4-29-2015

Introducing Green Infrastructure: Approaches to Prepare for San Diego's Changing Climate

San Diego Regional Climate Collaborative

Follow this and additional works at: https://digital.sandiego.edu/npi-sdclimate

Part of the Environmental Sciences Commons, and the Nonprofit Administration and Management Commons
INTRODUCING GREEN INFRASTRUCTURE:
APPROACHES TO PREPARE FOR SAN DIEGO’S CHANGING CLIMATE

APRIL 29, 2015
SAN DIEGO, CALIFORNIA | COUNTY OF SAN DIEGO ADMINISTRATION CENTER

WORKSHOP SUMMARY REPORT
Workshop Organizers

John Rozum, “Workshop Trainer” from the National Oceanic and Atmospheric Administration Coastal Training Program

Danielle Boudreau, Tijuana River National Estuarine Research Reserve
Laura Engeman, San Diego Regional Climate Collaborative
Basma Gaber, San Diego CivicSpark AmeriCorps Program

Additional Assistance Provided By:

Amber Pairis, San Diego Climate Science Alliance
Crystal Lee, San Diego Regional Climate Collaborative Intern
Stephen Bafumi, San Diego CivicSpark AmeriCorps Program

For more information and copies of the workshops presentations, go to: http://sdclimatecollaborative.org/project/green-infrastructure-in-the-san-diego-region/
# Table of Contents

Table of Contents ........................................................................................................................................... 3  
Participants ................................................................................................................................................... 4  
Workshop Agenda......................................................................................................................................... 5  
Overview ....................................................................................................................................................... 6  
Summary of Workshop Proceedings............................................................................................................. 8  
Benefits of Using Green Infrastructure To Prepare For Climate Change .................................................... 12  
Green infrastructure Case Studies .............................................................................................................. 14  
Workshop Definitions .................................................................................................................................. 19  
Funding Opportunities ................................................................................................................................ 22  
  California Proposition 1 Funding Opportunities ....................................................................................... 22  
  General Funding Opportunities .............................................................................................................. 24  
Additional Resources .................................................................................................................................. 27  
  Local Resources ....................................................................................................................................... 27  
  National Resources .................................................................................................................................... 27  
  Reports .................................................................................................................................................... 28
## PARTICIPANTS

### Organizers

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Rozum</td>
<td>Workshop Trainer, NOAA Coastal Training Program</td>
</tr>
<tr>
<td>Danielle Boudreau</td>
<td>Tijuana River National Estuarine Research Reserve</td>
</tr>
<tr>
<td>Laura Engeman</td>
<td>San Diego Regional Climate Collaborative</td>
</tr>
<tr>
<td>Basma Gaber</td>
<td>CivicSpark/AmeriCorps</td>
</tr>
</tbody>
</table>

### Speakers

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob</td>
<td>Consultant</td>
</tr>
<tr>
<td>Paul</td>
<td>San Diego International Airport</td>
</tr>
<tr>
<td>Patrick</td>
<td>City of Carlsbad</td>
</tr>
<tr>
<td>Crystal</td>
<td>City of Encinitas</td>
</tr>
</tbody>
</table>

### Attendees

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephen Bafumi</td>
<td>CivicSpark/AmeriCorps</td>
</tr>
<tr>
<td>Katie Baker</td>
<td>CRA, a GHD company</td>
</tr>
<tr>
<td>Timothy Barrett</td>
<td>Port of San Diego</td>
</tr>
<tr>
<td>Jerry Borja</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Ben Chandler</td>
<td>Haley &amp; Aldrich</td>
</tr>
<tr>
<td>Lorena Cordova</td>
<td>City of El Cajon</td>
</tr>
<tr>
<td>Eric Craig</td>
<td>City of El Cajon</td>
</tr>
<tr>
<td>Nick Deile</td>
<td>City of Encinitas</td>
</tr>
<tr>
<td>Berric Doringo</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Ana Eguiarte</td>
<td>Tijuana River National Estuarine Research Reserve</td>
</tr>
<tr>
<td>Joe Ellis</td>
<td>Marathon Construction</td>
</tr>
<tr>
<td>Joe Farace</td>
<td>County of San Diego</td>
</tr>
<tr>
<td>Nick Ferracone</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Peter Fogec</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Emily Guevara</td>
<td>The San Diego Foundation</td>
</tr>
<tr>
<td>Sumer Hasenin</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Sherri Howard</td>
<td>City of Carlsbad</td>
</tr>
<tr>
<td>Cara Lacey</td>
<td>San Diego County</td>
</tr>
<tr>
<td>Mo Lahsaie</td>
<td>City of Oceanside - Water Utilities Department</td>
</tr>
<tr>
<td>Crystal Lee</td>
<td>San Diego Regional Climate Collaborative</td>
</tr>
<tr>
<td>Genene Lehotsky</td>
<td>City of San Diego</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jose Lopez</td>
<td>National City</td>
</tr>
<tr>
<td>Anna Lowe</td>
<td>SANDAG</td>
</tr>
<tr>
<td>Michelle Martinez</td>
<td>SANDAG</td>
</tr>
<tr>
<td>Katie Matchett</td>
<td>CityPlace Planning</td>
</tr>
<tr>
<td>Eric Mosolgo</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Laurel Oolie</td>
<td>CivicSpark/AmeriCorps</td>
</tr>
<tr>
<td>Amber Pairis</td>
<td>CA Dept. of Fish and Wildlife/CA Landscape Conservation Cooperative</td>
</tr>
<tr>
<td>Jessie Powell</td>
<td>City of El Cajon</td>
</tr>
<tr>
<td>Carrie Purcell</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Nancy Richardson</td>
<td>County of San Diego</td>
</tr>
<tr>
<td>Ryan Rodman</td>
<td>City of Oceanside - Clean Water Program</td>
</tr>
<tr>
<td>Shelley Saitowitz</td>
<td>County of San Diego, Health &amp; Human Services Agency</td>
</tr>
<tr>
<td>Boushra Salem</td>
<td>City of Chula Vista</td>
</tr>
<tr>
<td>Nicole Salem</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Gary Smith</td>
<td>City of Oceanside</td>
</tr>
<tr>
<td>Andrew Spurgin</td>
<td>County of San Diego</td>
</tr>
<tr>
<td>Jonard Talamayan</td>
<td>City of San Diego</td>
</tr>
<tr>
<td>Merrill Taylor</td>
<td>Tetra Tech, Inc.</td>
</tr>
<tr>
<td>Claudia Tedford</td>
<td>CityPlace Planning, Inc.</td>
</tr>
<tr>
<td>Bill Valle</td>
<td>City of Chula Vista</td>
</tr>
<tr>
<td>Michael Van Antwerp</td>
<td>Port of San Diego</td>
</tr>
</tbody>
</table>

