INVITATION FOR BID
CONSTRUCTION
NO. 21-TA003283CD
PHASE II REPAIRS TO LAKE MANATEE DAM
PROJECT NO. 6108870
August 12, 2021

Manatee County BCC
Procurement Division
1112 Manatee Avenue West Ste 803
Bradenton, FL 34205
purchasing@mymanatee.org

Manatee County
FLORIDA

ADVERTISEMENT

INVITATION FOR BID CONSTRUCTION, NO. 21-TA003283CD
PHASE II REPAIRS TO LAKE MANATEE DAM

Manatee County, a political subdivision of the State of Florida (hereinafter referred to as County), will receive sealed bids from individuals, corporations, partnerships, and other legal entities authorized to do business in the State of Florida, to provide Phase II Repairs to Lake Manatee Dam, as specified in this Invitation for Bid Construction to include the installation and dewatering of cofferdams (steel sheetpile and pipe pile combi-walls): overwater work; diver supported underwater work; deep soil-mixing; concrete repairs; steel gate repairs; electrical and mechanical repairs to spillway gate structures; and, jet grouting.

DATE, TIME AND PLACE DUE:
The Due Date and Time for submission of Bids in response to this Invitation for Bid Construction (IFBC) **is September 29, 2021 at 3:00 PM ET.** Bids must be delivered to the following location: Manatee County Administration Building, 1112 Manatee Ave. W., Suite 803, Bradenton, FL 34205 prior to the Due Date and Time.

SOLICITATION INFORMATION CONFERENCE:
A non-mandatory Information Conference will be held at 10:00 am on August 20, 2021 at the Manatee County Administration Building, HR Training Room located at 1112 Manatee Avenue West, Suite 863, Bradenton, Florida, 34205. Attendance to non-mandatory information conferences is not required, but is strongly encouraged.

A mandatory site visit of the project site for interested contractors will be conducted by appointment only. See Article A.02 for details of dates and times.

DEADLINE FOR QUESTIONS AND CLARIFICATION REQUESTS:
The deadline to submit all questions, inquiries, or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid Construction to the Manatee County Procurement Division is September 9, 2021. Questions and inquiries should be submitted via email to the Designated Procurement Contact shown below.

Important: A prohibition of lobbying is in place. Review Section A.13 carefully to avoid violation and possible sanctions.

DESIGNATED PROCUREMENT CONTACT: Chris Daley - CPPO, CPPB, Procurement Project Manager
(941) 749-3048, Fax (941) 749-3034
Email: chris.daley@mymanatee.org
Manatee County Financial Management Department
Procurement Division

AUTHORIZED FOR RELEASE: Jacob Erickson, MBA, CPPO, NIGP-CPP

Digitally signed by Jacob Erickson, MBA, CPPO, NIGP-CPP
Date: 2021.08.13 11:29:29 -04'00'

Table of Contents

Section A, Information to Bidders

Section B, Bid Forms to be completed and returned with Bid

Appendix A, Minimum Qualifications
Appendix B, Bidder's Questionnaire
Appendix C, Safety Questionnaire
Appendix D, Environmental Crimes Certification
Appendix E, Florida Trench Safety Act
Appendix F, ePayables Application
Appendix G, Scrutinized Company Certification
Appendix H, Hold Harmless
Appendix I, Insurance Statement
Appendix J, Acknowledgement of Addenda
Appendix K, Affidavit of No Conflict
Appendix L, Bid Pricing Form

Section C, Bid Attachments

Bid Attachment 1- Insurance and Bond Requirements

Bid Attachment 2 - Technical Specifications

Bid Attachment 3 - Plans/Drawings

Bid Attachment 4 - Lake Manatee Dam 2020 Annual Inspection Report

Bid Attachment 5 - Lake Manatee Dam 2013 Supplemental Inspection Report

Bid Attachment 6 - Lake Manatee Dam Emergency Geotechnical Subsurface Investigation Data Report May 2015

Bid Attachment 7 - Paint Chip Coatings Report

Bid Attachment 8 - Boring Locations and Boring Logs

Bid Attachment 9 - Voids Under Stilling Basin and Downstream Apron

Bid Attachment 10 - Downstream Apron Concrete Thickness

Bid Attachment 11 - Original Design Drawings

Section D, Sample Construction Agreement with General Conditions of the Construction Agreement and Agreement Exhibits

SECTION A, INFORMATION FOR BIDDERS

To receive consideration, entities who submit a response to this Invitation for Bid Construction (Bidders) must meet the minimum qualification requirements and comply with the following instructions. Bid responses (Bids) will be accepted from single business entities, joint ventures, partnerships or corporations.

A.01 BID DUE DATE

The Due Date and Time for submission of Bids in response to this Invitation for Bid Construction (IFBC) **is September 29, 2021 at 3:00 PM ET.** Bids must be delivered to the following location: Manatee County Administration Building, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205 and time stamped by a Procurement representative prior to the Due Date and Time.

Bids received after the Due Date and Time will not be considered. It will be the sole responsibility of the Bidder to deliver its Bid to the Manatee County Procurement Division for receipt on or before the Due Date and Time. If a Bid is sent by U.S. Mail, courier or other delivery services, the Bidder will be responsible for its timely delivery to the Procurement Division. Bids delayed in delivery will not be considered, will not be opened at the public opening, and arrangements will be made for their return at the Bidder's request and expense.

A.02 SOLICITATION INFORMATION CONFERENCE AND SITE VISIT:

A non-mandatory Information Conference will be held at 10:00 am on August 20, 2021 at the Manatee County Administration Center, HR Training Room located at 1112 Manatee Avenue West, Suite 863, Bradenton, Florida. Attendance to non-mandatory information conferences is not required, but is strongly encouraged.

A mandatory site visit at the project site for interested contractors will be conducted by appointment only. The following dates are provided:

Monday, August 23, 2021
Tuesday, August 24, 2021
Monday, August 30, 2021
Tuesday, August 31, 2021

Times provided for these site visits include:
8:00 am to 9:30 am
10:00 am to 11:30 am

Contact Kate Quilty at 941-746-3020 ext 5005 to schedule appointment.

Attendance to mandatory information conferences and/or site visits are required to meet the minimum qualification requirements of the IFBC. Attendance to non-mandatory information conferences and/or site visit is not required but is strongly encouraged.

A.03 PUBLIC OPENING OF BIDS

Bids will be opened immediately following the Due Date and Time at the Manatee County Administration Building, Suite 803 in the presence of County officials. Bidders or their representatives may attend the Bid opening.

Manatee County will make public at the opening the names of the business entities which submitted a Bid and the total bid price submitted. No review or analysis of the Bids will be conducted at the Bid opening.

A.04 SUBMISSION OF BIDS

The contents of the Bid sealed package must include:

- One (1) bound original clearly identifying Bidder and marked "ORIGINAL".
- One (1) electronic format copy clearly identifying Bidder.

Electronic format copy should be submitted on a Universal Serial Bus (USB) portable flash memory drive or compact disc (CD) in Microsoft Office® or Adobe Acrobat® portable document format (PDF) in one continuous file. Do not password protect or otherwise encrypt electronic Bid copies. Electronic copies must be searchable and contain an identical Bid to the original.

Submit the Bid package in a sealed container with the following information clearly marked on the outside of the package: IFBC NO. 21-TA003283CD, Phase II Repairs to Lake Manatee Dam, Bidder's name, and Bidder's address. Bids must be delivered to the Manatee County Procurement Division prior to the Due Date and Time at the following address:

Manatee County Procurement Division
1112 Manatee Avenue West, Suite 803
Bradenton, FL 34205

A.05 DISTRIBUTION OF SOLICITATION DOCUMENTS

All documents issued pursuant to this IFBC are distributed electronically and available for download at no charge at www.mymanatee.org > *Bids and Proposals.* Documents may be viewed and downloaded for printing using Adobe Reader® software.

At its sole discretion, the County may utilize third-party providers to distribute proposals. Visit the third-party's website for more information regarding this service. Participation in the third-party system is not a requirement for doing business with Manatee County.

Additionally, the IFBC and all related documents are available for public inspection at the Manatee County Procurement Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205. Call (941) 749-3014 to schedule an appointment. Documents are available between the hours of 8:00 A.M. and 5:00 P.M., Monday through Friday, with the exception of County holidays.

As a courtesy, Manatee County notifies the Manatee County Chamber of Commerce and the Manatee County Black Chamber of Commerce of all active solicitations, who then distributes the information to its members.

A.06 EXAMINATION OF BID DOCUMENTS AND SITE(S)

It is the responsibility of each bidder before submitting a bid, to (a) examine the IFBC documents thoroughly; (b) visit the Project Site(s) to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work; (c) consider federal, state, and local codes, laws, and regulations that may affect costs, progress, performance, or furnishing of the Work; (d) study and carefully correlate bidder's observations with the IFBC documents; and (e) notify County in writing of all conflicts, errors, or discrepancies in the IFBC documents.

Each bidder may, at bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies, and obtain any additional information and data which pertain to the physical conditions at or contiguous to the Project Site(s) or otherwise which may affect cost, progress, performance or furnishing of the Work and which bidder deems necessary to determine his bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the IFBC documents. County will provide each bidder access to the site(s) to conduct such explorations and tests.

Bidder shall fill all holes, clean up and restore the Project Site(s) to its former condition upon completion of such explorations. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by successful bidder in performing the Work are identified in the IFBC documents.

All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by successful bidder. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by County unless otherwise provided in the IFBC documents.

Inspection of the Project Site(s) is a requirement to be considered for award of this bid. Prior to submitting a bid, each bidder shall examine the Project Site(s) and all conditions thereon fully familiarizing themselves with the full scope of the Work. Failure to become familiar with Project Site conditions will in no way relieve the successful bidder from the necessity of furnishing any materials or performing any Work that is required to complete the Project in accordance with the Project Plans and Specifications. Bidder shall acknowledge inspection of the Project Site(s) on his/her signed, submitted Bid Form.

A.07 ADDENDA

Any interpretations, corrections or changes to this IFBC will be made by addenda. Addenda will be posted on the Procurement Division's web page of the County website at http://www.mymanatee.org/purchasing > *Bids and Proposals*. For those solicitations that are advertised on a third-party website, addenda will also be posted on the third-

party's distribution system on the 'Planholders' link.

All addenda are a part of the IFBC and each Bidder will be bound by such addenda. It is the responsibility of each Bidder to read and comprehend all addenda issued. Failure of any Bidder to acknowledge an issued addendum in its Bid will not relieve the Bidder from any obligation contained therein.

A.08 BID FORMS

Bids must include the forms provided in this IFBC. If needed, additional pages may be attached to a form. Bidders must fully complete and execute all Bid Forms. Bid Forms must be executed by an authorized official of the company who has the legal authority to bind the company.

A.09 BID EXPENSES

All costs incurred by Bidder in responding to this IFBC will be the sole responsibility of the Bidder.

A.10 QUESTION AND CLARIFICATION PERIOD

Each Bidder shall examine all IFBC documents and will judge all matters relating to the adequacy and accuracy of such documents. Any questions or requests concerning interpretation, clarification or additional information pertaining to this IFBC, including the sample Agreement, shall be made in writing via email to the Manatee County Procurement Division to the Designated Procurement Contact or to purchasing@mymanatee.org. All questions received and responses given will be provided to potential bidders via an addendum to this IFBC.

Manatee County will not be responsible for oral interpretations given by other sources including County staff, representative, or others. The issuance of a written addendum by the Procurement Division is the only official method whereby interpretation, clarification or additional information will be given.

A.11 FALSE OR MISLEADING STATEMENTS

Bids which contain false or misleading statements, or which provide references which do not support an attribute or condition claimed by the Bidder, may be rejected. If, in the opinion of the County, such information was intended to mislead the County in its evaluation of the Bid, and the attribute, condition or capability is a requirement of this IFBC. Such Bidder will be disqualified from consideration for this IFBC and may be disqualified from submitting a response on future solicitation opportunities with the County.

A.12 CONFIDENTIALITY OF SECURITY RELATED RECORDS

a. Pursuant to Florida Statutes § 119.071(3), the following records (hereinafter referred to collectively as "the Confidential Security Records") are confidential and exempt from the disclosure requirements of Florida Statutes § 119.07(1):

    i. A Security System Plan or portion thereof for any property owned by or leased to

County or any privately owned or leased property held by County.

ii. Building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout and structural elements of a building, arena, stadium, water treatment facility, or other structure owned or operated by County.

iii. Building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout or structural elements of an attractions and recreation facility, entertainment or resort complex, industrial complex, retail and service development, office development, or hotel or motel development in the possession of, submitted to County.

b. Successful Bidder agrees that, as provided by Florida Statute, it shall not, as a result of a public records request, or for other reason disclose the contents of, or release or provide copies of the Confidential Security Records to any other party absent the express written authorization of County's Property Management Director or to comply with a court order requiring such release or disclosure. To the extent successful Bidder receives a request for such records, it shall immediately contact the County's designated Contract administrator who shall coordinate County's response to the request.

A.13 LOBBYING

After the issuance of any IFBC, prospective bidders, bidders, or their agents, representatives or persons acting at the request of such bidder shall not contact, communicate with or discuss any matter relating to the IFBC with any officer, agent or employee of Manatee County other than the Procurement Official or the contact identified in this IFBC, pursuant to the Manatee County Code of Laws. This prohibition includes copying such persons on all written communication, including email correspondence. This requirement begins with the issuance of an IFBC and ends upon execution of the final Agreement or when the IFBC has been cancelled. Violators of this prohibition shall be subject to sanctions as provided in the Manatee County Code of Laws.

A.14 UNBALANCED BIDDING PROHIBITED

County recognizes that large and/or complex projects will often result in a variety of methods, sources, and prices. However, where in the opinion of the County such variation does not appear to be justified given bid requirements and industry and market conditions, the Bid will be presumed to be unbalanced. Examples of unbalanced Bids will include:

a. Bids showing omissions, alterations of form, additions not specified, or required conditional or unauthorized alternate bids.
b. Bids quoting prices that substantially deviate, either higher or lower, from those included in the Bids of competitive Bidders for the same line item unit costs.
c. Bids where the unit costs offered are in excess of, or below reasonable cost analysis values.

In the event County determines that a Bid is presumed unbalanced, it will request the opportunity to and reserves the right to, review all source quotes, bids, price lists, letters of intent, and other supporting documentation which the Bidder obtained and upon which the Bidder relied upon to develop its Bid. County reserves the right to deem any presumptive unbalanced Bid where the Bidder is unable to demonstrate the validity and/or necessity of the unbalanced unit costs as non-responsive.

A.15 FRONT LOADING OF BID PRICING PROHIBITED

Prices offered for performance and/or acquisition activities which occur early in the Project Schedule, such as mobilization; clearing and grubbing; or maintenance of traffic; that are substantially higher than pricing of competitive bidders within the same portion of the Project Schedule, will be presumed to be front loaded. Front loaded bids could reasonably appear to be an attempt to obtain unjustified early payments creating a risk of insufficient incentive for the bidder to complete the Work or otherwise creating an appearance of an undercapitalized bidder.

In the event County determines that a bid is presumed to be front loaded, it will request the opportunity to, and reserves the right to, review all source quotes, bids, price lists, letters of intent, and other documents which the bidder obtained and upon which the bidder relied upon to develop the pricing or acquisition timing for these bid items. County reserves the right to reject as nonresponsive any presumptive front-loaded bids where the bidder is unable to demonstrate the validity and/or necessity of the front-loaded costs.

A.16 WITHDRAWAL OR REVISION OF BIDS

Bidders may withdraw Bids under the following circumstances:

a. If Bidder discovers a mistake(s) prior to the Due Date and Time. Bidder may withdraw its Bid by submitting a written notice to the Procurement Division. The notice must be received in the Procurement Division prior to the Due Date and Time for receiving Bids. A copy of the request shall be retained, and the unopened Bid returned to the Bidder; or

b. After the Bids are opened but before a contract is signed, Bidder alleges a material mistake of fact if:

    1. The mistake is clearly evident in the solicitation document; or
    2. Bidder submits evidence which clearly and convincingly demonstrates that a mistake was made in the Bid. Request to withdraw a Bid must be in writing and approved by the Procurement Official.

A.17 IRREVOCABLE OFFER

Any Bid may be withdrawn up until the Due Date and Time. Any Bid not so withdrawn shall, upon opening, constitute an irrevocable offer for a period of ninety (90) days to provide the goods or services set forth in this IFBC or until one or more of the Bids have been duly accepted by County, whichever occurs first.

A.18 RESERVED RIGHTS

County reserves the right to accept or reject any and/or all bids, to waive irregularities and minor technicalities, and to request resubmission. Also, County reserves the right to accept all or any part of the bid and to increase or decrease quantities to meet additional or reduced requirements of County. Any sole response received by the first submission date may or may not be rejected by County depending on available competition and current needs of County. For all items combined, the bid of the lowest, responsive, responsible bidder will be accepted, unless all bids are rejected.

The lowest, responsible bidder shall mean that Bidder who makes the lowest Bid to sell goods and/or services of a quality which meets or exceeds the quality of goods and/or services set forth in the IFBC documents or otherwise required by County.

To be responsive, a Bidder shall submit a Bid which conforms in all material respects to the requirements set forth in the IFBC.

To be a responsible bidder, the bidder shall have the capability in all respects to perform fully the bid requirements, and the tenacity, perseverance, experience, integrity, reliability, capacity, facilities, equipment, and credit which will assure good faith performance.

Also, County reserves the right to make such investigation as it deems necessary to determine the ability of any bidder to furnish the service requested. Information County deems necessary to make this determination shall be provided by the bidder. Such information may include, but shall not be limited to current financial statements, verification of availability of equipment and personnel, and past performance records.

A.19 APPLICABLE LAWS

Bidder must be authorized to transact business in the State of Florida. All applicable laws and regulations of the State of Florida and ordinances and regulations of Manatee County will apply to any resulting Agreement. Any involvement with the Manatee County Procurement Division shall be in accordance with the Manatee County Procurement Ordinance as amended.

A.20 COLLUSION

By submitting a bid in response to this IFBC, Bidder certifies that it has not divulged, discussed or compared its bid with any other bidder, and has not colluded with any other bidder or parties to this bid whatsoever. Further, Bidder, and in the case of a joint bid each party thereto, certifies as to their own organization, that in connection with this IFBC that:

a. All prices and/or cost data submitted have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices and/or cost data, with any other bidder or with any competitor;

b. All prices and/or cost data quoted for this bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder, prior to the scheduled opening, directly or indirectly to any other bidder or to any competitor;

c. No attempt has been made, or will be made, by Bidder to induce any other person or firm to submit or not to submit a bid for the purpose of restricting competition;

d. The only person or persons interested in this bid is/are named in Bidder's Bid and that no person other than those identified has any interest in the Bid or in the resulting Agreement to be entered into.

e. No person or agency has been employed or retained to solicit or secure the resulting Agreement upon an agreement or understanding or a commission, percentage, brokerage, or contingent fee except bona fide employees or established commercial agencies maintained by Bidder for purpose of doing business.

A.21 CODE OF ETHICS

With respect to this and any bid, if a Bidder violates, directly or indirectly, the ethics provisions of the Manatee County Procurement Code and/or Florida criminal or civil laws related to public procurement, including but not limited to Florida Statutes Chapter 112, Part II, Code of Ethics for Public Officers and Employees, such Bidder will be ineligible for award to perform the work described in this IFBC, and may be disqualified from submitting on any future quote or bid requests to supply goods or services to Manatee County. By submitting a bid, the Bidder represents to County that all statements made, and materials submitted are truthful, with no relevant facts withheld.

A.22 PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime, as that term is defined in Section 287.133, Florida Statutes, may not submit a bid to provide any goods or services to a public entity; may not submit a bid with a public entity for the construction or repair of a public building or public work; may not submit bids on leases of real property to a public entity; may not be awarded or perform Work as a contractor, supplier, Subcontractor, or consultant under an agreement with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, Florida Statutes, for CATEGORY TWO for a period of thirty-six (36) months following the date of being placed on the convicted list.

In addition, the Manatee County Code of Laws prohibits the award of any bid to any person or entity who/which has, within the past five (5) years, been convicted of, or admitted to in court or sworn to under oath, a public entity crime or of any environmental law that, in the reasonable opinion of the Procurement Official, establishes reasonable grounds to believe the person or business entity will not conduct business in a responsible matter.

To ensure compliance with the foregoing, the Code requires all persons or entities desiring to do business with County to execute and file with the Purchasing Official an affidavit, executed under the pain and penalties of perjury, confirming that person, entity and any person(s) affiliated with the entity, does not have such a record and is therefore eligible to seek and be awarded business with County. In the case of a business entity other than a partnership or a corporation, such affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, such affidavit shall be executed by the general partner(s). A Public Contracting and Environmental Crimes Certification form is attached herein for this purpose.

A.23 SCRUTINIZED COMPANIES

Florida Statutes § 287.135, as amended from time to time, may contain limitations on the part of a company to conduct business with the County. Submission of a response to this solicitation shall be subject to all procedural requirements contained within that statute including the submission of any required certification of eligibility to contract with the County. It shall be the responsibility of the company responding to this solicitation to concurrently review the current version of the statute and ensure it is compliant. To the extent a certification is required, it shall be provided on the form located at Appendix F *Vendor Certification Regarding Scrutinized Companies Lists*.

A.24 AGREEMENT

The successful Bidder will be required to execute the Agreement, a sample of which is attached hereto and made a part hereof. The County will transmit the Agreement to the successful Bidder for execution. The successful Bidder agrees to deliver the required number of duly executed copies of the Agreement, with any other required documents, to the County within ten calendar days of receipt.

A.25 LEGAL NAME

Bidders shall clearly indicate the full legal name, including any d/b/a, address, email address, and telephone number on the Bid Form. Bid Forms shall be signed above the typed or printed name and title of the signer. The signer must be an official of the organization and have the authority to bind the bidder to the submitted bid.

When bidder is a partnership, the Bid Form shall be signed in the name of the firm and by all partners required under the terms of the partnership agreement. When a corporation is a bidder, the authorized corporate officers shall sign.

Bidders who are corporations or limited partnerships shall provide a certified copy of their permit to transact business in the State of Florida, preferably along with the Bid Form, or within forty-eight (48) hours after request by County.

When submitting a bid as a joint venture, it must have filed paper documents with the Division of Profession's Construction Industry Licensing Board prior to submitting a bid.

A.26 DISCOUNTS

All discounts must be incorporated in the prices contained in the bid and not shown

separately. Unless otherwise specified in this IFBC, pricing must be all inclusive, including delivery costs. The prices indicated on the Pricing Form shall be the prices used in determining award.

A.27 TAXES

Manatee County is exempt from Federal Excise and State Sales Taxes. (F.E.T. Cert. No. 59-78-0089K; Florida Sales Tax Exempt Cert. No. 85-8012622206C-6). Therefore, the Bidder is prohibited from delineating a separate line item in its bid for any sales or service taxes.

The successful Bidder will be responsible for the payment of taxes of any kind, including but not limited to sales, consumer, use, and other similar taxes payable on account of the work performed and/or materials furnished under the award in accordance with all applicable laws and regulations.

A.28 QUALITY

Unless otherwise specifically provided in the IFBC documents, all goods provided shall be new, the latest make or model, of the best quality, of the highest grade of workmanship, and of the most suitable for the purpose intended.

Unless otherwise specifically provided in the IFBC documents, reference to any equipment, material, article or patented process, by trade name, brand name, make or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition.

A.29 AUTHORIZED PRODUCT REPRESENTATION

Bidder, by virtue of submitting the name and specifications of a manufacturer's product, will be required to furnish the named manufacturer's product. Failure to do so may, in the County's sole discretion, be deemed a material breach of the resulting agreement and shall constitute grounds for County's immediate termination of the resulting agreement.

A.30 ROYALTIES AND PATENTS

The successful Bidder shall pay all royalties and license fees for equipment or processes in conjunction with the equipment and/or services being furnished. Successful Bidder shall defend all suits or claims for infringement of any patent, trademark or copyright, and shall save County harmless from loss on account thereof, including costs and attorney's fees.

A.31 AMERICANS WITH DISABILITIES ACT

Manatee County does not discriminate upon the basis of any individual's disability status. This non-discrimination policy involves every aspect of County's functions including one's access to participation, employment, or treatment in its programs or activities. Anyone requiring reasonable accommodation for an information conference or bid opening should contact the person named on the cover page of this document at least twenty-four (24) hours in advance of either activity.

A.32 EQUAL EMPLOYMENT OPPORTUNITY

In accordance with Title VI of the Civil Rights Act of 1964, Title 15, Part 8 of the Code of Federal Regulations and the Civil Rights Act of 1992, Manatee County hereby notifies all Bidders that it will affirmatively ensure minority business enterprises are afforded full opportunity to participate in response to this IFBC and will not be discriminated against on the grounds of race, color, national origin, religion, sex, age, handicap, or marital status in consideration of award.

A.33 MINORITY AND/OR DISADVANTAGED BUSINESS ENTERPRISES

The State of Florida Office of Supplier Diversity provides the certification process and maintains the database of certified MBE/DBE firms. Additional information may be obtained at https://www.dms.myflorida.com/agency_administration/office_of_supplier_diversity_osd or by calling (850) 487-0915.

A.34 DELIVERY

Unless otherwise specified, all prices shall include all delivery cost (FOB Destination).

A.35 MATHEMATICAL ERRORS

a. Bid pricing forms without imbedded mathematical formulas: In the event of multiplication/extension error(s), the unit price shall prevail. In the event of addition error(s) the extension totals will prevail. In the event the dollar amount for contract contingency is omitted, it will be added to the total price of the Bid.

b. Bid pricing forms with imbedded mathematical formulas: Interactive bid pricing forms that contain mathematical formulas may be provided to automate lengthy and complex bid forms. In the event bid pricing forms with imbedded formulas are used and a multiplication/extension error(s) is discovered in the formula, the unit price entered by the Bidder shall prevail.

c. Bidder shall assume the responsibility and accuracy of the information input in the bid pricing form and therefore shall verify that the calculations are correct before submitting its Bid.

d. Regardless of the type of bid pricing form used, all Bids shall be reviewed mathematically by the County using these standards.

A.36 SUBCONTRACTORS

The successful bidder will obtain prior written approval from the County for any subcontractor(s) and the work each will perform. A subcontractor is defined as any entity performing work within the scope of the project who is not an employee of the successful Bidder.

Bidders subcontracting any portion of the work shall include a list of subcontractors along with their bid. The list shall include: name and address of subcontractor, type of work to be performed and the percent of the contract amount to be subcontracted.

A.37 E-Verify

Prior to the employment of any person under this contract, the successful Bidder shall utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of (a) all persons employed during the contract term by the successful Bidder to perform employment duties within Florida and (b) all persons, including subcontractors, assigned by the successful Bidder to perform work pursuant to the contract with Manatee County. For more information on this process, please refer to United States Citizenship and Immigration Service site at: http://www.uscis.gov/.

Only those individuals determined eligible to work in the United States shall be employed under this contract.

By submission of a bid in response to this IFBC, the successful Bidder commits that all employees and subcontractors will undergo e-verification before placement on this contract.

The successful Bidder shall maintain sole responsibility for the actions of its employees and subcontractors. For the life of the contract, all employees and new employees brought in after contract award shall be verified under the same requirement stated above.

A.38 DISCLOSURE

Upon receipt, all inquiries and responses to inquiries related to this IFBC become "Public Records," and shall be subject to public disclosure consistent with Florida Statues, Chapter 119.

Bids become subject to disclosure thirty (30) days after the opening or if a notice of intent to award decision is made earlier than this time as provided by Florida Statutes § 119.071(1)(b). No announcement or review of the bids shall be conducted at the public opening.

Based on the above, County will receive bids at the time and date stated and will make public at the opening the names of the business entities of all that submitted a bid.

If County rejects all bids and concurrently notices its intent to reissue the solicitation, the rejected bids are exempt from public disclosure until such time as County provides notice of an intended decision concerning the reissued solicitation or until County withdraws the reissued solicitation. A bid is not exempt for longer than twelve (12) months after the initial notice rejecting all bids.

Pursuant to Florida Statutes 119.0701, to the extent successful Bidder is performing services on behalf of the County, successful Bidder must:

a. Keep and maintain public records required by public agency to perform the service.

b. Upon request from the public agency's custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or

copied within a reasonable time at a cost that does not exceed the cost provided in Florida Statutes, Chapter 119, or as otherwise provided by law.

c. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the successful Bidder does not transfer the records to the public agency.

d. Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of contractor or keep and maintain public records required by the public agency to perform the service. If the successful Bidder transfers all public records to the public agency upon completion of the contract, the successful Bidder shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the successful Bidder keeps and maintains public records upon completion of the contract, the successful Bidder shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

IF THE SUCCESSFUL BIDDER HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE SUCCESSFUL BIDDER'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO ANY RESULTING CONTRACT, CONTACT COUNTY'S CUSTODIAN OF PUBLIC RECORDS AT:

Phone: (941) 742-5845
Email: debbie.scaccianoce@mymanatee.org
Mail: Manatee County BCC
Attn: Records Manager
1112 Manatee Ave W.
Bradenton, FL 34205.

A.39 LOCAL PREFERENCE

Local business is defined as a business legally authorized to engage in the sale of the goods and/or services, and which certifies within its Bid that for at least six (6) full months prior to the advertisement of this IFBC it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota County with at least one full-time employee at that location.

Local preference shall not apply to the following categories of agreements:

a. Purchases or agreements which are funded, in whole or in part, by a governmental or other funding entity, where the terms and conditions governing the funds prohibit the preference.

b. Any bid announcement which specifically provides that local preference, as set forth in this section, is suspended due to the unique nature of the goods or services sought, the existence of an emergency as found by either the County Commission or County

Administrator, or where such suspension is, in the opinion of the County Attorney, required by law.

c. For a competitive solicitation for construction services in which fifty percent (50%) or more of the cost will be paid from state.
d. To qualify for local preference under this section, **a local business must certify to County** by completing an "**Affidavit as to Local Business Form,"** which is available for download at www.mymanatee.org/vendor. Click on "Affidavit for Local Business" to access and print the form. Complete, notarize, and mail the notarized original to the following address: Manatee County Procurement Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205.
e. It is the responsibility of the bidder to ensure accuracy of the Affidavit as to Local Business and notify County of any changes affecting same.

A.40 VENDOR REGISTRATION

Registering your business will provide Manatee County a sourcing opportunity to identify suppliers of needed goods and services and identify local businesses. To register as a supplier with the County go to www.mymanatee.org/vendor. For assistance with supplier registration, call the Procurement Division main number at (941) 749-3014. Office hours are Monday – Friday, 8:00 A.M. to 5:00 P.M., excluding County holidays.

A link to Vendor Registration is listed on the Procurement Division's web page at http://www.mymanatee.org/home/government/departments/financial-management/purchasing.html. Click on *"Register as a Vendor",* then "*Vendor Registration Form"*. Registration is not mandatory to submit a Bid.

A.41 ENVIRONMENTAL SUSTAINABILITY

All bidders are encouraged to use as many environmentally preferable "green" products, materials, as supplies, as possible to promote a safe and healthy environment. Environmentally preferable are products or services that have a reduced adverse effect on the environment.

Bidder shall acknowledge in its Bid if Bidder has an environmental sustainability initiative. In addition, Bidder shall submit with its Bid a brief summary of Bidder's environmental sustainability initiative. This information will be used as a determining factor in the award decision when all other factors, including local preference, are otherwise equal.

A.42 ePAYABLES

Manatee County Board of County Commissioners and the Manatee County Clerk of the Circuit Court have partnered to offer the ePayables program, which allows payments to be made to vendors via credit cards.

The Clerk of the Circuit Court will issue a unique credit card number to vendor after goods are delivered or services rendered, vendors submit invoices to the remit to address on the purchase order. When payments are authorized, an email notification is sent to the vendor. The email notification includes the invoice number(s), invoice date(s), and amount of payment. There is no cost for vendors to participate in this program; however, there may

be a charge by the company that processes your credit card transactions.

If Bidder is interested in participating in this program, complete the ePayables Application attached herein and return the completed form via email to tina.mancini@manateeclerk.com.

A.43 BASIS OF AWARD

County will not make award to a Bidder who is delinquent in payment of any taxes, fees, fines, contractual debts, judgments, or any other debts due and owed to the County, or is in default on any contractual or regulatory obligation to the County. By submitting this solicitation response, Bidder attests that it is not delinquent in payment of any such debts due and owed to the County, nor is it in default on any contractual or regulatory obligation to the County. In the event the Bidder's statement is discovered to be false, bidder will be subject to suspension and/or debarment and the County may terminate any award it has with bidder.

Award shall be to the lowest, responsive, responsible bidder(s) meeting specifications which includes delivery time requirements, qualification requirements, and having the lowest total offer for requirements listed on the Bid Form for the Work as set forth in this IFBC. Bid prices shall include costs for furnishing all labor, equipment and/or materials for the completion of the Work to the County's satisfaction, in accordance with and in the manner set forth and described in the IFBC documents and within the prescribed time.

Only one (1) completion schedule for 600 calendar days shall be submitted and considered.

In evaluating Bids, County shall consider the qualifications of the Bidders; and if required, may also consider the qualifications of the subcontractors, suppliers, and other persons and organizations proposed. County may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work.

Whenever two or more responsive, responsible bids which are equal with respect to price and all other evaluation factors are received, the bid from the local business shall be given preference in award.

Whenever two or more responsive, responsible bids which are equal with respect to price are received, and both or neither of these bids are from a local business, the award shall be determined by a chance drawing, coin toss, or similar tie-breaking method conducted by the Procurement Division and open to the public.

Bidder acknowledges that County has, or may hire, others to perform work similar to or the same as that which is within the scope of work of this IFBC. In the event that the successful Bidder cannot meet the delivery time or availability requirements of materials, the County, at its sole discretion can obtain the goods and services from other sources.

A.44 SCOPE OF WORK

The successful Bidder shall furnish and install all materials, equipment and labor which is reasonably inferable and necessary for the proper completion of the Work specified in this IFBC, whether specifically indicated in the IFBC or not.

The successful Bidder shall furnish all shop drawings, work drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all Work required by these Specifications.

The successful Bidder shall perform the Work complete, in place and ready for continuous service and shall include any repairs, replacements, and / or restoration required as a result of damages caused prior to acceptance by the County.

The Work included in this BID consists of repairs to the Lake Manatee Dam to include the installation and dewatering of cofferdams (steel sheetpile and pipe pile combi-walls): overwater work; diver supported underwater work; deep soil-mixing; concrete repairs; steel gate repairs; electrical and mechanical repairs to spillway gate structures; and, jet grouting per the plans and specifications.

A.45 COMPLETION OF WORK

The Work will be completed and ready for final inspection within the specified calendar days from the date the Contract Time commences to run. Completion time shall be based on 600 calendar days.

A.46 LIQUIDATED DAMAGES

If the successful Bidder fails to achieve substantial completion of the Work within the contract time and as otherwise required by the Agreement (to include not only the entire Work but any portion of the Work as set forth therein), the County shall be entitled to retain or recover from the successful Bidder, as liquidated damages and not as a penalty, the sum of $4,993.00 per calendar day, commencing upon the first day following expiration of the contract time and continuing until the actual date of substantial completion.

Such liquidated damages are hereby agreed to be a reasonable estimate of damages the County will incur because of delayed completion of the Work. The County may deduct liquidated damages as described in this paragraph from any unpaid amounts then or thereafter due the successful bidder under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the successful bidder shall be payable to the County at the demand of the County, together with interest from the date of the demand at the maximum allowable rate.

A.47 CONTRACT CONTINGENCY WORK

Contract contingency is a monetary allowance used solely at County's discretion to handle unexpected conditions as required to satisfactorily complete the Work in accordance with the IFBC documents. A Field Directive must be issued by an authorized County representative to authorize use of contract contingency funds.

The percentage for contract contingency is listed on the Bid Form. Bidder shall enter the dollar amount for contract contingency based on the percentage of the total base bid. The total contract award will include contract contingency.

Appropriate uses of contract contingency include increases to existing bid item quantities that do not change the initial Scope of Work, which may be directed by County staff; modification items not originally bid which were unforeseen yet necessary during the Work to provide a safe, complete Project and that do not change the initial Scope of Work; and unanticipated conflicts and/or design changes required during construction which are necessary to provide a safe, complete Project and that do not change the initial Scope of Work.

Inappropriate uses of contract contingency include anything that changes the initial Scope of Work, including the Contract Sum and Contract Time, and adding bid items not previously contemplated that change the initial Scope of Work.

A.48 LICENSES AND PERMITS

The successful Bidder shall be solely responsible for obtaining all necessary license and permit fees, including, but not limited to, all license fees, permit fees, impact fees, or inspection fees, and responsible for the costs of such fees. Successful Bidder is solely responsible for ensuring all work complies with all Federal, State, local, and Manatee County ordinances, orders, codes, laws, rules, regulations, directives, and guidelines.

A.49 PROTEST

Any actual bidder, proposer, or contractor who is aggrieved in connection with the notice of intent to award of a contract with a value greater than $250,000 where such grievance is asserted to be the result of a violation of the requirements of the Manatee County Procurement Code or any applicable provision of law by the officers, agents, or employees of the County, may file a protest to the Procurement Official.

Protest must be in writing and delivered via email at purchasing@mymanatee.org or by hand delivery to the Procurement Division at 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205 by 5:00 p.m. on the fifth business day following the date of posting of the Notice of Intent to Award on the County website. There is no stay of the procurement process during a protest. The Procurement Official shall have the authority to settle and resolve a protest concerning the intended award of a contract.

For additional information regarding the County protest process, visit the Procurement Division webpage on the County website.

A.50 ACCESSIBILITY

The County is committed to making its documents and information technologies accessible to individuals with disabilities by meeting the requirements of Section 504 of the Rehabilitation Act and best practices (W3C WCAG 2). **For assistance with accessibility regarding this solicitation, contact the Manatee County Procurement Division via email at purchasing@mymanatee.org or by phone at 941-748-4501 X3014.**

Successful Bidder shall ensure all its electronic information, documents, applications,

reports, and deliverables required under this Agreement are in a format that meets the requirements of Section 504 of the Rehabilitation Act and best practices (W3C WCAG 2).

Where not fully compliant with these requirements and best practices, Successful Bidder shall provide clear points of contact for each document and information technology to direct users in how to obtain alternate formats. Further, successful Bidder shall develop accommodation strategies for those non-compliant resources and implement strategies to resolve the discrepancies.

A.51 SOLICITATION SCHEDULE

The following schedule has been established for this Solicitation process. Refer to the County's website (www.mymanatee.org > Business > *Bids & Proposals*) for meeting locations and updated information pertaining to any revisions to this schedule.

Scheduled Item	Scheduled Date
Non-Mandatory Information Conference 1112 Manatee Avenue West, Suite 863 Bradenton, FL 34205	August 20, 2021 at 10:00 AM, ET
Question and Clarification Deadline	September 9, 2021
Final Addendum Posted	September 16, 2021
Bid Response Due Date and Time	September 29, 2021, 3:00 PM, ET
Projected Award	October 2021

NOTE: Any statements contained in the Scope of Work, Bid Summary, Construction Agreement, General Conditions of the Construction Agreement and/or Exhibits which vary from the information in Section A, Information for Bidders, shall have precedence over the Information for Bidders.

END OF SECTION A

SECTION B, BID FORMS

(To be completed and returned with Bid)

APPENDIX A, MINIMUM QUALIFICATIONS

IFBC No. 21-TA003823CD

Bidders must submit the information and documentation requested in this Attachment that confirms Bidder meets the following minimum qualification requirement(s):

1. Must have been registered with the State of Florida, Division of Corporations to do business in Florida.

   No documentation is required. The County will verify registration.

2. Bidder, or its representative(s), has made an inspection of the construction site for work specified in this IFBC on or after the date of advertisement of this IFBC and prior to the Due Date and Time.

   Bidder must submit a statement on company letterhead and signed by an authorized official of Bidder that Bidder, or its representative(s), has made an inspection of the construction site, listing the date of the inspection and the individuals, by name, who conducted the inspection.

3. Bidder must have possessed a General Contractor's license issued by the Florida Department of Business and Professional Regulation for a period of at least five (5) consecutive years since August 1, 2016. License must be current and valid through the Due Date for submission of bids for this IFBC.

   Provide a copy of Bidder's General Contractor's license issued by the Florida Department of Business and Professional Regulation and documentation confirming Bidder has been licensed (or certified, as applicable) for the period of August 1, 2016 through the date of submission of the Bid.

4. Bidder, or Bidder's subcontractor, has provided embankment dam or levee construction or repair services for at least three (3) projects in which each project had a minimum contract value of $1 million, and were performed on significant or high hazard facilities (see Federal Guidelines for Dam Safety; Hazard Potential Classification System for Dams, FEMA, April 2004), and had an embankment height greater than 20 feet. At least one of the projects shall involve the use of steel sheet pile cofferdam with a minimum differential water height of 15 feet, and at least one project shall have involved the repair, rehabilitation, or installation of steel gates. Project clients must be agreeable to responding to an inquiry by the County.

   Provide the following information for the Three (3) qualifying project references.

   a) Name of Contractor who performed work
   b) Name of client
   c) Project name
   d) Contract value
   e) Location (City/State)
   f) Client contact name
   g) Contact phone
   h) Contact email
   i) Service dates (Start/End)

5. Bidder, or Bidder's subcontractor, has provided spillway gate repairs or rehabilitation for at least three (3) projects in which each project included the installation, repair or rehabilitation of steel spillway or flood gate structures. At least one of the projects shall have included the repair or replacement of the electrical and mechanical lifting mechanisms. Project clients must be agreeable to responding to an inquiry by the County.
   Provide the following information for the Three (3) qualifying project references.

   a) Name of Contractor who performed work
   b) Name of client
   c) Project name
   d) Location (City/State)
   e) Client contact name
   f) Contact phone
   g) Contact email
   h) Service dates (Start/End)

6. Bidder, or Bidder's subcontractor, has provided barge operations (or temporary floating work platforms) for at least three (3) projects in which each project included deployed barges for construction work with cranes and excavators over water. At least one of the projects shall have included a deployed barge in captive water which does not have access to the ocean. Project clients must be agreeable to responding to an inquiry by the County.
   Provide the following information for the Three (3) qualifying project references.

   a) Name of Contractor who performed work
   b) Name of client
   c) Project name
   d) Location (City/State)
   e) Client contact name
   f) Contact phone
   g) Contact email
   h) Service dates (Start/End)

7. Bidder, or Bidder's subcontractor, has provided steel sheet pile driving services over water for at least three (3) projects in which each project included a minimum of 15,000 square feet of steel sheet pile as measured by the cumulative driven area below grade. Project clients must be agreeable to responding to an inquiry by the County.
   Provide the following information for the Three (3) qualifying project references.

   a) Name of Contractor who performed work
   b) Name of client
   c) Project name
   d) Location (City/State)
   e) Client contact name
   f) Contact phone
   g) Contact email
   h) Service dates (Start/End)

8. Bidder, or Bidder's subcontractor, has provided steel pipe driving services over water for at least three (3) projects in which each project included a minimum of 1,000 linear feet, as measured below grade, of 24 inch or larger diameter pipe pile. Project clients must be agreeable to responding to an inquiry by the County.

Provide the following information for the Three (3) qualifying project references.

a) Name of Contractor who performed work
b) Name of client
c) Project name
d) Location (City/State)
e) Client contact name
f) Contact phone
g) Contact email
h) Service dates (Start/End)

9. Bidder, or Bidder's subcontractor, has constructed and maintained a braced steel sheet pile coffer dam for at least one (1) project which included excavation and underwater construction, and a minimum of 20 feet water level differential for a minimum period of 30 days. The project must have been located where potential for extreme flooding events required the development of an emergency cofferdam flooding plan. This location could have been in Florida, or near the Gulf of Mexico, or along the Atlantic Ocean coastline, or other location where such a plan was required. Project clients must be agreeable to responding to an inquiry by the County.

Provide the following information for the qualifying project references.

a) Name of Contractor who performed work
b) Name of client
c) Project name
d) Location (City/State)
e) Client contact name
f) Contact phone
g) Contact email
h) Service dates (Start/End)

10. Bidder, or Bidder's subcontractor, has provided cementitious jet grouting services for at least three (3) projects in which each project included grouting to depths of a minimum 25 feet below land surface, construction of overlapping columns capable of forming a seepage barrier, and a minimum of 1,500 cubic yards of grout mix. Project clients must be agreeable to responding to an inquiry by the County.

Provide the following information for the Three (3) qualifying project references.

a) Name of Contractor who performed work
b) Name of client
c) Project name
d) Location (City/State)
e) Client contact name
f) Contact phone
g) Contact email

11. Bidder, or Bidder's subcontractor, has provided sand/polymer void filling services for at least one (1) project that included pumping high permeability sand (SD or DS-SM) using a polymer or similar to fill voids adjacent to existing structures using a process designed to prevent damage to an overlying soil-cement slope, or concrete apron, or reinforced slab, or adjacent facility while maintaining permeability of the sand. Project clients must be agreeable to responding to an inquiry by the County.

Provide the following information for the qualifying project references.

a) Name of Contractor who performed work
b) Name of client
c) Project name
d) Location (City/State)
e) Client contact name
f) Contact phone
g) Contact email
h) Service dates (Start/End)

12. Bidder, or Bidder's subcontractor, has provided deep soil mixing services for at least three (3) projects since August 2016 in which each project included deep soil mixing to depths of a minimum 30 feet below ground surface, construction of overlapping columns capable of forming a seepage barrier, and a minimum of 1,500 cubic yards of deep soil mixing. Project clients must be agreeable to responding to an inquiry by the County.

Provide the following information for the Three (3) qualifying project references.

a) Name of Contractor who performed work
b) Name of client
c) Project name
d) Location (City/State)
e) Client contact name
f) Contact phone
g) Contact email
h) Service dates (Start/End)

13. Bidder, or Bidder's subcontractor, has provided upstream surface erosion protection systems for at least three (3) projects in which each project included the placement of or repairs to upstream surface erosion systems on earthen dams greater than 20 feet in height, involved both above and below water work using soil cement full depth replacement, structural concrete overlays, fabric-formed concrete mat, or similar for a minimum of 400 square yards. Project clients must be agreeable to responding to an inquiry by the County.

Provide the following information for the Three (3) qualifying project references.

a) Name of Contractor who performed work
b) Name of client
c) Project name
d) Location (City/State)
e) Client contact name
f) Contact phone
g) Contact email

14. Bidder, or Bidder's subcontractor, has provided emergency shutdown plans for hurricane, tropical storm, or heavy rainfall events involving over water or near water work for at least three (3) of the projects provided in items 4 thru 13 above in which each emergency shutdown plan demonstrated integration with the Owner's safety operations, and identified critical processes and decisions in preparation for, during, and immediately following these events. Project clients must be agreeable to responding to an inquiry by the County.

    Provide the following information for the Three (3) qualifying project references.

    a) Name of Contractor who performed work
    b) Name of client
    c) Project name
    d) Location (City/State)
    e) Client contact name
    f) Contact phone
    g) Contact email

15. Bidder, on the day the bid is submitted, has a certified or registered Qualifying Agent, as required by Section 489.119, Florida Statutes, and that Qualifying Agent has been the same Qualifying Agent of Bidder for a period of at least five (5) consecutive years, since August 1, 2016.

    Submit a copy of Bidder's Qualifying Agent's registration or certification along with supporting documentation confirming Qualifying Agent has been the Qualifying Agent for Bidder for five (5) consecutive years, since August 1, 2016.

16. Bidder is not on the Florida Department of Management Services Suspended, Debarred, Convicted Vendor Lists.

    No documentation is required. The County will verify

17. If Bidder is submitting as a joint venture must file the required documents with the Florida Department of Business and Professional Regulation as required by Florida Statute Section 489.119, prior to the Due Date and Time.

    If Bidder is not a joint venture, provide a statement to that effect. If Bidder is a joint venture, provide a copy of Bidder's approved filing with the Florida Department of Business and Professional Regulation.

18. Bidder has no reported conflict of interests in relation to this IFBC.

    Submit a fully completed copy of Appendix K. If applicable, on a separate page disclose the name of any officer, director or agent who is also an employee of the County. Disclose the name of any County employee who owns, directly or indirectly, any interest in the Bidder's firm or any of its branches. If no conflicts of interests are present, Bidder must submit a statement to that affect.

    END OF APPENDIX A

APPENDIX B, BIDDER'S QUESTIONNAIRE
IFBC No. 21-TA003823CD

Bidder must fully complete and return this form with its Bid. Bidder warrants the truth and accuracy of all statements and answers herein contained. (Attach additional pages if necessary.)

THIS QUESTIONNAIRE MUST BE COMPLETED AND SUBMITTED WITH YOUR BID

1. Contact Information:

FEIN #: _____

License #: _____
License Issued to: _____
Date License Issued (MM/DD/YR): _____
Company Name: _____
Physical Address: _____
City: _____ State of Incorporation: _____ Zip Code: _____
Phone Number: ( ) _____ Fax Number: ( ) _____
Email address: _____

2. Bidding as: an individual __; a partnership __; a corporation __; a joint venture __

3. If a partnership, list names and addresses of partners; if a corporation, list names of officers, directors, shareholders, and state of incorporation; if joint venture, list names and address of ventures' and the same if any venture are a corporation for each such corporation, partnership, or joint venture:

_____
_____
_____

4. Bidder is authorized to do business in the State of Florida: ☐ Yes ☐ No

For how many years? _____

5. Your organization has been in business (under this firm's name) as a

_____

Is this firm in bankruptcy? _____

6. Attach a list of projects where this specific type of Work was performed.

BIDDER: _____

7. Is this firm currently contemplating or in litigation? Provide summary details.

_____

_____

_____

8. Have you ever been assessed liquidated damages under a contract during the past five (5) years? If so, state when, where (contact name, address and phone number) and why.

_____

_____

_____

9. Have you ever failed to complete Work awarded to you? Or failed to complete projects within contract time? If so, state when, where (contact name, address, phone number) and why.

_____

_____

_____

10. Have you ever been debarred or prohibited from providing a bid to a governmental entity? If yes, name the entity and describe the circumstances.

_____

_____

_____

11. Will you subcontract any part of this Work? If so, describe which portion(s) and to whom.

_____

_____

_____

12. If any part of work will be subcontracted, list MBE/DBE/WBE/VETERAN to be utilized. Include the estimated dollar amount of the portion of Work each will perform.

_____

_____

_____

BIDDER: _____

13. What equipment do you own to accomplish this Work? (A listing may be attached)

_____

_____

14. What equipment will you purchase/rent for the Work? (Specify which)

_____

_____

15. If applicable to the Work for this IFBC, Drilling Supervisor Qualifications: Contractor shall provide a boring specialist who shall remain on the project site during the entirety of the directional boring operation. This includes, but is not limited to, drilling fluid preparation, seaming, boring and pulling. The boring specialist shall have a minimum of five (5) years' experience in supervising directional bores of similar nature, diameter, materials and lengths. (Reference: Specification Section 02619, Horizontal Directional Drilling).

Provide the contact information for a minimum of three (3) projects wherein the boring specialist has performed this type of work, diameter, materials and lengths.

Boring specialist's name: _____
Boring specialist's years of experience in supervising directional bores _____
Provide contact name, and contact number for projects:

_____

_____

_____

16. If applicable to the Work for this IFBC, Pipe Fusion Qualifications: All boring and fusing equipment shall be certified for operation. The Contractor responsible for thermal butt fusing pipe and fittings shall have manufacturer certification for performing such work or a minimum of five (5) years of experience performing this type of work.

Thermal butt fusing pipe and fittings contractor or subcontractor's name: _____
Attach a copy of contractor's/subcontractor's manufacturer certification to this Questionnaire
OR
Provide contractor's/subcontractor's years of experience in thermal butt fusing pipe and fittings

_____
If manufacturer certification is not provided, include contact name, and contact number for projects that confirms five years of experience:

_____

_____

BIDDER: _____

17. If applicable to the Work for this IFB, Pipe Bursting Qualifications: The Contractor shall be certified by the manufacturer of the pipe bursting system that they are fully trained licensed installer of the manufacturer's pipe bursting system. Contractor shall provide a letter to the County documenting this requirement. (Reference: Specification Section 02619A, Pipe Bursting (PB) of Existing Mains).

18. List the following regarding the surety which is providing the bond(s):

Surety's Name: _____

Address: _____

_____

Name, address, phone number and email of surety's resident agent for service of process in Florida:

Agent's Name: _____

Address: _____

_____

Phone: _____

Email: _____

19. Is Bidder a local business as defined in Section A.38, Local Preference?

☐ Yes ☐ No

If yes, by signing below Bidder certifies that for at least six months prior to the advertisement date of this IFB it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota counties with at least one full-time employee at that location.

BIDDER: _____

BY: _____

PRINTED NAME: _____

TITLE/DATE: _____

PHYSICAL ADDRESS OF QUALIFYING LOCAL LOCATION: _____

_____

NAME OF QUALIFYING EMPLOYEE AT LOCAL LOCATION: _____

20. Confirm if Bidder has an environmental sustainability initiative as defined in Section A.41.

☐ Yes ☐ No

If yes, submit a brief summary (2-3 paragraphs) of the environmental sustainability initiative.

21. Does Bidder have any previous project experience with Manatee County?

☐ Yes ☐ No

If yes, please identify the projects and date(s) that work was performed.

BIDDER: _____

APPENDIX C, SAFETY QUESTIONNAIRE
IFBC No. 21-TA003823CD

Bidder must fully complete and return this form with its Bid. Bidder warrants the truth and accuracy of all statements and answers herein contained. (Attach additional pages if necessary.)

THIS QUESTIONNAIRE MUST BE COMPLETED AND SUBMITTED WITH YOUR BID

1. Is your company registered with ISNet (http://www.isnetword.com) ? Yes or No _____
2. If so, what is your Dashboard Grade? _____
3. List your company's Interstate Experience Modification Rate (EMR) for the 3 most recent years and attach written verification from your insurance company.

YEAR	EMR
2018	
2019	
2020	

4. Use your last 3-year's OSHA 300 log to fill in the number of injuries and illnesses:

ITEM	YEAR	NUMBER
Number of lost workday (days away) cases:	2018	
	2019	
	2020	
Number of job transfer or restriction cases:	2018	
	2019	
	2020	
Number of other recordable cases:	2018	
	2019	
	2020	

Number of fatalities:	2018	
	2019	
	2020	

5. Employee hours worked and Recordable Incidence Rate (RIR) for the last 3 years. (Do not include any nonwork time, even though paid).

YEAR	**FIELD HOURS**	**FIELD RIR**	**OVERALL HOURS**	**OVERALL RIR**
2018				
2019				
2020				

6. Provide your company's OSHA citation history for the past 5 years. Include the following information for each citation:
    a. Location
    b. Date
    c. Type inspection
    d. Standard cited
    e. Violation type
    f. Current status

7. Are accident reports (OSHA 301) and report summaries sent to the following roles or equivalent?
   (Yes or No)

Field superintendent	
Vice president of construction	
President	

8. Do you hold site safety meetings for field supervisors? (Yes or No) _____

9. Do you conduct project safety inspections? (Yes or No) _____

10. Are accident records and accident summaries kept? (Yes or No) _____

11. Do you have a written safety program? (Yes or No) _____
    a. If yes, submit a copy of your written safety program.

12. Do you have an orientation program for new hires? (Yes or No) _____

13. Do you have a training program for newly hired or promoted supervision? (Yes or No) _____

14. Do you hold craft "toolbox" safety meetings and how often? (Yes or No) _____ / _____

BIDDER: _____

END OF EXHIBIT C

APPENDIX D, ENVIRONMENTAL CRIMES CERTIFICATION

IFBC No. 21-TA003823CD

SWORN STATEMENT PURSUANT TO ARTICLE V, MANATEE COUNTY PROCUREMENT CODE

Bidder must fully complete and return this form with its Bid. This form must be signed and sworn to in the presence of a notary public or other official authorized to administer oaths.

This sworn statement is submitted to the Manatee County Board of County Commissioners by

_____

[Print individual's name and title]

for _____ [Print name of entity submitting sworn statement]

whose business address is _____

and (if applicable) its Federal Employer Identification Number (FEIN) is _____. If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement: _____.

I understand that no person or entity shall be awarded or receive an Owner's Agreement for public improvements, procurement of goods or services (including professional services) or an Owner's lease, franchise, concession or management agreement, or shall receive a grant of Owner's monies unless such person or entity has submitted a written certification to Owner that it has not:

(1) been convicted of bribery or attempting to bribe a public officer or employee of Manatee County, the State of Florida, or any other public entity, including, but not limited to the Government of the United States, any state, or any local government authority in the United States, in that officer's or employee's official capacity; or

(2) been convicted of an agreement or collusion among bidders or prospective bidders in restraint of freedom of competition, by agreement to bid a fixed price, or otherwise; or

(3) been convicted of a violation of an environmental law that, in the sole opinion of Owner's Purchasing Official, reflects negatively upon the ability of the person or entity to conduct business in a responsible manner; or

(4) made an admission of guilt of such conduct described in items (1), (2) or (3) above, which is a matter of record, but has not been prosecuted for such conduct, or has made an admission of guilt of such conduct, which is a matter of record, pursuant to formal prosecution. An admission of guilt shall be construed to include a plea of nolo contendere; or

(5) where an officer, official, agent or employee of a business entity has been convicted of or has admitted guilt to any of the crimes set forth above on behalf of such an entity and pursuant to the direction or authorization of an official thereof (including the person committing the offense, if he is an official of the business entity), the business shall be chargeable with the conduct herein above set forth. A business entity shall be chargeable with the conduct of an affiliated entity, whether wholly owned, partially owned, or one which has common ownership or a common Board of Directors. For purposes of this Form, business entities are affiliated if, directly or indirectly, one business entity controls or has the power to control another business entity, or if an individual or group of individuals controls or has the power to control both entities. Indicia of control shall include, without limitation, interlocking management or ownership, identity of interests among family members, shared organization of a business entity following the ineligibility of a business entity under this Article, or using substantially the same management, ownership or principles as the ineligible entity.
(Continued)

Any person or entity who claims that this Article is inapplicable to him/her/it because a conviction or judgment has been reversed by a court of competent jurisdiction shall prove the same with documentation satisfactory to Owner's Purchasing Official. Upon presentation of such satisfactory proof, the person or entity shall be allowed to contract with Owner.

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR MANATEE COUNTY IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT ANY AGREEMENT OR BUSINESS TRANSACTION SHALL PROVIDE FOR SUSPENSION OF PAYMENTS, OR TERMINATION, OR BOTH, IF THE CONTRACTING OFFICER OR COUNTY ADMINISTRATOR DETERMINES THAT **SUCH** PERSON OR ENTITY HAS MADE FALSE CERTIFICATION.

_____

[Signature]

STATE OF _____COUNTY OF _____

Sworn to and subscribed before me this _ day of _____,20_____
by _____

Who is personally known / has produced _____ as identification

[Type of identification]

My commission expires _____

_____

Notary Public Signature

_____

[Print, type or stamp Commissioned name of Notary Public]

Signatory Requirement - In the case of a business entity other than a partnership or a corporation, this affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, this affidavit shall be executed by the general partner(s). In the case of a corporation, this affidavit shall be executed by the corporate president.

APPENDIX E, FLORIDA TRENCH SAFETY ACT

Bidder must fully complete and return this form with its Bid. This form must be singed in the presence of a notary public or by an officer authorized to administer oaths.

1. This Sworn Statement is submitted with **IFBC NO. 21-TA003823CD**
2. This Sworn Statement is submitted by_____ whose business address is_____ and, if applicable, its Federal Employer Identification Number (FEIN) is_____. If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement _____.
3. Name of individual signing this Sworn Statement is: _____, Whose relationship to the above entity is: _____.
4. The Trench Safety Standards that will be in effect during the construction of this project shall include, but are not limited to: Laws of Florida, Chapters 90-96, TRENCH SAFETY ACT, and OSHA RULES AND REGULATIONS 29 CFR 1926.650 Subpart P, effective October 1, 1990.
5. The undersigned assures that the entity will comply with the applicable Trench Safety Standards and agrees to indemnify and hold harmless the County and Engineer of Record, and any of their agents or employees from any claims arising from the failure to comply with said standard.
6. The undersigned has appropriated the following costs for compliance with the applicable standards:

Trench Safety Measure (Description)	Units of Measure (LF, SY)	Unit Quantity	Unit Cost	Extended Cost
a. _____	_____	_____	$_____	_____
b. _____	_____	_____	$_____	_____
c. _____	_____	_____	$_____	_____
d. _____	_____	_____	$_____	_____

7. The undersigned intends to comply with these standards by instituting the following procedures:
   _____
   _____
   _____

THE UNDERSIGNED, in submitting this bid, represents that they have reviewed and considered all available geotechnical information and made such other investigations and tests as they may deem necessary to adequately design the trench safety system(s) to be utilized on this project.

_____
(Authorized signature / Title)

SWORN to and subscribed before me this _____ day of _____, 20_____.
(Impress official seal)

Notary Public, State of _____: _____

My commission expires: _____

Angelina M. Colonneso
CLERK OF THE CIRCUIT COURT AND COMPTROLLER OF MANATEE COUNTY
1115 Manatee Avenue West, Bradenton, Florida 34205 - Phone (941) 749-1800 Fax (941) 741-4082, P.O. Box 25400, Bradenton, Florida 34206 - www.manateeclerk.com

Bidder must fully complete and return this form with its Bid.

APPENDIX F: ePAYABLES APPLICATION

Company name_____

Contact person_____

Phone number_____

Email Address_____

FINANCE USE ONLY

Open orders: YES or NO

PEID _____

CREATE DATE _____

CONFIRMED WITH

_____

_

Name and phone number

IFAS _____

BANK _____

INITIALS_____

Return completed form Via email to:
tina.mancini@manateeclerk.com
Via fax to: (941) 741-4011
Via mail:
PO Box 1000
Bradenton, Fl 34206

Revised: September 30, 2015

"Pride in Service with a Vision to the Future"
Clerk of the Circuit Court – Clerk of Board of County Commissioners – County Comptroller – Auditor and Recorder

APPENDIX G, SCRUTINIZED COMPANY CERTIFICATION
IFBC No. 21-TA003823CD

This certification is required pursuant to Florida State Statute Section 287.135.

As of July 1, 2011, a company that, at the time of bidding or submitting a proposal for a new contract or renewal of an existing contract, is on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with an agency or local governmental entity for goods or services of $1 million or more.

Bidder must fully complete and return this form with its Bid.

Company _____ FID or EIN No. _____

Address

_____

City _____ State _____ Zip _____

I, _____, as a representative of _____ certify and affirm that this company is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List.

_____ _____
Signature Title

_____ _____
Printed Name Date

APPENDIX H
MANATEE COUNTY, A POLITICAL SUBDIVISION OF THE STATE OF FLORIDA
INDEMNITY AND HOLD HARMLESS
IFBC No. 21-TA003823CD

Bidder must fully complete and return this form with its Bid.

Bidder shall defend, indemnify and hold harmless the County and all of the County's officers, agents, employees, and volunteers from and against all claims, liability, loss and expense, including reasonable costs, collection expenses, attorneys' fees, and court costs which may arise because of the negligence (whether active or passive), misconduct, or other fault, in whole or in part (whether joint, concurrent, or contributing), of Respondent, its officers, employees, representatives and agents in performance or non-performance of its obligations under the Contract/Agreement. Bidder recognizes the broad nature of this indemnification and hold harmless clause, as well as the provision of a legal defense to the County when necessary, and voluntarily makes this covenant and expressly acknowledges the receipt of such good and valuable consideration provided by the County in support of these indemnification, legal defense and hold harmless contractual obligations in accordance with the laws of the State of Florida. This clause shall survive the termination of this Contract/Agreement. Compliance with any insurance requirements required elsewhere within this Contract/Agreement shall not relieve Bidder of its liability and obligation to defend, hold harmless and indemnify the County as set forth in this article of the Contract/Agreement.

Nothing herein shall be construed to extend the County's liability beyond that provided in section 768.28, Florida Statutes.

PROJECT NUMBER AND/OR NAME	
INSURANCE AGENT	
RESPONDENT SIGNATURE	**DATE**

Acknowledgement:
STATE OF _____ COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____,

20____ by _____ [FULL LEGAL NAME], who is

personally known to me / has produced _____ as identification.

Notary Signature _____

Print Name _____

APPENDIX I, INSURANCE STATEMENT
IFBC No. 21-TA003823CD

Bidder must fully complete and return this form with its Bid.

THE UNDERSIGNED has read and understands the insurance requirements of this IFBC applicable to any contract resulting from this solicitation and shall provide the insurances required by this Appendix within ten (10) days from the date of Notice of Intent to Award.

Bidder Name: _____ Date: _____

Signature (Authorized Official): _____

Printed Name/Title: _____

Insurance Agency: _____

Agent Name: _____ Agent Phone: _____

APPENDIX J, ACKNOWLEDGMENT OF ADDENDA
IFBC No. 21-TA003823CD

The undersigned acknowledges receipt of the following addenda:

Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:

Print or type Bidder's information below:

Name of Bidder _____ Telephone Number _____

Street Address _____ City/State/Zip _____

Email Address _____

Print Name & Title of Authorized Officer _____ Signature of Authorized Official _____ Date _____

APPENDIX K, AFFIDAVIT OF NO CONFLICT
IFBC No. 21-TA003823CD

COUNTY OF _____
STATE OF _____

BEFORE ME, the undersigned authority, this _____ day of _____, 20____ personally appeared, _____, a principal with full authority to bind _____ (hereinafter the "Affiant"), who being first duly sworn, deposes and says:

(a) is not currently engaged or will not become engaged in any obligations, undertakings or contracts that will require the Affiant to maintain an adversarial role against the County or that will impair or influence the advice, recommendations or quality of work provided to the County; and

(b) has provided full disclosure of all potentially conflicting contractual relationships and full disclosure of contractual relationships deemed to raise a question of conflict(s); and

(c) has provided full disclosure of prior work history and qualifications that may be deemed to raise possible question of conflict(s).

Affiant makes this affidavit for the purpose of inducing Manatee County, a political subdivision of the State of Florida, to enter into an Agreement for PHASE 11 REPAIRS TO LAKE MANATEE DAM.

If applicable, on a separate page Bidder shall disclose the name of any officer, director or agent of Bidder who is also an employee of the County and the name of any County employee who owns, directly or indirectly, any interest in the Bidder's firm or any of its branches. If no conflicts of interest are present, submit a statement to that affect.

_____
Signature

_____
Print Name

SUBSCRIBED to and sworn before me this _____ day of _____, 20__.

[Notary Seal]

Notary Public

My commission expires: _____

_____
Notary Signature

_____
Print Name

Personally known OR produced identification. Type of identification produced _____

_____.

APPENDIX L, BID PRICING FORM

IFBC No.21-TA003823CD, Phase II Repairs to Lake Manatee Dam

Total bid Price/Offer for Bid "A": $_____Complete. Base on a completion time of 600 calendar days.

We, the undersigned, hereby declare that we have carefully reviewed the IFBC Documents in their entirety and with full knowledge and understanding of the Bid information and all its requirements, submit this Bid, which is complete in meeting each specification, term, and condition contained therein.

As Bidder, we understand that the IFBC documents, including but not limited to, all specifications, terms, and conditions shall be made a part of any resulting Agreement between County and the successful Bidder. Failure by successful Bidder to comply with such specifications, terms and conditions shall result in Agreement default, whereupon, the defaulting successful Bidder shall be required to pay for all re-procurement costs, damages, and attorney fees as incurred by County, and agrees to forfeit its bid bond.

Authorized Signature(s): _____

Name and Title of Above Signer(s):

_____

Date: _____

BID FORM
PHASE II REAPIRS TO LAKE MANATEE DAM
BID "A" BASED ON COMPLETION TIME OF 600 CALENDAR DAYS

Task Pay Item Number	Description	Estimated Quantity **A**	Unit	Material Cost **B**	Labor Cost **C**	Total Unit Price **(D) B+C**	Total Bid Price **A*D**
100	**Mobilization**						
101	Pre-Mobilization Activities (Construction Submittals….)	1	LS				
102	Utility Locates	1	LS				
103	Laydown and Setup	1	LS				
104	Office Set-Up, Maintenance and Operation	1	LS				
105	Erosion and Sediment Control Best Management Practices	1	LS				
106	Temporary Downstream Access Road	1	LS				
107	Temporary Boat/Barge Dock	1	LS				
108	General Conditions	1	LS				
109	Permits, Bonding, etc.	1	LS				
						MOBILIZATION SUBTOTAL=	
200	**Void Filling**						
201	Demonstration Project	1	LS				
202	Production – Downstream Apron	1	LS				
203	Production – Stilling Basin	1	LS				

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity A	Unit	Material Cost B	Labor Cost C	Total Unit Price (D) B+C	Total Bid Price A*D
						VOID FILLING SUBTOTAL=	
300	**Downstream Channel Repairs**						
301	Site Preparation (rip rap removal, excavation, engineered fill)	1	LS				
302	Existing Apron Slab Preparation	1	LS				
303	Reinforcement, Miscellaneous Metals, Expansion Joints, Sealant and Waterstop	1	LS				
304	Form, Pour and Cure Downstream Concrete Apron Overlay	1	LS				
305	Cast-in-Place Concrete Stairs	1	LS				
306	Concrete Stilling Basin Repairs (Skim Coat on End sill)	1	LS				
307	Training Wall Repairs	1	LS				
308	Demolition and Abandonment of Miscellaneous Metals and Drains	1	LS				
309	Ogee Repairs (Downstream and Upstream)	1	LS				
						DOWNSTREAM CHANNEL REPAIRS SUBTOTAL=	
400	**Downstream Pressure Relief System**						
401	Vertical Relief Wells	1	LS				
402	End Sill Relief Wells	1	LS				
						DOWNSTREAM PRESSURE RELIEF SYSTEM SUBTOTAL=	
500	**Encase Spillway with Seepage Barrier**						
501	Construction Grading	1	LS				

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity **A**	Unit	Material Cost **B**	Labor Cost **C**	Total Unit Price **(D) B+C**	Total Bid Price **A*D**
502	Sheet Piling Including Concrete Cap and Handrail Installation	1	LS				
503	Deep Soil Mixing (Test Sections, Final Design Approval, F&I), Assume 10% Portland Cement and 5% Bentonite by Weight	1	LS				
504	Jet Grouting (Test Sections, Final Design Approval, F&I), Assume 10% Portland Cement and 5% Bentonite by Weight	1	LS				
505	Concrete Slab on Grade Installation	1	LS				
506	Final Grading and Restoration	1	LS				
ENCASE SPILLWAY WITH SEEPAGE BARRIER SUBTOTAL=							
600	**Approach Channel Repairs**						
601	Installation of Combi-Wall North and South Embankments	1	LS				
602	Complete Demolition and Removal of Slope Paving and Soldier Pile Wall and Lagging	1	LS				
603	Removal, Abandonment and Grouting of Monitoring Wells and Drains	1	LS				
604	Construction Excavation and Final Grading at the North and South Embankments and Approach Channel Including Removal of Steel Debris, Jet Grout Spoils, Organics and Other Debris Within the Approach Channel and around the approach channel walls	1	LS				
604	Removal of Grout Spoils from Approach Slab	1	LS				
606	Install Sheet Pile and Combi Wall System with Structural Bracing	1	LS				

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity **A**	Unit	Material Cost **B**	Labor Cost **C**	Total Unit Price **(D) B+C**	Total Bid Price **A*D**
607	Install Dewatering Wells and Grout Plug at Approach Slab	1	LS				
608	Partial Dewater of Approach Slab and Approach Channel Area. Contractor May Fully Dewater at Their Discretion.	1	LS				
609	Fully Dewater for Pre-Construction Inspection	1	LS				
610	Complete Approach Slab Repairs	1	LS				
611	Complete Approach Wall Repairs	1	LS				
612	Fully Dewater for Approach Slab Repairs Inspection	1	LS				
613	Flood Containment Area and Cut Sheet Pile on Approach Channel	1	LS				
614	Install Secondary Seal on Approach Channel.	1	LS				
615	Cut Combi-Wall at North and South Abutments and Restore Grade and Slope Paving	1	LS				
616	Cut Combi Wall and Install Concrete Cap at Approach Slab	1	LS				
617	Install Riprap to Final Grade	1	LS				
618	Placement of Watertight Slab on Grade	1	LS				
619	Install Handrail	1	LS				
						APPROACH CHANNEL REPAIRS SUBTOTAL=	
700	**Stoplog Guide and Tainter Gate Rehabilitation**						

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity **A**	Unit	Material Cost **B**	Labor Cost **C**	Total Unit Price **(D) B+C**	Total Bid Price **A*D**
701	Stoplog Guide Repairs	1	LS				
702	Tainter Gate Repairs	1	LS				
703	Threshold Replacement	1	LS				
704	Course Screen Chamber - Concrete Repairs	1	LS				
705	Course Screen Chamber Miscellaneous Metal Removal/Refurbishment/Coating	1	LS				
706	48" Pipe Inspection	1	LS				
						STOPLOG GUIDE AND TAINTER GATE REHABILITATION SUBTOTAL=	
800	**Upstream Soil Cement Refurbishment**						
801	Uniform Section Mat Test Section	1	LS				
802	Concrete Slope Pavement Test Section	1	LS				
803	Spot Repair Test Section	1	LS				
804	Full Depth Soil Cement Test Section	1	LS				
805	Spot Repair at End of Flume	1	LS				
						UPSTREAM SOIL CEMENT REFURBISHMENT SUBTOTAL=	
900	**Mechanical Upgrade**						
901	Replace Electric Motors	1	LS				
902	Replace Gear Boxes	1	LS				

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity **A**	Unit	Material Cost **B**	Labor Cost **C**	Total Unit Price **(D) B+C**	Total Bid Price **A*D**
903	Replace Instrumentation and Controls	1	LS				
						MECHANICAL UPGRADE SUBTOTAL=	
1000	**Miscellaneous Improvements**						
1001	Laybys	1	LS				
1002	Concrete Deck Repairs	1	LS				
1003	New Deck Paint: Sand Blast, Remove Rust, Primer and Paint	1	LS				
1004	Add Safety Ladders	1	LS				
1005	Add/Replace Handrails	1	LS				
1006	Skim Coat Over Piers	1	LS				
1007	Boat Launch Improvements	1	LS				
1008	Bridge Repairs	1	LS				
						MISCELLANEOUS IMPROVEMENTS SUBTOTAL=	
1100	**Demobilization**						
1101	Full Depth Asphalt Milling and Asphalt Pavement	1	LS				
1102	Punchlist Inspection	1	LS				
1103	Restoration of Laydowns	1	LS				
1104	Final Cleanup	1	LS				

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity A	Unit	Material Cost B	Labor Cost C	Total Unit Price (D) B+C	Total Bid Price A*D
1105	Closeout Manuals / Submittals	1	LS				
1106	Red-Line Construction Drawings	1	LS				
1107	Borrow Area Reclamation	1	LS				
						DEMOBILIZATION SUBTOTAL=	
	TOTAL BASE BID "A"- Based on Completion Time of 600 Calendar Days						
	CONTRACT CONTINGENCY WORK (USED ONLY WITH COUNTY APPROVAL)					**10%**	
	TOTAL OFFER FOR BID "A" with Contract Contingenct- Vased on Completion Time of 600 Calendar Days						

THE FOLLOWING PAY ITEMS ARE INTENDED TO ESTABLISH UNIT RATES FOR UNFORESEEN CIRCUMSTANCES DURING THE CONTRACT PERIOD, AND WILL NOT BE UTILIZED TO DETERMNINE CONTRACT AWARD.

1200							
Task Number	Description	Estimated Quantity A	Unit	Material Cost B	Labor Cost C	Total Unit Price (D) B+C	Total Bid Price A*D
1	Standby Rate						
	a. Unmanned Equipment Rates	1	Hour				
	b. Earthwork Equipment Rates	1	Hour				
	c. Jet Grout Column Equipment Rates	1	Hour				
	d. Soil-Mixed Column Equipment Rates	1	Hour				
	e. Cofferdam Equipment Rates	1	Hour				
	f. Dive Team	1	Hour				
2	Emergency Demobilization						
	a. Demobilization	1	LS				
	b. Site Monitoring	5	Day				
	c. Standby rate	5	Day				

Bidder Name: _____

Authorized Signature: _____

Task Pay Item Number	Description	Estimated Quantity **A**	Unit	Material Cost **B**	Labor Cost **C**	Total Unit Price **(D) B+C**	Total Bid Price **A*D**
	d. Mobilization	1	LS				
3	Full Dewatering for Upstream Inspection	1	LS				
4	Installation of new Monitoring Wells and Instrumentation and Controls	1	LS				
5	48-inch Pipe Repair (In Situ-Form or equal)	1	LS				
6	Extra Jet Grout Columns (4-ft diameter), per length of wall	1	LF				
7	Extra Jet Grout Columns (8-ft diameter) per length of wall	1	LF				
	Extra Combi-Wall (Choose the total length of 1 pipe pile and sheet pile section)	1	LF				
9	Extra Concrete Surface Repairs	1	SF				
10	Extra Sheet Pile Wall	1	SF				
11	Extra Deep Soil Mix Columns (3-ft diameter), per length of wall	1	LF				
12	Select Engineered Fill	1	CYD				
13	Expansion Joint Replacement	1	LF				

Bidder Name: _____

Authorized Signature: _____

SECTION C, BID ATTACHMENTS

BID ATTACHMENT 1, INSURANCE AND BOND REQUIREMENTS

The CONTRACTOR will not commence work under the resulting Agreement until all insurance coverages indicated by an "X" herein have been obtained. The CONTRACTOR shall obtain and submit to the Procurement Division within ten (10) calendar days from the date of notice of intent to award, at its expense, the following minimum amounts of insurance (inclusive of any amounts provided by an umbrella or excess policy): Work under this Agreement cannot commence until all insurance coverages indicated herein have been obtained on a standard ACORD form (inclusive of any amounts provided by an umbrella or excess policy):

☒ **Automobile Liability Insurance Required Limits**

Coverage must be afforded under a per occurrence policy form including coverage for all owned, hired and non-owned vehicles for bodily injury and property damage of not less than:

- $2,000,000 Combined Single Limit; OR
- $ 1,000,000 Bodily Injury and $1,000,000 Property Damage
- $10,000 Personal Injury Protection (No Fault)
- $1,000,000 Hired, Non-Owned Liability
- $10,000 Medical Payments

This policy shall contain severability of interests' provisions.

☒ **Commercial General Liability Insurance Required Limits (per Occurrence form only; claims-made form is not acceptable)**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County, a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $3,000,000 Single Limit Per Occurrence
- $6,000,000 Aggregate
- $6,000,000 Products/Completed Operations Aggregate
- $1,000,000 Personal and Advertising Injury Liability
- $100,000 Fire Damage Liability
- $10,000 Medical Expense, and
- $1,000,000, Third Party Property Damage
- $6,000,000 Project Specific Aggregate (Required on projects valued at over $10,000,000)

This policy shall contain severability of interests' provisions.

☒ **Employer's Liability Insurance**

Coverage limits of not less than:

- $100,000 Each Accident
- $500,000 Disease Each Employee
- $500,000 Disease Policy Limit

☒ **Worker's Compensation Insurance**
☒ **US Longshoremen & Harbor Workers Act**
☒ **Jones Act Coverage**

Coverage limits of not less than:

- Statutory workers' compensation coverage shall apply for all employees in compliance with the laws and statutes of the State of Florida and the federal government.
- If any operations are to be undertaken on or about navigable waters, coverage must be included for the US Longshoremen & Harbor Workers Act and Jones Act.

Should 'leased employees' be retained for any part of the project or service, the employee leasing agency shall provide evidence of Workers' Compensation coverage and Employer's Liability coverage for all personnel on the worksite and in compliance with the above Workers' Compensation requirements. NOTE: Workers' Compensation coverage is a firm requirement. Elective exemptions are considered on a case-by-case basis and are approved in a very limited number of instances.

☐ **Aircraft Liability Insurance Required Limits**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Each Occurrence Property and Bodily Injury with no less than $100,000 per passenger each occurrence or a 'smooth' limit.
- $ General Aggregate.

☐ **Un-Manned Aircraft Liability Insurance (Drone)**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Each Occurrence Property and Bodily Injury; Coverage shall specifically include operation of Unmanned Aircraft Systems (UAS), including liability and property damage.
- $ General Aggregate

☐ **Installation Floater Insurance**
When the contract or agreement **does not** include construction of, or additions to, above ground building or structures, but does involve the installation of machinery or equipment, Installation Floater Insurance shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- 100% of the completed value of such addition(s), building(s), or structure(s)

☐ **Professional Liability and/or Errors and Omissions (E&O) Liability Insurances**
Coverage shall be afforded under either an occurrence policy form or a claims-made policy form. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

- $ 1,000,000 Bodily Injury and Property Damage Each Occurrence
- $ 2,000,000 General Aggregate

☒ **Builder's Risk Insurance**
When the contract or agreement includes the construction of roadways and/or the addition of a permanent structure or building, including the installation of machinery and/or equipment, Builder's Risk Insurance shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- An amount equal to 100% of the completed value of the project, or the value of the equipment to be installed
- The policy shall not carry a self-insured retention/deductible greater than $10,000

Coverage shall be for all risks and include, but not be limited to, storage and transport of materials, equipment, supplies of any kind whatsoever to be used on or incidental to the project, theft coverage, and Waiver of Occupancy Clause Endorsement, where applicable.

☐ **Cyber Liability Insurance**
Coverage shall comply with Florida Statute 501.171, shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County, a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Security Breach Liability
- $ Security Breach Expense Each Occurrence
- $ Security Breach Expense Aggregate
- $ Replacement or Restoration of Electronic Data
- $ Extortion Threats
- $ Business Income and Extra Expense
- $ Public Relations Expense

NOTE: Policy must not carry a self-insured retention/deductible greater than $25,000.

☐ **Hazardous Materials Insurance (As Noted Below)**
Hazardous materials include all materials and substances that are currently designated or defined as hazardous by the law or rules of regulation by the State of Florida or federal government.
All coverage shall be afforded under either an occurrence policy form or a claims-made policy form, and the policy shall be endorsed and name 'Manatee County, a political subdivision of the

State of Florida' as an Additional Insured. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

☐ ***Pollution Liability***
Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Bodily Injury and Property Damage to include sudden and gradual release, each claim and aggregate.

☐ ***Asbestos Liability (If handling within scope of Contract)***
Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Bodily Injury and Property Damage to include sudden and gradual release, each claim and aggregate.

☐ ***Disposal***
When applicable, CONTRACTOR shall designate the disposal site and furnish a Certificate of Insurance from the disposal facility for Environmental Impairment Liability Insurance covering liability.

- Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Liability for Sudden and Accidental Occurrences, each claim and an aggregate.
- Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Liability for Non-Sudden and Accidental Occurrences, each claim and an aggregate.

☐ **Hazardous Waste Transportation Insurance**
CONTRACTOR shall designate the hauler and have the hauler furnish a Certificate of Insurance for Automobile Liability insurance with Endorsement MCS-90 for liability arising out of the transportation of hazardous materials. EPA identification number shall be provided.

All coverage shall be afforded under either an occurrence policy form or a claims-made policy form and the policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

- Amount equal to the value of the contract, subject to a $1,000,000 minimum, per accident.

☐ **Liquor Liability Insurance**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- $1,000,000 Each Occurrence and Aggregate

☐ **Garage Keeper's Liability Insurance**

Coverage shall be required if the maintenance, servicing, cleaning or repairing of any County motor vehicles is inherent or implied within the provision of the contract.

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- Property and asset coverage in the full replacement value of the lot or garage.

☐ **Bailee's Customer Liability Insurance**

Coverage shall be required for damage and/or destruction when County property is temporarily under the care or custody of a person or organization, including property that is on, or in transit to and from the person or organization's premises. Perils covered should include fire, lightning, theft, burglary, robbery, explosion, collision, flood, earthquake and damage or destruction during transportation by a carrier.

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- Property and asset coverage in the full replacement value of the County asset(s) in the CONTRACTOR'S care, custody and control.

☐ **Hull and Watercraft Liability Insurance**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- $ Each Occurrence
- $ General Aggregate
- $ Fire Damage Liability
- $10,000 Medical Expense, and
- $ Third Party Property Damage
- $ Project Specific Aggregate (Required on projects valued at over $10,000,000)

☐ **Other [Specify]**

BOND REQUIREMENTS

☒ **Bid Bond**

A Bid Bond in the amount of 5% of the total offer. Bid bond shall be submitted with the sealed response and shall include project name, location, and / or address and project number. In lieu of the bond, the bidder may file an alternative form of security in the amount of 5% of the total offer. in the form of a money order, a certified check, a cashier's check, or an irrevocable letter of credit issued to Manatee County. NOTE: A construction project over $200,000 requires a Bid Bond in the amount of 5% of the total bid offer.

☒ **Payment and Performance Bond**

A Payment and Performance Bond shall be submitted by Successful Bidder for 100% of the award amount and shall be presented to Manatee County within ten (10) calendar days of issuance of the notice of intent to award. NOTE: A construction project over $200,000 requires a Payment and Performance Bond.

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INSURANCE REQUIREMENTS

I. THE POLICIES BELOW ARE TO CONTAIN, OR BE ENDORSED TO CONTAIN, THE FOLLOWING PROVISIONS:

1. Commercial General Liability and Automobile Liability Coverages

a. **"Manatee County, a Political Subdivision of the State of Florida," is to be named as an Additional Insured in respect to:** Liability arising out of activities performed by or on behalf of the successful Bidder, his agents, representatives, and employees; products and completed operations of the successful Bidder; or automobiles owned, leased, hired or borrowed by the successful Bidder. The coverage shall contain no special limitation(s) on the scope of protection afforded to the County, its officials, employees or volunteers.

In addition to furnishing a Certificate of Insurance, the successful Bidder shall provide the endorsement that evidences Manatee County being listed as an Additional Insured. This can be done in one of two ways: (1) an endorsement can be issued that specifically lists "Manatee County, a Political Subdivision of the State of Florida," as Additional Insured; or, (2) an endorsement can be issued that states that all Certificate Holders are Additional Insured with respect to the policy.

b. The successful Bidder's insurance coverage shall be primary insurance with respect to the County, its officials, employees and volunteers. Any insurance or self-insurance maintained by the County, its officials, employees or volunteers shall be excess of successful Bidder's insurance and shall be non-contributory.

c. The insurance policies must be on an occurrence form.

2. Workers' Compensation and Employers' Liability Coverages

The insurer shall agree to waive all rights of subrogation against the County, its officials, employees and volunteers for losses arising from work performed by the successful Bidder for the County.

II. GENERAL INSURANCE PROVISIONS APPLICABLE TO ALL POLICIES:

1. Prior to the execution of contract, or issuance of a Purchase Order, and then annually upon the anniversary date(s) of the insurance policy's renewal date(s) for as long as this contract remains in effect, successful Bidder shall furnish the County with a Certificate(s) of Insurance (using an industry accepted certificate form, signed by the Issuer, with applicable endorsements, and containing the solicitation or contract number, and title or description) evidencing the coverage set forth above and naming "Manatee County, a Political Subdivision of the State of Florida" as an Additional Insured on the applicable coverage(s) set forth above.

2. If the policy contains an aggregate limit, confirmation is needed in writing (letter, email, etc.) that the aggregate limit has not been eroded to procurement representative when supplying Certificate of Insurance.

   In addition, when requested in writing from the County, successful Bidder will provide the County with a certified copy of all applicable policies. The address where such certificates and certified policies shall be sent or delivered is as follows:

   Manatee County, a Political Subdivision of the State of Florida
   Attn: Risk Management Division
   1112 Manatee Avenue West, Suite 969
   Bradenton, FL 34205

3. The project's solicitation number and title shall be listed on each certificate.

4. successful Bidder shall provide thirty (30) days written notice to the Risk Manager of any cancellation, non-renewal, termination, material change, or reduction in coverage of any insurance policies to procurement representative including solicitation number and title with all notices.

5. successful Bidder agrees that should at any time successful Bidder fail to meet or maintain the required insurance coverage(s) as set forth herein, the County may terminate this contract.

6. The successful Bidder waives all subrogation rights against Manatee County, a Political Subdivision of the State of Florida, for all losses or damages which occur during the contract and for any events occurring during the contract period, whether the suit is brought during the contract period or not.

7. The successful Bidder has sole responsibility for all insurance premiums and policy deductibles.

8. It is the successful Bidder's responsibility to ensure that his agents, representatives and subcontractors comply with the insurance requirements set forth herein. successful Bidder shall include his agents, representatives, and subcontractors working on the project or at the worksite as insured under its policies, or successful Bidder shall furnish separate certificates and endorsements for each agent, representative, and subcontractor working on the project or at the worksite. All coverages for agents, representatives, and subcontractors shall be subject to all of the requirements set forth to the procurement representative.

9. All required insurance policies must be written with a carrier having a minimum A.M. Best rating of A- FSC VII or better. In addition, the County has the right to review the successful Bidder's deductible or self-insured retention and to require that it be reduced or eliminated.

III. Successful Bidder understands and agrees that the stipulated limits of coverage listed herein in this insurance section shall not be construed as a limitation of any potential liability to the County, or to others, and the County's failure to request evidence of this insurance coverage shall not be construed as a waiver of successful Bidder's obligation to provide and maintain the insurance coverage specified.

IV. The enclosed Hold Harmless Agreement shall be signed by the successful Bidder and shall become a part of the contract.

V. Successful Bidder understands and agrees that the County does not waive its immunity, and nothing herein shall be interpreted as a waiver of the County's rights, including the limitation of waiver of immunity, as set forth in Florida Statutes 768.28, or any other statutes, and the County expressly reserves these rights to the full extent allowed by law.

VI. No award shall be made until the Procurement Division has received the Certificate of Insurance and Hold Harmless Agreement in accordance with this section.

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BID ATTACHMENT 2, TECHNICAL SPECIFICATIONS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 3, PLAN SET / DRAWINGS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 4, LAKE MANATEE DAM 2020 ANNUAL INSPECTION REPORT

LAKE MANATEE DAM
2020 ANNUAL INSPECTION REPORT

Prepared for:

Carollo Engineers, Inc.
401 N Cattlemen Rd
Suite 306
Sarasota FL 34232-6441

Prepared by:

Wood Environment & Infrastructure Solutions, Inc.
1101 Channelside Dr., Ste. 200
Tampa, FL 33602

December 2020
Project No. 300472x11

TABLE OF CONTENTS

1.0 INTRODUCTION 2

1.1 Recommendation for Enhancements to Dam Safety Inspection Program 2

1.1.1 Informal Inspection 3

1.1.2 Intermediate Inspection 3

1.1.3 Formal Inspection 4

1.1.4 Special Inspection 8

1.2 Background 10

1.3 Changes to Scope of Inspection 11

2.0 DAM SAFETY INSPECTION 12

3.0 GEOTECHNICAL WALK-THROUGH VISUAL INSPECTION 13

3.1 Upstream Slope 13

3.2 Service Spillway, Apron, and Manatee River Channel 14

3.3 Crest Road 14

3.4 Downstream Slope 14

3.5 Toe Drain 15

3.6 Emergency Spillway 15

3.7 Piezometers 16

4.0 CONCRETE SERVICE SPILLWAY INSPECTION 16

4.1 General 16

4.2 General Concrete Condition 17

4.3 Spillway Ogee Monolith Joints 18

4.4 Tainter Gate Structural Framing 18

4.5 Stop Log Concrete Embedded Steel Guide Tracks 20

4.6 Tainter Gate Coating System 20

4.7 Tainter Gate Lifting Lugs, Shackles, and Cables 22

4.8 Tainter Gate Seals 22

4.9 Concrete Bridge Supports and Sheet Pile Wall 23

4.10 Bridge Framing and Concrete Deck Slab 23

4.11 Training Walls and Approach Walls 24

4.12 Spillway Slab and Concrete Apron 28

4.13 Stop Log Structural System 29
4.14 Upstream Intake Structure/Bar Screen Chamber 30
4.15 Fine Screen Chamber 31
5.0 TAINTER GATE CALIBRATION AND INSTRUMENT EVALUATION 31
6.0 CONCLUSIONS AND RECOMMENDATIONS 31

LIST OF FIGURES

FIGURE 1 Site Location Map
FIGURE 2 Aerial Photo
FIGURE 3 Service Spillway Location and Typical Embankment Section from Construction Drawings

LIST OF TABLES

TABLE 1 Recommended Lake Manatee Dam Inspection Program

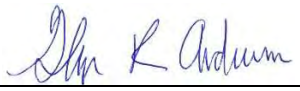
LIST OF APPENDICES

APPENDIX A 2020 Inspection Photographs
APPENDIX B Lake Manatee Dam Tainter Gate Calibration and Instrument Evaluation

CERTIFICATION
Tampa

Engineering Certification

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Wood Environment & Infrastructure Solutions, Inc., 1101 Channelside Drive, Suite 200, Tampa, FL 33602, a corporation authorized to operate as a business providing engineering consulting services (5392) by the State of Florida Department of Professional Regulation, Board of Engineers. I further certify that I, or others under my direct supervision, have prepared the geotechnical engineering evaluations, findings, opinions, calculations, conclusions or technical advice hereby represented in this report.

SIGNATURE: 

NAME: Glen Andersen, P.E.

LICENSE NO: 77304

DATE:

Report Title: Lake Manatee Dam
2020 Annual Inspection Report
Manatee County, FL

December 2020
Wood Project No. 300472x11

1.0 INTRODUCTION

The 2020 Dam Safety Inspection was conducted from June 2 to June 5, 2020 and the results are presented herein. This inspection is the last one before the initiation of the Phase II repairs whose intent is to:

1) Fill voids under the Stilling Basin, Downstream Training Walls, and Downstream Apron;
2) Repair damage to the Approach Channel and Approach Slab;
3) Repair damage to the upstream soil-cement slope; and,
4) Install a seepage cutoff wall around the entire Service Spillway to prevent future piping and internal erosion.

The structural component of the 2020 Dam Safety Inspection was performed by Mr. Mark Leon PE with Wood PLC support personnel from June 2 through June 5, 2020. A walk-through visual geotechnical inspection of the main dam, Service Spillway, and Emergency Spillway was performed by Dr. Glen Andersen, ScD, PE on June 3, 2020. The electrical component of the inspection was completed by PENN PRO under contract with Carollo during the same time frame as the structural inspection by Wood. The results of PENN PRO's electrical component inspections are included in Appendix B of this report. The scope of services performed for our inspection included the following tasks.

1.1 Recommendation for Enhancements to Dam Safety Inspection Program

Herein, Wood is recommending enhancements to the Manatee County Dam Safety Inspection program including the implementation of four types of dam inspections. This is to help the County raise the level of surveillance to be close to that of federal agencies managing similar high hazard dams. Wood will be happy to provide specific details of these recommendations including the level of effort for each, at the request of the County. These four recommended types of dam inspections are:

Informal Inspections – nearly continuous surveillance of the dam by all project personnel during daily operations and maintenance tasks to identify and report abnormal conditions

Intermediate Inspections – performed biennially to include a thorough field inspection of the dam and appurtenant structures by technically qualified engineers trained in recognizing abnormal conditions and that must be preceded by at least one Formal Inspection

Formal Inspections – performed once every 6 years by a team of highly-trained specialists under the direction of licensed professional engineers experienced in the investigation, design, construction, and operation of dams, one or more of which have not performed a previous inspection of the Lake Manatee Dam

Special Inspections – performed immediately after the dam has passed unusually large floods and after the occurrence of significant earthquakes, sabotage, or other unusual events reported by operating personnel

The following is a discussion on each of these new recommended inspections that includes the scope, frequency, suggested personnel, requirements, and Wood's suggested role. **Table 1** summarizes this information.

1.1.1 Informal Inspection

The purpose of and Informal Inspection is to provide a nearly continuous surveillance of the dam by all County employees who make frequent observations during daily operations. Wood recommends these informal inspections be performed daily. These inspectors are to identify and report abnormal conditions. Wood can provide checklists and annual training. These inspectors do not need to be formally educated in engineering or geology and can be operations and maintenance personnel. However, they should have sufficient training and experience and be trained to make their observations by engineering and operating specialists. They must understand the importance of their role in dam safety and that they are heavily relied upon as the first line of defense and should be careful in their inspecting and reporting.

The focus of Informal Inspections should be on detecting evidence of (or changes in) leakage, erosion, sinkholes, boils, seepage, slope stability, undue settlement, displacement, tilting, cracking, deterioration, improper functioning of drains, etc. Operating personnel should also make these inspections immediately after any unusual event such as large floods, suspected sabotage, or vandalism.

1.1.2 Intermediate Inspection

An Intermediate Inspection can be undertaken on a biennial interval and only after establishing a baseline of understanding through a Formal Inspection as to be outlined subsequently. If one has not been performed previously, then it should be undertaken first before an Intermediate Inspection is performed.

Intermediate inspections can have a magnitude and scope less than the current Lake Manatee Dam biennial inspection but should include a thorough field inspection of the dam and appurtenant structures and a review of the records of inspections since the last Formal Inspection. The total duration for an Intermediate inspection is expected to be approximately 3 days including pre-inspection preparations.

Intermediate Inspections should be performed by technically qualified engineers experienced in the operation and maintenance of dams and trained to recognize abnormal conditions. They should have access to and be familiar with all permanent Lake Manatee Dam documentation, especially the operations and maintenance history of the dam and should be directly and

intimately familiar with the operating characteristics of the dam. One or more representatives of Manatee County should participate in these inspections.

Prior to the inspection and based on the results of the last Formal Inspection and the intervening Intermediate Inspections, if any, the professional engineer leading the team should prepare an inspection plan based on the most recent Formal Inspection but modified to address issues found in the intervening Intermediate Inspections and Informal Inspections.

The results of the Intermediate Inspection should be memorialized in an engineering report that contains at a minimum the following items:

1) Overview to the dam history referencing the more detailed discussion in the last Formal Inspection
2) Summary of recommendations from the last Formal Inspection and intervening Intermediate Inspections and a determination of whether they have been implemented
3) An evaluation of the observations made during all Informal Inspections since the last Intermediate Inspection (or Formal Inspection if no intermediate inspections have taken place in the interim) and a discussion of whether the corresponding findings have been addressed
4) Photographs and corresponding discussions of all critical issues observed for each significant project feature and corresponding recommendations for maintenance and repair tasks
5) Recommendations for additional engineering evaluations as deemed appropriate

1.1.3 Formal Inspection

Formal Inspections should be conducted every six years and are designed to periodically verify the safety and integrity of the dam and appurtenant structures. Wood recommends the first Formal Inspection for the Lake Manatee Dam be conducted in 2023, the fiscal year following the completion of the Phase II repairs. Formal inspections are more involved than the current biennial inspections and will typically take place over multiple days with several days for pre-inspection engineering evaluations and discussions and 2 or more days for the field portion of the work.

Formal Inspections should be conducted by a team of highly trained specialists under the direction of a licensed professional engineer or engineering geologist with dam safety experience and in the investigation, design, construction, and operation of dams. At least one senior member of the inspection team should not have participated in the most recent Formal Inspection of the dam. The team should be selected based on the specific features of the dam and include individuals with appropriate specialized knowledge in structural, mechanical, electrical, hydraulic, and embankment design, geology, concrete materials, and construction procedures. The Formal Inspection team must be capable of interpreting structural performance and relating the conditions found to current design criteria and safety aspects. It is imperative the inspection team

adequately prepare for the field portion of the inspection by reviewing and discussing all documents relative to the safety of the dam prior to the inspection and by developing an inspection plan.

Formal Inspections should include the following elements:

1) An engineering evaluation to make sure the structures meet current accepted design criteria and practices.
2) A review of all pertinent documents including:
    a. Instrumentation data
    b. Operations
    c. Maintenance
    d. Original and subsequent subsurface investigations, design, and construction.
3) The preparation of Technical Pre-Inspection Packet to familiarize the team members with the general features of the Lake Manatee Dam that includes:
    a. A history of project deficiencies and remedial measures, technical summaries of the structural, material, and foundation conditions and a description of reservoir operation procedures.
    b. A written evaluation and plots of all instrumentation data and the location of all instrumentation.
    c. Project data, layout and typical section drawings, subsurface soil profile plots, examples of typical boring logs.
    d. Findings of the last Formal Inspection and all subsequent Intermediate Inspections and the status of recommended action items.
    e. A brief summary of past performance and problems concentrating on continuing conditions that may affect the overall stability and operational capability of the dam.
        i. This summary should also include specific photographs showing these conditions for comparison with new photos from the current inspection.
    f. A summary of the project's bridge and road inspections that may impact project safety or access during emergency conditions.
    g. A status of hydrologic re-evaluations.

4) The preparation of an Inspection Plan based on the most recent Formal Inspection and that includes the inspection and operation of those features related to the safety and stability of the dam and to the operational adequacy of the project.

    a. This inspection plan must be risk-informed and assure adequate coverage of the project.

        i. Risk-informed means it is designed to cover the most significant project features based on the potential for a failure and the consequences of failure. This includes evaluating the condition of features known to have been deteriorating and that were identified in prior inspections and the consideration of critical features that may not have exhibited deteriorating conditions on prior inspections.

    b. This inspection plan must also include a listing of required technical skills for the inspection team, items of equipment to be operated, and areas to be inspected.

    c. The inspection plan should include an Inspection Checklist that is developed as a detailed site-specific checklist of elements relative to the structural stability and operational adequacy of the project.

        i. The checklist should be developed for each structural component to ensure adequate examination coverage for each feature.

        ii. Instrumentation should be included to ensure the data is regularly collected and analyzed to ascertain whether the instruments are operating in a proper manner.

5) Formal Inspection items should include:

    a. Structural features, concrete surfaces, structural cracking, and deterioration of material.

    b. Joints and joint materials including relative movement at joints between structures or portions of structures.

    c. Water passages.

    d. Embankments including foundation drains.

    e. Unusual movement or cracking at or beyond the embankment or toe of slope.

    f. Seepage through or under embankment or abutment slopes.

    g. Sloughing, sinkholes, or erosion of embankment or abutment slopes.

h. Condition of riprap, armor, or another slope protection.

i. Scour protection for surface erosion control.

j. Conditions of relief wells, collector pipes, inspection manholes, or other seepage control features.

k. Condition and location of any known embedded utilities, including gas, water, sewer lines in the embankment, abutments, or toe of the dam.

l. Seepage, depressions, sinkholes, and soft, marshy areas downstream of the dam.

m. Tailrace area for muddy flows.

n. Vegetation management practices.

o. Spillways, spillway buckets, and stilling basins and outlet channels including submerged features.

p. Conditions of instrumentation and most recent measurements prior to inspection.

q. Reservoir rim conditions.

r. Detailed inspection of the entire dam and all appurtenant structures and equipment.

s. Underwater structures affecting the integrity of the structure and inspected by divers.

t. Photos from the same perspective as prior photographs to be able to make direct comparisons.

6) The Formal Inspection should include verification that:

a. Operating instructions are available.

b. Instrumentation is adequate.

c. Data is assessed to demonstrate structures are performing as designed.

d. Emergency provisions exist for access to and communication with all project operating facilities.

7) The Formal Inspection should result in the preparation of an inspection report summarizing the results of all pre-inspection analyses and visual observations and presenting recommendations for maintenance and repairs or further analyses as deemed appropriate.

1.1.4 Special Inspection

Special Inspections are conducted on an emergency basis following significant events that could potentially threaten the safety and/or operational integrity of the dam. The actual scope of these inspections will be highly dependent upon the nature of the event and on observations and engineering analyses performed during and immediately following the event. The specific scope for a Special Inspection is to be developed using a triage process with the structure of a Formal Inspection as a starting point.

The purpose of a Special Inspection is to assure the County of the continued safety and operational integrity of the dam following significant events such as unusually large floods (Hurricane Irma) or after the occurrence of significant earthquakes, sabotage, or other unusual events reported by operating personnel. The result of a Special Inspection should be the preparation of a report that verifies the continued safety and operational integrity of the dam and that presents any recommendations for maintenance and repairs or further analyses as deemed appropriate. Thus, the Special Inspection report will be similar to a Formal Inspection report.

Table 1 Recommended Lake Manatee Dam Safety Inspection Program

Inspection Type	Scope	Frequency and Start Date	Personnel	Requirements	Wood's Role	Comments
Informal Inspection	Nearly continuous surveillance of all dam features	Daily + fixed schedule or immediately after an unusual event	Project operations and maintenance	Annual training on where to look for and identify abnormal conditions. Inspection checklist to be used for fixed schedule inspections.	Provide annual training, establish fixed schedule checklist for logging and reporting	This is the first line of defense. Project personnel need to understand importance of their role.
Intermediate Inspection	Thorough inspection of dam and appurtenant structures, typically over a 1-day period with 1 to 2 days of pre-inspection preparations	Biennial starting in 2025 after 1st Formal Inspection	Technically qualified engineers and the dam operator	Performed only after a formal inspection. Engineers and/or engineering geologists need experience in operations and maintenance of dams and be trained to recognize abnormal conditions. Inspection plan must be developed prior to site visit and based on results from Formal Inspection. Inspectors must have access to and be familiar with the dam's design and operations and maintenance history.	Provide trained and qualified engineers, develop inspection plan, perform inspection, and oversee work	Scope is less than current biennial inspection process and guided directly by results of a Formal Inspection
Formal Inspection	Thorough evaluation and detailed inspection of the dam and appurtenant structures over multiple days to verify safety and integrity. Include critical underwater structures. Several days of pre-inspection preparations including engineering and planning.	Six years starting in 2023 after Phase II repairs completed	Highly-trained specialists under direction of experienced professional engineers or engineering geologist. Specialists include Structural, Mechanical, Electrical, Hydraulic, Geotechnical, Materials, and Construction Engineers, and Engineering Geologists	Evaluate structures against current design criteria and practices, review all pertinent documents, and verify adequate operating instructions, instrumentation, data assessments, and emergency communication provisions. Systematic inspection plan developed prior to site visit and based on pre-inspection evaluation.	Provide trained and qualified engineers and scientists to perform inspection and oversee work	This is an in-depth inspection meant to lower overall risk and more efficiently identify developing problems
Special Inspection	To be determined through triage and ongoing evaluations	Immediately following unusually large flood or unusual event	Selected from results of triage	Field observations, field measurements and engineering analyses necessary to assure continued safety and operational integrity	Conduct triage and assemble/coordinate inspection team and necessary field work	Triage process should use Formal Inspection as template

1.2 Background

Wood Environmental & Infrastructure Solutions (Wood.) was retained by Carollo Engineers, Inc. (Carollo) to complete an annual dam inspection at the Lake Manatee Reservoir Dam located in Manatee County, Florida. The dam is an in-stream reservoir that spans the Manatee River approximately 20 miles upstream of its discharge point into Tampa Bay. **Figure 1** shows the site location.

The dam was constructed between 1965 and 1967 and consists of an approximately 3,600-foot long earthen embankment whose axis is oriented about 35 degrees east of true north. An aerial photo of the southern portion of the embankment, the Service Spillway and a part of the northern embankment is provided on **Figure 2**. The embankment has a crest elevation ranging from 52.1 feet National Geodetic Vertical Datum of 1929 (NGVD29) to 55.3 feet, and the streambed downstream of the dam is approximately elevation –1 foot.

The embankment is comprised of silty to clayey sand upstream and downstream shell materials with a central core of clayey sand to sandy clay. The core is keyed into a relatively impermeable clayey sand to sandy clay subsurface stratum that is a part of the Hawthorn Formation. The top of this impermeable substratum is located at approximately elevation 10 feet and the deepest portion of the dam's core is keyed at approximately -4.5 ft immediately north of the Service Spillway in the location of the original riverbed prior to construction. An internal toe drain is located at the downstream toe of the earthen embankment.

During an in-depth supplemental inspection of the dam by Wood (formerly Amec) in 2013, serious concerns were raised concerning the structural integrity of the dam; both the service spillway and the adjacent zoned-earth embankment. Evidence strongly suggested the presence of an active internal erosion and piping failure mechanism in the embankment and immediately adjacent to and underneath portions of the service spillway. Indications of this potential failure mechanism were manifest in visual and physical observations since the dam went into service in 1967 and were documented by each dam safety inspection beginning with the first in 1978. This evidence became more apparent in subsequent inspections that were carried out by various engineering groups to the present time.

Based on the findings of our 2013 supplemental inspection, a Phase I emergency repair was implemented in early 2014. This repair consisted of installing a soil-cement slurry cut-off wall along the entire axis of the dam and varying in depth from 95 to 105 feet below the crest. This cut-off wall was installed using a combination of the Trench Re-mixing Deep (TRD) device and Jet Grout (JG) columns. Approximately 3,000 lineal feet of TRD wall was installed through the upstream side of the embankment's clayey core both north and south of the Service Spillway. The Jet Grout wall was installed underneath the Service Spillway located approximately 1500 ft from the south abutment and was also installed as a transition between the TRD wall and spillway from both the north and the south. Construction of the seepage cut-off wall took place from April 24,

2014 through September 11, 2014. During these emergency repair activities an annual inspection of the dam was not completed in 2014.

During the process of installing the jet grout cutoff wall under the Service Spillway, the approach slab was up-lifted and broken in several places. The jet grout process was temporarily suspended, and stress relief saw cuts were installed through the approach slab from the upstream edge to the downstream edge. Additionally, two 18-inch wide slots were cut through the approach slab from the upstream edge to the downstream edge to relieve grout pressures during the remainder of the jet grout column installations. As a result of the saw cuts and slots, large amounts of jet grout spoils ended up in mounds on top of the approach slab.

Dye studies performed after the Phase I installation and standpipe piezometer measurements after the jet grout wall was installed indicated that it was leaking, most likely where it crosses the two spillway approach walls and directly beneath these walls. It is also important to note that a backfill pressure relief drain was installed behind the two approach walls to relieve backfill water pressures during a rapid drawdown event. This drain crosses the jet grout wall and was not specifically grouted during the Phase I repairs. Therefore, it most likely acts as a direct conduit for reservoir water to cross the jet grout wall.

Due to this leakage, an evaluation was initiated to determine if it would be necessary to install a supplemental cutoff wall immediately upstream of the jet grout wall to prevent the leakage and if it would be necessary to repair the damage to the approach slab. These evaluations are being performed for the Phase II non-emergency repairs and are currently underway. These also include addressing the voids discovered beneath the stilling basin floor slab, under the downstream training walls, and beneath the downstream concrete apron. In conjunction with these evaluations, an assessment is being performed regarding the current condition of the spillway approach channel, its hydraulic capacity and long-term stability.

The Service Spillway is in the southern portion of the dam, and immediately south of the original riverbed. Refer to **Figure 3**. It consists of three 15-foot radius tainter gates, each one spanning 31.5 feet. The bottom of each tainter gate is set at elevation 26.8 feet. The spillway has upstream concrete approach walls and downstream concrete training walls, and a concrete stilling basin that discharges onto a concrete lined apron and into a riprap-lined channel that extends approximately 100 feet downstream of the spillway structure. The emergency spillway is located on the north abutment of the dam and is comprised of a series of eight bays of earthen plugs, which are designed to erode when overtopped at incremental rises in the reservoir water level between elevations 44.0 and 45.5 feet.

1.3 Changes to Scope of Inspection

The scope of the geotechnical portion of this 2020 Dam Safety Inspection report has been modified to be more consistent with an Intermediate Inspection by removing some of the geotechnical engineering calculations and evaluations. These are currently being placed into a

Geotechnical Basis of Design document in conjunction with the design process for the Phase II repairs that will be initiated in 2021. This Geotechnical Basis of Design document will be issued in 2021 and is also intended be one of the critical documents for conducting the first Formal Inspection.

The 2020 inspection involved a review of the:

- As-built construction documents
- Previous inspection reports
- Historical instrumentation data
- Operating records for the water treatment plant and dam
- Most recent dam operating procedures
- Documentation of remedial repairs and modifications to the dam and its appurtenances,
- Unusual conditions noted by the County since the last inspection

2.0 DAM SAFETY INSPECTION

The geotechnical walk-through visual inspection included observing and documenting the following general conditions:

- Condition of soil-cement and asphalt on upstream slope
- Vegetative cover on the downstream slope
- Significant erosion features
- Animal burrows and hog rooting,
- Signs of sloughing or slope movement
- Wet areas or signs of concentrated seepage

The embankment crest was inspected for signs of settlement or cracking. The Service Spillway channel was inspected for signs of seepage, erosion, or voids. The emergency spillway earthen plugs were inspected for signs of slope instability, erosion, and vegetative cover. Piezometric water elevations and seepage flow rate data are currently being evaluated for the Geotechnical Basis of Design document.

