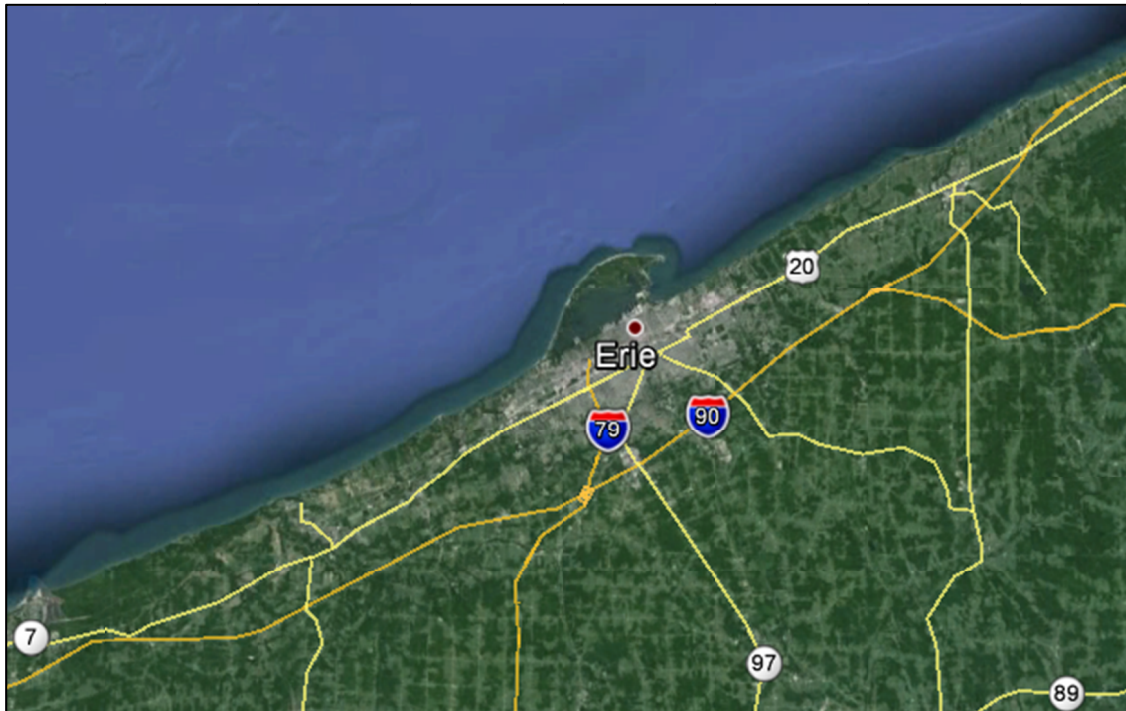




PennState



Photogrammetric Ground Control Survey Report

Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project

Pennsylvania State University

September 2015

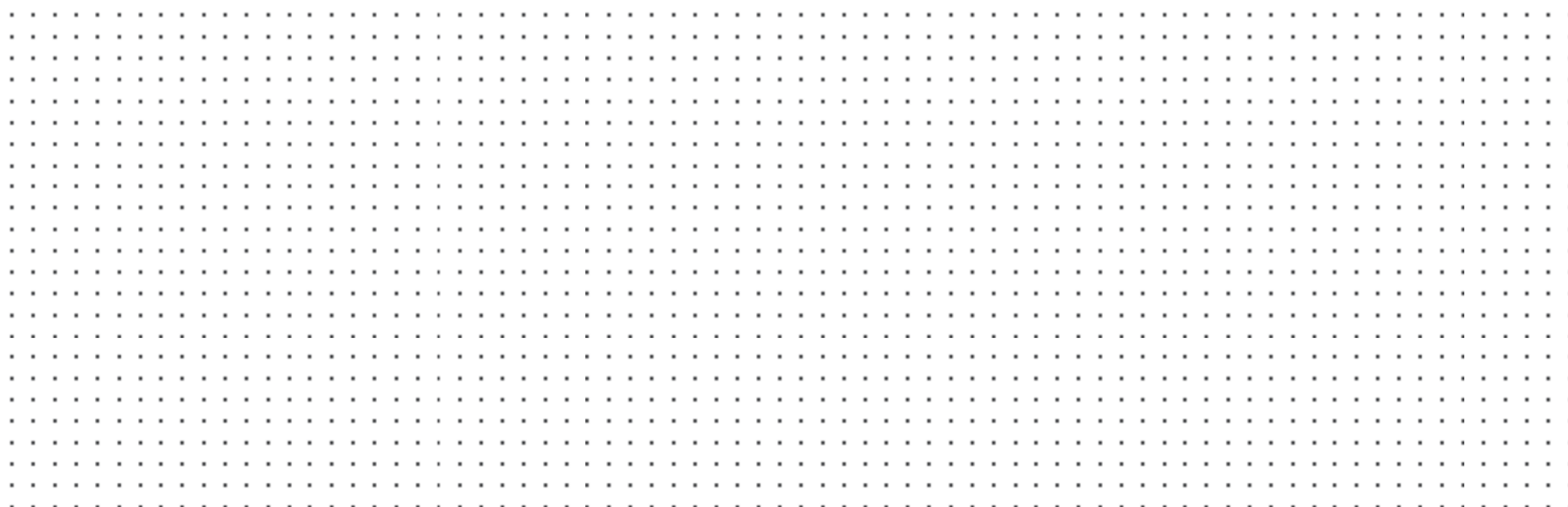
Photogrammetric Ground Control Survey Report

Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project

Pennsylvania State University

September 2015

Prepared by Woolpert, Inc.
4454 Idea Center Boulevard
Dayton, OH 45430
Woolpert.com





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Section 1: Photogrammetric Ground Control Survey Report

Introduction

This report contains a comprehensive outline of the photogrammetric ground control survey that supported the Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project. All surveys were performed in such a way as to achieve ground control accuracies that meet or exceed the National Mapping Accuracy Standards necessary to support new 1"=100' scale natural color digital orthoimagery with 6-inch pixel resolution across the Lake Erie Watershed project area. These surveys were also performed in compliance with the American Society for Photogrammetry and Remote Sensing (ASPRS) standards required to support new LiDAR data with 0.7 meter average point density.

The Lake Erie Watershed has a goal to develop and/or update certain geospatial datasets for use by state, county, and/or city agencies, in addition to the general public.

Project Area

The 2015 project area includes all 512 square miles comprising the Lake Erie Watershed corporation boundary including a 500-foot buffer zone outside of the project boundary.



Project Coverage Area

Purpose

The purpose of this survey was to establish new three-dimensional coordinates for 65 new LiDAR quality control points in predetermined land cover types. Photogrammetric mapping will be supported by previously surveyed ground control stations from past projects. These existing photogrammetric control stations, in conjunction with aerial triangulation, will be used as the basis for subsequent photogrammetric mapping as outlined in the Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy (NSSDA), published by the Federal Geographic Data Committee (FGDC-STD-007.3-1998) for ADS40 digital imagery capable of producing 1"=100' scale color digital orthoimagery at 6-inch pixel resolution. Newly established LiDAR quality control stations will be used as quality control for eventual LiDAR data with 0.7 meter average point density as outlined in the ASPRS Positional Accuracy Standards for Digital Geospatial Data (Edition 1, Version 1.0, November 2014).

Date of Survey

All ground control field operations took place between June 15 and June 23, 2015.

Monumentation

Woolpert field crews performed a field reconnaissance to verify the existence and suitability of preselected existing National Geodetic Survey (NGS) geodetic control stations. These existing geodetic control stations were utilized to ensure that quality x, y, and z coordinate values were computed for each of the newly established LiDAR quality control stations. Woolpert used a variety of land cover types for all 65 new LiDAR quality control stations in designated locations for both GPS observations and LiDAR quality control. Land cover types consisted of light-colored impervious surfaces, bare earth, short grass, tall grass, gravel, brush, and forest.

Recovery information sheets for the newly utilized geodetic control stations can be found in Section 4. A control diagram showing the LiDAR control stations used to support this photogrammetric mapping project can be found in Section 5 of this report. LiDAR quality control stations recovery information sheets were not documented.

Methodology

Real-Time Kinematic (RTK) GPS

For this survey, Woolpert field crews utilized two (2) Woolpert-owned, Trimble Navigation R8 Model 3 series dual frequency GPS receivers, and one (1) Woolpert-owned, Trimble Navigation R8 Model 2 series dual frequency GPS receiver. The field crew utilized Real-Time Kinematic (RTK) GPS surveying throughout the ground control data collection process. Using RTK GPS techniques, observations were performed on LiDAR quality control points. The survey was conducted using a 1-second epoch rate, in a fixed solution RTK mode, with each observation lasting 180 seconds. Each station was occupied twice to ensure the necessary horizontal and vertical accuracies were being met for this project.

RTK surveys were performed where cellular phone coverage was available and where baseline distance accuracy was maintained.

Static GPS

Due to the usage of RTK techniques, there were several disjointed base stations with accompanying RTK measurements. These stations were linked together via concurrent static observations, allowing for one contiguous network. CORS data was also implemented to improve network stability. Data from observation sessions typically lasted several hours, with each session utilizing a 5-second sync rate.

Post-Processing and Adjustments

All static GPS observations were processed using Trimble Navigation’s Trimble Business Center (TBC) 3.50 baseline processor with precise ephemeris. Both unconstrained and constrained adjustments were computed using trivial and nontrivial baselines. After an acceptable unconstrained least-squares adjustment was obtained, Woolpert performed a fully constrained least-squares adjustment by fixing the GPS network to existing NGS control stations with known coordinate data. Fixed solutions were obtained for all vector baselines.

During this project, the following stations were fixed during the constrained adjustment:

| 3-D STATIONS | |
|---------------------|--------------------|
| Description | PID |
| 100 | SET IRON PIN W/CAP |
| 101 | SET IRON PIN W/CAP |
| M 56 | NC0616 |

| 2-D HORIZONTAL STATIONS | |
|--------------------------------|------------|
| Description | PID |
| OHAS | DI1848 |

| 1-D VERTICAL STATIONS | |
|------------------------------|------------|
| Description | PID |
| D 406 | MB1777 |

| CONTROL CHECKS | |
|-----------------------|------------|
| Description | PID |
| RICHMOND | DG7224 |
| UPTC | AJ8355 |

Datum Reference and Final Coordinates

All new horizontal GPS control was based on the Pennsylvania State Plane Coordinate System (North Zone 3701), referenced to North American Datum 1983, HARN, expressed in U.S. survey feet. All vertical control was based on the North American Vertical Datum of 1988 (NAVD88) with GEOID09 applied to model the elevations, also expressed in U.S. survey feet. The coordinates for the ground control survey can be found in Section 2 of this report.

Accuracy Statement

The GPS adjustment indicates that the survey control network meets or exceeds the National Map Accuracy Standards (NMAS) necessary to support ADS40 digital imagery capable of producing 1"=100' scale natural color digital orthoimagery at 6-inch pixel resolution, in addition to adhering to the standards set forth by the American Society for Photogrammetry and Remote Sensing (ASPRS) in support of LiDAR data with 0.7 meter average point density.



Section 2: LiDAR Control Station Coordinate Listings

This section includes a complete listing of the final coordinates and orthometric heights for the Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project.

