Green Streets

Sustainable Stormwater Solutions for Greener Communities and a Cleaner Bay

As the Bay Area continues to grow—through development of roads, revitalization of neighborhoods, and construction of new offices and homes—we must work to ensure that the relationship between communities and the estuary is strong, healthy, and mutually beneficial.

Are you a city council member, city manager, or city staff person? This brochure presents an overview of model Green Streets projects as a starting point for implementing green infrastructure in your community.

SAN FRANCISCO ESTUARY PARTNERSHIP

IMPROVING WATER QUALITY IN THE SAN FRANCISCO ESTUARY

The 2015 State of the Estuary Report, published by the San Francisco Estuary Partnership (SFEP), uses 33 indicators to measure ecological conditions in San Francisco Bay. While water quality has improved because of major sewage treatment investments, stormwater and urban runoff pollution remain a threat to the health of local waterways and the Bay.

Green infrastructure incorporates natural functions into engineered stormwater systems to protect water resources while enhancing the urban form and quality of life. Green infrastructure practices allow rainwater to sink into soils rather than being routed directly into the Bay—reducing the burden on aging, undersized storm drain systems. When green infrastructure is applied in the public sphere, it becomes part of what is considered a **Green Street**.

The San Francisco Bay Regional Water Quality Control Board's current Municipal Regional Stormwater Pollution Prevention Permit (MRP 2.0) requires jurisdictions to prepare green infrastructure program frameworks that are approved by their local governing body by 2017. By 2020, jurisdictions must have prioritized green infrastructure plans and funding mechanisms in place to achieve PCB (polychlorinated biphenyl) and mercury load reductions.

In two case study projects (the San Pablo Avenue Rain Gardens and the Serramonte Library Parking Lot), water quality monitoring showed the following **significant reductions in pollutant ranges**, demonstrating how green infrastructure can improve local water quality.

- PCBs: ↓ 44%–99%
- PAHs (motor oils, diesel, and asphalt): ↓ 90%–97%
- Copper: ↓ 62%–99%
- Lead: ↓ 51%–98%
- Nickel: ↓ 20%–79%
- Mercury: ↓ 18%–78%

The San Pablo Avenue Rain Garden study also showed reductions in pesticide concentrations, which offers promise in green infrastructure's ability to treat emerging contaminants of concern as new products are developed and create new environmental challenges.

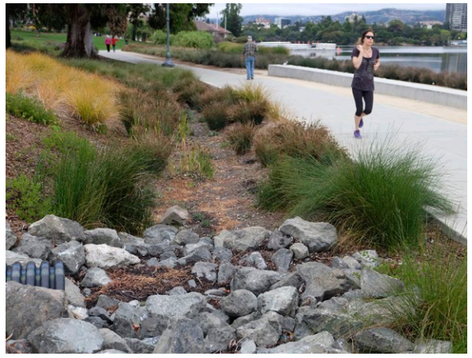
WHAT ARE GREEN STREETS?

When it rains, stormwater runs off the hard urban shell of rooftops and pavements, picking up a variety of contaminants, such as motor oils, heavy metals, pesticides, trash, and animal waste. This untreated water flows quickly into storm drain systems that lead to local waterways or the Bay. Pollutants and concentrated runoff volumes degrade water quality, diminish viable habitat for native species, impact health and recreational opportunities for shoreline communities, and threaten the region's precious natural resources.

Green Streets direct stormwater runoff to landscaped areas or to specially draining pavements, creating a network of green infrastructure elements. This infrastructure absorbs, filters, and breaks down pollutants carried by the stormwater before it enters storm drain pipes or infiltrates into native soils. This "Slow It, Spread It, Sink It" approach has a multitude of benefits, both to the public and to aquatic habitats.

