

**Agilent – Palo Alto  
CO-1**

*Site Location:*

395 Page Mill Road  
Palo Alto, CA

*Features:*

- Detention basin with native vegetation along banks
- Parking lot vegetated swales
- Roof downspouts draining to landscaping
- Promotes alternative transportation by providing bike racks and lockers, an onsite bus stop, and carpool/vanpool parking
- Structured parking lot (2 levels with top level draining to rock filter bed).



The detention basin, known as “The Swale” by Agilent employees, provides stormwater collection and treatment for the parking areas, visual amenities for employees, and a visual buffer for the neighboring residential community.

*Stormwater Benefits:*

- Reduced impervious surface area
- Natural treatment of runoff
- Reduced volume and velocity of runoff
- Reduced transportation related pollutants
- Reduced directly-connected impervious area (DCIA)



The parking lot is graded to drain into vegetated swales, shown here, and the detention basin.



Storm drains from the parking lot enter the detention basin through drains like this one.



The detention basin has two outlets to protect against localized flooding and to ensure that the basin drains within 72 hours for vector control.



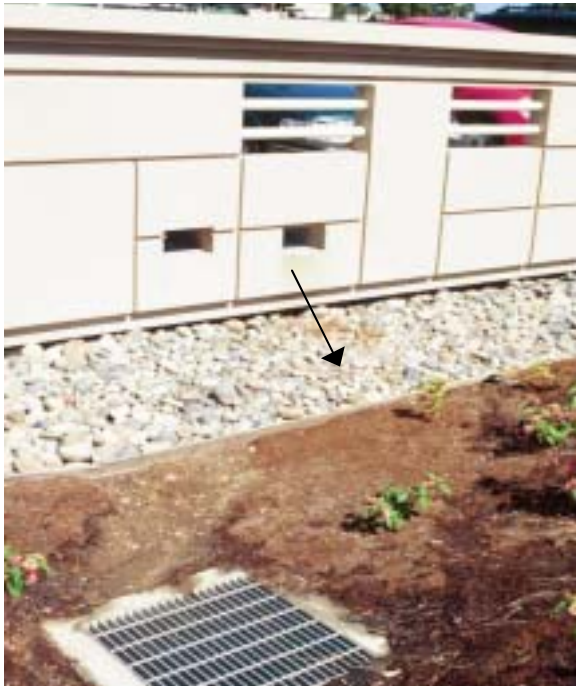
Bike racks and showers encourage employees to bike to work. Additional bike lockers and a bus stop are located at the Page Mill Road entrance.



Agilent encourages employees to carpool by providing designated car/van pool areas. Reducing vehicle trips traveled reduces the amount of pollutants such as hydrocarbons and brake pad dust released to the environment.



Runoff from this parking structure drains to the filter bed, described below. The two-story parking structure allows for roughly twice the number of vehicles for the same area of a typical surface parking lot, while allowing enough room on-site for the detention basin.



The runoff drains from the top of the parking structure to this rock filter bed for treatment and then to the storm drain system via the detention basin.



This rocky swale is used to slow and treat rooftop runoff before draining to the storm drain. A minimum two percent (2%) slope away from the building protects the building foundation from water damage.



Storm drains are clearly labeled with an educational “no dumping” message.



The detention basin collects water from the parking lot. The concrete edging protects the asphalt from water damage while the bumper stops help prevent cars from traveling over the vegetated swales.

