\$600 ¹³⁵	\$2.97	\$5,600	\$27.72
Ukiah	186	\$0.00	\$0.00	\$0.00 ¹³⁶	\$0.00	\$0.00 ¹³⁷	\$0.00	\$0.00 ¹³⁸	\$0.00	\$0.00 ¹³⁹	\$0.00	\$0.00 ¹⁴⁰	\$0.00	\$0.00 ¹⁴¹	\$0.00
Totals	143,073	\$ 179,705	\$35.75	\$1,016,794	\$153.39	\$ 294,935	\$ 64.90	\$ 312,640	\$ 59.12	\$ 766,693	\$61.78	\$ 98,900	\$12.97	\$ 2,669,667	\$387.916
Averages	5,110	\$ 6,418	\$ 1.28	\$ 36,314	\$ 5.48	\$ 10,533	\$ 2.32	\$ 11,166	\$ 2.11	\$ 27,382	\$ 2.21	\$ 3,532	\$0.46	\$ 95,345	\$ 13.85

¹ Although outside our survey area, the City of Washington, DC (population 599,657), spends an average of \$763,461 annually on street sweeping, and an additional \$163,300 on public education related to litter.

² Approximately \$8 - \$11 million annually on litter collection and disposal, as follows: Department of Sanitation charges Recreation and Parks \$3.7 - \$4 million annually for refuse collection and Recreation and Parks spends an estimate of \$4 - \$7 million for manual trash collection.

³ Volunteer cleanups: San Diego Coastkeeper - \$248,160; San Diego River Park Foundation - \$94,005. This value was calculated using a volunteer wage rate of \$21.36/hour. This value is a significant underestimate for two reasons: first, all San Diego Coastkeeper cleanups were calculated as two hours per volunteer, but Coastal Cleanup Day is a three-hour event; and second, it does not account for other organizations and private businesses that participate in cleanup efforts around the City.

⁴ Storm Water Division, City of San Diego: Street Sweeping: The entire budget line was used in this value because the Cal/EPA draft report titled *Economic Analysis of Marine Debris* measured this as a direct cost and did not subdivide the amount in any way. Also, the amount was consistent with that of a large city according to the draft report.

⁵ San Diego Park and Recreation Department: This value is an overestimate because it includes the cost associated with the removal of waste from permanent receptacles by members of the San Diego Park and Recreation Department maintenance staff.

⁶ CalTrans District 11 -- This value was calculated as 12.92% of a total cost of \$4,302,802. The County of San Diego is 4,199.89 square miles in area, and the City of San Diego is 325.188 square miles in area; therefore, the City of San Diego is 12.92 of the County by area.

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- ⁷ CalTrans District 11: Public Awareness Campaign: \$969; Storm Water Division, City of San Diego: Education and Outreach: \$1,200,000 - The entire budget line was used in this value because the Cal/EPA draft report titled *Economic Analysis of Marine Debris* measured this as a direct cost and did not subdivide the amount in any way. Also, the amount was consistent with that of a large city according to the draft report.
- ⁸ Residential Street Sweeping, \$1,956,600; RSS contract costs; ACB Street sweeping \$1,578,131.
- ⁹ Inlet Cleaning Program, \$1,022,955; Pump station cleaning and maintenance \$645,696 total; Assume 15% of sludge removed attributable to litter/trash. Pilot Inlet Trash Capture Program \$116,273.
- ¹⁰ Alternate Work Program \$122,000, street landscape complaint response, street/median cleaning \$696,318, supplemental landscape and events support \$350,845; parks maintenance \$1,897,719.
- ¹¹ Included in "Manual Cleanup"; beach litter pickup efforts are incidental to broader programs that address litter in general.
- ¹² \$1,136,000 for sweeping plus \$244,000 for hauling.
- ¹³ Includes relatively small amount for cleaning stormwater capture devices.
- ¹⁴ Includes beach and waterway cleanup and public education.
- ¹⁵ Included in Storm Drain Cleaning, relatively small amount.
- ¹⁶ Included in "Manual Cleanup." Outreach efforts are incidental to broader programs that address litter in general.
- ¹⁷ Power street sweepers: \$3,139,989 direct plus overhead of \$1,118,566 (71.56% on labor only); disposing of litter \$618,870 direct plus overhead of \$79,039.
- ¹⁸ \$779,189 direct plus overhead of \$319,491.
- ¹⁹ Picking up garbage within developed parks: \$863,263 for labor; \$60,000 for materials and supplies; \$60,000 to garbage hauler for a \$984,113 annual total. For trash removal from natural areas, about \$40,000.
- ²⁰ Trash racks: \$134,658 direct plus overhead of \$79,551; \$156,960 for maintaining Storm Filters plus other water quality devices.
- ²¹ Actual total is probably more -- from Environmental Services: \$19,498 per year for participation in Regional Coalition for Clean Rivers and Streams, educating the public about the impacts of stormwater runoff pollution (cannot break out litter component); from Parks Bureau: although Parks has signage throughout the park system regarding littering and promotes "Healthy Parks, Healthy Portland," they do not keep track at the level of detail regarding what would be considered as a public campaign regarding litter specifically.
- ²² Raking the beach: seven equipment operators and equipment: \$892,223 in labor annually and \$845,175 in equipment. This total includes beach re-nourishment: annual cost of roughly \$100,000 and a minimum of 75,000 cubic yards of sand moved.
- ²³ Swept 142 miles and picked up 10,760 tons of material.
- ²⁴ Maintenance for these devices is covered under the Los Angeles County Public Works Maintenance for FY 12. Maintenance cost for these devices would begin in FY 13 with a cost estimated to range from \$177,144 to \$772,992.
- ²⁵ Health Department: \$19,008; Harbor Department: \$2,835,394; Community Development : \$147,600
- ²⁶ Installation of two trash net systems at two storm drain pump stations, \$955,045; installation of a vortex separator system device at one storm drain pump station, \$539,634. The installation of 2,684 connector pipe screens (CPS) and the installation of 670 automatic retractable screens (ARS) was not included.

