# Appendix J

Standard Urban Stormwater Mitigation Plan

# STANDARD URBAN STORMWATER MITIGATION PLAN (SUSMP)

**For:**

## TTM 78210
## THE TERRACES AT WALNUT
## CITY OF WALNUT,

**Prepared for:**

# SUNJOINT DEVELOPMENT, LLC

**280 Machlin Ct.**
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## Background

On December 13, 2001, the Los Angeles Regional Water Quality Control Board (LARWQCB) adopted a National Pollutant Discharge Elimination System (NPDES) Permit (Order No. 01-182) to regulate municipal and urban runoff stormwater discharges within the County of Los Angeles. This Order was superseded by Order No. R4-2012-0175, NPDES No. CAS004001, which was adopted by the LARWQCB on November 8, 2012 and became effective on December 28, 21012. Under this Order, the Los Angeles County Flood Control District and incorporated cities within the County, including the City of Walnut, are required to ensure that all new development and redevelopment projects minimize impacts from storm water runoff and urban runoff discharges. Section VI.D of the Order requires the implementation of a Planning and Land Development Program (Program) pursuant to Part VI.D.7.b for all New Development and Redevelopment projects that trigger the applicability criteria discussed within Part VI.D.7.b. The development of this Standard Urban Stormwater Mitigation Plan (SUSMP) is intended to satisfy the requirements set forth in Order No. R4-2012-0175, Part VI.D.7. The SUSMP also ensures that the proposed post-construction Best Management Practices (BMPs) incorporated into the project will be maintained in perpetuity to reduce the discharge of pollutants from storm water and urban runoff discharges to the maximum extent practicable (MEP).

## Project Information

Sunjoint Development LLC. proposes to develop approximately 49 acres within Los Angeles County. The Project is located northeast of the intersection of North Grand Avenue and East Valley Boulevard within the City of Walnut (see Figure 1). The Project consists of 240 small lot single family units and a commercial area with sub-level parking.

Since the proposed project includes the creation and development of a commercial and residency lot with more than 10,000 square feet or more of impervious surface area, a Planning and Land Development Program is required and being implemented through this SUSMP. This SUSMP has been prepared in accordance with the requirements stated within Order NO. R4-2012-0175 and the Los Angeles County SUSMP Manual dated September 2002. This SUSMP provides information about the proposed project and discusses how features incorporated into the project design meet the applicable Planning and Land Development Program requirements. Appendices have been included to provide supporting detail.

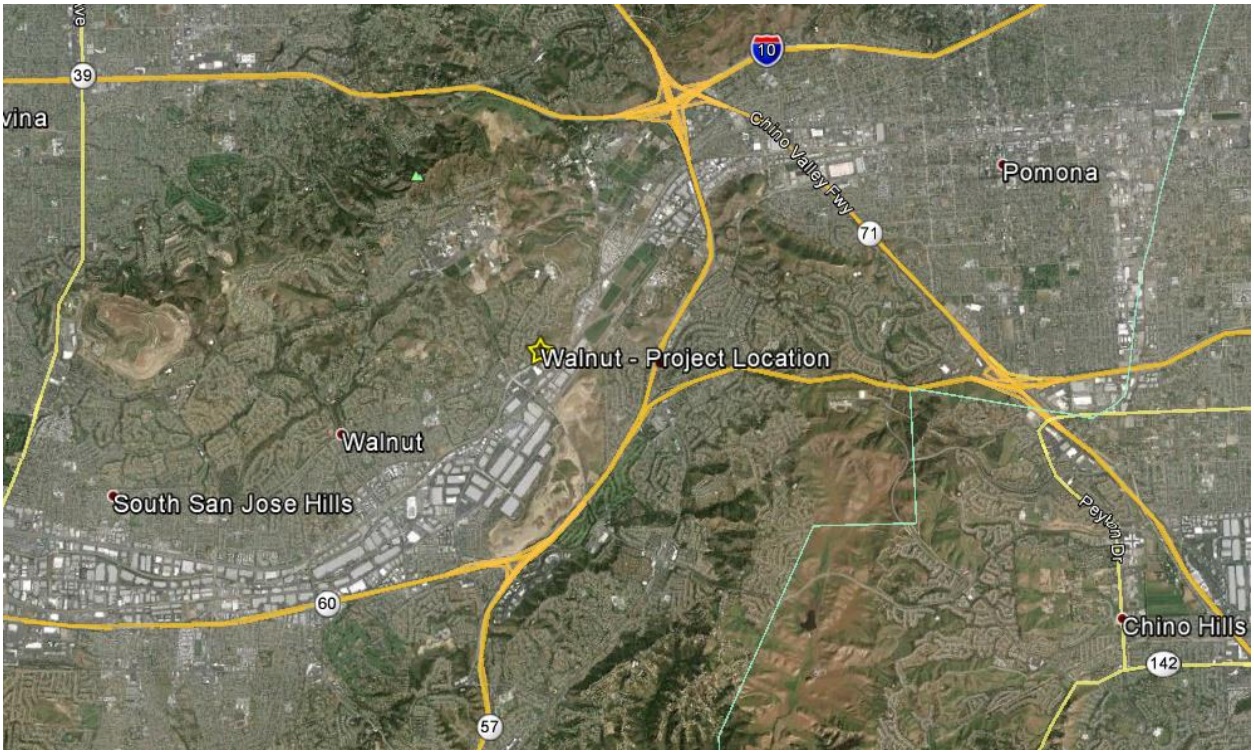
## Project Designation

Part 7.b.i of Order NO. R4-2012-0175 states: “Development projects subject to Permittee conditioning and approval for the design and implementation of post-construction controls to mitigate storm water pollution, prior to completion of the project(s), are:

(a) All development projects equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious surface area”

The Project is a **Designated Project/Planning Priority Project,** since the project area proposed is greater than 1 acre and will add more than 10,000 square feet of impervious surface area.

**Figure 1: Vicinity Map**




## Project Site Watershed

The project is located within the San Gabriel River Watershed which covers over 640 square miles. The San Gabriel River Watershed is located in the eastern portion of Los Angeles County. It is bound by the San Gabriel Mountains to the north, most of San Bernardino/Orange County to the east, the division of the Los Angeles River from the San Gabriel River to the west, and the Pacific Ocean to the south. The watershed drains into the San Gabriel River from the San Gabriel Mountains flowing 58 miles south until its confluence with the Pacific Ocean. Major tributaries to the San Gabriel River include Walnut Creek, San Jose Creek, Coyote Creek, and numerous storm drains from 19 incorporated cities. Channel flows pass through different sections in the San Gabriel River, diverting from the riverbed into four different spreading grounds, held behind several rubber dams for controlled flow and ground water recharge, and controlled through 10 miles of concrete channel bottom from below Whittier Narrows Dam to past Coyote Creek.

## Existing Drainage Patterns

The existing conditions for this site is an undeveloped open space with a hill in the middle. The site had been previously graded and has existing concrete v-ditches that drain the surface runoff into existing storm drains. The site is considered as 90% pervious and 10% impervious. Pipe flow enters San Jose Creek, a reinforced cement concrete (RCC) Channel. San Jose Creek confluences with the San Gabriel River to the east and eventually discharges into the Pacific Ocean.

Under existing development conditions, storm water is conveyed by surface flow from the project site to the existing north and south storm drain system along Valley Boulevard and onto adjacent neighborhood property. There are four existing sub drainage areas, each with its own drainage path.

In the existing condition sub-area A (1.5 acres) sheet flows to the northwestern corner of the site, enters a v-ditch, and drains into an inlet within the residential area along Roundup Dr.

Area D (17.2 acres), located in the northeast corner of the Project site flows east and enters the storm drain system along North Valley Blvd. The north storm drain system connects directly to San Jose Creek Channel.

Areas B and C both have surface flow that drain south into the existing storm drain system running south on Valley Blvd. Area B (11.3 acres) surface flow drains southwest along a concrete v-ditch and enters the storm drain system between the residential property and Walnut City Parks and Recreation facility. Area C (20.3 acres) also drains south and enters a catch basin onsite that also is conveyed south on Valley Blvd.

Details regarding the existing drainage areas are located in Appendix A, Exhibit A and the Hydrology Analysis.

## Proposed Drainage Patterns

The proposed site is comprised of about 45% pervious and 55% impervious surface area. The project includes small lot single family residential area with pocket parks and commercial area with sub-level parking. The development will direct flow to the Valley Blvd storm drain systems. The following outlines the drainage nodes and flow paths of the post development condition as indicated in the Hydrology Analysis.
Hydrology node Node 100- 0.4 acres flows to the northwestern corner of the site and the 1.1 acres of represents the existing sub-area A that drains towards the residential area. Due to the proposed grading, runoff to will be directed south towards Node 200 where it will be able to be mitigated for pollutants and flood.

Node 200.1 represents the initial area of the residential site that confluences with Node 200.2 downstream. Node 200.2 represents the connection to the flood basin that then will connect to Node 200.4. Node 200.4 represents the connection to the commercial area and Katchall Kleerstreem vault.

Node 200.3 represents the initial commercial area that will drain into the Katchall vault at node 200.4.

Node 200.4 will then connect to the existing 24” RCP along Valley Blvd at node 200.
Hydrology node Node 300- represents 8.1 acres of the project slope areas that are self-treating for pollution prevention and will be captured into pipes and drains and enters the existing storm drain system along North Valley Blvd.
Details regarding the proposed drainage areas are located in Appendix A, Exhibit B and the Hydrology Analysis.

## SUSMP Requirements

The Planning and Land Development Program requires that each Permittee implement a Program pursuant to Part VI.D.7.b for all New Development and Redevelopment projects subject to this Order to:

*"(1) Lessen the water quality impacts of development by using smart growth practices such as compact development, directing development towards existing communities via infill or redevelopment, and safeguarding of environmentally sensitive areas.*
*(2) Minimize the adverse impacts from storm water runoff on the biological integrity of Natural Drainage Systems and the beneficial uses of water bodies in accordance with requirements under CEQA (Cal. Pub. Resources Code § 21000 et seq.).*
*(3) Minimize the percentage of impervious surfaces on land developments by minimizing soil compaction during construction, designing projects to minimize the impervious area footprint, and employing Low Impact Development (LID) design principles to mimic predevelopment hydrology through infiltration, evapotranspiration and rainfall harvest and use.*
*(4) Maintain existing riparian buffers and enhance riparian buffers when possible.*
*(5) Minimize pollutant loadings from impervious surfaces such as roof tops, parking lots, and roadways through the use of properly designed, technically appropriate BMPs (including Source Control BMPs such as good housekeeping practices), LID Strategies, and Treatment Control BMPs.*
*(6) Properly select, design and maintain LID and Hydromodification Control BMPs to address pollutants that are likely to be generated, reduce changes to pre-development hydrology, assure long-term function, and avoid the breeding of vectors.*
*(7) Prioritize the selection of BMPs to remove storm water pollutants, reduce storm water runoff volume, and beneficially use storm water to support an integrated approach to protecting water quality and managing water resources in the following order of preference:*
*(a) On-site infiltration/retention, bioretention and/or rainfall harvest and use.*
*(b) On-site biofiltration, off-site ground water replenishment, and/or off-site retrofit."*
*(c) On-site Flow-through BMPs*

The following 17 categories are intended to address the requirements set forth by the Order. The following sections address each of the required categories and address how the proposed project meets the Program requirements to the MEP.

## 1. Smart Growth and Low Impact Development Practices

The sub-level parking structure inherently maximizes parking availability while minimizing impermeable surface footprint.

## 2. Conserve and Enhance Riparian Buffers and Natural Areas

Existing landscaped areas will be retained when feasible. Parks, vegetated slope areas, and common vegetated backyards will be placed throughout the site and will serve as vegetated buffers. The existing site does not have natural areas; area appears to be graded and vegetated.

## 3. Minimize Impervious Surfaces

As discussed in the first two sections, impervious surface is minimized by implementing vegetated surfaces, such as parks and slopes.

## 4. Protect Beneficial Uses and Biological Integrity of Natural Waters

According to Part VI.D.7.a of the Order, the Planning and Land Development Program must also address mitigation of potential adverse impacts on the biological integrity of Natural Drainage Systems and the beneficial uses of receiving water bodies in accordance with requirements under the California Environmental Quality Act (CEQA) (Cal. Pub. Resources Code § 21000 et seq.). The proposed project BMPs are designed to reduce potential pollutants of concern generated

from the development as well as mitigate any potential increase of runoff from the project through flood control measures.

