DRAINAGE MANUAL

DRAFT December 2019

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ABBREVIATIONS & ACRONYMS

ACRONYM / ABBREVIATION	DEFINITION
ac	Acres
APN	Assessor's Parcel Number
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
BSM	Biotreatment Soil Media
cf	Cubic Feet
cu. ft.	Cubic Feet
EPA	Environmental Protection Agency
FDC	Flow Duration Control
FEMA	Federal Emergency Management Agency
ft	Feet
gal	Gallons
GI	Green Infrastructure
GIS	Geographic Information System
HM	Hydromodification Management
LID	Low Impact Development
MRP	Municipal Regional Stormwater Permit
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PE	California Registered Professional Civil Engineer
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
ROW	Right-of-Way
RWQCB	Regional Water Quality Control Board
sq. ft.	Square Feet
sf	Square Feet
SLR	Sea Level Rise
SMC	San Mateo County
SMCWPPP	San Mateo Countywide Pollution Prevention Program
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
yr	Year

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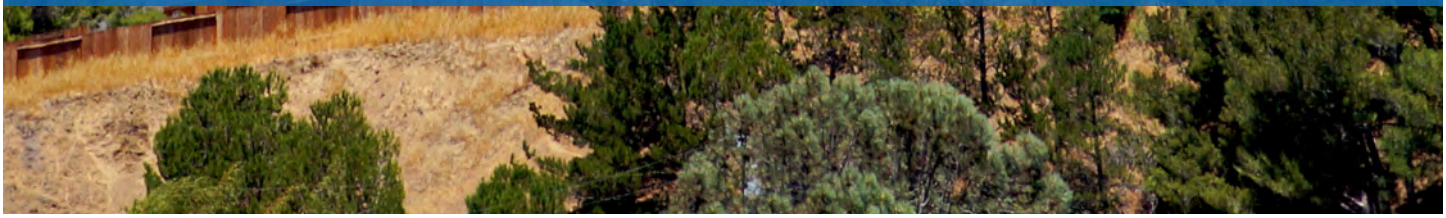
OVERVIEW OF SAN MATEO COUNTY'S APPROACH TO DRAINAGE

1.0

IN THIS CHAPTER



1.1 Introduction to Drainage Review in San Mateo County

The purpose of this manual is to clearly convey San Mateo County's drainage requirements for new development and redevelopment and establish the appropriate level of review based on project size and location to demonstrate that projects do not create additional stormwater flows across property lines. In other words, the post-development stormwater runoff peak flow and volume must be less than or equal to the undeveloped stormwater runoff peak flow and volume at each point of discharge from the project parcel, unless an alternative discharge point is otherwise approved by the County of San Mateo (County).

The County, like the rest of the San Francisco Bay Area, has been experiencing significant levels of development and urbanization, which lead to changes in the quantity and quality of stormwater runoff. Increased quantities of stormwater runoff due to increased impervious cover can cause flooding and damage to development, overload the County storm drainage systems, and cause erosion in naturalized channels and creeks. Poor water quality of stormwater runoff from urbanized areas pollutes the natural resources that are so valuable to the County, such as local creeks, the Bay, and the Ocean.

While development and redevelopment will continue to occur in the County, the long-term negative drainage impacts caused by new parking lots, buildings, and other impervious cover can be mitigated by requiring appropriate stormwater

View from Montara Lighthouse

management measures for new and redevelopment projects located in Unincorporated San Mateo County. These requirements are established by the Municipal Regional Stormwater Permit (MRP) and the County's Stormwater and Drainage Ordinance (Ordinance)[1]. The Ordinance codifies the County's drainage policies and stormwater management approach and ensures that projects avoid creating nuisance flooding and treat stormwater runoff, consistent with the requirements of the MRP. Compliance with these requirements is supported by guidance, review, and permitting by the County. Without County oversight, new development and redevelopment can result in flooding, drainage impacts on neighboring parcels, disruption to the County drainage system, and degradation of receiving waters. Proper drainage design and stormwater runoff mitigation is crucial to protecting both the built and natural environment within the County.

The *County of San Mateo Drainage Manual* (Manual) provides guidance to landowners, developers, engineers, architects, landscape architects, and the general public on the County's drainage policies. The Manual provides guidance for compliance with the County of San Mateo Stormwater and Drainage Ordinance for all stages of the development process, from design through permitting, construction, and post-construction. The Manual is intended only for use by projects in unincorporated County areas.

Projects for which fulfillment of the full requirements of the Manual is demonstrated to be infeasible may be allowed to partially implement the requirements at the discretion of the Community Development Director with appropriate demonstration and documentation of infeasibility.

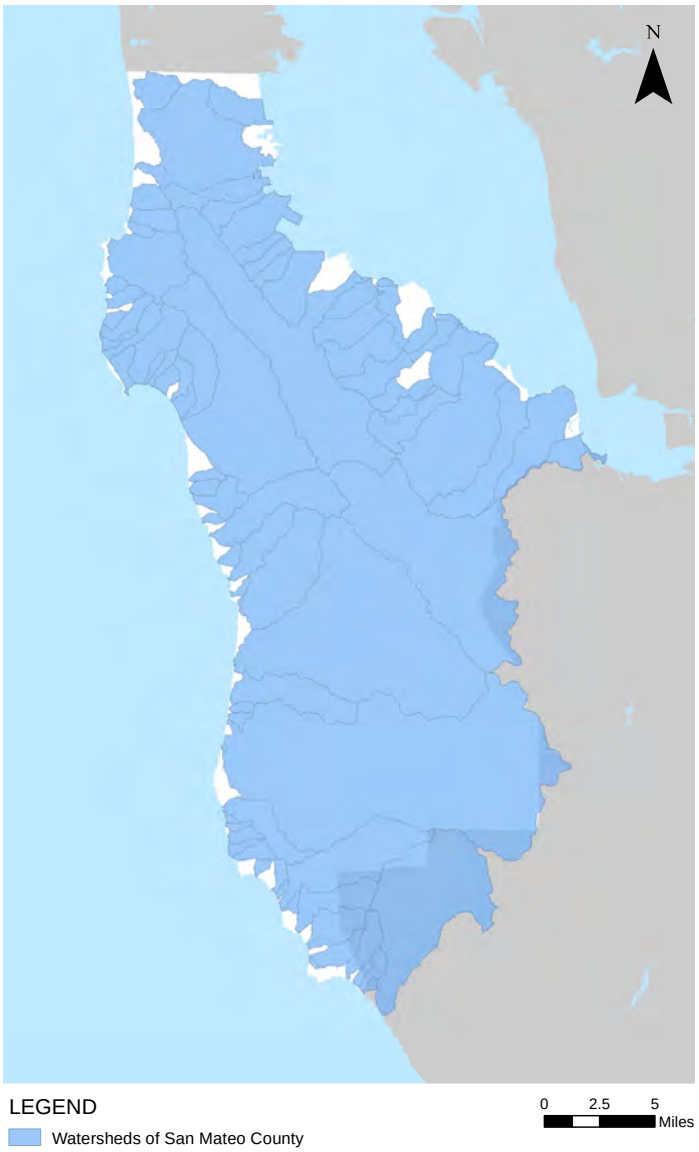


Figure 1-1. Watersheds of San Mateo County

[1] The Ordinance is currently in draft form and will be finalized following a six-month period for pilot implementation of the Drainage Manual.

1.2 Key Terms & Definitions

Best Management Practice (BMP): Any program, technology, process, siting criteria, operational method or measure, or engineered system, which when implemented prevents, controls, removes, or reduces pollution. Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce water pollution. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, litter or waste disposal, or drainage from raw material storage.

Bioretention: A type of Low Impact Development landscaped system designed to receive stormwater runoff and allow for temporary surface ponding from which water can evapotranspire, infiltrate into soil, and/or slowly be released through an underdrain.

C.3 Regulated Projects: Development and redevelopment projects as defined by Provision C.3.b.ii of the MRP. This includes public and private projects that create and/or replace 10,000 square feet or more of impervious surface, as well as restaurants, retail gasoline outlets, auto service facilities, and uncovered parking lots (stand-alone or part of another use) that create and/or replace 5,000 square feet or more of impervious surface. Single family homes that are not part of a larger plan of development are specifically excluded.

FEMA Flood Zones: The Federal Emergency Management Agency (FEMA) identifies geographic areas with varying levels of flood risk as designated flood zones. In this Manual, the term FEMA Flood Zones is used to refer to zones A, AE, AH, AO, D, or VE only.

Green Infrastructure: Low Impact Development stormwater infrastructure that is located in the public right-of-way or on public property.

Hydromodification: "Hydrograph modification", or more generally the changes in natural watershed hydrological processes and runoff characteristics caused by urbanization or other land use changes that result in increased runoff peak flows, volumes, and durations, causing increased erosion and sediment transport in receiving streams.

Impervious Surface: Any material that prevents or substantially reduces infiltration of water into the soil. This includes building roofs, driveways, patios, parking lots, impervious decking, streets, sidewalks, and any other continuous watertight pavement or covering. Compacted dirt and gravel surfaces that are at greater than 90% compaction are considered impervious surfaces as well.

Limits of Work: Includes all proposed improvements within the project parcel, as well as any work to be performed in the public right-of-way, such as sidewalk reconstruction or driveway approach improvements. The limits of work also includes any land-disturbing activity, such a clearing, grading, filling, excavation, and any other activity that may result in drainage impacts.

Low Impact Development (LID): Stormwater infrastructure that uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, LID refers to the patchwork of natural and landscaped areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood, street, or site, LID refers to stormwater management systems that mimic nature by soaking up, storing, and/or improving the quality of water.

Post-Development Conditions: The land use condition of the project site following the completion of construction for the project being proposed.

Prescriptive Design Measure: A drainage facility used to meet the Peak Flow and Volume Control Requirements of this Manual and detailed in the Fact Sheets in *Chapter 4*.

Project Parcel: The parcel on which the proposed project is located, as defined by property lines shown on a legal boundary survey or equal.

Replaced Impervious Area: Existing impervious surface that is removed and replaced on a parcel. This does not include interior remodels and routine maintenance or repair, including roof or exterior surface replacement, pavement resurfacing, repaving, and road pavement structural section rehabilitation within the existing footprint. Also excluded are structures constructed under an existing permitted roof structure, such as a carport enclosure or addition under an existing eave.

Total Project Impervious Area: The sum of all impervious surface areas created and/or replaced as part of the proposed project. Total Project Impervious Area includes any impervious areas planned for construction in the project parcel in the next five years, as well as any impervious areas created and/or replaced in the project parcel in the ten years preceding the current permit application. If your redevelopment project replaces 50 percent or more of the impervious surface of a previously existing development that was not subject to the Stormwater and Drainage Ordinance flow control requirements, then your Total Project Impervious Area includes all existing, new, and/or replaced impervious surfaces within the entire parcel. If your project replaces less than 50 percent of existing impervious surfaces, then your Total Project Impervious Area includes only the impervious area created or replaced as part of your project. See Section *2.1 Defining Your Project*, *STEP 2 Impervious Area Calculations* for more information.

Undeveloped Conditions: The conditions that existed on the project site prior to the occurrence of any development, sometimes referred to as the natural, historic, or unimproved condition of the land.

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DRAINAGE REVIEW PROJECT TYPE OVERVIEW

2.0

IN THIS CHAPTER

In Unincorporated San Mateo County, the following projects are required to go through Drainage Review:

- **Projects seeking a Planning and/or Building Permit that create and/or replace more than 150 square feet of impervious surface.**

However, projects that substantially alter drainage flows, including grading and retaining wall projects, are subject to Drainage Review at the County's discretion.

Drainage Review is generally performed by the County Planning & Building Department. However, projects that encroach in the public right-of-way (ROW) will be reviewed and permitted by the County's Public Works Department in a separate permitting process that is not included in the scope of this Manual. These projects must not adversely affect existing drainage capacity of drainage facilities in the ROW. Projects that create a substantial amount of new impervious surface in the ROW may be subject to additional flow, velocity, and/or volume control requirements. Contact the County's Public Works Department for more information on the permitting process for these projects.

All projects are highly encouraged to implement stormwater management solutions whenever feasible to contribute to improving drainage conditions in the County. Refer to the Prescriptive Design Measure Fact Sheets in *Chapter 4* for guidance on sizing and implementing simple stormwater management facilities on your site.

For projects that are required to go through Drainage Review, the County has established three categories of Drainage Review—Basic, Prescriptive, and Standard—to streamline the permitting process for small, simple projects with minimal drainage impacts, while ensuring that proper County oversight is provided for larger projects with significant drainage impacts. This chapter will guide you through determining the drainage review type for your project.

2.1 Defining Your Project

Before you can determine the drainage review type for your project, you will need to define the key characteristics of your project and site. This information will also be needed to complete the stormwater checklist (C.3 and C.6 Development Review Checklist). See *Appendix 1* for more information.

STEP 1 Determine the Limits of Work

The limits of work for your project includes all proposed improvements within your parcel, as well as any work to be performed in the public right-of-way, such as sidewalk reconstruction or driveway approach improvements. The limits of work should also include any land-disturbing activity, such a clearing, grading, filling, excavation, and any other activity that may result in drainage impacts.

STEP 2 Impervious Area Calculations

An impervious surface is any material that prevents or substantially reduces infiltration of water into the soil. This includes building roofs, driveways, patios, parking lots, impervious decking, streets, sidewalks, and any other continuous watertight pavement or covering. Compacted dirt and gravel surfaces that are at greater than 90% compaction are considered impervious surfaces as well. Impervious surface is calculated in units of square feet in the examples within this Manual. When performing impervious surface area calculations, look at your project site in plan view to avoid double counting areas.

The following surfaces require special consideration when performing impervious area calculations:

- Pervious/Permeable Paving and Artificial Turf
- Decks
- Decomposed Granite (DG)
- Garden Stepping Stones
- Pools

Pervious/Permeable Paving and Artificial Turf

Pervious/permeable paving or artificial turf is considered to be a pervious surface only if:

- It is constructed per the manufacturers' specifications
- It is designed to infiltrate into native soil and have the required depth of drain rock below the pervious paving per the criteria in the C.3 Regulated Projects Guide. For example, the minimum depth of drain rock below pavers to be considered "pervious" is 3" in Bay side locations and 4" in Coast side locations. See *Appendix 2*, Reference Documents, for more information.
- It is constructed on slopes less than 5%.
- Sand is not used to bed the pavers or used in the joints between the pavers.
- The soil below the pervious paving is not compacted more than 90%.

Decks

Decks are assumed to be pervious (e.g. constructed with minimum ¼" spacing between boards) unless they are constructed in an impervious manner. Plans should clearly specify whether decks are pervious or impervious.

Decomposed Granite (DG)

DG is assumed to be impervious unless demonstrated otherwise.

Garden Stepping Stones

Garden stepping stones and other informal landscape pathways are considered impervious if the individual paving stones are 6 square feet or larger or if paving stones of any size are laid on a compacted base with greater than 90% compaction.

Pools

Although pools are generally considered impervious surfaces, for the purposes of qualifying for Basic Drainage Review, the actual surface area of a proposed pool may be added into the new/replaced impervious surface area calculation at a factor of 0.5. For example, if a 500 square foot pool has a 300 square foot impervious patio around it and a 50 square foot pool equipment pad, the Total Project Impervious Area would be (0.5 x 500) + 300 + 50 or 600 square feet, which would qualify for Basic Drainage Review.

Other Exclusions

Specific activities are excluded from impervious area calculations:

- Roof replacement, including removal and replacement of an entire roof
- Construction of an addition under an existing permitted roof (e.g. an addition under an existing eve or enclosure of a carport)
- Exterior wall surface replacement
- Improving, replacing, or maintaining public infrastructure in the public right-of-way
- Pavement resurfacing within the existing footprint that does not result in changes to the footprint, grade, layout, or configuration of the paved surfaces, such as:
  - Routine pavement maintenance activities such as top-layer asphalt grinding and repaving
  - Repaving that occurs after conducting utility work under the pavement
  - Reconstruction of existing trails

If your redevelopment project replaces 50 percent or more of the impervious surface of a previously existing development that was not subject to the Stormwater and Drainage Ordinance flow control requirements, then your Stormwater Management Area includes the entire parcel consisting of all existing, new, and/or replaced impervious surfaces. If your project replaces less than 50 percent of existing impervious surfaces, then your Stormwater Management Area includes only the impervious area created or replaced as part of your project.

As part of the comprehensive streamlining of the drainage review process, multiple drainage applications for the same parcel should be minimized. Therefore, all impervious area calculations within the project parcel must include any impervious areas planned for construction in the next five years, as well as any impervious areas created and/or replaced in the ten years preceding the current permit application that

(1) required permitting and

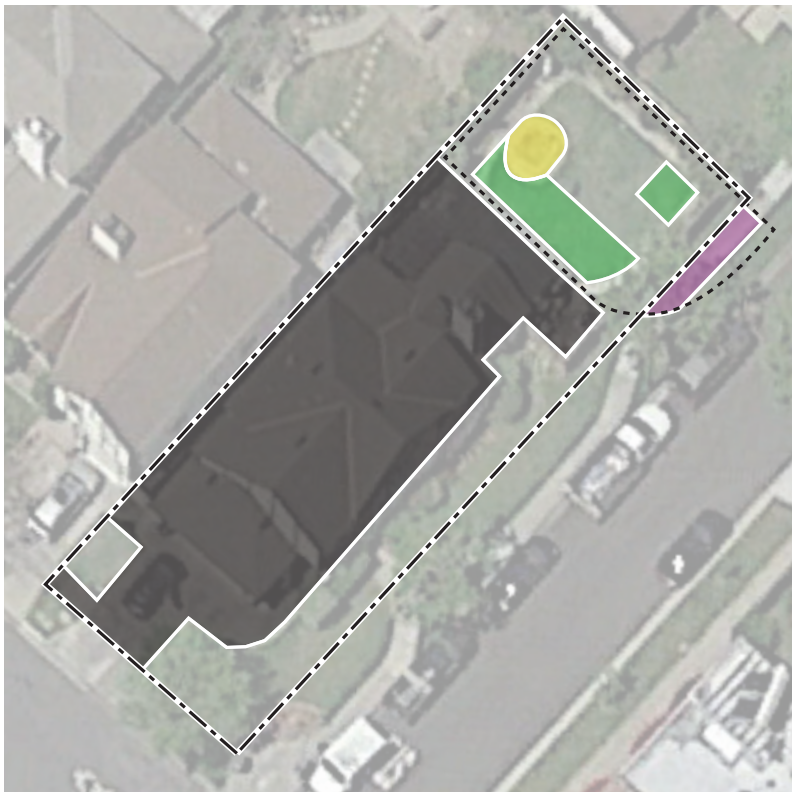
(2) were not managed by an existing drainage feature.

Table 2-1 summarizes the impervious surface area calculations that will be used both for determining your project drainage review type and for determining design requirements discussed in subsequent chapters.

Table 2-1. Impervious Surface Area Calculation Guide

Category of Impervious Surface		Description
A	New Parcel Impervious Surface	The sum of all new impervious surface areas to be created within the project parcel
B	Replaced Parcel Impervious Surface	The sum of all existing impervious surface areas to be replaced within the project parcel
C	Retained Parcel Impervious Surface	The sum of all existing impervious surfaces to be retained within the project parcel
D	New Right-of-Way Impervious Surface (excludes public infrastructure)	The sum of all new impervious surface areas to be created in the public right-of-way
E	Total Project Impervious Area	The sum of all impervious surface areas created and/or replaced as part of the project (A + B + D)*
F	Parcel Impervious Area	The sum of all impervious surface areas within the project parcel following completion of the project (A + B + C)

*If >50% of existing impervious is replaced, then your Total Project Impervious Area includes the entire parcel consisting of all existing, new, and/or replaced impervious surfaces (A+B+C+D).



Step 1 & 2

- Property Line
- Limits of Work
- A New Impervious Area
- B Replaced Impervious Area
- C Retained Impervious Area
- D New ROW Impervious Surface

LIMITS OF WORK	1,230 sq. ft

Impervious Category	Area (sq. ft.)
A	290
B	78
C	2,880
D	125
E	493
F	3,148

Figure 2-1. Example Parcel – Steps 1 & 2 Limits of Work & Impervious Area Calculations

STEP 3 Determine Project Parcel Topographic and Geographic Characteristics

Average Ground Slope

You will need to calculate the Average Ground Slope for the project Limits of Work using contour information. Applicants, particularly those whose project parcels feature steep slopes and/or complicated or unclear topography are encouraged to procure a topographic survey for their project site. If topographic survey is available for your project site, use the contours provided in the topographic survey. Otherwise, contours can be obtained from the San Mateo County Planning GIS Map. To use the GIS Map, simply enter your project parcel address or APN to locate your parcel and then check the "Contours" layer box to view the contours.