Long-term Green Street benefits and outcomes include:

- Decreased stormwater runoff volumes and velocities:
  - » Reduced localized flooding
  - » Reduced erosion of in-stream habitats
- Increased urban greening:
  - » Climate change resilience
  - » Reduced impact of the heat island effect
  - » Improved air quality and public health
  - » Community walkability and livability
- Improvements in ecological health:
  - » Prevent stormwater pollution
  - » Protect water quality
  - » Protect aquatic and wildlife habitat quality



ARE GREEN STREETS AFFORDABLE?

It is difficult to quantify the co-benefits of Green Streets solely through an economic lens. Most often, Green Street projects have higher upfront costs due to added design considerations, capital costs, and early maintenance needs. However, as the planted systems mature, **the co-benefits tend to increase while operations and maintenance (O&M) burdens decrease**, including irrigation.

Green infrastructure costs vary by the type and scale of the element and project. A recent model Green Street project in the Bay Area reconstructed over a mile of Hacienda Avenue, a residential roadway in Campbell, for $5.24 million. The project transformed about 25% of the roadway into a linear public green space, including a bioretention system and more than 60 newly planted street trees. The isolated costs of the green infrastructure elements, roughly $900,000, equate to 17% of the total project costs. This proportion of green infrastructure costs falls within SFEP's current **expected range (12%–25%) of added green infrastructure costs** to a larger street improvement project. As these practices become more standard, green infrastructure costs are expected to decrease.

GREEN INFRASTRUCTURE ELEMENTS

Trees & Plants

In addition to providing shade, high-quality pedestrian experiences, and increased property values, trees and plants are essential in managing stormwater runoff. Their ability to reduce stormwater volumes and improve water quality is enhanced when gutter flows are directed to planting zones.

San Pablo Avenue Rain Gardens

The City of El Cerrito retrofitted two sites along San Pablo Avenue with rain gardens to detain and treat runoff. The pilot project used curb cuts to allow gutter flow into 19 heavily planted bioretention cells. The treated water then enters sub-drain pipes that connect to the existing municipal storm drains, which discharge into Baxter and Cerrito creeks before running into San Francisco Bay. Outcomes include:

- Improved walking experience resulting from 19 street trees and an array of rain gardens
- Design preserves the existing curb and parking lane
- Increased awareness about stormwater pollution through interpretive signage

Bioretention

Bioretention basins (or rain gardens) are vegetated depressions filled with special soils that drain quickly and filter out pollutants. Microbes and root systems work to uptake and break down contaminants. Bioretention is often paired with curb extensions that slow traffic and reduce crosswalk distances to improve pedestrian safety and walkability.

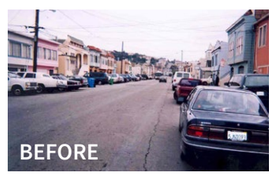
Permeable Surfaces

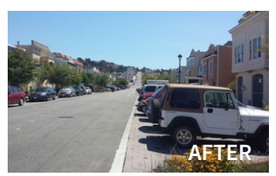
Permeable surfaces include special concrete and asphalt mixes as well as interlocking pavers. These surfaces, which function normally for driving and walking on, sit atop gravel layers that filter and hold tremendous volumes of stormwater.

Newcomb Avenue Model Block

As part of a comprehensive project to calm traffic, build community, and promote urban greening along Newcomb Avenue in the city's Bayview District, the City of San Francisco installed multiple green infrastructure technologies to improve drainage and water quality, and reduce runoff volumes into the city's combined stormwater/sanitary sewer system. The project included 13,052 square feet of permeable paving, 6,816 square feet of sidewalk landscaping, and 23 new trees. Outcomes include:

- Over 25% of impervious area converted, reducing runoff volume by 74%
- Decreased traffic volumes and speeds via added street medians and chicanes
- Community stewardship piloted through signed agreements for basic upkeep





GREEN STREETS

Green Streets incorporate multiple green infrastructure elements to maximize the infiltration of stormwater and the reduction of pollutants.

