Appendix D

Freeport Jetty Channel Widening
North Jetty Stability Analysis

FREEPORT JETTY CHANNEL WIDENING NORTH JETTY STABILITY ANALYSIS

Freeport, Texas

Prepared for

ConocoPhillips

Prepared by

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

J200.40233

June 2005

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

1.0 AUTHORIZATION

This study was authorized by Captain Kurt M. Hallier with ConocoPhillips on behalf of Port Freeport, the users of the deepwater ship channel, and the Brazos River Pilots Associations.

2.0 PURPOSE AND SCOPE

Presently, strong longshore currents make it difficult for a large ship to enter the Port Freeport Jetty Channel. Transitioning from a strong longshore current to the lack of significant cross current between the jetties is problematic with the existing 400-ft wide channel. Pilots feel that expanding the jetty channel from the current 400-ft width to 600 ft will provide the additional space necessary to accommodate the steering maneuvers required to make this transition. Presently, larger vessels are not allowed to enter the channel when the longshore current exceeds 0.5 knots or the wind exceeds 20 knots. The additional channel width should eliminate this restriction and ease vessel traffic limitations at Port Freeport.

Discussions with users of the Port have centered on widening the channel to the north. The existing south toe of the channel would remain in the same location and the north toe of the channel would move 200 ft to the north. This northern toe movement raises questions about the stability of the existing jetty structure and the effects of dredging on surrounding features.

This study was authorized in order to investigate channel layout options and evaluate the effect of the new channel width on the stability of the existing north jetty. The south jetty stability is not considered, because the south toe of the existing channel would not move under the above described scenario.

The purpose of this project was to:

- Develop desktop rectified aerial layouts of the existing channel alignment.
- Develop layouts for channel widening alternatives.
- Overlay widened channel layouts on aerial backgrounds.
- Develop channel cross-sections depicting past, current and proposed dredging templates and bottom elevations based on USACE data.
- Coordinate with Fugro Consultants (Fugro) in decisions concerning locations, extent and conditions to be analyzed for stability analysis cases. Review work by Fugro and incorporate their findings in our report.
- Provide guidance for costs comparisons between various dredging alternatives.
- Prepare a report outlining widening issues and options. This report will recommend an alignment and discuss relative cost differences between the options. Fugro's report will be included as an appendix to this report.

- Review the Fugro report prior to finalization.
- This report is not intended to address dredged material placement or permitting issues but will address channel geometry modifications to ease maneuvering issues for ship traffic.

3.0 EXECUTIVE SUMMARY

3.1 Channel Widening Options

The original concept for widening the Freeport Ship Channel was to extend the north toe of the channel further to the north by as much as 200 ft. This northern movement would widen the existing 400-ft wide channel to a total width of as much as 600 ft. If analyses indicated that the stability of the jetty would be compromised, then less widening would be considered. It is desirable to not effect the area of material referred to as "the wall" and its growth of seagrasses and the shoreline revetment section installed between approximate Sta. 45+00 and the existing U.S. Coast Guard (USCG) station.

In continued discussions, the Brazos Pilots Association pushed for a full 600-ft wide channel from the entrance channel, through the jetty channel and extending to the lower turning basin. The largest obstacle to overcome with the full 600-ft width concept was the affect on the shoreline revetment section and shoreline from approximate Sta. 45+00 to the USCG station. The resulting side slope from this widening would require the removal and reinstallation of the revetment section and would move the shoreline northward on the order of 50 ft or greater.

A compromise was reached wherein the channel would be widened 200 ft to the north from Sta. 0+00 to Sta. 40+00 providing a 600-ft channel width. From Sta. 40+00 to Sta. 45+00, the channel width would transition from 600-ft total width to 550-ft total width. The channel would be widened to a minimum width of 550 ft from Sta. 45+00 to the lower turning basin. This layout removes a portion of "the wall" and a portion of the seagrasses, but, it preserves the shoreline revetment between approximate Sta. 45+00 and the USCG station.

3.2 Slope Stability Summary

Based on stability analyses performed by Fugro, the jetty structure and shoreline stabilization sections will not be adversely affected by the widening of the channel. Summary results taken from Fugro's jetty stability analysis study are summarized as follows:

Table 3.1 Slope Stability Summary

Location	Desired Factor of Safety		Computed Least Factor of Safety	
	Short term	Long term[1]	Short term[2]	Long term
Station 5+00	=1.3	=(1.3 – 1.5)	1.77	1.79
Station 20+00	=1.3	=(1.3 – 1.5)	1.87	1.60
Station 40+00	=1.3	=(1.3 – 1.5)	1.82	1.5
Station 55+00	=1.3	=(1.3 – 1.5)	1.67	1.38

Notes: 1. Refer to Fugro report for more detailed explanation.
2. A factor of safety of 1.5 was calculated for shallow slope sloughing for short term conditions.
3. See Fugro report, Appendix D, for detailed results.

3.3 Dredge Volumes

The authorized dredge depth for the Jetty Channel is -45 ft MLT plus 2 ft of advanced maintenance plus 2 ft of allowable overdepth (OD). This results in a required depth of -47 ft MLT plus 2 ft of OD. It has been the desire of the users to only dredge the necessary depth and not the portion for advanced maintenance. Volumes were calculated for both the -45-ft and -47-ft scenarios.

Although not part of the original scope, dredge volumes for the entrance channel (end of jetties to the seabar) were calculated. The authorized dredge depth for the Entrance Channel is -47 ft MLT plus 2 ft of advanced maintenance plus 2 ft OD. This results in a required depth of -49 ft MLT plus 2 ft OD. Entrance Channel volumes were calculated for dredge depths of -45 ft plus 2 ft OD and for -49ft plus 2 ft OD. Summaries of dredge volumes are as follows:

Table 3.2 Dredge Volume Summary

Reach	Dredge Depths	Required Depth (CY)	Required Depth (CY)	Total Volume (CY)
Jetty Channel	*-45 FT + 2 FT OD*	1,452,022	78,296	1,530,318
Entrance Channel	*-45 FT + 2 FT OD*	672,589	220,556	893,145
			Total	**2,423,463**
Jetty Channel	*-47 FT + 2 FT OD*	1,554,881	78,296	1,633,177
Entrance Channel	*-49 FT + 2 FT OD*	1,245,202	315,963	1,561,165
			Total	**3,194,342**

3.4 Implication for Federal Assumption of Maintenance

It is very likely that the section of the widened portion of the channel will have to match the adjacent federal section (authorized dredge depths) prior to assumption. Because of the magnitude of the potential cost deferment ($5.8 million), the issue of when this deepening should be done merits further scrutiny.

3.5 Other Considerations

Allowances have been made in the estimate of probable costs to cover the costs of mitigating seagrass removal and required modification of aids to navigation. Chemical testing of dredged materials has been performed and no impact on dredging or placement is expected.

3.6 Probable Construction Costs and Comparisons

Opinions of probable construction costs were developed on the basis of comparative values assuming that all of the dredged material is placed offshore and that there is no fee required for disposal. Possible means of material removal are hydraulic cutter head dredge, hopper dredge, and/or clamshell dredge and scow. We recommend that dredging be permitted such that dredging contractors can select the most suitable and most economical dredge method(s) for this project based n their experiences and available equipment.

Our opinion of probable cost for dredging, depending on the initial dredge depth selected, is as follows:

Table 3.3 Opinions of Probable Construction Costs

Reach	Dredge Depths	Total Dredged Volume (CY)	Construction Cost
Jetty Channel	*-45 FT + 2 FT OD*	1,530,318	$21,100,000
Entrance Channel	*-45 FT + 2 FT OD*	893,145	
Jetty Channel	*-47 FT + 2 FT OD*	1,633,177	$27,000,000
Entrance Channel	*-49 FT + 2 FT OD*	1,561,165	

Note: Costs for removing existing debris or wrecks are not included in these costs.

THE REPORT

4.0 BACKGROUND

Presently, strong longshore currents make it difficult for a ship to enter the Port Freeport Jetty Channel. Transitioning from a strong longshore current to the lack of significant cross current between the jetties is problematic with the existing 400-ft wide channel. Pilots feel that expanding the jetty channel from the current 400-ft width to 600 ft will provide the additional space required to accommodate the steering maneuvers required to make this transition. Presently, larger vessels are not allowed to enter the channel when the longshore current exceeds 0.5 knots or the wind exceeds 20 knots. The additional channel width should eliminate this restriction and ease vessel traffic limitations at Port Freeport.

The U.S. Army Corps of Engineers (USACE) is currently evaluating widening the channel to 600 ft as well as deepening the current channel depth to as deep as elevation -60 ft. Initially, the USACE is proposing to widen the channel 150 ft to the north and 50 ft to the south. Port Freeport and the users of the port have expressed a desire to cooperate with and support the proposed USACE evaluation as much as practical, as it parallels this study.

The major concerns are relative to the stability of the new underwater dredged slopes as well as the overall stability of the existing north jetty, which will be closer to the proposed side slopes. Also, widening of the channel to the north could have adverse effects on the shoreline area, surface drainage, and existing stone shoreline protection system located between about Sta. 40+00 and Sta. 63+35.

4.1 Existing Channel Alignment and North Jetty Information

Existing land and channel features used for the study were provided by the USACE Drawing No. "NAD83BASE.DGN". The accuracy of the provided features was investigated using Navigation Charts and the following USACE record plans:

- Project Title "Construct 3,700 Feet of North Jetty and Remove Existing North Jetty", File No. 515-67, March 1987;
- Project Title "Dredge Entrance Channel Sta. -230+00 to Sta. +50+35.91", File No. 501-398, January 1990; and
- Project Title "South Jetty Rehabilitation – North Jetty Extension", File No. BRAZ 501-400, November 1990.

4.2 Aerial Photograph

The aerial photograph used for the evaluation was taken by Lanmon Aerial Photography, Inc. on August 6, 2003 (see E1). Fieldwork was performed to gather location data in order to rectify the aerial photograph to existing features such as street intersections and other visual markers. Although the entire limits of the aerial photograph were not completely rectified, the portions that include areas covered by this report were surveyed in order to adjust the scale of the layout.

4.3 Hydrographic Data

The jetty channel cross-sections included for this evaluation were generated from Shiner Moseley's hydrographic survey performed on October 10, 2004 (see E2). The generated channel cross-sections compared adequately with the USACE generated channel sections. The USACE channel cross-sections were generated from ASCII xyz survey data file, which was the result of surveys performed by the USACE in 2003. The USACE data was used to calculate dredge volumes for the entrance channel.

