

**Minimum Technical Standards Report  
Control Survey &  
Specific Purpose Survey for LiDAR**



**PREPARED FOR:  
UNITED STATES GEOLOGICAL SURVEY**



**PREPARED BY:  
NORTHROP GRUMMAN CORPORATION**

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UPPER SALINE WATERSHED LIDAR

CONTRACT # G10PC00150

NGC INTERNAL #B1M95813

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**Technical Standards Report  
Control Survey & Specific Purpose Survey for LiDAR**

LiDAR Elevation Mapping  
Upper Saline Watershed

Prepared For:

**US Geological Survey**  
1400 Independence Road  
Rolla, MO 65401  
Phone: 573.308.3587

Prepared By:

**Northrop Grumman Corporation**  
301 Voyager Way  
Huntsville, AL 35806  
Phone: 256.830.3691

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# Technical Standards Report Control Survey & Specific Purpose Survey for LiDAR

## LiDAR Elevation Mapping Upper Saline Watershed

### Introduction & Specifications

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The purpose of this Survey was to provide ground truth data which will be used to validate LiDAR data of the Upper Saline Watershed LiDAR dataset, the area of interest is located in Central Arkansas. The ground surveys were conducted utilizing a static network that was geodetically connected to the local CORS sites and follows the USGS LiDAR Base Specification Version 1.0 and the FEMA “*Guidelines and Specifications for Flood Hazard Mapping Partners*” to collect checkpoints for the main categories of ground cover in the study area. The vertical accuracy requirements meet or exceed the required RMSEz of 12.5cm and the vertical accuracy of 24.5cm at the 95% confidence level as specified by the SOW using NDEP/ASPRS methodologies referring to the NDEP\_Elevation\_Guidelines\_Ver1\_10May2004 .pdf.

## Datum & Coordinate Systems

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The LiDAR data and coordinate values associated with this project are referenced to the North American Datum of 1983, Universal Transverse Mercator Coordinate System, Zone 15 North, in units of Meters. The vertical datum is North America Vertical Datum of 1988, in units of Meters. Elevations were derived by using Geoid 12A

## Survey Area

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The project area is approximately 972 square miles and covers the area of interest: Upper Saline Watershed located in Central Arkansas.

## Control Survey

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The GPS survey was collected through static network techniques and was geodetically connected to the local CORS stations located in central Arkansas. The Standard Operating Procedure for the data collection includes a geodetic control network plan designed to maximize the use of the highest order control points in the area of interest, and to optimize the spatial distribution of geodetic control across the network. Also included is the simultaneous occupation of points designed to provide redundant vectors and loop closures, as well as a collection of a superfluity of points comparing observed values against published values of geodetic control points. In addition, the static GPS network was established to verify the compatibility and correlation of existing published NGS controls in the project area. Horizontal and vertical constraints were selected based on the order of accuracy and correlation of the controls selected.

### Local Network Accuracy

Several existing control monuments listed in the NSRS database were used as checks within the static network. This confirmed network accuracies were being met during the field survey as well as providing a redundancy check on the Network adjustment. The Specified local network accuracy of 5cm at the 95% confidence level was met or exceeded. The results and NSRS published point information are listed within the table below.

Name	Published			Surveyed			Differences		
	Northing	Easting	Elev.	Northing	Easting	Elev.	$\Delta$ North	$\Delta$ East	$\Delta$ Elev
LR 2 (AE2992)	3836958.947	556402.877	88.507	3836958.949	556402.869	88.488	-0.002	0.008	0.019
ARHP (DH7103)	3728617.221	444343.958	112.689	3728617.227	444343.962	112.688	-0.006	-0.004	0.001
OKHV (DF7475)	3864607.772	352184.755	178.091	3864607.771	352184.747	178.123	0.001	0.008	-0.032
PAGIS (AV0566)	3855611.741	568280.561	174.939	3855611.738	568280.590	174.925	0.003	-0.029	0.014

## Ground Truth Survey

Ground Truth data was collected of the major land cover classes present within the area of interest. 20 points were collected in each of the following land cover Bare-Earth (Open Terrain), Forested and Fully Grown. Points collected in taller vegetation were collected with a total station by establishing a pair of points during the survey using the local CORS network once completed the total station is used to collect points under the vegetation canopy.