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- ²⁷ About 3,500 volunteer hours result from Creek to Bay Day participation in Oakland. Staff cost for the event is approximately \$14,000/year.
- ²⁸ \$4.2 – \$4.6 million/year, includes operations and maintenance cost of \$10,000 per street sweeper per month. Oakland maintains 20 street sweepers. Residential areas are swept twice a month; industrial areas are swept once a week; commercial areas are swept three times a week.
- ²⁹ CDS units (design and installation): Lake Merritt: \$968,000; 73rd Ave: \$740,000; Alameda & High Streets: \$800,000; total: \$2,508,000
- ³⁰ Sponsoring I Love A Clean San Diego's Creek to Bay Cleanup events.
- ³¹ Contract cost.
- ³² Includes maintenance crew staff time, equipment, materials, and miscellaneous items.
- ³³ In FY 2009-2010, manual cleanup of litter from Chula Vista streets cost the City about \$77,000.
- ³⁴ In FY 2009-2010, about \$200,000 was spent on installing treatment control BMPs as part of City's streets improvement projects.
- ³⁵ Includes jurisdictional costs and City's share of costs for regional public education and outreach activities.
- ³⁶ Don't have "formal program"best guesstimate.
- ³⁷ 5mm screens inside catch basins.
- ³⁸ Volunteer river cleanups.
- ³⁹ Twice a month.
- ⁴⁰ Anticipated \$98,000, but spent more; generally inspected once a year.
- ⁴¹ Labor for five hotspots, does not include equipment, materials and/or disposal costs - absorbed into Public Works.
- ⁴² \$113,503 from grants to buy/install (screens w/hinged gates) and \$8,200 in City funds to identify locations to install.
- ⁴³ 2010 fiscal year.
- ⁴⁴ Ibid.
- ⁴⁵ Have received a grant for approximately 200,000 to install debris excluders in the next fiscal year.
- ⁴⁶ 2010 fiscal year.
- ⁴⁷ Equipment - \$395,200 ; maintenance included in Manual Cleanup
- ⁴⁸ We have a recycling program that allows our contractor to perform the following: 1) prepare and provide educational presentations to schools & colleges, 2) build up leadership role in collaborating with restaurant owners and residents for effective recycling methods, 3) publish articles in the local newspaper for promotions, 4) participate, be involved in activities, provide hands-on experience, and demonstrate various methods for event visitors, etc.
- ⁴⁹ Equipment installation was part of an ARRA grant; the cost varied per style (CPS or ARS) and size of catch basin; very approximate costs were: \$640,000; maintenance costs are not yet available.
- ⁵⁰ They have rivers and streams which are cleaned by two full-time persons, included in manual cleanup costs.
- ⁵¹ Two full time positions.

⁵² Ibid.

⁵³ Includes a month of in-classroom sessions with school children.

⁵⁴ Equipment - \$77,072.40 (180 devices); annual maintenance - 33, 969.60.

⁵⁵ Estimate includes personnel costs.

⁵⁶ Equipment - \$275,000; maintenance - \$1,000.

⁵⁷ Maintenance of structural trash BMPs, catch basin cleaning.

⁵⁸ Total cost for the four CDS unit projects was \$1.6 million; however only \$1.1 million was directly related to trash removal.

⁵⁹ Have three sweepers and one backup.

⁶⁰ Before and after storms.

⁶¹ Installing screens.

⁶² Part of the ARRA Grant; a very approximate estimate of the cost to purchase and install equipment is \$250,000; the annual maintenance cost is not yet available.

⁶³ Purchase and install: \$99,780; annual maintenance: \$3,833

⁶⁴ Unable to break out from regular maintenance

⁶⁵ Equipment - \$25,000 = buy/install; maintenance - \$20,000.

⁶⁶ Estimate.

⁶⁷ Buy/install screens = \$62,000; maintenance = \$3,000.

⁶⁸ Included in annual fees paid to County of Orange.

⁶⁹ Volunteers do park and creek cleanups, the city coordinate efforts.

⁷⁰ CNG Sweepers (natural gas).

⁷¹ Contracted to Los Angeles County.

⁷² Contract landscapers.

⁷³ They have six that they installed voluntarily a number of years ago at an estimated cost of \$15,000 each; \$4000 is an estimate of the annual maintenance.

⁷⁴ Just purchase cost, and not maintenance since it will just be installed this year.

⁷⁵ One beach at a lake, annual clean up.

⁷⁶ Parks comprise \$71,000 of costs.

⁷⁷ As much as \$10,000 each for each stormwater device, and \$1000 for device maintenance. TDK added the two numbers and sent an email requesting the number of devices purchased (no response received).

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- ⁷⁸ Part of general park budget; most of their waterfront is private property.
- ⁷⁹ This is their entire cost for street sweeping, litter pickup and street maintenance.
- ⁸⁰ Included with stormwater capture devices.
- ⁸¹ Included with street sweeping.
- ⁸² This is aggregate, and includes storm drain grate cleaning.
- ⁸³ No specific litter- or debris-related programs, not enough need to warrant.
- ⁸⁴ Street sweepers = \$28,200; disposal of litter = \$7,675.
- ⁸⁵ Have some expense, but not itemized in budget.
- ⁸⁶ Estimate.
- ⁸⁷ Have sumps, on rare occasions have to get them pumped.
- ⁸⁸ Help sponsor valley litter clean-up day, gets the kids involved.
- ⁸⁹ \$2000 for buying/installing equipment, \$5472 for maintenance.
- ⁹⁰ \$24,300 purchase and install equipment, \$23,173 for cleaning.
- ⁹¹ \$1,500 - buying/installation of devices; \$60,000- annual cleaning.
- ⁹² CPS/ARS.
- ⁹³ In house.
- ⁹⁴ \$0-the City has not installed any recently; \$200 for maintenance.
- ⁹⁵ No equipment purchases made this year; \$64,000 for maintenance.
- ⁹⁶ Estimate.
- ⁹⁷ Ibid.
- ⁹⁸ Ibid.
- ⁹⁹ Ibid.
- ¹⁰⁰ Equipment purchases - \$20,000; maintenance - \$2,000; both are estimates.
- ¹⁰¹ Estimate.
- ¹⁰² Allocation of percentage of time, three city workers (two maintenance/one mechanic).
- ¹⁰³ Ibid.
- ¹⁰⁴ Ibid.
- ¹⁰⁵ "Guesstimate."

