DUSTPAN DREDGE EVALUATION IN THE ATCHAFALAYA RIVER BAR CHANNEL, LOUISIANA

Introduction

The Coastal and Hydraulics Laboratory (CHL) of the U.S. Army Engineer Research and Development Center (ERDC) was requested by the U.S Army Engineer District, Vicksburg (MVK) to monitor a dustpan dredge demonstration project on the Atchafalaya River Bar Channel. This demonstration project evaluated the ability of a dustpan dredge to remove shoaling and study the movement of the material. The dustpan dredge was contracted by the U.S. Army Engineer District, New Orleans (MVN) to dredge the Atchafalaya River Bar Channel between channel stations 650+00 and 1050+00 beginning in October, 2005. Figure 1 shows the general location of the bar channel and study site. New Orleans district surveys from 8 September 2005, showed the channel in the project reach had shoaled above the authorized depth of -20 ft Mean Low Gulf (MLG). The reach to be dredged had shoaled up to between 3 and 5 feet above the authorized depth (-17 to -15 ft MLG). Lead line depths in the same reach show depths varying from -20 to -25 ft MLG.

Project Description and Background

The Atchafalaya River Bar Channel is part of a congressionally authorized navigation route serving the Port of Morgan City, Louisiana. The bar channel is 17 miles long and 400 feet wide. Water depths on either side of the channel are approximately 5 to 10 feet deep for most of the channel length. The authorized channel has a depth of -20 feet MLG. Historically the channel has been dredged to -24 ft MLG which includes an additional 2 feet of advance maintenance and 2 feet of allowable over-depth dredging as part of project maintenance.

Annual dredging requirements for the bar channel are quite large, ranging from about 9 to 11 million cubic yards. The disposal area for the dredge material is about 5000 feet west of the channel centerline. The disposal area was moved from the east side of the channel to the west side of the channel in 2003 after ERDC studies (Teeter et al., 2003) showed that net transport trends in the bay were primarily from the east to the west. In addition, the hydrographic surveys in the study indicate that dredging fails to clear the channel for more than a short period of time. Typically bar channel sediments are a very fine-grained, low density material, often referred to as either fluff or fluid mud. The sediment is made up of silts and clays. Generally, fluff is formed by the rapid deposition of fine grained silt and clay flocs from suspension and can be maintained by periodic agitation (such as by waves, currents, or vessel navigation). However, if undisturbed, the material settles, loses volume and becomes fluid mud, eventually forming a fully settled bed.

A value engineering study conducted in 2003 evaluated methods of improving navigation on the Atchafalaya River Bar Channel. The study recommendation to evaluate the use of dredges other than cutterheads resulted in the dustpan dredge demonstration conducted in October and November, 2005. An independent sediment tracer study was conducted concurrently with the dustpan dredge demonstration. The tracer study was designed to monitor sediment movement in the channel, in areas on either side of the channel, and in the disposal areas. The study was conducted for MVN under a contract with Evans Hamilton, Inc., and Environmental Tracing Systems Ltd.

Dredge Description

New Orleans District contracted with Weeks Marine, Inc., for the services of the Beachbuilder, a dustpan dredge (Figure 2). The Beachbuilder is an offshore dredge with pumps having 10000 horsepower that are primarily designed for beach fill applications. The dredge is 292 feet long, 72 feet wide, and has a draft of 10 feet. The actual dustpan is 32 feet wide and is capable of dredging at depths up to 70 feet deep. During normal operations, pumps force jets of water from nozzles above the dustpan to loosen material while the dustpan's suction pumps collect the sediment. Figure 3 shows the dustpan when raised above the water for maintenance. Figure 4 shows the jets being tested out of the water. The dredge has a 30 inch pipeline and is capable of pumping material to disposal areas thousands of feet from the channel. A floating flexible pipeline (Figure 5) is used to connect the continuously moving dredge to a rigid line running to the disposal area. The bridge of the dredge has instrumentation to log dredge position and movement, and a production meter that monitors the specific gravity and the velocity of the slurry being pumped. Figure 6 shows a normal operation for the Beachbuilder using 6 positioning anchors and cables. Winches are used to maneuver the dredge forward for up to1500 feet. The dredge is then pulled back to its starting point, offset to the side, and winched forward on an adjacent line. Since the dredge was designed to work offshore, it had sufficient size and freeboard to work on the Atchafalaya Bar Channel.

The proposed Atchafalaya dredging operation required significantly different operational methods; the channel was to remain open during the dredging operations and the normal 6 cable operation would block the channel. The original setup proposed by Weeks Marine was for only 4 cables to be used to position the dredge along with two tugboats to assist in keeping the platform located laterally and longitudinally (Figure 7). This method would not have cables crossing the navigation channel and would minimize navigation impacts. This method was used in a 2002 demonstration project on the Mississippi River below the Head of Passes in an active navigation channel. An additional operational modification on the Atchafalaya Bar Channel was to not use the jets on the dustpan in an effort to minimize suspension of the silty bed material.

ERDC Monitoring Plan

The dustpan dredge demonstration was to determine the efficiency of a dustpan dredge in the Atchafalaya River Bar Channel sediments and study the movement of the material. Historically cutterhead dredges have been used in the bar channel. Over time,

improvements to dredging techniques have made cutterhead dredges more efficient in the bar channel. The dustpan demonstration was to determine if a dustpan dredge might be still more efficient. A possible reason for increased efficiency was that the dustpan would not disturb (suspend) the bottom sediments during dredging and that the bottom materials (fluff and fluid mud) would actually flow to the dustpan. The ERDC monitoring plan helped to define field operation and monitoring activities for the dustpan demonstration.

The first test would determine the effects of the tugboats on the bottom materials. The proposed positioning method for the Beachbuilder (Figure 7) required 2 tugs and 4 cables to hold the dredge in position. The effects of the tugboats on the channel side slopes and bottom were to be examined. A potential problem with using the boats included the prop wash from the boats impinging on the side slope when operating near the channel toe. Also the stern tug would cause a prop wash jet to form either up or down the channel, depending on the direction of dredge movement. It should be noted that in the Atchafalaya Bar Channel the draft of the tugboats would make the propellers very close to the surface layer of the channel bed. A test of the tugs' influence would be done first so that it would be possible to quantify effects due to dredging.

The second planned test would position the dredge in a stationary position along the centerline of the channel, lower the dustpan head to a depth of -24 feet MLG, and begin pumping without water jet assistance. This initial test goal would define the effectiveness of maintenance dredging from a stationary location. Hydrographic surveys coupled with production meter data would be used to determine the ability of the shoal material to flow along the bottom to a fixed dredging position in both the longitudinal and lateral directions. If the method showed potential, additional monitoring and sampling would have been done to monitor channel depths, suspended materials, and bottom densities.

The third test proposed was a centerline cut to a depth of -24 ft MLG. Survey data analyzed on-site would determine the effectiveness of this method. This test would determine if the material on either side of the dustpan flowed to the dustpan as the dredge was winched along the channel centerline. The jets were not turned on. With the exception of the jets, this is typical of how a dustpan dredge normally works. The material in front of and to the sides of the dredge is loosened by the jets and removed by the dustpan as the dredge is winched forward. The test would help determine if a cut made deep into the bed material could weaken the sides so that material would slough off into the cut. This would reduce the number of dredge passes in the channel. Hydrographic surveys were used to evaluate the performance of this technique. Some of the operational procedures that could be varied in this test included:

a. Lowering the dustpan to a specific density.
b. Lowering the dustpan to a point of refusal in making the cut.
c. Lowering the dustpan to a point of refusal and using the water injection jets in making the cut.

If the third test was successful, a fourth test would evaluate the ability of the dredge to make fewer cuts than required for complete bottom coverage in the dredging area. The survey results from the previous test would be used to determine the spacing of the set over cuts. Figure 8 shows a possible scenario for this test. The figure shows that the entire width would not be dredged. The material from between the dredge cuts would flow to the cut area and fill a portion of the area. The 1000 foot minimum test section from the previous test would be used to evaluate this method of dredging. If the sides of the cuts slough into the cut, the number of cuts in the channel to achieve required channel depth could be reduced. Hydrographic surveys would be used to evaluate the performance of this technique. As before, some of the operational procedures could be varied in this test (see Test 3 above).

The fifth test would determine the time required to dredge the full channel width to the maximum allowable depth. The test would determine the speed and accuracy of dredging. The dredge would set up parallel lines and dredge the channel as quickly as possible to the -24 feet MLG depth. In this test the dredge position and movement would be determined based on conclusions from the previous tests. If the dredge was positioned perfectly and a pass resulted in a clean channel, a reach could be cleared in 13 passes of the 32 foot dustpan head. If 25% overlap was required, 17 passes would clean the 400 foot wide channel. Multiple hydrographic surveys would be used to monitor the effectiveness of this technique.

Dredging Operations and MVN Contract Requirements

The dustpan dredge demonstration project was to determine the feasibility of using dustpan dredges in the Atchafalaya Bar Channel. This demonstration would also determine if the dustpan dredge could meet MVN contractual requirements. MVN required the dredge contractor to provide a survey boat and crew capable of meeting specifications from the Hydrographic Surveying Engineering Manual (EM 1110-2-1003). A MVN inspector was always present on the survey boat when a before dredging or an after dredging survey was being conducted. He was also present when the survey crew took lead line measurements, bottom samples and Densitune drops. The contract required a preliminary survey on the channel centerline between stations 650+00 and 1050+00 and cross sections lines every 1000 feet. The dredging work was divided into performance reaches of 2000 feet. Immediately prior to dredging in a performance reach the contractor was to conduct cross section surveys of the 2000 foot reach with a properly calibrated dual frequency fathometer. The cross section lines were to be 1000 feet long and at 200 foot intervals. The contractor was also required to make lead line and Densitune measurements on each cross section at the channel centerline and 150 feet to either side of the centerline. The Densitune Silt Density Probe (Figure 9) is manufactured by Stema Survey Services and is a tuning fork type device with data logger that is calibrated to measure density and depth in channel bed materials. After dredging in a reach was complete the contractor was required to resurvey the same cross sections. On the dustpan contract, the channel cross sections did not have to meet a depth specification. The surveys from before and after dredging were used to compute quantities of dredged material. While the dredge was working in an area, check surveys

were usually made in the morning and afternoon to monitor dredge progress. The check surveys were also used to determine areas that needed additional dredging. All surveys were tide corrected for water level. The contractor was also required to collect 5 gallon surface samples of bottom material at the channel centerline and the toes of the cut at 0.5 mile intervals in the dredging reach prior to dredging.

Initial Channel Conditions

Prior to the start of dredging operations, the channel centerline and cross section survey was conducted on 6 October 2005. Typical channel depths in the survey reach were -15 to -17 feet MLG. Figure 10 is a typical channel cross section from the preliminary survey showing the high and low frequency depth records. Typically if a fluff layer exists the high frequency data will track the fluff and the low frequency will track the upper surface of the consolidated materials. Figure 11 shows the 2.0 foot difference between high and low frequency records at station 650+00. This separation is more than any other preliminary section. The cross section survey was used to select the dredging starting point at station 720+00 with the dredge working north. With very few exceptions the cross sections showed little or no separation between the high and low frequency records on the fathometer. The general lack of separation indicates consolidated shoal material with a density structure beyond what could be considered fluff or fluid mud. Densitune drops were made on 9 October, 2005. Figure 12 is a screen capture from a typical Densitune drop at the station 690+00 centerline. The plot shows that between a depth of -14 and -16 feet the channel density increased to a density slightly less than 1.3 kilograms/liter. The density remained at that level until the probe stopped at a depth near -22 feet MLG. The dual frequency fathometer and the Densitune records indicate the presence of more consolidated channel materials within 1 to 2 feet of the high frequency surface.

Dredge Set-up and Test Results

The Beachbuilder was moved to Station 720+00 on the Bar Channel and configured to move to the north. Reach 1 of the dredge test was from station 720+00 northward to station 700+00. The disposal area was located 5000 feet to the west of the channel. The dustpan demonstration and testing began on 17 October 2005. Weeks Marine modified the anchor configuration originally proposed for the Bar Channel work. Figure 13 shows the actual anchor alignment. Two anchors were placed on the west side of the channel and 2 anchors were placed on the east side of the channel. By placing the anchors on both sides of the channel tug assistance would be minimized. The anchors were located in the north and south directions in order to allow vessel positioning between station 720+00 and station 706+00. The discharge line was on the port side of the dredge which was the west side of the channel. A submerged pipeline 4000 feet long was connected to 2100 feet of floating pipeline. This was enough floating dredge line to allow dredging of 1400 feet of channel section without moving the submerged line. The plan was to slack the cables to the east side of the channel to allow traffic to pass to the east of the dredge. Tugs were positioned on the stern and the side of the dredge to assist if necessary. Sediment plumes developed behind the tugs when pushing. It should be also

noted that significant plumes often develop behind deep draft workboats in the channel. The dredge operators and MVN and MVK observers determined that tug assistance was not needed to maneuver the dredge under normal circumstances. The stern tug was removed. The tug on the side gave assistance when the cross channel cables were slacked to allow vessels to pass.