The structural inspection included a visual inspection on the observable portions (above water and above ground) of the primary spillway's structural elements, to provide an opinion on the condition of those elements and to evaluate the need for more detailed operational testing or inspection of the structures. The service spillway structural elements included the concrete ogee weir, the bridge framing and deck spanning the service spillway, the tainter gates, the tainter gate

trunnion connections, the stilling basin, the spillway apron, the upper accessible portions of the fine screen structure, and the bar screen structure.

The following sections present the results of the walk-through geotechnical visual inspection and the structural inspection.

3.0 GEOTECHNICAL WALK-THROUGH VISUAL INSPECTION

The dam embankment is comprised of compacted earth fill with a central impervious core of clayey sand to sandy clay, keyed into a relatively impervious strata throughout the majority of its alignment. The clay core was installed above the impervious strata in the vicinity of the northern and southern abutments. The original embankment section is illustrated on **Figure 3**. As discussed in the previous section of this report, a TRD wall was constructed along the majority of the embankment alignment to a bottom elevation between -40 to -50 feet. It was located near the upstream edge of the embankment crest and through the upstream portion of the impervious core. A jet grout wall was constructed to a bottom elevation of -50 feet in the vicinity of the service spillway.

3.1 Upstream Slope

The original construction drawings show the upstream slope of the embankment with a 3H:1V slope from its crest elevation (50 to 52 feet) down to a 12-foot-wide bench at elevation 25 feet. Below the bench, the slope was constructed at 4H:1V. A minimum 12-inch thick layer of soil-cement was placed on the slope between elevations 25 to 46 feet to prevent erosion from wave action. After the original construction, the top six feet of the upstream slope was steepened to around 2H:1V to 2.5H:1V in the process of raising the embankment crest and flattening the downstream slope. The centerline of the embankment was shifted upstream by a few feet to accommodate the downstream slope flattening. The upstream surface of the steepened slope was protected by a facing of asphaltic concrete. This layer of asphaltic concrete varies in thickness from 1 inch to several inches.

The junction between the upper steepened slope near the crest, and the lower flatter soil-cement covered slopes displays numerous areas where the asphaltic concrete has cracked and left exposed voids between the two facing materials **(Photos 1** and **2).** The asphaltic concrete shows signs of soil loss under the facing in some areas. The voids appear to have been caused by past soil erosion under the asphalt surface from surface runoff water on the crest road and cracks on the embankment slope. Concrete was placed along the shoulder of the crest road during the 2014 construction activities to seal the contact between the crest road and the upstream slope and this is beginning to deteriorate. Vegetation is also present in multiple areas along the contact between the original surface facing and the asphaltic concrete.

The soil-cement facing on the upstream slope continues to deteriorate and there are multiple areas with significant displacement and undermining. The following are approximate locations of

some of the most damaged areas: Sta 13+30; Sta 22+60; Sta 27+90; Sta 33+90; and Sta 38+00. Refer to **Photos 3** through **8**. These photos also show that shrinkage and thermal expansion/contraction has resulted in a network of horizontal and vertical cracks in the facing, which is normal for soil-cement of this age. The soil-cement facing observed was hard and durable, with bulldozer tracks from the original placement of the soil-cement still evident. Manatee County has sealed most of the exposed cracks within the soil-cement predominately using a cement grout. However, elastomeric and other fillers have also been used in some areas

The north abutment groin area was originally covered with a surficial layer of soil-cement and a concrete gutter. The upper portion of this slope was subsequently overlayed with asphaltic concrete. During this inspection we observed a significant amount of surface erosion and a gully undermining the concrete gutter and asphaltic concrete. This gully appears to be from storm water runoff entering cracks (**Photos 9** and **10**). This groin area should be repaired by either filling the void with grout or by installing a concrete lined ditch.

During the Phase II repairs, several demonstration projects will be implemented with different surface treatments to repair the damage in the upstream slope soil-cement and in the groin area. Further discussions of this deterioration and damage are being presented in the Geotechnical Basis of Design document for the Phase II repairs.

3.2 Service Spillway, Apron, and Manatee River Channel

The service spillway, downstream apron, and Manatee River Channel are being evaluated and repairs and upgrades are currently being designed for the Phase II repairs that will begin in November of 2021. The geotechnical conditions associated with the Service Spillway, Apron, and Manatee River Channel are being included in the Geotechnical Basis of Design document and will not be specifically addressed in this annual inspection report.

3.3 Crest Road

The crest road was re-paved at the end of the 2014 repairs and is in relatively good condition. Minor cracking was observed at various locations within the asphaltic concrete surface. Refer to **Photos 11** and **12** for examples of this cracking near Stations 22+60 and 38+00, respectively. These minor cracks should be sealed to prevent surface water infiltration.

3.4 Downstream Slope

A full evaluation of the downstream slope is being performed for the Geotechnical Basis of Design document and will be included in that document.

The downstream slope of the dam was generally uniform and covered with a good stand of mowed grass. We did not observe indications of noticeable large slope movements. Minor issues such as hog rooting and animal burrows should be repaired when observed by the mowers or

other Manatee County personnel. Animal burrows are often associated with small erosion gullies and areas of sparse vegetation. Any burrowing animals and hogs should be trapped and removed as appropriate and the areas disturbed by hogs and small animals should filled and revegetated.

Ruts caused by mowing equipment along the downstream slope of the dam can result in loss of vegetation and create uneven surfaces on the dam slope and should be filled in, regraded, and revegetated.

The downstream toe of the embankment and the surface water drainage ditches should be free draining. Stormwater catch basins, located both north and south of the Service Spillway at the downstream toe, should be silt free and without any vegetative debris accumulation. If these stormwaters catch basin begins to silt and collect vegetative debris, they should be flushed and the associated drainpipes cleared, and the vegetative debris removed.

3.5 Toe Drain

A thorough evaluation of the toe drain performance using the measured flow rates, lake levels and piezometric water elevations is being incorporated in the Geotechnical Basis of Design document and is being recommended as a part of both the Intermediate and Formal Inspection process going forward. This evaluation will not be presented herein. An enhanced geotechnical instrumentation package in the vicinity of the Service Spillway is being incorporated in the Phase II design. This will improve the ability of the dam safety engineers to assess the performance of the toe drain by contemporaneously tying the flow rates to the depths of tailwater behind the Service Spillway and the piezometers.

3.6 Emergency Spillway

The emergency spillway located north of the dam is approximately 850 feet wide and consists of eight bays separated by concrete training walls. Each bay has an earthen embankment (fuse plug) constructed to crest elevations ranging from 44.0 and 45.5 feet. Each fuse plug consists of a compacted earthen embankment with a flexible geotextile liner placed on its upstream slope and overlain with approximately 6 to 8-inch diameter rip rap. Downstream of the base slab was originally a grassed flat-bottomed channel allowed for overland flow to the Manatee River channel located about 4,300 feet downstream of the spillway.

Recent modifications (**Photo 13**) to the Emergency Spillway were made in 2017-2018 to allow its future temporary use as the primary spillway during the upcoming Phase II repairs to the Service Spillway. These changes are documented by construction draft drawings dated December 8, 2017 entitled "Construction Plans for Emergency Spillway Modifications".

Surface cracking and undermining due to surface runoff were encountered on the left abutment of the emergency spillway (**Photo 14**). We recommend that this groin area be repaired to prevent future surface erosion and undercutting.

The earthen fuse plugs in the bays of the Emergency Spillway appeared to be in good condition (**Photo 15**). The retaining walls at the abutments and between the individual bays were in good condition and appear similar to the 2018 inspection (**Photo 16**).

3.7 Piezometers

A thorough evaluation of the performance of the piezometers is being included in the Geotechnical Basis of Design document and will be incorporated in the Periodic Inspection process. It will not be presented herein.

4.0 CONCRETE SERVICE SPILLWAY INSPECTION

A visual inspection was completed on the observable portions (above water and above ground) of the primary spillway's structural elements, to provide an opinion on the condition of those elements and to evaluate the need for more detailed operational testing or inspection of the structures. The service spillway structural elements included the concrete ogee weir, the bridge framing and deck spanning the service spillway, the three tainter gates, the tainter gate trunnion connections, the stilling basin, the spillway apron, the upper portions of the fine screen structure, and the bar screen structure.

4.1 General

The concrete service spillway and related structural components associated with the Lake Manatee Dam system was observed by Wood PLC personnel on June 02 through June 05, 2020. The same Wood PLC personnel previously observed the service spillway and related structural components on July 25 through July 27, 2018. The service spillway and the related structural components that we observed generally included the concrete ogee weir, the bridge and deck spanning the service spillway, the tainter gates, trunnion anchoring systems, portions of the training walls and the approach walls, the service spillway apron, the fine screen, and the bar screen structures. Our observations were limited to structural components visually accessible from vantage points on and around the service spillway and the associated structural components (i.e., above the water line and above ground level). Observations via specialty access equipment were beyond the scope of this work. The information gathered was used to formulate opinions regarding of the condition of the various structural systems and used to identify items suggesting that a structural system may have been compromised, a further in-depth investigation maybe required, or the system appears to be approaching the end of its service life. Our opinions were based on the limited visual observations performed by our personnel and should be considered preliminary. Items of concern may exist in areas inaccessible to our personnel.

4.2 General Concrete Condition

Observations of the accessible portions of the exposed vertical concrete above the normal water line on the spillway structure, approach walls, and training walls generally indicated that the material appeared to be structurally sound with evidence of slight surface weathering. The surface weathering appeared to be consistent for the service environment with no relevant signs of distress. The structural integrity of the exposed vertical portion of concrete above the water line generally appeared to be unchanged from our last inspection and suitable for continued service.

Observations of the exposed concrete surface at the waterline and exposed surface areas typically subjected to water flow, including the accessible portions of the ogee, exhibited evidence of minor surface erosion, pitting, and exposed aggregate. The pitting generally appeared to be superficial "crater" style pits with depths on the order of fractions of an inch. The exposed aggregate generally appeared to be well bonded and structurally sound. No evidence of spalling or exposed reinforcing steel was noted during our observations. The majority of the concrete surface in the exposed eroded/pitted areas appeared structurally sound with no relevant change from our last inspection. The integrity of the exposed concrete appeared to be suitable for continued service (**Photo 17**).

We previously reported evidence of isolated surface deterioration associated with a number of grout plugs typically located in areas subjected to water flow. The grout plugs were installed during the original construction and were typically used to fill the small cavity in the concrete surface at the form tie locations. The deterioration noted at the grout plugs typically included shrinkage around the perimeter of the plug and other locations where the grout plug was completely gone. The voids resulting from the grout plug shrinkage and the cavities from the missing plugs potentially create access ports for lake water to reach the steel form ties and eventually the reinforcing steel. Based on our observations, no relevant indications were noted suggesting that steel form ties at the base of grout plug cavity were corroding. No evidence was noted suggesting that additional grout plugs were deteriorating or evidence suggesting that the existing deterioration was expanding. The grout plug deterioration generally appeared to be consistent with previous inspections.

Similar potential water intrusion "ports" were noted near the top of the waterline on the piers between the tainter gates as reported during previous annual inspections. These "ports" were typically linear type joints that appeared to coincide with pour joints during the original concrete placement (**Photo 18**). The lengths varied and the depths were unknown. No relevant change was noted from our previous inspections. Considering the potential adverse effects of the water intrusion, deteriorated grout plugs, missing grout plugs, open construction joints, and other surface discontinuities potentially capable of allowing water intrusion should be properly prepared and sealed during a scheduled outage event to reduce water intrusion.

4.3 Spillway Ogee Monolith Joints

Observations of the downstream side of the ogee indicated that each gate opening included a monolith joint oriented parallel to the direction of flow along the centerline of each gate opening. We previously noted that this was an open joint (i.e., no sealant) at all three gate locations extending from the crest down to the stilling basin. The width of the monolith joint varied along its length. As noted in previous inspections, the variation in the width of the joint primarily appeared to be attributable to minor surface erosion, particularly in the upper corners of the joint. The depth of the joint was approximately 6 inches deep as measured at a random location near the crest of the center ogee. No evidence of sealant was visually noted in the monolith joints along the downstream face of the ogee (**Photo 19**) consistent with previous inspections. Monolith joints were also located in the stilling basin slab and were excluded from this assessment due to inaccessibility (i.e., underwater).

We also noted evidence of transverse joints located on the downstream face of each ogee. These joints generally extended from pier to pier across the full width of the gate opening and were generally oriented perpendicular to the direction of the water flow. Some of the transverse joints included some form of sealant, sealant remnants, and/or evidence of localized concrete surface repair adjacent to the transverse joints. (**Photo 20**). The transverse joints generally appeared to be unchanged from previous inspections.

No relevant evidence of distress was noted with either the monolith joints or the transverse joints on the face of the ogee. In regard to the condition of the joint sealant remnants observed, we previously referenced the original design drawings and noted that the monolith joints appeared to have been designed with no specialized joint treatment other than water stops being included in the original construction and placed around the upstream face and across the bottom of the monolith joints. The transverse joints generally appeared to be construction joints resulting from the various concrete lifts placed during construction. In consideration that the design drawings provide no specific requirements for sealant at the surface of the monolith and transverse joints, maintenance of sealant in these particular ogee joints is considered to be optional. No significant evidence of change was visually noted from the previous inspection.

4.4 Tainter Gate Structural Framing

The structural frame assembly for the tainter gates generally included the skin plate, intercostal stiffeners, cross beams, cross beam bracing, and strut arms connected to a trunnion anchoring system located on the downstream face of each pier. Observations of the accessible structural components were performed from vantage points located at the crest of the ogee and from the landings at the trunnion anchoring system on the downstream face of the piers.

Observations of the accessible structural framing generally indicated that the majority of the structural steel components appeared to be in good condition with no relevant signs of distress. Framing members generally appeared to be straight and true and suitable for continued service.

The coating on the majority of the structural framing on the downstream portion of the gates generally appeared to be performing adequately (**Photos 21 and 22**). We did note evidence of localized coating deterioration and minor section loss primarily along the edge of the angle that contacts the sill at the underside of the tainter gate and near the lower corners of the gates adjacent to the side seals (**Photo 23**). Some of the section loss at that bottom edge of the gate appeared to pre-date the last coating activities. Other coating deterioration related issues at the bottom angle were more than likely due to being an access issue during the previous coating event. These items were noted in previous inspections exhibiting little to no relevant change. The present condition of the angles along the bottom edge of the tainter gates and the lower corners adjacent to the side seals generally appeared to have no significant adverse effect on the structural integrity of the gate. Continue to monitor the condition of the coating and the section loss on the structural components for evidence of change in future inspections.

Structural framing for the tainter gates includes a separate secondary framing component centered on each pier located between the trunnion landing and the bridge girders. The secondary frames were generally situated in the horizontal plane anchored to the outside face of each pier and appear to act as an emergency stop preventing a gate from over rotating into the stilling basin. The secondary frames at Gate Number 1 and Gate Number 3 extend over the top of the training walls and were anchored to the landside of the walls.

Observations of the accessible components of the secondary frames indicated that the integrity generally appeared to be intact with no significant evidence indicating that the structural system has been compromised. We did note that a portion of the secondary frame for Gate Number 3 located on the landside of the north training wall was no longer accessible due to a change in grade on the landside of the wall. Apparently, the fill material was added to landside of the north training wall subsequent to our last inspection burying a portion of frame and the associated connections (**Photo 24**). The buried components would be subjected to a harsher service environment than exposed to the atmosphere as designed. No corrosion inhibitors were noted in the original drawings other than a standard coating system suggesting that these components could be buried. The secondary framing components at this location should unearthed and positive drainage provided.

As noted in previous annual inspections, several locations in the trunnion anchoring system areas included framing components that were oriented such that rainwater, vegetation, and debris would collect in “pockets”, prematurely deteriorating the coating, and subsequently initiating corrosion (**Photos 25** and **26**). No evidence of maintenance activities was noted following our last inspection. Conditions generally remained the same as noted in previous inspections. Drain holes added at strategic locations in the framing components can be effective in reducing water accumulation. Vegetation along with debris accumulation should be removed periodically as maintenance items.

Other areas were noted in the trunnion anchoring system where the orientation of the components made it difficult to properly maintain an adequate coating system. The vertically

oriented anchor bolts and the base plates appeared to be particularly difficult to access for proper coating maintenance. Evidence of surface rust and pitting was noted at isolated locations in these areas (**Photo 27**). The anchor bolts located on the north pier of Gate Number 1 appeared to be the most severely impacted. Several anchor bolts at this location exhibited evidence of section loss due to corrosion. This condition generally appeared to be unchanged from our previous inspections. Access to the south pier trunnion anchorage was inaccessible considering that this location did not include a fixed access ladder like the other pier locations. Further evaluation of the anchor bolts with evidence of section loss should be implemented during a future scheduled outage and localized coating repairs initiated at these locations.

We previously reported that the trunnion bearings included no evidence of grease zerk fittings or other means of an external bearing lubricating system. Review of the design drawings indicated that the trunnion bearings appeared to be a self-lubricating bronze bushing design (**Photo 28**), which does not require grease. The bearing components appeared to be consistent with our previous inspections with no evidence of distress suggesting problems with the trunnion shafts or bushings. Witnessing the repetitive operation of the gates while cycled full height during the calibration exercise indicated that the rotational system of the trunnions and bushings appeared to be smooth, quiet, and free of excessive friction suggesting that the system was performing adequately. Periodic cycling of the gates can be beneficial in keeping rotational components in good working order and should be a continued practice.

4.5 Stop Log Concrete Embedded Steel Guide Tracks

Observations of the stop log slots indicated that the majority of the exposed portions of the embed angles on the outside corners and the slide plates along the contact face appeared to be sound and performing as designed. We did note evidence where the coating on the embed angle appeared to have been compromised primarily at the waterline with signs of surface rust, pitting, and minor section loss. Below the waterline the coating appeared nonexistent and was covered with scale build-up (**Photos 29** and **30**). No evidence of structural distress was noted with the exposed portion of the embedded items or the surrounding concrete slot. We did note evidence of significant "spray" and leakage working its way through the slot with the stop log in position particularly in the lower corners. Conditions generally appeared to be consistent with previous inspections. Continue to monitor the section loss on these components during scheduled outages. Consider taking advantage of any scheduled dewatering event to properly clean and recoat the compromised areas on the embedded components in the stop log slots.

4.6 Tainter Gate Coating System

Observations of the lake side portion of the tainter gates generally included the skin plate, side wall seals, and sill seal along the bottom of the gates. These components appeared to be structurally sound with no evidence of distress noted. The coating on the water side of the skin plate generally appeared to be in a serviceable condition with indications suggesting that further deterioration subsequent to our last inspection has continued to occur.

We continued to note evidence of minor discoloration and areas of brown algae type growth prevalent throughout the skin plate, seal retainer bars, and on seal bolts primarily on the waterside on all three gates (**Photos 31 and 32**). The algae growth generally appears to be a contributor in microbiologically influenced corrosion (MIC).

Our field personnel performing the annual inspection also performed the last three annual inspections. Based on visual observations, our field personnel generally noted that the extent of the algae growth coverage appears to continue to expand somewhat from previous observations. As with our previous inspection, our field personnel removed spot locations of the brown algae growth with plastic scrappers and generally noted a slight discoloration but otherwise the coating appeared to be intact at the test locations. We also noted isolated locations on the skin plates and the seal retainer bars where the coating appeared to have been compromised, presumably due to MIC, with early onset of corrosion impacting the base metal (**Photo 33**). These areas were evident with a raised "growth" of corrosion stemming from a small diameter breach in the coating. We noted the raised "growth" or pocket of corrosion to generally be limited to small, isolated locations. We also noted that the extent of the isolated areas with the raised "growth" appeared to expand with each subsequent annual inspection.

In addition to the brown algae on the waterside of the skin plate, we also noted evidence of "blisters" in the skin plate coating as noted during previous inspections. The "blisters" generally appeared to be a small, raised section of coating that feels like bumps to the touch. The "blisters" ranged in size from pin heads to quarter size were noted to be most prevalent on Gate No. 3 (**Photo 34**). Unlike the MIC related pockets of corrosion, the coating appeared to be intact with no evidence of corrosion build-up. However, the "blisters" were easily burst with hand pressure releasing moisture trapped between the plate material and the coating.

The "blisters" noted on Gate No.3 generally appeared to be more pin head sized and were more prevalent throughout the skin plate than on the other two gates. "Blisters" were noted on Gate No. 1 and Gate No. 2 and gave our field personnel the impression that the "blisters" were of a larger diameter and at isolated locations. Apparently, the lake water has breached the coating to base metal interface generating the "blister". We anticipate further "blister" development would continue without corrective actions.

The downstream face of the skin plate also included a greenish heavy algae growth at isolated locations on all three gates. We noted this algae growth in previous inspections. The growth was primarily located at the sidewalls of the gate at the pier interface where water spray was forced around the seal. The algae accumulation on the downstream face generally extended inward approximately 2 feet on the bottom half of the gates (**Photo 35**) with no significant change from our previous inspection. No significant evidence of structural distress related to the MIC, the coating "blisters", or the greenish algae accumulation was noted at this time. The MIC and the "blisters" are indicators that the existing coating system's performance life continues to be limited.

Based on the understanding that the primary spillway structure will potentially be at least partially dewatered for an extended period of time for an upcoming construction project, consider using this opportunity to refurbish the coating system on the tainter gates. As a minimum, surface blast to a near white finish, make any necessary structural repairs, and properly apply a coating system suitable for the service environment.

4.7 Tainter Gate Lifting Lugs, Shackles, and Cables

Observations of the lifting lugs, shackles, and wire ropes indicated that the majority of these components generally appeared to be in satisfactory condition with little to know relevant change from the previous inspection. The primary wire ropes and the redundant wire ropes visually appeared to be in a serviceable condition and performing adequately. No evidence of fraying or other visual signs of distress were noted. We did note several locations where the lifting rope appeared to be wearing a groove in the reinforcing pad attached to the skin plate directly above lifting lug. No issues with the grooving was noted. We also understand that the existing wire ropes were put in service in the 2007 to 2008 timeframe. Considering the service environment, a detailed assessment of the existing wire ropes should be implemented in an upcoming scheduled outage. Other available options may include replacing the wire ropes with new material or possibly swapping duty between the existing primary ropes and the redundant ropes. Typical wire rope and sleeve condition were noted (**Photo 36**).

The lifting lugs and the majority of the shackles were generally well coated with no relevant signs of distress. We also noted locations with newer shackles that appeared to have been installed subsequent to the last coating event and were in good condition.

We continued to note several locations with evidence of MIC in and around the hole where the shackle pin passed through the lifting lug (**Photo 37**) at both the primary wire rope connection and the redundanct cable connection as noted in previous inspections. No evidence of significant section loss was noted from our limited vantage point. The shackles at these locations should be removed during a scheduled outage event and further evaluation be performed on the lifting lugs. In the likelihood that no significant section loss is identified with the lug, properly clean the perimeter of the hole for the shackle pin and recoat. Replace shackles in like kind. Perform similar type inspection/maintenance service of the shackle to lifting cable thimble connection at locations exhibiting evidence of MIC growth. Replace in like kind any component in the sturctural system identified with relevant section loss due to corrosion or excessive wear. Continue to monitor the condition of the lifting lugs, shackles, thimbles, sleeves, and wire ropes that remain in service during future inspections.

4.8 Tainter Gate Seals

Observation of the tainter gate seals along the side walls and bottom of the gates indicated that the components appeared to be in fair condition, performing as designed, with minimal relevant change following our last inspection. The seal material for the side gate seals generally appeared

to be adequately maintaining its shape with no relevant evidence of cracking or distress. The side seal showed evidence of curling at the contact face with sill plate (**Photo 38**). The retainer bars appeared to be sound, well coated, and tightly secured in place. Bolts securing the seal retaining bars generally appeared to be sized appropriately for the application and in good condition. Evidence of algae buildup and scaling was noted as with other components. No relevant signs of distress were noted with the tainter gate seal assemblies during this inspection cycle. The bottom seal included evidence of curling and continued to be serviceable (**Photo 39**). Consider replacing the side seals and the bottom seal with new material in like kind should a planned extended dewatering event occur.

Observations of the sill plates placed along the crest of the ogee for the tainter gates to bear appeared intact and free of relevant signs of distress (**Photo 40**). Soundings performed along the length of the sill plates gave our field personnel the impression that the plates were well bonded and free of significant voids. The sill plates appeared to be suitable for continued service.

4.9 Concrete Bridge Supports and Sheet Pile Wall

Previous inspection reports indicated evidence of subsiding backfill at the north sheet pile wall and at the north end of the bridge deck. Apparently, this condition has been corrected. The corrective actions continue to perform properly. No evidence of distress at these locations was noted during our field observations.

4.10 Bridge Framing and Concrete Deck Slab

Observations of the bridge generally included the concrete deck slab and the structural steel superstructure. The superstructure generally included the primary beams spanning from pier to pier, the lateral bracing spanning from beam to beam, and the portions of the bearing connections at the pier interface. Our observations were performed from vantage points to include the top of the stop log while in the slotted position, from the pier landings near the trunnion supports, and from the concrete bridge deck. Based on our observations, we noted that the structural steel framing members appeared to be straight and true with no evidence of distress, alterations, previous repair work, or other indications suggesting that the structural system has been compromised (**Photos 41** and **42**). Accessible connections looked to be intact with workmanship generally consistent with industry standard. No relevant evidence of distress was noted from our vantage points. The interface between the structural steel framing and the concrete bridge deck showed no relevant signs of distress. No evidence of change was noted from our previous inspections.

The majority of the coating on the structural framing appeared to be intact and performing satisfactorily. We continued to note isolated locations with evidence of random rust staining. These areas appeared to be primarily concentrated towards the bottom flanges of the primary framing and generally located in splash zones near the piers. No evidence of relevant section loss was noted in areas exhibiting the rust staining. Continue to monitor the extent of rust staining in

subsequent scheduled outages and at some point, consider budgeting and scheduling for coating maintenance via bridge inspection equipment. The potential for an upcoming dewatering event will provide a unique access opportunity to the underside of the bridge deck for refurbishing the coating on the framing and should be taken into consideration.

Observations of the exposed portions of the reinforced concrete bridge deck generally indicated that the deck appeared to be in good condition and suitable for continued use. No relevant change was noted from our last inspection. We noted minor surface weathering on the top side with superficial cracks and localized surface chips. As previously reported, an isolated location with concrete spalling and exposed reinforcing steel with surface corrosion was noted on the underside of the bridge deck at the ladder landing on an outside corner of pier number 2 (**Photo 43**). No change was noted during this inspection. We also noted a localized area on the bridge at the stop log slot where a portion of the concrete slab corner broke off adjacent to the pier support leaving a portion of exposed reinforcing steel. The opening in the slab deck at the broken corner appeared to have been sealed with a caulking material a number of years ago and shows signs of age. Approximately 6 inches of the embedment angle that extends into the area where the decking broke off looked to be bent due to lack of support. Both the localized spalling area and the broke off corner of bridge decking appeared to have occurred a number of years ago with no significant adverse impact on the structural integrity of the decking and were noted on previous inspection reports. No significant evidence of exposed reinforcing steel and/or spalling was noted on the remaining areas of accessible bridge decking. Continue to monitor the condition of the bridge deck and maintain accordingly.

The embedded steel items framing the stop log openings in the bridge deck exhibited minor coating deterioration from abrasion and surface corrosion (**Photo 44**) in addition to the localized area of deformation noted at the broke off corner referenced above. No significant evidence of structural distress was noted with the embed angles. We did note several areas along the stop log slot where the bar that was welded to the horizontal leg as a spacer was dislodged and not functioning properly. The embed angle also appeared be accumulating dirt and debris. No change was noted from previous inspections. The overall condition of the embed angles generally appeared to be suitable for continued service. Consider removing the dirt and debris, and touching up the coating as a maintenance item.

As reported in previous annual inspection reports, the joint sealant at the gaps separating concrete deck panels appeared to be nearing the end of its service life (**Photo 45**). Condition of the sealant continues to degrade. Sealant cracking and separation was noted at several locations with the most pronounced being located at the north approach. Consider replacing the deteriorated sealant with a suitable material designed for the service environment.

4.11 Training Walls and Approach Walls

Observations of the exposed portions of concrete on the training walls and approach walls performed from the bridge deck and grade level vantage points indicated that the surface areas

generally appeared to be slightly weathered with no significant evidence of spalling or exposed reinforcing steel. The surface condition on the approach wall at the water line generally appeared to be slightly more eroded and pitted than the weathered portion above the water line (**Photo 46)**. Similar surface conditions were apparent on other vertical concrete sections in areas subjected to water flow (i.e., at the tainter gate openings). These conditions included minor surface erosion with exposed aggregate as noted in previous inspections. The aggregate appeared well bonded and the surface erosion shallow with no evidence of exposed reinforcing steel. No relevant changes associated with the condition of the training walls or approach walls were noted from previous inspections.

As reported in prior inspection reports, the lower portion of the water side of the training walls had evidence of similar surface erosion and pitting as noted in other areas subjected to water flow. The minor surface erosion and pitting generally extended up the training to just above the end sill elevation (i.e., the waterline established during a typical discharge event). A surface coating was applied over the minor surface erosion on the training wall several years ago. New sealant material was also added to the vertical joints separating the panels in both sets of training walls during this same timeframe. Observations from the base of the training walls indicated that the majority of the surface coating generally appeared to be intact and performing adequately with the exception of a couple of isolated locations on the north training wall (**Photo 47**). The coating in these isolated areas generally appeared to have deteriorated and/or peeled off of the concrete surface. Timely touch-up repairs to the coating at these locations should be considered as maintenance items in attempts to alleviate further coating deterioration. The surface coating and the sealant in the vertical joints generally appeared to be performing adequately and was noted to be suitable for continued service.

Observations of the expansion joints on the approach wall generally indicated that the joints appeared to be straight and true with no evidence of joint sealant was noted at the joints separating the panels on the approach walls. Reference of the original design drawings indicated that the expansion joint design in the approach walls and the training walls included water stops and pre-molded joint filler with no call out for a joint sealant at the wall surface. Sealant placed in these joints should be considered optional. We did note one joint location on the channel side of the south approach wall with evidence of localized spalling just above the waterline (**Photo 48**). The condition has no negative impact to the structural integrity of the wall panel. Proper repairs should be made at this location should a partial dewatering event becomes available.

Close-up observations of the training walls and the approach walls indicated evidence of superficial hairline cracks at the top of the walls in the majority of the wall panels. The cracks were typically oriented transverse to the width of the wall and located near the 1/3 span locations between the expansion joints in the individual wall panels. The cracks typically extended down the face of the wall panel 1 to 2 feet. The cracks were noted in previous annual inspections and generally appeared to be superficial and likely shrinkage cracks dating from early in the service life of the wall. No structural implications were noted or changes from previous inspections. Continue to monitor the cracks in future inspections.

The wall sections in both the training walls and the approach walls generally appeared to be straight and true at the majority of the vertical joints. In previous inspection reports we noted evidence of what appeared to be a lateral offset on the south approach wall adjacent the bar screen chamber. No evidence of distress was noted from our vantage points suggesting that the wall offset was active. The offset was noted to be in the vicinity of the recent jet grout cutoff wall installation and may or may not be a correlation. Our field personnel were of the general opinion that offset continued to appear unchanged from previous inspections. The offset was more than likely related to the difference in stiffness between the four-sided rectangular shaped bar screen chamber and the flat wall panel. Continue to monitor offset in future inspections.

We noted a similar lateral offset on either side of the Fine Screen Chamber on the south training wall (**Photo 49**). The top of the wall panel west of the chamber appeared to be offset approximately 1½ inches towards the stilling basin at this location as noted in previous inspections. No evidence was noted suggesting that the movement appeared to be active. Observations of the alignment plates bolted across the joint on top of the wall at this location indicated that the current wall alignment has little to no change following installation of the plates. Our field personnel were unclear when the alignment plates were installed. Based on the surface condition and weathering, the plate appeared to have been in service for quite a few years. A slight offset was noted at the west end of this same wall panel west of the Fine Screen Chamber. The wall panel beyond this location was a curved design. No significant structural issues were noted. Chances are that the rectangular shape of the Fine Screen Chamber is more rigid than the adjacent cantilevering wall section contributing to the pronounced lateral offset. Continue to monitor the vertical wall joint locations for signs of change in future inspections.

Observations of the north training wall indicated that a change in grade on the land side of the wall has occurred subsequent to last inspection. Apparently, fill material was brought in and the current grade appeared to be basically level with the top of the wall through generally midway in wall panel number 2 (**Photo 50**). A gradual change in grade commences midway on wall panel number 2 extending to the end of the north training wall. The end of the wall extends approximately 7.5 feet above the adjacent grade.

The additional backfill on the land side of the wall creates two issues. The increase in fill height has a corresponding increase in load on the retaining wall section. The increase in fill height also creates a potential fall hazard for personnel and motorized equipment. Lowering the grade to a minimum of 3 feet 6 inches below the top of the wall would eliminate the fall hazard as well as reducing the load on the retaining wall section. Other options would include installing a structural guardrail system on top of the wall to eliminate the existing safety hazard.

Observations of the expansion joints separating the north training wall panels indicated lateral offsets were present as noted in previous reports. For reference purposes, we labeled the north wall panel adjacent the ogee as panel number 1 with an upward number progression travelling west towards the end of the training wall. Using the panel labeling nomenclature, we measured

the lateral offset on either side of the joint for comparison to past inspections. We noted that the top of the wall at the east end of panel number 2 appeared to be offset approximately 2-1/4 inches towards the stilling basin. Observations of the alignment plates bolted across the joint on top of the wall at this location indicated a similar lateral offset towards the stilling basin with a measured offset of approximately ¾ inches. The offset values measured appeared consistent with previous inspections. No significant change in lateral offset was noted with the change in grade. We would anticipate that the difference in stiffness on either side of the joint adjacent to the ogee would be a contributor in the magnitude of the lateral offset.

The west end of panel number 2 included a lateral offset on the order of 7/8 inches with the alignment plates offset approximately 3/8 inches. The west end of panel number 3 had a slight offset towards the stilling basin but generally appeared to be straight and in alignment with the rest of the wall panels. No noticeable change was noted with the offsets when compared to previous inspections.

In previous inspection reports, we noted a variation in elevation at the north training wall footing to stilling basin slab interface. Referencing the design drawings provided, the top surface of the training wall footings was designed to be at the same elevation as the top surface of the stilling basin slab. Walking the perimeter of the stilling basin slab in approximately 12 inches of standing water, we noted that the elevation of the footings and stilling basin slab generally appeared to be consistent for the majority of the straight portion of the north and south training walls. An exception was noted in an area adjacent to the north training wall expansion joint separating wall panels 1 and 2. We noted an elevation differential on the order of 1 to 2 inches between the top surface of the wall footings and the top surface of the stilling basin slab. The elevation of the wall footings on either side of the expansion joint at this location generally appeared to be consistent. Further downstream, near the west end of wall panel number 2, the top surface of the wall footing appeared to be at the same level as the stilling basin slab. The elevation differentials were consistent during this inspection with no relevant indication of change.

We also noted that a triangular shaped portion of concrete was broken off from the upper surface of the stilling basin slab at the footing interface in the area with the elevation differential between the stilling basin slab and the wall footing. No adverse effects were noted compromising the structural integrity. No change was noted at the wall footing to stilling basin slab interface from previous inspections. Continue to monitor the locations in future inspections.

Continue the on-going monitoring program of the wall panel positions in the training walls with surveying equipment. Include the south approach wall to bar screen chamber interface in the monitoring program for data collection.

During our field observations, we noted that the design of both the north and south training walls includes a rectangular-shaped pocket or cavity in the concrete face to facilitate the trunnion anchoring system. We noted cracks in the concrete wall sections that appeared to initiate in the corners of the pocket and propagate diagonally upward (**Photo 51**). Cracks were noted on the

north and south walls with the north wall being more pronounced. The cracks generally appeared to be superficial with no significant evidence of displacement or active movement. The cracks were more than likely attributable to the geometry of the pocket and should be monitored for signs of change. No relevant change was noted following our last inspection. Based on our observations, the training walls and the approach walls appeared to be suitable for continued service.

4.12 Spillway Slab and Concrete Apron

Visual assessment of the condition of the spillway slab in the stilling basin was limited due to the presence of approximately 1 foot of standing water. Core holes completed in the slab found voids beneath the slab. The County has been aware of the voids for some time and plans to implement corrective actions at some point in the near future. No evidence of relevant structural deficiencies was noted with the stilling basin slab and should be suitable for continued service.

During the course of the inspection of the stilling basin slab, our field personnel noted an isolated discoloration on the surface of the slab in the standing water. After closer observations, the discoloration appeared to be a deposit of a granular type material (**Photos 52 and 53**). The origin of the material was unknown. The deposit was located near the center of the stilling basin slab generally in line with the fine screen chamber. No visual evidence was noted from our cursory observations suggesting that the material deposits were spoils from the indicating that the stilling basin being undermined. Continue to observe the stilling basin slab for reoccurrence of the granular deposits. Note any patterns or trends that may be applicable in attempts to identify a potential origin of the material deposits.

The concrete spillway apron area located downstream of the main spillway exhibited evidence of cracking, cracking with separation, minor displacement, and evidence of previous repair work. We also noted a few localized areas with exposed reinforcing steel along with vegetation and debris accumulation in various concrete joints (**Photos 54** and **55**). No evidence of change was noted from previous inspections. The granite rip rap downstream of the concrete apron generally appeared to be in a serviceable condition.

As previously reported, the original design drawings indicated that the stilling basin was originally constructed with a two-part sub-slab underdrain system. One part consisted of three lateral sub slab drains oriented perpendicular to river flow near the monolith joints. These laterals were connected by a manifold to drain lines running near and horizontally parallel to the training walls located both north and south of the stilling basin. A fourth lateral sub-slab drain was located along the end sill of the stilling basin. The end sill lateral was connected to approximately 9 uniformly space outlet pipes inclined at a roughly 45-degree angle. The inclined outlet pipes served as the discharge outlet for a portion of the underdrain system out the end sill and onto the apron.

The drawings indicated that drainpipes beneath the spillway slab were typically 8-inch diameter corrugated metal pipe. Visually confirming the functionality of the sub-slab underdrain during our site visit was not possible due to inaccessibility. We did note that several of the inclined drains

appeared to be included with gravel and exposed portions of the corrugated metal pipe appeared to be deteriorated. Other inclined pipe drains appeared to be opened to near the location of the end sill lateral pipe. Our field personnel probed down several of the open inclined pipes noting a gravel "feel" at the bottom. We would anticipate that the gravel "feel" would more than like be the material that was placed around the lateral drain during the original construction indicating that the corrugated metal drainpipe underneath the slab deteriorated that these locations (**Photo 56)**. Continue to monitor the condition of the inclined drainpipes in future inspections for evidence of change.

The original stilling basin design and construction included a series of uniformly spaced horizontal drains across the end sill. The drains were located just above the surface of the stilling basin slab designed to drain the standing surface water following a discharging event. We noted that the majority of the drains appeared to be functional and in good working order. Continue to monitor the functionality of the horizontal drains and maintain accordingly.

Portions of the stilling basin apron were bordered by a painted sheet pile retaining wall. The exposed portions of the sheet pile wall generally appeared to be in good condition. We did note evidence of localized deterioration with the sheet piles primarily located adjacent to the interface with the training walls. No significant changes were noted from previous inspections and the sheet piles generally appeared to be suitable for continued service (**Photo 57**). Continue to monitor condition in future inspections.

4.13 Stop Log Structural System

The structural steel stop log framing system; including the framing components, skin plate, rollers, and bearing pads; appeared to be in good, functional condition (**Photo 58**). Minor, localized framing dings and dents were noted that appeared to be consistent with the typical handling operation and posed no relevant compromise to the structural integrity of the system as noted in previous inspections. The exposed portions of the perimeter seals appeared to be in good condition with no significant evidence of being misshaped and/or cracked. The seal retainer bars were straight and properly seated with the bolting in good condition. The bearing pads and perimeter seals provided relatively good water retention for the majority of the contact surface when installed in the dewatering slot. We did note that a considerable amount of spray was forced through the gate seal near the bottom couple of feet of stop log when positioned in each gate slot. We anticipate that stop log slots at the gate locations may be contributors to the spray. No evidence of structural deficiencies was noted with the stop log or relevant changes noted following our last inspection. The stop log continues to be in a serviceable condition.

The stop log support structure was added in 2011. This structure is used to store the stop log when not deployed and continues to be in good working condition.

The County repaired the stop log coating, steel guide tracks, slide plates and seals as Bid Items of the construction documents for the Lake Manatee Dam Tainter Gate Repairs Project performed in 2010. We observed no significant evidence of distress associated with the structural components

following the repairs. The stop log system and storage frame appeared to be suitable for continued service. Consider rehabilitation of the stop log slots in the event that a temporary dewatering opportunity occurs.

4.14 Upstream Intake Structure/Bar Screen Chamber

The upstream intake chamber (bar screen chamber) passes water from the primary raw water intake through coarse screens. The water then flows through a 48-inch diameter cast iron pipe near the base of the chamber to the fine screen chamber. The bar screen chamber was partially dewatered during our site visit. Our personnel were able to enter the chamber and descend to the intermediate landing located at Elevation 31 feet. From this vantage point, we noted that the visually accessible portions of the concrete surface of the chamber appeared to be straight and true with no evidence of lateral movement, joint separation, or spalling. The interior concrete surface of the chamber included a coating system that appeared to be performing adequately. Typical algae growth and staining was noted with no relevant evidence suggesting that the coating has been compromised (**Photo 59**). No evidence of relevant change was noted following our last inspection.

Observations of the visually accessible portions of the steel sluice gates and gate rails indicated evidence of extensive surface rust and pitting with scale build-up that generally appeared to be attributable to MIC (**Photo 60**). The condition was generally unchanged from previous inspections. No evidence of significant section loss or deformation was noted. Regardless of the condition of the coating system, the structural integrity of the accessible sluice gates and the connection to the chamber wall visually appeared to be intact and structurally sound. The structural clips and attachment hardware appeared to be performing as designed. Similar to our last inspection, we noted that the seals on the middle gate and possibly the lower gate were likely approaching the end of their useful life considering that a significant amount of water was observed leaking around the seals with gates in the closed position. The mechanical hardware operating the sluice gates appeared to be functional. We did note evidence of scale build-up and isolated pockets of MIC noted on the connection rods and connection rod attachment brackets. No evidence of relevant distress with the connecting rods or attachments at the gate was noted. The discharge piping leading to the fine screen chamber was inaccessible during our site visit.

Observations of the access ladders, handrails, and other miscellaneous brackets indicated that these components appeared to structurally sound with no evidence of distress. A gap between a 90-degree elbow and electrical conduit was observed at the southeast corner of the structure and should be repaired.

Based on our observations, the bar screen chamber and associated components appeared to be suitable for continued service. Continue to monitor the condition of the components within the bar screen chamber for evidence of change in future inspections. Consider rehabilitation of these components should the opportunity for a scheduled temporary dewatering event occur.

4.15 Fine Screen Chamber

The fine screen chamber receives water from the primary raw water intake and the southern sub-slab drain line. This structure was partially dewatered during our site visit. Our personnel were able to enter the chamber and descend to the lower landing located at Elevation 18 feet. From this vantage point, we noted the concrete surfaces of the chamber appeared to be straight and true with no evidence of lateral movement, joint separation, or spalling. The interior concrete vertical surfaces of the chamber appeared to be performing adequately and were coated with what appeared to be a black mastic-like coating that was product residue from an add mixture routinely introduced into the fine screen chamber. No relevant signs of distress were noted suggesting that the chamber structure has been compromised (**Photo 61**).

The screen platform located near the bottom of the chamber (**Photo 62**) appeared to be intact and functioning properly. No significant evidence of distress was noted with the structural components, panel connections, or the perforated screening plates. The inaccessible sluice gates and mechanical gate operating components were apparently operational considering that the chamber was able to be dewatered for our personnel to gain access. The access ladders and handrails generally appeared to be in a serviceable condition. We did note evidence of active rust stains at the interface where the handrail extended into the concrete wall of the chamber. No evidence of distress was noted but care should be utilized when entering the chamber, and personnel should be alert of the potential for a weakened condition at the support. The metal grating and handrail system around the top of the chamber appeared structurally sound and suitable for continued service. Condition of the fine screen chamber generally appeared to be unchanged subsequent to our last inspection. No relevant issues impacting the structurally integrity of the fine screen chamber was noted. Continue to monitor in future inspections.

5.0 TAINTER GATE CALIBRATION AND INSTRUMENT EVALUATION

On June 2 through 5, PENN PRO performed the calibration of the Lake Manatee Tainter Gates 1, 2 and 3 (numbered from north to south). PENN PRO's scope of work included the verification and calibration of the height transmitter and inclinometer on each gate. A draft version of PENN PRO's report of inspection is included as **Appendix B**.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Lake Manatee Reservoir Dam has experienced a severe internal erosion and piping failure mechanism throughout its service life. The result of this mechanism was a significant loss of integrity of portions of the embankment's core (especially in the immediate vicinity of the Service Spillway) and the development of an active set of interconnected voids under the Service Spillway approach walls, downstream training walls, stilling basin, and discharge apron. This damage could have resulted in an uncontrolled release of the reservoir. Repeated loss of mostly embankment materials into the interconnected void systems and their subsequent flushing downstream has

resulted in repeated surficial expressions of settlement and sinkholes along both the northern and southern edges of the Service Spillway.

The installation of the deep seepage cutoff wall in 2014 reestablished the integrity of the embankment core's seepage cutoff function and is currently preventing a direct pipe from opening between the reservoir and the downstream river channel. Accordingly, the Lake Manatee Dam is now considered to be protected from an uncontrolled release of the reservoir.

The extensive and interconnected void systems under the training walls, stilling basin and downstream apron are still present and continue to facilitate additional loss of embankment materials, primarily following high tailwater releases. Although the original stilling basin underdrain system and the backfill drain system for the training walls has been compromised and is currently not functioning, the voids are acting as efficient drainage systems. The voids must be properly filled and the backfill and underdrain system functions must be restored in order to prevent ongoing loss of embankment materials. Phase II repairs are underway to meet these objectives with the beginning of construction planned for November of 2021.

Based on our observations and interactions with Manatee County staff, regular dam operations, maintenance, and inspection personnel appeared to be experienced and well-trained regarding their duties and dam safety issues. However, we are recommending an enhancement to the Dam Safety Inspection program for the Lake Manatee Dam with some additional training and the strengthening of Informal Inspections being performed by Manatee County staff.

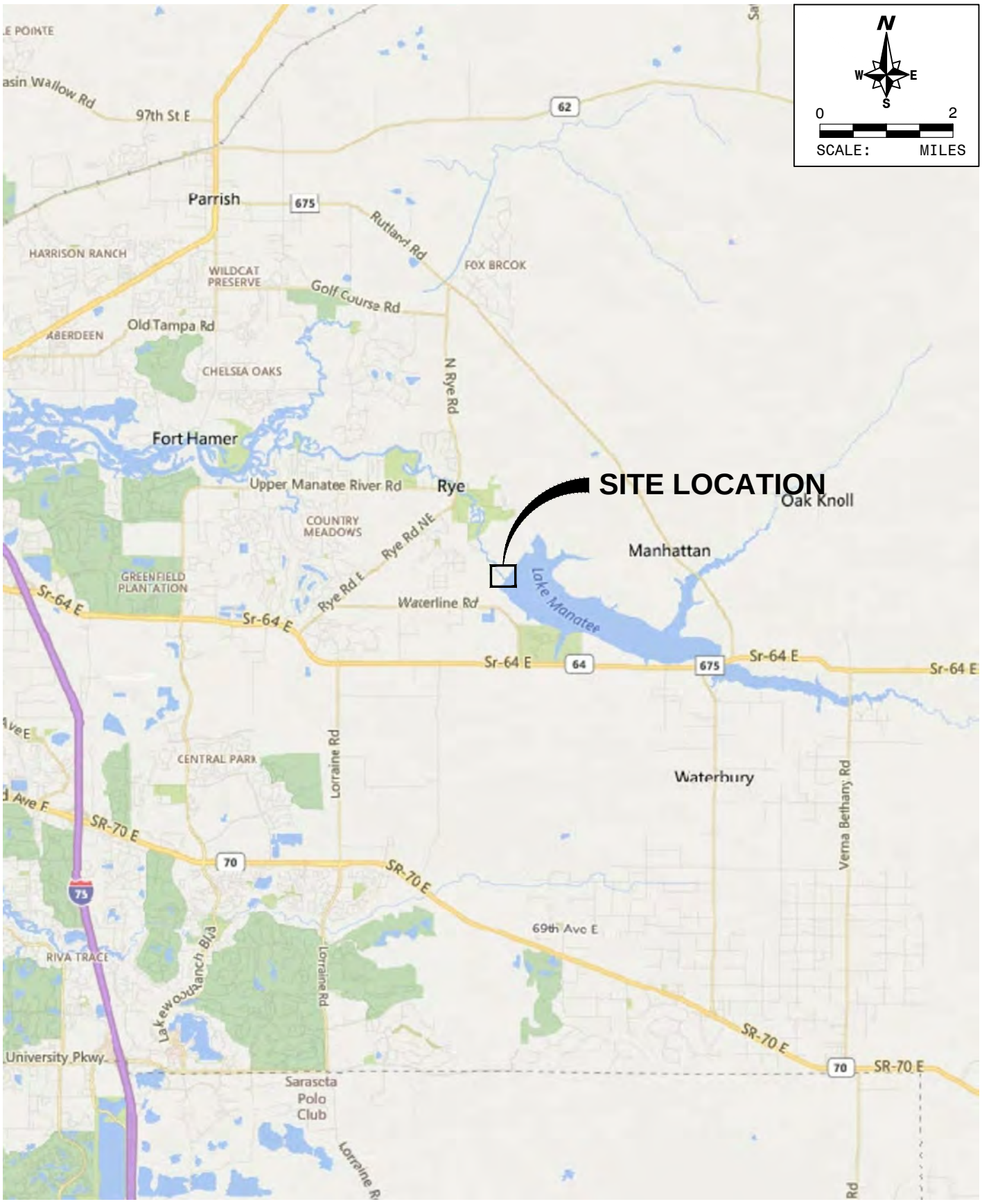
The recommendations discussed herein are being incorporated into the Plans and Specifications for the Phase II repairs and will not be summarized as previously. After completion of the Phase II repairs and the performance of the first Formal Inspection in 2023, a new list of maintenance and repair items will be generated.

Figures

FIGURE 1 Location Map

FIGURE 2 Aerial Photo

FIGURE 3 Service Spillway Location and Typical Embankment Section from Construction Drawings



wood.

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DATE:	REVISED:	DRAWN BY:
12/18/20	G.ANDERSEN	M. VIVES

SCALE:	PROJECT NO.:
AS-SHOWN	300472X11

LAKE MANATEE RESERVOIR

FIGURE-1
2020 DAM ANNUAL INSPECTION
SITE LOCATION MAP
MANATEE COUNTY, FLORIDA

PROJECT NUMBER: 300475x8 CITY: TAMPA
Z:\Geotech (300000)\Projects\300472x8 LK Manatee Dam 2018 Anl Insp\Drawings\CAD\2018\300472x8_AIR_FIG_Loc.dwg LAYOUT: FIGURE-1 SAVED: 7/27/2018 3:21 PM PLOTSTYLETABLE: CIVIL-MASTER.CTB PLOTTED: 7/27/2018 3:27 PM DRAWN BY: VIVES, MARTIN

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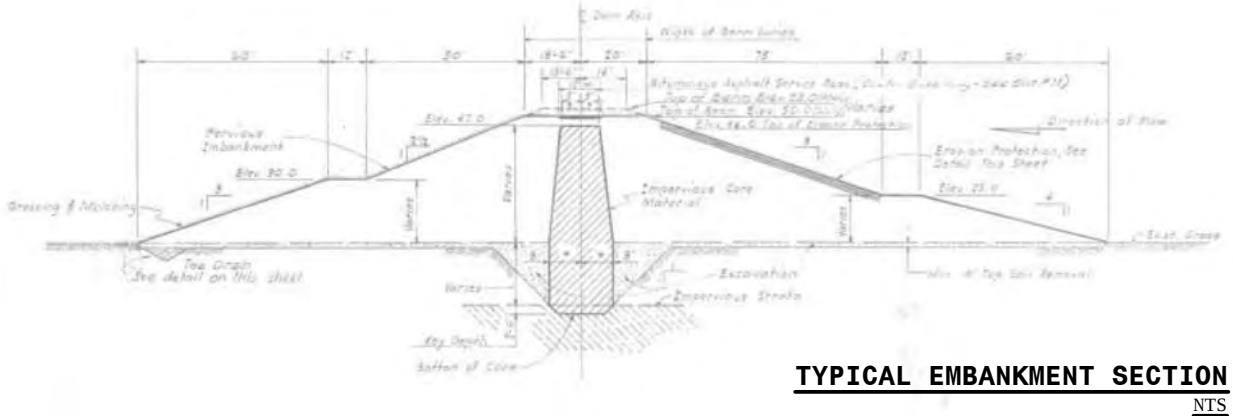
LAKE MANATEE RESERVOIR

FIGURE-2
2020 DAM ANNUAL INSPECTION
AERIAL MAP
MANATEE COUNTY, FLORIDA

DATE:	REVISED:	DRAWN BY:	SCALE:	PROJECT NO.:
12/18/20	G.ANDERSEN	M.VIVES	AS-SHOWN	300472X11

PROJECT NUMBER: 300475x8 CITY: TAMPA
Z:\Geotech (300000)\Projects\300472x8 Lk Manatee Dam 2018 Anl Insp\Drawings\CAD\2018\300472x8_AIR_FIG_Loc.dwg LAYOUT: FIGURE-2 SAVED: 7/27/2018 3:21 PM PLOTSTYLETABLE: CIVIL-MASTER.CTB PLOTTED: 7/27/2018 3:27 PM DRAWN BY: VIVES, MARTIN

SERVICE SPILLWAY LOCATION



TYPICAL EMBANKMENT SECTION

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LAKE MANATEE RESERVOIR

FIGURE-3

2020 DAM ANNUAL INSPECTION

SERVICE SPILLWAY LOCATION & TYPICAL EMBANKMENT SECTION

MANATEE COUNTY, FLORIDA

DATE:	REVISED:	DRAWN BY:	SCALE:	PROJECT NO.:
12/18/20	G. ANDERSEN	M.VIVES	AS-SHOWN	300472X11

PROJECT NUMBER: 300475x8 CITY: TAMPA
Z:\Geotech (300000)\Projects\300472x8 Lk Manatee Dam 2018 Anl Insp\Drawings\CAD\2018\300472x8_AIR_FIG_Loc.dwg LAYOUT: FIGURE-3 SAVED: 7/27/2018 3:21 PM PLOTSTYLETABLE: CIVIL-MASTER.CTB PLOTTED: 7/27/2018 3:27 PM DRAWN BY: VIVES, MARTIN

Appendix A

APPENDIX A

2020 Inspection Photographs

Facility: Lake Manatee Reservoir Dam	
Photograph: 1	**Date: 06/2020**
Description: **Erosion of asphaltic concrete on upper portion of upstream slope just north of the Service Spillway**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 2	**Date: 06/2020**
Description: **Undermining of asphaltic concrete on upper portion of upstream slope just north of the Service Spillway**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 3	**Date: 06/2020**
Description: **Soil-cement undermining at approximate Station 13+30**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 4	**Date: 06/2020**
Description: **Soil-cement undermining at approximate Station 22+60**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 5	**Date: 06/2020**
Description: **Displacement and undermining of soil-cement at approximate Station 27+90**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 6	**Date: 06/2020**
Description: **Displacement and undermining of soil-cement at approximate Station 33+90**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 7	**Date: 06/2020**
Description: **Close up of undermining of soil-cement at approximate Station 33+90**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 8	**Date: 06/2020**
Description: **Cracking in soil-cement showing the initiation of undermining at approximate Station 38+00**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 9	**Date: 06/2020**
Description: **Surface erosion and under-mining at groin area on north end of embankment**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 10	**Date: 06/2020**
Description: **Closer look at the undermin-ing of the surface protection in the groin area at the north end of the embankment**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 11	**Date: 06/2020**
Description: **Minor cracking on crest roadway near Station 22+60**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 12	**Date: 06/2020**
Description: **Some cracking on crest roadway near Station 38+00 showing end of TRD trench and infilled crest road removal area beyond end of TRD installation**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 13	**Date: 06/2020**
Description: **Recent modifications to Emergency Spillway to allow its temporary use as the primary spillway during the Phase II repairs**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 14	**Date: 06/2020**
Description: **Surface cracking and undermining of surface protection on left abutment of Emergency Spillway**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 15	**Date: 06/2020**
Description: Earthen fuse-plugs in Emergency Spillway	

Facility: Lake Manatee Reservoir Dam	
Photograph: 16	**Date: 06/2020**
Description: Typical condition of retaining wall between adjacent Emergency Spillway bays	

Facility: Lake Manatee Reservoir Dam	
Photograph: 17	**Date: 06/2020**
Description: **Typical condition of the concrete surface upstream of the gate below the waterline. Note surface condition of the concrete transitioning from above the waterline, through the waterline, and below the waterline.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 18	**Date: 06/2020**
Description: **Typical horizontal concrete construction joints below the waterline.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 19	**Date: 06/2020**
Description: **Typical monolith joint on ogee along centerline of each gate. Includes embedded waterstop.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 20	**Date: 06/2020**
Description: **Typical transverse construction joints from the original concrete placement.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 21	**Date: 06/2020**
Description: **Downstream face of gate showing typical framing and coating condition. Note the vegetation growing in debris pockets on structural framing.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 22	**Date: 06/2020**
Description: **Typical view of downstream gate framing and coating system.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 23	**Date: 06/2020**
Description: **Underside view of the bottom gate seal showing evidence of localized deterioration. Note algae accumulation on the structural framing.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 24	**Date: 06/2020**
Description: **Photo showing a portion of the structural steel framing buried at the north training wall to pier interface. Also, note that the grade appears to be flush with the top of the training wall creating a fall hazard.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 25	**Date: 06/2020**
Description: **Primary strut arm trunnion framing with evidence showing that the framing holds water leading to premature coating deterioration.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 26	**Date: 06/2020**
Description: **Another view of the primary strut arm trunnion framing with evidence showing that the framing holds water leading to premature coating deterioration.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 27	**Date: 06/2020**
Description: **Closeup view showing coating deterioration with localized corrosion in hard to access areas.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 28	**Date: 06/2020**
Description: **View of a typical strut arm trunnion.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 29	**Date: 06/2020**
Description: **Typical view of the embed angle at the waterline in the stop log slot. Note condition of coating the localized surface deterioration.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 30	**Date: 06/2020**
Description: **Typical view of the embed angle at the bottom of the stop log slot with evidence of MIC and algae growth. Also note the adequacy of the stop log seal. This location was non-typical considering minimal water was migrating around the seal.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 31	**Date: 06/2020**
Description: **Typical view of the upstream face of the tainter gate showing algae growth and accumulation.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 32	**Date: 06/2020**
Description: **Typical view of the upstream face on a different tainter gate showing algae growth and accumulation.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 33	**Date: 06/2020**
Description: **Typical corrosion pockets with evidence of MIC.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 34	**Date: 06/2020**
Description: **Closeup view of the upstream face of the skin plate showing evidence of water filled coating "blisters".**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 35	**Date: 06/2020**
Description: **Typical downstream view of the primary gate framing with evidence of algae growth, accumulation, and vegetation.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 36	**Date: 06/2020**
Description: **Typical arrangement of the primary wire rope and the redundant wire rope below the waterline.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 37	**Date: 06/2020**
Description: **Primary and secondary wire rope connections with evidence of MIC.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 38	**Date: 06/2020**
Description: **Typical closeup view of the side gate seal and portion of the bottom seal.**	

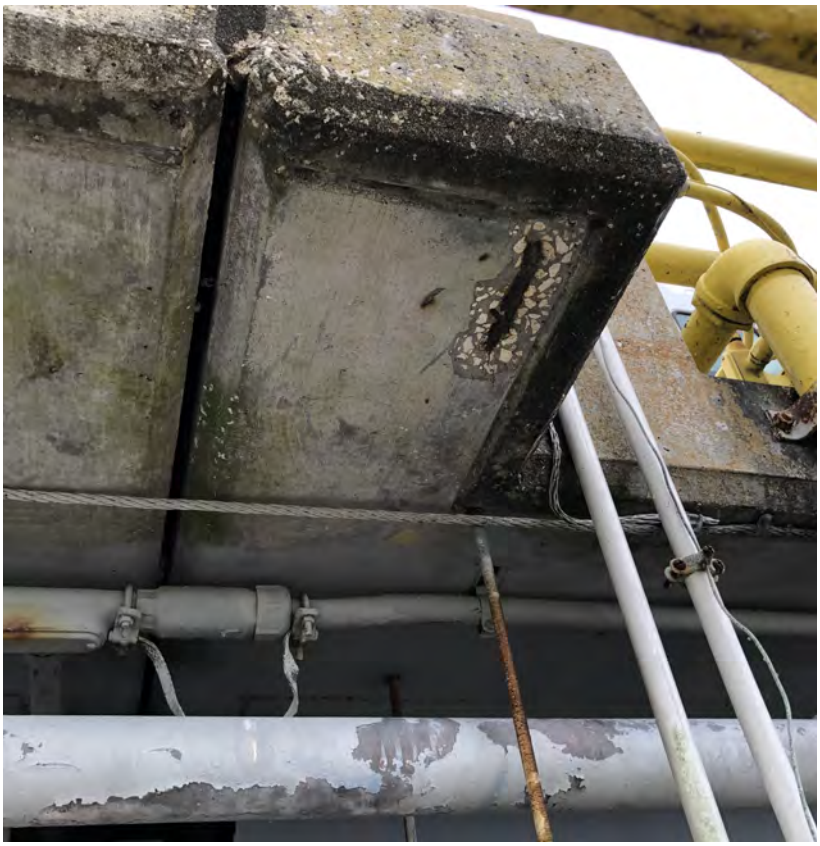
Facility: Lake Manatee Reservoir Dam	
Photograph: 39	**Date: 06/2020**
Description: **Closeup view of a typical bottom gate seal.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 40	**Date: 06/2020**
Description: **Typical view of the sill plate located on the crest of the ogee.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 41	**Date: 06/2020**
Description: **Typical view of the underside of the bridge deck structural framing.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 42	**Date: 06/2020**
Description: **Typical view of the structural bridge framing to pier connection.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 43	**Date: 06/2020**
Description: **Isolated location on the underside of the bridge deck with evidence of localized concrete spalling and exposed reinforcing steel. No evidence of change subsequent to our last inspection.**	

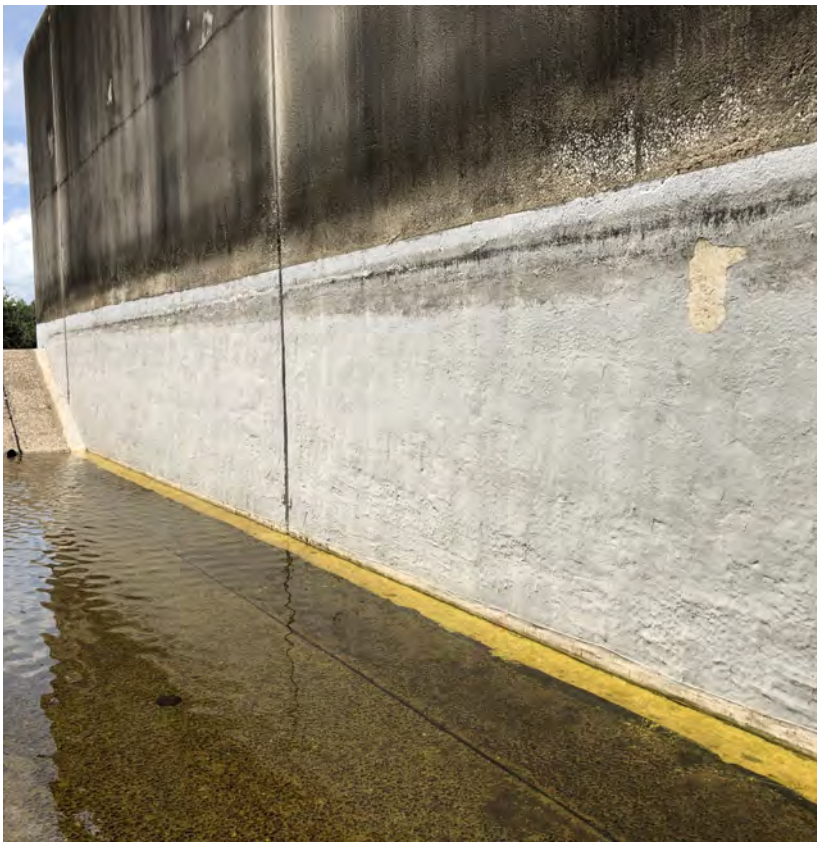


Facility: Lake Manatee Reservoir Dam	
Photograph: 44	**Date: 06/2020**
Description: **Typical view of the framed embed around the perimeter of the stop log slot. Note evidence of coating deterioration and surface rust with minor debris accumulation.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 45	**Date: 06/2020**
Description: **View of typical sealant deterioration at bridge deck expansion joints.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 46	**Date: 06/2020**
Description: **Typical surface weathering noted on the approach wall. Note contrast of surface concrete above and below the waterline.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 47	**Date: 06/2020**
Description: **North training wall showing evidence of localized coating deterioration. Condition visually appeared unchanged from previous inspections.**	



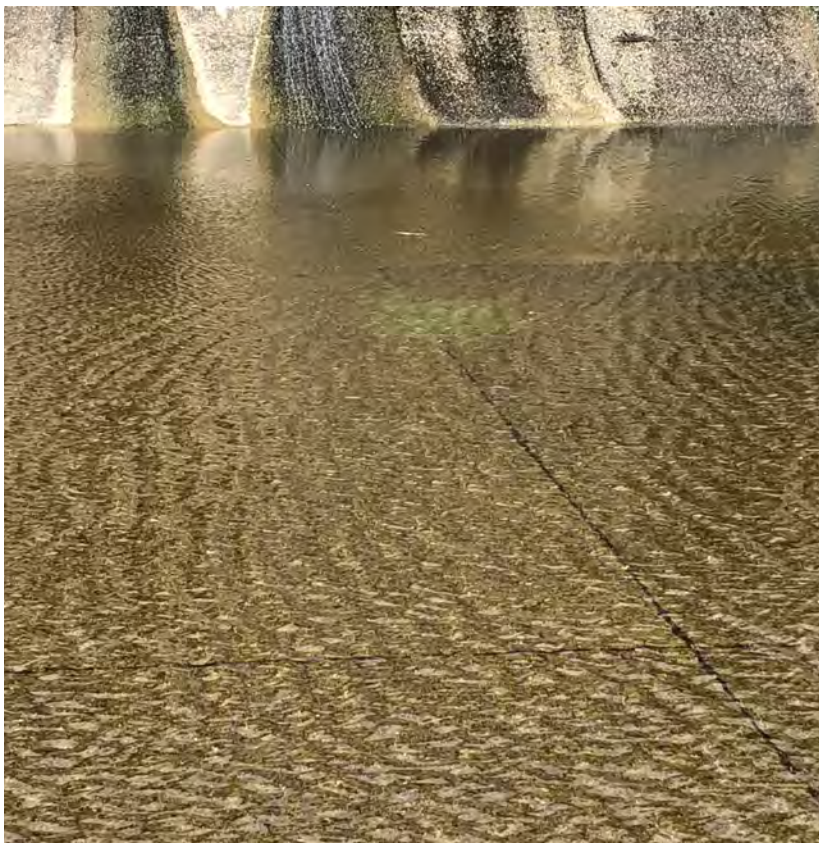
Facility: Lake Manatee Reservoir Dam	
Photograph: 48	**Date: 06/2020**
Description: **South approach wall showing localized concrete spall at expansion joint. Condition generally appeared unchanged from previous inspections.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 49	**Date: 06/2020**
Description: **Expansion joint offset noted at south training wall to fine screen chamber.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 50	**Date: 06/2020**
Description: **North training wall showing potential fall hazard due to change in grade.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 51	**Date: 06/2020**
Description: **Training wall pocket showing diagonal crack. No relevant change from previous inspections.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 52	**Date: 06/2020**
Description: **Isolated discoloration area of granular material accumulation noted in the stilling basin slab.**	



Facility: Lake Manatee Reservoir Dam	
Photograph: 53	**Date: 06/2020**
Description: **Closeup view of the granular material deposited on the surface of the stilling basin slab.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 54	**Date: 06/2020**
Description: **General condition of the stilling basin apron.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 55	**Date: 06/2020**
Description: **Stilling basin apron at north training wall to end sill interface.**	

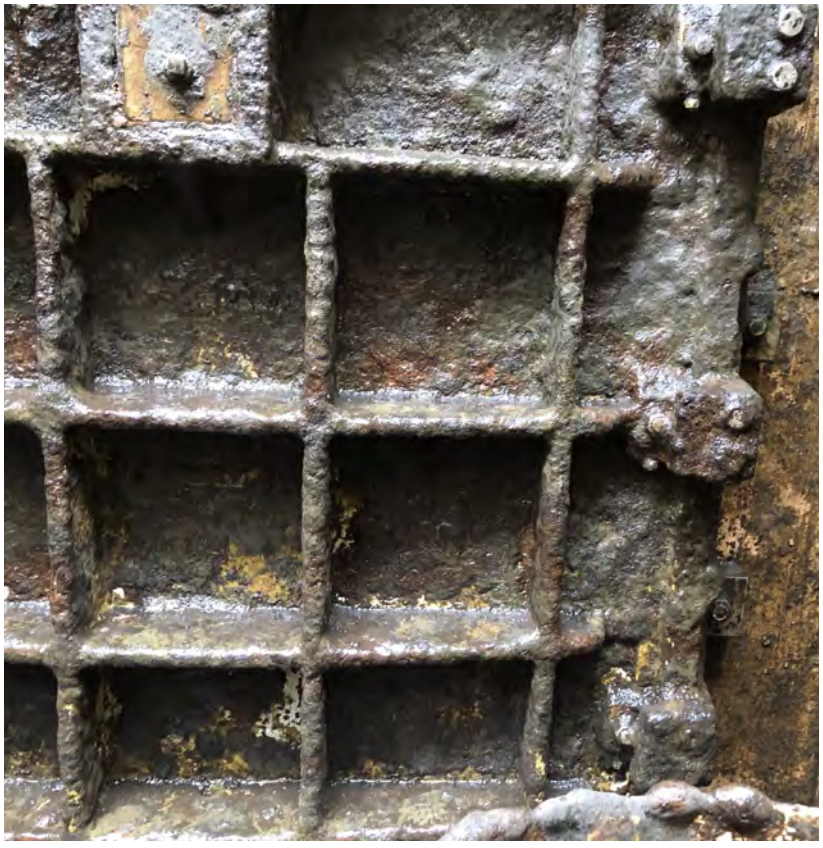
Facility: Lake Manatee Reservoir Dam	
Photograph: 56	**Date: 06/2020**
Description: **Closeup view of the inclined drain pipe on the end sill with evidence of pipe deterioration.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 57	**Date: 06/2020**
Description: **Typical condition of the steel sheet pile retaining tying into the training walls.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 58	**Date: 06/2020**
Description: **Stop log storage frame noted to be in a serviceable condition.**	

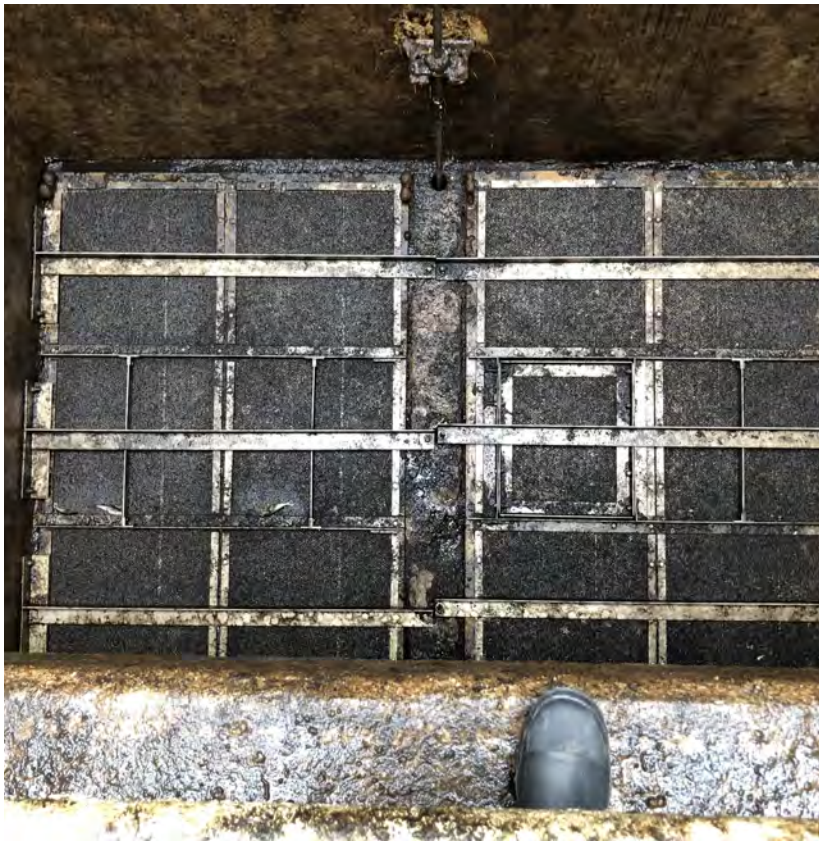
Facility: Lake Manatee Reservoir Dam	
Photograph: 59	**Date: 06/2020**
Description: **View of the interior of the middle portion of the bar screen chamber. Note the spray coming through closed gate seal.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 60	**Date: 06/2020**
Description: **Typical condition of bar screen chamber sluice gate.**	



Facility: Lake Manatee Reservoir Dam	
Photograph: 61	**Date: 06/2020**
Description: **Typical condition of interior surface of fine screen chamber.**	

Facility: Lake Manatee Reservoir Dam	
Photograph: 62	**Date: 06/2020**
Description: **View of fine screen chamber filter platform.**	



Appendix B

Lake Manatee Dam Tainter Gate Calibration and Instrument Evaluation

LAKE MANATEE DAM TAINTER GATE CALIBRATION AND INSTRUMENT EVALUATION

FOR

Dean Milton, Project Manager-Vice President

Carollo Engineering

ENVIRONMENT & INFRASTRUCTURE

BY

PENN PRO, Inc.

Engineering and Technical Services

JUNE 9, 2020

Bill Heath

John Ellington PE

Engineering Certification

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Penn Pro, Inc., 2830 Parkway Street, Lakeland, Florida 33811, a corporation authorized to operate as a business providing engineering and technical services (Florida State Board Number 00008490) by the State of Florida Department of Professional Regulation, Board of Engineers. I further certify that I or others under my direct supervision have prepared the "Lake Manatee Dam Tainter Gate Calibration and Instrument Evaluation hereby represented in this report.

SIGNATURE: _____

NAME: _____

LICENSE NUMBER: _____

DATE: _____

Lake Manatee Dam Tainter Gate Calibration and Instrument Evaluation

Gate Operation Background:

There are three Tainter gates at the Lake Manatee Dam that control the Lake level. Each of the three gates can be raised or lowered in precise increments from closed to a maximum height of 11 feet. The height indication is transmitted by a slide wire transmitter, mounted on a cam shaft that is physically attached to the main lifting shaft with a chain and sprocket assembly. The sprocket assembly is designed to provide an exact ratio to the total revolution and travel of the main shaft. As the cam shaft is rotated by the sprocket chain, the slide wire transmitter's resistance changes, simulating the gate height in a linear 4-20 milliamps (ma) output. The 4-20 ma signal is converted to engineering units in the plant's SCADA/ DCS system and calibrated to reflect the current gate position.

At a gate height slightly below 11 feet, a limit switch attached to the same cam shaft will override the SCADA or manual raise signal and shut off the corresponding gate motor. A second, physical, whisker type limit switch on the gate guide rail will shut off the motor upon a failure of the cam operated switch. If both limit switches fail, a mechanical stop will inhibit the gate travel and the lifting cables will snap, preventing a catastrophic failure and flooding of the discharge area.

Figure 1 TAINTER GATES, WITH INCLINOMETER AND HIGH LIMIT SWITCHES

An angle transmitter (inclinometer) is attached to the gate travel rail system. It also produces a 4-20 ma signal which is converted to indicate the gate angle. The relationship to height and inclination angle affords the operator a second indication of gate travel.

Scope and Procedure:

On June 2 and June 3, PENN PRO assisted in the calibration of the Lake Manatee Tainter Gates Numbers 1, 2

and 3. Our scope of work included the verification and calibration of the height transmitter and verification of the inclinometer on each gate. The actual calibration was completed by the site instrument technicians with the guidance of Bill Heath, Penn Pro engineer.

The minimum and maximum outputs of the 4-20 milli-ampere (ma) transmitter were adjusted to match zero (0) and eleven (11) feet. The adjustment was accomplished by closing each gate and setting the transmitter's output to 4 ma. Each gate was then opened to the normal, maximum travel of approximately eleven (11) feet and adjusted to indicate the calculated corresponding ma output. (The transmitter's calculated output at 11 Feet is 18.367 ma.) This procedure was repeated two times on each gate until a consistent output was maintained on all three gates.

The gates were raised to activate the cam travel and auxiliary limit switches. All six switches tripped their respective gate motor and no adjustment was required.

The gates were then closed and the ma readings were again checked for repeatability. Each gate was then raised to heights of 1 foot, 2 feet, 3 feet, 4 feet, 6 feet, 8 feet, 10 feet and 11 feet. At each step, the height was physically measured from the sill to the bottom plate attached to the individual gate. The measurement was then compared to the readings at the gate house and the SCADA system display in the control room.

At each stop, a milliamp (ma) reading from the slide-wire transmitter was recorded and compared to the expected, calculated values. The inclinometer readings were also recorded for accuracy.

The physical data, calculations and results are included in the calibration Tables 1, 2 and 3.

Figure 2 CLOSE UP VIEW OF UPPER LIMIT SWITCH

<u>Calibration results:</u>

The height transmitters on all gates are well within calibration standards. The maximum deviation, after calibration, was 1.72 per cent on gate 1, 1.40 per cent on gate 2 and 2.57 per cent on gate 3.

The errors should not be a cause of alarm, as they are still minimal and within the calibration tolerance. The maximum deviation in height was approximately 2.8" inches at 11 feet on gate 1.

The inclinometers cannot be adjusted. All 3 inclinometers appear to have degraded significantly from the last calibration and should be replaced. (See attached calculation sheets.)

The inclinometer readings are used as a backup to the height readings in case of a transmitter failure. The operator should note when there is a discrepancy in the height to angular relationship of a particular gate so the condition can be corrected.

Recommended Corrective Actions:

1. As noted in prior reports, the keyway between the motor and gear box on gate 1 is bent. (See picture in #8 below below.) It was noted that the cable broke on this gate approximately 6 years ago. A complete repair and alignment is necessary to assure the accuracy of the linear readings and to provide reliable performance of the gate.
   Considering the age and condition of the gear box, we would recommend a complete replacement and recalibration. The replacement gear box should be equipped with a torque limiting device which would alarm and reposition the gate once the recommended torque is exceeded.
2. The positioning instrumentation on all three gates is antiquated and should be repaired or replaced. The existing slide wire transmitter utilizes a rotating chain assembly, attached through several gear linkages to approximate the actual gate travel. Modern transmitters utilize discreet and precise measurements to assure a more accurate and repeatable positioning of each gate. At the very least, the components should be replaced with more precise, modern instrumentation.
3. Future calibrations should continue to provide sufficient time for multiple gate operations. The calibration procedure has been modified to include the proper adjustment of zero and span settings and multiple trials to offset hysteresis effects.
4. As recommended on a previous inspection, the emergency limit switches should be included in a preventative maintenance procedure for testing on a quarterly basis. The limit switches should be operated manually while raising each gate to verify proper operation.
5. Inspect and replace, as necessary, all surge protectors on a monthly preventive maintenance basis.

6. The inclinometers have been mounted on an isolation bracket as recommended. Electronic surge protectors should be mounted as close to the inclinometers as possible.
7. Repeated item: Protruding from the end of each gate brake assembly is

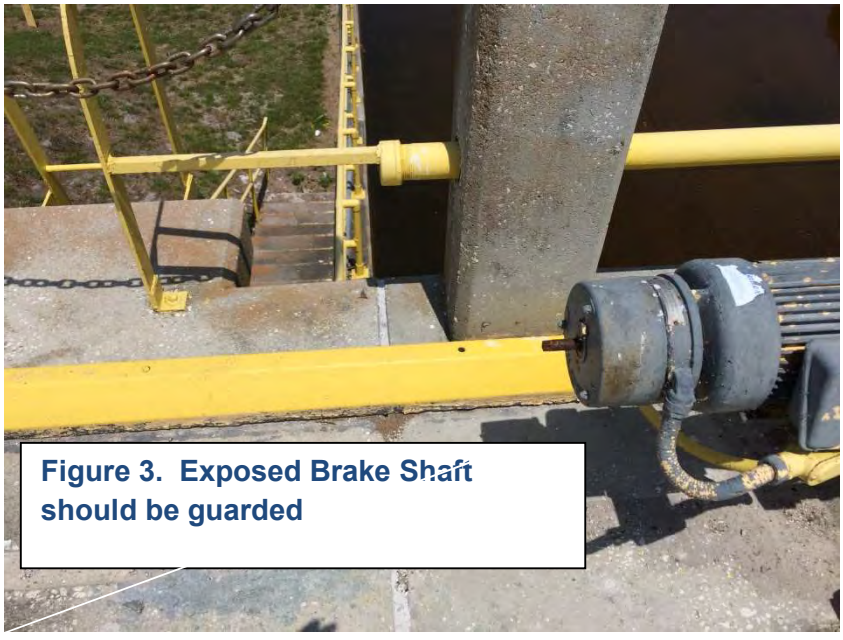


Figure 3. Exposed Brake Shaft should be guarded

an exposed, unguarded rotating shaft (See Picture). A guard should be installed to prevent accidental contact with the shaft.

8. Repeated Item: The shaft of the first, gate 1 gear box is twisted to the steel yield point. This should be taken out of service and repaired immediately to avoid additional damage. This condition is evidenced by the misalignment of the shaft key slot. (See recommendation 1.)

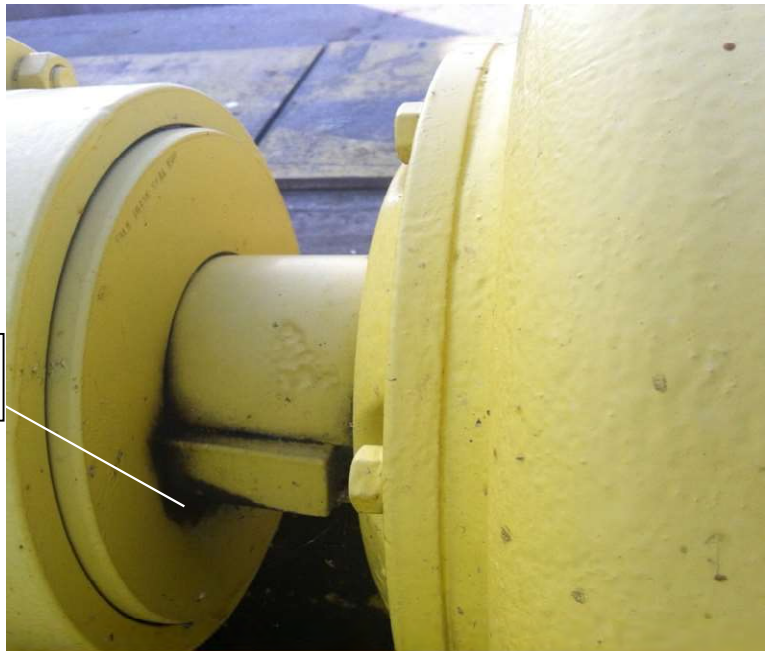


Figure 4. Damaged Keyway

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Figure 5. Tainter Gates

9. The east metal bollard is loose and should be reattached. (See picture below)

10. There are several ground wires at the control house which have been painted a grey color. All ground wires are required to be either bare copper or, if insulated, colored green for identification.

TABLE 1A. Tainter Gate 1 Calibration Final Attempt

Gate: 1 Date: 6/2/2020

	Target Values		Achieved			Calculated	Local Ind	Control Room		Calculated	Angular		Linear		Maximum Height Deviation (in)
Step	Height (in)	MA	MA	(ft.)	Cal Ft	MA	Hgt(ft.)	Height (ft.)	Angle	Angle	[1]Error	[2]Span	[3]Error	[4]Error	
				Measured	Based on MA	=.109(Ftx12)+4					Percent Measured/ Calcu	Percent Error percent span	Percent Measured/ Calcu	Percent Error percent span	
1	0	4.000	4.000	0.000	0.000	4.000	0.00	0.00	0.00		na	na	na	na	na
2	12	5.306	5.331	0.960	0.960	5.256	1.00	1.00	2.94	3.77	-22.02%	-0.49%	-1.41%	4.17%	0.480
3	24	6.612	6.626	2.010	2.008	6.629	2.00	2.00	6.81	7.64	-10.86%	-0.24%	0.05%	-0.50%	-0.120
4	36	7.918	7.929	3.000	3.004	7.924	3.01	2.99	10.74	11.52	-6.77%	-0.15%	-0.06%	-0.33%	-0.120
5	48	9.224	9.253	4.040	4.016	9.284	4.00	4.00	14.9	15.44	-3.50%	-0.08%	0.34%	-0.99%	-0.480
6	72	11.837	11.871	6.060	6.018	11.926	6.07	6.01	22.49	23.04	-2.39%	-0.05%	0.47%	-0.83%	-0.600
7	96	14.449	14.472	8.120	8.006	14.621	8.01	8.01	30.58	30.85	-0.88%	-0.02%	1.03%	-1.35%	-1.320
8	120	17.061	17.095	10.180	10.011	17.315	10.01	10.00	38.61	38.84	-0.59%	-0.01%	1.29%	-1.77%	-2.160
Cam Trip	132	18.370	18.207	11.100	10.862	18.519	10.88	10.87	42.53	42.49	0.09%	0.00%	1.71%	-2.07%	-2.760
Limit Switch Trip	134.4	18.585	18.540	11.360	11.116	18.859	11.14	11.12	42.53	42.51	0.05%	0.00%	1.72%	-2.11%	-2.880

Gate Radius= 15'-7/16" 180.4375

Notes:
1.) Error in Calculated Angle vs. Displayed
2.) Angular Error as per cent of 45° Span. Angles are in degrees.
3.) Error in Transmitted signal vs. Actual measurement
4.) Error in Height Displayed vs. Actual measurement
5.) Height at Limit Switch Shut Down

	Span	Zero	Total Span	Per in
MA	18.367	4.000	14.367	0.109
Feet/Inches"	11 Feet		132"	0.030

Calc MA = (Height * .109) +4

*TABLE 1B. Tainter Gate 1 Calibration As Found

Gate: 1 Date: 5/19/2016

	Target Values		Achieved			Calculated	Local Ind	Control Room		Calculated	Angular		Linear		
Step	Height (in)	MA	MA	(ft.)	Cal Ft	MA	Hgt(ft.)	Height (ft.)	Angle	Angle	[1]Error	[2]Span	[3]Error	[4]Error	
				Measured	Based on MA	Based on Measured				0	Percent	Percent	Percent	Percent	
1.AS Found 0	0	4.000	4.003	0.000	0.002	4.000	0.00	0.00	0	0					
2.1st Corrected 0	0	4.000	3.888	0.000	-0.086	4.000	0.00	0.00	0	0	na	na	na	na	
3. 2nd Corrected 0	0	4.000			na	4.000				0					
4. High Limit as Found	132	18.367	18.207	11.100	10.862	18.519	11.10			43.76		0.00%	1.71%	na	
5. 1st. Corrected HL	132	18.367	18.207	11.100	10.862	18.519	10.88	10.87	42.53	43.76		0.00%	1.71%	na	
6. 2nd corrected HL	132	na	18.540	11.360	11.116	18.859	11.14	11.12	42.53	43.76					

Notes:
1.) Error in Calculated Angle vs. Displayed
2.) Angular Error as per cent of 45° Span. Angles are in degrees.
3.) Error in Transmitted signal vs. Actual measurement
4.) Error in Height Displayed vs. Actual measurement
5.) Height at Limit Switch Shut Down

Span	Zero	Total Span	Per in
18.367	4.000	14.367	0.109
11 Feet	132.000	132"	0.030

Calc MA = (Height * .109) +4

TABLE 1A. Tainter Gate 2 Calibration Final Attempt

Gate: 2 Date: 6/3/2020

	Target Values		Achieved			Calculated	Local Ind	Control Room		Calculated	Angular		Linear		
Step	Height (in)	MA	MA	(ft.)	Cal Ft	MA	Hgt(ft.)	Height (ft.)	Angle	Angle	[1]Error	[2]Span	[3]Error	[4]Error	Height Deviation (in)
				Measured	Based on MA	=.109(Ftx12)+4					Measured/ Calcu	Error percent span	Measured/ Calcu	Error percent span	Displayed/Measured
1	0	4.000	3.999	0.000	-0.001	4.000	0.00	0.00	0.00		na	na	na	na	na
2	12	5.306	5.318	1.000	1.000	5.308	1.00	1.00	0	3.77	-100.00%	-2.22%	-0.19%	0.00%	0.000
3	24	6.612	6.620	2.010	2.003	6.629	2.01	1.98	2.9	7.64	-62.04%	-1.38%	0.14%	-1.49%	-0.360
4	36	7.918	7.918	3.080	2.995	8.029	3.01	3.00	6.76	11.52	-41.32%	-0.92%	1.40%	-2.60%	-0.960
5	48	9.224	9.210	4.060	3.983	9.310	4.01	3.98	10.81	15.44	-29.99%	-0.67%	1.09%	-1.97%	-0.960
6	72	11.837	11.806	6.060	5.968	11.926	6.01	5.98	14.88	23.04	-35.42%	-0.79%	1.02%	-1.32%	-0.960
7	96	14.449	14.407	8.040	7.956	14.516	8.01	7.97	22.96	30.85	-25.58%	-0.57%	0.76%	-0.87%	-0.840
8	na				-3.058	4.000			30.99	38.84	-20.21%	-0.45%	na	na	na
Cam Trip	131.52	18.350	18.349	10.050	10.970	17.145	10.97	na	na	42.49	na	na	na	na	na
Limit Switch Trip	134.4	18.585	18.590	10.960	11.154	18.336	11.20	na	na	43.49	na	na	na	na	na

Gate Radius= 15'-7/16" 180.4375

Notes:
1.) Error in Calculated Angle vs. Displayed
2.) Angular Error as per cent of 45° Span. Angles are in degrees.
3.) Error in Transmitted signal vs. Actual measurement
4.) Error in Height Displayed vs. Actual measurement
5.) Height at Limit Switch Shut Down

	Span	Zero	Total Span	Per in
MA	18.367	4.000	14.367	0.109
Feet/Inches"	11 Feet	132.000	132"	0.030

Calc MA = (Height * .109) +4

*TABLE 1B. Tainter Gate 2 Calibration As Found

Gate: 2 Date: 5/19/2016

	Target Values		Achieved			Calculated	Local Ind	Control Room		Calculated	Angular		Linear		
Step	Height (in)	MA	MA	(ft.)	Cal Ft	MA	Hgt(ft.)	Height (ft.)	Angle	Angle	[1]Error	[2]Span	[3]Error	[4]Error	Maximum Height Deviation (in)
				Measured	Based on MA	Based on Measured				0	Percent	Percent	Percent	Percent	
1.AS Found 0	0	4.000	3.999	0.000	-0.001	4.000	0.00	0.00	0.00	0					
2.1st Corrected 0	0	4.000	3.989	0.000	-0.001	4.000	0.00			0	na	na	na	na	na
3. 2nd Corrected 0	0	4.000		0.000	-0.001	4.000				0					
4. High Limit as Found	134.4	18.587	18.349	10.050	10.970	17.145				43.76		0.00%	-6.56%	na	
5. 1st. Corrected HL	na	18.587	18.590	10.960	11.154	18.336	10.97	na	na	43.76		0.00%	-1.37%	na	
6. 2nd corrected HL	na	18.587			11.154	18.336	11.20	na	na	43.76		0.00%	na	na	

Notes:
1.) Error in Calculated Angle vs. Displayed
2.) Angular Error as per cent of 45° Span. Angles are in degrees.
3.) Error in Transmitted signal vs. Actual measurement
4.) Error in Height Displayed vs. Actual measurement
5.) Height at Limit Switch Shut Down

Span	Zero	Total Span	Per in
18.367	4.000	14.367	0.109
11 Feet	132.000	132"	0.030

Calc MA = (Height * .109) +4

TABLE 1A. Tainter Gate 3 Calibration Final Attempt

Gate: 3 Date:

Step	Target Values Height (in)	Target Values MA	Achieved MA	Achieved (ft.) Measured	Achieved Cal Ft Based on MA	Calculated MA =.109(Ftx12)+4	Local Ind Hgt(ft.)	Control Room Height (ft.)	Control Room Angle	Calculated Angle	Angular [1]Error Percent Measured/ Calcu	Angular [2]Span Percent Error percent span	Linear [3]Error Percent Measured/ Calcu	Linear [4]Error Percent Error percent span	Maximum Height Deviation (in)
1	0	4.000	4.002	0.000	0.002	4.000	0.00	0.00	0.00		na	na	na	na	na
2	12	5.306	5.334	1.030	1.000	5.347	1.21	1.01	3.28	3.77	-13.00%	-0.29%	0.25%	-1.94%	-0.240
3	24	6.612	6.638	2.090	2.017	6.734	2.01	2.03	6.85	7.64	-10.34%	-0.23%	1.44%	-2.87%	-0.720
4	36	7.918	7.947	3.140	3.018	8.107	3.00	3.02	10.73	11.52	-6.86%	-0.15%	2.01%	-3.82%	-1.440
5	48	9.224	9.256	4.200	4.018	9.494	4.01	4.03	14.46	15.44	-6.35%	-0.14%	2.57%	-4.05%	-2.040
6	72	11.837	11.875	6.100	6.021	11.979	6.00	6.02	22.05	23.04	-4.30%	-0.10%	0.87%	-1.31%	-0.960
7	96	14.449	14.507	8.060	8.033	14.542	8.00	8.05	29.6	30.85	-4.05%	-0.09%	0.24%	-0.12%	-0.120
8	120	17.061	na	na						38.84	-100.00%	na	na	na	na
9	132	18.367	18.200	10.810	10.856	18.139	10.81	10.98	41.6	42.49	-2.09%	na	-0.33%	1.57%	2.040

Notes:
1.) Error in Calculated Angle vs. Displayed
2.) Angular Error as per cent of 45° Span. Angles are in degrees.
3.) Error in Transmitted signal vs. Actual measurement
4.) Error in Height Displayed vs. Actual measurement
5.) Height at Limit Switch Shut Down

	Span	Zero	Total Span	Per in
MA	18.367	4.000	14.367	0.109
Feet/Inches"	11 Feet	132.000	132"	0.030

Gate Radius= 15'-7/16" 180.4375

Calc MA = (Height * .109) +4

*TABLE 1B. Tainter Gate 3 Calibration As Found

Gate: 3 Date: 5/19/2016

Step	Target Values Height (in)	Target Values MA	Achieved MA	Achieved (ft.) Measured	Achieved Cal Ft Based on MA	Calculated MA Based on Measured	Local Ind Hgt(ft.)	Control Room Height (ft.)	Control Room Angle	Calculated Angle 0	Angular [1]Error Percent	Angular [2]Span Percent	Linear [3]Error Percent	Linear [4]Error Percent	Maximum Height Deviation (in)
1.AS Found 0	0	4.000	3.816	0.000	-0.141	4.000	0.00	0.00		0					
2.1st Corrected 0	0	4.000	4.002	0.000	-0.141	4.000	0.00	0.00	0.00	0	na	na	na	na	na
3. 2nd Corrected 0	0	4.000		0.000	-0.141	4.000				0					
4. High Limit as Found	132	18.367	18.200		10.856	4.000	10.81	10.98	41.6	43.76		0.00%	-78.02%	na	
5. 1st. Corrected HL	132	18.367	18.533		11.111	4.000				43.76		0.00%	-78.42%	na	
6. 2nd corrected HL	132	18.367			11.111	4.000				43.76		0.00%	na	na	

Notes:
1.) Error in Calculated Angle vs. Displayed
2.) Angular Error as per cent of 45° Span. Angles are in degrees.
3.) Error in Transmitted signal vs. Actual measurement
4.) Error in Height Displayed vs. Actual measurement
5.) Height at Limit Switch Shut Down

	Span	Zero	Total Span	Per in
	18.367	4.000	14.367	0.109
	11 Feet	132.000	132"	0.030

Calc MA = (Height * .109) +4

BID ATTACHMENT 5, LAKE MANATEE DAM 2013 SUPPLEMENTAL INSPECTION REPORT

Lake Manatee Dam
SUPPLEMENTAL INSPECTION REPORT
to the
2013 Annual Inspection

Prepared for:

Carollo Engineers, Inc.
Sarasota, FL

Prepared by:

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2000 E. Edgewood Drive, Suite 215
Lakeland, Florida 33803

Amec Foster Wheeler Project No. 300472X2

January 2015

TABLE OF CONTENTS

1.0 PROFESSIONAL ENGINEER CERTIFICATION 1
2.0 INTRODUCTION 2
3.0 PROJECT DESCRIPTION 5
3.1 Lake Manatee Dam 5
3.1.1 Modifications to the Original Dam 8
3.2 Topography and Bathymetry 9
3.3 Geology 10
3.4 Site Geomorphology 11
3.5 Hydrogeology 11
3.5.1 Surficial Aquifer System Characteristics 11
3.5.2 Intermediate Aquifer System or Intermediate Confining Unit Characteristics 12
3.5.3 Floridan Aquifer System Characteristics 12
3.5.4 Borrow Pit Excavation into the Intermediate Aquifer 12
3.5.5 Piezometric Water Elevations (PWE's) in Aquifers 13
3.6 Specific Design Details for the Service Spillway 15
4.0 LAKE MANATEE DAM INSPECTIONS 16
4.1 US Army Corps of Engineers Phase I Inspection, 1978 21
4.2 Bromwell Engineering, Inc. Phase II Inspection, 1979 23
4.3 HNTB Inc. Inspection 1980 – 1981 24
4.4 Camp, Dresser & McKee Inspections 1982 – 1988 24
4.5 Metcalf & Eddy Inspections 1989 – 1992 25
4.6 Black and Veatch Inspections 1993 - 1997 27
4.7 McKim & Creed Inspections 1998 - 2011 29
4.8 URS Letter 30
4.9 AMEC Inspections 2012 – 2014 31
4.10 Conclusions from Historical Data 32
5.0 AMEC FOSTER WHEELER SUPPLEMENTAL INSPECTION 37
5.1 Task 5: Historical Soil Loss behind Approach and Training Walls 37
5.2 Task 6: Slow-Moving Seepage Water Passing Through Manhole No. 6 40
5.3 Task 7: Inspect Spillway Structure below Water Level 42
5.4 Task 8: Spillway Stilling Pool Potential Voids and Underdrain Evaluation 46
6.0 DISCUSSION AND CONCLUSIONS 48

6.1 Critical Observations from Historical Data 48
6.2 Interpreted Failure Mechanism 49
6.3 Conclusion 50
7.0 REFERENCES 51

LIST OF TABLES

Table 1 Summary of Groundwater Monitoring Wells in the Vicinity of the Lake Manatee Dam from January 27, 2001 to May 23, 2003 14
Table 2 Locations and Types of Observations Consistent with Internal Erosion and Piping Failure Mechanism 19
Table 3 Locations of Evidence Consistent with Internal Erosion and Piping 21
Table 4 Summary of Historical Observations Based on Location Near the Service Spillway 33
Table 5 Piezometric Water Elevations in AMEC Piezometers 40
Table 6 Observations for UESI Dive Inspection of South Approach Wall 43
Table 7 Observations from UESI Dive Inspection of North Approach Wall 44
Table 8 Observations from UESI Dive Inspection of the 48-in Raw Water Intake Pipe 45
Table 9 Spillway Stilling Basin and Downstream Apron Coring Details 47

LIST OF FIGURES

FIGURE 1 Site Location Map
FIGURE 2 Arial Photograph of Dam and Spillway
FIGURE 3 Original Embankment Cross Section
FIGURE 4 Longitudinal Profile of Embankment and Bottom of Core Trench
FIGURE 5 Service Spillway Plan and Cross Section from Original Drawings
FIGURE 6 Plan and Section View of Backfill and Underdrain System for Training Walls and Stilling Basin
FIGURE 7 Aerial View of Service Spillway with Original Grading Plan Overlay
FIGURE 8 Topographic Map of Lake Manatee Dam Prior to Emergency Spillway
FIGURE 9 Bathymetric Survey of Lake Manatee Dam, USGS 2009
FIGURE 10 Bathymetric Survey of Main Borrow Pit, USGS 2009
FIGURE 11 Aerial Photograph of Main Borrow Pit During Construction
FIGURE 12 Geologic Map of Lake Manatee Dam Area
FIGURE 13 Generalized Correlation Chart for Lithostratigraphic and Hydrostratigraphic Units Near Lake Manatee Dam
FIGURE 14 Estimated Top of Intermediate Aquifer System / Intermediate Confining Unit

FIGURE 15 Lake Manatee ASR Wellfield and Locations of Wells #33 and #34 SWFWMD Regional Observation and Monitoring-well Program (ROMP)

FIGURE 16 Deepest Cut Section at Station 17+52

FIGURE 17 Flap Valve and Deflector Plate Detail

FIGURE 18 Plan View of Current Sheet Pile Seepage Cutoff System

FIGURE 19 Critical Seepage Paths and Locations of Significant Observations from Historical Inspection Reports

FIGURE 20 Aerial Photographs Showing Development of Sediment Island and Riverbank Erosion

FIGURE 21 Historical Observations During Construction as Documented by Corps of Engineers During 1978 Inspection

FIGURE 22 Critical Observation Locations in Corps of Engineers Phase I Inspection

FIGURE 23 Critical Observation Locations in Bromwell Engineering, Inc. Phase II Inspection

FIGURE 24 Critical Observation Locations in HNTB, Inc. Inspection (1980–1981)

FIGURE 25 Critical Observation Locations in Camp, Dresser & McKee Inspections (1982-1988)

FIGURE 26 Critical Observation Locations in Metcalf and Eddy Inspections (1989-1992)

FIGURE 27 Critical Observation Locations in Black and Veatch Inspections (1993-1997)

FIGURE 28 Critical Observation Locations in McKim & Creed Inspections (1998-2011)

FIGURE 29 Critical Observation Locations in AMEC Inspections (2012-2013)

FIGURE 30 Boring Location Plan with Historical Borings, near Service Spillway

FIGURE 31 Downstream Training Walls with Soil Boring Stick Logs

FIGURE 32 Toe Drain Inspection Observations by AMEC

FIGURE 33 Approach Walls and Slab Dive Inspection Observations

FIGURE 34 48-inch “Raw Water #1” Dive Inspection Observations

FIGURE 35 Downstream Concrete Apron Void Locations from Ground Penetrating Radar

FIGURE 36 Concrete Coring Locations in Stilling Basin and Downstream Concrete Apron

FIGURE 37 Probable Location of Piping Initiating Event

LIST OF APPENDICES

APPENDIX A Soil Boring Logs

APPENDIX B Underwater Engineering Services, Inc. Project Summary Report Manatee Lake Dam. December 3, 2013 and Underwater Engineering Services, Inc. Project Summary Report Manatee Lake Dam Raw Water Intake. December 19, 2013

APPENDIX C Integrity Drilling & Geophysical Services' Geophysical Investigation Report, Lake Manatee Spillway, Manatee County, FL. Dated: December 2, 2013

1.0 PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Amec Foster Wheeler Environment & Infrastructure, Inc., (Amec Foster Wheeler), 2000 E. Edgewood Drive, Suite 215, Lakeland, FL 33803, a corporation authorized to operate as a business providing engineering consulting services (5392) by the State of Florida Department of Professional Regulation, Board of Engineers. I further certify that I, or others under my direct supervision, have prepared the geotechnical engineering evaluations, findings, opinions, calculations, conclusions or technical advice hereby represented in this report.

GLEN ANDERSEN LICENSE No. 77304 STATE OF FLORIDA PROFESSIONAL ENGINEER

SIGNATURE: Glen R Andersen

NAME: Glen R. Andersen, ScD, P.E.
Senior Associate Engineer.

LICENSE No: 77304

DATE: January 30, 2015

REPORT TITLE:

Lake Manatee Dam
SUPPLEMENTAL INSPECTION REPORT
to the
2013 Annual Inspection

January 2015

2.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler, was retained by Carollo Engineers, Inc. (Carollo) to complete a supplemental inspection and analysis of the Lake Manatee Dam located in Manatee County near Bradenton, Florida. This evaluation was intended to address certain concerns that had been previously identified in the AMEC 2013 Annual Inspection Report and by others. A particular focus was placed on: the historical soil loss in the embankment, behind the spillway approach and training walls and underneath the stilling basin; slow moving water in the toe drains; and, the condition of the service spillway approach channel. This work began in October of 2013.

During the course of this work and as a result of the analysis of historical data, serious concerns developed about the structural integrity of the dam. These concerns centered on both the service spillway and the adjacent zoned-earth embankment. In particular, there was strong evidence in both the historical record and in the recent AMEC field inspections to suggest that an active internal erosion and piping failure mechanism existed in the embankment and immediately adjacent to and underneath the service spillway. Based upon the historical record, the conditions that created such a failure mechanism appeared to have been activated immediately following construction and appeared to have progressed and become more severe over the years.

Internal erosion as used by the U.S. Bureau of Reclamation and the U.S. Army Corps of Engineers is a term to describe the movement of soil particles under seepage gradients. This movement of particles can occur both in the embankment and the foundation. Piping is often used in the literature to refer to a specific kind of internal erosion when an open pipe occurs in an embankment or foundation under a supporting “roof”.

Internal erosion typically initiates in the downstream portion of a dam where the seepage gradients are the largest and progresses if the soil particles being transported are able to leave through an open seepage face. It then progresses upstream toward the reservoir. Internal erosion can be highly localized and is often very difficult to measure by instrumentation or geotechnical subsurface explorations. Many times the best way to determine whether internal erosion may be occurring at a dam is to look for external evidence of loss of soil material in the manner demonstrated by this report. If there is no supporting “roof” to create a pipe, then the result of internal erosion is often a loosening or raveling of the embankment and foundation as the overlying material collapses into the loosened zone.

However, if a supporting roof is present, then an open pipe can form and work its way back upstream towards the reservoir. As it gets closer to the reservoir, the length of the seepage path decreases and the seepage gradients between the upstream end of the pipe and the reservoir increase. If a pipe gets sufficiently close to the reservoir, then seepage gradients can increase significantly, accelerating the loss of material, and the result can be a direct pipe between the reservoir and the downstream river channel. Since internal erosion and piping can be difficult to detect, this failure mechanism can result in a rapid and uncontrolled release of the reservoir without warning.

Inspections have been conducted by various engineering organizations at the Lake Manatee Dam since 1978. In terms of identifying the internal erosion and piping failure mechanism, the portions of these inspection reports considered of most importance to the identification of the failure mechanism are the visual observations recorded by the various engineers, the geotechnical subsurface investigations conducted after the dam went into service, and the reported instrumentation data.

There is substantial evidence in the historical record that an internal erosion and piping failure mechanism is present at the dam and that it probably initiated shortly after construction at the downstream edge of the service spillway due to design flaws, preexisting regional groundwater artesian conditions and improper compaction during construction. There is also evidence to suggest that this failure mechanism rapidly manifested itself upstream of the core of the dam even before the initial dam safety inspection. By the time the Corps of Engineers performed the first inspection of the dam eleven (11) years after the dam went into service, they recorded several observations consistent with this failure mechanism. Through the subsequent years there is evidence this failure mechanism progressed, became more severe and manifested itself along the northern approach and training walls of the service spillway and along the toe of the embankment.

AMEC made its recommendation for the emergency installation of a deep seepage cutoff wall in the dam based upon a number of significant occurrences in the historical record. These included:

1) Vortices in the reservoir in front of the southern embankment at two locations, one near the southern approach wall to the service spillway and another at about Station 8+00, both of which were reported by the dam operators to the Corps of Engineers during the first inspection;
2) The formation of multiple voids and loss of embankment materials upstream of the embankment core behind both the northern and southern approach walls beginning in the mid 1980's;
3) The discovery by Black and Veatch in the mid 1990's of a large and high-flow capacity void system extending from the southern training wall base slab adjacent to the Ogee section of the spillway to the downstream edge of the stilling basin (under the stilling basin floor slab) and then underneath the concrete downstream apron beyond the stilling basin and into the discharge channel;
4) Large settlements under the southern and northern bridge deck approach slabs between the two sheet pile cutoff walls and along the upstream and downstream slope immediately adjacent to these cutoff walls, beginning in the mid 1990's and continuing to present day;
5) The formation of a large sediment island in the middle of the spillway discharge channel was first observed in a 1973 aerial photograph and subsequently photographed and placed in an inspection report by Camp, Dresser and McKee (1983), and then noted as a sediment island by Black and Veatch (1993); and,
6) A 20-cubic-yard sinkhole behind the northern training wall in 2009 immediately following a prolonged spillway release.

It is important to note that all of these significant occurrences have been located along the northern and southern edges of the service spillway and in the downstream river channel where the seepage gradients are the largest and hence, where evidence of an internal erosion and piping failure mechanism would be expected to be the most prevalent.

The loading condition of greatest concern to the integrity of the embankment dam and service spillway is a prolonged high flow rate release resulting in high tailwater conditions. During high tailwater conditions, the soils in the downstream shell and underneath the service spillway are expected to become fully saturated. When the gates are closed after the release, the rapid lowering of the tailwater pool with a nearly saturated downstream slope creates a rapid

drawdown condition that can move large volumes of soil into the previously established void system and downstream of the embankment.

As just mentioned, the release in 2009 resulted in the formation of a 20-cubic-yard sinkhole immediately behind the northern training wall and within close proximity of the embankment's clay core. The presence of voids and soft/loose zones near the service spillway and in the embankment and the formation of the large sediment island in the center of the spillway discharge channel, are evidence that a significant amount of material has been removed from the embankment and foundation soils.

After completing a substantial portion of the supplemental inspection and analysis, Amec Foster Wheeler met with representatives of Manatee County on February 13, 2014, to review the historical data and the Amec Foster Wheeler findings to date. The following conclusions were presented to the County:

1) Lake Manatee Dam is in a severely distressed state; and,
2) Without immediate intervention there is a high risk of an uncontrolled release of the reservoir, most likely following a large rainfall event and opening of the service spillway.

During this meeting, Amec Foster Wheeler made the following recommendations:

1) Short Term (prior to start of hurricane season)
    a. consider lowering the reservoir
    b. reestablish the seepage control function of the dam core (jet grouting, pressure injection, sheetpiling, or similar); and,
    c. work with specialty contractors to collect necessary information and develop cost estimates;
2) Long Term
    a. fill voids under stilling basin and training walls (jet grouting, pressure injection, excavation and replacement, or similar);
    b. densify backfill soils behind the approach and training walls (compaction grouting, pressure injection, excavation and replacement, or similar); and,
    c. reestablish seepage control for spillway structure and embankment;
3) Use the remaining funds on the Amec Foster Wheeler supplemental inspection contract to
    a. complete additional subsurface explorations to assess the extent of distress to the dam core (SPT and/or CPT piezocone); and,
    b. develop initial design recommendations for rehabilitation work.

Manatee County immediately accepted the Amec Foster Wheeler recommendations, lowered the reservoir to Elevation (El) 38 feet and sought emergency funding to address the "Short Term" recommendations with a Phase I emergency repair to install a deep seepage cutoff wall. An emergency subsurface exploration was launched involving CPT piezocone soundings, SPT borings, vibratory sonic cores, and the subsequent installation of standpipe piezometers to collect information necessary to design and assess the effectiveness of the recommended Phase I emergency repair.

Given the large amount of historical data used to identify the severely distressed state of the dam and the large amount of additional geotechnical subsurface information data collected to develop the design recommendations for the deep seepage cutoff wall, Amec Foster Wheeler has elected to produce two separate documents from these efforts. The present document contains a summary of the historical record and the Amec Foster Wheeler supplemental inspection data that led to the conclusion that the Lake Manatee Dam was in a severely distressed state. The second document presents the results of the emergency geotechnical subsurface investigation and engineering calculations used to design the Phase I emergency repair and to assess its effectiveness.

