Stantec

15% Assumptions and Basis of Design Document

University Lakes FRRD

October 6, 2021

Prepared for:

University Lakes, LLC

c/o LSU Real Estate and Facilities Foundation
3796 Nicholson Drive
Baton Rouge, LA 70802

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15% ASSUMPTIONS AND BASIS OF DESIGN DOCUMENT

Revision	Description	Author		Quality Check		Independent Review	

15% ASSUMPTIONS AND BASIS OF DESIGN DOCUMENT

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Prepared by  _____
(signature)

Ryan Lee Waldron, P.E.

Reviewed by  _____
(signature)

Thomas Cancienne, P.E.

Approved by  _____
(signature)

Hilary Thibodeaux, P.E.

Table of Contents

LIST OF APPENDICES

Abbreviations

BRAF	Baton Rouge Area Foundation
ECD	Earthen Containment Dike
HEC-RAS	Hydraulic Engineering Center River Analysis System
LiDAR	Light Detection and Ranging
LSU	Louisiana State University and Agricultural & Mechanical College
UL	University Lakes

1.0 BACKGROUND

1.1 DESCRIPTION OF LAKES

The Project involves the Flood Risk Reduction Design Services required for implementation of the 2016 Baton Rouge Lakes Master Plan for revitalization of the Baton Rouge/University Lakes System, which is comprised of six lakes (City Park Lake, Lake Erie, Crest Lake, University Lake, Campus Lake, and College Lake). The University Lakes team (UL) is seeking to improve water quality and flood risk reduction potential, increase natural habitat, and provide expanded and safer recreational opportunities for the Lake System. The Stantec Flood Risk Reduction Design Team (Design Team) was tasked with performing preliminary geometric design and cost estimation for the 15% Design Phase. This document outlines the basis of design and assumptions made to date.

1.2 PREVIOUS WORK COMPLETED

In 1933, a Cypress-Tupelo swamp adjacent to the LSU campus was donated to the university under the agreement that this area would be converted into public recreational space in perpetuity. The swamp was dug by hand in the mid-1930s as a Works Progress Administration project known as the City Park Lake Extension. This project removed over one million feet of timber and over 100,000 cubic yards of earth to create a Lake system with depths ranged from 4 to over 20 feet. This system was the first iteration of what is known as the LSU Lakes today.

In the decades following, maintenance was performed on the Lakes to address several ecological and environmental issues including invasive water hyacinth, algae blooms, fish kills, and sewage contamination.

By the late 1970s, siltation in the Lakes had reached a point where it was causing negative ecological effects, and officials determined the Lakes needed to be dredged. Between 1981 and 1983, nearly 375,000 cubic yards of dredge spoils were removed from the Lakes. One of the challenges of this initial dredging was the quantity of tree stumps that were encountered on the lake bottoms while dredging was occurring. These unaccounted-for stumps drove the project over budget and prevented the project from fully achieving its goals.

By 1984, significant erosion of the dredged material was occurring along the shorelines of the Lakes, so a geotechnical analysis was performed. Based on the geotechnical analysis, bank slopes were altered, and shoreline protection was added to reduce further erosion of the bank.

1.3 CURRENT CONDITION

Currently, the Lakes are very shallow due to continued siltation of the lake bottoms from surface runoff. This siltation has resulted in lake depths, on average of 3.5 feet, with many areas being much shallower. In addition, the surface runoff from neighboring residential areas and stormwater flow that discharges into the Lakes brings pollutants and additional nutrients into the Lake system. These factors combined have resulted in fish kills, high microorganism loads, and algae blooms that reduce the overall health and aesthetics of the Lake system.

1.4 LAKES PROGRAM

The LSU Real Estate and Facilities Foundation established University Lakes, LLC to “manage the design and implementation and to establish a long-term management structure to maintain the reimagined lake system.” To assist in this endeavor, University Lakes, LLC has hired several consultants including the Project Advisor, a Brailsford & Dunlavey/CSRS joint venture and the Master Designer, Sasaki. Additionally, The Stantec Team was selected to be the Designer for the Flood Risk Reduction component of the project.

2.0 BASIS OF DESIGN

2.1 MASTER PLAN

In December 2016, the Baton Rouge Lakes Master Plan was drafted by a team led by SWA Group and Jeffrey Carbo Landscape Architects for the Baton Rouge Area Foundation (BRAF). This document will serve as the conceptual guide for design.

2.2 DATA COLLECTION

2.2.1 Geotech

Geotechnical field data collection and analysis were performed by GeoEngineers, Inc. This data was provided as draft reports, Draft University Lakes Sampling Report and Draft University Lakes Preliminary Geotechnical Report, dated June 11, 2021 and August 6, 2021, respectively. Additional, historical geotechnical information was reviewed for use in 15% Design. A complete list of historical data reviewed is referenced in **Appendix D Data Gap Memo**.

2.2.2 Survey

Preliminary Boundary Surveys were performed by LandSource, Inc. in September 2021 for all six (6) lakes of the University Lake System. Final surveys stamped by a Louisiana registered land surveyor are required to proceed to future design phases.

2.2.2.1 Bathymetric

Preliminary Bathymetric Surveys were performed by C.H. Fenstermaker in July 2021 for all six (6) University Lakes.

2.2.2.2 Topographic

No Topographic Survey Point files have been provided to the Design Team to date. This data is necessary to proceed to future design phases.

2.2.2.3 Magnetometer

No Magnetometer Survey data has been provided to the Design Team to date. A Magnetometer Survey will need to be performed for dredging design to proceed.

2.2.2.4 Stump Survey

The Design Team has received preliminary stump identification data for the University, Campus, and Crest Lakes. The Design Team understands that City Park, Erie, and College Lakes will not undergo a stump survey at this time. Existing stump densities from the completed preliminary stump surveys will be applied to the lakes that will not be surveyed.

3.0 15% DESIGN

3.1 ASSUMPTIONS

The Following Assumptions were made during the design process based either on direction given to the design team, or in cases where information was lacking, but a reasonable assumption was practicable.

3.1.1 Minimum Depth of the Lake Systems

- Required minimum depth at center of lakes = 6 ft.
- Exception City Park Lake – Forebay depth = 9 ft.

3.1.2 Lake Connections

- City Park Lake and University Lake will be connected
  - Weir at May St. will be removed
  - City Park Lake will be connected to University Lake via a new bridge
- Crest Lake will be connected to University Lake per Sasaki 15% plan set
  - Crest Lake will be connected via a new box culvert(s) structure at the approximate middle of Crest Lake per Sasaki 15% plan set

- Lake Erie will remain connected to City Park Lake
  - Lake Erie will remain connected to City Park Lake via the existing bridge.

3.1.3 Water Surface Elevation

- To date, raising the water surface elevations to achieve minimum depth, other than what is required to connect City Park and University Lakes has not been evaluated.
- Proposed Water Surface Elevation will be assumed to be 20.6 ft. NAVD88 which is equal to the elevation of the outfall weir

3.1.4 Stumps

- Remove/grind all stumps is not required
- Stump Removal Assumptions for cost estimating:
  - Stumps within the dredge/excavation template will be removed/grinded
  - 50% of the Sonar Hits are assumed to be stumps.
  - As stump surveys were only conducted on 3 lakes, the other lakes were assumed to have the same density of stumps requiring removal in the dredging area as Campus Lake (the median lake in terms of stump density, and more conservative than the average), approximately 50 stumps per acre dredged.

3.1.5 Corporation Canal

- The Corporation Canal modifications proposed is not included in this package.
- If University Lakes, LLC elects to perform this work, a separate construction package should be prepared.

3.1.6 City Park Golf Course Lake

- This lake and proposed forebay have yet to be surveyed. No other information for this lake has been collected either (including Geotechnical data, unconsolidated layer depth, stumps, or magnetometer)
- Thus, no information quantifying the work to be performed here is provided in the 15% design.

3.1.7 Lake System Edge Design

- Lake edge treatment will generally remain consistent with the Sasaki 15% and the Master Plan recommendations, which are to construct “living” shorelines with some hardened edges and/or structure where needed to accommodate program.
- Deepening of the lakes will be accomplished through both mechanical excavation and hydraulic dredging
- Placement will generally follow the Sasaki 15% Draft Plans where possible. Small deviations will be made when budget or geotechnical properties make fill placement difficult or cost prohibitive.
- Fill placement will be done through a variety of means
  - Hydraulic fill placement – using earthen containment, geotextile fabric tubes, and sheet pile
  - Mechanical placement

3.1.8 Geotextile Fabric Tubes

- Length Assumed to be 100 ft. per tube
- Circumference assumed to be 60 ft.

3.1.9 Ratios of Cut to Fill

- Hydraulic Fill Consolidation - Geotube Conversion Factor = 2.25
- Hydraulic Dredge Cut:Fill Ratio = 1.75
- Mechanical Excavation Cut:Fill = 1.50

3.2 KEY DESIGN ELEMENTS/FEATURES

3.2.1 Dredging Design

It is anticipated that dredging will be conducted utilizing two primary techniques: Mechanical Dredging and Hydraulic Dredging.

- Mechanical Dredging is intended to be primarily used for the dredging of consolidated clay materials underlying the unconsoildated material or “fluff”. It is anticipated that this material will be placed on a barge to be moved from the center of the lake where deepening will occur to transport it the edge, where it will be placed for the features being developed there per the landscape design.
- Hydraulic Dredging is intended to be the primary means of excavating the unconsolidated materials on the lakebed. The pumping of this material will first be used to fill the geotextile fabric tubes that will be used for containment. After the tubes have been filled, any remaining material will be used to fill in the containment areas. Hydraulic Dredging use may be limited by the presence of stumps.

3.2.2 Containment

Due to the abundance of unconsolidated soils on the lakebed, that would be difficult to contain, process, or dewater, Geotextile Fabric Tubes were selected as the primary means of containment of the hydraulic dredged fill, as well at the primary destination of dredged “fluff.”

Some portion of the containment is anticipated to be constructed using Earthen Containment Dikes (ECD) constructed out of in situ materials. The material for constructing these dikes will be excavated from the containment side of the dike.

3.2.3 Fill Placement

Material excavated mechanically to a barge will be placed via side-casting into the narrower reaches that are required for fill placement. Material excavated via hydraulic dredging will be placed into containment areas confined by geotextile fabric tubes and ECDs

3.3 RECOMMENDATIONS FOR NEXT PHASE OF DESIGN

As the project progresses, additional information will become available to inform the design. Items anticipated to be among the new information effecting the future design include: coordination with and designs of the Master Designer, additional survey, modeling results, additional geotechnical data collection and analyses, and coordination with CMAR. For the future phase of development of this project, the Design Team recommends the following items of focus:

- Incorporation of additional data resulting from the Data Gap Analysis
    - Additional Survey
    - Additional Geotechnical sampling
    - Results of Geotechnical Analyses
- Refinement of Dredging Plan
    - Refinements based on additional Geotechnical Data (Settlement Analysis and Cuto:Fill Ratios)
    - Coordination with Master Designer
- Coordination with master designer to best utilize dredge fill to accomplish landscape design goals.
- Coordination with CMAR
    - Laydown and Staging
    - Overall Construction Approach & Methodology (Further development of the methodologies for entire project will be likely once input begins to be provided by the CMAR.)
- Potential inclusion of Golf Course Lake
- Coordination with other projects in vicinity (LADOTD I-10)
- Feasibility of Corporation Canal relocation.

15% ASSUMPTIONS AND BASIS OF DESIGN DOCUMENT

15% Design

Appendices

A. 15% Plans
B. 15% Cost Opinion
C. Neel-Schaffer Construction Cost Basis Document
D. Data Gap Memo
E. Draft Geotech Report

1.0 REFERENCES

Coastal Protection and Restoration Authority. *Marsh Creation Design Guidelines*. Baton Rouge, LA, 15 November 2017.

GeoEngineers. *University Lakes Sediment Sampling Report DRAFT*, Baton Rouge, LA, 11 June 2021.

SWA Group/Jeffrey Carbo Landscape Architects. *Baton Rouge Lakes Master Plan*. Baton Rouge, LA, December 2016.

