Los Angeles Regional Water Quality Control Board

TO: Los Angeles Regional Water Board Staff

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DATE: February 6, 2024

SUBJECT: Costs and Implications of CII Permit Options

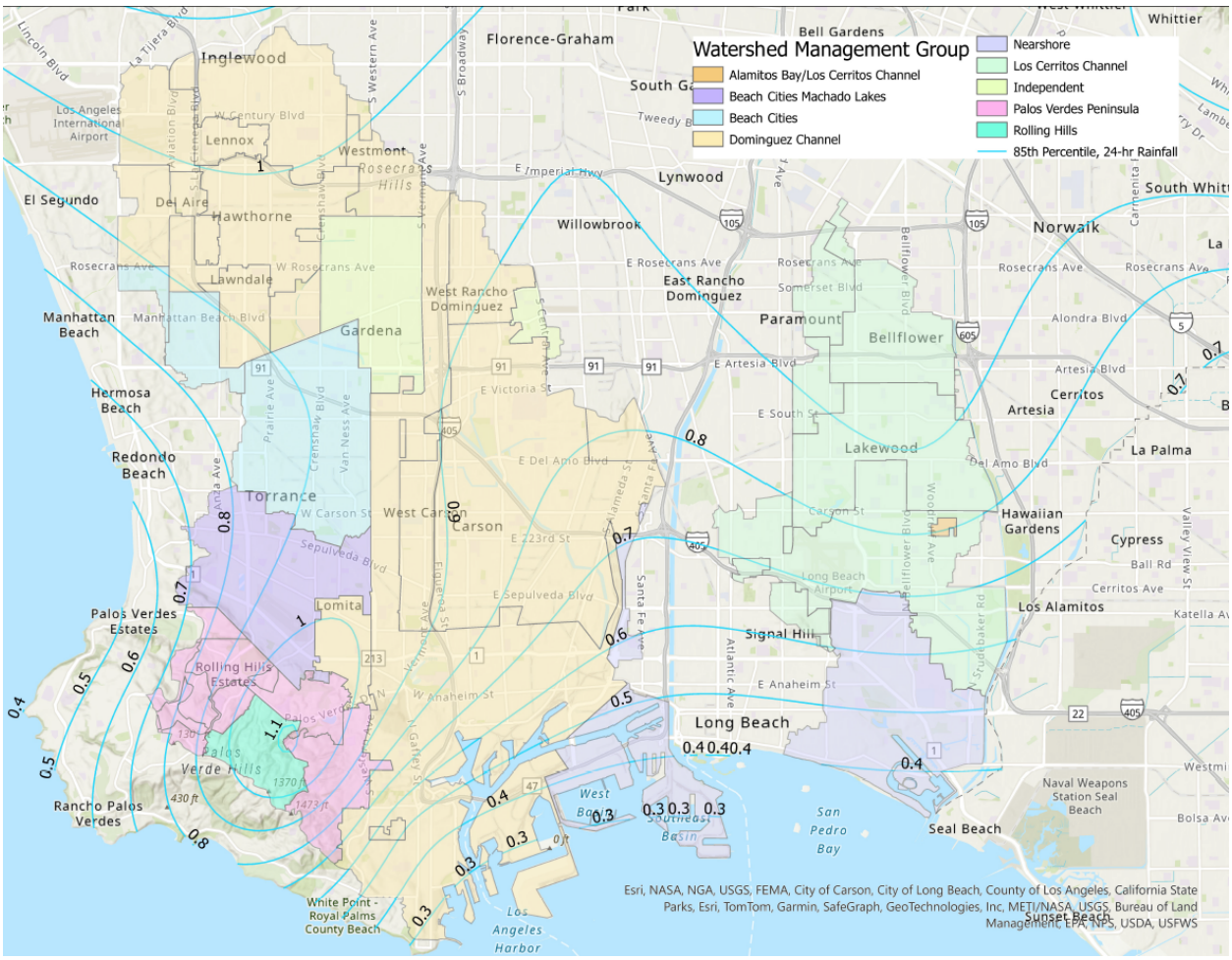
Introduction

The proposed Commercial, Industrial, Institutional (CII) Permit has three options for Dischargers to comply with water quality based effluent limitations.

- **Option 1**: Dischargers shall enter into an agreement with their local Watershed Management Group to fund, or partially fund, a regional project included in a Watershed Management Program developed to implement requirements of the Regional MS4 Permit.
- **Option 2**: Dischargers shall design, implement, and properly operate and maintain stormwater controls (structural and/or non-structural BMPs) with the effective capacity to capture and use, infiltrate, divert to the sanitary sewer, and/or evapotranspire all NSWDs and the volume of runoff produced up to and during an 85th percentile 24-hour storm event.
- **Option 3**: Dischargers shall provide direct demonstration of compliance with effluent limitations by developing and implementing a site-specific Monitoring and Reporting Plan.

Figure 1 shows a map of the CII watersheds and inches of rainfall for the 85th percentile 24-hour storm event.

Figure 1: CII watersheds (Dominguez Channel and Los Cerritos Channel Watersheds), and isohyetal map of 85th percentile, 24-hour rainfall



This memo summarizes analysis conducted by Board staff to estimate costs of Options 2 and 3, as well as discuss the implications on Option 1and the local economy.

Data

Data on BMP costs were collected from a variety of sources, with a focus on costs from retrofit projects occurring on private property because they would be most similar to projects occurring under Options 2 and 3. Local estimates were obtained from LA County Department of Public Works for parking lot retrofits the agency installed in Marina del Rey. Costs from public-private partnership programs administered by Philadelphia, PA and New York, NY were obtained through interviews with staff from the respective municipalities, as well as through cost data available online in the case of Philadelphia. Through these programs, the municipalities fund stormwater retrofits on private property, many of which are commercial, industrial, or institutional.

Aspen, CO and Grand Rapids, MI have in-lieu fee programs, where Permittees can pay a fee to comply with stormwater detention requirements rather than install onsite BMPs. These municipalities have estimated average BMP costs and set their in-lieu fees at approximately those values. Washington, D.C. has the most active stormwater credit trading program in the country, where Permittees can comply with LID requirements by purchasing credits from generators that have installed BMPs at offsite locations. In Washington, D.C.'s Stormwater Retention Credit Trading Program, one credit represents the retention of one gallon of stormwater per year. Because credits are traded on an open market, the most recent average credit price was assumed to represent the average annual BMP cost in Washington, D.C. Furthermore, costs by BMP type were obtained from a survey of 17 green infrastructure construction firms in Washington, D.C. by Galvin (2021).

For validation of BMP cost estimates, staff used Center for Neighborhood Technology's Green Values Stormwater Management Calculator, which sources its cost estimates from the RS Means Building Construction Cost Database and RS Means Site Work and Landscape Cost Database (Beauchamp & Adamowski, 2012).