Test 1. Tug Effects

Detailed monitoring of the tug effects on the bottom and side slopes was determined not to be necessary because of the limited use of the tugs.

Test 2. Stationary Point Dredging

The dredge was located at a fixed point and the dustpan head was lowered to -24 feet. At -24 feet the dustpan head had passed through 8 feet of soft material. The production meter showed that initial production was good, but within 30-40 seconds, clear water was being passed through the dredge line. The test was repeated and within 50 seconds the production meter indicated that there was little sediment in the water. The jets were off for this test. Basically the dredge was digging a hole and pulling water from above. The anticipated result that material would free-flow toward the intake proved incorrect. Once the material was removed from the immediate vicinity of the dustpan, no additional material was pumped.

Test 3. Centerline Dredging

The dredge was winched forward on the channel centerline for 600 to 700 feet in Reach 1. The dustpan was at elevation -24 feet MLG which meant there was about 8 feet of material above the dustpan. The water jets were off. The dredge was slowed when cavitation began. However this caused instantaneous production to drop from 2500 cy/hr to 1500 cy/hr. At the end of the line the dustpan head was raised and found to be 30 to 40 percent clogged with sediment. Figure 14 is a photo from the demonstration showing clogged sections of the dustpan head. The dredge was backed up and prior to the next pass the head was cleaned. The water jets were turned on at low pressure to help loosen the sediment in front of the head and to help prevent cavitation. Surveys after the first pass showed changes in depth up to about 3 feet at the channel centerline on station 716+00. The surface depression at the station was about 150 feet wide whereas the dustpan head is only 32 feet wide. The entire 8 feet of sediment above the dustpan was not removed in 1 pass. The dustpan head was passing underneath the sediment shoal, causing a slight depression in the upper shoal sediment layers. Therefore multiple passes were required to remove the shoal at each cut. The material at -24 feet MLG was very stiff. Dredge production was increased by lowering the head only to a depth of -22 feet MLG. Figures 15 thru 17 show the dredging progress based on the before dredging survey, the survey after the first pass on the afternoon of 17 October 2005, and the survey the morning of 18 October 2005, at stations 710+00, 716+00, and station 720+00. The initial pass of the dustpan dredge did not result in a clean channel at -24 feet MLG on any of the cross sections. The survey the morning of 18 October 2005 is the result of multiple

dredge passes with the dustpan being set over between passes. Only a few locations show that depths below 20 feet MLG have been cleared.

Test 4. Determination of Cut Spacing

This test was basically eliminated since the material did not flow to the dredge or fall into the cut. Also since a single pass did not clear the channel repeated passes were necessary on the same line. It was determined that set over dredging practices would be used. That is the dustpan dredge operation involves winching forward through a dredge cut, pulling back, moving over, and then pulling forward on an adjacent dredge cut, repeating this process until the desired area is clean. The bed material's inability to flow to the dredge was further verified on the second setup in Reach 1. On the afternoon of 20 October, 2005 dredging began in this reach. Through the night and into the next morning the dredge only worked on the west side of the channel. Sections from the 20 and 21 October, 2005 check surveys are shown in Figures 18 to 21. The east side of the channel has not been impacted by the dredging on the west side. The bed material was too stiff to flow into the dredged area.

Test 5. Minimize Time Requirements

Initially the first section of reach 1 was used for this test. The set over dredging practices described above were used. Survey data were collected in the morning and afternoon to determine areas where additional dredging was needed. This process basically began with the second dredge cut on 17 October 2005 and continued until the morning of 20 October 2005. The dredge was then repositioned to work the second section of reach 1. Figures 22 to 25 show the progression of depth at sections 710+00, 712+00, 716+00, and 718+00. A significant portion of the material was removed in the first half day of dredging. It should be noted the channel was not consistently cleared to a 22 foot depth. The channel cross sections show inconsistent depth when the bed neared a 22 foot depth. The surveys would indicate that material was being moved but not removed. Also dredge production dropped when a minimal cut was required after most of the bed material had been removed. Either the remaining bed material was too dense or too viscous for the dustpan head's available suction or the dustpan head was less efficient with minimal material higher than the intake. The decreased production of the dredge with time was noted in most of the reaches. The minimum number of passes required in any reach was 28 and the maximum number was 49. Twenty-eight passes would average out to be slightly over 2 passes everywhere in the reach. The winching system that positioned the dredge was not always precise enough to position the dustpan head exactly where it was needed for maximum production. The number of passes and hours required in each section were logged and reported in Table 1. In Table 1, the pumping time includes only the time that the dredge is advancing and pumping material. The repositioning time only includes the time during which the dredge is backing up. Any nonproductive time such as time for moving the anchors is not included in the table. The total time in a reach is the time that has to be considered in computing production.

Dustpan Dredge and Cutterhead Dredge Comparison

The dustpan dredge production was compared with the cutterhead dredge production during Bar Channel dredging in January 2005. In October 2005 the Beachbuilder dredged between Stations 665+00 and 740+00, which is a distance of 7500 feet. MVN files on the January 2005 contract showed that the cutterhead dredge George D. Williams dredged virtually the same reach during three time periods: 11-19 January, 22-24 January, and 30 January to 1 February, 2005. The dredge did not work continuously in the reach because it was moved offshore during periods of good weather. The cutterhead dredged from stations 665+70 to 743+80, a distance of 7810 feet on these days. The cutterhead dredge's daily advance was over 700 feet on 6 occasions during this operation. Table 2 shows a basic comparison of the two dredges.

The production capabilities of the dredges become more apparent when examining the yardages dredged which were based on before and after dredging surveys. MVN records report the cutterhead dredged 1,204,554 cubic yards of material. The dustpan dredged only 550,238 cubic yards. An average dredged cut can be calculated based on the volume dredged, the dredged distance, and the channel width of 400 feet. The average cutterhead cut was 10.4 feet deep and the average dustpan cut was 5.0 feet deep.

The dustpan dredge was on site for 26 days, which included 1 down day for weather and 1 for equipment problems. The cutterhead dredge was on site for 15 days with only 14 hours down time due to weather. The dredges can also be evaluated on an hourly production basis. The dustpan dredge was contracted on the basis of rental hours and the cutterhead dredge was contracted based on yardage dredged. Therefore discrepancies exist in the way that hours were tracked. As previously noted the 100% time for the dustpan dredge includes the repositioning time (backing up) even though material is not being pumped. The dustpan worked a total of 353.7 hours of 100% time. The pumping time was 263.4 hours and the repositioning time was 90.3 hours. The 119.9 hours of 70% time included operations necessary to the dredging operation such as waiting for vessels to pass, shifting anchors, and cleaning the dustpan head. The 30.4 hours of 35% time is down time due to weather and the 92.5 hours of no pay time is for nonproductive time such as repair or replacement of equipment or movement of the submersible line. The total time the dustpan dredge was onsite was 596.5 hours. In the defined channel section, the cutterhead worked a total of 249.6 hours regular time (dredging time), 73.67 hours down time, and 14.25 hours of down time due to weather for a total of 337.5 hours. Table 3 shows a breakdown of these documented hours. The documents do not define how many hours of the down time would have been in some pay category for an hourly rental contract and production will be considered with and without that time.

The cutterhead dredge was expected to dredge a minimum of 60,000 cubic yards per day or 2500 cubic yards per hour to stay on schedule. Table 4 shows a comparison of the hourly production of the two dredges. Considering only pumping time, the dustpan dredge averaged 2090 cubic yards per hour which was insufficient to have kept the

cutterhead dredge on schedule. If repositioning time is included in the calculation, production drops to 1555 cubic yards per hour. Possibly the best comparison between the two dredges would be the production rate of 1555 cubic yards per hour for the 100% time for the dustpan with the production rate of 4826 cubic yards per hour for regular time for the cutterhead. Since weather is a variable, the total times on site excluding weather can also be compared. In this calculation the dustpan dredge averaged 972 cubic yards per hour for the project and the cutterhead averaged 3726 cubic yards per hour. All comparisons indicate that the cutterhead production rate was 3 to 4 times that of the dustpan dredge.

Conclusions

The dustpan dredge was not an effective technique for clearing the Atchafalaya River Bar Channel. Dustpan dredges are designed to work best in noncohesive materials such as sands and gravels. The jets assist in loosening the material so that the dredge suction can remove it. Normally, the dustpan is pulled into the face of the material that has been loosened by the jets so there is a constant supply of material.

The testing determined that there was little flow of material to the dustpan head in either in the longitudinal or cross channel direction. This was verified by the stationary test, the centerline cut test, and dredging in reach 1.

The dustpan dredge could not clean the channel to the required depth in just one pass. This was demonstrated on the centerline cut and the dredging of only the west side of assignment 2 of reach 1. After the first few cuts, the material had only been lowered a few feet. Also after most of the material had been removed, the dustpan became less efficient since there was less vertical face to work against. The dustpan also had difficulty in the dense material at -24 feet MLG. A cutterhead dredge typically removes this material in one pass.

The dustpan dredge most likely can not meet performance criteria for a typical yardage type contract. On projects where the dredge is paid by the yardage removed, the finished channel must be at a minimum grade that is specified in the contract. The dustpan was unable to totally clear the channel to a depth of -22 feet MLG on any of the four reaches. Historically the channel was dredged to -24 feet MLG which included 2 feet for over-depth and 2 feet for advance maintenance.

The bar channel sediments were more consolidated than what is normally considered to be fluff or fluid mud at the time of dredging. The dual frequency transducer showed little or no separation between the high and the low frequency depths. Most of the Densitune records also indicate that within 2 feet of the bed surface the bed material is more consolidated than a fluid mud layer.

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Figure 24. Channel cross section at station 716+00 showing dredging progress from 17 October through 20 October, 2005.
Figure 25. Channel cross section at station 718+00 showing dredging progress from 17 October through 20 October, 2005.

Reach Number	Cubic Yards Removed	Assignment Number	Station 100 feet	Number of Passes	Assignment Pumping Time	Reposition Time	Total Time Each Assignment	Reach Pumping Time	Reach Reposition Time
1	200,704	1	720 - 706	38	31:21	15:24	46:45	55:36	26:29
		2	710 - 700	32	24:15	11:05	35:20		
2	136,201	1	700 - 690	28	21:25	07:10	28:35	50:15	15:45
		2	690 - 680	34	28:50	08:35	37:25		
3	126,996	1	680 - 670	35	44:30	10:05	54:35	68:40	21:45
		2	670 - 665	33	24:10	11:40	35:50		
4	144,965	1	720 - 730	49	44:25	15:20	59:45	88:55	26:20
		2	730 - 740		44:30	11:00	55:30		
Total Time					263:26	90:19	353:45		

Table 1. Dredging information from bar channel reaches as reported by MVN.

Dredge	Start Date	Station Range		Distance Dredged, Ft.	Number of Days	Cubic Yards Dredged	Average Cut, Ft.
		Start Station, Ft.	End Station, Ft				
Dustpan	17-Oct-05	66500	74000	7500	26	550238	5.0
Cutterhead	11-Jan-05	66570	74380	7810	15	1204554	10.4

Table 2. Comparison of performance between the dustpan and cutterhead dredges.

Dredge	Documented Hours	Type of Hours
Dustpan	263.43	100% Time (Pumping Time)
	90.32	100% Time (RepositioiningTime)
	353.75	100% Time (Total Time)
	119.93	70% Time
	30.42	35% Time
	92.48	0% Time
	596.58	Total Time on Site
Cutterhead	249.58	Regular time (RT)
	73.67	Down Time (DT)
	14.25	Down Time –Weather (DTW)
	337.50	Total Time on Site

Table 3. Comparison of dredging hours for the dustpan and cutterhead dredges.