University Lakes, LLC. *University Lakes Website*, 2021, https://www.universitylakesproject.org/. Accessed 20 September 2021

APPENDIX A

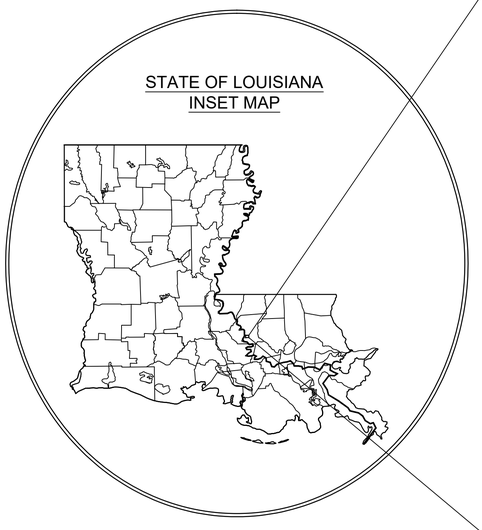
15% Plans

Appendix A – 15% PLANS

UNIVERSITY LAKES, LLC

UNIVERSITY LAKES
FLOOD RISK REDUCTION
PHASE I - CONCEPTUAL DESIGN
BATON ROUGE, LOUISIANA

OCTOBER 2021



PROJECT LOCATION
SCALE: 1' = 1000'

INDEX TO SHEETS

CHIEF, ENGINEERING DIVISION

ENGINEER MANAGER

PROJECT ENGINEER

15% PRELIMINARY DESIGN

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

PRELIMINARY
FOR REVIEW ONLY

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Stantec

ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

APPROVED BY: T. CANCIENNE

TITLE SHEET

DATE: 10/07/2021

SHEET SHEET G-101

SaveDate: 20211007 3:04 PM Login: Scott, Patrick
g:\101\cond.dwg

GENERAL NOTES:

1. EXISTING UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING UTILITY OPERATORS AND LOUISIANA ONE CALL (1-800-272-3020) AT LEAST FIVE WORKING DAYS PRIOR TO MOBILIZATION. ALL PIPELINES AND UNDERGROUND UTILITIES SHALL BE MARKED BY CONTRACTOR. CONTRACTOR SHALL MAINTAIN MARKERS DURING CONSTRUCTION. CONTRACTOR SHALL NOT ANCHOR, SPUD, OR EXCAVATE WITHIN 50 FT OF ANY PIPELINE.
2. CONTRACTOR SHALL BE FAMILIAR WITH AND ANTICIPATE EXISTING SOFT SOIL CONDITIONS AT THE WORK SITE. SOIL INVESTIGATION DATA WERE ACQUIRED BY GEOENGINEERS AND PRESENTED IN A GEOTECHNICAL DATA REPORT (REFER TO APPENDIX F IN SPECIFICATIONS). IN PREPARING BIDS, CONTRACTOR SHALL ANTICIPATE AVERAGE CONSTRUCTION SETTLEMENTS OF APPROXIMATELY 1.5 FT.
3. CONTRACTOR SHALL TAKE PRECAUTIONS, SECURE EQUIPMENT, AND PROTECT THE WORK AGAINST ADVERSE WEATHER AND MARINE CONDITIONS AND/OR SURGE/WAKE FROM PASSING VESSELS.
4. WATER DEPTHS VARY AND MAY NOT ACCOMMODATE DRAFT OF FULLY-LOADED BARGES. PROVISIONS SHALL BE MADE TO ACCESS SHALLOWER AREAS THROUGH USE OF LIGHT-LOADED BARGES OR OTHER EQUIPMENT SUITED TO SHALLOWER WATER.
5. CONTRACTOR SHALL STAKE LOCATIONS OF ALL TEMPORARY WARNING SIGNS FOR APPROVAL BY THE OWNER PRIOR TO INSTALLATION.
6. THE LIMITS OF ALL CONSTRUCTION SHALL BE MARKED/STAKED FOR CONCURRENCE BY THE OWNER PRIOR TO COMMENCING CONSTRUCTION. ADVANCE MARKING/STAKING MAY BE STAGED WITH ACTUAL PROGRESS OF WORK. REFER TO SPECIFICATION SECTION ## ## ## - CONSTRUCTION SURVEYING FOR ADDITIONAL REQUIREMENTS.
7. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE OWNER.
8. CONTRACTOR SHALL AVOID CONSTRUCTION ACTIVITIES WITHIN THE DESIGNATED DO NOT DISTURB AREAS.
9. THE CONTRACTOR WILL NEED TO COMPLY WITH LISTED PERMITS/APPROVALS.
10. FEDERAL AND STATE PERMITS THAT ARE REQUIRED TO PERFORM THE WORK HAVE BEEN SECURED BY THE GOVERNMENT OR THE GOVERNMENT'S APPOINTED REPRESENTATIVE . PERMIT CONDITIONS AFFECTING THE CONSTRUCTION PROCESSES HAVE BEEN INCLUDED IN APPENDIX __ OF THE SPECIFICATIONS.
11. GEOTECHNICAL ENGINEERING WAS PERFORMED BY GEOENGINEERS. FOR DETAILS SEE THE PRELIMINARY GEOTECHNICAL REPORT DATED APRIL 6, 2021.
12. THE CONTRACTOR IS RESPONSIBLE FOR CONTAINING ALL DREDGED MATERIAL INTENDED FOR USE AS FILL WITHIN THE BOUNDARIES OF THE PROPOSED FILL AREA. NO PAYMENT WILL BE MADE FOR FILL MATERIAL PLACED OUTSIDE THE BOUNDARIES OF FILL AREA AS SPECIFIED IN THE PLANS.
13. ANY DISCREPANCIES BETWEEN THESE PLANS AND THE CONSTRUCTION DOCUMENTS SHALL BE IMMEDIATELY REPORTED TO THE OWNER. ALL OTHER REGULATORY AUTHORIZATIONS ARE THE RESPONSIBILITY OF THE CONTRACTOR. COPIES OF ANY SPECIAL PERMITS THAT ARE OBTAINED BY THE CONTRACTOR MUST BE SUBMITTED TO THE GOVERNMENT.

SURVEY NOTES:

1. BOUNDARY SURVEYS WERE COMPLETED BY LANDSOURCE, INC. ON APRIL 1, 2021. BATHYMETRIC SURVEYS WERE COMPLETED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021. PROPERTY LINES AND RIGHT OF WAY ARE NOT INCLUDED IN 15% DESIGN.
2. ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) IN U.S. SURVEY FEET (FEET). ALL HORIZONTAL COORDINATES ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), LOUISIANA STATE PLANE, SOUTH ZONE, IN FEET.
3. THE CONTROL UTILIZED FOR THE SURVEY WAS PROVIDED TO CH FENSTERMAKER & ASSOCIATES, LLC FROM LANDSOURCE, INC.

PRIMARY GPS CONTROL COORDINATE LISTING

POINT	NORTHING	EASTING	ELEVATION
1_345o			
2_345o			
3_3450			
4_345o			
5_345t			
6_345o			
7_345q			
8_345t			
9_345t			
10_345t			

PROJECT REFERENCE CONTROL COORDINATE LISTING

POINT	NORTHING	EASTING	ELEVATION

4. SURVEY CONTROL EMPLOYED DURING CONSTRUCTION SHALL MATCH CONTROL PUBLISHED IN THESE CONTRACT DOCUMENTS. NO OTHER SURVEY CONTROL SHALL BE CONSIDERED. TO MAINTAIN CONSISTENCY BETWEEN PROJECT DESIGN AND CONSTRUCTED WORK, UPDATES, CORRECTIONS OR OTHER CHANGES PUBLISHED BY NGS AND/OR OTHER ENTITIES FOR THESE CONTROL MONUMENTS SHALL NOT BE APPLIED.
5. EXCEPT AS NOTED OTHERWISE, SPOT ELEVATIONS AND SURVEY TRANSECTS ARE BASED ON SURVEYS CONDUCTED BY CH FENSTERMAKER & ASSOCIATES, LLC DURING APRIL 1, 2021.

ABBREVIATIONS

ABBREVIATION	DEFINITION
NAVD	NORTH AMERICAN VERTICAL DATUM
NAD'83	NORTH AMERICAN DATUM OF 1983
NGS	NATIONAL GEODETIC SURVEY
USGS	UNITED STATES GEOLOGIC SURVEY
NTS	NOT TO SCALE
TBD	TO BE DETERMINED

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

DRAWN BY: P. SCOTT
DESIGNED BY: R. WALDRON

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

APPROVED BY: T. CANCIENNE

GENERAL NOTES AND ESTIMATED BID QUANTITIES

DATE: 10/07/2021

SHEET SHEET G-102

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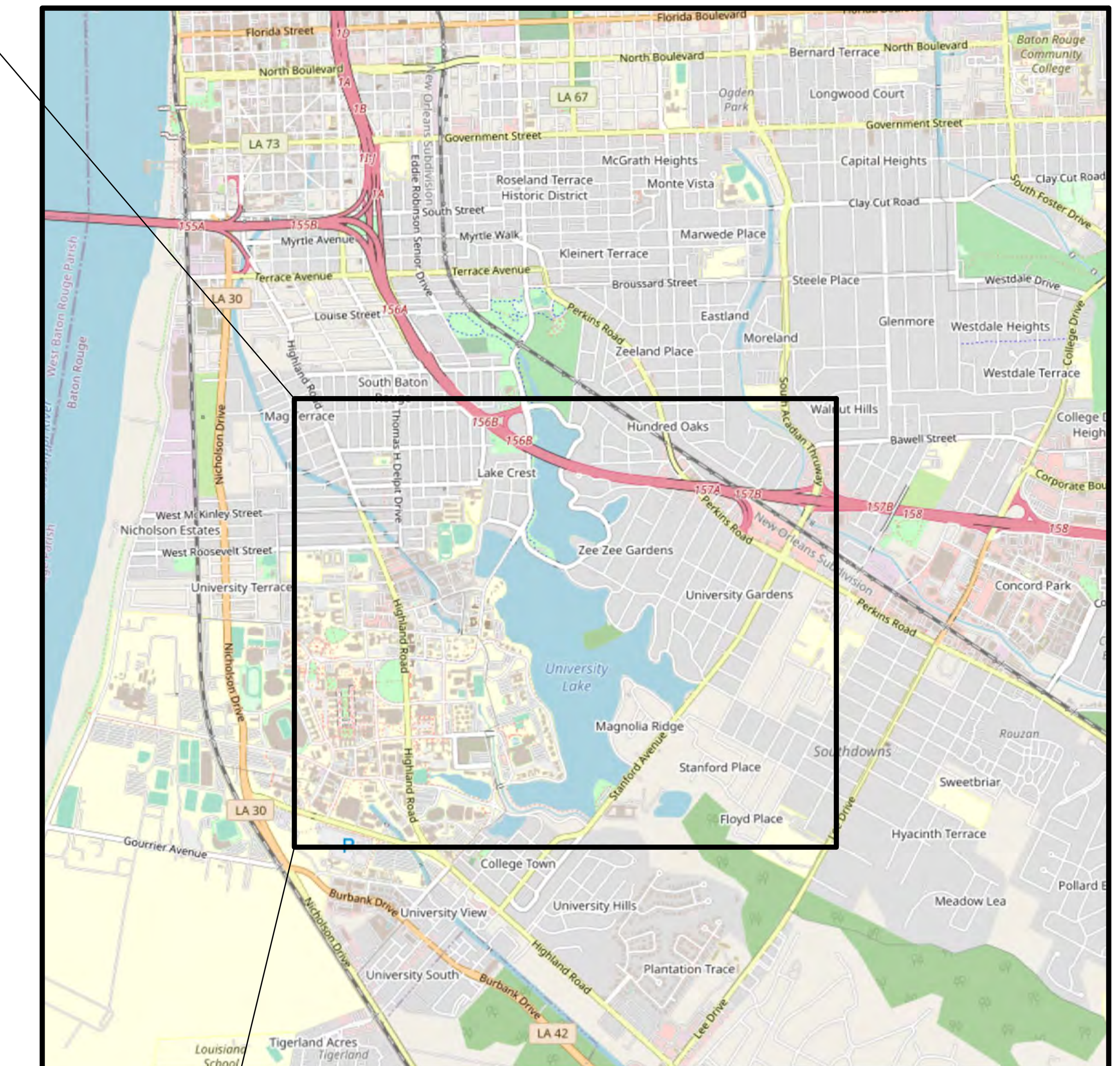
g-102 general notes.dwg

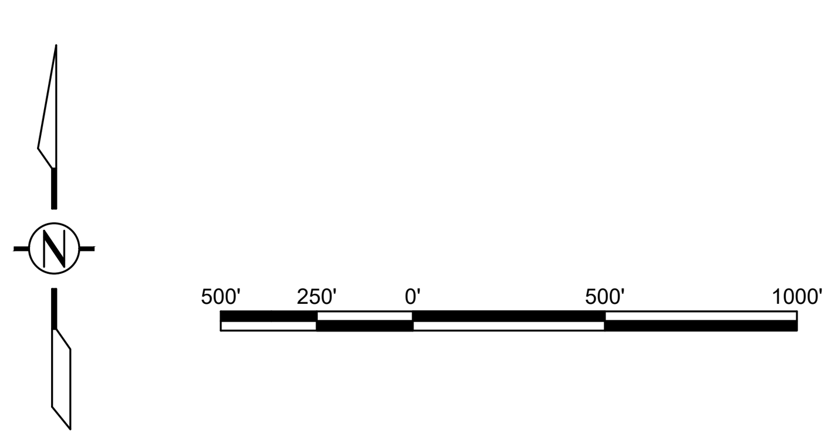
VICINITY SITE MAP

SCALE: 1" = 500'



LOCATION SITE MAP

SCALE: 1" = 2,500'



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LOCATION AND VICINITY MAP

DATE: 10/07/2021

DRAWN BY: P. SCOTT
DESIGNED BY: R. WALDRON
APPROVED BY: T. CANCIENNE
SHEET SHEET G-103

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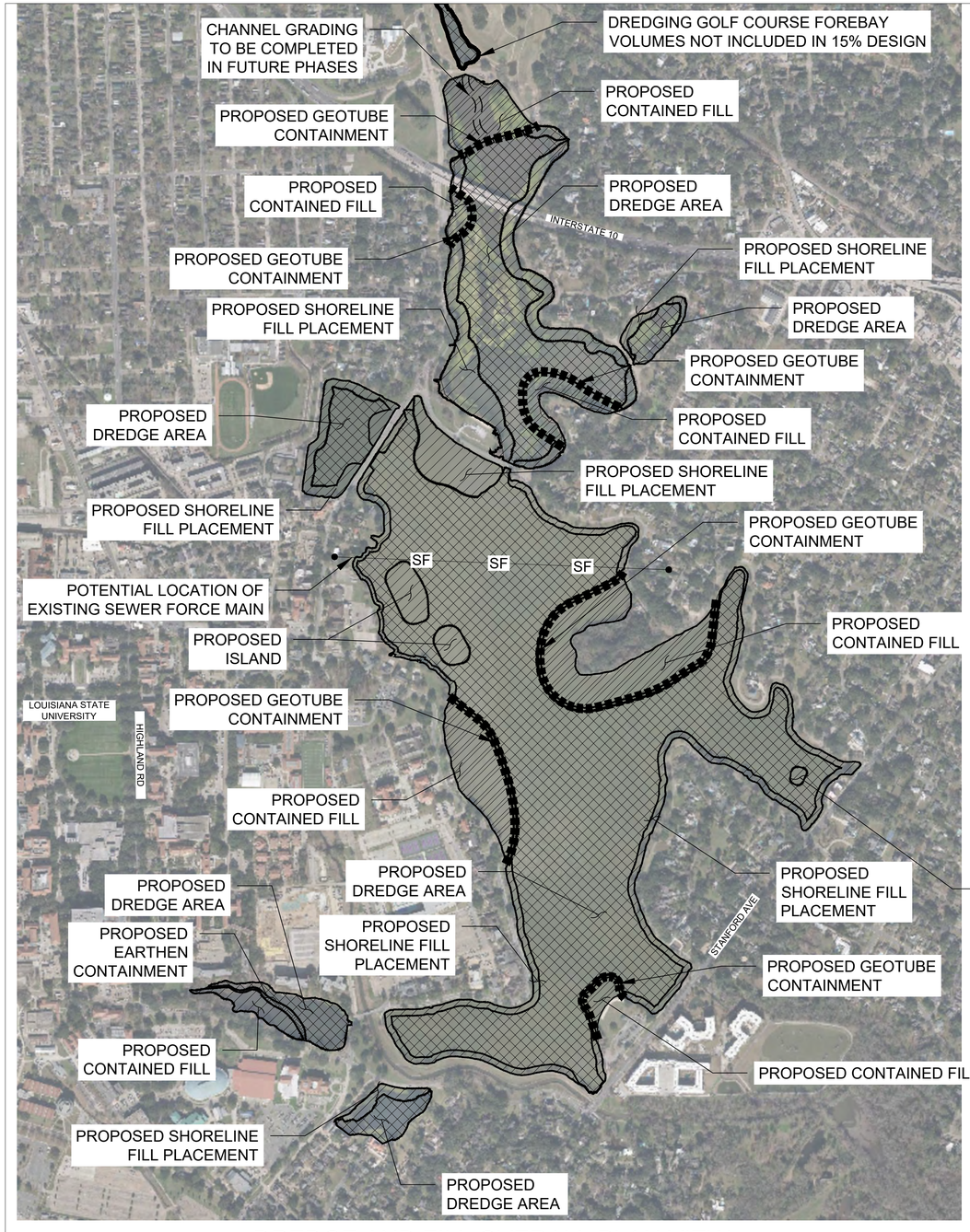
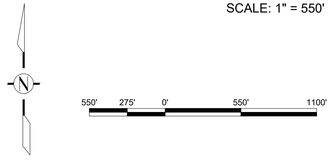
g-103 vicinity map.dwg



