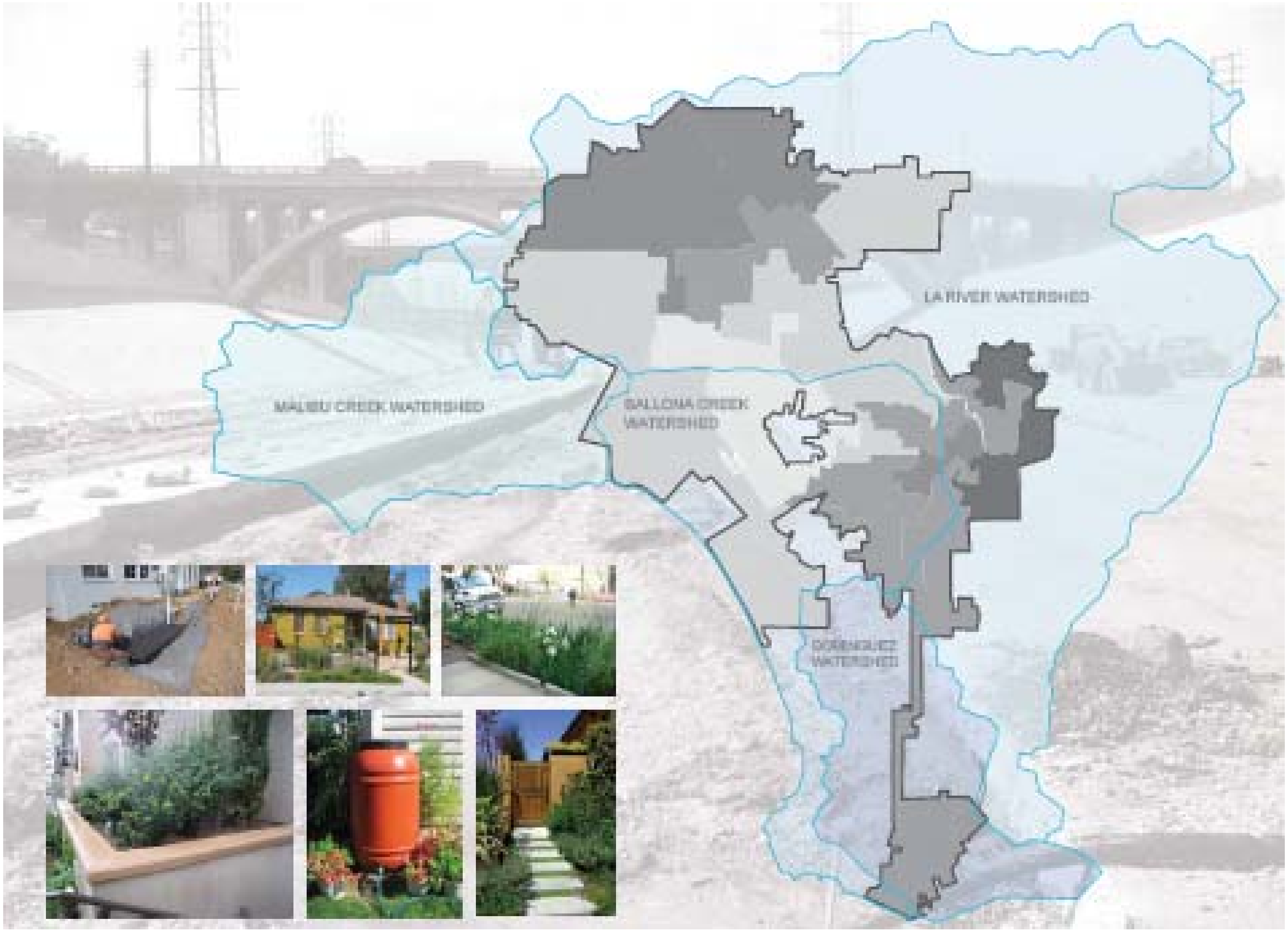

DEVELOPMENT BEST MANAGEMENT PRACTICES HANDBOOK

LOW IMPACT DEVELOPMENT MANUAL | PART B PLANNING ACTIVITES

June 2011 | 4TH EDITION

CITY OF LOS ANGELES
SANITATION
DEPARTMENT OF PUBLIC WORKS
Protecting Public Health and the Environment

WATERSHED PROTECTION DIVISION

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This 4th edition is a revision to the 3rd edition to reflect the newly adopted Low Impact Development (LID) requirements that take effect May 12, 2012. The handbook was created under the direction of the City of Los Angeles, who is fully responsible for the content within and a technical committee comprised of the Departments of Planning, Building and Safety, and Water and Power, the Bureaus of Street Services and Engineering, and individuals from the development, environmental, and consultant community.

This Development Best Management Practices Handbook, Part B Planning Activities, 4th edition was adopted by the City of Los Angeles, Board of Public Works on July 1, 2011 as authorized by Section 64.72 of the Los Angeles Municipal Code approved by Ordinance No. 173494.

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ACRONYMS AND ABBREVIATION

ASCE	American Society of Civil Engineers
BMP	Best Management Practices
BOE	Bureau of Engineering
BOS	Bureau of Sanitation
CGPL	California General Plan Law
CEQA	California Environmental Quality Act
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
C&A	Covenant and Agreement
DCP	Los Angeles Department of City Planning
DPW	Los Angeles Department of Public Works
EAF	Environmental Assessment Form
EIR	Environmental Impact Report
EPA	United States Environmental Protection Agency
ESA	Environmentally Sensitive Area
ETWU	Estimated Total Water Use
CGPL	California General Plan Law
HC	Hydrocarbons
LADBS	Los Angeles Department of Building and Safety
LID	Low Impact Development
MAWA	Maximum Applied Water Allowance
MEP	Maximum Extent Practicable (statutory standard)
MND	Mitigated Negative Declaration
MS4	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
O&G	Oil and Grease
O&M	Operation and Maintenance
PCIS	Plan Check and Inspection System
RGO	Retail Gasoline Outlets
RWQCB	Los Angeles Regional Water Quality Control Board
SIC	Standard Industrial Classification
SOR	Stormwater Observation Report
SWRCB	State Water Resources Control Board (California)
SUSMP	Standard Urban Stormwater Mitigation Plan
ULARA	Upper Los Angeles River Area
ULARWM	Upper Los Angeles River Area Watermaster
WEF	Water Environment Federation
WPD	Watershed Protection Division

SECTION 1: INTRODUCTION

1.1 BACKGROUND

Urban runoff discharged from municipal storm drain systems has been identified by local, regional, and national research programs as one of the principal causes of water quality impacts in most urban areas. Urban runoff potentially contains a host of pollutants such as trash and debris, bacteria and viruses, oil and grease, sediments, nutrients, metals, and toxic chemicals.

These contaminants can adversely affect receiving and coastal waters, associated biota, and public health. An epidemiological study by the Santa Monica Bay Restoration Project was conducted to investigate possible health effects of swimming in Santa Monica Bay. Study results indicated that individuals swimming near flowing storm drain outlets have a greater risk of developing various symptoms of illnesses compared to those swimming 400 yards away from the same drains. In addition, oil and grease from parking lots, leaking petroleum or other hydrocarbon products, leachate from storage tanks, pesticides, cleaning solvents, and other toxic chemicals can contaminate stormwater and be transported downstream into water bodies and receiving waters. Fertilizer constituents from lawns and golf courses or leaking septic tanks can cause algal blooms. Disturbances of the soil from construction can allow silt to wash into storm channels and receiving waters, making them muddy, cloudy, and inhospitable to natural aquatic organisms. Heavy metals are toxic to aquatic organisms and many artificial surfaces of the urban environment such as galvanized metal, paint, or preserved wood containing metals contribute to stormwater pollution as the surfaces corrode, flake, dissolve, or decay.

Land development and construction activities significantly alter drainage patterns and contribute pollutants to urban runoff primarily through erosion and removal or change of existing natural vegetation. When homes, shops, work places, recreational areas, roads, parking lots, and structures are built, increased flows are discharged into local waterways. As the amount of impervious surface increases, water that once percolated into the soil now flows over the land surface. Accordingly, increases in impervious surfaces can increase the frequency and intensity of stormwater flows through a watershed. Flow from rainstorms and other water uses wash rapidly across the impervious landscape, scouring the surface of various kinds of urban pollutants such as automotive fluids, cleaning solvents, toxic or hazardous chemicals, detergents, sediment, metals, bacteria, pesticides, oil and grease, and food wastes. These pollutants, unfiltered and unfettered, flow through stormwater infrastructure and ultimately contaminate receiving waters.

1.2 HANDBOOK PURPOSE AND SCOPE

The purpose of this handbook is to assist developers in complying with the requirements of the Development Planning Program regulations of the City's Stormwater Program. This handbook summarizes the City's project review and permitting process, identifies stormwater mitigation measures, and references source and treatment control BMP information. It provides guidance for individuals involved in new development and redevelopment projects. The target audience for this handbook includes developers, designers, contractors, homeowners, and City staffs that are engaged in plan-checking, permitting, and inspections related to land development activities. This handbook also contains the necessary forms and worksheets required to be completed by the developer for approval.

1.3 LEGAL FRAMEWORK

With public concern growing over urban runoff and stormwater pollution, local, state, and federal agencies have devised plans to control and/or treat stormwater-related pollution before it reaches receiving waters.

The Federal Clean Water Act is the principal vehicle for control of stormwater pollution. Under the Federal Clean Water Act, each municipality throughout the nation is issued a stormwater permit through the National Pollutant Discharge Elimination System (NPDES) program. The primary goal of each permit is to stop polluted discharges from entering the storm drain system and local receiving and coastal waters. In California, the NPDES stormwater permitting program is administered by the State Water Resources Control Board (SWRCB) through its nine Regional Boards.

On July 5, 1996, the Los Angeles Regional Water Quality Control Board (Regional Board or RWQCB) adopted Order No. 96-054- the NPDES Stormwater Permit (Permit) for the County of Los Angeles and cities within (NPDES No. CAS614001). The Permit was issued to Los Angeles County (Principal Permittee) and 84 cities (Permittees) to reduce pollutants discharged from their Municipal Separate Storm Sewer Systems (MS4) to the Maximum Extent Practicable (MEP) statutory standard. On December 13, 2001, the Regional Board adopted a new Permit (Order No. 01-182, NPDES Permit No. CAS004001).

The requirement to implement the Permit is based on federal and state statutes, including Section 402(p) of the Federal Clean Water Act, Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990, and the California Water Code. The Federal Clean Water Act amendments of 1987 established a framework for regulating stormwater discharges from municipal, industrial, and construction activities under the NPDES program. The primary objectives of the stormwater program requirements are to:

- Effectively prohibit non-stormwater discharges, and
- Reduce the discharge of pollutants from stormwater conveyance systems to the MEP statutory standard.

Based on the Permit issued by the Regional Board, the County and its co-permittees are required to develop and implement a number of stormwater management programs designed to reduce pollutants in stormwater and urban runoff. These programs are the Public Information and Participation Program, Industrial/Commercial Facilities Program, Illicit Connections and Illicit Discharges Elimination Program, Development Planning Program, Development Construction Program, Public Agency Activities Program, and the Monitoring and Reporting Program.

One of these programs, the Development Planning Program, focuses on preventing pollutants that could be generated from new development and redevelopment projects from reaching stormwater conveyance systems and receiving waters. Under this program, the RWQCB developed requirements for the Standard Urban Stormwater Mitigation Plan (SUSMP) which requires specific development and redevelopment categories to manage stormwater runoff. In 2002, the City of Los Angeles implemented the SUSMP program requiring all the affected land development projects to capture or treat stormwater runoff.

A relatively recent stormwater management approach aimed at achieving this goal is the use of Low Impact Development (LID). Over the past 10 years, LID practices have received increased attention and implementation, becoming a leading practice for stormwater management. In recognition of this, recent actions by the RWQCB, SWRCB, and US EPA have prioritized the use of LID as the preferred approach to stormwater management, including for the purpose of water quality compliance.

LID is a stormwater management strategy that seeks to mitigate the impacts of increases in runoff and stormwater pollution as close to its source as possible. LID comprises a set of site design approaches and Best Management Practices (BMPs) that promote the use of natural systems for infiltration, evapotranspiration, and use of stormwater. These LID practices can effectively remove nutrients, bacteria, and metals from stormwater while reducing the volume and intensity of stormwater flows. With respect to urban development and redevelopment projects, it can be applied onsite to mimic the site's predevelopment drainage characteristics. Through the use of various infiltration techniques, LID is geared towards minimizing surface area that produces large amounts of runoff and does not allow water to infiltrate into the ground. Where infiltration is infeasible, the use of bioretention, rain gardens, vegetated rooftops, and rain barrels that will store, evaporate, detain, and/or treat runoff can be used.

In November 2011, the City adopted the Stormwater LID Ordinance (Ordinance #181899) with the stated purpose of:

- Requiring the use of LID standards and practices in future developments and redevelopments to encourage the beneficial use of rainwater and urban runoff;
- Reducing stormwater/urban runoff while improving water quality;
- Promoting rainwater harvesting;
- Reducing offsite runoff and providing increased groundwater recharge;
- Reducing erosion and hydrologic impacts downstream; and
- Enhancing the recreational and aesthetic values in our communities.

In addition to SUSMP the City institutionalized the use of LID techniques for development and redevelopment projects. Subsequent to the adoption of the Stormwater LID Ordinance, this handbook has been amended to require stormwater mitigation for a much larger number of development projects.

In addition to the SUSMP and LID provisions, other programs dealing with stormwater pollution include the State of California General Plan Law (CGPL) for Municipalities and the California Environmental Quality Act (CEQA). The California CGPL and CEQA provide a basis for municipalities to review and comment on all projects within their jurisdiction. Under the CGPL, municipalities are required to develop policies and regulations that guide development within the municipality. Each development project is reviewed for conformance with these policies. Under CEQA, projects are also subject to review and comment for potential adverse environmental impacts, including impacts from stormwater discharges.

1.4 DEVELOPMENT PLANNING PROGRAM

The Development Planning Program is, in order of priority, comprised of a LID Plan, and/or a Standard Urban Stormwater Mitigation Plan (SUSMP), and/or a Site Specific Mitigation Plan. This handbook provides guidance for compliance with the LID, SUSMP, and Site Specific Mitigation Plan requirements. Project applicants will be required to incorporate stormwater mitigation measures into their design plans and submit the plans to the City for review and approval as described in Section 2.

1.4.1 Low Impact Development Plan

Adopted by the City of Los Angeles on November 14, 2011, the Stormwater LID Ordinance requires stormwater mitigation for a much larger number of development and redevelopment projects than was previously required under SUSMP. Prior to the implementation of the LID

Ordinance, the City's SUSMP program required only specific development and redevelopment categories to incorporate stormwater BMPs. The Stormwater LID Ordinance has expanded these categories to include all development and redevelopment projects that create, add, or replace 500 square feet or more of impervious area.

The Stormwater LID Ordinance applies to all development and redevelopment in the City of Los Angeles that requires building permits within the City after the ordinance effective date except for the following:

- A development or redevelopment that only creates, adds, or replaces less than 500 square feet of impervious area;
- A development or redevelopment involving only emergency construction activity required to immediately protect public health and safety;
- Infrastructure projects within the public right-of-way;
- A development or redevelopment involving only activity related to gas, water, cable, or electricity services on private property;
- A development or redevelopment involving only re-striping of permitted parking lots;
- A project involving only exterior movie and television production sets, or facades on existing developed site.