Workshop Agenda

April 29 2015
9:00 AM – 4:30 PM
County of San Diego
5500 Overland Avenue, San Diego, California
Training Room 120 (1st Floor)

Participants will be introduced to:

- Green infrastructure terms, concepts and approaches
- Ecological, economic, and societal benefits of using a green infrastructure approach and how it can help communities prepare for climate change impacts
- Using green infrastructure to prepare for a changing climate
- Innovative resources and partnerships for implementing green infrastructure

9:00 Participant Check-In

9:30 Welcome, Introductions and Goal of Workshop

9:55 Green Infrastructure Concepts and Principles - What is it?
John Rozum, NOAA Office for Coastal Management

10:10 Benefits of Green Infrastructure in Meeting Climate Preparedness Goals
Laura Engeman, San Diego Regional Climate Collaborative

10:40 Identifying San Diego Climate-related Hazards
Group Activity

10:55 Break

11:05 Approaches to Green Infrastructure
John Rozum, NOAA Office for Coastal Management

11:35 Identifying San Diego Green Infrastructure Projects and Opportunities
Group Activity

1:00 Identifying San Diego Green Infrastructure Projects and Opportunities
Group Activity Wrap Up

1:10 Green Infrastructure Projects - San Diego Regional Perspectives
- Parks, Open Space and Green Infrastructure
  Patrick McGarry, City of Carlsbad
- A Holistic Approach to Reducing Pollutants and Flooding
  Crystal Najera, City of Encinitas

2:20 Green Infrastructure Projects - San Diego Regional Perspectives (continued)
- Sea Level Rise, Stormwater and Water Recapture: A Systems Approach?
  Paul Manasjan, San Diego Airport Authority

2:50 Implementing Green Infrastructure: How to Integrate with Regulations and Overcome
- Group Activity (20 minutes)
- A GIS Tool For Alternative Compliance
  Bob Leiter (10 minutes)

3:30 Overcoming Barriers Panel Discussion
Panelists: Paul, Crystal, Patrick and Bob

4:00 Moving Forward: Next Steps
Group Activity

4:30 Wrap-Up

Presentations: www.sdclimatecollaborative.org/project/green-infrastructure-in-the-san-diego-region/
The “Introducing Green Infrastructure: Approaches to Prepare for San Diego’s Changing Climate,” workshop was designed to be an introductory overview of green infrastructure concepts and case studies, and how these approaches can be used to mitigate climate change impacts forecasted for San Diego County. It was also intended to bring together a diverse audience from various sectors and agencies in San Diego County and foster cross-sector dialogue about local practices of green infrastructure approaches, obtaining financing, and who has expertise that can help advance practices in the region.

A pre-workshop survey for registrants helped organizers to identify the expertise of the audience, as well as their general knowledge and experience with Green Infrastructure. The majority of attendees were from local agencies, and nearly two-thirds identified their expertise as that in planning or engineering. Organizers also conducted over 15 interviews with local agency staff and consultants during the development of the workshop to determine what entities were working on green infrastructure projects in the region, and how people were defining Green Infrastructure or these projects (i.e. Low impact development, stormwater BMPs). Based on these interviews, workshop organizers recognized that not only was there more than one definition for Green Infrastructure, but many in the San Diego region were not familiar with this term.

Through the workshop presentations, attendees were also provided with an overview of climate change impacts to the San Diego region, with special emphasis on precipitation and coastal storm changes that could impact stormwater infrastructure. Then, much of the workshop was focused on sharing San Diego Green Infrastructure practices and projects through working group sessions and local speakers.

Based on post-workshop evaluations, participants felt that they had gained a deeper understanding on Green Infrastructure and activities, and many of the participants felt that “hearing from others”, “learning about local case studies”, and “meeting others using green infrastructure” was very valuable in applying the concepts to their own local jurisdictions. Other comments also demonstrated an interest in next steps and additional assistance for
implementation including requests for “more information on financing”, “support for building upper management buy-in”, and “more details on tools for helping with regulatory compliance.”

To further support the application of green infrastructure approaches in San Diego County and build off of the momentum from this workshop, the organizers are looking to offer field trips of green infrastructure projects for department managers and elected officials, provide additional cross-departmental city trainings, and provide ongoing website and email announcements of funding, tools, and other resources.
MORNING

The workshop morning agenda focused on defining green infrastructure, identifying approaches and concepts, and looking at ways that green infrastructure can help to mitigate climate change impacts in the region. Several working sessions were also held for participants to identify climate hazards and green infrastructure projects in their jurisdictions and share these with other participants.

PRESENTATION: GREEN INFRASTRUCTURE CONCEPTS & PRINCIPLES – WHAT IS IT?

John Rozum, Coastal Land Use Specialist with the National Oceanic and Atmospheric Administration Office for Coastal Management, opened the workshop by providing a broad definition of green infrastructure as a concept combining principles of landscape architecture, landscape ecology, designing with nature, and conservation biology. He discussed its adaptability across broad spatial scales, within different urban developmental contexts, and with achieving multiple environmental, societal, and economic benefits. Mr. Rozum then identified successful green infrastructure in practice, highlighting projects that maximized multi-functionality, climate resilience, sense of place, and return on investment. Examples included community- and site-level approaches such as urban forestry coupled with additional wildland protection, low impact development practices, and mimicking natural or nature-based ecological defenses with hybrid structures. Finally, Mr. Rozum discussed how green infrastructure can be integrated into current planning processes and, in fact, enhance or inform projects working to meet conservation, hazard mitigation, or climate adaptation goals.
PRESENTATION: BENEFITS OF GREEN INFRASTRUCTURE IN MEETING CLIMATE PREPAREDNESS

GOALS

Laura Engeman, Manager of the San Diego Regional Climate Collaborative, kicked off an overview of expected climate change impacts to the San Diego region, including fewer rainfall events, but more intense storms when rainfall does occur. She highlighted that these climate impacts coupled with increasing costs of meeting new stormwater regulations, maintaining grey water infrastructure, and new state bond financing for water projects provide real opportunity for green infrastructure implementation. Ms. Engeman discussed how green infrastructure can be incorporated into community projects to lessen the stress on grey infrastructure by reducing and treating stormwater at its source while also delivering many other environmental, social and economic benefits. She highlighted urban parks as opportunities for alternative compliance to redirect flow from stormwater drains, recycle water for landscaping use, contribute to the beautification of neighborhoods, and improve habitat and air quality.

