thompson
ENGINEERING

SUPPLEMENTAL EVALUATION OF ALTERNATIVES

RESTORATION OF THE NORTHERN END OF MON LOUIS ISLAND FOWL RIVER, MOBILE COUNTY, ALABAMA

FEBRUARY 20, 2015

Prepared for:

Mobile Bay National Estuary Program
118 N. Royal Street, Suite 601
Mobile, AL 36602

Thompson Engineering Project No.: 13-1101-0242

2970 Cottage Hill Road, Ste. 190
Mobile, AL 36606
251.666.2443 ph. / 251.666.6422 fax
www.thompsonengineering.com

A THOMPSON HOLDINGS, INC. COMPANY

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION AND BACKGROUND

The Mobile Bay National Estuary Program (MBNEP) was awarded funding in late 2013 from the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund (GEBF) for Fowl River Watershed Restoration. The grant includes restoration of the northern tip of Mon Louis Island, which is situated at mouth of Fowl River at its entrance from Mobile Bay. The Mon Louis Island (MLI) restoration project is intended to protect 8 acres of existing tidal salt marsh threatened by shoreline erosion, and create up to 6 acres additional habitat. MBNEP established the overall goals for the MLI restoration to be: (1) stabilize the shoreline along the bay side of the northern tip of Mon Louis Island, and (2) create/enhance aquatic, wetland, and upland habitats to the extent feasible.

Field investigations and initial data acquisition activities were performed in late 2013 and early 2014, along with conceptual restoration planning and preliminary evaluation of alternatives. These were presented in a draft alternatives evaluation report in June 2014. A range of options was considered for shoreline stabilization, as well for land reclamation fill for marsh creation.

At that time, transport and delivery of fill materials from dredge material "beneficial use" sites or commercial borrow areas to the restoration site by truck or barge, with mechanical unloading and placement on the restoration site, appeared infeasible because of economic and other reasons. Hydraulic dredging of sediments from an open water borrow source located approximately 1,000 to 2,000 feet east of the restoration site was recommended as the most cost-effective method for marsh creation fill placement, and use of the open water borrow source was selected for advanced design. However, it was noted that increased regulatory review and possible permitting issues could be anticipated since the open water borrow area had not been dredged in the past.

For shoreline protection, after review of various technical, economic, and stakeholder acceptance issues presented in the June 2014 alternatives evaluation, MBNEP selected a continuous rock dike as the preferred method. Aesthetics and public acceptance were factors in the selection of the rock dike alternative. A breakwater design alignment for advanced design was selected with the resultant project features as summarized below:

Fill Quantity (in place)	- 24,800 CY
Dredge Quantity	- 37,200 CY
Total Shoreline Stabilization Length	- 1,420 ft.
Fill Area (Marsh Creation)	- 4 acres

Engineering for the selected alternative was advanced to a 50% Preliminary Design submittal dated August 22, 2014. That submittal included a Basis of Design Report, preliminary engineering drawings and outline specifications, the Engineer's Opinion of Probable Cost (OPC) for construction, and a final Alternatives Evaluation Report. It should be noted that the final alternatives evaluation report issued in August 2014 presented the same analysis as the draft report issued in June 2014, except that discussion was added describing selection of the preferred alternative.

Regulatory coordination with USACE was initiated coincident with a 9-15-2014 project review meeting between NFWF and MBNEP. The 50% Design submittal documents were shared with USACE at that time. A subsequent informal meeting was held with USACE planning and operational representatives on 9-30-2014 to discuss technical aspects of the proposed project. USACE suggested at that time that the Fowl River Dredge Material Management Area (DMMA) be further evaluated as a potential source of fill, with consideration of a material handling techniques that can handle slurries with higher solids content ("Putzmeister" pump technology). Investigation of the Fowl River DMMA was performed during October 2014.

On 10-29-2014 a formal permit "pre-application" meeting was held with USACE and several coordinating agencies, including the Alabama Department of Environmental Management (ADEM), Alabama Department of Conservation and Natural Resources (ADCNR), and National Oceanic and Atmospheric Administration (NOAA). Based on agency comments at the pre-application meeting and afterward, permitting issues related to the proposed open water borrow source appeared problematic. It was known by that time that use of the Fowl River DMMA did not appear feasible, and it was decided that additional, more in-depth, evaluation should be performed for other possible "beneficial use" dredge material borrow sources and fill delivery/placement methods. This report presents the results of these supplemental alternatives evaluations.

2.0 SUPPLEMENTAL ALTERNATIVES EVALUATION

2.1 General

During the original alternatives evaluation (reported in June 2014), delivery of large quantities of fill materials by haul truck via Old Shipyard Road (which accesses the restoration site from the south) was ruled out because of the expected public opposition, as well as the potential for damages to the roadway itself. Transport and delivery of fill materials to the site by barge, with mechanical unloading and placement on the site was considered for several possible sources of fill. These included commercial "borrow pit" sources, USACE dredge material areas on Blakeley and Pinto Islands, and the Alabama State Port Authority (ASPA) dredge material area the west end of the Theodore barge canal. As reported, transport and delivery costs were estimated on the order of $30 to $45 per cubic yard and such fill sources were ruled out at that time. During the previous evaluation, a local "heavy construction" contractor had been consulted who has direct experience in excavating and hauling dredge materials from both Blakeley Island and Theodore DMMAs. Their estimates included input from a local marine contractor for water-side operations, and considered two different barge loading areas, one of which was property at the end of Byrnewood Drive at the mouth of Fowl River on its north side (i.e., north and across the channel from the restoration site). For reference, the estimated costs using the ASPA Theodore DMMA and Byrnewood Drive barge loading / transfer location were around $35 per CY (including mobilization). Comparatively, estimates using the Blakeley Island DMMA and Byrnewood Drive barge loading / transfer location were around $44 per CY (including mobilization).

The Fowl River DMMA had been considered but not evaluated in detail during the initial alternatives analysis, because materials had never been mined from it before and there was no available information concerning its suitability. The testing of Fowl River navigation channel sediments, however, suggested that predominantly unsuitable fine-grained materials (silts and clays) would be anticipated.

The supplemental alternatives evaluation reported herein has considered variations in material handling, delivery, and placement methods, as well as site-specific sediment characterization at the Fowl River DMMA and the ASPA Theodore DMMA (see Figure 1, Location Map). Valuable advice and consultation was received from Nate Lovelace (USACE, Operations Division) and a marine dredging contractor with specialized material handling expertise.

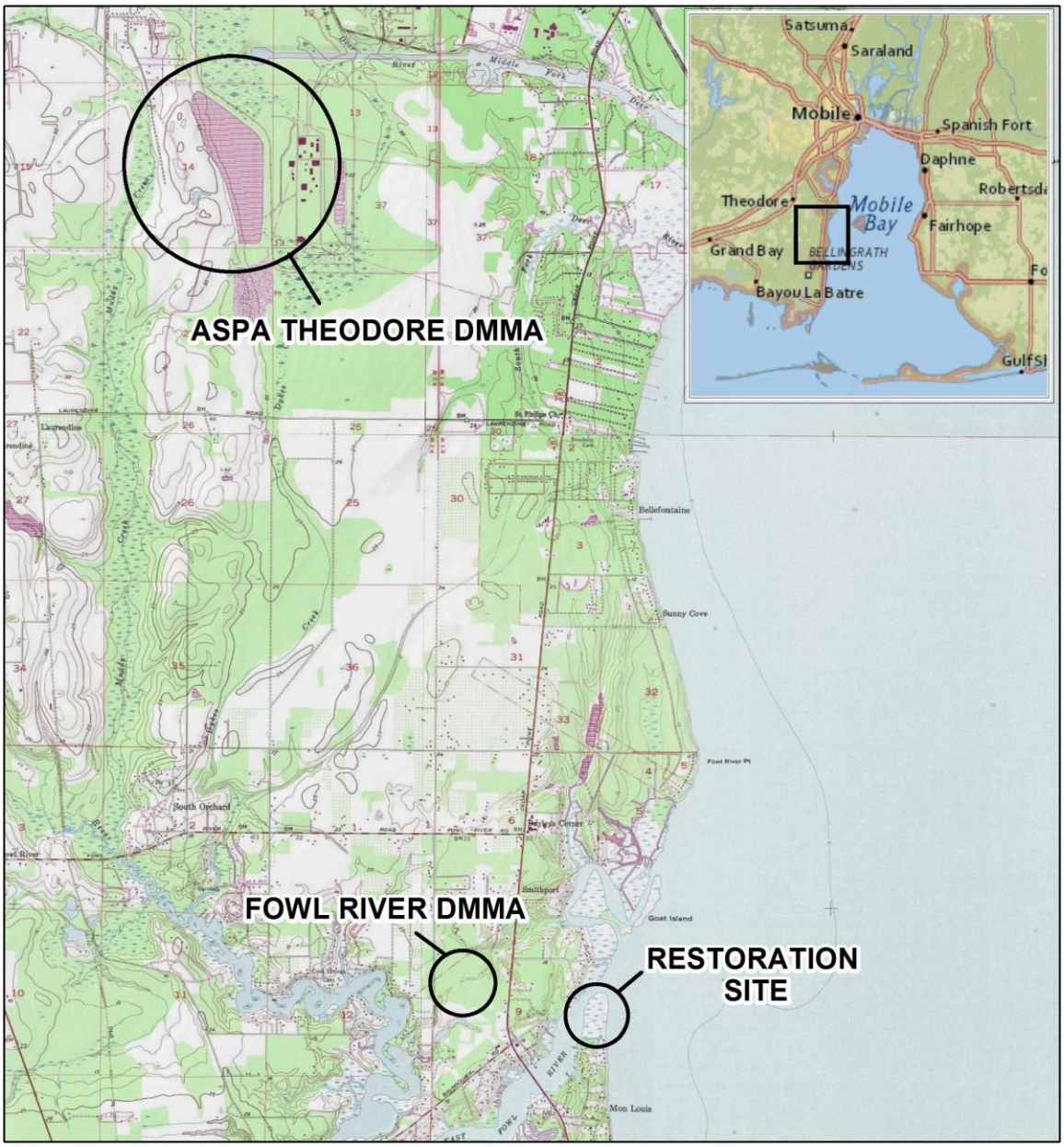


Figure 1: Beneficial Use Dredge Material Areas Investigated

2.2 Fowl River DMMA Evaluation

After arranging permission for access to the site from the Mobile County Environmental Services Department, Thompson Engineering performed subsurface investigation of the Fowl River DMMA on 10-9-2014. The investigations included hand auger borings in the upper cell where the best (sandiest) material would be encountered, immediately downstream of the location of inflow during dredging operations. Subsequently, laboratory tests were performed for classification purposes. A boring location map and boring logs with laboratory test results are included in Appendix A.

