

LiDAR Check Point Survey Report

“USGS – ARCHER AND JACKS COUNTIES, TX QL2 LiDAR”

USGS Contract: G10PC00013

Task Order Number: G13PD00855

Prepared for:
UNITED STATES GEOLOGICAL SURVEY



Prepared By:

Dewberry Consultants LLC

10003 Derekwood Lane, Suite 204

Lanham, Maryland, 20706

Phone (301)364-1855 Fax (301)731-0188

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 Including: a) Point Documentation Report & Photos of Survey Points

 b) Final Coordinate List in Excel Format

 c) NGS Data Sheets for Project Controls

1. INTRODUCTION

1.3 *Project Summary*

Dewberry Consultants, LLC is under contract to the USGS to provide 105 Check Points for USGS in the State of Texas. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of high resolution LiDAR-derived elevation products. As part of this work Dewberry staff will complete checkpoint surveys that will be used to evaluate vertical accuracy on the bare-earth terrain derived from the LiDAR.

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 LiDAR Check 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 Zone 14, NAD83 in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012A (Geoid12A).

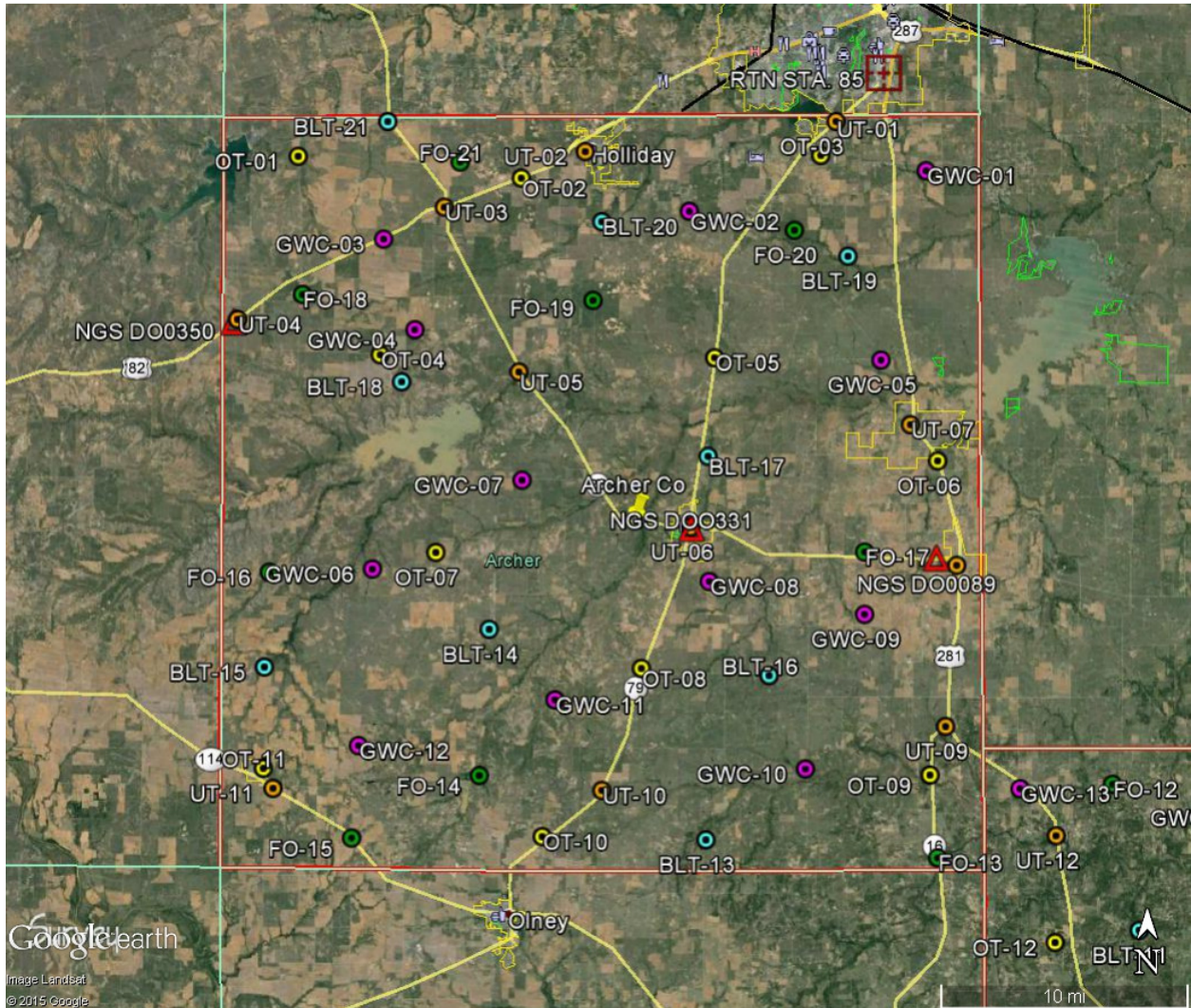
1.2 *Points of Contact*

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

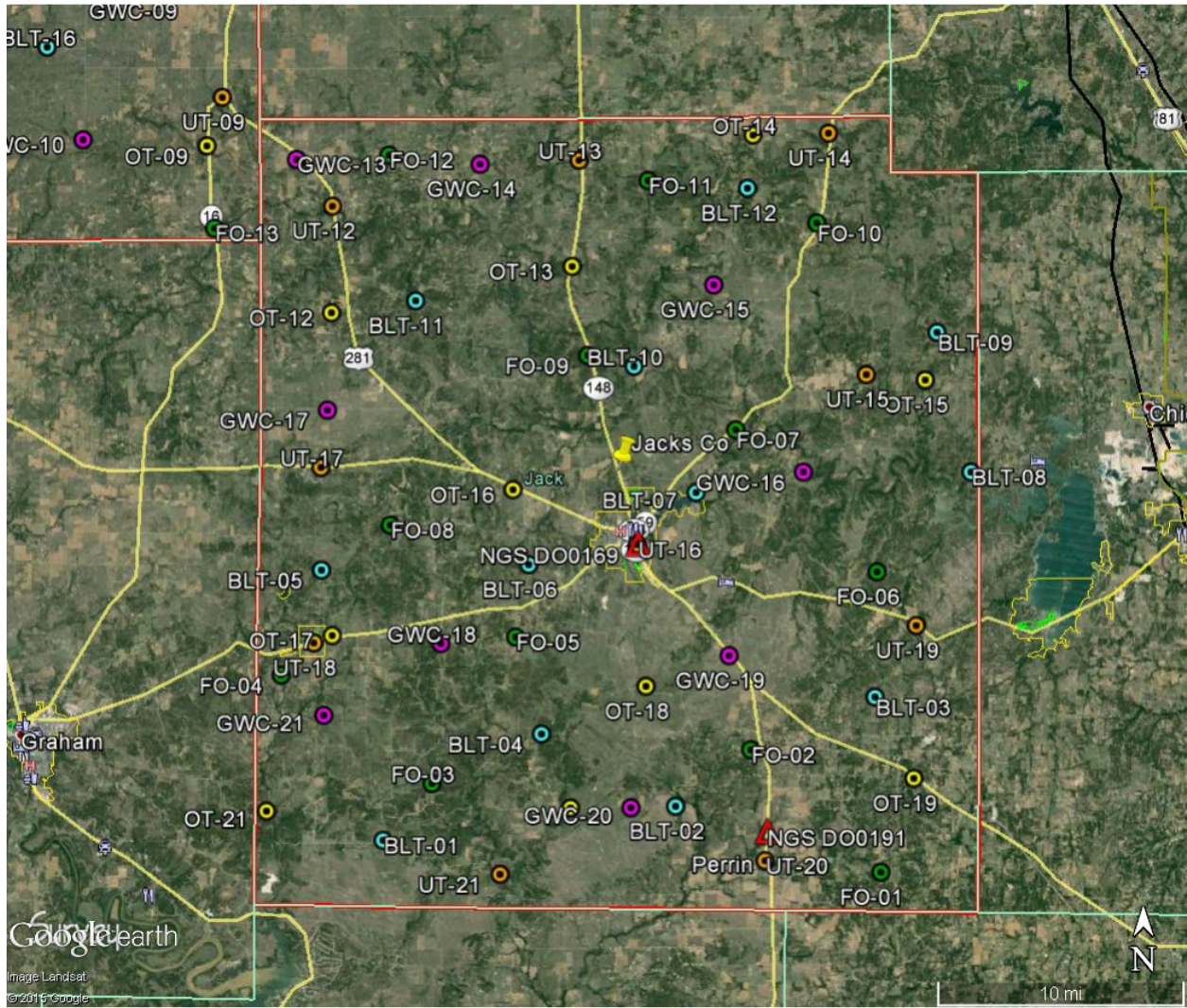
Dewberry Consultants LLC

Gary Simpson, L.S.
Senior Associate
10003 Derekwood Lane
Suite 204
Lanham, Maryland 20706
(301) 364-1855 direct
(301) 731-0188 fax

1.3 Project Area



Archer County



