Technical Report M14

SEDIMENTATION AND NAVIGATION STUDY OF THE LOWER ATCHAFALAYA RIVER AT MORGAN CITY & BERWICK, LOUISIANA, RIVER MILES 124.0 TO 118.5

HYDRAULIC MICRO MODEL INVESTIGATION

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INTRODUCTION

The Hydrologic Engineering Section of the U.S. Army Corps of Engineers, New Orleans District initiated a sedimentation and navigation improvement study of the Lower Atchafalaya River at Morgan City and Berwick, Louisiana. The purpose of the study was to evaluate a number of design alternatives and/or modifications for channel improvement on the Atchafalaya River between Miles 124.0 and 118.5.

Personnel from the New Orleans District directly in charge of the study and of overseeing the project included: Mr. James Austin, Mr. Donald Rawson, Ms. Stacey Frost, and Ms. Julie Vignes. Mr. Al Mistrot, Dredging Inspector, also of the New Orleans District, contributed invaluable information concerning the study reach.

The study was conducted between November 1999 and March 2000, using a physical hydraulic micro model at the St. Louis District's Applied River Engineering Center in St. Louis, Missouri. The study was performed by Mr. David Gordon, Hydraulic Engineer, with the assistance of Mr. Aron Rhoads and Mr. Edward Riiff, Engineering Technicians, and under direct supervision of Mr. Robert Davinroy, Director of the Applied River Engineering Center and District Potamologist for the St. Louis District.

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BACKGROUND

This report details a sedimentation and navigation study of the Lower Atchafalaya River using a physical hydraulic micro model. Micro model methodology was used to evaluate sediment transport and flow conditions of the Atchafalaya River at Morgan City and Berwick, Louisiana. Plate 1 is a vicinity map of the study reach.

Micro modeling methodology was used to evaluate the sediment transport and hydrodynamic response trends that could be expected to occur in the river from various channel improvement design alternatives. These alternatives were conceptualized and submitted by members of a study team representing the New Orleans District, the St. Louis District, and the Corps of Engineers Coastal and Hydraulics Laboratory. The primary goal was to evaluate the impacts of these measures on the resultant bed configuration (sediment transport response) and hydrodynamic response (flow patterns) within the study reach.

1. Study Reach

"The Atchafalaya River is the largest of all distributaries of the Mississippi River. The Corps of Engineers maintains a 12-foot deep by 125-foot wide Atchafalaya navigation channel that extends from the Mississippi River via Old River Lock downstream to the Gulf Intracoastal Waterway System (GIW) at Morgan City. Navigation is thereby shortened by almost 172 miles for vessels sailing between the Mississippi River above Old River Lock and the GIW in Southern Louisiana, saving time, money, and energy, and lessening traffic congestion at the port of New Orleans. The Lower Atchafalaya River is the natural outlet for the Atchafalaya River Basin, draining flows past Morgan City and Berwick into the Atchafalaya Bay and Gulf of Mexico." (Atchafalaya River Navigation Charts, U.S. Army Corps of Engineers, 1999)

Plate 2 is an aerial photomap depicting the characteristics, configuration and nomenclature of the Lower Atchafalaya River through the study reach. This reach of river, named Berwick Bay, is located on the Atchafalaya River between Morgan City and Berwick, Louisiana. The waterway is comprised of a complex network of GIW branches that converge through this reach to produce a very congested navigational area. At the upper end of the study reach, near Mile 119.0, the Atchafalaya flows from the north, while flows from Flat Lake and a branch of the GIW converge from the east. Near Mile 119.7, another branch of the GIW connects to the Atchafalaya from the west through the Berwick Lock. The Atchafalaya River then passes through Berwick Bay, which is located between the city of Berwick on the west and Morgan City on the east. Morgan City is located along the left descending bankline and Berwick is located along the right descending bankline.

Within Berwick Bay, three bridge crossings are located within a 1/3-mile stretch of river between Miles 121.0 and 121.3. Both the old and new U.S. Highway 90 bridges are located near Mile 121.0 while the Southern Pacific Railroad Bridge is located at Mile 121.3.

A major distributary of the Atchafalaya River is located along the left descending bankline near mile 121.4, just downstream of Berwick Bay and the bridge crossings. A portion of flow from the river distributes toward the east and south through both Bayou Boeuf and Bayou Schaffer.

2. Sedimentation Problem

This particular stretch of river has been one of the most troublesome reaches on the Atchafalaya River in terms of dredging cost, frequency, and volume. The New Orleans District must maintain 12-foot navigation depths between banklines within Berwick Bay to ensure adequate depths for the ports, facilities, and boat docks that are located along the riverfronts of both cities. Although Berwick has sufficient depth to maintain navigation, Morgan City is faced with a large depositional area that may accumulate enough sediment to halt navigation into the port facilities. Throughout the years, the planform of the river upstream of Berwick Bay has gradually changed. These changes have altered the flow patterns within the Bay, which has caused a steady increase in the rate of deposition along the Morgan City bankline, between Miles 120.0 and 121.5. The New Orleans District has dredged at this location approximately twice per year. Nearly one million cubic yards of material were removed from this site in 1999.

3. Navigation Problem

Another problem in this reach of river is safety. The three bridges spanning the river are located in close proximity to each other. The two highway bridges contain adequate navigation span widths of 580 feet and 520 feet (Plate 3). However, the Southern Pacific Railroad Bridge contains a lift-span with an extremely narrow navigation width of approximately 320 feet (Plates 3 and 4). Until the establishment of a stringent traffic control system by the U.S. Coast Guard in 1974, this bridge was listed as the “most hit” in the United States.

Historically, the flow and direction of currents in this area have not been conducive to safe navigation through these bridge spans. While the navigation spans of the bridge crossings are located in the center of the channel, the thalweg and the main concentration of flow are located near the right descending bankline along the Berwick side of the river. Therefore, the direction of river currents tends to divert downbound vessels attempting to navigate through the bridge spans toward the right descending bank. The misalignment of currents with the navigation spans has forced tow pilots to make precise adjustments to the position of their vessels well upstream of the bridges. A slightly misguided tow could easily collide with the many bridge piers located in the channel.

The following report was posted on the U.S. Coast Guard web site: "The Berwick Bay Vessel Traffic Service (VTS) was established in 1974 under the authority of the Ports and Waterways Safety Act of 1972 to improve maritime safety in Berwick Bay. This is one of the most hazardous waterways in the United States due to strong currents and a series of bridges that must be negotiated by inland tows traveling between Houston, Baton Rouge and New Orleans. In 1987, VTS Berwick Bay became part of the newly formed Marine Safety Office in Morgan City, Louisiana. This busy intersection, coupled with the narrow bridge navigation spans requires the VTS to maintain one-way traffic flow through the bridges. During seasonal high water periods, the VTS enforces towing regulations that require inland tows transiting the bridges to have a minimum amount of horsepower based on the length of tow. The direct control nature of the VTS's operations, and the high water towing regulations it enforces, makes VTS Berwick Bay unique among Coast Guard Vessel Traffic Services. These measures have successfully reduced the accident rate for inland tows transiting Berwick Bay from approximately 4.0 accidents per 1000 tow transits in 1990 to 0.38 accidents per 1000 tow transits in 1998. This amazing success resulted in the VTS being awarded a Vice-Presidential Hammer Award in 1996."

The depositional problems described previously have also contributed to the hazardous navigation conditions. Near Mile 119.5, downbound tows traveling along the left descending bank must prepare for a crossing between this point and Mile 120.0. Ideally, tows should complete this crossing into the center of the channel to become properly aligned with the downstream bridge crossings. However, the tows must avoid grounding on the point of the depositional area located along the left descending bank near Mile 120.0. To avoid of this point, pilots must take a path that carries the tows toward the right descending bank. Once clear of this point, pilots must quickly maneuver the tow back towards the center of channel to become properly aligned with the navigation spans of the bridges. The high velocities located along the right descending bank have made this maneuver all the more difficult. Therefore, a significant reduction in the width of the depositional area near Mile 120 is critical to improve navigation safety at the bridge crossings.

4. Study Purpose and Goals

The purpose of this study was to assess the present day sediment transport and flow response trends of the Atchafalaya River. The primary goals were to evaluate design alternatives that would reduce the deposition and dredging associated with the reach, and to provide improved flow conditions for navigation through the bridge crossings. Improving flow conditions included examining ways to reduce velocities and redistribute flow patterns in the Atchafalaya River channel by the use of underwater weirs. Assessments of each design alternative included the examination on the ultimate effects to sedimentation, flow patterns, and navigation within the main channel of the Atchafalaya River.

The three primary criteria that were required to improve conditions in the study reach were:

1. A significant reduction of a depositional area along the left descending bank between Miles 120.0 and 121.5 to reduce the frequency of dredging.
2. A removal of a point bar along the left descending bank between Miles 120.0 and 120.5 to reduce the navigation maneuvers required for the downbound approach to the bridge crossings.
3. A redistribution of flow patterns across the channel width and through the bridge openings to improve flow patterns and navigation conditions.

MICRO MODEL DESCRIPTION

1. Scales and Bed Materials

Plate 5 is a photograph of the Morgan City/Berwick Bay hydraulic micro model used in this study. The model encompassed the Atchafalaya River channel between Miles 116.5 and 126.0. After entrance and exit conditions in the model were adjusted, the actual study reach was between Miles 118.5 and 124.0. Portions of Flat Lake, Bayou Boeuf and Bayou Schaffer were also included in the model. The scales of the model were 1 inch = 600 feet, or 1:7200 horizontal, and 1 inch = 100 feet, or 1:1200 vertical, for a 6 to 1 distortion ratio. This distortion supplied the necessary forces required for the simulation of sediment transport conditions similar to those of the prototype. The bed material was granular plastic urea, Type II, with a specific gravity of 1.4.

2. Appurtenances

The micro model was constructed according to the recent high-resolution aerial photography of the study reach shown on Plate 2. The model was then placed in a standard micro model hydraulic flume. The riverbanks of the model were constructed from dense polystyrene foam, and modified during calibration with oil-based clay. Rotational jacks located within the hydraulic flume controlled the slope of the model. The measured slope of the insert and flume was approximately 0.01 inch/inch.

Flow into the model was regulated by customized computer hardware and software interfaced with an electronic control valve and submersible pump. This interface was used to automatically simulate repeatable discharge hydrographs in the model. Discharge was monitored by a magnetic flow meter interfaced with the customized computer program. Water stages were manually checked with a mechanical three-dimensional point digitizer. Resultant bed configurations were measured and recorded with a three-dimensional laser digitizer. Surface current patterns were captured and recorded using time exposure photography.

MICRO MODEL TESTS

1. Calibration and Verification

The calibration/verification of the micro model involved the adjustment of water discharge, sediment volume, hydrograph time scale, model slope, and entrance conditions of the model. These parameters were refined until the measured bed response of the model was similar to that of the prototype. (Note: all bed elevations described in this report are referenced to Mean Low Gulf or MLG.)

A. Design Hydrograph

In all model tests, an effective discharge hydrograph was simulated in the Atchafalaya River channel. This hydrograph served as the average design energy response of the river. Because of the constant variation experienced in the prototype, this hydrograph was used to theoretically analyze the ultimate expected sediment response. Each hydrograph simulated a discharge range between extreme low flow to high “within-channel” flow. (Flow rates in the model ranged between 0.85 to 1.35 gallons per minute.) Although water stages in the model are not directly scalable to actual stages of the river, low flow corresponded to an approximate stage of 0 feet while high flow corresponded to an approximate stage of +5 feet. The most important factors during the modeling process are the establishment of an equilibrium condition of sediment transport and the simulation of high and low energy conditions. High flow in the model simulated a peak energy condition representative of the river’s bed forming flow and sediment transport potential at bankfull stage. The time increment or duration of each hydrograph cycle (peak to peak) was two minutes. Plate 6 shows the typical, sine wave shaped hydrograph used in the study.

Flow was simulated from both the Atchafalaya River and Flat Lake. Although discharge and flow-split information was not available for this confluence area near Mile 119.0, it was determined that at certain conditions a significant amount of flow enters the Atchafalaya River from Flat Lake. The suspended sediment plumes shown in the aerial photograph on Plate 2 signified a substantial discharge from Flat Lake. A movable bed was simulated in the model through the main channel of the Atchafalaya River as well as through the Bayou Boeuf/Bayou Schaffer distributary complex. A fixed bed was constructed for the portion of the Flat Lake channel leading into the Atchafalaya River.

B. Prototype Data and Observations

To determine the general bed characteristics and sediment response trends that existed in the prototype, three hydrographic surveys were examined. Plates 7 and 8 display surveys from 1997 and 1999. An extremely detailed hydrographic survey was also collected in 1999 for the New Orleans District using multi-beam technology aboard the St. Louis District's M/V Boyer. The resultant survey, shown on Plate 9, was the primary survey used to calibrate the micro model. Older, historical surveys were not used in this study because it was determined that the bed and flow conditions have substantially changed in recent years. All three surveys used in the study indicated very similar trends.

The general trends of the prototype as observed in the hydrographic surveys are described as follows:

- The thalweg was located along the right descending bankline at the upper end the study reach near Mile 118.5 with depths that approached –90 feet MLG.
- The thalweg crossed toward the left descending bankline near the confluence with Flat Lake at Mile 119.0. Depths in the main channel along the outside of the bend approached –100 feet MLG.

- A crossing occurred between Miles 119.5 and 120.0, near the entrance to the Berwick Lock and the GIW, with depths near –50 feet MLG.
- A long, straight channel pattern form was located along the right descending bankline, adjacent to the city of Berwick between Miles 120.2 and 121.5 with depths that approached –70 feet MLG. The navigation span through the bridge crossings was located in the center of the river channel.
- The large, main piers of the lift span and the secondary piers of the railroad bridge crossing near Mile 121.3 caused the development of two major scour holes immediately downstream of the bridge. Depths approached –50 feet MLG in the smaller hole and –70 feet MLG in the larger hole.
- Between Miles 120.0 and 121.5, a large depositional area was located along the left descending bankline adjacent to Morgan City. Although the prototype survey indicated remnants of past dredge cuts, depths were generally between –5 and –10 feet MLG.
- Near Mile 121.5, a scour pattern occurred at the entrance to the Bayou Schaffer / Bayou Boeuf distributary complex with depths that approached –60 feet MLG.
- An unusual bed form was observed at this intersection. A large, underwater structure was pointed upstream at a depth of approximately –10 feet MLG.
- A short crossing toward the left descending bankline occurred near Mile 121.8, with depths between –30 and –40 feet MLG.
- The thalweg remained along the left descending bankline between Miles 121.8 and 122.6 with depths at approximately –60 feet MLG.
- Near Mile 122.8, the thalweg widened towards the opposite bankline and became slightly shallower, to a depth of –40 feet MLG.
- Between Miles 123.0 and 123.4, the thalweg continued along the left descending bankline at a depth of approximately –50 feet MLG.
- A short, deep crossing occurred near Mile 123.5 with depths of approximately –50 feet MLG. Between Miles 123.6 and 124.0, the thalweg continued along the right descending bankline at depths that approached –90 feet MLG.

The M/V Boyer also collected detailed velocity data using an Acoustic Doppler Current Profiler (ADCP). Plate 10 shows velocity vectors at a –5-foot depth and Plate 11 shows velocity contours at a –7-foot depth. This data indicated the following trends:

- Velocities between 3 and 5 feet/second were located in the thalweg positions observed in the hydrographic surveys.
- Velocities from 0 to 2 feet/second were located in the area of deposition along the left descending bank between Miles 120.0 and 121.5.
- Flow patterns were directed along the right descending bankline through the bridge crossings and away from the center of the channel where the navigation spans are located.

Plate 3 shows a diagram of the three bridge crossings located in this reach. The bridge piers were placed in the model as close as possible to their actual geographical locations, however their dimensions were not modeled to scale. Because of the distortion associated with a movable bed model, the piers were placed in the model to simulate an arbitrary scaled amount of roughness associated with the piers in the river. Therefore, the dimensions of the piers were selected such that the bed forms shown in the hydrographic survey would also be produced in the model. The model roughness associated with the piers of the railroad bridge was extremely critical because of the large scour holes that are shown in the hydrographic surveys immediately downstream of the bridge.

The photographs on Plate 4 show the railroad bridge and piers. The piers to the east of the navigation lift-span are located very close together. Since the distance between these piers is approximately 40 feet, an unusual amount of roughness is associated with this part of the structure in the river. Field observations determined that these piers have collected a large amount of debris throughout the years. Therefore, it was concluded that the section of bridge with the collection of debris acts somewhat like a river training structure and ultimately has a significant effect on the bed response of the river in this reach. Additional roughness was added to the model using screen mesh along this section of the piers to develop a bed response similar to that observed in the hydrographic survey.

Downstream of the railroad bridge, a small oil rig is located in the river along the left descending bankline near Mile 121.4. Field observations suggested that this structure also affects the bed response of the river. This structure was simulated in the model with screen mesh to achieve the bed response observed in the hydrographic surveys.

2. Base Test

A. Base Test Bathymetry

Model calibration was achieved once a favorable qualitative comparison of the prototype survey was made to several surveys of the model. The resultant bathymetry of this bed response served as the base test of the micro model. Plate 12 shows the resultant bed configuration of the micro model base test. The base test was developed from the simulation of successive repeatable design hydrographs until bed stability was reached and a similar bed response was achieved as compared with prototype surveys. This survey then served as the comparative bathymetry for all design alternative tests.

Results of the micro model base test bathymetry and a comparison to the prototype surveys indicated the following trends:

- The upper end of the study reach near Mile 118.5 was considered the entrance conditions of the model and therefore did not represent the actual thalweg location as shown in the prototype survey.
- Between Miles 119.0 and 119.6, at the confluence of the Atchafalaya River and Flat Lake, the thalweg developed along the left descending bank in a pattern very similar to that of the prototype. The thalweg was generally

deeper in the model than in the prototype, with depths between –50 and –160 feet MLG.

- The crossing between Miles 119.5 and 120.0 was located in the same general location as the prototype but was slightly shallower, with depths between –40 and –50 feet MLG.
- A long, straight channel formed along the right descending bankline between Miles 120.2 and 121.4 with depths that approached –70 feet MLG. The position and depth of the thalweg was similar to the prototype except near Mile 121.2, where depths were slightly shallower within the model.
- Between Miles 120 and 121.5, a large depositional area was evident along the left descending bankline. The elevation of the bar was slightly higher than shown in the prototype. The prototype survey represented an artificially maintained bed that had been repetitively dredged. The elevations in the model represented possible natural depths that may occur in the prototype without periodic dredging.
- The piers of the railroad bridge at Mile 121.3 formed two major scour hole patterns, with depths over –60 feet MLG. These patterns were similar to the scour holes observed in the prototype survey.
- At the juncture of the Bayou Boeuf / Schaffer distributary complex, the depth of the scour hole that formed near the mouth approached –40 feet MLG, which was slightly shallower than the prototype. The unusual bed form noticed from the prototype survey at this intersection was artificially placed in the model with non-moveable clay. This structure's elevation and location was critical in achieving the bathymetric trends downstream of this area.
- A short crossing formed just downstream of the distributary juncture at Mile 121.7. Between Miles 121.8 and 123.3, the thalweg formed along the left descending bankline in a pattern similar to the prototype, but with slightly shallower depths of over –50 feet MLG. The depositional area along the right descending bankline between Miles 121.6 and 122.3 was approximately 5 to 10 feet higher than the area shown in the prototype.

- A crossing formed near Mile 123.5 at a depth of approximately –40 feet MLG. The prototype surveys indicated slightly greater depths of –50 feet MLG.
- Between Miles 123.6 and 124.0, the thalweg formed along the right descending bankline with depths over –90 feet MLG.

Overall, the trends of the model as observed in the base test were very similar to those observed from the prototype surveys.

B. Cross-Sectional Comparisons

A comparative cross-sectional analysis was also performed for this study. The first step of this analysis compared the bathymetry of the 1999 prototype multi-beam survey to the bathymetry of the base test. This analysis used 26 cross-section ranges located throughout the study reach shown on Plate 13. The second step compared the bathymetry of the base test to the bathymetry of each design alternative using the same cross-section ranges. A computation of cross-sectional area below an elevation of 0 feet MLG was also completed at each range.

Plate 14 shows the cross-sectional comparison plots of the prototype survey and the base test at each range. Graphs showing the cross-sectional area and the percent differences in area between the prototype and the base test surveys at each range are shown on Plate 15. The plots and graphs indicated a very close correlation of cross-sectional alignments and areas between the model and the prototype. A computation using the absolute value of the percent difference in area between the base test and the prototype at each range revealed that the average difference in area was 8.2%.

C. Base Test Flow Visualization

In addition to the bathymetry collected from the model, flow visualization information was also recorded. Photographic time exposure was used to examine the general surface current patterns of the base test and of each design alternative test. Flow visualization photographs were taken at both low flow and high flow to better understand the flow patterns associated with each design alternative. Plate 16 shows the flow visualization photos of the base test at both low and high flow. The trends at both flow rates appeared very similar to the prototype velocity vectors shown on Plate 10. These photos then served as the comparative flow patterns for all design alternative tests.

The flow patterns from the model indicated the following trends:

- Between Miles 119.5 and 120.0, a crossing was observed from the left to the right descending bankline.
- The main flow lines were concentrated along the right descending bankline through Berwick Bay and the three bridge crossings. Although the navigation spans of the bridges are located in the center of the channel, most of the flow was directed to the right of these openings.
- A minimal amount of flow was evident in the depositional area along the left descending bank near Morgan City. Plates 10 and 11 indicate that low flows are present in this area of the prototype as well.
- A crossing to the left descending bankline was observed downstream of the Bayou Boeuf / Schaffer distributary complex near Mile 121.7.
- A minimal amount of flow was observed entering the Bayou Boeuf / Schaffer distributary complex. The prototype data also indicated minimal flow in this area.

3. Design Alternative Tests

Eleven design alternative plans were model tested to examine methods of modifying the sediment response trends that would minimize dredging and improve the flow patterns through the Berwick Bay reach. The impacts of each design alternative were assessed by examining both the flow and sediment response of the model and then comparing the resultant bed configuration and flow patterns to those of the base test condition.

<u>Alternative A:</u> *6 Weirs at a Depth of –20 Feet MLG*

- *Weir 1: 600 feet in Length on the Right Descending Bankline (RDB) at Mile 120.2*
- *Weir 2: 650 feet in Length on the RDB at Mile 120.3*
- *Weirs 3 through 6: 700 feet in Length on the RDB at Miles 120.4, 120.6, 120.7, and 120.8*

Plate 17 is a plan view map of the resultant bed configuration of Alternative A. Flow visualization photographs at both low and high flows are shown on Plate 18. The test results indicated that the design proved somewhat effective at increasing depths along the left descending bank. A large depositional area remained along this bank between Miles 120.0 and 120.3 and within the reach critical for navigation. Weir 1 induced excessive scour and a bar developed in mid channel near Mile 120.5. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 19 and 20 indicated a significant increase in area through the weir field as compared to the base test. The flow visualization indicated some improvement to the flow distribution across the channel width and through the bridge openings.

<u>Alternative B:</u> *6 Weirs at a Depth of –20 Feet MLG*

- *Weir 1: 350 feet in Length on the Left Descending Bankline (LDB) at Mile 119.2*
- *Weir 2: 400 feet in Length on the RDB at Mile 120.1*
- *Weir 3: 600 feet in Length on the RDB at Mile 120.3*
- *Weir 4: 550 feet in Length on the RDB at Mile 120.4*
- *Weir 5: 500 feet in Length on the RDB at Mile 120.6*

- *Weir 6: 400 feet in Length on the RDB at Mile 120.7*

Plate 21 is a plan view map of the resultant bed configuration of Alternative B. Flow visualization photographs at both low and high flows are shown on Plate 22. Test results indicated that depths were increased significantly along the left descending bank between Miles 120.4 and 121.5. A substantial portion of the bar remained along the bank between Miles 120.0 and 120.4, in the area critical for navigation. Weir 1, near Mile 119, had an insignificant effect on bed forms. Weirs 2 and 3 were very effective while Weirs 4 through 6 provided minimal impact to the bed forms. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 23 and 24 indicated an increase in area through the weir field as compared to the base test. Flow visualization indicated some improvement to the flow distribution across the channel width and through the bridge openings.

<u>Alternative C:</u> *8 Weirs at a Depth of –20 Feet MLG*

- *Weir 1: 350 feet in Length on the LDB at Mile 119.2*
- *Weir 2: 200 feet in Length on the RDB at Mile 119.8*
- *Weir 3: 400 feet in Length on the RDB at Mile 120.2*
- *Weir 4: 500 feet in Length on the RDB at Mile 120.3*
- *Weirs 5 through 8: 600 feet in Length on the RDB at Miles 120.4, 120.6, 120.7, and 120.8*

Plate 25 is a plan view map of the resultant bed configuration of Alternative C. Flow visualization photographs at both low and high flows are shown on Plate 26. The test results indicated that the design increased depths in the middle of the river channel throughout the depositional area. A portion of the bar approximately 300 feet wide remained along the left descending bank between Miles 120.1 and 120.8. Weir 1, near Mile 119, had an insignificant effect on bed forms. Weirs 6, 7, and 8 had a substantial impact at shifting the thalweg towards the middle of the channel and removing the downstream area of deposition. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 27 and 28 indicated a minor increase in area through the weir field as compared to the base test. Flow visualization indicated some improvement to the flow distribution across the channel width. The flow patterns were mostly affected near the downstream end of the weir field and through the bridge crossings.

Alternative C-2: *Alternative C Weirs Lowered to a Depth of –35 Feet MLG*

Plate 29 is a plan view map of the resultant bed configuration of Alternative C-2. Flow visualization photographs at both low and high flows are shown on Plate 30. The test results indicated that the design increased depths in the middle of the river channel throughout the depositional area. A portion of the bar approximately 200 feet wide remained along the left descending bank between Miles 120.1 and 121.1. The widest portion of this bar was evident near Mile 120.3 in the area critical for navigation. Weir 1, near Mile 119, had an insignificant effect on bed forms. Weirs 2 through 8 did not create a substantial shift of the thalweg towards the middle of the channel. The scour holes downstream of the railroad bridge demonstrated a minimal decrease in depth. The cross-sectional analysis on Plates 31 and 32 indicated a slight increase in area through the weir field as compared to the base test. Flow visualization indicated a minor redistribution of flow across the channel width although most of the flow patterns remained near the right descending bank.

Alternative D: *Weir 1 Removed from Alternative C*

Plate 33 is a plan view map of the resultant bed configuration of Alternative D. Flow visualization photographs at both low and high flows are shown on Plate 34. Test results indicated that depths increased significantly along the left descending bank between Miles 120.3 and 121.5 although a portion of the bar remained along the bank between Miles 120.0 and 120.3. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 35 and 36 indicated a slight increase in area through the weir field as compared to the base test. Flow visualization indicated some improvement to the flow distribution across the channel width. The improvement was especially evident near the downstream end of the weir field and through the bridge crossings.

<u>Alternative D-2:</u> *Alternative D Weirs Lowered to a Depth of –35 Feet MLG*

Plate 37 is a plan view map of the resultant bed configuration of Alternative D-2. Flow visualization photographs at both low and high flows are shown on Plate 38. The test results indicated that the design increased depths in the middle of the river channel throughout the depositional area. A substantial section of the bar remained along the left descending bank between Miles 120.0 and 120.5 and in the area critical for navigation. A smaller width of the bar remained along the bank between Miles 120.5 and 121.3. The scour holes downstream of the railroad bridge demonstrated a minimal decrease in depth. The cross-sectional analysis on Plates 39 and 40 indicated a minimal increase in area through the weir field as compared to the base test. Flow visualization indicated that most of the flow patterns remained concentrated near the right descending bank.

<u>Alternative E:</u> *Weirs 7 & 8 Removed from Alternative D*

Plate 41 is a plan view map of the resultant bed configuration of Alternative E. Flow visualization photographs at both low and high flows are shown on Plate 42. Test results indicated that depths increased in the middle of the river channel between Miles 120.0 and 121.5. A portion of the bar remained along the left descending bank between Miles 120.1 and 121.0. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 43 and 44 indicated an increase in area through the weir field as compared to the base test. Flow visualization indicated that most of the flow patterns remained concentrated near the right descending bank.

<u>Alternative F:</u> *14 Bendway Weirs at a Depth of –20 Feet MLG*

- *Weir 1: 200 Feet in Length on the RDB at Mile 119.5*
- *Weir 2: 200 Feet in Length on the RDB at Mile 119.55*
- *Weir 3: 300 Feet in Length on the RDB at Mile 119.6*
- *Weir 4: 300 Feet in Length on the RDB at Mile 119.7*
- *Weir 5: 350 Feet in Length on the RDB at Mile 119.8*
- *Weir 6: 350 Feet in Length on the RDB at Mile 119.9*
- *Weir 7: 400 Feet in Length on the RDB at Mile 120.0*
- *Weir 8: 450 Feet in Length on the RDB at Mile 120.1*
- *Weir 9: 500 Feet in Length on the RDB at Mile 120.2*
- *Weir 10: 550 Feet in Length on the RDB at Mile 120.3*
- *Weir 11: 550 Feet in Length on the RDB at Mile 120.4*
- *Weir 12: 600 Feet in Length on the RDB at Mile 120.5*
- *Weir 13: 600 Feet in Length on the RDB at Mile 120.6*
- *Weir 14: 550 Feet in Length on the RDB at Mile 120.7*

Plate 45 is a plan view map of the resultant bed configuration of Alternative F. Flow visualization photographs at both low and high flows are shown on Plate 46. The test results indicated that the design proved very effective at removing most of the depositional area along the left descending bank. A small portion of the bar was still evident along the bank between Miles 120.0 and 120.6. Although Weirs 1 through 5 were not very active, Weirs 6 through 14 were effective at shifting the thalweg slightly towards the middle of the channel. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 47 and 48 indicated a substantial increase in area through the weir field as compared to the base test. Flow visualization indicated a general redistribution of flow across the channel width. Most of the effect to the flow patterns was demonstrated in the downstream portion of the weir field.

<u>Alternative F-2</u>: *Alternative F Weirs Lowered to a Depth of –35 Feet MLG*

Plate 49 is a plan view map of the resultant bed configuration of Alternative F-2. Flow visualization photographs at both low and high flows are shown on Plate 50. The test results indicated that the design slightly increased depths in the middle of the river channel throughout the depositional area. A substantial section of the bar approximately 400 feet wide remained along the left descending bank between Miles 120.0 and 121.3. Weirs 1 through 5 became completely covered with bed material and proved ineffective. The thalweg of the channel remained along the right descending bank. The scour holes downstream of the railroad bridge demonstrated a minimal decrease in depth.
The cross-sectional analysis on Plates 51 and 52 did not indicate a change in area through the weir field as compared to the base test. Flow visualization indicated that most of the flow patterns remained concentrated near the right descending bank.

<u>Alternative G:</u> *10 Bendway Weirs at a Depth of –20 Feet MLG*

- *Weir 1: 400 Feet in Length on the RDB at Mile 119.6*
- *Weir 2: 500 Feet in Length on the RDB at Mile 119.7*
- *Weir 3: 600 Feet in Length on the RDB at Mile 119.8*
- *Weir 4: 600 Feet in Length on the RDB at Mile 119.9*
- *Weir 5: 600 Feet in Length on the RDB at Mile 120.0*
- *Weir 6: 700 Feet in Length on the RDB at Mile 120.2*
- *Weir 7: 800 Feet in Length on the RDB at Mile 120.3*
- *Weir 8: 800 Feet in Length on the RDB at Mile 120.4*
- *Weir 9: 800 Feet in Length on the RDB at Mile 120.5*
- *Weir 10: 700 Feet in Length on the RDB at Mile 120.6*

Plate 53 is a plan view map of the resultant bed configuration of Alternative G. Flow visualization photographs at both low and high flows are shown on Plate 54. The test results indicated that the design proved very effective at removing most of the depositional area along the left descending bank. A small portion of the bar approximately 100 feet wide was still evident between Miles 120.0 and 121.1. The weir field formed a smooth transition of the thalweg from the bend towards the middle of the channel and into the straight reach upstream of the bridges. The depth of the scour holes downstream of the railroad bridge decreased considerably. The cross-sectional analysis on Plates 55 and 56 indicated a significant increase in area through the weir field as compared to the base test. Cross-sectional areas outside of the weir field reach remained nearly unchanged. Flow visualization indicated a general redistribution of flow across the channel width. The main flow patterns were concentrated towards the center of the channel and through the navigation spans of the bridges.