The Fowl River DMMA sediments are predominantly clays and sandy clays throughout (USCS CH and CL), except for minor amounts of sandier materials in the borings closest to the dredge inflow location. These results indicated that conventional hydraulic pumping methods to transport the materials to the restoration site would not be feasible, for the same reasons that hydraulic dredging of navigation channel sediments was infeasible (insufficient receiving area capacity at the restoration site for effective and timely dewatering).

Using "Putzmeister" pump technology for finer-grained materials (silts and clays) holds promise for the type of sediments encountered in the Fowl River DMMA, because pumping a slurry with much higher solids content (than conventional hydraulic pumps) would minimize the dewatering difficulties at the placement site. Putzmeister technology is widely used for applications such as concrete pumps; however, its applicability for movement of dredge material sediments has many more uncertainties. Success could not be guaranteed for use of the technology to transport sediments over the distance from the Fowl River DMMA to the MLI restoration site, and therefore specifying its use in commercially-bid construction is impractical. Trial use of the technology would make an interesting demonstration project for research purposes, however.

2.3 Conventional Hydraulic Pumping From Byrnewood Drive Staging Area

Subsequent to determination that use of the Fowl River DMMA was not feasible, further discussions were held concerning other possible beneficial use areas (such as Gaillard Island). Consideration was also given to other methods of material transport and placement at the restoration site, as well as other possible staging areas. Consensus was reached that the most cost-efficient approach (that avoids use of the originally-proposed open water borrow site) would be to truck haul material from the ASPA Theodore DMMA to the Byrnewood Drive staging area, and then use conventional hydraulic slurry pumping to place the material on the restoration site. A temporary pipeline crossing the Fowl River navigation channel would need to be installed, as schematically depicted in Figure 2 below.

Verbal conversation with a representative of the Byrnewood Drive staging area property owner (Isle Aux Oies Corp.) indicated that the property probably could be made available for lease. Conversation with a representative of ASPA indicated that material from the Theodore DMMA could be used. Therefore, it was decided to perform continued evaluation of this option. It is noted that use of the materials the USACE Blakeley (or Pinto) Island DMMA would be technically feasible, but considerably more costly (~$9 per CY higher) due to the greater haul distance.

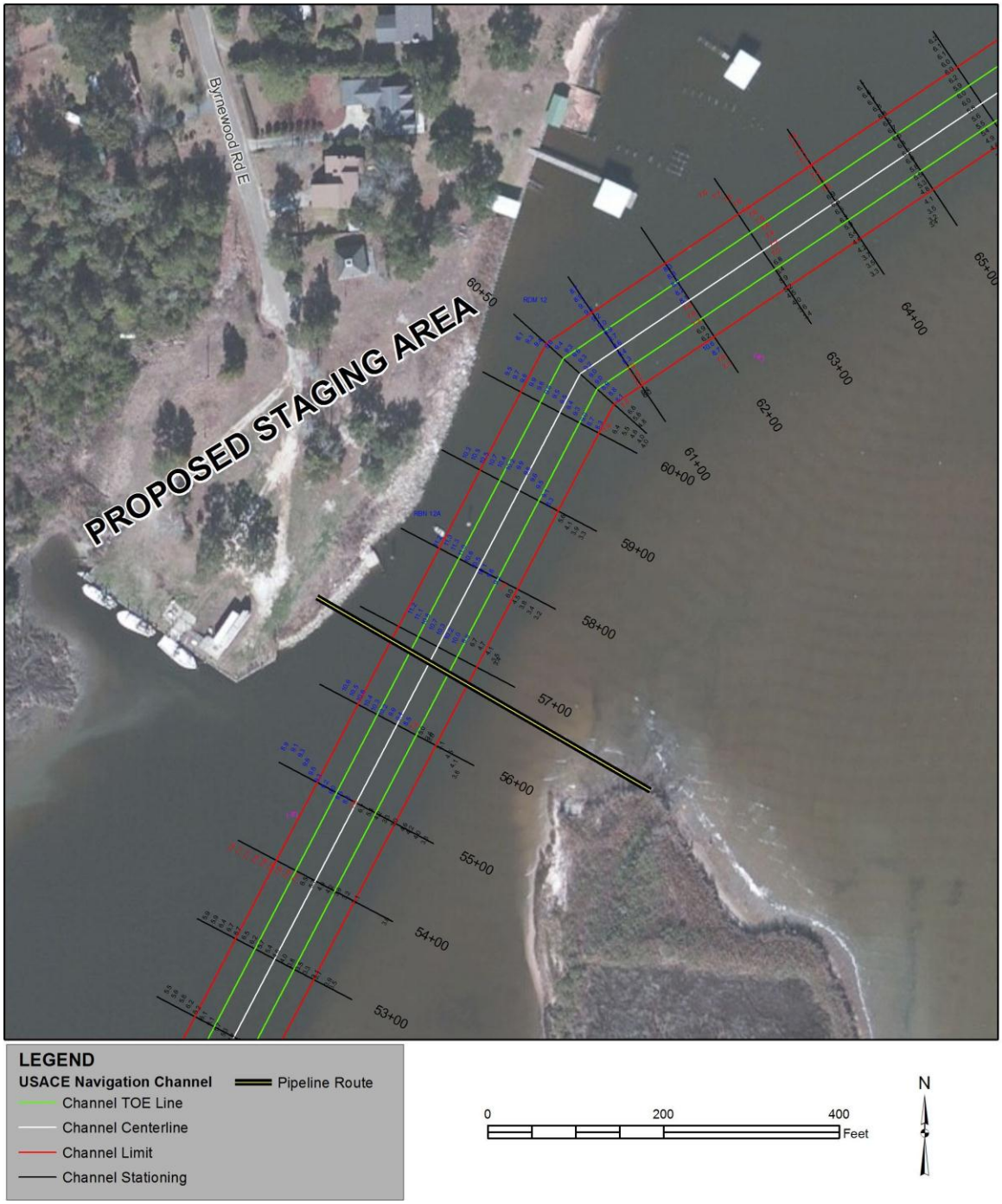


Figure 2: Byrnewood Drive Staging Area and Pipeline Crossing to Restoration Site

2.4 ASPA Theodore DMMA Evaluation

Although sediment characteristics at the ASPA Theodore DMMA were expected to be suitable, significant quantities of material have been removed in recent years and the available quantity of accessible suitable material was uncertain. After arranging permission to access the site from the ASPA, Thompson Engineering performed subsurface investigation of the ASPA DMMA on 1-14-2015. The investigations included hand auger borings at selected locations where material could potentially be excavated. Subsequent laboratory tests were performed for classification purposes. A boring location map and boring logs with laboratory test results are included in Appendix B.

Review of the soil borings material classifications, and depths prior to encountering groundwater, indicate that sufficient quantities of suitable material are available at the ASPA Theodore DMMA site.

2.5 Breakwater Construction Alternate Considerations

Comparative Durability of OysterBreak™

As noted previously, following the June 2014 alternatives evaluation MBNEP selected a continuous rock dike as the preferred shoreline stabilization method, and engineering of the rock dike breakwater was subsequently advanced to the 50% Design stage. The Preliminary Basis of Design Report dated August 22, 2014 included an analysis of the stability and damage potential of the structure during times when design conditions are exceeded, and the rock dike structure was analyzed under Category I-V storm surge and wave conditions. The analysis indicated that structure damage is not expected until a Category IV storm – at which time intermediate damage is expected to be sustained. During a Category V storm, over 30% of the rock is expected to be mobilized from the dike, resulting in structure failure.

During the 9-15-2014 project review meeting with MBNEP and NFWF, it was asked if similar analysis could be provided for the continuous OysterBreak™ structure alternative initially considered during the earlier Draft Alternatives Evaluation phase (June 2014) of project planning. Further evaluation was conducted, as presented below.

Hydraulic stability formulae such as the Hudson and van der Meer equations are not available for the unique geometry of the OysterBreak™ units. However, literature and design documentation from two OysterBreak™ living shoreline projects in Louisiana performed by others (one ongoing, one completed), indicate that, for approximately equivalent structure cross-sections, heavier (than those considered in the previous alternatives evaluation) OysterBreak™ units would be required for comparable stability

to a rubble-mound (rock dike) counterpart. Still, quantitative determination of the OysterBreak™ configuration and unit weight required to achieve the equivalent hydrodynamic stability (compared to rock) under design and category storm conditions, a 2D/3D numerical modeling assessment would be required.

In general, the OysterBreak™ technology is a relatively novel development in shoreline protection. There is still much uncertainty regarding long-term performance, stability, longevity, etc. of these structures on a site-specific basis. OysterBreak™ implementations are still being performed on the demonstration scale for state and federal entities, and are often accompanied by detailed 2D/3D numerical modeling assessments, in the absence of well-understood empirical calculations for stability and performance, backed up by years of industry knowledge and observations – such as exists for rock.

In summary, in absence of more detailed modeling analyses, the ability of the OysterBreak™ alternative to withstand more extreme storm events is subject to more uncertainty, compared to the selected rock dike alternative. While this could perhaps be mitigated by specifying heavier units, potential cost savings suggested by the June 2014 alternatives analysis would likely be negated.

