

20170064



**Survey Control Report for  
Lubbock Orthoimagery  
2016**

Alan R. Benham, RPLS



August 5, 2016



**Introduction:**

This control report documents the establishment of aerial photo control for the City of Lubbock Orthophotography Project 2016. Control from the previous project dated June 2, 2015 (BHI project Number 20150378) was utilized where possible. That existing control was utilized and repanelled where possible – those monuments that were destroyed were reestablished and are reported herein. In those cases, BHI opted to set new control consisting of either a 2” aluminum cap on 5/8”x18” rebar or a PK nail with 2” aluminum washer. Photo control was established with Real Time Kinematic GPS double observations or fast static observation. All plastic panel material was subsequently removed after the aerial photography acquisition. Additionally, two semi-permanent monuments were set, observed and adjusted through OPUS Projects as reported herein.

**Project Control Process Flowchart:**

See attachment

**Project Control Specifications:**

<b>Units:</b>	US Survey Foot
<b>Horizontal Datum:</b>	NAD_83(2011)(EPOCH:2010.0000)
<b>Vertical Datum:</b>	NAVD88
<b>Geoid Model:</b>	GEOID12A – for new control monumentation
<b>Projection:</b>	Transverse Mercator
<b>State Plane and/or UTM Zone:</b>	Texas North Central Zone (3002)
<b>Basis of Bearing:</b>	Grid Bearings
<b>Project Combined Factor:</b>	Delivered in Grid TX83-NCF
<b>Modification Method Used:</b>	N/A
<b>Field Methodology:</b>	OPUS Project and RTK
<b>Equipment Used:</b>	Trimble GPS Equipment
<b>Control Set Date:</b>	May – July 2016
<b>Observation Date:</b>	May – July 2016
<b>Adjustment/ Publication Date:</b>	August 5, 2016

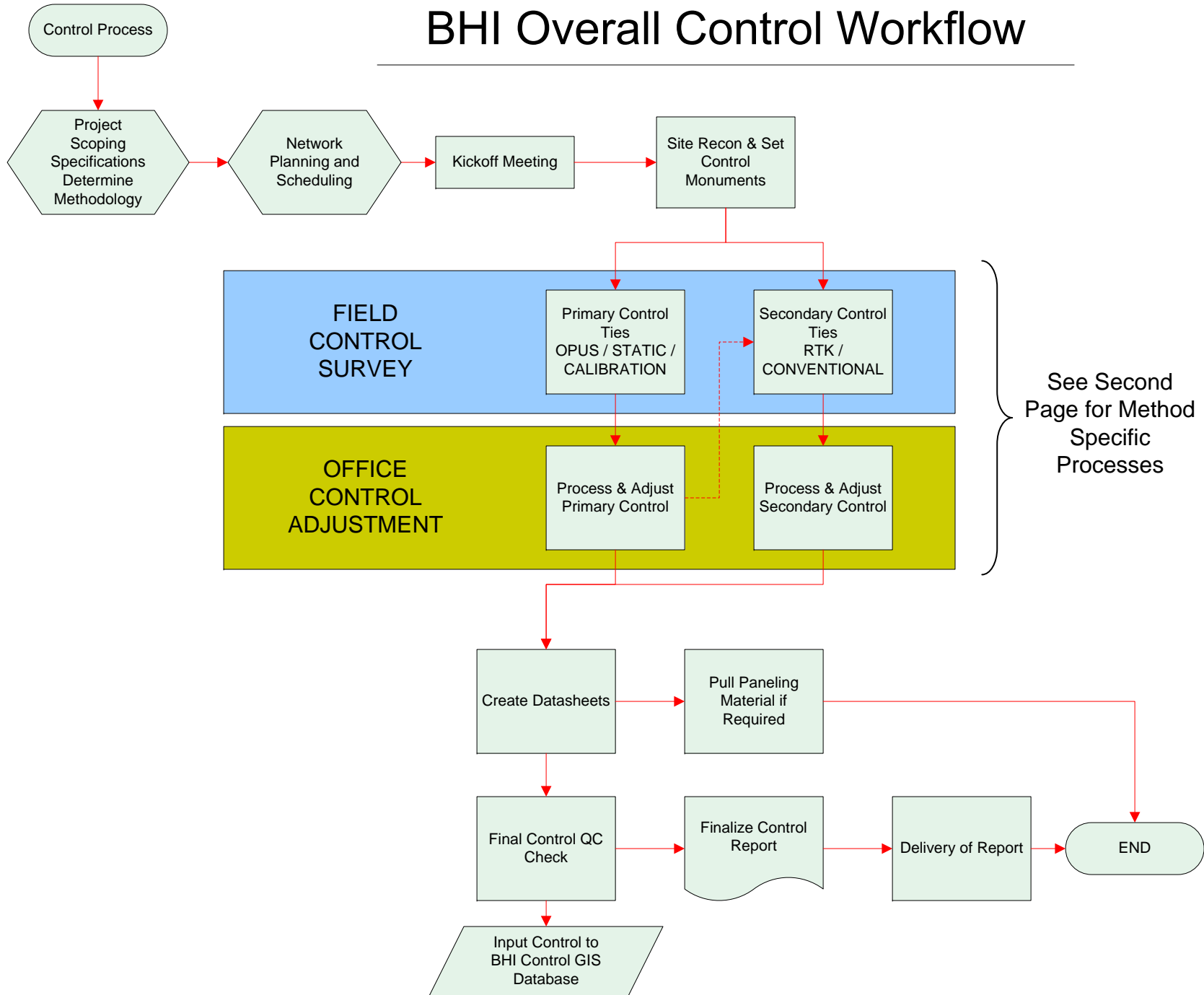
I, Alan R. Benham, Texas Registered Professional Land Surveyor No. 5814 do hereby certify that this Control Survey Report was prepared by me or under my direct supervision based on an actual survey on the ground as described herein; that I am responsible for this survey.

Alan R. Benham, PE, RPLS, CFedS  
Bohannon Huston, Inc.  
Courtyard I / 7500 Jefferson St. NE  
Albuquerque, NM 87109-4335  
(505).823.1000

August 5, 2016  
Date

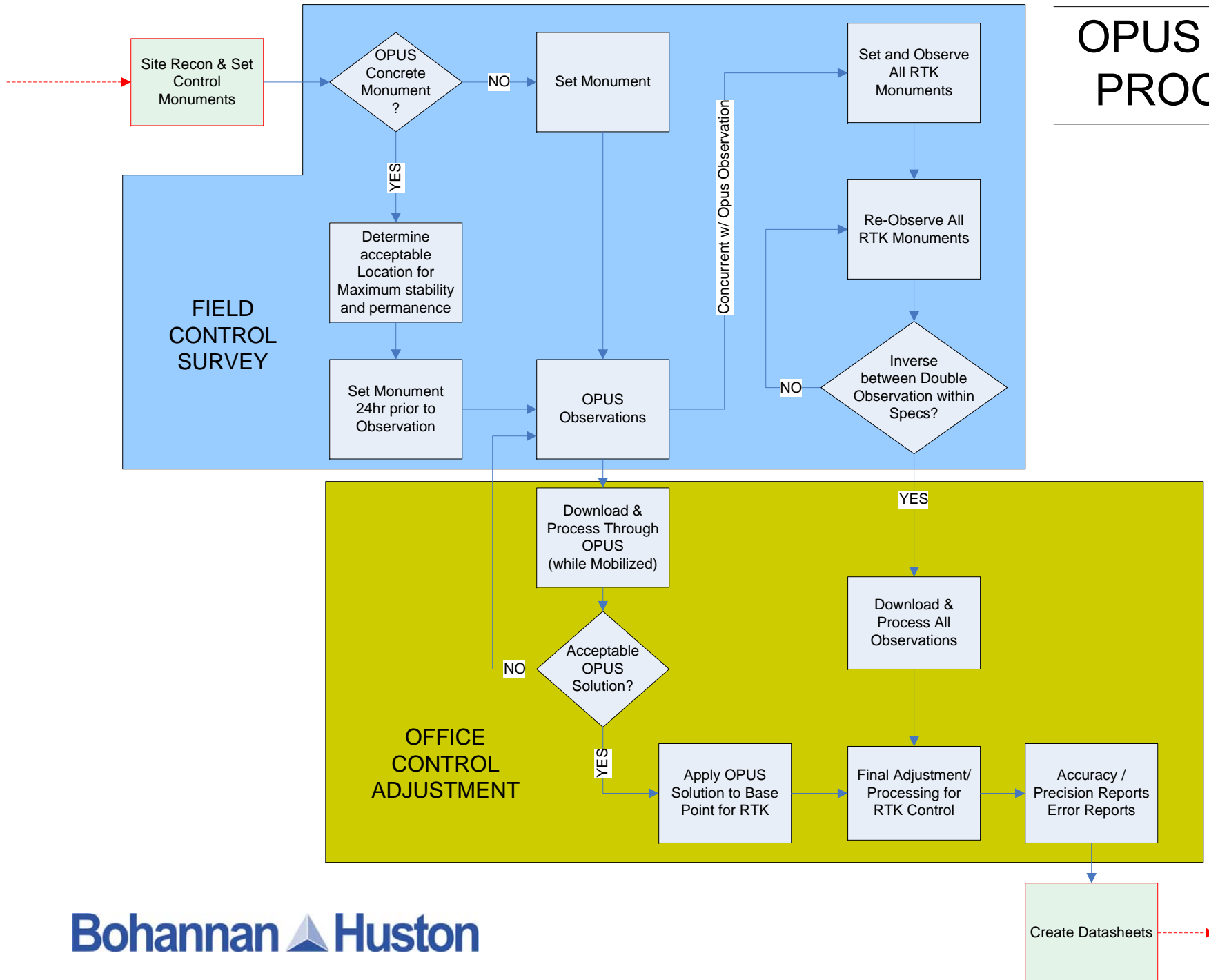


# BHI Overall Control Workflow



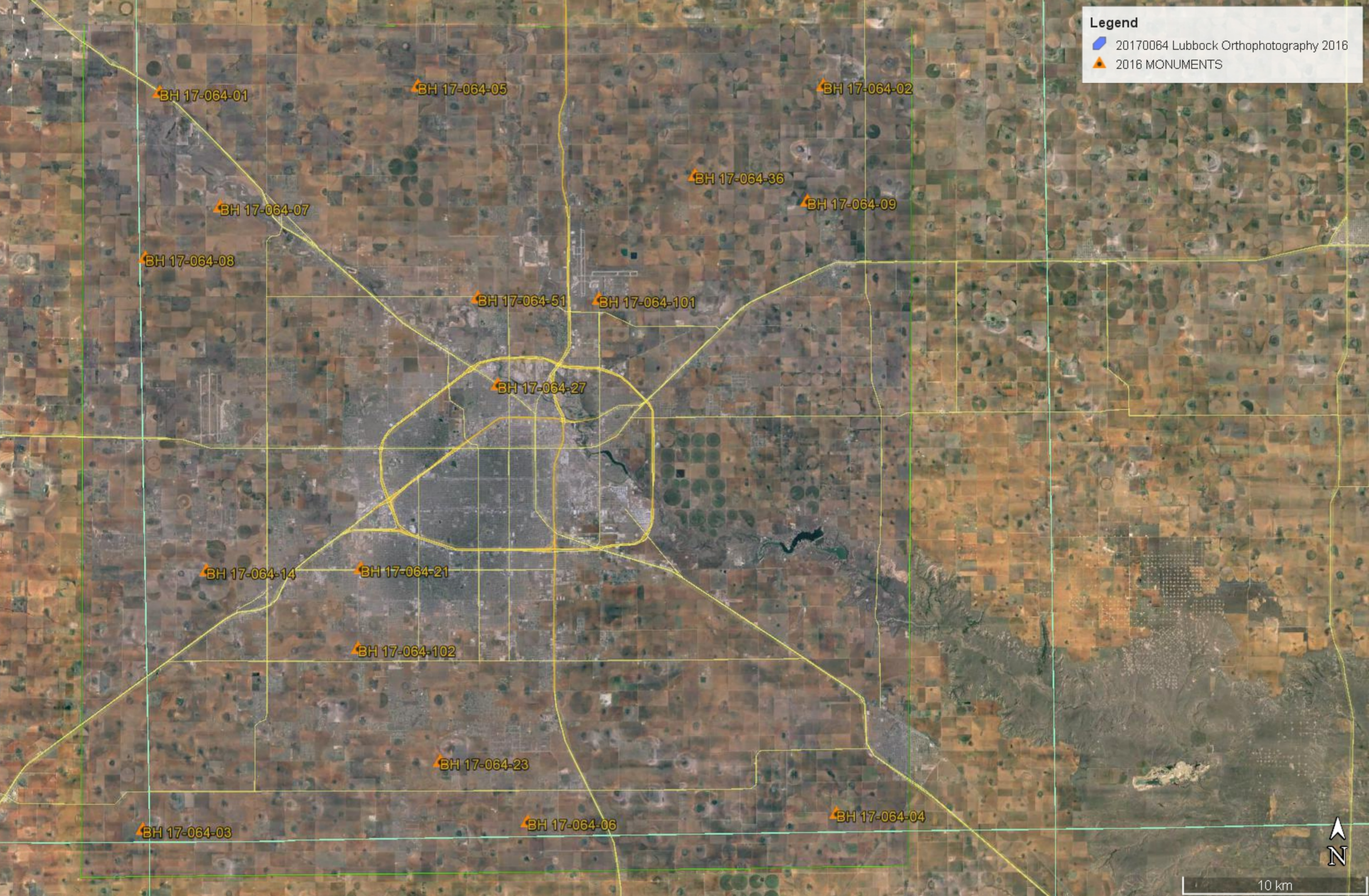
See Second Page for Method Specific Processes

# OPUS - RTK PROCESS



**Legend**

- 20170064 Lubbock Orthophotography 2016
- 2016 MONUMENTS



# Control Station Data



Name of Station: **BH 17-064-101**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 17-Jul-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 3.5" Brass Cap

Horizontal Method: OPUS

Station Height: 0.00 US Ft

Vertical Method: OPUS

Stamping: 17.064.101 2016

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 38' 58.95584"	7,299,087.124 US Ft	7,299,087.124 US Ft
Longitude   Easting   X:	W 101° 49' 07.29393"	958,738.916 US Ft	958,738.916 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	968.648 m	3,177.973 US Ft	3,260.351 US Ft

## Location

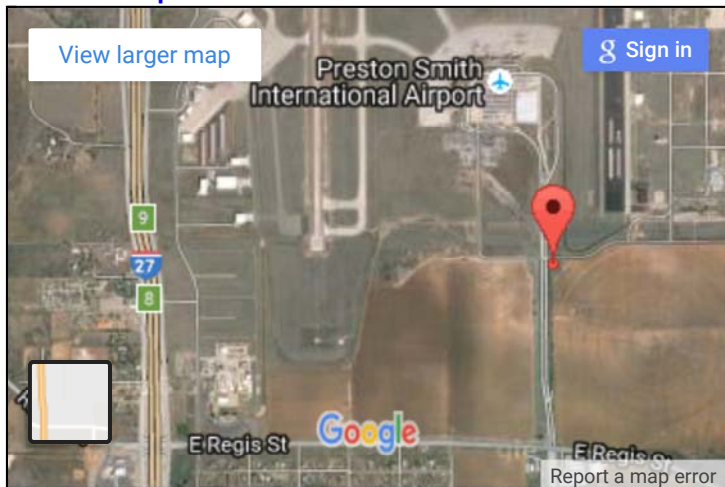
County & State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

