LLOYD
ENGINEERING, INC.

ALTERNATIVES ANALYSIS
LBC SHIP DOCK 5 PROJECT
SWG-2016-00832
HARRIS COUNTIES, TEXAS

Prepared for:

LBC Houston, LP
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Seabrook, Texas 77589

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Table of Contents

Acronyms and Abbreviations

BMP	best management practices
CY	cubic yard(s)
DSU	dock safety unit
E2EM	estuarine intertidal emergent
iHGM	interm hydrogeomorphic
LBC	LBC Houston, LP
LEI	Lloyd Engineering, Inc.
MLLW	mean lower low water
NHD	National Hydrography Dataset
NWI	National Wetlands Inventory
PEM	palustrine emergent
PFO	palustrine forested
PSS	palustrine scrub-shrub
RHA	Rivers and Harbors Act
SWG	Southwest Galveston District
USACE	U.S. Army Corps of Engineers
VCU	vessel control unit
WOUS	waters of the U.S.

1.0 Introduction

Lloyd Engineering, Inc. (LEI) on behalf of LBC Houston, LP (LBC) has prepared this alternatives analysis for the proposed Ship Dock 5 project to further justify the preferred site location and design with consideration to environmental impacts and constructability concerns. LBC proposes to construct and operate the Ship Dock 5 project at a site located adjacent to the Bayport Ship Channel, in Harris County, Texas. The proposed project consists of the construction of 1,077 feet of new 72-inch-diameter new bulkhead wall, 215 feet of sheet pile wall, new ship dock, breasting dolphins, and the construction of San Jacinto Junior College campus expansion facilities. Based on current project designs, the proposed project will include dredging 7.738 acres to a depth of -45 feet with a 2 foot over dredge to create the water depths necessary to safely maneuver incoming and outgoing vessels to the newly constructed ship dock. Dredging activities will result in the removal and relocation of approximately 450,000 cubic yards (CY). The proposed ship dock will be 60 feet wide and 90 feet long and will exhibit a 225-foot setback from the limits of the Bayport Ship Channel. The following sections detail the alternatives analysis study completed to support U.S. Army Corps of Engineers (USACE) Permit No. (SWG-2016-00832), as well as methods to be implemented to minimize potential impacts to waters of the U.S. (WOUS) as a result of construction activities.

2.0 Alternative Analysis Methodology

During the initial project feasibility study, an exhaustive alternatives analysis was conducted to determine the best project location and design which fulfills project goals and objectives while minimizing environmental impacts to the maximum extent practicable. The following sections provide details as to the alternatives analyzed, their associated impacts, and ability to fulfill project goals and objectives.

3.0 Alternative Site Analysis

LBC examined alternative project sites within the geographical area which encompassed the critical elements necessary to fulfill project objectives. The critical elements that were used to determine the preferred project site are listed below.

1. Extent of potential environmental impacts required for site modifications and construction activities.
2. Safety and navigability of incoming and outgoing vessel traffic with consideration to neighboring infrastructure and operations.
3. Overall project site constructability and associated cost.
4. Project site adjacency to existing pipeline and industrial infrastructure.
5. Neighboring land-use and esthetic perception of the proposed project.

The described critical elements necessary for the proposed project exist predominantly within highly industrialized corridors adjacent to waterways leading to Galveston Bay. A total of four alternatives were considered including No Action/No Build, Alternative Site A, Alternative Site B, and the Preferred Site. Refer to Appendix A, Figure 1 for a depiction of the locations of the project sites considered as part of the alternative site analysis.

3.1 No-Action/No-Build Alternative

The No-Action/No-Build alternative was considered as an alternative. However, the No-Action/No-Build alternative would not fulfill project objectives to offer clients the opportunity to import, export, and store petrochemical products ultimately to be sold on the domestic/international market. Construction of the proposed project would provide the intermodal transportation capabilities necessary to fulfill strategic corporate expansion initiatives and stability within a growing market.

3.2 Alternative Site A

Alternative Site A is located in Deer Park in southern Harris County, Texas. Based on a review of the National Wetlands Inventory (NWI), Alternative Site A would require permanent impacts to approximately 0.3 acres of tidally influenced wetlands and approximately 12.9 acres of non-tidally influenced wetlands. In addition, Alternative Site A would require impacts to a tidally influenced tributary that traverses the middle of the project area. Waterbodies located adjacent to Alternative Site A would require extensive dredging to provide sufficient depths necessary to safely navigate vessels to the proposed infrastructure. As such, impacts to oyster resources would likely be required to establish the site conditions required for operations. Additionally, Alternative Site A is not located adjacent to existing infrastructure and therefore would require

the installation of additional infrastructure to efficiently transport products, and thereby resulting in increased and dispersed impacts to WOUS.

