TRIP REPORT

Date: November 17, 2015

To: Rob Simcik

From: Scott R. Anderson, Hydrogeologist

Subject: Summary of Soil Infiltration Tests
Raystown Lake West
Sunoco Pipeline/Valve Stations
Penn Township, Huntingdon County, Pennsylvania

This trip report provides results of soil infiltration tests that were completed as part of the Segment 2 Pipeline Project for Sunoco, in Penn Township, Huntingdon County, Pennsylvania.

1.0 PURPOSE

This report presents the field data and results of double ring soil infiltration tests conducted to support the design of stormwater management systems at several locations in Penn Township, Huntingdon County, Pennsylvania. Two shallow tests (IT-1 and IT-2) were performed at the property. Test locations are listed by coordinates (latitude and longitude) in Table 1 and shown on the attached figures.

2.0 FIELD ACTIVIES

The infiltration tests were conducted by Mark Mengel and Matt Simcik of Tetra Tech, Inc., on September 21, 2015. The test locations were positioned in the field using a handheld, WAAS-enabled GPS unit and reference to google earth map. Table 1 provides the coordinates recorded in the field. IT-1 and IT-2 were located approximately in a field adjacent to a forest of moderate sized deciduous and pine trees. Photographs of testing locations are attached to this report.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. Double ring tests were performed at this site. The double ring test locations were prepared for test locations with a shovel. The double-ring infiltrometers that were used for testing consisted of 10-inch and 6-inch diameter sections of 10-inch steel casing. After digging to the target depth, the test surface was leveled, and any loose soil or fallen vegetation was removed. The rings were driven a minimum of 2 inches into the soil. Infiltration test depths are provided on Table 1.

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

During the testing, the weather was sunny and warm, approximately 70 degrees Fahrenheit, and no precipitation was observed during the tests.

In addition, a hand auger was advanced to approximately 3.0 feet bgs near the testing locations to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of the seasonal high water table. The hand auger was advanced to at least two feet below the target infiltration test depth or refusal, whichever was encountered first. Given the similar site conditions at both IT-1 and IT-2, a single boring was completed, approximately mid-way between their locations.

Descriptions of the soil were recorded on field logs, which were based on the form example in the BMP manual. Copies of the field soil logs are attached to this report.

3.0 RESULTS

3.1 SOILS DESCRIPTION

Soils encountered generally consisted of thin (up to 6 inches) brown to dark red topsoil/surface soil layer consisting of dry fine sands. The topsoil was underlain by a brown to dark red clay with fine sands (clay loam) with red sandstone rock fragments. This horizon was underlain by dark red sands and clay (sandy loam) with red sandstone rock fragments. These two loam layers were slightly moist. The final horizon consisted of dark red angular rock. Generally, angular rocks content increased with depth. Based on the frequency and size of rock fragments observed from 30 to 37 inches below ground surface, it was assumed that this was indicative of weathered rock, though this could not be confirmed due to the boring method employed. Thin grass roots were encountered in the topsoil/surface soils with only minimal roots being observed in the underlying soil horizons. Table 1 summarizes the depths of the infiltration tests (hand auger completed approximately 2 feet deeper than infiltration test depths).

The soils were noted to be moist to dry during the hand augering activities, with moisture in the middle zones (above assumed weathered rock zone). No groundwater or mottled soils were recorded.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey[1] data, the soil types for the test locations are mapped as follows:

- IT-1 and IT-2 – Calvin shaly silt loam (CaC soil symbol) with 8 to 15 percent slopes

Based on the interactive website PaGEODE, the geology of the site consists of sandstone of the Catskill Formation (Devonian). The Catskill Formation consists of gray-red sandstone, siltstone,

[1] http://websoilsurvey.nrcs.usda.gov/. Accessed November 4, 2015.

shale and mudstones, generally in a fining-upward sequence. A Geologic map is attached to this report.

3.2 INFILTRATION TEST RESULTS

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

Both tests exhibited a slow rate of infiltration requiring a 30-minute test cycle.