## Horizontal Accuracy Analysis

There is not a systematic method of testing when testing horizontal accuracy in LiDAR. The horizontal accuracy is checked by collecting building corners during the survey. Lines are then digitized while viewing the intensity images representing the building outline and the differences are measure from each individual survey point to the corner of the building outline. Stats are calculated to ensure horizontal tolerances are met. These measurements resulted in an RMSEr of 0.67 meters and a horizontal accuracy of 1.16 meter horizontal accuracy at the 95 % confidence interval. Method used was the NSSDA standard for horizontal accuracy assessment.

FGDC-STD-007.3-1998

$$\text{RMSE}_{\text{northing}} = \sqrt{[\sum (\text{CONTROL}_{\text{northing}} - \text{MEASURED}_{\text{northing}})^2/n]}$$

$$\text{RMSE}_{\text{easting}} = \sqrt{[\sum (\text{CONTROL}_{\text{easting}} - \text{MEASURED}_{\text{easting}})^2/n]}$$

$$\text{RMSE}_r = \sqrt{[\text{RMSE}_{\text{easting}}^2 + \text{RMSE}_{\text{northing}}^2]}$$

$$\text{RMSE accuracy} = 1.7308 * \text{RMSE}_r$$

## Vertical Accuracy Analysis

Data analysis was accomplished by comparing ground truth checkpoints with LIDAR points from the edited data set, which were within 1 meter horizontally from the ground truth points. Based on the number of returns and the density of points in this project, it was not necessary to compare to anything further away than 1meter horizontally from the ground truth points. Note that the edited LIDAR points are simply a subset of the raw LIDAR points. The points that fell above the ground surface on vegetation canopies, buildings, or other obstructions were removed from the data set. Comparisons were also made between the survey points and the LIDAR derived terrain surface. These comparisons provide an additional verification of the LIDAR data against the survey data. The vertical accuracy requirements meet or exceed the required RMSEz of 12.5cm and the vertical accuracy of 24.5cm at the 95% confidence level

$$\text{ACCURACY}_z = 1.96 * \text{RMSE}_z$$

Land Cover Category	# of Points	FVA vs TIN Required 24.5cm	FVA vs DEM Required 24.5cm	SVA vs DEM Target 36.0cm	CVA vs DEM Required 36.0cm
Consolidated All Classes	40				15.3cm
Bare earth (Open Terrain)	20	20.0cm	19.0cm		
Forested and Fully Grown	20			12.0cm	

