Appendix

D

Geotechnical Engineer Analysis

D.1 Analysis of Infiltration Restrictions

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Appendix D Geotechnical Engineer Analysis

D.1 Analysis of Infiltration Restrictions

This section is only applicable if the analysis of infiltration restrictions is performed by a licensed engineer practicing in geotechnical engineering. The SWQMP Preparer and Geotechnical Engineer must work collaboratively to identify any infiltration restrictions identified in Table D.1-1 below. Upon completion of this section, the Geotechnical Engineer must characterize each DMA as Restricted or Unrestricted for infiltration and provide adequate support/discussion in the geotechnical report. A DMA is considered restricted when one or more restrictions exist which cannot be reasonably resolved through site design changes.

Table D.1-1: Considerations for Geotechnical Analysis of Infiltration Restrictions

Restriction Element		Is Element Applicable? (Yes/No)
Mandatory Considerations	BMP is within 100’ of Contaminated Soils	
	BMP is within 100’ of Industrial Activities Lacking Source Control	
	BMP is within 100’ of Well/Groundwater Basin	
	BMP is within 50’ of Septic Tanks/Leach Fields	
	BMP is within 10’ of Structures/Tanks/Walls	
	BMP is within 10’ of Sewer Utilities	
	BMP is within 10’ of Groundwater Table	
	BMP is within Hydric Soils	
	BMP is within Highly Liquefiable Soils and has Connectivity to Structures	
	BMP is within 1.5 Times the Height of Adjacent Steep Slopes (≥25%)	
	County Staff has Assigned “Restricted” Infiltration Category	
Optional Considerations	BMP is within Predominantly Type D Soil	
	BMP is within 10’ of Property Line	
	BMP is within Fill Depths of ≥5’ (Existing or Proposed)	
	BMP is within 10’ of Underground Utilities	
	BMP is within 250’ of Ephemeral Stream	
	Other (Provide detailed geotechnical support)	
Result	Based on examination of the best available information, I have **not identified any restrictions** above.	☐ **Unrestricted**
	Based on examination of the best available information, I have **identified one or more restrictions** above.	☐ **Restricted**

Table D.1-1 is divided into Mandatory Considerations and Optional Considerations. Mandatory Considerations include elements that may pose a significant risk to human health and safety and must always be evaluated. Optional Considerations include elements that are not necessarily associated with human health and safety, so analysis is not mandated through this guidance document. All elements presented in this table are subject to the discretion of the Geotechnical Engineer if adequate supporting information is provided.

Applicants must evaluate infiltration restrictions through use of the best available data. A list of resources available for evaluation is provided in Section B.2

D.2 Determination of Design Infiltration Rates

This section is only applicable if the determination of design infiltration rates is performed by a licensed engineer practicing in geotechnical engineering. The guidance in this section identifies methods for identifying observed infiltration rates, corrected infiltration rates, safety factors, and design infiltration rates for use in structural BMP design. Upon completion of this section, the Geotechnical Engineer must recommend a design infiltration rate for each DMA and provide adequate support/discussion in the geotechnical report.

Table D.2-1: Elements for Determination of Design Infiltration Rates

Item	Value	Unit
Initial Infiltration Rate: Identify per Section D.2.1		in/hr
Corrected Infiltration Rate: Identify per Section D.2.2		in/hr
Safety Factor: Identify per Section D.2.3		unitless
Design Infiltration Rate: Corrected Infiltration Rate ÷ Safety Factor		in/hr

D.2.1 Initial Infiltration Rate

For purposes of this manual, the initial infiltration rate is the infiltration rate that has been identified based on the initial testing methods. Some of the acceptable methods for determining initial infiltration rates are presented in Table D.2-2 below, though other testing methods may be acceptable as evaluated by the geotechnical engineer. This table identifies what methods require application of correction factors, safety factors, and what BMPs types are ultimately acceptable for each testing method. The geotechnical engineer should use professional discretion when selecting a testing method as it may ultimately impact the types of BMPs that are permitted.

