SECTION 7

Comparison of Alternatives

This section presents the results of the screening analysis for the various conveyance channel and diversion pumping alternatives associated with the project. This screening analysis developed a range of representative, viable alternatives for further analysis in the 30 percent design stage. In addition, the NEPA process for environmental documentation will use this representative range of viable alternatives to determine environmental impacts and benefits. Further conclusions regarding possible project alternatives are discussed in Section 8.

This section is organized as follows:

- Preliminary screening – Applies first six screening criteria to reduce alternatives from 144 to 19. This qualitative screening was based on technical issues and costs.
- Cost development – Describes cost estimating information to be used for remaining quantitative screening.
- Cost efficiency screening – Applies final two quantitative screening criteria, reducing alternatives from 19 to 5.

7.1 Preliminary Screening of Conveyance Channel Alternatives

As summarized in Section 2, 144 conveyance channel alternatives were initially considered. These alternatives were developed from the following options:

- Two alignments (Donaldsonville and Smoke Bend)
- Two excavation depths for Smoke Bend only
- Two UPRR crossing concepts for Donaldsonville only (full replacement, do nothing)
- Two confluence concepts for Smoke Bend only (with and without check structure)
- Three target water surfaces for both alignments
- Eight possible dredging options for both alignments

In summary, 48 possible alternatives were suggested for Donaldsonville and 96 for Smoke Bend, for a total of 144.

To screen these alternatives down to a more manageable level for cost estimating, the initial six steps of the screening process shown on Figure 7-1 were applied. These preliminary steps were based on technical issues such as conveyance efficiency, UPRR crossing, energy expenditure, flow rate, and water level rise. This section documents the results of the screening process from 144 to 19 alternatives.

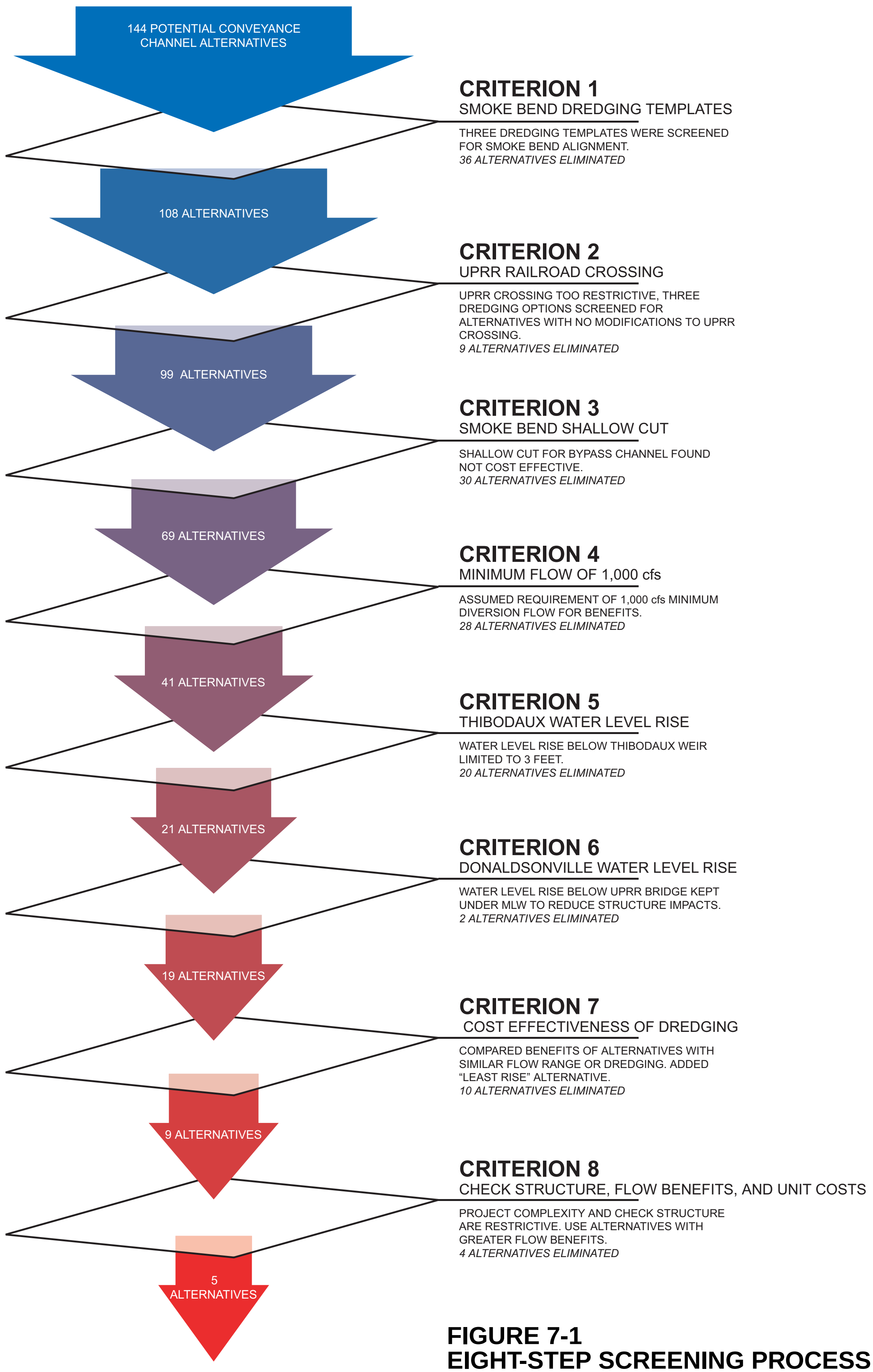

FIGURE 7-1
EIGHT-STEP SCREENING PROCESS
CONVEYANCE CHANNEL ALTERNATIVES
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To perform the initial screening, the design team evaluated numerous factors. Each screening criterion is ultimately related to a cost factor, but is also based on obvious comparisons. In this portion of the alternatives screening process, costs are used in a qualitative manner. Costs are used in a quantitative manner for the final two screening criteria.

For instance, the amount of dredging that is required for a given alternative varies, which will result in a variable cost. As described in Criterion 7, the tradeoffs between minor increased flow capacity and significant increased dredging requirements are used to screen some of the conveyance channel alternatives. Likewise, Criterion 8, which deals with the complexity of a check structure to control water levels in Donaldsonville, reflects the requirement for cost efficiency, project simplicity, and flow benefits.

Figure 7-1 illustrates the screening process that was used for conveyance channel alternatives. As shown on Figure 7-1, the number of conveyance channel alternatives was reduced from 144 to 19 in Screening Criteria 1 through 6, and then reduced from 19 to 5 in the final two screenings (Criteria 7 and 8). Screening Criteria 7 and 8 are discussed in Section 7.3. Specifics of Screening Criteria 1 through 6 are described in the following subsections.

7.1.1 Screening Criterion 1 – Smoke Bend Dredge Templates

In the beginning stages of the project during the channel hydraulics analysis for Bayou Lafourche, certain dredge templates were found to provide limited flow benefits for a significant difference in dredging quantity. The decision to keep a particular dredge template and eliminate another was based on flow to limit the number of alternatives for hydraulic analysis. All eight dredge templates (no dredge plus seven others) were used for the Donaldsonville alignment because this was the initial route for the project.

For the Smoke Bend alignment, as a bypass route, there was no reason to dredge through Donaldsonville. By eliminating the two dredge templates that included dredging through Donaldsonville and another dredge template that produced similar flows, three dredge templates were eliminated for hydraulic analysis in the Smoke Bend alignment.

This reduced the number of alternatives from 144 to 108.

7.1.2 Screening Criterion 2 – Union Pacific Railroad Crossing

A significant restriction to flow in Bayou Lafourche is the UPRR crossing in Donaldsonville. The railroad crosses the bayou just downstream of the Marchand Bridge. The bayou conveyance capacity is restricted by the existing three culverts at this location. As described in Section 5.1, the effective limit of the crossing is between 200 and 350 cfs without a significant increase to the upstream water level. Options exist to increase the flow capacity of this crossing to allow increased flows in the bayou in this reach up to approximately 1,000 cfs. However, a practical limit exists to increase flows that is driven by the ability to add additional culvert crossings at this location.

To pass flows exceeding 1,000 cfs under the railroad without raising upstream water levels significantly, a modified UPRR bridge will be required. This railroad crossing is on a main line; therefore, it would be difficult and costly to replace the entire crossing with a bridge.

Because of the limitation in allowable diversion flow without replacing the UPRR bridge, three additional dredge templates for the Donaldsonville alignment that had no railroad bridge modification were eliminated from further consideration. No additional hydraulic information could be learned by examining more dredge templates with the railroad bridge constriction.

This reduced the number of alternatives from 108 to 99.

7.1.3 Screening Criterion 3 – Smoke Bend Shallow Cut

As discussed in Sections 2 and 3, and shown on Figure 2-1, the two primary concepts for developing the bypass channel in the Smoke Bend alignment are as follows:

- **Shallow-cut channel:** Water surface essentially at the existing ground elevation, and a drop structure at the confluence with the bayou.
- **Deep-cut channel:** Water surface substantially below existing grade with the confluence water surface at the same elevation.

Section 3 discussed two possible routes for the bypass channel. The shorter of the two alignments was eliminated because it bisected several fields, easements, and potentially interfered with the Palo Alto Plantation.

The longer route, shown on Figure 3-6, was used to assess the required excavation and energy requirements (pumping) for the Smoke Bend alignment. Because of the difference in energy costs between the deep-cut (low-head) and the shallow-cut (high-head) concepts, the deep cut was found to be more economical.

With the shallow-cut bypass channel removed from further consideration, 30 alternatives were eliminated. This reduced the number of alternatives from 99 to 69.

Of these 69 alternatives, 39 were for the Donaldsonville alignment and 30 for the Smoke Bend alignment. These were the 69 alternatives that made up the set of alternatives examined in detail and shown in Table 3-5.

7.1.4 Screening Criterion 4 – Minimum Flow of 1,000 Cubic Feet Per Second

After review of previous Bayou Lafourche studies, the assumption was made that a minimum of 1,000 cfs would be needed to provide significant wetlands benefits (Average Annual Habitat Units). Therefore, alternatives shown in Table 3-5 that did not have flows near 1,000 cfs or greater were eliminated from further consideration.

In reviewing Table 3-5, 28 of the 69 alternatives were removed from further evaluation, which reduced the number of remaining alternatives to 41.

The 20 alternatives that were eliminated from the Donaldsonville alignment are as follows:

- Alternatives 1 through 5
- Alternatives 7, 8, 10, 11, 13, and 14
- Alternatives 16 through 19
- Alternatives 25, 28, 29, 34, and 37

The eight alternatives that were eliminated from the Smoke Bend alignment are as follows:

- Alternatives 40, 41, and 43
- Alternatives 52, 55, 56, 58, and 67

7.1.5 Screening Criterion 5 – Thibodaux Water Level Rise

The water level rise in Bayou Lafourche was an important concern in the project's alternative evaluation. The increased flows for the various dredge templates coupled with the Gulf backwater effects made the reach below the Thibodaux weir more susceptible to water level impacts than the upper reach through Donaldsonville. As the channel gets closer to the Gulf, dredging has a lesser effect on reducing the water line.

Detailed photo surveys and GIS mapping analysis of water elevations were used to evaluate the affected structures along the bayou. Several alternatives that used the MLW and MW target water levels resulted in a potential water level rise of 5 to 6 feet below the weir. Water level impacts are less above the weir because the weir artificially raises the water level.

Photo reviews and water line comparisons were used to estimate the impacted structure counts. Forty-seven structures were impacted in the first 2 miles below the Thibodaux weir, consisting of homes, docks, boat houses, sheds, and yards.

A count of impacted structures at a lesser water surface rise of 3 feet below the weir accounted for only 20 structures in the same 2 miles. Therefore, 27 fewer structures were impacted by the 3-foot rise versus the 5-foot rise. Extrapolating the added structure impacts for the 5- to 6-foot rise over the distance from Thibodaux to Lockport suggests that more than 200 additional structures would be affected than for a 3-foot water level rise.

The more significant impact of the 5- to 6-foot rise was determined to be an unacceptable level of property impact. However, the 3-foot water level rise was determined to be acceptable and, therefore, was established as the basis for Screening Criterion 5.

By restricting the water surface rise to 3 feet, corresponding to an elevation of 4.7 feet near the Thibodaux weir, another 20 alternatives were eliminated.

The seven alternatives that were eliminated from the Donaldsonville alignment are as follows:

- Alternatives 21, 24, and 27
- Alternatives 33, 35, 36, and 39

The 13 alternatives that were eliminated from the Smoke Bend alignment are as follows:

- Alternatives 45, 48, 50, 51, 53, 54 and 57
- Alternatives 60, 63, 65, 66, 68, and 69

After application of Screening Criterion 5, the number of alternatives remaining was reduced from 41 to 21.

Figure 7-2 shows the range of water surface level increases among the remaining 21 alternatives downstream of the Thibodaux weir. The figure also shows that the range of remaining alternatives has been limited to a 3-foot rise below the Thibodaux weir as expected following application of Screening Criterion 5.

7.1.6 Screening Criterion 6 – Donaldsonville Water Level Rise

Water level impacts in Donaldsonville were also considered. Figure 7-3 shows the range of water levels in Donaldsonville for the remaining 21 alternatives compared to the existing water level. The highest elevation alternative results in a water level rise of approximately 3.5 feet, which would cause significant property impacts within Donaldsonville.