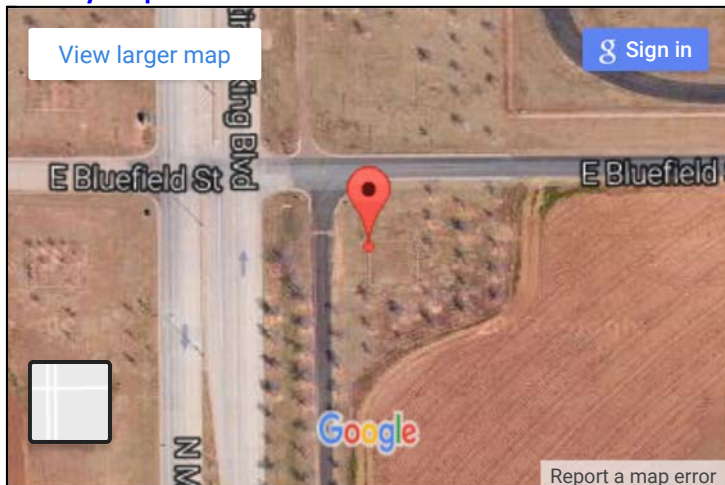
## Location Map:



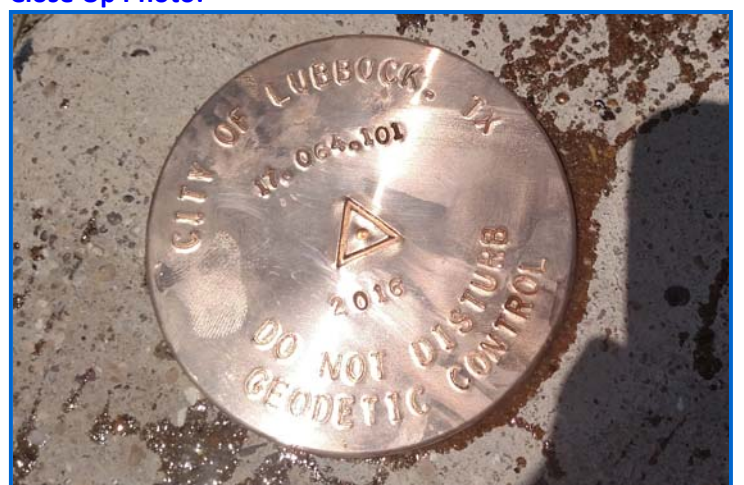
## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



# Control Station Data



Name of Station: **BH 17-064-102**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 17-Jul-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 3.5" Brass Cap

Horizontal Method: OPUS

Station Height: 0.00 US Ft

Vertical Method: OPUS

Stamping: 17.064.102 2016

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 28' 58.13044"	7,239,748.201 US Ft	7,239,748.201 US Ft
Longitude   Easting   X:	W 101° 57' 24.47821"	914,734.913 US Ft	914,734.913 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	978.502 m	3,210.302 US Ft	3,290.774 US Ft

## Location

County & State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

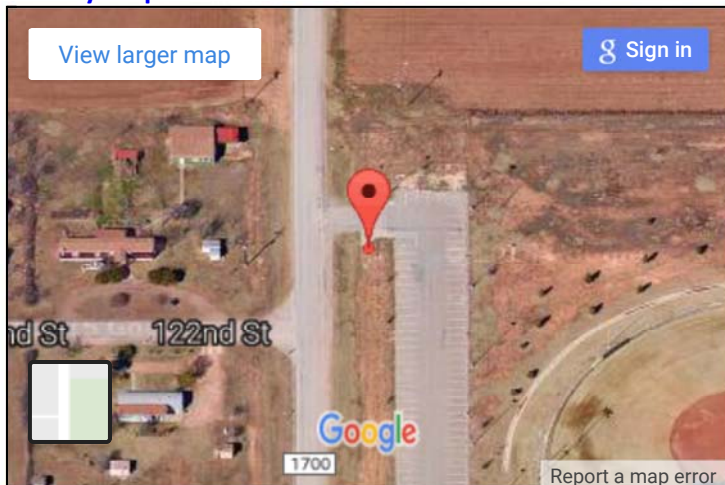
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



## Control Station Data

Name of Station: **BH 17-064-01**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 14-May-2016

BST Project #: 20170064

Project Name: Lubbock Orthophotography 2016

### Station Data

Type/Composition: Washer

Station Height: 0.00 US Ft

Stamping: BH 17-064-01

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

### Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 44' 54.51559"	7,337,523.009 US Ft	7,337,523.009 US Ft
Longitude   Easting   X:	W 102° 04' 15.76294"	883,206.904 US Ft	883,206.904 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	991.420 m	3,252.684 US Ft	3,334.117 US Ft

### Location

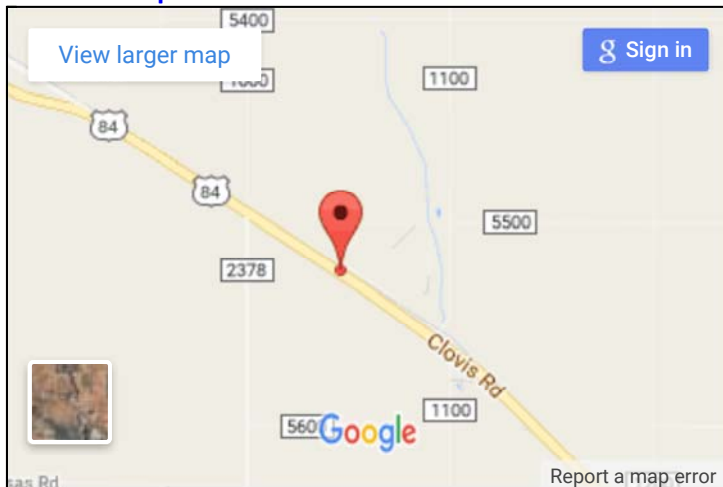
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

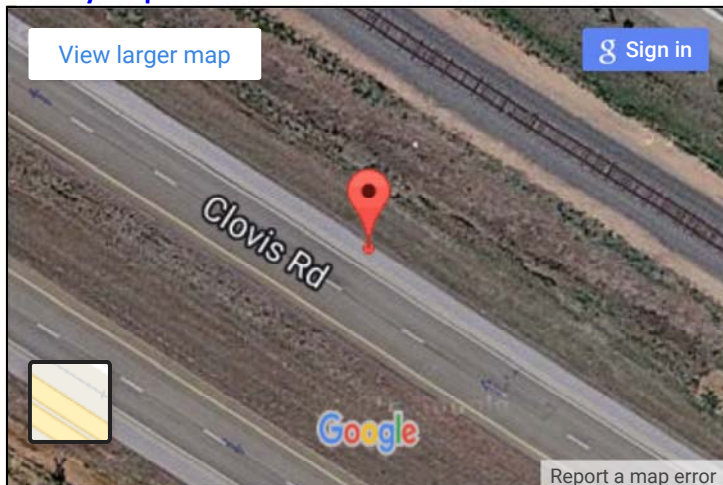
### Location Map:



### Vicinity Photo (Looking South):



### Vicinity Map:



### Close Up Photo:





## Control Station Data



Name of Station: **BH 17-064-02**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 16-May-2016

Project Name: Lubbock Orthophotography 2016

### Station Data

Type/Composition: 2" Aluminum Cap

Horizontal Method: Static

Station Height: 0.00 US Ft

Vertical Method: Static

Stamping: BH 17-064-02

### Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 45' 06.67427"	7,335,022.207 US Ft	7,335,022.207 US Ft
Longitude   Easting   X:	W 101° 41' 22.96362"	999,099.210 US Ft	999,099.210 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	964.688 m	3,164.982 US Ft	3,248.615 US Ft

### Location

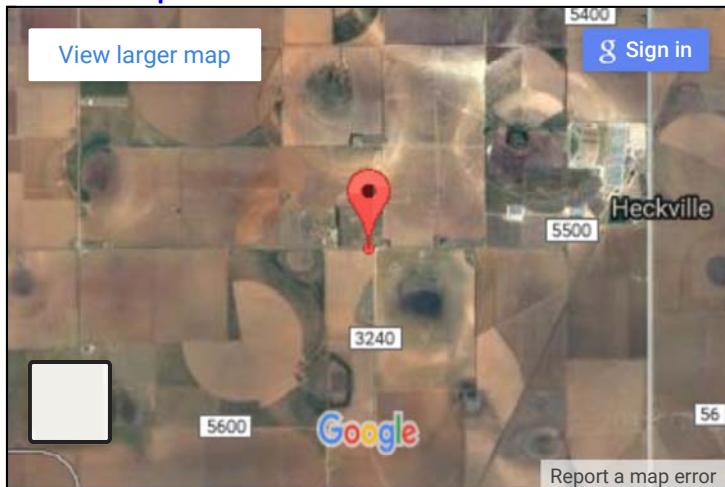
County & State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

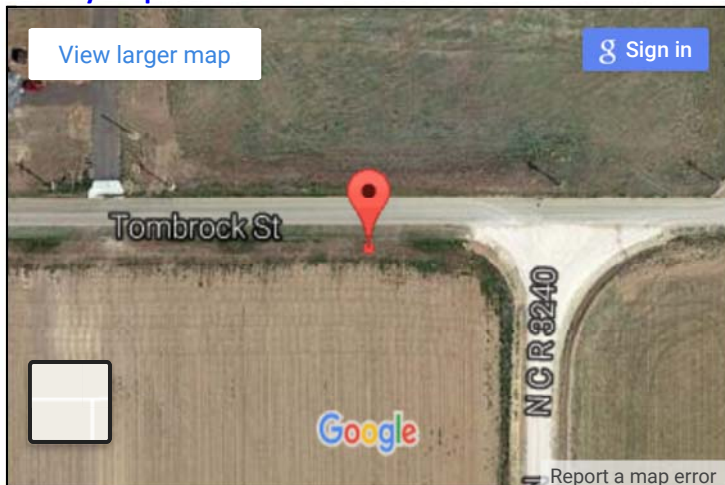
### Location Map:



### Vicinity Photo (Looking South):



### Vicinity Map:



### Close Up Photo:



## Control Station Data


Name of Station: **BH 17-064-03**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 16-May-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Horizontal Method: Static

Station Height: 0.00 US Ft

Vertical Method: Static

Stamping: BH 17-064-03

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 23' 45.47776"	7,209,425.904 US Ft	7,209,425.904 US Ft
Longitude   Easting   X:	W 102° 04' 48.31351"	876,089.775 US Ft	876,089.775 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	984.723 m	3,230.711 US Ft	3,310.122 US Ft

## Location

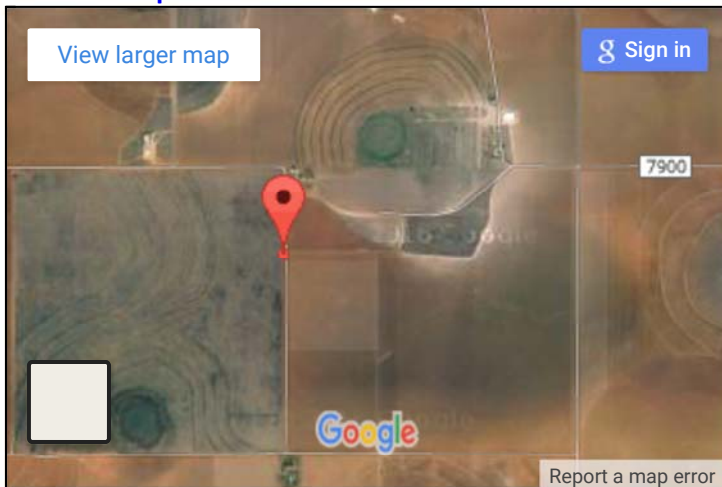
County &amp; State: Hockley, TX

Section:

Land Grant(s): None

Note(s):

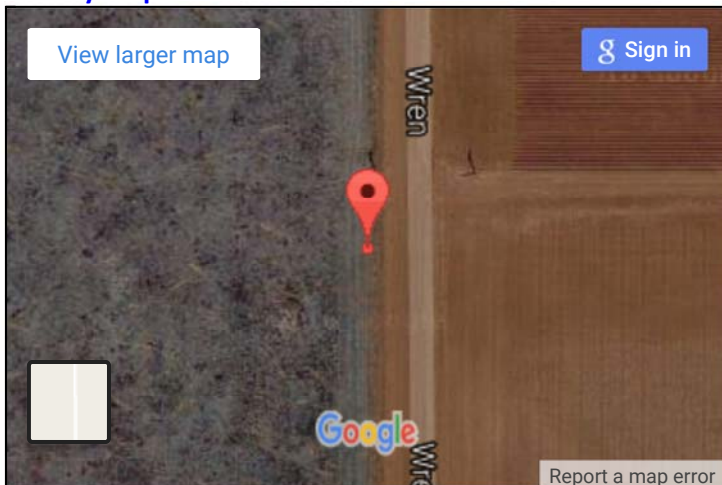
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



## Control Station Data



Name of Station: BH 17-064-04

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 13-May-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Horizontal Method: Static

Station Height: 0.00 US Ft

Vertical Method: Static

Stamping: BH 17-064-04

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 24' 12.29733"	7,208,232.885 US Ft	7,208,232.885 US Ft
Longitude   Easting   X:	W 101° 40' 57.96909"	997,368.106 US Ft	997,368.106 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	921.395 m	3,022.942 US Ft	3,104.769 US Ft

## Location

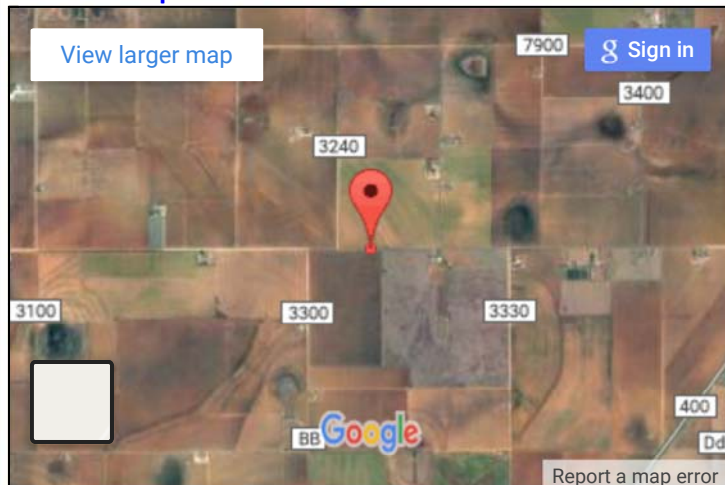
County &amp; State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

