

Stormwater Control Plan
For a Regulated Project
1515 Fourth Street Apartments
1515 4th Street, San Rafael, CA 94901

November 2021

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- Attch. 3 - Soils
- Attch. 4 - Educational Materials
- Attch. 5 - Operations & Maintenance Plan

Appendices

This Stormwater Control Plan was prepared using the template dated October 2018.

I. Project Data

Table 1. Project Data Form

Project Name/Number	1515 Fourth Street Apartments
Application Submittal Date	
Project Location	1515 4 th Street, San Rafael, CA 94901
Project Phase No.	N/A
Project Type and Description	Proposed apartment complex along with commercial space to be developed on existing lot.
Total Project Site Area (acres)	0.88 AC
Total New and Replaced Impervious Surface Area	38,332 sf
Total Pre-Project Impervious Surface Area	36,024 sf
Total Post-Project Impervious Surface Area	34,848 sf

II. Setting

II.A.1. Project Location and Description

The proposed project is located at 1515 4th Street in San Rafael, California in the County of Marin. The project proposes the complete redevelopment of the site, this will include the demolition of the existing building and parking lot. It will be replaced with a mix use residential/ commercial building. The proposed project will consist of 207 residential units and approximately 5,000 sf of commercial space. Site will also feature a courtyard and common areas throughout along with underground parking. Associated improvements such as landscaping and bioretention areas for the purposes of stormwater quality will be included.

II.B. Existing Site Features and Conditions

The current site houses a former bank branch, parking lot, and associated improvements such as landscaping, hardscaping, and driveways. The site currently drains from the north east, down towards the south west portion of the site. Flows then exit the site through perforated drainpipes located within the existing wall, at which point flows end up on Shaver Street.

II.C. Opportunities and Constraints for Stormwater Control

Opportunities: The project proposes common space areas which can be beautified by landscape additions. There will be a roof garden as well as a courtyard on the first level. This can be hybrid landscape/standing areas utilized for water retention as well as social space.

Constraints: The project site is going to be very dense and will be improved with the proposed structure and necessary parking spaces/driveways which will limit the amount of pervious area which can be used as bioretention on site. However, implementation of an in-vault media filter system will be utilized along with a SUSMP pump.

III. Low Impact Development Design Strategies

III.A. Optimization of Site Layout

III.A.1. Limitation of development envelope

III.A.2. Preservation of natural drainage features

III.A.3. Setbacks from creeks, wetlands, and riparian habitats

III.A.4. Minimization of imperviousness

III.A.5. Use of drainage as a design element

III.B. Dispersal of Runoff to Pervious Areas

III.C. Stormwater Control Measures

IV. Documentation of Drainage Design

IV.A. Descriptions of Each Drainage Management Area

IV.A.1. Table of Drainage Management Areas

DMA Name	Surface Type	Area (square feet)
1	Landscape/building/hardscape	38,332

IV.A.2. Drainage Management Area Descriptions

DMA 1

Per chapter 3, page 3-6 of the BASMAA manual, exceptions to bioretention are allowed. In some cases, it is very difficult to accommodate bioretention facilities on smaller, densely developed sites. Three-box-type biofilters or in-vault media filters may be used to meet treatment requirements in the following circumstances:

Projects that create or replace an acre or less of impervious area and are in a locally designated pedestrian-oriented commercial district and have at least 85% of the entire project site covered by permanent structures.

Facilities receiving runoff solely from existing (pre-project) impervious areas.

Historic sites, structures, or landscapes that cannot alter their original configuration without compromising their historic integrity.

The proposed tree-box-type biofilters or in-vault media filters must meet the "Technical Criteria for Non-LID Treatment Facilities" posted on the BASMAA website.

Stormwater will travel down through roof drains and will enter a Storm Water Diversion structure. The Diversion structure will then release .17 cfs into the in-vault media filter system, which will be sized using the technical criteria for non-lid treatment facilities as, outlined by BASMAA. After stormwater is filtered, it will then enter a pump vault which will pump stormwater out to the street at a designed 100 gpm.

IV.B. Tabulation and Sizing Calculations

IV.B.1. Information Summary for Bioretention Facility Design

Not feasible due to downtown setting and high-density activity areas.

IV.B.2. Self-Treating Areas

Not feasible due to downtown setting and high-density activity areas.

IV.B.3. Self-Retaining Areas

Not feasible due to downtown setting and high-density activity areas.

IV.B.4. Areas Draining to Self-Retaining Areas

Not feasible due to downtown setting and high-density activity areas.

IV.B.5. Areas Draining to Bioretention Facilities

Not feasible due to downtown setting and high-density activity areas.

IV.B.6. NON-LID-SIZING

Area

Flow rate = $A \times 0.2 \text{ (in./hr)} \times 1/12 \times 1/3600 = \text{cfs}$

$38,332 \times 0.2 \text{ (in./hr)} \times 1/12 \times 1/3600 = 0.17 \text{ cfs}$

Treatment flow = $0.17 \text{ cfs} / 76.3 \text{ gpm}$

Source Control Measures

IV.C. Site activities and potential sources of pollutants

Potential Source of Runoff Pollutants	Potential Pollutants
Vehicle Traffic	Organic compounds, heavy metals
Landscaping	Phosphorous, nitrogen, pesticides/herbicides

IV.D. Source Control Table

Potential source of runoff pollutants	Permanent source control BMPs	Operational source control BMPs
On-site storm drain inlets	<ul style="list-style-type: none"> Mark all inlets with the words "No Dumping! Flows to Bay" or similar. 	<ul style="list-style-type: none"> Maintain and periodically repaint or replace inlet markings Provide stormwater pollution prevention information to new site owners, lessees, or operators See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds maintenance" in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/bmphandbooks Include the following in lease agreements: "Tenant shall now allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
Plazas, sidewalks, and parking lots		<ul style="list-style-type: none"> Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Landscape/Outdoor pesticide use/Building and grounds maintenance	<p>Final landscape plans will accomplish the following:</p> <ul style="list-style-type: none"> • Preserve existing native trees, shrubs, and ground cover to the maximum extent possible • Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. • Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions • Consider using pest-resistant plants, especially adjacent to hardscape • To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions. 	
Fire Sprinkler Test Water	<ul style="list-style-type: none"> • Provide a means to drain fire sprinkler test water to the sanitary sewer. 	<ul style="list-style-type: none"> • See the note in Fact Sheet SC-41, "building and Grounds Maintenance," in the CASQA Stormwater Quality

IV.E. Features, Materials, and Methods of Construction of Source Control BMPs

x

V. Stormwater Facility Maintenance

V.A. Ownership and Responsibility for Maintenance in Perpetuity

The owner to be responsibility for all operation and maintenance of stormwater treatment and flow-control facilities until such time that a PMC is contracted.

V.B. Summary of Maintenance Requirements for Each Stormwater Facility

Stormwater Facility	Maintenance Activity	Maintenance Frequency
In-Vault Media System Filter	Maintenance to be conducted per manufacture’s recommendations: <ul style="list-style-type: none"> • Inspection of the vault interior to determine the need for maintenance. • Cartridge replacement and sediment removal. 	As recommended per manufacturer.

VI. Construction Checklist

[See the instructions on page 3-8 of the *Post-Construction Manual*.]

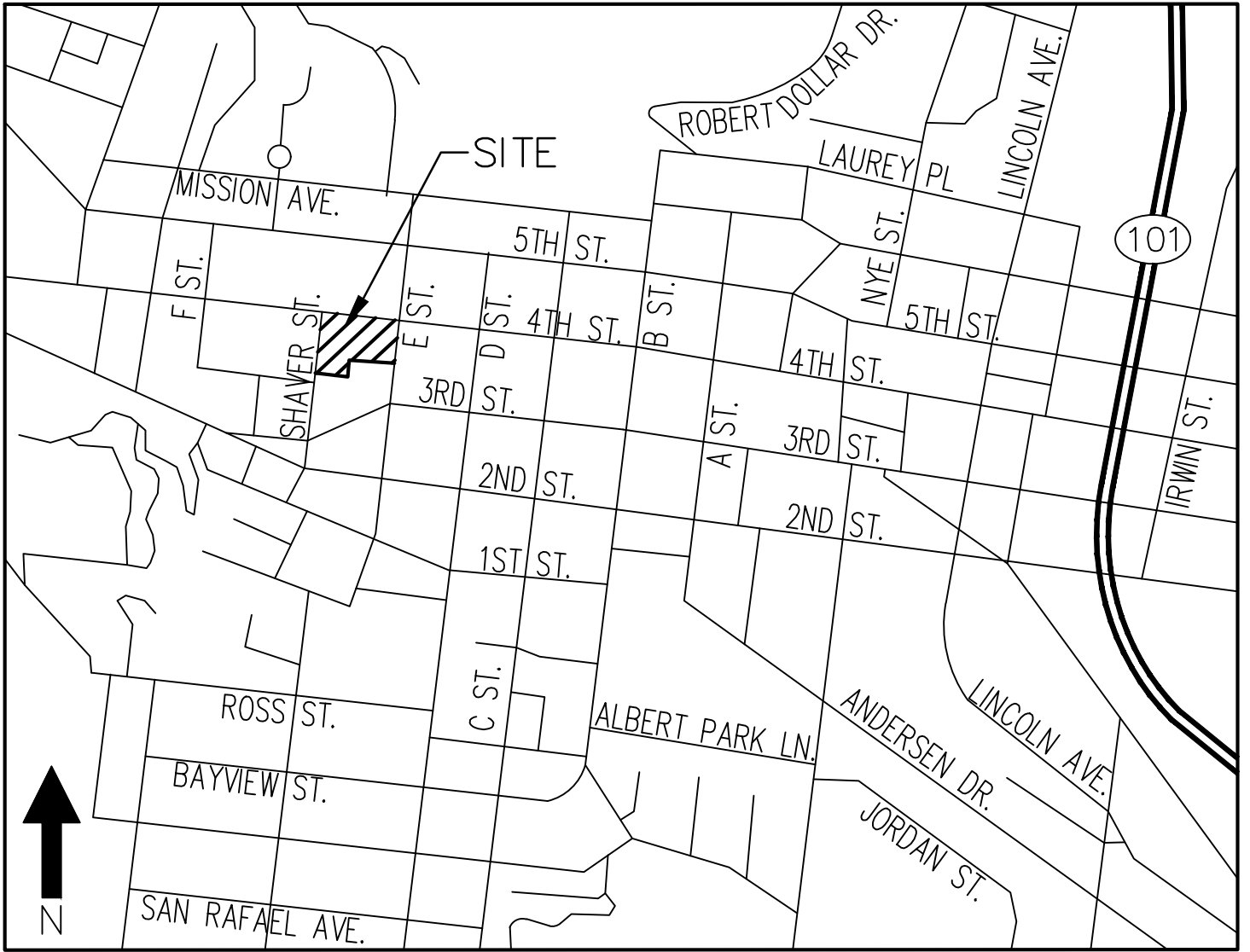
Stormwater Control Plan Page #	Source Control or Treatment Control Measure	See Plan Sheet #s
7	Mark all inlets with the words “No Dumping! Flows to Bay” or similar	
7	Preserve existing native trees, shrubs, and ground cover to the maximum extent possible	
7	Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.	
7	Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions	
7	To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	
7	Consider using pest-resistant plants, especially adjacent to hardscape	