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- ¹⁰⁶ Buying and installing = \$6,000; cleaning = \$4,000.
- ¹⁰⁷ They bill CalTrans for the only street sweeping they do (state highway runs through town).
- ¹⁰⁸ Two workers, eight hours each at \$35, two to three times per year.
- ¹⁰⁹ Volunteers, schools.
- ¹¹⁰ Natural gravel beds.
- ¹¹¹ Provide dump truck for city clean-up day.
- ¹¹² Our street sweeping is handled by an outside contractor; waste management is part of our refuse/recycling services. We do not have these services billed separately, so I don't know what these costs are annually.
- ¹¹³ We do not really have a stormwater budget.
- ¹¹⁴ Cleaning only
- ¹¹⁵ Estimated 20 hours per week for all "cleaning & maintenance" -- Calaveras County road maintenance employees earn \$21/hour, 10 hours x 52/weeks a year = \$10,920
- ¹¹⁶ Ibid.
- ¹¹⁷ Contract cost .
- ¹¹⁸ Percentage of maintenance payroll.
- ¹¹⁹ Ibid.
- ¹²⁰ Contract cost.
- ¹²¹ Rough estimate.
- ¹²² Clean-Up Week every April, they provide dumpsters and "burn pile."
- ¹²³ We are a VERY small community and don't provide any services of this nature.
- ¹²⁴ Ibid.
- ¹²⁵ Ibid.
- ¹²⁶ Ibid.
- ¹²⁷ Ibid.
- ¹²⁸ Local resident owns street sweeper, when the streets need sweeping, they call him.
- ¹²⁹ Percentage of maintenance payroll.
- ¹³⁰ Ibid.
- ¹³¹ They have a town clean-up day, but all services and labor are donated.

¹³² The lake is the County's responsibility, not theirs.

¹³³ Estimate -- allocated percentage of maintenance worker's salary.

¹³⁴ Ibid.

¹³⁵ Annual City-Wide Clean-Up Day.

¹³⁶ They expend no funds for these services.

¹³⁷ Ibid.

¹³⁸ Ibid.

¹³⁹ Ibid.

¹⁴⁰ Ibid.

¹⁴¹ Ibid.

Table 12: Cost Data for Cities Responding In All Categories^{cxlii}

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
San Diego, CA	1,301,617	\$342,165	\$0.26	\$4,800,000	\$3.69	\$6,400,000	\$4.92	\$809,505	\$0.62	\$555,922	\$0.43	\$1,200,969	\$0.92	\$14,108,561	\$10.84
San Jose, CA	964,695	\$126,619	\$0.13	\$3,534,731	\$3.66	\$1,784,924	\$1.85	\$3,066,882	\$3.18	\$116,273	\$0.12	\$247,124	\$0.26	\$8,876,553	\$9.20
Portland, OR	583,776	\$-	\$-	\$4,956,464	\$8.49	\$1,098,680	\$1.88	\$1,024,113	\$1.75	\$371,169	\$0.64	\$19,498	\$0.03	\$7,469,924	\$12.80
Long Beach, CA	462,604	\$1,837,398	\$3.97	\$5,054,886	\$10.93	\$700,000	\$1.51	\$3,002,002	\$6.49	\$1,494,679	\$3.23	\$883,042	\$1.91	\$12,972,007	\$28.04
Chula Vista, CA	243,916	\$1,000	\$0.00	\$257,000	\$1.05	\$1,098,000	\$4.50	\$77,000	\$0.32	\$200,000	\$0.82	\$72,000	\$0.30	\$1,705,000	\$6.99
Glendale, CA	196,847	\$-	\$-	\$1,224,210	\$6.22	\$156,676	\$0.80	\$10,000	\$0.05	\$40,000	\$0.20	\$5,000	\$0.03	\$1,435,886	\$7.29
Sunnyvale, CA	133,963	\$11,457	\$0.09	\$495,745	\$3.70	\$112,579	\$0.84	\$4,170	\$0.03	\$121,703	\$0.91	\$10,000	\$0.07	\$755,654	\$5.64
Everett, WA	103,019	\$-	\$-	\$1,093,100	\$10.61	\$400,100	\$3.88	\$110,100	\$1.07	\$395,200	\$3.84	\$59,000	\$0.57	\$2,057,500	\$19.97
Livermore, CA	80,968	\$17,500	\$0.22	\$419,000	\$5.17	\$74,969	\$0.93	\$-	\$-	\$111,042	\$1.37	\$35,000	\$0.43	\$657,511	\$8.12
Mountain View, CA	74,066	\$-	\$-	\$348,000	\$4.70	\$20,000	\$0.27	\$68,000	\$0.92	\$276,000	\$3.73	\$18,000	\$0.24	\$730,000	\$9.86
Wasco, CA	64,173	\$-	\$-	\$120,000	\$1.87	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$120,000	\$1.87
Gardena, CA	58,829	\$-	\$-	\$235,400	\$4.00	\$10,000	\$0.17	\$200,000	\$3.40	\$400,000	\$6.80	\$4,748	\$0.08	\$850,148	\$14.45
Huntington Park, CA	58,100	\$-	\$-	\$700,000	\$12.05	\$25,000	\$0.43	\$50,000	\$0.86	\$250,000	\$4.30	\$8,000	\$0.14	\$1,033,000	\$17.78
Fountain Valley, CA	55,313	\$68,127	\$1.23	\$368,050	\$6.65	\$538,778	\$9.74	\$104,956	\$1.90	\$103,613	\$1.87	\$42,163	\$0.76	\$1,225,687	\$22.16
West Hollywood, CA	34,399	\$-	\$-	\$275,000	\$7.99	\$25,000	\$0.73	\$101,000	\$2.94	\$45,000	\$1.31	\$10,000	\$0.29	\$456,000	\$13.26
Walnut, CA	29,172	\$800	\$0.03	\$104,000	\$3.57	\$100,000	\$3.43	\$10,000	\$0.34	\$4,000	\$0.14	\$10,000	\$0.34	\$228,800	\$7.84
San Pablo, CA	29,139	\$63,617	\$2.18	\$67,011	\$2.30	\$10,288	\$0.35	\$136,396	\$4.68	\$30,000	\$1.03	\$15,650	\$0.54	\$322,962	\$11.08
SeaTac, WA	26,909	\$1,560	\$0.06	\$92,000	\$3.42	\$90,000	\$3.34	\$91,000	\$3.38	\$11,000	\$0.41	\$5,000	\$0.19	\$290,560	\$10.80
Sanger, CA	24,270	\$-	\$-	\$72,000	\$2.97	\$1,200	\$0.05	\$5,000	\$0.21	\$1,000	\$0.04	\$250	\$0.01	\$79,450	\$3.27
Mercer Island, WA	22,699	\$-	\$-	\$1,300,000	\$57.27	\$-	\$-	\$-	\$-	\$1,030,000	\$45.38	\$-	\$-	\$2,330,000	\$102.65
Oak Harbor, WA	22,075	\$-	\$-	\$35,876	\$1.63	\$4,300	\$0.19	\$600	\$0.03	\$-	\$-	\$33,000	\$1.49	\$73,776	\$3.34
Arvin, CA	19,304	\$-	\$-	\$25,000	\$1.30	\$-	\$-	\$10,000	\$0.52	\$-	\$-	\$2,500	\$0.13	\$37,500	\$1.94