Table D.2-2: Acceptable Initial Infiltration Rate Methods

<table>
<tr><th>Category</th><th>Test</th><th>Correction Factor</th><th>Safety Factor</th><th>Suitable for Following BMPs</th></tr>
<tr><td>Desktop Methods*</td><td>NRCS Soil Survey Maps</td><td>Not Applicable</td><td>Not Applicable</td><td>BMPs with Underdrains</td></tr>
<tr><td rowspan="3">Correlation Methods</td><td>Grain Size Analysis</td><td rowspan="3">Not Applicable</td><td rowspan="3">Required (See Section D.2.3)</td><td rowspan="3">BMPs with Underdrains</td></tr>
<tr><td>Cone Penetrometer Testing</td></tr>
<tr><td>Laboratory Permeability Tests</td></tr>
<tr><td rowspan="4">Percolation Tests</td><td>Simple Open Pit Test</td><td rowspan="4">Required (See Section D.2.2)</td><td rowspan="4">Required (See Section D.2.3)</td><td rowspan="4">Any BMP Type</td></tr>
<tr><td>Open Pit Falling Head Test</td></tr>
<tr><td>Well Permeameter Method</td></tr>
<tr><td>Borehole Percolation Tests</td></tr>
<tr><td rowspan="4">Infiltration Tests</td><td>Double Ring Infiltrometer Test</td><td rowspan="4">Not Applicable</td><td rowspan="4">Required (See Section D.2.3)</td><td rowspan="4">Any BMP Type</td></tr>
<tr><td>Single Ring Infiltrometer Test</td></tr>
<tr><td>Large-scale Pilot Infiltration Test</td></tr>
<tr><td>Smaller-scale Pilot Infiltration Test</td></tr>
</table>

*Desktop methods may be performed without a geotechnical engineer. Refer to Basic Infiltration Analysis guidance in Section B.2.3 for more information.

NRCS Soil Survey Maps: NRCS Soil Survey maps can be used to establish approximate infiltration rates for use in BMP design. Under this method, default design infiltration rates may be applied based on the predominant NRCS soil type present within a proposed BMP location. Default design infiltration rates (in/hr) for each NRCS soil type are: A=0.300, B=0.200, C=0.100, D=0.025, Restricted=0.000. Use of these default design infiltration rates does not require application of any correction factors or safety factors.

Grain Size Analysis Testing: Hydraulic conductivity can be estimated indirectly from correlations with soil grain-size distributions. While this method is approximate, correlations have been relatively well established for some soil conditions. One of the most commonly used correlations between grain size parameters and hydraulic conductivity is the Hazen (1892, 1911) empirical formula (Philips and Kitch, 2011), but a variety of others have been developed. Correlations must be developed based on testing of site-specific soils. For purposes of this manual, saturated hydraulic conductivity and infiltration rate can be assumed to be equal.

Cone Penetrometer Testing: Hydraulic conductivity can be estimated indirectly from cone penetrometer testing (CPT). A cone penetrometer test involves advancing a small probe into the soil and measuring the relative resistance encountered by the probe as it is advanced. The signal returned from this test can be interpreted to yield estimated soil types and the location of key transitions between soil layers. If this method is used, correlations must be developed based on testing of site-specific soils. For purposes of this manual, saturated hydraulic conductivity and infiltration rate can be assumed to be equal.

Laboratory Permeability Testing: Laboratory testing can be performed to help evaluate the infiltration rates. The laboratory tests should be in accordance with ASTM or other approved procedures (e.g. ASTM D 5084 or D 5856). Several tests may be required from samples at different elevations to help evaluate the permeability characteristics of the soil strata.

Simple Open Pit Test: The Simple Open Pit Test is a falling head test in which a hole at least two feet in diameter is filled with water to a level of 6" above the bottom. Water level is checked and recorded regularly until either an hour has passed or the entire volume has infiltrated. The test is repeated two more times in succession and the rate at which the water level falls in the third test is used as the infiltration rate. This test identifies a percolation rate that should be converted to an infiltration rate using the Porchet method.

Open Pit Falling Head Test: This test is similar to the Simple Open Pit Test, but covers a larger footprint, includes more specific instructions, returns more precise measurements, and generally should be overseen by a geotechnical professional. Nonetheless, it remains a relatively simple test.

