4 BETTER DESIGNS FOR BUILDINGS, STREETS, AND DRAINAGE

4a | A Vision of Better Urban Drainage

The WMI envisions rebuilt and reconfigured urban drainage systems that minimize effects on creeks and wetlands. Within cities, more areas are maintained as natural reserves, parks, and unpaved open space. As denser, livable neighborhoods are created, runoff from roofs, plazas, sidewalks, and streets is routed to landscaped areas where it is detained and filtered through soil, then allowed to drain slowly away or percolate into the ground. Because peak discharges and runoff volume are reduced, there is less need to harden stream banks or to build flood control structures downstream.

4b | Why Drainage Matters

The width, depth, and sinuosity of a natural creek depend, in large part, on the size and frequency of floods. In geologic time, the creek adjusts to large and small floods, changing its course and cutting new channels. The creek's structure of shallows and pools, its mosaic of wet and damp habitat, depend on this dynamic equilibrium between the creek and its watershed.

When watershed drainage is altered to make land drain more quickly, the flow of water and sediment to the creek also changes. The same rainstorm now produces more runoff, and it reaches the creek faster. Floods are bigger and more frequent, with higher peak flows. The creek's dynamic equilibrium with its watershed has been disturbed.

As the creek widens or deepens, its banks erode. Sediment from this erosion (or from fast-moving runoff) can become embedded in stream gravels or fill in channels downstream.

To stop the flooding and erosion, streamside landowners or flood control agencies may decide to reinforce the banks with riprap or concrete, build levees, or engineer a straighter, more uniform channel.[1]

What if this destructive chain of events could be stopped before it started? Can land be developed and used without increasing runoff?

Avoiding increases in runoff has an additional benefit: It also avoids increases in the amount of pollutants reaching streams.

FAST FORWARD > > >

To comply with an RWQCB permit, the 15 SCVURPPP agencies implement a broad, complex program to reduce pollutants in urban runoff. See Chapter 9.

4c | Urbanization and Imperviousness

In the 1800s and early 1900s, farmers dug ditches in many areas of the Santa Clara Valley so that the clayey soils would drain.

But urbanization has an even greater effect on drainage. Because rooftops and streets are impervious to water, the amount of runoff is greatly increased. Pipes and channels carry the runoff to outfalls, where it spills directly into creek or wetland habitats. The runoff carries airborne pollutants that have settled on the roofs and pavement, as well as pollutants shed by automobiles or dumped in street gutters.

How can we measure urbanization and changes in a watershed's drainage?

One way is to estimate imperviousness—the percentage of a watershed's total area that has been paved or covered with impervious surfaces. In the Santa Clara Basin[2] and elsewhere,[3] studies have consistently associated watershed imperviousness with damage to stream habitat and to biological diversity.

There are other ways to measure the intensity of urbanization, for example, the number of residents, the total length of streets, or the length of drainage pipes and channels per unit area of watershed.[4]

Regardless of how we measure urbanization, urban drainage systems—the engineered pipes and channels that convey runoff to streams—are what links buildings, streets, and parking lots to stream habitat.

4d | Better Designs for Urban Drainage

Today, urban drainage systems are designed to efficiently remove runoff from streets and buildings and convey it downstream rapidly, to avoid local flooding. To protect urban streams and wetlands, however, we need drainage systems that retain runoff upstream, or detain it and release it slowly.

Conventional drainage is designed to collect runoff so it can be routed to pipes. The best way to detain and retain runoff is to disperse it to pervious, landscaped areas where it can infiltrate into the soil.

Simple designs that use natural materials can be reliable and relatively easy to maintain. Small paved areas, like driveways and walkways, can be sloped toward lawns or landscaping. Gravel, block pavers, or permeable asphalt can be used in place of impermeable paving.[5] Runoff from larger areas, such as rooftops or parking lots, can be routed to landscaped infiltration basins, which are designed to hold a few inches of water during and after storms. During rare, really big storms, these areas are allowed to overflow and drain offsite.

Development site architects, planners, and engineers can reduce the total amount of runoff from a site by limiting the widths of driveways and walkways, reducing parking (e.g., by sharing parking for facilities used at different times of the day) and by designing taller buildings with smaller footprints. "Neotraditional" designs for residential subdivisions can feature narrower streets (particularly streets with low traffic volume), parkway strips, and clustered housing with common open space.[6]

Designing sites to retain runoff is especially challenging in intensely developed areas, in areas where clayey soils slow infiltration, in areas with high groundwater tables, and on hillsides. Even on these sites, it may still be possible to retain runoff and let it drain slowly away. Where there is enough space, detention basins (which hold water long enough for many pollutants to settle out) can be used.[7,8] But it also may be possible to route runoff to lower-cost, more aesthetically pleasing rain gardens or bioretention basins.[9] Mulch, soil, and gravel; selected pest-resistant plants and trees, and underdrains help these landscape features effectively detain and filter runoff. All measures that detain or retain runoff must be operated and maintained correctly to avoid the creation of conditions that are conducive to mosquito habitat. It is important to ensure that runoff detention does not exceed 72 hours. The main goal is to avoid situations that create standing water.