LAKE ERIE WATERSHED 2015 ORTHO/LiDAR/HYDRO PROJECT

*Horizontal Datum: NAD 83 (HARN)
Vertical Datum: NAVD 88
Units: U.S. Survey Feet
State Plane Zone: Pennsylvania North (3701)
Geoid Model: Geoid 09
Coordinate System: Grid
Date: September 2015*

| LiDAR Quality Control Stations: | | | | |
|---------------------------------|-----------------|----------------|------------------|---------------------|
| Station Name | Northing (USFT) | Easting (USFT) | Elevation (USFT) | Station Description |
| 2001 | 555651.425 | 1252168.528 | 1233.128 | GRAVEL |
| 2002 | 592333.303 | 1215600.172 | 1133.607 | GRAVEL |
| 2003 | 667143.174 | 1218619.368 | 639.919 | WOOD CHIPS |
| 2004 | 735954.800 | 1336120.212 | 576.384 | DIRT |
| 2005 | 771660.592 | 1423657.278 | 605.487 | GRASS |
| 2006 | 739927.117 | 1416873.155 | 1290.594 | GRAVEL |
| 2007 | 668494.834 | 1346798.924 | 1239.283 | GRAVEL |
| 2008 | 638256.537 | 1260195.295 | 980.949 | DIRT |
| 2009 | 611935.172 | 1250915.516 | 907.601 | GRAVEL |
| 2010 | 686016.245 | 1290535.599 | 835.964 | DIRT |
| 2011 | 623803.511 | 1220168.791 | 974.010 | GRAVEL |
| 2012 | 703732.231 | 1384204.895 | 1389.105 | GRAVEL |
| 2013 | 749967.544 | 1378340.692 | 667.062 | GRASS |
| 2014 | 696178.467 | 1331684.426 | 1089.599 | ASPHALT |
| 2015 | 656340.492 | 1300713.851 | 1271.882 | GRASS |
| 2016 | 678695.051 | 1270470.298 | 771.552 | ASPHALT |
| 2017 | 651848.791 | 1241715.695 | 870.604 | SHORT GRASS |
| 2018 | 690075.666 | 1314366.114 | 946.989 | GRASS |
| 2019 | 723529.229 | 1352363.040 | 773.549 | DIRT |
| 2020 | 741131.183 | 1388466.510 | 840.211 | DIRT |
| 2021 | 590593.128 | 1253055.586 | 936.528 | DIRT |
| 2022 | 666895.616 | 1318417.246 | 1124.898 | TALL WEEDS |
| 2023 | 633414.302 | 1283229.570 | 1207.428 | GRAVEL |

| LiDAR Quality Control Stations: | | | | |
|---------------------------------|------------|-------------|-----------|---------------------|
| Station Name | Northing | Easting | Elevation | Station Description |
| | (USFT) | (USFT) | (USFT) | |
| 2024 | 716705.967 | 1316375.145 | 658.811 | ASPHALT |
| 2025 | 660321.006 | 1271770.030 | 937.496 | DIRT |
| 2026 | 723343.579 | 1329114.535 | 580.437 | ASPHALT |
| 2027 | 639522.304 | 1237183.468 | 907.730 | GRAVEL |
| 2028 | 594321.880 | 1232163.078 | 1152.395 | GRAVEL |
| 2029 | 698950.163 | 1364226.774 | 1357.170 | DIRT |
| 2030 | 722493.631 | 1395213.752 | 1452.872 | DIRT |
| 2031 | 762914.984 | 1405880.693 | 597.652 | GRAVEL |
| 2032 | 723998.780 | 1374520.592 | 1081.673 | BRUSH |
| 2033 | 677001.421 | 1248052.409 | 715.136 | DIRT |
| 2034 | 713028.102 | 1341827.168 | 869.345 | DIRT |
| 2035 | 647541.584 | 1216595.757 | 832.823 | GRAVEL |
| 3001 | 555655.671 | 1252206.262 | 1232.979 | TALL WEEDS |
| 3002 | 592453.727 | 1215502.920 | 1133.448 | FOREST |
| 3003 | 667159.828 | 1218721.799 | 640.035 | TALL WEEDS |
| 3004 | 735828.508 | 1336728.026 | 577.554 | BRUSH |
| 3005 | 771631.205 | 1423622.567 | 605.585 | TALL WEEDS |
| 3006 | 739831.755 | 1416837.715 | 1287.929 | FOREST |
| 3007 | 668519.071 | 1346878.808 | 1240.296 | BRUSH |
| 3008 | 638490.686 | 1260389.700 | 979.604 | TALL WEEDS |
| 3009 | 611877.970 | 1250828.456 | 903.449 | FOREST |
| 3010 | 685817.182 | 1291648.723 | 869.163 | TALL WEEDS |
| 3011 | 623828.488 | 1220838.104 | 972.808 | BRUSH |
| 3012 | 703709.750 | 1384199.690 | 1389.223 | BRUSH |
| 3013 | 750000.570 | 1378321.170 | 667.207 | FOREST |
| 3014 | 696164.868 | 1331646.400 | 1089.123 | TALL WEEDS |
| 3015 | 656390.478 | 1300696.566 | 1271.366 | TALL WEEDS |
| 3016 | 678832.608 | 1270000.803 | 765.917 | BRUSH |
| 3017 | 651747.650 | 1241695.586 | 872.049 | FOREST |
| 3018 | 690131.489 | 1314279.544 | 944.908 | BRUSH |
| 3019 | 723462.792 | 1352358.561 | 775.273 | FOREST |
| 3020 | 741258.347 | 1388506.579 | 838.149 | TALL WEEDS |
| 3021 | 590710.176 | 1253026.793 | 933.750 | FOREST |
| 3022 | 666844.507 | 1318399.247 | 1124.843 | FOREST |
| 3023 | 633364.531 | 1283305.829 | 1206.440 | BRUSH |
| 3024 | 716480.301 | 1316438.269 | 658.370 | BRUSH |
| 3025 | 660380.597 | 1271739.538 | 936.095 | BRUSH |
| 3026 | 725784.617 | 1378952.039 | 1131.571 | BRUSH |
| 3027 | 727664.127 | 1403212.336 | 1405.758 | FOREST |
| 3028 | 639336.103 | 1219118.122 | 905.113 | TALL WEEDS |
| 3029 | 594309.852 | 1232127.899 | 1151.051 | TALL WEEDS |
| 3030 | 705470.710 | 1298112.525 | 664.641 | FOREST |

| Geodetic Control Stations and/or Geodetic Checks: | | | | |
|---|-----------------|----------------|------------------|------------|
| Station Name | Northing (USFT) | Easting (USFT) | Elevation (USFT) | PID |
| 100* | 618911.720 | 1251141.081 | 1042.596 | IPIN W/CAP |
| 101* | 724123.932 | 1375496.242 | 1103.430 | IPIN W/CAP |
| D 406 | 611192.556 | 1343111.611 | 1143.170 | MB1777 |
| M 56 | 770634.638 | 1438062.852 | 752.164 | NC0616 |
| OHAS* | 653011.249 | 1206358.174 | 709.243 | DI1848 |
| RICHMOND** | 564071.633 | 1198169.938 | 1030.792 | DG7224 |
| UPTC** | 538515.106 | 1445269.647 | 1234.583 | AI8355 |

*This station was converted to HARN coordinates using GEOCON and GEOCON11

**This station was unconstrained and used as a check station.



**LAKE ERIE WATERSHED
2015 ORTHO/LiDAR/HYDRO PROJECT**

Horizontal Datum: NAD 83 (HARN)
Vertical Datum: NAVD 88
Units: U.S. Survey Feet
State Plane Zone: Pennsylvania North (3701)
Geoid Model: Geoid 09
Coordinate System: Geographic
Date: September 2015

| LiDAR Quality Control Stations: | | | | |
|---------------------------------|------------------|------------------|----------|---------------------|
| Station Name | Latitude | Longitude | Height | Station Description |
| | | | (USFT) | |
| 2001 | N41°39'42.99601" | W80°22'19.13004" | 1121.771 | GRAVEL |
| 2002 | N41°45'34.00366" | W80°30'36.07320" | 1021.504 | GRAVEL |
| 2003 | N41°57'53.64522" | W80°30'27.68008" | 526.193 | WOOD CHIPS |
| 2004 | N42°09'47.22059" | W80°04'57.43390" | 461.670 | DIRT |
| 2005 | N42°16'01.50212" | W79°45'46.48960" | 491.010 | GRASS |
| 2006 | N42°10'46.55961" | W79°47'06.77037" | 1177.231 | GRAVEL |
| 2007 | N41°58'43.86300" | W80°02'12.05117" | 1126.719 | GRAVEL |
| 2008 | N41°53'21.11469" | W80°21'06.11248" | 868.077 | DIRT |
| 2009 | N41°48'58.42680" | W80°22'58.16929" | 795.245 | GRAVEL |
| 2010 | N42°01'21.54558" | W80°14'43.33130" | 722.070 | DIRT |
| 2011 | N41°50'46.18946" | W80°29'48.98914" | 861.313 | GRAVEL |
| 2012 | N42°04'41.31774" | W79°54'08.55528" | 1276.244 | GRAVEL |
| 2013 | N42°12'16.45295" | W79°55'41.70754" | 552.552 | GRASS |
| 2014 | N42°03'13.25329" | W80°05'42.01080" | 976.014 | ASPHALT |
| 2015 | N41°56'31.37517" | W80°12'17.39557" | 1159.008 | GRASS |
| 2016 | N42°00'03.45824" | W80°19'06.17591" | 657.685 | ASPHALT |
| 2017 | N41°55'29.77582" | W80°25'15.86189" | 757.304 | SHORT GRASS |
| 2018 | N42°02'08.29461" | W80°09'29.22715" | 833.292 | GRASS |
| 2019 | N42°07'48.78499" | W80°01'17.51752" | 659.409 | DIRT |
| 2020 | N42°10'51.68701" | W79°53'24.31595" | 726.193 | DIRT |
| 2021 | N41°45'28.31666" | W80°22'21.38624" | 824.610 | DIRT |
| 2022 | N41°58'20.49990" | W80°08'27.08671" | 1011.965 | TALL WEEDS |
| 2023 | N41°52'40.02115" | W80°15'59.83812" | 1094.908 | GRAVEL |
| 2024 | N42°06'31.81333" | W80°09'12.40660" | 544.369 | ASPHALT |
| 2025 | N41°57'02.40265" | W80°18'41.77324" | 824.154 | DIRT |
| 2026 | N42°07'40.81564" | W80°06'25.86063" | 465.965 | ASPHALT |
| 2027 | N41°53'26.67455" | W80°26'10.73128" | 794.722 | GRAVEL |
| 2028 | N41°45'58.79679" | W80°26'58.45218" | 1040.325 | GRAVEL |
| 2029 | N42°03'49.10552" | W79°58'31.74872" | 1244.078 | DIRT |
| 2030 | N42°07'49.27283" | W79°51'48.69145" | 1339.666 | DIRT |
| 2031 | N42°14'30.99214" | W79°49'40.04157" | 483.192 | GRAVEL |