Table 1
Summary of Infiltration Test Results
Raystown Lake West
Penn Township, Huntingdon County, PA
Sunoco Pipeline/Valve Stations

Test Location (TP-)	Location Data		Test Depth (inches)	Infiltration Test Result (inches/hour)
	LATITUDE	LONGITUDE		
IT-1	40° 22' 28.26"	78° 4' 39.41"	6	0.1
IT-2	40° 22' 27.53"	78° 4' 39.65"	6	0.0

ATTACHMENTS

SITE FIGURE

SOIL LOGS

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Raystown Lake West
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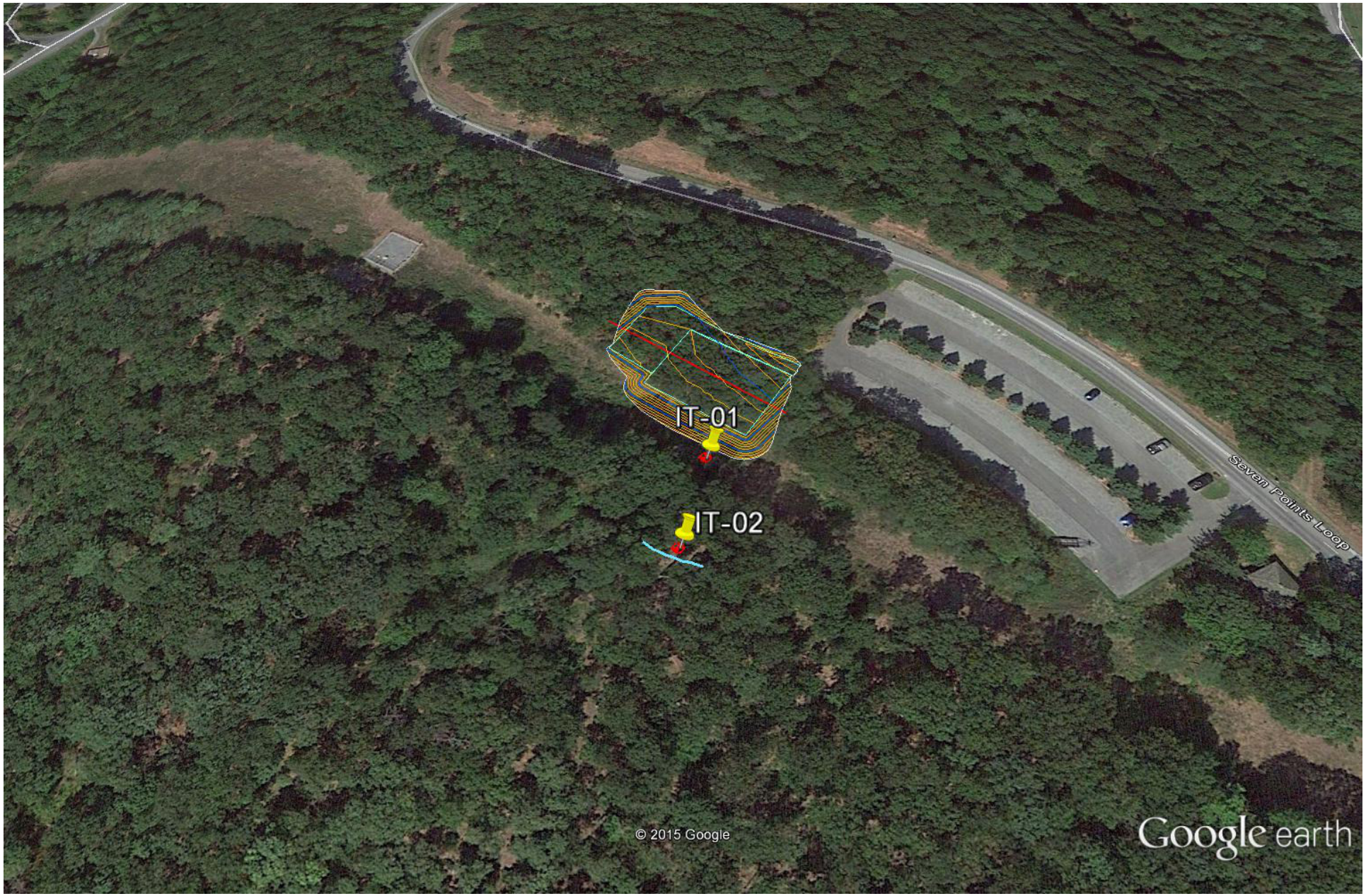
ATTACHMENTS