Breakwater Construction Methods

In the August 2014 50% Design, an access/work channel was proposed outboard and paralleling the breakwater, with an 80-foot width and 6-foot depth. This channel would allow side-by-side barge fleeting during construction. During the permit pre-application meeting, questions were raised whether the access/work channel could be constructed inboard of the dike to minimize channel dredging impacts. Preliminarily, pending updated geotechnical slope stability analysis during final design, inboard construction of the access/work channel appears feasible, but only for a lesser-width channel (~ 40-foot) which would eliminate side-by-side barge fleeting.

Construction of the rock dike breakwater with use of the Byrnewood Drive staging area was also considered. This alternate would involve truck haul of the bedding stone and rip rap to the staging area, where it would be loaded onto barges and transported across the channel to the work site. This alternate appears feasible and was used as the basis for the updated construction cost estimate presented in the next section.

3.0 ENGINEER'S OPINION OF PROBABLE COSTS

An Engineer's Opinion of Probable Costs (OPC) of construction for the Byrnewood Drive Staging Area Alternate has been prepared and is included in Appendix C. For reference purposes, the prior August 2014 Engineer's OPC for the 50% Design Open Water Borrow Source Alternate is also included in Appendix C.

The total estimated construction costs, including 10% contingencies, for the two alternates are summarized below:

Comparative Construction Cost Estimates With Contingencies

- Engineer's OPC – Byrnewood Drive Staging Area (Feb. 2015) $2,281,000
- Engineer's OPC – Open Water Borrow Alternate (Aug. 2014) $1,654,000

Difference $ 627,000

The Engineer's OPC for the Byrnewood Drive Staging Area Alternate assumes that soil fill would be truck hauled to the staging area, from which it would be slurry pumped across the channel to the restoration site. The OPC also assumes that rock dike construction materials (bedding stone and rip rap) would be truck hauled to the staging area and loaded onto barges there for transport to the work site. Based on the estimated soil fill of 37,200 CY, approximately 1,860 truckloads would be required if 20-CY dump trucks are used. Similarly, if rock materials are delivered in 30-ton loads, the estimated 7,527 tons of materials (2,380 tons of bedding stone and 4,877 tons of rip rap) would require approximately 242 truckloads. This volume of truck traffic on Byrnewood Drive, a residential road, would likely cause some damages that would require repair. Estimating such repairs is difficult with the limited information available at this time, and the Engineer's OPC includes a conservative allowance of $150,000 for Byrnewood Drive repair. This allowance, in essence, represents some extra contingency for the Byrnewood Drive Staging Area Alternate.

If the two alternates are compared without the 10% contingencies and without the Byrnewood Drive repair allowance, total estimated construction cost estimates would be:

Comparative Construction Cost Estimates Without Contingencies or Road Repair Allowance:

- Engineer's OPC – Byrnewood Drive Staging Area (Feb. 2015) $1,923,697
- Engineer's OPC – Open Water Borrow Alternate (Aug. 2014) $1,503,943

Difference $ 419,745

Comparison of the two alternates can also be presented for the relative proportions associated with rock dike construction (per linear foot of dike) and marsh creation (per

acre). This is intended to allow a basis of comparison with other projects, as well as between the two alternates. For the purpose of this comparison, and referencing the Engineer's OPCs in Appendix C, the proportional estimate from the August 2014 OPC for rock dike construction includes Item Nos. 1.00, 1.02 through 1.07, and 1.10. Likewise, the marsh creation proportion from August 2014 includes Item Nos. 1.01, 1.08, and 1.09. Similarly, the proportional estimate from the February 2015 OPC for rock dike construction includes Item Nos. 1.02 through 1.04, and 1.06 through 1.09. Likewise, the marsh creation proportion from February 2015 includes Item Nos. 1.00, 1.01, 1.05, 1.10, 1.11, and 1.13. Item No. 1.12 (Byrnewood Drive Repair Allowance) is not included in this comparison, nor are the 10% contingencies. The analysis yields the following comparison:

Comparative Rock Dike Construction Cost Estimates (Without Contingency):

- Engineer's OPC – February 2015 $ 831,600
- Engineer's OPC – August 2014 $ 951,900

  Difference ($ 120,300)

  For 1,420 linear feet of dike:
- Engineer's OPC – February 2015 $ 586 per lf
- Engineer's OPC – August 2014 $ 670 per lf

  Difference ($ 84 per lf)

Comparative Marsh Creation Construction Cost Estimates (Without Contingency or Byrnewood Drive Repair Allowance):

- Engineer's OPC – February 2015 $ 1,092,100
- Engineer's OPC – August 2014 $ 552,000

  Difference $ 540,100

  For 4 acres of marsh creation:
- Engineer's OPC – February 2015 $ 273,000 per acre
- Engineer's OPC – August 2014 $ 138,000 per acre

  Difference $ 135,000 per acre

The predominant reason for the cost differential between the two alternates is the increased cost related to land reclamation fill needed for marsh creation. In the August 2014 OPC, which assumed an open water borrow source and hydraulic dredging, related costs for the 37,200 CY dredging (Item Nos. 1.01 and 1.08) equaled $517,000 (~$14 per CY). In the February 2015 OPC, which assumes truck hauling the fill to the staging area and then slurry pumping it to the restoration site, related costs for the 37,200 CY required (Item Nos. 1.01, 1.10, and 1.11) equals $1,002,100 (~$27 per CY).

As evidenced from the above analysis, the cost-effectiveness of the marsh creation component of the project is substantially diminished unless a hydraulic dredging borrow source can be utilized. Consideration may be given to only constructing the shoreline stabilization component of the project at this time. In that event, it is recommended the August 2014 Engineer's OPC be used for budgetary purposes, including 10% contingency, as follows:

Recommended Budget for Rock Dike Construction Only (With Contingency):

- Engineer's OPC – August 2014 $ 951,900
- 10% Contingency $ 95,190

Total $1,047,090 ($1,050,000 rounded)

4.0 REFERENCES CITED

Thompson Engineering, Inc., June 4, 2014. Draft Alternatives Evaluation Report, Restoration of the Northern End of Mon Louis Island, Fowl River, Mobile County, Alabama.

Thompson Engineering, Inc., August 22, 2014. Alternatives Evaluation Report, Restoration of the Northern End of Mon Louis Island, Fowl River, Mobile County, Alabama.

Thompson Engineering, Inc., August 22, 2014. Preliminary Basis of Design Report, 50% Submittal (Draft).

APPENDIX A

FOWL RIVER DMMA SUBSURFACE INVESTIGATION

LEGEND

Boring Location

1:4,800

0 400 800 Feet

1 inch = 400 feet

N

City of Mobile 2010 Imagery - 1Ft. Resolution
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

MON LOUIS ISLAND
SHORELINE RESTORATION
MOBILE COUNTY, ALABAMA

thompson ENGINEERING

FIGURE 1
BORING LOCATION PLAN

PROJECT NO.: 13-1101-0242

DATE: OCTOBER 2014

P:\2013\1101\13-1101-0242 DISL-MBNEP Mon Louis Island S. O'Hearn\Drawings\MXD\Boring_Plan_PT(8.5x11).mxd

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-1

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 3.0 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 21 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1		Brown and gray												
20				S-2		Gray		83.8	67.6	77	52							
				S-3	CLAY (CH)	Gray												
5				S-4		Gray		86.0	101	94	67							
15				S-5		Gray												
						Boring terminated at 7.5 ft.												
						Northing: 165077 Easting: 1773439												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-2

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 3.0 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 21 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1		Gray and brown, with trace sand												
20				S-2		Gray		82.2	82.7	110	84							
				S-3	CLAY (CH)	Gray												
5				S-4		Gray		90.9	120	108	80							
15				S-5		Gray												
						Boring terminated at 7.5 ft.												
						Northing: 165046 Easting: 1773555												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-3

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 3.0 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 21 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1		Gray and brown												
20				S-2		Gray												
				S-3	CLAY (CH)	Gray												
5				S-4		Gray												
15				S-5		Gray												
						Boring terminated at 7.5 ft.												
						Northing: 165068 Easting: 1773728												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-4

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 3.0 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 21 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1		Gray and brown, with trace sand lenses												
20				S-2		Gray		87.9	70.9	85	61							
				S-3	CLAY (CH)	Gray												
5				S-4		Gray		90.0	99.6	131	101							
15				S-5		Gray												
						Boring terminated at 7.5 ft. Northing: 164985 Easting: 1773478												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-5

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 4.5 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 22 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1		Gray and brown, with some sand lenses												
20				S-2		Gray and brown		91.0	80.2	106	71							
				S-3	CLAY (CH)	Gray												
5				S-4		Gray		87.1	91.8	95	70							
15				S-5		Gray												
						Boring terminated at 7.5 ft. Northing: 164916 Easting: 1773551												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-6

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH:

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 22 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1	SANDY CLAY (CL)	Gray and brown, with some sand lenses												
20				S-2		Dark gray		91.9	107	79	50							
				S-3	CLAY (CH)	Dark gray												
5				S-4		Dark gray		64.7	53.8	46	30							
15				S-5	SANDY CLAY (CL)	Dark gray												
						Boring terminated at 7.5 ft. Northing: 164874 Easting: 1773830												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-7

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 4.5 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 22 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1	SILTY SAND (SM)	Fine grained, light brown, with 3" clay lense												
20				S-2	CLAY (CL)	Gray												
				S-3	CLAY (CH)	Gray												
5				S-4		Gray												
						Boring terminated @ 5.0'. Hit stump and could not advance.												
						Northing: 164808 Easting: 1773471												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-8

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 5.0 ft.

PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 23 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1	SILTY SAND (SM)	Gray and brown, with clay lenses												
				S-2	SILT (ML)	Gray		83.3	47.9	NP	NP							
20				S-3	CLAY (CL)	Gray												
				S-4		Gray		80.6	72.6	78	57							
5				S-5	CLAY (CH)	Gray												
						Boring terminated at 7.5 ft. Northing: 164804 Easting: 1773596												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B-9

PROJECT: Mon Louis Island Shoreline Restoration
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: J. Fancher

SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 5.0 ft.