As for additional costs under Option 3, data on average compensation for a consultant to prepare an MRP was derived from data from the U.S. Bureau of Labor Statistics (U.S. Bureau of Labor Statistics, 2022a; U.S. Bureau of Labor Statistics, 2022b). Staff followed the same assumed multiplier for consultant overhead as the Central Coast Water Board (PG Environmental and Eastern Research Group, 2021). Assumed hours required to prepare an MRP came from correspondence with staff from GSI Environmental (GSI Environmental, 2023). Laboratory costs for water quality monitoring were obtained from Babcock Laboratories, Inc. and an analysis by the State Water Resources Control Board (State Water Resources Control Board, 2020).

Staff used the GDP implicit price deflator by the U.S. Bureau of Economic Analysis to adjust costs to 2023 dollars. To account for regional differences in prices and adjust costs to be comparable to Los Angeles area prices, staff used regional price parities by the U.S. Bureau of Economic Analysis.

Methodology

Available cost estimates were organized into three categories: estimates by parcel surface area, estimates by volume of stormwater captured, and estimates by BMP type. Data sources were reviewed so that costs from projects not likely to be implemented under the CII Permit were omitted. For example, in the case of LA County, the cost for Parking Lot #9 in Marina del Rey was omitted from this analysis because the retrofits included recreational improvements, such as two parklets with seating, which CII Permittees likely would not install. In addition, the cost for the Marina del Rey Library Parking Lot was also omitted because the cost per acre was significantly higher than all other estimates in this analysis likely due to the drainage surface area being only 0.61 acres and the particular BMP installed, a membrane filtration system.

Estimates by surface area were converted to cost-per-acre units. Hence, estimates by volume and estimates by BMP type, which were also in volume units, were converted from per-gallon to per-acre-inch estimates to make them more easily comparable to estimates by surface area, though rainfall depths vary from 0.75-1.5 inches across all estimates.

Additional variables that affect final cost estimates were also considered and are presented in tables in the Results section. These variables include inches of rainfall capture required, average parcel surface area, whether operations and maintenance and soft costs were accounted for, sample sizes used to estimate final costs, and the year estimates were calculated.

Although there is limited data on BMP costs on commercial, industrial, and institutional property, publicly available data from the Philadelphia Water Department allowed for an estimation of an approximate cost curve for these types of projects.

Costs were adjusted to 2022 dollars using the GDP implicit price deflator by the U.S. Bureau of Economic Analysis. To account for regional differences in prices, costs were also adjusted to the Los Angeles-Long Beach-Anaheim, CA area price with regional price parity values from the U.S. Bureau of Economic Analysis.

From the estimates gathered, staff arrived at a final unit cost estimate that falls within a reasonable range of estimates from other municipalities. Staff notes that cost estimates do not account for pretreatment that Permittees may need to install, as discussed in Section 3.12.4.1.4 of the Revised CII Permit. Therefore, staff's final unit cost estimate represents a lower bound.

Staff also used CNT's Green Values Stormwater Management Calculator to validate final unit cost estimates by inputting characteristics from sites that represented average commercial sites and calculating potential costs if sufficient green infrastructure BMPs were installed to capture the required amount of stormwater. Sites were chosen that had values close to the average value of impervious acres, impervious percentage, and rainfall depth. The combination and amount of BMPs chosen represent ideal scenarios based on staff's assumptions of what might be installed if there were no other concerns that might prevent BMP installation, such as nearby groundwater contamination.

Results – Option 2

The results section is organized as follows. First, estimates from different municipalities are discussed, organized by estimates by surface area, volume, and BMP type. Staff's final Option 2 cost estimate is then presented, followed by validation using CNT's Stormwater Calculator.

Estimates by Surface Area

Costs by surface area were estimated for Los Angeles County, New York and Philadelphia, as presented in Table 1. The average Los Angeles County cost of $472,877/acre is the mean value of costs that the LA County of Department of Public Works paid to retrofit two parking lots in Marina del Rey with BMPs such as bioretention planters and biofiltration systems. The average cost for New York ($303,046/acre) was estimated from correspondences with staff from New York City Department of Environmental Protection regarding their public private partnership

program with contractor Arcadis. Their previous contract agreement was for $250,000/acre for planned parcels greater than 10 acres. Their current contract pays $350,000/acre, and so far a few projects have been implemented on parcels less than one acre. The average Philadelphia cost of $285,630 is the mean value of costs of 34 projects funded through the Stormwater Grants Program, the city's public-private partnership program that funds stormwater retrofits on private property. The LA County projects were designed to capture 1.32 inches of rainfall, which is between the depths captured by Philadelphia (1 inch) and New York (1.5-2.0 inches). In addition, the LA County projects were significantly smaller than the New York and Philadelphia projects. The Marina del Rey parking lots average about 1.37 acres, whereas the average Philadelphia parcel was about 5.00 acres. New York's average surface area is also estimated to be about 5.00 acres, though it is a rougher estimate derived from their previously planned projects of over 10 acres and the few projects that have been implemented so far under their current contract and are all less than one acre. None of the cost estimates account for O&M costs, but they do account for soft costs. Furthermore, all estimates are recent, with the oldest being from 2020 for Philadelphia.