This report is organized as follows. The Lake Manatee Dam is first described along with the surrounding topography, reservoir bathymetry, geology and hydrogeology. Observation data and geotechnical information from the various inspections are presented next. The data was collected in inspections beginning in 1978; eleven (11) years after the dam went into service. The various pieces of information from these inspections are linked to specific numbered locations on the dam. Discussions about the significance of the data are presented simultaneously with the data. The results of the Amec Foster Wheeler supplemental inspection are then presented followed by a summary and conclusions.

3.0 PROJECT DESCRIPTION

This report section provides an overview of the Lake Manatee Dam and the associated topography, bathymetry, geology, and hydrogeology. This information has been gathered from current topographic and bathymetric surveys, geologic maps published by the U.S. Geologic Survey, and papers written by scientists aimed at understanding the geology and hydrogeology of the area surrounding the dam.

3.1 Lake Manatee Dam

The Lake Manatee Dam (Dam) is located near Bradenton in Manatee County, Florida and was constructed between 1965 and 1967. It is an in-stream reservoir on the Manatee River approximately 20 miles upstream of its discharge point into Tampa Bay. Its primary function is a freshwater supply for users in Manatee and Sarasota Counties. A site location map is provided in **Figure 1**.

The Dam consists of an approximately 4,700-foot-long zoned-earth embankment with its axis oriented about 35 degrees east of true north. Based upon NGVD 29 vertical datum, the present elevation of the crest of the dam ranges from approximately 51 to 55 feet. As originally designed, the maximum crest elevation for the dam was 52 feet, but an additional 3 feet was added subsequently to both the northern and southern embankments to increase the freeboard in conjunction with the addition of an emergency spillway. An aerial view of the dam and spillway structure is presented in **Figure 2**. The principal spillway (called the service spillway) is located near the southern end of the dam and just south of the original Manatee River channel. The original freshwater intake for the water treatment plant is located on the south side of the service spillway and is called Raw Water #1. Freshwater enters a coarse-screen chamber located in the southern approach wall, then travels along a 48-inch pipe through the core of the dam to a fine-screen chamber. From there it flows southward to a pump house where it is pumped to the water treatment plant. A second raw water intake line is located along the southern edge of the lake shore east of the dam. The normal operating pool is approximately El. 38 feet.

The embankment is composed of a pervious, sandy, outer shell with a central clayey core. This clayey core is 10 feet wide at the top and increases to 16 feet wide near the bottom, where it was keyed into a relatively impermeable stratum with a key-in depth of 2.5 feet. This confining layer lies between the surficial aquifer and an intermediate aquifer. It is part of the Hawthorn Group and will be described in more detail subsequently. **Figure 3** presents a typical cross section for the embankment from the original as-built drawings. The upstream slope was designed at 4H to 1V from the upstream toe up to a horizontal bench at El. 25 feet, NVGD 29. Above this bench; the upstream slope was designed at 3H to 1V. The downstream slope was originally designed at 2.5H to 1V in the upper portion and extended down to a horizontal bench at El. 30 feet, beyond which the embankment slope was designed at 3H to 1V.

A toe drain was installed to lower water pressures in the downstream shell. The original outfall for the toe drains was constructed without backflow prevention. Hence, during high flow rate releases where the tailwater impounds above the invert of these drains, both the northern and southern toe drains are charged with tail water, thus increasing the rate at which the soils near the spillway and in the downstream toe area would saturate. When this toe drain was subsequently abandoned in place, the outfalls on both the north and south sides of the embankment were left unplugged and a portion of the toe drain is still open behind the face of each of these walls. The manholes were either fully or partially removed and the demolition plans for the drain pipes called for them to be filled with grout. Given that a portion of these pipes are still open behind the face of the training walls, during high tailwater releases the downstream portions of the original toe drain are still charged with tail water and it is possible that there is a direct conduit for this water into the original filter materials that surrounded the pipe, allowing these pressures to extend upstream along the original toe drain alignment.

A minimum 12-inch-thick soil cement cover was provided on the upstream slope as a wave erosion protection measure. Refer to **Figure 3**. This cover extends from the lower horizontal bench at El. 25 feet up the slope to El. 46 feet, NVGD 29. The original crest was designed to be approximately 27.5 feet wide with a 12 feet wide asphaltic concrete roadway along its centerline.

A longitudinal profile of the embankment and the designed bottom of the clay core is presented in **Figure 4**. The original bottom of the core trench is identified with a red dashed line. In the general location of the service spillway the clay core is keyed into the previously mentioned confining layer from the Hawthorn Group. The deepest portion of the original clay core extended down to El. -4.4 feet in the general vicinity of the service spillway. However, near the southern and northern abutments, the clay core rises out of this confining layer and does not function as a cutoff. Key locations along the profile, together with the associated stationing are also presented on **Figure 4**.

The service spillway structure consists of three 15-foot radius tainter gates, each one spanning a 31.5-foot bay. Refer to **Figure 5** for a plan view and exploded cross section of the service spillway. The bottom of each tainter gate is set at El. 26.8 feet, NVGD 29, on top of an Ogee section representing the lowest elevation to which the reservoir can be effectively lowered as there is no low-level outlet.

The spillway has upstream concrete approach walls and a concrete approach apron. It also has downstream concrete training walls and a stilling basin with an end sill for energy dissipation. The stilling basin floor slab is ground-founded and constructed of individual reinforced concrete sections. The first set of these sections immediately adjacent to the Ogee section is 5 feet thick. The next two sets of floor slab sections are 3.5 feet thick. The concrete approach walls and the downstream training walls have an inverted T-shape and together with the Ogee section

monoliths for the spillway are all founded on driven H-piles. The concrete stilling basin discharges over the end sill and into what was originally a bare-earth cut-soil channel connecting to the Manatee River. Subsequently, a concrete apron was placed to limit the amount of surface erosion.

The seepage cutoff system for the service spillway is also shown on **Figure 5**. It consists of a series of driven sheet piles that form a box around the edges of the approach slab and along the front edge of the Ogee spillway sections. These sheet piles pass underneath the base slabs of the two approach wall monoliths closest to the Ogee section and are connected to another sheet pile cutoff wall that extends both to the north and south of the spillway for a distance of approximately 30 feet. A second set of cutoff sheet piles also extend to the north and south parallel to but downstream of the first set of sheet piles and on the opposite side of the dam crest. Two foot thick reinforced concrete approach slabs with turned-down edges have been poured over these two sheet pile walls for access to the spillway bridge over the gates. These two sheet pile cutoff walls to the north and south were designed to extend into the embankment's clay core.

A final sheet pile cutoff wall is located under the end sill of the stilling basin and runs north to south between the two base slabs of the spillway downstream training walls. It is important to note that there were no seepage cutoff features placed underneath the two downstream training walls.

The original pressure relief systems for the service spillway stilling basin and downstream training walls are shown in **Figure 6**. They consist of two underdrain systems beneath the stilling basin floor slab and a backfill drain system behind the two training walls. The first stilling basin underdrain system is directly connected by riser pipes through the training wall base slabs to the backfill drain system. The backfill drain system runs along the back of the training walls just above the base slab and drains upstream towards the Ogee section. It is evacuated through a riser pipe and outfalls into the stilling basin with an invert at El. 11 feet, NVGD 29. The second stilling basin underdrain system runs underneath the end sill and drains directly into the downstream channel through 45-degree riser pipes running up through the floor slab and a portion of the end sill. It is important to note that these two stilling basin underdrain systems were not connected hydraulically and were designed to be independent.

A set of metal flapper valves were originally placed over each of the two outfall pipes of the combined underdrain/backfill drain system in order to prevent backflow when the stilling basin is full. At some point, these metal flapper valves came off (probably due to water forces from the open spillway gates) and the outfall openings were subsequently plugged by Manatee County. We note that during the time when the flapper valves were off (and possibly before) and the spillway gates were opened and the stilling basin was full (the end sill is at El. 13.25 feet, NVGD 29, 2.25 feet above the outfall invert) the backfill drains and underdrains were charged with tail water, thus allowing the backfill soils and foundation soils to saturate more rapidly.

As previously mentioned, the service spillway is located near the southern abutment of the dam and just south of the original river bed. **Figure 7** presents an aerial view of the spillway with the original grading plan as an overlay. The original design called for a cut earthen channel beyond the end sill, grading from El. 7 feet (elevation of the stilling basin floor slab) to the original river bottom at El. –1 foot, NVGD 29. Given that this was originally an unlined earthen channel, significant erosion must have occurred during each spillway release. Also, given that there were no seepage cutoff walls installed underneath the training wall base slabs, the soils in front of and underneath these base slabs downstream of the end sill may have eroded away shortly after the dam went into service. Critical seepage conditions probably developed underneath

these training wall base slabs downstream of the end sill, especially when the backfill soils were fully saturated following a prolonged high-flow release through the service spillway.

3.1.1 Modifications to the Original Dam

Over the service life of the Lake Manatee Dam several modifications have been made to address design deficiencies and deteriorating conditions. The most significant modifications prior to 2005 are summarized below.

Before 1979: A concrete apron with energy dissipation blocks was placed to cover the earthen channel between the stilling basin end sill and the original Manatee River channel. Sheet piles were placed at the end of this concrete apron. Sheet pile retaining walls were also placed beyond the downstream training walls to prevent additional loss of material from behind the downstream training walls.

1983: Two manholes were added to the toe drains.

1984 – 1985: The emergency spillway was constructed beyond the north end of the embankment. The excavated material from the emergency spillway channel was placed just south of the channel and decreased the effective length of the embankment from 4,700 ft to about 3,700 ft by filling in behind the embankment. The embankment crest was raised by approximately 3 feet. During this raising, the centerline of the crest roadway was shifted a few feet upstream and soil-cement was placed over the upper portion of the newly created portion of the upstream slope. The downstream slope was flattened to 3H to 1V and the access road to the emergency spillway was paved. The energy dissipation blocks were removed from the downstream concrete apron and slope protection was placed on the north riverbank beyond the previously installed sheet pile walls to address ongoing erosion issues. Orifice plates were placed on the two toe drain outlets but these still had no backflow prevention mechanism.

1990: Modifications were performed to the toe drain outlets on both the north and south side of the spillway to increase the drain capacity and to divert the discharge point further downstream.

1997: Regrading of the downstream embankment slopes was performed immediately behind the downstream training walls to reduce lateral earth pressures in an attempt to decrease lateral wall movements that were occurring.

2003: A toe drain rehabilitation project was implemented. This project included: abandoning the old toe drain in place and constructing a new toe drain further downstream and deeper into the foundation soils; re-sloping the upper portion of the downstream slope to 3H:1V; modifying the asphalt pavement downstream of the embankment on south side of service spillway; constructing a new asphalt roadway downstream of the embankment on the north side of the service spillway; repairing cracks and voids in the crest roadway and the upstream soil-cement slope; repairing surface erosion on inside face of training walls; repairing the end of downstream concrete apron where voids and scour holes had appeared; dredging the Manatee River where a sediment island had formed downstream of the service spillway; and, repairing the downstream channel riverbanks by placing cabled concrete revetment. The abandonment of the old toe drain involved the full or partial removal of all of the original manholes and a grouting of the toe drain pipe. However, the original outfalls were left open and the old toe drain pipe is presently open for some distance behind the training wall face.

2004: The tainter gates were repainted to protect from further corrosion. The stop log was repaired and repainted. This repair included the installation of new structural lifting attachments.

Shimming and grouting of base plates in the Ogee Section of Gate #1 was also performed. New seals were installed along the base of the stop log and a coating was applied to the embedded angles along the stop log slots.

2011: Tainter gate repairs were performed that included: applying protective coating; repairing and coating the stop log and guide tracks; repairing the upstream and downstream embankment slopes; replacing the coating system on the water side of the training walls and refurbishing their vertical joints; and, removing the cabled concrete revetment on a portion of the downstream channel slopes and replacing it with large diameter rip rap.

As part of this tainter gate repair project, the concrete approach walls were to be restored and recoated. The sheet pile cutoff wall on the approach slab was to have been protected against further corrosion and the entrance to the spillway channel was to be protected by rip rap. Unfortunately, the cofferdam installation necessary for these projects was unsuccessful and the approach area of the spillway could not be dewatered. However, sheetpiling was driven along the front edge and along the water side of the base slabs of the two approach walls up to the existing sheetpiling for the approach slab and previously discovered voids underneath these walls were tremmie-grouted from the surface. Additionally, some rip rap was placed along the upstream edge of the two approach walls outside of the approach channel in an attempt to prevent additional undermining of the approach walls.

3.2 Topography and Bathymetry

A topographic map with 5-feet ground surface contours, prepared prior to construction of the emergency spillway is shown in **Figure 8**. This map is based upon the NGVD 29 vertical datum and indicates that the maximum elevation of the northern and southern abutments is approximately El. 60 feet. Note that the northern abutment was subsequently cut to install the emergency spillway.

The results of a bathymetric survey performed by the USGS in 2009 are presented in **Figures 9** and **10**. The 2-foot contours shown on these figures are based upon the NAVD 88 vertical datum. In **Figure 9** the remnants of the borrow pits that were used to create the reservoir are visible. Some of these were located on the north side of the original river valley. However, and of particular importance to this report is the presence of a deep borrow pit located on the south side of the original river valley in close proximity to the embankment. Webb and Tessman (1968) logged the geologic profile in this southern borrow pit down to El. -35 feet.

An expanded view of the deep original borrow pit is presented in **Figure 10**. This figure indicates the present bottom is between approximately El. -10 feet and El. -12 feet. It appears to be relatively long and narrow. However, aerial photographs taken during construction appear to indicate that this pit may have been relatively wide with a somewhat flat bottom (see **Figure 11)**. Based upon this apparent geometry during construction and the depth of the geologic section logged at the same time and considering its present geometry, it is possible that some infilling and sloughing of the side walls has occurred over the years and that the present depth is less than the original excavation depth.

The depth of this borrow pit as it presently exists, or when it was excavated, is potentially significant because it extends below the deepest seepage cutoff depth of the embankment core trench at El. -4.4 feet, based upon NGVD 29 vertical datum. Refer to **Figure 4**. Based upon an extensive subsurface investigation along the centerline of the dam that was performed for the design of the deep seepage cutoff wall, it is possible that the borrow pit cut completely through the confining layer between the Surficial Aquifer System (SAS, to be defined subsequently) and

the Intermediate Aquifer System / Intermediate Confining Unit (IAS/ICU, to be defined subsequently. Overall, the IAS/ICU has a very low vertical permeability but has very high horizontal permeability zones as will be explained in the next section. Thus, the presence of this deep borrow pit just upstream of the embankment and spillway is considered to potentially have an influence on the seepage conditions underneath the embankment and service spillway because the seepage gradient may have increased as a result of a more direct connection between the reservoir and the downstream areas.

3.3 Geology

The deep borrow pit excavated just upstream of the main embankment on the southern abutment (south side of the Manatee River) was likely the principal source of the lower permeability core material in the zoned-earth dam. Webb and Tessman (1968) logged the borrow pit to El. -35 feet and concluded that it intercepted remnant layers of the Bone Valley and Hawthorn formations. The Bone Valley Formation is from the Pliocene age and the Hawthorn Formation is from the Middle Miocene age. Geologists have recently upgraded the Hawthorn Formation to a Group and downgraded the Bone Valley Formation to a member in the Peace River Formation of the Hawthorn Group. Refer to Petuch and Roberts (2007).

According to the Webb and Tessman (1968) geologic log of the Lake Manatee Dam site, a Quaternary deposit of surficial sand extends from about El. 21 to El. 8 feet. This is underlain by approximately 2 feet of gravel from the Bone Valley “Formation” (now a member of the Peace River Formation) extending to El. 6 feet. An unconformity of grayish green clay extends below the Bone Valley member with a total thickness of approximately 10 feet, down to El. – 4 feet. The Hawthorn “Formation” (now a Group) was encountered below this unconformity and extends to the terminal depth of the pit at El. -35 feet. The Hawthorn “Formation” (Peace River Formation) consists of clayey silts with fine to coarse sands, thin interbedded units of sand and clay and underlying limestone.

A geologic map drawn by the Florida State Geological Survey identifies the surficial material in the general vicinity of the Lake Manatee Dam as Quaternary (Qu) undifferentiated surficial sands that can be more than 20 feet thick. Refer to **Figure 12**. The Peace River Formation of the Hawthorn Group is also mapped near the dam and consists of interbedded quartz sands, clays, and carbonates, all of which are variably phosphatic.

The Bone Valley member of the Peace River Formation is described by the Florida Geologic Survey in **Figure 12** as consisting of pebble or gravel-sized phosphate fragments and sand-sized phosphate grains in a matrix of quartz sand and clay. The percentages of the various components are highly variable in this member. The Peace River Formation is described in **Figure 12** as consisting of interbedded quartz sands, clays and carbonates, all of which are variably phosphatic.

The interbedding of quartz sands with pebble or gravel-sized phosphate fragments with intermediate layers of clays gives the Hawthorn Group its anistotropic permeability characteristics. The vertical permeability is significantly lower than the horizontal permeability and permits the Hawthorn Group to function as a confining unit between a surficial aquifer and the underlying Floridan aquifer in this portion of the State of Florida. These concepts will be treated in more detail in the section on Hydrogeology. This large difference in vertical and horizontal permeability is considered to be of fundamental importance for understanding the observed behavior of the Lake Manatee Dam.

3.4 Site Geomorphology

The Lake Manatee Dam is located on the approximate axis of the Floridan Plateau which in the southern portion of Florida runs south through Tampa, offshore just west of Sanibel Island, west of Key West and east of the Dry Tortugas, ending at the southern tip of Florida in the Straits of Florida. The Florida Plateau is the oldest geomorphic feature in the general vicinity of the Lake Manatee Dam and was formed by marine sedimentation and volcanic activity approximately 530 million years ago. It includes the remnant and present day landform of Florida.

The Peninsular Arch is the next oldest geomorphic feature affecting the depositional environment in the location of the dam. From the Peninsular Arch, the geomorphology of the dam site lies within the Central or Mid-Peninsular Zone geomorphologic province of Florida, on the approximate boundary of the Desoto Plain (to the east) and the Gulf Coastal Lowlands (to the west).

The Desoto Plain is a flat plain with the northern edge at an elevation between 75 to 85 feet and terminating at approximately 60 feet. This structure was formed in a submarine depositional environment as a shoal with no linear features such as a relic shore line. The Gulf Coastal Lowlands are gentle depositional slopes and broad marine plains with some scarps and marine terraces. These two physiographic features are the fundamental components of the hydrologic system that directly affects the pore water pressures in the vicinity of the dam. The erosional characteristics of these subsurface features have played a role in defining the lithologic horizons in and around the dam.

3.5 Hydrogeology

The Manatee Dam (site) is located in the Manatee-Peace River Groundwater Area in south-central Manatee County, Florida. The hydrogeology in this area consists of three distinct hydrostratigraphic units: 1) the surficial aquifer system (SAS); 2) the intermediate aquifer system or intermediate confining unit (IAS/ICU); and, 3) the Floridan Aquifer comprised of the Upper Floridan aquifer (UFA), the Middle Floridan confining unit (MFCU) and the Lower Floridan aquifer (LFA). **Figure 13** is a generalized correlation chart for the lithostratigraphic and hydrostratigraphic units present in the general vicinity of the Dam. This chart was developed by the Florida Geological Survey and included in Bulletin 68 (2008). The major geologic units in each of the hydrostratigraphic units are identified. The following is a discussion of the characteristics of each of these aquifers.

3.5.1 Surficial Aquifer System Characteristics

The surficial aquifer system (SAS) has a highly variable lithology with undifferentiated sediments ranging from fine to medium quartz sand; phosphatic sand; clayey sand; and, some trace amounts of shell fragments. Refer to **Figure 13**. It extends from ground surface to as deep as approximately 50 feet below land surface (bls) in Central Florida. It is a water table aquifer with unconfined conditions and a depth to water generally within 5 feet (bls). Surface water bodies such as the Lake Manatee Reservoir and local topography affect the potentiometric surface in the SAS. Hence, localized groundwater flow directions in the SAS in the vicinity of the Lake Manatee Dam are expected to be dominated by the presence of the reservoir and the embankment and the hydrogeology of the natural abutments on the extreme northern and southern ends of the embankment. Since the topography rises towards the east and away from the Dam, the general direction for water flow in this aquifer is most likely from the east to the west.

3.5.2 Intermediate Aquifer System or Intermediate Confining Unit Characteristics

Underlying the SAS is the intermediate aquifer system or intermediate confining unit (IAS/ICU). It is comprised of the Hawthorn Group with multiple formations that collectively retard the exchange of water vertically between the overlying SAS and the underlying Florida aquifer system (FAS) but that can permit substantial horizontal flows. Refer to **Figure 13**. As previously mentioned, an important characteristic of the IAS/ICU is that it possesses multiple high permeability layers interspersed between low permeability layers. In general, the IAS/ICU in Florida contains three major permeable zones separated by less permeable zones. Permeable Zone 2 and Permeable Zone 3 are present at the Lake Manatee Dam. These two zones are confined. The low permeability confining unit between the surficial aquifer and Permeable Zone 2 was the apparent target for seepage cutoff with the clay core in the original embankment design and was completely removed in the deep borrow pit excavation near the service spillway, as previously explained.

The IAS/ICU generally extends from approximately 50 to 450 feet bls in the vicinity of the Lake Manatee Dam. In this location the Hawthorn Group includes both the Peace River Formation and the Arcadia Formation (the Tampa Member was logged, although the Venice Clay was absent). The Hawthorn Group is generally comprised of fossiliferous limestone and dolostone, quartz and phosphatic sand, and clay. Because of its heterogeneity and the limited monitoring well network, regional potentiometric surface maps are generally not available for the IAS/ICU. However, the Florida Geological Survey (2008) produced a contour map of the top of the IAS/ICU and this has been reproduced in **Figure 14**. The top of the IAS/ICU is at approximately El. 20 to El. 25 feet in the general vicinity of the dam.

3.5.3 Floridan Aquifer System Characteristics

Underlying the IAS/ICU is the Floridan aquifer system, which is approximately 1,400 feet thick in the general vicinity of the Lake Manatee Dam. The Floridan aquifer is the major source of freshwater in this portion of Florida and is also used for multiple aquifer storage and recovery (ASR) systems, such as the one located on the Manatee County Water Treatment plant and extending southward and eastward from it. In this location, the majority of the Floridan Aquifer is comprised of the Suwannee Limestone containing fossiliferous limestone and dolostone with some clay and quartz sand and traces of phosphate. The Floridan aquifer in the western portion of Manatee County from the coastline to the approximate area of the site has been characterized as having artesian flows. Artesian conditions in the Upper Floridan aquifer extend from the southern portion of Tampa Bay southward along the coast of Florida into Sarasota County. The area containing the Lake Manatee Dam and east of the dam has been characterized with very low to moderate natural recharge for the Floridan Aquifer. The natural aquifer recharge zone east of the site has a higher surface elevation which contributes to artesian conditions reported at some locations west of the dam.

3.5.4 Borrow Pit Excavation into the Intermediate Aquifer

Based upon the deep borrow pit logged by Webb and Tessman (1968) during construction of the Lake Manatee Dam, the most recent bathymetric survey in 2009, and geotechnical subsurface information that will be presented in a separate geotechnical data report for this project, the confining layer between the surficial aquifer and the intermediate aquifer may have been completely removed in the main borrow pit just upstream of the embankment dam near the south shore of the present reservoir. The impact of cutting through this confining layer upstream of the dam would have been to first create an exit point from the IAS/ICU during construction (thus limiting the depth of the excavation) and then to create a recharge point into

the IAS/ICU after the reservoir was impounded. Ponded water in the main borrow pit can be seen in the aerial photograph taken during construction and presented in **Figure 11**. Based upon the size of the embankment in the photograph, it is apparent that this photograph was taken near the end of construction of the embankment.

3.5.5 Piezometric Water Elevations (PWE's) in Aquifers

There is evidence to suggest that PWE's in the IAS/ICU beneath the Lake Manatee Dam are affected not only by reservoir levels but also by regional ground water conditions. These PWE's can be artesian and in some cases may actually be higher than the reservoir elevation itself. Regional artesian pressures in the IAS could create vertical seepage gradients in the embankment and foundation of the dam in excess of those expected by the designers of the original seepage control system. Hence, these pressures could accelerate the development and propagation of an internal erosion and piping failure mechanism as will be discussed subsequently. The following section presents evidence of these potential artesian conditions in the IAS immediately beneath the dam.

Piezometric water elevations in the aquifers just described are being monitored on a daily basis through a series of wells located both in the Manatee County ASR well field at the Water Treatment Plant and in the ROMP Well #33 cluster maintained by the Southwest Florida Water Management District (SWFWMD) located approximately 6.5 miles southeast of the Lake Manatee Dam. The PWE is the elevation to which a free-standing column of water will rise in an open standpipe with a screen and surrounding sand pack installed in an aquifer. ROMP stands for "Regional Observation Monitor-well Program" and is run by SWFWMD to collect information on groundwater conditions in southwest Florida. **Figure 15** presents the location of the ASR well field and the ROMP #33 well cluster in relationship to the Lake Manatee Dam.

The ASR well field contains a total of six (6) wells screened at various depths below ground surface. The ground surface in this well field ranges in elevation from approximately 50 feet to 53 feet, NGVD 1929. The ROMP #33 location has a cluster of seven (7) wells with various screened interval depths. The ground surface near the ROMP #33 well cluster is at approximately El. 74 to El. 75 feet, NAVD 88. Amec Foster Wheeler selected four of the wells from the ASR well field and three of the ROMP #33 wells to provide a summary of the measured PWE's in the IAS/ICU and Upper Floridan aquifers near the Lake Manatee Dam. Data from these wells were summarized from January 27, 2001 through May 23, 2003 on **Figure 15**. This time interval is considered to be representative of the typical behavior expected in these two aquifers.

The locations of each of these selected wells along with the corresponding aquifer, the approximate screened interval elevations, and maximum, minimum, and average PWE's are summarized on **Table1**. The corresponding water level of the Lake Manatee Reservoir is also provided for comparison purposes. Note that the water levels for the ASR well field and the Lake Manatee Reservoir are referenced to the NGVD 29 vertical datum and those for the ROMP #33 well-cluster are referenced to NAVD 88. Manatee County uses the NGVD 29 vertical datum for the dam and water treatment plant operational purposes. The conversion from NAVD 88 to NGVD 29 at the location of the Lake Manatee Dam has been determined by the Manatee County Surveyor using "Corpscon" software developed by the U.S. Army Corps of Engineers and is +0.95 feet. In other words, in order to make a direct comparison to NGVD 29, all NAVD 88 elevations at the Lake Manatee Dam would need to be increased by 0.95 feet.

Well D in the ASR well field is screened in the upper portion of the IAS/ICU. Given its proximity to the dam, this well can be considered as representative of the near-field conditions for the

aquifer located immediately beneath the Dam. Note that Well D is an observation well only and is never used for aquifer storage or recovery.

Consider the time history of PWE in the ASR Well D shown in **Figure 15** in comparison with the water level in the Lake Manatee Reservoir. The PWE in the upper portion of the IAS/ICU is either equal to or slightly below the lake level throughout most of the represented time history. Note also that the general shape of the Well D time history is similar to the lake level time history during certain time intervals. However, there are periods of time particularly at the beginning of the time history where the water level in Well D is actually above the corresponding water level in the lake. These two behaviors indicate that while the water heads in the IAS/ICU near the Lake Manatee Dam appear to be affected by the reservoir, probably through the deep excavation borrow pit as previously discussed, the reservoir is not the only water source affecting water heads in this location. Water heads in the IAS/ICU under the Lake Manatee Dam are also likely affected by regional groundwater conditions.

Consider now the two ROMP #33 wells screened in the IAS/ICU (26172 and 26167). As previously mentioned, these are located about 6.5 miles southeast of the dam with a ground surface ranging from El. 74 to El. 75 feet, NAVD 88. Well 26172 is screened from El. -21 to – 91 feet, NAVD 88 (upper portion of the IAS/ICU) and Well 26167 is screened from El. -141 feet to -216 feet, NAVD 88 (lower in the IAS/ICU). Based upon **Figure 15**, the PWE in the upper portion of the IAS/ICU is substantially higher than that of the lower portion. Also note that the PWE in the upper portion of the IAS/ICU (ROMP 26172) is substantially higher than both ASR Well D (at a similar position in the aquifer) and the lake level. These observations indicate that there is likely a regional groundwater flow regime in the upper portion of the IAS/ICU from east to west and that this flow is at least partially responsible for the water pressures in this aquifer at the Lake Manatee Dam.

Consider now the general trends in the time histories of the three ASR wells screened in the Upper Floridan aquifer (Well C-1, C-2 and A) and the ROMP #33 well screened in the same aquifer but approximately 6.5 miles to the east. While there are some variations in PWE's between these wells, they all exhibit the same general trends with roughly the same value. It is also interesting to note that the two ROMP #33 wells in the IAS/ICU also exhibit the same general trends, even though they have much higher PWE's.

Table 1 Summary of Groundwater Monitoring Wells in the Vicinity of the Lake Manatee Dam from January 27, 2001 to May 23, 2003

Location	Well Name	Aquifer	Screened Interval Elevation[1], (ft)	Piezometric Water Elevation[1], (ft)		
				Max	Min	Ave
ASR	A	Upper Floridan	-754 to -1088	25.7	-17.9	10.7
	C-1	Upper Floridan	-610 to -620	28.7	-21.4	11.2
	C-2	Upper Floridan	-348 to -448	34.2	-19.5	11.3
	D	IAS/ICU	-63 to -68	39.5	30.2	37.7
ROMP #33	26167	IAS/ICU	-141 to -216	41.9	22.5	34.1
	26171	Upper Floridan	-330 to -676	29.7	-22.5	11.2
	26172	IAS/ICU	-21 to -91	62.9	52.7	58.7
Lake	-	Surficial	-	41.3	37.0	39.2

Note 1: Elevations referenced to NGVD 29 for ASR wells and Lake; NAVD 88 for ROMP #33 wells. The conversion is NGVD 29 = NAVD 88 + 0.95 feet in the vicinity of the Lake Manatee Dam.

Given that the PWE in ASR Well D, located in the upper portion of the IAS/ICU ranges between approximately 30 feet to 40 feet, NGVD 29, with an average PWE of about 38 feet, and given

that the average PWE at the ROMP #33 well cluster site (26172) in the upper portion of the IAS/ICU is 58.7 feet, NAVD 88, it is probable that artesian water pressure conditions can exist in the upper portion of the IAS/ICU, particularly at lower ground surface elevations such as those on the downstream toe of the Lake Manatee Dam and beyond. Accordingly, based upon the information contained in **Table 1**, the IAS/ICU can be expected to exhibit intermittent artesian conditions in the general vicinity of the Lake Manatee Dam where the ground surface elevation drops below about El. 40 feet, NGVD 29 and might be expected to exhibit continuous artesian conditions where the ground surface elevation drops below about El. 30 feet, NGVD 29.

The bottom of the Manatee River immediately downstream of the Lake Manatee Dam presently varies between approximately El. 0 feet and El. -2 feet, NAVD 29. As previously mentioned, the original design plans show the service spillway earthen channel meeting the original river bottom at El. – 1 foot, NAVD 29. Refer back to **Figure 7**. Also, the deepest portion of the cutoff trench for the embankment was approximately El. -4.4 feet, NGVD 29. Refer to **Figure 16**. If the PWE's measured in ASR Well D and in the ROMP #33 well cluster are representative of the historic groundwater conditions in the IAS/ICU at the Lake Manatee Dam, artesian conditions may have been present near the river during construction of the dam and prior to the impoundment of the reservoir. These regional artesian conditions would have been most critical in the deepest portions of the cuts that were performed to install the embankment and these extended down to El. – 4.4 feet, NAVD 29.

Based upon the data presented in this section, it is possible that artesian conditions affected by both the reservoir and regional groundwater conditions may have been present in the foundation soils throughout the life of the dam and as such they may have played a role in the development and propagation of the internal erosion and piping failure mechanism as will be described subsequently.

3.6 Specific Design Details for the Service Spillway

Figure 5 presented a plan view and cross section of the service spillway structure from the as-built drawings. The total length of the spillway from the upstream end of the approach walls to the downstream end of the training walls is approximately 367 feet, NAVD 29. The pile-founded approach walls are approximately 148 feet long, and extend vertically from the top of their base slabs at El. 13 feet to El. 45, NAVD 29 (top of wall). The downstream pile-founded training walls are approximately 163 feet long, and extend vertically from the top of their base slabs at El. 7 feet to El. 34 feet, NAVD 29 (top of wall). The internal width between the walls of both the approach channel and stilling basin is 108 feet.

The approach slab has a top elevation of 13 feet, NAVD 29, and extends 36.75 feet upstream of the pile-founded Ogee section. Refer to **Figure 5**. This approach slab is completely surrounded with driven sheetpiling and has PVC type water-stops between the individual slab sections, between the approach slab and the approach wall base slabs, and between the approach slab and the Ogee concrete monoliths. Upstream of this slab, the approach channel was cut into natural ground to El. 15 feet, NAVD 29, with a down-ramp 10 feet long to meet the approach slab.

The stilling basin has a top of slab elevation of 7 feet. The first section immediately adjacent to the Ogee section is 5 feet thick and the final two sections are 3.5 feet thick. Each of these sections are subdivided into three slabs. An end sill is located at the end of the stilling basin with a top elevation of 13.25 feet, NAVD 29. According to the as-built sections, the stilling basin and the original unlined downstream channel were both placed in cut sections.

An under seepage control system was placed beneath the stilling basin floor slab. Refer to **Figure 6**. A total of four underdrains were placed beneath the slab sections (running from north to south). Three of these were directly connected to the training wall backfill drain system through six riser pipes passing through the training wall base slabs. Refer to **Figure 17**. These underdrains were placed at El. 1.0 foot beneath the 5-foot slab sections and at El. 2.5 feet, NAVD 29, beneath the 3.5-foot slab sections. The stilling basin underdrains and the training wall backfill drains were fed to a single set of riser pipes, one on the north wall and one on the south wall.

The riser pipes were connected to outfall pipes running through the two training walls with an invert at El. 11 feet, NAVD 29, immediately adjacent to the Ogee section of the spillway. Refer to **Figure 17**. As part of the original design, flap valves and deflector plates were placed on the end of these outfall pipes in an attempt to prevent backflow when the stilling basin is full. The as-built drawings show the deflector plate downstream of the flap valve. However, representatives of Manatee County confirmed that the deflector plates were located on the upstream side of the flap valves.

The original under seepage cutoff system was presented in **Figure 5**. A plan view of the current seepage cutoff system is presented in **Figure 18**. In addition to the original sheet piles, more sheet piles were installed on the water side of the two approach walls to support grouting operations under the approach wall base slabs where voids had been detected by divers. Sheet pile retaining walls were also installed downstream of the original training walls along the downstream edge of the concrete apron that was placed to prevent erosion of the original bare-earth soil spillway channel.

It is important to note that neither the approach walls nor the downstream training walls were designed with underseepage protection to prevent flow underneath their base slabs from upstream to downstream. The approach wall base slabs are partially protected from such a flow vector only by the sheet piling below the Ogee section of the spillway that is tied to the sheet pile cutoffs extending 30 feet north and south of the spillway. The downstream training wall base slabs have no such protection. Hence, material from underneath these training walls could be carried unchecked downstream along their entire axes if a void system were present because of the initiation of an internal erosion and piping feature. Materials underneath the approach wall base slabs could be carried downstream only after either going around or underneath the sheetpile cutoff walls. Evidence that this has occurred will be presented subsequently.

Given that both the approach walls and the downstream training walls are pile supported, their base slabs can provide a roof for the development of a pipe if the soils underneath them are removed. It is also important to note that if the soils beneath these wall base slabs are loosened and/or removed by upward flow and internal erosion, lateral movements of the walls would be expected because their lateral stiffness would decrease.

4.0 LAKE MANATEE DAM INSPECTIONS

Since 1978 (eleven years after the dam was placed into service) inspections have been performed by engineers from eight different groups including the federal government and private consulting engineering firms. These inspections (from oldest to newest) include: 1) Phase I Inspection by the US Army Corps of Engineers in 1978; 2) a Phase II Inspection and extensive subsurface investigation by Bromwell Engineering, Inc. in 1979; 3) an inspection by HNTB in 1981; 4) inspections by Camp, Dresser and McKee from 1982 to 1988; 5) inspections by Metcalf & Eddy from 1989 to 1992; 6) inspections by Black and Veatch from 1993 to 1997; 7) inspections by McKim and Creed from 1998 to 2011; and, 8) inspections by AMEC from 2012 to

present. In addition to these inspections, the URS Corporation performed a coffer dam design for dewatering the service spillway in 2009. When the coffer dam could not be installed and based upon their experience with the dam, URS issued a letter expressing specific concerns about its condition.

This report contains a summary of each of these inspections with an emphasis on specific observations that can be indicative of an internal erosion and piping failure mechanism. Prior to these summaries, a series of aerial photos are presented that show evidence of severe erosion in the downstream spillway channel and of the formation of a sediment island. These summaries utilize a spatial integration technique to identify the failure mechanism. The technique is to locate areas on the dam where the highest seepage gradients are expected and to superimpose on an aerial image of these areas numbered-zones where observations have been made by each inspection group and that are consistent with an internal erosion and piping failure mechanism. By looking at the resulting images from successive inspectors, the dam safety engineer is able to identify trends in the historical data.

The principal focus this data integration is on the service spillway and the embankment sections immediately adjacent to it. The northern and southern margins of the service spillway where it is embedded in the embankment represent the shortest seepage path from the reservoir to the Manatee River downstream. Hence, these two margins have higher seepage gradients than other areas and a greater risk for internal erosion and piping. The critical seepage paths and locations where significant historical observations have been made are depicted on **Figure 19**. These observation locations have been numbered for convenience and are summarized in **Table 2** along with the general types of observations made in each and the range in years for those observations. Photographs from the various inspections have been included at the end of this report as **Photograph 1** through **Photograph 25**. These are presented to show the types of observations that were made repeatedly and at the indicated locations. These photographs are referenced in **Table 2**.

When considering historical observations that are consistent with an internal erosion and piping failure mechanism, it is important to note that an observed loss of embankment material on the surface of a dam and/or adjacent to a spillway structure can be interpreted multiple ways. For example, it can be due to surface erosion caused by improper handling of surface runoff water, or it can also be due to internal erosion and subsequent settlement. Many of the previous visual observations made at the Lake Manatee Dam could have been interpreted either way but were generally interpreted by the inspectors as being caused by surface erosion. However, when the same evidence of loss of surficial material recurs at the same location over time and after repeated attempts to control surface water, and when local sinkholes appear in these areas, the evidence points to internal erosion. Thus, in determining which visual observations are to be summarized in this review, those identified by the engineers as either caused by surface erosion or by internal erosion and settlement are all included.

References made to previous inspections and to the work of other engineering firms should not be interpreted in any manner but to collect into one document data regarding the changing/evolving conditions of the Lake Manatee Dam that can be used to identify the active internal erosion and piping failure mechanism.

Six aerial photographs of the service spillway dating from 1973 to 2013 are presented in **Figure 20**. The first photograph in 1973 was taken five years before the first inspection by the Corps of Engineers. When considering these photos refer back to **Figure 7** to see an overlay of the original grading plan for the downstream channel of the service spillway on a recent aerial photo. Note that the original grade for the bare-earth discharge channel was on a constant slope

from El. 7 feet immediately adjacent to the stilling basin to El. – 1 foot, NAVD 29, in the old river channel.

Based upon the aerial photographs shown in **Figure 20**, the following observations can be made:

1) Significant erosion occurred on both the northern and southern discharge channel banks within 6 years of the dam going into service and this erosion progressed until the 1994 photograph where bank erosion protection had been added to the northern bank.
2) Sediments were accumulating in the river channel before 1973 and through 2003 when a dredging operation removed them.
3) After the dredging of these sediments in 2003, they have begun to accumulate again in the river channel as shown in the 2013 photograph.

While not definitive, these aerial photographs are consistent with an active internal erosion and piping failure mechanism where a build-up of sediments in the discharge channel comes from eroded embankment and foundation materials that have been transported to the channel through pipes under the stilling basin, training wall base slabs and downstream apron. However, with such large amounts of material being removed from the banks of the discharge channel, it is also possible that some of these sediments also came from the channel banks. It is considered likely that both of these mechanisms are present in the 1973, 1978 and 1984 photographs. However, after the 1984 picture when the channel banks had been stabilized, it is considered likely that the internal erosion and piping failure mechanism has played a larger role in the formation of the sediment island.

Table 2 Locations and Types of Observations Consistent with Internal Erosion and Piping Failure Mechanism

Location Number	Location Description	General Types of Observations	Years Observed	Example Photos
1	Northern Approach Wall Below Water	Voids under wall base slabs, voids with break in soil-cement slope and underlying embankment washout	2013	-
2	Northern Approach Wall Above Water	Depressions, surface erosion behind walls, outward movement/rotation of wall monoliths by as much as 2 inches, large void beneath soil-cement slope paving	1990 - 2013	1, 2
3	Northern Bridge Deck Approach Slab and Double Row Sheet Pile Cutoff	Weight-of-rod soil blow counts at bottom of clay core, persistent erosion adjacent to bridge, settlement along both sheet pile cutoff walls, subsidence of clay core between sheet piles, voids under secondary approach slab	1978 - 2014	3, 4, 5, 6
4	Northern Downstream Training Wall Adjacent to Bridge Deck	Persistent erosion, depressions and soft zone in embankment slope, numerous surface irregularities, subsidence and voids under access ladder slab	1985 - 2013	7
5	Northern Downstream Training Wall Adjacent to Stilling Basin	Irregularities along embankment surface behind wall, outward movement/rotation of wall up to 2 inches, depressions, voids with the suspicion of a “chimney” drain against the wall, 20 cu. yd. sinkhole in 2009, very loose soils in backfill adjacent to the wall from the bas slab level and upward	1978 - 2013	8, 9
6	Western Corner of Northern Downstream Training Wall	Severe erosion, loss of backfill material, large voids under concrete slab behind toe drain outfall box	1981 - 2008	10, 11
7	Northern Downstream Sheet Pile Wall	Severe erosion, seepage at west edge of sheet pile walls, multiple instances of depressions north of sheet pile wall and loss of backfill material, subsidence behind wall	1986 - 2004	12
8	Manatee River and Northern and Southern Riverbanks	Erosion, subsidence, large voids under surface protection materials on river banks, seepage daylighting on river banks, formation of large sediment island in river channel	1973 - 2008	13, 14, 15
9	Southern Approach Wall Below Water	Vortex in lake reported in 1975, large void with break in soil-cement slope and washout of embankment material	1975, 2013	-
10	Southern Approach Wall Above Water	Outward deflections of wall up to 2 inches, cracks, holes and voids in soil-cement slope with settlement and underlying soft soils	1987 - 2011	16
11	Southern Bridge Deck Approach Slab and Double Row Sheet Pile Cutoff	Erosion, settlement and depressions along both sides of sheet pile walls and in roadway with a large void under the approach slab and under the secondary approach slab	1981 – 2013	17
12	Southern Downstream Training Wall Adjacent to Bridge Deck	Loss of soil, erosion and undermining of concrete steps, settlement of stairway and gate motor control slab with a large void under the slab	1978 - 2003	18
13	Southern Downstream Training Wall Adjacent to Stilling Basin	Voids, depressions and erosion in embankment behind the wall, wall movement towards the stilling basin, large void under concrete pads, soil in close proximity to the wall very loose beginning at the elevation of the bottom of the base slab and extending upward, suspicion of “chimney” drain against wall	1978 - 2014	19, 20
14	Southern Downstream Sheet Pile Wall	Erosion, displacement, and loss of material behind wall, void under concrete pad, flowing water behind wall	1989 - 2013	21, 22
15	Stilling Basin	Void system underneath stilling basin discovered with dye study and confirmed with coring of floor slab	1997, 2013	-
16	Downstream Concrete Apron	Settling, cracking, undermining and deterioration of concrete, gap between sheet pile wall and	1978 - 2014	23

Location Number	Location Description	General Types of Observations	Years Observed	Example Photos
		concrete, voids detected underneath concrete		
17	Downstream Slope and Northern Toe Drain	Artesian pressures in piezometers, sag in toe drain, settlement, depressions, and undulations along ground surface at toe, sedimentation in toe drain, depressions and undulations on downstream slope	1979 - 2013	24
18	Downstream Slope and Southern Toe Drain	Surficial seepage in toe area, nearly continuous depressions along service road near toe, large depressions downstream of where vortices were observed in the reservoir, settlement of toe drain	1978 - 2008	25

Information from each of the inspections is presented herein as a series of figures (**Figures 20 through 29**). The narrative summaries in this report are close to the original statements made by the authors using the original terms insofar as possible. An overview of the various observations made by these groups of engineers is presented in **Table 2**. **Table 3** includes the name of the group of engineers the years spanning their inspections the locations of their observations as identified by the numbered areas shown on **Figure 19**; and, comments by Amec Foster Wheeler.

Table 3 Locations of Evidence Consistent with Internal Erosion and Piping

Group of Engineers	Years of Inspections	Locations of Observations from Figure 19	Comments
U.S. Army Corps of Engineers	1978	8, 9, 12, 13, 16, 17, 18	Some observations were from Manatee County personnel prior to Corps inspection and related to the Corps during interviews
Bromwell Engineering, Inc.	1979	3, 5, 13, 17, 18	Extensive subsurface investigation due to lack of original design information
HNTB	1981	3, 6, 11, 12, 18	
Camp, Dresser & McKee	1983 - 1988	3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 16, 17, 18	Used S&ME as subconsultant in 1983 for seepage inspection and evaluation
Metcalf & Eddy	1989 - 1992	2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 16, 17, 18	First to photograph sediment island and note movement of approach and training walls
Black and Veatch	1993 - 1997	2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18	First to specifically identify sediment island and voids under stilling basin
McKim and Creed	1998 - 2011	2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18	Used Driggers Engineering for additional subsurface investigation
URS	2009	1, 3, 5, 9, 11, 13, 15, 16	Not a formal inspection but from concerns raised after unsuccessful attempt to dewater the service spillway
AMEC	2012 - present	1, 2, 3, 4, 5, 9, 11, 13, 14, 15, 16, 17	Integrated all previous data and concluded the presence of active and worsening internal erosion and piping failure mechanism

Note that severe downstream river channel erosion and the formation of a sediment island in the spillway discharge channel is apparent in aerial photographs dating back to 1973 as shown in **Figure 20**.

The results of the recent Amec Foster Wheeler inspections are also summarized in this section. The next section presents the results from the Amec Foster Wheeler Supplemental Inspection.

4.1 US Army Corps of Engineers Phase I Inspection, 1978

At the request of Manatee County and with funding provided through the National Dam Safety Program, the Jacksonville District of the U.S. Army Corps of Engineers (USACE) performed a Phase I Inspection Dam in 1978, eleven years after the commissioning of the dam. The information presented herein comes from the portion of the original USACE report available at the Manatee Water Treatment Plant and from summaries by Bromwell Engineering, Inc. (1979) and Carrier et al. (1982) describing conclusions from the Corps report.

During its inspection the USACE interviewed operators of the dam and reviewed all available construction data. Observations by Florida Testing Laboratories and summarized by the Corps relative to the compaction of the embankment are given in **Figure 21**. These indicate that the compaction process was inadequate and that most of the density tests failed to meet compaction requirements. The sheepsfoot roller used to compact the dam had widened steel plates on the ends of the feet, partially negating the kneading effect expected by use of a sheepsfoot roller. In addition, the double drum compaction roller was pulled behind a tractor at about 12 mph to 15 mph, far in excess of normal compaction speeds. Also, the soil moisture conditioning process used a lay-down area that was too small and did not result in uniform water contents of the fill soils.

As a result of their inspection, the Corps made the following assessment on the condition of the dam: “At the time of the inspection of Lake Manatee Dam, there were no apparent indications of an immediate hazard to safety. However, during the inspection, several observations were made which resulted in the conclusion that the structure has some major deficiencies which require immediate attention.” These concerns centered on the potential for an overtopping failure due to inadequate spillway capacity and on the potential for instabilities in the dam related to inadequate seepage control and to the performance of the toe drain.

Specific observations of these “major deficiencies” included:

a) multiple vortices in the reservoir reported by the operators during low-pool conditions adjacent to the southern approach wall and along the southern embankment;

b) an existing damp area on the downstream slope at approximate Station 12+00;

c) existing depressions in the service road at approximately Station 8+00 downstream of where one of the vortices was reported to have occurred; and,

d) inadequate spillway discharge capacity for the probable maximum flood.

Additional observations included:

e) a 3-foot diameter by 2-foot deep sinkhole immediately adjacent to the south training wall and directly above the existing toe drain outfall;

f) loss of embankment material under the concrete stairway between the bridge deck and the southern downstream training wall;

g) nearly continuous series of depressions in the toe road on the south embankment with wet spots and two conical depressions approximately 6 feet in diameter and 6 inches deep at Station 8+00;

h) southern portion of the embankment has settled somewhat (approximately 2 feet relative to the general embankment elevation);

i) nearly continuous series of depressions along the toe of the northern embankment; and,

j) extensive erosion downstream of the stilling basin and the subsequent placement after construction of a rough concrete liner slab with sheet pile cutoffs to decrease this erosion.

The critical locations for these observations by the USACE are summarized in **Figure 22**. Although not definitive, these observations are consistent with active internal erosion along the south side of the service spillway on both the upstream and downstream sides of the embankment core; and with active internal erosion removing embankment/foundation materials

from the toe areas of the embankment. Note that although the Corps observed extensive erosion downstream of the stilling basin (apparent in **Figure 20**), they apparently did not compare the geometry of the discharge channel to the original design and did not link the sediment island in the channel to a possible internal erosion and piping failure mechanism.

4.2 Bromwell Engineering, Inc. Phase II Inspection, 1979

Bromwell Engineering, Inc. (BEI) performed a Phase II Inspection of the Lake Manatee Dam in 1979. It began with a review of the available design and construction information and found that several important types of historical information could not be located including: design reports; soil testing results, slope stability and seepage analyses; detailed records of compaction during construction; and design flood information for sizing the spillway. Given the lack of available information, an extensive field investigation effort was deemed necessary, including 12 test borings with disturbed and undisturbed sampling. Six piezometers were installed and two test pits were excavated at the northern and southern ends of the toe drain.

During the geotechnical subsurface investigation, the circulation of drilling fluid was lost at multiple borehole locations in the embankment. There were also locations where weight-of-hammer blow counts were observed in the clay core. BEI also noted that Shelby tubes could be pushed into the dam core by hand during drilling in some locations. These low density areas were typically found near the bottom of the clay core.

Specific observations by BEI included:

a) loss of drilling fluid circulation and weight-of-hammer blow counts indicating very loose and soft soils at or near the bottom of the core at multiple locations;

b) continuing erosion on the embankment slope just north of the service spillway downstream training wall;

c) possible artesian pressure conditions at the embankment toe just north of the service spillway at Station 17+00;

d) 2-foot diameter by 3-foot deep depression behind south downstream training wall;

e) practically continuous series of depressions in the toe road on the southern embankment of the dam; and,

f) toe drain collecting sediments and not functioning as designed, creating wet spots in the downstream toe areas on the south embankment.

The critical locations for observations from the BEI Phase II Inspection are shown on **Figure 23**. These observations indicate that in 1979 there was continuing evidence of active internal erosion on the south side of the spillway and evidence that such a process may have been activated on the north side of the spillway.

After the field and laboratory testing program, a hydrologic analysis of storm runoff and flood routing was performed and seepage and stability calculations were completed. BEI concluded that the spillway capacity was inadequate for anticipated peak storm events and that an emergency spillway was required for dam safety. It was also concluded that the toe drain did not extend far enough towards each of the abutments and that it was not effectively lowering the seepage pressures. They recommended a new toe drain be installed further downstream from the existing drain and that it be extended further towards the southern and northern abutments, and set deeper into the foundation soils.

4.3 HNTB Inc. Inspection 1980 – 1981

HNTB Inc. performed an annual inspection on the Lake Manatee Dam in 1981 and recorded the following observations:

a) erosion and loss of embankment material along the upstream side of the sheet pile cutoff walls north and south of the spillway bridge;

b) severe erosion and loss of material on the west end of the northern downstream training wall;

c) erosion and undermining of the concrete stairway next to the south downstream training wall; and,

d) a previously wet area reported to inspectors between the downstream toe and the service road of the south embankment at Station 12+00.

The specific locations for each of these observations are given in **Figure 24** along with additional descriptions. Taken together, these observations are consistent with an active internal erosion failure mechanism that is transporting embankment/foundation materials along both the northern and southern edges of the service spillway and in the embankment sections to the north and south.

4.4 Camp, Dresser & McKee Inspections 1982 – 1988

Camp, Dresser & McKee, Inc. (CDM) performed a series of inspections from 1982 through 1988 at the Lake Manatee Dam. It also commissioned a supplemental geotechnical subsurface investigation by the Pittsburgh Testing Laboratory.

During its inspections and on various occasions CDM observed piezometric water elevations in two of the piezometers at Station 6+00 (southern embankment) that were above the corresponding water levels in the reservoir at certain times indicating that the pore pressures in these piezometers were potentially affected by groundwater flow from the southern abutment independently from the reservoir.

The CDM observations related to an internal erosion and piping failure mechanism are as follows:

a) lost the circulation of drilling fluid and found very loose/soft soils in the clay core just north of the service spillway;

b) artesian pressures coming from deeper soil layers in toe area and further downstream at Station 17+50 (north of service spillway) and a zone where piezometric water elevations increased moving downstream of the dam;

c) erosion and loss of material along the sheet pile cutoff walls along both the northern and southern approach slabs of the service spillway;

d) ¾-inch outward displacement of southern approach wall monolith at the water intake structure for the water treatment plant (first reported movement of retaining walls in the service spillway);

e) undulations in the soil-cement surface cover on the upstream side of the dam near the northern and southern approach slabs to the bridge;

f) severe erosion and loss of material immediately adjacent to the north downstream training wall and along the downstream riverbanks resulting in undermining of the

surface protection materials, and a photograph showing the edge of the apparent sediment island in the downstream river channel;

g) erosion and undermining of the embankment materials under the stairway from the bridge deck to the south downstream training wall;

h) depression behind the south training wall;

i) depressions in old baffle block locations on downstream concrete apron; and,

j) settlement of the northern toe drain along with some unknown white substance being carried by the water in the drain.

In 1986 CDM concluded that after several attempts to provide surface protection to remediate the severe surface erosion occurring immediately downstream of the northern training wall (along the riverbank), "…it is probable that the exit of groundwater is a factor".

Persistent high porewater pressures (some of which were artesian) in the downstream toe area just north of the service spillway and an unknown white substance being washed through the northern toe drain, along with very soft materials at the bottom of the embankment core led CDM to hypothesize in 1988 that a change was occurring in the natural clay stratum beneath the dam in the vicinity of the service spillway. They suggested that the increase in pore water pressure could be due to the presence of a porous lens beneath the dam, the dissolving of phosphates within the soils or a change in the drainage system in the original cutoff layer of the dam.

CDM was so concerned about the apparent changing subsurface condition of the original seepage cutoff stratum for the dam on the northern side of the service spillway that they stated: "Depressing the toe drain to or very near this stratum could entail **substantial risk** unless the reservoir level was lowered appreciably and/or the groundwater in the area was controlled."

The locations of the CDM observations are identified on **Figure 25** along with additional descriptions. Taken together, these observations are consistent with an active internal erosion mechanism that is causing a loss of embankment and/or foundation material along both the northern and southern edges of the service spillway and in the embankment section to the north and south, with the deposition of these sediments in the spillway discharge channel.

4.5 Metcalf & Eddy Inspections 1989 – 1992

Metcalf & Eddy performed a series of inspections between 1989 and 1992 on the Lake Manatee Dam and made a series of observations including:

a) a depression and erosion in the soil-cement slope along the northern approach wall;

b) outward deflections of up to 2 inches on both the northern and southern approach wall monoliths (first reported movement of the northern approach wall);

c) depressions and erosion adjacent to the northern approach slab (both upstream and downstream) for the service spillway bridge;

d) several locations where piezometric water elevations were either higher than the reservoir level or where they experienced fluctuations of a larger magnitude than corresponding fluctuations in the reservoir level;

e) seepage between the northern downstream training wall and sheetpiling;

f) holes in the backfill behind the northern downstream training wall and sheet pile extension;

g) depressions along the sheet pile cutoff wall and cracking of the approach roadway adjacent to the south approach wall;

h) separation of sheet pile wall sections and loss of backfill material downstream of south training wall;

i) deterioration of the downstream concrete apron with sheet piling separating from downstream edge;

j) seepage from downstream northern river bank with two slope instabilities adjacent to the sheet pile wall extension and further downstream, and a photograph of a sediment island in the downstream river channel; and,

k) depressions and wet zones over the toe drains on both the northern and southern embankments, including a depression in the roadway below the dam at Station 14+25 on the southern embankment.

While Metcalf and Eddy concluded that piezometric water elevations were recorded as higher than the reservoir or that fluctuated more than the reservoir level were probably due to errors in readings or a plugging of the piezometers, it is also possible that such conditions could be due to other sources of groundwater flow such as from the abutments (as postulated by CMD) or from artesian conditions in underlying aquifers (as indicated in **Section 3.5.5** of this report). For example, one of the piezometers located downstream and just north of the service spillway had a water table reading at ground surface and Metcalf and Eddy concluded that it was plugged. However, artesian conditions have been measured by others historically at this same location.

In describing the holes discovered behind the northern downstream training wall and sheet pile extension during its 1992 inspection, Metcalf and Eddy allude to the potential for an internal erosion failure mechanism by stating that “The holes could have been formed by underground seepage leading to the bottom of the spillway wall.”

The outward deflections of training walls, in the absence of changes to loading conditions, are consistent with a decrease in lateral ground support along the upper portion of the support piles. This decrease in lateral support may be the result of soils surrounding the support piles being either physically removed or loosened by internal erosion processes, or may be the result of decreases in the surrounding soil effective stresses caused by upward seepage gradients. If soils were removed from under the base slabs of the approach and training walls, these pile supported base slabs could provide the roof to support a pipe.

Metcalf and Eddy photographed the presence of a sediment island in the downstream river channel in 1992 but did not comment on it specifically in the report. While not definitive because it could have been partially formed from scouring of the riverbank at the end of the concrete apron, the presence of this sediment island is consistent with an internal erosion and piping failure mechanism and could represent the accumulation of sediments removed from the embankment and foundation soils and transported into the river through high seepage gradients.

The general locations of Metcalf and Eddy observations are shown on **Figure 26** along with additional descriptions. Taken together these observations are consistent with active internal erosion occurring along both the northern and southern boundaries of the service spillway and in the adjacent embankment/foundation with the build-up of sediments in the discharge channel.

The movements of the walls are consistent with the loss of support soils under the approach wall base slabs and hence for the development of a pipe.

4.6 Black and Veatch Inspections 1993 - 1997

Black and Veatch performed a series of inspections of the Lake Manatee Dam from 1993 to 1997. During the course of these investigations they identified a potentially serious condition related to the observed movements of the approach and training walls and conducted a separate investigation of the stilling basin walls and published the results in a separate report in 1996 entitled “Stilling Basin Wall Investigation Summary Report”. They also injected dye into the stilling basin underdrain system to detect potential voids under the service spillway. During their inspections they recorded the following observations:

a) erosion, cracks and depressions in the soil-cement covering the slope adjacent to both the northern and southern approach walls;

b) erosion and settlement of embankment materials immediately adjacent to cutoff sheet pile walls on the bridge approaches and adjacent to the downstream training walls;

c) outward displacements or rotations of both northern and southern approach walls and both northern and southern downstream training walls;

d) evidence of vertical seepage from foundation soils into bottom of core at Station 17+00 (although there are irregularities in reported tip elevations of piezometers)

e) voids and depressions behind both the northern and southern downstream training walls with possible drainage “chimneys” into either joints between the retaining wall monoliths that may have failed or into a void caused by the outward displacements of the walls;

f) large erosion areas behind both downstream training walls near the junction of the sheet pile cutoff walls under the bridge deck approach slabs;

g) erosion and loss of surface protection material on northern riverbank and a sediment island in the downstream river channel;

h) a void system connecting the southern training wall base slab to the northwest corner of the stilling basin and extending underneath the downstream concrete apron;

i) a depressed phreatic surface behind the northern downstream training wall at Station 17+00 indicating seepage from the embankment downstream shell towards the stilling basin; and,

j) settlement, depressions, undulations, and bulging of the downstream slope near the locations of the north and south toe drains with no direct correlation between toe drain discharge and lake level.

Figure 5 and **Figure 6** provided original construction drawings for the service spillway seepage cutoff system and for the downstream training wall backfill drain and stilling basin underdrain systems, respectively. Note that the backfill drain system and the stilling basin underdrain systems were directly connected to each other through a manifold and riser pipes, the manifold doubling as the backfill drain. The end sill of the stilling basin has a separate and unconnected underdrain system with outflow pipes rising at 45 degrees and exiting on the downstream vertical face of the end sill. Note also that the end sill has a vertical seepage cutoff barrier that runs its entire width from the southern downstream training wall to the northern downstream training wall.

As a result of reports from operators that running water could be heard through the stilling basin underdrain and backfill drain outflow pipes, in 1995 Black and Veatch placed dye into the outflow pipe on the southern training wall and added 40 gpm of water to see where the dye would emerge but to no effect. They then filled the stilling basin with water and observed water freely rushing into the drain. Shortly thereafter they state: “dye was observed flowing out of the downstream face of the end sill at the end of the stilling basin, through the 4 inch diameter pipes that serve the 8 inch end sill underdrain. This water was being discharge with enough pressure to cause it to project upward about 2 feet, due to the angle of the pipes.”

Subsequent to this dye study, representatives of Manatee County repeated the same test but this time plugging the outflow pipes for the end sill underdrain. They found that after a period of time the dye was seen exiting through the discharge points of the concrete apron underdrain system downstream of the stilling basin. As previously noted, this concrete apron and underdrain system were added subsequent to the original construction when severe erosion had damaged the bare earth discharge channel.

Based upon the results of these dye studies and the fact that the underdrain system for the end sill was not designed to be hydraulically connected to the underdrain and backfill drain systems for the stilling basin and training walls, and the fact that the underdrain system for the concrete apron was not hydraulically connected to the end sill underdrain system, Black and Veatch concluded that: “The groundwater is apparently draining through an eroded path(s) below the stilling basin slab”.

However, given the presence of the sheet pile cutoff wall beneath the end sill and assuming that it was still intact, in order for the eroded path(s) identified by Black and Veatch to connect with voids under the concrete apron with a high-capacity flow path, these void(s) would most likely extend under the training wall base slabs around the edges of the cutoff wall. While sheet pile walls are typically not water tight, it is not likely that when they were installed there were large open joints at the ground surface between the adjacent sheet pile sections. The ground surface surrounding the sheet piles at the time of construction coincided with the bottom of the stilling basin floor slab and one-half foot above the training wall base slabs. Thus, it is possible to conclude from these dye studies that the discovered voids also extend under the downstream training wall base slabs.

Black and Veatch reported the formation of a sediment island in the downstream river channel closer to the southern bank in their 1993 inspection report. However, they did not determine the source of the sediment. While not definitive because it could have been partially formed from scouring of the riverbank at the end of the concrete apron, the presence of this sediment island is consistent with an internal erosion and piping mechanism and could represent the accumulation of sediments removed from the embankment and foundation soils and transported into the river under high seepage gradients.

Black and Veatch observed that piezometers in the embankment toe area near the southern abutment did not respond directly to lake levels. They also observed that the toe drain discharge measurements do not correlate directly to lake levels and postulated initially that the recording units were not functioning correctly. They noted in later inspections that the high flow rates in the toe drain appeared to correlate with high piezometric water elevations. These results indicate that groundwater seepage may be coming from the abutments and/or from underlying formations under artesian conditions.

The heads in piezometers downstream of the core in the cross section at Station 14+50 and Station 17+00 and underneath the Ogee section of the service spillway are lower than those in

the cross sections to the north and south and are indicative of an efficient pressure relief system beneath the service spillway. In 1995 Black and Veatch noted that there were spikes in the water pressures recorded under the Ogee section of the spillway by as much as 7 to 8 feet. In 1993, Black & Veatch attributed the drawdown of PWE's near the spillway to the stilling basin underdrain system. Such a condition and spikes in the water pressures under the Ogee section are also consistent with the formation of a void system under the training wall base slabs that extends close to the Ogee section and that is acting like a second underdrain system exiting underneath the concrete apron and directly into the river channel. Such an underdrain system can also be inferred by the previously described dye studies.

We note that the pile-supported training wall base slabs and the heavily reinforced stilling basin floor slab are all strong enough to support the roof for void system that could potentially extend all the way upstream to the sheet pile cutoff walls under the two bridge deck approach slabs and to within 30 feet of the embankment clay core because there is no seepage cutoff provided under these training walls.

Black and Veatch concluded that the observed movement of all four retaining walls in the service spillway was caused by changing loading conditions on the walls due to saturation of the backfill. However, this would only apply to the downstream side of the spillway and the piezometers in this location indicated lower phreatic surfaces because of an effective drainage system. We note that movements of these walls would also be expected if the underlying support piles were to lose a portion of their lateral capacity by the removal or loosening of the surrounding soils such as would occur if a pipe developed under the base slabs and internal erosion caused by high upward gradients acted on these soils.

In 1995, Black and Veatch installed four piezometers in the four corners of the stilling basin floor slab to monitor uplift pressures under the slab. With the exception of a few spikes in the readings (and these rapidly decreased in each case), the vast majority of readings exhibited consistent behavior with the majority of the piezometric water elevations falling below El. 10 feet but above 5 feet and with the upstream piezometers (eastern side of stilling basin) having higher pressures than the downstream piezometers (western side of stilling basin). The stilling basin floor slab is at El. 7 feet. These piezometers also indicate the presence of an effective underdrain system and that the previously identified void spaces under the training wall base slabs (bottom of base slabs at El. 3 feet) are probably filled with water most of the time.

Black and Veatch concluded in 1995 that, "The apparent erosion under the stilling basin slab is potentially a serious problem. The extent of the erosion is unknown at this time. The undermining of the structure, if extensive enough, could cause damage to the stilling basin and/or training wall footings. It is also possible that the erosion could progress from the downstream side of the dam to the upstream side. Such erosion could, therefore, threaten the integrity of the dam and perhaps could result in a breach in the dam." There was no mention of the potential for voids under the downstream training wall base slabs.

Each of these observations has been identified by location on **Figure 27**, along with additional descriptions. Taken together these observations are consistent with active internal erosion and piping occurring along both the northern and southern boundaries of the service spillway and the transport of these sediments to the spillway discharge channel.

4.7 McKim & Creed Inspections 1998 - 2011

McKim & Creed performed a series of inspections of the Lake Manatee Dam from 1998 to 2011. McKim & Creed also subcontracted with Driggers Engineering to perform geotechnical

subsurface investigations focusing on the embankments behind the northern and southern downstream training walls. The report contains the following observations:

a) large voids, settlement, and cracking on the upstream slopes behind both the northern and southern approach walls and voids under approach wall base slabs;

b) subsidence of the clay core below the northern bridge deck approach slab, soft soils in the clay core, and settlement of the embankment along the sheet pile cutoff wall/embankment interface at the southern approach slab;

c) settlement, erosion ruts, and depressions under concrete slabs behind both the northern and southern downstream training walls adjacent to the sheet pile cutoff walls;

d) large voids, erosion ruts and loose to very loose soils in the embankments behind the northern and southern downstream training walls, including the formation of a 20 cubic yard sinkhole behind the northern training wall in 2009 following a heavy rainfall event and a prolonged high flow rate release;

e) large voids, settlement, erosion and undermining of concrete mats and surfaces and loss of backfill material immediately downstream of the training walls, behind the sheet pile walls and along both the northern and southern riverbanks, accompanied with movement of the sheet piles;

f) continued presence of a sediment island in the river channel downstream of the concrete apron until 2003 when it was removed by dredging; and,

g) settlement of and sedimentation in the northern and southern toe drains.

The locations of each of these observations along with additional descriptions are presented in **Figure 28**. Taken together these observations are consistent with an internal erosion and piping failure mechanism occurring along both the northern and southern edges of the service spillway and the transport of these sediments to the spillway discharge channel. The creation of a 20-cubic-yard sinkhole behind the northern downstream training wall indicates that the void system previously identified by Black and Veatch under the stilling basin probably extended under the northern training wall base slab and became large enough to consume 20 cubic yards of embankment material.

4.8 URS Letter

In 2009, URS developed a set of design plans for the installation of a cofferdam in support of additional work on the tainter gates and approach channel. After an unsuccessful attempt to construct the cofferdam in front of the service spillway in 2011, it issued an unsolicited letter to Manatee County expressing significant concerns about the condition of the dam based upon observations made during the course of its work. URS said that its observations "…could be an indication of on-going internal degradation of the Dam's shell containment and clay core, the extent of which may not be fully measureable or even detectable without additional investigation."

The following is a list of conclusions on the condition of the dam contained in their letter:

a) there are voids beneath the pile supported upstream approach wall base slab;

b) the dam's shell containment material upstream of and immediately adjacent to the clayey core material north of the north approach wall has been significantly loosened;

c) the soil-cement slope protection near the bottom of the upstream slope on the north side of the north approach wall has sloughed and failed;

d) there are potential voids/gaps beneath the downstream training wall base slabs;

e) there is concern about the condition of the corrugated and perforated piping that forms the underdrain system beneath the stilling basin floor slab;

f) there are voids and flowing water conditions beneath the concrete apron beyond the stilling basin end sill; and,

g) significant loss of material has occurred in the backfill zone behind the training walls at various times over the life of the structure and has been repeatedly backfilled by Manatee County.

URS ends its letter by expressing significant concern about the overall condition and integrity of the dam's clay core in the vicinity of the spillway structure. If the loss of material under the upstream approach walls and downstream training walls extends close enough to the clay core and/or seepage cutoff walls, URS states the potential exists for a "significant seepage piping condition to be developed around or beneath the spillway structure. If such a condition is or has developed, it could become cause for the dam to fail by internal erosion in a rapid manner."

4.9 AMEC Inspections 2012 – 2014

AMEC performed inspections at the Lake Manatee Dam beginning in 2012. In 2013, these inspections were supplemented by diver inspections, ground penetrating radar, SPT borings, coring through the stilling basin floor slab, and video taping of the northern and southern toe drains. Specific details of these supplemental inspection items are presented in the following section.

During these inspections the following general observations were recorded:

1) large voids and collapse of the soil-cement slope paving below the water surface adjacent to the northern and southern approach walls;

2) large void under the soil-cement paving above the lake level and adjacent to the north approach wall;

3) large voids under the primary and secondary bridge deck approach slabs and between the sheet pile cutoff walls on both the north and south sides of the service spillway;

4) erosion, subsidence and loose to very loose embankment fill soils behind the north and south downstream training walls;

5) undermining of slope erosion protection on the north riverbank;

6) flowing water between the sheet pile wall and southern training wall;

7) multiple voids under the stilling basin floor slab that extend under the training wall base slabs;

8) multiple voids under the downstream concrete apron; and,

9) depressions in the downstream toe area of northern embankment just north of the service spillway.

Locations of these observations along with additional descriptions are presented in **Figure 29**. Taken together these observations are consistent with an internal erosion and piping failure mechanism occurring along both the northern and southern edges of the service spillway. Voids under the stilling basing that extend underneath the base slabs of the training walls and out to the river under the concrete apron represent a series of pipes supported by reinforced concrete roofs that have probably worked their way back to or very near the core of the dam. Given that

other inspectors have found evidence of voids under the approach wall base slabs, it is likely that very high gradients exist between these upstream voids and the voids under the training walls. These gradients are likely acting on the core of the dam and the materials beneath the core immediately adjacent to the spillway and are most likely responsible for the observed loosening and settlement of the core beneath the two approach slabs to the spillway bridge.

4.10 Conclusions from Historical Data

A summary of the previously reported observations from each of the engineering inspections is presented in **Table 4**. Each location where similar observations have been made has been given a number ranging from one (1) to eighteen (18) as previously indicated on **Figure 19**. In addition, a series of photographs from several of these inspections have been assembled for this report and are presented as **Photograph 1** through **Photograph 25**. These are provided to give a general overview of the nature of the visual observations found in the inspection reports used to create **Table 4**. The locations (zones at the dam) of each of these photographs have been included in their captions based upon the numbering system described above.

Based upon the historical data and the inspections of the Lake Manatee Dam beginning in 1978, AMEC draws the following conclusions with respect to the dam's condition prior to the emergency seepage cutoff wall installation in 2014.

Historical Conclusion 1 - Several conditions increased the potential for the initiation of an internal erosion and piping failure mechanism at the Lake Manatee Dam. These include:

a. substandard soil compaction procedures during construction that left loose and highly variable densities in the embankment dam;

b. design flaws in the service spillway that enhanced the downstream shell saturation process during high tail water releases, that caused high exit gradients in the spillway channel soils at the toe of the training walls (will be discussed subsequently), and that permitted the removal and/or loosening of soils surrounding the driven piling under the approach and training wall base slab;

c. a deep borrow pit that was excavated upstream of and in close proximity to the embankment and service spillway and extended through the originally design dam seepage confining layer creating a more direct seepage conduit from the reservoir to the underlying intermediate aquifer and potentially increasing vertical seepage gradients underneath the dam and in the downstream toe area; and,

d. regional artesian groundwater pressures in the IAS/ICU immediately beneath the Lake Manatee Dam and within 10 to 20 feet of the bottom of the originally designed seepage cutoff system (based upon soil boring information that will be presented subsequently in a geotechnical subsurface investigation data report).

Historical Conclusion 2 - Observations consistent with an active internal erosion and piping failure mechanism along the edges of the service spillway were present before the first inspection performed by the USACE in 1978.

Historical Conclusion 3 - The frequency and severity of observations consistent with an internal erosion and piping failure mechanism have increased over the years.

A more detailed description of the internal erosion and piping mechanisms present at the Lake Manatee Dam will be presented subsequently.

Table 4 Summary of Historical Observations Based on Location Near the Service Spillway

Callout	Location	Company	Year	Observations
General Comments	Embankment	Florida Testing Laboratories, Inc.	1966	Sheepsfoot roller empty, larger plates welded on feet to decrease pressure. Rubber-tired tractor pulling sheepsfoot at 12 to 15 mph. Drying and processing areas were too small. Equipment used could not break down clods. Mixed processed material with borrow pit material with no attempt to make uniform water content.
		US Army Corps of Engineers	prior to 1978	Vortices in reservoir observed by others near Station 8+00 and at raw water intake reported to the Corps during their inspection.
				Substantial amount of material placed in the embankment during construction failed to meet compaction requirements (Modified Procter).
1	Northern Approach Wall Below Water	McKim & Creed, PA	2011	Voids under base slabs of wall
		AMEC	2013	Void/break in soil-cement slope with washout below water line.
2	Northern Approach Wall Above Water	Metcalf & Eddy, Inc.	1990 - 1992	Depressions and erosion behind wall. One of the depressions is 10 feet wide and 20 feet long. Outward deflections of two of the wall monoliths closest to the gates (2 inches and 0.5 inches).
		Black & Veatch	1994 - 1995	Outward rotation of approach wall and soil-cement slope protection missing immediately north of the approach wall.
		McKim & Creed, PA	2010	The large void beneath the concrete pavement on the north side of the service spillway channel.
		AMEC	2012 - 2013	A void was detected beneath the concrete near the top of the north approach wall.
3	Northern Bridge Deck Approach Slab and Double Row Sheet Pile Cutoff	Bromwell Engineering, Inc.	1978	Very loose conditions at bottom of clay core at Station 17+00. Weight-of-hammer zones. Shelby tubes pushed by hand.
		HNTB	1981	Erosion on upstream slope adjacent to sheet pile wall.
		Camp, Dresser & McKee Inc.	1985	Weight-of-rod material at and near the bottom of the core at Station 17+00 with loss of circulation during drilling.
			1983 - 1987	Settlement along eastern and western sheet pile cutoff walls adjacent to bridge deck approach slab. Undulations in soil-cement surface upstream near approach slab to bridge.
		Metcalf & Eddy	1989 - 1992	Multiple areas of erosion adjacent to bridge.
		Black & Veatch	1993 - 1997	Erosion and gullies in soil-cement slope along sheet pile wall on the upstream side. Deterioration of soil-cement slope. Evidence of upward seepage from foundation into core of dam at Station 17+00.
		McKim & Creed, PA	2003 - 2005	Subsidence of clay core material between sheet pile walls. 4 feet deep void under slab in 2004.
			2008	Subsurface investigation by Driggers found very loose soils down to 28 feet below crest and material was more sandy than expected for a cohesive core.
		AMEC	2014	A 17-inch deep void was found below a 5-inch thick concrete slab. Air was felt blowing through hole. Large void under approach slab between sheet pile cutoff walls.
4	Northern Downstream Training Wall Adjacent to Bridge Deck	Camp, Dresser & McKee Inc.	1985	Erosion along the sheet pile wall adjacent to approach slab.
				Slope was flattened between 1984 & 1985. Soft zone found in slope.
			1987	Irregularities in surface of downstream slope just north of service spillway.
		Metcalf & Eddy, Inc.	1989	Depression/erosion at junction between sheet pile wall and downstream training wall.
			1990	More concrete bags have been added to the outside of the north wall to prevent additional erosion.
				Numerous irregularities and depressions in surface of the slope. Depression adjacent to bridge.
		Black & Veatch	1993, 1995	Erosion of soils, voids, and depressions at the intersection of sheet pile wall and downstream concrete training wall.
			1997	Depression just north of training wall adjacent to bridge.
		McKim & Creed, PA	2003 - 2007	Localized erosion, ruts, depressions and voids under access ladder slab.
		AMEC	2012 - 2013	The north side of the downstream training wall showed some signs of erosion and/or subsidence at the contact with the sheet pile wall.
5	Northern Downstream Training Wall Adjacent to Stilling Basin	Bromwell Engineering, Inc.	1978	Erosion of downstream slope continues to be a problem just north of spillway.
		Camp, Dresser & McKee Inc.	1987	Irregularities in surface of downstream slope just north of service spillway.
		Metcalf & Eddy, Inc.	1989	Deflections of wall noted up to 2".
			1992	Two new holes were discovered in the backfill behind the wall.
		Black & Veatch	1994 - 1997	Several indications of internal erosion. Depressions, voids, and erosion in the ground surface directly north of the training wall. Suspect that drainage “chimney” exists behind the training wall. Outward displacement of top of wall by as much as 2-1/2 inches.
		McKim & Creed, PA	2001, 2002, 2007	Possible loss of soil between training wall joints. In 2007, joints have failed and walls are tilting.
			2003	Erosion, ruts, and depressions after severe rains.
			2011	Suspect the training wall foundation has failed and should be replaced in the near future.
				The soil in close proximity of the underdrains exhibited loose to very loose conditions.
				As reported in the 2010 Annual Inspection Report, McKim & Creed representatives were contacted in mid September 2009 by Water Treatment Plant operations to observe a major sink hole that occurred along the north training wall of the spillway. At that time, the void was filled to stabilize the embankment in the area of the north training wall. It was reported that approximately 20 cubic yards of soil material was utilized to fill this void.
		AMEC	2013	SPT Borings indicated soft zones adjacent to the training wall at roughly the same elevation of the base slab,

Callout	Location	Company	Year	Observations
6	Western Corner of Northern Downstream Training Wall	HNTB	1981	A large area at the west end of the north spillway training wall has experienced severe erosion.
		Camp, Dresser & McKee Inc.	1982	Severe erosion of the bank at the end of the spillway requires immediate attention.
			1985, 1987	Fill between sheet piling and north training wall removed by erosion.
		Metcalf & Eddy, Inc.	1990 - 1992	A small amount of seepage was observed at the bottom of the north concrete wall where it changes from concrete to sheet piling.
			1990	More concrete bags have been added to the outside of the north wall to address surface erosion.
		Black & Veatch	1993	Erosion area along the toe.
		McKim & Creed, PA	2004 - 2005	Large voids under concrete slab behind toe drain outfall box.
			2008	New void under concrete slab behind toe drain outfall box. This occurred after grouting in 2007.
7	Northern Downstream Sheet Pile Wall	Camp, Dresser & McKee Inc.	1986	Severe erosion due to high groundwater.
			1987	Erosion along the east end of the sheet pile wall and north training wall.
			1988	Erosion along the west end of the sheet pile wall.
		Metcalf & Eddy, Inc.	1989	Seepage at west edge sheet pile wall.
			1990	Seepage along the sheet pile and concrete wall.
			1992	Erosion of sheet piles due to outfall from toe drain. Hole at west end of sheet pile wall.
		Black & Veatch	1994 - 1997	Multiple references to depressions several feet north of sheet pile wall. Loss of backfill material through gap in sheet pile.
		McKim & Creed, PA	2004	Subsidence and surface erosion of mat immediately adjacent to sheet pile wall on the downstream side.
8	Manatee River and Northern and Southern Riverbanks	U.S. Army Corps of Engineers	1979	A bench and scarp has formed on the southern banks of the river channel.
		Camp, Dresser & McKee Inc.	1983	Erosion of downstream channel just downstream of spillway. Erosion protection added to the downstream slopes beyond the sheet pile wall in 1985.
			1985	Severe erosion between north training wall and spillway channel cover (concrete).
		Metcalf & Eddy, Inc.	1989	Seepage noted on north downstream river bank beyond the training wall.
				Concrete bags were added to the slope downstream of the sheet pile wall to prevent erosion.
			1992	Loss of soil below slope west of northern sheet pile wall. Two slope instabilities on lower portion of the northern riverbank just downstream of sheet pile wall extension. Took picture of sediment island in downstream river channel.
		Black & Veatch	1993 - 1994	Erosion and undermining of surface protection material on north. Formation of a large sediment island in downstream river channel and attached to the southern bank.
			1995	Sak-crete bags have been placed at the downstream end of the north sheet pile wall apparently to prevent erosion of the embankment behind the sheeting.
			1997	Erosion of northern bank downstream of end sill and sheet piles.
		McKim & Creed, PA	1999 - 2000	Erosion of northern bank downstream of end sill and sheet piles.
			2000 - 2002	Erosion and undermining of concrete armoring on riverbanks. Island remains in downstream river channel.
			2003	Island in downstream channel dredged. Revetment mats placed on north and south riverbanks. These are subsiding.
			2004 - 2008	Subsidence, large voids and cracking of concrete revetment mats on north and south riverbanks. Some areas topped with concrete in 2004.
9	Southern Approach Wall Below Water	US Army Corps of Engineers	1975	Vortex reported by operators to Corps near water plant intake on May 27, 1975 during a low-water event.
		McKim & Creed, PA	2011	Voids under base slabs of wall
		AMEC	2013	Void/break in soil-cement slope with washout below water line.
10	Southern Approach Wall Above Water	Camp, Dresser & McKee	1987	¾-inch outward deflection of western-most approach wall monolith.
		Metcalf & Eddy, Inc.	1989, 1990	Outward deflection of approach walls next to intake chamber, 2-inches for the monolith closest to the dam crest and 0.5 inches for the one containing the coarse screen intake chamber.
		Black & Veatch	1993, 1994	Cracks and holes in soil-cement slope. Rotation of wall towards intake channel. Depressions and erosion behind wall.
		McKim & Creed, PA	2000 - 2007	Settlement around coarse-screen chamber next to south approach wall. New void in 2005.
			2011	A soft area in the soil-cement slope and a void on the south upstream embankment in the vicinity of the south approach wall.
11	Southern Bridge Deck Approach Slab and Double Row Sheet Pile Cutoff	HNTB	1981	Erosion on upstream slope adjacent to sheet pile wall.
		Camp, Dresser & McKee Inc.	1985, 1987	Erosion along the eastern and western sheet pile walls adjacent to the bridge. Undulations in soil-cement surface upstream near approach slab to bridge.
		Metcalf & Eddy, Inc.	1989, 1990	Depression and erosion along sheet pile wall.
			1990	Erosion along abutments to approach bridge.
			1992	Depression in roadway at STA 14+25.
		McKim & Creed, PA	2000	Settlement along sheet pile wall/embankment interface.
		AMEC	2013	An 8-inch deep void was found below 5-inch thick secondary concrete approach slab, which had been filled with broken concrete. Air was felt blowing through hole. Large void under primary approach slab between sheet pile cutoff walls.

Callout	Location	Company	Year	Observations
12	Southern Downstream Training Wall Adjacent to Bridge Deck	US Army Corps of Engineers	1978	Loss of soil underneath steps along south training wall.
		HNTB	1981	Erosion and undermining of concrete stairway adjacent to training wall.
		Camp, Dresser & McKee Inc.	1982, 1985, 1987	Erosion and undermining along stairs adjacent to bridge and settlement of gate motor control center.
		Black & Veatch	1993 - 1997	Erosion along stairs adjacent to bridge. Settlement of concrete stairway. Depression on downstream edge of wall. The soil in the area of the depression appeared to be washing downward into a void.
		McKim & Creed, PA	2000	Settlement of embankment at concrete spillway location.
			2001 - 2003	Settlement under concrete slab at electrical conduits. Large voids present under slab.
13	Southern Downstream Training Wall Adjacent to Stilling Basin	US Army Corps of Engineers	1978	Depression 3 feet deep 4 feet diameter just south of the training wall.
		Bromwell Engineering, Inc.	1979	3' diameter by 2' deep depression along the training wall.
		Camp, Dresser & McKee Inc.	1983	Erosion and settlement along southwest spillway wall. Depression along southwest corner of training wall.
		Metcalf & Eddy, Inc.	1989	Deflections of wall noted up to 2".
		Black & Veatch	1994 - 1997	Several indications of internal erosion. Depressions and erosion behind wall. Large void space under concrete pad on west side of fine screen chamber. Suspected the presence of "chimney" drain behind wall. Wall out-of-plumb by as much as 2-1/2 inches with movement of wall towards stilling basin.
		McKim & Creed, PA	2000-2004	Large void under the 6 feet by 6 feet concrete slab to the west of the fine screen chamber building. Signs of settlement along ground surface. Slab removed in 2004. Possible loss of soil through training wall joints.
			2007	Joint material between monoliths of concrete wall has failed.
			2011	The soil in close proximity to training wall base slab is loose to very loose in Driggers' subsurface investigation.
		AMEC	2013	SPT Borings indicated soft zones adjacent to the training wall roughly at the same elevation of the base slab and in similar locations to Drigger's previous borings.
14	Southern Downstream Sheet Pile Wall	Metcalf & Eddy, Inc.	1989	Separation of sheet pile wall, towards bottom of wall. Depression/erosion along sheet pile wall.
			1992	Displacement of sheet piles at west end.
		Black & Veatch	1993, 1995	Erosion at the end of the sheet pile wall.
		McKim & Creed, PA	2000	Displacement along west end of sheet pile wall.
			2003	Erosion and undermining of concrete slab next to weir box behind sheet pile wall.
			2003-2004	Loss of material and voids behind sheeting and under concrete pad.
		AMEC	2012 - 2013	Flowing water was observed at the junction between the sheet pile wall and south training wall.
15	Stilling Basin	Black & Veatch	1997	Evidence of void system under stilling basin from dye study.
		AMEC	2013	Voids were encountered below the concrete stilling basin.
16	Downstream Concrete Apron	US Army Corps of Engineers	1978	Excessive erosion downstream of the stilling basin. No concrete apron was present initially. The original channel was bare earth. Concrete apron was added later.
		Camp, Dresser & McKee Inc.	1983	3-foot depression at southwest end of concrete apron.
			1987	Depression at locations of old baffle blocks.
		Metcalf & Eddy, Inc.	1989 - 1992	Deterioration of concrete apron. Corrosion and splitting of sheet pile walls on downstream end. Cracking of concrete and sheet piles separating from concrete on downstream edge.
		Black & Veatch	1994 - 1997	Sheet pile wall displacement outward and undermining of the apron has occurred. Voids detected under apron with undermining and washout on downstream edge.
		McKim & Creed, PA	2000 - 2002	Lateral movement of the sheet pile and undermining of the apron. Large voids between apron and downstream sheet piles.
			2003	GPR survey found voids in multiple locations under the apron.
			2004 - 2008	Coring found multiple voids under apron as much as 1.75 inches deep. In 2006, found 4-inch void under apron. In 2007, four additional voids were detected. In 2008 the core holes that had been plugged failed and needed to be plugged again.
		AMEC	2014	GPR survey found voids in multiple locations under the apron. Coring at two locations near training wall base slabs discovered flowing water conditions.

Callout	Location	Company	Year	Observations
17	Downstream Slope and Northern Toe Drain	Bromwell Engineering, Inc.	1979	Possible artesian condition found in piezometers at STA 17+50. Erosion problems along the north bank of river channel.
		Camp, Dresser & McKee Inc.	1982 - 1987	Sag in toe drain just north of service spillway between 2nd and 3rd manhole. Video camera went underwater for 180 feet. Pipe coupling most likely displaced. Appreciable buildup of sediment in sagged section.
				Piezometers at toe and beyond for the cross section at Station 17+50 are showing artesian conditions.
				Video inspection indicated low segments between manhole 1 and 2. Obstruction observed in toe drain between manhole 2 and 3. Peeling of asphalt coating.
		Metcalf & Eddy, Inc.	1989 - 1992	Slow flow in toe drain between STA 18+50 and STA 21+25. Some piezometers on downstream side of dam are showing fluctuations much larger than those occurring in lake level. Multiple depressions along with wet zones along the toe. Downstream slope had numerous irregularities.
		Black & Veatch	1993 - 1995	Settlement/depression at STA 25+50 possibly due to settlement of backfill at modification to toe drain. Piezometer readings at cross section at STA 17+00 indicate lowering of phreatic surface in embankment below levels to the north and flow into the underdrain. Depression noted on slope with undulations in the downstream toe area likely caused by erosion.
			1997	Water pouring into toe drain through perforated holes. Asphalt toe drain lining peeling. Bulge in slope near STA 21+80.
		McKim & Creed, PA	2000, 2001	Sedimentation in northern toe drain. Corrugated metal pipe is deteriorating.
			2007	Decreased efficiency in the north toe drain caused by settlement.
		AMEC	2012	One small roughly circular depression about two inches deep was observed approximately midway up the slope between Toe Drain Manholes 6 and 7.
			2012 - 2013	Slow flowing water in toe drain observed in manhole 6.
18	Downstream Slope and Toe Drain South of Service Spillway	US Army Corps of Engineers	1978	Area of seepage on downstream toe and embankment at STA 12+00 and 13+50.
				Two conical depressions 6 feet diameter 6 inches deep on asphalt service road in vicinity of Station 8+00 (corresponding to vortices previously mentioned). Toe drain not constructed according to construction specifications. Fines filling toe drain, not allowing it to carry designed flow.
				Practically continuous series of depressions in the toe road on the south end of the dam.
		Bromwell Engineering, Inc.	1979	Inner filter of toe drain was placed with too many fines. Recommended replacement of entire toe drain. Wet spots along the toe of the slope between STA 10+00 to 15+00.
		HNTB	1981	Wet area reported previously at Station 12+00 between toe of slope and service road 3 feet east of toe drain but dry at the time of inspection.
		Camp, Dresser & McKee	1983, 1985, 1987	Moisture present in downstream slope area and soft ground at the embankment toe. Multiple areas of settlement along access road and partial blockage of toe drain.
		Metcalf & Eddy, Inc.	1989 - 1992	Depression with wet zones along the toe. Some piezometers on downstream side of dam are showing fluctuations much larger than those occurring in the reservoir. The downstream slope had numerous irregularities. More concrete bags have been added to south channel bank for surface erosion protection.
		Black & Veatch	1993 - 1997	Depression noted on slope. Seepage at toe of embankment between STA 10+00 to south training wall. Concerned about potential internal erosion.
		McKim & Creed, PA	2004	Small geysers found in southern toe drain.
			2005	Settlement of toe drain with joint offsets and sediments entering pipe, upward flow into pipe.
			2006	Sediment building up in weir box. Break in PVC toe drain pipe.
			2007	Groundwater inflow to toe drain at offset joints caused by settlement.
			2008	Substantial increase in toe drain flow rate.

5.0 AMEC FOSTER WHEELER SUPPLEMENTAL INSPECTION

Based upon Amec Foster Wheeler's inspections for 2012 and 2013 and prior inspections by others, several issues were identified concerning the overall performance of the Lake Manatee Dam. These include:

a) voids beneath the asphaltic concrete located on the upstream slope of the dam;

b) historical soil loss behind the approach and training walls;

c) slow-moving seepage water within Manhole No. 6 of the toe drain system as compared to surrounding manholes;

d) spillway structure needing inspection below the water level;

e) voids beneath stilling basin;

f) unknown condition of the underdrain system for the stilling basin and hydrostatic pressures that may be building up under the floor slab;

g) training wall backfill drains that may not be functioning;

h) unknown extent of voids under concrete apron downstream of the stilling basin end sill; and,

i) corroding sheet pile retaining walls downstream of the original concrete training walls that are losing structural section thickness.

The Amec Foster Wheeler supplemental inspection was organized into six general task categories to address these concerns. In the following sections, each task categories is defined and the results of the field investigations are presented.

Six general task categories were labeled Tasks 4 through 9 in the Amec Foster Wheeler proposal dated September 20, 2013 and are as follows:

Task 4 – Voids Beneath Asphaltic Concrete Located on the Upstream Slope;

Task 5 – Historical Soil Loss Behind Approach and Training Walls;

Task 6 – Slow-Moving Water Passing Through Manhole No. 6;

Task 7 – Inspect Spillway Structure Below Water Level;

Task 8 – Spillway Stilling Pool Potential Voids and Underdrain Evaluation; and,

Task 9 – Sheetpiling Retaining Wall Repair Options.

After Amec Foster Wheeler completed a portion of these tasks and Amec Foster Wheeler concluded that the dam was in a "significantly deteriorated state," the remaining funds allocated for these tasks were reallocated to initiate an emergency geotechnical subsurface investigation without addressing Tasks 4 and 9. These two tasks have been deferred to a future phase of work after the emergency repairs are completed.

The following is a summary of the results from the other four tasks that were completed in the supplemental inspection.

5.1 Task 5: Historical Soil Loss behind Approach and Training Walls

As previously mentioned, soil loss has been observed immediately behind both the approach and training walls on the northern and southern sides of the spillway structure. The purpose of

Task 5 was to collect additional subsurface information and to install piezometers to assist in explaining the causes of the observed soil loss behind the approach walls upstream and training walls downstream of the spillway gates.

The AMEC 2013 Annual Inspection Report stated:

"Due to past issues with soil loss behind the north and south approach walls, we recommend that piezometers be installed immediately behind the downstream training walls at selected locations based on standard penetration test (SPT) borings completed by Driggers Engineering Services, Inc. and included in the 2011 (McKim & Creed) Inspection Report."

"We further recommend that additional SPT borings be completed and piezometers be installed at selected locations behind the upstream approach walls to monitor the effectiveness of seepage control in the vicinity of the walls."

The field program to evaluate the historical soil loss behind the approach and training walls included the use of ground penetrating radar and SPT borings with piezometers. This section presents the results of this field investigation.

SPT Borings and Well Installations Behind Downstream Training Walls

Four Standard Penetration Tests (SPT) borings were performed in the backfill areas immediately north and immediately south of the downstream training walls. These were performed by Independent Drilling Inc. (IDI) of Leesburg, Florida in general accordance with ASTM D 1586 and were completed December 12 and December 13, 2013 using a Central Mining Equipment (CME) truck-mounted drill rig (DR8) with a mud rotary drilling method. The boring locations are shown on **Figure 30**. These borings were placed in the same general locations as those performed by Driggers Engineering Services, Inc. in 2011 for McKim & Creed. Also shown on this figure are the approximate locations of Drigger's borings and the original soil borings for the dam.

Soil samples were collected from the boreholes using a 1.5-inch-inside-diameter (ID) split-spoon sampler driven with a 140-pound automatic slide hammer falling a distance of 30 inches. An Amec Foster Wheeler staff engineer logged the borings in the field in general accordance with ASTM D 2487. A representative number of samples for characterization of the subsurface materials were collected at each of the boring locations at a typical 2.5-foot sampling interval. The SPT samples collected from the field program were placed in sealed containers and returned to the laboratory for additional visual classification. The conclusions and recommendations presented herein with respect to these soil borings are based upon a review of the soil test data and Amec Foster Wheeler's experience with similar projects and subsurface conditions. The boring logs based upon visual soil classifications only are included in **Appendix A.**

The subsurface geology at the site is illustrated by the soil boring logs in **Appendix A**, which should be consulted for detailed descriptions of the subsurface conditions encountered at each boring location. Boring stick logs with measured blow counts are also shown on **Figure 31** along with relative elevations of the stilling basin training walls and floor slab. The horizontal scale has not been included on the figure because the relative horizontal positions of the training walls and borings are conceptual only and meant to represent which borings are located behind the north and south walls. The original boring stick logs (located at the approximate centerline of the dam) are also included for reference.

In both the current Amec Foster Wheeler subsurface investigation and in the previous investigation by Driggers Engineering Services in 2011, zones of very loose material were found immediately behind the both the northern and southern downstream training walls. Referring to **Figure 31**, these zones extend approximately from the top to the bottom of base slabs of the training walls in Borings B-1, B-2, and B-3. Given that this material was in a previously filled zone and was likely compacted with at least some level of effort, the very loose densities encountered coupled with the identification of voids under the training walls (from the Amec Foster Wheeler investigation to be describe subsequently) indicate that some embankment material has been removed by internal erosion at or near the bottom of both the northern and southern training wall base slabs.

We note that the previously compacted material above the top of the base slabs also has relatively low blow counts, which is consistent with the raveling that would be expected to occur in a soil column above a zone where material was being removed by internal erosion. Raveling is a progressive loosening of the soils that proceeds upward as soil is removed from below and the overlaying material collapses into the void.

The following generalized strata identified within the termination depths of the four SPT borings are summarized below.

Stratum 1: FILL consisting of SAND (SP), SAND with Silt (SP-SM), SAND with Clay (SP-SC), Clayey SAND (SC), Silty SAND (SM); brown, dark brown, gray and greenish gray fine-grained quartz, variably silty, variably clayey, local cemented sand, phosphate grains; typically encountered from ground surface to a depth of 22 to 28 feet below existing ground surface (bls).

Stratum 2: NATIVE Soils consisting of Sandy CLAY (CL), CLAY (CL/CH) (**NATIVE**); gray to greenish gray fine-grained quartz, variably clayey and variably sandy, phosphate grains; 22 to 45 feet bgs. This stratum was apparently targeted by the designers as the original cutoff layer for the embankment dam's core.

Stratum 3: Silty SAND (SM); gray and greenish gray fine-grained quartz, variably silty, cemented sand and silt, phosphate grains and local limestone fragments; typically encountered underlying the sandy clay stratum at depths from 40 feet bgs to the termination depth of these borings. This stratum most likely represents the beginning of Permeable Zone 2 in the IAS/ICU previously described.

At the time of SPT drilling, groundwater was not encountered prior to the introduction of drilling fluid at 10 feet bgs in each of the four boring locations. Four piezometers were installed immediately adjacent to the SPT boring locations. These were covered with flush mounted monitoring well caps and imbedded in 2-foot by 2-foot concrete pads. The piezometers are intended for long-term monitoring of the groundwater levels in these areas. Ground water readings were recorded on December 16, 2013 and January 27, 2014. These readings are listed in **Table 5** and are presented both in terms of depth below ground surface and the approximate elevations based upon NGVD 29.

Table 5 Piezometric Water Elevations in Amec Foster Wheeler Piezometers

Date	Piezometer Readings, NGVD 29							
	B-01		B-02		B-03		B-04	
	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)
12/16/2013	18.34	8.16	23.40	5.60	18.48	5.52	-	-
1/27/2014	19.47	7.03	23.39	5.61	18.55	5.45	Dry	-

These groundwater readings have been placed on **Figure 31** and indicate that the phreatic surface behind the training walls roughly corresponds to the very loose soil zones at the bottom of the original compacted fill. We note that these elevations are well below the design outfall for the combined training wall backfill drain and stilling basin underdrain system which has an invert at El. 11 feet. Considering the head losses that would be present in the drainage pipes if water were flowing, the design piezometric water elevations for the underside of the stilling basin and the backfill drain would have been above El. 11 feet. Hence, the water pressures that currently exist behind the training walls and under the stilling basin are being lowered below their original design levels. Such a condition with water levels at or below the training wall base slabs and stilling basin floor slab is consistent with the presence of a void system that is acting like a very efficient pressure relief system.

Ground Penetrating Radar

A ground penetrating radar (GPR) survey was conducted on November 18, 2013 by Independent Drilling & Geophysical Services, LLC (IDGS) of Groveland, FL, a subsidiary of Scientific Applications in Forensic Engineering (SAFE), in order to determine if voids or cavities could be identified behind the approach and training walls. The GPR survey was performed on top of the soil-cement slopes adjacent to the north approach wall and on the downstream slope adjacent to the north and south downstream training walls.

IDGS determined that the GPR equipment was only able to survey the underlying soils beneath the soil-cement upstream slopes and along the downstream slopes to depths ranging from 2 to 20 feet using a 250 MHz antenna. A deeper penetration depth could not be achieved due to the cohesive nature of the material used to construct the dam. Given these limitations, the GPR equipment was not able to detect the presence of voids behind the approach and training walls.

The IDGS report is attached as an appendix to this report.

5.2 Task 6: Slow-Moving Seepage Water Passing Through Manhole No. 6

Deeper and slower moving seepage water was observed in Manhole No. 6 (MH6) during annual dam inspections by Amec Foster Wheeler and others. MH6 is located a few hundred feet north of the service spillway and in the general location of the Manatee River prior to construction of the dam. Refer to **Figure 32**. The purpose of Task 6 was to identify the reason for the deeper and slower moving water observed in MH6.

The AMEC 2013 Annual Inspection Report states:

“The water within Manhole No. 6 was deeper and slower moving than adjacent manholes. This may be the result of the pipe grade in the vicinity of the manhole, or it could indicate a restriction in the pipe downstream (south) of the manhole. The water level within the manhole should be observed for signs of increase of the water.”

Field Investigation

A camera survey of the entire toe drain system was conducted by Underwater Engineering Services, Inc. (UESI) of Fort Pierce, FL on November 20, 2013 to determine if any obstructions are causing the slow moving seepage water. **Photographs 27** through **41** are still shots taken from the video file. An *Inuktin VT100 Remote Operated Vehicle (pipe crawler)*, as seen in **Photograph 26**, was used to inspect the toe drains. UESI looped the video feed through its dive trailer to record the inspection. A copy of the inspection video can be found in the DVD attached to **Appendix B**.

UESI started the investigation at the southern most manhole, Manhole No. 1 (MH1), and drove the rover towards the north. Refer to **Photograph 27**. The rover was stopped at each joint in the perforated HDPE pipe and a full 360° pan of the pipe side walls was conducted. The rover continued north, stopping at all of the joints until it arrived at the next manhole, where it was then retrieved and removed from the manhole. The dive truck and trailer was then relocated to the next manhole and the process resumed.

The south toe drain with MH1 to MH4, measures approximately 1,100 linear feet. During the inspection of the south toe drain, an algae/sludge buildup was noted along the bottom of the pipes. Also, there were several water spouts coming through the pipe openings. The movement of the rover aided in removing some of the buildup material and allowed higher flows through the drain pipe. **Photographs 27** through **32** are still-shots of the southern toe drain.

Minor differential settlement of approximately 1/4 inch to ½ inch in the HDPE piping was observed at the joints. However, no precise displacement measurements were possible. At MH4 the plastic cover had fallen into the manhole (see **Photograph 32**). While it was not currently impeding flow, it could possibly block future flow. Several attempts were made to retrieve the cover from ground level, but these attempts were unsuccessful.

Once the south pipe inspection was completed, UESI relocated to the north toe drain and started the inspection process at MH9. The inspection continued south, stopping and resetting at each manhole. **Photographs 33** through **41** are still-shots of the northern toe drain. It extends for approximately 1,820 linear feet. A rubber gasket was found in the toe drain just south of MH8 (see **Photograph 33**). Minor build up of algae/sludge was observed, reaching as much as 2 inches thick in some areas (see **Photographs 34** through **37** and **41)**. As noted in the south toe drain, the rover was able to break through the build up and increase the flow.

The slow moving seepage water noted in MH6 during the 2011 dam inspection was observed starting just north of MH6. Slight differential displacements along the HDPE pipe joints were observed throughout the toe drain (see **Photographs 38** through **40**). However, in the last 580 feet of toe drain and in the vicinity of MH6, the differential displacements at the joints increased from 1/4-inch to approximately 2-inches progressively towards the south. At these locations the rubber gaskets at the joints were still intact along the top (12 o'clock position) of the pipe. The bottom (six o'clock position) of the toe drain pipe could not be seen because of higher water levels and the limitations of the rover.

While not definitive, these large differential movements of the toe drain pipes at the junctions are consistent with an internal erosion mechanism occurring in the foundation soils beneath the drain that results in ground settlements. As previously stated, MH6 is in the approximately location of the original riverbed for the Manatee River prior to construction.

A list of observations made during both toe drain inspections along with their approximate positions are summarized on **Figure 32**.

5.3 Task 7: Inspect Spillway Structure below Water Level

The purpose of Task 7 was to evaluate the condition of the concrete spillway structure below the surface of the lake.

The AMEC 2013 Annual Inspection Report states:

"Our inspection was limited to the readily observable portions (above water and above ground) of the concrete service spillway structure. In addition, areas requiring confined space access permits or bucket/lift trucks were excluded from this survey. We carried out this inspection to provide an opinion of the condition of those structures and evaluate the need for additional in-depth investigations. We suggest that divers be employed to inspect areas below water levels during subsequent inspections."

Field Investigation

An underwater inspection of the approach slab and north and south approach walls and the 48-inch raw water intake line was conducted by Underwater Engineering Services, Inc. (UESI) on November 18 and 19, 2013 and December 12, 2013. This inspection involved an underwater recorded inspection of the spillway structure including the: approach slab; north approach wall; south approach wall; sheet piles in front of the approach slab; top of base slabs for approach walls; soil-cement slope on the embankment slopes behind the approach walls; and, 48-inch raw water pipe (Raw Water #1). The diver inspection focused on the condition of the submerged concrete surfaces, evidence of exposed rebar within the structure, and pitting and cavitation within the sheet pile section. The inspection also looked for voids and checked for evidence of material movement under the action of seepage gradients in the submerged portion of the spillway. Areas of previously reported scouring along the leading edge of the upstream concrete slab and previous grouted portions of the approach walls were also to be observed and documented.

UESI started its inspection on the north side of the south approach wall on November 18, 2013. The inspection started adjacent to the tainter gates and continued east along the north side of the approach wall and wrapped around the wall to the south side. The diver viewed the concrete approach wall, concrete foundation, metal sheet piles, and soil-cement slope. A detailed map of the diver observations can be found in **Figure 33**. The observations are noted in **Table 6** and can be found in UESI's report in **Appendix B**.

Table 6 Observations for UESI Dive Inspection of South Approach Wall

No.	Observation	Approximate Location	Description
1	Concrete Scaling	Throughout South Wall	Approximately ¼ in deep scaling with exposed aggregate, typically from the high-water mark to bottom of wall
2	Vertical Crack	1 feet east of the SW corner of approach slab (north face)	8 in long ¾ in deep vertical crack 2 feet below water level
3	Concrete Scaling	51 feet east of first expansion joint (north face)	3 in by 5 in section of ½ in deep scaling at 21 feet below water level
4	Concrete Scaling	73 feet east of first expansion joint (north face)	4 in by 2.5 in section of 1 in deep scaling at 19 feet below water level
5	Undermining	20 feet west of east end of wall (south face)	Undermining of soil-cement slope with soil-cement broken off and collapsed into void. Void is approximately 2 feet deep extending laterally to 6 feet deep under the soil-cement slope

During the inspection of the south approach wall, the diver also viewed the newly installed sheet piles located approximately 3.5 feet off of the wall. These sheet piles were viewed for deterioration and separations along the joints. No such problems were noted. This sheet pile wall was placed during the void filling operation under the approach walls in 2011. It starts adjacent to the approach slab and continues east until it wraps around the end of the approach wall base slab where it is covered with 3-foot diameter riprap.

Once UESI finished the inspection of the south approach wall, it began inspecting the approach slab and sheet pile cutoff wall north of the approach wall. Observations from this inspection are also included on **Figure 33**. During the dive inspection, UESI indicated that the approach slab consists of a concrete slab that overhangs a sheet pile cutoff wall, running north-south between the approach wall base slabs. An inspection of the exposed concrete face was performed with no evidence of damage or deterioration. A scour hole was found in front of the approach slab. The depth of this scour hole ranges from 2 inches at the north and south training walls to about 48 inches at the center of the approach channel.

The approach slab had a layer of silt ranging in thickness from 1 inch to as much as 2 feet; the thickest portion was immediately adjacent to the Ogee spillway section. This soil was removed by the divers along the entire west side of the approach slab in order to inspect it. During this inspection, several steel grates were found lying on top of the slab. In addition, six large pieces of concrete debris were found scattered across the slab. The steel grates were confirmed by representatives of Manatee County to have been the grates blocking the slot in the road way for the “stop logs” that were removed by vandals and thrown into the reservoir. The concrete debris appeared to have been excess concrete over-pour from prior construction activities that had been dumped over the railing.

On November 19, 2013 UESI continued its dive inspection. UESI started at the water level on the soil-cement slope of the north approach wall and continued east along the north side of the wall to its end and then followed the wall west towards the spillway, ending at the Ogee section of the spillway. The diver viewed the concrete approach wall, concrete foundation, sheet piles,

and soil-cement slope. A detailed map of the observations can be found in **Figure 33**. The observations are noted in **Table 7** and can be found in UESI's report in **Appendix B**.

Table 7 Observations from UESI Dive Inspection of North Approach Wall

No.	Observation	Approximate Location	Description
6	Concrete Scaling	8 feet east of the first expansion joint (north face)	5 in by 7 in section of 1-inch deep scaling at 6 in below water level
7	Vertical Crack	15 feet east of first expansion joint (north face)	Vertical crack beginning at the soil-cement slope cover to top of wall, continuing along south face to 1 foot below water level
8	Missing grout	18 feet east of first expansion joint (north face)	Mechanical hole (1-1/4-in dia.) missing grout 1 foot below water level
9	Horizontal Separation	At second expansion joint	Expansion joint with 1 in separation at soil-cement slope cover and closes 4 feet from top of wall
10	Undermining	9.5 feet east of second expansion joint (north face)	Undermining of soil-cement slope with soil-cement broken off and collapsed into void, void is approximately 2 feet deep gradually closing as the void continues north for 9-feet, extends east for approximately 20 feet
11	Concrete Scaling	12 feet east of second expansion joint (north face)	6 in by 8 in section of 1/2-inch deep scaling at 18 feet below lake level (El. 20 feet)
12	Horizontal Separation	At third expansion joint (both faces)	Expansion joint with 1.5-inch separation at soil-cement slope cover that closes 2 feet from top of wall
13	Popouts	12 feet west of end of wall (south face)	6 feet by 2 feet section of popouts within the concrete 15 feet below water level
14	Concrete Scaling	8 in east of third expansion joint	1.5 feet by 1.5 feet section of 1/2-inch scaling at 17 feet below water level
15	Concrete Spall	Third expansion joint	2.5 in by 2.5 in section of 1-inch deep spalling at10 feet below water level
16	Concrete Scaling	Third expansion joint	7 feet by 4 feet section of 1/2-inch scaling at 14feet to 19 feet below water level
17	Horizontal Separation	At second expansion joint	Expansion joint with ½ in separation from top of wall to 2 feet below water level
18	Exposed Wire	2 feet west of second expansion joint	18 in long section of 1/8 in wire protruding out of wall
19	Missing grout	4 in east of first expansion joint	Mechanical hole (1-1/4 in diameter 2-1/2 in deep) just above water level
20	Horizontal Separation	At first expansion joint	Expansion joint with ¼ in separation at top of wall increasing to ¾ in at water level, heavy scaling in this area, separation closes 18-inches below water level
21	Concrete Scaling	14 feet west of first expansion joint (south face)	9 in by 2 in section of ½ in deep scaling at 3 feet below water level
22	Concrete Spall	20 feet west of first expansion joint (south face)	10 in by 12 in section of 2 in deep spall with no exposed rebar at 3 feet below water level
23	Missing Grout	20 feet west of first	Mechanical hole (1-1/4 in diameter 1-3/4 in

No.	Observation	Approximate Location	Description
		expansion joint (south face)	deep) just above water level
24	Concrete Spall	4 in east of west most end of wall (south face)	9 in by 4 in section of 1-inch deep spall with no exposed rebar at 2 feet below water level
25	Horizontal Separation	At western most end of wall along expansion joint (south face)	Expansion joint with1 in wide separation from water level to 3.5 feet below water level, separation was approximately 6 in deep

UESI returned to the site on December 12, 2013 to perform an inspection of the 48-inch raw water intake line in the coarse screen chamber located along the south approach wall. This intake pipe begins in the coarse screen chamber and continues west through the dam core and into the fine screen chamber. The dive started at the east end within the coarse screen chamber and continued west through the 48-inch iron pipe and concluding in the fine screen chamber. The observations are noted in **Table 8** and are summarized on **Figure 34**. The UESI dive inspection report can be found in **Appendix B**.

