TRIP REPORT
SOUTH PENNELL ROAD EFRD SITE – INFILTRATION TESTING

1.0 PURPOSE

This Trip Report presents the field data and results of double-ring soil infiltration tests conducted to support the design of a stormwater management system at the South Pennell Road EFRD site located in Middletown Township, Delaware County, Pennsylvania, as part of the Pennsylvania Pipeline Project (PPP) for Sunoco Pipeline, LP. Two shallow tests (IT-C and IT-D) were performed at the site. The test locations are listed by coordinates (latitude and longitude) in Table 1 and shown on the attached figure.

2.0 FIELD ACTIVITIES

The infiltration tests were conducted by Ken McGill and Heather Rychlak of CH2M Hill Inc., on October 6, 2016. The test locations were positioned in the field using a handheld, WAAS-enabled GPS unit. Table 1 provides the coordinates of the test locations. The tests were located in a utility right of way west of Lenni Road.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. The test locations were prepared with hand tools, and care was taken to minimize disturbance of the soil surface to be tested. Double-ring infiltrometers were used for testing and consisted of 8-inch diameter and 4-inch diameter sections of steel casing, each 10 inches in height. After digging to the target depth, the test surface was leveled, and loose soil and debris were removed. The rings were driven a minimum of 2 inches into the soil. The infiltration test depths are presented in Table 1.

The test locations were pre-soaked for 1 hour. The tests were then conducted with measurements at 10-minute or 30-minute intervals, based on the observed water level drop during the last half of the pre-soak period. Pre-soak and test information was recorded on infiltration test data sheets; copies of the test data sheets are attached to this report.

During the testing, the weather was sunny, approximately 70 degrees Fahrenheit, and no precipitation was observed during the time of testing. Additionally, no precipitation was observed 24 hours prior to testing.

A hand auger was utilized to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of the seasonal high water table near the test areas. This was completed from the ground surface down to two feet below the target infiltration test depth. Descriptions of the soil were documented on field logs, which were based on the form example in the BMP manual. Copies of the soil logs are attached to this report.

3.0 RESULTS

3.1 Soil Description

Soils encountered generally consisted of a thin (up to approximately 6 inches) very dark brown (7.5YR 2.5/2) organic loam topsoil/surface layer with fine roots throughout. This topsoil/surface layer was underlain by a brown (7.5YR 4/4) silt loam with few rock fragments. A second silt loam layer was found from 18-29 inches below ground surface which was very dark brown (7.5YR 2.5/2) in color and contained few rocks. Both test units were located immediately adjacent to an existing utility corridor and soils found within the units appeared to be fill from construction. Bedrock was not encountered.

Seasonal high water was not observed at the testing location, nor was any mottling observed.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey data, the soil type for the test locations is mapped as follows:

- Neshaminy Gravelly Silt Loam - (NaC3 soil symbol) with 8-15 percent slopes; with high runoff and is well drained.

3.2 Infiltration Tests Results

Table 1 summarizes the infiltration rates (inches per hour) calculated from the test data. The infiltration rates presented in Table 1 were calculated from the average water level drop of the last four stabilized readings measured in the inner ring.

The pre-soak test result for IT-C indicated a high infiltration rate, requiring a 10 minute test cycle; whereas, the pre-soak test result for IT-D indicated a low infiltration rate, requiring a 30 minute test cycle.

Two additional test locations (IT-A and IT-B) were proposed; however, discussions with the land agent indicated that the locations could not be tested due to land owner disputes.

Table 1
Summary of Infiltration Test Results
South Pennell Road EFRD
Middletown Township, Delaware County, PA
Sunoco PPP

Test Location (IT-)	Location Data		Test Depth (inches)	Infiltration Test Result (inches/hour)
	LATITUDE	LONGITUDE		
IT-C (shallow)	39.9027274°	- 075.4428057°	3	3.60
IT-D (shallow)	39.9025743°	- 075.4429231°	3	0.10