Rooftops and parking lots create much of the imperviousness in urban watersheds, but streets and highways—the public right-of-way—are also major sources of runoff. In some of the Santa Clara Basin's urban subwatersheds, 50-60% of the total area is covered by impervious surfaces. Streets and highways account for about a third of this imperviousness.[10]

Most residential lots drain to streets, where gutters convey runoff into drain pipes. Streets receive vehicle fluids and brake dust, litter, and illegally dumped materials. Although the state has adopted stringent regulations for runoff from local development sites,[11] recent guidelines[12] make it optional to control runoff from state highways.

Screens or traps can be installed to stop trash from entering storm drains.[13] Swales and bioretention areas adjoin catch basins along some new or reconstructed streets.[14]

The design of roads, and road drainage, is particularly important in rural areas. Flows from road drainage can cause severe erosion, especially when outfalls drain onto unprotected hillsides. Erosion of unpaved road surfaces can contribute fine sediment to sensitive headwaters creeks.

The buildings, streets, and drainage of the fully urbanized Santa Clara Basin are nearly completely built. Some watersheds will see very little new land developed in the next 20 years; even the still-developing Coyote and Arroyo de la Laguna watersheds are 90% "built-out."[15] Site design strategies such as pervious pavements, landscape detention, and rain gardens can be incorporated into redeveloped sites, but this will only happen over the course of many decades. Detention and retention of runoff from streets and highways will likely take longer.

Detention of runoff near the pipe outfall, just before it reaches the creek, may be an alternative (or a complement) to having detention and infiltration features dispersed throughout the watershed. Detention of these large flows would require heavily engineered structures and large basins at the pipe outfall. Smaller structures might be able to detain and treat dry-weather flows

Regulatory Corner

To comply with a provision of the stormwater permit, SCVURPPP and Santa Clara County have developed a Performance Standard for rural public works, including road construction, maintenance, and repairs.

and high-temperature runoff from small summertime and early fall storms. These small structures might also buffer "flash discharges" and remove trash.

4e | Strategies to Improve Buildings, Streets and Drainage

In the last few years, watershed advocates, engineers, landscape architects, and others have developed a panoply of land-use policies, site designs, landscape features, and engineered devices that, with varying degrees of success, reduce or retain runoff while improving site aesthetics and utility.

What has been done and what needs to be done to encourage developers to use these designs?

For the last decade, Santa Clara Basin municipalities have been working with RWQCB staff to reduce the effects of new development on downstream water quality.

One of the first problems identified, and the first focus of action, was to control sediment and other pollutants in runoff from construction sites. Construction contractors are required to revegetate slopes before, and limit grading activities during the rainy season, create temporary detention basins where needed, and protect storm drain inlets. The municipalities have adopted, and the RWQCB has approved, details for these Best Management Practices (BMPs) as well as schedules for site inspections and procedures for enforcement.[16]

In 1994, Santa Clara Basin municipalities (along with city, town, and county governments from around the Bay area) assisted RWQCB staff to prepare a set of recommendations regarding municipal policies for new development. That same year, all the municipalities adopted those recommendations.[17] They created guidelines and plans to revise their General Plan policies, to change their procedures for reviewing new developments, and to require detention and retention of runoff from larger sites. These guidelines and plans were later revised and incorporated into performance standards[18] for each municipality, which the RWQCB approved in 1996.[19]

The performance standards are updated and expanded through a process of continuous improvement. In 2002, SCVURPPP developed a performance standard for rural public works, including roads.[20]

In 1997, with the participation of Santa Clara Basin municipalities, the Bay Area Stormwater Management Agencies Association (BASMAA) published *Start at the Source: Design Guidance Manual for Stormwater Quality Protection.* The manual, which received an award from the American Association of Landscape

Architects, emphasizes the use of site design and pervious materials to minimize runoff. BASMAA published a revised and expanded edition in 1999.

Santa Clara Basin municipalities distribute *Start at the Source* and related outreach materials to developers, planners, engineers, and landscape architects who plan new developments in their jurisdiction. The municipalities also hold workshops and training sessions for these professionals and for the municipal staff who review their plans.