Alternative G-2: *Alternative G Weirs Lowered to a Depth of –35 Feet MLG*

Plate 57 is a plan view map of the resultant bed configuration of Alternative G-2. Flow visualization photographs at both low and high flows are shown on Plate 58. The test results indicated that the design slightly increased depths in the middle of the river channel throughout the depositional area. A substantial section of the bar with a width of approximately 400 feet remained along the left descending bank between Miles 120.1 and 121.4. The thalweg of the channel remained along the right descending bank. The scour holes downstream of the railroad bridge demonstrated a minimal decrease in depth. The cross-sectional analysis on Plates 59 and 60 did not indicate a change in area through the weir field as compared to the base test. Flow visualization indicated that most of the flow patterns remained concentrated near the right descending bank.

CONCLUSIONS

The following is a summary of the findings and recommendations of the Morgan City/Berwick Bay Micro Model Study.

1. Evaluation and Summary of the Model Tests

- The only river training structures model tested to solve the problems in the Morgan City/Berwick Bay reach was of the underwater variety. It was required that any design solution could not restrict vessel movement between both banklines of the river. Therefore, traditional dike structures were not considered feasible. All the weir designs studied in the micro model were tested at depths suitable for the passage of tow traffic at all river stages.

- The three primary factors which determined the effectiveness of each design alternative were:
  1. The reduction of the depositional area near the left descending bank between Miles 120.0 and 121.5.
  2. The improvement of the distribution of flow patterns across the channel width and through the bridge openings.
  3. The removal of the depositional area along the left descending bank between Miles 120.0 and 120.5 and in the area critical to navigation.

- The model test results of design alternatives B, C, C-2, D, D-2, E, F, and G provided the most positive impact to reducing the depositional area near the left descending bankline. These designs proved successful at significantly increasing depths through this area.

- The flow visualization results of design alternatives A, B, C, D, F, and G indicated the most positive impact to improving flow conditions. These designs proved successful at the redistribution of flow across the channel width and through the bridge openings.

- The model test results of design alternatives C, D, E, F, and G provided the most positive impact to the reduction of the depositional area along the left descending bank between Miles 120.0 and 120.5 and in the area critical to navigation. These designs proved successful at substantially removing this portion of the bar to provide improved downbound navigation.

- The model results of the Alternative C and D designs indicated that the effects to sediment transport and flow were very similar to each other. The Alternative D design tested the same structures in Alternative C but without the upstream most weir. A comparison of the bed and flow patterns induced by Alternatives C and D suggested that this structure had nearly an insignificant effect within the study reach. Therefore, Weir 1 was considered unnecessary to the design.

- The design alternatives that tested weirs at an elevation of –20 feet MLG demonstrated a considerable reduction in the depth of the scour holes formed by the piers of the railroad bridge. The reduction of depth in this area indicated a corresponding reduction in the local velocities and the turbulence generated by the bridge piers.

- A reduction of the height of the weirs to an elevation of –35 feet MLG in Alternatives C-2, D-2, F-2, and G-2 significantly reduced the impact of these structures on bed forms and flow patterns. These alternatives also had minimal effects on decreasing the depth of the scour holes downstream of the railroad bridge.

Therefore, alternatives C, D, F, and G were the only designs that generated improvements for all three criteria established previously. Although all four designs significantly reduced the depositional area, Alternatives F and G demonstrated more substantial improvements to the bed forms than the Alternative C and D designs. The width of the depositional area that remained in the Alternative C and D designs was much greater than the area that remained in the Alternative F and G designs. Alternatives C and D also contained the greatest remaining amount of deposition in the area critical to navigation, between Miles 120.0 and 120.5.

The Alternative F design had the most impact at removing the entire depositional area. However, the flow visualization results of the Alternative G design indicated a slightly greater effect on the distribution of flow patterns across the channel width and through the bridge crossing than the Alternative C, D, and F designs. All four designs demonstrated a significant decrease in the depth of the scour holes downstream of the railroad bridge, which signified a reduction of velocity and turbulence in this area for a general improvement of flow conditions.

2. Recommendations

- Although the Alternative C and D designs indicated positive results, the designs were based on the use of weirs angled perpendicular to the flow. This type of design has not been commonly used as a typical river training structure and therefore the impacts on navigation are relatively unknown. Weirs, like those in the Alternatives F and G designs, are angled upstream and have been used extensively to reduce point bar deposition and improve navigation conditions on the Middle Mississippi River since 1990. The hydraulic effects of these structures on moving vessels are well known.

- Overall, the weir configuration in the Alternative G design proved to be the most effective measure to alleviate a majority of sedimentation and flow problems through this reach of river. Of all the designs studied, the

Alternative G bathymetry results demonstrated the smoothest transition of bed forms from the upstream crossing into the straight reach of river. The results also indicated a complete shift of the thalweg towards the center of the channel at the upstream portion of the reach and an increase in cross-sectional area throughout the weir field. The flow visualization results indicated the greatest improvement of flow distribution across the channel width and the greatest reduction of flow directed towards the right descending bank. The length, angle, position, and elevation of each weir were critical to achieve the desired bed forms and flow patterns.

- The bendway weir configuration in Alternative F also proved to have nearly the same positive effects as the Alternative G design. However, this design would be much more costly to construct because of the additional weirs in the design.

- The model indicated that weir designs constructed at a low elevation did not generate the positive effects of the same structures built at a higher elevation. The model demonstrated that the weirs must be constructed at a higher elevation to have the proper influence on the bed and flow of the river. Although the structure elevations of the recommended weir designs are high in respect to the channel depth, the structures do not impede flow. The model indicated that the cross-sectional area with the weirs in place increases as compared to the base test. After weirs are typically constructed in the thalweg of a river, the bar on the inside of the bend is removed and the cross-sectional area is recovered or increased. Therefore, the channel retains its capacity to carry higher flows without increasing stage.

Therefore, the Alternative G weir design, at an elevation of –20 feet MLG, is the recommended solution as a means to decrease the depositional areas and improve flow patterns through Berwick Bay.

3. Interpretation of Model Test Results

In the interpretation and evaluation of the results of the tests conducted, it should be remembered that the results of these model tests were qualitative in nature. Any hydraulic model, whether physical or numerical, is subject to biases introduced as a result of the inherent complexities that exist in the prototype. Anomalies in actual hydrographic events, such as prolonged periods of high or low flows are not reflected in these results, nor are complex physical phenomena, such as the existence of underlying rock formations or other non-erodible variables. Flood flows were not simulated in this study.

This model study was intended to serve as a tool for the river engineer to guide in assessing the general trends that could be expected to occur in the actual river from a variety of imposed design alternatives. Measures for the final design may be modified based upon engineering knowledge and experience, real estate and construction considerations, economic and environmental impacts, or any other special requirements.

FOR MORE INFORMATION

For more information about micro modeling or the Applied River Engineering Center, please contact Robert Davinroy or David Gordon at:

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Phone: (314) 263-4714 or (314) 263-4230
Fax: (314) 263-4166

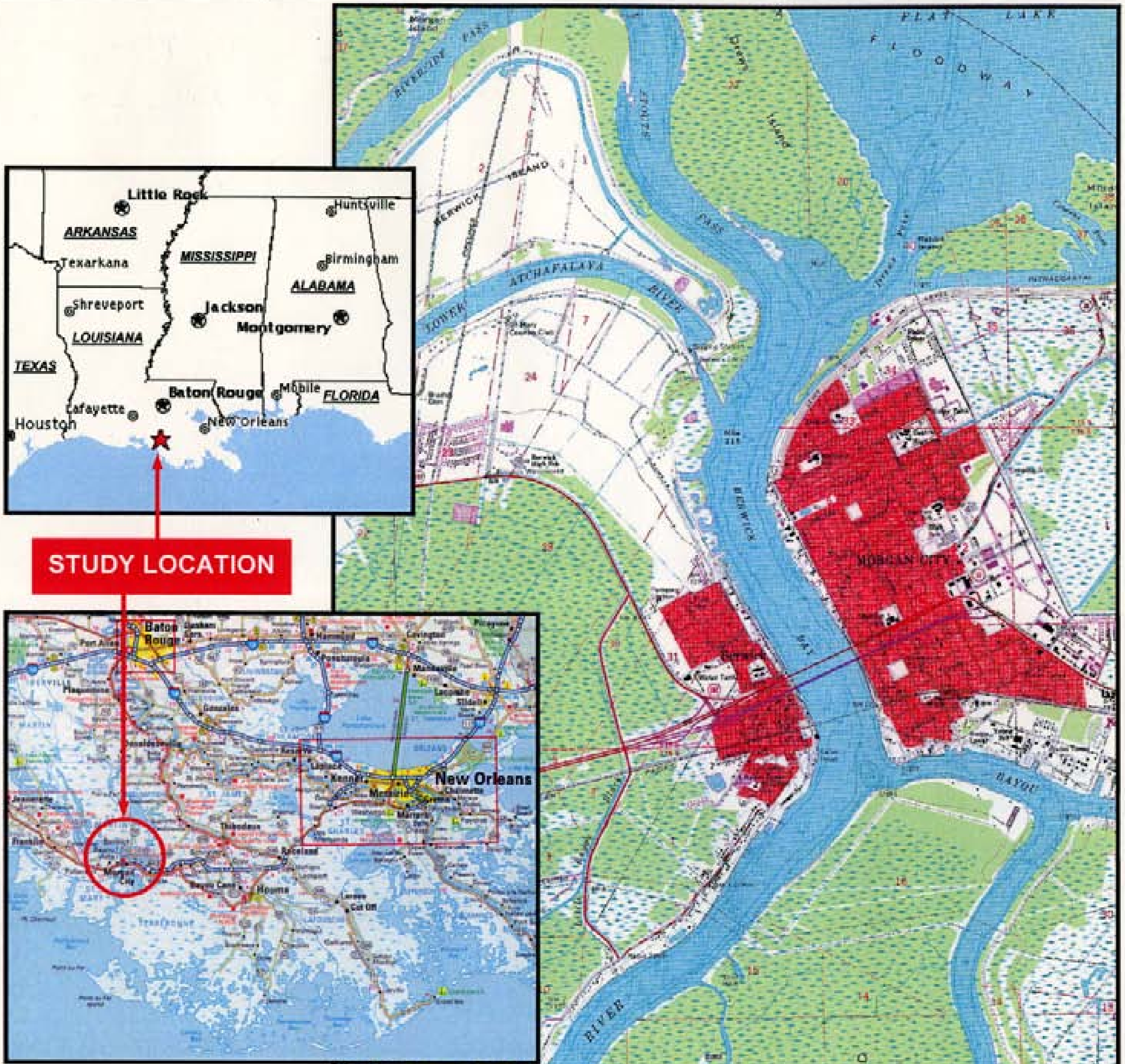
E-mail: Robert.D.Davinroy@mvs02.usace.army.mil
David.Gordon@mvs02.usace.army.mil

Or you can visit us on the World Wide Web at:

http://www.mvs.usace.army.mil/engr/river/river.htm

APPENDIX OF PLATES

Plate Numbers 1 through 60 follow:



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

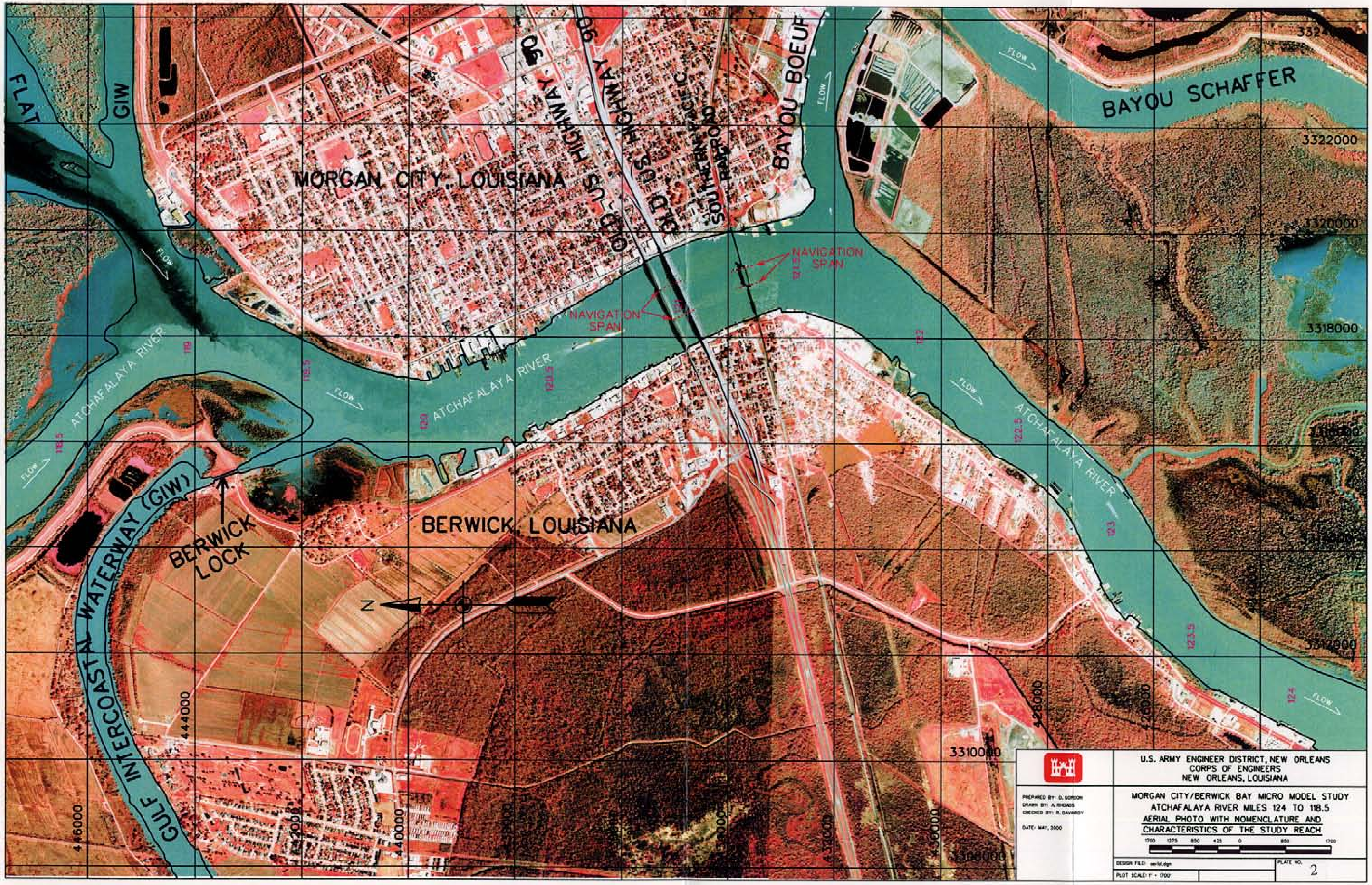
PREPARED BY: E. RIFF
CHECKED BY: D. GORDON

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

LOCATION MAP AND USGS QUAD OF THE STUDY REACH

LOCVIV.PUB

PLATE NO.
1



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NEW ORLEANS, LOUISIANA

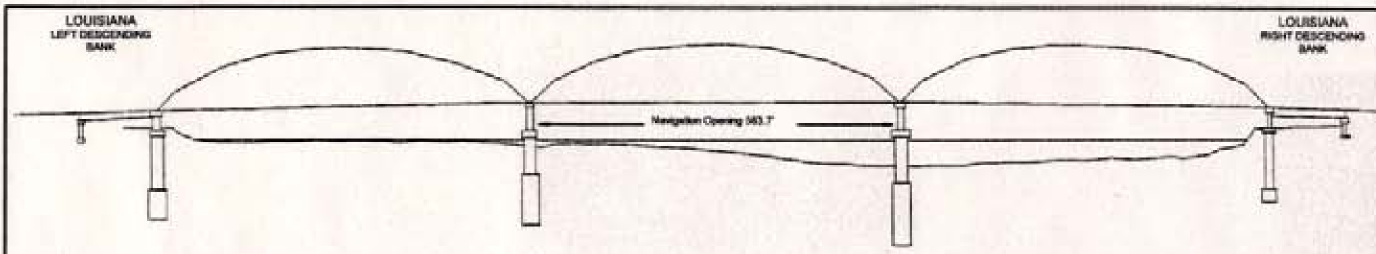
PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVAROY

DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
AERIAL PHOTO WITH NOMENCLATURE AND CHARACTERISTICS OF THE STUDY REACH

1700 1275 850 425 0 850 1700

DESIGN FILE: aerial.dgn
PLOT SCALE: 1" = 1700'
PLATE NO. 2



VERTICAL CLEARANCE = 57.3' MINUS MORGAN CITY GAGE 03780
LOWEST STEEL = 57.3' NGVD

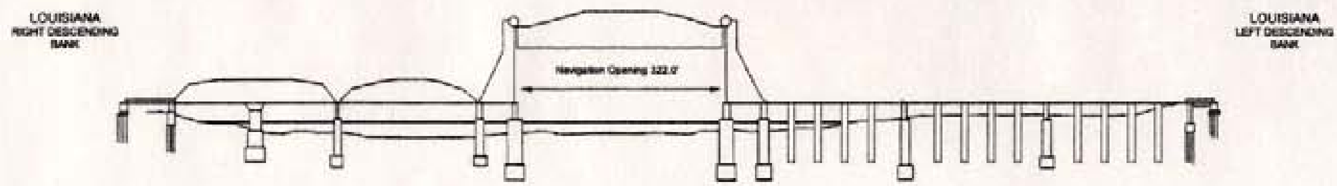
NOT TO SCALE
VIEW FROM UPSTREAM

MORGAN CITY U.S. HWY. NO. 90 BRIDGE
ATCHAFALAYA 1998 RIVER MILE 121.0
CLEARANCE DATA

VERTICAL CLEARANCE = 85.0' MINUS MORGAN CITY GAGE 03780
LOWEST STEEL = 85.0' NGVD

NOT TO SCALE
VIEW FROM DOWNSTREAM

MORGAN CITY U.S. HWY. NO. 90 BRIDGE
ATCHAFALAYA 1998 RIVER MILE 121.1
CLEARANCE DATA



VERTICAL CLEARANCE = 41.1' MINUS MORGAN CITY GAGE 03780
LOWEST STEEL = 41.1' NGVD

NOT TO SCALE
VIEW FROM DOWNSTREAM

MORGAN CITY S.P.(T&N.O.) R.R. BRIDGE
ATCHAFALAYA 1998 RIVER MILE 121.3
CLEARANCE DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: A. Rhoads
CHECKED BY: R. Dastmay

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 247 TO 239

BRIDGE CROSSING DIAGRAMS

BRIDGES.PUB

PLATE NO.
3

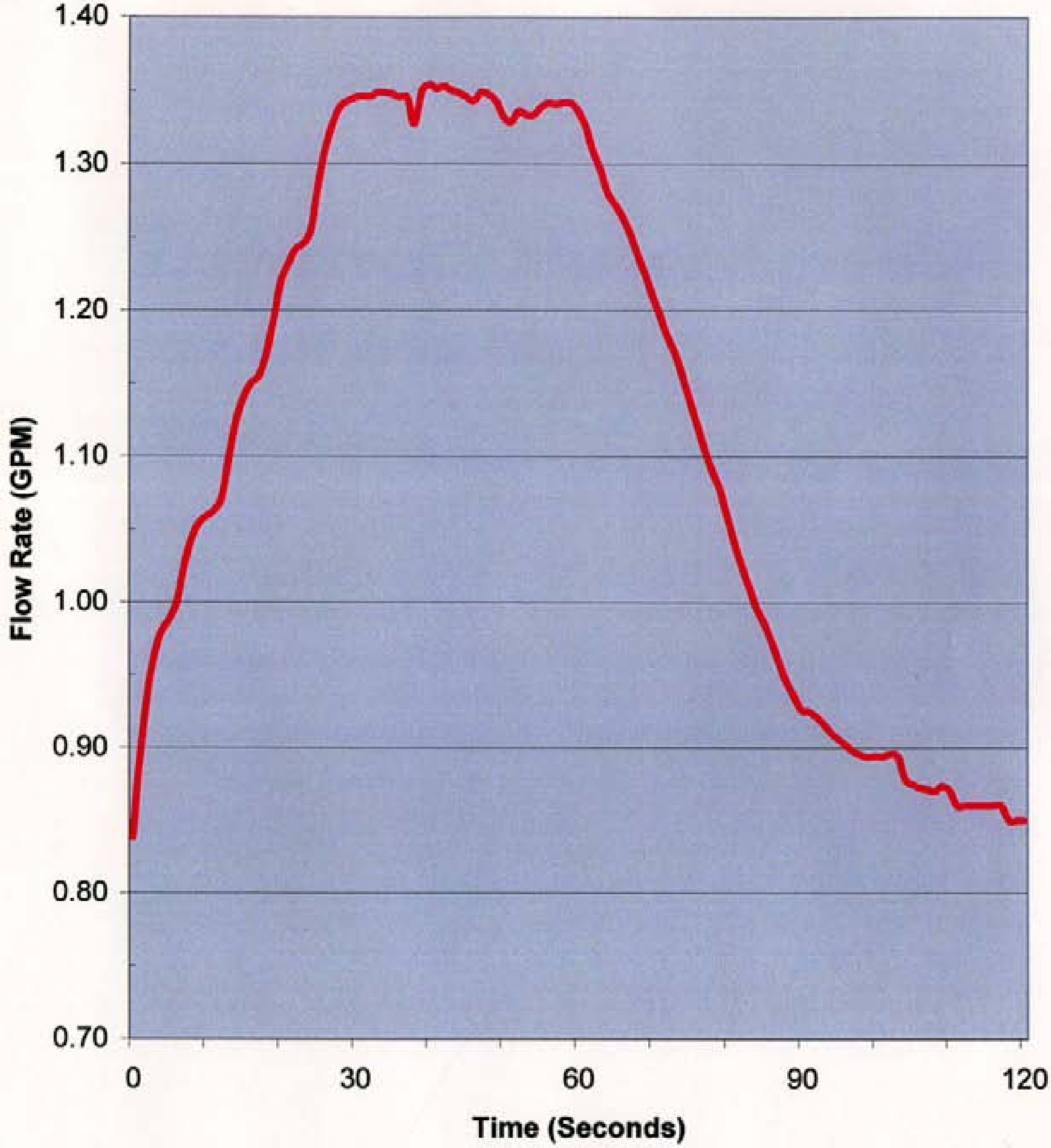
TOP PHOTO: Looking Downstream at the Lift Span Railroad Bridge from the Berwick, Louisiana Bankline.

BOTTOM PHOTO: Looking Westward at the Lift Span Railroad Bridge From Upstream at the Morgan City Bankline.

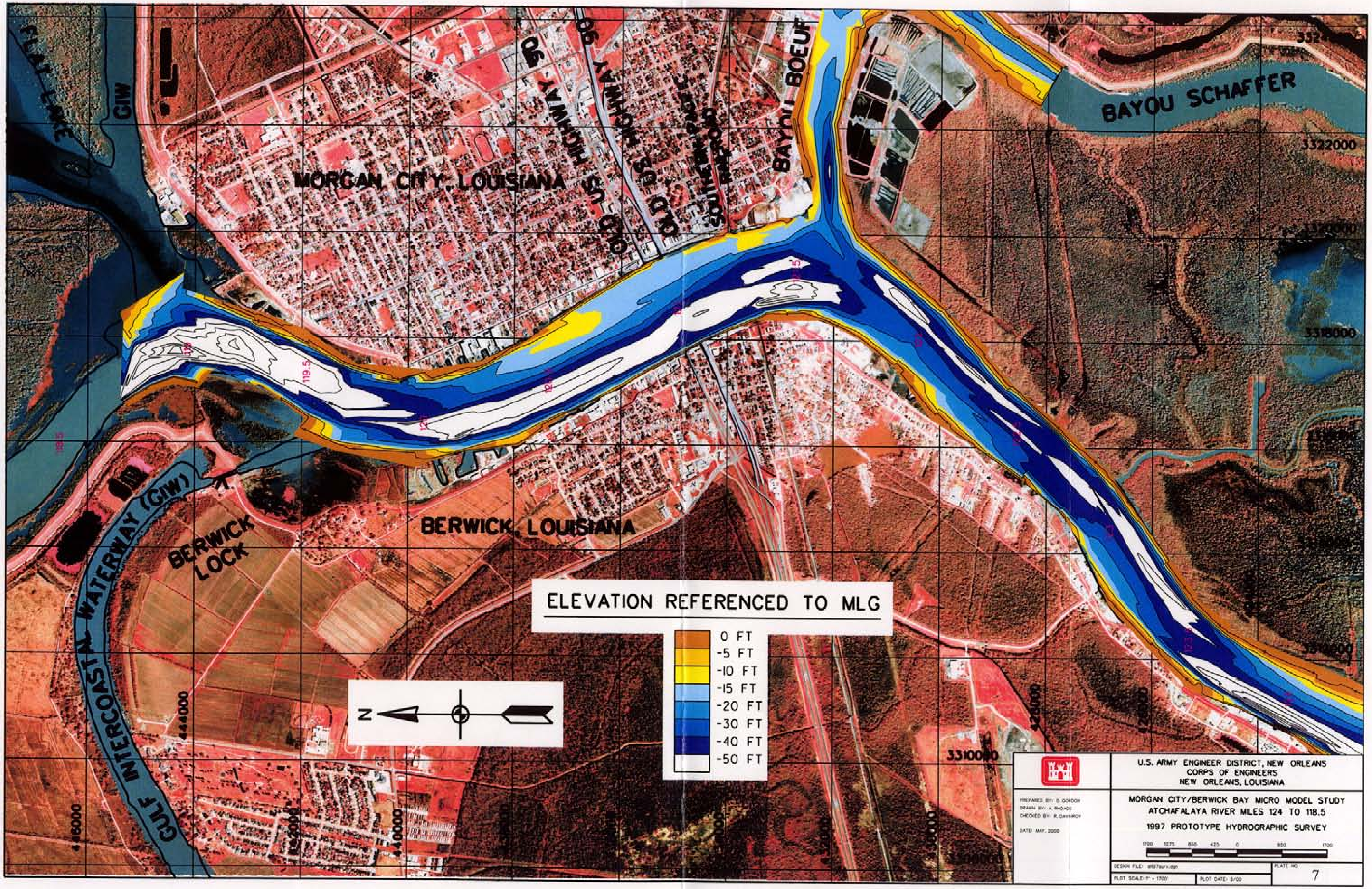
	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS **CORPS OF ENGINEERS** **NEW ORLEANS, LOUISIANA**
PREPARED BY: A. Rhoads CHECKED BY: R. Deslnoy	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 PHOTOGRAPHS OF THE LIFT SPAN RAILROAD BRIDGE
	BRIDGES.PUB — PLATE NO. 4

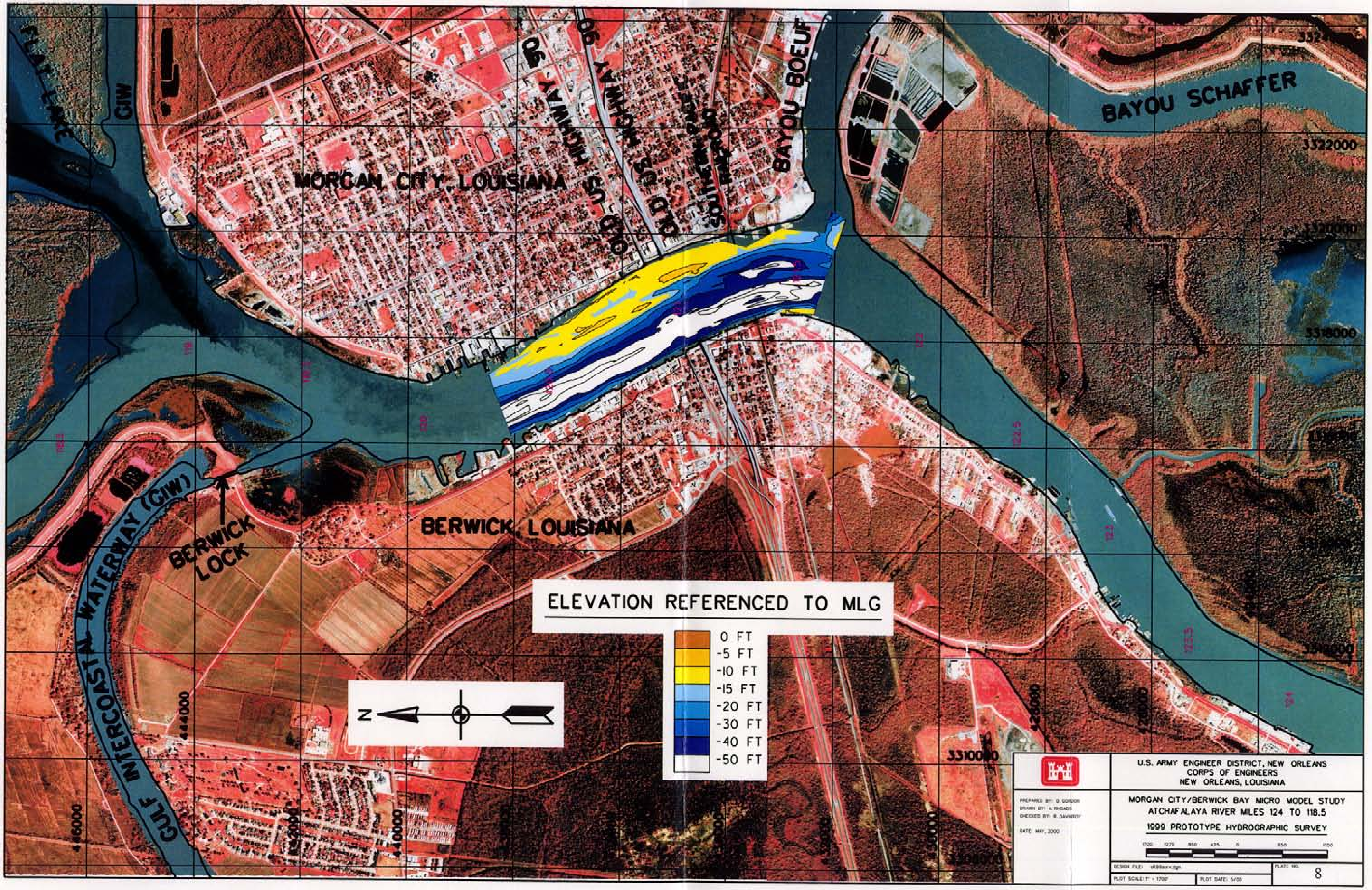
	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS NEW ORLEANS, LOUISIANA	
PREPARED BY: E. RIFF CHECKED BY: D. GORDON	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 PHOTOGRAPH OF THE MORGAN CITY/BERWICK BAY MICRO MODEL	
	MICRO MODEL.PUB	PLATE NO. 5