3.3 Alternative Site B

Alternative Site B is located in Seabrook in southern Harris County, Texas. Alternative Site B is located in between two public recreation areas (El Jardin Beach and Pine Gully Park). As such, there was a high concern regarding the overall esthetic perception of the proposed project due to its adjacency to two major public recreation areas. Construction within the Alternative Site B project area would require permanent impacts to approximately 3.2 acres of tidally influenced wetlands and 6.5 acres of non-tidally influenced wetlands. Additionally, Alternative Site B would require a significant volume of dredged material to be removed and relocated to provide the area necessary to safely navigate both incoming and outgoing vessels to the berth infrastructure. Alternative Site B is not located adjacent to any existing infrastructure and therefore would require the installation of additional product transport and storage facilities necessary to efficiently fulfill project goals and objectives.

3.4 Preferred Site

The Preferred Site is located adjacent to the Bayport Turning Basin in southern Harris County, Texas. The Preferred Site is approximately 22.74 acres in size consisting of 7.738 acres of open-water adjacent to the Bayport Turning Basin. Terrestrial portions of the Preferred Site consist of vegetated area located adjacent to existing LBC infrastructure. The Preferred Site is located within an already industrialized area therefore allowing for sufficient access to existing petrochemical infrastructure including pipelines and storage facilities. A formal wetland delineation was conducted within the project limits of the Preferred Site and approximately 2.165 acres of palustrine forested wetlands (PFO), 3.013 acres of palustrine scrub-shrub wetlands (PSS), 0.389 acres of palustrine emergent wetlands (PEM), and 0.138 acres of estuarine intertidal emergent (E2EM) wetlands were identified. Additionally, a functional wetland assessment was conducted using the USACE-Southwestern Galveston District (SWG) interm hydrogeomorphic (iHGM) approach to determine the functional capacity of the wetlands proposed to be impacted as a result of the proposed project. In summary, the wetlands located within the project area were considered low-quality wetlands commonly occurring within the region, and predominantly consisted of monocultures of highly invasive species (*Triadica sebifera* – Chinese tallow).

3.5 Alternative Site Analysis Summary

Table 1 provides a summary of the alternative site analysis completed for the proposed project. Based on this review, the Preferred Site was selected as it presented the lowest potential for environmental impacts, low constructability concerns and associated cost, is located adjacent to existing infrastructure, with only medium concern related to neighboring esthetic perception of the proposed project.

Table 1
Alternative Site Analysis
for the Ship Dock 5 Project

Alternative Site	Waterbody Impacts [d]	Tidally Influenced Wetland Impacts [c]	Non-Tidally Influenced Wetland Impacts [c]	Adjacent to Existing Infrastructure	Construction Cost	Neighboring Esthetic Perception Concern
No Action/No Build	0	0	0	N/A	N/A	N/A
Alternative Site A [b]	12.5	0.3	12.9	No	High	Low
Alternative Site B [b]	10.3	3.2	6.5	No	High	High
Preferred Site [a]	7.738	0.138	5.567	Yes	Low	Medium

a Wetland and waterbody counts include NHD, NWI, and field-collected data.
b Wetland and waterbody counts include NHD and NWI data.
c Total acreage of wetland impacts as a result of the construction and operation of the proposed project.
d Total acreage of waterbody impacts as a result of dredging activities and impacts to tributaries within the project area.

4.0 Alternative Design Analysis

Once the preferred project site was determined, an alternative design analysis was conducted to determine the optimal project design that would fulfill project goals and objectives while minimizing adverse impacts to the maximum extent practicable. Due to the nature of the proposed project and associated infrastructure, impacts to WOUS are unavoidable. Through collaboration between project engineers and environmental investigators multiple project designs were evaluated based on the designs ability to:

1. Accommodate for the space necessary for the required building and parking lot infrastructure associated with the expansion of the San Jacinto Junior College campus;
2. Provide sufficient access to both newly constructed and existing facilities;
3. Provide sufficient vehicle parking area and terminal equipment staging areas to accommodate for the expansion of existing facilities;
4. Ensure the structural integrity and longevity of constructed infrastructure to minimize the need for future maintenance activities and additional impacts to natural resources, and;

The required infrastructure to fulfill the objectives outlined above includes a building to support the San Jacinto Junior College Campus expansion initiatives and adequate parking areas, vessel control unit (VCU) building, dock safety unit (DSU) building, pipe rack, ship dock platform, and sufficient access roads to allow access between the proposed infrastructure and existing neighboring infrastructure. As part of the proposed project, modifications to existing site contours and elevations would be required to bring the project area to a sufficient elevation to ensure structural integrity and longevity of the constructed infrastructure. Two project design configurations were analyzed to determine which fulfilled the above described criteria with minimal impacts to WOUS, including wetlands.

