

# AIRBORNE LIDAR TASK ORDER REPORT



## USGS OLYMPIC PENINSULA WA QL1 LIDAR UNITED STATES GEOLOGICAL SURVEY (USGS)

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# PROJECT REPORT

## PROJECT NAME: USGS OLYMPIC PENINSULA WA QL1 LIDAR WOOLPERT PROJECT #73622

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# SECTION 1: OVERVIEW

## PROJECT NAME: USGS OLYMPIC PENINSULA WA QL1 LIDAR

### WOOLPERT PROJECT #73622

This report contains a comprehensive outline of the Olympic Peninsula WA QL1 LiDAR Processing task order for the United States Geological Survey (USGS). This task is issued under Contract Number G10PC00057, as task order number G13PD00849. The project area covers approximately 437 square miles along with a 100 meter buffer of the Olympic Peninsula in the counties of Jefferson and Clallam in north-western coastal Washington. The LiDAR was collected and processed to meet a maximum Nominal Post Spacing (NPS) of 0.35 meters. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath.

The data was collected using a combination of Leica ALS60 and ALS70 Multiple Pulses in Air (MPiA) LiDAR sensors mounted in a Partenavia aircraft.

The ALS60 sensor collects up to four returns per pulse, as well as intensity data, for the first three returns. If a fourth return was captured, the system does not record an associated intensity value. The aerial LiDAR was collected at the following sensor specifications:

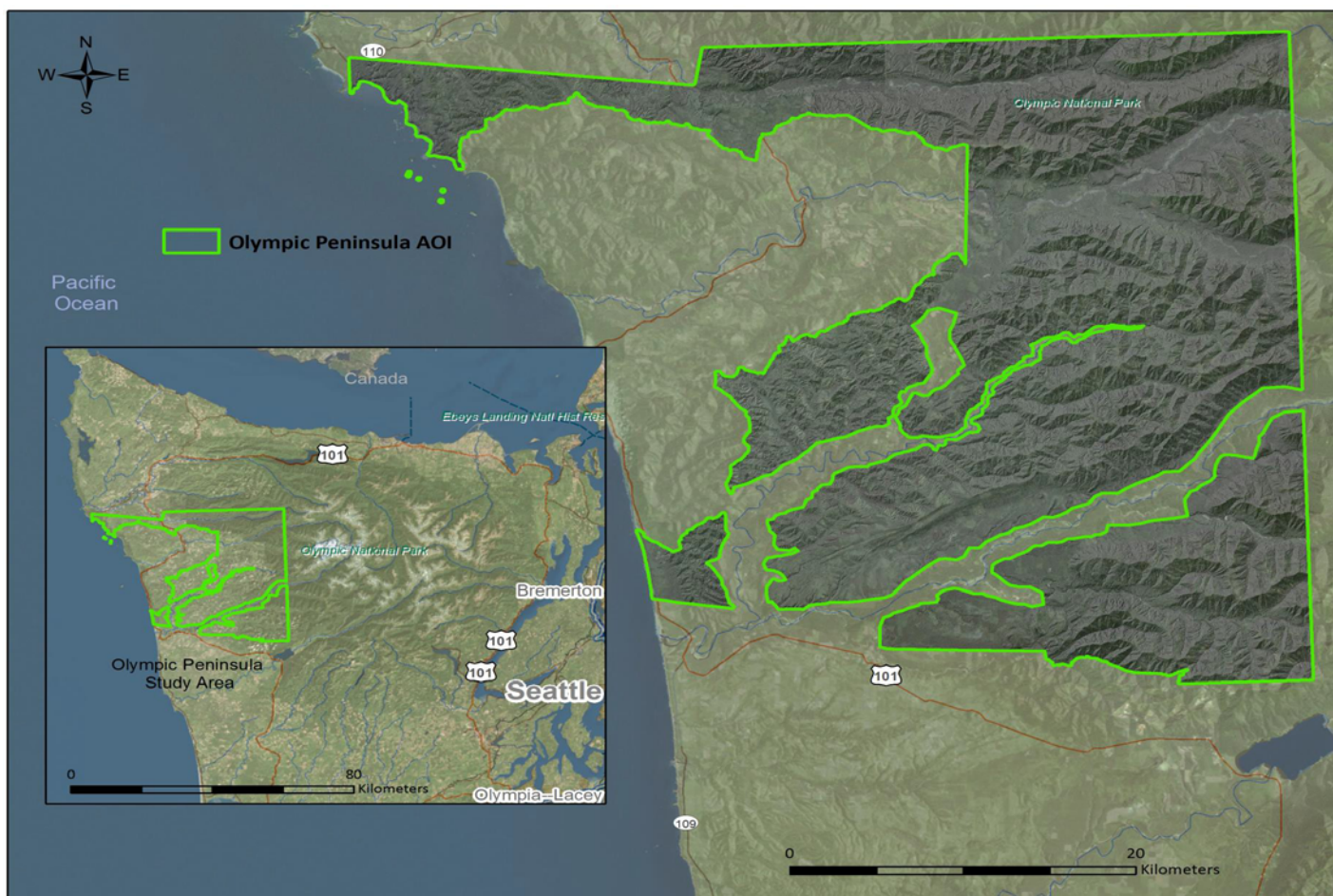
Post Spacing (Minimum):	1.15 ft. / 0.35m
AGL (Above Ground Level) average flying height:	2,953 ft. / 900 m
MSL (Mean Sea Level) average flying height:	variable
Average Ground Speed:	variable
Field of View (full):	28 degrees
Pulse Rate:	95-106 kHz
Scan Rate:	63.6 Hz
Side Lap (Average):	50%

The ALS70 sensor collects up to four returns per pulse, as well as intensity data, for the first three returns. If a fourth return was captured, the system does not record an associated intensity value. The aerial LiDAR was collected at the following sensor specifications:

Post Spacing (Minimum):	1.15 ft. / 0.35m
AGL (Above Ground Level) average flying height:	4,265 ft. / 1,300 m
MSL (Mean Sea Level) average flying height:	variable
Average Ground Speed:	variable
Field of View (full):	28-30 degrees
Pulse Rate:	180-199 kHz
Scan Rate:	41.7 Hz
Side Lap (Average):	50%

The LiDAR data was processed and projected in UTM, Zone 10, North American Datum of 1983 (2011) in units of meters. The vertical datum used for the task order was referenced to NAVD 1988, GEOID12A, in units of meters. In addition, a second data set covering the same AOI was processed in Washington State Plane South Zone, North American Datum of 1983 (HARN) in units of survey feet. The vertical datum used for this was referenced to NAVD 1988, GEOID12A, in units of survey feet.

Figure 1.1 LiDAR Task Order AOI



## SECTION 2: ACQUISITION

The data was collected using a combination of Leica ALS60 and ALS70 Multiple Pulses in Air (MPiA) LiDAR sensors mounted in a Partenavia aircraft.

In preparation for data collection, the contractor reviewed the project area and developed a specialized flight plan to ensure complete coverage of the Olympic Peninsula LiDAR study area at the target point density of  $\geq 8.0$  points/m<sup>2</sup> (0.74 points/ft<sup>2</sup>). Acquisition parameters including orientation relative to terrain, flight altitude, pulse rate, scan angle, and ground speed were adapted to optimize flight paths and flight times while meeting all contract specifications.

Factors such as satellite constellation availability and weather windows must be considered during the planning stage. Any weather hazards or conditions affecting the flight were continuously monitored due to their potential impact on the daily success of airborne and ground operations. In addition, logistical considerations including private property access and potential air space restrictions were reviewed.

All areas were surveyed with an opposing flight line side-lap of  $\geq 50\%$  ( $\geq 100\%$  overlap) in order to reduce laser shadowing and increase surface laser painting. To accurately solve for laser point position (geographic coordinates x, y and z), the positional coordinates of the airborne sensor and the attitude of the aircraft were recorded continuously throughout the LiDAR data collection mission. Position of the aircraft was measured twice per second (2 Hz) by an onboard differential GPS unit, and aircraft attitude was measured 200 times per second (200 Hz) as pitch, roll and yaw (heading) from an onboard inertial measurement unit (IMU). To allow for post-processing correction and calibration, aircraft and sensor position and attitude data are indexed by GPS time.

Table 2.1: ALS60 LiDAR System Specifications

The ALS70 200 kHz Multiple Pulses in Air (MPiA) LiDAR System has the following specifications:

Table 2.2: ALS60 LiDAR System Specifications	
Specification	
Operating Altitude	200 - 6,000 meters
Scan Angle	0 to 75° (variable)
Swath Width	0 to 1.5 X altitude (variable)
Scan Frequency	0 - 100 Hz (variable based on scan angle)
Maximum Pulse Rate	200 kHz
Range Resolution	Better than 1 cm
Elevation Accuracy	8 - 24 cm single shot (one standard deviation)
Horizontal Accuracy	7 - 64 cm (one standard deviation)
Number of Returns per Pulse	4 (first, second, third, last)
Number of Intensities	3 (first, second, third)
Intensity Digitization	8 bit intensity + 8 bit AGC (Automatic Gain Control) level
MPiA (Multiple Pulses in Air)	8 bits @ 1nsec interval @ 50kHz

Table 2.2: ALS60 LiDAR System Specifications	
Specification	
Laser Beam Divergence	0.22 mrad @ $1/e^2$ (-0.15 mrad @ $1/e$ )
Laser Classification	Class IV laser product (FDA CFR 21)
Eye Safe Range	400m single shot depending on laser repetition rate
Roll Stabilization	Automatic adaptive, range = 75 degrees minus current FOV
Power Requirements	28 VDC @ 25A
Operating Temperature	0-40°C
Humidity	0-95% non-condensing
Supported GNSS Receivers	Ashtech Z12, Trimble 7400, Novatel Millenium

Table 2.2: ALS70 LiDAR System Specifications

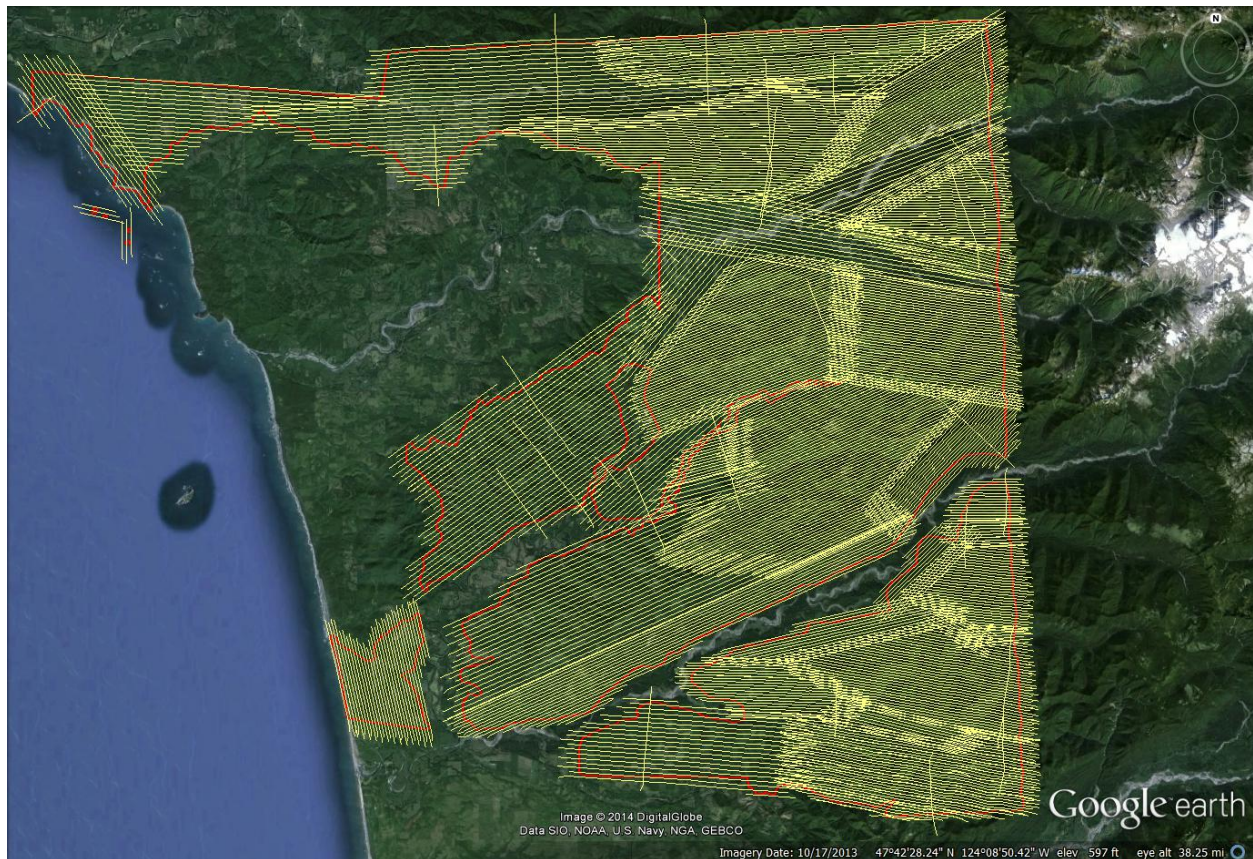
The ALS70 500 kHz Multiple Pulses in Air (MPiA) LiDAR System has the following specifications:

Specification	
Operating Altitude	200 - 3,500 meters
Scan Angle	0 to 75° (variable)
Swath Width	0 to 1.5 X altitude (variable)
Scan Frequency	0 - 200 Hz (variable based on scan angle)
Maximum Pulse Rate	500 kHz (Effective)
Range Resolution	Better than 1 cm
Elevation Accuracy	7 - 16 cm single shot (one standard deviation)
Horizontal Accuracy	5 - 38 cm (one standard deviation)
Number of Returns per Pulse	7 (infinite)
Number of Intensities	3 (first, second, third)
Intensity Digitization	8 bit intensity + 8 bit AGC (Automatic Gain Control) level
MPiA (Multiple Pulses in Air)	8 bits @ 1nsec interval @ 50kHz
Laser Beam Divergence	0.22 mrad @ $1/e^2$ (-0.15 mrad @ $1/e$ )
Laser Classification	Class IV laser product (FDA CFR 21)
Eye Safe Range	400m single shot depending on laser repetition rate
Roll Stabilization	Automatic adaptive, range = 75 degrees minus current FOV
Power Requirements	28 VDC @ 25A
Operating Temperature	0-40°C
Humidity	0-95% non-condensing
Supported GNSS Receivers	Ashtech Z12, Trimble 7400, Novatel Millenium

The LiDAR data was collected in twenty-one (21) separate missions, flown as close together as the weather permitted, to ensure consistent ground conditions across the project area.

An initial quality control process was performed immediately on the LiDAR data to review the data coverage, airborne GPS data, and trajectory solution. Any gaps found in the LiDAR data were relayed to the flight crew, and the area was re-flown.