For most projects in developed areas, a simple average slope calculation of (elevation difference between contours)/(distance between contour intervals) x 100% will be sufficient. However, for large undeveloped parcels, the Average Ground Slope can be found using the following formula:

$$S = \frac{0.00229 \times I \times L}{A}$$

where:

S = Average Ground Slope (%)

I = contour interval (feet)

L = combined length of all contours in the project Limits of Work (feet)

A = sum of area of project Limits of Work (acres)

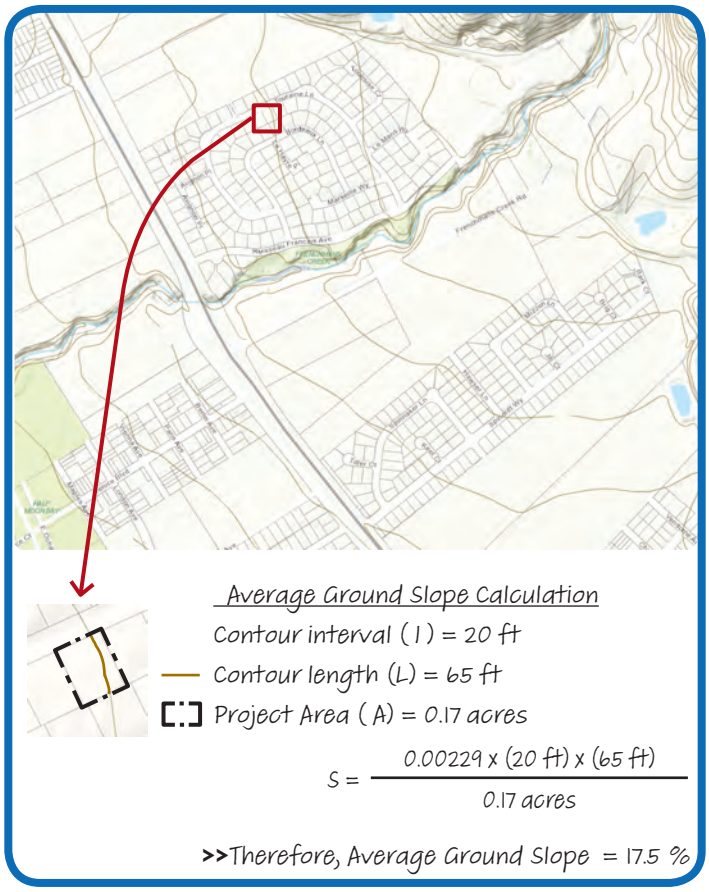


Figure 2-2. Average Ground Slope Calculation Using GIS Map Contours

Geo-hazard Zones

The County has identified areas that carry greater risk for development and drainage impacts due to geological conditions as geo-hazard zones.

Geo-hazard zones include the following:

- Landslide Zones
- Fault Zones
- Coastal Bluffs or Cliffs

You will need to verify whether the project parcel is within 100 feet of a geo-hazard zone. Using the GIS Map, locate your project parcel and check the "Landslide Zones" and "Fault Zones" layer boxes to see if the parcel is located inside or within 100 feet of a landslide zone or fault zone .

A coastal bluff or cliff is a scarp or steep face of rock, decomposed rock, sediment or soil resulting from erosion, faulting, folding, or excavation of the land mass and exceeding 10 feet in height. If your project site is near the coast, you can use the "Measure Distance" tool on the GIS Map to verify whether your parcel is located within 100 feet of a coastal bluff or cliff.

Aquatic Habitat Resources

Approximate mapping locations of aquatic habitat resources such as creeks, streams, and high tide water bodies are provided for your reference in GIS. This is not an exhaustive inventory of such areas, and biological reports and/or implementation of additional site disturbance constraints may be required on a project-by-project basis.

Figure 2-3. GIS Map – Geohazard Zone Layers

Beach near Pescadero

Project Watershed

To determine the watershed your project parcel is in navigate to the County Public Works Watershed Navigator and enter the address of your project parcel.

FEMA Flood Zones

The Federal Emergency Management Agency (FEMA) identifies geographic areas with varying levels of flood risk as designated flood zones. To identify whether the project parcel is within designated FEMA flood zones A, AE, AH, A0, D, or VE, use the GIS Map to locate your project parcel and check the "FEMA Flood Zones" layer box to see if the parcel is located within one of the designated FEMA flood zones. Note that Zone X (including shaded Zone X) is not included as a designated FEMA flood zone for the purpose of this Manual. The County recommends that all structures be built outside of FEMA flood zones, and that drainage structures also be built outside of FEMA flood zones when feasible.

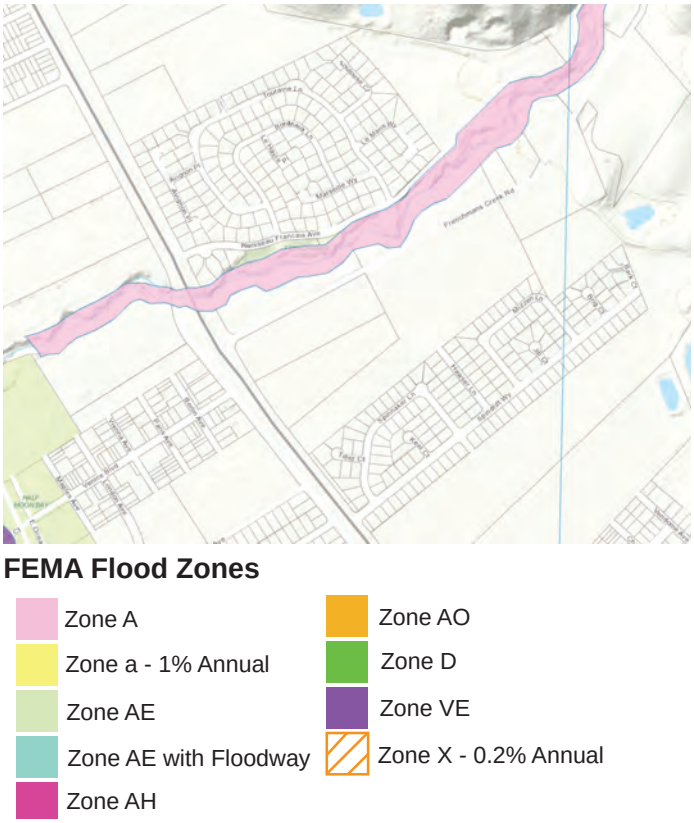
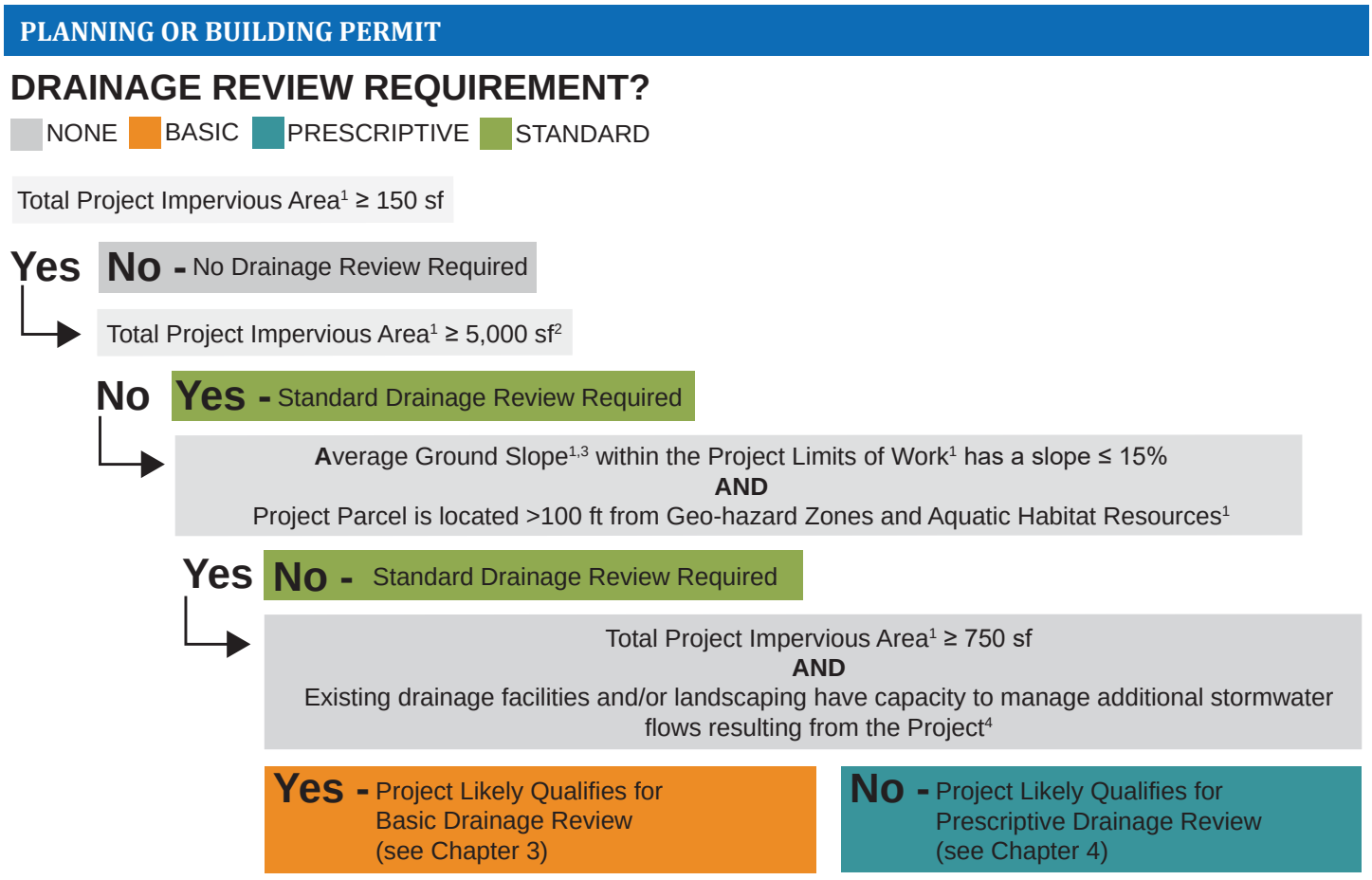


Figure 2-4. GIS Map – FEMA Flood Zones Layer

2.2 Classifying Drainage Review Project Types

Now that you have collected the key project and site characteristics, you will be able to determine the Drainage Review Type for your project. The following sections will guide you through the criteria that must be met for each type of Drainage Review. Refer to *Figure 2-5* for a flow chart summarizing the criteria.

Final determination of Drainage Review Project Type is at the discretion of the County. Projects that meet the criteria for Basic or Prescriptive Drainage Review may be required to go through Standard Drainage Review if deemed necessary by the County. Agricultural structures draining to large fields may qualify for a lower level of drainage review than dictated by criteria in this Manual. Contact the County Planning & Building Department for more information.



1. See Section *2.1 Defining Your Project* of for information on how to determine these project characteristics.
2. At the time of this Manual's publication, this threshold encompasses all C.3 Regulated Projects. All C.3 Regulated Projects require Standard Drainage Review.
3. Projects that require a Grading Permit will need to employ a California Registered Professional Civil Engineer (PE) even if the project qualifies for Basic or Prescriptive Drainage Review.
4. See Section *3.2 Performance Requirements* of for guidance on how to demonstrate this requirement is met.

Figure 2-5. Flow Chart for Determining Drainage Review Requirements for all Projects Seeking a Planning and/or Building Permit

2.2.1 Basic Drainage Review

A project that is seeking a Planning and/or Building Permit is subject to Basic Drainage Review if it meets the following conditions:

- The project has a site plan that accurately shows existing and proposed development and drainage conditions.
- Existing drainage facilities and/or landscaping have capacity to manage additional stormwater flows resulting from the Project.
- The Total Project Impervious Area is less than or equal to 750 square feet.
- The Average Ground Slope within the project Limits of Work has a slope of less than 15%.
- The project parcel is located more than 100 feet from Geo-hazard Zones and Aquatic Habitat Resources.

If your project satisfies the above criteria, your project may qualify for Basic Drainage Review. See *Chapter 3* for guidance on the permitting process, performance requirements, and calculations.

2.2.2 Prescriptive Drainage Review

A project that is seeking a Planning and/or Building Permit is subject to Prescriptive Drainage Review if it meets the following conditions:

- The project has a site plan that accurately shows existing and proposed development and drainage conditions.
- The project is NOT a C.3 Regulated Project.
- The Total Project Impervious Area is less than 5,000 square feet.
- The Average Ground Slope within the project Limits of Work has a slope of less than 15%.
- The project parcel is located more than 100 feet from Geo-hazard Zones and Aquatic Habitat Resources.
- Post-development stormwater runoff peak flow and volume is less than or equal to undeveloped stormwater runoff peak flow and volume through the use of *Chapter 4* Prescriptive Design Measures. Design options other than those described Chapter 4 may not be used*.

If your project satisfies the above criteria for Prescriptive Drainage Review, *Chapter 4* contains the guidance for your project on the permitting process, performance and design requirements, and calculations.

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* If your project satisfies all the criteria for Prescriptive Drainage Review but you do not want to use the Prescriptive Design Measures in *Chapter 4*, you may choose to go through Standard Drainage Review instead. Refer to *Chapter 5* for Standard Drainage Review permitting process and requirements.

2.2.3 Standard Drainage Review

A project that is seeking a Planning and/or Building Permit is subject to Standard Drainage Review if it meets the following conditions:

The project does not meet the criteria for Basic or Prescriptive Drainage Review.

If your project is subject to Standard Drainage Review, *Chapter 5* will guide you through the permitting process, design and performance requirements, and calculation methodology for your project.

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BASIC DRAINAGE REQUIREMENTS

3.0

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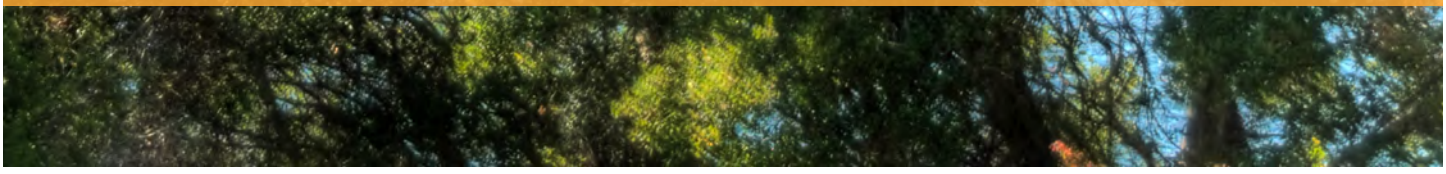

3.1 Permitting Process Overview

Now that you have used *Chapter 2* to determine that your project qualifies for Basic Drainage Review, you may be wondering: What is Basic Drainage Review?

Basic Drainage Review is the County's streamlined review process for small projects with minimal drainage impacts. The County will still need you to provide some information about your project to make sure that no negative drainage impacts will result from your project.

Use the step-by-step instructions to prepare your application. The Basic Drainage Review Application may be prepared by the property owner, applicant, architect, landscape architect, or other involved party and is NOT required to be prepared by a California Registered Professional Civil Engineer (PE). Use your best judgement to decide whether the services of a PE are needed.

If the Basic Drainage Review Application is not prepared by a PE and is not approved after two or more revisions, County staff may require the Application to be revised and resubmitted by a PE.

Step-by-Step Instructions:

1. Review *Section 3.2* and confirm that you can demonstrate compliance with the requirements through one or more of the three methods.
2. Fill out Pages 1 and 2 and any other relevant worksheets of the stormwater checklist (C.3 and C.6 Development Review Checklist). See *Appendix 1* for step-by-step instructions on completing this checklist.
3. Prepare a Site Plan for your project per the requirements listed in *Section 3.3*.
4. Submit your completed Site Plan and stormwater checklist to the County of San Mateo Planning and Building Department.

3.2 Performance Requirements

If your project meets the criteria for Basic Drainage Review per *Section 2.2*, you will need to use one or more of the following methods to demonstrate that existing drainage facilities and/or landscaping can manage the new stormwater flows associated with the proposed project:

1. There is no net increase in impervious area or change to existing drainage patterns within a drainage area (e.g. an existing garage is replaced by an accessory dwelling unit with a smaller footprint, or existing impervious patios or driveways are replaced with properly constructed permeable pavers or landscaping to compensate for new adjacent impervious roof areas).
2. New stormwater flows are routed to an existing stormwater management feature (e.g. dry well, detention tank, or bioretention planter) that can accommodate the new flows. If known, provide dimensions of the existing feature and the existing drainage report that contains information about the existing feature. Use the sizing methodology in *Section 4.2* to confirm that the existing feature can accommodate the new flows.
3. All new and replaced impervious areas are drained to on-site landscaping that can accommodate new stormwater flows. To demonstrate this, identify the landscaped area(s) and all impervious areas (including existing, replaced, and new) that drain to the landscaped area. Calculate or estimate the average slope of the landscaped area. Check that the ratio of landscaped area to impervious area meets the minimum requirements in *Table 3-1*. If the slope of the landscaped area is greater than 10%, the landscaped area is not suitable to manage stormwater flows, so you will need to use one of the other two methods to demonstrate compliance.

If you are not able to use one or more of the three methods to demonstrate that existing drainage facilities and/or landscaping can manage the new stormwater flows associated with the proposed project, you do not qualify for Basic Drainage Review, but will likely qualify for Prescriptive Drainage Review. Proceed to *Chapter 4* for guidance on the Prescriptive Drainage Review process and requirements.

RAIN GARDENS are small depressions with amended soil and robust vegetation. They collect runoff from downspouts and adjacent impervious surface.

DRY WELLS are small pits filled with gravel that allow runoff from downspouts to infiltrate below ground.

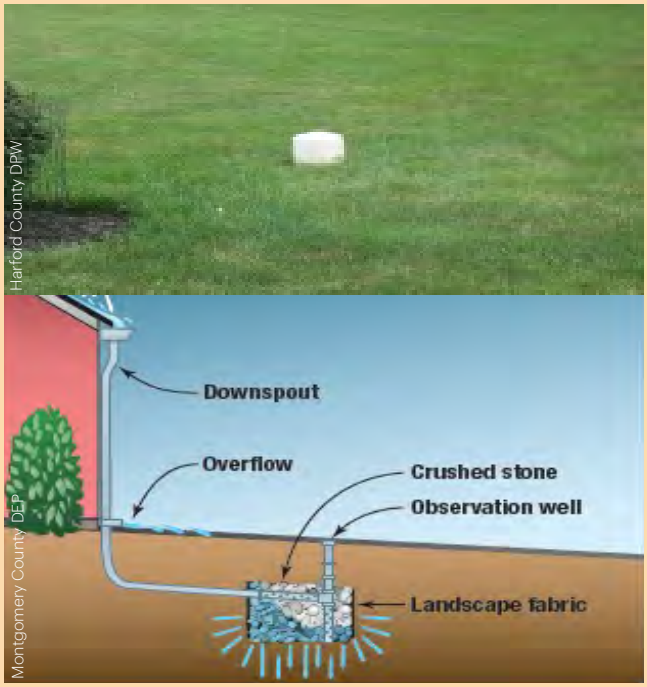

Figure 3-1. Identifying Common Drainage Facilities

3.3 Site Plan Requirements

If you can demonstrate that existing drainage facilities and/or landscaping can manage the new stormwater flows associated with the proposed project using one or more of the three methods, prepare a Site Plan to submit to the County. The Site Plan should include the following:

- Project parcel boundary
- Limits of work
- Show all existing, new, and replaced impervious surfaces on-site and their areas in square feet
- Show all existing and proposed drainage features on-site, including roof gutter downspout locations
- Provide slopes and direction of flow in the project vicinity. Ensure that surfaces adjacent to buildings are sloped away from buildings at 2% minimum for impervious surfaces and 5% minimum for pervious surfaces.
- If new and/or replaced impervious areas are drained to landscaping:
  - Show how stormwater flows are conveyed to landscaping.
  - Specify splash blocks at downspouts to promote dispersion to landscaping or appropriate erosion control measures at the ends of any pipes used for conveyance.
  - Outline the landscaped area proposed to manage flows and provide the slope and area of landscaping in square feet.
  - If grass or groundcover is not planted in the area, specify 3" of mulch cover or functional equivalent.