To perform this test, a hole is excavated at least 2 feet wide by 4 feet long (larger is preferred) and to a depth of at least 12 inches. The bottom of the hole should be approximately at the depth of the proposed infiltrating surface of the BMP. The hole is pre-soaked by filling it with water at least a foot above the soil to be tested and leaving it at least 4 hours (or overnight if clays are present). After pre-soaking, the hole is refilled to a depth of 12 inches and allow it to drain for one hour (2 hours for slower soils), measuring the rate at which the water level drops. The test is then repeated until successive trials yield a result with less than 10 percent change.

Well Permeameter Method (USBR 7300-89): Well permeameter methods were originally developed for purposes of assessing aquifer permeability and associated yield of drinking water wells.

This family of tests is most applicable in situations in which infiltration facilities will be placed substantially below existing grade, which limits the use of surface testing methods.

In general, this test involves drilling a 6 inch to 8 inch test well to the depth of interest and maintaining a constant head until a constant flow rate has been achieved. Water level is maintained with down-hole floats. A smaller diameter boring may be adequate, however this then requires a different correction factor to account for the increased variability expected. The Porchet method or the nomographs provided in the USBR Drainage Manual (United States Department of the Interior, Bureau of Reclamation, 1993) are used to convert the measured rate of percolation to an estimate of vertical hydraulic conductivity.

While these tests have applicability in screening level analysis, considerable uncertainty is introduced in the step of converting direct percolation measurements to estimates of vertical infiltration. Additionally, this testing method is prone to yielding erroneous results cases where the vertical horizon of the test intersects with minor lenses of sandy soils that allow water to dissipate laterally at a much greater rate than would be expected in a full-scale facility. To improve the interpretation of this test method, a continuous bore log should be inspected to determine whether thin lenses of material may be biasing results at the strata where testing is conducted. Consult USBR procedure 7300-89 for more details.

Source: (United States Department of the Interior, Bureau of Reclamation, 1990, 1993)

Borehole Percolation Tests: Borehole percolation tests were originally developed as empirical tests to estimate the capacity of onsite sewage disposal systems (septic system leach fields), but have more recently been adopted into use for evaluating storm water infiltration. Similar to the well permeameter method, borehole percolation methods primarily measure lateral infiltration into the walls of the boring and are designed for situations in which infiltration facilities will be placed well below current grade. The percolation rate obtained in this test should be converted to an infiltration rate using a technique such as the Porchet method.

This test is generally implemented similarly to the USBR Well Permeameter Method. Per the Riverside County Borehole Percolation method, a hole is bored to a depth at least 5 times the borehole radius. The hole is presoaked for 24 hours (or at least 2 hours if sandy soils with no clay). The hole is filled to approximately the anticipated top of the proposed infiltration basin. Rates of fall are measured for six hours, refilling each half hour (or 10 minutes for sand). Tests are generally repeated until consistent results are obtained.

The same limitations described for the well permeameter method apply to borehole percolation tests, and their applicability is generally limited to initial screening. To improve the interpretation of this test method, a continuous soil core can be extracted from the hole and below the test depth, following testing, to determine whether thin lenses of material may be biasing results at the strata where testing is conducted.

Sources: Riverside County Percolation Test (2011), California Test 750 (Caltrans, 1986), San Bernardino County Percolation Test (1992); USEPA Falling Head Test (USEPA, 1980).

In comparison to a double-ring infiltrometer, this test has the advantage of measuring infiltration over a larger area and better resembles the dimensionality of a typical small scale BMP. This test identifies a percolation rate that should be converted to an infiltration rate using the Porchet method. However, if this method is used to identify rates for a drywell BMP, the correction factor can be omitted at the discretion of the geotechnical engineer.

Double Ring Infiltrometer Test (ASTM 3385): The Double Ring Infiltrometer was originally developed to estimate the saturated hydraulic conductivity of low permeability materials, such as clay liners for ponds, but has seen significant use in storm water applications. The most recent revision of this method from 2009 is known as ASTM 3385-09. The testing apparatus is designed with concentric rings that form an inner ring and an annulus between the inner and outer rings. Infiltration from the annulus between the two rings is intended to saturate the soil outside of the inner ring such that infiltration from the inner ring is restricted primarily to the vertical direction.

