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SURVEYOR'S REPORT

Specific Purpose Survey of the United States
Geological Survey Well **PB 1639**
in
Palm Beach County, Florida

Prepared for:

South Florida Water Management District

3301 Gun Club Road
West Palm Beach, Florida 33406

Prepared by:

Peter Andersen, PSM, Vice President

Florida Professional Surveyor and Mapper
License Number 5199
State of Florida

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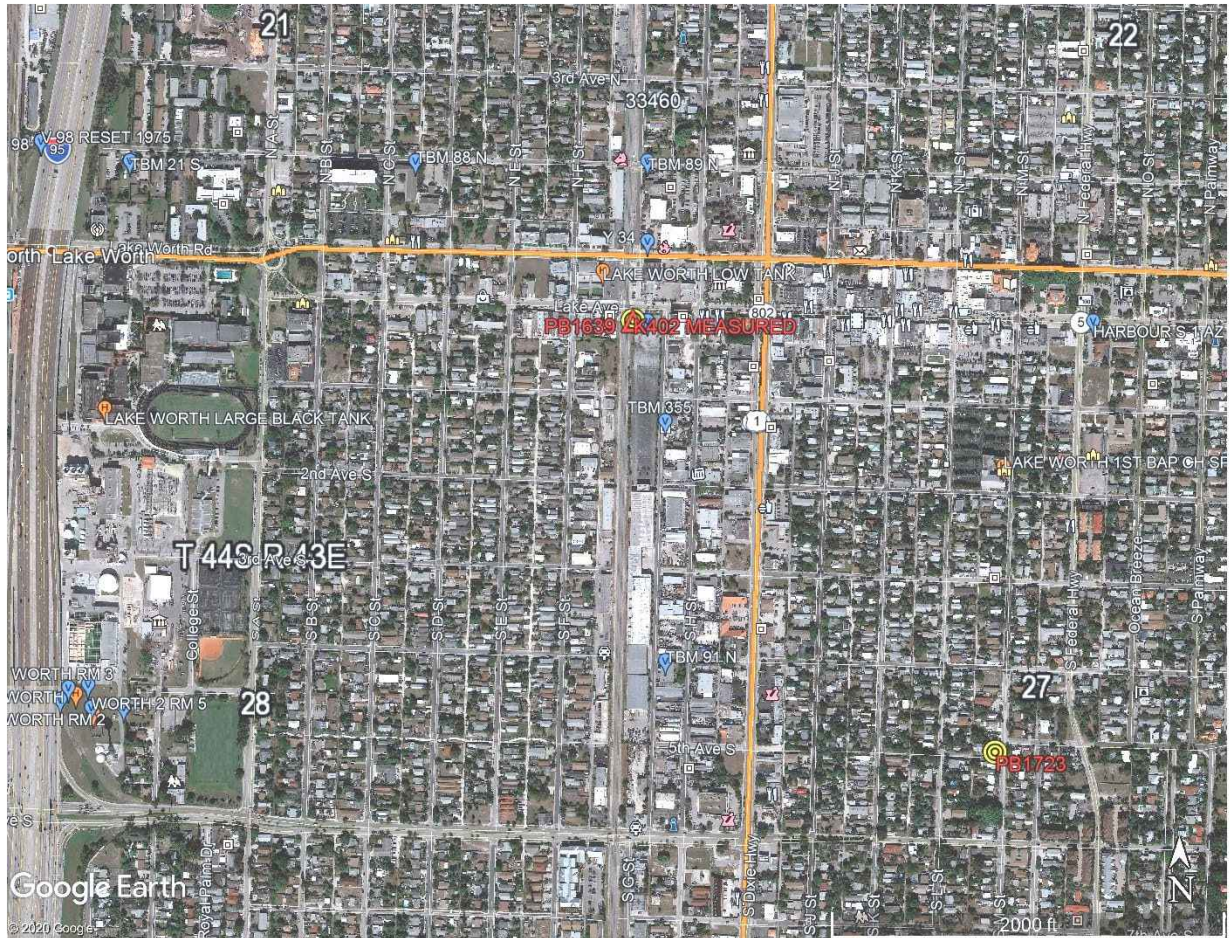
PURPOSE



The Purpose of this survey is to set an Elevation Referenced Mark (Benchmark) using the guidelines for a National Geodetic Survey (NGS), Class "C" concrete monument and to establish a North American Vertical Datum of 1988 (NAVD 88) on said Benchmark and on an additional Reference Point with a Brass Plate, both at United States Geological Survey Well "PB 1639".