Table 8 Observations from UESI Dive Inspection of the 48-in Raw Water Intake Pipe

No.	Observation	Approximate Location	Description
1	Coating on Concrete Walls	Throughout Intake Chamber	A light colored cementatious coating was applied to the wall
2	Pitting	Intake Gates	All three intake gates had 1/8 in to ¼ in deep pitting
3	Coating Failure	Intake Gates	80% of the coating on the gates is missing
4	Corrosion	Base Plate of Ladder	Minor corrosion to base plate of ladder
5	Corrosion	Intake Chamber Bolts of 6-inch pipe	Flange bolts for an abandoned 6 in pipe in the intake chamber are corroded
6	Foreign Material	Throughout Intake Chamber	Miscellaneous materials were located throughout the intake chamber, primarily pieces of steel
7	Separation at joint	81-feet west of east end of 48-inch Pipe Inlet	Gap between sections, pipe not inserted all the way into bell end
8	Pitting	Throughout 48-inch Piping	1/16 to 1/8 in deep pitting, typically ¾ in diameter

After the inspection was completed, UESI returned to the 48-inch pipe to take soundings on the wall using an ultrasonic thickness gage. A *Cygnus Multiple Echo* gage was employed, which utilizes a three echo return measuring system capable of measuring the thickness of any object with less than 6 mm of coating. The average thickness of the piping was measured as 0.296 inch. The thickest pipe wall reading was 0.505 inch and the thinnest was 0.16 inch. These two readings are considered to be outliers as a result of uncertainties in the measurement process and not representative of actual conditions.

5.4 Task 8: Spillway Stilling Pool Potential Voids and Underdrain Evaluation

The purpose of Task 8 was to collect additional subsurface information on the presence of voids under the stilling basin and whether or not the underdrain system is working.

The AMEC 2013 Annual Inspection Report states:

"The original sub-slab, apron and training wall underdrain system associated with the downstream portions of the spillway structure is over 40 years old and may be approaching the end of its service life. We recommend that the condition of the spillway slab and apron underdrain system be investigated further. We recommend that:

1) GPR anomalies previously identified should be investigated by coring through the concrete and probing or using appropriate means to determine the presence of voids. If the existing GPR data is not sufficient, then a new GPR survey may be required.
2) Any voids located should be backfilled with bentonite/cement grout or by other method.
3) The condition of the underdrains should be verified by camera investigation. This may require coring through the concrete apron at the locations of the underdrains as shown on the construction drawings.
4) The need for uplift pressure control should be assessed by the installation of a simple piezometer or pressure sensor system in the apron that is measured periodically and during high flow events. This system could be integrated into the existing piezometer system to better analyze critical subsurface pressures."

Field Investigation

A GPR survey conducted within the spillway apron downstream of the stilling basin end sill using a 500 MHz antenna provided an indication of the condition of the underlying soil to a depth of approximately 15 feet bgs. The GPR survey found that the concrete apron ranges in thickness from about 3 feet to as much as 5 feet. The GPR survey for the spillway apron also identified nineteen (19) possible voids and/or cavities beneath the concrete apron. A majority of the voids were found along the sheet pile retaining wall on the downstream perimeter of the concrete apron and just underneath the apron. The areas where the voids were identified in the IDGS report are summarized on **Figure 35**. The IDGS report can be found in **Appendix C**.

The spillway stilling basin was also to be evaluated with GPR first to locate voids. However, the slab was too thick and contained too much reinforcing steel to use GPR. Explorative coring in the stilling basin was used to learn the location of voids. The coring of the spillway stilling basin was conducted on December 13, 2013 and December 16, 2013 by True-Line Coring & Cutting (True-Line) of Tampa, FL.

The spillway stilling basin consists of 5-foot thick concrete slabs on the eastern third, and 3.5-foot-thick concrete slabs on the western two thirds. Eight 1.5-inch-diameter cores were cut through the spillway stilling basin slab. Five cores were cut on December 13, 2013 through the 3.5-foot-thick portion of the slab. Three cores were then cut through the 5-foot-thick slab on December 16, 2013. Two additional cores were cut on the west side of the stilling basin end sill through a varying thickness concrete apron. Coring locations are shown on **Figure 36** and the results of the coring along with an estimate of the relative density of the soils under the slab are summarized in **Table 9**. The relative density of the soils immediately beneath the slabs was estimated by pushing a piece of rebar with a welded t-handle into the soils (T-probe).

Table 9 Spillway Stilling Basin and Downstream Apron Coring Details

Core No.	Slab Thick. (in)	Approximate Void Depth (in)	Piezometric Water Elevation Relative to Top of Slab	Notes
C-1	43	8	Water drained through hole to soil below, water moving rapidly in void	Dense soils below void
C-2	43	No Void	Water level at top of slab	Dense soils at bottom of slab
C-3	45	2[3]	Water level at 9.5 in. below top of slab	Dense soils below void
C-4	41	2	Water level at 10 in. below slab top of slab	Soil Probe indicated loose soils for 18-inches below void
C-5	41	2[3]	No water pressure, water equalized at top of slab	Soil Probe indicated loose soils for 18-inches below void
C-6	60[1]	No Void	Water level at 7 in. above top of slab	No probe reading could be taken due to core not being extracted
C-7	59	1[3]	Water level at 7 in. above top of slab	Soil Probe indicated stiff soils below void
C-8	62.5	No Void	Water level at 4.5 in. above top of slab	Soil Probe indicated stiff soils below void
C-9	34	20[2]	Water level not measured	Soil Probe indicated stiff soils below void
C-10	55	2	Water level not measured	Soil Probe indicated stiff soils below void

1- Approximate depth of slab. Could not measure actual depth due to core breaking off in hole
2- Void present but some over drilling occurred. Soil found in coring cuttings.
3- Void found was likely caused by water pressure from coring operation

It is important to consider the rapidly moving water found in the void at C-1. Its position 18 inches north of the south training wall base slab is significant. Refer to **Figure 5**. There is a sheet pile cutoff wall under the end sill of the stilling basin in this location. This sheet pile does not extend under the training wall base slabs. Hence, the proximity of C-1 to the south training wall base slab and the position of the downstream sheet pile cutoff wall indicate that this void probably extends underneath the training wall base slab.

Both of the voids discovered under the concrete apron and under the stilling basin floor slab with rapidly moving water are definitive evidence of the formation of a pipe(s) under the spillway upstream of the Manatee River.

It is also important to note that the elevation of the top of the stilling basin floor slab is 7 feet. Based upon the water elevation measurements in each of the core holes, the uplift pressure under the floor slab corresponds to a piezometric water elevation that ranges from a little more than El. 7.5 feet to a little less than El. 6.5 feet. As previously mentioned, the designed uplift pressures for the stilling basin floor slab most likely corresponds to a piezometric water elevation greater than El. 11 feet, because this is the outfall elevation of the underdrain system. Hence, the voids under the stilling basin are lowering the uplift pressures below the design values and are presently acting as an efficient underdrain system.

6.0 DISCUSSION AND CONCLUSIONS

This final section summarizes the historical inspection data in conjunction with the Amec Foster Wheeler supplemental inspection data relative to the internal erosion and piping mechanism at the Lake Manatee Dam. Conclusions are then drawn about the deteriorating condition of the dam and the need for emergency repairs to prevent a breach of the embankment.

Based upon the results of the Amec Foster Wheeler supplemental investigation and a review of the historical data, an internal erosion and piping failure mechanism has been identified at the Lake Manatee Dam. One way to stop the breach of an embankment dam by an internal erosion and piping failure mechanism is to provide a barrier to internal erosion that halts the movement of soil particles. During design, such a barrier can be provided by a properly designed filter. After construction, a seepage cutoff wall is often the method of choice and was recommended at the Lake Manatee Dam.

6.1 Critical Observations from Historical Data

The following is a summary list of critical observations from the historical data and the Amec Foster Wheeler supplemental inspection data that were used to conclude that internal erosion and piping are occurring at the dam. Each of these have been previously discussed in this report.

a) Vortices in the reservoir above the embankment during low water operations

b) Large voids behind the both downstream training walls, including a 20-cubic-yard sinkhole after a prolonged and high flow release

c) Extensive void network with rapidly moving water under the stilling basin floor slabs, downstream training wall base slabs, and downstream concrete apron

d) Formation of sediment island in the downstream river channel dating back to at least 1973 (six years after the dam when into service)

e) Voids, depressions, erosion, settlements and loss of embankment materials immediately behind downstream training walls and under adjacent concrete structures such as stairways and support pads

f) Depressions, erosion, voids and loss of material along the two sheet pile cutoff walls and between the sheet piles under the bridge deck approach slabs

g) Very loose/soft soils, loss of drilling fluid circulation near the bottom of the embankment core in close proximity to the service spillway

h) Very loose soils at and below the top of the downstream training wall base slabs with corresponding low piezometric water elevations

i) Voids, depressions, and loss of material above water underneath the soil-cement slope cover and adjacent to the approach walls

j) Voids, depressions, undercutting and loss of surface protection materials beyond the downstream training walls and on the downstream riverbanks

k) Ponding of water in toe drains with large displacements between adjacent pipe sections

l) Lower than designed uplift pressures under the stilling basin and water pressures behind the training walls

m) Approach wall and downstream training wall deflections with no apparent changes in loading conditions

When presented together through the data integration process demonstrated in this report, this list provides a very strong indication that a serious internal erosion and piping failure mechanism was active at the Lake Manatee Dam and justifies the conclusion provided by Amec Foster Wheeler to representatives of Manatee County on February 13, 2014 that:

1) Lake Manatee Dam is in a severely distressed state; and,
2) Without immediate intervention there is a high risk of an uncontrolled release of reservoir, most likely following a large rainfall event and opening of the service spillway.

6.2 Interpreted Failure Mechanism

The observations just summarized are consistent with the development and progression of an internal erosion and piping failure mechanism. The available data suggest that shortly after construction a pipe developed underneath both downstream training walls at their western edge and progressed back upstream towards the reservoir. The contribution factors to the initiation of the erosion probably including:

1) a hydraulically connected backfill drain and stilling basin underdrain system with inadequate backflow prevention;
2) a toe drain system with no backflow prevention;
3) an unlined discharge channel immediately adjacent to the end sill of the stilling basin;
4) no seepage cutoff under the downstream training walls;
5) a deep borrow pit excavated upstream of the dam near the south shore of the lake and within 1,500 feet of the service spillway that cut through the designed confining layer for the embankment;
6) regional artesian pressure condition in the aquifer immediately below this confining layer; and,
7) reportedly poor soil compaction processes, a pipe developed underneath both downstream training walls at their western edge and worked its way back upstream towards the reservoir.

Initiating Event

The pipe(s) under the training walls and stilling basin of the Lake Manatee Dam probably initiated at the toes of the downstream training wall base slabs beyond the end sill in the area where the discharge channel was originally bare earth. **Figure 37** has been prepared to help illustrate how the pipe(s) could have initiated. In this figure, the original plan view for the stilling basin and cut earthen discharge channel are presented. A plan view and section for the western end of the downstream training wall is also presented along with an idealized cross section (A-A) drawn through the western end of the southern training wall. The same design detail is present on the western end of the northern training wall.

According to the original design drawings, the downstream discharge channel had a bare earth surface starting at El. 7 feet, NAVD 29, (also corresponding to the top of the training wall base slabs) and then graded down to El. -1 foot, NAVD 29, where it met the original river channel. As previously discussed and as a result of open toe drain outfalls and the charging of the backfill and underdrain systems, during a release of water through the spillway the backfill soils in the immediate vicinity of the training wall are expected to have become saturated during a prolonged release.

The bottom of the training wall base slab is at El. 3 feet, NAVD 29, the original ground surface in this area was at approximately El. 17.5 feet, NAVD 29, and the backfill height is up to El. 28 feet, NAVD 29. Thus, as much as 10 feet of additional soil weight was placed during the construction process over the native soils just beyond the heel of the training wall. Refer to **Figure 37**. The native clayey soils present at the approximate depth of the base slab for the training walls probably consolidated after the fill was placed, leading to a gap along the bottom of the pile-supported base slabs at the heel.

Following a high tail water, a rapid drawdown condition would have been present behind these walls. As scouring occurred on the bare earth channel bottom, the backfill soils at the toe of the training walls (originally only 4 feet thick) would have at least partially eroded. The previously described gap along the bottom of the base slabs at the heel would have been full of water under the total head conditions in the now saturated backfill. If the tail water elevation (and the corresponding head in the backfill soils) was at El. 21 feet, NAVD 29, (considered to be a conservative number based upon historical observations), this rapid drawdown condition with a gap under the base slab would have created a vertical gradient well in excess of 1, in the soils in the river channel in front of the training wall base slab. With such a large vertical gradient, the soils in front of the retaining wall would have liquefied and a significant amount of material would have been lost from underneath the base slab. This would have occurred even if there was no previous loss of soils due to scour in the discharge channel.

With this initial pipe and under the action of lateral gradients from the reservoir and vertical gradients from the underlying aquifer, soils probably eroded internally from both the embankment and the underlying confining layer, were transported into this pipe network and eventually carried out into the downstream river channel forming a sediment island.

When the concrete apron was placed over the discharge channel floor after construction but before the first inspection by the Corps of Engineers in 1978, probably slowed down the piping process. However, the pipes eventually extended under the apron, then progressed backward under the stilling basin floor slab, and likely have worked their way upstream to the two seepage cutoff walls on either side of the service spillway bridge deck. With much shorter seepage paths resulting in higher gradients, embankment and foundation materials in the vicinity of these two sheet pile cutoffs and near the approach walls have been eroded and transported downstream into the river channel.

6.3 Conclusion

Based upon the information presented in this report and to Manatee County representatives on February 13, 2013, Lake Manatee Dam was in a significantly distressed state with a high risk of an uncontrolled breach caused by an internal erosion and piping failure mechanism and following a prolonged high tailwater release from the service spillway.

7.0 REFERENCES

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FIGURES

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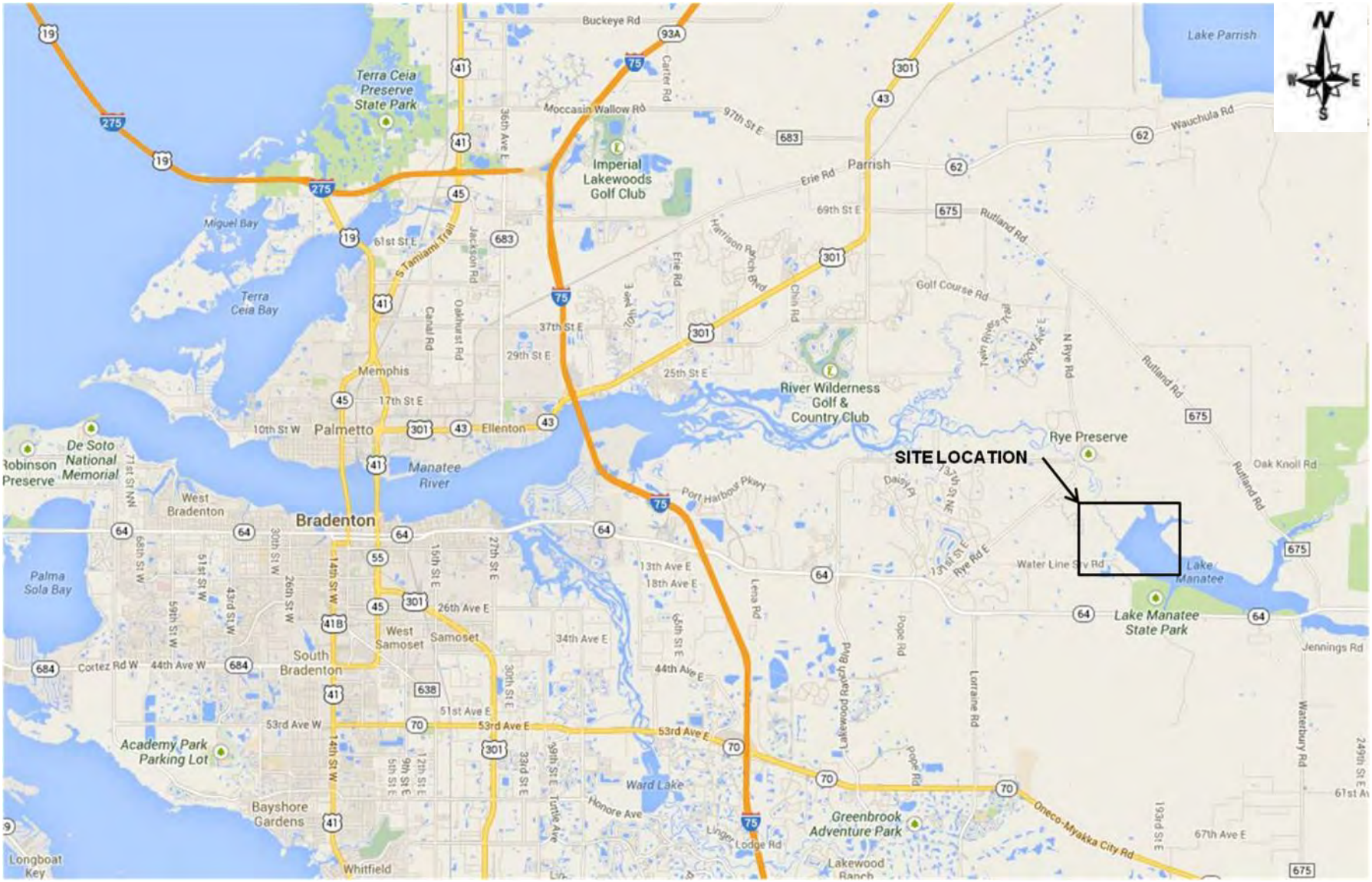
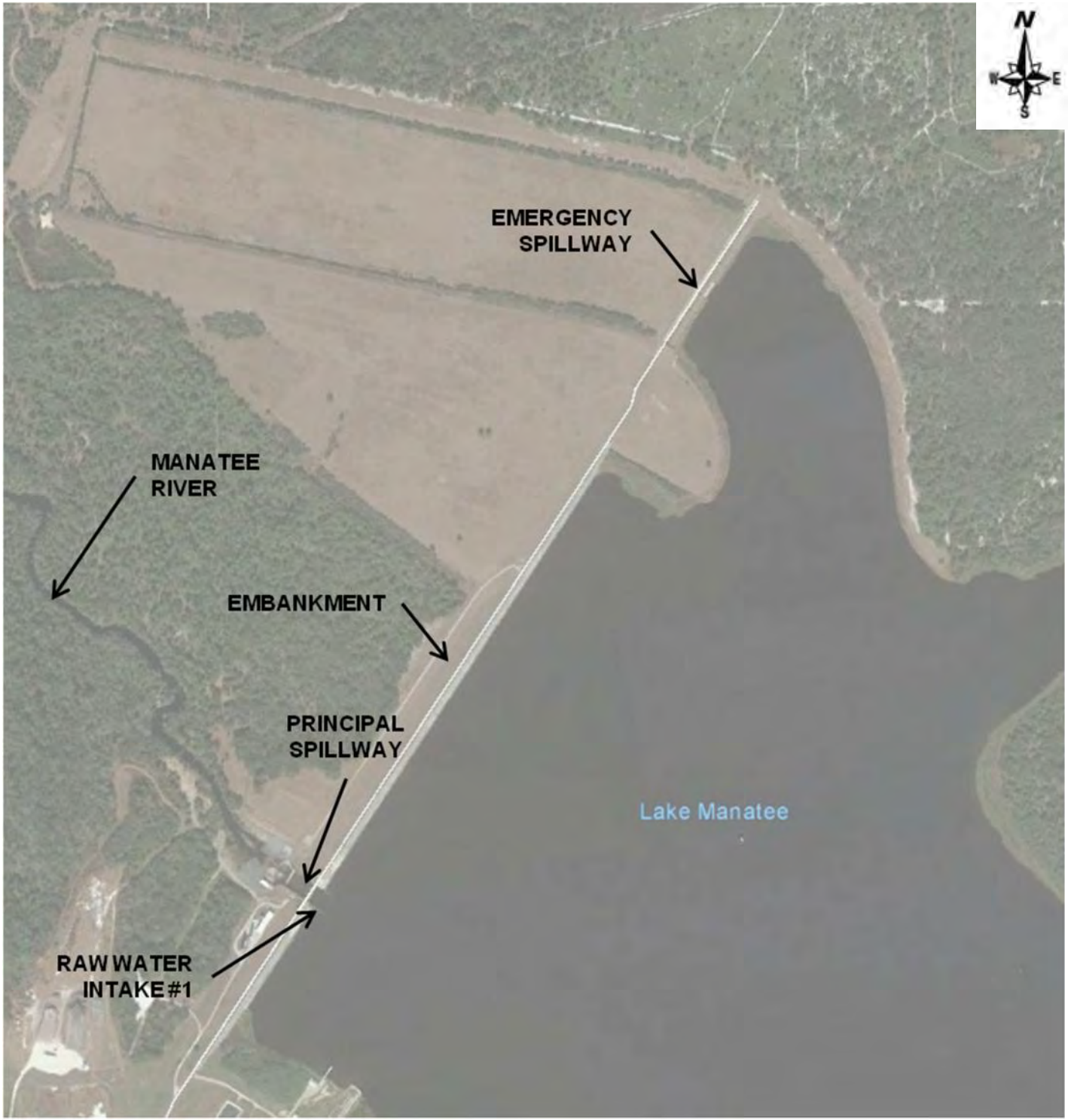


LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 1
Site Location Map

DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



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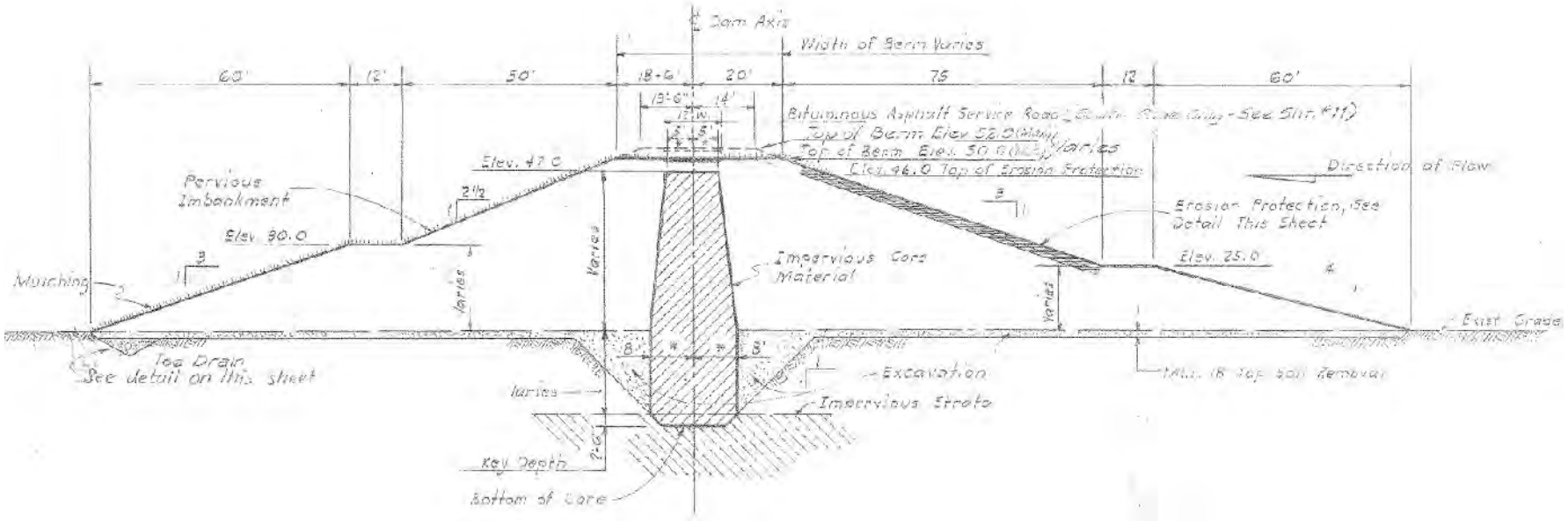
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 2
Aerial Photograph of Dam and Spillway

DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



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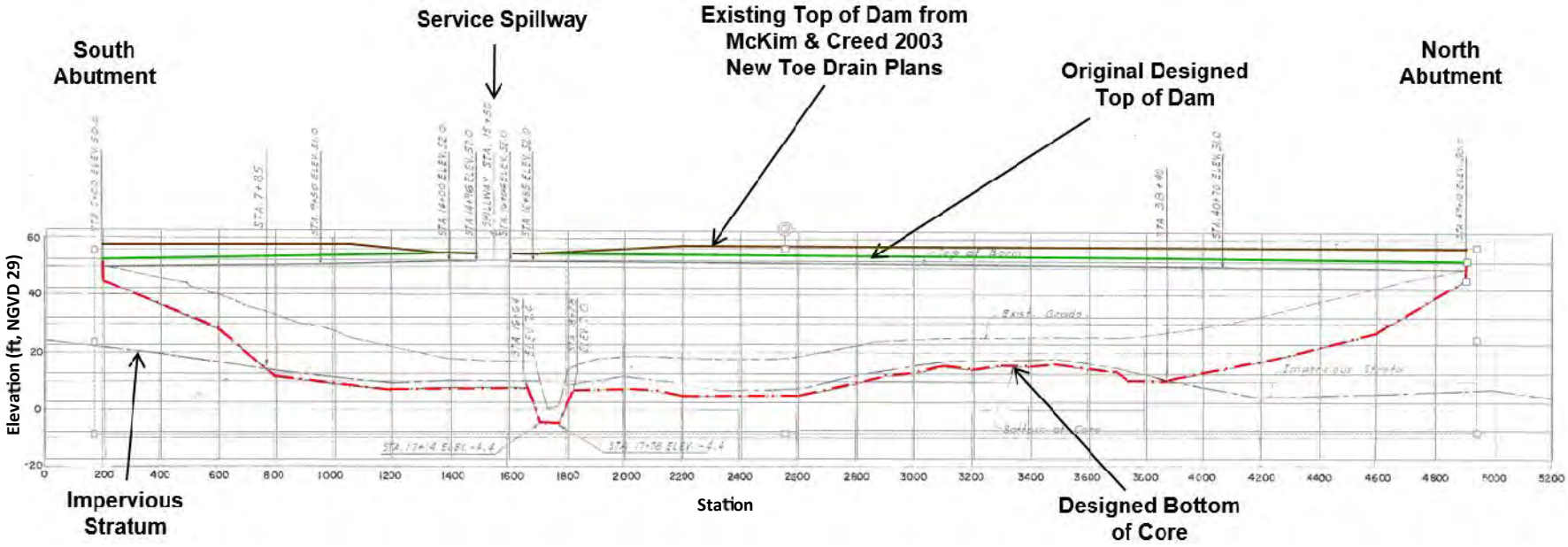
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 3
Original Embankment Cross Section

DATE:	01/24/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



Key Locations

Station 7+85	Core trench rises out of impervious stratum south of service spillway. South of this location the core of the dam was not designed as a seepage cutoff
Station 14+96	South side of service spillway
Station 15+50	Centerline of service spillway
Station 16+04	North side of service spillway
Station 17+14	Start of deepest portion of core trench in old river channel at El. –4.4 ft
Station 17+78	End of deepest portion of core trench in old river channel at El.—4.4 ft
Station 38+40	Core trench rises out of impervious stratum on north of service spillway. North of this location the core of the dam was not designed as a seepage cutoff

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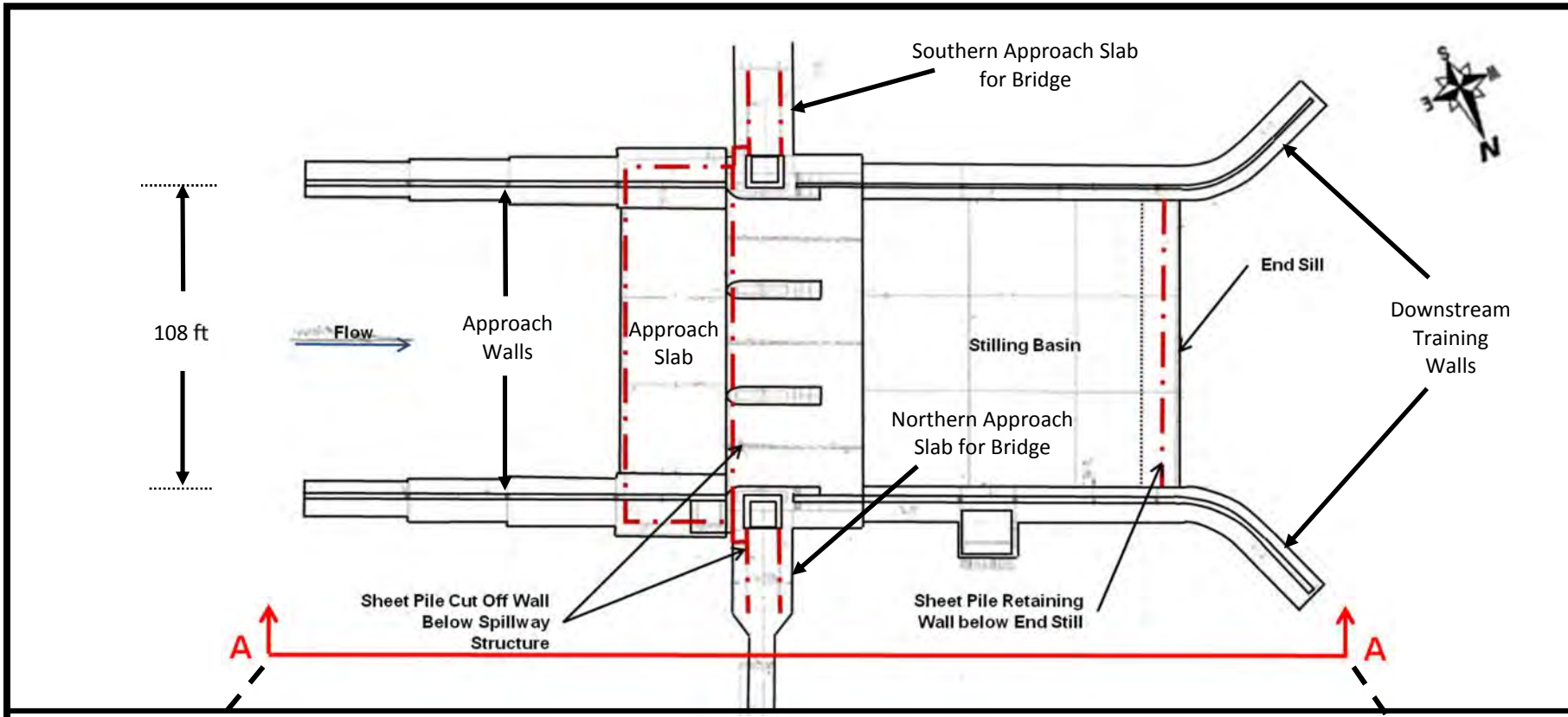
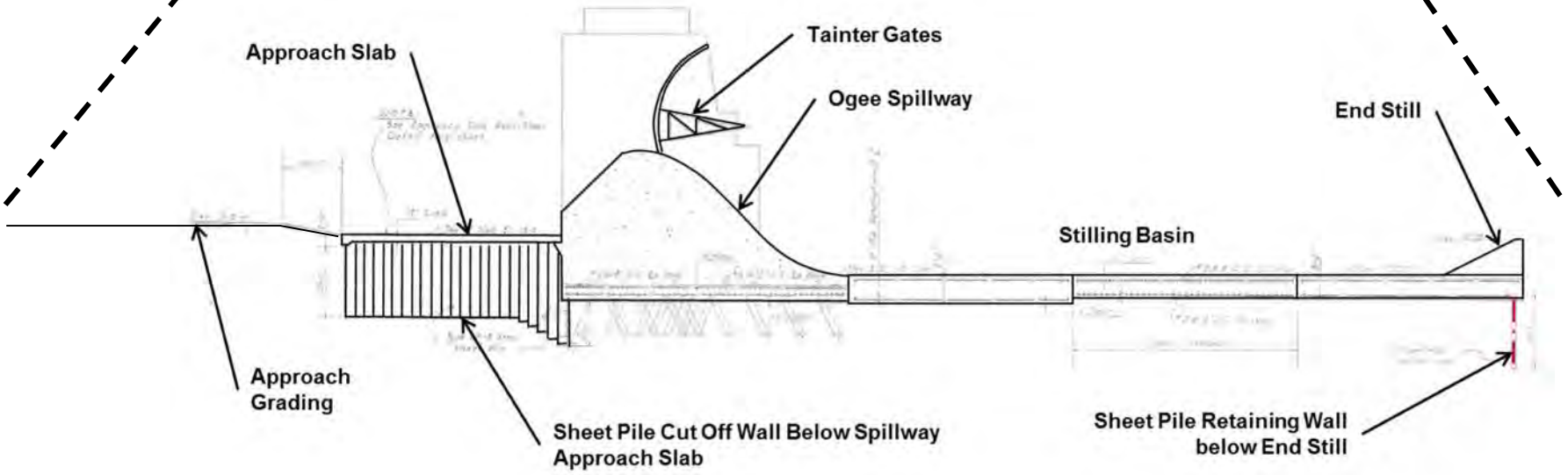
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 4
Longitudinal Profile of Embankment and Bottom of Core Trench

DATE: 01/24/14
PROJECT NO.: 300472x2
DRAWN BY: NJD
SCALE: N.T.S.





Section A-A

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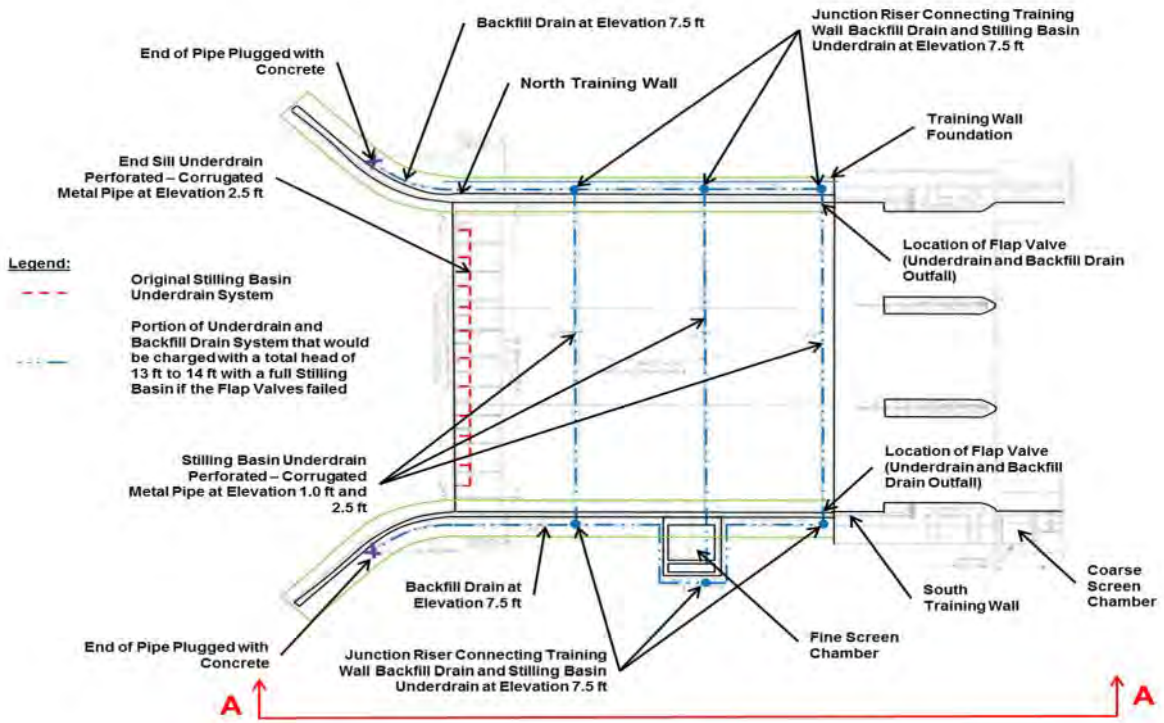
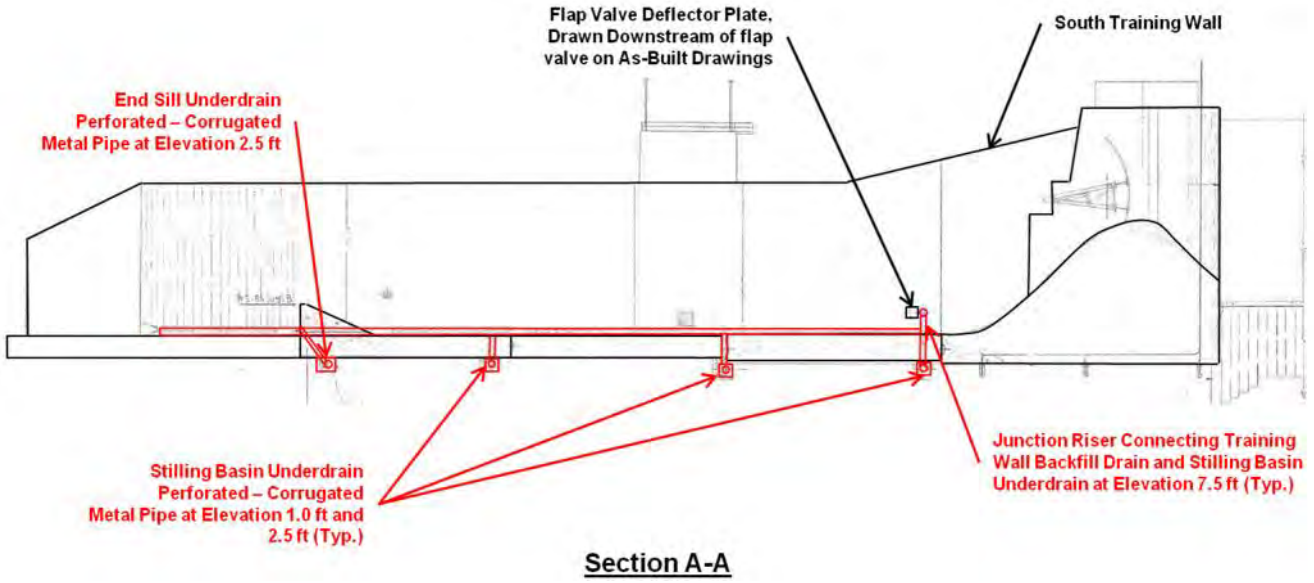
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 5
Service Spillway Plan and Cross Section from Original Drawings

DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.





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LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 6
Plan and Section View of Backfill and Underdrain System for Training Walls and Stilling Basin

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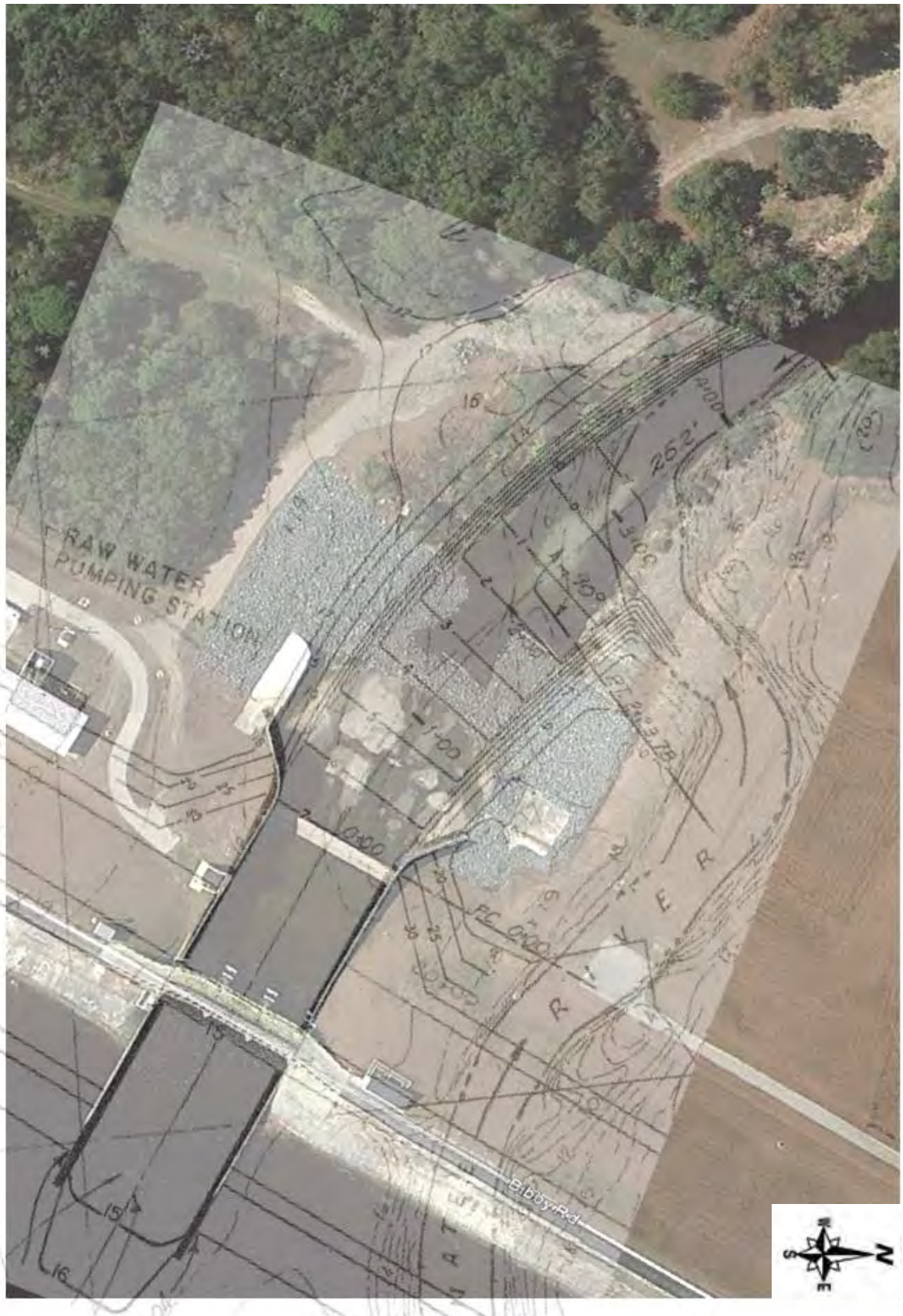
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 7
Aerial View of Service Spillway with Original Grading Plan Overlay

DATE: 9/22/14
PROJECT NO.: 3004722
DRAWN BY: NJD
SCALE: N.T.S.

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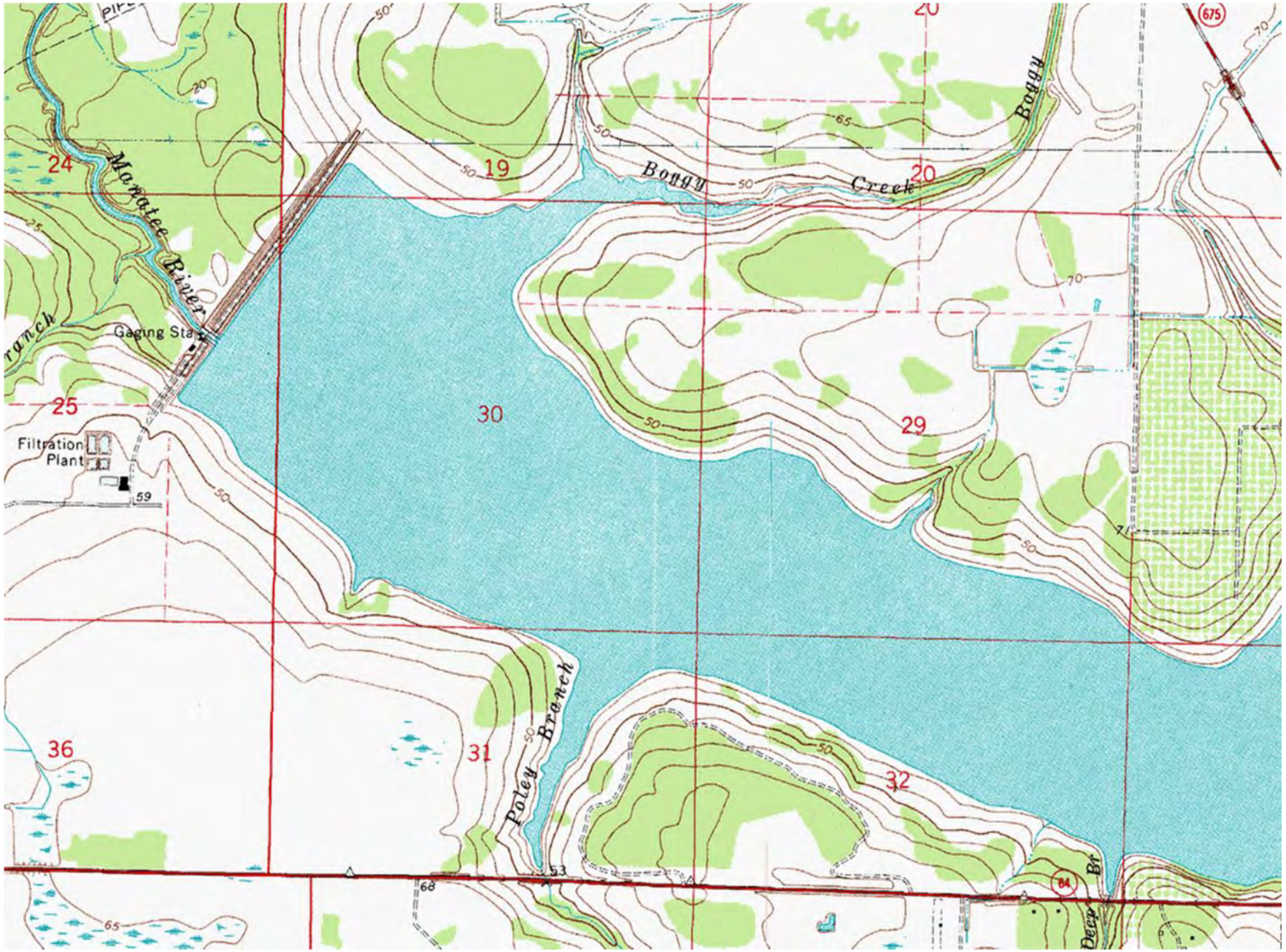

5-ft Contour Line Intervals

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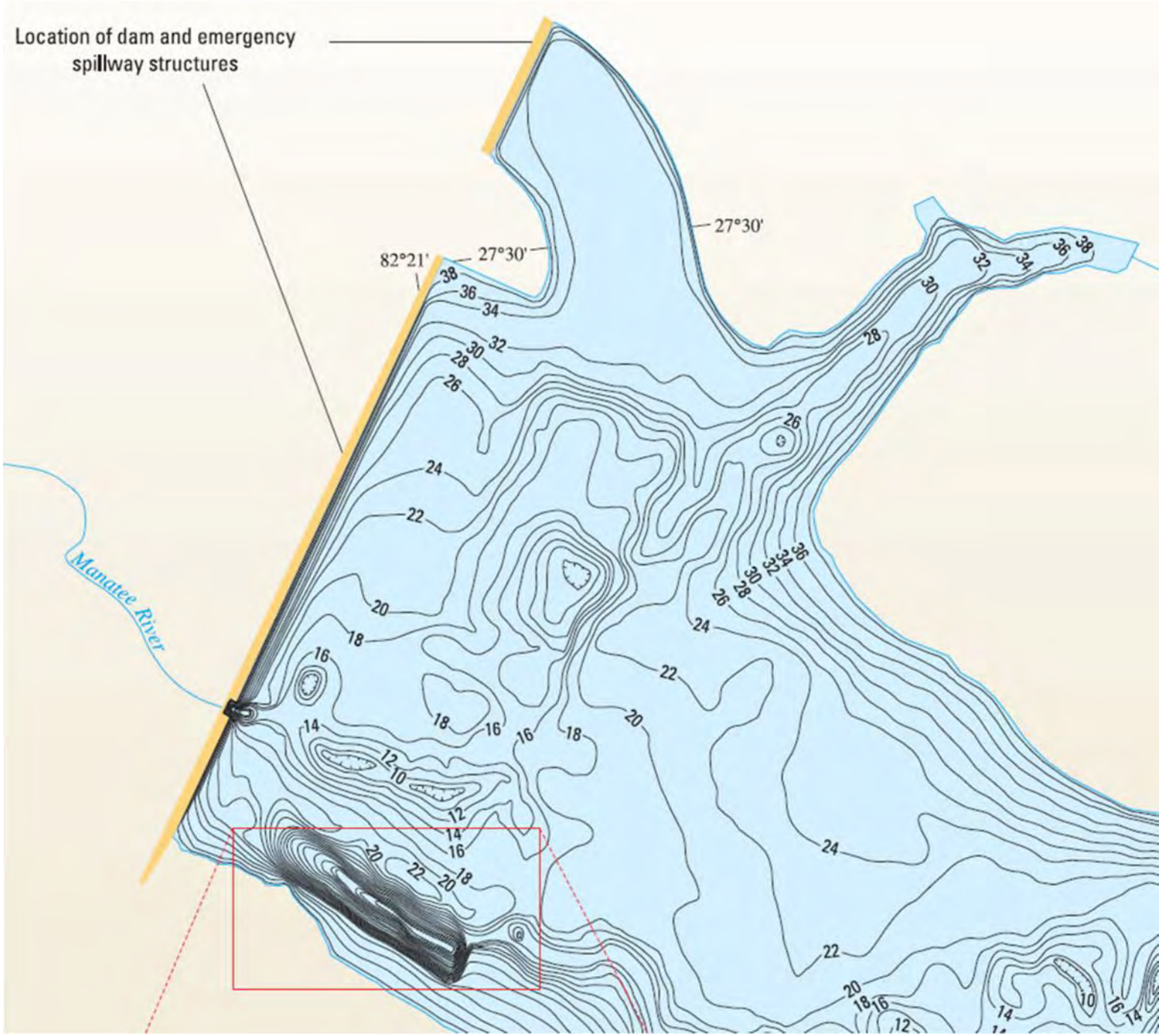
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 8
Topographic Map of Lake Manatee Dam Prior to Emergency Spillway

DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



2– ft Contours Based on NAVD 88

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LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 9
Bathymetric Survey of Lake Manatee Dam, USGS 2009

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PROJECT NO.:	300472x2
DRAWN BY:	NJD
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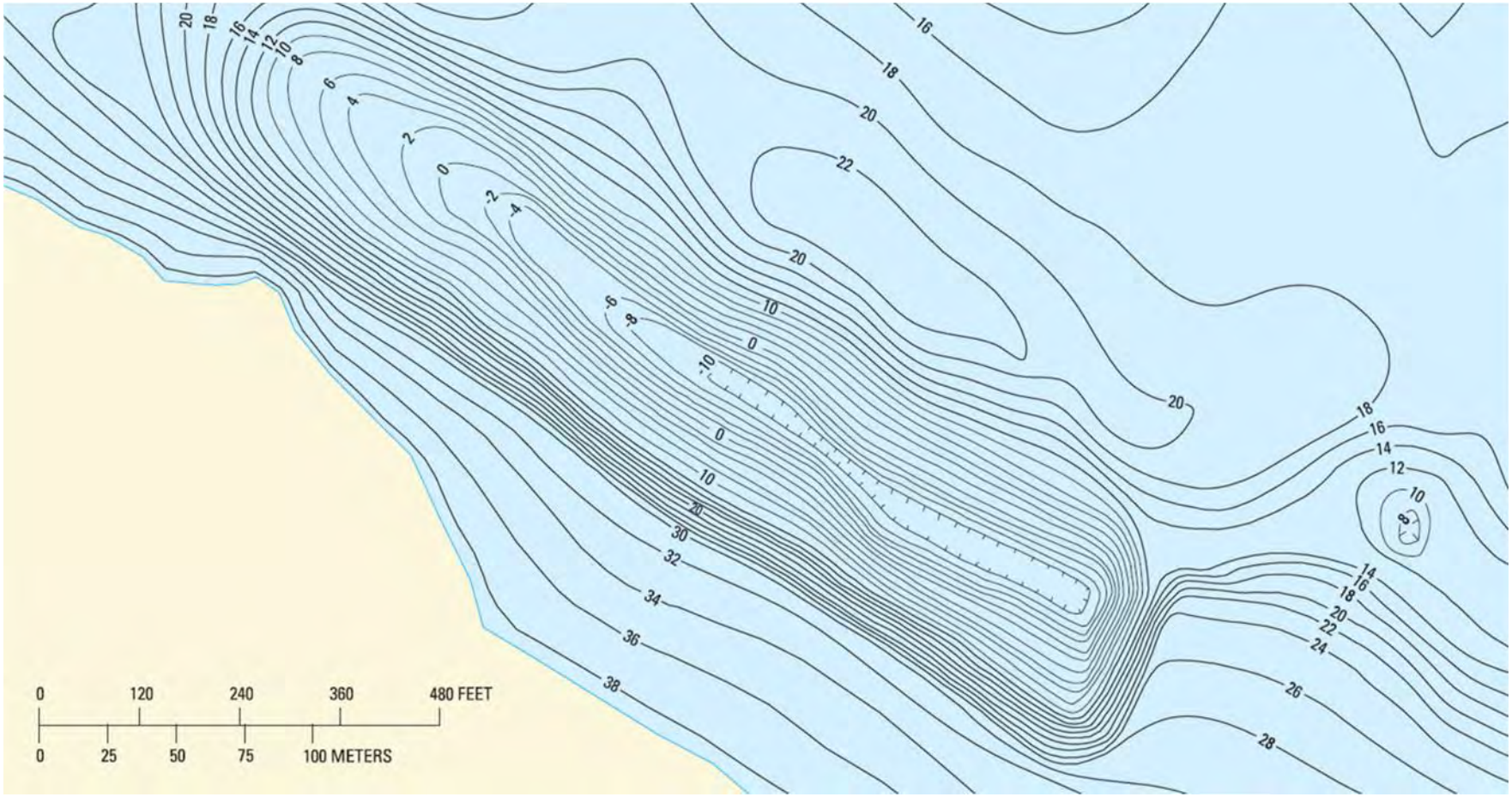


2-ft Contours Based on NAVD 88

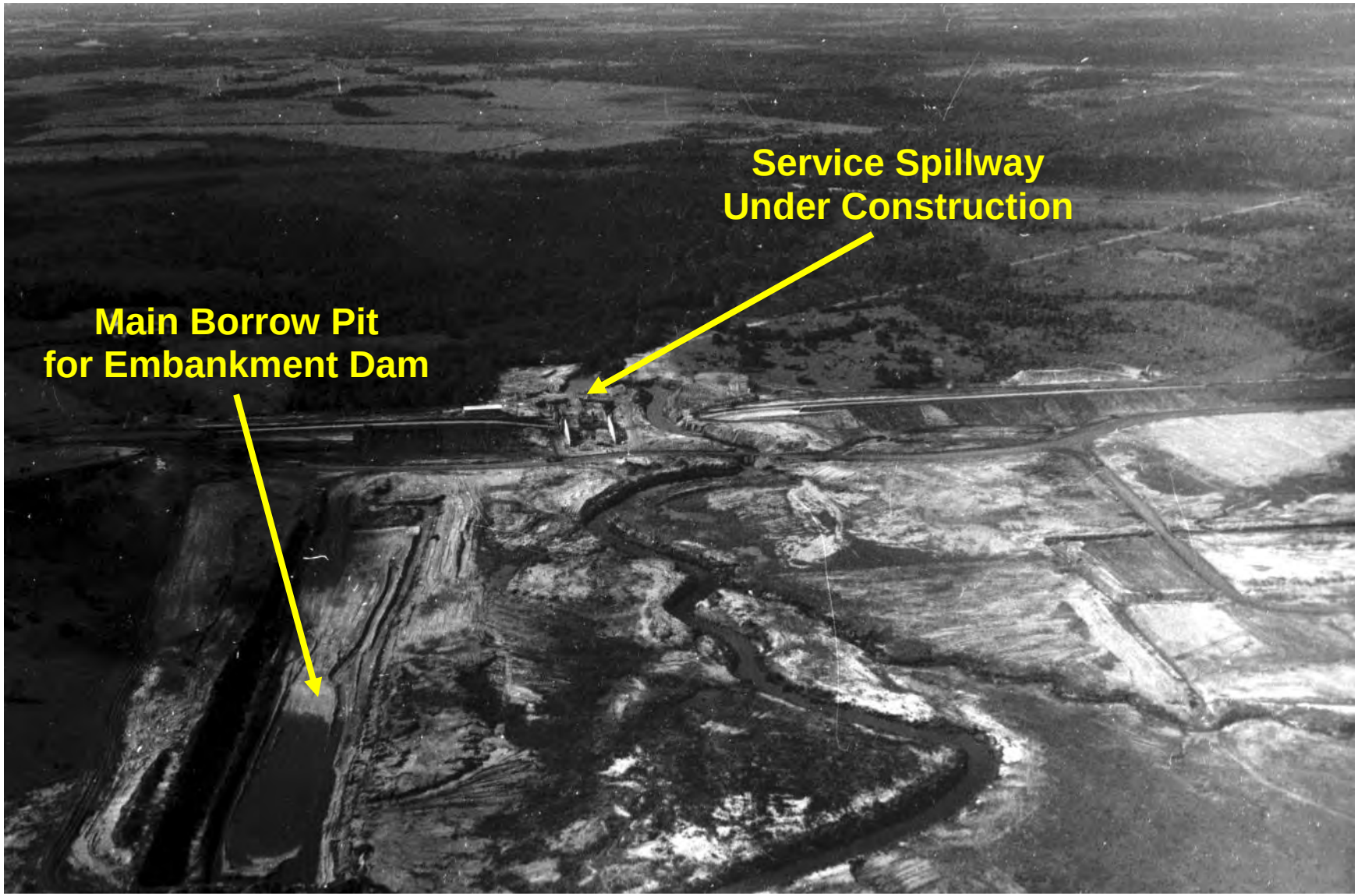
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 10
Bathymetric Survey of Main Borrow Pit, USGS 2009

DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.

Aerial Photograph Provided by Manatee County Library

Archive # 14753-A, September 30, 1966



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LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 11
Aerial Photograph of Main Borrow Pit During Construction

DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.

GEOLOGIC MAP OF MANATEE COUNTY FLORIDA

BY
KEN CAMPBELL P.G. #192
1993

FLORIDA GEOLOGICAL SURVEY EST. 1907

WALTER SCHMIDT
STATE GEOLOGIST AND CHIEF

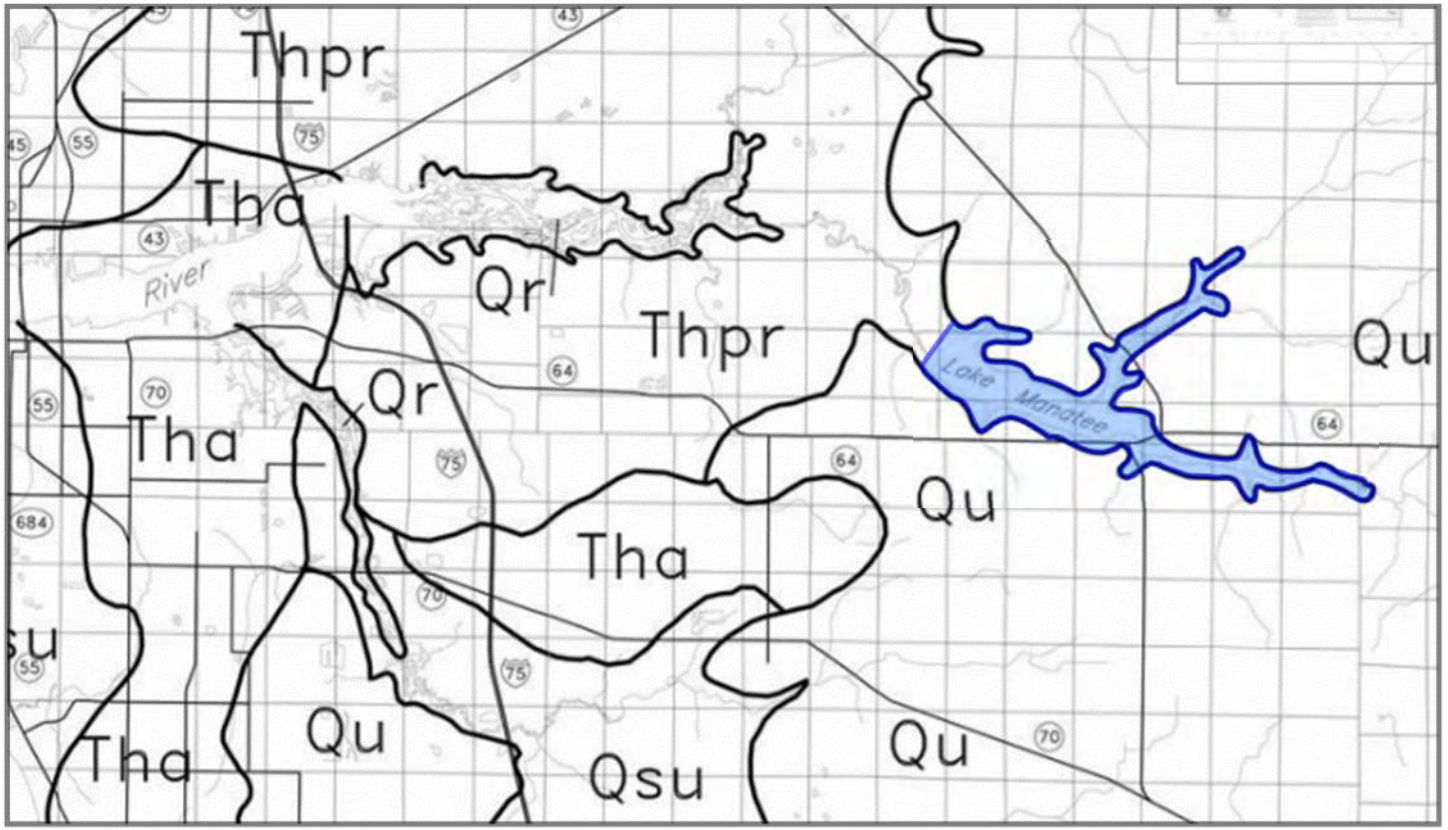
Qu– Undifferentiated surficial sands, clayey sands, clays, marls and peats >20 feet thick. No formations recognized.

TERTIARY

Tha– Arcadia Formation (undifferentiated) of the Hawthorn Group. Consists predominantly of carbonates which are variably quartz and phosphate sandy and clayey. Sand and clay beds are often present. Dolostone is generally the dominant carbonate component except in the Tampa Member.

Thpb–Bone Valley Member of the Peace River Formation, Hawthorn Group. Consists of pebble– or gravel–sized phosphate fragments and sand–sized phosphate grains in a matrix of quartz sand and clay. Percentages of the various components are highly variable.

Thpr–Peace River Formation of the Hawthorn Group. Consists of interbedded quartz sands, clays and carbonates, all of which are variably phosphatic.



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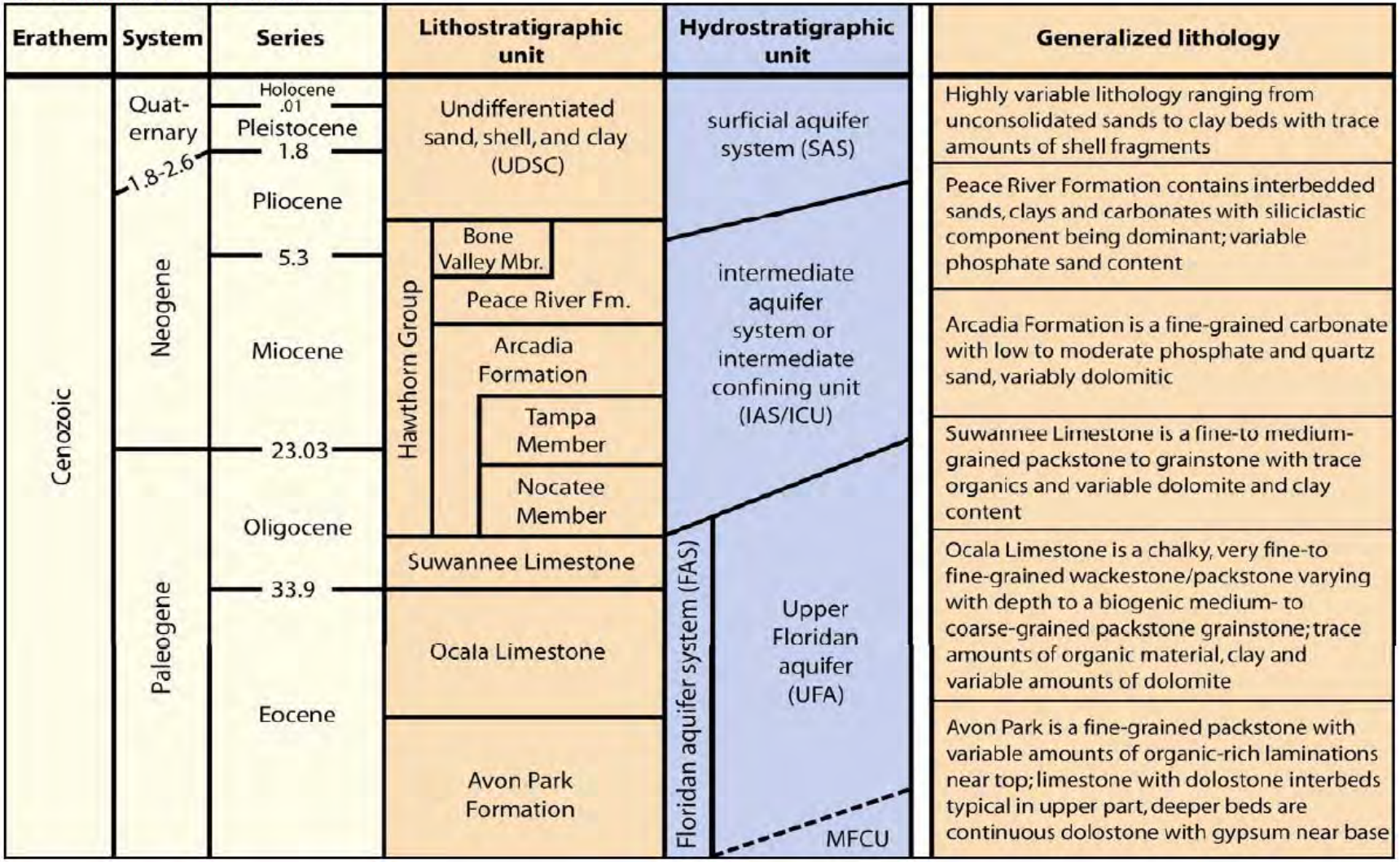
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 12
Geologic Map of Lake Manatee Dam Area

DATE: 9/22/14
PROJECT NO.: 300472x2
DRAWN BY: NJD
SCALE: N.T.S.

Table 2. Generalized correlation chart for units mapped within study area (ages compiled from Covington, 1993, Missimer et al., 1994, Scott et al., 1994, and Wingard et al., 1994). Numbers are million years before present. Ages are included for reference only and are not scaled to correlate with all columns in the table. MFCU is Middle Floridan confining unit; UDSC includes the Tamiami, Ft. Thompson and Caloosahatchee Formations.



(from Florida Geologic Survey Bulletin 68)

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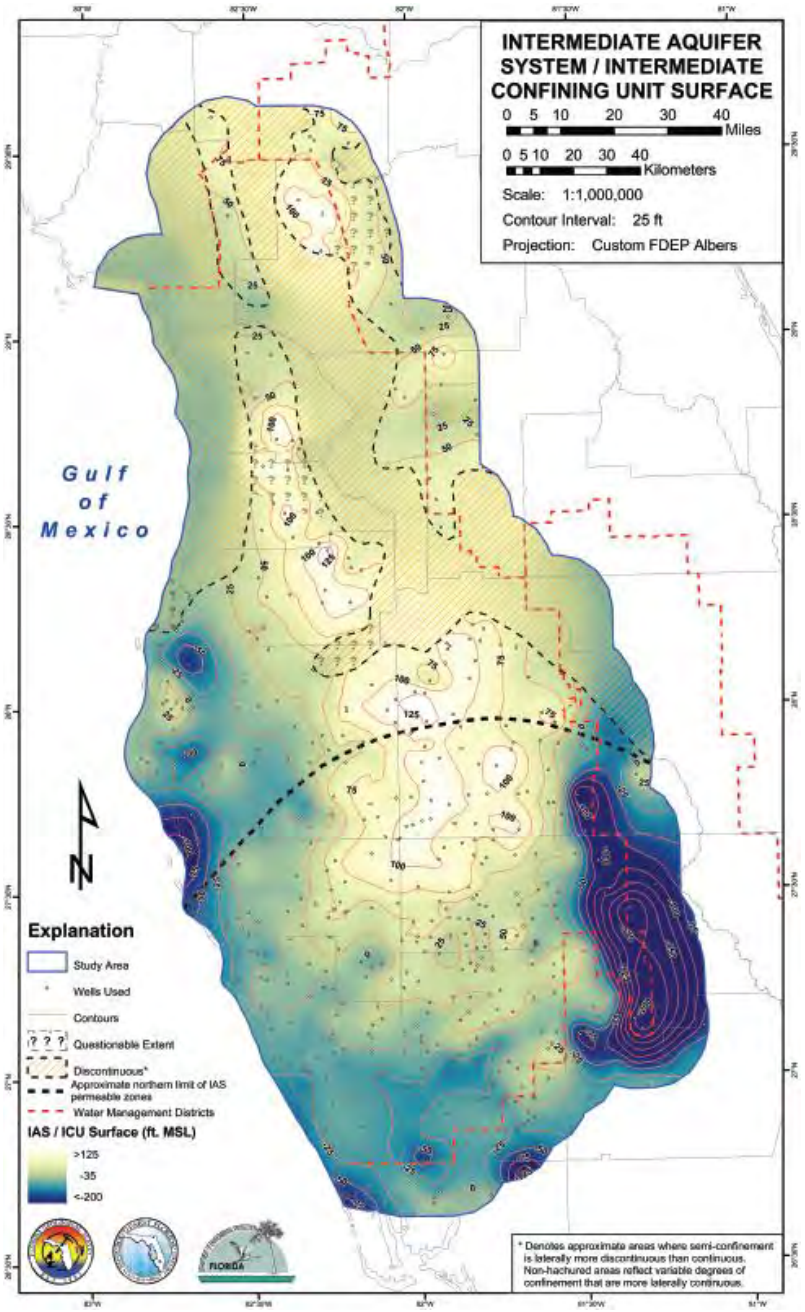
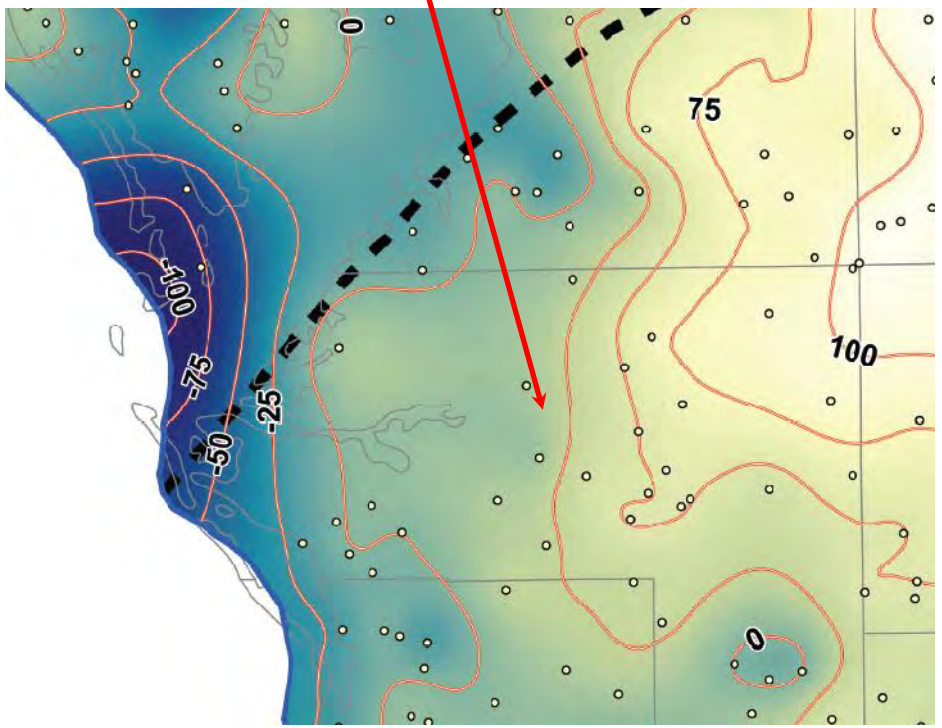
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 13
Generalized Correlation Chart for Lithostratigraphic and Hydrostratigraphic Units Near lake Manatee Dam

DATE: 9/29/14
PROJECT NO.: 300472x2
DRAWN BY: NJD
SCALE: N.T.S.



Approximate Location of Lake Manatee Dam



(from Florida Geologic Survey Bulletin 68)

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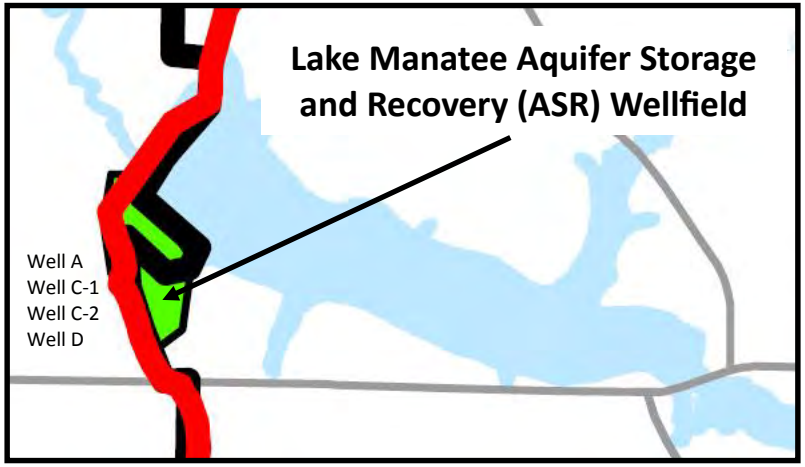
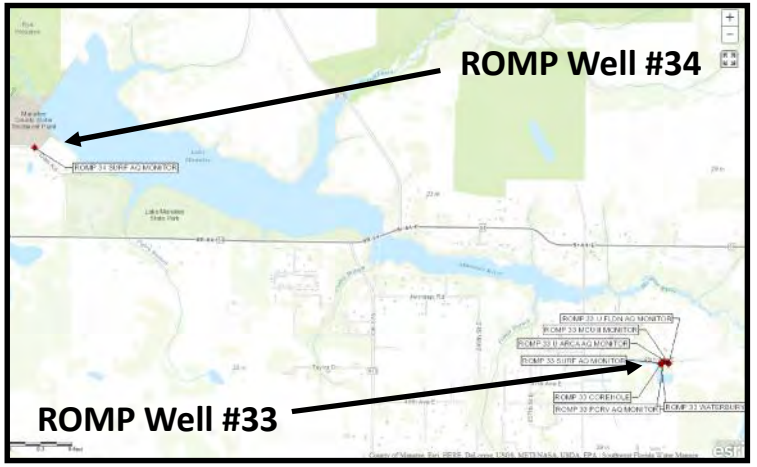
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 14
Estimated Top of Intermediate Aquifer System / Intermediate Confining Unit

DATE:	9/29/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.





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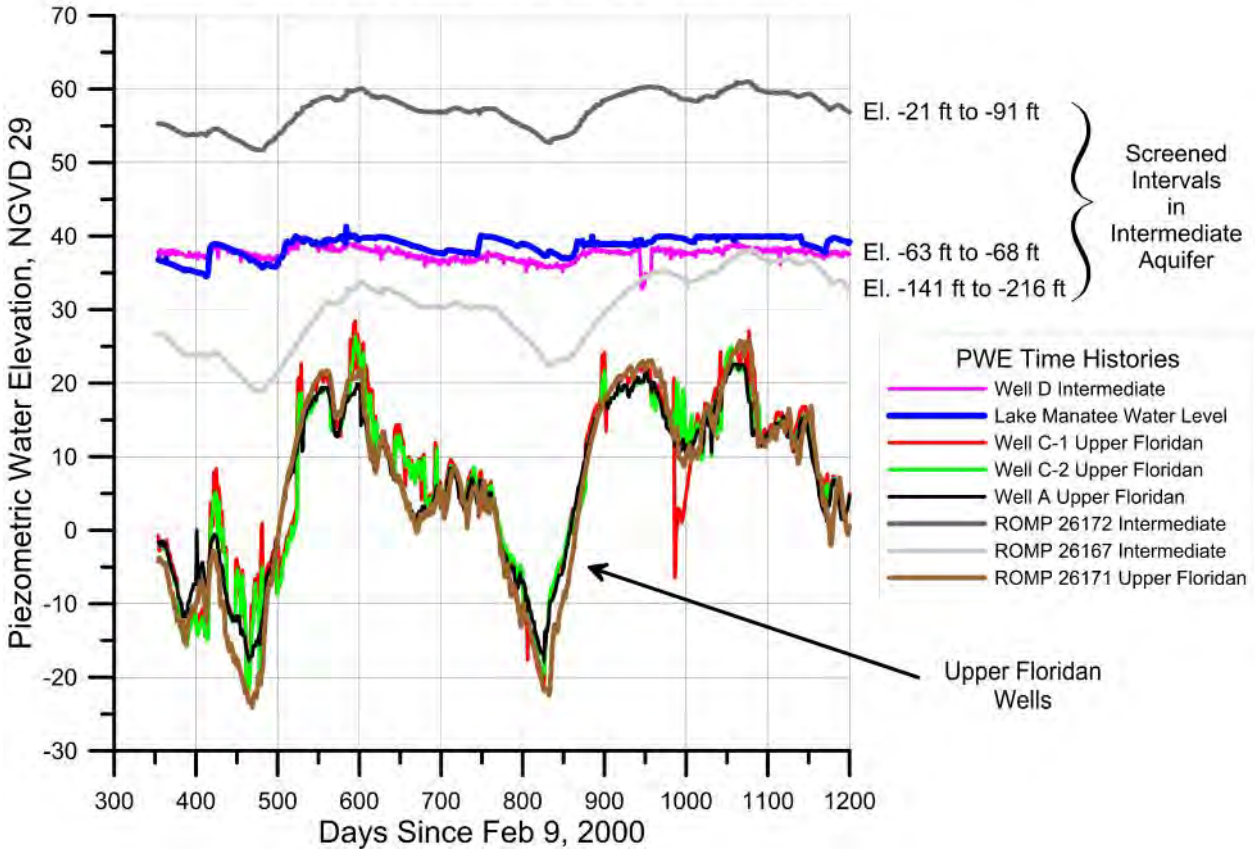
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 15
Lake Manatee ASR Wellfield and Locations of Wells #33 and #34
SWFWMD Regional Observation and Monitor-well Program (ROMP)

Lake Manatee Dam Aquifer Piezometric Water Elevations
ASR Well Field and ROMP #33



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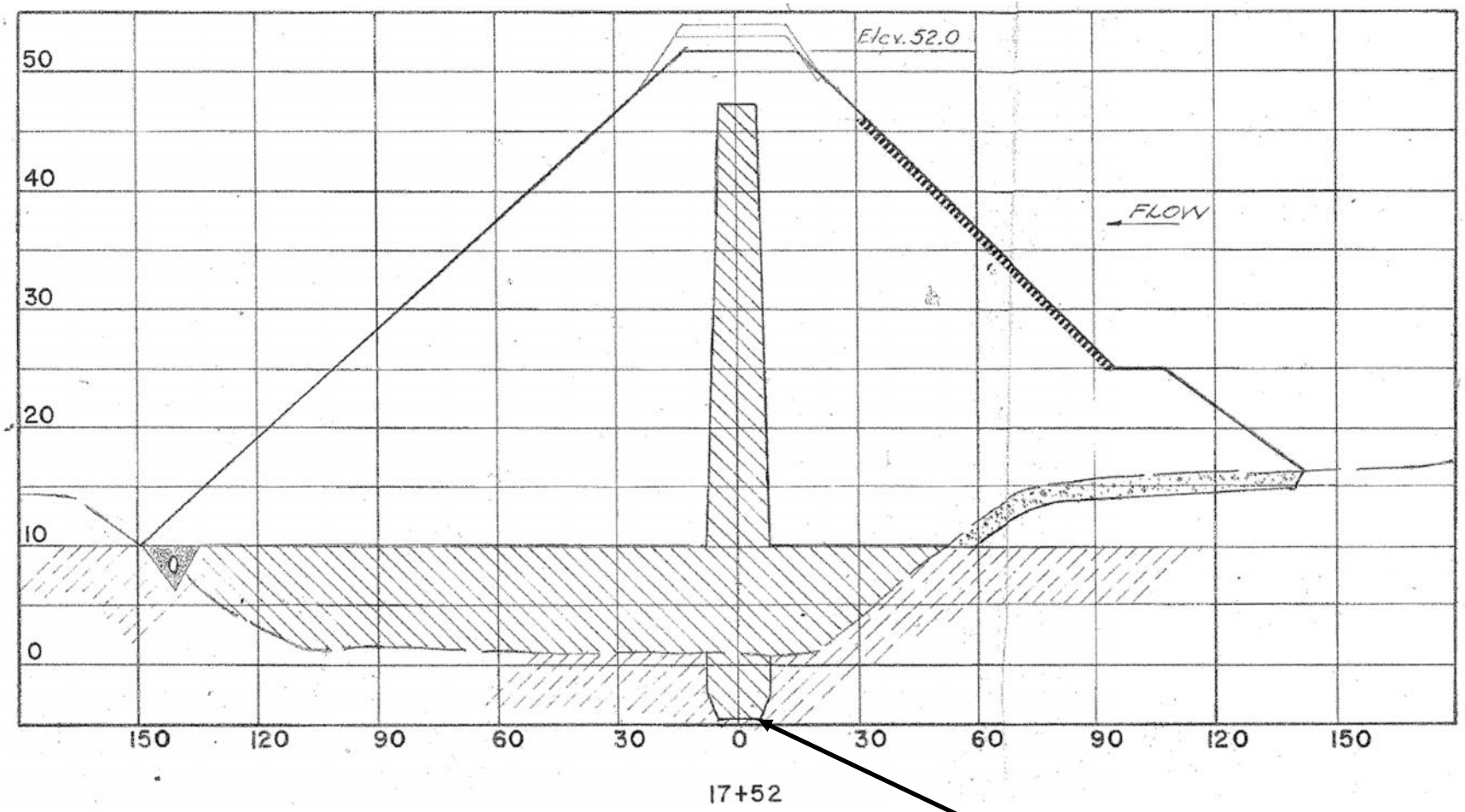

Deepest Cut at El. –4.4 ft

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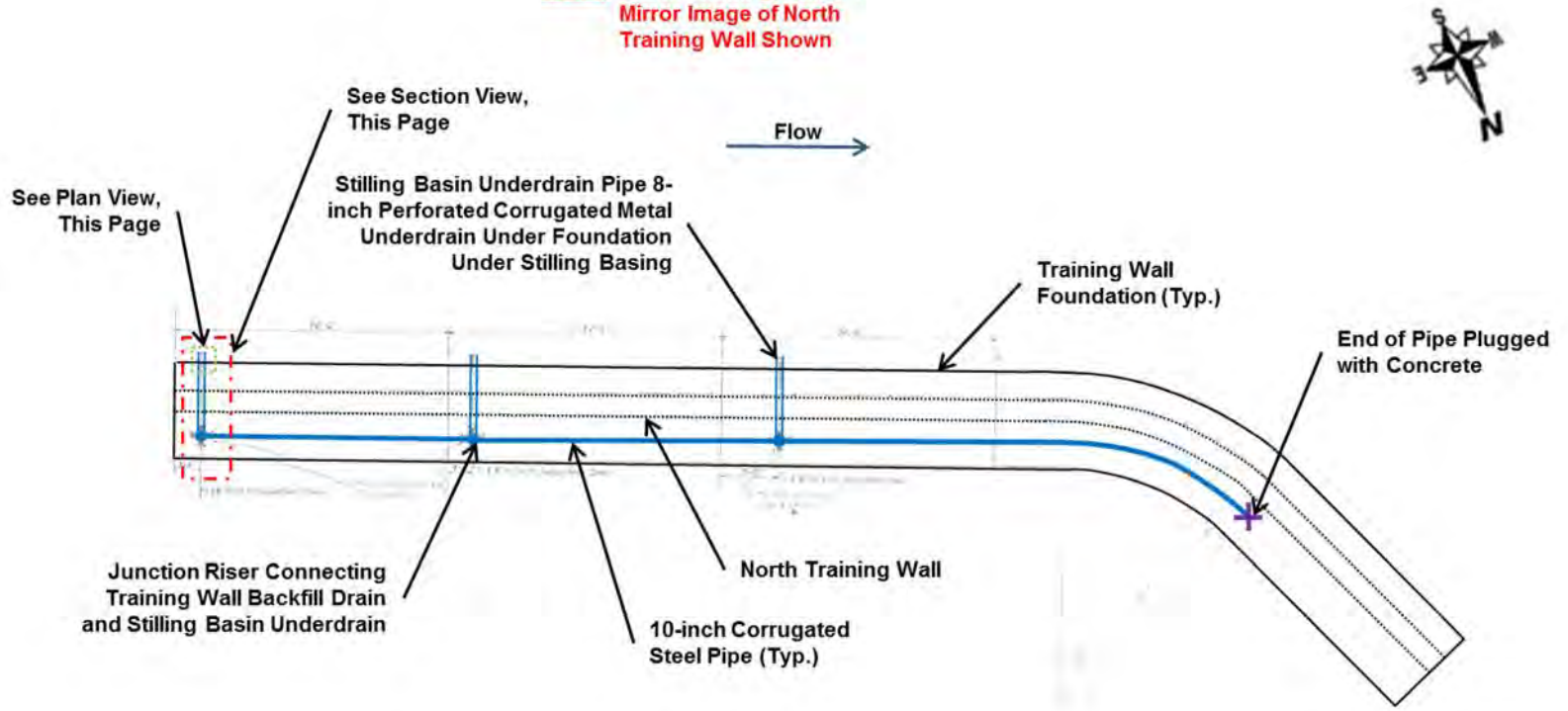
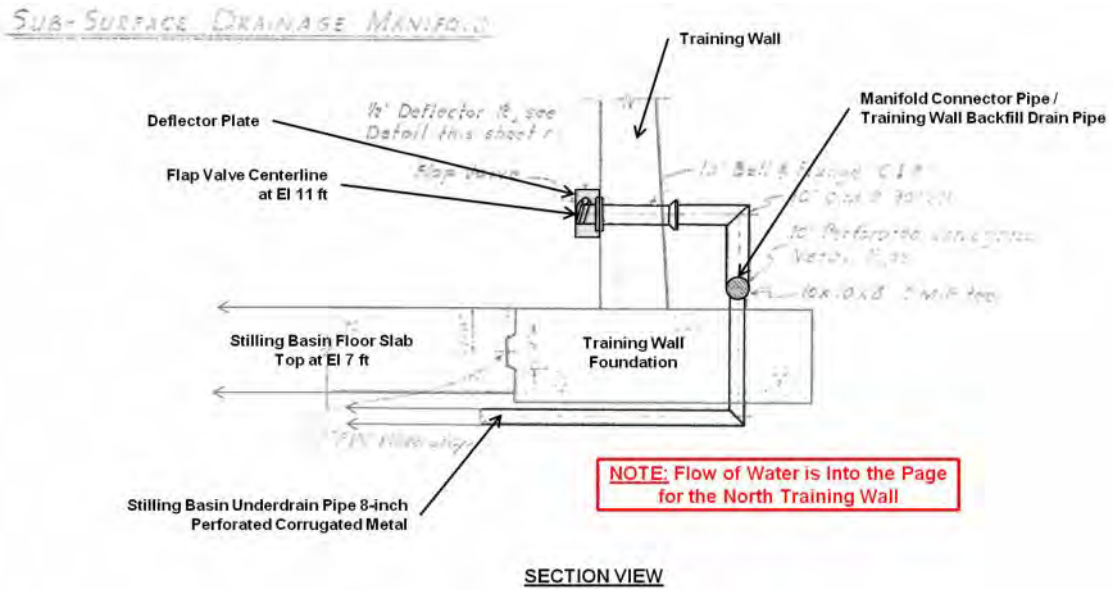
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 16
Deepest Cut Section at STATION 17+52

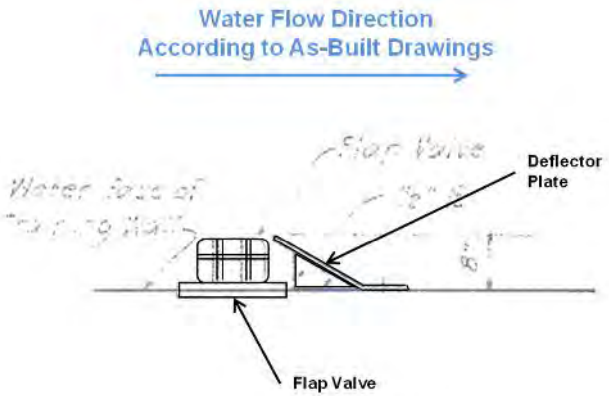
DATE:	9/22/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.

NOTE: South Training Wall is a Mirror Image of North Training Wall Shown





SECTION VIEW



PLAN VIEW

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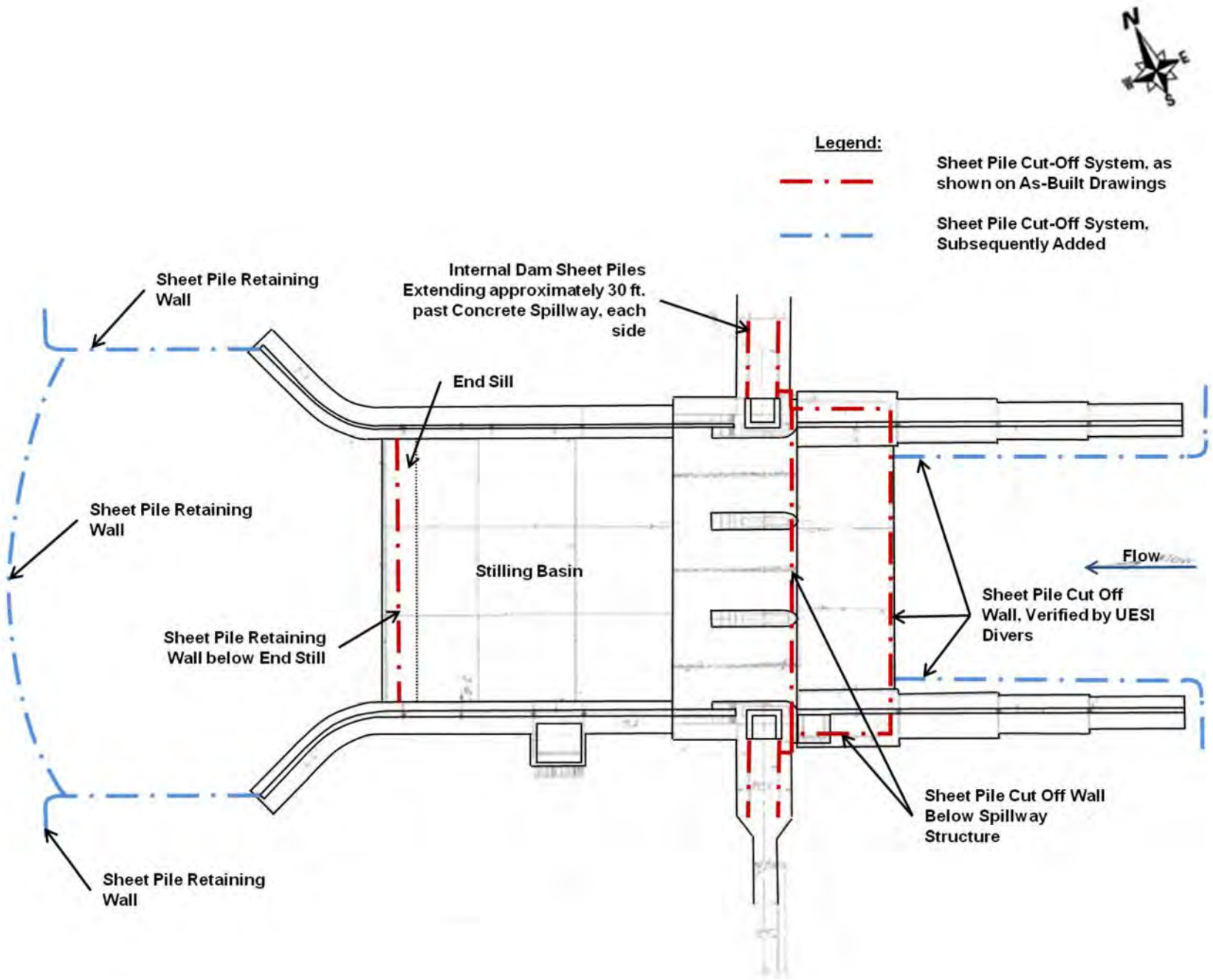
LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 17
Flap Valve and Deflector Plate Detail

DATE:	9/23/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



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LAKE MANATEE DAM
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FIGURE 18
Plan View of Current Sheet Pile Seepage Cutoff System

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SCALE:	N.T.S.

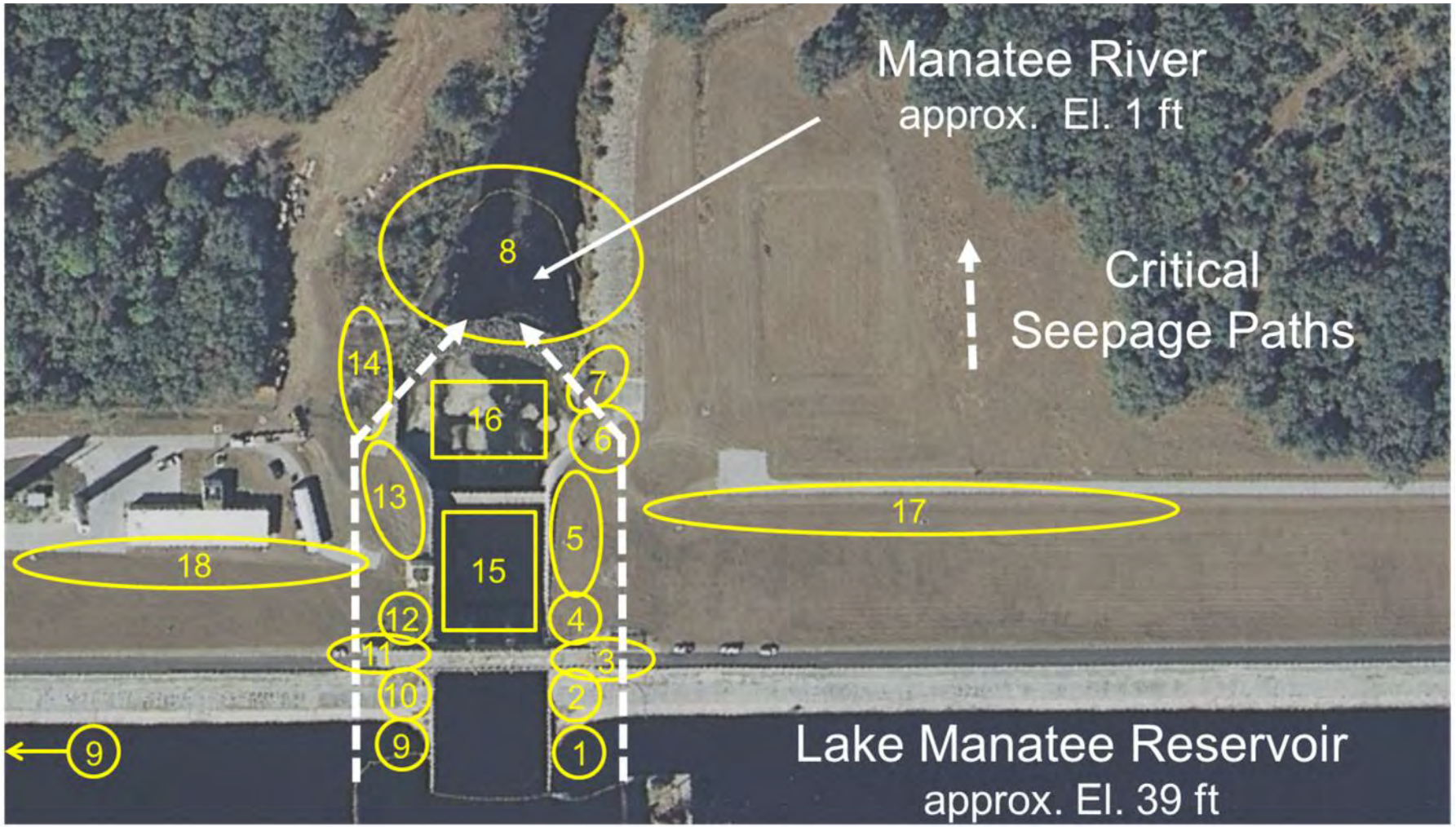

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FIGURE 19
Critical Seepage Paths and Locations of Significant Observations
From Historical Inspection Reports

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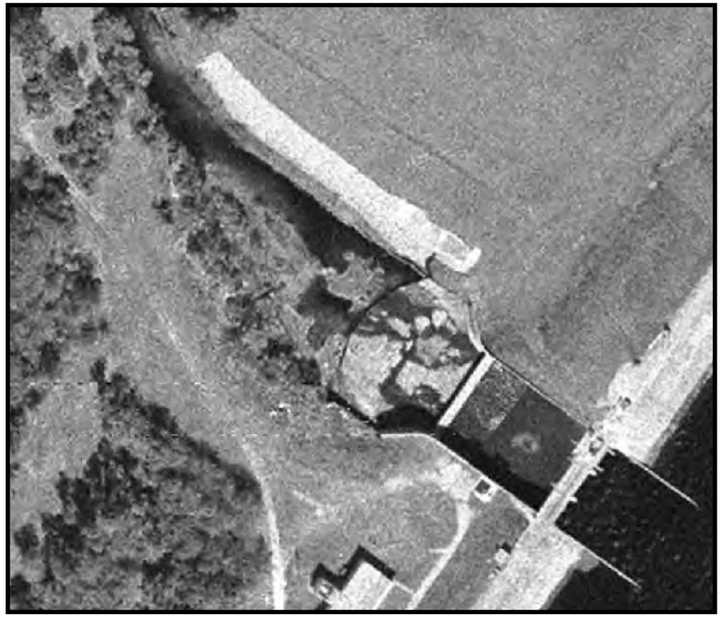
1973

1978

1984

1994



2003

2013

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FIGURE 20
Aerial Photographs Showing Development of Sediment Island and Riverbank Erosion

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During Construction
by
Florida Testing Laboratories

a) Sheepsfoot roller modified by welding on widened steel plates

b) Compaction rollers being pulled at 12 to 15 mph

c) Soil processing did not create uniform water content

d) Most of the density tests performed on embankment fill materials did not meet compaction requirements

LAKE MANATEE DAM
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FIGURE 21
Historical Observations During Construction as Documented by Corps of Engineers During 1978 Inspection

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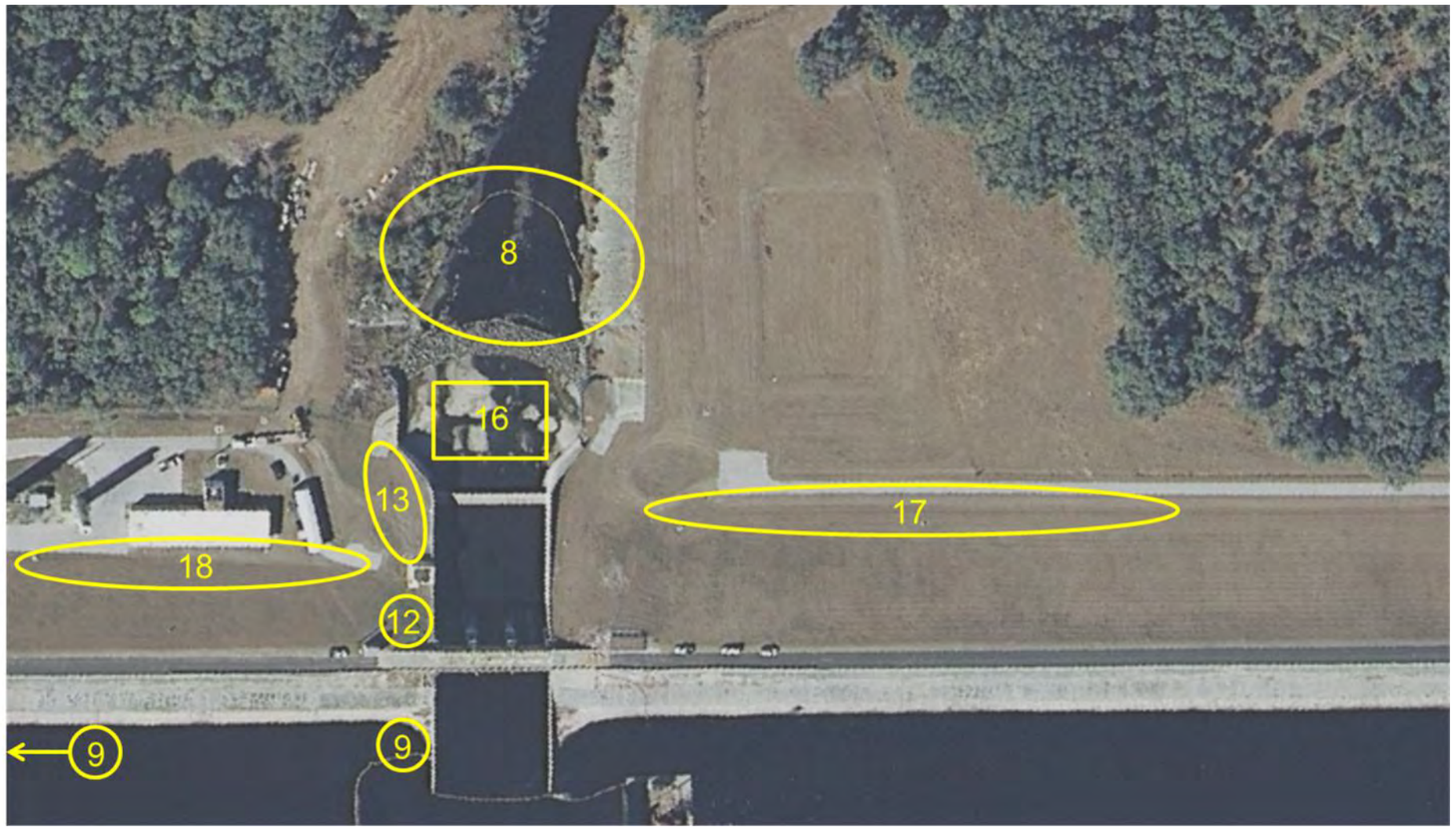

First Inspection (1978)
by
U.S. Army Corps of Engineers

8) Bench and scarps have formed on the banks of the river channel

9) Vortices in reservoir STA 8+00 and at raw water intake reported by dam operators

12) Loss of soil under concrete steps behind south training wall

13) Depression 4' diameter 3' deep behind south training wall

16) Excessive erosion downstream of stilling basin, concrete over riprap added

17) Nearly continuous series of depressions in the toe road

18) Wet spots that occur occasionally on upstream side of toe road and multiple depressions in service road

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 22
Critical Observation Locations in Corps of Engineers Phase I Inspection

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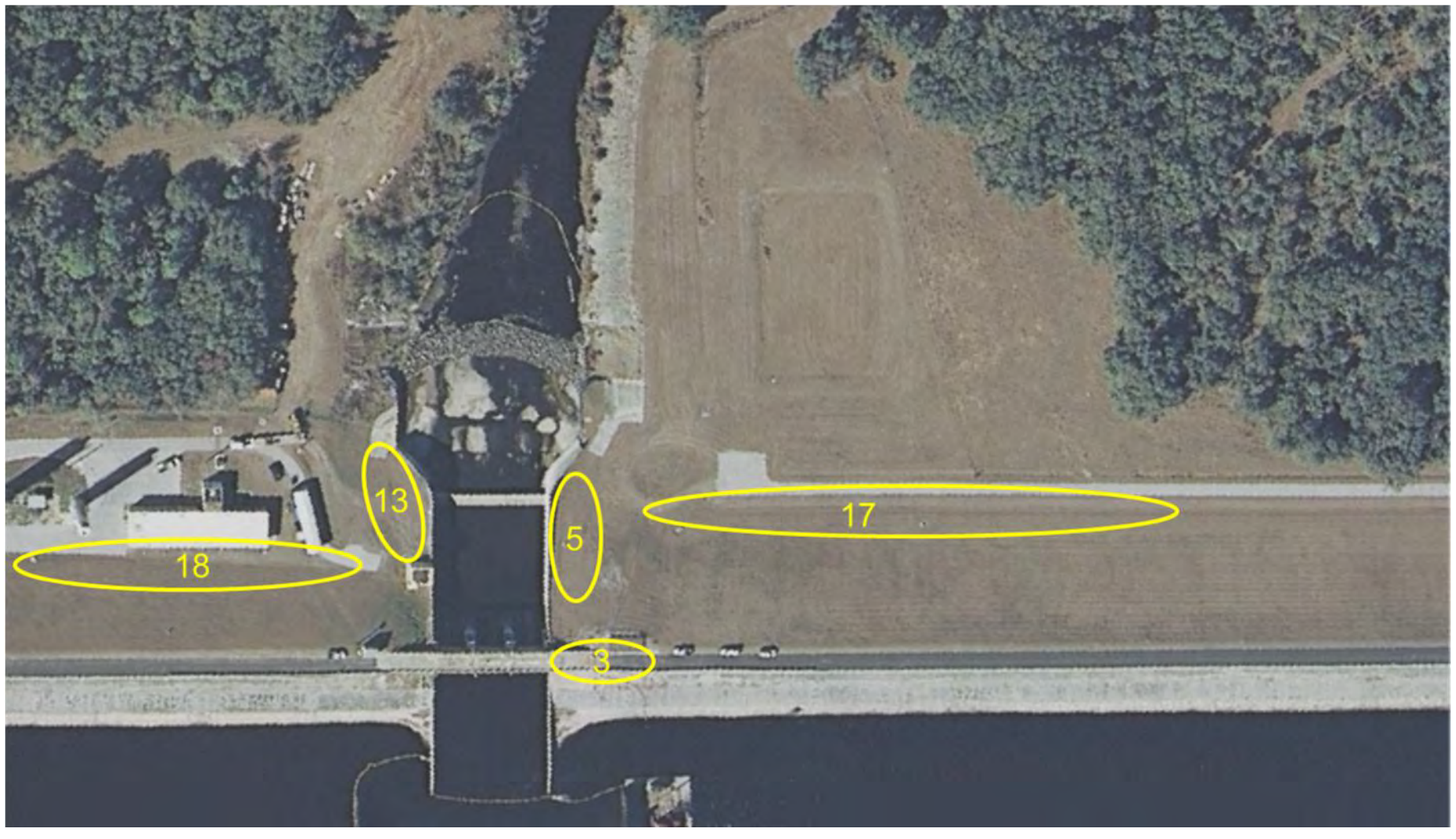

Second Inspection (1979)
by
Bromwell Engineering, Inc.

a) Multiple boreholes in embankment with lost circulation, low blow counts and W-O-H materials

3) Very loose conditions at bottom of core at STA 17+00

5) Erosion of downstream slope just north of spillway continues

13) Depression 3' diameter 2' deep behind South Training Wall

17) Possible artesian pressures at STA 17+50 in toe area

18) Toe drain not functioning, wet spots and practically continuous series of depressions along toe of south embankment

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 23
Critical Observation Locations in Bromwell Engineering, Inc., Phase II Inspection

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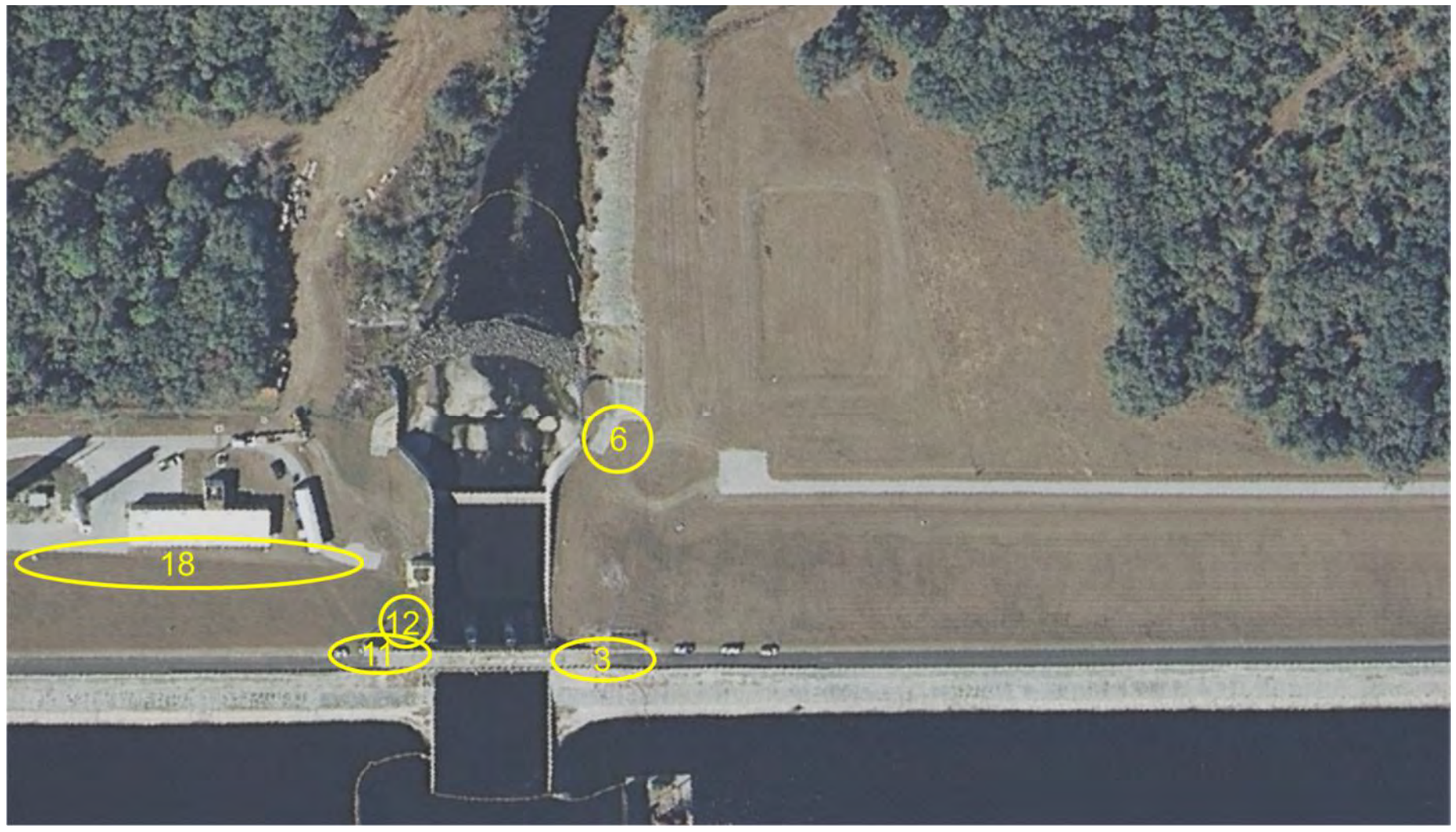

Third Set of Inspections (1980 - 1981)
by
HNTB Corporation

3) Erosion of slopes along upstream side of sheetpile wall

6) Large area with severe erosion on west end of north training wall

11) Erosion of slopes along upstream side of sheetpile wall

12) Erosion undermining stairway next to training wall

18) Wet area at downstream toe STA 12+00

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 24
Critical Observation Locations in HNTB Inspection (1980-1981)