7	Provide a means to drain fire sprinkler test water to the sanitary sewer.	
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VII. Certifications

The preliminary design of stormwater treatment facilities and other stormwater pollution control measures in this plan are in accordance with the current edition of the BASMAA *Post-Construction Manual* [Check with local staff regarding other certification requirements.]

Figure I. Vicinity Map

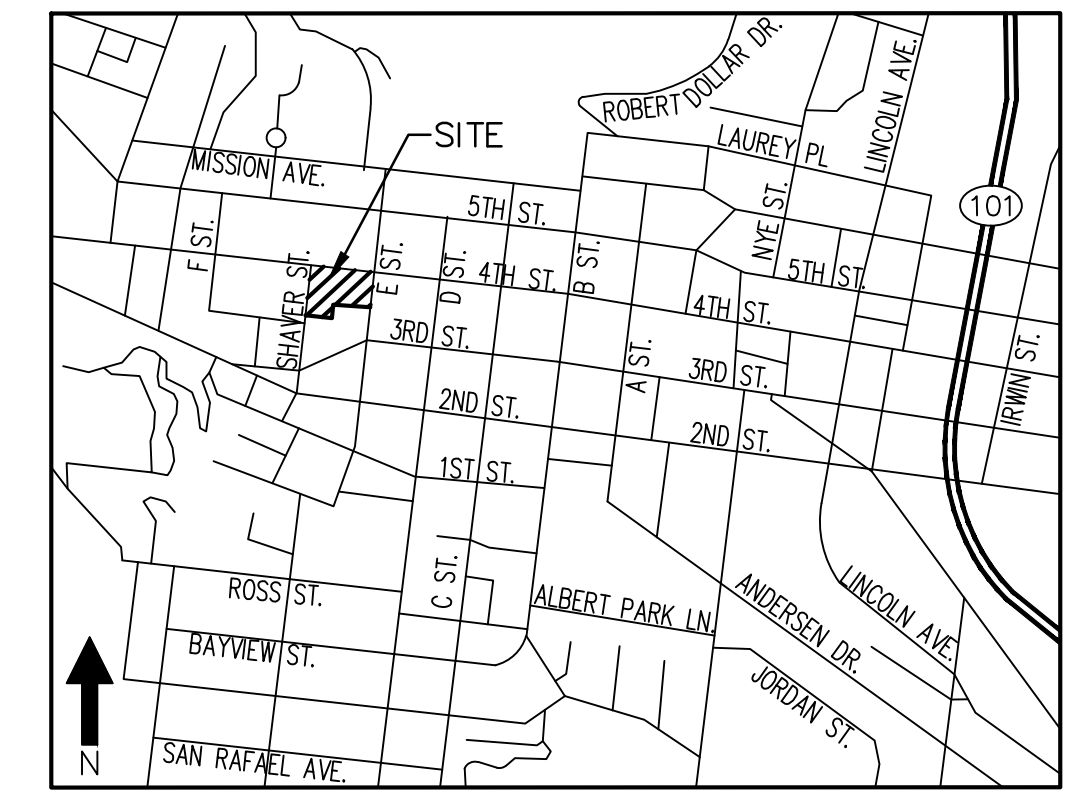


VICINITY MAP

N.T.S.

Attachment 1. Stormwater Control Plan Exhibit

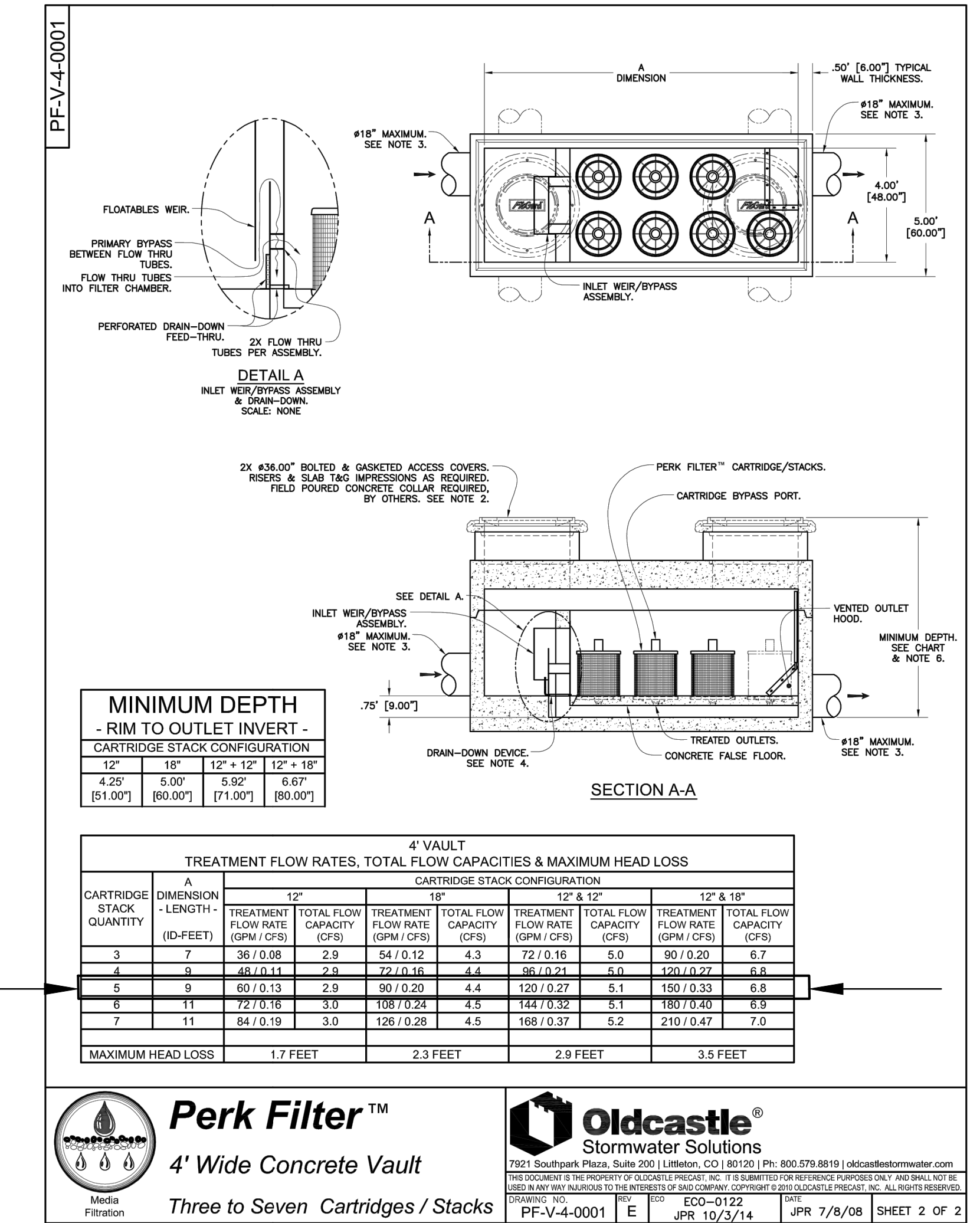
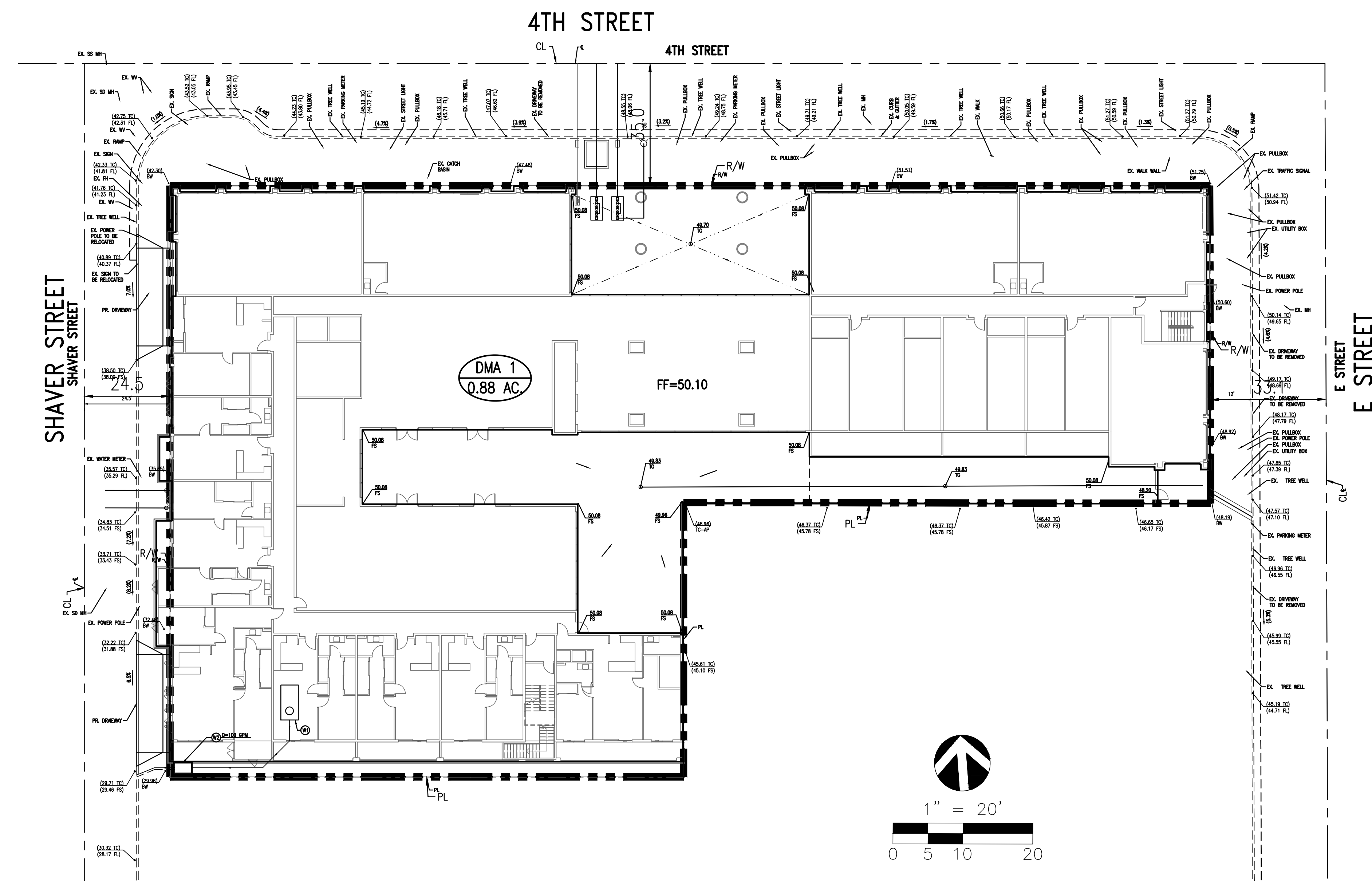
STORMWATER CONTROL PLAN 1515 4TH STREET.