The structural impacts of the Donaldsonville water level rise were evaluated by reviewing the inundation lines for the MW and MLW target level contours. Figures 7-4 and 7-5 are examples in the Donaldsonville area, below the UPRR bridge, where the MLW and MW water lines show significant impacts for the highest water level rise of more than 3 feet for MW, compared to the MLW rise of about 1.0 to 1.5 feet.

Because of the impacts for the more than 3-foot rise in Donaldsonville, two alternatives were eliminated from further consideration. The effect of removing these alternatives is shown on Figure 7-3. The remaining alternatives fit below the MLW target level, which is shown on Figure 7-3 and defined as the new maximum water line in Donaldsonville. Both of these alternatives, 30 and 42, were for the Donaldsonville alignment and reduced the number of remaining alternatives from 21 to 19.

7.2 Cost Development

This section discusses the cost development activities associated with the Phase 1 design. This cost information was used for screening the remaining alternatives through Criteria 7 and 8.

7.2.1 Cost Estimating Approach

The development of cost estimates at the Phase 1 design stage of the project was completed to compare cost differences among alternatives. Cost will be a key criterion for further screening of the remaining alternatives following the qualitative screening process.

The estimate was prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineering International. According to these guidelines, the estimate is a Class 4 estimate, which is defined as follows:

> This estimate is prepared based on limited information, where the preliminary engineering is from 1 to 5 percent complete. Detailed strategic planning, project screening, confirmation of economic and or technical feasibility, and preliminary budget approval are needed to proceed. Examples of estimating methods used would be equipment and or system process factors, scale-up factors, and parametric and modeling techniques. The expected accuracy ranges for this estimate are -15 to -30 percent on the low side and +20 to +50 percent on the high side.

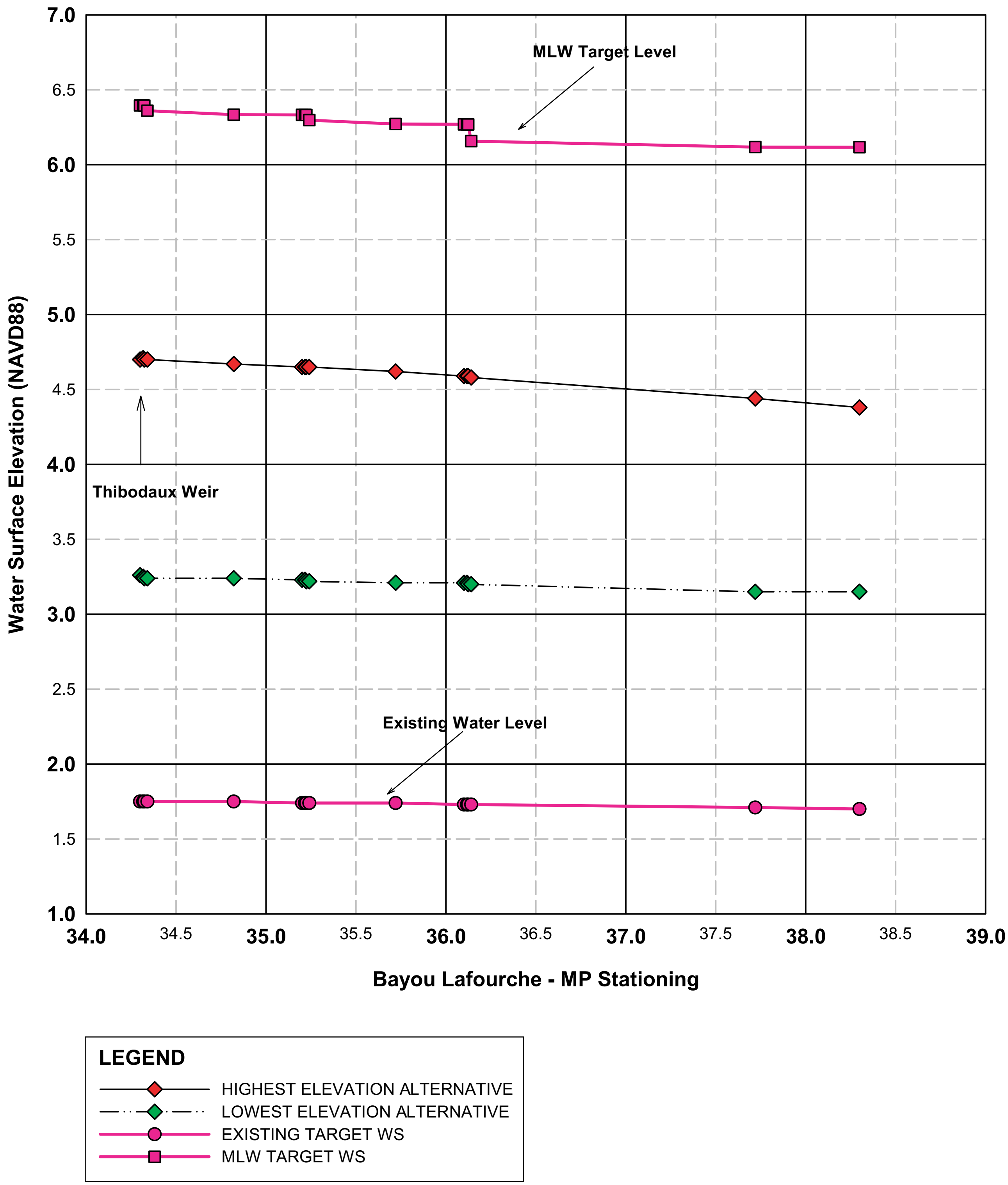

FIGURE 7-2
RANGE OF WATER LEVELS BELOW THIBODAUX
21 ALTERNATIVES AFTER SCREENING CRITERION 5
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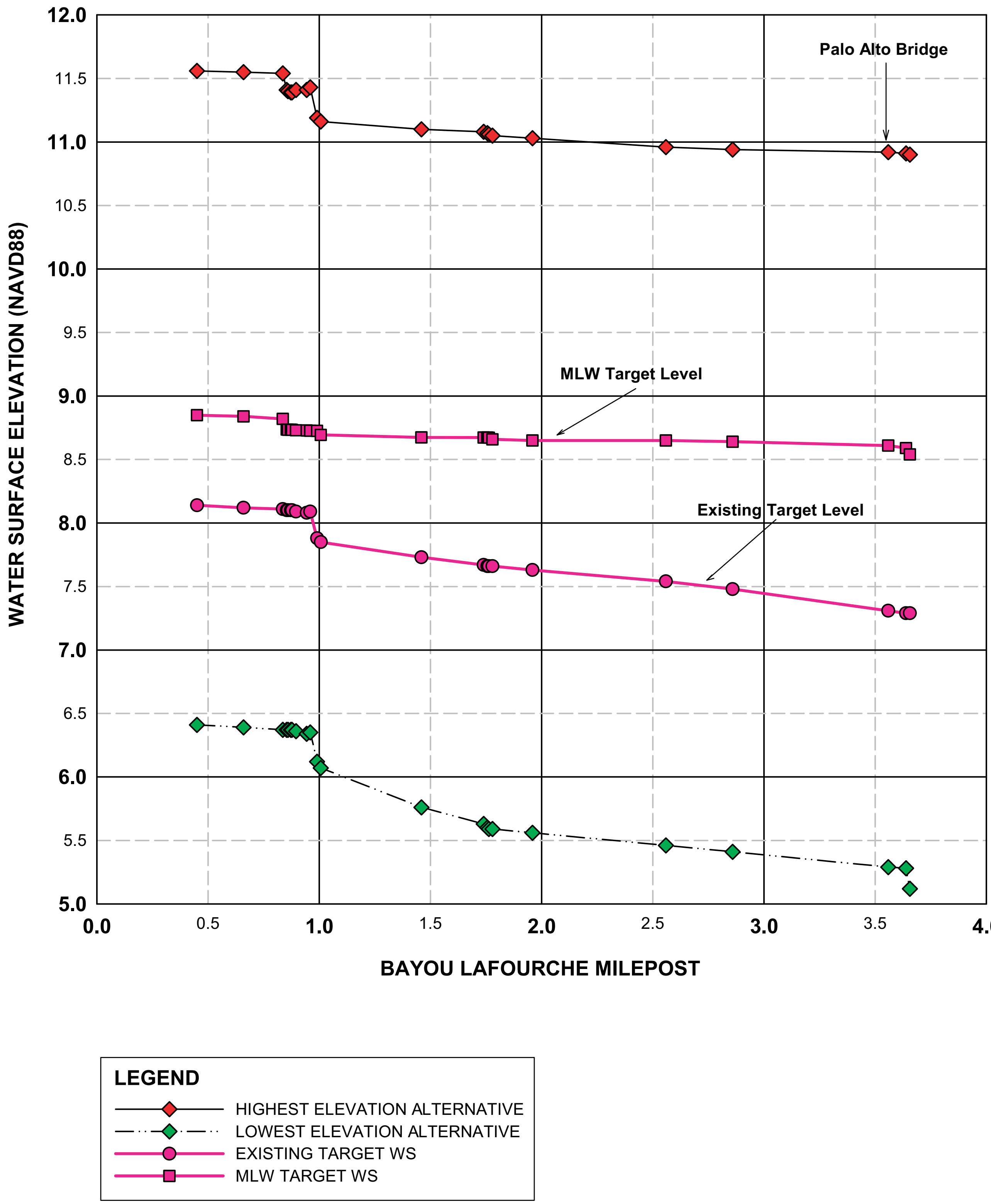

FIGURE 7-3
RANGE OF WATER LEVELS IN DONALDSONVILLE
21 ALTERNATIVES AFTER SCREENING CRITERION 5
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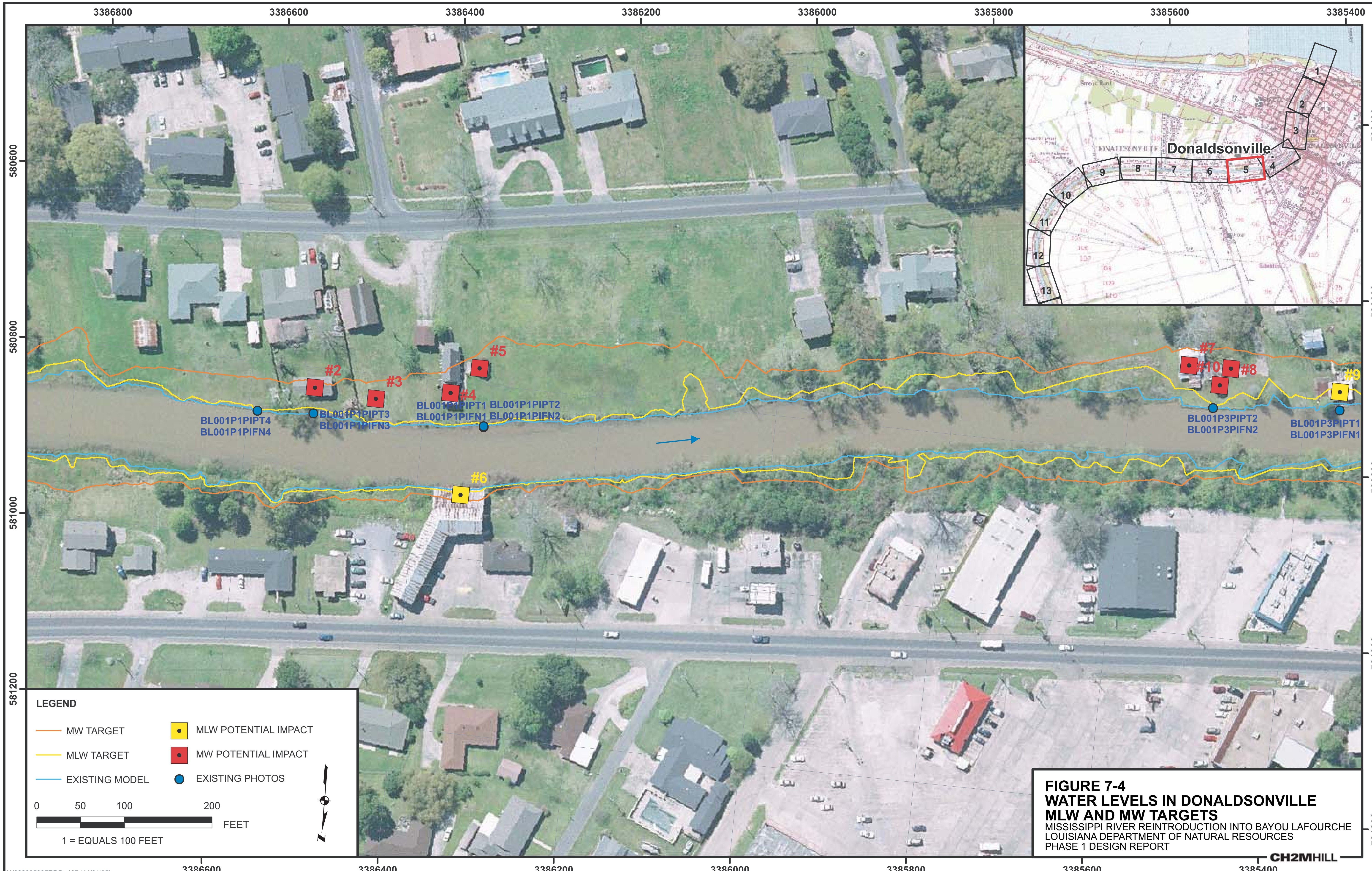