Dredge	Production Hours	Production Rates, Cubic Yards/ Hour	Type of Hours Used to Calculate Rates
Dustpan	263.26	2090	100% (Pumping Time)
	353.75	1555	100% (Total Time)
	473.68	1162	100%+70%
	566.16	972	100%+ 70%+0% (No Weather Time)
Cutterhead	249.58	4826	RT
	323.25	3726	RT+DT
		2500	Required Average Production

Table 4. Production rates for the dustpan and cutterhead dredges.

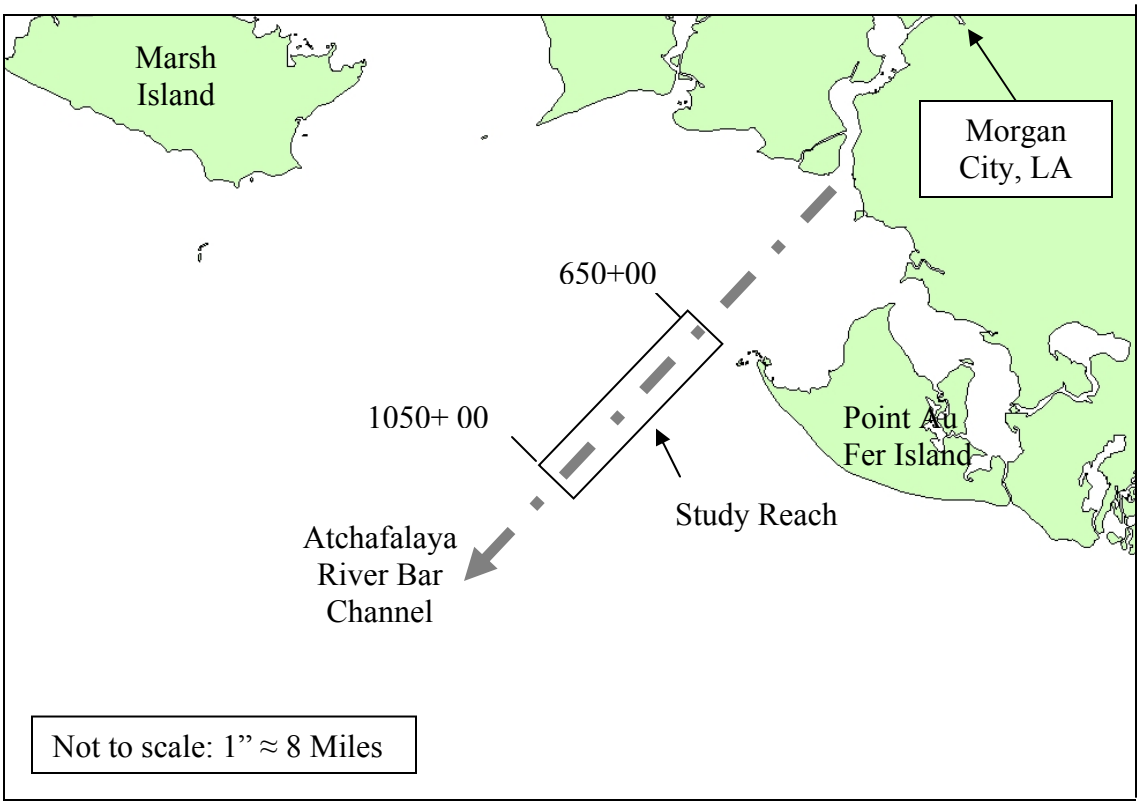

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Figure 2. The Beachbuilder dredge shown on the Atchafalaya River Bar Channel.

Figure 3. The Beachbuilder's dustpan raised out of water for maintenance.

Figure 4. Testing of the Beachbuilder dredge dustpan jets.

Figure 5. The floating flexible pipeline connects the dredge to the rigid pipeline.

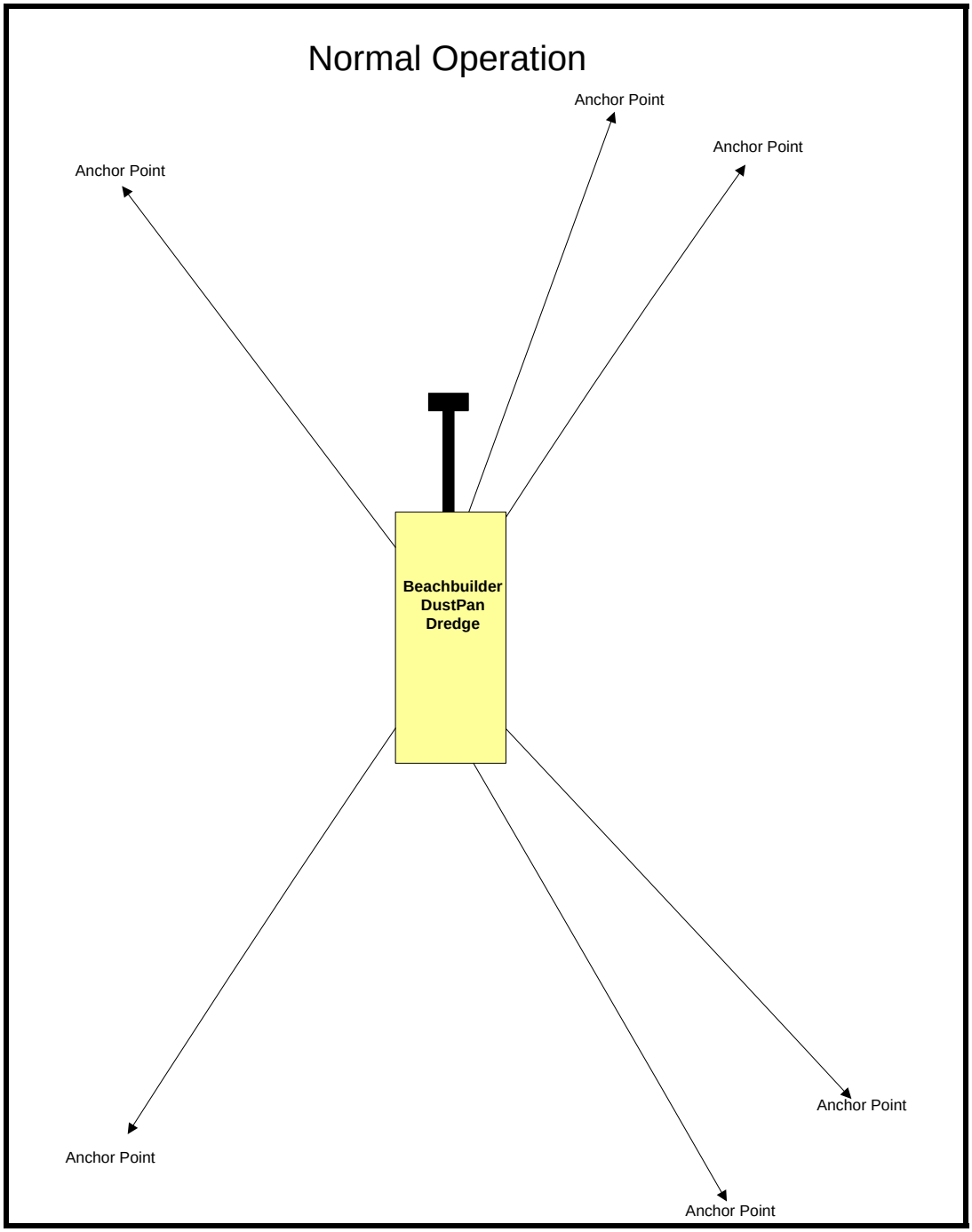


Figure 6. The diagram shows the Beachbuilder's normal 6-cable positioning setup.

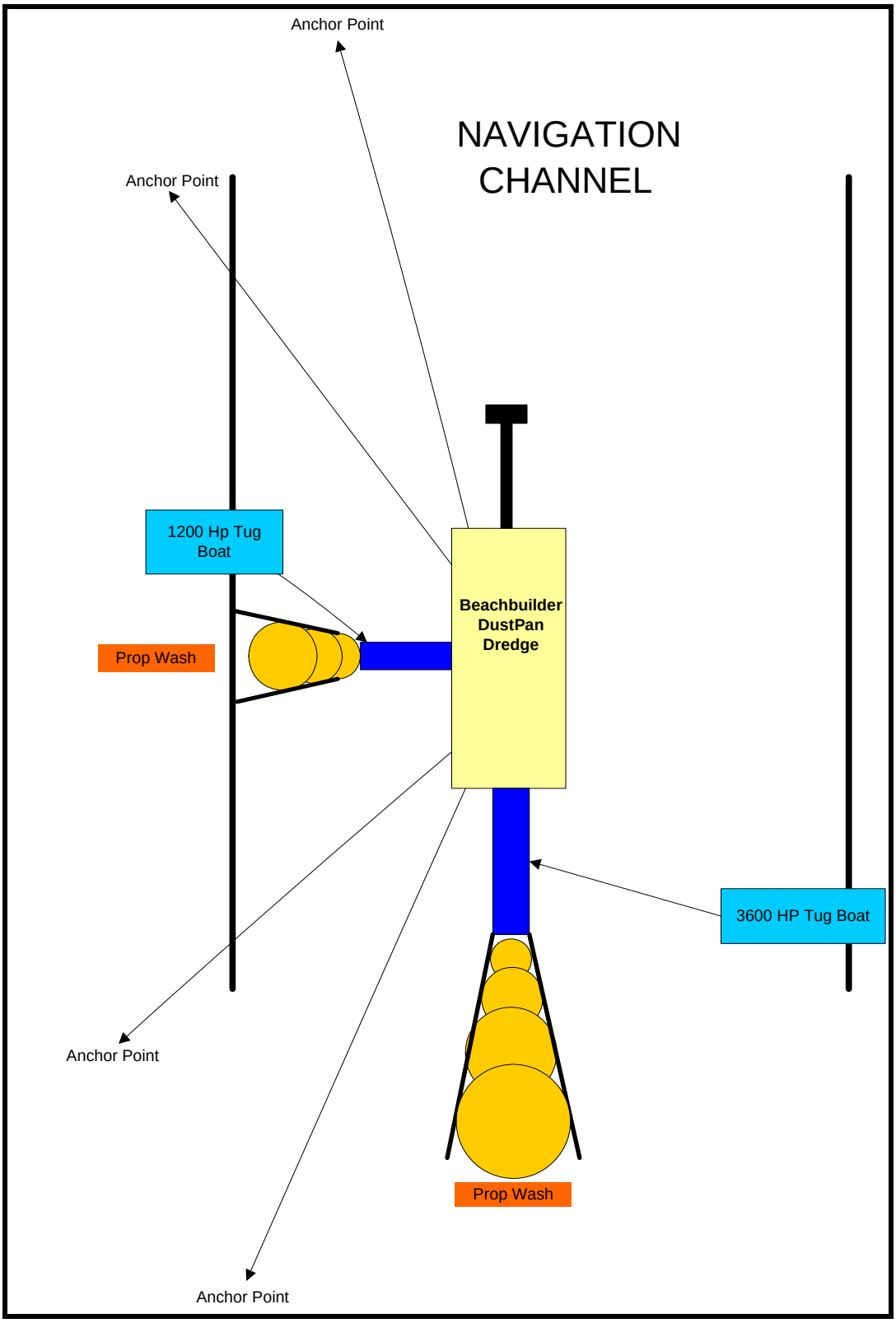


Figure 7. Diagram of the proposed Atchafalaya River Bar Channel Beachbuilder setup with 4 cables and 2 tugs. The orange circles show the expected zone of prop wash.