BEST MANAGEMENT PRACTICES NOTES:

VICINITY MAP
N.T.S.

- W1 — INSTALL CONTECH IN-VAULT MEDIA FILTER SYSTEM.
- W2 — INSTALL DUPLEX 100 GPM SUMP PUMP PER MANUFACTURER'S SPECIFICATIONS.



Perk Filter™
4' Wide Concrete Vault
Three to Seven Cartridges / Stacks

Oldcastle®
Stormwater Solutions

7821 Southpark Plaza, Suite 200 | Littleton, CO 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

W1 — STORMFILTER STANDARD DETAIL
NOT TO SCALE

Attachment 2. Bioretention Calculations

Attachment 2

Non-LID Sizing

Area

Flow Rate = $A \times 0.2 \text{ (in./hr)} \times 1/12 \times 1/3600 = \text{cfs}$

$38,332 \times 0.2 \text{ (in./hr)} \times 1/12 \times 1/3600 = 0.13$

cfs Treatment Flow = **0.17 cfs / 76.3 gpm**

Attachment 3. Soils



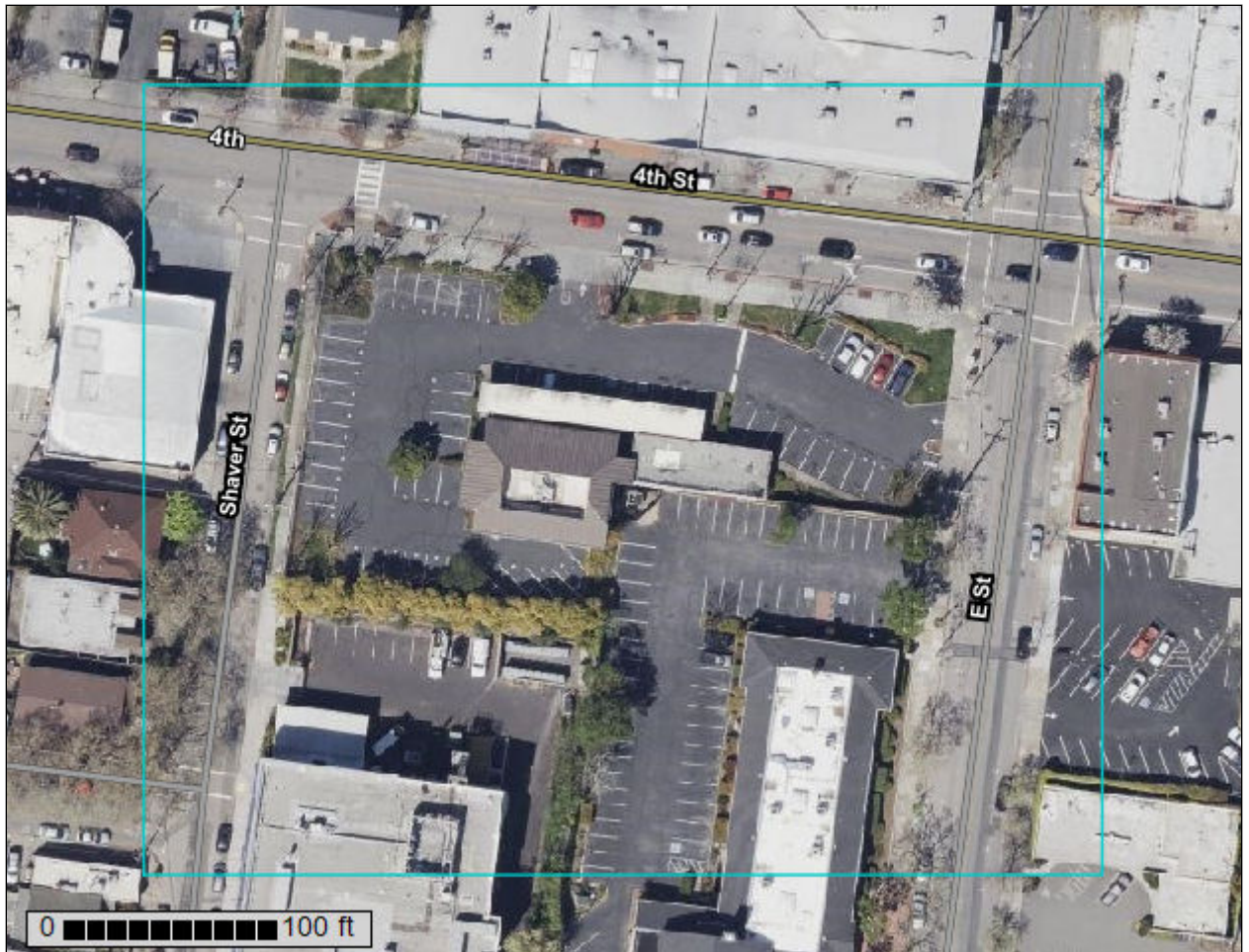
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Marin County, California