FIGURE 7-4
WATER LEVELS IN DONALDSONVILLE
MLW AND MW TARGETS
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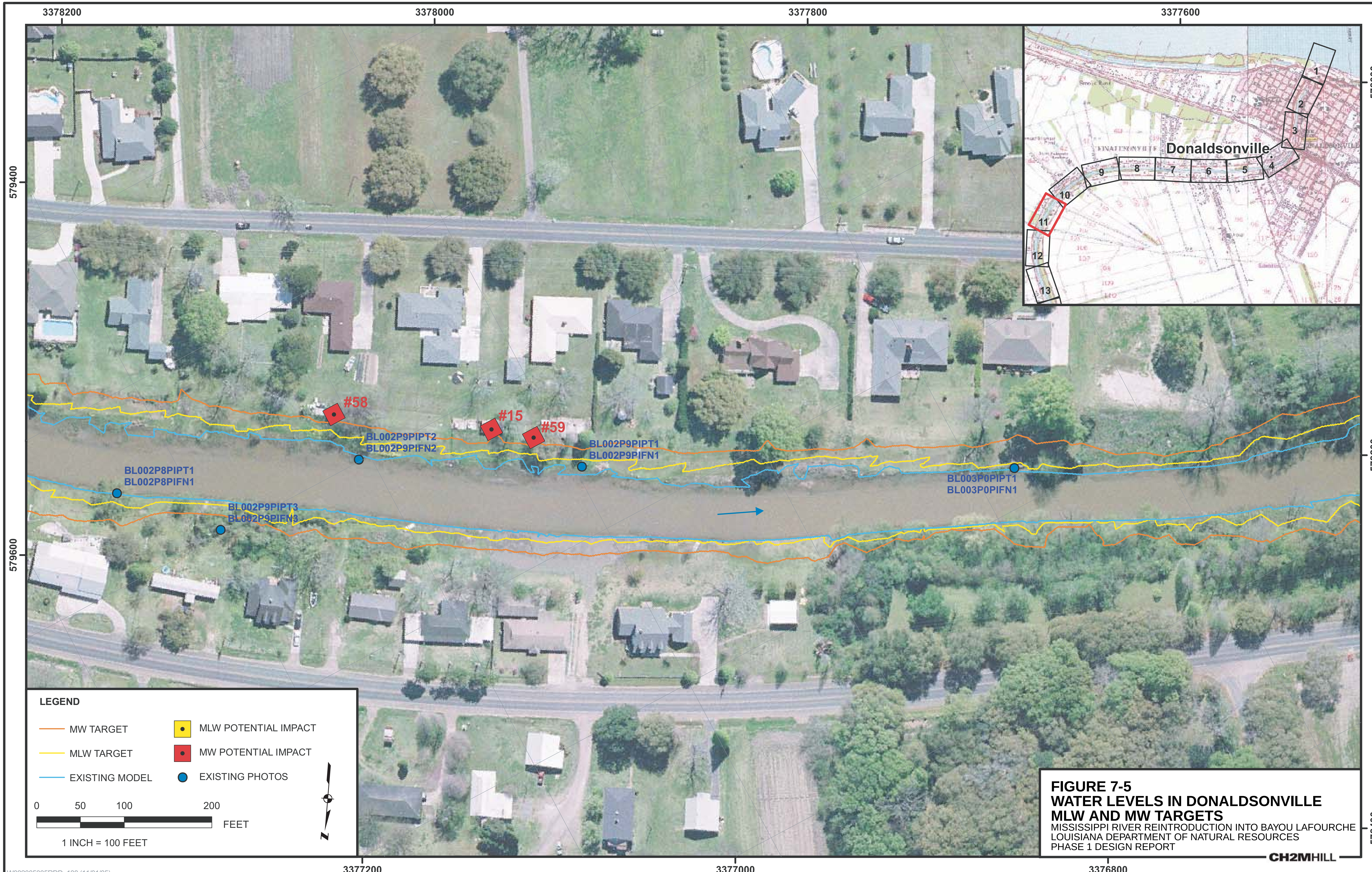

FIGURE 7-5
WATER LEVELS IN DONALDSONVILLE
MLW AND MW TARGETS
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The costs presented in this section of the report do not represent total construction, land acquisition, or capital costs. Therefore, they are not suitable for use in developing funding projections or total cost budget requirements.

7.2.2 Conveyance Channel Improvements

Dredging of Bayou Lafourche

Dredging of the bayou is a significant component of the estimated costs of individual alternatives. Section 6 of the Phase 1 design discusses the dredging requirements resulting from each alternative.

The volume and distribution of the material to be dredged will directly translate into project cost and schedule considerations. The cost effectiveness (e.g., cost per cy of material dredged) will vary as a function of total volume and physical distribution along the bayou.

In addition, the physical and chemical properties of the dredged material will be considered in the evaluation of management and disposal options. Landowner willingness to accept dredged material will be heavily influenced by the potential presence of contaminants. Thus, physical and chemical characteristics will affect the feasibility of many aspects of a dredging plan and might limit dredging alternatives.

For the Phase 1 evaluation, the following assumptions were made with regard to dredging costs:

- Material would be hydraulically dredged from a barge and conveyed via pipeline.
- Dredged material would be conveyed to upland environments for placement and dewatering.
- Disposal cells for the dredged material would be constructed on private lands through temporary easements.
- Beneficial reuse of the dredged material following dewatering is assumed to be viable (pending further evaluation of the sediments), but no value credit is factored into the costs.

According to these assumptions, a unit cost of $10 per cy of dredged material was used for the Phase 1 cost evaluations. This unit cost was not varied to account for differences between sediment characteristics at this stage of the project development. A single cost value at this stage is appropriate given the amount of data available to characterize the dredging costs. A refined cost estimate will be prepared for the selected alternatives in the 30 percent design evaluation. The refined estimates will include the development of specific dredge management plans for the selected alternatives.

Table 7-1 summarizes the dredging costs associated with the alternatives remaining from the qualitative screening process. As noted in Table 7-1, minor differences occur in dredging requirements for similar dredge templates because of the specific adjustments that were performed in the HEC-RAS analysis for the two alignments.

TABLE 7-1
Dredging Costs Associated with Remaining 19 Alternatives
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Dredge Template	Remaining Alternatives	Dredging Volume (cy)	Estimated Dredging Costs ($)
2-0@RM29, BL	15 and 38	2,900,000	29,000,000
2-ALL, SB	44 and 59	4,600,000	46,000,000
2-ALL, BL	6 and 20	4,800,000	48,000,000
8-2@RM3.4	26	4,900,000	49,000,000
8-2@RM29, SB	49 and 64	6,400,000	64,000,000
8-2@RM29, BL	12, 31, and 32	6,700,000	67,000,000
8-ALL, SB	46, 47, 61, and 62	8,200,000	82,000,000
8-ALL, BL	9, 22, and 23	8,600,000	86,000,000

Notes:

Refer to Section 3.3 for a discussion of the dredge template characteristics.

BL = Bayou Lafourche
SB = Smoke Bend

Construction of New Bypass Channel

A new bypass channel around Donaldsonville beginning at Smoke Bend on the Mississippi River is included in the alternatives that remain following the Screening Criterion 6. The new bypass channel will be approximately 13,500 feet long with a trapezoidal design section of varying widths (depending on the design flow). A summary of the general hydraulic characteristics of the bypass channel for the range of flow conditions is provided in Table 7-2.

TABLE 7-2
Hydraulic Characteristics of Smoke Bend Bypass Channel
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Design Flow (cfs)	Bottom Width (feet)	Normal Depth (feet)	Design Slope (ft/ft)	Average Velocity at Normal Depth (fps)
500	5	8.7	0.00022	2.0
1,000	5	13.3	0.00013	2.0
2,000	5	18.8	0.000084	2.0
3,000	30	19.2	0.000065	2.0

Notes:

Hydraulic characteristics are based on trapezoidal section with 2.5:1 (H:V) slopes.

ft/ft = foot per foot

As noted in Table 7-3, two configurations of the bypass channel were developed: shallow and deep. Screening Criterion 3 eliminated the shallow configuration from further consideration. However, the discussion of the shallow configuration is presented in this subsection as a reference to the reader. Figure 7-6 shows the schematic configuration of the two bypass channel cross sections.

TABLE 7-3
Remaining Conveyance Channel Alternatives Following Qualitative Screening
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Alternative No.	Alternative Alignment	Railroad Crossing	Check Structure	Dredging Template	Target Water Surface Level	Mississippi River Resultant Quantity (cfs)	Palo Alto Bridge Resultant Quantity (cfs)	Donaldsonville WSE (feet)	Bayou Lafourche Dredging (cy)	Smoke Bend Excavation						
										Deep Channel			Shallow Channel			
										WSE (feet)		Excavation Quantity (cy)	WSE (feet)			Excavation Quantity (cy)
										Upstream	Downstream		Upstream	Downstream	Confluence Elevation	
6	BL	NM	NA	2-ALL	MW	1,030	NA	11.6	4,770,000	--	--	--	--	--	--	--
9	BL	NM	NA	8-ALL	MW	1,040	NA	11.5	8,620,000	--	--	--	--	--	--	--
12	BL	NM	NA	8-2@RM29	MW	1,040	NA	11.5	6,732,000	--	--	--	--	--	--	--
15	BL	NM	NA	2-0@RM29	MW	1,025	NA	11.5	2,850,000	--	--	--	--	--	--	--
20	BL	M	NA	2-ALL	MLW	1,020	NA	8.7	4,770,000	--	--	--	--	--	--	--
22	BL	M	NA	8-ALL	E	1,300	NA	7.6	8,620,000	--	--	--	--	--	--	--
23	BL	M	NA	8-ALL	MLW	1,600	NA	8.8	8,620,000	--	--	--	--	--	--	--
26	BL	M	NA	8-2@RM3.4	MLW	1,250	NA	8.8	4,926,000	--	--	--	--	--	--	--
31	BL	M	NA	8-2@RM29	E	1,100	NA	7.0	6,732,000	--	--	--	--	--	--	--
32	BL	M	NA	8-2@RM29	MLW	1,530	NA	8.8	6,732,000	--	--	--	--	--	--	--
38	BL	M	NA	2-0@RM29	MLW	970	NA	8.8	2,850,000	--	--	--	--	--	--	--
44	SB	NM	N	2-ALL	MLW	NA	1,400		4,545,000	10.0	8.55	901,505	20.0	18.5	8.6	388,926
46	SB	NM	N	8-ALL	E	NA	1,320		8,237,000	7.9	6.34	1,017,226	20.0	18.4	6.3	366,849
47	SB	NM	N	8-ALL	MLW	NA	2,000		8,237,000	9.7	8.51	1,160,484	20.0	18.8	8.5	553,798
49	SB	NM	N	8-2@RM29	E	NA	980		6,351,000	7.5	5.53	896,802	20.0	18.1	5.5	272,578
59	SB	NM	Y	2-ALL	MLW	NA	1,390		4,545,000	10.0	8.55	897,048	20.0	18.5	8.6	386,168
61	SB	NM	Y	8-ALL	E	NA	1,320		8,237,000	7.9	6.34	1,017,226	20.0	18.4	6.3	366,849
62	SB	NM	Y	8-ALL	MLW	NA	2,000		8,237,000	9.7	8.51	1,160,484	20.0	18.8	8.5	553,798
64	SB	NM	Y	8-2@RM29	E	NA	980		6,351,000	7.4	5.51	898,143	20.0	18.1	5.5	272,578

Note:
BL = Bayou Lafourche
M = Modified
N = No
NA = Not Applicable
NM = Not Modified
SB = Smoke Bend
WSE = Water Surface Elevation
Y = Yes

