CITY OF MONTCLAIR

Montclair Civic Center
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Site Evaluation and Testing Protocols for Storm Water Infiltration Best Management Practices

I. Introduction

Water Quality – A National, State, and Local Concern

Throughout the United States, many rivers, creeks, streams, lakes, wetlands, and estuaries have become polluted to the point where these water bodies can no longer be utilized or enjoyed to their maximum capabilities. In California, 779 water bodies have been identified as being impaired. Locally, there are impaired water bodies located downstream of the City of Montclair.

The leading contributors to pollution of water bodies are generally associated with a growing population and the support of that growth. Specifically, urban areas, construction, industry, resource extraction, forestry, and agriculture are commonly identified sources of pollutants in water bodies.

Call to Action

To address this pollution, the United States Congress adopted the Clean Water Act, and the California Legislature adopted the Porter-Cologne Water Quality Act. These Acts empower the United States Environmental Protection Agency and California's State Water Resources Control Board and Regional Water Quality Control Boards (RWQCBs) to implement programs aimed at protection and restoration of water bodies, and to initiate civil and criminal actions against polluters.

The RWQCB-Santa Ana Region issued the City of Montclair a National Pollutant Discharge Elimination System (NPDES) Permit allowing the City to operate its storm drain system with the condition that the City implements programs to control the discharge of pollutants from the storm drain system. A key provision of the permit is to control the discharge of pollutants associated with development.

City of Montclair Requirements

The City of Montclair requires that development projects prepare and implement a Water Quality Management Plan (WQMP). The purpose of the WQMP is to identify how pollution associated with the development project will be controlled for the life of the project. At a minimum, the WQMP must describe a combination of site design, source control, and treatment control best management practices (BMPs) that will be incorporated into the project to reduce the discharge of pollutants to receiving waters, and most importantly, to ensure that the project does not contribute to impairment of California's water resources.

The document, ***San Bernardino County Stormwater Program – Model Water Quality Management Plan Guidance*** (WQMP Guidance Document), provides basic guidance on how to prepare a WQMP. The document is available at http://www.co.san-bernardino.ca.us/stormwater/educational_materials.htm

Infiltration Treatment Control BMPs

One of the most effective methods to reduce the discharge of pollutants associated with new development and redevelopment projects, and to comply with the requirements of the WQMP, is to maintain a post-development hydrograph that is similar to the pre-development hydrograph in terms of flow rates, flow volumes, and duration of flow. Because site development often increases the imperviousness of a site, and in turn the volume of runoff produced by storms, maintaining conditions similar to the pre-development hydrograph usually involves infiltration.

While infiltration BMPs are one of the most effective BMPs, they are associated with a high rate of failure. Review of failed infiltration BMPs reveals that many of the BMPs were doomed from the start because of insufficient pre-design site investigation, inappropriate design, under design, improper installation, and improper maintenance. As a result, infiltration BMPs have earned a poor reputation.

II. Purpose

The purpose of this Policy is to set forth the site evaluation and testing protocols for storm water infiltration BMPs included in WQMPs for new development and re-developments projects in the City of Montclair.

III. Applicability

This Policy is applicable to all projects proposing infiltration BMPs. Infiltration BMPs include, but are not limited to, BMPs that directly or indirectly convey rainfall, surface runoff, or other flows into the ground for the purpose of reducing runoff flow rates, runoff volumes, or pollutants contained in runoff. Infiltration BMPs include, but are not limited to, surface BMPs such as retention basins, infiltration trenches, and permeable pavements, and subsurface BMPs such as commercially manufactured infiltration systems, dry wells, seepage pits, and Class V wells. BMPs such as vegetated swales, bioretention cells (with subdrains), and detention basins where infiltration is not the intended function and where infiltration occurs only by happenstance are not subject to this Policy.

The City of Montclair's determination regarding the applicability of this Policy shall be final.

IV. Laws and Regulations

Users of this Policy shall be aware of and comply with applicable federal, state, and local laws, codes, regulations, rules, and permit requirements applicable to infiltration BMPs. In the event the user of this Policy identifies a conflict between this Policy and applicable laws, codes, regulations, rules, or permit requirements, the user shall immediately notify the City of Montclair, in writing, providing the specifics of the conflict, and shall cease use of the Policy until the conflict is resolved.