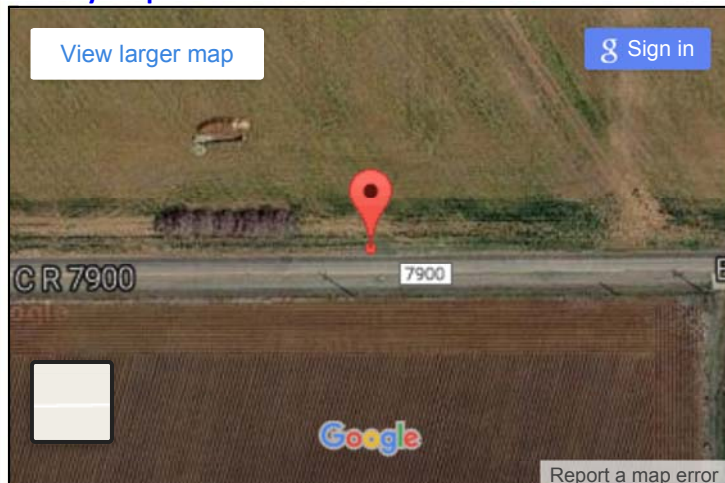
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



## Control Station Data


Name of Station: **BH 17-064-05**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 14-May-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Horizontal Method: Real-Time Kinematic

Station Height: 0.00 US Ft

Vertical Method: Real-Time Kinematic

Stamping: BH 17-064-05

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 45' 05.72025"	7,337,154.181 US Ft	7,337,154.181 US Ft
Longitude   Easting   X:	W 101° 55' 21.69384"	928,314.008 US Ft	928,314.008 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	995.085 m	3,264.707 US Ft	3,347.216 US Ft

## Location

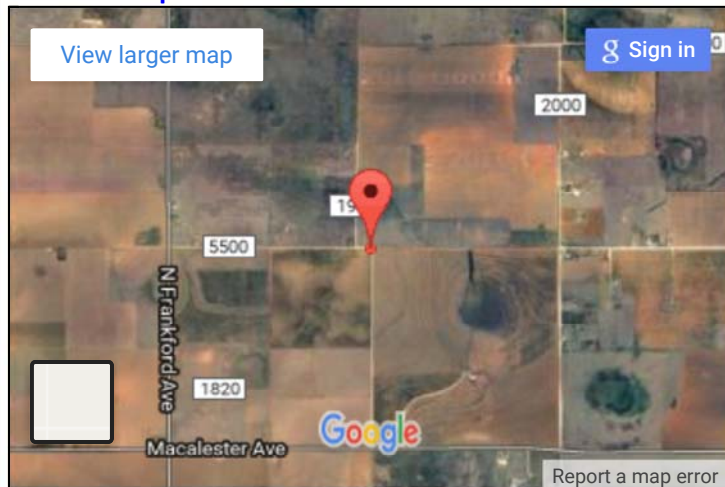
County &amp; State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

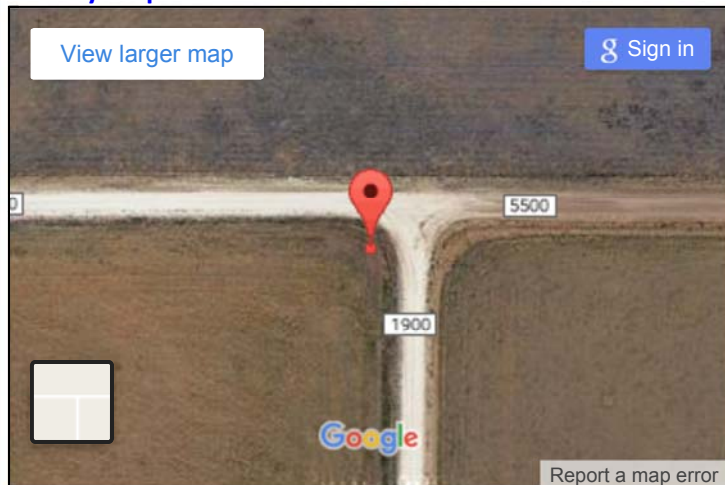
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



# Control Station Data



Name of Station: **BH 17-064-06**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 13-May-2016

BST Project #: 20170064

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: BH 17-064-06

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 23' 59.23588"	7,208,595.273 US Ft	7,208,595.273 US Ft
Longitude   Easting   X:	W 101° 51' 35.20885"	943,333.918 US Ft	943,333.918 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	955.524 m	3,134.917 US Ft	3,215.617 US Ft

## Location

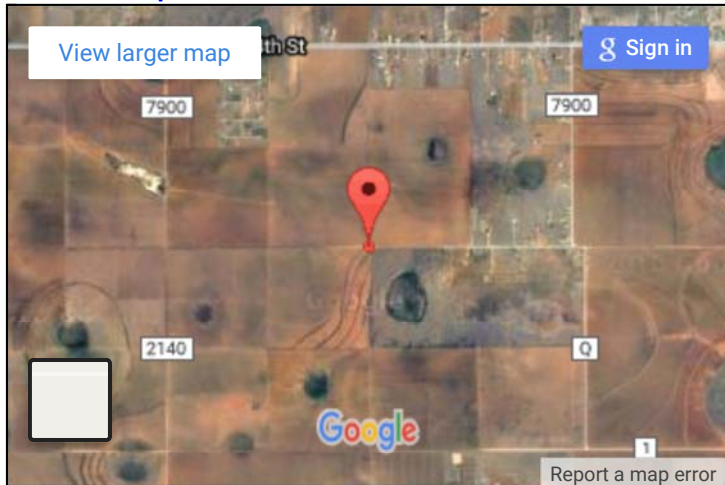
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

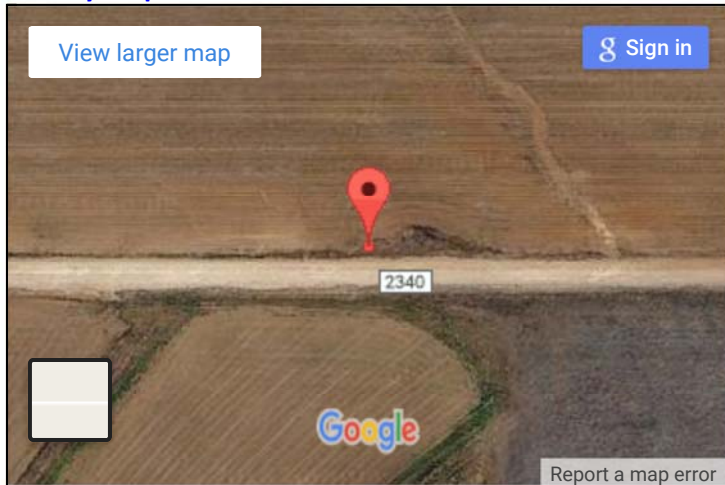
## Location Map:



## Vicinity Photo (Looking West):



## Vicinity Map:



## Close Up Photo:



## Control Station Data

Name of Station: **BH 17-064-07**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 14-May-2016

BST Project #: 20170064

Project Name: Lubbock Orthophotography 2016

### Station Data

Type/Composition: 2" Washer

Station Height: 0.00 US Ft

Stamping: BH 17-064-07

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

### Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 41' 37.76273"	7,317,288.155 US Ft	7,317,288.155 US Ft
Longitude   Easting   X:	W 102° 02' 10.12186"	893,140.305 US Ft	893,140.305 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	982.308 m	3,222.789 US Ft	3,304.178 US Ft

### Location

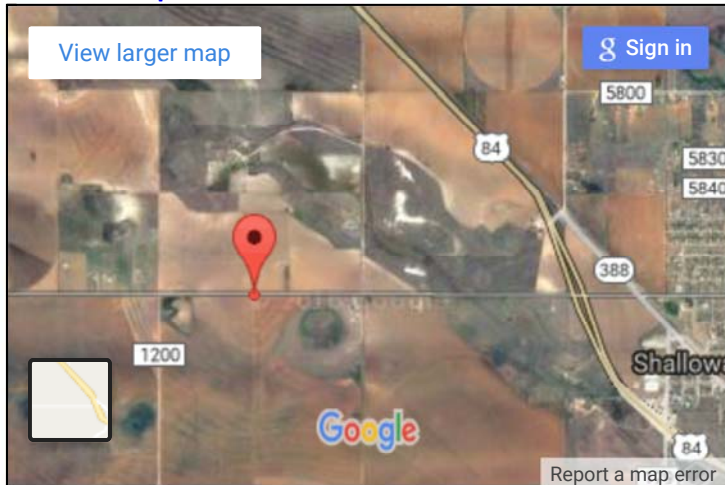
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

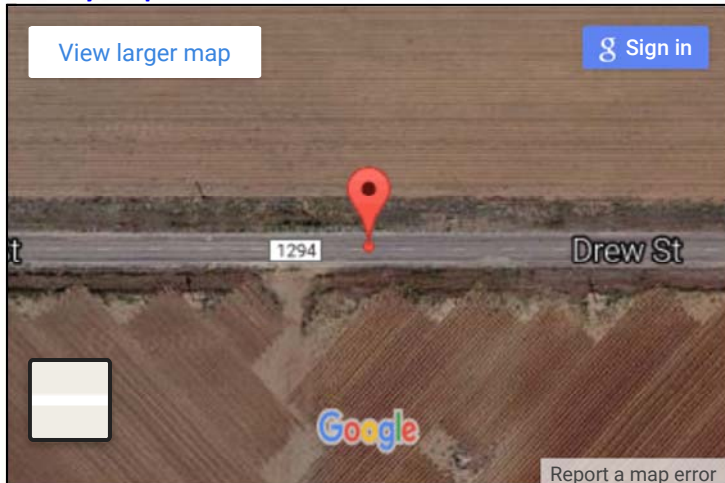
### Location Map:



### Vicinity Photo (Looking South):



### Vicinity Map:



### Close Up Photo:



## Control Station Data


Name of Station: **BH 17-064-08**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 14-May-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: Washer

Horizontal Method: Real-Time Kinematic

Station Height: 0.00 US Ft

Vertical Method: Real-Time Kinematic

Stamping: BH 17-064-08

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 40' 09.53336"	7,308,817.657 US Ft	7,308,817.657 US Ft
Longitude   Easting   X:	W 102° 04' 44.70944"	879,782.986 US Ft	879,782.986 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	1,000.704 m	3,283.141 US Ft	3,364.048 US Ft

## Location

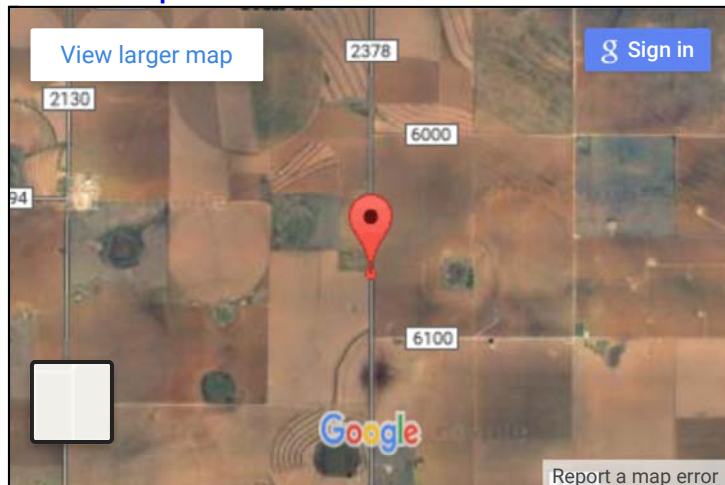
County &amp; State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

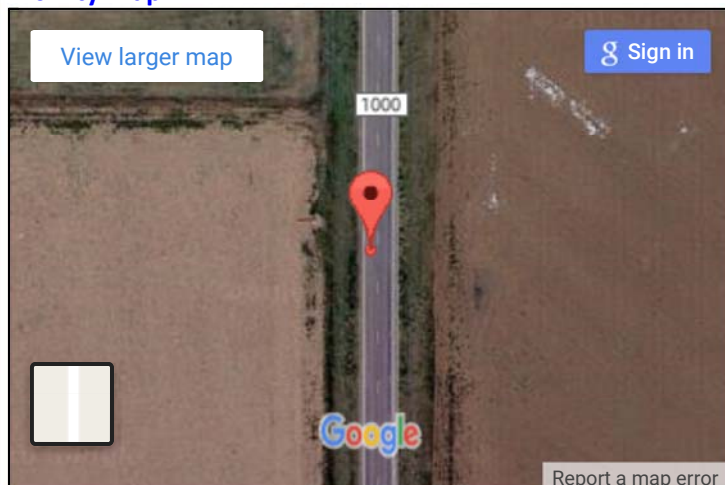
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



## Control Station Data

Name of Station: **BH 17-064-09**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 16-May-2016

Project Name: Lubbock Orthophotography 2016

### Station Data

Type/Composition: 2" Aluminum Cap

Horizontal Method: Static

Station Height: 0.00 US Ft

Vertical Method: Static

Stamping: BH 17-064-09

### Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 41' 47.60249"	7,314,995.845 US Ft	7,314,995.845 US Ft
Longitude   Easting   X:	W 101° 41' 56.48767"	995,657.319 US Ft	995,657.319 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	955.272 m	3,134.088 US Ft	3,217.287 US Ft

### Location

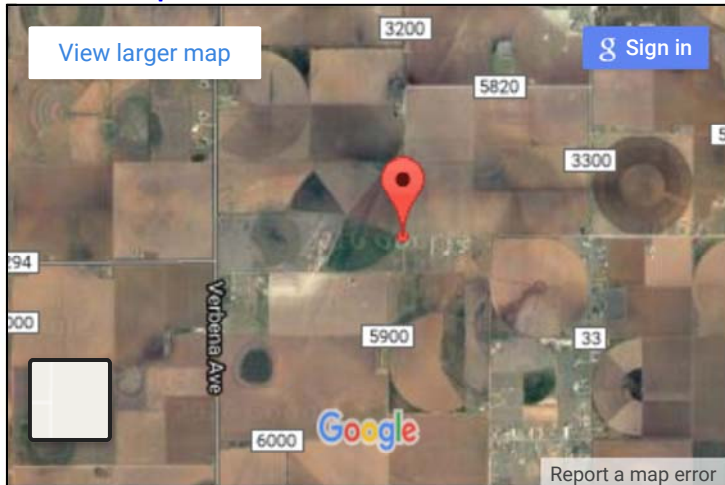
County & State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