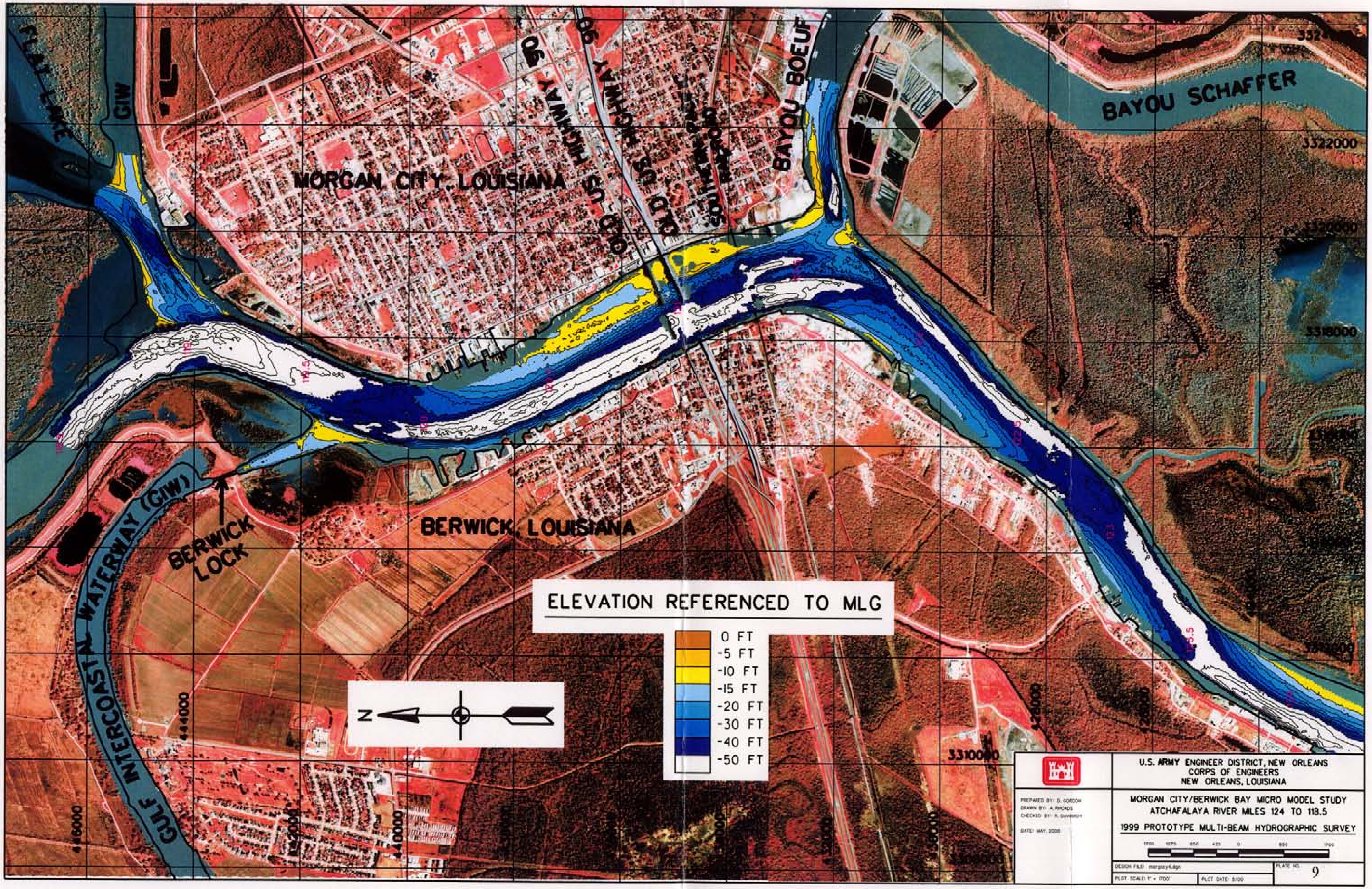
Typical Micro Model Hydrograph



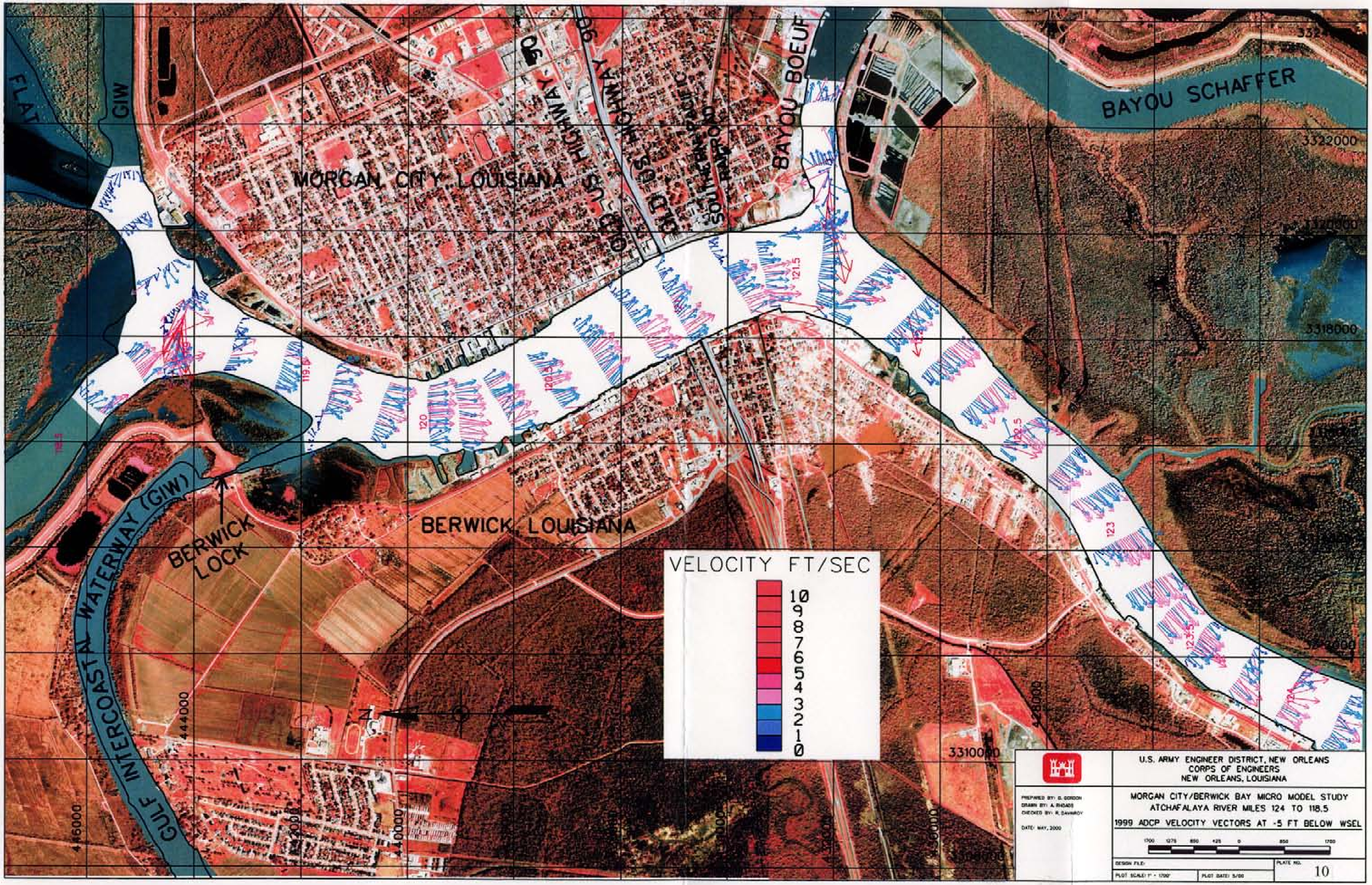
	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS **CORPS OF ENGINEERS** **NEW ORLEANS, LOUISIANA**
PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 <u>TYPICAL MICRO MODEL HYDROGRAPH</u>
	MC HYDROGRAPH.PUB
	PLATE NO. 6


BAYOU SCHAFFER
MORGAN CITY, LOUISIANA
OLD US. HIGHWAY 90
OLD U.S. HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
GIW
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3310000
444000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
1997 PROTOTYPE HYDROGRAPHIC SURVEY
PLATE NO.
7

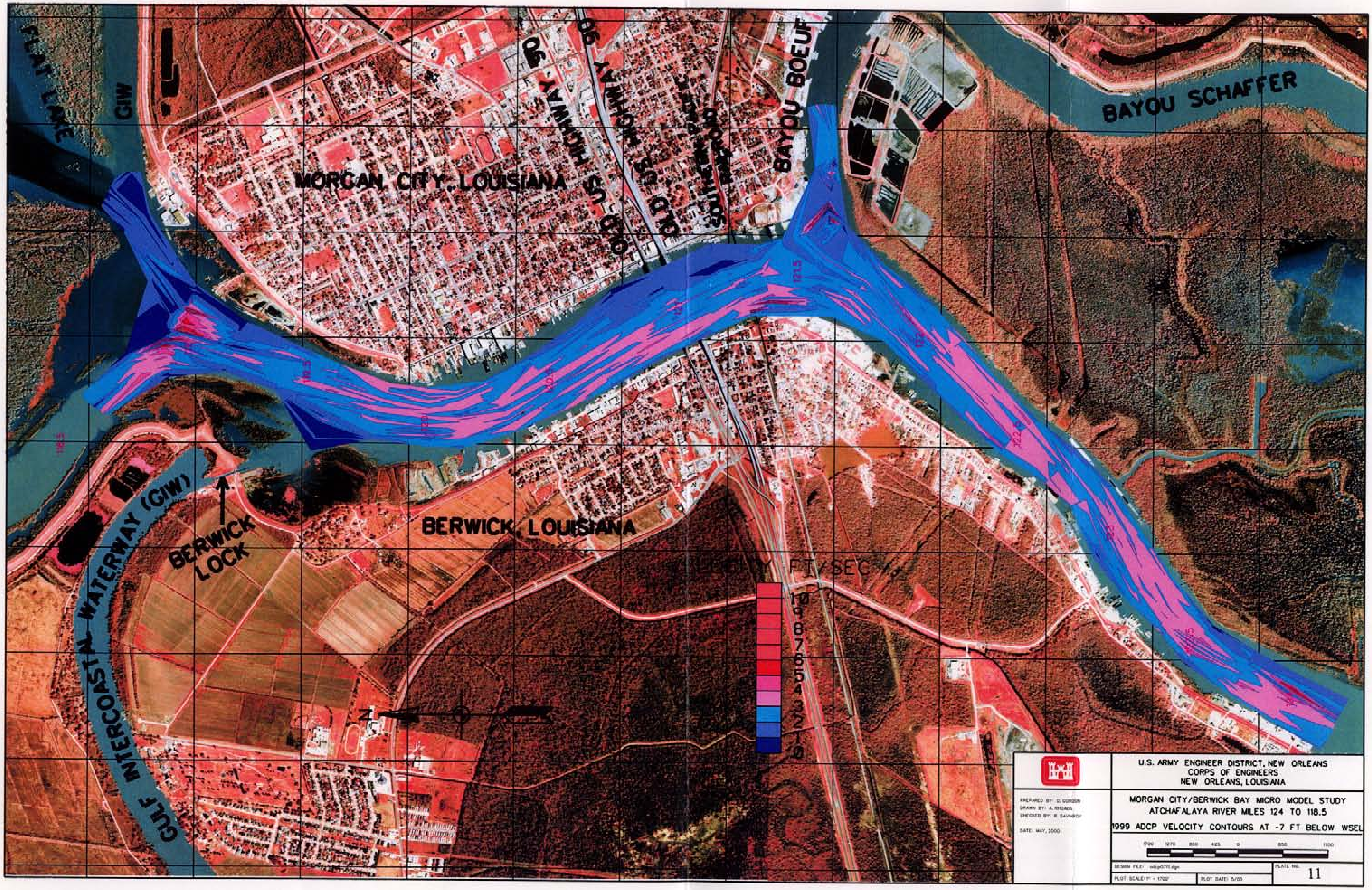

MORGAN CITY, LOUISIANA
BERWICK, LOUISIANA
BAYOU SCHAFFER
BAYOU BOEUF
SOUTHERN PACIFIC RAILROAD
OLD US HIGHWAY 90
OLD US HIGHWAY 90
US HIGHWAY 90
FLAT LAKE
GIW
GULF INTERCOASTAL WATERWAY (GIW)
BERWICK LOCK
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3318000
3310000
444000
446000
440000
428000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
DATE: MAY, 2000
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
1999 PROTOTYPE HYDROGRAPHIC SURVEY
PLATE NO.
8



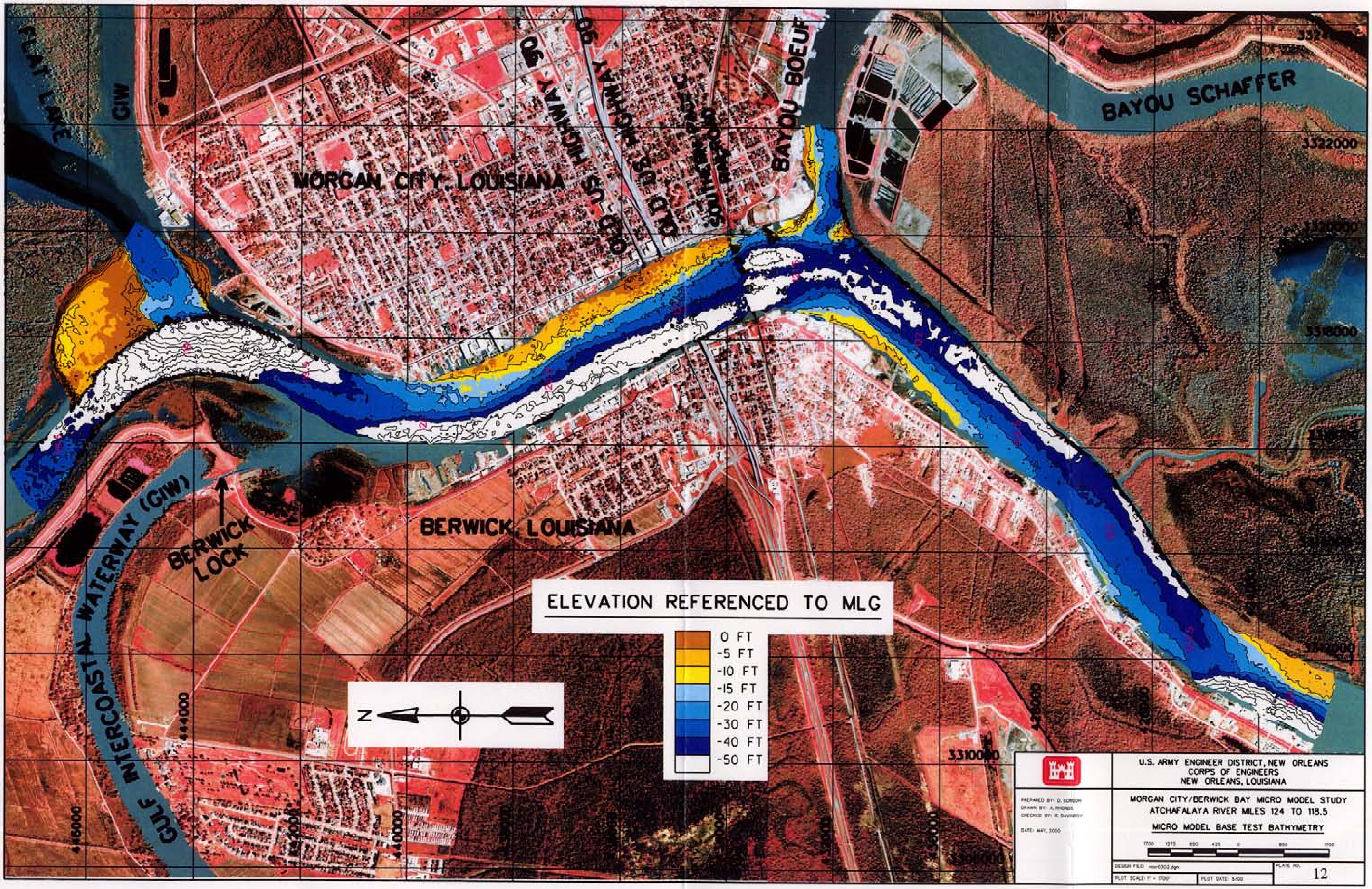
FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
BAYOU SCHAFFER
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3318000
3310000
444000
446000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
1999 PROTOTYPE MULTI-BEAM HYDROGRAPHIC SURVEY
PLATE NO.
9

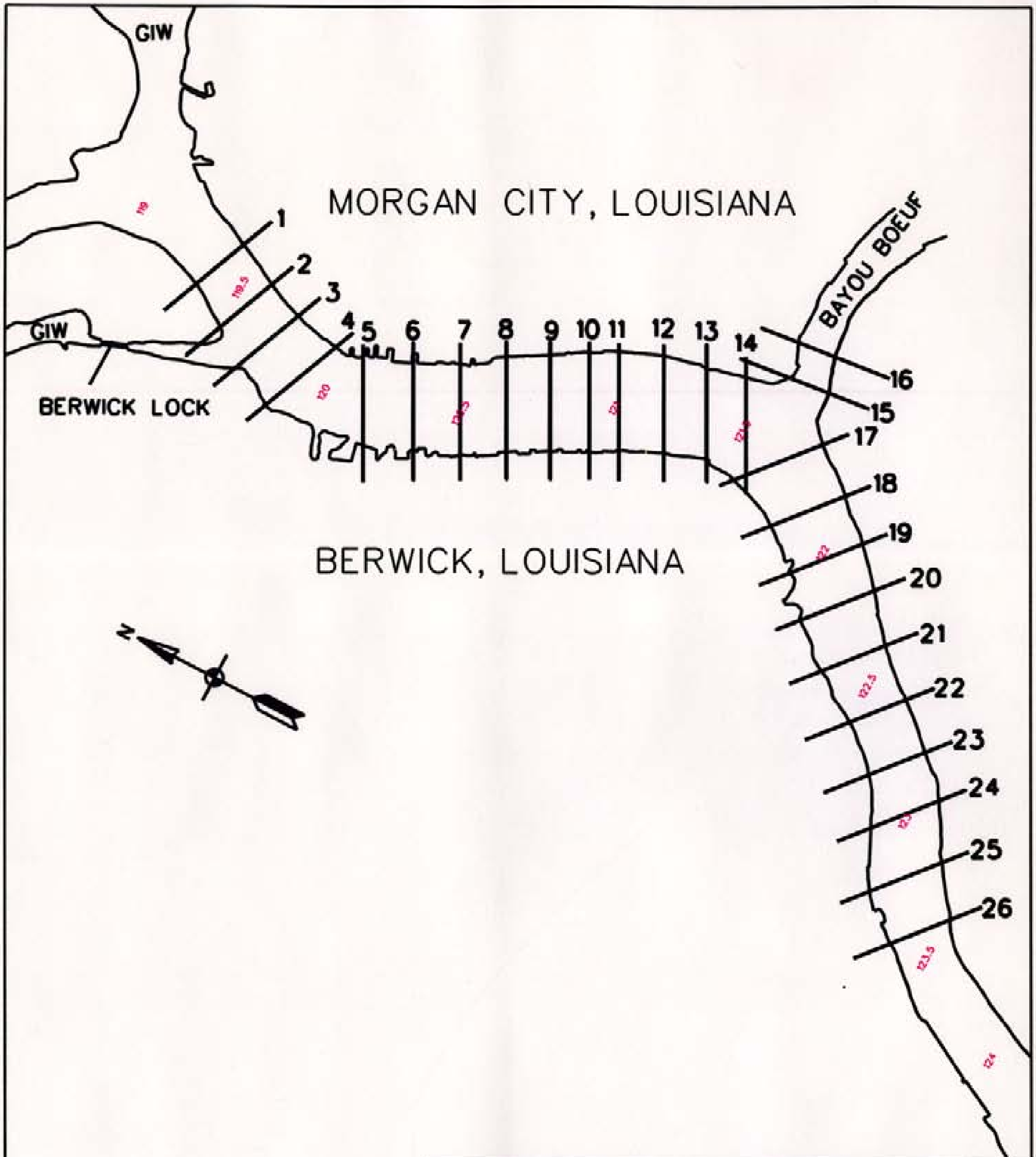


MORGAN CITY, LOUISIANA
BERWICK, LOUISIANA
BAYOU SCHAFFER
BAYOU BOEUF
GIW
FLAT
OLD U.S. HIGHWAY 90
OLD U.S. HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
GULF INTERCOASTAL WATERWAY (GIW)
BERWICK LOCK
VELOCITY FT/SEC
10
9
8
7
6
5
4
3
2
1
0
3322000
3318000
3310000
444000
446000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
1999 ADCP VELOCITY VECTORS AT -5 FT BELOW WSEL
DATE: MAY, 2000
PLATE NO.
10



FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
US HIGHWAY 90
OLD US HIGHWAY 90
BAYOU BOEUF
BAYOU SCHAFFER
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
FT/SEC
10
9
8
7
6
5
4
3
2
1
0
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
1999 ADCP VELOCITY CONTOURS AT -7 FT BELOW WSEL
DATE: MAY, 2000
PLATE NO. 11


FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
BAYOU SCHAFFER
3322000
3320000
3318000
3310000
GULF INTERCOASTAL WATERWAY (GIW)
BERWICK LOCK
BERWICK, LOUISIANA
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
446000
444000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
MICRO MODEL BASE TEST BATHYMETRY
PLATE NO.
12



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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NEW ORLEANS, LOUISIANA

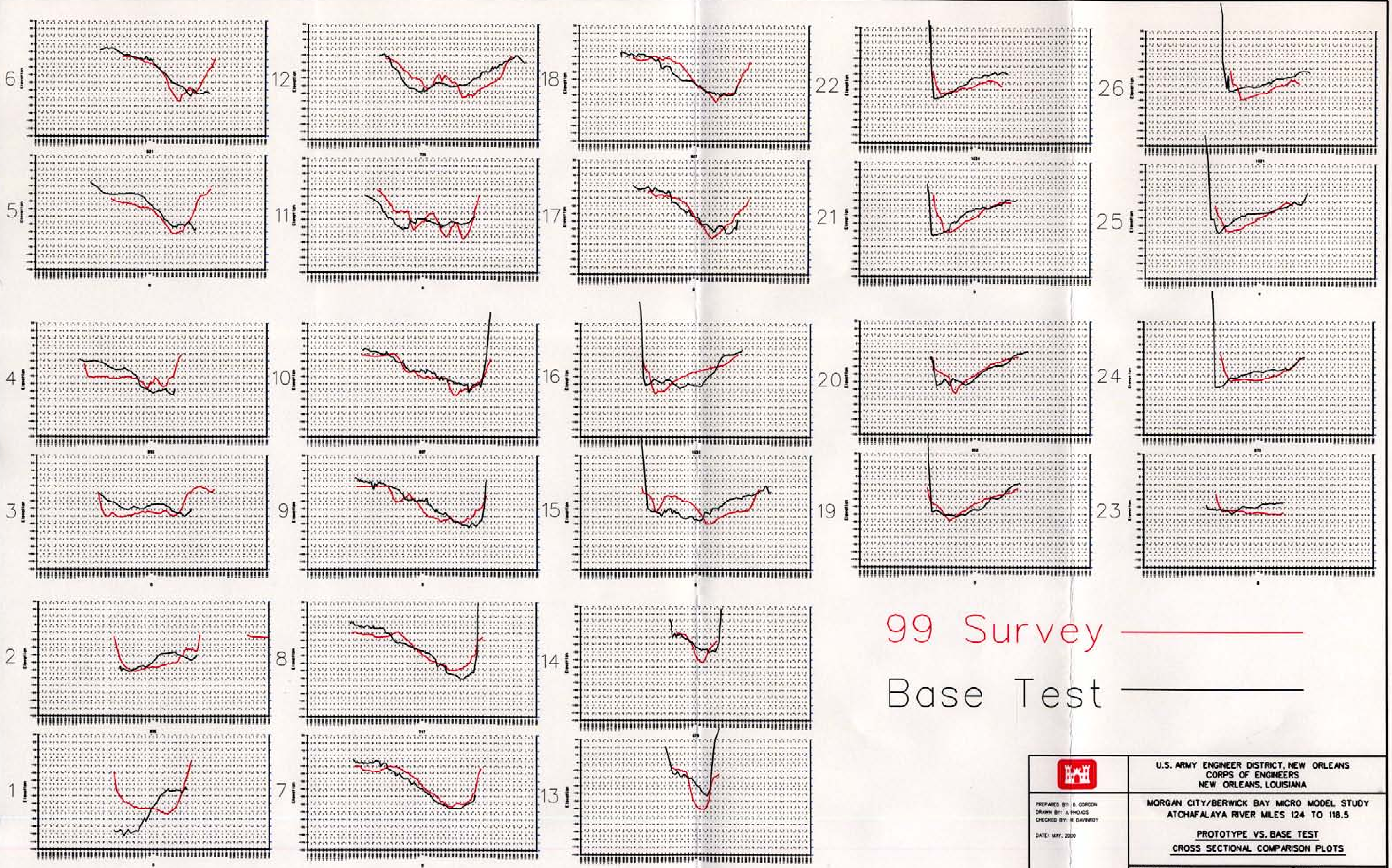
PREPARED BY: D. Gordon
DRAWN BY: D. Gordon
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

CROSS SECTION LOCATIONS

DESIGN FILE: D:\PROJECT\MORGAN CITY\DGN\SECTIONS1.DGN
PLOT SCALE: 1" = 2500'

PLATE NO. 13



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

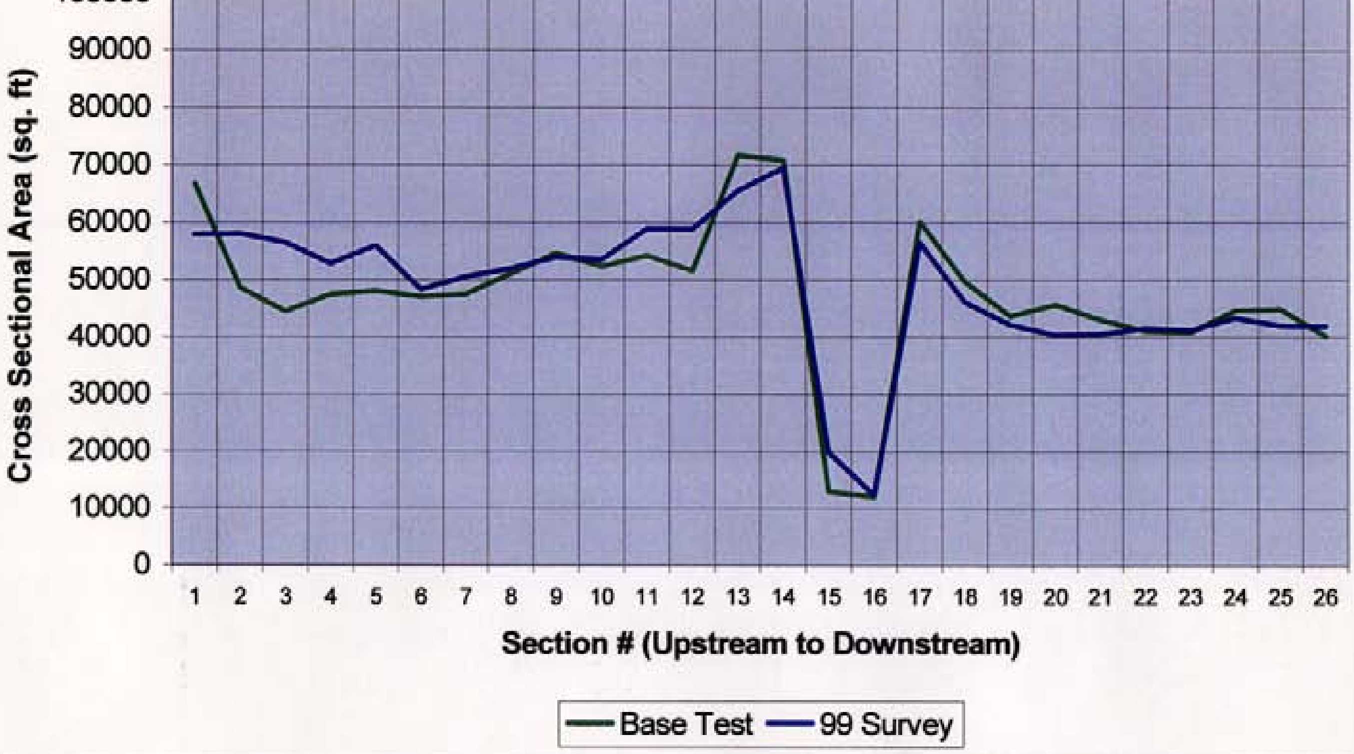
DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

PROTOTYPE VS. BASE TEST
CROSS SECTIONAL COMPARISON PLOTS

DESIGN FILE: xsec11.dgn
PLOT SCALE: 1" - 1200'
PLATE NO. 14

Morgan City Micro Model
Cross Sectional Area Comparison: PROTOTYPE VS BASE TEST



Morgan City Micro Model
Percent Difference in Cross Sectional Area: PROTOTYPE VS. BASE TEST

USING ABSOLUTE VALUES OF THE PERCENT DIFFERENCE AT EACH CROSS SECTION RANGE, THE AVERAGE DIFFERENCE IN CROSS SECTIONAL AREA BETWEEN THE BASE TEST AND THE PROTOTYPE WAS 8.2%.

	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS **CORPS OF ENGINEERS** **NEW ORLEANS, LOUISIANA**
PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 PROTOTYPE VS BASE TEST, CROSS SECTIONAL AREA COMPARISON GRAPHS
	SECTIONS.PUB
	PLATE NO. 15

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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NEW ORLEANS, LOUISIANA

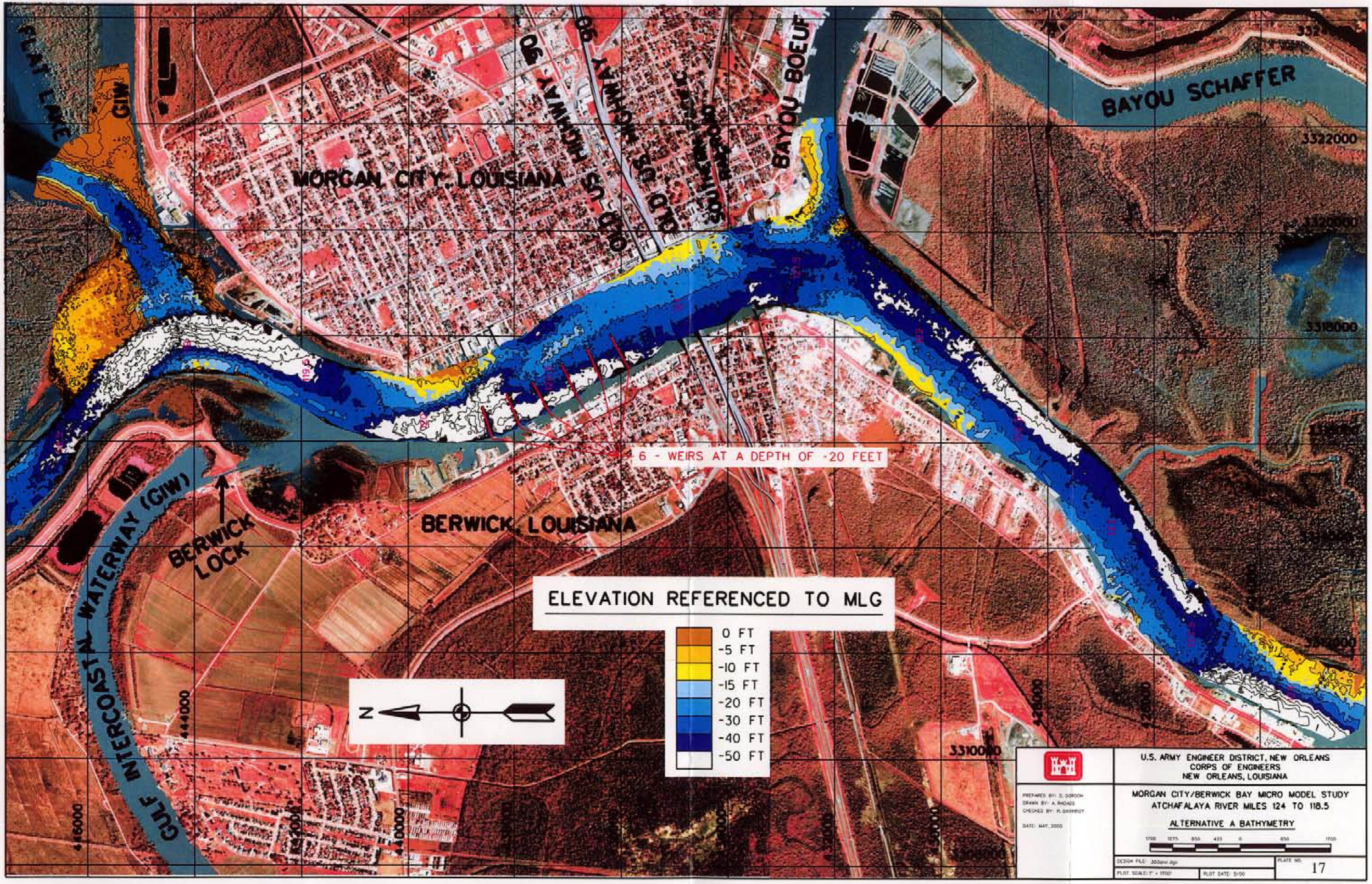
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