SITE FIGURE



Google earth

feet 400

meters 100

SOIL LOGS

Tetra Tech, Inc.

BORING LOG

PROJECT NAME: Sunoco Pipeline
PROJECT NUMBER: 112IC07309
DRILLING COMPANY:
DRILLING RIG:

BORING No.: Ray Stown
DATE: 9/21/15
GEOLOGIST (Field Persons): MS + MM
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							Brown to Dark Red, Moist		Multiple Rock				
							Major, Fine Sands		Fragments				
							Minor Silts, clays						
0-6							Dark Red to Brown, Moist		Rock is red Sandstone				
							Major clays and Fine		Angulared				
							Sands, Multiple Rock						
6-12							Fragments ~0.5 inch						
							Dark red, Moist, Major						
							clays with Fine Sands.						
							Prevelent rock Fractures						
12-18							From ~0.5 inch to ~1.0 inch						
							Dark red, Slightly Moist,		Rocks Sandstone				
							Major clays with Fine		~0.5 inch to 2.0 inch				
							Sands. Prevelent Rock Fragments						
18-24													
							Dark red, Dry, Major		Rock Fragments				
							Fine Sands possibly Silts, Minor		0.75 inch - 0.05				
							clays Red Sandstone Fragments						
24-30													
							Dark red, Dry, Major		Rock Fragments				
							Fine Sands, possibly Silts,		~1 inch - 0.05 inch				
							Minor clays, Red Sandstone Fragments		Mostly grinded Rock Not Soil				
30-37							End Test						
							at 37 inch						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes _____ No _____ Well I.D. #:

TETRA TECH

Soil Log

Tested By: MS
Test Pit: Raystown West
Geology: Catskill Formation
Date: 9-21-15
Soil Type: Calvin Shaly Silt Loam (CaC)
Project: Sunoco
Elevation:
Land Use: Field / Wood Land
Project No.: 112IC07309
Equipment Used: Hand Augur
Weather: 70°F, clear

Additional Comments: Test was ended at 37 inches

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"	6"	Top Soil	Major Fine Sands	Brown to Dark Red	—	Slight/Low amount of Rock Fragments	—	—	Dry
A	6"	24"	Clay Loam	Major Clays with Fine Sands	Brown to Dark Red	—	Rock Fragments Red SS Very Broken	—	—	Slightly Moist to Dry
B	24"	~30"	Sandy Loam	Major Fine Sands, Minor Clays	Dark Red.	—	Broken Red SS	—	—	Slightly Moist
C	~30"	37"	—	Broken Red SS	Dark Red	—	Broken Red SS	≥ 37.00"	—	Dry
										Notes ~30" Soil changed From
										Mostly Soil to Mostly Rock
										Fragment at C Horizon

INFILTRATION TEST DATA SHEETS

Raystown West #1		Test Loc. 6" deep	Test Date 9/21/2015
Time	Elapsed Time (minutes)	Water Level Drop (in)	Volume of Water Added (L)
1720	30	0.06	0.15
1750	60	0.06	0.15
1820	90	0.06	0.15
1850	120	0.06	N/A

Infiltration Rate
Average Stabilized Rate (in/hr)
0.1

Raystown West #2		Test Loc. 6" deep	Test Date 9/21/2015
Time	Elapsed Time (minutes)	Water Level Drop (in)	Volume of Water Added (L)
1712	30	0.00	0.05
1742	60	0.00	0.05
1812	90	0.00	0.05
1842	120	0.00	N/A