AFTERNOON

The afternoon agenda included three local speakers sharing lessons in planning and implementing green infrastructure projects. A fourth speaker then introduced a local GIS tool that was under development at the University of California San Diego (UCSD) to help local agencies identify alternative compliance options to meeting stormwater regulations, such as green infrastructure projects in adjacent properties, parks, or landscaping.

PRESENTATION: PARKS, OPEN SPACE AND GREEN INFRASTRUCTURE

Patrick McGarry, Civic Projects Manager from the City of Carlsbad, presented on the sustainable infrastructure that was incorporated into the building and design of the Carlsbad Alga Norte Community Park. By having two of the three fields built with synthetic (artificial turf), the water, chemical and run-off management costs have been reduced significantly. The park uses bio swales to treat its storm water on-site. The chlorine from swimming pool run-off is
dissipated by exposure to UV and the plants act as scrubbers. The park also uses recycled water for all irrigation of 32 acres, and a StormTreat© system at its dog park. The park has reduced its overall energy use by 30%, and has a 250kW producing solar array which makes it a net zero park. The sustainable infrastructure used in this project conserves water and energy, and helps to keep our water and air clean while providing healthy recreation for the community.

**PRESENTATION: A HOLISTIC APPROACH TO REDUCING POLLUTANTS AND FLOODING**

Crystal Najera, from the City of Encinitas Public Works Department, described a green infrastructure planning project that was funded through a Proposition 84 grant. The Cottonwood Creek Watershed Low Impact Development Retrofit Plan was designed to reduce pollutant loading and alleviate flooding problems in several adjacent neighborhood streets. The project began with watershed characterization and the prioritization of eight project sites, where the greatest benefit in flood and pollutant reduction could be found. These included a commercial center, a middle school, a park, and streets and intersections. Ms. Najera described the green infrastructure techniques to be used to improve these areas which included permeable pavement, bioretention systems, native landscaping, and curb cuts. The project also included the development of a training program on the principles of low impact development for engineers and planners, as well as a residential outreach pilot project which was used to identify barriers for installing LID around homes.

**PRESENTATION: SEA LEVEL RISE, STORMWATER AND WATER RECAPTURE: A SYSTEMS APPROACH?**

Paul Manasjan, Director of Environmental Affairs for the San Diego County Regional Airport Authority, presented on a whole systems approach to sea level rise, stormwater and water recapture. As a result of worsening storms and rising seas, the airport, whose entire footprint is within a former tidal zone, is taking the appropriate steps to prepare for these threats and create a more climate resilient airport. A rainwater use study was completed to improve the use and efficiency of rainwater. It found a potential cost savings of up to $300,000 annually from using rainwater for non-potable uses. The Airport’s Environmental, Facilities and Planning divisions have been and will continue to evaluate flood risk and develop a strategic
master drainage plan. They are working diligently to develop a comprehensive understanding of the hydrology of the airport, identify impacts of possible sea level rise and potential strategies to alleviate those impacts. Through this collaboration they hope to improve the airport’s resiliency, conserve water and save money in the future.

**PRESENTATION: HOW TO INTEGRATE GREEN INFRASTRUCTURE WITH REGULATIONS AND OVERCOME BARRIERS**

Bob Leiter, lecturer at the University of California, San Diego (UCSD) and former land use planner for multiple San Diego agencies, presented the UCSD Spatial Analysis and Communication Toolbox, which will “create a comprehensive set of models and tools for preparing, analyzing and visualizing alternative land use and transportation scenarios at the neighborhood scale” through GIS and the scenario planning software, CommunityViz. The Toolbox can be used for water quality planning and water resources planning. For the workshop, Mr. Leiter demonstrated the steps of a Phase 1 water quality model project, which included developing planning scenarios, applying control measures, and producing and comparing stormwater compliance cost estimates across multiple scenarios.

**WORKSHOP CONCLUSION**

The workshop concluded with an overview of financing opportunities to implement green infrastructure and then participants were offered several next step options to elect, or register for including: additional information on the GIS tool, local fieldtrips of green infrastructure projects, or additional training at their agency/jurisdiction.

*Workshop materials and handouts are provided in the following pages.*
<table>
<thead>
<tr>
<th>Benefits of using Green Infrastructure to Prepare for Climate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drought</strong></td>
</tr>
<tr>
<td>Decreased precipitation will stress already fragile local water supplies.</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td>Rising temperatures, a dwindling water supply, and a growing population will lead to increased local energy demands. Increased energy demand will increase CO2 emissions, which creates a feedback loop that will exacerbate climate change.</td>
</tr>
<tr>
<td><strong>Flooding</strong></td>
</tr>
<tr>
<td>More frequent extreme precipitation events will lead to more frequent:</td>
</tr>
<tr>
<td>• Localized flooding from rainfall overwhelming the capacity of urban drainage systems.</td>
</tr>
<tr>
<td>• Riverine flooding from river flows exceeding the capacity of river channels.</td>
</tr>
</tbody>
</table>

**Green Infrastructure & Climate Resilience**

- Infiltration-based GI practices (raingardens, green streets) allow rainwater to soak into the ground replenishing local groundwater reserves.
- Rainwater harvesting techniques (rain barrels, cisterns) can reduce demand for potable water for landscape irrigation in public parks and municipal buildings, or for non-potable uses such as toilet flushing and cooling systems.

- Lower building energy demands
  - Through shading, windbreak, and evapotranspiration, trees and vegetative cover can lower ambient air temperatures, lessening the need to turn up air conditioning in summer months.
  - Insulation provided by green roofs can reduce the amount of energy needed for cooling and heating.
  - Spend less energy managing water
  - By reducing flows into sewer systems, recharging aquifers, and conserving water, GI can help reduce municipal and domestic energy use to move water.

- GI can help reduce localized flooding by absorbing rainfall, preventing water from overwhelming pipe networks and pooling in streets or homes.
- A combination of GI, open space preservation, and floodplain management can complement gray infrastructure approaches in reducing the volume of stormwater that floods into rivers, reducing riverine flooding.