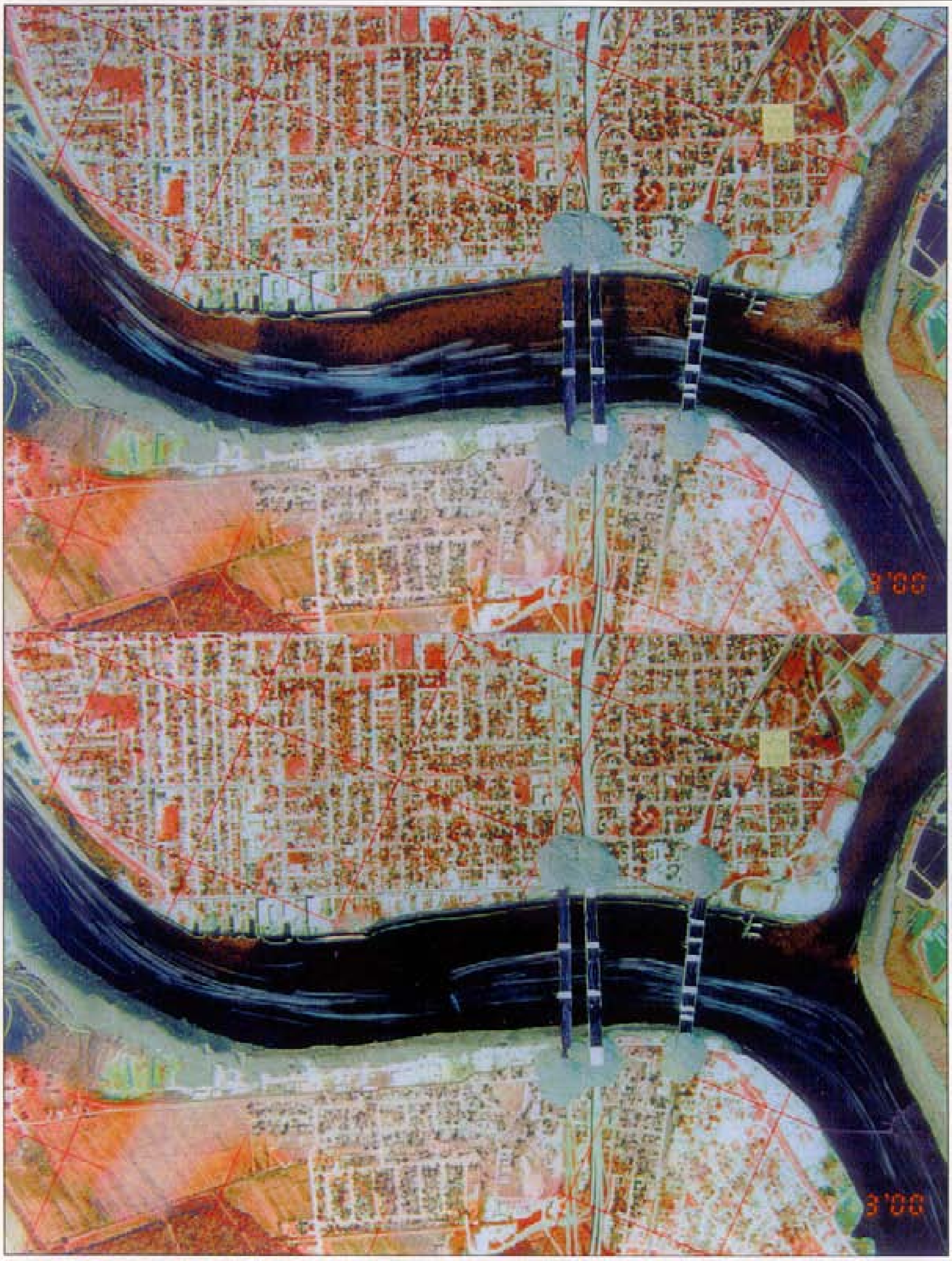
BASE TEST
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
16



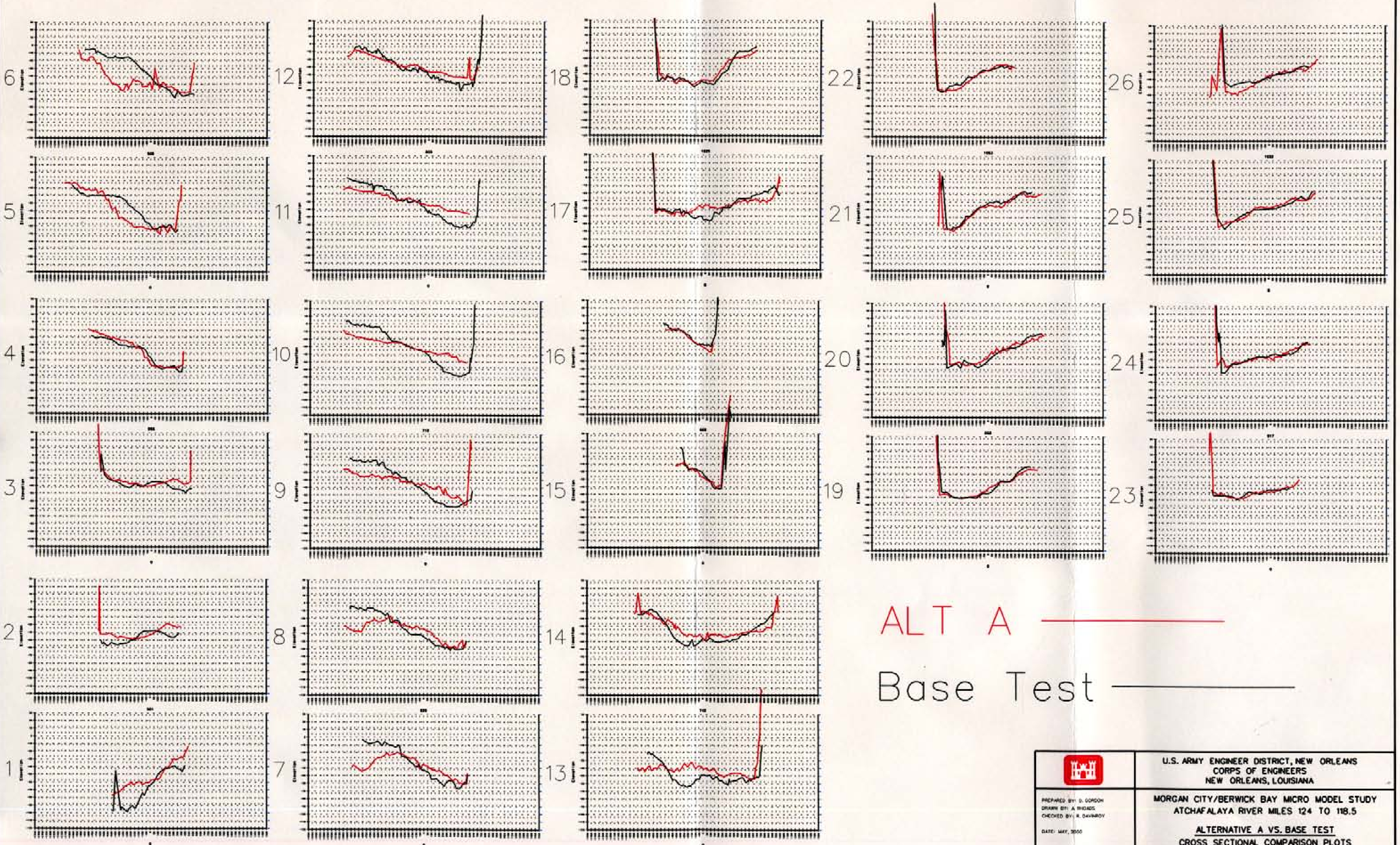
FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
BAYOU SCHAFFER
3322000
6 - WEIRS AT A DEPTH OF -20 FEET
GULF INTERCOASTAL WATERWAY (GIW)
BERWICK LOCK
BERWICK, LOUISIANA
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
444000
3310000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE A BATHYMETRY
PLATE NO.
17



TOP PHOTO: Low Flow

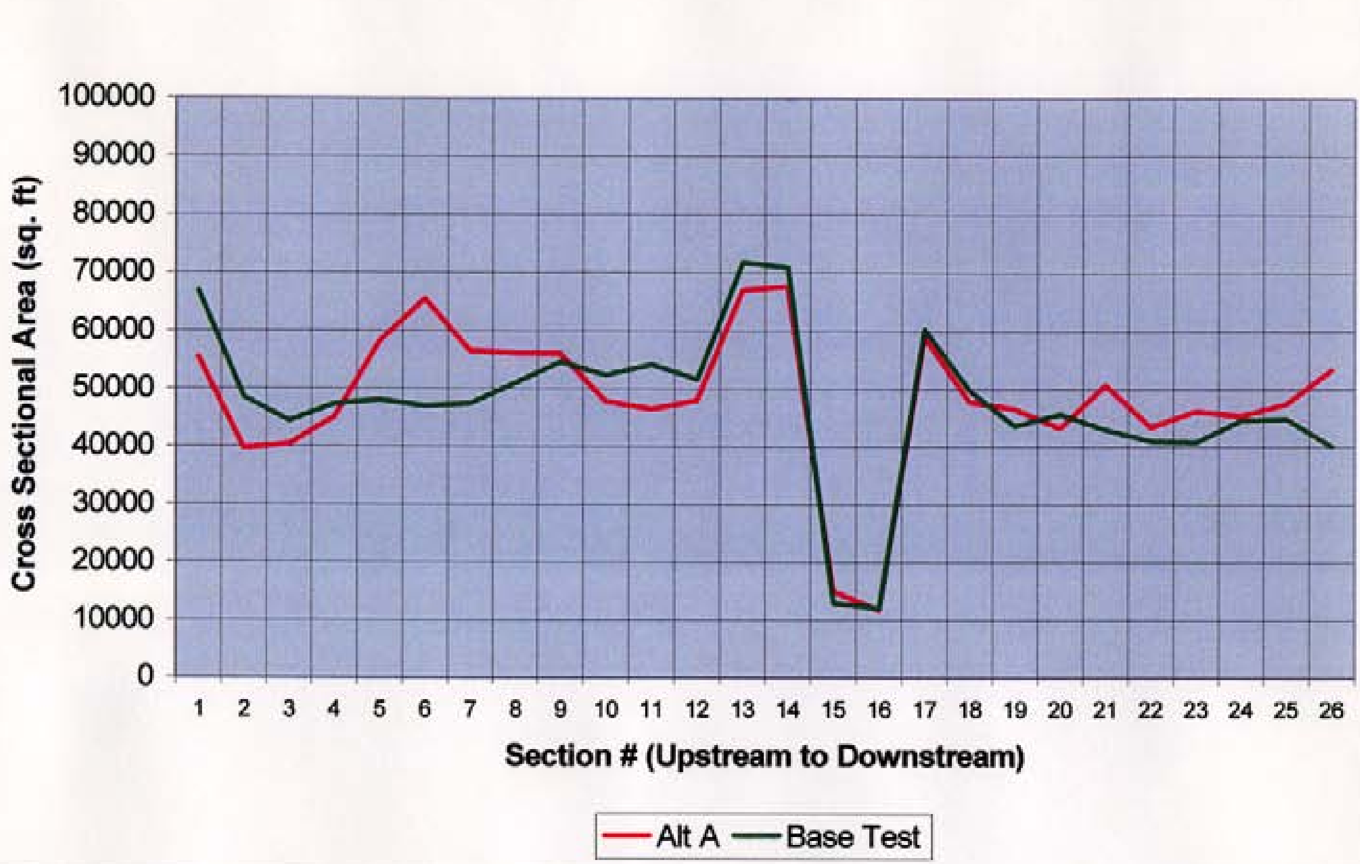
BOTTOM PHOTO: High Flow

	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS **CORPS OF ENGINEERS** **NEW ORLEANS, LOUISIANA**
PREPARED BY: A. Rhoads CHECKED BY: R. Dedroy	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 ALTERNATIVE A FLOW VISUALIZATION
	FLOWVISPLATES.PUB — PLATE NO. 18

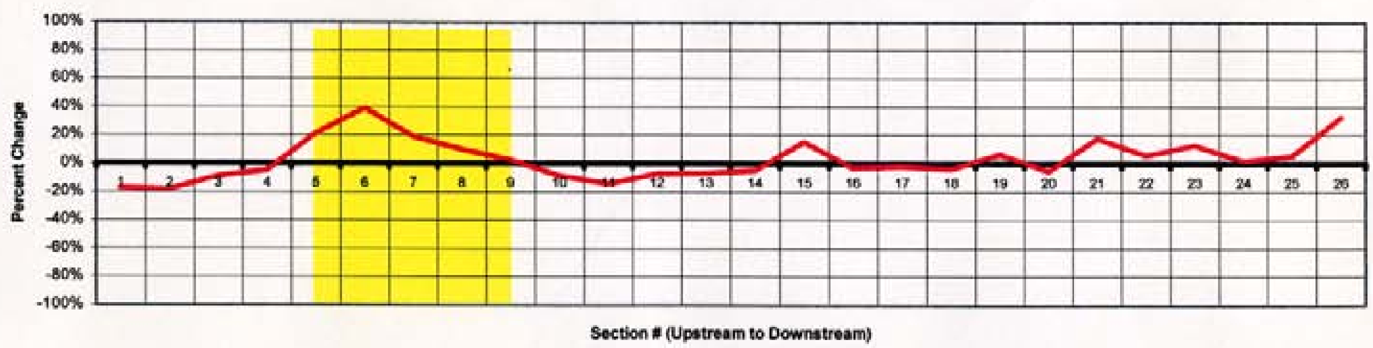


	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS NEW ORLEANS, LOUISIANA
PREPARED BY: D. GORDON DRAWN BY: A. RHOADS CHECKED BY: R. DAVAROY DATE: MAY, 2000	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 <u>ALTERNATIVE A VS. BASE TEST</u> <u>CROSS SECTIONAL COMPARISON PLOTS</u>
	DESIGN FILE: [illegible] PLOT SCALE: 1" = 1200' PLATE NO. 19

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT A



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT A



WITHIN THE WEIR FIELD (SECTIONS 5 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +18.4%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

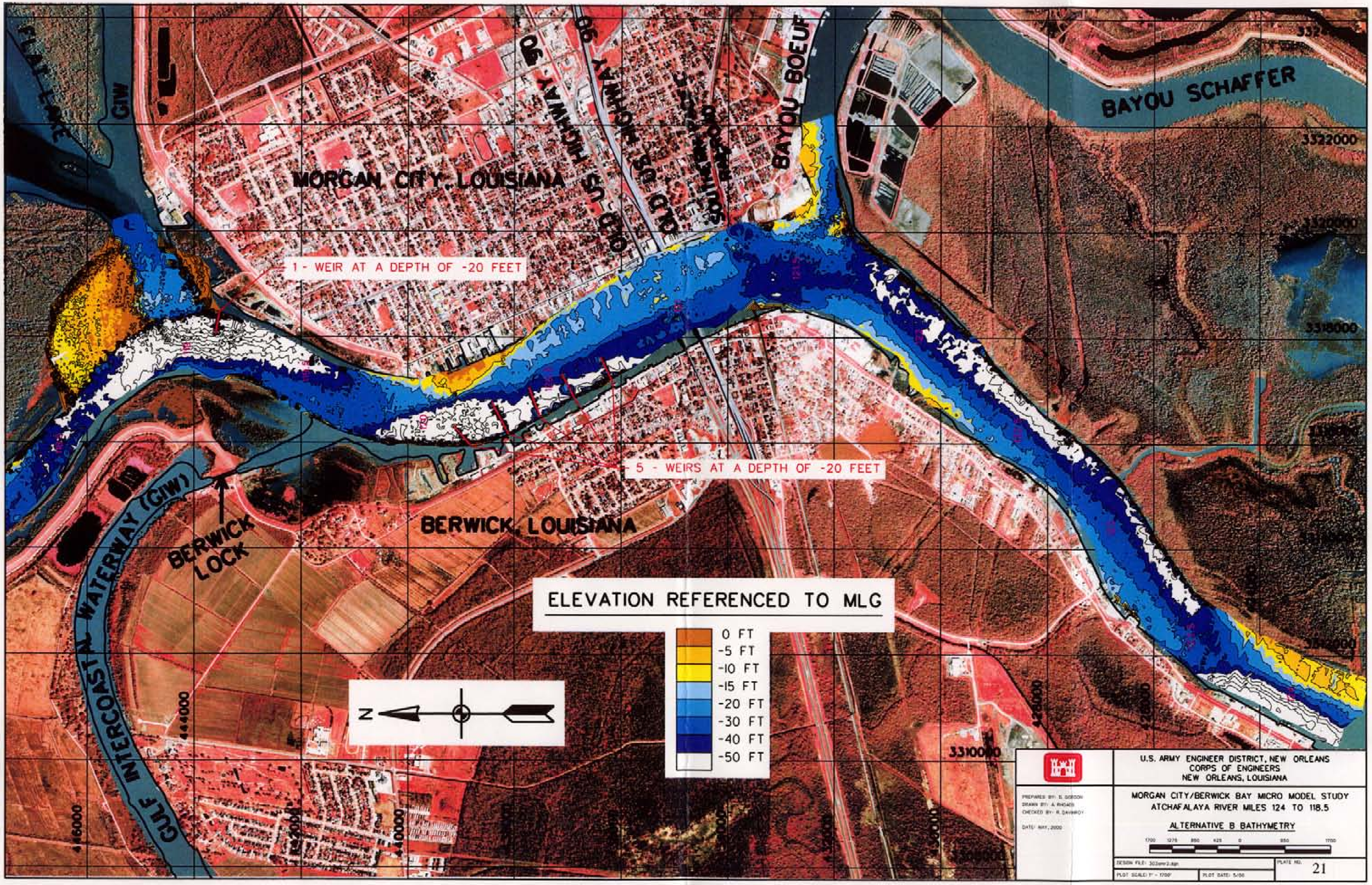
PREPARED BY: A. Rhoads
CHECKED BY: R. Devinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

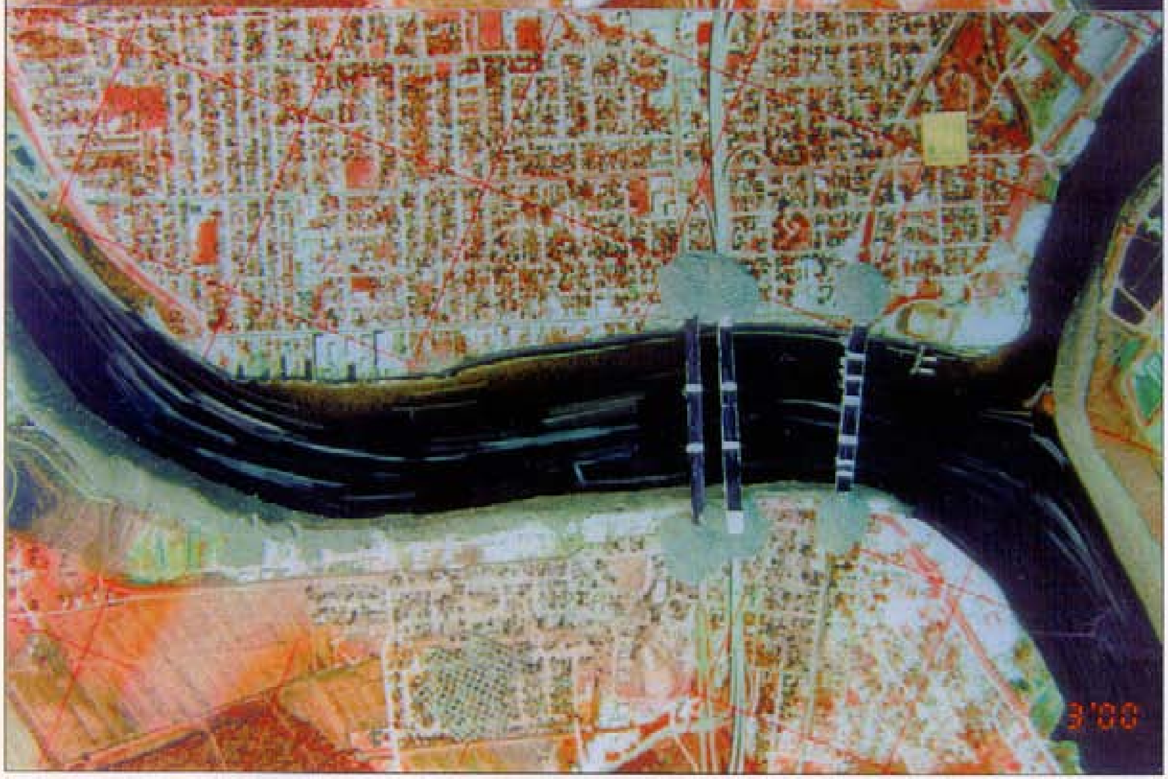
ALTERNATIVE A VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO. 20



FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
BAYOU SCHAFFER
1 - WEIR AT A DEPTH OF -20 FEET
5 - WEIRS AT A DEPTH OF -20 FEET
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3318000
3310000
446000
444000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE B BATHYMETRY
1700 1275 850 425 0 850 1700
PLATE NO. 21



TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

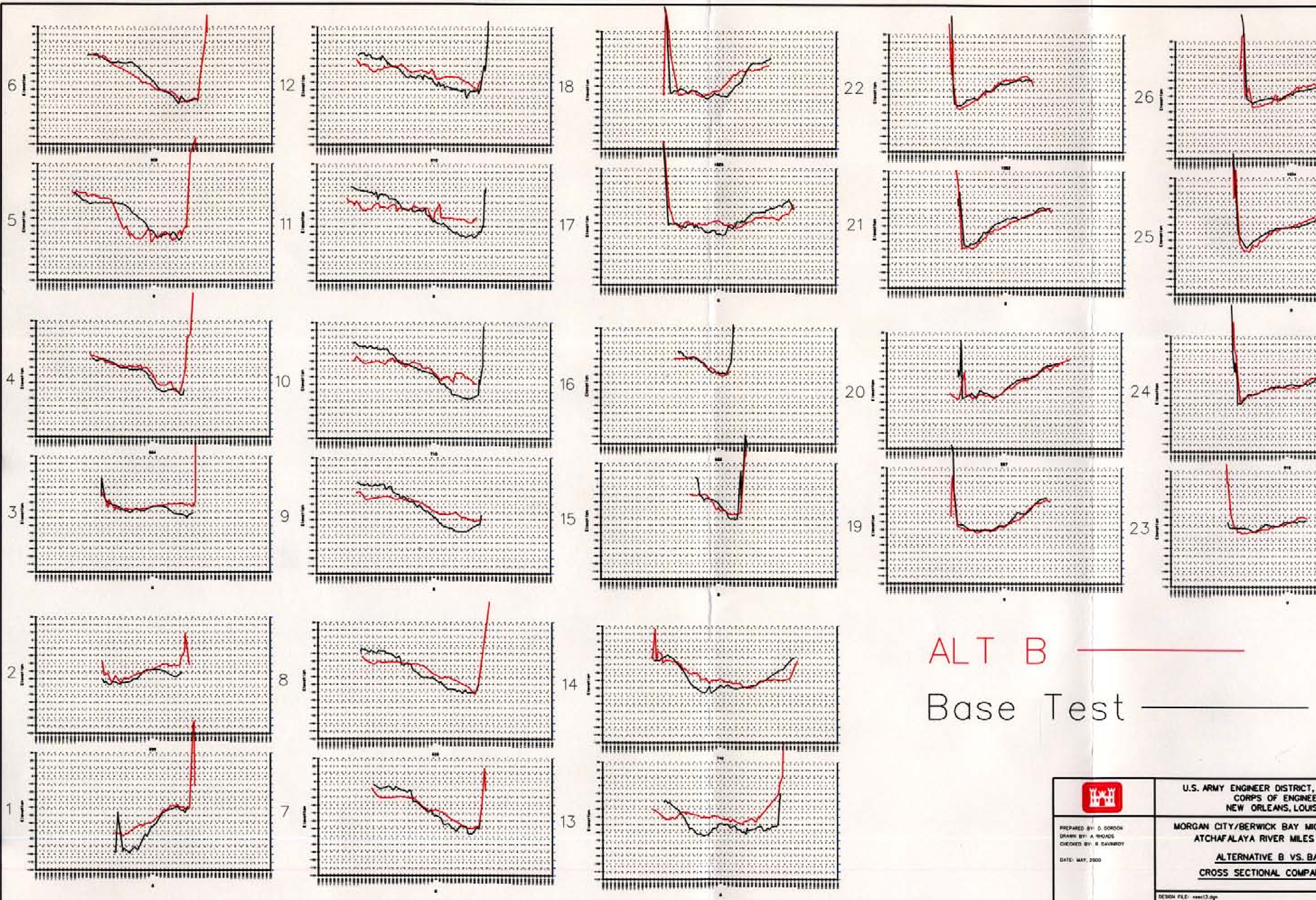
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE B
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
22



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

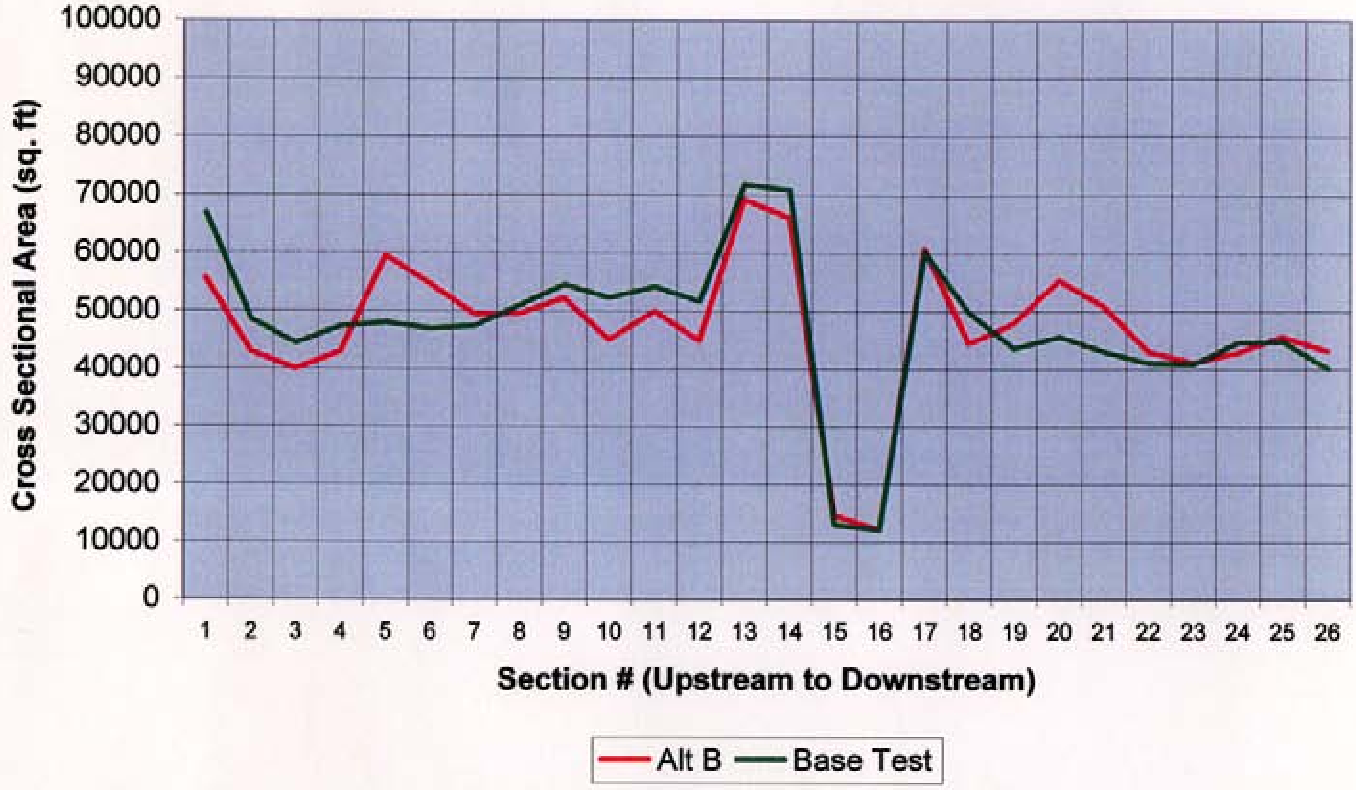
ALTERNATIVE B VS. BASE TEST

CROSS SECTIONAL COMPARISON PLOTS

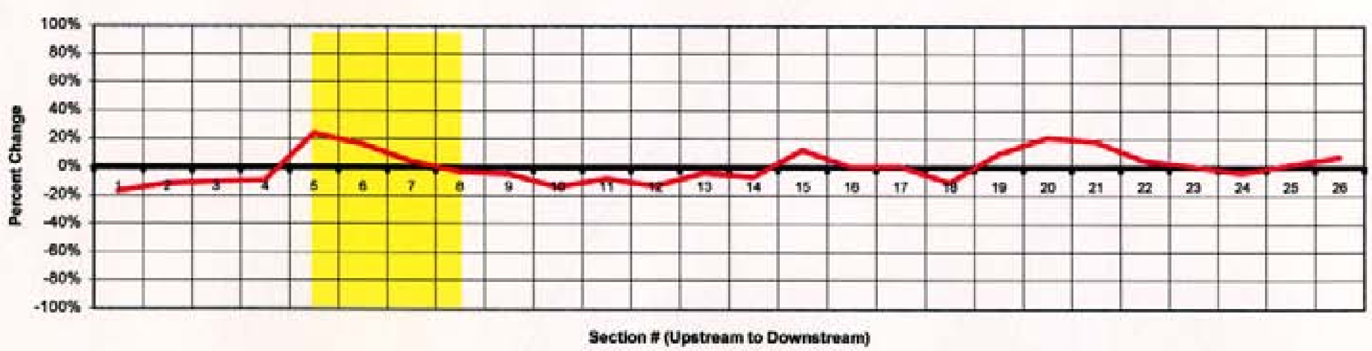
DESIGN FILE: xsect3.dgn
PLOT SCALE: 1" = 1200'

PLATE NO. 23

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT B



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT B



WITHIN THE WEIR FIELD (SECTIONS 5 – 8), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +10.4%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

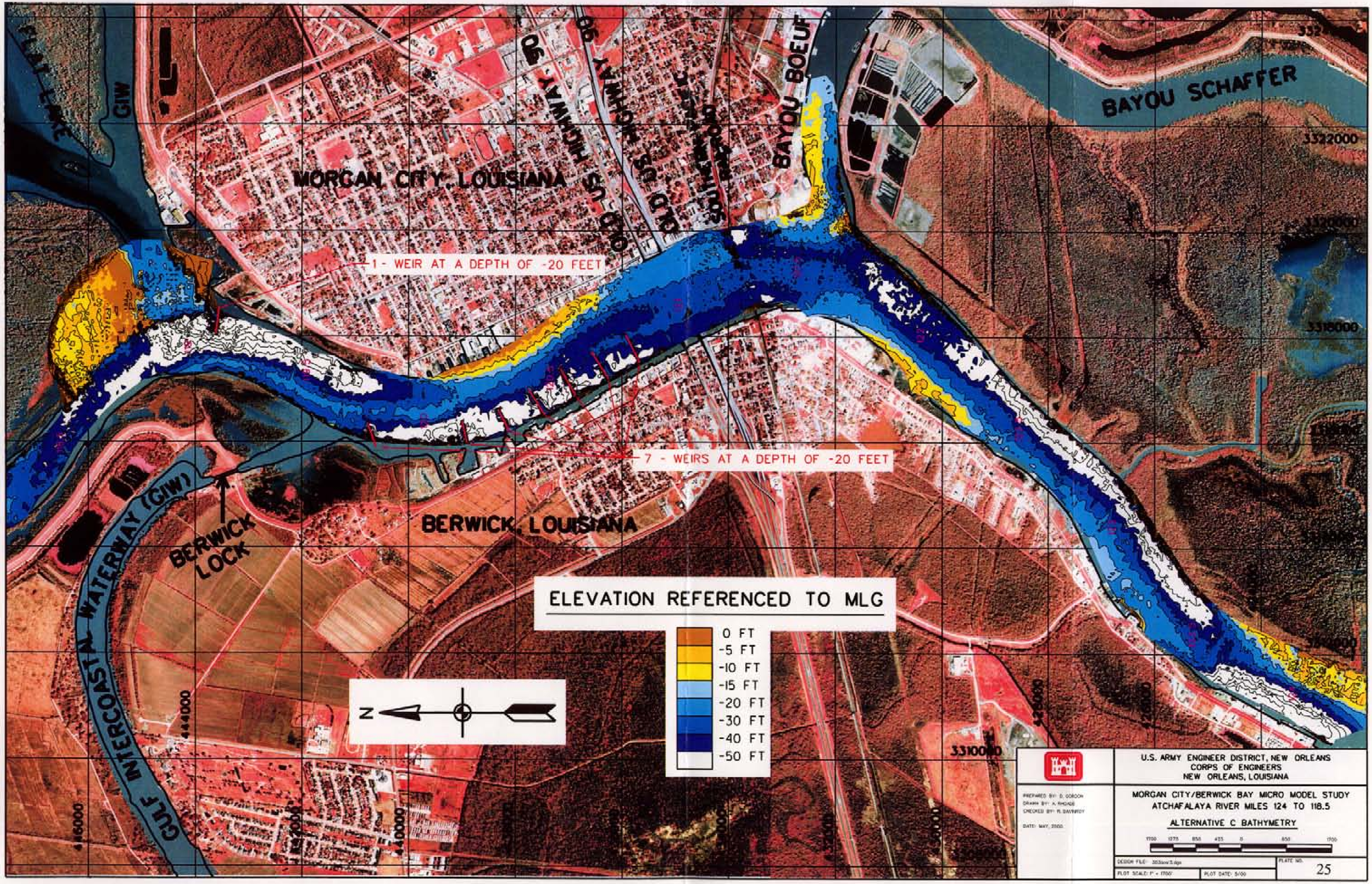
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