Figure 2.1: LiDAR Flight Layout





# SECTION 3: LIDAR DATA PROCESSING

## APPLICATIONS AND WORK FLOW OVERVIEW

1. Resolve kinematic corrections for aircraft position data using kinematic aircraft GPS and static ground GPS data. Develop a smoothed best estimate of trajectory (SBET) file that blends post-processed aircraft position with sensor head position and attitude recorded throughout the survey.  
**Software:** IPAS TC v3.1, Waypoint GPS v8.3, Trimble Business Center v3.00, Graphic Calculator 2013.
2. Calculate laser point position by associating SBET position to each laser point return time, scan angle, intensity, etc. Create raw laser point cloud data for the entire survey in \*.las (ASPRS v. 1.2) format. Convert data to orthometric elevations by applying a Geoid12A correction.  
**Software:** ALS Post Processing Software v.2.74.
3. Import raw laser points into manageable blocks (less than 500 MB) to perform manual relative accuracy calibration and filter erroneous points. Classify ground points for individual flight lines.  
**Software:** TerraScan v.14.
4. Using ground classified points per each flight line, test the relative accuracy. Perform automated line-to-line calibrations for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift. Calculate calibrations on ground classified points from paired flight lines and apply results to all points in a flight line. Use every flight line for relative accuracy calibration.  
**Software:** TerraScan v.14.
5. Classify resulting data to ground and other client designated ASPRS classifications. Assess statistical absolute accuracy via direct comparisons of ground classified points to ground control survey data  
**Software:** TerraScan v.14, TerraModeler v.14.
6. Generate bare earth models as triangulated surfaces. Generate highest hit models as a surface expression of all classified points. Export all surface models as 1m EDRAS Imagine (.img) files and 3 ft ESRI Grids.  
**Software:** TerraScan v.14, TerraModeler v14, ArcMap v10.1
7. Export intensity images as GeoTIFFs at 1m and 3ft pixel resolutions  
**Software:** TerraScan v.14, TerraModeler v14, ArcMap v10.1

## LIDAR DATA PROCESSING

When the sensor calibration, data acquisition, and GPS processing phases were complete, the formal data reduction processes included:

- Processed individual flight lines to derive a raw “Point Cloud” LAS file. Matched overlapping flight lines, generated statistics for evaluation comparisons, and made the necessary adjustments to remove any residual systematic error.

- Calibrated LAS files were imported into the task order tiles and initially filtered to create a ground and non-ground class. Then additional classes were filtered as necessary to meet client specified classes.
- Once all project data was imported and classified, survey ground control data was imported and calculated for an accuracy assessment. As a QC measure, Woolpert has developed a routine to generate accuracy statistical reports by comparisons against the TIN and the DEM using surveyed ground control of higher accuracy. The LiDAR is adjusted accordingly to meet or exceed the vertical accuracy requirements.
- The LiDAR tiles were reviewed using a series of proprietary QA/QC procedures to ensure it fulfills the task order requirements. A portion of this requires a manual step to ensure anomalies have been removed from the ground class.
- The LiDAR LAS files are classified into the Default (Class 1), Ground (Class 2), Noise (Class 7), Water (Class 9), Ignored Ground (Class 10) classifications.
- FGDC Compliant metadata was developed for the task order in .xml format for the final data products.
- The horizontal datum used for the task order was referenced to UTM, Zone 10, North American Datum of 1983 (2011) in units of meters. The vertical datum used for the task order was referenced to NAVD88, GEOID12A, in units of meters. In addition, a second data set covering the same AOI was processed in Washington State Plane South Zone, North American Datum of 1983 (HARN) in units of survey feet. The vertical datum used for this was referenced to NAVD 1988, GEOID12A, in units of survey feet.

# SECTION 4: HYDROLOGIC FLATTENING

## HYDROLOGIC FLATTENING OF LIDAR DEM DATA

Olympic Peninsula WA QL1 LiDAR Processing task order required the compilation of breaklines defining water bodies and rivers. The breaklines were used to perform the hydrologic flattening of water bodies, and gradient hydrologic flattening of double line streams and rivers. Lakes, reservoirs and ponds, at a minimum size of 2-acres or greater, were compiled as closed polygons. The closed water bodies were collected at a constant elevation. Rivers and streams, at a nominal minimum width of 30.5 meters (100 feet), were compiled in the direction of flow with both sides of the stream maintaining an equal gradient elevation.

## LIDAR DATA REVIEW AND PROCESSING

The following steps were utilized to hydrologically flatten the water bodies and for gradient hydrologic flattening of the double line streams within the existing LiDAR data.

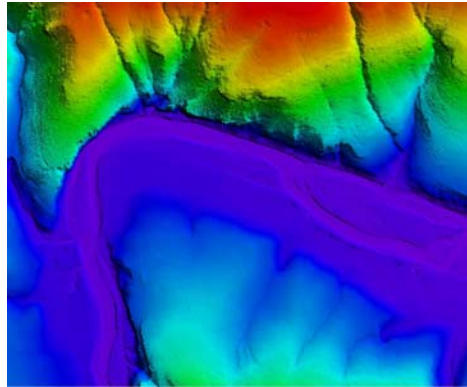
Lakes and other closed water bodies within the study area that met a minimum area of 2 acres or streams that met a minimum width of 100-ft were flattened to a consistent water level. The hydro-flattening process eliminates artifacts in the digital terrain model caused by both increased variability in ranges or dropouts in laser returns due to the low reflectivity of water.

Hydro-flattening of closed water bodies was performed using a combination of automated and manual detection and adjustment techniques designed to identify water boundaries and levels. Water boundary polygons were developed using an algorithm which weights LiDAR-derived slopes, intensities, and return densities to detect the water's edge. Water's edge polygons were then manually reviewed and edited as necessary.

Once polygons were developed, water elevations were obtained from the filtered LiDAR returns. Lakes were assigned a consistent elevation for an entire polygon while rivers were assigned consistent elevations on opposing banks and smoothed to ensure downstream flow through the entire river channel. The initial ground classified points falling within water polygons were reclassified as water points to omit them from the final ground model.

Water's edge breaklines were then incorporated into the hydro-flattened DEM by enforcing triangle edges (adjacent to the breakline) to the elevation values of the breakline. This implementation corrected interpolation along the hard edge. Water surfaces were obtained from a TIN of the 3-D water's edge breaklines resulting in the final hydro flattened model ([Figure 4.1](#)).

Figure 4.1



1. All ground points were reclassified from inside the hydrologic feature polygons to water, class nine (9).
2. All ground points were reclassified from within a buffer along the hydrologic feature breaklines to buffered ground, class ten (10).
3. The LiDAR ground points and hydrologic feature breaklines were used to generate a new digital elevation model (DEM).

Figure 4.2



Figure 4.3



Figure 4.2 reflects a DEM generated from original LiDAR bare earth point data prior to the hydrologic flattening process. Note the “tinning” across the lake surface.

Figure 4.3 reflects a DEM generated from LiDAR with breaklines compiled to define the hydrologic features. This figure illustrates the results of adding the breaklines to hydrologically flatten the DEM data. Note the smooth appearance of the lake surface in the DEM.

Terrascan was used to add the hydrologic breakline vertices and export the lattice models. The hydrologically flattened DEM data was provided to USGS in ERDAS .IMG format at a 1-meter cell size. In addition, the hydrologically flattened DEM data was provided to the USGS in ESRI ArcGrid format at a 3-

foot cell size.

The hydrologic breaklines compiled as part of the flattening process were provided to the USGS as an ESRI shapefile. The breaklines defining the water bodies greater than 2-acres were provided as a PolygonZ file. The breaklines compiled for the gradient flattening of all rivers and streams at a nominal minimum width of 30.5 meters (100 feet) were provided as a PolylineZ file.

## DATA QA/QC

Initial QA/QC for this task order was performed in Global Mapper v15, by reviewing the grids and hydrologic breakline features. Additionally, ESRI software and proprietary methods were used to review the overall connectivity of the hydrologic breaklines.

Edits and corrections were addressed individually by tile. If a water body breakline needed to be adjusted to improve the flattening of the DEM data, the area was cross referenced by tile number, corrected accordingly, a new DEM file was regenerated and reviewed.

# SECTION 5: FINAL ACCURACY ASSESSMENT

## FINAL VERTICAL ACCURACY ASSESSMENT

The vertical accuracy statistics were calculated by comparison of the LiDAR bare earth points to the ground surveyed quality check points.

Table 5.1: Overall Vertical Accuracy Statistics UTM 10N, NAD83 (2011), NAVD88, GEOID12A

Average error	0.046	meters
Minimum error	-0.070	meters
Maximum error	0.230	meters
Root mean square	0.073	meters
Standard deviation	0.057	meters

Table 5.2: Swath Quality Check Point Analysis, FVA, UTM 10N, NAD83 (2011), NAVD88, GEOID12A

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Dz (meters)
2001	416261.7	5291687	228.64	0.05
2002	416498.9	5291524	228.96	0.11
2003	416531.7	5291463	230.57	0.04
2004	416757.7	5291199	237.44	0.04
2005	416697.7	5291269	236.48	0.12
2006	416630.2	5290675	236.39	0.06
2007	416628.6	5290676	236.47	0.1
2008	416629.3	5290678	236.42	0.04
2009	416630.8	5290679	236.33	0.01
2010	416633.6	5290681	236.19	0.02
2011	416636	5290681	236.09	-0.02
2012	416637.8	5290680	236.01	0
2013	416638.8	5290679	235.9	0.08
2014	416641.4	5290681	236.44	0.18
2015	416639.8	5290674	235.44	0
2016	416639.6	5290672	235.33	-0.04

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Dz (meters)
2017	416640.5	5290670	235.07	0
2018	416639.8	5290668	234.94	-0.05
2019	416640.1	5290666	234.89	0.11
2020	416636.2	5290660	235.49	0.13
2021	416629.9	5290663	235.62	0.01
2022	416627.8	5290666	235.88	0.21
2023	416624.5	5290671	235.69	0.14
2024	416622.8	5290675	235.71	0.09
2025	416621	5290677	235.64	0.09
2026	416617.4	5290683	235.54	0.03
2027	416626.1	5290699	235.71	0.06
2028	416623.9	5290702	235.99	-0.01
2029	416659.8	5290664	231.82	0.01
2030	416661.6	5290666	231.79	0.05
2031	416664.4	5290667	231.75	0.03
2032	416667.1	5290667	231.83	-0.02
2033	416669.6	5290670	232.01	0.04
2034	416671.8	5290670	232.05	0.05
2035	416673.5	5290672	232.04	0.04
2036	416675.1	5290674	232.1	0.05
2037	416677.7	5290675	232.15	0.08
2038	416679.1	5290673	231.98	0.1
2039	416681.1	5290673	231.97	0.06
2040	416683.3	5290673	231.93	0
2041	416681.3	5290678	232.14	0.04
2042	416679.2	5290680	232.21	0
2043	416676.7	5290683	232.19	0.01

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Dz (meters)
2044	416674.8	5290685	232.15	0.03
2045	416672.8	5290683	232.08	0.06
2046	416665.8	5290687	231.76	0.01
2047	416663.1	5290688	231.83	-0.01
2048	416660.4	5290689	231.83	0.02
2049	416658.3	5290689	231.82	0.02
2050	416655.1	5290691	231.93	0.04
2051	416655.5	5290694	231.86	0.04
2052	416649.6	5290698	231.89	0.05
2053	416648.8	5290699	231.87	-0.01
2054	416648.7	5290700	231.77	0.06
2055	416649.3	5290702	231.48	-0.05
2056	416650.8	5290703	231.23	0.06
2057	416651.8	5290705	230.88	-0.07
2058	416649	5290704	231.23	0.11
2059	425639.9	5295586	218.71	0.11
2060	425711.5	5295540	218.39	0.09
2061	425767.9	5295445	216.49	0.13
2062	426636.7	5295065	216.67	0.01
2063	426639.7	5295084	217.37	0.05
2064	426508.2	5295424	222.68	0.03
2065	426387.2	5295566	225.08	0.06
2066	425855.6	5295632	219.78	0.14
2067	419941.4	5296181	134.31	0.08
2068	416703.2	5273546	142.76	0.05
2069	416369.6	5273244	137.6	0.01
2070	416489.9	5273340	140.09	-0.01



Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Dz (meters)
2071	414944.8	5272971	120.47	0.05
2072	414719.9	5272559	115.82	0.01
2073	414750.3	5272685	115.63	0.03
2074	414773.6	5272771	115.9	0.03
2075	410013.2	5272466	274.77	-0.02
2076	410067.3	5272481	276.83	-0.01
2077	411070.8	5272935	303.19	0.08
2078	410907.3	5272867	298.04	0
2079	410641.9	5272763	293.43	0.01
2080	410447	5272691	289.17	0
2081	410226.2	5272570	282.31	0.18
2082	413803	5265750	132.66	0.05
2083	413779.5	5265726	131.97	-0.01
2084	413717.4	5265664	130.31	0.09
2085	405072.9	5283105	392.67	0.23
2086	405066	5283093	393.59	0.05
2087	390928.1	5302149	203.73	-0.04
2088	390852.6	5302985	190.98	0.08
2089	390876.2	5302972	189.92	0.08
2090	390834.2	5303000	191.92	-0.01

## VERTICAL ACCURACY CONCLUSIONS

LAS Swath Fundamental Vertical Accuracy (FVA) Tested 0.143 meters fundamental vertical accuracy at 95 percent confidence level, derived according to NSSDA, in open terrain in open using (RMSEz) x 1.9600, tested against the TIN.

Bare-Earth DEM Fundamental Vertical Accuracy (FVA) Tested 0.122 meters fundamental vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 Tested against the DEM.