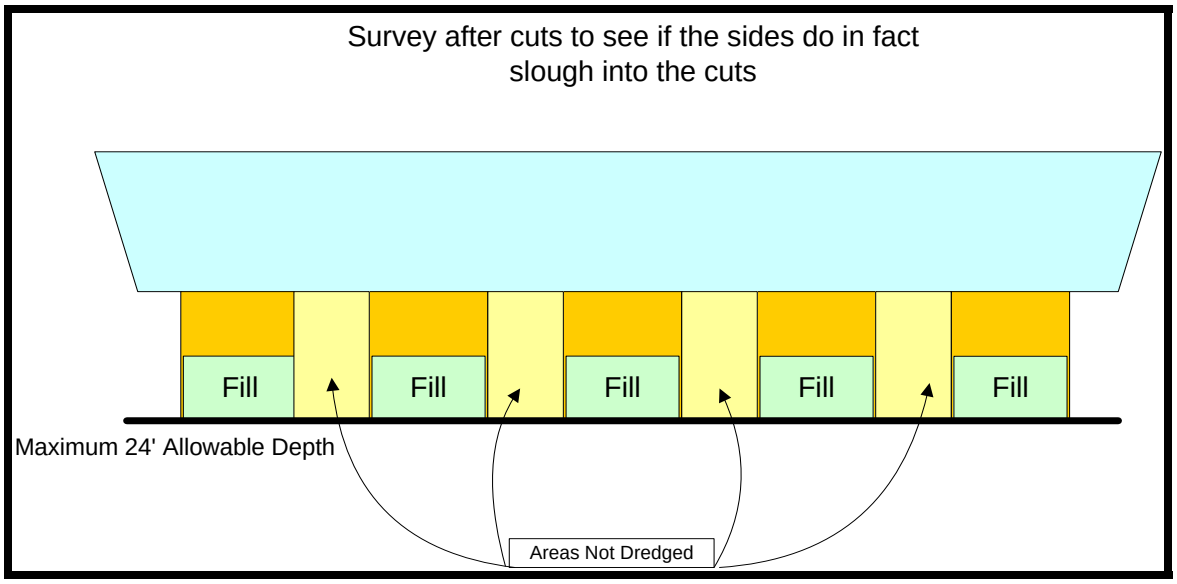


Figure 8. Proposed layout of dustpan dredge cuts if channel materials flow to the dustpan. The spacing between cuts would have depended on the depth of cut and how well the material flowed to the cuts. Material from the areas not dredged would flow to the cut areas and fill above the cut bottom. The benefit would be fewer dredge passes in a reach.

Figure 9. Photograph of Densitune silt density probe by Stema Survey Services.

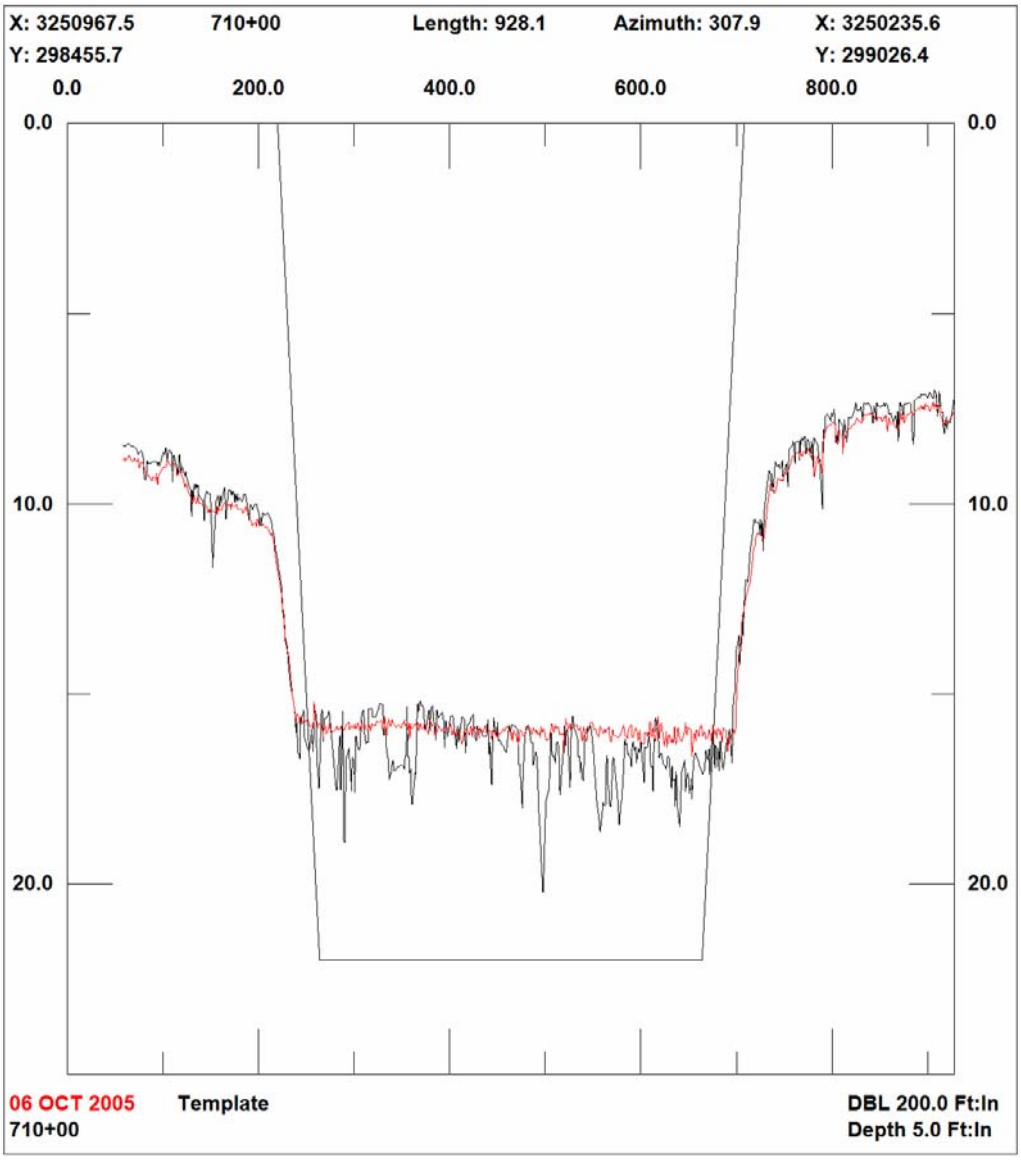


Figure 10. Channel cross section 710+00 from the preliminary survey showing the typical separation between the high frequency (red) and low frequency (black) depths.

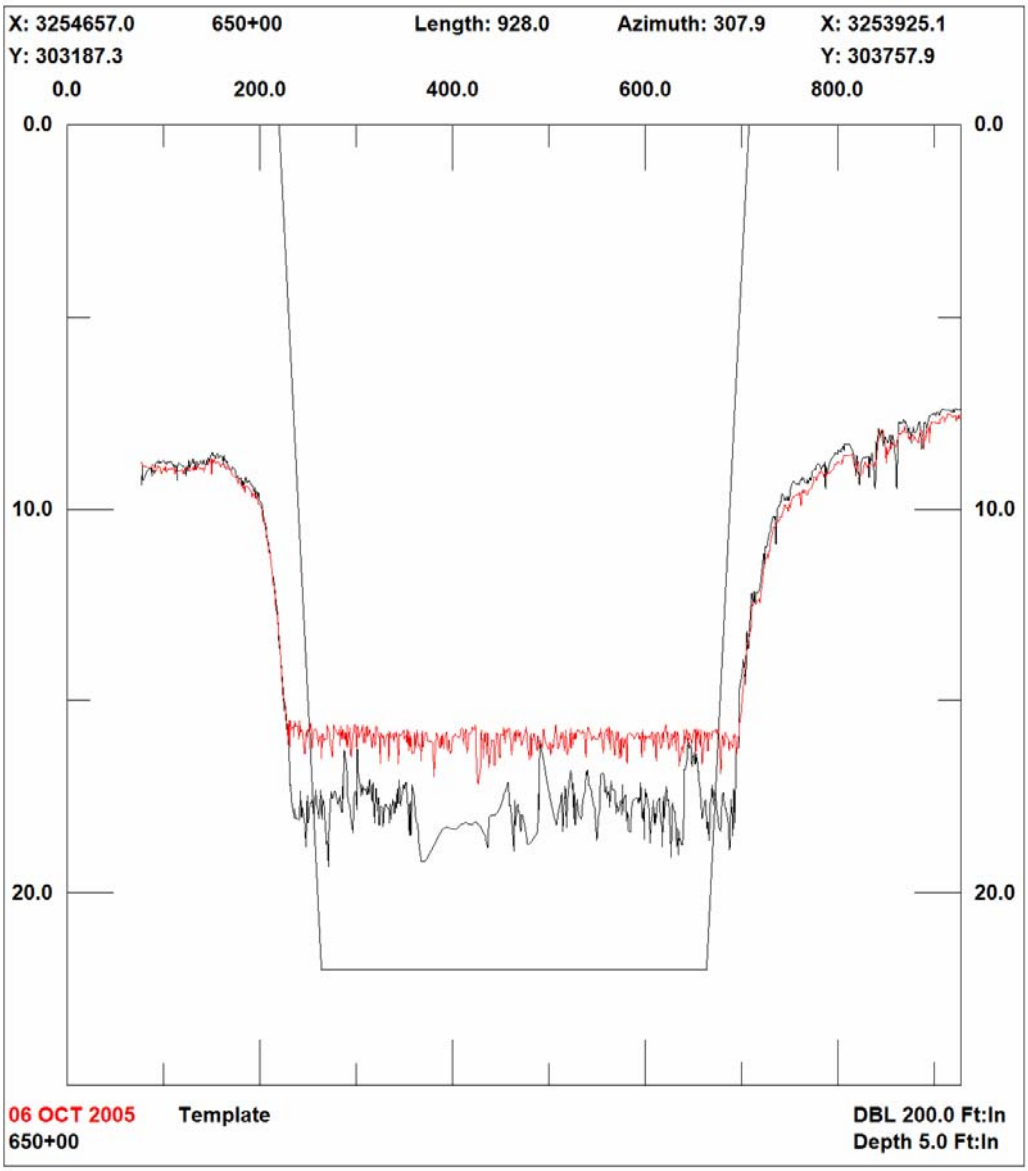


Figure 11. Channel cross section 650+00 from the preliminary survey showing an average 2.0 foot separation between the high frequency (red) and low frequency (black) depths.

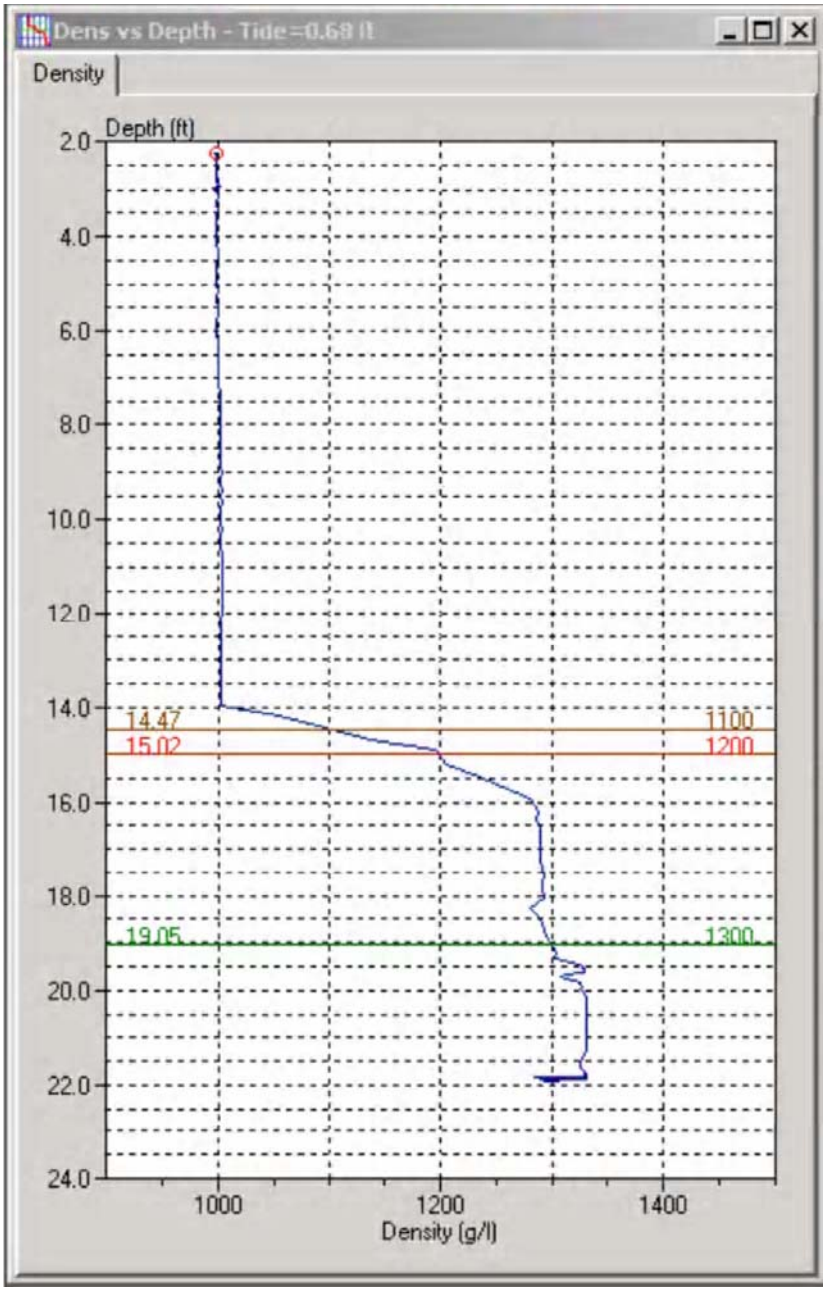


Figure 12. The plot shows data from a Densitune drop at the channel station 690+00 centerline. The horizontal scale is density in grams/ liter and the vertical scale is tide corrected depth in feet MLG.