Table 3-1. Minimum Allowable Ratios of Landscaped Area to Impervious Area for Management of Stormwater Flows

Slope of Landscaped Area	Minimum Allowable Ratio of Landscaped Area to Impervious Area
0–4%	1:1 (e.g. 100 sf of landscaping can receive flows from up to 100 sf of impervious area)
>4–8%	2:1 (e.g. 200 sf of landscaping can receive flows from up to 100 sf of impervious area)
>8-10%	3:1 (e.g. 300 sf of landscaping can receive flows from up to 100 sf of impervious area)
>10%	None

- For proposed minor drainage features:
  - Specify diameters and material of new pipes. All proposed drainage pipes should be minimum 4" in diameter.
  - Vegetated swales should be minimum 4" deep as feasible with maximum 2:1 side slopes. Swales with flow paths greater than 2% should have appropriate erosion control measures (grass, rock, mulch, etc.)
  - Provide a cross section for all proposed swales and pervious pavements.
  - Stormwater is NOT allowed to be routed to foundation subdrains unless there is sufficient grade separation to prevent stormwater from inadvertently flowing to drain.
- If new pools are proposed:
  - Show a sanitary sewer cleanout in the pool vicinity.
  - Add the following note to the Site Plan: During pool draining activities, no water may run off-site. All pool water must be either diverted to landscaping or the sanitary sewer (with a permit from the sewer district).
- If retaining walls are proposed:
  - Retaining walls must demonstrate adequate drainage.
  - Subdrainage may not drain to stormwater conveyances unless there is adequate grade separation such that there is no risk of stormwater inundating the subdrain.
  - Show any conveyances used to route stormwater around retaining walls, if applicable.
  - Retaining walls may not result in new flows draining to neighboring properties.
- Include the following notes on the Site Plan:
  - No net increase in stormwater runoff (relative to undeveloped conditions) may drain onto adjacent properties. The existing storm drainage from the adjacent properties shall not be blocked by the new development.
  - The owner shall adequately maintain the property's stormwater management facilities.

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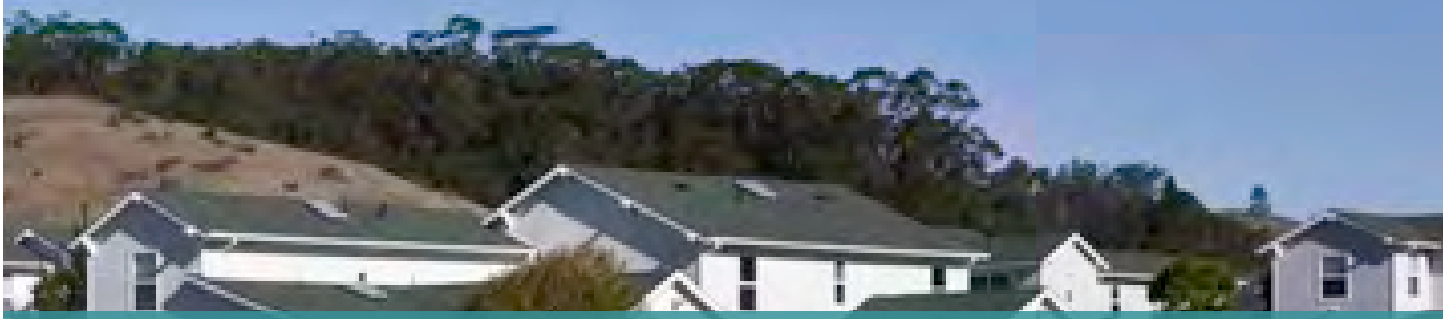
PRESCRIPTIVE DRAINAGE REQUIREMENTS



4.0

IN THIS CHAPTER

4.1 Permitting Process Overview

If you have determined that your project qualifies for Prescriptive Drainage Review, this chapter will guide you through the design and permitting process for your project.

Prescriptive Drainage Review is the County's review process for medium-sized projects with minimal drainage impacts. Unlike Basic Drainage Review projects, these projects still require the design of new drainage facilities, but the County's goal is to provide enough information in this Manual for property owners or other applicants to design the drainage facilities and prepare a complete application that meets the County's Peak Flow and Volume Control Requirements.

Use the step-by-step instructions to prepare your application. The Prescriptive Drainage Review Application may be prepared by the property owner, applicant, architect, landscape architect, or other involved party and is NOT required to be prepared by a California Registered Professional Civil Engineer (PE). Use your best judgement to decide whether the services of a PE are needed.

If the Prescriptive Drainage Review Application is not prepared by a PE and is not approved after two or more revisions, County staff may require the Application to be revised and resubmitted by a PE.

Step-by-Step Instructions:

1. Fill out Pages 1 and 2 and any other relevant worksheets of the stormwater checklist (C.3 and C.6 Development Review Checklist). See *Appendix 1* for step-by-step instructions on completing this checklist.
2. Review *Section 4.2* and select one or more Prescriptive Design Measures you will use to meet the Peak Flow and Volume Control Requirements. Follow the instructions on the Prescriptive Design Measure Fact Sheet to size and design the measure(s).
3. Prepare a Drainage Plan for your project using the *Table 4-2. Prescriptive Drainage Review Drainage Plan Checklist* for guidance.
4. Submit your completed Drainage Plan, stormwater checklist, and signed Prescriptive Design Measure Fact Sheet(s) to the County of San Mateo Planning and Building Department.

4.2 Prescriptive Sizing Guidelines

The addition of impervious area on your project may increase the quantity and the rate at which stormwater runoff leaves the project parcel. To mitigate the potential impacts from the increase in stormwater runoff due to development, the County requires all projects to meet the Peak Flow and Volume Control requirements: **post-development runoff peak flow and volume must be less than or equal to undeveloped runoff peak flow and volume.**

To meet the Peak Flow and Volume Control requirements, Prescriptive Drainage Review projects must use one or more of the following Prescriptive Design Measures:

- Landscaped Area
- Rain Garden
- Dry Well
- Planter Box
- Pervious Pavement

Figure 4-1. Step 1: Prescriptive Design Measure Sizing

Review the following Prescriptive Design Measure Fact Sheets to determine which measures are best suited to your project. Once you have chosen one or more Prescriptive Design Measures, use the following steps to size the Prescriptive Design Measure to meet the Peak Flow and Volume Control Requirements. If your project only creates or replaces impervious area within an area that drains to an existing stormwater management feature (e.g. drywell, raingarden, etc.) that can accommodate the stormwater flows from the impervious areas, you do not need to construct a new stormwater management feature. Instead, you can show the existing feature on your plans and either (1) provide a drainage report prepared during the design of that feature or (2) fill out a Prescriptive Design Measure Fact Sheet for the feature, clearly indicating that it is "existing," to demonstrate that the existing feature is adequately sized.

Step 1. Delineate new impervious surfaces, flow paths, and Prescriptive Design Measure location.

- On your Drainage Plan, identify all the new impervious surfaces on your parcel and their areas in square feet.
- On your Drainage Plan, identify the location of the Prescriptive Design Measure(s).
- On your Drainage Plan, use arrows to show the flow path for runoff from new impervious surfaces to the Prescriptive Design Measure(s)

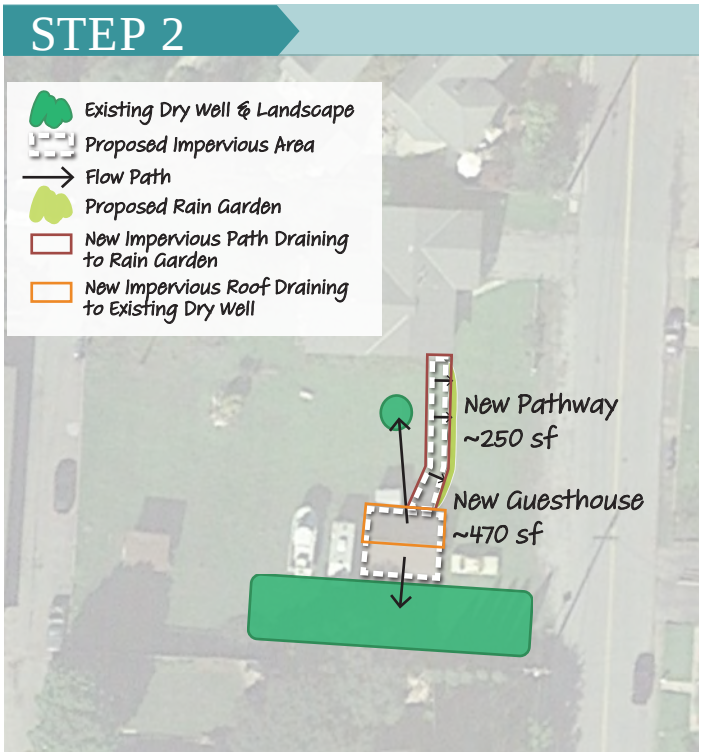


Figure 4-2. Step 2: Prescriptive Design Measure Sizing

Step 2. Calculate the Contributing Area for each Prescriptive Design Measure

› For each Prescriptive Design Measure, draw a boundary around all the new impervious surfaces that drain to that measure.

› Sum the impervious areas within that boundary to calculate the Contributing Area to that Prescriptive Design Measure.

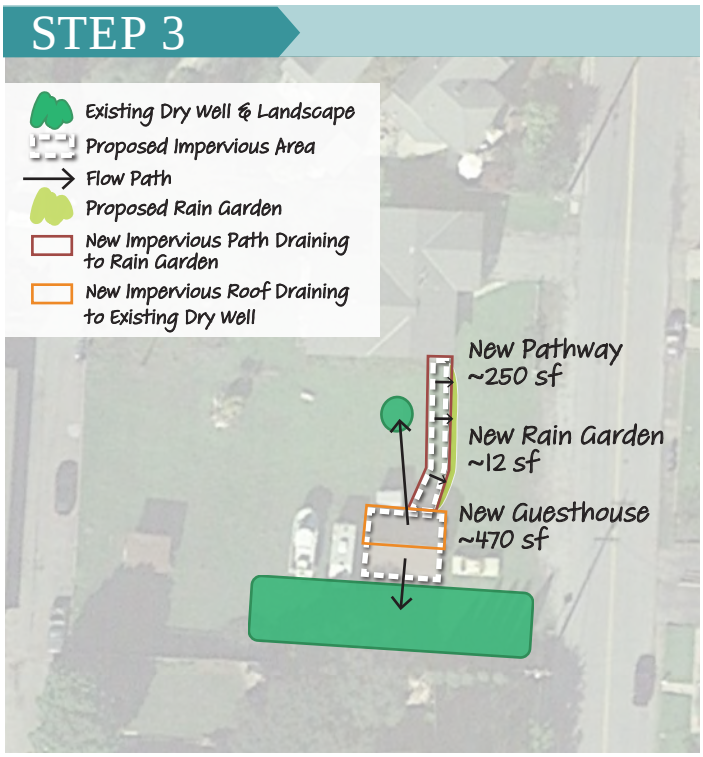


Figure 4-3. Step 3: Prescriptive Design Measure Sizing

Step 3. Determine the required size for the Prescriptive Design Measure(s) chosen

› Using the Contributing Area you calculated in Step 2, look up the required size in the sizing table provided in the Prescriptive Design Measure Fact Sheet.

› Indicate the size and dimensions of the Prescriptive Design Measure on your Drainage Plan.

› If you are a Registered Professional Civil Engineer, you are permitted to submit engineering calculations for the sizing of the Prescriptive Design Measures instead of using the sizing criteria in *Table 4-1* and in the Fact Sheets.

Table 4-1 summarizes the sizing criteria for the different Prescriptive Design Measures based on the contributing impervious area. Continue on to the following pages for more detailed information on each of the Prescriptive Design Measures.

Table 4-1. Typical Sizing Criteria for Prescriptive Design Measures

Typical Sizing Criteria for Prescriptive Design Measures							
			Drywell (gravel filled)			Pervious Pavement	
Contributing Area [sf impervious]	Landscaped Area (1:1 ratio) [sf]	Rain Garden [sf]	Drywell (gravel filled) [cf]	Drywell (assuming Detail 1 with 4 ft depth) [sf]	Planter Box [sf]	Pervious Pavement Area (1 ft gravel subbase) [sf]	Pervious Pavement Area (2 ft gravel subbase) [sf]
<500	500	30	100	25	50	90	45
500 – 1,000	1,000	60	200	50	100	180	90
1,001 – 1,500	1,500	90	300	75	150	270	135
1,501 – 2,000	2,000	120	400	100	200	360	180
2,001 – 2,500	2,500	150	500	125	250	450	225

Table 4-2. Prescriptive Drainage Review Drainage Plan Checklist

Drainage Plan Checklist	Done
Project Parcel Boundary	
Limits of Work	
All NEW Impervious Surface (Location & Square Footage)	
All REPLACED Impervious Surface (Location & Square Footage)	
Existing Drainage Flow Paths (It is recommended to conduct a topographic site survey as necessary to confirm slopes and direct of flow)	
Existing On-site Conveyances	
Existing Drainage Facilities	
Prescriptive Design Measure(s) (Location & Cross-Section Details)	
Proposed Drainage Flow Paths. Show: › How Runoff from New Impervious Surfaces Will Be Routed to Prescriptive Design Measure(s) › Surfaces are sloped away from buildings at 2% minimum for impervious surfaces and 5% minimum for pervious surfaces.	
For Proposed Minor Drainage Features: › Specify diameters and material of new pipes. All proposed drainage pipes should be minimum 4" in diameter. › Vegetated swales should be minimum 4" deep as feasible with maximum 2:1 side slopes. Swales with flow paths greater than 2% should have appropriate erosion control measures (grass, rock, mulch, etc). Provide a cross section for all proposed swales. › Stormwater is NOT allowed to be routed to foundation subdrains unless there is sufficient grade separation to prevent stormwater from inadvertently flowing to the subdrain.	
If New Pools are Proposed: › Show a sanitary sewer cleanout in the pool vicinity. › Add the following note to the Drainage Plan: "During pool draining activities, no water may run off-site. All pool water must be either diverted to landscaping or the sanitary sewer (with a permit from the sewer district).	
If Retaining Walls are Proposed: › Retaining walls must demonstrate adequate drainage. › Subdrainage may not drain to stormwater conveyances unless there is adequate grade separation such that there is no risk of stormwater inundating the subdrain. › Show any conveyances used to route stormwater around retaining walls, if applicable. › Retaining walls may not result in new flows draining to neighboring properties.	
Include the Following Notes on the Drainage Plan: › No net increase in stormwater runoff (relative to undeveloped conditions) may drain onto adjacent properties. The existing storm drainage from the adjacent properties shall not be blocked by the new development. › The owner shall adequately maintain the property's stormwater management facilities.	

Prescriptive Design Measure Fact Sheet

Landscaped Area

Dry creek infiltrates and conveys runoff.

▶ Designing landscaped areas to soak up rainfall runoff from building roofs and paved areas helps protect water quality in local creeks and waterways. These landscape designs reduce polluted runoff and help prevent creek erosion.

As the runoff flows over vegetation and soil in the landscaped area, the water percolates into the ground and pollutants are filtered out or broken down by the soil and plants. This fact sheet shows how you can design your landscape to absorb runoff from impervious surfaces, such as roofs, patios, driveways, and sidewalks, with landscape designs that can be very attractive.

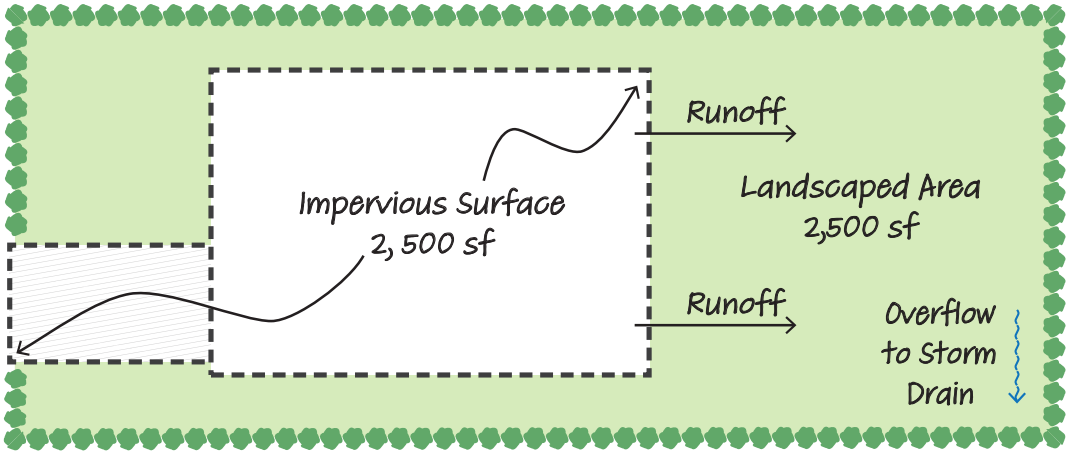
Is a Landscaped Area Feasible at My Project?

Landscaped areas are appropriate where the following site characteristics are present:

▶ Roofs, driveways, parking areas, patios, and walkways that drain to an existing landscape, or an area that may be converted to landscape.
▶ Landscaped areas have a slope of less than 5%.
▶ Well-drained soil; soil amendments may be used in areas with poor drainage.
▶ Runoff is directed away from building foundations.
▶ Runoff does not create ponding around trees and plants that won't tolerate wet conditions.

How large does my landscaped area need to be?

▶ The landscaped area should be equal to the area of the contributing impervious surface. For example (see below), to manage runoff from a 2,500 square foot roof or paved surface, you should have 2,500 square feet of landscaping.
▶ However, remember that the contributing impervious surface must be able to drain to the designated landscaped area! For example, if your roof drains through rain gutters into a narrow side yard area, you cannot count the backyard landscaped area if the runoff from the downspouts does not actually drain to the backyard.



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Content adapted from Bay Area Stormwater Management Agencies Association (BASMAA)

December 2019

Prescriptive Design Measure Fact Sheet

Landscaped Area

Design Checklist

▶ When using landscaped area to manage stormwater runoff, the following design criteria should be considered:

- ☐ Maximize the use of landscaping and natural areas that already exist. Try to design new landscapes immediately adjacent to impervious surfaces.
- ☐ Landscaped areas should have slopes of less than 5%
- ☐ Small landscaped areas should have berms or grading such that water does not simply flow through; 3" difference in grading is recommended.
- ☐ Water should flow evenly (without concentrating runoff into small streams) from the impervious surface to the landscape; this will maximize the filtration and settling of sediment and pollutants and prevent erosion. The design should avoid allowing straight channels and streams to form.
- ☐ Amend soils to improve drainage, when necessary.
- ☐ If the project is located next to standard asphalt or concrete pavement, and there is concern about water undermining the pavement, include a water barrier in the design.
- ☐ Use curb cuts to create places where water can flow through to the landscape
- ☐ Redirect flows from roof downspouts to adjacent landscapes rather than directly to a storm drain system. Downspout systems should incorporate a splash block to slow the runoff flow rate; a landscape flow path length of 10 to 15 feet is recommended.
- ☐ Use drought-tolerant native or climate-adapted plant species whenever possible. Avoid invasive or pest species. A list of invasive species may be found at the California Invasive Plant Council website (www.cal-ipc.org). Contact municipal staff for a list of plants suitable for stormwater management areas.
- ☐ Design the landscape area so that overflow from large storms discharges to another landscaped area or the storm drain system to prevent flooding
- ☐ Projects shall comply with the Water Efficient Landscaping Ordinance (WELO) as applicable. https://planning.smcgov.org/water-efficient-landscape-ordinance-welo
- ☐ Incorporate any appropriate soil stabilization and erosion control measures, such as rock cobble at water entrances and minimum 3" of mulch (or equivalent cover) in unplanted areas.

Operations & Maintenance

▶ The following practices will help maintain your landscape to keep it attractive and managing stormwater runoff effectively:

- ☐ During dry months, irrigate outside the rainy season as needed during the first year to encourage root growth and establish the plants. In subsequent years, irrigate as needed by the plant species to maintain plant health.
- ☐ Repair signs of erosion immediately and prevent further erosion by reinforcing the surrounding area with ground cover or using rocks for energy dissipation.
- ☐ If standing water remains in the landscaped area for more than 4 days, use additional soil amendments to improve infiltration.
- ☐ Inspect the locations where water flows into a landscaped area from adjacent pavement to ensure that there is positive flow into the landscape, and vegetation or debris does not block the entrance point.

▶ In the following table, fill in the contributing area that will be draining to the landscaped area and the surface area of the landscaped area you are proposing to use to manage stormwater runoff at your property. Landscaped area must be greater than or equal to contributing area.

Project Information

Project Contributing Area (sq. ft.)	Landscaped Area (sq. ft.)

Owner Certification

As the owner of the project property, I hereby acknowledge that the above information is true, accurate and complete, to the best of my knowledge.

Signature **Date**

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Content adapted from Bay Area Stormwater Management Agencies Association (BASMAA)

December 2019

Prescriptive Design Measure Fact Sheet

Landscaped Area

Techniques to Manage Stormwater in Landscaping

Direct Roof Runoff to Landscape:

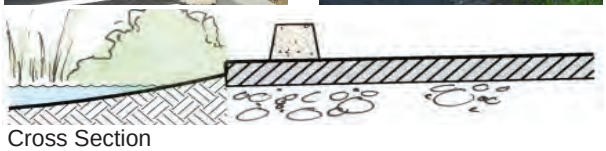
▶ Use additional piping to connect the downspout to the landscape if needed.
▶ Direct runoff away from building foundations.
▶ Prevent erosion by installing:
- Splash blocks,
- Rain chains,
- Pop-up drainage emitter connected to a pipe that carries runoff away from the foundation, or
- Other energy dissipation technique.