| LiDAR Quality Control Stations: | | | | |
|---------------------------------|------------------|------------------|----------|---------------------|
| Station Name | Latitude | Longitude | Height | Station Description |
| | | | (USFT) | |
| 2032 | N42°07'59.05869" | W79°56'23.72239" | 967.961 | BRUSH |
| 2033 | N41°59'40.06321" | W80°24'02.25678" | 601.208 | DIRT |
| 2034 | N42°06'02.33491" | W80°03'33.57109" | 755.370 | DIRT |
| 2035 | N41°54'39.46186" | W80°30'46.17717" | 719.574 | GRAVEL |
| 3001 | N41°39'43.04923" | W80°22'18.63482" | 1121.623 | TALL WEEDS |
| 3002 | N41°45'35.16217" | W80°30'37.40641" | 1021.343 | FOREST |
| 3003 | N41°57'53.84187" | W80°30'26.33192" | 526.309 | TALL WEEDS |
| 3004 | N42°09'46.13511" | W80°04'49.32146" | 462.849 | BRUSH |
| 3005 | N42°16'01.20395" | W79°45'46.94201" | 491.108 | TALL WEEDS |
| 3006 | N42°10'45.60964" | W79°47'07.21115" | 1174.568 | FOREST |
| 3007 | N41°58'44.12318" | W80°02'11.00237" | 1127.732 | BRUSH |
| 3008 | N41°53'23.48452" | W80°21'03.63632" | 866.728 | TALL WEEDS |
| 3009 | N41°48'57.83579" | W80°22'59.29554" | 791.094 | FOREST |
| 3010 | N42°01'19.89642" | W80°14'28.51419" | 755.288 | TALL WEEDS |
| 3011 | N41°50'46.64568" | W80°29'40.16074" | 860.113 | BRUSH |
| 3012 | N42°04'41.09445" | W79°54'08.61686" | 1276.363 | BRUSH |
| 3013 | N42°12'16.77423" | W79°55'41.97786" | 552.696 | FOREST |
| 3014 | N42°03'13.10883" | W80°05'42.50976" | 975.537 | TALL WEEDS |
| 3015 | N41°56'31.86395" | W80°12'17.64294" | 1158.490 | TALL WEEDS |
| 3016 | N42°00'04.67897" | W80°19'12.44530" | 652.044 | BRUSH |
| 3017 | N41°55'28.77099" | W80°25'16.08652" | 758.752 | FOREST |
| 3018 | N42°02'08.82208" | W80°09'30.39443" | 831.208 | BRUSH |
| 3019 | N42°07'48.12776" | W80°01'17.55382" | 661.135 | FOREST |
| 3020 | N42°10'52.95255" | W79°53'23.82568" | 724.127 | TALL WEEDS |
| 3021 | N41°45'29.46391" | W80°22'21.81274" | 821.830 | FOREST |
| 3022 | N41°58'19.99029" | W80°08'27.30623" | 1011.911 | FOREST |
| 3023 | N41°52'39.55155" | W80°15'58.81136" | 1093.922 | BRUSH |
| 3024 | N42°06'29.60227" | W80°09'11.48644" | 543.934 | BRUSH |
| 3025 | N41°57'02.98218" | W80°18'42.19992" | 822.751 | BRUSH |
| 3026 | N42°08'17.79682" | W79°55'25.52460" | 1017.892 | BRUSH |
| 3027 | N42°08'42.24831" | W79°50'04.22629" | 1292.550 | FOREST |
| 3028 | N41°53'19.23305" | W80°30'09.38539" | 792.071 | TALL WEEDS |
| 3029 | N41°45'58.66718" | W80°26'58.91125" | 1038.981 | TALL WEEDS |
| 3030 | N42°04'35.79543" | W80°13'10.33652" | 550.293 | FOREST |

| Geodetic Control Stations and/or Geodetic Checks: | | | | |
|---|------------------|------------------|----------|------------|
| Station Name | Latitude | Longitude | Height | PID |
| | | | (USFT) | |
| 100* | N41°50'07.38666" | W80°22'57.99207" | 930.101 | IPIN W/CAP |
| 101* | N42°08'00.53806" | W79°56'10.82028" | 989.735 | IPIN W/CAP |
| D 406 | N41°49'16.99993" | W80°02'40.75495" | 1031.566 | MB1777 |
| M 56 | N42°15'54.63368" | W79°42'34.65090" | 638.029 | NC0616 |
| OHAS* | N41°55'30.22129" | W80°33'03.84516" | 595.834 | DI1848 |
| RICHMOND** | N41°40'49.38554" | W80°34'13.79856" | 919.063 | DG7224 |
| UPTC** | N41°37'43.70214" | W79°39'50.62087" | 1125.591 | AI8355 |

*This station was converted to HARN coordinates using GEOCON and GEOCON11.

**This station was unconstrained and used as a check station.



Section 3: Existing NGS Control Information Sheets

This section contains the published National Geodetic Survey (NGS) Datasheets used in the final control network for the Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project.

The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.7
1      National Geodetic Survey,  Retrieval Date = JUNE 26, 2015
MB1777 *****
MB1777 CBN          - This is a Cooperative Base Network Control Station.
MB1777 DESIGNATION - D 406
MB1777 PID         - MB1777
MB1777 STATE/COUNTY- PA/CRAWFORD
MB1777 COUNTRY    - US
MB1777 USGS QUAD   - CAMBRIDGE SPRINGS (1975)
MB1777
MB1777                      *CURRENT SURVEY CONTROL
MB1777
MB1777* NAD 83(2011) POSITION- 41 49 16.99994(N) 080 02 40.75455(W)  ADJUSTED
MB1777* NAD 83(2011) ELLIP HT- 314.403 (meters) (06/27/12)  ADJUSTED
MB1777* NAD 83(2011) EPOCH   - 2010.00
MB1777* NAVD 88 ORTHO HEIGHT - 348.439 (meters) 1143.17 (feet) ADJUSTED
MB1777
MB1777 NAD 83(2011) X  - 822,995.509 (meters) COMP
MB1777 NAD 83(2011) Y  - -4,688,805.265 (meters) COMP
MB1777 NAD 83(2011) Z  - 4,231,049.853 (meters) COMP
MB1777 LAPLACE CORR   - 2.61 (seconds) DEFLEC12B
MB1777 GEOID HEIGHT   - -34.03 (meters) GEOID12B
MB1777 DYNAMIC HEIGHT - 348.296 (meters) 1142.70 (feet) COMP
MB1777 MODELED GRAVITY - 980,203.3 (mgal) NAVD 88
MB1777
MB1777 VERT ORDER     - FIRST CLASS II
MB1777
MB1777 Network accuracy estimates per FGDC Geospatial Positioning Accuracy
MB1777 Standards:
MB1777      FGDC (95% conf, cm)      Standard deviation (cm)      CorrNE
MB1777      Horiz Ellip              SD_N   SD_E   SD_h      (unitless)
MB1777 -----
MB1777 NETWORK      0.70   1.35              0.32   0.24   0.69      0.02484447
MB1777 -----
MB1777 Click here for local accuracies and other accuracy information.
MB1777
MB1777
MB1777.The horizontal coordinates were established by GPS observations
MB1777.and adjusted by the National Geodetic Survey in June 2012.
MB1777
MB1777.NAD 83(2011) refers to NAD 83 coordinates where the reference
MB1777.frame has been affixed to the stable North American tectonic plate. See
MB1777.NA2011 for more information.
MB1777
MB1777.The horizontal coordinates are valid at the epoch date displayed above
MB1777.which is a decimal equivalence of Year/Month/Day.
MB1777
MB1777.The orthometric height was determined by differential leveling and
MB1777.adjusted by the NATIONAL GEODETIC SURVEY
MB1777.in June 1991.

```



MB1777
 MB1777.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 MB1777
 MB1777.The Laplace correction was computed from DEFLEC12B derived deflections.
 MB1777
 MB1777.The ellipsoidal height was determined by GPS observations
 MB1777.and is referenced to NAD 83.
 MB1777
 MB1777.The dynamic height is computed by dividing the NAVD 88
 MB1777.geopotential number by the normal gravity value computed on the
 MB1777.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 MB1777.degrees latitude (g = 980.6199 gals.).
 MB1777
 MB1777.The modeled gravity was interpolated from observed gravity values.
 MB1777
 MB1777. The following values were computed from the NAD 83(2011) position.
 MB1777
 MB1777;

| | North | East | Units | Scale Factor | Converg. |
|-----------------|-----------------|--------------|-------|--------------|------------|
| MB1777;SPC PA N | - 186,291.864 | 409,381.247 | MT | 0.99998166 | -1 31 04.8 |
| MB1777;SPC PA N | - 611,192.56 | 1,343,111.64 | sFT | 0.99998166 | -1 31 04.8 |
| MB1777;UTM 17 | - 4,630,386.637 | 579,340.763 | MT | 0.99967746 | +0 38 13.4 |

 MB1777
 MB1777!

| | | | | | |
|-----------------|--------------|---|------------|---|------------|
| MB1777!SPC PA N | - 0.99995069 | x | 0.99998166 | = | 0.99993235 |
| MB1777!UTM 17 | - 0.99995069 | x | 0.99967746 | = | 0.99962817 |

 MB1777
 MB1777

SUPERSEDED SURVEY CONTROL

 MB1777

| | | | | | |
|--------|--------------------|-------------------|--------------------|--------------|-----|
| MB1777 | NAD 83(2007)- | 41 49 17.00008(N) | 080 02 40.75526(W) | AD(2002.00) | 0 |
| MB1777 | ELLIP H (02/10/07) | 314.420 (m) | | GP(2002.00) | |
| MB1777 | NAD 83(1992)- | 41 49 17.00000(N) | 080 02 40.75564(W) | AD() | A |
| MB1777 | ELLIP H (03/28/01) | 314.426 (m) | | GP() | 3 2 |
| MB1777 | NAVD 88 (03/28/01) | 348.44 (m) | 1143.2 | (f) LEVELING | 3 |
| MB1777 | NGVD 29 (06/03/92) | 348.593 (m) | 1143.68 | (f) ADJUSTED | 1 2 |

 MB1777
 MB1777.Superseded values are not recommended for survey control.
 MB1777
 MB1777.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 MB1777.See file dsdata.txt to determine how the superseded data were derived.
 MB1777
 MB1777_U.S. NATIONAL GRID SPATIAL ADDRESS: 17TNG7934030386(NAD 83)
 MB1777
 MB1777_MARKER: I = METAL ROD
 MB1777_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
 MB1777_SP_SET: STAINLESS STEEL ROD
 MB1777_STAMPING: D 406 1982
 MB1777_MARK LOGO: NGS
 MB1777_PROJECTION: FLUSH
 MB1777_MAGNETIC: N = NO MAGNETIC MATERIAL
 MB1777_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 MB1777_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 MB1777+SATELLITE: SATELLITE OBSERVATIONS - May 02, 2012
 MB1777_ROD/PIPE-DEPTH: 12.8 meters
 MB1777_SLEEVE-DEPTH : 3.0 meters
 MB1777



WOOLPERT

| | HISTORY | - Date | Condition | Report By |
|--------|---------|------------|------------|-----------|
| MB1777 | HISTORY | - 1982 | MONUMENTED | NGS |
| MB1777 | HISTORY | - 20000505 | GOOD | PADT |
| MB1777 | HISTORY | - 20070508 | GOOD | BAKER |
| MB1777 | HISTORY | - 2008 | GOOD | TERRSV |
| MB1777 | HISTORY | - 20120502 | GOOD | PADT |

MB1777

MB1777

MB1777

STATION DESCRIPTION

MB1777'DESCRIBED BY NATIONAL GEODETIC SURVEY 1982

MB1777'2.2 KM (1.4 MI) NE FROM CAMBRIDGE SPRINGS.

MB1777'2.2 KM (1.4 MI) NORTH ALONG U.S. HIGHWAY 19 FROM THE BRIDGE OVER

MB1777'FRENCH CREEK IN CAMBRIDGE SPRINGS TO THE MARK ON THE RIGHT IN A SMALL

MB1777'PARKING LOT, 30.4 METERS (100.0 FT) SOUTH-SOUTHEAST FROM THE

MB1777'CENTERLINE OF U.S. HIGHWAY 19, 7.0 METERS (3.5 FT) NORTHWEST FROM

MB1777'PIPE GATE POST AND 4.4 METERS (14.5 FT) NORTHWEST FROM THE CENTER OF

MB1777'PIPE GATE.

MB1777'THE MARK IS ABOVE LEVEL WITH HIGHWAY.

MB1777

MB1777

STATION RECOVERY (2000)

MB1777

MB1777'RECOVERY NOTE BY PA DEPT OF TRANSP 2000 (JAW)

MB1777'RECOVERED IN GOOD CONDITION.

MB1777

MB1777

STATION RECOVERY (2007)

MB1777

MB1777'RECOVERY NOTE BY M BAKER JR INCORPORATED 2007 (RGH)

MB1777'RECOVERED IN GOOD CONDITION.

MB1777

MB1777

STATION RECOVERY (2008)

MB1777

MB1777'RECOVERY NOTE BY TERRA SURV 2008 (JVH)

MB1777'RECOVERED AS DESCRIBED.

MB1777

MB1777

STATION RECOVERY (2012)

MB1777

MB1777'RECOVERY NOTE BY PA DEPT OF TRANSP 2012 (CRF)

MB1777'RECOVERED IN GOOD CONDITION.

The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.7
1      National Geodetic Survey,  Retrieval Date = JUNE 26, 2015
NC0616 *****
NC0616  FBN          -  This is a Federal Base Network Control Station.
NC0616  DESIGNATION -  M 56
NC0616  PID          -  NC0616
NC0616  STATE/COUNTY-  NY/CHAUTAUQUA
NC0616  COUNTRY      -  US
NC0616  USGS QUAD    -  RIPLEY (1954)
NC0616
NC0616                                *CURRENT SURVEY CONTROL
NC0616
NC0616*  NAD 83(2011) POSITION- 42 15 54.63372(N) 079 42 34.64952(W)  ADJUSTED
NC0616*  NAD 83(2011) ELLIP HT- 194.458 (meters) (06/27/12)  ADJUSTED
NC0616*  NAD 83(2011) EPOCH   - 2010.00
NC0616*  NAVD 88 ORTHO HEIGHT - 229.260 (meters) 752.16 (feet) ADJUSTED
NC0616
NC0616  NAD 83(2011) X  - 844,485.255 (meters)  COMP
NC0616  NAD 83(2011) Y  - -4,651,343.605 (meters)  COMP
NC0616  NAD 83(2011) Z  - 4,267,578.009 (meters)  COMP
NC0616  LAPLACE CORR   - 5.33 (seconds)  DEFLEC12B
NC0616  GEOID HEIGHT   - -34.78 (meters)  GEOID12B
NC0616  DYNAMIC HEIGHT - 229.181 (meters) 751.90 (feet) COMP
NC0616  MODELED GRAVITY - 980,270.3 (mgal)  NAVD 88
NC0616
NC0616  VERT ORDER      -  FIRST      CLASS II
NC0616
NC0616  Network accuracy estimates per FGDC Geospatial Positioning Accuracy
NC0616  Standards:
NC0616      FGDC (95% conf, cm)      Standard deviation (cm)      CorrNE
NC0616      Horiz Ellip              SD_N   SD_E   SD_h      (unitless)
NC0616  -----
NC0616  NETWORK      0.70   1.37              0.32   0.24   0.70      -0.06927867
NC0616  -----
NC0616  Click here for local accuracies and other accuracy information.
NC0616
NC0616
NC0616.The horizontal coordinates were established by GPS observations
NC0616.and adjusted by the National Geodetic Survey in June 2012.
NC0616
NC0616.NAD 83(2011) refers to NAD 83 coordinates where the reference
NC0616.frame has been affixed to the stable North American tectonic plate. See
NC0616.NA2011 for more information.
NC0616
NC0616.The horizontal coordinates are valid at the epoch date displayed above
NC0616.which is a decimal equivalence of Year/Month/Day.
NC0616
NC0616.The orthometric height was determined by differential leveling and
NC0616.adjusted by the NATIONAL GEODETIC SURVEY
NC0616.in November 1993.