DREDGE AND FILL OVERALL PLAN VIEW

SCALE: 1" = 550'



ESTIMATED QUANTITIES - GEOTUBE CONTAINMENT	
	LENGTH (LF)
UNIVERSITY LAKE	5,492
CITY PARK LAKE	2,802

LEGEND

- DREDGE AREA
- SHORELINE PLACEMENT AREA
- CONTAINED FILL PLACEMENT AREA
- EARTHEN CONTAINMENT
- GEOTUBE CONTAINMENT

NOTES:

1. BATHYMETRIC DATA SHOWN IS BASED ON SURVEY DATA COLLECTED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021.
2. ELEVATIONS PROVIDED HEREIN ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD88) - GEOID 18.
3. COORDINATE SYSTEM: STATE PLAN NAD83 (2011), US FOOT, LOUISIANA SOUTH ZONE 1702.
4. CONTOURS SHOWN WERE GENERATED USING CROSS SECTIONS COLLECTED AT 200FT INTERVALS WITHIN THE SURVEY AREA AS PROVIDED BY THE SURVEYOR.
5. AERIAL IMAGERY SHOWN IS FOR REFERENCE ONLY AND MAY NOT REFLECT CURRENT CONDITIONS.
6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.
7. PRESENTED VOLUME QUANTITIES ARE RAW CUT VOLUME QUANTITIES. THERE ARE NO SHRINK/SWELL FACTORS ASSOCIATED WITH THE VALUES.

ESTIMATED QUANTITIES - CITY PARK LAKE		
	VOLUME (CY)	AREA (ACRES)
UNCONSOLIDATED DREDGE	95,805.70	27.24
CLAY DREDGE	62,681.04	21.63
SHORELINE FILL	38,001.69	13.96
CONTAINED FILL	56,235.96	13.99

ESTIMATED QUANTITIES - UNIVERSITY LAKE		
	VOLUME (CY)	AREA (ACRES)
UNCONSOLIDATED DREDGE	320,543.46	124.71
CLAY DREDGE	306,410.99	118.39
SHORELINE FILL	58,531.07	31.77
CONTAINED FILL	163,698.62	22.98
ISLAND FILL	25,711.13	3.81

ESTIMATED QUANTITIES - ERIE LAKE		
	VOLUME (CY)	AREA (ACRES)
UNCONSOLIDATED DREDGE	8,023.33	2.48
CLAY DREDGE	2,198.50	1.12
SHORELINE FILL	1,285.51	1.07

ESTIMATED QUANTITIES - CAMPUS LAKE		
	VOLUME (CY)	AREA (ACRES)
UNCONSOLIDATED DREDGE	7,990.53	4.12
CLAY DREDGE	6,470.71	2.68
SHORELINE FILL	450.07	0.23
CONTAINED FILL	11,057.42	2.48

ESTIMATED QUANTITIES - CREST LAKE		
	VOLUME (CY)	AREA (ACRES)
UNCONSOLIDATED DREDGE	9,651.49	4.29
CLAY DREDGE	3,510.02	4.21
SHORELINE FILL	13,535.21	4.79

ESTIMATED QUANTITIES - COLLEGE LAKE		
	VOLUME (CY)	AREA (ACRES)
UNCONSOLIDATED DREDGE	7,056.55	3.29
SHORELINE FILL	3,562.79	1.45

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DATE: 10/07/2021

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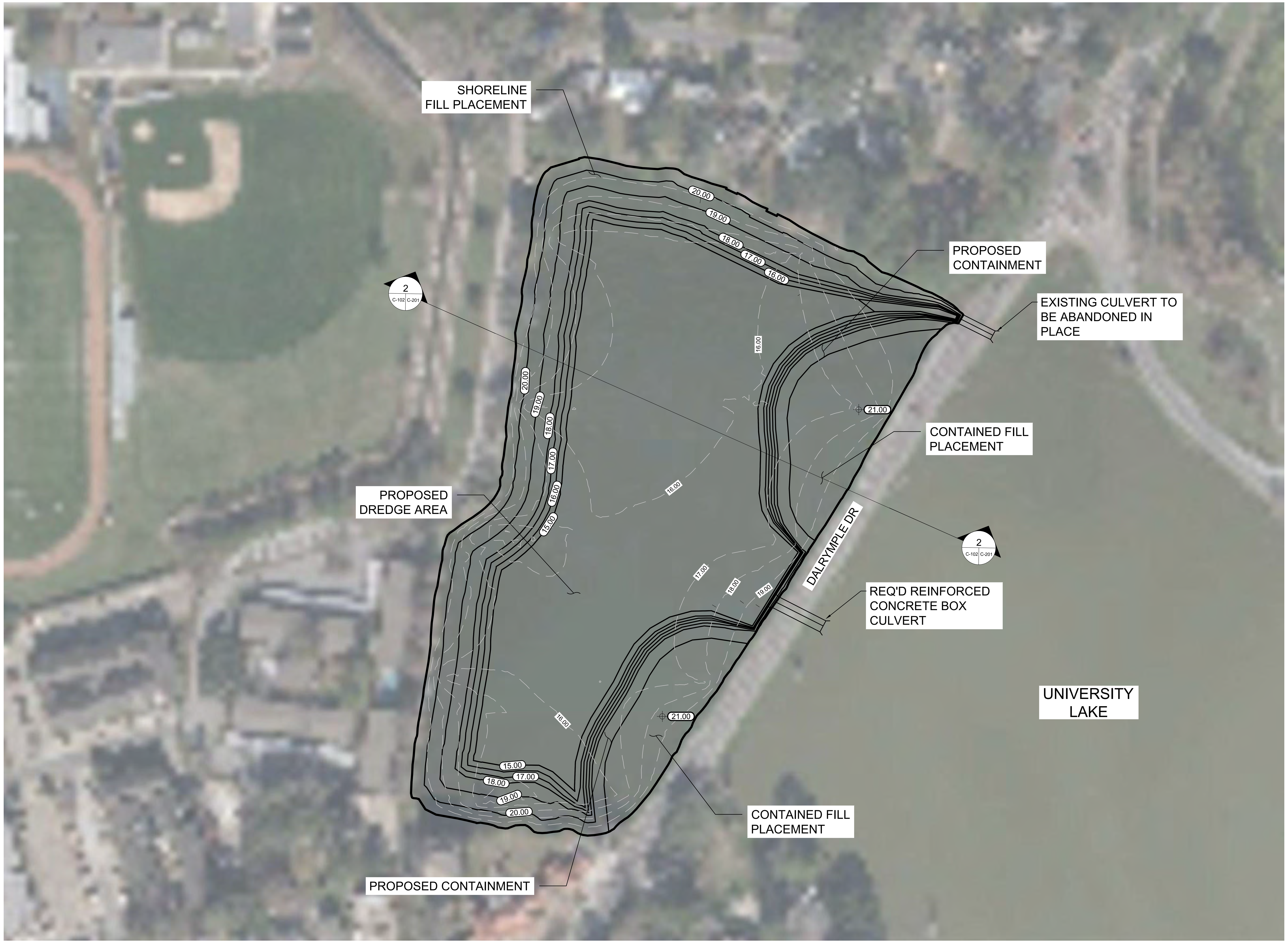

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6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.

LAKE CREST GRADING PLAN

SCALE: 1" = 75'

N

75' 37.5' 0' 75' 150'

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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Stantec

ENGINEER OF RECORD: RYAN WALDRON
LOUISIANA PE LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

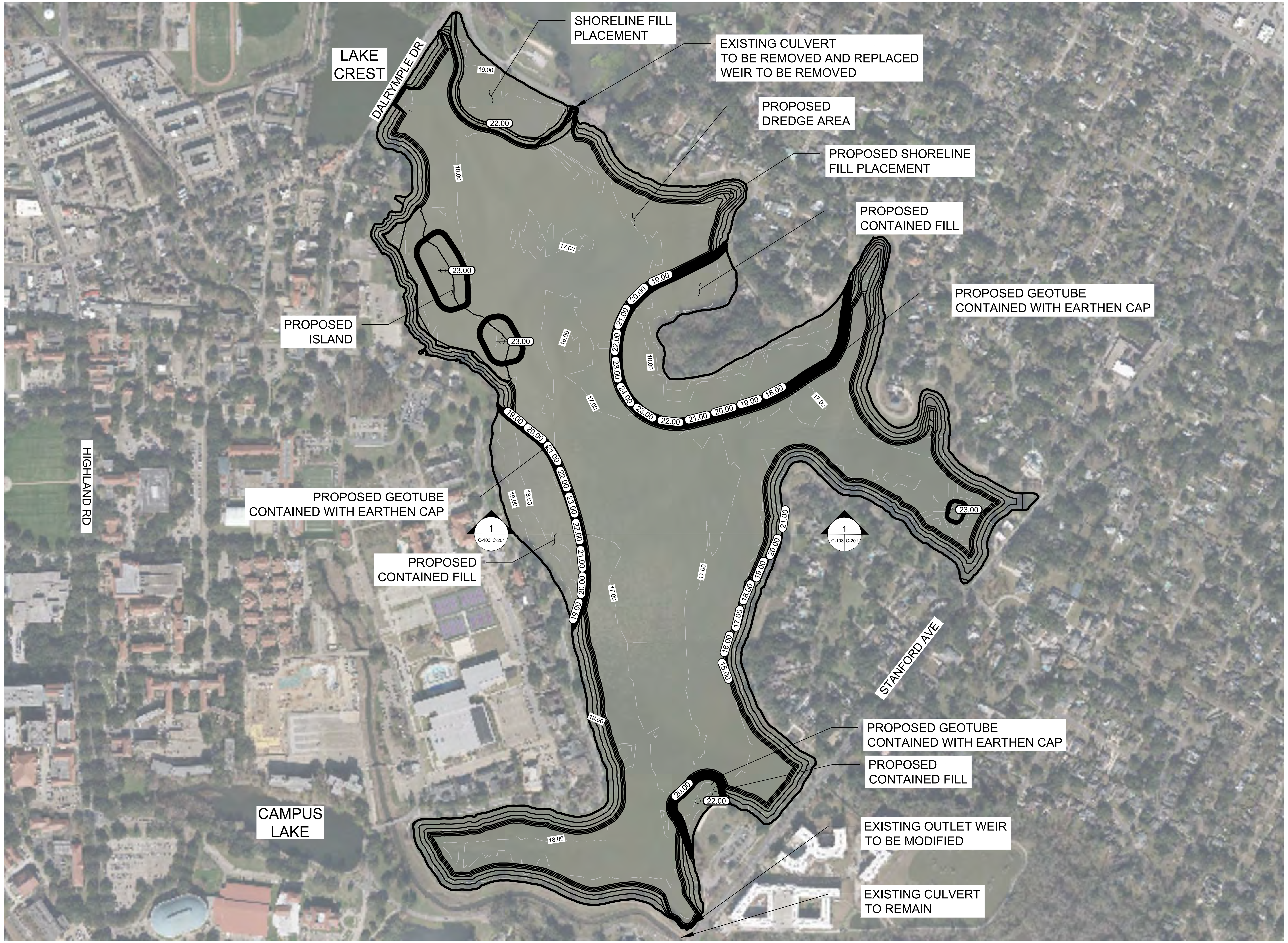
LAKE CREST GRADING PLAN

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE

SHEET SHEET C-102

SaveDate: 2021/10/28 4:59 PM Login: Scott, Patrick
c-101 to 107 grading.dwg



UNIVERSITY LAKE GRADING PLAN

SCALE: 1" = 325'

NOTES:

1. BATHYMETRIC DATA SHOWN IS BASED ON SURVEY DATA COLLECTED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021.
2. ELEVATIONS PROVIDED HEREIN ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD88) - GEOID 18.
3. COORDINATE SYSTEM: STATE PLAN NAD83 (2011), US FOOT, LOUISIANA SOUTH ZONE 1702.
4. CONTOURS SHOWN WERE GENERATED USING CROSS SECTIONS COLLECTED AT 200FT INTERVALS WITHIN THE SURVEY AREA AS PROVIDED BY THE SURVEYOR.
5. AERIAL IMAGERY SHOWN IS FOR REFERENCE ONLY AND MAY NOT REFLECT CURRENT CONDITIONS.
6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.