Splash Block

Downspout Connected to Landscape

Direct Parking Lot Runoff to Landscape:

▶ During storms, parking lots generate large amounts of runoff, which picks up oils, grease, and metals from vehicles. Landscaped areas can be designed to absorb and filter this runoff.
▶ Landscaped areas must be below the paved elevation. Allow an elevation change of 4 to 6 inches between the pavement and the soil, so that vegetation or mulch build-up does not block the flow.
▶ Grade the paved area to direct runoff towards the landscaping.
▶ If possible, provide a long path for runoff to infiltrate (while meeting the landscaped area sizing requirement).
▶ Provide multiple access points for runoff to enter the landscape. Install curb cuts or separate wheel stops for the water to flow through. Provide cobbles or other permanent erosion control at points of concentrated flow.



Cross Section

View from Above

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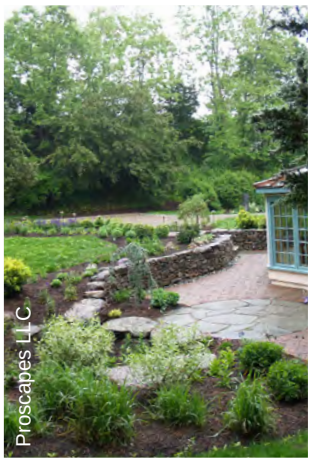
Prescriptive Design Measure Fact Sheet

Landscaped Area

Techniques to Manage Stormwater in Landscaping

Manage Runoff from Driveways / Small Paved Areas

- ▶ Driveways, sidewalks, patios, walkways, and other small paved areas can offer creative opportunities to drain runoff to landscaping.
- ▶ Install landscape adjacent to the paved surface, and grade the paved area so runoff flows toward the landscaping.
- ▶ Landscaped areas must be below the paved elevation. Allow an elevation change of 4 to 6 inches between the pavement and the soil, so that vegetation or mulch build-up does not block the flow.
- ▶ Install cobbles or rocks where runoff enters the landscape to avoid erosion.
- ▶ Use appropriate sizing ratio.
- ▶ Use drought-tolerant native or climate-adapted plants to reduce irrigation.



Proscapes, LLC

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Content adapted from Bay Area Stormwater Management Agencies Association (BASMAA)

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Prescriptive Design Measure Fact Sheet

Rain Garden

Rain gardens combine beauty, habitat, and stormwater management.

▶ A rain garden is a depressed area in the landscape that collects rainwater from a roof or other impervious surfaces and allows the water to soak into the ground. Rain gardens are typically planted with native plants, grasses, and flowering perennials, providing an attractive way to reduce runoff. More complex rain gardens with special soil, called biotreatment soil, and drainage systems are often called bioretention areas. Refer to the SMCWPPP C.3 Regulated Projects Guide for information on how to design a bioretention area. Including elements of this more complex design, such as biotreatment soil, in your rain garden is recommended, but not required.

Are Rain Gardens Feasible at my Project?

Rain gardens are appropriate where the following site characteristics are present:

▶ Roof areas with downspouts or other impervious areas can be directed to drain to the rain garden.

▶ The rain garden should have well-drained soil and be relatively flat. Soil amendments can improve infiltration in areas with poor drainage. Add about 3 inches of compost to any soil type and till it in to a depth of about 12 inches.

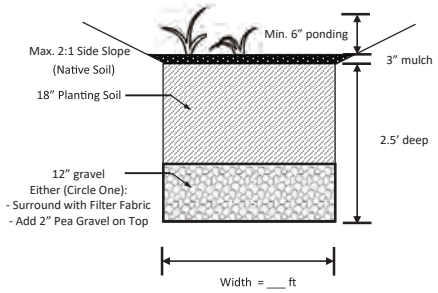
▶ Rain gardens should be installed at least 5 feet from property lines, 10 feet from building foundations, and 25 feet from septic tanks and dispersal fields.

▶ Overflow from the rain garden can be directed to a pervious area or storm drain system such that excess water will not flow towards any nearby foundations or neighboring properties.

▶ A front or backyard can work well for rain garden, especially in areas where the slope naturally takes the stormwater.

How large does my rain garden need to be?

▶ Rain gardens are typically composed of a 12 inch layer of gravel with an 18 inch layer of soil on top of the gravel. Rain gardens are depressed below the surrounding surfaces, with 6 inches of open space from the top of the rain garden sides to the top of the soil, called the "ponding depth."For rain gardens designed with this typical section, the following table can be used as minimum sizing guidance.



Rain Garden Section Example Detail

Rain Garden Sizing Table

Contributing Area (sq. ft.)	Rain Garden Area (sq. ft.)
<500	30
500 - 1,000	60
1,001 - 1,500	90
1,501 - 2,000	120
1,001 - 2,500*	150

* Projects adding roof or impervious areas in excess of 2,500 square feet shall add 30 sq. ft. of rain garden surface area per every 500 square feet of additional area.

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Content adapted from Long Beach Development Services

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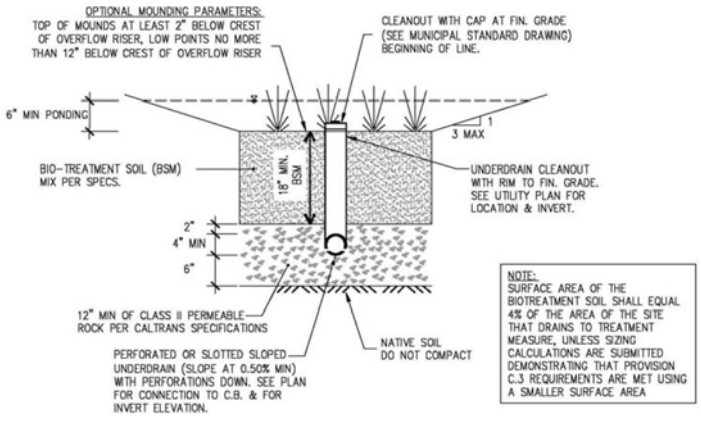
Prescriptive Design Measure Fact Sheet

Rain Garden

Design Checklist

▶ When installing a rain garden, the following design criteria shall be considered:

- ☐ Rain garden is located at least 5 feet from property lines, 10 feet from building foundations, and 25 feet from septic tanks and dispersal fields.
- ☐ Rain garden has been located to intercept and collect runoff via a roof downspout or adjacent impervious area.
- ☐ Rain garden is not located over shallow utilities. Utilities have been located before digging by calling USA North 811 at (800) 642-2444 or www.usanorth811.org at least two days before digging.
- ☐ Rain garden is located on a relatively flat area, away from slopes greater than 10%.
- ☐ Drought and or flood resistant native plants species should be used whenever possible. Invasive or pest species should be avoided. Contact County staff for a list of plants appropriate for rain gardens or see C.3 Regulated Projects Guide Appendix A. A list of invasive species may be found at the California Invasive Plant Council (www.cal-ipc.org)
- ☐ Projects shall comply with the Water Efficient Landscaping Ordinance (WELO) as applicable.



Typical Bioretention Area Cross Section (see SMCWPPP C.3 Regulated Projects Guide for more information)

Operations & Maintenance

▶ Once a rain garden is installed, the following maintenance criteria shall be followed:

- ☐ Rain gardens will be irrigated periodically (as needed) during dry months, especially while plans are being established. Plants will be inspected for health and replaced as necessary. Weeds will be removed as often as possible.
- ☐ Areas of erosion will be repaired. Further erosion can be prevented by stabilizing the eroding soil with ground cover or using energy dissipation techniques (e.g. splashblock or cobbles) below downspouts.
- ☐ Standing water will not remain in rain gardens for more than 3 days. Extended period of flooding may kill vegetation and result in the breeding of mosquitoes or other vectors.
- ☐ If roof downspouts are connected to rain gardens, rain gutters and downspouts will be inspected and cleaned at least twice annually.

▶ In the following table, fill in the contributing area that will be draining to the rain garden and the surface area of the rain garden you are proposing to install at your property.

Project Information

Project Contributing Area (sq. ft.)	Rain Garden Area (sq. ft.)

Owner Certification

As the owner of the project property, I hereby acknowledge that the above information is true, accurate and complete, to the best of my knowledge.

Signature **Date**

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Content adapted from Long Beach Development Services

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Prescriptive Design Measure Fact Sheet

Dry Well

Dry Well systems present an easy to install and sustainable solution for stormwater control.

Is a Dry Well Feasible at My Project?

Dry wells are appropriate where the following site characteristics are present:

▶ Roof areas with downspouts or other impervious areas can be connected to the dry well.
▶ Dry wells should be installed at least 5 feet from property lines, 10 feet from building foundations, and 25 feet from septic tanks and dispersal fields.
▶ Overflow from the dry well can be directed to a pervious area or storm drain system such that excess water will not flow towards any nearby foundations or neighboring properties.

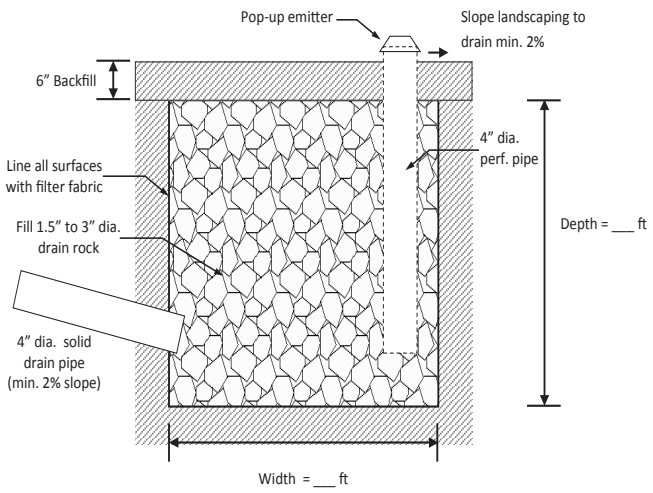
How large does my dry well need to be?

▶ A dry well should be sized to capture the runoff produced from the design storm over the connected impervious area, with account taken for any gravel or fill material that is used. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for dry wells.

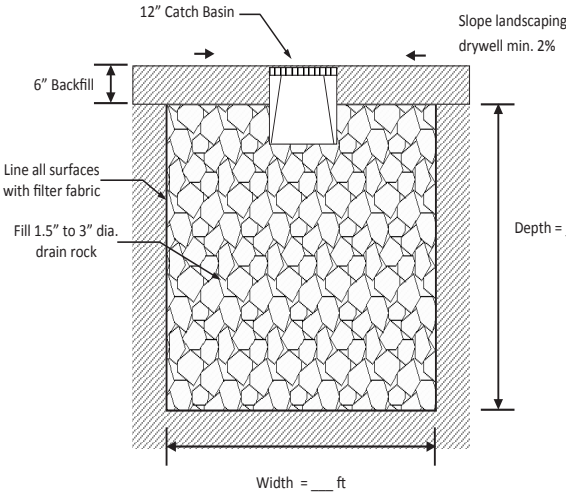
Dry Well Sizing Table

Contributing Area (sq. ft.)	Dry Well Volume Without Fill (cubic ft)	Dry Well with Gravel Fill (cubic ft)
<500	35	100
500 - 1,000	70	200
1,001 - 1,500	105	300
1,501 - 2,000*	140	400

* Projects adding roof or impervious areas in excess of 2,000 sq ft shall add 35 cubic ft of dry well volume (without fill) or 100 cubic ft of dry well volume (with gravel fill) per every 500 sq ft of additional area.



Drywell Section Example Detail
for direct connection to storm drain pipes



Drywell Section Example Detail
for indirect / overland storm-water flow

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Content adapted from Long Beach Development Services

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Prescriptive Design Measure Fact Sheet

Dry Well

Design Checklist

▶ When installing a dry well, the following design criteria shall be considered:

- ☐ Dry well is located at least 5 feet from property lines, 10 feet from building foundations, and 25 feet from septic tanks and dispersal fields.
- ☐ In areas where information about the depth to groundwater is unknown, the maximum depth of the dry well shall be 5'.
- ☐ Dry well is installed to intercept and collect runoff via a downspout from a roof or adjacent impervious area.
- ☐ Utilities have been located before digging by calling USA North 811 at (800) 642-2444 or www.usanorth811.org at least two days before digging.
- ☐ The soil under the dry well has been over-excavated to at least one foot in depth. The soil has been re placed uniformly without compaction, or amended with 15-30% of coarse sand and replaced without compaction.
- ☐ Dry well is appropriately sized in accordance with the sizing table shown.
- ☐ For dry wells with gravel fill use 2" diameter or greater stone.
- ☐ A sedimentation basin or debris box has been installed, and a fine mesh screen has been installed on the inlet to prevent sediment and debris from entering the dry well.
- ☐ An overflow has been incorporated in the dry well such that excess water will flow into the storm drain system or another pervious area and away from any nearby foundations or neighboring properties. Optional: An observation well consisting of a slotted or perforated pipe (typically PVC), 4 – 6 inches in diameter, capped with an above-ground, sealable lid has been incorporated into the dry well.

Operations & Maintenance

▶ Once a dry well is installed, the following maintenance criteria shall be followed in order to allow the measure to function properly:

- ☐ Water level, drawdown time, and evidence of clogging will be monitored monthly during the rainy season.
- ☐ Standing water will not remain above the dry well for more than 4 days. Extended periods of flooding may result in the breeding of mosquitoes or other vectors.
- ☐ If roof downspouts are connected to the dry well, rain gutters and downspouts will be inspected and cleaned at least twice annually.
- ☐ If the dry well ever becomes plugged and overflows on a continual basis, the dry well will be repaired or replaced as necessary, and gravel media fill will be cleaned or replaced to enhance the infiltration capacity.

▶ In the following table, fill in the contributing area that will be draining to the dry well and the volume of the dry well you are proposing to install at your property.

Project Information

Project Contributing Area (sq. ft.)	Dry Well Type (with or without fill)	Dry Well Volume (cubic ft)

Owner Certification

As the owner of the project property, I hereby acknowledge that the above information is true, accurate and complete, to the best of my knowledge.

Signature **Date**

San Mateo County Planning and Building Department
455 County Center 2nd Floor
Redwood City, CA 94063
(650) 363-4161 www.planning.smcgov.org

Content adapted from Long Beach Development Services

December 2019

Prescriptive Design Measure Fact Sheet

Planter Box

Planter boxes are easy to install and maintain, provide natural filtration of stormwater, and enhance the aesthetics of your property.

Are Planter Boxes Feasible at My Project?

Planter boxes are appropriate where the following site characteristics are present:

- ▶ Roof areas with downspouts or roof areas without downspouts that can be drained to the planter(s)
- ▶ A level, firm surface away from retaining wall structures is available for support of the planter(s). Planters should only be elevated with solid construction materials, such as concrete or wood

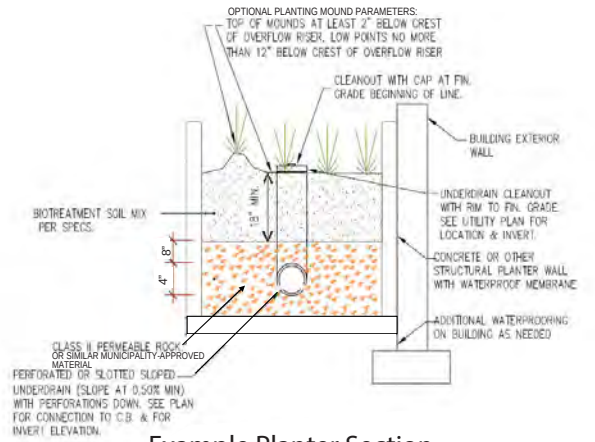
How large does my planter box need to be?

▶ The total size of planter(s) necessary to capture run-off from a given roof area is shown in the table to the right. The table assumes a minimum planter depth of 2.5 feet, with 2 feet of soil and 0.5 feet of storage space, or “freeboard”, above the soil surface.

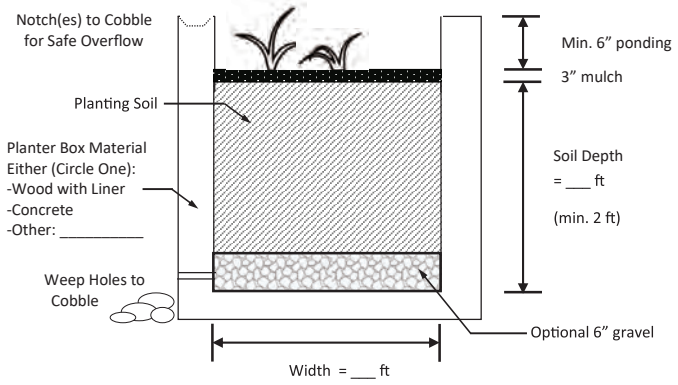
Planter Box Sizing Table

Contributing Area (sq. ft.)	Total Surface Area of Planter(s) (sq. ft.)
<500	50
500 - 1,000	100
1,001 - 1,500	150
1,501 - 2,000	200
1,001 - 2,500*	250

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 50 sq. ft. of planter box surface area per every 500 sq. ft. of additional area.



Example Planter Section with Underdrain



Note: Include weepholes, underdrains, etc as needed to ensure that ponded water completely drains within 4 days.

Planter Section Example Detail

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Content adapted from Long Beach Development Services

December 2019

Prescriptive Design Measure Fact Sheet

Planter Box

Design Checklist

▶ When installing a planter box, the following design criteria shall be considered:

- ☐ Planters should NOT be placed directly against wooden structures.
- ☐ At least 6 inches of storage is present between the planting surface and the crest of each planter.
- ☐ At locations implementing multiple planters, planters are placed directly adjacent to one another so as to minimize the impervious space between planters.
- ☐ Surface of planter is level.
- ☐ Planting soil is at least 2 feet deep.
- ☐ Planting soil contains no more than 30% compost.
- ☐ Projects shall comply with the Water Efficient Landscaping Ordinance (WELO) as applicable. https://planning.smcgov.org/water-efficient-landscape-ordinance-welo

Operations & Maintenance

▶ Once a planter box is installed, the following maintenance criteria shall be followed:

- ☐ Planters will undergo annual plant and soil maintenance typical of landscape care procedures to ensure optimum filtration, storage, and drainage capabilities.
- ☐ Following rain events, planters will be inspected to ensure that standing water is not present in the planter for more than 4 days. Ponded water that is not completely drained after 4 days can cause vector breeding.
- ☐ Pesticide additives will not be used in the planters.

▶ In the following table, fill in the contributing area that will be draining to the planter(s) and the surface area of the planter(s) you are proposing to install at your property.

Project Information

Project Contributing Area (sq. ft.)	Total Surface Area of Planter(s) (sq. ft.)

Owner Certification

As the owner of the project property, I hereby acknowledge that the above information is true, accurate and complete, to the best of my knowledge.

Signature **Date**

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Content adapted from Long Beach Development Services

December 2019

Prescriptive Design Measure Fact Sheet

Pervious Pavement

Did you know there are pavement choices that let the water seep right through?

Is Pervious Pavement Feasible at My Project?

▶ There are many different types of pervious pavement, including porous asphalt, pervious concrete, permeable and porous units pavers, reinforced gravel paving, and reinforced grass paving. The use of the surface (i.e., foot traffic, vehicular traffic, recreation), site conditions, aesthetic qualities, and maintenance requirements should be considered when selecting the type of pervious pavement.

Pervious pavement is appropriate where the following site characteristics are present:

▶ Pervious pavements should work well on most sites where paved surfaces such as patios and walkways exist and slopes are less than 2 percent.

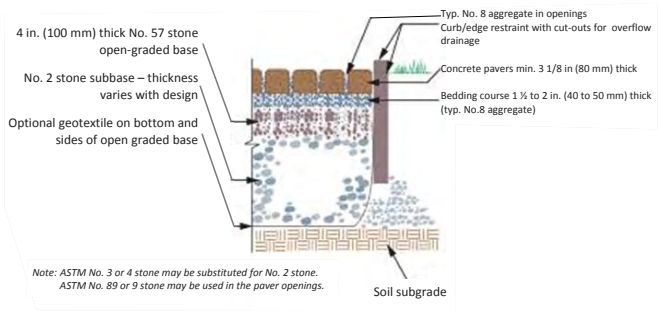
▶ Pervious pavement applications for stormwater retention should be installed at least 3 feet from public sidewalks and 10 feet from building foundations.

How much pervious pavement do I need?

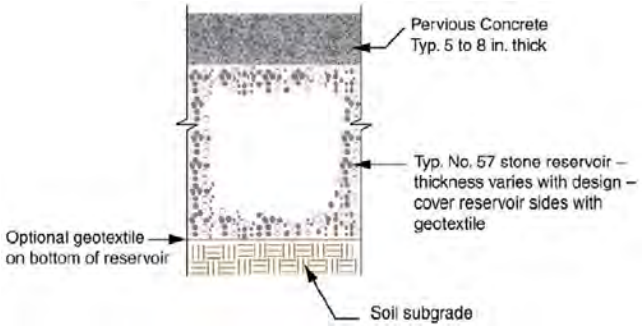
Pervious Paving Sizing Table

Contributing Area (sq. ft.)	Pervious Pavement Area - 1ft Gravel Subbase (sq. ft.)	Pervious Pavement Area - 2ft Gravel Subbase (sq. ft.)
<500	90	45
500 - 1,000	180	90
1,001 - 1,500	270	135
1,501 - 2,000	360	180
2,001 - 2,500*	450	225

* Projects adding roof or impervious areas in excess of 2,500 square feet shall add 90 sq. ft. of pervious pavement (with 1' gravel subbase) or 45 sq. ft. of pervious pavement (with 2' gravel subbase) per every 500 square feet of additional area.