```



NC0616
NC0616.The X, Y, and Z were computed from the position and the ellipsoidal ht.
NC0616
NC0616.The Laplace correction was computed from DEFLEC12B derived deflections.
NC0616
NC0616.The ellipsoidal height was determined by GPS observations
NC0616.and is referenced to NAD 83.
NC0616
NC0616.The dynamic height is computed by dividing the NAVD 88
NC0616.geopotential number by the normal gravity value computed on the
NC0616.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
NC0616.degrees latitude (g = 980.6199 gals.).
NC0616
NC0616.The modeled gravity was interpolated from observed gravity values.
NC0616
NC0616. The following values were computed from the NAD 83(2011) position.
NC0616
NC0616;
NC0616;SPC NY W - North 252,161.070 East 257,079.539 Units MT Scale Factor 1.00004370 Converg. -0 45 27.2
NC0616;SPC NY W - 827,298.44 843,435.12 sFT 1.00004370 -0 45 27.2
NC0616;UTM 17 - 4,680,025.155 606,421.841 MT 0.99973935 +0 52 04.6
NC0616
NC0616!
NC0616!SPC NY W - Elev Factor x Scale Factor = Combined Factor
NC0616!UTM 17 - 0.99996950 x 1.00004370 = 1.00001320
NC0616!UTM 17 - 0.99996950 x 0.99973935 = 0.99970886
NC0616
NC0616 SUPERSEDED SURVEY CONTROL
NC0616
NC0616 NAD 83(2007)- 42 15 54.63393(N) 079 42 34.65032(W) AD(2002.00) 0
NC0616 ELLIP H (02/10/07) 194.469 (m) GP(2002.00)
NC0616 ELLIP H (09/18/02) 194.476 (m) GP() 4 2
NC0616 NAD 83(1996)- 42 15 54.63368(N) 079 42 34.65090(W) AD() B
NC0616 ELLIP H (07/22/97) 194.447 (m) GP() 1 1
NC0616 NAVD 88 (07/22/97) 229.26 (m) 752.2 (f) LEVELING 3
NC0616 NAVD 88 (??/??/92) 229.256 (m) 752.15 (f) POSTED 3
NC0616 NGVD 29 (??/??/92) 229.428 (m) 752.72 (f) ADJ UNCH 1 2
NC0616
NC0616.Superseded values are not recommended for survey control.
NC0616
NC0616.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
NC0616.See file dsdata.txt to determine how the superseded data were derived.
NC0616
NC0616_U.S. NATIONAL GRID SPATIAL ADDRESS: 17TPG0642180025(NAD 83)
NC0616
NC0616_MARKER: DB = BENCH MARK DISK
NC0616_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
NC0616_SP_SET: SET IN TOP OF CONCRETE MONUMENT
NC0616_STAMPING: M 56 1934
NC0616_MARK LOGO: CGS
NC0616_PROJECTION: FLUSH
NC0616_MAGNETIC: N = NO MAGNETIC MATERIAL
NC0616_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
NC0616+STABILITY: SURFACE MOTION
NC0616_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
NC0616+SATELLITE: SATELLITE OBSERVATIONS - April 26, 2013

| NC0616 | | | | |
|--------|---------|------------|----------------|-----------|
| NC0616 | HISTORY | - Date | Condition | Report By |
| NC0616 | HISTORY | - 1934 | MONUMENTED | CGS |
| NC0616 | HISTORY | - 1961 | MARK NOT FOUND | CGS |
| NC0616 | HISTORY | - 1983 | MARK NOT FOUND | NGS |
| NC0616 | HISTORY | - 19951201 | GOOD | NYDT |
| NC0616 | HISTORY | - 19970101 | GOOD | FA |
| NC0616 | HISTORY | - 19970909 | GOOD | FA |
| NC0616 | HISTORY | - 20010729 | GOOD | NGS |
| NC0616 | HISTORY | - 20051015 | GOOD | USPSQD |
| NC0616 | HISTORY | - 20130426 | GOOD | PADT |

NC0616

NC0616

STATION DESCRIPTION

NC0616

NC0616'DESCRIBED BY COAST AND GEODETIC SURVEY 1934

NC0616'IN RIPLEY.

NC0616'AT RIPLEY, CHAUTAUQUA COUNTY, ON THE NEW YORK CENTRAL RAILROAD, WEST

NC0616'OF THE STATION AND A ROAD CROSSING, AND ABOUT 2 FEET LOWER THAN THE

NC0616'TOP OF THE RAIL. A STANDARD DISK, STAMPED M 56 1934 AND SET IN THE

NC0616'TOP OF A CONCRETE POST.

NC0616

NC0616

STATION RECOVERY (1961)

NC0616

NC0616'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1961

NC0616'MARK NOT FOUND.

NC0616

NC0616

STATION RECOVERY (1983)

NC0616

NC0616'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1983

NC0616'NOT RECOVERED, THE RAILROAD STATION HAS BEEN TORN DOWN AND THE

NC0616'DESCRIPTION IS INADEQUATE.

NC0616

NC0616

STATION RECOVERY (1995)

NC0616

NC0616'RECOVERY NOTE BY NY DEPT OF TRANSP 1995 (KDS)

NC0616'RECOVERED INTACT IN 1995 BY THE NEW YORK STATE DEPARTMENT OF

NC0616'TRANSPORTATION AND PRIVATE FIRM. TO REACH THE STATION FROM THE

NC0616'JUNCTION OF NY ROUTE 76 AND US ROUTE 20 IN RIPLEY, GO SOUTH ON NY

NC0616'ROUTE 76 FOR 0.24 KM (0.15 MI) ,OVER A DOUBLE SET OF RAILROAD TRACKS,

NC0616'TO THE STATION ON THE RIGHT. THE STATION IS NEAR A LARGE, AT GRADE,

NC0616'RAILROAD CROSSING, SOUTH OF A DOUBLE SET OF TRACKS AND NORTH OF A

NC0616'SINGLE TRACK, ALL ACTIVE. THE STATION IS A BRONZE DISK SET IN A

NC0616'SQUARE CONCRETE POST. IT IS 21.3 M (69.88 FT) WEST OF THE CENTERLINE

NC0616'OF NY ROUTE 76, 4.6 M (15.09 FT) NORTHWEST OF A 2.0 M (6.56 FT) SQUARE

NC0616'CONCRETE SIGNAL EQUIPMENT SHELTER, 8.2 M (26.90 FT) SOUTH OF THE SOUTH

NC0616'RAIL OF THE DOUBLE TRACKS, AND 13.7 M (44.95 FT) WEST SOUTHWEST OF THE

NC0616'WESTERN CROSSING ARM SIGNAL ON THE SOUTH SIDE OF THE DOUBLE TRACKS.

NC0616'THE NORTH FACE OF THE POST WAS BROKEN AND THE DISK SLIGHTLY DAMAGED,

NC0616'BUT BOTH DISK AND POST APPEAR STRAIGHT, SECURE, AND UNMOVED.

NC0616

NC0616

STATION RECOVERY (1997)

NC0616

NC0616'RECOVERY NOTE BY FISHER ASSOCIATES 1997 (PGS)

NC0616'GOOD.