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

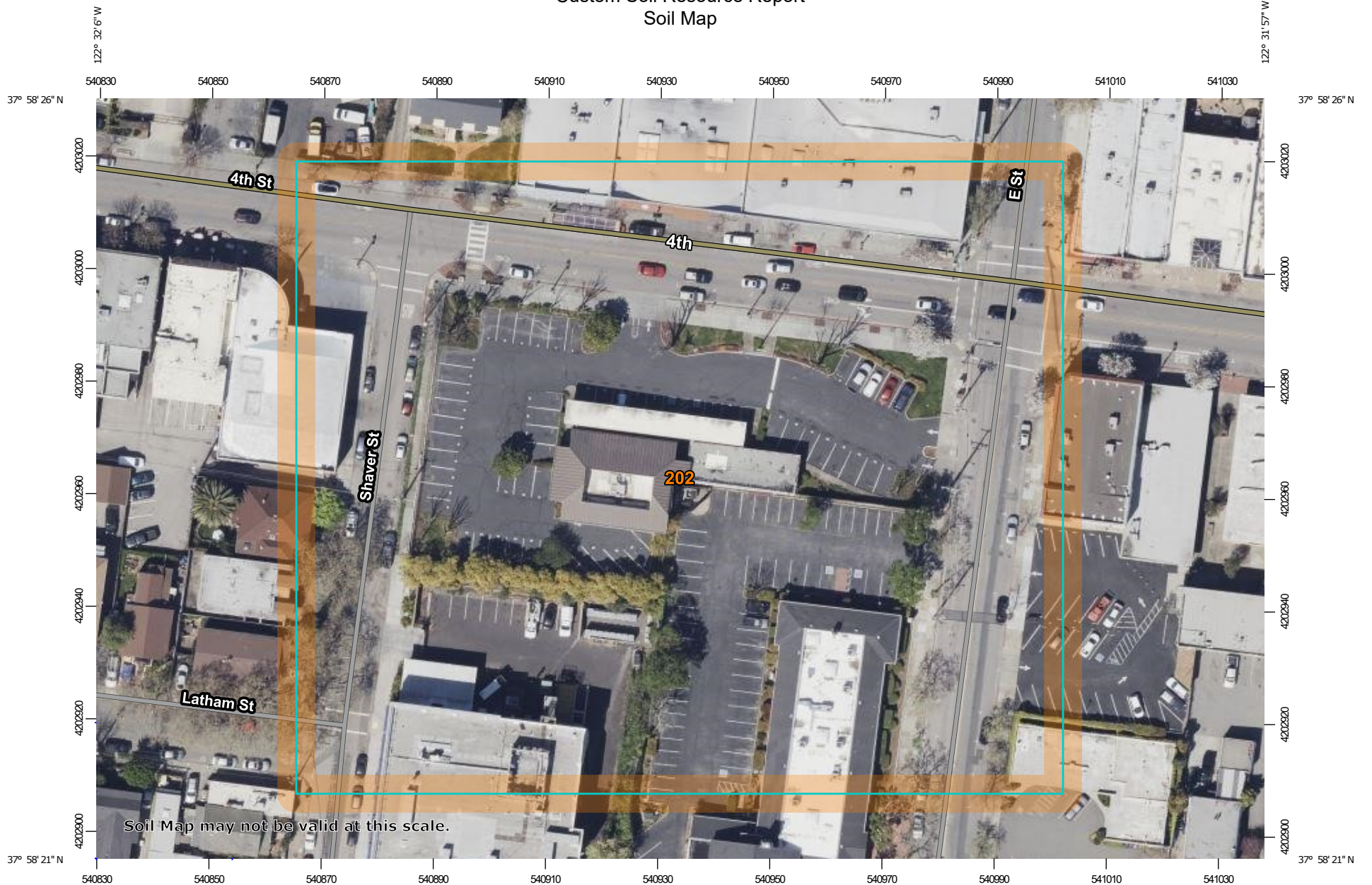
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

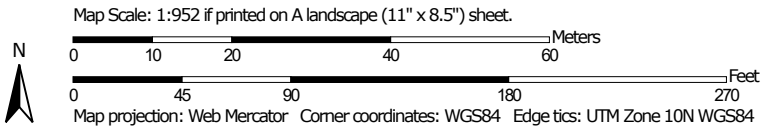
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Marin County, California
 Survey Area Data: Version 15, Sep 9, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 7, 2021—Mar 31, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
202	Urban land-Xerorthents complex, 0 to 9 percent slopes	3.8	100.0%
Totals for Area of Interest		3.8	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

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onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Marin County, California

202—Urban land-Xerorthents complex, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: hf4d
Elevation: 0 to 500 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 270 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 70 percent
Xerorthents and similar soils: 20 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Valley floors
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Ecological site: R015XY003CA - Loamy Bottom
Hydric soil rating: No

Description of Xerorthents

Setting

Landform: Valley floors, tidal flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Earth spread deposits derived from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 0 to 9 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): 8s
Land capability classification (nonirrigated): 8s
Ecological site: R015XY003CA - Loamy Bottom
Hydric soil rating: No

Minor Components

Hydraquents

Percent of map unit: 2 percent

Landform: Tidal flats

Landform position (two-dimensional): Backslope

Hydric soil rating: Yes

Unnamed, briefly flooded soils

Percent of map unit: 1 percent

Hydric soil rating: No

Cole

Percent of map unit: 1 percent

Hydric soil rating: No

Slopes more than 9 percent

Percent of map unit: 1 percent

Hydric soil rating: No

Reyes

Percent of map unit: 1 percent

Landform: Salt marshes

Landform position (two-dimensional): Backslope

Hydric soil rating: Yes

Blucher

Percent of map unit: 1 percent

Hydric soil rating: No

Novato

Percent of map unit: 1 percent

Landform: Salt marshes

Landform position (two-dimensional): Backslope

Hydric soil rating: Yes

Ballard

Percent of map unit: 1 percent

Hydric soil rating: No

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Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

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Attachment 4. Educational Materials

POLLUTION PREVENTION

IT'S PART OF THE PLAN

MAKE SURE YOUR CREWS AND SUBS DO THE JOB RIGHT!

Runoff from streets and other paved areas is a major source of pollution in our local waterways and the San Francisco Bay. Construction activities can directly affect the health of our waterways unless contractors and crews plan ahead to keep dirt, debris, and other construction waste away from storm drains and local creeks. Following these guidelines will ensure your compliance with local ordinance requirements. Storm drain polluters may be liable for fines! For more information, contact your local stormwater coordinator (see reverse side).

EARTHWORK & CONTAMINATED SOILS

- ▶ Avoid scheduling earth disturbing activities during the rainy season. If grading activities during wet weather are allowed in your permit, be sure to implement all measures necessary to prevent erosion and sediment runoff.
- ▶ Mature vegetation is the best form of erosion control. Minimize disturbance to existing vegetation whenever possible.
- ▶ If you disturb a slope during construction, prevent erosion by securing the soil with erosion control fabric, or seed with fast-growing grasses as soon as possible. Place a silt barrier downslope until soil is secure.
- ▶ Keep excavated soil securely covered and bermed on the site where it is least likely to receive run-on. Transfer to dump trucks should occur on the site, not in the street.
- ▶ Use straw wattles, silt fences, gravel bags, check dams, or other control measures to prevent the flow of silt from the site and into storm drains or creeks.

PAVING/ASPHALT WORK

- ▶ Do not pave or conduct other concrete/asphalt work during wet weather or when rain is forecast.
- ▶ Always seal off storm drain inlets and manholes when paving or applying seal coat, tack coat, slurry seal, etc.
- ▶ Do not sweep or wash down excess materials into storm drains, ditches, or creeks. Collect these materials and return them to stockpiles, or dispose of properly.
- ▶ Do not use water to wash down fresh asphalt or concrete pavement.

DEWATERING OPERATIONS

- ▶ Reuse uncontaminated water for dust control, irrigation, or another on-site purpose to the greatest extent possible.
- ▶ Be sure to call the local Stormwater Coordinator before discharging water to a street, storm drain, or creek. Only clean groundwater can be discharged to a storm drain. Settling, filtration, treatment, or removal may be required.

MATERIALS STORAGE & WASTE DISPOSAL

- ▶ Sweep streets and other paved areas daily. Never wash down streets or work areas with water!
- ▶ Be sure to store any stockpiles of dirt, sand, asphalt, concrete, grout, mortar, etc. under cover and away from drainage areas. These materials must never reach a storm drain, creek, or other watercourse. Stockpiles must be kept onsite, not in the street.
- ▶ Collect and retain all concrete washout water and solids in leak proof containers so that none of the caustic material reaches the soil surface where it can migrate to surface waters or into the groundwater.
- ▶ All water from washing exposed aggregate concrete must also be diverted and captured into leak proof containers where it will not come in contact with the soil.
- ▶ All collected wash water and solids must be properly recycled or removed off site for appropriate disposal.

HAZARDOUS MATERIALS MANAGEMENT

- ▶ Label all hazardous materials/wastes (such as pesticides, paints, thinners, solvents, fuel, oil, and antifreeze) in accordance with city, state, and federal regulations.
- ▶ Store hazardous materials and wastes in secondary containment and cover them during wet weather.
- ▶ Follow manufacturer's application instructions for hazardous materials. Be careful not to use more than necessary.
- ▶ Do not apply pesticides, herbicides, or other chemicals outdoors when rain is forecast within 48 hours.
- ▶ Dispose of hazardous materials/waste at the Hazardous Waste Collection Facility. For more information:
 - Novato businesses call - 800-243-0291
 - All other businesses in Marin call - 415-485-6806

CONTINUED ON BACK

PAINTING

- ▶ Never rinse paint brushes or materials onto the ground, into a storm drain or backyard drain, or on the street!
- ▶ Paint out excess water-based paint before rinsing brushes, rollers, or containers in a sink with a drain that goes to sanitary sewer.
- ▶ Paint out excess oil-based paint before cleaning brushes in paint thinner or solvent in a proper container.
- ▶ Filter paint thinners and solvents for reuse whenever possible. Dispose of all leftover paints, oil-based paint sludge, and unusable thinner at the hazardous waste collection facility. (See reverse for Hazardous Materials Management.)

LANDSCAPING

- ▶ Schedule grading and excavation projects for dry weather.
- ▶ Disturb the least amount of soil and existing vegetation as possible to complete the work.
- ▶ Protect stockpiles and landscaping materials from wind and rain by storing them under secured tarps or plastic sheeting and berm as needed to prevent run-on.
- ▶ Protect storm drain inlets with gravel bag berms, filter mats or other inlet protection measures.
- ▶ Use temporary check dams, wattles, silt fences, and other sediment control devices to keep your dirt onsite.
- ▶ Revegetate the area. It's an excellent form of erosion control for any site.
- ▶ Store pesticides, fertilizers, and other chemicals indoors or in a locked shed or storage cabinet with secondary containment. Clean up all spills immediately.
- ▶ Make sure all products are properly labeled and check inventory before buying additional products.
- ▶ Properly rinse and dispose of containers according to the manufacturer's label recommendations.
- ▶ Take all unwanted products to the haz-waste facility. (See reverse for Hazardous Materials Management.)
- ▶ Collect lawn and garden clippings, pruning waste and tree trimmings. Chip, if necessary, and compost.
- ▶ Do not place yard waste in gutters. In communities with curbside yard waste recycling, leave clippings and pruning waste for pick-up in approved bags or containers or, take to a landfill that composts yard waste.
- ▶ Do not blow, sweep, or rake leaves and other yard waste into the street, storm drain, or creek.