Permeable Interlocking Concrete Pavers Section



Typical Porous Concrete Pavement Section

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Content adapted from Long Beach Development Services

December 2019

Prescriptive Design Measure Fact Sheet

Pervious Pavement

Design Checklist

▶ When installing pervious pavement, the following design criteria shall be considered:

- ☐ Installed gravel subbase is an open-grade base of crushed stone, which has 35 to 45 percent pore space to allow for adequate drainage and storage.
- ☐ Site soils are suitable for infiltration (infiltration rate at least 0.5 inches per hour).
- ☐ Depth to groundwater is at least 5 vertical feet.
- ☐ Slope is flat or nearly flat (not greater than 5 percent).
- ☐ Flow directed to pervious pavement is dispersed so as not to be concentrated at a small area of pavement.
- ☐ No erodible areas (i.e. landscaped area) drain onto the pervious pavement.
- ☐ The subgrade is uniform and compaction is the minimum required for structural stability.
- ☐ Proprietary products are installed per the manufacturer's specifications.

Porous Concrete

Operations & Maintenance

▶ Once pervious pavement is installed, the following maintenance criteria shall be followed:

- ☐ The use of leaf blowers on pervious pavement can force dirt and debris into pavement void spaces. Avoid blowing leaves, grass trimmings, and other debris across pervious pavement.
- ☐ Remove weeds from pavement and replace missing sand or gravel between pavers as needed.
- ☐ Inspect pavement after rains for ponding or other visible problems. If there are problems with standing water, vacuum sweeping with specialized equipment may be required.
- ☐ Proprietary products must be maintained per manufacturer's recommendations.

▶ In the following table, fill in the contributing area that will be draining to the pervious pavement and the surface area of the pervious pavement you are proposing to install at your property.

Project Information

Project Contributing Area (sq. ft.)	Pervious Pavement Area (sq. ft.)

Owner Certification

As the owner of the project property, I hereby acknowledge that the above information is true, accurate and complete, to the best of my knowledge.

Signature **Date**

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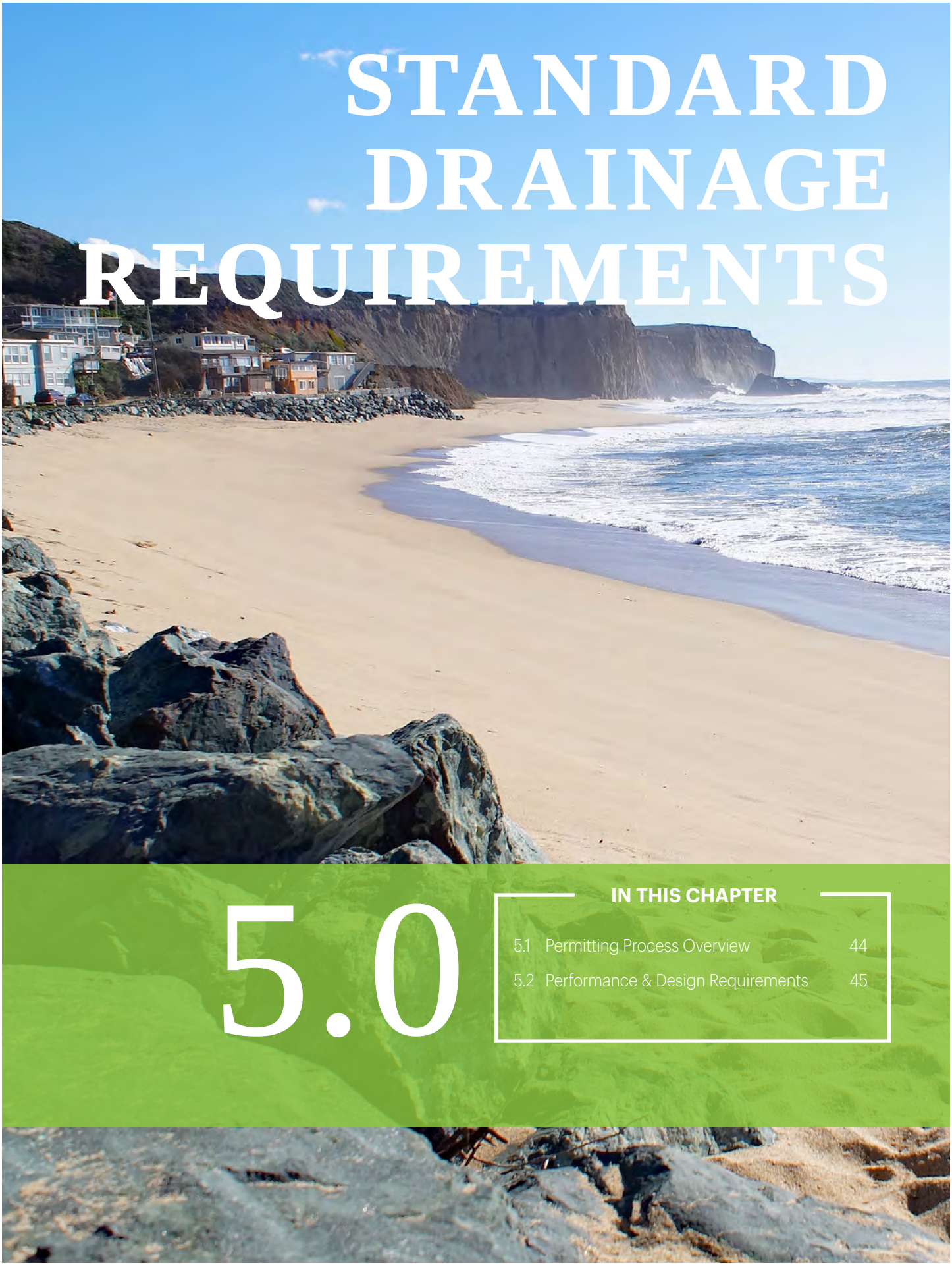


STANDARD DRAINAGE REQUIREMENTS

5.0

IN THIS CHAPTER

5.1 Permitting Process Overview

Except for small projects that qualify for Basic or Prescriptive Drainage Review, all projects that require a Planning and/or Building Permit will need to go through the County of San Mateo Standard Drainage Review process.

The Standard Drainage Review process combines the various drainage and stormwater management requirements that may apply to your project into one application and review process. Some requirements, such as stormwater treatment requirements for C.3 Regulated Projects, are detailed in other guidance documents and so will not be detailed in this Manual, but are included in the submittal requirements for a Standard Drainage Review application.

Use the following step-by-step instructions to prepare your application. **The Standard Drainage Review Application must be prepared, signed, and stamped by a California Registered Professional Civil Engineer (PE).**

Standard Drainage Review Application

1 *Pre-Application Meeting (Optional)*

In the early stages of your project planning and design process, you may schedule a pre-application meeting with County Planning and Building Department staff. This will be an opportunity for you to ask questions about the County's requirements, talk through your intended stormwater management approach, and to receive informal feedback from the County.

2 *Design Your Project*

Use this Manual as a reference as you design your project. Thinking about drainage and stormwater management requirements early in the design process can lead to cost-saving and optimized solutions.

3 *Prepare Standard Drainage Review Application*

The submittal requirements for a Standard Drainage Review Application are:

- Completed stormwater checklist (C.3 and C.6 Development Review Checklist). See *Appendix 1* for step-by-step instructions on completing this checklist.
- Drainage Plan
- Drainage Report. See *Appendix 3* for an example Drainage Report.

4 *Submit Your Application*

The complete Standard Drainage Review Application should be submitted to the County Planning and Building Department. Your application and plans will be routed as appropriate for review.

5.2 Performance & Design Requirements

The County of San Mateo has established a set of performance and design requirements that all projects subject to Standard Drainage Review must satisfy, but not every aspect of each requirement will apply to all projects. The applicant must use their judgement to determine which requirements apply.

While these requirements are broken down into distinct categories, a strategy for compliance with one requirement may satisfy other requirements as well. For example, a bioretention area that treats runoff for compliance with stormwater treatment requirements may also help reduce stormwater runoff rate and volume. The applicant is encouraged to consider these requirements as a whole to develop a unified drainage strategy.

The County's drainage policy can be broken down into three main components:

- The post-development stormwater runoff peak flow and volume must be less than or equal to the undeveloped stormwater runoff peak flow and volume at each point of discharge from the project parcel, unless an alternative discharge point is otherwise approved by the County.
- Conveyance systems must be adequately sized and designed to accommodate design flows.
- Stormwater treatment measures shall be sized and designed per the design criteria provided in the SMCWPPP C.3 Regulated Projects Guide (see *Appendix 2*, Reference Documents).

The following section describes these three main components and other considerations critical to the design of your project drainage system.

5.2.1 Peak Flow and Volume Control

Peak Flow and Volume Control Requirements

Determining the peak flow and volume control requirements for your project requires the following steps:

Peak Flow and Volume Control Requirements

1. *Define your Stormwater Management Area* - If your project replaces 50 percent or more of the impervious surface of a previously existing development that was not subject to the Stormwater and Drainage Ordinance peak flow and volume control requirements, then your Stormwater Management Area is the entire parcel consisting of all existing, new, and/or replaced impervious surfaces. If your project replaces less than 50% of existing impervious surfaces, then your Stormwater Management Area includes only the impervious area created and/or replaced as part of your project.
2. *Identify all the points of discharge for stormwater* runoff from the project parcel. Points of discharge include sheet flow onto adjacent private property, discharge into the drainage system in the public ROW, or any discharge into any distinct drainage course.
3. *Delineate the tributary areas for stormwater runoff* from the Stormwater Management Area for each point of discharge from the project site for undeveloped and post-development conditions.
4. *Calculate the stormwater runoff peak flow and volume* for each tributary area for undeveloped and post-development conditions using the calculation methodology described later in this chapter.

The post-development stormwater runoff peak flow and volume must be less than or equal to the undeveloped stormwater runoff peak flow and volume at each point of discharge from the project parcel, unless an alternative discharge point is otherwise approved by the County.

If the post-development stormwater runoff peak flow and/or volume is greater than the undeveloped runoff peak flow and/or volume for any point of discharge, implement a stormwater management feature to reduce the peak flow and/or runoff volume to undeveloped conditions. Examples of stormwater management features that may be used include:

- Dry wells
- Detention basins
- Bioretention areas
- Subsurface infiltration systems
- Infiltration trenches
- Pervious pavement

If a metering device is needed to maintain post-development flow rates at undeveloped levels, a pump may not be used as the metering or limiting device to control flows; rather, an orifice sized to adequately limit flows to undeveloped levels shall be used upstream of the pump sump.

Peak Flow and Volume Control Design Criteria

Design Storm

Projects shall use the 10-year design storm for all peak flow and volume calculations.

Storm Duration

For peak flow calculations, the storm duration shall be equal to time of concentration for the tributary drainage area for which the calculations are being performed. For runoff volume calculations, the storm duration shall be equal to 1 hour.

Rainfall Intensity

To determine the rainfall intensity, the designer shall use rainfall data from National Oceanic and Atmospheric Administration (NOAA) Atlas 14. NOAA has developed a website, the Precipitation Frequency Data Server (PFDS), which allows the user to choose a NOAA station on a map and view the Atlas 14 precipitation frequency estimates for that station. The designer will need to use the NOAA PFDS website to choose the NOAA station closest to the project site and select "Precipitation intensity" for the data type option. The precipitation intensity can then be read from the displayed table, where the "Average recurrence interval" is the design storm for the project (e.g., 10-year or 100-year) and the "Duration" is equal to the storm duration for the calculation being performed.

Time of Concentration

Time of concentration (T_c) is defined as the time required for runoff to travel from the hydraulically most distant point in the watershed or tributary area to the point of discharge for which the flow is to be calculated. There are many methods for calculating time of concentration. One of the simplest methods is the NRCS watershed lag method, which is a function of flow length, average watershed or tributary area land slope, and curve number. The NRCS watershed lag method is well described in USDA NRCS National Engineering Handbook, Part 630 Hydrology. Another commonly used method is described in USDA NRCS Technical Release 55, Chapter 3 Time of Concentration and Travel Time and involves summing the travel times for components of the drainage system, namely sheet flow, shallow concentrated flow, and open channel flow. For drainage flow paths that consist of sheet flow of less than 300 feet, the Kirpich Formula and Kerby-Hathaway equation are approximations that may be used to calculate time of concentration. Other methods are allowed; the method used and reference document for the method should be described in the Drainage Report.

Regardless of the method used to calculate time of concentration, the following are the minimum T_c values that may be used:

- For undeveloped peak flow calculations, the minimum T_c value shall be 10 minutes.
- For post-development peak flow calculations, the minimum T_c value shall be 10 minutes.

Use these minimum values even when calculations result in a lesser time of concentration. In addition, the T_c value used for undeveloped peak flow calculations may not be smaller than the T_c value used for post-development peak flow calculations.

Factor of Safety

If the project is proposing to use storage of stormwater on-site to meet the peak flow and volume control requirements, the calculated minimum amount of storage needed to meet the requirements shall be multiplied by a factor of safety to determine the required minimum storage volume. A minimum factor of safety of 1.2 is required. A factor of safety of 1.5 is recommended for all sites in order to account for future impervious area construction and irregular maintenance in addition to field measurements/ construction irregularities.

Peak Flow and Volume Control Calculation Methods

The following section will offer a brief discussion of the County's preferred calculation methods. Additional methods may be used at the applicant's discretion with approval from the County. This Manual is not intended to provide textbook-level instruction on hydrologic and hydraulic calculation methodology, but rather provide a framework for performing calculations. Reference documents are listed following the description of each calculation method to provide additional in-depth guidance on the method.

The designer will need to perform peak flow calculations to determine that post-development peak flows are less than or equal to undeveloped peak flows for each point of discharge from the site.

The Rational Method is a simple method for estimating the peak discharge from small watersheds using the empirical formula:

$$Q=CiA$$

where:
Q = peak rate of runoff (cubic feet per second)
C = runoff coefficient
i = average rainfall intensity (inches per hour)
A = drainage area (acres)

The Rational Method may only be used for determining pre- and post-development peak flows for **tributary areas under 10 acres**.

If undeveloped conditions of the project site are unknown, a runoff coefficient of C=0.3 shall be used for undeveloped peak flow calculations.

Reference Document:

- California Department of Transportation. December 2015. Highway Design Manual, Chapter 810 Hydrology.

Hydrograph Methods determine the rate of flow over a span of time for the runoff from a watershed due to a design storm. The graphical representation of these results, where flow rate is the y-axis and time is the x-axis, is known a runoff hydrograph. The peak of the hydrograph is the peak flow for the watershed. Unlike the Rational Method, Hydrograph Methods also produce the calculated runoff volume, which is found as the area under the hydrograph. Two examples of commonly used hydrograph methods are the Santa Barbara Urban Hydrograph Method (SBUH) and the Soil Conservation Service (SCS), now called the Natural Resources Conservation Service (NRCS), Curve Number Method; see reference documents below for guidance on these methods.

Reference Documents:

- City of Portland. August 2016. Stormwater Management Manual, Appendix A, Stormwater Design Methodologies, Santa Barbara Urban Hydrograph Method.
- USDA Natural Resources Conservation Service. June 1986. Technical Release 55 – Urban Hydrology for Small Watersheds.

Computer Models can also be used for peak flow calculations, but the designer is encouraged to fully understand the assumptions and methodology underlying the computer program before relying upon it as a design tool. The County will accept the use of a number of computer models, including but not limited to SWMM, HydroCAD, and Civil 3D. As the output files from these computer models vary significantly, the applicant must use their best judgement to decide what documentation from the computer model needs to be provided to the County to demonstrate compliance with the performance and design requirements.

Hydrograph Methods and **Computer Models** may also be used for runoff volume calculations. Additional methods may be accepted with approval from the County, and will need to be clearly described and sourced by the applicant.

5.2.2 Design Requirements

Infiltration Setbacks

All proposed drainage facilities that allow for infiltration such as bioretention areas and dry wells must meet the minimum horizontal setback and vertical separation requirements in Table 5-1.

Horizontal setbacks are measured as the horizontal distance from the edge of the drainage facility and vertical separation distance is measured as the vertical distance from the base of the drainage facility. Exceptions to these requirements may be approved on a case-by-case basis and will require documentation from a professional geotechnical engineer verifying that the reduced setback will not result in negative impacts.

The maximum depth for an infiltration feature shall be 10 feet, provided that data supports adequate groundwater separation. In areas where information about the depth to groundwater is unknown, the maximum depth of an infiltration feature shall be 5 feet. Infiltration features should be designed to be wider than they are deep whenever feasible.

Table 5-1. Infiltration Setback Requirements

Minimum Horizontal Setback Requirements	
Distance (feet)	Setback from
5	Property line[1]
10[2]	From adjacent foundations
150	From coastal bluffs or cliffs
100	Drinking water wells
Minimum Vertical Separation Requirements	
Distance (feet)	Vertical Separation from
4	Bedrock
10	Seasonal High Groundwater (dry wells and infiltration trenches)
5	Seasonal High Groundwater (permeable pavers and bioretention features)

1. Pervious pavement (including pervious driveways) and infiltration features less than 1' in vertical height are not considered significant infiltration features and do not need to meet the 5-foot setback requirement from the property line.
2. If 10' is infeasible, a setback a 5' is allowed with approval from a geotechnical engineer. In all cases, infiltration features must remain outside the angle of repose for foundations (e.g. 1:1 slope from the bottom of the building foundation is allowed for subsurface infiltration systems).

Drawdown Requirements

All proposed drainage facilities must meet the following drawdown requirements:

- Drainage facilities must have room for a second 10-year storm within 24 hours.
- Drainage facilities must completely drain within 5 days.

If the infiltration rate of the native soil prevents an infiltration-based drainage facility from meeting the drawdown requirements, an underdrain or metered outlet should be used.

To determine the infiltration rate of the native soil, infiltration testing in the vicinity of the infiltration-based drainage facility should be performed. San Francisco Public Utilities Commission's guidance document "Determination of Design Infiltration Rates for the Sizing of Infiltration-based Green Infrastructure Facilities" provides information on recommended infiltration rate testing methodology. Alternate methodology may be allowed with approval by the County.

If infiltration testing is not performed, the Table 5-2 may be used as a guide for determining the design infiltration rate based on the native soil type; however, the County may require field infiltration testing to be performed during construction to verify the infiltration rate used for the design of the infiltration-based drainage facilities .

Table 5-2. Determining Design Infiltration Rate from Soil Type

SCS Hydrologic Soil Group	Soil Textures	Corresponding Unified Soil Classification System Category	Design Infiltration Rate (in/hr)
A	Gravel, sandy gravel, and silty gravels	GW – Well-graded gravels, sandy gravels GP – gap-graded or uniform gravels, sandy gravels GM – silty gravels, silty sandy gravels SW – well-graded, gravelly sands	1.0
	Sand, loamy sand, or sandy loam	SP – Gap-graded or uniform sands, gravelly sands	
B	Silty sands, silty loam	SP – Gap-graded or uniform sands, gravelly sands	0.35
	Loam	MH – Micaceous silts, diatomaceous silts, volcanic ash	
C	Sandy clay loam	ML – Silts, very fine sands, silty or clayey fine sands	0.20
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay	GC – Clayey gravels, clayey sandy gravels SC – Clayey sands, clayey gravelly sands CL – Low plasticity clays, sandy or silty clays OL – Organic silts and clays of low plasticity CH – Highly plastic clays and sandy clays OH – Organic silts and clays of high plasticity	0.10

Source: Adapted from the SFPUC Stormwater Management Requirements and Design Guidelines (2016) and the Minnesota Stormwater Manual (2019).

Septic Tank and Dispersal Field Setbacks

All proposed drainage facilities must maintain minimum horizontal setback distances from existing and proposed septic tanks and dispersal fields per the requirements in the San Mateo County Onsite Systems Manual.

Relevant setbacks from Table 3-1 of the San Mateo County Onsite Systems Manual (May 2016) are summarized in Table 5-3; however, the applicant should refer to the latest version of the San Mateo County Onsite Systems Manual to verify these requirements.