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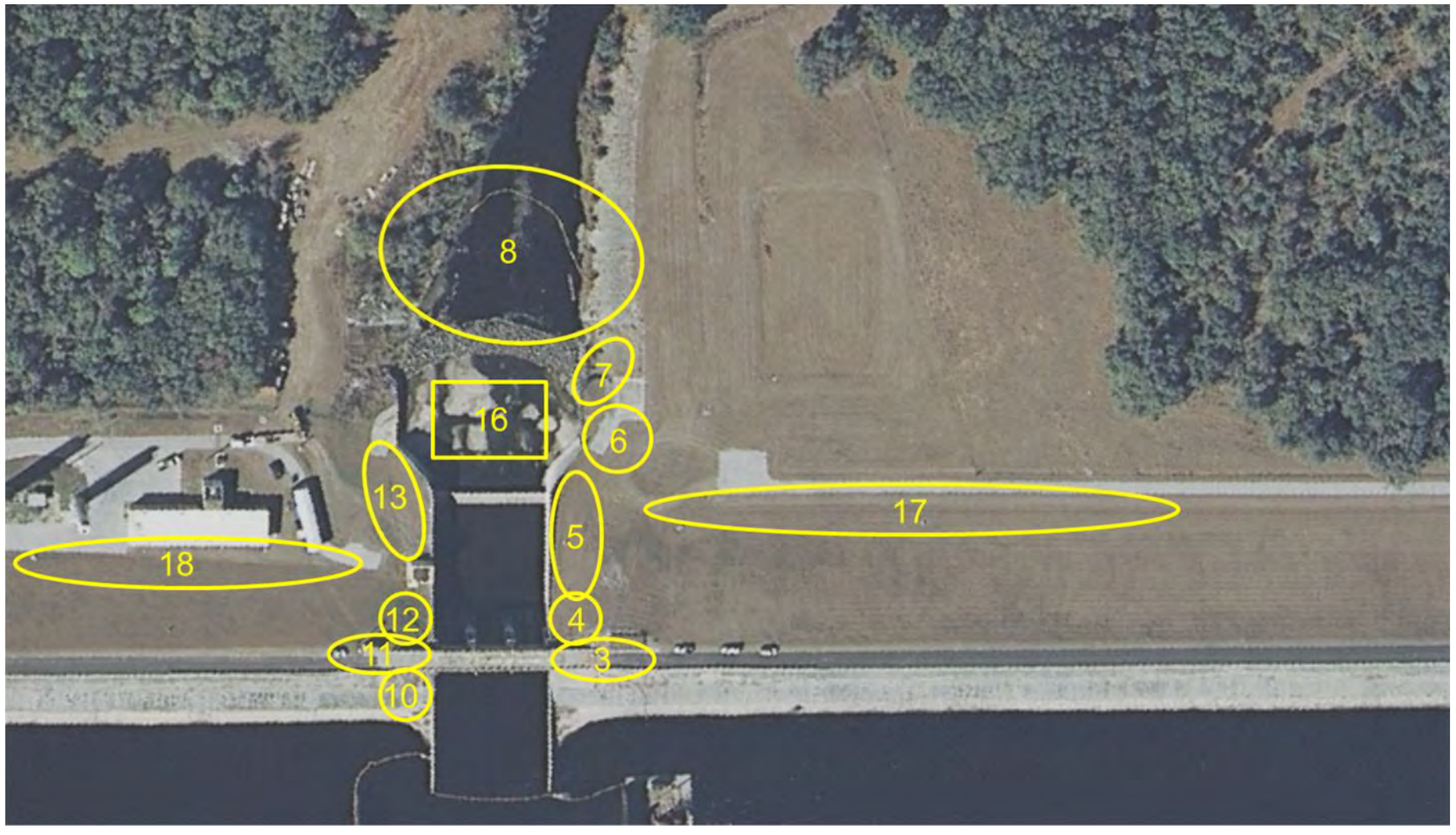
Fourth Set of Inspections
(1982 - 1988)
by
Camp, Dresser & McKee



3) Boring through crest at STA 17+00 found weight-of-rod material and loss of circulation at bottom of core, settlement along eastern and western sheetpile cutoff walls next to northern approach slab and undulations on upstream soil-cement surface

4) Erosion along sheetpile wall

5) Irregularities in embankment surface

6) Fill between north sheetpiling and training wall removed by severe erosion

7) Severe erosion behind sheetpile wall

8) Severe erosion on downstream riverbanks undermining surface protection

10) Outward deflection of wall

11) Erosion along eastern and western sheetpile cutoff walls next to southern approach slab and undulations on upstream soil-cement surface

12) Erosion undermining stairway behind south training wall and settlement of gate motor control center

13) Erosion and settlement along with a depression along southwest corner of training wall

16) Depressions at locations of old baffle blocks and 3 ft depression at southwest end of concrete apron

17) Toe drain settlement, ponding of water and build-up of appreciable amounts of sediment in drain

18) Moisture present on downstream portion of slope and soft ground in toe area with reoccurring settlement/depressions along access road and partial blockage of toe drain

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 25
Critical Observation Locations in Camp, Dresser & McKee Inspections (1982-1988)

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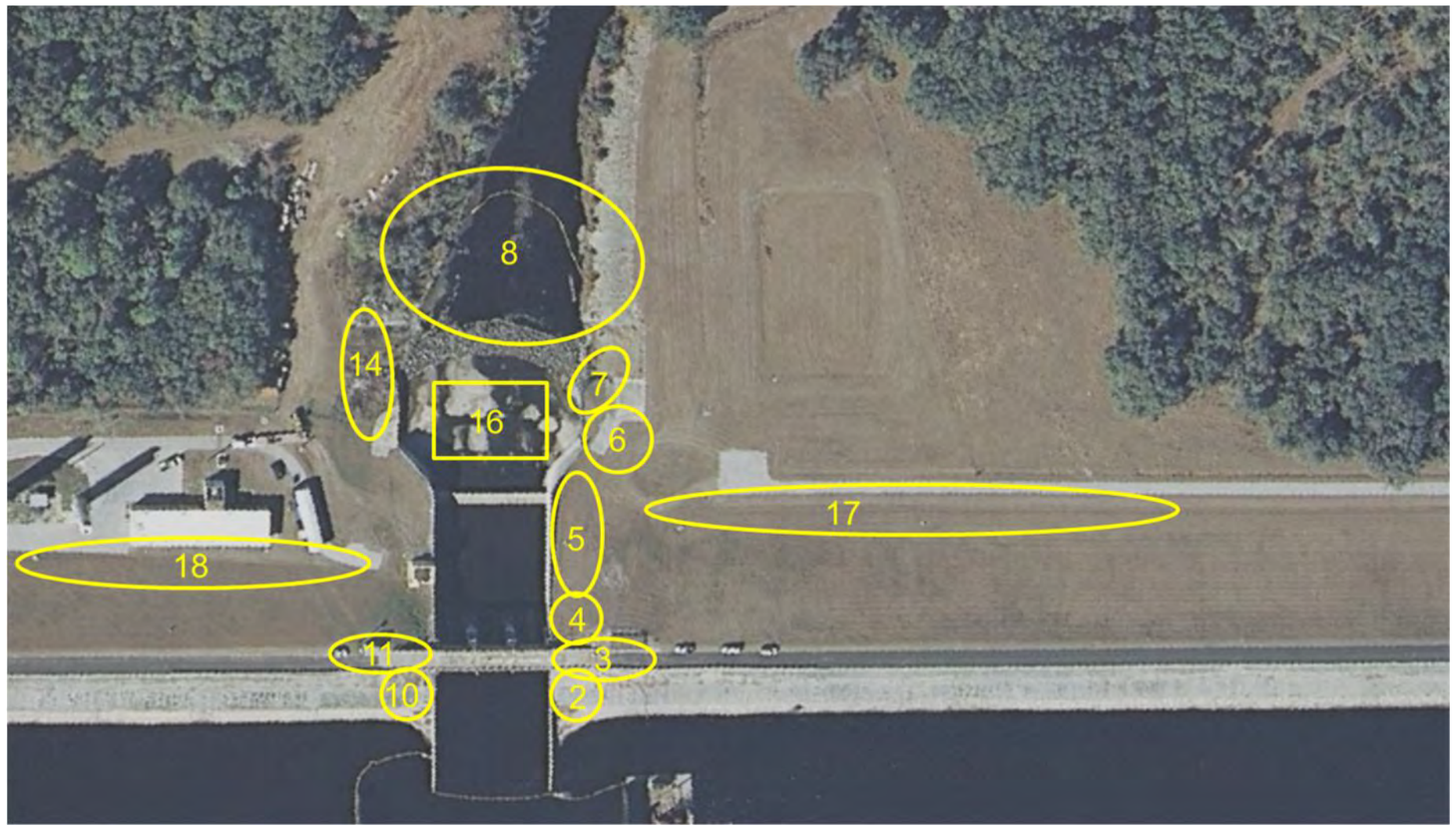
Fifth Set of Inspections
(1989 - 1992)
by
Metcalf and Eddy



2) Localized depressions and erosion along north approach wall above water

3) Erosion adjacent to north approach slab

4) Depressions, erosion along north sheetpile cutoff and surface of slope

5) Two new holes in backfill, one of them was 3 ft wide and 3 ft deep

6) Seepage through wall between concrete and sheetpiling, 1 ft wide 3 ft deep hole

7) Seepage and erosion at edge of sheetpile wall

8) Seepage from downstream north channel bank with two slope instabilities, sediment island in river channel

10) Outward displacement of wall, up to 2 inches

11) Depressions along sheetpile wall and erosion along abutments to approach slab

13) Outward displacement of wall, up to 2 inches

14) Separation of sheetpile wall and loss of material behind with a depression

16) Deterioration of concrete apron, undermining of concrete with sheetpiling pulling away from concrete

17) Depressions and wet zones over toe drains, irregular downstream slopes, some downstream piezometers with fluctuations much larger than changes in reservoir levels

18) Depressions and wet zones over toe drains, irregular downstream slopes, cracking and erosion in roadway at STA 14+25, some downstream piezometers with fluctuations much larger than changes in reservoir levels

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 26
Critical Observation Locations in Metcalf and Eddy Inspections (1989-1992)

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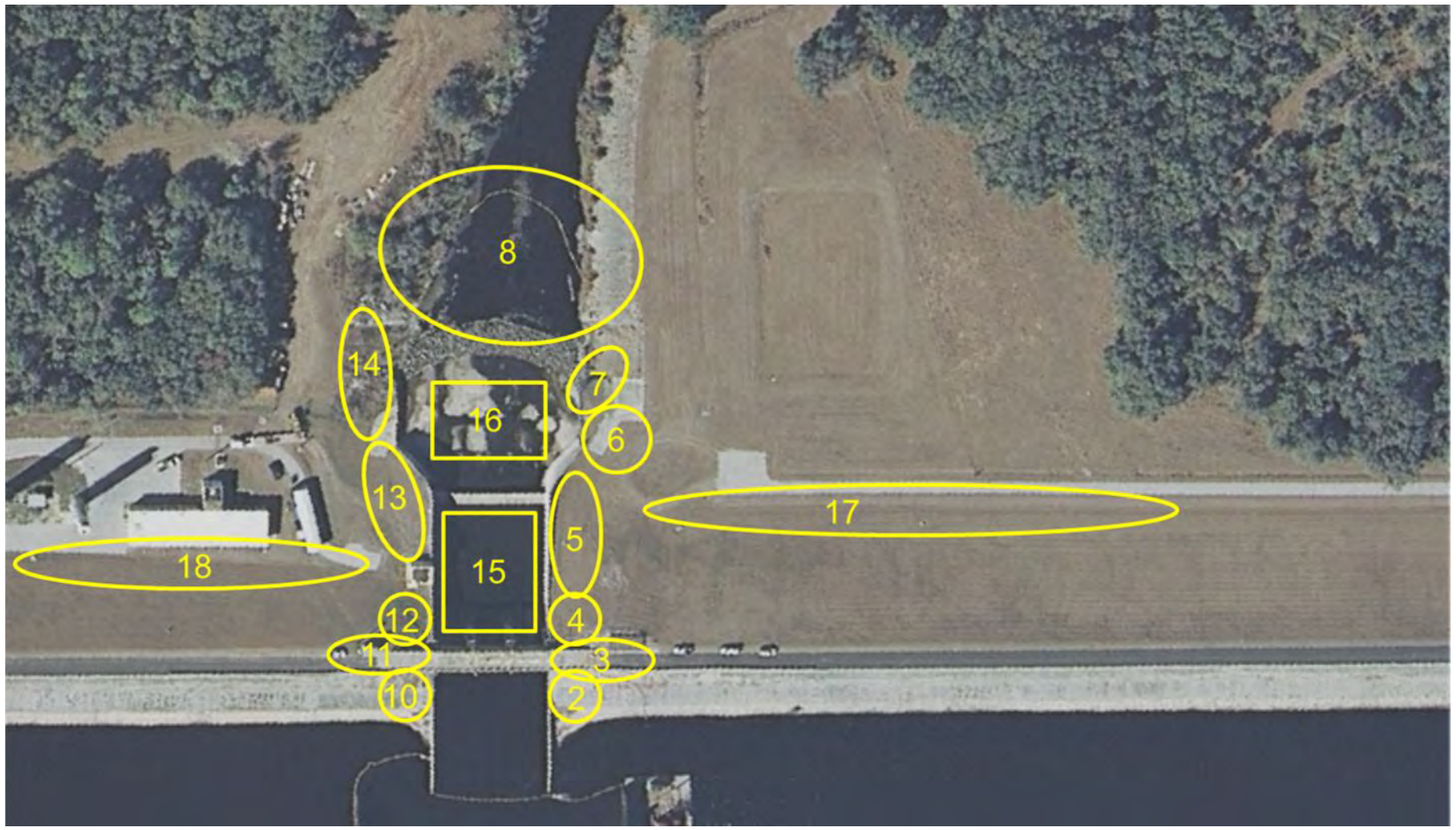
Sixth Set of Inspections
(1993 - 1997)
by
Black and Veatch



2) Erosion of soil–cement slope adjacent to approach wall, suspected voids and depressions, and outward movement of wall

3) Erosion along both sides of sheetpile cutoff wall, evidence of upward seepage from foundation and into embankment core

4) Erosion of soils and depression at intersection of sheetpile wall and concrete training wall

5) Voids behind training wall, movement of wall towards stilling basin, depression of phreatic surface in shell materials, suspected presence of drainage chimney behind the wall

6) Large erosion area at toe of slope

7) Depressions north of sheetpile wall and loss of backfill materials through gap in sheetpile wall

8) Erosion and undermining of surface protection material on north bank of river, formation of sediment island in river channel

10) Active erosion and cracks and holes in soil-cement slope, suspected presence of voids and outward deflection of wall

11) Erosion along sheetpile wall on upstream slope

12) Erosion of embankment undermining stairway

13) Movement of wall towards stilling basin, depression on downstream edge of wall, suspected presence of drainage chimney behind wall

14) Erosion at edge of sheetpile wall

15) Void system under stilling basin

16) Sheetpile displacement, washout of material under apron

17) Settlement, depressions, undulations, bulging in slope, no direct correlation between toe drain discharge and lake level

18) Depression in slope, seepage in toe area between STA 10+00 and south training wall

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 27
Critical Observation Locations in Black and Veatch Inspections (1993-1997)

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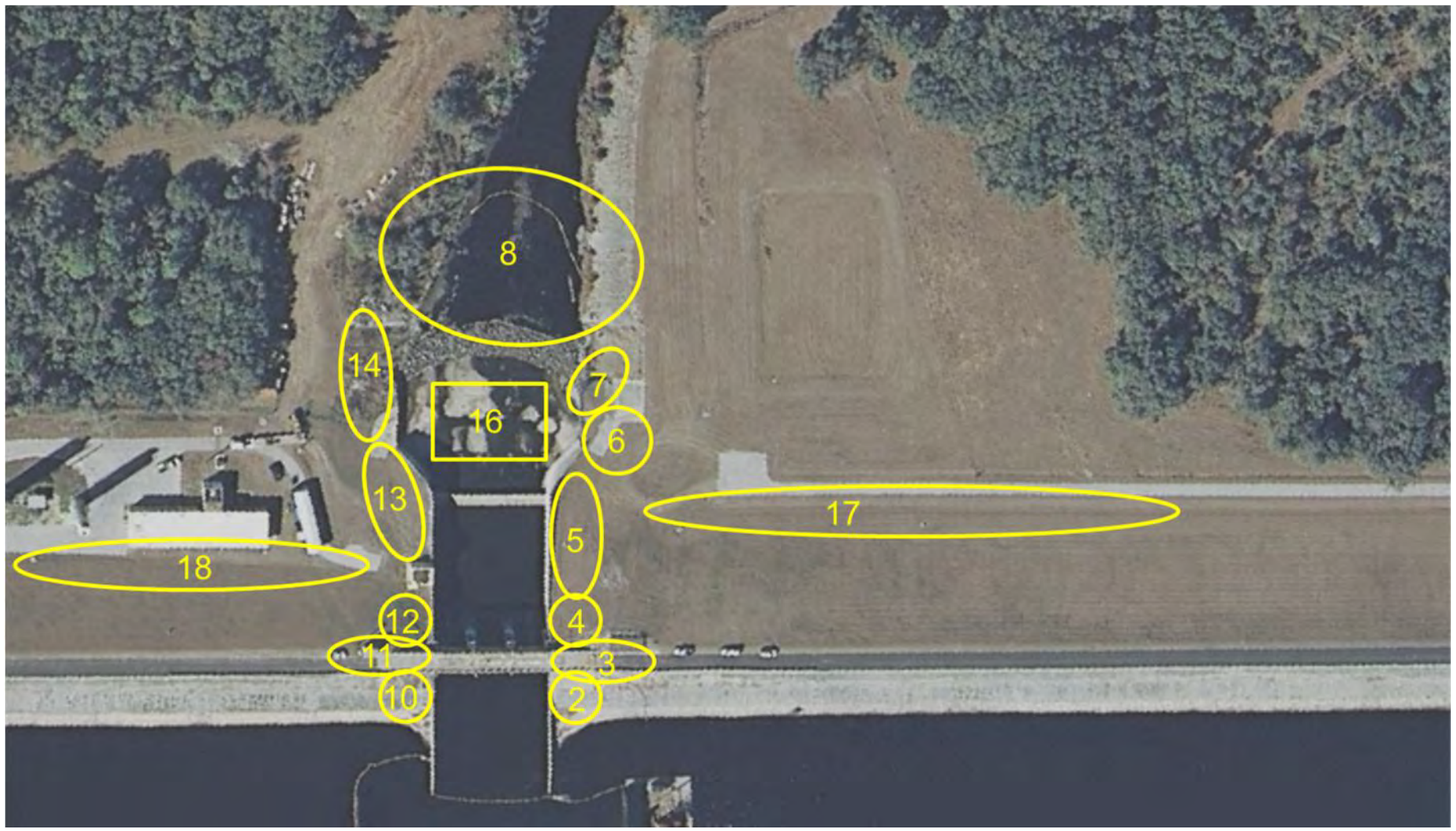
Seventh Set of Inspections
(1998 - 2011)
by
McKim and Creed



2) Large void beneath concrete slope pavement on north side of spillway

3) Subsidence of clay core material between sheetpile walls, 4 ft deep void, very loose soils down to 28 ft

4) Localized erosion, ruts, depressions and voids under access ladder slab

5) Erosion ruts, depressions, loose to very loose soils, 20 yd^3 void in 2009, joint in training wall failed, walls tilt

6) Large voids under concrete slab behind toe drain outfall

7) Subsidence and erosion of mat adjacent to sheetpile wall

8) Erosion, subsidence and undermining of concrete mats on riverbanks, formation of sediment island in downstream channel

10) Voids, settlements and soft area in soil cement next to coarse screen chamber

11) Settlement along sheetpile wall-embankment interface

12) Settlement of embankment under slab at electrical control box

13) Large void under concrete slab west of fine screen chamber, loose to very loose soils adjacent and below backfill drain for training wall, walls tilt

14) Displacement and loss of material behind sheetpile wall, erosion and void under concrete slab over toe drain outfall

16) Sheetpile displacement, multiple voids under apron

17) Sedimentation, and settlement in toe drain with decreased efficiency

18) Settlement of toe drain, high flow rates 2008, small geysers at inflow ports, sediment building up in weir box

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 28
Critical Observation Locations in McKim & Creed Inspections (1998-2011)

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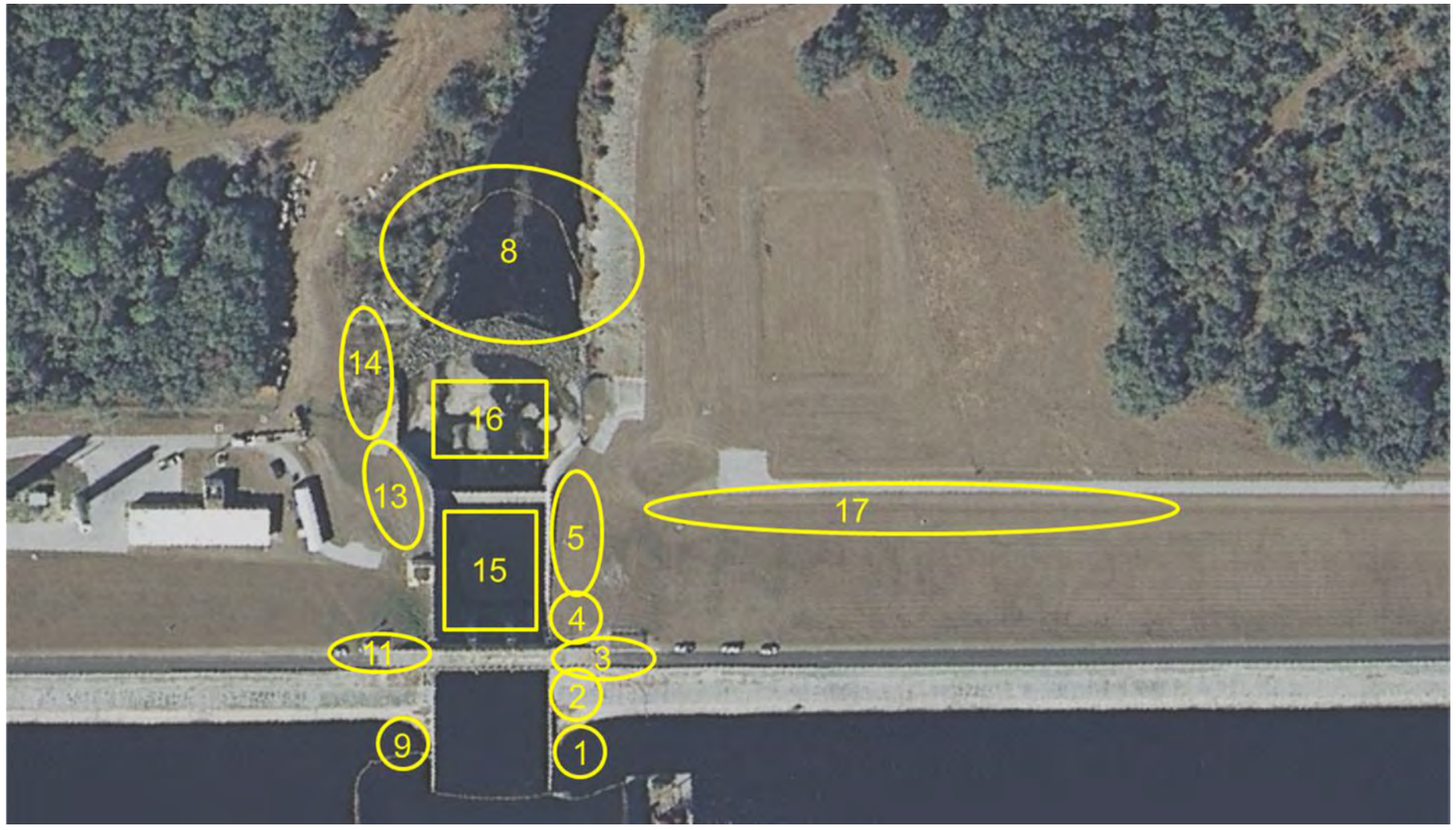

Eighth Set of Inspections
(2012 - 2013)
by
AMEC

1) Large void and break in soil-cement slope below water line
2) Large void below concrete slope patch
3) Large voids under primary and secondary approach slabs
4) Erosion and subsidence adjacent to training wall
5) Loose to very loose soil near foundation of training wall
5) Undermining of slope erosion protection on north riverbank
9) Large void and break in soil-cement slope below water line
11) Large voids under primary and secondary approach slabs
13) Loose to very loose soil near foundation of training wall
14) Flowing water between sheetpile and south training wall
15) Voids observed under stilling basin
16) Multiple voids detected under concrete apron
17) Depressions in slope near toe and slower flows in portions of toe drain near outfall

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 29
Critical Observation Locations in AMEC Inspections (2012-2013)

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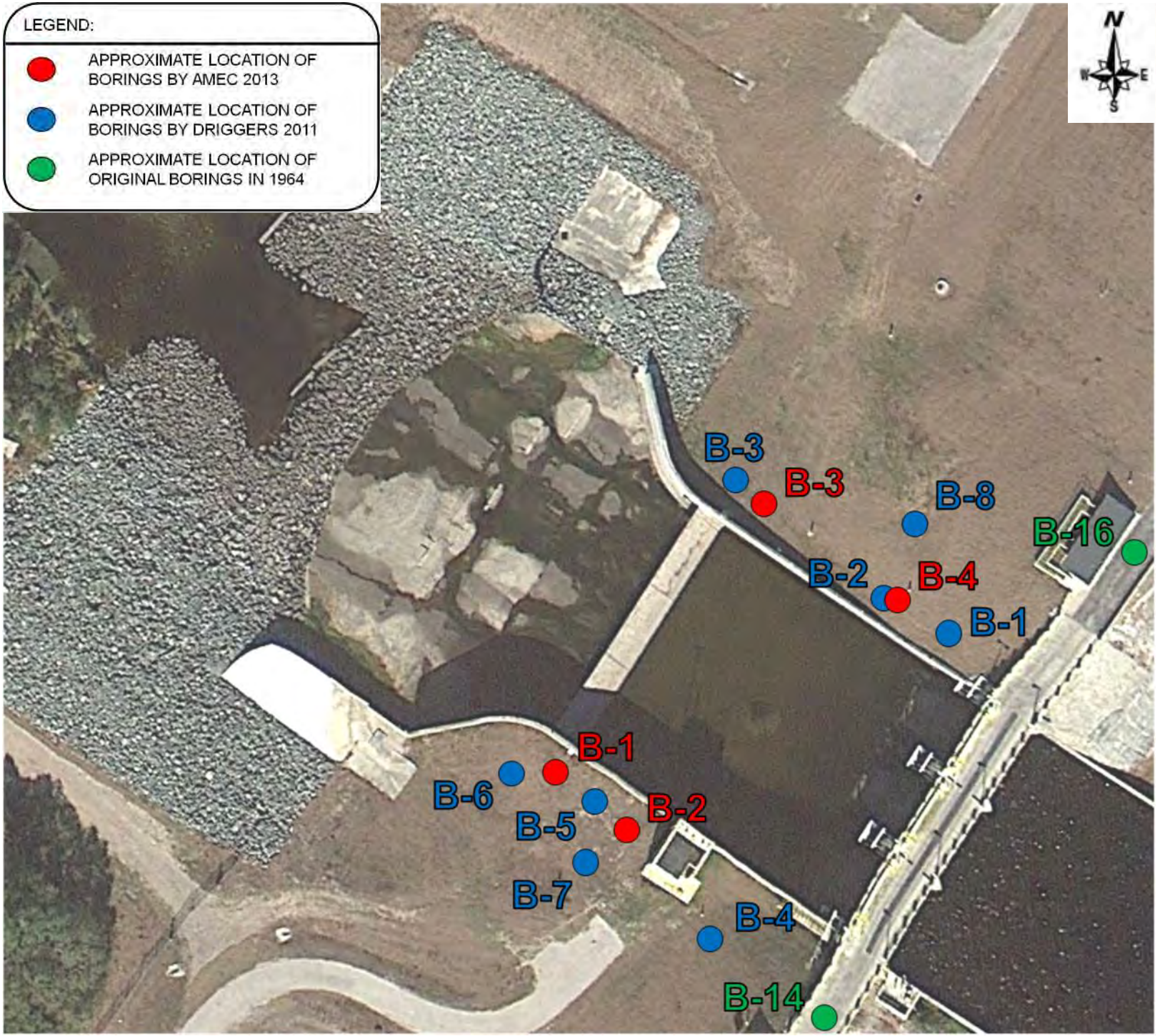

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LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 30
Boring Location Plan with Historical Borings Near Service Spillway

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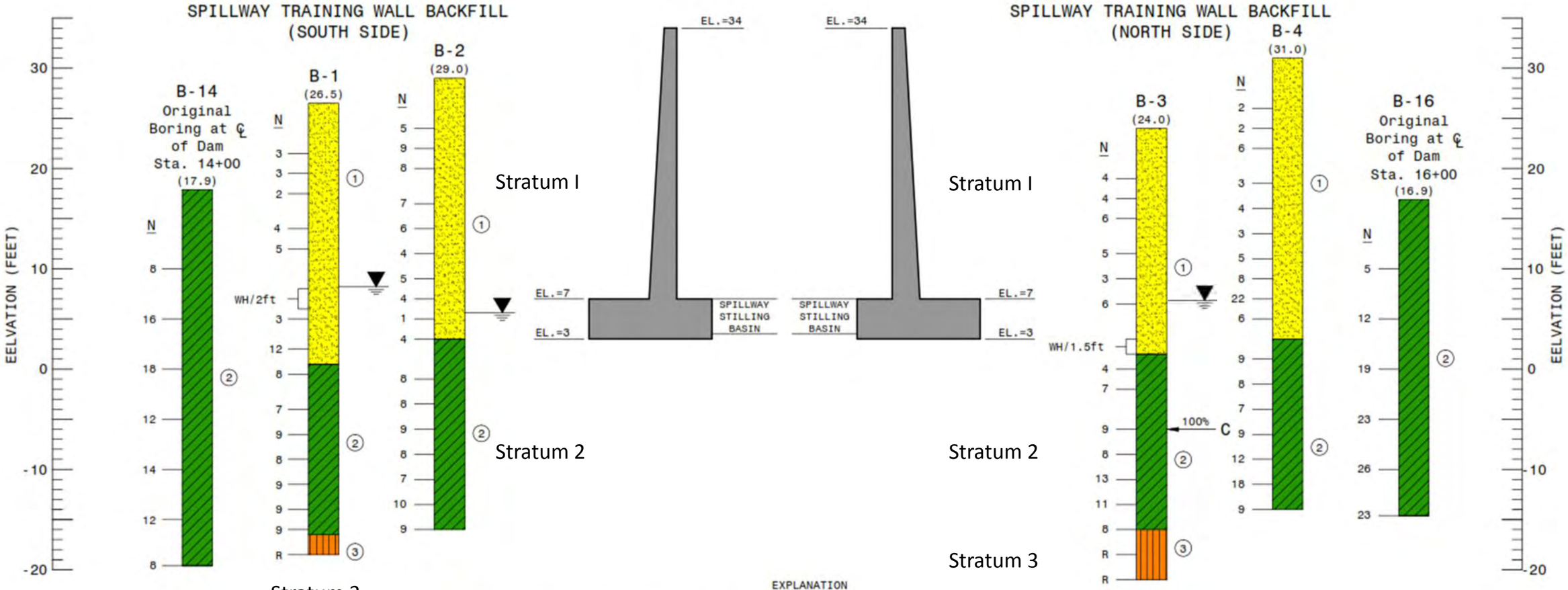

EXPLANATION

① Stratum 1: SAND, SAND with SILT, SAND with CLAY, CLAYEY SAND, SILT SAND (FILL); brown, dark brown, gray and greenish gray fine-grained quartz, variably silty, variably clayey, local cemented sand, phosphate grains; typically encountered from ground surface to a relatively shallow depth of 22 to 28 feet below existing ground surface (bgs). (USCS = SP, SP-SM, SP-SC, SM, SC)

② Stratum 2: SANDY CLAY, CLAY; gray to greenish gray fine-grained quartz, variably clayey and variably sandy, phosphate grains; typically encountered underlying the silty SAND / clayey SAND (FILL) stratum at depths from 22 to 45 feet bgs (USCS = SC, CL/CH)

③ Stratum 3: SILTY SAND; gray and greenish gray fine-grained quartz, variably silty, cemented sand and silt, phosphate grains and local limestone fragments; typically encountered underlying the sandy clay stratum at depths from 40 feet bgs to termination depth (USCS = SM)

SP	UNIFIED SOIL CLASSIFICATION SYSTEM classification
78	SPT N-value
▼	Depth of water table
100% C	Loss of Circulation
WR	Weight of Rod
WH	Weight of Hammer
NR	No Recovery
R	Refusal
(26.5)	Approximate Elevation

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 31
Downstream Training Walls with Soil Boring Stick Logs

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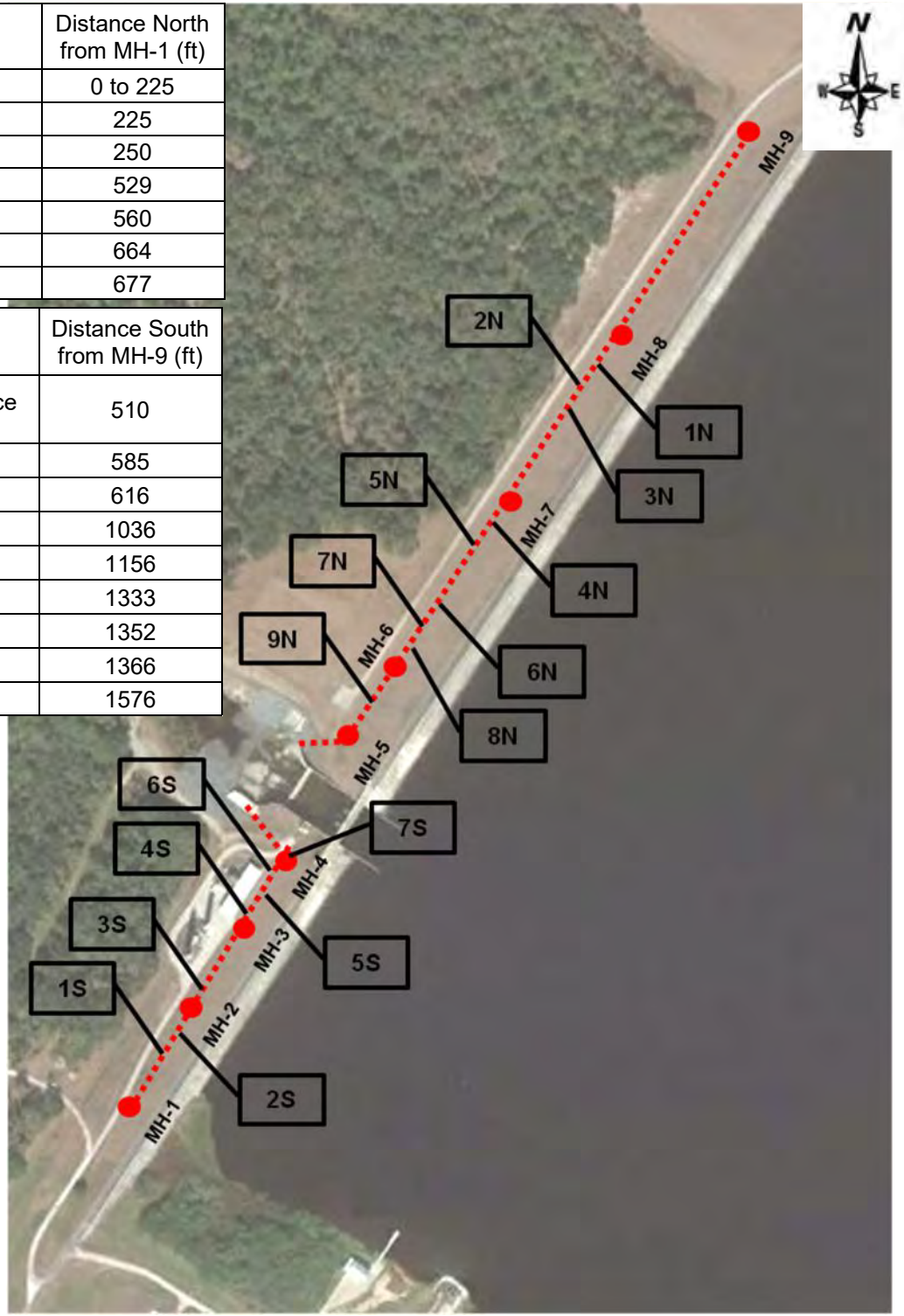
Call Out	Description	Distance North from MH-1 (ft)
1S	Dry pipe with small amount of dried sludge	0 to 225
2S	Build up of sludge	225
3S	Build up of sludge	250
4S	Excess Water through perforated hole	529
5S	Excess Water through perforated hole	560
6S	Excess Water through perforated hole	664
7S	Manhole cover in manhole	677

Call Out	Description	Distance South from MH-9 (ft)
1N	Rubber gasket found in middle of pipe, no evidence of missing gasket at joints prior to location	510
2N	Build up of sludge	585
3N	Build up of sludge	616
4N	Build up of sludge in perforated hole	1036
5N	Build up of sludge in perforated hole	1156
6N	Differential displacement at pipe sections	1333
7N	Differential displacement at pipe sections	1352
8N	Differential displacement at pipe sections	1366
9N	Build up of sludge	1576



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LAKE MANATEE DAM
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FIGURE 32
Toe Drain Inspection Observations by AMEC

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PROJECT NO.: 300472x2
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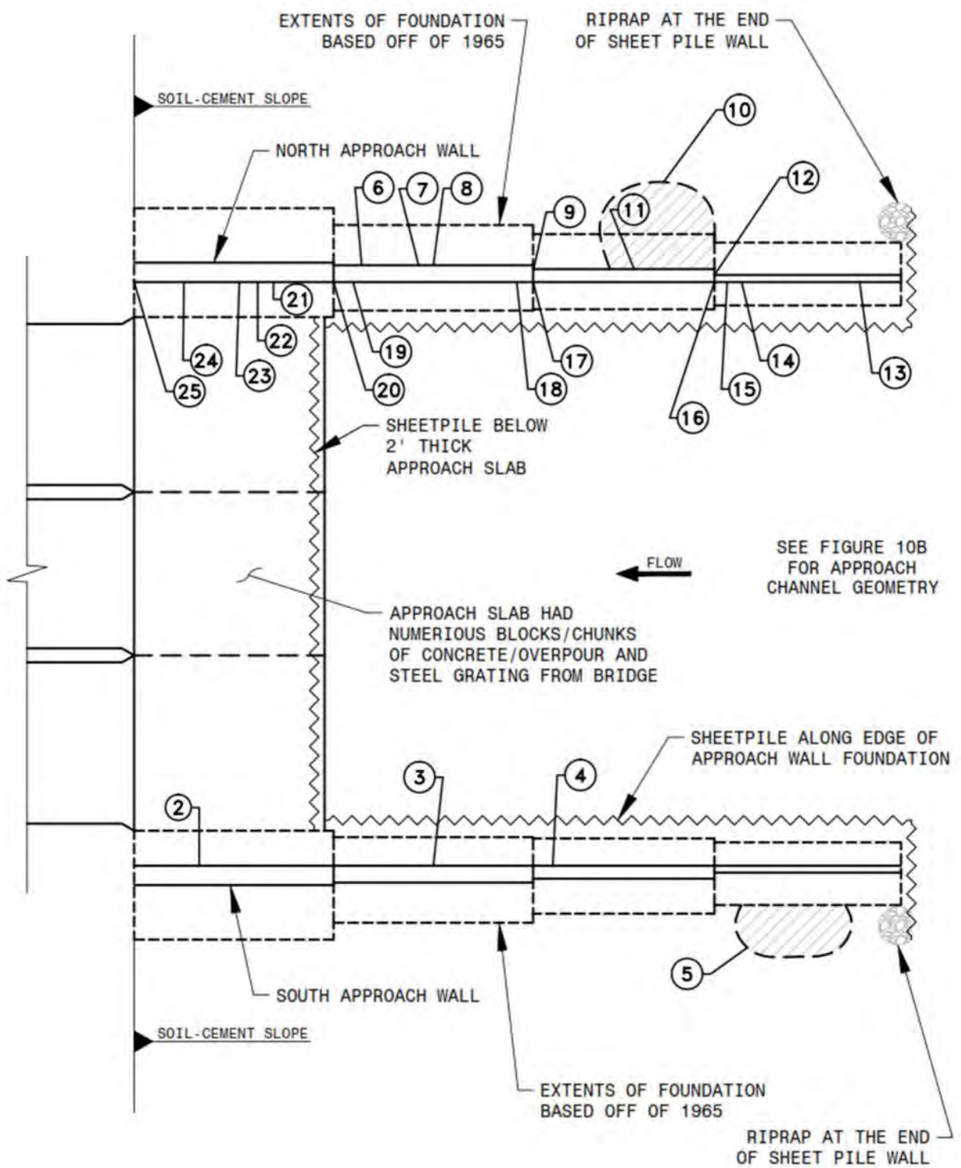
SCALE: N.T.S.



Observation No.	Observation	Approximate Location	Description
1	Concrete Scaling	Throughout south wall	Approximately 1/4-inch deep scaling with exposed aggregate, typically from high-water mark to bottom of wall
2	Vertical Crack	1-foot east of the SW corner of approach slab	8-inch long 3/4-inch deep vertical crack 2-feet below water level
3	Concrete Scaling	51-feet east of first expansion joint	3-inch by 5-inch section of 1/2-inch deep scaling 21-feet below water level
4	Concrete Scaling	73-feet east of first expansion joint	4-inch by 2.5-inch section of 1-inch deep scaling 19-feet below water level
5	Undermining	20-feet west of east end of wall	Undermining of soil-cement slope with soil-cement broken off and collapsed into void, approximately 2-feet deep void extending laterally to 6-feet under soil-cement slope
6	Concrete Scaling	8-feet east of the first expansion joint	5-inch by 7-inch section of 1-inch deep scaling 6-inches below water level
7	Vertical Crack	15-feet east of first expansion joint	Vertical crack from soil-cement slope to top of wall, continuing along south face to 1-foot below water level
8	Missing grout	18-feet east of first expansion joint	Mechanical hole (1-1/4-inch dia.) missing grout 1-foot below water level
9	Horizontal Separation	At second expansion joint	1-inch separation at interface of soil-cement wall and approach wall, closes 4-feet from top of wall
10	Undermining	9.5-feet east of second expansion joint	Undermining of soil-cement slope with soil-cement broken off and collapsed into void, void is approximately 2-feet deep gradually closing as the void continues north for 9-feet, extends east for approximately 20-feet east
11	Concrete Scaling	12-feet east of second expansion joint	6-inch by 8-inch section of 1/2-inch deep scaling 18-feet below grade
12	Horizontal Separation	At third expansion joint	1.5-inch separation at interface of soil-cement wall and approach wall, closes 2-feet from top of wall
13	Popouts	12-feet west of end of wall	6-feet by 2-feet section of popouts within the concrete 15-feet below water level
14	Concrete Scaling	8-inch east of third expansion joint	1.5-feet by 1.5-feet section of 1/2-inch scaling 17-feet below water level
15	Concrete Spall	Third expansion joint	2.5-inch by 2.5-inch section of 1-inch deep spalling10-feet below water level
16	Concrete Scaling	Third expansion joint	7-feet by 4- feet section of 1/2-inch scaling14 o 19-feet below water level
17	Horizontal Separation	At second expansion joint	1/2-inch separation between wall section from top of wall to 2-feet below water level
18	Exposed Wire	2-feet west of second expansion joint	18-inch long section of 1/8-inch wire protruding out of wall
19	Missing grout	4-inches east of first expansion joint	Mechanical hole (1-1/4-inch diameter 2-1/2-inch deep) just above water level
20	Horizontal Separation	At first expansion joint	1/4-inch separation at top of wall increasing to ¾-inch at water level, heavy scaling in this area, separation closes 18-inches below water level
21	Concrete Scaling	14-feet west of first expansion joint	9-inch by 2-inch section of ½-inch deep scaling 3-feet below water level
22	Concrete Spall	20-feet west of first expansion joint	10-inch by 12-inch section of 2-inch deep spall with no exposed rebar 3-feet below water level
23	Missing Grout	20-feet west of first expansion joint	Mechanical hole (1-1/4-inch diameter 1-3/4-inch deep) just above water level
24	Concrete Spall	4-inches east of west most end of wall	9-inch by 4-inch section of 1-inch deep spall with no exposed rebar 2-feet below water level
25	Horizontal Separation	At west most end of all along expansion joint	1-inch wide separation at joint from water level to 3.5-feet below water level, separation was approximately 6-inches deep

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 33
Approach Walls and Slab Dive Inspection Observations

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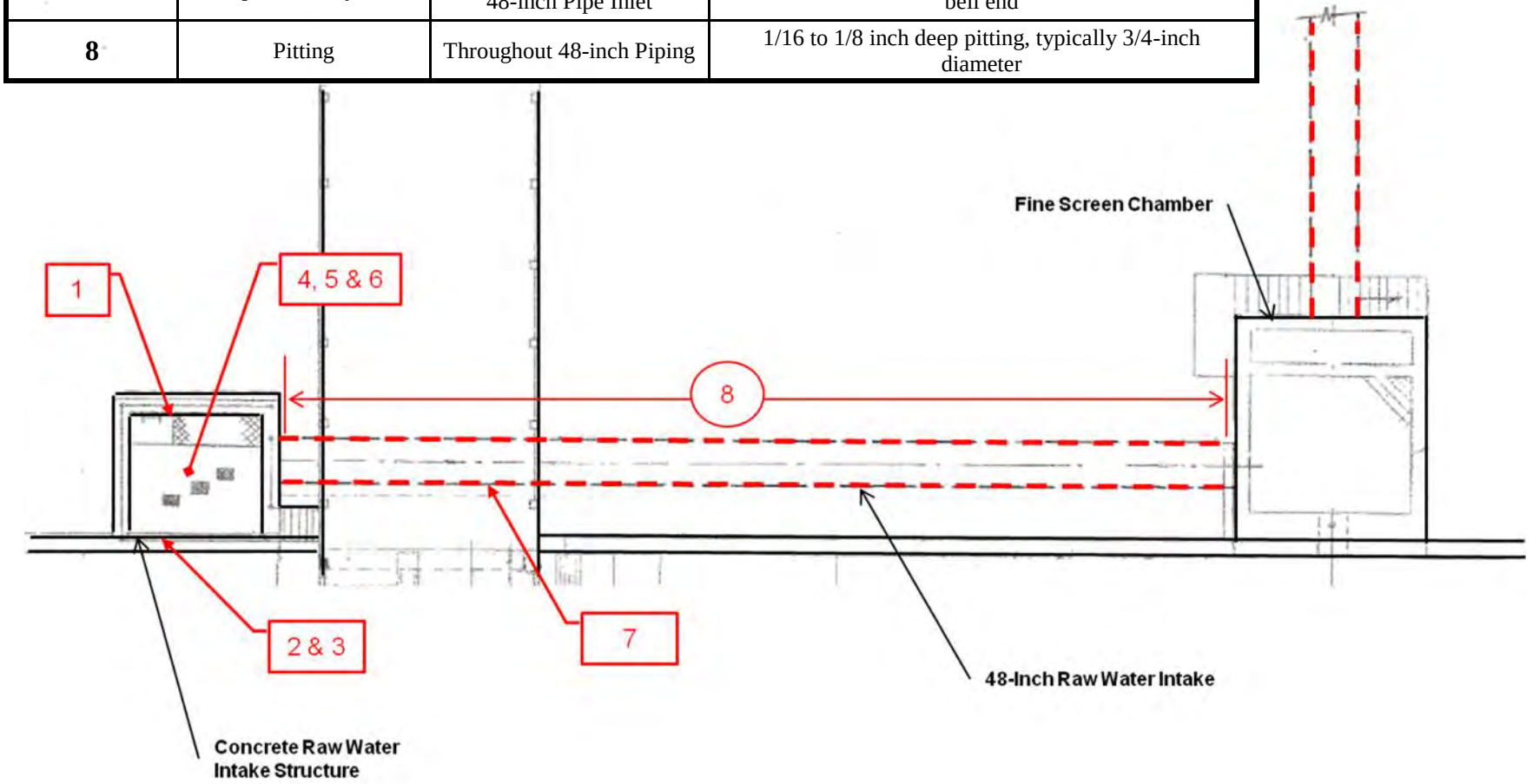
Number	Observation	Approximate Location	Description
1	Coating to Concrete Walls	Throughout Intake Chamber	A light colored Cementations coating was applied to the wall
2	Pitting	Intake Gates	All three intake gates had 1/8 to 1/4-inch deep pitting
3	Coating Failure	Intake Gates	80% of the coating on the gates is missing
4	Corrosion	Base Plate of Latter	Minor corrosion to base plate of stairs
5	Corrosion	Intake Chamber Bolts of 6 -inch pipe	Flange bolts for a 6-inch pipe in the intake chamber are corroded
6	Foreign Material	Throughout Intake Chamber	Miscellaneous materials were located throughout the intake chamber, primarily steel pieces
7	Separation at joint	81-feet west of east end of 48-inch Pipe Inlet	Gap between sections, pipe not inserted all the way into bell end
8	Pitting	Throughout 48-inch Piping	1/16 to 1/8 inch deep pitting, typically 3/4-inch diameter



amec foster wheeler
2000 E Edgewood Dr., Ste # 215
Lakeland, FL 33803
863.667.2345 www.amecfw.com

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 34
48-inch "Raw Water #1" Dive Inspection Observations

DATE: 10/22/14
PROJECT NO.: 300472x2
DRAWN BY: NJD
SCALE: N.T.S.

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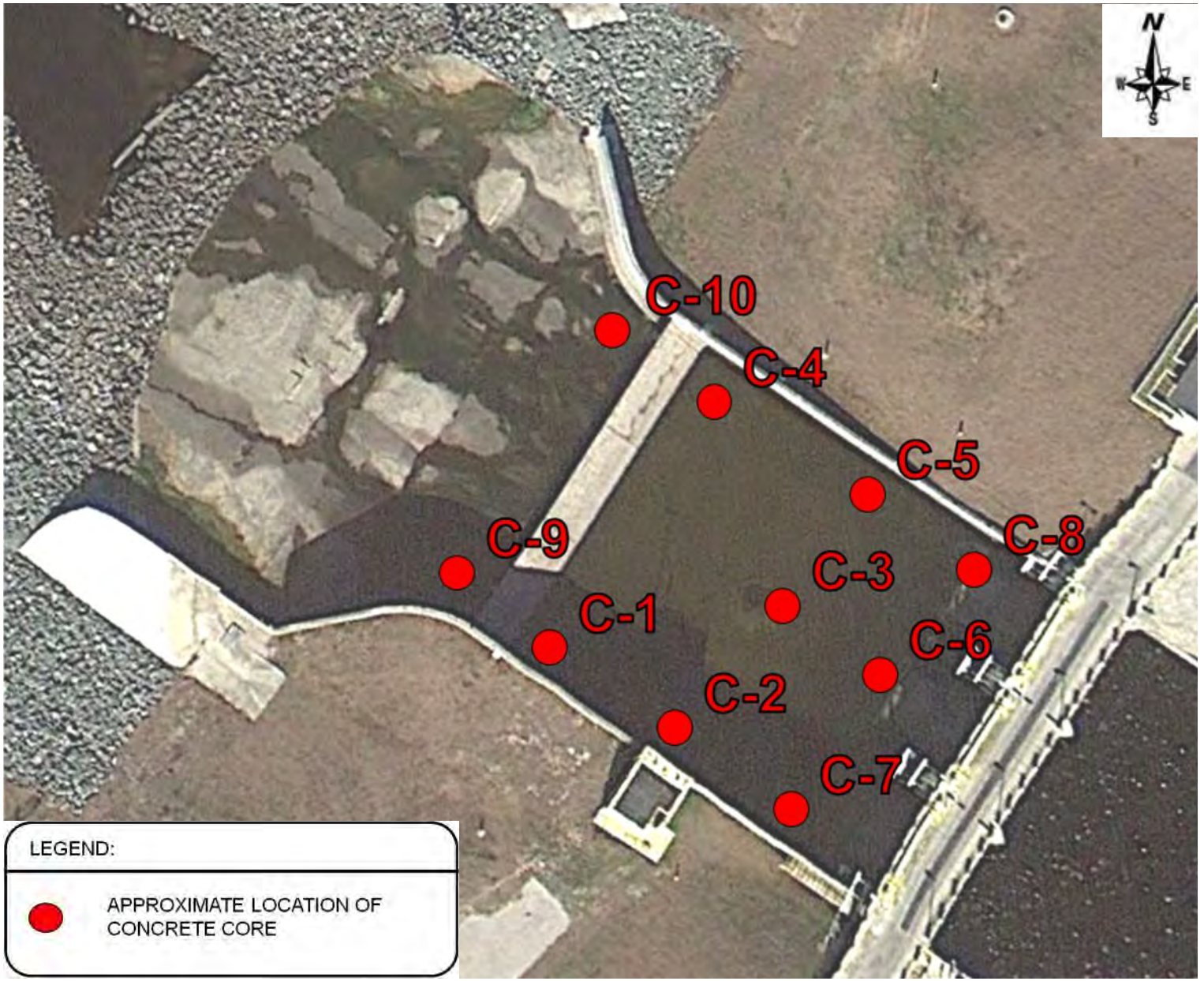
Ste # 215
Lakeland, FL 33803
863.667.2345 www.amecfw.com

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 35
Downstream Concrete Apron Void Locations from Ground Penetrating Radar

DATE:	01/24/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.

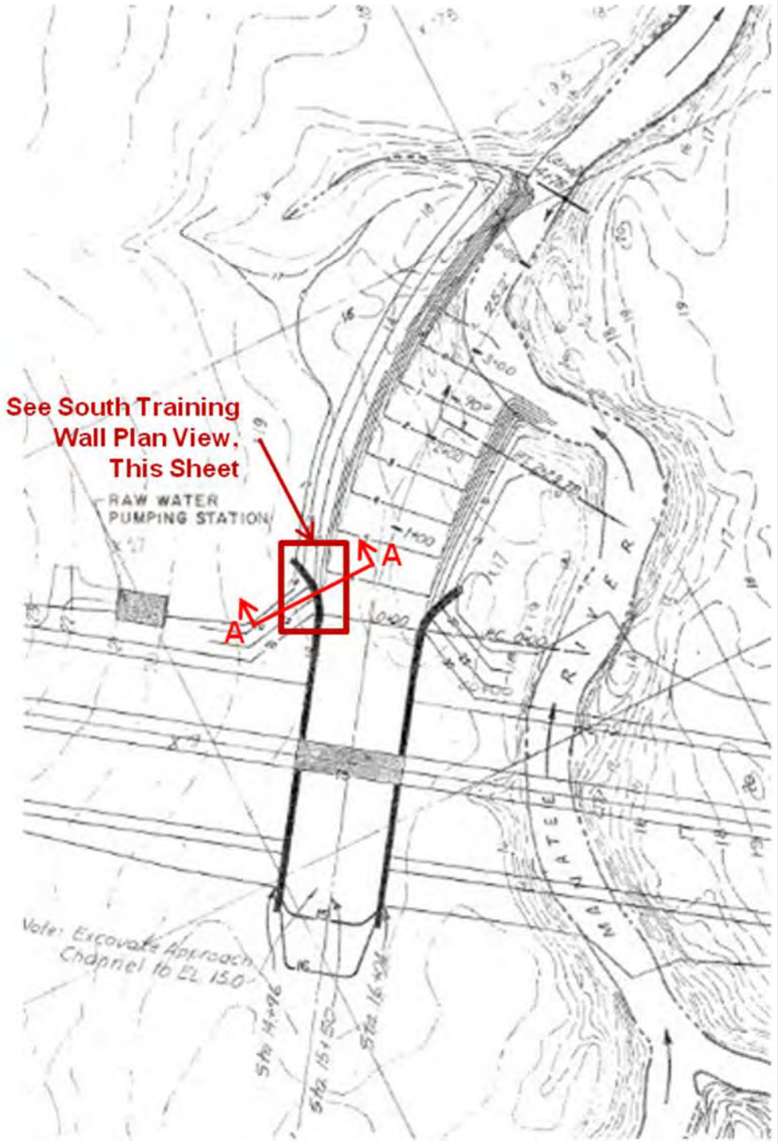


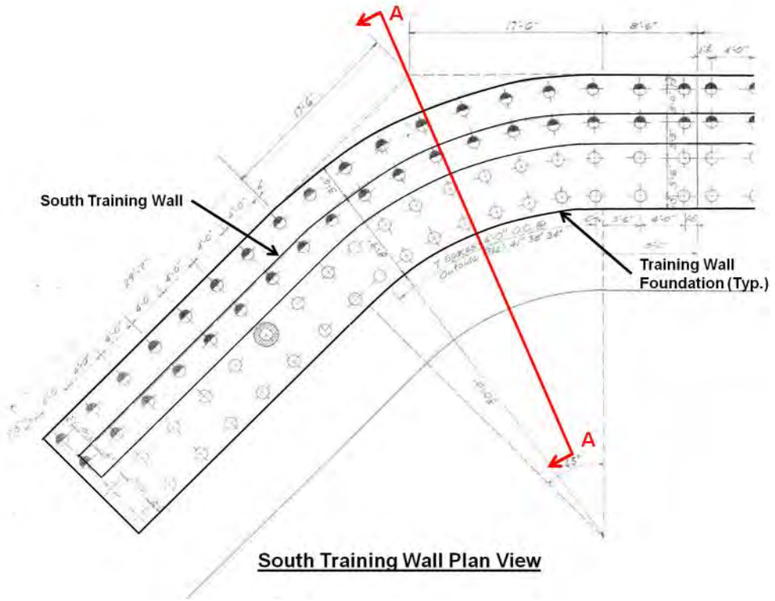
amec foster wheeler
2000 E Edgewood Dr.,
Ste # 215
Lakeland, FL 33803
863.667.234
www.amecfw.com

LAKE MANATEE
SUPPLEMENTAL DAM INSPECTION

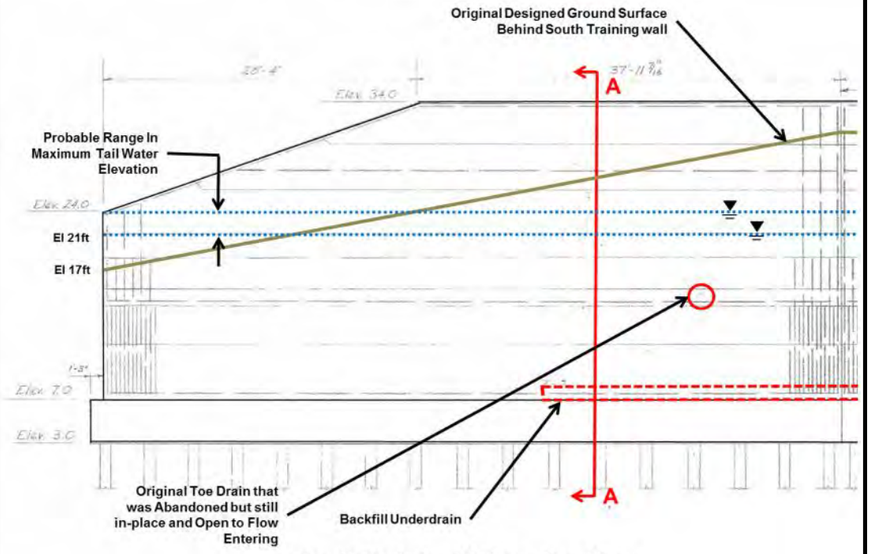
FIGURE 36
Concrete Coring Locations in Stilling Basin and Downstream Concrete Apron

DATE:	01/24/14
PROJECT NO.:	300472x2
DRAWN BY:	NJD
SCALE:	N.T.S.



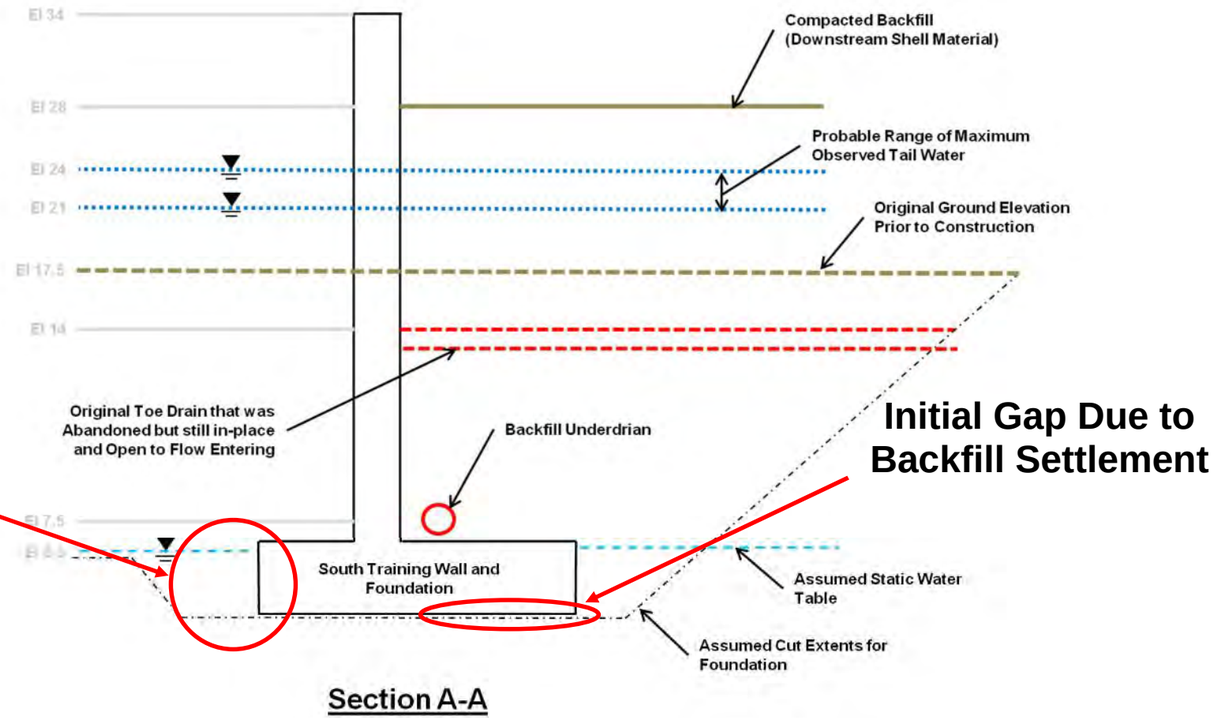


South Training Wall Plan View



South Training Wall Section View

Piping most likely initiated here



Initial Gap Due to Backfill Settlement

Section A-A

LAKE MANATEE DAM
SUPPLEMENTAL DAM INSPECTION

FIGURE 37
Probable Location of Piping Initiating Event

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Lakeland, FL 33803
863.667.2345
www.amecfw.com

DATE:	DRAWN BY:	CHECKED BY:	SCALE:	PROJECT NO.
01-16-2014	NJD	GA	N.T.S.	300472x2

PHOTOGRAPHS

Photograph #1: ZONE 2 Erosion/Void at corner of northern approach wall and upstream sheetpile cutoff wall, observed by Metcalf and Eddy (1992)

Photograph #2: ZONE 2 Erosion/ Void at corner of northern approach wall and upstream sheetpile cutoff wall, observed by Black and Veatch (1995)

Photograph #3: ZONE 3 Erosion along the northern upstream sheetpile wall adjacent to the bridge, observed in 1982 by Camp, Dresser & McKee

Photograph #4: ZONE 3 Erosion along the northern downstream sheetpile wall adjacent to the bridge, observed in 1982 by Camp, Dresser & McKee

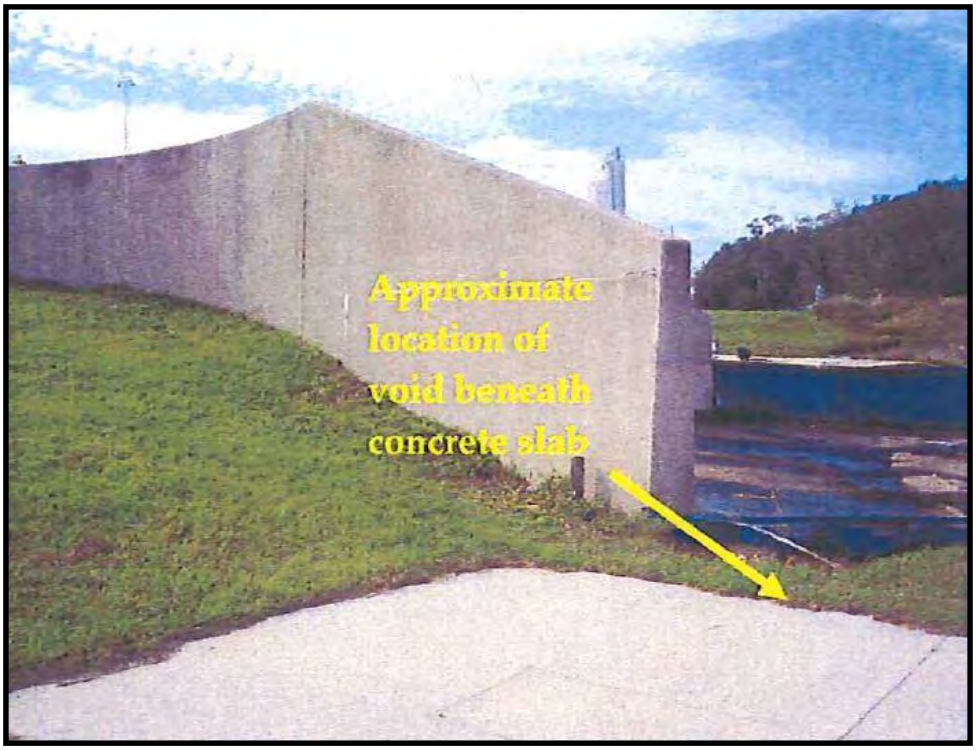
Photograph #5: ZONE 3 Void under secondary approach slab on north side of bridge, observed by Amec (2013), see Photograph #6

Photograph #6: ZONE 3 Void under secondary approach slab on north side of bridge, observed by Amec (2013), see Photograph #5

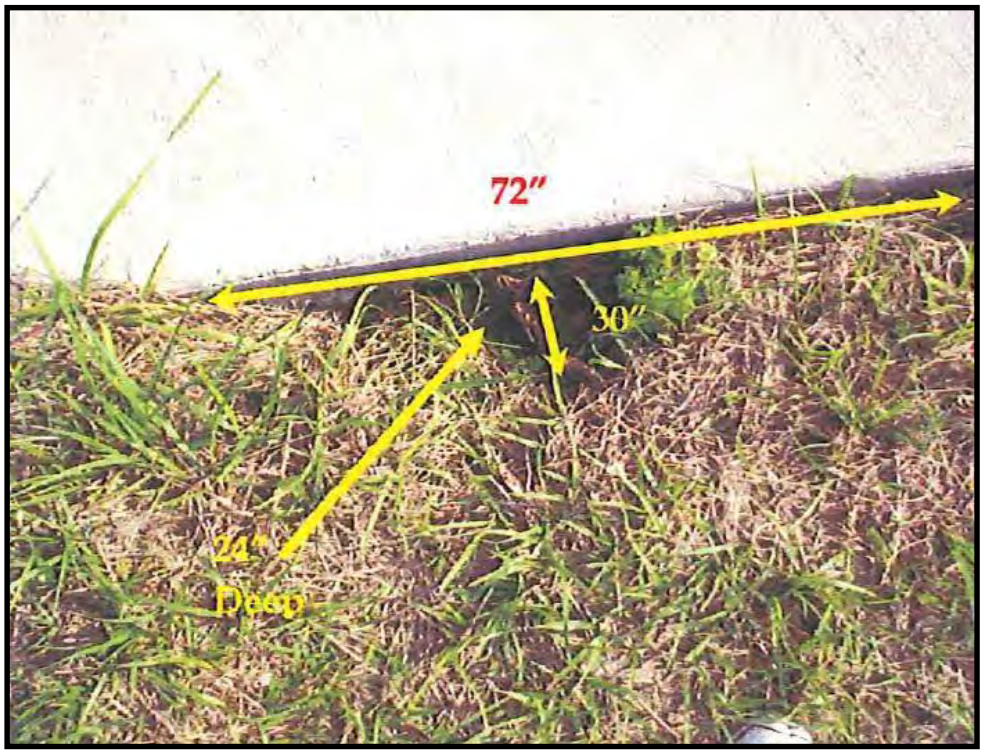
Photograph #7: ZONE 4 Erosion/settlement along northern downstream sheetpile cutoff wall at junction with training wall, observed by Black and Veatch (1995)

Photograph #8: ZONE 5 Hole behind northern training wall, observed by Metcalf and Eddy (1992)

Photograph #9: ZONE 5 Man standing in depression behind northern training wall, observed by Black and Veatch (1995)



Photograph #10: ZONE 6 Location of void underneath concrete slab at end of northern training wall, observed by McKim and Creed (2006), see also Photograph #11



Photograph #11: ZONE 6 Zoom in on void beneath concrete slab beyond northern training wall shown in Photograph #10, observed by McKim and Creed (2006)

Photograph #12: ZONE 7 Erosion/undermining of slope protection on north bank just beyond sheetpile retaining wall, observed by Camp, Dresser & McKee (1986)

Photograph #13: ZONE 8 Settlement and undermining of slope protection on north bank, observed by Metcalf and Eddy (1992)

Photograph #14: ZONE 8 Subsidence under revetment on south bank, observed by McKim & Creed (2008)

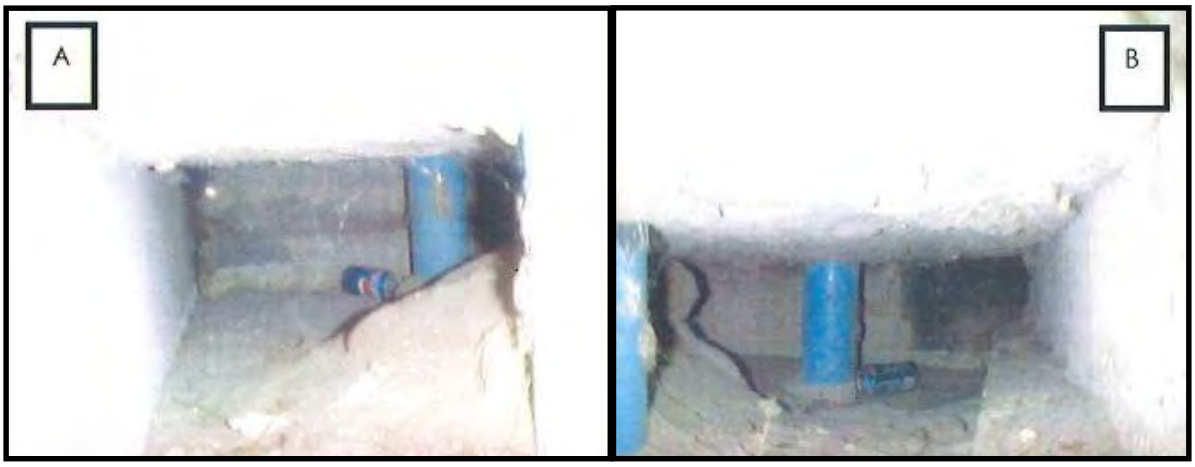
Photograph #15: ZONE 8 Sediment island in river channel, observed by Black and Veatch (1993)

Photograph #16: ZONE 10 Void adjacent to coarse screen chamber on southern approach wall, observed by McKim & Creed (2005, 2006)

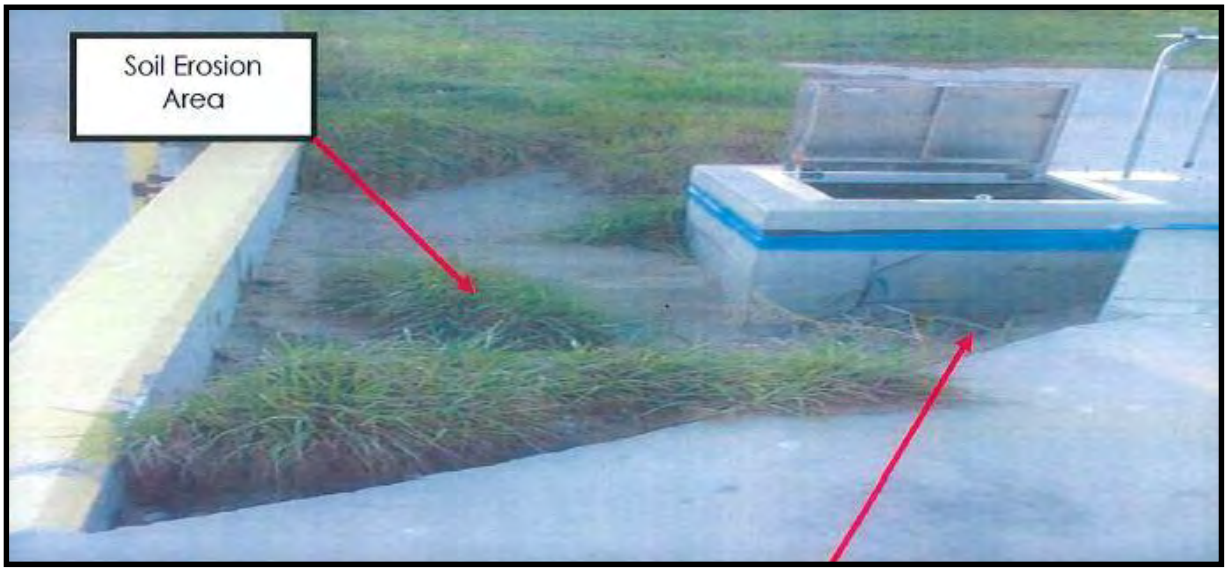
Photograph #17: ZONE 11 Void under southern secondary approach slab to bridge deck (zoomed in), observed by Amec (2014)

Photograph #18: ZONE 12 Voids under gate control box slab on south side of spillway, observed by McKim & Creed (2003)

Photograph #19: ZONE 13 Locations of voids under concrete pad on west side of fine-screen chamber, observed by McKim and Creed (2003)

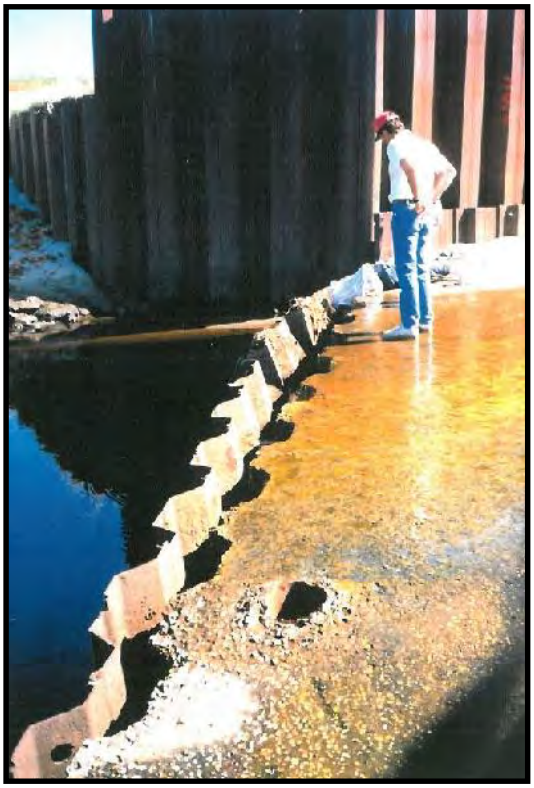


Photographs #20: ZONE 13 Voids under concrete pad on west side of fine-screen chamber, observed by McKim & Creed (2003)



Photograph #21: ZONE 14 Erosion and void location under concrete pad behind southern sheetpile wall, observed by McKim and Creed (2004), see Photograph #22

Photographs #22: ZONE 14 Void under concrete pad behind southern sheetpile wall, observed by McKim & Creed (2004), see Photograph #21



Photograph #23: ZONE 16 Gap between downstream apron and sheetpile, observed by Black and Veatch (1994)

Photographs #24: ZONE 17 Depression on downstream slope of northern embankment, observed by Metcalf and Eddy (1989)

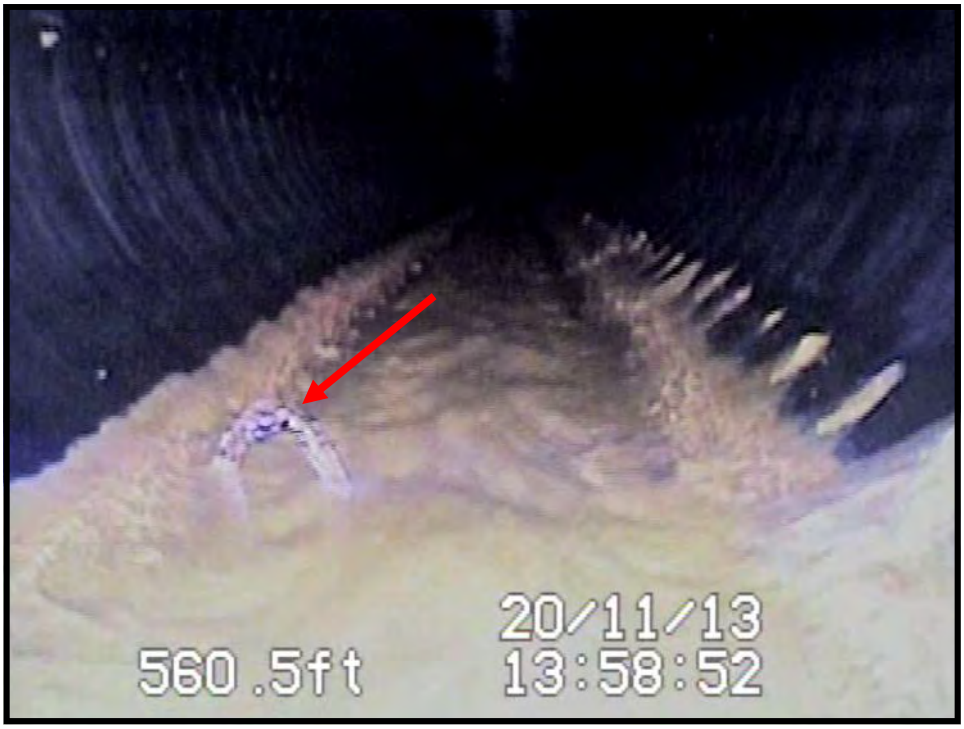
Photograph #25: Zone 18 Depression in roadway at toe of southern embankment at STA 14+25, observed by Metcalf and Eddy (1992)

Photograph #26: Inuktin VT100 Remote Operated Vehicle (pipe crawler)

Photograph #27: Start of water flow in South Toe Drain with build up of sludge

Photograph #28: Build up of sludge in South Toe Drain

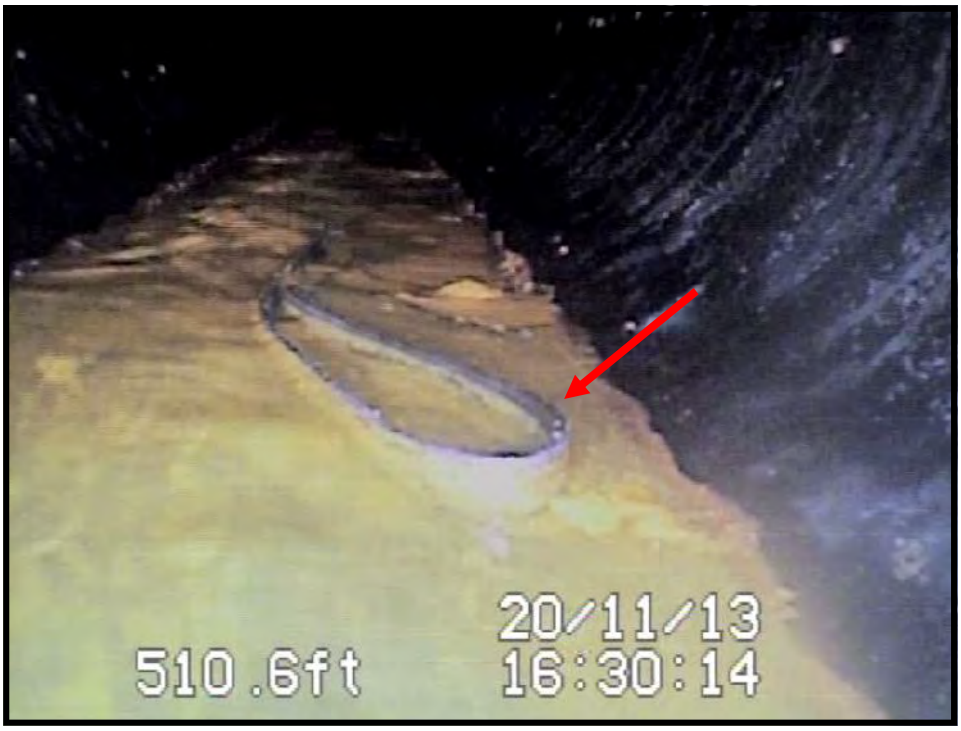
Photograph #29: Water through perforated holes in South Toe Drain



Photograph #30: Water through perforated holes in South Toe Drain

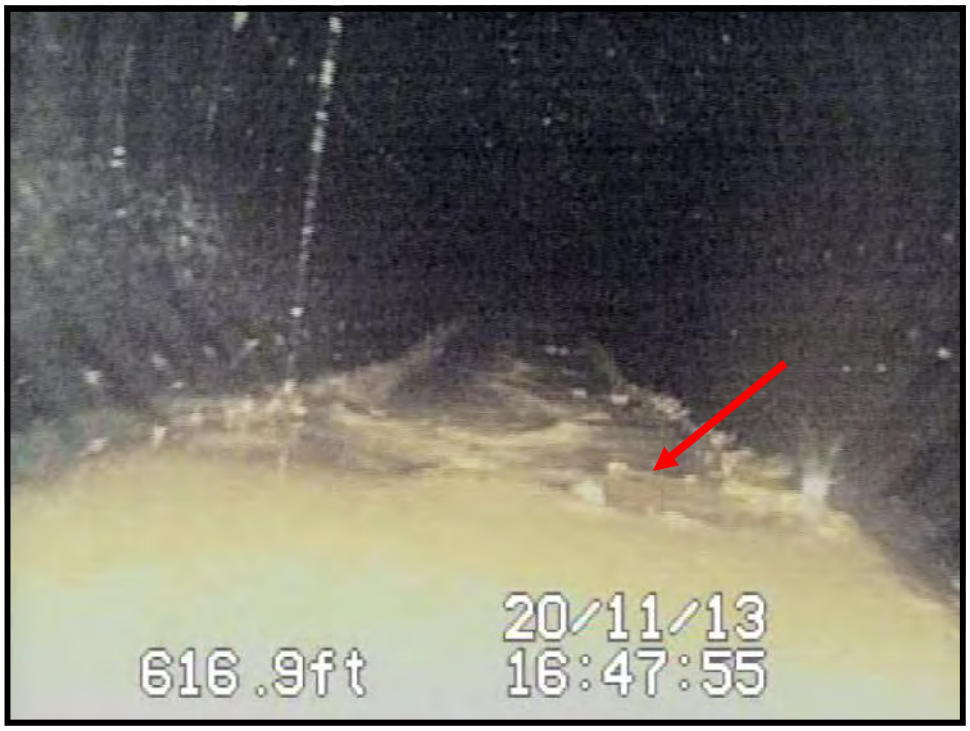
Photograph #31: Water through perforated holes in South Toe Drain

Photograph #32: Manhole cover in toe drain alignment



Photograph #33: Rubber Gasket in North Toe Drain

Photograph #34: Build up of sludge in North Toe Drain



Photograph #35: Build up of sludge in North Toe Drain

Photograph #36: Build up of sludge in perforated holes in North Toe Drain

Photograph #37: Build up of sludge in perforated holes in North Toe Drain

Photograph #38: Differential Displacement along pipe joints in North Toe Drain

Photograph #39: Differential Displacement along pipe joints in North Toe Drain

Photograph #40: Differential Displacement along pipe joints in North Toe Drain

Photograph #41: Build up of sludge in North Toe Drain

APPENDIX A

Soil Boring Logs

WELL NUMBER B-01

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/12/13 **COMPLETED** 12/12/13 **GROUND ELEVATION** 25.6 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 14+77.4, L145ft **AFTER DRILLING** 18.34 ft / Elev 7.26 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1			SP		brown fine-grained quartz SAND with little cemented sand and gravel (FILL)	
	AU 2					2.0 / 23.6	
5	SS 1	1-2-1-2 (3)		SP-SC		brown, dark brown, gray, fine-grained quartz SAND with clayey nodules (FILL)	Grout
	SS 2	1-1-2-1 (3)					
10	SS 3	1-1-1-1 (2)					
	SS 4	1-2-2 (4)					
15	SS 5	3-2-3 (5)				15.0 / 10.6	
	SS 6	1-1-3 (4)		SM		dark brown, variably SILTY SAND (FILL)	Bentonite Plug
20	SS 7	0	WOH - 2ft				Sand Pack
	SS 8	1-2-1 (3)				21.5 / 4.1	Screen
25	SS 9	4-6-6 (12)		SC		greenish gray, variably CLAYEY SAND (FILL)	
	SS 10	2-3-5 (8)				26.0 / -0.4	
30	SS 11	3-3-4 (7)		CL		greenish gray, variably SANDY CLAY, trace to little sand sized phosphate particles (NATIVE)	
	SS 12	1-4-5 (9)					
35	SS 13	3-3-5 (8)					

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GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35							
	SS 14	3-4-5 (9)		CL		greenish gray, variably SANDY CLAY, trace to little sand sized phosphate particles (NATIVE) *(continued)* 1-inch sand lens at 37-ft	
40	SS 15	2-4-5 (9)					
	SS 16	2-4-5 (9)					
	SS 17	10-50/5"				43.0 -17.4	
				SM		greenish gray SILTY SAND, mostly cemented sand and silt (NATIVE)	
						44.4 -18.8	

Bottom of borehole at 44.4 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

WELL NUMBER B-02

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/12/13 **COMPLETED** 12/13/13 **GROUND ELEVATION** 28.3 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 14+77.4, L112ft **AFTER DRILLING** 23.40 ft / Elev 4.90 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1		SP-SM		brown, pale brown, gray, fine-grain quartz SAND with SILT, trace clayey nodules, trace cemented sand (FILL)	
	AU 2					
					4.0 / 24.3	
5	SS 1	3-2-3-3 (5)	SP-SM		brown, fine-grain quartz SAND with SILT, trace clay, trace cemented sand (FILL)	
	SS 2	2-4-5-6 (9)				
10	SS 3	4-4-4-4 (8)			10.0 / 18.3	Grout
	SS 4	2-3-4 (7)	SM		brown, dark brown, variably SILTY SAND, few clay (FILL)	
15	SS 5	2-2-4 (6)				
	SS 6	2-2-2 (4)				
20	SS 7	2-3-2 (5)			20.0 / 8.3	
	SS 8	1-1-3 (4)	SP-SM		brown, light brown, fine-grain quartz SAND with SILT (FILL)	Bentonite Plug
					23.0 / 5.3	Sand Pack
25	SS 9	1-1-0 (1)	SP-SC		gray, greenish gray, fine-grained quartz SAND with CLAY, few silt (FILL)	
					26.0 / 2.3	Screen
	SS 10	2-3-1 (4)	CL		greenish gray, variably SANDY CLAY, trace sand sized phosphate particles (NATIVE)	
30	SS 11	2-3-5 (8)				
	SS 12	2-4-4 (8)				
35	SS 13	2-4-5 (9)				

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GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35			CL		greenish gray, variably SANDY CLAY, trace sand sized phosphate particles (NATIVE) *(continued)*	
	SS 14	2-3-5 (8)				
40	SS 15	3-2-5 (7)				
	SS 16	2-6-4 (10)				
45	SS 17	2-4-5 (9)			45.0 -16.7	

Bottom of borehole at 45.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

WELL NUMBER B-03

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/13/13 **COMPLETED** 12/13/13 **GROUND ELEVATION** 25.2 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 16+10.4, L146ft **AFTER DRILLING** 18.48 ft / Elev 6.72 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1			SP		brown, gray, fine grain quartz SAND, trace silt (FILL)	
	AU 2					2.0 black matting at 1.5-ft 23.2	
5	SS 1	1-2-2-2 (4)		SP-SM		dark gray, dark brown, brown, light brown, fine-grain quartz SAND with SILT, few clayey nodules (FILL)	
	SS 2	1-1-3-2 (4)					Grout
10	SS 3	2-3-3-1 (6)				10.0 15.2	
	SS 4	2-2-3 (5)		SM		brown, dark brown modeling, variably SILTY fine-grain quartz SAND, some cemented sand (FILL)	
15	SS 5	2-1-2 (3)					
	SS 6	1-2-4 (6)					Bentonite Plug
						18.0 7.2	
20	SS 7	1-3-3 (6)		SP-SC		gray, greenish gray, fine to medium grain quartz SAND with CLAY, trace organics (FILL)	Sand Pack
	SS 8	0	WOR - 1.5ft				Screen
	SS 9	2-1-3 (4)				22.5 2.7	
25				CL		greenish gray, variably SANDY CLAY, few to some sand sized phosphate particles (NATIVE)	
	SS 10	3-3-4 (7)					
30	SS 11	2-4-5 (9)	loss of drilling fluid circulation at 30-ft				
	SS 12	2-4-4 (8)					
35	SS 13	3-6-7 (13)					

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GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35							
	SS 14	2-5-6 (11)		CL		2-inch sand lens at 34.5-ft greenish gray, variably SANDY CLAY, few to some sand sized phosphate particles (NATIVE) *(continued)*	
	SS 15	3-3-5 (8)					
40						40.0 -14.8	
	SS 16	28-50/2"		SM		greenish gray, SILTY SAND, cemented sand and silt, some sand sized phosphate particles (NATIVE)	
	SS 17	50/4"				43.8 -18.6	
						Bottom of borehole at 43.8 feet.	

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

WELL NUMBER B-04

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/13/13 **COMPLETED** 12/13/13 **GROUND ELEVATION** 30.8 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 16+11.1, L84ft **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1		SM		brown, dark brown, SILTYSAND, trace clay (FILL)	Grout
	AU 2					
5	SS 1	1-1-1-1 (2)				
	SS 2	1-1-1-1 (2)				
10	SS 3	2-3-3-4 (6)				
					11.0 / 19.8	
	SS 4	1-1-2 (3)	SM		brown, light brown, dark brown, dark gray, SILTY SAND (FILL)	
15	SS 5	1-2-2 (4)				
	SS 6	1-1-2 (3)			wood fragments at tip of sample at 17 ft	Bentonite Plug
20	SS 7	2-3-2 (5)				Sand Pack
	SS 8	2-3-5 (8)				Screen
					23.0 / 7.8	
25	SS 9	6-11-11 (22)	SP-SC		gray, dark gray, SAND with SILT, few clayey nodules, petroleum odor (FILL)	
					25.0 / 5.8	
	SS 10	1-1-5 (6)	SC		greenish gray, variably CLAYEY SAND, few cemented sand (NATIVE)	
30	SS 11	7-5-4 (9)				
					28.0 / 2.8	
	SS 12	2-3-5 (8)	CL		greenish gray, variably SANDY CLAY, trace to few sand sized phosphate particles (NATIVE)	
35	SS 13	2-3-4 (7)				

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GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35						
	SS 14	3-4-5 (9)	CL		greenish gray, variably SANDY CLAY, trace to few sand sized phosphate particles (NATIVE) *(continued)*	
40	SS 15	4-4-8 (12)				
	SS 16	10-10-8 (18)				
45	SS 17	2-4-5 (9)			45.0 -14.2	

Bottom of borehole at 45.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 10/22/14 10:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\LAB & FIELD TEST\BORING LOGS\300472X2 - MANAEE COUNTY DAM.GPJ

APPENDIX B

Underwater Engineering Services, Inc. Project Summary Report Manatee Lake Dam. December 3, 2013 and Underwater Engineering Services, Inc. Project Summary Report Manatee Lake Dam Raw Water Intake. December 19, 2013

(Video inspection on DVD attached to this report)

Project Summary Report
Manatee Lake Dam

Prepared for:

AMEC

in accordance with AMEC Work Order No. C012304978

UESI Job No. ENG2013806

Prepared by: Matt Herold – Project Manager Date: 12-3-2013

Reviewed & Approved: Graham Cofer – Commercial Diving Manager Date: 12-3-13

Underwater Engineering Services, Inc.
3306 Enterprise Road, Fort Pierce, FL 34982
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UESI
Underwater Engineering Services, Inc.

PURPOSE AND SCOPE

An inspection of the Lake Manatee Dam spillway and toe drain was conducted from November 18 – 20, 2013. The purpose of this assignment was to provide an underwater structural inspection of portions of the Lake Manatee Dam, which is an earthen dam with a concrete spillway and outlet structure. There was concern regarding possible erosion or settling of the spillway apron and water leakage through the dam.

The scope of work included:

1. Visual inspection and condition assessment of the spillway approach slab (apron), identifying pitting, cracking, evidence of cavitation, spalling with exposed rebar, sheet pile corrosion at the leading edge, scouring, and voids.
2. Visual Inspection and condition assessment of the north and south spillway approach walls, including the previous grout repairs, noting pitting, cracking, spalling with exposed rebar and scouring, voids or other evidence of material transportation with the flow of water.
3. Inspection of the toe drain piping via remote crawler.

UESI worked as a subconsultant to the prime consultant, AMEC on this project. The Technical Lead for AMEC was Glen Anderson, PhD.

GENERAL DESCRIPTION OF STRUCTURES

The Lake Manatee Dam is located in Manatee County, FL, approximately 12 miles east of Bradenton, FL. It is an earthen dam, approximately 3200 feet long with a 12-in.-diameter toe drain on the downstream side for the full length. The dam has a dual-gate spillway, approximately 80 ft wide with 148-ft-long approach walls. The approach apron was originally 37 feet long when the dam was constructed in 1965 (plan date). The slab was later extended with the addition of the approach walls (unknown time). The elevation of the approach slab was 13.0 and 15.0 for the original apron and the slab extension, respectively.

METHOD OF INVESTIGATION

The diving inspection was performed by a three-person team. The inspectors accessed the underwater areas from the embankment by the spillway. The inspection was performed with one inspection diver, one rescue-diver/tender and one dive supervisor. Underwater visibility was approximately 18". The air temperature ranged from 80 to 85 degrees. The water temperature was approximately 70 degrees. The average depth of the water was less than 30 ft. Submerged sections typically exhibited light algae. The channel bottom along the apron toe and approach walls was typically comprised of moderately soft sand and silt with penetrations of up to 1 ft.

On November 18, 2013 UESI divers arrived at the Manatee Lake Dam, and after meeting with AMEC representatives, verified that the lockout/ tagout of the spillway gates and raw water intake pumps was satisfactory. A pre-job briefing and safety tailboard meeting was completed before the divers entered the water to perform the inspections. For the diving inspections UESI utilized a surface supplied dive system with an Outland Technologies helmet mounted camera, with live audio and video feed to the dive station where the dive supervisor, and client representatives could monitor the dive real time and see what the diver was looking at.

UWS 3210 Video System Used for the Underwater Inspection.

UESI enclosed dive trailer used for the inspections.

EXISTING CONDITIONS

South Approach Wall

The wall was inspected using a surface supplied commercial diver with a camera mounted on his helmet. The Dive Supervisor and client representative were able to view the entire inspection, listen to the narrative and make comments on the video which is included with this report. The visibility during this dive was approximately 18 inches.

Following is a list of items noted during inspection. Refer to the end of the report for a drawing showing locations of items.

A. Scaling, ¼" deep, with exposed aggregate over the entire length of wall from the high water mark down – Refer to Photograph #1

B. Vertical crack, 8" long by ¾" wideby ¾" deep, located on the north side of the wall, 1' east of the expansion joint where the wall meets the buttress, and 2 feet below the waterline (approx elevation of crack = 37.5)

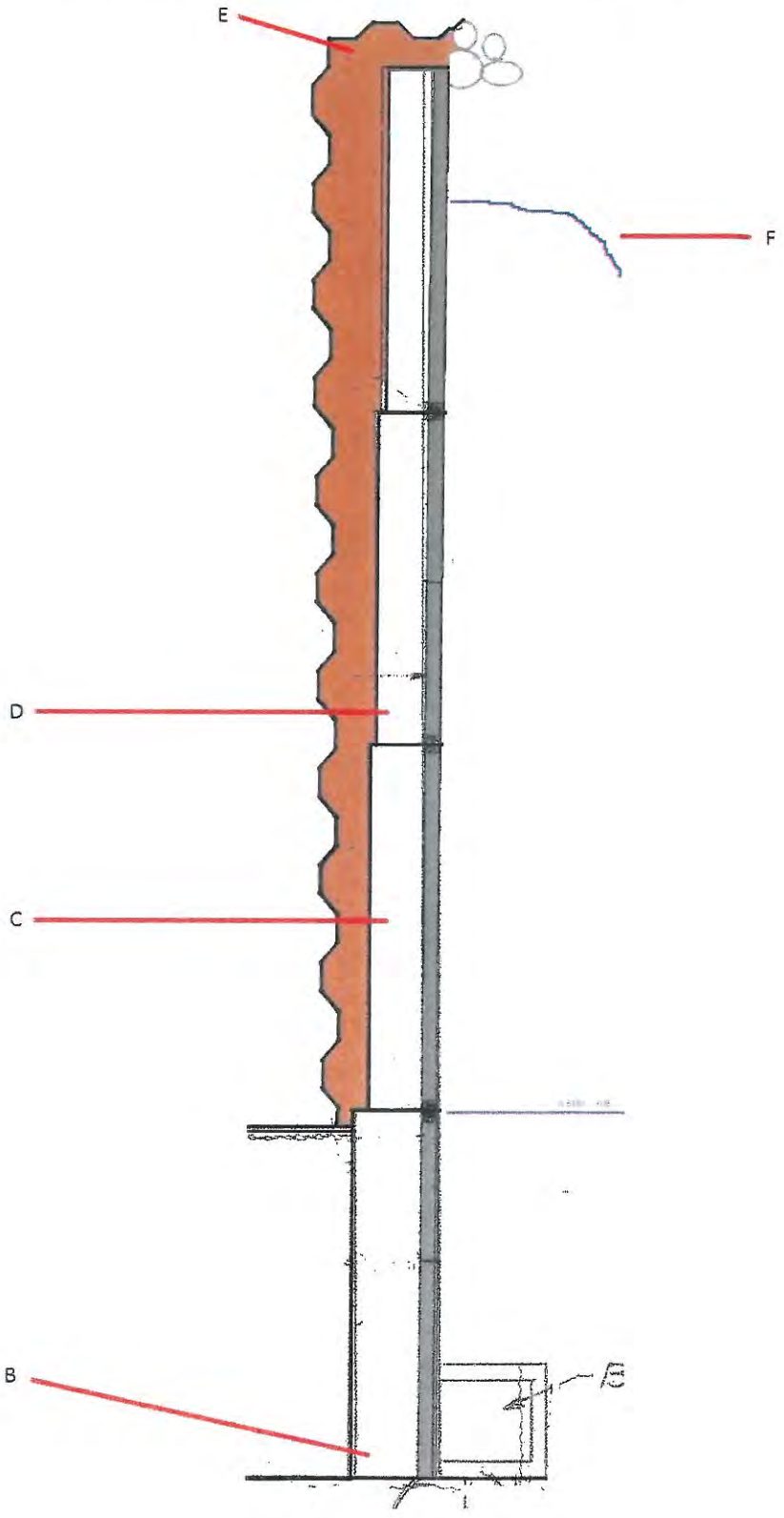
C. Localized area 3" X 5" with scaling ½" deep located 51' east of the expansion joint where the wall meets the buttress, approximate elevation = 18.5
D. Localized area with deeper scaling – 4" X 2.5" X 1" deep, located 73' east of the buttress, elevation 20.5

E. The wall has had sheet pile driven approximately 3.5' to the north side of the footer to an elevation 6" below the top of the footer.Tthe area between the footer and sheet pile is filled with grout. The sheet pile appeared to be in good condition with little evidence of deterioration and no separation in any knuckles. At the east end of the wall the sheet pile turns to the south 3' east of the wall. The sheet pile is exposed at the NE corner, then after approximately 8', it is covered by 3'-diameter riprap boulders.

F. 20' West from the East end of the wall on the south side, it appears as though the soils cement which covers the embankment adjacent to the wall has cracked, became undermined and the eastern section collapsed (concrete pieces could be felt with the probe 2' below the sandy soil, the western portion is undermined - at the wall there is a 2' tall void 6'+ deep, as the diver followed the void to the south, the void became smaller, by 10' south the void is 18" tall and 12" deep, at this point the crack turns west and travels 2' after 2' the crack is closed and there is no void.

N

South Approach wall Locations of findings



Approach Slab

UESI divers then proceeded to inspect the approach slab. The leading edge of the slab is 2' thick on top of a sheet pile toe wall, the slab overhangs the sheet pile by approximately 12". At the SE corner of the slab, there is approximately 2" of sheet pile exposed, with riprap along the east side. The height of exposure remained at 2" for 20', then increased to 48" for approximately 30', then gradually tapered down to zero at the north end of the slab – see Manatee Dam Plan View with Elevations. There was no evidence of damage or deterioration in the exposed areas of the slab. It was covered in silt with depths ranging from 1" to 2' (thicker near the spill way). The slab also had a large amount of debris, including several steel hatch covers which were used to cover the stop log slot in the road – Manatee County representatives stated that vandals had caused this. The covers are 2'x3'x1" thick, (6) large pieces of concrete debris ranging in size from 3' by 4' by 4" to 7'by 7' by 3". There were also several areas of concrete overpour and a raised section which was formed and poured. The raised section was 6" high by 3' wide (north to south) by 30' long, extending east from the bullnose overtop the southern expansion joint.

North Approach Wall

On Tuesday, after a pre job safety tailboard meeting, and lockout/ tagout verification, UESI divers inspected the north approach wall. As with the south wall, the entire surface from the high water mark down was covered with ¼" deep scaling with exposed aggregate. The wall has had sheet pile driven approximately 3.5' to the south side of the footer to an elevation 6" below top of footer and the area between the footer and sheet pile is filled with grout. The sheet pile appeared to be in good condition with little evidence of deterioration and no separation in any knuckles. At the east end of the wall, the sheet pile turns to the north 3' east of the wall, and after approximately 8' the sheet pile is covered by a pile of 3'-diameter riprap boulders.

Following is a list of items noted during the inspection. Refer to the end of the report for a drawing showing the locations of the items.

A. 5" by 7" area of 1" deep scaling, located 8' from expansion joint and at Elevation 39'

B. Vertical hairline crack extends from soil cement interface on north side (Elevation 38.5)up to top, crosses through wall and extends from the top of wall down to elevation 38 – see photo #5

C. Mechanical hole 1¼" dia. missing grout, located approximately 18' east of expansion joint, elevation 38

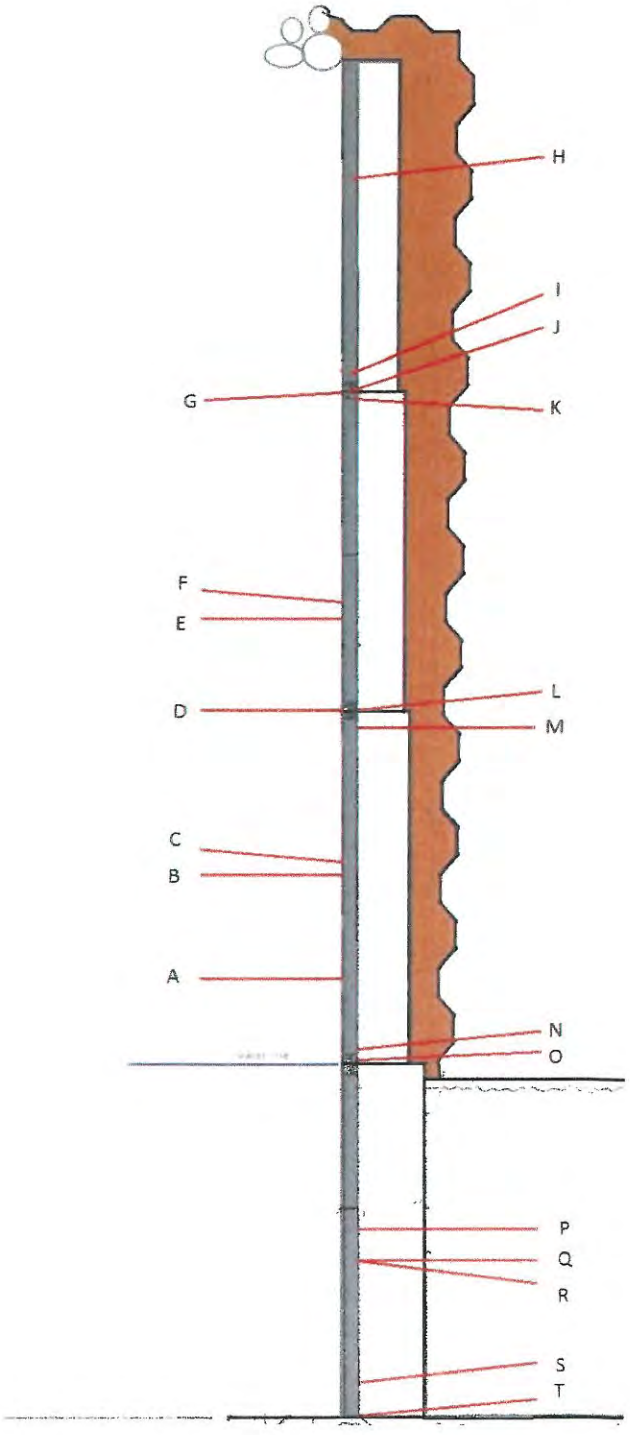
D. Expansion joint has 1" of separation at the bottom end (Elevation 36.5). The gap closes 4' from top of wall.

E. 9 ½' east of expansion joint, it appears as though the soils cement which covers the embankment adjacent to the wall has cracked, become undermined, and has broken off, the break extends from the wall where there is a void underneath which is 2' tall and extends more than 6' to the west, as the diver followed the break north the void gradually shrank, by 6' north the void was 6" tall 18" deep, by 9' north the crack and associated void closed. It appeared that the soil cement east of the break has collapsed as there appeared to be broken pieces under soil as the diver probed it, the diver continued east approximately 20' at which point the soil cement appeared to be intact and continued until it ran into the rip rap at the east end of the wall

F. Local scaling, 6" by 8" by ½" deep (maximum), located 12' east of expansion joint, elevation 20.

G. Easternmost Expansion joint has 1½" gap at top, gap closed 2' down – this condition exists on both the north and south sides.
H. Area of ½"-deep popouts, 6' by 2', located 12' west of end of wall on south side, from Elevation 23.5 to 17.5.
I. Area of scaling, 1½' by 1' by ½" deep, located 8" east of joint and at Elevation 22.0.
J. Spall at expansion joint, 2½" by 2½" by 1" deep, located atElevation 29.0
K. Area of scaling, 7'high by 4'wide by ½" deep, located at and west of expansion joint and from Elevation 18.5 to 25.5.
L. Gap in expansion joint, ½" wide, from Elevation 37.0 to top of wall.
M. 18' long piece of wire – approximately 1/8" diam. 18" long at surface of concrete, slightly protruding, since the reinforcement of the wall is rebar, AMEC representatives felt this was probably a piece of tie wire which was used while tying the rebar cage. – see photo #3
N. Mechanical hole missing grout, 1¼" diameter by 2½" deep, located 4" east of expansion joint andat Elevation 40.0
O. Expansion joint has ¼" separation at top of wall, then increasing to ¾" with heavy pitting at waterline (Elevation 39.5),then closed 18" below waterline(Elevation 38.0)
P. Area of scaling with exposed aggregate, 9" by 2" x ½" deep, located 14' west of expansion jointand at Elevation 35.5.
Q. Spall with no exposed rebar, 10" by 12" by 2" deep (max.), located 20' west of expansion jointand at Elevation 34.5. Refer to Photograph #4
R. Mechanical hole missing grout, 1¼" diameter by 1¾" deep, located 20 ' west of expansion joint, and at Elevation 40.0.
S. Spall with no exposed rebar, 9" by 4" by 1" deep (max.), located 4" east of expansion joint and at Elevation 36.5.
T. Expansion joint between wall and north buttress is closed at top of walland 2' down, then opens to 1" wide at waterline (Elevation 39.5), then closed by Elevation 36.0. At Elevation 34.5 there is an area 6" high by ¾" wide, where the expansion joint appears eroded. The diver could put the folding ruler 6" into joint. Refer to Photograph #6.

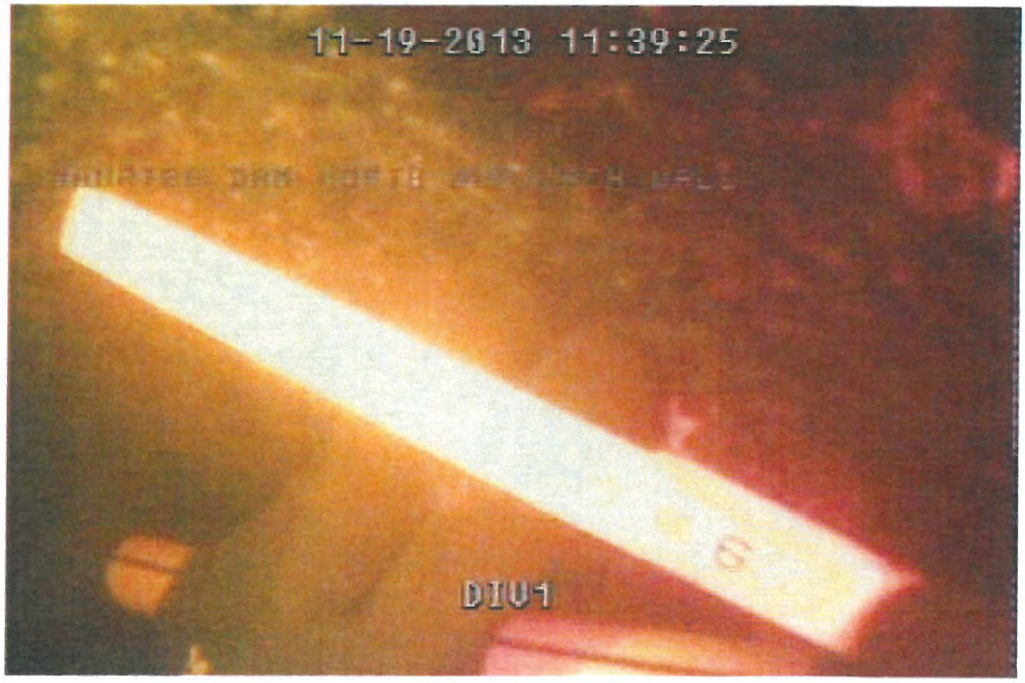
North Approach Wall Location of Findings



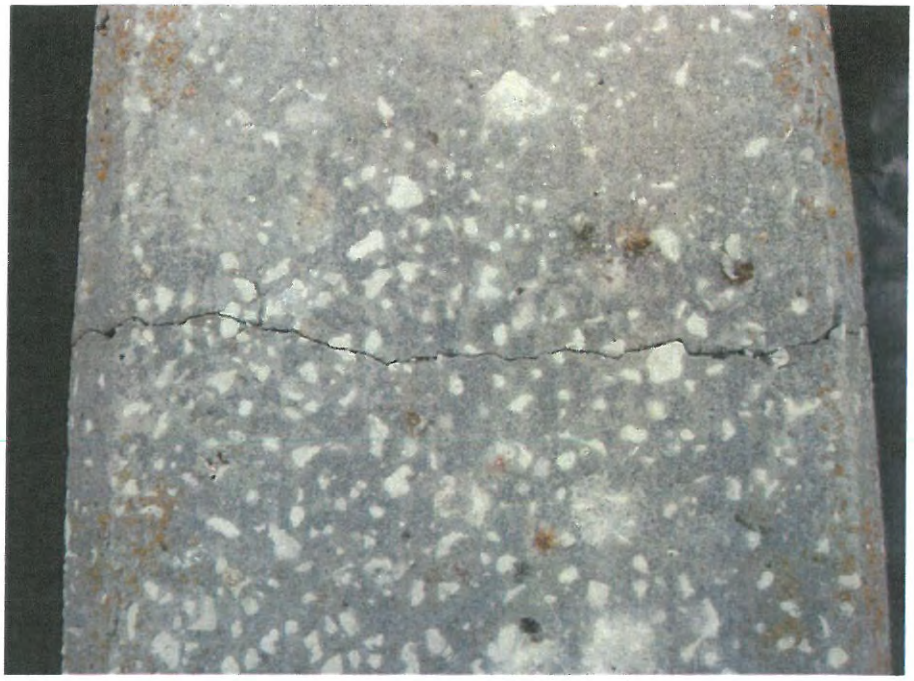
Photograph #1: View of typical scaling with exposed aggregate of the approach walls and one of the mechanical holes. This hole has the grout intact.