## **Appendix A**

# The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.4
1      National Geodetic Survey,  Retrieval Date = DECEMBER  5, 2013
AE2992
*****
AE2992  CBN          -  This is a Cooperative Base Network Control Station.
AE2992  DESIGNATION -  LR 2
AE2992  PID          -  AE2992
AE2992  STATE/COUNTY-  AR/PULASKI
AE2992  COUNTRY     -  US
AE2992  USGS QUAD   -  ALEXANDER (1986)
AE2992
AE2992                                *CURRENT SURVEY CONTROL
AE2992
-----
AE2992* NAD 83(2011) POSITION- 34 40 22.98066(N) 092 23 03.62592(W)
ADJUSTED
AE2992* NAD 83(2011) ELLIP HT- 62.008 (meters) (06/27/12)
ADJUSTED
AE2992* NAD 83(2011) EPOCH - 2010.00
AE2992* NAVD 88 ORTHO HEIGHT - 88.507 (meters) 290.38 (feet)
ADJUSTED
AE2992
-----
AE2992 NAD 83(2011) X - -218,463.364 (meters) COMP
AE2992 NAD 83(2011) Y - -5,246,650.869 (meters) COMP
AE2992 NAD 83(2011) Z - 3,608,131.506 (meters) COMP
AE2992 LAPLACE CORR - 0.38 (seconds)
DEFLEC12A
AE2992 GEOID HEIGHT - -26.50 (meters)
GEOID12A
AE2992 DYNAMIC HEIGHT - 88.426 (meters) 290.11 (feet) COMP
AE2992 MODELED GRAVITY - 979,713.2 (mgal) NAVD
88
AE2992
AE2992 VERT ORDER - FIRST CLASS II
AE2992
AE2992 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
AE2992 Type Horiz Ellip Dist(km)
AE2992 -----
AE2992 NETWORK 0.54 1.45
AE2992 -----
AE2992 MEDIAN LOCAL ACCURACY AND DIST (005 points) 0.45 1.29 6.95
AE2992 -----
AE2992 NOTE: Click here for information on individual local accuracy
AE2992 values and other accuracy information.
AE2992
AE2992
AE2992.The horizontal coordinates were established by GPS observations
AE2992.and adjusted by the National Geodetic Survey in June 2012.
```



AE2992  
 AE2992.NAD 83(2011) refers to NAD 83 coordinates where the reference  
 AE2992.frame has been affixed to the stable North American tectonic plate.  
 See

AE2992.[NA2011](#) for more information.

AE2992  
 AE2992.The horizontal coordinates are valid at the epoch date displayed  
 above

AE2992.which is a decimal equivalence of Year/Month/Day.

AE2992

AE2992.The orthometric height was determined by differential leveling and  
 AE2992.adjusted by the NATIONAL GEODETIC SURVEY

AE2992.in May 2008.

AE2992

AE2992.The X, Y, and Z were computed from the position and the ellipsoidal  
 ht.

AE2992

AE2992.The Laplace correction was computed from DEFLEC12A derived  
 deflections.

AE2992

AE2992.The ellipsoidal height was determined by GPS observations  
 AE2992.and is referenced to NAD 83.

AE2992

AE2992.The dynamic height is computed by dividing the NAVD 88  
 AE2992.geopotential number by the normal gravity value computed on the  
 AE2992.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45  
 AE2992.degrees latitude (g = 980.6199 gals.).

AE2992

AE2992.The modeled gravity was interpolated from observed gravity values.

AE2992

AE2992. The following values were computed from the NAD 83(2011) position.

AE2992

AE2992;	North	East	Units	Scale Factor	
Converg.					
