US Army Corps
Galveston District

Cedar Bayou, Texas

Dredged Material Management Plan and Environmental Assessment

(Channel from Mile -2.5 to Mile 3.0)

U.S. Army Corps of Engineers
Galveston District
Southwestern Division
Draft Report for IRC
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Cedar Bayou, Texas
Dredged Material Management Plan
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Acronyms and Abbreviations

AAHU	Average Annual Habitat Units
ASA/CW	Assistant Secretary of the Army, Civil Works
BCR	Benefit to Cost Ratio
BU	Beneficial Use
CBLC	Cedar Bayou Lower Channel
CCCBND	Chambers County-Cedar Bayou Navigation District
CG	Construction General
CLCND	Chambers-Liberty Counties Navigation District (non-Federal Sponsor)
CFR	Code Federal Regulations
DMMP	Dredged Material Management Plan
EA	Environmental Assessment
EFH	Essential Fish Habitat
EM	Engineering Manual
ENR	Engineering News-Record
ER	Engineering Regulation
FEIS	Final Environmental Impact Statement
FY	Fiscal Year
GIWW	Gulf Intracoastal Waterway
HEP	Habitat Evaluation Procedures
HL&P	Houston Lighting and Power
HSC	Houston Ship Channel
LERRD	Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas1.51
MCY	Million Cubic Yards
MLT	Mean Low Tide
MLLW	Mean Lower Low Water
NAD	North American Datum
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NWI	National Wetlands Inventory
O&M	Operations and Maintenance
PA	Placement Area
PDT	Project Delivery Team
PL	Public Law
SH	State Highway
TCEQ	Texas Commission on Environmental Quality
TPCS	Total Project Cost Summary
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WCSC	Waterborne Commerce Statistics Center
WRDA	Water Resources Development Act

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EXECUTIVE SUMMARY

This Dredged Material Management Plan/Draft Environmental Assessment (DMMP/EA) presents the U.S Army Corps of Engineers (USACE), Galveston District plan for maintenance dredging and placement of dredged materials from the lower approximately 5.8 miles of the Cedar Bayou, Texas, Project.

A figure from the 1990 Galveston District Project Maps Book (Figure 1) has been included to best demonstrate the parameters originally used to describe the project known as Cedar Bayou, Texas. The project originally provided for a channel 10 feet deep at mean low tide (MLT) by 100 feet wide from the Houston Ship Channel to a point on Cedar Bayou approximately 11 miles above the mouth. As displayed in the figure, the project begins at the intersection of the Houston Ship Channel and the Cedar Bayou Channel southeast of Hog Island at approximately Mile -2.5. From there the channel extends eastward across Galveston Bay to the mouth of Cedar Bayou, at Mile 0.7. At this point it extends upstream to Mile 11, the upstream limit of the authorized Federal project.

The lower segment from Mile -2.5 to Mile 3 is currently the only improved portion of the Cedar Bayou Channel and is regularly maintained by the Galveston District. The Chambers-Liberty Counties Navigation District (CLCND), who has jurisdiction over the Cedar Bayou from the Houston Ship Channel to Mile 3, is the non-Federal Sponsor for this portion of the channel and for this DMMP/EA.

The Chambers County-Cedar Bayou Navigation District (CCCBND) has jurisdiction over Cedar Bayou from Mile 3 to Mile 11 near the State Highway 146 bridge. The Water Resources Development Act (WRDA) of 1986 (Public Law (PL) 99-662)) deauthorized their portion of the channel from Mile 3 to Mile 11. WRDA 2000 (Section 349(a)(s) of PL 106-541) later reauthorized the segment of channel from approximately Mile 3 to Mile 11. Subsequent to WRDA 2000, the CCCBND submitted the *Cedar Bayou Navigation District Channel Improvements Project, Chambers and Harris Counties, Texas, Final Feasibility Study and Final Environmental Impact Statement,* dated August 2005 and revised March 2006. The aforementioned feasibility study included a DMMP for the channel from Mile 3 to Mile 11, as such; that portion of Cedar Bayou, Texas from Mile 3 to Mile 11 is not included in this DMMP.

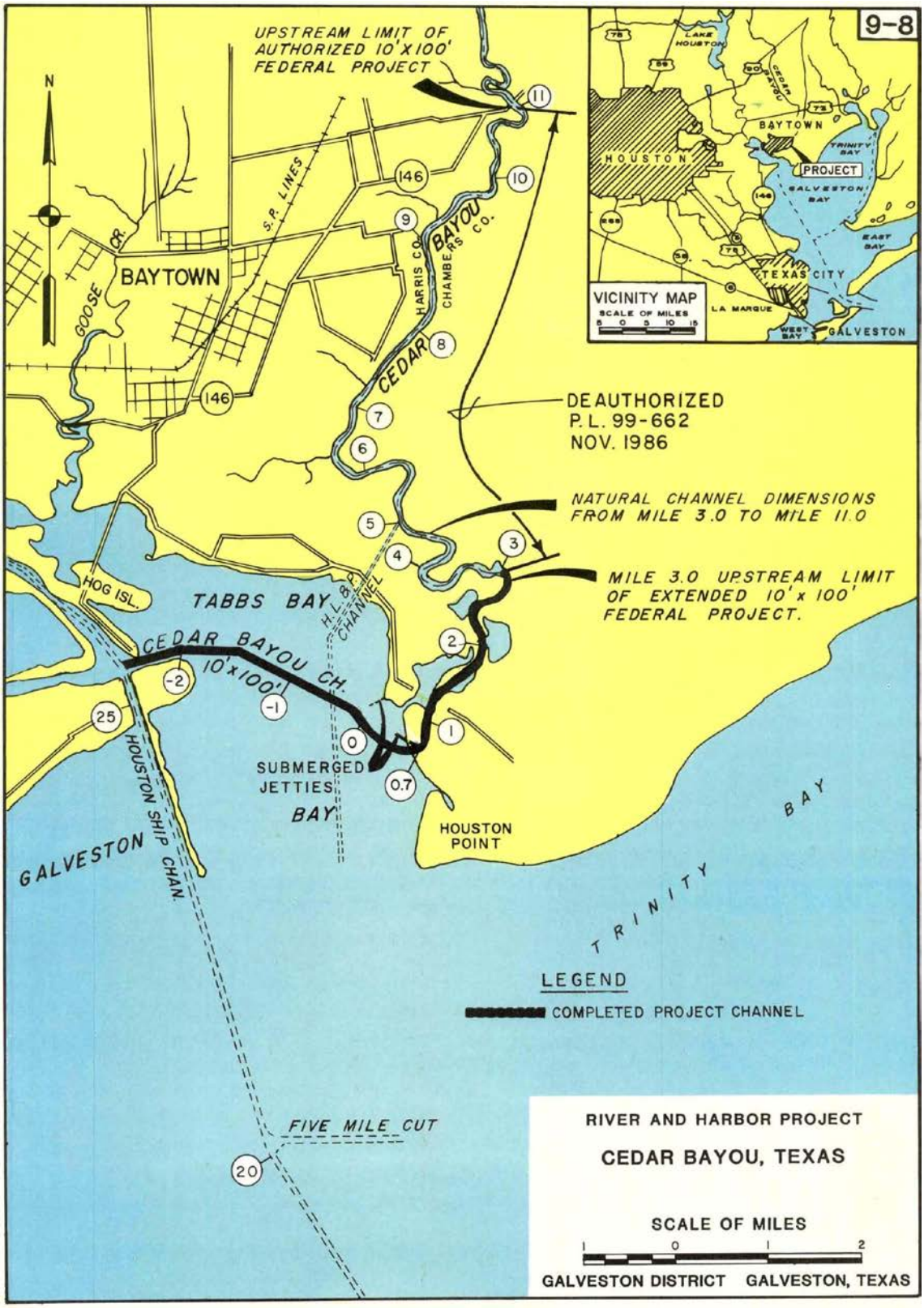

Figure ES- 1 - Cedar Bayou, Texas Project from 1990 Galveston District Project Maps Book

Galveston District completed a preliminary assessment (*Cedar Bayou Navigation Channel, Texas Final Preliminary Assessment*, dated February 2010) to document the continued viability of the project and the availability of dredged material placement for a minimum of 20 years. The analysis concluded in a recommendation that due to current capacity, engineering, and environmental issues with the existing placement areas (PAs), a new DMMP should be developed. The DMMP will identify new placement alternatives and develop a minimum of 20 years of capacity for future maintenance of the lower segment of the Cedar Bayou channel.

USACE policy requires environmentally sound dredging and placement or management of dredged material as defined by applicable laws and policies. This can best be achieved through the development of a long-term management strategy for dredged material as delineated in a DMMP.

The DMMP originally authorized for this segment of channel involved six PAs, five of which may no longer be used due to environmental and/or engineering issues. Four of the original PAs are in open water and have established marsh or oysters while the fifth PA is small, contains a building, road and dock, and three recorded prehistoric archeological sites determined to be contributing elements to the Cedar Bayou National Register Historic District. The Tentatively Selected Plan or Base Plan requires new land acquisition; therefore, Headquarters, USACE approval will be required for this decision document.

The average dredging frequency for the channel is every five years. Approximately 503,500 cubic yards of material are dredged during each dredging cycle. The shoaling rate is approximately 100,700 cubic yards annually.

The Tentatively Selected Plan would provide 20 years capacity and involves the continued use of PA 6 until there is no remaining capacity. In addition, the plan requires the acquisition of an approximately 110-acre parcel of land for construction of a new upland confined PA (PA 7), approximately 89-acres in size. The proposed PA 7 has been designed with the smallest practicable footprint to minimize impacts to environmental resources and still meet the dredged material placement requirements of the project. Approximately 2.64 acres of in-kind marsh construction is required to compensate for approximately 2.56 acres of unavoidable fill impacts to intertidal marsh dominated by smooth cordgrass. The estimated project cost at fiscal year 2014 levels (October 2013 price levels) is $28.4 million; specifically, Construction General is $8.9 million and O&M (2015-2034) is $19.5 million.

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1.0 INTRODUCTION

1.1 Purpose of Report

The Cedar Bayou, Texas, Federal navigation project includes approximately 5.8 miles of improved and maintained channel and approximately eight miles of channel which is authorized but not yet constructed. This report involves the approximately 5.8 miles of improved and maintained portion of Cedar Bayou channel, herein after referred to as Cedar Bayou Lower Channel (CBLC).

The purpose of this decision document is to 1) describe the existing conditions of the CBLC; and 2) describe and document the selection of a dredged material management plan (DMMP). In February 2010, the Galveston District completed a preliminary assessment titled *The Cedar Bayou Navigation Channel, Texas, Final Preliminary Assessment (*Preliminary Assessment*)* which concluded that there is not sufficient capacity for 20-year placement of dredge material from the CBLC. Five of the six dredged material placement areas (PAs) authorized for this portion of the Project are no longer viable due to engineering or environmental constraints.

1.2 Project Area Description

Cedar Bayou is a natural stream originating east of Houston in Liberty County, Texas (Figure 1). The bayou flows approximately 45 miles to its confluence with Galveston Bay, and forms the boundary between Harris and Chambers Counties. The bayou becomes navigable by commercial barge traffic just south of State Highway (SH) 146 in the City of Baytown.

Cedar Bayou, Texas, is a navigation project extending from its junction with the Houston Ship Channel (HSC) alignment at Station 0+00 (called Mile -2.5 in the authorization documents), eastward across Galveston Bay, to the mouth of Cedar Bayou (called Mile 0), then to a point approximately three miles upstream of the mouth at Station 301+56.27 (called Mile 3.0). The term “Station” refers to a horizontal distance in feet measured along the centerline of the channel and is used to indicate the relative location of a particular portion of the channel. The stationing for the CBLC described above is the currently used alignment adjusted post-HSC widening and deepening. This approximately 5.8-mile segment of channel, situated approximately five miles

southeast of Baytown, Texas, is federally authorized and currently maintained by Galveston District at 10 feet deep at mean low tide (MLT) by 100 feet wide.

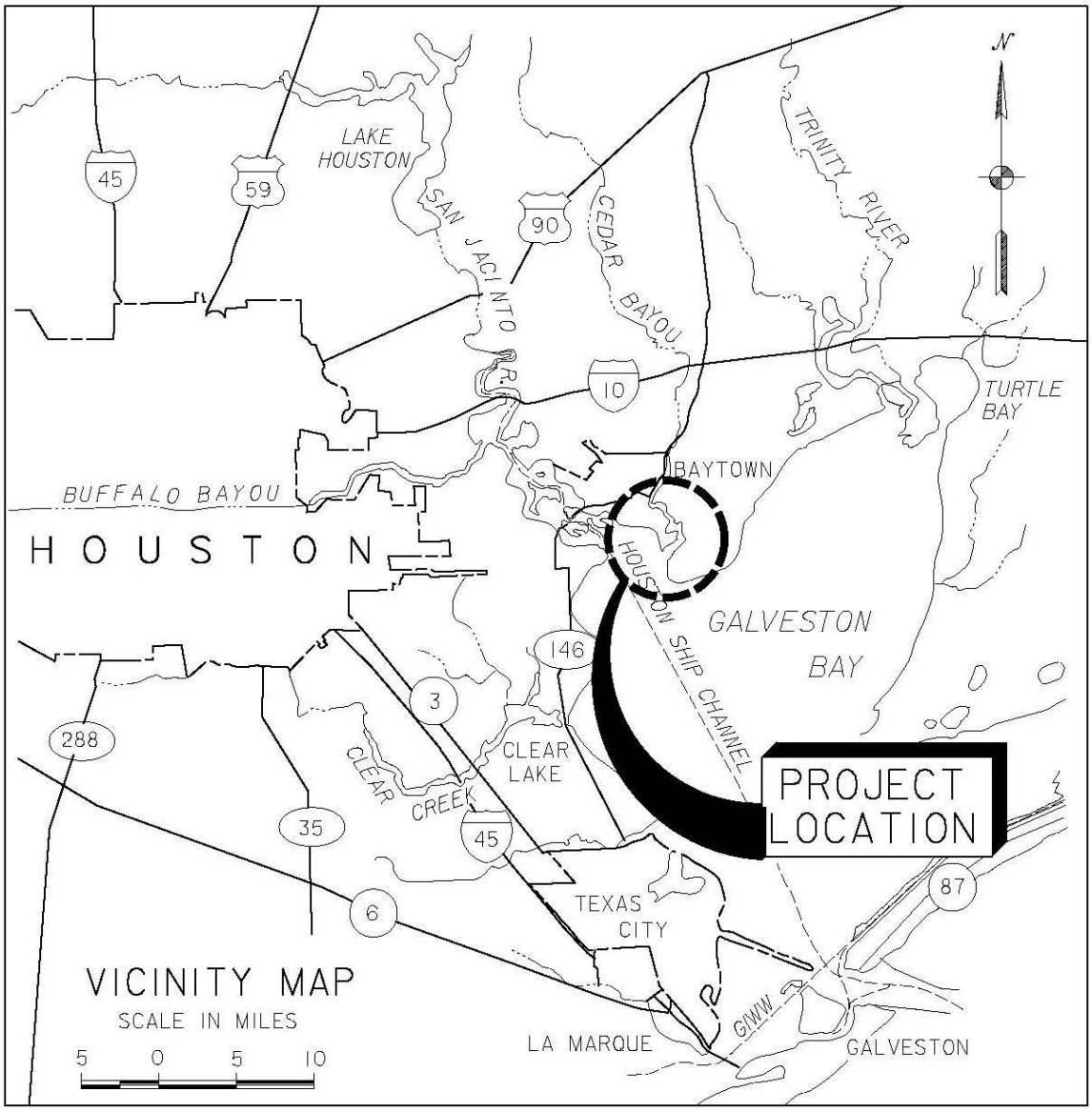

Figure 1 – Vicinity Map

The channel has historically been divided into two sections identified as the Bay Reach and Bayou Reach. Historically, the Bay Reach began at the intersection with the HSC alignment at about Station -5+91 (Mile -2.5) and ended at Station 150+00 (about Mile 0). The Bayou Reach (land cut) began at Station 150+00 and ended at about Station 301+56.27 (Mile 3.0). The current channel alignment has updated stationing at the HSC and upstream ends of the CBLC project as described in the previous paragraph, which differs from the historic stationing.

The average dredging frequency for Cedar Bayou is every five years. Approximately 503,500 cubic yards of material are dredged from the authorized channel during each dredging cycle. The shoaling rate is approximately 100,700 cubic yards annually.

The authorized channel, which is used by shallow draft barges and recreational boats, services the chemical and aggregate industry located on Cedar Bayou in West Chambers County. Industrial facilities along the bayou include the Chevron Phillips Chemical's Cedar Bayou Chemical Plant, Cedar Crossing Industrial Park, Wal-Mart Distribution Center, Home Depot Distribution Center, Jindal Steel, Bayer Baytown Industrial Park, and many others.

The upper segment of the Cedar Bayou Federal channel from Mile 3.0 to Station Mile 11.0 was de-authorized by the Water Resources Development Act (WRDA) of 1986 and then re-authorized under WRDA 2000. The portion of the channel above Mile 3.0 is not included in this DMMP as the approved Feasibility Report for the upper portion of the channel included a DMMP for the 50-year period of analysis (see Section 1.4.2 Development History).

1.3 Scope of Study

Navigation is a priority mission of the U.S. Army Corps of Engineers (USACE) and effective accomplishment of this mission requires dredging to achieve navigable channel dimensions sufficient to meet the needs of waterborne transportation. In this effort, USACE is committed to environmentally sound dredging and placement or management of dredged materials as defined by applicable laws and policies. This can best be achieved through the development of a long-term management strategy for dredged material as delineated in a DMMP. It is the policy of USACE that all DMMPs include an assessment of potential beneficial use (BU) of dredged material for environmental purposes including fish and wildlife habitat creation and restoration and/or hurricane and storm damage reduction.

