Ground Control Point Survey Report

"PALM BEACH COUNTY LiDAR"
USGS Contract: G16PC00020
Task Order Number:
G16PD00456

Prepared for:
United States Geological Survey (USGS)

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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

1.1 *Project Summary*

Dewberry Consultants LLC is under contract to the United States Geological Survey to provide 65 Ground Control Points in the County of Palm Beach, in the State of Florida. 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 a Control Survey of Ground Control Points (GCPs) that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted from December 20, 2016 – February 14, 2017.

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 their corresponding coordinate differences are shown in Section 5 of this report.

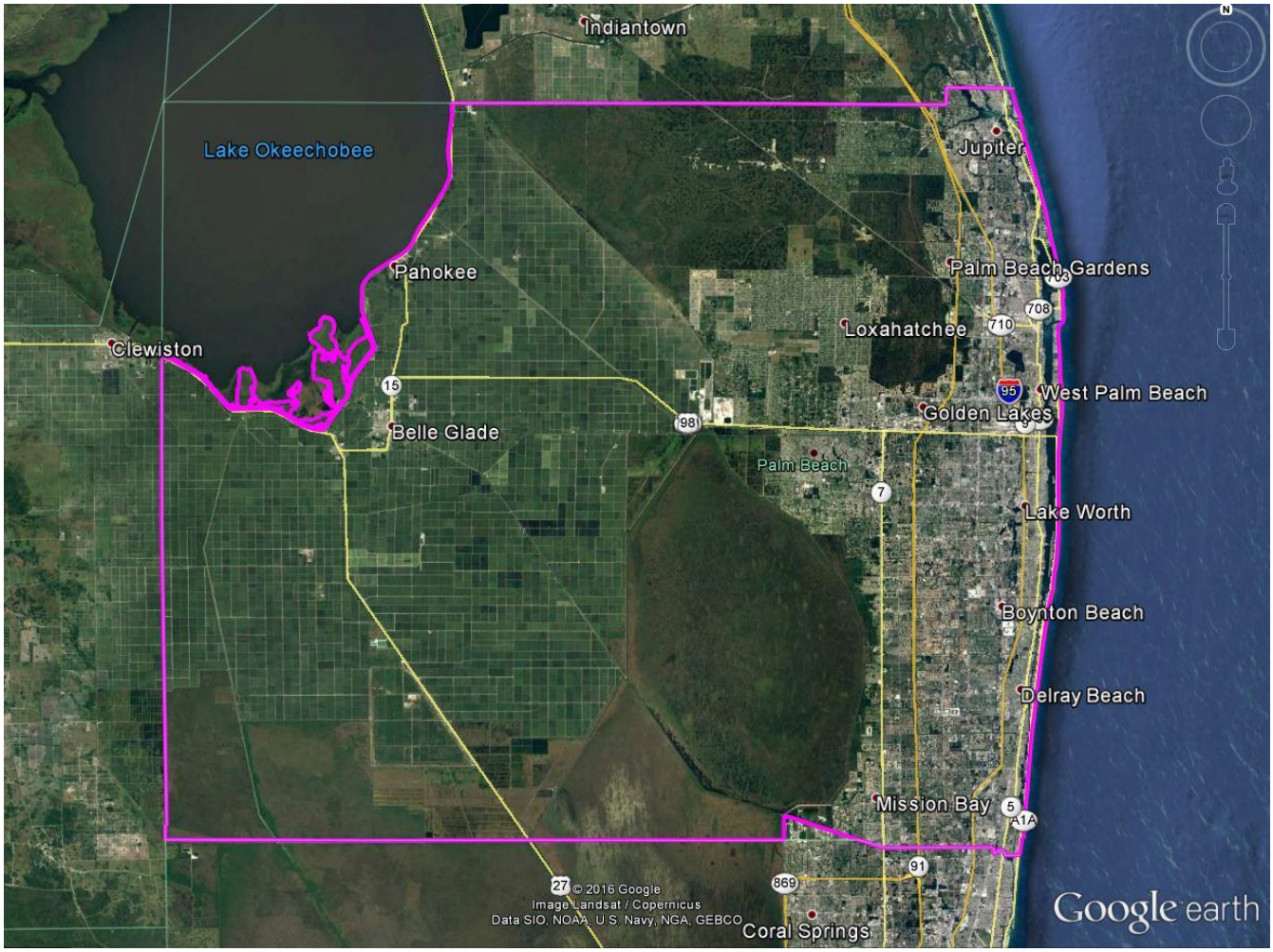
Final horizontal coordinates are referenced to Florida State Plane Coordinate System, East Zone, NAD83 (2011 Adjustment) in U.S. Survey feet. Final vertical elevations are referenced to NAVD88 in U.S. Survey feet using Geoid model 2012B (Geoid12B).

1.2 *Points of Contact*

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

Dewberry Engineers, Inc.
William D. Donley, PSM
Associate Vice President
131 West Kaley Street
Orlando, Florida 32806
(321) 354-9834

1.3 *Project Area*



PROJECT DETAILS

2.1 *Survey Equipment*

In performing the GPS observations, a Spectra Precision SP80 receiver/antenna attached to a two meter fixed height pole with a Spectra Precision Ranger 3 Data Collector were used to perform the field surveys.

2.2 *Survey Point Details*

The 65 Ground Control Points were well distributed throughout the project area.

A sketch was made for each location and a nail & disk or iron rod & cap were set at the point where possible or at an identifiable point. The Ground Control 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 Engineers, Inc. office located in Orlando, FL was tied to a Real Time Network (RTN) managed 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).

2.4 *Field Survey Procedures and Analysis*

Dewberry field surveyors used a Spectra Precision SP80 receiver, which is a geodetic quality dual frequency GPS receiver, to collect data at each surveyed location.

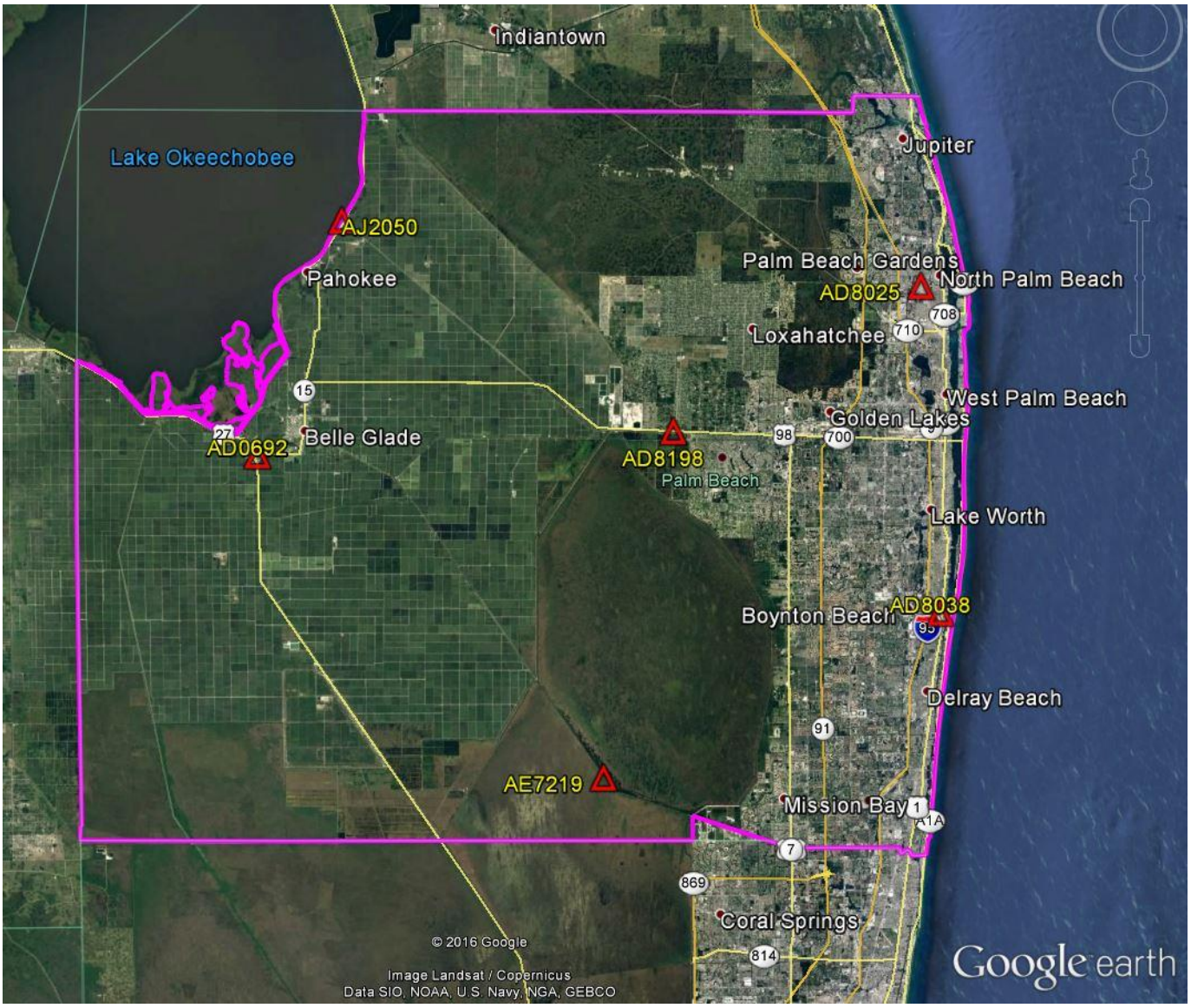
All locations were occupied once with approximately 50% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerance of ± 5cm or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for approximately 1.5 minutes in duration and measured to 90 epochs.

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

Six (6) existing NGS monuments listed in the NSRS database were located as an additional QA/QC method to check the accuracy of the VRS network. The results are as follows:

NGS PT. ID	Designation	As Surveyed (ft)			Published (ft)			Differences (ft)		
		Northing	Easting	Elev.	Northing	Easting	Elev.	Δ N	Δ E	Δ Elev.
AD8198	J 413	854938.05	879898.39	15.29	854938.08	879898.37	15.39	0.03	0.02	0.10
AD0692	872 2625 TIDAL 1	846966.62	750065.45	19.83	846966.62	750065.45	19.88	0.00	0.00	0.05
AD8025	V 402	900458.58	957185.90	16.60	900458.65	957185.87	16.71	0.07	0.03	0.11
AD8038	G 402	798923.76	963705.28	11.23	798923.64	963705.25	11.31	0.12	0.03	0.09
AE7219	FCE 1987	747311.68	858571.74	21.34	747311.64	858571.72	21.40	0.04	0.02	0.06
AJ2050	CAN RM 1	919959.27	776091.69	33.26	919959.32	776091.71	33.35	0.05	0.02	0.10

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 Trimble VRS Now software enables high-accuracy positioning in real time across a geographic region. The Trimble VRS Now software package uses real-time data streams from the 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 Spectra Precision – Survey Office.

Downloaded data is run through the Survey Office program to obtain the following reports; points list, point derivations and a vector spreadsheet. 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 AutoCAD Civil 3D 2016 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*

PALM BEACH COUNTY LiDAR POINTS			
POINT ID	NORTHING (FT)	EASTING (FT)	ELEV. (FT)
GCP			
GC_01	953197.913	783299.648	18.948
GC_02	955179.734	858986.987	26.272
GC_03	956109.807	954935.876	12.951
GC_04	902576.061	960156.902	4.649
GC_05	797608.132	965261.047	1.960
GC_06	729257.754	954881.241	12.785
GC_07	725829.548	886648.624	10.849
GC_08	727814.650	807508.264	18.288
GC_09	726178.467	729890.265	21.538
GC_10	772899.889	694327.151	17.229
GC_11	874086.162	694869.245	12.838
GC_12	858986.935	763236.627	12.630
GC_13	913070.360	780197.991	15.142
GC_14	911871.765	829792.328	15.634
GC_15	901001.455	895328.672	22.495
GC_16	851899.248	858281.483	21.065
GC_17	838396.609	969906.763	4.443
GC_18	764623.870	958548.722	17.371
GC_19	837457.691	925854.986	21.058
GC_20	806034.620	939518.581	18.098
GC_21	871274.770	907043.515	17.141
GC_22	890926.573	810951.277	17.156
GC_23	852432.417	816559.621	15.725
GC_24	839344.322	885249.506	14.493
GC_25	777736.110	837185.071	16.350
GC_26	782188.493	769364.804	15.557
GC_27	807580.466	751383.412	17.345
GC_28	823322.213	836969.366	17.975
GC_29	876318.145	865427.748	18.332
GC_30	842927.663	701355.325	16.396
GC_31	750111.169	758604.127	20.429
GC_32	810245.887	794868.150	11.064
GC_33	893099.751	757079.865	10.661

PALM BEACH COUNTY LiDAR POINTS			
POINT ID	NORTHING (FT)	EASTING (FTE)	ELEV. (FT)
GCP			
GC_34	927613.700	941455.059	19.900
GC_35	884819.219	942425.211	16.282
GC_36	814961.838	905651.952	17.224
GC_37	751796.816	935374.902	19.590
GC_38	769902.799	815998.190	11.197
GC_39	726585.120	694668.772	23.193
GC_40	859401.049	718390.217	15.031
GC_41	840299.564	791867.921	18.763
GC_42	931369.091	892026.412	21.377
GC_43	772640.959	911888.362	16.762
GC_44	948568.897	898264.407	22.238
GC_45	811209.825	707829.405	16.241
GC_46	954246.667	813352.730	25.289
GC_47	951501.722	933851.310	12.300
GC 48	747339.445	858534.924	21.379
GC_49	726871.348	916828.479	18.526
GC_50	847011.137	749721.016	13.595
GC_51	764164.380	719307.289	14.494
HC_01	951214.588	783263.505	15.992
HC_02	955976.065	954979.525	12.006
HC_03	729258.353	954909.190	12.817
HC_04	726347.390	729790.697	16.310
HC_05	859026.171	763231.528	12.812
HC_06	901179.170	895236.867	22.220
HC_07	777740.561	837491.200	13.632
HC_08	807603.741	751360.909	17.500
HC_09	837381.777	925811.698	21.625
HC_10	851825.661	858246.165	19.289
HC 11	839441.514	885401.657	14.493
HC_11	840290.967	791876.038	18.625
HC 12	823296.993	836959.274	18.688
HC_12	874598.917	694874.962	12.346

4. *GPS OBSERVATIONS*

POINT #	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBVERV. DATE	RE-OBSERV. JULIAN DATE	RE-OBSERV. TIME
GCP						
GC_01	1/26/2017	026	16:21	2/14/2017	045	12:05
GC_02	1/26/2017	026	14:39	N/A	N/A	N/A
GC_03	12/22/2016	357	9:50	12/22/2016	357	14:59
GC_04	1/3/2017	003	14:18	1/4/2017	004	13:59
GC_05	1/10/2017	010	12:12	1/11/2017	011	8:17
GC_06	1/21/2017	021	7:35	N/A	N/A	N/A
GC_07	1/19/2017	019	14:58	1/20/2017	020	10:38
GC_08	2/8/2017	039	9:55	2/14/2017	045	10:10
GC_09	2/9/2017	040	8:52	N/A	N/A	N/A
GC_10	2/9/2017	040	10:35	N/A	N/A	N/A
GC_11	2/7/2017	038	13:38	2/8/2017	039	13:46
GC_12	2/7/2017	038	12:22	2/14/2017	045	10:56
GC_13	2/7/2017	038	10:45	2/14/2017	045	11:36
GC_14	2/7/2017	038	11:35	N/A	N/A	N/A
GC_15	1/26/2017	026	12:18	N/A	N/A	N/A
GC_16	1/27/2017	027	8:03	N/A	N/A	N/A
GC_17	1/10/2017	010	11:05	1/11/2017	011	7:30
GC_18	1/11/2017	011	14:20	1/18/2017	018	14:57
GC_19	1/9/2017	009	15:59	1/10/2017	010	7:36
GC_20	1/10/2017	010	15:19	1/11/2017	011	9:34
GC_21	1/5/2017	005	13:01	1/9/2017	009	11:24
GC_22	1/26/2017	026	17:25	N/A	N/A	N/A
GC_23	1/27/2017	027	12:18	N/A	N/A	N/A
GC_24	1/5/2017	005	14:26	1/6/2017	006	14:15
GC_25	1/27/2017	027	9:35	N/A	N/A	N/A
GC_26	2/8/2017	039	8:12	2/14/2017	045	10:31
GC_27	2/8/2017	039	11:26	2/8/2017	039	17:17
GC_28	1/27/2017	027	8:51	N/A	N/A	N/A
GC_29	1/20/2017	020	14:26	N/A	N/A	N/A
GC_30	2/7/2017	038	14:15	N/A	N/A	N/A
GC_31	2/8/2017	039	15:27	N/A	N/A	N/A
GC_32	2/8/2017	039	8:48	N/A	N/A	N/A
GC_33	1/27/2017	027	13:09	2/14/2017	045	11:18

POINT #	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBVERV. DATE	RE-OBSERV. JULIAN DATE	RE-OBSERV. TIME
GCP						
GC_34	1/3/2017	003	15:14	1/4/2017	004	10:54
GC_35	1/3/2017	003	16:19	1/4/2017	004	15:04
GC_36	1/10/2017	010	8:16	1/10/2017	010	16:41
GC_37	1/19/2017	019	10:37	N/A	N/A	N/A
GC_38	2/9/2017	040	16:06	N/A	N/A	N/A
GC_39	2/9/2017	040	9:57	N/A	N/A	N/A
GC_40	2/7/2017	038	13:09	2/8/2017	039	13:24
GC_41	1/27/2017	027	12:43	N/A	N/A	N/A
GC_42	12/21/2016	356	14:51	1/3/2017	003	11:00
GC_43	1/11/2017	011	11:33	2/14/2017	045	8:42
GC_44	12/21/2016	356	13:38	12/22/2016	357	14:00
GC_45	2/7/2017	038	14:54	N/A	N/A	N/A
GC_46	1/26/2017	026	15:45	N/A	N/A	N/A
GC_47	12/22/2016	357	13:16	1/3/2017	003	9:53
GC 48	1/27/2017	027	10:11	N/A	N/A	N/A
GC_49	1/20/2017	020	12:00	N/A	N/A	N/A
GC_50	2/8/2017	039	12:09	2/8/2017	039	17:36
GC_51	2/8/2017	039	16:09	N/A	N/A	N/A
HC_01	1/26/2017	026	16:33	2/14/2017	045	12:00
HC_02	12/22/2016	357	10:15	12/22/2016	357	14:55
HC_03	1/21/2017	021	7:32	N/A	N/A	N/A
HC_04	2/9/2017	040	9:04	N/A	N/A	N/A
HC_05	2/7/2017	038	12:25	2/14/2017	045	11:03
HC_06	1/26/2017	026	12:03	N/A	N/A	N/A
HC_07	1/27/2017	027	9:28	N/A	N/A	N/A
HC_08	2/8/2017	039	11:28	2/8/2017	039	17:19
HC_09	1/9/2017	009	16:02	1/10/2017	010	7:34
HC_10	1/27/2017	027	8:15	N/A	N/A	N/A
HC 11*	1/5/2017	005	14:31	1/6/2017	006	14:19
HC_11*	1/27/2017	027	12:41	N/A	N/A	N/A
HC 12*	1/27/2017	027	8:48	N/A	N/A	N/A
HC_12*	2/7/2017	038	13:29	2/8/2017	039	13:40

* Dewberry Engineers, Inc. was provided the GCPs for this project. Within the GCPs provided were two HC 11 and two HC 12 points, with one label being separated by a space and the other separated by "_" as shown above.

5. ***POINT COMPARISON***

LiDAR QA/QC				
POINT ID	CHECK POINT ID	Δ NORTH	Δ EAST	VERTICAL Δ
GCP				
GC_01	GC_01B	0.04	0.01	0.01
GC_03	GC_03B	0.03	0.06	0.03
GC_04	GC_04B	0.06	0.01	0.12
GC_05	GC_05B	0.05	0.03	0.04
GC_07	GC_07B	0.00	0.02	0.04
GC_08	GC_08B	0.03	0.05	0.13
GC_11	GC_11B	0.02	0.02	0.11
GC_12	GC_12B	0.01	0.05	0.13
GC_13	GC_13B	0.05	0.02	0.03
GC_17	GC_17B	0.08	0.00	0.03
GC_18	GC_18B	0.04	0.01	0.05
GC_19	GC_19B	0.07	0.00	0.03
GC_20	GC_20B	0.01	0.01	0.06
GC_21	GC_21C	0.01	0.02	0.11
GC_24	GC_24	0.01	0.03	0.12
GC_26	GC_26	0.01	0.01	0.14
GC_27B	GC_27C	0.04	0.00	0.08
GC_33	GC_33B	0.04	0.01	0.07
GC_34	GC_34B	0.13	0.09	0.16
GC_35	GC_35C	0.11	0.13	0.00
GC_36B	GC_36C	0.08	0.01	0.03
GC_40	GC_40B	0.00	0.10	0.04
GC_42	GC_42B	0.00	0.02	0.13
GC_43	GC_43C	0.05	0.00	0.09
GC_44	GC_44B	0.02	0.08	0.02
GC_47	GC_47B	0.02	0.00	0.07
GC_50B	GC_50C	0.05	0.02	0.06
HC_01	HC_01B	0.03	0.01	0.03
HC_02	HC_02B	0.02	0.05	0.00
HC_05	HC_05B	0.06	0.02	0.04
HC_08B	HC_08C	0.00	0.03	0.09
HC_09	HC_09B	0.00	0.03	0.07
HC 11	HC 11B	0.07	0.04	0.15
HC_12	HC_12B	0.03	0.05	0.06