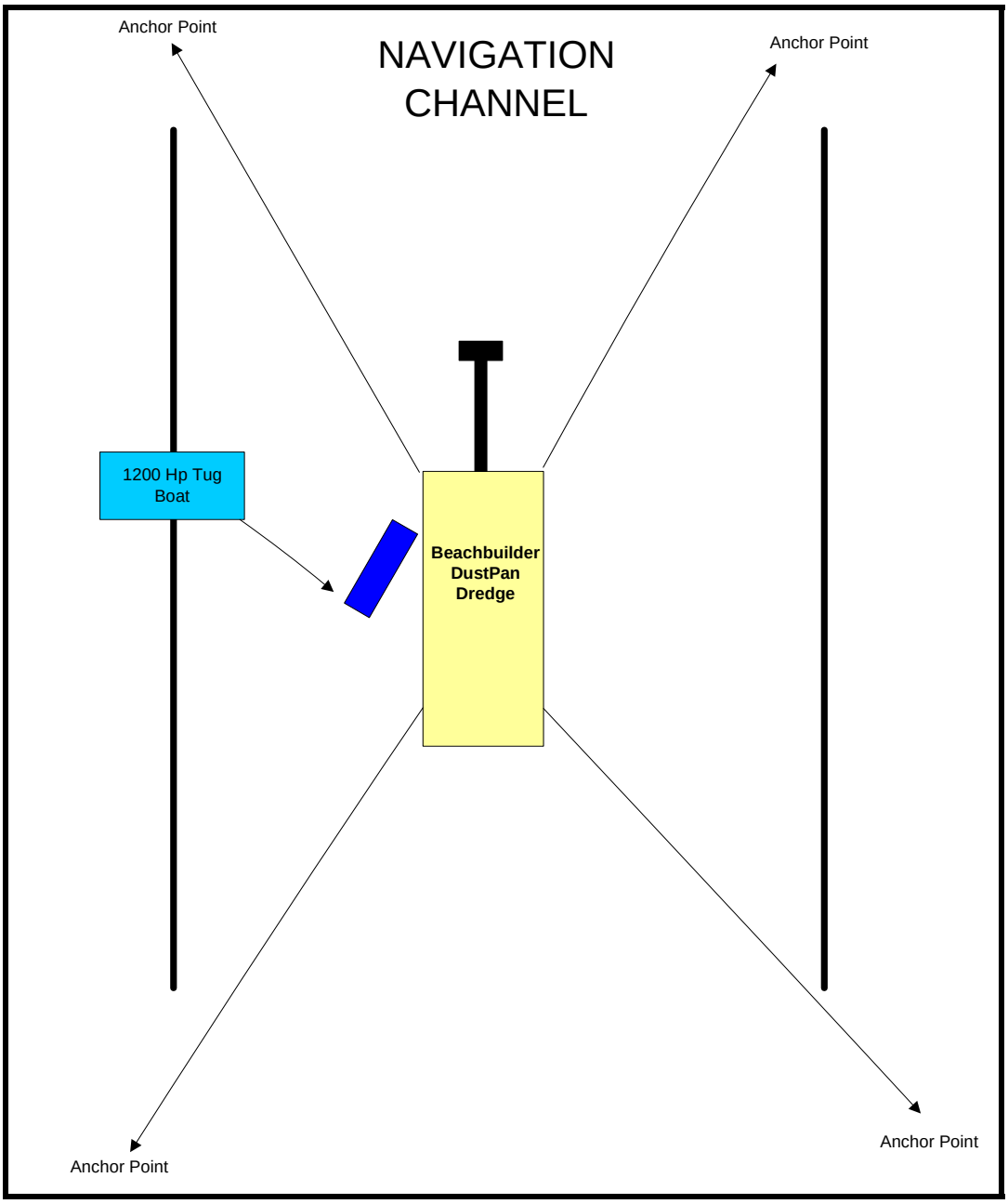


Figure 13. Diagram of the Beachbuilder setup for the Atchafalaya Bar Channel with 4 cables and a tug on the side.

Figure 14. The photograph shows sections of the dustpan head clogged by bed material.

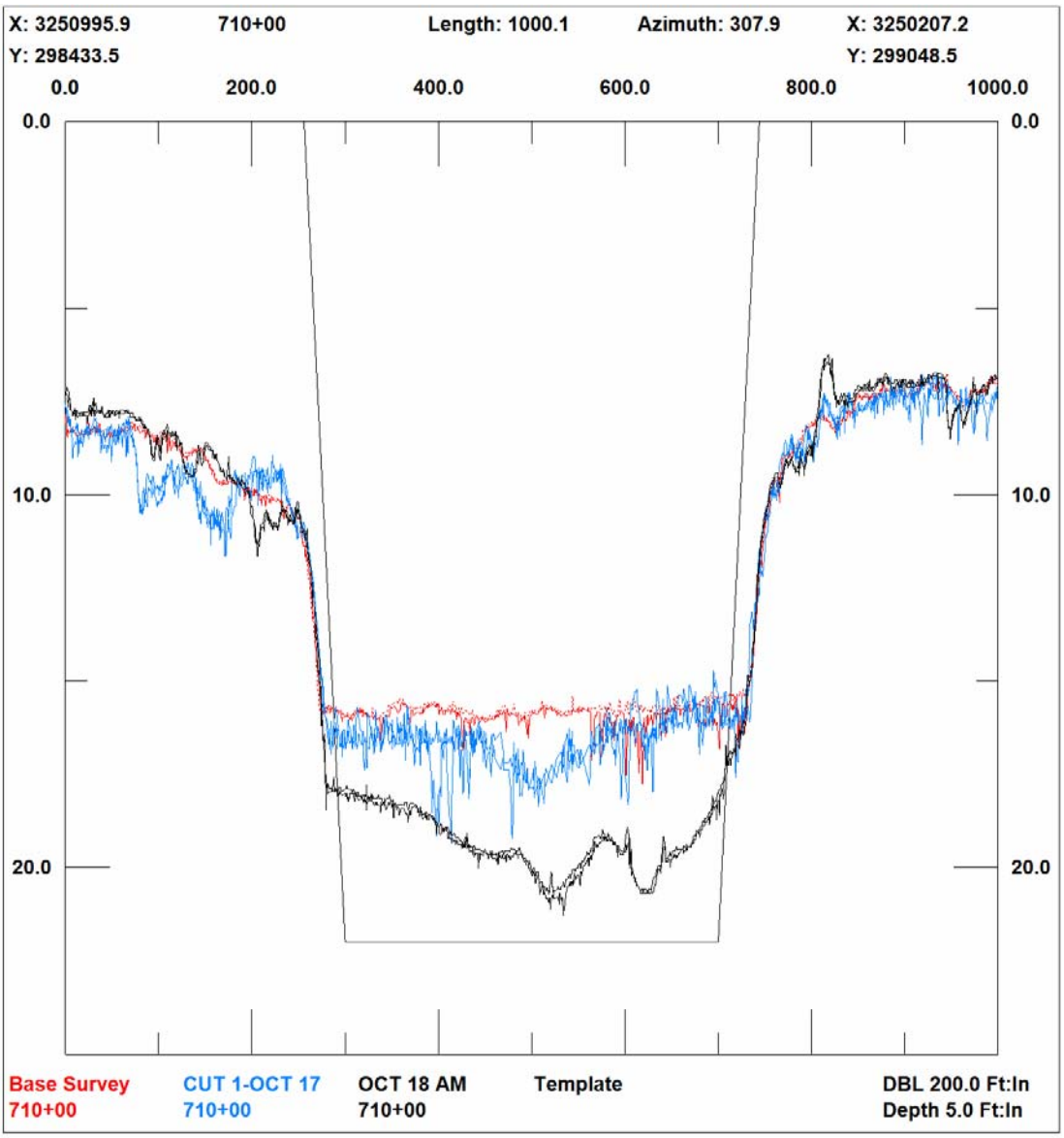


Figure 15. The dredging progress at station 710+00 is shown based on the before dredging survey (red), the survey after the first dustpan pass on 17 October (blue), and the morning survey of 18 October after multiple passes. (black)

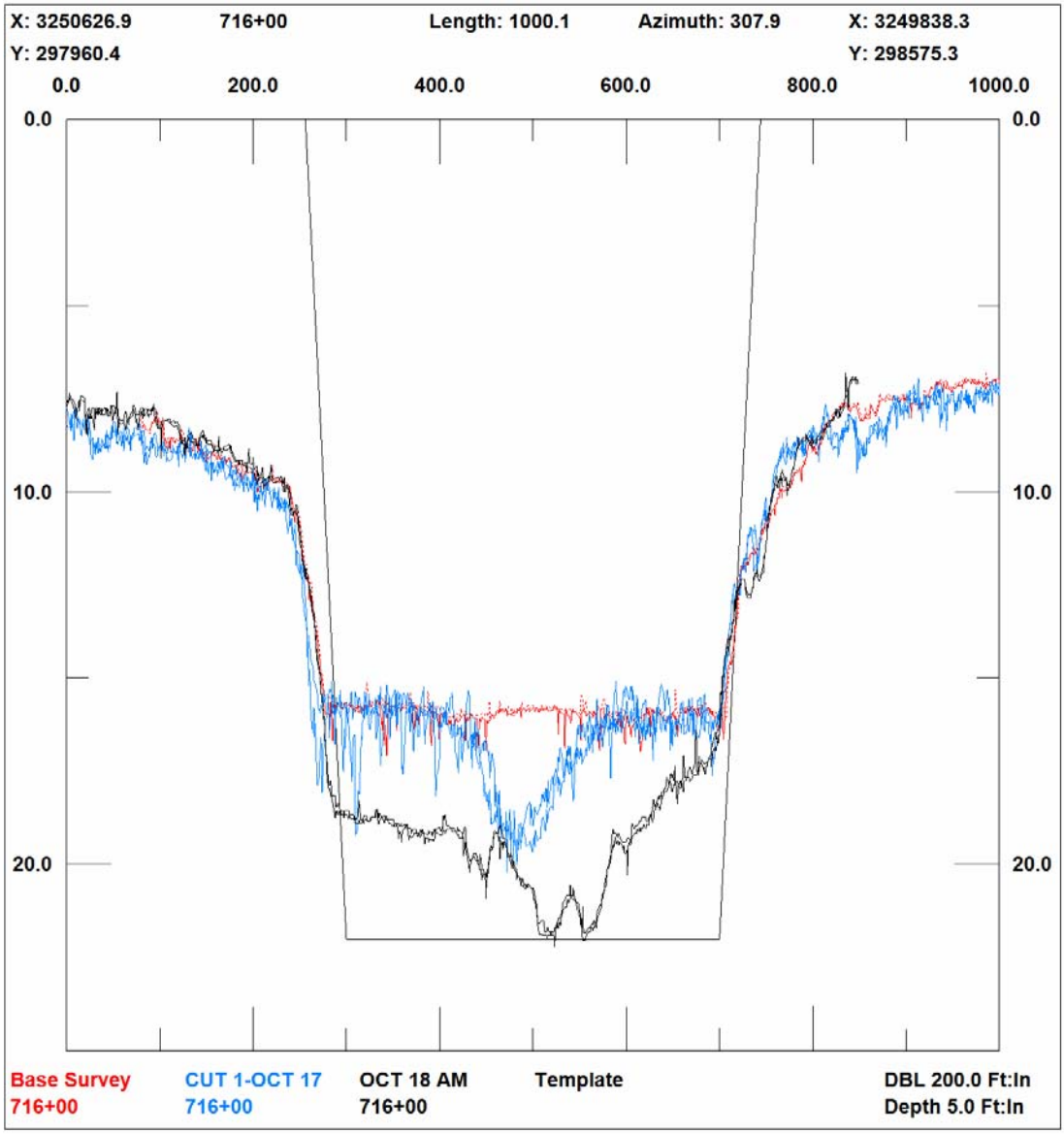


Figure 16. The dredging progress at station 716+00 is shown based on the before dredging survey, the survey after the first dustpan pass on 17 October, and the morning survey of 18 October after multiple passes.