Table 1: BMP cost estimates by surface area

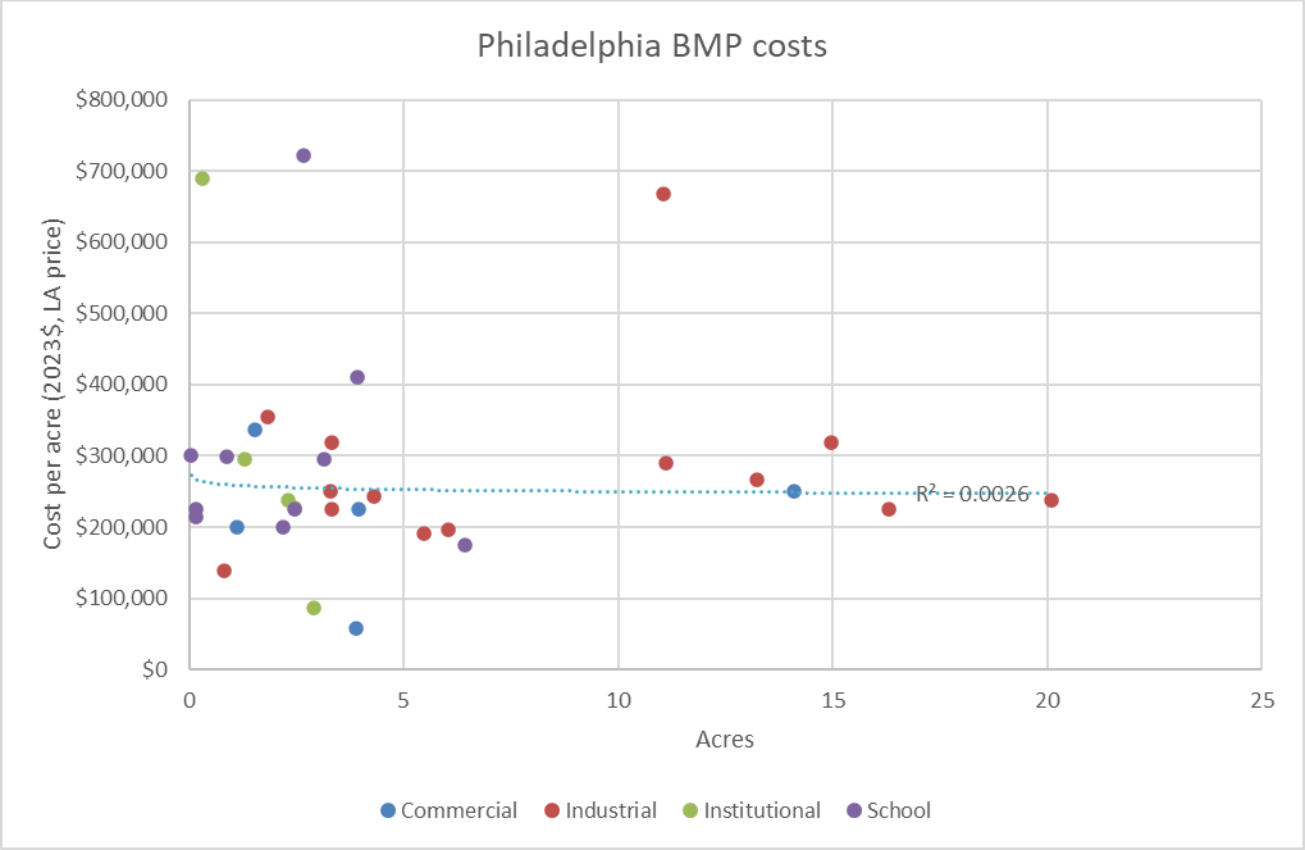
Municipality	Average $/ac (2023$, LA price)	Rainfall inches	Average surface area (ac)	Accounts for O&M?	Accounts for soft costs?	Sample size	Year(s) of estimates
Los Angeles County, CA	$472,877	1.32	1.37	No	Yes	2	2015
New York, NY	$303,046	1.50-2.00	~5.00	No	Yes	Unknown	2022-23
Philadelphia, PA	$285,630	1.00	5.00	No	Yes	34	2020-23

Sources: Los Angeles County Public Works (e-mail correspondence, 2023); NYC Department of Environmental Protection (2023)*; Philadelphia Water Department,* (2020; 2022)

The likely average cost of Option 2 would be similar to the estimates for New York and Philadelphia, as the average rainfall captured and average surface area treated are more similar to the conditions under the CII permit. One reason for LA County's high estimate is because the County's projects capture 1.32 inches of rainfall, which is higher than what would be required in the CII watersheds, where rainfall for the 85th percentile 24-hour storm event ranges from 0.30-1.10 inches, as shown in Figure 1. Furthermore, the parcels subject to the CII Permit are five or more acres, and the average surface area treated for the LA County projects is 1.37. The average surface area treated for New York and Philadelphia is about five acres. When considering both rainfall and parcel surface area, the Philadelphia estimate would be most similar to what would likely be implemented under the CII Permit, as their projects are designed to address 1.00 inches. New York's projects are required to address between 1.50-2.00 inches, though projects implemented so far have been designed to address 2.00 inches. It should also be noted, however, that staff from Philadelphia and New York acknowledged that their estimates likely did not cover all capital costs (Philadelphia Water Department, 2022; NYC Department of Environmental Protection, 2023).

A more in-depth examination of Philadelphia's costs from 2020-2023 is presented in Figure 2. Unit costs in general are higher for smaller parcels and then decline and level off at about $250,000/ac after about five acres, with the exception of one industrial parcel that is over $600,000/ac. Based on this data, it appears that parcel size is the main determinant of cost, and it does not appear that land use type has a discernible effect on cost. However, this is not definitive, as there are only 34 data points.

Figure 2: BMP costs from Philadelphia, PA



Sources: Philadelphia Water Department, (2020; 2022; 2023a; 2023b)

Estimates by Volume

Estimates for BMP costs by volume, presented in Table 2, further support that the likely cost of Option 2 will be similar to Philadelphia's estimate of $285,630/acre and New York's estimate of $303,046/acre. Original costs were in per-cubic-feet units and converted to per-acre-inch units to make values comparable to costs by surface area. Aspen's average cost is $317,322/acre-inch, and Grand Rapids' average cost is $310,041/acre-inch (City of Aspen, 2020; Odefey, et al., 2019). Both estimates are from LID in-lieu fee estimates. Aspen's cost was not converted to a Los Angeles cost, as the U.S. Bureau of Economic Analysis does not have a regional price parity

value for Aspen. It is notable, however, that Aspen residents on average are more affluent than Los Angeles County residents. The median household income in 2021 was $89,625 in Aspen and $76,367 in Los Angeles County. The poverty rate is also much lower in Aspen (3.1%) than in Los Angeles County (14.1%). While information is available on the required inches of rainfall captured, 0.75 inches for Aspen and 1.00 inch for Grand Rapids, the average surface area that BMPs actually address is unknown for both municipalities. Other details about Aspen's estimate, including whether it accounts for O&M and soft costs, and the sample size used in their calculation, are unknown. As for Grand Rapids, its estimate does not account for O&M, though it does account for soft costs. Its estimation sample size is also unknown. Aspen's estimate is from 2021 and Grand Rapids' is from 2019.

An estimate for annual BMP cost is also presented in Table 2 for Washington, D.C. This value of $47,644/ac-in/year is derived from the average credit price in 2022 on the city's Stormwater Retention Credit Trading Program and was converted from a per-gallon-year price to a per-acre-inch-year price. Credits have both a volume and a time component, in that one credit represents the price of addressing one gallon of stormwater per year. Washington, D.C. requires 0.80 or 1.20 inches of stormwater retention, depending on the level of land disturbance for a development. After BMPs are installed, they must be maintained on a long-term basis in order to keep generating credits. Because the estimate is the average of what is agreed upon between credit buyers and sellers, and because it is an active market, it can be assumed that the prices are at least sufficient to cover capital costs, O&M, and soft costs.