**Agilent – Palo Alto  
CO-1 (cont.)**

*Lessons Learned:*

- The irrigation heads originally installed for the retention basin caused some ponding for greater than 72 hours until they were modified to target areas requiring water. The local vector control agency brought mosquito fish for mosquito control while the irrigation challenge was being diagnosed and addressed.
- During the rainy cloudy days, the water in the parking lot catch basins may take longer than 72 hours to drain. Maintenance staff must periodically clean debris from catch basins.
- The detention basin has also served as a useful indicator for irrigation leaks for sprinklers within the parking lot biofilter landscaping. When maintenance staff sees ponded water in the detention basin during a dry spell, they investigate for potential leaks.
- The landscape service provider must carefully control the scheduling of irrigation system to prevent overwatering and water build up in the detention basin.
- Shredded bark was installed initially along the detention basin banks to hold the soils without clogging the system until vegetation became established.
- The site designer highly recommends checking after the first rain to make sure the entire system is working correctly. For the roof downspouts, the rainwater initially started pooling behind the header boards at the bottom of the roof downspouts. Notches cut in the header board ensure proper drainage away from building with a minimum 2% slope.
- Maintenance costs and effort are comparable to that for typical landscaping according to Agilent maintenance staff.

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**Pacific Shores Center  
CO-2**



*Site Location:*

1500 Seaport Boulevard  
Redwood City, CA

*Features:*

- Multi-purpose detention basin and playing fields
- Second detention basin with cobble bottom
- Parking lot vegetated swales
- 3 miles of paved trails that are an extension of the Bay Trail

*Stormwater Benefits:*

- Reduced amount of impervious surface area
- Natural treatment of runoff
- Reduced volume and velocity of runoff
- Reduced directly-connected impervious area (DCIA)



This athletic field also serves as a detention basin. The basin is designed to fill up to a four-foot depth and drain within eight (8) hours.

**Pacific Shores Center  
CO-2 (cont.)**



*Photograph taken from: <http://www.pacificshores.com/>*

This photograph offers an aerial view of baseball fields and detention basin.



*Photograph taken from: <http://www.pacificshores.com/>*

The multi-story buildings allow for vast landscaping that helps reduce the amount of runoff from the site.



*Photograph taken from: <http://www.pacificshores.com/>*

Aerial view of Pacific Shores Center shows an ideal area to enjoy the Bay Trail.



Parking lot dividers are used as infiltration areas with vegetated swales and trees. Boulders are used to prevent automobile encroachment across the swale.



The parking lot is graded to drain to these vegetated swales, planted with vegetation and trees. The swales were excavated and backfilled with imported sandy loam soil to increase porosity, and constructed with perforated sub-drains. The concrete strip protects the asphalt from water damage. This image was taken prior to grass establishment.

**Pacific Shores Center  
CO-2 (cont.)**



*Photograph courtesy of Bill Southard (DES, Architects and Engineers)*

Cobbles along this detention basin run for several hundred feet to prevent channeling during high runoff.



*Photograph courtesy of Bill Southard (DES, Architects and Engineers)*

This photo shows the vegetated swale after the native vegetation has grown in.

*Lessons Learned:*

- Trees planted with only two (2) stakes for support in sandy loam soil within the vegetated swales blew over during a windstorm prior to root establishment. Using three (3) stakes per tree are now recommended.

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## 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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## 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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**Legacy Tech Park  
CO-11**

*Site Location:*

Gold Street and Hwy 237 (in Alviso)  
San Jose, CA

*Features:*

- Vegetative swales
- Curb cuts
- Rock cobbles to prevent erosion

*Stormwater Benefits:*

- Natural treatment of runoff
- Reduced volume and velocity of runoff



*Photograph courtesy of Mike Campbell (RBF Consulting)*

Grassy swale drains toward storm drain after filtering runoff.



*Photograph courtesy of Mike Campbell (RBF Consulting)*

The vegetative swales at this site are one of San Jose's first examples in an industrial park, and are very well maintained.



*Photograph courtesy of Mike Campbell (RBF Consulting)*

Curb cuts allow runoff water to drain toward rock cobbles, then into the vegetated areas. The cobbles help prevent the runoff from eroding the soil and vegetation where the water runs from the parking lot into the swale.

## Legacy Tech Park CO-11 (cont.)



*Photograph courtesy of Mike Campbell (RBF Consulting)*

The curb cut allows runoff from the fire lane to enter the concave turf swale for natural treatment. The cobbles help prevent soil erosion.