Dredged material management planning for all Federal harbor projects is conducted by USACE to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically justified, and ensure that long-term placement facilities are available. Ultimately, the DMMP identifies specific measures necessary to manage the volume of material likely to be dredged within the CBLC over the next 20-year period.

1.4 Authorization and Development History

1.4.1 Authorization Documents

DMMP Studies for existing projects are conducted pursuant to existing authorities for individual project operation and maintenance (O&M), as provided in public laws authorizing specific projects. Table 1 provides dates and descriptions of authorized features for the Cedar Bayou, Texas Project.

Table 1 – Authorization Documents

Date	Project and Work Authorized for Cedar Bayou, Texas Project	Documents
September 19, 1890	Congress, by act of September 19, 1890, appropriated as follows: "Improving Cedar Bayou, Texas, by removal of bar at the mouth of said bayou, where it empties into Galveston Bay; Completing improvement, eighteen thousand one hundred and fifty dollars."	Rivers and Harbor Act of 1890 (26 Statute 444)
July 3, 1930	Provides for a "channel 10 feet deep and 100 feet wide from Houston Ship Channel to a point on bayou 11 miles above the mouth." The project also includes the jetties at the mouth of the bayou provided for under the previous project.	Rivers and Harbor Act of 1930, P.L. 520 (S. Doc. No. 107, 71st Cong., 2d session)
November 17, 1986	Deauthorization of "the project for navigation, Cedar Bayou (mile 3.0 to mile 11.0), Harris, Texas, authorized by the River and Harbor Act of September 19, 1890, as amended by the River and Harbor Act of July 3, 1930, Public Law 520, Seventy-first Congress."	WRDA 1986, P.L. 99-662, (100 Stat 4219), Section 1002
December 11, 2000	Reauthorization "for construction of a navigation channel 12 feet deep by 125 feet wide from Mile -2.5 (at the junction with the Houston Ship Channel) to Mile 11.0 on Cedar Bayou."	WRDA 2000, P.L. 106-541, (114 Statute 2632), Section 349(a)(2).
November 8, 2007	Section 349(a)(2) of the WRDA 2000 (114 Stat. 2632) is amended by striking "12 feet deep by 125 feet wide" and inserting "that is 10 feet deep by 100 feet wide". Specifies cost sharing for construction and operation and maintenance of the project shall be determined in accordance with Section 101 of the WRDA 1986	WRDA 2007, P.L. 110-114 (121 Statute 1041), Section 3147

1.4.2 Development History

Navigation improvements to Cedar Bayou were originally authorized by the Rivers and Harbors Act of 1890. The authorization provided for the dredging of a channel 5 feet deep by 100 feet wide through the bar at the mouth of the bayou and the construction of jetties extending out from the shore on each side of the channel at the mouth. This work was completed in 1905. The two brush and stone jetties soon became submerged and ceased to function in connection with the navigation project.

In 1930 the project was authorized to provide a 10-foot deep by 100-foot wide channel from the HSC to a point on Cedar Bayou 11 miles above the mouth of the bayou. In 1931, a portion of the authorized channel was constructed from the HSC to a point about 0.8 miles above the mouth of Cedar Bayou, approximately 3.5 miles in length. The improvements from Mile 0.8 to Mile 11.0 were not completed at that time due to an incrementally unfavorable benefit to cost ratio (BCR).

In 1971 a restudy of the project determined that an extension of the project to Mile 3 would have a favorable BCR. In 1975 the channel was realigned from Mile 0.1 to Mile 0.8 and extended from Mile 0.8 to Mile 3. In the 1970s Houston Lighting and Power (HL&P, currently Reliant Energy) dredged a 20-foot deep cooling water channel within a portion of Cedar Bayou, from an HL&P cutoff channel to Reliant Energy's Cedar Bayou Generating Station.

In 1986 the upper portion of the Cedar Bayou, Texas project, from Mile 3 to Mile 11, was deauthorized in the WRDA. Figure 2 provides a Map for Cedar Bayou, Texas Project from the Galveston District 1990 Project Book; a snapshot of the project to this point.

In 1989, USACE, Galveston District prepared a Reconnaissance Report that proposed channel improvements for a 14-mile section of the Bayou from the HSC to the SH 146 bridge. The report analyzed alternatives and identified a selected plan to deepen and widen the channel to 12- by 125 feet and straighten a series of bends that restrict efficient navigation. Although the economic analysis indicated that the selected plan would produce net benefits (i.e., the average annual benefits resulting from the project would be greater than the average costs) no subsequent action was taken due to the lack of a cost sharing non-Federal sponsor.

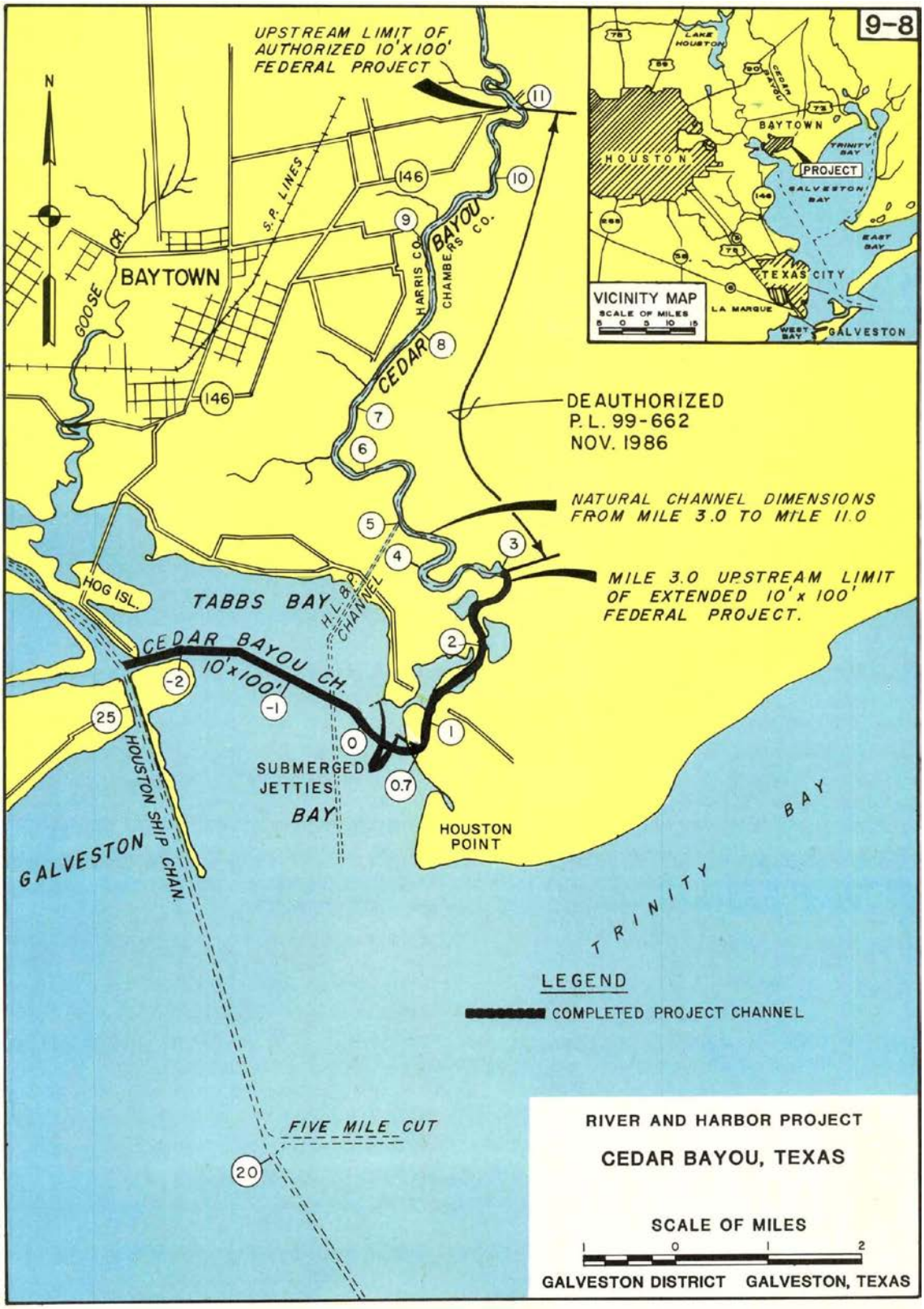

Figure 2 - Cedar Bayou, Texas Project from 1990 Galveston District Project Maps Book

Section 349 of WRDA 2000, which reauthorized the channel from Mile 3.0 to Mile 11, states:

> *(a) IN GENERAL – each of the following projects may be carried out by the Secretary, and no construction on any such project may be initiated until the Secretary determines that the project is technically sound, environmentally acceptable, and economically justified, as appropriate.*
>
> *(2) Cedar Bayou, Texas – The project for navigation, Cedar Bayou, Texas, authorized by the first section of the Act entitled "An Act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes", approved September 19, 1890 (26 Statute 444), and modified by the first section of the Act entitled "An Act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes", approved 3 July 1930 (46 Statute 926), and deauthorized by Section 1002 of the Water Resources Development Act of 1986 (100 Statute 4219), except that the project is authorized only for construction of a navigation channel 12 feet deep by 125 feet wide from Mile -2.5 (at the junction with the Houston Ship Channel) to Mile 11.0 on Cedar Bayou."*

Subsequent to WRDA 2000, the non-Federal interests conducted the *Cedar Bayou Navigation District Channel Improvements Project, Chambers and Harris Counties, Texas, Final Feasibility Study and Final Environmental Impact Statement* dated 2005 and revised in 2006. The Assistant Secretary of the Army, Civil Works (ASA/CW) approved the Feasibility Study on July 10, 2006. The recommended project extended the channel from Mile 3.0 to Mile 11, just below SH 146 to the authorized dimensions of 10 feet deep by 100 feet wide. The DMMP for this segment above Mile 3.0 is contained in the aforementioned 2006 Feasibility Report.

Section 3147 of WRDA 2007 modified Section 349(a)(2) of the WRDA 2000 to direct the Secretary to credit, in accordance with Section 221 of the Flood Control Act of 1970 (42 U.S.C. 1962d-5b), toward the non-Federal share of the cost of the project the cost of planning and design work carried out by the non-Federal interest for the project before the date of the partnership agreement for the project. This modification specifies that cost sharing for construction and O&M of the project shall be determined in accordance with Section 101 of WRDA 1986 (33 U.S.C. 2211). This modification also amended Section 349(a)(2) of WRDA 2000 (114 Stat. 2632) by striking "12 feet deep by 125 feet wide" and inserting "that is 10 feet deep by 100 feet wide."

Subsequent to the 2006 Feasibility Report for the upper Cedar Bayou, Texas Project from Mile 3.0 to Mile 11, an Economic Update was completed in August 2013 and plans and specifications are currently under development.

The Sponsor for this DMMP is Chambers-Liberty Counties Navigation District (CLCND), which has jurisdiction over Cedar Bayou Channel from the HSC to Mile 3. However, the Sponsor for the entire Cedar Bayou, Texas project is jointly shared by the Chambers County-Cedar Bayou Navigation District (CCCBND) and the CLCND. The CCCBND's jurisdiction extends from Mile 3 to Mile 11, at the SH 146 bridge.

1.5 Channel Alignment

The CBLC extends from the intersection with the HSC alignment in the Upper Galveston Bay to a point about 3.0 miles upstream of the mouth of Cedar Bayou. In the year 2000 a contract was issued for the deepening and widening of the HSC. This contract relocated the HSC alignment about 120 feet to the east, moving the point of intersection of both channels about 114 feet to the northeast. This new location of the intersection was first shown in the 2010 dredging contract plans of Cedar Bayou Channel. During the performance of the dredging contract a modification was issued to move the channel alignment northward, away from Atkinson Island, resulting in a channel shift to the north ranging from about 50 feet to 130 feet in the section nearest to the HSC (Station 0+00 to Station 26+52.02). As part of the same modification, the station assignment for the section of channel moved was changed so that the CBLC junction with the HSC is now designated as Station 0+00 as described in Section 1.2. The upstream end of the moved section is located at Station 26+52.02 downstream which is equivalent to Station 21+95.17 upstream. The introduced equation provides for approximate matching of station numbers with the previous alignment for the remainder of the upstream portion of the channel.

Prior to the HSC deepening and widening the location of the junction of both channels was at Coordinates X=3,243,972.09 and Y=13,817,948.06 with an equivalent CBLC alignment Station -5+90.91. The HSC deepening and widening project resulted in the coordinates of the CBLC junction with HSC alignment being moved to X=3,244,068.11 and Y=13,817,971.74 with a resulting CBLC Station -4+76.28. Following the 2010 contract modification, the coordinates of the channel junction became X=3,244,050.59 and Y=13,818,019.24 at CBLC Station 0+00. The most upstream point of the channel is at coordinates X=3,264,873.65 and Y=13,824,232.46 which is equivalent to Station 301+56.27 on the CBLC alignment. Coordinates shown above are referenced to the North American Horizontal Datum of 1983 (NAD83) and are congruent with the Texas Plane Coordinate Grid System, South Central Zone. Station numbers will be used instead of mile markers to describe the project (See Figure 3).

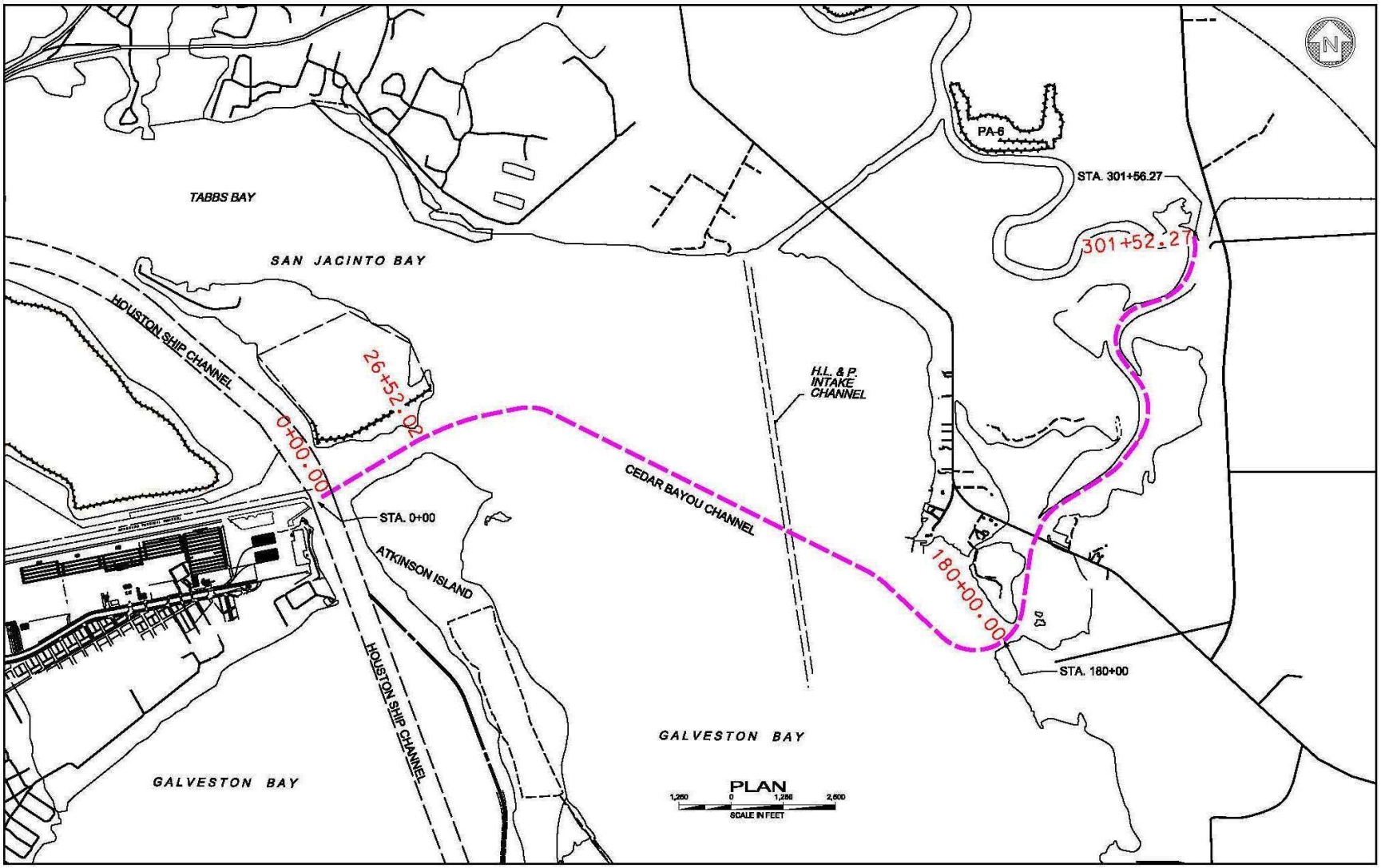

Figure 3 - New Station Numbers for the Cedar Bayou Lower Channel Segment

1.6 Datum

1.6.1 Vertical Datum

Army regulations and USACE Headquarters guidance on tidal datum, provided in Engineering Technical Letter 1110-2-349 *Requirements and Procedures for Referencing Coastal Navigation Projects to Mean Lower Low Water Datum*, dated April 1, 1993, and Engineering Manual (EM) 1110-2-1003, dated April 1, 2002, stress the necessity of converting local datum, such as MLT to Mean Lower Low Water (MLLW). EM 1110-2-1003 further states that MLLW should be tied to the North American Vertical Datum (NAVD) 88. The predominant reason for conversion to MLLW is the need for consistency within the shipping and dredging industries with regard to channel depths.

