Project Report To
Texas Water Development Board

1700 North Congress Avenue
Austin, Texas 78711-3231

Single Beam Bathymetric Survey of Brazos River from East Columbia to the Gulf of Mexico.

Prepared By:

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1.0 Introduction
On September 1st and between September 8th and September 13th, 2009 Hydrographic Consultants, Ltd performed a Single Beam, Hydrographic Survey of the Lower Brazos River for the Texas Water Development Board. The survey was performed as described in our proposal by running 1 serpentine line and 2 wing lines through each section.

2.0 Scope of Work
The survey coverage was to consist of 35 miles of river below the SH-35 Bridge in East Columbia to the Gulf of Mexico (figure 1). The survey area was divided into 5 separate reaches, each reach was completed before proceeding to the next. Two (2) longitudinal lines along the river and 1 sinusoidal line were run (figure 2). 3 Onset “Hobo” water level data loggers were installed and operated to collect water level data at a 30 second interval for the entire duration of the survey. The “Hobo” data loggers were referenced to 5 control points established along the river with a Trimble RTK system. An additional Hobo pressure gauge was used to compensate for changes in barometric pressure.

Figure 1. Survey Area.
3.0 Equipment and Methodology

One survey vessel was mobilized for the duration of the project.

An Odom CVM and an Odom CV100 single beam echo sounder operating at 200KHz were used to measure water depths. The CVM and CV100 were calibrated at the start and end of each days survey work with a Bar Check. The horizontal position was obtained with a Trimble DSM 232 DGPS receiver corrected by signals from the USCG beacon at Angleton. Coastal Oceanographic’s “Hypack 2008” hydrographic software package was used to collect data from both the Odom Echo Sounder and the Trimble DGPS which also provided real time line guidance for the helmsman.

Prior to Single Beam data collection, 5 temporary control points were set using a Trimble RTK (5700 / SPS 881) system. (See Section 3.2)

The survey layout consisted of a total of three (3) survey lines down the length of the Brazos River. Specifically 2 parallel longitudinal lines and 1 Sinusoidal “S” Line were run. (See Figure 2)
3.1 Equipment Installation and Calibration

The survey equipment was mobilized onto a 19 foot fiberglass Carolina Skiff equipped with a 60 H.P. outboard motor. The echo sounder transducer was solidly mounted, through the hull on the Port side close amidships. The DGPS antenna was mounted directly above the transducer so that no horizontal offsets were present. An external LCD monitor was available for the helmsman to assist with line guidance. All the survey equipment was powered by a 12V Gel cell battery. At the start and end of each day’s survey, the calibration of the echo sounder was checked by lowering a weighted plate on a calibrated wire rope beneath the echo sounder’s transducer (Bar Check). Settings for draft and speed of sound in water were entered into the sounder after the first bar check and the settings verified each day.

![Figure 3. Electronic Echogram of a typical Bar Check used to calibrate the Echo Sounder at 5, 10 and 15 ft.](image)

The position obtained from the DGPS receiver was compared to the temporary control points before any hydrographic data was collected to ensure no gross GPS errors.

3.2 Geodesy and Vertical Control

The survey was performed using the following geodetic and local grid parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellipsoid</td>
<td>NAD 83 (WGS-84)</td>
</tr>
<tr>
<td>Projection</td>
<td>US State Plane</td>
</tr>
<tr>
<td>Zone</td>
<td>TX 4204 Texas South Central</td>
</tr>
<tr>
<td>Horizontal Units</td>
<td>US Survey Feet</td>
</tr>
<tr>
<td>Vertical Units</td>
<td>US Survey Feet</td>
</tr>
</tbody>
</table>
Vertical Control

A Trimble 5700 / SPS 881 RTK system was used to vertically reference the 5 tidal stations that were set along the river. The RTK base station was setup at NGS monument AM0021 (figure 4). The RTK was checked in at 1 other NGS monument AM0052 (figure 5).

Figure 4. RTK Base Station setup on NGS monument AM0021.

Figure 5. NGS Monument AM0052 used as check in point.
Due to the elongated nature of the project area, several base station setups were required. This was accomplished by establishing temporary benchmarks relative to AM0021 suitable for a base station occupation along the river.

Each tidal station was monumented with a “Magnail” driven into a solid wood bulkhead piling or an “X” mark chiseled into a concrete bulkhead. For accurate calibration, a conventional level was used to measure the water level each time a water level logger was launched or retrieved.

All water level loggers were configured to log data at 30 sec. intervals throughout the 6 days that the hydrographic survey was being performed.

3.3 Tides

Due to the elongated nature of the survey, it was decided to use 4 data loggers to record the water level (tide) during the survey. 3 loggers were in the water at all times relative to the sections being surveyed at the time. An additional logger was used to compensate for any errors that could be caused by barometric changes throughout the survey.

The Hobo Water Level Logger is a compact device that measures and internally logs pressure, temperature and time. The data logger is enclosed in a weighted, plastic tube that is suspended in the water column by a wire rope. Because the data logger is recording pressure and time only, a conversion must be performed to convert pounds per square inch into feet of water. Further, the scale must be shifted so that the water depth reported by the data logger is the same as the tide at any given instance. Figure 6 shows the position of each tidal station along the river.

Figure 6. Showing NGS control points and relative position of the five water level logger stations located along the Lower Brazos Valley.
Gauge 1 was located at the SH-35 Bridge crossing the Brazos River (figure 7). The water level was measured when the logger was launched before surveying Section 1 and when the logger was retrieved after Section 1 was completed.

![Gauge 1 Location](image1)

*Figure 7. Showing location of the Hobo water level logger at Gauge 1.*

Gauge 2 was located about 10.9 river miles downstream from Gauge 1 near a public boat ramp at the end of Nicholson Road (figure 8). The water level was measured when the logger was launched before surveying Section 1 and when the logger was retrieved after Sections 2 and 3 were completed.

![Gauge 2 Location](image2)

*Figure 8. Showing location of Hobo water level logger at Gauge 2.*
Gauge 3 was located about 6.8 river miles downstream from Gauge 2 at a public boat ramp near the FM 2004 bridge crossing the Brazos River (figure 9). The water level was measured when the logger was launched before surveying Section 1 and when the logger was retrieved after Sections 2-4 were completed.

![Figure 9. Showing location of Hobo water level logger at Gauge 3.](image)

Gauge 4 was located about 11 river miles downstream from Gauge 3 at a public boat ramp near the SH-36 Bridge crossing the Brazos River (figure 10). The water level was measured when the logger was launched before surveying Section 3 and when the logger was retrieved after Section 4 was completed.

![Figure 10. Showing location of Hobo water level logger at Gauge 4.](image)
Gauge 5 was located about 3.1 river miles downstream from Gauge 4 at a public boat ramp near the end of Levee Road (figure 11). The water level was measured when the logger was launched before surveying Section 4 and when the logger was retrieved after Section 5 was completed.

![Figure 11. Showing location of Hobo water level logger at Gauge 5.](image)

All water level loggers were configured to log data (temperature, water pressure and time) at 30 second intervals throughout the 6 days that the survey was being performed. After the survey was completed, the data loggers were downloaded and exported into a standard Excel spreadsheet format. The Hobo software allows for the inclusion of the barometric logger’s data to compensate for changes in barometric pressure.
3.4 RiverTide

A custom software package “RiverTide”, was written specifically for river projects, to interpolate the tide (water elevation) between each of the gauges, based on the along river distance between the gauges. Once the tide data from the gauges has been processed by RiverTide, a seamless tide file is produced for any location at any time along the river, weighted by its position relative to the gauges and time. This tide file is then applied to the raw depth soundings to produce a tide corrected depth reduced to the NAVD88 datum.

![Fig. 12 Screen Capture of RiverTide showing two tide gauge locations. The red and blue text are azimuth and distance vectors](image)
Fig. 13 Zoomed in screen capture of above showing distance and azimuth vectors.

Fig. 14 A graphic representation of the interpolated water level between Gauges. Example from Rio Grand job.
All uncorrected soundings and raw tide files are included with this report for further or alternative analysis by Texas Water Development Board.