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## Communications Hill/Helzer Ranch MF-1

*Site Location:*

3000 Narvaez Avenue  
San Jose, CA

*Features:*

- Landscaped areas provide detention for floods and stormwater
- Downspouts disconnected
- Higher density housing

*Stormwater Benefit:*

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



Photograph courtesy of Jenny Nusbaum (City of San Jose)

Rooftop runoff drains through downspouts to landscaping for treatment and infiltration.



Photograph courtesy of Jenny Nusbaum (City of San Jose)

This large grassy swale provides area for runoff to percolate into the soil, reduce downstream peak flows, and to receive treatment via settling and filtration.

**Communications Hill/Helzer Ranch  
MF-1 (cont.)**



*Photograph courtesy of Jenny Nusbaum (City of San Jose)*

This outdoor space for the community to enjoy also acts as a detention basin for stormwater.



*Photograph courtesy of Jenny Nusbaum (City of San Jose)*

Infiltration is allowed to occur in this detention basin before entering the drainage system.

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## Le Mirador Senior Housing MF-6

*Site Location:*

1191 Coleman Road  
San Jose, CA

*Features:*

- High density multi-story senior housing area
- Vegetative swale

*Stormwater Benefits:*

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

*Before*



Photograph courtesy of Mike Campbell (RBF Consulting)

This photo illustrates the swale when plant growth was hindered by the native clay soil. The parking lot is graded to drain to the swale.

*After*



Photograph courtesy of Mike Campbell (RBF Consulting)

The densely landscaped vegetative swale was made possible by replacing the native clay soil with sandy loam soil.

*Lessons Learned:*

- Over 2 feet of the native clay soil was replaced with sandy loam, which improved growth and infiltration.

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**Santa Clara Valley Water District Headquarters  
PA-1**

*Site Location:*

5700 Almaden Expressway  
San Jose, CA

*Features:*

- Parking lot swales
- Rooftop downspouts drain to landscaping
- Multi-story building allows reduced building footprint

*Stormwater Benefits:*

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



*Photograph courtesy of Jenny Nusbaum (City of San Jose)*

Rooftop runoff drains to landscaping, breaking up directly-connected impervious area (DCIA).

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*Photograph courtesy of Jenny Nusbaum (City of San Jose)*

Multi-story building allows room for ample landscaping onsite for rooftop drainage and aesthetics.



*Photograph courtesy of Jenny Nusbaum (City of San Jose)*

Vegetative swales within the parking lot collect drainage through curbside gaps. Concrete curb protects asphalt.

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**Silver Creek Valley Road  
PA-5**

*Site Location:*

Silver Creek Valley Road between  
Hwy. 101 and Hellyer Avenue  
San Jose, CA

*Features:*

- Vegetative swales
- Street trees

*Stormwater Benefits:*

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



*Photograph courtesy of Mike Campbell (RBF Consulting)*

This parking lot has curb cuts in order for the water to drain from the parking lot into the vegetative swale.



*Photograph courtesy of Mike Campbell (RBF Consulting)*

The street serving this industrial campus area is graded to drain to the swale, providing adequate slope for proper drainage. The flush concrete curb protects the asphalt from water damage.



*Photograph courtesy of Mike Campbell (RBF Consulting)*

When swales are designed to include trees, locating the trees on the banks of the swale, as shown in this photograph, is recommended. Otherwise, the trees may become over-saturated, or their roots may create high areas at the bottom of the swale that could impact the swale's performance.

**Silver Creek Valley Road  
PA-5 (cont.)**



*Photograph courtesy of Mike Campbell (RBF Consulting)*

This is another grassy swale with street trees. Trees that maintain their canopies during the wet months provide greater stormwater benefit than deciduous trees.