Table 5-3. Septic Tank & Dispersal Field Setback Requirements

Site Feature	Minimum Horizontal Setback Distance (feet)	
	Septic Tank	Dispersal Field
Groundwater interceptor trench or drain	5	25
Stormwater infiltration trench, gallery, or well	25	25
Drainage ditch or swale (from edge of flow path)		
General, lined or unlined	25	25
Evidence of sustained wet conditions or ponding	25	50

5.2.3 Conveyance System Requirements

Engineered conveyance systems provide for the collection and transport of stormwater runoff from project sites. Components of the conveyance system can be configured to match the needs, constraints, and desired aesthetic of a project site. Different types of conveyance structures include naturalized drainage ditches or swales, pipes, open culverts and valley gutters. Concentrated flow within a conveyance system can be a powerful force that can erode or wash away vulnerable elements of the conveyance system itself. For that reason, the system must meet certain design criteria to protect against erosion, property damage, and downstream pollution in the form of sedimentation.

Conveyance system design must meet the following guidelines:

Sizing

Conveyance systems shall be designed to accommodate design flows for the following design storms:

- Pipes shall be sized for the minimum 10-year design storm.
- Above ground conveyances in FEMA Flood Zones shall be sized for the minimum 100-year design storm. Above ground conveyances outside of FEMA Flood Zones may be sized for the 10-year design storm.
- Community conveyances that have the potential to cause flooding to neighboring parcels if they back up shall be sized for the minimum 100-year design storm with the time of concentration calculated based on all contributing watersheds, unless otherwise directed by County staff. Community conveyances are simply conveyances that direct flows for multiple parcels and may cross through multiple parcels.

Storm duration for the design storm shall be equal to the time of concentration calculated for the tributary area for the conveyance.

Velocity Mitigation/Energy Dissipation Requirements

All discharge outlets into landscaping or naturalized drainage courses must be fit with appropriate energy dissipation measures (e.g. splash pads, cobbles/boulders). Refer to Caltrans guidance on outlet protection/velocity dissipation devices and US Army Corps of Engineers guidance on riprap design for more information.

Downspouts must be connected properly to drainage conveyance facilities.

Minimum/Maximum Slopes

Earthen channels with greater than two (2) percent slope must have appropriate bed and side slope stabilization measures to prevent erosion and mobilization of channel materials. Channels with slopes greater than five (5) percent must have periodic check dams with the top of each successive check dam at an elevation equal to or higher than the base of the previous check dam. Earthen channels shall not exceed eight (8) percent slope under any conditions.

Site design for conveyance lines made of constructed materials shall attempt to follow existing grade in a manner that minimizes slope along the flow path. Stabilization measures such as thrust blocks may be required for pipes with abrupt changes in grade and/or direction.

Allowable Angles and Curves

All 90° turns and "T" connections of pipes shall be either combination Wye and 1/8 Bend type or sweep type (have radius at each turn). All sweeps must be oriented in the downslope direction.

Earthen channels and valley gutters shall have maximum turns of 30 degrees, and open culverts shall have maximum turns of 45 degrees. More severe turns require either a junction box or an armored stilling pool where energy is dissipated and water overflows into the downstream conveyance line. Earthen channels must have appropriate armoring at turns to deflect oncoming flows into the downstream channel alignment.

Offsets

The edge of flow path for drainage cleanouts, inlets/outlets, swales, and detention/retention facilities must maintain a buffer of:

- 25 feet away from septic fields or sanitary sewer cleanouts/pipelines (see San Mateo County Onsite Systems Manual – Section 3, Page 4 for more details); and
- At least two (2) feet away from utility lines.

Drainage device outlets must be located at least five (5) feet away from neighboring property lines and ten (10) feet from foundation centerlines.

Maintenance Access

All major drainage facilities shall be designed with adequate access to allow for the prescribed regular maintenance activities for those facilities. Cleanouts, access covers, and grates shall be installed as appropriate.

5.2.4 Stormwater Treatment Requirements

All Standard Drainage Review projects must fill out a C.3 and C.6 Development Review Checklist. The Checklist will help applicants establish whether a project is a Regulated Project under the Municipal Regional Stormwater Permit (MRP) and subject to additional stormwater treatment requirements.

Project applicants should refer to the SMCWPPP C.3 Regulated Projects Guide (see *Appendix 2*) for detailed guidance on stormwater treatment requirements and design. A brief summary of the requirements is as follows.

The C.3 Regulated Projects Guide describes four categories of post-construction stormwater treatment requirements:

- Site Design Measures
- Source Control Measures
- Stormwater Treatment Measures
- Hydromodification Management (HM) Measures

Site Design Measures are site planning techniques for pollution prevention and reduction in flow rates and durations, by protecting existing natural resources and reducing impervious surfaces of development projects. Use Worksheet C of the C.3 and C.6 Development Review Checklist to indicate which Site Design Measures are used by your project.

Source Control Measures consist of either structural project features or operational "good housekeeping" practices that prevent pollutant discharge and runoff at the source, such as by keeping pollutants from coming into contact with stormwater. Use Worksheet B of the C.3 and C.6 Development Review Checklist to indicate which Source Control Measures are used by your project.

Stormwater Treatment Measures are engineered systems that are designed remove pollutants from stormwater through evapotranspiration, infiltration, rainwater harvesting and reuse, or biotreatment. Stormwater treatment measures must be designed per the hydraulic design criteria listed in MRP Provision C.3.d and detailed in the C.3 Regulated Projects Guide.

Note that the hydraulic design criteria for stormwater treatment measures to meet the stormwater treatment requirements is different than the peak flow and volume control requirements presented in Section 5.2.1 of this Manual. Applicants can either address these requirements with separate drainage features (e.g. a bioretention basin that drains to an infiltration trench) or together (e.g. with a metered flow-through planter with adequate ponding capacity). Regardless of the design approach, separate calculations showing compliance with the peak flow and volume requirements, stormwater treatment requirements, and conveyance requirements will need to be completed and included in the project's drainage report.

Hydromodification Management (HM) Measures include site design and source control measures that promote infiltration or otherwise minimize the change in the rate and flow of runoff, when compared to the undeveloped condition. HM measures also include constructed facilities (such as basins, ponds, or vaults) that manage the flow rates and volumes of stormwater leaving a site, and under some conditions can also include re-engineering of at-risk channels downstream from the site. Provision C.3 of the MRP requires C.3 Regulated Projects that qualify as Hydromodification Management (HM) Projects to retain, detain, or infiltrate runoff so that post-project flows and durations match pre-project conditions. Applicants should refer to the the C.3 Regulated Projects Guide to determine if a project is a HM Project.

5.2.5 Special Circumstances

Sea Level Rise & Coastal Erosion

Seal level rise (SLR) impacts include flooding, stronger waves, rising groundwater tables and saltwater intrusion, and increased erosion of the shoreline, all of which are exacerbated by coastal storms. Projects should consider SLR impacts and, where necessary, be adaptively managed to minimize sea level rise risks over the life of the project. For specific SLR projections, consider the Sea Level Rise Guidance produced by the State of California's Ocean Protection Council (http://www.opc.ca.gov/updating-californias-sea-level-rise-guidance). Where appropriate, design should take into account historic and future erosion and changes in groundwater elevation.

Tsunami Analysis

Specific projects within Tsunami Inundation zones may require additional analysis. Use the San Mateo County Planning and Building Department GIS Map to verify whether the project is located within an inundation zone; contact your project Planner or the Planning Department for further information.

FEMA Flood Zones

If your project is located in a FEMA Flood Zone (zones A, AE, AH, AO, D, VE), refer to FEMA guidelines (https://msc.fema.gov/portal/search) and the most current California building code for more information.

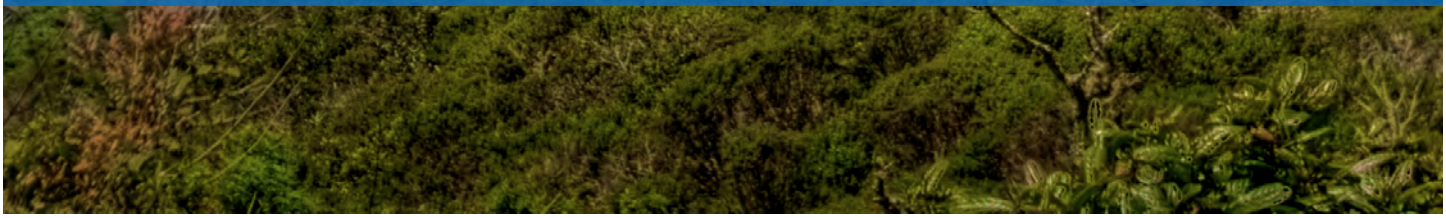
5.2.6 Other County Policies

The new Stormwater and Drainage Ordinance will institute trash capture requirements in the County. At the time of this Manual's publication, these trash capture requirements are still under development. Contact the County Planning and Building Department for more information.

NEXT STEPS

6.0

IN THIS CHAPTER



6.1 Requirements During Construction

After approval of your project and permit issuance, the next step is to construct your project. The following section details requirements that must be followed during the construction phase.

6.1.1 Erosion Control

An Erosion and Sediment Control Plan must be prepared and submitted by the applicant for review and approval by the San Mateo County Planning and Building Department prior to the issuance of a demolition, grading, or building permit for any project that involves site disturbance. Projects that disturb more than one acre of land require a Stormwater Pollution Prevention Plan (SWPPP) to detail the BMPs that will be used to minimize erosion, sediment transport, and non-stormwater discharges. SWPPPs must be prepared by a Qualified SWPPP Developer (QSD) and implemented by a Qualified SWPPP Practitioner (QSP). Appropriate sediment and erosion control measures shall be implemented throughout the construction phase. Interim stormwater control measures shall also be implemented as necessary to prevent additional flows across property lines and flooding of adjacent property.

6.1.2 Drainage System Inspections

For Standard Drainage Review projects, the project civil engineer shall observe and approve the stormwater management related construction.

Schedule the project civil engineer to observe and approve construction of major drainage system elements. Construction observation letter(s) shall be submitted to the County periodically as needed to drainage@smcgov.org, and will include the status of construction, frequency of observations, confirmation of significant dimensions for drainage features, system testing results (if applicable), and any minor deviations from the plans. Major deviations from the plans require revisions to the Drainage Application and resubmittal to the County for approval. The letters shall also include photos of the following as applicable: erosion control measures, stormwater retention and/or treatment devices, orifices (with confirmation of diameter), pumps, pipes before burial, material labels and/or receipts, and final landscaping. County approval of the stamped and signed observation letter(s) is required for final drainage inspection sign-off.

Alternatively, Standard Drainage Review projects can pre-arrange for the County to conduct the inspections with notification prior to permit issuance; appropriate fees will be charged up front for an assumed number of inspections for the project duration. All inspections for Basic and Prescriptive Drainage Review projects will be conducted by the County. Call the automated line at (650) 306-8415 with code 181 to schedule appropriate drainage inspections, including one before backfill of installed drainage features, and one for final walk around.

Supplemental inspections may be required at the County's discretion. C.3 Regulated Projects will require at least two County inspections of the stormwater treatment system in addition to any inspections arranged for the drainage system.

6.2 Operations & Maintenance Requirements

Property owners are responsible for proper operation and maintenance of their on-site drainage systems. Proper maintenance is essential in order to sustain the appearance and function of your drainage system. Systems that contain living elements such as bioretention also require proper plant care in order to maintain health, appearance, and function. Ongoing maintenance of your drainage system provides assurance that it will perform as intended over its full lifespan.

For all drainage systems:

- All surface drain inlets and trench drains shall be kept free of trash and accumulated debris.
- All maintenance boxes should be opened and inspected and all drainage systems flushed twice each year, once before winter begins and once mid-winter.
- Guidance on proper care for different types of LID facilities is provided in the C.3 Regulated Projects Guide and the GI Design Guide (see *Appendix 2*).

For non-Regulated projects:

- Owners will be required to sign a stormwater management owner's consent form (OCF), certifying that they will inspect and maintain the property's stormwater management features after construction.

For C.3 Regulated Projects:

- Private C.3 Regulated projects require that an Operations & Maintenance Agreement be developed and recorded at the end of the construction process. An example template can be found here: https://planning.smcgov.org/documents/operation-maintenance-om-template-agreement-county-san-mateo-only
- Additional guidance on operation and maintenance of stormwater treatment facilities required by the MRP is provided in Chapter 8 of the C.3 Regulated Projects Guide. Appendix G of the C.3 Regulated Projects Guide provides templates for use in documenting the owner's maintenance requirements for submittal to the County.
- Additional reports will be required for LID facilities. LID facilities will be inspected by the County periodically, on average every five years. Visit the following link for more information: https://planning.smcgov.org/operation-maintenance-om-private-stormwater-treatment-measures

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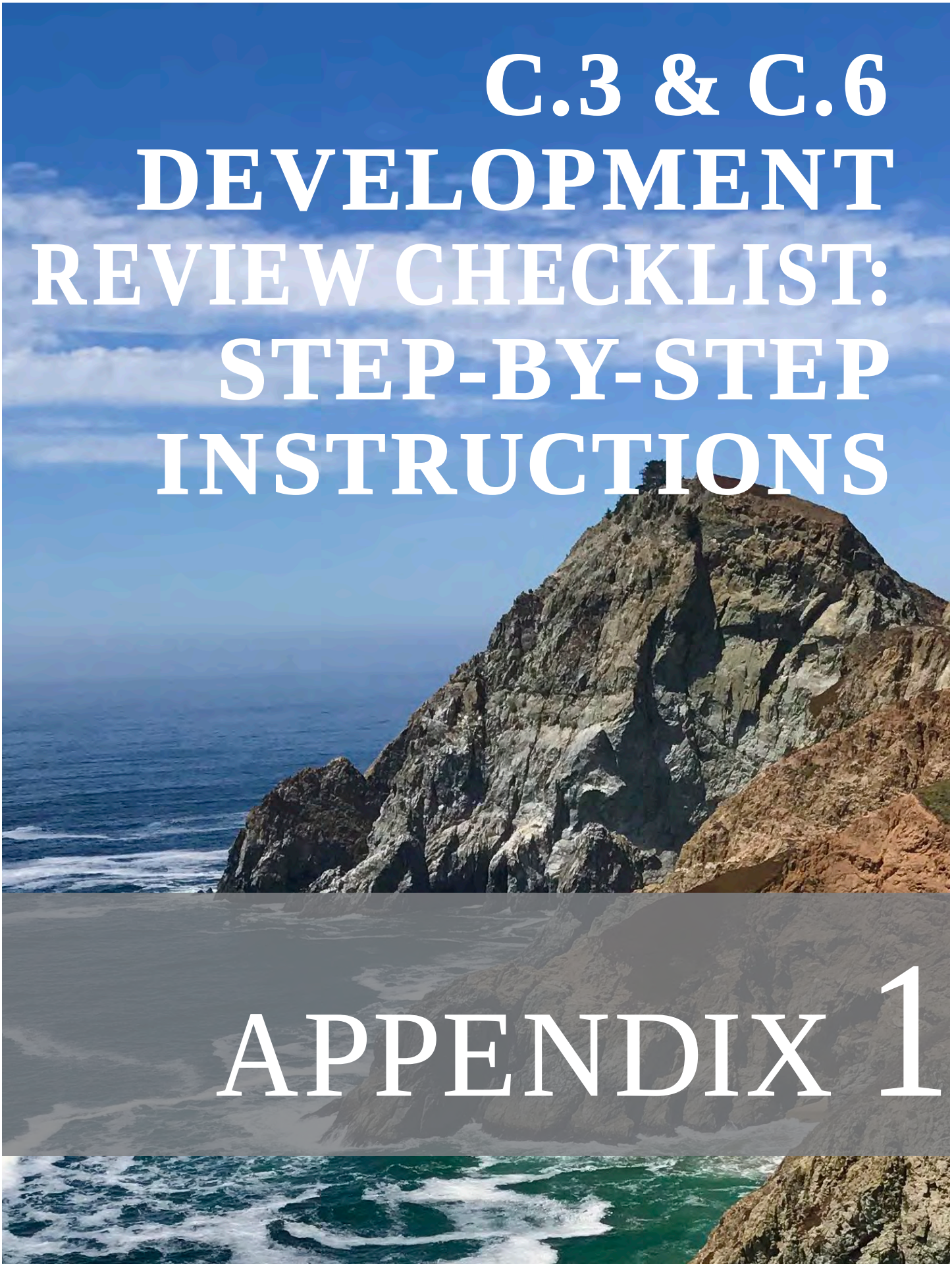


C.3 & C.6 DEVELOPMENT REVIEW CHECKLIST: STEP-BY-STEP INSTRUCTIONS

APPENDIX 1

How to fill out a C.3 and C.6 Development Review Checklist: Step-by-Step for Single-Family Homes and Small Projects

San Mateo County Planning & Building uses the C.3 and C.6 Development Review Checklist (available at https://planning.smcgov.org/documents/c3-and-c6-development-review-checklist) to help track compliance with the Regional Municipal Permit and determine key project characteristics for drainage review projects of all sizes.

While the complete form package is quite lengthy, for most projects you need to only fill out the FIRST TWO PAGES and possibly a few RELEVANT WORKSHEETS. While this guidance is intended for primarily single-family homes and other small projects, all projects can use this guidance to help fill out the first pages; larger projects simply continue on with the checklist and associated worksheets.

How do you know what to fill out? Let's take it step-by-step.

PAGE 1 - FILL OUT SOME BASIC PROJECT INFORMATION. FIRST CHECK THAT THE TOP OF THE FORM LOOKS LIKE THIS:

SAN MATEO COUNTYWIDE Water Pollution Prevention Program

TIP: confirm correct jurisdiction

COUNTY OF SAN MATEO
Planning & Building Department
455 County Center, 2nd Floor
Redwood City, CA 94063
BLD: 650-599-7311/PLN: 650-363-1825
http://planning.smcgov.org/

C.3 and C.6 Development Review Checklist
Municipal Regional Stormwater Permit (MRP)
Stormwater Controls for Development Projects

Note that San Mateo County does NOT accept Small Projects Checklists.

STEP I.A - ENTER BASIC PROJECT DATA

I.A **Enter Project Data** *(For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report.)*

Project Name: Case Number:

Project Address & Cross St.:

Project APN: Project Watershed:

Applicant Name: **I.A.4** Slope on Site:

Applicant Phone: Applicant Email Address:

Much of the basic project data is similar to what you entered on your permit application, with a few exceptions:

- Case Number: Assigned by the building or planning department. This will start with PLN or BLD and the year.
- Project Watershed: Available on the County's GIS mapping system here: https://gis.smcgov.org/apps/planning
- Slope on Site: See Section *2.1 Defining Your Project* of the County of San Mateo Drainage Manual.

How to fill out a C.3 and C.6 Development Review Checklist: Step-by-Step for Single-Family Homes and Small Projects

STEP I.A.1 - SELECT YOUR DEVELOPMENT TYPE. CHECK ALL BOXES THAT APPLY.

I.A.1

Development type: (check all that apply)

- ☐ Single Family Residential: A stand-alone home that is not part of a larger project.
- ☐ Single Family Residential: Two or more lot residential development.[1] # of units: _____
- ☐ Multi-Family Residential # of units: _____
- ☐ Commercial
- ☐ Industrial, Manufacturing
- ☐ Mixed-Use # of units: _____
- ☐ Streets, Roads[2], etc.
- ☐ 'Redevelopment' as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred.
- ☐ **'Special land use categories'** as defined by MRP: (1) auto service facilities[3], (2) retail gasoline outlets, (3) restaurants, (4) uncovered parking area (stand-alone or part of a larger project)
- ☐ Institutions: schools, libraries, jails, etc.
- ☐ Parks and trails, camp grounds, other recreational
- ☐ Agricultural, wineries
- ☐ Kennels, Ranches
- ☐ Other, Please specify_____

Project Description[4]: _____

(Also note any past or future phases of the project.) _____

_____

Single-family home additions and accessory dwelling units should check the first box of the above for "Single Family Residential." Don't forget to add a brief project description.

STEP I.A.2 - ENTER THE TOTAL AREA OF SITE. FOR MOST PROJECTS, THIS WILL BE THE AREA OF THE PROJECT PARCEL.

I.A.2 Total Area of Site: _____ acres

For very large parcels with a small project area, projects that cover multiple parcels, and/or projects that include a significant amount of work in the right-of-way (e.g., greater than 1,000 sq ft of disturbance) use the Limits of Work from *2.1* of the Drainage Manual or a similar rational value.

STEP I.A.3 - ENTER THE TOTAL AREA OF LAND DISTURBED DURING CONSTRUCTION.

I.A.3 Total Area of land disturbed during construction (include clearing, grading, excavating and stockpile area):_____ acres.

TIP: Divide by 43,560 to convert square feet to acres

How to fill out a C.3 and C.6 Development Review Checklist: Step-by-Step for Single-Family Homes and Small Projects

STEP I.A.5 - TELL US WHO IS FILLING OUT THIS FORM. IF WE HAVE ANY QUESTIONS, THIS IS WHO WE WILL CONTACT FIRST.