Figure 15. Tidal graph referenced to NAVD88, showing relationship of the water levels throughout the survey period.
Survey Results

4.1 Data Cleaning and Processing

The Odom CVM is a paperless echo sounder. It is connected to the Hypack data collection computer by a high speed Ethernet interface. Not only are the digital soundings sent to Hypack but also an electronic version of the actual echogram (see Figure 3). This feature is very useful for data processing in Hypack because the electronic echogram is available as a window in the single beam editor portion of Hypack (see Figure 16). It is very easy to recognize where the echo sounder has digitized on noise in the water column rather than the river bed and it is also easy to correct this during data processing. Without this feature it can be quite time consuming to check through the paper scrolls particularly in very shallow water and noisy conditions. The Hypack single beam editor utility was also used to inspect the navigation data for any jumps due to GPS or differential outages caused by overhanging vegetation (not a major problem on this survey). Once the data had been cleaned the tide file was applied and the corrected file exported as an ASCII X,Y,Z data set. An export of the same file with no tide applied was also exported. All data is available on the DVD that accompanies this report.

![Figure 16. Typical Screen from Hypack Single Beam Editor showing Echogram (top right) Spreadsheet (top left) and plan view (bottom).](image-url)
4.2 Quality Control

Before any hydrographic data was collected the DGPS antenna was placed over a control point to ensure there were no gross DGPS errors and that the correct WGS84 to US State Plane (Texas South Central 4204) conversion was being performed. A “bar check” was performed and logged at the start and end of each day’s survey activity to correct for any changes in the vessel’s draft and water velocity. As a further QC check, the area of overlap between one river section and the next was compared. A cross section was cut across the junction of all sections to ensure that no depth errors had been introduced.

Fig. 17 River Section 1 to River Section 2 Cross Section
Fig. 18 River Section 2 to River Section 3 Cross Section

Fig. 19 River Section 3 to River Section 4 Cross Section
4.3 Final Products

The DVD contains the following data files:

<table>
<thead>
<tr>
<th>Directory</th>
<th>Contents</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Data</td>
<td>Corrected ASCII X,Y,Z</td>
<td>Both +Z and –Z</td>
</tr>
<tr>
<td>Report</td>
<td>Main + Control Reports</td>
<td>Adobe PDF format</td>
</tr>
<tr>
<td>Pictures</td>
<td>All pictures from Brazos</td>
<td></td>
</tr>
<tr>
<td>Raw Data</td>
<td>Hypack File</td>
<td>Version 2008</td>
</tr>
<tr>
<td></td>
<td>Uncorrected ASCII X,Y,Z</td>
<td>Both +Z and -Z</td>
</tr>
<tr>
<td></td>
<td>Raw Tide Files</td>
<td>From Tide Logger</td>
</tr>
</tbody>
</table>
4.4 Control Network Summary

Introduction

Before commencement of the hydrographic portion of the project, a survey team was mobilized to investigate and document existing geodetic control, set temporary control points along the survey area as required and establish the location and access requirements of boat ramps that would be required during the hydrographic portion of the survey.

9/1/09

Travel from Houston to Project Area

NGS Monument Search

AM0021 – Found as described
AM0052 – Found as described
AW0103 – Found as described
AW4137 – Found as described
AW0102 – Abandoned (unable to reach)
AW1188 – Abandoned (unable to reach)
AW4353 – Abandoned (unable to reach)
AW4355 – Abandoned (unable to reach)
AW4356 – Abandoned (unable to reach)
AM0047 – Not found
AW4130 – Not found
AW4135 – Not found

Monumenting

Gauge 1 and Gauge 4 were monumented with Mag Nail set in concrete bulkheads or bridge abutments. Gauge 2 and Gauge 3 were monumented with a Mag Nail set in the center of 12” bulkhead pilings. Gauge 5 was monumented with a chiseled “X” in a concrete bulkhead.

Measuring

RTK base station set up on AM0021
Vertical check-in at AM0052
Monuments measured: Gauge 4, Gauge 5, TBM “Peach”

RTK base station set up on TBM “Peach”
Vertical check-in at AM0052
Monuments measured: Gauge 3, TBM “DOC”

RTK base station set up on TBM “DOC”
Vertical check-in at “Peach” and AW0103
Monuments measured: Gauge 2, TBM “CR507”
RTK base station set up on TBM “CR507”
Vertical check-in at AW0103, AW4137
Monuments measured: TBM “4137”

RTK base station set up on TBM “4137”
Vertical check-in at “CR507”
Monuments measured: Gauge 1

Travel from Project Area to Houston
HCL Vertical Control Descriptions and Locations
Gauge 1

State Plane TX South 4204
X: 3051992.243
Y: 13615516.687
Z: 42.697

Monumented: 09/01/2009

WGS84
Lat: 29°08'37.33976"N
Long: 95°36'18.28377"W

Description:
Mag nail set in asphalt at the top of a concrete bridge abutment.

Location:
To get to Gauge 1 from the intersection of FM 1495 and SH-36 travel West on SH 36 for about 24.75 miles to the intersection of SH 36 and SH 35. Turn right, follow 35 for about 3.25 miles across the Brazos River Bridge. Monument is about 20 feet north of the centerline of the east bound lane at the top of the embankment behind a wooden post guard rail on the east bank of the river.
Gauge 2/Boat Ramp 1

State Plane TX South 4204
Monumented: 09/01/2009
X: 3075654.170
Y: 13581411.600
Z: 5.720

WGS84
Lat: 29°02'52.93277"N
Long: 95°32'02.93092"W

Description:
Mag nail set in top of 12” bulkhead piling on downstream side of boat ramp.

Location:
To get to Gauge 2 from the intersection of FM 1495 and SH-36 travel West on SH 36 for about 16.5 miles to the intersection of SH 36 and SH 332 (FM 521). Turn right on 332 for about 0.75 miles. Turn right on Brazos River Road for about 1.25 miles to Nicholson Road on left. Monument is at the end of Nicholson Road on the downstream bulkhead wall.
Gauge 3/Boat Ramp 2

State Plane TX South 4204
X: 3094067.320
Y: 13576007.170
Z: 7.923

Monumented: 09/01/2009

WGS84
Lat: 29°01'53.99960"N
Long: 95°28'37.38267"W

Description:
Mag nail set in top of 12” bulkhead piling on north side of boat ramp.

Location:
To get to Gauge 3 from the intersection of FM 1495 and SH-36 travel West on SH 36 for about 11 miles to the intersection of SH 36 and FM 2004. Turn right on 2004 for about 4.1 miles. Turn left after the bridge to the public boat ramp entrance. Monument is set in the top of the corner piling of the north bulkhead at the end of the ramp.
Gauge 4/Boat Ramp 3

State Plane TX South 4204
X: 3125756.683
Y: 13546045.640
Z: 4.38

Monumented: 09/01/2009

WGS84
Lat: 28°56'47.90165"N
Long: 95°22'50.98369"W

Description:
Stainless steel nail set in asphalt at the corner of a concrete bulkhead on the downstream side of a boat ramp.

Location:
To get to Gauge 4 from the intersection of FM 1495 and SH-36 travel West on SH 36 for about 2.4 miles. Turn right immediately after the bridge and loop underneath. Turn left toward the river. Monument is set in the asphalt in the corner of the concrete bulkhead on the downstream side of the boat ramp.
Gauge 5/Boat Ramp 4

State Plane TX South 4204

Monumented: 09/01/2009

X: 3125067.127
Y: 13529606.703
Z: 4.373

WGS84

Lat: 28°54'05.42402"N
Long: 95°23'04.43183"W

Description:
Chiseled “X” in concrete bulkhead.