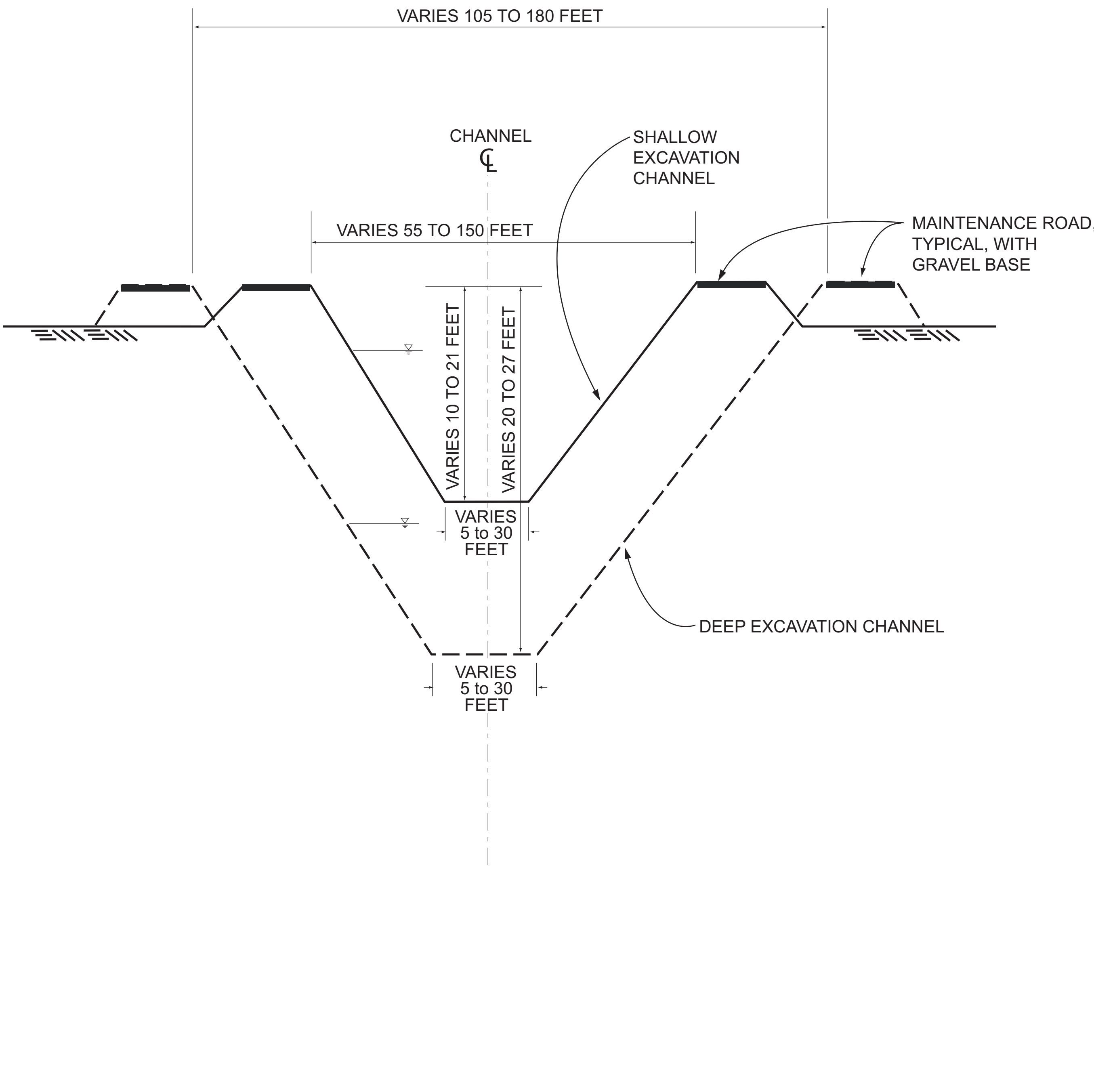

FIGURE 7-6
SCHEMATIC REPRESENTATION OF BYPASS CHANNEL CROSS SECTIONS
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The shallow excavation configuration was developed to minimize the excavation and land acquisition requirements for the bypass channel. The water surface of the shallow bypass channel configuration was placed near the existing land surface downstream of the railroad crossing at the Smoke Bend diversion facility location and then translated along the bypass alignment at the design slope. Excavation requirements for the channel were developed using the resulting topography along the alignment. Because the excavation was minimized, a drop structure is required at the confluence with the bayou to introduce the flows into the bayou.

The deep-excavation configuration was developed to match the water surface profile elevation at the confluence with the bayou. The required water surface at the confluence was determined from the HEC-RAS analysis, and the channel template was translated from the confluence to the railroad crossing at Smoke Bend along the alignment at the design slope. Excavation requirements for the channel were then developed using the resulting topography.

Excavation methods for both channel configurations are generally the same until the excavation encounters the groundwater. The soils along the alignment are generally clayey in nature and suitable for excavation using scraper methods until the water table is encountered. Spoil excavation materials can be spread in the surrounding lands (with the appropriate easements and agreements). According to field observations along the alignment, suitable lands are available within a 1- to 2-mile distance of the alignment to dispose the excess materials from the channel excavation.

After the excavation reaches the water table, scraper methods will not be suitable. In those reaches of the channel, dewatering techniques might be employed along with excavators using hoe- or clamshell-type heads or drag lines. Truck hauling would be used to dispose of the excavated materials from this portion of the excavation.

As noted in the discussion of Screening Criterion 3, the shallow-cut option was not economically viable. The costs for excavation of the bypass channel were evaluated for the deep-channel configuration. It is anticipated that excavation below the water table would be required for essentially the entire reach of the deep-channel configuration. In accordance with previous project experience and discussions with local excavation contractors, a unit cost of $6 per cy is estimated for the deep-channel configuration.

Hydraulic Structures in Bayou Lafourche and Bypass Channel

Numerous hydraulic structures in the bayou or bypass channel are required for the various alternatives, depending on the characteristics of the alternatives. Because the flow varies for an alternative, depending on the target water level elevation and dredge template, a parametric approach was developed for determining the estimated costs associated with the hydraulic structures. This approach focused on estimating the costs for each structure over a range of flow conditions, followed by fitting a specific cost curve for the structure. The flow range selected for this analysis was 500 to 3,000 cfs. Details of each structure are provided in the following subsections.

Bypass Channel Siphons. The bypass channel will be required to cross numerous features along the alignment from Smoke Bend to the confluence near the Palo Alto Bridge. According to the field observation of the bypass channel alignment, the channel will be required to cross the Bayou McCall, two drainage channels, and five roadways (both paved and unpaved). In addition to these crossings, the channel will be required to cross the highway parallel to the bayou.

Structures consisting of inverted siphons or pile-supported bridges will be used for these crossings. For this Phase 1 evaluation, it was assumed that crossings will be made using inverted siphons. For ease of construction, the siphon barrels will be configured with rectangular sections. Cast-in-place construction of the siphons will be employed. Where the channel crosses a significant drain or bayou, the flow from the drain/bayou will be shunted around the excavation site of the siphon. Dewatering will likely be required for each facility. Steel sheet shoring would be used to minimize the excavation impacts on the surrounding areas and protect the excavation. Figure 7-7 shows a typical bypass channel siphon crossing. Table 7-4 summarizes the estimated costs of the channel siphon structures for these crossings.

TABLE 7-4
Bypass Channel Crossings
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Design Flow (cfs)	Configuration	Estimated Cost ($)
500	2- to 5-foot x 10-foot barrels	1,300,000
1,000	4- to 7-foot x 10-foot barrels	2,000,000
2,000	4- to 9-foot x 10-foot barrels	3,500,000
3,000	5- to 7-foot x 20-foot barrels	6,000,000

Highway 1 Crossing and Drop Structure at Bayou Lafourche. After the bypass channel reaches the bayou, the flow is required to cross the adjacent Highway 1. A drop structure is required at this location for the shallow excavation channel configuration.

Similar construction methods, as previously described for the channel crossings, would be used for this facility. The crossing would also be similar in nature to the channel crossings. Therefore, for the deep-excavation channel configuration, the crossing costs described in Table 7-4 were used for this facility.

For the drop structure (required for the shallow excavation channel configuration), additional costs were developed to reflect the requirements to transition water levels to the bayou. A vertical box structure with a sill to maintain hydraulic control (forming a simple weir) was used to estimate the costs of this facility. A summary of costs for the drop structure is presented in Table 7-5. Figure 7-8 shows the road crossing and drop structure at this location.

Union Pacific Railroad Crossing in Donaldsonville. The railroad crossing in Donaldsonville is currently an earthen embankment across the bayou with two corrugated metal pipes and one box culvert through it to allow flow. The existing conduits are sufficiently large for the existing flow; however, for flows greater than about 300 cfs, upstream water levels will quickly increase. In Alternative 15 (see Table 3-5), for example, approximately 1,000 cfs can

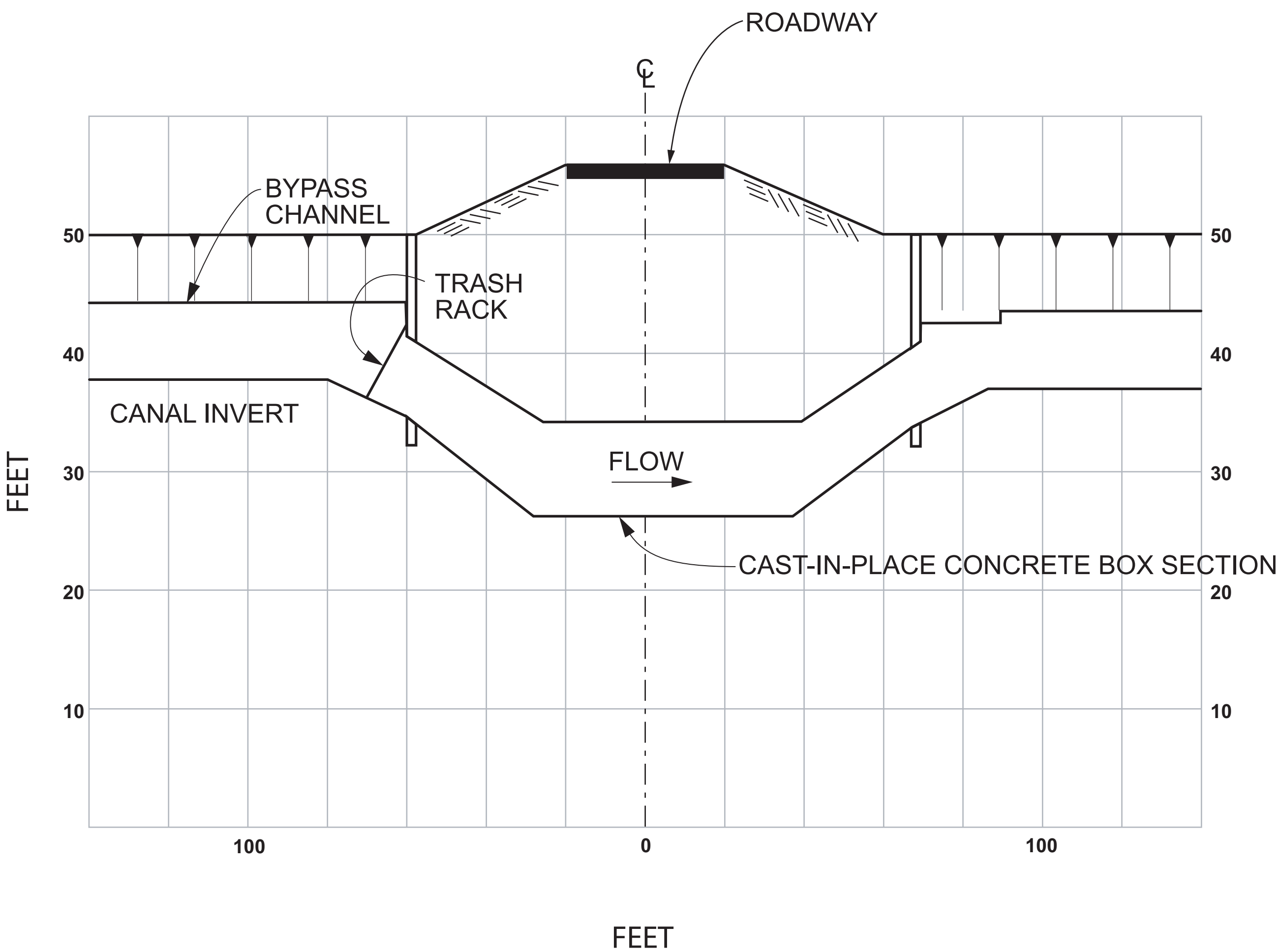

FIGURE 7-7
TYPICAL BYPASS CHANNEL
SIPHON CROSSING
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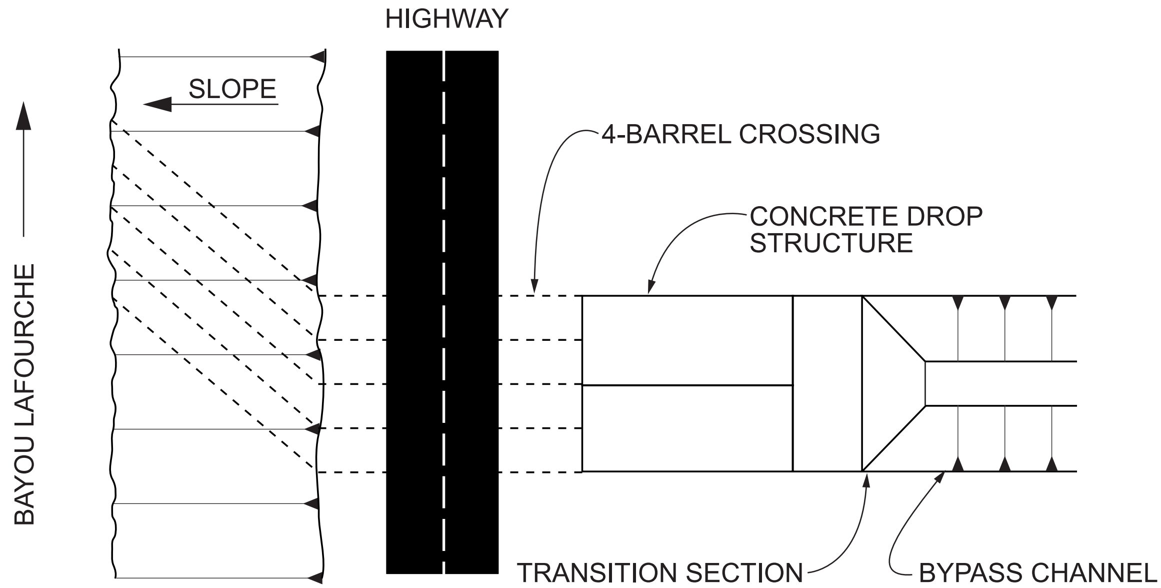

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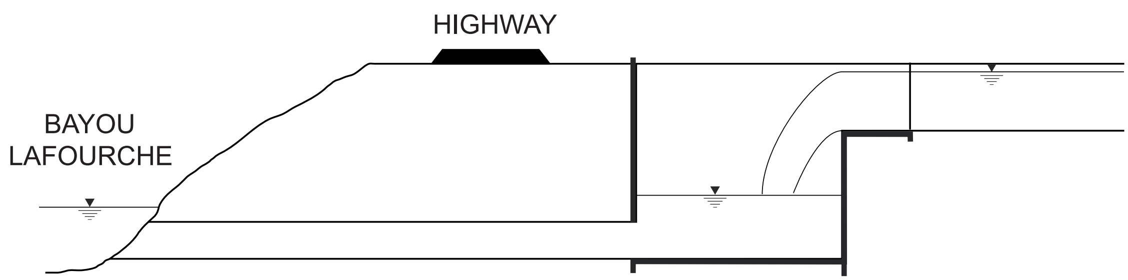

SECTION

FIGURE 7-8
ROAD CROSSING
AND DROP STRUCTURE
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be passed through the existing configuration, but the upstream water surface approaches the MW target. As described in the screening process, the ability to increase the capacity of this crossing much above 1,000 cfs is limited. This is because there is minimal room to add additional conduits for the flow, which would result in the need to construct a bridge if additional flow were required.