City	Population (2010 Census)	Beach/ Waterway Cleanup	Per Capita	Street Sweeping	Per Capita	Storm Drain Cleaning & Maintenance	Per Capita	Manual Cleanup	Per Capita	Stormwater Capture Devices	Per Capita	Public Education	Per Capita	Total	Per Capita
The Dalles, OR	13,620	\$-	\$-	\$70,493	\$5.18	\$-	\$-	\$15,000	\$1.10	\$47,473	\$3.49	\$-	\$-	\$132,966	\$9.76
Auburn, CA	13,330	\$-	\$-	\$88,000	\$6.60	\$40,000	\$3.00	\$8,500	\$0.64	\$61,500	\$4.61	\$5,000	\$0.38	\$203,000	\$15.23
Commerce, CA	12,823	\$-	\$-	\$150,000	\$11.70	\$85,000	\$6.63	\$70,000	\$5.46	\$560,000	\$43.67	\$25,000	\$1.95	\$890,000	\$69.41
Pt. Orchard, WA	11,144	\$-	\$-	\$50,000	\$4.49	\$1,000	\$0.09	\$-	\$-	\$200	\$0.02	\$20,000	\$1.79	\$71,200	\$6.39
Signal Hill, CA	10,834	\$-	\$-	\$150,400	\$13.88	\$1,000	\$0.09	\$81,000	\$7.48	\$64,000	\$5.91	\$7,500	\$0.69	\$303,900	\$28.05
Capitola, CA	9,918	\$15,000	\$1.51	\$100,000	\$10.08	\$25,000	\$2.52	\$30,000	\$3.02	\$22,000	\$2.22	\$25,000	\$2.52	\$217,000	\$21.88
Sutherlin, OR	7,810	\$48,000	\$6.15	\$30,000	\$3.84	\$15,000	\$1.92	\$20,800	\$2.66	\$10,000	\$1.28	\$2,000	\$0.26	\$125,800	\$16.11
Del Mar, CA	4,151	\$114,005	\$27.46	\$160,301	\$38.62	\$20,195	\$4.87	\$-	\$-	\$1,120	\$0.27	\$-	\$-	\$295,621	\$71.22
Cle Elum, WA	1,872	\$-	\$-	\$2,100	\$1.12	\$6,500	\$3.47	\$2,000	\$1.07	\$-	\$-	\$-	\$-	\$10,600	\$5.66
Winlock, WA	1,339	\$-	\$-	\$200	\$0.15	\$4,000	\$2.99	\$2,000	\$1.49	\$-	\$-	\$-	\$-	\$6,200	\$4.63
Millersburg, OR	1,329	\$-	\$-	\$20,000	\$15.05	\$20,000	\$15.05	\$1,400	\$1.05	\$-	\$-	\$-	\$-	\$41,400	\$31.15
Blue Lake, CA	1,253	\$-	\$-	\$3,000	\$2.39	\$4,800	\$3.83	\$1,300	\$1.04	\$400	\$0.32	\$500	\$0.40	\$10,000	\$7.98
Malin, OR	805	\$-	\$-	\$200	\$0.25	\$-	\$-	\$200	\$0.25	\$-	\$-	\$-	\$-	\$400	\$0.50
Bingen, WA	712	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Dufur, OR	604	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Mosier, OR	433	\$-	\$-	\$700	\$1.62	\$500	\$1.15	\$300	\$0.69	\$-	\$-	\$-	\$-	\$1,500	\$3.46
Detroit, OR	202	\$-	\$-	\$-	\$-	\$1,000	\$4.95	\$4,000	\$19.80	\$-	\$-	\$600	\$2.97	\$5,600	\$27.72
Ukiah, OR	186	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Totals	4,682,218	\$2,647,248	\$0.57	\$26,402,867	\$5.64	\$12,874,489	\$2.75	\$9,117,224	\$1.95	\$6,323,294	\$1.35	\$2,766,544	\$0.59	\$60,131,679	\$648.35
Average	117,055	66,181	\$1.08	660,072	\$6.96	321,862	\$2.26	227,931	\$1.96	158,082	\$3.46	69,164	\$0.49	1,503,292	\$16.21

^{cxlii} Please see Tables 8-11 for notes to accompany this data.