Location:
To get to Gauge 5 from the intersection of FM 1495 and SH-36 travel West on SH 36 for about 1.3 miles. Take the exit for Brazosport Road. Turn left on Brazosport Rd then the immediately right onto Levee Road. Continue south on Levee Road for 3.15 miles to the ramp entrance on the right. Monument is a chiseled “X” in the corner of the concrete bulkhead on the downstream side at the end of the boat ramp.
## Distance Between Vertical Controls

<table>
<thead>
<tr>
<th>Monuments</th>
<th>Distance (River Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gulf-Gauge 5</td>
<td>1.81</td>
</tr>
<tr>
<td>Gauge 5-Gauge 4</td>
<td>3.16</td>
</tr>
<tr>
<td>Gauge 4-Gauge 3</td>
<td>11.05</td>
</tr>
<tr>
<td>Gauge 3-Gauge 2</td>
<td>6.80</td>
</tr>
<tr>
<td>Gauge 2-Gauge 1</td>
<td>10.97</td>
</tr>
<tr>
<td>Gauge 1-End of Project</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34.39</strong></td>
</tr>
</tbody>
</table>
NGS Control Descriptions and Locations
(as found by HCL)
AM0021

State Plane TX South 4204  Monumented:  1954
X:  3137091.40
Y:  13551024.73
Z:  0.9

WGS84
Lat:  28°57'33.68748"N
Long:  95°20'41.70264"W

Description:
Azimuth disk set in the top of a 12” square concrete monument projecting about 0.4 foot above ground level. Stamped “MIDWAY 1954”.

Location:
To get to AM0021 from the intersection of FM 1495 and SH-36 travel North on FM 1495 for about 1.54 miles to the intersection of FM 1495 and Old Surfside Road. Travel West on Old Surfside Road for 250 feet from the center of the intersection. Monument is 72 feet south of the centerline of the road at the base of a barbed wire fence and 145 feet west of the corner of the fence.
AM0052

State Plane TX South 4204  Monumented:  1931
X:  3113155.25
Y:  13553883.82
Z:  6.60

WGS84
Lat:  28°58'09.31280"N
Long:  95°25'10.06739"W

Description:
Triangulation station disk set in the top of a 12” square concrete monument projecting about 0.5 foot above ground level. Stamped “JONES 1931”.

Location:
To get to AM0021 from the intersection of FM 1495 and SH-36 travel West on SH-36 for 4.9 miles. Monument is in a pasture 145 feet north of the centerline of the road, 59 feet past a barbed wire fence and 72 feet west of a barbed wire fence.
AW0103

**State Plane TX South 4204**

Monumented: 1961

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>3064527.99*</td>
<td>13576646.07*</td>
<td>28.00</td>
</tr>
</tbody>
</table>

**WGS84**

Lat: 29°02'09.01635"N*

Long: 95°34'09.82002"W*

* Scaled Coordinates

**Description:**
Survey disk set in a concrete culvert flush with the ground. Stamped “K586 RESET 1961”

**Location:**
To get to AW0103 from the intersection of FM 1495 and SH-36 travel West on SH-36 for 15.6 miles to the intersection of SH-36 and FM 521. Monument is about 30 feet west of the centerline of SH-36, and about 106 feet south-east of the traffic signal on the shoulder of the south-east bound lane. The disk is set in the top of an abandoned concrete culvert that has been filled with asphalt, flush with the road.
AW4137

**State Plane TX South 4204**  
Monumented: 1973

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>3035820.70*</td>
<td>13614605.32*</td>
<td>34.40</td>
</tr>
</tbody>
</table>

**WGS84**

Lat: 29°08'32.93249"N*
Long: 95°39'20.89134"W*

* Scaled Coordinates

**Description:**
Benchmark disk set in a concrete culvert. Stamped “J 1220 1973”

**Location:**
To get to AW4137 from the intersection of FM 1495 and SH-36 travel West on SH-36 for about 25.15 miles. Monument is about 30 feet west of the centerline of SH-36 just south of a dirt residential driveway, set in the top of the northwest end of a culvert headwall.
NGS Control Data Sheets
**AM0021**

HT_MOD - This is a Height Modernization Survey Station.

**AM0021**

**DESIGNATION** - MIDWAY AZ MK

**AM0021**

**PID** - AM0021

**AM0021**

**STATE/COUNTY** - TX/BRAZORIA

**AM0021**

**USGS QUAD** - FREEPORT (1974)

**AM0021**

*CURRENT SURVEY CONTROL*

**AM0021**

<table>
<thead>
<tr>
<th>NAD 83(NSRS2007)</th>
<th>NAVD 88</th>
<th>Accuracy Estimates (at 95% Confidence Level in cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 57 33.68748(N)</td>
<td>0.26 (meters)</td>
<td>11.15 10.33 25.77</td>
</tr>
<tr>
<td>095 20 41.70263(W)</td>
<td>0.9 (feet)</td>
<td>NETWORK AM0021 MIDWAY AZ MK</td>
</tr>
</tbody>
</table>

**AM0021**

**LOCAL**

<table>
<thead>
<tr>
<th>Type</th>
<th>PID</th>
<th>Designation</th>
<th>North</th>
<th>East</th>
<th>Ellip</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCAL</td>
<td>AW0096 PLANT B 2</td>
<td>13.19 11.78 15.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOCAL</td>
<td>AM0024 PLANT A</td>
<td>11.70 9.96 10.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOCAL</td>
<td>AM0052 JONES</td>
<td>14.11 12.31 13.82</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AM0021**

**LOCAL AVERAGE** | 13.00 11.35 13.11 |

**AM0021**

**VERT ORDER** - FIRST CLASS I (See Below)

**AM0021**

The horizontal coordinates were established by GPS observations and adjusted by the National Geodetic Survey in February 2007.

**AM0021**

The orthometric height was determined by GPS observations and a high-resolution geoid model using precise GPS observation and processing techniques.

**AM0021**

The vertical order pertains to the NGVD 29 superseded value.

**AM0021**

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

**AM0021**

The Laplace correction was computed from DEFLEC99 derived deflections.

**AM0021**

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

**AM0021**

The geoid height was determined by GEOID03.

**AM0021**

**SPC TXSC**

<table>
<thead>
<tr>
<th>Elev Factor</th>
<th>x</th>
<th>Scale Factor</th>
<th>Combined Factor</th>
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</thead>
<tbody>
<tr>
<td>-4,130,360.598</td>
<td>-1</td>
<td>0.99988458</td>
<td>+ 1 47 26.4</td>
</tr>
<tr>
<td>-13,551,024.73</td>
<td>-1</td>
<td>0.99988458</td>
<td>+ 1 47 26.4</td>
</tr>
<tr>
<td>3,205,747.792</td>
<td>-1</td>
<td>1.00024446</td>
<td>- 1 08 09.2</td>
</tr>
</tbody>
</table>

**AM0021!!**

- Elev Factor x Scale Factor = Combined Factor
AM0021 SUPERSEDED SURVEY CONTROL

AM0021 NAD 83(1993) - 28 57 33.68720(N) 095 20 41.70275(W) AD( ) 1
AM0021 ELLIP H (12/03/01) -26.082 (m) GP( ) 4 2
AM0021 NAD 83(1993) - 28 57 33.6843(N) 095 20 41.69838(W) AD( ) 3
AM0021 NAD 83(1986) - 28 57 33.69479(N) 095 20 41.67773(W) AD( ) 3
AM0021 NAD 27 - 28 57 32.80500(N) 095 20 40.89500(W) AD( ) 3
AM0021 NGVD 29 (??/??/92) -0.380 (m) 1.25 (f) ADJ UNCH 1 1

AM0021 Superseded values are not recommended for survey control.
AM0021 NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AM0021 See file dsdata.txt to determine how the superseded data were derived.