POOL/SPA MAINTENANCE

- ▶ Never discharge swimming pool, fountain, or spa water (and/or backwash water) to a street, storm drain, or creek. Call MCSTOPPP at 415-473-6528 to request a free brochure - or go to www.mcstoppp.org and look under Community Resources -> Businesses Resources.

VEHICLE & EQUIPMENT MAINTENANCE

- ▶ Frequently inspect vehicles and equipment for leaks. Use drip pans to catch leaks until repairs are made; repair leaks promptly.
- ▶ Do not clean vehicles or equipment on site using soaps, solvents, degreasers, steam cleaning equipment, etc.
- ▶ Do not conduct fueling or maintenance for vehicles or equipment on site unless absolutely necessary. If fueling or maintenance must be done, put down tarps or plastic in a bermed area and use drip pans large enough to contain any spills. Collect and dispose of any hazardous materials properly.

SAW CUTTING

- ▶ Always completely seal or barricade storm drain inlets when saw cutting. Use sand bags, barrier dikes, adhesive mats, or similar to keep all slurry, water, and fines out of the storm drain system. If saw-cut slurry materials enter a storm drain, clean up with dry methods or vacuum the storm drain immediately.
- ▶ Shovel, absorb, and/or vacuum up saw-cut slurry, water and fines as you're cutting. Remove all waste in sealed, transportable containers as soon as you are finished.

STORMWATER COORDINATORS

(Call During Normal Business Hours)

Town of San Anselmo
415-258-4616

City of Sausalito
415-289-4100

Town of Corte Madera
415-927-5057

City of San Rafael
415-485-3355

City of Belvedere
415-435-3838

County Unincorporated
415-473-6528

Town of Ross
415-453-1453

Town of Tiburon
415-435-7354

Town of Fairfax
415-458-2370

City of Larkspur
415-927-5017

City of Novato
415-897-4361

City of Mill Valley
415-388-4033

To report illegal discharges to storm drains or local waterways occurring after normal business hours, call 911 or your local fire department.

To report oil and chemical spills occurring in "open waters" or "on land" call 1-800-OILS911

To report habitat destruction, fish kills, or poaching, call the California Department of Fish and Wildlife at 888-334-2258.

Hazardous Waste Collection Facility

Businesses

Businesses that generate less than 27 gallons or 220 pounds of hazardous waste per month (known as Conditionally Exempt Small Quantity Generators) can take advantage of using a county-wide Collection Facility. Costs are based on the type and amount of hazardous waste brought in for disposal. Businesses must have a California ID number to dispose of their waste. For information on the ID number, call 1-800-618-6942 or go to http://www.dtsc.ca.gov/IDManifest/ID_Numbers.cfm and obtain Form 1358.

Appointments are necessary to use the Facility: Novato businesses should call 892-6395. All other businesses in Marin should call 485-5648.

Households

Disposal is free to Marin households. Call 892-7344 for Novato residents and 485-6806 for all other residents of Marin. No appointments are necessary. Call for locations and hours of operation.

Choosing a “Green” Painter

Is your painting company listed as a “green business” that is concerned about doing the job in a way that protects our creeks and watersheds? For more information, go to www.greenbusinessca.org and www.marinegreenbusiness.org

Specialty Paints

Copper-based anti-fouling paints are polluting the Bay. Alternatives to this specialty paint can be found at http://ucanr.org/sites/coast/Nontoxic_Antifouling_Strategies

MCSTOPPP gratefully acknowledges the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) for the original concept and text of this brochure

Local Stormwater Coordinators

Belvedere.....	435-3838
Corte Madera.....	927-5057
County Uninc.....	473-3748
Fairfax.....	453-1584
Larkspur.....	927-5017
Mill Valley.....	388-4033
Novato.....	899-8246
Ross.....	453-1453 ext. 163
San Anselmo.....	258-4600
San Rafael.....	485-3355
Sausalito.....	289-4100 ext. 106
Tiburon.....	435-7399

State Agencies

*California Regional Water Quality Control Board
San Francisco Bay Region (510) 622-2300.*

Department of Toxic Substances (for questions about hazardous waste or materials), call the Public and Business Liaison Hotline, Regional Duty Officers at (800) 728-6942 or (800) 72TOXIC.



**TO LEARN MORE, contact MCSTOPPP:
415-473-6528 or
mcstoppp@marincounty.org
www.mcstoppp.org**

If you require materials in alternative formats, please call 415-473-4381(voice) or CRS 711 or email disabilityaccess@marincounty.org

Painting and Application of Solvents and Adhesives

Best Management Practices for the Construction Industry



Who should use this brochure?

- Painters
- Homeowners
- Paperhangers
- Plasterers
- Graphic artists
- Dry wall crews
- Floor covering installers
- General contractors
- Home builders
- Developers

Preventing Pollution: It's Up to Us

In the San Francisco Bay Area, storm drains transport water directly to local creeks and the Bay without treatment. Unfortunately, the water carries with it common sources of pollution that include fluids from vehicles, construction debris, sediment created by erosion, landscaping runoff containing pesticides or weed killers, and materials such as used motor oil, antifreeze, and paint products that people pour or spill into a street or storm drain.

Do the Job Right!

Handling Paint Products

- Keep all liquid paint products and wastes away from the gutter, street, and storm drains.** Liquid residues from paints, thinners, solvents, glues, and cleaning fluids are hazardous wastes and must be disposed of at a hazardous waste collection facility (see back of this brochure).
- When thoroughly dry, completely empty paint cans (including some aerosols), may be disposed of as garbage or recycled. Check with your local garbage hauler/recycler. Either way, take the lid off all cans to ensure they are dry and to let the hauler know they are empty.
- Brushes, rags, and drop cloths may be tossed in the garbage if they *are not* saturated or heavily soiled with oil paint or other flammable/combustible materials. If they *are* saturated – or heavily soiled – they must be brought to the hazardous waste collection facility listed on the reverse side of this brochure.

Storm Drain Pollution from Paints, Solvents, and Adhesives

All paints, solvents, and adhesives contain chemicals that are harmful to wildlife in local creeks, San Francisco Bay, and the Pacific Ocean. Toxic chemicals may come from liquid or solid products or from cleaning residues or rags. Paint material and wastes, adhesives and cleaning fluids should be recycled when possible, or disposed of properly to prevent these materials from flowing into storm drains and waterways. **All storm drains lead to local creeks, the Bay or Ocean.**

Recycle/Reuse Leftover Paints

- Recycle excess **water-based (latex) paint** by bringing it to the Hazardous Waste Collection Facility (See back page. Call first. No container over 5 gallons accepted.).
- Unopened cans of paint might be able to be returned to the paint vendor. Check with the vendor regarding its return policy.

Painting Cleanup

- Never rinse paint containers into a storm drain, creek, gutter or *any* drain.
- For **water-based paints**, paint out brushes as much as possible - then rinse brush in a sink with a drain that goes to the sanitary sewer. Never pour excess paint of any kind down a storm drain or any other drain.
- For **oil-based paints**, paint out brushes to the extent possible and clean with thinner or solvent in a proper container. Allow paint particles to settle and form “sludge”. Dispose of sludge at the Hazardous Waste Facility (see other side). Re-use remaining solvent/thinner.

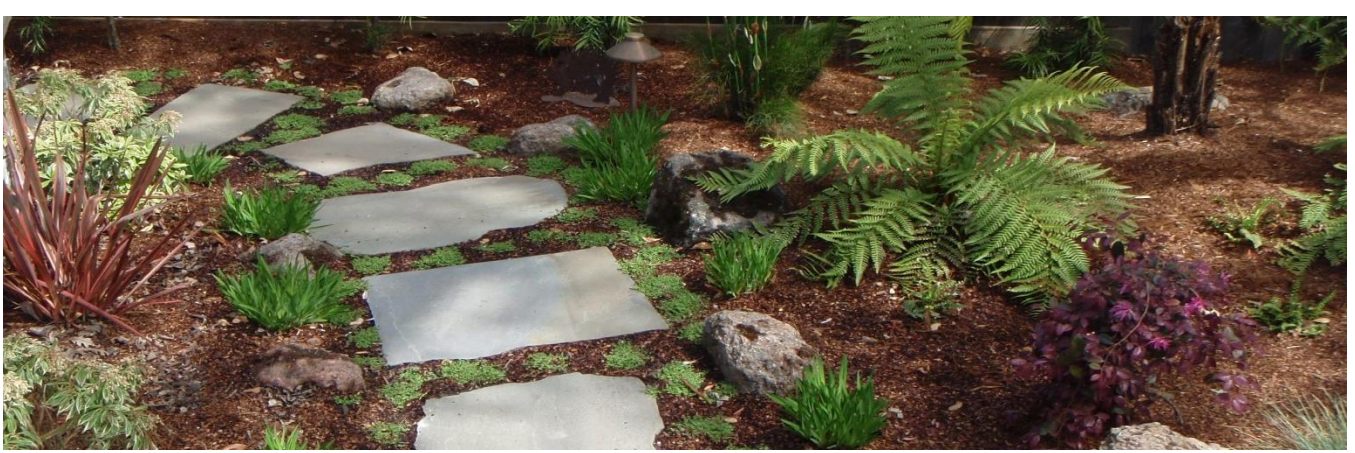


Dispose of Unwanted Paints/Products

- Dispose of unwanted oil-based and latex paints, thinners, sludge, adhesives, etc. by bringing them to the hazardous waste facility. This includes containers with hardened residue in them – with the exception of small amounts (less than 1 inch) of hardened latex paint in a can which may be tossed in the trash with the lid taken off. (See “Hazardous Waste Collection Facility” on back of this brochure.)