## 5. Minimize Storm Water Pollutants of Concern

Pollutants generating from developed areas are dependent upon the type of development and land use is associated with the specific project. The project contains parking areas, commercial areas, streets, pedestrian access, vegetated and residential areas. Pollutants anticipated to be generated on-site are suspended solids, total phosphorus, copper, lead, zinc, total nitrogen, and TKN, see Table 1 below.

**Table 1: Typical Pollutants of Concern**

| Land Use | Pollutants of Concern [2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Suspended Solids | Total Phosphorus | Total Nitrogen | Total Kjeldahl Nitrogen | Cadmium, Total | Chromium, Total | Copper, Total | Lead, Total | Zinc, Total |
| High Density Single Family Residential | X | X | | | [4] | [4] | X | X | X |
| Multi-Family Residential | X | | | | [4] | [4] | X | | X |
| Mixed Residential | X | X | X | | [4] | [4] | X | X | X |
| Commercial | X | X | X | X | [4] | [4] | X | X | X |
| Industrial | X | X | X | X | [4] | [4] | X | X | X |
| Critical Facilities [3] | X | [4] | [4] | [4] | [4] | [4] | X | X | X |
| Transportation (streets, roads) | X | X | X | X | [4] | [4] | X | X | X |
| Institutional (educational facilities) | X | | | | [4] | [4] | X | | X |

[1] Adapted from Table A-3 of the *Technical Manual for Stormwater Best Management Practices in the County of Los Angeles* (February 2004) and the Southern California Coastal Water Research Project Land Use Specific Storm Water Monitoring Data. X = exceedance of "standard" by observed median/average concentration; blank = no exceedance of "standard" by observed median/average concentration.

[2] Derived from Table 11 of the 2012 Los Angeles County MS4 Permit (page 104).

[3] Critical facilities include automobile dismantling (SIC 50xx), automobile repair (SIC 75xx), metal fabrication (SIC 34xx), motor freight (SIC 42xx), automobile dealerships (SIC 55xx), chemical manufacturing (SIC 28xx), and machinery manufacturing (SIC 35xx).

[4] No available data to determine if these pollutants of concern originate from this land use. Pollutant is assumed to be produced by this land use unless otherwise proven by the project applicant.

Receiving waters which are impaired for one or any of the pollutants of concern which are anticipated from the project need to be addressed through the proposed project BMPs. Table 2 provides a list of downstream receiving water body impairments including both 303(d) and TMDL impairments.

**Table 2: Receiving Water Body Impairments**

| Receiving Water Body | 2012 303(d) Impairment(s) | TMDL(s) |
|---|---|---|
| San Jose Creek Reach 2 | Coliform Bacteria | None |
| San Jose Creek Reach 1 | Ammonia, Coliform Bacteria, pH, Total Dissolved Solids, Toxicity | Coliform Bacteria (Est. 2009) |
| San Gabriel River Reach 3 | Indicator Bacteria | None |
| San Gabriel River Reach 2 | Coliform Bacteria, Cyanide, Lead | Coliform Bacteria (Est. 2011), Lead (Est. 2007) |
| San Gabriel River Reach 1 | Coliform Bacteria, pH, | pH (Est. 2009) |

All of the potential pollutants of concern anticipated from the site will be controlled using the proposed biofiltration basins with underdrains and Katchall Kleerstream units.

Details regarding the BMPs configuration, treatment process, and maintenance are attached in the fact sheets located in Appendix B.

**Low Impact Development (LID) Strategies**

Three biofiltration basins with underdrains are proposed to treat runoff from the residential areas, Area 1A in Exhibit B. Biofiltration basins provide a vegetated area and allow ponding during storm events and filter through the biofilters via biofiltration soil media before being collected by an underdrain. Biofiltration can be used to treat Total Nitrogen, Total Kjeldahl Nitrogen, Chromuim, and Lead. Katchall Kleerstream vaults is an online system used to treat first flush storm water runoff. Katchall Kleerstream vaults with mixed media are designed to treat Nitrates, Nitrites, Phosphates and Phosphorous, and Heavy Metals. Calculations, BMP selection, and BMP sizing can be found in Appendix A.

**Treatment Control BMPs**

The site will implement three biofiltration basins with underdrains in order to treat Areas A1, B1, B2, and C1 of the residential areas. Underdrains are required due to the instability of the site topography. The remaining areas 1A-5, 1A-6, and 3A-1 will be treated with Katchall Kleerstream, a flow-through BMP.

Details for treatment control BMPs are located in Appendix B. A BMP Drainage Map is provided in Appendix A Exhibit C.

**Source Control BMPs**

Additionally, the following non-structural BMPs will be implemented to reduce or eliminate the off-site discharge of pollutants:

- Routine landscape maintenance, including proper pickup and disposal of trash throughout the site (including parking areas), sediment and green waste
- Proper fertilizer and pesticide management (minimizing use, not applying before predicted rain, proper disposal of unused/excess product).
- Automated Smart Timer irrigation system with moisture sensors to minimize excess runoff.
- The parking structure and surface level parking lots will receive street sweeping services as needed. Recommended frequency is bi-monthly.
- Activity restrictions including but not limited to: dumping hazardous material into the storm drains, washing down contaminated spills from the parking areas into the storm drain,

washing and cleaning of vehicles, repair or maintenance of vehicles that would allow oil, grease, fuel, or other fluid into the storm drain.

- Single trash cans are only anticipated in common areas such as parks and parking lots. Trash cans will be free of debris and emptied on a weekly basis. Increase frequency as needed.
- Litter control and maintenance throughout the property and parking structure.
- Hose bibs are not anticipated within the structure and are not being implemented on site.
- Public education through storm drain stencils on all storm drain inlets and catch basins.
- Fire line testing activities are considered routine maintenance and testing activities necessary for the protection of life and property. These activities include building fire suppression system maintenance and testing (e.g. sprinkler line flushing) and fire hydrant testing and maintenance. These activities are classified as Conditionally Exempt Essential Non-Storm Water Discharges. On-site testing is anticipated to take place twice annually. Recommendations and requirements include and are not limited to:
    - Testing shall take place during the dry season on non-rainy days only.
    - Prior to discharge sediment/debris/trash or any other visible pollutants must be removed from the gutters and/or flow paths to avoid discharging pollutants into the drains and underground infiltration system.
    - All discharge must be drained to a landscaped area or to the BMP in a non-erosive manner.
    - Maintenance personnel performing tests are required to comply with all of the requirements set forth in the CAL FIRE, Office of the State Fire Marshal's *Water-Based Fire Protection Systems Discharge Best Management Practices Manual* (September 2011) or equivalent BMP manual for fire training activities and post-emergency firefighting activities.
    - Whenever there is a discharge of 100,000 gallons or more into the MS4, Permittees shall require advance notification by the discharger to the potentially affected MS4 Permittees, including at a minimum the LACFCD, if applicable, and the Permittee with jurisdiction over the land area from which the discharge originates.

Details for source control BMPs are located in Appendix B.

## 6. BMP Selection Criteria

The Order requires the selection of BMPs to be prioritized based on the most effective means to remove storm water pollutants, reduce storm water runoff volume, and beneficially use storm water to support an integrated approach to protecting water quality and managing water resources. The order of preference is on-site infiltration, bioretention, and/or rainfall harvest and use. The Order also states, when evaluating the potential for on-site retention, each project shall also consider the maximum potential for evapotranspiration from green roofs and rainfall harvest and use. When 100% on-site retention is determined to be infeasible, the project site may biofiltrate, 1.5 times the portion of the remaining SWQDv. The remaining SWQDv that cannot be retained or biofiltered must reduce the pollutant loading through the use of flow-through BMPs. Flow-through BMPs must be sized based on the intensity of at least 0.2 inches per hour or one year one-hour rainfall intensity as determined by the most recent Los Angeles County hydrology web-based map.

Due to the complexity of the project, it is infeasible to retain 100% SWQDv. The density and the topography creates significant difficulty for compliance with on-site retention. The second option for compliance is biofiltration. This project includes three biofiltration basins (A, B and C) that will

treat the residential area. Areas 1A-1, 1A-2, and 1A-3 are treated by basins A, B, and C respectively. Area 1A-4 is treated by a combination of the three basins.

Due to the complexity of the development, it is infeasible to biofiltate the remaining acreage of the site. Therefore, flow-through BMPs will be placed to treat the remaining area. Katchalls will be placed to treat Areas 1A-5, 1A-6, and 3A-1. .

Details regarding the proposed drainage areas are located in Appendix A, Exhibit C.

## 7. Design Standards for Structural or Treatment Control BMPs

The design standards for structural or treatment control BMPs presented in this section are intended to meet the design requirements in the Order.

**Storm Water Quality Design**

Except as provided in Part VI.D.7.c.ii. (Technical Infeasibility or Opportunity for Regional Ground Water Replenishment), Part VI.D.7.d.i (Local Ordinance Equivalence), or Part VI.D.7.c.v (Hydromodification), the project is required to retain on-site the SWQDv defined as the runoff from the 0.75-inch, 24-hour rain event or the 85th percentile, 24-hour rain event, as determined from the Los Angeles County 85th percentile precipitation isohyetal map, whichever is greater. The project site is located in an area where the 85$^{th}$ percentile, 24-hour precipitation depth is 1 inch and will therefore govern as the design precipitation depth. The isohyetal map including the project location is provided in Appendix A.

BMP sizing calculations are provided in Appendix A of the SUSMP.

The volume of stormwater runoff that must be retained/treated at a project site is calculated using HydroCalc and summarized in Table 3.

**Table 3: Stormwater Runoff Volume**

| SubArea ID | Area (ac) | 85$^{th}$ Percentile Runoff Volume (ac-ft) | Remaining 1.5 x SWQDv Biofiltration (ac-ft) | Basin Volume Provided (ac-ft) |
|---|---|---|---|---|
| 1A-1 | 3.40 | 0.19 | 0.28 | 0.45 |
| 1A-2 | 8.17 | 0.45 | 0.68 | 1.04 |
| 1A-3 | 6.85 | 0.38 | 0.57 | 0.63 |
| 1A-4 | 6.55 | 0.36 | 0.54 | |
| **TOTAL** | **24.97** | **1.38** | **2.07** | **2.11** |

The remaining SWQDv will be treated using flow-through BMPs.Katchall Kleerstream. BMPs selected must meet the pollutant-specific benchmarks as required per NPDES permit. Flow-through BMPs must be sized based on the greater of the rainfall intensity of 0.2 inches per hour or the 1-year 1-hour rainfall intensity determined by the most recent Los Angeles County isohyetal map. The 1-year 1-hour intensity for the project site is 0.36 according to the Los Angeles County hydrology manual.

Katchall Kleerstream vaults are designed according to the water quality flow rate and the 50-year peak flow rate. The Katchall Kleerstream was designed using Rational Method for peak flow analysis. Rainfall intensities include the 0.36 in/hr for water quality flow analysis and intensities taken from Hydrocalc for the 50-year. SWQDv's for the peak flows through BMPs can

be seen below in Table 4 and Katchall Kleerstream design flow capacities can be found in Appendix B.

**Table 4: SWQDv Flow-Through BMP's**

| SubArea ID | Area (ac) | 1-year Rainfall Intensity Peak Flow Rate (cfs) | 50-year Rainfall Intensity Peak Flow Rate (cfs) | Katchall Media Flow Rate (cfs) | Katchall Overflow Rate (cfs) | Model Proposed |
|---|---|---|---|---|---|---|
| **1A-5** | 3.75 | 0.95 | 6.07 | 2.34 | 7.45 | Model #8-6-6 |
| **1A-6** | 2.23 | 0.72 | 4.95 | 2.34 | 7.45 | Model # 8-6-6 |
| **3A-1** | 5.23 | 1.69 | 11.57 | 3.12 | 16 | Model #10-8-6 |

The remaining area is self treating area or areas outside of the hydrology boundary. BASIN

## Hydromodification Requirements

As stated in the Hydromodification (Flow/Volume/Duration) Control Criteria, Part VI.D.7.c.iv in the Order;

> *"Each Permittee shall require all New Development and Redevelopment projects located within natural drainage systems as described in Part VI.D.7.c.iv.(1)(a)(iii) to implement hydrologic control measures, to prevent accelerated downstream erosion and to protect stream habitat in natural drainage systems. The purpose of the hydrologic controls is to minimize changes in post-development hydrologic storm water runoff discharge rates, velocities, and duration. This shall be achieved by maintaining the project's pre-project storm water runoff flow rates and durations."*

Natural drainage systems that are subject to the hydromodification assessments and controls as described in the Order include all drainages that have not been improved (e.g., channelized or armored with concrete, shot-crete, or rip-rap) or drainage systems that are tributary to a natural drainage system.