Photograph #2 View of typical scaling underwater

Photograph #3: View of the 18" piece of wire protruding from the North wall – item "M"



Photograph #4: View of spalling – Item Q of the north wall findings



Photograph #5: View of crack running through the top of the north approach wall – Item "B" of the north wall findings

Photograph #6: View of the expansion joint of the north wall meeting the buttress - Item "T"

Toe Drains

On Wednesday November 20, 2013 UESI utilized an Inuktun VT100 crawler to remotely inspect the toe drains below the dam. The inspection began at the manhole at the southern end of the south toe drain, and proceeded north once the vehicle had reached the next manhole it was retrieved and then lowered into the next hole, always inspecting while traveling north to ensure a seamless video inspection. In the Southern drain there was a very minor amount of "sludge"(1" or less) build up at the 6 o'clock position of the pipe, water was flowing in the pipe with no blockages. One issue was discovered in the south pipe, that was in the manhole at the north east corner of the pump building, the plastic cover which sits below the manhole cover had fallen down and was laying in the junction box, this could potentially create a blockage in the pipe if it is not removed – see photo #7, 8, and 9. After inspecting the entire southern drain which totaled approximately 1100', UESI moved to the north end of the northern toe drain and repeated the process moving south. In the northern drain there was some sedimentation, ranging from very minor up to approximately 2", is some areas this sedimentation was acting as a small dam inside the pipe, as the crawler moved through these areas it broke up the wall and let the water pass more freely. The length of the northern toe drain totaled approximately 1820'

Inuktin VT 100 Remote Operated Vehicle (pipe crawler) used for the Toe Drain

Photo #7 shows the plastic cover at the bottom of the junction box of the southern toe drain at the northeast corner of the pump building.

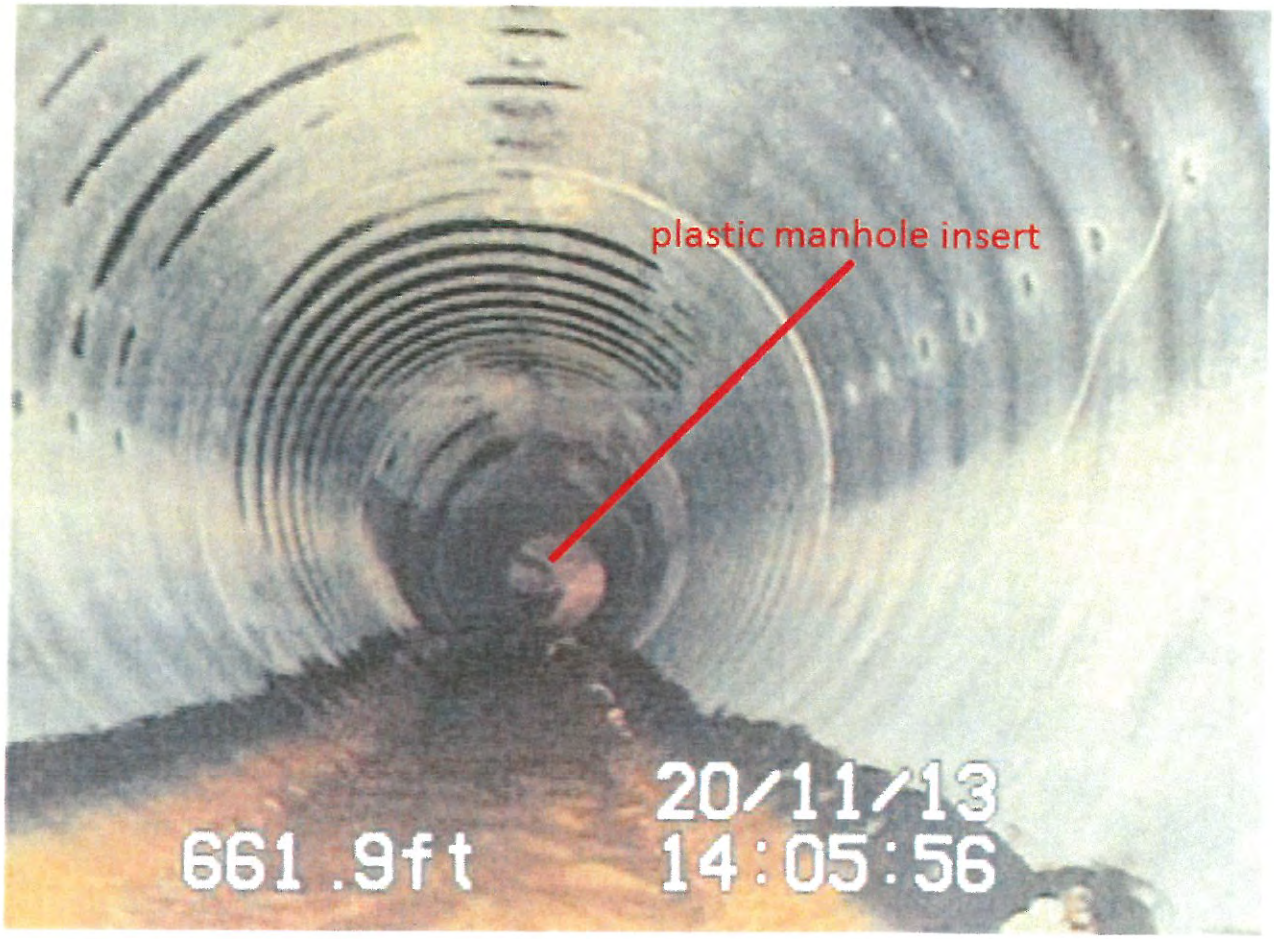


Photo #8 shows the plastic manhole insert

Photo # 9 shows the plastic manhole insert

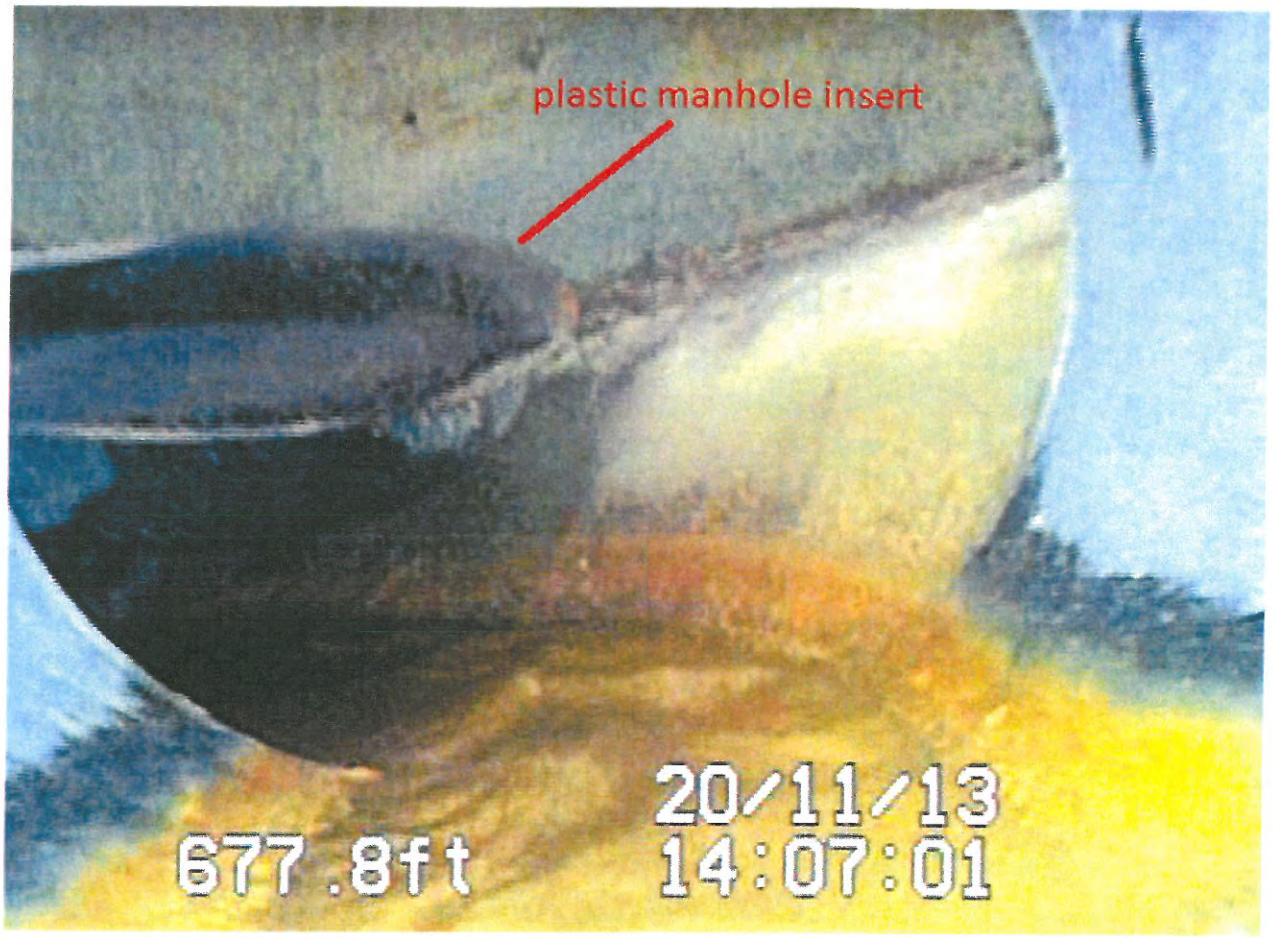


Photo #10 is of the Inuktun VT100 at the bottom of a junction box preparing to enter the pipe.

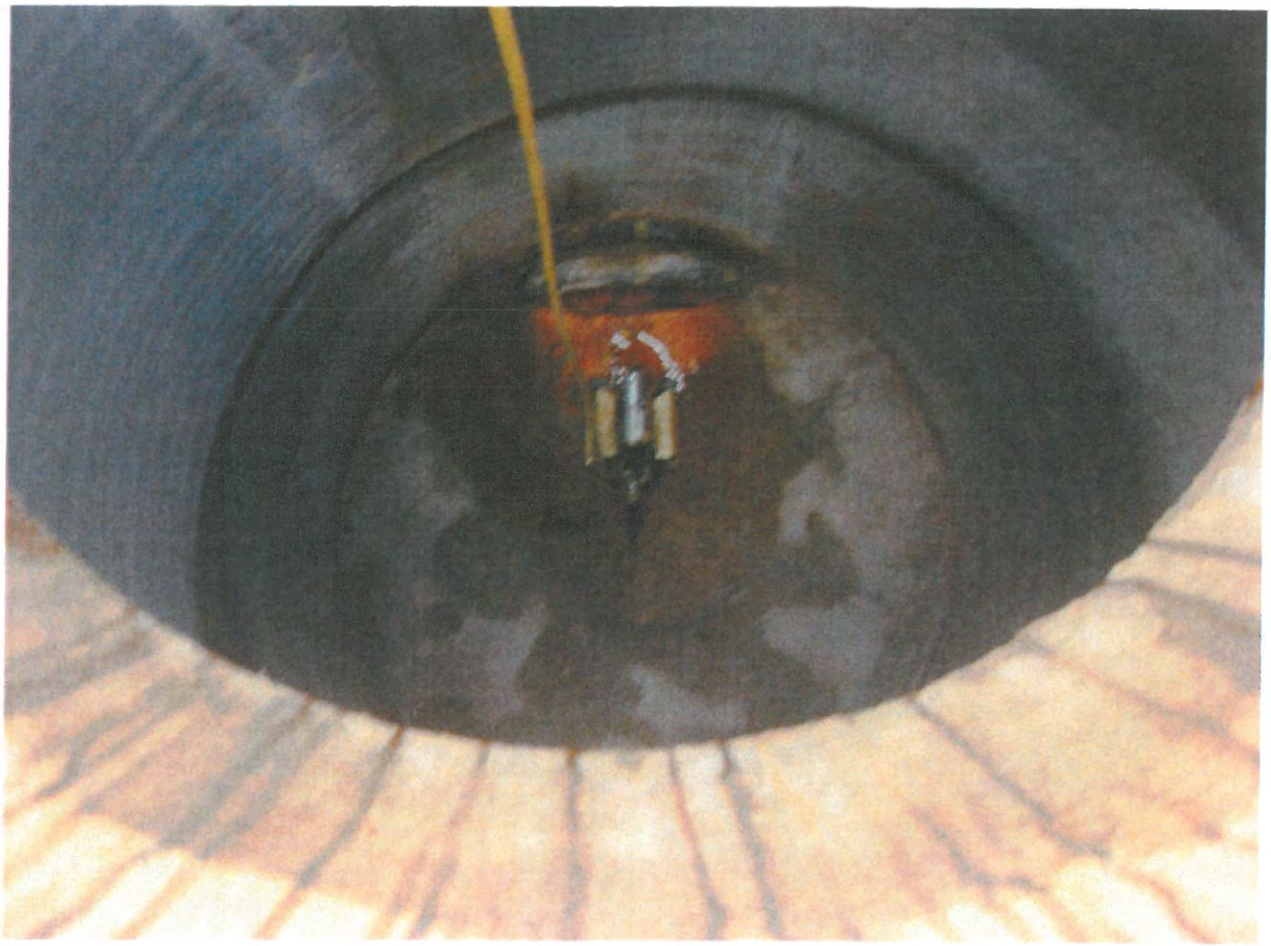
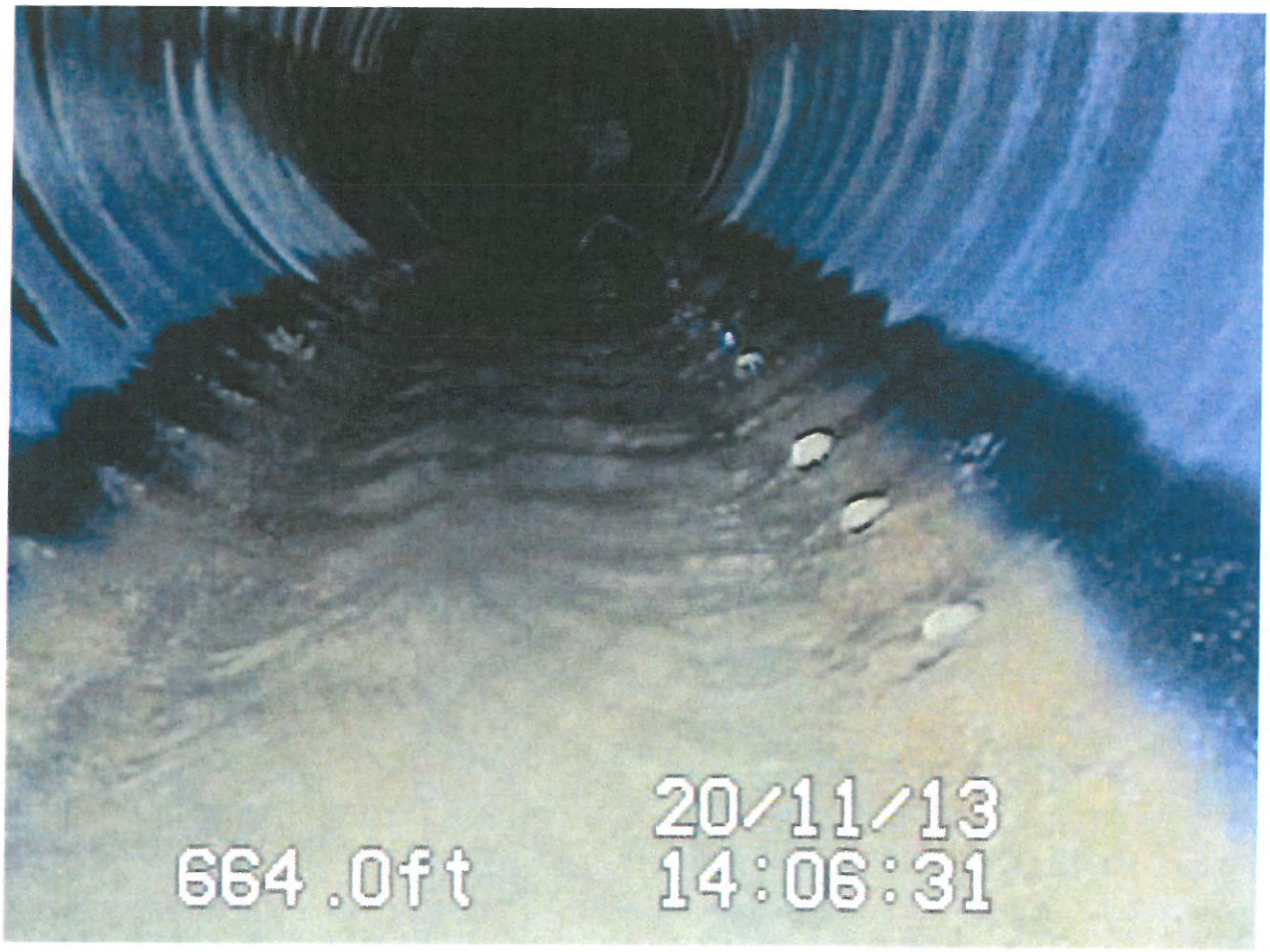
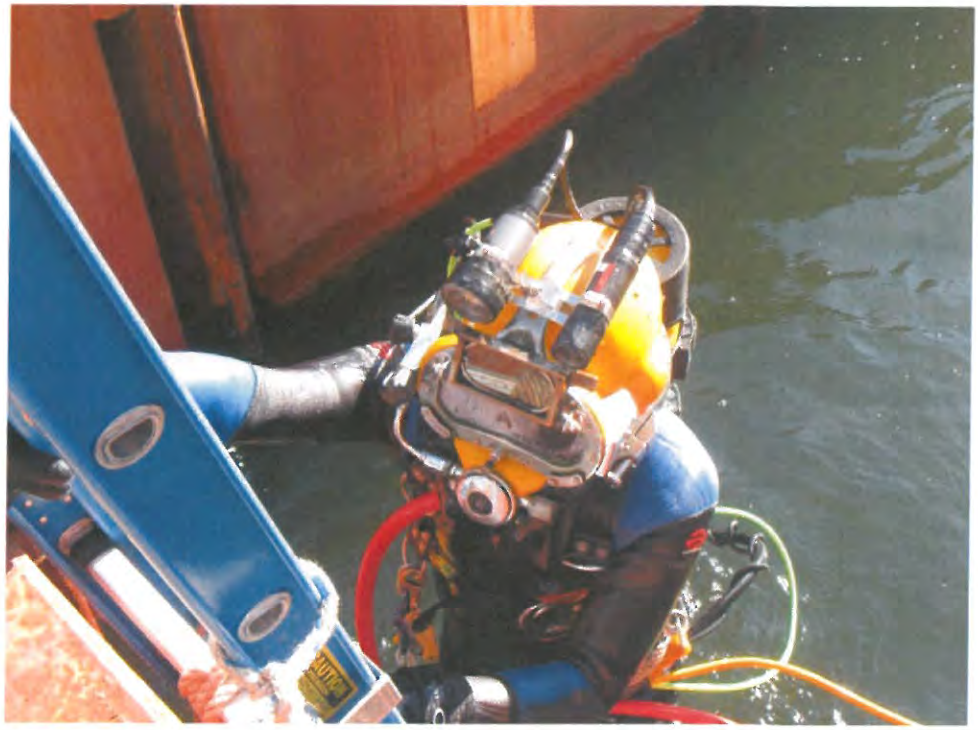


Photo # 11 shows water coming in through the perforations in the toe drain



Project Summary Report
Manatee Lake Dam Raw Water Intake



Prepared for:

AMEC

in accordance with AMEC Work Order No. C012304978

UESI Job No. ENG2013806

Prepared by: Matt Herold – Project Manager Date: 12-19-2013

Reviewed & Approved: Graham Cofer – Commercial Diving Manager Date: 12-19-2013

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PURPOSE AND SCOPE

An inspection of the Lake Manatee Dam Raw Water Intake was conducted on December 12 – 20, 2013. The purpose of this assignment was to provide an underwater inspection of the interior of the course screen Intake structure and 48" raw water intake pipe at the Lake Manatee Dam, which is an earthen dam with a concrete spillway and outlet structure located near Bradenton, Florida.

The scope of work included:

1. Visual inspection and condition assessment of the course screen intake structure
2. Visual Inspection and condition assessment of the 48" raw water intake pipe which runs east to west between the course screen chamber and fine screen.
3. Provide Ultrasonic thickness readings of the raw water pipe.

UESI worked as a subconsultant to the prime consultant, AMEC on this project. The Technical Lead for AMEC was Glen Anderson, PhD.

GENERAL DESCRIPTION OF STRUCTURES

The Lake Manatee Dam is located in Manatee County, Florida approximately 12 miles east of Bradenton, Florida. The Dam has a raw water intake structure, which supplies water to the water treatment facility located on site. The structure consists of a bar screen intake chamber on the upstream side of the spillway connected to a fine screen chamber on the downstream side of the spillway. The two chambers are connected with 87' of 48" diameter steel pipe.

METHOD OF INVESTIGATION

The diving inspection was performed by a six-person team. The Divers accessed the underwater areas from the ladder into the Intake Chamber. The inspection was performed with one inspection diver, one in-water tender, one rescue-diver, two tenders, and one dive supervisor. Underwater visibility was approximately 30". The air temperature was 70 degrees. The water temperature was approximately 70 degrees. The average depth of the water was less than 30 feet. Submerged sections typically exhibited light marine growth.

On December 12, 2013, UESI divers arrived at the Manatee Lake Dam and met with AMEC and Manatee County representatives. UESI verified that the Lock-out/Tag-out (de-energizing controls) of the spillway gates and raw water intake pumps was satisfactory, a confined entry permit issued, rescue equipment staged, and that a pre-job briefing and safety tailboard meeting were completed prior to the start of dive operations. UESI utilized a General Oceanics Model 2135 flow meter to verify there was zero flow in the pipe prior to diver entry.

A surface supplied dive system with an Outland Technologies helmet mounted camera provided live audio and video feed to the dive station so that the dive supervisor and client representatives could view the inspection real-time. The Diver/inspector carried a Cygnus diver-held multiple echo ultrasonic digital thickness gauge to take wall thickness readings in the pipe.

Outland Technologies UWS 3210 Video System

Figure 1

Figure 2

UESI Enclosed Dive Trailer

General Oceanics Flow Meter model 2135

Figure 3

Figure 4

Cygnus Underwater Diver Held Multiple Echo Ultrasonic Thickness Gauge

EXISTING CONDITIONS

Intake Chamber

The interior of the Intake Chamber was inspected using a surface supplied commercial diver with a helmet mounted camera. The Dive Supervisor and client representative were able to view the entire inspection, listen to the narrative, and make comments on the video. The recoded video is included with this report. The visibility during inspection was approximately 3 feet. UESI divers inspected the walls, valve gates, and ladders in the intake chamber.

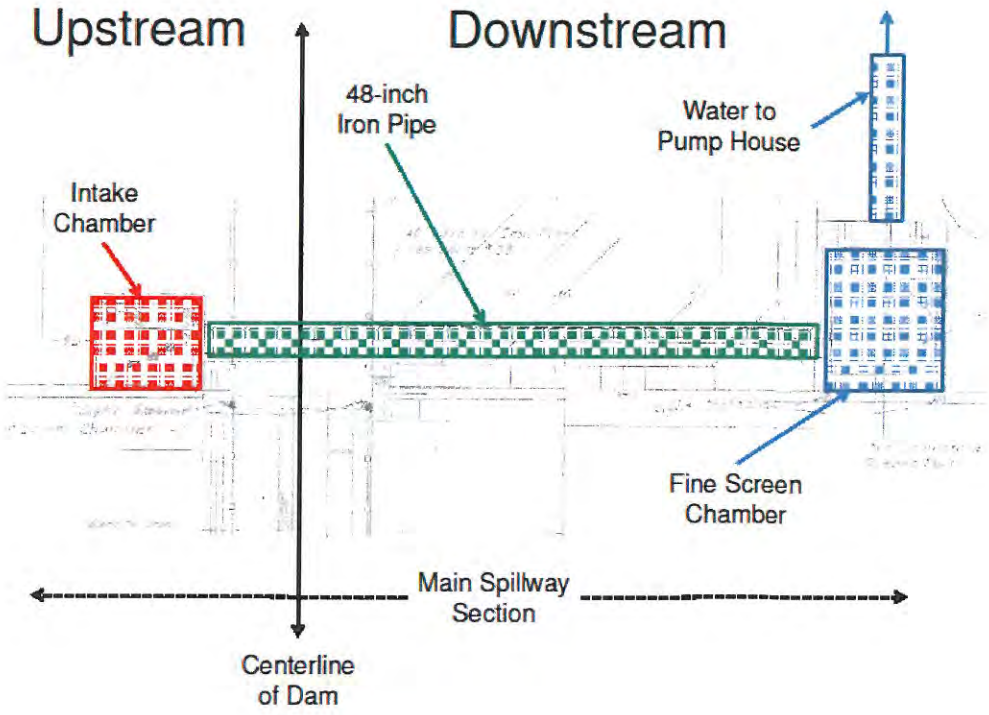


Figure 5

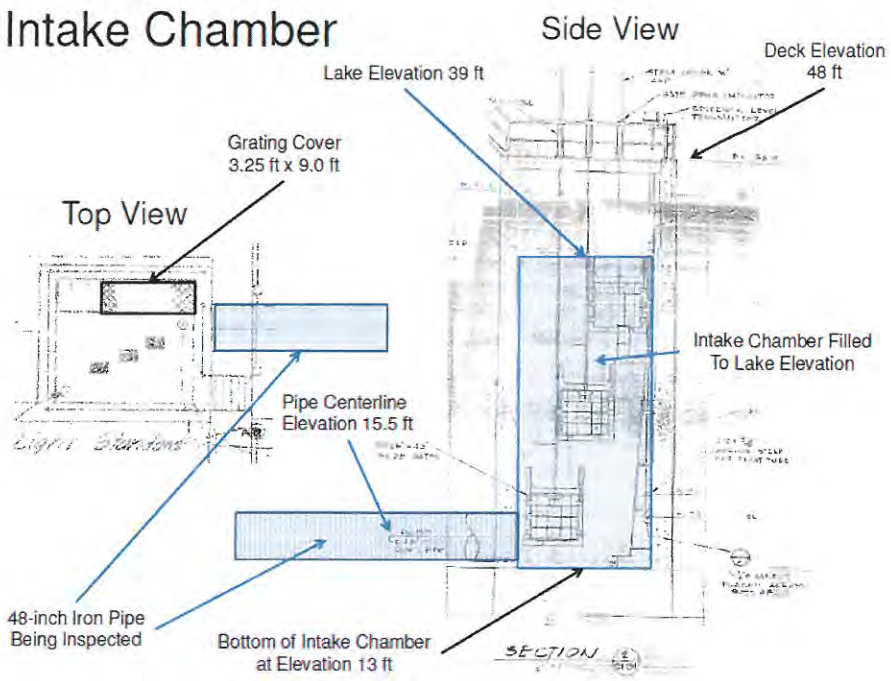


Figure 6

Following is a list of items noted during inspection of the Intake chamber

A. Walls – the portions of the concrete walls that were accessible were covered in a light marine growth and what appeared to be a brushed on light colored cementitious coating - no defects or indications were noted.
B. All three of the intake gates exhibit uniform pitting – ⅛" to ¼" deep over the entire gate, with heavier corrosion around the stainless steel fasteners.
C. All three of the intake gates have approximately 80% coating failure – see figure 7 photo
D. Ladders appeared to be in serviceable condition, with only minor corrosion found on the base plate of the upper ladder. – see figure 8 photo.
E. There is a vertical 6" pipe which runs down near the eastern wall – it appears to be abandoned. The flange bolts are heavily corroded – see figure 9 photo.
F. There was a large amount of foreign material removed from the chamber including a bucket, numerous pieces of stainless steel hardware –most of which appeared to have been cut off and was probably dropped during installation or modification of the gates. There were also gate, but as none of the gates appeared to missing components, these were probably dropped during installation – See figure 10 Photo.
G. The guide for the eastern gate has some loose hardware.

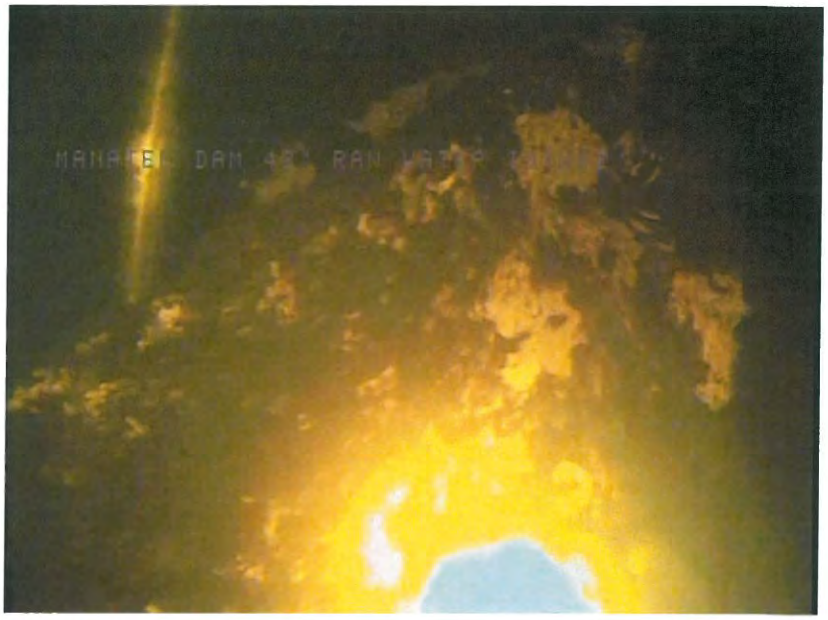


Photo 7 shows one of the gate valve stem guides and illustrates coating loss typical on all of the gates. Coating remains in the white areas and the darker areas show failed coating and general corrosion of the substrate.

Figure 7

Photo 8 shows the diver pointing to minor corrosion of the upper ladder mounting plate

Figure 8

Photo 9 shows corroded hardware in the flanges of the abandoned 6" pipe on the east side of the coarse screen chamber

Figure 9

Photo 10 shows assorted foreign material removed from the coarse screen chamber

Figure 10

48" Raw Water Intake Pipe

Once the coarse screen chamber was inspected, a second diver entered the water to act as an in-water tender for the penetration into the 48" pipe. Each joint was inspected and the distance from east end of pipe, type of joint, and general condition were documented. Although not identified on the drawings, joints appear to be welded or bell socket type joints. Vertical and horizontal measurements were taken at every second joint.

Joint #	Distance	Height	Width	Type of Joint	Comments
Start	0			Start of pipe	30% coverage of ¾" diameter blisters between 5 and 7 o'clock pipe position, pitting 1/16-1/8" deep, ¾" diameter, some cracking and checking of coating with Corrosion bleed-out.
1	3'-10"			Welded	Same as previous
2	10'-5"	3'-10"	3'-10"	Welded	30% coverage of ¾" diameter blisters between 5 and 7 o'clock pipe position, pitting 1/16-1/8" deep, ¾" diameter
3	17'-1"			Bell Socket	¾" to 1" gap (pipe not inserted all the way into bell end) coverage of pitting reduced to 10%
4	36'-11"	3'-10"	3'-10"	Welded	10% coverage of ¾" diameter blisters between 5 and 7 o'clock pipe position, pitting 1/16-1/8" deep, ¾" diameter
5	43'-8"			welded	Same as previous
6	52'-4"	3'-10"	3'-10"	Welded	Same as previous
7	57'			Welded	Same as previous
8	63'-6"	3'-10"	3'-10"	Welded	Same as previous
9	70'-2"			Welded	Same as previous
10	76'-11"	3'-10"	3'-10"	Welded	Same as previous
11	81'-6"			Bell Socket	Gap between sections (pipe not inserted all the way into bell end) 1-¾" pitting consistent with previous
12	87'	3'-10"	3'-10"	End of pipe	10% coverage of ¾" diameter blisters between 5 and 7 o'clock pipe position, pitting 1/16-1/8" deep, ¾" diameter

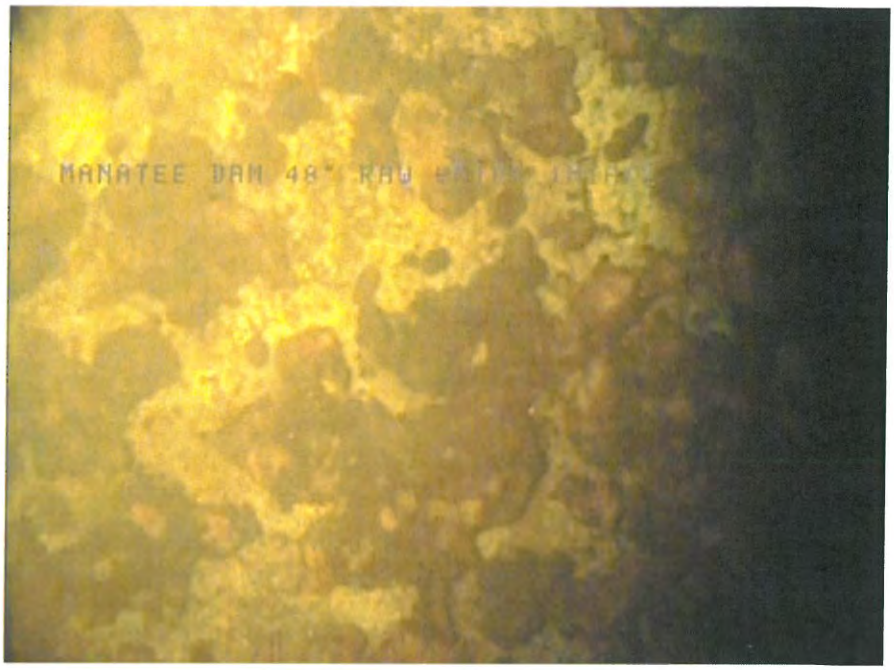


Figure 11

Photo 11 shows rust nodules at the invert of the eastern end of the pipe prior to cleaning with a wire brush to check for pitting

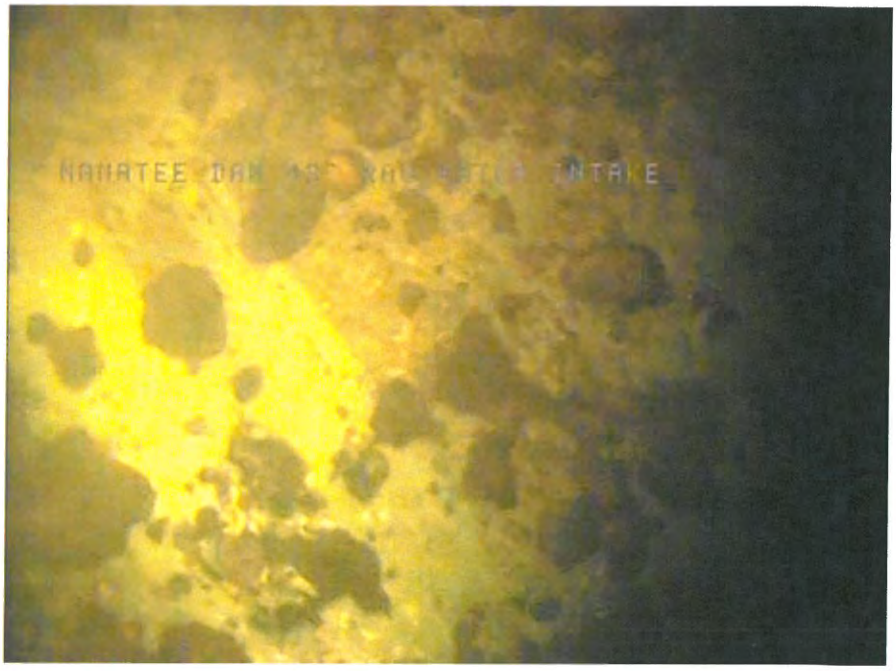


Figure 12

Photo 12 shows the same area as the previous photo after cleaning away the rust to visually inspect the pitting of the substrate. Pitting averaged ¾" diameter with a depth of 1/16" to 1/8"

Figure 13

Photo 13 shows cracking of the coating at the first joint.

Figure 14

Photo 14 shows the gap in the third joint which appears to be a bell socket joint

Photo 15 shows the diver measuring the gap in the 11th joint (also appears to be bell socket)

Figure 15

UESI utilized a Cygnus Underwater Diver-held Multiple Echo Ultrasonic Thickness Gauge to get thickness readings on the pipe, immediately prior to use it was verified to be in calibration, by testing it on the .500" calibration block which comes with the instrument.

Measurements taken with the Cygnus Multiple Echo gage all are error checked using three return echoes to give repeatable, reliable results. With multiple echo, readings are taken by measuring the time delay between any three consecutive back wall echoes. The time of T1 (coating thickness) is ignored. The times of T2 and T3 are equal to the time that it takes to travel through the metal. Only by looking at three echoes can the measurements be automatically verified (where T2 = T3)

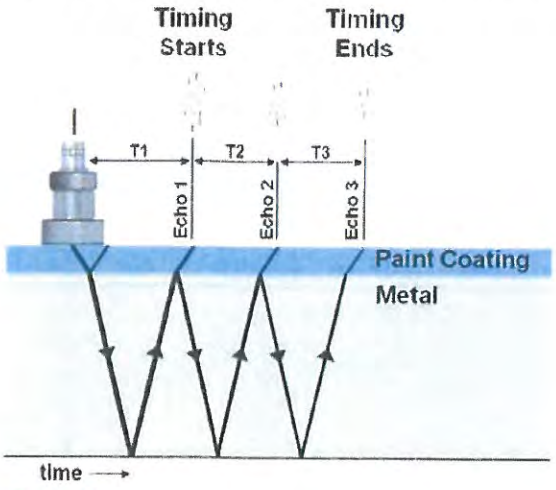


Figure 16

Thickness readings were taken at the east end of the pipe, then at 20' intervals, and again at the west end of the pipe. Four (4) readings were taken at the 12:00, 3:00, 6:00, and 9:00 o'clock positions on the pipe wall at each station. All distances and position references are facing downstream (West). Thickness data are shown on the table below.

Station Distance from East End	UT Location Pipe Position	1st Reading Inches	2nd Reading Inches	3rd Reading Inches	4th Reading Inches
1'	12:00	0.335	0.320	0.300	0.305
1'	3:00	0.225	0.325	0.325	0.295
1'	6:00	0.225	0.325	0.480	0.380
1'	9:00	0.505	0.295	0.225	0.300
20'	12:00	0.245	0.425	0.195	0.175
20'	3:00	0.285	0.335	0.355	0.365
20'	6:00	0.375	0.230	0.235	0.325
20'	9:00	0.350	0.265	0.375	0.190
40'	12:00	0.325	0.225	0.300	0.260
40'	3:00	0.295	0.305	0.395	0.395
40'	6:00	0.365	0.275	0.355	0.325
40'	9:00	0.240	0.295	0.285	0.295
60'	12:00	0.265	0.330	0.215	0.280
60'	3:00	0.235	0.275	0.305	0.385
60'	6:00	0.350	0.335	0.330	0.285
60'	9:00	0.275	0.160	0.345	0.320
80'	12:00	0.325	0.330	0.255	0.250
80'	3:00	0.240	0.315	0.250	0.215
80'	6:00	0.315	0.245	0.205	0.315
80'	9:00	0.315	0.255	0.320	0.290
86'	12:00	0.265	0.270	0.235	0.255
86'	3:00	0.230	0.305	0.265	0.255
86'	6:00	0.300	0.355	0.355	0.270
86'	9:00	0.305	0.250	0.255	0.300

APPENDIX C

Integrity Drilling & Geophysical Services' Geophysical Investigation Report, Lake Manatee Spillway, Manatee County, FL. Dated: December 2, 2013

Geophysical Investigation Report

Lake Manatee Spillway

Manatee County, FL

Completed for AMEC E & I

Prepared by Integrity Drilling and Geophysical Services, LLC (I.D.G.S.)

Groveland, FL

INTEGRITY
DRILLING & GEOPHYSICAL SERVICES

December 2, 2013

Mr. Glen Andersen, P.E.
AMEC E & I
2000 East Edgewood Drive, Suite #215
Lakeland, FL 33803

Re: **Geophysical Investigation Report**
Lake Manatee Spillway
Manatee County, FL
AMEC Project Number 300472X2

Dear Mr. Andersen,

On behalf of Integrity Drilling & Geophysical Services, LLC (I.D.G.S.), I am pleased to provide you with the findings and summary of results of the geophysical investigation completed at the Lake Manatee Spillway located in Manatee County, FL. During the investigation, Ground Penetrating Radar (GPR) was utilized to explore the potential presence of voids and / or cavities along the sides of and on the apron of the spillway. Please do not hesitate to contact me should you have any questions, comments, or concerns regarding the geophysical survey completed at the Lake Manatee Spillway Site or our opinions discussed herein.

Respectfully Submitted,
Independent Drilling & Geophysical Services, LLC

TROY L. BOURN LICENSE No. 2767 STATE OF FLORIDA PROFESSIONAL GEOLOGIST

12/2/2013

Troy L. Bourn, P.G.
Senior Geologist / Geophysicist
Registered Florida Professional Geologist No. 2767

Introduction

At the request of Mr. Glen Andersen, P.E., with AMEC E & I, I.D.G.S. completed a Ground Penetrating Radar (GPR) survey at the Lake Manatee Spillway located in Manatee County, FL on November 18, 2013.

This GPR investigation was completed to determine if any subsurface voids or cavities (that could be associated with erosion processes) were apparent in the data collected across the spillway. The survey consisted of recording digital GPR data across accessible areas of the site. Additionally, marking paint was used to approximately delineate any area(s) that might be associated with a potential subsurface void or cavity. The approximate locations of the GPR transect lines are depicted on the attached Figure 1. The GPR profiles collected on site are also attached for reference.

Description of Geophysical Investigation Methods and Settings

GPR is a type of induced geophysical surveying that involves the transmittal of short pulses of high-frequency electromagnetic waves into the subsurface. The intensity of the reflected waves, measured at the GPR receiver, is interpreted to determine variations in the electrical impedance of the subsurface materials. These variations are mainly due to the dielectric properties of the earth and construction materials.

Reflection of the electromagnetic waves occurs where there are impedance contrasts. These impedance contrasts can include voids and cavities, natural variations in soil moisture content, density, fines content, cementation, and bedding planes. The radar signal is often attenuated (weakened) by an increase in moisture content, which has a higher conductivity; similarly, clayey soils / materials have lower impedance and rapidly attenuate the GPR signal; therefore, penetration of the radar signal through wet clayey soils and materials can be extremely limited. Accordingly, the depth of electromagnetic wave penetration is absolutely site-specific and conditions beyond the effective depth of radar penetration remain unknown.

The GPR survey conducted at the spillway was completed in accessible areas of the spillway and within the spillway discharge apron, in order to determine the observable presence or absence of any potential subsurface voids and / or cavities surrounding the sheet piles and under the concrete discharge apron. The GPR data were collected using a cart-based Sensors & Software, Inc.,

Noggin GPR system. The digital GPR data collected were then processed using the DEWOW (a high pass filter) and a selected gain, to amplify the radar signal.

The GPR data collection system was first tested to determine depth settings across portions of the spillway prior to collecting data, in order to optimize equipment settings for the subject property. It was requested that I.D.G.S. was to survey for potential voids at depths up to approximately 30 feet below ground surface (BGS) for portions of the areas adjacent to both sides of the spillway structure. Additionally, I.D.G.S was asked to identify, if present, any shallow voids or cavities below the spillway concrete apron. Data for most of the profiles completed adjacent to the spillway were collected using the 250 MHz antenna at a depth setting of approximately 190 nanoseconds (to depths of approximately 30 feet BGS). Data for the profiles completed on the spillway concrete apron, (and on one of the profiles adjacent to the up-stream portion of the spillway), were collected using the 500 MHz antenna at a depth setting of approximately 90 nanoseconds (approximately 15 feet BGS).

Interpretation of Observed Reflections in GPR Transect Profiles

The GPR data profiles completed on the spillway berm show a somewhat continuous, variably thick, reflective facies consisting of planar horizontal sub-parallel reflections on the down-stream portions of the survey. These types of reflective patterns are typical of layering within a unit of predominately sandy soils with variable accumulations of fines within the soil unit. Additionally, the topography at the site has caused some of the reflections on the associated profiles to appear be dipping. These reflections are related to the topographic relief of the embankment system of the berm on the sides of the spillway. The profiles associated with the sides of the spillway showed that the depth limits of the observed reflections ranged from approximately 2 to 20 feet BGS. No apparent voids or cavities were apparent on the reflections observed on the GPR profiles completed on the sides of the spillway. The cohesive nature of the soils used to create the embankment system did not allow deeper signal penetration. The GPR signal was attenuated at varying depths due to the soil composition / conditions present at the site.

GPR data collected within the spillway concrete apron indicated the possible presence of numerous minor voids and / or cavities beneath the concrete and along the sheet pile border. Approximately 19 areas were located and marking paint was used on the concrete apron itself, as directed by AMEC E & I, to delineate the areas in question that may be potential voids. The

potential voids were approximately 6 to 12 inches in depth and were located immediately under the concrete apron or along the perimeter of the area adjacent to the sheet piles that border the concrete apron.

The properties of the concrete impeded the penetration of the radar signal on the up-stream transect of the spillway. The concrete mix appeared to include a variety of aggregates, both cohesive, and non-cohesive. This type of concrete is not amenable to GPR data acquisition, as the signal cannot travel through materials containing abundant fines. After surveying this area, it was decided that further testing would have no benefit to the project.

There were no indications of significant voids or cavities within the depth of signal penetration below the concrete apron. Some of the reflections observed were indicative of noise / reverberations, and / or "air waves" of the radar signal from the spillway walls, standing water, and / or reinforcement, etc. Additionally, the observed reflections indicated that the apron was likely modified by prior construction activities and the type of reinforcement varied throughout portions of the accessible surveyed areas. The observable thickness of the concrete apron varied from approximately 3 to 5 feet throughout the area.

Limitations

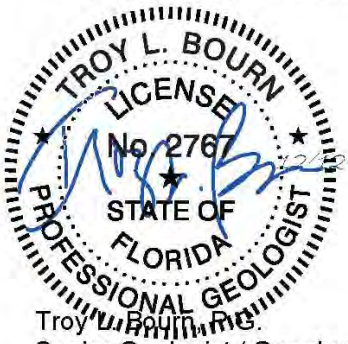
Interpretation of GPR profiles discussed in this report is subjective and our analyses were based, in part, from prior interpretive knowledge in the area and many test sites throughout the state. We offer no warranty or guarantee regarding the geological conditions that may exist beyond the effective depth of the GPR signal. Additionally, different subsurface conditions that could not be observed during our investigation may exist. Furthermore, the sheet piles surrounding the concrete apron could also affect the radar signal, creating "noise" or data that may or may not be representative of actual site conditions. Much of the concrete apron contained metal reinforcement. This metal reinforcement may "hide" or "mask" any potential voids or cavities that may be present below the metal reinforcement itself. The effective radar signal is transmitted off of the metal reinforcement and is hence unable to travel to depths beyond the surface of the steel.

The GPR survey was conducted in accordance with industry standards of care and established practices (e.g. *Standard Guide for Using the Surface Ground Penetrating Radar Method for*

Subsurface Investigation ASTM D 6432). All data were collected in a manner consistent with the customs and practices of other professional geophysical firms operating in the state of Florida.

We appreciate your consideration in using our geophysical capabilities for this project. Please contact us should you have any questions, comments, and / or concerns. Digital GPR data are available upon request.

Sincerely,
Integrity Drilling & Geophysical Services, LLC



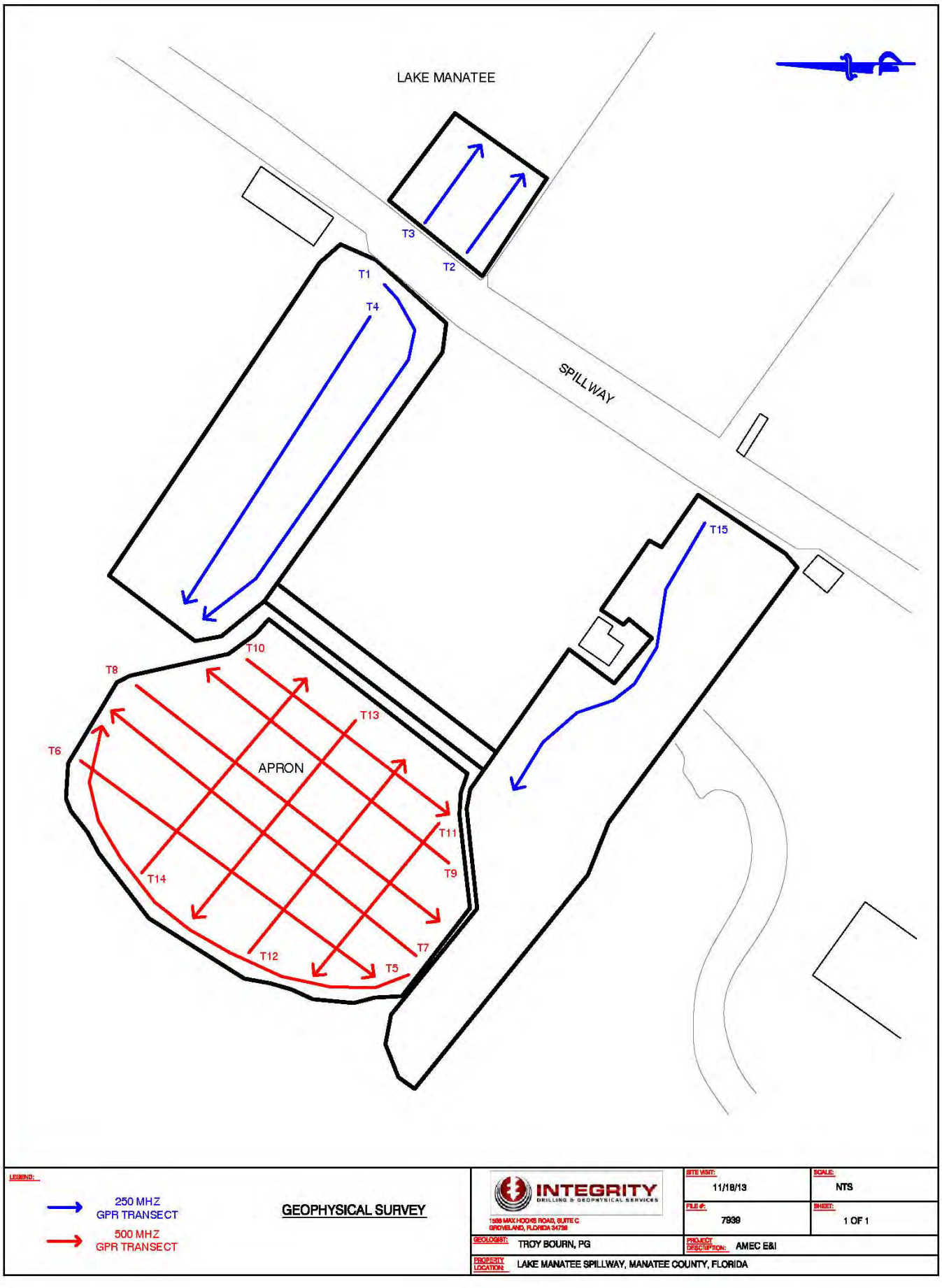
12/12/2013

Troy L. Bourn, P.G.
Senior Geologist / Geophysicist
Registered Florida Professional Geologist No. 2767

12/12/2013

David Wilshaw, M.S., P.G.
Principal Geologist
Registered Florida Professional Geologist No. 2413

ATTACHMENTS



LEGEND:

250 MHZ GPR TRANSECT

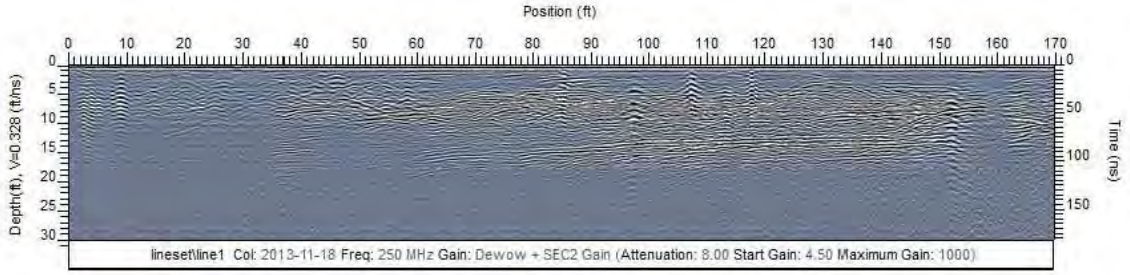
500 MHZ GPR TRANSECT

GEOPHYSICAL SURVEY

INTEGRITY DRILLING & GEOPHYSICAL SERVICES

1508 MAX HOOKS ROAD, SUITE C
GROVELAND, FLORIDA 34736

SITE VISIT: 11/18/13	SCALE: NTS
FILE #: 7939	SHEET: 1 OF 1
GEOLOGIST: TROY BOURN, PG	PROJECT DESCRIPTION: AMEC E&I
PROPERTY LOCATION: LAKE MANATEE SPILLWAY, MANATEE COUNTY, FLORIDA	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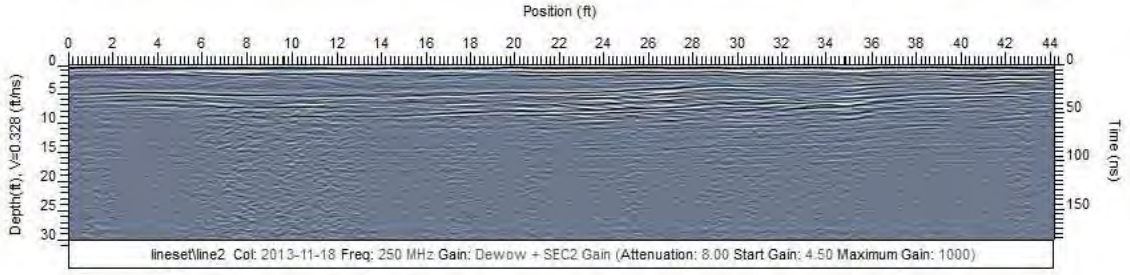
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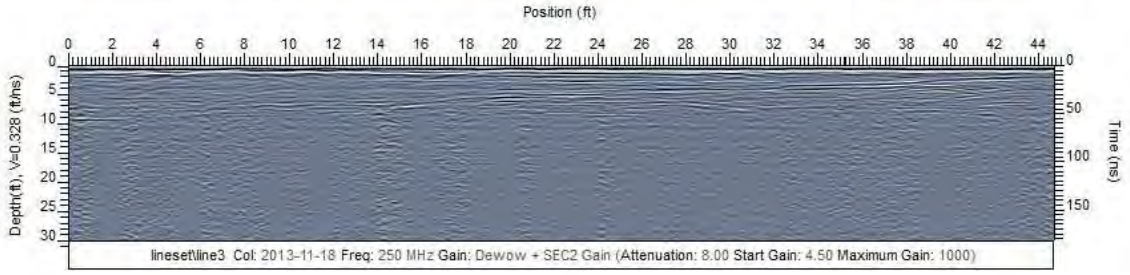
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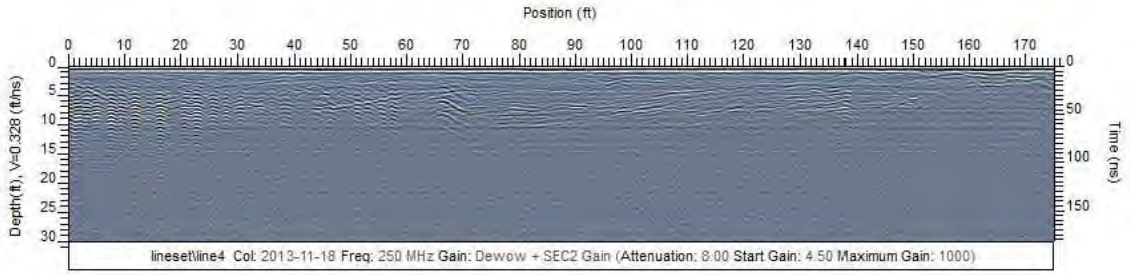
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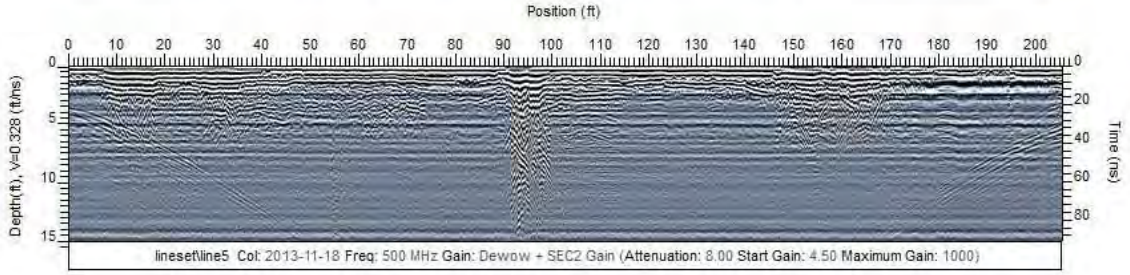
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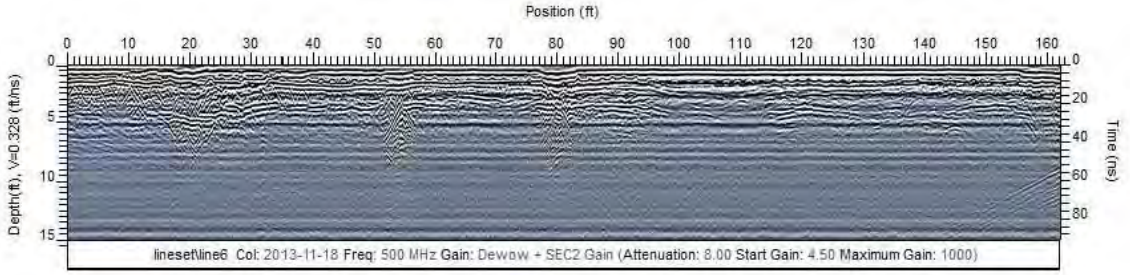
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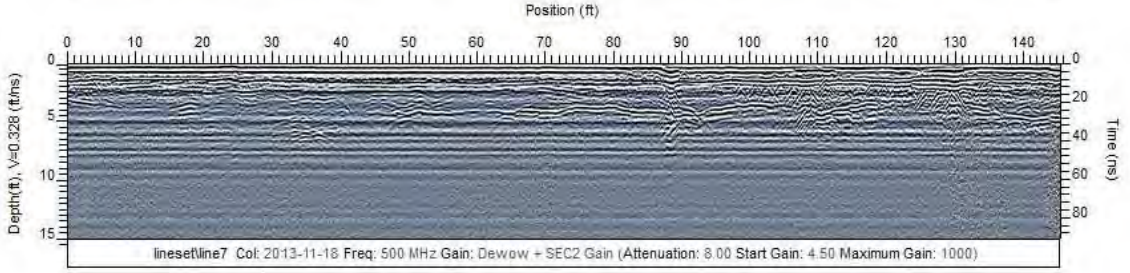
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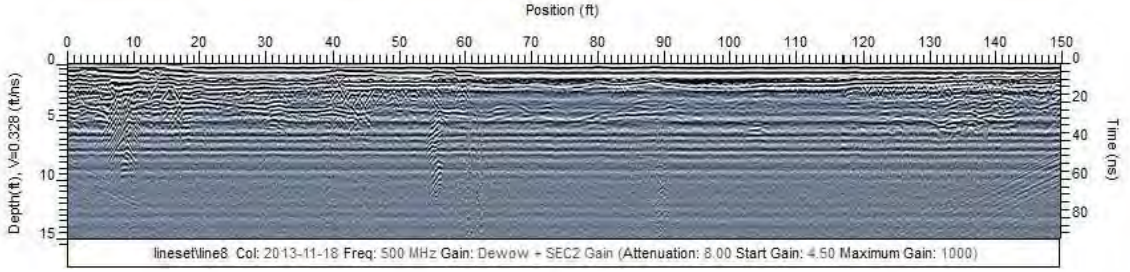
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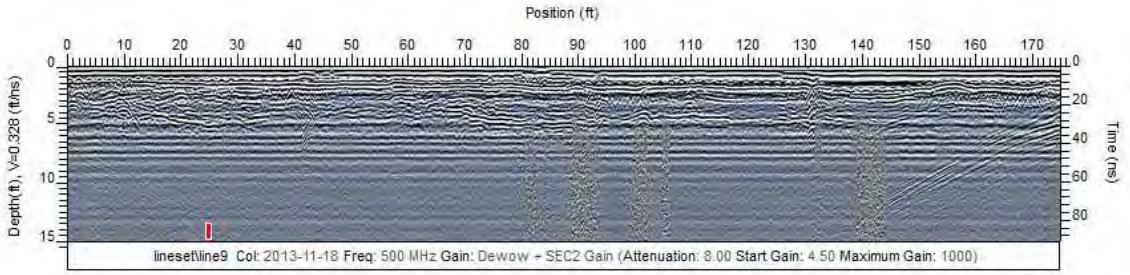
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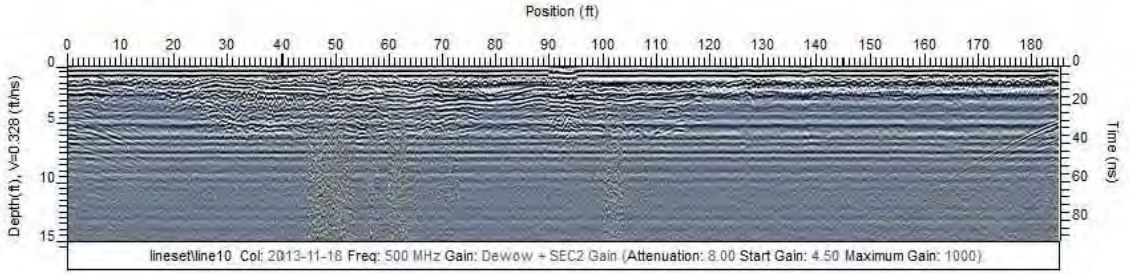
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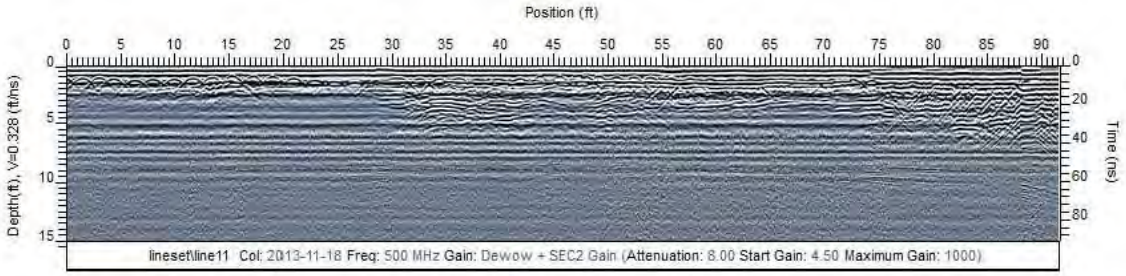
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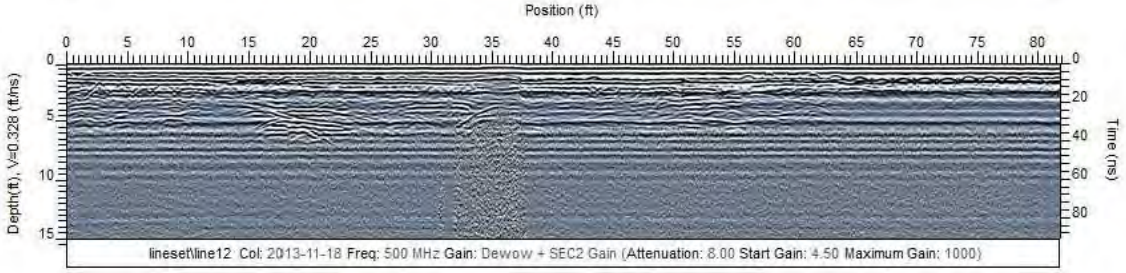
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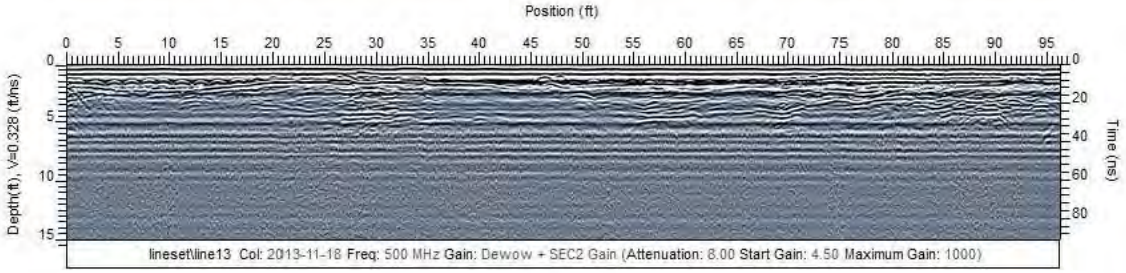
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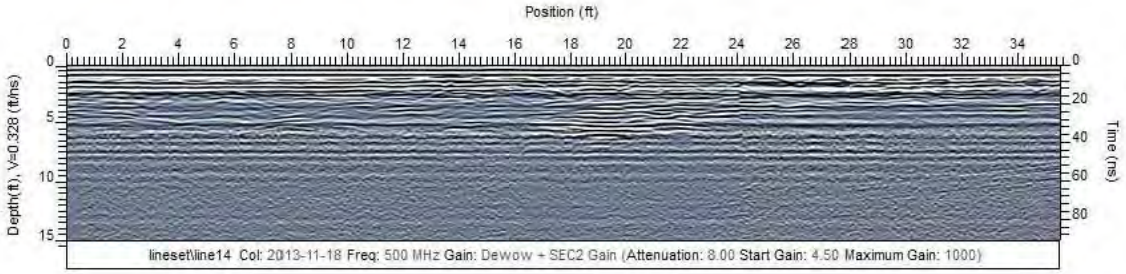
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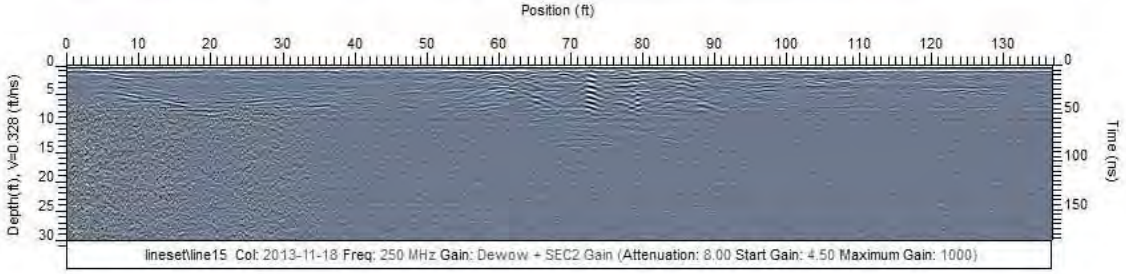
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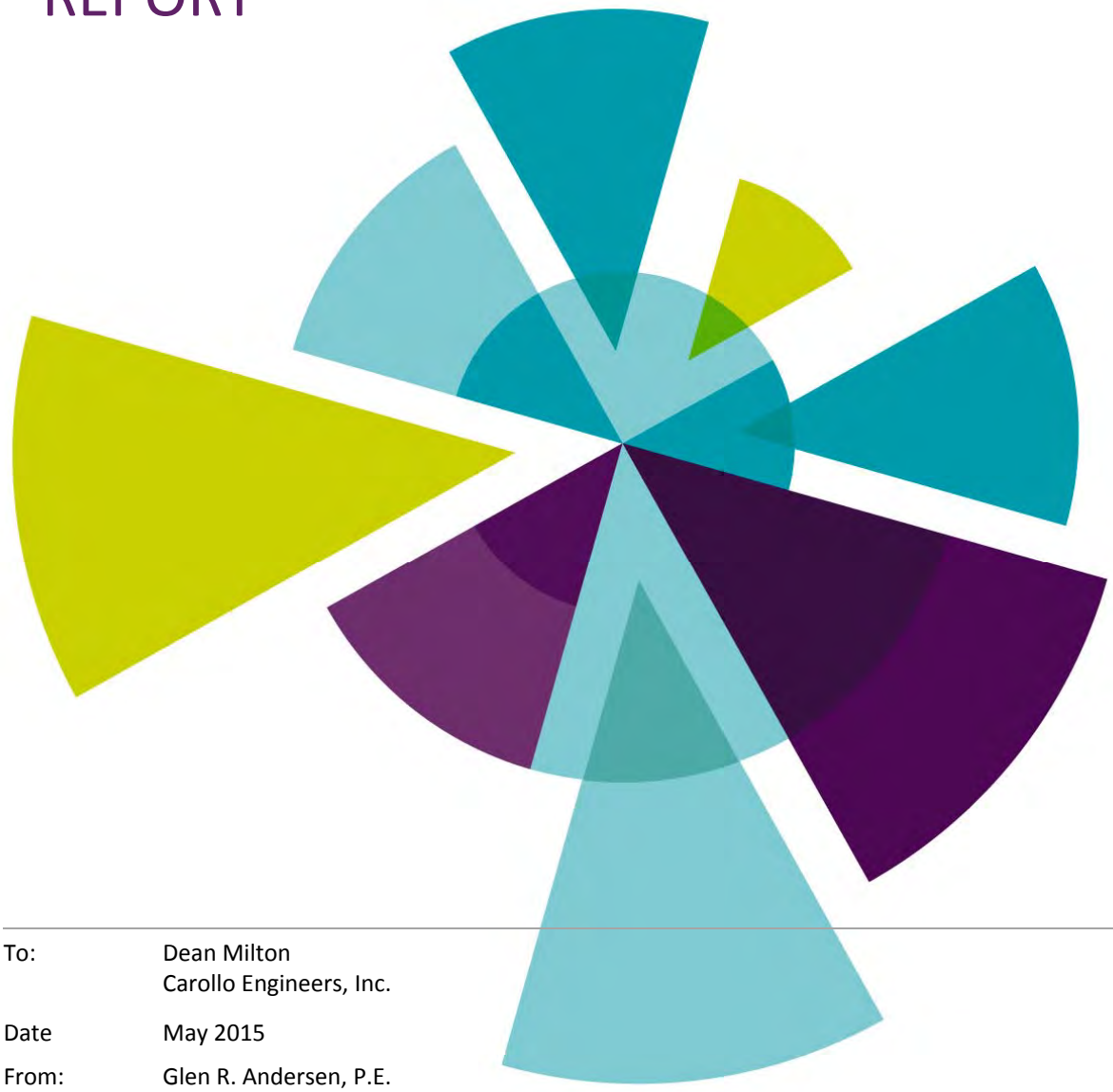
BID ATTACHMENT 6, LAKE MANATEE DAM EMERGENCY GEOTECHNICAL SUBSURFACE INVESTIGATION DATE REPORT MAY 2015

LAKE MANATEE DAM EMERGENCY GEOTECHNICAL SUBSURFACE INVESTIGATION DATA REPORT



To:	Dean Milton Carollo Engineers, Inc.
Date	May 2015
From:	Glen R. Andersen, P.E. Amec Foster Wheeler Environment & Infrastructure, Inc.

LAKE MANATEE DAM
EMERGENCY GEOTECHNICAL SUBSURFACE INVESTIGATION DATA REPORT

Prepared for:

Carollo Engineers, Inc.
401 N Cattleman Rd
Sarasota, Florida 34232-6441

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.
2000 E. Edgewood Dr., Ste. 215
Lakeland, FL 33803

May 2015
Project No. 300472x2

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION AND SITE LOCATION 1
2.0 DESCRIPTION OF SITE INVESTIGATION AND TESTING 3
2.1 Initial SPT Borings and Piezometers 3
2.2 Emergency SPT Borings 5
2.3 Emergency CPT Soundings 7
2.4 Emergency Sonic Cores 9
2.5 Standpipe Piezometers 10
2.6 Laboratory Testing 15
2.7 Piezometer Permeability testing 15
2.8 Piezometric Water Elevations 17

LIST OF TABLES

TABLE 1: Piezometric Water Elevations in Amec Foster Wheeler Piezometers for Supplemental Inspection Report 5
TABLE 2: Summary of Amec Foster Wheeler Piezometer Construction 12
TABLE 3: Permeability in Amec Foster Wheeler Piezometers 15
TABLE 4: Average Combined Permeabilities for Deep, Medium and Shallow Zones 17

LIST OF FIGURES

FIGURE 1 Site Location Map
FIGURE 2 Boring Location Plan – South End
FIGURE 3 Boring Location Plan – North End
FIGURE 4 Piezometer Location Plan

LIST OF APPENDICES

APPENDIX A Amec Foster Wheeler's Initial Inspection Boring logs
APPENDIX B Amec Foster Wheeler's Emergency SPT Boring logs
APPENDIX C Direct Push Service, Inc. CPT Report
APPENDIX D Amec Foster Wheeler's Emergency Sonic Core logs
APPENDIX E Amec Foster Wheeler Piezometer and Well Logs
APPENDIX F Amec Foster Wheeler Laboratory Testing Results
APPENDIX G Amec Foster Wheeler Piezometer Readings

CERTIFICATION
Lakeland

Engineering Certification

I hereby certify that I am a registered professional engineer in the State of Florida practicing with Amec Foster Wheeler Environment & Infrastructure, Inc., 2000 E. Edgewood Drive, Suite 215, Lakeland, FL 33803, a corporation authorized to operate as a business providing engineering consulting services (5392) by the State of Florida Department of Professional Regulation, Board of Engineers. I further certify that I, or others under my direct supervision, have prepared the geotechnical engineering evaluations, findings, opinions, calculations, conclusions or technical advice hereby represented in this report.

SIGNATURE:

NAME: Nickolas J. Depin, P.E.

LICENSE NO: 78481

DATE: 5/4/2015

Report Title: Lake Manatee Dam
Emergency Geotechnical Subsurface Investigation
Data Report

May 2015

1.0 PROJECT DESCRIPTION AND SITE LOCATION

The Lake Manatee Dam is located near Bradenton in Manatee County, Florida. It was constructed between 1965 and 1967 as an in-stream reservoir on the Manatee River approximately 20 miles upstream of its discharge point into Tampa Bay. Its primary function is a freshwater supply for users in Manatee and Sarasota Counties, the site location map is shown on **Figure 1**. The original dam consisted of an approximately 4,700-foot-long zoned-earth embankment with a clayey core, granular upstream and downstream shells, and a crest elevation (El.) of 52 feet based upon the National Geodetic Vertical Datum, 1929 (NGVD 29). After construction, an emergency spillway was placed in the north abutment and excavated materials from its discharge channel were placed to the south of the emergency spillway and downstream of the dam centerline against the northernmost portion of the embankment; thus, effectively decreasing the embankment length to approximately 3,700 feet. The present elevation of the crest ranges from approximately 51 feet to 55 feet due to an additional 3 feet of material added to increase the embankment freeboard when the emergency spillway was constructed.

The principal spillway (also called the service spillway) is located approximately 1,500 feet north of the southern abutment and just south of the original Manatee River channel. A freshwater intake for the water treatment plant is located on the south side of the service spillway on the southern wall of the approach channel. The original clay core of the embankment was keyed into a geologic unit known as the Hawthorn Group that was intended to function as a confining layer. A toe drain was installed along the entire northern and southern embankments with discharge points in the service spillway downstream of the stilling basin.

The Lake Manatee Dam was designed without a low-level outlet. Water is removed from the reservoir through the service spillway, the emergency spillway or by intake pipes to the water treatment plant. The service spillway consists of three 15-foot radius tainter gates, each one spanning a 31.5-feet-wide bay. This spillway has upstream concrete approach walls, a bare earth approach channel, and a concrete approach apron immediately upstream of the Ogee portion of the spillway. It also has downstream concrete training walls and a concrete stilling basin with an end sill. The stilling basin floor slab is ground-founded and consists of individual reinforced concrete sections. The concrete approach walls and the downstream training walls each have an inverted T-shape and together with the Ogee-section monoliths are all founded on driven H-piles.

The original underseepage cutoff system for the service spillway consists of a series of driven sheet piles forming a box around the edges of the upstream approach slab and along the front edge of the Ogee spillway sections. These sheet piles pass underneath the base slabs of the two approach wall monoliths closest to the Ogee section and are connected to another sheet pile cutoff wall that extends away from the northern and southern exterior monoliths of the spillway for a distance of approximately 30 feet. A second set of cutoff sheet piles also extend to the north and south, parallel to but downstream of the first set of sheet piles. These two parallel sheet pile cutoff walls were designed to extend into the embankment's clay core. A final sheet pile cutoff wall was placed under the end sill of the stilling basin running north to south between the two base slabs for the downstream training walls. No seepage cutoff was placed under the downstream training walls.

Subsequent to the original design and when a downstream concrete apron was placed over the original bare earth discharge channel beyond the stilling basin, additional sheet piles were also

driven along the edges of this apron, forming retaining walls along its sides and confinement at its downstream edge. When voids were discovered under the upstream approach wall base slabs in 2011, additional sheet piling was driven in front of the approach wall base slabs inside the spillway channel in order to fill these voids with tremied grout.

The original under-pressure relief and backfill drain systems for the stilling basin and the downstream training walls consisted of two sets of underdrains beneath the stilling basin floor slab sections and a backfill drain behind the two training walls. The first set of stilling basin underdrains system is directly connected by riser pipes through the training wall base slabs to the backfill drain system. The backfill drain system runs along the back side of the training walls just above the base slabs and drains upstream into the stilling basin near the Ogee section. These two backfill drains are evacuated through riser pipes and outfalls, one on each side of the stilling basin. The second stilling basin underdrain system runs beneath the end sill and evacuates directly into the downstream channel through a series of 45-degree riser pipes running up through the floor slab and the downstream edge of the end sill.

Amec Foster Wheeler 2013 Supplemental Inspection

During the course of the Amec Foster Wheeler 2103 Supplemental Inspection and as a result of an analysis of historical data, serious concerns were raised about the structural integrity of the dam (both the service spillway and the adjacent zoned-earth embankment). In particular, there was strong evidence to suggest the presence of an active internal erosion and piping failure mechanism in the embankment and immediately adjacent to and underneath portions of the service spillway. Based upon the historical record and as-built drawings, the conditions that created such a failure mechanism appeared to have been activated immediately after construction and to have progressed and become more severe over the years.

In early 2014, Amec Foster Wheeler and Carollo met with representatives of Manatee County to review the historical data and preliminary findings of the 2013 Supplemental Inspection and presented the following conclusions:

1) Lake Manatee Dam is in a severely distressed state; and,
2) Without immediate intervention, there is a high risk of an uncontrolled release of the reservoir, most likely following a large rainfall event and prolonged opening of the service spillway.

During this meeting, Amec Foster Wheeler made the following short-term recommendations:

1) Short-Term (prior to start of hurricane season)
    a. consider lowering the reservoir;
    b. reestablish the seepage control function of the dam core (jet grouting, pressure injection, sheet piling, or similar); and,
    c. work with specialty contractors to collect necessary information and develop cost estimates.

These short-term recommendations were implemented through a 2014 Phase I emergency repair that involved the design and installation of a deep (95 feet to 105 feet) seepage cutoff wall under the service spillway and through the northern and southern embankments and extending to near the northern and southern abutments.

The purpose of this report is to present the data from the emergency geotechnical subsurface investigation implemented in support of the design of the deep seepage cutoff wall. Justification for the installation of this deep seepage cutoff wall can be found in a companion report entitled "Lake Manatee Dam Supplemental Inspection Report to the 2013 Annual Inspection", Amec Foster Wheeler, January 2015 (Supplemental Inspection Report).

2.0 DESCRIPTION OF SITE INVESTIGATION AND TESTING

The emergency geotechnical subsurface investigation included the following four fieldwork items:

1. Standard Penetration Test (SPT) borings with laboratory index testing for soil classification purposes;
2. Static Cone Penetrometer (CPT) soundings;
3. Continuous sonic cores; and,
4. Installation of standpipe piezometers.

The following sections present the results of these field tests.

2.1 Initial SPT Borings and Piezometers

During the initial field explorations carried out in December of 2013 for the Supplemental Inspection Report, Amec Foster Wheeler conducted four Standard Penetration Test borings (SPT) in general accordance with ASTM D 1586. Independent Drilling Inc. (IDI) of Leesburg, Florida, performed the drilling on December 12 and 13, 2013. These were previously described in the Supplemental Inspection Report. Soil samples were collected from the boreholes using a 1.5-inch inside diameter (ID) split-spoon sampler driven with a 140-pound automatic slide hammer falling a distance of 30 inches. Amec Foster Wheeler staff engineers and staff geologists familiar with the field procedures and visual soil classification logged the borings in the field in general accordance with ASTM D 2488. The drilling was performed to a maximum of 45 feet below ground surface (bgs). Temporary piezometers consisting of 2-inch diameter PVC with bottom screens were installed in these four borings to monitor the ground water levels in the embankment and foundation soils behind both the northern and southern stilling basin training walls. These borings were labeled B-1 through B-4 and their locations are shown on **Figure 1**. Boring logs based on visual classifications both in the field and subsequently in the laboratory are presented for these borings in **Appendix A**. No laboratory testing was performed for this portion of the subsurface investigation.

The soils underlying the Lake Manatee Dam belong to the Peace River Formation in the Hawthorn Group. The Hawthorn Group consists of interbedded quartz sands, clays, and carbonates, all of which are variably phosphatic. This interbedding of quartz sands with pebble or gravel-sized phosphate fragments and intermediate layers of clays gives the Hawthorn Group its anistotropic permeability characteristics. The vertical permeability is significantly lower than the horizontal permeability and permits the Hawthorn Group to function as a confining unit between a surficial aquifer and the underlying Floridan aquifer in this portion of the State of Florida. This large difference in vertical and horizontal permeability is considered to be of fundamental importance in understanding the observed behavior of the Lake Manatee Dam.

A more detailed description of the site geology can be found in the Supplemental Inspection Report. The following is a brief overview to the geology encountered in these borings.

The following generalized strata were identified within the termination depths of the four SPT borings and are summarized below.

Stratum 1: FILL materials consisting of: SAND (SP), poorly graded SAND with Silt (SP-SM), poorly graded SAND with Clay (SP-SC), Clayey SAND (SC), and Silty SAND (SM). These soils are brown, dark brown, gray, and greenish gray fine-grained quartz, variably silty, variably clayey, locally cemented sands, and phosphate grains. The FILL was typically encountered from ground surface to a depth of 22.5 to 26 feet bgs. The fill materials were originally placed as engineered fill but were encountered in these borings to have relative densities ranging from very loose to medium dense, some of which had very low blow counts and zones where the SPT sampler penetrated full depth under the weight of the hammer without impact (termed weight-of-hammer, WHO, herein).

It is important to note that the very loose zones of material behind the downstream training walls encountered in these borings corresponds to the backfill zone directly behind the training wall base slabs as was illustrated in Figure 31 of the Supplemental Inspection Report. As pointed out in that report, the discovery of very loose soils in this location is consistent with the presence of a large void system immediately underneath the training wall base slabs and with internal erosion in the backfill soils that carries soil particles into that void.

Stratum 2: Native soils from the Hawthorn Group immediately below the fill consist of Sandy CLAY (CL) with a relatively low permeability and Silty SAND (SM). Based upon original design drawings, these CLAY soils are most likely those intended as the cutoff layer for the embankment dam's clayey core. These soils are gray to greenish gray fine-grained quartz, variably clayey and variably sandy, with phosphate grains. The consistency of these soils ranges from soft to very stiff, with the softer soils located near the interface with the overlying fill soils. In B-3 and at a depth of 30 feet bgs, circulation of the drilling fluid was lost, indicating the presence of a void or open soil matrix in this stratum and is consistent with an internal erosion and piping failure mechanism. This cohesive layer was encountered from approximately 22.5 feet to 45 feet bgs.

The Silty SAND (SM) immediately below the Sandy CLAY has a higher permeability. These soils are gray and greenish gray fine-grained quartz, variably silty, cemented sand and silt, phosphate grains and local limestone fragments. These Silty SANDS were found to be very dense and were encountered in B-1 and B-3 underlying the Stratum 2 CLAYS at depths from 40 feet to 43 feet bgs and extending to the terminal depths of these borings.

At the time of SPT drilling, groundwater was not encountered prior to the introduction of drilling fluid at 10 feet bgs in each of the four boring locations. Four piezometers were subsequently installed immediately adjacent to the SPT boring locations. Details of these piezometer installations can be found on the corresponding boring logs in **Appendix A**. These were installed at the bottom of **Stratum 1** (FILL) in each of four borings using a 5-foot well screen with a 6-foot sand pack and a bentonite plug. They were covered with flush mounted monitoring well caps, imbedded in 2-foot-by-2-foot concrete pads, and are intended for long-term monitoring of the groundwater levels in the FILL materials. Groundwater readings were recorded on December 16, 2013 and January 27, 2014. These readings are summarized in

Table 1 both in terms of depth below ground surface and the approximate elevations based upon NGVD 29 and a visual estimate of ground surface elevations.

TABLE 1: Piezometric Water Elevations in Amec Foster Wheeler Piezometers for Supplemental Inspection Report

Date	Piezometer Readings, NGVD 29							
	B-01		B-02		B-03		B-04	
	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)
12/16/2013	18.3	8.2	23.4	5.6	18.5	5.5	-	-
1/27/2014	19.5	7.0	23.4	5.6	18.6	5.5	Dry	-

2.2 Emergency SPT Borings

After meeting with Carollo Engineering and Manatee County on February 13, 2014, Amec Foster Wheeler initiated the emergency subsurface exploration program with additional SPT borings along the crest of the dam and in the toe area. Since the need for a deep seepage cutoff wall had been previously established in the Supplemental Inspection Report to prevent continued internal erosion and the development of a pipe across the core of the dam, the purpose of this exploration program was to design the depth and extent of that cutoff wall.

Drilling for this emergency subsurface exploration program was performed by IDI and by the Madrid Engineering Group (MEG) of Bartow, Florida commencing on February 19, 2014. These borings were advanced using rotary wash techniques. Forty-four additional borings were advanced, sixteen of which were located along the toe of the dam (B-05 through B-20) to a typical termination depth of 20 to 30 feet bgs. The remaining twenty-eight borings (B-21 through B-49) were located along or slightly upstream of the centerline of the dam (proposed alignment of the deep seepage cutoff wall) to a typical termination depth of between 90 to 110 feet bgs. These borings were labeled B-5 through B-48 and their locations are shown on **Figure 2** and **Figure 3**.

The soils encountered in these borings were visually classified in the field in general accordance with ASTM D 2488. Representative portions of these soil samples were then transported to the laboratory for additional index testing that included moisture content, Atterberg Limits, and percent passing the #200 sieve. The field visual classifications were then corrected in accordance with the results of the laboratory tests and in general accordance with ASTM D 2487 and these corrected boring logs are found in **Appendix B**.

The SPT sampling intervals for borings B-5 through B-20 consisted of continuous sampling in the top 10 feet followed by 2.5-foot intervals to the termination depth. In some cases, these intervals were increased to 5-foot near the bottom of the borings.

The sampling intervals for borings B-21 through B-48 were varied throughout the field program in response to observed conditions with a particular emphasis on the materials at or near the bottom of the original embankment section and near the terminal depth of the borings where the deep seepage cutoff wall would potentially extend. These sampling intervals ranged from continuous, to 2.5 feet, to 5 feet, to 10 feet. In locations where CPT's were pushed adjacent to the borings, some of these were drilled without sampling where the CPT soundings had been

performed and others were sampled continuously to provide correlations between SPT and CPT results. In general, tighter sampling intervals were used for the initial borings and larger sampling intervals were used for later borings.

The following is a brief overview to the soils encountered in these borings. As with the previous borings, these were divided into: **Stratum 1** – FILL; and, **Stratum 2** - Native Hawthorn Group soils.

Borings B-5 through B-20 (Downstream of Embankment in Toe Area)

The general subsurface conditions encountered in the borings downstream of the embankment in the toe area and in the general vicinity of the service spillway are as follows.

Stratum 1: FILL materials placed in the embankment section that consist of Clayey SAND (SC), Silty SAND (SM), poorly graded SAND (SP), poorly graded GRAVEL (GP), and poorly graded SAND with Silt (SP-SM). These FILL materials in some of the borings were found to contain debris (plastics, glass, cloth, wire, decomposing plant roots, and wood fragments). These FILL materials were classified as very loose to very dense in terms of relative density with total thicknesses of up to 24 ft. The minimum blow count in the FILL was “weight-of-hammer” and the maximum blow count in these materials was 76 blows per ft. The thicker FILL materials were generally found in the original river channel just north of the service spillway, refer to the Supplemental Inspection Report.

Stratum 2: Hawthorn Group soils encountered in these borings beneath the FILL included Clayey SAND (SC), Sandy CLAY (CL), Sandy fat CLAY (CH), fat CLAY with Sand (CH), Sandy Elastic SILT (MH) and Silty SAND (SM). Some of these soils are cemented. The CLAYS encountered in Stratum 2 are firm to hard with respect to consistency. The SANDS and SILTS encountered in Stratum 2 are very loose to very dense with respect to relative density. The minimum blow count in the Stratum 2 soils was 2 and the maximum was “refusal”. The looser soils were typically found near the top of this stratum in contact with the overlying FILL materials.

The vast majority of the borings downstream of the embankment (13 out of 16) found clayey soil (SC or CL) immediately beneath the FILL materials from Stratum 1. In the remaining three borings, SANDS and SILTS (SM, MH) were encountered immediately beneath the FILL. The clayey soils in Stratum 2 most likely represent the target cutoff layer for the key trench of the embankment clayey core.

Borings B-21 through B-48 (Along the Centerline of the Embankment)

Twenty-seven borings (B-21 through B-48) were advanced through the embankment crest either on the centerline or just upstream of it. These borings were laid out from the southern abutment to the northern abutment and indicate the presence of the same two strata just described. Because they are located along the crest, each boring would have passed through fill materials including the lower permeability embankment core and/or the higher permeability upstream shell before penetrating into the native soils of the Hawthorn Group.

Stratum 1: FILL materials encountered in the embankment consist of poorly graded SAND with Silt (SP-SM), Sandy CLAY (CL), poorly graded SAND (SP), Silty SAND (SM), poorly graded SAND with Clay (SP-SC) and Clayey SAND (SC). The relative density of these Sandy FILL

materials ranges from very loose to dense. Of these twenty-seven borings, twenty-one of them encountered very loose FILL materials, representing 80% of all of the borings. In these borings with very loose materials, eleven of them had weight-of-hammer blow counts indicating that extremely loose conditions are present in approximately 40% of the embankment borings. Of the remaining borings not encountering very loose conditions, five (5) of them encountered loose FILL materials.

Only one boring out of the twenty-seven advanced through the Stratum 1 FILL materials in the embankment encountered medium dense soils as a lowest relative density. Thus, about 95% of all of the borings advanced through the embankment FILL materials encountered very loose to loose relative densities. This finding is of particular significance because these soils were originally placed as engineered fill and have most likely been loosened over the years through the process of internal erosion described in the Supplemental Inspection Report. It is also significant that this loosening appears to be wide spread throughout the embankment and not just concentrated in the vicinity of the service spillway.

Stratum 2: The native soils of the Hawthorn Group underlying the embankment FILL consist of poorly graded SAND (SP), Silty SAND (SM), Clayey SAND (SC), Sandy CLAY (CL), Sandy fat CLAY (CH), fat CLAY with SAND (CH), poorly graded SAND with Silt (SP-SM), poorly graded SAND with Clay (SP-SC), and Sandy Elastic SILT (MH). While the actual stratification of the Hawthorn Group was found to be heterogeneous, there are some general trends that should be pointed out.

The Hawthorn Group has alternating layers of high permeability and low permeability soils. As previously mentioned, these alternating layers give the Hawthorn Group significant anisotropic permeability with the horizontal permeability being much higher than the vertical permeability.

The upper portion of the Hawthorn Group in these borings generally tends to be more cohesive (lower permeability). However, some locations immediately below the embankment FILL materials are non-cohesive with higher permeabilities. Very loose to loose relative densities were encountered near the top of these Stratum 2 soils in borings B-31, B-32, B-33, B-34, B-40, B-41, B-44, B-47, and B-48, representing about one third of all of the borings advanced in Stratum 2.

The low permeability soils in Stratum 2 near the top of the stratum were generally underlain by higher permeability soils with slight to heavily cemented zones and moderate to very high blow counts. These higher permeability soils in Stratum 2 were, in turn, generally underlain by lower permeability soils with more extensive cementation and very high blow counts. Given the multiple layers of lower permeability, soils throughout the Hawthorn Group and the apparent lower permeability (more heavily cemented nature) of the deepest layers encountered these borings, the designed depth of the seepage cutoff wall that tips out at the bottom of these borings is considered to provide an adequate seepage cutoff.

2.3 Emergency CPT Soundings

Cone Penetration Testing (CPT) was performed along the crest of the dam through the embankment core and into the foundation to provide a rapid determination of soil strength and relative density/consistency and to determine the extent of the softened zones that had been identified by others in previous subsurface explorations. As initially envisioned, the proposed seepage cutoff wall was to be placed in the immediate vicinity of the service spillway where the

extensive evidence of internal erosion and piping had been identified in the Supplemental Inspection Report. However, the results of these CPT soundings indicated that the damage to the core and upper portion of the foundation soils was widespread.

Thirty-four CPT soundings were conducted between February 20 and 27, 2014 by Direct Push Services (DPS) of Lake Wales, Florida. In these tests, a 1.4-inch diameter piezocone was continuously pushed in 5-foot intervals. Cone tip resistance, porewater pressure on the shaft between the cone and the friction sleeve, and sleeve friction were continuously recorded during each push. In some locations, pore pressure dissipation tests were conducted by holding the probe in a given position and measuring the decrease in pore pressure over time.

The testing was performed in general accordance to ASTM D 5778. The soundings were labeled CPT-1 through CPT-36 (CPT-29 and CPT-30 were omitted in the field). The locations of each are given on **Figure 2** and **3**. These soundings were advanced through the embankment sections and into the underlying Hawthorn Group soils where they typically met with refusal within a few feet.

The observed behavior in these soundings is complex and considered to be the effect of extensive and prolonged weakening of the embankment core through internal erosion processes. A complete interpretation of this complex behavior is beyond the scope of this data report. However, there are some general observations worth noting.

All but one of the thirty four CPT soundings (CPT-23) show at least some very loose to loose and soft materials in the embankment. Several soundings show extensive zones of very loose and soft materials in the embankment. These include CPT-1, CPT-2, CPT-7, CPT-33, and CPT 34. It is important to note that these particular soundings are located immediately adjacent to the service spillway on the north and south sides between the sheet pile cutoff walls and just beyond these sheetpile walls. Given the presence of these sheet pile cutoff walls and the very loose and soft materials between these, it is considered likely that materials have been removed from beneath the sheetpiles by the internal erosion process described in the Supplemental Inspection Report.

All but two of the thirty four CPT soundings showed very high tip resistance in the embankment (CPT-14 and CPT 34 excluded). These results indicate highly variable densities/strengths in the embankment section and some zones where gravel or cobble-sized particles are present or where some cementation has occurred.

There are several CPT soundings near the bottom of the embankment or in the native Hawthorn Group with pore water pressures significantly higher than the reservoir head. These are CPT-10, CPT-11, CPT-19, and CPT-33 and might be indicative of very loose embankment materials collapsing above the piezocone as a result of penetration.

In addition, some of the dissipation tests indicated a build-up of porewater pressures after the cone push stopped and at the start of the dissipation. These soundings are from CPT-4, CPT-5, CPT-7, CPT-12 and CPT-13. These results might also be indicative of a delayed collapse of very loose materials in the vicinity of the cone head.

The report issued by DPS containing all of these results can be found in **Appendix C**.

2.4 Emergency Sonic Cores

Four sonic cores were advanced through the embankment and into the foundation soils in an effort to: collect continuous samples of the materials and improve the interpretations of the SPT borings and CPT soundings; to provide a better understanding of the geology; and, to finalize the proposed depth of the deep seepage cutoff wall. These cores were located along the centerline of the crest of the dam; two of them to the north and two of them to the south of the service spillway.

TerraSonic International, of Apopka, FL performed sonic coring beginning on March 11, 2014 to depths ranging from 100 to 110 feet bgs using a 3-in core barrel with external casing. Continuous samples were collected and field classified by an Amec Foster Wheeler field geologist familiar with the Unified Soil Classification System. These were logged in general accordance with ASTM D 2488 but with additional terminology to describe the variability of the soils encountered. Representative portions of these cores were transported to the laboratory for additional index testing including moisture content (ASTM D 2216), fines content (ASTM D 6913), and Atterberg Limits (ASTM D 4318). These laboratory testing results were used to correct the field classifications of the samples in accordance with ASTM D 2487

The geologist also used a pocket penetrometer to estimate the consistency of the more clayey portions of the soil matrix. Since the sonic cores are disturbed samples and although the results of these pocket penetrometer tests are presented on the core logs, relative density and consistency descriptors are not used on the logs.

These sonic cores were identified as Sonic-1 through Sonic-4 and are considered to be the most accurate representation of the subsurface conditions in the embankment section and the foundation soils. Tier locations are shown on **Figure 2** and **3**. Amec Foster Wheeler's logs for these cores can be found in **Appendix D**. After drilling, these cores were laid out on the crest of the dam and inspected by the Amec Foster Wheeler deep seepage cutoff wall senior design engineering team prior to being discarded.

These sonic cores encountered the previously identified the Stratum 1 – Fill Materials and the Stratum 2 – Native Hawthorn Group soils. The following is a brief discussion of the subsurface conditions found during sonic coring.

Stratum 1 – FILL materials in the embankment dam consist of Silty SANDS (SM), poorly graded SANDS with Silt (SP-SM), and Clayey SANDS (SC).

There were three locations in these sonic cores with no core recovery in Stratum 1. One of these was Sonic-2 between a depth of 6 feet and 10 feet. While advancing Sonic-1 and Sonic-4, the driller observed a collapse of the embankment material in the core. At both of these locations (one on the southern embankment and the other on the northern embankment) and over the 20 foot sampling interval from 10 feet to 30 feet below the crest of the dam, the core barrel advanced under the weight of the cross head without any rotation or vibration. In Sonic-1, there was a total collapse of 5 feet representing a 25% loss of the volume of the core and in Sonic-4; there was a total collapse of 10 feet representing a 50% loss of the volume of the core.

Thus, in one-half of the sonic cores in embankment FILL materials, such loose conditions were present that the cores actually collapsed between 25% and 50% of their total volume during sampling. Anecdotally, after Sonic-1 was grouted, a senior engineer returned to the site the

following day and observed the grout had settled more than 10 ft and a void larger in diameter than the original core hole was present above the grout plug. This core hole was subsequently regrouted.

Stratum 2 – Native Hawthorn Group soils found below the embankment FILL in these sonic cores consist of Clayey SAND (SC), Sandy Elastic CLAY (MH), poorly graded SAND (SP), poorly graded SAND with Silt (SP-SM), Sandy CLAY (CL), Silty SAND (SM), Sandy SILT (ML), and Dolostone. While the actual stratigraphy observed in these cores is heterogeneous, some general trends were observed as follows.

1) The top of the Hawthorn Group soils (at the embankment / foundation interface) consists of lower permeability and more cohesive soils, Clayey SAND (SC) and Sandy Elastic SILT (MH) in three of the four sonic cores. Sonic-3 had Silty SAND (SM) at the embankment fill / natural soil interface.
2) Beneath these lower permeability soils in the Hawthorn Group, there were higher permeability layers consisting of poorly graded SAND (SP), poorly graded SAND with Silt (SP-SM), and Silty SAND (SM), interspersed between lower permeability layers that included Sandy SILT (ML), Sandy Elastic SILT (MH), Sandy CLAY (CL) and Dolostone.
3) The bottom of these sonic cores in the Hawthorn Group soils encountered lower permeability soils consisting of Sandy SILT (ML), Sandy Elastic SILT (MH), and Clayey SAND (SC).

These sonic cores were used to confirm that the designed bottom of the deep seepage cutoff wall at a depth ranging from 95 feet to 105 feet \would cut through several lower permeability layers and be keyed into a lower permeability layer, thus allowing it to function as a deep seepage cutoff wall.

2.5 Standpipe Piezometers

After the completion of the cut-off wall constructed by Hayward Baker, Amec Foster Wheeler installed a total of twenty seven groups of open standpipe piezometers at the Lake Manatee Dam to monitor the ground water conditions and the long-term performance of the deep seepage cutoff wall. These were labeled PZ-1 through PZ-27 and their locations can be found on **Figure 4**. Nineteen of these groups were installed on the embankment immediately downstream of the seepage cutoff wall, one of them was installed immediately upstream of the seepage cutoff wall just north of the service spillway (PZ-6A), and the remaining seven were installed in the downstream toe area.

These piezometers were installed by sonic core rigs operated by TerraSonic and Cascade Drilling, L.P. (Cascade), of Brooksville, FL. The installations began on March 11, 2014. Amec Foster Wheeler personnel were present during installation to visually log the core holes and direct and document the well installation details. Amec Foster Wheeler staff geologists familiar with the field procedures and the Unified Soil Classification System (USCS) logged the borings in the field in general accordance with ASTM D 2487.

The piezometers installed through the embankment were placed in groups of three as follows:

1) one at approximately 120 feet below the crest, labeled deep (**D**) and corresponding to the bottom of the designed seepage cutoff wall at approximately El. -65 feet (NGVD 29);
2) a second at approximately 75 feet below the crest, labeled middle (**M**) and corresponding to the high permeability zone of the Hawthorn Group at approximately El. -25 feet (NGVD 29); and,
3) a final one at approximately 45 feet below the crest, labeled shallow (**S**) and corresponding to the bottom of the embankment section at approximately El. 2 feet (NGVD 29).

The piezometers installed in the downstream toe area were placed in pairs as follows:

1) one labeled deep (**D**) and installed at approximately El. -65 feet, corresponding to the deep piezometers installed through the embankment; and,
2) another labeled middle (**M**) and installed at approximately El. -25 feet (NGVD 29) corresponding to the middle piezometers installed through the embankment in the high permeability zone of the Hawthorn Group.

These piezometers were constructed using a 2-inch schedule 40 PVC installed through the 6-inch annulus of the sonic coring casing. A well-screen from 10 feet to 15 feet long was placed at the bottom of the well just above the termination depth, and typically installed on top of a sand blank. Sand was then placed around the well-screen extending 2 to 3 feet above the top of the screen. The sand placed above, below and surrounding the screen is referred to as the “sand pack”. A bentonite plug, typically between 2 and 4 feet thick, was placed on top of the sand pack to seal off the screen and sand pack from influence from the hydrogeologic conditions in the overlaying soils. The bentonite plugs for each borehole were constructed by placing bentonite pellets into the annulus and allowing them to hydrate for 30-minutes to create the desired seal. The remainder of the hole was finished by grouting with a cement and water mixture.

Amec Foster Wheeler’s boring logs and well diagrams for these piezometers can be found in **Appendix E**. The soil classifications on these logs are based upon visual classifications without supporting laboratory testing. A summary of the well construction and elevations of the top and bottom of the sand pack and the top and bottom of screen are given in **Table 2**.

TABLE 2: Summary of Amec Foster Wheeler Piezometer Construction

Well ID	Northing	Easting	Elevation (ft)	Well Depth (ft)	Diameter (in)	Filter Bottom (ft)	Screen Length (ft)	Screen		Sand Pack (ft)	Sand Pack	
								Top Elev.	Bot. Elev.		Top Elev.	Bot. Elev.
PZ-1-D	1148679.0	541085.9	51.97	121.0	6.625	1.00	15.0	-53.03	-68.03	17.00	-52.03	-69.03
PZ-1-M	1148674.7	541082.9	51.95	76.0	6.625	1.00	15.0	-8.05	-23.05	17.00	-7.05	-24.05
PZ-1-S	1148782.7	541016.5	51.95	49.0	6.625	1.00	10.0	13.95	3.95	12.00	14.95	2.95
PZ-2-D	1148588.5	541023.0	53.73	121.0	6.625	1.00	15.0	-51.27	-66.27	17.00	-50.27	-67.27
PZ-2-M	1148584.2	541020.1	53.84	76.0	6.625	1.00	15.0	-6.16	-21.16	17.00	-5.16	-22.16
PZ-2-S	1148580.1	541017.2	53.86	49.0	6.625	1.00	10.0	15.86	5.86	12.00	16.86	4.86
PZ-3-D	1148708.4	541151.5	46.31	120.0	6.625	0.50	15.0	-58.19	-73.19	16.50	-57.19	-73.69
PZ-3-M	1148707.1	541146.9	46.90	75.0	6.625	0.50	15.0	-12.60	-27.60	11.50	-16.60	-28.10
PZ-3-S	1148706.2	541142.8	47.37	40.0	6.625	1.00	10.0	18.37	8.37	12.00	19.37	7.37
PZ-4-D	1148829.9	541225.1	48.44	120.0	6.625	0.00	15.0	-56.56	-71.56	18.50	-53.06	-71.56
PZ-4-M	1148834.8	541227.5	49.62	74.0	6.625	0.00	15.0	-9.38	-24.38	17.00	-7.38	-24.38
PZ-4-S	1148838.8	541229.7	50.46	50.0	6.625	0.00	10.0	10.46	0.46	12.50	12.96	0.46
PZ-5-D	1148911.5	541255.5	53.04	120.0	6.625	0.00	15.0	-51.96	-66.96	17.00	-49.96	-66.96
PZ-5-M	1148916.1	541258.4	53.51	75.0	6.625	0.50	15.0	-5.99	-20.99	18.00	-3.49	-21.49
PZ-5-S	1148920.8	541261.0	52.95	50.0	6.625	0.50	10.0	13.45	3.45	12.50	15.45	2.95
PZ-6-D	1148984.4	541306.7	53.15	120.0	6.625	0.50	15.0	-51.35	-66.35	18.50	-48.35	-66.85
PZ-6-M	1148988.9	541310.1	53.43	75.0	6.625	0.50	15.0	-6.07	-21.07	18.00	-3.57	-21.57
PZ-6-S	1148993.3	541312.9	43.71	51.0	6.625	1.30	10.0	4.01	-5.99	12.50	5.21	-7.29
PZ-6A-D	1148972.4	541312.3	53.63	120.0	6.625	1.00	15.0	-50.37	-65.37	17.00	-49.37	-66.37
PZ-6A-M	1148978.6	541317.0	53.88	80.0	6.625	1.00	15.0	-10.12	-25.12	17.00	-9.12	-26.12
PZ-6A-S	1148981.2	541319.2	53.91	55.4	6.625	1.30	10.0	9.81	-0.19	12.00	10.51	-1.49
PZ-7-D	1149054.5	541350.9	54.28	120.0	6.625	0.00	15.0	-50.72	-65.72	17.50	-48.22	-65.72
PZ-7-M	1149059.0	541354.3	54.29	75.0	6.625	2.00	15.0	-3.71	-18.71	21.00	0.29	-20.71
PZ-7-S	1149063.4	541358.4	54.19	50.0	6.625	2.00	10.0	16.19	6.19	16.00	20.19	4.19
PZ-8-D	1149135.6	541409.5	54.41	120.0	6.625	2.00	15.0	-48.59	-63.59	21.00	-44.59	-65.59
PZ-8-M	1149140.1	541413.0	54.38	75.0	6.625	2.00	15.0	-3.62	-18.62	21.00	0.38	-20.62
PZ-8-S	1149143.6	541416.0	54.32	50.0	6.625	2.00	10.0	16.32	6.32	16.00	20.32	4.32
PZ-9-D	1149219.7	541471.0	54.33	120.0	6.625	2.00	15.0	-48.67	-63.67	21.00	-44.67	-65.67
PZ-9-M	1149223.9	541474.7	54.01	75.0	6.625	0.00	15.0	-5.99	-20.99	17.00	-3.99	-20.99

Well ID	Northing	Easting	Elevation (ft)	Well Depth (ft)	Diameter (in)	Filter Bottom (ft)	Screen Length (ft)	Screen		Sand Pack (ft)	Sand Pack	
								Top Elev.	Bot. Elev.		Top Elev.	Bot. Elev.
PZ-9-S	1149227.9	541477.6	54.06	50.0	6.625	2.00	10.0	16.06	6.06	16.00	20.06	4.06
PZ-10-D	1149387.9	541591.0	54.59	120.0	6.625	0.00	15.0	-50.41	-65.41	17.00	-48.41	-65.41
PZ-10-M	1149392.6	541594.1	54.64	75.0	6.625	0.00	15.0	-5.36	-20.36	17.00	-3.36	-20.36
PZ-10-S	1149396.9	541597.1	54.61	50.0	6.625	0.00	10.0	14.61	4.61	13.00	17.61	4.61
PZ-11-D	1149570.8	541719.7	54.35	120.0	6.625	0.00	15.0	-50.65	-65.65	17.00	-48.65	-65.65
PZ-11-M	1149575.2	541722.6	54.36	75.0	6.625	0.00	15.0	-5.64	-20.64	17.00	-3.64	-20.64
PZ-11-S	1149579.7	541725.9	54.33	52.0	6.625	2.00	10.0	14.33	4.33	15.00	17.33	2.33
PZ-12-D	1149734.9	541836.7	54.47	120.0	6.625	0.00	15.0	-50.53	-65.53	17.00	-48.53	-65.53
PZ-12-M	1149740.0	541839.7	54.54	75.0	6.625	0.00	15.0	-5.46	-20.46	17.00	-3.46	-20.46
PZ-12-S	1149743.7	541842.0	54.61	50.0	6.625	0.00	10.0	14.61	4.61	13.00	17.61	4.61
PZ-13-D	1149906.0	541957.9	54.45	120.0	6.625	0.00	15.0	-50.55	-65.55	17.00	-48.55	-65.55
PZ-13-M	1149911.0	541961.3	54.36	75.0	6.625	0.50	15.0	-5.14	-20.14	17.00	-3.64	-20.64
PZ-13-S	1149915.1	541964.3	54.40	50.0	6.625	0.50	10.0	14.90	4.90	13.00	17.40	4.40
PZ-14-D	1150070.9	542074.0	54.41	120.0	6.625	0.00	15.0	-50.59	-65.59	18.00	-47.59	-65.59
PZ-14-M	1150075.9	542077.4	54.45	75.0	6.625	0.00	15.0	-5.55	-20.55	17.00	-3.55	-20.55
PZ-14-S	1150080.0	542080.4	54.51	50.0	6.625	0.00	10.0	14.51	4.51	13.00	17.51	4.51
PZ-15-D	1150180.4	541939.1	54.51	125.0	6.625	0.00	15.0	-55.49	-70.49	17.00	-53.49	-70.49
PZ-15-M	1150184.7	541942.1	54.51	75.0	6.625	0.00	15.0	-5.49	-20.49	17.00	-3.49	-20.49
PZ-15-S	1149845.2	541694.0	54.51	50.0	6.625	0.00	10.0	14.51	4.51	13.00	17.51	4.51
PZ-16-D	1149849.7	541696.4	19.43	82.0	6.625	0.50	15.0	-47.07	-62.07	17.50	-45.07	-62.57
PZ-16-M	1150398.7	542306.5	19.43	55.0	6.625	0.50	15.0	-20.07	-35.07	17.50	-18.07	-35.57
PZ-17-D	1150403.0	542309.1	19.45	100.0	6.625	0.50	15.0	-65.05	-80.05	17.00	-63.55	-80.55
PZ-17-M	1150406.6	542312.0	19.46	55.0	6.625	0.50	15.0	-20.04	-35.04	17.50	-18.04	-35.54
PZ-18-D	1149128.5	541195.2	19.12	82.0	6.625	0.50	15.0	-47.38	-62.38	17.50	-45.38	-62.88
PZ-18-M	1149133.3	541196.9	18.86	55.0	6.625	0.50	15.0	-20.64	-35.64	23.50	-12.64	-36.14
PZ-19-D	1148631.3	541054.1	52.66	123.0	6.625	1.00	15.0	-54.34	-69.34	19.00	-51.34	-70.34
PZ-19-M	1148628.4	541052.0	52.85	79.0	6.625	1.00	15.0	-10.15	-25.15	19.00	-7.15	-26.15
PZ-19-S	1148625.3	541050.3	52.85	54.0	6.625	1.00	10.0	9.85	-0.15	14.00	12.85	-1.15
PZ-20-D	1148497.9	540959.2	54.40	120.0	6.625	1.00	15.0	-49.60	-64.60	19.50	-46.10	-65.60
PZ-20-M	1148494.7	540956.6	54.42	75.6	6.625	7.00	15.0	0.84	-14.16	17.58	-3.58	-21.16

Well ID	Northing	Easting	Elevation (ft)	Well Depth (ft)	Diameter (in)	Filter Bottom (ft)	Screen Length (ft)	Screen		Sand Pack (ft)	Sand Pack	
								Top Elev.	Bot. Elev.		Top Elev.	Bot. Elev.
PZ-20-S	1148492.1	540954.4	54.35	50.0	6.625	1.00	10.0	15.35	5.35	13.00	17.35	4.35
PZ-21-D	1148337.4	540843.0	53.95	120.8	6.625	0.83	15.0	-51.05	-66.05	17.83	-49.05	-66.88
PZ-21-M	1148334.5	540841.7	54.05	75.0	6.625	1.00	15.0	-4.95	-19.95	19.00	-1.95	-20.95
PZ-21-S	1148332.3	540839.9	54.02	52.0	6.625	1.00	10.0	13.02	3.02	15.00	17.02	2.02
PZ-22-D	1148178.0	540731.8	54.06	121.0	6.625	1.00	15.0	-50.94	-65.94	19.00	-47.94	-66.94
PZ-22-M	1148175.6	540729.9	54.07	76.0	6.625	1.00	15.0	-5.93	-20.93	19.00	-2.93	-21.93
PZ-22-S	1148172.7	540727.7	54.04	50.0	6.625	1.00	10.0	15.04	5.04	14.00	18.04	4.04
PZ-23-D	1147945.0	540565.8	54.50	120.0	6.625	1.00	15.0	-49.50	-64.50	20.00	-45.50	-65.50
PZ-23-M	1147942.4	540564.2	54.46	75.8	6.625	0.75	15.0	-5.54	-20.54	17.75	-3.54	-21.29
PZ-23-S	1147940.4	540562.8	54.46	55.4	6.625	1.40	10.0	10.46	0.46	15.85	14.91	-0.94
PZ-24-D	1148097.3	540517.8	38.28	100.0	6.625	0.25	15.0	-46.47	-61.47	17.25	-44.47	-61.72
PZ-24-M	1148092.8	540513.8	38.75	55.0	6.625	0.25	15.0	-1.00	-16.00	17.25	1.00	-16.25
PZ-25-D	1148527.7	540765.7	25.15	91.0	6.625	1.00	15.0	-49.85	-64.85	18.00	-47.85	-65.85
PZ-25-M	1148522.3	540763.8	25.44	48.0	6.625	1.00	15.0	-6.56	-21.56	18.00	-4.56	-22.56
PZ-26-D	1148934.1	540729.4	20.74	86.0	6.625	0.00	15.0	-50.26	-65.26	20.00	-45.26	-65.26
PZ-26-M	1148925.5	540735.2	20.85	45.0	6.625	0.00	15.0	-9.15	-24.15	17.50	-6.65	-24.15
PZ-27-D	1149156.4	540932.0	16.13	80.5	6.625	0.00	15.0	-49.37	-64.37	19.00	-45.37	-64.37
PZ-27-M	1149150.2	540939.7	15.99	40.5	6.625	0.00	15.0	-9.51	-24.51	18.00	-6.51	-24.51
Well-1	1148782.7	541016.5	28.10	61.0	10	1.00	15.0	-16.90	-31.90	19.00	-13.90	-32.90
Well-2	1148894.3	541146.4	35.79	55.0	10	1.00	15.0	-3.21	-18.21	18.00	-1.21	-19.21

2.6 Laboratory Testing

As previously mentioned, disturbed samples collected during the emergency SPT boring program and the Sonic coring program were recovered from the borings and tested in the laboratory for index properties including moisture content (ASTM D 2216), fines content (ASTM D 6913), and Atterberg Limits (ASTM D 4318). These laboratory testing results were used to correct the visual classifications in accordance with ASTM D 2487. These index properties are summarized in **Appendix F**.