The Galveston District is currently in the process of converting all depths to MLLW and when that task is complete those changes will be presented in future reports. Elevations in this report are referenced to the MLT local vertical datum for channel elevation to maintain consistency with previously reported elevations. The elevations of the PAs are referenced to NAVD 88.

1.6.2 Horizontal Datum

Horizontal coordinates will be based on NAD 83, Texas State Plane Coordinates, South Central Zone.

2.0 PROJECT CONDITIONS

2.1 Description of Existing Conditions

USACE is responsible for maintaining Cedar Bayou Channel to its authorized dimensions to ensure navigability of the waterway. Six PAs were originally authorized for the placement of dredged material from the CBLC (Figure 4). National Environmental Policy Act (NEPA) coordination for these six PAs is documented in the *Maintenance Dredging Cedar Bayou Channel, Final Environmental Statement*, dated 12 June 1975 (1975 FEIS).

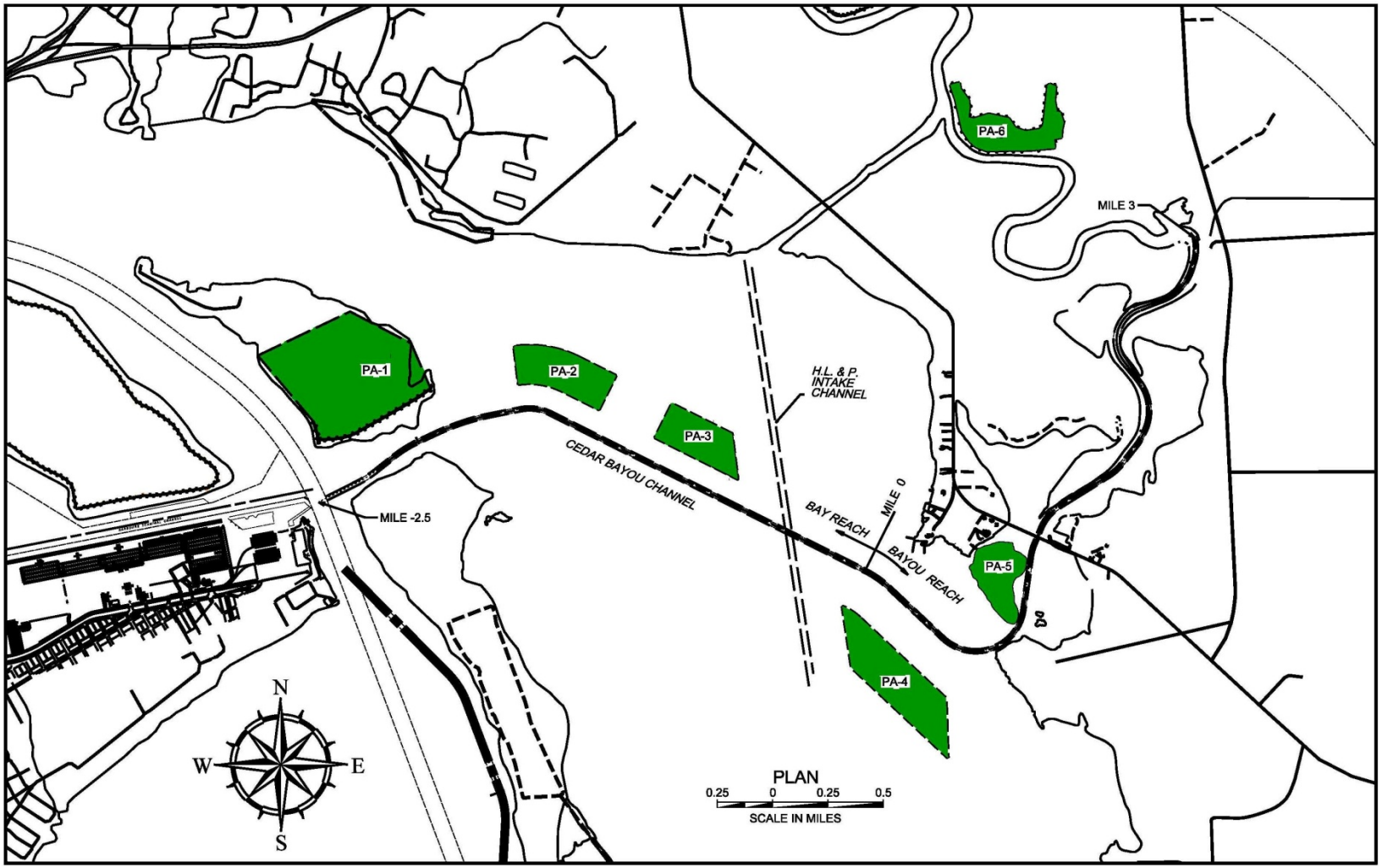

Figure 4 - PAs Coordinated in 1975 FEIS

2.1.1 Authorized PAs

PA 1 (Hog Island)

PA 1 occupies an area approximately 200 acres in size. The site is unconfined with one containment dike on the south side and underground pipelines, overhead power lines and wetlands on site. This PA hasn't been used since the 1980's. The 1975 FEIS indicates that this area was coordinated and described to be developed as a totally confined area. Despite agency concurrence in 1975, this PA was never developed as coordinated. The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) and recent aerial photography indicates most of the PA is now intertidal marsh. Therefore, use of PA 1, for future placement is no longer considered feasible.

PAs 2, 3, and 4 (Open Water)

PAs 2, 3, and 4 are unconfined open water sites that total about 150 acres in combined area. Because they are unconfined (no containment dikes) open water sites they essentially provide unlimited capacity. These PAs were used for routine maintenance of the Bay Reach from 1972 to 2002. The 2002 contract limited dredged material discharge to the western half of PA 4 due to the presence of oyster reefs in the vicinity. Oyster surveys using side-scan sonar were performed during March 2009, followed by substrate verification conducted from March 31 through April 3, 2009. The survey results verified that significant oyster resources have established within and adjacent to these three sites. Continued use of these PAs would result in impacts to oysters, both from direct burial and increased turbidity. Therefore, use of PAs 2, 3 and 4, for future placement is no longer considered feasible.

PA 5 (Boaz Island)

PA 5 is approximately 34 acres in area located on privately owned land acquired by revocable easement. Current aerial photography shows a road, building, and fishing pier on the site. PA 5 has not been used since publication of the 1975 FEIS because the area is small and three recorded prehistoric archeological sites that have all been determined to be contributing elements to the Cedar Bayou National Register Historic District are documented at the site. Therefore, use of PA 5, for future placement is no longer considered feasible.

PA 6 (Snoopy)

PA 6 is a 44 acre area acquired by a 70-acre revocable easement. The current useable area of the PA (the area inside the perimeter containment dike centerline), is about 37 acres in size. The estimated capacity of PA 6 is 65,000 cubic yards in its current configuration. The remaining capacity of PA 6 with the proposed containment dike raised to a maximum elevation of +27 feet NAVD 88 is estimated to be about 879,000 cubic yards. PA 6 has historically been the sole PA used for all material dredged from the Bayou Reach; the location of PA 6 does not render it an efficient location for placement of the material dredged from the Bay Reach. The non-Federal Sponsor (CLCND) owns this site in fee.

See Table 2 for easement information and a condensed status of existing PAs designated for the CBLC.

Table 2 – Status of Existing PAs

PA	Owner(s) / Easement	Status
PA 1 (Hog Island)	Port of Houston / Navigation Servitude	*PA 1 - no longer available
PA 2	State of Texas / Navigation Servitude	*Oysters – no longer available
PA 3	State of Texas / Navigation Servitude	*Oysters – no longer available
PA 4	CLCND / Navigation Servitude	*Oysters – no longer available
PA 5 (Boaz Island)	Private Owner / RE Instrument dated March 15, 1974 Revocable Instrument; Revocation permitted 10 years after execution of easement; currently not revoked.	*PA 5 - no longer available
PA 6 (Snoopy)	CLCND/Government currently hold a Revocable Easement dated March 15, 1974. CLCND shall convey a non-revocable Non-Standard Perpetual Easement	Available; capacity issues

* No longer available for use as coordinated in the 1975 FEIS. Development of the PA at this time would require new NEPA coordination due to changes in site condition and new environmental regulatory requirements.

2.1.2 Dredging Quantities

Investigations for the Preliminary Assessment determined that with regular project funding available, the average dredging frequency for this segment of the Cedar Bayou, Texas channel is every five years. Calculations showed that approximately 503,500 cubic yards (pay volume) of material are dredged from the CBLC during each dredging cycle. The shoaling rate is approximately 100,700 cubic yards annually.

The main source for historical dredging quantities for the Federal project was the Dredging Histories Data Base, which was also used to estimate quantities presented in the Preliminary Assessment of Cedar Bayou in 2010. The historical quantities covered a period that started in 1975 as year zero and culminated in 2002.

During that period the channel or sections of it were dredged five times (1982, 1989, 1996, 1999, and 2002). The channel dimensions are anticipated to remain unchanged; therefore, the estimated historical maintenance quantities were used to project estimated quantities for the 20-year period of analysis considered for this study. Table 3 presents the historic annual dredging volumes by reach based on paid quantities dredged from the authorized channel (up to and including advance maintenance and allowable overdepth) as reported in the Dredging Histories Data Base.

Table 3 – Historic Annual Dredge Material Volume by Reach

Reach[1]	**Dredged Volume (cy)[2]**
Bay Reach [Sta. -5+90.91 to Sta. 150+00]	54,800
Bayou Reach [Sta. 150+00 to Sta. 302+00]	45,900
Total	**100,700**

[1]*Historic Station Numbers*

[2]*cubic yard (cy)*

The need to account for additional quantities other than the paid quantities (described above) from the Federal project shown in Table 3 that are deposited in the project PAs was recognized. The additional quantities considered include: 1) material excavated outside of the channel template during regular maintenance dredging of the Federal project for which no payment is made (non-pay volume); 2) dredging performed by local entities outside of the Federal project (permit work); and 3) dredging additional volume during the first maintenance cycle of the period of analysis to attain the desired advance maintenance depth and allowable overdepth channel template. See Section 3.6 for a discussion of advance maintenance and allowable overdepth.

The non-paid quantities are assumed to be about twenty percent of the paid quantities in each contract. To account for the non-paid quantities in this report an amount equal to twenty percent, or 100,700 cubic yards per five year maintenance cycle was added to the quantities reported in the Dredging Histories Data Base. Additional quantities also included dredged work performed at various docking facilities along the channel in the vicinity of the Federal project. Non-Federal quantities that could be deposited in the Federal project PA(s) were estimated at 25,000 cubic yards per five year maintenance cycle based on permits issued in the past. An additional volume

of 338,778 cubic yards would be dredged during the first maintenance cycle in order to attain the desired 2 feet advance maintenance and 2 feet allowable overdepth for the tentatively selected plan. Including pay volumes from the Federal channel, non-pay volumes, permit work, and additional volume during the first dredge cycle, the total dredged maintenance volume anticipated to be deposited in the project PA(s) is about 2.9 million cubic yards (MCY) for the 20-year period of analysis. Table 4 includes all dredging quantities anticipated for the project. Note the Bay and Bayou Reaches are defined as Station 0+00 to Station 180+00, and Station 180+00 to Station 301+56.27 for the projected dredging quantities as described in Sections 3.3.4 and 5.1.1.

Table 4 - Dredging Volumes for Existing Conditions

Description	Bay Reach	Bayou Reach	Totals
Paid Volume[1]/Cycle[2] (cy)	319,295	184,205	503,500
Non-Pay Volume/Cycle (cy)	63,859	36,841	100,700
Permit Volume/Cycle (cy)		25,000	25,000
Totals/Cycle (cy)	383,154	246,046	629,200
Paid Volume/One Time Additional Volume (cy)	204,170	134,608	338,778
Totals/20-YR (cy)	1,736,786	1,118,792	2,855,578

[1]*Paid Volume includes advance maintenance and allowable overdepth*
[2]*5-Year Maintenance Cycle*

2.2 Projections of Future Conditions Without Management Plan

Due to their current status (refer to Table 2), PA 1, PA 2, PA 3, PA 4, and PA 5 no longer provide feasible means by which to meet long-term dredged material placement requirements for the CBLC. Currently PA 6 has capacity remaining of about 879,000 cubic yards; however, this capacity will not meet the project's needs for the next 20 years.

PA 6 is the only authorized PA available for use and it is approaching maximum capacity. This PA has capacity (at maximum allowable dike elevation of +27 feet) to contain maintenance dredging volumes from the Bayou Reach (Station 180+000 to Station 301+56.27) over three 5-year maintenance cycles; however, it does not have the capacity to contain any maintenance material from the Bay Reach in addition to the Bayou Reach. PA 6 does not have remaining capacity to contain all the maintenance volume from the entire channel (Bay and Bayou Reaches) for one maintenance cycle. If this report is not approved, this lower segment of the Cedar Bayou, Texas, Project would not have sufficient placement capacity to maintain authorized depths for the next 20 years.

A 20-year placement plan which provides suitable capacity is needed Without a long-term placement plan maintenance dredging will stop once PA 6 has reached its maximum capacity.

Maintenance dredging delays could result in economic losses to industry dependent on commercial navigation on Cedar Bayou Channel.

2.3 Without Project Condition

The Without-Project Condition is the scenario that would most likely occur without a new DMMP for the CBLC. Under the Without-Project Condition, dredging would continue until PA 6 has no remaining capacity. Once PA 6 is full there would be no future dredging of the lower channel. Therefore, under the Without-Project Condition it is most likely that the CBLC would be allowed to shoal at approximately one foot per year, until the channel would reach its natural depth of approximately seven feet. Commercial and recreational navigation would continue; however, shipping would be less efficient as commercial navigation would be hampered by the shallow draft of the channel and be forced to light load.

2.4 Problems and Opportunities

The following water resources problems and opportunities have been defined, to date, as part of this study involving the CBLC extending from the intersection of Cedar Bayou, Texas Channel and the HSC to Mile 3. They include the following:

2.4.1 Problems

- The CBLC (lower 5.8 mile channel segment) does not have dredged material placement capacity sufficient to accommodate 20 years of maintenance dredging.

Per ER 1105-2-100, Appendix E-15, if the preliminary assessment determines that there is not sufficient capacity to accommodate maintenance dredging for the next 20 years, then a DMMP study must be performed.

2.4.2 Opportunities

The following are some of the opportunities in the project area to develop future dredged material placement capacity for the project:

- The opportunity to secure new upland confined PA(s).

- The opportunity to develop a borrow agreement for entities to use material from the PA. If material can be removed and used periodically it would result in the creation of additional storage within the PA.

- The opportunity to find BU for the maintenance dredged materials.

The potential for construction of new dredged material placement site(s) creates opportunities for solving the lack of capacity for dredged material for the 20-year period of analysis. The BU of dredged material provides opportunities in the project area for the restoration and/or enhancement of shoreline and wetlands lost, many of which have occurred due to erosion and or subsidence, and opportunities to increase fish and wildlife habitat.

2.5 Goals, Objectives, and Constraints

2.5.1 Goal

The goal of this study is to develop a DMMP that will accommodate at least 20-year placement of dredged material associated with maintenance dredging of the CBLC taking into consideration cost and environmental concerns.

2.5.2 Objectives

The following planning objective was used in formulation and evaluation of alternative plans:

- Identify the least cost plan for placement of dredged material associated with the maintenance dredging of the CBLC while considering other preferential measures such as any locally preferred plan (LPP) during the 20-year period of analysis.

2.5.3 Constraints

The following constraints were applied to this DMMP:

- The study process and plans must comply with Federal and State laws and policies;

- Measures considered must not have an adverse impact to fish and wildlife habitat; and

- Measures must avoid adverse impacts to the proposed Cedar Bayou, Texas (upper channel) placement and BU Project [see *Cedar Bayou Navigation District Channel Improvements Project, Chambers and Harris Counties, Texas, Final Feasibility Study, August 2005*].

3.0 IDENTIFICATION AND EVALUATION OF DREDGED MATERIAL PLACEMENT MEASURES

3.1 Measures

For purposes of ensuring the long-term viability of the Cedar Bayou Channel, a wide variety of measures were introduced at different points in the plan formulation and evaluation process. Following preliminary evaluation, a number of the dredged material placement options were eliminated from further consideration while others were carried forward. Those measures that did not address one or more of the DMMP study objectives were eliminated. In order to evaluate the preliminary measures, screening criteria that would likely have the most influence in determining the viability of the alternatives were identified.

The following criteria were used to evaluate and initially screen the measures:

- Environmental Issues – a measure that increases (or causes) adverse impact on sensitive habitats or species that cannot be mitigated in a cost effective way will be eliminated from further study.

- Engineering Issues – any site considered for a new PA (upland confined or BU) must be large enough to provide the required capacity for the 20-year DMMP. The existing soils at any site considered for placement must be able to provide adequate foundation support and meet acceptable borrow quality for containment dike or levee construction as required to provide the required capacity. New PA sites must be accessible for entry of construction equipment and crews and for dredged pipe entry either by direct access from the Federal channel or via pipeline easement(s). New PA sites must be situated such that dredging effluent water can be drained from the site in a manner that minimizes impacts to the environment and that allows for proper management of water quality.

- Initial Projected Costs – measures that are very expensive due to construction cost, environmental impacts and resultant mitigation costs will be eliminated from further study.

- Proximity to Channel – In regards to pumping distance, the farther the distance of the PA or BU site is from the channel, the more the cost of the pumping increases. Longer pipe requiring boosters is less efficient than shorter pumping distances.

- Real Estate Issues – Real estate examines ownership issues related to the site of the measure. Property not available or for which a 10/404 Regulatory permit application is under review will be eliminated from further study.