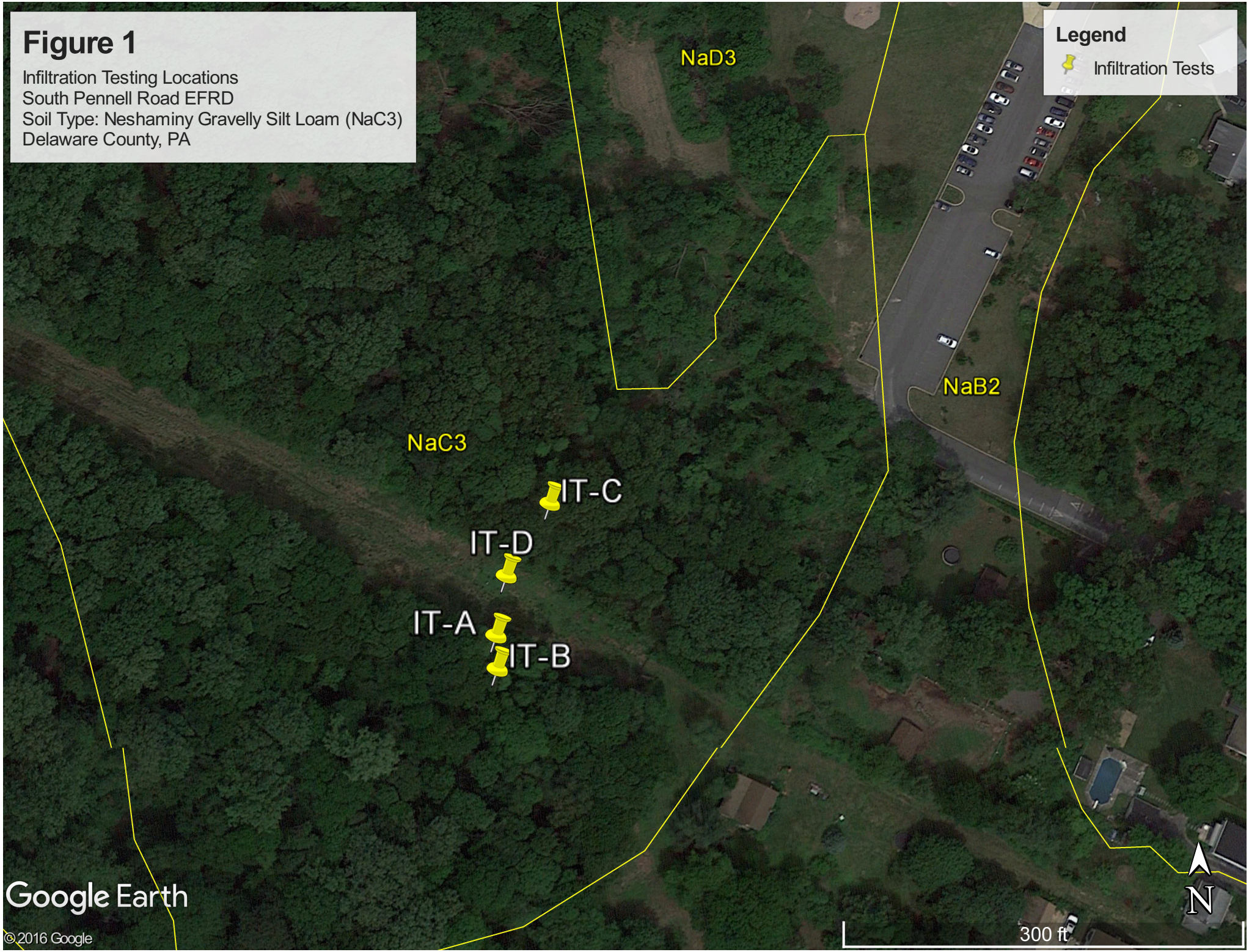
Figure 1
Infiltration Testing Locations
South Pennell Road EFRD
Soil Type: Neshaminy Gravelly Silt Loam (NaC3)
Delaware County, PA
Legend
Infiltration Tests
NaD3
NaB2
NaC3
IT-C
IT-D
IT-A
IT-B
Google Earth
©2016 Google
N
300 ft

ATTACHMENTS

SOIL LOGS

TETRA TECH

Soil Log

Tested By: H Rychlak ; K. McGill **Project:** Sunoco **Project No.:** 112IC05958

Test Pit: "C; S. Pennell Rd **Date:** 10/6/16 **Elevation:** — **Equipment Used:** Auger

Geology: — **Soil Type:** loam **Land Use:** Seconday successional woods **Weather:** 75° F clear

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	5"	loam	organic	7.5YR 2.5/2	N/A	roots	N/A	N/A	
A	5"	18"	loam	silts rocks	7.5YR 3/4	N/A	Rocks	N/A	N/A	
B	18"	24"	loam	silts	7.5YR 2.5/2	N/A	Rocks	N/A	N/A	