Infiltration Rate
Average Stabilized Rate (in/hr)
0.0

TETRA TECH

INFILTRATION TEST DATA SHEET

PROJECT NAME: Sunoco Pipe Pipeline TEST AREA ID: RAYSTOWN WEST IT-1
PROJECT NUMBER: 112ICO7309 PERSONNEL: MM, MS

TEST METHOD: (Double-Ring Infiltrometer) Percolation

Location Coordinates or Description:
N: 40° 22' 28.26"
W: 78° 4' 39.41"

INNER RING INSIDE DIAMETER: 6"

OUTER RING INSIDE DIAMETER: 10"

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

DATE(s): 9-21-15

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 4-6 inches): 7 1/2"

MEASURING POINT: (Ring Rim) Indicator Mark DEPTH OF TEST: 6"

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE* (units ____)	REMARKS
PRESOAK DATA				
1550	0	-	9.4 L	
1620	30	3/16	1.2 L	
1650	60	1/16	200 ml	
TEST DATA				
1720	90	1/16	150 ml	
1750	120	1/16	150 ml	
1820	150	1/16	150 ml	
1850	180	1/16	-	END OF TEST

*For double ring test, the volume of water added equals the sum for the inner and outer rings.

TETRA TECH

INFILTRATION TEST DATA SHEET

PROJECT NAME: Sunoco P.Pe line TEST AREA ID: RAYSTOWN WEST IT-2
PROJECT NUMBER: 112IC07309 PERSONNEL:

TEST METHOD: Double-Ring Infiltrometer Percolation

Location Coordinates or Description:
N: 40° 22' 27.53"
W: 78° 4' 39.65"

INNER RING INSIDE DIAMETER: 6"

OUTER RING INSIDE DIAMETER: 10"

PERCOLATION HOLE DIAMETER: N/A (If performing an open hole percolation test)

DATE(s): 9-21-15

Distance from the bottom of the inner ring/hole to measuring point (minimum water column of 4-6 inches): 7½"