AM0021 U.S. NATIONAL GRID SPATIAL ADDRESS: 15RTN7148205748(NAD83)
AM0021 MARKER: DZ = AZIMUTH MARK DISK
AM0021 SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AM0021 SP_SET: SET IN TOP OF CONCRETE MONUMENT
AM0021 STAMPING: MIDWAY 1954
AM0021 STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AM0021 STABILITY: SURFACE MOTION
AM0021 SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AM0021 SATELLITE: SATELLITE OBSERVATIONS - February 18, 2005

AM0021 HISTORY - Date Condition Report By
AM0021 HISTORY - 1954 MONUMENTED CGS
AM0021 HISTORY - 1973 GOOD NGS
AM0021 HISTORY - 1978 GOOD NGS
AM0021 HISTORY - 20050218 GOOD USPSQD

AM0021 STATION DESCRIPTION

AM0021 DESCRIBED BY COAST AND GEODETIC SURVEY 1954
AM0021 REACHED FROM THE JUNCTION OF STATE HIGHWAY 523 AND FARM AND
AM0021 MARKET ROAD 1460 IN THE EASTERN EDGE OF VELASCO BY GOING
AM0021 EASTERLY ON ROAD 1460 FOR 0.3 MILE TO STATION MIDWAY ON THE LEFT.
AM0021 TO REACH THE AZIMUTH MARK FROM STATION MIDWAY, CONTINUE EASTERLY
AM0021 ON ROAD 1460 FOR 0.3 MILE TO THE AZIMUTH MARK ON THE RIGHT.
AM0021 THE AZIMUTH MARK, A STANDARD DISK SET IN A CONCRETE MONUMENT,
AM0021 IS 73 FEET SOUTH OF THE CENTERLINE OF ROAD 1460, 6 FEET NORTH
AM0021 OF A CABLE LINE POLE, 3 FEET WEST OF A WITNESS POST, AND 1
AM0021 FOOT WEST OF A FENCE LINE. THE DISK IS STAMPED MIDWAY 1954,
AM0021 AND THE MARK PROJECTS 4 INCHES.

AM0021 STATION RECOVERY (1973)

AM0021 RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1973
AM0021 0.65 MILE FROM FREEPORT.
AM0021 0.65 MILE EAST ALONG COUNTY ROAD 229 FROM THE JUNCTION OF VELASCO
AM0021 BOULEVARD AT FREEPORT, AT THE JUNCTION OF FARM ROAD 1495 (PINE
AM0021 STREET), 71 FEET SOUTH OF THE CENTER LINE OF THE COUNTY ROAD, 296 FEET
AM0021 WEST-SOUTHWEST OF THE CENTER OF THE JUNCTION, 61 FEET EAST OF A
AM0021 TELEPHONE POLE, 81 1/2 FEET WEST OF TELEPHONE POLE 11 1/2 WITH A GUY
AM0021 WIRE, 77 FEET WEST OF A METAL BOX OF AN UNDERGROUND TELEPHONE CABLE,
AM0021 1 FOOT NORTH OF A FENCE, 2.0 FEET EAST OF A WITNESS POST, ABOUT 1/2
FOOT LOWER THAN THE ROAD, AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FOOT ABOVE THE GROUND.

STATION RECOVERY (1978)

RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1978 RECOVERED IN GOOD CONDITION.

STATION RECOVERY (2005)

RECOVERY NOTE BY US POWER SQUADRON 2005 (GWS) RECOVERED IN GOOD CONDITION.
National Geodetic Survey, Retrieval Date = APRIL 28, 2009

**AM0052**  ***********************************************************************
**AM0052**  HT_MOD      -  This is a Height Modernization Survey Station.
**AM0052**  DESIGNATION -  JONES
**AM0052**  PID         -  AM0052
**AM0052**  STATE/COUNTY-  TX/BRAZORIA
**AM0052**  USGS QUAD   -  JONES CREEK (1974)

**AM0052**  *CURRENT SURVEY CONTROL

**AM0052**  ___________________________________________________________________
**AM0052**  * NAD 83(NSRS2007)-  28 58 09.31285(N) 095 25 10.06740(W)  ADJUSTED
**AM0052**  * NAVD 88         -         2.01   (meters)    6.6   (feet)  GPS OBS

**AM0052**  ___________________________________________________________________
**AM0052**  X           -    -527,433.451  (meters)                     COMP
**AM0052**  Y           -  -5,559,505.227  (meters)                     COMP
**AM0052**  Z           -   3,070,908.388  (meters)                     COMP
**AM0052**  LAPLACE CORR-           0.58  (seconds)                    DEFLEC99
**AM0052**  ELLIP HEIGHT-         -24.453 (meters)          (02/10/07) GPS OBS
**AM0052**  GEOID HEIGHT-         -26.47  (meters)                     GEOID03

**AM0052**  ------- Accuracy Estimates (at 95% Confidence Level in cm) --------
**AM0052**  Type    PID    Designation                      North   East  Ellip
**AM0052**  -------------------------------------------------------------------
**AM0052**  NETWORK AM0052 JONES                            14.97  13.21  26.93
**AM0052**  -------------------------------------------------------------------

**AM0052**  VERT ORDER  -  FIRST     CLASS I (See Below)

The horizontal coordinates were established by GPS observations and adjusted by the National Geodetic Survey in February 2007. The orthometric height was determined by GPS observations and a high-resolution geoid model using precise GPS observation and processing techniques. The vertical order pertains to the NGVD 29 superseded value.

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

The Laplace correction was computed from DEFLEC99 derived deflections.

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

The geoid height was determined by GEOID03.

**AM0052**  Primary Azimuth Mark                     Grid Az
**AM0052**  SPC TXSC     -  JONES AZ MK                              028 59 47.3
**AM0052**  UTM  15      -  JONES AZ MK                              031 55 22.8
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<td>AW6836</td>
<td>ANGLETON MUNICIPAL TANK</td>
<td>APPROX. 21.7 KM</td>
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SUPERSEDED SURVEY CONTROL