1.4.2 Standard Urban Stormwater Mitigation Plan (SUSMP)

The SUSMP was adopted by the Regional Board on March 8, 2000 under Resolution No. R-00-02, and was further amended by the SWRCB on October 5, 2000 under State Water Board Order WQ 2000-11. The SUSMP was developed as part of the municipal stormwater program to address stormwater pollution from new development and redevelopment projects.

The NPDES Permit cites the categories of new development and redevelopment projects that require stormwater mitigation measures and outlines the necessary BMPs applicable to each category. The following project categories require a SUSMP:

1. Single-family hillside residential developments [1]
2. Housing developments (including single-family homes, multi-family homes, condominiums, and apartments) of ten or more units

1 Single-family hillside developments less than one acre excluded from the numerical Structural and Treatment Control BMP design standard requirements.

3. Industrial/Commercial [2] developments of one acre or more of impervious surface area
4. Automotive service facilities (SIC 5013, 5014, 5541, 7532-7534, and 7536-7539)
5. Retail gasoline outlets
6. Restaurants (SIC 5812)
7. Parking lots with 5,000 square feet or more of surface area, including accessory driveways, or with 25 or more parking spaces
8. Projects located in, adjacent to, or discharging directly to a designated Environmentally Sensitive Area (ESA)

1.4.3 Site Specific Mitigation Plan

New development and/or redevelopment projects not requiring a LID or SUSMP but which may potentially have adverse impacts on stormwater quality must incorporate a Site Specific Mitigation plan to mitigate stormwater pollution. Such projects may have, but are not limited to, one or more of the following characteristics:

1. Vehicle or equipment fueling areas
2. Vehicle or equipment maintenance areas, including washing and repair
3. Commercial or industrial waste handling or storage
4. Outdoor handling or storage of hazardous materials
5. Outdoor manufacturing areas
6. Outdoor food handling or processing
7. Outdoor animal care, confinement, or slaughter
8. Outdoor horticulture activities
9. Major transportation projects

Projects with one or more of the above characteristics or any project that is subject to the Site Specific Mitigation requirement will be required to incorporate appropriate stormwater mitigation measures or apply either LID or SUSMP to satisfy stormwater requirements.

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2 Industrial/Commercial Facility: any facility involved and/or used in the production, manufacturing, storage, transportation, distribution, exchange or sale of goods and/or commodities, and any facility involved and/or used in providing professional and non-professional services. This category of facilities includes, but is not limited to, any facility defined by the Standard Industrial Classifications (SIC).

SECTION 2: PROJECT REVIEW AND PERMITTING PROCESS

2.1 PLAN APPROVAL PROCESS

The requirement to incorporate stormwater pollution control measures into the design plans of new development and redevelopment projects in order to mitigate stormwater quality impacts is implemented through the City's plan review and approval process. During the review process, the plans will be reviewed for compliance with the City's General Plans, zoning ordinances, and other applicable local ordinances and codes, including stormwater requirements. Plans and specifications will be reviewed to ensure that the appropriate BMPs are incorporated to address stormwater pollution prevention goals. The reviewer will also determine if project designs need to be modified to address stormwater pollution prevention objectives.

New development and redevelopment projects are mainly processed through DCP and LADBS. Entitlement approvals are processed by DCP and these projects require discretionary action. Building/Grading Permit approvals are processed by LADBS.

2.1.1 Department of City Planning Process

The Permit requirements are incorporated into the CEQA process for discretionary projects. The CGPL and CEQA provide a basis for municipalities to review and comment on all projects within their jurisdiction. Under the CGPL, municipalities are required to develop policies and regulations that guide developments within their municipalities. Each development project is then reviewed for conformance with these policies. Under CEQA, projects are also subject to review for any adverse impacts the projects may have on the environment, including those impacts from stormwater discharges. These project types (e.g., zone variances, conditional use permits, plan amendments, site plan reviews, etc.) are considered discretionary review projects requiring review by an elected or appointed decision-making body. Mitigation measures for stormwater quality impacts (such as stormwater BMPs) will be incorporated into the project during environmental and project reviews. The project will be reviewed to ensure that required stormwater BMPs are included. Planning approvals for discretionary projects will not be granted until stormwater mitigation measures are incorporated into the project plans.

All applications for DCP's discretionary decisions are required to be accompanied by an environmental clearance (e.g., Categorical Exemption, Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report). When an applicant files an application for a discretionary project, DCP staff at the public counter will determine whether the project qualifies for an exemption from CEQA. If the project is not exempt and could possibly have a significant impact, the applicant files an Environmental Assessment Form (EAF).

The DCP Environmental Review Section prepares the Initial Study and Checklist. DCP will indicate if the project will impact water absorption rates, drainage patterns, urban runoff or other water quality issues. If no significant effect upon the environment is found, a Negative Declaration will be issued for the project. If mitigation measures are needed, a Mitigated Negative Declaration (MND) is issued for the project, or an Environmental Impact Report (EIR) is required. Stormwater mitigation measures (as shown in Appendix B) will be added to the MND or the EIR for the decision-maker to impose as conditions.

The project applicant must incorporate stormwater pollution control measures into the design plans and submit these plans to the Department of Public Works, Bureau of Sanitation, Watershed Protection Division (WPD) for review and approval. See Appendix C for contact information. Upon satisfaction that all stormwater requirements have been met, WPD staff will stamp the plan approved. Following approval by DCP, building/grading permits are obtained from LADBS.

2.1.2 Department of Building and Safety Process

Applicants must submit design plans to LADBS personnel for review and approval prior to issuance of building/grading permits. LADBS personnel determine if the project requires stormwater mitigation measures and refer applicable projects to WPD for review and approval. LADBS issues the applicant a "Clearance Worksheet" that identifies all of the outstanding approvals from City agencies. A building/grading permit will be issued once all corrections have been completed and clearances are obtained, including for stormwater requirements.

Outlined below are some guidelines for project applicants to follow in submitting design plans for review and approval.

Step One - Submit design plans

The project applicant submits the design plans to LADBS. During the plan review process, LADBS will refer projects needing discretionary action to DCP for additional processing.

Step Two - Define the project category

The plan check engineer will review the design plans and determine if the project is subject to the LID provisions, falls under any of the SUSMP categories or meets any of the characteristics identified under Site Specific Mitigation. If the project is subject to LID provisions, falls under any of the SUSMP categories or meets any of the characteristics identified under Site Specific Mitigation the plan check engineer will refer the applicant to WPD.

Step Three – Issue Building and/or Grading Permit

Once all items on the "Clearances Worksheet" have been completed, including stormwater requirements imposed by WPD, the plan check engineer issues the Building and/or Grading Permit.

2.1.3 Department of Public Works / Bureau of Sanitation Process

To ensure compliance with all City Codes, it is recommended that the architect, civil engineer, plumbing engineer, and/or landscape architect coordinate at the early stage of the project design. Also WPD plan-checking staff is available for consultation regarding the applicable requirements based on the project concept.

Step One - Identify appropriate BMPs

Identify, evaluate, and incorporate into the plan documents the appropriate BMPs for the project categories listed in Section 3.1 (LID), Section 3.2 (SUSMP), or Section 3.3 (Site Specific Mitigation) of this handbook, whichever is applicable.

To assist the residents in small scale residential development/redevelopment projects (4 units or less) Appendix E contains prescriptive methods detailing BMPs to be incorporated into the design plans. The advantage of the prescriptive methods is they were developed as pre-approved designs. Use of prescriptive methods for these types of project categories will dramatically reduce plan preparation and review time.

Approval for development projects and building/grading permits will not be granted/issued until appropriate and applicable stormwater BMPs are incorporated into the project design plans. Also, a plumbing permit from LADBS will be required for certain treatment control BMPs such as grease traps, sump pumps, and clarifiers. For all projects other than small scale residential developments (4 units or less), if an infiltration BMP is chosen for treatment control, a soils report to address the feasibility of infiltration will be required to be submitted with the plan for review and approval.

Step Two– Submit LID, SUSMP, and/or Site Specific Mitigation plans to WPD for review

For first review, the following is a list of the minimum submittal requirements for Small Scale Residential Developments (4 units or less):

- One (1) set of full plans (plot, elevation, utility, mechanical, plumbing, architectural, and landscape plans).
- Plans must include at least the following:

    - Location, size, and capacity of all BMPs on plans
    - Landscaping areas

- Draft Covenant & Agreement (C&A) Form (Appendix D) with an Operation & Maintenance Plan as discussed in Section 2.3.

For first review, the following is a list of the minimum submittal requirement for all other projects:

- One (1) set of grading and/or site plans (may need plumbing, architectural, and landscape plans).
- Plans must be wet-stamped and signed by an engineer or architect.
- Plans must include, but not limited to, at least the following:
    - Location of all BMPs on plans, including elevations and drainage patterns.
    - Detailed drawings of all BMPs, including model, size, and capacity
    - Stenciling note and/or detail
    - Trash enclosure location and details
    - Landscaping areas
- Flow calculations identifying flow rate or volume of stormwater runoff that must be treated (see Appendix F). Submit the manufacturer's product specifications to verify that the selected BMP model can adequately handle the design flow rate.
- Draft Covenant & Agreement (C&A) Form (Appendix D) with an Operation & Maintenance Plan as discussed in Section 2.3

Step Three – WPD Approval

WPD plan-checking staff will review the submitted documents and identify corrections. Once all LID/SUSMP/Site Specific Mitigation requirements have been met, WPD staff will stamp **four (4) sets** of the approved plans, sign the applicant's clearance worksheet, and clear the project in the LADBS plan check tracking system, known as the Plan Check and Inspection System (PCIS).

2.2 INSPECTION PROCESS

To ensure that all stormwater related BMPs are constructed and/or installed in accordance with the approved LID, SUSMP, Site Specific Mitigation Plan the City requires a Stormwater Observation Report (SOR) to be submitted to the City prior to the issuance of the Certificate of Occupancy.

All projects reviewed and approved will require a SOR which shall be prepared, signed, and stamped by the engineer of record (for example, a California-licensed civil engineer, architect, contractor or qualified professional) responsible for the approved LID/SUSMP/Site Specific Mitigation Plan, certifying that:

1. He/she is the engineer or architect responsible for the approved LID/SUSMP/Site Specific Mitigation Plan and
2. He/she or the designated staff under his/her responsible charge has performed the required site visits at each significant construction stage and at completion to verify that the BMPs shown on the approved plan have been constructed and installed in accordance with the approved LID/SUSMP/Site Specific Mitigation Plan.

An original SOR needs to be submitted and not a photocopy. The Certificate of Occupancy will be issued by LADBS after all required clearances are obtained, including the one by WPD plan-checking staff. At that stage the project has been determined, through the normal inspection process, to be built in accordance with the approved plan, including the construction and/or installation of appropriate stormwater-related BMPs and the project has been determined to comply with all applicable codes, ordinances, and other laws.

2.3 BMP MAINTENANCE

A Covenant and Agreement (C&A) document shall be submitted, along with the design plans showing the project's stormwater measures, during the plan review and approval process, and must be signed by the legal owner or authorized agent of the property. The C&A shall also be recorded with the County Recorder. The City will withhold the grading and/or building permit for the development application until this requirement is satisfied. A sample form of the C&A is provided in Appendix D.

Maintenance is crucial for proper and continuous operation, effectiveness, and efficiency of a structural or treatment control BMP. The cost of long-term maintenance should be evaluated during the BMP selection process. By signing a maintenance form, the legal property owner affirms he/she will perform regular and long-term maintenance of all BMPs installed onsite. For residential properties where the structural or treatment control BMPs are located within a common area and will be maintained by a homeowner's association, language regarding the responsibility for maintenance must be included in the project's conditions, covenants and restrictions (CC&Rs). The C&A is bound to the property and transfers to the new owner with any subsequent sale of the property. It should be noted that an original copy of the letter of authority should be submitted for individuals signing the C&A form that are not the property owners. Attached to the C&A will be an Operation and Maintenance (O&M) Plan (see Appendix D for a sample) describing the BMP operation and maintenance procedures, employee training program and duties, operating schedule, maintenance frequency, routine service schedule, and other activities. A maintenance log shall be maintained at the facility to document all of the activities mentioned above. These documents may be inspected by the City of Los Angeles at any time and shall be made available to the City upon request.

2.4 MUNICIPAL PROJECTS

Stormwater mitigation measures are required for all projects subject to the LID, SUSMP, or Site Specific Mitigation Plan. City projects that will be processed through DCP and/or LADBS will be subject to the review and approval process described in Section 2.1. For other City projects that do not undergo the plan review and approval process with DCP and/or LADBS, the public agency must use this handbook to incorporate the required stormwater mitigation measures into their projects.

Public agency projects other than from the City of Los Angeles, such as State of California, County of Los Angeles, the Metropolitan Transit Authority that are subject to the SUSMP or Site Specific Mitigation and require a permit from the City of Los Angeles are required to implement stormwater mitigation measures. In addition non-roadway transportation projects that meet the thresholds for LID/SUSMP categories are also required to implement stormwater mitigation measures. Examples of such projects include the rail lines and stations, airport runways, and busways. Such projects must incorporate stormwater BMPs into their design plans and specifications, which must be submitted to WPD for review and approval.

SECTION 3: STORMWATER MANAGEMENT MEASURES

3.1 LOW IMPACT DEVELOPMENT (LID) PLAN

Project applicants for all developments and redevelopments will be required to incorporate stormwater mitigation measures into their design plans and submit the plans to the City for review and approval. The design plans will be subjected to a review process as indicated in Section 2, prior to the issuance of approvals for building and/or grading permits.

Projects that are part of a larger common plan of development involving five units or more will be subject to the requirements for "All Other Development", as set forth in Section 3.1.2. This includes projects that are subject to one common grading permit and projects that have phased schedules or are intended to be sectioned-off for sale to individual homeowners.

Project applicants for all developments and redevelopments will also be required incorporate the following performance measures and practices into their design plans.

Peak Stormwater Runoff Discharge Rates

New development and/or redevelopment projects that drain to natural drainage systems in a small part of the Upper Los Angeles watershed shall control post-development peak storm water runoff discharge rates, velocities, and duration (peak flow control) to mimic pre-development hydrology and to prevent accelerated stream erosion and to protect stream habitat. These controls should be consistent with the Hydromodification Control Plan developed by the County of Los Angeles, Department of Public Works.

Conserve Natural Areas

Each project site possesses unique topographic, hydrologic and vegetative features, some of which are more suitable for development than others. Locating development on the least sensitive portion of a site and conserving naturally vegetated areas can minimize environmental impacts in general and stormwater runoff impacts in particular.

If applicable and feasible for the given site conditions, the following measures are required and should be included in the project site layout:

1. Concentrate or cluster improvements on the least-sensitive portions of the site, while leaving the remaining land in a natural undisturbed state;
2. Limit clearing and grading of native vegetation at the site to the minimum area needed to build the home, allow access, and provide fire protection;
3. Maximize trees and other vegetation at the site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought-tolerant plants; and
4. Preserve riparian areas and wetlands.

Protect Slopes and Channels
Erosion of slopes and channels can be a major source of sediment and associated pollutants, such as nutrients, if not properly protected and stabilized.