- Conflicts with another Federal Project – Any measure that would impact or overlap another Federal project's placement plan will be eliminated from further study. The CBLC is adjacent to both the upper Cedar Bayou Federal Channel (channel and BU authorized but not constructed) and the HSC and associated PAs and BU.

Each of the measures was assessed and a determination was made regarding whether it should be retained for the next screening of alternative plans.

3.1.1 Nonstructural Measures

- Deauthorize Channel and Utilize another Port
- Alternative Mode of Commodity Transport

3.1.2 Structural Measures

Table 5 is a compilation of all dredged material placement options identified by the project delivery team (PDT), of which the non-Federal Sponsor is a member. Figure 5 shows the general location of each of the structural measures considered.

Table 5 – Preliminary Measures

#	Name of Measure	Iteration of Screening Dropped	Reason(s) for Dropping	#	Name of Measure	Iteration of Screening Dropped	Reason(s) for Dropping
1	PA 6 Tip to Tip Expansion	**2nd**	**1, 2**	26	Negrohead Lake - BU	**Carried Forward***	
2	PA 6 Land Swap	**2nd**	**1, 2**	27	Ash Lake - BU	**Carried Forward***	
3	HSC Atkinson Island Cells	**1st**	**5**	28	Fisher Lake – BU	**Carried Forward***	
4	Marrow Marsh – BU	**Carried Forward***		29	Create "Woodstock" PA by "Snoopy"	1st	**1,2**
5	Jennings Tract – BU	**2nd**	**2, 4**	30	Reclaim degraded borrow pits	**1st**	**1**
6	Upland East of Marrow Marsh	**2nd**	**1, 2, 3**	31	Private property disposal	**1st**	**1,4**
7	Ijams Lake Marsh Creation	**1st**	**5**	32	Utilize property in foreclosure	**1st**	**4**
8	Waste Management (Baytown Landfill)	**1st**	**1**	33	Creation of Bird / Habitat for Wildlife	**1st**	**1,3**
9	Any Area Northeast of PA 6	**1st**	**1,2**	34	Creation of Aquatic Vegetation	**Considered in BU Alternatives**	
10	Open Water Sites	**1st**	**1**	35	Beach Restoration***	**1st**	**1,2,4**
11	Alternative Channel	**1st**	**1, 2, 3, 4**	36	Placement Area Borrow MOA	**2nd**	**1**
12	PA 14/15 Marsh Creation	**1st**	**5**	37	Base Material for Roads and Parking Areas	**1st**	**1**
13	Remove Oysters from Existing Open Water PAs	**1st**	**1**	38	Sediment Control Structures	**1st**	**3**
14	Boaz Island (PA 5) Fringe Marsh	**1st**	**1, 2, 3, 4**	39	Scott Bay Marshes	**1st**	**2**
15	Unconfined Disposal to Create Oyster Habitat	**1st**	**1**	40	Brinson Point Shoreline	**1st**	**3**
16	Goose Creek Stream Project	**1st**	**2**	41	Morgan Point to Red Bluff Shoreline	**1st**	**3**
17	Tabbs Bay Evergreen Point Shoreline - BU	**1st**	**2, 3**	42	Boaz Island (PA 5)	**2nd**	**1, 2, 3, 4**
18	Marsh Creation north of Atkinson Island	**1st**	**3, 5**	43	Behind Spillman Island – BU	**1st**	**2, 5**
19	Regional Sediment Management (RSM)	**1st**	**3**	44	Upland East of Land Fill	**Carried Forward**	
20	Expand Hogg Island (Existing PA 1)	**1st**	**1**	45	Upland East of Land Fill (extended)	**2nd**	**3**
21	Utilize old pits NW of power-lines ROW (near HL&P canal)	**1st**	**1, 2**	46	South of APL Road	**2nd**	**1, 3, 4**
22	Filter wetland opportunities for industry	**1st**	**1, 2**	47	Abandoned RV Park	**Carried Forward**	
23	Upland next to Baytown Landfill	**1st**	**1**	NS1	No Action Alternative	**Carried Forward**	
24	Sediment Basin in Channel	**1st**	**2**	NS2	Deauthorize Channel	**1st**	**5**
25	Longer pipeline pumps (outside 2 mile)	Up to 6- mile considered**					

*These four measures were combined into one Alternative and Carried Forward for Further Analysis
**This was considered in developing measures; however, this is more of a parameter.
***A suitable location was never conceived for this.

1. Environmental Issues; 2. Engineering Issues; 3. Initial Projected Costs; 4. Real Estate; 5. Conflicts with Another Federal Project

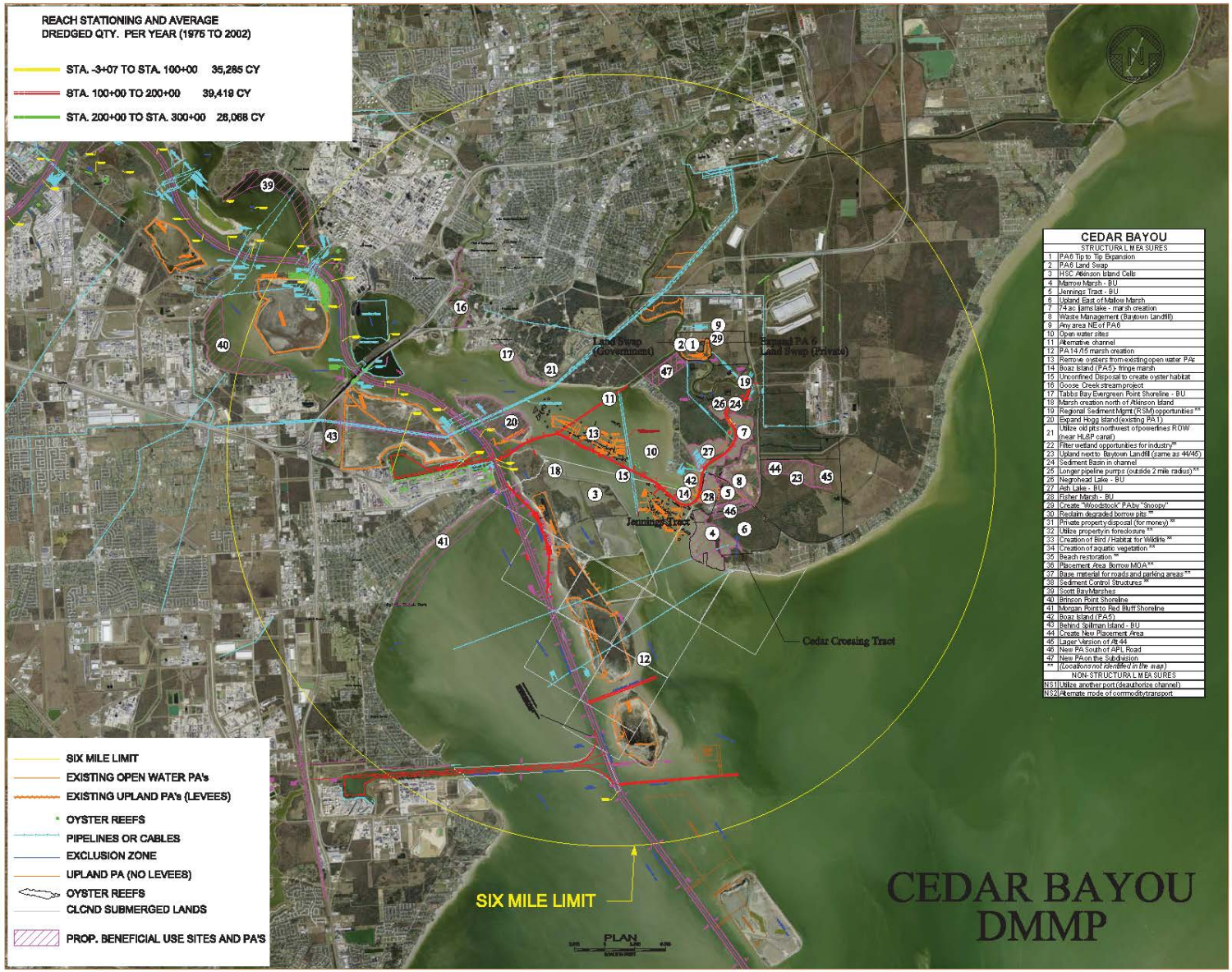

Figure 5 – Approximate Location For All Measures Considered

3.2 Measures Eliminated During First and Second Screening

The measures were subjected to two initial screenings in order to reduce the number of measures prior to pursuing in-depth analysis. Table 5 above (Section 3.1.2) lists preliminary measures that were considered, the iteration of screening (using the criteria listed in Section 3.1) during which a measure was dropped (if it was dropped) and the reason(s) for dropping the measure from further consideration. If the measure was not dropped from consideration during the initial two screenings it is noted in the table as being carried forward for additional analysis. The majority of the measures were screened out for multiple reasons.

Of the 47 measures screened, nine were dropped due to environmental issues alone and 14 other measures had a combination of reasons for dropping which included environmental issues. Environmental issues included greater impacts to the environment (forested and stream) which would require high mitigation costs, oyster impacts, or potential contaminants (e.g. waste management). Measures that included disposal of dredged material in an unconfined manner in open bay waters where there was no clear opportunity for BU were dropped from further consideration. These alternatives were determined to have unacceptable adverse impacts as they would involve repeated uncontrolled affects to water quality and aquatic organisms during maintenance dredging events, including smothering of oyster habitat that is prolific along the bay reach of the CBLC. All but four BU measures were screened out, mostly during the first iteration of screening per the criteria listed in Section 3.1. Four BU sites remained after the second iteration of screening. The PDT combined the four BU sites into one alternative and carried them forward for further analysis, including depth surveys of the four sites.

Development of a borrow agreement could conceivably be done by the CLCND as long as the agreement was in compliance with all State and Federal laws and NEPA requirements. However, it was decided that the option of a borrow agreement provided insufficient operational benefits and increased environmental liability, making it a non viable option.

Only three measures were dropped due to engineering issues alone. Fourteen other measures were dropped for a combination of reasons, one of which was engineering issues. In some cases, such as the PA 6 Tip to Tip Expansion the adjacent land is quite a bit higher than the existing PA. Some of the measures such as the PA 6 Land Swap would have an insignificant increase in capacity. Some of the shorelines were heavily reveted with bulkheads and structures while other measures resulted in very little capacity. Placement measures less than 20 acres in size were dismissed as they were not considered feasible due to the cost of constructing containment dikes, shore protection, etc and the small capacity they ultimately provide.

Initial project costs on thirteen of the measures contributed to their being screened out. In some cases these were due to mitigation costs such as in the case of the upland east of Marrow Marsh which was an excellent location but covered with dense forest some of which was forested wetlands. Creation of a bird island was an issue with cost and also proximity to the shoreline which is an important concern in relation to predators.

Eight measures had issues with real estate, including the Jennings Tract for which a Regulatory 404 permit application is under review for development.

Lastly, the PDT, inclusive of the sponsor agreed that it was important not to overlap or conflict with another Federal project. The HSC, Texas project and the portion of the Cedar Bayou, Texas project under jurisdiction of the CCCBND have BU and PAs that the PDT agreed to avoid. Measures such as the HSC Atkinson Island Cells, PA 14/15 Marsh Creation, and Behind Spilman Island – BU would overlap with the HSC project while Ijams Lake Marsh Creation would overlap with the BU project for the upper section of Cedar Bayou under the CCCBND jurisdiction.

The non-structural measure "Deauthorize Channel and Utilize another Port" was eliminated due to the fact that the upper channel was recently reauthorized and is currently undergoing Pre-Construction Engineering and Design. If the lower channel is not maintained then navigable depths will not be available to access the upper channel.

3.3 Screened Alternatives

Upon completion of the second iteration of the screening, four alternatives (Figure 6) that remained were carried forward for additional analysis.

- Alternative 1: No Action, continued use of PA 6
- Alternative 2: BU Sites *(a combination of the Marrow Marsh, Negrohead Lake, Ash Lake, and Fisher Lake Alternatives)* and PA 6;
- Alternative 3: A confined upland PA east of the Landfill and PA 6; and
- Alternative 4: A confined upland PA at the abandoned RV park and PA 6.

Continued use of PA 6 for Alternatives 1 through 4 would include routine maintenance activities to ensure the efficient use of the PA (Section 5.1.3).

Each of these alternatives is further described in the following sections.

3.3.1 Alternative 1: No Action, continued use of PA 6

Under the No Action Alternative, the Federal channel project base plan would not change. The project would have six authorized PAs, five of which are no longer available for use. Hog Island PA (PA 1) was never constructed and is now classified as intertidal marsh. Oysters have established in the three open water PAs (PA 2, PA 3, and PA 4) and Boaz Island PA (PA 5) is no longer available due to lack of capacity, environmental limitations, and issues with real estate.

Therefore, all dredged material would be pumped into PA 6; however, PA 6 does not have sufficient capacity for 20 years of maintenance dredging for the entire channel. Maintenance dredging of the channel would continue until PA 6 ran out of capacity. At this point, maintenance dredging would no longer be possible and the channel would begin to fill in until it reached its natural depth and was no longer navigable to commercial barges.

Figure 6 – General Location of Alternatives 1-4 (Each Alternative includes PA 6)

3.3.2 Alternative 2: BU Sites and PA 6

BU alternatives considered for this DMMP effort included new marsh creation at four locations near the mouth of and along the Bayou Reach of Cedar Bayou (at Marrow Marsh, Negrohead Lake, Ash Lake, and Fisher Lake) (see Figure 7). Analysis of the BU alternatives indicate that individually they are 1) not feasible for long term use due to their limited capacity/size, and 2) their cost to construct is high when compared to upland sites having a much higher capacity in comparison. Therefore, this alternative includes all four BU sites.

Figure 7 - Plan View of Alternative 2 (PA 6 not shown)

3.3.3 Alternative 3 – Confined Upland PA East of Landfill and PA 6

This alternative consists of the creation of a new confined upland PA (Figure 8). The proposed upland site was determined to meet reasonable size, location, and environmental criteria for further consideration. The proposed upland PA is located approximately 1½ miles east-northeast of the mouth of Cedar Bayou on uplands east of the existing Waste Management commercial landfill.

Figure 8 - Plan View of Alternative 3 (PA 6 not shown)

3.3.4 Alternative 4 – Confined Upland PA at the Abandoned RV Park and PA 6

This alternative consists of the creation of a new confined upland PA (Figure 9). The proposed upland site was determined to meet reasonable size, location, cost, and environmental criteria for further consideration. This proposed upland site is located approximately two miles north-northwest of the mouth of Cedar Bayou on the south bank just across Cedar Bayou from existing PA 6.

This proposed new upland PA would be located such that the maximum pumping distance from the Cedar Bayou Bay Reach (about 3.2 miles) would approximately equal the maximum pumping distance (about 3.1 miles) for the Bayou Reach segment to existing PA 6. In order for these pumping distances to be approximately equal, it is recommended to shift the intersection of the Bay and Bayou reaches from Station 150+00 further upstream to Station 180+00. Another advantage to this recommended shift is that a lower volume of maintenance material would be pumped to PA 6, thus extending its life.

Figure 9 - Plan View of Alternative 4 (includes PA 6)

3.4 Evaluation Criteria and Alternatives Screening

The USACE and the non-Federal Sponsor are looking for the least cost, environmentally acceptable alternative that meets the needs of the project. Five criteria were used to compare and evaluate the four alternatives: 1) 20 years of dredged material capacity; 2) environmental acceptability; 3) real estate costs; 4) construction costs; and 5) environmental mitigation costs (see Table 6).

Table 6 - Comparison of Alternatives

Evaluation Criteria	**Screened Alternatives (Alt)**			
	Alt 1 (No Action)	Alt 2 (BU)	Alt 3 (Upland PA-East of Landfill)	Alt 4 (New PA – RV Park)
Provides 20 Years Dredged Material Capacity	No	No	Yes	Yes
Environmentally Acceptable	Yes	Yes	Yes	Yes
Real Estate Costs*	None	None	$10,200,000	$2,400,000
Construction Costs*	None	**	$3,900,000	$3,900,000
Environmental Mitigation Costs*	None	None	None	$500,000
Estimated costs for Alt 3 and Alt 4			**$14,100,000**	**$6,600,000**

**All costs are approximate preliminary costs (Oct 2011 price levels) developed for screening purposes.*

***Costs were not developed for BU due to insufficient capacity*

Alternative 1, the No-Action Alternative, would continue the use of only PA 6 for the Bay and Bayou Reaches. Under Alternative 1, PA 6 would be at full capacity after the first maintenance cycle, falling considerably short of the capacity requirements needed to continue maintenance through the 20-year period of analysis. Therefore, Alternative 1 is not considered viable as it does not provide placement of maintenance dredged material over the 20-year period of analysis.

Alternative 2 (BU) also does not provide sufficient placement capacity for maintenance material over the 20-year period of analysis. BU site identification was maximized to the greatest extent possible based on the criteria listed in Section 3.1. Prior to the final screening of the alternatives, depth surveys for the BU measures were completed and analyzed. Due to the shallow depths (3 feet on average) and low maximum target elevations required for developing marsh sites, the BU sites would be full after two cycles of maintenance dredging for the Bay Reach. Even with the addition of BU, PA 6 would still reach full capacity after only 3 cycles of maintenance dredging for the Bayou Reach. Therefore, Alterative 2 was dropped from further consideration since it would not provide sufficient capacity to continue maintenance through the 20-year period of analysis.