NAD 83(1993)-  28 58 09.31252(N)    095 25 10.06750(W) AD( ) 1
ELLIP H (12/03/01) -24.381  (m)  GP( ) 4 2
NAD 83(1993)-  28 58 09.31503(N)    095 25 10.06490(W) AD( ) 1
ELLIP H (02/16/96) -24.419  (m)  GP( ) 5 1
NAD 83(1968)-  28 58 09.32511(N)    095 25 10.04297(W) AD( ) 1
NAD 29 (?!!??/92)  2.194  (m) 7.20  (f) ADJ UNCH  1 1
AM0052
AM0052.Superseded values are not recommended for survey control.
AM0052.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AM0052.See file dsdata.txt to determine how the superseded data were derived.
AM0052
AM0052_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RTN6423706991(NAD 83)
AM0052_MARKER: DS = TRIANGULATION STATION DISK
AM0052_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AM0052_SP_SET: CONCRETE POST
AM0052_STAMPING: JONES 1931
AM0052_MARK LOGO: CGS
AM0052_MAGNETIC: O = OTHER; SEE DESCRIPTION
AM0052_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AM0052+SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AM0052+SATELLITE: SATELLITE OBSERVATIONS - August 27, 2006
AM0052
AM0052_HISTORY     - Date     Condition        Report By
AM0052     - 1931     MONUMENTED       CGS
AM0052     - 1934     GOOD            CGS
AM0052     - 1937     GOOD            TXHD
AM0052     - 1942     GOOD            CGS
AM0052     - 1943     GOOD            NGS
AM0052     - 1954     GOOD            CGS
AM0052     - 1960     GOOD            CGS
AM0052     - 1963     GOOD            CGS
AM0052     - 1963     GOOD            NGS
AM0052     - 1978     GOOD            NGS
AM0052     - 1987     GOOD            USPSQD
AM0052     - 19921125 GOOD          NOS
AM0052     - 20060827 GOOD          INDIV
AM0052 STATION DESCRIPTION
AM0052 DESCRIBED BY COAST AND GEODETIC SURVEY 1931 (FLG)
AM0052 ABOUT 4 MILES NW OF FREEPORT, ON N SIDE OF SHELL ROAD, ROUTE
AM005236, FROM FREEPORT TO BRAZORIA. A NEW ROAD WAS UNDER CONSTRUCTION
AM0052 IN 1931. STATION IS ABOUT 3/4 MILE E OF JONES CREEK BRIDGE,
AM0052 57 FEET N OF CENTER OF LONE OAK TREE STANDING N OF ROAD ABOUT
AM0052 100 YARDS E OF STORE AND GAS STATION, 99 FEET N OF CENTER
AM0052 LINE OF SHELL ROAD, AND 0.45 FOOT S OF FENCE LINE.
AM0052 SURFACE, UNDERGROUND, AND REFERENCE MARKS ARE STANDARD
AM0052 DISKS SET IN CONCRETE.
AM0052 SURFACE MARK PROJECTS ABOUT 5 INCHES ABOVE GROUND.
AM0052 REFERENCE MARK NO. 1 PROJECTS ABOUT 8 INCHES ABOVE GROUND,
AM0052 IS 174.8 FEET NE OF OAK TREE, 139 FEET N OF CENTER LINE OF
AM0052 SHELL ROAD, 1.3 FEET S OF FENCE LINE, AND 144.16 FEET FROM
AM0052 STATION, N 88 DEG 45 MIN E.
AM0052 REFERENCE MARK NO. 2 PROJECTS ABOUT 12 INCHES ABOVE GROUND,
AM0052 1.45 FEET S OF PICKET FENCE AROUND HOUSE OF MRS. J.B. PETZOLD,
AM0052 92.4 FEET W OF SE CORNER OF FENCE, 42.2 FEET SW OF SW CORNER
AM0052 OF HOUSE, 8.0 FEET NE OF CENTER OF 2 1/2-INCH OAK TREE, AND
AM0052 APPROXIMATELY 450 FEET FROM STATION, N 34 DEG 42 MIN W.
AM0052 BEARING FROM STATION OF FREEPORT MUNICIPAL
AM0052 TANK, DISTANT APPROXIMATELY 5 MILES IS S 74 DEG 10 MIN E.
AM0052 STATION RECOVERY (1934)
AM0052 RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1934 (TMP)
AM0052 RECOVERED. STATION MARK AND REFERENCE MARKS WERE ALL FOUND AND IN
AM0052 GOOD CONDITION.
AM0052 STATION RECOVERY (1937)
AM0052 RECOVERY NOTE BY TEXAS HIGHWAY DEPARTMENT 1937
AM0052 STATION RECOVERED IN GOOD CONDITION. NO ATTEMPT WAS MADE TO
AM0052 RECOVERED REFERENCE MARKERS. THE DESCRIPTION AS GIVEN FOR
AM0052 LOCATING THE STATION IS CORRECT, EXCEPT THE WORDS SHELL ROAD
AM0052 SHOULD NOW READ CONCRETE ROAD.
AM0052 STATION RECOVERY (1942)
AM0052 RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1942 (EHS)
AM0052 STATION WAS RECOVERED AS DESCRIBED AND FOUND TO BE IN GOOD
AM0052 CONDITION.
AM0052 STATION IS ABOUT 0.6 MILE E OF EASTERLY ONE OF TWO HIGHWAY
AM0052 BRIDGES OVER JONES CREEK, ABOUT 0.1 MILE SE OF ROADSIDE PARK
AM0052 ON THE NE SIDE OF THE HIGHWAY AND ON LAND OWNED BY MRS. J.B.
AM0052 PETZOLD IN 1942. IT IS ABOUT 325.0 FEET E OF STORE AND FILLING
AM0052 STATION ON THE SW SIDE OF THE HIGHWAY, ABOUT 149.0 FEET N
AM0052 OF THE CENTER LINE OF THE PAVEMENT AT THE INTERSECTION OF
AM0052 ROAD LEADING SOUTHWESTERLY TO RANCH, 60.9 FEET N OF POWER
AM0052 POLE WITH GUY WIRE, 57.4 FEET NE OF LONE LIVE OAK TREE, 60.3
FEET N OF RIGHT-OF-WAY FENCE, 14.3 FEET W OF N-S FENCE AND
AM0052'3.0 FEET W OF A 4- BY 4-INCH WOODEN MARKER POST.  THE
AM0052'STATION MARK IS STAMPED JONES 1931 AND PROJECTS
AM0052'ABOUT 0.5 FOOT.
AM0052'
AM0052'REFERENCE MARK NO. 1 IS STAMPED JONES NO. 1 1931.
AM0052'IT IS ABOUT 179.0 FEET N OF THE CENTER LINE OF THE PAVEMENT,
AM0052'133.0 FEET E OF N-S FENCE, 144.2 FEET E OF THE STATION AND
AM0052'89.0 FEET N OF RIGHT-OF-WAY FENCE.  THE REFERENCE MARK PROJECTS
AM0052'0.7 FOOT.
AM0052'
AM0052'REFERENCE MARK NO. 2 IS STAMPED JONES NO. 2 1931.
AM0052'IT IS ABOUT 450.0 FEET NW OF THE STATION, 42.3 FEET SW OF THE
AM0052'SW CORNER OF HOUSE OCCUPIED BY MRS. J.B. PETZOLD IN 1942,
AM0052'8.0 FEET NE OF LARGE LIVE OAK TREE IN THE NW CORNER OF PASTURE
AM0052'AND 1.5 FEET S OF PICKET FENCE AROUND YARD.  THE MONUMENT
AM0052'PROJECTS 0.9 FOOT.
AM0052'
AM0052'1STATION IS REACHED FROM THE FREEPORT CITY WATER TANK.  PROCEED
AM0052'4.5 MILES NORTHWESTERLY ALONG STATE HIGHWAY 36 TO THE SITE OF
AM0052'THE STATION.
AM0052
AM0052'                  STATION RECOVERY (1943)
AM0052
AM0052'RECOVERY NOTE BY NATIONAL GEODETiC SURVEY 1943
AM0052'4.5 MI NW FROM FREEPORT.
AM0052'TO REACH FROM THE CITY WATER TANK AT FREEPORT—PROCEED
AM0052'NORTHWesterLY
AM0052'4.5 MILES ALONG STATE HIGHWAY NO. 36 TO SITE OF STATION.  STATION IS
AM0052'ABOUT 2.5 MILES NORTHWEST OF THE HIGHWAY DRAW-BRIDGE OVER THE
AM0052'RIVER, ABOUT 0.1 MILE SOUTHEAST OF A TEXAS HIGHWAY ROADSiDE PARK,
AM0052'ABOUT 325.0 FEET EAST OF A STORE AND FILLiNG STATION ON SOUTHWEST SiDE
AM0052'OFT HIGHWAY, 149.0 FEET NORTH OF THE CENTERLINE OF THE HIGHWAY AT
AM0052'INterSECTION OF A LANE LEADING SOUTHERLY, 60.9 FEET NORTH OF A POWER
AM0052'POLE WITH GUY WIRE AT A T JUNCTiON OF POWER LINE, 60.3 FEET NORTH OF
AM0052'RIGHT-OF-WAY FENCE AND 3.0 FEET WEST OF A 4 BY 4 INCH WOODEN MARKER
AM0052'POST.  A TRIANGULATION-STATION DISK SET IN CONCRETE POST PROJECTiNG
AM0052'ABOUT 0.5 FOOT.
AM0052
AM0052'                  STATION RECOVERY (1954)
AM0052
AM0052'RECOVERY NOTE BY COAST AND GEODETiC SURVEY 1954 (HSC)
AM0052'THE STATION WAS RECOVERED AS DESCRiBED BY F.L.G. IN 1931 AND
AM0052'THE STATION MARK AND BOTH REFERENCE MARKS WERE FOUND IN GOOD
AM0052'CONDITION.  AN AZiMiTH MARK AND REFERENCE MARK NO. 3 WERE
AM0052'SET BY THIS PARTY.
AM0052'
AM0052'A COMPLETE DESCRIPTION FOLLOWS--
AM0052'
AM0052'THE STATION IS LOCATED ABOUT 5 MILES NORTHWEST OF FREEPORT,
AM0052'3.5 MILES SOUTH OF CLUTE, 3 MILES WEST OF VELasCO, AND ON
AM0052'PROPErTY OWNED BY MR. L.E. CURBELLO, WHO RESIDES AT THE
AM0052'STATION SITE.
AM0052'
AM0052'REACHED FROM THE WEST END OF THE BRAZOS RIVER BRIDGE ON
AM0052'STATE HIGHWAY 36 IN FREEPORT BY GOING WESTERLY ON HIGHWAY 36
FOR 2.2 MILES TO HAGERMAN ROAD ON THE RIGHT*. CONTINUE AM0052 STRAIGHT AHEAD FOR 0.3 MILE TO THE GULF PARK ROAD ON THE LEFT AM0052 AND THE STATION ON THE RIGHT.