325' 162.5' 0' 325' 650'

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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Stantec

ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

UNIVERSITY LAKE GRADING PLAN

DATE: 10/07/2021

DRAWN BY: P. SCOTT
DESIGNED BY: R. WALDRON
APPROVED BY: T. CANCIENNE
SHEET SHEET C-103

CAMPUS LAKE GRADING PLAN

SCALE: 1" = 70'

70' 35' 0' 70' 140'

NOTES:

1. BATHYMETRIC DATA SHOWN IS BASED ON SURVEY DATA COLLECTED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021.
2. ELEVATIONS PROVIDED HEREIN ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD88) - GEOID 18.
3. COORDINATE SYSTEM: STATE PLAN NAD83 (2011), US FOOT, LOUISIANA SOUTH ZONE 1702.
4. CONTOURS SHOWN WERE GENERATED USING CROSS SECTIONS COLLECTED AT 200FT INTERVALS WITHIN THE SURVEY AREA AS PROVIDED BY THE SURVEYOR.
5. AERIAL IMAGERY SHOWN IS FOR REFERENCE ONLY AND MAY NOT REFLECT CURRENT CONDITIONS.
6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.

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ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

CAMPUS LAKE GRADING PLAN

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE | SHEET SHEET C-104

SaveDate: 2021/10/28 4:59 PM Login: Scott, Patrick
c-101 to 107 grading.dwg

NOTES:

1. BATHYMETRIC DATA SHOWN IS BASED ON SURVEY DATA COLLECTED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021.
2. ELEVATIONS PROVIDED HEREIN ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD88) - GEOID 18.
3. COORDINATE SYSTEM: STATE PLAN NAD83 (2011), US FOOT, LOUISIANA SOUTH ZONE 1702.
4. CONTOURS SHOWN WERE GENERATED USING CROSS SECTIONS COLLECTED AT 200FT INTERVALS WITHIN THE SURVEY AREA AS PROVIDED BY THE SURVEYOR.
5. AERIAL IMAGERY SHOWN IS FOR REFERENCE ONLY AND MAY NOT REFLECT CURRENT CONDITIONS.
6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.

COLLEGE LAKE GRADING PLAN

SCALE: 1" = 60'

N

60' 30' 0' 60' 120'

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

DRAWN BY: P. SCOTT

DESIGNED BY: R. WALDRON

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

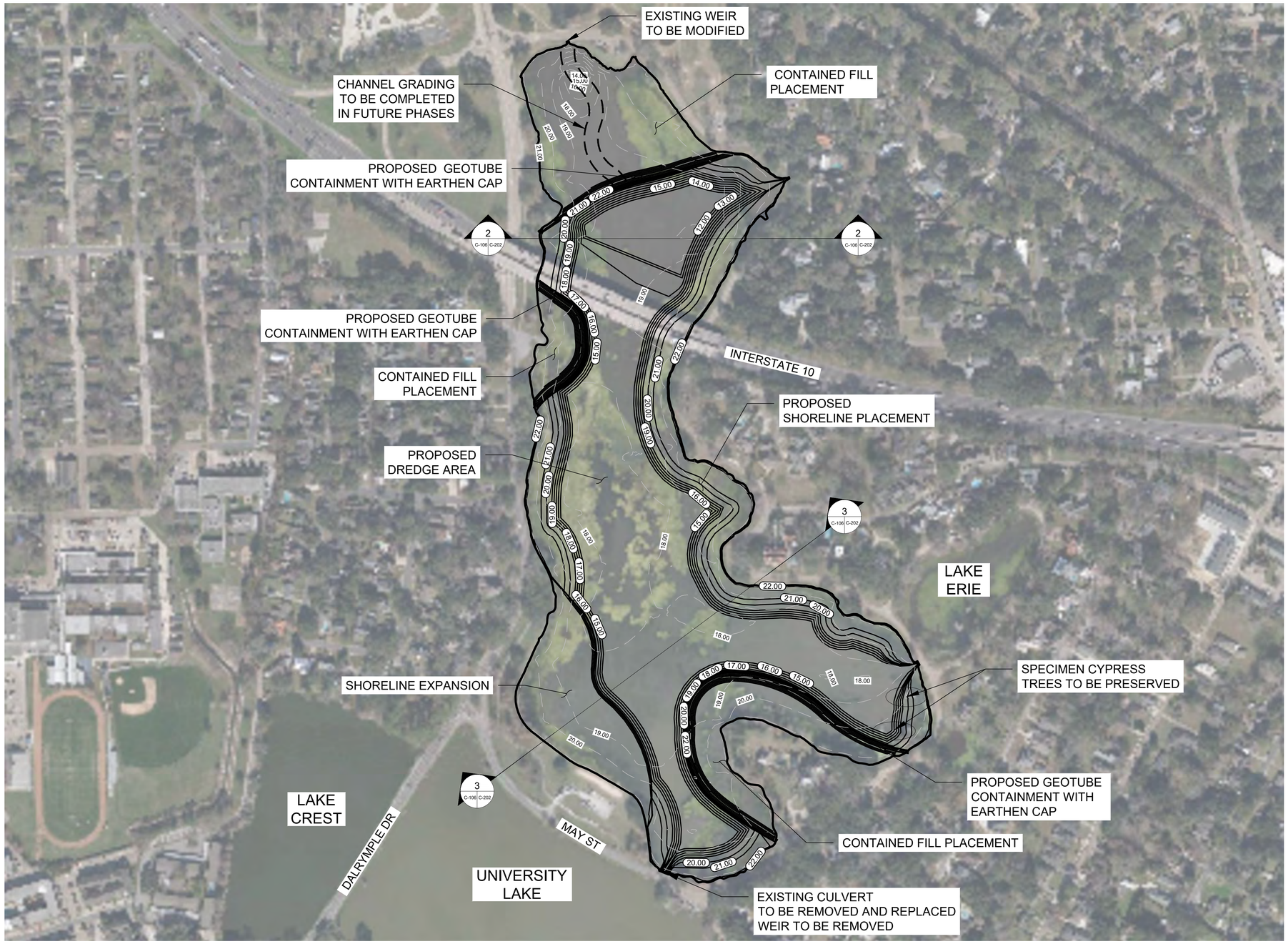
APPROVED BY: T. CANCIENNE

COLLEGE LAKE GRADING PLAN

DATE: 10/07/2021

SHEET SHEET C-105

SaveDate: 2021/10/28 4:59 PM Login: Scott, Patrick
c-101 to 107 grading.dwg



CITY PARK LAKE GRADING PLAN

SCALE: 1" = 200'

NOTES:

1. BATHYMETRIC DATA SHOWN IS BASED ON SURVEY DATA COLLECTED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021.
2. ELEVATIONS PROVIDED HEREIN ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD88) - GEOID 18.
3. COORDINATE SYSTEM: STATE PLAN NAD83 (2011), US FOOT, LOUISIANA SOUTH ZONE 1702.
4. CONTOURS SHOWN WERE GENERATED USING CROSS SECTIONS COLLECTED AT 200FT INTERVALS WITHIN THE SURVEY AREA AS PROVIDED BY THE SURVEYOR.
5. AERIAL IMAGERY SHOWN IS FOR REFERENCE ONLY AND MAY NOT REFLECT CURRENT CONDITIONS.
6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.

200' 100' 0' 200' 400'

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

CITY PARK GRADING PLAN

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE

SHEET C-106

SaveDate: 20211028, 4:59 PM Login: Scott, Patrick
c:\c3d 19.1\01 grading.dwg

NOTES:

1. BATHYMETRIC DATA SHOWN IS BASED ON SURVEY DATA COLLECTED BY CH FENSTERMAKER & ASSOCIATES, LLC ON APRIL 1, 2021.
2. ELEVATIONS PROVIDED HEREIN ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD88) - GEOID 18.
3. COORDINATE SYSTEM: STATE PLAN NAD83 (2011), US FOOT, LOUISIANA SOUTH ZONE 1702.
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6. NATURAL GROUND ELEVATIONS SHOWN ARE FOR REFERENCE ONLY.

LAKE ERIE GRADING PLAN

SCALE: 1" = 50'

N

50' 25' 0' 50' 100'

REV.	DATE	DESCRIPTION	BY
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UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

LAKE ERIE GRADING PLAN

DATE: 10/07/2021

DRAWN BY: P. SCOTT

DESIGNED BY: R. WALDRON

APPROVED BY: T. CANCIENNE

SHEET SHEET C-107

SaveDate: 2021/10/28 4:59 PM Login: Scott, Patrick
c-101 to 107 grading.dwg

LEGEND

Red	101-120 STUMPS PER ACRE
Orange	81-100 STUMPS PER ACRE
Yellow	61-80 STUMPS PER ACRE
Green	41-60 STUMPS PER ACRE
Blue	21-40 STUMPS PER ACRE
Cyan	1-20 STUMPS PER ACRE
Light cyan	0 STUMPS PER ACRE

NOTES:

1. STUMP DENSITY MAPS WERE DEVELOPED BASED ON POINTS IDENTIFIED IN THE SONAR SURVEY CONDUCTED BY CH FENSTERMAKER & ASSOCIATES, LLC AS STUMPS.
2. STUMP LOCATIONS WERE NOT PROVIDED FOR CITY PARK LAKE, LAKE ERIE, OR COLLEGE LAKE.

STUMP DENSITY MAP

SCALE: 1" = 500'

500' 250' 0' 500' 1000'

REV.	DATE	DESCRIPTION	BY
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LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

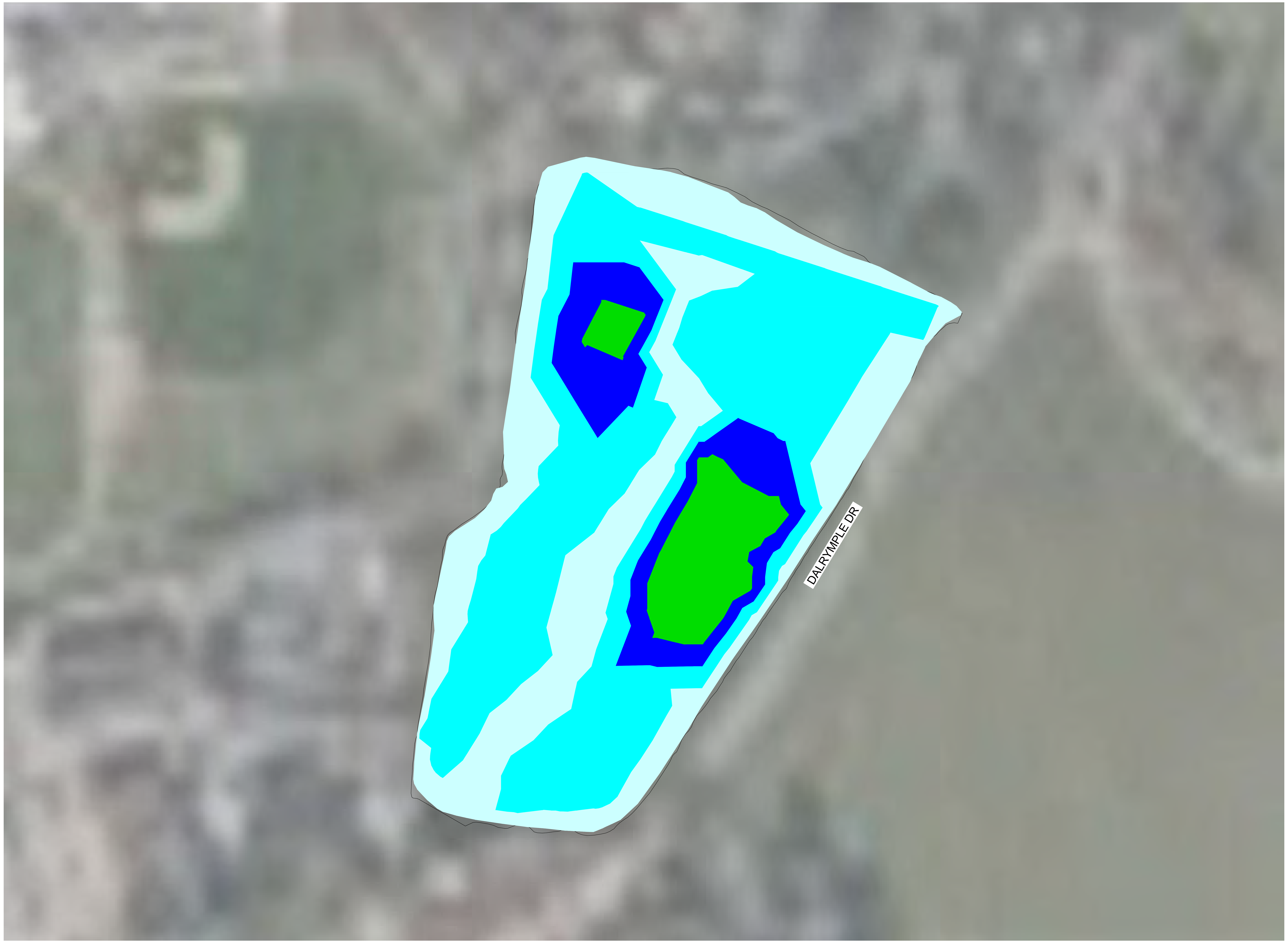
UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

STUMP DENSITY MAP

DATE: 10/07/2021

DRAWN BY: P. SCOTT
DESIGNED BY: R. WALDRON
APPROVED BY: T. CANCIENNE
SHEET SHEET C-108



LEGEND

- 101-120 STUMPS PER ACRE
- 81-100 STUMPS PER ACRE
- 61-80 STUMPS PER ACRE
- 41-60 STUMPS PER ACRE
- 21-40 STUMPS PER ACRE
- 1-20 STUMPS PER ACRE
- 0 STUMPS PER ACRE

NOTES:

1. STUMP DENSITY MAPS WERE DEVELOPED BASED ON POINTS IDENTIFIED IN THE SONAR SURVEY CONDUCTED BY CH FENSTERMAKER & ASSOCIATES, LLC AS STUMPS.
2. STUMP LOCATIONS WERE NOT PROVIDED FOR CITY PARK LAKE, LAKE ERIE, OR COLLEGE LAKE.