5.0 FULL CHANNEL WIDENING ALTERNATIVE

From a navigation point of view, the most desirable alternative would be to increase the existing 400-ft channel width to 600 ft beginning at Sta. 0+00 and extending all the way into the lower turning basin (near the existing USCG station). The proposed channel widening from Sta. 0+00 to Sta. 52+00 will be 200 ft. However, the channel widening from Sta. 52+00 to Sta. 63+35 would be 128 ft since the existing channel width to the north of the channel centerline is 272 ft (the channel is currently 472 ft wide in this area).

Widening between Sta. 40+00 and the USCG station will have impacts on existing seagrasses and existing shorelines. These areas have emergent and shallow areas adjacent the channel, some of which support seagrass growth. Dredging these areas will remove a portion of the seagrass and require that the existing shoreline revetment be removed and relocated to the north. Determination of property ownership and discussions with the city of Surfside would need to be scheduled to explore this option. Due to shoreline impacts, drawings were not prepared for this option.

6.0 PARTIAL CHANNEL WIDENING ALTERNATIVES

6.1 Partial Channel Widening 400 Ft to 600 Ft Option

This alternative entails increasing of the existing channel width from 400 ft to 600 ft beginning at Sta. 0+00 and ending at Sta. 38+00. The proposed channel widening will be 200 ft in the direction of the north jetty. Thereafter, the proposed widened channel width will transition from 600 ft in width at Sta. 38+00 to tie into the existing channel width at Sta. 43+00; i.e. transition the additional north side channel width from 200 ft to 0 ft. The proposed length of the transition is 500 ft.

As a result of ongoing discussions with the Brazos Pilots, this option was considered not adequate by the Pilots and abandoned.

6.2 Partial Channel Widening 550 Ft to 600 Ft Option

This alternative entails increasing of the existing channel width from 400 ft to 600 ft beginning at Sta. 0+00 and ending at Sta. 40+00 (see E3 and E4). The proposed channel widening will be 200 ft in the direction of the north jetty. Thereafter, the proposed widened channel will transition from 600 ft in width at Sta. 40+00 to 550 ft in width at Sta. 45+00. The proposed 550-ft channel width will be constant and will end at Sta. 63+46.

The layout of this channel widening option is included in Appendix A along with channel cross-sections showing dredge depth of -45 ft + 2 ft OD. Dredge volumes were calculated using the double end area method and using three-dimensional computer models. Since overdepth calculations were straight forward, manually calculated overall depth volumes were added to computer generated prism volume to obtain otal dredge volumes. Tables in Appendix B show calculated dredge volumes by both methods. The summary dredge volumes for the minimum required depth and for the authorized depths are as follows:

Table 6.1 Dredge Volume Summary

Reach	Dredge Depths	Required Depth (CY)	Required Depth (CY)	Total Volume (CY)
Jetty Channel	*-45 FT + 2 FT OD*	1,452,022	78,296	1,530,318
Entrance Channel	*-45 FT + 2 FT OD*	672,589	220,556	893,145
			Total	**2,423,463**
Jetty Channel	*-47 FT + 2 FT OD*	1,554,881	78,296	1,633,177
Entrance Channel	*-49 FT + 2 FT OD*	1,245,202	315,963	1,561,165
			Total	**3,194,342**

7.0 UNDERWATER DREDGE SLOPE AND NORTH JETTY STABILITY

Fugro performed all of the slope stability analyses in accordance the USACE guidelines presented in EM 1110-2-2904, "Design of Breakwaters and Jetties", 8 August 1986 and EM 1110-2-1902, "Slope Stability", 31 October 2003.

Fugro completed slope stability analyses on widened channel cross-sections at Sta. 55+00, Sta. 40+00, Sta. 20+00, and Sta. 5+00 with 3 (horizontal) on 1 (vertical) underwater dredge slope configuration as provided by Shiner Moseley. The slope stability analyses yielded factors of safety of 1.3 and greater for short-term and 1.3 to 1.5 or greater for long-term conditions as shown in table 7.1. Additionally, the stability of 4 (horizontal) on 1(vertical) underwater dredge slope was analyzed at Sta. 40+00, Sta. 20+00, and Sta. 5+00 and yielded factors of safety of 1.3 and greater for short-term and 1.3 to 1.5 and greater for long-term loading conditions in each case.

Table 7.1 Slope Stability Summary

Location	Desired Factor of Safety		Computed Least Factor of Safety	
	Short term	Long term [1]	Short term [2]	Long term
Station 5+00	=1.3	=(1.3 – 1.5)	1.77	1.79
Station 20+00	=1.3	=(1.3 – 1.5)	1.87	1.60
Station 40+00	=1.3	=(1.3 – 1.5)	1.82	1.5
Station 55+00	=1.3	=(1.3 – 1.5)	1.67	1.38

Notes: 1. Refer to Fugro report for more detailed explanation.
2. A factor of safety of 1.5 was calculated for shallow slope sloughing for short term conditions.
3. See Fugro report, Appendix D, for detailed results.

Fugro's final report is included in Appendix D.

8.0 AIDS TO NAVIGATION

The existing channel centerline has range markers at the end of the entrance and jetty channel reach. The front range has an optical height of 40 ft and is located just offshore of a dredged material disposal area seaward of the intracoastal and on the north side of the ship channel. The rear range has an optical height of 148 ft and is located on Dow Chemical property adjacent to a drainage ditch. The line of site of the centerline and the ranges pass almost over a turning dolphin at a Dow Chemical ship dock. This dock is capable of berthing large tankers with high freeboards and bridges with high air drafts that could interfere with line of sight.

Moving the existing ranges 100 **f** in a northerly direction to reflect the new channel centerline, will make the line of site pass through a tanker at the Dow facility. The air draft of the tanker will necessitate taller towers when these range markers are moved. Discussions with the Pilots, USCG, Port Freeport, and other users will be necessary to determine new designs and locations for the ranges. Other buoys will also probably have to be relocated. An amount of $500,000 has been included to cover the costs of these modifications.

Since this is a public waterway and is adjacent to a federal project (the existing ship channel), it may be possible for the USCG to make aids to navigation changes under their federal budget. It could also be that for that to take place, federal assumption of maintenance for the channel may have to be in place.

9.0 SEAGRASS REPLACEMENT

The channel widening project will eliminate a small amount of seagrass that exists along the north bank of the ship channel between Sta. 38+00 and Sta. 45+00. Cost provisions have been included in the estimate of probable construction costs to mitigate the loss of this seagrass by reestablishing seagrass beds at the rate of 3:1 (relocated acreage:affected acreage). A suitable location will need to be determined for the relocation effort.

10.0 IMPLICATIONS FOR FEDERAL ASSUMPTION OF MAINTENANCE

It is our understanding that a primary objective is to get the federal government to assume the maintenance cost of the widened increment. This will require congressional action, which is being pursued by Port Freeport's representatives. Congress will normally closely consult with the USACE prior to any such authorization. It is very probable that the USACE will insist that the widened increment be dredged to the same depth as the adjacent federal section prior to the federal assumption of maintenance. Thus a key issue is whether or not the widened increment should be initially constructed to the same depth as the adjacent federal channel (jetty channel –45 ft + 2ft advanced maintenance + 2ft overdepth and entrance channel –47 ft + 2 ft advanced maintenance + 2ft overdepth) or should initial construction be to a lesser depth and then be deepened immediately prior to federal maintenance assumption. Because of the magnitude of the potential cost deferment ($5.8 million), this question merits further attention.

11.0 PROBABLE CONSTRUCTION COSTS

Opinion of probable construction costs are provided in Appendix C. Costs for both the -45 dredge depth and the -47/-49 (jetty channel / entrance channel) dredge depths have been presented. Costs for removing wrecks or other physical items from the area to be dredged have not been included. The existence of these items should be explored in subsequent detailed geophysical studies.

Dredging costs can fluctuate significantly due to the amount of dredging work in progress nationwide (how busy dredge contractors are), fuel costs fluctuation, and increased dredge volumes from the time initial estimates of volumes are made. Contingency amounts have been included in the opinion of costs for these items. Other costs that have been included are mitigation for disturbed seagrasses and modifications to aids to navigation.

Opinion of construction amounts for both depth options are as follows:

Table 11.1 Opinions of Probable Construction Costs

Reach	Dredge Depths	Total Dredged Volume (CY)	Construction Cost
Jetty Channel	*-45 FT + 2 FT OD*	1,530,318	$21,100,000
Entrance Channel	*-45 FT + 2 FT OD*	893,145	
Jetty Channel	*-47 FT + 2 FT OD*	1,633,177	$27,000,000
Entrance Channel	*-49 FT + 2 FT OD*	1,561,165	

Notes: Costs for removing existing debris or wrecks are not included in these costs.

12.0 SUMMARY AND CONCLUSION

The proposed widening of the Port Freeport entrance channel (end of jettys to the seabar) and the jetty channel (end of jetties to the lower turning basin) is being considered to ease navigation constraints due to longshore currents and winds when approaching the jetty channel. It is proposed that the entrance channel be widened 200 ft to the north providing a total 600-ft width. The recommended widening limits for the jetty channel are as follows:

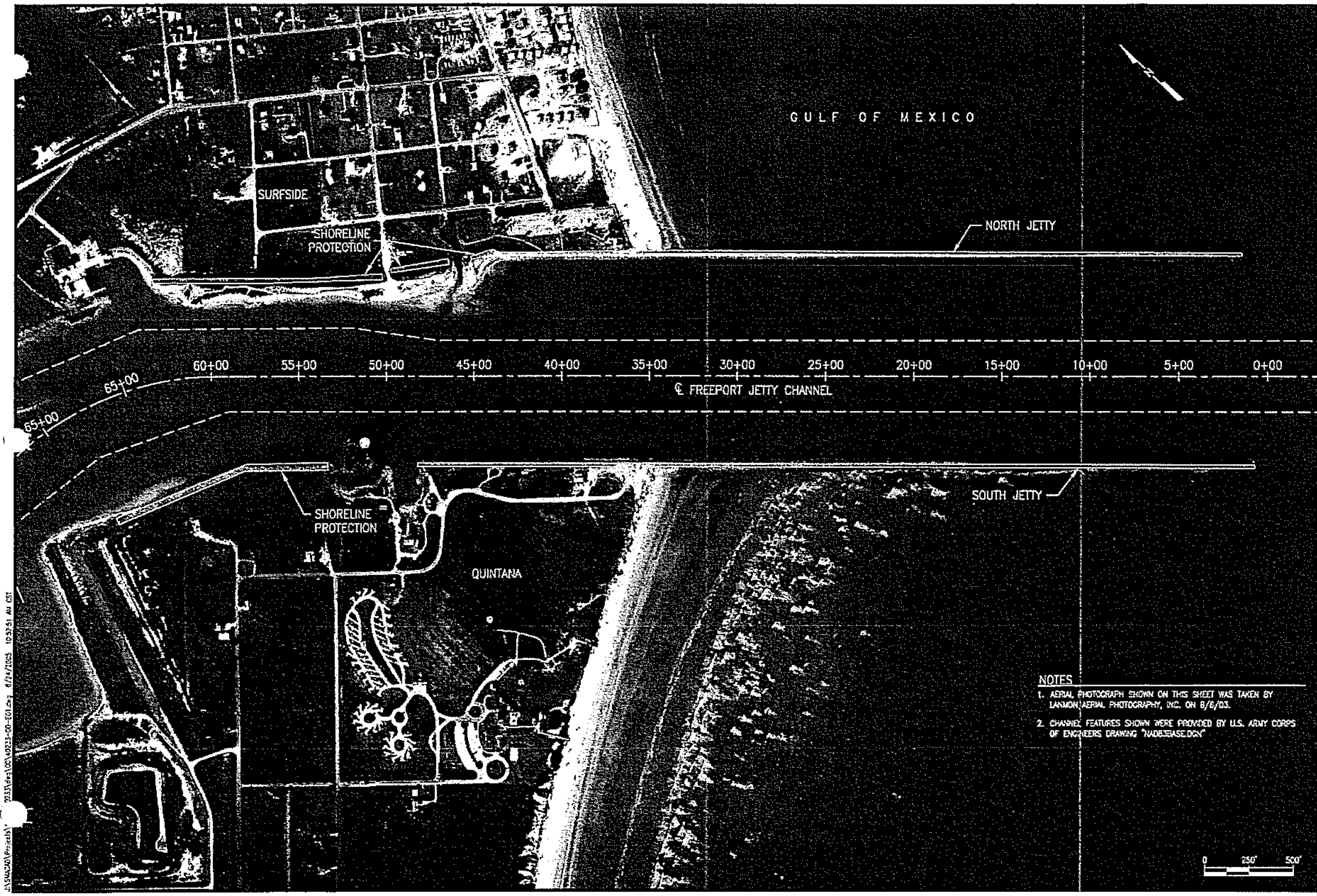
Sta. 0+00 to Sta. 40+00.....widen 200 ft to the north for a total width of 600 ft

Sta. 40+00 to Sta. 45+00 .....widen to the north to transition from a width of 600 ft to 550 ft

Sta. 45+00 to Sta. 63+46.....widen to the north for total width of 550 ft

Volumes of material removed and resulting costs vary depending on the initial dredge depth selected. Dredge depth can either be selected based on the needed depth for the deepest draft ship or on the existing congressionally authorized depths and allowances for advanced maintenance and allowable overdepth. Selecting the shallowest needed dredge depths will result in the lowest initial construction cost. However, if it is desired to pursue legislation to include the widened channel under federal maintenance, it will probably be necessary to dredge to the authorized depth to establish a history of need for these depths and the need for federal maintenance assumption. If

federal assumption of maintenance is being contemplated, then federal assumption evaluation criteria should be investigated prior to making this decision.



REV	DATE	DESCRIPTION	APP
0			

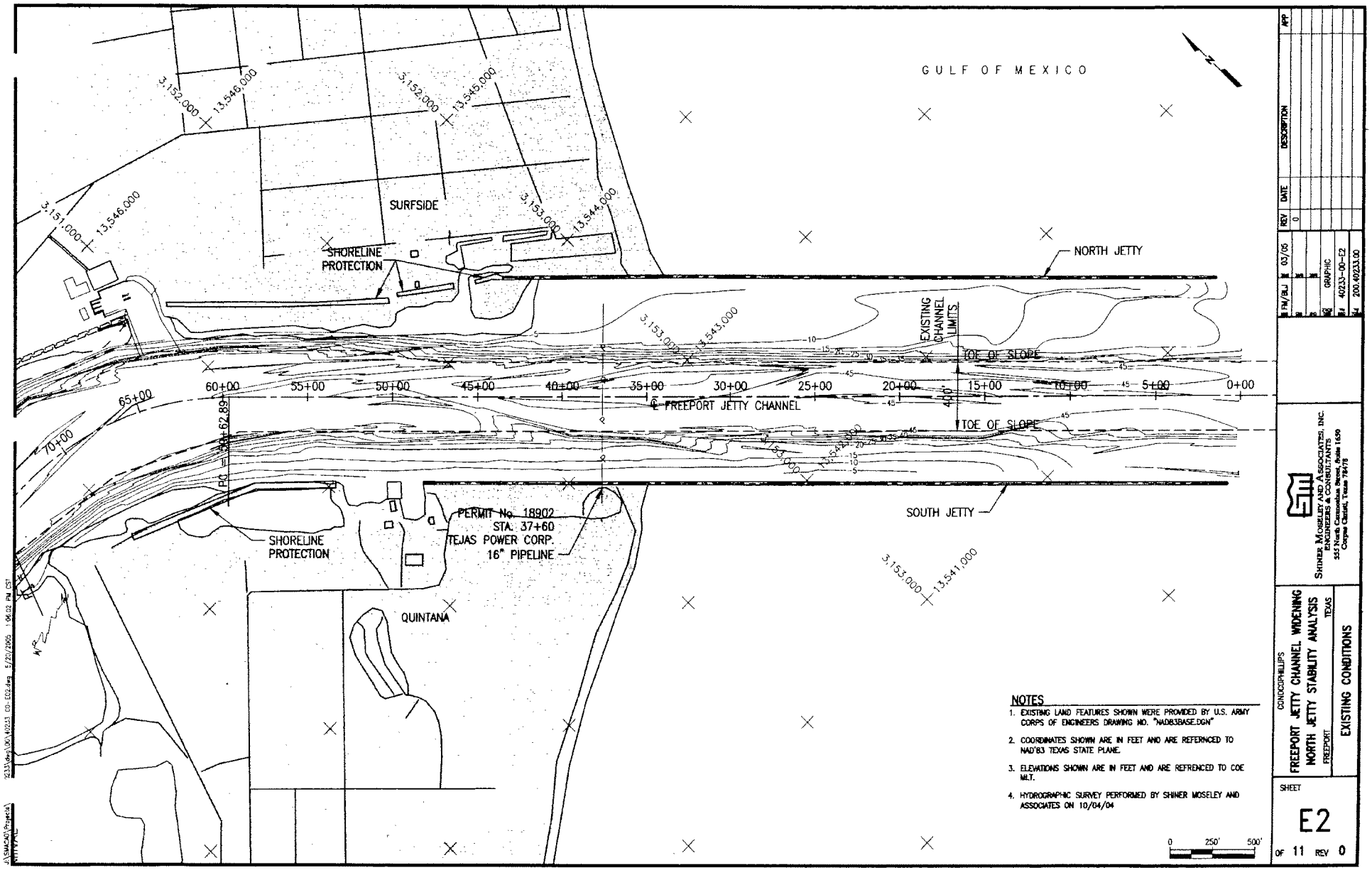
FM 03/05
GRAPHIC
40233-00-E1
200.40233.00

Shiner Moseley and Associates, Inc.
Engineers & Consultants
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS
EXISTING CHANNEL ALIGNMENT

SHEET E1 OF 11 REV 0

J:\SHACAD\Projects\...0233\dwg\00\40233-00-E01.dwg 6/24/2005 10:57:51 AM CST



NOTES

1. EXISTING LAND FEATURES SHOWN WERE PROVIDED BY U.S. ARMY CORPS OF ENGINEERS DRAWING NO. "NAD83BASE.DGN"
2. COORDINATES SHOWN ARE IN FEET AND ARE REFERNCED TO NAD'83 TEXAS STATE PLANE.
3. ELEVATIONS SHOWN ARE IN FEET AND ARE REFRENCED TO COE MLT.
4. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

0 250' 500'

REV	DATE	DESCRIPTION	APP
0			

FN/BLJ	03/05	GRAPHIC
BY	DATE	JOB
		402.33-00-E2
		200.402.33.00

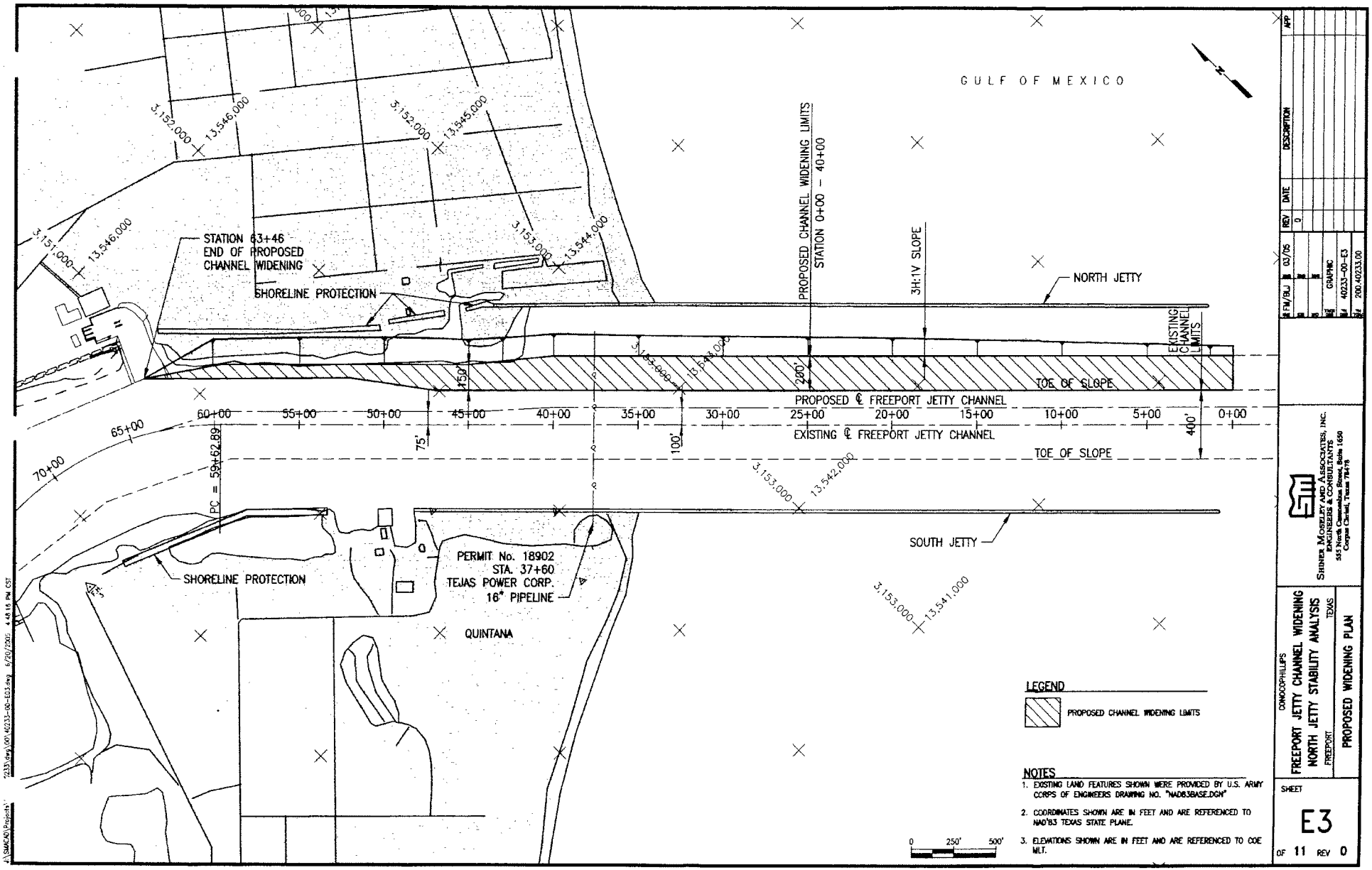
SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS

EXISTING CONDITIONS

SHEET
E2
OF 11 REV 0

J:\SMCAD\Projects\402.33 - 00 - E02.dwg 5/20/2005 1:06:02 PM CST


GULF OF MEXICO
STATION 63+46
END OF PROPOSED
CHANNEL WIDENING
SHORELINE PROTECTION
PROPOSED CHANNEL WIDENING LIMITS
STATION 0+00 - 40+00
3H:1V SLOPE
NORTH JETTY
EXISTING CHANNEL LIMITS
TOE OF SLOPE
PROPOSED ℄ FREEPORT JETTY CHANNEL
EXISTING ℄ FREEPORT JETTY CHANNEL
SOUTH JETTY
PERMIT No. 18902
STA. 37+60
TEJAS POWER CORP.
16" PIPELINE
QUINTANA
PC = 59+62.89
3,152,000
13,546,000
3,152,000
13,545,000
3,151,000
13,546,000
3,153,000
13,544,000
3,153,000
13,543,000
3,153,000
13,542,000
3,153,000
13,541,000
150'
200'
75'
100'
400'
60+00
55+00
50+00
45+00
40+00
35+00
30+00
25+00
20+00
15+00
10+00
5+00
0+00
65+00
70+00
LEGEND
PROPOSED CHANNEL WIDENING LIMITS
NOTES
1. EXISTING LAND FEATURES SHOWN WERE PROVIDED BY U.S. ARMY CORPS OF ENGINEERS DRAWING NO. "NAD83BASE.DGN"
2. COORDINATES SHOWN ARE IN FEET AND ARE REFERENCED TO NAD'83 TEXAS STATE PLANE.
3. ELEVATIONS SHOWN ARE IN FEET AND ARE REFERENCED TO COE MLT.
0
250'
500'
APP
DESCRIPTION
DATE
REV
0
03/05
FW/BJJ
GRAPHIC
40233-00-E3
200.40233.00
CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT
TEXAS
PROPOSED WIDENING PLAN
STEVENS MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
535 North Corporate Road, Suite 1650
Corpus Christi, Texas 78478
SHEET
E3
OF 11 REV 0
J:\SMA\40\Projects\7233\dwg\001\40233-00-E03.dwg 6/20/2005 4:48:16 PM CST

REV	DATE	DESCRIPTION	APP
0			

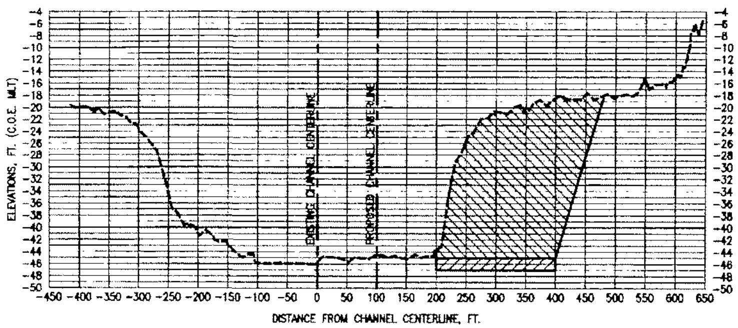
FM/BJ 03/05
GRAPHIC
40233-00-E4
200.40233.00

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

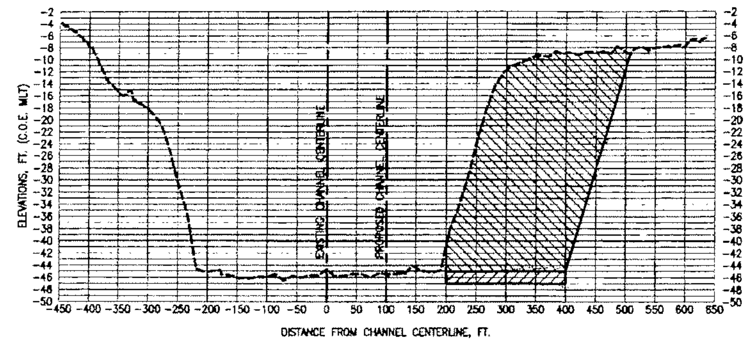
CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS
PROPOSED WIDENING PLAN AERIAL

SHEET E4 OF 11 REV 0

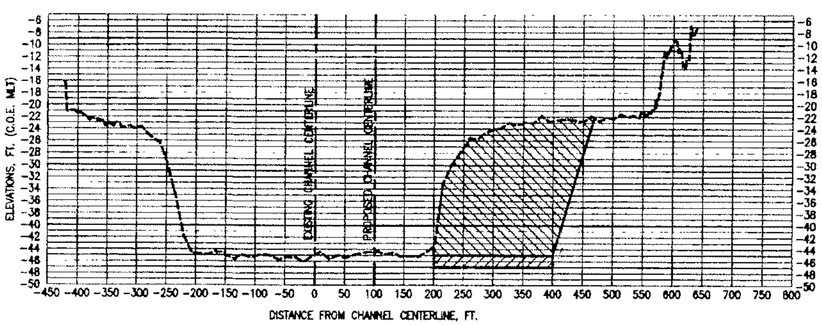
J:\SMCAD\Projects\0233\dwg\00\40233-00-E04.dwg 6/21/2005 10:15:24 AM CST



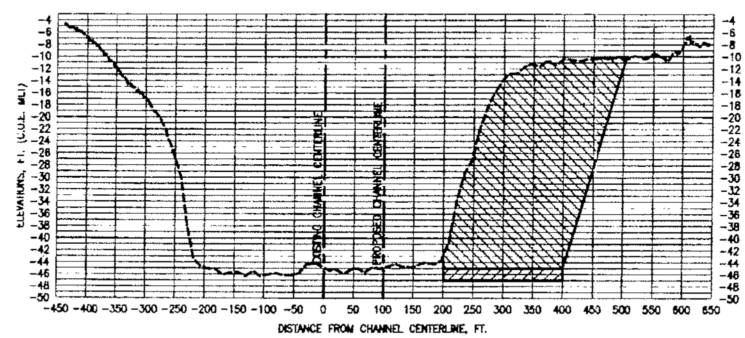
10+00



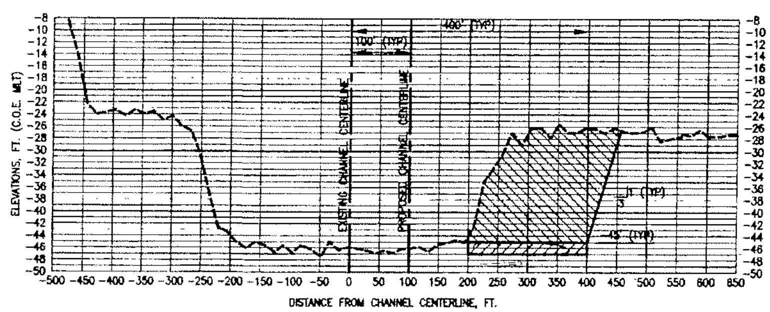
25+00



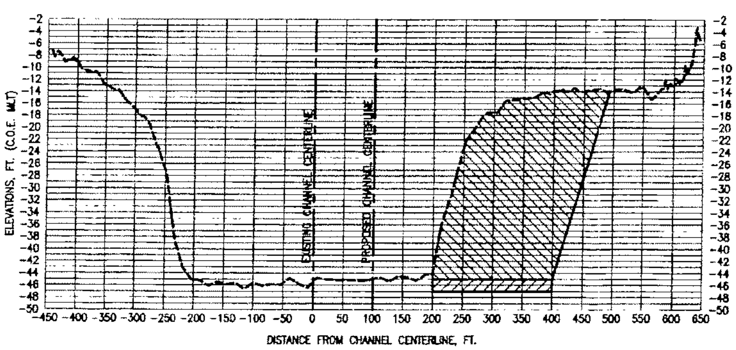
5+00



20+00



0+00



15+00

HORIZONTAL 0 100' 200'

VERTICAL 0 10' 20'

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- - - - APPROXIMATE EXISTING GRADE
—— PROPOSED DREDGE LIMITS
DREDGE AREA
2' ALLOWABLE OVERDEPTH

REV	DATE	DESCRIPTION	APP
0			

FM/BLJ 03/05
GRAPHIC
40233-00-E5
200.40233.00

Shiner Moseley and Associates, Inc.
Engineers & Consultants
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS

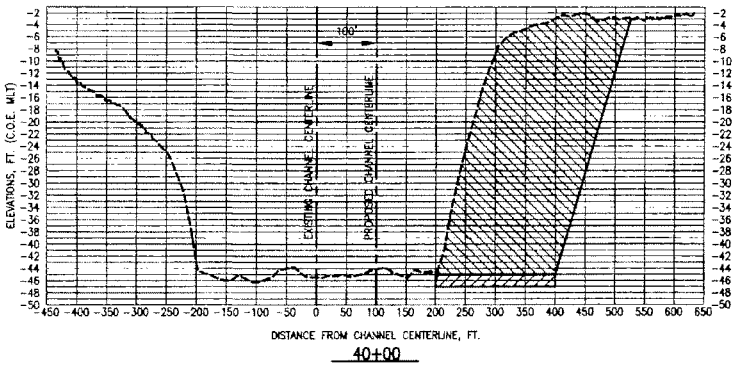
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

FREEPORT TEXAS

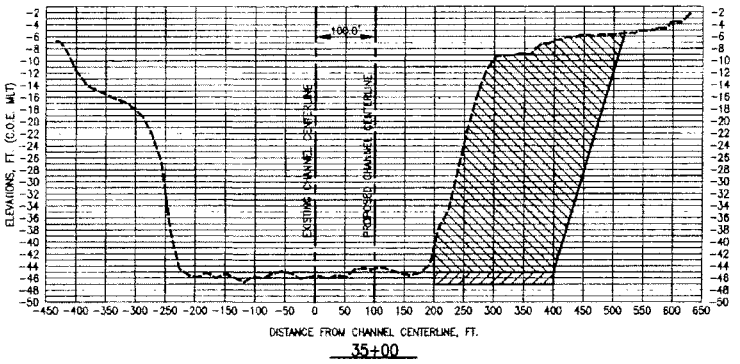
JETTY CHANNEL SECTIONS
STA. 0+00 - STA. 25+00

SHEET E5 OF 11 REV 0

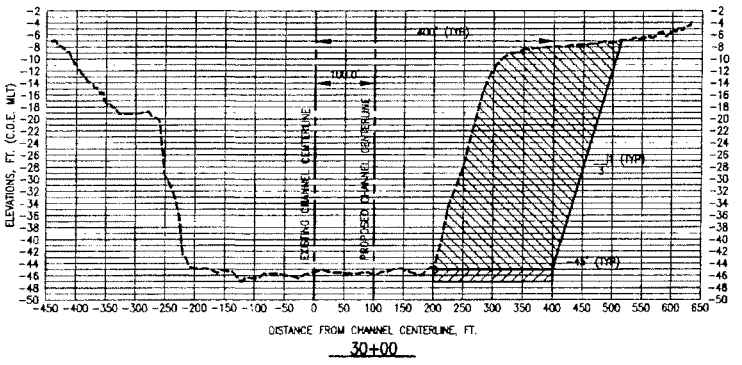
J:\SMACAD\Projects\2233\dwg\00\40233-00-E05.dwg 6/20/2005 5:05:26 PM CST



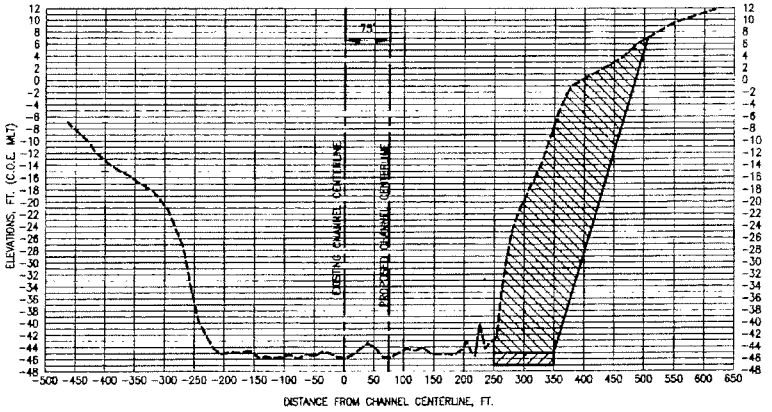
40+00



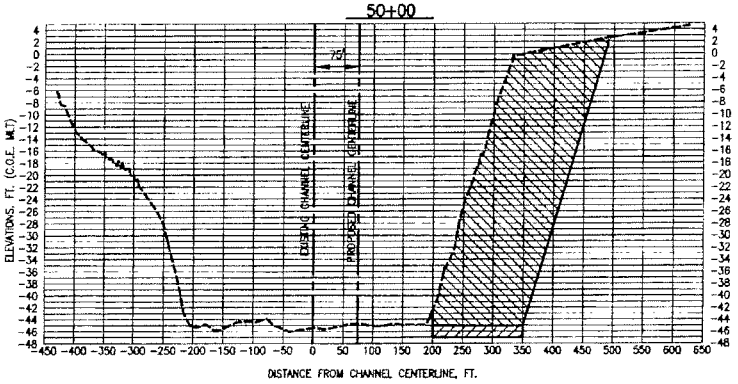
35+00



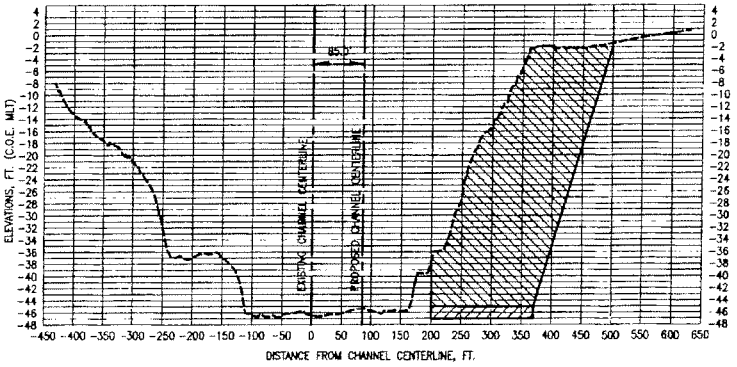
30+00



50+00



45+00



43+00

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

HORIZONTAL 0 100' 200'

VERTICAL 0 10' 20'

APP	DESCRIPTION	DATE	REV
			0

FW/BJ	03/05
GRAPHIC	
40233-00-E6	
200-40233.00	

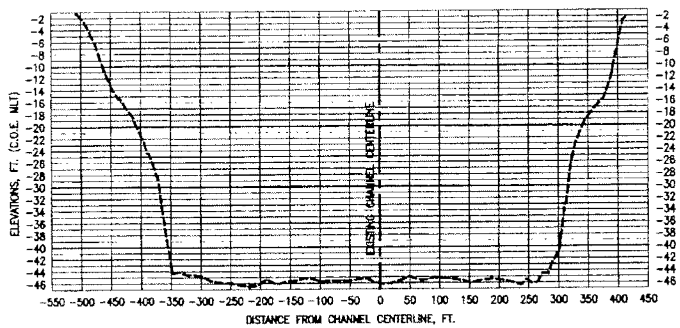
SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
TEXAS
FREEPORT
JETTY CHANNEL SECTIONS
STA. 30+00 - STA. 50+00

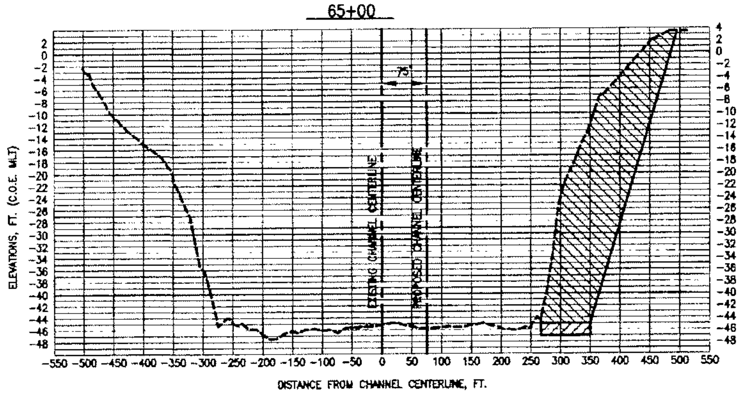
SHEET E6
OF 11 REV 0

J:\233\dwg\GA\40233-00-E06.dwg 6/20/2005 5:17:31 PM CST

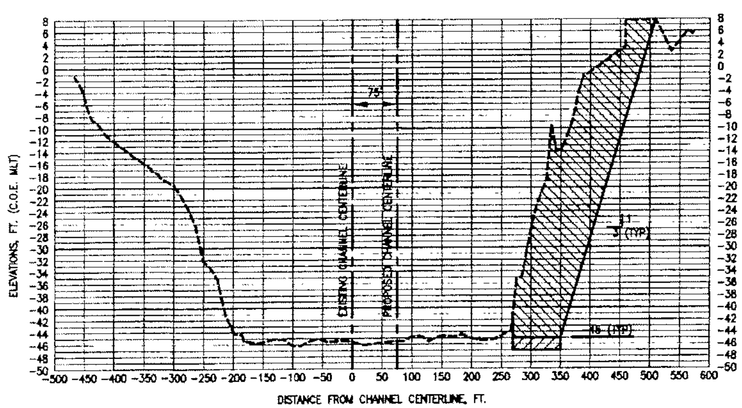
J:\CIVIL\CADD Projects\



65+00



60+00



55+00

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

HORIZONTAL 0 100' 200'

VERTICAL 0 10' 20'