Table 2: BMP cost estimates by volume

Municipality	Average $/ac-in (2023$, LA price)	Rainfall inches	Accounts for O&M?	Accounts for soft costs?	Sample size	Year(s) of estimates
One-time cost						
Aspen, CO*	$317,322	0.75	Unknown	Unknown	Unknown	2021
Grand Rapids, MI	$310,070	1.00	No	Yes	Unknown	2019
Annual cost						
Washington, D.C.	$47,648	0.80-1.20	Yes	Yes	Unknown	2022

*No regional price parity value is available for Aspen, CO, hence the price for Aspen has not been regionally adjusted.
Sources: City of Aspen (2020)*, Odefey, et al.* (2019)*, Department of the Energy and Environment* (2024)

Estimates by BMP Type

Cost estimates from Washington, D.C. by BMP type are presented in Table 3. Data was obtained in a survey of 17 green infrastructure firms by Galvin (2021) and converted from original costs per cubic feet to costs per acre-inch. Infiltration has the lowest cost of $260,003/ac-in, and green roofs have the highest cost of $1,289,476/ac-in. It is unclear what specific BMP that infiltration refers to, e.g. infiltration basin, trench, etc. Estimates represent construction costs only. All costs

in previous sections represent costs of projects that combine multiple BMPs, but costs presented here show that previous estimates are reasonable, as they fall within the range presented here.

Table 3: BMP cost estimates by BMP type

Municipality	Average $/ac-in (2023$, LA price)	Rainfall inches	Accounts for O&M?	Accounts for soft costs?	Sample size	Year(s) of estimates
Washington, D.C.						
Bioretention	$334,971	0.80-1.20	No	No	17	2021
Green Roofs	$1,289,476	0.80-1.20	No	No	17	2021
Infiltration	$260,003	0.80-1.20	No	No	17	2021
Permeable Pavement	$486,719	0.80-1.20	No	No	17	2021
Rainwater Harvesting	$495,589	0.80-1.20	No	No	17	2021

Source: Galvin (2021)

Board staff estimate

Staff's final cost estimate is provided in Table 4. The available data presented thus far allows for an estimate of capital costs of around $285,000-$325,000/ac-in in 2023 dollars. Estimates do not account for pretreatment BMPs as discussed in Section 3.12.4.1.4 of the CII permit. In addition, this estimate accounts for soft costs but not O&M. Dominguez Channel's 2021 EWMP assumes annual O&M costs are 1.5% of capital costs. Going by this assumption, annual O&M costs would be $4,275-$4,875/ac-in. Assuming BMP lifespans of about 20 years, or capital costs plus 19 years of O&M, and a 2% discount rate[1], the annualized BMP cost is $21,107-$24,069/ac-in. A detailed annualization table is provided in the Appendix.

Table 4: Final Option 2 cost estimate

Final Option 2 Cost Estimate	Capital Cost (per ac-in)	Annual O&M (per ac-in)	Net Present Value (20 years, undiscounted)	Annualized (20 years, 2%)
Low	$285,000	$4,275	$366,225	$21,107
High	$325,000	$4,875	$417,625	$24,069

Source: LA Regional Water Board Analysis

Data is limited regarding the financial situations of most Permittees. However, in order to provide some reference regarding compliance costs, the average commercial rent in Los Angeles County in 2023 was roughly $36 per square foot (Matthews, 2023). Most commercial parcels in the CII watersheds are shopping centers that comprise mostly parking lots, and the estimated average rent is per retail square feet. Staff reviewed satellite imagery of CII parcels and assumed an average retail space percentage of 30% per commercial parcel for this illustrative example. Not accounting for common area maintenance fees that cover parking lot maintenance, as limited

[1] A discount rate of 2% was used according to guidance in the revised OMB Circular A-4 published in November 2023.

data is available, the average commercial rent for the entire parcel would be $470,448 per acre. The average BMP cost annualized over 20 years would represent about 4.5%-5.1% of the average commercial rent. As for industrial parcels, the average rent in 2023 was about $20.42 per square foot (Jozsa, 2024). Assuming an average industrial operating space of 80% per parcel and not accounting for common area maintenance fees, the average industrial rent for the entire parcel would be $711,597 per acre. The average BMP cost annualized over 20 years would represent about 3.0%-3.4% of the average industrial rent.

CNT Stormwater Calculator Validation

To validate cost estimates, staff chose two case study parcels to compare final costs calculated from the previously estimated unit costs and final costs as calculated with Center for Neighborhood Technology's Green Values Stormwater Management Calculator. Commercial parcels in Gardena, CA in the Dominguez Channel Watershed and in Signal Hill, CA in the Los Cerritos Channel Watershed were chosen because their impervious acreage, impervious percentage, and rainfall for the 85th percentile 24-hour storm event were close to watershed averages. The Stormwater Management Calculator did not have scenarios for industrial or institutional land uses.

Prior to estimating costs with the Stormwater Management Calculator, staff multiplied the number of impervious acres by rainfall inches at each case study parcel site to obtain the number of acre-inches required to be captured, then multiplied this value by the estimated unit costs of $285,000-$325,000/ac-in to obtain low and high capital cost estimates, as shown in Table 5.

Table 5: Case study parcel characteristics and costs estimated by staff

Watershed	Address	Impervious Percentage	Impervious Acres	Rainfall Inches	Capital Cost Estimate (Low)	Capital Cost Estimate (High)
Dominguez Channel	611 W. Redondo Beach Blvd., Gardena, CA	84.96	7.83	0.90	$2,008,395	$2,290,275
Los Cerritos Channel	950 E. 33rd St., Signal Hill, CA	85.15	7.04	0.70	$1,404,480	$1,601,600

When inputting values into the Stormwater Management Calculator, staff assumed that there were no feasibility concerns like groundwater contamination that would limit the installation of infiltration BMPs. Staff also assumed that Permittees would be willing to lose a limited number of parking spaces as part of the stormwater retrofit. Staff selected a combination of BMPs that could likely be implemented, comprising rain gardens, trees, amended soil, parking lot swales, and permeable pavement that would capture the equivalent of the 85th percentile 24-hour storm event across the parcel. Details on specific input values are provided in the Appendix.

BMP costs as calculated by the Stormwater Management Calculator are presented in Table 6 and Table 7 for Dominguez Channel and Los Cerritos Channel, respectively. Because the tool calculates construction costs using nationwide average unit costs, staff added an additional 30% to original totals to account for soft costs based on estimates for small scale projects from Environmental Finance Center at Sacramento State (2019), as well as an additional 31.8% derived from U.S. BEA's regional price parity value for Los Angeles-Long Beach-Anaheim to account for the difference in costs in the Los Angeles area. Costs were adjusted to 2023 dollars using GDP implicit price deflator. This yielded a final capital cost of $2.10 million for Dominguez Channel, which falls within staff's estimated range of $2.01-$2.29 million. For Los Cerritos Channel, the final capital cost was $1.42 million, which also falls within staff's estimated range of $1.40-$1.60 million. In the Dominguez Channel case study, the total O&M cost is about 0.83% of the total capital cost. For Los Cerritos Channel, the total O&M cost is about 1.12% of the total capital cost.