Alternatives 3 and 4 include the construction of new PAs on vacant tracts of land for the placement of dredged material from the Bay Reach in addition to the continued use of PA 6 for the placement of material from the Bayou Reach. Both alternatives would provide sufficient capacity to continue maintenance dredging of the project through the 20-year period of analysis. Though Alternative 3 would be the environmentally preferred alternative as it involves no impacts to aquatic resources, Alternative 4 would still be environmentally acceptable since the unavoidable impacts to the 2.56 acres of tidal marsh could be resolved through mitigation.

3.5 Identification of Tentatively Selected Plan

The overall estimated cost to implement Alternative 3 ($14M) was substantially higher than the estimated costs for Alternative 4 ($6.6M) primarily due to land costs. Alternative 3 real estate costs were twice that of Alternative 4 because the current land owner of the Alternative 3 site intends to develop the land commercially, whereas, the current land owner of the Alternative 4 site wants to sell the land. Therefore, due to overall lower costs for implementation, Alternative 4 was identified as the Tentatively Selected Plan.

Alternative 4, the continued use of PA 6 and construction of the new 89-acre confined upland PA (to be referred to from this point on as PA 7), is technically feasible, environmentally acceptable, and is the lowest cost plan that meets planning objectives and constraints. As such, Alternative 4 is the Tentatively Selected Plan (Figure 10 and Figure 11); the new management plan for the placement of dredged materials from the CBLC. This alternative was evaluated in further detail and refined later in this document under Section 5.0 DESCRIPTION OF MANAGEMENT PLAN.

3.6 Advance Maintenance and Allowable Overdepth

The channel has historically been maintained to various depths of advance maintenance and allowable overdepth below the authorized 10-foot channel template. Until the last dredging contract (FY 2010), the channel has been maintained to total depths ranging from 13 to 14 feet. The total depths included 1 or 2 feet of advance maintenance depth and 1 or 2 feet of allowable overdepth. The FY 2010 dredging contract had the channel dredged to a total depth of 11 feet (10 foot authorized plus 1 foot of allowable overdepth) because of reduced funding availability. For comparison of maintenance costs going forward, costs were developed for maintenance to total depths of 14 feet (10 feet authorized plus 2 feet advance maintenance and 2 feet of allowable overdepth) and 11 feet (10 feet authorized plus 1 foot allowable overdepth).

Maintenance of the 14-foot deep template would require additional dredging volume of 338,778 cubic yards during the first contract to achieve the template and requires an average dredging cycle length of five years. Dredging volumes for the 14-foot template would be about 842,278 cubic yards (pay volume) during the first contract, then about 503,500 cubic yards (pay volume) per 5-year cycle thereafter. The 11-foot deep template requires an average dredging volume of about 302,100 cubic yards (pay volume) per cycle with an average cycle length of three years. Although the 11-foot template requires a lesser volume of dredging per cycle, it requires seven maintenance dredging contracts during the 20-year period of analysis compared with four contracts for the 14-foot template. The more frequent cycles with lower dredging volumes required by the 11-foot template results in higher unit costs due to the inherent inefficiencies of dredging small quantities and depths as well as higher dredge mobilization and contractor management costs over the 20-year period of analysis. Therefore, annualized maintenance costs for the 14-foot template are lower than the 11-foot template.

Figure 10 – Tentatively Selected Plan; Existing PA 6 and Proposed PA 7 (Previously Alternative 4)

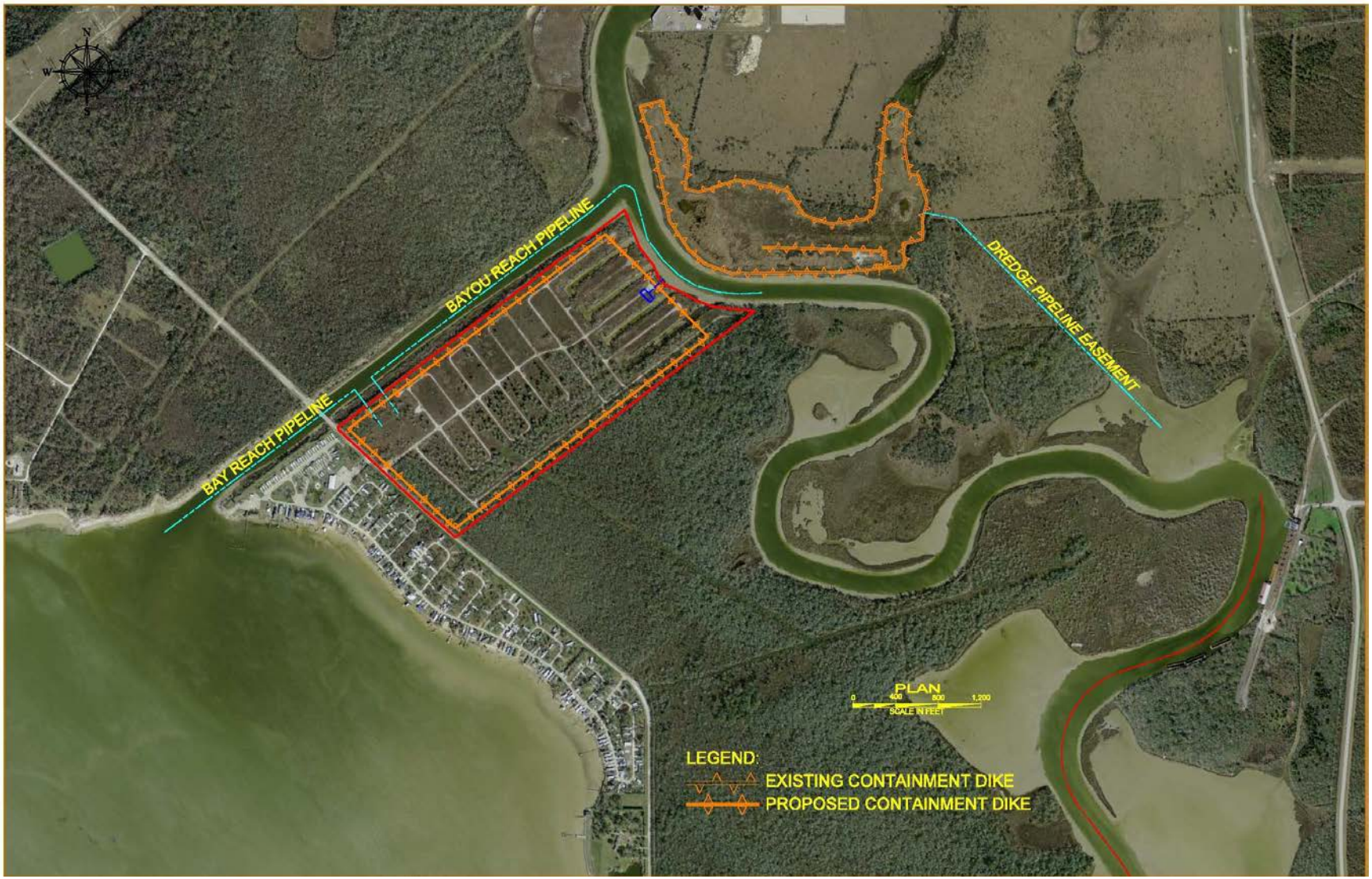

Figure 11 – Aerial View of Tentatively Selected Plan including Pipeline Routes

4.0 ECONOMICS

4.1 Economic Assessment

4.1.1 Prior Economic Conditions

As many as fourteen brickyards are located in the Cedar Bayou navigation channel region at the time of its original authorization in 1890. The original authorization was to remove the bar at the mouth of the bayou. Many of the brick structures in the greater Houston and Galveston area came from these brickyards and utilized the Cedar Bayou navigation channel.

In the 1920s, the Cedar Bayou navigation channel had a channel depth of about 8 feet and was primarily used to import crushed shell for road building and to export crude oil from adjacent oilfields. Tonnage movements on the channel ranged from 34,000 to 72,000 tons from 1925 to 1928 and spiked to 311,000 tons in 1929 due to increased oil exports. The increase in oil movements led to authorization, in 1930, of a 10-foot deep by 100-foot wide channel to a point 11 miles above the mouth of the Cedar Bayou Channel. Work was completed for a 3.5-mile reach, from the intersection with the HSC to a point 0.8 miles above the mouth of the Cedar Bayou Channel, but the remaining channel was not improved at that time.

By the 1960s, commodity movements were averaging about 240,000 tons and consisted primarily of petroleum, aggregates, and steel products. The petroleum products were moved in tank barges, and the other products were moved in barges that typically measured 35-feet wide by 195-feet long with drafts of 9-10 feet deep. The barges were typically light-loaded due to depth limits and were moved with 600 horsepower towboats. An economic restudy was completed in 1971 to examine channel improvements above Mile 0.8 and recommended that the channel improvements be extended to Mile 3.0. The recommendations were approved and in 1975 the 10-foot deep by 100-foot wide channel was extended. The economic analysis did not forecast increases in tonnage on the Cedar Bayou Channel, so the BCR greater than 1.0 rested solely on the expectation that volumes would be at least 240,000 tons annually.

4.1.2 Current Economic Conditions

Annual tonnage on the Cedar Bayou Channel has increased to more than one million tons through the last decade. Annual tonnage peaked at 1,444,000 tons in 2008 before dropping down to below a million tons during 2009 and 2010. Annual tonnages included tonnages moving to docks in the lower Cedar Bayou as well as through traffic tonnages destined for docks above Mile 3.0. An inbound manufacturing goods increase of 300,000 tons in primary forms of iron and steel explains the 2008 peak. The dominant subdivisions of manufacturing goods

responsible for the influx were; iron pipes, steel sheet and other primary forms of iron and steel inbound/outbound. Manufacturing shipments then rested back around its traditional percentage of the total, approximately 15 percent. Chemical and Manufacturing goods remain the largest percentage of the total commodities shipped with 78 percent and 11 percent respectively for 2010. Chemical compounds such as Benzene and Toluene are the largest percentage of the chemical category. These chemicals are flammable and pose an environmental hazard if not contained. Petroleum shipment began to significantly appear on the Cedar Bayou Channel in 2008 and have been steadily about five percent of the total commodities moved on the channel. The recent commodity data from the Waterborne Commerce Statistics Center (WCSC) is summarized in the chart below (Table 7).

Table 7 - Commodity Movement on Cedar Bayou

Year	Tonnage (x 1000)	Petroleum (x 1000)	Petroleum (% of Total)	Chemical (x 1000)	Chemical (% of Total)	Crude Oil (x 1000)	Crude Oil (% of Total)	Manufactured Goods (x 1000)	Manufactured Goods (% of Total)
2003	972	13	1%	715	74%	169	17%	75	8%
2004	1,151	40	3%	803	70%	133	12%	125	11%
2005	1,172	1	0%	809	69%	158	13%	114	10%
2006	1054	2	0%	851	81%	28	3%	140	13%
2007	1030	0	0%	864	84%	17	2%	150	15%
2008	1455	85	6%	806	55%	85	6%	477	33%
2009	945	77	8%	659	70%	57	6%	151	16%
2010	931	28	3%	722	78%	74	8%	106	11%

Source: WCSC Gray Book (IWR-WCUS-10-2)

Eighty three percent of the vessels utilizing Cedar Bayou Channel are 8- and 9-foot shipped depth; with 95 percent falling within the 7- to 10-foot depth range. The beneficiaries of a deeper maintained Cedar Bayou Channel are those falling in this shipped draft range. The vessel depth by trips can be found on Table 8. Loaded drafts of the vessels utilizing the Cedar Bayou Channel are between the ranges of 7 to 12 feet maximum loaded draft. The majority of which would continue to benefit at a channel depth of 12 feet given a 2.5 underkeel clearance. The data shows a few vessels drafting at or above 11 feet; taking advantage of advanced maintenance. Given an underkeel clearance of 2.5 feet; vessels drafting at 10 foot appear to be utilizing 12.5 feet of actual channel depth. The characteristics of these vessels are dry cargo barges, flat deck barges, liquid cargo barges and open hopper barges. The dimensions ranging from 140 feet long, 34 feet wide and maximum draft of 7 feet; to 360 feet long, 54 feet wide and a maximum draft of 12 feet. In addition to the cargo vessel some crew boat/utility vessels travel the Cedar Bayou Channel.

Table 8 – Trips on Cedar Bayou (2008 – 2010) – Light loaded trip/ not beneficial

Sailing Draft	2008	2009	2010	Total	Percent	Distribution
<=3	815	496	566	1877	0.32	
4	10	2	0	12	0	
5	16	18	2	36	0.01	
6	217	68	14	299	0.05	
7	445	551	346	1342	0.23	
8	506	403	460	1369	0.23	
9	435	166	137	738	0.13	
10	48	64	40	152	0.03	
11	1	1	3	5	0	
12	4	4	3	11	0	
Total	2497	1773	1571	5841	1	

WCSC detailed data on all vessels

Table 9 shows that 71 percent of the Cedar Bayou traffic is inbound/outbound from the Houston main channel. The inbound/outbound relationship of the Cedar Bayou Channel to the Port of Houston identifies the connection to the international market for commodities. The commodities making the short trip from the Port of Houston to the Cedar Bayou Channel are primarily raw manufactured goods and unrefined petro-chemicals. Those commodities making the short trip back to the Port of Houston are further refined manufacturing goods and petro-chemicals. Port of Pittsburg is the furthest destination of the vessels that appear on the Cedar Bayou Channel at approximately 1,000 miles. Finished pipes and steel are the bulk of the commodities making the long trip to Pennsylvania. Ports include those of Savannah and ports along the Gulf Intracoastal Waterway (GIWW), Lower and Upper Mississippi River, and the Ohio River.

Table 9 – Tonnage on Cedar Bayou by Region of Destination/Origin (2008 – 2010 Average)

Region	Average Yearly Tons	(2008-2010) Share of Tonnage	
Houston TX	785,703	71%	2,357,108
Greater Houston Area (Bayport/Texas City/Galveston)	54,089	5%	162,268
Guadalupe River to Victoria TX	58,128	5%	174,383
Beaumont TX	53,853	5%	161,560
Chocolate Bayou TX	46,714	4%	140,142
Lower Mississippi	30,292	3%	90,877
Ohio River	55,447	5%	166,342
Other port	25,836	2%	77,507
Total Tonnage	1,110,062	100%	3,330,187

Source: WCSC detailed records

Eighty five percent of the tows used on Cedar Bayou are equal to or less than 1,000 horsepower. The tow boat characteristics were provided by WCSC detailed records and are summarized in Table 10. Most tows are either 400 horsepower or 800 horsepower. On average the tows push two barges per trip and are arranged front to back or single file due to the narrow areas of the Cedar Bayou Channel.

Table 10 - Tow Horsepower used on Cedar Bayou (2008-2010)

Tow Horsepower	Count	Percent	Distribution
400	4	0.0023	
600	417	0.2419	
670	6	0.0035	
700	185	0.1073	
740	64	0.0371	
800	438	0.2541	
850	10	0.0058	
900	165	0.0957	
1000	224	0.1299	
1020	3	0.0017	
1200	83	0.0481	
1350	2	0.0012	
1400	2	0.0012	
1570	20	0.0116	
1700	8	0.0046	
1800	34	0.0197	
1950	8	0.0046	
2000	42	0.0244	
2400	2	0.0012	
2600	6	0.0035	
3200	1	0.0006	
Grand Total	1724	1	

Source: WCSC detailed records

4.1.3 Brief History of Industries and Facilities

A testament to the historical and current industries and facilities was provided by the local cooperating navigation district. In the 1960s, U.S. Steel Corp, later acquired by U.S. Denro Steel, developed a steel mill on Cedar Bayou and constructed a dock facility to move materials by barge. This facility is utilized by Jindal Steel and Saw Pipes USA Inc., for the production of various size pipes for the oil field and construction industries.

In 1970, Bayer constructed a chemical manufacturing facility on the upper portion of the navigation channel. Between the years 1996–2001, the chemical manufacturing facility doubled its' capacity. This facility currently covers 1,700 acres, retains approximately 1,300 employees and currently has a replacement value of $3.7 billion.

Another notable activity is the establishment of the Chambers County Improvement District #1, which constructed and operates a dock facility for barging materials. In 2013, the upper section of one of the world's largest offshore drilling platforms was fabricated and transported by barge from this facility (see front cover of this report). The bottom section was constructed in Corpus Christi, Texas.

C.P. Terminal operates an oil transportation facility near the mouth of the bayou. IPSCO Koppel Steel operates a barge docking facility in the upper portion of the channel. A private entity is currently constructing a barge docking facility in the upper portion of the channel and it is reasonably foreseeable that one will be built at the mouth of Cedar Bayou in the not too distant future.

4.2 Benefit Methodology

Study benefits are the difference in commercial navigation vessel transportation costs between the Without-Project condition (allow channel to shoal in) and the With-Project condition (continue to maintain the channel). Vessel transportation costs were based on commodity levels and origin destination patterns that took place during the 2008 through 2010 commercial navigation season. Detailed information on vessel transit movements was obtained from the WCSC for the years 2008-2010 seasons, which was used to develop transportation costs by channel depth. These transportation costs by channel depth were then used to develop Without-Project and With-Project condition transportation costs for the study period 2015 to 2034.

The WCSC data itemized characteristics of each trip made and the vessel used for 2008 through 2010. The data was aggregated to study the number of trips by barge, location, commodity and vessel characteristics. Hourly costs for each vessel were approximated by comparing with the 2008 Shallow-Draft/Inland Vessel Operating Costs derived by Informa. These costs were updated to FY 2013 dollars by using an Engineering News-Record (ENR) construction cost index of 1.165. Industry has indicated that vessels typically travel about six miles per hour en route. From the tonnage carried by each vessel, a weight was derived based on the percent of total tonnage carried on each vessel. This weight for each vessel was used to determine a weighted round trip mileage of 68 miles for a representative barge. With the assumption that vessels travel at six miles per hour, a representative barge travels 11.33 hours roundtrip.