## SUPPLEMENTAL VERTICAL ACCURACY ASSESSMENTS

Table 5.3: Quality Check Point Analysis, Urban, UTM 10N, NAD83 (2011), NAVD88 GEOID12A

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Dz (meters)
3001	416840.07	5290741.394	231.69	0.079
3002	416839.096	5290744.285	231.43	0.018
3003	416837.965	5290747.096	231.24	0.057
3004	416837.232	5290749.034	231.15	0.048
3005	416836.437	5290751.15	231.05	0.039
3006	416835.643	5290753.271	230.98	0.011
3007	416834.776	5290755.319	230.86	0.041
3008	416834.052	5290757.721	230.79	0.01
3009	416833.168	5290759.84	230.72	0.019
3010	416832.339	5290762.008	230.59	0.024
3011	416831.544	5290764.095	230.5	0.029
3012	416830.864	5290766.221	230.38	0.07
3013	416829.993	5290768.705	230.33	0.012
3014	416829.301	5290770.792	230.27	0.005
3015	416828.563	5290772.824	230.17	0.018
3016	416827.749	5290774.705	230.08	0.043
3017	416826.772	5290777.705	230	0.018
3018	416826.015	5290779.746	229.93	0.014
3019	416825.148	5290782.176	229.89	0.019
3020	416824.223	5290785.039	229.82	0.018
3021	416823.29	5290787.85	229.74	0.008
3022	416822.519	5290790.365	229.68	0.023
3023	416821.61	5290792.761	229.66	0.012

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Dz (meters)
3024	416820.636	5290795.244	229.64	0.021
3025	416819.64	5290797.92	229.66	0.003
3026	416818.706	5290800.795	229.66	0.038
3027	416817.641	5290803.274	229.72	0.027
3028	416816.578	5290806.145	229.81	0.007

## ACCURACY CONCLUSIONS

Urban Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.065 meters supplemental vertical accuracy at the 95th percentile in the Urban supplemental class reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Urban Errors larger than 95th percentile include:

- Point 3001, Easting 416840.07, Northing 5290741.394, Z-Error 0.079 meters

Table 5.4: Quality Check Point Analysis, Tall Weeds and Crops, UTM 10N, NAD83 (2011), NAVD88 GEOID12A

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4001	419268.034	5291123.698	564.12	0.178
4002	419269.031	5291123.526	564.32	0.054
4003	419257.155	5291125.319	562.97	0.158
4004	419258.348	5291124.906	562.73	0.177
4005	419258.219	5291124.067	562.73	0.454
4006	419254.04	5291126.541	562.32	0.062
4007	419328.48	5291138.335	572.97	0.342
4008	421304.092	5291423.073	726.96	0.105
4009	421302.981	5291423.503	726.82	0.024
4010	421301.311	5291423.478	726.72	0.07
4011	421299.674	5291423.359	726.54	0.064

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4012	421300.792	5291425.475	726.77	0.005
4013	421305.542	5291428.039	727.3	0.027
4014	421306.079	5291429.317	727.41	0.019
4015	421307.481	5291430.273	727.54	0.027
4016	421306.05	5291424.436	727.18	0.088
4017	421307.69	5290755.284	781.88	0.079
4018	416215.76	5291725.424	229.15	0.058
4019	416235.643	5291721.353	228.29	0.037
4020	421353.359	5290363.859	825.21	0.016
4021	421379.975	5290388.866	832.39	0.037
4022	421376.715	5290374.166	830.68	0.06
4023	416517.938	5291498.203	229.57	0.032
4024	421375.489	5290373.485	830.51	0.052
4025	416858.727	5291107.231	235.58	0
4026	416747.038	5291208.918	237.06	0.093
4027	415599.168	5284343.61	258.74	0.008
4028	415476.065	5284433.674	254.1	0.078
4029	421369.649	5290331.479	826.39	0.005
4030	421370.807	5290331.44	826.07	0.17
4031	421371.821	5290330.637	825.48	0.234
4032	421370.926	5290333.336	826.16	0.206
4033	421370.143	5290335.366	826.23	0.044
4034	421369.547	5290337.199	826.11	0.009
4035	421369.261	5290339.916	826.03	0.015
4036	421366.037	5290348.085	826.24	0.105
4037	421364.074	5290350.32	825.96	0.153
4038	421352.151	5290358.233	825.45	0.006

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4039	421352.276	5290359.827	825.38	0.007
4040	421352.304	5290362.066	825.2	0.03
4041	421352.706	5290364.157	825.13	0.019
4042	421352.941	5290366.937	825.03	0.033
4043	421354.033	5290369.375	824.87	0.03
4044	421354.643	5290371.665	824.69	0.004
4045	417000.712	5290781.548	228.57	0.003
4046	416998.265	5290781.002	228.72	0.018
4047	416995.885	5290779.326	228.82	0.002
4048	416995.014	5290776.436	228.93	0.041
4049	416987.426	5290788.503	228.65	0.046
4050	416982.713	5290788.644	228.58	0.021
4051	416978.636	5290788.321	228.54	0.017
4052	416975.328	5290788.469	228.52	0.008
4053	416971.817	5290788.173	228.49	0.047
4054	416937.778	5290798.538	228.52	0.018
4055	416935.181	5290801.297	228.44	0.016
4056	416931.082	5290803.18	228.36	0.04
4057	416928.29	5290804.799	228.46	0.009
4058	416925.662	5290807.727	228.52	0.057
4059	425606.035	5295643.073	218.73	0.067
4060	425645.437	5295585.31	218.57	0.009
4061	425677.398	5295555.225	218.43	0.007
4062	425700.789	5295380.692	214.44	0.059
4063	425720.969	5295405.305	214.63	0.165
4064	425735.546	5295431.012	215.32	0.083
4065	426638.107	5295088.239	217.33	0.057

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4066	426534.787	5295285.774	220.58	0.026
4067	426523.029	5295343.316	221.5	0.032
4068	426504.402	5295455.268	223.12	0.052
4069	426249.198	5295655.647	225.65	0.004
4070	426131.072	5295631.543	224.32	0.061
4071	425969.362	5295640.323	221.6	0.058
4072	425824.041	5295599.59	219.71	0.014
4073	425805.836	5295517.017	216.86	0.051
4074	423518.13	5295080.405	189.39	0.063
4075	423491.793	5295080.82	190.39	0.099
4076	423338.909	5295079.997	196.13	0.089
4077	420022.35	5296194.657	132.2	0.018
4078	419973.683	5296186.101	133.25	0.058
4079	423160.738	5296768.692	131.44	0.034
4080	423096.786	5296738.084	131.22	0.028
4081	416748.567	5273561.048	142.84	0.099
4082	416685.995	5273511.644	141.4	0.006
4083	416393.376	5273251.276	139.14	0.045
4084	416458.895	5273309.901	138.96	0.004
4085	411026.166	5272915.106	301.62	0.1
4086	410911.325	5272870.093	298.05	0.069
4087	410782.041	5272805.915	296.18	0.054
4088	410617.335	5272745.287	293.23	0.07
4089	410428.02	5272668.199	287.87	0.078
4090	428815.513	5271310.787	788.25	0.033
4091	430823.644	5263439.538	775.51	0.112
4092	430551.038	5263407.71	769.59	0.004

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4093	430490.079	5263370.547	768.3	0.068
4094	425152.025	5267651.928	591.73	0.078
4095	424888.878	5267632.446	606.17	0.022
4096	423959.204	5267257.107	571.2	0.105
4097	423774.086	5267258.135	555.9	0.043
4098	420578.314	5272111.734	164.76	0.024
4099	420577.736	5272108.798	164.76	0.026
4100	420579.024	5272105.567	164.74	0.018
4101	420578.614	5272103.121	164.7	0.057
4102	420579.317	5272101.05	164.76	0.029
4103	420579.938	5272099.596	164.74	0.02
4104	420580.265	5272097.96	164.8	0.038
4105	420580.613	5272096.534	164.75	0.003
4106	420581.63	5272095.638	164.85	0.022
4107	420590.293	5272095.969	164.99	0.043
4108	420591.663	5272095.866	165.09	0.031
4109	420591.751	5272094.409	165.11	0
4110	420592.947	5272094.046	165.15	0.026
4111	420592.617	5272091.333	165.17	0.008
4112	420592.583	5272086.996	165.09	0.038
4113	420592.536	5272085.416	165.11	0.081
4114	420592.673	5272082.749	165.08	0.016
4115	420593.313	5272081.323	165.14	0.053
4116	420594.378	5272076.13	165.1	0.032
4117	420594.851	5272074.088	165.13	0.033
4118	420595.416	5272072.388	165.11	0.001
4119	420595.339	5272069.807	165.08	0.047

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4120	420595.951	5272068.652	165.11	0.04
4121	420596.271	5272065.844	165.08	0.01
4122	420596.99	5272063.565	165.11	0.063
4123	420597.058	5272061	165.2	0.092
4124	420597.229	5272058.378	165.21	0.018
4125	420598.011	5272054.743	165.16	0.034
4126	401180.328	5269836.234	118.71	0.01
4127	401181.411	5269834.927	118.39	0.03
4128	401184.372	5269833.216	117.99	0.098
4129	401186.643	5269831.709	117.45	0.033
4130	401189.407	5269829.243	116.96	0.002
4131	401193.696	5269827.093	116.37	0.107
4132	401200.464	5269830.316	115.77	0.027
4133	401203.376	5269828.483	115.32	0.017
4134	401206.024	5269826.802	114.79	0.059
4135	401208.976	5269824.906	114.45	0.06
4136	401210.208	5269817.365	113.66	0.002
4137	401217.702	5269812.828	112.44	0.044
4138	401221.172	5269811.202	111.95	0.07
4139	401224.833	5269808.569	111.32	0.118
4140	401232.927	5269810.864	110.57	0.304
4141	401236.346	5269808.661	109.98	0.176
4142	401238.912	5269807.034	109.66	0.206
4143	401236.194	5269801.926	109.3	0.019
4144	401240.261	5269799.754	108.88	0.054
4145	401242.178	5269798.204	108.62	0.086
4146	401244.769	5269796.628	108.37	0.14



Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4147	401247.198	5269794.9	107.84	0.117
4148	401249.752	5269793.525	107.83	0.118
4149	401252.324	5269791.391	107.47	0.046
4150	401259.171	5269784.143	106.66	0.037
4151	401262.644	5269781.135	106.32	0.112
4152	401264.165	5269778.952	106	0.06
4153	401267.176	5269777.197	105.68	0.014
4154	399441.259	5269359.332	121.17	0.145
4155	399440.521	5269360.222	121.12	0.075
4156	399439.838	5269361.381	120.91	0.01
4157	399441.604	5269361.645	121.18	0.138
4158	399444.111	5269361.568	121.48	0.201
4159	399444.965	5269363.034	121.39	0.008
4160	399445.757	5269364.633	121.62	0.127
4161	399447.738	5269365.24	121.71	0.028
4162	399448.717	5269366.888	121.79	0.131
4163	399450.168	5269367.923	122.12	0.173
4164	399451.33	5269369.215	122.25	0.047
4165	399451.963	5269370.208	122.31	0.03
4166	399452.265	5269371.788	122.46	0.11
4167	399453.188	5269372.646	122.48	0.055
4168	399461.196	5269369.584	122.6	0.212
4169	399461.796	5269370.35	122.65	0.176
4170	399462.383	5269371.088	122.77	0.194
4171	399463.534	5269372.036	122.91	0.056
4172	399464.06	5269373.245	123.11	0.252
4173	399464.548	5269374.21	123.04	0.1

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4174	399464.844	5269375.131	123.14	0.152
4175	399465.659	5269376.416	123.21	0.14
4176	399466.763	5269378.146	123.45	0.145
4177	399467.99	5269379.905	123.59	0.029
4178	399468.744	5269382.252	123.84	0.215
4179	397591.995	5268999.433	11.36	0.054
4180	397591.032	5269001.361	11.43	0.111
4181	397590.647	5269003.515	11.38	0.022
4182	397590.211	5269005.402	11.42	0.037
4183	397589.718	5269007.657	11.53	0.038
4184	397589.6	5269010.129	11.58	0.029
4185	397588.068	5269016.003	11.64	0.001
4186	397588.116	5269019.51	11.67	0.046
4187	397588.267	5269022.227	11.65	0.04
4188	397588.525	5269025.07	11.63	0.029
4189	397587.493	5269027.491	11.51	0.017
4190	397587.035	5269031.319	11.58	0.143
4191	397587.128	5269034.1	11.62	0.112
4192	397586.994	5269036.899	11.57	0.038
4193	397586.47	5269039.402	11.56	0.005
4194	397586.097	5269042.119	11.56	0.031
4195	397585.649	5269044.881	11.53	0.018
4196	397585.545	5269046.628	11.54	0.001
4197	397584.766	5269052.622	11.51	0.019
4198	397584.663	5269055.246	11.56	0.002
4199	397584.585	5269057.399	11.54	0.001
4200	397583.919	5269059.787	11.53	0.011

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4201	397583.828	5269062.21	11.47	0.04
4202	397583.709	5269064.34	11.46	0.025
4203	397582.104	5269065.827	11.45	0.002
4204	397580.549	5269068.17	11.4	0.016
4205	405489.653	5274490.729	162.81	0.054
4206	405489.539	5274488.322	162.88	0.034
4207	405489.658	5274485.951	162.96	0.141
4208	405489.768	5274483.327	163.04	0.136
4209	405490.093	5274480.658	163.12	0.083
4210	405490.125	5274478.989	163.14	0.102
4211	405490.291	5274477.106	163.04	0.042
4212	405490.212	5274474.701	163.12	0.098
4213	405490.424	5274471.005	163.23	0.039
4214	405491.449	5274456.665	164.49	0.083
4215	405491.66	5274454.291	164.64	0.058
4216	405491.723	5274452.294	164.79	0.006
4217	405491.455	5274448.825	165.16	0.052
4218	405491.947	5274445.715	165.34	0.015
4219	405491.886	5274443.14	165.49	0.019
4220	405491.962	5274440.77	165.6	0.038
4221	405492.415	5274435.754	165.83	0.028
4222	405492.279	5274432.745	165.98	0.023
4223	405492.589	5274430.302	166.14	0.011
4224	405493.085	5274427.71	166.28	0.019
4225	405493.165	5274424.626	166.45	0.035
4226	405493.158	5274421.201	166.6	0.136
4227	405493.709	5274416.881	166.54	0.014

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
4228	405493.816	5274413.617	166.65	0.005
4229	405494.157	5274409.995	166.9	0.136
4230	405500.028	5274397.579	167.31	0.074
4231	405494.751	5274390.484	167.86	0.033
4232	405494.814	5274386.197	168.04	0.074
4233	413930.674	5291398.8	527.15	0.003
4234	402735.099	5299396.056	187.95	0.042
4235	402733.616	5299401.995	187.76	0.097
4236	402735.272	5299384.101	188.37	0.029
4237	402961.118	5300055.183	177.5	0.08
4238	402951.71	5300058.063	177.3	0.025
4239	404262.525	5301959.247	175.75	0.045
4240	404340.352	5301690.385	179.42	0.027
4241	404036.952	5301372.866	186.22	0.05
4242	403998.298	5301255.057	186.67	0.292
4243	417812.667	5265433.835	179.82	0.072
4244	405724.506	5278135.202	174.77	0.108
4245	405707.134	5278161.947	177.18	0.045
4246	405194.834	5278479.344	192.21	0.004
4247	405186.551	5278450.363	190.04	0.089
4248	405199.901	5278397.886	186.52	0.01
4249	389860.682	5304230.525	173.7	0.115
4250	390650.871	5303375.126	180.13	0.061
4251	389998.141	5304021.594	156.29	0.018
4252	389970.67	5304322.936	138.61	0.334

## ACCURACY CONCLUSIONS

Tall Weeds and Crops Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.185 meters supplemental vertical accuracy at the 95th percentile in the Tall Weeds and Crops supplemental class and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Tall Weeds and Crops Errors larger than 95th percentile include:

- Point 4005, Easting 419258.219, Northing 5291124.067, Z-Error 0.454 meters
- Point 4007, Easting 419328.48, Northing 5291138.335, Z-Error 0.342 meters
- Point 4031, Easting 421371.821, Northing 5290330.637, Z-Error 0.234 meters
- Point 4032, Easting 421370.926, Northing 5290333.336, Z-Error 0.206 meters
- Point 4140, Easting 401232.927, Northing 5269810.864, Z-Error 0.304 meters
- Point 4142, Easting 401238.912, Northing 5269807.034, Z-Error 0.206 meters
- Point 4158, Easting 399444.111, Northing 5269361.568, Z-Error 0.201 meters
- Point 4168, Easting 399461.196, Northing 5269369.584, Z-Error 0.212 meters
- Point 4170, Easting 399462.383, Northing 5269371.088, Z-Error 0.194 meters
- Point 4172, Easting 399464.06, Northing 5269373.245, Z-Error 0.252 meters
- Point 4178, Easting 399468.744, Northing 5269382.252, Z-Error 0.215 meters
- Point 4242, Easting 403998.298, Northing 5301255.057, Z-Error 0.292 meters

Table 5.5: Quality Check Point Analysis, Brush Lands and Trees, UTM 10N, NAD83 (2011), NAVD88 GEOID12A