Table 6: BMP costs of representative commercial site in Dominguez Channel Watershed estimated with CNT Green Values Stormwater Management Calculator

Dominguez Channel Parcel BMPs	**Capital**	**Annual O&M**
Rain Garden	$15,175	$1,025
Trees	$2,500	$1,800
Amended Soil	$2,900	$0
Parking Lot Swales	$92,325	$4,575
Permeable Parking	$1,070,652	$2,467
Total (2022$)	$1,183,552	$9,867
Total after adding soft costs	$1,538,618	$12,827
Total after adjusting to 2023$	$1,594,552	$13,293
Total after adjusting for LA costs	**$2,101,620**	**$17,521**

Table 7: BMP costs of representative commercial site in Los Cerritos Channel Watershed estimated with CNT Green Values Stormwater Management Calculator

Los Cerritos Channel Parcel BMPs	**Capital**	**Annual O&M**
Rain Garden	$15,175	$1,025
Trees	$2,500	$1,800
Amended Soil	$1,450	$0
Parking Lot Swales	$92,325	$4,575
Permeable Parking	$687,456	$1,584
Total (2022$)	$798,906	$8,984
Total after adding soft costs	$1,038,578	$11,679
Total after adjusting to 2023$	$1,076,334	$12,104
Total after adjusting for LA costs	**$1,418,608**	**$15,953**

Results – Option 3

As the means of compliance for Option 3 are similar to Option 2, with the addition of treatment and discharge, BMP implementation costs for Options 2 and 3 are similar. However, Option 3 also requires the development and implementation of a site-specific MRP. An analysis of these costs is presented in this section.

MRP Development Costs

For MRP development costs, staff assumed plans would be prepared by a consultant who is an environmental scientist. The mean hourly wage for an environmental scientist in the Los Angeles-Long Beach-Anaheim, CA area is $48.39 in 2023 dollars (U.S. Bureau of Labor Statistics, 2022b). Wages on average comprise about 70.5% of total compensation in the Pacific West region, therefore the total assumed wage is $68.63 (U.S. Bureau of Labor Statistics, 2022a). In addition, based on an analysis by the Central Coast Water Board, staff assumed a multiplier of 2.97 to account for consultant's overhead, administrative costs, and profit, resulting in a wage of $203.84 per hour (PG Environmental and Eastern Research Group, 2021). Assuming that it will take about 20-50 hours to create an MRP (GSI Environmental, 2023), the estimated cost range to prepare an MRP is $4,077-$10,192.

Laboratory Costs

Table 11 presents estimated annual water quality monitoring laboratory costs by receiving waterbody. For waterbodies that require multiple tests for varying parameters, these costs were summed. Costs presented account for the four required sampling events per year. Annual costs range from $600 to $6,787.

Table 8: Per-Unit Annual Monitoring Costs by Receiving Waterbody

Waterbody	Annual Monitoring Cost
Alamitos Bay	$600.00
Los Angeles Harbor – Inner Cabrillo Beach Area	$600.00
Torrance Lateral Channel	$6,334.88
Dominguez Channel	$6,786.88
Dominguez Channel Estuary	$600.00
Dominguez Channel Estuary (below Vermont Avenue)	$5,162.88
Los Cerritos Channel	$1,567.50
Los Cerritos Channel (above Atherton Street)	$452.00
Los Cerritos Channel (below Atherton Street)	$600.00
Los Cerritos Channel Estuary	$600.00

Waterbody	Annual Monitoring Cost
Machado Lake	$2,584.00
Colorado Lagoon	$5,762.88
Long Beach Inner Harbor	$5,162.88
Los Angeles Inner Harbor	$5,162.88
Long Beach Outer Harbor (inside breakwater)	$5,162.88
Los Angeles Outer Harbor (inside breakwater)	$5,162.88
Los Angeles River Estuary	$5,162.88
San Pedro Bay Near/Off Shore Zones	$5,162.88
Los Angeles Harbor – Cabrillo Marina	$5,162.88
Los Angeles Harbor – Consolidated Slip	$5,162.88
Los Angeles Harbor – Inner Cabrillo Beach Area	$5,162.88
Fish Harbor	$5,162.88

Sources: Babcock Laboratories, Inc.; State Water Resources Control Board (2020)

Discussion

Using estimates from other municipalities and validating with the CNT Stormwater Calculator, staff has estimated that under Option 2, BMP capital costs would be about $285,000-$325,000/ac-in. Annualizing over 20 years with O&M, BMP costs would be $21,107-$24,069/ac-in. As these costs represent 1.3%-2.7% of average commercial and industrial rents, costs would generally not be onerous. Staff's estimated annualized costs are similar to most municipalities considered for this analysis, but roughly half the annual price per ac-in of Washington D.C.'s credit price. This is likely a reflection of the difference in size and types of parcels that participate in Washington, D.C.'s stormwater credit trading market compared to the size and types of parcels from municipalities that staff derived Option 2 estimates from, and which CII parcels are more similar to. Many of the credit buyers in Washington, D.C. are downtown parcels that are smaller in parcel area and have a high opportunity cost of land compared to other municipalities examined and CII parcels.

Implications for Option 1

Option 1 costs will depend on costs of Options 2 and 3. It can reasonably be expected that Permittees would choose the cheapest option, and it would not make sense to choose the Option 1 fee if it is higher than the BMP costs of the other options. With an estimate of Option 2 costs, it is possible to estimate potential annual revenues to watershed management groups under Option 1 by multiplying the cost per acre-inch by the number of impervious acres under the CII Permit under their jurisdictions. Assuming a theoretical scenario with no feasibility concerns at any CII sites, if the Option 1 in-lieu fee is set at the value of the average BMP cost, approximately half of Permittees would choose Option 1. However, real-life feasibility concerns would mean that for

more than half of Permittees, they would choose Option 1 because it is either cheaper or conditions at their site would not allow them to install sufficient BMPs to comply with Options 2 or 3. For example, the combination of BMPs that will need to be installed in order to comply with Option 2 will likely need to include some infiltration. However, there may be a contaminated groundwater plume at or near the site, therefore infiltration BMPs would be inappropriate to install. Given that industrial sites have historically been located in significant portions of the CII watersheds, this will likely be a common occurrence, hence a majority will likely choose Option 1, though it is unclear how large that majority would be. Furthermore, watershed management groups may choose to lower or raise the Option 1 in-lieu fee to encourage or discourage compliance through Option 1.