4.1 Alternative Design A – Original Design

The Original Design consist of modifications to existing project area contours and elevations to land located above the mean lower low water (MLLW) line as well as the discharge of fill material located below the MLLW line. Approximately 1.1 acres of open-water located below the MLLW would be filled behind the proposed bulkhead wall to create the space necessary to accommodate the proposed infrastructure

associated with the Original Design. The Original Design would result in approximately 14.5 acres of permanent impacts to WOUS, including wetlands, as a result of the required modifications to existing site elevations and fill activities within areas located behind the bulkhead wall. Refer to Appendix A, Figure 2 for a depiction of the Original Design for the proposed project.

Following conversations with the Houston Piolets, modifications to the original project design were required to ensure the navigational safety for incoming and outgoing vessel traffic as well as on-site and neighboring personnel. As such, LBC revised the proposed project design to what is now recognized as the Preferred Design.

4.2 Preferred Design

Through collaboration between project engineers and environmental investigators, the Preferred Design was developed to accommodate for the navigational safety concerns of the Houston Piolets and minimize impacts to WOUS where possible. The preferred design utilizes the minimum space possible to safely construct and operate the proposed infrastructure. The Preferred Design consisted of modifications to the alignment of the proposed bulkhead wall to avoid fill within all areas located below the MLLW. Additionally, the revised alignment provided the space necessary to ensure the safety of on-site and neighboring personnel and ongoing vessel traffic. The Preferred Design would result in approximately 13.44 acres of unavoidable permanent impacts to WOUS as a result of the required modifications to existing elevations to establish site conditions to ensure structural integrity and longevity of the proposed project. Refer to Appendix A, Figure 3 for a depiction of the Preferred Design for the proposed project.

5.0 Alternative Analysis Summary

This analysis was completed based on comprehensive knowledge of the requirements to complete a project in this environment. The information was assembled, as requested, to further justify the preferred project site location and design with consideration to environmental impacts and constructability concerns. The preferred project location and design was selected as it presents the lowest potential for environmental impacts, constructability concerns, and hazard to project personnel while accomplishing the project purpose and need.

6.0 Avoidance and Minimization of Adverse Effects to Waters of the U.S.

Through collaboration between project engineers and environmental investigators, LBC has minimized impacts to WOUS, including wetlands, through strategic site selection, modifications to project designs, and minimization of the space necessary to fulfill project goals and objectives. Best Management Practices (BMPs) will be utilized to minimize the potential for temporary impacts to waters of the U.S. to the greatest extent practicable during construction and dredging activities. The excavation and temporary side casting of material will be completed using BMPs. As such, material temporarily side-cast will be placed at nearby locations of the highest elevation practicable to prevent potential adverse effects as a result of the proposed construction activities.

LBC has made every effort to prevent the development of multiple sites which reduces operational efficiencies, requires the installation of additional infrastructure (i.e. pipelines; storage facilities), and results in increased and dispersed impacts to WOUS and fragmentation of natural resources. For impacts to WOUS that cannot be avoided, LBC is proposing compensatory mitigation through a permittee-responsible mitigation project.