Project Exemptions:

Per Part VI.D.7c.iv.(1)(b) of the Order, Permittees may exempt the following projects from implementation of hydromodification controls where assessments of downstream channel conditions and proposed discharge hydrology indicate that adverse hydromodification effects to beneficial uses of Natural Drainage Systems are unlikely:

1. Projects that are replacement, maintenance or repair of a Permittee's existing flood control facility, storm drain, or transportation network.
2. Redevelopment Projects in the Urban Core that do not increase the effective impervious area or decrease the infiltration capacity of pervious areas compared to the pre-project conditions.
3. Projects that have any increased discharge directly or via a storm drain to a sump, lake, area under tidal influence, into a waterway that has a 100-year peak flow (Q100) of 25,000 cfs or more, or other receiving water that is not susceptible to hydromodification impacts.
4. Projects that discharge directly or via a storm drain into concrete or otherwise engineered (not natural) channels (e.g., channelized or armored with rip rap, shotcrete, etc.), which, in turn, discharge into receiving water that is not susceptible to hydromodification impacts.

5. LID BMPs implemented on single family homes are sufficient to comply with hydromodification criteria.

The project development discharges directly into the storm drain system and then enters San Jose Creek, which is a concrete lined channel. The project is considered exempt per condition number 4.

## 8. Protect Slopes and Channels

Slopes will be protected by safely conveying stormwater runoff from the tops of slopes and slopes will be vegetated with native or drought-tolerant species.

## 9. Provide Storm Drain System Stenciling and Signage

All on-site storm drain inlets/catch basins will be labeled with "No Dumping – Drains to Ocean" or an equivalent message as directed by the City. Markers may be purchased from the City for a nominal fee. An example of an approved stencil can be found in Appendix E.

## 10. Properly Design Outdoor Material Storage Areas

This requirement does not apply to the project, as the project does not include any outdoor material storage areas. There are no proposed outdoor storage facilities or activities involving vehicle fueling, vehicle washing, or food processing on the site.

## 11. Properly Design Trash Storage Areas

Single trash cans are anticipated in park areas, parking lots, and community collection trash areas. Trash cans will be free of debris and emptied weekly, increase frequency as needed. Storage areas will be on impervious paved surface area and constructed to divert storm water runoff. Signs will be posted on all dumpsters to discourage the disposal of liquids and hazardous materials.

## 12. Provide Proof of Ongoing BMP Maintenance

A combination of structural and non-structural BMPs will be implemented and maintained where applicable by Home Owner Association (HOA) in the residential area and by commercial owners in the commercial area to minimize the pollutants of concern and to maximize the pollutant reduction to the MEP.

The following is a description of routine maintenance activities for each of the BMPs being implemented in the project:

- Katchall Kleerstream will need to be inspected once during dry season if present and every 4 months during wet season for obstructions and or accumulations.
- Mixed media within the Katchall Kleerstream rule of thumb for replacement is about 3-5 years for residential areas and 1-2 years for commercial areas.
- Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years).
- Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly-designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the biofiltration area and flow dissipation and erosion protection strategies in the pretreatment area and flow entrance should be reassessed. If sediment is deposited in

the biofiltration area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits. Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species.

- Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.
- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, biofiltration facilities are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters.
- In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two to three inch depth at least once every two years.

The biofiltration basins, drainage system, and Katchall Kleerstream vaults in the residential area will be maintained by the HOA, while the Katchall Kleerstream and drainage system in the commercial area will be maintained by commercial owners.

In order to certify that the BMPs implemented as a part of this project are maintained properly, inspection forms have been developed with maintenance procedures for the HOA and commercial area. An Operation and Maintenance Plan has been included in Appendix D and highlights what needs to be maintained, signs that maintenance is necessary, how maintenance should be conducted, who to contact for assistance, and inspection forms to assist in facilitating the inspection process and recordkeeping. Inspection records shall be kept in an easy to access location for review by regulatory agencies, as necessary. BMP inspection forms and detailed maintenance requirements are also included in Appendix D.

## 13. Individual Priority Project Categories

Table 5 shows individual priority project categories included in this project and those that were not included.

**Table 5: Priority Project Categories**

| Category | Requirement | Check One | | Explanation |
|---|---|---|---|---|
| | | Included | Not Applicable | |
| Single-Family Hillside Home | Conserve natural areas | X | | See below |
| | Protect slopes and channels | X | | See below |
| 1 acre or larger Industrial /Commercial Development | Properly design loading/unloading dock areas | X | | See below |
| | Properly design repair/maintenance bays | | X | No repair bays |
| | Properly design vehicle/equipment wash areas | | X | No wash areas |
| Restaurants | Properly design equipment/accessory wash areas | X | | See below |
| Retail Gasoline Outlets | Properly design fueling area | | X | Not a gasoline outlet |
| Automotive Repair Shops | Properly design fueling area | | X | Not an auto repair shop |
| | Properly design repair/maintenance bays | | X | Not an auto repair shop |
| | Properly design vehicle/equipment wash areas | | X | Not an auto repair shop |
| | Properly design loading/unloading dock areas | | X | Not an auto repair shop |
| Parking Lots | Properly design parking area | X | | See below |
| | Properly design to limit oil contamination and perform maintenance | X | | See below |

Hillside Homes or Hillside Management Area (HMA)" means any portion of a lot or parcel of land which contains terrain with a natural slope gradient of 25 percent or steeper.
Specific Requirements:

1. Conserve natural areas;
2. Protect slopes and channels;
3. Provide storm drain system stenciling and signage;
4. Divert roof runoff to vegetated areas before discharge, unless the diversion would result in slope instability; and
5. Direct surface flow to vegetated areas before discharge unless the diversion would result in slope instability.

The proposed project will conserve natural areas such as slopes and pocket parks. Slopes will be well established with vegetation and retaining walls. Direct surface flow to vegetated slopes will result in slope instability.

Restaurants within the commercial area shall properly design accessory wash areas. Restaurants will have designated wash areas and will be inspected periodically.

Commercial loading areas with loading and unloading dock areas.

Specific Requirements:

1. Provide designated loading and unloading area. Construct/pave outdoor loading/unloading dock areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to materials being handled in the loading/unloading dock area.
2. The loading and unloading docks will be covered and designed to preclude urban run-on and runoff. Cover outdoor loading/unloading dock areas to a distance of at least 10 feet beyond the loading dock or building face if there is no raised dock. If the cover or roof structure does not include sidewalls, then the roof overhang must extend beyond the grade break. The overhang must extend a minimum of 20 percent of the roof height.
    a. If covers or interior transfer bays are not feasible, install a seal or door skirt and provide a cover to shield all material transfers between trailers and building.

Designated commercial loading and unloading areas will be provided and will be designed with impervious surface. Loading docks will either have a cover to prevent run-on and runoff or cover shields and sealed doors will be used.

"Parking Lot" means land area or facility for parking or storage of motor vehicles used for business, commerce, industry, or personal use, with a lot size of 5000 square feet or more of surface area, or with 25 or more parking spaces.

Specific Requirements:

1. Properly Design Parking Area
    - Reduce impervious land coverage of parking area by providing planter strips between parking bays.
    - Infiltrate runoff into landscaped areas before it reaches the storm drain system.
    - Treat runoff on-site before it reaches the street and storm drain system.

2. Properly Design to Limit Oil Contamination and Perform Maintenance
    - Treat to remove oil and petroleum hydrocarbons at parking lots that are heavily used.
    - Ensure adequate operation and maintenance of treatment systems, particularly sludge and oil removal, system fouling, and plugging prevention control.

The commercial area, parking lots and structure have been designed to minimize the offsite transport of pollutants by treating the first flush runoff through the proposed Katchall Kleerstream devices. The system will treat all of the runoff produced from the 85$^{th}$ percentile storm event. There are no proposed outdoor storage facilities or activities involving vehicle fueling, or vehicle washing on the site.

## 14. Mitigation Funding

Mitigation will be funded by the homeowners association and commercial renting fees for operation, inspection, routine maintenance, and upkeep of stormwater quality control measures.

## 15. Limitation on Use of On-Site Infiltration and Retention BMPs

According to Part 7.c.ii.2 of the Order, to demonstrate technical infeasibility, the project applicant must demonstrate that the project cannot reliably retain 100 percent of the SWQDv on-site, even

with the maximum application of green roofs and rainwater harvest and use. The applicant must also demonstrate that compliance with the applicable post-construction requirements would be technically infeasible by submitting a site-specific hydrologic and/or design analysis conducted and endorsed by a registered professional engineer, geologist, architect, and/or landscape architect. Technical infeasibility may result from conditions including:

a) The infiltration rate of saturated in-situ soils is less than 0.3 inch per hour and it is not technically feasible to amend the in-situ soils to attain an infiltration rate necessary to achieve reliable performance of infiltration or bioretention BMPs in retaining the SWQDv on-site.
b) Locations where seasonal high ground water is within 5 to 10 feet of the surface,
c) Locations within 100 feet of a ground water well used for drinking water,
d) Brownfield development sites where infiltration poses a risk of causing pollutant mobilization,
e) Other locations where pollutant mobilization is a documented concern
f) Locations with potential geotechnical hazards, or
g) Smart growth and infill or redevelopment locations where the density and/or nature of the project would create significant difficulty for compliance with the on-site volume retention requirement.)

The nature (high slopes) and density of the project site would create significant difficulty in meeting the on-site retention requirement, therefore biofiltration and flow-through BMPs will be used.

## 16. Certification for Stormwater Treatment Mitigation

The proposed improvements stated within this SUSMP are believed to meet the requirements set forth in Order No. R4-2012-0175. Rebecca Kinney, a registered Civil Engineer in the State of California, will provide certification for the information and water quality recommendations found in this report. Modifications to the project plans or variations in subsurface conditions due to any activities prior to installation of the BMPs may require re-evaluation of the recommendations contained in this report. The data, opinions, and recommendations contained herein are applicable to the specific design elements and locations which are the subject of this report. Data, opinions, and recommendations herein have no applicability to any other design elements or to any other locations, and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Michael Baker International.

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. Include printed name, position/title and date along with signature.

| Printed Name | Position/Title | Signature | Date |
|---|---|---|---|

## 17. References

| SUGGESTED RESOURCES | HOW TO GET A COPY |
|---|---|
| *Stormwater Quality- MS4 permit*<br>MS4 Discharges within the Coastal Watersheds of Los Angeles County – Order No. R4-2012-0175 NPDES No. CAS004001 | http://ladpw.org/wmd/NPDES/ |
| *City of Walnut Municipal Code: Title V. Public Works Chapter 21-80 Stormwater Pollution Control Measures for Development* | http://qcode.us/codes/walnut/ |
| *County of Los Angeles Municipal Code* | https://www.municode.com/library/ca/los_angeles_county/codes/code_of_ordinances?nodeId=TIT12ENPR_CH12.84LOIMDEST |
| *2014 the County of Los Angeles revised LID requirements* | http://dpw.lacounty.gov/wmd/dsp_LowImpactDevelopment.cfm |
| *The Los Angeles County Storm Drain System* | http://dpw.lacounty.gov/fcd/stormdrain/disclaimer.cfm |
| *California Storm Water Best Management Practices Handbooks (2003) for Construction Activity, Municipal, and Industrial/Commercial* - Presents a description of a large variety of Structural BMPs, Treatment Control, BMPs and Source Control BMPs | Los Angeles County Department of Public Works<br>Cashiers Office<br>900 S. Fremont Avenue<br>Alhambra, CA 91803<br>(626) 458-6959 |
| *Second Nature: Adapting LA's Landscape for Sustainable Living* (1999) by Tree People Detailed discussion of BMP designs presented to conserve water, improve water quality, and achieve flood protection | Tree People<br>12601 Mullholland Drive<br>Beverly Hills, CA 90210<br>(818) 753-4600 (?<br>info@treepeople.org |
| *Caltrans Storm Water Quality Handbook: Planning and Design Staff Guide (Best Management Practices Handbooks* (1998) - Presents guidance for design of storm water BMPs | California Department of Transportation<br>P.O. Box 942874<br>Sacramento, CA 94274<br>(916) 653-2975 |

# APPENDIX A: Hydrology Maps, Hydrology Results, and BMP Location Map


## LEGEND

- DRAINAGE BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- 1B / 11.3 — SUBAREA DESIGNATION / AREA (ACRES)
- 100 — HYDROLOGY NODE
- EXISTING STORM DRAIN

250 125 0 250

SCALE: 1"=250'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# EXHIBIT A
# EXISITING HYDROLOGY
# TTM 78210
# THE TERRACES AT WALNUT

SINGLE FAMILY
12 LOTS
60'X120'

100

1C
0.4

200.1

300

1D
8.1

1A
35.3

3A
5.2

200.3

200.2

200.4

200

NO HOSE BIBS OR WASHING AREAS IN SUBTERRANEAN PARKING STRUCTURE.