Appendix C: Respondents, Participating Cities

Kier Associates would like to thank the following individuals for responding to our request and providing data used in this study:

Informant	Position/Department	City	County	State	Population (2010 Census)	Interview Date	Interviewer
Aguiar, Steve	Environmental Compliance Supervisor, Water Resources/Public Works Department	Livermore	Alameda	CA	80,968	May-12	Kalla Hirschbein
Amimoto, Lauren	Senior Administrative Analyst	Inglewood	Los Angeles	CA	112,241	July-11	Timothy Degen Kelly
Aminpour, Khosro, P.E.	Department of Public Works, Storm Water Management Division	Chula Vista	San Diego	CA	243,916	July-11	Timothy Degen Kelly
Anderson, Dave	Public Works Director	The Dalles	Wasco	OR	13,620	June-12	Barbara Healy Stickel
Archer, Andrea, P.E.	Assistant City Engineer/Stormwater Manager	Port Orchard	Kitsap	WA	11,144	May-12	Barbara Healy Stickel
Bachen, Bruce	Director, Seattle Public Utilities Drainage and Wastewater Quality Division	Seattle	Seattle	WA	608,660	June-12	Barbara Healy Stickel
Bebee, Steve	Operations Manager, Department of Public Works	Oak Harbor	Island	WA	22,075	May-12	Barbara Healy Stickel
Berchtold, John	City Administrator	Blue Lake	Humboldt	CA	1,253	May-12	Barbara Healy Stickel
Brending, Jan	City Administrator	Bingen	Klickitat	WA	712	May-12	Barbara Healy Stickel
Burke, Jerry L., P.E.	City Engineer/Assistant Public Works Director	Glendora	Los Angeles	CA	49,737	July-11	Timothy Degen Kelly
Butzlaff, Jeff	Interim City Manager	Ione	Amador	CA	7,918	June-12	Barbara Healy Stickel
Castillo, Barbara	City Administrator/Recorder	Millersburg	Linn	OR	1,329	June-12	Barbara Healy Stickel
Clark, Thomas	Community Development Director	Hughson	Stanislaus	CA	6,640	June-12	Barbara Healy Stickel
Clifton, Darla	City Recorder	Dufur	Wasco	OR	604	May-12	Barbara Healy Stickel
Conrad, Rich	City Manager	Mercer Island	King	WA	22,699	June-12	Barbara Healy Stickel
Cooper, Russell	Public Worker Director	Monmouth	Polk	OR	9,534	June-12	Barbara Healy Stickel
Crook, Angela	Assistant City Manager	Orland	Glenn	CA	7,291	June-12	Barbara Healy Stickel
Curiel, Christina	Engineering Assistant	Azusa	Los Angeles	CA	46,361	May-12	Barbara Healy Stickel
Curry, Theda	Clerk/Treasurer	Winlock	Lewis	WA	1,339	June-12	Barbara Healy Stickel
David Liu	Public Works Director	Diamond Bar	Los Angeles	CA	55,544	July-11	Timothy Degen Kelly
Felix, John	Engineering Division	Gardena	Los Angeles	CA	58,829	July-11	Timothy Degen Kelly
Fields, Tony	City Clerk	Cle Elum	Kittitas	WA	1,872	June-12	Barbara Healy Stickel
Foltz, Bruce	Finance Director	Wasco	Kern	CA	64,173	June-12	Barbara Healy Stickel
Glassco, Alicia	San Diego Coastkeeper	San Diego	San Diego	CA	1,301,617	June-12	Saskia VanGendt
Hauerwass, Steve	Public Works Director/City Engineer	Fountain Valley	Orange	CA	55,313	June-12	Barbara Healy Stickel
Huff, Dan	Public Works Director	Sutherlin	Douglas	OR	7,810	August-12	Barbara Healy Stickel
Hunter, John	Consultant, John L. Hunter Inc.	Huntington Park	Los Angeles	CA	58,100	June-12	Barbara Healy Stickel
Hunter, John	Consultant, John L. Hunter Inc.	Signal Hill	Los Angeles	CA	10,834	June-12	Barbara Healy Stickel
Hunter, John	Consultant, John L. Hunter Inc.	South Gate	Los Angeles	CA	94,300	June-12	Barbara Healy Stickel
Huth, Scott	City Manager	Del Mar	San Diego	CA	4,151	May-12	Barbara Healy Stickel
Huun, Sherrill	City Manager	Sacramento	Sacramento	CA	466,488	June-12	Barbara Healy Stickel
Hyland, Kristy-McCumby	Administrative Analyst	Sunnyvale	Santa Clara	CA	133,963	July-11	Timothy Degen Kelly
Jean	Office of the City Clerk	Mosier	Wasco	OR	433	June-12	Barbara Healy Stickel
Jensen, Alicia	City Manager	Walnut	Los Angeles	CA	29,172	June-12	Barbara Healy Stickel
Jesberg, Steve	Public Works Director	Capitola	Santa Cruz	CA	9,918	May-12	Barbara Healy Stickel