2.7 Piezometer Permeability testing

Hydraulic Conductivity testing was performed by an Amec Foster Wheeler representative from July 11 through 16, and August 9 through November 14, 2014. Piezometer locations were tested primarily using falling head tests in general accordance with recommendations provided by the United States Bureau of Reclamation (USBR) Engineering Geology Field Manual, Volume II, Chapter 17, Water Testing and Permeability (2011), . The piezometers were filled with water, and the drop in the water level was measured over time using a *Solinst* Level logger. Data from these tests were used to estimate hydraulic conductivity. Borehole permeability tests carry inherent uncertainties and are considered to be less accurate than aquifer pumping tests for estimating permeability. According to the USBR, this lower accuracy is due to: 1) short duration of testing; and 2) the interval being tested is no undisturbed, open, dimensioned as assumed and representative. Therefore the results presented herein should be used for comparison purposes only. Pump drawdown tests are planned for the Phase II repairs project and will be presented in subsequent engineering reports.

Due to the permeability of the middle, **M**, piezometers, the testing for this layer lasted approximately 30 minutes per test. The permeability of the shallow and deep. **S** and **D**, piezometers required permeability testing from between two and eight hours. Field parameters were recorded during each hydraulic conductivity test and calculated values of horizontal hydraulic conductivity in each of the piezometer are summarized in **Table 3**.

In some cases, a constant-head pumping test was run at the shallow and deep, **S** and **D**, piezometers due to the relatively low hydraulic conductivity of the materials encountered within the piezometers' screen intervals. Groundwater was pumped from the piezometers at a constant rate, and the drawdown in the well was measured. Data from these pumping tests were also used to estimate the hydraulic conductivity. Average permeabilities determined from these hydraulic conductivity tests are summarized in **Table 3**.

TABLE 3: Permeability in Amec Foster Wheeler Piezometers

Well ID	Depth	Average Permeability (cm/sec)	Well ID	Depth	Average Permeability (cm/sec)
PZ-1	Deep	3.84E-06	PZ-13	Deep	1.50E-05
	Middle	1.99E-04		Middle	1.43E-03
	Shallow	7.62E-07		Shallow	4.76E-05
PZ-2	Deep	1.67E-06	PZ-14	Deep	2.39E-05
	Middle	2.23E-04		Middle	1.41E-03

Well ID	Depth	Average Permeability (cm/sec)	Well ID	Depth	Average Permeability (cm/sec)
	Shallow	1.50E-06		Shallow	-
PZ-3	Deep	4.90E-05	PZ-15	Deep	1.83E-05
	Middle	9.70E-04		Middle	9.10E-05
	Shallow	4.58E-04		Shallow	-
PZ-4	Deep	6.69E-05	PZ-16	Deep	6.94E-05
	Middle	7.97E-04		Middle	1.81E-04
	Shallow	3.53E-06	PZ-17	Deep	1.95E-05
PZ-5	Deep	3.32E-06		Middle	2.33E-04
	Middle	3.61E-03	PZ-18	Deep	5.37E-05
	Shallow	1.50E-06		Middle	2.49E-04
PZ-6	Deep	5.14E-06	PZ-19	Deep	1.78E-05
	Middle	5.02E-04		Middle	1.91E-04
	Shallow	4.38E-06		Shallow	1.83E-04
PZ-6A	Deep	4.22E-05	PZ-20	Deep	1.52E-05
	Middle	1.91E-04		Middle	3.80E-04
	Shallow	4.29E-04		Shallow	1.96E-05
PZ-7	Deep	5.31E-06	PZ-21	Deep	9.07E-06
	Middle	3.94E-04		Middle	3.47E-04
	Shallow	7.91E-07		Shallow	1.95E-05
PZ-8	Deep	1.19E-05	PZ-22	Deep	2.13E-05
	Middle	2.86E-04		Middle	2.28E-04
	Shallow	1.99E-06		Shallow	1.30E-05
PZ-9	Deep	3.01E-05	PZ-23	Deep	3.40E-05
	Middle	7.27E-05		Middle	1.46E-04
	Shallow	1.48E-06		Shallow	1.06E-05
PZ-10	Deep	3.03E-05	PZ-24	Deep	5.10E-05
	Middle	2.60E-04		Middle	8.99E-04
	Shallow	1.79E-06	PZ-25	Deep	2.02E-05
PZ-11	Deep	3.78E-06		Middle	8.09E-04
	Middle	1.04E-04	PZ-26	Deep	-
	Shallow	9.10E-07		Middle	1.16E-03
PZ-12	Deep	3.89E-05	PZ-27	Deep	-
	Middle	5.50E-04		Middle	1.64E-03
	Shallow	5.38E-06			

The combined average permeability values for each of these three zones are summarized in Table 4 below.

TABLE 4: Average Combined Permeabilities for Deep, Medium and Shallow Zones

Zone	Average Permeability
Deep	2.54E-05 cm/sec
Middle	6.27E-04 cm/sec
Shallow	6.34E-05 cm/sec

2.8 Piezometric Water Elevations

In addition to permeability testing, piezometric water elevations (PWE's) were recorded for each piezometer between June 13, 2014 and March 23, 2015 by Amec Foster Wheeler staff. During critical construction stages for the deep seepage cutoff wall, measurements were recorded throughout the day and at critical locations near the service spillway. These were used to evaluate the initial performance of the newly installed wall. After the completion of the deep seepage cut-off wall, Amec Foster Wheeler staff recorded measurements periodically until March 23, 2015. Manatee County staff are currently recording PWE's. Time history plots of the PWE's for each group of piezometers are found individually in **Appendix G**.

A thorough evaluation of behavior of the seepage cutoff wall using the measured PWE's is beyond the scope of this data report and will be performed during the Phase II repairs on the dam. However, there are some general trends in the data that can be highlighted. Figures 5, 6, and 7 present the measured PWE's for each of the piezometers on March 6, 2015 for the Shallow, Middle and Deep locations, respectively.

Artesian pressures were encountered in the downstream toe areas at PZ-16, PZ-17, PZ-26 and PZ-27. These observations are consistent with a relatively high permeability zone of Hawthorn Group soils directly below the original confining layer for the embankment, but are also with artesian pressures observed regionally and previously discussed in the Supplemental Inspection report.

The measured PWE's in Figure 5 indicate that for the shallow zone, the highest heads are located at the extreme northern and southern ends of the seepage cutoff wall near the abutments. Such a behavior should be expected for seepage from the reservoir and around the edges of the seepage cutoff wall. Figure 5 also indicates that the lowest water pressures downstream of the cutoff and in the (S) zone are found in the vicinity of the service spillway; with the exception of PZ-3 and PZ-4. These two piezometers are located downstream of the Jet Grout Wall, behind the spillway approach walls, and upstream of the original sheetpiles driven to the immediate north and south of the spillway. Partial "bathtubs" have been created in these two locations by the installation of the Jet Grout wall. Pumping tests in these two wells indicate that the amount of seepage passing through the Jet Grout Wall is approximately 2 gpm and 0.2 gpm at PZ-3 (south approach wall) and PZ-4 (north approach wall), respectively.

Figures 5, 6, 7 and the time history plots in Appendix G indicate that in twenty one of the twenty six piezometers located downstream of the seepage cutoff wall, there is a clear upward vertical gradient from the deepest zone (bottom of seepage cutoff wall) to the shallowest zone (bottom

of embankment clay core). These are PZ-1 through PZ-14 (excluding PZ-6A that is located upstream of the cutoff wall), PZ-16, PZ-18 through PZ-21, PZ-25, and PZ-26. These upward gradients are consistent with underseepage below the deep seepage cutoff wall from the reservoir. These upward seepage gradients are also consistent with regional artesian pressures in the Intermediate Aquifer as discussed in the Supplemental Inspection Report.

In PZ-6A (immediately upstream of the seepage cutoff wall) and PZ-17 (in the downstream toe area of the northern embankment) there are vertical downward seepage gradients. A downward seepage gradient upstream of the seepage cutoff wall is expected and is an indication that seepage from the reservoir is being forced downward by the presence of the wall. Although the downward seepage gradient in the toe area is slight, it is not expected and illustrates the complexity of the hydrogeologic conditions at the site.

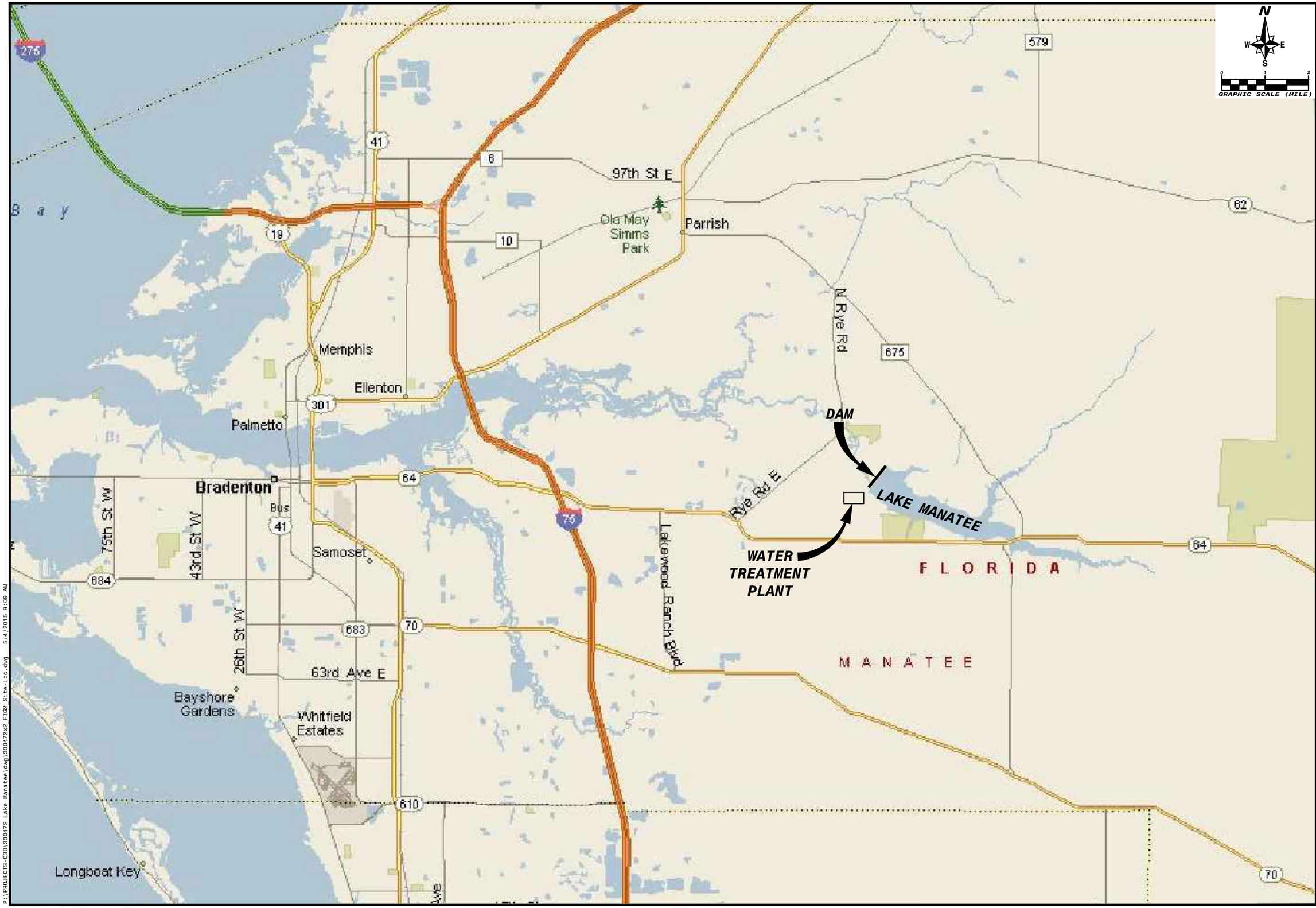
Figures

FIGURE 1 Site Location Map

FIGURE 2 Boring Location Plan – South End

FIGURE 3 Boring Location Plan – North End

FIGURE 4 Piezometer Location Plan



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NO.	DATE	REVISION

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LAKE MANATEE RESERVOIR
MANATEE COUNTY UTILITIES DEPARTMENT
SITE LOCATION MAP
MANATEE COUNTY, FLORIDA

DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 1

LEGEND

B-X	SPT BORING
CPT-X	CPT SOUNDING
SONIC-X	SONIC BORING
5+00	APPROX. ORIGINAL ℄ STATIONING

SOURCE OF AERIAL: SWFWMD 2014

P:\PROJECTS-CSD\300472 Lake Manatee\dwg\300472x2 FIG2 BoringLoc.dwg 5/4/2015 9:09 AM

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LAKE MANATEE RESERVOIR

MANATEE COUNTY UTILITIES DEPARTMENT

BORING LOCATION PLAN

SOUTH END

MANATEE COUNTY, FLORIDA

DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 2

LEGEND

B-X	SPT BORING
CPT-X	CPT SOUNDING
SONIC-X	SONIC BORING
5+00	APPROX. ORIGINAL ℄ STATIONING

SOURCE OF AERIAL: SWFWMD 2014

NO.	DATE	REVISION

amec foster wheeler
Amec Foster Wheeler
Environment & Infrastructure, Inc.
2000 E. Edgewood Dr., Suite 215, Lakeland, FL 33803
Phone: 1.863.667.2345 Fax: 1.863.667.2667
www.amecfw.com CA-5392

LAKE MANATEE RESERVOIR
MANATEE COUNTY UTILITIES DEPARTMENT
BORING LOCATION PLAN
NORTH END
MANATEE COUNTY, FLORIDA

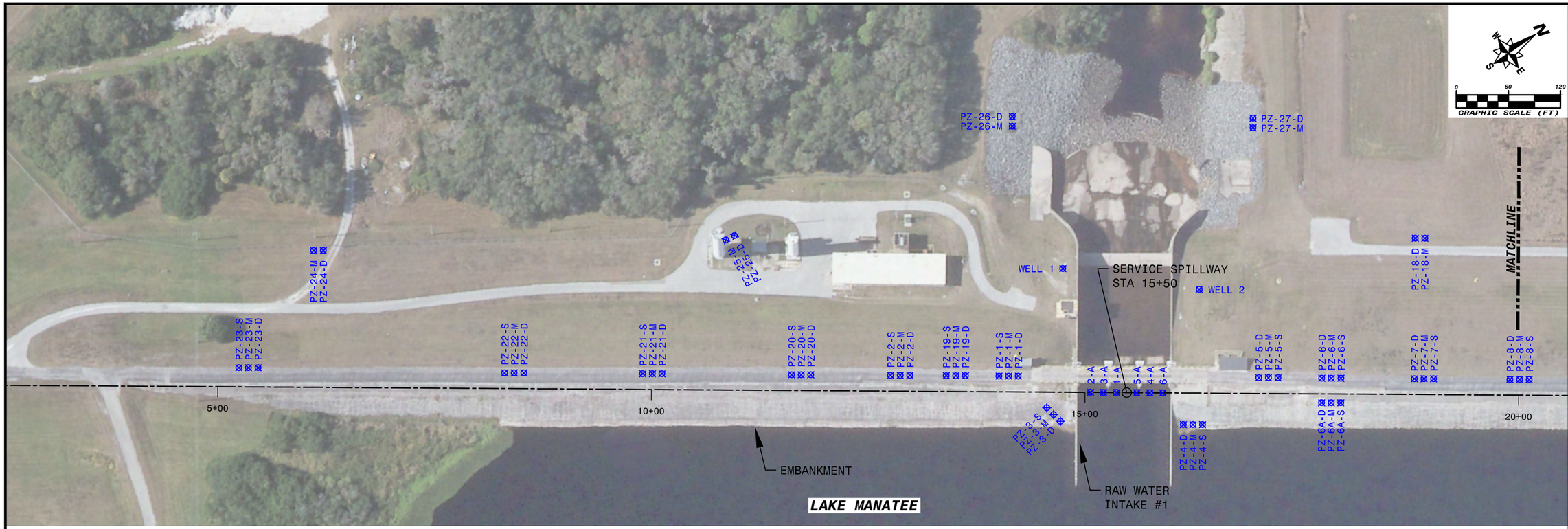
DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 3

P:\PROJECTS-C3D\300472 Lake Manatee\dwg\300472x2 FIG2 BoringLoc.dwg 5/4/2015 9:09 AM



SOURCE OF AERIAL: SWFWMD 2014

P:\PROJECTS-C3D\300472 Lake Manatee\dwg\300472x2 FIG2-Piezometer-Loc.dwg 5/4/2015 9:09 AM

NO.	DATE	REVISION

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LAKE MANATEE RESERVOIR

MANATEE COUNTY UTILITIES DEPARTMENT

PIEZOMETER LOCATION PLAN

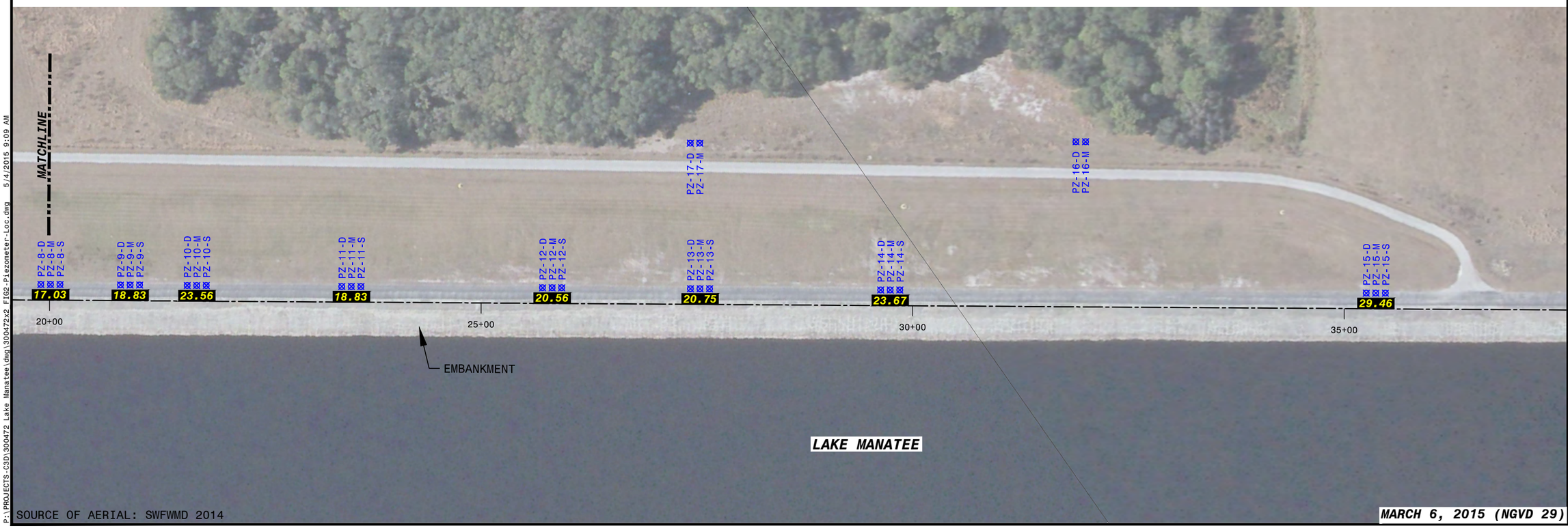
MANATEE COUNTY, FLORIDA

DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 4



SOURCE OF AERIAL: SWFWMD 2014

MARCH 6, 2015 (NGVD 29)

NO.	DATE	REVISION

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LAKE MANATEE RESERVOIR

MANATEE COUNTY UTILITIES DEPARTMENT

SHALLOW PIEZOMETRIC WATER ELEVATIONS NEAR BOTTOM OF DAM CORE MANATEE COUNTY, FLORIDA

DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 5

P:\PROJECTS-C3D\300472 Lake Manatee\dwg\300472x2 FIG2-Piezometer-Loc.dwg 5/4/2015 9:09 AM

SOURCE OF AERIAL: SWFWMD 2014

MARCH 6, 2015 (NGVD 29)

P:\PROJECTS-C3D\300472 Lake Manatee\dwg\300472x2 FIG2-Piezometer-Loc.dwg 5/4/2015 9:09 AM

NO.	DATE	REVISION

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LAKE MANATEE RESERVOIR

MANATEE COUNTY UTILITIES DEPARTMENT

MIDDLE PIEZOMETRIC WATER ELEVATIONS IN HIGH PERMEABILITY LAYER MANATEE COUNTY, FLORIDA

DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 6

SOURCE OF AERIAL: SWFWMD 2014

MARCH 6, 2015 (NGVD 29)

P:\PROJECTS-C3D\300472 Lake Manatee\dwg\300472x2 FIG2-Piezometer-Loc.dwg 5/4/2015 9:09 AM

NO.	DATE	REVISION

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www.amecfw.com CA-5392

LAKE MANATEE RESERVOIR

MANATEE COUNTY UTILITIES DEPARTMENT

DEEP PIEZOMETRIC WATER ELEVATIONS AT BOTTOM OF CUTOFF WALL MANATEE COUNTY, FLORIDA

DATE: May 4, 2015
DRAWN BY: MAJ
CHECKED BY: ND
PROJECT NO.: 300472X2

NICKOLAS DEPIN, P.E.
FLA. REG. NO. 78481

DATE:

FIGURE 7

Appendix A

Amec Foster Wheeler's Initial Inspection Boring Logs

WELL NUMBER B-01

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/12/13 **COMPLETED** 12/12/13 **GROUND ELEVATION** 25.6 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 14+77.4, L145ft **AFTER DRILLING** 18.34 ft / Elev 7.26 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1			SP		(SP) brown poorly graded fine grained quartz SAND with little cemented sand and gravel (FILL)	
	AU 2					2.0	23.6
5	SS 1	1-2-1-2 (3)		SP-SC		(SP-SC) brown, dark brown, gray, poorly graded fine grained quartz SAND with CLAY, very loose to loose, with clayey nodules (FILL)	Grout
	SS 2	1-1-2-1 (3)					
10	SS 3	1-1-1-1 (2)					
	SS 4	1-2-2 (4)					
15	SS 5	3-2-3 (5)				15.0	10.6
	SS 6	1-1-3 (4)		SM		(SM) dark brown, variably SILTY SAND, very loose (FILL)	Bentonite Plug
20	SS 7	0	WOH - 2 ft				Sand Pack
	SS 8	1-2-1 (3)				21.5	4.1
25	SS 9	4-6-6 (12)		SC		(SC) greenish gray, variably CLAYEY SAND, very loose to medium dense (FILL)	Screen
	SS 10	2-3-5 (8)				26.0	-0.4
30	SS 11	3-3-4 (7)		CL		(CL) greenish gray, variably SANDY CLAY, firm to stiff, trace to little sand sized phosphate particles (NATIVE)	
	SS 12	1-4-5 (9)					
35	SS 13	3-3-5 (8)					

(Continued Next Page)

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35							
	SS 14	3-4-5 (9)		CL		(CL) greenish gray, variably SANDY CLAY, firm to stiff, trace to little sand sized phosphate particles (NATIVE) *(continued)* - 1-inch sand lense at 37-ft	
40	SS 15	2-4-5 (9)					
	SS 16	2-4-5 (9)					
	SS 17	10-50/5"				43.0 -17.4	
				SM		(SM) greenish gray SILTY SAND, very dense, mostly cemented sand and silt (NATIVE) 44.4 -18.8	

Bottom of borehole at 44.4 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

WELL NUMBER B-02

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/12/13 **COMPLETED** 12/13/13 **GROUND ELEVATION** 28.3 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 14+77.4, L112ft **AFTER DRILLING** 23.40 ft / Elev 4.90 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1		SP-SM		(SP-SM) brown, pale brown, gray, poorly graded fine grained quartz SAND with SILT, loose, trace clayey nodules, trace cemented sand (FILL)	
	AU 2					
5	SS 1	3-2-3-3 (5)			- brown, trace clay	
	SS 2	2-4-5-6 (9)				
	SS 3	4-4-4-4 (8)				
10					10.0	18.3
	SS 4	2-3-4 (7)	SM		(SM) brown, dark brown, variably SILTY SAND, very loose to loose, trace clay (FILL)	Grout
15	SS 5	2-2-4 (6)				
	SS 6	2-2-2 (4)				
20	SS 7	2-3-2 (5)			20.0	8.3
	SS 8	1-1-3 (4)	SP-SM		(SP-SM) brown, light brown, poorly graded fine grained quartz SAND with SILT, very loose (FILL)	Bentonite Plug
					23.0	5.3
25	SS 9	1-1-0 (1)	SP-SC		(SP-SC) gray, greenish gray, poorly graded fine grained quartz SAND with CLAY, very loose, few silt (FILL)	Sand Pack
					26.0	2.3
	SS 10	2-3-1 (4)	CL		(CL) greenish gray, variably SANDY CLAY, soft to stiff, trace sand sized phosphate particles (NATIVE)	Screen
30	SS 11	2-3-5 (8)				
	SS 12	2-4-4 (8)				
35	SS 13	2-4-5 (9)				

(Continued Next Page)

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

WELL NUMBER B-02

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35			CL		(CL) greenish gray, variably SANDY CLAY, soft to stiff, trace sand sized phosphate particles (NATIVE) *(continued)*	
	SS 14	2-3-5 (8)				
	SS 15	3-2-5 (7)				
40						
	SS 16	2-6-4 (10)				
	SS 17	2-4-5 (9)				
45					45.0 -16.7	

Bottom of borehole at 45.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

WELL NUMBER B-03

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/13/13 **COMPLETED** 12/13/13 **GROUND ELEVATION** 25.2 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 16+10.4, L146ft **AFTER DRILLING** 18.48 ft / Elev 6.72 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1			SP		(SP) brown, gray, poorly graded fine grained quartz SAND, trace silt (FILL)	
	AU 2					2.0 - black matting at 1.5-ft 23.2	
5	SS 1	1-2-2-2 (4)		SP-SM		(SP-SM) dark gray, dark brown, brown, light brown, poorly graded fine grained quartz SAND with SILT, very loose to loose, few clayey nodules (FILL)	Grout
	SS 2	1-1-3-2 (4)					
10	SS 3	2-3-3-1 (6)				10.0 15.2	
	SS 4	2-2-3 (5)		SM		(SM) brown, dark brown modeling, variably SILTY fine grained quartz SAND, very loose to lose, some cemented sand (FILL)	
15	SS 5	2-1-2 (3)					
	SS 6	1-2-4 (6)				18.0 7.2	Bentonite Plug
20	SS 7	1-3-3 (6)		SP-SC		(SP-SC) gray, greenish gray, poorly graded fine to medium grained quartz SAND with CLAY, very loose to loose, trace organics (FILL)	Sand Pack
	SS 8	0	WOR - 1.5 ft				Screen
	SS 9	2-1-3 (4)				22.5 2.7	
25				CL		(CL) greenish gray, variably SANDY CLAY, soft to stiff, few to some sand sized phosphate particles (NATIVE)	
	SS 10	3-3-4 (7)					
30	SS 11	2-4-5 (9)	loss of drilling fluid circulation at 30-ft				
	SS 12	2-4-4 (8)					
35	SS 13	3-6-7 (13)				- 2-inch sand lense at 34.5-ft	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35							
	SS 14	2-5-6 (11)		CL		(CL) greenish gray, variably SANDY CLAY, soft to stiff, few to some sand sized phosphate particles (NATIVE) *(continued)*	
40	SS 15	3-3-5 (8)				40.0 -14.8	
	SS 16	28-50/2"		SM		(SM) greenish gray, SILTY SAND, very dense, cemented sand and silt, some sand sized phosphate particles (NATIVE)	
	SS 17	50/4"				43.8 -18.6	

Bottom of borehole at 43.8 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

WELL NUMBER B-04

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 12/13/13 **COMPLETED** 12/13/13 **GROUND ELEVATION** 30.8 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary (Automatic Hammer) **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 16+11.1, L84ft **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU 1		SM		(SM) brown, dark brown, SILTY SAND, very loose to loose, trace clay (FILL)	
	AU 2					
5	SS 1	1-1-1-1 (2)				
	SS 2	1-1-1-1 (2)				
10	SS 3	2-3-3-4 (6)				Grout
	SS 4	1-1-2 (3)			- brown, light brown, dark brown, dark gray	
15	SS 5	1-2-2 (4)				
	SS 6	1-1-2 (3)			- wood fragments at tip of sample at 17 ft	Bentonite Plug
20	SS 7	2-3-2 (5)				Sand Pack
	SS 8	2-3-5 (8)				Screen
					23.0 / 7.8	
25	SS 9	6-11-11 (22)	SP-SC		(SP-SC) gray, dark gray, poorly graded SAND with CLAY, medium dense, few clayey nodules, petroleum odor (FILL)	
					25.0 / 5.8	
	SS 10	1-1-5 (6)	SC		(SC) greenish gray, variably CLAYEY SAND, loose, few cemented sand (NATIVE)	
					28.0 / 2.8	
30	SS 11	7-5-4 (9)	CL		(CL) greenish gray, variably SANDY CLAY, firm to very stiff, trace to few sand sized phosphate particles (NATIVE)	
	SS 12	2-3-5 (8)				
35	SS 13	2-3-4 (7)				

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

WELL NUMBER B-04

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35			CL		(CL) greenish gray, variably SANDY CLAY, firm to very stiff, trace to few sand sized phosphate particles (NATIVE) *(continued)*	
	SS 14	3-4-5 (9)				
	SS 15	4-4-8 (12)				
40						
	SS 16	10-10-8 (18)				
	SS 17	2-4-5 (9)				
45				45.0	-14.2	

Bottom of borehole at 45.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:10 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

Appendix B

Hand Augur Boring Logs

BORING NUMBER B-05

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION 21.4 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 20+10.6, L120ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SS 1	2-4-5-12 (9)	MC = 13%	SC		(SC) light brown, brown, dark brown, CLAYEY fine grained quartz SAND, loose to dense, trace organics (FILL)	
	SS 2	13-16-15-12 (31)	MC = 18%				
						4.0 - 2-inch greenish gray SANDY CLAY lense at 3.5 ft	17.4
5	SS 3	7-10-9-6 (19)	MC = 10%	SM		(SM) brown, SILTY SAND, loose to medium dense (FILL)	
	SS 4	5-4-4-3 (8)	MC = 15%			- some clayey nodules	
						7.5	13.9
				SP		8.0 (SP) white, light gray, very pale brown, poorly graded fine grained quartz SAND, loose (FILL)	13.4
10	SS 5	5-3-2-2 (5)		GP		(GP) poorly graded GRAVEL with fine grained quartz SAND, loose to very dense, damp above 11 ft (FILL)	
	SS 6	16-27-35 (62)				- pale brown, light gray, gray, fine grained quartz SAND pocket below 11.5 ft	
						13.0	8.4
15	SS 7	7-3-8 (11)	MC = 30%	SC		(SC) greenish gray, gray, dark gray, variably CLAYEY SAND, medium dense, trace sand sized phosphate particles, some top soil in sample 7 (NATIVE)	
	SS 8	5-6-8 (14)	MC = 36% LL = 35 PL = 17 #200 = 19%				
20	SS 9	4-6-10 (16)	MC = 54%			- some phosphate pebbles	
						20.0	1.4

Bottom of borehole at 20.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-06

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION 22.6 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 20+23.4, L115ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SS 1	2-2-2-2 (4)	MC = 11%	SM		(SM) brown, dark brown, gray, fine grained quartz SILTY SAND, very loose to dense, trace silt, trace organics (FILL)	
	SS 2	2-2-1-1 (3)	MC = 12%				
5	SS 3	1-1-1-2 (2)	MC = 19%				
	SS 4	2-3-2-3 (5)	MC = 12%			- pockets of brown, greenish gray, variably CLAYEY fine grained quartz SAND and pockets of brown, very dark brown, fine grained quartz SAND, organic staining	
10	SS 5	3-2-2-2 (4)	MC = 13%				
	SS 6	9-32-44 (76)	MC = 23%			- light gray, gray, pale brown, possible construction rubble	
						13.0	9.6
15	SS 7	13-14-13 (27)	MC = 20%	SM		(SM) dark brown, fine to medium-grained quartz SILTY SAND, dense, few sand sized phosphate particles (NATIVE)	
						15.5	7.1
	SS 8	9-8-8 (16)	MC = 26%	SC		(SC) greenish gray, CLAYEY SAND, loose to medium dense, few to some sand sized phosphate particles	
20							
	SS 9	3-3-4 (7)	MC = 34% #200 = 31%				
						22.5	0.1

Bottom of borehole at 22.5 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-07

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION 19.5 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 20+13.2, L155ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	2-2-6-7 (8)	MC = 6%	SM		(SM) brown, dark brown, very dark brown, gray, fine grained quartz SILTY SAND, loose to medium dense, slight organic odor (FILL)
	SS 2	12-15-14-14 (29)	MC = 4%			
5	SS 3	14-13-11-11 (24)	MC = 11%			- possible construction debris
						6.0 / 13.5
	SS 4	19-19-21-19 (40)	MC = 6%	SM		(SM) white, light gray, pale brown, fine grained quartz SILTY SAND, dense, few cemented sands, possible construction debris (POSSIBLE FILL)
10	SS 5	14-15-18-16 (33)	MC = 22%			- pockets of light gray and white fine to medium-grained quartz (SP-SM)
						10.5 / 9.0
	SS 6	2-1-1 (2)	MC = 43%	SC		(SC) greenish gray, variably CLAYEY SAND, very loose to loose, trace sand sized phosphate particles (NATIVE)
15	SS 7	6-5-5 (10)	MC = 28% LL = 41 PL = 23 #200 = 33%			- light gray
20	SS 8	4-5-5 (10)	MC = 43%			- coarser with larger phosphate particles below 18 ft
						20.0 / -0.5

Bottom of borehole at 20.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-08

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION 19.8 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 19+81.6, L156ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	3-4-8-7 (12)	MC = 5%	SM		(SM) brown, dark brown, gray, fine grained quartz SILTY SAND, medium dense, trace organics, slight organic odor (FILL)
	SS 2	8-12-12-12 (24)	MC = 7%			- trace clayey nodules
5	SS 3	10-9-5-4 (14)	MC = 7%			- trace cemented sand
						6.0 13.8
	SS 4	7-10-14-11 (24)	MC = 8%	SM		(SM) light brown, fine grained quartz SILTY SAND, medium dense, with pockets of light gray and white silty sand (POSSIBLE FILL)
						8.0 11.8
10	SS 5	14-12-14-9 (26)	MC = 15%	SP		(SP) white, light gray, very light gray, poorly graded fine grained quartz SAND, medium dense (POSSIBLE NATIVE)
	SS 6	11-13-9 (22)	MC = 21%			
						13.0 6.8
15	SS 7	5-5-5 (10)	MC = 35% LL = 40 PL = 20 #200 = 28%	SC		(SC) greenish gray, variably CLAYEY SAND, loose to medium dense, trace sand sized phosphate particles (NATIVE)
20	SS 8	4-6-7 (13)	MC = 43%			- more clayey with larger phosphate particles below 18 ft
						20.0 -0.2

Bottom of borehole at 20.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-09

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION 19.7 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 19+53.0, L156ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SS 1	4-4-7-9 (11)	MC = 6%	SM		(SM) brown, dark brown, fine grained quartz SILTY SAND, medium dense, trace organics, slight organic odor to 2 ft (FILL)	
	SS 2	9-12-7-7 (19)	MC = 9%				
5	SS 3	10-9-6-6 (15)	MC = 10%				
						- trace clay	13.7
	SS 4	8-13-14-15 (27)	MC = 9%	SM		(SM) light brown, fine grained quartz SILTY SAND, medium dense, pockets of light gray and white (SP-SM) (POSSIBLE FILL)	
10	SS 5	14-14-14-14 (28)	MC = 17%				
	SS 6	15-17-6 (23)	MC = 22%				
						- coarser below 12 ft with trace organics	6.7
15	SS 7	5-5-5 (10)	MC = 34% LL = 33 PL = 20 #200 = 21%	SC		(SC) greenish gray, variably CLAYEY SAND, loose to medium dense, trace sand-sized phosphate particles (NATIVE)	
20	SS 8	6-9-11 (20)	MC = 60%				-0.3

Bottom of borehole at 20.0 feet.

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BORING NUMBER B-10

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION 19.1 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 18+28.4, L172ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SS 1	3-5-7-6 (12)	MC = 10%	SM		(SM) brown, dark brown, very dark brown, fine grained quartz SILTY SAND, very loose to medium dense, trace glass fragments (FILL)	
	SS 2	6-11-12-9 (23)	MC = 13%				
5	SS 3	4-4-2-1 (6)	MC = 11%				
	SS 4	1-0-1-0 (1)	MC = 10%			- roots	
	SS 5	0-1-0-1 (1)	MC = 12% WOH - 6-inches			- small light gray clayey sand clods	
10						- 2-inch greenish gray CLAY pocket at 9 ft	
	SS 6	0-0-1 (1)	MC = 27% WOH - 1 ft			- variably SILTY fine grained quartz SAND, few plastics and glass below 1	
						13.0	6.1
15	SS 7	1-2-3 (5)	MC = 38%	SC		(SC) greenish gray, variably CLAYEY SAND, loose, trace sand sized phosphate particles (NATIVE)	
						17.0	2.1
				CL		(CL) greenish gray, SANDY CLAY, stiff, layers of silty sand (SM), few sand sized phosphate particles	
20	SS 8	4-4-7 (11)	MC = 82%			20.0	-0.9

Bottom of borehole at 20.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-11

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/20/14 **COMPLETED** 2/20/14
GROUND ELEVATION 17.8 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 17+87.7, L208ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	4-7-9-13 (16)	MC = 11%	SM		(SM) dark brown, SILTY fine grained quartz SAND, very loose to medium dense, trace size shell fragments, light organic odor (FILL) - 1in clayey sand pocket at 1 ft
	SS 2	8-10-14-17 (24)	MC = 4%			
5	SS 3	11-11-12-11 (23)	MC = 11%			
	SS 4	8-8-7-7 (15)	MC = 5%			- less silty 6 ft to 10 ft - trace cemented sand nodules at 6 to 6.5 ft - light gray (SP-SM) pockets below 6.5 ft
	SS 5	5-5-3-4 (8)	MC = 4%			
10						
	SS 6	1-2-2 (4)	MC = 25%			- gray (SP) pockets - wet at 11 ft
15	SS 7	1-2-2 (4)	MC = 27%			
	SS 8	1-1-6 (7)	MC = 25%			
20	SS 9	2-4-5 (9)	MC = 33%			- dark brown, gray, more silty below 18 ft
						20.5 -2.7
	SS 10	2-2-3 (5)	MC = 93%	MH		(MH) greenish gray, SANDY elastic SILT, firm to stiff, trace silt, trace sand sized phosphate particles (NATIVE)
25	SS 11	4-4-5 (9)	MC = 82% LL = 134 PL = 68 #200 = 61%			
	SS 12	4-5-7 (12)	MC = 99%			28.0 -10.2
	SS 13	47-50/2"		SC		(SC) gray, CLAYEY SAND, very dense, few sand sized phosphate particles, cemented zones - light gray, cemented dolomitic silt at 29 ft 29.2 -11.4

Bottom of borehole at 29.2 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-12

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 2/20/14 **COMPLETED** 2/20/14 **GROUND ELEVATION** 14.9 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 17+34.3, L296ft **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	5-6-9-8 (15)	MC = 9%	SM		(SM) dark brown, SILTY fine grained quartz SAND, medium dense to very dense, organic odor (FILL)
	SS 2	9-15-15-19 (30)	MC = 11%			- cemented sand pockets
5	SS 3	13-21-32-26 (53)	MC = 8%			
	SS 4	24-25-27-26 (52)	MC = 9%			
10	SS 5	11-11-9-8 (20)	MC = 20%			
						10.5 4.4
	SS 6	6-5-4 (9)	MC = 24%	SM		(SM) gray, greenish gray, brown, SILTY fine grained quartz SAND, loose, trace sand sized phosphate particles (NATIVE)
						13.5 1.4
15	SS 7	2-5-5 (10)	MC = 31%	SC		(SC) dark greenish gray, CLAYEY SAND, loose to medium dense, trace silt, trace sand sized phosphate particles
	SS 8	5-5-7 (12)	MC = 53%			
						18.0 -3.1
20	SS 9	4-6-7 (13)	MC = 83%	CH		(CH) dark greenish gray, SANDY fat CLAY, stiff to hard, trace silt, trace sand sized phosphate particles
	SS 10	4-4-6 (10)	MC = 109%			- layers and pockets of phosphatic silty sand
25	SS 11	4-6-6 (12)	MC = 106%			
	SS 12	50/2"				- layer of dolomitic SILT at 25.5 ft
						- less sandy below 28 ft
30	SS 13	11-16-22 (38)	MC = 40% LL = 55 PL = 26 #200 = 91%			30.0 -15.1
						Bottom of borehole at 30.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-13

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 2/20/14 **COMPLETED** 2/20/14 **GROUND ELEVATION** 14.7 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 16+88.4, L404ft **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	2-3-9-9 (12)	MC = 7%	SM		(SM) pale brown, brown, dark brown, SILTY fine grained quartz SAND, loose to dense, trace organics, slight organic odor (FILL)
	SS 2	8-8-9-7 (17)	MC = 9%			
5	SS 3	2-5-3-3 (8)	MC = 8%			- local construction debris (cloth and wire) at 5 ft
	SS 4	5-8-8-10 (16)	MC = 8%			
10	SS 5	12-14-18-19 (32)	MC = 11%			
	SS 6	14-16-18 (34)	MC = 16%			- few silty nodules, slight petroleum odor (11 ft to 15 ft)
15	SS 7	7-8-4 (12)	MC = 18%			
	SS 8	4-3-2 (5)	MC = 20%			- some shell fragments - trace construction debris (brick fragments) between 16 ft and 17.5 ft
20	SS 9	4-4-6 (10)	MC = 20%			
	SS 10	4-5-7 (12)	MC = 93%	CL		20.5 -5.8 (CL) greenish gray, SANDY CLAY, stiff, trace silt, trace sand sized phosphate particles (NATIVE)
25	SS 11	5-12-13 (25)	MC = 51%	SC		23.0 -8.3 (SC) light gray, gray, dark gray, CLAYEY fine grained quartz SAND, medium dense to very dense, dolomitic, trace silt, some sand sized phosphate particles
	SS 12	26-50/5"	MC = 26%			- trace cemented sandy clay layers
30	SS 13	10-16-14 (30)	MC = 47%			- layers and pockets of dark gray silty sand with sand sized phosphate particles below 28 ft
	SS 14	32-26-50/4"	MC = 25%			
35	SS 15	15-19-38 (57)	MC = 31%			35.0 -20.3 - dolomitic cemented SANDY CLAY layer

Bottom of borehole at 35.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-14

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/20/14 **COMPLETED** 2/20/14
GROUND ELEVATION 17.7 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 17+54.5, L147ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	2-2-4-3 (6)	MC = 65%	SM		(SM) dark brown, SILTY fine grained quartz SAND, very loose to medium dense, trace organics, slight organic odor (FILL)
	SS 2	6-7-10-8 (17)	MC = 12%			- 2 inch clayey sand pocket at 3 ft
5	SS 3	5-6-6-5 (12)	MC = 9%			- local cemented sand nodules
	SS 4	6-3-3-3 (6)	MC = 11%			
	SS 5	1-1-1-2 (2)	MC = 12%			- trace fine gravel size cemented sand
10						
	SS 6	2-2-3 (5)	MC = 19%			
						- wet below 13.5 ft
15	SS 7	4-4-3 (7)	MC = 21%			- light gray sand zones 13.5 ft to 17.5 ft
	SS 8	6-8-7 (15)	MC = 22%			
20	SS 9	2-2-2 (4)	MC = 29%			- trace decomposing plant roots
	SS 10	5-6-4 (10)	MC = 35%			- large, coarse 3 inch decomposing wood fragment at 21 ft
						24.0 -6.3
25	SS 11	7-5-5 (10)	MC = 55% MC = 22%	CL		(CL) greenish gray, SANDY CLAY, stiff, few sand sized phosphate particles (NATIVE)
	SS 12	4-5-5 (10)	MC = 79%			
						29.5 -11.8
30	SS 13	6-8-40 (48)	MC = 26% MC = 69% LL = 71 PL = 32 #200 = 65%	CH		30.0 -12.3 (CH) light gray, SILTY fat CLAY, hard, dolomitic, few cemented sands, trace sand sized phosphate particles Bottom of borehole at 30.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:59 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-15

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/20/14 **COMPLETED** 2/20/14
GROUND ELEVATION 15.8 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 17+17.0, L219ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	4-6-9-9 (15)	MC = 9%	SP-SM		(SP-SM) dark brown, poorly graded fine grained quartz SAND with SILT, loose to medium dense, trace organics, slight organic odor (FILL)
	SS 2	9-18-16-17 (34)	MC = 8%			
5	SS 3	7-11-12-10 (23)	MC = 10%			
	SS 4	8-5-4-4 (9)	MC = 12%			- light gray, gray, trace organics below 6 ft
						8.0 / 7.8
10	SS 5	2-2-2-5 (4)	MC = 38%	SC		(SC) light gray, gray, greenish gray, CLAYEY fine grained quartz SAND, very loose to medium dense, trace cementation, trace sand sized phosphate particles (NATIVE)
	SS 6	3-3-3 (6)	MC = 32%			
15	SS 7	7-6-7 (13)	MC = 43%			
	SS 8	7-7-8 (15)	MC = 68%			- greenish gray below 15 ft
20	SS 9	5-7-5 (12)	MC = 80% #200 = 22%			
	SS 10	6-7-10 (17)	MC = 76%			
25	SS 11	4-6-6 (12)	MC = 104%			25.0 / -9.2

Bottom of borehole at 25.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-16

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 2/20/14 **COMPLETED** 2/20/14 **GROUND ELEVATION** 15.9 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 17+84.8, L271ft **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SS 1	2-4-5-6 (9)	MC = 7%	SP-SM		(SP-SM) brown, dark brown, poorly graded fine grained quartz SAND with SILT, loose to medium dense, trace white sand (FILL)	
	SS 2	8-10-13-12 (23)	MC = 10%				
5	SS 3	4-7-8-8 (15)	MC = 10%				
	SS 4	8-9-6-5 (15)	MC = 11%			- dark brown, black 6 ft to 8 ft	
10	SS 5	5-3-3-3 (6)	MC = 11%			- gray, light brown 8 ft to 10.5 ft	
						10.5	5.4
	SS 6	1-0-0-1/0"	WOH - 1 ft MC = 26%	SC		(SC) gray, greenish gray, CLAYEY fine grained quartz SAND, very loose, trace sand sized phosphate particles (POSSIBLE FILL)	
						13.0	2.9
15	SS 7	6-9-10 (19)	MC = 25% #200 = 2%	SP		(SP) pale gray, gray, pale brown, poorly graded fine grained quartz SAND, loose to medium dense, trace organics, possible riverbed sediments (POSSIBLE FILL)	
	SS 8	10-13-8 (21)	MC = 22%				
20	SS 9	9-13-14 (27)	MC = 24%				
	SS 10	10-4-6 (10)	MC = 26%			- trace decomposing wood fragments	
						23.0	-7.1
25	SS 11	4-4-6 (10)	MC = 85%	CL		(CL) greenish gray, SANDY CLAY, stiff, trace sand sized phosphate particles (NATIVE)	
						25.5	-9.6
	SS 12	26-50/1"	MC = 35%	SC		(SC) light gray, greenish gray, CLAYEY fine grained quartz SAND, very dense, trace sand sized phosphate particles - 3-inch cemented silt lense at 26.5 ft	
						28.0	-12.1
30	SS 13	18-21-24 (45)	MC = 29%	CL		(CL) greenish gray, light gray, SANDY CLAY, hard, locally cemented, trace sand seams with phosphate particles, clay portions hard and dry	
	SS 14	21-50/4"	MC = 36%				
						33.0	-17.1
35	SS 15	8-8-17 (25)		SC		(SC) gray, dark gray, greenish gray, CLAYEY fine grained quartz SAND, medium dense - 3-inch partially cemented clay lense at 34 ft	
						35.0	-19.1

Bottom of borehole at 35.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-17

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/21/14 **COMPLETED** 2/21/14
GROUND ELEVATION 30.8 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 14+75.6, L72ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	AU 1		MC = 6%	SM		(SM) pale brown, brown, SILTY fine grained quartz SAND, loose to medium dense, trace organics, slight organic odor (FILL)
	AU 2		MC = 9%			
5	SS 3	2-3-2-2 (5)	MC = 12%			
	SS 4	4-5-5-3 (10)	MC = 15%			
10	SS 5	3-5-7-7 (12)	MC = 19%			
	SS 6	3-4-4 (8)	MC = 18%			
15	SS 7	4-7-10 (17)	MC = 15%			- brown 13.5 ft to 15 ft
	SS 8	6-9-9 (18)	MC = 16%			- light brown, dark brown below 15.5 ft
20	SS 9	5-9-12 (21)	MC = 17%			
	SS 10	8-12-6 (18)	MC = 18%			
						23.0 / 7.8
25	SS 11	4-4-5 (9)	MC = 43% LL = 48 PL = 20 #200 = 32%	SC		(SC) greenish gray, CLAYEY SAND, loose to dense, trace sand sized phosphate particles (NATIVE)
	SS 12	3-4-3 (7)	MC = 44%			
30	SS 13	5-18-15 (33)	MC = 24%			- greenish gray, light gray
	SS 14	3-3-4 (7)	MC = 32%			
						33.5 / -2.7
35	SS 15	4-7-5 (12)	MC = 39% LL = 47 PL = 32 #200 = 49%	SM		(SM) greenish gray, SILTY SAND, medium dense, trace sand sized phosphate particles
						35.0 / -4.2
						Bottom of borehole at 35.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-18

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/21/14 **COMPLETED** 2/21/14
GROUND ELEVATION 25.7 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 14+02.4, L160ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	AU 1		MC = 10%	SM		(SM) brown, gray, SILTY fine grained quartz SAND, very loose to very dense, trace clayey nodules (FILL)
	AU 2		MC = 10%			
5	SS 3	1-2-3-3 (5)	MC = 12%			- trace fine gravel
	SS 4	7-6-6-6 (12)	MC = 11%			
10	SS 5	5-5-3-2 (8)	MC = 11%			
	SS 6	1-1-1 (2)	MC = 20%			
15	SS 7	19-33-28 (61)	MC = 16%			- loss of circulation at 13 ft, encountered toe drain aggregate, abandoned hole and moved west 1, drilled down to 13.5 ft and began sampling
	SS 8	21-25-24 (49)	MC = 21%			
						18.0 - wet 7.7
20	SS 9	1-2-3 (5)	MC = 46%	SC		(SC) greenish gray, CLAYEY fine grained quartz SAND, loose to medium dense, trace sand sized phosphate particles (NATIVE)
	SS 10	4-4-5 (9)	MC = 32%			
25	SS 11	9-9-9 (18)	MC = 24%			
	SS 12	4-4-5 (9)	MC = 24%			
						28.0 -2.3
30	SS 13	4-4-5 (9)	MC = 62% LL = 92 PL = 43 #200 = 72%	MH		(MH) greenish gray, elastic SILT with sand, stiff, trace sand sized phosphate particles
						30.0 -4.3
						Bottom of borehole at 30.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-19

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/21/14 **COMPLETED** 2/21/14
GROUND ELEVATION 27.9 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 10+50.7, L108ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	AU 1		MC = 6%	SM		(SM) brown, dark brown, SILTY fine grained quartz SAND, loose to medium dense, few shell fragments, trace organics, slight organic odor (FILL)
	AU 2		MC = 8%			
5	SS 3	3-4-4-4 (8)	MC = 9%			
	SS 4	4-5-6-4 (11)	MC = 12%			- light gray, pale brown, less silty below 6 ft
	SS 5	2-2-2-2 (4)	MC = 23%			- wet below 8 ft
10						
	SS 6	15-7-8 (15)	MC = 28%			
	SS 7	7-5-3 (8)	MC = 20%			
15						15.5 / 12.4
	SS 8	1-2-2 (4)	MC = 39%	SC		(SC) greenish gray, CLAYEY SAND, very loose to dense, trace sand-sized phosphate particles (NATIVE)
	SS 9	3-4-4 (8)	MC = 38%			
20						
	SS 10	12-21-37 (58)	MC = 22%			- few sand-sized phosphate particles
	SS 11	11-14-20 (34)	MC = 32%			
25						
	SS 12	4-7-7 (14)	MC = 23% LL = 30 PL = 16 #200 = 24%			- trace sand-sized phosphate particles
	SS 13	5-6-6 (12)	MC = 65%			
30						30.0 / -2.1

Bottom of borehole at 30.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-20

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/21/14 **COMPLETED** 2/21/14
GROUND ELEVATION 28.4 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 9+53.7, L106ft
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	AU 1		MC = 7%	SM		(SM) brown, dark brown, SILTY fine grained quartz SAND, very loose to loose, few fine shell fragments (FILL)
	AU 2		MC = 13%			
5	SS 3	1-1-1-2 (2)	MC = 16%			
	SS 4	1-1-7-3 (8)	MC = 21%			- brown 6 ft to 8 ft
						8.0 / 20.4
10	SS 5	6-6-9-7 (15)	MC = 34%	SM		(SM) brown, pale brown, SILTY fine to medium-grained quartz SAND, medium dense (POSSIBLE FILL)
						10.5 / 17.9
	SS 6	1-2-3 (5)	MC = 60%	SM		(SM) greenish gray, SILTY fine grained quartz SAND, loose, little sand-sized phosphate particles, minor silt (NATIVE)
						13.0 / 15.4
15	SS 7	1-1-2 (3)	MC = 42%	SC		(SC) greenish gray, CLAYEY fine grained quartz SAND, very loose to very dense, few sand sized phosphate particles
	SS 8	3-3-4 (7)	MC = 38%			
20	SS 9	3-3-4 (7)	MC = 34%			
	SS 10	10-33-50/4"	MC = 21%			- pale brown, gray, dolomitic (cemented) 20.5 ft to 25.5 ft
25	SS 11	4-6-20 (26)	MC = 31%			
						- dark greenish gray
	SS 12	6-6-7 (13)	MC = 58%			26.5 / 1.9
30	SS 13	7-12-12 (24)	MC = 74% LL = 100 PL = 41 #200 = 73%	CH		(CH) greenish gray, fat CLAY with sand, very stiff, few sand-sized phosphate particles
						30.0 / -1.6
						Bottom of borehole at 30.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-21

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 2/26/14 **COMPLETED** 2/26/14 **GROUND ELEVATION** 52.11 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 17+02.1; Adjacent to CPT-7 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	28-30	MC = 11%	SP-SM		(SP-SM) brown, dark brown, poorly graded fine grained quartz SAND with SILT, dense, local clay, trace cemented sand (FILL)
	SS 2	23-23-26-24 (49)	MC = 10% #200 = 8%			
5	SS 3	9-10-12-17 (22)	MC = 17%			
						6.0
	SS 4	10-7-6-9 (13)	MC = 17% LL = 34 PL = 20 #200 = 31%	SC		(SC) greenish gray, light gray, variably CLAYEY SAND, very loose to dense, few to some sand sized phosphate particles (FILL)
	SS 5	6-8-8-11 (16)	MC = 15%			- local silt layer
10						
	SS 6	6-8-5 (13)	MC = 19%			
	SS 7	4-4-5 (9)	MC = 21% LL = 51 PL = 18 #200 = 36%			
15						
	SS 8	4-5-4 (9)	MC = 21%			
	SS 9	4-6-6 (12)	MC = 20%			
20						
	SS 10	3-2-3 (5)	MC = 23% LL = 44 PL = 17 #200 = 33%			
	SS 11	3-4-4 (8)	MC = 20%			
25						
	SS 12	2-3-3 (6)	MC = 22%			
	SS 13	5-3-4 (7)	MC = 21% LL = 48 PL = 17 #200 = 36%			
30						
	SS 14	3-3-3 (6)	MC = 24%			
	SS 15	4-5-3 (8)	MC = 22%			
35						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35						(SC) greenish gray, light gray, variably CLAYEY SAND, very loose to dense, few to some sand sized phosphate particles (FILL) *(continued)*	
	SS 16	2-2-2 (4)	MC = 22%			- 1-inch sand lense at 37 ft	
40	SS 17	4-4-3 (7)	MC = 22%				
	SS 18	1-1-2 (3)	MC = 20% LL = 31 PL = 15 #200 = 26%	SC		- few silt	
45	SS 19	4-4-6 (10)	MC = 34% LL = 51 PL = 26 #200 = 31%				
	SS 20	12-18-24 (42)	MC = 24% LL = 34 PL = 20 #200 = 47%				
50	SS 21	4-5-7 (12)	MC = 33% LL = 42 PL = 20 #200 = 25%				
						51.0	1.1
	SS 22	5-9-10 (19)	LL = 97 PL = 50 MC = 41%	SM		52.0 (SM) greenish gray, light gray, variably SILTY SAND, medium dense, few to some sand sized phosphate particles (NATIVE)	0.1
			LL = 39 PL = 21 #200 = 20%	CH		53.0 - 1-inch sand lense at 51 ft and 2-inch sand lense at 52 ft	-0.9
55	SS 23	6-8-12 (20)	MC = 102% LL = 155 PL = 58 #200 = 83%	SC		54.0 (CH) greenish gray, light gray, fat CLAY with sand, medium dense to very dense, few to some sand-sized phosphate particles	-1.9
	SS 24	10-12-16 (28)	MC = 53% LL = 38 PL = 22 #200 = 45%	CH		56.0 (SC) greenish gray, light gray, CLAYEY SAND, medium dense to very dense, few to some sand-sized phosphate particles	-3.9
60	SS 25	27-34-30 (64)	MC = 73% LL = 97 PL = 50 #200 = 90%	SC		(CH) greenish gray, light gray, fat CLAY with sand, medium dense to very dense, few to some sand-sized phosphate particles - 4-inch sand lense at 54.5 ft (SC) greenish gray, light gray, CLAYEY SAND, medium dense to very dense, few to some sand-sized phosphate particles - pockets of clay and sand - sandy seams	
	SS 26	12-12-18 (30)	MC = 50% LL = 51 PL = 31 #200 = 41%			61.0	-8.9
65	SS 27	5-12-18 (30)	MC = 41% LL = 52 PL = 22 #200 = 28%	CH		63.0 (CH) greenish gray, light gray, fat CLAY with sand, medium dense to very dense, few to some sand-sized phosphate particles	-10.9
	SS 28	37-32-50/3"	MC = 56% LL = 79 PL = 37 #200 = 61%	SC		(SC) greenish gray, light gray, CLAYEY SAND, medium dense to very dense, few to some sand-sized phosphate particles	
70	SS 29	50/1"	MC = 44% LL = 39			68.0 - 1-inch cemented silt at tip of sample	-15.9
				SP-SM		(SP-SM) greenish gray, poorly graded SAND with SILT, very dense, few sand sized phosphate particles	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70			PL = 33 #200 = 43%			71.0	-18.9
			MC = 33% #200 = 27%	SM		(SM) greenish gray, SILTY SAND, dense, some sand sized phosphate particles, local cemented silt lense throughout (max lense 0.5-inch)	
75	SS 30	31-26-12 (38)	MC = 21% #200 = 16%			77.0	-24.9
	SS 31	50/5"	MC = 24% #200 = 44%	SC		(SC) greenish gray, CLAYEY SAND, very dense, some sand sized phosphate particles, local cemented sands	
80							
85	SS 32	50/1"				87.0	-34.9
	SS 33	0-0-11 (11)	MC = 68% LL = 105 PL = 56 #200 = 75% WOH - 1 ft	CH		(CH) greenish gray, variably fat CLAY with sand, very soft to hard, trace sand sized phosphate particles	
90						- greenish gray, light gray, more sandy, dolomitic silt, few sand sized phosphate particles, local cemented sands, trace silt, below 92 ft	
95	SS 34	50/3"	MC = 20% #200 = 56%			97.0	-44.9
	SS 35	8-9-16 (25)	MC = 38% #200 = 22%	SM		(SM) greenish gray, SILTY SAND, medium dense, trace clay	
100						100.0	-47.9
						Bottom of borehole at 100.0 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-22

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 2/26/14 **COMPLETED** 3/3/14
GROUND ELEVATION 52.88 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 13+50.2; Adjacent to CPT-3
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	26-12-13-18 (25)	MC = 10%	SP-SM		(SP-SM) brown, dark brown, poorly graded SAND with SILT, medium dense to very dense, trace clay nodules at top of sample (FILL)
	SS 2	17-32-30-31 (62)	MC = 11%			- trace cemented sand below 2 ft
5	SS 3	12-14-18-21 (32)	MC = 17% #200 = 6%			
	SS 4	14-5-9-15 (14)	MC = 15%			7.0 45.9
	SS 5	6-10-16-14 (26)	MC = 15% #200 = 28%			(SC) greenish gray, variably CLAYEY SAND, medium dense to very dense, few to some sand sized phosphate particles (FILL)
10						- 1-inch of cemented silt at 9.5 ft
	SS 6	8-6-7 (13)	MC = 18%			
15						
	SS 7	8-7-5 (12)	MC = 21%			
20				SC		
	SS 8	8-7-5 (12)	MC = 22% LL = 43 PL = 17 #200 = 32%			
25						
	SS 9	7-8-13 (21)	MC = 19%			
30						
	SS 10	9-9-11 (20)	MC = 26%			
35						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35						(SC) greenish gray, variably CLAYEY SAND, medium dense to very dense, few to some sand sized phosphate particles (FILL) *(continued)*
40	SS 11	3-7-9 (16)	MC = 21% LL = 39 PL = 16 #200 = 31%			
45	SS 12	8-10-50/5"	MC = 25%			- trace silt
				SC		- some sand sized phosphate particles, less clayey below 47 ft
50	SS 13	6-8-10 (18)	MC = 15% LL = 43 PL = 25 #200 = 39%			
55	SS 14	8-9-12 (21)	MC = 26%			- clayey zones below 57 ft
60	SS 15	5-6-10 (16)	MC = 17% LL = 154 PL = 74 #200 = 59%		59.5	- 2-inches of CLAY at tip of sample -6.6
65				MH		(MH) greenish gray, variably sandy elastic SILT, stiff (NATIVE)
70	SS 16	8-16-20 (36)	MC = 52% #200 = 82%	CL	67.0	-14.1 (CL) greenish gray, CLAY with sand, hard - sandy clay layer in between 69.5 ft and 7

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70						
				CL		(CL) greenish gray, CLAY with sand, hard *(continued)* - 1-inch sand lense at 69 ft and 2-inch sand lense at tip of sample (7)
75						75.0 -22.1
				SM		(SM) greenish gray, SILTY SAND, very dense, cemented sand and silt, few sand sized phosphate particles - hard drilling encountered from 75 ft to 92 ft
	SS 17	21-50/4"	MC = 21% #200 = 19%			
80						
85						
	SS 18	50/1"	MC = 18%			- no sample recovered
90						
						93.0 -40.1
	SS 19	13-50/4"	MC = 46% LL = 49 PL = 32 #200 = 39%	SC		(SC) greenish gray, CLAYEY SAND, very dense, cemented sand and silt, few sand sized phosphate particles
95						95.0 -42.1
	SS 20	8-9-14 (23)	MC = 38%	CL		(CL) greenish gray, slightly SANDY CLAY, hard
	SS 21	5-8-12 (20)	MC = 36% #200 = 64%			
100						
	SS 22	50/5"				
						102.0 -49.1
	SS 23	22-24-21 (45)	MC = 24% LL = 44	SC		(SC) greenish gray, CLAYEY SAND, dense
105						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
105			PL = 24 #200 = 41%	SC		(SC) greenish gray, CLAYEY SAND, dense *(continued)*
	SS 24	11-16-18 (34)	MC = 36%			
110	SS 25	6-8-12 (20)	MC = 38% #200 = 20%			110.0 -57.1

Bottom of borehole at 110.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-23

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/3/14 **COMPLETED** 3/3/14
GROUND ELEVATION 50.96 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 16+20.6; Adjacent to CPT-33
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						CPT pushed to 45 ft, mud rotary drilling to 43 ft prior to sampling, refer to CPT-33
5						
10						
15						
20	AU					
25						
30						
35						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35						CPT pushed to 45 ft, mud rotary drilling to 43 ft prior to sampling, refer to CPT-33 *(continued)*
40						43.0 8.0
45	SS 1	11-5-5-8 (10)	MC = 17% #200 = 42%	SC		(SC) gray, CLAYEY SAND, loose to medium dense (FILL) - phosphatic clays, few sand-sized phosphate particles
50	SS 2	6-9-11-11 (20)	MC = 22% LL = 33 PL = 19 #200 = 42%			- trace sand sized phosphate particles 52.0 -1.0
55	SS 3	5-5-6-9 (11)	MC = 69% LL = 101 PL = 51 #200 = 92%	MH		(MH) dark gray, gray, variably elastic SILT, stiff to very stiff, few sand sized phosphate particles (NATIVE)
60	SS 4	7-8-10-18 (18)	MC = 58% #200 = 64%			- more sandy below 58 ft 62.0 -11.0
65	SS 5	5-6-9-12 (15)	MC = 50% LL = 68 PL = 32	SC		(SC) dark gray, variably CLAYEY SAND, medium dense, few sand-sized phosphate particles
70	SS 6	5-9-8-15 (17)	MC = 71% #200 = 65%			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SC		(SC) dark gray, variably CLAYEY SAND, medium dense, few sand-sized phosphate particles *(continued)*
						72.0 -21.0
	SS 7	50/1"		SM		(SM) gray, SILTY SAND, very dense, heavy cementation, sand to gravel sized phosphate particles
75						
	SS 8	50/1"				
80						
	SS 9	50/3"				
85						85.0 -34.0
				SC		(SC) gray, CLAYEY SAND, very dense, cementation, sand to gravel sized phosphate particles - gray, greenish gray, variably silty, trace yellow calcareous sand
	SS 10	5-5-12-50/3"	MC = 49% LL = 91 PL = 45			
90						
	SS 11	50/3"				
	SS 12	50/3"	MC = 27% #200 = 47%			
95						95.0 -44.0
	SS 13	6-6-9-15 (15)	MC = 36% #200 = 22%	SM		(SM) gray, SILTY SAND, medium dense to very dense, heavy cementation, sand to gravel sized phosphate particles
	SS 14	22-30-30-31 (60)	MC = 26%			
100						
	SS 15	8-11-11-20 (22)	MC = 29%			
						103.0 -52.0
						Bottom of borehole at 103.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-24

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/3/14 **COMPLETED** 3/3/14
GROUND ELEVATION 50.95 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 14+71.1; Adjacent to CPT-34
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						CPT pushed to 45 ft, mud rotary drilling to 43 ft prior to sampling, refer to CPT-34
5						
10						
15						
20	AU					
25						
30						
35						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35						CPT pushed to 45 ft, mud rotary drilling to 43 ft prior to sampling, refer to CPT-34 *(continued)*
40						43.0 8.0
45	SS 1	2-2-2-3 (4)	MC = 24% #200 = 37%	SC		(SC) greenish gray, CLAYEY SAND, very loose to loose, trace silt, sand sized phosphate particles (FILL)
50	SS 2	3-4-5-10 (9)	MC = 26%			52.0 -1.1
55	SS 3	5-5-7-8 (12)	MC = 40% LL = 47 PL = 23	CL		(CL) dark gray, greenish gray, variably sandy CLAY, stiff to hard (NATIVE)
60	SS 4	5-3-7-10 (10)	MC = 50%			- few sand sized phosphate particles
65	SS 5	6-6-8-16 (14)	MC = 69%			
70	SS 6	6-19-11-28 (30)	MC = 42%			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-24

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				CL		(CL) dark gray, greenish gray, variably sandy CLAY, stiff to hard (NATIVE) *(continued)*	
						72.0	-21.1
	SS 7	50/4"	MC = 23%	SM		(SM) gray, SILTY SAND, very dense, heavily cemented	
75							
	SS 8	50/2"	MC = 27%				
80							
	SS 9	18-12-32-50/1"	MC = 33% #200 = 13%			- gray, dark gray, some sand sized phosphate particles below 82 ft	
85							
						87.0	-36.1
	SS 10	7-6-8-13 (14)	MC = 69% LL = 132 PL = 71 #200 = 64%	MH		(MH) dark greenish gray, greenish gray, light gray, variably sandy elastic SILT, stiff to hard, cemented	
90							
	SS 11	8-45-50/1"	MC = 62%			92.0	-41.1
	SS 12	42-25-20 (45)	MC = 61% LL = 61 PL = 31 #200 = 48%	SC		(SC) light gray, CLAYEY SAND, dense, cemented	
95						96.0	-45.1
	SS 13	27-50/2"	MC = 36% #200 = 67%	CL		(CL) light gray, variably SANDY CLAY, hard, cemented	
	SS 14	50/4"	MC = 29%			98.8	-47.9
						Bottom of borehole at 98.8 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-25

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/3/14 **COMPLETED** 3/3/14
GROUND ELEVATION 53.04 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 17+42.6; Adjacent to CPT-14
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	50/4"		SC		(SC) brown, CLAYEY SAND, very dense, possible cementation (FILL)
5						5.0
10	SS 2	2-1-1-1 (2)		SP		(SP) dark brown, poorly graded fine SAND, very loose, organic staining (FILL)
15						
20	SS 3	1-0-1-0 (1)	MC = 18% #200 = 4%			
25						
30	SS 4	0-0-0-0 (0)	WOH - 2 ft			
35	SS 5	0-0-0-0 (0)	WOH - 2 ft			- no sample recovered
48.0						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SP		(SP) dark brown, poorly graded fine SAND, very loose, organic staining (FILL) *(continued)*
	SS 6	0-0-0-0 (0)	WOH - 2 ft			39.0 14.0
40				SC		(SC) light greenish gray, bluish gray, CLAYEY SAND, very loose to loose, sand sized phosphate particles (FILL)
	SS 7	2-2-3-3 (5)	MC = 20% #200 = 30%			
45						
	SS 8	1-2-3-8 (5)	MC = 20% #200 = 33%			
50						
	SS 9	0-0-0-0 (0)	WOH - 2 ft			
55						57.0 -4.0
	SS 10	26-39-38-19 (77)		SP		(SP) light brown, poorly graded fine to medium grained SAND, very dense, sand sized phosphate particles (NATIVE)
60						62.0 -9.0
	SS 11	8-11-25-22 (36)	MC = 27%	SC		(SC) gray, greenish gray, CLAYEY SAND, dense, sand sized phosphate particles, pockets/seams/vertical features of fine sand
65						
	SS 12	8-11-25-22 (36)	MC = 33%			
70						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-25

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				SC		(SC) gray, greenish gray, CLAYEY SAND, dense, sand sized phosphate particles, pockets/seams/vertical features of fine sand *(continued)*	
						72.0	-19.0
	SS 13	50/3"		SP-SM		(SP-SM) gray, poorly graded fine grained SAND with SILT, very dense, sand-sized phosphate particles, cementation	
75						77.0	-24.0
	SS 14	21-14-30-50/3"		SM		(SM) gray, light gray, SILTY SAND, very dense, cemented silt layers	
80							
	SS 15	32-50/3"					
85							
	SS 16	4-5-5-18 (10)	MC = 71%				
90						87.0	-34.0
				CL		(CL) light green, greenish gray, variably sandy CLAY, stiff	
						90.5	-37.5
	SS 17	28-18-50/4"	MC = 94% #200 = 31%	SM		(SM) gray, dark gray SILTY SAND, sand-sized phosphate particles, cemented silt layers, medium dense to very dense	
	SS 18	50/1"					
95							
	SS 19	21-10-15-50/2"	MC = 32% #200 = 26%				
	SS 20	14-14-15-21 (29)	MC = 34%				
100						100.0	-47.0

Bottom of borehole at 100.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-26

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/4/14 **COMPLETED** 3/4/14
GROUND ELEVATION 54.3 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AE **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 5+46.5; Adjacent to CPT-9
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	10-9-15-17 (24)	MC = 15% #200 = 22%	SM		(SM) brown, SILT SAND, medium dense to dense, few limestone pebbles (FILL)
5	SS 2	5-7-10-17 (17)	MC = 17%			
8.0						46.3
10	SS 3	4-3-6-7 (9)	MC = 20% #200 = 30%	SC		(SC) gray, greenish gray, CLAYEY SAND, loose to medium dense, trace sand-sized phosphate particles (FILL)
15	SS 4	4-5-8-9 (13)	MC = 24%			
20	SS 5	4-6-10-11 (16)	MC = 20% #200 = 28%			
24.0						30.3
25	SS 6	3-3-14-37 (17)	MC = 24% #200 = 4%	SP		(SP) dark brown, brown, reddish brown, poorly graded SAND, dense, slight organic odor (FILL)
30	SS 7	23-24-20-26 (44)	MC = 20% #200 = 3%			
32.0						22.3
35	SS 8	1-3-4-3 (7)	MC = 32% #200 = 11%	SP-SC		(SP-SC) gray, greenish gray, poorly graded SAND with CLAY, loose, trace sand-sized phosphate particles (FILL)

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35						36.0	18.3
				SC		(SC) gray, greenish gray, CLAYEY SAND, very loose, trace sand-sized phosphate particles (FILL)	
40	SS 9	0-0-0-1 (0)	MC = 57% WOH - 1.5 ft			- 1-inch sand lense	
						42.0	12.3
				SC		(SC) light gray, CLAYEY SAND, very dense, trace sand sized phosphate particles, some cementation (NATIVE)	
45	SS 10	4-23-34-50/5"	MC = 24%			47.0	7.3
				CL		(CL) dark gray, variably sandy CLAY, stiff to hard	
50	SS 11	5-5-8-8 (13)	MC = 68% #200 = 68%				
55	SS 12	1-8-12-16 (20)	MC = 52% LL = 96 PL = 35 #200 = 52%				
60	SS 13	7-9-13-50/5"	MC = 46% #200 = 62%			- 1-inch sand lense	
						62.0	-7.7
				SP-SM		(SP-SM) gray, poorly graded SAND with SILT, very dense, some sand sized phosphate particles, some cementation	
65	SS 14	50/5"	MC = 24%			67.0	-12.7
				SC		(SC) gray, CLAYEY SAND, medium dense to very dense, interbedded phosphatic sand seams, some cementation	
70	SS 15	6-9-17-29 (26)	MC = 61%				

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70						(SC) gray, CLAYEY SAND, medium dense to very dense, interbedded phosphatic sand seams, some cementation *(continued)*	
75	SS 16	18-37-38-50/5"	MC = 22% #200 = 17%	SC			
						77.0	-22.7
80	SS 17	13-29-50/5"	MC = 28%	SM		(SM) greenish gray, SILTY SAND, very dense, some cementation, few sand-sized phosphate particles	
						82.0	-27.7
85	SS 18	34-18-20-45 (38)	MC = 16% #200 = 7%	SP-SM		(SP-SM) dark gray, poorly graded SAND with SILT, dense, some sand-sized phosphate particles, heavily cemented zones	
						86.0	-31.7
90	SS 19	50/2"	MC = 26% #200 = 60%	CL		(CL) olive, greenish gray, variably sandy CLAY, hard, trace sand-sized phosphate particles, heavy cementation	
	SS 20	13-15-19-50/2"	MC = 36% #200 = 68%				
95	SS 21	50/2"	MC = 29% #200 = 59%				
						95.0	-40.7
	SS 22	5-50/4"	MC = 41% LL = 46 PL = 26	SC		(SC) gray, CLAYEY SAND, very dense to medium dense, some cementation	
100	SS 23	5-4-7-11 (11)					
						100.0	-45.7

Bottom of borehole at 100.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-27

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/4/14 **COMPLETED** 3/4/14
GROUND ELEVATION 54.25 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 12+52.0; Adjacent to CPT-4
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SC		(SC) gray, light greenish gray, CLAYEY SAND, loose to medium dense, some sand sized phosphate particles (FILL)
10	SS 1	6-10-8-8 (18)	MC = 15%			
15						- dark greenish gray, trace sand sized phosphate particles
20	SS 2	3-2-3-2 (5)	MC = 22%			
25	SS 3	3-4-1-2 (5)	MC = 26%			
30	SS 4	0-5-6-7 (11)	MC = 21%			
35	SS 5	3-2-4-3 (6)	MC = 22%			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) gray, light greenish gray, CLAYEY SAND, loose to medium dense, some sand sized phosphate particles (FILL) *(continued)*
40	SS 6	2-3-3-2 (6)	MC = 20%			
45	SS 7	3-3-5-5 (8)	MC = 20%			
47.0						7.3
50	SS 8	3-3-5-6 (8)	MC = 39% LL = 46 PL = 24 #200 = 12%	SC		(SC) greenish gray, poorly graded CLAYEY SAND, loose, trace sand sized phosphate particles (NATIVE)
52.0						2.3
55	SS 9	4-5-14-13 (19)		CL		(CL) greenish gray, SANDY CLAY, very stiff, trace sand sized phosphate particles - trace sand sized phosphate particles
60	SS 10	6-7-11-15 (18)	MC = 45% MC = 27%			- fine sand pockets - 3-inch sand lense at 59 ft
61.0						-6.8
64.0	SS 11	4-10-12-15 (22)	MC = 32% MC = 47%	SC		(SC) dark greenish gray, CLAYEY SAND, medium dense - 3-inch sand lense at 64 ft
65						-9.8
70	SS 12	5-4-6-9 (10)	MC = 98%	CL		(CL) greenish gray, variably sandy CLAY, stiff

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				CL		(CL) greenish gray, variably sandy CLAY, stiff *(continued)*
						72.0 -17.8
	SS 13	50/2"		SM		(SM) gray, dark gray, SILTY fine to medium grained quartz SAND, very dense, some sand-sized phosphate particles, heavily cemented zones
75						
	SS 14	26-47-50/1"	MC = 18%			
80						
	SS 15	50/1"				
85						86.0 -31.8
	SS 16	12-44-50/1"		SP-SM		(SP-SM) gray, dark gray, poorly graded fine to medium quartz SAND with SILT, very dense, same sand-sized phosphate particles, cemented zones
90						92.0 -37.8
	SS 17	30-50/1"	MC = 31%	CL		(CL) greenish gray, variably sandy CLAY, hard, trace sand sized phosphate particles, cemented zones
95						95.0 -40.8
	SS 18	7-8-22 (30)	MC = 40%	SC		(SC) greenish gray, CLAYEY SAND, medium dense, trace sand sized phosphate particles
	SS 19	10-10-14 (24)	MC = 36% LL = 58 PL = 29 #200 = 24%			
100						100.0 -45.8
						Bottom of borehole at 100.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-28

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/4/14 **COMPLETED** 3/4/14
GROUND ELEVATION 54.32 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 11+49.1; Adjacent to CPT-5
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SM		(SM) brown, dark brown, SILTY SAND, very loose to dense (FILL)
10	SS 1	8-14-18-17 (32)	MC = 17%			
20	SS 2	0-1-3-2 (4)				- no sample recovered
25						25.0
30	SS 3	0-0-1-1 (1)	MC = 35% WOH - 1 ft	SC		(SC) greenish gray, gray, variably CLAYEY SAND, very loose to medium dense, some sand sized phosphate particles (FILL)
35	SS 4	0-0-0-0 (0)	MC = 31% WOH - 2 ft			29.3

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35	SS 5	1-2-2-3 (4)	MC = 30%	SC		(SC) greenish gray, gray, variably CLAYEY SAND, very loose to medium dense, some sand sized phosphate particles (FILL) *(continued)*
						- some drier portions (34 to 5)
40	SS 6	2-2-2-3 (4)	MC = 26%			
45	SS 7	2-3-7-5 (10)	PP = 2 tsf MC = 22%			
50	SS 8	3-3-10-15 (13)	PP = 2.25 tsf MC = 22%			
						51.0 3.3
55	SS 9	7-9-10-12 (19)	PP = 2.75 tsf MC = 25%	SP-SC		(SP-SC) greenish gray, gray, poorly graded fine grained quartz SAND with CLAY, medium dense, some sand sized phosphate particles, trace coarse phosphate particles (NATIVE)
60	SS 10	8-7-9-12 (16)	PP = 2 tsf MC = 40% ~~MC = 33%~~ #200 = 9%			- sand lenses throughout sample
65	SS 11	3-5-7-11 (12)	PP = 2.0 tsf MC = 57%			
70	SS 12	6-39-50/1"	PP = 1.5 tsf MC = 23%			68.5 - 1-inch cemented clay lense at 69 ft -14.2
				SC		(SC) light greenish gray, pale gray, variably CLAYEY fine to medium grained SAND, very dense, some sand sized phosphate particles

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SC		(SC) light greenish gray, pale gray, variably CLAYEY fine to medium grained SAND, very dense, some sand sized phosphate particles *(continued)*
						72.0 -17.7
	SS 13	28-50/4"		SM		(SM) gray, light gray, SILT fine to medium grained SAND, very dense, trace clay, some sand sized phosphate particles
75						- rig chatter - heavily cemented layers throughout
	SS 14	50/2"				
80						
	SS 15	50/0"				- no recovery
85						
	SS 16	50/1"				
90						
						92.0 -37.7
	SS 17	23-41-37-50 (78)	PP = 4.1 tsf MC = 33% LL = 52 PL = 36	CH		(CH) light greenish gray, fat CLAY with sand, hard, heavily cemented
95	SS 18	14-50/4"	PP = 3.9 tsf MC = 33% #200 = 76%			
						98.7 -44.4
	SS 19	50/2"	PP = 3.5 tsf MC = 29%			Bottom of borehole at 98.7 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-29

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/4/14 **COMPLETED** 3/4/14
GROUND ELEVATION 54.26 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 18+43.2; Adjacent to CPT-11
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	50/4"	MC = 18%	SM		0.5 - 6-inches of dam crest roadway (asphalt with base course) 53.8 (SM) brown, dark brown, variably SILTY SAND, loose (FILL)
10	SS 2	2-2-2-2 (4)	MC = 17%			
15						15.0 39.3
20	SS 3	0-0-2-2 (2)	MC = 22% WOH - 1 ft	SC		(SC) light gray, gray, greenish gray, CLAYEY SAND, very loose to medium dense, some sand sized phosphate particles (FILL)
30	SS 4	0-2-4-9 (6)	MC = 18%			- drier zones throughout
35						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) light gray, gray, greenish gray, CLAYEY SAND, very loose to medium dense, some sand sized phosphate particles (FILL) *(continued)*
40	SS 5	5-6-9-10 (15)	MC = 19%			
45	SS 6	10-7-9-10 (16)	MC = 28%			
						47.0 7.3
50	SS 7	8-7-8-10 (15)	MC = 31%	SC		(SC) gray, dark gray, variably CLAYEY SAND, loose to medium dense, some fine to coarse phosphate particles (NATIVE)
55	SS 8	2-4-5-8 (9)	MC = 26%			
						- pockets of fine to medium sand
60	SS 9	16-12-12-23 (24)	MC = 32% #200 = 18% MC = 67% LL = 104 PL = 46 #200 = 80%			59.0 -4.7
65	SS 10	4-9-20-20 (29)	MC = 45%	MH		(MH) light gray, greenish gray, elastic SILT with sand, very stiff, some sand sized phosphate particles
						67.0 -12.7
70	SS 11	6-11-13-18 (24)	MC = 35%	SC		(SC) gray, dark gray, greenish gray, variably CLAYEY SAND, medium dense, some sand sized phosphate particles

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-29

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				SC		(SC) gray, dark gray, greenish gray, variably CLAYEY SAND, medium dense, some sand sized phosphate particles *(continued)*	
						72.0	-17.7
	SS 12	50/2"		SM		(SM) gray, dark gray, SILTY SAND, very dense, some fine to medium phosphate particles, heavily cemented layers	
75							
	SS 13	30-44-50/4"	MC = 20% #200 = 13%				
80							
						83.0	-28.7
	SS 14	14-12-14-24 (26)	MC = 45%	CL		(CL) greenish gray, dark gray, variably sandy CLAY, very stiff to hard, heavily cemented layers	
85							
	SS 15	5-4-50/5"	MC = 56%				
90							
	SS 16	50/3"	MC = 30%			- light gray, yellowish gray, drier matrix	
						92.5	-38.2
	SS 17	31-17-32-50/3"	MC = 32%	SM		(SM) gray, SILTY SAND, medium dense to very dense, trace fine phosphate particles, heavily cemented layers	
95							
	SS 18	10-9-16-13 (25)	MC = 34%				
						97.8	-43.5
	SS 19	50/3"	MC = 25%			Bottom of borehole at 97.8 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-30

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/4/14 **COMPLETED** 3/5/14
GROUND ELEVATION 54.21 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 19+41.8; Adjacent to CPT-12
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	36-14-12-11 (26)	MC = 13%	SM		(SM) brown, dark brown, SILTY SAND, loose to medium dense, trace fine gravel, slight organic odor (FILL)
10	SS 2	2-2-5-10 (7)	MC = 17%			
15						15.0
20	SS 3	1-4-4-6 (8)	MC = 20%	SC		(SC) gray, light gray, CLAYEY SAND, loose to medium dense, pockets of brown silty clay, some fine phosphate particles (FILL)
30	SS 4	3-2-3-5 (5)	MC = 26%			
35	SS 5	6-7-10-11 (17)	MC = 20%			39.2

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) gray, light gray, CLAYEY SAND, loose to medium dense, pockets of brown silty clay, some fine phosphate particles (FILL) *(continued)*
40	SS 6	4-6-7-6 (13)	MC = 23%			
45	SS 7	3-4-4-7 (8)	MC = 24%			
47.0						7.2
50	SS 8	2-4-4-6 (8)	MC = 35%	SC		(SC) gray, greenish gray, variably CLAYEY SAND, loose to very dense, sand sized phosphate particles, layers and pockets of clay and sand (NATIVE)
55	SS 9	4-4-6-8 (10)	MC = 29%			
60	SS 10	6-17-17-22 (34)	MC = 54%			
65	SS 11	7-32-32-50/5"	MC = 16% MC = 67%			- some cemented layers below 63 ft
70	SS 12	4-9-21-18 (30)				

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70						(SC) gray, greenish gray, variably CLAYEY SAND, loose to very dense, sand sized phosphate particles, layers and pockets of clay and sand (NATIVE) *(continued)*	
75	SS 13	6-36-50/5"	MC = 26% MC = 27% #200 = 16%	SC			
						77.0	-22.8
80	SS 14	31-50/5"		SM		(SM) gray, greenish gray, SILTY SAND, very dense, some cementation - layer of sandy clay (CL)	
85	SS 15	11-9-12-19 (21)	MC = 29% MC = 61%				
						84.0	-29.8
90	SS 16	8-7-9-50/3"	MC = 71%	CL		(CL) greenish gray, yellowish gray, variably sandy CLAY, hard - cemented layers below 93 ft	
	SS 17	50/5"	MC = 27%				
						92.0	-37.8
95	SS 18	16-22-50/4"	MC = 29%	SC		(SC) gray to dark gray, variably CLAYEY SAND, very dense, trace fine phosphate particles, heavily cemented	
	SS 19	50/5"	MC = 25%				
	SS 20	10-50/5"	MC = 34% LL = 44 PL = 24 #200 = 46%				
						98.4	-44.2
						Bottom of borehole at 98.4 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-31

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/5/14 **COMPLETED** 3/5/14
GROUND ELEVATION 54.25 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AE **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 6+45.0; Adjacent to CPT-36
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	6-9-9-11 (18)	MC = 10%	SM		(SM) dark brown, SILTY SAND, medium dense (FILL)
10	SS 2	8-9-6-7 (15)	MC = 16% MC = 17%			
					9.0	- trace organics 45.3
				SC		(SC) gray, variably CLAYEY SAND, very loose to medium dense, some sand-sized phosphate particles (FILL)
20	SS 3	1-0-1-1 (1)	MC = 30%			- gravel sized piece of cemented silt
25	SS 4	1-5-4-5 (9)	MC = 22%			
30	SS 5	2-2-3-4 (5)				- no recovery
					32.0	22.3
35	SS 6	2-3-3-2 (6)	MC = 23%	SM		(SM) brown, gray, SILTY SAND, loose (NATIVE)

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SM		(SM) brown, gray, SILTY SAND, loose (NATIVE) *(continued)*
						37.0 17.3
				SC		(SC) gray, brownish gray, greenish gray, variably CLAYEY SAND, very loose to medium dense
40	SS 7	1-1-2-2 (3)	MC = 51%			
45	SS 8	3-6-11-19 (17)	MC = 23%			- few sand lenses
						47.0 7.3
				CH		(CH) greenish gray, fat CLAY with sand, stiff to hard, variably sandy
50	SS 9	2-5-5-8 (10)	MC = 65% LL = 80 PL = 33 #200 = 73%			
55	SS 10	3-5-7-8 (12)	MC = 69%			- vertical cracks filled with sand and horizontal sand lenses with phosphate particles
60	SS 11	50/5"	MC = 87%			- some cementation below 58 ft
						62.0 -7.8
				SC		(SC) greenish gray, dark gray, CLAYEY SAND, medium dense to very hard, some sand-sized phosphate particles, heavily cemented zones
65	SS 12	50/4"	MC = 28%			
70	SS 13	16-50/4"	MC = 24%			- fine to medium sand lenses

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SC		(SC) greenish gray, dark gray, CLAYEY SAND, medium dense to very hard, some sand-sized phosphate particles, heavily cemented zones *(continued)*
75	SS 14	5-4-8-12 (12)				
						77.0 -22.8
	SS 15	6-30-50/5"	MC = 29%	SM		(SM) light gray, SILTY SAND, very dense, some sand sized phosphate particles, heavily cemented zones
80						
	SS 16	50/4"	MC = 20%			
85						
						87.0 -32.8
	SS 17	50/2"		CH		(CH) light gray, light olive gray, fat CLAY with sand, stiff to hard, heavily cemented zones - no recovery
90	SS 18	50/0"				
	SS 19	6-5-7-29 (12)	MC = 33%			- desiccated
95						
	SS 20	50/5"	MC = 38% LL = 51 PL = 28 #200 = 52%			- vertical cracks filled with sand and horizontal sand seams/lenses
	SS 21	8-19-17-16 (36)	MC = 41% LL = 82 PL = 28 #200 = 68%			
100						100.0 -45.8
						Bottom of borehole at 100.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-32

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/5/14 **COMPLETED** 3/5/14 **GROUND ELEVATION** 54.25 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY AE **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 7+48.4; Adjacent to CPT-35 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	8-8-9-9 (17)	MC = 17% #200 = 22% MC = 96%	SM		(SM) brown, dark brown, SILTY SAND, loose to medium dense, clods of cemented silts (FILL)
5						
10	SS 2	5-5-4-5 (9)	MC = 21% #200 = 20% MC = 19%			9.0 (SC) greenish gray, light olive gray, light gray, variably CLAYEY SAND, loose to very loose, some sand sized phosphate particles (FILL)
15						
20	SS 3	2-4-2-3 (6)	MC = 25% #200 = 32%	SC		- cemented fragments
25	SS 4	0-0-0-2 (0)	MC = 33% #200 = 31% WOH - 1.5 ft			- small cemented inclusions
30	SS 5	1-2-3-3 (5)	MC = 21% LL = 44 PL = 18 #200 = 37%			
35	SS 6	1-3-5-7 (8)				- no recovery

45.3

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) greenish gray, light olive gray, light gray, variably CLAYEY SAND, loose to very loose, some sand sized phosphate particles (FILL) *(continued)*
40	SS 7	1-2-3-3 (5)	MC = 33% #200 = 42%			
						42.0 12.3
45	SS 8	1-2-3-11 (5)	MC = 31%	SC		(SC) gray, light olive gray, light gray, variably CLAYEY SAND, loose, some sand sized phosphate particles (NATIVE)
50	SS 9	4-5-5-7 (10)	MC = 38% #200 = 37%			
						51.0 3.3
55	SS 10	4-4-7-9 (11)	MC = 68% #200 = 59%	CL		(CL) gray, light olive gray, light gray, variably SANDY CLAY, stiff to hard, some sand sized phosphate particles (NATIVE)
60	SS 11	5-20-30-50/3"	MC = 35% #200 = 56% MC = 25%			- cemented layers below 58 ft
65	SS 12	10-16-28-50/5"	MC = 43% #200 = 94%			
						67.0 -12.8
70	SS 13	12-13-13-18 (26)	MC = 28% #200 = 22%	SM		(SM) gray, black and white, SILTY medium grained SAND, medium dense, few sand sized phosphate particles

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				SM		(SM) gray, black and white, SILTY medium grained SAND, medium dense, few sand sized phosphate particles *(continued)*	
						72.0	-17.8
	SS 14	17-28-23-19 (51)	MC = 43% LL = 101 PL = 51 #200 = 86%	MH		(MH) greenish gray, elastic SILT, hard, few seams of fine sand, some sand sized phosphate particles	
75						77.0	-22.8
	SS 15	13-20-18-16 (38)	MC = 27% #200 = 22%	SM		(SM) greenish gray, SILTY SAND, dense to very dense, few sand sized phosphate particles	
80							
	SS 16	50/3"				- light gray, dark gray, fine to medium sands, sand-sized phosphate particles, cemented zones below 83 ft - no recovery	
85							
	SS 17	48-50/2"	MC = 17% #200 = 15%				
90							
	SS 18	50/3"				92.0	-37.8
	SS 19	41-50/2"	MC = 28% LL = 42 PL = 26 #200 = 72%	CL		(CL) light gray, light olive gray, gray, variably sandy CLAY, hard, heavily cemented	
95							
	SS 20	50/5"					
	SS 21	50/2"	MC = 39% #200 = 74%				
100						100.5	-46.3
	SS 22	8-9-13-30 (22)	MC = 44% LL = 52 PL = 27 #200 = 50%	SC		(SC) light gray, light olive gray, gray, variably CLAYEY SAND, medium dense	
						102.5	-48.3
						Bottom of borehole at 102.5 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-33

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/5/14 **COMPLETED** 3/5/14
GROUND ELEVATION 54.32 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 10+49.5; Adjacent to CPT-6
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				SM		(SM) brown, dark brown SILTY SAND, dense, trace organics (FILL)	
5							
10	SS 1	11-18-21-15 (39)	MC = 18% MC = 16%				
						9.5	44.8
				SC		(SC) gray, light gray, CLAYEY SAND, dense, trace sand sized phosphate particles (FILL)	
						13.0	41.3
15				SM		(SM) brown, dark brown, SILTY SAND, medium dense (FILL)	
20	SS 2	5-7-5-3 (12)					
						24.0	30.3
25				CL		(CL) greenish gray, variably SANDY CLAY, very soft (FILL)	
30	SS 3	0-0-2-2 (2)	MC = 28% WOH - 1 ft			- cemented light gray inclusions	
						32.0	22.3
35	SS 4	0-2-3-4 (5)	PP = 0.5 tsf MC = 27%	SC		(SC) gray, light gray CLAYEY SAND, loose to medium dense, few sand sized phosphate particles (FILL)	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35				SC		(SC) gray, light gray CLAYEY SAND, loose to medium dense, few sand sized phosphate particles (FILL) *(continued)*	
40	SS 5	4-4-5-6 (9)	PP = 0.75 tsf MC = 23%				
45	SS 6	3-6-7-8 (13)	PP = 3.5 tsf MC = 29%				
50	SS 7	17-5-10-14 (15)	PP = 1.75 tsf MC = 29%			- sandy seams	
						51.0	3.3
55	SS 8	4-5-9-11 (14)	MC = 62% MC = 31%	SC		(SC) dark greenish gray, greenish gray, CLAYEY SAND, medium dense, few sand sized phosphate particles (NATIVE) - hard drilling at 52 ft - multiple pockets of silty sand (SM)	
60	SS 9	8-9-13-21 (22)	PP = 2.5 tsf MC = 62% MC = 32%				
						59.0	-4.7
				SM		(SM) dark gray, greenish gray, SILTY SAND, medium dense, trace sand sized phosphate particles	
						62.0	-7.7
65	SS 10	3-4-5-7 (9)		SC		(SC) dark gray, greenish gray, CLAYEY SAND, loose, few sand sized phosphate particles	
						67.0	-12.7
70	SS 11	50/3"	MC = 46%	CL		(CL) light gray, dark gray, SANDY CLAY, hard, seams of sand with phosphate particles, heavily cemented	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				CL		- hard drilling at 71 ft
					71.0	-16.7
						(SM) gray, pale gray, light greenish gray, SILTY SAND, medium dense to very dense, sand sized phosphate particles, cemented zones
75	SS 12	6-6-7-9 (13)				
	SS 13	50/0"				- heavily cemented layer
80				SM		
	SS 14	50/3"				- slight cementation
85						
	SS 15	50/3"				
90						
					91.0	-36.7
						(MH) light greenish gray, variably elastic SILT with sand, very stiff to hard, heavily cemented zones
95	SS 16	8-11-26-25 (37)	MC = 37% LL = 64 PL = 36 #200 = 72%			
	SS 17	7-10-26 (36)	MC = 37%	MH		
	SS 18	27-50/3"	MC = 26%			- hard and dry
100						
	SS 19	10-12-18 (30)	MC = 33%			
					102.5	-48.2
						Bottom of borehole at 102.5 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-34

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/5/14 **COMPLETED** 3/5/14
GROUND ELEVATION 54.2 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 20+41.3; Adjacent to CPT-13
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	24-25-17-10 (42)	MC = 7%	SM		(SM) brown, SILTY SAND, loose to dense (FILL)
10	SS 2	4-10-21-25 (31)	MC = 17%			
20	SS 3	3-4-4-3 (8)	MC = 20%			
25						25.0
30	SS 4	1-3-4-3 (7)	MC = 24%	SC		(SC) gray, brown, CLAYEY SAND, loose, few sand sized phosphate particles (FILL)
35	SS 5	3-4-3-4 (7)	MC = 29%			- thin layer of dark brown top soil

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) gray, brown, CLAYEY SAND, loose, few sand sized phosphate particles (FILL) *(continued)*
						- gray, greenish gray
40	SS 6	2-2-3-3 (5)	MC = 27%			
45	SS 7	3-2-4-5 (6)	MC = 21%			
						47.0 7.2
50	SS 8	3-5-5-6 (10)	MC = 31%	SM		(SM) gray, dark gray, SILTY SAND, loose, few sand sized phosphate particles (NATIVE)
55	SS 9	6-4-5-6 (9)	MC = 23% MC = 30% LL = 32 PL = 19 #200 = 21%			54.0 0.2
60	SS 10	9-15-25-50 (40)	MC = 21%	SC		(SC) gray, CLAYEY SAND, dense, few sand sized phosphate particles
						62.0 -7.8
65	SS 11	33-38-50/5"	MC = 21%	SM		(SM) gray, SILTY SAND, medium dense to very dense, few sand sized phosphate particles, heavily cemented zones
70	SS 12	7-11-19-28 (30)	MC = 32%			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SM		(SM) gray, SILTY SAND, medium dense to very dense, few sand sized phosphate particles, heavily cemented zones *(continued)*
	SS 13	14-10-19-50/3"	MC = 31% MC = 33%			74.0 -19.8
75				CL		(CL) greenish gray, light gray, variably sand CLAY, hard, heavily cemented
	SS 14	50/1"				
80						82.0 -27.8
	SS 15	10-9-11-21 (20)	MC = 30%	SM		(SM) dark gray, greenish gray, SILTY SAND, medium dense, few sand sized phosphate particles
85						87.0 -32.8
	SS 16	5-4-8-13 (12)		CL		(CL) greenish gray, variably sandy CLAY, stiff to hard, heavily cemented
90	SS 17	50/5"				
	SS 18	14-28-34-50/1"	MC = 29%			- gray, few sand sized phosphate particles, below 92 ft
95	SS 19	21-11-50/4"	MC = 47%			
	SS 20	50/2"	MC = 20% #200 = 56%			
100						
	SS 21	4-6-12-25 (18)	MC = 38% LL = 48 PL = 28 #200 = 54%			102.0 -47.8
						Bottom of borehole at 102.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-35

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/5/14 **COMPLETED** 3/6/14 **GROUND ELEVATION** 54.18 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Madrid Engineering Group **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY LG **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 21+40.9; Adjacent to CPT-15 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	21-13-12-12 (25)	MC = 13%	SM		(SM) brown, light gray, SILTY SAND, medium dense to dense (FILL)
10	SS 2	14-16-17-18 (33)	MC = 19%			
20	SS 3	8-7-8-5 (15)	MC = 17%			
30	SS 4	12-7-6-6 (13)	MC = 18%			
32.0						22.2
35	SS 5	2-3-4-4 (7)	MC = 24%	SC		(SC) light gray, CLAYEY SAND, very loose to dense, few sand sized phosphate particles (FILL)

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) light gray, CLAYEY SAND, very loose to dense, few sand sized phosphate particles (FILL) *(continued)*
40	SS 6	1-1-2-2 (3)	MC = 32%			
45	SS 7	4-4-5-4 (9)	MC = 25%			
50	SS 8	3-3-3-4 (6)	MC = 37%			
55	SS 9	20-25-12-16 (37)	MC = 24% #200 = 24%			
						57.0 -2.8
60	SS 10	16-21-27-25 (48)	MC = 23%	SM		(SM) light gray, SILTY SAND, clayey pockets, few sand sized phosphate particles, lightly cemented (NATIVE)
65	SS 11	34-42-50/5"	MC = 21%			
						64.0 -9.8
70	SS 12	6-20-24-30 (44)	MC = 88% MC = 29%	CL		(CL) light gray, greenish gray, variably SANDY CLAY, hard, few sand sized phosphate particles
						69.0 -14.8
				SM		

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-35

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70			#200 = 14%	SM		(SM) light gray, slightly SILTY SAND, dense, few sand sized phosphate particles *(continued)*
						72.0 -17.8
				CL		(CL) greenish gray, light greenish gray, variably sandy CLAY, hard, heavily cemented zones
75	SS 13	29-32-29-44 (61)	MC = 32%			- sandy seams
	SS 14	50/3"				
80						
	SS 15	35-50/5"				
85						
	SS 16	10-7-12-13 (19)	MC = 65% #200 = 84%			
90						
	SS 17	50/3"				- some cemented clayey seams
95	SS 18	50/4"				- yellowish, sandy
	SS 19	50/3"				
100						
	SS 20	50/5"				100.4 -46.2
						Bottom of borehole at 100.4 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-36

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/7/14 **COMPLETED** 3/7/14
GROUND ELEVATION 54.24 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 22+42.0; Adjacent to CPT-16
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SP		(SP) dark brown, poorly graded SAND, medium dense (FILL)
10	SS 1	15-11-12-9 (23)	MC = 17% #200 = 41%			9.0
				SC		(SC) light gray, variably CLAYEY SAND, very loose to dense, trace sand sized phosphate particles (FILL)
20	SS 2	4-3-2-2 (5)	MC = 22% LL = 28 PL = 13			
30	SS 3	0-1-2-3 (3)	MC = 27%			
35	SS 4	1-1-2-2 (3)	MC = 33% LL = 45 PL = 21			45.2 - cemented seams

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35				SC		(SC) light gray, variably CLAYEY SAND, very loose to dense, trace sand sized phosphate particles (FILL) *(continued)*	
40	SS 5	0-2-3-3 (5)				- no sample recovered	
45	SS 6	2-2-3-3 (5)	MC = 26%				
						47.0	7.2
50	SS 7	4-4-6-8 (10)	MC = 38%	CL		(CL) light gray, variably SANDY CLAY, stiff (FILL)	
						52.0	2.2
55	SS 8	4-9-50/3"	MC = 22%	SC		(SC) light gray, variably CLAYEY SAND, very dense, heavily cemented layers (NATIVE)	
						57.0	-2.8
60	SS 9	15-22-26-32 (48)	MC = 28% MC = 22%	CL		(CL) gray, variably sandy CLAY, very stiff, slightly silty, few sand sized phosphate particles	
						59.0	-4.8
65	SS 10	22-22-43-44 (65)	MC = 23% #200 = 12%	SP-SM		(SP-SM) gray, poorly graded fine to medium coarse grained SAND with SILT, very dense, partially cemented	
70	SS 11	20-21-31-33 (52)	MC = 57% LL = 46 PL = 21	CL			
						69.0	-14.8

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				CL		(CL) light green, greenish gray variably sandy CLAY, stiff to hard, few sand sized phosphate particles *(continued)*	
75	SS 12	11-7-15-19 (22)				- 4-inch sand lense at 73 ft	
80	SS 13	50/1"	MC = 34%			- cemented below 78 ft, few sand sized phosphate particles	
						82.0	-27.8
85	SS 14	13-18-12-50/3"		SM		(SM) gray, SILTY SAND, very dense, pockets of clayey particles, few sand sized phosphate particles, cemented - 4-inch sand lense at 84 ft	
						86.0	-31.8
90	SS 15	11-8-8-16 (16)	MC = 79%	CL		(CL) light green, greenish gray, variably sandy CLAY, stiff to very stiff, trace sand sized phosphate particles	
	SS 16	9-5-7-11 (12)	MC = 84%				
						92.0	-37.8
95	SS 17	8-50/3"		SC		(SC) yellowish, CLAYEY SAND, very dense, fine to medium grained sand, few sand sized phosphate particles, heavily cemented	
	SS 18	35-50/5"					
						96.0	-41.8
	SS 19	24-12-17-49 (29)	MC = 42% LL = 48 PL = 26 #200 = 71%	CL		(CL) yellowish, CLAY with sand, very stiff, some sand sized phosphate particles	
						99.0	-44.8
						Bottom of borehole at 99.0 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-37

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/7/14 **COMPLETED** 3/7/14
GROUND ELEVATION 54.2 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 23+42.9; Adjacent to CPT-17
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SC		(SC) gray, light gray, variably CLAYEY SAND, very loose to medium dense, few sand sized phosphate particles (FILL)
10	SS 1	6-11-8-9 (19)	MC = 16% LL = 27 PL = 15 #200 = 39%			
20	SS 2	0-0-0-0 (0)	WOH - 2 ft			- no recovery
	SS 3	0-0-0-2 (0)	MC = 22% WOH - 1.5 ft			
25						25.0
30	SS 4	4-6-13-7 (19)	MC = 23%	SM		29.2 (SM) dark brown, SILTY SAND, medium dense, few sand sized phosphate particles (FILL)
35						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SM		(SM) dark brown, SILTY SAND, medium dense, few sand sized phosphate particles (FILL) *(continued)*
						37.0 17.2
				SC		(SC) gray, light gray, variably CLAYEY SAND, loose, few sand sized phosphate particles (FILL)
40	SS 5	2-2-4-3 (6)	MC = 31% #200 = 44%			
45	SS 6	3-3-3-4 (6)	MC = 27%			
50	SS 7	2-4-6-6 (10)	MC = 39%			
						52.0 2.2
55	SS 8	15-16-19-50 (35)	MC = 34% LL = 33 PL = 23	CL		(CL) light green, variably SANDY CLAY, hard, few sand sized phosphate particles (NATIVE)
						58.0 -3.8
60	SS 9	5-5-11-24 (16)		SP-SM		(SP-SM) gray, poorly graded SAND with SILT, medium dense to very dense, few sand-sized phosphate particles, coarser sand particle towards bottom of samples, with layers of CLAYEY SAND, moderately to heavily cemented
65	SS 10	38-42-50/5"				
70	SS 11	31-32-43-47 (75)				

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-37

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				SP-SM		(SP-SM) gray, poorly graded SAND with SILT, medium dense to very dense, few sand-sized phosphate particles, coarser sand particle towards bottom of samples, with layers of CLAYEY SAND, moderately to heavily cemented *(continued)*	
						72.0	-17.8
				CL		(CL) light greenish gray, variably SANDY CLAY, hard	
	SS 12	31-37-32-27 (69)	MC = 42%			74.0	-19.8
75				SM		(SM) light greenish gray, SILTY fine to medium grained SAND, very dense, few sand sized phosphate particles	
						77.0	-22.8
	SS 13	15-19-26-36 (45)	MC = 46% MC = 40%	CL		(CL) light greenish gray, variably sandy CLAY, hard to stiff, few sand sized phosphate particles	
80						- greenish gray below 8	
	SS 14	50/3"				- cemented with medium to coarse grained sands 83 to 87 ft	
85							
	SS 15	15-39-25-22 (64)	MC = 23% #200 = 12%				
90	SS 16	4-5-6-9 (11)	MC = 84%				
	SS 17	7-12-9-10 (21)	MC = 89%				
95	SS 18	50/3"	MC = 73% #200 = 59%			- heavily cemented below 95 ft	
	SS 19	50/5"	MC = 31% LL = 40 PL = 28			97.9	-43.7
						Bottom of borehole at 97.9 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-38