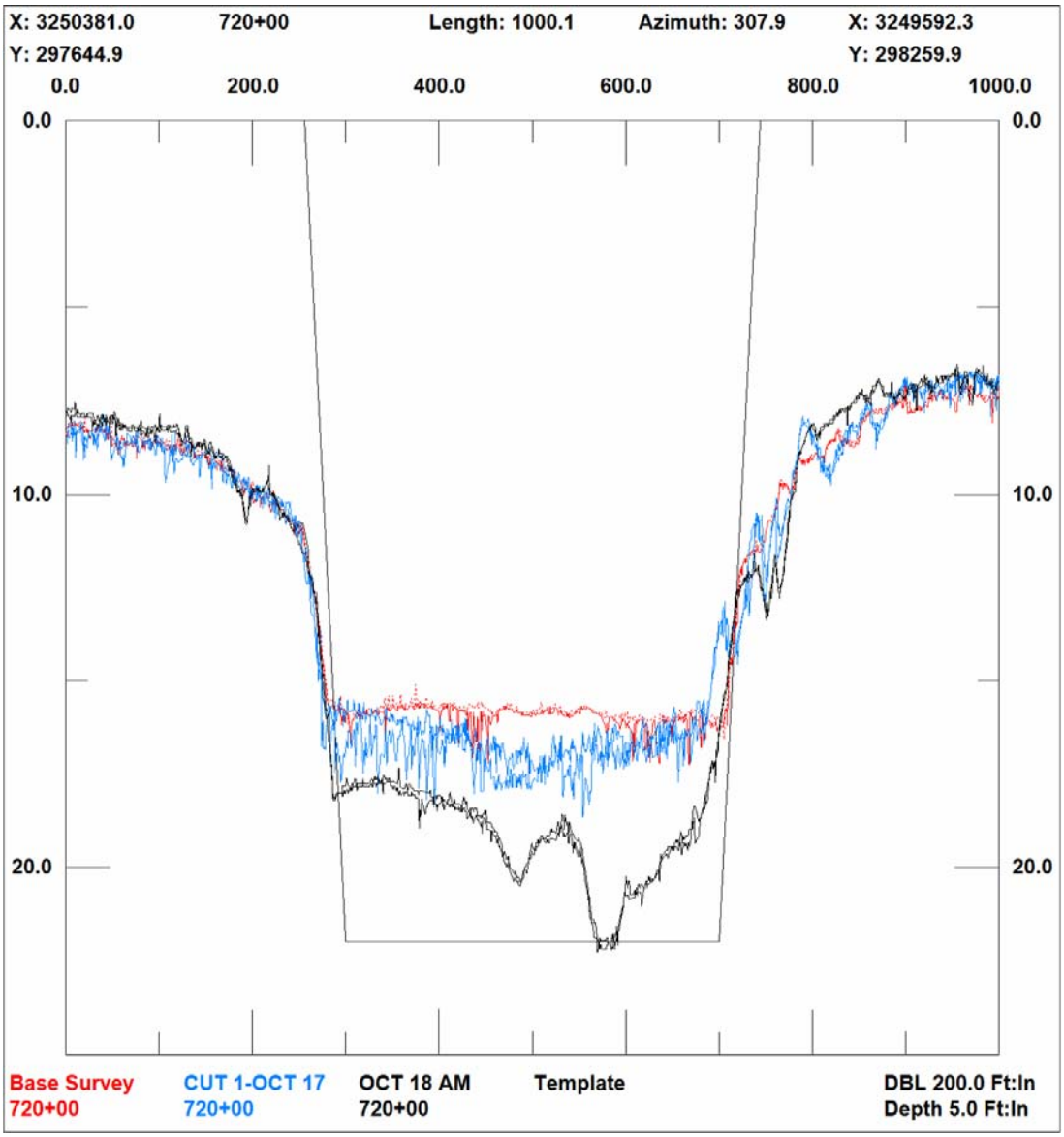


Figure 17. The dredging progress at station 720+00 is shown based on the before dredging survey, the survey after the first dustpan pass on 17 October, and the morning survey of 18 October after multiple passes.

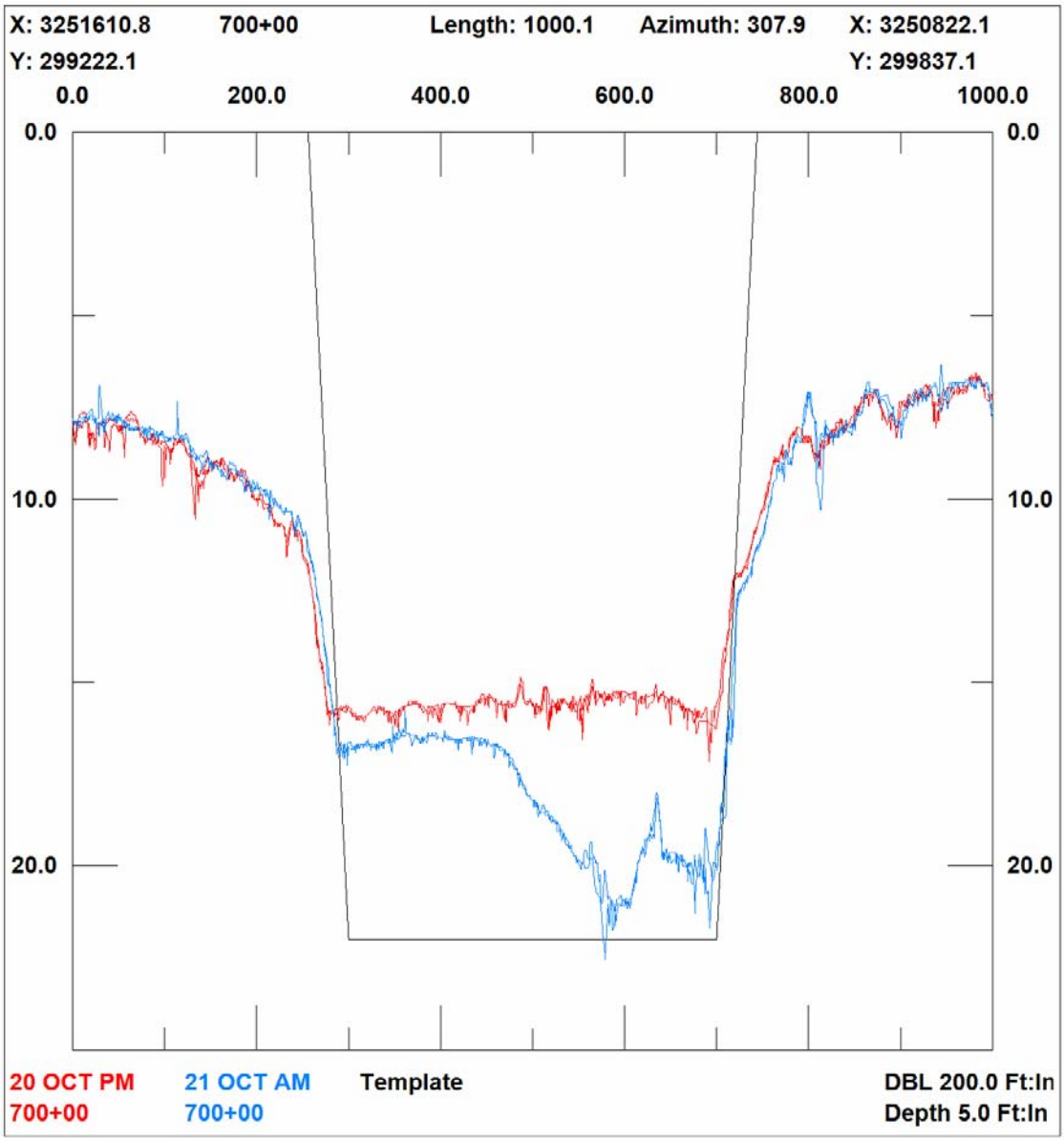


Figure 18. Channel cross section at Station 700+00. At the start of Assignment 2 of Reach 1, the dredge only worked on the west (right) side of the channel. The 20 October PM survey is after the work started (red). The 21 October AM survey was the next morning (blue).

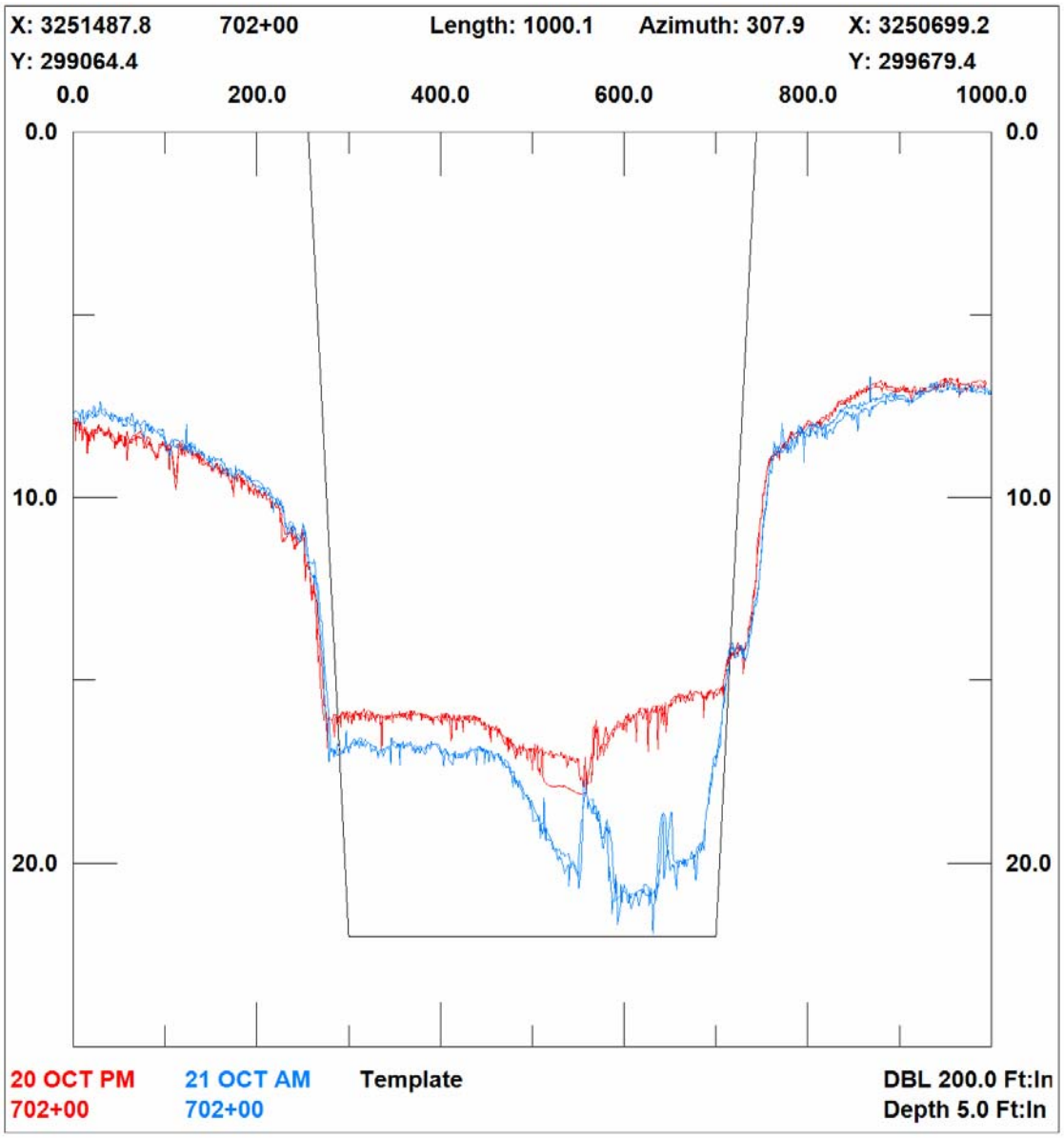


Figure 19. Cross section at Station 702+00. At the start of Assignment 2 of Reach 1, the dredge only worked on the west side of the channel. The 20 October PM survey is after the work started. The 21 October AM survey was the next morning.

