STORMWATER IN BEVERLY HILLS, CA

From Rancho Rodeo de las Aguas to 90210

KC Urban Stormwater Conference
February 2019
2028 Olympics in Los Angeles

- Infrastructure Investments revitalizing communities
- Job Creation
- Demonstration and Recognition
- Milestone Goal
Beverly Hills & Ballona Creek
BEVERLY HILLS GREEN CIP

Opportunities and Challenges
Project Objectives
Prioritization
Evaluation of Costs
Innovative Ideas & Lessons Learned
Opportunities and Challenges

Opportunities
• Iconic parks and boulevards, gardens
• Mildly sloped terrain
• Wide parkways (< 70-feet)
• Conservation Driven by Cost of Water

Challenges
• Iconic parks and boulevards, gardens
• High property values
• Limited infiltration potential (County requires 0.3 in/hour)
• Potential liquefaction when interbedded granular soils are present
Stormwater CIP Objectives

1. Identify Optimal Project Sites

2. Develop Concepts

3. Develop Plan to Satisfy EWMP Compliance Strategy
   Using LID, Green Street, Regional Projects, Institutional Control Measures to capture 87 acre-ft of stormwater runoff during the 85th percentile storm.

4. Budget and Prioritize CIP projects, 10-year Timeline
GSI Identification Process

- Key Data for Public Land
  - Existing Land Use, Topography, Surface Drainage
  - Stormwater Infrastructure
  - Soil Data
  - 2016 Roadway Condition Assessment Report
- Process identified distributed sites providing over 83 acre-ft potential stormwater capture
- Site Visits provided confirmation for each type
Hydrogeological Investigation Results

County Requirements for Stormwater Infiltration projects include:

- Infiltration rate > .3 inches per hour
- Invert of stormwater infiltration > 10' above groundwater
- Infiltration shall not increase potential for seismic settlement due to liquefaction
- Infiltration shall not increase potential settlement of structures on or adjacent to site

Results of hydrogeological investigations:

- Site infiltration rate: 0.01 inches per hour
- Site soils: interbedded granular soils subject to liquefaction
GSI Concepts for Beverly Hills

- Curb Extensions
- Sidewalk Vaults
- Median Bioretention
- Permeable Pavement
- Subsurface Storage
- Residential Programs
## Prioritization of Sites

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
<th>RELATIVE SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Volume Capture</strong></td>
<td>Unique value (AF) for each project site, multiplied by factor of ten (10).</td>
<td>Varies</td>
</tr>
<tr>
<td><strong>Multiple Benefit</strong></td>
<td>Overlap with Roadway Improvement Plan</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Overlap with Beverly Hills CIP Project (Parks, Water Mains, Land Acquisition, etc.)</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>No Roadway Improvements</td>
<td>0</td>
</tr>
<tr>
<td><strong>Property Ownership</strong></td>
<td>City-Owned Property</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Non-City Owned Property (Schools, Commercial/Business)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Proximity to Storm Drainage Infrastructure</strong></td>
<td>Yes</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
</tbody>
</table>

### Prioritization Objectives
- Maximize Stormwater Volume Capture
- Coordinate with City Projects to Minimize Disturbance
- Reduce Access Issues by utilizing City owned properties
- Proximity to Stormwater Infrastructure reduces additional infrastructure needs

### Prioritization Opportunities
- Complete Streets Plan (CIP No. 0100)
- Water Main and Hydrant Replacement Plan (CIP No. 0387)
- Land Acquisition (CIP No. 0647)
- Street Tree Removal (CIP No. 0089)
- Alley Repaving (CIP No. 0080)
- Stormwater Rehab Program (No. 0260)
Refining Cost Opinions

2016 Ballona Creek EWMP Cost Functions

<table>
<thead>
<tr>
<th>BMP CATEGORY</th>
<th>BMP TYPE</th>
<th>FUNCTIONS FOR ESTIMATING TOTAL COST†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Capital Cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Annual O&amp;M</td>
</tr>
<tr>
<td>LID and Green Streets</td>
<td>Bioretention with Underdrain</td>
<td>Cost = 17.688 (A) + 2.165 (Vt) + 2.64 (Vm) + 3.3 (Vu)</td>
</tr>
<tr>
<td></td>
<td>Permeable Pavement with Underdrain</td>
<td>Cost = 33.594 (A) + 3.3 (Vu)</td>
</tr>
</tbody>
</table>

EWMP Cost Development

- 2016 EWMP Cost Functions were used to establish planning level costs. These were developed by refining 2011 LACFCD Watershed Management Modeling System (WMMS) cost functions, developed with data from 2005-2009

CIP Cost Development

Typical Project Bid Tabs developed for each project category, providing:

- More detailed assessment of project components
- Project costs informed by current dollars
- Average unit costs for Los Angeles area
- Vendor costs obtained for specific items.
- Construction Contingency of 30%
- Additional 20% for Planning and Design

2018 Stormwater CIP: BMP Facility Refined Costs

<table>
<thead>
<tr>
<th>FACILITY TYPE</th>
<th>CAPITAL COST/GALLON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidewalk Vault</td>
<td>$7</td>
</tr>
<tr>
<td>Street Median Bioretention</td>
<td>$7 - $9</td>
</tr>
<tr>
<td>Curb Extension</td>
<td>$13</td>
</tr>
<tr>
<td>Permeable Pavement</td>
<td>$5 - $7</td>
</tr>
<tr>
<td>Subsurface Storage</td>
<td>$3 - $8</td>
</tr>
</tbody>
</table>
What changed? EWMP Compared to 2018 CIP