Informant	Position/Department	City	County	State	Population (2010 Census)	Interview Date	Interviewer
Kelly, Mary	Director of Administrative Services	Angels Camp	Calaveras	CA	3,836	June-12	Barbara Healy Stickel
Krauss, Doug, P.E.	Administrative Analyst, Department of Public Works	Hawthorne	Los Angeles	CA	83,945	July-11	Timothy Degen Kelly
Ledbetter, Kit	Director of Parks & Recreation	SeaTac	King	WA	26,909	May-12	Kalla Hirschbein
Ledesma, Paul	Environmental Services Department	San Jose	Santa Clara	CA	964,695	July-11	Timothy Degen Kelly
Len	City Employee	Paramount	Los Angeles	CA	55,018	July-11	Timothy Degen Kelly
Marston, Thomas	Finance Director	San Gabriel	Los Angeles	CA	39,718	June-12	Barbara Healy Stickel
McDaniel, Todd	Public Works Director	Omak	Okanogan	WA	2,552	May-12	Barbara Healy Stickel
Milliman, Gary	City Manager	Brookings	Curry	OR	6,336	June-12	Barbara Healy Stickel
Moore, Marilou	Public Works Director	Everett	Snohomish	WA	103,019	May-12	Barbara Healy Stickel
Mulligan, John	Interim Public Works Director	Sanger	Fresno	CA	24,270	June-12	Barbara Healy Stickel
Nila, Gina	Environmental Services Manager	Commerce	Los Angeles	CA	12,823	June-12	Barbara Healy Stickel
Nussbaum, Gary	Department of Public Works	Chewelah	Stevens	WA	2,607	June-12	Barbara Healy Stickel
Oillataguerre, Maurice	Operations Coordinator/Public Education Coordinator	Glendale	Los Angeles	CA	196,847	July-11	Timothy Degen Kelly
Pearlstein, Sharon	City Engineer	West Hollywood	Los Angeles	CA	34,399	June-12	Barbara Healy Stickel
Picard, Carole	Mayor	Ukiah	Umatilla	OR	186	June-12	Barbara Healy Stickel
Powell, David	Finance Director	Arvin	Kern	CA	19,304	June-12	Barbara Healy Stickel
Reilly, Douglas C.	Assistant City Manager	Laguna Woods	Orange	CA	16,192	June-12	Barbara Healy Stickel
Robinson, Matthew	District Department of the Environment	Washington	Washington	DC	599,657	July-11	Timothy Degen Kelly
Rosenfield, Ken	Public Works Director	Laguna Hills	Orange	CA	30,344	June-12	Barbara Healy Stickel
Russell, Pamela	City Manager	Etna	Siskiyou	CA	737	June-12	Barbara Healy Stickel
Samkian, Karineh	Environmental Program Analyst, Public Works Department	San Pablo	Contra Costa	CA	29,139	June-12	Barbara Healy Stickel
Sarmiento, Liga	Executive Assistant to the City Manager	Mountain View	Santa Clara	CA	74,066	May-12	Barbara Healy Stickel
Schroeder, Bernie	Public Works Director	Auburn	Placer	CA	13,330	May-12	Barbara Healy Stickel
Scianna, Carol	Environmental Services Manager	Winters	Yolo	CA	6,624	June-12	Barbara Healy Stickel
Shaw, Lisa	Financial Planning Division, OMF	Portland	Multnomah	OR	583,776	May-12	Barbara Healy Stickel
Shay, Michael	Principal Civil Engineer	Redondo Beach	Los Angeles	CA	66,748	July-11	Timothy Degen Kelly
Soliman, Maged	Department of Public Works	Los Angeles	Los Angeles	CA	3,831,868	July-11	Timothy Degen Kelly
Sprouse, Chrissy	Paralegal, Department of Public Works	Mount Vernon	Skagit	WA	31,743	June-12	Barbara Healy Stickel
Sullivan, Marlisa	Town Manager	Lakeview	Lake	OR	2,294	June-12	Barbara Healy Stickel
Tang, Diana	Government Affairs Analyst	Long Beach	Los Angeles	CA	462,604	July-11	Timothy Degen Kelly
Thomas, Bill	Street Superintendent	Kent	King	WA	92,411	June-12	Barbara Healy Stickel
Tuden, Rebecca	Watershed Specialist, Department of Public Works	Oakland	Alameda	CA	409,184	July-11	Timothy Degen Kelly
Unidentified	City Hall Employee	Detroit	Marion	OR	202	June-12	Barbara Healy Stickel
Willis, Joe	Public Works Director	Medina	King	WA	2,969	May-12	Barbara Healy Stickel
Zieg, Gary	Mayor	Malin	Klamath	OR	805	May-12	Barbara Healy Stickel

Appendix D: Cities Randomly Selected and Contacted by Kier Associates

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Anderson	Shasta	CA	9,932	NPDES General Permit No. CAS000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Angels Camp	Calaveras	CA	3,836	NPDES General Permit No. CAS000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Arvin	Kern	CA	19,304	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Auburn	Placer	CA	13,330	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Azusa	Los Angeles	CA	46,361	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Bakersfield	Kern	CA	346,473	NPDES Permit No. CA00883399: Waste Discharge Requirements for the County of Kern and the City of Bakersfield for Urban Storm Water Discharges
Bingen	Klickitat	WA	712	NPDES Permit No. WA0022373: Municipal Waste Discharge Permit
Blue Lake	Humboldt	CA	1,253	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Bradbury	Los Angeles	CA	1,048	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Brookings	Curry	OR	6,336	NPDES Permit No. ORS101773: National Pollutant Discharge Elimination System Waste Discharge Permit
Buena Park	Orange	CA	80,530	NPDES Permit No. CAS618030: Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the Incorporated Cities of Orange County within the Santa Ana Region Area wide Urban Storm Water Runoff
Camas	Clark	WA	19,355	NPDES Permit No. WAR045004: Municipal Storm Water Phase II Permit for Western Washington
Capitola	Santa Cruz	CA	9,918	NPDES General Permit No. S000004: Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
				(MS4s) (General Permit)
Chewelah	Stevens	WA	2,607	NPDES Permit No. WA0023604: Municipal Waste Discharge Permit
Clayton	Contra Costa	CA	10,897	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Cle Elum	Kittitas	WA	1,872	NPDES Permit No. WA0021983: Municipal Waste Discharge Permit
Colusa	Colusa	CA	5,971	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Commerce	Los Angeles	CA	12,823	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Coquille	Coos	OR	3,866	NPDES Permit No. ORS003885: National Pollutant Discharge Elimination System Waste Discharge Permit
Davis	Yolo	CA	65,622	NPDES General Permit No. S000004: Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (General Permit)
Del Mar	San Diego	CA	4,151	NPDES Permit No. CAS0108758: Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority
Detroit	Marion	OR	202	NPDES Permit No. ORS102905:: National Pollutant Discharge Elimination System Waste Discharge Permit (Marion County)
Dufur	Wasco	OR	604	NPDES Permit No. ORS102478: National Pollutant Discharge Elimination System Waste Discharge Permit
Eastvale	Riverside	CA	53,670	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Etna	Siskiyou	CA	737	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Everett	Snohomish	WA	103,019	NPDES Permit No. WAR045515: Municipal Storm Water Phase II Permit for Western Washington
Fife	Pierce	WA	9,173	NPDES Permit No. WAR045007: Municipal Storm Water Phase II Permit for Western Washington