TO REACH THE AZIMUTH MARK FROM THIS POINT, GO NORTH ON AM0052 HAGERMAN ROAD FOR 0.3 MILE TO THE AZIMUTH MARK ON THE RIGHT. AM0052

THE STATION MARK, A STANDARD DISK SET IN A CONCRETE MONUMENT, AM0052 IS 149 FEET NORTH OF THE CENTERLINE OF HIGHWAY 36, 62 FEET AM0052 NORTHWEST OF A FENCE CORNER POST, 12 FEET WEST OF A FENCE, AM0052 AND 2 FEET NORTH OF A WITNESS POST. THE DISK IS STAMPED AM0052 JONES 1931, AND THE MARK PROJECTS 4 INCHES.

REFERENCE MARK NO. 1, A STANDARD DISK SET IN A CONCRETE AM0052 MONUMENT, IS 145 FEET NORTHEAST OF THE FENCE CORNER POST AND AM0052 89 FEET NORTH OF A RIGHT-OF-WAY FENCE. THE DISK IS STAMPED AM0052 JONES NO 1 1931, AND THE MARK PROJECTS 8 INCHES.

REFERENCE MARK NO. 2, A STANDARD DISK SET IN A CONCRETE AM0052 MONUMENT, IS 10 FEET EAST OF A FENCE CORNER POST, 8 FEET AM0052 NORTHEAST OF A 30-INCH OAK TREE AND 1 FOOT SOUTH OF A PICKET AM0052 FENCE. THE DISK IS STAMPED JONES NO 2 1931 AND PROJECTS AM0052 12 INCHES.

REFERENCE MARK NO. 3, A STANDARD DISK SET IN A CONCRETE AM0052 MONUMENT, IS 91 FEET NORTH OF THE CENTERLINE OF THE HIGHWAY AM0052 36, 90 FEET WEST OF A POWER POLE AND 1 FOOT NORTH OF THE AM0052 RIGHT-OF-WAY FENCE. THE DISK IS STAMPED JONES NO 3 1931 AND AM0052 PROJECTS 5 INCHES.

THE AZIMUTH MARK, A STANDARD DISK SET IN A CONCRETE MONUMENT, AM0052 IS 24 FEET SOUTH OF THE APPROXIMATE CENTER OF A SHELL ROAD, AM0052 2 FEET SOUTH OF A POWER POLE, 2 FEET NORTH OF A WITNESS POST AM0052 AND 1 FOOT WEST OF A FENCE CORNER POST. THE DISK IS STAMPED AM0052 JONES 1931 RESET 1954 AND PROJECTS 5 INCHES.

HEIGHT OF LIGHT ABOVE MARK 34.4 METERS.

STATION RECOVERY (1960)

STATION RECOVERY (1963)

RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1960 (JKW) AM0052 STATION, THREE REFERENCE MARKS AND AZIMUTH MARK RECOVERED AM0052 IN GOOD CONDITION. THE DISTANCES TO THE REFERENCE MARKS WERE AM0052 VERIFIED. THE 1954 RECOVERY NOTE BY H.S. COLE IS COMPLETE.

STATION RECOVERY (1963)

RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1963 (GCR) AM0052 THE STATION WAS RECOVERED. ALL MARKS WERE FOUND, HOWEVER IN AM0052 CHECKING THE DISTANCE AND DIRECTIONS TO THE REFERENCE MARKS, AM0052 SOME CHANGES ARE EVIDENT.

THE STATION MARK, 12 BY 12 INCH CONCRETE POST WITH STANDARD AM0052 DISK STAMPED JONES 1931, PROJECTS 5-INCHES ABOVE THE GROUND. AM0052 THE MARK IS SITUATED IN PASTURE LAND NORTH OF STATE HIGHWAY AM0052 AND ABOUT 500 FEET SOUTH-SOUTHEAST OF RESIDENCE OCCUPIED AM0052 BY L.E. CURBELLO. THE MARK IS IN GOOD CONDITION.
REFERENCE MARK NO. 1, 12 BY 12 INCH CONCRETE POST WITH STANDARD DISK STAMPED JONES NO 1 1931, PROJECTS 12 INCHES ABOVE THE GROUND. THE MONUMENT IS SOLID BUT IS LEANING SLIGHTLY.

REFERENCE MARK NO. 2, 12 BY 12 INCH CONCRETE POST WITH STANDARD DISK STAMPED JONES NO 2 1931, PROJECTS 12 INCHES ABOVE THE GROUND. THE MONUMENT IS SOLID BUT IS LEANING SLIGHTLY.

REFERENCE MARK NO. 3, 12 BY 12 INCH CONCRETE POST WITH STANDARD DISK STAMPED JONES NO 3 1931, PROJECTS 4 INCHES ABOVE THE GROUND. THE MARK IS IN GOOD CONDITION. IT IS 2 FEET NORTH OF RIGHT-OF-WAY FENCE.

AZIMUTH MARK, 8 BY 8 INCH CONCRETE POST WITH STANDARD DISK STAMPED JONES 1931 RESET 1954, PROJECTS 2 INCHES ABOVE THE GROUND. IT IS SITUATED 29 FEET EAST OF CENTERLINE OF TAR ROAD, 6 FEET NORTH OF CENTERLINE OF DRIVEWAY LEADING TO RESIDENCE NO. 322 AND 3 FEET SOUTHWEST OF FENCE CORNER POST.

TO REACH THE STATION FROM THE ROAD INTERSECTION AND CAUTION LIGHT AT JONES CREEK, GO EAST ON STATE HIGHWAY 36 FOR 1.65 MILES*, TURN LEFT INTO PRIVATE ROAD AND GO NORTH 0.1 MILE TO RESIDENCE OF MR. L.E. CURBELLO AND BOARD GATE INTO PASTURE. ENTER PASTURE AND DRIVE SOUTHEAST 0.1 MILE TO STATION.

*TO REACH AZIMUTH FROM THIS POINT CONTINUE EAST ON HIGHWAY 36 FOR 0.2 MILE TO SIDE ROAD LEFT, TURN LEFT AND GO NORTH ON TAR ROAD FOR 0.25 MILE TO THE AZIMUTH MARK ON RIGHT.

STATION RECOVERY (1963)

STATION RECOVERY (1978)

STATION RECOVERY (1987)

STATION RECOVERY (1992)

STATION RECOVERY (2006)

STATION RECOVERY (2006) (AB)
National Geodetic Survey, Retrieval Date = FEBRUARY 9, 2009

AW0103 ***********************************************************************
AW0103 DESIGNATION - K 586 RESET 1961
AW0103 PID - AW0103
AW0103 STATE/COUNTY - TX/BRAZORIA
AW0103 USGS QUAD - BRAZORIA (1952)

AW0103 *CURRENT SURVEY CONTROL

AW0103 NAD 83(1986) - 29 02 09. (N) 095 34 10. (W) Scaled
AW0103 NAVD 88 - 8.53 (+/-2cm) 28.0 (feet) VERTCON

AW0103 GEOID HEIGHT - 26.64 (meters) GEOID03
AW0103 VERT ORDER - FIRST CLASS I (See Below)

AW0103 The horizontal coordinates were scaled from a topographic map and have
an estimated accuracy of +/- 6 seconds.

AW0103 The NAVD 88 height was computed by applying the VERTCON shift value to
the NGVD 29 height (displayed under SUPERSEDED SURVEY CONTROL.)

AW0103 The vertical order pertains to the NGVD 29 superseded value.

AW0103 The geoid height was determined by GEOID03.

AW0103

AW0103 North East Units Estimated Accuracy
AW0103 SPC TXSC - 4,138,170. 934,070. MT (+/- 180 meters Scaled)
AW0103

AW0103 SUPERSEDED SURVEY CONTROL

AW0103 NGVD 29 (??/??/92) 8.548 (m) 28.04 (f) ADJ UNCH 1 1

AW0103

AW0103 Superseded values are not recommended for survey control.

AW0103 NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AW0103 See file dsdata.txt to determine how the superseded data were derived.