LAKE CREST STUMP DENSITY MAP

SCALE: 1" = 75'

N

75' 37.5' 0' 75' 150'

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

LAKE CREST STUMP DENSITY MAP

DATE: 10/07/2021

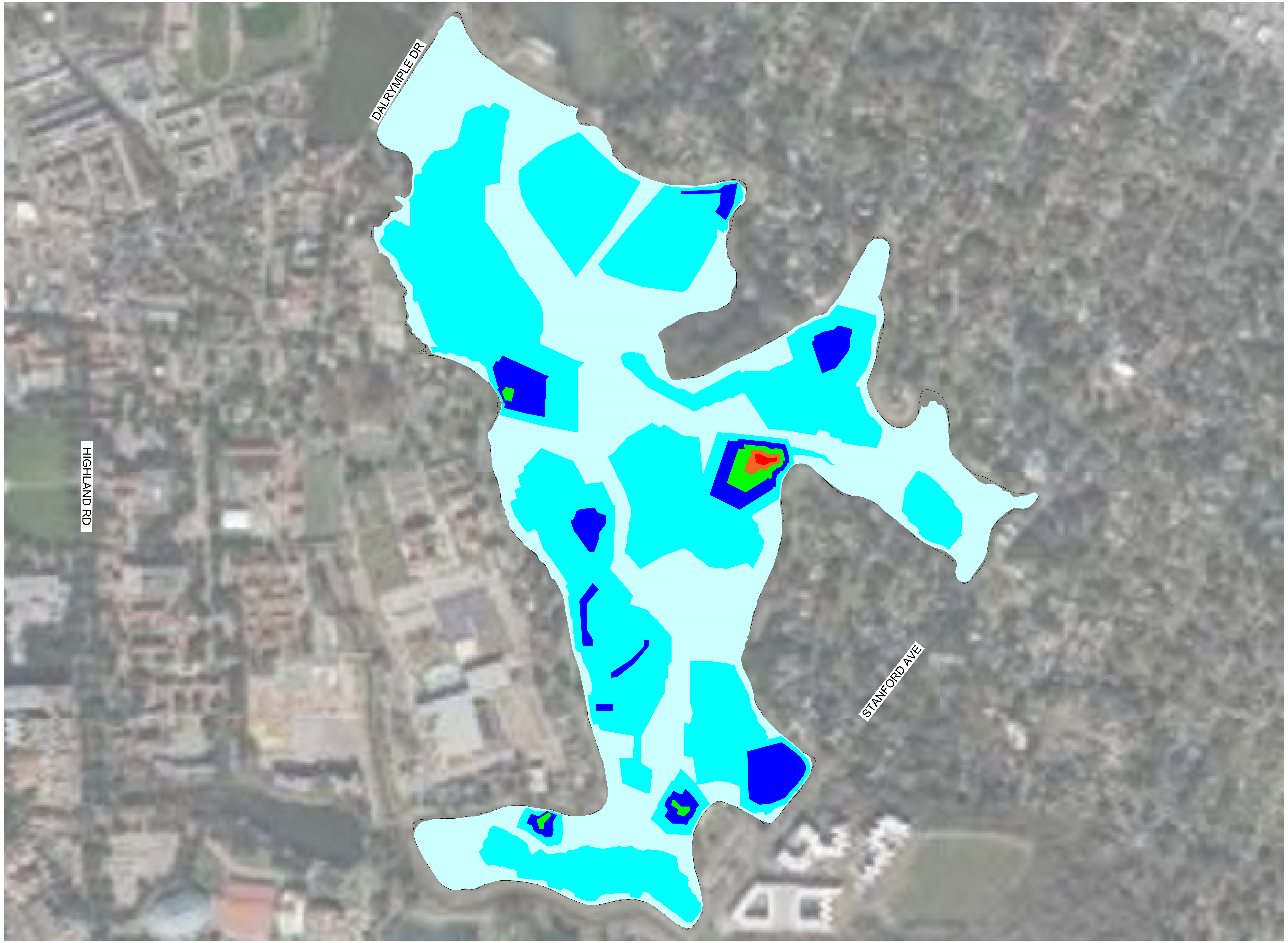
DRAWN BY: P. SCOTT

DESIGNED BY: R. WALDRON

APPROVED BY: T. CANCIENNE

SHEET SHEET C-109

SaveDate: 2021/10/07 3:31 PM Login: Scott, Patrick
c-108 to 114 stump density.dwg



LEGEND

Red	101-120 STUMPS PER ACRE
Orange	81-100 STUMPS PER ACRE
Yellow	61-80 STUMPS PER ACRE
Green	41-60 STUMPS PER ACRE
Blue	21-40 STUMPS PER ACRE
Cyan	1-20 STUMPS PER ACRE
Light cyan	0 STUMPS PER ACRE

NOTES:

1. STUMP DENSITY MAPS WERE DEVELOPED BASED ON POINTS IDENTIFIED IN THE SONAR SURVEY CONDUCTED BY CH FENSTERMAKER & ASSOCIATES, LLC AS STUMPS.
2. STUMP LOCATIONS WERE NOT PROVIDED FOR CITY PARK LAKE, LAKE ERIE, OR COLLEGE LAKE.

UNIVERSITY LAKE STUMP DENSITY MAP

SCALE: 1" = 325'

N

325' 162.5' 0' 325' 650'

REV.	DATE	DESCRIPTION	BY
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UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

UNIVERSITY LAKE STUMP DENSITY MAP

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE | SHEET SHEET C-110

LEGEND

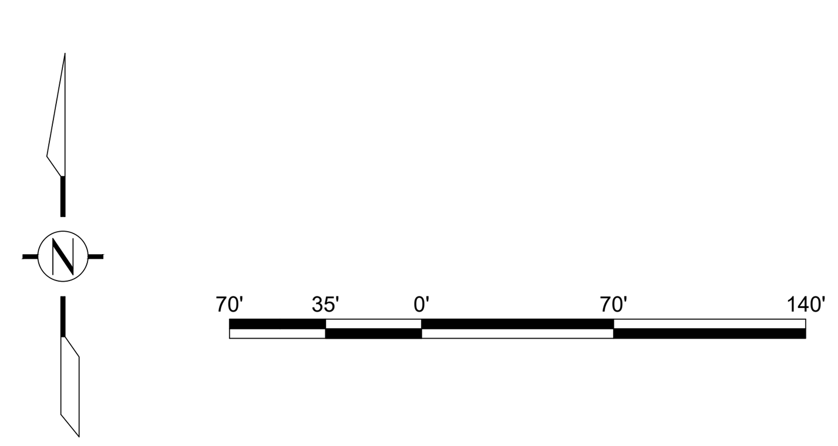
Color	Description
Red	101-120 STUMPS PER ACRE
Orange	81-100 STUMPS PER ACRE
Yellow	61-80 STUMPS PER ACRE
Green	41-60 STUMPS PER ACRE
Blue	21-40 STUMPS PER ACRE
Cyan	1-20 STUMPS PER ACRE
Light cyan	0 STUMPS PER ACRE

NOTES:

1. STUMP DENSITY MAPS WERE DEVELOPED BASED ON POINTS IDENTIFIED IN THE SONAR SURVEY CONDUCTED BY CH FENSTERMAKER & ASSOCIATES, LLC AS STUMPS.
2. STUMP LOCATIONS WERE NOT PROVIDED FOR CITY PARK LAKE, LAKE ERIE, OR COLLEGE LAKE.

CAMPUS LAKE STUMP DENSITY MAP

SCALE: 1" = 70'



REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

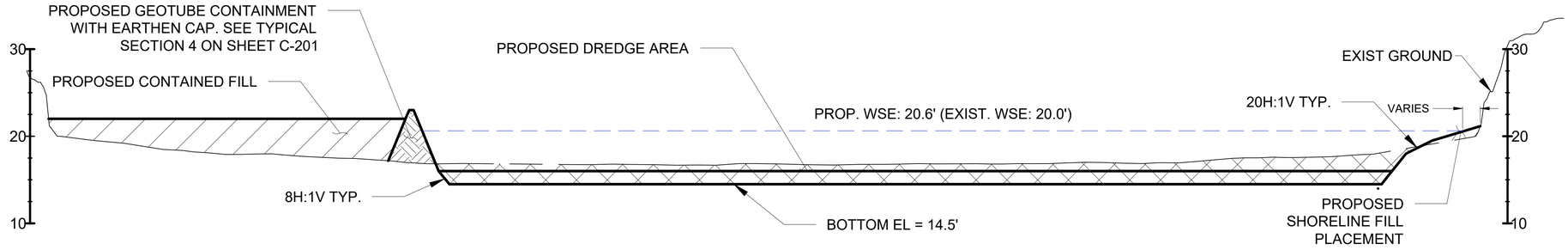
STANTEC PROJECT NUMBER: 177311664

CAMPUS LAKE STUMP DENSITY MAP

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE | SHEET SHEET C-111

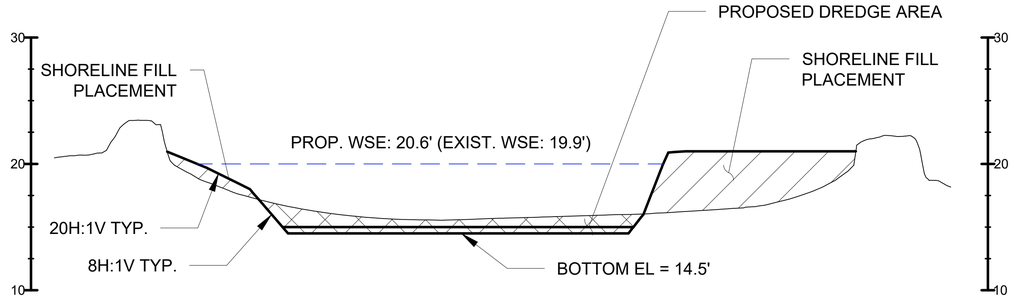
SaveDate: 2021/10/07 3:31 PM Login: Scott, Patrick
c-108 to 114 stump density.dwg



1 TYPICAL SECTION - UNIVERSITY LAKE

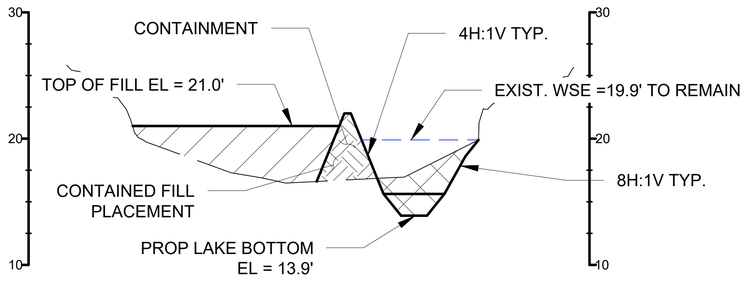
SCALE: H 1"=100'; V 1"=10'

HORIZONTAL GRAPHIC SCALE
100' 50' 0 100' 200'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE



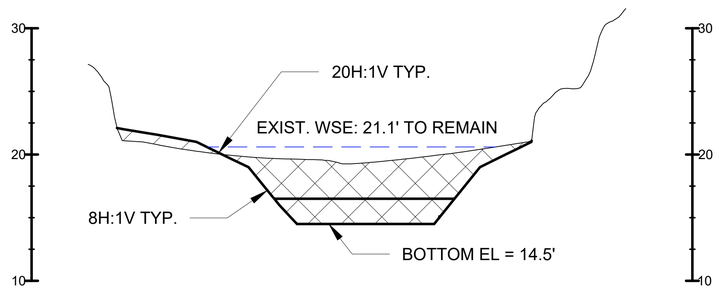
2 TYPICAL SECTION - LAKE CREST

SCALE: H 1"=60'; V 1"=6'



3 TYPICAL SECTION - LAKE ERIE

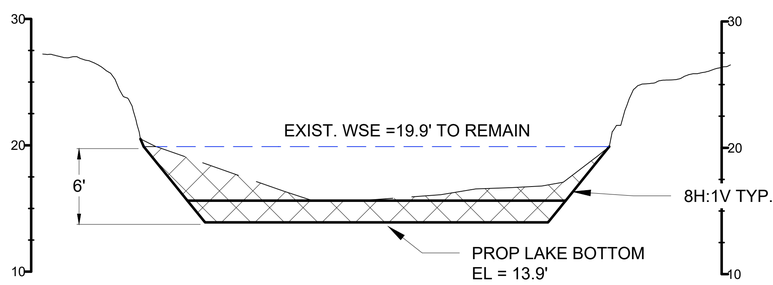
SCALE: H 1"=60'; V 1"=6'



4 TYPICAL SECTION - CAMPUS LAKE

SCALE: H 1"=60'; V 1"=6'

HORIZONTAL GRAPHIC SCALE
60' 30' 0 60' 120'
6' 3' 0 6' 12'
VERTICAL GRAPHIC SCALE



5 TYPICAL SECTION - CAMPUS LAKE

SCALE: H 1"=60'; V 1"=6'

LEGEND

- DREDGE AREA
- SHORELINE PLACEMENT AREA
- EARTHEN CONTAINMENT

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RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

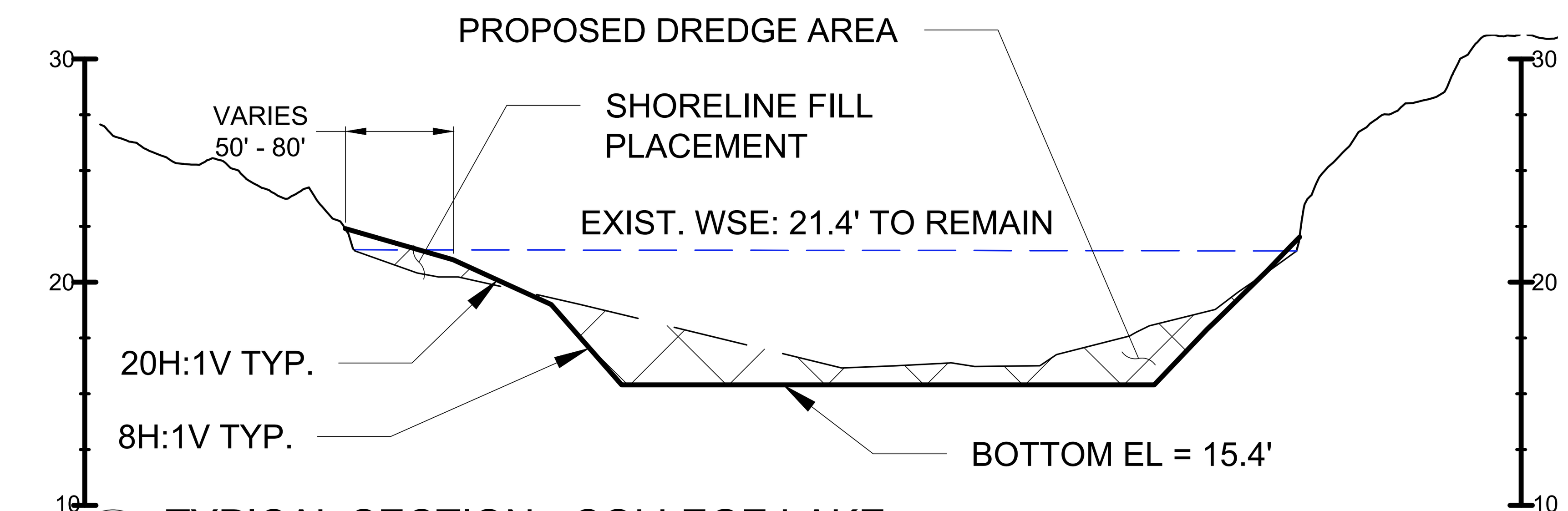
UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