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5001	416253.792	5291677.137	229.46	0.014
5002	415504.769	5284403.013	256.17	0.03
5003	420866.725	5289038.303	810.14	0.102
5004	420865.547	5289037.291	810.15	0.069
5005	420863.48	5289036.072	809.8	0.32
5006	420860.877	5289034.033	809.09	0.09
5007	420865.59	5289039.479	810.16	0.036
5008	420868.594	5289038.172	809.84	0.159
5009	420870.383	5289039.903	809.98	0.161
5010	420871.262	5289039.188	809.68	0.207
5011	420871.302	5289038.188	809.29	0.313
5012	420872.361	5289038.367	809.1	0.363
5013	420871.876	5289037.301	808.87	0.099

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5014	420870.662	5289036.839	808.71	0.309
5015	420869.942	5289036.182	808.91	0.101
5016	420868.667	5289036.026	809.08	0.079
5017	420862.206	5289029.306	805.88	0.125
5018	420862.508	5289027.824	805.22	0.263
5019	420862.486	5289026.663	804.97	0.229
5020	420866.83	5289027.521	805.2	0.031
5021	420868.443	5289026.913	804.79	0.282
5022	420868.809	5289028.616	805.55	0.108
5023	416760.093	5290824.884	241.69	0.129
5024	416758.596	5290822.847	241.79	0.181
5025	416755.86	5290821.074	241.93	0.125
5026	416748.057	5290814.796	241.47	0.076
5027	416747.995	5290810.58	241.01	0.147
5028	416744.663	5290808.322	241.43	0.233
5029	416741.13	5290806.525	242.13	0.06
5030	416738.412	5290806.878	243.11	0.103
5031	416734.235	5290808.619	243.64	0.062
5032	416731.027	5290809.954	244.11	0.002
5033	416725.848	5290807.68	244.5	0.095
5034	416722.301	5290805.729	243.81	0.081
5035	416715.827	5290801.801	242.9	0.232
5036	416712.578	5290796.571	243.1	0.088
5037	416713.756	5290791.843	242.7	0.084
5038	416975.973	5290793.762	228.68	0.038
5039	416972.023	5290795.594	228.71	0.096
5040	416968.453	5290795.709	228.54	0.008

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5041	416965.037	5290797.144	228.48	0.045
5042	416811.716	5291166.659	236.59	0.014
5043	416810.746	5291171.066	236.73	0.112
5044	416811.053	5291174.697	236.99	0.073
5045	416811.391	5291178.198	236.98	0.15
5046	416812.536	5291181.879	237.15	0.01
5047	416813.695	5291186	237.58	0.067
5048	416815.442	5291190.524	237.99	0.048
5049	416819.633	5291192.36	237.92	0.044
5050	416816.984	5291200.134	237.36	0.059
5051	416817.298	5291201.815	237.18	0.087
5052	416813.907	5291206.974	237.1	0.119
5053	416811.006	5291213.185	237.8	0.011
5054	416808.071	5291212.274	238.08	0.064
5055	416804.078	5291212.6	238.34	0.086
5056	416800.301	5291213.679	238.53	0.026
5057	416798.185	5291215.5	238.69	0.001
5058	416794.213	5291217.46	238.55	0.1
5059	416790.961	5291219.364	238.73	0.115
5060	416788.335	5291220.225	238.81	0.095
5061	416785.57	5291219.29	238.67	0.067
5062	416782.312	5291218.555	238.69	0.16
5063	416779.321	5291221.365	238.68	0.078
5064	416774.834	5291222.113	237.99	0.037
5065	416769.8	5291222.225	237.46	0.059
5066	416767.665	5291223.655	237.36	0.113
5067	416762.613	5291225.461	237.18	0.07

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5068	416759.137	5291228.96	237.25	0.067
5069	416754.79	5291229.52	237.17	0.062
5070	416750.839	5291229.501	237.15	0.007
5071	416741.662	5291238.43	236.87	0.049
5072	416740.922	5291241.987	236.94	0.078
5073	416736.768	5291246.16	236.98	0.101
5074	416738.615	5291252.658	236.98	0.079
5075	416737.587	5291254.953	237.03	0.086
5076	416731.57	5291259.998	236.62	0.028
5077	416730.373	5291257.409	236.71	0.072
5078	416725.759	5291261.071	236.79	0.074
5079	416723.299	5291264.606	236.85	0.035
5080	416721.239	5291289.291	238.72	0.096
5081	416721.174	5291296.262	239	0.077
5082	416720.492	5291302.327	239.01	0.029
5083	416719.007	5291305.883	239.07	0.044
5084	416728.983	5291300.32	239.49	0.04
5085	416741.85	5291292.446	240.11	0.06
5086	416768.402	5291292.557	238	0
5087	416775.131	5291293.59	237.43	0.036
5088	416783.556	5291291.887	236.72	0.005
5089	416791.181	5291293.162	236.56	0.015
5090	416823.696	5291276.838	233.95	0.089
5091	416825.158	5291275.147	234.05	0.072
5092	416826.979	5291272.646	233.95	0.031
5093	416829.933	5291275.144	234.11	0.094
5094	416831.517	5291272.233	234.19	0.028



Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5095	416832.322	5291265.274	234.23	0.038
5096	416832.685	5291263.178	233.94	0.057
5097	416835.759	5291259.697	233.19	0.093
5098	425507.109	5295671.108	218.57	0.03
5099	425514.729	5295652.855	218.73	0.131
5100	425525.369	5295663.169	218.56	0.077
5101	425522.97	5295675.7	218.57	0.115
5102	425580.145	5295657.614	219.24	0.036
5103	425613.303	5295628.188	219.4	0.071
5104	425662.468	5295578.034	218.68	0.032
5105	425672.227	5295548.743	218.19	0.09
5106	425742.701	5295499.219	218.02	0.03
5107	425774.445	5295442.214	216.81	0.02
5108	426703.675	5295023.95	216.73	0.06
5109	426495.06	5295421.457	222.44	0.001
5110	426469.236	5295516.034	224.35	0.221
5111	426351.97	5295614.094	225.54	0.158
5112	425879.621	5295632.412	219.62	0.088
5113	423467.89	5295070.017	191.49	0.026
5114	423286.018	5295084.006	196.45	0.141
5115	423330.35	5295068.076	196.94	0.034
5116	420150.244	5296256.971	128.55	0.035
5117	420028.611	5296196.915	132.35	0.186
5118	416748.309	5273545.793	142.37	0.174
5119	416390.776	5273245.316	138.92	0.005
5120	414938.388	5273008.774	120.8	0.011
5121	414917.028	5272960.072	119.74	0.025

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5122	414817.612	5272868.483	118.22	0.002
5123	410072.188	5272478.031	276.65	0.001
5124	399461.9	5269392.336	123.68	0.165
5125	399461.622	5269390.81	123.77	0.052
5126	399459.912	5269391.301	123.38	0.097
5127	399460.194	5269389.783	123.63	0.208
5128	399458.596	5269389.874	123.38	0.138
5129	399458.465	5269388.384	123.41	0.164
5130	399456.331	5269388.61	123.19	0.154
5131	399457.516	5269386.911	123.41	0.213
5132	399455.453	5269386.346	123.34	0.212
5133	399454.055	5269386.042	123.16	0.084
5134	399455.218	5269385.078	123.29	0.093
5135	399455.197	5269383.714	123.41	0.195
5136	399456.202	5269383.012	123.47	0.104
5137	399452.783	5269382.37	123.15	0.007
5138	399452.439	5269379.766	122.72	0.156
5139	399451.611	5269378.641	122.5	0.221
5140	399450.544	5269376.399	122.16	0.133
5141	399448.771	5269375.551	121.9	0.038
5142	399448.183	5269375.055	121.9	0.156
5143	399447.7	5269375.413	121.63	0.069
5144	399448.865	5269374.228	122.04	0.219
5145	399447.57	5269373.796	122.05	0.289
5146	399446.1	5269373.164	121.78	0.176
5147	399446.017	5269370.332	121.5	0.25
5148	399444.242	5269370.621	121.28	0.072

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5149	397588.839	5268992.246	10.86	0.041
5150	397587.351	5268992.335	10.73	0.319
5151	397585.334	5268995.666	10.04	0.249
5152	397584.717	5268997.264	9.77	0.072
5153	397583.804	5268997.525	9.3	0.066
5154	397583.729	5268995.233	9.06	0.057
5155	397582.687	5268995.306	8.7	0.224
5156	397581.99	5268996.986	8.17	0.201
5157	397581.396	5268994.928	8.03	0.237
5158	397580.018	5268997.141	7.92	0.303
5159	397579.278	5268996.397	7.53	0.19
5160	397579.928	5268994.224	7.17	0.142
5161	397578.745	5268993.686	6.7	0.186
5162	397577.577	5268995.18	6.82	0.335
5163	397575.637	5268994.246	6.19	0.146
5164	397578.653	5268987.509	5.98	0.067
5165	397578.726	5268986.43	6.08	0.103
5166	397581.704	5268982.657	6.35	0.012
5167	397583.323	5268979.317	7.1	0.031
5168	397584.616	5268981.93	7.78	0.37
5169	397585.668	5268983.337	9.14	0.036
5170	397586.154	5268985.937	9.83	0.245
5171	397587.154	5268986.749	10.34	0.259
5172	397589.141	5268987.037	10.97	0.164
5173	405493.94	5274379.378	168.37	0.025
5174	405493.24	5274378.077	168.53	0.053
5175	405492.536	5274377.622	168.65	0.116

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5176	405493.955	5274376.411	168.57	0.029
5177	405492.299	5274376.04	168.7	0.039
5178	405493.864	5274374.345	168.78	0.004
5179	405492.517	5274373.681	168.84	0.053
5180	405493.517	5274372.601	168.85	0.093
5181	405491.975	5274372.194	168.88	0.113
5182	405493.247	5274371.256	168.92	0.007
5183	405492.936	5274369.894	169.32	0.263
5184	405494.459	5274368.337	169.42	0.059
5185	405492.684	5274367.576	169.45	0.131
5186	405492.036	5274366.446	169.51	0.063
5187	405493.677	5274365.215	169.57	0.032
5188	405493.12	5274363.184	169.86	0.013
5189	405491.627	5274362.813	169.71	0.113
5190	405491.816	5274361.419	169.95	0.095
5191	405491.845	5274360.548	170.15	0.134
5192	405491.379	5274359.848	170.18	0.004
5193	405491.565	5274359.101	170.18	0.074
5194	405491.115	5274358.391	170.22	0.079
5195	405493.175	5274358.265	170.31	0.091
5196	405504.569	5274360.4	170	0.147
5197	405504.837	5274358.829	170.06	0.207
5198	405504.878	5274357.935	170.1	0.182
5199	405506.001	5274355.398	170.22	0.016
5200	413932.253	5291394.351	527.06	0.051
5201	402633.342	5299323.944	193.08	0.174
5202	402632.042	5299321.299	193.22	0.084

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
5203	402731.849	5299389.524	188.18	0.118
5204	402804.118	5299440.539	187	0.07
5205	402862.318	5299621.427	185.95	0.033
5206	403787.81	5300317.743	182.24	0.201
5207	403800.324	5300349.143	181.57	0.122
5208	404243.614	5302160.838	180.34	0.062
5209	404244.625	5302152.939	180.58	0.091
5210	404114.446	5302064.265	174.14	0.277
5211	404201.45	5301586.806	183.19	0.179
5212	403973.133	5301237.637	186.34	0.053
5213	413786.166	5265738.628	132.61	0.192
5214	417762.39	5265385.96	170.2	0.022
5215	417868.197	5265486.147	187.86	0.149
5216	417937.444	5265635.871	192.92	0.033
5217	417892.208	5265538.659	192.55	0.018
5218	405722.923	5278150.821	175.73	0.147
5219	405717.93	5278158.8	176.7	0.114
5220	405185.06	5278503.59	192.28	0.021
5221	405188.502	5278493.067	192.16	0.03
5222	390655.562	5303364.875	180.52	0.057
5223	390646.912	5303381.441	180.23	0.082
5224	390032.18	5303996.306	156.72	0.14
5225	389994.897	5304026.358	156.36	0.156

## ACCURACY CONCLUSIONS

Brush Lands and Trees Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.263

meters supplemental vertical accuracy at the 95th percentile in the Brush Lands and Trees supplemental class reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Brush Lands and Trees Errors larger than 95th percentile include:

- Point 5005, Easting 420863.48, Northing 5289036.072, Z-Error 0.320 meters
- Point 5011, Easting 420871.302, Northing 5289038.188, Z-Error 0.313 meters
- Point 5012, Easting 420872.361, Northing 5289038.367, Z-Error 0.363 meters
- Point 5014, Easting 420870.662, Northing 5289036.839, Z-Error 0.309 meters
- Point 5021, Easting 420868.443, Northing 5289026.913, Z-Error 0.282 meters
- Point 5145, Easting 399447.57, Northing 5269373.796, Z-Error 0.289 meters
- Point 5150, Easting 397587.351, Northing 5268992.335, Z-Error 0.319 meters
- Point 5158, Easting 397580.018, Northing 5268997.141, Z-Error 0.303 meters
- Point 5162, Easting 397577.577, Northing 5268995.18, Z-Error 0.335 meters
- Point 5168, Easting 397584.616, Northing 5268981.93, Z-Error 0.370 meters
- Point 5210, Easting 404114.446, Northing 5302064.265, Z-Error 0.277 meters

Table 5.6: Quality Check Point Analysis, Forested and Fully Grown, UTM 10N, NAD83 (2011), NAVD88 GEOID12A

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
6001	419340.536	5291139.87	574.56	0.133
6002	419342.1	5291140.177	575.01	0.055
6003	419342.837	5291150.139	578.17	0.181
6004	421371.191	5290375.1	830.01	0.206
6005	416882.945	5291082.505	234.98	0.001
6006	421380.049	5290365.346	829.5	0.034
6007	421371.919	5290318.574	826.46	0.467
6008	421372.582	5290316.462	826.14	0.21
6009	420880.228	5289034.473	806.68	0.08
6010	420882.424	5289033.444	806.71	0.176
6011	420884.315	5289033.971	806.37	0.413
6012	420885.723	5289034.948	806.45	0.352
6013	416855.947	5290722.775	232	0.032
6014	416854.512	5290726.299	231.45	0.033
6015	416947.346	5290835.258	227.61	0.074
6016	416952.34	5290832.071	228.02	0.068

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
6017	416829.989	5290800.345	227.83	0.016
6018	416829.083	5290800.692	227.83	0.029
6019	416828.157	5290800.182	227.93	0.014
6020	416827.267	5290799.911	228.18	0.02
6021	416826.625	5290800.801	228.23	0.037
6022	416826.431	5290801.831	228.27	0.042
6023	416826.521	5290802.421	228.25	0.122
6024	416827.095	5290794.81	228.87	0.039
6025	416822.043	5290806.86	229.29	0.19
6026	416821.461	5290808.313	229.47	0.059
6027	416820.377	5290810.968	229.77	0.103
6028	416818.271	5290815.088	229.84	0.041
6029	416819.985	5290816.266	229.71	0.1
6030	425493.258	5295678.507	218.77	0.101
6031	425475.489	5295682.181	218.03	0.12
6032	425678.047	5295352.515	214.42	0.196
6033	426697.878	5295017.087	216.62	0.104
6034	426676.764	5295027.487	216.5	0.087
6035	426643.206	5295061.563	217	0.063
6036	426597.901	5295116.602	217.74	0.029
6037	426423.645	5295555.352	225.56	0.023
6038	423525.663	5295072.349	188.49	0.027
6039	417485.195	5295644.72	125.38	0.025
6040	417497.171	5295603.294	125.65	0.077
6041	417498.391	5295560.73	125.4	0.007
6042	417528.059	5295480.896	125.57	0.179
6043	417545.812	5295445.259	125.49	0.131