AE2992;SPC AR S	- 622,604.726	364,776.042	MT	0.99998046	-0 12
54.4					
AE2992;SPC AR S	- 2,042,662.34	1,196,769.40	sFT	0.99998046	-0 12
54.4					
AE2992;UTM 15	- 3,836,958.947	556,402.877	MT	0.99963921	+0 21
00.9					

AE2992

AE2992!  
 AE2992!SPC AR S - Elev Factor x Scale Factor = Combined Factor  
 AE2992!UTM 15 - 0.99999027 x 0.99998046 = 0.99997073  
 AE2992!UTM 15 - 0.99999027 x 0.99963921 = 0.99962948

AE2992

AE2992	-----			
AE2992	PID	Reference Object	Distance	Geod. Az
AE2992				dddmss.s
AE2992	AE2985	AHTD LR 1	170.766 METERS	10606

AE2992|

AE2992

AE2992

SUPERSEDED SURVEY CONTROL

AE2992  
AE2992 NAD 83(2007)- 34 40 22.98066(N) 092 23 03.62685(W) AD(2002.00) 0  
AE2992 ELLIP H (02/10/07) 62.029 (m) GP(2002.00)  
AE2992 ELLIP H (09/21/01) 62.033 (m) GP( ) 4  
2  
AE2992 NAD 83(1997)- 34 40 22.98053(N) 092 23 03.62709(W) AD( ) B  
AE2992 ELLIP H (09/19/97) 62.014 (m) GP( ) 4  
1  
AE2992 NAVD 88 (09/19/97) 88.5 (m) GEOID96 model used GPS OBS  
AE2992  
AE2992.Superseded values are not recommended for survey control.  
AE2992  
AE2992.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
AE2992.[See file dsdata.txt](#) to determine how the superseded data were derived.  
AE2992  
AE2992\_U.S. NATIONAL GRID SPATIAL ADDRESS: 15SWU5640236958(NAD 83)  
AE2992  
AE2992\_MARKER: F = FLANGE-ENCASED ROD  
AE2992\_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)  
AE2992\_STAMPING: AHTD LR2 1997  
AE2992\_MARK LOGO: ARHD  
AE2992\_PROJECTION: RECESSED 0 CENTIMETERS  
AE2992\_MAGNETIC: I = MARKER IS A STEEL ROD  
AE2992\_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL  
AE2992\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
AE2992+SATELLITE: SATELLITE OBSERVATIONS - May 05, 2007  
AE2992\_ROD/PIPE-DEPTH: 6.10 meters  
AE2992\_SLEEVE-DEPTH : 1.0 meters  
AE2992  
AE2992 HISTORY - Date Condition Report By  
AE2992 HISTORY - 1997 MONUMENTED ARHD  
AE2992 HISTORY - 20070505 GOOD NGS  
AE2992  
AE2992 STATION DESCRIPTION  
AE2992  
AE2992'DESCRIBED BY ARKANSAS DEPARTMENT OF TRANSPORTATION 1997 (DDK)  
AE2992'THE STATION IS LOCATED ON THE SOUTHWEST SIDE OF LITTLE ROCK, AT THE  
AE2992'ARKANSAS HIGHWAY AND TRANSPORTATION DEPARTMENT CENTRAL OFFICE AND  
AE2992'DISTRICT 6. OWNERSHIP--STATE OF ARKANSAS, PO BOX 190296, LITTLE ROCK  
AE2992'AR 72219-0296, PHONE 501-569-2173, DISTRICT ENGINEER IS LEONARD HALL.  
AE2992'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAY 338 (BASELINE  
AE2992'ROAD AND MABELVALE PIKE) AND INTERSTATE 30 (EXIT 130) LOCATED ON THE  
AE2992'SOUTHWEST SIDE OF LITTLE ROCK, GO NORTH ON STATE HIGHWAY 338  
(BASELINE  
AE2992'ROAD AND MABELVALE PIKE) FOR 0.08 KM (0.05 MI) TO A T-JUNCTION. TURN  
AE2992'RIGHT, EAST ON MABELVALE PIKE FOR 0.08 KM (0.05 MI) TO THE JUNCTION  
OF  
AE2992'MABELVALE PIKE ON THE LEFT. TURN LEFT, NORTH ON MABELVALE PIKE FOR  
AE2992'0.40 KM (0.25 MI) TO THE JUNCTION OF A PAVED ROAD LEFT LEADING TO THE  
AE2992'ARHD DISTRICT 6. TURN LEFT, WEST ON THE PAVED ROAD FOR 0.40 KM (0.25  