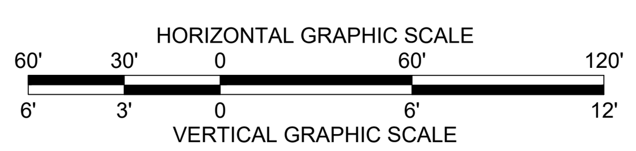
DATE: 10/07/2021

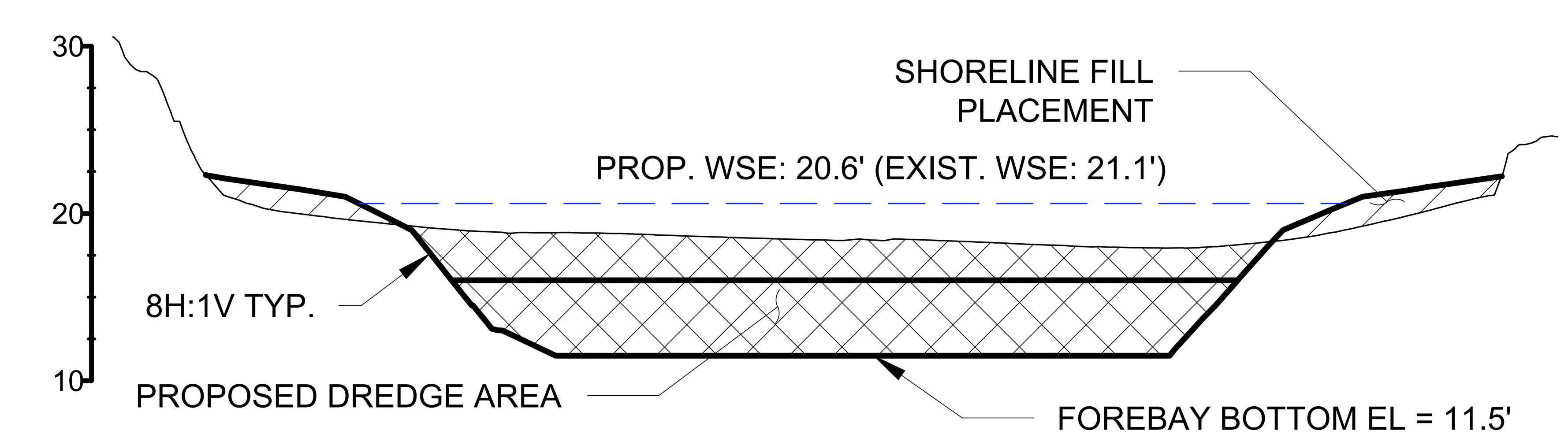
DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE | SHEET C-201

SaveDate: 2021/10/28 4:49 PM Login: Scott, Patrick
c-201 - 202 typical sections_contained.dwg

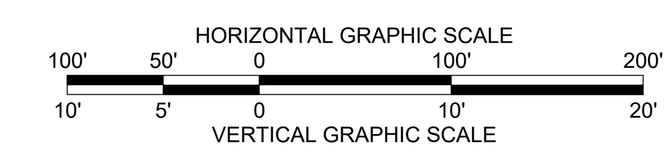


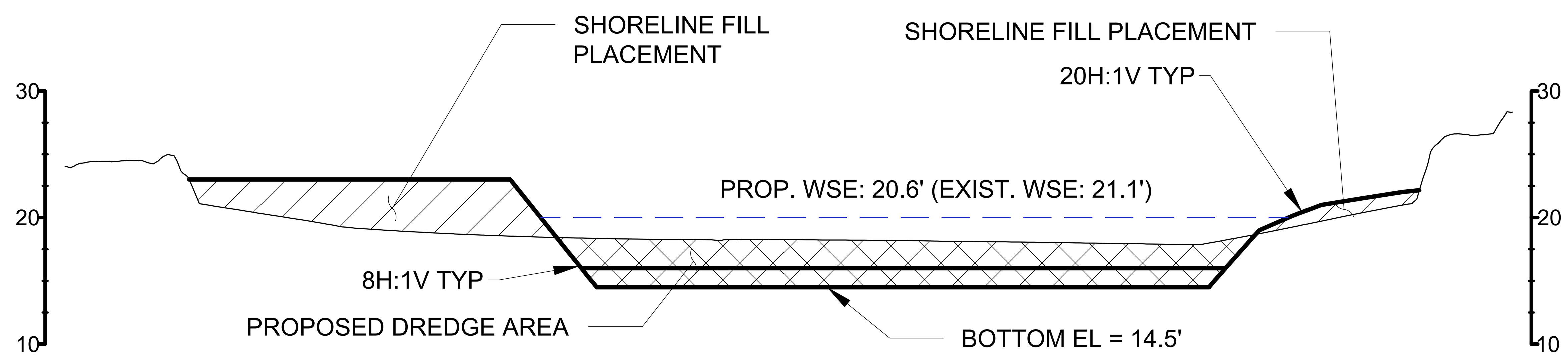
1 TYPICAL SECTION - COLLEGE LAKE
SCALE: H 1"=60'; V 1"=6'



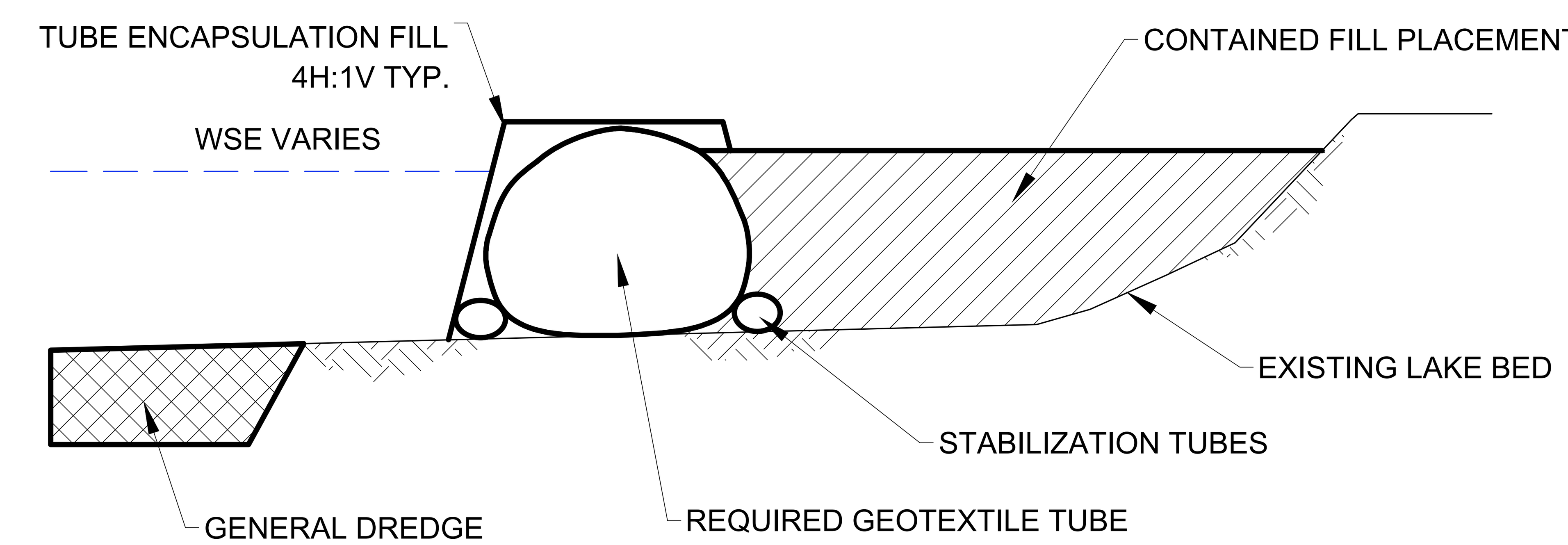


2 TYPICAL SECTION - CITY PARK LAKE
SCALE: H 1"=100'; V 1"=10'





3 TYPICAL SECTION - CITY PARK LAKE
SCALE: H 1"=100'; V 1"=10'



4 STRUCTURAL GEOTEXTILE TUBE CROSS SECTION
N.T.S.

LEGEND

- DREDGE AREA
- SHORELINE PLACEMENT AREA
- EARTHEN CONTAINMENT

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

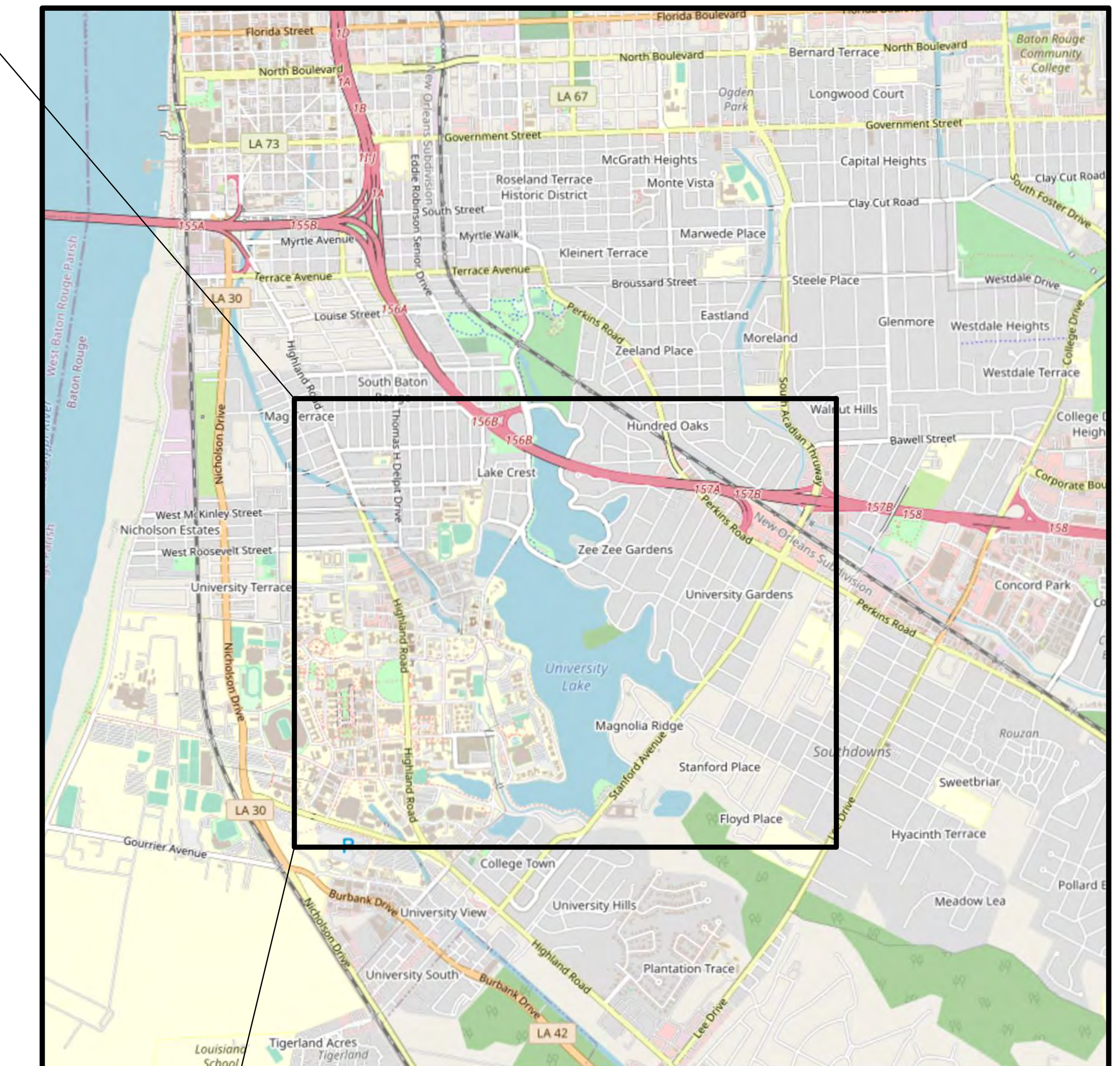
UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE | SHEET C-202

SaveDate: 2021/10/28 4:49 PM Login: Scott, Patrick
c-201, 202 typical sections_combined.dwg

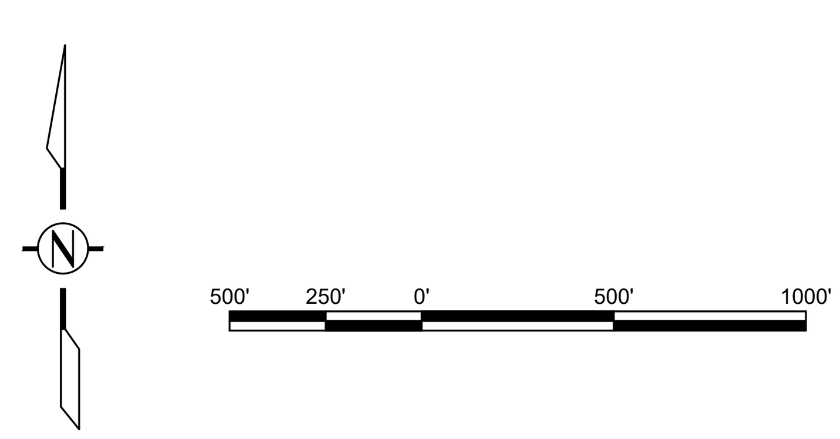


LOCATION SITE MAP

SCALE: 1" = 2,500'