LOCATION OF PROJECT

The United States Geological Survey Well "PB 1639" is located in the Section 28, Township 44 South, Range 43 East, Palm Beach County, Florida.



General Location (Not to Scale)

PROJECT VERTICAL DATUM

The project vertical datum is the North American Vertical Datum (NAVD) of 1988.

To convert the NAVD 88 elevation to the National Geodetic Vertical Datum (NGVD) of 1929 at **Station PB 1639 add 1.535**. These values are based on Corpscon 6.0.1, a U.S. Army Corps of Engineers, Engineering Research and Development Center Windows based program to convert coordinates and elevations between datums using the updated vertcon05.txt and the vertcone.05 files supplied by the U.S Army Corps of Engineers. South Atlantic Division, Jacksonville, Florida.

PROJECT HORIZONTAL DATUM

The project horizontal datum is the State Plane Coordinate System, Florida East Zone, North American Datum 83, adjustment of 2011.

LEVELING METHODS

The leveling for this project was performed in accordance with standard survey practice using conventional third order methods, techniques and equipment.

The allowable error on this project meets or exceeds closures as required by SFWMD (.02 v miles) per executed SOW for 4600003703 WO07. National Geodetic Survey (NGS) monument "K 402" (NGSPID AD8035) is located approximately 25 feet from USDA Well PB 1639 and will be used for site benchmark.

GPS METHODS

Latitude and longitude for the New Benchmark "K 402" were established by observing a 4.5 hour Static Sessions on March 25, 2020 using a Trimble 5700 dual frequency receiver S/N 0220381397. The data from these sessions was sent to the NGS "OPUS" site for post processing on May 3, 2020 and the reports were received from the "OPUS" site the same day.

Surveyors' Notes:

1. All measurements herein are in United States Survey feet and decimal thereof, unless otherwise specified.
2. Underground utilities were not located as part of this survey.
3. This survey report or copies thereof are not valid without the original signature and seal of a Florida licensed Surveyor and Mapper.
4. Additions or deletions to this survey report by other than the signing party (or parties) is prohibited without written consent of the signing party (or parties).
5. To convert from NAVD 88 to NGVD 29 add 1.519 feet. This value is based on Corpscon 6.0.1 a U.S. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.05 files supplied by the U.S. Army Corps of Engineers South Atlantic Division, Jacksonville Fl.
6. Date of last field work: March 25, 2020, GCY job No. 18-1020-07.
7. SFWMD Data records (on file at the District's headquarters):
 - A. Electronic Data files:
Miscellaneous picture files
Digital level run
File names: XXXXXX.DAT
 - B. Conventional reporting
Field Book: 1863 pages 24-26

SURVEYOR'S CERTIFICATION

In my professional opinion this Specific Purpose Survey meets applicable portions of the Standards of Practice set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 5J-17, Florida Administrative Code. This report is prepared for the sole and specific use of the South Florida Water Management District and is not assignable.

March 25, 2020

Last date of Survey



Peter Andersen, PSM, Vice President
Florida Professional Surveyor and Mapper
License Number 5199
State of Florida
GCY, Inc. LB No 4108

NOTE:

This is an electronically signed and sealed document pursuant to Chapter 5J-17.062, Florida Administrative Code. The printed survey map or report or copies thereof are not valid without the original signature and seal of a Florida licensed surveyor or mapper.





SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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| | | | |
|--|---|-----------------------------|---|
| U.S.G.S. Station Name: PB 1639 | U.S.G.S. Station Number: 263656080033502 | Agency: GCY, INC. | Date of Field Work: 3/25/2020 |
| Party Chief: LAPOLLA | Field Book: GCY 1863 | Page(s): 24-26 | Report Prepared by: ANDERSEN |

SITE SPECIFIC DATA

| | | | |
|---|---|---|---------------------------------------|
| Site Benchmark: PB 1639 | Benchmark Elevation(s) (NAVD88): 15.682 | Corpscon 6.0.1 Conversion Factor (NAVD88 to NGVD29) + 1.535 | |
| Well Reference Elevation (NAVD88): 17.987 | DTW: 10.95 (3/ 25/ 2020 at 9:48 AM) | Ground Elevation (NAVD88): 16.0 | Pad Elevation (NAVD88): N/A |