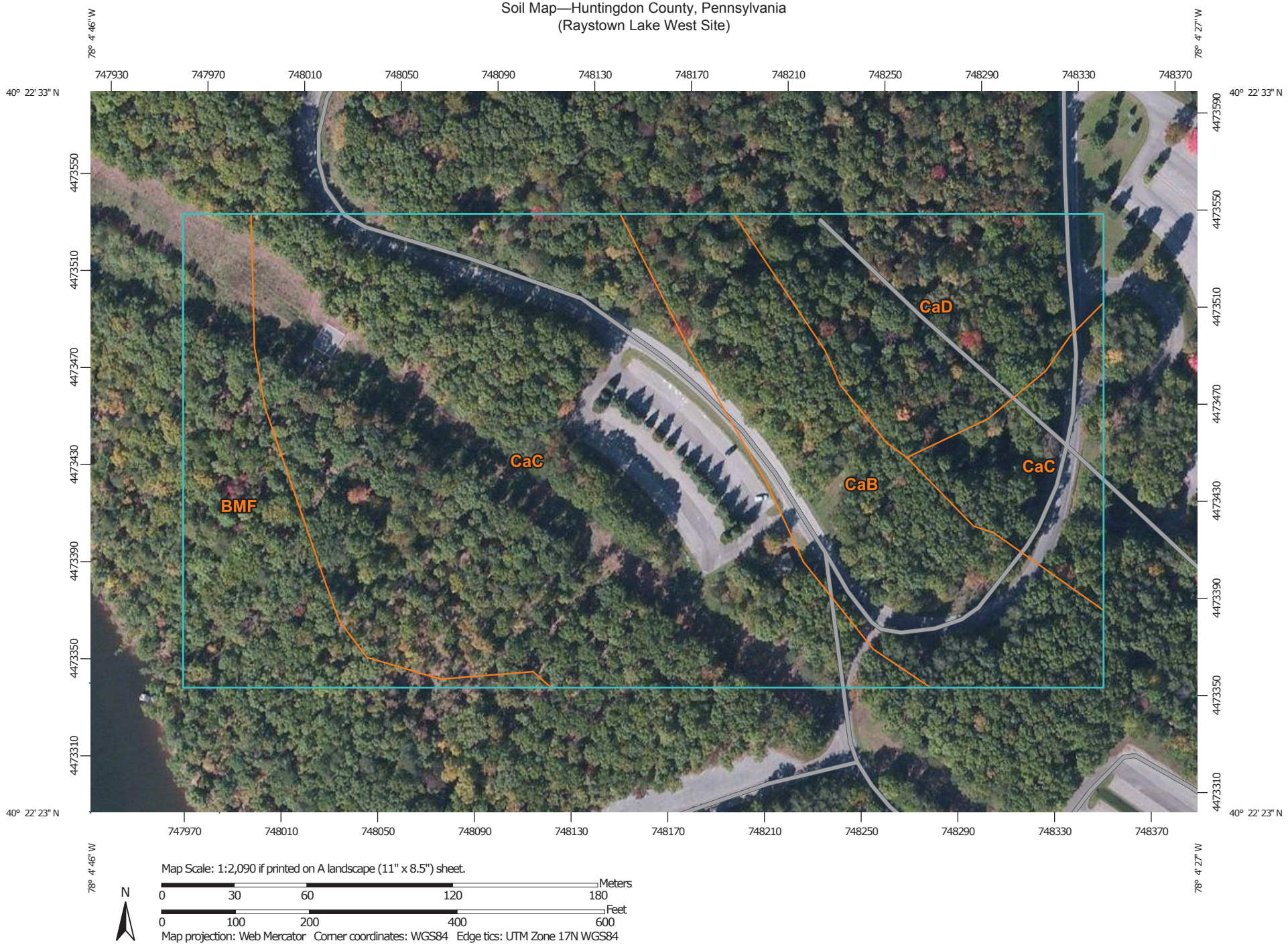
MEASURING POINT: Ring Rim Indicator Mark DEPTH OF TEST: 6"

TIME	ELAPSED TIME SINCE START OF TEST (minutes)	WATER LEVEL DROP, INNER RING OR PERCOLATION HOLE (inches)	VOLUME OF WATER ADDED AT EACH CYCLE* (units ____)	REMARKS
PRESOAK DATA				
1542	0	—	9.4	
1612	30	2/16	600 ml	
1642	60	0/16	50 ml	
TEST DATA				
1712	90	0/16	50 ml	
1742	120	0/16	50 ml	
1812	150	0/16	50 ml	
1842	180	0/16	—	END OF TEST

*For double ring test, the volume of water added equals the sum for the inner and outer rings.

SOIL MAP FIGURE AND SUPPORTING MATERIAL

Soil Map—Huntingdon County, Pennsylvania
(Raystown Lake West Site)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Huntingdon County, Pennsylvania
Survey Area Data: Version 7, Sep 18, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