Jacks County

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 TSC3 Data Collector to collect GPS raw data were used to perform the field surveys.

2.2 *Survey Point Detail*

The 105 LiDAR Check 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 LiDAR Check Point locations are detailed on the “Ground Control Point Documentation Report” sheets attached to this report.

2.3 *Network Design*

The GPS survey performed by Dewberry Consultants, LLC office located in Lanham, MD was tied to a Real Time Network (RTN) managed by Western Data Systems. 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 $\pm 5\text{cm}$ 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 18 and 20 minutes.

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

Three (3) existing NGS monument listed in the NSRS database were located as an additional QA/QC method to check the accuracy of the VRS network as well as being the primary project control monuments designated as PID DO0115, DO0169 and DO0418. The results are as follows:

NGS PT. ID	As Surveyed (M)			Published (M)			Differences (M)		
	Northing(M)	Easting(M)	Elev.(M)	Northing(M)	Easting(M)	Elev.(M)	ΔN	ΔE	$\Delta \text{Elev.}$
DO 0814	3733775.470	509178.179	358.551	3733775.431	509178.137	358.5	0.039	0.042	0.051
DO 0115	3705079.450	551412.427	339.344	3705079.496	551412.381	339.298	0.046	0.046	0.046
JACKSBORO	3675761.525	578522.250	329.996	3675761.570	578522.208	329.987	0.045	0.042	0.009

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

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 GPSNet system 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 TBC or 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 2014) 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***

POINT #	NORTHING (M)	EASTING (M)	ELEV. (M)
BRUSH & LOW TREES POINTS			
BLT-1	3656584.660	562037.359	368.523
BLT-2	3658871.613	581046.989	344.628
BLT-3	3665924.209	594018.125	301.740
BLT-4	3663464.814	572307.067	363.011
BLT-5	3674078.739	557996.403	408.154
BLT-6	3674477.126	571453.780	349.851
BLT-7	3679168.640	582341.302	310.662
BLT-8	3680559.297	600257.623	264.990
BLT-9	3689411.576	597706.491	301.319
BLT-10	3687318.900	578282.145	284.378
BLT-11	3691558.468	564153.480	298.534
BLT-12	3698861.840	585622.979	324.677
BLT-13	3697317.096	535871.570	337.987
BLT-14	3710933.217	521766.673	340.109
BLT-15	3708245.880	507191.321	355.344
BLT-16	3707919.841	539817.880	324.218
BLT-17	3722054.279	535967.987	294.584
BLT-18	3726806.647	516040.639	351.050
BLT-19	3735014.219	545001.890	290.443
BLT-20	3737142.015	528992.614	310.291
BLT-21	3743606.966	515043.884	318.879
FOREST POINTS			
FO-1	3654620.477	594529.218	385.020
FO-2	3662534.429	585935.136	363.912
FO-3	3660324.634	565207.468	432.061
FO-4	3667254.989	555381.060	362.970
FO-5	3669767.133	570642.907	374.011
FO-6	3674083.042	594043.609	290.063
FO-7	3683227.351	584863.516	282.701
FO-8	3676981.431	562427.949	351.726
FO-9	3687981.032	575283.928	298.082
FO-10	3696656.240	590175.621	362.653
FO-11	3699351.528	579145.831	295.309
FO-12	3700957.419	562203.451	307.466

FO-13	3696103.762	550928.350	307.954
FO-14	3701411.415	521146.357	344.032
FO-15	3697727.477	512619.614	380.677
FO-16	3714491.070	507501.603	349.059
FO-17	3715933.330	546063.042	309.828
FO-18	3732331.468	509587.180	343.765
FO-19	3732087.452	528413.631	315.530
FO-20	3736666.246	541506.557	301.766
FO-21	3740991.448	519770.315	318.169
GRASS, WEEDS & CROPS POINTS			
GWC-1	3740557.431	550054.712	296.551
GWC-2	3737849.260	534649.930	315.093
GWC-3	3735658.885	514789.233	342.223
GWC-4	3730149.593	517096.945	348.691
GWC-5	3728297.380	547119.692	293.267
GWC-6	3714709.359	514160.706	343.819
GWC-7	3720479.280	524079.680	330.986
GWC-8	3713969.720	536016.645	318.354
GWC-9	3711893.024	546092.705	312.313
GWC-10	3701903.900	542290.216	321.732
GWC-11	3706263.649	526076.501	327.508
GWC-12	3703299.325	513287.342	399.538
GWC-13	3700657.924	556234.176	312.070
GWC-14	3700365.664	568202.108	295.577
GWC-15	3692610.305	583459.301	320.747
GWC-16	3680511.622	589336.767	277.144
GWC-17	3684420.266	558325.956	334.123
GWC-18	3669336.187	565761.591	373.573
GWC-19	3668619.624	584521.224	355.810
GWC-20	3658760.527	578161.477	353.069
GWC-21	3664653.328	558150.101	366.118
OPEN TERRAIN POINTS			
OT-1	3741333.014	509250.293	320.086
OT-2	3739964.981	523709.961	326.251
OT-3	3741469.430	543163.470	308.646
OT-4	3728526.744	514631.529	356.516
OT-5	3728411.377	536319.163	298.546

OT-6	3721818.047	550815.230	300.369
OT-7	3715792.265	518273.208	331.864
OT-8	3708365.373	531634.468	327.737
OT-9	3701529.345	550384.913	306.691
OT-10	3697501.213	525232.042	373.035
OT-11	3701841.976	507144.666	384.759
OT-12	3690725.992	558559.263	331.456
OT-13	3693778.308	574224.922	286.655
OT-14	3702331.226	585984.436	317.387
OT-15	3686507.759	597256.306	315.448
OT-16	3679314.473	570419.744	319.772
OT-17	3669840.457	558690.164	376.148
OT-18	3666195.668	581356.236	370.894
OT-19	3660704.458	596583.285	353.719
OT-20	3658695.697	574234.644	327.750
OT-21	3658448.376	554424.162	335.708
URBAN TERRAIN POINTS			
UT-1	3743697.233	544150.349	302.209
UT-2	3741683.935	527885.343	322.045
UT-3	3738061.082	518749.266	339.404
UT-4	3730780.075	505373.480	369.807
UT-5	3727451.941	523629.888	305.851
UT-6	3717486.384	534807.892	324.436
UT-7	3724138.407	549043.058	297.810
UT-8	3715070.148	552068.979	324.403
UT-9	3704673.529	551382.380	336.865
UT-10	3700489.409	529092.662	352.821
UT-11	3700555.839	507777.674	398.490
UT-12	3697624.323	558584.450	302.741
UT-13	3700661.112	574652.445	313.913
UT-14	3702463.076	590899.340	322.617
UT-15	3686839.454	593410.435	300.784
UT-16	3675783.482	578537.463	330.121
UT-17	3680707.799	557920.001	357.567
UT-18	3669360.3	557489.807	381.724
UT-19	3670566.596	596753.506	280.709
UT-20	3655336.119	586910.395	319.689
UT-21	3654405.31	569651.239	304.100

4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBSERV. DATE	RE-OBSERV. TIME
BLT-1	1/8/2015	8	9:22	N/A	N/A
BLT-2	1/7/2015	7	16:01	1/8/2015	7:06
BLT-3	1/7/2015	7	11:30	1/7/2015	19:44
BLT-4	1/7/2015	7	16:55	1/8/2015	7:29
BLT-5	1/8/2015	8	14:08	1/9/2015	5:49
BLT-6	1/7/2015	7	14:22	N/A	N/A
BLT-7	1/9/2015	9	7:51	N/A	N/A
BLT-8	1/9/2015	9	11:07	N/A	N/A
BLT-9	1/9/2015	9	10:15	N/A	N/A
BLT-10	1/9/2015	9	12:58	N/A	N/A
BLT-11	1/8/2015	8	15:42	1/10/2015	6:34
BLT-12	1/9/2015	9	16:27	N/A	N/A
BLT-13	1/10/2015	10	16:55	1/11/2015	6:39
BLT-14	1/11/2015	11	11:34	N/A	N/A
BLT-15	1/11/2015	11	9:55	N/A	N/A
BLT-16	1/10/2015	10	16:08	1/11/2015	18:44
BLT-17	1/10/2015	10	13:56	1/11/2015	19:26
BLT-18	1/11/2015	11	14:35	N/A	N/A
BLT-19	1/10/2015	10	11:41	N/A	N/A
BLT-20	1/12/2015	12	12:31	N/A	N/A
BLT-21	1/12/2015	12	9:24	N/A	N/A
FO-1	1/7/2015	7	8:59	1/7/2015	18:10
FO-2	1/7/2015	7	10:24	1/7/2015	18:53
FO-3	1/8/2015	8	9:55	1/8/2015	17:53
FO-4	1/8/2015	8	11:04	N/A	N/A
FO-5	1/7/2015	7	14:51	N/A	N/A
FO-6	1/7/2015	7	12:25	1/7/2015	20:30
FO-7	1/9/2015	9	8:23	N/A	N/A
FO-8	1/8/2015	8	13:32	1/9/2015	6:19
FO-9	1/9/2015	9	12:28	N/A	N/A
FO-10	1/9/2015	9	15:53	1/12/2015	16:47
FO-11	1/9/2015	9	14:33	N/A	N/A
FO-12	1/8/2015	8	16:34	N/A	N/A
FO-13	1/10/2015	10	8:05	N/A	N/A
FO-14	1/11/2015	11	12:47	N/A	N/A
FO-15	1/11/2015	11	8:32	N/A	N/A
FO-16	1/11/2015	11	11:23	N/A	N/A

FO-17	1/10/2015	10	14:24	1/12/2015	14:44
FO-18	1/11/2015	11	16:36	N/A	N/A
FO-19	1/12/2015	12	12:02	N/A	N/A
FO-20	1/10/2015	10	11:59	1/12/2015	6:31
FO-21	1/12/2015	12	10:02	N/A	N/A
GWC-1	1/10/2015	10	13:02	1/12/2015	5:31
GWC-2	1/12/2015	12	12:54	N/A	N/A
GWC-3	1/12/2015	12	8:57	N/A	N/A
GWC-4	1/11/2015	11	14:56	N/A	N/A
GWC-5	1/10/2015	10	11:17	1/12/2015	13:23
GWC-6	1/11/2015	11	10:45	N/A	N/A
GWC-7	1/11/2015	11	13:30	N/A	N/A
GWC-8	1/10/2015	10	15:20	1/11/2015	17:59
GWC-9	1/10/2015	10	9:21	1/11/2015	18:18
GWC-10	1/10/2015	10	16:31	1/11/2015	7:11
GWC-11	1/11/2015	11	12:19	N/A	N/A
GWC-12	1/11/2015	11	9:12	N/A	N/A
GWC-13	1/8/2015	8	17:03	1/9/2015	18:20
GWC-14	1/9/2015	9	17:49	1/12/2015	17:49
GWC-15	1/9/2015	9	16:52	1/12/2015	16:24
GWC-16	1/12/2015	12	15:07	N/A	N/A
GWC-17	1/8/2015	8	14:53	1/10/2015	7:01
GWC-18	1/8/2015	8	12:18	N/A	N/A
GWC-19	1/7/2015	7	15:47	1/8/2015	5:46
GWC-20	1/7/2015	7	17:40	1/8/2015	6:28
GWC-21	1/8/2015	8	10:29	1/8/2014	18:21
OT-1	1/12/2015	12	10:38	N/A	N/A
OT-2	1/12/2015	12	8:22	N/A	N/A
OT-3	1/10/2015	10	12:20	1/12/2015	5:49
OT-4	1/11/2015	11	15:15	N/A	N/A
OT-5	1/10/2015	10	13:32	1/12/2015	6:58
OT-6	1/10/2015	10	10:38	1/12/2015	14:06
OT-7	1/11/2015	11	11:05	N/A	N/A
OT-8	1/10/2015	10	15:44	1/11/2015	7:31
OT-9	1/10/2015	10	8:39	1/10/2015	18:39
OT-10	1/10/2015	10	17:26	1/11/2015	5:49
OT-11	1/11/2015	11	9:34	N/A	N/A
OT-12	1/8/2015	8	15:14	1/10/2015	6:10
OT-13	1/9/2015	9	13:42	1/9/2015	19:18
OT-14	1/9/2015	9	15:05	N/A	N/A
OT-15	1/9/2015	9	9:07	1/12/2015	15:53
OT-16	1/8/2015	8	12:52	1/9/2015	6:49

OT-17	1/8/2015	8	11:45	1/9/2015	5:19
OT-18	1/7/2015	7	16:12	1/8/2015	6:02
OT-19	1/7/2015	7	10:58	1/7/2015	19:20
OT-20	1/7/2015	7	17:21	1/8/2015	6:49
OT-21	1/8/2015	8	16:01	N/A	N/A
UT-1	1/10/2015	10	12:37	1/12/2015	6:11
UT-2	1/12/2015	12	7:55	N/A	N/A
UT-3	1/11/2015	11	17:06	N/A	N/A
UT-4	1/11/2015	11	15:50	N/A	N/A
UT-5	1/11/2015	11	14:12	N/A	N/A
UT-6	1/10/2015	10	14:50	N/A	N/A
UT-7	1/10/2015	10	10:58	1/12/2015	13:48
UT-8	1/10/2015	10	9:46	N/A	N/A
UT-9	1/10/2015	10	8:56	1/10/2015	19:01
UT-10	1/10/2015	10	17:50	1/11/2015	6:15
UT-11	1/11/2015	11	8:51	N/A	N/A
UT-12	1/8/2015	8	16:07	1/10/2015	5:40
UT-13	1/9/2015	9	14:02	1/9/2015	18:47
UT-14	1/9/2015	9	15:36	1/12/2015	17:19
UT-15	1/9/2015	9	8:47	1/12/2015	15:28
UT-16	1/7/2015	7	13:06	1/8/2015	5:21
UT-17	1/8/2015	8	14:32	1/10/2015	7:23
UT-18	1/8/2015	8	11:28	1/8/2015	18:43
UT-19	1/7/2015	7	11:56	1/7/2015	20:09
UT-20	1/7/2015	7	9:43	1/7/2015	18:33
UT-21	1/8/2015	8	7:50	1/8/2015	19:23