Slope protection practices must conform to design requirements or standards set forth by local permitting agency erosion and sediment control standards and design standards. The post-construction design criteria described below are intended to enhance and be consistent with these local standards.

1. Slopes must be protected from erosion by safely conveying runoff from the tops of slopes.
2. Slopes must be vegetated with first consideration given to native or drought-tolerant species.

The following measures should be implemented to provide erosion protection to unlined receiving streams on the project site. Activities and structures must conform to applicable permitting requirements, standards and specifications of agencies with jurisdiction (e.g., U.S. Army Corps of Engineers, California Department of Fish and Game, or RWQCB).

1. Utilize natural drainage systems to the maximum extent practicable, but minimize runoff discharge to the maximum extent practicable.
2. Stabilize permanent channel crossings.
3. Install energy dissipaters, such as rock riprap, at the outlets of storm drains, culverts, conduits or channels that discharge into unlined channels.

Provide Storm Drain System Stenciling and Signage
Storm drain message markers or placards are required at all storm drain inlets within the boundary of the project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations must be identified on the development site map.

Some local agencies within the City have approved storm drain message placards for use. Consult local permitting agency stormwater staff to determine specific requirements for placard types and methods of application.

3.1.1 Environmentally Sensitive Areas (ESAs)

Development and redevelopment projects that are greater than or equal to 1 acre **or** greater than or equal to 2,500 square feet and within an ESA, shall comply with the standards and requirements of Section 3.1.3 - All Other Developments.

3.1.2 SMALL SCALE RESIDENTIAL DEVELOPMENTPROJECTS (4 UNITS AND LESS)

Small scale residential projects include all projects that increase impervious area by more than 500 square feet (i.e., residential development of 4 units or less and all other developments that are not subject to Section 1.4.2). The majority of these projects are not required to complete formal hydrologic analysis or obtain approval from the Upper Los Angeles River Area (ULARA) Watermaster. The basic objectives for these projects include reducing a site's impervious surfaces, improving a site's ability to infiltrate stormwater, conserving stormwater runoff for other on-site water demand uses, and reducing negative impacts downstream.

REQUIREMENTS:

i. Development or redevelopment less than 1 acre shall implement adequately sized LID BMP alternatives as defined and listed in Appendix E; or

ii. Development or redevelopment that are one acre or larger, the development shall comply with the standards and requirements of Section 3.1.3 - All Other Developments.

BEST MANAGEMENT PRACTICES (BMPS):

Upon filing an application for a Building Permit with LADBS, a separate plot plan identifying the LID BMPs that are used (including size) and drainage area tributary to each BMP shall be shown in accordance with the prescriptive methods.

The following LID BMPs have been established as prescriptive LID improvement features to be employed on a qualifying small scale project. These BMPs are presented in the form of Fact Sheets in Appendix E with the intent of providing self-contained BMP background context and sizing requirements to facilitate a permit applicant to follow and comply with the City of Los Angeles' Stormwater LID Ordinance. Applicants may choose from one or more of the prescriptive BMPs to comply with the ordinance.

The prescriptive specific small scales BMPs include the following:

1. Rain Barrels & Small Cisterns
2. Permeable Pavements (or Porous Pavement Systems)
3. Planter Boxes
4. Rain Gardens
5. Dry Wells

Figure 3.1 demonstrates the use of all five of these small scale residential BMPs at a residence.

Figure 3.1- Small Scale Residential BMP Schematic

3.1.3 ALL OTHER DEVELOPMENTS

Any new development or redevelopment project that does not meet the requirements of Section 3.1.2 – Small Scale Residential Development Projects, shall comply with this section.

A LID Plan shall be prepared to comply with the following:

1. Stormwater runoff will be infiltrated, evapotranspired, captured and used, and/or treated through high removal efficiency Best Management Practices onsite, through stormwater management techniques as identified in Section 4.1. The onsite stormwater management techniques must be properly sized, at a minimum, to infiltrate, evapotranspire, store for use, and/or treat through a high removal efficiency biofiltration/biotreatment system, without any stormwater runoff leaving the site to the maximum extent feasible, for at least the volume of water produced by the water quality design storm event that results from:

    i. The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area using a 48 to 72-hour drawdown time, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998); or

    ii. The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in the California Stormwater Best Management Practices Handbook – Industrial/Commercial, (2003); or

    iii. The volume of runoff produced from a 0.75 inch storm event.

2. Pollutants shall be prevented from leaving the development site for a water quality design storm event as defined above unless it has been treated through an onsite high removal efficiency biofiltration/biotreatment system.

3. Hydromodification impacts shall be minimized to natural drainage systems.

REQUIREMENTS:

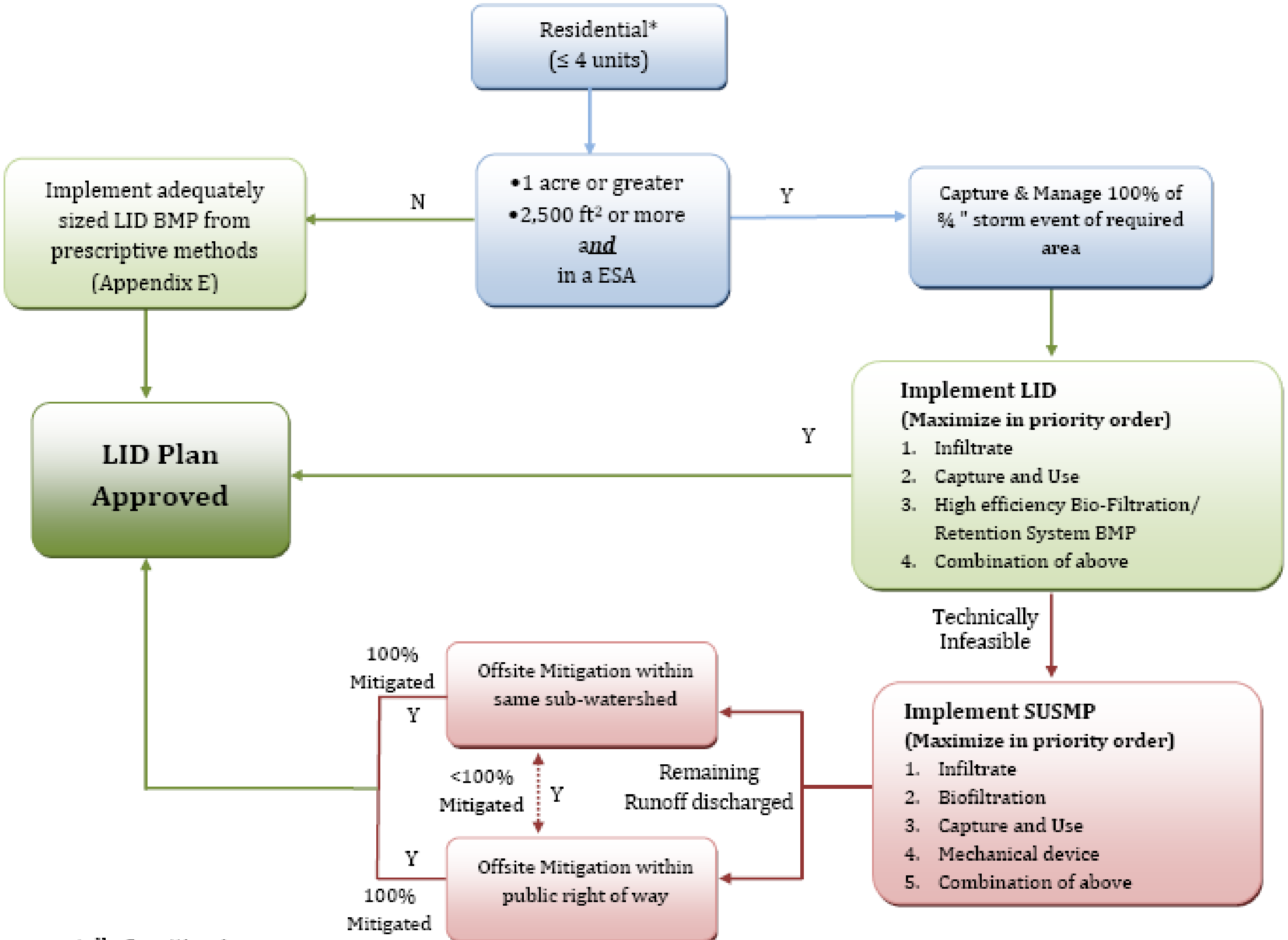
All other developments (residential developments of 5 units or more and nonresidential developments) shall adhere to the following requirements:

1. For new development or where redevelopment results in an alteration of at least fifty percent or more of the impervious surfaces of an existing developed site, the entire site shall comply with the standards and requirements of Section 3.1.3; or

2. Where the redevelopment results in an alteration of less than fifty percent of the impervious surfaces of an existing developed site, only such incremental development shall comply with the standards and requirements of Section 3.1.3.

If partial or complete onsite compliance of any type is technically infeasible, the project Site and LID Plan shall be required to comply with, at a minimum, all applicable SUSMP requirements (Appendix G) in order to maximize onsite compliance. Any remaining runoff that cannot feasibly be managed onsite must be mitigated under the Offsite Mitigation Option. Figure 3.2 is a schematic which depicts the design requirements for small scale residential projects, while Figure 3.3 depicts the design requirements for all other developments.

Low Impact Development
Plan Check Process

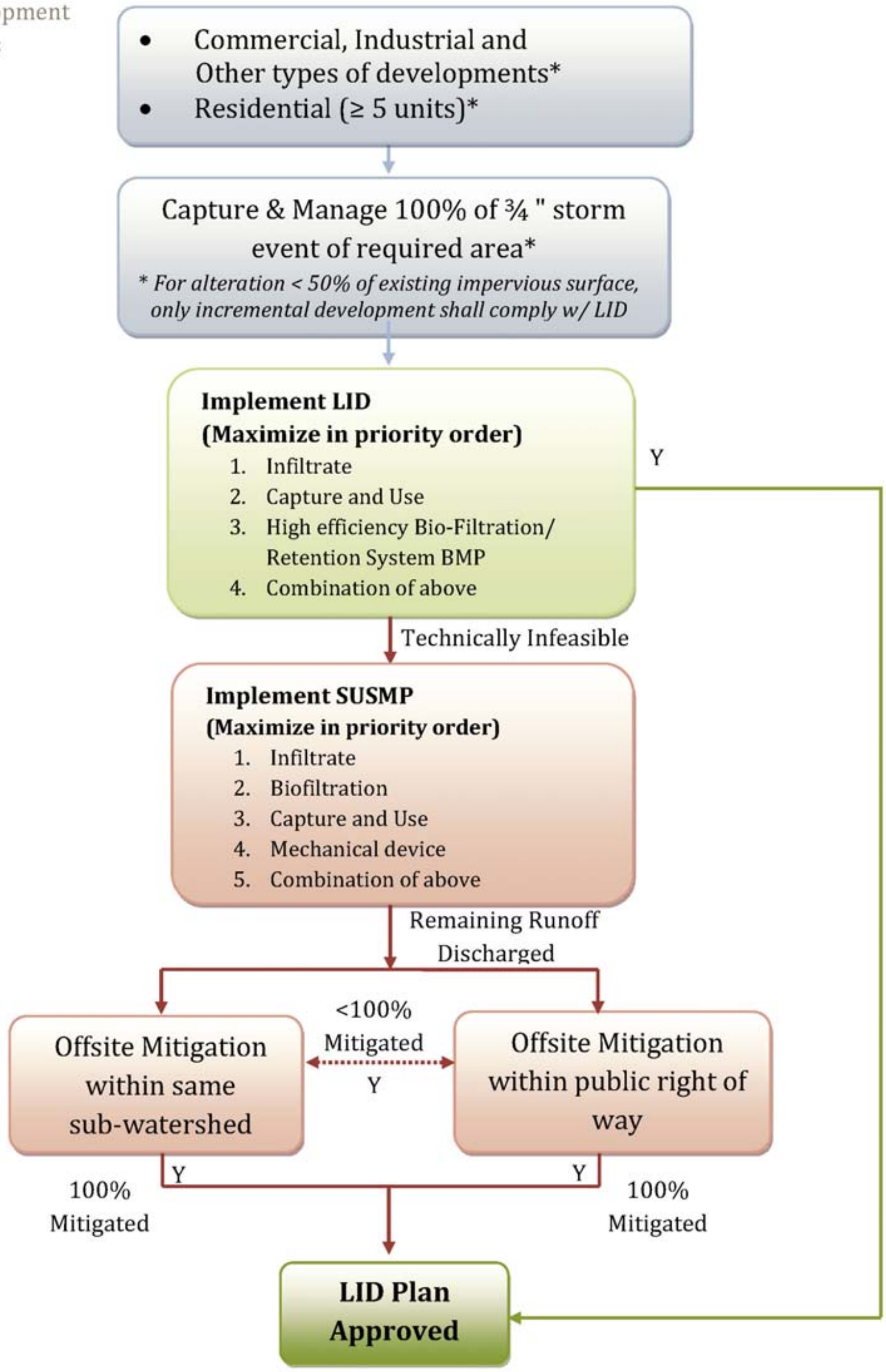


ESA – Environmentally Sensitive Area

* New and Re-development < 500 ft² are Exempt from the LID Ordinance

Figure3.2- Requirements for Residential Development of 4 Units or Less

Low Impact Development Plan Check Process



* New and Re-development < 500 ft² are exempt from the LID Ordinance

Figure 3.3 – Requirements for All Other Development

3.2 STANDARD URBAN STORMWATER MITIGATION PLAN (SUSMP)

Any project that cannot comply with the LID requirements in Section 3.1 shall be required to comply with, at a minimum, all applicable SUSMP requirements (Appendix G) in order to maximize onsite compliance.

Project applicants will be required to incorporate stormwater mitigation measures into their design plans and submit the plans to the City for review and approval. The design plans will be subjected to a review process as indicated in Section 2, prior to the issuance of approvals for building and/or grading permits.

3.3 SITE SPECIFIC MITIGATION

Site Specific project applicants will be required to submit to the City a design plan that incorporates appropriate stormwater mitigation measures and details the source and treatment control BMPs, and must also submit the O&M plan for the treatment control BMPs. All maintenance agreements should refer the Covenant and Agreement forms in Appendix D. The design plans will be subject to the review and approval process described in Section 2, prior to the issuance of building or grading permits.

3.4 SOURCE CONTROL MEASURES

Source control measures are low-technology practices designed to prevent pollutants from contacting stormwater runoff or to prevent discharge of contaminated runoff to the storm drainage system. This section addresses site-specific source control measures consisting of specific design features or elements. These control measures have been developed for specific types of sites or activities that have been identified as potential significant sources of pollutants in stormwater. Each of the measures specified in this section should be implemented in conjunction with any other operational source control measure such as good housekeeping, and employee training to optimize pollution prevention.

The measures addressed in this section apply to both stormwater and non-stormwater discharges. Non-stormwater discharges are the discharge of any substance, such as process wastewater, to the storm drainage system or water body that is not composed entirely of stormwater. Stormwater that is mixed or commingled with other non-stormwater flows is considered non-stormwater. Discharges of stormwater and non-stormwater to the storm drainage system or a water body may be subject to local, state, or federal permitting prior to discharge. The appropriate agency should be contacted prior to any discharge. Discuss the matter with the stormwater staff if you are uncertain as to which agency should be contacted.