The WCSC data also itemizes trips made by towboats and pushboats from 2008 to 2010. By aggregating the data and calculating the trips by horsepower, a comparison is made to the 2008 Shallow-Draft/Inland Vessel Operating Costs by Informa. Weighting the trips of each horsepower category to the total trips, multiplied by the updated hourly cost, yields a weighted hourly towboat cost. Repeating this process, but adjusting the hourly cost yields a representative hourly towboat cost of $309.66 while towing, and when the barge is loading or unloading, an idling towboat hourly cost of $237.52.

Multiplying the weighted hours for a representative trip by the weighted vessel hourly costs yield the round trip voyage costs of a barge and tow. By adding the weighted cost per barge, and adding the towboat cost divided by the number of barges per tow gives the total voyage cost per barge.

The tons capacity per vessel minus the difference between the loaded draft and available channel depth multiplied by the tons per inch gives the approximate tons per vessel at each channel depth alternative. This tonnage multiplied by the share of cargo gives weighted tons for each channel depth. The sum of the weighted tonnage yields the weighted tons per barge at each channel depth alternative. The total voyage cost per barge divided by the weighted tons per barge gives the cost per ton at each channel depth. The cost per ton multiplied by the total annual tonnage results in total voyage costs at each channel depth. Adding the cost of the idling towboat and barges while the barges load and unload gives the total annual transportation cost and potential savings at the full channel depth compared with each channel depth alternative. Benefits (and costs) were discounted to October 2013 dollars (FY 2014) using the Federal Discount rate of 3.50 percent to calculate net excess benefits and the BCR.

4.3 Results

Based on total tonnage, barges on Cedar Bayou include liquid cargo, flat deck, covered dry cargo and open hopper barges. Liquid cargo barges made up the largest portion with dimensions ranging from 360 feet length, 54 feet width and 12 feet draft to 140 feet length, 34 feet width, and 7 feet draft. With respect to depth shipped of tonnage 52 percent drafted 8 feet, 31 percent drafted 9 feet, and 7 percent drafted 10 feet depths. Combined, 91 percent of the barges drafted 8 feet or deeper. At least 91 percent of barges are thought to be at channel capacity; if not all vessels.

4.3.1 Average Annual Benefits

The 2008-2010 tonnage on Cedar Bayou averaged 1.110 million tons. In the analysis the tonnage grew to 1.6 million tons by calendar year 2030. Table 11 shows the most likely average annual transportation cost at each channel depth and associated project benefits. The most likely growth rate (2.68 percent) was developed using the average percent change from 2001-2010. A ten foot channel scenario with an additional two feet in advanced maintenance and two feet of allowable over depth has a total annual cost savings of approximately $5,265,413 as compared to a Without-Project condition because of the fewer trips required to carry the same tonnage. A ten foot channel with an additional two foot of additional over depth equates to the next highest savings scenario due to frequency of dredging cycles not allowing shoaling in of the channel. The 10+2 feet scenario is based on a three year dredging cycle. The three year dredge cycle provides more 10+ feet years than in the 10+2+1 scenario but not as many 10+ feet depth years as in the 10+2+2 scenario.

Table 11 – Annual Transportation Cost for Reduced Channel Depths (Most Likely)

Channel Depth	Annual Transportation Cost**	Average Annual Benefit*
Without project depth	$7,505,420	$-
9	$4,039,942	$3,420,206
10	$3,346,050	$4,196,339
10+1 (11)***	$2,855,699	$4,784,719
10+2 (12)	$2,570,702	$5,170,263
10+2+1 (13)****	$2,441,575	$5,058,916
10+2+2 (14)	$2,357,833	$5,265,413

**Figures are in 2014 dollars using a Federal Discount Rate of 3.50 percent, derived from October 2013 price levels*
***Annual vessel transportation costs at certain depths prior to shoaling and annualizing with base year tonnage.*
****includes allowable overdepth only (e.g., 10 foot channel depth +1 foot allowable overdepth=11 foot total depth).*
*****includes advance maintenance (+2) and allowable overdepth (+1).*

4.3.2 Incremental Economic Analysis

Incremental analysis describes an analysis to justify dredging of the Cedar Bayou Channel in one-foot increments. The net excess benefits increase with increasing depth (Table 12). The existing fleet would not be able to beneficially utilize an increment above 14 (10+2+2) feet and could not be justified under current channel authority, thus 10+2+2 feet was the last increment justified.

Table 12 - Incremental Economic Analysis

Channel Depth Alternatives*	10+2+2 Feet	10+2+1 Feet	10+2 Feet	10+1 Feet	10 Feet
Average Annual Benefits**	$5,265,413	$5,058,916	$5,170,263	$4,784,720	$4,196,339
Average Annual Cost	$1,669,941	$1,617,304	$2,061,707	$1,820,955	$1,580,203
Net Excess Benefits	$3,595,472	$3,441,612	$3,108,556	$2,963,765	$2,616,137
BCR	3.15	3.13	2.51	2.63	2.66

***Channel depth + advance maintenance + allowable overdepth. If only one number is added to the channel depth that indicates allowable overdepth.*

**Figures are in 2014 dollars using a Federal Discount Rate of 3.50 percent, derived from October 2013 price levels*

4.3.3 Anticipated Effects of a Slow Economy

Future benefits could be affected by the slowed recession recovery. According to WCSC data round trips declined from 959 roundtrips in 2008, to 628 in 2009, and to 624 in 2010. Preliminary 2011 data shows a round trip count of 1,060, a level even higher than 2008. Without any real evidence of a slowing economic activity a scenario of zero percent growth in trips and tonnage was used to account for the possibility of a lagged recession recovery. If the economy remains lagging in their recession recovery for the next two decades, the annual benefits of a 10+2+2 foot channel for this twenty-year study are estimated at $4,581,042. This is the anticipated low scenario, displayed in Table 13.

Table 13 - Annual Transportation Cost for Reduced Channel Depths Adjusting for the Effects of a Prolonged Slow Recovery (Low)

Channel Depth	Annual Transportation Cost*	Average Annual Benefit**
With-out project	$6,359,457	$-
9	$4,039,942	$3,153,762
10	$3,346,050	$3,740,471
10+1 (11)***	$2,855,699	$4,205,750
10+2 (12)	$2,570,702	$4,510,416
10+2+1 (13)****	$2,441,575	$3,423,099
10+2+2 (14)	$2,357,833	$4,581,042

**Annual vessel transportation costs at certain depths prior to shoaling and annualizing with base year tonnage.*

***Figure are in 2014 dollars using a Federal Discount Rate of 3.50 percent, derived from October 20132 price levels*

****includes allowable overdepth only (e.g., 10 foot channel depth +1 foot allowable overdepth=11 foot total depth).*

*****includes advance maintenance (+2) and allowable overdepth (+1).*

4.3.4 Annual Costs

Average annual costs include the initial cost of construction of the disposal area, maintenance of the disposal area and annual dredging contracts. Dredging costs were estimated in a five year dredging cycle at the 10+2+2 foot increment to take advantage of efficiencies gained in larger

dredging efforts in longer periods. The difference between the 13 foot scenario (5 year dredge cycle) and the 12 foot scenario (3 year dredging cycle) highlights the effects on annualized dredging cost of longer dredge cycles and fewer contracts. The average annual dredging costs are estimated to be $1,052,747.

Table 14 displays the projected costs of construction of containment dikes and maintaining the channel from the years 2015 to 2034. The average annual expected cost in 2014 dollars totals $1,669,941 using a Federal Discount Rate of 3.50 percent.

Table 14 - Average Annual Construction and Operation and Maintenance Costs

Project Year	Year	Construction Cost*	PA 7-Cost	Total
1	2015	$943,000	$8,924,000	$9,867,000
2	2016	$4,340,000**		$4,340,000
3	2017	$10,000		$10,000
4	2018	$718,000		$718,000
5	2019	$749,000		$749,000
6	2020	$10,000		$10,000
7	2021	$3,368,000**		$3,368,000
8	2022			
9	2023	$706,000		$706,000
10	2024	$767,000		$767,000
11	2025			
12	2026	$3,297,000**		$3,297,000
13	2027			
14	2028	$445,000		$445,000
15	2029	$200,000		$200,000
16	2030			
17	2031	$3,368,000**		$3,368,000
18	2032			
19	2033	$427,000		$427,000
20	2034	$173,000		$173,000
Total		**$19,521,000**		**$28,445,000**
Average Annual Cost		**$1,052,747**	**$617,194**	**$1,669,941**

Note: Figures are in 2014 dollars using a Federal Discount Rate of 3.50 percent, derived from October 2013 price level.

**Costs represent containment dike and DAMP work as well as dredging.*

***Years with dredging cost built in.*

4.3.5 Sensitivity Analysis

An analysis was conducted to assess the effects of uncertainty from the baseline assumptions. Variation from the baseline assumptions could impact the BCR outcome both positively and negatively. Many baseline assumptions were provided by industry observations. Table 15 shows variations to some of the baseline assumptions. The probability of commodity flow returning to a historical high growth rate is more likely than a continued slow recovery. The results of the sensitivity analysis indicates that it is more to likely to be a variation in an assumption which increases the shippers benefits than an assumption that could cause negative variation on the shippers benefits. Uncertainty in upper channel authorization led to a sensitivity scenario with only the traffic destined to the Lower Cedar Bayou docks. Even without the upper channel project in the without project condition the continued maintenance of the Lower Cedar Bayou Channel is justified with net excess benefits of $825,853 and a BCR of 1.49.

Table 15 - Annual Transportation Cost Savings of Dredging Channel to 10+2+2 Feet

	Average Annual Benefits of Dredging to 10+2+2 Feet	Average Annual Cost	Benefit / Cost Ratio	% of Baseline
Baseline (Projected Traffic Levels increase 2.68% annually from Low)	$5.265 M	$1.670 M	3.15	---
Variations from Baseline				
Lower Channel Traffic Only	$2.495 M	$1.670 M	1.49	47 %
Tonnage Levels Remain Low	$4.581 M	$1.670 M	2.74	87 %
Trips Resemble a Recession (85% of Normal Trips)	$4.475 M	$1.670 M	2.68	85%
Efficiency increases to 4 Hours to Load/Unload	$4.113 M	$1.670 M	2.46	78 %
Tonnage Levels are at “Normal” levels (High)	$5.689 M	$1.670 M	3.41	108 %
Barges per Tow Reduced to 1.25 from 2.0	$7.937 M	$1.670 M	4.75	151 %

Note: Figures are in 2014 dollars using a Federal Discount Rate of 3.505 percent, derived from October 2013 price level.

4.3.6 Alternatives and Regional Effects

Industry located on Cedar Bayou utilizes the channel primarily for three activity purposes. This section will evaluate alternative transportation modes to these activities that utilize the navigation channel. The main three activities on the Cedar Bayou Channel are:

1. Inbound petrochemical liquids to be further refined, stored, or for the connection to truck, rail or long distance barge and/or a combination of refined, stored and shipped;

2. Inbound ingot and primary forms of iron or steel to be molded, stored and shipped; and

3. Outbound refined petrochemical and molded iron/steel to the port of Houston for export.

The Cedar Bayou Channel can be thought of as an extension to the other Houston ports. The activity on the channel is indirect or induced by the activity in the greater Houston ports. The Cedar Bayou Channel is an extension to the greater channel where any distance further away from Houston's industrial activity adds transportation costs for any transportation alternative including barge. The Cedar Bayou relationship to Houston is displayed in Table 16 where 71 percent of Cedar Bayou traffic is in transit to or from the Port of Houston. The greater Houston port activities are important on a national and global scale; Cedar Bayou's proximity and activity connection to the greater Houston ports positions the Cedar Bayou Channel on a national and global economic role. The activities listed above provide manufacturing jobs to Baytown, Western Chambers County and Eastern Harris County. Intermediate goods, such as those produced in the Cedar Bayou industrial yards, have far reaching manufacturing connections dependent on production efficiencies experienced in the Cedar Bayou. Oil and gas production, offshore drilling and chemical refineries all have connections with Cedar Bayou which highlight the importance of the activities on the Cedar Bayou Channel. The Bayer chemical manufacturing facility (mentioned earlier in Section 4.1.3) alone employees 1,300 people. Employees' disposable income, value added to intermediate manufacturing goods, and public services such as schools and police would be drastically impacted with any reduction of these activities on Cedar Bayou.

Table 16 - Cedar Bayou Shipped and Received Origin and Destination

Tonnage on Cedar Bayou by Region (2008-2010 Average)		
Region	Tons	Share of Tonnage
Houston	785,703	71%
Greater Houston Area (Bayport/Texas City/Galveston)	54,089	5%
Guadalupe River to Victoria TX	58,128	5%
Beaumont	53,853	5%
Chocolate Bayou TX	46,714	4%
Lower Mississippi	30,292	3%
Ohio River	55,447	5%
Other port	25,836	2%
Total Tonnage	1,110,062	100%

Source: WCSC detailed records

With the national importance of these activities, additional transportation mode alternatives were considered for this analysis to enable the Cedar Bayou industrial activity to stay connected to the Port of Houston.

Connect to Houston with More Pipeline

The primary preferred mode of transporting liquids is pipeline. Pipelines in the region are fully utilized for the movement of petroleum products, raw and refined. A large portion of the products appearing on Cedar Bayou are petrochemical by-products from the refining process such as Toluene, Benzene and Acetone. Additional pipeline alternatives include increasing the size and number of pumps on existing pipelines and/or building additional storage facilities and using existing pipelines to move multiple products. However, these alternatives also have disadvantages when compared to moving products by barge. Increasing the size and number of pumps on existing pipelines is expensive and does not provide the flexibility of being able to easily move multiple products. Building additional storage areas creates other issues with hazardous waste by-products, the lack of space for storage facilities in Houston and inefficiency due to downtime of the pipelines for alternating products through the lines.

With a closure of the Cedar Bayou, industry interested in exporting liquids would need to utilize more pipelines into the main Houston ports; pipelines which are at or near capacity with very little easement space to improve the capacity. This would be the same scenario for industry interested in importing through Houston; they would need to utilize other ports in the greater Houston port area for the connection to pipeline, many of which are in the same situation of being at or near pipeline capacity.

1. Utilize Different Rail Connection

Rail connections are available to connect the Cedar Bayou industry facilities with the greater Houston ports; however the rail connections are also at or near capacity. The same issue of increased capacity and real-estate anticipated with the pipeline alternative leaves this alternative without merit. Due to economies of scale, rail is higher cost than barge and pipeline. Similar to trucking, rail also poses additional risk because of the toxicity and sensitivity of the products and by-products being transported. Some of the products moved on the Cedar Bayou Channel must be climate controlled or they become explosive.

The effects of both poor rail connection and pipeline alternatives would strain the growth of the regional economy. Relatively sufficient industrial real estate capacity around the navigation channel has enabled steady growth of the Cedar Bayou industrial yard and the regional economy. Without the Cedar Bayou capacity and efficiencies the regional growth would stagnate. Without continued maintenance of the Cedar Bayou Channel depth the Cedar Bayou industrial yard would be forced to down size, laying-off employees, and eliminating a significant amount from its payrolls. This reduction, if not absorbed, would increase regional unemployment and reduce local tax revenue.

2. Barge to the GIWW, Then Truck the Rest of the Way

The connection between rail and truck would be less efficient due to the compounding synergy proved by other similar industry activity in Houston, i.e. other petroleum activity in Houston to assist in fully loading deep draft vessels and the effects of location proximity to the chemical by-products origin (petroleum refinement in Houston). Cedar Bayou is the destination and origin for vessels currently utilizing the GIWW. With the current channel depth of Cedar Bayou being similar to the Upper inland waterway system the efficiencies gained from the barge traffic on the Mississippi River would not be obtained. The vessels would be forced to light load the entire distance, stop to load deeper or utilize rail/truck from the lower Mississippi River or GIWW. The products would then be offloaded into storing facilities. Local industry indicated that trucking product into the facilities is not an option because trucks cannot handle the volume of product. Also, the extra handling of product and use of trucks would add significantly to the unit cost of the product. Finally, the risk and hazards of a spill are increased with the extra handling due to the nature of the commodities being transported. The significant increase in truck traffic would also produce unmanageable congestion, clean air concerns, and damage to roads and highways.

3. Truck all the way

Finished pipe and steel products are the primary commodity making the trips to/from the upper end of the inland waterway system (Port of Pittsburg). The raw iron/steel is brought into the Cedar Bayou industrial yards either by connection to the Port of Houston or by rail then pressed and molded into sheet and pipe then shipped to the other ports on the GIWW and inland waterway system. Port of Pittsburg is the longest distance in the data. Trucking the entire distance, over 1,300 miles, would be expensive on the direct trucking costs and the indirect costs of highway infrastructure would put a significant burden on those states it is required to pass through. The significant increase in truck traffic would also produce unmanageable congestion and clean air concerns.

4. Shut Down Operations and Relocate

This scenario involves shutting down the industrial facilities located on the Cedar Bayou Channel and relocating their activity elsewhere. The next best practice to remain near the Port of Houston would be to relocate the industrial facilities to another nearby channel such as Chocolate Bayou or Houston, Texas City and Galveston, all of which have little/no space along the channel. This would be an expensive initial cost and an increased transportation cost for the additional distance. The current pipeline infrastructure that assists the industrial activity along Cedar Bayou would go unutilized and be expensive to replace when relocating the industrial facilities to Chocolate Bayou or Galveston.