NC0616



NC0616 STATION RECOVERY (1997)
NC0616
NC0616'RECOVERY NOTE BY FISHER ASSOCIATES 1997 (KR)
NC0616'GOOD.
NC0616
NC0616 STATION RECOVERY (2001)
NC0616
NC0616'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2001 (CSM)
NC0616'RECOVERED AS DESCRIBED.
NC0616'
NC0616'
NC0616
NC0616 STATION RECOVERY (2005)
NC0616
NC0616'RECOVERY NOTE BY US POWER SQUADRON 2005 (DH)
NC0616'RECOVERED IN GOOD CONDITION.
NC0616
NC0616 STATION RECOVERY (2013)
NC0616
NC0616'RECOVERY NOTE BY PA DEPT OF TRANSP 2013 (CRF)
NC0616'RECOVERED IN GOOD CONDITION.

The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.7
1      National Geodetic Survey,  Retrieval Date = JUNE 26, 2015
DI1848 *****
DI1848  CORS          -  This is a GPS Continuously Operating Reference Station.
DI1848  DESIGNATION  -  ASHTABULA COUNTY CORS ARP
DI1848  CORS_ID     -  OHAS
DI1848  PID         -  DI1848
DI1848  STATE/COUNTY-  OH/ASHTABULA
DI1848  COUNTRY     -  US
DI1848  USGS QUAD   -  CONNEAUT (1996)
DI1848
DI1848                      *CURRENT SURVEY CONTROL
DI1848
DI1848*  NAD 83(2011) POSITION- 41 55 30.22143(N) 080 33 03.84434(W)  ADJUSTED
DI1848*  NAD 83(2011) ELLIP HT- 181.594 (meters) (08/??/11)  ADJUSTED
DI1848*  NAD 83(2011) EPOCH   - 2010.00
DI1848*  NAVD 88 ORTHO HEIGHT -          *(meters)          *(feet)
DI1848
DI1848  NAD 83(2011) X  - 780,243.384 (meters)  COMP
DI1848  NAD 83(2011) Y  - -4,688,216.492 (meters)  COMP
DI1848  NAD 83(2011) Z  - 4,239,535.881 (meters)  COMP
DI1848  GEOID HEIGHT   - -34.57 (meters)  GEOID12B
DI1848
DI1848 Network accuracy estimates per FGDC Geospatial Positioning Accuracy
DI1848 Standards:
DI1848          FGDC (95% conf, cm)          Standard deviation (cm)          CorrNE
DI1848          Horiz Ellip                  SD_N   SD_E   SD_h          (unitless)
DI1848 -----
DI1848 NETWORK      2.00   6.55                0.90   0.73   3.34          -0.02109990
DI1848 -----
DI1848 Click here for local accuracies and other accuracy information.
DI1848
DI1848
DI1848.The coordinates were established by GPS observations
DI1848.and adjusted by the National Geodetic Survey in August 2011.
DI1848
DI1848.NAD 83(2011) refers to NAD 83 coordinates where the reference
DI1848.frame has been affixed to the stable North American Tectonic Plate.
DI1848
DI1848.The coordinates are valid at the epoch date displayed above
DI1848.which is a decimal equivalence of Year/Month/Day.
DI1848
DI1848.The PID for the CORS L1 Phase Center is DL6181.
DI1848
DI1848.The XYZ, and position/ellipsoidal ht. are equivalent.
DI1848
DI1848.The ellipsoidal height was determined by GPS observations
DI1848.and is referenced to NAD 83.
DI1848
DI1848. The following values were computed from the NAD 83(2011) position.

```



DI1848
 DI1848;
 DI1848;SPC OH N - North East Units Scale Factor Converg.
 DI1848;SPC OH N - 252,604.639 761,654.642 MT 1.00005117 +1 16 49.3
 DI1848;SPC OH N - 828,753.72 2,498,861.94 sFT 1.00005117 +1 16 49.3
 DI1848;UTM 17 - 4,641,553.382 537,223.123 MT 0.99961705 +0 17 59.9
 DI1848
 DI1848!
 DI1848!SPC OH N - Elev Factor x Scale Factor = Combined Factor
 DI1848!SPC OH N - 0.99997152 x 1.00005117 = 1.00002269
 DI1848!UTM 17 - 0.99997152 x 0.99961705 = 0.99958858

SUPERSEDED SURVEY CONTROL

DI1848 NAD 83(CORS)- 41 55 30.22156(N) 080 33 03.84480(W) AD(2002.00) c
 DI1848 ELLIP H (10/??/06) 181.590 (m) GP(2002.00) c c

DI1848.Superseded values are not recommended for survey control.

DI1848.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 DI1848.See file dsdata.txt to determine how the superseded data were derived.

DI1848_U.S. NATIONAL GRID SPATIAL ADDRESS: 17TNG3722341553(NAD 83)

DI1848_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA

STATION DESCRIPTION

DI1848'DESCRIBED BY NATIONAL GEODETIC SURVEY 2011
 DI1848'STATION IS A GPS CORS. LATEST INFORMATION INCLUDING POSITIONS AND
 DI1848'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
 DI1848'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.

DI1848' ftp://cors.ngs.noaa.gov/cors/README.txt
 DI1848' ftp://cors.ngs.noaa.gov/cors/coord/coord_08
 DI1848' ftp://cors.ngs.noaa.gov/cors/station_log
 DI1848' http://geodesy.noaa.gov/CORS

The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.7
1      National Geodetic Survey,  Retrieval Date = JUNE 26, 2015
DG7224 *****
DG7224 CBN          - This is a Cooperative Base Network Control Station.
DG7224 DESIGNATION - RICHMOND
DG7224 PID          - DG7224
DG7224 STATE/COUNTY- OH/ASHTABULA
DG7224 COUNTRY      - US
DG7224 USGS QUAD    - LEON (1994)
DG7224
DG7224                      *CURRENT SURVEY CONTROL
DG7224
DG7224* NAD 83(2011) POSITION- 41 40 49.38647(N) 080 34 13.79842(W) ADJUSTED
DG7224* NAD 83(2011) ELLIP HT- 280.166 (meters) (06/27/12) ADJUSTED
DG7224* NAD 83(2011) EPOCH - 2010.00
DG7224* NAVD 88 ORTHO HEIGHT - 314.2 (meters) 1031. (feet) GPS OBS
DG7224
DG7224 NAVD 88 orthometric height was determined with geoid model GEOID03
DG7224 GEOID HEIGHT - -33.98 (meters) GEOID03
DG7224 GEOID HEIGHT - -34.05 (meters) GEOID12B
DG7224 NAD 83(2011) X - 781,633.290 (meters) COMP
DG7224 NAD 83(2011) Y - -4,706,423.892 (meters) COMP
DG7224 NAD 83(2011) Z - 4,219,342.619 (meters) COMP
DG7224 LAPLACE CORR - 0.53 (seconds) DEFLEC12B
DG7224
DG7224 Network accuracy estimates per FGDC Geospatial Positioning Accuracy
DG7224 Standards:
DG7224      FGDC (95% conf, cm)      Standard deviation (cm)      CorrNE
DG7224      Horiz Ellip              SD_N   SD_E   SD_h      (unitless)
DG7224 -----
DG7224 NETWORK      0.63   1.57              0.28   0.23   0.80      -0.02517163
DG7224 -----
DG7224 Click here for local accuracies and other accuracy information.
DG7224
DG7224
DG7224.The horizontal coordinates were established by GPS observations
DG7224.and adjusted by the National Geodetic Survey in June 2012.
DG7224
DG7224.NAD 83(2011) refers to NAD 83 coordinates where the reference
DG7224.frame has been affixed to the stable North American tectonic plate. See
DG7224.NA2011 for more information.
DG7224
DG7224.The horizontal coordinates are valid at the epoch date displayed above
DG7224.which is a decimal equivalence of Year/Month/Day.
DG7224
DG7224.The orthometric height was determined by GPS observations and a
DG7224.high-resolution geoid model.
DG7224
DG7224.The X, Y, and Z were computed from the position and the ellipsoidal ht.
DG7224

```



DG7224.The Laplace correction was computed from DEFLEC12B derived deflections.
 DG7224

DG7224.The ellipsoidal height was determined by GPS observations
 DG7224.and is referenced to NAD 83.

DG7224

DG7224. The following values were computed from the NAD 83(2011) position.
 DG7224

| DG7224; | | North | East | Units | Scale Factor | Converg. |
|-----------------|---|--|--------------|------------|--------------|------------|
| DG7224;SPC OH N | - | 225,398.777 | 760,644.336 | MT | 0.99999628 | +1 16 03.3 |
| DG7224;SPC OH N | - | 739,495.82 | 2,495,547.29 | sFT | 0.99999628 | +1 16 03.3 |
| DG7224;UTM 17 | - | 4,614,379.841 | 535,747.685 | MT | 0.99961573 | +0 17 08.2 |
| DG7224! | - | Elev Factor x Scale Factor = Combined Factor | | | | |
| DG7224!SPC OH N | - | 0.99995606 | x | 0.99999628 | = | 0.99995234 |
| DG7224!UTM 17 | - | 0.99995606 | x | 0.99961573 | = | 0.99957181 |

DG7224

DG7224 SUPERSEDED SURVEY CONTROL

DG7224

| | | | | | |
|--------|--------------------|-------------------|--------------------|-------------|-----|
| DG7224 | NAD 83(2007)- | 41 40 49.38662(N) | 080 34 13.79919(W) | AD(2002.00) | 0 |
| DG7224 | ELLIP H (02/10/07) | 280.179 (m) | | GP(2002.00) | |
| DG7224 | NAD 83(1995)- | 41 40 49.38670(N) | 080 34 13.79933(W) | AD() | A |
| DG7224 | ELLIP H (09/23/04) | 280.182 (m) | | GP() | 4 1 |

DG7224

DG7224.Superseded values are not recommended for survey control.

DG7224

DG7224.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

DG7224.See file dsdata.txt to determine how the superseded data were derived.

DG7224

DG7224_U.S. NATIONAL GRID SPATIAL ADDRESS: 17TNG3574714379(NAD 83)

DG7224

DG7224_MARKER: DD = SURVEY DISK

DG7224_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)

DG7224_STAMPING: RICHMOND 2002

DG7224_MARK LOGO: NONE

DG7224_PROJECTION: RECESSED 18 CENTIMETERS

DG7224_MAGNETIC: O = OTHER; SEE DESCRIPTION

DG7224_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

DG7224_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

DG7224+SATELLITE: SATELLITE OBSERVATIONS - June 06, 2003

DG7224_ROD/PIPE-DEPTH: 8.53 meters

DG7224_SLEEVE-DEPTH : 0.9 meters

DG7224

| DG7224 | HISTORY | - Date | Condition | Report By |
|--------|---------|------------|------------|-----------|
| DG7224 | HISTORY | - 200211 | MONUMENTED | OH-007 |
| DG7224 | HISTORY | - 20030606 | GOOD | WOOLPT |

DG7224 HISTORY - 200211 MONUMENTED OH-007

DG7224 HISTORY - 20030606 GOOD WOOLPT

DG7224

DG7224

STATION DESCRIPTION

DG7224

DG7224'DESCRIBED BY WOOLPERT CONSULTANTS 2003 (GTF)

DG7224'THE STATION IS LOCATED IN RICHMOND TOWNSHIP, ABOUT 5.2 MI NORTH OF

DG7224'ANDOVER, 5.0 MI EAST OF DORSET, 2.4 MI SOUTH OF NORTH RICHMOND, AND

DG7224'2.8 MI WEST OF THE OHIO/PENNSYLVANIA STATE LINE.