**Resources**

- Stormwater Capture Potential in Urban and Suburban California (Pacific Institute, NRDC, 2014)
- The Untapped Potential of California’s Water Supply (Pacific Institute, NRDC, 2014)
- Using Green Infrastructure to Reduce Flood Risks (TNC, 2014)
- Climate Ready Water Utilities (EPA, 2015)
### Integrating GI Practices to Address Multiple Impacts

By combining GI approaches in a project’s design, more than one climate impact can be mitigated.

**Example:** Planting native, drought-tolerant shade trees in and around green-infiltration based practices (roadside planters, bioswales) can help to reduce localized flooding while boosting roadside cooling and shading.

### Further Resources

- Reducing Climate Risks with Natural Infrastructure (TNC, 2014)
- The Value of Green Infrastructure for Urban Climate Adaptation (Center for Clean Air Policy, 2011)

### Works Cited

Information in handout from:
- Green Infrastructure for Climate Resiliency (EPA, 2014).

---

**Benefits of using Green Infrastructure to Prepare for Climate Change**

<table>
<thead>
<tr>
<th>Heat</th>
<th>Sea Level Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat waves will become more frequent, more severe, and longer. Rising temperatures will be exacerbated by the urban heat island effect, which occurs when cities replace natural land cover with pavement, buildings, and other artificial surfaces that absorb and retain heat.</td>
<td>Rising sea levels, coupled with storm surges and high tides will lead to more frequent coastal flooding, exacerbating shoreline erosion and increasing damage to property and infrastructure.</td>
</tr>
</tbody>
</table>

**Green Infrastructure & Climate Resiliency**

- Integration of GI into regular street upgrades and capital improvement projects (planting trees, green roofs) can provide both direct and ambient cooling effects.
- Living shorelines use plants, reefs, and natural barriers to reduce erosion and flooding, while simultaneously improving water quality, enhancing aquatic habitat, and sequestering carbon.

**Resources**

- Adapting to Urban Heat: A Tool Kit for Local Governments (Georgetown Climate Center, 2012)
- Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use (Georgetown Climate Center, 2011)
The following case studies from Southern California have been compiled through the efforts of CivicSpark member Basma Gaber and San Diego Regional Climate Collaborative intern, Crystal Lee, by engaging with local governments and through feedback from workshop participants. These select projects offer some inspiration and points of contact for current and future projects in Southern California. This is not meant to be a complete resource for green infrastructure projects. Additional resources for green infrastructure can be found in the Additional Resources section of this report.

**CONTENTS**

- A Avenue Green Street Pedestrian Pathway *(National City)*
- Bannock Avenue Neighborhood Streetscape Enhancements *(San Diego)*
- Cottonwood Creek Watershed Low Impact Development Retrofit Study *(Encinitas)*
- Elmer Avenue Green Street *(Los Angeles)*
- Kellogg Park Green Lot Infiltration Project *(San Diego)*
- Loma Alta Slough Vector Habitat Remediation Project *(Oceanside)*
- Mission Avenue Improvements Project *(Oceanside)*
- North Avenue Channel Protection Project *(Oceanside)*
- UCSD Keeling Apartments *(San Diego)*

**A Avenue Green Street Pedestrian Pathway**

**Location**: A Avenue between 8th Street (103 E 8th Street) and 16th Street (187 E 16th Street), National City

**Cost**: $3.5 million; Prop 84 Stormwater Grant, SANDAG SGIP Grant

**Status**: In progress, estimated completion 2016

**Contact**: City Engineering Department – (619) 336-4380

Website: [http://astreet.nationalcityprojects.com/](http://astreet.nationalcityprojects.com/)

This project will implement low-impact development (LID) infiltration measures along portions of A Avenue between E. 8th Street and Kimball Park to treat urban stormwater runoff prior to entering the storm drain system and discharging into Paradise Creek. Other improvements include enhanced crosswalks with pedestrian refuge islands and corner bulb-outs for traffic calming, pedestrian actuated flashing crosswalk signs, and high intensity signing and striping; new ADA curb ramps; walking paths through Kimball Park; and permeable pavers at the new gateway plaza. Interpretive signs and creek-themed art will teach how urban runoff connects citizens to the creek as it flows through bioretention swales down the street, across the park, and into Paradise Creek.
Bannock Avenue Neighborhood Streetscape Enhancements

**Location:** Clairemont Mesa Blvd, Dubois Dr, Manitou Way, Bannock Ave, Genesee Ave, Providence Rd, New Haven Rd, Appleton St Conrad Ave, Millwood Rd, Rebel Rd, Ensign St, Frink Ave, Lehrer Dr (an area around North Clairemont Community Park, 4421 Bannock Ave, San Diego, CA)

**Cost:** $1.8 million; Prop 84, Integrated Regional Water Management

**Status:** In progress

**Contact:** Claudia Abarca — cabarca@sandiego.gov

The goal of this project is to reduce stormwater pollutants and runoff volume into the Tecolote Canyon watershed using curb cuts to divert stormwater runoff into swales planted with many native plants including scarlet monkey flower, assorted native grasses, and Western Redbud trees. The curb cuts and swales also bring beauty and cooler temperatures to the local residents and pedestrians.

Cottonwood Creek Watershed Low Impact Development Retrofit Study

**Location:** Cottonwood Creek Watershed, Encinitas (study focused on four sites)

**Cost:** $274,115; Prop 84 Stormwater Planning Grant

**Status:** Study completed.

**Contact:** Christy Villa – cvilla@encinitasca.gov


The project consisted of a thorough watershed-wide analysis to identify opportunities for both public and private LID retrofit projects. The identified LID retrofit projects were prioritized based on those projects that achieve the most effective runoff volume and bacteria load reduction. The project resulted in several LID features, a comprehensive LID implementation plan for the watershed, and re-vegetation of the creek which provides flood control for 2,100 acres of watershed that flows into the park. A watershed scale outreach and training program was also developed to educate, promote, and incentivize the use of LID features on residential and commercial properties.
Elmer Avenue Green Street

- **Location:** 7700 Elmer Avenue, Los Angeles
- **Cost:** $2.5 million; Prop 13 State Water Resources Control Board, CalFed, Prop 50 Department of Water Resources
- **Status:** Completed, 2010
- **Contact:** Dr. Christopher Solek, Council for Watershed Health — chris@watershedhealth.org
- **Website:** [http://watershedhealth.org/programsandprojects/was.aspx?search=elmer](http://watershedhealth.org/programsandprojects/was.aspx?search=elmer)

A completed makeover involving one federal agency, one state agency, as many as six city agencies, three nonprofit groups and 24 homeowners. All 24 homes on the block donated some of their front yard closest to the street to the project. In return, all received new curving sidewalks, solar street lamps and gutters with curb breaks feeding rainwater from the street into bioswales. The urban forestry non-profit TreePeople also conducted community workshops to educate homeowners on how to tend to their new “high-performance landscapes”.