Horizon:	USDA Definition
O	Organic debris
A	Dark colored, mixed mineral organic matter
B	Maximum accumulation of silicate clay minerals
C	Weathered parent material
R	Layer of consolidated rock beneath the soil

Soil Textural Class
Use ternary diagram from US Department of Agriculture Soil Conservation Service

Boundary
Use depth and classification
Classification as Follows:
Abrupt
Clear
Gradual
Diffuse

Notes:

Adjacent to pipeline ROW. Secondary successional forest No bedrock encountered

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

112IC05958

Tested By: K. Nuble; K. McGill
Project: Sunoco PPP
Project No.: —
Test Pit: 4; S. Pennell Rd
Date: 10/5/2016
Elevation:
Equipment Used: Hand Auger
Geology:
Soil Type:
Land Use: ROW
Weather: Sunny 75°F

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	O	6"	Silt Loam	Organics	5YR3/3	None	Roots/ rocks	No	No	
A	6"	13"	Silt Loam	Mineral material/ gravel	7.5YR4/4		Rock fragments	No	No	Refusal at 13" increasing rock fragments

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification Classification as Follows: Abrupt	Test location located on a slope disturbed fill.
A	Dark colored, mixed mineral organic matter			
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

INFILTRATION TEST DATA SHEETS

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco
PROJECT NUMBER: 112SC05958
TEST AREA ID: S. Pennell Rd EFRD (15874.20)
PERSONNEL: K. McGill; H. Rychlak

TEST METHOD: ~~Double Ring Infiltrometer~~ Percolation
Single Ring Infiltrometer

Location Coordinates or Description:
Location "C" - PCS-6.05
Lat = 39.902 7274°
Long = -075.442 8057°

INNER RING INSIDE DIAMETER/HEIGHT: 4" / 10"
OUTER RING INSIDE DIAMETER/HEIGHT: 8" / 10"

PERCOLATION HOLE DIAMETER: _____ (If performing an open hole perc test)

DATE(s): 10/6/2016

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches):

MEASURING POINT: (Ring Rim) Indicator Mark

DEPTH OF TEST: Surface Test

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
PRESOAK DATA				
17:55	0	----------		No Rain for 24 hours
18:25	30	2.5"	0.6L	
18:55	60	2.5"	0.6L	5 inches per hour
TEST DATA				
18:55	0			Started Test
19:05	10	1.1"	0.3L	
19:15	20	1.1"	0.3L	
19:25	30	1.1"	0.3L	
19:35	40	1.1"	0.3L	
19:45	50	0.6"	0.2L	
19:55	60	0.6"	0.2L	
20:05	70	0.6"	0.2L	
20:15	80	0.6"	0.2L	Ended Test
				Infiltration = 3.6" per hour

INFILTRATION TEST DATA SHEET

Tetra Tech, Inc.

PROJECT NAME: Sunoco
PROJECT NUMBER: 112 IC 05958
TEST AREA ID: S. Penn II Rd. EFRD (15874-20)
PERSONNEL: K. McGill; H. Rychlak

TEST METHOD: ~~Double Ring Infiltrometer~~ Percolation
~~Single Ring Infiltrometer~~

Location Coordinates or Description:
Location "d" - PCS 6.05
Lat. = 39.9025743
Long = -075.4429231

INNER RING INSIDE DIAMETER/HEIGHT: 4"/10"
OUTER RING INSIDE DIAMETER/HEIGHT: 8"/10"

PERCOLATION HOLE DIAMETER: NA (If performing an open hole perc test)

DATE(s): 10/6/2016

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 6-8 inches):

MEASURING POINT: ~~Ring Rim~~ Indicator Mark

DEPTH OF TEST: Surface

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE, INNER RING (liters)	REMARKS
PRESOAK DATA				
17:45	0	----------		No rain for 24 hrs
18:15	30	0.1"	0.05L	
18:45	60	0.1"	0.05L	0.2" inches per hour
TEST DATA				
18:46	0	----------		Started Test
19:15	30	0.1"	0.05L	
19:45	60	0.0"	0 L	
20:15	90	0.0"	0 L	
20:45	120	0.1"	0.05L	Stopped TEST
				Infiltration = 0.2"/hour