

Contents

	Page
Executive Summary	ii
Acronyms and Abbreviations	xxviii
Section	
1 Introduction	1-1
1.1 Background	1-1
1.2 Purpose of Phase 1 Design Report	1-4
1.3 Scope	1-5
1.4 Report Organization	1-6
2 Overview of Alternatives Development	2-1
2.1 General Approach	2-1
2.2 Conveyance Systems.....	2-2
2.2.1 Route	2-4
2.2.2 Hydraulic Structures.....	2-4
2.2.3 Target Water Levels	2-4
2.2.4 Dredge Template	2-5
2.2.5 Bypass Channel Depth.....	2-5
2.3 Diversion Structures	2-5
2.3.1 Diversion Site Locations	2-6
2.3.2 Pump Station Configuration.....	2-6
2.3.3 Pump Intake.....	2-6
2.3.4 Pump Discharge	2-6
2.3.5 Sedimentation Facilities.....	2-6
2.3.6 Existing Pump Station	2-7
2.4 System Control and Monitoring.....	2-7
2.4.1 Weir Systems.....	2-7
2.4.2 Check Structure	2-8
2.4.3 Monitoring Stations.....	2-8
2.5 Infrastructure, Utility, and Site Modifications	2-8
2.6 Comparison of Alternatives.....	2-8
3 Conveyance Evaluation	3-1
3.1 Modeling Software.....	3-3
3.1.1 HEC-RAS.....	3-3
3.1.2 TABS-MD.....	3-3
3.2 HEC-RAS Model Calibration.....	3-5
3.2.1 Data Sources for HEC-RAS Model.....	3-5
3.2.2 Calibration Results	3-7

Contents, Continued

	Page
3.3	Model Implementation of Alternatives.....3-10
3.3.1	Channel Route Alternatives.....3-10
3.3.2	Withdrawals for Alternative Evaluations.....3-13
3.3.3	Target Water Levels.....3-15
3.3.4	Channel Hydraulics Controls and Structures.....3-17
3.3.5	Channel Configuration and Dredge Templates.....3-20
3.3.6	Smoke Bend Bypass Channel Configuration.....3-26
3.4	Results of Conveyance Analysis.....3-27
3.4.1	Methodology.....3-27
3.4.2	Preliminary Results Discussion.....3-33
4	Diversion Structures.....4-1
4.1	Hydraulic Planning Criteria.....4-1
4.1.1	Flow Ranges for Facility Sizing.....4-1
4.1.2	Mississippi River Stages.....4-1
4.2	Diversion Site Locations.....4-3
4.3	Intake Alternatives.....4-3
4.3.1	Piped Intake.....4-6
4.3.2	Forebay Intake.....4-9
4.4	Discharge Alternatives.....4-9
4.4.1	Over-levee Discharge Piping.....4-12
4.4.2	Through-levee Discharge Piping.....4-13
4.5	Sediment Alternatives.....4-13
4.5.1	Existing Sediment Sources.....4-13
4.5.2	Sediment Facilities Downstream of Pump Stations.....4-14
4.6	Pump Station Alternatives.....4-14
4.6.1	Rehabilitation of Existing Pump Station.....4-14
4.6.2	New Pump Station.....4-15
4.6.3	Check Structure Pump Station.....4-19
4.7	Diversion Structure Considerations.....4-20
5	Infrastructure, Utility, and Site Modifications.....5-1
5.1	Railroad Crossings.....5-1
5.2	Roads and Bridges.....5-2
5.3	Utility Conflicts.....5-4
5.3.1	Water Intakes and Drainage Structures.....5-4
5.3.2	Overhead Utilities.....5-7
5.3.3	Belowground Utilities.....5-7
5.4	Site Modifications.....5-10
5.4.1	Rights-of-Way and Easements.....5-10
5.4.2	Land Use Modifications.....5-10