AE2992'MI) TO THE STATION ON THE RIGHT. THE STATION IS A PUNCH HOLE ON THE  
AE2992'TOP OF A STAINLESS STEEL ROD ENCASED IN A 6-INCH PVC PIPE WITH ARHD  
AE2992'LOGO CAP. LOCATED 37.16 M (121.92 FT) SOUTHEAST OF A UTILITY POLE,  
AE2992'27.50 M (90.22 FT) EAST OF A CHAIN LINK FENCE, 10.10 M (33.14 FT)  
AE2992'NORTH OF THE CENTER OF A PAVED ROAD AND 1.00 M (3.28 FT) SOUTH OF A  
AE2992'FIBERGLASS WITNESS POST. NOTE--THE SLEEVE DEPTH DOES NOT MEET THE

AE2992'SPECIFICATION FOR A CLASS A ROD MARK.  
AE2992  
AE2992 STATION RECOVERY (2007)  
AE2992  
AE2992'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2007 (JBW)  
AE2992'RECOVERED AS DESCRIBED.  
PROGRAM = datasheet95, VERSION = 8.4  
1 National Geodetic Survey, Retrieval Date = APRIL 2, 2014  
DH7103  
\*\*\*\*\*  
DH7103 CORS - This is a GPS Continuously Operating Reference  
Station.  
DH7103 DESIGNATION - HOPE CORS ARP  
DH7103 CORS\_ID - ARHP  
DH7103 PID - DH7103  
DH7103 STATE/COUNTY- AR/HEMPSTEAD  
DH7103 COUNTRY - US  
DH7103 USGS QUAD - HOPE (1978)  
DH7103  
DH7103 \*CURRENT SURVEY CONTROL  
DH7103

---

DH7103\* NAD 83(2011) POSITION- 33 41 45.77875(N) 093 36 01.95699(W)  
ADJUSTED  
DH7103\* NAD 83(2011) ELLIP HT- 85.699 (meters) (08/??/11)  
ADJUSTED  
DH7103\* NAD 83(2011) EPOCH - 2010.00  
DH7103\* [NAVD 88](#) ORTHO HEIGHT - 112.689 (meters) 369.71 (feet)  
ADJUSTED  
DH7103

---

DH7103	NAD 83(2011) X	-	-333,600.326 (meters)	COMP
DH7103	NAD 83(2011) Y	-	-5,301,622.680 (meters)	COMP
DH7103	NAD 83(2011) Z	-	3,518,494.008 (meters)	COMP
DH7103	GEOID HEIGHT	-	-26.98 (meters)	

GEOID12A  
DH7103 VERT ORDER - SECOND CLASS I  
DH7103  
DH7103 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)  
DH7103 Type Horiz Ellip Dist(km)  
DH7103 -----  
DH7103 NETWORK 1.02 3.65  
DH7103 -----  
DH7103 NOTE: Click [here](#) for information on individual local accuracy  
DH7103 values and other accuracy information.  
DH7103  
DH7103  
DH7103.The coordinates were established by GPS observations  
DH7103.and adjusted by the National Geodetic Survey in August 2011.  
DH7103  
DH7103.NAD 83(2011) refers to NAD 83 coordinates where the reference  
DH7103.frame has been affixed to the stable North American Tectonic Plate.  
DH7103  
DH7103.The coordinates are valid at the epoch date displayed above  
DH7103.which is a decimal equivalence of Year/Month/Day.  
DH7103  
DH7103.The orthometric height was determined by differential leveling and

DH7103.adjusted by the NATIONAL GEODETIC SURVEY  
DH7103.in February 2014.  
DH7103  
DH7103.No vertical observational check was made to the station.  
DH7103  
DH7103.The PID for the CORS L1 Phase Center is DI3468.  
DH7103  
DH7103.The XYZ, and position/ellipsoidal ht. are equivalent.  
DH7103  
DH7103.The ellipsoidal height was determined by GPS observations  
DH7103.and is referenced to NAD 83.  
DH7103  
DH7103. The following values were computed from the NAD 83(2011) position.  
DH7103  
DH7103;  