DG7224'

DG7224'TO REACH THE STATION FROM THE INTERSECTION OF COUNTY ROAD 6, STATE

DG7224'ROUTE 7, AND STATE ROUTE 85 IN ANDOVER, GO NORTH FOR 5.1 MI ON ROUTE



WOOLPERT

DG7224'7 TO FOOTVILLE-RICHMOND RD. AND THE STATION IN THE NORTHWEST QUADRANT
DG7224'OF THE INTERSECTION.

DG7224'

DG7224'THE STATION IS A BRONZE DISK ON A STAINLESS STEEL ROD DRIVEN TO
DG7224'REFUSAL, STAMPED ---RICHMOND 2002---, SET IN A CONCRETE MONUMENT
DG7224'RECESSED 18.2 CM BELOW THE GROUND AND INSIDE A MONUMENT BOX. THE
DG7224'STATION IS 17.6 FT SOUTH OF THE EAST POST OF THE RICHMOND TOWN HALL
DG7224'SIGN, 30.7 FT WEST OF THE WEST EDGE OF ROUTE 7/COUNTY ROAD 6
DG7224'PAVEMENT, 41.3 FT NORTH OF POWER POLE NUMBER 100151, AND 53.2 FT EAST
DG7224'OF THE SOUTHEAST CORNER OF THE TOWN HALL BUILDING.

The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.7
1      National Geodetic Survey,      Retrieval Date = JUNE 26, 2015
AI8355 *****
AI8355  CORS          -   This is a GPS Continuously Operating Reference Station.
AI8355  DESIGNATION  -   UNIVERSITY OF PIT CORS ARP
AI8355  CORS_ID      -   UPTC
AI8355  PID          -   AI8355
AI8355  STATE/COUNTY-   PA/CRAWFORD
AI8355  COUNTRY      -   US
AI8355  USGS QUAD    -   TITUSVILLE NORTH (1973)
AI8355
AI8355                      *CURRENT SURVEY CONTROL
AI8355
AI8355*  NAD 83(2011) POSITION- 41 37 43.70163(N) 079 39 50.62091(W)  ADJUSTED
AI8355*  NAD 83(2011) ELLIP HT- 343.168 (meters) (08/??/11)  ADJUSTED
AI8355*  NAD 83(2011) EPOCH   - 2010.00
AI8355*  NAVD 88 ORTHO HEIGHT -          *(meters)          *(feet)
AI8355
AI8355  NAD 83(2011) X   -   856,681.178 (meters)          COMP
AI8355  NAD 83(2011) Y   -  -4,697,261.986 (meters)          COMP
AI8355  NAD 83(2011) Z   -   4,215,103.986 (meters)          COMP
AI8355  GEOID HEIGHT    -           -33.25 (meters)          GEOID12B
AI8355
AI8355  Network accuracy estimates per FGDC Geospatial Positioning Accuracy
AI8355  Standards:
AI8355          FGDC (95% conf, cm)      Standard deviation (cm)      CorrNE
AI8355          Horiz Ellip              SD_N   SD_E   SD_h          (unitless)
AI8355  -----
AI8355  NETWORK      0.72   2.30              0.32   0.26   1.17          0.00990649
AI8355  -----
AI8355  Click here for local accuracies and other accuracy information.
AI8355
AI8355
AI8355.The coordinates were established by GPS observations
AI8355.and adjusted by the National Geodetic Survey in August 2011.
AI8355
AI8355.NAD 83(2011) refers to NAD 83 coordinates where the reference
AI8355.frame has been affixed to the stable North American Tectonic Plate.
AI8355
AI8355.The coordinates are valid at the epoch date displayed above
AI8355.which is a decimal equivalence of Year/Month/Day.
AI8355
AI8355.The PID for the CORS L1 Phase Center is D02144.
AI8355
AI8355.The XYZ, and position/ellipsoidal ht. are equivalent.
AI8355
AI8355.The ellipsoidal height was determined by GPS observations
AI8355.and is referenced to NAD 83.
AI8355
AI8355. The following values were computed from the NAD 83(2011) position.

```

```

AI8355
AI8355;
           North      East      Units Scale Factor Converg.
AI8355;SPC PA N  - 164,139.717  440,519.068  MT  0.99996363  -1 15 58.4
AI8355;SPC PA N  -  538,515.05  1,445,269.64  sFT 0.99996363  -1 15 58.4
AI8355;UTM 17    - 4,609,426.230  611,281.127  MT  0.99975239  +0 53 15.2
AI8355
AI8355!
AI8355!SPC PA N  - Elev Factor x Scale Factor = Combined Factor
AI8355!SPC PA N  -  0.99994618 x 0.99996363 = 0.99990981
AI8355!UTM 17    -  0.99994618 x 0.99975239 = 0.99969858

```

AI8355

AI8355 SUPERSEDED SURVEY CONTROL

AI8355

