TERRA ASSOCIATES, Inc.
Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

February 20, 2025
Project No. T-8565

Mr. Tyler Litzenberger
Vector Development Company
11335 Northeast 122nd Way, Suite 105
Kirkland, Washington 98034

Subject: Offsite Infiltration Testing
Freeman Logistics
Freeman Road East and North Levee Road East
Fife, Washington

Dear Mr. Litzenberger:

As requested, we have completed infiltration testing for the proposed infiltration facilities at the project site. Our infiltration testing consisted of five small-scale Pilot Infiltration Tests (PITs). The tests were completed in the shoulder on the west side of Freeman Road East and were conducted in general conformation with the procedures outlined in Appendix III-A (Methods for Determining Design Infiltration Rates) of the 2021 Pierce County Stormwater and Site Development Manual.

The approximate location is shown on attached Figure 1. The test results are summarized below:

Test No.	Approximate Test Elevation (ft)	Test Depth (ft) below Existing Ground Level	Steady State Flow Rate (gpm)	Measured Infiltration Rate (Isat initial) (in/hr)	Correction Factor CFT[1]	Estimated Design Infiltration Rate (Isat design = Isat initial x CFT) (in/hr)
PIT-1	34	5	7.0	48.8	0.028	1.34
PIT-2	34	5	15.9	87.4	0.028	2.43
PIT-3	34	5	9.0	72.2	0.028	2.01
PIT-4	32	5	5.0	40.1	0.028	1.12
PIT-5	32	5	2.1	14.4	0.028	0.40

ft Feet based on available topography
gpm Gallons per minute
in/hr Inches per hour
1 2021 Pierce County Stormwater and Site Development Manual

The results of the testing show infiltration rates of approximately 0.40 to 2.43 inches per hour. Averaging the five infiltration rates we get a long-term infiltration rate of 1.46 inches per hour. Based on the site geology and previous studies, we recommend using a design infiltration rate of 1.5 inches per hour.

Once the facility has been excavated, the soil should be observed to confirm the material is consistent with the material tested. The raw pilot infiltration test data has been included as Figures 2 through 6.

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

Sincerely yours,
TERRA ASSOCIATES, INC.