TABLE 7-5
Road Crossing and Drop Structure at Bayou Lafourche
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Design Flow (cfs)	Estimated Cost ($)
500	1,600,000
1,000	2,500,000
2,000	4,500,000
3,000	8,000,000

The cost of a railroad bypass or shoofly and new bridge was investigated to develop an understanding of the potential expense for alternatives requiring the UPRR replacement. Figure 7-9 shows an arrangement of the bypass that conforms to the UPRR design specifications for speed and curve radius. A total cost of approximately $8,000,000 was estimated for the shoofly and new bridge, and was included in those remaining alternatives that required the UPRR bridge replacement.

Bulkhead Placement along Bayou. Most of the remaining alternatives following Screening Criterion 6 will include an increase to the existing water level. Many structures and developed property along Bayou Lafourche extend to the water's edge and include bulkheads to protect from wave action, flooding, and erosion.

The photo review of the bayou properties showed that some of the existing bulkheads have a few feet of freeboard. However, many of the backyards are landscaped to the water's edge. The detailed review of the property photos and water level rise for each alternative was used to assess where bulkheads might be replaced or installed to protect from a rise in water level.

Estimates of required bulkheading length were made from the topography along the bayou, and associated costs were compared to the cost of replacing the impacted structures. From preliminary geotechnical boring logs, the depth of the bulkheads was estimated at 20 feet, and a cost per square foot of $28, for a total cost per linear foot of $560.

Figure 7-10 shows a typical section view of a bulkhead placement along the bayou. The height of the bulkhead above the proposed water level will be determined during final design. Native backfill material will be used behind the bulkhead to maintain typical property slopes and existing integrity of the land. Detailed surveys and topography will be needed during final design to accurately place the bulkheads and key the structure into the bank.

Additional bulkheads for bank stability concerns were evaluated over the length of the bayou from Donaldsonville to Lockport based on the largest potential dredge template of 8 feet. No bulkheads were assumed for any part of the bayou for the 2-foot dredging.

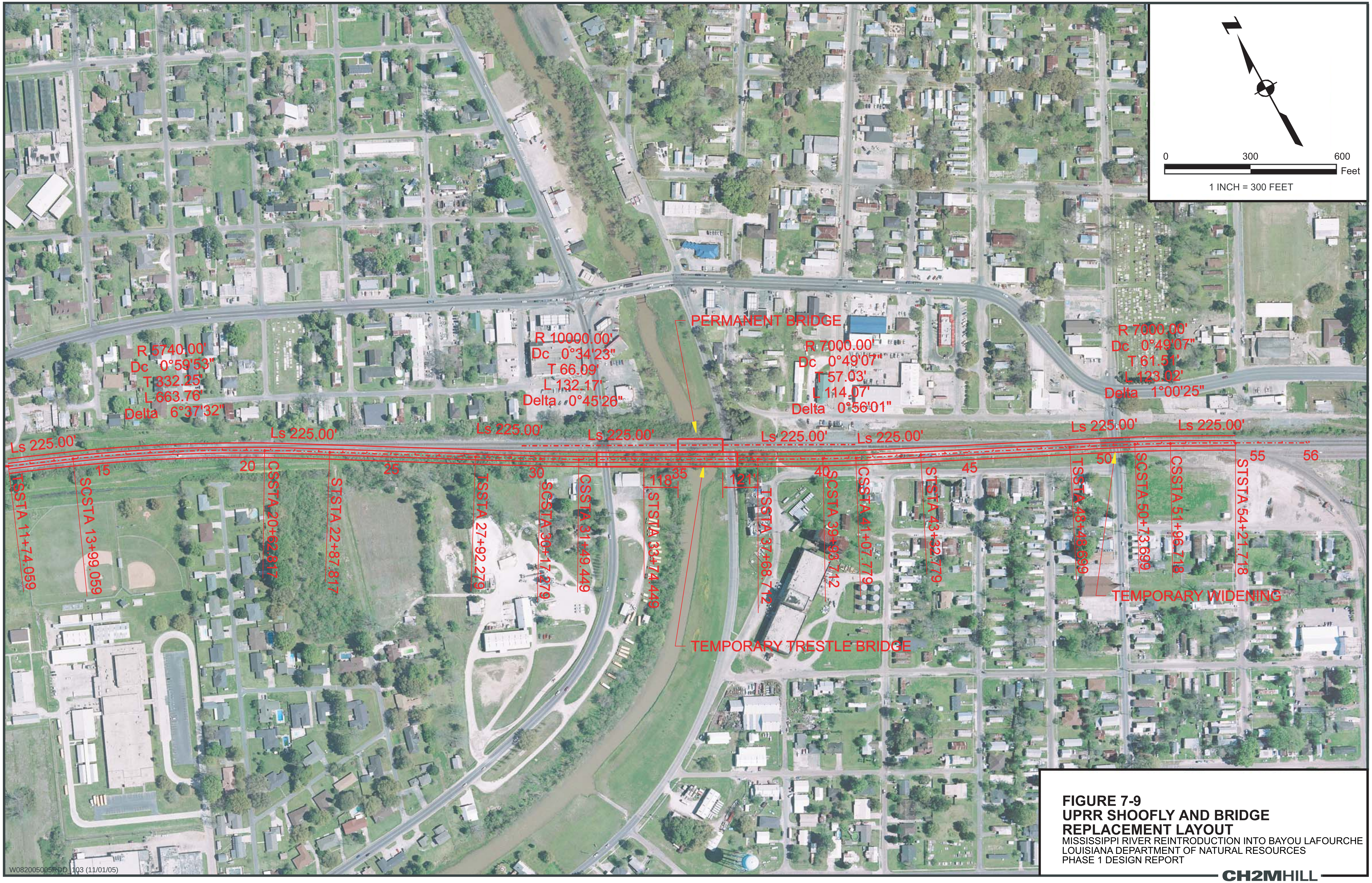

FIGURE 7-9
UPRR SHOOFLY AND BRIDGE REPLACEMENT LAYOUT

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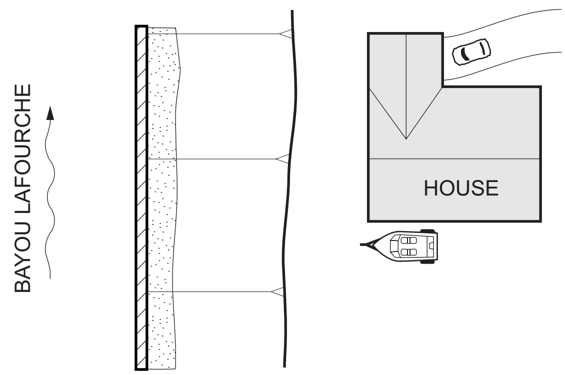

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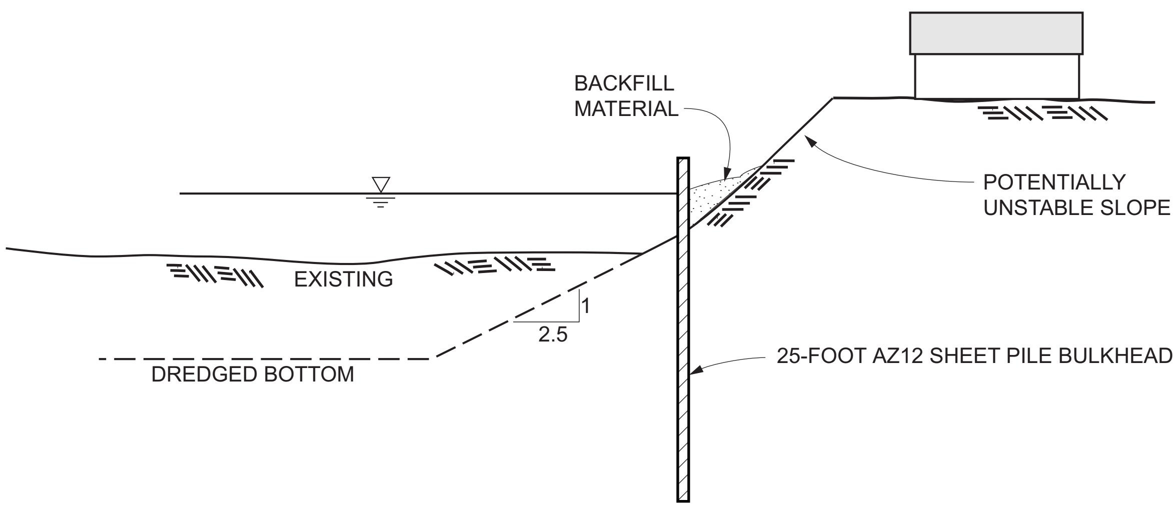

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FIGURE 7-10
BULKHEAD
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Typical channel cross sections in the steeper bank slope areas were used to evaluate the stability characteristics and determine potential length of bulkheads needed to stabilize the banks.

Deployable Weirs in Bayou. As described in Section 3, the existing weir at Thibodaux will be removed as part of the recommended project to facilitate delivery of additional flows to the Gulf. The existing weir is a concrete sill with numerous slide gates to provide control of the water surface. This weir currently provides hydraulic control of the flow in the bayou so that the Thibodaux water treatment plant intake remains in operation (the intake is located approximately 50 feet upstream of the weir).

To maintain this required level of hydraulic control during conditions of low flow in the bayou, a deployable weir will be required at this location. An inflatable rubber dam is recommended for this structure and would have the dual purpose of adjusting the bayou water surface during periods of low flow and for use in an emergency situation, such as a toxic spill, to prevent downstream contamination. The Thibodaux weir replacement dam would likely be located downstream in a wider section of the bayou to allow space for the rubber dam and for a bypass channel should the dam need repair.

In addition to the deployable weir located near Thibodaux, a weir will likely be required near the Palo Alto Bridge (just upstream of the confluence with the bypass channel). This structure would be provided as a means of isolating the upper bayou from the lower bayou during those potential instances of contamination in the upper bayou. Contamination could occur because of spills or accidents in the watershed between the Mississippi River and the Palo Alto Bridge or in the Mississippi River itself.

Figure 7-11 shows a typical rubber dam section view. Rubber dam weirs typically consist of a concrete slab construction with cut-off walls anchored into the channel bottom. The rubber bladder is composed of thick (0.75 inch minimum) impregnated rubber that is highly durable and resistant to damage. The bladder is filled with air from a small compressor on the shore to approximately 5 to 7 pounds per square inch. These dams would normally be operated in the deflated mode (depending on the flow in the bayou and the water surface level at the Thibodaux water treatment plant intake). When deflated, they would rest on the concrete slab structure. When the water surface must be maintained, the compressor would inflate the dam. These dams would be 8 to 12 feet high and approximately 100 to 150 feet long.

The final locations of the deployable weirs will be discussed further as part of 30 percent design. Bayou flows and control scenarios will need to be incorporated.

The estimated cost of each of these deployable weirs is approximately $3,000,000.

Check Structure with Pump Station at Confluence

As noted in Table 7-3, a check structure in the bayou is planned for some of the remaining alternatives. The check structure would prevent higher water levels, resulting from increased flows through the bypass channel, from migrating upstream in the bayou near Donaldsonville.