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
6044	417560.148	5295369.722	125.68	0.14
6045	419937.046	5296180.524	134.19	0.094
6046	423176.885	5296764.695	131.37	0.073
6047	416775.432	5273584.638	142.8	0.096
6048	416620.446	5273458.442	141.16	0.197
6049	416362.795	5273237.728	137.25	0.108
6050	414963.88	5273053.99	126.76	0.09
6051	414740.307	5272590.214	116.4	0.061
6052	414726.356	5272633.316	115.8	0.032
6053	414743.299	5272693.757	115.68	0.026
6054	410005.576	5272458.467	274.31	0.053
6055	430778.688	5263442.401	774.98	0.044
6056	430567.832	5263398.608	768.89	0.115
6057	430527.726	5263409.816	769.69	0.086
6058	428684.133	5265302.766	732.22	0.039
6059	423983.597	5267248.679	571.9	0.031
6060	420612.1	5272032.649	165.92	0.014
6061	420614.506	5272032.691	166.02	0
6062	420616.152	5272031.876	166.13	0.025
6063	420617.302	5272031.511	166.14	0.029
6064	420619.862	5272029.93	165.67	0.101
6065	420620.209	5272028.249	165.49	0.134
6066	420618.701	5272027.112	165.62	0.098
6067	420620.832	5272023.929	165.32	0.096
6068	420631.594	5272024.317	165.52	0.02
6069	420633.668	5272019.938	165.91	0.225
6070	420627.312	5272015.932	165.55	0.055



Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
6071	420625.895	5272016.395	165.55	0.043
6072	420624.524	5272016.999	165.46	0.164
6073	420620.941	5272018.322	165.29	0.106
6074	420616.302	5272019.314	165.19	0.036
6075	420615.681	5272021.503	165.48	0.012
6076	420615.263	5272022.558	165.58	0.009
6077	420621.433	5272032.679	165.8	0.077
6078	420623.191	5272032.258	165.76	0.086
6079	420623.531	5272030.428	165.67	0.034
6080	420627.152	5272029.216	165.58	0.097
6081	420629.094	5272029.584	165.67	0.067
6082	402635.361	5299332.701	192.61	0.206
6083	402630.686	5299347.934	192.55	0.042
6084	402641.322	5299352.753	191.91	0.045
6085	402634.869	5299364.544	191.67	0.006
6086	402679.037	5299364.57	190.81	0.086
6087	402885.268	5299641.345	184.92	0.031
6088	402881.5	5299674.027	184.32	0.003
6089	402904.709	5299688.746	183.33	0.04
6090	402908.321	5299683.579	183.47	0.037
6091	402946.996	5299919.029	180.32	0.246
6092	402966.697	5300027.138	178.36	0.112
6093	402949.727	5300058.174	177.31	0.004
6094	402983.407	5300177.658	175.76	0.053
6095	403021.003	5300274.161	175.23	0.102
6096	403044.189	5300360.164	178.83	0.036
6097	403055.064	5300426.428	179.02	0.019

Point ID	Easting (UTM meters)	Northing (UTM meters)	Elevation (meters)	Abs. Dz (meters)
6098	403786.163	5300322.518	182.13	0.038
6099	403792.968	5300325.759	182.11	0.016
6100	404694.254	5302587.373	185.49	0.162
6101	404258.645	5302199.015	179.82	0.121
6102	404248.663	5302186.383	179.7	0.06
6103	404284.213	5301955.378	175.53	0.007
6104	404306.853	5301640.697	182.29	0.121
6105	404192.917	5301580.263	183.19	0.037
6106	403791.219	5301115.058	179.36	0.267
6107	417956.808	5265676.629	192.37	0.107
6108	417968.043	5265675.054	194.45	0.266
6109	417954.307	5265641.426	194.83	0.047
6110	405200.252	5278243.798	184.82	0.054
6111	405201.491	5278241.435	184.89	0.049
6112	389855.11	5304232.106	173.62	0.026
6113	389872.811	5304202.34	173.93	0.077
6114	390820.728	5302989.776	191.69	0.415
6115	390813.182	5303014.733	191.49	0.203
6116	390645.521	5303379.454	180.13	0.061
6117	390666.976	5303377.126	181.51	0.175
6118	390671.368	5303380.212	181.25	0.137
6119	390001.107	5304048.765	153.97	0.135
6120	389972.859	5304394.352	133.37	0.251
6121	389963.328	5304384.645	135.63	0.071
6122	389967.879	5304326.861	138.49	0.091
6123	389967.663	5304318.787	139.23	0.237

## ACCURACY CONCLUSIONS

Forested and Fully Grown Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.251 meters supplemental vertical accuracy at the 95th percentile in the Forested and Fully Grown supplemental class and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Forested and Fully Grown Errors larger than 95th percentile include:

- Point 6007, Easting 421371.919, Northing 5290318.574, Z-Error 0.467 meters
- Point 6011, Easting 420884.315, Northing 5289033.971, Z-Error 0.413 meters
- Point 6012, Easting 420885.723, Northing 5289034.948, Z-Error 0.352 meters
- Point 6114, Easting 390820.728, Northing 5302989.776, Z-Error 0.415 meters

## CONSOLIDATED VERTICAL ACCURACY ASSESSMENT

### ACCURACY CONCLUSIONS

Consolidated Vertical Accuracy (CVA) Tested 0.229 meters consolidated vertical accuracy at the 95th percentile level; reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. CVA is based on the 95th percentile error in all land cover categories combined.

- Point 5035, Easting 402881.500, Northing 5299674.027, Z-Error 0.232 meters
- Point 5028, Easting 402881.500, Northing 5299674.027, Z-Error 0.233 meters
- Point 4031, Easting 402904.709, Northing 5299688.746, Z-Error 0.234 meters
- Point 5157, Easting 402908.321, Northing 5299683.579, Z-Error 0.237 meters
- Point 6125, Easting 402946.996, Northing 5299919.029, Z-Error 0.237 meters
- Point 5170, Easting 402966.697, Northing 5300027.138, Z-Error 0.245 meters
- Point 6093, Easting 402949.727, Northing 5300058.174, Z-Error 0.246 meters
- Point 5151, Easting 402983.407, Northing 5300177.658, Z-Error 0.249 meters
- Point 5147, Easting 403021.003, Northing 5300274.161, Z-Error 0.250 meters
- Point 6122, Easting 403044.189, Northing 5300360.164, Z-Error 0.251 meters
- Point 4172, Easting 403055.064, Northing 5300426.428, Z-Error 0.252 meters
- Point 5171, Easting 403786.163, Northing 5300322.518, Z-Error 0.259 meters
- Point 5018, Easting 403792.968, Northing 5300325.759, Z-Error 0.263 meters
- Point 5183, Easting 404694.254, Northing 5302587.373, Z-Error 0.263 meters
- Point 6110, Easting 404258.645, Northing 5302199.015, Z-Error 0.266 meters
- Point 6108, Easting 404248.663, Northing 5302186.383, Z-Error 0.267 meters
- Point 5210, Easting 404284.213, Northing 5301955.378, Z-Error 0.277 meters
- Point 5021, Easting 404306.853, Northing 5301640.697, Z-Error 0.282 meters
- Point 5145, Easting 404192.917, Northing 5301580.263, Z-Error 0.289 meters
- Point 4242, Easting 403791.219, Northing 5301115.058, Z-Error 0.292 meters
- Point 5158, Easting 417956.808, Northing 5265676.629, Z-Error 0.303 meters
- Point 4140, Easting 417968.043, Northing 5265675.054, Z-Error 0.304 meters
- Point 5014, Easting 417954.307, Northing 5265641.426, Z-Error 0.309 meters
- Point 5011, Easting 405200.252, Northing 5278243.798, Z-Error 0.313 meters
- Point 5150, Easting 405201.491, Northing 5278241.435, Z-Error 0.319 meters
- Point 5005, Easting 389855.110, Northing 5304232.106, Z-Error 0.320 meters

- Point 5162, Easting 389872.811, Northing 5304202.340, Z-Error 0.335 meters
- Point 4007, Easting 390820.728, Northing 5302989.776, Z-Error 0.342 meters
- Point 6012, Easting 390813.182, Northing 5303014.733, Z-Error 0.352 meters
- Point 5012, Easting 390645.521, Northing 5303379.454, Z-Error 0.363 meters
- Point 5168, Easting 390666.976, Northing 5303377.126, Z-Error 0.370 meters
- Point 6011, Easting 390671.368, Northing 5303380.212, Z-Error 0.413 meters
- Point 6114, Easting 390001.107, Northing 5304048.765, Z-Error 0.415 meters
- Point 4005, Easting 389972.859, Northing 5304394.352, Z-Error 0.454 meters
- Point 6007, Easting 389963.328, Northing 5304384.645, Z-Error 0.467 meters

Table 5.7: Overall Vertical Accuracy Statistics Washington State Plane South, NAD83 (HARN), NAVD88, GEOID12A

Average error	0.151	Feet
Minimum error	-0.229	Feet
Maximum error	0.755	Feet
Root mean square	0.239	Feet
Standard deviation	0.187	Feet

Table 5.8: Swath Quality Check Point Analysis, Washington State Plane South, NAD83 (HARN), NAVD88, GEOID12A

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Dz (Feet)
2001	751006.6	910185.3	749.9649	0.164
2002	751768	909626.4	750.8179	0.361
2003	751869.2	909423.5	756.3297	0.131
2004	752583.5	908535.2	778.869	0.131
2005	752393.8	908768.1	775.4569	0.394
2006	752111.1	906827.8	775.3585	0.197
2007	752106.1	906832	775.4898	0.328
2008	752108.6	906837.7	775.5226	0.131
2009	752113.6	906842.1	775.3257	0.033
2010	752123.1	906845.8	774.8336	0.066
2011	752130.8	906845.5	774.6367	-0.066
2012	752136.6	906843.1	774.3087	0.000
2013	752139.7	906839.9	773.6853	0.262

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Dz (Feet)
2014	752148.6	906847.8	775.1289	0.591
2015	752142.6	906824.9	772.4386	0.000
2016	752141.9	906817.2	772.2089	-0.131
2017	752144.4	906811.8	771.2247	0.000
2018	752142	906803.9	770.9622	-0.164
2019	752142.7	906797.4	770.2732	0.361
2020	752129.2	906777	772.1761	0.427
2021	752108.9	906787.5	772.9963	0.033
2022	752102.4	906797.3	773.1932	0.689
2023	752092.2	906816.5	772.7995	0.459
2024	752086.8	906827.2	773.0291	0.295
2025	752081.1	906835.1	772.7995	0.295
2026	752070	906855.7	772.6682	0.098
2027	752100.3	906906	773.1276	0.197
2028	752093.3	906917.4	774.2758	-0.033
2029	752207.1	906787	760.5292	0.033
2030	752213.3	906795	760.2995	0.164
2031	752222.6	906797.8	760.2339	0.098
2032	752231.5	906799.2	760.6604	-0.066
2033	752240	906806.2	761.0541	0.131
2034	752247.4	906808.6	761.1525	0.164
2035	752252.8	906814.1	761.1525	0.131
2036	752258.6	906820.1	761.3166	0.164
2037	752267	906821.9	761.3822	0.262
2038	752271.5	906815.6	760.7588	0.328
2039	752277.9	906815.4	760.8573	0.197
2040	752285.3	906815.5	760.9229	0.000

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Dz (Feet)
2041	752279.1	906831.6	761.4806	0.131
2042	752272.4	906839.8	761.8415	0.000
2043	752264.4	906847.9	761.7431	0.033
2044	752258.7	906854.9	761.5462	0.098
2045	752251.9	906851.2	761.2181	0.197
2046	752229.3	906864.6	760.3323	0.033
2047	752220.6	906865.7	760.6276	-0.033
2048	752211.7	906870.4	760.5292	0.066
2049	752204.8	906871.9	760.4964	0.066
2050	752194.6	906877.4	760.7916	0.131
2051	752196.2	906886.8	760.562	0.131
2052	752177.2	906900.2	760.6276	0.164
2053	752174.7	906904.5	760.7588	-0.033
2054	752174.5	906909.4	760.2011	0.197
2055	752176.7	906914.3	759.6105	-0.164
2056	752181.7	906919.1	758.4294	0.197
2057	752185.1	906923	757.7077	-0.230
2058	752176.1	906922.3	758.2654	0.361
2059	782176.2	922011	717.1894	0.361
2060	782406.2	921852.5	716.2052	0.295
2061	782581.5	921535.6	709.8404	0.427
2062	785392.5	920198.1	710.8246	0.033
2063	785404.4	920260.7	712.9899	0.164
2064	785008.3	921389.9	730.4768	0.098
2065	784625.8	921867.1	738.2523	0.197
2066	782888.5	922139	720.6015	0.459
2067	763542.1	924549.1	440.3858	0.262

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Dz (Feet)
2068	750583.5	850627.2	468.2072	0.164
2069	749457.8	849669.5	451.4094	0.033
2070	749862.3	849974.9	459.6443	-0.033
2071	744755.7	848923.4	395.0775	0.164
2072	743975.2	847593.9	379.9529	0.033
2073	744088	848005.7	379.2639	0.098
2074	744173.5	848284.3	380.1498	0.098
2075	728525.5	847773.7	901.5392	-0.066
2076	728704.5	847818.7	908.2649	-0.033
2077	732043.5	849204.3	994.4523	0.262
2078	731499.9	848998.8	977.8185	0.000
2079	730618.8	848685.4	962.6611	0.033
2080	729971.7	848467.6	948.7176	0.000
2081	729235.2	848093.8	925.6205	0.591
2082	740264.4	825350.8	435.0708	0.164
2083	740184.9	825276.8	433.0039	-0.033
2084	739974.8	825078.5	427.2297	0.295
2085	713416.3	883186.4	1287.529	0.755
2086	713392.3	883145.8	1291.138	0.164
2087	668973.1	947115.2	668.5347	-0.131
2088	668811.5	949867.1	626.3104	0.262
2089	668887.5	949822.2	622.8327	0.262
2090	668752.3	949917.1	629.6897	-0.033

## VERTICAL ACCURACY CONCLUSIONS

LAS Swath Fundamental Vertical Accuracy (FVA) Tested 0.469 feet fundamental vertical accuracy at 95

percent confidence level, derived according to NSSDA, in open terrain in open using (RMSEz) x 1.9600, tested against the TIN.

Bare-Earth DEM Fundamental Vertical Accuracy (FVA) Tested 0.400 feet fundamental vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 Tested against the DEM.