Implications on local economy

Stakeholders have raised concerns of the CII Permit's financial impacts on Permittees and consumers. However, there is uncertainty in the implications of this cost analysis on the local economy. Costs may be passed onto consumers, but it is difficult to definitively say whether that will happen in reality and at what magnitude. This will depend on a number of factors, including how responsive consumers are to price changes of good and services offered and the level of competition that Permittees face. Empirical research by Doyle and Sampantharak (2008) and Stolper (2016) found that consumers closer to borders where fuel taxes were charged faced lower price increases because they could more easily buy cheaper gas across the border. This could apply to consumers in the CII watersheds, as they can travel to neighboring watersheds not subject to the CII Permit. There is also a body of literature that finds that higher competition leads to lower costs passed down to consumers (Doyle & Sampantharak, 2008; Kopczuk, Marion, Muehlegger, & Slemrod, 2016; Miller, Osborne, & Sheu, 2017; Muehlegger & Sweeney, 2022). It is difficult to assess the level of competition that Permittees face, however.

Permittees will have increased costs that may or may not be passed onto consumers, but firms that engage in stormwater BMP design, installation, and maintenance will also collect more revenues. Some portion of workers in the stormwater sector will be local, as installation and maintenance necessarily must be done through manual labor. Depending on the share of Permittees that are local or outside companies, and depending on the level of costs passed onto consumers, there will be some level of resource transfer to local workers both from within the local economy and from profits that would have gone to outside companies.

As for overall societal benefits, if the BMPs implemented are mainly green infrastructure, which not only improve water quality but also can reduce urban heat, improve neighborhood aesthetics, mitigate flood risk, and improve recreational opportunities in the case of Option 1, then benefits to society can outweigh the costs (Diringer, Shimabuku, & Cooley, 2020). In addition, as a significant portion of Dominguez Channel Watershed is comprised of disadvantaged communities that have high Black and Hispanic populations, these communities stand to gain greater marginal benefits if projects are focused in their neighborhoods.

Conclusion

After reviewing BMP costs from various municipalities, staff arrived at an average annualized BMP cost of $21,107-$24,069/ac-in. Estimates were validated using CNT's Green Values Stormwater Management Calculator. Other municipalities have set in-lieu fees at the average price of onsite BMP implementation. If watershed management groups do the same with the Option 1 fee, they will likely collect revenues that would substantially contribute to funding regional projects. Although stakeholders have raised concerns about the CII Permit's impacts to the local economy, the impacts depend on various factors that are difficult to assess. However, some level of resources will be transferred to local workers who install and maintain BMPs, and increased funding for green infrastructure and regional projects will contribute towards improving water quality and providing other societal benefits, especially if located in disadvantaged communities.

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Appendix

Annualization calculation:

Capital Cost $/ac-in (low)	$285,000
Capital Cost $/ac-in (high)	$325,000
Annual O&M (low)	$4,275
Annual O&M (high)	$4,875
CC + 19 years O&M (low, undiscounted)	$366,225
CC + 19 years O&M (high, undiscounted)	$417,625

Annualized cost		$21,106.59		$25,920.37
Net present value		$345,122.97		$423,835.22
	Ac-in (low)		Ac-in (high)	
Year	Undiscounted	Discounted 2%	Undiscounted	Discounted 2%
1	$285,000.00	$279,411.76	$325,000.00	$318,627.45
2	$4,275.00	$4,109.00	$4,875.00	$4,685.70
3	$4,275.00	$4,028.43	$4,875.00	$4,593.82
4	$4,275.00	$3,949.44	$4,875.00	$4,503.75
5	$4,275.00	$3,872.00	$4,875.00	$4,415.44
6	$4,275.00	$3,796.08	$4,875.00	$4,328.86
7	$4,275.00	$3,721.64	$4,875.00	$4,243.98
8	$4,275.00	$3,648.67	$4,875.00	$4,160.77
9	$4,275.00	$3,577.13	$4,875.00	$4,079.18
10	$4,275.00	$3,506.99	$4,875.00	$3,999.20
11	$4,275.00	$3,438.22	$4,875.00	$3,920.78
12	$4,275.00	$3,370.81	$4,875.00	$3,843.90
13	$4,275.00	$3,304.71	$4,875.00	$3,768.53
14	$4,275.00	$3,239.92	$4,875.00	$3,694.64
15	$4,275.00	$3,176.39	$4,875.00	$3,622.20
16	$4,275.00	$3,114.11	$4,875.00	$3,551.17
17	$4,275.00	$3,053.04	$4,875.00	$3,481.54
18	$4,275.00	$2,993.18	$4,875.00	$3,413.28
19	$4,275.00	$2,934.49	$4,875.00	$3,346.35
20	$4,275.00	$2,876.95	$4,875.00	$3,280.74

