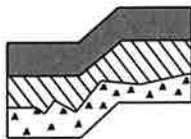


DESIGN MEMORANDUM



TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

To: Mr. Tyler Litzenberger

Date: April 25, 2025

Vector Development

Project Number: T-8565

From: Carolyn S. Decker, P.E.

Project Name: Freeman Logistics

Subject: Infiltration Rate - Frontage

Pierce County, Washington

Reference: Geotechnical Report, Freeman Logistics, Freeman Road East and 19th Avenue Northwest, Pierce County, Washington, Project No. T-8565, prepared by Terra Associates, Inc., dated August 11, 2021, revised July 11, 2022

Tyler:

As requested, we have evaluated the use of infiltration facilities at the project site. Specifically, we have looked at the potential to use infiltration facilities along the frontage of the Freeman Logistics project located in Pierce County, Washington.

The referenced report shows the various subsurface explorations that have been completed at the project site along with the laboratory testing completed on the samples obtained in the field.

In order to evaluate the infiltration potential for facilities along the frontage, we used the Soil Grain Size Analysis Method as outlined in Volume V Section 5.4 of the 2024 Washington State Department of Ecology Stormwater Management Manual for Western Washington, to determine a preliminary long-term design infiltration rate. This method correlates the saturated hydraulic conductivity with the D₁₀, D₆₀, and D₉₀ particle sizes determined from gradation testing of the soils in accordance with ASTM Test Designation D-422. The D₁₀ particle size represents the grain size below which ten percent of the soil is smaller in size. The D₆₀ particle size represents the grain size below which 60 percent of the soil is smaller in size. The D₉₀ particle size represents the grain size below which 90 percent of the soil is smaller in size. The particle sizes are put in the Massman formula to determine the saturated hydraulic conductivity. Gradation curves from laboratory testing on the soils are in the referenced report. Based on the results of the testing, a long-term design infiltration rate of 0.1 inches per hour would be expected for the site.

The calculated 0.1 inches per hour is below the manual required 0.3 inches per hour for infiltration to be feasible. Therefore, it is our opinion that infiltration at the site remains infeasible and conventional stormwater control methods should be used.

The 2024 Washington State Department of Ecology Stormwater Management Manual for Western Washington states that the grain size analysis method should not be used to derive infiltration rates for formations that have been glacially consolidated. This was added to the manual because the grain size analysis method typically overestimates the infiltration rate for a formation.

The concern had been that this method was used for infiltration facilities that were founded in Advance Outwash which is a sand formation typically found below a glacial till formation and while permeable, the density of the formation can restrict the infiltration rate. In order to prevent engineers from using the grain size analysis for the Advance Outwash formation, the Department of Ecology restricted the use of the method to un glacially consolidated formations.

The purpose of our analysis is to demonstrate that the soils at the site are not suitable for infiltration. By utilizing the grain size analysis method, we are potentially overestimating the infiltration rate for the project site. If an overestimated infiltration rate is below the threshold for feasibility, it is our opinion that the site soils would not be suitable for any infiltration. Therefore, the grain size analysis method should be an acceptable method for confirming infeasibility.

We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