To conduct this test, both the center ring and annulus between the rings are filled with water. There is no pre-wetting of the soil in this test. However, a constant head of 1 to 6 inches is maintained for 6 hours, or until a constant flow rate is established. Both the inner flow rate and annular flow rate are recorded, but if they are different, the inner flow rate should be used. There are a variety of approaches that are used to maintain a constant head on the system, including use of a Mariotte tube, constant level float valves, or manual observation and filling. This test must be conducted at the elevation of the proposed infiltrating surface; therefore application of this test is limited in cases where the infiltration surface is a significant distance below existing grade at the time of testing.

This test is generally considered to provide a direct estimate of vertical infiltration rate for the specific point tested and is highly replicable. However, given the small diameter of the inner ring (standard diameter is 12 inches, but it can be larger), this test only measures infiltration rate in a small area. Additionally, given the small quantity of water used in this test compared to larger scale tests, this test may be biased high in cases where the long term infiltration rate is governed by groundwater mounding and the rate at which mounding dissipates (i.e., the capacity of the infiltration receptor). Finally, the added effort and cost of isolating vertical infiltration rate may not necessarily be warranted considering that BMPs typically have a lateral component of infiltration as well. Therefore, while this method has the advantages of being technical rigorous and well standardized, it should not necessarily be assumed to be the most representative test for estimating full-scale infiltration rates. Source: American Society for Testing and Materials (ASTM) International (2009).

Single Ring Infiltrometer Test: The single ring infiltrometer test is not a standardized ASTM test, however it is a relatively well-controlled test and shares many similarities with the ASTM standard double ring infiltrometer test (ASTM 3385-09). This test is a constant head test using a large ring (preferably greater than 40 inches in diameter) usually driven 12 inches into the soil. Water is ponded above the surface. The rate of water addition is recorded and infiltration rate is determined after the flow rate has stabilized. Water can be added either manually or automatically.

The single ring used in this test tends to be larger than the inner ring used in the double ring test. Driving the ring into the ground limits lateral infiltration; however some lateral infiltration is generally considered to occur. Experience in Riverside County (CA) has shown that this test gives results that are close to full-scale infiltration facilities. The primary advantages of this test are that it is relatively simple to conduct and has a larger footprint (compared to the double-ring method) and restricts horizontal infiltration and is more standardized (compared to open pit methods). However, it is still a relatively small scale test and can only be reasonably conducted near the existing ground surface.

Large Scale Pilot Infiltration Test: As its name implies, this test is closer in scale to a full-scale infiltration facility. This test was developed by Washington State Department of Ecology specifically for storm water applications.

To perform this test, a test pit is excavated with a horizontal surface area of roughly 100 square feet to a depth that allows 3 to 4 feet of ponding above the expected bottom of the infiltration facility.

Water is continually pumped into the system to maintain a constant water level (between 3 and 4 feet about the bottom of the pit, but not more than the estimated water depth in the proposed facility) and the flow rate is recorded. The test is continued until the flow rate stabilizes. Infiltration rate is calculated by dividing the flow rate by the surface area of the pit.

This test has the advantage of being more resistant to bias from localized soil variability and being more similar to the dimensionality and scale of full scale BMPs. It is also more likely to detect long term decline in infiltration rates associated with groundwater mounding. As such, it remains the preferred test for establishing design infiltration rates in Western Washington (Washington State Department of Ecology, 2012). In a comparative evaluation of test methods, this method was found to provide a more reliable estimate of full-scale infiltration rate than double ring infiltrometer and borehole percolation tests (Philips and Kitch 2011).

The difficulty encountered in this method is that it requires a larger area be excavated than the other methods, and this in turn requires larger equipment for excavation and a greater supply of water. However, this method should be strongly considered when less information is known about spatial variability of soils and/or a higher degree of certainty in estimated infiltration rates is desired.

Smaller-Scale Pilot Infiltration Test: The smaller-scale PIT is conducted similarly to the large-scale PIT but involves a smaller excavation, ranging from 20 to 32 square feet instead of 100 square feet for the large-scale PIT, with similar depths. The primary advantage of this test compared to the full-scale PIT is that it requires less excavation volume and less water. It may be more suitable for small-scale distributed infiltration controls where the need to conduct a greater number of tests outweighs the accuracy that must be obtained in each test, and where groundwater mounding is not as likely to be an issue.

