

**SGI/Google
CO-4**

Site Location:

1600 Amphitheater Parkway
Mountain View, CA

Features:

- Green roof – entire ground level of complex including landscaped area is built above an underground parking lot
- Permeable pavement
- Native vegetation
- Multi-story buildings reduce building footprint
- Bike racks promote bicycle commuting

Stormwater Features:

- Reduced building footprint
- Natural treatment of runoff
- Transportation-related pollutant reduction
- Reduced velocity of runoff
- Reduced impervious surface area



The parking lot can be seen below the turf on the level above.



This tree in the parking lot grows up through an opening in the roof garden area. Trees and other vegetation help reduce the volume and velocity of rainwater.



This grassy rooftop area planted with trees reduces and provides some natural treatment of runoff.

**SGI/Google
CO-4 (cont.)**



Permeable pavement is used in this courtyard.



Permeable pavement and landscaped areas fill the courtyard on top of the parking structure.



Bike racks promote alternative transportation, perhaps providing easy access to other buildings on the campus.



Turf and gravel surrounds this pathway, providing an area for infiltration to occur.

**SGI/Google
CO-4 (cont.)**



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Permeable pavement and native vegetation surround this multi-story complex.

**Stanford University Medical Center
CO-5**

Site Location:

300 Pasteur Drive
Palo Alto, CA

Features:

- Roof garden above parking structure
- Street trees
- Native vegetation

Stormwater Benefits:

- Reduced impervious surfaces
- Natural treatment of runoff
- Reduces volume and velocity of runoff



Photograph courtesy of Joe Teresi (City of Palo Alto)

From this angle, it is possible to see the parking structure beneath the roof garden.



Photograph courtesy of Joe Teresi (City of Palo Alto)

This roof garden provides not only aesthetic benefits, but also a large area for stormwater infiltration to occur.



Photograph courtesy of Joe Teresi (City of Palo Alto)

At the end of the pathway, trees line the nearby street. The trees and the rooftop vegetation reduce the volume and velocity of stormwater runoff while providing for some natural treatment.

**University Medical Center
CO-5 (cont.)**



Photograph courtesy of Joe Teresi (City of Palo Alto)

The roof garden uses only one type of vegetation, which facilitates maintenance.

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Gap Corporate Headquarters
CO-6



Photograph courtesy of Paul Kephart (Rana Creek Habitat Restoration)

Aerial view of the building's roof garden shows the vegetative areas planted on top of the building made to appear like rolling hills.

Location:

901 Cherry Avenue
San Bruno, CA
Completed 1997
195,000 sq. ft.

Costs:

- Roof garden: approx. \$24/sq.ft. (\$1.6 million)²
- Total cost for building ~ \$60 million

Stormwater Benefits:

- Reduced impervious surface area
- Natural treatment of runoff
- Reduced volume and velocity of runoff

Features:

- 69,000 sq. ft. green roof blends in with surrounding hillside grasslands
- Native grasses and wildflowers
- Natural day lighting
- Raised floor for individually-controlled air delivery
- Preserved grove of native oaks
- 2nd most energy-efficient building in California (exceeds requirements by 30%)
- Received a Green Roofs Award of Excellence in 2003.

² Paul Kephart estimates that the costs for green roofs have dropped to roughly \$8-11 per square foot in the United States (pers. comm., November 12, 2003).

**Gap Corporate Headquarters
CO-6 (cont.)**

Project Details:

- It is estimated that the roof garden captures and stores about 70% of the rainfall. Other benefits include better insulation of the building, reducing the costs of heating and cooling, and mitigating the “heat island effect.”
- The roof irrigation system and annual mowing help mitigate fire risks. The roof is irrigated once per year and mowed by 10 gardeners armed with “weed eaters” in early July. The clippings are left on the roof to provide nutrients for the vegetation.
- The roof membrane has a 40-year warranty against leakage.
- GIS is used to map and manage the roof garden, allowing the building owner to index plants and locate utilities, such as water and electrical lines for maintenance purposes.
- The roof was planted using live plugs of six (6) different types of grasses (as opposed to hydroseeding or hand broadcasting) in six (6) inches of soil. The vegetation has grown to form a 5-inch mat of fibrous roots.

Lessons Learned:

- Gap estimates that the cost of the roof, HVAC, lighting, and other environmental features will be repaid in cost savings from reduced energy and maintenance bills within eight (8) years.
- The roof provides an effective acoustic barrier from the nearby San Francisco Airport.
- Cost-benefit study shows annual maintenance costs are about 70% of the costs for a conventional roof.