Some of the measures presented in this section require connection to the sanitary sewer system. Connection and discharge to the sanitary sewer system without prior approval or obtaining the required permits is prohibited. Contact the WPD staff to obtain information regarding obtaining sanitary sewer permits from the appropriate City office. Discharges of certain types of flows to the sanitary sewer system may be cost prohibitive and may not be allowed. The designer is urged to contact the appropriate City offices prior to completing site and equipment design of the facility.

Site-specific source control measures and associated design features specified for various sites and activities are summarized in Table 3.1. Fact Sheets are presented in Appendix H for each source control measure. These sheets include design criteria established by the City to ensure effective implementation of the required measures. Finally the CEQA Mitigation Measures listed in Appendix B includes a number of additional source control measures that should be implemented.

The source control measures and the site specific requirements that are discussed in this section should be incorporated in the design plans when appropriate. The C&A should also make a reference to any long-term operational plans such as a Stormwater Pollution Prevention Plan (SWPPP) to commit the facility to these measures.

Table 3.1: Summary of Site-Specific Source Control Measure Design Features

Site-Specific Source Control Measure [a]	**DESIGN FEATURE OR ELEMENT**						
	Signs, placards, stencils	Surfacing (compatible, impervious)	Covers, screens	Grading/berming to prevent run-on	Grading/berming to provide secondary containment	Sanitary sewer connection	Emergency Storm Drain Seal
Storm Drain Message and Signage (S-1)	X						
Outdoor Material Storage Area Design (S-2)		X	X	X	X		X
Outdoor Trash Storage and Waste Handling Area Design (S-3)		X	X	X		X	
Outdoor Loading/Unloading Dock Area Design (S-4)		X	X	X	X		
Outdoor Repair/Maintenance Bay Design (S-5)		X	X	X	X		X
Outdoor Vehicle/Equipment/ Accessory Washing Area Design (S-6)		X	X	X	X	X	X
Fueling Area Design (S-7)		X	X	X	X		X

(a) Refer to Fact Sheets in Appendix H for detailed information and design criteria.

SECTION 4: BMP PRIORITIZATION AND SELECTION

4.1 PRIORITIZATION OF BMP SELECTION

BMPs shall be designed to manage and capture stormwater runoff. Infiltration systems are the first priority type of BMP improvements as they provide for percolation and infiltration of the stormwater into the ground, which not only reduces the volume of stormwater runoff entering the MS4, but in some cases, can contribute to groundwater recharge. If stormwater infiltration is not possible based on one or more of the project site conditions listed below, the developer shall utilize the next priority BMP.

The order of priority specified below shall apply to all projects categorized as "all other developments" in accordance with Section 3.1.3. Each type of BMP shall be implemented to the maximum extent feasible when determining the appropriate BMPs for a project.

1. Infiltration Systems
2. Stormwater Capture and Use
3. High Efficiency Biofiltration/Bioretention Systems
4. Combination of Any of the Above

For purposes of compliance with the LID requirements, and without changing the priority order of design preferences as mentioned in this section, all runoff from the water quality design storm event, as determined in Section 3.1.3 above, that has been treated through an onsite high removal efficiency biofiltration system shall be credited as equivalent to 100% infiltration regardless of the runoff leaving the site from the onsite high removal efficiency biofiltration system and that runoff volume shall not be subject to the offsite mitigation requirements.

If partial or complete onsite compliance of any type is technically infeasible, the project Site and LID Plan shall be required to comply with, at a minimum, all applicable SUSMP requirements in order to maximize onsite compliance. Under this option a mechanical / hydrodynamic unit may be used. Any remaining runoff that cannot feasibly be managed onsite must be mitigated under the offsite mitigation option.

4.2 INFILTRATION FEASIBILITY SCREENING

The implementation of infiltration BMPs may be deemed infeasible at a project site due to existing site conditions. To assist in the determination of compliance feasibility, a categorical screening of specific site information shall be carried out to assess site conditions.

The first category of screening shall consist of specific site conditions which, if present at the site, would deem the specified BMP-type “feasible”. The second category of screening shall consist of specific site conditions which, if present at the site, would deem the BMP-type “potentially feasible”. Project locations passing this screening category may still be able to utilize the screened compliance measure, though the implementation of such a measure may require supplementary actions. The third category of screening shall consist of site conditions which, if present at the site, would deem a specified BMP-type “infeasible”. This type of screening can generally be carried out in the pre-planning stage of a project. These categorical screenings must be verified by a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional geotechnical engineer or geologist and approved by LADBS.

To assist in the determination of site feasibility for infiltration BMPs, Table 4.1 has been created.

	Category 1 Screening (Feasible)	**Category 2 Screening (Potentially Feasible)**	**Category 3 Screening (Infeasible)**
Description	1. Underlying Groundwater ☐ Depth of bottom of infiltration facility to seasonal high groundwater is > 10 ft 2. Site Soils ☐ Infiltration rate (K_{sat}) is > 0.5 in/hr ☐ Geotechnical hazards are not a potential near the site 3. Site Surroundings ☐ Buildings or structures are at least 25 ft away from the potential infiltration BMP ☐ Site is not located within the designated hillside grading area. ☐ No continuous presence of dry weather flows	1. Underlying Groundwater ☐ Depth from bottom of infiltration facility to seasonal high groundwater is ≤ 10 ft ☐ Unconfined aquifer is present with beneficial uses that may be impaired by infiltration. Full treatment required if this is the case ☐ Groundwater is known to be polluted. Infiltration must be determined to be beneficial 2. Site Soils ☐ Infiltration rate is ≤ 0.5 in/hr but potential connectivity to higher K_{sat} soils is feasible ☐ Geotechnical hazards such as liquefaction are a potential near the site 3. Site Surroundings ☐ Buildings or structures are within 10 to 25 ft of the potential infiltration BMP ☐ High-risk areas such as service/gas stations, truck stops, and heavy industrial sites. Full treatment is required if this is the case, or high-risk areas must be separate from stormwater runoff mingling	1. Underlying Groundwater ☐ Depth from bottom of infiltration facility to seasonal high groundwater is ≤ 5 ft ☐ Sites with soil and/or groundwater contamination** 2. Site Soils ☐ Infiltration rate is ≤ 0.3 in/hr and connectivity to higher K_{sat} soils is infeasible ☐ Building sites designated "Landslide" or "Hillside Grading" areas as specified by the Department of City Planning's Zone Information and Map Access System (ZIMAS) ☐ Geotechnical hazards such as liquefaction, collapsible soils, or expansive soils exist 3. Site Surroundings ☐ Site is located on a fill site ☐ Site is located on or within 50 feet upgradient of a steep slope (20% or greater) and has not been approved by a professional geotechnical engineer or geologist
Instructions	If all of the above boxes are checked, they shall be confirmed by a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional geotechnical engineer or geologist, verifying that infiltration BMPs are feasible at the site*. Otherwise, proceed to Category 2 screening.	If all of the above boxes are checked, or if corresponding boxes in Category 1 are checked in combination with the above boxes, a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional geotechnical engineer or geologist shall be carried out to approve infiltration measures*. Otherwise, proceed to Category 3 screening.	If any of the above boxes are checked, a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional geotechnical engineer or geologist shall be submitted to prove infiltration practices are not feasible. *

Table 4.1: Infiltration Feasibility Screening

* Geotechnical Reports shall be approved by LADBS Grading Division. See Geotechnical Report Requirements herein.

** The presence of soil and/or groundwater contamination and/or the presence of existing or removed underground storage tanks shall be documented by CEQA or NEPA environmental reports, approved geotechnical reports, permits on file with the City, or a review of the State of California's Geotracker website.

Assessing Site Infiltration Feasibility

Assessing a site's potential for implementation of Low Impact Development Best Management Practices (LID BMPs) and infiltration BMPs requires both the review of existing information and the collection of site-specific measurements. Available information regarding site layout and slope, soil type, geotechnical conditions, and local groundwater conditions should be reviewed as discussed below. In addition, soil and infiltration testing is required to be conducted to determine if stormwater infiltration is feasible and to determine the appropriate design parameters for the infiltration BMP.

Geotechnical Considerations and Report Requirements:

As determined by the City of Los Angeles, Department of Building and Safety, Grading Division, a geotechnical report will be required for projects that will incorporate infiltration as part of the drainage system. Geotechnical reports shall be signed by a professional Geotechnical or Civil Engineer licensed in the State of California and/or a Certified Engineering Geologist.

Refer to Building & Safety information bulletin, "Guidelines for Stormwater Infiltration" for additional information, Appendix I.

http://ladbs.org/LADBSWeb/LADBS_Forms/InformationBulletins/IB-P-BC2008-118StormwaterInfiltn.pdf

Site Conditions

Slope:

The site's topography should be assessed to evaluate surface drainage, topographic high and low points, and to identify the presence of steep slopes that qualify as hillside locations, all of which have an impact on what type of infiltration BMPs will be most beneficial for a given project site. Stormwater infiltration is more effective on level or gently sloping sites. On hillsides, infiltrated runoff may seep a short distance down slope, which could cause slope instability depending on the soil or geologic conditions, or result in nuisance seepage. Figure E-1 in Appendix E provides general guidance of the City with slopes greater than 15%.

Soil Type and Geology:

The site's soil types and geologic conditions should be determined to evaluate the site's ability to infiltrate stormwater and to identify suitable, as well as unsuitable locations for locating infiltration-based BMPs.

In addition, available geologic or geotechnical reports on local geology should be reviewed to identify relevant features such as depth to bedrock, rock type, lithology, faults, and hydrostratigraphic or confining units. These geologic investigations may also identify shallow water tables and past groundwater issues that are important for BMP design (see below). Figure E-5 in Appendix E provides general guidance identifying parts of the City that have well-draining soil conditions.

Groundwater Considerations:

The depth to groundwater beneath the project during the wet season may preclude infiltration. A minimum of five feet of separation to the seasonal (December through April) high ground water level and mounded groundwater level is required. For projects located in the Upper Los Angeles River Area, ten feet of separation is required.

Infiltration on sites with contaminated soils or groundwater that could be mobilized or exacerbated by infiltration is not allowed, unless a site-specific analysis determines the infiltration would be beneficial. A site-specific analysis may be conducted where groundwater pollutant mobilization is a concern to allow for infiltration-based BMPs. Areas with known groundwater impacts include sites listed by the RWQCB's Leaking Underground Storage Tanks (LUST) program and Site Cleanup Program (SCP). The California State Water Resources Control Board maintains a database of registered contaminated sites through their 'Geotracker' Program. Registered contaminated sites can be identified in the project vicinity when the site address is typed into the "map cleanup sites" field. Mobilization of groundwater contaminants may also be of concern where contamination from natural sources is prevalent (e.g., marine sediments, selenium rich groundwater, to the extent that data is available). Figure E-3 in Appendix E provides general guidance identifying parts of the City that may be in areas of concern.

Upper Los Angeles River Watermaster Requirements:

Infiltration projects located in the Upper Los Angeles River Area (ULARA) must comply with the requirements of the ULARA Watermaster. See Appendix J for requirements and approval process. Boundaries of the ULARA are shown in Appendix J.

Managing Offsite Drainage:

Locations and sources of offsite run-on to the site must be identified early in the design process. Offsite drainage must be considered when determining appropriate BMPs for the site so that the drainage can be managed. By identifying the locations and sources of offsite drainage, the volume of water running onto the site may be estimated and factored into the siting and sizing of onsite BMPs. Vegetated swales or storm drains may be used to intercept, divert, and convey offsite drainage through or around a site to prevent flooding or erosion that might otherwise occur.

4.3 CAPTURE AND USE FEASIBILITY SCREENING

Capture and use, commonly referred to as rainwater harvesting, collects and stores stormwater for later use, thereby reducing the quantity of stormwater runoff. Partial capture and use can also be achieved as part of a treatment train by directing the overflow to a bioretention system to provide additional volume reduction and water quality treatment in instances where the quantity of runoff from a storm event exceeds the volume of the collection tank.

In the City of Los Angeles, the use of collected stormwater will primarily be limited to irrigation of landscaped surfaces. However, as new guidelines and guidance becomes available the potential for other uses of collected stormwater will be considered. Capture and use BMPs that are designed with the intent to use captured stormwater for indoor or consumptive purposes will be reviewed on a case-by-case basis to ensure that all treatment, plumbing, and Building and Safety codes are met.

At a minimum, capture and use BMPs must be designed and maintained to ensure adequate capacity is available to capture the stormwater quality design volume within 3 days of a storm event that is forecasted to have a 50% or grater probability of providing precipitation. Precipitation forecast information must be obtained from the National Weather Service Forecast Office (e.g. by entering the zip code of the developments location at http://www.srh.noaa.gov/forecast). BMPs sized to capture only the runoff produced from the 0.75 inch storm event, or BMPs designed to capture less than this volume if being used in conjunction with other BMPs, must therefore drawdown their entire captured volume within 3 days of a storm event. Capture and use BMPs designed for storm events larger than 0.75 inches are not required to disperse their entire captured volume within 3 days of capture; rather, the requirement mandates that enough water be dispersed from the BMP to ensure that adequate capacity is available to capture the next storm event up to 0.75 inches.

In instances where the quantity of runoff from the 0.75 inch storm event exceeds the volume of the collection tank, partial capture and use can also be achieved as part of a treatment train by directing the overflow to stable vegetated areas where erosion or suspension of sediment is not a factor or through a high flow biotreatment BMP to provide additional volume reduction and water quality treatment. Overflow from the tank into the storm drain system is not allowed.

The implementation of capture and use BMPs may be deemed infeasible at a project site due to existing site conditions. To assist in the determination of compliance feasibility, a categorical screening of specific site information shall be carried out to assess site conditions. This screening approach follows the same general guidelines as those designed for the infiltration feasibility screening. Table 4.2 has been created to help determine site feasibility for capture and use BMPs.

<table>
<tr><th></th><th>Category 1 Screening
(Feasible)</th><th>Category 2 Screening
(Potentially Feasible)</th><th>Category 3 Screening
(Infeasible)</th></tr>
<tr><td>Description</td><td>1. Landscaped Area
☐ Landscaped area categorization of 1 exists in accordance with Table 4.3
☐ Captured volume equal to or less than the Estimated Total Water Usage (ETWU) from October 1 - April 30.
2. Site Soils
☐ Geotechnical hazards are not a potential near the site
3. Vector Control
☐ Approved vector control measures will be implemented</td><td>1. Landscaped Area
☐ Landscaped area categorization of 2 exists in accordance with Table 4.3
☐ Captured volume greater than the Estimated Total Water Usage (ETWU) from October 1 - April 30.
2. Site Soils
☐ Geotechnical hazards such as liquefaction are a potential near the site
☐ Soil hydraulic conductivities are sufficient for the designed water application rate; if not, soil amendments will be implemented</td><td>1. Landscaped Area
☐ Landscaped area categorization of 3 exists in accordance with Table 4.3
2. Site Soils
☐ Geotechnical hazards such as landsliding, collapsible soils, or expansive soils exist
3. Site Surroundings
☐ Site is located on or within 50 feet of a steep slope (20% or greater) as determined by the Department of Building and Safety; irrigation within 3 days of a rain event could cause geotechnical instability</td></tr>
<tr><td>Instructions</td><td>If all of the above boxes are checked, they shall be confirmed by a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional civil engineer, geotechnical engineer, geologist, or landscape architect, verifying that capture and use BMPs are feasible at the site.* Otherwise, proceed to Category 2 screening.</td><td>If all of the above boxes are checked, or if corresponding boxes in Category 1 are checked in combination with the above boxes, a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional civil engineer, geotechnical engineer, geologist, or landscape architect, shall be carried out to approve capture and use measures.* Otherwise, proceed to Category 3 screening.</td><td>If any of the above boxes are checked, a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional geotechnical engineer, geologist, or landscape architect shall be submitted to prove capture & use practices are not feasible. *</td></tr>
</table>

Table 4.2: Capture and Use Feasibility Screening

* Geotechnical Reports shall be approved by LADBS Grading Division. See Geotechnical Report Requirements contained in the Infiltration Feasibility section.