I.A.5 Certification:

Name of person completing the form:_____Title:_____

Phone number: _____Email address:_____

☐ By checking this box, I certify that the information provided on this form is correct and acknowledge that, should the project exceed the amount of new and/or replaced impervious surface provided in this form, the as-built project may be subject to additional improvements. Initials:_____ Date: _____

I have attached the following: ☐ Preliminary Calculations ☐ Final Calculations ☐ A copy of site plan showing areas

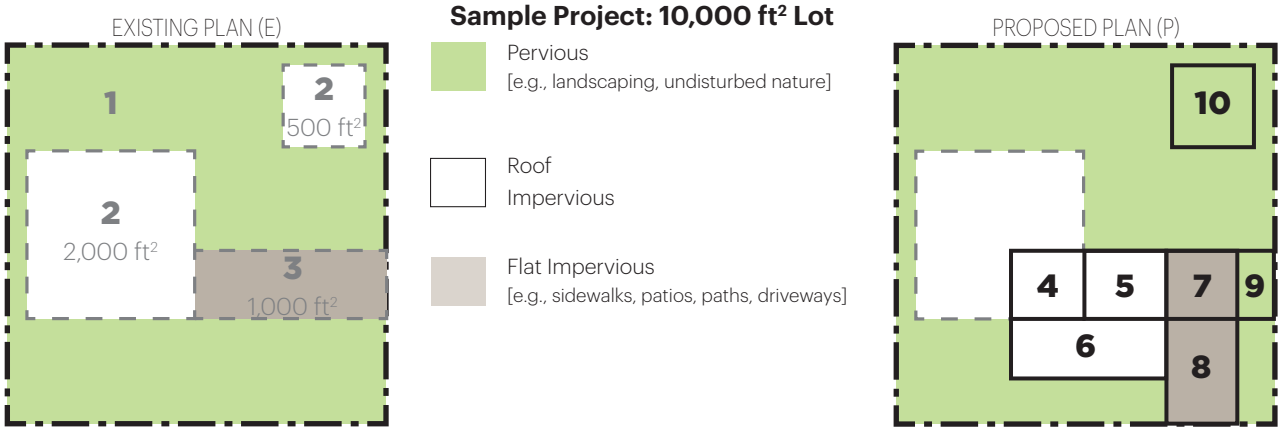
Reminder to check the box certifying that if the project scope expands, additional stormwater/drainage improvements may be required.

The project plans should include a clear site map and/or drainage map showing all existing and proposed impervious areas. For complicated projects, include a site plan with highlighted calculation areas attached to this form.

How to fill out a C.3 and C.6 Development Review Checklist: Step-by-Step for Single-Family Homes and Small Projects

PAGE 2 - FILL OUT TWO TABLES.

TABLE I.B.1: FILL OUT THE SUMMARY OF IMPERVIOUS AND PERVIOUS SURFACES ONSITE.



EXISTING				PROPOSED			
				6	1,000	ft²	(E) Pervious **>> replaced by new Roof Impervious**
				8	800	ft²	(E) Pervious **>> replaced by new Flat Impervious**
				9	100	ft²	(E) Flat Impervious **>> replaced by new Pervious Paving**
Pervious Area	1	6,500	ft²	--	4,600	ft²	unchanged
				4	400	ft²	(E) Roof Impervious **>> replaced by new Roof Impervious**
				10	500	ft²	(E) Roof Impervious **>> replaced by new Pervious**
Roof Impervious Area	2	2,500	ft²	--	1,600	ft²	unchanged
				5	500	ft²	(E) Flat Impervious **>> replaced by new Roof Impervious**
				7	400	ft²	(E) Flat Impervious **>> replaced by new Flat Impervious**
Flat Impervious Area	3	1,000	ft²	--	100	ft²	unchanged

Our example translates to Table I.B.1 as follows (numbers in red correlate to the areas above):

Table I.B.1 Impervious[5] and Pervious Surfaces

Type of Impervious[5] Surface	I.B.1.a Pre-Project Impervious[5] Surface (sq.ft.)	I.B.1.b Existing Impervious[5] Surface to be Retained[6] (sq.ft.)	I.B.1.c Existing Impervious[5] Surface to be Replaced[6] (sq.ft.)	I.B.1.d New Impervious[5] Surface to be Created[6] (sq.ft.)	I.B.1.e (auto-sum) Post-Project Impervious[5] Surface (sq.ft.) (=b+c+d)
Roof area(s)	(2) 2,500	(2-4-10) 1600	(4+5) 900	(6) 1,000	3,500
Impervious[5] sidewalks, patios, paths, driveways, streets	(3) 1,000	0	(7) 400	(8) 800	1,200
Impervious[5] uncovered parking[7]	0	0	0	0	0
Totals of Impervious Surfaces:	3,500	1,600	1,300	1,800	4,700

I.B.1.f - Total Impervious[5] Surface Replaced and Created *(sum of totals for columns I.B.1.c and I.B.1.d)*: 3100 (auto-sum)

Type of Pervious Surface	Pre-Project Pervious Surface (sq.ft.)		Post-project Pervious Surface (sq.ft.)
Landscaping	(1) 6,500		(1-6-8+10) 5,200
Pervious Paving		I.B.1.e.1:	(9) 100
Green Roof			
(auto-sum) Totals of Pervious Surfaces:	6,500		5,300
(auto-sum)Total Site Area (Total Impervious[5]+Total Pervious=**I.A.2**)	10,000		10,000

TIP: Your total site area should be the same pre- and post-project

How to fill out a C.3 and C.6 Development Review Checklist: Step-by-Step for Single-Family Homes and Small Projects

TABLE I.B.2 - FILL OUT THE TABLE THAT DETERMINES WHICH WORKSHEETS APPLY TO YOUR PROJECT.

STEP I.B.2.A: DOES YOUR PROJECT INVOLVE EARTHWORK? [E.G., EXCAVATION, CUT, FILL]

I.B.2 Please review and attach additional worksheets as required below using the Total Impervious Surface (IS) Replaced and Created in cell I.B.1.f from Table I.B.1 above and other factors:

	Check all that apply:	Check One Yes	Check One No	Attach Worksheet
I.B.2.a	Does this project involve any earthwork? If YES, then Check Yes, and Complete Worksheet A. If NO, then go to I.B.2.b	☐	☐	A

If **YES**, then your project needs to fill out Worksheet A. If **NO**, you do **NOT** need to fill out Worksheet A.

WORKSHEET A: Check each box as you include the Construction Best Management Practices (BMPs) on your erosion control plan. Indicate in the blank space which sheet contains the appropriate notes.

» Worksheet A Example:

Yes	Plan Sheet	Best Management Practice (BMP) Notes
☑	EC-1	Erosion Control Point of Contact. *(Provide an Erosion Control Poin title/qualification, email, and phone number. The EC Point of Conta*

STEP I.B.2.B - USE TABLE I.B.1 TO DETERMINE WHETHER THE TOTAL IMPERVIOUS SURFACE REPLACE AND CREATED IS GREATER THAN 2,500 SQUARE FEET.

	Check all that apply:	Check One Yes	Check One No	Attach Worksheet
I.B.2.b	Is **I.B.1.f** greater than or equal to 2,500 sq.ft? If YES, then the Project is subject to Provision C.3.i. - complete Worksheets B, C & go to I.B.2.c. If NO, then Stop here - go to I.A.5 and complete Certification.	☑	☐	B, C

From above, the example value for I.B.1.f: 3100 is greater than 2,500 sq ft.

If **YES**, then your project needs to fill out Worksheets B and C. If **NO**, you do **NOT** need to fill out Worksheets B and C (unless Worksheet B is requested by the permit reviewer for special project types).

WORKSHEET B: Check each box as you include applicable source control best management practices as part of your project. Indicate in the blank space which sheet contains the appropriate elements. For single family homes, make sure to review the source controls that apply to all project types. An example Worksheet B with the source controls applicable to all project types is on the following pages.

WORKSHEET C: Select all applicable design measures for your project. Projects that create and/or replace 2,500 to 10,000 sq ft of impervious surface, or single-family homes greater than 10,000 sq ft, are required to implement at least one of the measures a-f. An example Worksheet C is on the following pages.

How to fill out a C.3 and C.6 Development Review Checklist: Step-by-Step for Single-Family Homes and Small Projects

STEP I.B.2.C - USE TABLE I.B.1 TO DETERMINE WHETHER STORMWATER REQUIREMENTS APPLY TO JUST THE PROJECT AREA OR THE ENTIRE SITE.

	Check all that apply:	Check One		Attach Worksheet
		Yes	No	
I.B.2.c	Is the total Existing IS to be Replaced (column **I.B.1.c**) 50 percent or more of the total Pre-Project IS (column **I.B.1.a**)? If YES, site design, source control and treatment requirements apply to the whole site. Continue to I.B.2.d If NO, these requirements apply only to the impervious surface created and/or replaced. Continue to I.B.2.d	☐	☑	

From above, the example value of 1,300 square feet to be replaced is 37% of the total pre-project impervious surface value of 3,500

STEPS I.B.2.D AND I.B.2.E: DETERMINE WHETHER THE PROJECT IS A C.3 REGULATED SITE.

As of the 2015 MRP, stand-alone single-family houses are **EXEMPT** from being considered a regulated site.

STAND-ALONE RESIDENCES CAN STOP HERE –

You have successfully completed the C.3 and C.6 Development Review Checklist.

Projects with new and replaced impervious area greater than 10,000 sq ft or restaurants, auto service facilities, gas stations, and uncovered parking lots greater than 5,000 sq ft are C.3 Regulated projects and should continue with the rest of the checklist and associated worksheets.

Worksheet B Example

C3 - Source Controls

Select appropriate source controls and identify the detail/plan sheet where these elements are shown.

Yes	Detail/Plan Sheet No., or "N/A"	Features that require source control measures	Source Control Measures (Refer to Local Source Control List for detailed requirements)
☐		Storm Drain (street/road projects)	Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.
☐		Floor Drains (non-residential)	Plumb interior floor drains to sanitary sewer[8] [or prohibit].
☐		Parking garage (non-single-family residential)	Plumb interior parking garage floor drains to sanitary sewer.[8]
☑	LC1	Landscaping (all project types)	▪ Retain existing vegetation as practicable. ▪ Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects. ▪ Minimize use of pesticides and quick-release fertilizers. ▪ Use efficient irrigation system; design to minimize runoff.
☑	C1	Pool/Spa/Fountain (all project types)	Provide connection to the sanitary sewer to facilitate draining.[8]
☐		Food Service Equipment (non-residential)	Provide sink or other area for equipment cleaning, which is: ▪ Connected to a grease interceptor prior to sanitary sewer discharge.[8] ▪ Large enough for the largest mat or piece of equipment to be cleaned. ▪ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.
☐		Refuse Areas (non-single-family residential)	▪ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff. ▪ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.[8]
☐		Outdoor Process Activities [9] (non-residential)	Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer.[8]
☐		...ment/ Materials ...sidential)	▪ Cover the area or design to avoid pollutant contact with stormwater runoff. ▪ Locate area only on paved and contained areas. ▪ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer[8], and contain by berms or similar.
☐		...ent Cleaning ...ly residential)	▪ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer[8], and sign as a designated wash area. ▪ Commercial car wash facilities shall discharge to the sanitary sewer.[8]
☐		Vehicle/ Equipment Repair and Maintenance (non-single-family residential)	▪ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas. ▪ No floor drains unless pretreated prior to discharge to the sanitary sewer.[8] ▪ Connect containers or sinks used for parts cleaning to the sanitary sewer.[8]
☐		Fuel Dispensing Areas (non-residential)	▪ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break. ▪ Canopy shall extend at least 10 ft. in each direction from each pump and drain away from fueling area.
☐		Loading Docks (non-residential)	▪ Cover and/or grade to minimize run-on to and runoff from the loading area. ▪ Position downspouts to direct stormwater away from the loading area. ▪ Drain water from loading dock areas to the sanitary sewer.[8] ▪ Install door skirts between the trailers and the building.
☑	A-1	Fire Sprinklers (all project types)	Design for discharge of fire sprinkler test water to landscape or sanitary sewer.[8]
☑	A-5	Miscellaneous Drain or Wash Water (all project types)	▪ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.[8] ▪ Roof drains from equipment drain to landscaped area where practicable. ▪ Drain boiler drain lines, roof top equipment, all wash water to sanitary sewer.[8]
☑	A-1	Architectural Copper Rinse Water (all project types)	▪ Drain rinse water to landscaping, discharge to sanitary sewer[8], or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."

TIP: The boxed entries apply to all project types.

Worksheet C Example

Low Impact Development – Site Design Measures

Select Appropriate Site Design Measures *(Required for C.3 Regulated Projects; all other projects are encouraged to implement site design measures, which may be required at municipality discretion.) Projects that create and/or replace 2,500 – 10,000 sq.ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface, must include* ***one of Site Design Measures a through f*** *(Provision C.3.i requirements).[10] Larger projects must also include applicable Site Design Measures g through i. Consult with municipal staff about requirements for your project.*

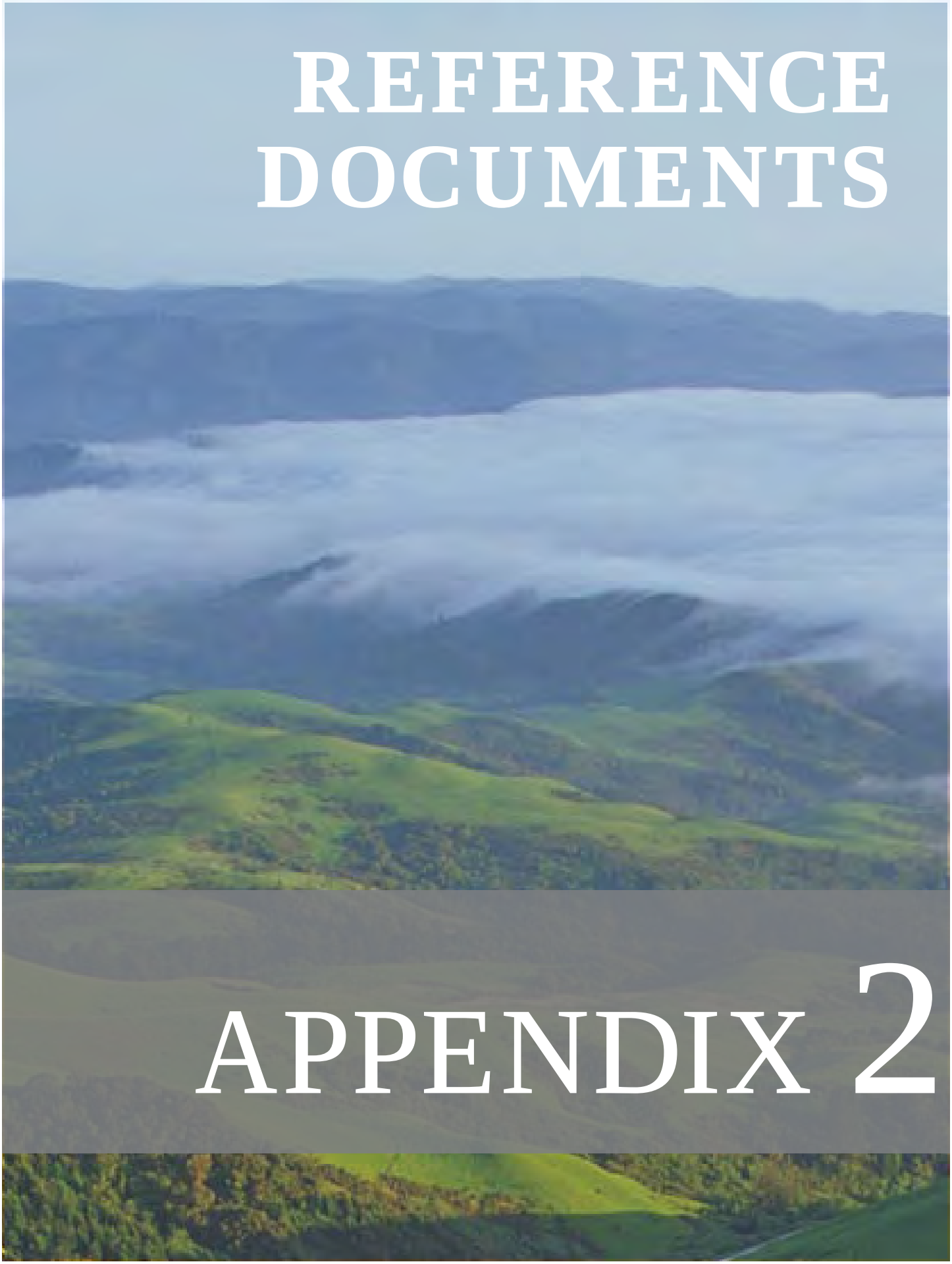
Select appropriate site design measures and Identify the Plan Sheet where these elements are shown.

Yes	Plan Sheet Number	
☐		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
☑	C-1	b. Direct roof runoff onto vegetated areas.
☐		c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
☐		d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
☑	C-1	e. Construct sidewalks, walkways, and/or patios with pervious or permeable surfaces. Use the specifications in the C3 Technical Guidance (Version 4.1) downloadable at www.flowstobay.org/newdevelopment.
☐		f. Construct bike lanes, driveways, and/or uncovered parking lots with pervious surfaces. Use the specifications in the C3 Technical Guidance (Version 4.1) downloadable at www.flowstobay.org/newdevelopment.
☐		g. Limit disturbance of natural water bodies and drainage systems; minimize compaction of highly permeable soils; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies.
☐		h. Conserve natural areas, including existing trees, other vegetation and soils.
☐		i. Minimize impervious surfaces.

TIP: Single-family homes proposing 2,500 sq ft or more of impervious surface MUST include AT LEAST ONE of these measures

Regulated Projects can also consider the following site design measures to reduce treatment system sizing:

Yes	Plan Sheet Number	
☐		j. Self-treating area (see Section 4.2 of the C.3 Technical Guidance)
☐		k. Self-retaining area (see Section 4.3 of the C.3 Technical Guidance)
☐		l. Plant or preserve interceptor trees (Section 4.1, C.3 Technical Guidance)



REFERENCE DOCUMENTS

APPENDIX 2

Introduction

The Manual does not seek to recreate the content in pre-existing standards, guidance documents, and regulations, but rather summarize and present the information in a clear and cohesive unified document. Therefore, the Manual will often provide brief explanations for content included in reference documents that the reader can seek out for more information when needed. An effort has been made to clearly cite reference documents throughout the Manual when applicable. The following existing documents contain information pertinent to the County's design, construction, and post-construction requirements. A brief summary of the content of each document is provided as follows.

Design Requirements

Municipal Regional Stormwater Permit (MRP), Provision C.3 New Development and Redevelopment [🔗]: Contains the requirements for Regulated Projects to control the flow of stormwater and stormwater pollutants from new and redevelopment sites by enforcing the use of source control, site design, stormwater treatment, and hydromodification measures.

San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) C.3 Regulated Projects Guide (C.3 Guide) [🔗]: The C.3 Guide contains guidance for use by developers, builders, and project applicants to design and build low impact development projects to meet stormwater quality requirements in the MRP. The guidance in the C.3 Guide is specific to Regulated Projects and is incorporated by reference, not repeated, in this Manual. The C.3 Regulated Projects Guide is an updated version of the SMCWPPP C.3 Stormwater Technical Guidance document, and will supersede that document when completed (approximately March 2020). In the interim, the C.3 Stormwater Technical Guidance Version 5.0 may be used as a reference.

SMCWPPP Green Infrastructure Design Guide (GI Design Guide) [🔗]: Created as a guide to aid jurisdictions in transitioning to green infrastructure, the GI Design Guide contains design guidance, standards, and typical details for green infrastructure implementation in public rights-of-way and on public parcels. Much of the content of the GI Design Guide is also applicable to LID facilities on private projects, but it is not specific to Regulated Projects.

County Subdivision Regulations Chapter 3, Article 6 Storm Drainage [🔗]: Establishes that the subdivider will be responsible for the design and installation of a storm drainage system within the subdivision, and that no tentative map or tentative parcel map shall be approved until and unless the County is assured that adequate drainage will be provided. This assurance is provided through the Drainage Review process described in Chapter 3, 4, or 5 of this Manual.

San Mateo County Department of Public Works Standard Drawings for Public Improvement and Standard Specifications: Contains the County's standard details and specifications that must be used for any work performed within the public right-of-way (ROW). Project plans and specifications must reference and be consistent with these standards when the project limits of work include drainage improvements in the public ROW.

Sustainable Streets Typical Design Details (GI Details): In addition to the Public Works Standard Drawings, the GI Details contain standard details and specifications for use specifically in the design of green infrastructure facilities in the public ROW.