For more information, go to: <http://www.bayareacouncil.org/bp/bestpractices/bp185.html>

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Architect of Record/Interior Design:

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Landscape Architect:

Hargreaves Associates

Porter Drive CO-9

Site Location:

3150 Porter Drive
Palo Alto, CA

Features:

- Vegetated swale
- Native vegetation

Stormwater Benefits:

- Natural treatment of runoff
- Reduced volume of runoff
- Reduced velocity of runoff
- Reduced pesticide requirements
- Reduced directly-connected impervious area (DCIA)



Photograph courtesy of Joe Teresi (City of Palo Alto)

The bioswale, shown before landscaping had fully matured, was planted using native vegetation along the banks. Check dams extend the retention time, allowing for additional infiltration (see arrows).



Photograph courtesy of Joe Teresi (City of Palo Alto)

The same bioswale, after landscaping has become established, appears natural and aesthetically pleasing.

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Designer Contact:

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Porter Drive CO-9 (cont.)

Site Location:

3170 Porter Drive
Palo Alto, CA

Features:

- Pervious pavement
- Vegetated swale

Stormwater Benefits:

- Natural treatment of runoff
- Reduced impervious surface area
- Reduced directly-connected impervious area (DCIA)



Photograph courtesy of Joe Teresi (City of Palo Alto)

The parking area, adjacent to heritage oak trees, is made of permeable pavement which decreases the amount of impervious surface area at the site.



Photograph courtesy of Joe Teresi (City of Palo Alto)

The edges of the vegetated swale are flush with the parking lot, so that runoff can drain into the swale.



Photograph courtesy of Joe Teresi (City of Palo Alto)

This is a close-up photograph of the permeable pavers in the parking stalls.

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**Porter Drive
CO-9 (cont.)**

Site Location:

3180 Porter Drive
Palo Alto, CA

Cost of Ecostone Pavement:

- \$9-15/s.f. for installation

Features:

- Unit pavers of Ecostone on sand
- Vegetated swale

Stormwater Benefits:

- Reduced impervious surface area



Photograph courtesy of Joe Teresi (City of Palo Alto)

This photo shows the construction of the permeable pavement in the parking area. The spaces between pavers are filled with sand instead of grouted, allowing infiltration through the pavement. The concrete border (see arrow) protects the asphalt from water damage.

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**Hillview
CO-10**

Site Location:

3300 Hillview
Palo Alto, CA

Features:

- Parking lot biofilters
- Commercial building courtyard with pervious pavement
- Courtyard also serves a buffer between multi-story building and the creek behind
- Section of parking lot drains to swale of native plants between courtyard and riparian area
- Buildings set back from riparian corridor

Stormwater Benefits:

- Reduced impervious surface area
- Natural treatment of runoff
- Reduced runoff velocity
- Setback from riparian corridor
- Reduced directly-connected impervious area (DCIA)



Pervious pathway placed through the courtyard allows easy access for visitors as well as drainage areas for stormwater. The creek runs behind the trees towards the back. Between the trees and the benches is a swale of native vegetation that treats water from the parking lot.



The parking lot design incorporates biofilters to filter and infiltrate runoff before entering the storm drain. Concrete edging protects the asphalt parking lot from water damage.

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Basking Ridge SF-1

Site Location:

Basking Ridge Avenue
San Jose, CA

Features:

- Two detention ponds
- Wetland vegetation
- Parking pullouts and narrower streets

Stormwater Benefits:

- Natural treatment of runoff
- Reduced velocity of flows
- Reduced impervious surface area



Photograph courtesy of Sheila Tucker (BASMAA)

Parking pullouts allow narrower streets that require less land area and provide more space for trees and grass. These landscaped areas reduce the volume and velocity of rainwater and maximize infiltration. Properties on narrow streets with tree-lined landscapes typically have higher property values. The use of narrow streets also reduces construction costs.

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Photograph courtesy of Sheila Tucker (BASMAA)

Stormwater runoff is directed into the detention pond which temporarily holds the water, allowing for settling of sediments and pollutant removal to occur. The system releases runoff slowly to reduce downstream peak flows.



Photograph courtesy of Sheila Tucker (BASMAA)

Wetland vegetation helps to remove dissolved metals and nutrients. A walking trail bordering the pond on Dana Court demonstrates how a stormwater treatment device can benefit the environment and be attractive, thereby enhancing the neighborhood character.

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Note: Some text courtesy of Sheila Tucker (BASMAA)