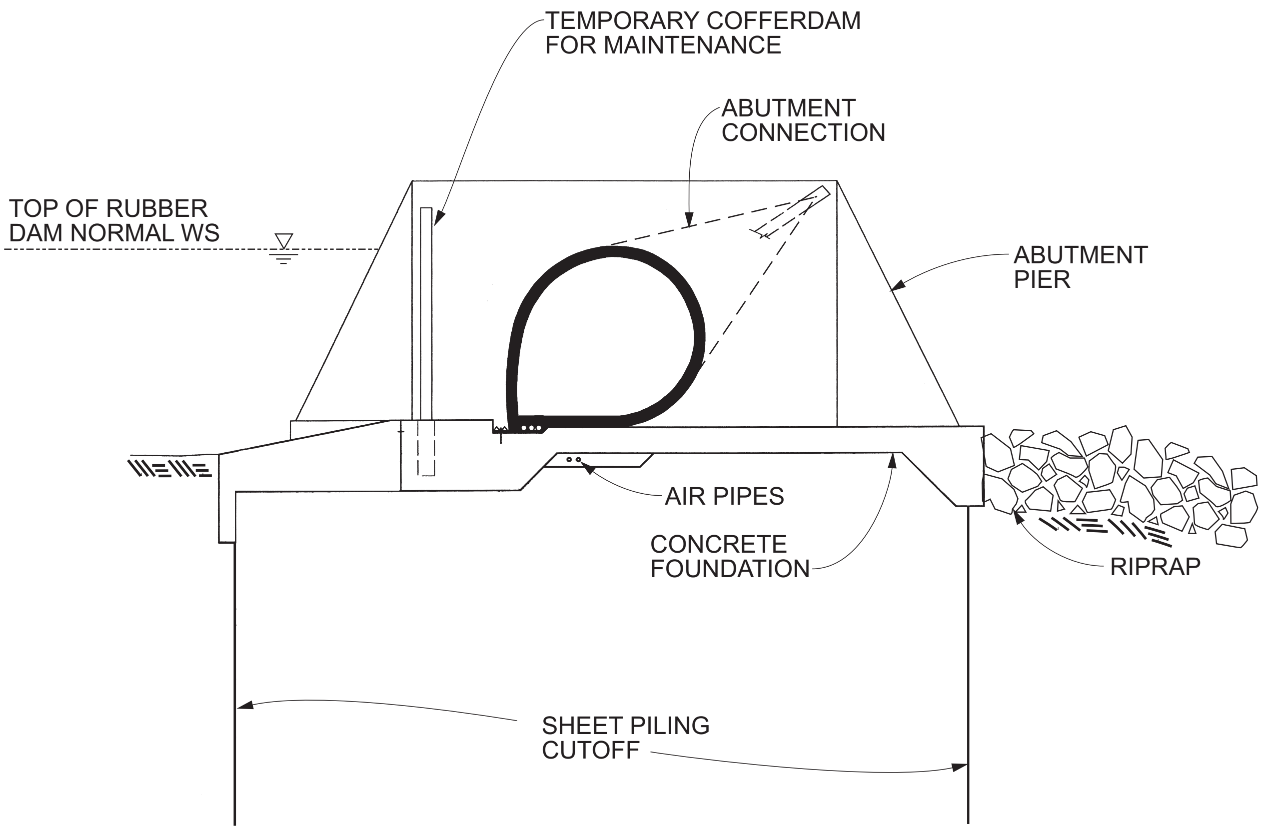

FIGURE 7-11
RUBBER DAM WEIR
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As described in Section 3, a maintenance flow of approximately 100 cfs would be provided in the upper bayou. This maintenance flow, combined with any stormwater contributions to the upper bayou, would be pumped around the check structure located at the confluence with the bypass channel. For the Phase 1 design evaluation, the pump station was sized at 500 cfs to allow sufficient capacity for stormwater contributions.

The check structure would be similar to the deployable weir structures described previously. The rubber dam weir would be configured to align with the high water surface being on the south side of the structure. This weir would normally be fully inflated to separate the water surfaces in the lower bayou from the upper bayou (at the confluence with the bypass channel). In those instances when rainfall or other events require, the weir would be deflated allowing passage of increased flows. Figure 7-12 shows the typical configuration of this structure. The estimated cost of this structure, including the 500-cfs pump station, is approximately $5,000,000.

Utilities Relocation and Bridge Protection

As described in Section 5, numerous existing utilities are located in the bayou from the Mississippi River to 5 miles downstream of Thibodaux (about RM 38.0). An inventory of the utilities has been completed and is documented in Appendix H.

A preliminary cost allowance has been included in the estimated costs for relocating the utilities in the bayou. The cost allowance is primarily a function of the dredge template employed for each alternative, but also the alignment selected. The estimated amount of underground utility replacements and the cost allowance for the remaining alternatives from the screening process are summarized in Table 7-6.

TABLE 7-6
Cost Allowance for Utility Relocation Requirements
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Dredge Template	Remaining Alternatives	Number of Replacement Utilities	Estimated Cost ($)
2-0@RM29, BL	15 and 38	39	4,000,000
8-2@RM3.4	26	53	5,000,000
8-2@RM29, BL	12, 31, and 32	63	6,000,000
8-2@RM29, SB	49 and 64	55	5,500,000
2-ALL, BL	6 and 20	52	5,000,000
2-ALL, SB	44 and 59	45	4,500,000
8-ALL, BL	9, 22, and 23	74	7,000,000
8-ALL, SB	46, 47, 61, and 62	66	6,500,000

Note: Refer to Section 3 for a discussion of the dredge template characteristics.

Modifications to increase the flow will have limited impacts to existing bridges in the bayou.

The Louisiana Department of Transportation has indicated that the vehicle bridges are all founded on piles and removal of up to 8 feet of earth material under the bridges will likely not affect their structural capacity. The structural integrity of the bridges will be assessed

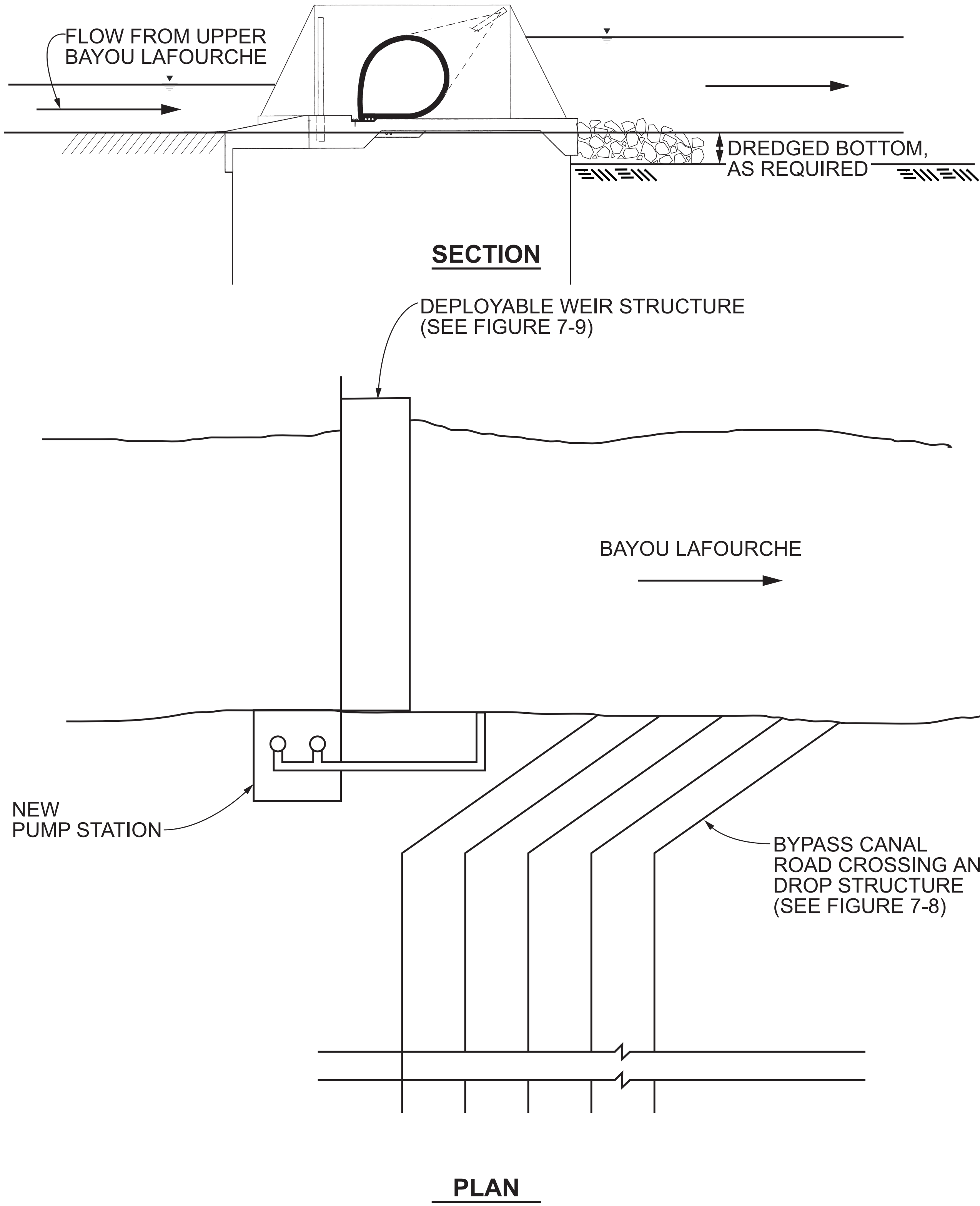

FIGURE 7-12
CHECK STRUCTURE WITH PUMP STATION AT CONFLUENCE
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during the 30 percent design phase. Should the potential exist for erosion around the upstream or downstream approaches, some type of riprap or erosion mattress would be provided. No cost allowance is provided at this time.

7.2.3 Diversion Facility Improvements

New Diversion Facility at Smoke Bend

A new diversion facility is required at Smoke Bend for some of the remaining alternatives following the qualitative screening. This diversion facility is described in more detail in Section 4 of this report.

For the purposes of developing a cost estimate for the diversion facility, the diversion facility was assumed to have the characteristics of the existing Donaldsonville facility. A listing of the major characteristics is as follows:

- Piped suction intake
- Discharge piping routed over the levee
- Pump station located on the river side of the levee
- Pedestrian access to the pump station deck
- Pumps designed to meet the design flow with no excess capacity or backup pumps
- Limited standby power
- Sedimentation basin located at the beginning of the bypass channel
- No upgrade needed to the local utilities for electrical service

Refer to Figures 4-4 and 4-5 for a representation of the pump station configuration used for the cost estimates.

A summary of the estimated costs of this new diversion facility at Smoke Bend at various flow conditions is provided in Table 7-7.

TABLE 7-7
Estimated Costs for Smoke Bend Diversion Facility
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

Design Capacity (cfs)	Base Pump Station Cost		Intake System ($)	Discharge System ($)	Diversion Facility Cost	
	Low Head ($)	High Head ($)			Low Head ($)	High Head ($)
200	1,900,000	2,600,000	1,500,000	2,700,000	6,100,000	6,800,000
500	3,300,000	4,600,000	2,000,000	4,000,000	9,300,000	10,600,000
1,000	5,700,000	8,100,000	4,000,000	5,800,000	15,500,000	17,900,000
1,500	7,500,000	11,000,000	5,000,000	8,200,000	20,700,000	24,200,000
2,000	11,000,000	16,000,000	5,800,000	9,400,000	26,200,000	31,200,000
3,000	15,000,000	22,000,000	12,000,000	13,000,000	40,0600,000	47,000,000

Note:

Discharge system costs include tunneled crossings under Highway 1 and the UPRR to deliver water to the bypass channel.

As shown in Table 7-7, the base pump station costs are varied depending on the head conditions for the pump. The low-head pump station would be used with the deep-excavation configuration of the bypass channel. The high-head pump station would be used for the shallow excavation configuration of the bypass channel.

A schematic view of the different head conditions is shown on Figure 7-13. As shown on Figure 7-13, the water surface elevations in the bypass channel vary depending on the excavation condition. Also, Table 7-3 indicates that the water surface elevations in the bypass channel vary as a function of design flow. These effects have been factored into the costs presented in Table 7-7.

Economic Analysis of Smoke Bend Pump Station and Excavation Configurations

As part of the detailed cost estimate development in Section 7.2, comparative construction costs were developed for the bypass channel facilities. These costs included the Smoke Bend diversion facilities, the bypass channel excavation, and the bypass channel structures.

At the conclusion of this analysis, the comparative construction costs between a deep-excavation configuration and the shallow excavation configuration were approximately equal for all flow conditions analyzed. On inspection of the cost results, it was evident that the increased costs for the deep-excavation configuration were generally offset by the reduced costs of the base pump station, because the deep-excavation condition results in low-head pump station requirements (refer to Figure 7-13).

For the Phase 1 design evaluation, screening one of the two bypass channel excavation configurations was desirable. Because the diversion pump station could operate at two distinct head conditions for the two excavation configurations, the potential cost tradeoffs in energy over the life of the project were evaluated.

A present-worth analysis over a 20-year term was performed on the difference in pumping between the high-head (associated with the shallow excavation configuration) and the low-head (associated with the deep-excavation configuration) pump station for the range of flows being considered.

The variation in water surface elevation in the Mississippi River was reviewed as part of this analysis. Detailed information on this variation is presented in Appendix F. Based on the historical patterns of water surface elevation variations in the Mississippi River, it was determined that there were significant periods when a siphon condition would be achievable for delivering flows to the bypass channel if the water surface elevations were sufficiently lowered as expected with the deep-excavation condition. The analysis indicated that for approximately 4 to 5 months of the year, a siphon condition would be possible for the bypass channel. In addition to the effects of the siphon, the reduced pumping to the lower head conditions of the deep-excavation bypass channel had a significant effect on the power consumption by the pump station.

