

# ECO-FRIENDLY PARKING LOT DEMONSTRATION SITE

## Parking Plaza #5, Menlo Park

(bounded by Santa Cruz Ave., Crane St., Menlo Ave., and Evelyn St.)

This site is one of two sites that comprise a San Francisquito Watershed Council project<sup>1</sup> to demonstration materials and techniques that reduce urban runoff. Urban runoff – the rainfall that flows off of rooftops, road, and parking lots – washes pollutants into creeks and increases creek bank erosion. The two techniques used at this 1-acre public parking lot replace 5,500 square feet with permeable concrete and direct runoff from adjacent asphalt and rooftops to landscaped strips (biofilters) that filter out pollutants as water sinks into the ground. For more detailed information on the project and techniques used, see [www.sanfrancisquito.org/runoff](http://www.sanfrancisquito.org/runoff).

### SUMMARY OF TECHNIQUES USED

Technique	Dimensions	Total cost <sup>(a)</sup>	Unit cost	Average annual runoff reduction <sup>(b)</sup>
(1) Permeable concrete	5,500 square feet	\$55,000	\$10.00 / sq. ft.	100,000 gallons
(2) Biofilter	1,400 square feet	\$39,000	\$27.86 / sq. ft.	185,000 gallons
TOTAL		\$94,000		285,000 gallons

Notes:

(a) Includes labor, materials, equipment rental, and dump fees. Does not include cost of asphalt portions of the lot (~31,000 square feet).

(b) Based on estimated infiltration of at least 10 inches per year (average annual rainfall is 18 inches). Future monitoring data will refine this estimate.

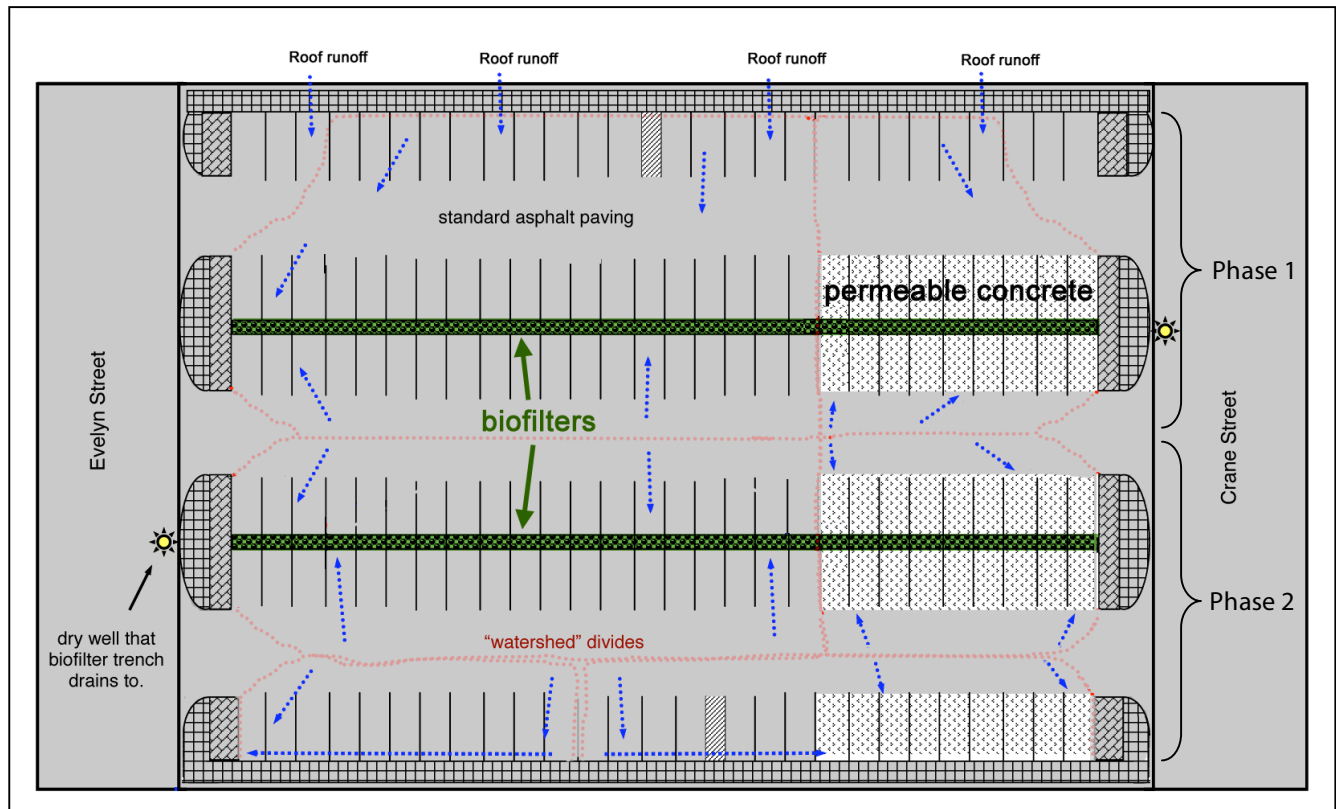


Figure 1. Site diagram (post-project)

