



Stormwater Management Solutions

**carollo**
Engineers...Working Wonders With Water®



Water is ALL We Do. **And We Do ALL Water.**

As the largest water-focused engineering firm in the country, Carollo's leadership in potable water, wastewater, and water reuse is well known. But today's complex water challenges require creative solutions, and more and more communities are adopting a "One Water" philosophy in which stormwater plays a critical role.

Carollo develops innovative and comprehensive strategies for stormwater management aligned with basic tenets of holistic watershed management.

- **Recognize All Water has Value.** Stormwater should be infiltrated into groundwater and reused to improve receiving water quality.
- **Provide Multiple Benefits.** Our projects incorporate green infrastructure elements that benefit the local community.
- **Focus on Systems.** Our watershed-based approach recognizes complex interdependencies, leading to more sustainable solutions.

Core Services



Watershed Planning

Focused on understanding, maintaining, and improving hydrology and water quality in the natural and built environment.



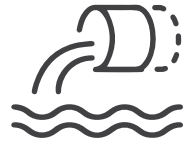
Green Infrastructure and Low Impact Development (LID)

Centered on mimicking pre-development hydrology to use natural systems for stormwater management.



Stormwater Treatment/Best Management Practices (BMPs)

Emphasis on managing the hydrology and water quality of urban runoff.

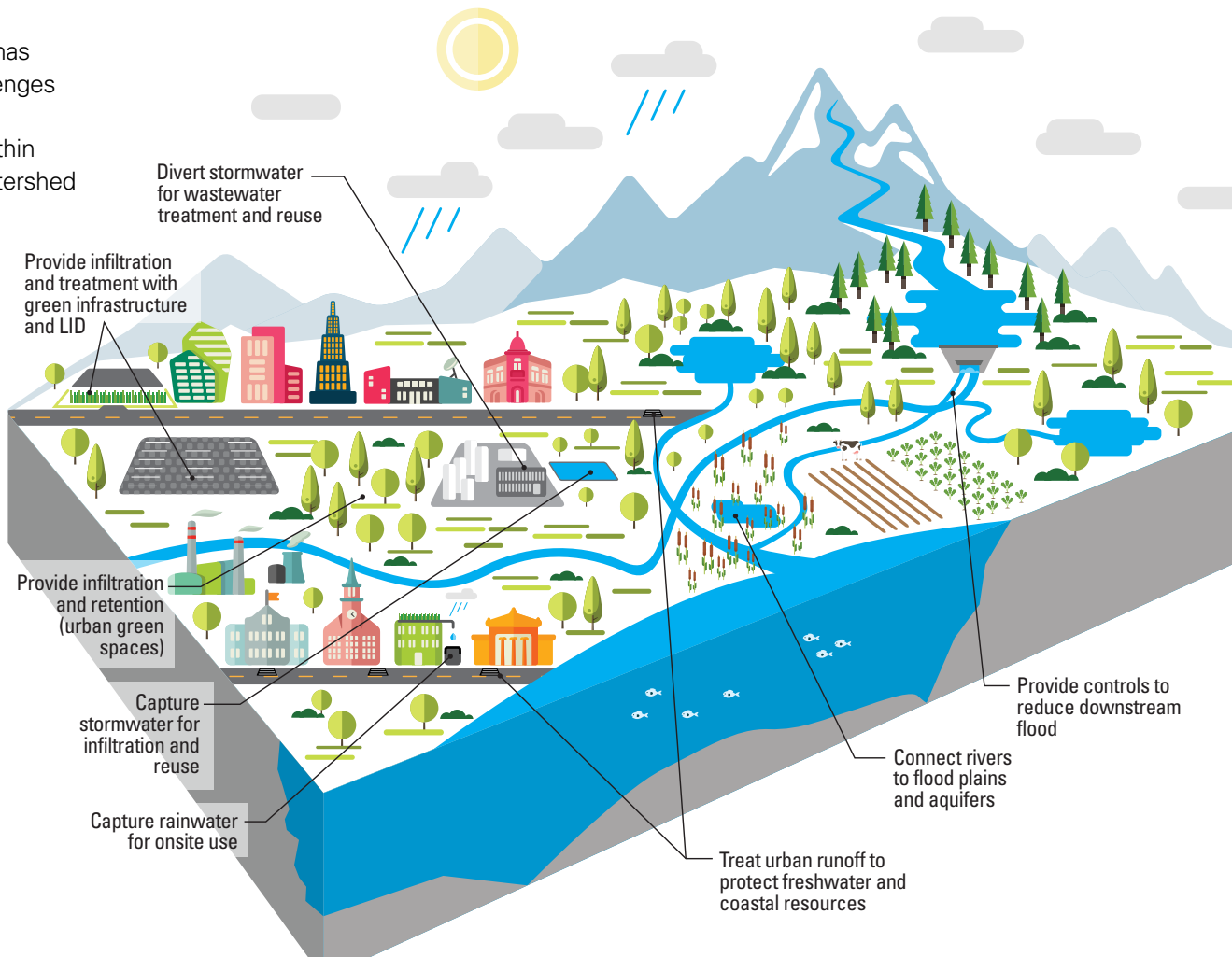


Stormwater Infrastructure

Structured to maintain, improve, and expand storm drain/sewer systems.