Contents, Continued

	Page
6	Dredging, Disposal, and Beneficial Reuse Analysis6-1
6.1	Dredge Volumes 6-1
6.2	Sediment Quality 6-2
6.2.1	Sediment Study Overview 6-2
6.2.2	Sediment Quality Relative to Beneficial Agricultural Reuse 6-3
6.3	Disposal and Reuse Options 6-8
6.3.1	Disposal Options 6-8
6.3.2	Reuse Options 6-10
6.4	Dredging Method Options 6-11
6.4.1	Dredging Equipment 6-12
6.4.2	Conveyance/Transport 6-13
6.5	Cost Development 6-14
6.6	Permitting and Public Involvement 6-14
7	Comparison of Alternatives 7-1
7.1	Preliminary Screening of Conveyance Channel Alternatives 7-1
7.1.1	Screening Criterion 1 – Smoke Bend Dredge Templates 7-3
7.1.2	Screening Criterion 2 – Union Pacific Railroad Crossing 7-3
7.1.3	Screening Criterion 3 – Smoke Bend Shallow Cut 7-4
7.1.4	Screening Criterion 4 – Minimum Flow of 1,000 Cubic Feet Per Second 7-4
7.1.5	Screening Criterion 5 – Thibodaux Water Level Rise 7-5
7.1.6	Screening Criterion 6 – Donaldsonville Water Level Rise 7-6
7.2	Cost Development 7-6
7.2.1	Cost Estimating Approach 7-6
7.2.2	Conveyance Channel Improvements 7-11
7.2.3	Diversion Facility Improvements 7-26
7.2.4	Structure Impact Inventory and Costs 7-30
7.3	Cost Efficiency Screening of Alternatives 7-32
7.3.1	Screening Criterion 7 – Cost Effectiveness of Dredging 7-32
7.3.2	Screening Criterion 8 – Check Structure, Flow Benefits, and Unit Cost 7-35
8	Summary of Recommended Alternatives and Considerations for the 30 Percent Design Evaluation 8-1
8.1	Description of the Short List of Alternatives Recommended for 30 Percent Design Analysis 8-1
8.1.1	Alternative 15 8-3
8.1.2	Alternative 32 8-3
8.1.3	Alternative 38 8-5
8.1.4	Alternative 44 8-5
8.1.5	Alternative 47 8-6

Contents, Continued

	Page
8.2 Required Evaluations and Issue Coordination for 30 Percent Design.....	8-6
8.2.1 General Engineering Evaluations	8-6
8.2.2 Environmental Evaluations	8-7
8.2.3 Property, Stakeholder, and Agency Coordination	8-8
8.3 Development of Program Budgets from Comparative Cost Estimates.....	8-9
8.4 Summary of Recommendations	8-10
8.4.1 Integration of Design Activities with Environmental Documentation	8-10
8.4.2 Coordination of Project Activities with Other Stakeholders.....	8-10
9 Louisiana Department of Natural Resources and U.S. Environmental Protection Agency Review	9-1
10 References	10-1

Appendices

A	Phase 1 Modeling Preliminary Results
B	Historical Water Users along Bayou Lafourche
C	Historical Water Level Investigation
D	Smoke Bend Canal Sizing and Dredging Volumes
E	Bayou Lafourche Alignment Conveyance Alternative Matrix/Water Level Profiles
F	Mississippi River Stage Elevation 1951 to 2004
G	Pump Curve and Sizing Data
H	Existing Utility Owners and Pipe Elevations
I	Review of the Wetlands Value Assessment Process and Role in Coastal Wetlands Planning, Protection, and Restoration Act
J	Phase 1 Geotechnical Report
K	Comparing Dredging Requirements with Target Water Levels and Diversion Flows

Tables

3-1	Summary of Calibration Results, HEC-RAS Model	3-10
3-2	Description of Dredge Templates by Design Reach.....	3-23
3-3	Identification Scheme of Dredge Templates in HEC-RAS Model	3-26
3-4	Combinations of Alignments, Dredge Templates, and Target Water Levels that Form the Phase 1 Design Alternatives.....	3-28

Contents, Continued

	Page
3-5 Summary of Estimated Allowable Flow for Each Alternative and Target Water Level	3-31
3-6 Summary of Estimated Dredging and Excavation Quantities for Each Alternative	3-34
3-7 Allowable Flow Rates and Dredge Quantities for Selected Alternatives	3-36
3-8 Bayou Lafourche Evaluation Matrix – Dredging Quantity Projections	3-38
4-1 Pumping Unit Configurations	4-1
4-2 Pump and Intake Piping Configurations	4-6
4-3 Pump and Discharge Piping Configurations	4-12
4-4 Pump Performance Points	4-15
5-1 Preliminary Estimate of Utility Crossing Replacements for Each Dredge Template Used in the Phase 1 Design	5-10
6-1 Dredge Quantity Summary	6-2
7-1 Dredging Costs Associated with Remaining 19 Alternatives	7-12
7-2 Hydraulic Characteristics of Smoke Bend Bypass Channel	7-12
7-3 Remaining Conveyance Channel Alternatives Following Qualitative Screening	7-13
7-4 Bypass Channel Crossings	7-16
7-5 Road Crossing and Drop Structure at Bayou Lafourche	7-19
7-6 Cost Allowance for Utility Relocation Requirements	7-24
7-7 Estimated Costs for Smoke Bend Diversion Facility	7-26
7-8 Summary of Present-worth Analysis for Bypass Channel Excavation Condition	7-29
7-9 Structure Impact Inventory	7-31
7-10 Summary of Costs Associated with Remaining Alternatives	7-33
8-1 Recommended Alternatives for Further Study in the 30 Percent Design	8-2
9-1 LDNR- and EPA-recommended Alternatives for Further Study in the 30 Percent Design	9-3