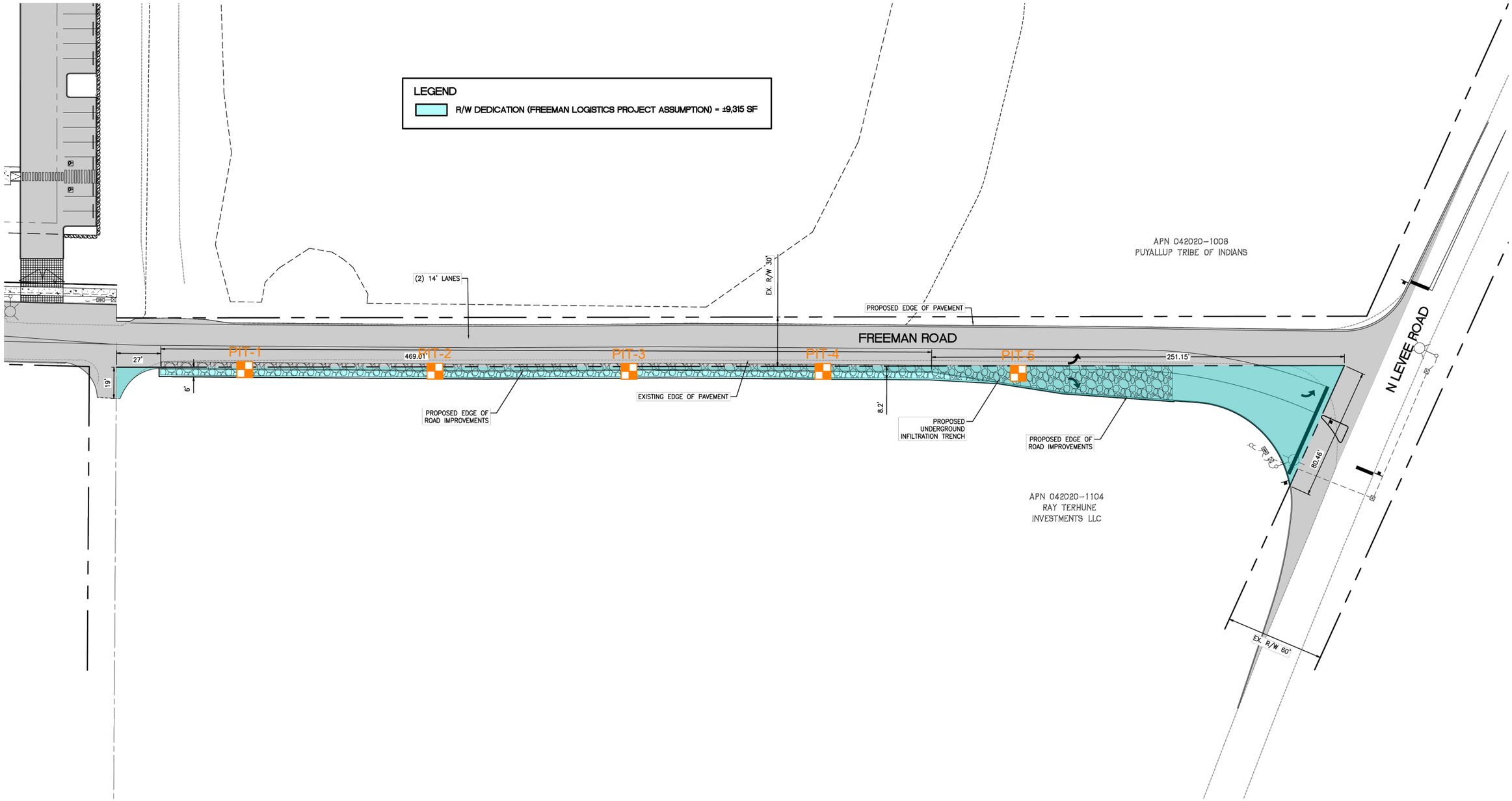
John Mahke, L.E.G.
Project Geologist

Carolyn S. Decker, P.E.
President

2-20-25

CAROLYN S. DECKER
STATE OF WASHINGTON
47016
REGISTERED
PROFESSIONAL ENGINEER

Enclosed: Figure 1 – Exploration Location Plan
Figures 2 through 6 – PIT Raw Data



NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY BARGHAUSEN.

LEGEND:

APPROXIMATE PILOT INFILTRATION TEST LOCATION

0 60 120

APPROXIMATE SCALE IN FEET

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

EXPLORATION LOCATION PLAN
FREEMAN LOGISTICS
PIERCE COUNTY, WASHINGTON

Proj.No. T-8565	Date: FEB 2025	Figure 1

Test Number:	**PIT-1**
Project Name:	**Freeman Logistics**
Project Number:	**T-8565**
Test Date:	**2/5/2025**

hole dimensions	3.5'x4'	
Hole area	14	square feet
initial meter reading	0	gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)
15	97	6.50	0.9
30	225	6.50	1
45	320	7.30	1
60	430	7.00	1
75	545	7.10	1
90	740	7.00	1
105	755	6.90	1
120	900	7.00	1
135	980	7.00	1.05
150	1076	7.10	1.05

use mean flow rate of last half hour of test as steady state infiltration rate

7.03 gpm

0.94 cfm

infiltration rate=steady sate flow divided by area of pit

0.07 feet per minute

0.81 inches per minute

Falling head test

time (minute)	HEAD (feet)
0	1.05
1	0.9
3	0.8
5	0.7
7	0.6
9	0.5
12	0.4
16	0.3
20	0.2
26	0.1
34	0

measured infiltration rate using steady state data: 48.35 inches per hour

measured infiltration rate using falling head data: 22.24 inches per hour

Correction factors		*factors were obtained from the 2021 Pierce County Stormwater Management and Site Development Manual*
F-testing	0.5	
F-geometry	0.07	
F-plugging	0.8	
n/a	n/a	

corrected steady state infiltration rate	**1.34**	inches per hour
corrected falling head infiltration rate	**0.62**	inches per hour

Test Number:	**PIT-2**
Project Name:	**Freeman Logistics**
Project Number:	**T-8565**
Test Date:	**2/5/2025**

hole dimensions	3.5'x5'	
Hole area	17.5	square feet
initial meter reading	0	gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)
15	255	17.50	0.7
30	515	16.60	0.85
45	760	16.30	0.95
60	1000	16.00	1
75	1245	15.80	1
90	1475	15.60	1
105	1711	15.60	1
120	2052	15.90	1
135	2290	15.90	1
150	2545	15.90	1

use mean flow rate of last half hour of test as steady state infiltration rate

15.90 gpm

2.13 cfm

infiltration rate=steady sate flow divided by area of pit

0.12 feet per minute

1.46 inches per minute

Falling head test

time (minute)	HEAD (feet)
0	1
1	0.8
2	0.7
3	0.6
4	0.5
5	0.3
6	0.2
7	0.1
8	0

measured infiltration rate using steady state data: 87.45 inches per hour

measured infiltration rate using falling head data: 90.00 inches per hour

Correction factors		*factors were obtained from the 2021 Pierce County Stormwater Management and Site Development Manual*
F-testing	0.5	
F-geometry	0.07	
F-plugging	0.8	
n/a	n/a	

corrected steady state infiltration rate	**2.43**	inches per hour
corrected falling head infiltration rate	**2.50**	inches per hour