GEOGRAPHIC DATA

| | | |
|---|--|------------------------------------|
| Section 28 | Township 44 S | Range 43 E |
| Well Latitude: 26° 36' 57.0243" N | Well Longitude: 80° 03' 33.7305" W | Location Source: RTK GPS |
| State Plane Coordinates: | Northing (Y) = 830660.893 | Easting (X) = 963496.608 |

Notes: NAVD88 – North American Vertical Datum of 1988; NGVD29- National Geodetic Vertical Datum of 1929; Corpscon 6.0.1 - A U.S. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.05 files supplied by the U.S. Army Corps of Engineers South Atlantic Division, Jacksonville FL.

PICTURES

Aerial of Overall Well Site



Not to scale (GoogleEarth product)



Well Site and Well Head



Well: "PB 1639"
Reference Point: MAGIC MARKER
BOX

Reference Point El. = 17.987
feet NAVD88

Distance to Water = 13.27
feet from reference point
(03/ 25/ 2020 at 9:48 AM)





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New Aluminum Tag





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USGS RMs - NONE



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Site Benchmark

Site Benchmark Overall Photo



Site BM:



Latitude: $26^{\circ} 36' 56.79475''$ N
Longitude: $80^{\circ} 03' 33.76796''$ W
NAVD88 EL = 15.682





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Source Benchmarks

NO PHOTOS AVAILABLE



"K 402" Benchmark Datasheet (1 OF 3)

5/3/2020

DATASHEETS

The NGS Data Sheet

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

PROGRAM = datasheet95, VERSION = 8.12.5.7

Starting Datasheet Retrieval...

1 National Geodetic Survey, Retrieval Date = MAY 3, 2020

AD8035 *****

AD8035 DESIGNATION - K 402
AD8035 PID - AD8035
AD8035 STATE/COUNTY- FL/PALM BEACH
AD8035 COUNTRY - US
AD8035 USGS QUAD - LAKE WORTH (2018)

AD8035 *CURRENT SURVEY CONTROL
AD8035

AD8035* NAD 83(1986) POSITION- 26 36 56. (N) 080 03 33. (W) SCALED
AD8035* NAVD 88 ORTHO HEIGHT - 4.780 (meters) 15.68 (feet) ADJUSTED
AD8035
AD8035 GEOID HEIGHT - -26.283 (meters) GEOID18
AD8035 DYNAMIC HEIGHT - 4.773 (meters) 15.66 (feet) COMP
AD8035 MODELED GRAVITY - 979,112.3 (mgal) NAVD 88

AD8035 VERT ORDER - FIRST CLASS II
AD8035

AD8035.The horizontal coordinates were scaled from a map and have
AD8035.an estimated accuracy of +/- 6 seconds.

AD8035.The orthometric height was determined by differential leveling and
AD8035.adjusted by the NATIONAL GEODETIC SURVEY
AD8035.in June 2002.

AD8035.Significant digits in the geoid height do not necessarily reflect accuracy.
AD8035.GEOID18 height accuracy estimate available [here](#).

AD8035.Click [photographs](#) - Photos may exist for this station.
AD8035

AD8035.The dynamic height is computed by dividing the NAVD 88
AD8035.geopotential number by the normal gravity value computed on the
AD8035.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AD8035.degrees latitude (g = 980.6199 gals.).

AD8035.The modeled gravity was interpolated from observed gravity values.
AD8035

AD8035; North East Units Estimated Accuracy
AD8035;SPC FL E - 253,160. 293,700. MT (+/- 180 meters Scaled)

AD8035_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK936442(NAD 83)
AD8035

AD8035 SUPERSEDED SURVEY CONTROL
AD8035

AD8035 NAVD 88 (05/20/94) 4.785 (m) 15.70 (f) SUPERSEDED 1 2
AD8035 NGVD 29 (09/01/92) 5.248 (m) 17.22 (f) ADJUSTED 1 2

AD8035.Superseded values are not recommended for survey control.
AD8035

AD8035.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AD8035.See file [dsdata.pdf](#) to determine how the superseded data were derived.
AD8035

AD8035_MARKER: F = FLANGE- ENCASED ROD

https://www.ngs.noaa.gov/cgi-bin/ds_mark.pl?PidBox=AD8035

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"K 402" Benchmark Datasheet (2 OF 3)

