9 Next Steps

This document illustrates an approach and philosophy towards site planning and design for stormwater management. The design details and site planning principles presented here are proven, practical methods for reducing the impact of new development on environmental quality.

This approach seeks to restore the hydrologic cycle by infiltrating runoff into the soil as close to its source as possible. It proposes simple site planning principles to cluster development, preserve natural areas, and avoid development on fragile lands. It accepts impervious land coverage as an environmental indicator, and seeks to maximize the permeability of new development. It aims to achieve all these objectives economically while creating communities that are more beautiful and desirable places to live.

The document has one goal: to create better projects. Because of the complex nature of development, this goal can only be achieved if developers, regulatory agencies, local governments, designers, contractors, maintenance staff, and others in the real estate industry work cooperatively.

Each group active in development can take a series of steps to create better projects.

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Communities can be built that reward investment, are kind to the natural environment, and make better places for people to live.

Next Steps

9.1 *Frequently asked questions*

9.1 Frequently asked questions. The techniques described in this document have three basic goals:

– to minimize or reduce overall impervious land coverage,
– to ensure that remaining impervious areas are not directly connected to a storm drain system as far as feasible, and
– to slow runoff within a drainage system.

Because this approach is different than the conventional stormwater management approach of conveying water offsite as quickly as possible – "getting rid of the water" – it often raises questions. A few of the most frequently asked questions are addressed below.

If pollutants infiltrate into the soil, will there be a problem with contaminated soil or groundwater in the long term?

Not usually, especially in residential areas. The risk of contamination is a function of a compound's relative mobility, concentration, and solubility. In residential areas, the concentrations of most pollutants are generally low, and capturing them in the ground where they will eventually degrade is usually the best way to manage them. A recent study published by the U.S. EPA found that residential areas pose the least risk of groundwater contamination from infiltration practices. This study found that the risk from compounds with greatest potential for groundwater pollution – nitrate-nitrogen, pesticides, organic compounds and heavy metals – was generally low provided that runoff percolates through the soil layer. Runoff from some sites in residential communities with higher concentrations of pollutants, such as car wash facilities and service stations, may not be suitable for infiltration.

If water is standing in pools, won't they breed mosquitoes?

Not if the pools are properly designed. All of the techniques described in this document that utilize surface drainage – such as infiltration basins, biofilters, and detention basins – can be designed to dry up within 48 hours of a storm. Even an extended retention basin, which is a semi-permanent pool that holds water for two or three weeks, should be designed to dry up in the spring before temperatures are warm enough to breed mosquitoes.

What about expansive clay soils that don't infiltrate?

The Bay Area's expansive clay soils – with their high runoff potential and low infiltration rates – present special challenges. Also, because these soils have a high swelling potential, care must be taken to prevent damage to foundations from saturated soils. Though infiltration may not be feasible, retention and detention strategies that hold water for later release are often practical. Minimizing impervious land coverage and directly-connected impervious areas are also viable strategies, even in expansive clay soils.

You recommend reducing street widths by adopting "neo-traditional" standards. How is that going to help?

The street is the single most important design element in site planning. Reducing street widths can reduce overall impervious land coverage significantly. For example, most Bay Area municipal street standards mandate between 80 and 100% impervious surface coverage in the right-of-way for streets, curb, gutter and sidewalk. If new standards are adopted for the most lightly traveled local streets, impervious surface coverage can be reduced by 25 to 60%. This alone helps to reduce the generation of "new" runoff from a proposed development. If the street design includes alternative stormwater collection strategies, such as linear biofilters and infiltration basins rather than standard catch basins and storm drains, the pollution generated by vehicles can be controlled near its source.

What about cost? Aren't these designs expensive to build?

These designs emphasize source control because it's the cheapest form of pollution control. Treatment control systems – collecting pollutants and treating them at the end of a pipe before the outfall – are more expensive to build and maintain, and require treating greater quantities of runoff.

Of the source control designs illustrated here, costs vary. Some designs, like concave vegetated surfaces or sloping driveways towards adjacent landscape rather than towards curbs and gutters, are cost neutral. Others, like gravel parking aisles, are less costly than conventional pavements. Cluster development, a

Frequently asked questions, continued

strategy for minimizing overall impervious land coverage, can be less expensive than conventional development because of reductions in roadway and utility requirements. Some of the techniques, such as pervious concrete, do add cost when compared to conventional materials, but these costs can sometimes be offset by savings generated by not having to install an underground drainage system.

Aren't these designs more expensive to maintain? And who's responsible for maintaining them, anyway?

Though some of the design details need special maintenance, many of them don't. For example, a lawn with a gently sloping concave surface requires the same maintenance as one that is convex. Yet the concave lawn holds water, making it a stormwater management device, while the convex lawn sheds water, making it a contributor to "new" runoff. Overall, the maintenance requirements of the designs recommended here can be comparable to conventional practice, though they may require a different kind of maintenance.