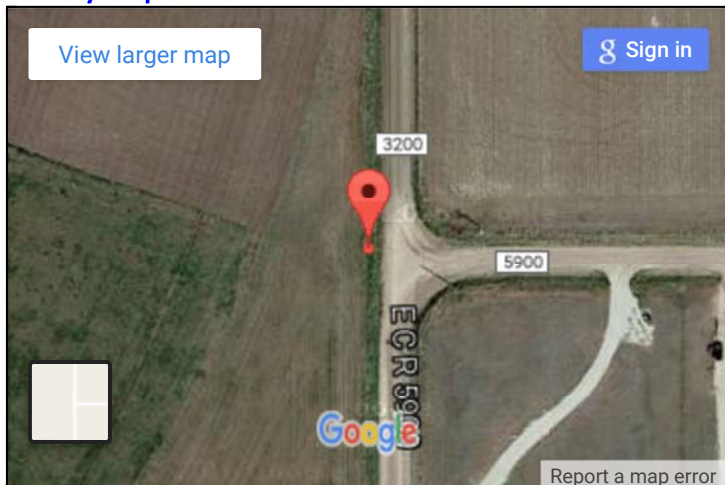
### Location Map:



### Vicinity Photo (Looking West):



### Vicinity Map:



### Close Up Photo:





# Control Station Data



Name of Station: **BH 17-064-14**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 16-May-2016

BST Project #: 20170064

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: BH 17-064-14

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 31' 11.22858"	7,254,075.690 US Ft	7,254,075.690 US Ft
Longitude   Easting   X:	W 102° 02' 37.40405"	888,700.811 US Ft	888,700.811 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	986.696 m	3,237.186 US Ft	3,317.357 US Ft

## Location

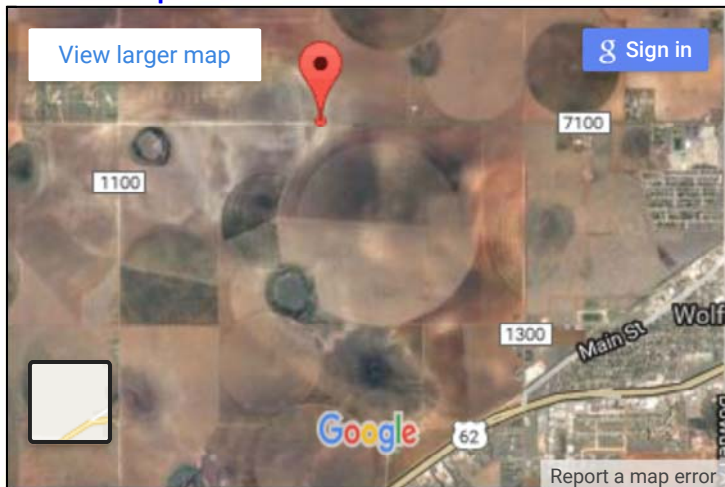
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

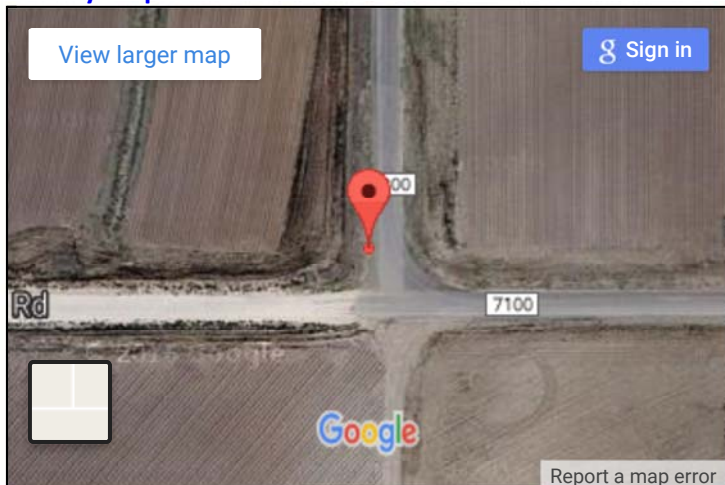
## Location Map:



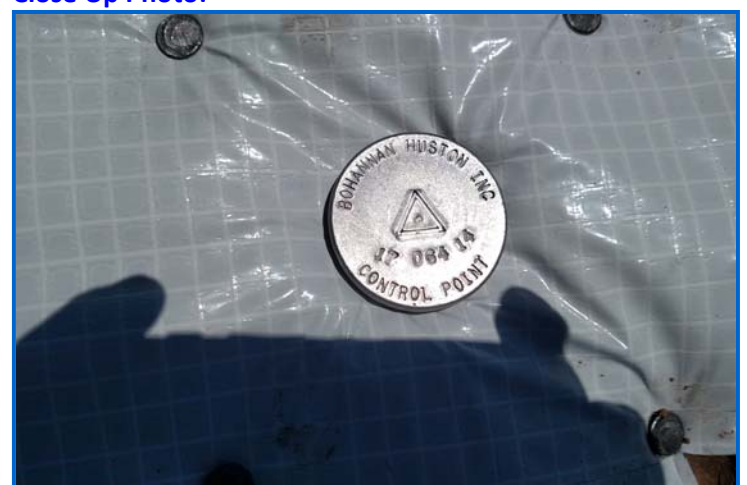
## Vicinity Photo (Looking South):



## Vicinity Map:



## Close Up Photo:



## Control Station Data


Name of Station: **BH 17-064-21**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 16-May-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Horizontal Method: Static

Station Height: 0.00 US Ft

Vertical Method: Static

Stamping: BH 17-064-21

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 31' 15.35434"	7,253,594.918 US Ft	7,253,594.918 US Ft
Longitude   Easting   X:	W 101° 57' 19.07503"	915,648.363 US Ft	915,648.363 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	974.799 m	3,198.154 US Ft	3,278.887 US Ft

## Location

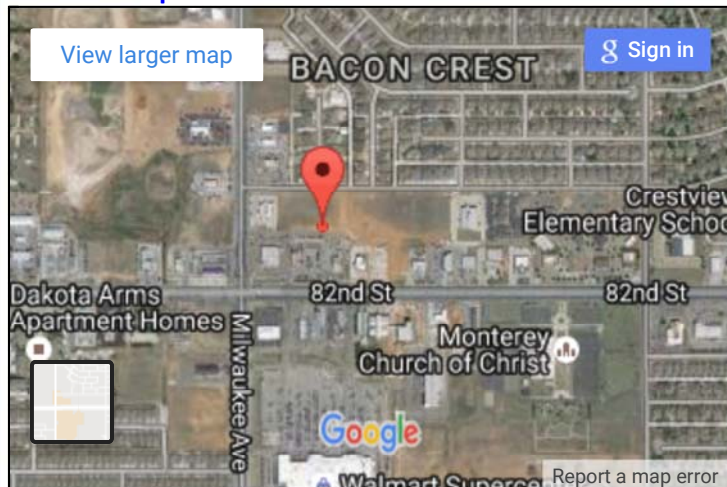
County &amp; State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

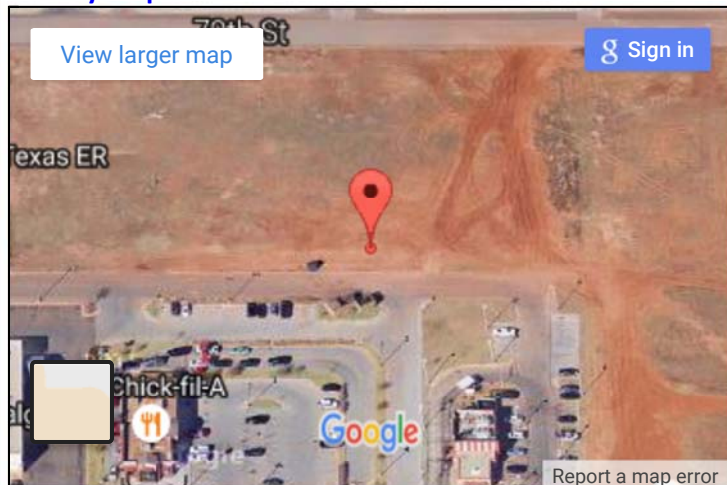
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



## Control Station Data

Bohannon  Huston

Name of Station: BH 17-064-23

Establishing Group: Bohannon Huston, Inc.

Observation Date: 13-May-2016

BST Project #: 20170064

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: BH 17-064-23

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 25' 43.21737"	7,219,591.164 US Ft	7,219,591.164 US Ft
Longitude   Easting   X:	W 101° 54' 35.45874"	928,402.667 US Ft	928,402.667 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	961.429 m	3,154.287 US Ft	3,234.785 US Ft

## Location

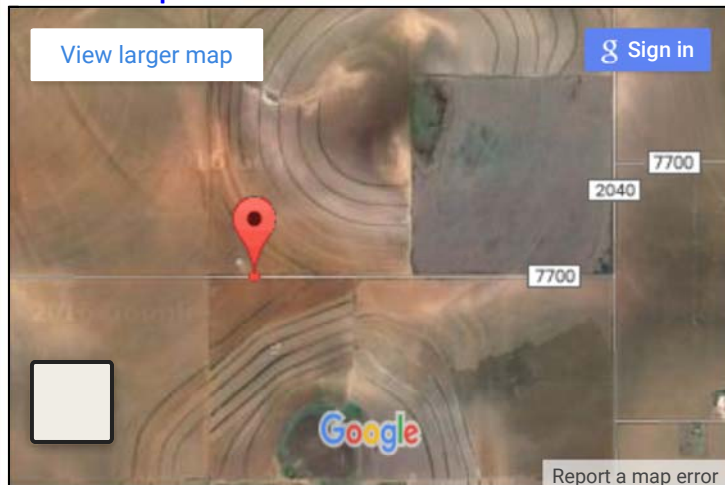
County &amp; State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

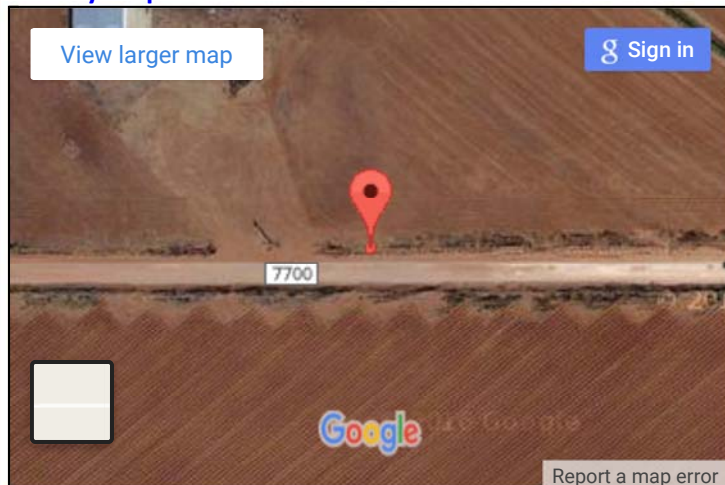
## Location Map:



## Vicinity Photo (Looking North):



## Vicinity Map:



## Close Up Photo:



## Control Station Data

Name of Station: **BH 17-064-27**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 15-May-2016

BST Project #: 20170064

Project Name: Lubbock Orthophotography 2016

### Station Data

Type/Composition: Washer

Station Height: 0.00 US Ft

Stamping: BH 17-064-27

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

### Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 36' 31.70131"	7,284,774.992 US Ft	7,284,774.992 US Ft
Longitude   Easting   X:	W 101° 52' 36.64408"	940,572.770 US Ft	940,572.770 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	956.008 m	3,136.501 US Ft	3,218.300 US Ft

### Location

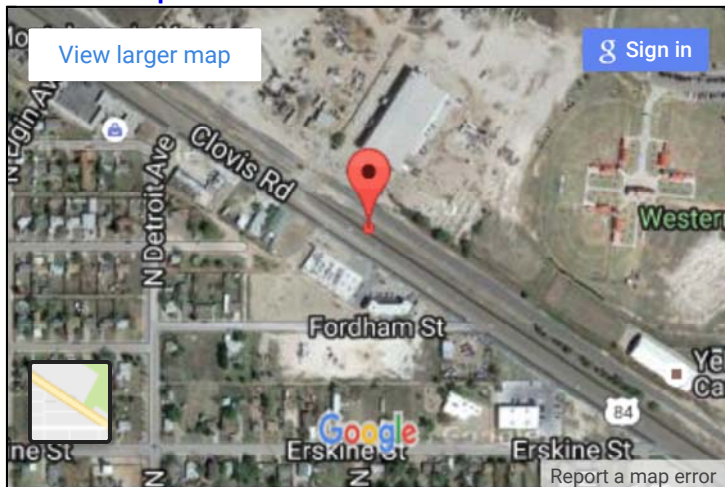
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

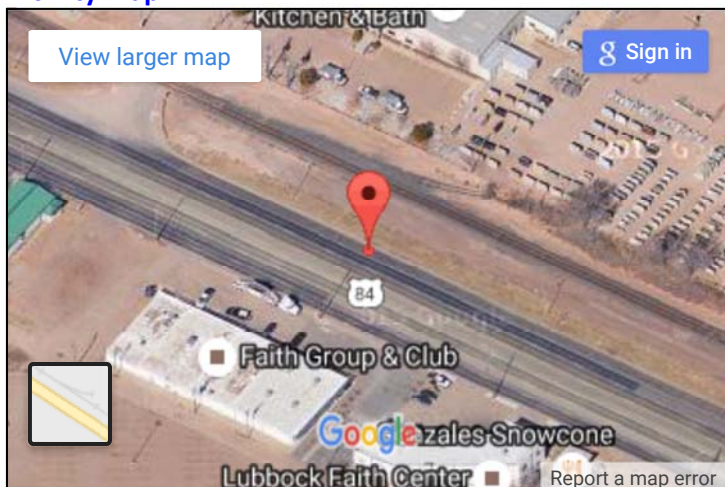
### Location Map:



### Vicinity Photo (Looking South):



### Vicinity Map:

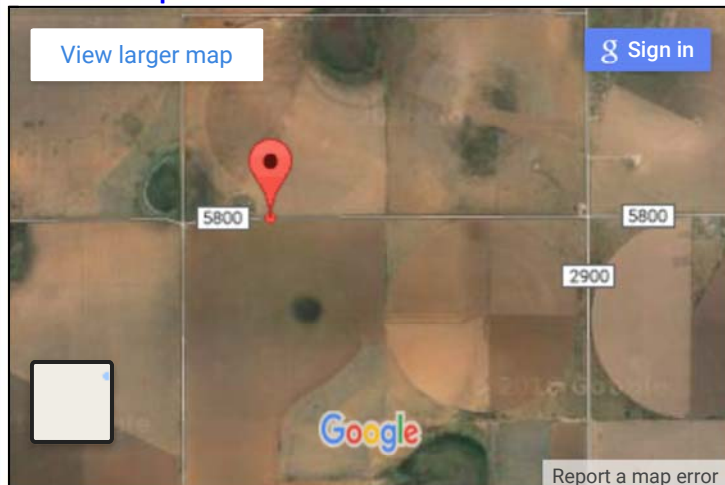
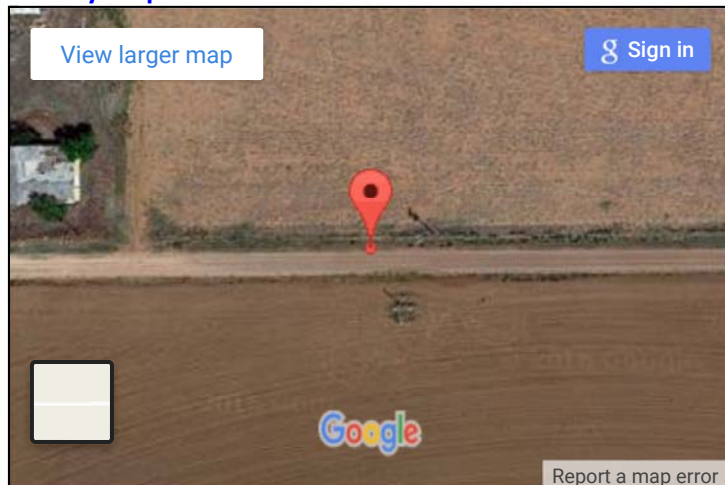


### Close Up Photo:



**Control Station Data****Bohannon**  **Huston****Name of Station:** BH 17-064-36**Establishing Group:** Bohannon Huston, Inc.**Observation Date:** 15-May-2016**BST Project #:** 20170064**Project Name:** Lubbock Orthophotography 2016**Station Data****Type/Composition:** 2" Aluminum Cap**Station Height:** 0.00 US Ft**Stamping:** BH 17-064-36**Horizontal Method:** Real-Time Kinematic**Vertical Method:** Real-Time Kinematic**Coordinate Data**

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 42' 31.93962"	7,320,078.341 US Ft	7,320,078.341 US Ft
Longitude   Easting   X:	W 101° 45' 48.63982"	976,191.962 US Ft	976,191.962 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	968.963 m	3,179.006 US Ft	3,262.053 US Ft

**Location****County & State:** Lubbock, TX**Land Grant(s):** None**Note(s):****Section:****Location Map:****Vicinity Photo (Looking North):****Vicinity Map:****Close Up Photo:**

## Control Station Data


Name of Station: **BH 17-064-51**

Establishing Group: Bohannon Huston, Inc.