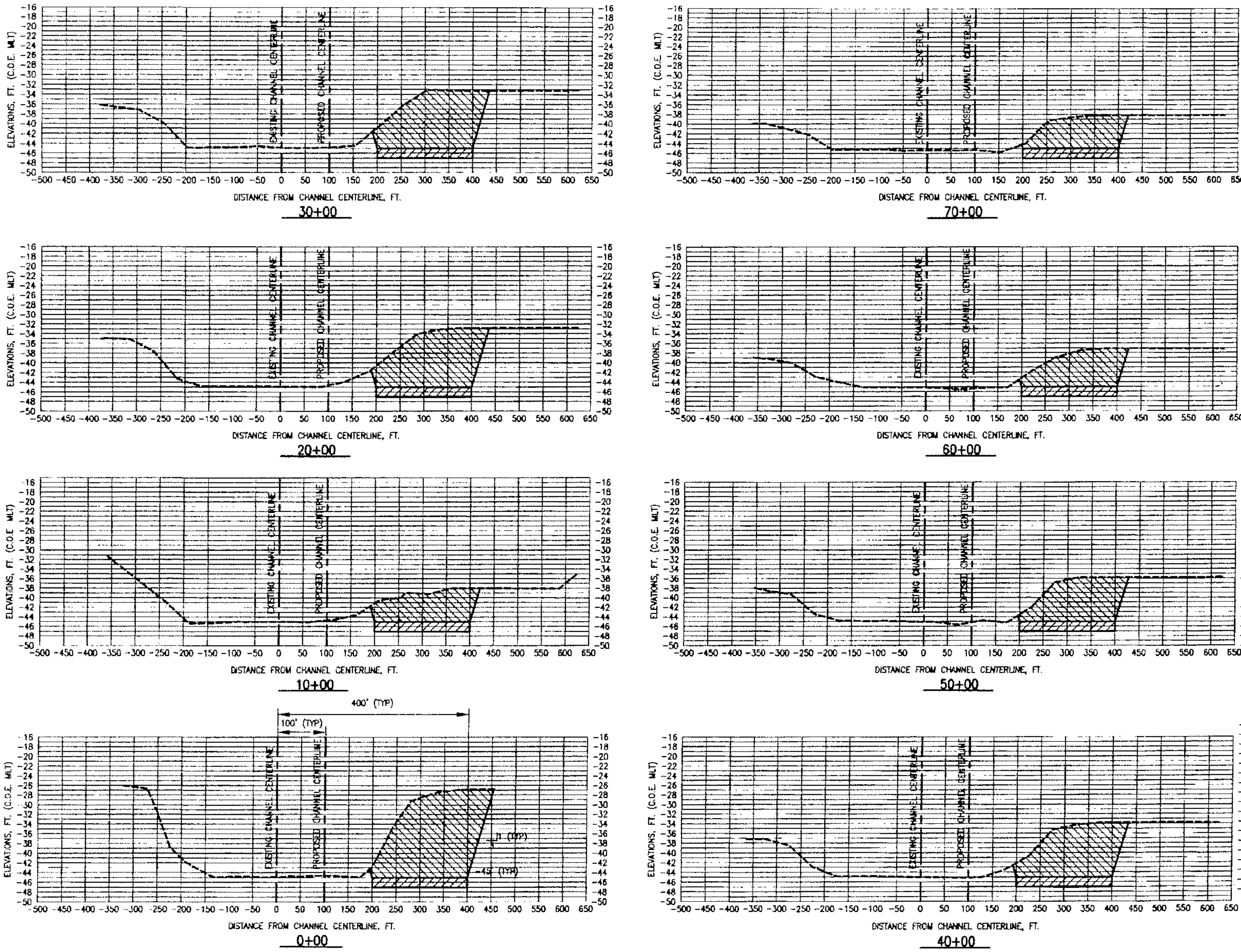
SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS
JETTY CHANNEL SECTIONS
STA. 55+00 - STA. 65+00

SHEET E7 OF 11 REV 0

FN/BLJ	03/05	REV	DATE	DESCRIPTION	APP
		0			
GRAPHIC					
40233-00-E7					
200.40233.00					

J:\SMACAD\Projects\7233\dwg\00\40233-00-E07.dwg 5/21/2005 10:13:10 AM CST



NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

VERTICAL: 0 10' 20'

HORIZONTAL: 0 100' 200'

REV	DATE	DESCRIPTION	APP
0			

FM: 03/05
GRAPHIC
40233-00-E8
200.40233.00

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS

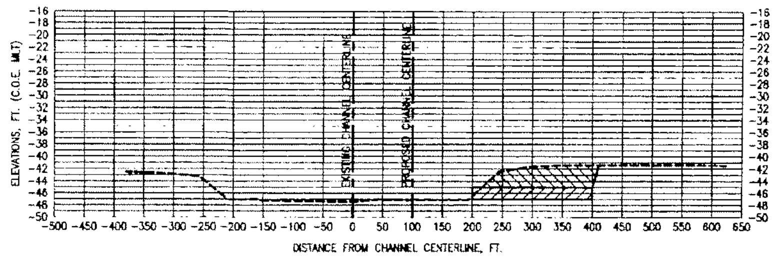
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

FREEPORT TEXAS

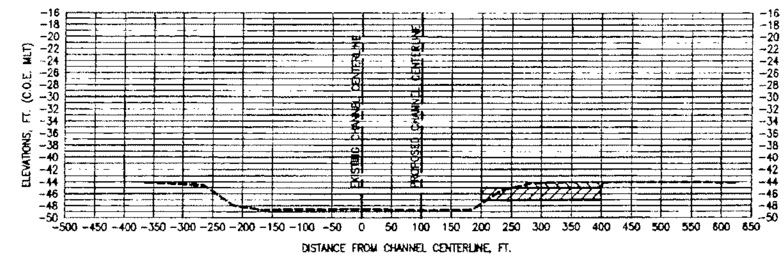
ENTRANCE CHANNEL SECTIONS
STA. 0+00 - STA. 70+00

SHEET E8 OF 11 REV 0

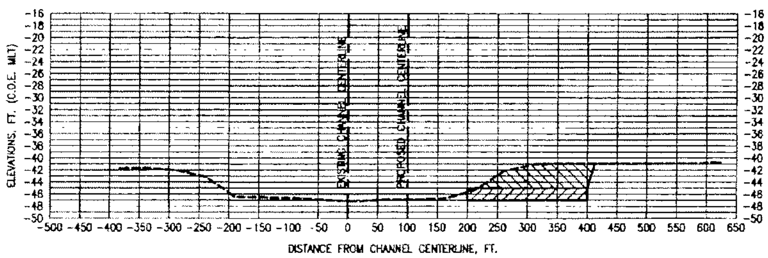
J:\SMACAD\Projects\2233\dwg\00\40233-00-E08.dwg 6/21/2005 10:12:25 AM CST



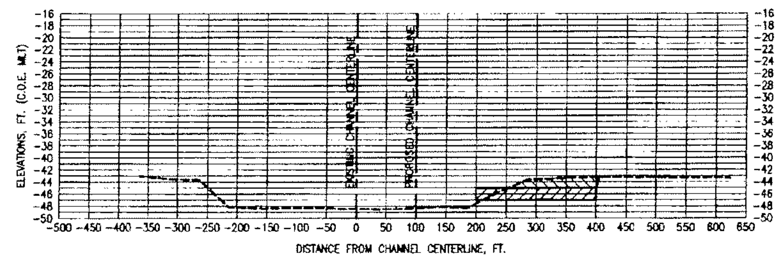
110+00



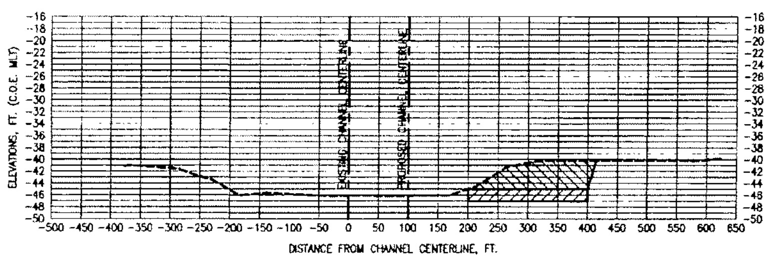
150+00



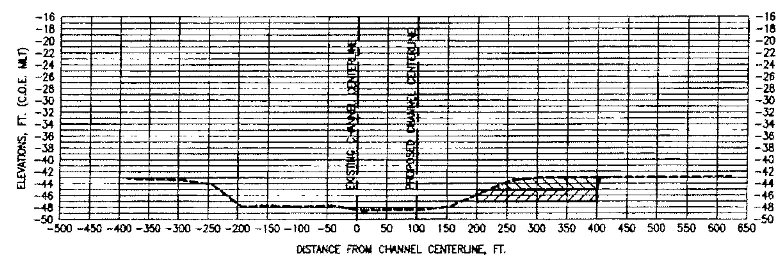
100+00



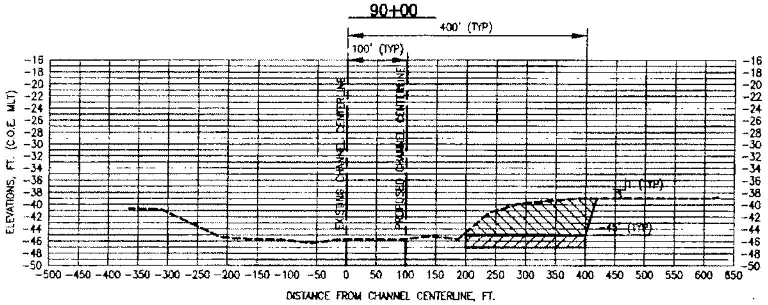
140+00



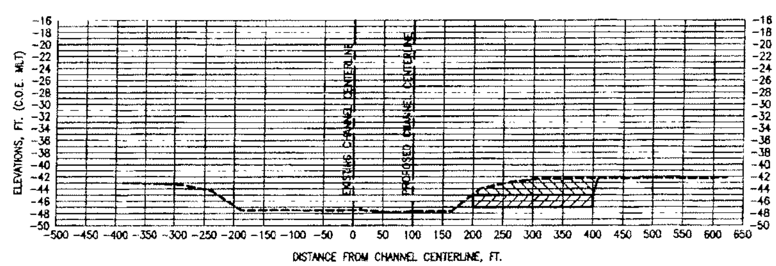
90+00



130+00



80+00



120+00

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH

0 10' 20' VERTICAL

0 100' 200' HORIZONTAL

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

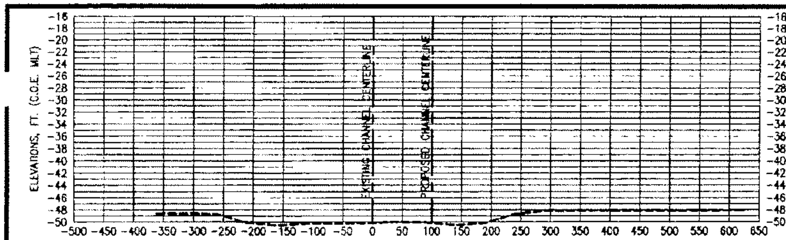
CONOCOPHILLIPS
FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
FREEPORT TEXAS
ENTRANCE CHANNEL SECTIONS
STA. 80+00 - STA. 150+00

SHEET E9 OF 11 REV 0

FM 03/05
GRAPHIC
40233-00-E9
200.40233.00

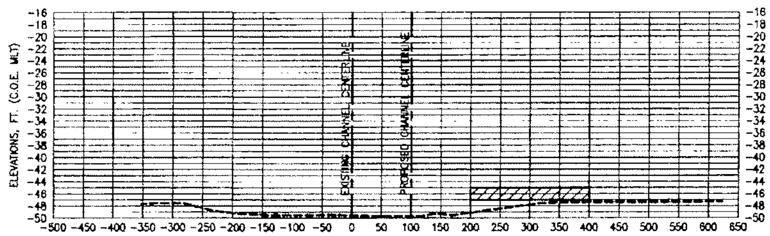
REV	DATE	DESCRIPTION	APP
0			

J:\SMACAD\Projects\0233\dwg\00\40233-00-E9.dwg 5/21/2005 10:10:45 AM CST



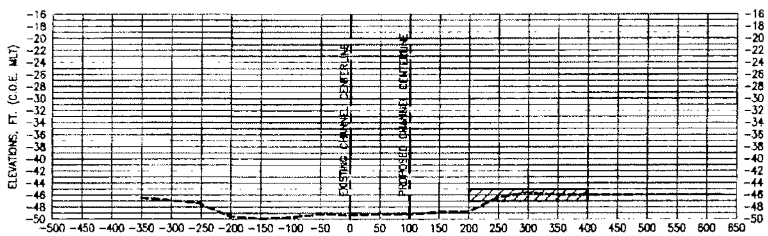
DISTANCE FROM CHANNEL CENTERLINE, FT.