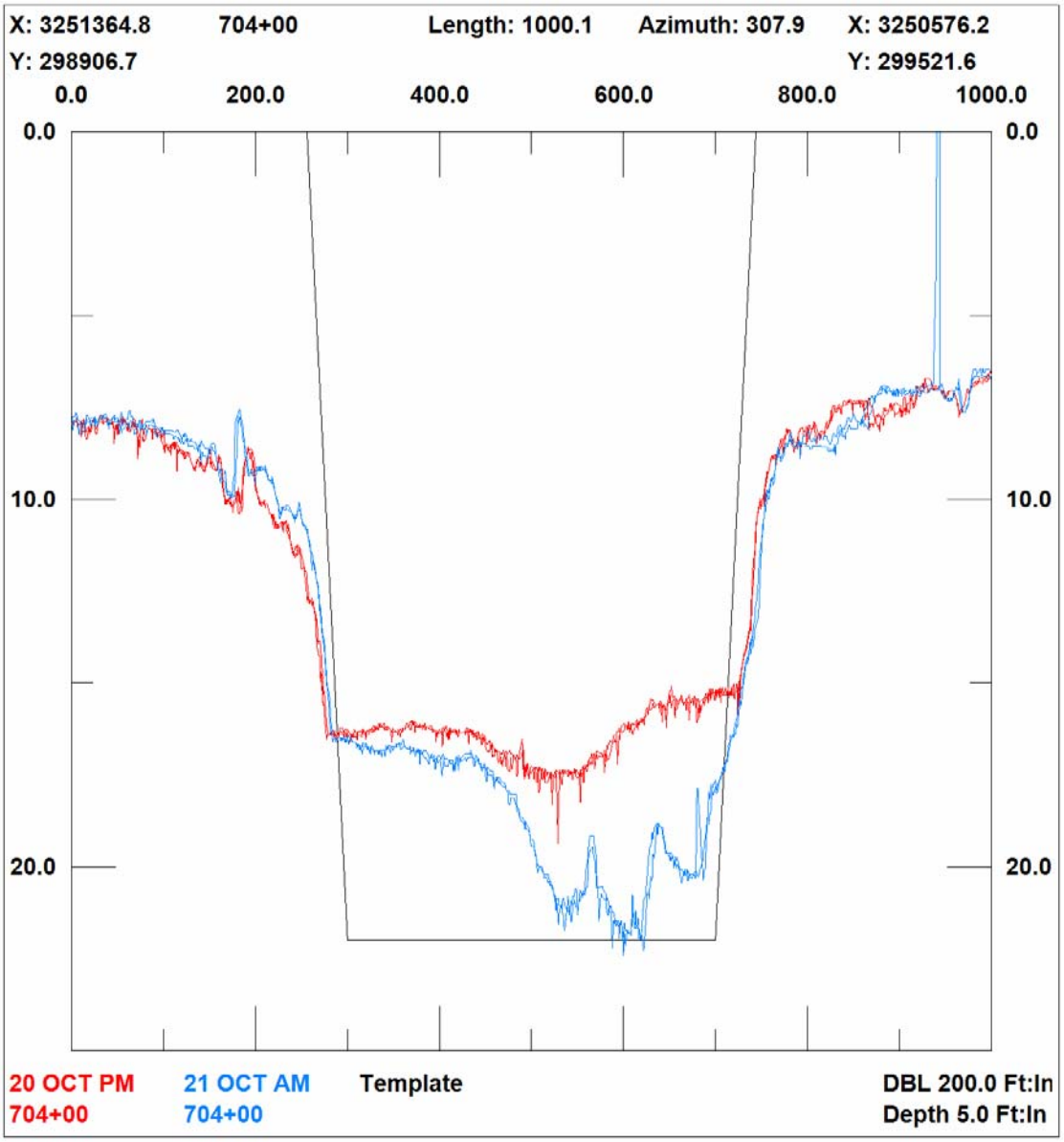


Figure 20. Cross section at Station 704+00. At the start of Assignment 2 of Reach 1, the dredge only worked on the west side of the channel. The 20 October PM survey is after the work started. The 21 October AM survey was the next morning.

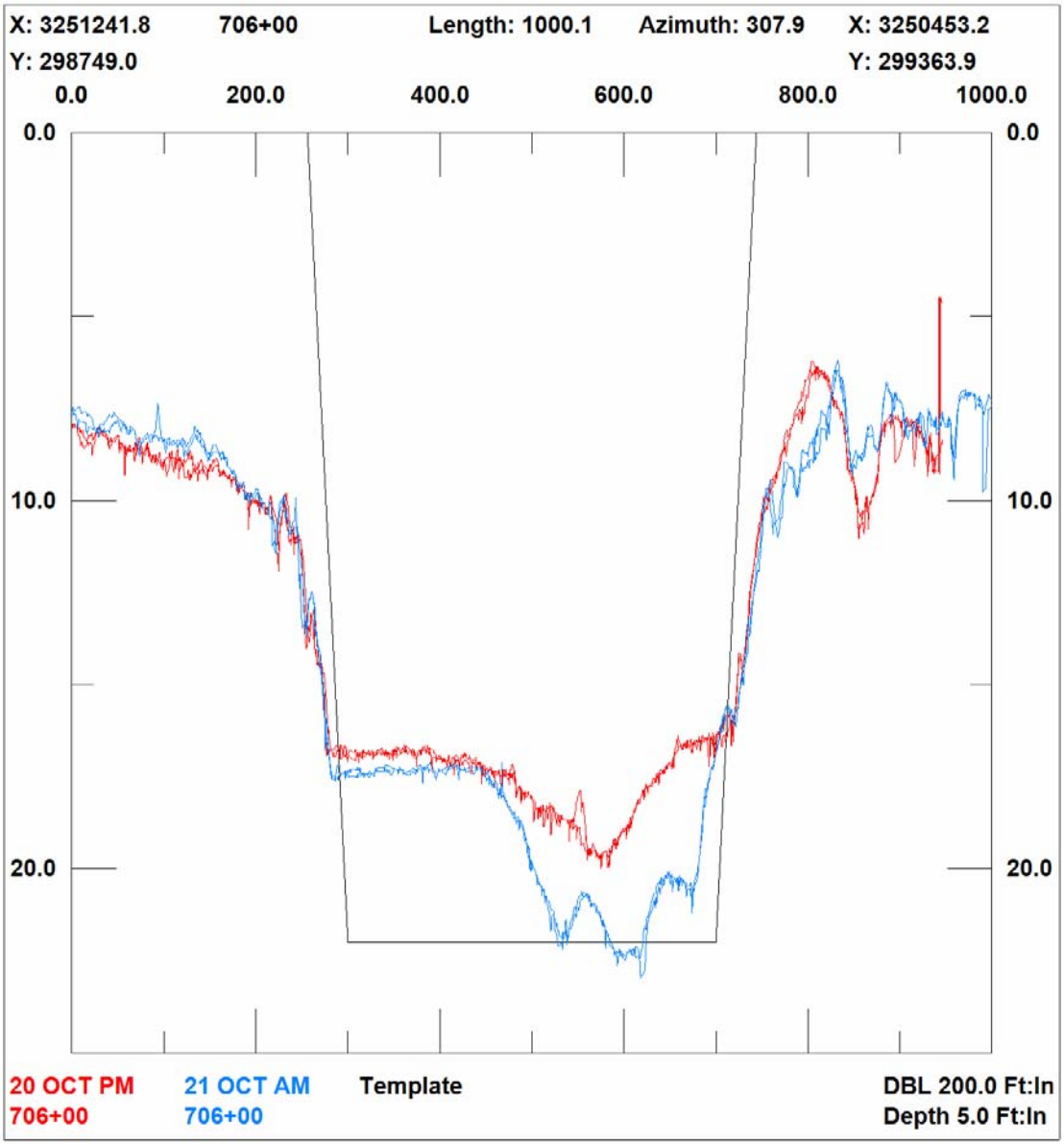
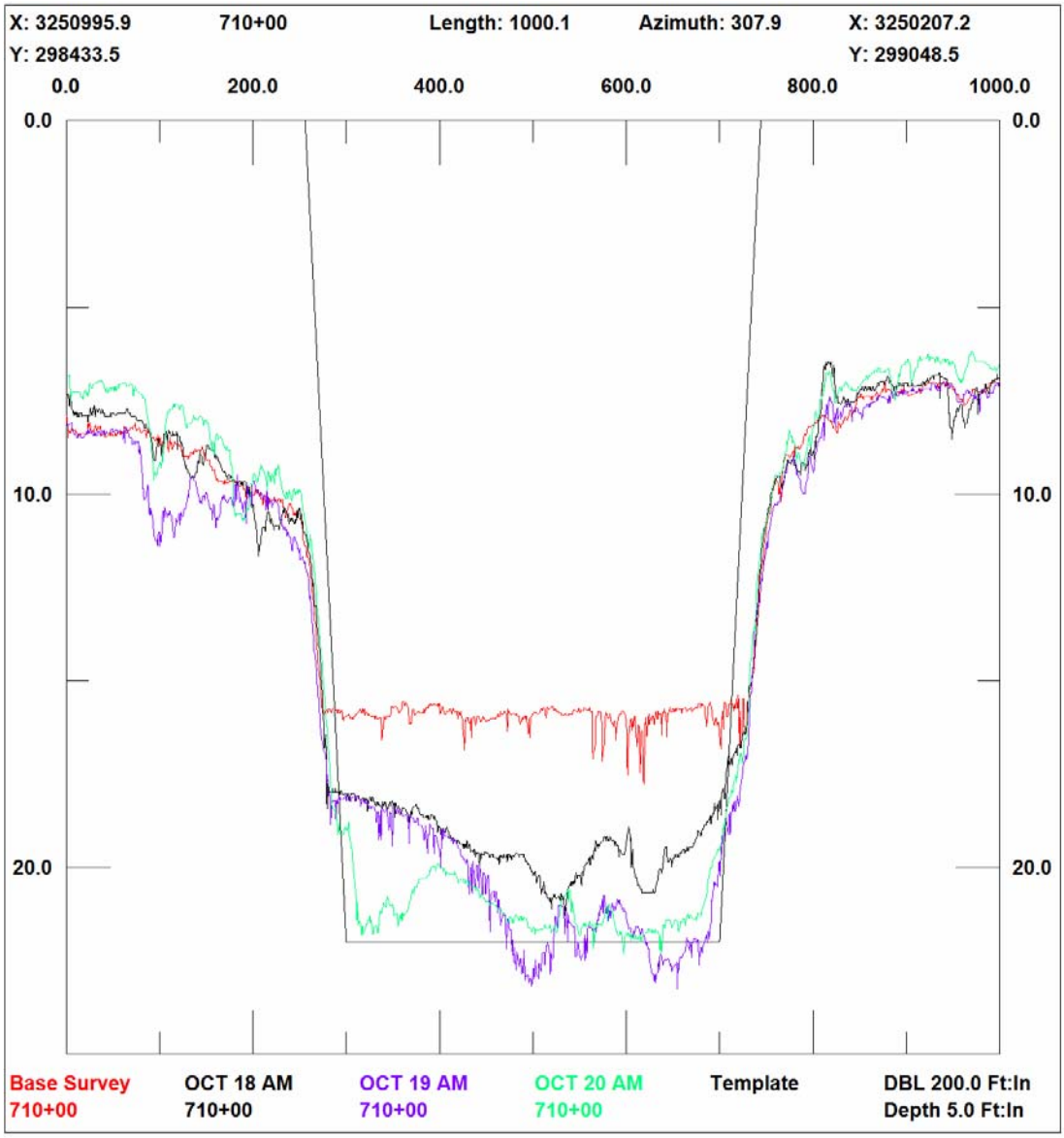


Figure 21. Cross section at Station 706+00. At the start of Assignment 2 of Reach 1, the dredge only worked on the west side of the channel. The 20 October PM survey is after the work started. The 21 October AM survey was the next morning.



Figures 22. These low frequency records show the increase in channel depth at Station 710+00. The dredging started on the afternoon of 17 October 2005. Surveys are shown for the mornings of 18 October, 19 October, and 20 October. The variable depth on the left overbank is probably due to longitudinal stationing errors since the right overbank is consistent. Dredging between 19 October and 20 October resulted in limited removal of material with previously dredged areas being filled. This occurred on other stations in all of the reaches.