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Firebaugh	Fresno	CA	7,549	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Fountain Valley	Orange	CA	55,313	NPDES Permit No. CAS618030: Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the Incorporated Cities of Orange County within the Santa Ana Region Area wide Urban Storm Water Runoff
Galt	Sacramento	CA	23,647	NPDES Permit No. CAS082597: Waste Discharge Requirements Cities of Citrus Heights, Elk Grove, Folsom, Galt, Rancho Cordova, Sacramento, and County of Sacramento Storm Water Discharges from Municipal Separate Storm Sewer System Sacramento County
Gustine	Merced	CA	5,520	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Honolulu	Honolulu	HI	390,738	NPDES Permit No. HIS000002: Authorization to Discharge under the National Pollutant Discharge Elimination System
Hughson	Stanislaus	CA	6,640	NPDES General Permit No. S000004: Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (General Permit)
Huntington	Baker	OR	440	NPDES Permit No. ORS101726: National Pollutant Discharge Elimination System Waste Discharge Permit
Huntington Park	Los Angeles	CA	58,100	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Ione	Amador	CA	7,918	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Kent	King	WA	92,411	NPDES Permit No. WAR045520: Municipal Storm Water Phase II Permit for Western Washington
Laguna Hills	Orange	CA	30,344	NPDES Permit No. CAS618030: Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the Incorporated Cities of Orange County within the Santa Ana Region Area wide Urban Storm Water Runoff; NPDES Permit No. CAS0108740: Waste Discharge Requirements for Discharges of Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watershed of the County of Orange, and the Orange County Flood Control District Within the San Diego Region

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Laguna Woods	Orange	CA	16,192	NPDES Permit No. CAS618030: Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the Incorporated Cities of Orange County within the Santa Ana Region Area wide Urban Storm Water Runoff; NPDES Permit No. CAS0108740: Waste Discharge Requirements for Discharges of Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watershed of the County of Orange, and the Orange County Flood Control District Within the San Diego Region
Lakeview	Lake	OR	2,294	NPDES Permit No. ORS101594: National Pollutant Discharge Elimination System Waste Discharge Permit
Livermore	Alameda	CA	80,968	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Livingston	Merced	CA	13,058	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Lomita	Los Angeles	CA	20,256	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Malin	Klamath	OR	805	
Martinez	Contra Costa	CA	35,824	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Medina	King	WA	2,969	NPDES Permit No. WAR045527: Municipal Storm Water Phase II Permit for Western Washington
Mercer Island	King	WA	22,699	NPDES Permit No. WAR045528: Municipal Storm Water Phase II Permit for Western Washington
Millersburg	Linn	OR	1,329	NPDES Permit No. ORS102603: National Pollutant Discharge Elimination System Waste Discharge Permit
Monmouth	Polk	OR	9,534	NPDES Permit No. ORS101919: National Pollutant Discharge Elimination System Waste Discharge Permit
Mosier	Wasco	OR	433	NPDES Permit No. ORS101495: National Pollutant Discharge Elimination System Waste Discharge Permit
Mount Vernon	Skagit	WA	31,743	NPDES Permit No. WAR045553: Municipal Storm Water Phase II Permit for Western Washington
Mountain View	Santa Clara	CA	74,066	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Murrieta	Riverside	CA	103,466	NPDES Permit No. CAS618033: Waste Discharge Requirements for the Riverside County Flood Control and Water Conservation District, the County of Riverside, and the Incorporated Cities of Riverside County Within the Santa Ana Region; NPDES Permit No. CAS0108766: Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the County of Riverside, the City of Murrieta, the City of Temecula and the Riverside County Flood Control and Water Conservation District Within the San Diego Region
Napa	Napa	CA	76,915	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Napavine	Lewis	WA	1,766	NPDES Permit No. WA0021105: Municipal Waste Discharge Permit (Chehalis)
Oak Harbor	Island	WA	22,075	NPDES Permit No. WAR045554: Municipal Storm Water Phase II Permit for Western Washington
Omak	Okanogan	WA	2,552	NPDES Permit No. WA0020940: Municipal Waste Discharge Permit
Orland	Glenn	CA	7,291	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Palouse	Whitman	WA	998	NPDES Permit No. WA0044806: Municipal Waste Discharge Permit
Port Orchard	Kitsap	WA	11,144	NPDES Permit No. WAR045536: Municipal Storm Water Phase II Permit for Western Washington
Portland	Multnomah	OR	583,776	NPDES Permit No. ORS101314: National Pollutant Discharge Elimination Municipal Separate Storm Sewer System (MS4) Discharge Permit
Poulsbo	Kitsap	WA	9,200	NPDES Permit No. WAR045537: Municipal Storm Water Phase II Permit for Western Washington
Sacramento	Sacramento	CA	466,488	NPDES Permit No. CAS082597: Waste Discharge Requirements Cities of Citrus Heights, Elk Grove, Folsom, Galt, Rancho Cordova, Sacramento, and County of Sacramento Storm Water Discharges from Municipal Separate Storm Sewer System Sacramento County
San Fernando	Los Angeles	CA	23,645	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
San Gabriel	Los Angeles	CA	39,718	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
San Pablo	Contra Costa	CA	29,139	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Sanger	Fresno	CA	24,270	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
SeaTac	King	WA	26,909	NPDES Permit No. WAR045541: Municipal Storm Water Phase II Permit for Western Washington
Seattle	Seattle	WA	608,660	NPDES Permit No. WAR044503: Municipal Storm Water Phase I General Permit
Signal Hill	Los Angeles	CA	10,834	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Sonora	Tuolumne	CA	4,903	NPDES Permit No. CA0084727: Waste Discharge Requirements for Tuolumne Utilities District, Sonora Regional Wastewater Treatment Plant and Jamestown Sanitary District
South Gate	Los Angeles	CA	94,300	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Sutherlin	Douglas	OR	7,810	NPDES Permit No. ORS101993: National Pollutant Discharge Elimination System Waste Discharge Permit
The Dalles	Wasco	OR	13,620	NPDES Permit No. ORS101728: National Pollutant Discharge Elimination System Waste Discharge Permit
Ukiah	Umatilla	OR	186	
Walnut	Los Angeles	CA	29,172	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Wasco	Kern	CA	64,173	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems
Wenatchee	Chelan	WA	31,925	NPDES Permit No. WAR0462011: Municipal Storm Water Phase II Eastern Washington General Permit
West Hollywood	Los Angeles	CA	34,399	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Winlock	Lewis	WA	1,339	NPDES Permit No. WA0021199: Municipal Waste Discharge Permit