If this industrial and connection activity is transferred to Chocolate Bayou, Galveston, Freeport or even Beaumont it would consist of an economic impact movement within the greater Houston region. The industrial activity would remain within close proximity to the Port of Houston for its deep draft and international vessels. However an alternative site would result in an increase in transportation costs to and from the new location. This increased cost would consist of a long term significant direct regional economic impact. The regional economic impact would indirectly result in a loss of support jobs and income. The induced effects of which results in less tax revenue collected in the region having profound effects on local law enforcement, local governments and schools.

4.4 Conclusion

The number of trips and loaded drafts were the basis for the analysis. Table 17 shows that the most likely average annual benefits exceed the costs of maintaining the channel based on 2008-2010 data and a Federal Discount Rate of 3.50 percent. Table 18 shows the most likely average

annual benefits and costs with a 7.0 percent Federal discount rate. The facility is expected to be filled and traffic is expected to increase by a historical trend of 2.68 percent annually. Businesses operating more efficiently and increasing the number of barges per tow also affects the benefits.

Table 17 - Project Summary Given Most Likely Scenario (3.5% Discount Rate)

Average Annual Benefits	Average Annual Construction and O&M Costs	BCR
$5,265,413	$1,910,088	2.76

Note: Figures are in 2014 dollars using a Federal Discount Rate of 3.50 percent.

Table 18 - Project Summary Given Most Likely Scenario (7% Discount Rate)

Average Annual Benefits	Average Annual Construction and O&M Costs	BCR
$5,021,159	$2,172,2746	2.31

Note: Figures are in 2014 dollars using a Federal Discount Rate of 7.0 percent.

Regional benefits are also important. With the continued maintenance of Cedar Bayou there are direct Federal expenditures in construction and maintenance of dredge material disposal sites as well as dredging contracts that provide annual direct jobs and indirect regional economic impacts.

Federal investments in navigation systems also provide savings/efficiencies to shippers. It is assumed that any savings to shippers eventually get passed onto the end consumers. Even though the products moving on Cedar Bayou are not end consumer products the products are inputs to final consumer product. The efficiencies are eventually retained in the final consumer products. The final consumer's disposable income savings translates to their ability to purchase other end consumer products, contributing to induced regional economic activity. The entirety of regional economic impacts include the direct impact of Federal expenditures, indirect activity from Federal expenditures and induced activities either from Federal expenditures or consumer saving on final demand products. The regional economic impact include providing a local tax base to support schools and emergency services, employment in the region, payroll income and value added to intermediate goods.

Even more difficult to quantify is the multi-regional connections. The intermediate goods (petrochemical and molded/fitted metal) traversing Cedar Bayou are important input to offshore oil/gas production. The offshore drilling industry has multi-region effects. Any disturbance to their activity would result in ripples not only through the Baytown region but the entire gulf

coast. The offshore drilling industry is not solely dependent on Cedar Bayou; however, without the channel efficiencies the machinery fabrication could relocate. Manufacturing facilities tend to "cluster" due to synergies and economies of scale. Cedar Bayou commodity types, consistent activities, and proximity to the HSC access to international markets exemplifies this cluster attitude. It is likely some of the plants in these other industries will relocate overseas if their input costs increase domestically.

5.0 DESCRIPTION OF MANAGEMENT PLAN

The identification of the Tentatively Selected Plan from the various alternatives was based upon environmental, engineering, and cost factors. The environmental consequences are fully described in Section 4 of the EA.

5.1 Plan Description

5.1.1 Dredging Plan

Continued maintenance of this project requires a dredge to excavate and deposit maintenance material into PAs on an average cycle of once every five years. It is estimated that approximately 2.9 million cubic yards (including volumes from the Federal channel, non-pay volumes, permit work, and additional volume during the first dredge cycle as described in Section 2.1.2 Dredging Quantities) will be dredged in a 20-year period. The tentatively selected plan would provide capacity for a 20-year period. Dredging has historically been done by hydraulic cutterhead dredge; this methodology continues to be used. Other types of equipment could also be used; however, cutterhead dredges are generally the most economical dredging equipment for this type of dredging.

The dredged maintenance material would be placed into two PAs, depending upon the channel reach. The Bay Reach (Station 0+00 to Station 180+00) section (383,154 cubic yards per cycle) would typically be placed into the new upland confined PA (PA 7). The Bayou Reach (Station 180+00 to Station 301+56.27) section (221,046 cubic yards per cycle) would typically be placed into existing PA 6 for the first three maintenance cycles or approximately 15 years into the analysis period at which time PA 6 would be considered full. Thereafter, the Bayou Reach maintenance material would be placed into PA 7. All of the additional volume (338,778 cubic yards) dredged only during the first maintenance cycle of this DMMP would be placed into PA 7. The Bayou Reach maintenance volume from about Station 231+43 to Station 301+56.27 (221,046 cubic yards) would be placed in PA 6 during the first cycle. The balance of the Bayou Reach from Station 180+00 to Station 231+43 (134,608 cubic yards) would be placed in PA 7.

The remainder of the additional volume (204,170 cubic yards) would originate from the Bay Reach and be placed in PA 7.

Table 19 identifies the estimated dredging quantities and placement plan for the 20-year period of analysis (years 2015 through 2034). Specific quantities would be determined by hydrographic surveys performed prior to each dredging cycle.

Table 19 - Cedar Bayou 20-Year Dredging Quantities and Placement Plan

Year	Dredging Reach Description	Placement Plan Volumes (CY)[1]	
		Existing PA 6	New Upland PA (PA 7)
2016	Bay Reach (Station 0+00 to 180+00)		587,324
	Bayou Reach (Station 180+00 to 231+43)		134,608
	Bayou Reach (Station 231+43 to 301+56.27)	221,046	
	Permit Work	25,000	
2021	Bay Reach (Station 0+00 to 180+00)		383,154
	Bayou Reach (Station 180+00 to 301+56.27)	221,046	
	Permit Work	25,000	
2026	Bay Reach (Station 0+00 to 180+00)		383,154
	Bayou Reach (Station 180+00 to 301+56.27)	221,046	
	Permit Work	25,000	
2031	Bay Reach (Station 0+00 to 180+00)		383,154
	Bayou Reach (Station 180+00 to 301+56.27)		221,046
	Permit Work		25,000
Totals		738,138	2,117,440

[1]*The volumes shown for the Federal Project include estimated non-pay volumes.*

The capacity of PA 6 (assuming maximum containment dike elevation of 27 feet) prior to this management plan is about 879,000 cubic yards. After the 20-year period of analysis PA 6 would have a capacity of about 141,000 cubic yards. The proposed PA 7 would have a capacity of about 4.5 MCY at the assumed maximum containment dike elevation of 45 feet. PA 7 would have an estimated remaining capacity of about 2.4 MCY following the 20-year period of analysis.

Throughout the duration of each dredging contract, the contractor would establish and maintain a quality control system for managing dredged material in accordance with contract requirements.

During each dredging contract, the contractor would remove ponded water inside the upland confined PAs by lowering the spillway weirs at each drop-outlet structure at a rate that would ensure water quality standards are met by the resulting effluent. This is accomplished by systematically removing the uppermost stop-log timbers used to control weir height as the ponding level is drawn down.

Following each dredging contract, the confined upland PAs would continue to be dewatered using lateral and perimeter ditching constructed between cycles to facilitate drainage to the drop-outlet structure. The continuing dewatering efforts would promote: 1) removal of most remaining ponded water; 2) positive drainage of precipitation; 3) drying of the dredged material; and 4) increased vertical settlement of fine-grained dredged material, thus providing additional long-term storage capacity. In addition, field survey crews from USACE generally monitor and remove ponded water from PAs by lowering the weir height of the drop-outlet structures between cycles.

5.1.2 New Upland PA (PA 7)

PA 7 (Figure 12) would be located approximately two miles from the mouth of Cedar Bayou on an approximately 110-acre property that was partially developed for a recreational vehicle park; however, the project was abandoned. The PA footprint area measured inside the proposed perimeter containment dike centerline is about 89 acres. The property is generally rectangular in shape with the long sides running in an approximately northeast to southwest direction. For the purposes of this discussion, the northeast end will be referred to as the north end and vise versa. The site is bounded by Tri-Cities Beach Road to the south, HL&P canal to the west, Cedar Bayou to the north, and vacant property to the east. Existing infrastructure within the site includes asphalt surfaced roads, and underground utilities including storm and sanitary sewers, sanitary pump station, and water distribution pipelines.

A geotechnical study was performed at the proposed PA site to characterize the subsurface soils. Fourteen borings (designated 13-B1 through 13-B14) were drilled to the 20-foot, 40-foot, 60-foot, and 80-foot depths at selected locations. Based on the results of the sampling and testing program, the site stratigraphy consists predominantly of firm to hard clays, sandy clays, and silty clays from the surface down to elevations ranging from about -45 feet to -49 feet NAVD 88. Natural silty sand, sand with silt, and sand layers were encountered below about elevations -43 feet and -49 feet in boreholes 13-B6 and 13-B7. The majority of the near-surface materials consist of firm to hard clays and silty clays which are ideal materials for building perimeter containment dikes for PAs. Geotechnical boring locations and logs are attached to this report in Appendix C.

Soil shear strength and classification test results obtained from the geotechnical exploration program were analyzed and used to develop soil models and to perform stability analyses for the proposed containment dikes. Slope stability analyses were performed using the computer program GeoStudio SLOPE/W for short term (undrained) and long term (drained) conditions. The stability analysis was performed using the Morgenstern-Price method which is a limit equilibrium formulation and satisfies moment and force equilibrium and considers both shear and normal interslice forces. Results of the stability analysis indicted the proposed containment dike constructed as described in the following paragraphs to elevation +32 feet would have factors of safety of 2.4 and 1.4 for short and long term conditions, respectively. The dike constructed to elevation +45 feet would have factors of safety of 1.6 and 1.3 for short and long term, respectively. The Corps of Engineers Engineering Manual (EM) 1110-2-5027, "Confined Disposal of Dredged Material", Table 6-6, recommends a minimum factor of safety of 1.3 for both short and long term conditions for containment dikes. The analyses indicated the proposed dikes would meet EM 1110-2-5027 recommendations.

The containment dikes would be constructed to about elevation +32 feet (NAVD 88) with a 10-foot crown width, and side slopes of 1 vertical to 3 horizontal. Actual containment dike heights relative to existing elevations would vary from about 12 feet at the south end of the PA to over 20 feet where existing canals cross the containment dike alignment at the north end. This is a typical containment dike template for USACE Galveston District dredge material PAs.

The containment dike footprint and proposed borrow areas would be cleared of vegetation and existing infrastructure. The resulting exposed ends of storm sewers would be grouted and the sanitary sewer and water pipes would be capped prior to containment dike construction.

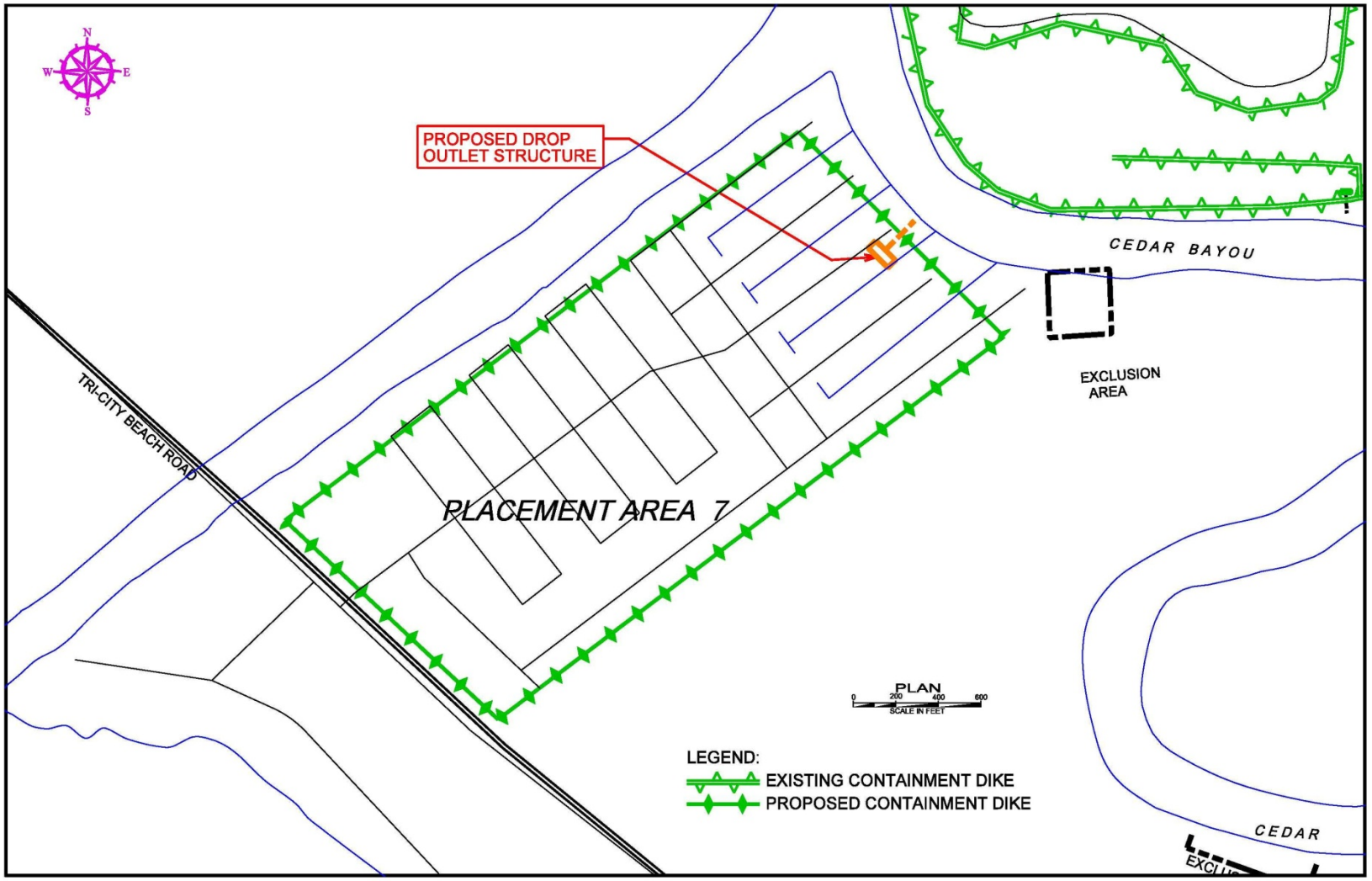

Figure 12 - PA 7 Plan View (Component of Tentatively Selected Plan)

Debris removed from the containment dike footprint and borrow area would be buried onsite in the southern ends of the existing canals connected to Cedar Bayou located at the north end of the PA. Containment dikes would be constructed across the canals prior to debris burial in order to isolate the debris from Cedar Bayou.

The initial construction of the containment dike would consist of borrowing materials from the interior of the PA either by excavation of suitable fill soils and hauling the materials to the containment dike construction area, or by side-cast methods. The borrow method used is dependent upon location of suitable fill soils and would be determined during the preconstruction engineering and design phase. The containment dike would be constructed using the semi-compacted technique by compacting the borrow material in 12-inch lifts using a bull dozer of minimum specified size. The final crown and outside slope of the containment dikes would be seeded using the hydro-mulch method. The need for any training dikes, their location, and size would be determined during the PED phase.

An effluent drop-outlet structure would be constructed at the north end of the PA with discharge into Cedar Bayou. The structure would be positioned far enough away from the containment dike to allow future containment dike raisings as required over the life of the PA

The project would meet the requirements of the State of Texas general permit for storm water discharges from construction sites as administered by the Texas Council on Environmental Quality (TCEQ). The contractor would file a Storm Water Notice of Intent that must be approved by the State of Texas, prior to start of work. The submitted Storm Water Pollution Prevention Plan would identify the appropriate Best Management Practices that provide erosion and sediment controls and are applicable to the site conditions.

The configuration and containment dike elevation of the new PA was developed to contain the anticipated dredging volumes over the 20-year period of analysis. Light detection and ranging (LIDAR) data obtained from the Texas Natural Resources Information System (TNRIS) was utilized to develop a surface model using Microstation and the InRoads application. The surface model was used to calculate volumes of the new PA at various containment dike elevations in order to determine the required dike elevation to contain estimated 20-year DMMP volumes presented in Table 19 as well as to determine the PA volume at the maximum allowable dike elevation. The estimated PA capacity with containment dikes constructed to elevation +32 feet would be 2.5 MCY. The PA capacity at the maximum containment dike elevation of +45 feet was estimated to be 4.5 MCY. Consolidation analyses are not needed for this type of earthen structure because gradual settlements of 6 to 18 inches over time are common. The clay material in the containment dike can tolerate the settlement due to its plastic behavior.

During dredging operations the dredged material would be discharged into the new PA near the southwest corner in order to provide the greatest possible ponding time and distance between influent and the outlet structure. The drop-outlet structure weir acts as a filter mechanism and would be composed of wooden stop-logs for ponding level control. Clean water would be discharged into Cedar Bayou through a discharge pipe which is buried under the containment dike and connected to the drop-outlet structure.

5.1.3 Existing Upland PA 6

The existing upland PA 6 is about 37 acres in plan area (inside the perimeter containment dike centerline) and has a small effluent drop-outlet structure located on the south perimeter containment dike with an associated training dike as shown in Figure 13. The estimated capacity of PA 6 is 65,000 cubic yards in its current configuration. It is anticipated that PA 6 containment dike would be raised a total of about 11 feet above its existing elevation in three separate contracts to reach its estimated maximum elevation of 27 feet NAVD 88. The remaining capacity of PA 6 with the proposed containment dike raises is estimated to be 878,830 cubic yards. Containment dike raising construction is anticipated to be accomplished using the side-cast method using existing materials within the PA footprint.