<sup>1</sup>Funding for this project has been provided in full or in part through an Agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto for the implementation of California's Nonpoint Source Pollution Control Program. The contents of this document do not necessarily reflect the views and policies of the SWRCB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

## DETAILED INFORMATION BY TECHNIQUE

### (1) Pervious concrete

Material	Dimensions, description
Pervious concrete	5,500 sq. ft., 6" deep
Permeable base	3/4" crushed rock (ASTM #57), 6" deep

**Benefits:** 5,500 square feet of asphalt replaced, absorbs runoff from 5,800 square feet of asphalt and 6,100 square feet of rooftop. No ponding has been observed (storage capacity of concrete and base rock has not been exceeded) from 10/06 to 3/07. Measured infiltration rate of 38 inches/hour on 5/18/06.

**Additional notes:** Pervious concrete is essentially the same as conventional concrete minus the sand (coarse aggregate, cement, water, admixtures). It derives its strength (ranges from 500 – 4000 psi, with a typical value around 2500 psi) from its low water : cement ratio and is very sensitive to water content. Evaporation retardant and curing compound used during installation. There are several methods to finish the concrete surface including crossing rolling and use of a vibratory tamper on plywood. New surface finishing methods are being developed . Requires 7-10 days to cure.

**Lessons learned:**

- Since use of pervious concrete is still relatively new in the Bay Area, it is critical that the project owner (a) be familiar with the product and know what a successful installation looks like, and (b) make use of existing resources in the design of the project. During the course of this project, Andy Youngs of the California Nevada Cement Promotion Council provided invaluable technical assistance. Also, several websites including <http://www.perviouspavement.org/> and <http://www.concreteresources.net/cd/> provide information on design, specifications, construction, and inspection of pervious concrete.
- Parking Plaza #5 was renovated in two phases (see Figure 1) to avoid losing use of full lot at once. The first installation of Phase 2 pervious concrete failed (surface aggregate detached on nearly entire area) and was removed and replaced. The second installation was accepted. Possible factors in the poor curing of the failed section include: mix may have been too dry, ambient temperatures for Phase 2 installation (June 2006) were warmer than Phase 1 installation (November 2005), finished section may not have been covered with plastic quickly enough, plastic cover blew off of some sections during curing period. Also, a vibratory tamper was used to finish the surface of the second Phase 2 installation, compared to use of a roller for Phase 1 and the first Phase 2 installation. It was thought that the vibratory tamper produced a smoother, more intact surface than the roller did.

### (2) Biofilters

Material	Dimensions, description
Soil	8" deep, at top
Sand	16" deep, below soil
Gravel	3/4" crushed rock, 2.5 – 5.0 feet deep, below sand
Perforated drain pipe	6" diameter pipe, running length of biofilter at bottom of gravel layer

**Benefits:** 1,400 square feet of asphalt replaced, absorbs runoff from 12,200 square feet of asphalt and 12,800 square feet of rooftop. Some amount of subsurface drainage from the pervious concrete may drain into the biofilters as well.

**Additional notes:** Runoff from the majority of the parking lot drains to the biofilters. The soil and sand filter pollutants out of the water as it seeps downward.

**Lessons learned:**

- When water reaches the bottom of the gravel layer, it flows through the perforated drain to a drywell (see Figure 1). Because the drain pipe is located at the bottom of the gravel layer, all of the water flows out of the biofilter to the drywell. If the drain pipe were instead located at top of gravel layer, stored water could seep into the ground the entire length of the biofilter instead of just in the drywell.
- The Phase 1 biofilter did not drain properly because soil and sand did not provide sufficient drainage. Overflow inlets that pipe surface water directly to the perforated pipe at the bottom of the biofilter were installed to eliminate ponding. The soil and sand specifications were revised for Phase 2 to ensure adequate drainage, and this biofilter drains properly.

**(3) Asphalt:** The parking lot is just under one acre in total area. The remaining area (other than the pervious concrete and biofilters) is asphalt. Detailed information is not given for the asphalt because it is not a runoff reduction technique.

**We gratefully acknowledge the City of Menlo Park for its willingness to use pervious concrete and its management of the construction of this project.**