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**Sand Hill Road  
PA-6**

*Site Location:*

Sand Hill Road  
Palo Alto, CA

*Features:*

- Roadside bioswales
- Curb cuts

*Stormwater Benefits:*

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

*Construction Cost for Bioswale\*:*

- \$80/linear foot for 4,000 linear ft.  
(\$320,000 total)



*Photograph courtesy of Joe Teresi (City of Palo Alto)*

Designed swale shown before landscaping has fully grown in.



*Photograph courtesy of Joe Teresi (City of Palo Alto)*

Curbside gaps allow runoff to drain off street into the swale.



*Photograph courtesy of Joe Teresi (City of Palo Alto)*

Vegetation has grown in on the swale. Swale is wide enough that mowing and regular maintenance is not difficult.

\* The street borders Stanford University, which paid for the improvements.

## Sand Hill Road PA-6 (cont.)



Photograph courtesy of Joe Teresi (City of Palo Alto)

Storm drain inlet shown up close in swale.

### *Lessons Learned:*

- Make curb cuts wider.
- The roadside bioswale is most useful for stretches of road without driveways that would interrupt the swale.

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**Baylands Parking Lot  
PA-7**

*Site Location:*

East end of Embarcadero Road  
(Adjacent to PA Sailing Station)  
Palo Alto, CA

*Features:*

- Bioswales
- Non-petroleum paving materials

*Stormwater Benefits:*

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

*Note:*

- The bioswale was under construction at the time these photographs were taken (November 13, 2003).



The filtered runoff drains into this storm drain at the downstream end of the swale.



The bioswale surrounds the parking lot, providing runoff treatment before it drains to the storm drain.



Parking lot is graded so that runoff drains into the swale.

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Alum Rock Branch Library  
PA-13

*Site Location:*

3090 Alum Rock Avenue  
San Jose, CA

*Features:*

- Retention Pond
- Vegetated Bioswales
- Water-conserving Irrigation System

*Stormwater Benefits:*

- Natural treatment of runoff
- Reduced volume and velocity of runoff
- Reduced directly-connected impervious area (DCIA)
- Reduced dry weather flows



Roof runoff is directed to retention pond for natural treatment of stormwater.



Direction of water travel in retention pond



← and ↑  
Curb cuts allow parking lot runoff to drain to vegetated bioswale.





Vegetated bioswales at rear of building collect runoff from roof downspouts and walkway.



Vegetated bioswale at front of building collects runoff from surrounding walkways.

Site plan of Alum Rock Branch Library



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**Tully Community Branch Library and Ball Fields  
PA-14**

*Site Location:*

880 Tully Road  
San Jose, CA

*Features:*

- Vegetated Bioswales
- Water-conserving Irrigation System
- Connects with Coyote Creek Trail, Allowing Bicycle and Pedestrian Access

*Stormwater Benefits:*

- Natural treatment of runoff
- Reduced Volume and Velocity of Runoff
- Reduced Directly-connected Impervious Area (DCIA)
- Reduced Dry Weather Flows



Runoff from surrounding impervious areas flows to vegetated bioswale.



Vegetated bioswale collects runoff from building



Walkway and roof runoff drain to vegetated bioswale



Runoff from parking lot drains to vegetated bioswale



Carex grasses in vegetated bioswale



Vegetated bioswale collects runoff from walkways (above and right)



Site plan of Tully Community Branch Library



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Saratoga Retirement Community – Phase 2  
MF-11