**Total Capital Cost (2016): $71.95M**

**Total Existing Project Cost (2018): $10.5M**

**Total Planned Capital Cost (2018): $121.6M**

**EWMP Proposed Strategies**
- 39 AF, $26.99M
- 37 AF, $40.88M
- 11 AF, $4.07M

**CIP Proposed Strategies**
- 39 AF, $46.8M
- 21 AF, $32.2M
- 16.8 AF, $42.6M
- 10 AF, $10.5M
CIP Project Capacity by Subwatershed, Project Summaries

CIP-47. This site is located along South Spalding Drive near Beverly Hills High School. The recommended solution is sidewalk biofiltration consisting of a total of 3 vaults adding 0.05 AF of volume capture. This project intersects a planned 2019 roadway project, presenting the opportunity for coordination. It is located adjacent to existing stormwater drainage infrastructure.

<table>
<thead>
<tr>
<th></th>
<th>Sidewalk Biofiltration</th>
</tr>
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<tbody>
<tr>
<td>Project Type</td>
<td></td>
</tr>
<tr>
<td>Opinion of Capital Cost (2018)</td>
<td>$116,400</td>
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<tr>
<td>Scheduled Implementation</td>
<td>2021</td>
</tr>
<tr>
<td>Captured Volume (AF)</td>
<td>0.05</td>
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<tr>
<td>Priority Score</td>
<td>91</td>
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<tr>
<td>Number of Vaults</td>
<td>3</td>
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<tr>
<td>EWMP Basin ID</td>
<td>105111</td>
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## CIP Implementation Summary

<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>FY 2019-2020</td>
<td>21</td>
<td>$32,200,000</td>
<td>$32,200,000</td>
<td>$966,000</td>
<td>$966,000</td>
<td>$966,000</td>
<td>$33,166,000</td>
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<tr>
<td>FY 2020-2021</td>
<td>9.16</td>
<td>$14,316,700</td>
<td>$14,746,200</td>
<td>$201,598</td>
<td>$207,600</td>
<td>$1,173,600</td>
<td>$15,919,800</td>
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<tr>
<td>FY 2021-2022</td>
<td>5.13</td>
<td>$10,501,300</td>
<td>$11,140,800</td>
<td>$201,860</td>
<td>$214,200</td>
<td>$1,387,800</td>
<td>$12,528,600</td>
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<tr>
<td>FY 2022-2023</td>
<td>6.91</td>
<td>$10,820,600</td>
<td>$11,824,000</td>
<td>$431,569</td>
<td>$471,700</td>
<td>$1,859,500</td>
<td>$13,683,500</td>
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<tr>
<td>FY 2023-2024</td>
<td>8.59</td>
<td>$11,635,800</td>
<td>$13,096,200</td>
<td>$349,074</td>
<td>$392,900</td>
<td>$2,252,400</td>
<td>$15,348,600</td>
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<td>FY 2024-2025</td>
<td>5.82</td>
<td>$9,264,800</td>
<td>$10,740,400</td>
<td>$189,374</td>
<td>$219,500</td>
<td>$2,471,900</td>
<td>$13,212,300</td>
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<tr>
<td>FY 2025-2026</td>
<td>3.33</td>
<td>$7,643,600</td>
<td>$9,126,900</td>
<td>$31,524</td>
<td>$37,600</td>
<td>$2,509,500</td>
<td>$11,536,400</td>
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<tr>
<td>FY 2026-2027</td>
<td>2.81</td>
<td>$7,926,600</td>
<td>$9,748,700</td>
<td>$105,572</td>
<td>$129,800</td>
<td>$2,639,300</td>
<td>$12,388,000</td>
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<tr>
<td>FY 2027-2028</td>
<td>4.78</td>
<td>$6,938,900</td>
<td>$8,790,000</td>
<td>$171,943</td>
<td>$217,800</td>
<td>$2,857,100</td>
<td>$11,647,100</td>
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<tr>
<td>FY 2028-2029</td>
<td>5.12</td>
<td>$8,603,100</td>
<td>$11,225,100</td>
<td>$258,509</td>
<td>$337,300</td>
<td>$3,194,400</td>
<td>$14,419,500</td>
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LID Ordinances: 1.80

Residential Program: 2.80, $1,725,900***

**Includes construction costs, contingency, engineering, and construction management.

**Escalated at 3% per year.

***Total Residential LID Program costs, assuming $194,100 annual expense escalated at 3% per year over 8-year implementation schedule.
Stormwater Capital Improvement Program Impact

Approximately **840** acres of impervious drainage area will be treated through various structural and non-structural BMP and LID strategies.

Approximately **25** million gallons of stormwater runoff will be captured and treated during each storm event greater than or equal to 1.1 inches, the 85th percentile storm event.
Innovative Ideas to Address Infiltration Challenges

Potential Options

- Harvesting and Direct Stormwater Reuse for Parks
- Treatment and Discharge back to the MS4
- Diversion to Sanitary Sewer

Diversion to sewer requires detaining stormwater volume for 24 hours after storm event, coordination with County
Lessons Learned

• Escalation of 2005-2009 Regional Cost Functions did not provide conservative planning estimates

• Cost efficiency of strategies varied

• Collaboration with neighboring municipalities to leverage funding and volume where it’s available.

• Strategies to Minimize Disruption
  • Roadway Improvement & Complete Streets Plan
  • Water Main and Hydrant Replacement Plan
  • Street Tree Removal
  • Alley Repaving
  • Stormwater Rehab Program

Cost Efficiency by Facility Type

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