Appendix A

Alternatives Analysis Figures

ALTERNATIVE SITE ANALYSIS MAP

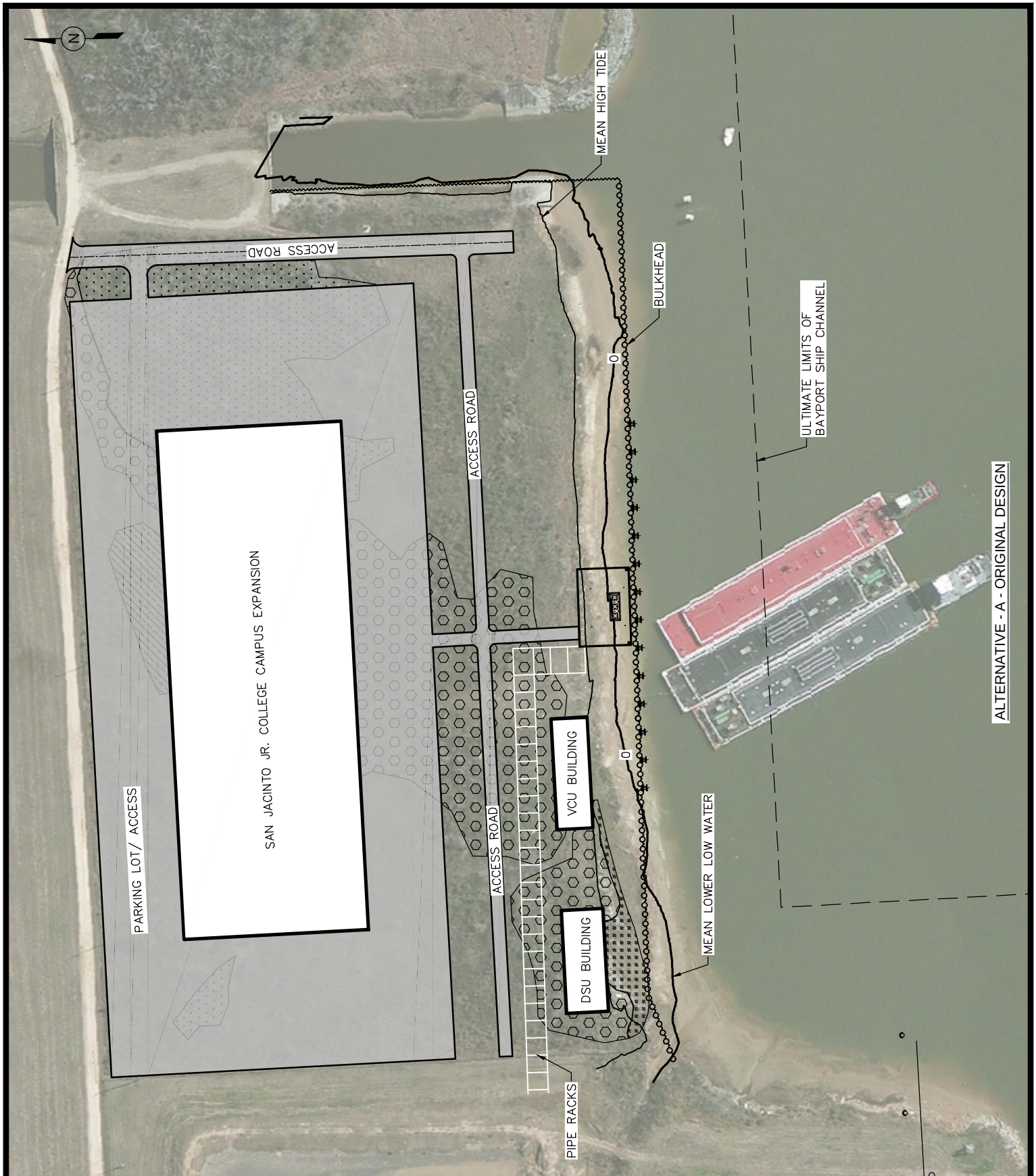
PURPOSE:	PROPOSED SHIP DOCK 5 ALTERNATIVES ANALYSIS	OWNER:	LBC HOUSTON, LP
		APPLIED BY:	LLOYD ENGINEERING
		APPLIC. No:	SWG-2016-00832
LOCATION:	HOUSTON, TX	COUNTY:	HARRIS
		WATER BODY:	BAYPORT SHIP CHANNEL
		DATUM:	MLLW

LLOYD ENGINEERING, INC
HOUSTON TEXAS, USA
LICENSE NO. F-002846

DESIGN BY:	MW
DRAWN BY:	JB
SCALE:	1"=6000'-0"
DATE:	01/13/17

SHEET No:
FIGURE 1

FILE NAME: E:\Dropbox (Lloyd Engineering)\LEI PROJECTS\LBC\Houston DOCK\Ship Dock 5\PERMITS\ALTERNATIVES ANL\FIG.1_ALTERNATIVE ANALYSIS MAP.dwg LAYOUT NAME: Layout1 PLOTTED: Friday, February 03, 2017 - 3:22pm USER: Jesus



PURPOSE:	PROPOSED SHIP DOCK 5 ALTERNATIVES ANALYSIS	OWNER:	LBC HOUSTON, LP	LLOYD ENGINEERING, INC HOUSTON TEXAS, USA LICENSE NO. F-002846	DESIGN BY: MW
		APPLIED BY:	LLOYD ENGINEERING		DRAWN BY: JB
		APPLIC. No:	SWG-2016-00832		SCALE: 1"=150'-0"
LOCATION:	HOUSTON, TX	COUNTY:	HARRIS		DATE: 01/13/17
		WATER BODY:	BAYPORT SHIP CHANNEL		SHEET No: FIGURE 2
		DATUM:	MLLW		