190+00



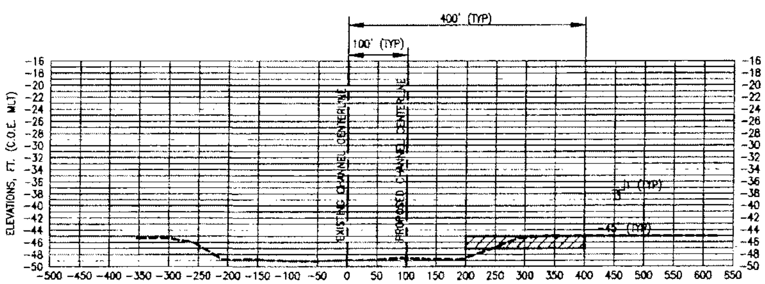
DISTANCE FROM CHANNEL CENTERLINE, FT.

180+00



DISTANCE FROM CHANNEL CENTERLINE, FT.

170+00



DISTANCE FROM CHANNEL CENTERLINE, FT.

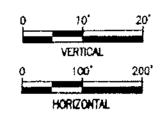
160+00

NOTES

1. HYDROGRAPHIC SURVEY PERFORMED BY SHINER MOSELEY AND ASSOCIATES ON 10/04/04

LEGEND

- APPROXIMATE EXISTING GRADE
- PROPOSED DREDGE LIMITS
- DREDGE AREA
- 2' ALLOWABLE OVERDEPTH



REV	DATE	DESCRIPTION	APP
0			

FM 03/05
GRAPHIC
40233-00-E10
200.40233.00

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS
555 North Carancahua Street, Suite 1650
Corpus Christi, Texas 78478

CONOCOPHILLIPS

FREEPORT JETTY CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS

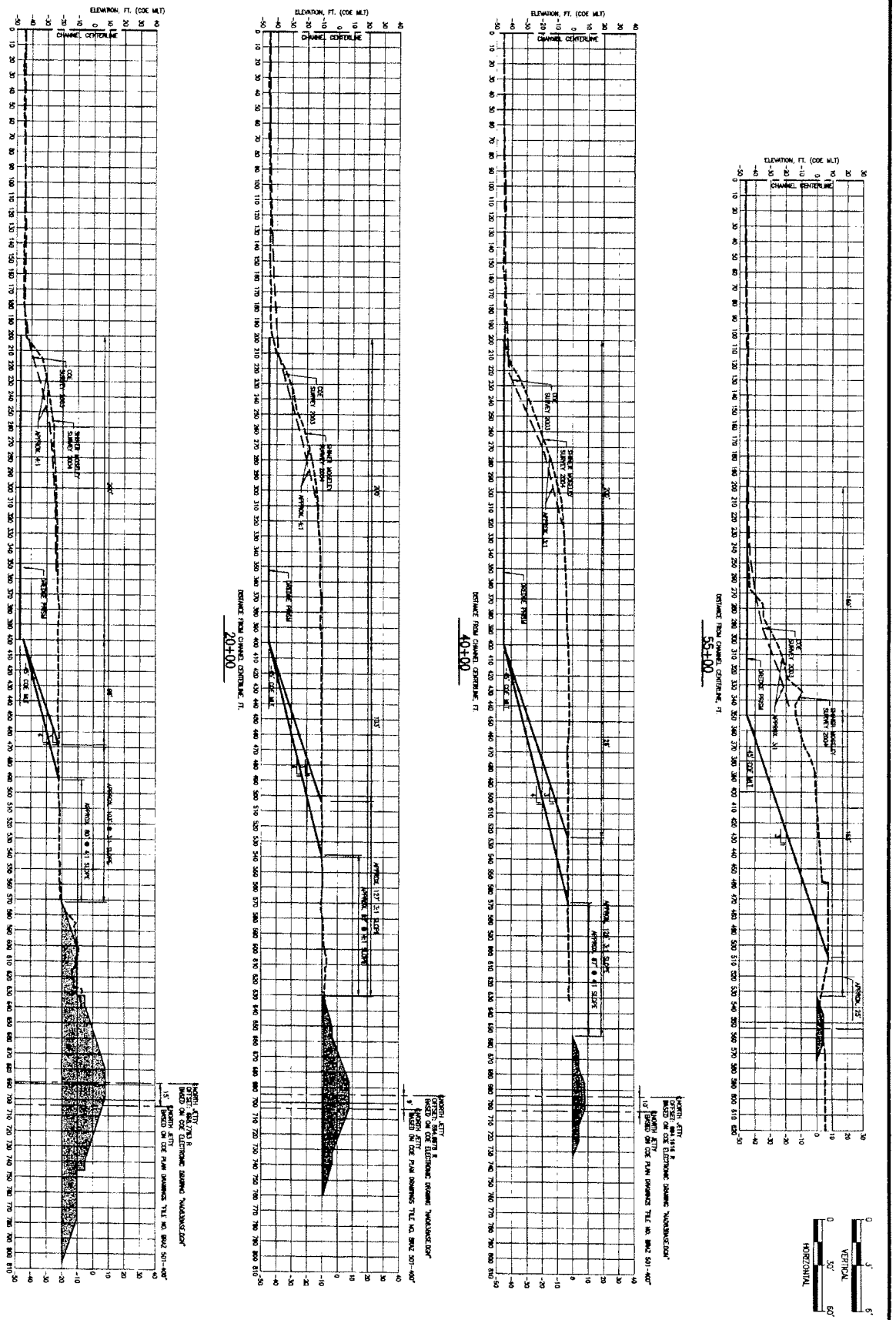
FREEPORT TEXAS

ENTRANCE CHANNEL SECTIONS
STA. 160+00 - STA. 190+00

SHEET E10 OF 11 REV 0

J:\SMACAD\Projects\...233\dwg\00\40233-00-E10.dwg 6/21/2005 8:39:34 AM CST

J:\SMACAD\Projects\ "233\dwg\00\40233-00-E10.dwg 6/21/2005 8:39:14 AM CST



SHEET E11 OF 11 REV 0	CONOCOPHILLIPS FREEPORT JETTY CHANNEL WIDENING NORTH JETTY STABILITY ANALYSIS FREEPORT TEXAS SIDE SLOPE SECTIONS STA. 5+00, 20+00, 40+00, & 55+00	SHINER MOSELEY AND ASSOCIATES, INC. ENGINEERS & CONSULTANTS 555 North Carancahua Street, Suite 1650 Corpus Christi, Texas 78478		BY FM DATE 03/05 CHK APP DWG GRAPHIC JOB 40233-00-E11 PROJ 200.40233.00	REV	DATE	DESCRIPTION	APP
					0			

Table B.1: Jetty Channel Dredge Volumes Dredge Depth -45ft x 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		3,472		400	
	500		75,741		7,407
5+00		4,708		400	
	500		92,389		7,407
10+00		5,270		400	
	500		107,926		7,407
15+00		6,386		400	
	500		125,981		7,407
20+00		7,220		400	
	500		136,852		7,407
25+00		7,560		400	
	500		139,750		7,407
30+00		7,533		400	
	500		144,380		7,407
35+00		8,060		400	
	500		151,481		7,407
40+00		8,300		400	
	300		85,550		4,111
43+00		7,099		340	
	200		52,585		2,370
45+00		7,099		300	
	500		111,083		4,630
50+00		4,898		200	
	500		90,991		3,352
55+00		4,929		162	
	500		87,259		3,037
60+00		4,495		166	
	500		41,620		1,537
65+00		0		0	
		Subtotal	1,443,589		78,296
				TOTAL	1,521,885
				COMPUTER GENERATED VOLUME	1,452,022 CY
				ALLOWABLE OVERDEPTH VOLUME	78,296 CY
				TOTAL VOLUME	1,530,318 CY (+0.55%)

Table B.2: Entrance Channel Dredge Volume Dredge Depth -45ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		3,124		380	
	400		40,541		5,630
4+00		2,349		380	
	200		17,881		2,815
6+00		2,479		380	
	400		31,556		5,630
10+00		1,781		380	
	400		31,185		5,630
14+00		2,429		380	
	200		17,222		2,815
16+00		2,221		380	
	400		33,148		5,630
20+00		2,254		380	
	400		32,333		5,630
24+00		2,111		380	
	200		15,670		2,815
26+00		2,120		380	
	400		30,200		5,630
30+00		1,957		380	
	400		29,030		5,630
34+00		1,962		380	
	200		14,459		2,815
36+00		1,942		380	
	400		28,548		5,630
40+00		1,912		380	
	400		25,793		5,630
44+00		1,570		380	
	200		12,204		2,815
46+00		1,725		380	
	400		24,296		5,630
50+00		1,555		380	
	400		22,407		5,630
54+00		1,470		380	
	200		10,115		2,815
56+00		1,261		380	
	400		19,459		5,556
60+00		1,366		370	
	400		18,481		5,556
64+00		1,129		380	
	200		8,363		2,778
66+00		1,129		370	
	400		16,689		5,556
70+00		1,124		380	
	400		16,644		5,630
74+00		1,123		380	
	200		7,911		2,815
76+00		1,013		380	
	400		13,778		5,556
80+00		847		370	
	400		10,970		5,481
84+00		634		370	
	200		4,770		2,741
86+00		654		370	
	400		10,096		5,481