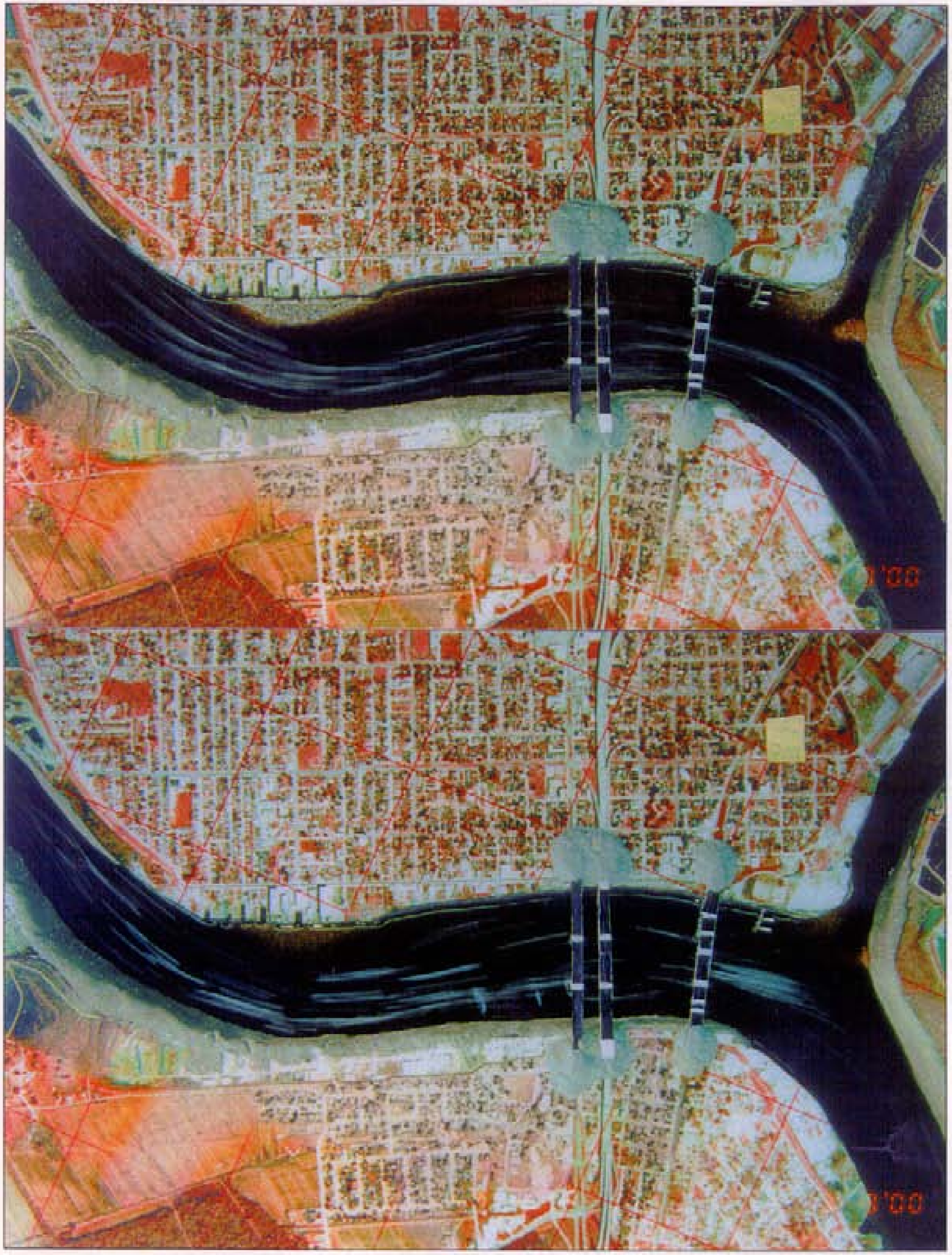
ALTERNATIVE B VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO.
24



MORGAN CITY, LOUISIANA
BERWICK, LOUISIANA
BAYOU SCHAFFER
BAYOU BOEUF
GIW
OLD US HIGHWAY 90
US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
GULF INTERCOASTAL WATERWAY (GIW)
BERWICK LOCK
1 - WEIR AT A DEPTH OF -20 FEET
7 - WEIRS AT A DEPTH OF -20 FEET
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3318000
3310000
444000
446000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE C BATHYMETRY
PLATE NO.
25



TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

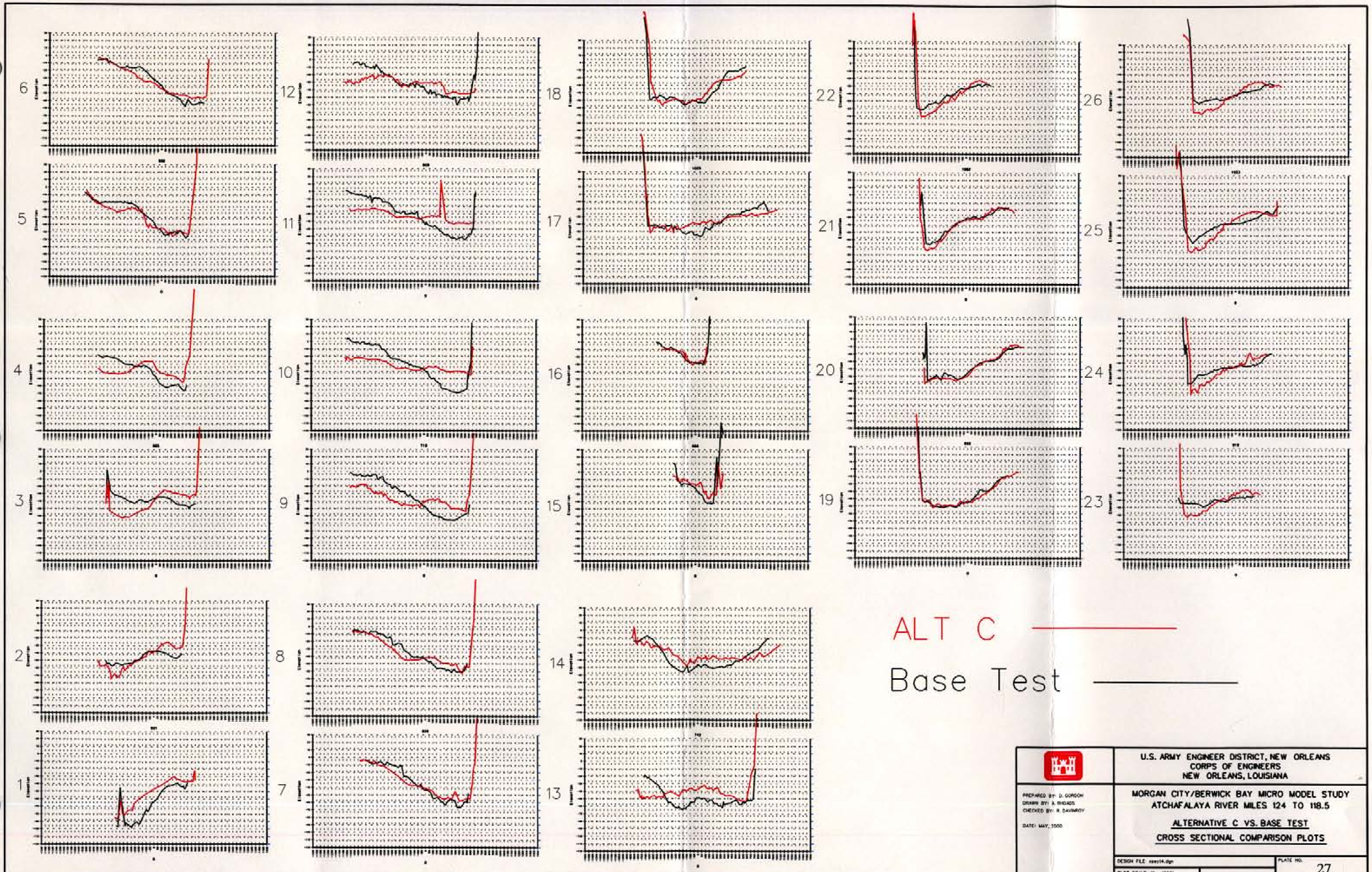
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE C
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
26



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

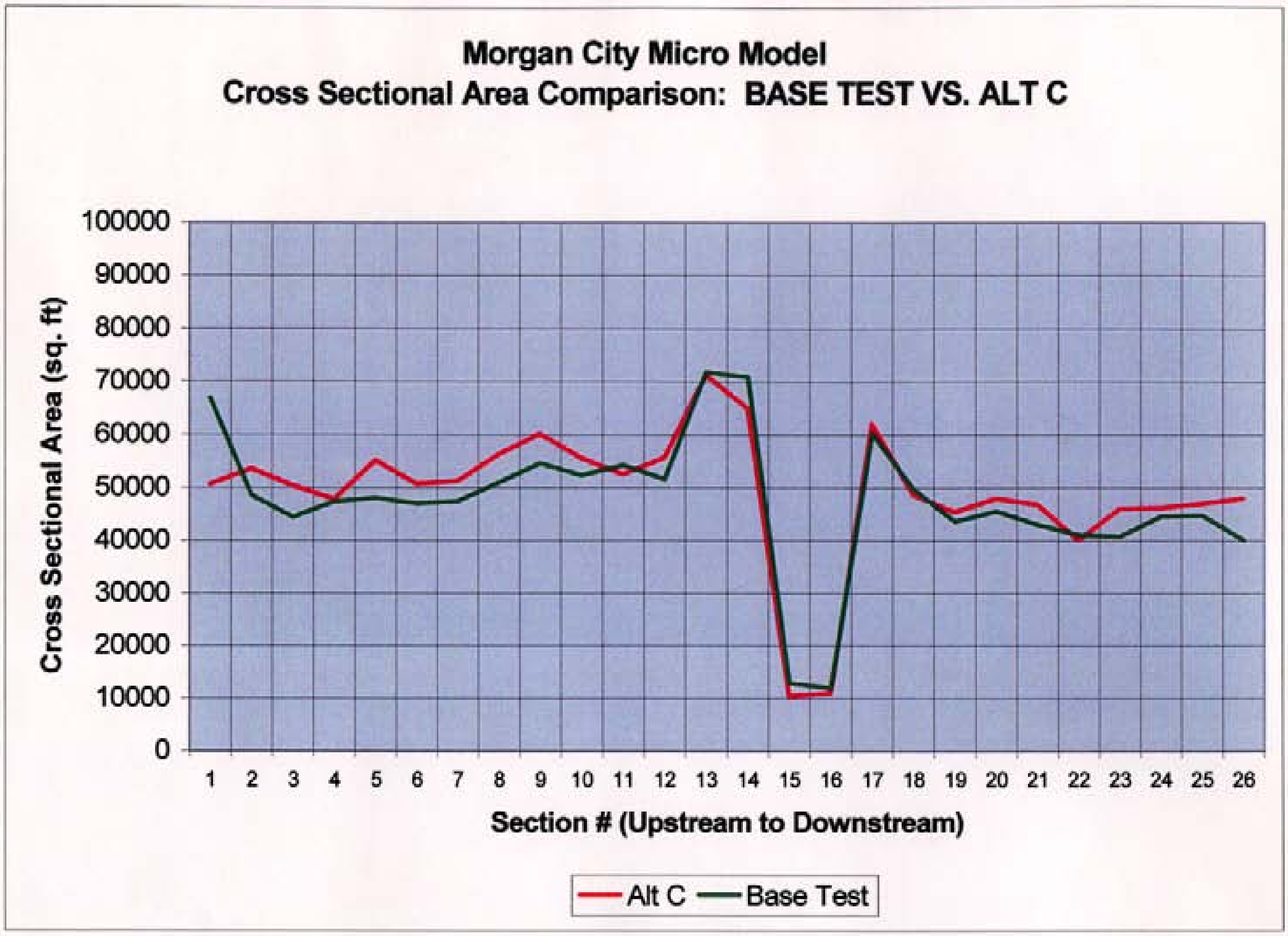
ALTERNATIVE C VS. BASE TEST

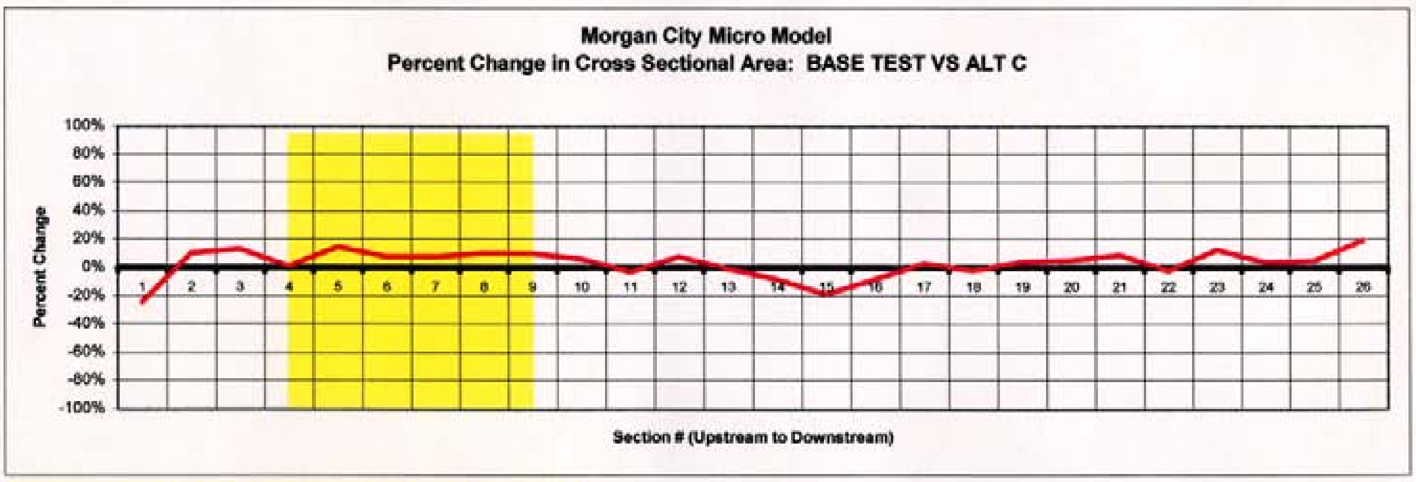
CROSS SECTIONAL COMPARISON PLOTS

DESIGN FILE: xsec14.dgn

PLOT SCALE: 1" = 1200'

PLATE NO. 27





WITHIN THE WEIR FIELD (SECTIONS 4 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +8.7%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

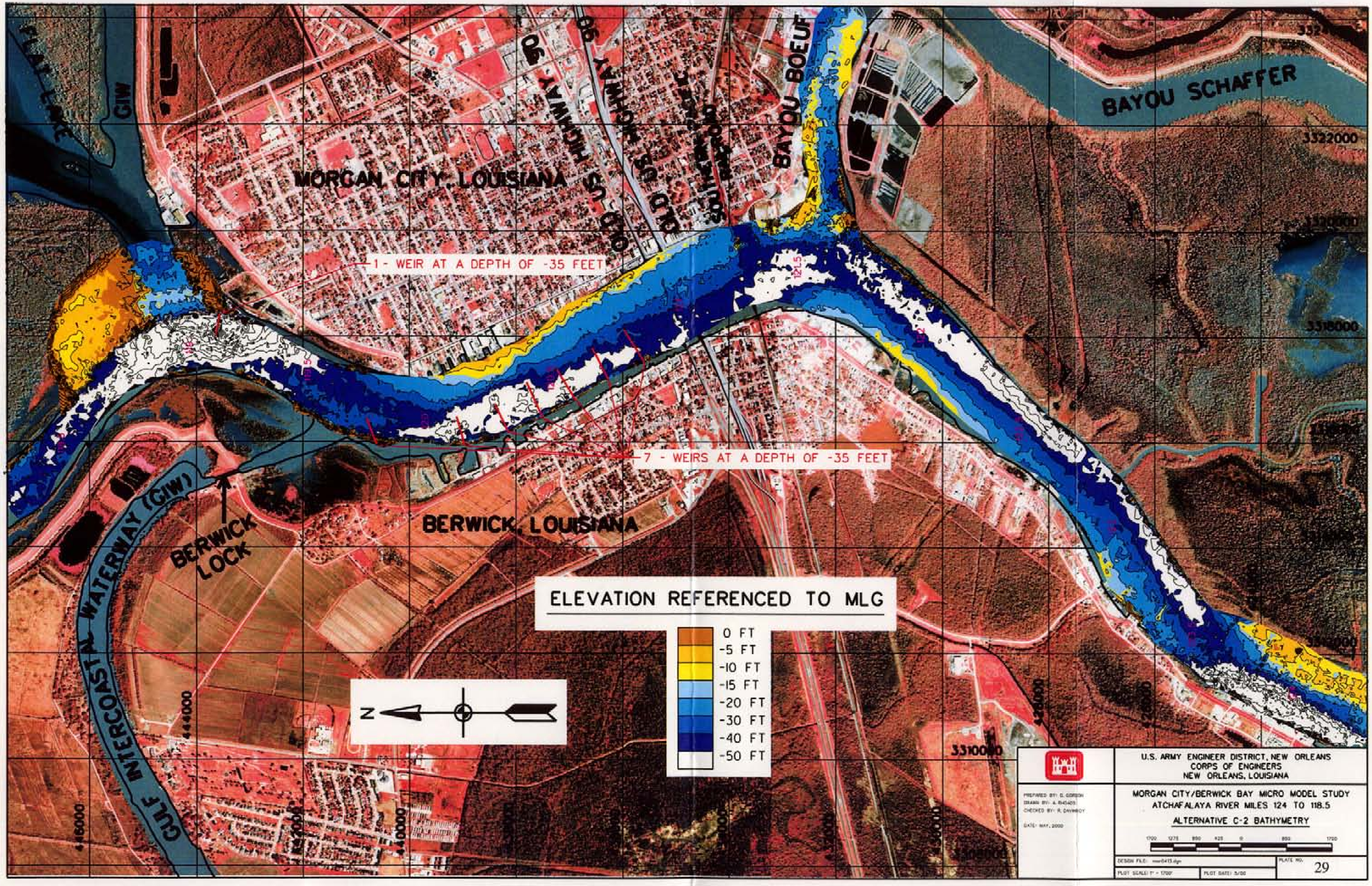
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE C VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO. 28



MORGAN CITY, LOUISIANA
BERWICK, LOUISIANA
BAYOU SCHAFFER
BAYOU BOEUF
GIW
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
1 - WEIR AT A DEPTH OF -35 FEET
7 - WEIRS AT A DEPTH OF -35 FEET
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3318000
3310000
444000
446000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE C-2 BATHYMETRY
DATE: MAY, 2000
PLOT SCALE: 1" = 1700'
PLOT DATE: 5/00
PLATE NO.
29

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

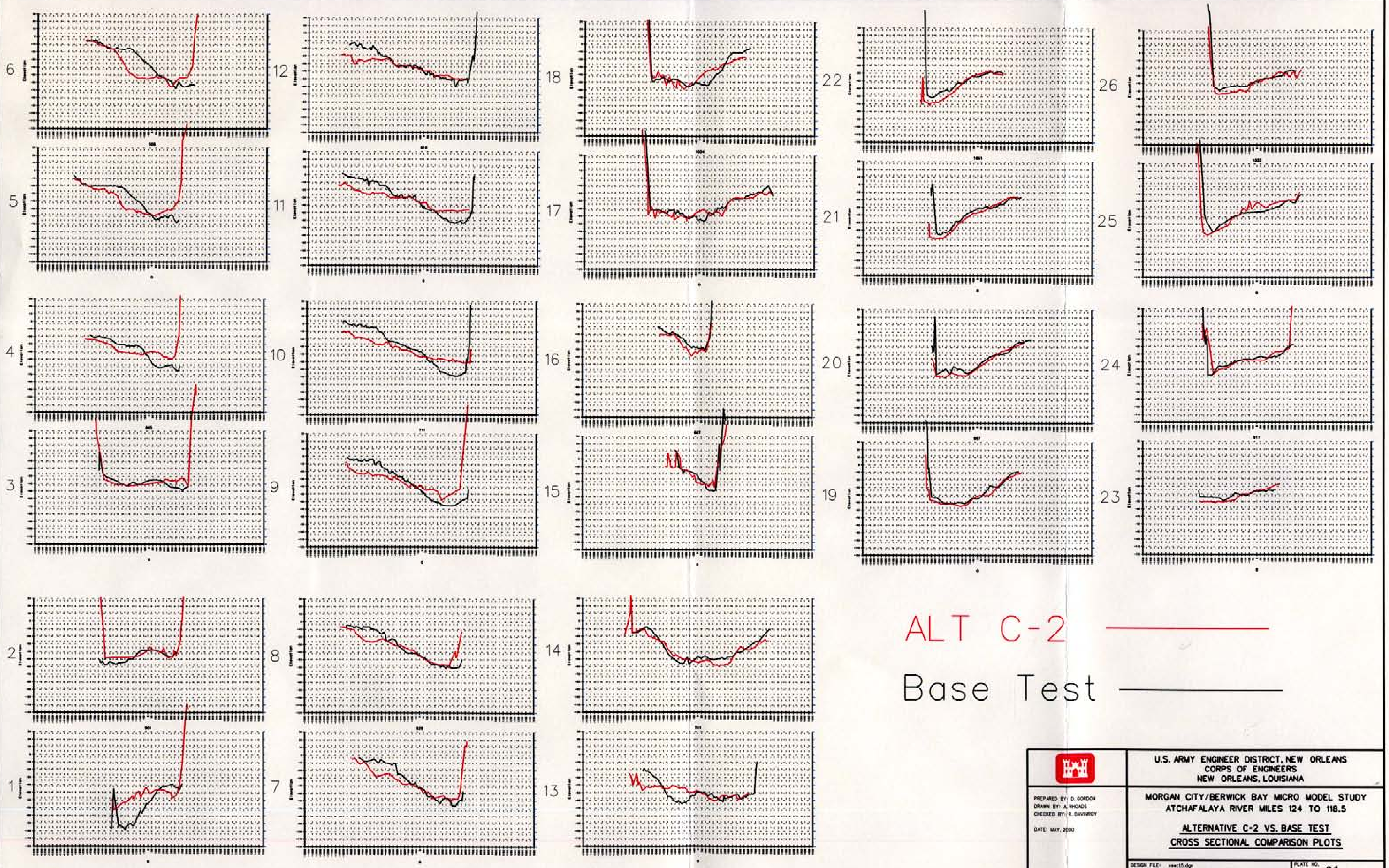
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE C-2
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO. 30



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

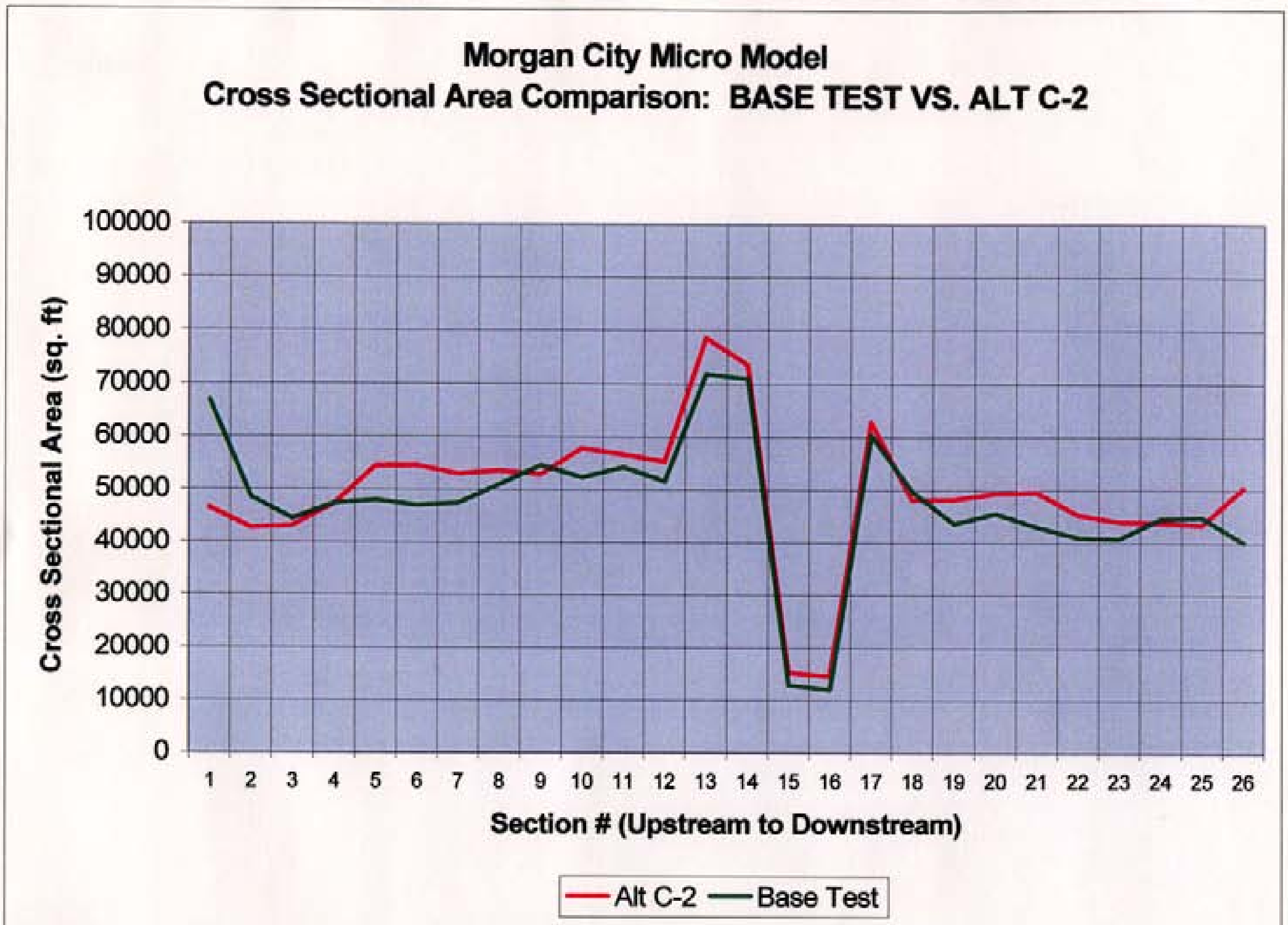
PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

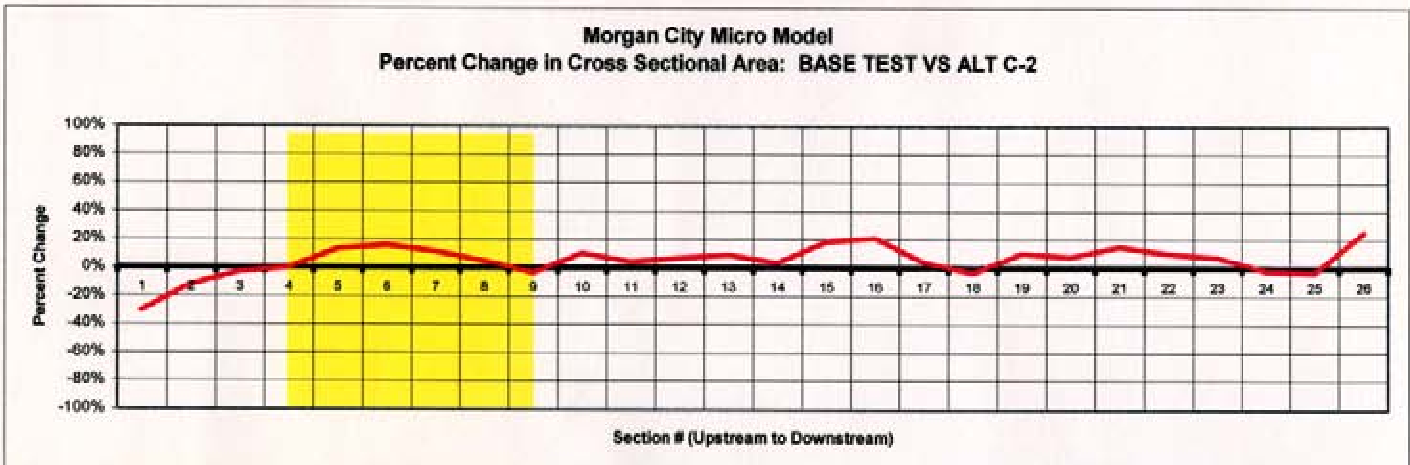
DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE C-2 VS. BASE TEST
CROSS SECTIONAL COMPARISON PLOTS

DESIGN FILE: xsect5.dgn
PLOT SCALE: 1" = 1200'
PLATE NO. 31





WITHIN THE WEIR FIELD (SECTIONS 4 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +7.1%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

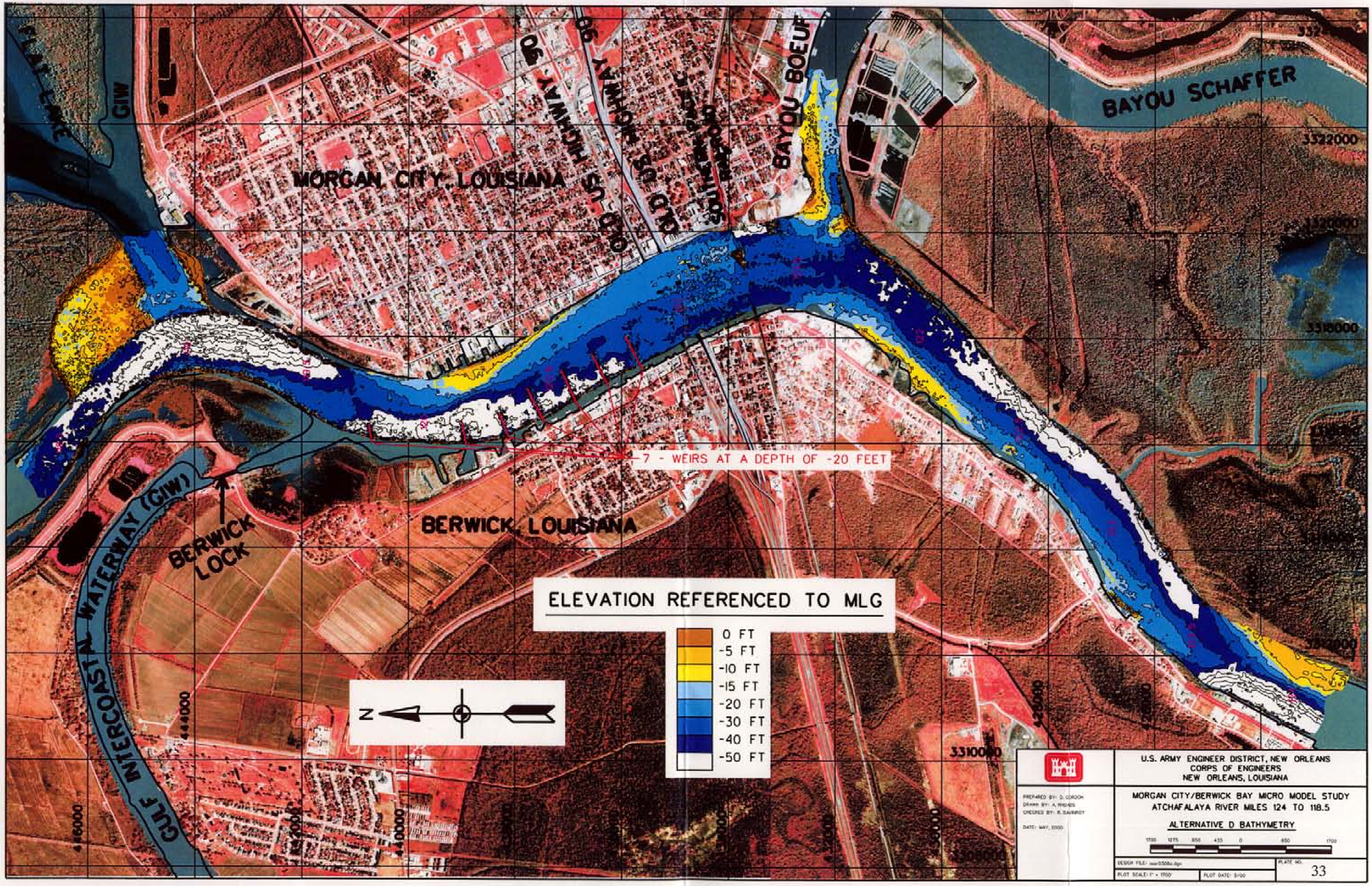
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