5/3/2020

DATASHEETS

AD8035_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
 AD8035_STAMPING: K 402 1991
 AD8035_MARK LOGO: NGS
 AD8035_PROJECTION: FLUSH
 AD8035_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET
 AD8035_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 AD8035_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 AD8035+SATELLITE: SATELLITE OBSERVATIONS - April 21, 2006
 AD8035_ROD/PIPE-DEPTH: 13.2 meters

| AD8035 | HISTORY | - Date | Condition | Report By |
|--------|---------|------------|------------|-----------|
| AD8035 | HISTORY | - 1991 | MONUMENTED | NGS |
| AD8035 | HISTORY | - 20001206 | GOOD | USPSQD |
| AD8035 | HISTORY | - 20011221 | GOOD | USPSQD |
| AD8035 | HISTORY | - 20020222 | GOOD | FLDEP |
| AD8035 | HISTORY | - 20040127 | GOOD | USPSQD |
| AD8035 | HISTORY | - 20041117 | GOOD | FLDEP |
| AD8035 | HISTORY | - 20050127 | GOOD | USPSQD |
| AD8035 | HISTORY | - 20060421 | GOOD | USPSQD |

AD8035

STATION DESCRIPTION

AD8035

AD8035'DESCRIBED BY NATIONAL GEODETIC SURVEY 1991
 AD8035'IN LAKE WORTH, AT THE INTERSECTION OF THE FLORIDA EAST COAST RAILROAD
 AD8035'AND LAKE AVENUE, 20.5 M (67.3 FT) SOUTH OF AND LEVEL WITH THE AVENUE
 AD8035'CENTER, 9.1 M (29.9 FT) EAST OF THE NEAR RAIL, 6.9 M (22.6 FT) WEST
 AD8035'OF THE CENTER OF RAILROAD AVENUE, AND 0.3 M (1.0 FT) SOUTH OF A
 AD8035'WITNESS POST. NOTE--ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH
 AD8035'LOGO CAP.

AD8035

STATION RECOVERY (2000)

AD8035

AD8035'RECOVERY NOTE BY US POWER SQUADRON 2000 (AAS)
 AD8035'RECOVERED IN GOOD CONDITION.

AD8035

STATION RECOVERY (2001)

AD8035

AD8035'RECOVERY NOTE BY US POWER SQUADRON 2001 (AAS)
 AD8035'RECOVERED IN GOOD CONDITION.

AD8035

STATION RECOVERY (2002)

AD8035

AD8035'RECOVERY NOTE BY FL DEPT OF ENV PRO 2002 (JLM)
 AD8035'RECOVERED AS DESCRIBED.

AD8035

STATION RECOVERY (2004)

AD8035

AD8035'RECOVERY NOTE BY US POWER SQUADRON 2004 (AAS)
 AD8035'RECOVERED IN GOOD CONDITION.

AD8035

STATION RECOVERY (2004)

AD8035

AD8035'RECOVERY NOTE BY FL DEPT OF ENV PRO 2004 (JLM)
 AD8035'RECOVERED IN GOOD CONDITION.

AD8035'

AD8035'NOTE A MAGNET WAS PLACED INSIDE OF THE NATIONAL GEODETIC SURVEY LOGO
 AD8035'CAP.

AD8035

STATION RECOVERY (2005)

AD8035

AD8035'RECOVERY NOTE BY US POWER SQUADRON 2005 (AAS)
 AD8035'RECOVERED IN GOOD CONDITION.

AD8035

STATION RECOVERY (2006)

AD8035

https://www.ngs.noaa.gov/cgi-bin/ds_mark.pl?PidBox=AD8035

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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"K 402" Benchmark Datasheet (3 OF 3)

5/3/2020

DATASHEETS

AD8035'RECOVERY NOTE BY US POWER SQUADRON 2006 (AAS)
AD8035'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:01



SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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Field Notes (1 of 3)

STO AVE S. + S. M ST.
LAKE WOOD

SFWMD-USOS / P 13 WELLS

BENCH RUN FOR NEW BM PB 1723 (NUMBER)

PEG TEST:

Coll. ERR. OLD = 1.9" Coll. ERR. NEW = 2.2"

DIFF = 0.4" RETICLE = 4.94"

| STA | TOTAL DIST | ELEV | ADJ |
|----------------|------------|---------|-----|
| P233 | 0 | 14.977' | |
| 6 | 1680.67' | 14.872' | |
| NEW BM PB 1723 | 4067.76' | 9.827' | |
| 77 | 6092.56' | 16.756' | |
| K402 | 8167.33' | 15.76' | |