Kellogg Park Green Lot Infiltration Project

- **Location:** La Jolla Shores, 8257 Camino Del Oro, San Diego
- **Cost:** $982,000; City of San Diego Storm Waste CIP Funds
- **Status:** Completed 2011
- **Contact:** City of San Diego Engineering and Capital Projects Department

The Kellogg Park Green Lot replaced 18,000 square feet of asphalt concrete on the northern and southern ends of the lot with permeable pavers to capture large amounts of surface water. In addition, a vegetated bio-swale was constructed on the east side and a filter bed was added to the west side between the parking lot and beach walk to capture and infiltrate runoff.
Loma Alta Slough Vector Habitat Remediation Project

**Location:** Loma Alta Slough surrounded by the beach to the west, Buccaneer Beach Park to the south, the railroad to the east and the La Salina Wastewater Treatment Plant to the north, Oceanside

**Estimated Cost:** about $1 – 1.5 million

**Status:** In design feasibility phase

**Contact:** Gary Smith, City of Oceanside - GSmith@ci.oceanside.ca.us

The goal of the project is to eliminate the stagnant and ponded water along the northerly section of the Loma Alta Slough that provides ideal breeding habitat for mosquitos. The slough is an estuary that is routinely treated for mosquitos by the Department of Environmental Health during the summer as part of the County’s Vector Control Program. The project is expected to steepen and deepen the channel and replace invasive vegetation with native vegetation along the westerly edge, as well as create a wetland from Pacific Street to Coast Hwy on the northerly bank. Water quality will be improved, which then decreases the vector problem.

Mission Avenue Improvements Project

**Location:** Mission Avenue between Home Street (999 Mission Ave) and Coast Highway (202 County Highway S21), Oceanside

**Cost:** about $2.5 million

**Status:** Completed, 2014

**Contact:** Kathy Baker, Redevelopment Manager – kbaker@ci.oceanside.ca.us


Reconstruction of Mission Ave in Oceanside to treat stormwater and improve drainage through a series of bioswales, retention areas and various filtration options. Combined with sidewalk widening, street furniture, decorative street lights, and additional parking spaces, this project provided water quality benefits while improving pedestrian user experience, calming traffic, and accommodating future growth as part of their Walkable Communities Plan for the downtown area.
North Avenue Channel Protection Project

Location: Loma Alta Creek and North Avenue, Oceanside
Cost: about $1.3 million
Status: In beginning construction phase, estimated completion fall/winter 2016
Contact: Gary Smith, City of Oceanside - GSmith@ci.oceanside.ca.us

The continual erosion of the earthen embankment and the undermining of concrete headwalls and structures from stormwater flows within the channel make this project necessary. Given that the embankment supports, North Avenue, the City would like to preserve the integrity of the street with an embankment that is constructed using suitable materials to provide adequate formation support and long-term stability, while satisfying all regulatory agency requirements. A bioengineered panel will be installed, featuring alternative materials to concrete, such as rocks. Additionally, invasive vegetation will be removed and additional native vegetation, such as coastal sage scrub species, will be planted in the area outside of the creek.

UCSD Keeling Apartments

Location: UCSD, 10280 North Torrey Pines Road, Suite 470, La Jolla CA 92039
Cost: $46 million
Status: Completed, 2012
Contact: Carin Whitney, & James Timberlake, KiernanTimberlake – cwhiney@kiernantimberlake.com or timberlake@kiernantimberlake.com
Website: http://www.aiatopten.org/node/79

The UCSD Charlies David Keeling Apartments is a LEED Platinum project that manages 100% of onsite precipitation over ~158,000 square feet with a combination of bioswales, basins, weirs and conveyance channels. The basins, weirs, and planted swales manage the runoff throughout the complex, which is at the low end of the campus stormwater system, heightening the need for water management. The stormwater system was designed to control potential flooding, and can capture and slow-release water levels up to a 100-year storm event. During heavy rains, overflow from the green roof is directed to the courtyard retention basins, allowing sediment and pollutants to settle and filter out before water leaves the site. The stormwater is ultimately diverted to the arroyo bioswale, which filters pollutants and captures suspended sediments through plants, rocks, and soil.
To aid the understanding of the concepts presented at the workshop, the following selected definitions were provided to the attendees. There are a variety of definitions for each of these terms; however, the basic concepts remain the same.

**WHAT IS GREEN INFRASTRUCTURE?**

“Green infrastructure uses natural hydrologic features to manage water and provide environmental and community benefits. Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.” – U.S. EPA, “What is Green Infrastructure”

**WHAT IS NATURAL INFRASTRUCTURE?**

“Natural infrastructure (sometimes called green or sustainable infrastructure) is the interconnected network of natural and undeveloped areas needed to maintain and support ecosystems. They also provide a wide array of environmental, health and economic benefits such as mitigating climate change impacts and sustaining clean air and water. Our Natural Infrastructure has been declining – in quality and quantity – since the start of the industrial revolution. Government agencies and organizations faced with sprawl and other poorly planned development often conserve and restore land and waterways in a haphazard manner. This reactive approach to conservation ignores ecosystem processes. On the other hand, the Natural Infrastructure approach is proactive with an emphasis on connectivity to support longterm sustainability.” – U.S. EPA, “Natural Infrastructure”