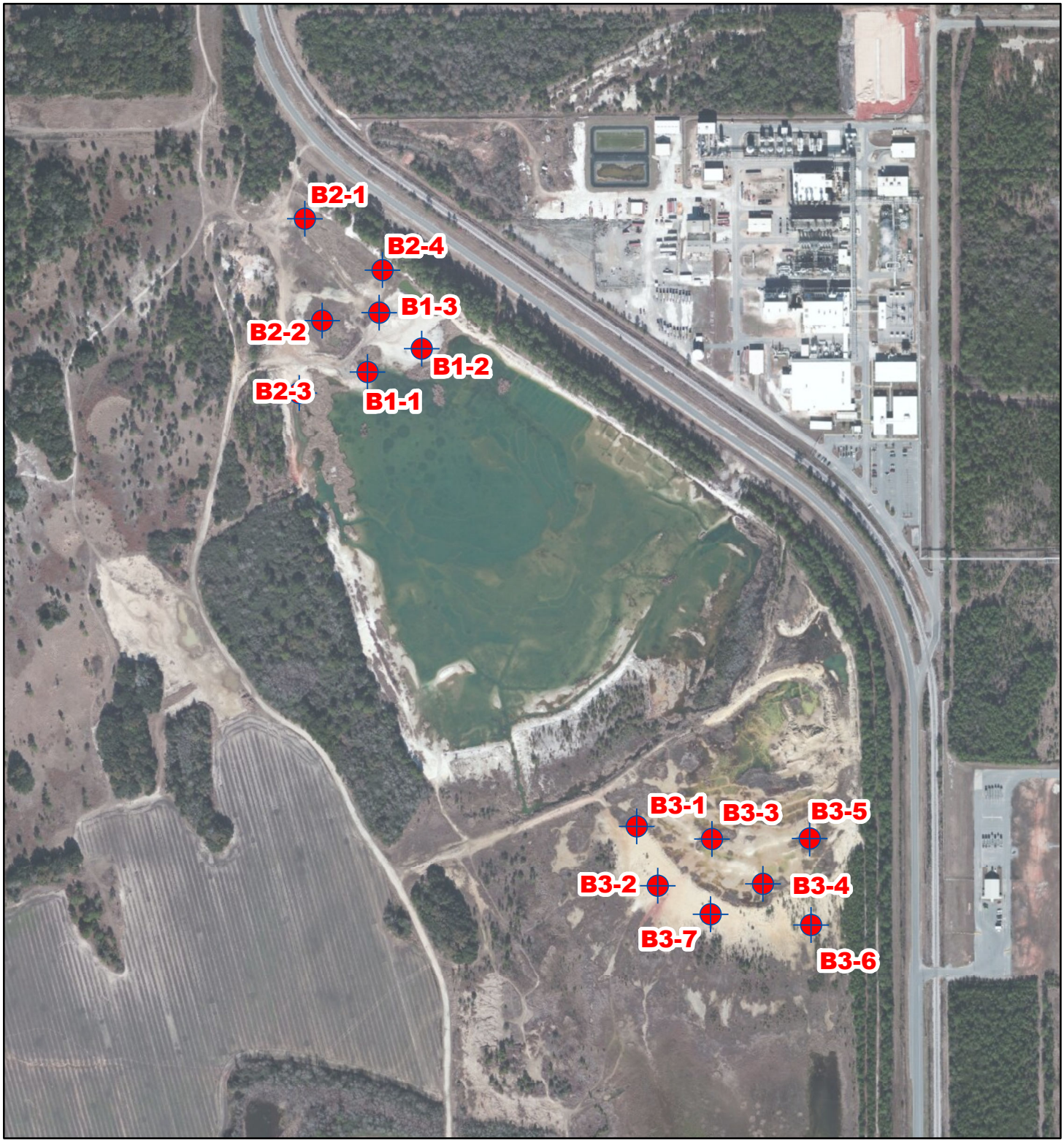
PAGE: 1 of 1
LAT.: ---
LONG.: ---
DATE: 10/09/14
WEATHER: Sunny
ELEVATION: 24 ft.

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0				S-1		Light brown and light gray, then, fine grained, light												
				S-2	SANDY CLAY (CL)	brown, silty sand Gray												
20				S-3	SAND (SP)	Fine to medium grained, red and light brown, with trace												
5				S-4	SANDY CLAY (CL)	clay lenses, sandy clay bottom 2"												
				S-5	SILTY SAND (SM)	Dark gray, then bottom 12" fine grained, silty sand												
				S-6	CLAY SAND (SC)	Fine grained, light brown and gray												
15						Fine grained, dark gray, with clay lenses												
						Boring terminated at 9.0 ft.												
						Northing: 164684 Easting: 1773796												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

APPENDIX B

ASPA THEODORE DMMA SUBSURFACE INVESTIGATION



1:6,000

0 500 1,000 1,500 Feet

1 inch = 500 feet

N

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ASPA THEODORE DREDGE AREA
MBNEP MON LOUIS ISLAND RESTORATION

thompson ENGINEERING

SOIL TEST BORING LOCATIONS

PROJECT NO.:	DATE:
13-1101-0242	FEBRUARY 2014

P:\2013\1101\13-1101-0242 DISL--MBNEP Mon Louis Island S. O'Hearn\Drawings\MXD\Boring_Plan_ASPA Theodore Dredge Area_PT(8.5x11).mxd

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B1-1

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 3 ft.

PAGE: 1 of 1

LAT.: N30.52835

LONG.: W88.14729

DATE: 1/14/15

WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine to medium grained, light brown												
					SANDY CLAY (CL-SC)	Light brown												
					SAND (SP)	Medium grained, light gray Moist at 2.5 ft. Saturated at 3.0 ft.												
						Boring terminated at 3.5 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B1-2

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 4 ft.

PAGE: 1 of 1

LAT.: N30.52858

LONG.: W88.14668

DATE: 1/14/15

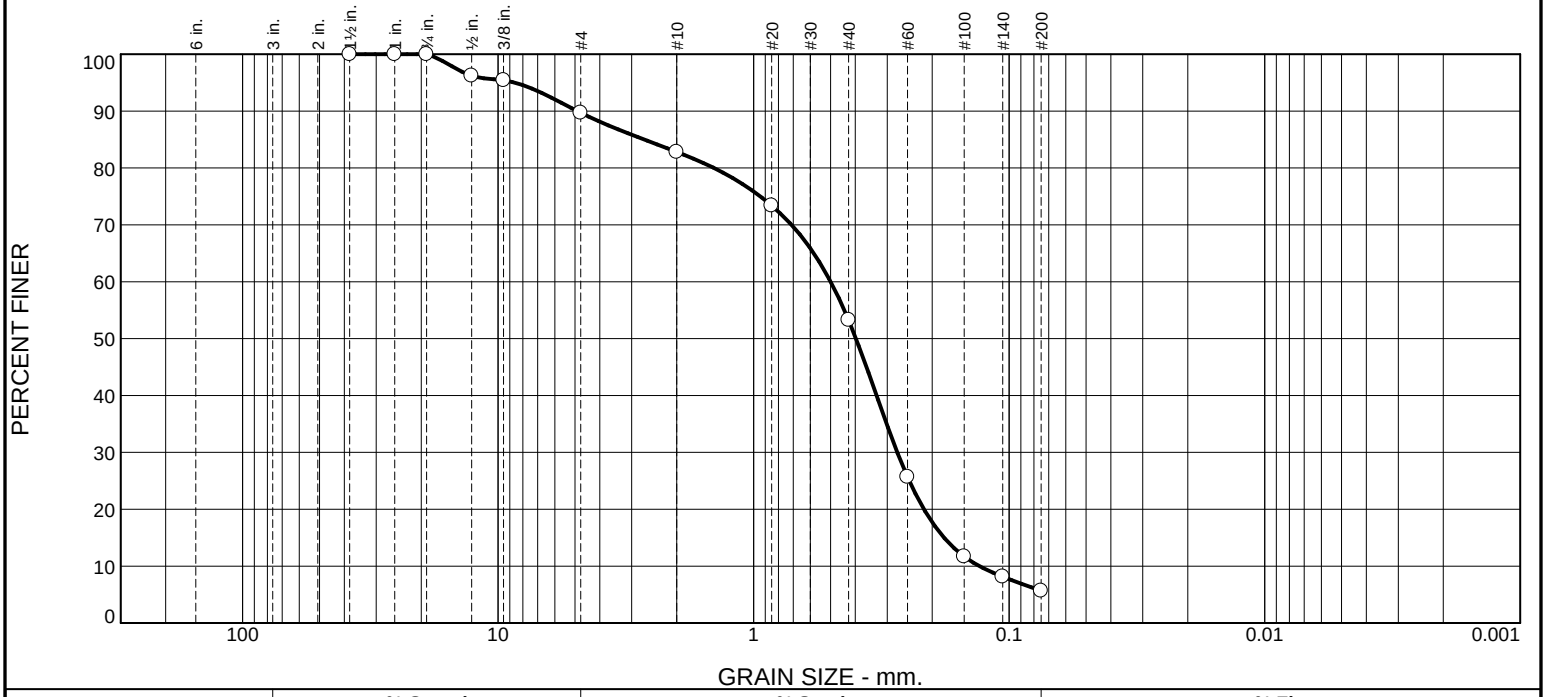
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine to medium grained, white Fine to coarse grained, light brown, moist at 3 ft. Boring terminated at 4.0 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.3	6.9	29.5	47.6	5.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	96.2		
.375	95.4		
#4	89.7		
#10	82.8		
#20	73.4		
#40	53.3		
#60	25.7		
#100	11.7		
#140	8.2		
#200	5.7		

* (no specification provided)

Material Description

Brown, coarse to fine grained, SLIGHTLY SILTY SAND (SP-SM), with trace gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 4.8935 D_{85}= 2.6798 D_{60}= 0.4994
D_{50}= 0.3976 D_{30}= 0.2739 D_{15}= 0.1797
D_{10}= 0.1307 C_u= 3.82 C_c= 1.15