North East Units Scale Factor  
Converg.  
DH7103;SPC AR S - 515,331.189 251,625.121 MT 0.99993580 -0 53  
44.9  
DH7103;SPC AR S - 1,690,715.74 825,540.08 sFT 0.99993580 -0 53  
44.9  
DH7103  
DH7103!  
- Elev Factor x Scale Factor = Combined Factor  
DH7103!SPC AR S - 0.99998655 x 0.99993580 = 0.99992235  
DH7103  
DH7103  
SUPERSEDED SURVEY CONTROL  
DH7103  
DH7103 NAD 83(CORS)- 33 41 45.77881(N) 093 36 01.95741(W) AD(2002.00) c  
DH7103 ELLIP H (11/??/05) 85.694 (m) GP(2002.00) c  
c  
DH7103  
DH7103.Superseded values are not recommended for survey control.  
DH7103  
DH7103.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
DH7103.[See file dsdata.txt](#) to determine how the superseded data were  
derived.  
DH7103  
DH7103\_U.S. NATIONAL GRID SPATIAL ADDRESS: 15SVT4434328617(NAD 83)  
DH7103  
DH7103\_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA  
DH7103  
DH7103  
STATION DESCRIPTION  
DH7103  
DH7103'DESCRIBED BY NATIONAL GEODETIC SURVEY 2011  
DH7103'STATION IS A GPS CORS. LATEST INFORMATION INCLUDING POSITIONS AND  
DH7103'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE  
DH7103'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.  
DH7103' ftp://cors.ngs.noaa.gov/cors/README.txt  
DH7103' ftp://cors.ngs.noaa.gov/cors/coord/coord\_08  
DH7103' ftp://cors.ngs.noaa.gov/cors/station\_log  
DH7103' http://geodesy.noaa.gov/CORS

\*\*\* retrieval complete.  
Elapsed Time = 00:00:02  
PROGRAM = datasheet95, VERSION = 8.4  
1 National Geodetic Survey, Retrieval Date = APRIL 2, 2014  
DF7475

\*\*\*\*\*

DF7475 CORS - This is a GPS Continuously Operating Reference Station.  
 DF7475 DESIGNATION - HEAVENER CORS ARP  
 DF7475 CORS\_ID - OKHV  
 DF7475 PID - DF7475  
 DF7475 STATE/COUNTY- OK/LE FLORE  
 DF7475 COUNTRY - US  
 DF7475 USGS QUAD - HEAVENER (1981)  
 DF7475  
 DF7475 \*CURRENT SURVEY CONTROL  
 DF7475

---

DF7475\* NAD 83(2011) POSITION- 34 54 47.37901(N) 094 37 05.09242(W)  
 ADJUSTED  
 DF7475\* NAD 83(2011) ELLIP HT- 146.531 (meters) (08/??/11)  
 ADJUSTED  
 DF7475\* NAD 83(2011) EPOCH - 2010.00  
 DF7475\* [NAVD 88](#) ORTHO HEIGHT - \*(meters) \*(feet)  
 DF7475

---

DF7475	NAD 83(2011) X	-	-421,573.964 (meters)	COMP
DF7475	NAD 83(2011) Y	-	-5,219,068.017 (meters)	COMP
DF7475	NAD 83(2011) Z	-	3,630,054.946 (meters)	COMP
DF7475	GEOID HEIGHT	-	-31.56 (meters)	

GEOID12A

DF7475  
 DF7475 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)  
 DF7475 Type Horiz Ellip Dist(km)  
 DF7475 -----

DF7475	NETWORK	0.55	1.91
--------	---------	------	------

DF7475 -----

DF7475 NOTE: Click [here](#) for information on individual local accuracy  
 DF7475 values and other accuracy information.

DF7475  
 DF7475

DF7475.The coordinates were established by GPS observations  
 DF7475.and adjusted by the National Geodetic Survey in August 2011.  
 DF7475

DF7475.NAD 83(2011) refers to NAD 83 coordinates where the reference  
 DF7475.frame has been affixed to the stable North American Tectonic Plate.  