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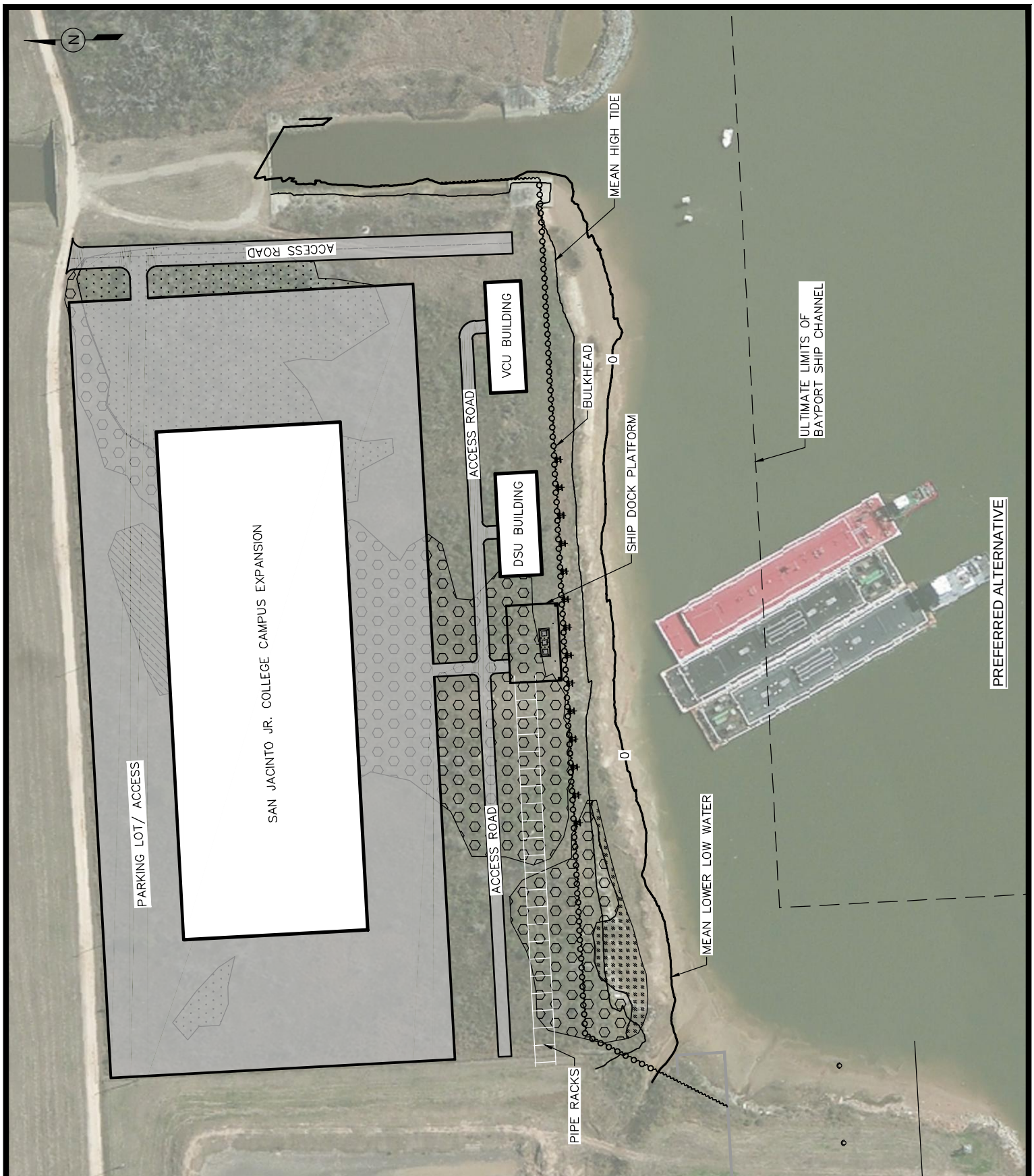

PURPOSE:	PROPOSED SHIP DOCK 5 ALTERNATIVES ANALYSIS	OWNER:	LBC HOUSTON, LP
		APPLIED BY:	LLOYD ENGINEERING
		APPLIC. No:	SWG-2016-00832
LOCATION:	HOUSTON, TX	COUNTY:	HARRIS
		WATER BODY:	BAYPORT SHIP CHANNEL
		DATUM:	MLLW

LLOYD ENGINEERING, INC
HOUSTON TEXAS, USA
LICENSE NO. F-002846

DESIGN BY:	MW
DRAWN BY:	JB
SCALE:	1"=150'-0"
DATE:	01/13/17

SHEET No:

FIGURE 3

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