Test Number:	**PIT-3**
Project Name:	**Freeman Logistics**
Project Number:	**T-8565**
Test Date:	**2/4/2025**

hole dimensions	3'x4'	
Hole area	12	square feet
initial meter reading	0	gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)
15	110	7.20	1
30	223	7.20	1
45	360	9.30	1
60	495	9.00	1
75	630	9.00	1
90	745	9.00	1
105	906	9.00	1
120	1037	9.16	1
135	1172	9.13	1
150	1307	9.01	1
165	1445	9.01	1
180	1577	9.00	1

use mean flow rate of last half hour of test as steady state infiltration rate

9.01 gpm

1.20 cfm

infiltration rate=steady sate flow divided by area of pit

0.10 feet per minute

1.20 inches per minute

Falling head test

time (minute)	HEAD (feet)
0	1.05
1	0.9
2	0.8
3	0.7
4	0.6
5	0.5
6	0.4
8	0.3
10	0.2
12	0.1
14	0

measured infiltration rate using steady state data: 72.24 inches per hour

measured infiltration rate using falling head data: 54.00 inches per hour

Correction factors		*factors were obtained from the 2021 Pierce County Stormwater Management and Site Development Manual*
F-testing	0.5	
F-geometry	0.07	
F-plugging	0.8	
n/a	n/a	

corrected steady state infiltration rate	**2.01**	inches per hour
corrected falling head infiltration rate	**1.50**	inches per hour

Test Number:	**PIT-4**
Project Name:	**Freeman Logistics**
Project Number:	**T-8565**
Test Date:	**2/4/2025**

hole dimensions	3'x4'	
Hole area	12	square feet
initial meter reading	0	gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)
15	70	4.65	1
30	145	4.75	1
45	252	7.40	1
60	435	7.40	1
75	546	5.60	1
90	630	5.60	1
105	696	5.50	1
120	759	4.90	1
135	835	4.90	1
150	909	5.00	1
165	984	5.00	1
180	1060	5.00	1

use mean flow rate of last half hour of test as steady state infiltration rate

5.00 gpm

0.67 cfm

infiltration rate=steady sate flow divided by area of pit

0.06 feet per minute

0.67 inches per minute

Falling head test

time (minute)	HEAD (feet)
0	1
2	0.8
4	0.7
6	0.6
8	0.5
10	0.4
13	0.3
16	0.2
21	0.1
26	0

measured infiltration rate using steady state data: 40.10 inches per hour

measured infiltration rate using falling head data: 27.69 inches per hour

Correction factors		*factors were obtained from the 2021 Pierce County Stormwater Management and Site Development Manual*
F-testing	0.5	
F-geometry	0.07	
F-plugging	0.8	
n/a	n/a	

corrected steady state infiltration rate	**1.12**	inches per hour
corrected falling head infiltration rate	**0.77**	inches per hour

Test Number:	**PIT-5**
Project Name:	**Freeman Logistics**
Project Number:	**T-8565**
Test Date:	**2/4/2025**

hole dimensions	3.5'x4'	
Hole area	14	square feet
initial meter reading	0	gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)
15	131	3.00	1.2
30	176	3.00	1.2
45	215	2.70	1.2
60	261	2.70	1.2
75	297	2.50	1.2
90	330	2.20	1.2
105	364	2.10	1.2
120	396	2.10	1.2
135	428	2.10	1.2
150	460	2.10	1.2
165	520	2.10	1.2
180	595	2.10	1.2

use mean flow rate of last half hour of test as steady state infiltration rate

2.10 gpm

0.28 cfm

infiltration rate=steady sate flow divided by area of pit

0.02 feet per minute

0.24 inches per minute

Falling head test

time (minute)	HEAD (feet)
0	1.2
5	1.1
15	0.95
24	0.5
30	0.5
36	0.7
41	0.6
46	0.5
52	0.4
58	0.3
65	0.2
73	0

measured infiltration rate using steady state data: 14.44 inches per hour

measured infiltration rate using falling head data: 11.84 inches per hour

Correction factors		*factors were obtained from the 2021 Pierce County Stormwater Management and Site Development Manual*
F-testing	0.5	
F-geometry	0.07	
F-plugging	0.8	
n/a	n/a	

corrected steady state infiltration rate	**0.40**	inches per hour
corrected falling head infiltration rate	**0.33**	inches per hour