 DF7475

DF7475.The coordinates are valid at the epoch date displayed above  
 DF7475.which is a decimal equivalence of Year/Month/Day.  
 DF7475

DF7475.The PID for the CORS L1 Phase Center is DF7476.  
 DF7475

DF7475.The XYZ, and position/ellipsoidal ht. are equivalent.  
 DF7475

DF7475.The ellipsoidal height was determined by GPS observations  
 DF7475.and is referenced to NAD 83.  
 DF7475

DF7475. The following values were computed from the NAD 83(2011) position.  
 DF7475

DF7475;	North	East	Units	Scale	Factor
---------	-------	------	-------	-------	--------

Converg.  
 DF7475;SPC OK S - 180,418.249 908,982.451 MT 0.99995237 +1 55  
 10.7



## **Appendix B**

## Fundamental Vertical Accuracy Point List

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Point ID	LAT	LONG	Easting	Northing	Elevation	Ellipsoid	Feature Code
1-3	34°51'55.403601988"	W93°04'34.745571352"	493024.45	3858118	160.352	131.933	BARE EARTH OPEN TERRAIN
2-3	34°47'38.979297734"	W92°40'16.309570010"	530078.808	3850266	178.781	151.462	BARE EARTH OPEN TERRAIN
3-5	34°44'19.581049904"	W92°34'04.942587874"	539542.092	3844159	161.598	134.671	BARE EARTH OPEN TERRAIN
4-3	34°44'23.350046446"	W93°04'17.511515688"	493452.086	3844193	241.465	213.535	BARE EARTH OPEN TERRAIN
5-3	34°39'13.251679191"	W92°27'41.287607323"	549348.272	3834771	109.559	83.069	BARE EARTH OPEN TERRAIN
6-3	34°39'10.476216757"	W93°03'28.994615732"	494680.199	3834555	285.764	258.142	BARE EARTH OPEN TERRAIN
7-3	34°39'49.977663854"	W92°41'39.670388613"	528004.421	3835812	164.091	137.203	BARE EARTH OPEN TERRAIN
8-3	34°34'06.724422043"	W92°59'23.750033534"	500923.65	3825197	181.949	154.753	BARE EARTH OPEN TERRAIN
9-5	34°35'58.906378851"	W92°22'40.587605844"	557039.367	3828828	98.273	71.884	BARE EARTH OPEN TERRAIN
10-3	34°33'20.436486096"	W92°50'44.746299688"	514150.056	3823782	167.807	140.989	BARE EARTH OPEN TERRAIN
11-3	34°29'17.781560609"	W92°27'21.629259530"	549947.483	3816431	120.252	94.038	BARE EARTH OPEN TERRAIN
12-3	34°27'02.205672830"	W92°39'17.818552633"	531695.485	3812175	91.33	64.984	BARE EARTH OPEN TERRAIN
13-3	34°47'45.496091525"	W92°50'31.188295527"	514453.761	3850429	213.258	185.633	BARE EARTH OPEN TERRAIN
14-3	34°41'46.405298371"	W92°50'00.762366226"	515245.214	3839369	168.242	140.951	BARE EARTH OPEN TERRAIN
15-3	34°32'57.087206090"	W92°18'04.494606154"	564110.525	3823274	86.628	60.304	BARE EARTH OPEN TERRAIN
16-3	34°35'23.725906373"	W92°30'48.656325850"	544613.025	3827676	106.607	80.223	BARE EARTH OPEN TERRAIN
17-3	34°44'13.571044978"	W92°58'38.081661919"	502083.059	3843890	210.945	183.226	BARE EARTH OPEN TERRAIN
18-3	34°36'59.459185912"	W92°54'57.593513528"	507700.894	3830521	142.057	114.877	BARE EARTH OPEN TERRAIN
19-3	34°49'15.297978066"	W92°58'14.565111179"	502678.34	3853184	303.957	276.019	BARE EARTH OPEN TERRAIN
20-3	34°32'00.255543152"	W92°40'45.298672460"	529434.23	3821348	126.373	99.906	BARE EARTH OPEN TERRAIN



## **Appendix C**