Table B.2: Entrance Channel Dredge Volume Dredge Depth -45ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
90+00		709		370	
	400		10,948		5,481
94+00		769		370	
	200		5,381		2,741
96+00		684		370	
	400		10,207		5,481
100+00		694		370	
	400		8,867		5,556
104+00		503		380	
	200		3,970		2,778
106+00		569		370	
	400		7,756		5,556
110+00		478		380	
	400		6,570		5,630
114+00		409		380	
	200		2,719		2,741
116+00		325		360	
	400		6,096		5,407
120+00		498		370	
	400		6,096		5,407
124+00		325		360	
	200		2,704		2,741
126+00		405		380	
	400		5,111		5,333
130+00		285		340	
	400		4,222		5,037
134+00		285		340	
	200		1,630		2,667
136+00		155		380	
	400		3,333		5,556
140+00		295		370	
	400		2,741		4,963
144+00		75		300	
	200		815		2,296
146+00		145		320	
	400		1,815		4,630
150+00		100		305	
	400		1,704		4,852
154+00		130		350	
	200		481		2,593
156+00		0		350	
	400		0		4,593
160+00		0		270	
	400		0		2,370
164+00		0		50	
	200		0		185
166+00		0		0	
		Subtotal	636,919		220,556
				TOTAL	857,474
				COMPUTER GENERATED VOLUME	672,589 CY
				ALLOWABLE OVERDEPTH VOLUME	220,556 CY
				TOTAL VOLUME	893,145 CY (+4.2%)

Table B.3: Jetty Channel Dredge Volume Dredge Depth -47ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		4,079		400	
	500		85,139		7,407
5+00		5,116		400	
	500		101,167		7,407
10+00		5,810		400	
	500		108,769		7,407
15+00		5,937		400	
	500		125,694		7,407
20+00		7,638		400	
	500		146,222		7,407
25+00		8,154		400	
	500		150,824		7,407
30+00		8,135		400	
	500		155,657		7,407
35+00		8,676		400	
	500		166,463		7,407
40+00		9,302		400	
	300		95,261		4,111
43+00		7,845		340	
	200		57,863		2,370
45+00		7,778		300	
	500		128,287		4,630
50+00		6,077		200	
	500		105,194		3,352
55+00		5,284		162	
	500		94,444		3,037
60+00		4,916		166	
	500		45,519		1,537
65+00		0		0	
		Subtotal	1,566,504		78,296
				TOTAL	1,644,800
				COMPUTER GENERATED VOLUME	1,554,881 CY
				ALLOWABLE OVERDEPTH VOLUME	78,296 CY
				TOTAL VOLUME	1,633,177 CY (-0.7%)

Table B.4: Entrance Channel Dredge Volume Dredge Depth -49ft + 2ft Overdepth					
STA.	DIST.	DREDGE PRISM		ALLOWABLE OVERDEPTH	
		AREA	VOLUME CY	AREA	VOLUME CY
0+00		4,182		400	
	400		54,830		5,926
4+00		3,220		400	
	200		25,674		2,963
6+00		3,712		400	
	400		49,126		5,926
10+00		2,920		400	
	400		47,704		5,926
14+00		3,520		400	
	200		24,804		2,963
16+00		3,177		400	
	400		47,385		5,926
20+00		3,220		400	
	400		46,593		5,926
24+00		3,070		400	
	200		23,933		2,963
26+00		3,392		400	
	400		48,185		5,926
30+00		3,113		400	
	400		45,800		5,926
34+00		3,070		400	
	200		22,581		2,963
36+00		3,027		400	
	400		45,481		5,926
40+00		3,113		400	
	400		38,763		5,926
44+00		2,120		400	
	200		17,233		2,963
46+00		2,533		400	
	400		39,756		5,926
50+00		2,834		400	
	400		39,281		5,926
54+00		2,469		400	
	200		18,207		2,963
56+00		2,447		400	
	400		34,822		5,926
60+00		2,254		400	
	400		32,281		5,926
64+00		2,104		400	
	200		16,300		2,963
66+00		2,297		400	
	400		32,126		5,926
70+00		2,040		400	
	400		32,919		5,926
74+00		2,404		400	
	200		16,459		2,963
76+00		2,040		400	
	400		29,741		5,926
80+00		1,975		400	
	400		25,126		5,926
84+00		1,417		400	
	200		11,607		2,963
86+00		1,717		400	
	400		22,578		5,926
90+00		1,331		400	

	400		21,830		5,926
94+00		1,616		400	
	200		11,552		2,963
96+00		1,503		400	
	400		21,948		5,926
100+00		1,460		400	
	400		21,622		5,926
104+00		1,459		400	
	200		10,226		2,963
106+00		1,302		400	
	400		20,926		5,926
110+00		1,523		400	
	400		20,985		5,926
114+00		1,310		400	
	200		9,622		2,963
116+00		1,288		400	
	400		20,000		5,926
120+00		1,412		400	
	400		18,726		5,926
124+00		1,116		400	
	200		9,296		2,963
126+00		1,394		400	
	400		18,111		5,926
130+00		1,051		400	
	400		16,370		5,926
134+00		1,159		400	
	200		8,741		2,963
136+00		1,201		400	
	400		17,163		5,926
140+00		1,116		400	
	400		13,667		5,926
144+00		729		400	
	200		5,641		2,963
146+00		794		400	
	400		11,926		5,926
150+00		816		400	
	400		12,726		5,926
154+00		902		400	
	200		6,419		2,963
156+00		831		400	
	400		10,926		5,926
160+00		644		400	
	400		9,385		5,926
164+00		623		400	
	200		4,930		2,963
166+00		708		400	
	400		8,422		5,926
170+00		429		400	
	400		6,993		5,926
174+00		515		400	
	200		3,100		2,963
176+00		322		400	
	400		5,726		5,926
180+00		451		400	
	400		4,081		5,926
184+00		100		400	
	200		926		2,963
186+00		150		400	
	400		1,852		5,926
190+00		100		400	

	400		1,111		5,926
194+00		50		400	
	200		185		2,963
196+00		0		400	
	400		0		5,926
200+00		0		400	
	400		0		4,444
204+00		0		200	
	200		0		1,944
206+00		0		325	
	400		0		3,889
210+00		0		200	
	400		0		2,963
214+00		0		200	
	200		0		1,481
216+00		0		200	
	400		0		2,963
220+00		0		200	
	400		0		1,630
224+00		0		20	
	200		0		167
226+00		0		25	
	400		0		185
230+00				0	
		Subtotal	1,244,430		315,963
				TOTAL	**1,560,393**
				COMPUTER GENERATED VOLUME	**1,245,202 CY**
				ALLOWABLE OVERDEPTH VOLUME	**315,963 CY**
				TOTAL VOLUME	**1,561,165 CY (+0.05%)**

OPINION OF PROBABLE CONSTRUCTION COST

FREEPORT CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
JETTY CHA. AT -45+2FT OD
ENTRANCE CHA. AT -45FT+2FT OD

BUDGET REVIEW

PREPARED FOR:
ConocoPhillips Company
900 Threadneedle
Houston, Texas 77252

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

PROJECT MANAGER: DCH
EST. BY: SFB
SMA PROJECT No.: J200.40233
UPDATED: June 27, 2005

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	UNIT COST	TOTAL	EXTENDED TOTALS
Dredging					$16,140,778
Mob/Demob	1	LS	$550,000	$550,000	
Pipelines	1	LS	$350,000	$350,000	
Dredging Required Depth	2,124,611	CY	$6.00	$12,747,666	
Dredging Over Depth	298,852	CY	$6.00	$1,793,112	
Disposal	2,423,463	CY	$0.00	$0	
Mitigation	4	AC	$50,000.00	$200,000	
Aids to Navigation	1	LS	$500,000	$500,000	
SUBTOTAL					**16140778**
Dredging Contingency	(5% of Dredging Subtotal)				$727,039
Fuel Cost Contingency	(20% of Dredging Subtotal)				$2,908,156
Hydrographic Surveys					$250,000
Construction Administration And Project Management	(2% of Subtotal)				$322,816
Engineering					$750,000
TOTAL PROJECT COST					**$21,098,789**

NOTES:

Entrance Channel quantities based on USACE posted data dated 2003.

Jetty Channel quantities based on SMA fieldwork dated October 10, 2004.

Aids to navigation for public waterways may qualify for federal funding.

Assume offshore placement of dredged material with no fees for disposal.

Diesel fuel cost can fluctuate greatly and can have large impacts on dredging cost.

Costs for removing existing debris or wrecks are not included in these costs.

OPINION OF PROBABLE CONSTRUCTION COST

FREEPORT CHANNEL WIDENING
NORTH JETTY STABILITY ANALYSIS
JETTY CHA. AT-47FT+2FT OD
ENTRANCE CHA. AT -49FT+2FT OD

BUDGET REVIEW

PREPARED FOR:
ConocoPhillips Company
900 Threadneedle
Houston, Texas 77252

SHINER MOSELEY AND ASSOCIATES, INC.
ENGINEERS & CONSULTANTS

PROJECT MANAGER: DCH
EST. BY: SFB
SMA PROJECT No.: J200.40233
UPDATED: June 27, 2005

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	UNIT COST	TOTAL	EXTENDED TOTALS
Dredging					$20,766,052
Mob/Demob	1	LS	$550,000	$550,000	
Pipelines	1	LS	$350,000	$350,000	
Dredging Required Depth	2,800,083	CY	$6.00	$16,800,498	
Dredging Over Depth	394,259	CY	$6.00	$2,365,554	
Disposal	3,194,342	CY	$0.00	$0	
Mitigation	4	AC	$50,000.00	$200,000	
Aids to Navigation	1	LS	$500,000	$500,000	
SUBTOTAL					**20766052**
Dredging Contingency	(5% of Dredging Subtotal)				$958,303
Fuel Cost Contingency	(20% of Dredging Subtotal)				$3,833,210
Hydrographic Surveys					$250,000
Construction Administration And Project Management	(2% of Subtotal)				$415,321
Engineering					$750,000
TOTAL PROJECT COST					**$26,972,886**

NOTES:

Entrance Channel quantities based on USACE posted data dated 2003.

Jetty Channel quantities based on SMA fieldwork dated October 10, 2004.

Aids to navigation for public waterways may qualify for federal funding.

Assume offshore placement of dredged material with no fees for disposal.

Diesel fuel cost can fluctuate greatly and can have large impacts on dredging cost.

Costs for removing existing debris or wrecks are not included in these costs.