78 NEW T.P.
32

1863 27

18-1020-07-02

8:30 SUNNY

LEICA DINA-10

JOB: WELL PB 1723

LINE: PB 1723

DESK

NGS BM P233 PID: AD2758

NAVD 88 = 14.977'

FIND M.D.B. NAIL + BRASS WASHER "TRAVERSE WEST SIDE OF DIM, 115' EAST 48.271" OF THE E OF EAST COAST ST, SOUTH SIDE OF 6TH AVE S. (BM 1803-27A)

NEW BM PB 1723 (BM 1803-27B)

SET 1 1/2" (I.D.) IRON PIPE W/ ALUMI CAP 2.3' E OF WELL PB 1723 "SFWMD PB 1723 LAKE WOOD 2020".

(BM 1803-27C) FIND 1/2" I.R. + YELLOW CAP "M.L.S. INC LB 6838" 75' S. OF THE E OF 3 AVE S ON E. SIDE OF STATE HWY

NGS BM K402 PID: AD8035

ERR: +0.078

(BUST) (SEE NOTE ON PG 28)

K402 AD 8035
15.682'



SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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Field Notes (2 of 3)

| BFWMD-USGS / PWS WELLS | | | |
|------------------------------|------------|---------|-----|
| CHECK ANOTHER BENCH (NO. 88) | | | |
| STA | TOTAL DIST | ELEV | ADJ |
| P233 | 0 | 14.977' | |
| Dawson | 1990.56' | 14.817' | |

18-10-07-02 1863 28

84° Sunny J. W. Lotmans
 Lora Davis M. Larina PC
 Job: Well P233 B. Goodman X
 Line: Dawson
 DESK
 NGS BM P233 Listed = 14.977'

P.B.C. BM "DAWSON"
 NAVD 88 EL = 14.83'
 Error = -.013

NOTE!
 (USING ELEVATIONS FROM RUN ON PG 27)
 ✓ IN BM MUST BE THE BAD BM.

Dawson 14.83'



South Florida Water Management District Benchmark Datasheet

Designation: PB 1639 Project Name: USGS PHASE 3 WELLS Type: V State Plane Zone: FL East
Stamping: PB 1639 LB4108 2020 Field Book Name: GCY 1863 Field Book Page: 24-26
Established By: GCY, INC. Recovered By: Recovery Date:
Surveyor: ANDERSEN Established Date: 03/25/20 Status: New

GEOGRAPHIC POSITION INFORMATION

Section: 28 Township: 44 SOUTH Range: 43 EAST
County: PALM BEACH Quadrangle: LAKE WORTH Quad Index: 1281 NGS Source BM(s): K 402
NAD83 Adj. Year: 2011 Vertical Datum: NAVD1988 Horizontal Datum: NAD1983 NGS PID(s): AD8035
NAVD88 Elevation (feet): 15.682 NGVD29 Elevation (feet): 17.217 2022 Elevation: NGS NAVD88 Elev (ft): 15.682
NAVD88 Class: II NGVD29 Class: II Other Elevation: NGS NAVD88 Elev (m): 4.78
NAVD88 Order: 1ST NGVD29 Order: 31ST Other Elevation Type: NGS 2022 Elev (ft):

CORPSCON 6.0.1 CONVERSION FACTOR (NAVD88 TO NGVD29): (A U.S. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.05 files supplied by the U.S. Army Corps of Engineers South Atlantic Division, Jacksonville FL)

Vertical Datum Offset: + 1.535 Actual NGS Elevation or ngvd29.txt file: OPUS Ortho Height: 16.512
Northing (Y) (feet): 830637.692 Easting (X) (feet): 963493.375 Source of Latitude & Longitude: OPUS SOLUTION
Latitude: 26 36 56.79475 Longitude: 80 3 33.76796
DD° MM' SS" DD° MM' SS"
Latitude (Decimal Degrees): 26.61577632 Longitude (Decimal Degrees): -80.05937999