Paint Removal and Building Cleaning

- Sweep paint chips and dust from non-hazardous dry stripping & sand blasting into plastic drop cloths. Dispose as trash.
- Chemical paint stripping residue and chips and dust from marine paints or paints containing lead, mercury or tributyl tin must be disposed of as hazardous wastes. Lead-based paint removal requires a state certified contractor. For more information, go to <http://www.cdph.ca.gov/programs/CLPPB/Page/s/LRCHomeLeadTest.aspx> or <http://www.epa.gov/lead/index.html>
- Wash water from painted buildings constructed before 1978 can contain high amounts of lead, even without paint chips. Before you begin pressure washing or stripping pre-1978 building exteriors, test paint for lead by taking paint scrapings to a state-certified laboratory. See Yellow Pages under Laboratories - Analytical. If laboratory analysis shows that the paint contains lead, under no circumstances should you dry sand, belt sand, use open flame or power wash.
- When stripping or cleaning building exteriors with high-pressure water, block storm drains. Direct wash water onto a dirt area and spade into soil. Or, check with the local wastewater treatment authority to find out if you can collect (mop or vacuum) building cleaning water and dispose to the sanitary sewer. Sampling of the water may be required to assist the wastewater treatment authority in making its decision.



Congrats on your project! But remember, you can help . . .

Slow the Flow, Keep Rain Onsite!

- When it rains, **large volumes of runoff** from our roofs, driveways, and streets pour into our local creeks.
- All of this runoff, or stormwater, can **harm fish and insects** in their creek habitat, sometimes washing them away.
- Runoff also carries pollutants like bacteria, pesticides, and heavy metals into our creeks, bays and the ocean.
- State and Local Clean Water Laws require certain projects to balance increased runoff from hard surfaces by including areas that slow the flow, filter pollutants, and improve creek health for years to come!

If your project is creating or replacing **2,500 sq.ft. or more of hard surfaces** like roof tops, sidewalks, or driveways you will need to submit a Stormwater Control Plan (SCP) that details design onsite to reduce post-construction runoff:

	Amount of Hard Surfaces/Type of Project	Requirements
Small Projects	<ul style="list-style-type: none"> ≥2,500 sq.ft. Single Family Detached Home ≥2,500 to <5,000 sq.ft. Other projects 	Small Project SCP that outlines site design measures that keep stormwater from leaving your property
Regulated Projects	≥5,000 sq.ft. All projects except Single Family Detached Homes	Regulated Project SCP that shows site design measures, source control, and bioretention to mitigate increased runoff



Site design measures include limiting grading and impervious surfaces, directing runoff to landscaping, using pervious pavements, conserving and planting natural areas, and having a setback from the stream.

For details on requirements and templates for Small and Regulated Projects, visit the MCSTOPPP Post-Construction website:

<http://www.marincounty.org/depts/pw/divisions/mcstoppp/development/new-and-redevelopment-projects?panelnum=2>



POLLUTION PREVENTION

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MAKE SURE YOUR CREWS AND SUBS DO THE JOB RIGHT!

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DEWATERING OPERATIONS

- ▶ Reuse uncontaminated water for dust control, irrigation, or another on-site purpose to the greatest extent possible.
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HAZARDOUS MATERIALS MANAGEMENT

- ▶ Label all hazardous materials/wastes (such as pesticides, paints, thinners, solvents, fuel, oil, and antifreeze) in accordance with city, state, and federal regulations.
- ▶ Store hazardous materials and wastes in secondary containment and cover them during wet weather.
- ▶ Follow manufacturer's application instructions for hazardous materials. Be careful not to use more than necessary.
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CONTINUED ON BACK

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LANDSCAPING

- ▶ Schedule grading and excavation projects for dry weather.
- ▶ Disturb the least amount of soil and existing vegetation as possible to complete the work.
- ▶ Protect stockpiles and landscaping materials from wind and rain by storing them under secured tarps or plastic sheeting and berm as needed to prevent run-on.
- ▶ Protect storm drain inlets with gravel bag berms, filter mats or other inlet protection measures.
- ▶ Use temporary check dams, wattles, silt fences, and other sediment control devices to keep your dirt onsite.
- ▶ Revegetate the area. It's an excellent form of erosion control for any site.
- ▶ Store pesticides, fertilizers, and other chemicals indoors or in a locked shed or storage cabinet with secondary containment. Clean up all spills immediately.
- ▶ Make sure all products are properly labeled and check inventory before buying additional products.
- ▶ Properly rinse and dispose of containers according to the manufacturer's label recommendations.
- ▶ Take all unwanted products to the haz-waste facility. (See reverse for Hazardous Materials Management.)
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- ▶ Do not place yard waste in gutters. In communities with curbside yard waste recycling, leave clippings and pruning waste for pick-up in approved bags or containers or, take to a landfill that composts yard waste.
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POOL/SPA MAINTENANCE

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- ▶ Frequently inspect vehicles and equipment for leaks. Use drip pans to catch leaks until repairs are made; repair leaks promptly.
- ▶ Do not clean vehicles or equipment on site using soaps, solvents, degreasers, steam cleaning equipment, etc.
- ▶ Do not conduct fueling or maintenance for vehicles or equipment on site unless absolutely necessary. If fueling or maintenance must be done, put down tarps or plastic in a bermed area and use drip pans large enough to contain any spills. Collect and dispose of any hazardous materials properly.

SAW CUTTING

- ▶ Always completely seal or barricade storm drain inlets when saw cutting. Use sand bags, barrier dikes, adhesive mats, or similar to keep all slurry, water, and fines out of the storm drain system. If saw-cut slurry materials enter a storm drain, clean up with dry methods or vacuum the storm drain immediately.
- ▶ Shovel, absorb, and/or vacuum up saw-cut slurry, water and fines as you're cutting. Remove all waste in sealed, transportable containers as soon as you are finished.

STORMWATER COORDINATORS

(Call During Normal Business Hours)

Town of San Anselmo
415-258-4616

City of Sausalito
415-289-4100

Town of Corte Madera
415-927-5057

City of San Rafael
415-485-3355

City of Belvedere
415-435-3838

County Unincorporated
415-473-6528

Town of Ross
415-453-1453

Town of Tiburon
415-435-7354

Town of Fairfax
415-458-2370

City of Larkspur
415-927-5017

City of Novato
415-897-4361

City of Mill Valley
415-388-4033

To report illegal discharges to storm drains or local waterways occurring after normal business hours, call 911 or your local fire department.

To report oil and chemical spills occurring in "open waters" or "on land" call 1-800-OILS911

To report habitat destruction, fish kills, or poaching, call the California Department of Fish and Wildlife at 888-334-2258.

PERMITTING AGENCIES

Plan in advance. Obtaining some permits can be a lengthy process and may take up to a year depending on the complexity of your project.

Bay Area Joint Aquatic Resources Permit Application (JARPA)

This is a permit application for development, construction, grading, erosion repair, or restoration activities in or near Bay Area aquatic environments. It allows applicants to fill out one application, and submit copies of the same information to all of the state, federal, and regional agencies involved in the permitting process. The local permits still need to be filled out separately. The JARPA application is available online at www.mcstoppp.org, under "Caring for our Creeks". Click on "Creek permits" and then on "JARPA application". Access the JARPA site directly at:

<http://www.abag.ca.gov/bayarea/sfep/projects/JARPA/JARPA.html>

Does your project require California Environmental Quality Act (CEQA) Review?

The main purpose of CEQA review is to identify and prevent significant potential environmental impacts from proposed projects. CEQA review is usually handled by the local municipality's planning department. The cost of preparing an initial study or a full CEQA document is often passed on to the property owner.

California Department of Fish and Game

P.O. Box 47, Yountville, CA 94599

(707) 944-5500

www.dfg.ca.gov/1600/

Contact DFG for an application, or submit a completed JARPA application. The agreement fee for most homeowner streambank repair projects is \$500 if the overall cost of the project is between \$10,000 and \$25,000. The complete fee schedule for the Lake and Streambed Alteration Agreement with DFG is available online: <http://www.dfg.ca.gov/1600/fees2005.html>



U.S. Army Corps of Engineers
333 Market Street, Suite 812, San Francisco,
CA 94105

(415) 977-8436

www.spn.usace.army.mill/regulatory/

Streambank repair work often comes under Nationwide Permit 13: Bank Stabilization, and there will be no charge for the permit, although the ACOE may need advance notification of the work. If your project does not fall under Nationwide Permit 13 requirements, and depending on the details of the repair, the permit fee may be up to \$100. Call for the appropriate form, or submit a completed JARPA application.

S. F. Bay Regional Water Quality Control Board

1515 Clay Street, Suite 1400, Oakland, CA
94612

(510) 622-2300

<http://www.swrcb.ca.gov/rwqcb2/certs.htm>

The Water Board issues water quality certifications for all Army Corps of Engineers permits. Contact the RWQCB for an application, or submit a completed JARPA application. Consult the Water Board website for a permit fee schedule for bank stabilization projects.

Local Permitting Agency

Visit the MCSTOPPP website, <http://mcstoppp.org>, and contact your local MCSTOPPP stormwater coordinator for more information on local creek permit requirements. For unincorporated Marin, contact the Marin County Public Works Department, (415)499-6549. The Public Works Department issues any necessary grading, building, or creek permits for unincorporated Marin. Call or visit the website below for information regarding applications or fees. www.co.marin.ca.us/depts/pw/main/landdevelopment.cfm

What Causes Erosion?