AW0103 U.S. NATIONAL GRID SPATIAL ADDRESS: 15RTN497146(NAD 83)
AW0103 MARKER: DD = SURVEY DISK
AW0103 SETTING: 30 = SET IN A LIGHT STRUCTURE
AW0103 SP_SET: CULVERT
AW0103 STAMPING: K 586 RESET 1961

AW0103 STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY

AW0103 HISTORY - Date Condition Report By
AW0103 HISTORY - 1961 MONUMENTED CGS
AW0103 HISTORY - 1963 GOOD NGS
AW0103 HISTORY - 1978 GOOD NGS
AW0103 HISTORY - 1987 GOOD USPSQD
AW0103 HISTORY - 1987 GOOD USPSQD
AW0103 HISTORY - 1989 GOOD USPSQD
AW0103 HISTORY - 19940416 GOOD USPSQD
AW0103 HISTORY - 20010428 GOOD USPSQD

AW0103

AW0103 STATION DESCRIPTION

AW0103 DESCRIBED BY COAST AND GEODETIC SURVEY 1961
AW0103 0.6 MI S FROM BRAZORIA.
AW0103 TO REACH FROM THE MISSOURI PACIFIC RAILROAD STATION AT BRAZORIA.
PROCEED 0.6 MILE SOUTHERLY ALONG STATE HIGHWAY NO. 36 TO SITE OF BENCH. BENCH MARK IS AT THE INTERSECTION OF STATE HIGHWAY NO. 36 AND F.M. ROAD NO. 521. 79 FEET EAST OF THE CENTERLINE OF F.M. 521, 31.0 FEET SOUTHWESTERLY AND ABOUT 0.5 FEET BELOW THE CENTERLINE OF THE STATE HIGHWAY 36. IT IS A STANDARD BENCH MARK DISK SET HORIZONTALLY IN THE CENTER OF THE WEST HEADWALL OF CONCRETE BOX CULVERT UNDER HIGHWAY.

STATION RECOVERY (1963)
STATION RECOVERY (1978)
STATION RECOVERY (1987)
STATION RECOVERY (1987)
STATION RECOVERY (1989)
STATION RECOVERY (1994)
STATION RECOVERY (2001)
MARKED K586 RESET 1961
The horizontal coordinates were scaled from a topographic map and have an estimated accuracy of +/- 6 seconds.

The NAVD 88 height was computed by applying the VERTCON shift value to the NGVD 29 height (displayed under SUPERSEDED SURVEY CONTROL.)

The vertical order pertains to the NGVD 29 superseded value.

The geoid height was determined by GEOID03.

Superseded values are not recommended for survey control.

See file dsdata.txt to determine how the superseded data were derived.

AW4137_U.S. NATIONAL GRID SPATIAL ADDRESS: 15RTN416266(NAD 83)

AW4137_MARKER: DB = BENCH MARK DISK

AW4137_SETTING: 30 = SET IN A LIGHT STRUCTURE

AW4137_SP_SET: CULVERT

AW4137_STAMPING: J 1220 1973

AW4137_STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY

AW4137

AW4137 DESCRIPTION

AW4137 DESCRIBED BY NATIONAL GEODETIC SURVEY 1973

AW4137 IN WEST COLUMBIA.

AW4137 AT WEST COLUMBIA, 0.35 MILE NORTHWEST ALONG STATE HIGHWAY 36 FROM THE
AW4137"JUNCTION OF STATE HIGHWAY 35, 0.35 MILE SOUTHEAST ALONG STATE
HIGHWAY
AW4137"FROM THE JUNCTION OF FARM ROAD 1301, 0.1 MILE NORTHWEST OF THE
AW4137"JUNCTION OF JACKSON STREET, 17 FEET SOUTHWEST OF THE CENTER LINE OF
AW4137"THE SOUTHWEST LANES OF THE HIGHWAY, IN THE TOP AND 0.9 FOOT
SOUTHEAST
AW4137"OF THE NORTHWEST END OF THE SOUTHWEST CONCRETE HEADWALL OF A
DOUBLE
AW4137"BOX CULVERT, 22 FEET SOUTHEAST OF THE CENTER LINE OF THE DRIVEWAY TO
AW4137"414 COLUMBIA DRIVE, AND ABOUT 0.5 FOOT LOWER THAN THE HIGHWAY.
AW4137
AW4137                         STATION RECOVERY (1987)
AW4137
AW4137"RECOVERY NOTE BY US POWER SQUADRON 1987 (MVM)
AW4137"RECOVERED IN GOOD CONDITION.
AW4137
AW4137                         STATION RECOVERY (1987)
AW4137
AW4137"RECOVERY NOTE BY US POWER SQUADRON 1987 (LWM)
AW4137"RECOVERED IN GOOD CONDITION.
AW4137
AW4137                         STATION RECOVERY (1988)
AW4137
AW4137"RECOVERY NOTE BY US POWER SQUADRON 1988 (MVM)
AW4137"RECOVERED IN GOOD CONDITION.
AW4137
AW4137                         STATION RECOVERY (1989)
AW4137
AW4137"RECOVERY NOTE BY US POWER SQUADRON 1989 (JLH)
AW4137"RECOVERED IN GOOD CONDITION.
AW4137
AW4137                         STATION RECOVERY (1994)
AW4137
AW4137"RECOVERY NOTE BY US POWER SQUADRON 1994
AW4137"RECOVERED IN GOOD CONDITION.
**Daily Log Sheet**

**Date:** 9/8/09  
**Project:** Brazos River  
**Client:** TWDB  
**Job No:**  
**Vessel:** Skiff  
**Location:** Lake Jackson, Texas  
**Equipment:**  
- Trimble DSM
- Odom
- Onset
- Leica
- 232 Hydrotrac CVM
- Hobo U20
- Runner24
- & CV100

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>9:00</td>
<td>Depart Houston with survey equipment and skiff</td>
</tr>
<tr>
<td>11:15</td>
<td>Arrive at boat ramp near gauge 3. Load equipment in boat.</td>
</tr>
<tr>
<td>11:45</td>
<td>Launch Boat</td>
</tr>
<tr>
<td>11:55</td>
<td>Launch gauge 3. Measure from gauge 3 to water</td>
</tr>
<tr>
<td>12:00</td>
<td>Run upstream to gauge 2</td>
</tr>
<tr>
<td>13:09</td>
<td>Launch gauge 2. Measure from gauge 2 to water</td>
</tr>
<tr>
<td>13:35</td>
<td>Run upstream to gauge 1</td>
</tr>
<tr>
<td>14:47</td>
<td>Launch Gauge 1. Level from Gauge 1 to water.</td>
</tr>
<tr>
<td>15:00</td>
<td>Setup survey equipment</td>
</tr>
<tr>
<td>15:45</td>
<td>Equipment Problem run back to boat ramp</td>
</tr>
<tr>
<td>16:42</td>
<td>Arrive at boat ramp. Pull boat. Disassemble Equipment</td>
</tr>
<tr>
<td>17:26</td>
<td>Tim returned to Houston to pick up Odom CVM</td>
</tr>
<tr>
<td>17:44</td>
<td>Refuel boat</td>
</tr>
<tr>
<td>18:01</td>
<td>Arrival at hotel. Unload equipment from boat and truck.</td>
</tr>
</tbody>
</table>
### Daily Log Sheet

**Date:** 9/9/09  
**Project:** Brazos River  
**Client:** TWDB  
**Job No:**  
**Vessel:** Skiff  
**Location:** Lake Jackson, Texas  
**Equipment:** Trimble DSM Odom Onset Leica  
232 Hydrotrac CVM Hobo U20 Runner24 & CV100

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:15</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>6:25</td>
<td>Depart hotel for boat ramp</td>
</tr>
<tr>
<td>7:03</td>
<td>Arrive at boat ramp near gauge 3.</td>
</tr>
<tr>
<td>7:05</td>
<td>Wait for thunderstorm to pass.</td>
</tr>
<tr>
<td>10:30</td>
<td>Launch Boat. Test equipment. Barcheck</td>
</tr>
<tr>
<td>10:56</td>
<td>Begin survey section 1 and 2. Ran One longitudinal line in section 2, Ran two longitudinal lines in sec 1</td>
</tr>
<tr>
<td>11:30</td>
<td>Barcheck</td>
</tr>
<tr>
<td>17:41</td>
<td>Measure from gauge 2 to water</td>
</tr>
<tr>
<td>18:05</td>
<td>Arrive at boat ramp. Pull boat. Disassemble equipment</td>
</tr>
<tr>
<td>18:31</td>
<td>Refuel boat</td>
</tr>
<tr>
<td>18:48</td>
<td>Arrive at hotel. Transfer data to FTP server</td>
</tr>
</tbody>
</table>