V. Safety

Users of this Policy must follow and comply with all safety regulations, including but not limited to notifying Underground Service Alert of Southern California before excavation and compliance with Cal/OSHA worker and public protection requirements, including excavation safety.

VI. Procedure

The site evaluation and testing protocols for storm water infiltration BMPs consists of four parts:[1] [2]

- Part 1 – Preliminary Site Evaluation
- Part 2 – Field Validation of Preliminary Site Evaluation
- Part 3 – In Situ Soil Infiltration Rate Testing
- Part 4 – Reporting

The four part process must be completed and the report included in any WQMP proposing infiltration BMPs in the City of Montclair. If at any point in the four-part procedure the site is determined to be unsuitable for infiltration BMPs, the procedure may be truncated and attention directed to evaluation of alternative, non-infiltration BMPs.

Part 1 – Preliminary Site Evaluation

The purpose of Part 1 is to determine the preliminary suitability of a site, or a location on a site, for use of infiltration BMPs. The information collected at this stage will help determine if infiltration BMPs are likely to be feasible at the site based on reconnaissance level information. The reconnaissance level information required for this Part is generally available from widely available public sources, visual observation of the site and the vicinity, and configuration of the project site.

The following information shall be obtained for the Preliminary Site Evaluation:

1. Area site map consisting of an engineered plot map, Assessor's Parcel Map, or neat sketch, or equal, showing the following:
   a. Dimensions of the site;
   b. Location of the site in relation to adjacent streets and/or properties;
   c. Proposed land use (Residential, Commercial, Industrial);
   d. General direction of existing site drainage;
   e. Areas of the site with slopes exceeding 15%;
   f. NRCS (SCS) soil type boundaries and soil types;[3]
   g. Location of buildings and other structures on site and within 100 feet of the property line;
   h. Location of wells on site and within 100 feet of the property line;
   i. Location of leach fields, septic tanks, and underground storage tanks on site and within 100 feet of the property line; and
   j. Location of contaminated soils on site.
2. Summary of estimated soil properties significant to infiltration BMPs for each soil map symbol reported by USDA for the site, including but not limited to the following:
   a. Soil series;
   b. Soil map symbol;
   c. Hydrologic soils group;
   d. Hydric soils rating;
   e. Depth to bedrock or hardpan;
   f. Properties by range of depths:
      i. USDA texture;
      ii. Unified classification;

iii. Permeability;
iv. Shrink-swell potential;
v. Depth to groundwater; and
vi. Depth to seasonally high groundwater.

The information assembled during the Part 1 – Preliminary Site Evaluation must be reviewed to make an initial determination of the suitability of the site and locations on the site for infiltration BMPs, including suitability of site soils and consideration of site and off-site features that could potentially be impacted by the infiltration BMPs. If the determination is that infiltration BMPs appear to be suitable and are to be considered further, then Part 2 is required.

Part 2 – Field Validation of Preliminary Site Evaluation

The purpose of Part 2 is to refine and field validate the information collected in Part 1.

The following field explorations shall be conducted and data summaries prepared:

1. Part 2 shall be performed under the supervision of a Geotechnical Engineer, Civil Engineer, Engineering Geologist, or Professional Geologist licensed by the State of California, in strict accordance with regulations applicable to work.
2. Identify or establish a permanent vertical and horizontal reference point for the site. Show and describe the reference point on the area site map.
3. Implement soil borings or test pits.
   g. Soil Borings
      i. 2 borings (minimum) for sites up to 2 acres, and 1 additional boring (minimum) for every 2 additional acres or portions thereof.
      ii. Borings shall be conducted in the general vicinity of proposed infiltration BMPs. On sites with multiple USDA mapped soils, at least 50% of the required borings shall be conducted in the mapped soil where the infiltration BMPs are proposed, and at least one boring shall be conducted in the mapped soil adjacent to the mapped soil where the infiltration BMP is proposed if the adjacent mapped soil boundary is within 100 feet of any feature of the infiltration BMPs.
      iii. Borings shall be advanced to 20 feet (minimum) below the bottom elevation of proposed infiltration BMPs, or to bedrock.