San Pablo Avenue Green Stormwater Spine

Albany, Berkeley, El Cerrito, Emeryville, Oakland, San Pablo & Richmond

This project will construct green infrastructure retrofits at seven sites in seven cities along San Pablo Avenue, a Priority Development Area corridor established by Plan Bay Area. The project designs vary, but each emphasizes planted bioretention systems to reduce runoff and add needed greenery to improve the pedestrian experience along this car-centric avenue. The project will include public-private partnerships, pilot new specific plan roadway layouts, and create public gathering spaces. Outcomes include:

- Over 8 acres of impervious surface runoff treated
- More than 80 trees planted
- Interpretive signage explaining Green Street principles

Hacienda Avenue Green Street Improvement Project

Campbell

As part of a comprehensive street improvement project (including 62 street trees, a road diet, street regrading, bike lanes, and streetlight upgrades), this three-quarter-mile road reconstruction project in Campbell added sidewalks and curb extensions with bioretention to decrease stormwater runoff rates and improve water quality. The City, opportunistically, coordinated upgrades of underground utilities while the street was reconstructed. Outcomes include:

- Improved community aesthetics and pedestrian facilities
- Early monitoring results showed complete elimination of runoff to storm drain inlets
- Traffic speed reduction
- Improved water quality

Serramonte Main Branch Library Stormwater Treatment Gardens

Daly City

This project in Daly City created extended rain gardens, or bioretention cells, around the public library, collecting and treating nearly 4 acres of runoff from the parking lot and surrounding areas. Outcomes include:

- Protection from seasonal flooding
- Reduction in pollution loads entering the storm drain
- Visitors learn about stormwater pollution prevention from multilingual interpretive signage (over 20,000 visitors a month)
- Library grounds offer outdoor walking trails and seating opportunities

Photo Credit: CMG Landscape Architecture

THE PATH TO GREEN STREETS

Is your city ready to incorporate green infrastructure into a project or program? Below are some of the ways you can plan for and implement green infrastructure projects of all scales. The SFEP website has links to these and other supporting resources, which include model ordinances, green infrastructure design tools, funding alternatives, and additional case studies. This information, as well as more details about the projects in this brochure, can be found at:

www.sfestuary.org/greenstreets

Planning

Developing a successful Green Streets plan or program requires policy guidance, tools and analytics, and coordination between multiple departments and stakeholders. The SFEP website has **model ordinance language** to integrate green infrastructure into existing public improvement programs—a good place to start for jurisdictions interested in building more sustainability into their road network. This website also includes links to **GreenPlan-IT**, a downloadable GIS-based green infrastructure planning tool that can help staff identify the most cost-effective suite of projects and prepare realistic budget estimates for decision-makers.

Funding

Many green infrastructure projects in the Bay Area have successfully leveraged federal, state, and regional funds. **Proposition 1 - Water Bond Grants,** the Sustainable Growth Council's **Urban Greening Program,** the EPA's **Water Quality Improvement Fund**, and the new Bay Area **Clean Water, Pollution Prevention, and Habitat Restoration Program (Measure AA)** are key funding sources in the near term. Jurisdictions planning ambitious integrated stormwater infrastructure upgrades, road rehabilitation, and Green Street programs may consider the **Clean Water State Revolving Fund**, which offers very low interest loans. Information about applying for these financial resources is available on the SFEP website.

Implementation

The integration of GI elements into planned capital improvement projects for local streets and sidewalks is an exceptional opportunity to address multiple issues both above and below the surface. The SFEP webpage links to design guidance resources for **green infrastructure site selection and sizing, plant recommendations, and operation and maintenance guidelines**. SFEP is working with partners to develop web-based GI tracking systems for project reporting and inspections that will align with municipal annual reporting requirements to the Water Board.

SAN FRANCISCO ESTUARY PARTNERSHIP

ABOUT SFEP

The San Francisco Estuary Partnership (SFEP) was established more than 25 years ago by the State of California and the US Environmental Protection Agency to prepare and implement a plan to better protect and restore the estuary. SFEP is one of 28 National Estuary Programs across the country. Today, SFEP manages over $100 million in regional restoration, water quality, and climate resiliency projects. The partnership is a program of ABAG. Visit us at:

www.sfestuary.org