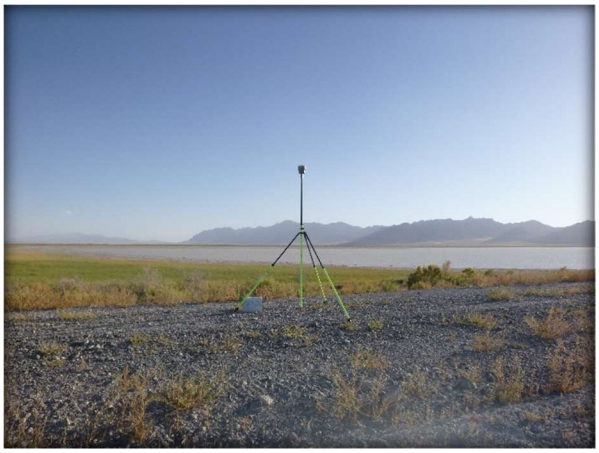
Ground Control Point Survey Report

Fish Springs UT Topobathy LiDAR Project
USGS Contract: 140G0221D0009
Task Order Number: 140G0222F0225

Prepared for:
United States Geological Survey (USGS)



Prepared By:

Dewberry Engineers Inc.

4601 Forbes Boulevard, Suite 300
Lanham, Maryland, 20706
Phone (301)364-1855 Fax (301)731-0188

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1. INTRODUCTION

1.1 *Project Summary*

Dewberry Engineers Inc. is under contract to the United States Geological Survey to provide 7 Ground Control Points in the State of Utah. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of LiDAR products. As part of this work Dewberry staff will complete Ground Control Point surveys that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted September 11, 2022 thru September 20, 2022.

Existing NGS Control Points were located and surveyed to check the accuracy of the RTK/GPS survey equipment with the results shown in Section 2.4 of this Report.

As an internal QA/QC procedure and to verify that the Ground Control Points meet the 95% confidence level approximately 50% of the points were re-observed and are shown in Section 5 of this report.

Final horizontal coordinates are referenced to UTM 12 North, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2018B (Geoid18B).

1.2 *Points of Contact*

Questions regarding the technical aspects of this report should be addressed to:

Dewberry Engineers Inc.

Gary D. Simpson, L.S.
Senior Associate
4601 Forbes Boulevard
Suite 300
Lanham, Maryland 20706
(301) 364-1855 direct
(301) 731-0188 fax

1.3 *Project Area*

PROJECT DETAILS

2.1 *Survey Equipment*

In performing the GPS observations Trimble R-10 GNSS receiver/antenna attached to a two-meter fixed height pole with a Trimble TSC7 Data Collector to collect GPS raw data were used to perform the field surveys.

2.2 *Survey Point Detail*

The 7 Ground Control Points were well distributed throughout the project area.

A sketch was made for each location and a nail was set at the point where possible or at an identifiable point. The Ground Control Point locations are detailed on the "Control Point Documentation Report" sheets attached to this report.

2.3 *Network Design*

The GPS survey performed by Dewberry Engineers Inc. office located in Lanham, MD was tied to a Real Time Network operated by Trimble. The network is a series of "real-time" continuously operating, high precision GPS reference stations. All of the reference stations have been linked together using Trimble GPSNet software, creating a Virtual Reference Station System (VRS).

The Trimble NetR5 Reference Station is a multi-channel, multi-frequency GNSS (Global Navigation Satellite System) receiver designed for use as a stand-alone reference station or as part of a GNSS infrastructure solution. Trimble R-Track technology in the NetR5 receiver supports the modernized GPS L2C and L5 signals as well as GLONASS L1/L2 signals.

2.4 *Field Survey Procedures and Analysis*

Dewberry field surveyors used Trimble R-10 GNSS receivers, which is a geodetic quality dual frequency GPS receiver, to collect data at each surveyed location.

All locations were occupied once with approximately 50% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerance of ± 5cm or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for approximately three (3) minutes in duration and measured to 180 epochs.

Each occupation which utilized OPUS (if used) was occupied between 20 and 30 minutes.

Field GPS observations are detailed on the "Control Point Documentation Reports" submitted as part of this report.

Three (3) existing NGS monument listed in the NSRS database were located for the Louisiana area as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as KO0306, KO0308, and KO0303 . The results are as follows:

	Observed Values			Data Sheet Values					
PT. #	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.	Δ X	Δ Y	Δ Z
A81	4410595.166	296924.723	1312.550	N/A	N/A	1312.524	N/A	N/A	0.026
C81	4413086.069	302027.273	1318.788	N/A	N/A	1318.777	N/A	N/A	0.011
M79	4419202.262	292057.352	1313.440	N/A	N/A	1313.410	N/A	N/A	0.030

The above results indicate that the VRS network is providing positional values within the 5cm parameters for this survey.

NGS Monuments

2.5 *Adjustment*

The survey data was collected using Virtual Reference Stations (VRS) methodology within a Virtual Reference System (VRS).

The system is designed to provide a true Network RTK performance, the RTKNet software enables high-accuracy positioning in real time across a geographic region. The RTKNet software package uses real-time data streams from the Trimble network user and generates correction models for high-accuracy RTK GPS corrections throughout the network. Therefore, corrections were applied to the points as they were being collected, thus negating the need for a post process adjustment.

2.6 *Data Processing Procedures*

After field data is collected the information is downloaded from the data collectors into the office software. The Software program used is called Trimble Business Center.

Downloaded data is run through the TBC program to obtain the following reports; points report, point comparison report and a point detail report. The reports are reviewed for point accuracy and precision.

After review of the point data an "ASCII" or "txt" file which is the industry standard is created. Point files are loaded into our CADD program (Carlson Survey 2021) to make a visual check of the point data (Pt. #, Coordinates, Elev. and Description). The data can now be imported into the final product.

3. *FINAL COORDINATES/ELEVATIONS*

POINT ID	NORTHING (m)	EASTING (m)	ELEV. (m)
UTM 12 NORTH, NAD 83 (2011), NAVD 88, Meters, Geoid 18			
GCP			
GCP-1	4419793.496	299576.052	1307.547
GCP-2	4417863.911	293748.435	1313.311
GCP-3	4415724.571	297386.321	1311.322
GCP-4	4412126.709	300326.325	1311.995
GCP-5	4411579.498	298412.931	1313.121
GCP-6	4410664.785	294962.657	1324.494
GCP-7	4413909.100	295482.327	1313.336

4. *GPS OBSERVATIONS*

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
GCP-1	9/18/2022	261	18:14	N/A	N/A
GCP-2	9/14/2022	257	15:18	9/18/2022	16:44
GCP-3	9/12/2022	255	17:12	9/13/2022	17:55
GCP-4	9/13/2022	256	15:41	N/A	N/A
GCP-5	9/13/2022	256	14:51	N/A	N/A
GCP-6	9/12/2022	255	12:43	9/13/2018	13:18
GCP-7	9/12/2022	255	15:40	9/13/2022	16:45

5. *POINT COMPARISON*

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Difference (M)
GCP-1	GCP-1 CK	N/A	N/A	N/A
GCP-2	GCP-2 CK	0.000	0.023	0.011
GCP-3	GCP-3 CK	-0.010	0.013	-0.001
GCP-4	GCP-4 CK	N/A	N/A	N/A
GCP-5	GCP-5 CK	N/A	N/A	N/A
GCP-6	GCP-6 CK	0.001	0.017	0.000
GCP-7	GCP-7 CK	-0.004	-0.021	0.016