   h. Test Pits
      i. 2 test pits (minimum) for sites up to 4 acres, and 1 additional test pit (minimum) for every 3 additional acres or portions thereof.
      ii. Test pits shall be conducted in the general vicinity of proposed infiltration BMPs. On sites with multiple USDA mapped soils, at least 50% of the required test pits shall be conducted in the mapped soil where the infiltration BMPs are proposed, and at least one test pit shall be conducted in the mapped soil adjacent to the mapped soil where the infiltration BMP is proposed if the adjacent mapped soil boundary is within 100 feet of any feature of the infiltration BMPs.
      iii. Test pits shall be advanced to 10 feet (minimum) below the bottom elevation of proposed infiltration BMPs, or to bedrock.
   i. Soil borings and test pits shall be logged. The log shall include, but not be limited to, the following information:
      i. Upper and lower limits of each soil horizon;
      ii. USDA soil texture and Unified classification for each horizon;
      iii. Munsell soil color for each soil horizon;
      iv. Soil structure, grade size, and shape of soil particles for each horizon;
      v. Occurrence or evidence of saturated soil, water table, or groundwater;
      vi. Occurrence or evidence of fill soils or disturbed soils;
      vii. Occurrence or evidence of soil contamination by type; and
      viii. Other information relevant to the site and implementation of infiltration BMPs.
4. The area site plan shall be updated to show the location of soil borings and test pits, with each location keyed to correspond to the logs.
5. Other information identified in Part 1 shall be field verified (e.g., drainage patterns; slopes; location of buildings, water wells, septic systems, and contaminated soils; and etc.), and the area site plan updated accordingly.

The information and data collected during Part 2 – Field Validation of Preliminary Site Evaluation must be reviewed to update the determination of the suitability of the site and locations on the site for infiltration BMPs, including suitability of site soils and consideration of site and off-site features that could potentially be impacted by the infiltration BMPs. If the determination is that infiltration BMPs appear to be

suitable and are to be considered further, then Part 3 is required.

Part 3 – In Situ Soil Infiltration Rate Testing
The purpose of Part 3 is to determine the in situ infiltration rate for site soils and the design infiltration rate for infiltration BMPs.

1. Part 3 shall be performed under the supervision of a Geotechnical Engineer, Civil Engineer, Engineering Geologist, or Professional Geologist licensed by the State of California, in strict accordance with regulations applicable to work.
2. Identify locations for conducting Double Ring Infiltrometer (DRI) tests to determine the in situ infiltration rates.
    a. 2 DRI tests (minimum) shall be conducted in the proposed location of the infiltration BMP. On sites where proposed infiltration BMPs will overlie multiple USDA mapped soils, or soils likely to have different infiltration capabilities as determined following Part 2, at least 2 DRI tests (minimum) shall be conducted in each soil underlying the proposed infiltration BMPs. Overall, 2 DRI tests (minimum) for sites up to up to 2 acres, and 1 additional DRI test (minimum) for every 2 additional acres or portions thereof, shall be conducted.
    b. The DRI test shall be conducted at the bottom elevation of the proposed infiltration BMP.
3. DRI tests shall be conducted at the prescribed locations in accordance with ASTM D 3385 – 03[4] and the requirements herein. Where the requirements of ASTM D 3385 – 03 and the requirements herein differ, the requirements herein shall prevail.
4. The following requirements represent changes or clarifications to the procedures set forth in ASTM D 3385 – 03;
    a. ASTM D 3385 – 03, 1.7 – The United States Customary Units or the International System of Units (SI) may be utilized.
    b. ASTM D 3385 – 03, 4.1 – The steady state infiltration velocity shall be the infiltration rate resulting from a particular test.
    c. ASTM D 3385 – 03, 6.1 – The inner cylinder and outer cylinder diameters shall not be less than 300 mm (12 in.) and 600 mm (24 in.), respectively.
    d. ASTM D 3385 – 03, 8.1.1 – The soil strata to be tested is the strata that corresponds to the bottom elevation of the proposed infiltration BMP.
    e. ASTM D 3385 – 03, 8.7.3 – The duration of each DRI test shall be the greater of 6 hours or the time required to reach a relatively constant rate. A relatively constant rate is reached when the average rate for the most recent 1 hour period is 90% or greater than the average rate over the 2 hour period preceding the most recent 1 hour period.
    f. ASTM D 3385 – 03, 10.1.12 – A plot of the infiltration rate versus time shall be provided. Infiltration rate in in/hr or cm/hr shall be on the "Y" axis and time in min shall be on the "X" axis.
5. The area site plan shall be updated to show the location of DRI tests, with each location keyed to correspond to the plots.
6. The measured, relatively constant infiltration rate resulting from each DRI test shall be divided by a correction factor. The correction factor adjusts the measured infiltration rate for the occurrence of less permeable soil horizons below the surface, the potential variability in the subsurface soils throughout the infiltration site, changes over time, and other factors.
    a. Identify the minimum correction factor to apply to the results of each DRI test:
        i. Locate the column along the top of the table that corresponds to the texture of the soil located at the elevation of the bottom of the proposed infiltration BMP.
        ii. Locate the row along the left side of the table that corresponds to the texture of the soil of the least permeable soil horizon located within five feet of the elevation of the bottom of the proposed infiltration BMP.
        iii. Identify the cell where the column and row identified above intersect. Use the legend to identify the correction factor corresponding to the intersection point.
    b. Divide the relatively constant infiltration rate resulting from each DRI test by the correction factor.

The information and data collected during Part 3 – In Situ Soil Infiltration Rate Testing must be reviewed to update the determination of the suitability of the site and locations on the site for infiltration BMPs, including suitability of site soils and consideration of site and off-site features that could potentially be impacted by the infiltration BMPs. If the determination is that infiltration BMPs appear to be suitable and are to be proposed for the project, then Part 4 is required.

Part 4 – Reporting

The purpose of Part 4 is to formally document the results of the site evaluation and testing conducted to determine the suitability of the site for infiltration BMPs. The report described herein must be submitted for all projects proposing infiltration BMPs.

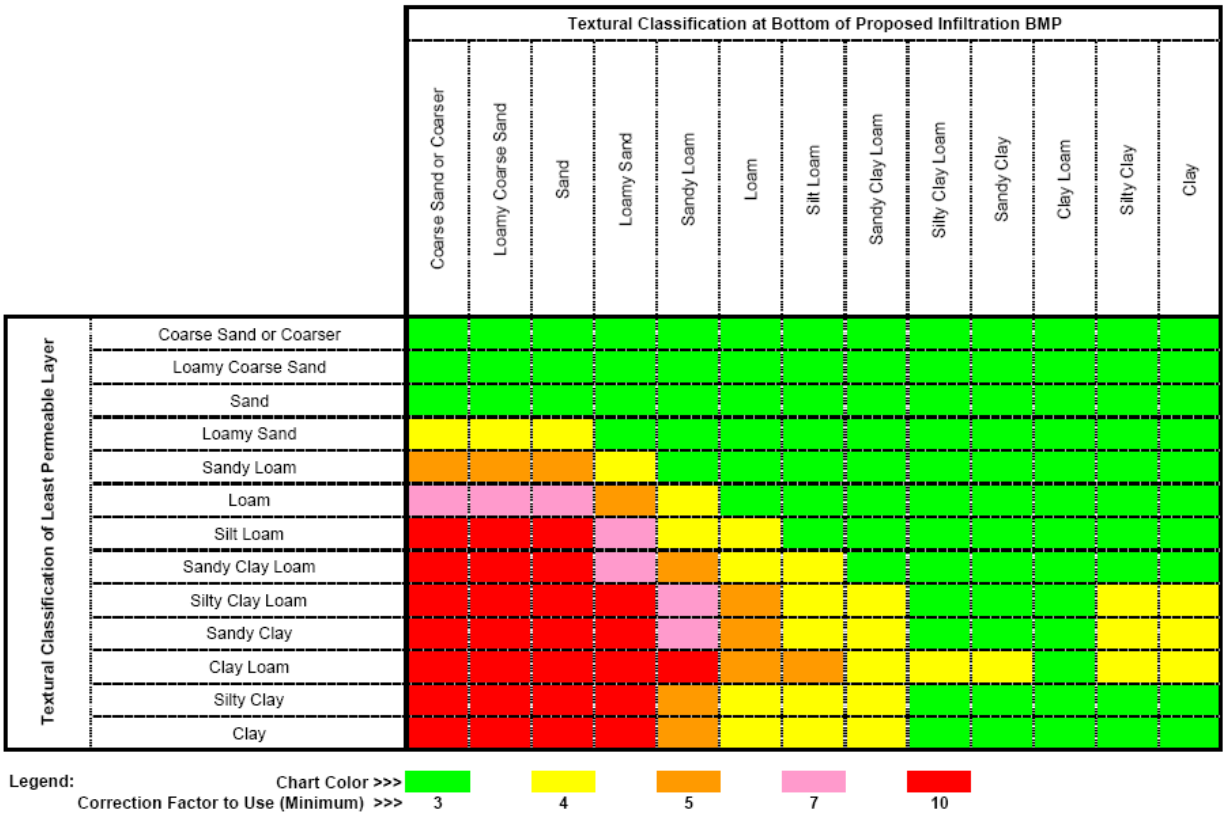
The report shall be entitled:

Site Evaluation and Field Testing Results
Suitability Determination and Recommendations
For Storm Water Infiltration BMPs At
[Insert Project Name and Location]
[Insert Date]

The report shall include the following information:

1. Part 4 shall be performed under the supervision of a Geotechnical Engineer, Civil Engineer, Engineering Geologist, or Professional Geologist licensed by the State of California, in strict accordance with regulations applicable to work.
2. The information described in Part 1 – Preliminary Site Evaluation.
3. The information described in Part 2 – Field Validation of Preliminary Site Evaluation. Updates to information from Part 1 shall be clearly identified. A log shall be included for each soil boring and test pit.
4. The information described in Part 3 – In Situ Soil Infiltration Rate Testing. For each DRI test, the Report described in ASTM D 3385 – 03 and this protocol shall be provided.
5. Updated area site map. The site map shall be updated to show the proposed location of infiltration BMPs.
6. A DRI Test Summary Matrix that summarizes the results of all DRI tests conducted for the project. The DRI Test Summary Matrix shall include the following information for each DRI test:
    a. DRI test identifier, keyed to the area site map.
    b. The measured, relatively constant infiltration rate.
    c. The Soil Texture (BMP Bottom) corresponding to the bottom of the proposed infiltration BMP.
    d. The Soil Texture (Limiting Horizon) corresponding to the limiting soil profile within five feet of the bottom of the proposed infiltration BMP.
    e. The Constant Infiltration Rate Correction Factor.
    f. The Maximum Design Infiltration Rate, calculated by dividing the measured, relatively constant infiltration rate by the Constant Infiltration Rate Correction Factor.
    g. The Recommended Design Infiltration Rate as recommended by the professional signing and sealing the report. The recommended design infiltration rate shall not exceed the maximum design infiltration rate. The professional may elect to use a lower rate based on review of site data, local data, and experience.
7. Composite Design Infiltration Rate for each infiltration BMP.
    a. For soils with one mapped soil, the Composite Design Infiltration Rate is the average of all the Recommended Design Infiltration Rates for DRI tests (two minimum) conducted in the proposed location of the BMP.
    b. For soils with multiple mapped soils, or with soils likely to have different infiltration capabilities as determined in Part 2, the Composite Design Infiltration Rate is calculated in two steps. First, the Composite Design Infiltration Rate for each soil is calculated as described immediately above. Second, a weighted average Composite Design Infiltration Rate soil is calculated by weighing the results for each soil by the area it represents within then proposed infiltration BMP.
    c. The Composite Design Infiltration Rate as recommended by the professional signing and sealing the report. The Composite Design Infiltration Rate shall not exceed the Composite Design Infiltration Rate calculated as described above. The professional may elect to use a lower rate based on review of site data, local data, and experience.
8. A statement regarding the suitable types of storm water infiltration BMPs to be designed based on the Composite Design Infiltration Rate included in the report. The list shall be specific (e.g., retention basin, underground infiltration chambers, infiltration trench, etc.).
9. The signature and seal of the Geotechnical Engineer, Civil Engineer, Engineering Geologist, or Professional Geologist licensed by the State of California and responsible for the contents of the report, in strict accordance with regulations applicable to work.

Constant Infiltration Rate Correction Factors



[1] United States Environmental Protection Agency, Storage/Sedimentation Facilities for Control of Storm and Combined Sewer Overflows - Design Manual, 1997.

[2] Wisconsin Department of Natural Resources, Conservation Practices Standards, Site Evaluation for Stormwater Infiltration, February 2004.

[3] United States Department of Agriculture – Soil Conservation Service, Soil Survey of San Bernardino County, Southwestern Part, California, January 1980.

United States Department of Agriculture – Natural Resources Conservation Services, Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

[4] ASTM International, Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer (ASTM D 3385 – 03), August 2003, http://www.astm.org/.