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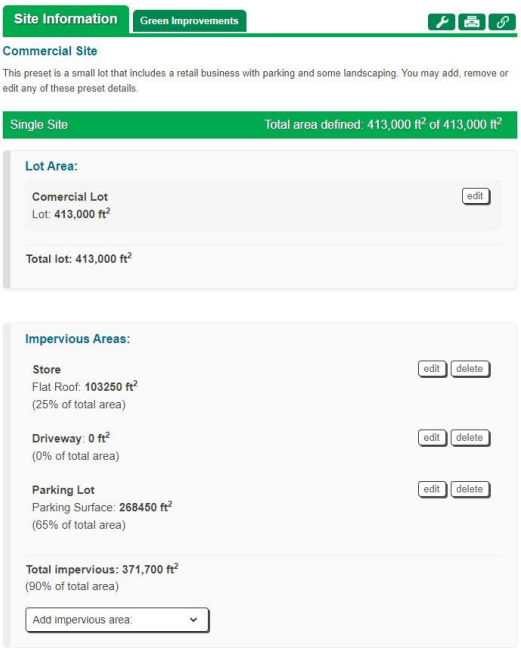
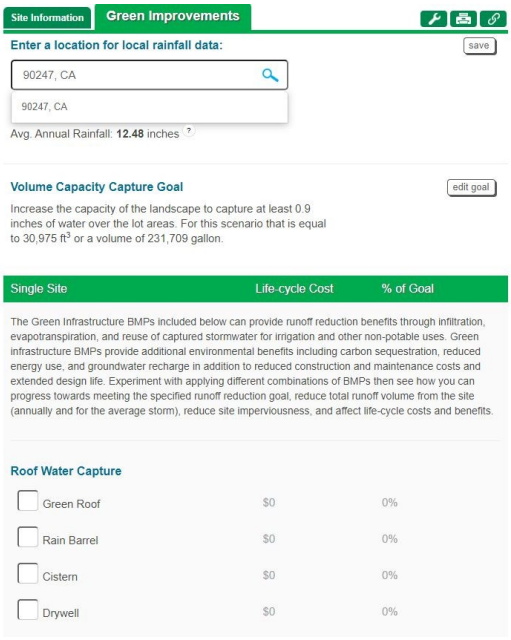
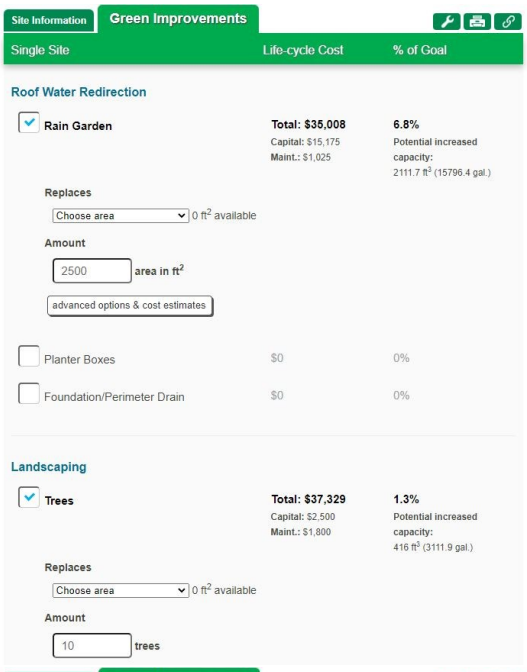
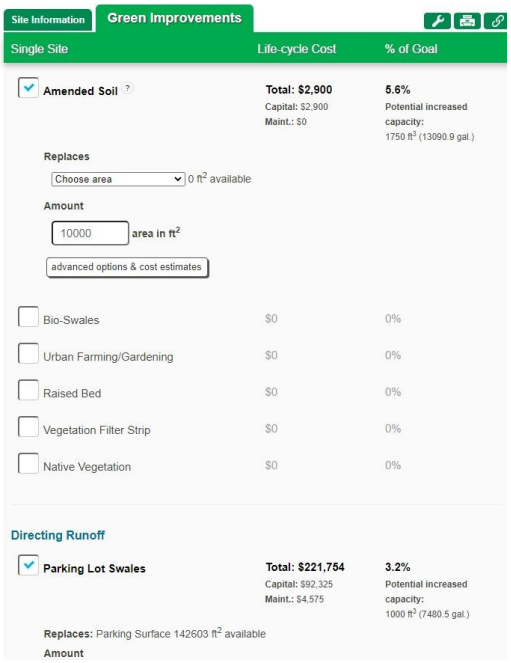
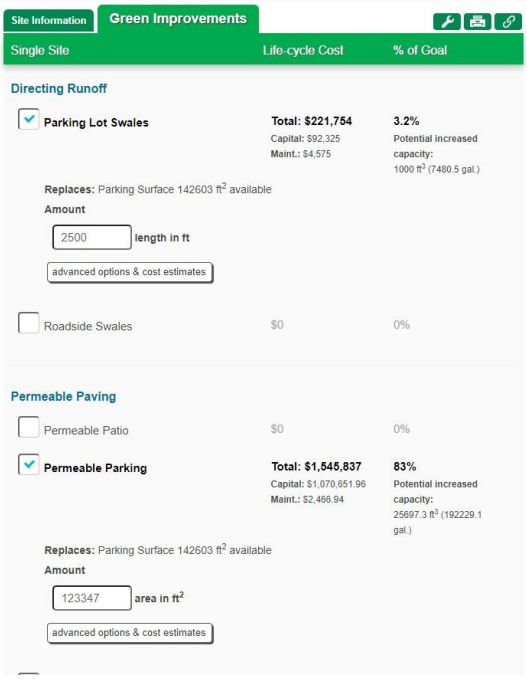
CNT Green Values Stormwater Management Calculator Input Values for representative commercial site in Dominguez Channel Watershed:



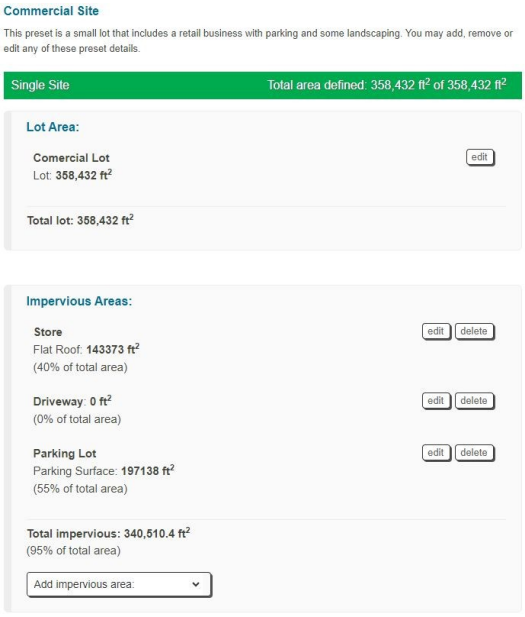


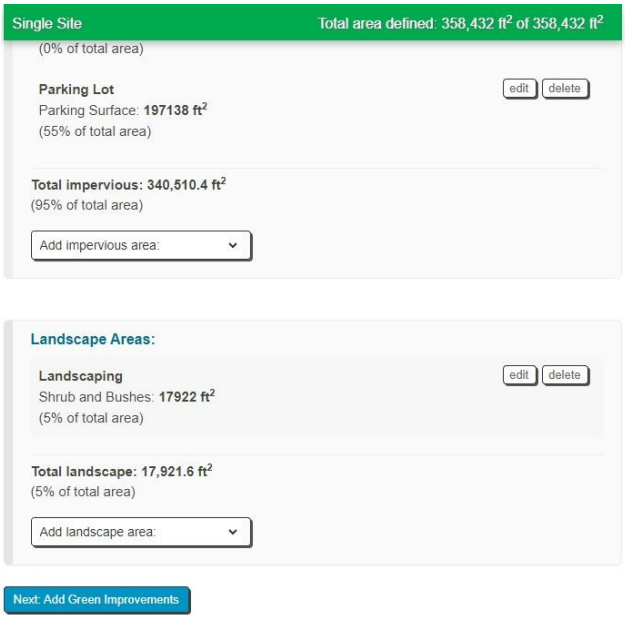

Site Information
Green Improvements
Single Site
Life-cycle Cost
% of Goal
Roof Water Redirection
Rain Garden
Total: $35,008
Capital: $15,175
Maint.: $1,025
6.8%
Potential increased capacity:
2111.7 ft³ (15796.4 gal.)
Replaces
Choose area
0 ft² available
Amount
2500
area in ft²
advanced options & cost estimates
Planter Boxes
$0
0%
Foundation/Perimeter Drain
$0
0%
Landscaping
Trees
Total: $37,329
Capital: $2,500
Maint.: $1,800
1.3%
Potential increased capacity:
416 ft³ (3111.9 gal.)
Replaces
Choose area
0 ft² available
Amount
10
trees