Beginning in 1997, the WMI's Land Use Subgroup began to look for ways that municipalities might do more to reduce runoff from new and redeveloped sites. The LUS, in a series of studies sponsored by SCVURPPP, cataloged municipal policies that are relevant to land use, imperviousness, and drainage and compared and contrasted existing policies against an ideal or model, set of development principles.[21]

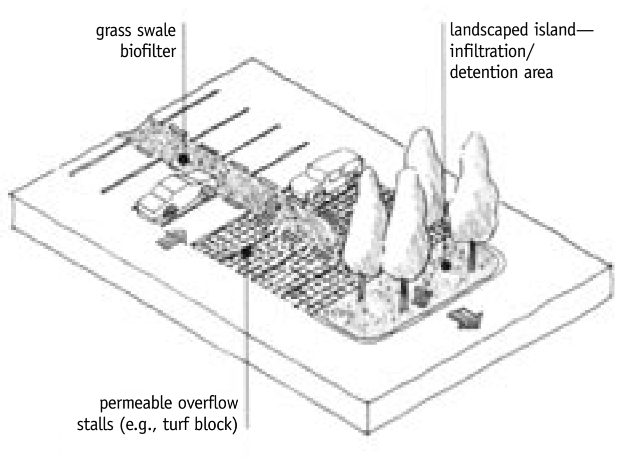
Some municipalities' current design standards, regulations, codes, and engineering details require collection of runoff and transport off-site; these practices may unnecessarily preclude retention and infiltration.

SCVWD can coordinate more closely with municipalities' efforts to reduce imperviousness by improving interagency communication at the Board/Council, management, and first-line staff levels.

4f | WMI Strategic Objective: Promote Drainage Systems that Detain or Retain Runoff

The WMI advocates site development designs and drainage system designs that detain or retain runoff to protect streams and habitats from flash runoff, erosion, and pollutants, and to protect from downstream flooding, while preventing groundwater pollution.

To meet these goals, cities, towns and the County should revise some of their standards for site development and drainage systems. In areas where increased runoff could cause increased erosion of creek beds and banks, siltation, or other effects on streams, new and rebuilt sites and drainage systems should (where feasible) incorporate features to detain or retain runoff.



4.1 Overflow parking design (from *Start at the Source*).

Regulatory Corner: Stormwater Permit Requirements For New Development

In October 2001, the RWQCB revised the SCVURPPP co-permittees' permit to discharge stormwater to local creeks and southern South San Francisco Bay.* Under the new provisions, cities, towns, and the County must require many proposed development projects to incorporate treatment controls to remove runoff pollutants.

The municipalities must also address increases in peak flow and runoff volume to avoid increased erosion of creek beds and banks, siltation of stream-beds, or other effects on streams. In some instances, this could require that future development projects be designed so that runoff is not increased above pre-development amounts. However, the cities and towns, county, and SCVWD have the option of showing that existing drainage facilities, or new facilities, can handle the increases without causing any damage to creeks, or propose alternative standards based on the condition of specific creeks.

The revisions also require the co-permittees to continue upgrading their programs to control erosion and sedimentation from construction projects and to insure that new commercial buildings include features to limit the flow of pollutants from dumpsters and outdoor wash areas. The provisions imposed extensive administrative and reporting requirements on the local government agencies.

*Order 01-119, issued October 17, 2001.
www.swrcb.ca.gov/rwqcb2/OrderNum/01-119final.doc

4g | Next Steps for the WMI

4g1 WMI Actions Needed to Implement the Strategic Objective

- Work with SCVURPPP to facilitate implementation of the RWQCB stormwater permit.
- Review the results of SCVURPPP's Development Policies Comparison and identify policies that limit detention and infiltration of runoff and potential improvements to policies controlling erosion and sedimentation from construction sites.
- In cooperation with SCVURPPP, develop model public works policies, specifications, and details to encourage detention and infiltration of runoff.
- Coordinate and integrate implementation of the guidance manual and other outcomes of SCVURPPP's Hydromodification Management Plans with Watershed Stewardship Plans (Chapter 8) and with General Plans and Specific Area Plans (Chapter 3).
- In cooperation with SCVURPPP, distribute model public works specifications and details to municipalities in presentations to managers and public works departments and in workshops for public works staff, developers, and engineering consultants.
- Provide a neutral place where contentious issues relating to drainage design methods and effectiveness can be referred.
- Develop indicators of progress for buildings, streets, and drainage.

4g2 Other WMI Actions that Support the Strategic Objective

- Track and participate in SCVWD research on the feasibility of regional detention, retention, or treatment facilities.