BST Project #: 20170064

Observation Date: 14-May-2016

Project Name: Lubbock Orthophotography 2016

## Station Data

Type/Composition: Washer

Horizontal Method: Real-Time Kinematic

Station Height: 0.00 US Ft

Vertical Method: Real-Time Kinematic

Stamping: BH 17-064-51

## Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude   Northing   Y:	N 33° 39' 01.66295"	7,300,035.817 US Ft	7,300,035.817 US Ft
Longitude   Easting   X:	W 101° 53' 17.56642"	937,602.475 US Ft	937,602.475 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID12A)
Elevation:	961.331 m	3,153.968 US Ft	3,235.995 US Ft

## Location

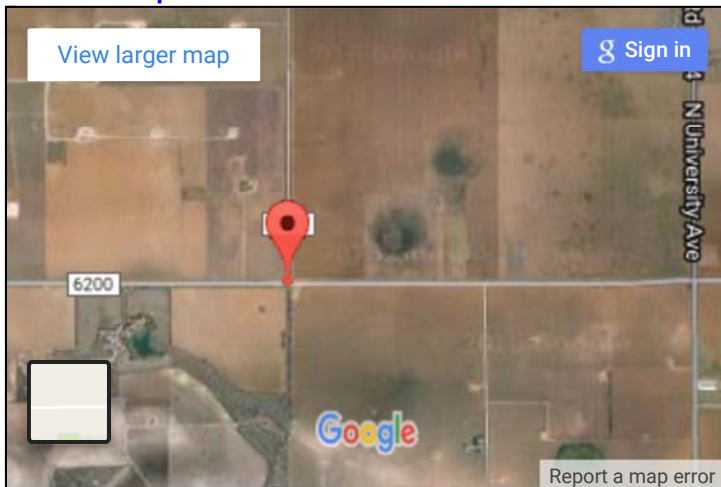
County &amp; State: Lubbock, TX

Section:

Land Grant(s): None

Note(s):

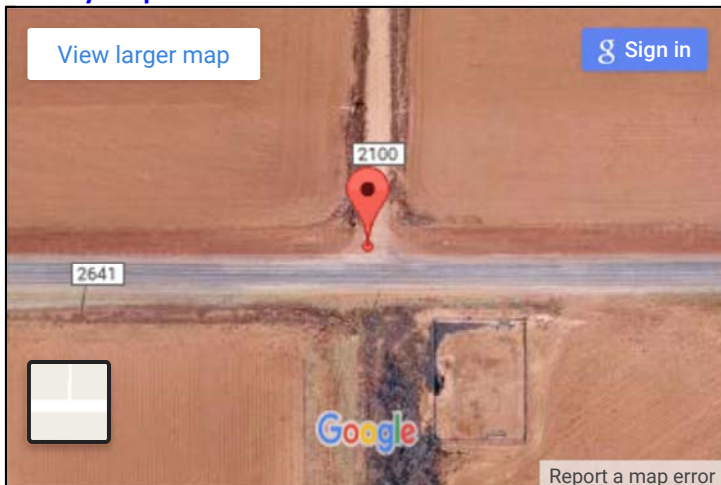
## Location Map:



## Vicinity Photo (Looking East):



## Vicinity Map:



## Close Up Photo:



Project ID: <b>LUB2016</b>								
Manager Keyword: <b>LUB16PM</b>								
Session Keyword: <b>LUB16SES</b>								
Date	Approx Local Start Time	Approx Local End Time	Duration	Data File	Station	HI to ARP	Receiver Type	Rinex File Name
7/17/2016	8:05:00 AM	11:24:00 AM	3hr 19min	07681990.T02	BH 17-064-101	1.677 m	R8-4	010107681990.16o
7/17/2016	11:32:00 AM	2:03:00 PM	2hr 31min	07681991.T02	BH 17-064-101	1.634 m	R8-4	010107681991.16o
7/17/2016	7:15:00 AM	10:36:00 AM	3hr 21min	07401991.T02	BH 17-064-102	1.521 m	R8-4	010207401991.16o
7/17/2016	10:42:00 AM	3:02:00 PM	4hr 20min	07401992.T02	BH 17-064-102	1.487 m	R8-4	010207401992.16o
CORS ADD TO PROJECT								
ZJX1								

# BH 17-064-101 Solution

MARK  Processing Results From

Scale uncertainties by

[Manage Coordinates](#)

Coordinate Source: network-FINAL											
REF FRAME: IGS08 (2016.5428)			NAD_83(2011) (2010.0000)			COORDINATE SYSTEM:			SPC 4202 TXNC UTM 14		
LAT: N33:38:58.97305 ±0.001 m			N33:38:58.95586 ±0.001 m			NORTHING:			2224766.205 m 3726882.284 m		
EAST LON: E258:10:52.66376 ±0.001 m			E258:10:52.70608 ±0.001 m			EASTING:			292224.206 m 238595.240 m		
WEST LON: W101:49:07.33624 ±0.001 m			W101:49:07.29392 ±0.001 m			CONVERGENCE:			-1.80999649° -1.56276294°		
EL HGT: 967.558 ±0.004 m			968.648 ±0.004 m			POINT SCALE:			0.99992697 1.00044250		
X: -1088736.572 ±0.001 m			-1088735.750 ±0.001 m			COMBINED FACTOR:			0.99977494 1.00029039		
Y: -5203002.110 ±0.004 m			-5203003.508 ±0.004 m			U.S. NATIONAL GRID:			14SKC3859526882		
Z: 3514705.584 ±0.003 m			3514705.747 ±0.003 m								
ORTHO HGT: 993.757 ±0.064 m (H = h - N WHERE N = GEOID12A HGT)											
DATA FILE	ANTENNA	HEIGHT (m)	EPH TYPE	OBS (%)	FIXED (%)	RMS (m)	LAT (m)	LON (m)	HGT (m)	SOLUTION	
0101199n.16o	TRMR8-4 NONE	1.677	rapid	95.0	100.0	—	0.001	0.001	0.004	network-FINAL	
0101199q.16o	TRMR8-4 NONE	1.634	rapid	95.0	100.0	—	0.001	0.001	0.004	network-FINAL	
Preferences			Best Available	≥80.0	≥80.0	≤0.025	≤0.020	≤0.020	≤0.040	Preferences	

MARK  Processing Results Table

Scale uncertainties by  Show  preferences  network  session  OPUS  published.

The "zero" point coordinates, N33:38:58.97305, W101:49:07.33624, 967.558 m el. height, are the mean of all network adjustments.

	NORTH (cm)	EAST (cm)	UP (cm)	REFERENCE FRAME	EPOCH (GPS)
OPUS SOLUTIONS					
0101199n.16o	0.1 ±0.7	0.0 ±0.5	-1.3 ±0.8	IGS08	2016-07-17T15:04:36
0101199q.16o	-0.8 ±1.2	0.3 ±1.8	2.6 ±5.1	IGS08	2016-07-17T17:42:43
SESSION SOLUTIONS					
2016-199-A	0.0 ±0.1	-0.1 ±0.1	-0.4 ±0.5	IGS08	2016-07-17T11:42:25
2016-199-B	0.0 ±0.1	0.1 ±0.1	1.1 ±0.8	IGS08	2016-07-17T11:50:30
NETWORK SOLUTIONS					
network-FINAL	0.0 ±0.1	0.0 ±0.1	0.0 ±0.4	IGS08	2016-07-17T16:01:31

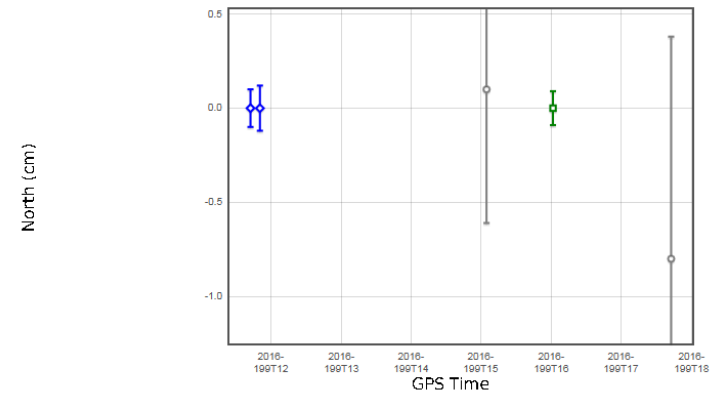
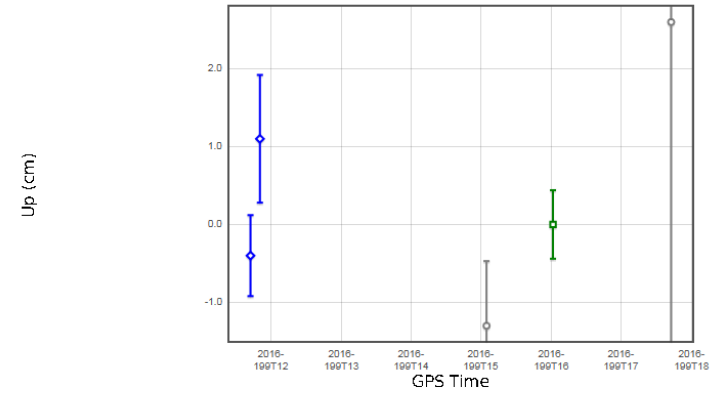
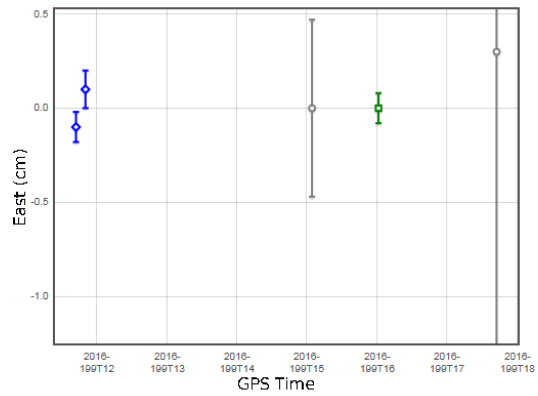
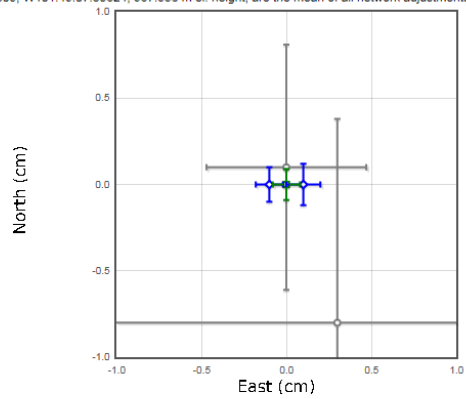
Website Owner: National Geodetic Survey / Last modified by OPUS Projects team



# BH 17-064-101 Solution

MARK 0101 Processing Results Plots

Scale uncertainties by 2.0x (95.4%) Show preferences network session OPUS published.  
The "zero" point coordinates, N33:38:58.97305, W101:49:07.33624, 967.558 m el. height, are the mean of all network adjustments.



# BH 17-064-102 Solution

MARK  Processing Results From

Scale uncertainties by

[Manage Coordinates](#)

Coordinate Source: network-FINAL										
REF FRAME: IG508 (2016.5428)			NAD_83(2011) (2010.0000)			COORDINATE SYSTEM: SPC 4202 TXNC			UTM 13	
LAT:	N33:28:58.14747 ±0.000 m		N33:28:58.13043 ±0.000 m		NORTHING:		2206679.665 m		3708959.180 m	
EAST LON:	E258:02:35.47948 ±0.000 m		E258:02:35.52180 ±0.000 m		EASTING:		278811.759 m		782777.086 m	
WEST LON:	W101:57:24.52052 ±0.000 m		W101:57:24.47820 ±0.000 m		CONVERGENCE:		-1.88531913"		1.68000807"	
EL HGT:	977.411 ±0.002 m		978.502 ±0.002 m		POINT SCALE:		0.99990085		1.00058596	
X:	-1103397.229 ±0.001 m		-1103396.408 ±0.001 m		COMBINED FACTOR:		0.99974727		1.00043228	
Y:	-5210385.055 ±0.002 m		-5210386.454 ±0.002 m		U.S. NATIONAL GRID:		13SGT8277708959			
Z:	3499284.278 ±0.001 m		3499284.442 ±0.001 m							
ORTHO HGT: 1003.030 ±0.064 m (H = h - N WHERE N = GEOID12A HGT)										
DATA FILE	ANTENNA	HEIGHT (m)	EPH TYPE	OBS (%)	FIXED (%)	RMS (m)	LAT (m)	LON (m)	HGT (m)	SOLUTION
0102199m.16o	TRMR8-4 NONE	1.521	rapid	94.7	98.4	—	0.000	0.000	0.002	network-FINAL
0102199p.16o	TRMR8-4 NONE	1.487	rapid	94.7	98.4	—	0.000	0.000	0.002	network-FINAL
Preferences			Best Available	≥80.0	≥80.0	≤0.025	≤0.020	≤0.020	≤0.040	Preferences

MARK  Processing Results Table

Scale uncertainties by  Show  preferences  network  session  OPUS  published.

The "zero" point coordinates, N33:28:58.14747, W101:57:24.52053, 977.411 m el. height, are the mean of all network adjustments.