Remarks

Natural Moisture: 21.5%

Date Received: **Date Tested:** 1/19/15

Tested By: R. Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B1-2 **Depth:** 0.0'-4.0'

Sample Number: Composite

Date Sampled: 1/19/15

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program

Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B1-3

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area
PROJECT NO.: 13-1101-0242
CLIENT: Mobile Bay National Estuary Program
LOCATION: Refer to boring location plan
ENGINEER: M. Montgomery

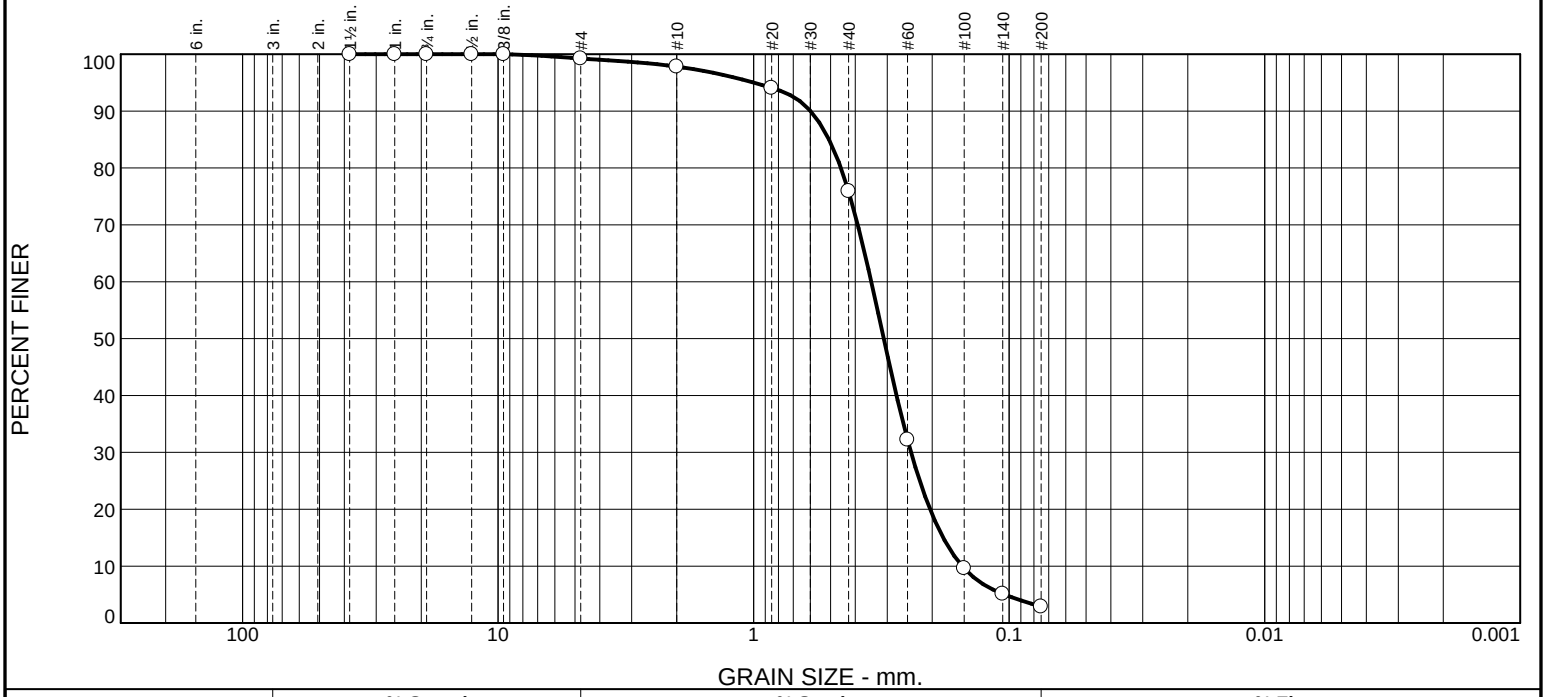
SAMPLE METHOD: ASTM D1586
TYPE BORING: Hand Auger
DRILLER: N/A
DRILL RIG: N/A
WATER DEPTH: 6 ft.

PAGE: 1 of 1
LAT.: N30.52893
LONG.: W88.14716
DATE: 1/15/15
WEATHER: Overcast
ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine to medium grained, light brown Light gray Light brown Light gray to gray Gray, moist at 5.0 ft.												
5						Boring terminated at 6.0 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	1.4	21.9	73.0	2.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	100.0		
#4	99.2		
#10	97.8		
#20	94.1		
#40	75.9		
#60	32.2		
#100	9.6		
#140	5.1		
#200	2.9		

* (no specification provided)

Material Description

Light brown, fine to medium grained, SAND (SP)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 0.5983 D_{85}= 0.5068 D_{60}= 0.3465
D_{50}= 0.3095 D_{30}= 0.2422 D_{15}= 0.1812
D_{10}= 0.1526 C_u= 2.27 C_c= 1.11

Remarks

Natural Moisture: 17.0%

Date Received: **Date Tested:** 1/19/15

Tested By: R.Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B1-3 **Depth:** 0.0'-6.0' **Date Sampled:** 1/19/15

Sample Number: Composite

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program

Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B2-1

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 9 ft.

PAGE: 1 of 1

LAT.: N30.52985

LONG.: W88.14801

DATE: 1/14/15

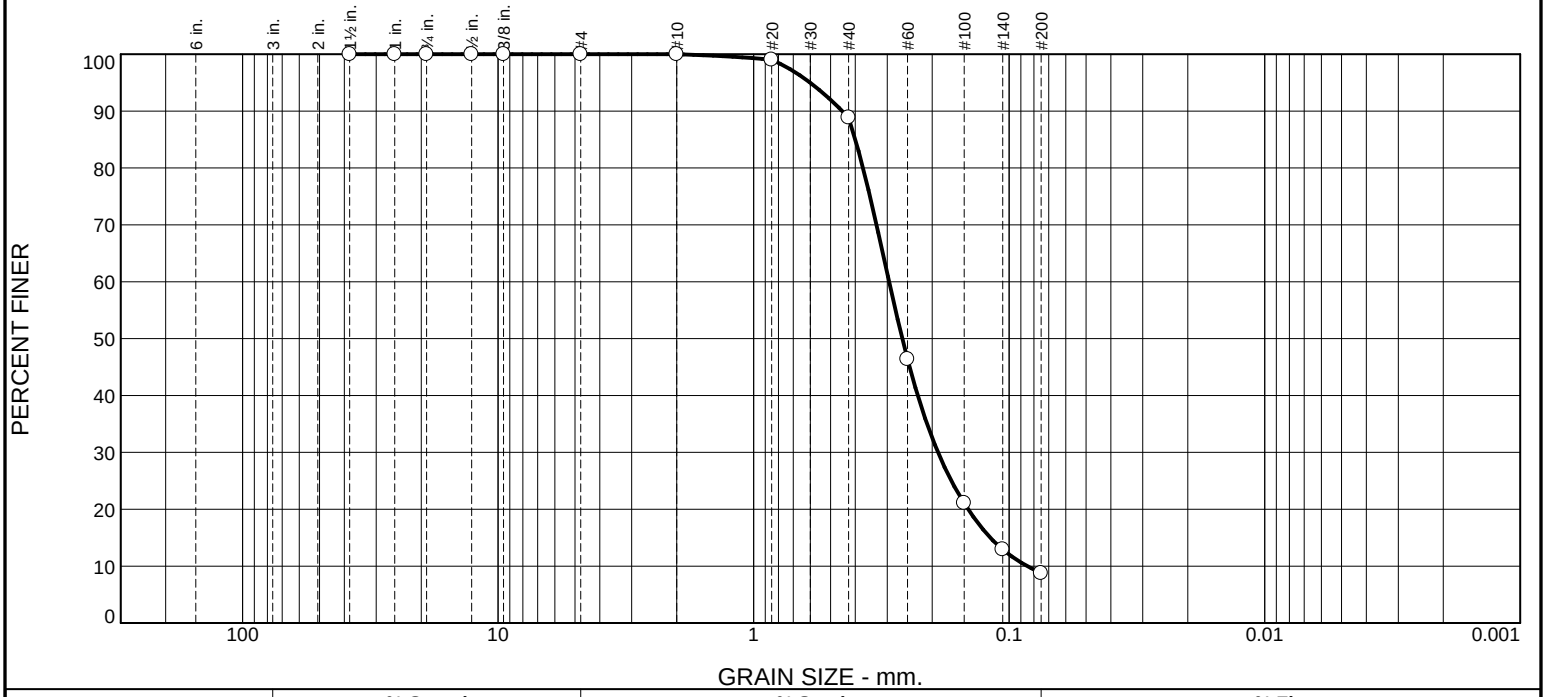
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0						Fine grained, light brown to brown White to light gray White												
					SAND (SP)	Reddish brown												
5						Reddish brown, light brown, and light gray Very fine to fine grained												
					SILTY SAND (SM)	gray to light gray at 5 ft. Orange												
						Very fine to fine grained, brown, moist												
					SAND (SP)	Fine grained, light brown to orangish brown Reddish brown												
						Boring terminated at 9.0 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	11.2	80.0	8.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.0		
#40	88.8		
#60	46.4		
#100	21.1		
#140	12.9		
#200	8.8		

* (no specification provided)

Material Description

Light brown and red, fine grained, SLIGHTLY SILTY SAND (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.4498 D_{85}= 0.3997 D_{60}= 0.2949
D_{50}= 0.2619 D_{30}= 0.1898 D_{15}= 0.1185
D_{10}= 0.0848 C_u= 3.48 C_c= 1.44

Remarks

Natural Moisture: 13.1%

Date Received: **Date Tested:** 1/19/15

Tested By: R.Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B2-1 **Depth:** 0.0'-9.0'

Sample Number: Composite

Date Sampled: 1/19/15

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program

Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B2-2

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 8.5 ft.