Table 4.3 has been created to help determine site feasibility for capture and use BMPs based on the local infiltration rate as well and the percent of the project that is landscaped. The table is to be used in conjunction with Table 4.2 to determine site feasibility.

Table 4.3: Landscaped Area Categorization

	Percent of Project that is Landscaped					
Local Infiltration Rate	0-5%	5-10%	10-20%	20-30%	30-50%	>50%
0.3 - 0.5 in/hr	2	2	2	1	1	1
0.2 - 0.3 in/hr	3	2	2	2	1	1
0.1 - 0.2 in/hr	3	3	2	2	2	1
0 - 0.1 in/hr	3	3	3	2	2	2

Assessing Site Capture and Use Feasibility

As with infiltration BMPs, assessing a site's potential for implementation of capture and use BMPs requires both the review of existing information and the collection of site-specific measurements. Available information regarding the site's landscaped area should be reviewed as discussed below. In addition, human health concerns should be prioritized, particularly with regards to vector control issues arising from the addition of standing water on site.

Landscaped Area Assessment

For capture and use BMPS, captured rainfall is stored during rain events and used for irrigation purposes at a later time, thereby offsetting potable water demand and reducing pollutant loading to the storm drain system. Therefore, sufficient landscaped area with appropriate water demand is needed for the captured runoff to be directed to. A properly sized cistern should be able to contain the runoff generated from the design storm event and discharge that water for irrigation use within a specified drawdown time.

In the City of Los Angeles, cisterns will primarily be sized to capture the runoff generated from the 0.75 inch storm while meeting the drawdown time requirement. A site's landscaped area must therefore be able to retain this volume of water within the appropriate drawdown time. Depending on the type of irrigation application that is desirable at a site, two different methods exist to determine if a site has adequate landscaped cover for capture and use feasibility:

1. For sites with sufficient agronomic demand to meet or exceed the captured supply of stormwater within the drawdown time, Category 1 Feasibility may apply. Agronomic demand must be calculated and reported by a professional landscape architect or qualified professional.
2. For sites with sufficient landscaped area and dispersal capacity (i.e. ability to receive irrigation water without generating runoff) to meet or exceed the captured supply of stormwater within the drawdown time, Category 2 Feasibility may apply. The dispersal capacity can be assumed to be equal to the infiltration capacity of the site soil for

simplicity. The infiltration rate must be calculated and reported by a professional landscape architect, civil engineer, geotechnical engineer, or geologist.

The above criteria must be assessed assuming that no irrigation occurs within the first 24 hours immediately following a storm. This means that a drawdown time of 72 hours must consider only 48 hours of active application. Agronomic demands and infiltration rates must be assessed within 3 days of a storm event to account for resulting diminished demands.

BMPs designed for extended holding times shall be reviewed on a case-by-case basis for feasibility. A site not meeting the minimum landscaped area criteria is not feasible for capture and use BMPs (See Table 4.3 in conjunction with Table 4.2).

<u>Los Angeles County Department of Public Health Requirements</u>

Projects that are implementing rainfall or urban runoff capture and distribution systems must obtain approval from the County of Los Angeles, Department of Public Health. See Appendix K for the Policy and Operation Manual.

<u>Vector Control Considerations</u>

A vector is any insect, arthropod, rodent, or other animal that is capable of harboring or transmitting a causative agent of human disease. In the City of Los Angeles, the most significant vector population related to stormwater is mosquitoes.

Vector sources occur where conditions provide habitat suitable for breeding, particularly any source of standing water. This means that stormwater BMPs, especially those of the capture and use type, can be breeding grounds for mosquitoes and other vectors resulting in adverse public health effects related to vectors and disease transmission. Because of this, efforts shall be made to design capture and use BMPs that do not facilitate the breeding of vectors. Vectors should be considered during the preparation of stormwater management and maintenance plans and during preconstruction planning to avoid creating possible public health hazards.

Oversized capture and use BMPs designed to hold captured stormwater for longer than 72 hour periods will require additional treatment such as filtration or disinfection to protect the collection tanks from fouling, to prevent the breeding of vectors, and/or to improve the quality of water for reuse applications. These BMPs must have appropriate vector control measures incorporated into the design of the system to exclude vector access and breeding (i.e., observation access for vector inspection and treatment). They should be approved by the County of Los Angeles Department of Public Health. These scenarios will be reviewed on a case-by-case basis.

If vector breeding is taking place at a site as a result of contained stormwater or inadequately maintained BMPs, the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).

4.4 INFILTRATION BMPS

Infiltration refers to the physcial process of percolation, or downward seepage, of water through a soil's pore space. As water infiltrates, the natural filtration, adsorption, and biological decomposition properties of soils, plant roots, and micro-organisms work to remove pollutants prior to the water recharging the underlying groundwater. Infiltration BMPs include infiltration basins, infiltration trenches, infiltration galleries, bioretention without an underdrain, dry wells, and permeable pavement. Infiltration can provide multiple benefits, including pollutant removal, peak flow control, groundwater recharge, and flood control. However, conditions that can limit the use of infiltration include soil properties, proximity to building foundations and other infrastructure, geotechnical hazards (e.g., liquefaction, landslides), and potential adverse impacts on groundwater quality (e.g industrial pollutant source areas, contaminated soils, groundwater plumes)[3]. To ensure that infiltration would be physcially feasible and desireable (i.e., not have adverse impacts), a categorical screening of site feasibility criteria must be completed prior to the use of infiltration BMPs following the guidelines presented in Section 4.2.

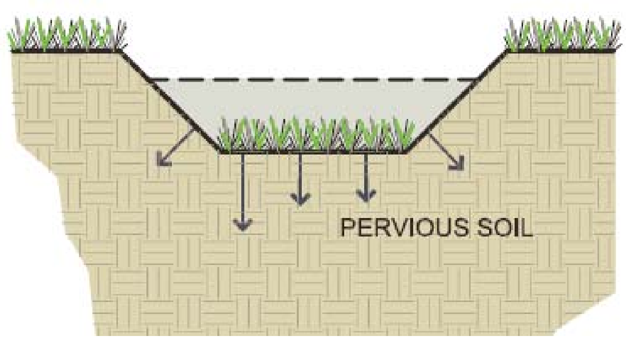
4.4.1 Infiltration BMP Types

<u>Surface Infiltration BMPs</u>

These BMPs rely on infiltration in a predominantly vertical (downward) direction and depend primarily on soil characteristics in the upper soil layers. These infiltration BMPs include:

Infiltration Basins

An infiltration basin consists of an earthen basin constructed in naturally pervious soils with a flat bottom typically vegetated with dry-land grasses or irrigated turf grass. An infiltration basin functions by retaining the design runoff volume in the basin and allowing the retained runoff to percolate into the underlying native soils over a specified period of time.



Infiltration Trenches

Infiltration trenches, which are similar to basins, are long, narrow, gravel-filled trenches, often vegetated, that infiltrate stormwater runoff from small drainage areas. Infiltration trenches may include a shallow depression at the surface, but the majority of runoff is stored in the void space within the gravel and infiltrates through the sides and bottom of the trench.

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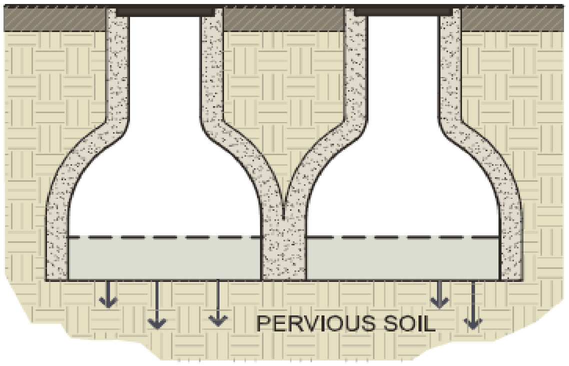
3 Depending on the design of the infiltration practice, Federal Underground Injection Control (UIC) Rules (40 CFR 144) may apply, which may further restrict the use of infiltration facilities in some locations.

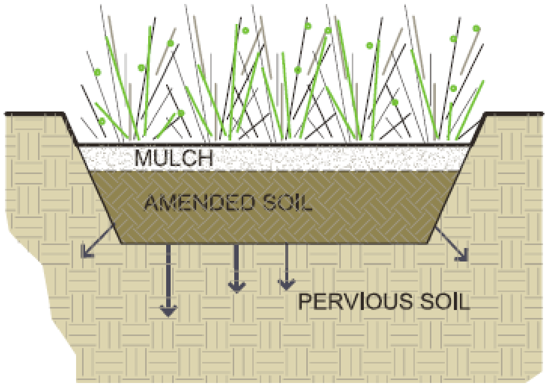
Infiltration Galleries

Infiltration galleries are open-bottom, subsurface vaults that store and infiltrate stormwater. A number of vendors offer prefabricated, modular infiltration galleries that provide subsurface storage and allow for infiltration. Infiltration galleries come in a variety of material types, shapes and sizes.



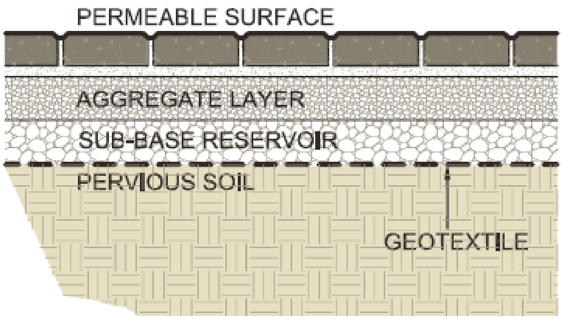
Bioretention

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, plantings, and, optionally, a subsurface gravel reservoir layer.



Permeable Pavements

Permeable (or pervious) pavements contain small voids that allow water to pass through to a stone base. They come in a variety of forms; they may be a modular paving system (concrete pavers, modular grass or gravel grids) or poured-in-place pavement (porous concrete, permeable asphalt). All permeable pavements with a stone reservoir base treat stormwater and remove sediments and metals to some degree by allowing stormwater to percolate through the pavement and enter the soil below.

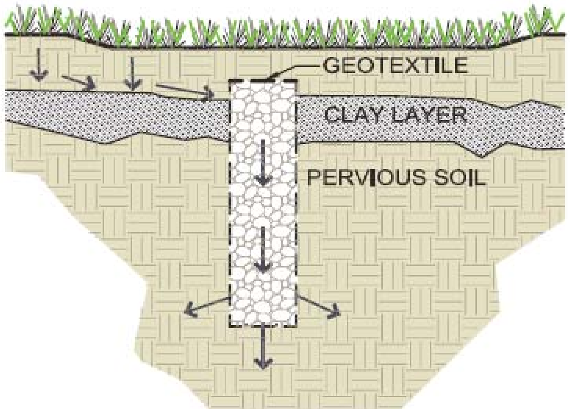


<u>Multi-Directional Infiltration BMPs</u>

These BMPs take advantage of the hydraulic conductivities (K_{sat}) of multiple soil strata and infiltration in multiple directions. They may be especially useful at locations where low K_{sat} values are present near the surface and soils with higher permeabilities exist beneath. A Multi-Directional Infiltration BMP may be implemented to infiltrate water at these lower soil layers, thus allowing infiltration to occur at sites that otherwise would be infeasible. These infiltration BMPs typically have smaller footprints and include, but are not limited to:

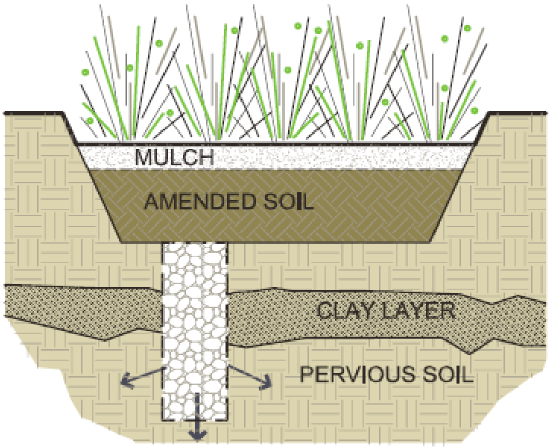
Dry Wells

A dry well is defined as an excavated, bored, drilled, or driven shaft or hole whose depth is greater than its width. Drywells are similar to infiltration trenches in their design and function, as they are designed to temporarily store and infiltrate runoff, primarily from rooftops or other impervious areas with low pollutant loading. A dry well may be either a drilled borehole filled with aggregate or a prefabricated storage chamber or pipe segment.



Hybrid Bioretention/Dry Wells

A bioretention facility with dry wells is useful in areas with low surface-level hydraulic conductivities that would normally deem a bioretention BMP infeasible but have higher levels of permeability in deeper strata. By incorporating drywells underneath the bioretention facility, water is able to be infiltrated at deeper soil layers that are suitable for infiltration, if present. This hybrid BMP combines the aesthetic and filtration qualities of a bioretention facility with the enhanced infiltration capabilities of a dry well.



4.4.2 Siting Requirements and Opportunity Criteria

Drainage areas implementing infiltration BMPs must pass the Category 1 or Category 2 Screening in accordance with the siting requirements set forth in Table 4.1. This screening process must be approved by a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional geotechnical engineer or geologist.

Additionally, drainage areas that will result in high sediment loading rates to the infiltration facility shall require pretreatment to reduce sediment loads and avoid system clogging. Examples of appropriate pretreatment may include: sedimentation/settling basins, baffle boxes, hydrodynamic separators, media filters, vegetated swales, or filter strips.

4.4.3 Calculating Size Requirements for Infiltration BMPs

The main challenge associated with infiltration BMPs is preventing system clogging and subsequent infiltration inhibition. In addition, infiltration BMPs must be designed to drain in a reasonable period of time so that storage capacity is available for subsequent storms and so that standing water does not result in vector risks or plant mortality. Infiltration BMPs should be designed according to the requirements listed in Table 4.4 and outlined in the text following.

Infiltration facilities must be sized to completely infiltrate the design capture volume within 48 hours. Steps for the simple sizing method are provided below.

Step 1: Calculate the Design Volume

Infiltration facilities shall be sized to capture and infiltrate the design capture volume (V_{design}) based on the runoff produced from a 0.75-inch (0.0625 ft) storm event.

$$V_{design}\ \text{(cu ft)} = 0.0625\ \text{(ft)} \times \textit{Catchment Area}\ \text{(sq ft)}$$

Where:

Catchment Area = (Impervious Area x 0.9) + [(Pervious Area + Undeveloped Area) x 0.1]

For catchment areas given in acres, multiply the above equation by 43,560 sq. ft./acre.