“In its broadest application, natural infrastructure encompasses an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife." – U.S. EPA, “Natural Infrastructure and Green Communities: Linking Landscapes and Communities”
WHAT IS LOW IMPACT DEVELOPMENT?
“LID works to replicate natural hydrologic processes and reduce the disruptive effects of urban development and runoff, has emerged as an alternative approach that is complementary to conventional stormwater management measures including stormwater best management practices (BMPs) used to manage runoff. LID is based on many of the functional unit processes found in the natural environment to treat storm water runoff, balancing the need for engineered systems during urban development with natural features and treatment processes. By using the functional unit processes of the natural environment to provide stormwater treatment and control, and employing distributed controls to maximize water storage and re-use opportunities, LID techniques can enhance infiltration, percolation, and evapotranspiration to reduce adverse effects on surface waters, encourage groundwater recharge, and enhance water quality. LID methods offer great versatility in design, and can be incorporated into new urban development, redevelopment designs, and alternative transportation design with relative ease.” – City of San Diego Storm Water Division, San Diego Low Impact Design Manual

“Low impact development refers to a variety of both structural and unstructured stormwater management strategies that forego traditionally complex and costly grey infrastructure (pipes, sewers, etc.) for green space, native landscaping, natural hydrologic functions and other micro approaches.” – U.S. EPA, “Terminology of Low Impact Development”

WHAT IS URBAN GREENING?
“Urban greening programs usually include creation and maintenance of green space, such as parks planting and care of trees; and the creation of green infrastructure such as rain gardens and green roofs” – City of Pittsburgh, “Urban Greening: What is Urban Greening?”

“Urban greening refers to public landscaping and urban forestry projects that create mutually beneficial relationships between city dwellers and their environments.” – Capital Roots, “About Urban Greening”

WHAT ARE GREEN STREETS?
“Green streets can incorporate a wide variety of design elements including street trees, permeable pavements, bioretention, and swales. Although the design and appearance of green streets will vary, the functional goals are the same: provide source control of stormwater, limit its transport and pollutant conveyance to the collection system, restore predevelopment hydrology to the extent possible, and provide environmentally enhanced roads. Successful application of green techniques will encourage soil and vegetation contact and infiltration and retention of stormwater.” – U.S. EPA, Managing Wet Weather with Green Infrastructure: Municipal Handbook (2008)
WHAT IS URBAN FORESTRY?
“Urban forestry is the care and management of trees and all associated vegetation and related resources where people live, work, and play. Urban forestry is distinct from arboriculture in that it focuses on trees at a larger scale (e.g. neighborhood, city, or county) whereas arboriculture often deals with individual tree care or the management of small groups of trees. “Community trees and the urban forest they comprise are valuable assets...Healthy urban forests improve the livability of our cities, villages, and townships by cleaning air and water, conserving energy, enhancing property values, making our neighborhoods safer, abating noise, attracting business and customers, and enriching aesthetics.” – Ohio DNR Division of Forestry, “Urban Forestry”

WHAT ARE LIVING SHORELINES?
“Living Shoreline treatments address erosion in lower energy situations by providing long-term protection, restoration or enhancement of vegetated shoreline habitats through strategic placement of plants, stone, sand fill and other structural or organic materials. Living Shoreline treatments do not include structures that sever the natural processes & connections between uplands and aquatic areas.” – Center for Coastal Resources Management, “Living Shorelines: Why a living shoreline?”

“Living shoreline projects utilize a variety of structural and organic materials, such as wetland plants, submerged aquatic vegetation, oyster reefs, coir fiber logs, sand fill, and stone.” – NOAA, “Living Shorelines”
FUNDING OPPORTUNITIES

Below is a list of funding options for financing green infrastructure projects in the San Diego Region. This information was compiled by the San Diego Regional Climate Collaborative. More information can be found at our website: http://www.sdclimatecollaborative.org

CALIFORNIA PROPOSITION 1 FUNDING OPPORTUNITIES

Several funding sources are going to become available in 2015 that provide significant opportunity for funding green infrastructure projects from Proposition 1 funding. Information on the Prop 1 funds most relevant to Green Infrastructure are listed below. Information on all Prop 1 Programs can also be found here.

STATE COASTAL CONSERVANCY | Prop 1 Funding

Chapter 6 of Prop 1 allocates $100.5 million to the Conservancy for competitive grants for multibenefit ecosystem and watershed protection and restoration projects, Water Code Section 79731(j). The Conservancy expects to grant approximately $10 million each year for about ten years.

- RFP expected to be released in July/August 2015.
- Access the Draft Guidelines.
- Funding purposes include the following:
  - Implement watershed adaptation projects in order to reduce the impacts of climate change on communities and ecosystems.
  - Restore river parkways throughout the state, including but not limited to projects pursuant to the California River Parkways Act of 2004 and urban river greenways
  - Protect and restore rural and urban watershed health to improve watershed storage capacity, forest health, protection of life and property, stormwater resource management, and greenhouse gas reduction.
  - Reduce pollution or contamination of rivers, lakes, streams, or coastal waters, prevent and remediate mercury contamination from legacy mines, and protect or restore natural system functions that contribute to water supply, water quality, or flood management.

SAN DIEGO RIVER CONSERVANCY | Prop 1 Funding

Chapter 6 of Prop 1 allocated $17 million to the Conservancy for competitive grants for multibenefit ecosystem and watershed protection and restoration projects. The Conservancy works along the entire length of the San Diego River as well as all of the contributing area to the
San Diego River (its “watershed”) consisting of several streams, reservoirs, wetlands, the estuary and uplands.

- Access the Draft Guidelines and the Prop 1 Grant Application.
- Funding purposes include the following:
  ✓ Implement watershed adaptation projects in order to reduce the impacts of climate change on communities and ecosystems
  ✓ Protect and restore aquatic, wetland and migratory bird ecosystems including fish and wildlife corridors and the acquisition of water rights for instream flow
  ✓ Implement fuel treatment projects to reduce wildlife risks, protect watersheds tributary to water storage facilities and promote watershed health
  ✓ Assist in the recovery of endangered, threatened, or migratory species by improving watershed health, instream flows, fish passage, coastal or inland wetland restoration, or other means, such as natural community conservation plan and habitat conservation plan implementation

**DEPT. OF FISH AND WILDLIFE | Prop 1 Watershed Restoration Grants**

The CDFW is developing two new grant programs to fund multi-benefit ecosystem and watershed protection and restoration projects, as outlined in Prop 1. Relevant to San Diego, the Watershed Restoration Grant Program will focus on water quality, river, and watershed protection and restoration projects of statewide importance outside of the Sacramento-San Joaquin Delta. This grant program will invest $285 million in projects over a 10 year period.