PAGE: 1 of 1

LAT.: N30.52885

LONG.: W88.14781

DATE: 1/14/15

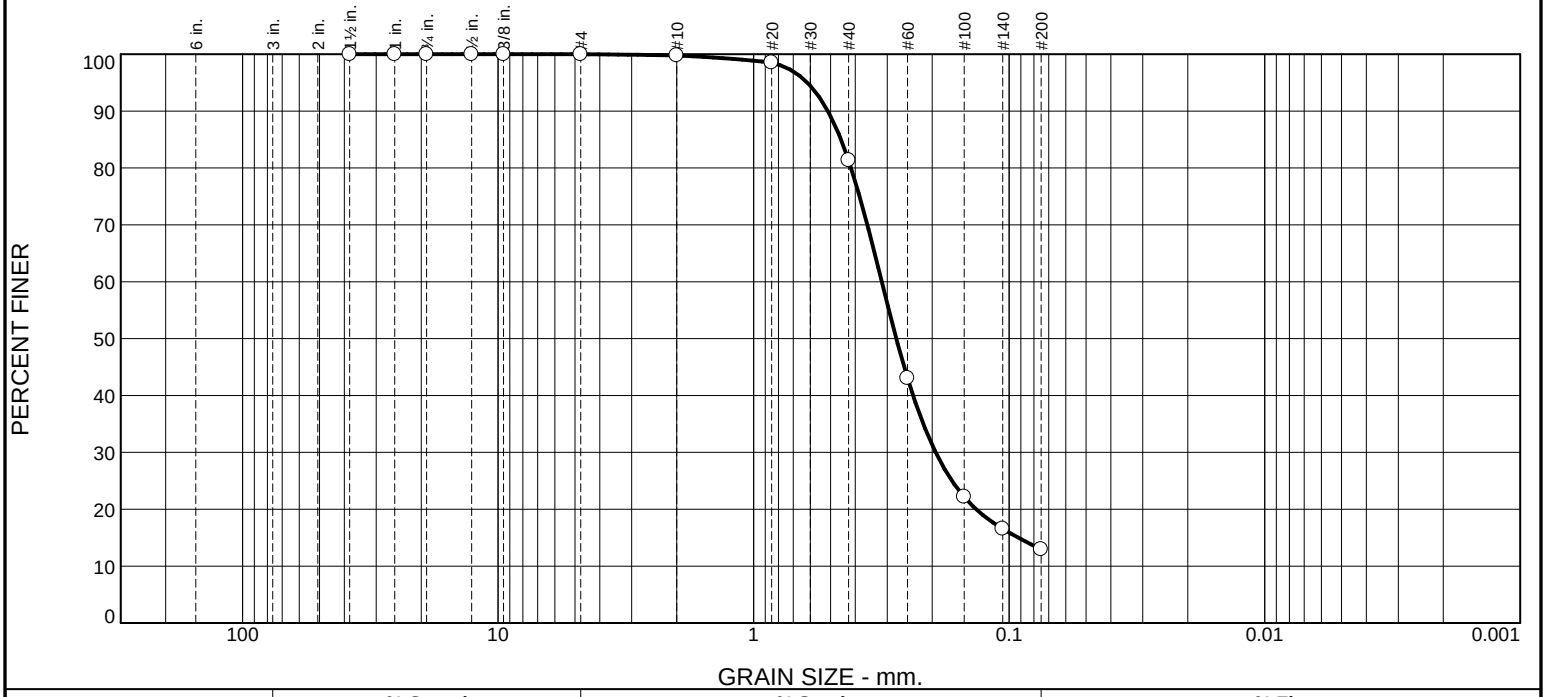
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine to medium grained, gray												
					SILTY SAND (SM)	Very fine to fine grained, dark gray at 0.5 ft.												
						Fine grained, dark gray to black at 1 ft.												
					SAND (SP)	Dark brown Brown Yellowish brown Light brown to white Fine to medium grained, white at 5 ft.												
5						Gray Fine grained, dark gray, moist at 7.5 ft.												
						Light and dark gray, saturated at 8.5 ft.												
						Boring terminated at 9.0 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	18.4	68.5	12.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	100.0		
#4	100.0		
#10	99.8		
#20	98.6		
#40	81.4		
#60	43.1		
#100	22.2		
#140	16.6		
#200	12.9		

* (no specification provided)

Material Description

Light gray, fine grained, SILTY SAND (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.5119 D_{85}= 0.4548 D_{60}= 0.3151
D_{50}= 0.2764 D_{30}= 0.1938 D_{15}= 0.0921
D_{10}= C_u= C_c=

Remarks

Natural Moisture: 15.0%

Date Received: **Date Tested:** 1/19/15

Tested By: R. Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B2-2 **Depth:** 0.0'-8.5' **Date Sampled:** 1/19/15
Sample Number: Composite

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program
Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B2-3

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 3 ft.

PAGE: 1 of 1

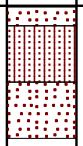
LAT.: N30.52814

LONG.: W88.14806

DATE: 1/14/15

WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, light brown												
					SILTY SAND (SM)	Very fine to fine grained												
					SAND (SP)	Medium grained, gray Moist at 2.5 ft. Wood present, saturated at 3.0 ft.												
						Boring terminated at 3.5 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B2-4

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH:

PAGE: 1 of 1

LAT.: N30.52935

LONG.: W88.14713

DATE: 1/15/15

WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					CLAYEY SAND (SC)	Fine grained, brown												
					SAND (SP)	Fine grained, gray saturated from surface runoff												
						Boring terminated at 3.0 ft. due to cave in, saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-1

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 3.5 ft.

PAGE: 1 of 1

LAT.: N30.52391

LONG.: W88.14421

DATE: 1/14/15

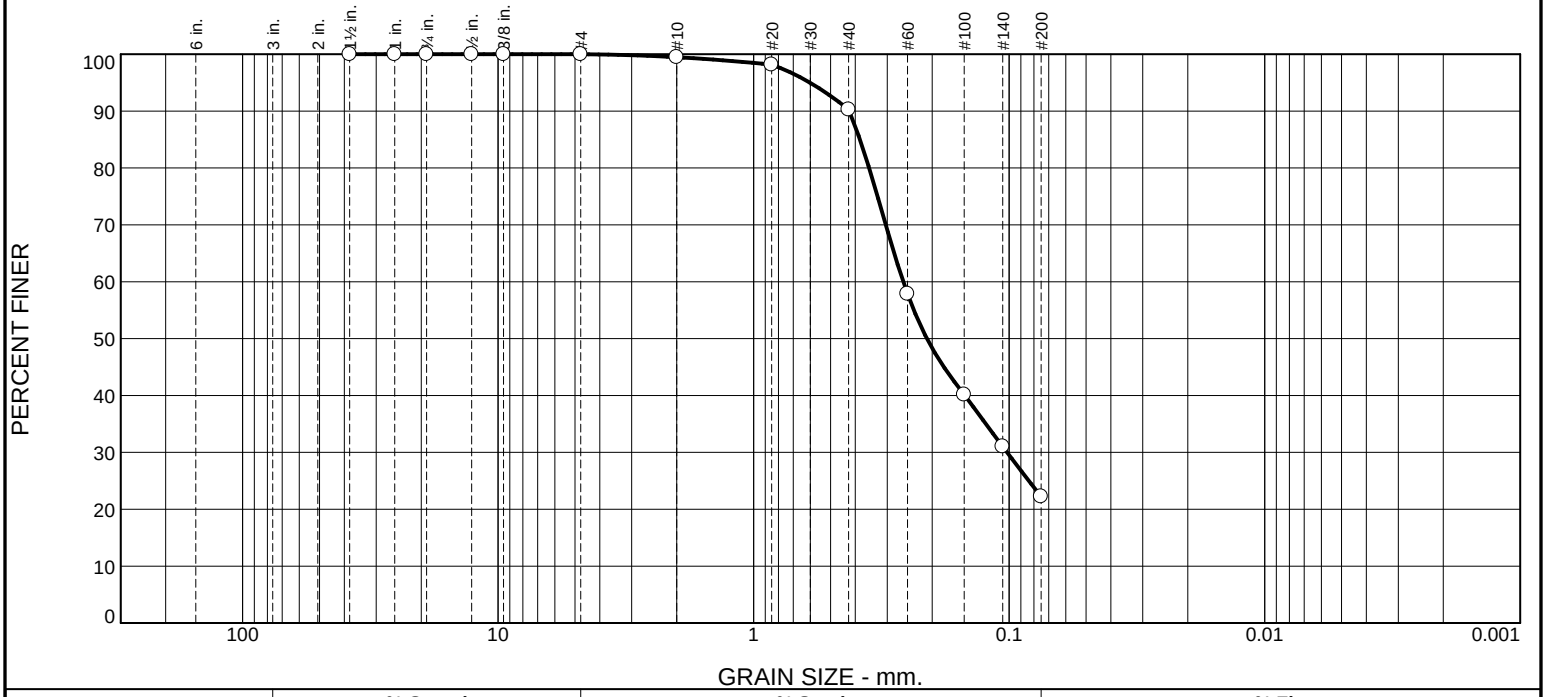
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, orangish brown to light brown												
					SILTY SAND (SM)	Fine grained gray with 2" clay lense												
					SAND (SP)	Black Very fine to fine grained with black organics Fine grained, gray, saturated												
						Boring terminated at 4 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	9.2	68.1	22.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	100.0		
#4	100.0		
#10	99.5		
#20	98.2		
#40	90.3		
#60	57.9		
#100	40.2		
#140	31.0		
#200	22.2		

* (no specification provided)

Material Description

Yellowish brown and gray, fine to medium grained, SILTY SAND (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.4224 D_{85}= 0.3835 D_{60}= 0.2596
D_{50}= 0.2098 D_{30}= 0.1019 D_{15}=
D_{10}= C_u= C_c=

Remarks

Natural Moisture: 25.4%

Date Received: **Date Tested:** 1/19/15

Tested By: R. Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B3-1 **Depth:** 0.0'-4.0'
Sample Number: Composite

Date Sampled: 1/19/15

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program
Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-2

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 4 ft.