```

AI8355 ELLIP H (06/27/12) 343.177 (m) GP(2010.00)
AI8355 NAD 83(2011)- 41 37 43.70184(N) 079 39 50.62084(W) AD(2010.00) c
AI8355 NAD 83(CORS)- 41 37 43.70203(N) 079 39 50.62191(W) AD(2002.00) c
AI8355 ELLIP H (11/??/08) 343.186 (m) GP(2002.00) c c
AI8355 ELLIP H (02/10/07) 343.198 (m) GP(2002.00)
AI8355 NAD 83(2007)- 41 37 43.70206(N) 079 39 50.62197(W) AD(2002.00) c
AI8355 NAD 83(CORS)- 41 37 43.70206(N) 079 39 50.62197(W) AD(2002.00) c
AI8355 ELLIP H (03/??/02) 343.198 (m) GP(2002.00) c c
AI8355 NAD 83(CORS)- 41 37 43.70220(N) 079 39 50.62206(W) AD(1997.00) c
AI8355 ELLIP H (11/??/00) 343.190 (m) GP(1997.00) c c

```

AI8355

AI8355.Superseded values are not recommended for survey control.

AI8355

AI8355.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AI8355.See file dsdata.txt to determine how the superseded data were derived.

AI8355

AI8355_U.S. NATIONAL GRID SPATIAL ADDRESS: 17TPG1128109426(NAD 83)

AI8355

AI8355_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA

AI8355

AI8355 STATION DESCRIPTION

AI8355

AI8355'DESCRIBED BY NATIONAL GEODETIC SURVEY 2011

AI8355'STATION IS A GPS CORS. LATEST INFORMATION INCLUDING POSITIONS AND

AI8355'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE

AI8355'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.

AI8355' ftp://cors.ngs.noaa.gov/cors/README.txt

AI8355' ftp://cors.ngs.noaa.gov/cors/coord/coord_08

AI8355' ftp://cors.ngs.noaa.gov/cors/station_log

AI8355' http://geodesy.noaa.gov/CORS



Section 4: Station Recovery Information Sheets

This section contains the station recovery information sheets for each of the geodetic control stations (no CORS) that were established or recovered for the Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project.

Geodetic Control

| GPS Observation Log Sheet | | W WOOLPERT |
|--------------------------------------|---|-----------------------------|
| Project Name: <u>Erie Lidar 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/15/15</u> |
| Station Name: <u>100</u> | Operator Name: <u>Ron Siny</u> | |
| Latitude: <u>41° 50' 07.44"</u> | Julian Day: <u>166</u> | Session No. <u>1</u> |
| Longitude: <u>80° 22' 58.02"</u> | Start Time: <u>3:18</u> | End Time: <u>6:15</u> |
| Ellip. Height: <u>931.509 m</u> | Data File Name: <u>4351162</u> | |
| Type of Mark: <u>IP w/ cap</u> | Type of Receiver: <u>Trimble R2 model 3</u> | |
| Stamping on Mark: <u>N/A</u> | Type of Antenna: <u>Trimble External</u> | |
| Weather Condition: <u>20's Sunny</u> | Antenna Height: <u>2.0 m</u> to bottom of antenna mount | |

The sketch map shows the station location (100) marked with a triangle. It is situated near Millgrove Rd and State Route 18. The area is divided into various terrain types: Gravel, Grass, Trees, Asphalt, and a Farm Field. A PNA Pole is also indicated. A north arrow is present in the top left corner of the sketch area.


GPS Observation Log Sheet




| | | |
|--------------------------------------|---|-----------------------------|
| Project Name: <u>Erie LiDAR 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/16/15</u> |
| Station Name: <u>100</u> | Operator Name: <u>Ron Sirey</u> | |
| Latitude: <u>41° 50' 07.44"</u> | Julian Day: <u>167</u> | Session No. <u>1</u> |
| Longitude: <u>80° 22' 58.02"</u> | Start Time: <u>8:39</u> | End Time: <u>7:16</u> |
| Ellip. Height: <u>924.880 ft.</u> | Data File Name: <u>43511670</u> | |
| Type of Mark: <u>IP w/cap</u> | Type of Receiver: <u>Trimble R8 model 3</u> | |
| Stamping on Mark: <u>n/a</u> | Type of Antenna: <u>Trimble Internal</u> | |
| Weather Condition: <u>70's Rain</u> | Antenna Height: <u>20 m</u> | to bottom of antenna mount |



- See Previous -

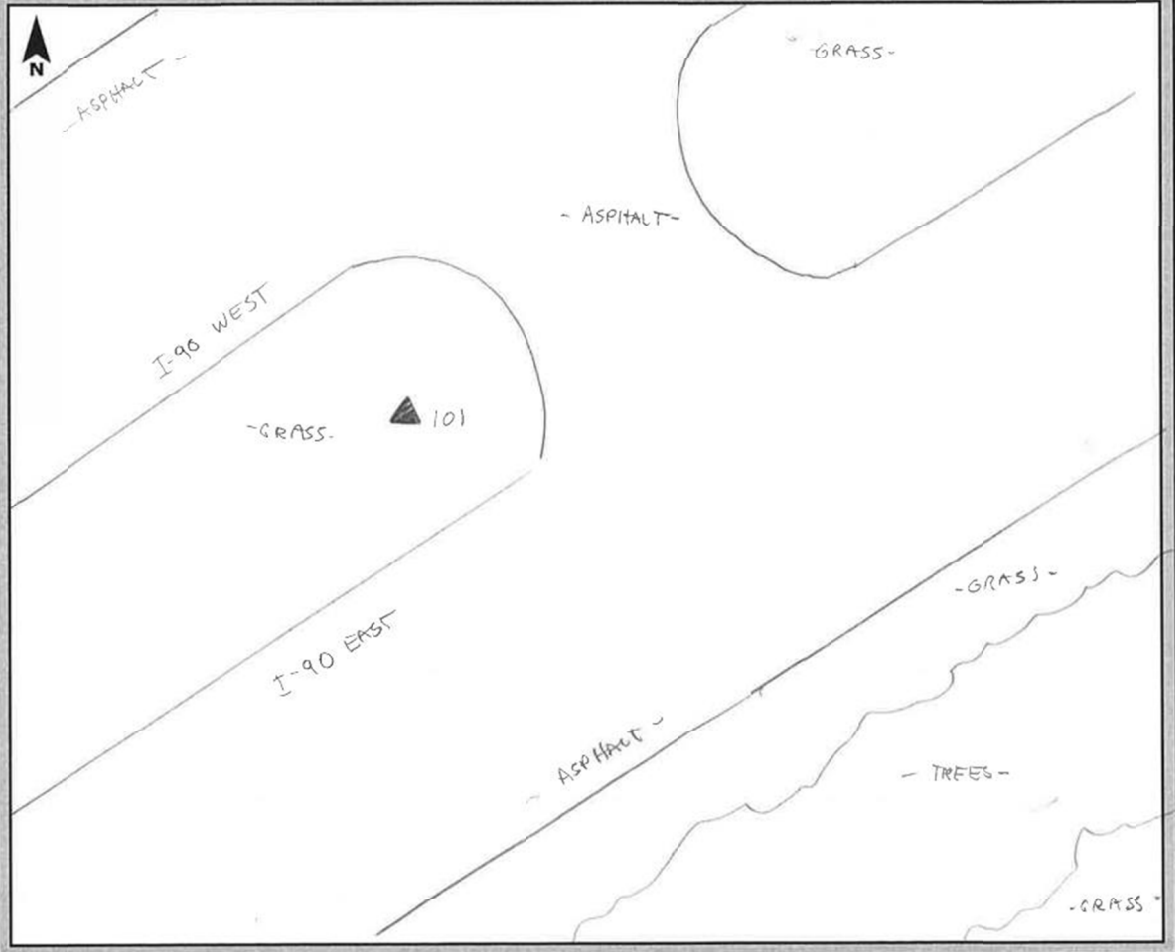
| GPS Observation Log Sheet | |  |
|--|---|---|
| Project Name: <u>Erie LiDAR 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/17/15</u> |
| Station Name: <u>100</u> | Operator Name: <u>Ron Smay</u> | |
| Latitude: <u>41° 50' 07.41"</u> | Julian Day: <u>108</u> | Session No. <u>1</u> |
| Longitude: <u>80° 22' 58.01"</u> | Start Time: <u>8:18</u> | End Time: <u>4:58</u> |
| Ellip. Height: <u>929.6855ft</u> | Data File Name: <u>4351680</u> | |
| Type of Mark: <u>IP w/cap</u> | Type of Receiver: <u>Trimble R2 model S</u> | |
| Stamping on Mark: <u>n/a</u> | Type of Antenna: <u>Trimble Inerant</u> | |
| Weather Condition: <u>overcast 70s</u> | Antenna Height: <u>2.0 m</u> to bottom of antenna mount | |



- See Previous -

GPS Observation Log Sheet

| | | |
|--------------------------------------|---|-----------------------------|
| Project Name: <u>Erie Lidar 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/16/15</u> |
| Station Name: <u>101</u> | Operator Name: <u>Ron Smiy</u> | |
| Latitude: <u>42° 08' 00.58"</u> | Julian Day: <u>167</u> | Session No. <u>1</u> |
| Longitude: <u>77° 56' 10.85"</u> | Start Time: <u>7:44</u> | End Time: <u>2:01</u> |