D.2.2 Corrected Infiltration Rate

For purposes of this manual, the corrected infiltration rate is the initial infiltration rate as modified by appropriate correction factors needed to convert from percolation to infiltration or to correct for effects of water temperature. The sections below present discussion on correction factors that should be considered by the Geotechnical Engineer.

D.2.2.1 Percolation Rate Correction Factor

A common misunderstanding is that the “percolation rate” obtained from a percolation test is equivalent to the “infiltration rate” obtained from tests such as a single or double ring infiltrometer test which is equivalent to the “saturated hydraulic conductivity”. In fact, these terms have different meanings. Saturated hydraulic conductivity is an intrinsic property of a specific soil sample under a given density. It is a coefficient in Darcy’s equation (Darcy 1856) that characterizes the flux of water that will occur under a given gradient. The measurement of saturated hydraulic conductivity in a laboratory test is typically referred to as “permeability”, which is a function of the density, structure, stratification, fines, and discontinuities of a given sample under given controlled conditions. In contrast, infiltration is the downward entry of water into the soil. The velocity at which water enters the soil is infiltration rate. Infiltration rate is typically expressed in inches per hour. For the purposes of this manual, saturated hydraulic conductivity and infiltration rate can be assumed to be equal. Similarly, to permeability, infiltration rate can be limited by a number of factors including the layering of soil, density, discontinuities, and initial moisture content. These factors control how quickly water can move through a soil. However, infiltration rate can also be influenced by mounding of groundwater, and the rate at which water dissipates horizontally below a BMP – both of which describe the "capacity" of the "infiltration receptor" to accept this water over an extended period. For this reason, an infiltration test should ideally be conducted for a relatively long duration resembling a series of storm events so that the capacity of the infiltration receptor is evaluated as well as the rate at which water can enter the system. Infiltration rates are generally tested with larger diameter holes, pits, or apparatuses intended to enforce a primarily vertical direction of flux.

In contrast, percolation is tested with small diameter holes, and it is mostly a lateral phenomenon. The direct measurement yielded by a percolation test tends to overestimate the infiltration rate, except perhaps in cases in which a BMP has similar dimensionality to the borehole, such as a dry well. Adjustment of percolation rates may be made to an infiltration rate using a technique such as the Porchet Method. For drywell BMPs this adjustment may be determined per other methods, (i.e. USBR 7300-89), or may be omitted entirely at the discretion of the geotechnical engineer.

Percolation Rate Conversion Example

Problem:

Apply the Porchet Method (Inverse Borehole Method) to determine the corrected infiltration rate from the following inputs:

- Total depth of test hole, D_T = 60 inches
- Initial depth to water, D_O = 12.25 inches
- Final depth to water, D_f = 13.75 inches
- Test hole radius, r = 4 inches
- Time interval, Δt = 10 minutes

Solution:

1. Solve for the height of water at the beginning of the selected time interval, H_O:

   $H_O = D_T - D_O = 60 - 12.25 = 47.75$ inches

2. Solve for the height of water at the end of the selected time interval, Hf:

   Hf = DT - Df = 60 -13.75 = 46.25 inches

3. Solve for the change in height of water over the selected time interval, ΔH:

   ΔH = HO - Hf = 47.75 - 46.25 = 1.50 inches

4. Calculate the average head over the selected time interval, Havg:

   Havg = (Ho + Hf)/2 = (47.75 + 46.25)/2 = 47.00 inches

5. Calculate the tested infiltration rate, It, using the following equation:

   It= (ΔH*60*r) /(Δt*(r+2Havg))

   It = (1.50 in * 60 min/hr * 4 in) / (10 min * (4 inch + (2 * 47 in))) = 0.37 in/hr

D.2.2.2 Temperature Correction Factor

The rate of infiltration through soil is affected by the viscosity of water, which in turn is affected by the temperature of water. As such, infiltration rate is strongly dependent on the temperature of the infiltrating water (Cedergren, 1997). For example, Emerson (2008) found that wintertime infiltration rates below a BMP in Pennsylvania were approximately half their peak summertime rates. As such, it is important to consider the effects of temperature when planning tests and interpreting results.