Watershed Opportunities

Each project has specific challenges that must be integrated within the larger watershed and system.



Innovative Tools

Carollo employs innovative tools, datasets, and analytics to optimize stormwater management solutions, all of which can be tailored to specific project and client needs.



National Experience

Stormwater Management Projects



Los Angeles, CA
Broadway Neighborhood Greenway | *Stormwater Green Infrastructure*



Houston, TX
Stormwater Evaluation Enhancement Tool (SWEET) | *Stormwater Resiliency Planning*



Omaha, NE
Miller Park Sewer Separation Modeling and Flood Mitigation



Palm Beach County, FL
Southwest Florida L8 Pump Station | *Stormwater Infrastructure*

Project Spotlight

Safe, Clean Water Program Los Angeles, CA

Los Angeles watersheds lose more than 100 billion gallons of water to the ocean annually—enough to supply more than 2 million people. Much of this loss is due to inadequate capture of stormwater runoff. In response, L.A. County initiated its \$300 million/year Safe, Clean Water (SCW) Program. Funded by tax revenues, approximately \$100 million of this program is managed annually by the Los Angeles Bureau of Sanitation (LASAN) to maximize city water quality, water supply, and community benefits, particularly in disadvantaged communities.

As program manager for LASAN's portion of the program, Carollo's role is to:

- Maximize LASAN's return on investment, meet SCW municipal program requirements, and achieve stormwater management goals.
- Prioritize and deliver hundreds of individual projects, including green infrastructure, green streets, infiltration/recharge systems, urban lake retrofits, and water capture and harvesting systems.
- Complete an asset management plan and CIP.
- Conduct project monitoring, tracking, accounting, and reporting.
- Comply with all applicable regulations, including L.A.'s progressive MS4 permit.
- Forecast budgets and revenue, and identify alternative financing.
- Facilitate stakeholder involvement.

Potential projects within each community are scored and prioritized based on how much stormwater they can capture and beneficially use. Projects include bioretention (below) and other green infrastructure/LID measures.



SAFE CLEAN WATER PROGRAM

4

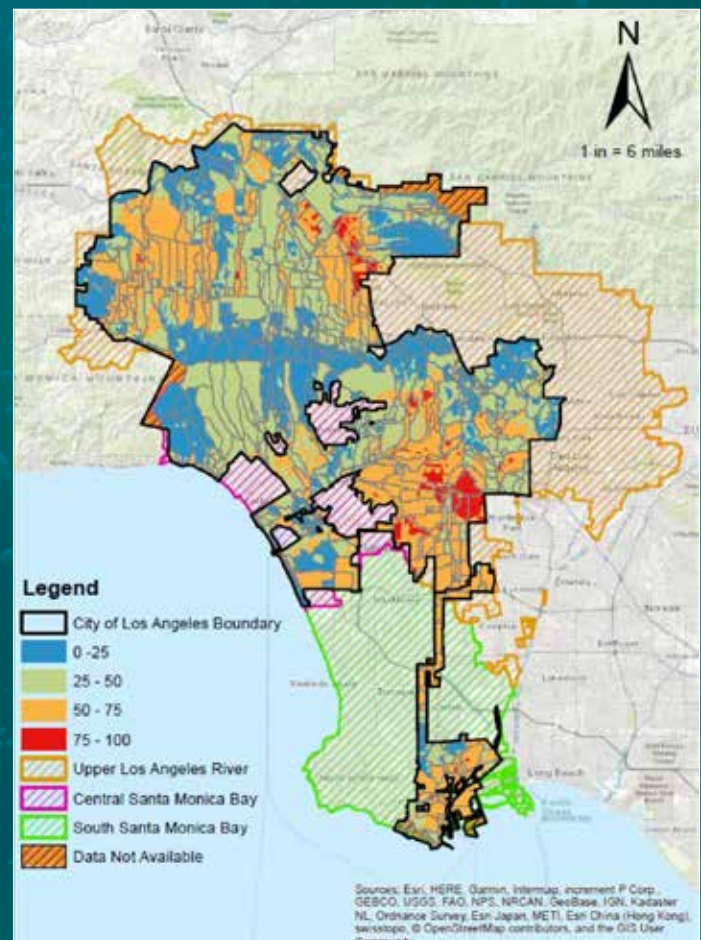
Major city watersheds impacted

100+

Potential city projects identified and prioritized

\$10-20B

Expected in new regional projects over the next 20 years



Project Success Stories

One Water LA Stormwater and Urban Runoff Facilities Plan

Los Angeles, CA

Los Angeles developed the One Water LA 2040 Plan to realize a strategic vision and manage all types of water resources as “One Water.” As prime consultant, Carollo led a team of 20+ subconsultants to help Los Angeles make multi-billion dollar water infrastructure decisions and create a more water-resilient and sustainable city. Work included developing a Stormwater and Urban Runoff Facilities Plan that:

- Identified multi-departmental agency collaboration opportunities to integrate stormwater solutions in a wide variety of sectors.
- Outlined strategies to comply with new stringent stormwater quality regulations and protect against drought and climate change threats.
- Prioritized more than 1,200 stormwater projects based on water quality, water supply, and flood mitigation benefits to achieve a stormwater capture goal of 150,000 AFY by 2035.