![Map of Brazoria with water gauges](image)
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:10</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>6:25</td>
<td>Depart hotel for boat ramp</td>
</tr>
<tr>
<td>7:00</td>
<td>Arrive at boat ramp near gauge 3.</td>
</tr>
<tr>
<td>7:25</td>
<td>Launch Boat. Test equipment. Barcheck</td>
</tr>
<tr>
<td>7:40</td>
<td>Run from gauge 3 upstream to gauge 2</td>
</tr>
<tr>
<td>8:12</td>
<td>Measure from gauge 2 to water</td>
</tr>
<tr>
<td>8:17</td>
<td>Begin survey section 1. Ran one serpentine line in section 1</td>
</tr>
<tr>
<td>11:47</td>
<td>Section 1 complete</td>
</tr>
<tr>
<td>12:00</td>
<td>Level from gauge 1 to water</td>
</tr>
<tr>
<td>12:30</td>
<td>Pull gauge 1</td>
</tr>
<tr>
<td>12:32</td>
<td>Run to gauge 3</td>
</tr>
<tr>
<td>13:43</td>
<td>Set gauge 3. Measure from gauge 3 to water</td>
</tr>
<tr>
<td>13:45</td>
<td>Begin survey section 2. Ran one serpentine line in section 2</td>
</tr>
<tr>
<td>17:38</td>
<td>Arrive at boat ramp. Pull boat. Disassemble equipment. Measure from gauge 3 to water</td>
</tr>
<tr>
<td>18:09</td>
<td>Arrive at hotel. Transfer data to FTP server.</td>
</tr>
</tbody>
</table>
### Daily Log Sheet

- **Date:** 9/11/09
- **Project:** Brazos River
- **Client:** TWDB
- **Job No:**
- **Vessel:** Skiff
- **Location:** Lake Jackson, Texas
- **Equipment:**
  - Trimble DSM
  - Odom 232
  - Hydrotrac CVM
  - Onset Hobo U20
  - Leica Runner24 & CV100

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>6:00</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>6:15</td>
<td>Depart hotel for boat ramp</td>
</tr>
<tr>
<td>6:20</td>
<td>Refuel boat</td>
</tr>
<tr>
<td>6:50</td>
<td>Arrive at boat ramp near gauge 3.</td>
</tr>
<tr>
<td>7:00</td>
<td>Launch boat. Test equipment.</td>
</tr>
<tr>
<td>7:13</td>
<td>Measure from gauge 3 to water</td>
</tr>
<tr>
<td>7:32</td>
<td>Barcheck</td>
</tr>
<tr>
<td>7:41</td>
<td>Begin survey section 2. Ran one longitudinal line.</td>
</tr>
<tr>
<td>9:11</td>
<td>Section 2 complete</td>
</tr>
<tr>
<td>9:17</td>
<td>Measure from gauge 2 to water. Pull gauge 2</td>
</tr>
<tr>
<td>9:20</td>
<td>Run to gauge 4</td>
</tr>
<tr>
<td>10:28</td>
<td>Set gauge 4. Level from gauge 4 to water</td>
</tr>
<tr>
<td>10:35</td>
<td>Begin survey section 3. Ran one longitudinal line. Ran one serpentine line.</td>
</tr>
<tr>
<td>16:54</td>
<td>Run back to gauge 3</td>
</tr>
<tr>
<td>17:29</td>
<td>Arrive at boat ramp</td>
</tr>
<tr>
<td>17:32</td>
<td>Measure from gauge 3 to water.</td>
</tr>
<tr>
<td>18:12</td>
<td>Arrive at hotel. Transfer data to FTP server.</td>
</tr>
</tbody>
</table>

---

![Map of Lake Jackson and vicinity with gauges marked]
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>6:20</td>
<td>Depart hotel for boat ramp</td>
</tr>
<tr>
<td>6:26</td>
<td>Refuel boat</td>
</tr>
<tr>
<td>7:00</td>
<td>Arrive at boat ramp near gauge 4.</td>
</tr>
<tr>
<td>7:15</td>
<td>Level from gauge 4 to water</td>
</tr>
<tr>
<td>7:20</td>
<td>Launch boat. Test equipment.</td>
</tr>
<tr>
<td>7:38</td>
<td>Run Upstream</td>
</tr>
<tr>
<td>8:16</td>
<td>Barcheck</td>
</tr>
<tr>
<td>8:23</td>
<td>Begin survey section 3. Ran two longitudinal line.</td>
</tr>
<tr>
<td>11:45</td>
<td>Section 3 complete</td>
</tr>
<tr>
<td>11:46</td>
<td>Run to gauge 3</td>
</tr>
<tr>
<td>11:55</td>
<td>Measure from gauge 3 to water. Pull gauge 3</td>
</tr>
<tr>
<td>12:57</td>
<td>Set gauge 5. Measure from gauge 5 to water</td>
</tr>
<tr>
<td>12:59</td>
<td>Begin survey section 4. Ran two longitudinal lines. Ran one serpentine line.</td>
</tr>
<tr>
<td>15:56</td>
<td>Section 4 complete</td>
</tr>
<tr>
<td>16:20</td>
<td>Barcheck</td>
</tr>
<tr>
<td>16:55</td>
<td>Arrive at boat ramp. Level from gauge 4 to water</td>
</tr>
</tbody>
</table>
| 17:50 | Arrive at hotel. Transfer data to FTP server.
Date: 9/13/09

**Project:** Brazos River  
**Client:** TWDB  
**Job No:**

**Vessel:** Skiff  
**Location:** Lake Jackson, Texas  

**Equipment:** Trimble DSM Odom Onset Leica

---

<table>
<thead>
<tr>
<th>Time</th>
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</tr>
</thead>
<tbody>
<tr>
<td>6:00</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>6:28</td>
<td>Depart hotel for boat ramp</td>
</tr>
<tr>
<td>6:34</td>
<td>Refuel boat</td>
</tr>
<tr>
<td>7:05</td>
<td>Arrive at boat ramp near gauge 5.</td>
</tr>
<tr>
<td>7:10</td>
<td>Launch boat. Test equipment.</td>
</tr>
<tr>
<td>7:30</td>
<td>Measure from gauge 5 to water.</td>
</tr>
<tr>
<td>7:42</td>
<td>Barcheck</td>
</tr>
<tr>
<td>7:51</td>
<td>Begin survey section 5. Ran two longitudinal lines. Ran one serpentine line.</td>
</tr>
<tr>
<td>11:52</td>
<td>Section 5 complete</td>
</tr>
<tr>
<td>12:06</td>
<td>Barcheck</td>
</tr>
<tr>
<td>12:10</td>
<td>Run to gauge 4</td>
</tr>
<tr>
<td>12:32</td>
<td>Level from gauge 4 to water. Pull gauge</td>
</tr>
<tr>
<td>12:34</td>
<td>Run back to gauge 5</td>
</tr>
<tr>
<td>12:52</td>
<td>Measure from gauge 5 to water.</td>
</tr>
<tr>
<td>12:55</td>
<td>Pull boat</td>
</tr>
<tr>
<td>13:30</td>
<td>Arrive at hotel. Transfer data to FTP server.</td>
</tr>
<tr>
<td>Time</td>
<td>Activity</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>7:45</td>
<td>Load all equipment into trucks and boat</td>
</tr>
<tr>
<td>8:00</td>
<td>Depart from Lake Jackson</td>
</tr>
<tr>
<td>8:10</td>
<td>Refuel boat</td>
</tr>
<tr>
<td>9:40</td>
<td>Arrive in Houston at office</td>
</tr>
<tr>
<td>9:45</td>
<td>Clean up equipment and boat</td>
</tr>
</tbody>
</table>