## SUPPLEMENTAL VERTICAL ACCURACY ASSESSMENTS

Table 5.9: Quality Check Point Analysis, Urban, Washington State Plane South, NAD83 (HARN), NAVD88, GEOID12A

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Dz (Feet)
3001	752806.596	907023.929	760.1354726	0.259186
3002	752803.699	907033.514	759.2824568	0.059055
3003	752800.279	907042.852	758.6590991	0.187007
3004	752798.074	907049.286	758.3638245	0.15748
3005	752795.684	907056.31	758.0357415	0.127952
3006	752793.298	907063.35	757.8060834	0.036089
3007	752790.664	907070.158	757.4123838	0.134514
3008	752788.537	907078.113	757.1827257	0.032808
3009	752785.855	907085.156	756.9530676	0.062336
3010	752783.359	907092.354	756.5265597	0.07874
3011	752780.966	907099.283	756.231285	0.095144
3012	752778.955	907106.327	755.8375855	0.229658
3013	752776.353	907114.566	755.673544	0.03937
3014	752774.298	907121.485	755.4766942	0.016404
3015	752772.087	907128.227	755.1486112	0.059055
3016	752769.61	907134.482	754.8533365	0.141076
3017	752766.715	907144.425	754.5908701	0.059055
3018	752764.442	907151.199	754.361212	0.045932
3019	752761.848	907159.26	754.2299788	0.062336



Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Dz (Feet)
3020	752759.108	907168.748	754.0003207	0.059055
3021	752756.337	907178.066	753.7378543	0.026247
3022	752754.067	907186.396	753.5410045	0.075459
3023	752751.332	907194.351	753.4753879	0.03937
3024	752748.393	907202.597	753.4097713	0.068897
3025	752745.401	907211.479	753.4753879	0.009842
3026	752742.634	907221.007	753.4753879	0.124672
3027	752739.396	907229.25	753.6722377	0.088582
3028	752736.204	907238.778	753.9675124	0.022966

## ACCURACY CONCLUSIONS

Urban Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.213 feet supplemental vertical accuracy at the 95th percentile in the Urban supplemental class reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Urban Errors larger than 95th percentile include:

- Point 3001, Easting 752806.596, Northing 907023.929, Z-Error 0.259 feet

Table 5.10: Quality Check Point Analysis, Tall Weeds and Crops, Washington State Plane South, NAD83 (HARN), NAVD88, GEOID12A

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4001	760811.393	908027.744	1850.781746	0.583988
4002	760814.646	908027.077	1851.437912	0.177165
4003	760775.87	908034.184	1847.008792	0.518371
4004	760779.741	908032.706	1846.221393	0.580707
4005	760779.231	908029.967	1846.221393	1.489497
4006	760765.776	908038.515	1844.876252	0.203411
4007	761011.207	908069.529	1879.817091	1.122044
4008	767521.962	908799.874	2385.032082	0.344487

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4009	767518.362	908801.399	2384.572766	0.07874
4010	767512.881	908801.489	2384.244683	0.229658
4011	767507.498	908801.268	2383.654134	0.209973
4012	767511.384	908808.095	2384.408725	0.016404
4013	767527.232	908816.016	2386.147564	0.088582
4014	767529.125	908820.154	2386.508456	0.062336
4015	767533.824	908823.145	2386.934964	0.088582
4016	767528.527	908804.143	2385.753865	0.288713
4017	767464.87	906608.689	2565.215259	0.259186
4018	750859.911	910316.581	751.8021647	0.190288
4019	750924.721	910301.175	748.980651	0.121391
4020	767574.312	905319.832	2707.373617	0.052493
4021	767664.211	905399.126	2730.929975	0.121391
4022	767651.999	905351.236	2725.319756	0.19685
4023	751827.829	909539.986	753.1801133	0.104987
4024	767647.907	905349.129	2724.762015	0.170603
4025	752905.53	908222.195	772.8979008	0
4026	752549.601	908567.314	777.753529	0.305117
4027	748075.8	886163.16	848.8819206	0.026247
4028	747681.24	886471.321	833.65887	0.255905
4029	767624.413	905211.922	2711.244996	0.016404
4030	767628.208	905211.675	2710.195131	0.557741
4031	767631.452	905208.936	2708.259441	0.767714
4032	767628.794	905217.883	2710.490405	0.675851
4033	767626.435	905224.623	2710.720063	0.144357
4034	767624.669	905230.698	2710.326364	0.029527
4035	767624.011	905239.642	2710.063898	0.049212

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4036	767614.277	905266.774	2710.752872	0.344487
4037	767608.067	905274.309	2709.834239	0.501967
4038	767569.768	905301.499	2708.161016	0.019685
4039	767570.343	905306.716	2707.931358	0.022966
4040	767570.666	905314.058	2707.340809	0.098425
4041	767572.2	905320.877	2707.111151	0.062336
4042	767573.258	905329.973	2706.783068	0.108267
4043	767577.092	905337.859	2706.258135	0.098425
4044	767579.329	905345.308	2705.667585	0.013123
4045	753337.75	907139.095	749.8992834	0.009842
4046	753329.666	907137.557	750.3914079	0.059055
4047	753321.685	907132.304	750.7194909	0.006562
4048	753318.53	907122.912	751.0803821	0.134514
4049	753294.881	907163.283	750.1617498	0.150918
4050	753279.433	907164.231	749.9320917	0.068897
4051	753266.025	907163.592	749.8008585	0.055774
4052	753255.188	907164.419	749.7352419	0.026247
4053	753243.639	907163.81	749.636817	0.154199
4054	753133.037	907201.324	749.7352419	0.059055
4055	753124.801	907210.643	749.4727755	0.052493
4056	753111.548	907217.243	749.2103091	0.131233
4057	753102.556	907222.842	749.5383921	0.029527
4058	753094.236	907232.719	749.7352419	0.187007
4059	782070.934	922200.732	717.6159175	0.219816
4060	782194.242	922007.159	717.0909847	0.029527
4061	782295.995	921905.159	716.6316685	0.022966
4062	782354.725	921330.142	703.5411573	0.193569

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4063	782423.471	921408.81	704.164515	0.541337
4064	782473.947	921491.644	706.4282876	0.272309
4065	785399.673	920273.943	713.0227556	0.187007
4066	785081.089	920932.673	723.6854527	0.085302
4067	785048.453	921122.669	726.7038162	0.104987
4068	784998.895	921491.881	732.0187606	0.170603
4069	784182.306	922175.616	740.3192602	0.013123
4070	783792.274	922108.726	735.9557564	0.200131
4071	783262.645	922154.219	727.0318992	0.190288
4072	782781.676	922035.579	720.8311307	0.045932
4073	782713.428	921766.554	711.4807656	0.167322
4074	775162.948	920570.175	621.3563691	0.206692
4075	775076.586	920574.254	624.6371989	0.324802
4076	774574.926	920587.326	643.4691624	0.291994
4077	763809.09	924586.328	433.7257088	0.059055
4078	763648.543	924563.276	437.1705802	0.190288
4079	774164.599	926145.915	431.2322781	0.111548
4080	773951.629	926052.094	430.5104955	0.091863
4081	750733.753	850671.934	468.6337386	0.324802
4082	750523.386	850516.324	463.9093436	0.019685
4083	749536.574	849692.397	456.4946681	0.147637
4084	749757.56	849877.952	455.9041187	0.013123
4085	731894.918	849143.526	989.5639054	0.328083
4086	731513.544	849007.712	977.8513428	0.226377
4087	731082.812	848810.52	971.7161909	0.177165
4088	730536.248	848628.627	962.0377428	0.229658
4089	729907.257	848395.277	944.4524947	0.255905

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4090	790087.155	842043.461	2586.114145	0.108267
4091	795861.028	816014.117	2544.316372	0.367453
4092	794963.457	815937.898	2524.89386	0.013123
4093	794759.638	815822.29	2520.661589	0.223096
4094	777690.856	830419.147	1941.365459	0.255905
4095	776825.592	830382.431	1988.740642	0.072178
4096	773737.022	829247.211	1874.010022	0.344487
4097	773129.853	829269.713	1823.813325	0.141076
4098	763147.578	845522.031	540.5495294	0.07874
4099	763145.379	845512.459	540.5495294	0.085302
4100	763149.27	845501.727	540.4839128	0.059055
4101	763147.673	845493.745	540.3526796	0.187007
4102	763149.765	845486.878	540.5495294	0.095144
4103	763151.652	845482.044	540.4839128	0.065617
4104	763152.556	845476.644	540.6807626	0.124672
4105	763153.55	845471.93	540.5167211	0.009842
4106	763156.794	845468.885	540.8448041	0.072178
4107	763185.247	845469.077	541.3041203	0.141076
4108	763189.731	845468.597	541.6322032	0.101706
4109	763189.869	845463.808	541.6978198	0
4110	763193.755	845462.494	541.829053	0.085302
4111	763192.392	845453.628	541.8946696	0.026247
4112	763191.832	845439.404	541.6322032	0.124672
4113	763191.515	845434.226	541.6978198	0.265747
4114	763191.689	845425.463	541.5993949	0.052493
4115	763193.641	845420.718	541.7962447	0.173884
4116	763196.599	845403.573	541.6650115	0.104987

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4117	763197.94	845396.825	541.7634364	0.108267
4118	763199.617	845391.19	541.6978198	0.003281
4119	763199.098	845382.731	541.5993949	0.154199
4120	763200.987	845378.879	541.6978198	0.131233
4121	763201.746	845369.634	541.5993949	0.032808
4122	763203.87	845362.084	541.6978198	0.206692
4123	763203.828	845353.662	541.9930945	0.301836
4124	763204.118	845345.043	542.0259028	0.059055
4125	763206.308	845333.038	541.8618613	0.111548
4126	699279.067	840059.163	389.4673139	0.032808
4127	699282.485	840054.764	388.4174483	0.098425
4128	699292.022	840048.846	387.1051164	0.321521
4129	699299.316	840043.668	385.3334682	0.108267
4130	699308.129	840035.294	383.7258616	0.006562
4131	699321.976	840027.799	381.790172	0.351049
4132	699344.51	840037.673	379.821674	0.088582
4133	699353.874	840031.36	378.3453006	0.055774
4134	699362.387	840025.573	376.6064608	0.193569
4135	699371.875	840019.049	375.4909786	0.19685
4136	699375.138	839994.185	372.899123	0.006562
4137	699399.253	839978.529	368.8965106	0.144357
4138	699410.469	839972.838	367.2889039	0.229658
4139	699422.206	839963.823	365.2219811	0.387138
4140	699448.994	839970.517	362.7613587	0.997372
4141	699459.983	839962.938	360.8256691	0.577426
4142	699468.232	839957.336	359.7758035	0.675851
4143	699458.789	839940.86	358.5947048	0.062336

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4144	699471.907	839933.316	357.2167562	0.177165
4145	699478.035	839928.034	356.3637405	0.282151
4146	699486.372	839922.597	355.543533	0.459316
4147	699494.162	839916.678	353.8046932	0.383857
4148	699502.398	839911.904	353.7718849	0.387138
4149	699510.615	839904.638	352.5907861	0.150918
4150	699532.328	839880.157	349.9333139	0.121391
4151	699543.411	839869.931	348.8178318	0.367453
4152	699548.175	839862.613	347.7679662	0.19685
4153	699557.871	839856.546	346.7181007	0.045932
4154	693525.161	838674.071	397.5381553	0.47572
4155	693522.832	838677.067	397.3741139	0.246062
4156	693520.711	838680.939	396.6851396	0.032808
4157	693526.531	838681.623	397.5709636	0.452755
4158	693534.747	838681.112	398.5552126	0.659447
4159	693537.7	838685.833	398.2599379	0.026247
4160	693540.462	838690.997	399.0145288	0.416665
4161	693547.023	838692.784	399.3098035	0.091863
4162	693550.405	838698.089	399.5722699	0.429789
4163	693555.271	838701.334	400.6549437	0.567584
4164	693559.216	838705.453	401.0814516	0.154199
4165	693561.395	838708.645	401.2783014	0.098425
4166	693562.548	838713.796	401.7704259	0.360891
4167	693565.665	838716.516	401.8360425	0.180446
4168	693591.618	838705.646	402.2297421	0.695536
4169	693593.665	838708.097	402.3937836	0.577426
4170	693595.667	838710.457	402.7874831	0.636481

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4171	693599.54	838713.448	403.2467993	0.183726
4172	693601.39	838717.36	403.9029653	0.826769
4173	693603.09	838720.475	403.6733072	0.328083
4174	693604.156	838723.466	404.0013902	0.498686
4175	693606.962	838727.597	404.2310483	0.459316
4176	693610.762	838733.158	405.0184475	0.47572
4177	693614.969	838738.802	405.4777636	0.095144
4178	693617.684	838746.423	406.2979711	0.705378
4179	687421.88	837684.133	37.27022732	0.177165
4180	687418.92	837690.557	37.49988541	0.364172
4181	687417.879	837697.662	37.33584392	0.072178
4182	687416.644	837703.897	37.46707712	0.121391
4183	687415.259	837711.345	37.8279684	0.124672
4184	687415.127	837719.466	37.99200989	0.095144
4185	687410.707	837738.893	38.18885969	0.003281
4186	687411.226	837750.392	38.28728458	0.150918
4187	687412.001	837759.289	38.22166799	0.131233
4188	687413.141	837768.588	38.15605139	0.095144
4189	687410.005	837776.636	37.7623518	0.055774
4190	687408.897	837789.24	37.99200989	0.469159
4191	687409.489	837798.353	38.12324309	0.367453
4192	687409.338	837807.549	37.9592016	0.124672
4193	687407.877	837815.813	37.9263933	0.016404
4194	687406.934	837824.764	37.9263933	0.101706
4195	687405.749	837833.871	37.8279684	0.059055
4196	687405.588	837839.612	37.8607767	0.003281
4197	687403.65	837859.355	37.7623518	0.062336



Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4198	687403.583	837867.973	37.9263933	0.006562
4199	687403.549	837875.043	37.8607767	0.003281
4200	687401.61	837882.945	37.8279684	0.036089
4201	687401.562	837890.903	37.63111861	0.131233
4202	687401.391	837897.902	37.59831031	0.082021
4203	687396.279	837902.946	37.56550201	0.006562
4204	687391.42	837910.792	37.40146052	0.052493
4205	713895.277	854883.336	534.1519111	0.177165
4206	713894.655	854875.452	534.3815692	0.111548
4207	713894.801	854867.661	534.6440356	0.462597
4208	713894.891	854859.042	534.906502	0.446193
4209	713895.682	854850.253	535.1689684	0.272309
4210	713895.615	854844.775	535.234585	0.334645
4211	713895.965	854838.581	534.906502	0.137795
4212	713895.458	854830.7	535.1689684	0.321521
4213	713895.772	854818.553	535.5298597	0.127952
4214	713897.656	854771.406	539.6637053	0.272309
4215	713898.103	854763.597	540.1558298	0.190288
4216	713898.104	854757.039	540.6479543	0.019685
4217	713896.867	854745.687	541.8618613	0.170603
4218	713898.16	854735.434	542.4524107	0.049212
4219	713897.695	854726.994	542.9445352	0.062336
4220	713897.699	854719.211	543.3054265	0.124672
4221	713898.668	854702.71	544.0600173	0.091863
4222	713897.912	854692.853	544.5521418	0.075459
4223	713898.677	854684.807	545.0770746	0.036089
4224	713900.037	854676.253	545.5363908	0.062336