*Site Location:*

14500 Fruitvale Avenue  
Saratoga, CA

*Features:*

- Vegetated Bioswale
- Detention Pond

*Stormwater Benefits:*

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



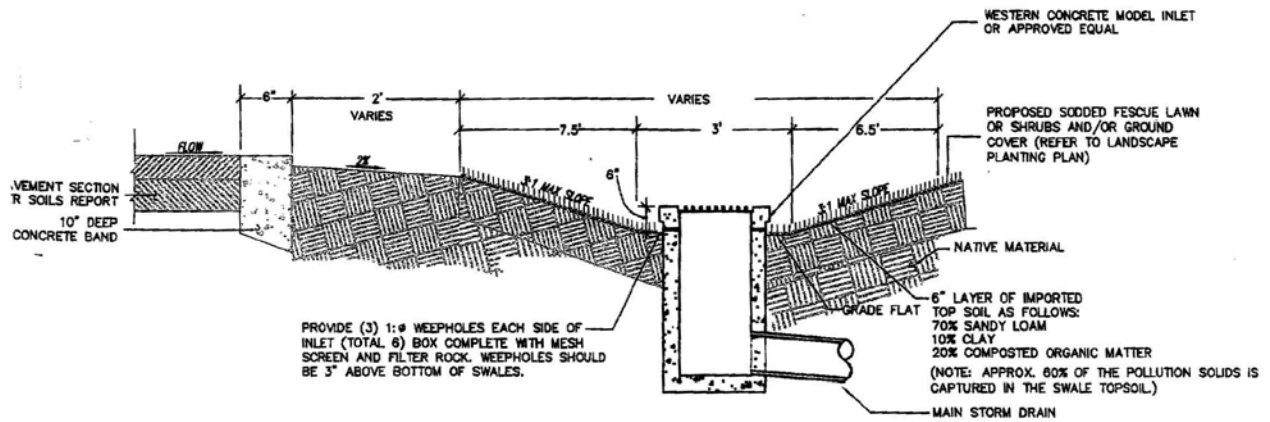
This parking lot has curb cuts in order for the water to drain from the parking lot into the vegetative swale (see section view next page).



The parking lot is graded above the swale in order for the water to flow into the vegetated areas.



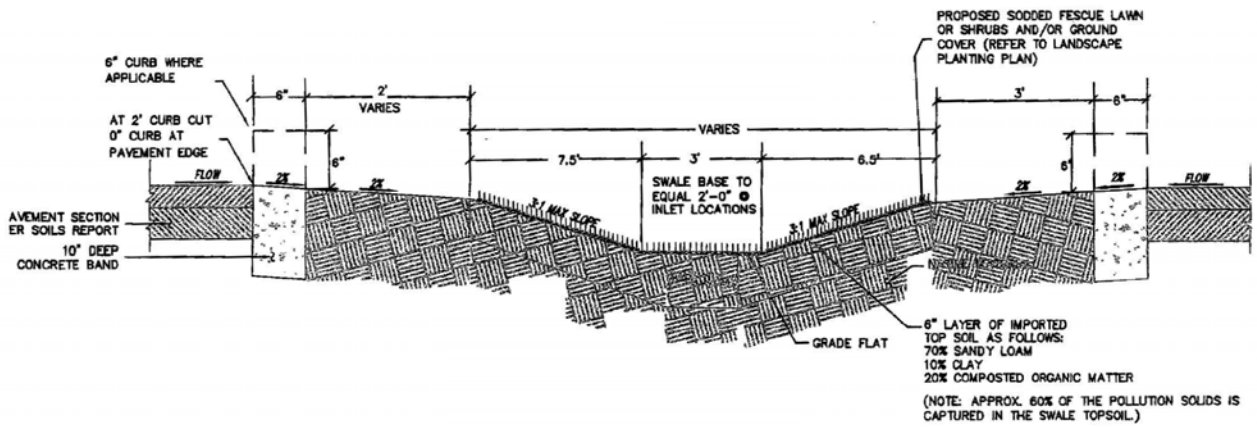
Overview of swale showing raised inlet (see section view next page)



**BIOSWALE WITH AREA DRAIN**

NIS

Section view of raised inlet in swale



**BIOSWALE WITH 2' CURB CUT**

NIS

Section view of curbcuts leading to swale



Detention pond onsite is similar in design to the detention pond shown in Phase I (page III-14). The facility is responsible for maintenance.



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