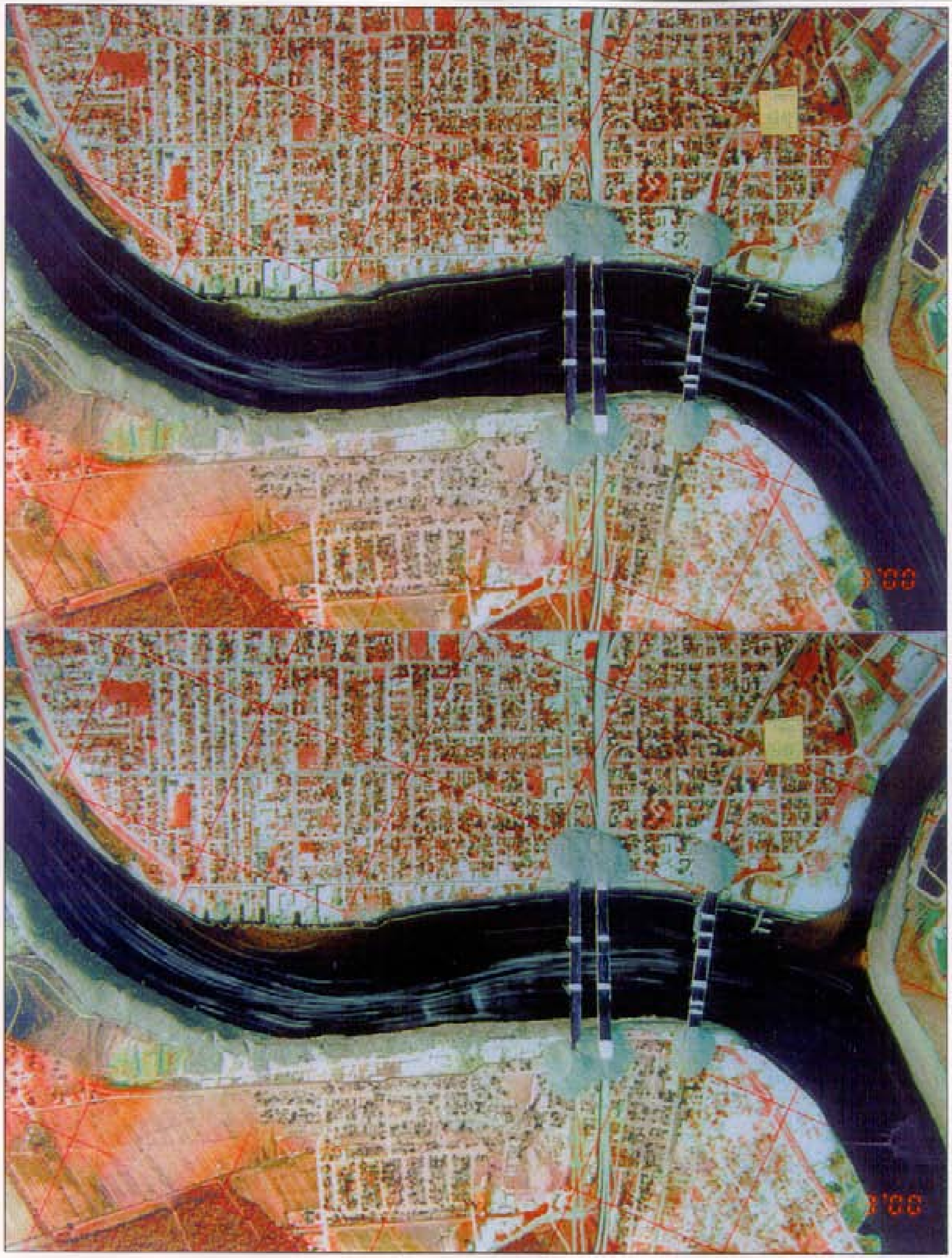
ALTERNATIVE C-2 VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO. 32



BAYOU SCHAFFER
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
GIW
7 - WEIRS AT A DEPTH OF -20 FEET
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3320000
3318000
3310000
444000
446000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE D BATHYMETRY
1700 1275 850 425 0 850 1700
PLATE NO.
33



TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

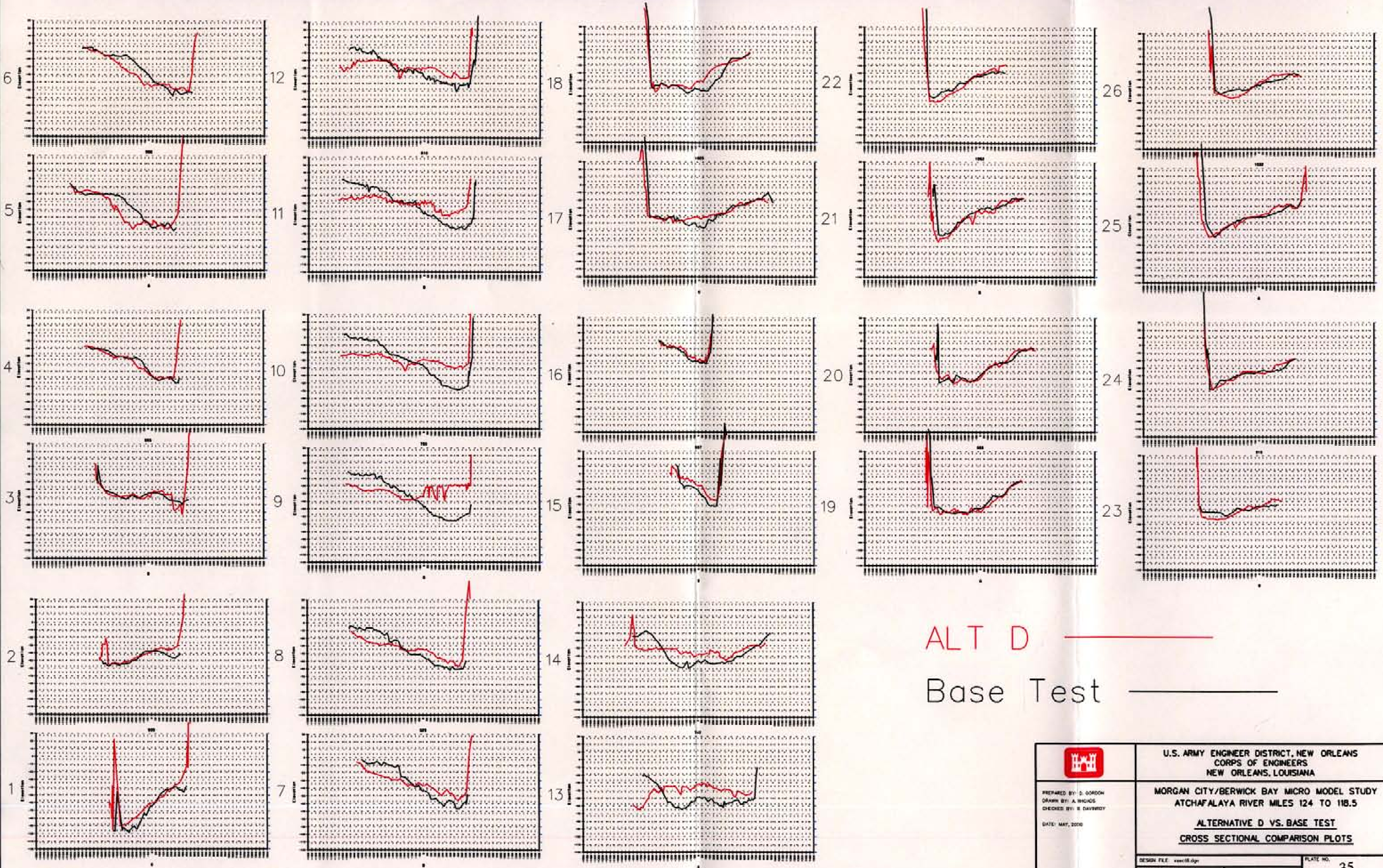
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE D
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
34



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: B. DAVENPORT
DATE: MAY, 2000

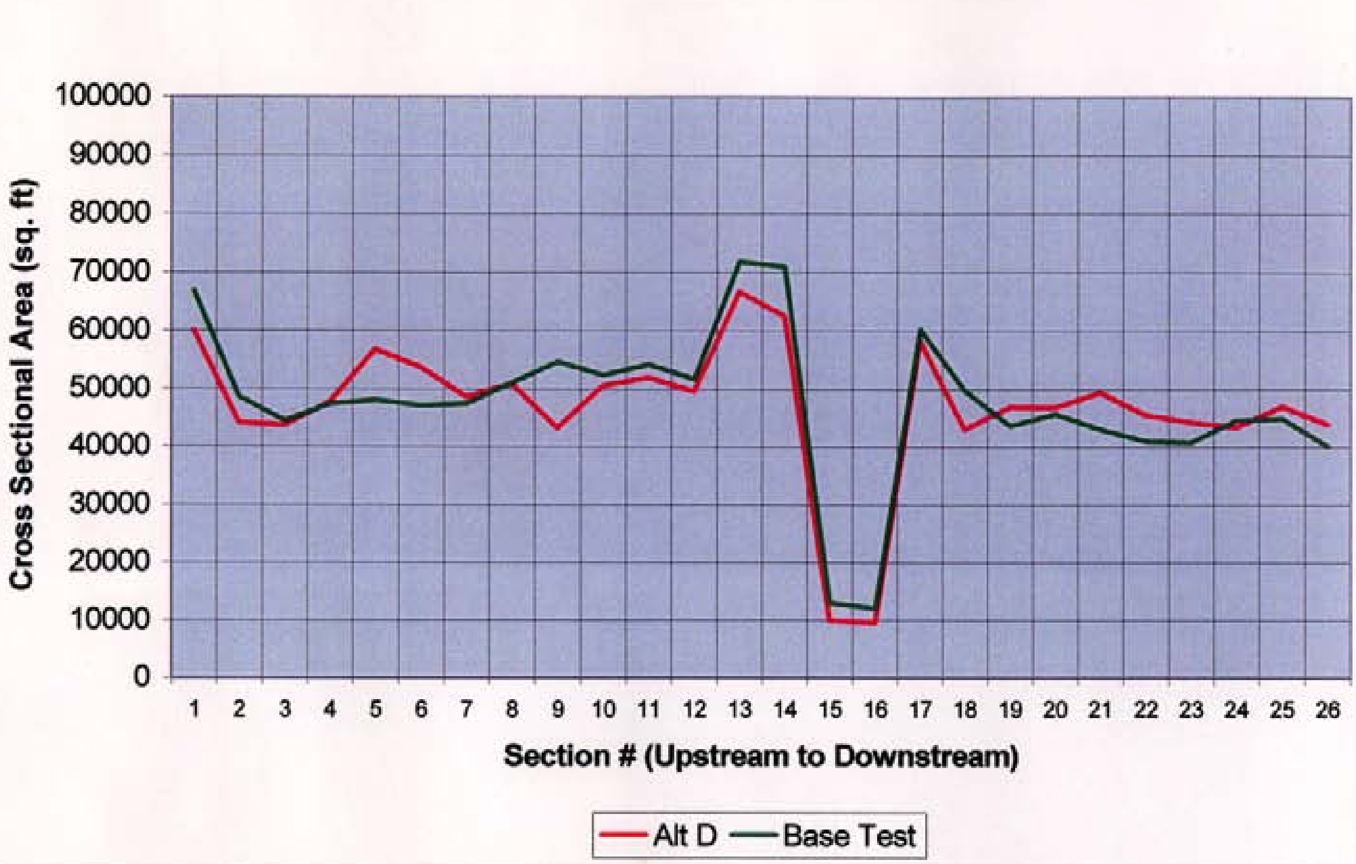
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE D VS. BASE TEST

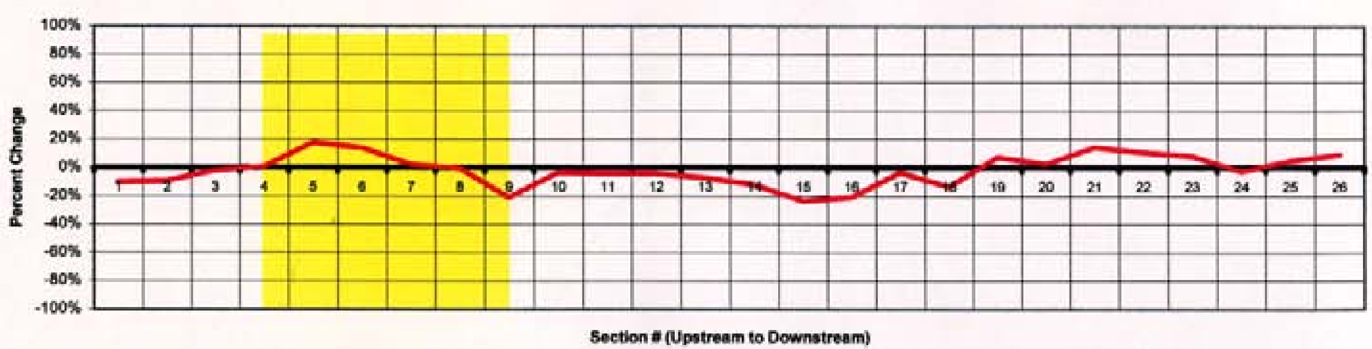
CROSS SECTIONAL COMPARISON PLOTS

DESIGN FILE: [illegible]	PLATE NO. 35
PLOT SCALE: 1" = 1200'	

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT D



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT D



WITHIN THE WEIR FIELD (SECTIONS 4 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +2.4%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

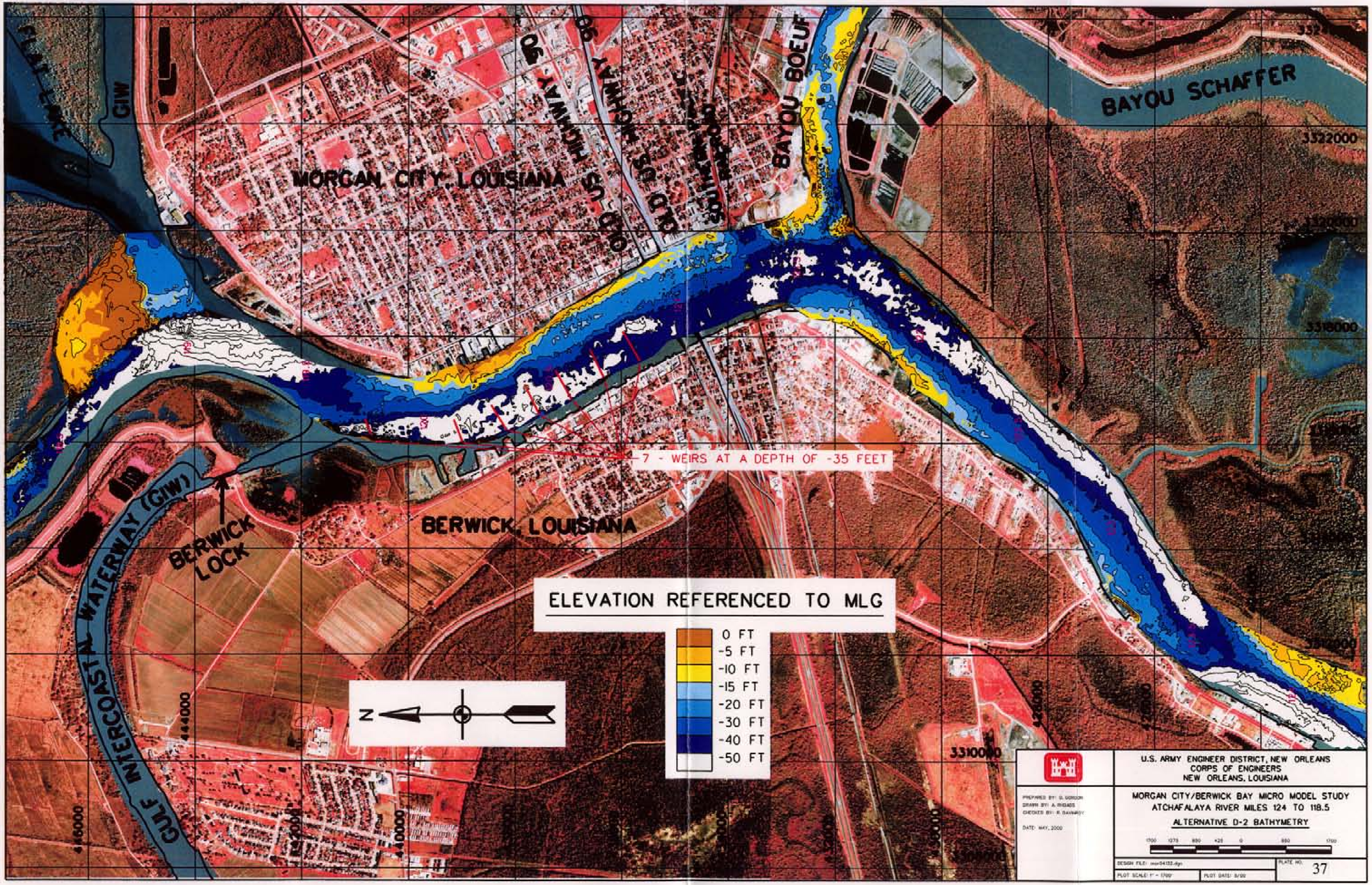
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE D VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO.
36



BAYOU SCHAFFER
BAYOU BOEUF
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
GIW
7 - WEIRS AT A DEPTH OF -35 FEET
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
322000
318000
310000
444000
446000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE D-2 BATHYMETRY
DATE: MAY, 2000
PLATE NO.
37

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

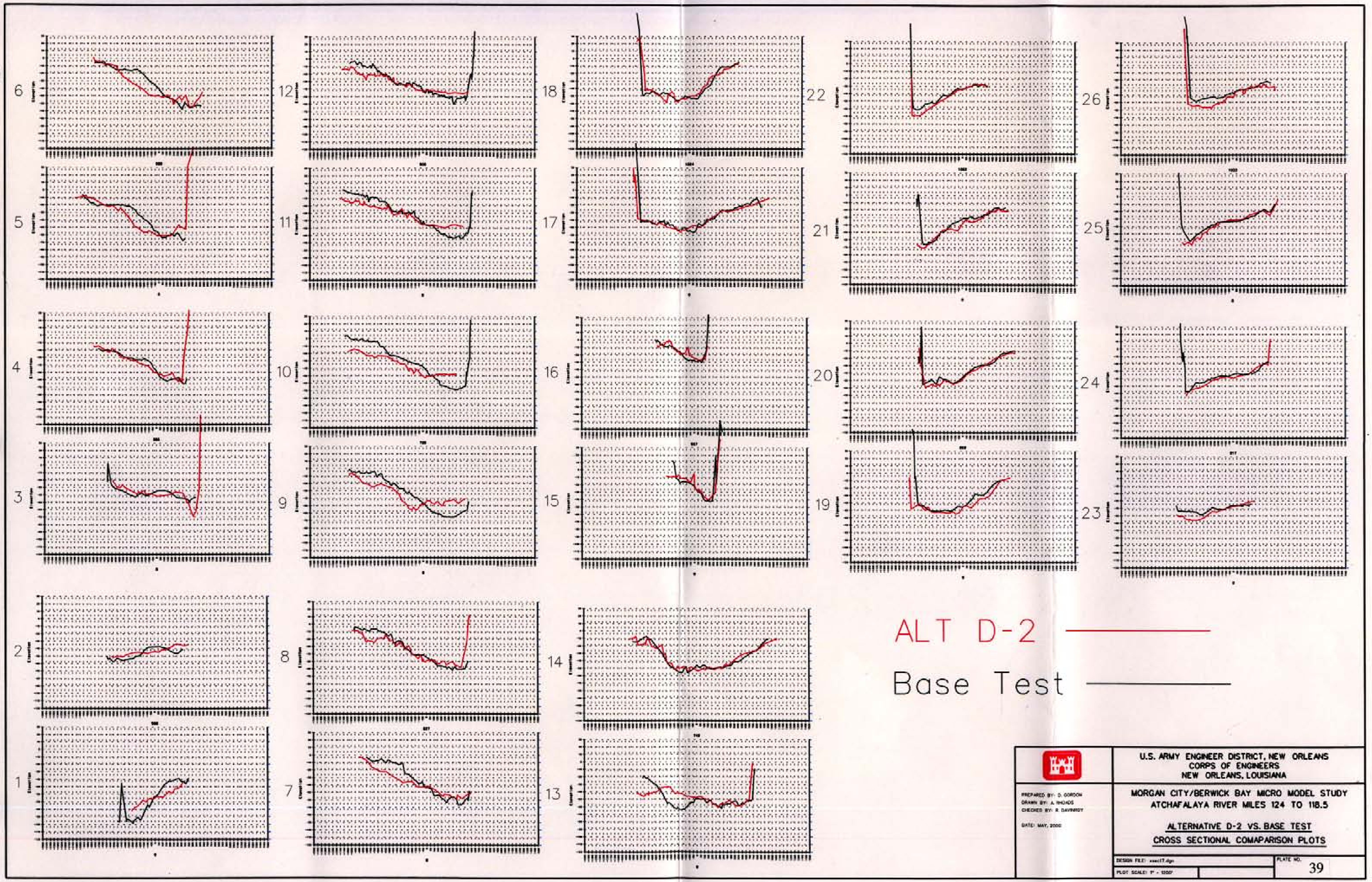
PREPARED BY: A. Rhoads
CHECKED BY: R. Dastroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE D-2
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
38



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

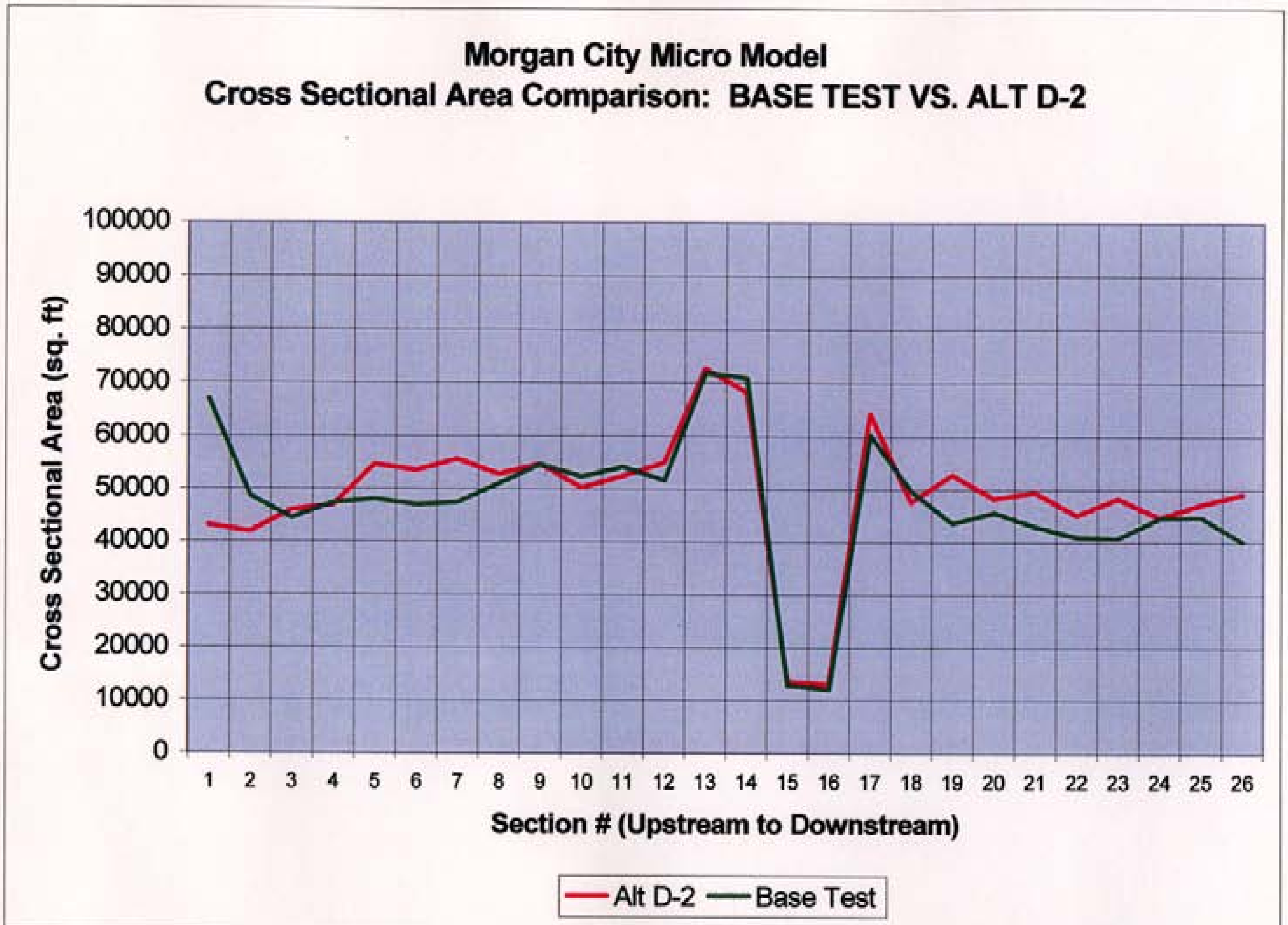
DATE: MAY, 2000

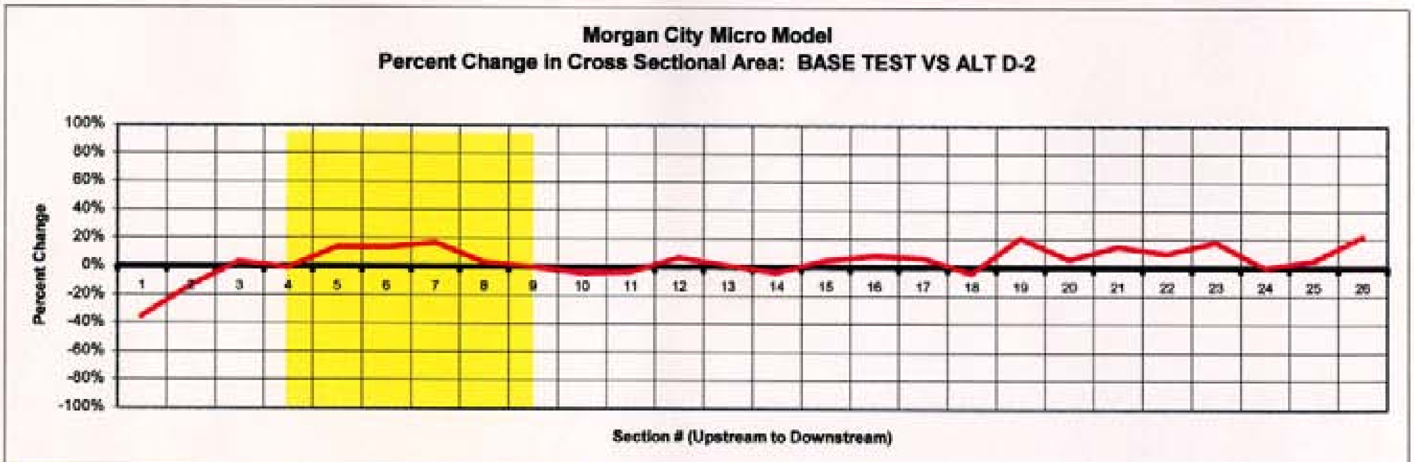
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE D-2 VS. BASE TEST
CROSS SECTIONAL COMAPARISON PLOTS

DESIGN FILE: xsect7.dgn
PLOT SCALE: 1" = 1000'

PLATE NO. 39





WITHIN THE WEIR FIELD (SECTIONS 4 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +7.9%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

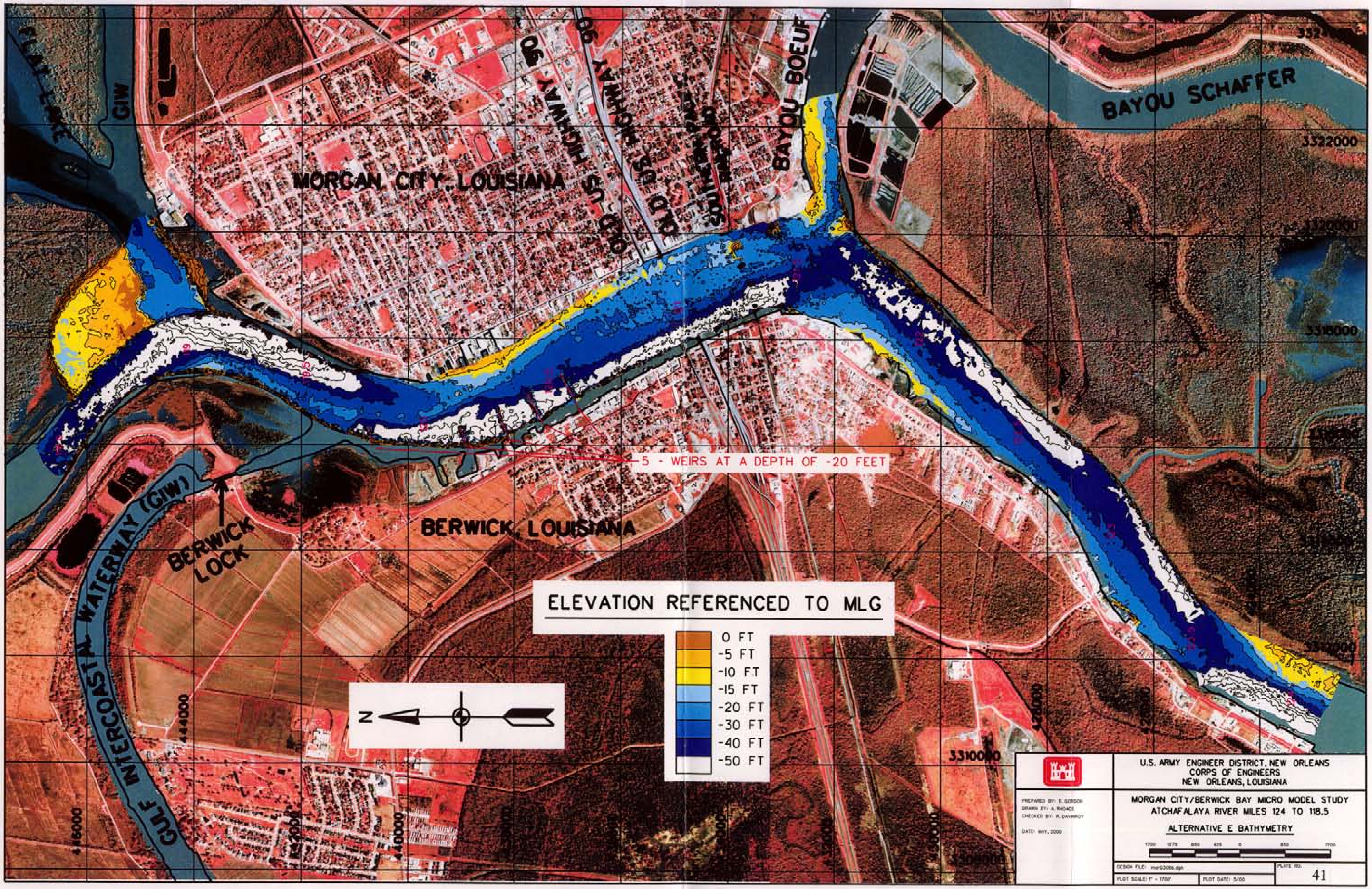
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE D-2 VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO.
40


BAYOU SCHAFFER
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
GIW
5 - WEIRS AT A DEPTH OF -20 FEET
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
322000
318000
3310000
444000
446000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE E BATHYMETRY
PLATE NO.
41

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

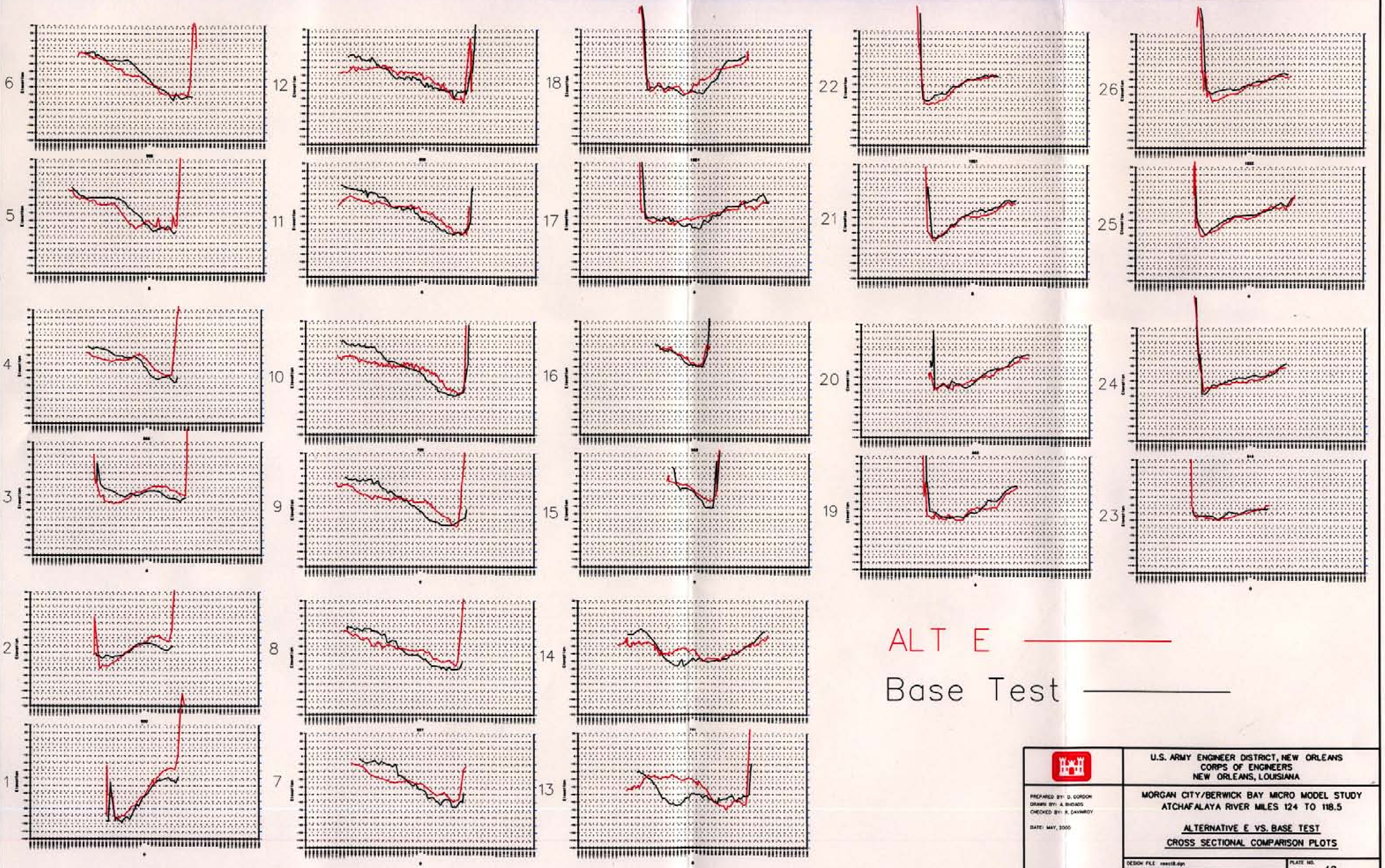
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE E
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
42