Maintenance responsibility will depend on the control's design and location. Some controls located on private property, such as a dry well or concave lawn near a home, will be maintained by the homeowner. Other controls, such as swales or basins along streets or in parks, may be maintained by a public agency. Still others may be the responsibility of a homeowner's association or management company. In all cases adequate maintenance and proper education are critical to the long-term viability of each control. Once people understand the design intent of a control, and are given guidance on its proper maintenance, acceptance increases and maintenance effort can be optimized.

What about liability?

Compared to building large, single detention basins, the approach described in these pages minimizes risk. By minimizing impervious surface coverage and creating multiple, small basins in the landscape, overall runoff is reduced, and the runoff that remains is held in small, shallow pools for limited periods of time. These small source controls, if properly designed and maintained, present very limited risk.

For example, Village Homes, in Davis, California was built in the mid-1970s using a surface drainage system that includes infiltration basins in private gardens, community lawns and children's playgrounds connected by a continuous network of seasonal swales and pools. For over twenty years this system has functioned successfully in a residential environment with no injuries or litigation associated with the storm drain system.

Where can I get more copies of this manual?

Call your local stormwater program (see Resources, p. 154). They can get you more copies of this manual and help you to implement its design philosophy into your project.

I need more technical information. Where can I get it?

This document contains general technical information and design guidance. For more technical information, see the Resources section and the bibliography.

Next Steps

9.2 *Getting started*

9.2 Getting Started. The following lists illustrate the wide range of options available that each of the groups active in development can take to begin implementing guidelines for better site planning and design. The lists are not meant to be mandates or all-inclusive, but to serve as a menu for each community to select from depending upon priorities, resources, and local conditions.

Regulatory agencies

- promote education and exchange of information on stormwater management
- create a regulatory environment that facilitates the implementation of better stormwater management practices
- assist local governments in the monitoring and evaluation of alternative stormwater management practices
- recognize and reward projects that take risks and that embrace better stormwater management practices.

Local governments

- adopt standards and alternatives for design and stormwater management, such as impervious surface reduction and on-site stormwater infiltration or detention
- establish an incentive program to encourage alternatives that achieve water quality goals
- establish a penalty program for projects that do not achieve water quality goals
- adopt access street standards for low volume, access streets
- adopt drainage standards and details that permit surface drainage and infiltration/retention systems in combination with conventional underground conveyance systems
- review zoning and other ordinances for driveways, setbacks, lot coverage, and other factors to accommodate more environmentally responsible land use
- modify maintenance practices on public lands and in the public right-of-way to accommodate stormwater infiltration/detention systems
- build a culture of environmental stewardship across all departments and offices
- use these principles and techniques in siting and designing government facilities.

The building industry

- think of water as an amenity to be featured rather than a liability to be gotten rid of or a hazard from which the public must be protected
- market the stormwater system as a landscape feature that can improve product competitiveness
- explore techniques that have proven successful elsewhere, but have not yet been widely used in the Bay Area
- work cooperatively with local governments to build prototype projects that demonstrate better stormwater management practices
- invest in designs and materials that may have a higher initial cost, but that yield long-term value
- educate landscape crews on maintenance practices for stormwater infiltration systems and soil health
- exhibit a willingness to take risks in order to advance the industry and improve the environment.

Design professionals

- invest in continuing education to learn about better stormwater management practice and design
- educate clients and approval bodies on the principles and advantages of designing developments for better stormwater management
- test designs and approaches to ensure successful implementation
- conceive of the drainage system as a fundamental design element to be creatively explored
- complete post-construction review of built projects to evaluate long-term performance of stormwater system designs
- practice continuous incremental improvement of stormwater system designs and detailing.

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9.3 *Keys to success*

9.3 Keys to success. Site planning and design for stormwater management involves the coordination of many disciplines and activities. Building successful projects requires careful follow-through from concept to design to construction and maintenance.

Conceptual stage

- be sure to understand site constraints, local microclimates, and soil conditions
- determine regulatory environment and which particular design strategies are favored by regulatory agencies
- have a preliminary meeting between the development team and local government officials to discuss overall stormwater management goals and strategies
- consult local stormwater program to learn what has worked (and what hasn't) in a local area.

Design stage

- establish a stormwater management awareness among all disciplines in the design team
- hold regular cross-discipline coordination meetings to evaluate overall stormwater management solutions as design develops
- consult with local nurseryperson or horticulturist to determine appropriate plant material selection for the site's microclimate
- verify that stormwater systems are sized appropriately for the given water quality volume, and that residence time will be within acceptable limits
- carefully coordinate related design elements, especially
  – underground utilities and surface drainage
  – curb cuts and catch basins
  – materials and pavement selection
  – downspouts, area drains and roof drains
  – grading of roads, parking and adjacent landscape areas
- check proposed stormwater solutions with geotechnical engineer to verify suitability given site soil conditions

Construction documents stage

- ensure details and specifications are coordinated across disciplines (e.g. civil engineering and landscape architecture)
- if plans call for unconventional detailing, such as notched curbs or porous asphalt, be sure they are clearly and boldly identified on the drawings as different from conventional details (or contractor may not notice the difference)
- double-check all calculations for proper sizing and function
- if using manufactured products, such as turf block or catch basin inserts, take advantage of manufacturer's design consultation services, if available