Table 4.4: Infiltration BMP Design Criteria

Design Parameter	Unit	Basins and Trenches	Galleries	Bioretention	Permeable Pavement	Dry Well	Hybrid Bioretention/ Dry Well
Design Capture Volume, $V_{capture}$	cubic feet	0.0625 (ft) x Catchment Area (sq. ft.)[a]					
Design Surface Drawdown Time	hr	48					
Setbacks and Elevations	feet	In accordance with the Infiltration Feasibility Criteria, Section 4.2					
Pretreatment	-	Appropriate Treatment Control Measure shall be provided as pretreatment for all tributary surfaces other than roofs					
Hydraulic Conductivity, $K_{sat,measured}$	in/hr	Measured hydraulic conductivity at the location of the proposed BMP at the depth of the proposed infiltrating surface (or effective infiltration rate when multi directional infiltration is occurring					
Factor of Safety, FS[b]	-	3					
Facility geometry	-	Bottom slope ≤ 3% (basins); side slope shall not exceed 3:1 (H:V)	Flat bottom slope	Bottom slope ≤ 3%; side slope shall not exceed 3:1 (H:V)	Pavement slope ≤ 5%; If ≥ 2%, area shall be terraced	Typical 18 – 36 inch diameter; flat bottom slope	Bioretention: Bottom slope ≤ 3%; side slope shall not exceed 3:1 Drywell: flat bottom
Ponding Depth	inch	18 (maximum)[c]					
Media Depth	feet	2 (min) 8 (max)	-	2 (min) 8 (max)	2 (min) 8 (max)	-	2 (min) 8 (max)
Gravel media diameter	inch	1 – 3	-	-	1 - 2	3/8 – 1	3/8 - 1
Inlet erosion control	-	Energy dissipater to reduce velocity					
Overflow device	-	Required if system is on-line and does not have an upstream bypass structure.Shall be designed to handle the peak storm flow in accordance with the Building and Safety code and requirements					

a: Catchment area = (impervious area x 0.9) + [(pervious area + undeveloped area) x 0.1]

b: Listed FS values to be used only if soil infiltration / percolation test was performed and a detailed geotechnical report from a professional geotechnical engineer or engineering geologist is provided. A FS of 6 will be assigned if only a boring was done.

c: Ponding depth may vary for galleries (which have a storage depth) and may be different from one vendor to another. Ponding depth is not necessarily applicable to permeable pavement.

Step 2: Determine the Design Infiltration Rate

The infiltration rate will decline between maintenance cycles as the surface becomes clogged with particulates and debris. Monitoring of actual facility performance has shown that the full-scale infiltration rate is far lower than the rate measured by small-scale testing. It is important that adequate conservatism is incorporated in the sizing of facilities depending on a site's infiltration rate and expected surface loading. Where applicable, the measured infiltration rate discussed here is the infiltration rate of the underlying soils and not the infiltration rate of the filter media bed or engineered surface soils.Facility maintenance is required to maintain the infiltration rate for the life of the project. Infiltration rates used for design must be divided by the appropriate factors of safety.

$$K_{sat,design} = K_{sat,measured}/FS$$

Where:

FS = Infiltration factor of safety, in accordance with Table 4.4

Measured infiltration rates shall be determined by in-ground, site specific infiltration tests or can be based on laboratory tests conducted on soil samples collected during the exploratory work for a site-specific geotechnical report.

Step 3: Calculate the BMP Surface Area

Determine the size of the required infiltrating surface by assuming the design capture volume will fill the available ponding depth plus the void spaces based on the porosity of the gravel fill (normally about 30 - 40% [4]) or amended soil (normally about 20 – 30%).

Determine the minimum infiltrating surface area necessary to infiltrate the design volume:

$$A_{min} = (V_{design} \times 12 \text{ in/ft}) / (T \times K_{sat,\ design})$$

Where:

A_{min} = Minimum infiltrating surface area (ft^2)

T = Drawdown time (hours), 48 hours

The calculated minimum BMP surface area only considers the surface area of the BMP where infiltration can occur. For dry wells, the calculated surface area is the total surface area of the well lying in soils with $K_{sat,measured}$ values > 0.3 in/hr. In other words, the portion of the dry well that extends through impermeable layers should not be considered part of the infiltrating area. For the hybrid bioretention/dry well BMP design, the calculated BMP surface area applies to the combined surface area of the bioretention facility and the infiltrating portion of the underlying dry well(s).

4 Terzaghi and Peck stated that in the densest possible arrangement of cohesionless spheres, the porosity is equivalent to 26%; in the loosest possible arrangement, the porosity is equal to 47% (Terzaghi K. and Peck R. Soil Mechanics in Engineering Practice. 2nd ed. New York: John Wiley and Sons; 1967).

For infiltration basins, the surface area should be calculated as the surface area at mid-ponding depth. For infiltration trenches, the surface area should be calculated at the bottom of the trench.

Note that A_{min} represents the minimum calculated surface area. It is up to the discretion of the developer if A_{min} will be exceeded to allow for less media storage.

*Step 4: Calculate the Total Storage Volume**

Determine the storage volume of the infiltration unit to be filled with media for capturing the design capture volume.

$$V_{storage} = V_{design} / n$$

Where:

$V_{storage}$ = Minimum media storage of the infiltration facility (ft^3)
n = void ratio (use 0.40 for gap graded gravel)

* Note: Dry wells with gravel fill may not store the entire design volume; additional storage unit(s) to capture the remaining design volume may be required upstream of the dry well.

Step 5: Calculate the Media Storage Depth

Determine the depth of the infiltration unit to be filled with media for capturing the design capture volume. The depth shall not exceed 8 feet – except for dry well(s).

$$D_{media} = V_{storage} / A_{min}$$

Where:

D_{media} = Minimum media storage depth of the infiltration facility (ft)

If D_{media} is calculated as greater than 8 feet, the design infiltration area (A_{design}) shall be increased and the depth of media shall be recalculated until it is less than 8 feet.

Many project developers may elect to increase the design infiltration area such that $A_{design} > A_{min}$. This is especially feasible where infiltration rates are relatively high (leading to a low A_{min} value). The depth of media (D_{media}) should be calculated using the actual design area in Step 5 above. For projects with designed infiltration areas significantly higher than A_{min}, it may be feasible to have no media storage (i.e. D_{media} = 0 ft). For this to apply, the following condition must be met:

$$A_{design} \geq (V_{design} \times 12in/ft) / (K_{sat,design} \times T)$$

Infiltration Sizing Example

Given: 30,000 ft^2 apartment complex (including parking) with 10,000 ft^2 of landscaped area. An infiltration test has resulted in a $K_{sat,measured}$ value of 1.0 in/hr; Factor of Safety = 3. Design an infiltration trench meeting the sizing requirements. Assume the trench is full of gap-graded gravel with a porosity of 0.4.

1) Determine V_{design}

   Catchment Area = $(30{,}000 ft^2 \times 0.9) + [(10{,}000\ ft^2) \times 0.1] = 28{,}000\ ft^2$

   $\mathbf{V_{design}} = 0.0625\ ft * 28{,}000\ ft^2 = \mathbf{1{,}750\ ft^3}$

2) Determine $K_{sat,design}$

   $\mathbf{K_{sat,design}} = k_{sat,\ measured}\ /\ FS\ = (1\ in/hr) / 3 = \mathbf{0.333\ in/hr}$

3) Determine A_{min}

   $\mathbf{A_{min}} = (V_{design} \times 12 / (T \times k_{sat,\ design})$

   $= (1{,}750\ ft^3 \times 12\ in/ft)/(48 hrs \times 0.333\ in/hr) = \mathbf{1{,}314\ ft^2}$

4) Determine $V_{storage}$

   $\mathbf{V_{storage}} = V_{design}\ /\ n = 1{,}750 / 0.4 = \mathbf{4{,}375\ ft^3}$

5) Determine D_{media}

   $\mathbf{D_{media}} = V_{storage}\ /\ A_{min} = 4{,}375\ ft^3 / 1{,}314\ ft^2 = \mathbf{3.33\ ft}$

The trench should therefore be designed with a minimum of 1,314 ft^2 of infiltrating surface area. At this minimum surface area, the gravel media depth should be at least 3.33 ft.

4.4.4 Design Criteria and Requirements

Unless specifically stated, the following criteria and requirements listed below are required for the implementation of all infiltration BMPs. Provisions not met must be approved by the City of Los Angeles.

Permeable Pavement Application
Los Angeles World Airports Parking

- Infiltration BMPs have been designed and constructed to promote uniform ponding and infiltration.
- Where necessary, a sediment forebay or separate pretreatment unit (e.g. vegetated swale, filter strip, hydrodynamic device, etc.) is located between the inlet and infiltration BMP. The sediment forebay has a volume greater than or equal to 25% of the total design volume.
- Sediment forebay has a minimum length to width ratio of 2:1 and is designed to conduct flow to the infiltration BMP.
- Any embankment slopes (interior and exterior) are not steeper than 3:1 (H:V) unless approved by the City of Los Angeles.
- The bottom of the infiltration bed is native soil and has been over-excavated to at least one foot in depth. It is recommended that the excavated soil be amended with 2 – 4 inches of coarse sand (e.g., 2 – 5 mm sand) before being replaced uniformly without compaction.
- The hydraulic conductivity (Ksat) of the subsurface layers is sufficient to ensure the maximum drawdown time of 48 hours.
- Where Ksat values are greater than 2.4 in/hr, pretreatment is provided to address pollutants of concern prior to infiltration to protect groundwater quality; pretreatment may be considered to be addressed in the amended media or sand layers within the BMP if provided.
- Provided overflow safely conveys flows to the downstream stormwater conveyance system, an additional BMP, or an alternatively acceptable discharge point.
- Where the infiltration system is placed underground, an observation well is provided for inspection/mainteance purposes.
- Porous pavement facilities consist of various layers of material. The top layer consists of either asphalt or concrete with a percentage of voids of at least 15%. This layer is followed by a stone reservoir layer or a thick layer of aggregate with 25-35% voids. Two

transition layers are also present. The depth of each layer and the specific materials used shall be determined by a licensed civil engineer.

- Dry wells shall be filled with washed 3/4 – 1 inch crushed rock, recycled concrete aggregate, or open-graded gravel (i.e. gravel with a small percentage of small particles). If a perforated pipe has been installed in the well, perforations are 3/8” and are smaller than the fill gravel. A woven geotextile shall be placed over the top of the drywell to prevent sediment clogging.

4.4.5 Soil and Vegetation Requirements

Soil and vegetation to be incorporated in infiltration facilities shall be selected by a licensed landscape architect. In general, drought and flood resistant plant species native to California should be selected when possible. Soil media should be selected to not restrict performance requirements. Selected soils shall therefore have a higher hydraulic conductivity than the underlying soil, shall be able to support the selected plant palette, and shall be graded to provide adequate filtration as to not clog underlying soils.

4.4.6 Construction Requirements

To preserve and avoid the loss of infiltration capacity, the following construction guidelines shall be adhered to:

- The entire area draining to the infiltration facility is stabilized before construction of the infiltration facility begins, or a diversion berm is placed around the perimeter of the infiltration site to prevent sediment entrance during construction.
- Infiltration BMPs shall not be used as sediment control facilities during construction.
- Compaction of the subgrade with vehicles and/or equipment is minimized. If the use of heavy equipment on the base of the facility cannot be avoided, the infiltrative capacity shall be restored by tilling or aerating prior to placing the infiltrative bed.

Underground Infiltration Units
Lowe’s, Pacoima

- Where pervious pavement is to be installed, installation of the pavement shall be scheduled as the the last installation at a development site. Vehicular traffic is prohibited for at least 2 days following installation. Site materials shall not stored on pervious pavement.

4.4.7 Operations and Maintenance

- Frequent inspections of the infiltration facilities shall occur to ensure that surface ponding infiltrates into the subsurface completely within the design drawdown time following storms. If vector breeding is taking place at a site as a result of contained stormwater or inadequately maintained BMPs, the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).
- Regular inspections shall take place to ensure that the pretreatment sediment removal BMP/forebay is working efficiently. Sediment buildup exceeding 50% of the forebay sediment storage capacity shall be removed.
- The infiltration facility shall be maintained to prevent clogging. Maintenance activities include checking for debris/sediment accumulation and removal of such debris.
- Facility soil (if applicable) shall be maintained. Flow entrances, ponding areas, and surface overflow areas will be inspected for erosion periodically. Soil and/or mulch will be replaced as necessary to maintain the long-term design infiltration rate for the life of the project.
- Site vegetation shall be maintained as frequently as necessary to maintain the aesthetic apperance of the site as well as the filtration capabilities (where applicable). This includes the removal of fallen, dead, and/or invasive plants, watering as necessary, and the replanting and/or reseeding of vegetation for reestablishment as necessary.
- Pervious pavement areas that are damaged or clogged shall be replaced/repaired per manufacture's recommendation as needed.

4.5 CAPTURE AND USE BMPS

Underground Cistern
Photo Credit: TreePeople

Capture and Use refers to a specific type of BMP that operates by capturing stormwater runoff and holding it for efficient use at a later time. On a commercial or industrial scale, capture and use BMPs are typically synonomous with cisterns, which can be implemented both above and below ground. Cisterns are sized to store a specified volume of water with no surface discharge until this volume is exceeded. The primary use of captured runoff is for subsurface drip irrigation purposes. The temporary storage of roof runoff reduces the runoff volume from a property and may reduce the peak runoff velocity for small, frequently occurring storms. In addition, by reducing the amount of stormwater runoff that flows overland into a stormwater conveyance system, less pollutants are transported through the conveyance system into local streams and the ocean. The onsite use of the harvested water for non-potable domestic purposes conserves City-supplied potable water and, where directed to unpaved surfaces, can recharge groundwater in local aquifers.

4.5.1 Siting Requirements and Opportunity Criteria

Drainage areas implementing capture and use BMPs must pass the Category 1 or Category 2 Screening in accordance with the siting requirements set forth in Section 4.3. This screening process must be approved by a site-specific geotechnical investigation report and/or hydrologic analysis conducted and certified by a State of California registered professional civil engineer, geotechnical engineer, geologist, or other qualified professional.

4.5.2 Calculating Size Requirements for Capture and Use BMPs

At a minimum, capture and use BMPs must be designed and maintained to ensure adequate capacity is available to capture the stormwater quality design volume within 3 days of a likely storm event. A likely storm event is any weather pattern that is forecast to have a 50% or greater probability of providing precipitation at the development site. Precipitation forecast information must be obtained from the National Weather Service Forecast Office (e.g. by entering the zip code of the developments location at http://www.srh.noaa.gov/forecast).

BMPs sized to capture the runoff produced from the 0.75 inch storm event, or BMPs designed to capture less than this volume, if being used in conjunction with other BMPs, must therefore drawdown their entire captured volume within 3 days of a likely storm event.

Capture and use BMPs designed for storm events larger than 0.75 inches are required to disperse enough water from the BMP within 3 days of a likely storm event to ensure that adequate capacity is available to capture the next storm event up to 0.75 inches. In instances where the quantity of runoff from the 0.75 inch storm event exceeds the volume of the collection tank, partial capture and use can also be achieved as part of a treatment train by directing the overflow to stable vegetated areas where erosion or suspension of sediment is not a factor or through a high flow biotreatment BMP to provide additional volume reduction and water quality treatment. Overflow from the tank into the storm drain system is not allowed.