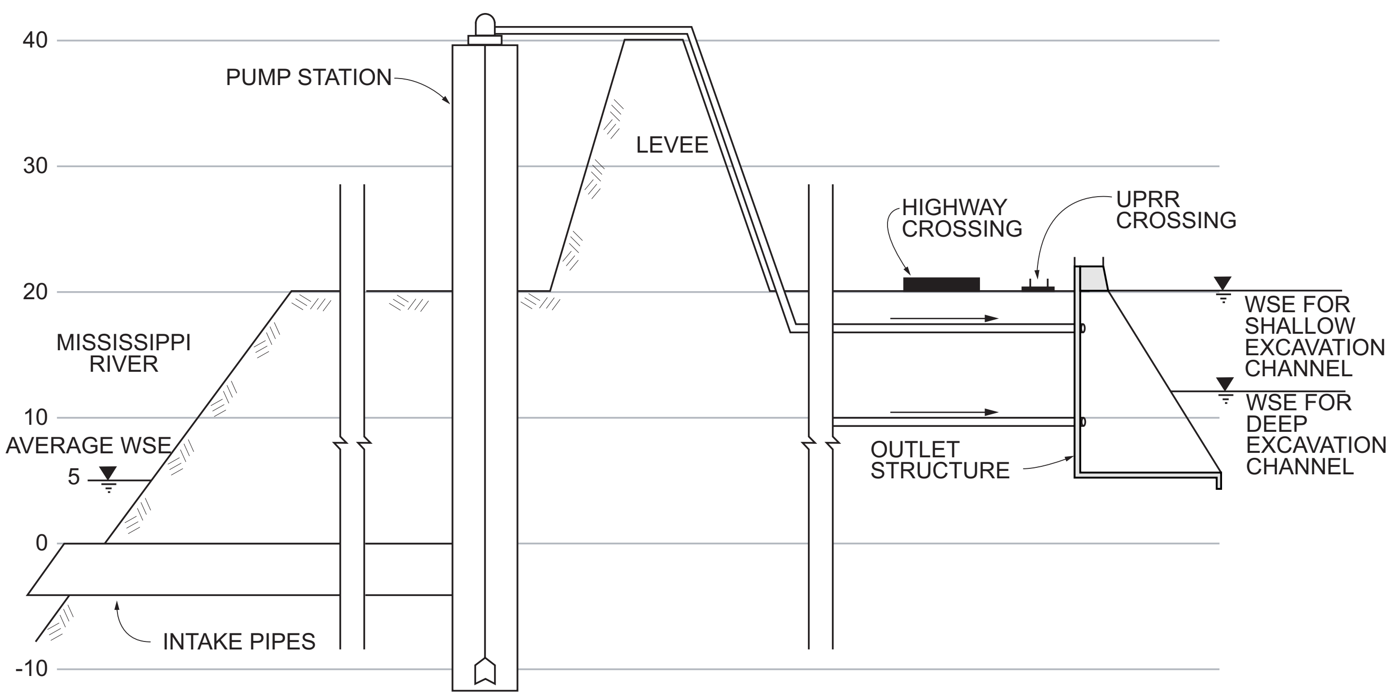

FIGURE 7-13
TYPICAL HEAD CONDITIONS AT SMOKE BEND DIVERSION FACILITY
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A summary of the assumptions used for the present-worth analysis to compare the two bypass channel conditions follows:

- Current 2004 cost of electricity is approximately $0.065 per kilowatt hour.
- Operating brake horsepower for each of the pump sizes based on a selected pump and operating efficiency for each operating condition.
- System curve development was based on yearly mean average river conditions including representative piping and station losses.
- Pump operation of 8,760 hours per year per pump for the high-head alternative (continuous pumping 12 months per year).
- Pump operation of 5,100 hours per year per pump for the low-head alternative (continuous pumping 7 months per year – July through January).
- Pump selection operating at the yearly mean average river level of 11.7 feet for pump operation for the high-head alternative (mean average for 12 months).
- Pump selection operating at the yearly mean average river level of 8.0 feet for pump operation for the low-head alternative (mean average for 7 months of pumping – July through January).
- Discharge water surface of 20.0 used for the high-head alternative.
- Discharge water surface of 10.5 used for the low-head alternative.
- A 3 percent rate of increase for the electrical costs per year based on the Department of Energy projected energy costs for the project period of 20 years.

Table 7-8 summarizes the results of this present-worth analysis.

TABLE 7-8
Summary of Present-worth Analysis for Bypass Channel Excavation Condition
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

	Low-head Pump Station		High-head Pump Station		
Design Capacity (cfs)	**Annual Power Costs ($ 2004)**	**Present Worth of Power Costs ($)**	**Annual Power Costs ($ 2004)**	**Present Worth of Power Costs ($)**	**Difference in Present-worth Costs ($)**
500	190,000	2,700,000	500,000	7,800,000	5,100,000
1,000	360,000	5,400,000	1,000,000	15,400,000	10,000,000
1,500	450,000	6,700,000	1,400,000	21,200,000	14,500,000
2,000	640,000	9,500,000	1,900,000	27,900,000	18,400,000
3,000	920,000	13,600,000	2,900,000	42,700,000	29,100,000

Notes:
Low-head pump station associated with deep-excavation configuration for bypass channel.
High-head pump station associated with shallow-excavation configuration for bypass channel.

As shown in Table 7-8, under all conditions the low-head pump station results in the favorable present-worth costs. For the higher flow conditions, the difference in present-worth costs is significant.

Therefore, the shallow excavation configuration for the bypass channel was screened in Criterion 3 from further consideration in the Phase 1 design evaluation. The shallow-cut excavation configuration was associated with the high-head pump station requirements. Any pump station costs or excavation costs for remaining Smoke Bend alternatives after Screening Criterion 6 were based on the deep-cut, low-head facility costs.

Modifications to the Donaldsonville Facility

As noted in Section 2, the existing capacity of the Donaldsonville diversion facility is approximately 340 cfs. This facility was originally constructed in 1955.

In some of the remaining alternatives, the Donaldsonville facility is used to deliver water to the bayou. The cost of pumping for these alternatives was based on the cost of a new pump station at the Donaldsonville site.

7.2.4 Structure Impact Inventory and Costs

An important environmental and project cost component was the water level impact to structures along the shoreline of Bayou Lafourche. The majority of the remaining alternatives (13 out of 19) include some measure of increased water level between a few inches to about 3 feet. For the most part, the water level rise is approximately 1.0 to 1.5 feet in the reach from the Mississippi River to the Thibodaux weir, and about 1.0 to 3.0 feet downstream of the Thibodaux weir to Lockport.

The rise in water level from these alternatives will affect a variety of structures along the bayou including single-family homes. Many of the affected structures will be boat houses, boat docks, equipment sheds and out buildings, yards (land), pile supports, bulkheads, and other miscellaneous structures.

The linkage of water level rise, dredging, and diversion flow was critical to understanding the alternative development and subsequent screening process. The LDNR requested the completion of a dredging matrix that related flow and water levels in a December 22, 2004, letter to CH2M HILL. Appendix K provides a TM discussing the methods and approach, using available model results, to completing the matrix of dredge quantities. The dredge quantity matrix shows the relationship between water levels and flow as related to dredging and, ultimately, project costs.

During reconnaissance field investigations, photographs of the potentially impacted structures were taken within the project study area primarily focusing on the cities of Donaldsonville and Thibodaux, and the reach between Thibodaux and Lockport. The photographic survey produced more than 450 photos of structures to be previewed in the water level survey and structure impact analysis.

Water level inundation contours for the study area were developed to represent the general water level rise expected for the remaining 19 alternatives. The range of water level rise for the remaining alternatives fell within a somewhat narrow bandwidth in the Donaldsonville and Thibodaux areas.

For the structure impact inventory, a typical water level rise of 1.5 feet above existing in Donaldsonville to 1.0 feet above existing upstream of the Thibodaux weir, and a 3.0-foot rise above existing downstream of the Thibodaux weir to a 1.0-foot rise in Lockport were used to evaluate impacted structures.

The photographs were linked to the structure location in a GIS database using field notes. The expected water level contours and the photos were reviewed to assess the impact of the proposed projects on the structures. As the photos were reviewed, the GIS database was annotated and used to catalog an impact or non-impacted structure. The structure impact count was then accumulated by reach to estimate the cost of impacted structures.

Table 7-9 shows the count of impacted structures, including land (backyards) as an entity, in the study area from the Mississippi River to Lockport in three separate reaches, (1) Donaldsonville to the Palo Alto Bridge, (2) Palo Alto Bridge to Thibodaux weir, and (3) Thibodaux weir to Lockport. The second reach was not directly inventoried using a photo survey, but rather used the upper Donaldsonville reach to proportion the impacted structures.

TABLE 7-9
Structure Impact Inventory
Mississippi River Reintroduction into Bayou Lafourche – Phase 1 Design Report

	Remaining Alternatives								
	Donaldsonville Alignment			Smoke Bend Alignment			Least Rise Alternative		
Reach	Structures	Docks	Land	Structures	Docks	Land	Structures	Docks	Land
Donaldsonville to Palo Alto Bridge	7	0	7	0	0	0	0	0	0
Palo Alto Bridge to Thibodaux Weir	15	7	59	15	7	59	0	0	0
Thibodaux Weir to Lockport	30	156	66	30	156	66	12	134	33

The acres of impacted land or yards were estimated from the water line contour maps. Approximate costs of structures and land were developed using an average value for the impacted structure count based on local anecdotal information.

Because of the sensitivity of the water level impacts, a “least rise” (least structure impact) alternative was developed, and was defined as follows:

- 1,000-cfs flow
- 8-foot dredge template for entire channel length.

An additional HEC-RAS run was completed for this least rise alternative, and a new water surface was defined and added to the GIS mapping. This then allowed another set of impact calculations to be generated, which are shown in Table 7-9.

The impacted structure costs for each reach were then summed by alignment (Donaldsonville or Smoke Bend) and inserted into the project costs. For the 19 remaining alternatives (excepting the least rise alternative) the value of the structure impact inventory ranged from $5,000,000 to $6,000,000. The least rise alternative was found to have the least impact on structures, per its fundamental purpose, with a structure value of less than $1,000,000.

7.3 Cost Efficiency Screening of Alternatives

Following the development of estimated costs for the various alternatives as documented in Section 7.2, a quantitative cost-efficiency screening analysis was performed on the remaining 19 alternatives included in Table 7-3. The results of this analysis and the listing of recommended alternatives are documented in the sections that follow.

7.3.1 Screening Criterion 7 – Cost Effectiveness of Dredging

Table 7-10 summarizes the remaining alternatives following the application of Screening Criteria 1 through 6. As shown in Table 7-10, 19 alternatives remain. The estimated comparative costs for these alternatives are also presented in Table 7-10.

The next step in the screening process for the remaining alternatives was to compare the alternatives for flow and dredging cost-effectiveness. Figure 7-14 was developed to facilitate this approach because, as illustrated on Figure 7-14, there were alternatives with similar diversion flow but vastly different dredging quantities, and there were alternatives with similar dredging quantities but different flows.

Where appropriate, screening decisions were made on these remaining alternatives to determine the viable alternatives for proceeding beyond the Phase 1 design. The details of these comparisons are presented in the following subsections.

Comparison of Similar Dredging Quantity but Different Diversion Flow

Alternatives 9, 22, 23, 46, and 61. Each of these alternatives requires between 8.0 and 8.5 mcy of dredging for diversion flows of 1,000 to 1,600 cfs. Most of the cost of the alternatives is effectively represented by the amount of dredging required. Alternatives 47 and 62 also require similar dredging but provide 2,000 cfs of flow. As such, it is not cost effective, because of flow and dredging, to keep Alternatives 9, 22, 23, 46, and 61.

By eliminating these five, the remaining alternatives were reduced from 19 to 14.

Alternatives 12, 31, 49, and 64. In a similar manner, Alternatives 12, 31, 49, and 64 each require 6 to 7 mcy of dredging for diversion flows of about 1,000 cfs. Alternative 32 provides for more than 1,500 cfs with the similar amount of dredging. Thus, it is not cost effective, based on flow and dredging, to keep Alternatives 12, 31, 49, and 64.

By eliminating these four, the remaining alternatives were reduced from 14 to 10.

Alternatives 6 and 20. Alternative 6 and 20 each require about 5 mcy of dredging for a diversion flow of 1,000 cfs. Three other alternatives, 26, 44, and 59, provide *greater* flow between 1,200 and 1,400 cfs for approximately the same amount of dredging. As a result, it is not cost effective, based on flow and dredging, to keep Alternatives 6 and 20.

By eliminating these two, the remaining alternatives were reduced from 10 to 8.