If possible, testing should be conducted at a temperature that approximates the typical runoff temperatures for the site during the times when rainfall occurs. If this is not possible, then the results of infiltration tests should be adjusted to account for the difference between the temperature at the time of testing and the typical temperature of runoff when rainfall occurs. The measured infiltration can be adjusted by the ratio of the viscosity at the test temperature versus the typical temperature when rainfall occurs (Cedergren, 1997), per the following formula:

$$K_{Typical} = K_{Test} \times \left(\frac{\mu_{Test}}{\mu_{Typical}} \right)$$

Where:

$K_{Typical}$ = the typical infiltration rate expected at typical temperatures when rainfall occurs

K_{Test} = the infiltration rate measured or estimated under the conditions of the test

$\mu_{Typical}$ = the viscosity of water at the typical temperature expected when rainfall occurs

μ_{Test} = the viscosity of water at the temperature at which the test was conducted

D.2.3 Safety Factors

A safety factor between 2.0 and 9.0 must be applied to the infiltration rates determined above[2]. Application of a safety factor reduces initial or corrected infiltration rates in order to account for various considerations that can impact infiltration rates measured rates over time. In order to minimize safety factor impacts, applicants should consider performing rigorous site investigation, incorporating pretreatment and resiliency into the site design, and taking steps to reduce incidental compaction within BMP footprints.

If the proposed BMP utilizes an underdrain, a default safety factor of 2.0 may be applied or a more detailed safety factor may be determined per Table D.2-3. If the proposed BMP does not utilize an underdrain, then the safety factor must be determined through completion of Table D.2-3.

[2] Use of default design infiltration rates based on NRCS soil type does not require application of safety factor.

Table D.2-3: Determination of Safety Factor

Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	
	Soil Texture Class	0.25		
	Soil Variability	0.25		
	Depth to Groundwater/Obstruction	0.25		
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	
	Resiliency	0.25		
	Compaction	0.25		
	Design Safety Factor, $S_B = \Sigma p$			
Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)				

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

Table D.2-4: Guidance for Determining Individual Factor Values

Consideration	High Concern (3 points)	Medium Concern (2 points)	Low Concern (1 point)
Infiltration Testing Method	Any	At least 2 tests of any kind within 50' of BMP.	At least 4 tests within BMP footprint, OR Large/Small Scale Pilot Infiltration Testing over at least 5% of BMP footprint.
Soil Texture Class	Unknown, Silty, or Clayey	Loamy	Granular/Slightly Loamy
Soil Variability	Unknown or High	Moderately Homogeneous	Significantly Homogeneous
Depth to Groundwater/ Obstruction	<5' below BMP	5-15' below BMP	>15' below BMP
Pretreatment	None/Minimal	Provides good pretreatment OR does not receive significant runoff from unpaved areas	Provides excellent pretreatment OR only receives runoff from rooftops and road surfaces.
Resiliency	None/Minimal	Includes underdrain/backup drainage that ensures ponding draws down in <96 hours	Includes underdrain/backup drainage AND supports easy restoration of impacted infiltration rates.
Compaction	Moderate Likelihood	Low Likelihood	Very Low Likelihood

D.3 Geotechnical Reporting Requirements

This section is only applicable if a licensed engineer practicing in geotechnical engineering has performed the determination of infiltration restrictions and/or design infiltration rates. The geotechnical report must document the following items in the geotechnical report.

- **Date of site analysis**
- **Scope and results of testing**
- **Public health and safety requirements that affect infiltration locations**
    - Must address Mandatory Considerations presented in Appendix D.1
- **Conclusions**
    - Characterize DMAs as Restricted or Unrestricted for Infiltration
    - Identify Design Infiltration Rates for DMAs
- **Correspondence between County Staff and Geotechnical Engineer (if applicable)**
    - Development status of site prior to the project application (i.e. new development with raw ungraded land, or redevelopment with existing graded conditions)
    - The history of design discussions for the site proposed project
    - Site design alternatives considered to achieve infiltration or partial infiltration on site
    - Physical impairments and public safety concerns (i.e. fire road egress, sewer lines, etc)
    - The extent low impact development BMP requirements were included in the project design

It is ultimately the responsibility of the SWQMP Preparer (not the geotechnical engineer) to interpret the conclusions made in the geotechnical report and ensure they are appropriately supported/reflected in associated SWQMP submittal materials such as checklists, narratives, calculations, exhibits, and supplemental reports.