Upland PA 6 would be managed in a similar manner as described for the New Upland PA 7 for removal of ponded water during and after dredging contracts and for dewatering the PA using interior perimeter and lateral ditching to promote drying and consolidation of the dredged material between dredging contracts.

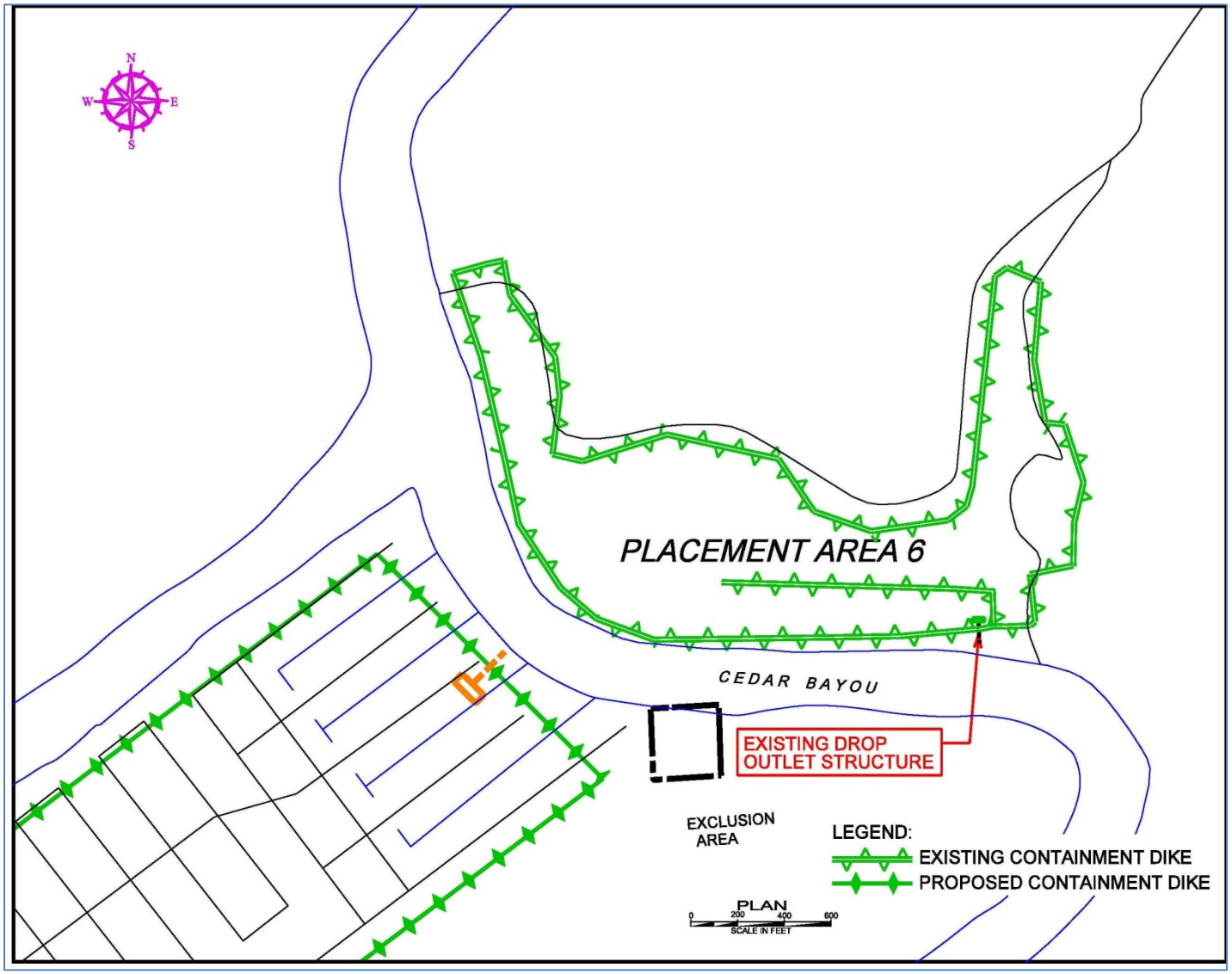

Figure 13 - PA 6 Reconfiguration ((Component of Tentatively Selected Plan)

5.1.4 Mitigation

The Tentatively Selected Plan has been designed with the smallest practicable footprint to meet the requirements of the proposed project. Construction of the PA 7 component of the Tentatively Selected Plan would permanently impact 2.56 acres of estuarine wetlands located along the canal edges. All impacts to wetlands (Figure 14) would be mitigated pursuant to the Mitigation Plan (Figure 15) described in detail in Section 5.0 of the EA.

As addressed in the EA both brown shrimp and red drum are found in Cedar Bayou and would make use of the estuarine habitat that would be impacted by construction of PA 7. A Habitat Evaluation Procedure (HEP) Analysis, developed by the USFWS, was performed on the proposed impact area for the Tentatively Selected Plan to determine the appropriate amount of mitigation that would be required to replace the values and functions of the aquatic habitat lost due to construction of PA 7. As addressed in the EA and HEP analysis, the average annual habitat units (AAHUs) computed for the 2.56 acres takes into account the quality conferred to it by the adjacent open water area. Based upon the conclusions of the HEP analysis it was determined that 2.64 acres of in-kind mitigation would be required to fully mitigate for impacts resulting from the construction of PA 7.

To maximize the mitigation area for both of the aforementioned species 2.64 acres of smooth cordgrass would be planted. The plan would require planting to achieve 100 percent coverage of the mitigation area with 60 percent of open water edge fringed with persistent emergent vegetation. The project first cost of the wetland mitigation at October 2013 price levels is $284,000 in CG funds. An additional five contracts are included for O&M for a total of $50,000. Monitoring activities, including performance standards, monitoring methods, remedial actions and schedule are fully addressed in Section 5.0 of the EA

The draft DMMP and EA were developed last fall (2013), and at that time, there were no mitigation banks available for this service area that could be used for the mitigation to offset environmental impacts. In February 2014 a new mitigation bank, the Gulf Coast Plains Mitigation Bank (GCPMB) was established that could potentially be used as this project is in the bank's secondary service area. While the GCPMB has the appropriate type of credits available for mitigation for impacts resulting from this project, the credits are determined using the Tidal Fringe Interim Hydrogeomorphic Model (iHGM), which has not been certified or approved for use in Civil Works planning projects by the Ecosystem Restoration Planning Center of Expertise and HQ. As such, wetland creation, onsite and in-kind was chosen as mitigation for this project.

Figure 14– Proposed Placement Area and Resulting Tidal Wetland Impacts.

Figure 15 – Mitigation Plan for the Tentatively Selected Plan

5.2 Items of Local Cooperation

The non-Federal Sponsor for the CBLC is the CLCND. The Cedar Bayou Channel from the intersection with the HSC at Station 0+00 to Station 301+56.27 is located within the CLCND boundaries.

The non-Federal Sponsor is required to provide all necessary lands, easements, rights-of-way, relocations and dredged or excavated material disposal areas (LERRDs). The non-Federal Sponsor shall purchase the land in fee and convey a non-standard perpetual disposal area easement to the Government. The non-standard perpetual disposal easement is necessary to assure the Government's right to utilize PA 7 and PA 6 commensurate with its O&M responsibilities for the Project. The real estate requirements must support construction as well as O&M.

The non-Federal Sponsor has and continues to pay 10 percent of the cost for containment features for the maintenance of the Cedar Bayou Channel. Pursuant to current guidance, Construction-General (CG) cost-sharing requires that the non-Federal Sponsor (for a channel less than 20-feet in depth) pay 10 percent of the total first and continuing construction costs. The remaining 90 percent is paid by the Federal government.

6.0 NEPA REQUIREMENTS

6.1 Environmental Documentation

A Draft EA has been prepared to satisfy the requirements of all applicable environmental laws and regulations. Preparation was in accordance with the Council on Environmental Quality's (CEQ's) implementing regulations for NEPA, 40 Code of Federal Regulations (CFR) Parts 1500 – 1508, and the USACE ER 200-2-2, Environmental Quality: Procedures for Implementing NEPA. The planning and implementation of the proposed project is consistent with the USACE Environmental Operating Principles and in accordance with the "USACE Campaign Plan" goals. For a detailed discussion of the environmental effects associated with the Tentatively Selected Plan please refer to Section 4.0 of the Draft EA. Summary points of the environmental effects discussed in the Draft EA are included in the following paragraphs.

- The environmental review of the Tentatively Selected Plan included consideration of sea level rise impacts to the Tentatively Selected Plan, project impacts to vegetation, wildlife, aquatic resources including Essential Fish Habitat (EFH), threatened and endangered species, cultural resources, socioeconomic resources, Environmental Justice, Prime and

Unique Farmlands, Hazardous, Toxic, and Radioactive Wastes, air, noise, water quality, as well as alternative courses of action and cumulative impacts.

- Construction of the Tentatively Selected Plan would result in permanent fill impacts to 2.56 acres of wetlands in the proposed PA 7 footprint. All impacts to wetlands would be mitigated pursuant to the Mitigation Plan described in detail in Section 5.0 of the EA. The existing PA 6 was previously coordinated and authorized for use of dredged material placement in the 1975 FEIS.
- Construction of the Tentatively Selected Plan would change the current land use for the project footprint. However, this land is already heavily disturbed from previous construction. Therefore, construction of a PA at this location would not be considered an adverse impact to land use.
- The Biological Opinion (Appendix B of the EA) concludes that the construction of the Tentatively Selected Plan would not affect any federally listed threatened or endangered species or their habitat.
- Historic properties or recorded archeological sites would not be affected by the proposed action.
- The proposed project was found to be compliant with the Endangered Species Act, Clean Air Act, Clean Water Act, EFH, the Texas Coastal Management Plan (TCMP) and other relevant laws and executive orders as discussed in Section 7.0 of the Draft EA.
- There would be no long-term impacts to water quality from the proposed activities.

The proposed project is expected to contribute beneficially to navigation efficiency by maintaining navigable depths for commerce and is not expected to contribute negative cumulative impacts to the area.

6.2 Public Involvement

The public will have an opportunity to comment on the project during the 30-day public review of the DMMP/EA document. Any comments submitted during that process will be considered and addressed. The Cedar Bayou DMMP is very limited in scope and non-controversial.

7.0 REAL ESTATE CONSIDERATIONS

The non-Federal Sponsor is required to furnish any LERRDs for the project. The non-Federal Sponsor would be eligible for LERRD credit related to the acquisition of the property required for PA 7 under the amended Local Cooperation Agreement (LCA) developed from this DMMP Report. This report includes a Real Estate Plan in Appendix B. In 2012, Chambers County conveyed PA 6, in fee, to the CLCND via a Special Warranty Deed dated 17 April 2012, and recorded on 28 March 2012, at document number 75799, deed record Vol.1344, pg 635. The Tentatively Selected Plan requires the non-Federal Sponsor to assure the availability of and capacity in PA 6. The non-Federal Sponsor shall convey to the Government a non-revocable, Non-Standard Perpetual Disposal Easement for PA 6.

Construction of the proposed PA 7 would require the acquisition of a 110-acre property that was previously developed as a recreational vehicle park. Dredge material from the Bay reach would be conveyed to PA 7 via a non-permanent dredge pipeline which would be floated within the navigable waters of the HL&P canal during dredge cycles. When it becomes necessary to place dredge materials from the Bayou Reach into PA 7, a non-permanent dredge pipeline would again be utilized. The non-Federal Sponsor shall acquire fee simple title to the property subject to certain existing easements and less mineral interest. The non-Federal Sponsor shall also convey to the Government a Non-Standard Perpetual Disposal Easement for the placement of dredge materials.

The proposed plan does not require any Access/Staging Areas. The construction of the containment dikes would be conducted within proposed PA 7 property boundaries.

PA's 1 thru 4 were constructed under Navigational Servitude; therefore the non-Federal Sponsor will not be eligible for LERRD credit related to PA's 1 thru 4. PA's 5 and 6 were constructed under a prior authorization. The non-Federal sponsor shall not receive credit for the value of an LER, including incidental costs, which have been provided previously as an item of cooperation for another Federal project, including projects that preceded enactment of WRDA 1986. To date the non-Federal Sponsor has not submitted a request for credit for PA's 5 and 6. All LERRD credit requests must comply with ER 405-1-12 paragraph 12-35 and any additional requirements set forth in the LCA. If submitted, credits for PAs 5 and 6 would be accounted for under the prior LCA. The non-Federal sponsor would be eligible for LERRD credit related to the acquisition of the property required for PA 7 under the amended LCA developed from this DMMP Report. Requests for such credit must comply with ER 405-1-12 paragraph 12-35 and any additional requirements set forth in the amended LCA.

8.0 COST APPORTIONMENT

The costs for implementing DMMPs for existing projects are O&M costs and shall be shared in accordance with navigation O&M cost sharing provisions applicable to the authorized navigation project. Dredged material disposal facility costs shall be shared in accordance with Section 201 of the WRDA 1996 (P.L. 104-303) and United States Code (33 USC 2211).

The cost estimate (see Appendix A) was prepared using the latest MII Unit Price Books, labor rates, and equipment rates for Region 6, fiscal year 2014 (October 2013). The estimate was divided into 14 contracts including dredging, and construction, maintenance, and rehabilitation of PAs, to correspond with the dredging cycles for CBLC. The midpoint date of the construction contracts were developed in conjunction with the project manager for developing fully funded costs. The estimate was prepared in accordance with ER 1110-2-1302, dated September 15, 2008. The costs were escalated in accordance with the above ER and EM 1110-2-1304, dated March 31, 2013. All of the data was input into the Total Project Cost Summary Sheet (TPCS). The baseline estimate provides for all pertinent elements for a complete project ready for operation.

Since the project cost was under 40 million dollars an abbreviated risk analysis was performed with the cooperation of the Project Delivery Team (PDT) in October 2012, revised September 2013. The risks were quantified and a cost risk model was developed to determine a contingency. The contingency along with the estimate was used in the TPCS.

First Costs for the Tentatively Selected Plan or Management Plan are detailed in Table 20.

Table 20 - Tentatively Selected Plan - First Costs Allocation ($000) [1]

Cost Account		Federal Share (90%)	Non-Federal Share (10%)	Total
	Construction General - General Navigation Features (GNF)			
12	Navigation Ports & Harbors	$3,240	$360	$3,600
06	Fish & Wildlife Facilities	$256	$28	$284
01	Lands	$0	$4,207	$4,207
30	Engineering and Design	$610	$68	$678
31	Construction Management	$139	$16	$155
	Total GNF[2]	**$4,245**	**$4,679**	**$8,924**
Operations and Maintenance – 100% Federal Cost				
	O&M (2015-2034)[3]	$19,521	$0	$19,521
	Total First Cost (CG & O&M)	**$23,766**	**$4,679**	**$28,445**

[1] Price Level – October 2013
[2]TPCS includes a 23 percent contingency for CG
[3]TPCS includes a 22 percent contingency for O&M (Dredging and Maintenance of PAs)

The non-Federal Sponsor is responsible for paying their percentage of the construction based on project depth (in this case it is less than 20 feet so their share is 10 percent). They are also responsible for providing LERRD. The DMMP costs in the cost estimate are addressed in the first contract. Subsequent contracts shown in the TPCS are O&M costs.

9.0 FEDERAL AND NON-FEDERAL RESPONSIBILITIES

The LCA will detail the specifics of responsibilities of both USACE and the non-Federal Sponsor. The proposed work is not within the provisions of the existing agreement, thus modification of the LCA would be necessary. Cost sharing of the $8,924,000 construction cost (minus $4,207,000 LERRD) would be 90 percent Federal and 10 percent non-Federal.

The major functions that the Corps would provide for this project are as follows:

- Continued project management during design and construction;
- Engineering and design including pre-dredge and after-dredge surveys, additional geotechnical investigations during design, preparation of project plans and specifications, preparation of cost estimates, and any required engineering during construction;
- Contracting services;
- Construction supervision and administration;
- Quality assurance (supervision and inspection) of construction contracts; and
- Required environmental monitoring during construction.

The CLCND supports this project and has agreed to act as the non-Federal sponsor for the project including cost-sharing the construction of PA 7. The CLCND would work with USACE to secure the necessary state and local permits and approvals for construction of the new PA 7. USACE would obtain the Water Quality Certification under Section 401 of the Clean Water Act and a Coastal Zone Management consistency determination from the TCEQ.

10.0 SPONSOR WILLINGNESS AND CAPABILITY

In a letter dated, May 29, 2013, the non-Federal sponsor stated their intent to continue to sponsor and fund their cost-shared percentage of the future maintenance of the CBLC. Based on the non-Federal sponsor's expressed intent to cost share the continued maintenance of the channel, it has been determined that the non-Federal sponsor is fully aware of the cost-sharing requirements and financially capable of fulfilling those commitments.

11.0 RECOMMENDATIONS

I have weighed the benefits to be obtained from the modification of the existing PA (PA 6) and proposed construction of the new PA (PA 7) for placement of dredged material from the CBLC against the potential impacts and costs of alternate placement options.

The recommended updated management plan is the Tentatively Selected Plan that would provide sufficient long-term dredged material disposal capacity for the CBLC through the 20-year period of analysis. This plan complies with USACE policy to accomplish the placement of dredged material associated with construction or maintenance material of a navigation project in the least costly manner while remaining consistent with sound engineering practices and meeting Federal environmental standards.

Based on these factors, I recommend approval of the 2014 Dredged Material Management Plan for the Cedar Bayou Channel in Harris and Chambers County, Texas.

_____ _____

Date

Richard P. Pannell
Colonel, Corps of Engineers
District Commander

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APPENDIX A

Cost Appendix

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APPENDIX B

Real Estate Plan

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APPENDIX C

Soil Boring Logs

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APPENDIX D

Drawings

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APPENDIX E

Value Engineer Study Memorandum

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