- Access the Draft Project Solicitation and Evaluation Guidelines.
- The first proposal solicitation notice is expected for release in July of 2015. For more information:
  - Funding purposes include meeting the broad objectives of the following:
    ✓ Restoring/protecting coastal wetland habitat;
    ✓ Modernizing stream crossings, culverts, and bridges;
    ✓ Reconnecting historical flood plains
    ✓ Restoring river channels;
    ✓ Restoring or enhancing riparian, aquatic, and terrestrial habitat;
    ✓ Supplying water to wetlands;
    ✓ Improving local watershed management; and
    ✓ Removing sediment or trash.

**STATE WATER RESOURCES CONTROL BOARD | Prop 1 Stormwater Management**

Prop 1 allocates $200 million to the SWRCB for stormwater projects. The draft grant guidelines will be released in April 2016 and RFPs are expected to be solicited in July 2016.
**Ocean Protection Council | **Prop 1 Grant Program

Prop 1 Chapter 6, “Protecting Rivers, Lakes, Streams, Coastal Waters, and Watersheds”, allocates $30 million to the OPC for a competitive grant program for multibenefit ecosystem and watershed protection and restoration projects in accordance with statewide priorities, CWC §79730 and §79731(d). It is the intent of the OPC to fund projects that meet Prop 1 criteria and fulfill of the mission of the OPC to ensure that California maintains healthy, resilient, and productive ocean and coastal ecosystems for the benefit of current and future generations.

- Access the Draft Grant Guidelines.

**Dept. of Water Resources | Integrated Regional Water Management**

Prop 1 authorized the appropriation of $510 million in Integrated Regional Water Management funding for Implementation and Planning efforts to each hydrologic region of the State as identified in the California Water Plan. Of this $510 million, a portion will be devoted to assisting disadvantaged communities. $52 million has been allocated to the San Diego funding area.

- To stay up to date on the Prop 1 Grant Program, sign up to receive IRWM emails.

**General Funding Opportunities**

**U.S. Environmental Protection Agency (EPA) | Funding Website**

The EPA offers a number of grant and funding resources for green-infrastructure-related projects. For a complete list of available funding opportunities, visit the EPA website.

**EPA | Smart Growth Implementation Assistance**

This EPA program is an annual, competitive solicitation open to state, local, regional, and tribal governments (and nonprofits that have partnered with a governmental entity) that want to incorporate smart growth techniques into their future development.

**FEMA | Hazard Mitigation Assistance**

FEMA’s Hazard Mitigation Assistance grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages.

**State Water Resources Control Board | Clean Water State Revolving Fund**
The Clean Water State Revolving Fund (CWSRF) program offers low cost financing for a wide variety of water quality projects including those that address nonpoint source pollution, watershed protection, and municipal wastewater treatment. The program has significant financial assets, and is capable of financing projects from $1 million to $100 million. Since 2009, states have been required to spend a portion of CWSRF funds for “green” projects (green infrastructure, water or energy efficiency improvements, environmentally innovative activities) – currently 10% of CWSRF funding.

- **How to Use CWSRF To Fund Green Infrastructure FACT SHEET**

**Wells Fargo and National Fish & Wildlife Foundation | **ENVIRONMENTAL SOLUTIONS FOR COMMUNITIES GRANT**

This program funds highly-visible projects that link economic development and community wellbeing to the stewardship and health of the environment. Specifically, it supports visible and accessible demonstration projects that showcase innovative, cost-effective and environmentally-friendly approaches to improve environmental conditions within urban communities by ‘greening’ traditional infrastructure and public projects such as storm water management and flood control, public park enhancements, and renovations to public facilities.

- Up to $100,000 available, but average grant size is $40,000
- RFP release for 2016 grant cycle likely to be released in September 2015.

**U.S. Dept. of Housing and Urban Development | **COMMUNITY DEVELOPMENT BLOCK GRANT**

The Community Development Block Grant (CDBG) is a flexible program that provides communities with resources to address a wide range of unique community development needs. Each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available.

- Last year, more than $12 million was awarded to cities in San Diego County through the CDBG

**Surdna Foundation | **SUSTAINABLE ENVIRONMENTS PROGRAM**

The Sustainable Environments Program supports innovative stormwater run-off practices that capture and slowly release water into existing drains, pipes and sewers, or reuse rain water where it falls (sometimes called “green infrastructure”) instead of building expensive pipes and sewer tunnels.
• Access the instructions for how to apply.

**EPA | Urban Waters Small Grants**

The goal of the Urban Waters Small Grants program is to fund research, investigations, experiments, training, surveys, studies, and demonstrations that will advance the restoration of urban waters by improving water quality through activities that also support community revitalization and other local priorities.

• RFP for the 2016 fiscal year may be released in summer 2015
• The 2013/2014 year saw $2.1 million in grants awarded at $40,000 - $60,000 each

**CalFire Urban and Community Forestry | Cap-and-Trade Grant**

CalFire Urban and Community Forestry offered 5 Greenhouse Gas Reduction Fund (GGRF) grants last year. The grants supported urban tree planting projects, jurisdiction-wide tree inventory and urban forest mapping, analysis, and long-term management planning, urban wood and biomass utilization projects, projects to assist local entities purchase and improve unused lots, and projects for urban green infrastructure.

• See last year’s RFPs and more general information on the program.
• RFP for the 2016 fiscal year may be released in November 2015
• The 2013/2014 year saw $17 million in grants awarded through the five programs

**Wildlife Conservation Society | Climate Adaptation Fund**

Grants are awarded to projects that serve as innovative examples of on-the-ground efforts helping species and the ecosystems on which they depend adapt to changing climatic conditions across the United States. WCS is proud to support these groundbreaking and important projects that serve as models of best practice for future-smart and sustainable investments in restoration, land and water management actions, and science-based adaptation for many years to come.

• Potential funding source for developing coastal “living shorelines” to address coastal flooding and sea-level rise.
• RFPs for the 2016 year may be released in April 2016
ADDITIONAL RESOURCES

LOCAL RESOURCES

San Diego Regional Climate Collaborative | LINK

A webpage of Green Infrastructure resources for San Diego County

San Diego County

- LID Handbook | PDF
- “San Diego County: Assessment of water resources, green infrastructure, and utility rates” | PDF
- The County is also drafting a Green Streets Guidebook, expected for release fall 2015.