PAGE: 1 of 1

LAT.: N30.52333

LONG.: W88.14397

DATE: 1/14/15

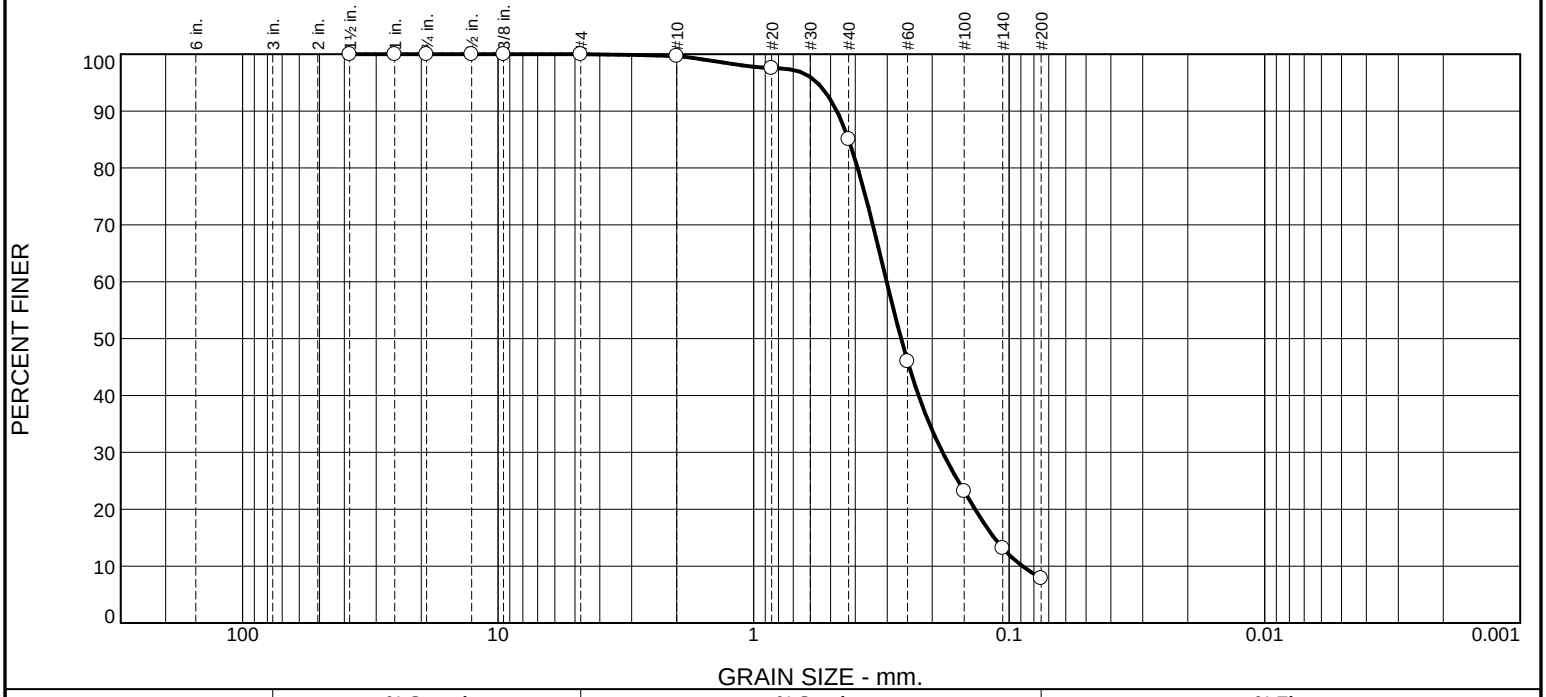
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, orangish brown to light brown Gray Fine to medium grained, light brown at 2.5 ft. Gray, moist at 3.5 ft. Boring terminated at 4 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	14.6	77.2	7.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	100.0		
#4	100.0		
#10	99.7		
#20	97.6		
#40	85.1		
#60	46.0		
#100	23.2		
#140	13.2		
#200	7.9		

* (no specification provided)

Material Description

Yellowish brown and gray, fine to medium grained, SLIGHTLY SILTY SAND (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.4720 D_{85}= 0.4245 D_{60}= 0.3014
D_{50}= 0.2647 D_{30}= 0.1822 D_{15}= 0.1144
D_{10}= 0.0886 C_u= 3.40 C_c= 1.24

Remarks

Natural Moisture: 18.6%

Date Received: **Date Tested:** 1/19/15

Tested By: R.Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B3-2 **Depth:** 0.0'-4.0'
Sample Number: Composite

Date Sampled: 1/19/15

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program
Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-3

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 2 ft.

PAGE: 1 of 1

LAT.: N30.52401

LONG.: W88.14336

DATE: 1/14/15

WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, orangish brown to light brown Medium grained, gray with organics Fine to medium grained, gray Boring terminated at 2 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-4

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 0.5 ft.

PAGE: 1 of 1

LAT.: N30.52335

LONG.: W88.14278

DATE: 1/14/15

WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, orangish brown, moist Gray, saturated at 0.5 Boring terminated at 1 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-5

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 1.5 ft.

PAGE: 1 of 1

LAT.: N30.52380

LONG.: W88.14225

DATE: 1/14/15

WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Medium grained, orangish brown, moist Gray, moist at 1 ft. Boring terminated at 1.5 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-6

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 2.5 ft.

PAGE: 1 of 1

LAT.: N30.52295

LONG.: W88.14223

DATE: 1/14/15

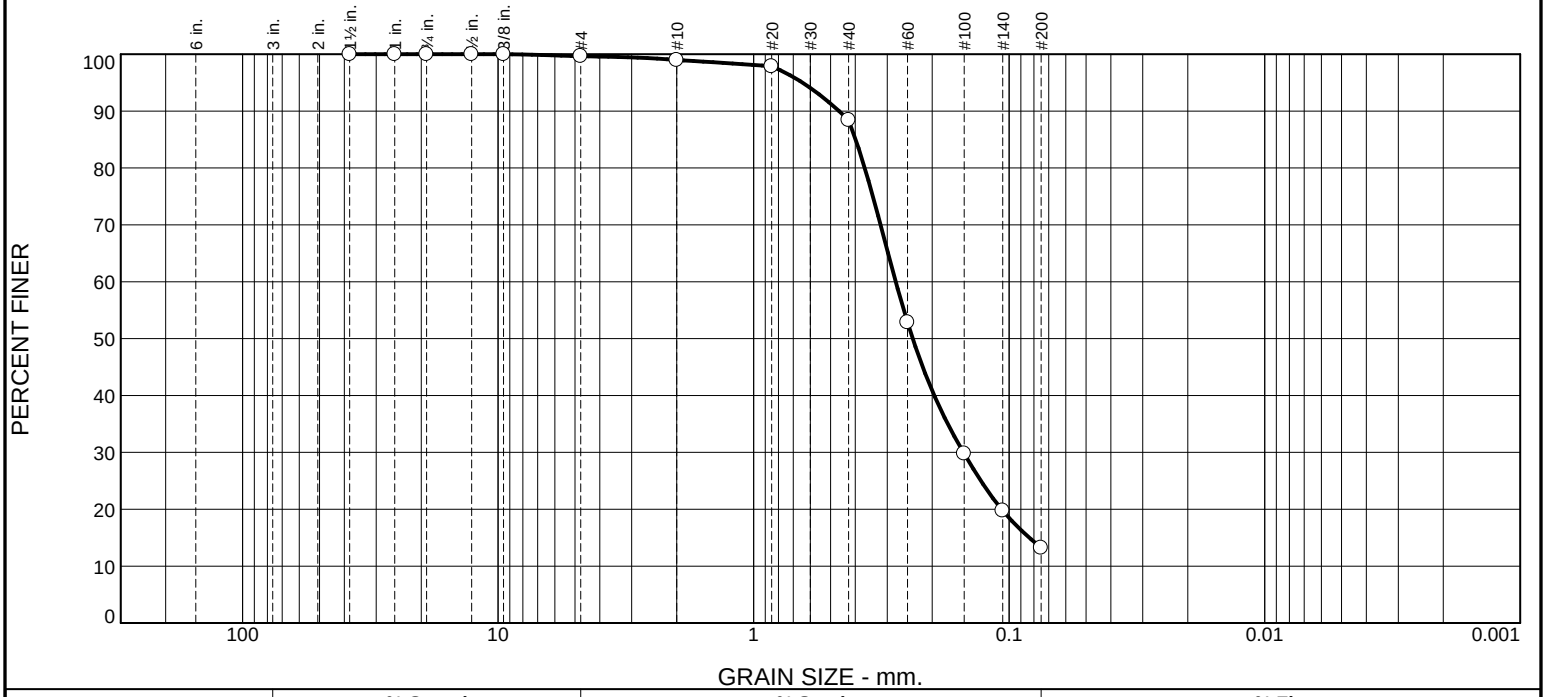
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, light brown, gray, and orangish brown Fine to medium grained at 1.5 ft. Light gray with clay lenses at 2 ft. Medium grained at 2.2 ft. Saturated at 2.5 ft. Boring terminated at 3.0 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.7	10.6	75.2	13.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	100.0		
#4	99.7		
#10	99.0		
#20	97.9		
#40	88.4		
#60	52.9		
#100	29.8		
#140	19.8		
#200	13.2		

* (no specification provided)

Material Description

Yellowish brown, fine to medium grained, SILTY SAND (SM), with clay nodules

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.4629 D_{85}= 0.3983 D_{60}= 0.2778
D_{50}= 0.2386 D_{30}= 0.1510 D_{15}= 0.0833
D_{10}= C_u= C_c=

Remarks

Natural Moisture: 22.6%

Date Received: **Date Tested:** 1/19/15

Tested By: R. Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B3-6 **Depth:** 0.0'-6.0' **Date Sampled:** 1/19/15
Sample Number: Composite

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program
Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

thompson ENGINEERING

RECORD OF TEST BORING

BORING NO.: B3-7

PROJECT: Mon Louis Island Shoreline Restoration
ASPA Theodore Dredge Area

PROJECT NO.: 13-1101-0242

CLIENT: Mobile Bay National Estuary Program

LOCATION: Refer to boring location plan

ENGINEER: M. Montgomery

SAMPLE METHOD: ASTM D1586

TYPE BORING: Hand Auger

DRILLER: N/A

DRILL RIG: N/A

WATER DEPTH: 4 ft.