GEOTECHNICAL BORING LOCATION MAP

SCALE: 1" = 500'



REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

GEOTECHNICAL BORING LOCATION MAP

DATE: 10/07/2021

DRAWN BY: P. SCOTT | DESIGNED BY: R. WALDRON | APPROVED BY: T. CANCIENNE | SHEET B-101

SaveDate: 2021/10/07 4:30 PM Login: Scott, Patrick
b-101, 102, 103 borings.dwg

Drilled	Start 4/27/2021	End 4/27/2021	Total Depth (ft)	20	Logged By AJW / Checked By DSE	Driller	Specialized Environmental Services, Inc.	Drilling Method	Wet Rotary
Surface Elevation (ft) / Vertical Datum	Undetermined / NAVD88		Hammer Data	N/A		Drilling Equipment	Single-Engine Airboat		
Latitude / Longitude	30.4273 / -91.1681		System / Datum	Geographic / NAD83 (feet)		Depth of water to mudline at time of exploration (ft)	1.5		

Notes:

Recovered (in)	Blows/foot or Pocket Pen (TSF)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Shear Strength, (KSF)	Confining Pressure, (PSI)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	Passing No. 200 Sieve, %	PID (PPM)
18	0.0	1	CH	Gray clay with trace organic matter (very soft) (Organic Content = 3.7%, Consol)	45	75.9				51	28		
21	0.0	2		Gray clay with ferrous nodules and trace organic matter (very soft)	47								
22	0.5	3		Gray clay with ferrous nodules and trace organic matter (soft)	35	86	0.37	5	15	53	31	99	
22	0.5	4	CL	Gray clay with silt (medium)	32								
23	0.0	5		Gray clay with silt and organic matter (very soft)	38								
24	1.0	6		Brown clay with silt (stiff)	31								
13	0.5	7	CH	Gray clay with silt lenses and organic matter (very soft)	29	87.8	0.19	5.2	15				
7		8	CL	Gray clay with silt	32								
9	1.0	9	CH	Gray clay (stiff)	34								
7	0.5	10		Gray clay (medium)	41								

DRAFT

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on , Vertical approximated based on
*Indicates a remold was used for strength testing.

Log of Boring B-1

GeoEngineers

Project: LSU Lakes Sediment Sampling
Project Location: Baton Rouge, Louisiana
Project Number: 24892-001-00

Figure C-2
Sheet 1 of 1

Drilled	Start 4/27/2021	End 4/27/2021	Total Depth (ft)	20	Logged By AJW / Checked By DSE	Driller	Specialized Environmental Services, Inc.	Drilling Method	Wet Rotary
Surface Elevation (ft) / Vertical Datum	Undetermined / NAVD88		Hammer Data	N/A		Drilling Equipment	Single-Engine Airboat		
Latitude / Longitude	30.4215 / -91.1691		System / Datum	Geographic / NAD83 (feet)		Depth of water to mudline at time of exploration (ft)	Not Determined		

Notes:

Recovered (in)	Blows/foot or Pocket Pen (TSF)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Shear Strength, (KSF)	Confining Pressure, (PSI)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	Passing No. 200 Sieve, %	PID (PPM)
10	0.5	1	CH	Gray clay with organic matter (medium)	52								
13	0.5	2		Gray clay with ferrous nodules and organic matter (medium)	44	75.7	0.7	5	9	89	60		
14	0.5	3		Gray clay (medium)	64								
16	0.5	4		Gray clay with ferrous nodules and organic matter (medium)	37	79.9	0.74	5	7				
12	0.5	5		Gray clay with ferrous nodules and trace organic matter (medium) (Consol)	39	82.7				74	49		
22	0.5	6		Gray and brown clay with ferrous nodules (medium)	38								
28	0.5	7		Gray clay with ferrous nodules (medium)	39								
23	1.0	8		Gray clay with ferrous nodules (stiff)	47								
11	0.5	9		Gray clay (medium)	54								
9	0.5	10		Gray clay (medium)	60								

DRAFT

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on , Vertical approximated based on
*Indicates a remold was used for strength testing.

Log of Boring B-2

GeoEngineers

Project: LSU Lakes Sediment Sampling
Project Location: Baton Rouge, Louisiana
Project Number: 24892-001-00

Figure C-3
Sheet 1 of 1

Drilled	Start 4/27/2021	End 4/27/2021	Total Depth (ft)	20	Logged By AJW / Checked By DSE	Driller	Specialized Environmental Services, Inc.	Drilling Method	Wet Rotary
Surface Elevation (ft) / Vertical Datum	Undetermined / NAVD88		Hammer Data	N/A		Drilling Equipment	Single-Engine Airboat		
Latitude / Longitude	30.4179 / -91.1654		System / Datum	Geographic / NAD83 (feet)		Depth of water to mudline at time of exploration (ft)	2.3		

Notes:

Recovered (in)	Blows/foot or Pocket Pen (TSF)	Sample Name	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Shear Strength, (KSF)	Confining Pressure, (PSI)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	Passing No. 200 Sieve, %	PID (PPM)
15	0.0	1	CH	Gray clay with organic matter (very soft)	202								
18	0.5	2		Gray clay with organic matter (medium) (Organic Content = 8%, Consol)	109	43.5				116	77		
27	0.5	3		Gray clay with organic matter (soft)	63	59.9	0.34	5	9				
24	0.5	4		Gray clay (medium)	77								
18	0.5	5		Gray clay with organic matter (medium)	58	64.8	0.52	5	4	93	61		
20	0.5	6		Gray clay (medium)	67								
10	0.5	7		Gray clay with organic matter (very soft)	83	52.7	0.18	5.2	10				
28	0.5	8		Gray clay (medium)	79								
8	0.5	9		Gray clay with organic matter (medium)	82								
23	0.5	10		Gray clay with organic matter (medium)	85								

DRAFT

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on , Vertical approximated based on
*Indicates a remold was used for strength testing.

Log of Boring B-3

GeoEngineers

Project: LSU Lakes Sediment Sampling
Project Location: Baton Rouge, Louisiana
Project Number: 24892-001-00

Figure C-4
Sheet 1 of 1

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

PRELIMINARY
FOR REVIEW ONLY

NOT TO BE USED FOR CONSTRUCTION, BIDDING, OR AS THE BASIS FOR THE ISSUANCE OF A PERMIT.

Stantec

ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

DRAWN BY: P. SCOTT
DESIGNED BY: R. WALDRON

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

APPROVED BY: T. CANCIENNE

GEOTECHNICAL BORING LOGS 1 OF 2

DATE: 10/07/2021

SHEET B-102

SaveDate: 2021/10/07 4:30 PM Login: Scott, Patrick
b-101, 102, 103 borings.dwg

Log of Boring B-4

Drilled	Start 4/27/2021	End 4/27/2021	Total Depth (ft)	20	Logged By AJW / Checked By DSE	Driller: Specialized Environmental Services, Inc.	Drilling Method: Wet Rotary

Surface Elevation (ft) / Vertical Datum	Undetermined / NAVD88	Hammer Data	N/A	Drilling Equipment	Single-Engine Airboat
Latitude / Longitude	30.4137 / -91.168	System / Datum	Geographic / NAD83 (feet)	Depth of water to mudline at time of exploration (ft)	2.0
Notes:					

Recovered (in)	Blows/foot or Pocket Pen (TSF)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Shear Strength, (KSF)	Confining Pressure, (PSI)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	Passing No. 200 Sieve, %	PID (PPM)
21	0.0		1		CH	Gray clay with organic matter (very soft)	47								
14	0.0		2			Gray clay (soft)	41	68.3	0.38	5	5				
18	0.5		3			Gray clay (medium) (Consol)	35	83.1				65	45		
15	0.5		4			Gray clay with silt pockets and organic matter (medium)	45								
23	1.0		5		CL	Gray silty clay with trace organic matter (medium)	30	91	0.68	5	15	35	12		
28	0.5		6			Gray clay with silt and organic matter (medium)	37								
22	0.5		7			Gray clay with silt and ferrous nodules (medium)	38								
			8		CH	No Recovery	36								
16	0.0		9			Gray clay with ferrous nodules and silt pockets (very soft)	34								
16	0.0		10			Gray clay with ferrous nodules, calcareous nodules, and organic matter (very soft)	33								

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on , Vertical approximated based on
*Indicates a remold was used for strength testing.

Log of Boring B-4

GeoEngineers

Project: LSU Lakes Sediment Sampling
Project Location: Baton Rouge, Louisiana
Project Number: 24892-001-00

Figure C-5
Sheet 1 of 1

Log of Boring B-5

Drilled	Start 4/27/2021	End 4/27/2021	Total Depth (ft)	20	Logged By AJW / Checked By DSE	Driller: Specialized Environmental Services, Inc.	Drilling Method: Wet Rotary

Surface Elevation (ft) / Vertical Datum	Undetermined / NAVD88	Hammer Data	N/A	Drilling Equipment	Single-Engine Airboat
Latitude / Longitude	30.4092 / -91.1634	System / Datum	Geographic / NAD83 (feet)	Depth of water to mudline at time of exploration (ft)	1.7
Notes:					

Recovered (in)	Blows/foot or Pocket Pen (TSF)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Shear Strength, (KSF)	Confining Pressure, (PSI)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	Passing No. 200 Sieve, %	PID (PPM)
17	0.0		1		CH	Gray clay with organic matter (very soft)	144								
20	0.0		2			Gray clay with organic matter and calcareous nodules (very soft)	162								
21	0.5		3			Gray clay with organic matter (very soft) (Organic Content = 14.8%)	100	45.2	0.23	5	9	134	93		
22	0.0		4			Gray clay with organic matter (very soft)	105								
26	0.0		5			Gray clay with organic matter (very soft)	102								
27	0.0		6		OH	Gray organic clay (very soft)	154	34.1	0.19	5	7				
22	0.0		7			Brownish gray organic clay (very soft) (Consol)	100	42.8				137	91		
22	0.0		8		CH	Gray clay with organic matter (very soft)	151								
12	0.0		9			Gray clay with organic matter (very soft)	151								
9	0.0		10			Gray clay with organic matter (very soft)	201								

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on , Vertical approximated based on
*Indicates a remold was used for strength testing.

Log of Boring B-5

GeoEngineers

Project: LSU Lakes Sediment Sampling
Project Location: Baton Rouge, Louisiana
Project Number: 24892-001-00

Figure C-6
Sheet 1 of 1

Log of Boring B-6

Drilled	Start 4/27/2021	End 4/27/2021	Total Depth (ft)	20	Logged By AJW / Checked By DSE	Driller: Specialized Environmental Services, Inc.	Drilling Method: Wet Rotary

Surface Elevation (ft) / Vertical Datum	Undetermined / NAVD88	Hammer Data	N/A	Drilling Equipment	Single-Engine Airboat
Latitude / Longitude	30.4087 / -91.1695	System / Datum	Geographic / NAD83 (feet)	Depth of water to mudline at time of exploration (ft)	2.0
Notes:					

Recovered (in)	Blows/foot or Pocket Pen (TSF)	Collected Sample	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Shear Strength, (KSF)	Confining Pressure, (PSI)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	Passing No. 200 Sieve, %	PID (PPM)
16	0.0		1		OH	Gray organic clay with wood fragments (very soft)	143	28.5	0.03	5	9				
24	0.0		2			Gray organic clay with wood fragments (very soft) (Organic Content = 13.6%, Consol)	117	38.7				124	77		
19	0.0		3			Gray organic clay with wood fragments and peat (very soft) (Organic Content = 27.0%)	301	17.9	0.09	5	9	223	149		
15	0.0		4		CH	Gray clay with organic matter (very soft)	125								
27	0.0		5			Brown and gray clay with organic matter (very soft)	350								
25	0.0		6			Gray clay with organic matter (very soft)	184								
24	0.0		7			Gray clay with organic matter and wood throughout sample (very soft)	316								
28	0.0		8			Gray clay with organic matter and wood at 14 feet (very soft)	38								
28	0.0		9			Gray clay with organic matter (very soft)	162								
28	0.5		10			Gray clay with organic matter and silt pockets (medium)	106								

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on , Vertical approximated based on
*Indicates a remold was used for strength testing.