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

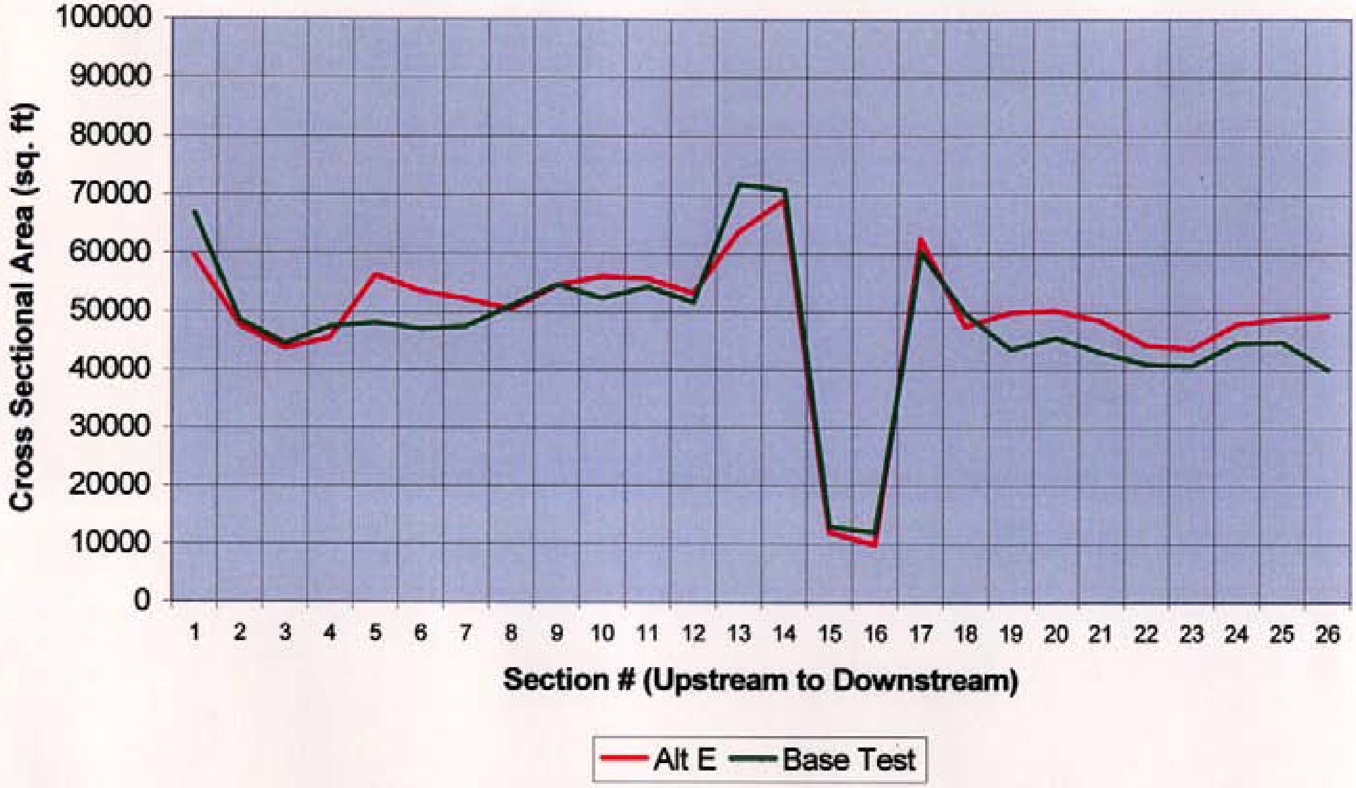
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE E VS. BASE TEST
CROSS SECTIONAL COMPARISON PLOTS

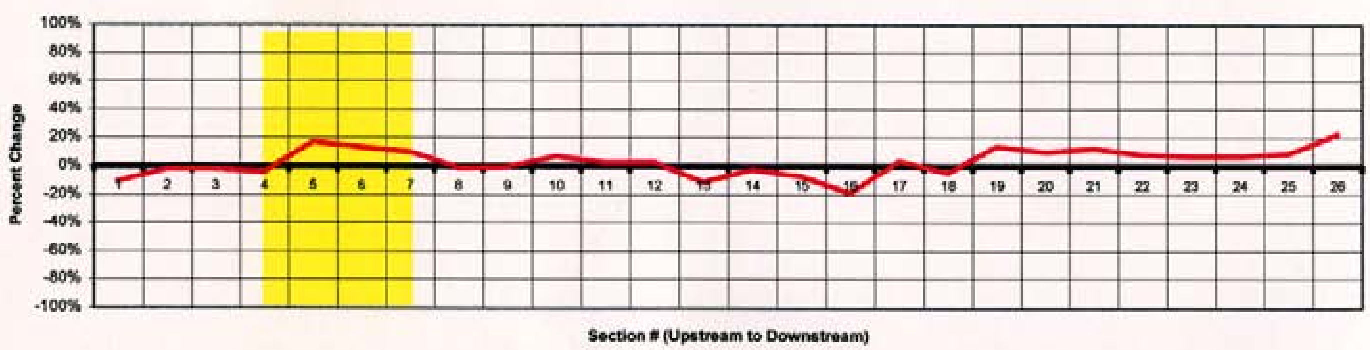
DESIGN FILE: xsect8.dgn
PLOT SCALE: 1" = 1200'

PLATE NO. 43

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT E



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT E



WITHIN THE WEIR FIELD (SECTIONS 4 – 7), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +9.2%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

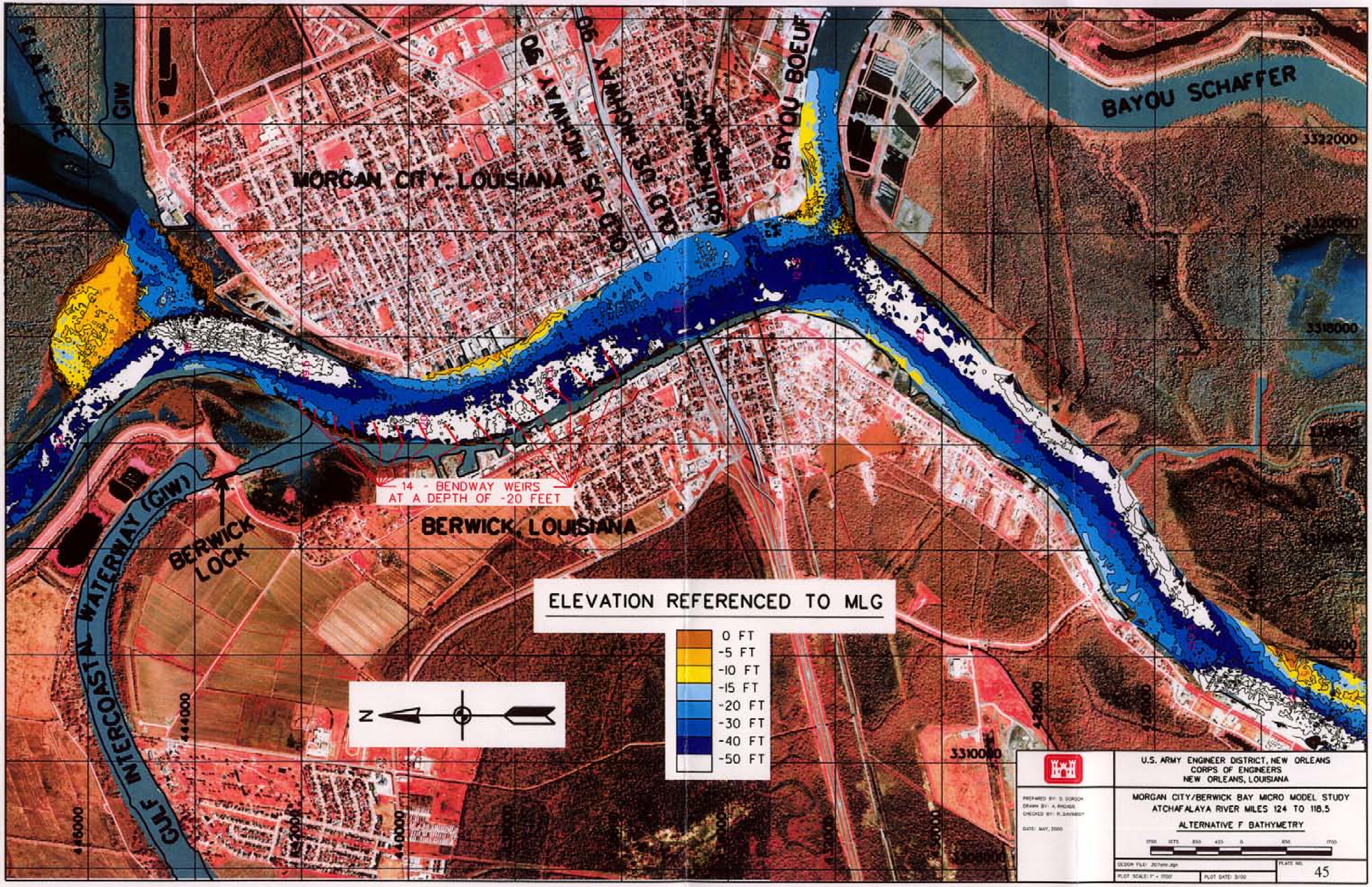
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE E VS BASE TEST, CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO. 44



FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
BAYOU SCHAFFER
3322000
3318000
14 - BENDWAY WEIRS
AT A DEPTH OF -20 FEET
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
444000
446000
440000
3310000
3308000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE F BATHYMETRY
DATE: MAY, 2000
PLATE NO.
45

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

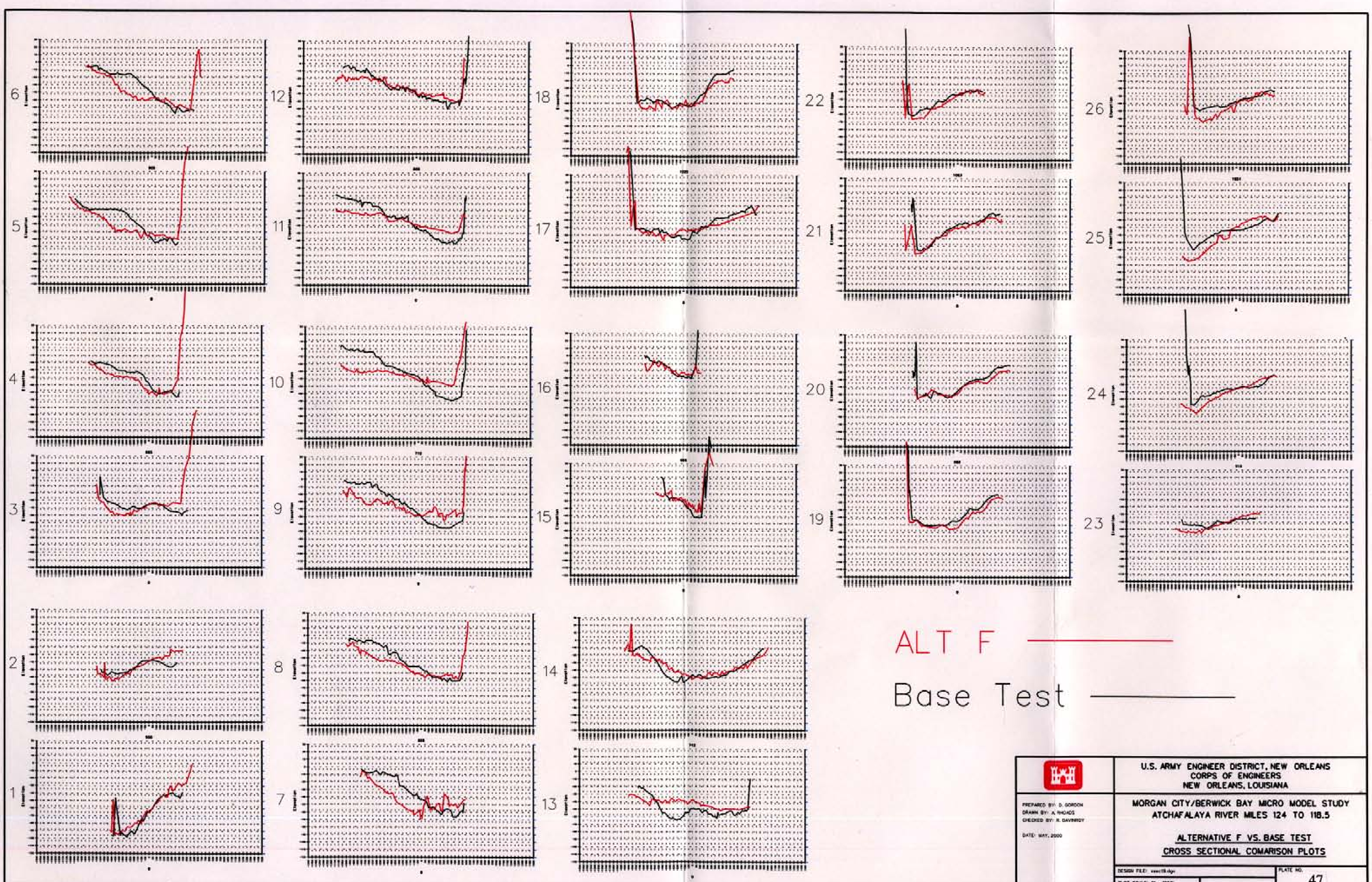
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE F
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO.
46



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

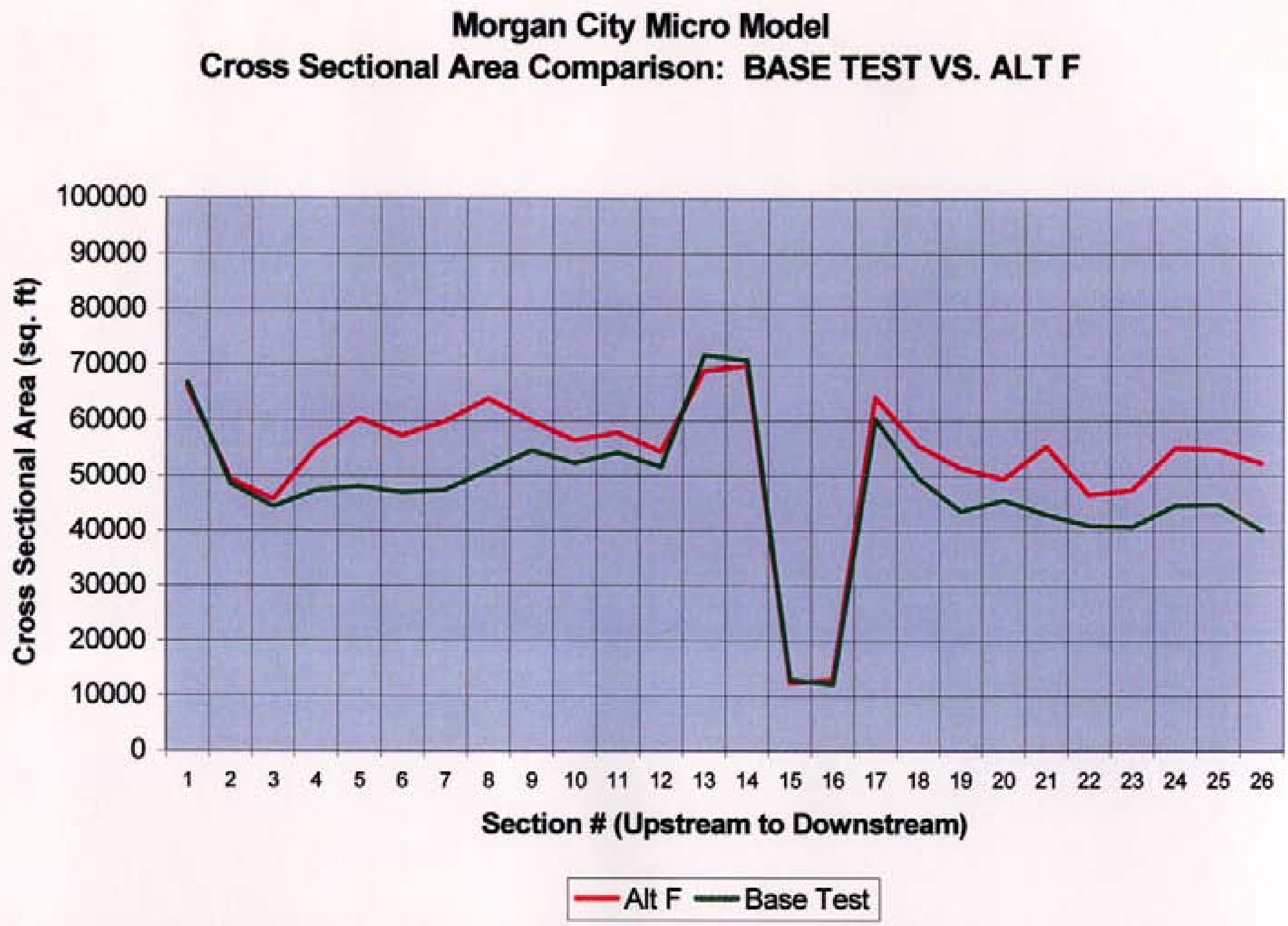
PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

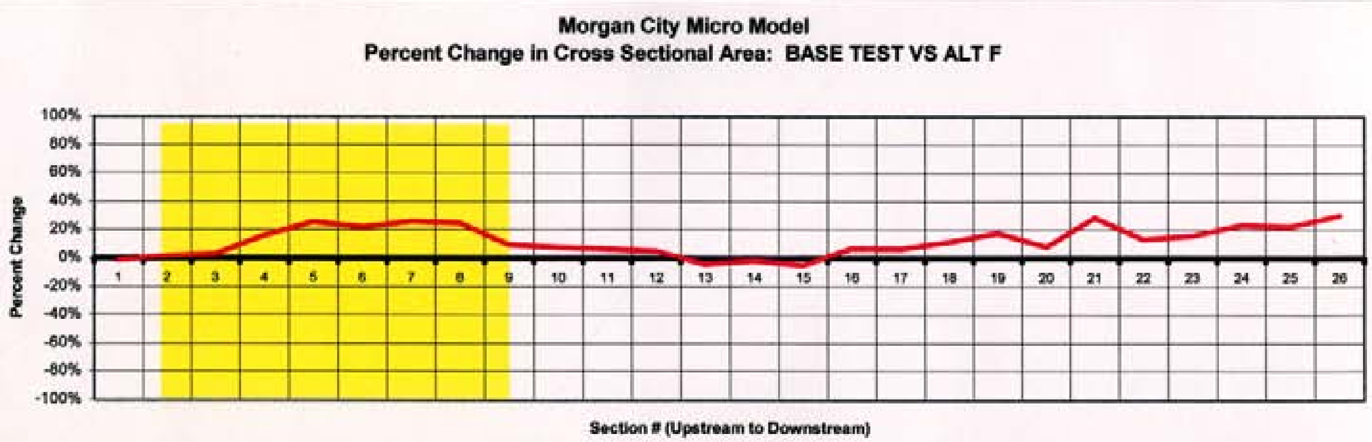
DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE F VS. BASE TEST
CROSS SECTIONAL COMARISON PLOTS

DESIGN FILE: xsec18.dgn		PLATE NO. 47
PLOT SCALE: 1" - 1200'		





WITHIN THE WEIR FIELD (SECTIONS 2 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +16.1%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

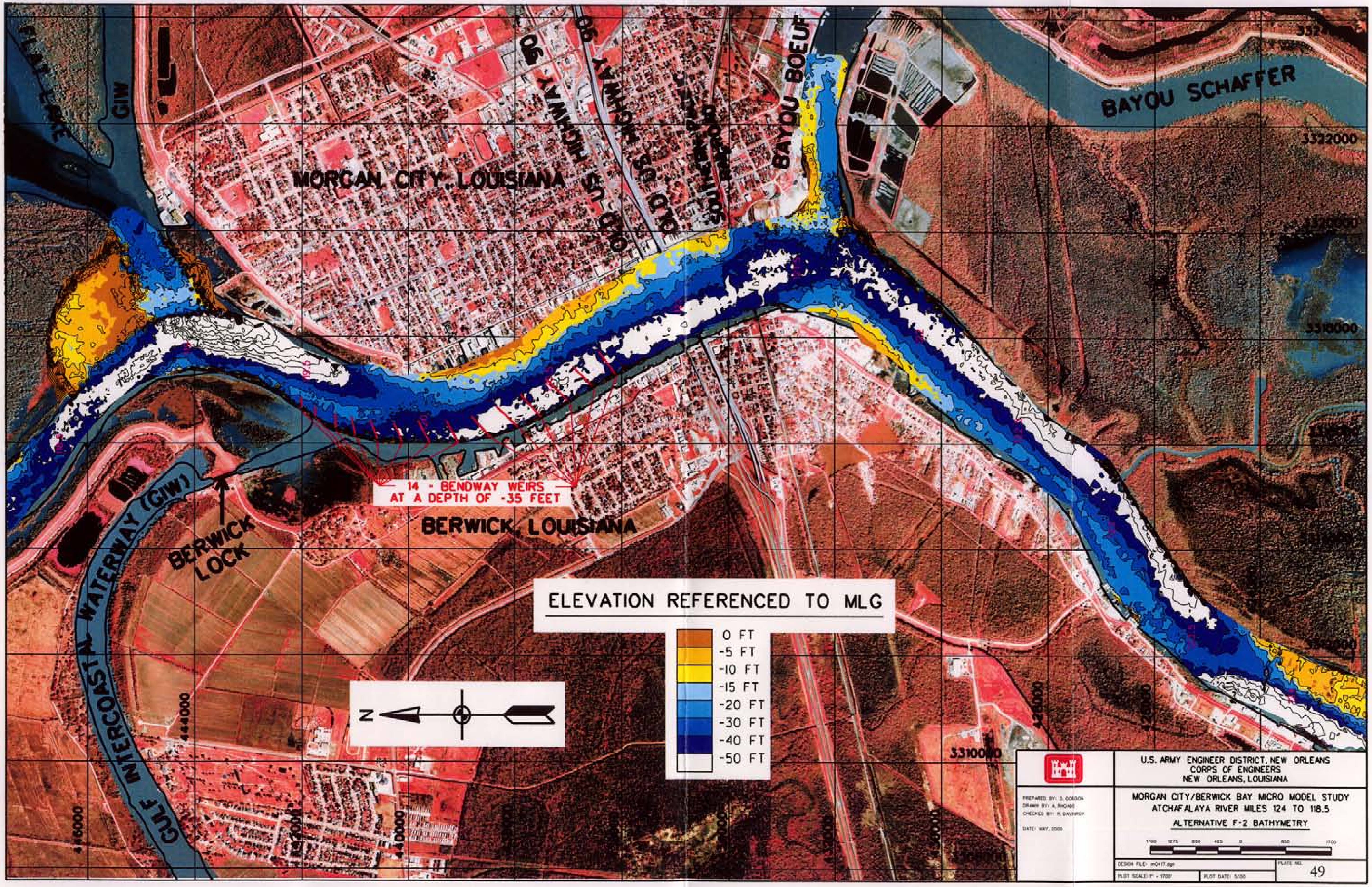
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE F VS BASE TEST, CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

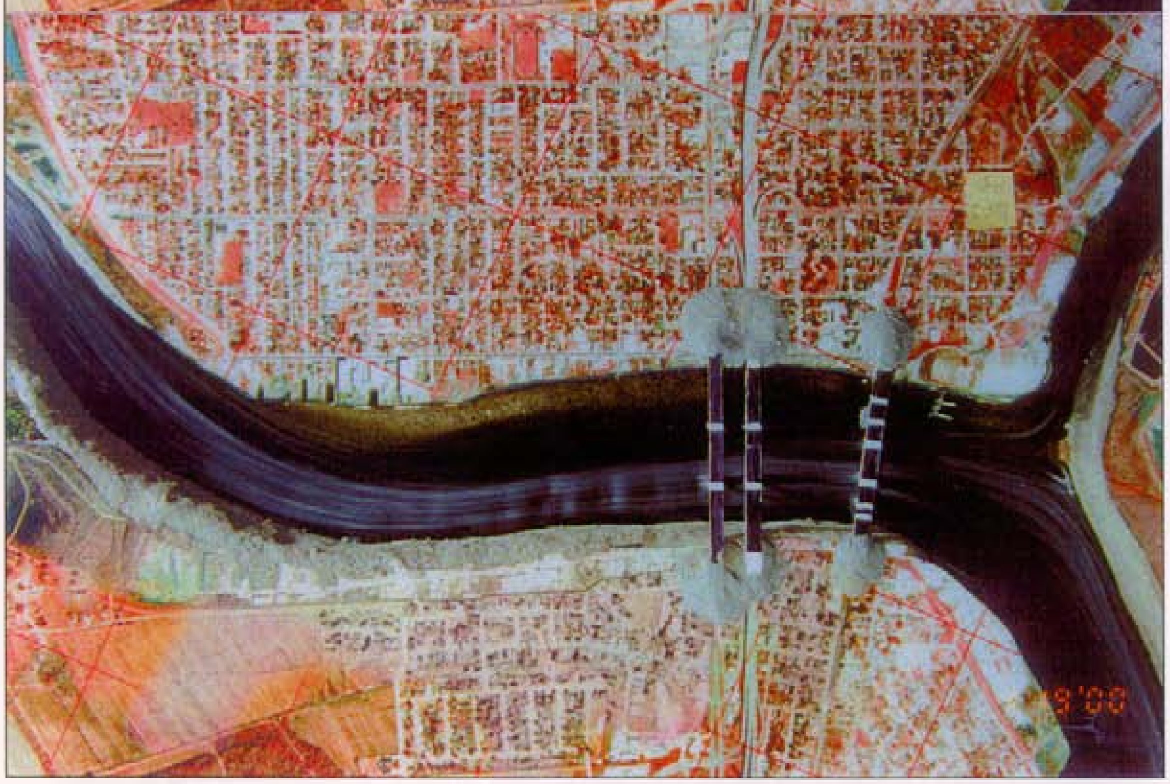
PLATE NO. 48



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE F-2 BATHYMETRY

PLATE NO. 49



TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

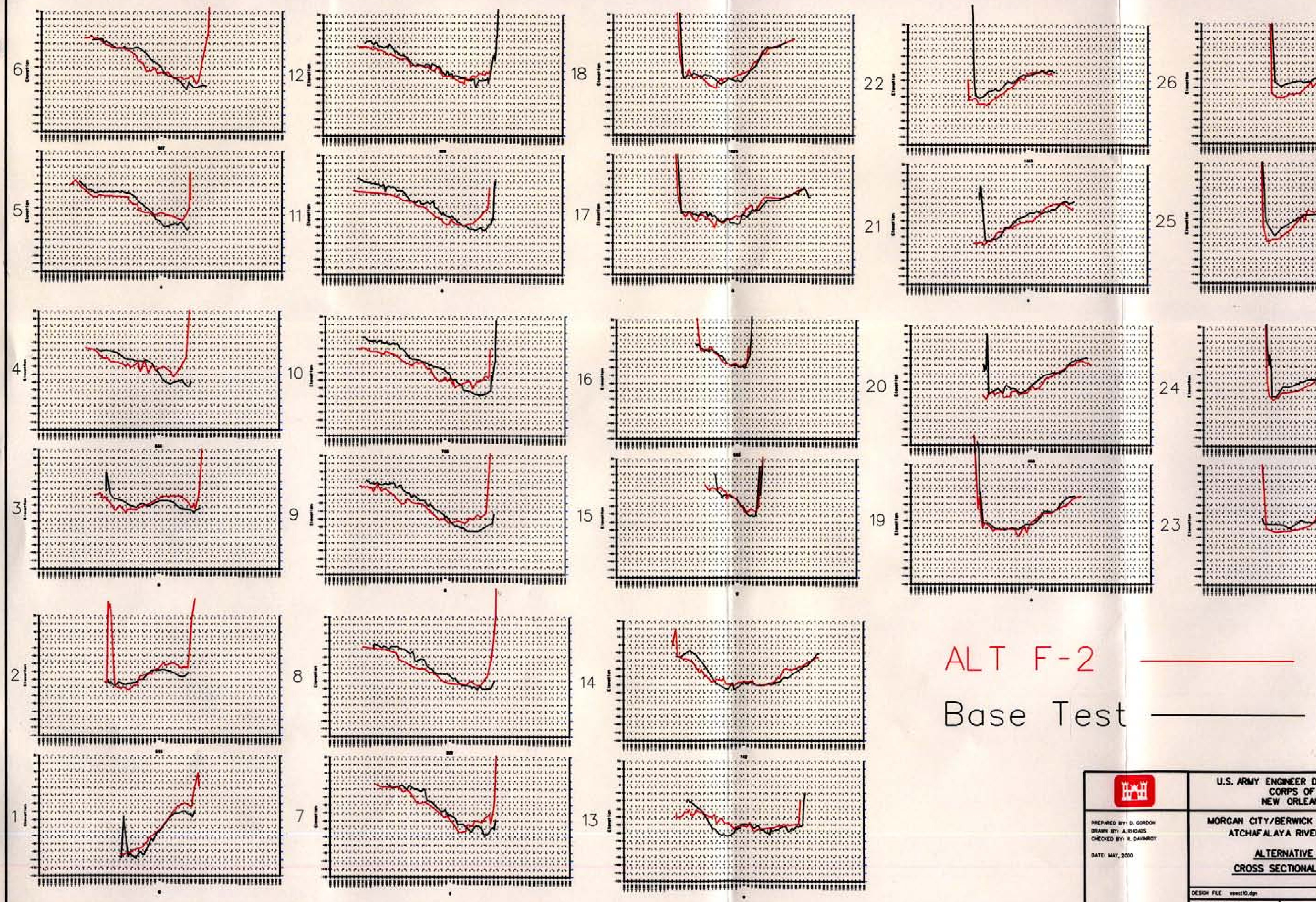
PREPARED BY: A. Rhoads
CHECKED BY: R. Davinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE F-2
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO. 50