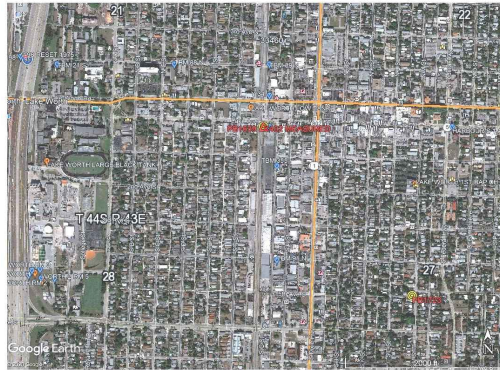
RECOVERY DATA

How to Reach: IN LAKE WORTH, AT THE INTERSECTION OF THE FLORIDA EAST COAST RAILROAD AND LAKE AVENUE, 20.5 M (67.3 FT) SOUTH OF AND LEVEL WITH THE AVENUE CENTER, 9.1 M (29.9 FT) EAST OF THE NEAR RAIL, 6.9 M (22.6 FT) WEST OF THE CENTER OF RAILROAD AVENUE, AND 0.3 M (1.0 FT) SOUTH OF A WITNESS POST. NOTE--ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH LOGO CAP.
Description/Notes:

Notable Landmarks:
Other Source Benchmarks:

PICTURES

Aerial View of Overall Site



PICTURES

Site Sketch



From: opus
To: Pete Andersen
Subject: OPUS solution : 13970850.t01 OP1588525880467
Date: Sunday, May 03, 2020 1:15:31 PM

FILE: 13970850.t01 OP1588525880467

NGS OPUS SOLUTION REPORT
=====

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: <https://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: petea@gcyinc.com DATE: May 03, 2020
RINEX FILE: 13970850.20o TIME: 17:15:15 UTC

SOFTWARE: page5 1801.18 master96.pl 160321 START: 2020/03/25 14:08:00
EPHEMERIS: igs20983.eph [precise] STOP: 2020/03/25 18:42:00
NAV FILE: brdc0850.20n OBS USED: 10845 / 11713 : 93%
ANT NAME: TRM39105.00 NONE # FIXED AMB: 60 / 65 : 92%
ARP HEIGHT: 1.585 OVERALL RMS: 0.017(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) ITRF2014 (EPOCH:2020.2314)

X: 985023.827(m) 0.004(m) 985022.999(m) 0.004(m)
Y: -5620402.970(m) 0.003(m) -5620401.381(m) 0.003(m)
Z: 2840209.314(m) 0.010(m) 2840209.151(m) 0.010(m)

LAT: 26 36 56.79475 0.011(m) 26 36 56.81488 0.011(m)
E LON: 279 56 26.23204 0.004(m) 279 56 26.21249 0.004(m)
W LON: 80 3 33.76796 0.004(m) 80 3 33.78751 0.004(m)
EL HGT: -21.548(m) 0.002(m) -23.148(m) 0.002(m)
ORTHO HGT: 4.735(m) 0.050(m) [NAVD88 (Computed using GEOID18)]

UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 17) SPC (0901 FL E)
Northing (Y) [meters] 2944224.473 253178.875
Easting (X) [meters] 593641.407 293673.368
Convergence [degrees] 0.42143333 0.42143333
Point Scale 0.99970826 1.00004947
Combined Factor 0.99971164 1.00005286

US NATIONAL GRID DESIGNATOR: 17RNK9364144224(NAD 83)

BASE STATIONS USED

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|--------|-------------------------------|-------------|--------------|-------------|
| DF9225 | ZMA1 MIAMI WAAS 1 CORS ARP | N254928.585 | W0801909.066 | 91417.7 |
| DP6859 | FLF1 FL FOUNDATION 1 CORS ARP | N253655.240 | W0802309.913 | 115552.0 |
| DE9138 | OKCB OKEECHOBEE CORS ARP | N271557.715 | W0805119.181 | 106951.1 |

NEAREST NGS PUBLISHED CONTROL POINT

AD8035 K 402 N263656.000 W0800333.000 32.4

Palm City

28 April 2020

INPUT

Geographic, fhpgn - Florida HPGN
Vertical - NAVD88, U.S. Feet

OUTPUT

State Plane, fhpgn - Florida HPGN
0901 - Florida East, U.S. Feet
Vertical - NGVD29 (Custom), U.S. Feet

PB 1639

1/1

Latitude: 26 36 56.8
Longitude: 080 03 33.8
Elevation/Z: 0

Northing/Y: 830638.200
Easting/X: 963490.462
Elevation/Z: 1.535
Convergence: 0 25 17.14625
Scale Factor: 1.000049467
Combined Factor: 1.000053515

Remark: