

# ***GROUND CONTROL SURVEY REPORT***

**GPS SURVEY  
FOR LIDAR CONTROL**

**GRANT COUNTY, WI WROC LIDAR SURVEY**

**GRANT COUNTY, WISCONSIN**

*Services provided by:*

**AYRES**  

---

**ASSOCIATES**

**Geospatial Services  
1802 Pankratz Street  
Madison, WI 53716**

## **ABSTRACT**

This report documents the GPS ground surveys conducted in support of FEMA accuracy testing of the lidar data collection for Grant County, Wisconsin, in 2011. Surveys were conducted at 5 sites utilizing the base stations established in the static network. These surveys established “ground truth” data at each site on different surface types, including bare earth, low grass, brush lands, low trees, forest, high grass, weeds, crops, and urban areas. Statistical comparisons were made between ground truth points collected from the ground survey and the elevation at the associated horizontal coordinates represented on the LiDAR-derived digital terrain model.

## **SAMPLE POINTS/TEST POINTS**

The ground survey test points were distributed and categorized into sites as shown in the Test Survey Locations map on the next page.

## **DATA ANALYSIS**

To qualify as an acceptable accuracy test, the lidar data must be compared with a dataset of higher accuracy – in this instance ground survey. To develop a comparable dataset of points from the lidar dataset, a utility from proprietary software was used.

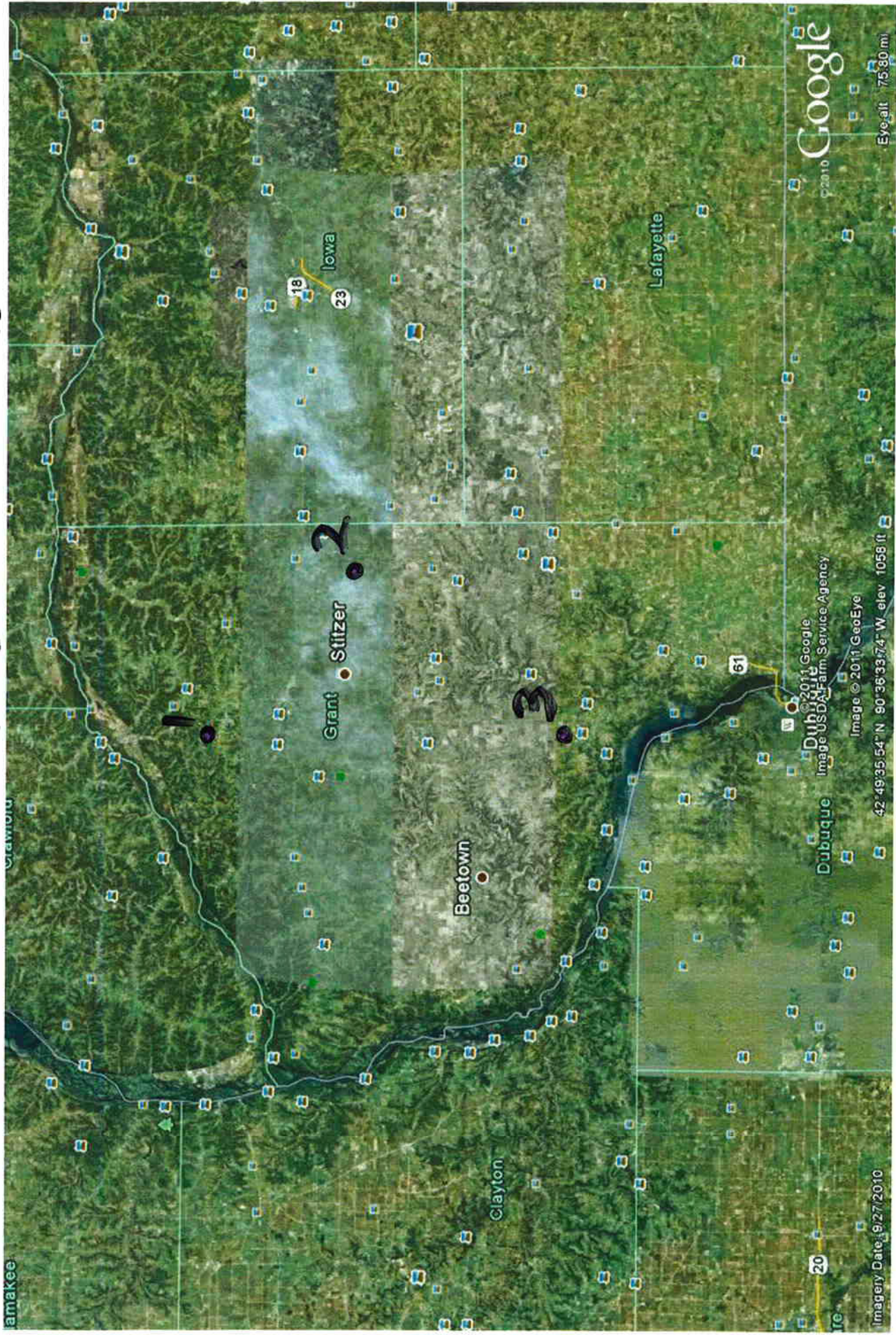
The ground control survey results were imported into an ESRI Pointz shapefile with each point’s information as attributes. The utility then accessed the lidar and generated a triangulated irregular network (TIN), which is a continuous digital terrain surface, using the bare-earth lidar points and the compiled breaklines. The utility probed the TIN surface to determine its elevations at each of the survey point’s horizontal locations.

The elevation was then appended as a field to the Pointz shapefile; the attributes for each point were exported to a database; and then statistical analysis was performed. The results can be seen on the following pages.

## **OVERALL ACCURACY**

A comparison of ground survey versus lidar model values indicates a vertical root mean square error (RMSEz) of 0.425 feet. This is within the FEMA specified vertical accuracy tolerance of 0.6. This RMSEz equates to a tested 0.834 feet vertical accuracy at 95% confidence level.

# FEMA LiDAR Checks Site Locations



**GROUND TRUTH ANALYSIS**  
Comparison of Lidar Points to Ground-Truth Points  
Grant County Coordinate System WISCRS  
NAD 83 HARN / NAVD 88, survey feet

Field definitions

Name – The designation given to the ground survey point to identify it with its coordinates and land cover type

X, Y, and Z – The coordinates that describe the point's horizontal and vertical location within the Grant County WISCRS Coordinate System. The X and Y values are shared between the ground control points and lidar comparison points. The Z field shows the elevation of the survey number. The lidar comparison point's elevation is implicit in the analysis' delta Z

Delta Z – The error, the difference between the elevation at a horizontal location as determined by ground survey and as determined by the lidar dataset

Delta Z Squared – The value of squaring Delta Z

Land Cover – The predominant land cover category at the location of the survey point

Statistic definitions

Sum – The sum of the analysis' Delta Z Squared values

Average – The average of the analysis' Delta Z Squared values

RMSE – The root mean squared error, the square root of the average of the squared errors

Accuracyz – The product of multiplying the RMSE with 1.96, a conversion between the RMSE value and a value with a 95% confidence level

Name	X	Y	Z	Delta_Z	Delta_Z_Sq	TYPE
1000	874079.31	558919.73	1105.41	0.2690	0.072361	CK
1001	874027.18	556321.02	1109.85	-0.2500	0.062500	MOWED GRASS
1002	874029.46	556323.12	1109.88	-0.2350	0.055225	MOWED GRASS
1003	874031.10	556324.85	1109.78	-0.2250	0.050625	MOWED GRASS
1004	874033.25	556326.82	1109.75	-0.2320	0.053824	MOWED GRASS
1005	874035.06	556328.97	1109.89	-0.2020	0.040804	MOWED GRASS
1006	874032.81	556331.00	1109.78	-0.2130	0.045369	MOWED GRASS
1007	874030.59	556328.54	1109.72	-0.1890	0.035721	MOWED GRASS
1008	874028.44	556326.54	1109.83	-0.2130	0.045369	MOWED GRASS
1009	874026.33	556324.52	1109.90	-0.3100	0.096100	MOWED GRASS
1010	874024.21	556322.57	1109.93	-0.2930	0.085849	MOWED GRASS
1011	874021.89	556324.96	1109.87	-0.1790	0.032041	MOWED GRASS
1012	874024.46	556326.97	1109.84	-0.1950	0.038025	MOWED GRASS
1013	874026.66	556328.97	1109.81	-0.2290	0.052441	MOWED GRASS
1014	874028.43	556330.86	1109.77	-0.1570	0.024649	MOWED GRASS
1015	874030.49	556332.47	1109.82	-0.2830	0.080089	MOWED GRASS
1016	874028.45	556334.61	1109.75	-0.2410	0.058081	MOWED GRASS
1017	874026.22	556332.42	1109.72	-0.2260	0.051076	MOWED GRASS
1018	874023.88	556330.42	1109.74	-0.2430	0.059049	MOWED GRASS
1019	874021.98	556328.68	1109.81	-0.2190	0.047961	MOWED GRASS
1020	874019.96	556326.88	1109.81	-0.1630	0.026569	MOWED GRASS
1021	874017.76	556329.47	1109.79	-0.2460	0.060516	MOWED GRASS
1022	874019.74	556331.80	1109.78	-0.3040	0.092416	MOWED GRASS
1023	874021.63	556333.99	1109.77	-0.3360	0.112896	MOWED GRASS
1024	874023.46	556335.53	1109.72	-0.3110	0.096721	MOWED GRASS
1025	874025.37	556337.60	1109.65	-0.2910	0.084681	MOWED GRASS
1026	878755.37	553452.21	1077.78	0.4270	0.182329	TALL GRASS
1027	878752.19	553452.15	1077.75	0.1810	0.032761	TALL GRASS
1028	878749.46	553452.12	1077.68	0.3460	0.119716	TALL GRASS
1029	878746.48	553452.23	1077.81	0.4980	0.248004	TALL GRASS
1030	878743.04	553452.15	1077.75	0.7220	0.521284	TALL GRASS
1031	878743.41	553449.89	1077.75	0.8300	0.688900	TALL GRASS
1032	878745.64	553449.52	1077.92	0.5520	0.304704	TALL GRASS
1033	878749.17	553448.87	1077.95	0.3720	0.138384	TALL GRASS
1034	878750.91	553448.33	1078.16	0.3340	0.111556	TALL GRASS
1035	878754.11	553448.11	1078.22	0.5520	0.304704	TALL GRASS
1036	878753.85	553445.10	1078.27	0.8800	0.774400	TALL GRASS
1037	878751.03	553444.99	1078.15	0.6980	0.487204	TALL GRASS
1038	878747.76	553445.27	1077.86	0.6010	0.361201	TALL GRASS
1039	878744.45	553445.62	1077.89	0.8050	0.648025	TALL GRASS
1040	878742.26	553445.84	1078.07	0.6770	0.458329	TALL GRASS
1041	878741.11	553443.03	1077.92	0.8320	0.692224	TALL GRASS
1042	878743.58	553442.54	1078.01	0.8040	0.646416	TALL GRASS
1043	878746.81	553442.32	1078.13	0.4610	0.212521	TALL GRASS
1044	878749.92	553442.75	1078.15	0.5010	0.251001	TALL GRASS
1045	878753.29	553441.78	1078.29	0.9040	0.817216	TALL GRASS
1046	878753.91	553438.37	1078.26	0.8620	0.743044	TALL GRASS
1047	878751.31	553438.31	1078.37	0.2740	0.075076	TALL GRASS
1048	878747.80	553438.24	1078.13	0.5880	0.345744	TALL GRASS
1049	878744.63	553438.94	1077.93	0.7570	0.573049	TALL GRASS
1050	878741.69	553439.58	1078.06	0.7120	0.506944	TALL GRASS
1051	878736.52	553421.82	1078.85	0.9310	0.866761	TREE COVE
1052	878736.49	553418.78	1079.35	0.5170	0.267289	TREE COVE
1053	878735.94	553416.20	1079.83	0.2960	0.087616	TREE COVE
1054	878735.31	553413.55	1080.35	0.2030	0.041209	TREE COVE
1055	878734.92	553410.69	1080.51	0.1790	0.032041	TREE COVE
1056	878738.83	553411.42	1080.23	0.0420	0.001764	TREE COVE
1057	878739.12	553414.82	1079.70	0.6920	0.478864	TREE COVE
1058	878739.45	553417.93	1079.43	0.5500	0.302500	TREE COVE
1059	878739.85	553420.47	1079.00	0.7670	0.588289	TREE COVE
1060	878740.49	553423.26	1078.75	0.8120	0.659344	TREE COVE
1061	878743.47	553423.05	1079.00	0.0440	0.001936	TREE COVE

1062	878742.65	553419.93	1079.11	0.3040	0.092416	TREE COVE
1063	878741.77	553416.88	1079.47	0.4840	0.234256	TREE COVE
1064	878741.55	553413.82	1079.86	0.4310	0.185761	TREE COVE
1065	878740.62	553410.44	1079.81	0.7030	0.494209	TREE COVE
1066	878731.32	553412.21	1080.28	0.2040	0.041616	TREE COVE
1067	878732.04	553415.89	1079.69	0.4500	0.202500	TREE COVE
1068	878732.63	553418.58	1079.65	0.2080	0.043264	TREE COVE
1069	878733.32	553422.06	1079.15	0.2890	0.083521	TREE COVE
1070	878733.76	553424.69	1078.82	0.3950	0.156025	TREE COVE
1071	878730.52	553426.12	1078.60	0.7370	0.543169	TREE COVE
1072	878730.06	553423.68	1079.23	0.2400	0.057600	TREE COVE
1073	878730.00	553421.15	1079.36	0.2280	0.051984	TREE COVE
1074	878730.11	553417.27	1079.85	0.1850	0.034225	TREE COVE
1075	878730.94	553413.34	1080.14	0.2630	0.069169	TREE COVE
1076	878819.10	553425.16	1081.52	0.3970	0.157609	BRUSH/LOW
1077	878821.32	553422.35	1081.89	0.2540	0.064516	BRUSH/LOW
1078	878823.03	553417.37	1082.41	0.3710	0.137641	BRUSH/LOW
1079	878824.00	553414.23	1082.96	0.0990	0.009801	BRUSH/LOW
1080	878826.69	553410.82	1083.34	0.1330	0.017689	BRUSH/LOW
1081	878829.80	553415.49	1082.98	0.2710	0.073441	BRUSH/LOW
1082	878827.39	553417.56	1082.81	0.2060	0.042436	BRUSH/LOW
1083	878826.43	553421.06	1082.27	0.3210	0.103041	BRUSH/LOW
1084	878825.22	553424.26	1081.90	0.0300	0.000900	BRUSH/LOW
1085	878822.73	553427.94	1081.34	0.4650	0.216225	BRUSH/LOW
1086	878826.49	553429.67	1081.46	0.3170	0.100489	BRUSH/LOW
1087	878827.25	553426.94	1082.06	0.0010	0.000001	BRUSH/LOW
1088	878829.20	553423.83	1082.35	0.0780	0.006084	BRUSH/LOW
1089	878832.46	553420.68	1082.57	0.5780	0.334084	BRUSH/LOW
1090	878834.69	553418.24	1083.09	0.5080	0.258064	BRUSH/LOW
1091	878836.09	553423.46	1082.52	1.0610	1.125721	BRUSH/LOW
1092	878834.45	553425.90	1082.57	0.4110	0.168921	BRUSH/LOW
1093	878832.16	553429.26	1082.41	0.0960	0.009216	BRUSH/LOW
1094	878830.24	553431.64	1082.02	0.2570	0.066049	BRUSH/LOW
1095	878828.54	553433.43	1081.85	0.2070	0.042849	BRUSH/LOW
1096	878832.98	553433.87	1081.55	1.1110	1.234321	BRUSH/LOW
1097	878835.05	553429.84	1082.76	0.2230	0.049729	BRUSH/LOW
1098	878835.87	553424.71	1082.89	0.4840	0.234256	BRUSH/LOW
1099	878836.18	553422.35	1083.22	0.5160	0.266256	BRUSH/LOW
1100	878834.22	553418.27	1083.09	0.4440	0.197136	BRUSH/LOW
1101	882624.43	551013.84	1020.76	-0.0430	0.001849	GRAVEL
1102	882624.94	551009.71	1020.75	0.0820	0.006724	GRAVEL
1103	882625.00	551007.35	1020.69	0.1330	0.017689	GRAVEL
1104	882625.93	551004.42	1020.67	0.0720	0.005184	GRAVEL
1105	882626.31	551001.02	1020.57	0.0410	0.001681	GRAVEL
1106	882629.91	551001.69	1020.59	0.0100	0.000100	GRAVEL
1107	882629.11	551005.46	1020.74	-0.0130	0.000169	GRAVEL
1108	882628.30	551008.25	1020.75	0.0150	0.000225	GRAVEL
1109	882627.70	551010.77	1020.79	-0.0210	0.000441	GRAVEL
1110	882627.23	551014.76	1020.76	-0.0410	0.001681	GRAVEL
1111	882630.98	551015.00	1020.79	0.0150	0.000225	GRAVEL
1112	882630.88	551011.57	1020.79	-0.0930	0.008649	GRAVEL
1113	882631.38	551008.84	1020.73	-0.0490	0.002401	GRAVEL
1114	882631.60	551006.14	1020.72	-0.0490	0.002401	GRAVEL
1115	882632.08	551003.09	1020.59	0.0210	0.000441	GRAVEL
1116	882635.66	551001.94	1020.57	-0.0080	0.000064	GRAVEL
1117	882635.10	551005.51	1020.64	-0.0610	0.003721	GRAVEL
1118	882634.87	551008.42	1020.64	0.0780	0.006084	GRAVEL
1119	882634.32	551011.56	1020.72	0.0190	0.000361	GRAVEL
1120	882633.78	551014.52	1020.79	-0.0590	0.003481	GRAVEL
1121	882637.42	551015.45	1020.77	-0.0970	0.009409	GRAVEL
1122	882637.36	551011.85	1020.72	0.0090	0.000081	GRAVEL
1123	882638.25	551009.23	1020.65	-0.0170	0.000289	GRAVEL
1124	882638.59	551006.47	1020.59	-0.0990	0.009801	GRAVEL

1125	882639.34	551003.50	1020.53	-0.0770	0.005929 GRAVEL
1126	882651.80	551012.55	1020.66	-0.0100	0.000100 ASPH
1127	882650.72	551016.11	1020.68	-0.1170	0.013689 ASPH
1128	882650.33	551019.23	1020.74	-0.0920	0.008464 ASPH
1129	882650.17	551021.96	1020.76	0.0320	0.001024 ASPH
1130	882650.15	551024.99	1020.79	0.0080	0.000064 ASPH
1131	882653.34	551024.92	1020.74	-0.0270	0.000729 ASPH
1132	882653.51	551020.53	1020.65	-0.1160	0.013456 ASPH
1133	882653.35	551018.31	1020.62	-0.0930	0.008649 ASPH
1134	882653.45	551015.69	1020.55	-0.0460	0.002116 ASPH
1135	882653.29	551012.56	1020.49	0.1030	0.010609 ASPH
1136	882656.52	551012.25	1020.37	0.0330	0.001089 ASPH
1137	882656.26	551015.53	1020.46	-0.0720	0.005184 ASPH
1138	882656.23	551018.52	1020.49	-0.0740	0.005476 ASPH
1139	882656.27	551021.43	1020.52	-0.0350	0.001225 ASPH
1140	882656.17	551024.21	1020.59	0.0270	0.000729 ASPH
1141	882659.30	551023.90	1020.44	0.1900	0.036100 ASPH
1142	882659.00	551019.78	1020.41	0.0330	0.001089 ASPH
1143	882658.88	551017.28	1020.39	-0.0020	0.000004 ASPH
1144	882659.06	551014.48	1020.34	0.0110	0.000121 ASPH
1145	882658.99	551011.64	1020.36	-0.0770	0.005929 ASPH
1146	882661.86	551012.26	1020.20	-0.0100	0.000100 ASPH
1147	882661.68	551015.62	1020.20	0.0820	0.006724 ASPH
1148	882661.71	551018.35	1020.25	0.0690	0.004761 ASPH
1149	882661.74	551021.09	1020.28	0.1460	0.021316 ASPH
1150	882661.83	551024.14	1020.33	0.1100	0.012100 ASPH
1153	801793.57	557441.18	1128.55	0.2310	0.053361 CK
1154	801793.65	557441.12	1128.67	0.0970	0.009409 CK
1155	801793.54	557441.14	1128.65	0.1400	0.019600 CK
1200	822849.88	615356.83	722.05	-0.0240	0.000576 CK
1201	830940.91	593702.77	1221.74	0.0530	0.002809 MOWED GRASS
1202	830941.18	593706.22	1221.97	0.0150	0.000225 MOWED GRASS
1203	830941.52	593708.66	1222.15	0.0320	0.001024 MOWED GRASS
1204	830941.71	593711.40	1222.35	-0.0030	0.000009 MOWED GRASS
1205	830941.93	593714.35	1222.49	-0.0350	0.001225 MOWED GRASS
1206	830945.41	593713.98	1222.68	-0.2040	0.041616 MOWED GRASS
1207	830944.78	593710.52	1222.38	0.0070	0.000049 MOWED GRASS
1208	830944.15	593708.16	1222.17	0.0380	0.001444 MOWED GRASS
1209	830943.84	593705.57	1222.07	-0.0480	0.002304 MOWED GRASS
1210	830943.52	593703.18	1221.95	0.0720	0.005184 MOWED GRASS
1211	830946.79	593702.87	1222.09	-0.0180	0.000324 MOWED GRASS
1212	830946.79	593706.39	1222.21	-0.0290	0.000841 MOWED GRASS
1213	830947.14	593709.24	1222.40	0.0060	0.000036 MOWED GRASS
1214	830947.43	593711.89	1222.59	-0.0860	0.007396 MOWED GRASS
1215	830947.67	593714.17	1222.78	-0.1080	0.011664 MOWED GRASS
1216	830951.14	593714.19	1222.95	-0.0940	0.008836 MOWED GRASS
1217	830950.72	593710.98	1222.64	-0.0510	0.002601 MOWED GRASS
1218	830950.36	593708.41	1222.45	-0.0220	0.000484 MOWED GRASS
1219	830949.90	593705.88	1222.35	-0.0470	0.002209 MOWED GRASS
1220	830949.45	593703.28	1222.15	-0.0720	0.005184 MOWED GRASS
1221	830952.92	593702.86	1222.35	-0.1130	0.012769 MOWED GRASS
1222	830953.28	593706.45	1222.49	-0.1640	0.026896 MOWED GRASS
1223	830953.56	593709.06	1222.62	-0.1650	0.027225 MOWED GRASS
1224	830953.86	593712.01	1222.78	-0.0750	0.005625 MOWED GRASS
1225	830954.32	593714.67	1223.03	-0.0370	0.001369 MOWED GRASS
1226	820988.17	596378.86	1212.01	-0.1090	0.011881 GRAVEL
1227	820988.14	596375.94	1211.98	-0.0370	0.001369 GRAVEL
1228	820988.26	596373.23	1212.04	0.0650	0.004225 GRAVEL
1229	820988.30	596370.32	1212.08	0.0280	0.000784 GRAVEL
1230	820988.38	596367.48	1212.12	0.0310	0.000961 GRAVEL
1231	820984.85	596367.77	1212.24	-0.0160	0.000256 GRAVEL
1232	820985.32	596372.18	1212.11	0.0520	0.002704 GRAVEL
1233	820985.37	596374.66	1212.04	-0.0260	0.000676 GRAVEL

1234	820985.30	596377.46	1211.99	-0.0180	0.000324	GRAVEL
1235	820985.45	596380.18	1211.93	0.0210	0.000441	GRAVEL
1236	820981.55	596379.95	1211.91	-0.0580	0.003364	GRAVEL
1237	820981.91	596376.58	1211.98	-0.0510	0.002601	GRAVEL
1238	820982.25	596373.31	1212.04	0.0360	0.001296	GRAVEL
1239	820982.14	596370.66	1212.11	0.0460	0.002116	GRAVEL
1240	820982.13	596368.07	1212.13	0.0140	0.000196	GRAVEL
1241	820978.97	596367.99	1212.15	-0.0560	0.003136	GRAVEL
1242	820979.38	596371.70	1212.11	-0.0400	0.001600	GRAVEL
1243	820979.53	596374.08	1212.06	-0.0980	0.009604	GRAVEL
1244	820979.45	596377.03	1211.96	-0.1070	0.011449	GRAVEL
1245	820979.57	596379.61	1211.97	-0.1540	0.023716	GRAVEL
1246	820976.28	596379.21	1211.86	-0.0400	0.001600	GRAVEL
1247	820976.86	596375.64	1211.94	-0.0770	0.005929	GRAVEL
1248	820976.88	596372.62	1211.90	0.0420	0.001764	GRAVEL
1249	820976.73	596370.36	1212.04	0.0040	0.000016	GRAVEL
1250	820976.88	596367.62	1212.03	0.0270	0.000729	GRAVEL
1251	821026.05	597692.56	1181.57	-0.0020	0.000004	ASPH
1252	821025.82	597688.99	1181.66	-0.1720	0.029584	ASPH
1253	821025.91	597685.96	1181.63	-0.0490	0.002401	ASPH
1254	821026.07	597682.92	1181.68	-0.1170	0.013689	ASPH
1255	821026.06	597680.01	1181.68	-0.1390	0.019321	ASPH
1256	821029.76	597680.16	1182.00	-0.1780	0.031684	ASPH
1257	821029.42	597683.51	1181.89	-0.1000	0.010000	ASPH
1258	821029.22	597686.36	1181.88	-0.1770	0.031329	ASPH
1259	821029.34	597688.85	1181.83	-0.1260	0.015876	ASPH
1260	821029.20	597691.36	1181.80	-0.0540	0.002916	ASPH
1261	821033.15	597691.19	1182.00	-0.0390	0.001521	ASPH
1262	821032.51	597687.95	1182.02	-0.0980	0.009604	ASPH
1263	821032.26	597684.95	1182.04	-0.1280	0.016384	ASPH
1264	821032.15	597682.00	1182.02	-0.0650	0.004225	ASPH
1265	821032.47	597679.10	1182.08	-0.1010	0.010201	ASPH
1266	821036.28	597679.97	1182.22	-0.0180	0.000324	ASPH
1267	821036.07	597683.64	1182.23	-0.1440	0.020736	ASPH
1268	821035.99	597687.02	1182.14	0.0020	0.000004	ASPH
1269	821036.07	597689.70	1182.07	0.0360	0.001296	ASPH
1270	821036.08	597692.33	1182.05	-0.0550	0.003025	ASPH
1271	821035.95	597695.16	1181.94	-0.0320	0.001024	ASPH
1272	821031.94	597695.48	1181.86	-0.0340	0.001156	ASPH
1273	821029.50	597695.54	1181.72	-0.0020	0.000004	ASPH
1274	821026.59	597695.52	1181.51	0.0540	0.002916	ASPH
1275	821024.58	597695.50	1181.38	0.0390	0.001521	ASPH
1276	820353.86	602713.85	1107.85	0.3950	0.156025	BRUSH/LOW
1277	820350.88	602712.03	1108.04	0.4870	0.237169	BRUSH/LOW
1278	820347.42	602711.30	1108.01	0.5340	0.285156	BRUSH/LOW
1279	820344.14	602711.36	1108.06	0.4130	0.170569	BRUSH/LOW
1280	820340.30	602711.55	1107.97	0.6080	0.369664	BRUSH/LOW
1281	820339.26	602708.02	1108.01	0.8300	0.688900	BRUSH/LOW
1282	820343.27	602707.79	1108.50	0.3150	0.099225	BRUSH/LOW
1283	820346.42	602707.32	1108.56	0.3650	0.133225	BRUSH/LOW
1284	820348.90	602707.17	1108.32	0.5170	0.267289	BRUSH/LOW
1285	820352.68	602706.28	1108.22	0.5530	0.305809	BRUSH/LOW
1286	820351.52	602701.87	1108.59	0.6280	0.394384	BRUSH/LOW
1287	820348.21	602702.29	1108.77	0.6280	0.394384	BRUSH/LOW
1288	820345.31	602703.27	1109.33	0.0420	0.001764	BRUSH/LOW
1289	820342.19	602705.52	1109.00	0.0760	0.005776	BRUSH/LOW
1291	820355.87	602715.82	1107.55	0.4040	0.163216	BRUSH/LOW
1292	820351.45	602718.47	1107.88	0.0090	0.000081	BRUSH/LOW
1293	820347.05	602719.00	1107.32	0.5920	0.350464	BRUSH/LOW
1294	820343.87	602719.95	1107.46	0.5320	0.283024	BRUSH/LOW
1295	820339.85	602721.74	1107.37	0.3460	0.119716	BRUSH/LOW
1296	820341.81	602726.54	1106.85	0.6100	0.372100	BRUSH/LOW
1297	820345.82	602725.82	1107.01	0.6360	0.404496	BRUSH/LOW



1298	820349.44	602724.90	1107.10	0.5270	0.277729 BRUSH/LOW
1299	820354.04	602723.38	1106.90	0.9290	0.863041 BRUSH/LOW
1300	820358.29	602722.17	1107.06	0.7960	0.633616 BRUSH/LOW
1301	820433.95	602775.55	1103.34	0.4890	0.239121 TALL GRASS
1302	820431.19	602772.47	1103.65	0.5170	0.267289 TALL GRASS
1303	820429.25	602770.11	1103.69	0.5930	0.351649 TALL GRASS
1304	820427.39	602767.62	1103.72	0.6300	0.396900 TALL GRASS
1305	820425.15	602765.21	1103.87	0.7040	0.495616 TALL GRASS
1306	820427.90	602762.51	1103.82	0.4540	0.206116 TALL GRASS
1307	820430.34	602765.13	1103.76	0.4070	0.165649 TALL GRASS
1308	820432.57	602767.88	1103.55	0.6320	0.399424 TALL GRASS
1309	820434.49	602770.49	1103.35	0.4980	0.248004 TALL GRASS
1310	820436.72	602772.46	1103.19	0.7250	0.525625 TALL GRASS
1311	820440.04	602770.66	1103.07	0.9050	0.819025 TALL GRASS
1312	820438.28	602767.31	1103.26	0.6030	0.363609 TALL GRASS
1313	820436.88	602764.21	1103.29	0.6320	0.399424 TALL GRASS
1314	820435.05	602761.53	1103.25	0.8900	0.792100 TALL GRASS
1315	820434.17	602758.51	1103.37	0.7320	0.535824 TALL GRASS
1316	820437.28	602756.91	1103.27	0.5430	0.294849 TALL GRASS
1317	820438.91	602759.62	1103.16	0.6790	0.461041 TALL GRASS
1318	820440.81	602762.26	1103.14	0.6590	0.434281 TALL GRASS
1319	820442.36	602764.33	1102.92	0.8260	0.682276 TALL GRASS
1320	820444.36	602766.37	1102.95	0.7110	0.505521 TALL GRASS
1321	820447.89	602763.50	1102.60	0.4340	0.188356 TALL GRASS
1322	820445.52	602761.03	1102.86	0.5730	0.328329 TALL GRASS
1323	820444.33	602757.84	1102.85	0.6620	0.438244 TALL GRASS
1324	820441.19	602755.09	1102.84	0.7700	0.592900 TALL GRASS
1325	820438.72	602756.45	1103.13	0.6100	0.372100 TALL GRASS
1326	820466.29	602968.29	1101.72	0.6400	0.409600 TREE COVE
1327	820463.34	602967.42	1101.97	0.1230	0.015129 TREE COVE
1328	820460.94	602966.78	1101.59	0.3970	0.157609 TREE COVE
1329	820461.29	602963.74	1101.42	0.6990	0.488601 TREE COVE
1330	820465.21	602964.25	1101.87	0.4870	0.237169 TREE COVE
1331	820468.75	602965.13	1101.63	1.1320	1.281424 TREE COVE
1332	820472.55	602966.06	1102.84	0.2440	0.059536 TREE COVE
1333	820478.68	602968.20	1102.83	0.1670	0.027889 TREE COVE
1334	820480.15	602964.27	1102.35	0.7290	0.531441 TREE COVE
1335	820475.34	602963.56	1102.43	0.8390	0.703921 TREE COVE
1336	820471.34	602963.55	1102.50	0.2840	0.080656 TREE COVE
1337	820467.56	602963.20	1102.19	0.4280	0.183184 TREE COVE
1338	820464.14	602963.02	1101.83	0.4410	0.194481 TREE COVE
1339	820468.23	602957.61	1102.23	0.5300	0.280900 TREE COVE
1340	820471.00	602958.57	1102.38	0.4700	0.220900 TREE COVE
1341	820474.51	602959.16	1102.83	0.1180	0.013924 TREE COVE
1342	820477.88	602960.09	1102.25	0.7860	0.617796 TREE COVE
1343	820477.91	602956.39	1102.64	0.4270	0.182329 TREE COVE
1344	820473.73	602956.61	1102.83	0.1780	0.031684 TREE COVE
1345	820470.91	602955.44	1102.50	0.4720	0.222784 TREE COVE
1346	820461.55	602951.09	1101.59	0.4840	0.234256 TREE COVE
1347	820465.12	602951.86	1101.63	0.9860	0.972196 TREE COVE
1348	820469.21	602951.57	1101.91	0.7700	0.592900 TREE COVE
1349	820473.38	602951.88	1102.85	0.0490	0.002401 TREE COVE
1350	820476.48	602951.50	1101.93	1.0110	1.022121 TREE COVE
1351	822849.92	615356.82	722.02	0.0110	0.000121 CK
1352	875414.36	643437.08	684.06	0.2130	0.045369 CK
1353	875414.42	643437.08	684.10	0.1770	0.031329 CK
1354	875414.44	643437.09	684.07	0.2100	0.044100 CK
1355	738057.40	570521.73	731.28	-0.0050	0.000025 CK
1356	738057.43	570521.82	731.21	0.0680	0.004624 CK
1357	740470.15	488770.57	977.72	-0.2030	0.041209 CK
1400	827917.53	481731.57	977.74	0.3900	0.152100 CK
1401	823435.78	466995.68	993.42	-0.0470	0.002209 ASPH
1402	823438.63	466996.67	993.41	0.0070	0.000049 ASPH

1403	823440.94	466997.94	993.38	-0.0630	0.003969 ASPH
1404	823443.45	466998.49	993.27	0.2670	0.071289 ASPH
1405	823445.76	466999.30	993.45	-0.3330	0.110889 ASPH
1406	823445.78	466996.04	993.49	-0.0510	0.002601 ASPH
1407	823442.02	466994.89	993.65	-0.0490	0.002401 ASPH
1408	823439.06	466993.66	993.50	0.0060	0.000036 ASPH
1409	823435.88	466992.82	993.65	-0.2420	0.058564 ASPH
1410	823433.06	466991.86	993.69	-0.2530	0.064009 ASPH
1411	823434.12	466988.29	993.59	-0.1530	0.023409 ASPH
1412	823436.86	466989.08	993.65	0.1460	0.021316 ASPH
1413	823439.08	466989.80	993.60	-0.0540	0.002916 ASPH
1414	823441.51	466990.57	993.50	0.0130	0.000169 ASPH
1415	823443.78	466991.27	993.46	0.0560	0.003136 ASPH
1416	823444.16	466987.63	993.48	-0.2260	0.051076 ASPH
1417	823441.65	466986.82	993.67	-0.3820	0.145924 ASPH
1418	823438.19	466985.55	993.55	-0.0270	0.000729 ASPH
1419	823434.83	466984.89	993.60	0.0200	0.000400 ASPH
1420	823432.74	466984.30	993.76	-0.0470	0.002209 ASPH
1421	823433.71	466979.85	993.75	-0.1620	0.026244 ASPH
1422	823436.80	466980.83	993.75	-0.1830	0.033489 ASPH
1423	823439.44	466981.41	993.63	-0.3550	0.126025 ASPH
1424	823442.17	466982.08	993.59	-0.3090	0.095481 ASPH
1425	823445.67	466982.67	993.52	0.0950	0.009025 ASPH
1426	823333.98	467098.67	991.15	-0.4390	0.192721 CONC
1427	823331.29	467097.56	991.23	-0.2360	0.055696 CONC
1428	823328.30	467096.28	991.25	-0.1650	0.027225 CONC
1429	823325.94	467095.40	991.45	-0.3410	0.116281 CONC
1430	823323.42	467094.42	991.44	-0.2630	0.069169 CONC
1431	823322.44	467097.73	991.44	-0.2930	0.085849 CONC
1432	823325.56	467098.67	991.40	-0.3870	0.149769 CONC
1433	823327.62	467099.69	991.21	-0.2360	0.055696 CONC
1434	823329.82	467100.37	991.09	-0.1600	0.025600 CONC
1435	823331.96	467101.15	991.10	-0.3600	0.129600 CONC
1436	823330.62	467104.07	991.04	-0.2760	0.076176 CONC
1437	823327.63	467102.25	991.19	-0.3550	0.126025 CONC
1438	823325.34	467101.30	991.30	-0.4180	0.174724 CONC
1439	823322.95	467100.29	991.42	-0.3050	0.093025 CONC
1440	823320.46	467099.21	991.52	-0.3500	0.122500 CONC
1441	823319.88	467102.64	991.42	-0.3070	0.094249 CONC
1442	823322.54	467103.27	991.30	-0.2710	0.073441 CONC
1443	823324.74	467104.18	991.19	-0.4110	0.168921 CONC
1444	823327.07	467105.09	991.13	-0.4270	0.182329 CONC
1445	823329.57	467106.01	990.97	-0.2640	0.069696 CONC
1446	823328.22	467109.00	991.04	-0.3500	0.122500 CONC
1447	823325.54	467107.80	991.21	-0.4750	0.225625 CONC
1448	823323.01	467106.84	991.22	-0.2540	0.064516 CONC
1449	823320.62	467106.04	991.34	-0.2570	0.066049 CONC
1450	823318.25	467105.12	991.51	-0.3130	0.097969 CONC
1451	823485.64	467197.81	988.91	1.0860	1.179396 MOWED GRASS
1452	823486.72	467194.94	988.98	1.0580	1.119364 MOWED GRASS
1453	823487.82	467192.46	989.07	1.1090	1.229881 MOWED GRASS
1454	823488.68	467189.88	989.04	1.2350	1.525225 MOWED GRASS
1455	823489.78	467187.33	989.03	1.1670	1.361889 MOWED GRASS
1456	823486.48	467186.13	989.07	1.0570	1.117249 MOWED GRASS
1457	823485.45	467189.76	989.09	1.1240	1.263376 MOWED GRASS
1458	823484.52	467192.16	988.90	1.1760	1.382976 MOWED GRASS
1459	823483.41	467194.82	988.94	1.0290	1.058841 MOWED GRASS
1460	823482.72	467197.13	988.96	0.9700	0.940900 MOWED GRASS
1461	823480.12	467195.84	989.00	1.0520	1.106704 MOWED GRASS
1462	823481.42	467192.38	989.03	1.0560	1.115136 MOWED GRASS
1463	823482.27	467190.14	989.05	1.0980	1.205604 MOWED GRASS
1464	823482.95	467187.53	989.03	1.1730	1.375929 MOWED GRASS
1465	823483.89	467184.87	989.03	0.9770	0.954529 MOWED GRASS

1466	823480.70	467183.78	988.92	1.3470	1.814409 MOWED GRASS
1467	823479.84	467186.93	989.13	1.0760	1.157776 MOWED GRASS
1468	823478.83	467189.46	989.07	1.1100	1.232100 MOWED GRASS
1469	823477.67	467192.37	989.07	0.9640	0.929296 MOWED GRASS
1470	823476.95	467194.85	989.17	0.8100	0.656100 MOWED GRASS
1471	823473.99	467193.48	989.13	0.9820	0.964324 MOWED GRASS
1472	823474.65	467190.01	989.25	0.9370	0.877969 MOWED GRASS
1473	823475.80	467186.93	989.34	0.9120	0.831744 MOWED GRASS
1474	823476.82	467184.34	989.36	0.8890	0.790321 MOWED GRASS
1475	823477.72	467181.63	989.46	0.8200	0.672400 MOWED GRASS
1476	820687.19	479040.69	898.81	-0.1570	0.024649 TALL GRASS
1477	820684.02	479040.39	898.84	-0.0230	0.000529 TALL GRASS
1478	820681.27	479039.75	898.93	-0.1080	0.011664 TALL GRASS
1479	820690.11	479041.72	898.85	-0.1820	0.033124 TALL GRASS
1480	820693.50	479042.25	898.88	-0.0160	0.000256 TALL GRASS
1481	820694.12	479038.70	898.83	0.0410	0.001681 TALL GRASS
1482	820691.43	479038.39	898.74	-0.0520	0.002704 TALL GRASS
1484	820685.55	479037.45	898.79	-0.0160	0.000256 TALL GRASS
1485	820682.20	479036.67	899.22	-0.3230	0.104329 TALL GRASS
1486	820683.03	479033.88	899.03	-0.2560	0.065536 TALL GRASS
1487	820686.14	479034.91	899.29	-0.5110	0.261121 TALL GRASS
1488	820689.32	479035.82	898.97	-0.3330	0.110889 TALL GRASS
1489	820691.98	479035.78	899.21	-0.4560	0.207936 TALL GRASS
1490	820694.66	479035.95	899.47	-0.5330	0.284089 TALL GRASS
1491	820696.01	479033.07	899.25	-0.0800	0.006400 TALL GRASS
1492	820692.24	479033.40	899.00	-0.2240	0.050176 TALL GRASS
1493	820689.07	479032.50	899.15	-0.3870	0.149769 TALL GRASS
1494	820686.31	479032.05	899.20	-0.4690	0.219961 TALL GRASS
1495	820683.68	479031.46	898.52	0.1890	0.035721 TALL GRASS
1496	820684.94	479028.97	899.33	-0.4590	0.210681 TALL GRASS
1497	820687.88	479029.69	898.87	-0.2360	0.055696 TALL GRASS
1498	820690.74	479031.11	898.59	0.1270	0.016129 TALL GRASS
1499	820693.52	479029.44	899.26	-0.5190	0.269361 TALL GRASS
1500	820695.95	479029.46	899.12	-0.0170	0.000289 TALL GRASS
1501	820387.20	479052.42	914.22	0.0920	0.008464 TREE COVE
1502	820386.01	479049.56	914.64	-0.1910	0.036481 TREE COVE
1503	820385.04	479047.05	914.84	-0.0530	0.002809 TREE COVE
1504	820383.94	479044.35	915.13	-0.0860	0.007396 TREE COVE
1505	820382.91	479041.79	915.47	-0.1290	0.016641 TREE COVE
1506	820380.34	479042.98	915.37	-0.0240	0.000576 TREE COVE
1507	820381.56	479045.98	914.94	-0.1800	0.032400 TREE COVE
1508	820382.46	479048.26	914.72	-0.1200	0.014400 TREE COVE
1509	820383.76	479050.95	914.58	-0.0040	0.000016 TREE COVE
1510	820384.76	479053.24	914.36	-0.0920	0.008464 TREE COVE
1511	820382.68	479054.54	914.22	-0.0960	0.009216 TREE COVE
1512	820381.04	479052.07	914.43	-0.0980	0.009604 TREE COVE
1513	820380.10	479049.16	914.73	-0.0580	0.003364 TREE COVE
1514	820379.13	479046.86	914.92	0.0070	0.000049 TREE COVE
1515	820378.02	479044.47	915.25	0.0920	0.008464 TREE COVE
1516	820375.13	479046.12	915.12	-0.0520	0.002704 TREE COVE
1517	820376.62	479049.14	914.84	-0.0730	0.005329 TREE COVE
1518	820377.81	479051.97	914.64	-0.0570	0.003249 TREE COVE
1519	820379.34	479054.71	914.33	-0.0570	0.003249 TREE COVE
1520	820380.56	479057.21	914.18	-0.2880	0.082944 TREE COVE
1521	820377.91	479058.68	913.99	-0.0960	0.009216 TREE COVE
1522	820376.33	479056.48	914.28	-0.2590	0.067081 TREE COVE
1523	820375.17	479054.26	914.56	-0.1530	0.023409 TREE COVE
1524	820373.99	479052.00	914.81	-0.3000	0.090000 TREE COVE
1525	820372.64	479049.71	914.98	-0.1700	0.028900 TREE COVE
1526	816415.79	473741.47	881.88	0.0360	0.001296 BRUSH/LOW
1527	816412.17	473742.17	881.78	-0.0830	0.006889 BRUSH/LOW
1528	816408.30	473741.80	881.70	0.3430	0.117649 BRUSH/LOW
1529	816406.33	473741.93	881.93	0.1170	0.013689 BRUSH/LOW

1530	816403.19	473741.41	881.35	0.3640	0.132496	BRUSH/LOW
1531	816403.49	473744.81	881.68	0.2030	0.041209	BRUSH/LOW
1532	816406.17	473745.05	881.82	0.3840	0.147456	BRUSH/LOW
1533	816408.61	473744.72	881.73	0.5480	0.300304	BRUSH/LOW
1534	816412.51	473745.33	881.48	0.2240	0.050176	BRUSH/LOW
1535	816415.94	473746.51	881.82	-0.0630	0.003969	BRUSH/LOW
1536	816410.06	473737.50	881.53	0.1690	0.028561	BRUSH/LOW
1537	816412.08	473738.52	882.02	-0.3780	0.142884	BRUSH/LOW
1538	816414.09	473738.26	881.87	0.0730	0.005329	BRUSH/LOW
1539	816416.77	473739.40	882.15	-0.1490	0.022201	BRUSH/LOW
1540	816419.60	473740.59	882.11	0.3050	0.093025	BRUSH/LOW
1541	816420.83	473737.48	882.31	0.5410	0.292681	BRUSH/LOW
1542	816417.51	473736.31	882.19	0.0350	0.001225	BRUSH/LOW
1543	816414.95	473736.02	881.93	0.2490	0.062001	BRUSH/LOW
1544	816413.10	473734.35	882.11	0.1030	0.010609	BRUSH/LOW
1545	816410.11	473733.50	882.14	0.0120	0.000144	BRUSH/LOW
1546	816413.15	473731.06	882.22	-0.0620	0.003844	BRUSH/LOW
1547	816415.81	473731.82	882.23	0.0050	0.000025	BRUSH/LOW
1548	816419.83	473733.52	882.41	0.2200	0.048400	BRUSH/LOW
1549	816421.47	473733.42	882.73	0.0360	0.001296	BRUSH/LOW
1550	816422.67	473735.56	882.73	0.1520	0.023104	BRUSH/LOW
1551	827917.51	481731.55	977.77	0.3620	0.131044	CK
1552	827917.55	481731.64	977.81	0.3080	0.094864	CK
1553	894163.50	423967.75	1027.19	0.2800	0.078400	CK
1554	894163.48	423967.68	1027.21	0.2580	0.066564	CK
5013	894163.48	423967.76	1027.19	0.2810	0.078961	CP
5015	868379.42	415605.61	960.98	0.1800	0.032400	CP
5034	759696.34	475549.99	948.31	-0.1040	0.010816	CP
5035	740470.20	488770.53	977.60	-0.0770	0.005929	CP
5040	738057.41	570521.88	731.23	0.0440	0.001936	CP
5042	827917.51	481731.59	977.75	0.3730	0.139129	CP
5051	875414.40	643437.08	684.06	0.2160	0.046656	CP
5052	852839.06	646148.22	672.27	0.1890	0.035721	CP
5053	822849.88	615356.87	722.06	-0.0260	0.000676	CP
5268	876956.92	544954.53	1092.23	0.4430	0.196249	CP
5306	813058.44	472350.39	974.62	0.0300	0.000900	CP
5312	874079.26	558919.67	1105.39	0.3040	0.092416	CP
5318	801793.55	557441.19	1128.71	0.0750	0.005625	CP
5319	808461.37	544381.08	1031.55	0.3790	0.143641	CP
5326	729545.93	561887.65	1099.90	0.7290	0.531441	CP
5330	812521.32	606691.17	1184.12	0.4350	0.189225	CP

Sum	87.145781
Average	0.181176
RMSE	0.425648
AccuracyZ	0.834270

**FIELD NOTES**

Project FEMA ground survey notes

Contains point number and descriptions

Includes Control and Check Points left out of statistical analysis

9-6-11 Grant County LIDAR checks/Ground-Truthing

Jace Veyster

Base: VRS

Rover: Trimble RG

- Checked into PID "DH531Z" (Pt. 1000) (NGS Mon)
- Did vertical localization ✓
- Horizontal ✓

Site 2:

Mowed Grass: 1001-1025

Tall Grass/Weeds: 1026-1050

~~R~~ Tree Cover: 1051-1075

Brush/Low Trees: 1076-1100

Gravel: 1101-1125

Asphalt: 1126-1150

- Checked into PID "DH5318" End ✓ (NGS Mon)
- (Pt. 1153)

9-7-11

Grant County LIDAR checks/Ground-Truthing

Jace Veyster 3

Base: VRS

Rover: Trimble R8

- Checked into PID "DH5053" (Pt. 1200) (NGS Mon)
- Vertical ✓
- Horizontal ✓

Site 1:

Mowed Grass: 1201-1225

Gravel: 1226-1250

Asphalt: 1251-1275

Brush/Low Trees: 1276-1300

Tall Grass/Weeds: 1301-1325

Tree Cover: 1326-1350

- Checked into PID "DH5053" End ✓ (NGS Mon)
- (Pt. 1351)

9-8-11 Grant County L. Dike checks / Ground-Truthing

Jace  
Vegetar

Base: VRS

Rover: Trimble RS

(Nas mon.)

- Checked into PID "DH5042" (Pl. 1400)

Vertical ✓ (within 0.02)

Horizontal ✓

Site 3: Asphalt: 1401-1425

Concrete: 1426-1450

Mowed Grass: 1451-1475

Tall Grass/Woeds: 1476-1500

Tree Cover: 1501-1525

Brush/Low Trees: 1526-1550

- Checked into PID "DH5042" <sup>(Nas mon.)</sup> END

(Pl. 1551)