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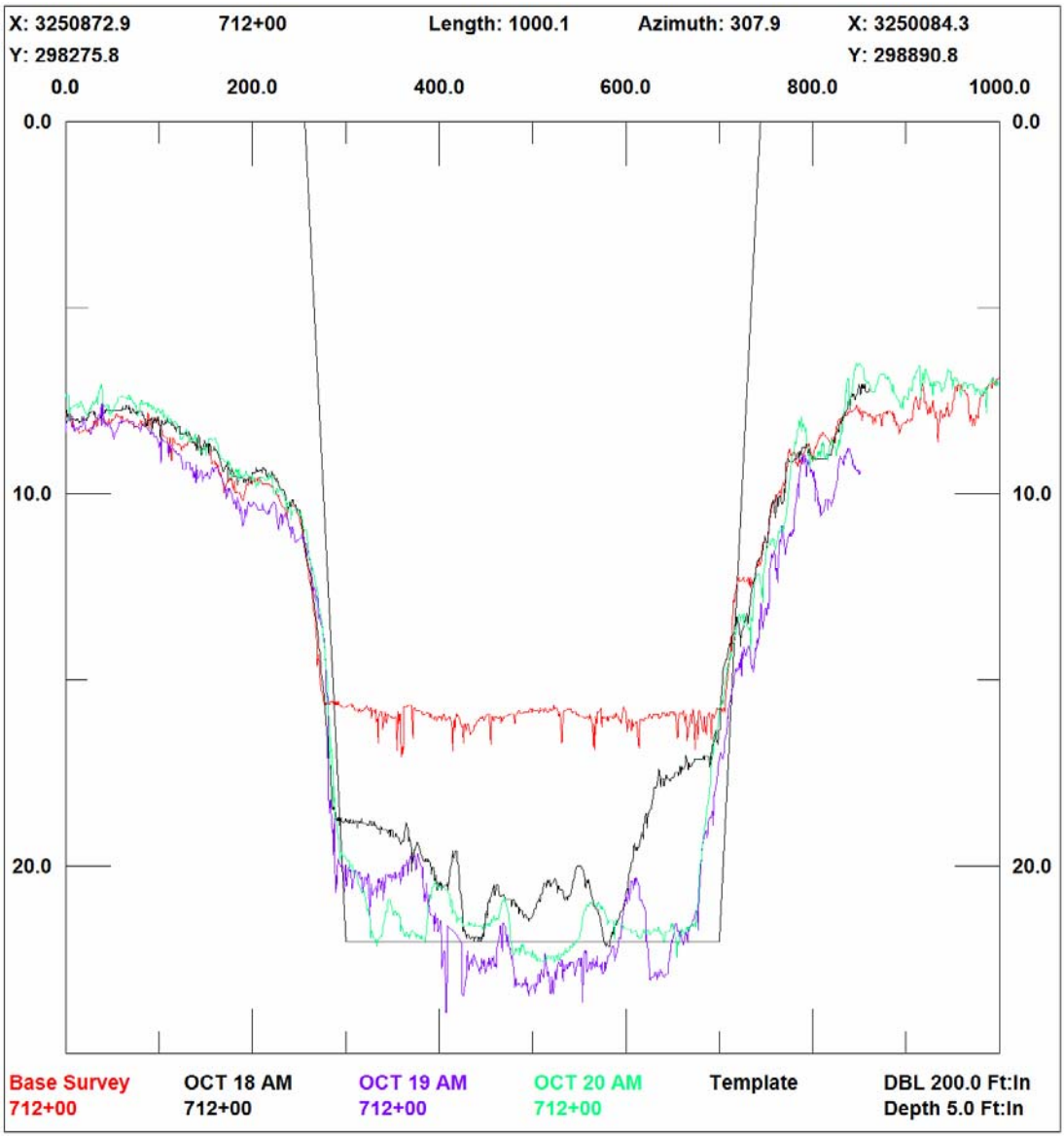

Figure 23. These low frequency records show the increase in channel depth at Station 712+00. The dredging started on the afternoon of 17 October 2005. Surveys are shown for the mornings of 18 October, 19 October, and 20 October. The data for 19 October and 20 October are correct based on the depths in the toes of the channel. As stated on Figure 21, dredging between 19 October and 20 October resulted in limited removal of material with previously dredged areas being filled.

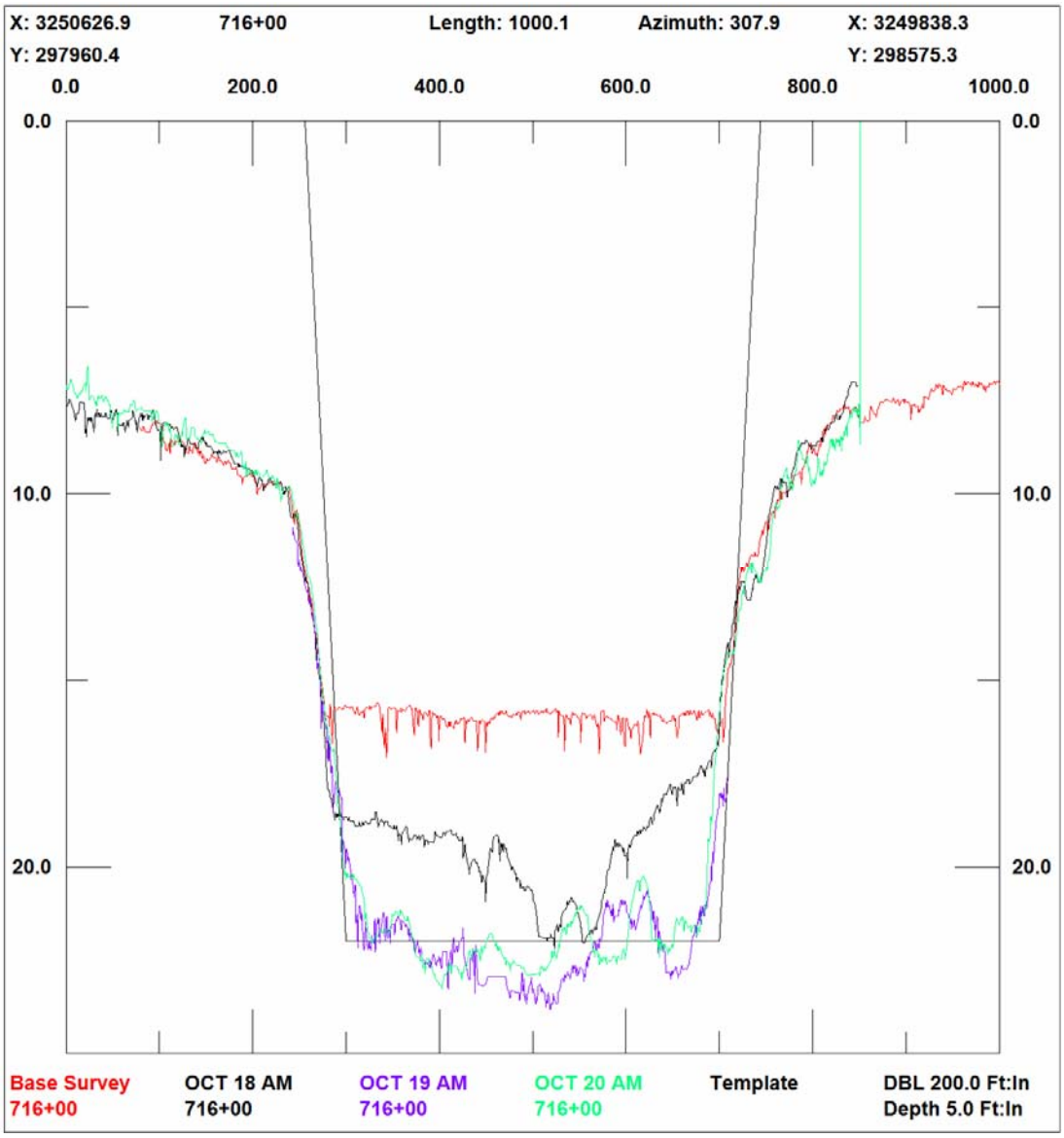

Figure 24. These low frequency records show the increase in channel depth at Station 716+00. The dredging started on the afternoon of 17 October 2005. Surveys are shown for the mornings of 18 October, 19 October, and 20 October. As stated on Figure 21 and 22, dredging between 19 October and 20 October resulted in limited removal of material with previously dredged areas being filled.

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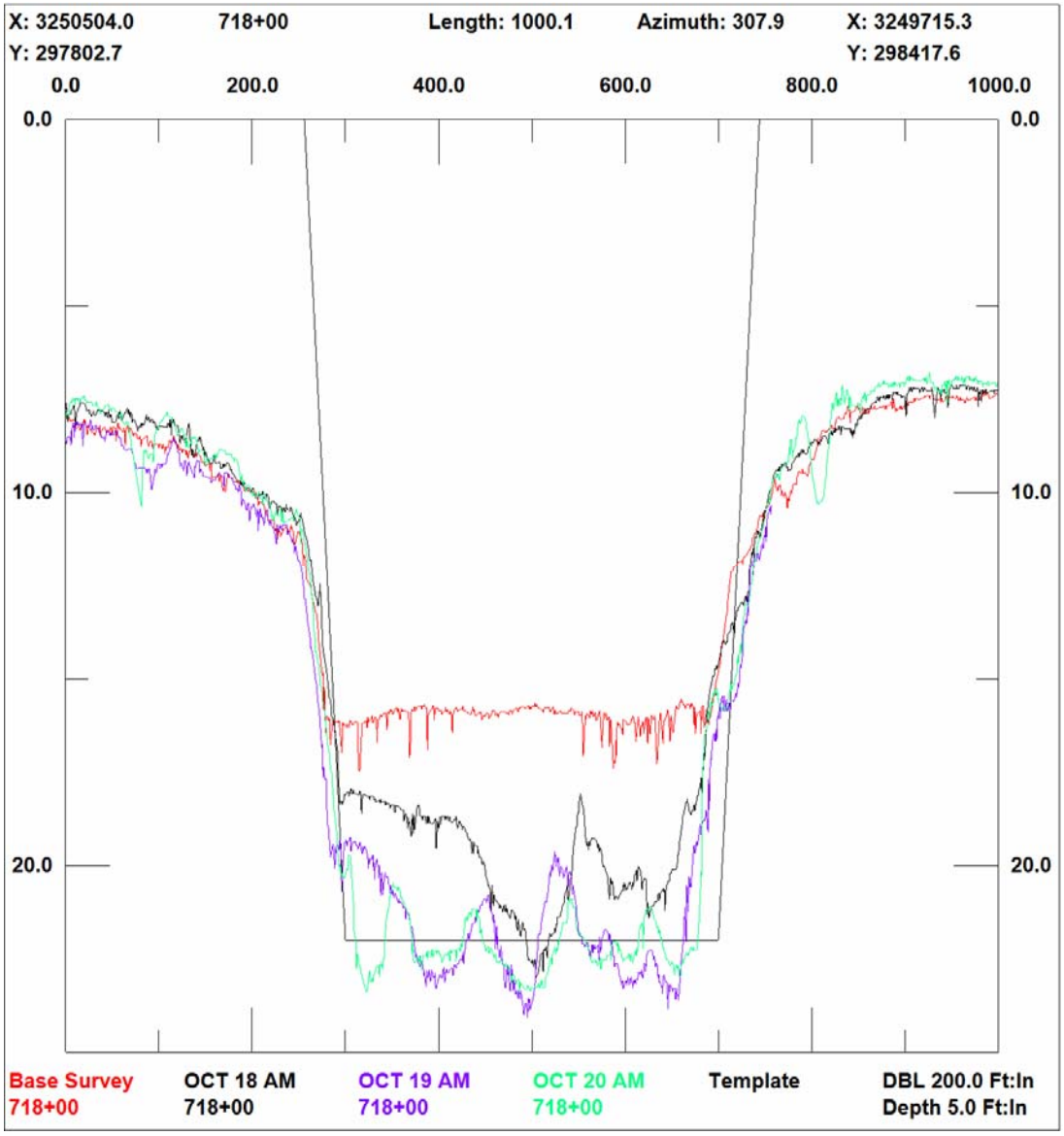

Figure 25. These low frequency records show the increase in channel depth at Station 718+00. The dredging started on the afternoon of 17 October 2005. Surveys are shown for the mornings of 18 October, 19 October, and 20 October. As stated on previous figures, dredging between 19 October and 20 October resulted in limited removal of material with previously dredged areas being filled.