Develop an effective solution to creekbank erosion by understanding it's causes. Flowing water removes creekbank sediment and may originate from the following three sources or a combination of these sources:

Surface Flow: Often the easiest to address. Water flowing over the top of the ground usually causes steep, vertical bank erosion. Common sources include culverts, driveways, ditches or drainage from roofs.

Ground Water: Water flowing a few inches to a few feet below the ground frequently surfaces on a creekbank before reaching the creek channel. Planting these areas with native plants is a good method for controlling erosion caused by groundwater. Check to make sure you are not indirectly contributing excess subsurface flow through yard or garden irrigation.

Stream Dynamics: Natural changes - such as big storm events or human activities - can cause the creek channel to adjust. Removing vegetation along a creek can reduce creekbank stability. This can lead to creekbank failure, particularly during large storm events.

Modifications to a creek's bed and bank will alter how the water flows and may increase erosion both upstream and downstream. An increase in sediment from erosion in the watershed will cause alternate banks to erode in a classic "S" pattern as growing gravel bars direct creekflow into the opposite bank. A fallen tree or other obstruction can cause site-specific erosion.



Repairing Creekbank Erosion



For more information on creek stewardship, see **Creek Care: A Guide for Marin Residents.**





For a free copy call the
Marin County Stormwater Pollution
Prevention Program at:

(415) 499-6528

www.mcstoppp.org




IS ALL EROSION BAD?

Not necessarily. Creeks need to be able to adjust to storm events in the watershed by changing their shape. Undercut banks and fallen trees provide important habitat for salmonid fish (coho salmon and steelhead) and other creek dwellers. Answering the following questions can help you determine whether to intervene or let nature take its course:

-  Is the erosion threatening a structure, road, utility pole, or other property?
-  Is it threatening riparian habitat or a special tree?
-  Is it extremely active? Does it grow rapidly during most rainstorms?
-  Does it appear to be caused by a person-made change, such as road, culvert, or yard drainage?

AM I WORKING ON A CREEK?

A creek is defined as any drainage with a definite bed and bank. There are three general classifications of creeks:

-  Perennial – flows year-round.
-  Intermittent – surface flow only occurs during a portion of the year (the creek dries up in the summer).
-  Ephemeral – flows only during and shortly after rain events.

Before beginning work on any creek, even a small intermittent or ephemeral creek, the U.S. Army Corps of Engineers, the CA Department of Fish and Game, the S.F. Bay Regional Water Quality Control Board, and your local municipality require regulatory review of the proposed project.

According to the Water Board's Basin Plan, all creeks, drainages, and tributaries have the same beneficial uses as the major stream systems of which they are a part. These small creeks are a fundamental part of Marin's watersheds, and preserving their habitat and function is just as critical as protecting the habitat of the larger streams and the Bay.

STEPS TO TAKE!

Document the site. If you are repairing your erosion site yourself, you will need this information for getting permits. If an engineer or agency is helping you, this information will save them time, and you money.

Photograph the site. Remember to include a reference object to indicate size.

Make a sketch of the site. Include length and height of the eroding area. Show structures and how far away they are. Include vegetation and any biological information you know, i.e. last year steelhead spawned here, etc.

Walk up and down the creek if you can. Indicate on your sketch what is happening near your site. Investigate possible upstream sources of erosion such as a fallen tree, rock riprap, or anything that might redirect the flow of water. Are your neighbors experiencing similar erosion problems?

Should this be a cooperative project?

If some of your neighbors have similar streambank erosion, you might want to consider working together. Benefits include sharing the permit and planning costs, and building repairs that complement and even enhance each other. Cooperative projects, done in conjunction with a local agency or group, also may be eligible for private or government grant programs.



Consider professional help. You should consider professional help when:

Costs are high. Either the repair is major, and/or an effective repair could result in significant damage to a structure, road, or other valuable property.

Working space is limited. This situation often requires technical expertise. **County laws and common sense dictate professional design.** For example, in Marin County, most creek work projects require a permit.

Your attempts to repair the erosion aren't working and you're stumped! Civil engineers, biologists, and other restoration specialists can be helpful in designing repairs. Ask the individual or firm if they have done this type of work before. How do they plan to repair the site? How will they access the site? What type of equipment will be used? How long will the work take? What is the estimated cost of designing and constructing the repair? Can they assist you in obtaining the permits? Ask to visit project sites they have repaired, and discuss the project with the homeowner.

Consider a range of alternatives. Remember fish and wildlife! Be sure not to constrict the channel. *Stream Corridor Restoration: Principles, Processes and Practices* contains hands-on, practical advice, available online at:

http://www.nrcs.usda.gov/technical/stream_restoration/. You can also find information at: www.mcstoppp.org, under "Caring for our Creeks". Click on "Anne Riley's Primer on Stream and River Protection for the Regulator and Program Manager".

Include native plants in your repair. The extensive root systems of some native plants can help with creekbank stability. Even rock riprap, when interplanted with willows or other trees, can enhance habitat. Willow walls, brush mattresses, and other techniques known as bio-technical bank stabilization can stabilize creekbanks completely with living materials. They are described at www.mcstoppp.org under the subject "Creek Bank Restoration & Repair Guidance."



Obtain necessary permits. Most creek repair work requires permits from the U.S. Army Corps of Engineers, the Regional Water Quality Control Board, CA Department of Fish & Game, and your local municipality (your city, or for unincorporated Marin, the County of Marin).

Do the work carefully. Be careful to protect water quality and existing habitat during construction. Proper measures should be taken to avoid muddying the water. Protect existing native plants if possible, or salvage native plants prior to construction and incorporate them in the final re-vegetation stage. Generally, all work must be completed after April 15th and before October 15th of each year.

Monitor and care for your repair.

Water newly planted vegetation throughout the first few post-project summers to allow plants to succeed. Check your repair before the winter rainy season and after each storm. Prevent your project from failing by addressing small problems sooner rather than later.

Take photographs for a few years after project completion from the same point where you shot the "before" photo. It's fun to see the changes, and it may even help others design more effective repairs.



Disclaimer

Every attempt has been made to assure that the information contained in this publication is accurate. The County of Marin, its cities, the Marin County Stormwater Pollution Prevention Program, and the Marin County Department of Public Works assume no responsibility and disclaim any liability for any injury or damage resulting from the use or effect of any product or information specified in this publication.

Low Impact Development (LID)

A Sensible Approach to Land Development and Stormwater Management



An educational program for land use decision makers that addresses the relationship between land use and natural resource protection.



What is Low Impact Development (LID)?

LID is an alternative method of land development that seeks to maintain the natural hydrologic character of the site or region. The natural hydrology, or movement of water through a watershed, is shaped over centuries under location-specific conditions to form a balanced and efficient system. When hardened surfaces such as roads, parking lots, and rooftops are constructed, the movement of water is altered; in particular, the amount of runoff increases and infiltration decreases. This results in increased peak flow rate and volume, and pollution levels in stormwater runoff. LID designs with nature in mind: working with the natural landscape and hydrology to minimize these changes. LID accomplishes this through source control, retaining more water on the site where it falls, rather than using traditional methods of funneling water via pipes into local waterways. Both improved site design and specific management measures are utilized in LID designs. LID has been applied to government, residential, and commercial development and redevelopment, and has proven to be a cost-efficient and effective method for managing runoff and protecting the environment.

Using LID Tools in Residential Development

NATURAL DRAINAGE FLOW
Reduces need for grading and constructed drainage systems by building house in a location that permits preservation of natural pattern of stormwater drainage

PRESERVED NATIVE VEGETATION
Enhances the aesthetic quality of community and improves the evaporation-transpiration rate

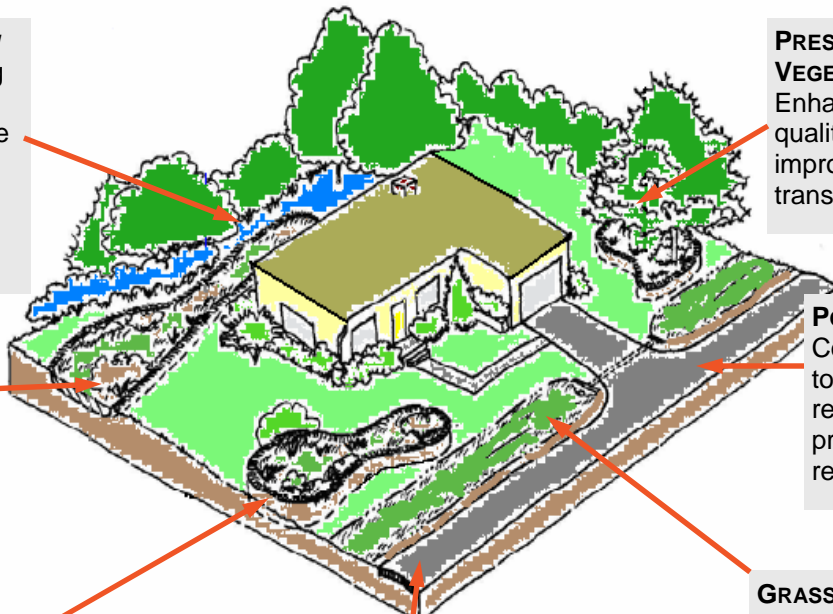
BIORETENTION CELL OR RAIN GARDEN
Depressions that contain soil amendments that promote infiltration of stormwater

POROUS PAVEMENT
Concrete that allows rain to infiltrate, thereby reducing runoff and promoting groundwater recharge

AMENDED SOIL
Soil enriched with sand and organic materials increases the capacity of soil to infiltrate water

REDUCED HARDSCAPE
Narrower streets, sidewalks, and driveways increases pervious areas and open spaces

GRASSY SWALE
Vegetated channels that slow stormwater runoff and promotes infiltration, traps sediment, and helps treat pollutants



Traditional vs. LID Stormwater Management

Historically, in the U.S., the motto for stormwater management has been “**conveyance**,” move water away from the site where it falls as quickly and efficiently as possible. Traditional management tools include street gutters and curbs, pipes, and canals to remove water from the developed areas. To receive this increased volume, creeks and rivers are re-shaped and lined with concrete. Detention ponds, some with water quality filtration devices, regulate discharge to reduce peak flow impacts on receiving waters. For the most part, these practices reduce flood impacts, but do not completely address water quality, and aquatic and riparian habitat degradation issues.