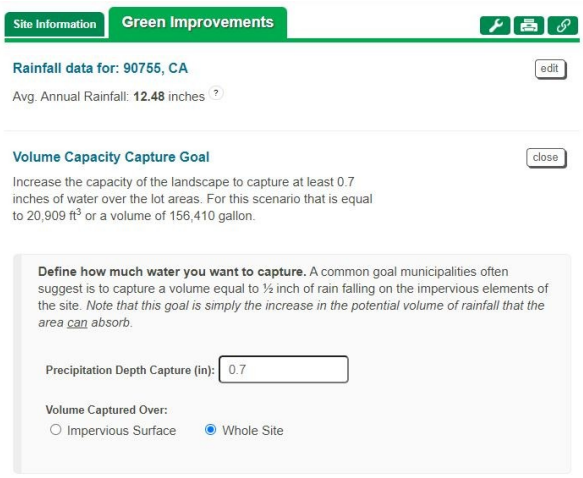

Site Information
Green Improvements
Single Site
Life-cycle Cost
% of Goal
Amended Soil
Total: $2,900
Capital: $2,900
Maint.: $0
5.6%
Potential increased capacity:
1750 ft³ (13090.9 gal.)
Replaces
Choose area
0 ft² available
Amount
10000
area in ft²
advanced options & cost estimates
Bio-Swales
$0
0%
Urban Farming/Gardening
$0
0%
Raised Bed
$0
0%
Vegetation Filter Strip
$0
0%
Native Vegetation
$0
0%
Directing Runoff
Parking Lot Swales
Total: $221,754
Capital: $92,325
Maint.: $4,575
3.2%
Potential increased capacity:
1000 ft³ (7480.5 gal.)
Replaces: Parking Surface 142603 ft² available
Amount

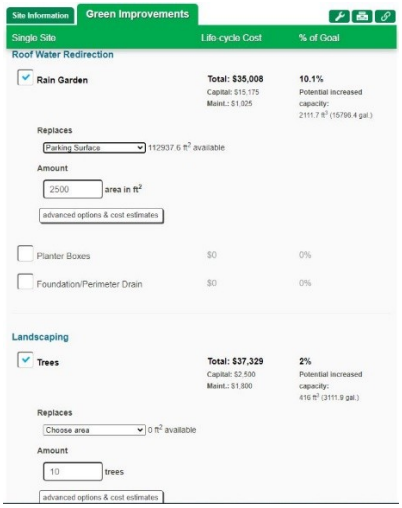

Site Information
Green Improvements
Single Site
Life-cycle Cost
% of Goal
Directing Runoff
Parking Lot Swales
Total: $221,754
Capital: $92,325
Maint.: $4,575
3.2%
Potential increased capacity:
1000 ft³ (7480.5 gal.)
Replaces: Parking Surface 142603 ft² available
Amount
2500
length in ft
advanced options & cost estimates
Roadside Swales
$0
0%
Permeable Paving
Permeable Patio
$0
0%
Permeable Parking
Total: $1,545,837
Capital: $1,070,651.96
Maint.: $2,466.94
83%
Potential increased capacity:
25697.3 ft³ (192229.1 gal.)
Replaces: Parking Surface 142603 ft² available
Amount
123347
area in ft²
advanced options & cost estimates

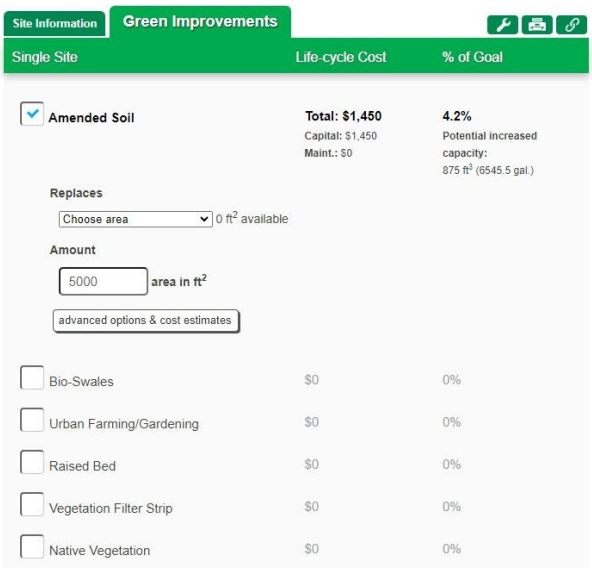
CNT Green Values Stormwater Management Calculator Input Values for representative commercial site in Los Cerritos Channel Watershed:

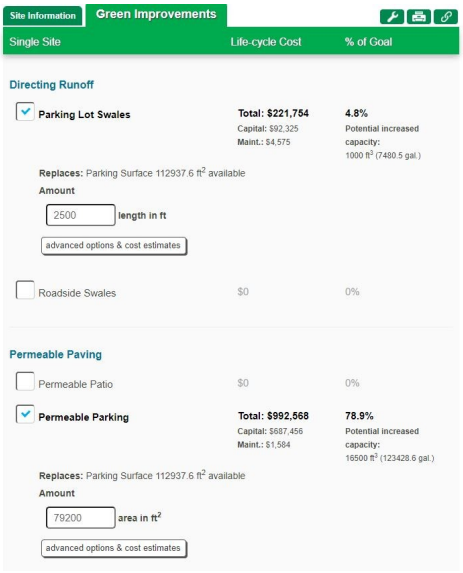









Site Information
Green Improvements
Single Site
Life-cycle Cost
% of Goal
Amended Soil
Total: $1,450
Capital: $1,450
Maint.: $0
4.2%
Potential increased capacity:
875 ft³ (6545.5 gal.)
Replaces
Choose area
0 ft² available
Amount
5000
area in ft²
advanced options & cost estimates
Bio-Swales
$0
0%
Urban Farming/Gardening
$0
0%
Raised Bed
$0
0%
Vegetation Filter Strip
$0
0%
Native Vegetation
$0
0%


Site Information
Green Improvements
Single Site
Life-cycle Cost
% of Goal
Directing Runoff
Parking Lot Swales
Total: $221,754
Capital: $92,325
Maint.: $4,575
4.8%
Potential increased capacity:
1000 ft³ (7480.5 gal.)
Replaces: Parking Surface 112937.6 ft² available
Amount
2500
length in ft
advanced options & cost estimates
Roadside Swales
$0
0%
Permeable Paving
Permeable Patio
$0
0%
Permeable Parking
Total: $992,568
Capital: $687,456
Maint.: $1,584
78.9%
Potential increased capacity:
16500 ft² (123428.6 gal.)
Replaces: Parking Surface 112937.6 ft² available
Amount
79200
area in ft²
advanced options & cost estimates