TABLE 7-10

Summary of Costs Associated with Remaining Alternatives

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Alternative No.	Alternative Alignment	Dredging	Maximum Water Surface Limit	Mississippi River Resultant Quantity (cfs) RS 226	Palo Alto Bridge Resultant Quantity (cfs) RS 211	Dredging Cost ($)	Bypass Channel Excavation Cost ($)	Diversion Facility Costs, Low Head ($)	Bypass Channel Crossings ($)	Check Structure and Pump Station ($)	Highway 1 Crossing and Drop Structure ($)	Railroad Modification at Donaldsonville ($)	Utility Replacement Cost ($)	Bulkhead Cost ($)	Land Cost ($)	Structure Cost ($)	Deployable Weirs ($)	Total ($)
6	BL	2-ALL	MW	1,030	--	47,700,000	--	15,600,000	--	--	--	--	5,200,000	406,000	530,400	5,691,000	6,000,000	81,127,400
9	BL	8-ALL	MW	1,040	--	86,200,000	--	15,700,000	--	--	--	--	7,400,000	8,800,000	530,400	5,691,000	6,000,000	130,321,400
12	BL	8-2@RM29	MW	1,040	--	67,300,000	--	15,700,000	--	--	--	--	7,000,000	6,200,000	530,400	5,691,000	6,000,000	108,421,400
15	BL	2-0@RM29	MW	1,025	--	28,500,000	--	15,500,000	--	--	--	--	4,000,000	406,000	530,400	5,691,000	6,000,000	60,627,400
20	BL	2-ALL	MLW	1,020	--	47,700,000	--	15,500,000	--	--	--	8,000,000	5,200,000	406,000	526,000	5,686,000	6,000,000	89,018,000
22	BL	8-ALL	E	1,300	--	86,200,000	--	18,900,000	--	--	--	8,000,000	7,400,000	7,100,000	--	--	6,000,000	133,600,000
23	BL	8-ALL	MLW	1,600	--	86,200,000	--	22,800,000	--	--	--	8,000,000	7,400,000	7,500,000	526,000	5,686,600	6,000,000	144,112,600
26	BL	8-0@RM3.4	MLW	1,250	--	49,300,000	--	18,300,000	--	--	--	8,000,000	5,000,000	--	526,000	5,686,600	6,000,000	92,812,600
31	BL	8-2@RM29	E	1,100	--	67,300,000	--	16,400,000	--	--	--	8,000,000	7,000,000	6,200,000	--	--	6,000,000	110,900,000
32	BL	8-2@RM29	MLW	1,530	--	67,300,000	--	21,900,000	--	--	--	8,000,000	7,000,000	6,200,000	526,000	5,686,600	6,000,000	122,612,600
38	BL	2-0@RM29	MLW	970	--	28,500,000	--	14,900,000	--	--	--	8,000,000	4,000,000	406,000	526,000	5,686,600	6,000,000	68,018,600
44	SB	2-ALL	MLW	--	1,400	45,500,000	5,409,030	22,800,000	19,800,000	--	2,480,000	--	4,500,000	406,000	500,400	5,266,600	6,000,000	112,662,030
46	SB	8-ALL	E	--	1,320	82,400,000	6,103,356	21,600,000	18,800,000	--	2,350,000	--	6,600,000	7,500,000	500,400	--	6,000,000	151,853,756
47	SB	8-ALL	MLW	--	2,000	82,400,000	6,962,904	31,800,000	28,500,000	--	3,560,000	--	6,600,000	7,500,000	500,400	5,266,600	6,000,000	179,089,904
49	SB	8-2@RM29	E	--	980	63,510,000	5,380,812	16,900,000	15,000,000	--	1,880,000	--	5,500,000	6,200,000	500,400	--	6,000,000	120,871,212
59	SB	2-ALL	MLW	--	1,390	45,500,000	5,382,288	22,600,000	19,700,000	5,000,000	2,460,000	--	4,500,000	406,000	500,400	5,266,600	6,000,000	117,315,288
61	SB	8-ALL	E	--	1,320	82,400,000	6,103,356	21,600,000	18,800,000	5,000,000	2,350,000	--	6,600,000	7,500,000	500,400	--	6,000,000	156,853,756
62	SB	8-ALL	MLW	--	2,000	82,400,000	6,962,904	31,800,000	28,500,000	5,000,000	3,560,000	--	6,600,000	7,500,000	500,400	5,266,600	6,000,000	184,089,904
64	SB	8-2@RM29	E	--	980	63,510,000	5,388,858	16,900,000	15,000,000	5,000,000	1,880,000	--	5,500,000	6,200,000	500,400	--	6,000,000	125,879,258

Notes:
BL = Bayou Lafourche
SB = Smoke Bend

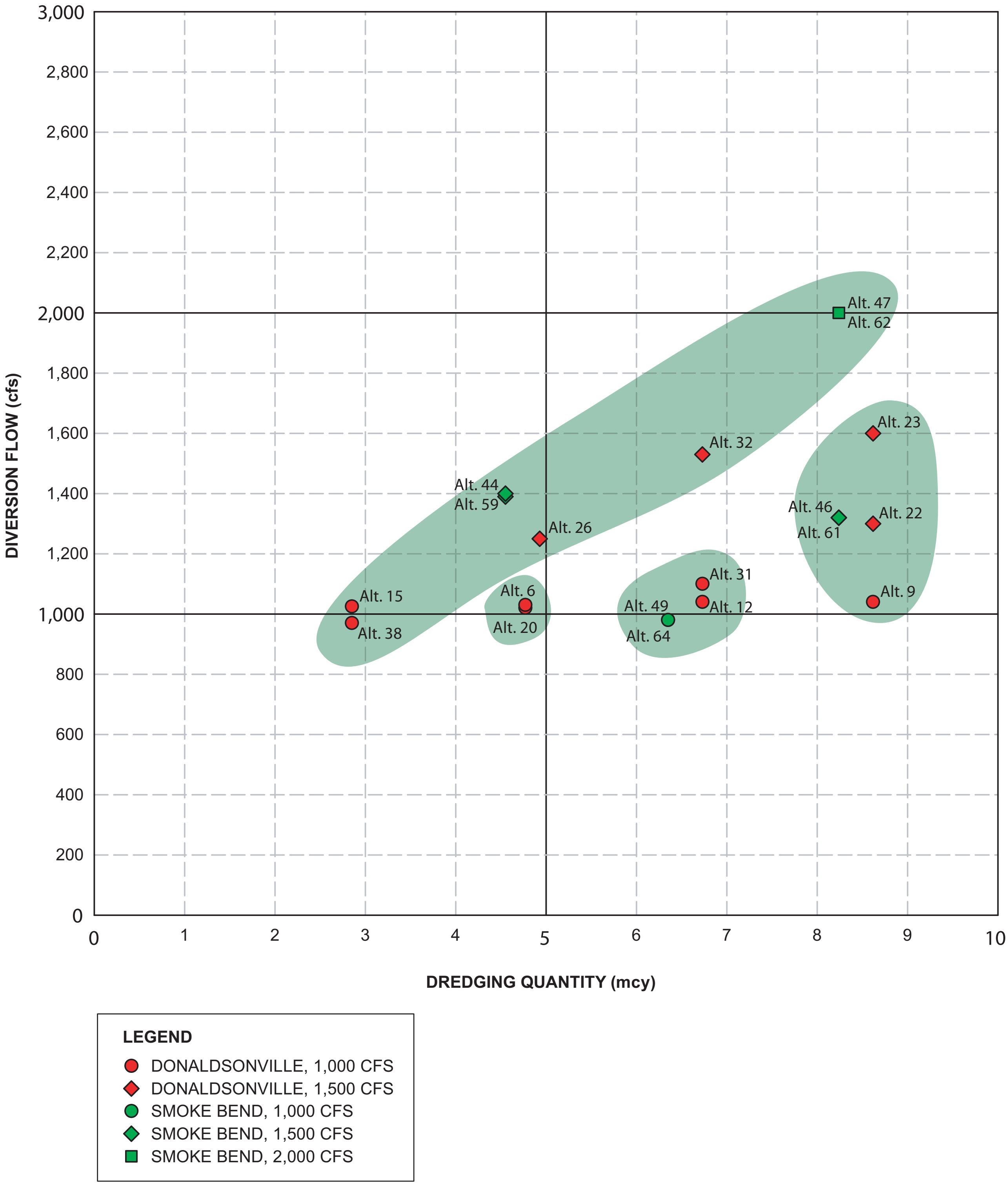


FIGURE 7-14
FLOW VERSUS DREDGING VOLUME EFFECTIVENESS
19 REMAINING ALTERNATIVES
MISSISSIPPI RIVER REINTRODUCTION INTO BAYOU LAFOURCHE
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
PHASE 1 DESIGN REPORT

CH2MHILL

Incorporation of the Least Rise Alternative

The least rise alternative was defined for this project, not in terms of cost effectiveness or minimum impacts, but in terms of the ***least amount of water level rise*** expected along the bayou for the minimum flow of 1,000 cfs. Detailed review of photographs and water level inundation line maps demonstrated that a rise of the water surface by more than a few feet could affect hundreds of structures between Donaldsonville and Lockport. The least rise alternative, as described above, using a minimum diversion flow of 1,000 cfs and a maximum dredging of 8 feet, was developed to determine the lowest water level rise.

Adding the least rise alternative increased the remaining alternatives to be carried into the last phase of the screening process, Criterion 8, from 8 to 9.

7.3.2 Screening Criterion 8 – Check Structure, Flow Benefits, and Unit Cost

The remaining nine alternatives were summarized on a common flow versus project unit cost diagram to delineate similarities and differences in project costs and flow. Figure 7-15 presents this analysis. As shown on Figure 7-15, the remaining alternatives generally follow the trend of rising costs with rising diversion flow.

Least Rise Alternative. The one obvious exception to this trend was the least rise alternative, which was the most expensive project for the amount of flow diverted. Because of the high unit cost, the least rise alternative was eliminated from further consideration.

By eliminating the least rise alternative, the remaining alternatives were reduced from 9 to 8.

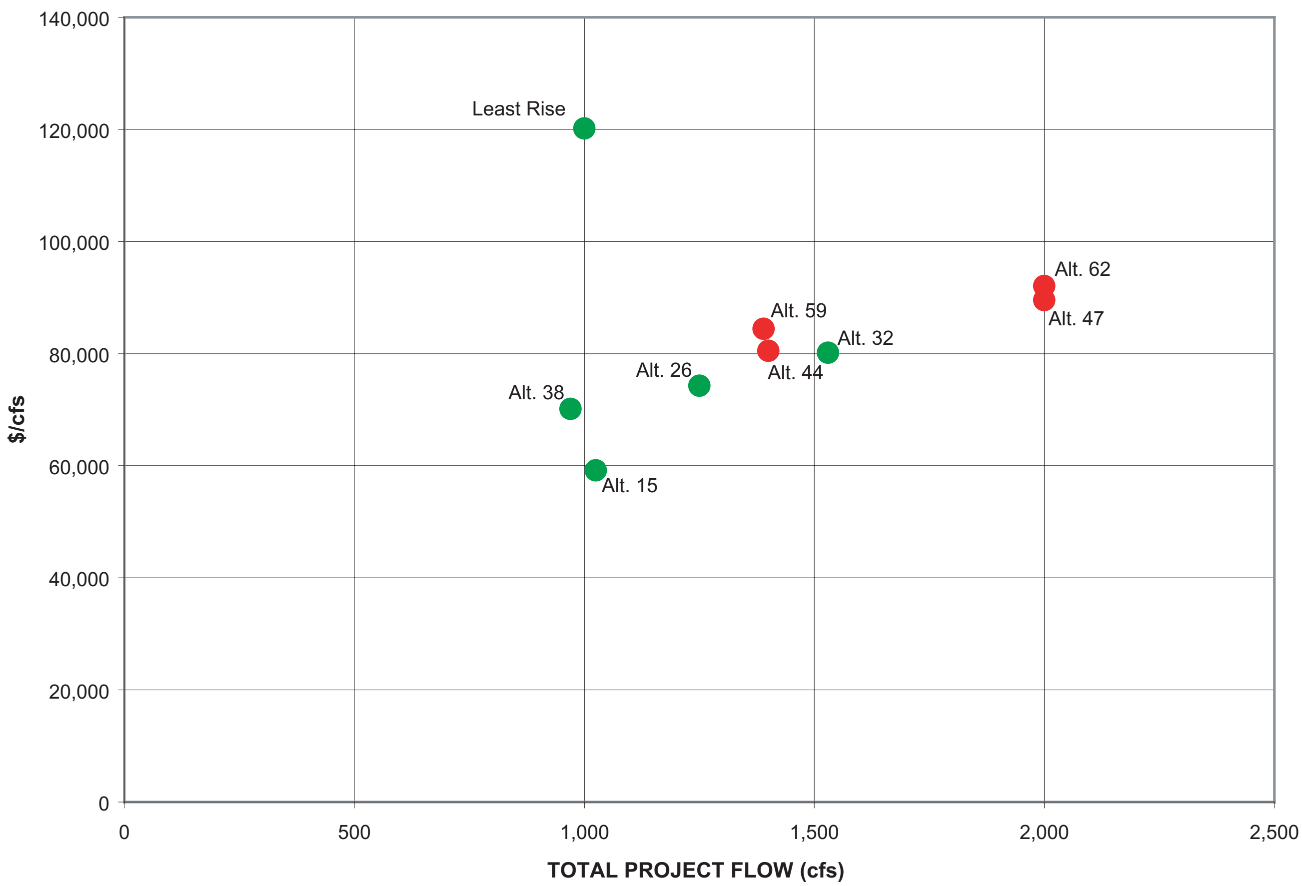
Alternatives 59 and 62. These alternatives both require a check structure to limit the rise in water level in Donaldsonville upstream of the Smoke Bend bypass confluence. The use of a check structure and associated pump station adds operational complexity to the overall project with a second pump station, and only benefits the Donaldsonville area. In addition, the backwater effect caused by the remaining Smoke Bend alternatives into Donaldsonville, with no check structure, was within the limits of the MLW target elevation. This is the elevation that was previously established as an acceptable level in Criterion 6.

Because of the complex implications of a second pump station and coordinated operation of the check structure to maintain upstream water level, Alternatives 59 and 62 were screened from further consideration. By eliminating these two alternatives, the remaining alternatives were reduced from 8 to 6.

Alternatives 26 and 32. These two alternatives are within the same flow region shown on Figure 7-15 and have about the same unit cost per cfs. Both alternatives require a UPRR crossing replacement, but Alternative 32 carries a greater flow (see Table 7-3). Because Alternative 32 has a higher diversion flow, Alternative 26 was eliminated from further consideration. By eliminating one more alternative, the remaining alternatives were reduced from 6 to 5.

The five remaining alternatives for further evaluation are as follows:

- Donaldsonville alignment: Alternatives 15, 32, and 38
- Smoke Bend alignment: Alternatives 44 and 47



LEGEND

- DONALDSONVILLE ALTERNATIVES
- SMOKE BEND ALTERNATIVES

FIGURE 7-15
UNIT COST VERSUS DIVERSION FLOW
NINE REMANING ALTERNATIVES

MISSISSIPPI RIVER REINTRODUCTION INTO BAYOU LAFOURCHE
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