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4225	713899.981	854666.128	546.0941319	0.114829
4226	713899.605	854654.893	546.5862563	0.446193
4227	713900.967	854640.665	546.3894065	0.045932
4228	713900.981	854629.947	546.7502978	0.016404
4229	713901.726	854618.03	547.5705053	0.446193
4230	713919.705	854576.695	548.9156455	0.242781
4231	713901.663	854553.964	550.720102	0.108267
4232	713901.428	854539.895	551.3106514	0.242781
4233	743329.634	909480.619	1729.489466	0.009842
4234	707424.445	936869.956	616.6319741	0.137795
4235	707420.19	936889.592	616.0086164	0.31824
4236	707423.782	936830.717	618.0099226	0.095144
4237	708233.764	939009.076	582.3473019	0.262466
4238	708203.196	939019.492	581.691136	0.082021
4239	712699.21	945121.808	576.6058497	0.147637
4240	712926.87	944231.743	588.6464953	0.088582
4241	711898.831	943221.278	610.9561384	0.164041
4242	711759.896	942838.76	612.4325118	0.958002
4243	753385.218	823901.087	589.9588272	0.23622
4244	715041.477	866814.594	573.3906364	0.35433
4245	714987.247	866904.12	581.2974364	0.147637
4246	713339.389	867998.14	630.6083093	0.013123
4247	713309.229	867903.922	623.4889085	0.291994
4248	713347.613	867730.398	611.9403874	0.032808
4249	665685.121	954053.66	569.8801484	0.377295
4250	668189.56	951166.26	590.9758845	0.200131
4251	666114.611	953354.119	512.7609004	0.059055

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
4252	666055.441	954345.528	454.7558283	1.095797

## ACCURACY CONCLUSIONS

Tall Weeds and Crops Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.607 feet supplemental vertical accuracy at the 95th percentile in the Tall Weeds and Crops supplemental class and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Tall Weeds and Crops Errors larger than 95th percentile include:

- Point 4005, Easting 760779.231, Northing 908029.967, Z-Error 1.494 feet
- Point 4007, Easting 761011.207, Northing 908069.529, Z-Error 1.122 feet
- Point 4031, Easting 767631.452, Northing 905208.936, Z-Error 0.767 feet
- Point 4032, Easting 767628.794, Northing 905217.883, Z-Error 0.676 feet
- Point 4140, Easting 699448.994, Northing 839970.517, Z-Error 0.997 feet
- Point 4142, Easting 699468.232, Northing 839957.336, Z-Error 0.676 feet
- Point 4158, Easting 693534.747, Northing 838681.112, Z-Error 0.659 feet
- Point 4168, Easting 693591.618, Northing 838705.646, Z-Error 0.696 feet
- Point 4170, Easting 693595.667, Northing 838710.457, Z-Error 0.636 feet
- Point 4172, Easting 693601.390, Northing 838717.360, Z-Error 0.826 feet
- Point 4178, Easting 693617.684, Northing 838746.423, Z-Error 0.705 feet
- Point 4242, Easting 665685.121, Northing 954053.660, Z-Error 0.958 feet

Table 5.11: Quality Check Point Analysis, Brush Lands and Trees, Washington State Plane South, NAD83 (HARN), NAVD88, GEOID12A

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5001		910154.246	752.819222	0.045932
5002	747772.243	886367.774	840.4501878	0.098425
5003	765841.053	901021.312	2657.931511	0.334645
5004	765837.084	901018.113	2657.964319	0.226377
5005	765830.177	901014.327	2656.816029	1.049866
5006	765821.427	901007.907	2654.48664	0.295275
5007	765837.451	901025.287	2657.997127	0.11811
5008	765847.171	901020.689	2656.947262	0.521652

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5009	765853.219	901026.183	2657.406578	0.528214
5010	765856.029	901023.747	2656.422329	0.679132
5011	765856.057	901020.462	2655.142805	1.0269
5012	765859.55	901020.94	2654.519448	1.190941
5013	765857.848	901017.493	2653.764857	0.324802
5014	765853.818	901016.103	2653.239924	1.013776
5015	765851.388	901014.022	2653.89609	0.331364
5016	765847.189	901013.641	2654.453831	0.259186
5017	765825.299	900992.262	2643.955176	0.410104
5018	765826.137	900987.369	2641.789828	0.862858
5019	765825.945	900983.562	2640.96962	0.75131
5020	765840.285	900985.929	2641.724211	0.101706
5021	765845.514	900983.768	2640.379071	0.925194
5022	765846.89	900989.317	2642.872502	0.35433
5023	752552.828	907306.079	792.9437713	0.423227
5024	752547.707	907299.551	793.2718543	0.59383
5025	752538.548	907294.016	793.7311704	0.410104
5026	752512.302	907274.225	792.2219887	0.249343
5027	752511.664	907260.4	790.712807	0.482282
5028	752500.499	907253.336	792.0907555	0.764433
5029	752488.724	907247.805	794.3873364	0.19685
5030	752479.843	907249.243	797.6025497	0.337925
5031	752466.319	907255.385	799.3413895	0.203411
5032	752455.933	907260.096	800.8833796	0.006562
5033	752438.708	907253.17	802.1629032	0.311679
5034	752426.87	907247.135	799.8991306	0.265747
5035	752405.226	907234.916	796.9135754	0.761153

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5036	752394.027	907218.093	797.5697414	0.288713
5037	752397.405	907202.461	796.2574094	0.27559
5038	753257.849	907181.717	750.2601747	0.124672
5039	753245.08	907188.134	750.3585996	0.31496
5040	753233.38	907188.88	749.8008585	0.026247
5041	753222.321	907193.94	749.6040087	0.147637
5042	752757.431	908422.006	776.2115389	0.045932
5043	752754.703	908436.564	776.6708551	0.367453
5044	752756.084	908448.445	777.5238709	0.239501
5045	752757.554	908459.896	777.4910626	0.492124
5046	752761.69	908471.854	778.0488037	0.032808
5047	752765.917	908485.254	779.4595605	0.219816
5048	752772.115	908499.915	780.8047008	0.15748
5049	752786.054	908505.506	780.5750427	0.144357
5050	752778.165	908531.284	778.7377779	0.193569
5051	752779.369	908536.766	778.1472286	0.285432
5052	752768.776	908554.041	777.8847622	0.390419
5053	752759.899	908574.716	780.1813431	0.036089
5054	752750.176	908572.03	781.0999754	0.209973
5055	752737.11	908573.511	781.9529912	0.282151
5056	752724.83	908577.441	782.5763489	0.085302
5057	752718.076	908583.633	783.1012817	0.003281
5058	752705.248	908590.473	782.6419655	0.328083
5059	752694.775	908597.054	783.2325149	0.377295
5060	752686.249	908600.15	783.4949813	0.311679
5061	752677.081	908597.367	783.0356651	0.219816
5062	752666.317	908595.292	783.1012817	0.524933

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5063	752656.794	908604.819	783.0684734	0.255905
5064	752642.151	908607.736	780.8047008	0.121391
5065	752625.648	908608.622	779.0658609	0.193569
5066	752618.791	908613.534	778.7377779	0.370734
5067	752602.403	908619.98	778.1472286	0.229658
5068	752591.361	908631.817	778.3768867	0.219816
5069	752577.157	908634.103	778.1144203	0.203411
5070	752564.193	908634.448	778.0488037	0.022966
5071	752535.007	908664.687	777.1301713	0.160761
5072	752532.946	908676.433	777.3598294	0.255905
5073	752519.749	908690.551	777.4910626	0.331364
5074	752526.478	908711.679	777.4910626	0.259186
5075	752523.342	908719.314	777.6551041	0.282151
5076	752504.123	908736.485	776.3099638	0.091863
5077	752499.929	908728.115	776.6052385	0.23622
5078	752485.17	908740.605	776.8677049	0.242781
5079	752477.464	908752.455	777.0645547	0.114829
5080	752473.251	908833.651	783.1997066	0.31496
5081	752473.757	908856.527	784.1183389	0.252624
5082	752472.145	908876.495	784.1511472	0.095144
5083	752467.639	908888.314	784.347997	0.144357
5084	752499.794	908869.035	785.7259456	0.131233
5085	752541.194	908841.876	787.7600601	0.19685
5086	752628.314	908839.503	780.8375091	0
5087	752650.496	908842.198	778.967436	0.11811
5088	752677.96	908835.742	776.6380468	0.016404
5089	752703.107	908839.139	776.113114	0.049212

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5090	752808.095	908782.232	767.5501481	0.291994
5091	752812.717	908776.534	767.8782311	0.23622
5092	752818.433	908768.141	767.5501481	0.101706
5093	752828.382	908776.032	768.0750809	0.308398
5094	752833.278	908766.318	768.3375473	0.091863
5095	752835.201	908743.405	768.4687805	0.124672
5096	752836.176	908736.491	767.5173398	0.187007
5097	752845.902	908724.754	765.0567174	0.305117
5098	781749.273	922302.917	717.0909847	0.098425
5099	781772.389	922242.247	717.6159175	0.429789
5100	781808.361	922274.987	717.0581764	0.252624
5101	781801.783	922316.346	717.0909847	0.377295
5102	781987.495	922251.11	719.2891407	0.11811
5103	782093.243	922151.148	719.8140735	0.232939
5104	782249.366	921981.531	717.451876	0.104987
5105	782278.361	921884.427	715.8442693	0.295275
5106	782504.46	921714.678	715.2865283	0.098425
5107	782602.722	921524.382	711.3167241	0.065617
5108	785608.152	920056.258	711.0542577	0.19685
5109	784964.757	921381.919	729.7877963	0.003281
5110	784889.795	921694.87	736.0541813	0.725063
5111	784515.19	922028.684	739.9583689	0.518371
5112	782967.408	922137.525	720.535856	0.288713
5113	774997.051	920541.278	628.2461118	0.085302
5114	774401.817	920605.935	644.519028	0.462597
5115	774545.616	920549.099	646.1266346	0.111548
5116	764235.104	924777.576	421.7506798	0.114829

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5117	763829.864	924593.09	434.2178333	0.610234
5118	750731.332	850621.917	467.0917486	0.570864
5119	749527.429	849673.114	455.7728855	0.016404
5120	744738.479	849047.063	396.3242483	0.036089
5121	744663.381	848889.502	392.8465686	0.082021
5122	744327.796	848599.308	387.8597072	0.006562
5123	728720.35	847808.157	907.6415835	0.003281
5124	693596.273	838780.207	405.7730383	0.541337
5125	693595.204	838775.23	406.068313	0.170603
5126	693589.645	838777.017	404.7887894	0.31824
5127	693590.414	838772.008	405.6089968	0.682413
5128	693585.181	838772.472	404.7887894	0.452755
5129	693584.598	838767.597	404.8872143	0.538056
5130	693577.621	838768.559	404.1654317	0.505248
5131	693581.333	838762.863	404.8872143	0.698817
5132	693574.507	838761.223	404.6575562	0.695536
5133	693569.89	838760.37	404.0670068	0.27559
5134	693573.606	838757.088	404.4935147	0.305117
5135	693573.396	838752.615	404.8872143	0.639762
5136	693576.62	838750.209	405.084064	0.341206
5137	693565.339	838748.455	404.0341985	0.022966
5138	693563.942	838739.949	402.6234416	0.511809
5139	693561.11	838736.344	401.9016591	0.725063
5140	693557.378	838729.099	400.7861769	0.43635
5141	693551.475	838726.501	399.9331612	0.124672
5142	693549.495	838724.934	399.9331612	0.511809
5143	693547.948	838726.158	399.0473371	0.226377



Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5144	693551.647	838722.151	400.3924773	0.718502
5145	693547.354	838720.867	400.4252856	0.94816
5146	693542.467	838718.946	399.5394616	0.577426
5147	693541.903	838709.664	398.6208292	0.820207
5148	693536.11	838710.795	397.8990466	0.23622
5149	687410.787	837660.883	35.62981239	0.134514
5150	687405.915	837661.328	35.20330451	1.046585
5151	687399.642	837672.463	32.93953189	0.816927
5152	687397.783	837677.768	32.05370783	0.23622
5153	687394.815	837678.719	30.51171779	0.216535
5154	687394.332	837671.208	29.72431862	0.187007
5155	687390.922	837671.555	28.54321987	0.734906
5156	687388.809	837677.138	26.80438004	0.659447
5157	687386.648	837670.448	26.34506386	0.777557
5158	687382.356	837677.849	25.98417257	0.994091
5159	687379.852	837675.485	24.70464892	0.623358
5160	687381.76	837668.29	23.52355017	0.465878
5161	687377.824	837666.647	21.98156013	0.610234
5162	687374.146	837671.668	22.37525971	1.099078
5163	687367.686	837668.804	20.3083369	0.479001
5164	687376.885	837646.394	19.61936262	0.219816
5165	687377.013	837642.847	19.94744561	0.337925
5166	687386.393	837630.164	20.83326967	0.03937
5167	687391.36	837619.04	23.29389208	0.101706
5168	687395.87	837627.479	25.52485639	1.213907
5169	687399.466	837631.985	29.98678501	0.11811
5170	687401.329	837640.464	32.25055762	0.803803

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5171	687404.693	837643.025	33.92378086	0.849735
5172	687411.24	837643.765	35.99070367	0.538056
5173	713897.857	854517.616	552.3933252	0.082021
5174	713895.427	854513.42	552.918258	0.173884
5175	713893.07	854512	553.3119576	0.380576
5176	713897.601	854507.881	553.0494912	0.095144
5177	713892.13	854506.835	553.4759991	0.127952
5178	713897.089	854501.113	553.7384655	0.013123
5179	713892.602	854499.074	553.9353153	0.173884
5180	713895.771	854495.428	553.9681235	0.305117
5181	713890.67	854494.252	554.0665484	0.370734
5182	713894.746	854491.044	554.1977816	0.022966
5183	713893.586	854486.608	555.5101136	0.862858
5184	713898.421	854481.343	555.8381966	0.193569
5185	713892.52	854479.03	555.9366215	0.429789
5186	713890.278	854475.39	556.1334713	0.206692
5187	713895.534	854471.182	556.3303211	0.104987
5188	713893.497	854464.577	557.2817617	0.042651
5189	713888.561	854463.514	556.7896372	0.370734
5190	713889.038	854458.922	557.5770364	0.311679
5191	713889.043	854456.061	558.2332024	0.439631
5192	713887.442	854453.813	558.3316273	0.013123
5193	713887.975	854451.344	558.3316273	0.242781
5194	713886.426	854449.061	558.4628605	0.259186
5195	713893.171	854448.435	558.7581352	0.298556
5196	713930.768	854454.264	557.7410779	0.482282
5197	713931.485	854449.083	557.9379277	0.679132

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5198	713931.527	854446.146	558.0691609	0.597111
5199	713934.95	854437.708	558.4628605	0.052493
5200	743334.356	909465.86	1729.194191	0.167322
5201	707083.193	936643.851	633.4626313	0.570864
5202	707078.656	936635.308	633.9219475	0.27559
5203	707413.11	936848.861	617.3865649	0.387138
5204	707655.45	937008.787	613.5151857	0.229658
5205	707864.999	937596.232	610.0703143	0.108267
5206	710972.894	939785.384	597.8984355	0.659447
5207	711017.18	939887.109	595.7002795	0.400261
5208	712657.912	945785.115	591.6648588	0.203411
5209	712660.416	945759.096	592.4522579	0.298556
5210	712224.212	945481.578	571.3237136	0.90879
5211	712460.515	943906.224	601.0152239	0.587269
5212	711675.545	942784.2	611.349838	0.173884
5213	740208.109	825316.767	435.0708491	0.629919
5214	753215.343	823749.23	558.3972439	0.072178
5215	753572.784	824066.956	616.3366994	0.488844
5216	753815.41	824550.962	632.9376985	0.108267
5217	753656.975	824236.738	631.7237915	0.059055
5218	715037.895	866865.994	576.5402331	0.482282
5219	715022.338	866892.684	579.722638	0.374015
5220	713309.825	868078.685	630.8379674	0.068897
5221	713320.031	868043.81	630.4442678	0.098425
5222	668203.896	951132.149	592.2554081	0.187007
5223	668177.22	951187.384	591.3039675	0.269028
5224	666223.682	953267.663	514.1716572	0.459316