Construction stage

- hold a pre-bid meeting with all contractors to review principal design elements and site conditions
- hold a pre-construction meeting with selected contractor to review construction documents in detail, especially details that differ from those conventionally used
- explain to the contractor the design intent of the various stormwater management designs– if they understand why something is designed a certain way, they are more likely to build it the way it's designed
- insist on meeting with the job foreman, not just the contractor's estimator or client service representative– the foreman will be the one actually supervising the work
- make periodic site visits during construction to ensure that designs are being correctly implemented

Post-construction stage

- hold a project closing meeting with the contractor to verify that designs were correctly implemented and to learn how they could be improved
- hold a meeting with the owner or the owner's maintenance staff to explain the stormwater system
- provide the owner and the maintenance staff with a Management Handbook describing how the stormwater system is designed to work and how to maintain it
- make post-occupancy visits to evaluate long-term performance

Next Steps

9.4 *Resources*

9.4 Resources. The following resources are available for further information and assistance with particular aspects of site planning and design for stormwater management protection.

Regional water resources and pollution prevention

Bay Area Stormwater Management Agencies Association (BASMAA)
1515 Clay Street, Suite 1400
Oakland, California 94612
voice: 510 622.2300
www.basmaa.org

Alameda Countywide Clean Water Program
510 670.5543

Contra Costa Clean Water Program
925 313.2360

San Mateo Countywide Stormwater Pollution Prevention Program
650 599.1406

Vallejo Sanitation and Flood Control District
707 644.8949

Fairfield-Suisun Urban Runoff Management Program
707 429.8930

Marin County Stormwater Pollution Prevention Program
415 485.3363

Santa Clara Valley Urban Runoff Pollution Prevention Program
800 794.2482

California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612
510 622.2300

Central Valley Region
3443 Routier Road, Suite A
Sacramento, California 95827
916 255.3000

California Environmental Protection Agency
State Water Resources Control Board
901 P Street
Sacramento, California 95814
voice: 916 657.1025
fax: 916 657.2127

Local planning and development

Association of Bay Area Governments (ABAG)
P.O. Box 2050
Oakland, California 94604-2050
voice: 510 464.7900
fax: 510 464.7970
info@abag.ca.gov

Out-of-state planning and pollution prevention

Site Planning for Urban Stream Protection
available from Department of Environmental Programs
Metropolitan Washington Council of Governments
777 N. Capitol Street N.E., Suite 300
Washington, DC 20002
voice: 202 962.3200

The Center for Watershed Protection
8391 Main Street
Ellicott City, Maryland 21043
voice: 410 461.8323
New document for planning and zoning: *Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds.* October 1998.

Resources, continued

Nonpoint Education for Municipal Officials (NEMO)
Univ. of Connecticut Cooperative Extension System
1066 Saybrook Road, Box 70
Haddam, Connecticut 06438
voice: 860 345.4511
fax: 860 345.3357

Technical documents

California Storm Water Best Management Practice Handbooks
Stormwater Quality Task Force (Roesner, Walker, et. al.).
available through Blue Print Service, Oakland, CA.
510 287.5485

Design and Construction of Urban Stormwater Management Systems
American Society of Civil Engineers Manuals and Reports of Engineering Practice No. 77
Water Environment Federation Manual of Practice FD-20
jointly published by ASCE and WEF, 1992

Urban Runoff Quality Management
WEF Manual of Practice No. 23
ASCE Manual and Report on Engineering Practice No. 87
jointly published by American Society of Civil Engineers (ASCE) and the Water Environment Federation (WEF)
voice: (WEF) 703 684.2400
www.wef.org
www.asce.org

Stormwater Infiltration
by Bruce K. Ferguson
CRC Press
Boca Raton, FL

Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality
Environmental Protection Agency (EPA-440/5-87-001)
Washington, DC

Economic Benefits of Runoff Controls
Environmental Protection Agency. (EPA 841-S-95-002)
Washington, DC

Low-Impact Development Design Manual
Department of Environmental Resources
Prince George's County, Maryland

On-site Residential Stormwater Management Alternatives
Dept. of Civil Engineering
University of Washington
3201 Fremont Avenue North
Seattle, Washington 98103
206 543.5539

Impervious Surface Reduction Study
City of Olympia Public Works Department
P.O. Box 1967
Olympia, Washington 98507-1967
voice: 360 753.8598
fax: 360 753.8087

Time-Saver Standards for Landscape Architecture, second ed.
by Charles W. Harris & Nicholas T. Dines, co-editors
McGraw-Hill Publishing Company, New York, 1998.

Traffic Engineering for Neo-Traditional Neighborhood Design
Institute of Transportation Engineers (ITE)
525 School Street, S.W., Suite 410
Washington, DC 20024-2729
voice: 202 544.8050
fax: 202 863.5486
www.ite.org