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Winters	Yolo	CA	6,624	NPDES General Permit No. S000004: Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems

In addition, data for the following cities was furnished to Kier Associates by Saskia van Gendt, Resource Conservation Specialist at the Environmental Protection Agency.²⁶

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Los Angeles	Los Angeles	CA	3,831,868	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
San Diego	San Diego	CA	1,301,617	NPDES Permit No. CAS0108758: Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority
San Jose	Santa Clara	CA	964,695	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Washington		DC	599,657	NPDES Permit No. DC0000221: Authorization to Discharge under the National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit
Long Beach	Los Angeles	CA	462,604	NPDES Permit No. CAS004003: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the City of Long Beach
Oakland	Alameda	CA	409,184	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Chula Vista	San Diego	CA	243,916	NPDES Permit No. CAS0108758: Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority

²⁶ See Kelly, Timothy Degan, "Draft - Economic Analysis of Marin Debris," edited by Saskia van Gendt, August 5, 2011.

City	County	State	Population (2010 Census)	MS4 Storm Water Ordinances
Glendale	Los Angeles	CA	196,847	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Sunnyvale	Santa Clara	CA	133,963	NPDES Permit No. CAS612008: SF Bay Municipal Regional Permit for the Discharge of Stormwater Runoff from Municipal Separate Storm Sewer Systems (MS4s)
Inglewood	Los Angeles	CA	112,241	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Hawthorne	Los Angeles	CA	83,945	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Redondo Beach	Los Angeles	CA	66,748	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Gardena	Los Angeles	CA	58,829	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Diamond Bar	Los Angeles	CA	55,544	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Paramount	Los Angeles	CA	55,018	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach
Glendora	Los Angeles	CA	49,737	NPDES Permit No. CAS004001: Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, except the City of Long Beach

Appendix E: Technical Appendix

To compute a confidence limit on total per capita spending for trash control, it was first necessary to determine which set of cities constituted an appropriate sample. The data set actually consists of two samples: one of 15 cities given by the client at the outset (Given) and the other of West Coast cities picked at random, as described elsewhere (Random, n=51). There was a bias in the Given sample in that, by the definition used here, no small cities were included.

To determine if a population-size bias might cause a per capita spending bias, a first test was performed using only the Random data set. This test (a one-factor ANOVA with four levels of population size) produced a non-significant result, i.e., <1% of the variance in per capita spending was explained by population size category. This result (Table A1) was taken as justification for pooling the per capita spending totals for cities regardless of population size.

TABLE A1: ANALYSIS OF VARIANCE OF TOTAL PER CAPITAL SPENDING, RANDOM SAMPLE OF WEST COAST CITIES

DEP VAR: TOTPERCAPITA N: 51 MULTIPLE R: 0.05351 SQUARED MULTIPLE R: 0.00286

<u>Source</u>	<u>Sums of Squares</u>	<u>Df</u>	<u>Mean Square</u>	<u>F-Ratio</u>	<u>P</u>
GRP\$	52.167	3	17.389	0.045	0.987
Error	18169.798	47	386.591		

LEAST SQUARES MEANS

		<u>LS Mean</u>	<u>SE</u>	<u>N</u>
GRP\$	Largest	9.76	11.35	3
GRP\$	Larger	12.69	9.83	4
GRP\$	Mid-Sized	14.02	4.92	16
GRP\$	Smaller	13.85	3.72	28

The next test inspected the difference between the Given and Random data sets. This test (a separate variances t-test, Table A2) found a non-significant difference of \$1.52 per capita spending between the two data sets.

TABLE A2: T-TEST OF RANDOM VS. GIVEN DATA SETS FOR TOTAL SPENDING

<u>Group</u>	<u>N</u>	<u>Mean</u>	<u>SD</u>	<u>T</u>	<u>df</u>	<u>P</u>
Given	15	12.05	8.28	-0.444	54.6	0.659
Random	51	13.57	19.09			

Given the great variation in per capita spending, as indicated by the standard deviations (SD) given in Table A2 and the ranges reported in the main text, it appears quite safe to combine the two samples into a single sample. This single sample has a mean per capita total of \$13 with a 95% confidence limit of approximately \$9 to \$17.50 (Table A3).

TABLE A3: TOTAL PER CAPITA SPENDING BY 65 CITIES IN THE COMBINED DATA SET

N of cases	66
Minimum	\$ 0.00
Maximum	\$ 102.65
Mean	\$13.23
95% CL Upper	\$17.45
95% CL Lower	\$ 9.00
Standard Dev	\$17.19

These statistics do not differ materially from those derived from the random sample only (n=50, mean = \$13.57, 95% C.L. = \$8.20 - \$18.94 per capita). Based as it is on a smaller sample, this confidence limit is naturally wider. Either of these estimates should work for planning purposes, i.e., it is very likely that a wider survey of West-Coast cities would produce an estimate of total per capita spending for trash control within these limits.