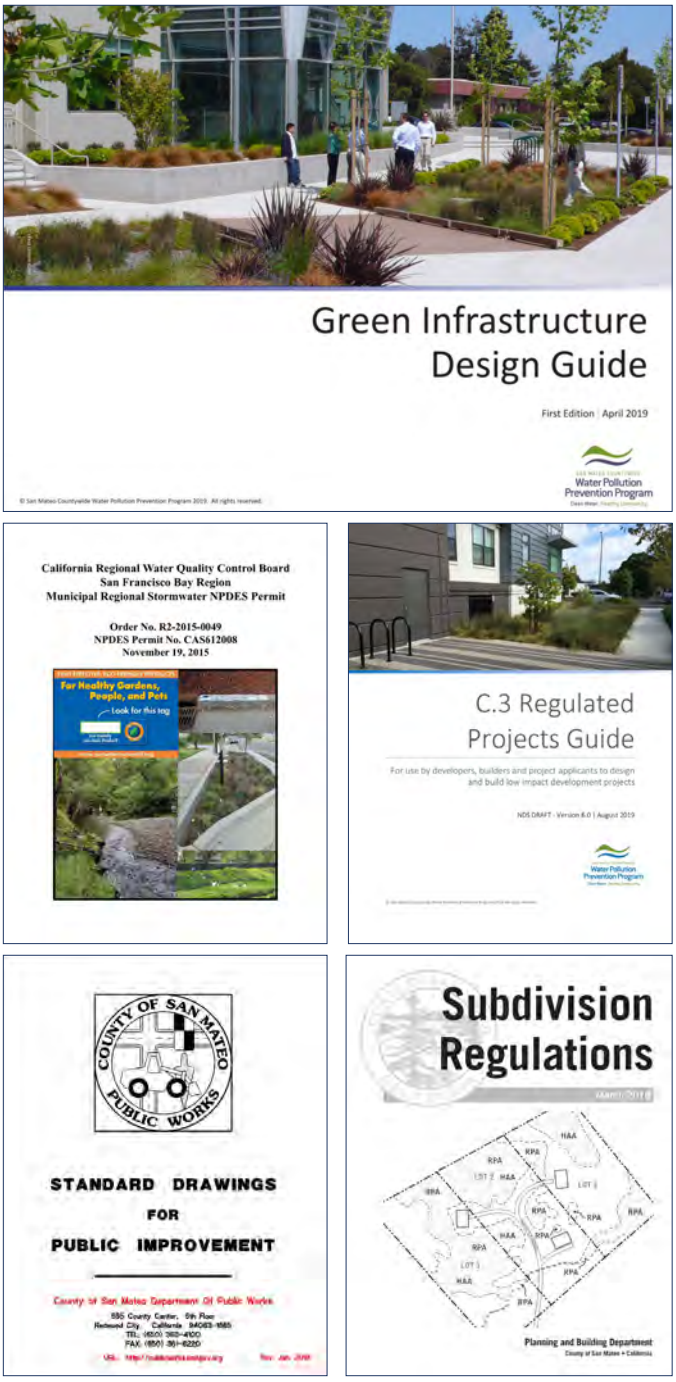


Figure A2-1. Selection of Reference Documents

County of San Mateo Sea Level Rise Vulnerability Assessment: In 2018, the County finalized the Sea Change SMC Sea Level Rise Vulnerability Assessment in coordination with cities, agencies, businesses, community groups, and others (www.seachangesmc.org). The County's Vulnerability Assessment used three inundation scenarios and one erosion scenario: the 1% annual-chance flood (known as the 100-year flood), 3.3 feet of sea level rise plus the 1% annual-chance flood, and 6.6 feet of sea level rise plus the 1% annual-chance flood. By 2020, the County will have additional models and tools showing climate impacts on changes in precipitation and river discharge, wildfire risk, and urban heat impacts. In the meantime, for specific projections, consider the Sea Level Rise Guidance produced by the State of California's Ocean Protection Council (http://www.opc.ca.gov/updating-californias-sea-level-rise-guidance/). This guidance states that by 2030 water levels will rise by 0.5 to 1 foot; by 2040 by 0.8 to 1.8 feet; and by 2050 by 1.1 to 2.7 feet.

Design and Calculations Guidance

SMCWPPP C.3 Regulated Projects Guide (C.3 Guide) [🔗]: Contains guidance on sizing and design of stormwater treatment measures per the hydraulic design criteria of the MRP. (See description under previous section "Design Requirements.")

California Department of Transportation. December 2015. Highway Design Manual, Chapter 810 Hydrology [🔗]: Contains guidance on use of the Rational Method for peak flow calculations.

City of Portland. August 2016. Stormwater Management Manual, Appendix A, Stormwater Design Methodologies, Santa Barbara Urban Hydrograph Method [🔗]: Contains guidance on use of the Santa Barbara Urban Hydrograph Method for peak flow and runoff volume calculations.

USDA Natural Resources Conservation Service. June 1986. Technical Release 55 – Urban Hydrology for Small Watersheds [🔗]: Contains guidance on use of the NRCS Curve Number Method for peak flow and runoff volume calculations.

San Francisco Public Utilities Commission. April 2017. Determination of Design Infiltration Rates for the Sizing of Infiltration-based Green Infrastructure Facilities [🔗]: Contains guidance on procedures for determining design infiltration rates used for sizing of infiltration-based drainage facilities.

Construction Requirements

County Grading Ordinance [🔗]: Summarizes erosion and sediment control requirements. An erosion and sediment control plan and subsequent implementation shall be required except where an environmental assessment by the County Planning Division of the site shows that such plan is not necessary. Plans shall conform to standards as detailed in the Grading Permit Performance Standards Handbook, which details requirements for Erosion and Sediment Control Plans, Grading Standards, Geotechnical Report Guidelines and Dust Control Plan Guidelines.

MRP, Provision C.6 Construction Site Control [🔗]: Requires implementation of appropriate and effective erosion and other construction pollutant controls by construction site operators/developers. Worksheet A of the C.3 and C.6 Development Review Checklist lists the Construction BMPs that must be included on the Erosion Control Plan.

State Construction General Permit (CGP) [🔗]: Contains stormwater and erosion control requirements for projects that disturb 1 acre or more of land (or less than 1 acre if part of a common plan of development) during the construction phase. Projects of this size need to file a Notice of Intent for coverage under the CGP, in addition to any other permits required by the County.

SMCWPPP Construction Web Page [🔗]: This page provides resources to help project applicants include appropriate construction stormwater controls in development project designs, including: Construction Best Management Practice (BMP) Tips; Construction BMP Brochures; creek and wetland permitting information; forms and checklists; posters; and additional information.

Post-Construction Requirements

MRP, Provision C.3.h Operation and Maintenance of Stormwater Treatment Systems [🔗]: Requires the County to implement an Operation and Maintenance (O&M) Verification Program for stormwater treatment systems constructed by Regulated Projects, and for project owners to provide assurance that they will maintain the systems via a maintenance agreement or other mechanism.

C.3 Regulated Projects Guide, Chapter 8 Operation and Maintenance, and Appendix G Operation and Maintenance Document Templates [🔗]: Contains maintenance requirements for pervious pavement, stormwater treatment, and hydromodification management facilities included in Regulated Projects. Owners must develop a maintenance plan and execute a maintenance agreement to assure these facilities continue to function effectively and do not cause flooding, create habitat for mosquitoes, or otherwise become a nuisance. Appendix G of the C.3 Regulated Projects Guide provides templates for use in documenting the owner's maintenance requirements for submittal to the County.

SMCWPPP Green Infrastructure Design Guide (GI Design Guide [🔗]: The GI Design Guide provides specific and detailed recommendations on how to maintain green infrastructure through a user-friendly "field guide" format. Regulated Projects may use the GI Design Guide as a reference but must still adhere to the requirements detailed in Chapter 8 of the C.3 Guide.

EXAMPLE DRAINAGE REPORT FOR A NEW SINGLE FAMILY RESIDENCE

APPENDIX 3

The following is an EXAMPLE of a basic Drainage Report for a new single family residence. Drainage Reports will vary based on project requirements, complexity, and appropriate methodologies selected by the design professional. Refer to the Drainage Report Checklist at the end of this Appendix for a complete list of items to be included in your Drainage Report.

REPORT CONTENT	STEP
DRAINAGE REPORT for County Center House 455 County Center, Redwood City, CA 94063	***Project Name + Address***
APN: 052-337-020	***Assessor's Parcel Number***
October 1, 2019	***Report Date & Revisions***
Prepared by: San Mateo County Planning & Building 455 County Center, 2nd Floor Redwood City, CA 94063 drainage@smcgov.org	***Report Preparer Name, Contact Information, Stamp & Signature***

REPORT CONTENT

Project Description

The proposed project is a home with swimming pool, pool house, guest house (ADU) and associated improvements. The project sits on a 30,000 square foot recently subdivided lot. There is approximately 10,000 square feet of impervious surface proposed, with 18,500 square feet of landscaping and a combined 1,500 square feet of pervious pavers and permeable decks.

The existing structure is an 18,000 square foot office building with associated improvements. All surface improvements will be completely demolished. One storm drain line along the northern edge will be replaced.

Project existing and proposed impervious surfaces are summarized in the table below.

	Existing Impervious Area (sq. ft.)	Proposed Impervious Area (sq. ft.)
Roofs	18,000	5,000
Decks	0	0 (1,000 sq. ft. permeable)
Pool	0	600
Driveways	0	2,000
Patios + sidewalks	10,000	2,400 (500 sq. ft. permeable)
TOTAL	**28,000**	**10,000**

Project Site Drainage Considerations

The average slope of the site is 1%.

The site is approximately 800 feet from Redwood Creek. Existing public storm drain infrastructure includes a 15" storm drain pipe along the northern edge of the property (to be replaced) and a catch basin inlet approximately 50 feet from the eastern edge of the property.

The project is in the Redwood Creek Watershed, which ultimately flows to the Bay.

A small portion of the site is located within FEMA flood Zone AE with a base elevation of 10 feet. New structures are to be constructed outside of the identified flood zone. Every effort was made to construct drainage features outside of the flood zone; however, a small corner of the infiltration facility is located in Zone AE.

The geotechnical report indicates that groundwater is approximately 20 feet below ground surface and there are no significant slopes or close bedrock in the vicinity, so infiltration features are appropriate. No percolation testing information or soil type information is available for the project, so a worst-case scenario of Type D soil is assumed.

STEP

Project Description

Existing and Proposed Impervious Area Calculations

Site Slope

Site or Adjacent waterways/ infrastructure

Project Watershed

FEMA Flood Zone

Infiltration Information

REPORT CONTENT

Project Drainage Calculations – Flow & Volume Control

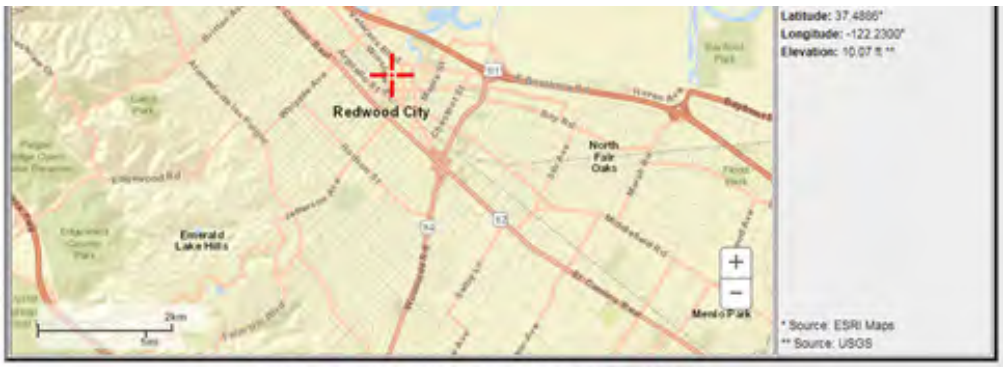
The rational method was selected as the calculation method for this project because of the relatively simple nature of the project and because the project size is less than 10 acres.

A 10-year design storm was used for calculating the pre-and post-development peak flow and runoff volumes for this project per the County's minimum guidelines.

A factor of safety of 1.5 was selected to account for currently unplanned minor changes in impervious area on-site, low maintenance periods, and potential construction errors.

Time of concentration was determined using the equation for the NRCS watershed lag method. As these values were less than the County minimum Time of Concentrations, the minimum pre- (10 minutes) and post (10 minute) development times of concentration were used.

Rainfall intensity for the project site was obtained from NOAA's Precipitation Frequency Data Server: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca. As can be seen in the image below, the intensity for a 10-minute duration, 10-year design storm is 1.87 inches per hour.



POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.49 (1.32-1.69)	1.81 (1.61-2.06)	2.24 (1.99-2.57)	2.62 (2.29-3.01)	3.12 (2.64-3.72)	3.52 (2.92-4.30)	3.94 (3.18-4.92)	4.37 (3.42-5.63)	4.97 (3.72-6.68)	5.44 (3.90-7.60)
10-min	1.07 (0.948-1.21)	1.30 (1.15-1.46)	1.61 (1.43-1.84)	1.87 (1.64-2.15)	2.24 (1.90-2.67)	2.52 (2.09-3.08)	2.82 (2.27-3.53)	3.13 (2.45-4.04)	3.56 (2.66-4.79)	3.89 (2.81-5.44)
15-min	0.860 (0.764-0.976)	1.05 (0.929-1.19)	1.30 (1.15-1.48)	1.51 (1.32-1.74)	1.80 (1.53-2.15)	2.04 (1.68-2.48)	2.27 (1.84-2.84)	2.52 (1.96-3.26)	2.87 (2.15-3.86)	3.14 (2.27-4.39)
30-min	0.598 (0.530-0.678)	0.728 (0.646-0.828)	0.902 (0.800-1.03)	1.05 (0.922-1.21)	1.25 (1.06-1.49)	1.41 (1.17-1.72)	1.58 (1.27-1.98)	1.75 (1.37-2.26)	1.99 (1.49-2.69)	2.18 (1.58-3.05)
60-min	0.422 (0.375-0.480)	0.514 (0.456-0.585)	0.638 (0.565-0.726)	0.741 (0.650-0.853)	0.885 (0.749-1.06)	0.998 (0.827-1.22)	1.12 (0.900-1.40)	1.24 (0.970-1.60)	1.41 (1.06-1.90)	1.54 (1.11-2.15)
2-hr	0.308 (0.274-0.350)	0.372 (0.330-0.424)	0.459 (0.406-0.524)	0.532 (0.467-0.612)	0.634 (0.537-0.756)	0.715 (0.592-0.872)	0.798 (0.644-1.00)	0.886 (0.694-1.14)	1.01 (0.756-1.36)	1.10 (0.798-1.54)
3-hr	0.258 (0.229-0.293)	0.312 (0.277-0.355)	0.386 (0.341-0.440)	0.447 (0.392-0.515)	0.533 (0.452-0.636)	0.602 (0.498-0.734)	0.673 (0.543-0.842)	0.748 (0.586-0.965)	0.852 (0.639-1.15)	0.935 (0.675-1.31)

STEP

Selection of Calculation Methodology

Design Storm

Factor of Safety

Time of Concentration

Rainfall Intensity

REPORT CONTENT	STEP

Undeveloped Peak Flow

Topographic site survey shows that under existing conditions, the entire site sheet flows to the east, so there is only one point of discharge and one tributary area for calculations. Undeveloped peak flow is calculated as follows:

Q_{pre} = CiA

Q_{pre} = 0.3 x 1.87 in/hr x 30,000 sq ft x 1 acre/43,560 sq ft

Q_{pre} = 0.386 cfs

Undeveloped Peak Flow Calculations

Post-Development Site Runoff

Post-development site runoff also flows generally to the east. Post-development runoff is calculated as:

Q_{post} = CiA

Q_{post} = 1.87 in/hr x (0.3 x 20,000 sq ft x 1 acre/43560 sq ft + 0.9 x 10,000 sq ft x 1 acre/43560 sq ft)

Q_{post} = 0.644 cfs

Post-Development Peak Flow Calculations

Project Site Drainage Considerations

San Mateo County requires that the project runoff from a 10-year 1-hr duration design storm be retained onsite. For a 10-year storm, the intensity for a 1 hour duration is 0.741 in/hr.

Change in runoff: $\Delta Q = A_{project\ impervious} \times \Delta C \times i$ = 10,000 x (0.9-0.3) x 0.741 = 0.102 cfs

Change in volume for 10-year design storm: $\Delta V = \Delta Q$ x Duration = 367 cf

Minimum required volume (with Factor of Safety) = FS* ΔV = 1.5 x 367 = 551 cf

Retention Calculations

Proposed Mitigation Features

In order to contain this volume of runoff, it is proposed to route stormwater to a new infiltration-based retention feature that consists of a 55' long 36" diameter perforated pipe surrounded by 6" of gravel on all sides. The system overflows through a 12"x12" grate at the top. The detention storage is therefore:

Volume Pipe = 3.14 x r^2 x L = 388 cf

Gravel void ratio = 0.35

Volume Gravel = 172 cf

Total Volume = 560 cf

Proposed Mitigation Features Descriptions

As determined above, it is appropriate to use infiltration in this area. However, the following checks need to be completed to verify that infiltration will adequately address runoff from the site:

1. Room for a second 10-year storm within 24 hrs. Volume percolated in 24 hrs = 220 sq ft x 0.06 in/hr x 1 ft/12 in x 24 hr = 26; 560 + 26 – 367 = 219 cf; 219 cf < 367 cf
2. Drains within 5 days (due to the open grate)
   Area of percolation = 55 ft x 4 ft = 220 sq ft
   Percolation rate = 0.06 in/hr
   Volume percolated in 5 days = 220 sq ft x 0.06 in/hr x 1 ft/12 in x 24 hr x 5 = 132 cf << 560 cf

The above criteria are not satisfied by the current design, and so a metered outlet device has been selected.

Check: Infiltration-Only?

REPORT CONTENT	STEP

Metered outlet sizing:

Area of property that is not routed to infiltration area: 10,000 sq ft pervious.

Q_{other} = 1.87 in/hr x (0.3 x 10,000 sq ft x 1 acre/43560 sq ft) = 0.129 cfs

$Q_{allowable} = Q_{pre} - Q_{other}$ = 0.386 - 0.129 = 0.257

Small orifice: Q_{max} = A x 0.99 x SQRT(2 x 32.2 x H)

$Q_{max} = Q_{allowable}$; 0.257 = A x 0.99 x SQRT(2 x 32.2 x 4.5); A = 2.20 in^2; 1.67" max orifice

use 1.5" orifice

Check: Metered outlet?

There is sufficient slope such that the outlet pipe from the bottom of the infiltration pipe has a min. 1% slope to the outfall. A pump is not needed in this case.

Check: Outfall design?

Should the system experience a greater than 10-year storm, the system will overflow through the grate at the top and sheet flow safely away.

Overflow

Conveyance Sizing

Conveyance Sizing

The conveyance system leading to the infiltration pipe drains most of the property with limited run-on. About half of the site is routed through a pipe to the middle of the infiltration feature, while the other half is routed to the southern end. Per the above NOAA table, sizing the system for a 10-year 10-minute time of concentration storm means using an intensity value of 1.87 in/hr.

$Q_{conveyance}$ = 1.87 in/hr x (0.3 x 20,000 sq ft x 1 acre/43560 sq ft + 0.9 x 10,000 sq ft x 1 acre/43560 sq ft) x 1/2

$Q_{conveyance}$ = 0.322 cfs

Given that all pipes onsite are minimum 1.5% slope, a minimum 6-inch pipe is required for each inlet pipe to the infiltration feature per the conveyance sizing table attached at the end of this Report.

Project Stormwater Treatment Requirements

Subject to C.3i?

As a project greater than 2,500 sq ft, the project is subject to C.3.i. See Worksheets B and C of the attached C.3 Checklist.

C.3 Regulated Project

The project is part of a larger subdivision that is required to comply with regulated project (Provision C.3) as noted in its subdivision conditions of approval.

REPORT CONTENT

Stormwater from the project will flow through (1) a flow-through planter with waterproof liner adjacent to the house foundations and (2) an unlined bioswale adjacent to the new driveway prior to entering the infiltration feature. The Drainage Management Area (DMA) routed to each of these features is used to size the treatment features per the C.3 Technical Guidance.

DMA	DMA Area	Treatment Sizing Method	Required Treatment Area	Provided Treatment Area
DMA 1 (roofs)	5,000 sq ft	Combination Flow & Volume	156 sq ft (see attached worksheet)	Two 20 ft x 4 ft flow-through planters = 160 sq ft
DMA 2 (driveway, patios, and some landscaping)	4,400 sq ft impervious + 1,000 sq ft pervious x 0.1 = 4,500 sq ft effective impervious	4% guideline	180 sq ft	60 ft long 3 ft bioretention area = 180 sq ft

Operations & Maintenance

Recommended operations and maintenance for the proposed drainage system onsite includes:

- Clear debris from inlets as needed.
- Monitor for ponding
- Maintain appropriate vegetation for infiltration measures per the C.3 Technical Guidance.

As a C.3 Regulated Project, an Operations and Maintenance (O&M) Agreement will need to be recorded for the property prior to the Building Permit final. A draft O&M agreement has been prepared separately.

Attachments

Figure 1: Site and Drainage Improvements

Worksheet for Calculating the Combination Flow & Volume Method

C.3 and C.6 Development Review Checklist

Conveyance Sizing Table

STEP

Subject to C.3i?

Recommended O&M

Attachments