***First-of-its-kind
“one water” program,
providing an industry
benchmark for managing
water resources.***

Utilities Management Optimization Plan

Boynton Beach, FL

Frequent flooding under both normal and severe rainfall events has become a priority resource management concern for Boynton Beach. To address flooding concerns, Carollo developed a Utilities Management Optimization Plan that:

- Optimized alternatives through stormwater modeling using USEPA SWMM 5.0, along with GIS and LIDAR for model inputs.
- Evaluated cost, flood mitigation effectiveness, ease of construction, and likelihood of community acceptance.
- Recommended a new system consisting of LID and green infrastructure to collect and treat runoff prior to discharge into an existing 72-inch pipe.



***Maximum efficiency
in stormwater capture
to meet regulatory,
flood control, and
irrigation needs.***

Pure Water San Diego Stormwater Planning

San Diego, CA

San Diego’s Pure Water Program is a phased, multi-year program to provide a reliable, sustainable water supply through expanded reuse and advanced water purification. In response to reduced sewer flows resulting from prolonged drought and water conservation measures, Carollo designed upgrades to the North City Pure Water Facility. Work included assessing the feasibility of diverting stormwater into the existing sewer system as an additional water supply. This effort:

- Assessed stormwater capture potential.
- Evaluated wastewater collection, treatment, and infrastructure improvements required for effective stormwater capture.
- Identified relevant regulations and engaged regional stakeholders.



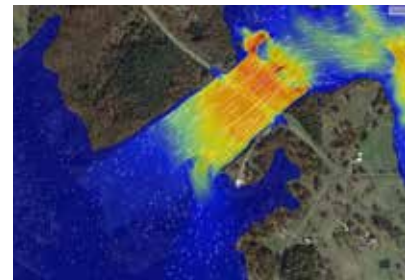
***Support for stormwater
harvesting to
supplement potable
supply.***

Emergency Spillway Stormwater Evaluation

Franklin County, TX

In 2015, the Lake Cypress Springs watershed experienced a historic flood event as a result of a 350-year storm. Lake waters rose to record levels and homes, boats, and boathouses, as well as utility infrastructure, sustained thousands of dollars in damages. As a result, Carollo conducted an emergency spillway elevation that:

- Produced three alternative designs to address extreme event conditions through 2-D modeling using HEC-RAS 5.0.
- Effectively illustrated the differences in the alternatives' responses to the modeled flood event.
- Supported decision making, concern mitigation, and public engagement with thorough technical information and visuals.



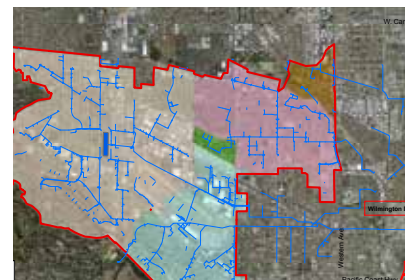
2-D modeling technical support for critical flood mitigation and community impact decisions.

Machado Lake Enhanced Watershed Management Plan

Torrance, CA

The Machado Lake nutrient TMDL sets stormwater phosphorus and nitrogen load reduction targets for communities in the Machado Lake watershed. Carollo developed a watershed management plan to address impairments in the City of Torrance's service area located in the watershed. The plan resulted in:

- Retrofit of structural BMPs through field reconnaissance and satellite imagery.
- Waste load allocation through a pollutant load modeling analysis with SWMM and PLAT.
- An optimized program of structural BMPs and LID/green infrastructure with associated implementation costs.



Innovative watershed plan incorporating the most cost-effective BMPs for water quality improvements.

Overflow Control Program

Kansas City, MO

As a result of an EPA consent decree to reduce SSO volume and frequency, Kansas City initiated a multi-million-dollar Overflow Control Program (OCP) that incorporated gray infrastructure improvements to reduce CSOs, and green infrastructure to benefit impacted communities and gain public support. Carollo's work on the program included evaluating the 280-acre Sewer Outfall 066/067 watershed, which involved:

- Modeling to assess separating the combined system into independent storm and sanitary systems to reduce CSOs in a downstream urban creek.
- Gray infrastructure, and a triple bottom line plus (TBL+) approach to incorporate green infrastructure for water quality treatment, urban habitat creation, and aesthetic improvements.
- Technical support from conceptual design through final design.



TBL+ analysis for a comprehensive understanding of alternative CSO benefits.

carollo.com

Points of Contact



Jim Rasmus, PE

Stormwater Services Lead
jrasmus@carollo.com



Heather Harris, PE

Texas Stormwater Lead
hharris@carollo.com



Carollo's commitment to the water industry has been a hallmark of the company since our inception in 1933. This single-minded focus allows us to deliver innovative water solutions, a collaborative environment, and exceptional client service. Our passion about ALL water systems means we strive to sustainably maximize the use and benefits of this precious resource.