Capture and use BMPs designed for these extended holding times will require additional treatment such as filtration or disinfection to protect the collection tanks from fouling, to prevent the breeding of vectors, and/or to improve the quality of water for reuse applications. These scenarios will be reviewed on a case-by-case basis.

4.5.3 Calculating the Minimum Capture Volume for a 72-hour Holding Time

Assuming that demands and conditions at a site indicate that the 72-hour drawdown time requirement will be met, all cisterns shall be sized to capture the runoff generated from the 0.75-inch storm event at a minimum[5]:

$$V_{design} \text{ (gallons)} = 0.4675 * \textit{Catchment Area} \text{ (sq. ft.)}$$

Where:

Catchment Area = (Impervious Area x 0.9) + [(Pervious Area + Undeveloped Area) x 0.1]

For catchment areas given in acres, multiply the above equation by 43,560 sq. ft./acre.

4.5.4 Irrigation / Dispersial of Captured Stormwater

If a developer desires to hold harvested stormwater for an extended period of time, for the purpose of irrigation during dry periods, calculations in line with the California Department of Water Resources Model Water Efficent Landscape Ordiance AB 1881 (also refer to City of Los Angles Irrigation Guidelines[6]) shall be provided. Captured stormwater should be used to offset the potable irrigation demand that would occur during the rain season (Oct 1 – Apr 31, 7 months). If the volume of captured stormwater exceeds the Estimated Total Water Use for the rain season ($ETWU_7$),excess stormwater shall, at a minimum:

1. Establish a schedule to release captured stormwater over landscaping, and;
2. Ensure the BMP is designed and maintained to ensure adequate capacity and is available to capture the stormwater quality design volume within 3 days of a likely storm event.

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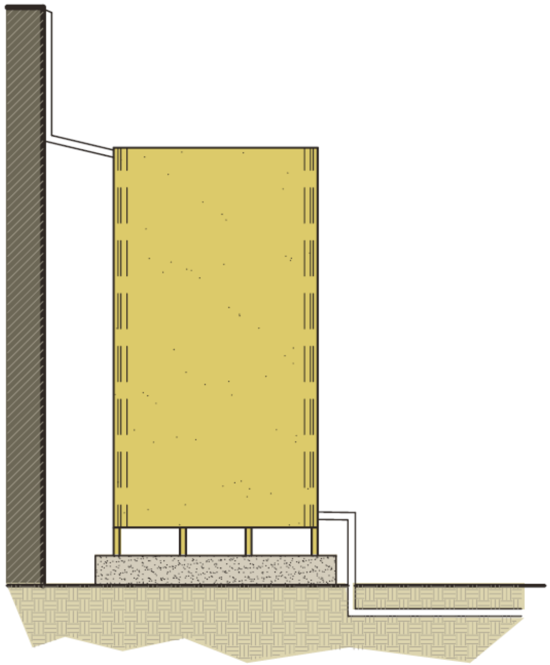
5 Capture and use BMPs used in combination with other BMP types to collectively meet the water quality design storm standard set forth in Section 3.1.3 may be sized to capture less than V_{design}.

6 City of Los Angles Irrigation Guidelines: http://cityplanning.lacity.org/Forms_Procedures/2405.pdf

4.5.3 Design Criteria and Requirements

- Unless specifically stated, the following criteria and requirements listed below are required for the implementation of all capture and use BMPs. Provisions not met must be approved by the City of Los Angeles.
- Fertilizers, pesticides, or herbicides on landscaped areas shall be minmized.
- Above-ground cisterns are secured in place and designed to meet seismic requiremnts for tanks.
- Overflow outlet is provided upstream of the tank inlet and is designed to disperse overflow onsite. Dispersial and overflow must be through an approved landscape areas where erosion or suspension of sediment is minimized, or through a high flow biotreatment BMP. Overflow from the tank into the storm drain system is not allowed.



Cistern Example
Image Credit: AHBE Landscape Architects

- For landscape applications, a subsurface drip irrigation system, a pop up, or other approved irrigation system, has been aproved and installed to adequately discharge the captured water[7].
- If a pumping system is used, a reliable pump capable of delivering 100% of the design capacity is provided. Pump is accessible for maintenance. Pump has been selected to operate within 20% of its best operating efficiency. A high/low-pressure pump shut off system is installed in the pump discharge piping in case of line clogging or breaking.
- If an automated harvesting control system is used, it is complete with a rainfall or soil moisture sensor. The automated system has been programmed to not allow for continuous application on any area for more than 2-hours.
- Dispersion is directed so as not to knowingly cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement.
- Cisterns do not allow UV light penetration to prevent algae growth.
- Cistern placement allows easy access for regular maintenance. If cistern is undergrond, manhole shall be accessible, operational, and secure.

7 If alternative distribution systems (such as spray irrigation) are approved, the City will establish guidelines to implement these new systems.

- Refer to County of Los Angeles , Department of Health Services for additional guidelines and requiremnets.
- Provide observation access for vector inspection and treatment.

4.5.4 Operations and Maintenance

- Cistern components, including spigots, downspouts, and inlets will be inspected 4 times annually to ensure proper functionality. Parts will be repaired or replaced as needed.
- Cisterns and their components will be cleaned as necessary to prevent algae growth and the breeding of vectors.
- Dispersion areas will be maintained to remove trash and debris, loose vegetation, and rehabilitate any areas of bare soil.
- Effective energy dissipation and uniform flow spreading methods will be employed to prevent erosion and facilitate dispersion.
- Cisterns will be emptied as necessary to prevent vector breeding, unless exclusion devices are implemented to prevent vector access. If vector breeding is taking place at a site as a result of contained stormwater or inadequately maintained BMPs, the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).

4.6 BIOFILTRATION BMPS

Projects that have demonstrated they cannot manage 100% of the water quality design volume onsite through infiltration and/or capture and use BMPs may manage the remaining volume through the use of a high removal efficiency biofiltration/biotreatment BMP. A high removal efficiency biofiltration/biotreatment BMP shall be sized to adequately capture 1.5 times the volume not managed through infiltration and/or capture and use.

Bioretention (Planter Boxes)
Photo Credit: City of Los Angeles

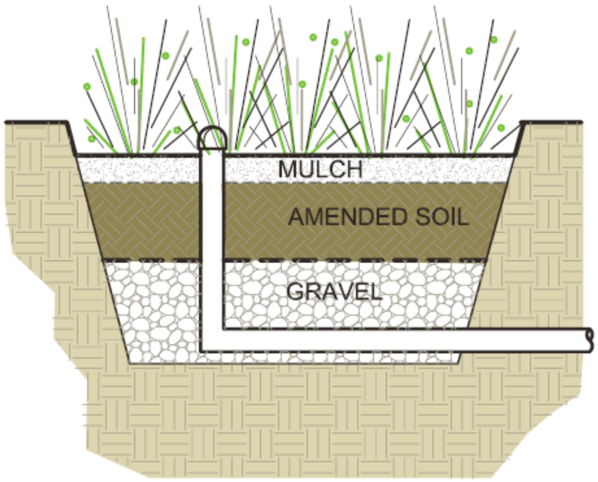
Biofiltration BMPs are landscaped facilities that capture and treat stormwater runoff through a variety of physical and biological treatment processes. Facilities normally consist of a ponding area, mulch layer, planting soils, plants, and in some cases, an underdrain. Runoff that passes through a biofiltration system is treated by the natural adsorption and filtration characteristics of the plants, soils, and microbes with which the water contacts. Biofiltration BMPs include vegetated swales, filter strips, planter boxes, high flow biotreatment units, bioinfiltration facilities, and bioretention facilities with underdrains. Biofiltration can provide multiple benefits, including pollutant removal, peak flow control, and low amounts of volume reduction through infiltration and evapotranspiration.

4.6.1 Biofiltration BMP Types

Biofiltration BMPs rely on various hydraulic residence times and flow-through rates for effective treatment. As a result, a variety of BMPs are available.

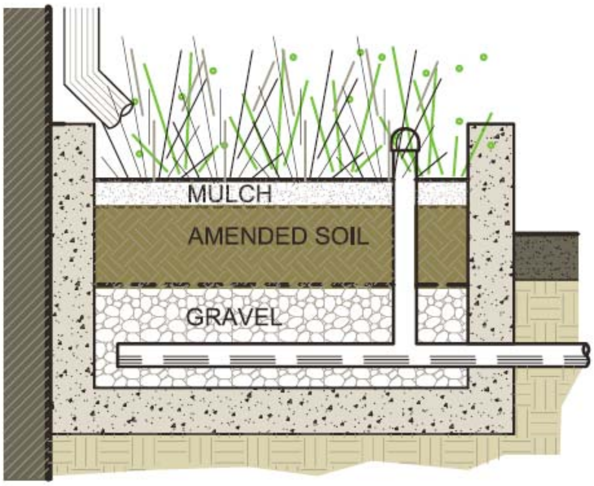
Bioretention with Underdrain

Bioretention facilities are landscaped shallow depressions that capture and filter stormwater runoff. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, and biodegraded by the soil and plants. Because they are not contained within an impermeable structure, they may allow for infiltration. For sites not passing the infiltration feasibility screening for reasons other than low infiltration rates (such as soil contamination, expansive soils, etc.), an impermeable liner may be needed to prevent incidental infiltration.



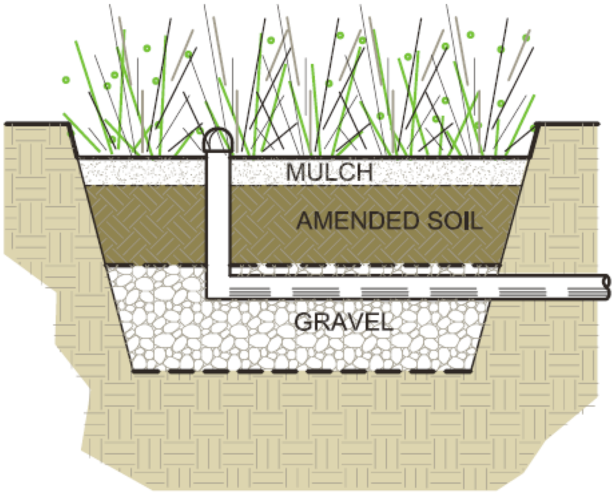
Planter Boxes

Planter boxes are bioretention treatment control measures that are completely contained within an impermeable structure with an underdrain (they do not infiltrate). They are similar to bioretention facilities with underdrains except they are situated at or above ground and are bound by impermeable walls. Planter boxes may be placed adjacent to or near buildings, other structures, or sidewalks.

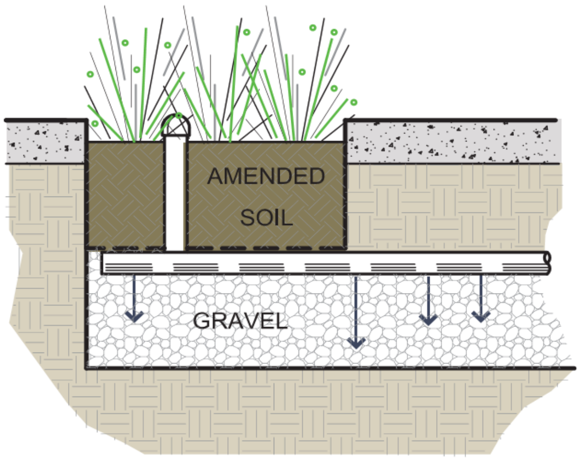


Bioinfiltration

Bioinfiltration facilities are designed for partial infiltration of runoff and partial biotreatment. These facilities are similar to bioretention devices with underdrains but they include a raised underdrain above a gravel sump designed to facilitate infiltration and nitrification/denitrification. These facilities can be used in areas where there are little to no hazards associated with infiltration, but infiltration screening does not allow for infiltration BMPs due to low infiltration rates or high depths of fill.

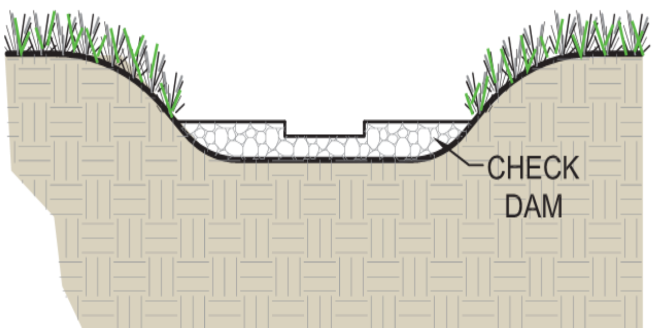


High-Flow Biotreatment with Raised Underdrain



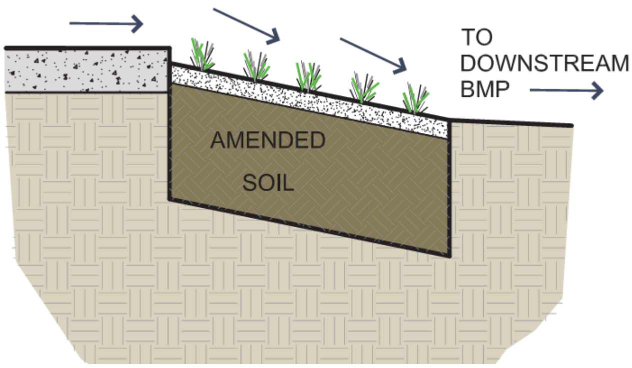
High-flow biotreatment devices are proprietary treatment BMPs that incorporate plants, soil, and microbes engineered to provide treatment at higher flow rates and with smaller footprints than their non-proprietary counterparts. Like bioinfiltration devices, they should incorporate a raised underdrain above a gravel sump to facilitate incidental infiltration where feasible. They must be shown to have pollutant removal efficiencies equal to or greater than the removal efficiencies of their non-proprietary counterparts. Proof of this performance must be provided by adequate third party field testing.

Vegetated Swales



Vegetated swales are open, shallow channels with dense, low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff to downstream discharge points. An effective vegetated swale achieves uniform sheet flow through the densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location and is the choice of the designer. Most swales are grass-lined.

Filter Strips (to be used as part of a treatment train)



Filter strips are vegetated areas designed to treat sheet flow runoff from adjacent impervious surfaces such as parking lots and roadways, or intensive landscaped areas such as golf courses. While some assimilation of dissolved constituents may occur, filter strips are generally more effective in trapping sediment and particulate-bound metals, nutrients, and pesticides. Filter strips are more effective when the runoff passes through the vegetation and thatch layer in the form of shallow, uniform flow. Filter strips are primarily used to pretreat runoff before it flows to an infiltration BMP or another biofiltration BMP.

4.6.2 Siting Requirements and Opportunity Criteria

Sites with plans to implement high removal efficiency biofiltration/biotreatment systems for the management of stormwater must first be screened for infiltration and capture and use BMP feasibility. Biofiltration should be implemented to treat all runoff onsite to the maximum extent feasible at sites incapable of implementing infiltration and/or capture and use BMPs as a result of the feasibility screening process set forth in this handbook.

Sites implementing biofiltration BMPs must have sufficient area available to ensure that BMPs produce adequate contact time for filtration to occur. For biofiltration BMPs with underdrains, sufficient vertical relief must exist to permit vertical percolation through the soil media to the underdrain below. For biofiltration BMPs with incidental infiltration, it must be demonstrated that there are no hazards associated with infiltration (i.e. infiltration screening does not allow for infiltration BMPs due to low infiltration rates or high depths of fill).