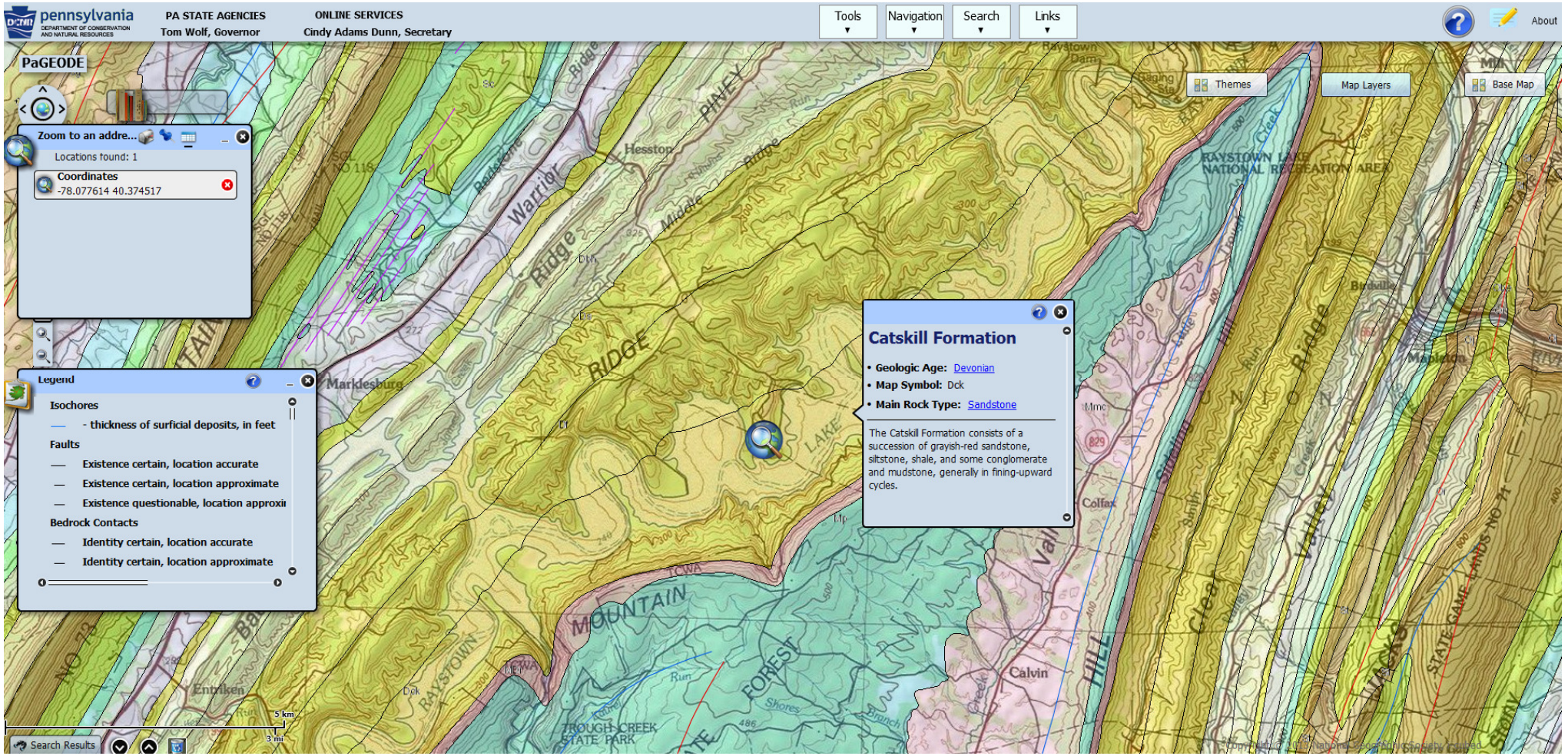
Date(s) aerial images were photographed: Oct 6, 2011—Oct 17, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Huntingdon County, Pennsylvania (PA061)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BMF	Berks-Weikert association, steep	2.3	12.3%
CaB	Calvin shaly silt loam, 3 to 8 percent slopes	3.4	18.4%
CaC	Calvin shaly silt loam, 8 to 15 percent slopes	10.3	55.9%
CaD	Calvin shaly silt loam, 15 to 25 percent slopes	2.5	13.3%
Totals for Area of Interest		**18.4**	**100.0%**

SITE GEOLOGY MAP



Geologic Map of the Raystown Lake West Site

PHOTOGRAPHS

PHOTOGRAPHS
INFILTRATION TESTING
SUNOCO PIPELINE
RAYSTOWN LAKE WEST SITE
HUNTINGDON COUNTY, PA

Description: Test at Raystown Lake West IT-2, approximately 6 inches deep.

Date: September 21, 2015

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