PAGE: 1 of 1

LAT.: N30.52305

LONG.: W88.14337

DATE: 1/14/15

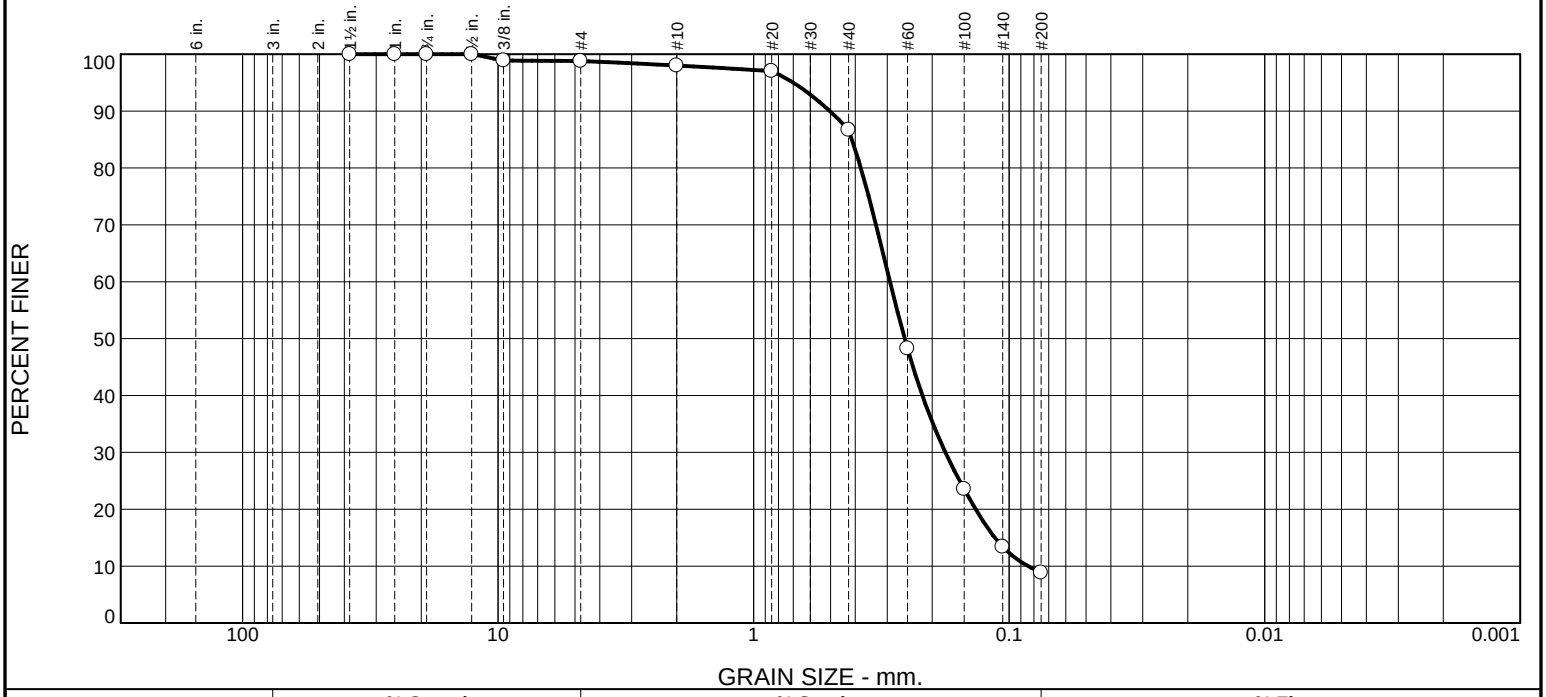
WEATHER: Overcast

ELEVATION:

DEPTH/ ELEV.	SYMBOL	SAMPLER	SPT BLOWS	SAMPLE I.D. NO.	MAJOR SOIL COMPONENT	OTHER COMPONENTS	N	%F	MC	LL	PI	UW	OC	UU	UC	PP	VS	FS
0					SAND (SP)	Fine grained, orangish brown to light brown Gray and orangish brown with some gray clay lenses at 1.5 ft. Medium grained, light gray Moist at 3.5 ft. Boring terminated at 4.0 ft. saturated												

Refer to Notes and Legend on separate sheet for additional information. This Record of Test Boring is part of the project Geotechnical Report. Actual strata changes may be gradual over depth.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.2	0.8	11.3	77.8	8.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
.75	100.0		
.50	100.0		
.375	98.9		
#4	98.8		
#10	98.0		
#20	97.0		
#40	86.7		
#60	48.3		
#100	23.5		
#140	13.4		
#200	8.9		

* (no specification provided)

Material Description

Yellowish brown, fine grained, SLIGHTLY SILTY SAND (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.5029 D_{85}= 0.4120 D_{60}= 0.2926
D_{50}= 0.2563 D_{30}= 0.1776 D_{15}= 0.1138
D_{10}= 0.0843 C_u= 3.47 C_c= 1.28

Remarks

Natural Moisture: 17.8%

Date Received: **Date Tested:** 1/19/15

Tested By: R. Byrd

Checked By: C. Dugger

Title: Materials Engineering Lab

Source of Sample: B3-7 **Depth:** 0.0'-4.0'

Sample Number: Composite

Date Sampled: 1/19/15

Thompson Engineering

Mobile, Alabama

Client: Mobile Bay National Estuary Program

Project: ASPA Theodore Dredge Area

Project No: 13-1101-0242 **Figure**

APPENDIX C

ENGINEER'S OPINION OF PROBABLE COSTS OF CONSTRUCTION

Engineer's Opinion of Probable Construction Cost *[Preliminary]*
50% Design Submittal - Byrnewood Drive Staging Area Alternate
February 2015

Mobile Bay National Estuary Program
Restoration of the Northern End of Mon Louis Island
Fowl River, Mobile County, Alabama

Item No.	Description of Work	Qty.	Unit	Unit Cost	Subtotal
1.00	Mob / De-Mob Excavation Equipment	1	LS	$ 15,000.00	$15,000.00
1.01	Mob / De-Mob Rip Rap / Marsh Creation Equip.	1	LS	$ 100,000.00	$100,000.00
1.02	Project Layout	1	LS	$ 10,000.00	$10,000.00
1.03	Install Temporary Warning Signs	3	Each	$ 2,500.00	$7,500.00
1.04	Install Filter Fabric	4,761	S.Y	$ 7.75	$36,897.75
1.05	Staging Area Property Rental	1	LS	$ 40,000.00	$40,000.00
1.06	Purchase / Haul Bedding Stone to Staging Area	2,380	TON	$ 65.00	$154,700.00
1.07	Install Bedding Stone	2,380	TON	$ 37.00	$88,060.00
1.08	Purchase / Haul Rip Rap to Staging Area	4,877	TON	$ 70.00	$341,390.00
1.09	Install Rip Rap	4,877	TON	$ 37.00	$180,449.00
1.10	Excavate / Haul - ASPA DMDA to Staging Area	37,200	CY	$ 7.25	$269,700.00
1.11	Slurry Fill Marsh Creation	37,200	C.Y.	$ 17.00	$632,400.00
1.12	Repair Byrnewood Drive	1	Allow	$ 150,000.00	$150,000.00
1.13	Vegetative Plantings	1	LS	$ 35,000.00	$35,000.00
1.14	Install Permanent Warning Signs	3	Each	$ 4,200.00	$12,600.00
	Subtotal Estimated Construction Cost:				**$2,073,696.75**
	Contingency @10%				$207,369.68
	Estimated Cost Including Contingency				**$2,281,066.43**
	Preliminary Estimated Construction Cost Total (Rounded)				***$2,281,000***

thompson
ENGINEERING

Engineer's Opinion of Probable Construction Cost *[Preliminary]*
50% Design Submittal - Open Water Borrow Source Alternate
August 25, 2014

Mobile Bay National Estuary Program
Restoration of the Northern End of Mon Louis Island
Fowl River, Mobile County, Alabama

Item No.	Description of Work	Qty.	Unit	Unit Cost	Subtotal
1.00	Mob / De-Mob Crane Barge	1	LS	$ 160,000.00	$160,000.00
1.01	Mob / De-Mob Dredge / Marsh Creation Equip.	1	LS	$ 300,000.00	$300,000.00
1.02	Project Layout	1	LS	$ 10,000.00	$10,000.00
1.03	Install Temporary Warning Signs	3	Each	$ 2,500.00	$7,500.00
1.04	Excavate Access Channel	24,000	C.Y	$ 5.00	$120,000.00
1.05	Install Filter Fabric	4,761	S.Y	$ 7.75	$36,897.75
1.06	Install Bedding Stone	2,380	TON	$ 80.00	$190,400.00
1.07	Install Rip Rap	4,877	TON	$ 85.00	$414,545.00
1.08	Dredge Fill Marsh Creation	37,200	C.Y.	$ 5.83	$217,000.00
1.09	Vegetative Plantings	1	LS	$ 35,000.00	$35,000.00
1.10	Install Permanent Warning Signs	3	Each	$ 4,200.00	$12,600.00
	Subtotal Estimated Construction Cost:				**$1,503,942.75**
	Contingency @10%				$150,394.28
	Estimated Cost Including Contingency				**$1,654,337.03**
	Preliminary Estimated Construction Cost Total (Rounded)				***$1,654,000***

thompson
ENGINEERING