Contents, Continued

		Page
Figures		
1-1	Project Area	1-2
2-1	Conveyance Alternatives Characterization Diagram.....	2-3
2-2	Eight-step Screening Process Conveyance Channel Alternatives	2-10
2-3	Process for Comparing Alternatives.....	2-11
3-1	Study Area of Bayou Lafourche Simulated during the Phase 1 Design.....	3-2
3-2	30 Percent Design TABS-MD Model Simulation Area.....	3-4
3-3	Reported Flow versus Stage for the USGS Donaldsonville Gage.....	3-6
3-4	Locations of Study Area Monitoring Stations	3-8
3-5	Rating Curve at Lockport.....	3-9
3-6	Smoke Bend Bypass Alignment Alternatives.....	3-12
3-7	Dugas Bypass Alignment Alternative	3-14
3-8	Target Water Levels	3-16
3-9	Difference between Estimated Existing Water Level and the Historical Mean Low and Mean Water Levels	3-18
3-10	2-foot Dredge Template Design Reach Schematic	3-21
3-11	8-foot Dredge Template Design Reach Schematic	3-22
3-12	2-foot Dredge Template.....	3-24
3-13	8-foot Dredge Template.....	3-25
4-1	Mississippi River Stage Data	4-2
4-2	Donaldsonville Diversion Location	4-4
4-3	Smoke Bend Diversion Location	4-5
4-4	Pump Station Profile No. 1.....	4-7
4-5	Pump Station Site Plan No. 1	4-8
4-6	Pump Station Profile No. 2.....	4-10
4-7	Pump Station Site Plan No. 2.....	4-11

Contents, Continued

	Page
4-8 Pump Station Profile No. 3.....	4-16
4-9 Typical Pump Station Plan.....	4-18
5-1 Railroad Tracks in Project Area.....	5-3
5-2 Roads and Bridges in Project Area.....	5-5
5-3 Utilities.....	5-8
6-1 Bayou Lafourche Sediment Sampling Locations.....	6-4
7-1 Eight-step Screening Process Conveyance Channel Alternatives.....	7-2
7-2 Range of Water Levels below Thibodaux, 21 Alternatives after Screening Criterion 5.....	7-7
7-3 Range of Water Levels in Donaldsonville, 21 Alternatives after Screening Criterion 5.....	7-8
7-4 Water Levels in Donaldsonville, Panel 5 – MLW and MW Targets.....	7-9
7-5 Water Levels in Donaldsonville, Panel 11 – MLW and MW Targets.....	7-10
7-6 Schematic Representation of Bypass Channel Cross Sections.....	7-14
7-7 Typical Bypass Channel Siphon Crossing.....	7-17
7-8 Road Crossing and Drop Structure.....	7-18
7-9 UPRR Shoofly and Bridge Replacement Layout.....	7-20
7-10 Bulkhead.....	7-21
7-11 Rubber Dam Weir.....	7-23
7-12 Check Structure with Pump Station at Confluence.....	7-25
7-13 Typical Head Conditions at Smoke Bend Diversion Facility.....	7-28
7-14 Flow versus Dredging Volume Effectiveness Alternatives, 19 Remaining Alternatives.....	7-34
7-15 Unit Cost versus Diversion Flow – Nine Remaining Alternatives.....	7-36
8-1 Cost-efficiency Plot of Five Remaining Alternatives.....	8-4
9-1 Water Surface Profiles, Seven Remaining Alternatives, Bayou Lafourche Channel.....	9-2
9-2 Cost-efficiency Plot of Seven Remaining Alternatives.....	9-4

Acronyms and Abbreviations

1998 Summary Report	<i>Evaluation of Bayou Lafourche Wetlands Restoration Project: Coastal Wetlands Planning, Protection and Restoration Act Project PBA-20</i>
1D	one dimensional
2D	two dimensional
BL	Bayou Lafourche
CDF	confined disposal facility
CEC	cation exchange capacity
cfs	cubic feet per second
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
cy	cubic yard
cy/ft	cubic yards per foot
DCP	data collection platform
E	existing water level
E&D	Engineering and Design
EPA	U.S. Environmental Protection Agency
fps	feet per second
ft/ft	foot per foot
GIS	Geographic Information System
H:V	horizontal:vertical
HEC-RAS	Hydrologic Engineering Center-River Analysis System
LDNR	Louisiana Department of Natural Resources
LFWD	Lafourche Freshwater District
M	modified
mcy	million cubic yards
MHW	mean high water
MLW	mean low water
MRRBL	Mississippi River Reintroduction into Bayou Lafourche

MW	mean water
NAVD88	North American Vertical Datum 1988
NB	new bridge
NEPA	National Environmental Policy Act
NM	not modified
RM	River Mile
SB	Smoke Bend
SCADA	supervisory control and data acquisition
Sediment Study	<i>The Bayou Lafourche Sediment Study</i>
TM	technical memorandum
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WES	Waterways Experiment Station
WSE	water surface elevation