4.6.3 Calculating Size Requirements for Biofiltration BMPs

Biofiltration BMPs should be designed according to the requirements listed in Table 4.5 and outlined in the section below.

Table 4.5: Biofiltration BMP Design Criteria

Design Parameter	Unit	Bioretention with Underdrain	Planter Box	Bioinfiltration	High Flow Biotreatment[a]	Vegetated Swale	Filter Strip
Design Capture Volume, $V_{capture}$	cubic feet	1.5 x 0.0625 ft * Catchment Area (sq. ft.)[b]					-
Design Drawdown Time	hr	48 (surface); 96 (total)				-	-
Factor of Safety[c]	-	2				-	
Soil Media Infiltration Rate	in/hr	5 (max)			Per manufacturer's standards	-	
Design Contact Time	min	-				≥ 7	
Slope in Flow Direction	%	-				1% (min) 6% (max)	2% (min) 33% (max)
Design Flow Velocity	ft/sec	-				≤ 1	
Maximum Ponding/Flow Depth	inch	18	12	18	-	5	1
Minimim Width	ft	2			-	2	15
Soil Depth	ft	2 (3 preferred) Topped with 3" of mulch			-	2	-
Underdrain	-	Slotted PVC pipe embeded in 12" gravel section and located 1" from bottom of facility		Slotted PVC pipe at least 2' above bottom of facility	Per manufacturer's standards	N/A	Not required
Inlet erosion control	-	Energy dissipater to reduce velocity					
Overflow device	-	Required if system is on-line and does not have an upstream bypass structure. Shall be designed to handle the peak storm flow in accordance with the Building and Safety code and requirements					Not Required

a: High flow biotreatment BMP design criteria displayed in Table 4.5 are general guidelines. Specific designs will vary depending on the vendor, design type, size, etc. High flow biotreatment BMPs must be sized to treat the design capture volume specified. They must be shown (by third party field testing) to have a pollutant removal efficiency equal to or greater than their non-proprietary counterparts.

b: Catchment area = (impervious area x 0.9) + [(pervious area + undeveloped area) x 0.1]

c: Listed FS values to be used only if soil infiltration / percolation test was performed and a detailed geotechnical report from a professional geotechnical engineer or engineering geologist is provided A FS of 6 will be assigned if only a boring was done.

Bioretention, Planter Box, Bioinfiltration, and High-Flow Biotreatment Sizing

With the exception of swales and filter strips, biofiltration facilities can be sized using one of two methods: a simple sizing method or a hydrologic routing modeling method. With either method the design capture volume must be completely infiltrated within the drawdown time shown in Table 4.5. Steps for the simple sizing method are provided below.

Step 1: Calculate the Design Volume

Biofiltration facilities shall be sized to capture and treat 150% of the design capture volume (V_{design}) based on the runoff produced from a 0.75-inch (0.0625 ft) storm event.

$$V_{design} \text{ (cu ft)} = 1.5 * 0.0625 \text{ ft} * \textit{Catchment Area} \text{ (sq. ft.)}$$

Where

Catchment area = (Impervious Area x 0.9) + [(Pervious Area + Undeveloped Area) x 0.1]

Step 2: Determine the Design Infiltration Rate

The infiltration rate will decline between maintenance cycles as the surface and underlying soil matrix becomes clogged with particulates and debris. Monitoring of actual facility performance has shown that the full-scale infiltration rate is far lower than the rate measured by small-scale testing. It is important that adequate conservatism is incorporated in the sizing of facilities depending on a site's infiltration rate and expected surface loading. Unlike infiltration BMPs, the measured infiltration rate discussed here is the infiltration rate of the filter media bed or engineered surface soils in the biofilter. A target long-term $K_{sat,media}$ of 5 in/hr is recommended for non-proprietary amended soil media. Facility maintenance is required to maintain the infiltration rate for the life of the project. Infiltration rates used for design must be divided by the appropriate factors of safety.

$$K_{sat,design} = K_{sat,media}/FS$$

Step 3: Calculate the BMP Ponding Depth

Select a ponding depth (d_p) that satisfies geometric criteria and is congruent with the constraints of the site. The ponding depth must satisfy the maximum ponding depth constraint shown in Table 4.5 as well as the following:

$$d_p \text{ (ft)} = (K_{sat,design} \times T) / 12$$

Where:

d_p = Ponding depth (ft)

$K_{sat,design}$= Design infiltration rate of filter media (in/hr)

T = Required surface drain time (hrs), from Table 4.5

Step 4: Calculate the BMP Surface Area

Calculate infiltrating surface area (filter bottom area) required:

$$A_{min} = \frac{V_{design}}{[(T_{fill}K_{sat,design}/12) + d_p]}$$

Where:

A_{min} = Design infiltrating area (ft^2)

T_{fill}= Time to fill to max ponding depth with water (hrs) [unless a hydrologic routing model is used, assume a maximum of 3 hours]

The calculated BMP surface area only considers the surface area of the BMP where infiltration through amended media can occur. The total footprint of the BMP should include a buffer for side slopes and freeboard.

Bioinfiltration BMPs and high-flow biotreatment devices should incorporate a raised underdrain above the gravel sump to facilitate incidental infiltration where feasible. For these instances, infiltration screening in accordance with Section 4.2 must be carried out to show that infiltration BMPs are not allowed due to low infiltration rates or high depths of fill (i.e. there are not hazards associated with infiltration). These BMPs are not suitable for project sites that do not pass infiltration feasibility screening due to associated hazards of infiltration (e.g. high groundwater table, contaminated soil or groundwater, landslide zones, etc.)

Swale Sizing

Swales shall be designed with a trapezoidal channel shape with side slopes of 3:1 (H:V). They shall incorporate at least two feet of soil beneath the vegetated surface. The following steps shall be followed for swale sizing. As is the case with other biofiltration BMPs, the sizing criteria presented in Table 4.5 must be met.

Step 1: Determine the Swale Base Width and Corresponding Unit Length

The base width of a swale must be between 2 and 10 feet. The designer may select the base width that is most appropriate for the site, but the swale length (per unit catchment area) must meet the minimum requirements as shown in Table 4.6 below.

Table 4.6: Swale Base Length (Per Unit Catchment Area)

Base of Swale	ft	2	3	4	5	6	7	8	9	10
Minimum Swale Length per Acre of Catchment Area	ft/acre	770	635	535	470	415	370	335	305	285

Step 2: Determine the Distance Between Check Dams

For volume storage, swales must incorporate check dams at specified intervals depending on the longitudinal slope of the swale, which must be between one and six percent. The check dams must be 12 inches in height and include a 6 inch deep notch in the middle of the check dam that is between one and two feet wide. All check dam structures shall extend across the entire base of the swale. They may be designed using a number of different materials including concrete blocks, gabions, gravel bags, rip rap, or earthen berms. The distance between successive check dams shall be determined from the longitudinal slope of the swale in the flow direction. Table 4.7 summarizes the design distances between check dams based on slope.

*Table 4.7: Check Dam Spacing Requirements for Swales**

Slope	%	1	2	3	4	5	6
Distance Between Checkdams	ft	N/A	N/A	33	25	20	17

* Depending on location of swale, approval from LADBS grading Division may be required.

For intermediary slopes not shown in Table 4.7, linear interpolation may be used to calculate the distance between check dam structures.

Step 3: Determine the Total Swale Length

The total length of the swale (L_{swale}) is a function of the catchment area and unit swale length from Table 4.6. Total swale length is calculated as follows:

$$L_{swale}\text{ (ft)} = \textit{Catchment Area}\text{ (ft}^2\text{) x (1 acre/43,560 ft}^2\text{) x } \textit{Swale Length per Acre of Catchment Area}\text{ (ft/acre)}$$

Where

Catchment area = (Impervious Area x 0.9) + [(Pervious Area + Undeveloped Area) x 0.1]

If there is adequate space on the site to accommodate a larger swale, consider using a greater length to increase the hydraulic residence time and improve the swale's pollutant removal capability. If the calculated length is too long for the site, the layout may be modified by meandering the swale or increasing the base width of the swale up to 10 feet. The total swale length shall never be less than 100 feet.

Filter Strip Sizing

Because filter strips are most often used for pretreatment purposes, their design will depend on the desired flow-rate to be treated and the type of BMP downstream, among other factors. As a result, filter strip sizing is not covered in this handbook, but will be determined on a case-by-case basis by the City of Los Angeles.

Bioinfiltration Sizing Example

Given: 100,000 ft^2 commercial development, 100% impervious (negligible landscaping). Design a bioinfiltration BMP to treat runoff from the entire development ($K_{sat,media}$= 5 in/hr; Factor of Safety = 2.).

1) Determine V_{design}
   Catchment Area = (100,000ft^2 x 0.9) = 90,000ft^2
   $\boldsymbol{V_{design}}$ = 1.5 x 0.0625ft x 90,000ft^2 = **8,500 ft^3**

2) Determine $K_{sat,design}$
   $\boldsymbol{K_{sat,design}}$ = (5 in/hr) /2 = **2.5 in/hr**

3) Determine d_p
   d_p = (2.5 in/hr * 48 hrs)/12 = 10.0 ft

   Adhering to the max ponding depth requirements of Table 4.5, $\boldsymbol{d_p}$ **= 1.50 ft**

4) Calculate the infiltrating surface area, A_{min}

   $$A_{min} = \frac{8{,}500\ cuft}{[(3hr * 2.5\ in/hr\ /12) + 1.5\ ft]} = \mathbf{4{,}000\ ft^2}$$

For a full capture system, bioinfiltration units must be designed with a combined surface area of 4,000 ft^2.

4.6.4 Design Criteria and Requirements

Unless specifically stated, all criteria and requirements listed below are required for the implementation of all biofiltration BMPs. Provisions not met must be approved by the City of Los Angeles.

Bioretention in a Parking Lot
Photo Credit: Geosyntec Consultants

- Where applicable, biofiltration BMPs shall be constructed with a minimum planting soil depth of 2 feet (3 feet preferred) and topped with 3 inches of mulch.
- Where applicable, biofiltration BMPs shall be designed to drain below the planting soil in less than 48 hours and completely drain from the underdrains in 96 hours.
- Underdrains shall be constructed of slotted PVC pipe, sloped at a minimum 0.5% and placed per Table 4.5 requirements. Underdrains drain freely to a downstream stormwater conveyance system, an additional BMP, or an alternatively acceptable discharge point.
- If system is online, an overflow is present. The overflow safely conveys flows to the downstream stormwater conveyance system, an additional BMP, or an alternatively acceptable discharge point.
- Inflow to swales shall be directed towards the upstream end of the swale.
- Bioinfiltration BMPs and high-flow biotreatment BMPs designed for secondary infiltration shall pass the infiltration feasibility screening for all hazardous criteria. If necessary, weep holes shall be used to increase infiltration.
- Swales shall be constructed with a bottom width between 2 and 10 feet. Check dams shall be incorporated at the appropriate distances as specified in Table 4.7. Check dams are 12 inches in height and include a 6 inch deep notch in the middle of the check dam that is 1-2 feet wide. Each check dam extends across the entire width of the swale's base.
- Filter strips shall be constructed to extend across the full width of the tributary area. They shall be designed with sufficient slope in the flow direction to prevent ponding. They shall have a minimum length of 4 ft in the flow direction when sized for pretreatment purposes.

4.6.5 Soil and Vegetation Requirements

Soil and vegetation to be incorporated in biofiltration facilities shall be selected by a licensed landscape architect. In general, drought and flood resistant plant species native to Southern California should be selected when possible. Soil media should be selected to facilitate vigorous plant growth and not restrict performance requirements. Where the project receiving waters are impaired for nutrients, media should be selected to minimize the potential for leaching of nutrients from biofiltration systems.

4.6.6 Operations and Maintenance

Biofiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. In general, biofiltration maintenance requirements are typical landscape care procedures. The following operations and maintenance practices will be adhered to:

- Facility soil will be maintained. Flow entrances, ponding areas, and surface overflow areas will be inspected for erosion periodically. Soil and/or mulch will be replaced as necessary to maintain an infiltration rate at or near the initial $K_{sat,design}$value for the duration of the project.
- Site vegetation will be maintained as frequently as necessary to maintain fire protection, public safety, and the aesthetic appearance of the site as well as the filtration capabilities. This includes the removal of fallen, dead, and/or invasive plants, watering as necessary, and the replanting and/or reseeding of vegetation for reestablishment as necessary. Swales and filters will be mowed as necessary.
- BMP inlets will be inspected and maintained to ensure even flow enters the facility. Sediment collecting at the inlet will be removed as necessary.
- Proprietary devices will be inspected and maintained in accordance with the requirements of the manufacturer.

SECTION 5: OFFSITE MITIGATION MEASURES

5.1 OFFSITE MITGATION MEASURES

The option for offsite mitigation shall only be exercised after the following conditions have been met:

1. All the stormwater management techniques allowed (i.e., in priority order of infiltration, capture and use, treated through high removal efficiency biofiltration system) have been exhausted (i.e. are deemed technically infeasible), and;

2. All applicable Standard Urban Stormwater Mitigation Plan (SUSMP) requirements are implemented in order to maximize onsite compliance, and;

Offsite project BMPs should be located as close as possible to the project site, on private and/or public land, and should address a mix of land uses similar to those included in the proposed project. The offsite project shall not be located within waters of the U.S. and it shall be demonstrated that equivalent pollutant removal is accomplished prior to discharge to waters of the U.S.

For the remaining runoff that cannot feasibly be managed onsite, the project shall implement offsite mitigation in either:

1. The public right of way immediately adjacent to the subject development and/or;

2. Within the same sub-watershed (as defined as draining to the same hydrologic area as defined in the Basin Plan) as the proposed project

Construction of an offsite mitigation project(s) shall achieve at least the same level of water quality protection as if all of the runoff were retained onsite and also be sized to mitigate the volume from the onsite and the tributary area from the adjacent street (from the crown of the street to the curb face for the entire length of the development site). All City Departments will assist the developer, when and where feasible, permitting and implementation of LID BMP projects within the public right of way.

Construction work in the public right-of-way will be the responsibility of the developer, and requires a “Revocable Permit” from the Department of Public Works, Bureau of Engineering (BOE). The developer will also be required to file a covenant and agreement with the county recorder’s office to insure the owner assumes full responsibility for perpetual maintenance of the onsite and offsite BMP(s) executed by a covenant and agreement. The type of BOE permit required depends on the scope of construction work. Additional permit information and detailed flowcharts can be found at: http://eng.lacity.org/techdocs/permits/index.htm

Green Infrastructure Projects

In an effort to assist developers the City has recently approved and adopted a series of green street standard plans. These plans provide a series of standards that developers can implement utilizing the public right of way immediately adjacent to the development. These standard plans provide general requirements for green streets, parkway swales in major/secondary highways, parkway swales in local/collector streets, parkway swales with no street parking, vegetated stormwater curb extensions, and interlocking pavers for vehicular and pedestrian alleys. The green street standard plans can be obtained from the Bureau of Engineering's Website at:

- http://eng.lacity.org/techdocs/stdplans/s-400.htm
- http://eng.lacity.org/techdocs/stdplans/Pdfs/Green%20Street%20Standard%20Plans%20FAQ%20Sheet_091010.pdf

Additional information on the City's Green Streets and Green Alleys design Guidelines can be found at: www.lastormwater.org