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

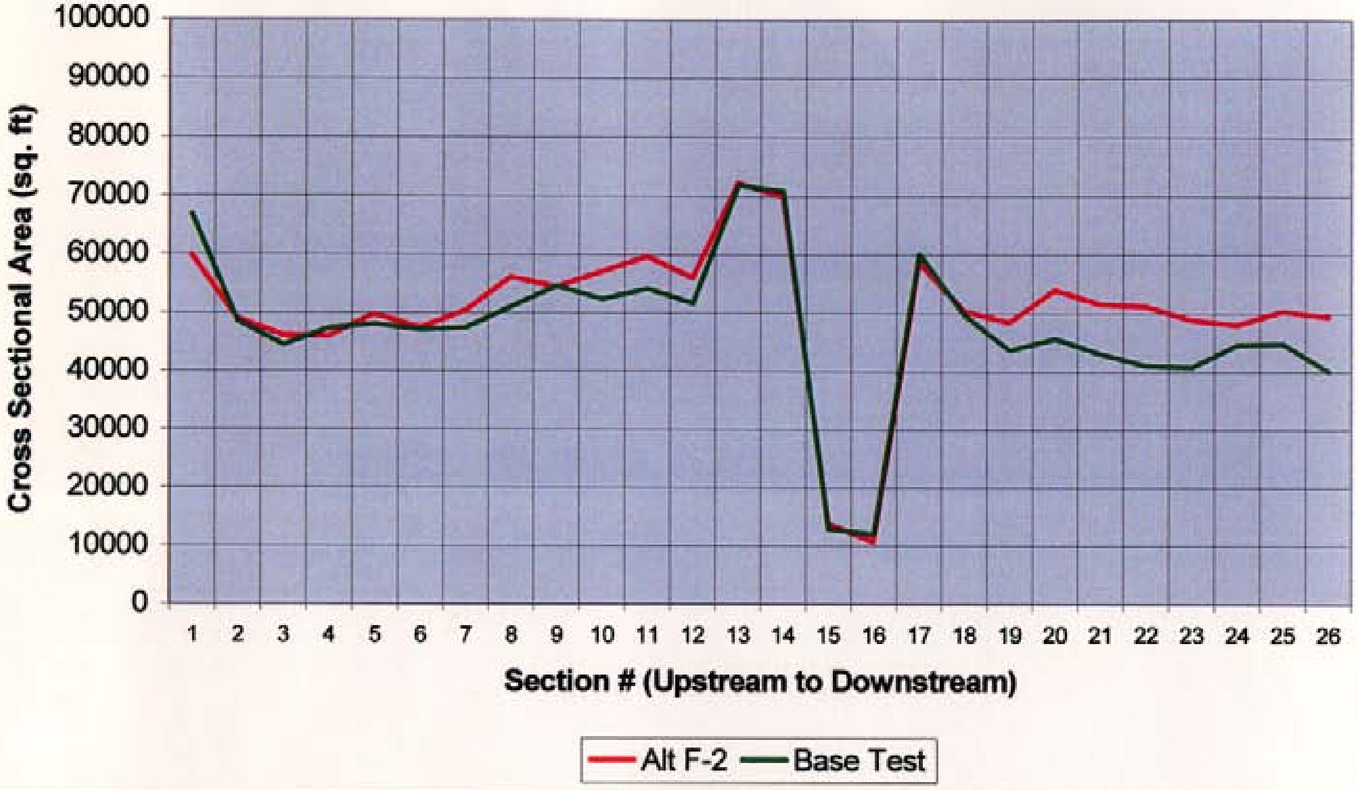
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE F-2 BASE TEST
CROSS SECTIONAL COMPARISON PLOTS

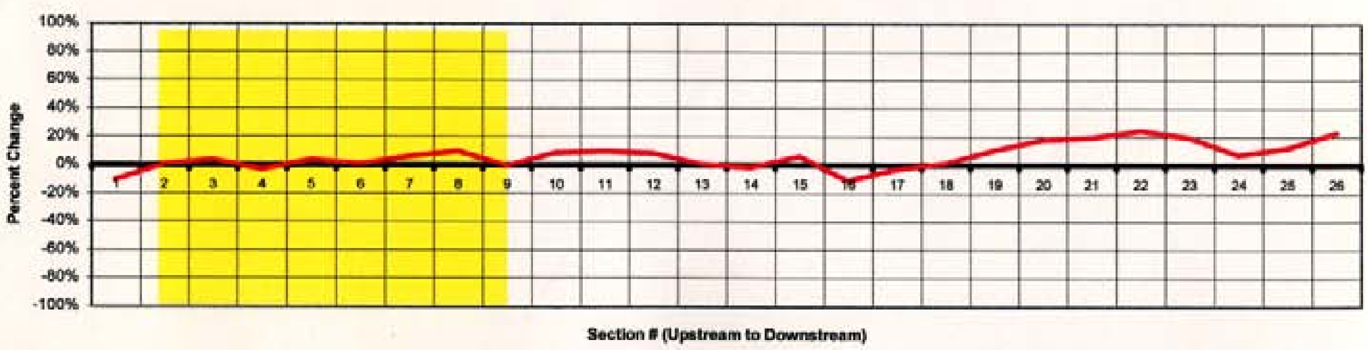
DESIGN FILE: xsect10.dgn
PLOT SCALE: 1" = 1200'

PLATE NO. 51

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT F-2



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT F-2



WITHIN THE WEIR FIELD (SECTIONS 2 – 9), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +2.8%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

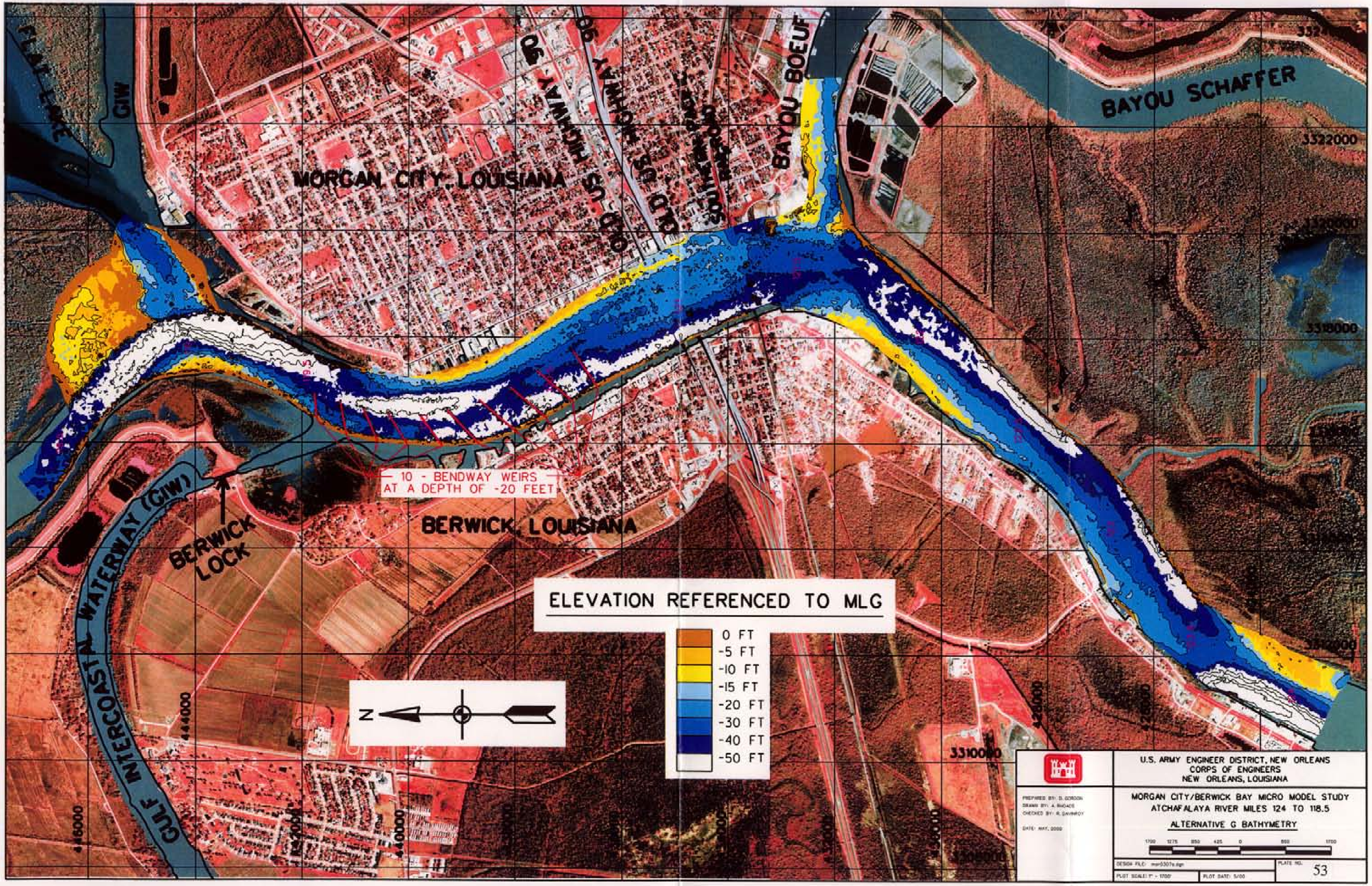
PREPARED BY: A. Rhoads
CHECKED BY: R. Deviney

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE F-2 VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO. 52

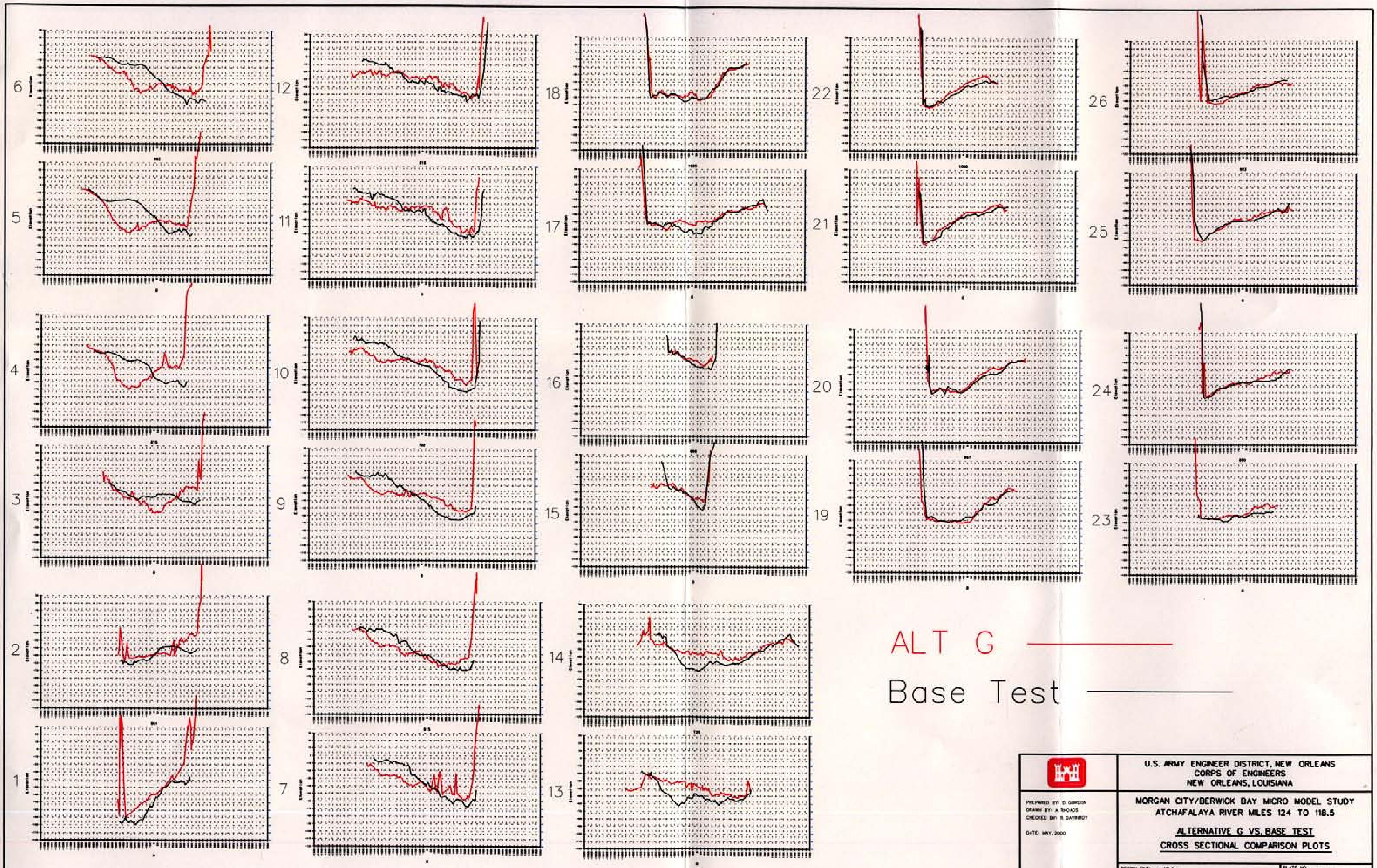


FLAT LAKE
GIW
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
BAYOU SCHAFFER
3322000
3318000
10 - BENDWAY WEIRS
AT A DEPTH OF -20 FEET
BERWICK, LOUISIANA
GULF INTERCOASTAL WATERWAY (GIW)
BERWICK LOCK
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
444000
446000
440000
428000
3310000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY
DATE: MAY, 2000
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE G BATHYMETRY
1700 1275 850 425 0 850 1700
PLOT SCALE: 1" = 1700'
PLOT DATE: 5/00
PLATE NO.
53

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS **CORPS OF ENGINEERS** **NEW ORLEANS, LOUISIANA**
PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	MORGAN CITY/BERWICK BAY MICRO MODEL STUDY ATCHAFALAYA RIVER MILES 124 TO 118.5 ALTERNATIVE G FLOW VISUALIZATION
	FLOWVISPLATES.PUB — PLATE NO. 54



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: B. DAVINROY

DATE: MAY, 2000

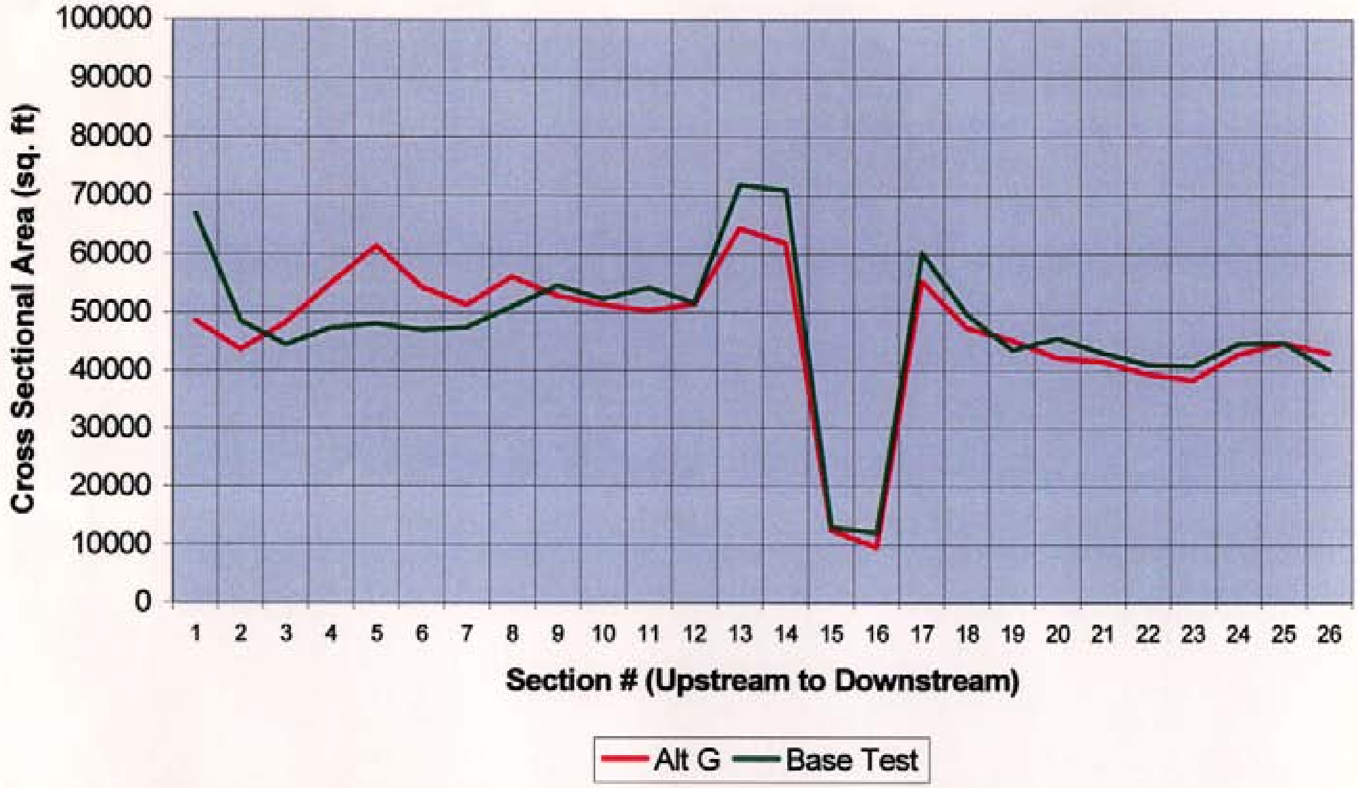
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE G VS. BASE TEST
CROSS SECTIONAL COMPARISON PLOTS

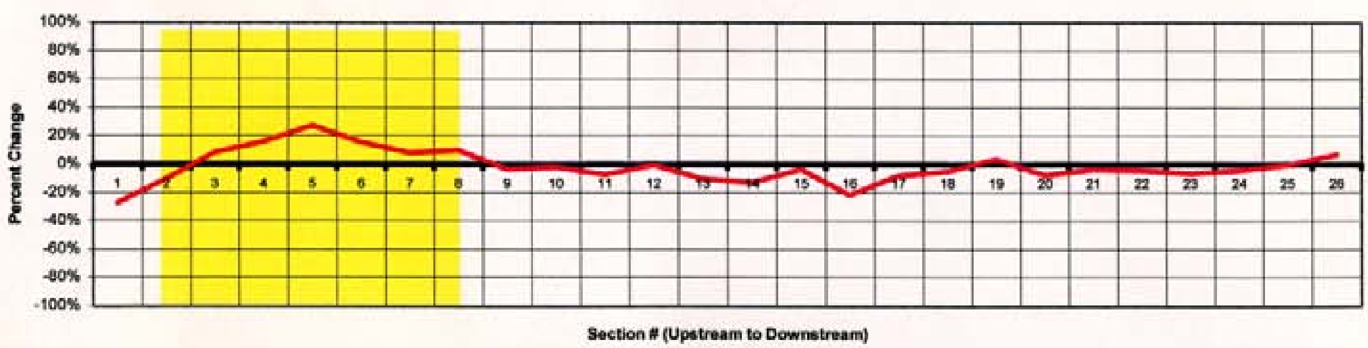
DESIGN FILE: xsect11.dgn
PLOT SCALE: 1" = 1200'

PLATE NO. 55

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT G



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT G



WITHIN THE WEIR FIELD (SECTIONS 2 – 8), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +10.8%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

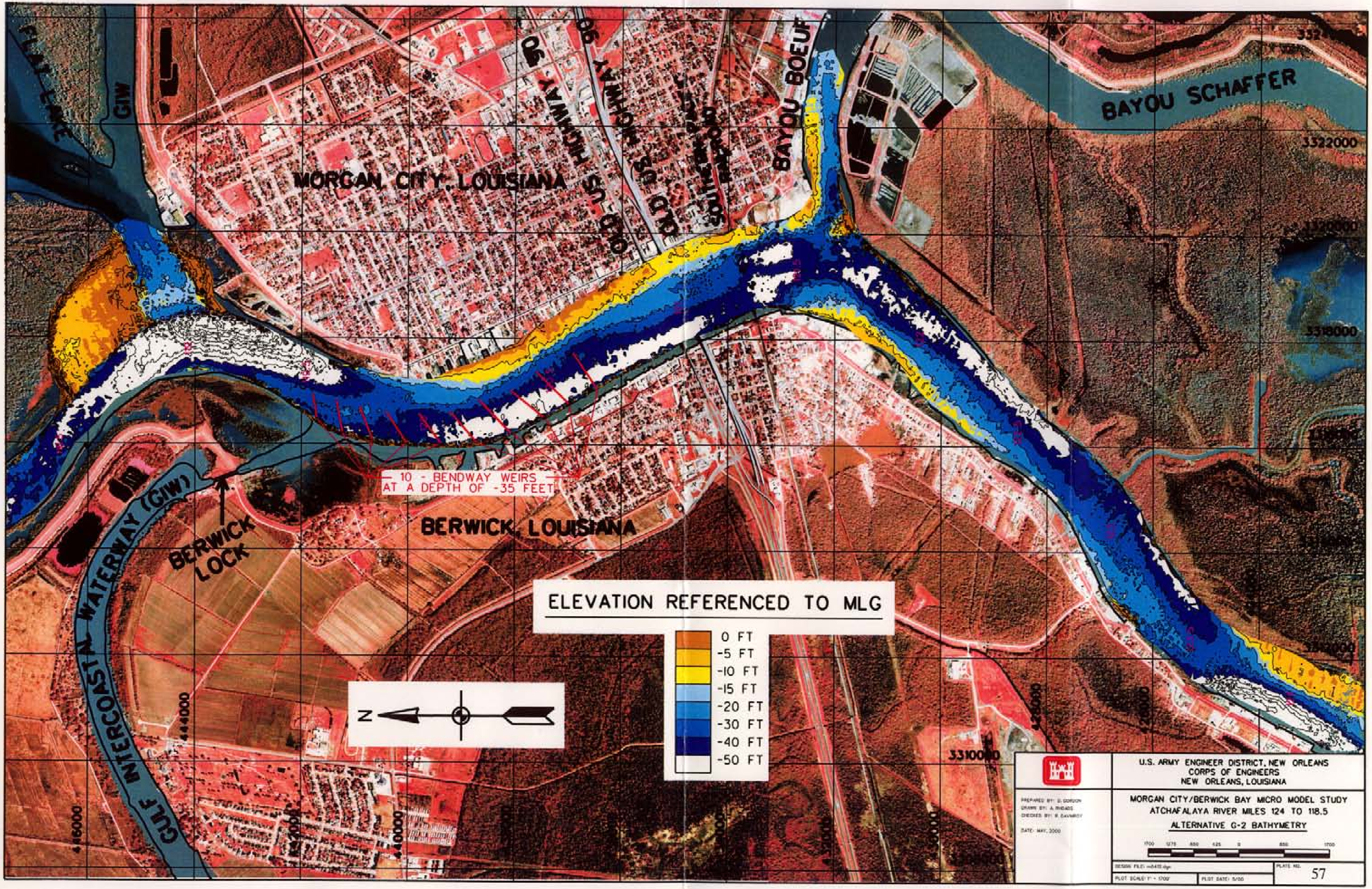
PREPARED BY: A. [illegible]
CHECKED BY: R. [illegible]

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE G VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO.
56


BAYOU SCHAFFER
MORGAN CITY, LOUISIANA
OLD US HIGHWAY 90
OLD US HIGHWAY 90
SOUTHERN PACIFIC RAILROAD
BAYOU BOEUF
GIW
10 - BENDWAY WEIRS AT A DEPTH OF -35 FEET
BERWICK, LOUISIANA
BERWICK LOCK
GULF INTERCOASTAL WATERWAY (GIW)
ELEVATION REFERENCED TO MLG
0 FT
-5 FT
-10 FT
-15 FT
-20 FT
-30 FT
-40 FT
-50 FT
N
3322000
3320000
3318000
3310000
444000
446000
440000
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5
ALTERNATIVE G-2 BATHYMETRY
DATE: MAY, 2000
PLATE NO.
57

TOP PHOTO: Low Flow

BOTTOM PHOTO: High Flow

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

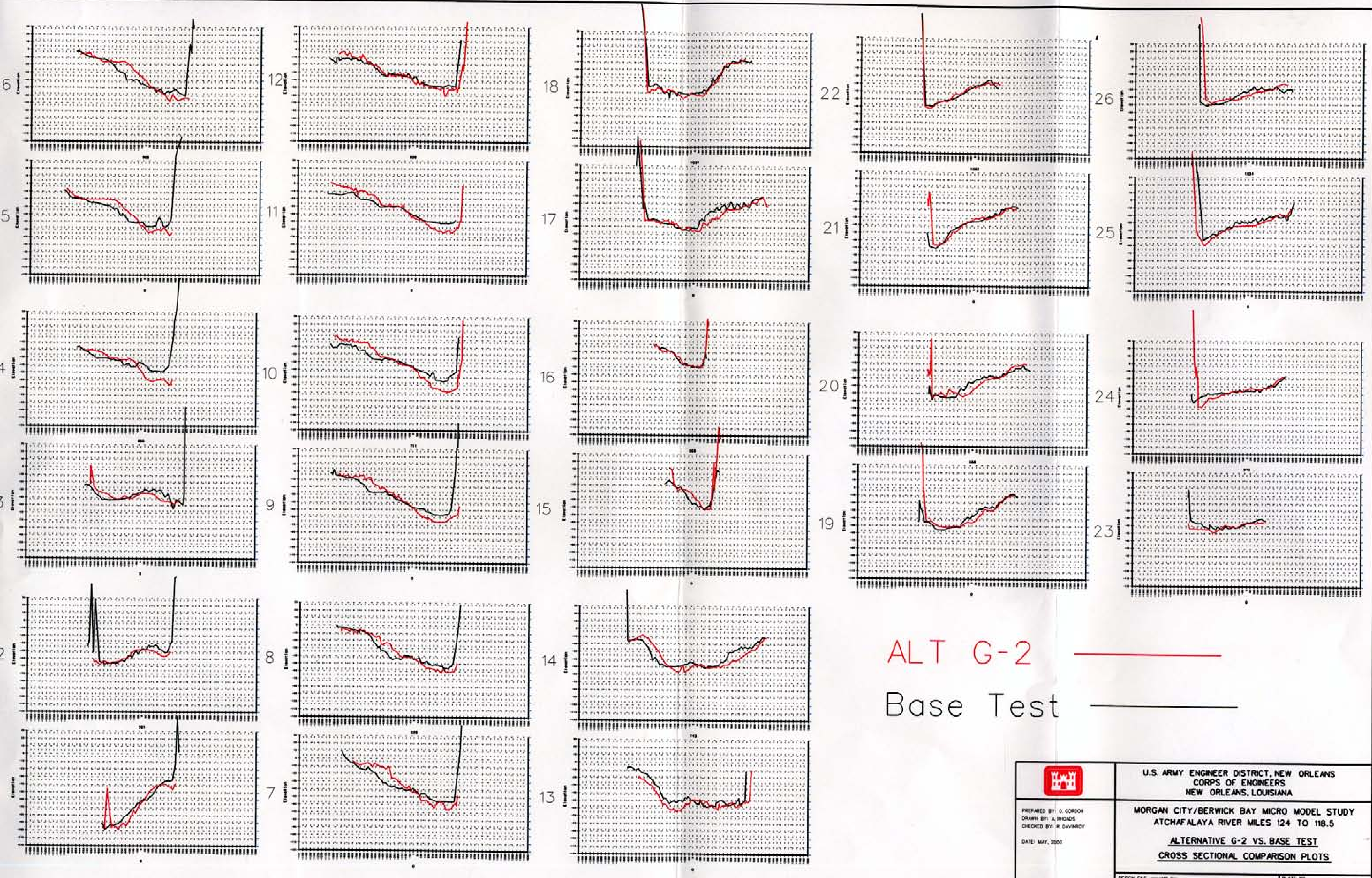
PREPARED BY: A. Rhoads
CHECKED BY: R. Dasinroy

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE G-2
FLOW VISUALIZATION

FLOWVISPLATES.PUB

PLATE NO. 58



U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE G-2 VS. BASE TEST

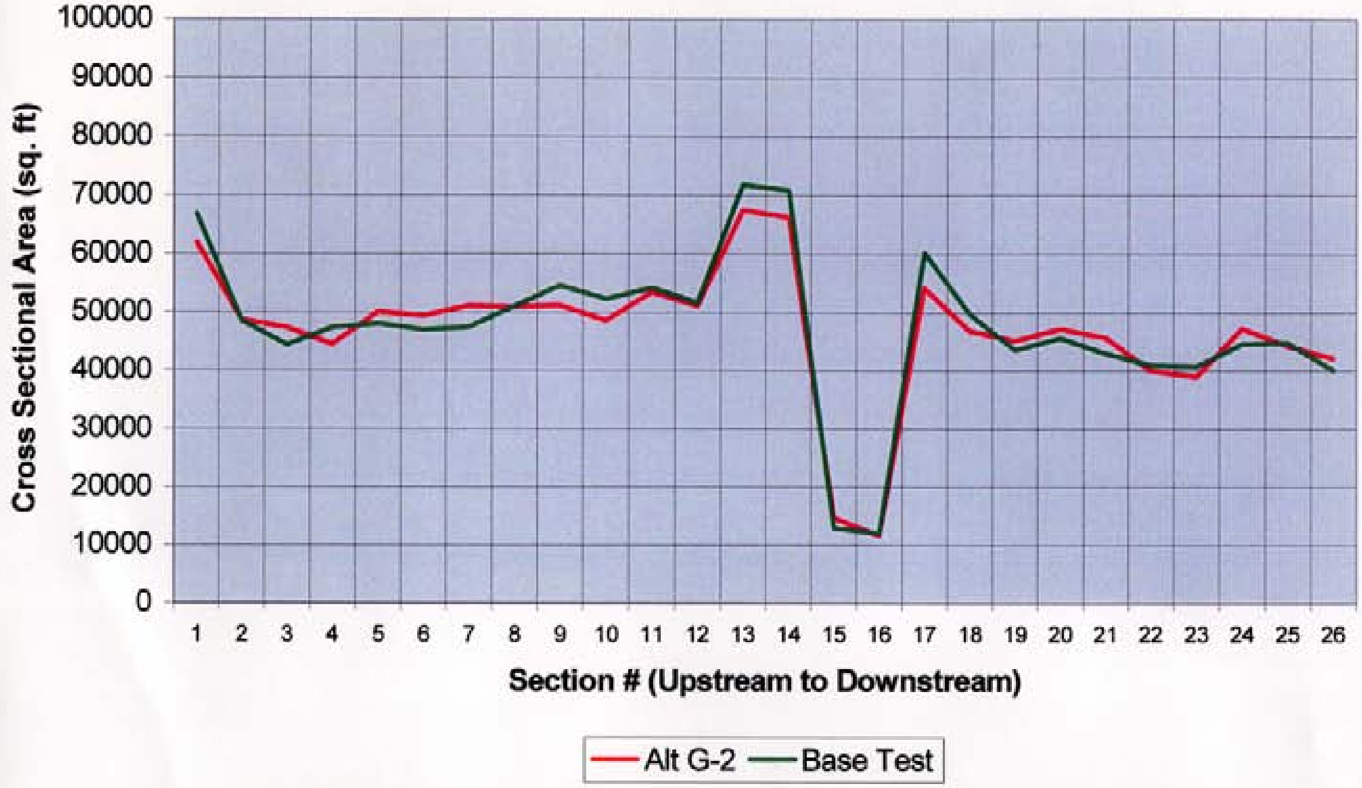
CROSS SECTIONAL COMPARISON PLOTS

DESIGN FILE: xsect12.dgn

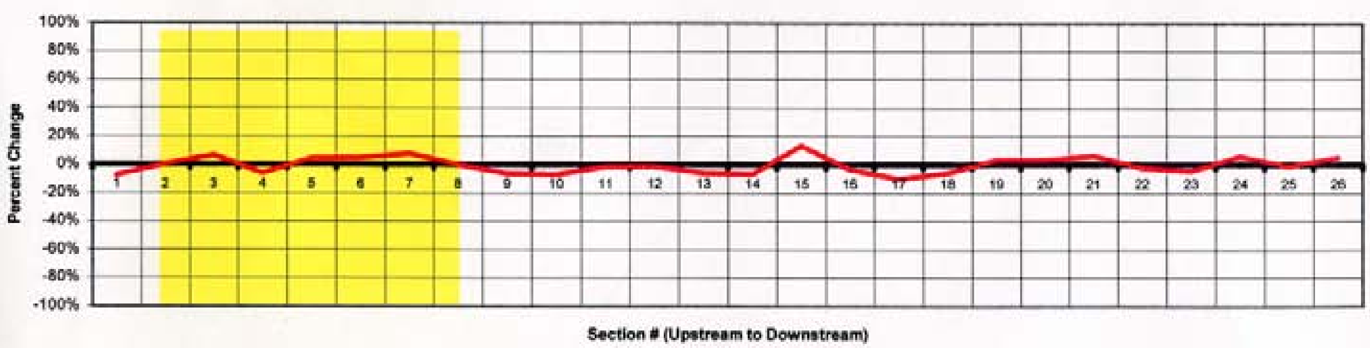
PLOT SCALE: 1" = 1200'

PLATE NO. 59

Morgan City Micro Model
Cross Sectional Area Comparison: BASE TEST VS. ALT G-2



Morgan City Micro Model
Percent Change in Cross Sectional Area: BASE TEST VS ALT G-2



WITHIN THE WEIR FIELD (SECTIONS 2 – 8), THE AVERAGE CHANGE IN CROSS SECTIONAL AREA WAS +2.5%.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY: A. Rhoads
CHECKED BY: R. Dealmay

MORGAN CITY/BERWICK BAY MICRO MODEL STUDY
ATCHAFALAYA RIVER MILES 124 TO 118.5

ALTERNATIVE G-2 VS BASE TEST,
CROSS SECTIONAL AREA COMPARISON GRAPHS

SECTIONS.PUB

PLATE NO.
60