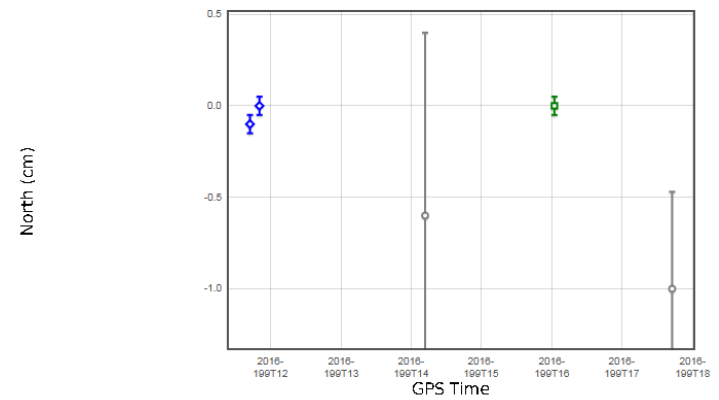
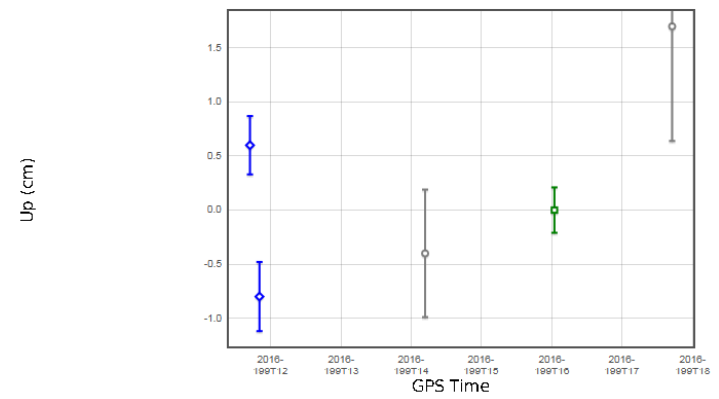
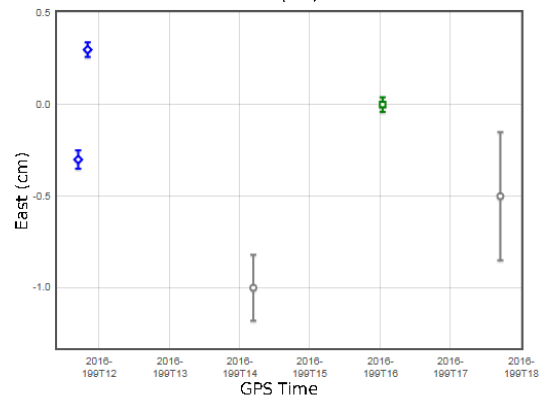
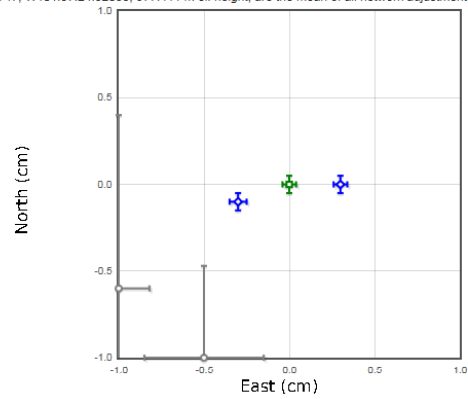
	NORTH (cm)	EAST (cm)	UP (cm)	REFERENCE FRAME	EPOCH (GPS)
○ OPUS SOLUTIONS					
0102199m.16o	-0.6 ±1.0	-1.0 ±0.2	-0.4 ±0.6	IGS08	2016-07-17T14:11:54
0102199p.16o	-1.0 ±0.5	-0.5 ±0.4	1.7 ±1.1	IGS08	2016-07-17T17:42:43
◇ SESSION SOLUTIONS					
2016-199-A	-0.1 ±0.1	-0.3 ±0.1	0.6 ±0.3	IGS08	2016-07-17T11:42:25
2016-199-B	0.0 ±0.1	0.3 ±0.0	-0.8 ±0.3	IGS08	2016-07-17T11:50:30
□ NETWORK SOLUTIONS					
network-FINAL	0.0 ±0.0	0.0 ±0.0	0.0 ±0.2	IGS08	2016-07-17T16:02:15

Website Owner: National Geodetic Survey / Last modified by OPUS Projects team

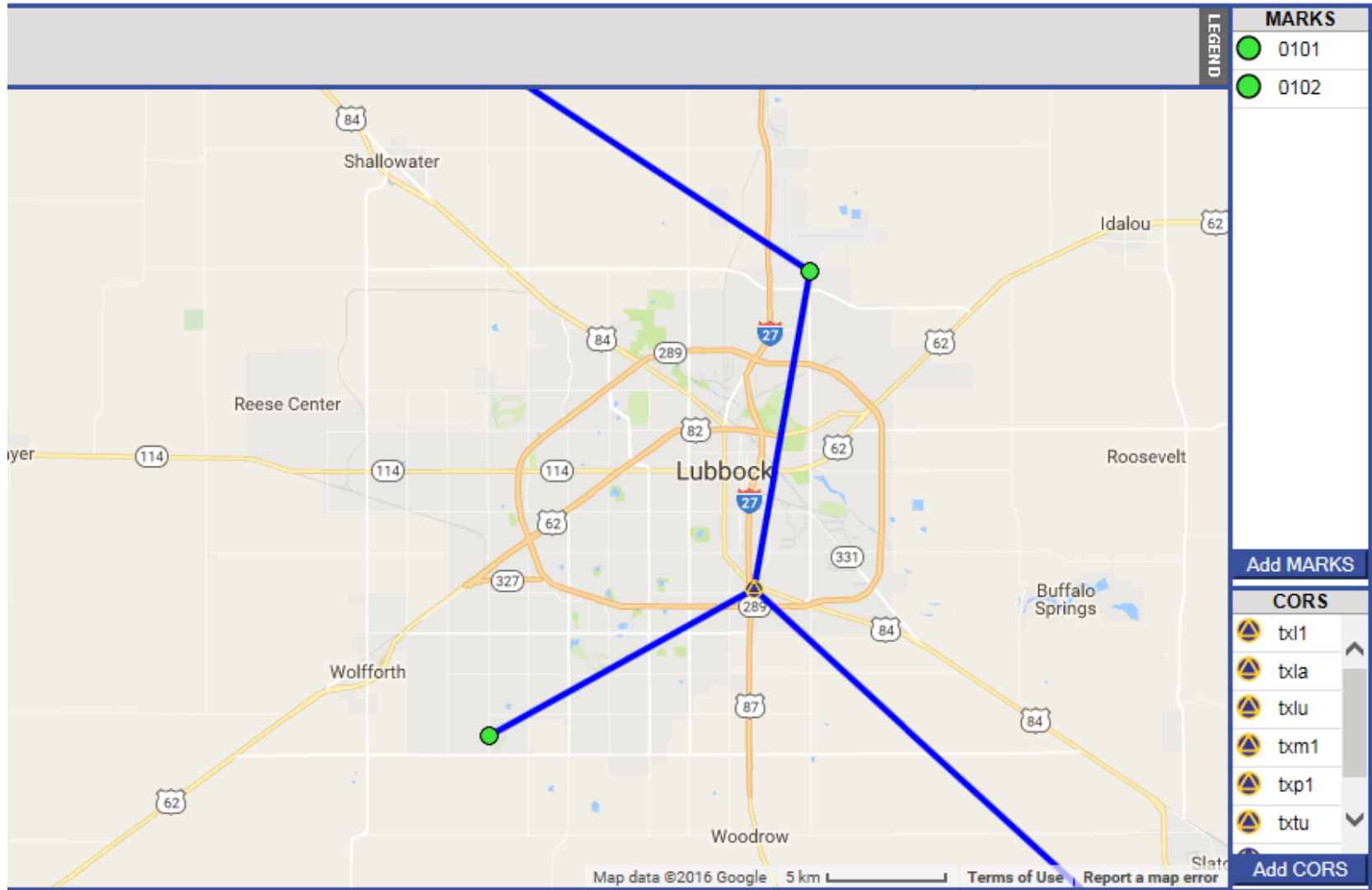
# BH 17-064-102 Solution

MARK 0102 Processing Results Plots

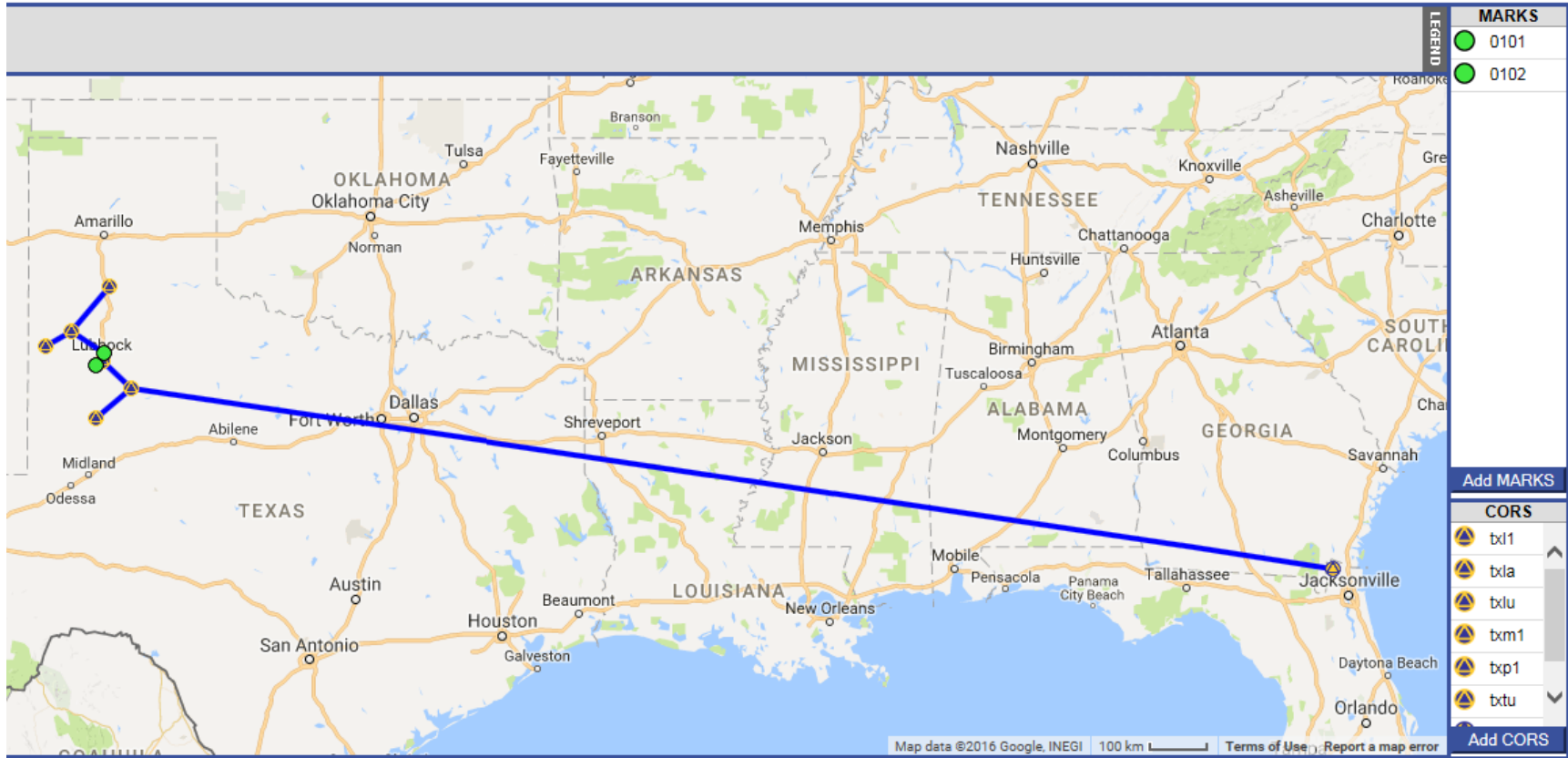
Scale uncertainties by 1.0x (68.3%) Show preferences network session OPUS published.  
 The "zero" point coordinates, N33:28:58.14747, W101:57:24.52053, 977.411 m el. height, are the mean of all network adjustments.



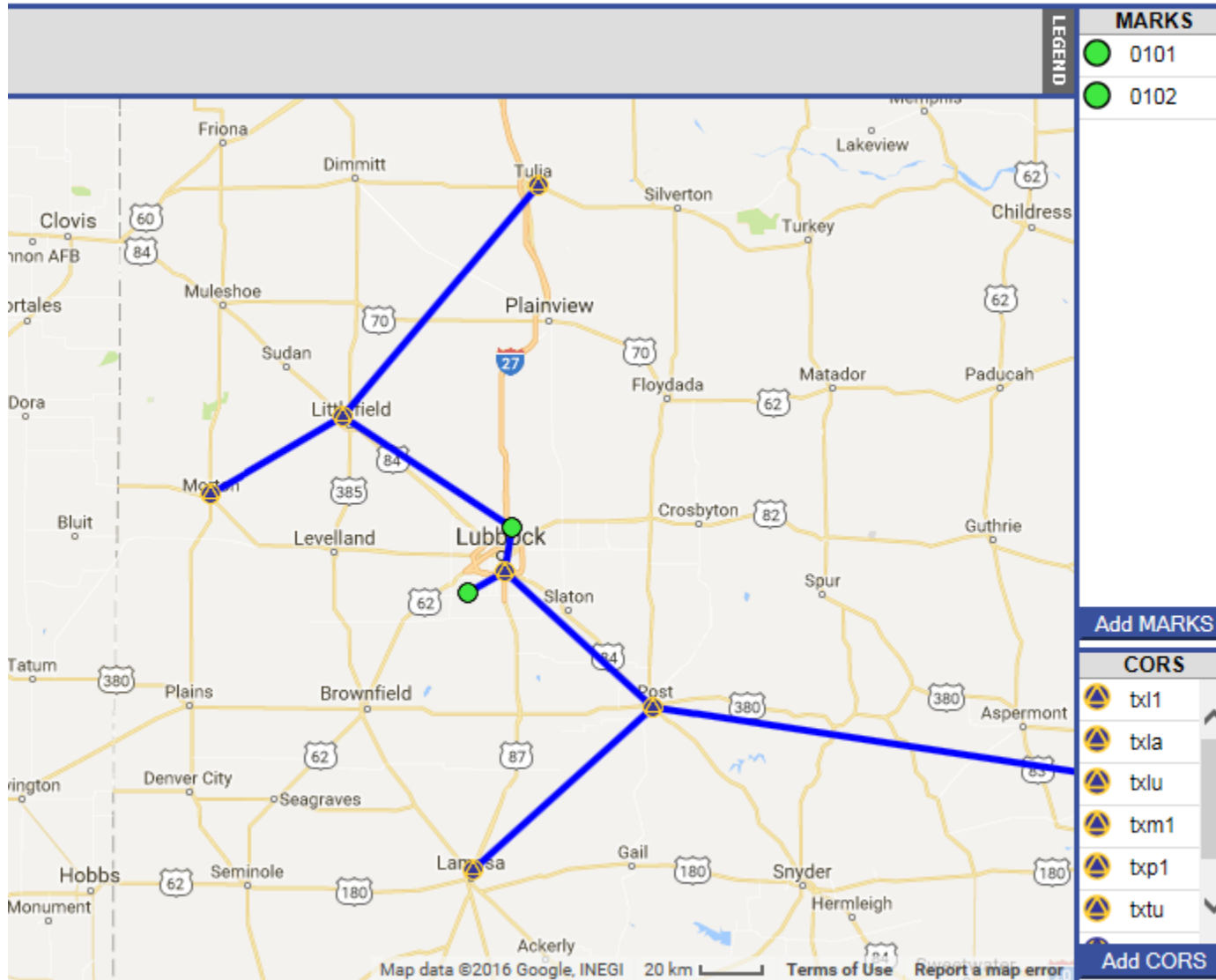
# Network Map



# Network Map



# Network Map



**NGS OPUS-PROJECTS NETWORK ADJUSTMENT REPORT**

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All coordinate accuracies reported here are 1 times the formal uncertainties from the solution. For additional information: [geodesy.noaa.gov/OPUS/Using\\_OPUS-Projects.html#accuracy](http://geodesy.noaa.gov/OPUS/Using_OPUS-Projects.html#accuracy)