| Ellip. Height: <u>984 GRS sf</u> | Data File Name: <u>5840670</u> | |
| Type of Mark: <u>IP w/cap</u> | Type of Receiver: <u>Trimble R8 model 2</u> | |
| Stamping on Mark: <u>N/A</u> | Type of Antenna: <u>Trimble Internal</u> | |
| Weather Condition: <u>70% Rain</u> | Antenna Height: <u>2.0 m</u> | to bottom of antenna mount |



GPS Observation Log Sheet

| | | |
|---|--|------------------------------------|
| Project Name: <u>Erie Lidar 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/22/15</u> |
| Station Name: <u>101</u> | Operator Name: <u>Ron Siney</u> | |
| Latitude: <u>42° 08' 00.56"</u> | Julian Day: <u>173</u> | Session No.: <u>1</u> |
| Longitude: <u>79° 56' 10.86"</u> | Start Time: <u>12:01</u> | End Time: <u>5:47</u> |
| Ellip. Height: <u>983.797 SF+</u> | Data File Name: <u>43511730</u> | |
| Type of Mark: <u>IP w/cap</u> | Type of Receiver: <u>Trimble R8 model 3</u> | |
| Stamping on Mark: <u>N/A</u> | Type of Antenna: <u>Trimble Internal</u> | |
| Weather Condition: <u>Sunny 70's</u> | Antenna Height: <u>2.0 m</u> to bottom of antenna mount | |



- See Previous -

GPS Observation Log Sheet



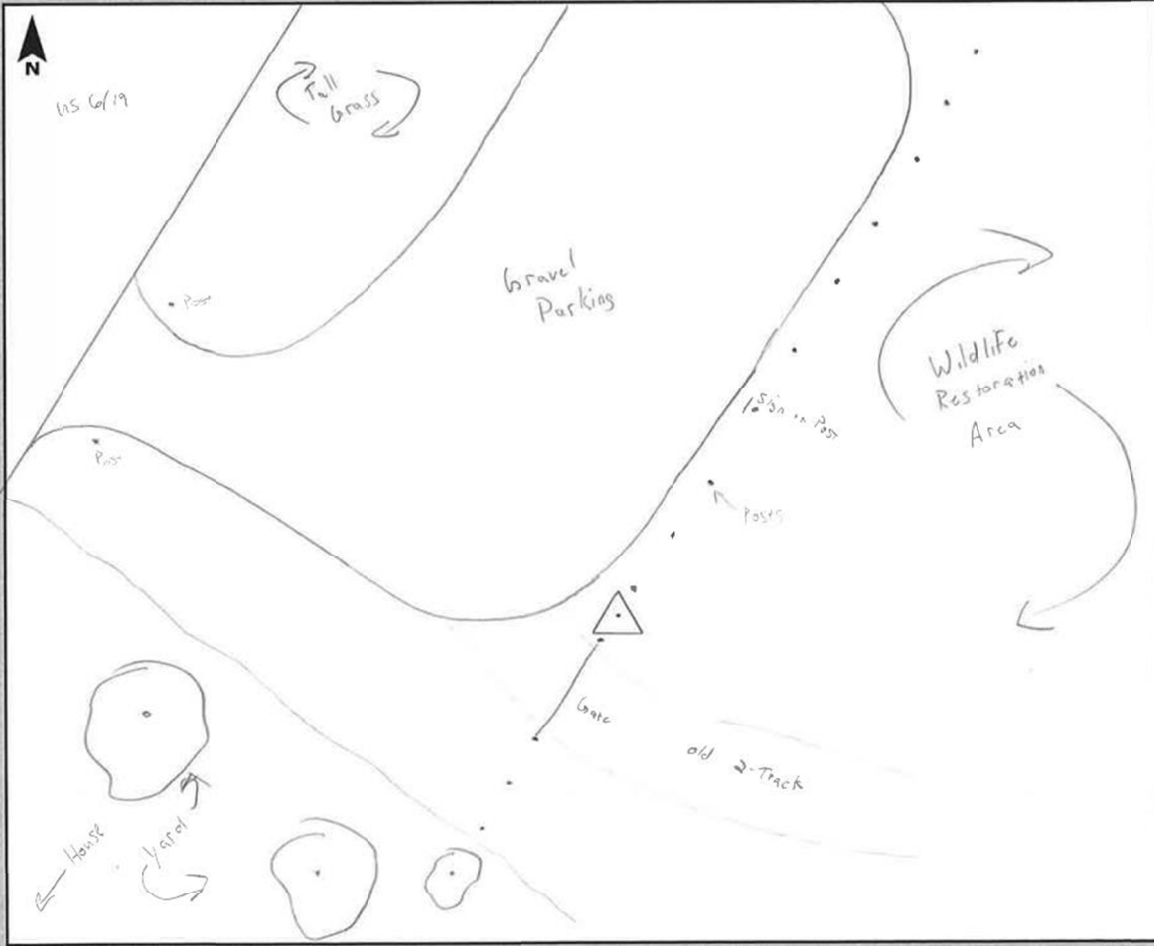
| | | |
|---|---|-----------------------------|
| Project Name: <u>Erie Lidar 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/23/15</u> |
| Station Name: <u>101</u> | Operator Name: <u>Ron Siney</u> | |
| Latitude: <u>42°08'00.57"</u> | Julian Day: <u>174</u> | Session No. <u>1</u> |
| Longitude: <u>79°56'10.83"</u> | Start Time: <u>7:21</u> | End Time: <u>5:49</u> |
| Ellip. Height: <u>989.841</u> | Data File Name: <u>43511740</u> | |
| Type of Mark: <u>IP w/ cap</u> | Type of Receiver: <u>Trimble R8 model 3</u> | |
| Stamping on Mark: <u>n/a</u> | Type of Antenna: <u>Trimble Internal</u> | |
| Weather Condition: <u>overcast 70's</u> | Antenna Height: <u>2.8 m</u> | to bottom of antenna mount |



- See Previous -

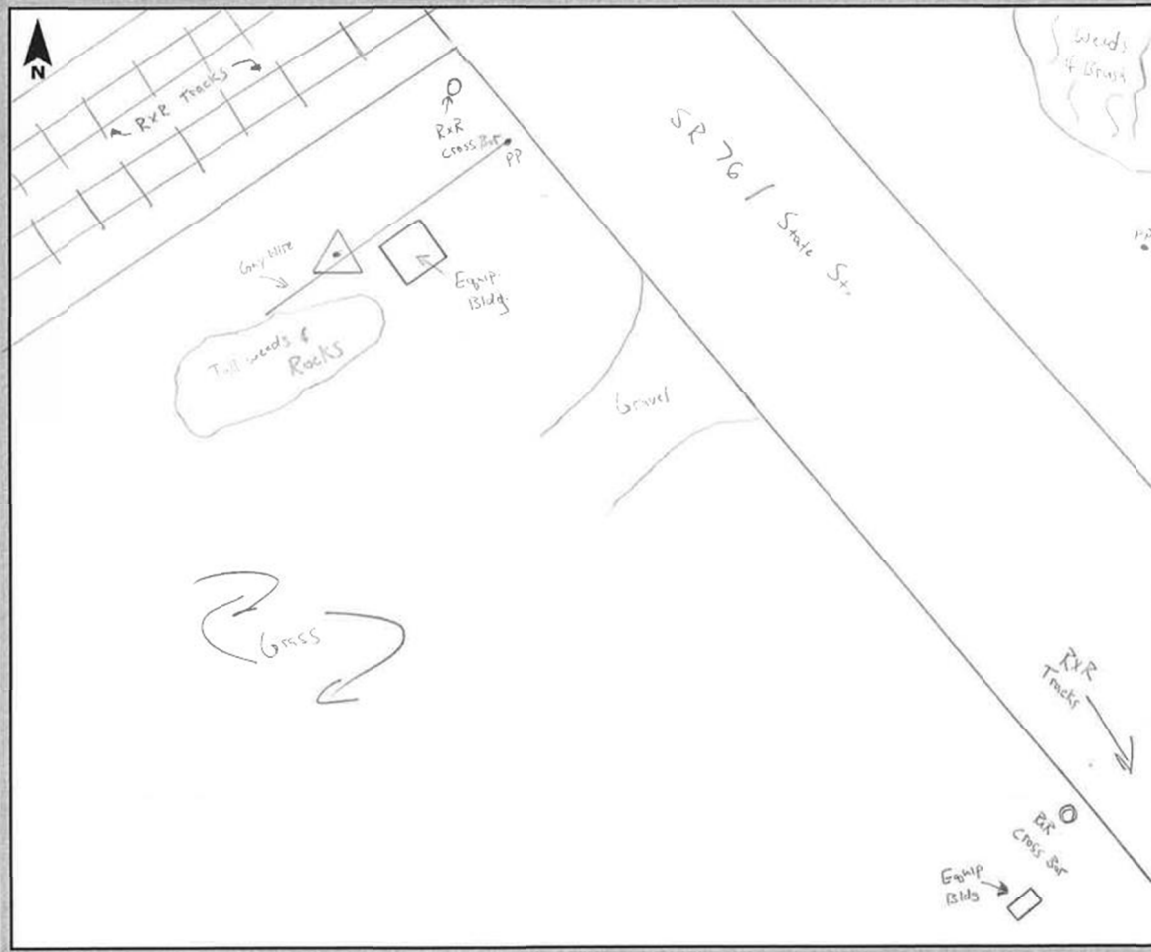
GPS Observation Log Sheet

| | | |
|---|---|-----------------------------|
| Project Name: <u>Erie LiDAR 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/16/15</u> |
| Station Name: <u>D 406 / MB 1777</u> | Operator Name: <u>Ron Sney</u> | |
| Latitude: <u>41° 49' 17.01"</u> | Julian Day: <u>167</u> | Session No. <u>2</u> |
| Longitude: <u>80° 02' 40.77"</u> | Start Time: <u>12:01</u> | End Time: <u>12:51</u> |
| Ellip. Height: <u>1028.255 ss-</u> | Data File Name: <u>06101671</u> | |
| Type of Mark: <u>SS. Rod w/ DOT Cap</u> | Type of Receiver: <u>Trimble RB model 3</u> | |
| Stamping on Mark: <u>D 406 1982</u> | Type of Antenna: <u>Trimble Internal</u> | |
| Weather Condition: <u>Sunny 70's</u> | Antenna Height: <u>2.0 m</u> | to bottom of antenna mount |



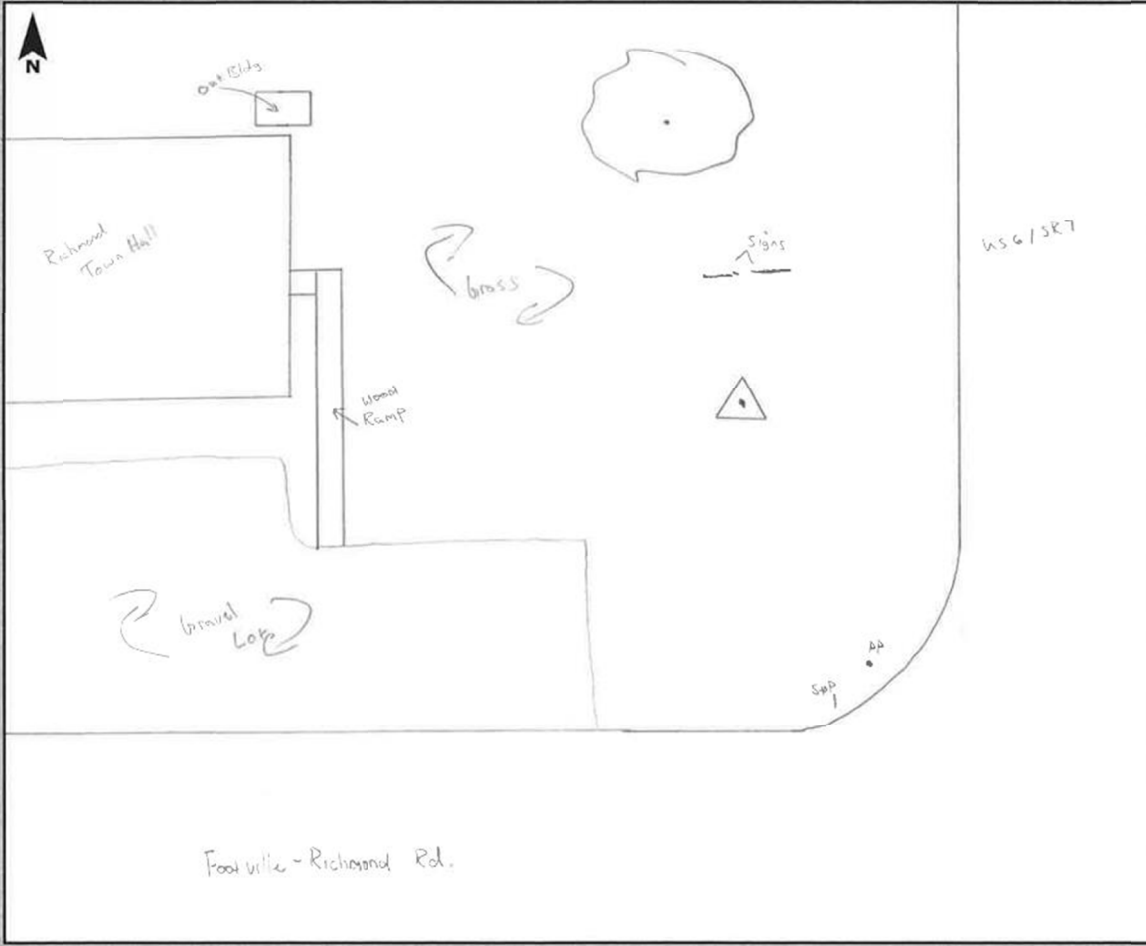
GPS Observation Log Sheet

| | | |
|---------------------------------------|---|-----------------------------|
| Project Name: <u>Erie Lidar 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/16/15</u> |
| Station Name: <u>MS6/NC0616</u> | Operator Name: <u>Ron Sindy</u> | |
| Latitude: <u>42° 15' 54.63"</u> | Julian Day: <u>167</u> | Session No. <u>3</u> |
| Longitude: <u>79° 42' 34.65"</u> | Start Time: <u>2:06</u> | End Time: <u>3:36</u> |
| Ellip. Height: <u>634.275 SF</u> | Data File Name: <u>06101672</u> | |
| Type of Mark: <u>BM Disk in Conc.</u> | Type of Receiver: <u>Trimble RR model 3</u> | |
| Stamping on Mark: <u>M 56 1934</u> | Type of Antenna: <u>Trimble Internal</u> | |
| Weather Condition: <u>Sunny 80's</u> | Antenna Height: <u>2.0 m</u> to bottom of antenna mount | |



GPS Observation Log Sheet

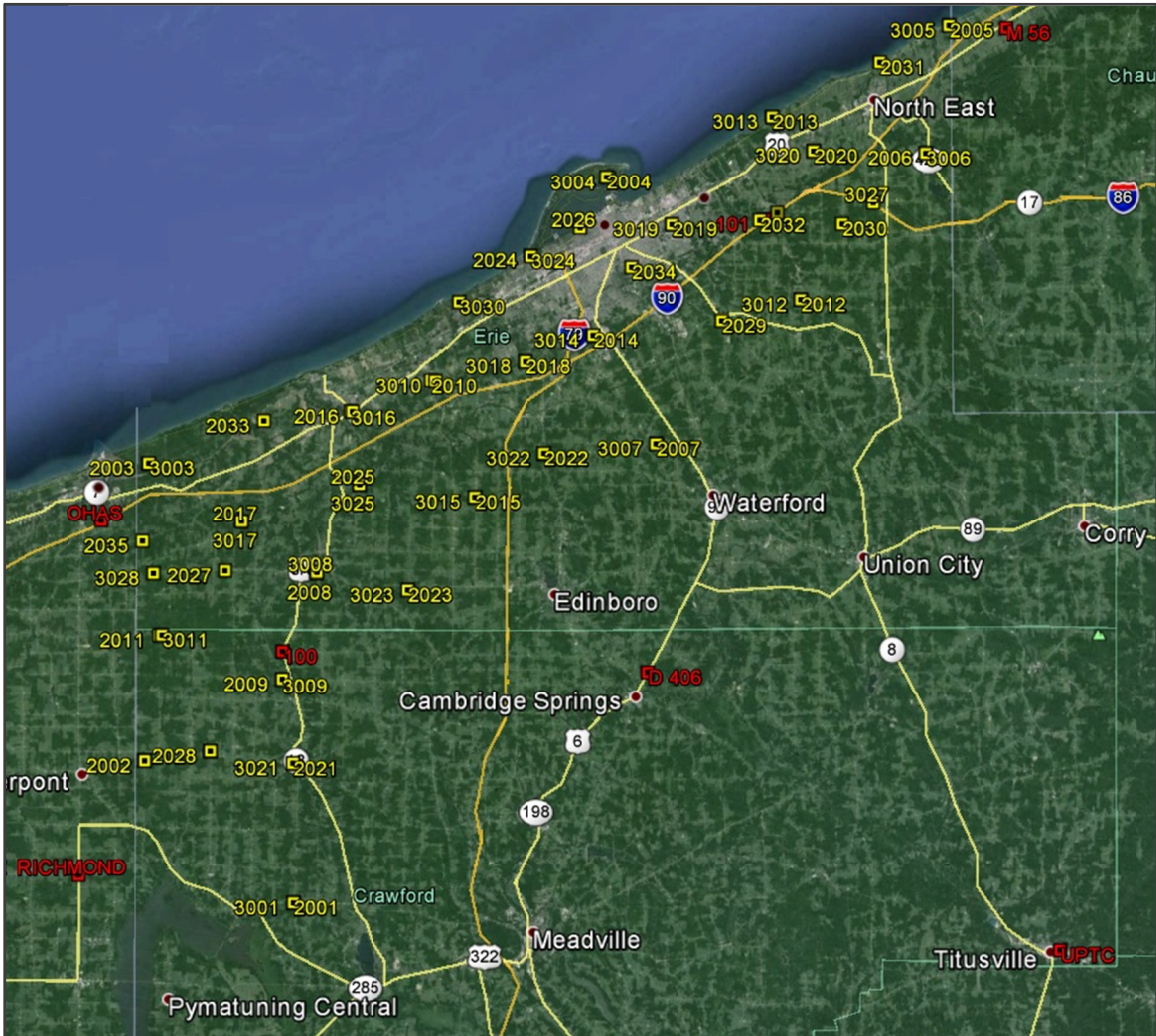
| | | |
|--|---|-----------------------------|
| Project Name: <u>Erie Lidar 2015</u> | Project Number: <u>75294</u> | Survey Date: <u>6/16/15</u> |
| Station Name: <u>Richmond / D67224</u> | Operator Name: <u>Ron Sney</u> | |
| Latitude: <u>41° 40' 49.41"</u> | Julian Day: <u>167</u> | Session No. <u>1</u> |
| Longitude: <u>80° 34' 13.84"</u> | Start Time: <u>9:31</u> | End Time: <u>11:01</u> |
| Ellip. Height: <u>910.775 sft</u> | Data File Name: <u>06101670</u> | |
| Type of Mark: <u>Survey Dot on S.S. Road</u> | Type of Receiver: <u>Trimble RP model 3</u> | |
| Stamping on Mark: <u>Richmond 2002</u> | Type of Antenna: <u>Trimble Inernal</u> | |
| Weather Condition: <u>Overcast 70's</u> | Antenna Height: <u>20 m</u> | to bottom of antenna mount |





Section 5: GPS Control Diagram

This section contains a graphical representation of the new control stations used for the Lake Erie Watershed 2015 Ortho/LiDAR/Hydro Project.



**LAKE ERIE WATERSHED
2015 ORTHO/LI DAR/HYDRO PROJECT**

Horizontal Datum: NAD 83 (HARN)
 Vertical Datum: NAVD 88
 Units: U.S. Survey Feet
 State Plane Zone: Pennsylvania North (3701)
 Geoid Model: Geoid 09
 Coordinate System: Grid
 Date: September 2015



LiDAR Quality Control Station
 Geodetic Control Station and/or Geodetic Check

NOT TO SCALE