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
5225	666104.458	953370.081	512.9905585	0.511809

## ACCURACY CONCLUSIONS

Brush Lands and Trees Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.863 Feet supplemental vertical accuracy at the 95th percentile in the Brush Lands and Trees supplemental class reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Brush Lands and Trees Errors larger than 95th percentile include:

- Point 5005, Easting 765830.177, Northing 901014.327, Z-Error 1.049 feet
- Point 5011, Easting 765856.057, Northing 901020.462, Z-Error 1.027 feet
- Point 5012, Easting 765859.550, Northing 901020.940, Z-Error 1.191 feet
- Point 5014, Easting 765853.818, Northing 901016.103, Z-Error 1.014 feet
- Point 5021, Easting 765845.514, Northing 900983.768, Z-Error 0.925 feet
- Point 5145, Easting 693547.354, Northing 838720.867, Z-Error 0.948 feet
- Point 5150, Easting 687405.915, Northing 837661.328, Z-Error 1.046 feet
- Point 5158, Easting 687382.356, Northing 837677.849, Z-Error 0.994 feet
- Point 5162, Easting 687374.146, Northing 837671.668, Z-Error 1.099 feet
- Point 5168, Easting 687395.870, Northing 837627.479, Z-Error 1.213 feet
- Point 5210, Easting 744738.479, Northing 849047.063, Z-Error 0.909 feet

Table 5.12: Quality Check Point Analysis, Forested and Fully Grown, Washington State Plane South, NAD83 (HARN), NAVD88, GEOID12A

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
6001	761050.918	908073.321	1885.03361	0.43635
6002	761056.08	908074.167	1886.509984	0.180446
6003	761059.526	908106.773	1896.877406	0.59383
6004	767633.973	905354.87	2723.1216	0.675851
6005	752982.431	908138.58	770.9294029	0.003281
6006	767662.027	905321.957	2721.448377	0.111548
6007	767630.529	905169.351	2711.474654	1.532148
6008	767632.486	905162.354	2710.424789	0.688974
6009	765884.957	901007.354	2646.57984	0.262466
6010	765892.055	901003.751	2646.678264	0.577426

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
6011	765898.313	901005.285	2645.562782	1.354983
6012	765903.033	901008.345	2645.825249	1.154852
6013	752856.763	906961.209	761.1525298	0.104987
6014	752852.419	906972.918	759.3480734	0.108267
6015	753168.213	907320.803	746.7496867	0.242781
6016	753184.268	907309.833	748.094827	0.223096
6017	752779.603	907218.367	747.4714693	0.052493
6018	752776.667	907219.599	747.4714693	0.095144
6019	752773.576	907218.021	747.7995523	0.045932
6020	752770.628	907217.224	748.6197597	0.065617
6021	752768.614	907220.21	748.7838012	0.121391
6022	752768.084	907223.609	748.9150344	0.137795
6023	752768.44	907225.535	748.8494178	0.400261
6024	752769.538	907200.507	750.8835323	0.127952
6025	752754.207	907240.56	752.2614809	0.623358
6026	752752.447	907245.387	752.8520303	0.193569
6027	752749.165	907254.209	753.8362792	0.337925
6028	752742.681	907267.942	754.0659373	0.134514
6029	752748.425	907271.63	753.6394294	0.328083
6030	781704.594	922328.621	717.7471507	0.331364
6031	781646.677	922342.508	715.3193366	0.3937
6032	782277.206	921240.047	703.4755407	0.643043
6033	785588.425	920034.341	710.6933664	0.341206
6034	785520.228	920070.64	710.2996669	0.285432
6035	785413.648	920185.899	711.9400818	0.206692
6036	785270.693	920371.145	714.3678959	0.095144
6037	784744.278	921828.568	740.0239855	0.075459

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
6038	775186.831	920542.968	618.4036222	0.088582
6039	755428.645	923043.731	411.3504491	0.082021
6040	755463.664	922906.589	412.2362732	0.252624
6041	755463.278	922766.822	411.4160657	0.022966
6042	755552.38	922501.85	411.9738068	0.587269
6043	755606.949	922383.105	411.7113404	0.429789
6044	755646.193	922133.811	412.3346981	0.459316
6045	763527.771	924548.758	440.2545603	0.308398
6046	774217.161	926131.137	431.00262	0.239501
6047	750824.319	850746.548	468.5025054	0.31496
6048	750302.861	850348.562	463.1219444	0.646323
6049	749434.854	849651.11	450.2938997	0.35433
6050	744826.773	849192.762	415.8779943	0.295275
6051	744045.475	847694.435	381.8885969	0.200131
6052	744004.159	847837.269	379.9200989	0.104987
6053	744065.979	848033.795	379.5263994	0.085302
6054	728499.815	847750.851	899.9644416	0.173884
6055	795713.847	816028.158	2542.577533	0.144357
6056	795017.608	815906.302	2522.597279	0.377295
6057	794887.2	815947.217	2525.221943	0.282151
6058	789035.064	822347.644	2402.289247	0.127952
6059	773816.172	829217.042	1876.306603	0.101706
6060	763250.245	845259.103	544.355292	0.045932
6061	763258.142	845258.992	544.683375	0
6062	763263.458	845256.149	545.0442663	0.082021
6063	763267.193	845254.833	545.0770746	0.095144
6064	763275.427	845249.382	543.5350846	0.331364

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
6065	763276.392	845243.831	542.9445352	0.439631
6066	763271.328	845240.257	543.3710431	0.321521
6067	763277.99	845229.595	542.3867941	0.31496
6068	763313.335	845229.757	543.0429601	0.065617
6069	763319.686	845215.177	544.3224837	0.738187
6070	763298.422	845202.692	543.141385	0.180446
6071	763293.821	845204.357	543.141385	0.141076
6072	763289.386	845206.48	542.8461103	0.538056
6073	763277.768	845211.19	542.2883692	0.347768
6074	763262.652	845214.924	541.9602862	0.11811
6075	763260.841	845222.169	542.9117269	0.03937
6076	763259.579	845225.673	543.2398099	0.029527
6077	763280.865	845258.238	543.9615924	0.252624
6078	763286.589	845256.675	543.8303593	0.282151
6079	763287.515	845250.637	543.5350846	0.111548
6080	763299.269	845246.287	543.2398099	0.31824
6081	763305.677	845247.293	543.5350846	0.219816
6082	707090.718	936672.372	631.9206413	0.675851
6083	707076.949	936722.828	631.7237915	0.137795
6084	707112.338	936737.543	629.6240604	0.147637
6085	707092.381	936776.889	628.8366612	0.019685
6086	707237.284	936772.429	626.0151475	0.282151
6087	707942.34	937659.215	606.6910596	0.101706
6088	707933.342	937766.821	604.7225616	0.009842
6089	708010.997	937812.721	601.4745401	0.131233
6090	708022.316	937795.398	601.9338562	0.121391
6091	708173.424	938563.852	591.5992422	0.807084

Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
6092	708249.181	938916.496	585.1688156	0.367453
6093	708196.702	939020.061	581.7239442	0.013123
6094	708319.49	939408.583	576.638658	0.173884
6095	708452.761	939721.31	574.8998181	0.334645
6096	708537.676	940001.072	586.7108057	0.11811
6097	708580.172	940217.344	587.3341633	0.062336
6098	710967.982	939801.218	597.5375442	0.124672
6099	710990.641	939811.151	597.4719276	0.052493
6100	714180.224	947138.084	608.5611326	0.531494
6101	712711.153	945908.816	589.9588272	0.39698
6102	712677.105	945868.401	589.5651276	0.19685
6103	712769.964	945106.883	575.8840671	0.022966
6104	712811.857	944072.178	598.062477	0.39698
6105	712431.848	943885.636	601.0152239	0.121391
6106	711066.127	942400.774	588.4496455	0.875982
6107	753883.142	824682.665	631.1332421	0.351049
6108	753919.835	824676.338	637.9573682	0.872701
6109	753871.302	824567.443	639.2040836	0.154199
6110	713332.88	867224.883	606.3629766	0.177165
6111	713336.701	867217.003	606.5926347	0.160761
6112	665667.004	954059.419	569.617682	0.085302
6113	665722.017	953959.95	570.6347393	0.252624
6114	668707.207	949884.628	628.9022778	1.361544
6115	668685.015	949967.277	628.2461118	0.666008
6116	668172.453	951181.008	590.9758845	0.200131
6117	668242.599	951171.167	595.5034297	0.574145
6118	668257.325	951180.84	594.6504139	0.449474



Point ID	Easting (WASP Feet)	Northing (WASP Feet)	Elevation (Feet)	Abs. Dz (Feet)
6119	666127.132	953442.952	505.1493751	0.442912
6120	666069.958	954579.592	437.5642798	0.823488
6121	666037.693	954548.726	444.9789553	0.232939
6122	666046.688	954358.691	454.3621287	0.298556
6123	666045.15	954332.226	456.7899428	0.777557

## ACCURACY CONCLUSIONS

Forested and Fully Grown Land Cover Classification Supplemental Vertical Accuracy (SVA) Tested 0.823 feet supplemental vertical accuracy at the 95th percentile in the Forested and Fully Grown supplemental class and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. Forested and Fully Grown Errors larger than 95th percentile include:

- Point 6007, Easting 767630.529, Northing 905169.351, Z-Error 1.532 feet
- Point 6011, Easting 765898.313, Northing 901005.285, Z-Error 1.355 feet
- Point 6012, Easting 765903.033, Northing 901008.345, Z-Error 1.155 feet
- Point 6114, Easting 668707.207, Northing 949884.628, Z-Error 1.362 feet


## CONSOLIDATED VERTICAL ACCURACY ASSESSMENT

### ACCURACY CONCLUSIONS

Consolidated Vertical Accuracy (CVA) Tested 0.751 feet consolidated vertical accuracy at the 95th percentile level; reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. CVA is based on the 95th percentile error in all land cover categories combined.

- Point 5035, Easting 752405.226, Northing 907234.916, Z-Error 0.761 feet
- Point 5028, Easting 752500.499, Northing 907253.336, Z-Error 0.764 feet
- Point 4031, Easting 767631.452, Northing 905208.936, Z-Error 0.767 feet
- Point 5157, Easting 687386.648, Northing 837670.448, Z-Error 0.778 feet
- Point 6123, Easting 666045.150, Northing 954332.226, Z-Error 0.776 feet
- Point 5170, Easting 687401.329, Northing 837640.464, Z-Error 0.804 feet
- Point 6093, Easting 708196.702, Northing 939020.061, Z-Error 0.807 feet
- Point 5151, Easting 687399.642, Northing 837672.463, Z-Error 0.817 feet
- Point 5147, Easting 693541.903, Northing 838709.664, Z-Error 0.820 feet
- Point 6122, Easting 666046.688, Northing 954358.691, Z-Error 0.823 feet
- Point 4172, Easting 693601.390, Northing 838717.360, Z-Error 0.826 feet
- Point 5171, Easting 687404.693, Northing 837643.025, Z-Error 0.850 feet
- Point 5018, Easting 765826.137, Northing 900987.369, Z-Error 0.863 feet
- Point 5183, Easting 713893.586, Northing 854486.608, Z-Error 0.863 feet

- Point 6110, Easting 713332.880, Northing 867224.883, Z-Error 0.873 feet
- Point 6108, Easting 753919.835, Northing 824676.338, Z-Error 0.876 feet
- Point 5210, Easting 744738.479, Northing 849047.063, Z-Error 0.909 feet
- Point 5021, Easting 765845.514, Northing 900983.768, Z-Error 0.925 feet
- Point 5145, Easting 693547.354, Northing 838720.867, Z-Error 0.948 feet
- Point 4242, Easting 711759.896, Northing 942838.760, Z-Error 0.958 feet
- Point 5158, Easting 687382.356, Northing 837677.849, Z-Error 0.994 feet
- Point 4140, Easting 699448.994, Northing 839970.517, Z-Error 0.997 feet
- Point 5014, Easting 765853.818, Northing 901016.103, Z-Error 1.014 feet
- Point 5011, Easting 765856.057, Northing 901020.462, Z-Error 1.027 feet
- Point 5150, Easting 687405.915, Northing 837661.328, Z-Error 1.046 feet
- Point 5005, Easting 765830.177, Northing 901014.327, Z-Error 1.049 feet
- Point 5162, Easting 687374.146, Northing 837671.668, Z-Error 1.099 feet
- Point 4007, Easting 761011.207, Northing 908069.529, Z-Error 1.122 feet
- Point 6012, Easting 765903.033, Northing 901008.345, Z-Error 1.155 feet
- Point 5012, Easting 765859.550, Northing 901020.940, Z-Error 1.191 feet
- Point 5168, Easting 687395.870, Northing 837627.479, Z-Error 1.213 feet
- Point 6011, Easting 765898.313, Northing 901005.285, Z-Error 1.355 feet
- Point 6114, Easting 668707.207, Northing 949884.628, Z-Error 1.362 feet
- Point 4005, Easting 760779.231, Northing 908029.967, Z-Error 1.494 feet
- Point 6007, Easting 767630.529, Northing 905169.351, Z-Error 1.532 feet

Approved By:			
Title	Name	Signature	Date
Associate LiDAR Specialist Certified Photogrammetrist #1281	Qian Xiao		September 2014

# SECTION 6: FINAL DELIVERABLES

## FINAL DELIVERABLES

The final LiDAR deliverables provided for the NAD83 (2011) UTM10 Meters delivery listed below.

- LAS v1.2 classified point cloud
- LAS v1.2 raw unclassified point cloud flight line strips no greater than 2GB. Long swaths greater than 2GB will be split into segments)
- Hydrologically flattened Polygon z and Polyline z shapefiles
- Hydrologically flattened bare earth 1-meter DEM in ERDAS .IMG format
- First Return 1-meter DSM in ERDAS .IMG format
- 8-bit gray scale intensity images in 1-meter pixel TIF file format
- Tile Layout and data extent provided as ESRI shapefile
- Control points provided as ESRI shapefile
- FGDC compliant metadata per product in XML format
- LiDAR processing report in pdf format
- Survey report in pdf format

The final LiDAR deliverables provided for the Washington State Plane South US Feet delivery listed below.

- Hydrologically flattened Polygon z and Polyline z shapefiles
- Hydrologically flattened bare earth 3-foot DEM in ESRI ArcGrid format
- First Return 3-foot DSM in ESRI ArcGrid format
- 8-bit gray scale intensity images in 3-foot pixel TIF file format
- Tile Layout and data extent provided as ESRI shapefile
- Control points provided as ESRI shapefile
- FGDC compliant metadata per product in XML format
- LiDAR processing report in pdf format
- Survey report in pdf format



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