In contrast with the traditional approaches, the guiding principle of low impact development approaches is not conveyance; it is “**source control and infiltration**”. LID techniques seek to maximize the area available for infiltration so that runoff volume and pollutant concentrations are reduced. This is achieved through a variety of site design and engineered infiltration techniques. Site design techniques include locating open spaces in low-lying areas to serve as a detention/retention basin and avoid development on permeable soils to promote infiltration and groundwater recharge. Engineered techniques include the use of grassy swales, bioretention cells, and porous pavement.

LID Benefits

Water Quality

- Contributes to groundwater recharge through infiltration
- Improves surface water quality
- Protects stream and lake quality from large volumes of polluted runoff

Meets Clean Water Act Requirements

- Source control reduces the pollutant level and volume of runoff entering a water body, complying with National Pollutant Discharge Elimination System (NPDES) and anti-degradation policy;
- This also aids in complying with 401 certification requirements

Flood Control

- Reduces frequency & severity of floods
- Reduces peak flow volume & velocity

Habitat Protection

- Preserves stream & riparian habitats
- Preserves regional trees & vegetation
- Reduces eroded sediment loading into streams & lakes

Community Value

- Increases aesthetics and recreational opportunities in protected riparian habitats
- Increases land value by having a cleaner environment
- Increases public/private collaborative partnerships

LID Challenges

Lack of Information

- Many municipal planners, consultants and the general public are unfamiliar with the benefits of LID practices and how to utilize them in different environments.

Inflexible Regulations/Ordinances

- Existing rules often lack the flexibility to implement LID solutions

Maintenance

- Some LID tools require maintenance by homeowners and local public works departments to function properly

Presence of Contaminants

- Use of filtration practices can threaten groundwater quality if high levels of soil contaminants are present.



Stormdrain leading to bioretention cell

Roof runoff drains to grassy swale

www.main.nc.us/riverlink/content/12chap/chap12.htm

Economic Issues

The **economic benefits** of LID include:

- Reduced costs of stormwater infrastructure, including curbs and gutters
- Reduced stormwater utility fees
- Increased land value
- Decreased spending on current and future environmental conservation programs

Specific cost savings vary on a case by case basis. There can be **additional costs**:

- Higher installation costs for certain soil types and gradients
- Increased landscape maintenance costs

Issue	Savings
Higher Lot Value	\$3000 more per lot
Lower Cost Per Lot	\$4800 less cost per lot
Enhanced Marketability	80% of lots sold in first year
Added Amenities	23.5 acres of green-space/parks
Recognition	National, state, and professional
Total Economic Benefit	Over \$2,200,000 added to profit

The above table, from **Gap Creek residential subdivision**, Sherwood, AR, illustrates the financial benefits of using LID methods. *Tyne & Associates, North Little Rock, AR*

Addressing LID Implementation Challenges

Solutions

Clay Soils/Limited Space

The combination of clay soils and small lot sizes can work well together. As clays are naturally less pervious, less engineering and land is required to achieve predevelopment infiltration rates. Use integrated stormwater management techniques, a combination of traditional and LID approaches. Significant stormwater runoff reduction can still be achieved.

Local Codes Aren't LID-friendly

Revise local codes & ordinances to support use of LID techniques. Check out the Center for Watershed Protection's website for suggested guidelines (www.cwp.org/COW_worksheet.htm).

Don't know what would work and where

Educate planning & public works staff. Numerous references are available on the use of LID in a variety of settings (see Online References).

Some communities that have found solutions

Hercules has modified stormwater management guidelines that fit LID principles, city codes that allow administrative approval for LID projects, and limited street lengths.

Contra Costa incorporated LID measures into their Standard Urban Stormwater Management Plan (SUSMP) for new development (<http://www.ccleanwater.org/construction/nd.php>). **Sacramento**, likewise, is publishing their own design manual in Fall, 2006 that includes LID measures.

San Diego has new parking standards for intensive commercial zones that include smaller parking spaces and driveways, plus new guidelines requiring reduced imperviousness for parking spaces.

Santa Monica encourages LID by requiring that all new developments and substantial remodels submit an "Urban Runoff Mitigation Plan", and reduce projected runoff for the site by 20%. The city recommends LID technologies.

LID as a Re-design Strategy

Retrofit a Parking Lot to increase permeability. Over sixty-five percent of impervious areas are associated with "habitat for cars". Using porous pavement in parking lots is a simple way to increase infiltration and reduce runoff. When the US Navy Yard in Washington, D.C. needed to repave its parking lot, they used porous pavers. They also added bioretention cells to the landscaped areas and disconnected downspouts. The re-design did not alter the amount of parking spots, but reduced peak runoff and pollution, thus protecting and helping to restore the Anacostia and Potomac Rivers and the Chesapeake Bay.



Porous pavement covers about 1/3 of each parking space in the D.C. Navy Yard parking



LID street design: vegetated swales, no curbs, and narrower streets promote infiltration of stormwater.

Alter street design to increase infiltration. In a landmark project in Seattle, the Street Edge Alternative or SEA project involved building vegetated swales, bioretention cells, and narrower streets without curbs to promote an effective drainage and filtration system. The system reduced peak runoff for the 2 year flood event by 98%, and is capable of conveying the 25 year flood event. The local watershed provides spawning habitat for endangered salmon. The project was so successful that similar ones are being planned throughout the city.

Replace lawns with rain gardens. Rain gardens are small bioretention cells landscaped with plants, trees, and grasses. They are a particularly good way for individual homeowners to enhance their landscaping while protecting water quality. By planting easy-care native wildflowers, hardy perennials and grasses, attractive gardens can be constructed that have the added environmental benefits. More information on rain gardens is available at: <http://www.healthylandscapes.org/raingarden.htm>. Information on plants compatible for use in a California rain garden is posted at:

http://www.bbg.org/gar2/topics/design/2004sp_raingardens.html.



Rain garden in a small backyard that collects runoff from roof and patio.

LID as a Design Strategy

LID is more than a collection of engineered tools. It is a comprehensive design technique incorporating site planning and integrated management measures.

LID design principles include:

- Extensive site assessment of hydrology, topography, soils, vegetation and water features;
- Higher density, clustered housing, preserving open spaces to facilitate infiltration and protect habitats;
- Street layout that minimizes road length and width, calming traffic while allowing safe access of emergency vehicles.

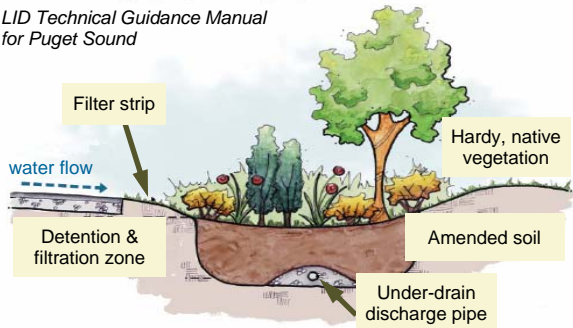
LID Technical Guidance Manual for Puget Sound



In this example, LID design reduces imperviousness by changing the cul-de-sac design, reducing street width and lot size, and instead clustering houses around common green spaces that also serve as infiltration sites and preserving natural features.

Examples of LID

LID Technical Guidance Manual for Puget Sound



Basic Components of a Bioretention Cell

To see how to engineer bioretention cells with the proper gradient and components visit:
www.lowimpactdevelopment.org/epa03/biospec.htm



Rain Gardens and grass swales between houses are used at Douglas Ranch, Granite Bay, CA to catch and filter runoff from roofs and driveways before entering a local stream.



Curb Cuts permit stormwater to flow into grassy swales to reduce roadway contaminants that flow into nearby waterways. They can also be used in *existing* landscaped areas.



Hollywood Driveways have a dividing strip of grass in order to reduce the amount of impervious surface. Another way to reduce driveway space is to share one with a neighbor.

Online Resources

Low Impact Development Center
 U.S. Environmental Protection Agency
 Stormwater Manager's Resource Center
 National NEMO Network
 LID Urban Design Tools
 National Association of Home Builders
 California Stormwater Quality Association

www.lowimpactdevelopment.org
www.epa.gov/owow/nps/urban.html
www.stormwatercenter.net
www.nemonet.uconn.edu
www.lid-stormwater.net
www.toolbase.org/index-toolbase.asp
www.cabmphandbooks.com

Prepared by Office of Environmental Health Hazard Assessment & the California Water & Land Use Partnership (CA WALUP)
 Written by E. Ruby & D. Gillespie, student interns, OEHHA. For more information contact Barbara Washburn: bwashburn@oehha.ca.gov.

CA WALUP is an educational program for land use decision makers addressing the relationship between land use and natural resource protection. The CA WALUP is a Charter Member of the National NEMO Network. CA WALUP website: <http://cawalup.usc.edu>



Attachment 5. Operations & Maintenance Plan