5. ***POINT COMPARISON***

POINT ID	POINT CK	DELTA NORTH (M)	DELTA EAST (M)	VERT. DIFF (M)
BLT-2	BLT-2CK	0.003	0.002	0.004
BLT-3	BLT-3CK	0.002	0.003	0.001
BLT-4	BLT-4CK	0.007	0.004	0.007
BLT-5	BLT-5CK	0.001	0.008	0.016
BLT-11	BLT-11CK	0.002	0.010	0.006
BLT-13	BLT-13CK	0.004	0.003	0.012
BLT-16	BLT-16CK	0.006	0.001	0.018
BLT-17	BLT-17CK	0.001	0.002	0.004
FO-1	FO-1CK	0.012	0.004	0.003
FO-2	FO-2CK	0.001	0.012	0.006
FO-3	FO-3CK	0.009	0.008	0.007
FO-6	FO-6CK	0.004	0.001	0.021
FO-8	FO-8CK	0.002	0.011	0.018
FO-10	FO-10CK	0.000	0.003	0.004
FO-17	FO-17CK	0.004	0.001	0.002
FO-20	FO-20CK	0.007	0.002	0.016
GWC-1	GWC-1CK	0.000	0.002	0.004
GWC-5	GWC-5CK	0.011	0.001	0.007
GWC-8	GWC-8CK	0.006	0.004	0.024
GWC-9	GWC-9CK	0.005	0.003	0.012
GWC-10	GWC-10CK	0.005	0.004	0.005
GWC-13	GWC-13CK	0.002	0.001	0.018
GWC-14	GWC-14CK	0.003	0.015	0.001
GWC-15	GWC-15CK	0.002	0.000	0.008
GWC-17	GWC-17CK	0.003	0.007	0.006
GWC-19	GWC-19CK	0.009	0.005	0.002
GWC-20	GWC-20CK	0.003	0.003	0.001
GWC-21	GWC-21CK	0.002	0.002	0.001
OT-3	OT-3CK	0.005	0.002	0.011
OT-5	OT-5CK	0.001	0.003	0.018
OT-6	OT-6CK	0.001	0.001	0.017
OT-8	OT-8CK	0.000	0.002	0.004
OT-9	OT-9CK	0.001	0.004	0.012
OT-10	OT-10CK	0.001	0.003	0.014
OT-12	OT-12CK	0.002	0.006	0.010

OT-13	OT-13CK	0.005	0.009	0.002
OT-15	OT-15CK	0.003	0.009	0.003
OT-16	OT-16CK	0.005	0.005	0.007
OT-17	OT-17CK	0.006	0.007	0.019
OT-18	OT-18CK	0.001	0.004	0.005
OT-19	OT-19CK	0.007	0.005	0.005
OT-20	OT-20CK	0.006	0.005	0.006
UT-1	UT-1CK	0.004	0.001	0.003
UT-7	UT-7CK	0.003	0.002	0.005
UT-9	UT-9CK	0.008	0.018	0.010
UT-10	UT-10CK	0.001	0.001	0.008
UT-12	UT-12CK	0.002	0.002	0.004
UT-13	UT-13CK	0.005	0.003	0.007
UT-14	UT-14CK	0.000	0.004	0.003
UT-15	UT-15CK	0.003	0.000	0.008
UT-16	UT-16CK	0.002	0.005	0.010
UT-17	UT-17CK	0.000	0.004	0.001
UT-18	UT-18CK	0.004	0.002	0.001
UT-19	UT-19CK	0.010	0.002	0.001
UT-20	UT-20CK	0.002	0.000	0.003
UT-21	UT-21CK	0.010	0.006	0.012