PROPOSED DETENTION BASIN

EAST VALLEY BOULEVARD
NORTH STORM DRAIN CONNECTION
TO SAN JOSE CREEK

EAST VALLEY BOULEVARD
SOUTH STORM DRAIN
CONNECTION TO SAN JOSE
CREEK

NORTH

## LEGEND

- DRAINAGE BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- 1B / 11.3 — SUBAREA DESIGNATION / AREA (ACRES)
- 100 — HYDROLOGY NODE

200 100 0 200

SCALE: 1"=200'

# EXHIBIT B
# PROPOSED HYDROLOGY MAP
# TTM 78210
# THE TERRACES AT WALNUT

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SINGLE FAMILY
12 LOTS
60'X120'

1C
0.4

1A-1
3.4

1A-3
6.9

1D
8.1

1A-4
6.6

1A-2
8.2

1A-5
3.8

1A-6
2.2

3A-1
5.2

BASIN A

BASIN B

BASIN C

KATCHALL VAULT 1

KATCHALL VAULT 2

KATCHALL VAULT 3

PROPOSED DETENTION BASIN

NORTH VALLEY BOULEVARD STORM DRAIN CONNECTION TO SAN JOSE CREEK

SOUTH VALLEY BOULEVARD STORM DRAIN CONNECTION TO SAN JOSE CREEK

NO HOSE BIBS OR WASHING AREAS IN SUBTERRANEAN PARKING STRUCTURE.

COMMERCIAL PAD

NORTH

## LEGEND

- DRAINAGE BOUNDARY
- FLOW PATH
- STORM DRAIN
- B-12 / 11.3 — SUBAREA DESIGNATION / AREA (ACRES)
- OPEN SPACE/ VEGETATED AREA
- AREA TREATED BY BASIN A
- AREA TREATED BY BASIN B
- AREA TREATED BY BASIN C
- AREA TREATED BY BASINS A, B, AND C
- AREA TREATED BY KATCHALL VAULT 1
- AREA TREATED BY KATCHALL VAULT 2
- AREA TREATED BY KATCHALL VAULT 3
- BIORETENTION BASIN
- KATCHALL VAULT

200 100 0 200

SCALE: 1"=200'

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# EXHIBIT C
# BMP LOCATION MAP
# TTM 78210
# THE TERRACES AT WALNUT

# Appendix B: BMP Fact Sheets

# BIO-1: Biofiltration

### Definition

A biofiltration area is a vegetated shallow depression that is designed to receive and treat stormwater runoff from downspouts, piped inlets, or sheet flow from adjoining paved areas. A shallow ponding zone is provided above the vegetated surface for temporary storage of stormwater runoff. During storm events, stormwater runoff accumulates in the ponding zone and gradually infiltrates the surface and filters through the biofiltration soil media before being collected by an underdrain system.

Stormwater runoff treatment occurs through a variety of natural mechanisms as stormwater runoff filters through the vegetation root zone. In biofiltration areas, microbes and organic material in the biofiltration soil media help promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture and promote the drying of the soil through transpiration. Biofiltration areas are typically planted with native, drought-tolerant plant species that do not require fertilization and can withstand wet soils for at least 96 hours.

A schematic of a typical biofiltration area is presented in Figure E-7.

#### *LID Ordinance Requirements*

Biofiltration can be used as an alternative compliance measure.

| Pollutant of Concern | Treated by Biofiltration? |
|---|---|
| Suspended solids | No |
| Total phosphorus | No |
| Total nitrogen | Yes |
| Total Kjeldahl nitrogen | Yes |
| Cadmium, total | No |
| Chromium, total | Yes |
| Copper, total | No |
| Lead, total | Yes |
| Zinc, total | No |

Source: Treatment Best Management Practices Performance, Los Angeles Regional Water Quality Control Board, December 9, 2013.

***Advantages***

- Has a low cost for installation
- Enhances site aesthetics
- Requires little maintenance

***Disadvantages***

- May require individual owner/tenants to perform maintenance

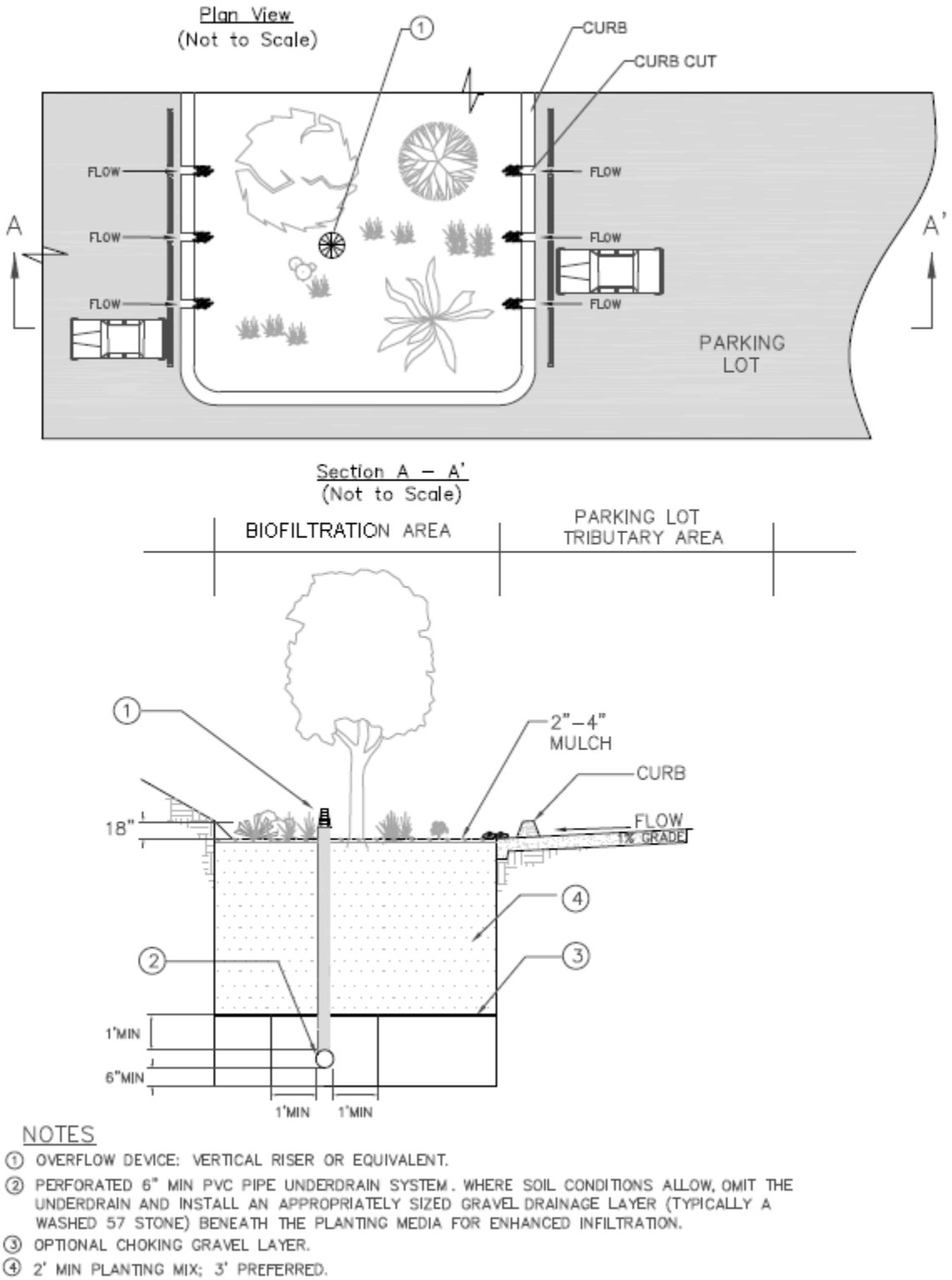



**Figure E-7. Biofiltration Area Schematic**

## General Constraints and Implementation Considerations

- Biofiltration areas can be applied in various settings including, but not limited to:
  - Individual lots for rooftop, driveway, and other on-site impervious surface
  - Shared facilities located in common areas for individual lots
  - Areas within loop roads or cul-de-sacs
  - Landscaped parking lot islands
  - Within right-of-ways along roads
  - Common landscaped areas in apartment complexes or other multi-family housing designs
  - Parks and along open space perimeter
- If tire curbs are provided and parking stalls are shortened, cars are allowed to overhang the biofiltration area.
- Biofiltration areas must be located sufficiently far from structure foundations to avoid damage to structures (as determined by a certified structural or geotechnical engineer).
- Any parking areas bordering the biofiltration area must be monolithically poured concrete or deepended curb concrete to provide structural stability to the adjacent parking section.
- Geomembrane liners must be used in areas subject to spills or pollutant hot spots.
- During construction activities should avoid compaction of native soils below planting media layer or gravel zone.
- Stormwater runoff must be diverted around the biofiltration area during the period of vegetation establishment. If diversion is not feasible, the graded and seeded areas must be protected with suitable sediment controls (i.e., silt fences).All damaged areas should be repaired, seeded, or re-planted immediately.
- The general landscape irrigation system should incorporate the biofiltration area, as applicable.

## Design Specifications

The following sections describe the design specifications for biofiltration areas.

### *Geotechnical*

Due to the potential to contaminate groundwater, cause slope instability, impact surrounding structures, and potential for insufficient infiltration capacity, an extensive geotechnical site investigation must be conducted during the site planning process to verify site suitability for biofiltration. All geotechnical investigations must be performed according to the most recent GMED Policy GS 200.1. Soil infiltration rates and the

groundwater table depth must be evaluated to ensure that conditions are satisfactory for proper operation of a biofiltration area. The project applicant must demonstrate through infiltration testing, soil logs, and the written opinion of a licensed civil engineer that sufficiently permeable soils exist on-site to allow the construction of a properly functioning biofiltration system.

Biofiltration areas are appropriate for soils with a minimum corrected in-situ infiltration rate of 0.3 in/hr. The geotechnical report must determine if the proposed project site is suitable for a biofiltration area and must recommend a design infiltration rate (see "Design Infiltration Rate" under the "Sizing" section). The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move through the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

***Pretreatment***

Pretreatment refers to design features that provide settling of large particles before stormwater runoff enters a stormwater quality control measure in order to reduce the long-term maintenance burden. Pretreatment should be provided to reduce the sediment load entering a biofiltration area in order to maintain the infiltration rate of the biofiltration area. To ensure that biofiltration areas are effective, the project applicant must incorporate pretreatment devices that provide sediment removal (e.g., vegetated swales, vegetated filter strips, sedimentation manholes, and proprietary devices). The use of at least two pretreatment devices is highly recommended for biofiltration areas.

***Geometry***

- Biofiltration areas must be sized to capture and treat 1.5 times the SWQDv that is not reliably retained on the project site with an 18-inch maximum ponding depth.
- The planting soil depth must be a minimum of two feet, although three feet is preferred. The planting soil depth should provide a beneficial root zone for the chosen vegetation and adequate water storage for the stormwater runoff. A deeper planting soil depth will also provide a smaller surface area footprint.
- A gravel storage layer below the biofiltration area soil media is required to provide adequate temporary storage to retain 1.5 times the SWQDv that is not reliably retained on the project site and to promote infiltration.

***Sizing***

Biofiltration areas are sized using a simple sizing method where 1.5 times the SWQDv that is not reliably retained on the project site must be completely filtered within 96 hours. If the incoming stormwater runoff flow rate is lower than the long term filtration rate, above ground storage does not need to be provided. If the incoming stormwater runoff flow rate is higher than the long term filtration rate, above ground storage shall be provided (see steps below).

Step 1: Calculate the design volume

Biofiltration areas should be sized to capture and treat 1.5 times the portion of the SWQDv (see Section 6 for SWQDv calculation procedures) that is not reliability retained on the project site, as calculated by the equation below:

$$V_B = 1.5 \times (SWQDv - V_R)$$

Where:

$V_B$ = Biofiltration volume [$ft^3$];
SWQDv = Stormwater quality design volume [$ft^3$]; and
$V_R$ = Volume of stormwater runoff reliably retained on-site [$ft^3$].

Step 2: Calculate the design infiltration rate

Determine the corrected in-situ infiltration rate ($f_{design}$) of the native soil using the procedures described in the most recent GMED Policy GS 200.1.

Step 3: Calculate the surface area

Select a surface ponding depth (d) that satisfies the geometric criteria and meets the site constraints. Selecting a deeper ponding depth (up to 1.5 ft) generally yields a smaller footprint, however, it will require greater consideration for public safety, energy dissipation, and plant selection.

Calculate the time for the selected ponding depth to filter through the planting media using the following equation:

$$\mathrm{d} = t_p \times \frac{\mathrm{f_{design}}}{12}$$

Where:

d = Ponding depth (max 1.5 ft) [ft];
$t_p$ = Required detention time for surface ponding (max 96 hr) [hr]; and
$f_{design}$ = Design infiltration rate [in/hr].

If $t_p$ exceeds 96 hours, reduce surface ponding depth (d). In nearly all cases, $t_p$ should not approach 96 hours unless $f_{design}$ is low.

Calculate the required infiltrating surface (filter bottom area) using the following equation:

$$A = \frac{V_B}{d}$$

Where:

A = Bottom surface area of biofiltration area [$ft^2$];
$V_B$ = Biofiltration design volume [$ft^3$]; and
d = Ponding depth (max 1.5 ft) [ft].

***Flow Entrance and Energy Dissipation***

Maintain a minimum slope of 1 percent for pervious surfaces and 0.5 percent for impervious surfaces to the biofiltration area inlet. The following types of flow entrance can be used for biofiltration cells:

- Level spreaders (i.e., slotted curbs) can be used to facilitate sheet flow.
- Dispersed, low velocity flow across a landscape area. Dispersed flow may not be possible given space limitations or if the biofiltration area is controlling roadway or parking lot flows where curbs are mandatory.
- Dispersed flow across pavement or gravel and past wheel stops for parking areas.
- Flow spreading trench around perimeter of biofiltration area. May be filled with pea gravel or vegetated with 3:1 side slopes similar to a swale. A vertical-walled open trench may also be used at the discretion of LACDPW.
- Curb cuts for roadside or parking lot areas, if approved by LACDPW: curb cuts should include rock or other erosion controls in the channel entrance to dissipate energy. Flow entrance should drop two to three inches from curb line and provide an area for settling and periodic removal of sediment and coarse material before flow dissipates to the remainder of the biofiltration area.
- Piped entrances, such as roof downspouts, should include rock, splash blocks, or other erosion controls at the entrance to dissipate energy and disperse flows.
- Woody plants (trees, shrubs, etc.) can restrict or concentrate flows and can be damaged by erosion around the root ball and must not be placed directly in the entrance flow path.

***Drainage***

Biofiltration areas must be designed to drain below the planting soil in less than 96 hours. Soils must be allowed to dry out periodically in order to restore hydraulic capacity to receive stormwater runoff from subsequent storm events, maintain infiltration rates, maintain adequate soil oxygen levels for healthy soil biota and vegetation, and provide proper soil conditions for biodegradation and retention of pollutants.

***Underdrain***

Biofiltration areas require an underdrain to collect and discharge stormwater runoff that has been filtered through the soil media, but not infiltrated, to another stormwater quality control measure, storm drain system, or receiving water. The underdrain must have a mainline diameter of eight inches using slotted PVC SDR 26 or PVC C9000. Slotted PVC allows for pressure water cleaning and root cutting, if necessary. The slotted pipe

should have two to four rows of slots cut perpendicular to the axis of the pipe or at right angles to the pitch of corrugations. Slots should be 0.04 to 0.1 inches wide with a length of 1 to 1.25 inches. Slots should be longitudinally-spaced such that the pipe has a minimum of one square inch opening per lineal foot and should face down.

The underdrain should be placed in a gravel envelope (Class 2 Permeable Material per Caltrans Spec. 68-1.025) that measures three feet wide and six inches deep. The underdrain is elevated from the bottom of the biofiltration area by six inches within the gravel envelope to create a fluctuating anaerobic/aerobic zone below the underdrain to facilitate denitrification within the anaerobic/anoxic zone and reduce nutrient concentrations. The top and sides of the underdrain pipe should be covered with gravel to a minimum depth of 12 inches. The underdrain and gravel envelope should be covered with a geomembrane liner to prevent clogging. The following aggregate should be used for the gravel envelope:

| Particle Size (ASTM D422) | % Passing by Weight |
|---|---|
| ¾ inch | 100% |
| ¼ inch | 30-60% |
| #8 | 20-50% |
| #50 | 3-12% |
| #200 | 0-1% |

Underdrains should be sloped at a minimum of 0.5 percent and must drain freely to an approved discharge point.

Rigid non-perforated observation pipes with a diameter equal to the underdrain diameter should be connected to the underdrain to provide a clean-out port as well as an observation well to monitor drainage rates. The wells/clean-outs should be connected to the perforated underdrain with the appropriate manufactured connections. The wells/clean-outs should extend six inches above the top elevation of the biofiltration area mulch, and should be capped with a lockable screw cap. The ends of underdrain pipes not terminating in an observation well/clean-out should also be capped.

***Hydraulic Restriction Layer***

Lateral infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent waterproofing, may be placed along the vertical walls to reduce lateral flows. This geomembrane liner must have a minimum thickness of 30 mils and meet the requirements of Table E-12. Generally, waterproof barriers should not be placed on the bottom of the biofiltration unit, as this would prevent incidental infiltration which is important to meeting the required pollutant load reduction.

**Table E-12. Geomembrane Liner Specifications for Biofiltration Areas**

| Parameter | Test Method | Specifications |
|---|---|---|
| Material | | Nonwoven geomembrane liner |
| Unit weight | | 8 oz/yd$^3$ (minimum) |
| Filtration rate | | 0.08 in/sec (minimum) |
| Puncture strength | ASTM D-751 (Modified) | 125 lbs (minimum) |
| Mullen burst strength | ASTM D-751 | 400 lb/in$^2$ (minimum) |
| Tensile strength | AST D-1682 | 300 lbs (minimum) |
| Equiv. opening size | US Standard Sieve | No. 80 (minimum) |

***Planting/Storage Media***

- The planting media placed in the biofiltration area should achieve a long-term, in-place infiltration rate of at least 5 in/hr. Higher infiltration rates of up to 12 in/hr are permissible. The biofiltration soil media must retain sufficient moisture to support vigorous plant growth.
- The planting media mix must consist of 60 to 80 percent sand and 20 to 40 percent compost.
- Sand should be free of wood, waste, coatings such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing the No. 200 sieve size should be non-plastic. Sand for biofiltration should be analyzed by an accredited laboratory using #200, #100, #40, #30, #16, #8, #4, and 3/8 sieves (ASTM D422 or as approved by the local permitting authority) and meet the following gradations (Note: all sand complying with ASTM C33 for fine aggregate comply with the gradation requirements listed below):

| Particle Size (ASTM D422) | % Passing by Weight |
|---|---|
| 3/8 inch | 100% |
| #4 | 90-100% |
| #8 | 70-100% |
| #16 | 40-95% |
| #30 | 15-70% |
| #40 | 5-55% |
| #110 | 0-15% |
| #200 | 0-5% |

Note: The gradation of the sand component of the biofiltration soil media is believed to be a major factor in the infiltration rate of the media mix. If the desired hydraulic conductivity of the biofiltration soil media cannot be achieved within the specified proportions of sand and compost (#2), then it may be necessary to utilize sand at the coarser end of the range specified minimum percent passing.

- Compost should be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes, or other organic material not including manure or biosolids meeting standards developed by the USCC. The product shall be certified through the USCC STA Program (a compost testing and information disclosure program). Compost quality shall be verified via a laboratory analysis to be:
    - Feedstock materials must be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
    - pH between 6.5 and 8.0 (may vary with plant palette)
    - Organic Matter: 35 to 75 percent dry weight basis
    - Carbon and Nitrogen Ratio: 15:1 < C:N < 25:1
    - Maturity/Stability: Compost must have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120°F) upon delivery or rewetting is not acceptable.
    - Toxicity: any one of the following measures is sufficient to indicate non-toxicity:
        - $NH_4$:$NH_3$ < 3
        - Ammonium < 500 ppm, dry weight basis
        - Seed germination > 80 percent of control
        - Plant trials > 80 percent of control
        - Solvita® > 5 index value
    - Nutrient content:
        - Total Nitrogen content ≥ 0.9 percent preferred
        - Total Boron should be < 80 ppm; soluble boron < 2.5 ppm
    - Salinity: < 6.0 mmhos/cm
    - Compost for biofiltration area should be analyzed by an accredited laboratory using #200, ¼-inch, ½-inch, and 1-inch sieves (ASTM D422) and meet the gradation requirements in the table below:

| Particle Size (ASTM D422) | % Passing by Weight |
|---|---|
| 1 inch | 99-100 |
| ½ inch | 90-100 |
| ¼ inch | 40-90 |
| #200 | 2-10 |

Tests should be sufficiently recent to represent the actual material that is anticipated to be delivered to the site. If processes or sources used by the supplier have changed significantly since the most recent testing, new tests should be requested.

The gradation of compost used in biofiltration soil media is believed to play an important role in the saturated infiltration rate of the media. To achieve a higher saturated infiltration rate, it may be necessary to utilize compost at the coarser end of the range (minimum percent passing). The percent passing the #200 sieve (fines) is believed to be the most important factor in hydraulic conductivity.

In addition, coarser compost mix provides more heterogeneity of the biofiltration soil media, which is believed to be advantageous for more rapid development of soil structure needed to support healthy biological processes. This may be an advantage for plant establishment with lower nutrient and water input.

- Biofiltration soil media not meeting the above criteria should be evaluated on a case-by-case basis. Alternative biofiltration soil media must meet the following specifications:

  "Soils for biofiltration facilities must be sufficiently permeable to infiltrate stormwater runoff at a minimum of rate of 5 in/hr during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation." The following steps shall be followed by LACDPW to verify that alternative biofiltration soil media mixes meet the specification:

  - Submittals – The applicant must submit to LACDPW for approval:
    - A sample of mixed biofiltration soil media.
    - Certification from the soil supplier or an accredited laboratory that the biofiltration soil media meets the requirements of this specification.
    - Certification from an accredited geotechnical testing laboratory that the biofiltration soil media has an infiltration rate between 5 and 12 in/hr.
    - Organic content test results of the biofiltration soil media. Organic content test shall be performed in accordance with the Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
    - Organic grain size analysis results of mixed biofiltration soil media performed in accordance with ASTM D422, Standard Test Method for Particle Size Analysis of Soils.
    - A description of the equipment and methods used to mix the sand and compost to produce the biofiltration soil media.
  - The name of the testing laboratory(ies) and the following information:

- Contact person(s)
- Address(es)
- Phone contact(s)
- E-mail address(es)
- Qualifications of laboratory(ies) and personnel including date of current certification by STA, ASTM, or approved equal.

o Biofiltration soils shall be analyzed by an accredited laboratory using #200 and ½-inch sieves (ASTM D422 or as approved by LACDPW), and meet the gradation described in the table below:

| Particle Size (ASTM D422) | % Passing by Weight |
|---|---|
| ½ inch | 97-100 |
| #200 | 2-5 |

- Biofiltration soil media shall be analyzed by an accredited geotechnical laboratory for the following tests:
  - o Moisture – density relationships (compaction tests) must be conducted on biofiltration soil media. Biofiltration soil media for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  - o Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.
- Mulch is recommended for the purpose of retaining moisture, preventing erosion, and minimizing weed growth. Projects subject to the California Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least 2 inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Biofiltration areas must be covered with two to four inches (average three inches) of mulch at the start and an annual placement (preferably in June after weeding) of one to two inches of mulch beneath plants.
- The planting media design height must be marked appropriately, such as a collar on the overflow device or with a stake inserted two feet into the planting media and notched, to show biofiltration surface level and ponding level.

***Vegetation***

Prior to installation, a licensed landscape architect must certify that all plants, unless otherwise specifically permitted, conform to the standards of the current edition of American Standard for Nursery Stock as approved by the American Standards Institute, Inc. All plant grades shall be those established in the current edition of American Standards for Nursery Stock.

- Shade trees must have a single main trunk. Trunks must be free of branches below the following heights:

| CALIPER (in) | Height (ft) |
|---|---|
| 1½-2½ | 5 |
| 3 | 6 |

- Plants must be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 96 hours.
- It is recommended that a minimum of three types of tree, shrubs, and/or herbaceous groundcover species be incorporated to protect against facility failure due to disease and insect infestations of a single species.
- Native plant species and/or hardy cultivars that are not invasive and do not require chemical inputs must be used to the maximum extent practicable.

The biofiltration area should be vegetated to resemble a terrestrial forest community ecosystem, which is dominated by understory trees, a shrub layer, and herbaceous ground cover. Select vegetation that:

- Is suited to well-drained soil;
- Will be dense and strong enough to stay upright, even in flowing water;
- Has minimum need for fertilizers;
- Is not prone to pests and is consistent with Integrated Pest Management practices; and
- Is consistent with local water conservation ordinance requirements.

***Irrigation System***

Provide an irrigation system to maintain viability of vegetation, if applicable. The irrigation system must be designed to local code or ordinance specifications.

***Restricted Construction Materials***

The use of pressure-treated wood or galvanized metal at or around a biofiltration area is prohibited.

***Overflow Device***

An overflow device is required at the 18-inch ponding depth. The following, or equivalent, should be provided:

- A vertical PVC pipe (SDR 26) to act as an overflow riser.
- The overflow riser(s) should be eight inches or greater in diameter, so it can be cleaned without damage to the pipe.

- The inlet to the riser should be at the ponding depth (18 inches for fenced biofiltration areas and 6 inches for areas that are not fenced), and be capped with a spider cap to exclude floating mulch and debris. Spider caps should be screwed in or glued (e.g., not removable). The overflow device should convey stormwater runoff in excess of 1.5 times the SWQDv that is not reliably retained on the project site to an approved discharge location (another stormwater quality control measure, storm drain system, or receiving water).

### Maintenance Requirements

Maintenance and regular inspections are important for proper function of biofiltration areas. Biofiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. In general, biofiltration maintenance requirements are typical landscape care procedures and include:

- Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years).
- Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly-designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the biofiltration area and flow dissipation and erosion protection strategies in the pretreatment area and flow entrance should be reassessed. If sediment is deposited in the biofiltration area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.
- Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species.
- Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.
- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, biofiltration facilities are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters.
- In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two to three inch depth at least once every two years.

- Analyze soil for fertility and pollutant levels if necessary. Biofiltration soil media are designed to maintain long-term fertility and pollutant processing capability.
- Eliminate standing water to prevent vector breeding.
- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.
- Inspect, and clean if necessary, the underdrain.

A summary of potential problems that need to be addressed by maintenance activities is presented in Table E-13.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater quality control measures. The property owner is responsible for compliance with the maintenance agreement. A sample maintenance agreement is presented in Appendix H.

**Table E-13. Biofiltration Troubleshooting Summary**

| Problem | Conditions When Maintenance Is Needed | Maintenance Required |
|---|---|---|
| Vegetation | Overgrown vegetation | Mow and prune vegetation as appropriate. |
| | Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds | Remove this vegetation and plant native species as needed. |
| Trash and Debris | Trash, plant litter, and dead leaves present | Remove and properly dispose of trash and debris. |
| Irrigation (if applicable) | Not functioning correctly | Check irrigation system for clogs or broken lines and repair as needed. |
| Inlet/Overflow | Inlet/overflow areas clogged with sediment and/or debris | Remove material. |
| | Overflow pipe blocked or broken | Repair as needed. |
| Erosion/Sediment Accumulation | Splash pads or spreader incorrectly placed<br>Presence of erosion or sediment accumulation | Check inlet structure to ensure proper function. Repair, or replace if necessary, the inlet device. Repair eroded areas with gravel as needed. Re-grade the biofiltration area as needed. |
| Contaminants and Pollution | Any evidence of oil, gasoline, contaminants, or other pollutants | Remove any evidence of visual contamination from floatables such as oil and grease. |
| Standing water | Standing water observed more than 96 hours after storm event | Inspect, and clean as needed, the underdrain to ensure proper function. Clear clogs as needed. Remove and replace planter media (sand, gravel, topsoil, mulch) and vegetation. |

# Appendix C: BMP Design Criteria

## ATTACHMENT H. BIORETENTION / BIOFILTRATION DESIGN CRITERIA

**Note:** A significant portion of the information in this appendix has been copied verbatim from the *Ventura County Technical Guidance Manual*, Updated 2011, and modified to reflect recent changes to the bioretention/biofiltration soil media specifications as adopted by the California Regional Water Quality Control Board, San Francisco Region, on November 28, 2011, Order No. R2-2011-083, Attachment L. Permittees can submit alternate Bioretention/Biofiltration Design Criteria subject to Executive Officer approval.

### 1. Geometry

**a.** Bioretention/biofiltration areas shall be sized to capture and treat the design with an 18-inch maximum ponding depth. *The intention is that the ponding depth be limited to a depth that will allow for a healthy vegetation layer.*

**b.** Minimum planting soil depth should be 2 feet, although 3 feet is preferred. *The intention is that the minimum planting soil depth should provide a beneficial root zone for the chosen plant palette and adequate water storage for the SWQDv.*

**c.** A gravel storage layer below the bioretention/biofiltraton soil media is required as necessary to provide adequate temporary storage to retain the SWQDv and to promote infiltration.

### 2. Drainage

**a.** Bioretention and biofiltration BMPs should be designed to drain below the planting soil in less than 48 hours and completely drain in less than 96 hours. *The intention is that soils must be allowed to dry out periodically in order to restore hydraulic capacity needed to receive flows from subsequent storms, maintain infiltration rates, maintain adequate soil oxygen levels for healthy soil biota and vegetation, and to provide proper soil conditions for biodegradation and retention of pollutants.*

**b.** *Biofiltration BMPs are designed and constructed with an underdrain. The underdrain is preferably placed near the top of the gravel storage area to promote incidental infiltration and enhanced nitrogen removal*. However, if *in-situ,* underlying soils do not provide sufficient drainage, the underdrain may need to be placed lower in the gravel storage area (within 6 inches of the bottom) to prevent the unit from holding stagnant water for extended periods of time. At many sites, clay soils will drain sufficiently fast, particularly if they are not compacted. Observing soil moisture and surface conditions in the days following a wet period may provide sufficient information for making this decision and may be more directly applicable than *in situ* or laboratory testing of soil characteristics[1].

### 3. Overflow

An overflow device is required at the 18-inch ponding depth. The following, or equivalent, should be provided:

**a.** A vertical PVC pipe (SDR 35) to act as an overflow riser.

[1] Dan Cloak, Dan Cloak Environmental Consulting to Tom Dalziel, Contra Costa County, February 22, 2011.

**b.** The overflow riser(s) should be 6 inches or greater in diameter, so it can be cleaned without damage to the pipe.

The inlet to the riser should be at the ponding depth (18 inches for fenced bioretention areas and 6 inches for areas that are not fenced), and be capped with a spider cap to exclude floating mulch and debris. Spider caps should be screwed in or glued, i.e., not removable.

**4. Integrated Water Quality/ Flow Reduction/Resources Management Criteria**

**a.** When calculating the capacity of an infiltration system, each Permittee shall account for the 24-hour infiltration assuming that the soil is saturated. Infiltration BMPs shall be limited to project sites where the in-situ soil or the amended on-site soils have a demonstrated infiltration rate under saturated conditions of no less than 0.3 inch per hour.

**b.** Bioretention BMPs shall be designed to accommodate the minimum design flow at a surface loading rate of 5 inches per hour and no greater than 12 inches per hour, and shall have a total volume, including pore spaces and pre-filter detention volume of no less than the SWQDv.

**c.** If rainwater harvested for use in irrigation is to be credited toward the total volume of storm water runoff retained on-site, each Permittee shall require the project proponent to conduct a conservative (assuming reasonable worst-case scenarios) assessment of water demand during the wet-weather season. This volume will be referred to as the "reliable" estimate of irrigation demand. The portion of water to be credited as retained on-site for use in irrigation shall not exceed the reliable estimate of irrigation demand.

**d.** Harvested rainwater must be stored in a manner that precludes the breeding of mosquitoes or other vectors or with a draw down not to exceed 96 hours.

**e.** When evaluating the potential for on-site retention, each Permittee shall consider the maximum potential for evapotranspiration from green roofs and rainfall harvest and use.

**f.** Project requirements shall address at a minimum the potential use of harvested rainwater for non-potable uses including toilet flushing, laundry, and cooling water makeup water. If the municipal, building or county health code(s) does not allow such use of harvested rainwater, each Permittee shall develop a model ordinance and submit it to the city council or County Supervisors for consideration within 24 months after the Order effective date. The model ordinances shall be based on the International Association of Plumbing and Mechanical Officials' (IAPMO's) Green Plumbing and Mechanical Code Supplement to the 2012 National Standard Plumbing Code, or similar guidance to ensure the safe and effective use of harvested rainwater, separate from the existing provisions, if any, for reclaimed wastewater. California is in the process of adopting its 2012 update to the Uniform Plumbing Code that incorporates the IAPMO Green Plumbing and Mechanical Code Supplement. If the State of California update incorporates the IAPMO Green Plumbing and Mechanical Code Supplement, Permittees are not required to adopt a mode ordinance addressing the potential use of harvested rainwater for non-potable uses including toilet flushing, laundry, and cooling water makeup water.

**5. Hydraulic Restriction Layers**

Infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent water proofing, may be placed along the vertical walls to reduce lateral flows. This liner should have a minimum thickness of 30 mils. Generally, waterproof barriers should not be placed on the bottom of the biofiltration unit, as this would prevent incidental infiltration which is important to meeting the required pollutant load reduction.

**6. Planting/Storage Media Specifications**

**a.** The planting media placed in the cell should achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Higher infiltration rates of up to 12 inches per hour are permissible. Bioretention/biofiltration soil shall retain sufficient moisture to support vigorous plant growth.

**b.** Planting media should consist of 60 to 80% fine sand and 20 to 40% compost.

**c.** Sand should be free of wood, waste, coating such as clay, stone dust, carbonate, etc. or any other deleterious material. All aggregate passing the No. 200 sieve size should be non-plastic. Sand for bioretention should be analyzed by an accredited lab using #200, #100, #40, #30, #16, #8, #4, and 3/8 sieves (ASTM D 422 or as approved by the local permitting authority) and meet the following gradation (Note: all sands complying with ASTM C33 for fine aggregate comply with the gradation requirements provided in Table H-1):

**Table H-1. Sand Texture Specifications**

| | **Percent Passing by Weight** | |
|---|---|---|
| **Sieve Size ASTM D422** | **Minimum** | **Maximum** |
| 3 /8 inch | 100 | 100 |
| No. 4 | 90 | 100 |
| No. 8 | 70 | 100 |
| No. 16 | 40 | 95 |
| No. 30 | 15 | 70 |
| No. 40 | 5 | 55 |
| No. 110 | 0 | 15 |
| No. 200 | 0 | 5 |

**Note:** The gradation of the sand component of the media is believed to be a major factor in the hydraulic conductivity of the media mix. If the desired hydraulic conductivity of the media cannot be achieved within the specified proportions of sand and compost (#2), then it may be necessary to utilize sand at the coarser end of the range specified in above (“minimum” column).

**d.** Compost should be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes, or other organic materials not including manure or biosolids meeting standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program). Compost quality should be verified via a lab analysis to be:

- Feedstock materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
- Organic matter: 35-75% dry weight basis.
- Carbon and Nitrogen Ratio: 15:1 < C:N < 25:1
- Maturity/Stability: shall have dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120 F) upon delivery or rewetting is not acceptable.
- Toxicity: any one of the following measures is sufficient to indicate non-toxicity:
  - NH4:NH3 < 3
  - Ammonium < 500 ppm, dry weight basis
  - Seed Germination > 80% of control
  - Plant trials > 80% of control
  - Solvita® > 5 index value
- Nutrient content:
  - Total Nitrogen content 0.9% or above preferred
  - Total Boron should be <80 ppm, soluble boron < 2.5 ppm
- Salinity: < 6.0 mmhos/cm
- pH between 6.5 and 8 (may vary with plant palette)
- Compost for bioretention should be analyzed by an accredited lab using #200, ¼ inch, ½ inch, and 1 inch sieves (ASTM D 422) and meet the gradation described in Table H-2:

**Table H-2. Compost Texture Specifications**

| | **Percent Passing by Weight** | |
|---|---|---|
| **Sieve Size ASTM D422** | **Minimum** | **Maximum** |
| 1 inch | 99 | 100 |
| ½ inch | 90 | 100 |
| ¼ inch | 40 | 90 |
| #200 | 2 | 10 |

Tests should be sufficiently recent to represent the actual material that is anticipated to be delivered to the site. If processes or sources used by the supplier have changed significantly since the most recent testing, new tests should be requested.

Note: the gradation of compost used in bioretention/biofiltratation media is believed to play an important role in the saturated hydraulic conductivity of the media. To achieve a higher saturated hydraulic conductivity, it may be necessary to utilize compost at the coarser end of this range ("minimum" column). The percent passing the #200 sieve (fines) is believed to be the most important factor in hydraulic conductivity.

In addition, a coarser compost mix provides more heterogeneity of the bioretention media, which is believed to be advantageous for more rapid development of soil structure needed to support health biological processes. This may be an advantage for plant establishment with lower nutrient and water input.

**e.** Bioretention/Biofiltration soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification:

"Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation." The following steps shall be followed by the Permittees to verify that alternative soil mixes meet the specification:

- Submittals – The applicant must submit to the Permittee for approval:
  - A sample of mixed bioretention/biofiltration soil.
  - Certification from the soil supplier or an accredited laboratory that the bioretention/biofiltration soil meets the requirements of this specification.
  - Certification from an accredited geotechnical testing laboratory that the bioretention/biofiltration soil has an infiltration rate of between 5 and 12 inches per hour.
  - Organic content test results of mixed bioretention/biofiltration soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
  - Organic Grain size analysis results of mixed bioretention/biofiltration soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
  - A description of the equipment and methods used to mix the sand and compost to produce the bioretention/biofiltration soil.
- The name of the testing laboratory(s) and the following information:
  - Contact person(s)
  - Address(s)
  - Phone contact(s)
  - email address(s)
  - Qualifications of laboratory(s), and personnel including date of current
  - Certification by STA, ASTM, or approved equal.
- Bioretention/biofiltration soils shall be analyzed by an accredited lab using #200, and 1/2" inch sieves (ASTM D 422 or as approved by municipality), and meet the gradation described in Table H-3).

**Table H-3. Alternative Bioretention/Biofiltration Soil Texture Specifications**

| | **Percent Passing by Weight** | |
|---|---|---|
| **Sieve Size ASTM D422** | **Minimum** | **Maximum** |
| ½ inch | 97 | 100 |
| 200 | 2 | 5 |

- Bioretention/biofiltration soils shall be analyzed by an accredited geotechnical lab for the following tests:
  - Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention/biofiltration soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  - Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

**7. Mulch for Bioretention/Biofiltration Facilities**

Mulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Projects subject to the State's Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least two inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. It is recommended to apply 1" to 2" of composted mulch, once a year, preferably in June following weeding

**8. Plants**

**a.** Plant materials should be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 to 96 hours.

**b.** It is recommended that a minimum of three types of tree, shrubs, and/or herbaceous groundcover species be incorporated to protect against facility failure due to disease and insect infestations of a single species.

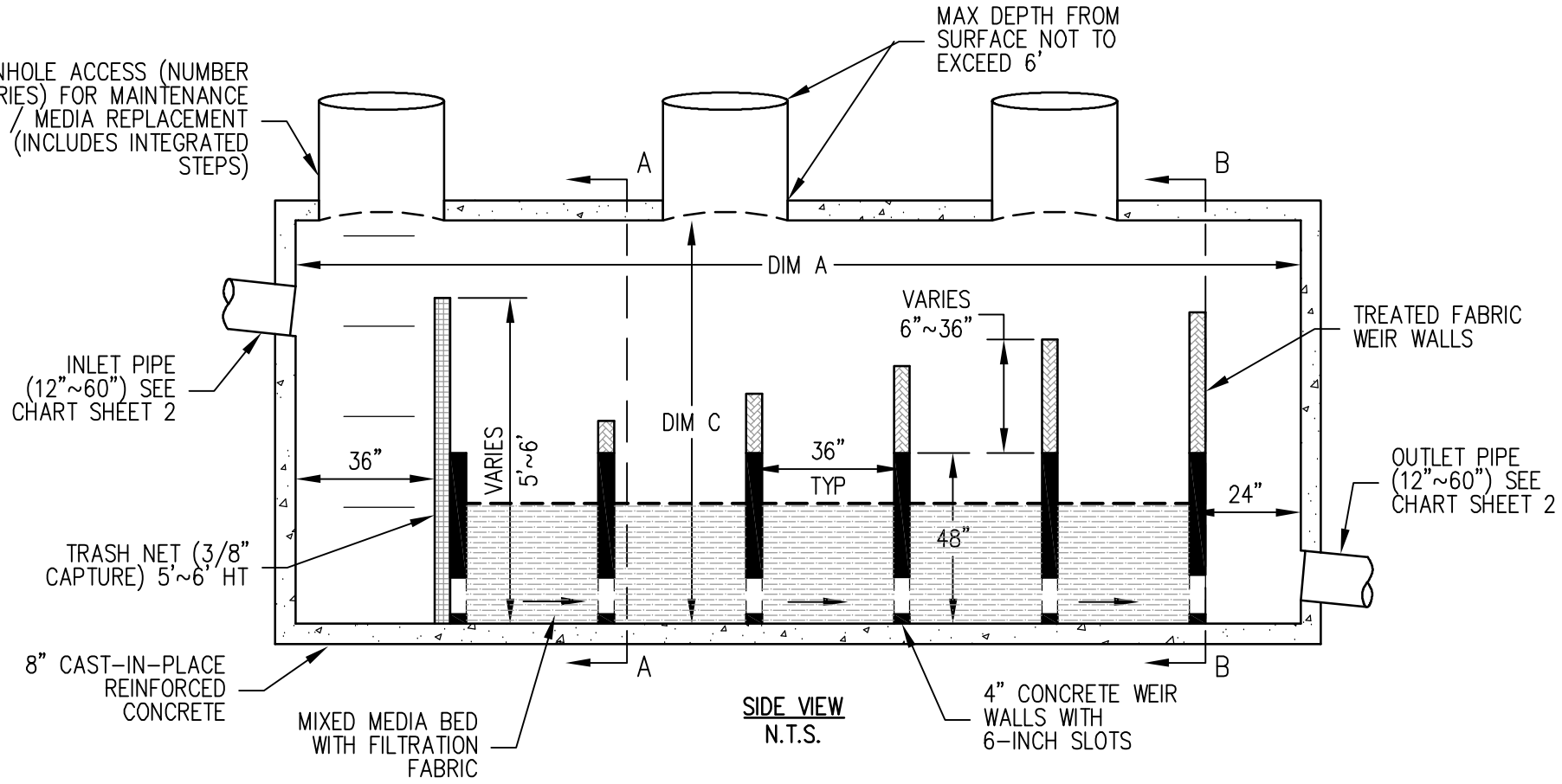
**c.** Native plant species and/or hardy cultivars that are not invasive and do not require chemical inputs should be used to the maximum extent practicable.

## References

California Regional Water Quality Control Board, San Francisco Bay Region. 2011. Municipal Regional Stormwater Permit (Order No. R2-2011-0083, Attachment L). Adopted November 28, 2011.

Dan Cloak, Dan Cloak Environmental Consulting to Tom Dalziel, Contra Costa County, February 22, 2011.<http://www.cccleanwater.org/c3-guidebook.html>. Accessed on January 31, 2012.

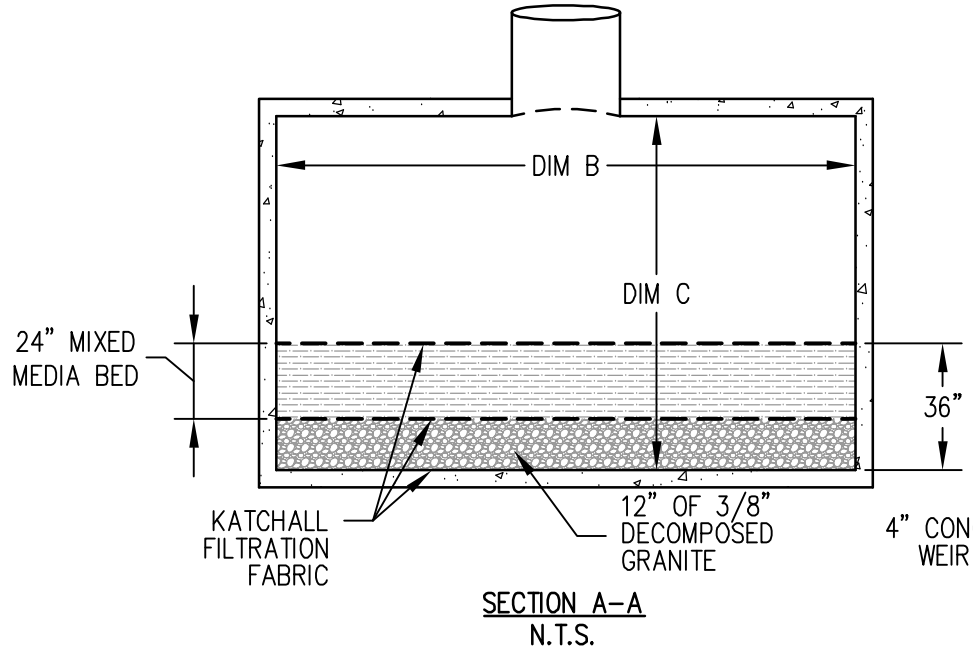
Geosyntec Consultants and Larry Walker Associates. 2011. *Ventura County Technical Guidance Manual for Stormwater Quality Control Measures, Manual Update 2011. Appendix D*. Prepared for the Ventura Countywide Stormwater Quality Management Program. July 13, 2011.



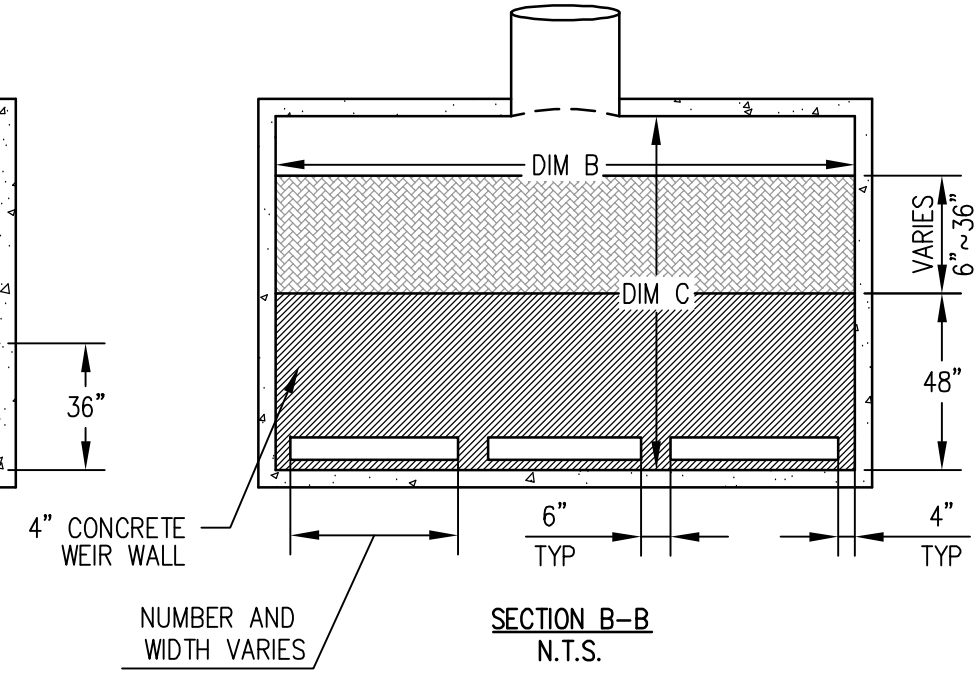

NOTES:

1. CUSTOM SIZES AVAILABLE – CALL FOR QUOTE.
2. MANHOLES ARE TRAFFIC RATED AND CAN OPTIONALLY INCLUDE LOCKING BOLTS.
3. STEPS INCLUDED ALONG VAULT WALL AND MANHOLE SHAFT FOR SAFETY (16" SPACING).
4. FILTER FABRICS / MEDIA:
   – TEST RESULTS AVAILABLE UPON REQUEST.

| KATCHALL FILTRATION SYSTEMS, LLC | KLEERSTREAM™ FILTRATION VAULTS | | |
|---|---|---|---|
| 1-866-KATCHALL WWW.KATCHALL.NET | REVISION: C | DWG NUM: KRST-000 | SHEET: 1 OF 3 |

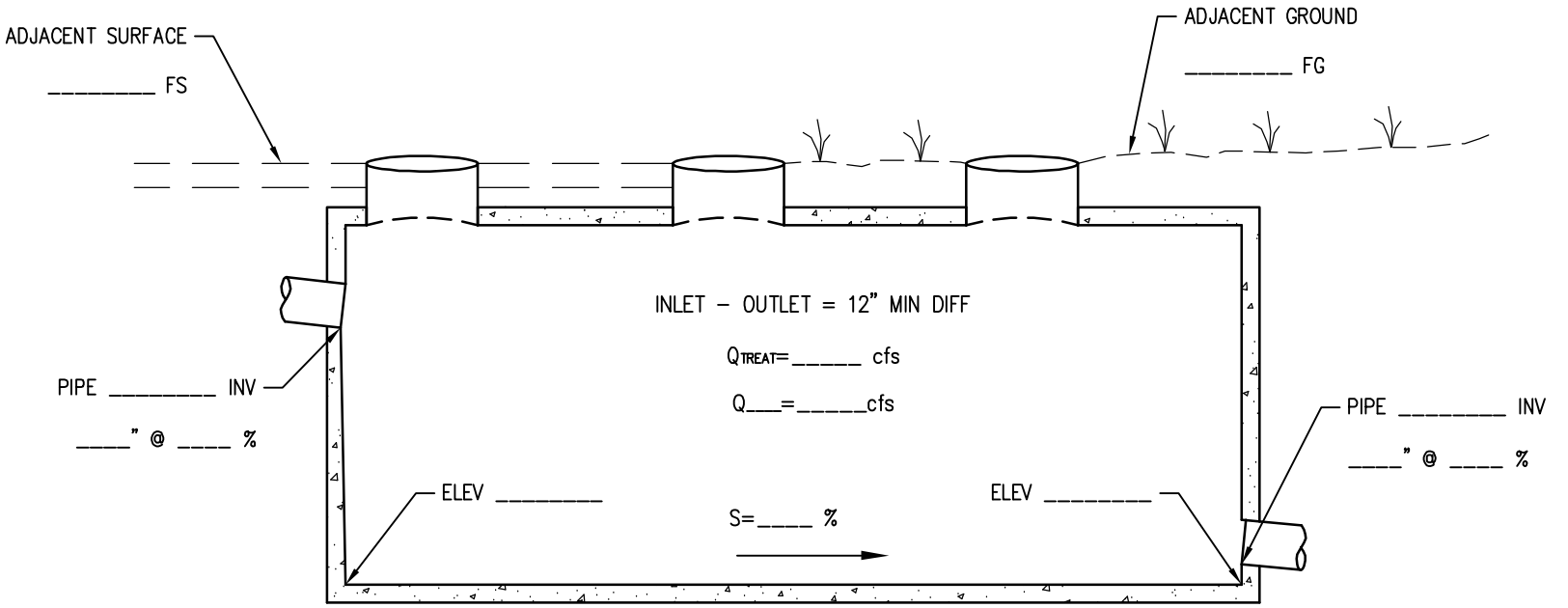



SECTION A–A
N.T.S.

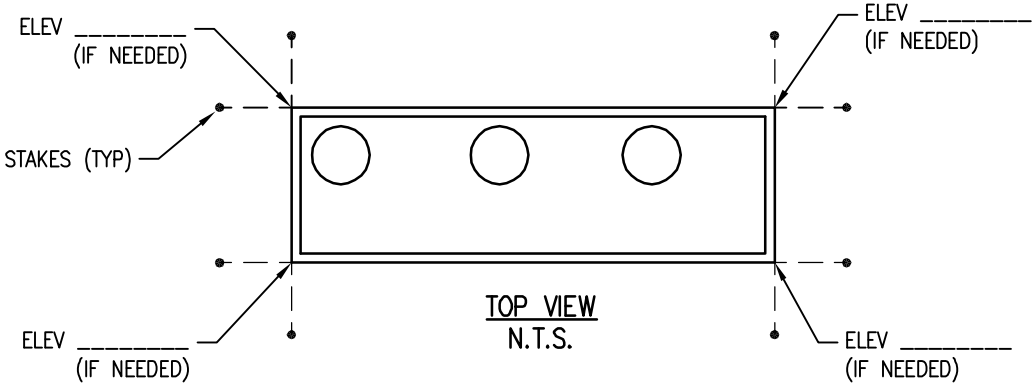



SECTION B–B
N.T.S.

| MODEL NUMBER | DIMENSION A INT / EXT (FT) | DIMENSION B INT / EXT (FT) | DIMENSION C INT / EXT (FT) | MAXIMUM PIPE DIAMETER (IN) | SOLID WASTE CAPACITY (CU FT) | MEDIA BED (SQ FT) | MEDIA FLOW (CFS) | FILTER AREA (SQ FT) | TOTAL FLOW RATE (GPM / CFS) |
|---|---|---|---|---|---|---|---|---|---|
| 8–6–6 | 8 / 9.3 | 6 / 7.3 | 6 / 7.3 | 24 | 90 | 36 | 2.34 | 18 | 3,344 / 7.45 |
| 10–8–6 | 10 / 11.3 | 8 / 9.3 | 6 / 7.3 | 24 | 144 | 48 | 3.12 | 39 | 7,181 / 16.0 |
| 12–10–8 | 12 / 13.3 | 10 / 11.3 | 8 / 9.3 | 60 | 180 | 80 | 5.20 | 75 | 13,778 / 30.7 |
| 20–11–8 | 20 / 21.3 | 11 / 12.3 | 8 / 9.3 | 60 | 198 | 104 | 6.76 | 116 | 21,453 / 47.8 |
| 25–11–8 | 25 / 26.3 | 11 / 12.3 | 8 / 9.3 | 60 | 198 | 184 | 11.96 | 155 | 28,544 / 63.6 |




SIDE VIEW
N.T.S.




TOP VIEW
N.T.S.

NOTES:

1. FOR USE WITH KATCHALL KLEERSTREAM™ FILTERS.
2. ENGINEER, ARCHITECT, OR LANDSCAPE ARCHITECT TO PROVIDE SITE-SPECIFIC DESIGN DATA TO KATCHALL PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES BY KATCHALL OR THEIR ASSIGNED REPRESENTATIVES.
3. ENGINEER, ARCHITECT, OR LANDSCAPE ARCHITECT IS TO INSURE VAULTS WILL FIT IN PROPOSED LOCATIONS AND DOES NOT CONFLICT WITH ANY SITE UTILITIES OR OTHER SURROUNDING FINISH SURFACES.
4. ACCESS PORTS MAY BE FLUSH WITH TOP OF VAULT OR COLLARS ADDED TO RAISE MANHOLE COVERS TO THE SURFACE. NOTE THAT INSTALLATION OF TOP OF VAULT FLUSH WITH ADJACENT SURFACES REQUIRES ELEVATIONS AT ALL FOUR CORNERS PLUS ELEVATIONS OF ALL MANHOLE COVERS / ACCESS POINTS.
5. HORIZONTAL CONTROL (8 STAKES TYPICAL, 3 STAKES MINIMUM) SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR/ OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION OF VAULT(S).

PROJECT:

MODEL:

UNIT #:

| KATCHALL FILTRATION SYSTEMS, LLC | KATCHALL KLEERSTREAM™ ENGINEERING WORKSHEET | | |
|---|---|---|---|
| 1-866-KATCHALL WWW.KATCHALL.NET | REVISION: C | DWG NUM: KAWS-000 | SHEET: OF |

# APPENDIX D: Operation and Maintenance of BMPs

**OPERATION & MAINTENANCE PLAN**
**FOR BIOFILTRATION BASIN**

**Maintenance Requirements**

Maintenance and regular inspections are important for proper function of biofiltration areas. Biofiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. In general, biofiltration maintenance requirements are typical landscape care procedures and include:

1. Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years).
2. Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly-designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the biofiltration area and flow dissipation and erosion protection strategies in the pretreatment area and flow entrance should be reassessed. If sediment is deposited in the biofiltration area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.
3. Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species.
4. Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.
5. Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, biofiltration facilities are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters.
6. In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two to three inch depth at least once every two years.
7. Analyze soil for fertility and pollutant levels if necessary. Biofiltration soil media are designed to maintain long-term fertility and pollutant processing capability.
8. Eliminate standing water to prevent vector breeding.
9. Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.
10. Inspect, and clean if necessary, the underdrain.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater quality control measures. The property owner is responsible for compliance with the maintenance agreement.

## BMP Inspection Log

**BMP:** _____

| Date | Maintenance Performed | Re-Inspection Date | Comments |
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RECORDING REQUESTED BY
AND MAIL TO:

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUILDING AND SAFETY DIVISION
900 S. FREMONT AVENUE, 3RD FLOOR
ALHAMBRA, CA 91803-1331

Space above this line is for Recorder's use

# COVENANT AND AGREEMENT
# REGARDING THE MAINTENANCE OF LOW IMPACT DEVELOPMENT (LID) & NATIONAL POLLUTANTS DISCHARGE ELIMINATION SYSTEM (NPDES) BMPs

The undersigned, _____ ("Owner"), hereby certifies that it owns the real property described as follows ("Subject Property"), located in the County of Los Angeles, State of California:

LEGAL DESCRIPTION

ASSESSOR'S ID #_____TRACT NO._____LOT NO._____

ADDRESS: _____

_____

Owner is aware of the requirements of the County of Los Angeles' Green Building Standards Code, Title 31, Section 4.106.4 (LID), and National Pollutant Discharge Elimination System (NPDES) permit. The following post-construction BMP features have been installed on the Subject Property:

- □ Porous pavement
- □ Cistern/rain barrel
- □ Infiltration trench/pit
- □ Bioretention or biofiltration
- □ Rain garden/planter box
- □ Disconnect impervious surfaces
- □ Dry Well
- □ Storage containers
- □ Landscaping and landscape irrigation
- □ Green roof
- □ Other _____

_____

The location, including GPS x-y coordinates, and type of each post-construction BMP feature installed on the Subject Property is identified on the site diagram attached hereto as Exhibit 1.

Owner hereby covenants and agrees to maintain the above-described post-construction BMP features in a good and operable condition at all times, and in accordance with the LID/NPDES Maintenance Guidelines, attached hereto as Exhibit 2.

Owner further covenants and agrees that the above-described post-construction BMP features shall not be removed from the Subject Property unless and until they have been replaced with other post-construction BMP features in accordance with County of Los Angeles' Green Building Standards Code, Title 31 and NPDES permit.

Owner further covenants and agrees that if Owner hereafter sells the Subject Property, Owner shall provide printed educational materials to the buyer regarding the post-construction BMP features that are located on the Subject Property, including the type(s) and location(s) of all such features, and instructions for properly maintaining all such features.

Owner makes this Covenant and Agreement on behalf of itself and its successors and assigns. This Covenant and Agreement shall run with the Subject Property and shall be binding upon owner, future owners, and their heirs, successors and assignees, and shall continue in effect until the release of this Covenant and Agreement by the County of Los Angeles, in its sole discretion.

Owner(s):

By:_____ Date:_____

By:_____ Date:_____

(PLEASE ATTACH NOTARY)

REFERENCE

PLAN CHECK NO.: _____ DISTRICT OFFICE NO.:_____

ATTACHMENTS

RECORDING REQUEST BY AND MAIL TO:

County of Los Angeles
Department of Public Works

Building and Safety – Drainage and Grading Section
Land Development – Drainage and Grading Section

P.O. Box 1460
Alhambra, California 91802-1460

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# COVENANT FOR MAINTENANCE OF WATER QUALITY (WQ) DEVICES

I (we) _____, hereby certify that I (we) am (are) the legal owner(s) of Tract # _____, and as such owners for the mutual benefit of future purchasers, their heirs, successors, and assigns, do hereby fix the following protective conditions to which their property, or portions thereof, shall be held, sold and/or conveyed.

That owner(s) shall maintain the WQ system shown on attached Exhibit A map and on Grading Plan GPC # _____, on file in the office of the Director of Public Works, in a good and functional condition at least once a year and retain proof of the inspection. The owner(s) shall perform this responsibility, unless the County discharges this obligation through a subsequently recorded written instrument.

The undersigned also covenants and agrees for himself, his heirs, successors, and assigns, to indemnify, defend, and save harmless the County, its agents, officers and employees from and against any and all liability, expenses, including defense costs and legal fees, and claims for damages of any nature whatsoever, including, but not limited to, bodily injury, death, personal injury, or property damage arising from or connected with the construction or maintenance of said work.

Owner(s):

By: _____ Date: _____

By: _____ Date: _____

## APPENDIX E: Storm Drain Stencil Example


NO DUMPING
THIS DRAINS TO OCEAN

# APPENDIX F: Geotechnical Findings

Will be provided in final submittal