Log of Boring B-6

GeoEngineers

Project: LSU Lakes Sediment Sampling
Project Location: Baton Rouge, Louisiana
Project Number: 24892-001-00

Figure C-7
Sheet 1 of 1

REV.	DATE	DESCRIPTION	BY
0	10/2021	PHASE I PRELIMINARY DRAWING SET	##

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Stantec

ENGINEER OF RECORD:
RYAN WALDRON
LOUISIANA PE
LICENSE NO.: 37706

UNIVERSITY LAKES PROJECT

BATON ROUGE, LOUISIANA

DRAWN BY: P. SCOTT
DESIGNED BY: R. WALDRON

UNIVERSITY LAKES - PHASE I

STANTEC PROJECT NUMBER: 177311664

APPROVED BY: T. CANCIENNE

GEOTECHNICAL BORING LOGS 2 OF 2

DATE: 10/07/2021

SHEET B-103

SaveDate: 2021/10/07 4:30 PM Login: Scott, Patrick
b-101, 102, 103 borings.dwg

Appendix B – ENGINEER'S OPINION OF PROBABLE COST

Engineer's Opinion of Probable Construction Cost					
	Item	Quantity	Unit		Item Cost
1	Mobilization/Demobilization (Dredging)	1	LS		$ 5,734,417.90
2	University Lake	1	EA		$ 21,184,572.13
3	Campus Lake	1	EA		$ 639,865.18
4	Crest Lake	1	EA		$ 403,489.94
5	City Park Lake	1	EA		$ 5,030,660.60
6	Lake Erie	1	EA		$ 254,373.46
7	College Lake	1	EA		$ 181,050.10

Sub-Total		$ 33,428,429
Contingency	30%	$ 10,028,529
Total		$ 43,456,958

Lake Totals					
Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Mobilization/Demobilization (Dredging)	1	LS		$ 5,734,417.90
2	Hydraulic Dredging	168,699	CY	$ 8.74	$ 1,474,426.64
3	Mechanical Dredging & Material Handling	381,256	CY	$ 56.68	$ 21,609,589.51
4	Stump Removal (7.3 Stumps/Acre)	2,588	Acre	$ 314.52	$ 813,977.76
5	Containment (In Situ Dike)	1,174	LF	$ 100.00	$ 117,400.00
6	Containment (Geotube)	8,294	LF	$ 81.28	$ 674,094.85
7	Hydraulic Dredging for Geotube Filling	279,923	CY	$ 8.74	$ 2,446,522.65
8	Surveys	66	EA	varies	$ 558,000.00

CITY PARK LAKE

Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Hydraulic Dredging	1,238	CY	$ 8.74	$ 10,822.22
2	Mechanical Dredging & Material Handling	62,681	CY	$ 56.68	$ 3,552,759.08
3	Stump Removal (50 Stumps/Acre)	1090	Ea.	$ 314.52	$ 342,826.80
4	Containment (In Situ Dike)	0	LF	$ 100.00	$ -
5	Containment (Geotube)	2802	LF	$ 81.28	$ 227,732.55
6	Hydraulic Dredging for Geotube Filling	94,568	CY	$ 8.74	$ 826,519.95
7	Surveys	10	EA	$ 7,000.00	$ 70,000.00

Lake Sub-Total $ 5,030,660.60

UNIVERSITY LAKE

Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Hydraulic Dredging	135,188	CY	$ 8.74	$ 1,181,547.14
2	Mechanical Dredging & Material Handling	306,411	CY	$ 56.68	$ 17,367,374.91
3	Stump Removal	729	Ea.	$ 314.52	$ 229,285.08
4	Containment (In Situ Dike)	200	LF	$ 100.00	$ 20,000.00
5	Containment (Geotube)	5492	LF	$ 81.28	$ 446,362.30
6	Hydraulic Dredging for Geotube Filling	185,355	CY	$ 8.74	$ 1,620,002.70
7	Surveys	32	EA	$ 10,000.00	$ 320,000.00

Lake Sub-Total $ 21,184,572.13

LAKE ERIE

Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Hydraulic Dredging	8023	CY	$ 8.74	$ 70,121.02
2	Mechanical Dredging & Material Handling	2199	CY	$ 56.68	$ 124,639.32
3	Stump Removal (50 Stumps/Acre)	56	Ea.	$ 314.52	$ 17,613.12
4	Containment (In Situ Dike)	0	LF	$ 100.00	$ -
5	Containment (Geotube)	0	LF	$ 81.28	$ -
6	Hydraulic Dredging for Geotube Filling	0	CY	$ 8.74	$ -
7	Surveys	6	EA	$ 7,000.00	$ 42,000.00

Lake Sub-Total $ 254,373.46

CREST LAKE

Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Hydraulic Dredging	9201	CY	$ 8.74	$ 80,416.74
2	Mechanical Dredging & Material Handling	3494	CY	$ 56.68	$ 198,039.92
3	Stump Removal	264	Ea.	$ 314.52	$ 83,033.28
4	Containment (In Situ Dike)	0	LF	$ 100.00	$ -
5	Containment (Geotube)	0	LF	$ 81.28	$ -
6	Hydraulic Dredging for Geotube Filling	0	CY	$ 8.74	$ -
7	Surveys	6	EA	$ 7,000.00	$ 42,000.00

Lake Sub-Total $ 403,489.94

COLLEGE LAKE

Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Hydraulic Dredging	7057	CY	$ 8.74	$ 61,678.18
2	Mechanical Dredging & Material Handling	0	CY	$ 56.68	$ -
3	Stump Removal (50 Stumps/Acre)	246	Ea.	$ 314.52	$ 77,371.92
4	Containment (In Situ Dike)	0	LF	$ 100.00	$ -
5	Containment (Geotube)	0	LF	$ 81.28	$ -
6	Hydraulic Dredging for Geotube Filling	0	CY	$ 8.74	$ -
7	Surveys	6	EA	$ 7,000.00	$ 42,000.00

Lake Sub-Total $ 181,050.10

CAMPUS LAKE

Item	Description	Quantity	Unit	Unit Cost	Item Cost
1	Hydraulic Dredging	7991	CY	$ 8.74	$ 69,841.34
2	Mechanical Dredging & Material Handling	6471	CY	$ 56.68	$ 366,776.28
3	Stump Removal	203	Ea.	$ 314.52	$ 63,847.56
4	Containment (In Situ Dike)	974	LF	$ 100.00	$ 97,400.00
5	Containment (Geotube)	0	LF	$ 81.28	$ -
6	Hydraulic Dredging for Geotube Filling	0	CY	$ 8.74	$ -
7	Surveys	6	EA	$ 7,000.00	$ 42,000.00

Lake Sub-Total $ 639,865.18

Appendix C - CONSTRUCTION COST BASIS DOCUMENT

Stump Removal

1) Assumed Crew - Additional Costs for Marine based work including higher worker's compensation premiums and health benefits.

Labor crew	QTY	Rate HRLY	Loaded - Marine 40%	Loaded Benefits 30%	Total HRLY
Excavator Op	2.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Boat Op (Tug/Push Boat)	1.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Deck Hands - Tug	2.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Deck Hands - Excavator Deck	1.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Crew Boat Op (Jon Boat)	1.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Welder	2.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Asst Super./Foreman ($60K)	1.00	$ 23.08*	$ 9.23	$ 6.92	$ 39.23
Superintendent ($85K)	1.00	$ 32.69*	$ 13.08	$ 9.81	$ 55.58
Parts Runner	1.00	$ 10.00	$ 4.00	$ 3.00	$ 17.00
Total Crew - HRLY Rate					$ 315.81

*Salaried Employee

1) Assumed Equipment – 176HR per Month for rented equipment. FOG – Fuel/Oil/Grease

Equipment	QTY	Monthly Rental Rate	HRLY Rate	Notes
3 barges & Spud unit	1	$ 11,000.00	$ 62.50	Monthly Rental
Excavator (Cat 345LR/Hyd 290LR)	2	$ 12,000.00	$ 136.36	Monthly Rental
3-barge setup	2	$ 9,000.00	$ 102.27	Monthly Rental
Small Tug/push boat	1	$ 7,500.00	$ 42.61	Monthly Rental
Stump Grinding head	1	$ 15,000.00	$ 80.51	purchased
Jon Boat/Crew Boat	1	$ 3,500.00	$ 18.79	purchased
Total Equipment - HRLY Rate			$ 443.04	
FOG per Hour (25% EQ Rate)			$ 110.76	

2) Other Costs - $309.85 per HR
   a) Field Office Overhead (FOOH) – 9% of Labor & Equipment
   b) Contractor Home Office Overhead – 12% all Field costs without Material
   c) Contractor Profit – 10% all other costs
   d) Contractor Bond Premium – 1% all other costs
3) Used the stump data table from University Lake to quantify stumps.
   a) CHF identified 147 with the designation of STUMP
   b) CHF identified 2 with the designation for size of stump but were otherwise not indicated as stump. These were included in the stump count
   c) Total Stumps identified - 149
4) CHF identified 1422 other "Sonar Contact"
   a) Assumed that 25% of these contacts were additional stumps or cypress knees that would need to be addressed. Additional stumps added to density - 356

5) Total Stump density of University Lake - 505 stumps
6) University Lake is approximately 192 acres with the assumed stump density of 505 total stump. This equals approximately 2.5 stumps per acres.
7) University Lake stump density was then applied to the balance of the lakes for the follow summary:

	Acres	Stumps
City Park	52.61	135.44
Erie	3.54	9.11
Campus	5.13	13.22
Crest	9.43	24.28
College	4.73	12.19
University		504.50
Total Stumps		698.73

8) It was then assumed that the following values for the minimum and maximum number of stumps that could be clear per hour.
   a) Minimum – 3 stumps per hour
   b) Maximum – 5 stumps per hour
9) Using the previously established crew labor and equipment rates of $1180 per hour, the costs per stump would range between $235 and $393 per stump with the average of $314.52 per stump.
10) Little material costs are expected with this type of work however 5% was included to cover ropes, lanyards, and other misc. rigging tools.

Mechanical Dredging

1) Assumed Crew - Additional Costs for Marine based work including higher worker's compensation premiums and health benefits.

Labor crew	QTY	Salary Rate HRLY	Loaded - Marine 40%	Loaded Benefits 30%	Total HRLY
Excavator Op	2.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Boat Op (Tug/Push Boat)	1.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Deck Hands - Tug	2.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Deck Hands – Exc. Deck	1.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Crew Boat Op (Jon Boat)	1.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Welder	2.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Asst Super./Foreman ($60K)	1.00	$ 23.08*	$ 9.23	$ 6.92	$ 39.23
Superintendent ($85k)	1.00	$ 32.69*	$ 13.08	$ 9.81	$ 55.58
Parts Runner	1.00	$ 10.00	$ 4.00	$ 3.00	$ 17.00
Total Crew - HRLY Rate					$ 315.81

11) Assumed Equipment - 176HR per Month for rented equipment. FOG – Fuel/Oil/Grease

		Rental Hours per Month		176
Equipment	QTY	Monthly Rental Rate	HRLY Rate	
3 barges & Spud unit	1.00	$ 11,000.00	$	62.50
Excavator (Cat 345LR/Hyd 290LR)	2.00	$ 12,000.00	$	136.36
3-barge setup	2.00	$ 9,000.00	$	102.27
Small Tug/push boat	1.00	$ 7,500.00	$	42.61
Jon Boat/Crew Boat	1			
Total Equipment - HRLY Rate			$	343.75
FOG per Hour (25% EQ Rate)			$	85.94

2) Other Costs - $265.63 per HR
    a. Field Office Overhead (FOOH) – 9% of Labor & Equipment
    b. Contractor Home Office Overhead – 12% all Field costs without Material
    c. Contractor Profit – 10% all other costs
    d. Contractor Bond Premium – 1% all other costs
3) Mechanical dredging would utilize an excavator on a flexi-float style spud barge and have 2 smaller flexi-float scow barges setups that would ferry between the excavator and the disposal location.
    a. Flexi-float style barges generally draft 30inches or so. Barges can be configured in a number of shapes and sizes as needed for construction.
4) There would be a second excavator at disposal site to remove material from barges
5) The excavator would cycle between 20 & 30 cycles per hour and would have between a 1 & 3 cubic yard bucket. (cycle rate from EM 1110-2-5025)
    a. Balance of assumptions use the 1cy bucket as the most likely sized bucket for the work.
    b. Buckets would likely have drain holes
6) Crews would work between 10hr and 12hr per day as actual productive hours.
    a. Winter work may have fewer productive work (6-8hr per day). Barge based work is increasingly dangerous to operate during night hours even with light towers.
    b. At a minimum 1hr per day should be considered for startup and cleanup time for the crew
7) 50% of the material would be stacked/retained on the barges through transport and to offloading. Balance of material would be suspended sediment to be hydraulically dredged.
8) Volume based on current design 15% design package
    a. 3 machine setups considered for productivity
9) If the project overall construction timeline exceeds 1 year, an annualized value for the equipment may be more suitable to use.
10) Costs per cy range between $45.63 to $56.68 for an average of $51.16 per cy.
    a. Little material costs are expected with this type of work however 5% was included to cover ropes, lanyards, and other misc. rigging tools.

Hydraulic Dredging

1) Assumed Crew – Additional Costs for Marine based work including higher worker's compensation premiums and health benefits.

Labor crew	QTY	Rate HRLY	Loaded - Marine 40%	Loaded Benefits 30%	Total HRLY
Excavator Op	1.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Boat Op (Tug/Push Boat)	1.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Deck Hands - Tug	2.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Deck Hands - Excavator Deck	1.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Crew Boat Op (Jon Boat)	1.00	$ 15.00	$ 6.00	$ 4.50	$ 25.50
Welder	1.00	$ 25.00	$ 10.00	$ 7.50	$ 42.50
Asst Super/Foreman ($65K)	1.00	$ 23.08*	$ 9.23	$ 6.92	$ 39.23
Superintendent ($80K)	1.00	$ 32.69*	$ 13.08	$ 9.81	$ 55.58
Parts Runner	1.00	$ 10.00	$ 4.00	$ 3.00	$ 17.00
Total Crew - HRLY Rate					$ 315.81

2) Assumed Equipment - 176HR per Month for rented equipment. FOG – Fuel/Oil/Grease

Equipment	QTY	Monthly Rental Rate	HRLY Rate
3 barges & Spud unit	1.00	$ 11,000.00	$ 62.50 Monthly Rental
Excavator (Cat 345LR/Hyd 290LR)	1.00	$ 12,000.00	$ 68.18 Monthly Rental
3-barge setup	1.00	$ 9,000.00	$ 51.14 Monthly Rental
Small Tug/push boat	1.00	$ 7,500.00	$ 42.61 Monthly Rental
Dredge	1.00	$ 15,000.00	$ 85.23 Monthly Rental
Jon Boat	1.00		Paid through other work
Total Equipment - HRLY Rate			$ 309.66
FOG per Hour (25% EQ Rate)			$ 77.41

3) Other Costs - $250.44 per HR
    a. Field Office Overhead (FOOH) – 9% of Labor & Equipment
    b. Contractor Home Office Overhead – 12% all Field costs without Material
    c. Contractor Profit – 10% all other costs
    d. Contractor Bond Premium – 1% all other costs
4) Assumed only 8" or 12" dredges would be used due to the minimal draft in lake.
5) Hydraulic dredging % solids range between 10% & 20%
6) Based on EM 1110-2-5025 Table 2-8 Production Rate
    a. 8" – 0.13 CY/s (468 CY/HR)
    b. Through interpolation - 12" - 0.338 CY/s (1216.8 CY/HR)
7) Crews would work between 10hr and 12hr per day as actual productive hours.