These positions were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

SUBMITTED BY: abenham  
 SOLUTION FILE NAME: network-FINAL.sum  
 SOLUTION SOFTWARE: GPSCOM(1504.23)  
 SOLUTION DATE: 2016-08-04T12:20:08 UTC  
 STANDARD ERROR OF UNIT WEIGHT: 0.784  
 TOTAL NUMBER OF OBSERVATIONS: 193768  
 TOTAL NUMBER OF MARKS: 9  
 NUMBER OF CONSTRAINED MARKS: 6

START TIME: 2016-07-17T00:00:00 GPS  
 STOP TIME: 2016-07-17T23:59:30 GPS  
 FREQUENCY: L1 -> ION-FREE (L6)  
 OBSERVATION INTERVAL: 30 s  
 ELEVATION CUTOFF: 15 deg  
 TROPO INTERVAL: 1800 s [STEP-OFFSET PARAMETERIZATION]  
 DD CORRELATIONS: ON

INCLUDED SOLUTION	RMS	SOFTWARE	RUN DATE
1) 2016-199 A	1.7 cm	page5(1509.10)	2016-08-04T12:15 UTC
2) 2016-199 B	1.7 cm	page5(1509.10)	2016-08-04T12:17 UTC

BASELINE	LENGTH	RMS	OBS	OMITTED	FIXED	IN SOLUTION(S)
0102-txlu	12.092 km	1.5 cm	5756	6.0%	98.4%	1, 2
txlu-0101	12.875 km	1.6 cm	4498	5.0%	100.0%	1, 2
txml-txll	44.009 km	1.4 cm	37246	3.9%	100.0%	1, 2
txpl-txlu	58.217 km	1.8 cm	37320	3.7%	99.5%	1, 2
txll-0101	58.677 km	1.4 cm	4478	4.9%	100.0%	1, 2
txla-txpl	70.449 km	1.5 cm	36562	5.9%	98.6%	1, 2
txtu-txll	86.738 km	1.5 cm	37670	2.1%	99.2%	1, 2
zjxl-txpl	1852.381 km	2.1 cm	30238	5.5%	64.9%	1, 2

+++++  
 UNCONSTRAINED MARKS  
 +++++

MARK: 0101 (0101 1)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5428)  
 X: -1088735.750 m 0.001 m -1088736.572 m 0.001 m  
 Y: -5203003.508 m 0.002 m -5203002.110 m 0.002 m  
 Z: 3514705.747 m 0.001 m 3514705.584 m 0.001 m  
 LAT: 33 38 58.95586 0.000 m 33 38 58.97305 0.000 m  
 E LON: 258 10 52.70608 0.000 m 258 10 52.66376 0.000 m  
 W LON: 101 49 07.29392 0.000 m 101 49 07.33624 0.000 m  
 EL HGT: 968.648 m 0.002 m 967.558 m 0.002 m  
 ORTHO HGT: 993.757 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 14)	SPC (4202 TXNC)
NORTHING (Y)	3726882.284 m	2224766.205 m
EASTING (X)	238595.240 m	292224.206 m
CONVERGENCE	-1.56276294 deg	-1.80999649 deg
POINT SCALE	1.00044250	0.99992697
COMBINED FACTOR	1.00029039	0.99977494

US NATIONAL GRID DESIGNATOR: 14SKC3859526882 (NAD 83)

+++++

MARK: 0102 (0102 1)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5428)  
 X: -1103396.408 m 0.001 m -1103397.229 m 0.001 m  
 Y: -5210386.454 m 0.002 m -5210385.054 m 0.002 m  
 Z: 3499284.442 m 0.001 m 3499284.278 m 0.001 m  
 LAT: 33 28 58.13043 0.000 m 33 28 58.14747 0.000 m  
 E LON: 258 02 35.52180 0.000 m 258 02 35.47948 0.000 m  
 W LON: 101 57 24.47820 0.000 m 101 57 24.52052 0.000 m  
 EL HGT: 978.502 m 0.002 m 977.411 m 0.002 m  
 ORTHO HGT: 1003.030 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 13)	SPC (4202 TXNC)
NORTHING (Y)	3708959.180 m	2206679.665 m
EASTING (X)	782777.086 m	278811.759 m
CONVERGENCE	1.68000807 deg	-1.88531913 deg
POINT SCALE	1.00058596	0.99990085
COMBINED FACTOR	1.00043228	0.99974727

US NATIONAL GRID DESIGNATOR: 13SGT8277708959 (NAD 83)



+++++

MARK: zjx1 (zjx1 a 3)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2016.5423)
X:	772647.145 m	0.001 m	772646.348 m 0.001 m
Y:	-5434463.365 m	0.001 m	-5434461.847 m 0.001 m
Z:	3237231.692 m	0.001 m	3237231.549 m 0.001 m
LAT:	30 41 55.87240	0.000 m	30 41 55.89517 0.000 m
E LON:	278 05 30.55347	0.001 m	278 05 30.53183 0.001 m
W LON:	81 54 29.44653	0.001 m	81 54 29.46817 0.001 m
EL HGT:	3.196 m	0.001 m	1.735 m 0.001 m
ORTHO HGT:	31.508 m	0.029 m	(H = h - N WHERE N = GEOID12A HGT)

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 17)	SPC (0901 FL E)
NORTHING (Y)	3396580.031 m	705688.827 m
EASTING (X)	413026.653 m	112996.968 m
CONVERGENCE	-0.46367817 deg	-0.46367817 deg
POINT SCALE	0.99969331	1.00003452
COMBINED FACTOR	0.99969281	1.00003402

US NATIONAL GRID DESIGNATOR: 17RMP1302696580 (NAD 83)

+++++  
CONSTRAINED MARKS  
+++++

MARK: tx11 (tx11 a 1)

CONSTRAIN: 3-D NORMAL

ADJUST X:	0.000m (0.000m)	Y:	0.004m (0.001m)	Z:	-0.006m (0.001m)
ADJUST N:	-0.003m (0.000m)	E:	-0.001m (0.000m)	H:	-0.006m (0.001m)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2016.5423)
X:	-1133101.339 m	0.000 m	-1133102.162 m 0.000 m
Y:	-5175377.124 m	0.001 m	-5175375.732 m 0.001 m
Z:	3541378.425 m	0.001 m	3541378.265 m 0.001 m
LAT:	33 56 18.22680	0.000 m	33 56 18.24395 0.000 m
E LON:	257 39 01.72419	0.000 m	257 39 01.68130 0.000 m
W LON:	102 20 58.27581	0.000 m	102 20 58.31870 0.000 m
EL HGT:	1072.695 m	0.001 m	1071.624 m 0.001 m
ORTHO HGT:	1097.287 m	0.064 m	(H = h - N WHERE N = GEOID12A HGT)

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 13)	SPC (4202 TXNC)
NORTHING (Y)	3758490.340 m	2258443.551 m
EASTING (X)	744975.700 m	244188.701 m
CONVERGENCE	1.48050260 deg	-2.09950728 deg
POINT SCALE	1.00033987	0.99999224
COMBINED FACTOR	1.00017144	0.99982387

US NATIONAL GRID DESIGNATOR: 13SGT4497558490 (NAD 83)

+++++

MARK: txla (txla a 1)  
CONSTRAIN: 3-D NORMAL  
ADJUST X: 0.003m (0.000m) Y: -0.002m (0.001m) Z: -0.003m (0.001m)  
ADJUST N: -0.003m (0.000m) E: 0.003m (0.000m) H: -0.001m (0.001m)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5423)  
X: -1111261.409 m 0.000 m -1111262.226 m 0.000 m  
Y: -5253344.830 m 0.001 m -5253343.422 m 0.001 m  
Z: 3432215.906 m 0.001 m 3432215.736 m 0.001 m  
LAT: 32 45 40.90149 0.000 m 32 45 40.91808 0.000 m  
E LON: 258 03 21.82929 0.000 m 258 03 21.78740 0.000 m  
W LON: 101 56 38.17071 0.000 m 101 56 38.21260 0.000 m  
EL HGT: 892.758 m 0.001 m 891.650 m 0.001 m  
ORTHO HGT: 916.880 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

UTM COORDINATES STATE PLANE COORDINATES  
UTM (Zone 13) SPC (4202 TXNC)  
NORTHING (Y) 3628966.287 m 2126679.133 m  
EASTING (X) 786307.464 m 277384.236 m  
CONVERGENCE 1.65488775 deg -1.87830362 deg  
POINT SCALE 1.00061089 0.99988538  
COMBINED FACTOR 1.00047066 0.99974525

US NATIONAL GRID DESIGNATOR: 13SGS8630728966 (NAD 83)

+++++

MARK: txlu (txlu a 6)  
CONSTRAIN: 3-D NORMAL  
ADJUST X: -0.000m (0.000m) Y: 0.002m (0.001m) Z: 0.004m (0.001m)  
ADJUST N: 0.005m (0.000m) E: -0.001m (0.000m) H: 0.001m (0.001m)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5424)  
X: -1092364.620 m 0.000 m -1092365.440 m 0.000 m  
Y: -5209400.911 m 0.001 m -5209399.510 m 0.001 m  
Z: 3504137.816 m 0.001 m 3504137.650 m 0.001 m  
LAT: 33 32 07.49102 0.000 m 33 32 07.50810 0.000 m  
E LON: 258 09 25.83768 0.000 m 258 09 25.79545 0.000 m  
W LON: 101 50 34.16232 0.000 m 101 50 34.20455 0.000 m  
EL HGT: 957.122 m 0.001 m 956.027 m 0.001 m  
ORTHO HGT: 981.962 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

UTM COORDINATES STATE PLANE COORDINATES  
UTM (Zone 14) SPC (4202 TXNC)  
NORTHING (Y) 3714265.471 m 2212167.499 m  
EASTING (X) 236008.380 m 289583.845 m  
CONVERGENCE -1.57143256 deg -1.82315691 deg  
POINT SCALE 1.00045929 0.99990817  
COMBINED FACTOR 1.00030898 0.99975795

US NATIONAL GRID DESIGNATOR: 14SKC3600814265 (NAD 83)

+++++

MARK: txml (txml a 1)  
CONSTRAIN: 3-D NORMAL  
ADJUST X: -0.000m (0.000m) Y: -0.002m (0.001m) Z: -0.008m (0.001m)  
ADJUST N: -0.008m (0.000m) E: -0.000m (0.000m) H: -0.003m (0.001m)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5423)  
X: -1172866.269 m 0.000 m -1172867.092 m 0.000 m  
Y: -5179261.528 m 0.001 m -5179260.135 m 0.001 m  
Z: 3522926.382 m 0.001 m 3522926.220 m 0.001 m  
LAT: 33 44 16.16995 0.000 m 33 44 16.18679 0.000 m  
E LON: 257 14 25.18335 0.000 m 257 14 25.14024 0.000 m  
W LON: 102 45 34.81665 0.000 m 102 45 34.85976 0.000 m  
EL HGT: 1126.645 m 0.001 m 1125.577 m 0.001 m  
ORTHO HGT: 1149.973 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

UTM COORDINATES STATE PLANE COORDINATES  
UTM (Zone 13) SPC (4202 TXNC)  
NORTHING (Y) 3735341.401 m 2237678.422 m  
EASTING (X) 707543.355 m 205396.491 m  
CONVERGENCE 1.24470890 deg -2.32320092 deg  
POINT SCALE 1.00013105 0.99994419  
COMBINED FACTOR 0.99995419 0.99976736

US NATIONAL GRID DESIGNATOR: 13SGT0754335341 (NAD 83)

+++++

MARK: txpl (txpl a 1)  
CONSTRAIN: 3-D NORMAL  
ADJUST X: -0.005m (0.000m) Y: -0.004m (0.001m) Z: -0.000m (0.001m)  
ADJUST N: -0.003m (0.000m) E: -0.005m (0.000m) H: 0.004m (0.001m)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5423)  
X: -1054455.933 m 0.000 m -1054456.751 m 0.000 m  
Y: -5239004.344 m 0.001 m -5239002.938 m 0.001 m  
Z: 3471338.667 m 0.001 m 3471338.501 m 0.001 m  
LAT: 33 10 57.07303 0.000 m 33 10 57.09015 0.000 m  
E LON: 258 37 12.36582 0.000 m 258 37 12.32415 0.000 m  
W LON: 101 22 47.63418 0.000 m 101 22 47.67585 0.000 m  
EL HGT: 768.733 m 0.001 m 767.624 m 0.001 m  
ORTHO HGT: 794.013 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

UTM COORDINATES STATE PLANE COORDINATES  
UTM (Zone 14) SPC (4202 TXNC)  
NORTHING (Y) 3674044.478 m 2171773.623 m  
EASTING (X) 278112.909 m 331486.897 m  
CONVERGENCE -1.30306960 deg -1.57068049 deg  
POINT SCALE 1.00020707 0.99987522  
COMBINED FACTOR 1.00008637 0.99975456

US NATIONAL GRID DESIGNATOR: 14SKB7811274044 (NAD 83)

+++++

MARK: txtu (txtu a 1)  
CONSTRAIN: 3-D NORMAL  
ADJUST X: 0.000m (0.000m) Y: -0.001m (0.001m) Z: 0.009m (0.001m)  
ADJUST N: 0.006m (0.000m) E: 0.000m (0.000m) H: 0.006m (0.001m)