City of San Diego

- Low Impact Development Design Manual | PDF
- LID Project Location Brochure & Map | PDF

“San Diego, 2050 is Calling. How Will We Answer?” | LINK

A summary of climate change impacts expected for the San Diego region and examples of local leadership in addressing these impacts.

NATIONAL RESOURCES

Center for Watershed Protection | LINK

The Center for Watershed Protection, Inc. is dedicated to fostering responsible land and water management through applied research, direct assistance to communities, award-winning training, and access to a network of experienced professionals. As national experts in stormwater and watersheds, this organization takes a practical approach to complex, technical watershed management issues, providing collaborative leadership across disciplines and professions with a commitment to protect, restore, and enhance our streams, rivers, lakes, wetlands, and bays.

Green Infrastructure Center | LINK

The Green Infrastructure Center is a nonprofit organization founded in December 2006 to assist communities in developing strategies for protecting and conserving their ecological and cultural assets through environmentally sensitive decisions, lifestyles, and planning.
Low Impact Development Center | LINK

The organization provides information on low impact development methods, examples, and provides access to related publications and manuals.

National Low Impact Development Atlas | LINK

This atlas highlights innovative low impact development practices around the country. The 31 member programs of the National NEMO Network have compiled the projects highlighted on this site and will continue to add new projects as they become available. Each project balloon contains project specifics, a summary of the project, photos (when available), and links to more information.

U.S. Environmental Protection Agency (EPA) – Green Infrastructure | LINK

This EPA website provides basic information about green infrastructure along with tools, resources, funding opportunities, case studies, research, and reports on green infrastructure.

U.S. EPA – Green Infrastructure for Climate Resiliency | LINK

This EPA website includes information on how green infrastructure can be used to improve community resiliency against climate change, discussing tools and providing resources to help inspire climate action.

U.S. EPA Climate Ready Water Utilities Initiative | LINK

This initiative assists the water sector, which includes drinking water, wastewater, and stormwater utilities, in addressing climate change impacts. Through the development of practical and easy-to-use tools, EPA promotes a clear understanding of climate science and adaptation options by translating complex climate projections into accessible formats.

U.S. EPA Green Infrastructure: Cost-Benefit Resources | LINK

The EPA provides cost analyses and cost-benefit resources related to green infrastructure techniques for managing stormwater.

REPORTS

A Flood of Benefits: Using Green Infrastructure to Reduce Flood Risks | PDF

River floodplains present two great challenges to those seeking sustainable management of the world’s rivers: the need for actions to reduce flood risk and the need to maintain or restore the connections between rivers and floodplains. This report explains how the green infrastructure approach can be used to address both objectives.

Adapting to Urban Heat: A Tool Kit for Local Governments | PDF

This Urban Heat Tool Kit is designed to help local government reduce the effects of increased heat on their communities and citizens. It provides an analytic tool for policy makers to consider a combination of four-built environment changes, providing clear
criteria for selecting among these approaches. It also examines the roles government can play in pursuing these changes.

**Banking on Green** | [PDF](#)
---
This report focuses on the economic impacts caused by polluted urban runoff, also known as “stormwater,” a significantly growing source of water pollution in the United States. It’s not intended to be an academic or technical document, but instead to be an “easy to read” compendium of current experiences, analysis and knowledge.

**Economic Assessment of Green Infrastructure Strategies for Climate Change Adaptation: Pilot Studies in the Great Lakes Region** | [PDF](#)
---
This report aims to assess the economic benefits of green infrastructure as a method of mitigating the negative effects of extreme precipitation and flooding in the Great Lakes region and develop an analytical framework that can be used by other communities.

**Green Works for Climate Resilience: A Guide to Community Planning for Climate Change** | [PDF](#)
---
The intent of this guide is to provide an overview of the kinds of nature-based approaches that can be used to respond to and prepare for the impacts of climate change. It highlights common examples, profiles approaches that communities are already using, and describes strategies that communities can use to implement nature-based approaches.

**Managing Wet Weather with Green Infrastructure Action Strategy** | [PDF](#)
---
The purpose of this action strategy is to promote the benefits of using green infrastructure in mitigating overflows from combined and separate sewers and reducing runoff by encouraging the use of green infrastructure as prominent components of combined and separate sewer overflow plans, municipal stormwater programs, and nonpoint source and watershed planning efforts.

**National Fish, Wildlife, and Plants Climate Adaptation Strategy** | [FULL STRATEGY](#) | [HIGHLIGHTS](#)
---
This report provides effective steps to help natural resources and the communities that depend on them be more resilient and adaptable to a changing climate. These steps are the result of collaboration among federal, state, and tribal governments.

**Permitting Green Infrastructure: A Guide to Improving Municipal Stormwater Permits and Protecting Water Quality** | [PDF](#)
---
This guide is intended to be a resource for community and watershed advocates that provides clear examples of new stormwater permits that encourage or require low impact development or green infrastructure.

**Putting a Price on Riparian Corridors as Water Treatment Facilities** | [PDF](#)
---
This report describes a method of comparing the water quality treatment services of “brick and mortar” water treatment plants to those provided by naturally functioning riparian systems in order to help determine the economic efficiency of the construction of either, compared to their similar benefits.
Reducing Climate Risks with Natural Infrastructure | PDF

This report evaluates nine green infrastructure case studies in California. Each improves flood or coastal protection, provides habitat and preserves or restores the natural dynamics between water and land. Available data on the costs and benefits of each case are reviewed and, where possible, are compared with the costs and benefits of a gray alternative at the same site.

Stormwater Capture Potential in Urban and Suburban California | PDF

This analysis was developed to provide a comprehensive picture of the potential for stormwater capture to augment local water supplies. The analysis focuses on urbanized Southern California and the San Francisco Bay Area.

The Value of Green Infrastructure for Urban Climate Adaptation | PDF

This report provides information on the costs and benefits of green infrastructure solutions for bolstering local adaptation to climate change, and will evaluate the performance and benefits of a selection of green infrastructure solutions, using their range of technological, managerial, institutional, and financial innovations as a proxy for their value for climate adaptation.

The Untapped Potential of California’s Water Supply: Efficiency, Reuse, and Stormwater | PDF

This report examines the significant potential contributions available from four priority opportunities: improved efficiency in urban and agricultural water use, reuse and recycling of water, and increased capture of local rainwater.

Using Nature to Reduce Climate and Disaster Risk | PDF

This brochure provides information on how nature can play a role in reducing climate and hazard risks to society, the economy, and environment.