REF FRAME: NAD\_83(2011) (2010.0000) IGS08 (2016.5423)  
X: -1070355.678 m 0.000 m -1070356.501 m 0.000 m  
Y: -5150738.708 m 0.001 m -5150737.320 m 0.001 m  
Z: 3595962.021 m 0.001 m 3595961.865 m 0.001 m  
LAT: 34 32 01.41983 0.000 m 34 32 01.43757 0.000 m  
E LON: 258 15 38.36781 0.000 m 258 15 38.32513 0.000 m  
W LON: 101 44 21.63219 0.000 m 101 44 21.67487 0.000 m  
EL HGT: 1035.923 m 0.001 m 1034.853 m 0.001 m  
ORTHO HGT: 1062.220 m 0.064 m (H = h - N WHERE N = GEOID12A HGT)

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 14)	SPC (4201 TX N)
NORTHING (Y)	3824745.853 m	1059238.301 m
EASTING (X)	248586.316 m	178027.051 m
CONVERGENCE	-1.55372364 deg	-0.13870743 deg
POINT SCALE	1.00037917	1.00002898
COMBINED FACTOR	1.00021652	0.99986639

US NATIONAL GRID DESIGNATOR: 14SKD4858624745 (NAD 83)

**NGS OPUS-PROJECTS SESSION SOLUTION REPORT**

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All coordinate accuracies reported here are 1 times the formal uncertainties from the solution. For additional information: [geodesy.noaa.gov/OPUS/Using\\_OPUS-Projects.html#accuracy](http://geodesy.noaa.gov/OPUS/Using_OPUS-Projects.html#accuracy)

These positions were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

```

SUBMITTED BY:                abenham
SOLUTION FILE NAME:          2016-199-A.sum
SOLUTION SOFTWARE:           page5(1509.10)
SOLUTION DATE:               2016-08-04T12:15:44 UTC
STANDARD ERROR OF UNIT WEIGHT: 0.777
TOTAL NUMBER OF OBSERVATIONS: 97395
TOTAL NUMBER OF MARKS:       9
NUMBER OF CONSTRAINED MARKS: 6

OVERALL RMS:                 1.7 cm
START TIME:                  2016-07-17T00:00:00 GPS
STOP TIME:                   2016-07-17T23:59:30 GPS
PROGRAM OPERATION:           FULL RUN
FREQUENCY:                   L1 -> ION-FREE (L6)
OBSERVATION INTERVAL:        30 s
ELEVATION CUTOFF:            15 deg
TROPIC INTERVAL:             1800 s [STEP-OFFSET PARAMETERIZATION]
DD CORRELATIONS:             ON
    
```

BASELINE	LENGTH	RMS	OBS	OMITTED	FIXED
0102-txlu	12.092 km	1.4 cm	2634	2.9%	96.6%
txlu-0101	12.875 km	1.5 cm	2663	1.1%	100.0%
txml-txll	44.009 km	1.4 cm	18623	3.9%	100.0%
txpl-txlu	58.217 km	1.8 cm	18660	3.7%	99.5%
txll-0101	58.677 km	1.4 cm	2580	3.9%	100.0%
txla-txpl	70.449 km	1.5 cm	18281	5.9%	98.6%
txtu-txll	86.738 km	1.5 cm	18835	2.1%	99.2%
zjx1-txpl	1852.381 km	2.1 cm	15119	5.5%	64.9%

**NGS OPUS-PROJECTS SESSION SOLUTION REPORT**

=====

All coordinate accuracies reported here are 1 times the formal uncertainties from the solution. For additional information: [geodesy.noaa.gov/OPUS/Using\\_OPUS-Projects.html#accuracy](http://geodesy.noaa.gov/OPUS/Using_OPUS-Projects.html#accuracy)

These positions were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

SUBMITTED BY: abenham  
SOLUTION FILE NAME: **2016-199-B.sum**  
SOLUTION SOFTWARE: page5(1509.10)  
SOLUTION DATE: 2016-08-04T12:17:19 UTC  
STANDARD ERROR OF UNIT WEIGHT: 0.789  
TOTAL NUMBER OF OBSERVATIONS: 96373  
TOTAL NUMBER OF MARKS: 9  
NUMBER OF CONSTRAINED MARKS: 6

OVERALL RMS: 1.7 cm  
START TIME: 2016-07-17T00:00:00 GPS  
STOP TIME: 2016-07-17T23:59:30 GPS  
PROGRAM OPERATION: FULL RUN  
FREQUENCY: L1 -> ION-FREE (L6)  
OBSERVATION INTERVAL: 30 s  
ELEVATION CUTOFF: 15 deg  
TROPO INTERVAL: 1800 s [STEP-OFFSET PARAMETERIZATION]  
DD CORRELATIONS: ON

BASELINE	LENGTH	RMS	OBS	OMITTED	FIXED
0102-txlu	12.092 km	1.6 cm	3122	8.5%	100.0%
txlu-0101	12.875 km	1.7 cm	1835	10.2%	100.0%
txml-txl1	44.009 km	1.4 cm	18623	3.9%	100.0%
txpl-txlu	58.217 km	1.8 cm	18660	3.7%	99.5%
txl1-0101	58.677 km	1.5 cm	1898	6.2%	100.0%
txla-txpl	70.449 km	1.5 cm	18281	5.9%	98.6%
txtu-txl1	86.738 km	1.5 cm	18835	2.1%	99.2%
zjx1-txpl	1852.381 km	2.1 cm	15119	5.5%	64.9%

**BH 17-064-102 1<sup>st</sup> Observation**

**NGS OPUS SOLUTION REPORT**

=====

All computed coordinate accuracies are listed as peak-to-peak values.  
 For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: abenham@bhinc.com    DATE: August 04, 2016  
 RINEX FILE: 0101199q.16o     TIME: 15:39:28 UTC

SOFTWARE: page5 1209.04 master92.pl 160321                      START: 2016/07/17 16:34:00  
 EPHEMERIS: igr19060.eph [rapid]                                    STOP: 2016/07/17 19:05:30  
 NAV FILE: brdc1990.16n    OBS USED: 6477 / 7221 : 90%  
 ANT NAME: TRMR8-4    # FIXED AMB: 51 / 56 : 91%  
 ARP HEIGHT: 1.634    OVERALL RMS: 0.015(m)

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000)                      IGS08 (EPOCH:2016.5430)

X:        -1088735.753(m)    0.009(m)                      -1088736.574(m)    0.009(m)  
 Y:        -5203003.535(m)    0.042(m)                      -5203002.136(m)    0.042(m)  
 Z:              3514705.754(m)    0.016(m)                      3514705.592(m)    0.016(m)

LAT:       33 38 58.95556        0.010(m)                      33 38 58.97278        0.010(m)  
 E LON:    258 10 52.70618        0.015(m)                      258 10 52.66388        0.015(m)  
 W LON:    101 49 7.29382        0.015(m)                      101 49 7.33612        0.015(m)  
 EL HGT:              968.674(m)    0.043(m)                      967.584(m)    0.043(m)  
 ORTHO HGT:            993.783(m)    0.074(m) [NAVD88 (Computed using GEOID12B)]

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 14)	SPC (4202 TXNC)
Northing (Y) [meters]	3726882.274	2224766.196
Easting (X) [meters]	238595.243	292224.209
Convergence [degrees]	-1.56276292	-1.80999647
Point Scale	1.00044250	0.99992697
Combined Factor	1.00029038	0.99977493

US NATIONAL GRID DESIGNATOR: 14SKC3859526882(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DO9608	TXP1 POST CORS ARP	N331057.073	W1012247.633	65968.7
DO9484	TXL1 LITTLEFIELD CORS ARP	N335618.226	W1022058.275	58676.7
DP4773	TXM1 MORTON CORS ARP	N334416.170	W1024534.816	87802.1

NEAREST NGS PUBLISHED CONTROL POINT

AB6602	LBB B3	N333919.083	W1014927.872	815.9
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**BH 17-064-101 2<sup>nd</sup> Observation**

**NGS OPUS SOLUTION REPORT**

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All computed coordinate accuracies are listed as peak-to-peak values.  
For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: abenham@bhinc.com  
RINEX FILE: 0101199n.16o

DATE: August 04, 2016  
TIME: 15:38:55 UTC

SOFTWARE: page5 1209.04 master51.pl 160321      START: 2016/07/17 13:08:00  
EPHEMERIS: igr19060.eph [rapid]                 STOP: 2016/07/17 16:25:00  
NAV FILE: brdc1990.16n                         OBS USED: 8381 / 8896 : 94%  
ANT NAME: TRMR8-4                             # FIXED AMB: 42 / 42 : 100%  
ARP HEIGHT: 1.677                             OVERALL RMS: 0.012(m)

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000)                             IGS08 (EPOCH:2016.5427)

X:	-1088735.748(m)	0.005(m)	-1088736.569(m)	0.005(m)
Y:	-5203003.497(m)	0.004(m)	-5203002.098(m)	0.004(m)
Z:	3514705.740(m)	0.009(m)	3514705.578(m)	0.009(m)

LAT:	33 38 58.95587	0.006(m)	33 38 58.97309	0.006(m)
E LON:	258 10 52.70607	0.004(m)	258 10 52.66377	0.004(m)
W LON:	101 49 7.29393	0.004(m)	101 49 7.33623	0.004(m)
EL HGT:	968.634(m)	0.007(m)	967.545(m)	0.007(m)
ORTHO HGT:	993.743(m)	0.017(m)	[NAVD88 (Computed using GEOID12B)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 14)	SPC (4202 TXNC)
Northing (Y) [meters]	3726882.284	2224766.206
Easting (X) [meters]	238595.240	292224.206
Convergence [degrees]	-1.56276294	-1.80999649
Point Scale	1.00044250	0.99992697
Combined Factor	1.00029039	0.99977494

US NATIONAL GRID DESIGNATOR: 14SKC3859526882(NAD 83)

**BASE STATIONS USED**

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DP4773	TXM1 MORTON CORS ARP	N334416.170	W1024534.816	87802.1
DO9484	TXL1 LITTLEFIELD CORS ARP	N335618.226	W1022058.275	58676.7
DO9608	TXP1 POST CORS ARP	N331057.073	W1012247.633	65968.7

**NEAREST NGS PUBLISHED CONTROL POINT**

AB6602	LBB B3	N333919.083	W1014927.872	815.9
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# BH 17-064-102 1<sup>st</sup> Observation

## NGS OPUS SOLUTION REPORT

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All computed coordinate accuracies are listed as peak-to-peak values.  
 For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: abenham@bhinc.com                                  DATE: August 04, 2016  
 RINEX FILE: 0102199p.16o                                  TIME: 15:40:17 UTC

SOFTWARE: page5 1209.04 master92.pl 160321	START: 2016/07/17 15:44:00
EPHEMERIS: igr19060.eph [rapid]	STOP: 2016/07/17 20:07:00
NAV FILE: brdc1990.16n	OBS USED: 10826 / 11990 : 90%
ANT NAME: TRMR8-4                      NONE	# FIXED AMB: 67 / 77 : 87%
ARP HEIGHT: 1.487	OVERALL RMS: 0.016(m)

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000)                                  IGS08 (EPOCH:2016.5430)

X:	-1103396.418(m)	0.005(m)	-1103397.238(m)	0.005(m)
Y:	-5210386.473(m)	0.021(m)	-5210385.073(m)	0.021(m)
Z:	3499284.443(m)	0.002(m)	3499284.279(m)	0.002(m)
LAT:	33 28 58.13009	0.009(m)	33 28 58.14713	0.009(m)
E LON:	258 2 35.52157	0.006(m)	258 2 35.47927	0.006(m)
W LON:	101 57 24.47843	0.006(m)	101 57 24.52073	0.006(m)
EL HGT:	978.519(m)	0.018(m)	977.428(m)	0.018(m)
ORTHO HGT:	1003.047(m)	0.032(m)	[NAVD88 (Computed using GEOID12B)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 13)	SPC (4202 TXNC)
Northing (Y) [meters]	3708959.170	2206679.654
Easting (X) [meters]	782777.081	278811.753
Convergence [degrees]	1.68000804	-1.88531917
Point Scale	1.00058596	0.99990085
Combined Factor	1.00043227	0.99974727

US NATIONAL GRID DESIGNATOR: 13SGT8277708959(NAD 83)

BASE STATIONS USED					
PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)	
DO8869	TXLA LAMESA CORS ARP	N324540.901	W1015638.170	80034.2	
DF5391	TXLU LUBBOCK RRP2 CORS ARP	N333207.490	W1015034.162	12092.4	
DP4773	TXM1 MORTON CORS ARP	N334416.170	W1024534.816	79710.5	

NEAREST NGS PUBLISHED CONTROL POINT			
PID	DESIGNATION	LATITUDE	DISTANCE
DP0654	SHEPARD	N332833.759	W1015358.557 5369.2

# BH 17-064-102 2<sup>nd</sup> Observation

## NGS OPUS SOLUTION REPORT

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All computed coordinate accuracies are listed as peak-to-peak values.  
For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: abenham@bhinc.com  
RINEX FILE: 0102199m.16o

DATE: August 04, 2016  
TIME: 15:39:53 UTC

SOFTWARE: page5 1209.04 master93.pl 160321      START: 2016/07/17 12:17:00  
EPHEMERIS: igr19060.eph [rapid]                  STOP: 2016/07/17 15:39:00  
NAV FILE: brdc1990.16n                          OBS USED: 8611 / 9080 : 95%  
ANT NAME: TRMR8-4                              # FIXED AMB: 54 / 54 : 100%  
ARP HEIGHT: 1.521                              OVERALL RMS: 0.014(m)

REF FRAME: NAD\_83(2011)(EPOCH:2010.0000)      IGS08 (EPOCH:2016.5426)

X:	-1103396.418(m)	0.003(m)	-1103397.238(m)	0.003(m)
Y:	-5210386.452(m)	0.018(m)	-5210385.052(m)	0.018(m)
Z:	3499284.435(m)	0.009(m)	3499284.271(m)	0.009(m)

LAT:	33 28 58.13024	0.017(m)	33 28 58.14728	0.017(m)
E LON:	258 2 35.52140	0.003(m)	258 2 35.47910	0.003(m)
W LON:	101 57 24.47860	0.003(m)	101 57 24.52090	0.003(m)
EL HGT:	978.498(m)	0.010(m)	977.407(m)	0.010(m)
ORTHO HGT:	1003.026(m)	0.020(m)	[NAVD88 (Computed using GEOID12B)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 13)	SPC (4202 TXNC)
Northing (Y) [meters]	3708959.174	2206679.659
Easting (X) [meters]	782777.076	278811.749
Convergence [degrees]	1.68000801	-1.88531919
Point Scale	1.00058596	0.99990085
Combined Factor	1.00043228	0.99974727

US NATIONAL GRID DESIGNATOR: 13SGT8277708959(NAD 83)

### BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DO8869	TXLA LAMESA CORS ARP	N324540.901	W1015638.170	80034.2
DP4773	TXM1 MORTON CORS ARP	N334416.170	W1024534.816	79710.5
DF5391	TXLU LUBBOCK RRP2 CORS ARP	N333207.490	W1015034.162	12092.4

### NEAREST NGS PUBLISHED CONTROL POINT

DP0654	SHEPARD	N332833.759	W1015358.557	5369.2
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