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/7/14 **COMPLETED** 3/7/14
GROUND ELEVATION 54.28 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 8+48.9; Adjacent to CPT-8
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						(SM) brown, dark brown, SILTY SAND, medium dense to very dense (FILL)
10	SS 1	17-23-40-46 (63)	MC = 18%	SM		
15	SS 2	7-10-12-14 (22)	MC = 21% #200 = 14%			
18.0						
20	SS 3	1-2-2-2 (4)	MC = 27% #200 = 28%	SC		(SC) greenish gray, variably CLAYEY SAND, very loose, few sand sized phosphate particles (FILL)
25	SS 4	0-0-3-3 (3)	MC = 38% WOH - 1 ft			
27.0						27.3
30	SS 5	4-3-2-3 (5)	PP = 3.0 tsf MC = 23% #200 = 5% MC = 39%	SP		(SP) very dark brown, poorly graded SAND, very loose, clayey pockets, few sand sized phosphate particles (FILL)
29.5						24.8
35	SS 6	5-9-3-5 (12)	PP = 1.5 tsf MC = 23%	CL		(CL) greenish gray, yellowish greenish gray, variably SANDY CLAY, stiff, few sand sized phosphate particles (FILL)

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				CL		(CL) greenish gray, yellowish greenish gray, variably SANDY CLAY, stiff, few sand sized phosphate particles (FILL) *(continued)*
40	SS 7	3-4-5-5 (9)	PP = 1.5 tsf MC = 26%			
45	SS 8	3-4-7-18 (11)	PP = 2.4 tsf MC = 27%			
						47.0 7.3
50	SS 9	5-10-10-14 (20)	PP = 4.5 tsf MC = 29%	SC		(SC) greenish gray, yellowish greenish gray, variably CLAYEY SAND, medium dense to very dense, few sand sized phosphate particles (NATIVE)
55	SS 10	3-6-10-12 (16)	PP = 2.15 tsf			- pockets of sand
60	SS 11	7-10-12-25 (22)	PP = 2.25 tsf			
65	SS 12	10-19-50/5"	PP = 2.75 tsf			- cemented below 64 ft
						66.0 -11.7
70	SS 13	50/0"		SM		(SM) gray, dark gray, SILTY SAND, very dense, slightly clayey, trace sand sized phosphate particles, heavily cemented - no recovery

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-38

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70							
						(SM) gray, dark gray, SILTY SAND, very dense, slightly clayey, trace sand sized phosphate particles, heavily cemented *(continued)*	
	SS 14	50/2"		SM			
75						77.0	-22.7
	SS 15	15-16-45-50/4"	PP = 3.75 tsf MC = 23% LL = 32 PL = 18 #200 = 25%	SC		(SC) dark greenish gray, variably CLAYEY SAND, very dense, trace sand sized phosphate particles, heavily cemented	
80							
	SS 16	50/2"					
85						- cemented clays	
						87.0	-32.7
	SS 17	50/0"		SM		(SM) light gray, SILTY SAND, very dense, cemented, trace sand sized phosphate particles	
90						91.0	-36.7
	SS 18	50/2"	PP = 3.75 tsf	CL		(CL) greenish gray, variably sandy CLAY, hard, trace sand sized phosphate particles, heavily cemented	
95							
	SS 19	50/5"	PP = 3.0 tsf			- fine to medium sands	
	SS 20	50/3"				98.8	-44.5
						Bottom of borehole at 98.8 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-39

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/5/14 **COMPLETED** 3/7/14
GROUND ELEVATION 54.26 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 9+49.4; Adjacent to CPT-10
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SP		(SP) light brown to dark, brown, poorly graded SAND, loose to medium dense (FILL)
10	SS 1	10-13-15-18 (28)	MC = 17%			- light gray clay lense at 9.5 ft (CL)
15	SS 2	3-3-4-2 (7)	MC = 24%			
15.0						39.3
20	SS 3	0-1-2-1 (3)	PP = 0.5 tsf MC = 30% #200 = 29%	SC		(SC) greenish gray, variably CLAYEY SAND, very loose to loose, trace to few sand sized phosphate particles (FILL)
25	SS 4	0-0-0-0 (0)	PP = 0.3 tsf MC = 33% WOH - 2 ft			
30	SS 5	2-2-3-4 (5)	MC = 28%			- 1-inch sand lense at 18 ft
35	SS 6	0-0-0-6 (0)	PP = 0.75 tsf MC = 26% WOH - 1.5 ft			- cemented sand particles

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) greenish gray, variably CLAYEY SAND, very loose to loose, trace to few sand sized phosphate particles (FILL) *(continued)*
40	SS 7	2-3-4-7 (7)	PP = 1.0 tsf MC = 23%			
45	SS 8	2-3-3-5 (6)	PP = 2.0 tsf MC = 36%			
						46.0 8.3
50	SS 9	4-4-7-11 (11)	PP = 2.0 tsf MC = 26%	SC		(SC) greenish gray, variably CLAYEY SAND, medium dense to very dense, trace to few sand sized phosphate particles (NATIVE)
55	SS 10	4-6-8-12 (14)	PP = 2.0 tsf MC = 44%			
60	SS 11	4-7-50/5"	PP = 2.0 tsf MC = 88% MC = 43% #200 = 13%			- dark gray, dark greenish gray cemented below 59 ft
						62.0 -7.7
65	SS 12	4-9-50/5"	PP = 2.1 tsf MC = 44%	CL		(CL) greenish gray, dark greenish gray, variably SANDY CLAY, hard, trace sand sized phosphate particles, sandy lenses throughout, partially cemented
						67.0 -12.7
70	SS 13	50/5"	MC = 22% #200 = 15%	SM		(SM) light gray, gray, SILTY SAND, very dense, trace sand sized phosphate particles, with cemented layers

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70						(SM) light gray, gray, SILTY SAND, very dense, trace sand sized phosphate particles, with cemented layers *(continued)*
75	SS 14	50/1"		SM		77.0 -22.7
80	SS 15	50/5"	PP = 4.5 tsf MC = 20%	CL		(CL) light greenish gray, variably sandy CLAY, hard, trace sand sized phosphate particles, partially cemented 82.0 -27.7
85	SS 16	50/4"	MC = 20% #200 = 23%	SC		(SC) gray, light gray, CLAYEY SAND, very dense, trace sand sized phosphate particles
90	SS 17	36-50/5"	MC = 18%			92.0 -37.7
95	SS 18	12-50/5"	PP = 2.75 tsf MC = 47%	CH		(CH) greenish gray, pale gray, variably sandy CLAY, hard, trace sand sized phosphate particles, cemented layers - thin sand lenses
	SS 19	25-50/4"	PP = 3.1 tsf MC = 36%			- cemented sands
100	SS 20	50/0"				
	SS 21	37-50/1"	PP = 2.75 tsf MC = 47% LL = 59 PL = 30			102.5 -48.2
105	SS 22	39-46-31 (77)	PP = 2.5 tsf MC = 23%	SP-SM		(SP-SM) gray, dark gray, poorly graded SAND with SILT, very dense, partially cemented

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
105			#200 = 6%			106.0	-51.7
	SS 23	9-8-13-26 (21)	PP = 2.0 tsf	CL		(CL) greenish gray, variably sandy CLAY, very stiff, trace sand lenses	
						108.0	-53.7
						Bottom of borehole at 108.0 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-40

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/7/14 **COMPLETED** 3/7/14 **GROUND ELEVATION** 54.35 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY AE **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 36+53.0; Adjacent to CPT-28 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	13-9-15-16 (24)	MC = 12%	SP		(SP) dark brown to brown, poorly graded SAND, medium dense (FILL)
5						
						7.0
10	SS 2	6-5-5-6 (10)	MC = 16% #200 = 27%	SC		(SC) gray, greenish gray, light gray, CLAYEY SAND, very loose to very dense, trace to few sand sized phosphate particles (FILL)
15						
20	SS 3	2-2-3-4 (5)	MC = 24%			
25	SS 4	1-1-2-2 (3)	MC = 27% LL = 43 PL = 22			
30	SS 5	3-4-3-5 (7)	MC = 26%			
35	SS 6	3-4-5-5 (9)	MC = 23%			- cemented clays
						47.4

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) gray, greenish gray, light gray, CLAYEY SAND, very loose to very dense, trace to few sand sized phosphate particles (FILL) *(continued)*
40	SS 7	4-5-6-6 (11)	MC = 21%			
						42.0 12.4
45	SS 8	4-20-32-50/2"	MC = 21%	SC		(SC) gray, CLAYEY SAND, loose to medium dense, trace to few sand sized phosphate particles, some cemented layers (NATIVE) - coarse grained sands
50	SS 9	2-2-10-8 (12)	MC = 32% LL = 45 PL = 27			
55	SS 10	2-3-4-5 (7)	MC = 29%			- vertical sand seams
						56.0 -1.7
60	SS 11	2-3-4-5 (7)	MC = 32% #200 = 10%	SP-SC		(SP-SC) light gray, poorly graded SAND with CLAY, loose, trace to few sand sized phosphate particles, trace cemented nodules
						62.0 -7.7
65	SS 12	3-4-4-5 (8)	MC = 66% LL = 43 PL = 24	SC		(SC) light gray, CLAYEY SAND, loose to medium dense, trace to few sand sized phosphate particles, trace cemented nodules
70	SS 13	5-5-13-13 (18)	MC = 87%			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-40

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70						(SC) light gray, CLAYEY SAND, loose to medium dense, trace to few sand sized phosphate particles, trace cemented nodules *(continued)*	
75	SS 14	10-11-10-17 (21)	MC = 22% #200 = 17%	SC			
							77.0 -22.7
80	SS 15	23-20-19-19 (39)	MC = 24% LL = 33 PL = 20	CL		(CL) light greenish gray, variably SANDY CLAY, hard, trace to few sand sized phosphate particles, desiccated clayey nodules - fine to coarse grained sands, cemented sands	
							82.0 -27.7
85	SS 16	10-19-29-50/5"	MC = 19% #200 = 14%	SC		(SC) light gray, CLAYEY SAND, very dense, trace to few sand sized phosphate particles, cemented layers	
90	SS 17	8-12-20-50/5"	MC = 22%			- fine to medium grained sands	90.0 -35.7
95	SS 18	50/5"	MC = 17%	SM		(SM) light gray, gray, SILTY SAND, very dense, trace to few sand sized phosphate particles, cemented layers	
	SS 19	19-32-36-19 (68)	MC = 23% #200 = 17%				
	SS 20	50/3"	MC = 30%				96.0 -41.7
100	SS 21	17-5-8-14 (13)	MC = 36%	CL		(CL) gray, greenish gray, variably sandy CLAY, stiff to hard, trace to few sand sized phosphate particles, cemented layers	
	SS 22	50/3"	MC = 25%				100.8 -46.4
						Bottom of borehole at 100.8 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-41

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/7/14 **COMPLETED** 3/7/14
GROUND ELEVATION 54.33 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AE **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 34+53.2; Adjacent to CPT-27
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	40-36-22-18 (58)	MC = 12%	SM		(SM) gray to dark brown, SILTY SAND, very dense (FILL)
5						7.0
10	SS 2	4-6-5-5 (11)	MC = 16% LL = 31 PL = 15 #200 = 28%	SC		(SC) brownish gray, gray, greenish gray, light greenish gray, variably CLAYEY SAND, very loose to medium dense, fine to medium grained sands, trace to few sand sized phosphate particles (FILL)
15						
20	SS 3	1-2-3-3 (5)	MC = 27%			
25	SS 4	1-0-3-4 (3)	MC = 26%			
30	SS 5	1-2-4-4 (6)	MC = 23%			
35	SS 6	2-3-5-6 (8)	MC = 23%			- sand lenses

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) brownish gray, gray, greenish gray, light greenish gray, variably CLAYEY SAND, very loose to medium dense, fine to medium grained sands, trace to few sand sized phosphate particles (FILL) *(continued)*
						37.0 17.3
						(SC) gray, greenish gray, light greenish gray, variably CLAYEY SAND, loose to medium dense, fine to medium grained sands, trace to few sand sized phosphate particles (NATIVE)
40	SS 7	5-7-10-11 (17)	MC = 17%			- vertical sand seams
45	SS 8	5-3-6-10 (9)	MC = 33% #200 = 45%			
50	SS 9	5-4-5-6 (9)	MC = 67%			- fine grained sandy lenses
55	SS 10	2-3-3-5 (6)	MC = 35%	SC		
60	SS 11	1-3-3-5 (6)	MC = 30%			
65	SS 12	3-5-5-7 (10)	MC = 61%			
70	SS 13	16-11-12-15 (23)	MC = 27% LL = 28 PL = 20			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-41

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SC		(SC) gray, greenish gray, light greenish gray, variably CLAYEY SAND, loose to medium dense, fine to medium grained sands, trace to few sand sized phosphate particles (NATIVE) *(continued)*
					72.0	-17.7
	SS 14	12-13-18-50/2"	MC = 19%	SM		(SM) light gray, light greenish gray, SILTY SAND, dense to very dense, trace to few sand sized phosphate particles, partially cemented layers
75						
	SS 15	11-10-25-35 (35)	MC = 21%			
80						
	SS 16	14-50/5"	MC = 23% #200 = 16%			
85						
	SS 17	9-11-17-27 (28)	MC = 21%			
90					90.0	- phosphatic sand lense -35.7
	SS 18	28-50/3"	MC = 18% #200 = 9%	SP-SM		(SP-SM) light gray, light greenish gray, poorly graded SAND with SILT, dense to very dense, trace to few sand sized phosphate particles
	SS 19	12-22-25-30 (47)	MC = 25%			
95					95.0	- cemented layers -40.7
	SS 20	50/0"		CL		(CL) gray, light greenish gray, variably sandy CLAY, hard to firm, trace to few sand sized phosphate particles, some desiccated clay nodules, cemented layers
	SS 21	5-28-22-21 (50)	MC = 31%			
100						
	SS 22	4-6-8-14 (14)	MC = 51%			
	SS 23	3-3-5-9 (8)	MC = 66% #200 = 68%			
105					105.0	-50.7

Bottom of borehole at 105.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-42

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/10/14 **COMPLETED** 3/10/14
GROUND ELEVATION 54.32 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Independent Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 32+45.9; Adjacent to CPT-26
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SC		(SC) greenish gray, variably CLAYEY SAND, very loose to medium dense, fine to coarse sands (FILL)
10	SS 1	4-6-5-5 (11)	MC = 18% #200 = 35%			- shell fragments, sand lenses
20	SS 2	0-1-1-1 (2)	MC = 24%			- loss of drilling fluid circulation from 16 ft to 4, casing installed to 20 ft, cirulation regained
25	SS 3	1-2-3-3 (5)	PP = 1.3 tsf MC = 27% LL = 40 PL = 18			
30	SS 4	3-2-3-4 (5)	PP = 3.25 tsf MC = 21%			
35	SS 5	4-6-7-7 (13)	PP = 4.5 tsf MC = 21%			

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35						(SC) greenish gray, variably CLAYEY SAND, very loose to medium dense, fine to coarse sands (FILL) *(continued)*
40	SS 6	4-4-6-8 (10)	PP = 1.75 tsf MC = 24%	SC		
45	SS 7	3-19-15-12 (34)	PP = 3.5 tsf MC = 24%			44.0 10.3
						(CL) greenish gray, variably sandy CLAY, stiff to very stiff, trace sand sized phosphate particles (NATIVE)
50	SS 8	4-4-10-15 (14)	PP = 1.25 tsf MC = 18% #200 = 56% MC = 47%	CL		
55	SS 9	5-5-7-11 (12)	PP = 0.75 tsf MC = 66%			
60	SS 10	3-5-8-8 (13)	PP = 2.25 tsf MC = 49% MC = 28%			- fine grained sand layer
						61.0 -6.7
65	SS 11	4-6-11-14 (17)	PP = 3.25 tsf MC = 25% LL = 37 PL = 19 #200 = 43%	SC		(SC) greenish gray, light greenish gray, slightly CLAYEY SAND, medium dense to dense, trace sand sized phosphate particles
70	SS 12	14-26-20-14 (46)	MC = 21% #200 = 25%			- cemented layer

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-42

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SC		(SC) greenish gray, light greenish gray, slightly CLAYEY SAND, medium dense to dense, trace sand sized phosphate particles *(continued)*
						72.0 -17.7
				SM		(SM) greenish gray, light greenish gray, SILTY SAND, very dense, trace clay, trace sand sized phosphate particles, with cemented layers
75	SS 13	9-14-44-50/4"	MC = 22%			
80	SS 14	42-35-37-31 (72)	MC = 19%			- sand lense at 79 ft
	SS 15	44-50/4"	MC = 20%			
85						- sand lense at 84 ft
						86.0 -31.7
				SP-SC		(SP-SC) greenish gray, light greenish gray, poorly graded SAND with CLAY, very dense, trace sand sized phosphate particles, partially cemented
90	SS 16	15-25-28-23 (53)	MC = 21% LL = 26 PL = 17 #200 = 9%			- gravel size particles
						92.0 -37.7
				SC		(SC) greenish gray, light greenish gray, CLAYEY SAND, cemented clay nodules, fine to medium grained sands
95	SS 17	12-23-14-17 (37)	PP = 2.5 tsf MC = 24% #200 = 28% MC = 28%			
						95.0 -40.7
	SS 18	50/2"		CH		(CH) greenish gray, light greenish gray, fat CLAY with sand, hard, trace sand sized phosphate particles, heavily cemented
100	SS 19	12-30-50/3"	PP = 2.75 tsf MC = 32% LL = 54 PL = 31			
	SS 20	50/5"	PP = 3.5 tsf MC = 23%			101.4 -47.1
						Bottom of borehole at 101.4 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-43

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/10/14 **COMPLETED** 3/10/14 **GROUND ELEVATION** 54.29 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 30+48.6; Adjacent to CPT-25 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	14-12-14-14 (26)	MC = 13%	SM		(SM) brown, dark brown, SILTY fine grained quartz SAND, medium dense, trace shell fragments (FILL)
5						
						6.0
				SC		(SC) light greenish gray, greenish gray, gray, light gray, variably CLAYEY SAND, very loose to medium dense, few gravel, trace sand sized phosphate particles (FILL)
10	SS 2	5-6-5-8 (11)	PP = 4.25 tsf MC = 15% #200 = 30%			- trace shell fragments
15						
20	SS 3	3-4-2-3 (6)	PP = 2.8 tsf MC = 20%			- sand lenses
25	SS 4	2-2-3-3 (5)	PP = 1.6 tsf MC = 24%			- sand lenses
30	SS 5	2-2-1-2 (3)	PP = 1.5 tsf MC = 25%			
35	SS 6	2-3-6-7 (9)	PP = 3.5 tsf MC = 21%			- sand lenses, cementation

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) light greenish gray, greenish gray, gray, light gray, variably CLAYEY SAND, very loose to medium dense, few gravel, trace sand sized phosphate particles (FILL) *(continued)*
						37.0 17.3
				CL		(CL) light greenish gray, greenish gray, gray, light gray, CLAY with sand, firm to very stiff, few gravel, trace sand sized phosphate particles (NATIVE)
40	SS 7	4-6-7-9 (13)	PP = 4.1 tsf MC = 19%			
45	SS 8	8-10-6-6 (16)	PP = 1.75 tsf MC = 17%			- dolomitic
50	SS 9	5-11-11-13 (22)	PP = 1.1 tsf MC = 58% ~~MC = 28%~~ #200 = 80%			- 2-inch sand lense at 48.5 ft, 3-inch sand lense at 49 ft
55	SS 10	4-4-4-7 (8)	PP = 0.5 tsf MC = 82%			
60	SS 11	3-3-3-6 (6)	PP = 1.1 tsf MC = 39%			
65	SS 12	8-11-12-31 (23)	PP = 3.25 tsf MC = 23% LL = 28 PL = 20			
						67.0 -12.7
70	SS 13	12-18-20-28 (38)	MC = 21% #200 = 9%	SP-SC		(SP-SC) gray, dark gray, poorly graded fine to medium grained SAND with CLAY, medium dense to very dense, trace sand sized phosphate particles, some cemented layers

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SP-SC		(SP-SC) gray, dark gray, poorly graded fine to medium grained SAND with CLAY, medium dense to very dense, trace sand sized phosphate particles, some cemented layers *(continued)*
75	SS 14	20-14-16-18 (30)	MC = 19%			- 2-inch greenish gray clay lense at 73 ft
	SS 15	50/3"	MC = 17%			- greenish gray, light greenish gray, trace sand sized and pebble sized phosphate particles
80						
85	SS 16	12-21-25-19 (46)	PP = 3.25 tsf MC = 24% #200 = 9% MC = 30%			
						84.0 -29.7
90	SS 17	26-27-30-34 (57)	MC = 24%	SP-SM		(SP-SM) gray, dark gray, poorly graded fine to medium grained SAND with SILT, very dense, trace sand sized phosphate particles, partially cemented layers
95	SS 18	6-8-11-13/0"	PP = 1.75 tsf MC = 24%			- light gray, light greenish gray
						95.5 -41.2
	SS 19	18-50/5"	MC = 23%	SP		(SP) gray, dark gray, poorly graded fine to medium grained SAND, very dense, trace sand sized phosphate particles, partially cemented
						98.0 -43.7
100	SS 20	42-50/5"	PP = 4.5 tsf MC = 33% #200 = 61%	CL		(CL) light gray, gray, light greenish gray, variably sandy CLAY, hard, trace sand sized and pebble sized phosphate particles, heavily cemented
	SS 21	50/5"	PP = 4.75 tsf			
	SS 22	35-42-50/1"	PP = 4.25 tsf			
						104.6 -50.3

Bottom of borehole at 104.6 feet.

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BORING NUMBER B-44

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/10/14 **COMPLETED** 3/10/14
GROUND ELEVATION 54.2 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 24+42.5; Adjacent to CPT-18
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SC		(SC) light gray, CLAYEY SAND, very loose to medium dense, trace sand sized phosphate particles (FILL)
10	SS 1	6-6-7-7 (13)	MC = 17%			
20	SS 2	1-1-1-1 (2)	MC = 26%			
30	SS 3	3-10-12-16 (22)				29.0 — 25.2
				SP		(SP) dark brown, poorly graded SAND, medium dense, slight organic odor (FILL)
						32.0 — 22.2
35				SC		(SC) light gray, yellowish gray, CLAYEY SAND, loose to medium dense, trace sand sized phosphate particles (NATIVE)

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) light gray, yellowish gray, CLAYEY SAND, loose to medium dense, trace sand sized phosphate particles (NATIVE) *(continued)*
40	SS 4	2-2-4-4 (6)	MC = 30% LL = 35 PL = 19 #200 = 38%			
45	SS 5	3-4-4-4 (8)	MC = 24%			- pockets of phosphatic sand
50	SS 6	0-3-3-4 (6)	MC = 21%			
55	SS 7	5-6-9-16 (15)	MC = 26% #200 = 29%			- pockets of phosphatic sand
60	SS 8	6-9-14-14 (23)	MC = 20%			
						62.0 -7.8
65	SS 9	13-21-24-35 (45)	MC = 25% #200 = 14%	SM		(SM) light gray, SILTY fine to medium grained SAND, dense to very dense, few sand sized phosphate particles, partially cemented
70	SS 10	16-26-36-28 (62)	MC = 23%			

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BORING NUMBER B-44

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70						(SM) light gray, SILTY fine to medium grained SAND, dense to very dense, few sand sized phosphate particles, partially cemented *(continued)*
75	SS 11	23-18-28-35 (46)	MC = 24%			- light gray, greenish gray below 74 ft
80	SS 12	23-30-29-50/4"	MC = 20%	SM		- cemented layer
85	SS 13	19-22-26-23 (48)	MC = 32% #200 = 12%			- less silty below 83 ft
						87.0 -32.8
90	SS 14	35-20-50/4"	MC = 39% LL = 69 PL = 31	SC		(SC) light green, greenish gray, variably CLAYEY SAND, medium dense to very dense, cemented layers - sandy pockets
	SS 15	14-12-10-13 (22)	MC = 87%			
95	SS 16	2-6-9-23 (15)	MC = 98%			
						95.0 -40.8
	SS 17	50/3"	MC = 42% LL = 46 PL = 30	SM		(SM) yellowish to greenish gray, SILTY SAND, very dense, heavily cemented
						97.7 -43.5
	SS 18	50/2"	MC = 26% #200 = 31%			Bottom of borehole at 97.7 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:00 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-45

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/10/14 **COMPLETED** 3/10/14
GROUND ELEVATION 54.3 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Madrid Engineering Group
GROUND WATER LEVELS:
DRILLING METHOD Standard Penetration / Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 25+43.4; Adjacent to CPT-19
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0				SC		(SC) light gray, CLAYEY SAND, very loose to medium dense, few sand sized phosphate particles (FILL)
5						
10	SS 1	7-6-6-5 (12)	MC = 18% #200 = 31%			- slight organic odor
15						
20	SS 2	0-0-2-1 (2)	WOH - 1 ft			- no recovery
	SS 3	1-1-1-1 (2)	MC = 29%			
25						
30	SS 4	7-8-5-5 (13)	MC = 19% #200 = 6%			
				SP-SM		29.0 (SP-SM) light brown, poorly graded SAND with SILT, medium dense, few sand sized phosphate particles (FILL) 25.3
35				SC		32.0 (SC) light gray, CLAYEY SAND, very loose to loose, few sand sized phosphate particles (FILL) 22.3

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) light gray, CLAYEY SAND, very loose to loose, few sand sized phosphate particles (FILL) *(continued)*
40	SS 5	0-0-2-1 (2)	MC = 32% LL = 32 PL = 18 #200 = 26% WOR - 1 ft			
45	SS 6	0-3-3-5 (6)	MC = 25%			
50	SS 7	2-2-2-4 (4)				- no recovery
	SS 8	1-2-2-2 (4)	MC = 22%			51.0 3.3
				SP-SM		(SP-SM) light gray, poorly graded SAND with SILT, very loose, few sand sized phosphate particles (FILL)
55	SS 9	4-4-7-12 (11)	MC = 22% LL = 29 PL = 18	CL		53.0 1.3 (CL) light green, greenish gray, SANDY CLAY, stiff to hard, few sand sized phosphate particles (NATIVE)
60	SS 10	14-15-18-26 (33)	MC = 22%			
65	SS 11	12-16-41-47 (57)	MC = 18% MC = 19%			64.0 -9.7
70	SS 12	27-34-26-28 (60)		SM		(SM) gray, greenish gray, SILTY SAND, very dense, few coarse grained sands, few sand sized phosphate particles, partially cemented

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70				SM		(SM) gray, greenish gray, SILTY SAND, very dense, few coarse grained sands, few sand sized phosphate particles, partially cemented *(continued)*	
75	SS 13	45-48-50/5"	MC = 23% #200 = 23%				
80	SS 14	20-22-32-33 (54)	MC = 29%			- coarse sands	
						82.0	-27.7
85	SS 15	13-14-20-29 (34)	MC = 28% LL = 31 PL = 21	CL		(CL) light green, greenish gray, variably sandy CLAY, hard, few sand sized phosphate particles - medium to coarse grained sands	
						87.0	-32.7
90	SS 16	8-7-25-20 (32)	MC = 60% LL = 105 PL = 49	MH		(MH) light green, greenish gray, variably sandy elastic SILT, very stiff to hard, few sand sized phosphate particles, cemented layers	
	SS 17	6-5-7-10 (12)	MC = 70%				
	SS 18	5-5-10-50/4"	MC = 89%				
95	SS 19	50/2"	MC = 33% LL = 42 PL = 26	CL		(CL) light green, greenish gray, variably sandy CLAY, hard, few sand sized phosphate particles, heavily cemented - yellowish gray to greenish gray	
	SS 20	30-50/5"	MC = 31%				
						98.4	-44.1
						Bottom of borehole at 98.4 feet.	

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BORING NUMBER B-46

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/11/14 **COMPLETED** 3/11/14 **GROUND ELEVATION** 54.36 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 26+44.9; Adjacent to CPT-23 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	15-19-25-27 (44)	MC = 9%	SM		(SM) brown, dark brown SILTY fine to medium grained SAND, dense (FILL)
10	SS 2		MC = 16% #200 = 46%			9.0
15	SS 3	2-2-4-5 (6)	MC = 16% #200 = 30%	SC		(SC) light green, greenish gray, CLAYEY SAND, very loose to loose, trace sand sized phosphate particles (FILL) - cemented clay nodules
20	SS 4	1-2-1-3 (3)	MC = 21%			
25	SS 5	1-2-3-4 (5)	MC = 22%			
30	SS 6	0-0-1-2 (1)	MC = 26% WOH - 1 ft			- sand lenses, cemented clay nodules
35	SS 7	1-3-3-5 (6)	MC = 24%			45.4

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) light green, greenish gray, CLAYEY SAND, very loose to loose, trace sand sized phosphate particles (FILL) *(continued)*
40	SS 8	1-2-2-3 (4)	MC = 25%			- cemented clays
45	SS 9	2-3-5-8 (8)	MC = 23% LL = 39 PL = 20			
50	SS 10	2-1-2-2 (3)	LL = 46 PL = 24			
55	SS 11	2-2-3-4 (5)	MC = 44% LL = 25 PL = 19			
						57.0 -2.6
60	SS 12	5-6-6-13 (12)	MC = 24%	SC		(SC) greenish gray, variably CLAYEY SAND, medium dense, trace sand sized phosphate particles (NATIVE)
						62.0 -7.6
65	SS 13	6-14-19-21 (33)	MC = 25% #200 = 10%	SP-SM		(SP-SM) gray, dark gray, greenish gray, poorly graded SAND with SILT, dense to very dense, trace sand sized phosphate particles, cemented layers
70	SS 14	15-23-26-24 (49)	MC = 21%			- fine to medium grained sand lenses

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BORING NUMBER B-46

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SP-SM		(SP-SM) gray, dark gray, greenish gray, poorly graded SAND with SILT, dense to very dense, trace sand sized phosphate particles, cemented layers *(continued)*
75	SS 15	12-18-20-23 (38)	MC = 22%			- cemented
80	SS 16	17-20-23-22 (43)	MC = 22%			
85	SS 17	15-28-32-30 (60)				- cemented
90	SS 18	12-10-16-23 (26)				
	SS 19	12-11-21 (32)	MC = 29% LL = 58 PL = 29 #200 = 15%			- sandy lenses at 91.5 ft
95	SS 20	7-10-50/3"		SC		- cemented clays, cemented sand lense at 94.5 ft
	SS 21	50/5"				
100	SS 22	25-18-24 (42)	LL = 58 PL = 29			

88.5 -34.1

100.0 -45.6

Bottom of borehole at 100.0 feet.

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BORING NUMBER B-47

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/11/14 **COMPLETED** 3/11/14 **GROUND ELEVATION** 54.32 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 28+44.7; Adjacent to CPT-24 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	8-13-19-20 (32)	MC = 12%	SM		(SM) brown, dark brown, SILTY SAND, dense, trace shell fragments (FILL)
5						6.0
10	SS 2	6-7-7-6 (14)	PP = 4.5 tsf MC = 15% #200 = 38%	SC		(SC) dark gray, gray, light gray, variably CLAYEY SAND, loose to medium dense, trace sand sized phosphate particles (FILL) - trace cemented clay nodules
15	SS 3	2-3-4-3 (7)	PP = 2.25 tsf MC = 17%			
20	SS 4	2-2-3-3 (5)	PP = 1.75 tsf MC = 21%			
25	SS 5	1-2-4-6 (6)	PP = 1.25 tsf MC = 20%			
30	SS 6	3-4-3-4 (7)	PP = 2.5 tsf MC = 24%			
35	SS 7	3-3-5-5 (8)	PP = 2.3 tsf MC = 21%			48.3

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				SC		(SC) dark gray, gray, light gray, variably CLAYEY SAND, loose to medium dense, trace sand sized phosphate particles (FILL) *(continued)*
40	SS 8	3-4-4-5 (8)	PP = 3.75 tsf MC = 21%			
						42.0 12.3
45	SS 9	4-7-15-9 (22)	PP = 2.0 tsf MC = 15%	SC		(SC) dark gray, gray, light gray, variably CLAYEY SAND, loose to medium dense, trace sand sized phosphate particles (NATIVE)
						- 2-inches clay lense at 44.5 ft
50	SS 10	5-5-6-6 (11)	PP = 1.0 tsf MC = 27% #200 = 31%			
55	SS 11	9-7-8-10 (15)	PP = 1.0 tsf MC = 50%			- trace sand lenses
60	SS 12	2-3-4-9 (7)	PP = 1.25 tsf MC = 29%			
65	SS 13	8-6-12-22 (18)	PP = 1.25 tsf MC = 24%			- cemented sand and clay nodules
						67.0 -12.7
70	SS 14	17-21-19-28 (40)	MC = 19% #200 = 7%	SP-SM		(SP-SM) gray, dark gray, poorly graded fine to medium grained SAND with SILT, dense to very dense, trace sand sized phosphate particles, partially cemented layers

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				SP-SM		(SP-SM) gray, dark gray, poorly graded fine to medium grained SAND with SILT, dense to very dense, trace sand sized phosphate particles, partially cemented layers *(continued)*
75	SS 15	14-25-30-47 (55)	MC = 19%			- cemented clays
80	SS 16	15-27-36-41 (63)	MC = 17% #200 = 5%			- trace shell fragments
82.0						-27.7
85	SS 17	10-19-32-50/4"	PP = 3.75 tsf MC = 19% #200 = 28%	SM		(SM) light gray, gray, light greenish gray, variably SILTY SAND, medium dense to very dense, trace sand sized and pebble sized phosphate particles, cemented layers
90	SS 18	17-15-8-13 (23)	PP = 1.75 tsf MC = 22%			
	SS 19	50/2"				- no recovery
95	SS 20	6-5-10 (15)	PP = 1.5 tsf MC = 27%			- variably sandy lenses
	SS 21	20-50/5"	MC = 33% LL = 70 PL = 40			- sandy lenses
100	SS 22	30-23-29 (52)	MC = 31%			-sandy lenses
100.0						-45.7
						Bottom of borehole at 100.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-48

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/6/14 **COMPLETED** 3/6/14 **GROUND ELEVATION** 54.2 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Independent Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Standard Penetration / Mud Rotary **AT TIME OF DRILLING** ---

LOGGED BY AE **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 44+98.0; Adjacent to CPT-32 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS 1	5-6-12-9 (18)	MC = 11% #200 = 6%	SP		(SP) brown to dark brown, poorly graded SAND with SILT, medium dense to dense (FILL)
5	SS 2	10-18-27-46 (45)	MC = 12%			
10	SS 3	7-12-8-4 (20)	MC = 17% #200 = 7%			
12.0						42.2
15	SS 4	2-2-3-3 (5)	MC = 26% #200 = 32%	SC		(SC) greenish gray, light gray, variably CLAYEY SAND, very loose to medium dense, few sand sized phosphate particles (FILL)
20	SS 5	1-1-3-4 (4)	MC = 26%			
25	SS 6	2-6-6-9 (12)	MC = 23%			
30	SS 7	2-3-4-4 (7)	MC = 27% LL = 43 PL = 20			
32.0						22.2
35	SS 8	9-16-21-20 (37)	MC = 27% #200 = 4%	SP		(SP) brown, poorly graded SAND, medium dense, partially cemented (NATIVE)

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35				SP		(SP) brown, poorly graded SAND, medium dense, partially cemented (NATIVE) *(continued)*	
						37.0	17.2
				SM		(SM) dark gray, greenish gray, variably SILTY SAND, very loose to loose, trace sand sized phosphate particles	
40	SS 9	1-1-2-4 (3)	MC = 28% #200 = 18%				
45	SS 10	11-8-2-2 (10)	MC = 22%			- medium to coarse grained sands	
						47.0	7.2
50	SS 11	1-0-1-0 (1)	MC = 31% #200 = 7%	SP-SC		(SP-SC) greenish gray, poorly graded SAND with CLAY, very loose, trace sand sized phosphate particles	
						52.0	2.2
55	SS 12	12-16-27-18 (43)	MC = 5% LL = 25 PL = 19 #200 = 35%	SC		(SC) greenish gray, CLAYEY SAND, dense, trace sand sized phosphate particles, partially cemented	
						57.0	-2.8
60	SS 13	10-24-5/5"	MC = 27%	CL		(CL) light greenish gray, light gray, variably sandy CLAY, hard, trace sand sized phosphate particles, partially cemented	
						62.0	-7.8
65	SS 14	5-11-15-22 (26)	MC = 36%	SC		(SC) greenish gray, variably CLAYEY SAND, medium dense, trace sand sized phosphate particles	
						67.0	-12.8
70	SS 15	4-6-6-11 (12)		CL		(CL) light greenish gray, light gray, variably sand CLAY, soft to very stiff, trace sand sized phosphate particles	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

BORING NUMBER B-48

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70				CL		(CL) light greenish gray, light gray, variably sand CLAY, soft to very stiff, trace sand sized phosphate particles *(continued)*
75	SS 16	1-2-2-6 (4)				
80	SS 17	4-4-6-8 (10)				
85	SS 18	4-7-12-18 (19)				85.0 -30.8

Bottom of borehole at 85.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 15:01 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

Appendix C

Direct Push Service, Inc. CPT Report

March 12, 2014

Glen R. Andersen, ScD, PE
Associate Engineer – Geotechnical
AMEC Environment and Infrastructure
2000 E. Edgewood Drive, Suite 215
Lakeland, FL 33803

Re: Lake Manatee Dam CPT Borings

Dear Mr. Andersen,

Direct Push Services, LLC (DPS) was retained by AMEC Environment and Infrastructure to perform cone penetrometer test (CPT) borings at the Lake Manatee Dam located in Bradenton, Florida. The purpose of performing the CPT borings were to provide geotechnical data to evaluate subsurface conditions at the site with respect to soil classification and relative strength. DPS completed the CPT program on February 27, 2014, and the investigation results are enclosed herein.

The investigation and data collection was performed in general accordance with the American Society for Testing of Materials (ASTM) Standard D 5778 for performing electronic piezocone penetration testing of soils. During each CPT, continuous measurements of the tip and sleeve resistance were recorded, as well as the tilt angle and pore pressure. **Attachment A** provides a more complete description of the CPT procedures and analysis employed during the investigation.

TESTING APPARATUS

The investigation was performed using a track-mounted, self-anchoring Geoprobe 6625CPT to advance an electronic piezocone penetrometer. The piezocone used in the investigation was manufactured by Geosoft, and is equipped to record continuous data during each CPT test. The data recorded by the cone was evaluated using the Geosoft CPT Pro version 5.50 computer program.

The piezocones used during the investigation were calibrated in accordance with ASTM D 5778 on January 30, 2014 by Geoprobe, Inc. (tip serial #4275). The tip has a 60° apex angle, and a 1.4 inch diameter. The piezocone is equipped with a sintered bronze fine porous filter, and glycerin (95% pure) was used for de-airing each filter under vacuum prior to each CPT.

CONE PENETRATION TESTS

The investigation was completed on February 27, 2014 by performing thirty six CPT borings. The borings were completed at the location generally described by AMEC. The borings were advanced to a depth ranging from 12 feet to approximately 60 feet below ground surface (bgs). The CPT test performed at the Lake Manatee Dam was completed without complications, interruptions, or interferences that would impact the reliability of the subsurface data collected. Therefore, the testing data and the resulting data evaluations are considered sufficiently reliable and accurate for the boring locations. The CPT was performed with a continuous push. All of the data recording devices functioned properly, and the tilt angle remained sufficiently vertical during the push.

The CPT data is presented in **Attachment B**. The reported testing data includes soil classification, tip resistance, sleeve friction ratio, pore pressure, and correlated SPT 'N' values. The test was terminated due to the increase in the point resistance on the Geoprobe.

DPS appreciates this opportunity to provide you with geotechnical testing services. Please call me if you have any questions or require additional information.

Sincerely,
DIRECT PUSH SERVICES, LLC

Scott Blackburn
General Manager

Telephone (863) 676-0088 P.O. Box 3998, Lake Wales, Florida 33859 Facsimile (863) 223-8525

Attachment A

DIRECT PUSH SERVICES, LLC

CONE PENETRATION TESTING DESCRIPTION AND SUMMARY

Cone penetration testing is a geotechnical technique designed to evaluate subsurface conditions and geotechnical soil properties. Cone penetrometer tests are a quasistatic penetration test, meaning that the cone is pushed at a slow rate rather than driven with a hammer or rotary drilling. During a cone penetration test (CPT), a cylindrical metal cone is advanced below land surface at a constant and slow rate, normally by a hydraulic press. As the cone is advanced, measurements are made and data is recorded that indicate the various soil properties encountered by the cone. Cone penetration testing is a cost effective and rapid test method when compared to other subsurface testing procedures.

The CPT is designed to evaluate subsurface conditions based primarily on the resistance to penetration encountered by the cone tip. Resistance measurements are also recorded for the cone sleeve, or shaft. In the case of piezocones, subsurface pore pressure can also be measured to assist the evaluation of soil types. The CPT can be performed by continuously advancing the cone without withdrawing it from the borehole. This makes a CPT very time-effective when compared to other testing procedures such as Standard Penetration Test (SPT) where the penetrometer must be withdrawn from the borehole at each test interval.

CPT can be performed using a variety of different cones. However, cone penetrometers with 60 degree apex angle and a 1.4 inch diameter have generally become the standard tip design. This translates to a cone base area of 1.54 square inches. The rate of tip advancement is also important, and an advancement rate of 0.79 inches (2 centimeters) per second has also become standard.

The CPT method has been standardized by the American Society for Testing and Materials (ASTM) under standard designation D 5778. ASTM D 5778 sets forth standard procedures for determining cone resistance from electronic friction-cone penetrometers and pore pressure using piezocone penetrometers.

Standard data collected during a CPT is the cone resistance and friction sleeve resistance. The cone resistance, or end bearing resistance, is measured by the force required to advance the cone, and is equal to the vertical force applied divided by the cone base area. The friction sleeve resistance, or local side friction, measures the amount of friction on the cone sleeve, and is equal to the shear force applied to the sleeve divided by the sleeve surface area.

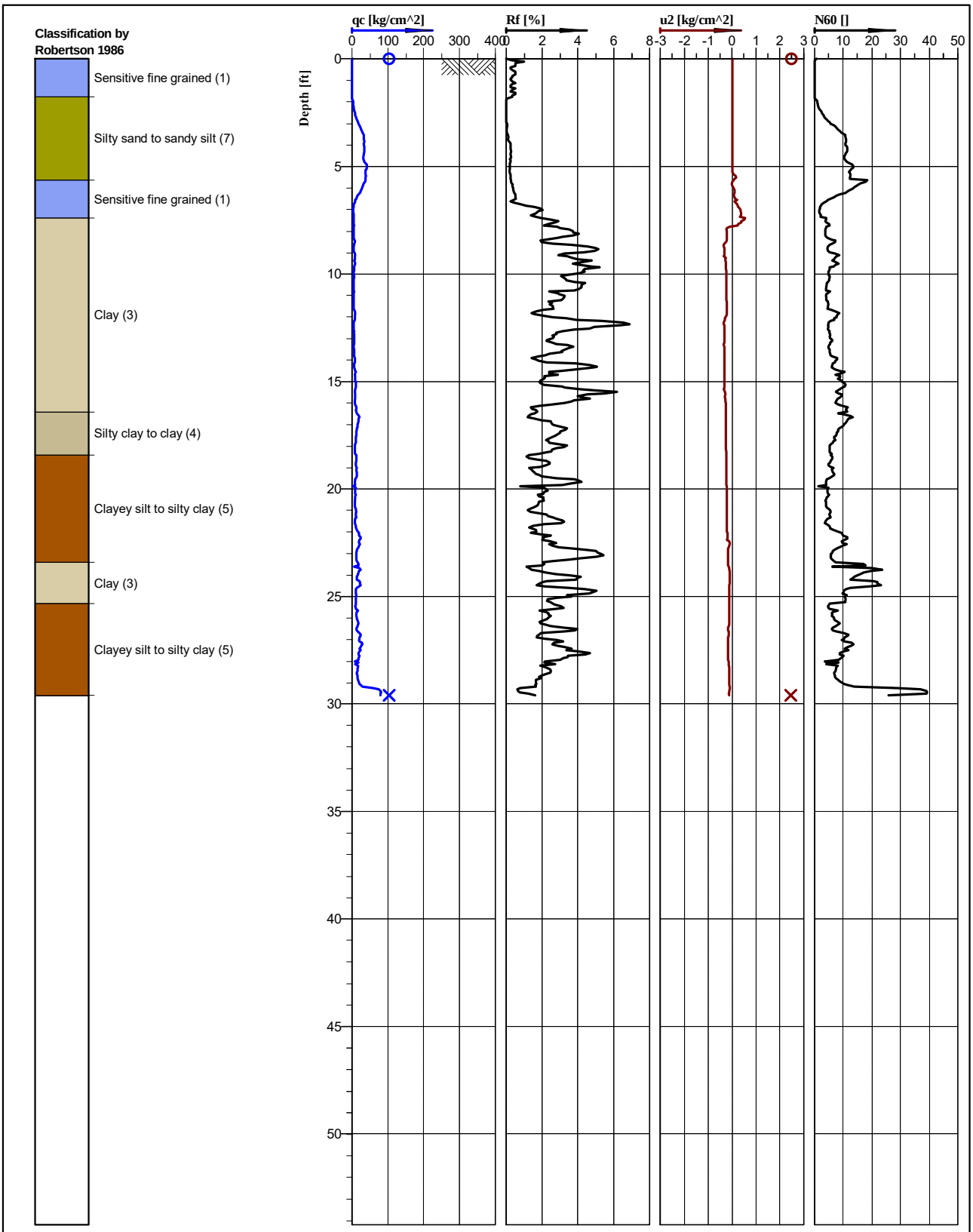
The CPT data discussed above is commonly used to calculate the corrected total cone resistance, pore water pressure ratio, and friction ratio. The corrected total cone resistance is the tip resistance corrected for pore pressure acting behind the tip, and allows an estimate of the total tip resistance to be made. The pore water pressure ratio is expressed as a percentage, and represents the ratio of excess pore pressure to cone resistance. The friction ratio is the ratio of sleeve resistance to tip resistance measured at a point where the middle of the sleeve and the tip are at equal depths.

The CPT provides data that can be used to estimate various subsurface properties including soil type and strength. Piezocone penetrometer tests are highly effective for identifying sand, silt, and clay layers, as well as determining pore pressure. These tests are also moderately effective for determining other geotechnical engineering properties including friction angle, undrained shear strength, density index, constrained modulus, coefficient of consolidation, permeability, horizontal stress, and over consolidation ratios.

Modern CPTs are performed using cones with electronic circuitry embedded directly in the tips to record subsurface measurements. These measurements can be transmitted directly to the operator for instant computer storage of the data, or stored within the tip for data retrieval at the end of the CPT. By either method, the data collected during the CPT can be recorded on a computer and available for analysis directly following the CPT.

Direct Push Services employs the use of CPT Pro (version 5.5) software developed by Geosoft to evaluate the CPT data. Most of the data interpretations are based upon work produced by P.K. Robertson. While it is beyond the scope of this summary to discuss each evaluation performed by the software, descriptions of any reported data are available upon request.

Attachment B



Location: North Apron of Spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/20/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 30feet. 2 foot void under slab. No anchors used.		File: LMDamCPT-1.cpd	

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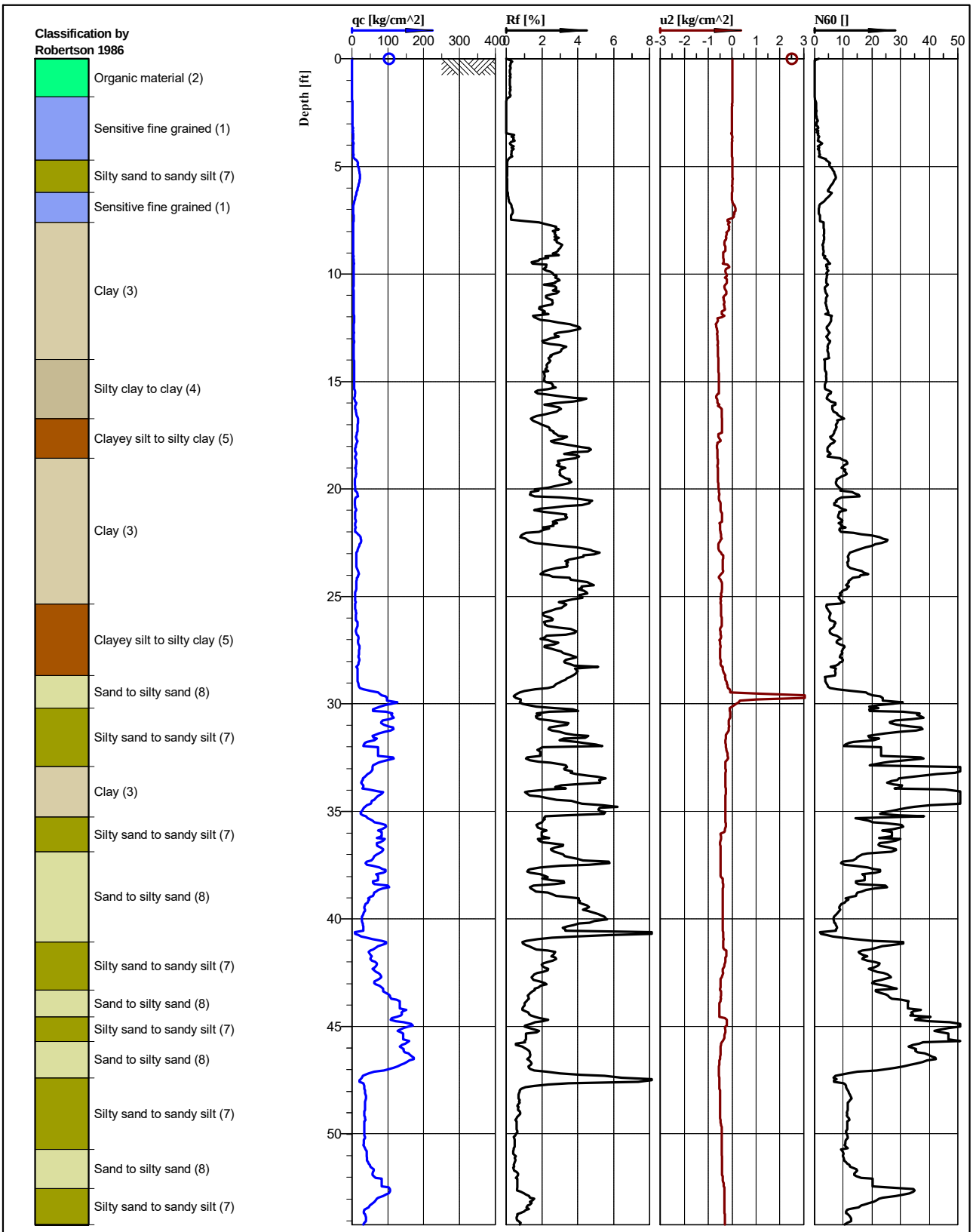
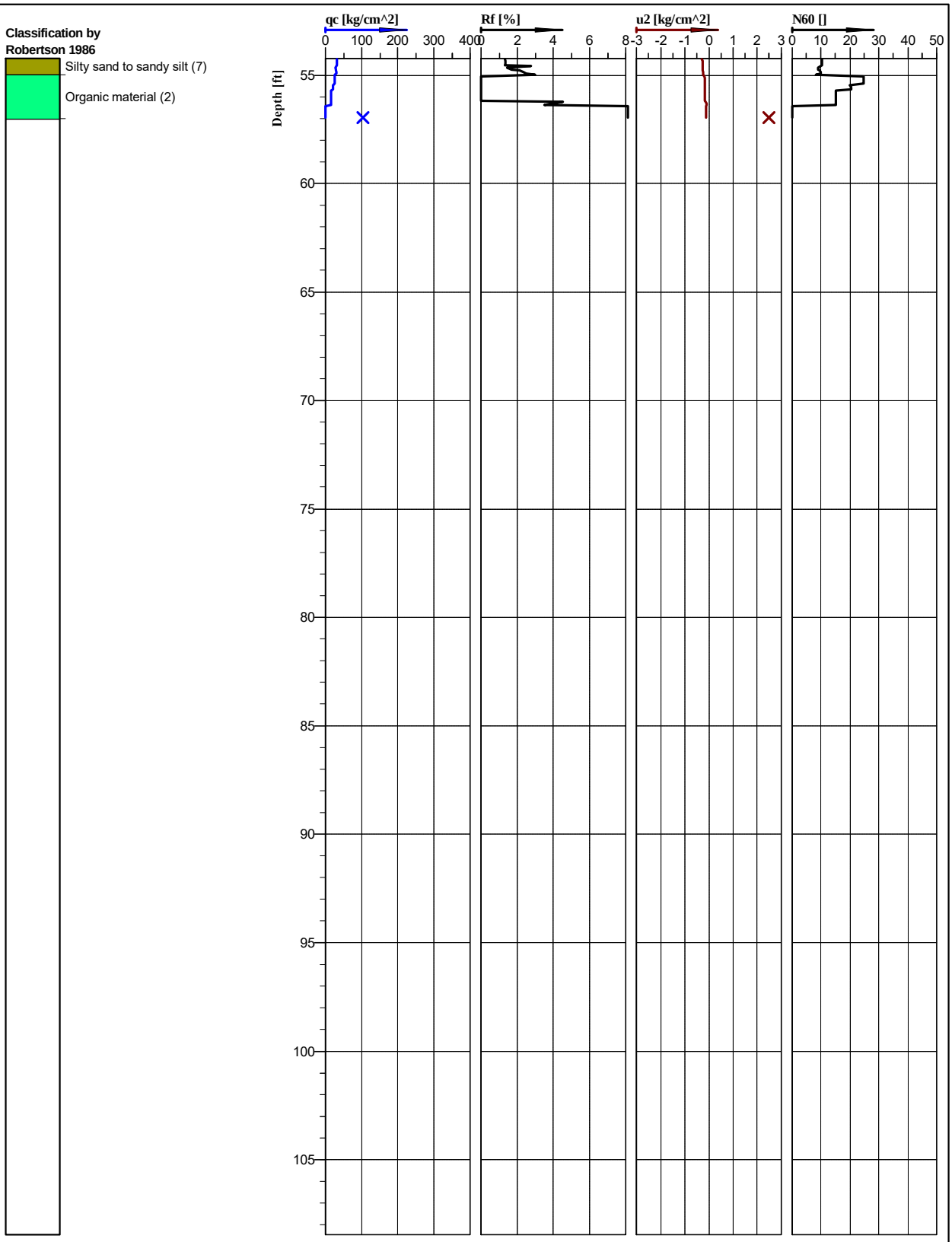
DIRECT PUSH SERVICES, LLC



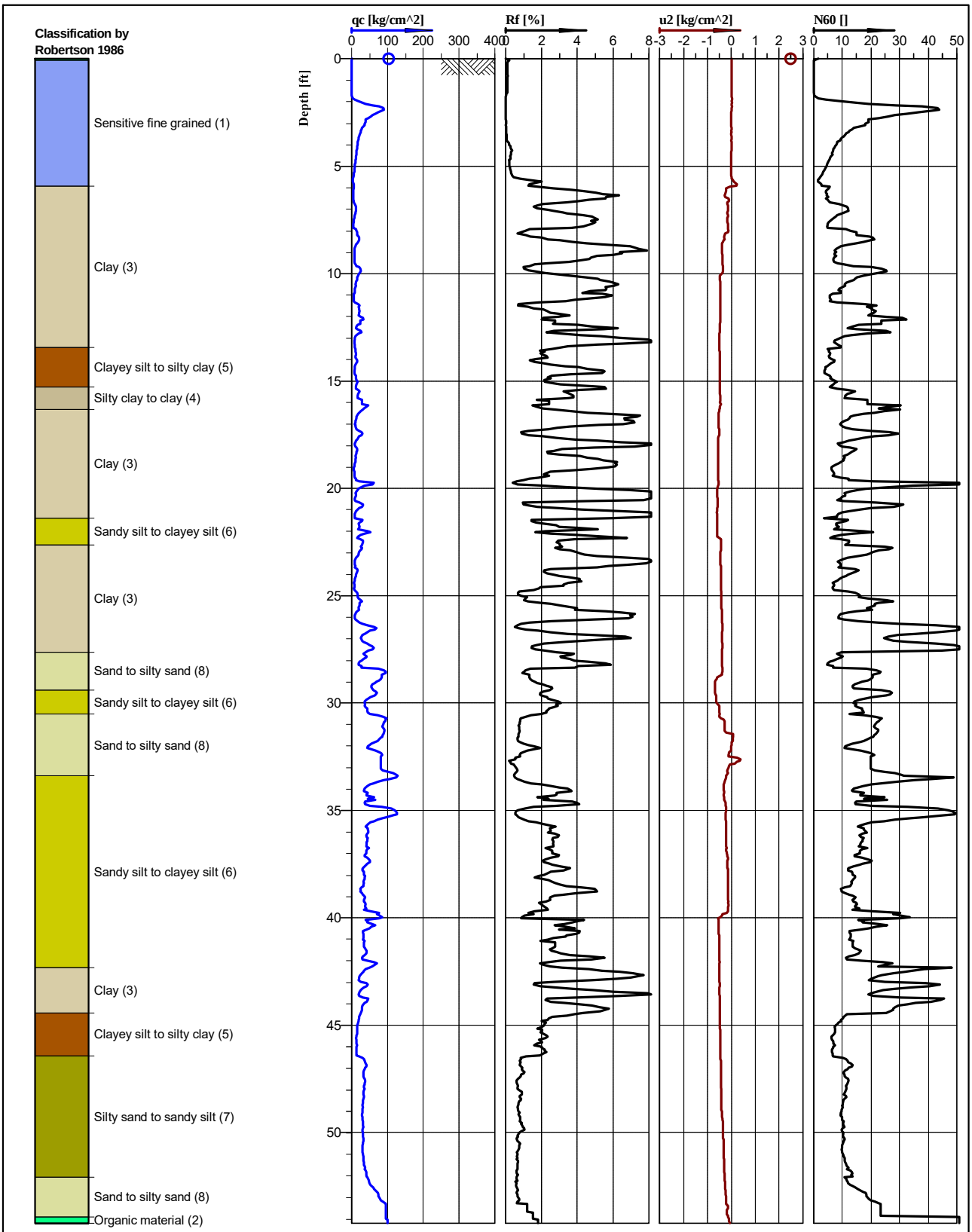
Location: North Apron of Spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: B
Project ID: 212-400	Client: AMEC	Date: 2/20/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-1b.cpd	

DPS DIRECT PUSH SERVICES, LLC



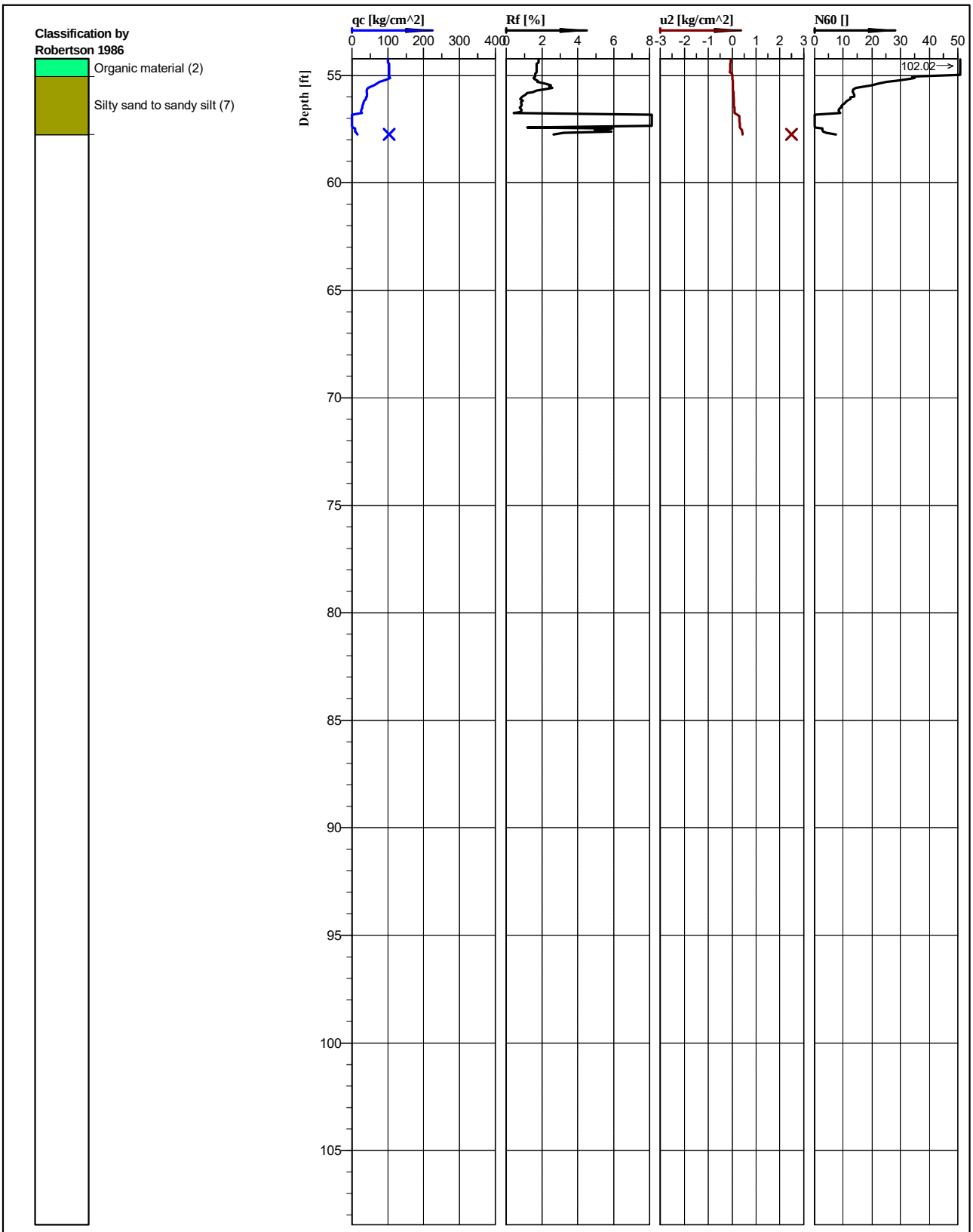
Location: North Apron of Spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: B
Project ID: 212-400	Client: AMEC	Date: 2/20/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-1b.cpd	

DPS
DIRECT PUSH SERVICES, LLC



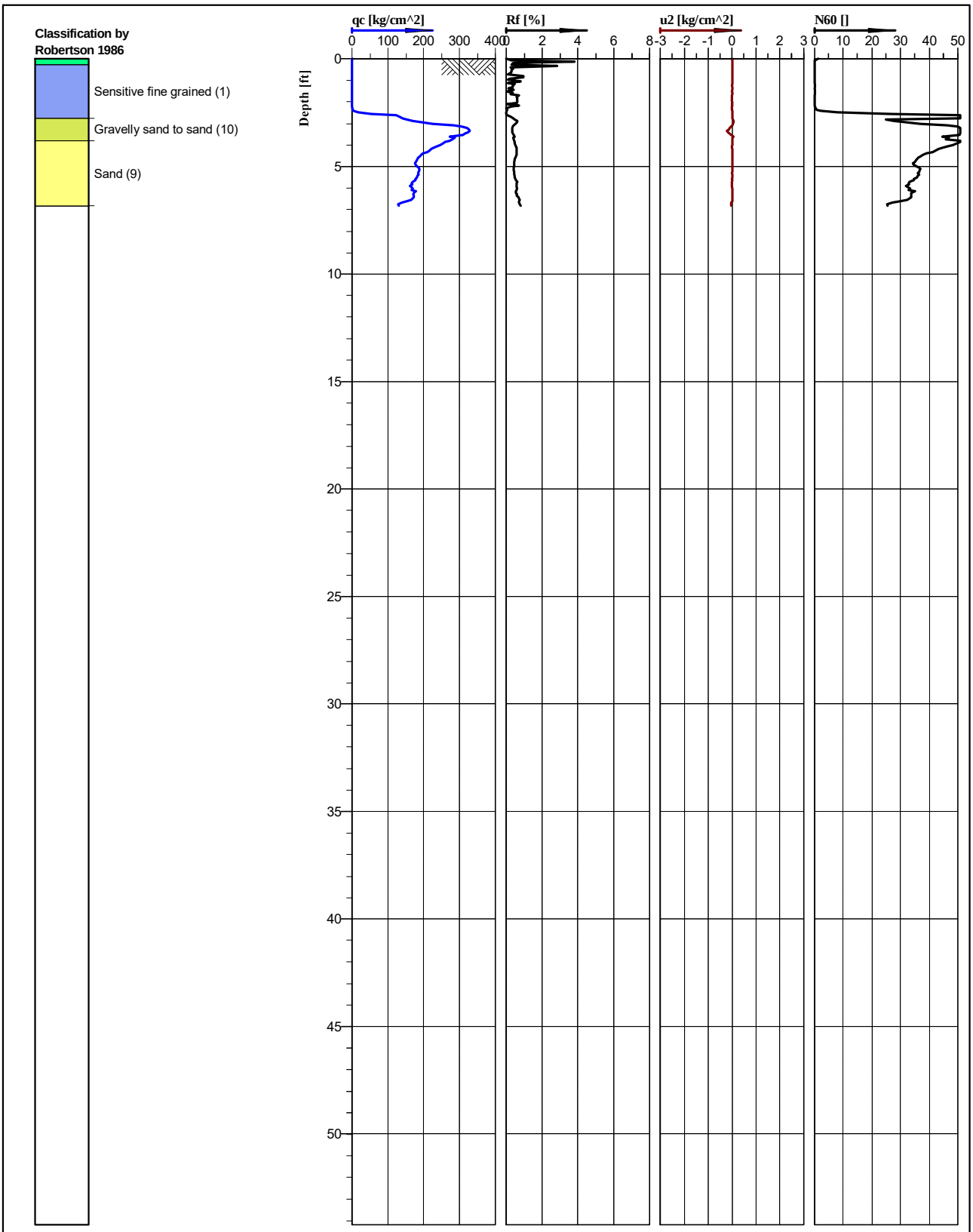
Location: South Apron of Spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/20/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 57 feet.		File: LMDamCPT-2.cpd	

DPS DIRECT PUSH SERVICES, LLC



Location: South Apron of Spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/20/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 57 feet.		File: LMDamCPT-2.cpd	

DPS DIRECT PUSH SERVICES, LLC



Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 7 feet.		File: LMDamCPT-3.cpt	

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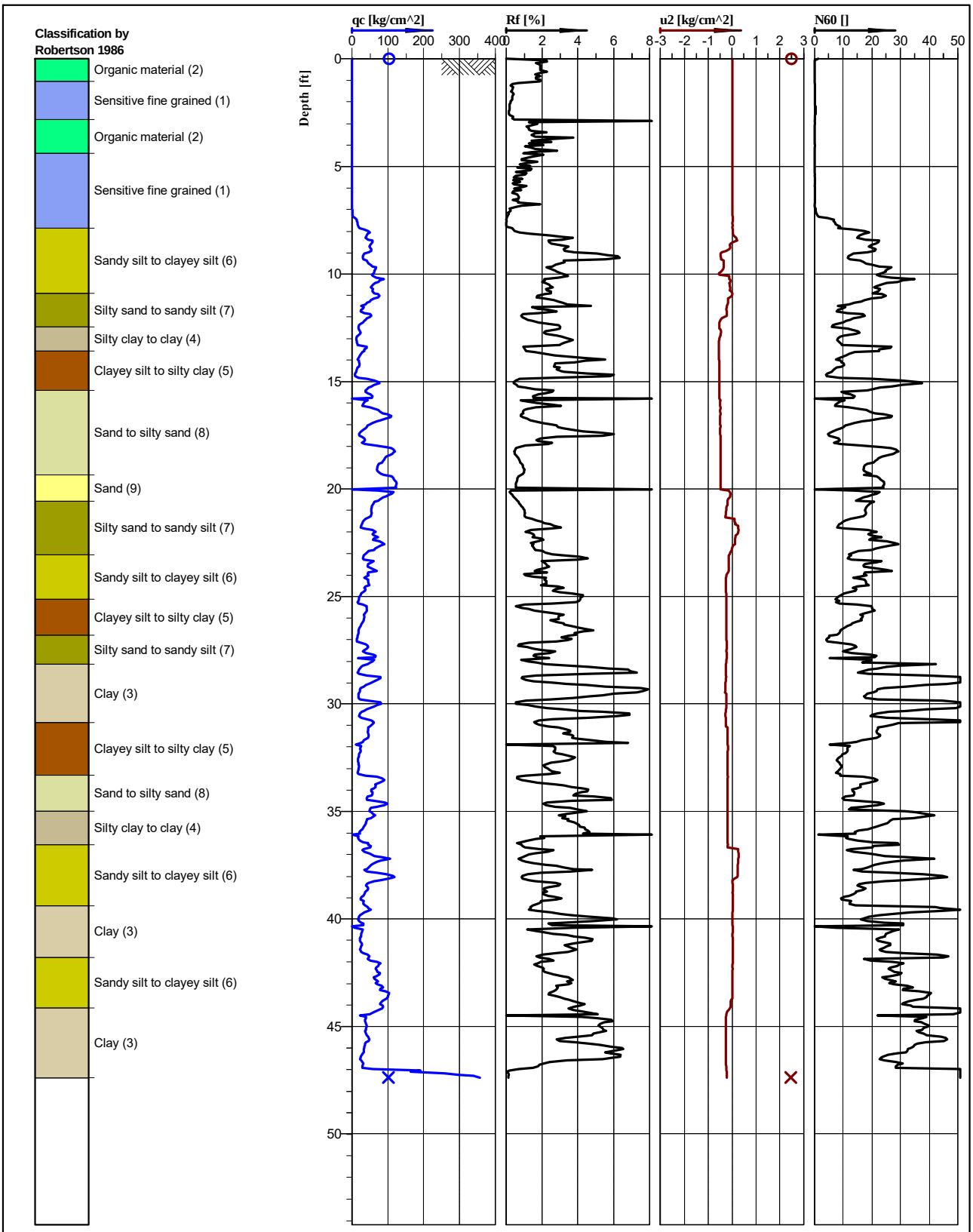

Location: Per CLient's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: B
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 47.5 feet.		File: LMDamCPT-3b.cpt	

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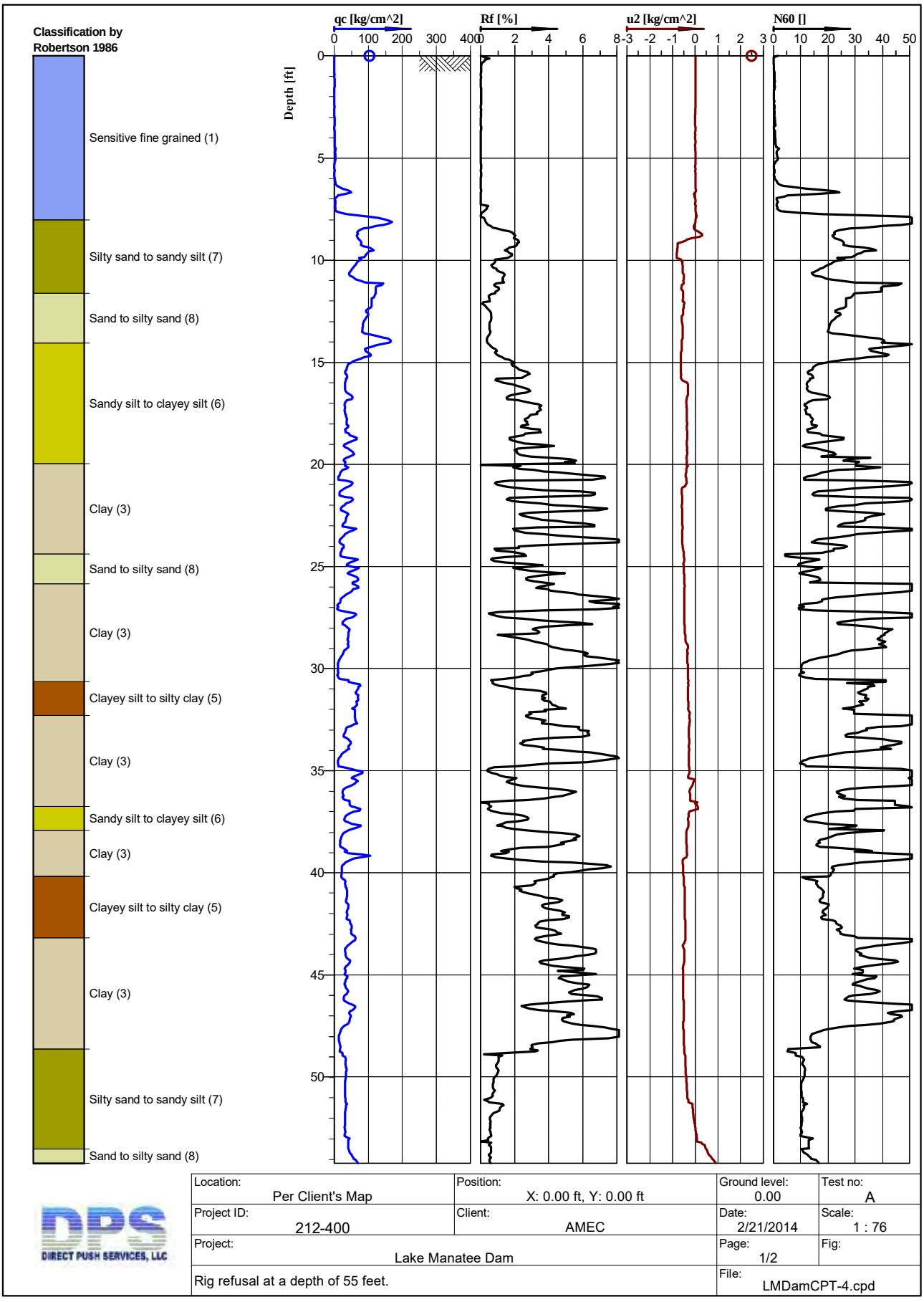
DIRECT PUSH SERVICES, LLC



Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-4.cpd	

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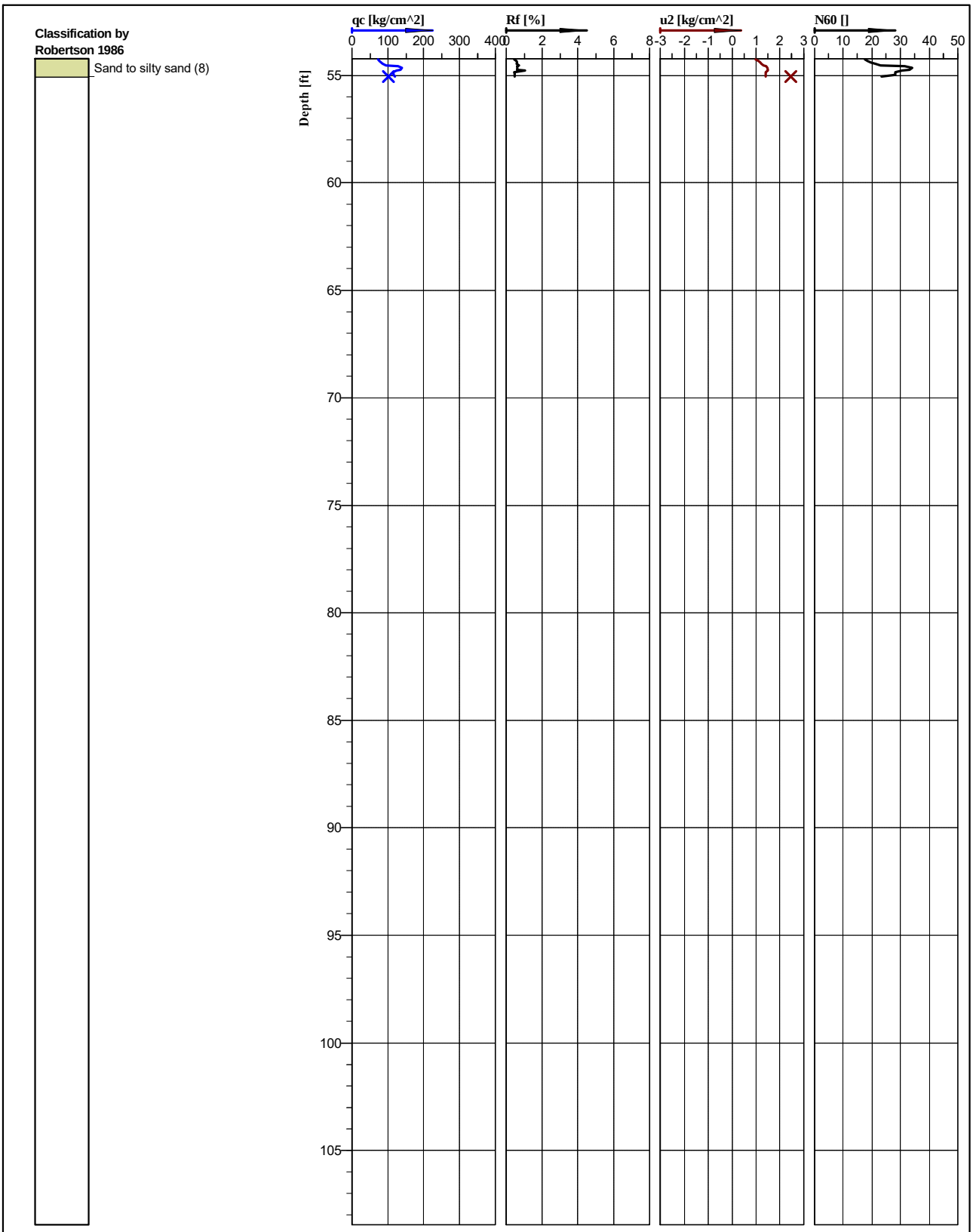

Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-4.cpd	

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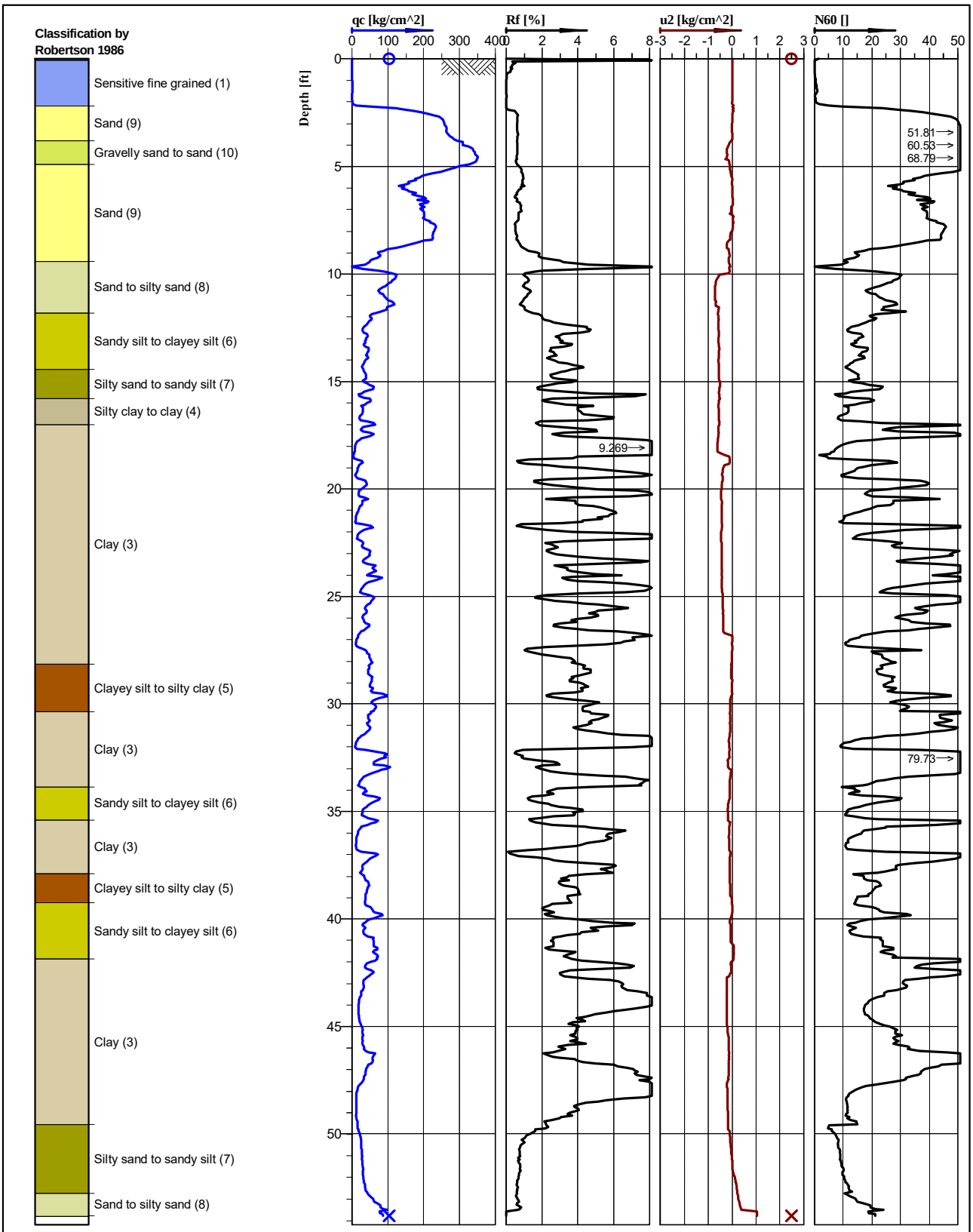

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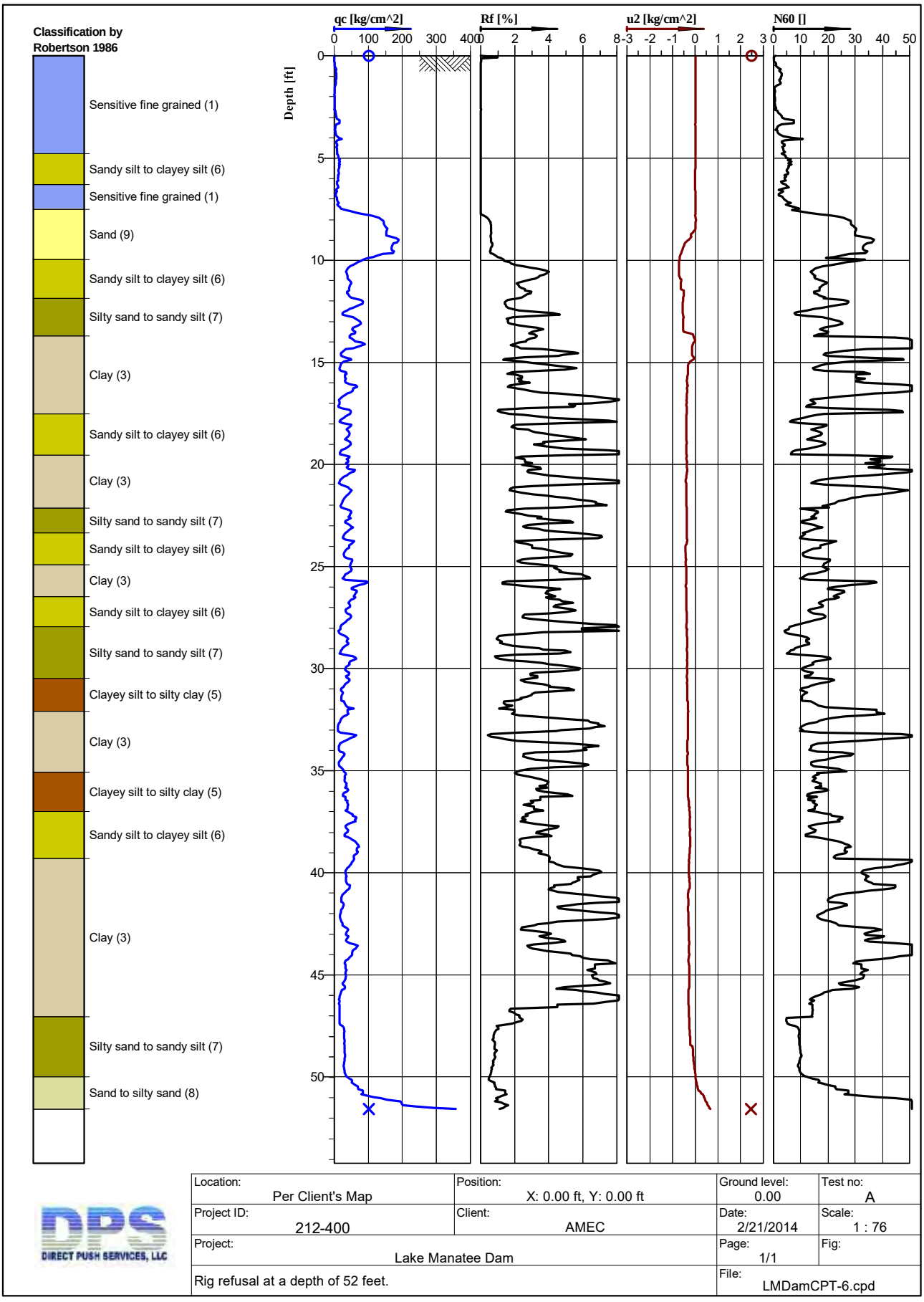
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 54 feet.		File: LMDamCPT-5.cpd	

DPS
DIRECT PUSH SERVICES, LLC



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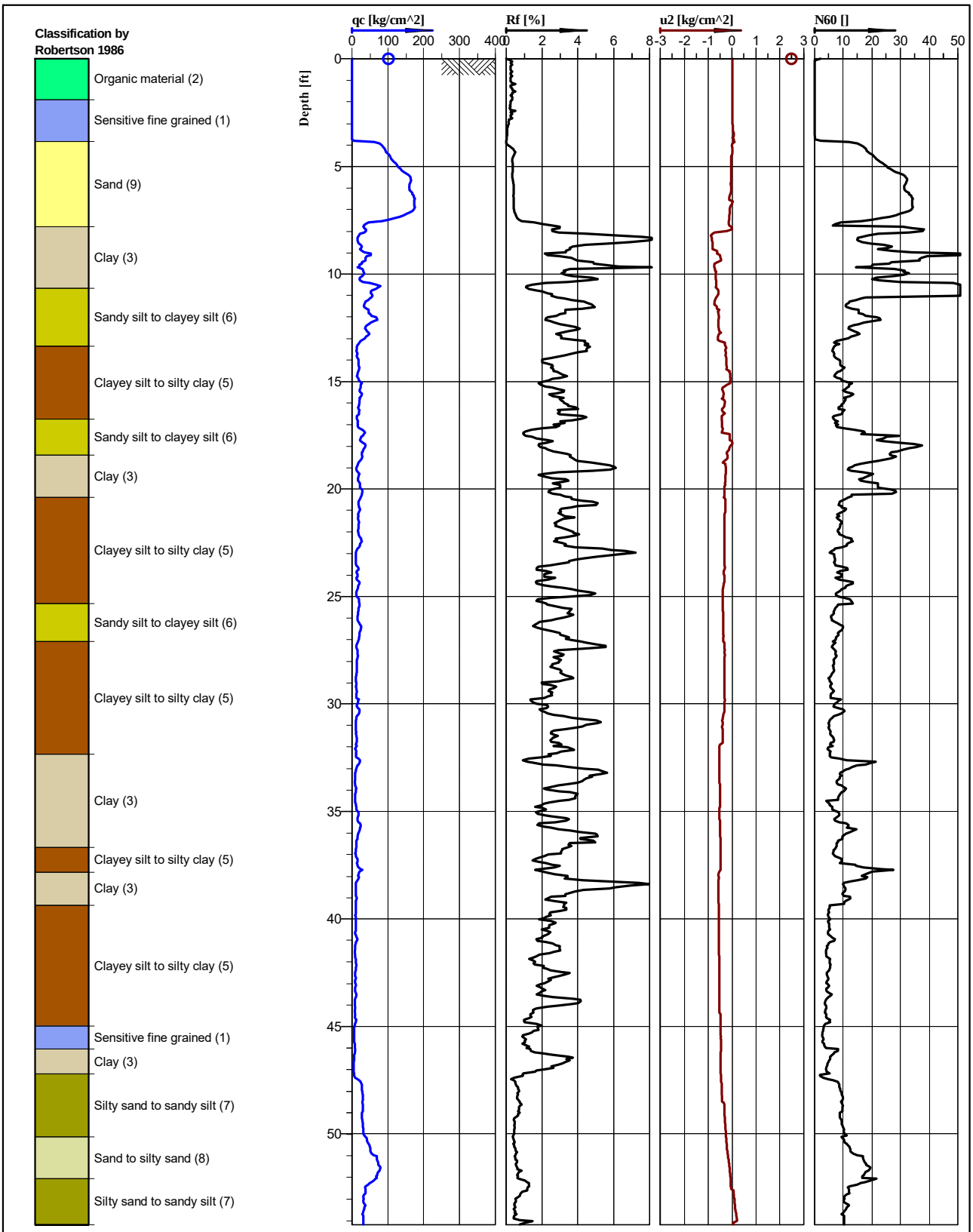
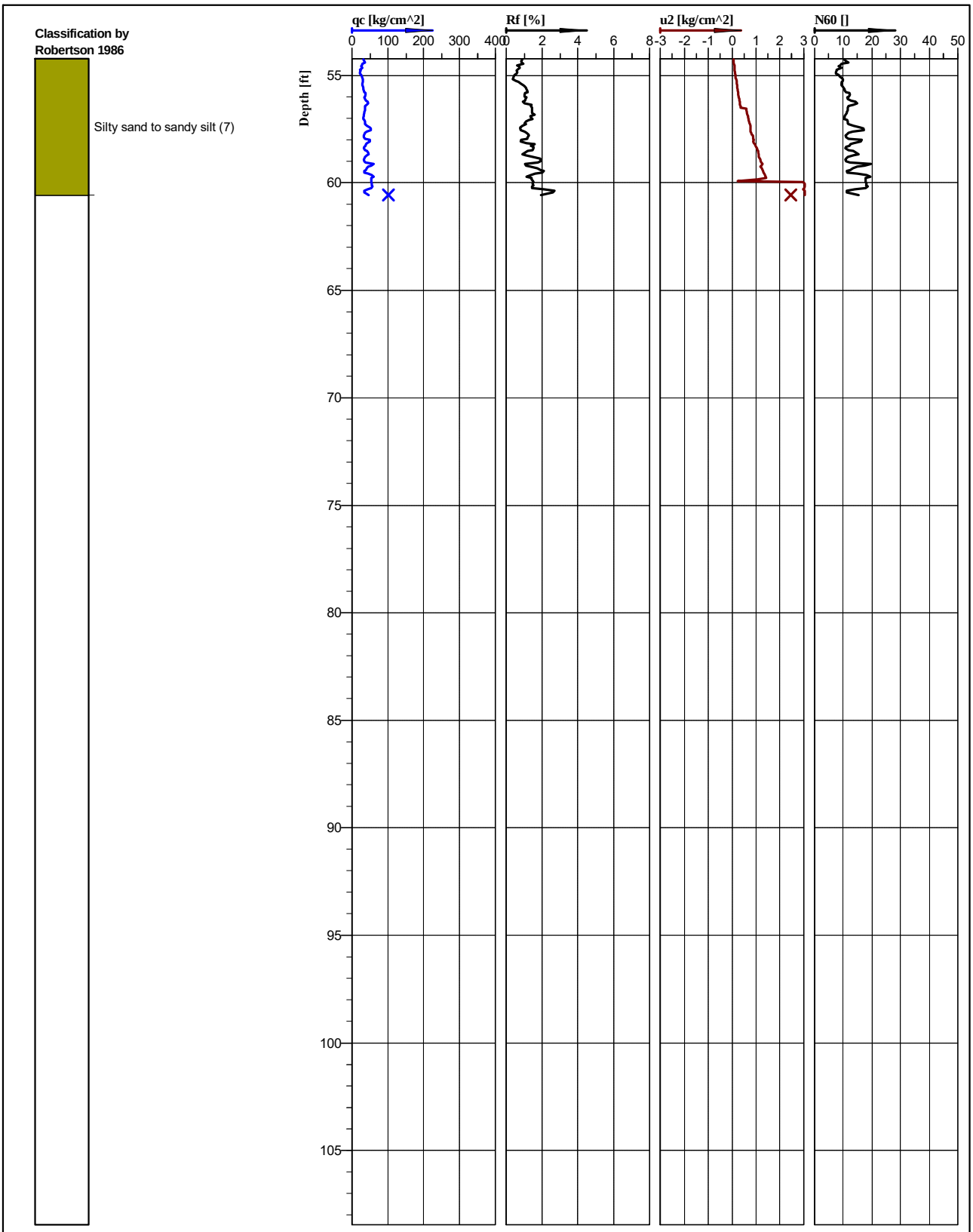
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 52 feet.		File: LMDamCPT-6.cpd	

DPS DIRECT PUSH SERVICES, LLC



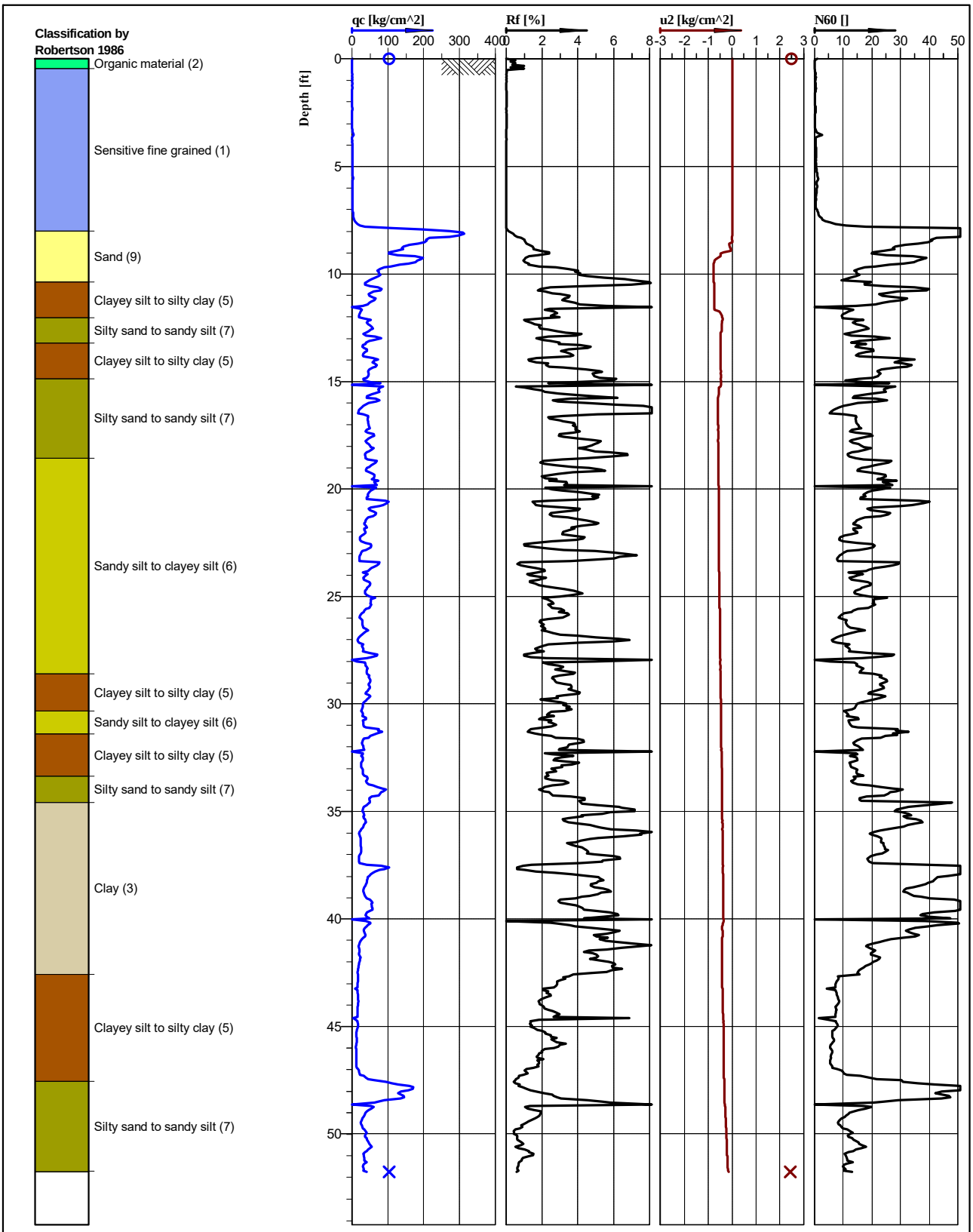
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/22/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 60 feet. Pre-bored to 4 feet.		File: LMDamCPT-7.cpd	

DPS DIRECT PUSH SERVICES, LLC



Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/22/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 60 feet. Pre-bored to 4 feet.		File: LMDamCPT-7.cpd	

DPS
DIRECT PUSH SERVICES, LLC



Location: 600 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 52 feet. Bored to 7.5 feet.		File: LMDamCPT-8.cpd	

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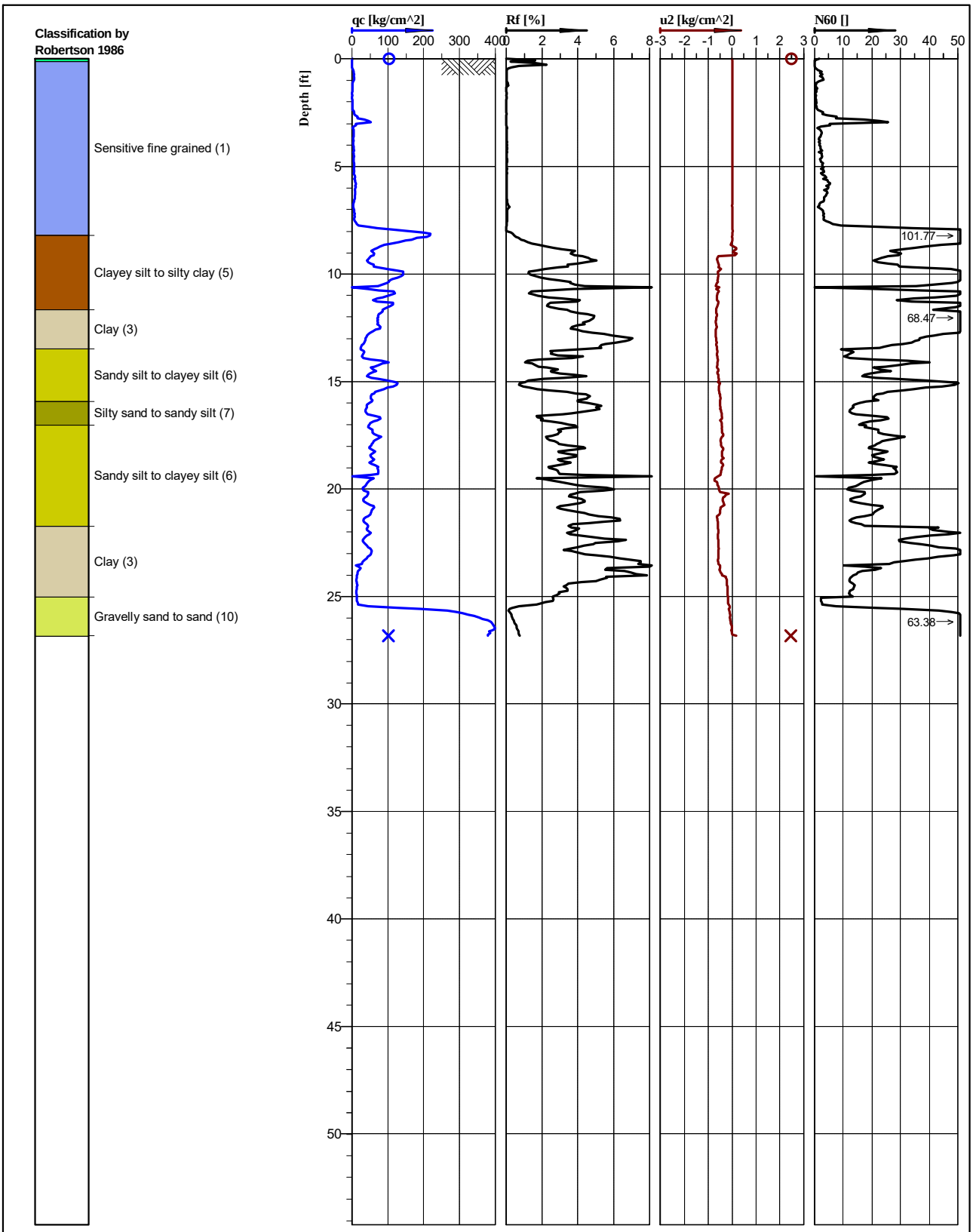
DIRECT PUSH SERVICES, LLC



Location: 900 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 26 feet. Bored to 7.5 feet.		File: LMDamCPT-9.cpt	

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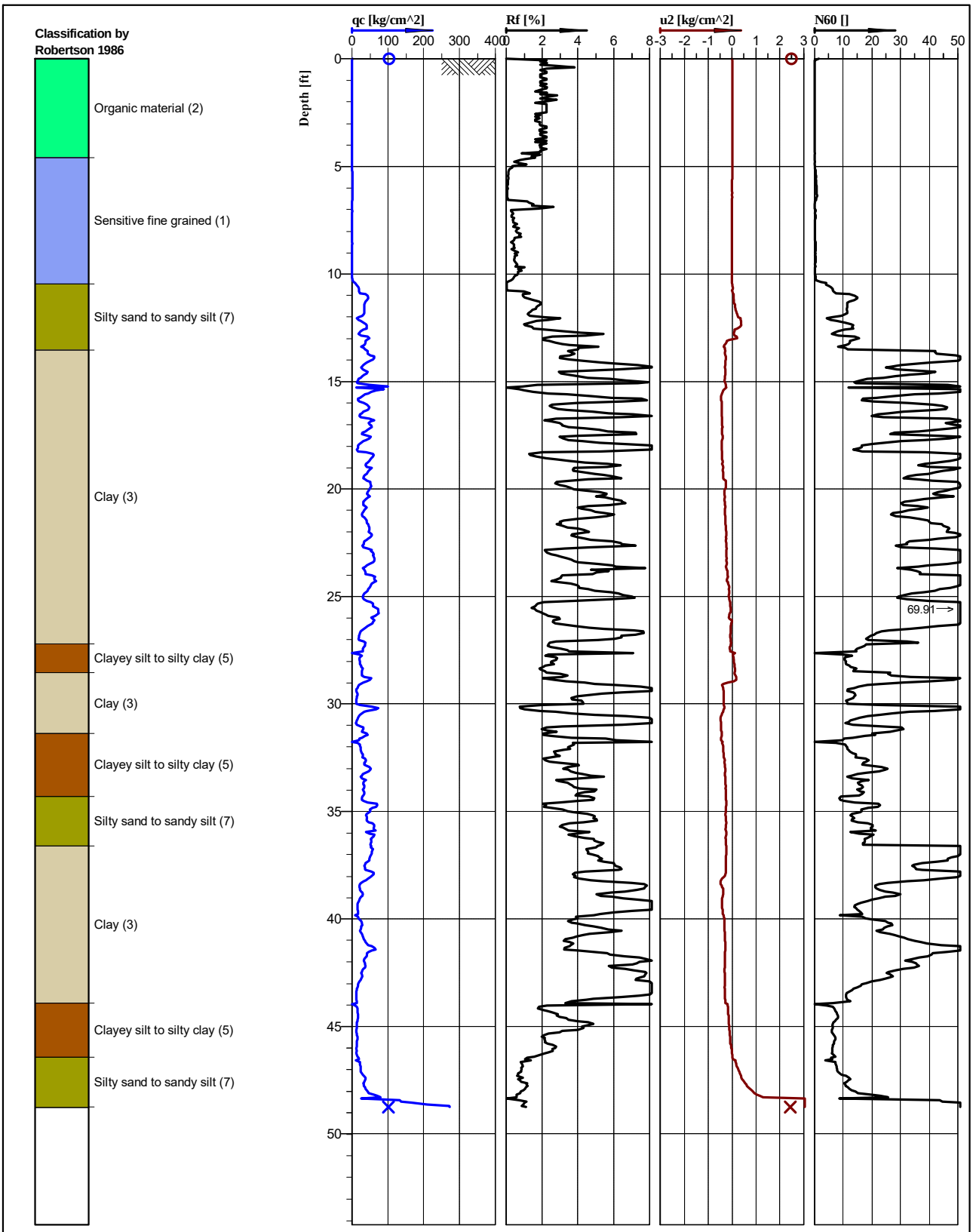
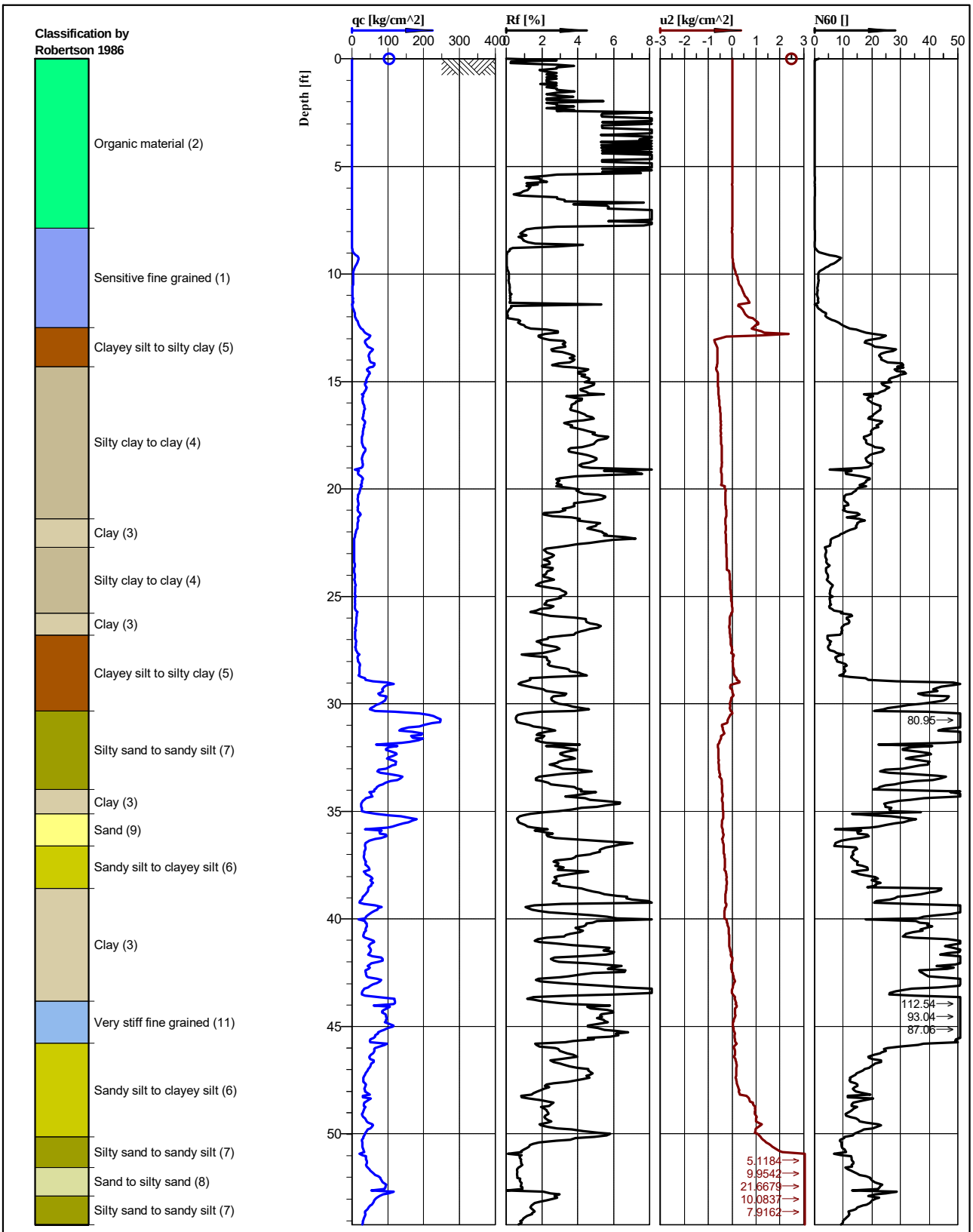
DIRECT PUSH SERVICES, LLC



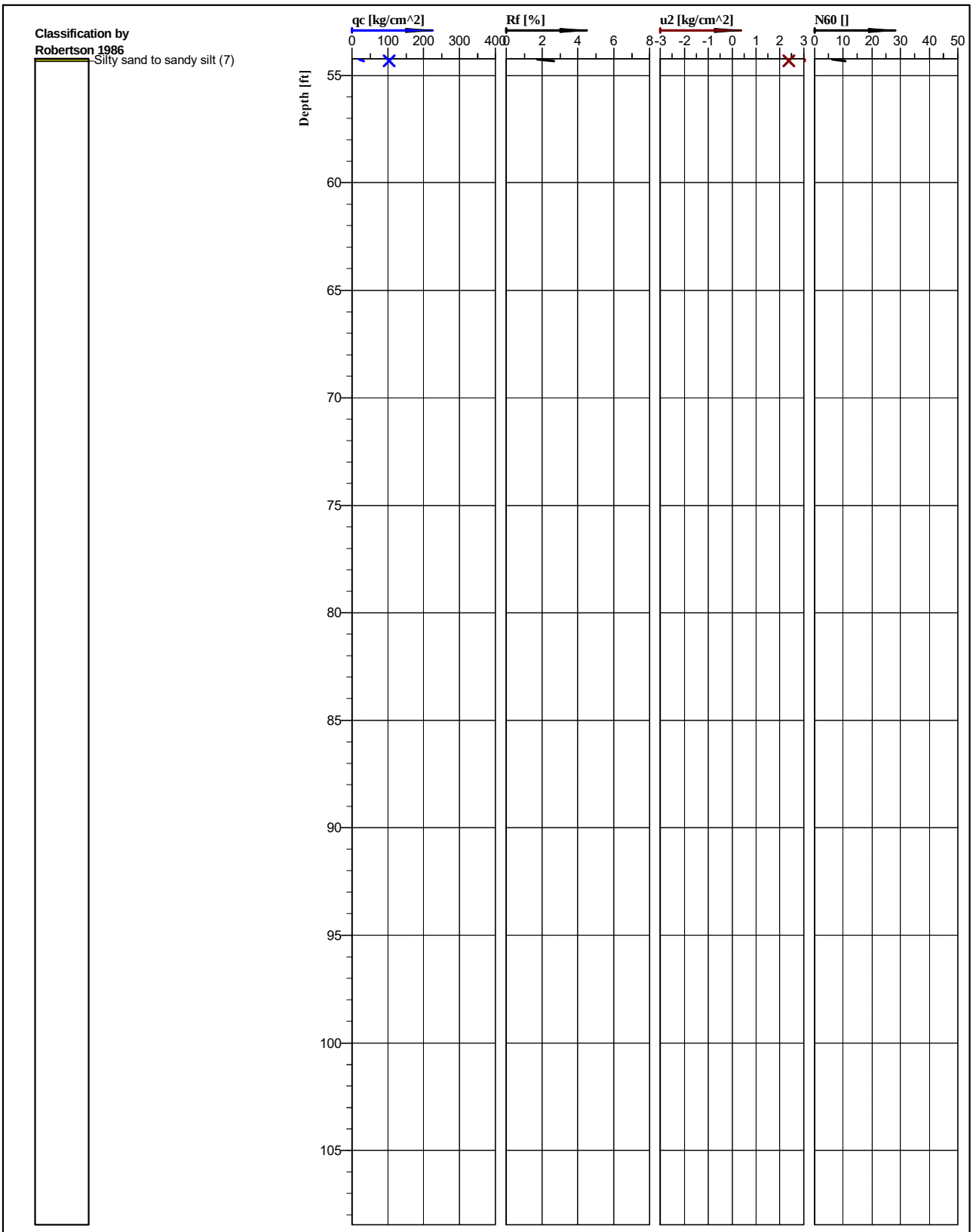
Location: 500 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 49 feet. Bored to 11 feet.		File: LMDamCPT-10.cpt	

DPS DIRECT PUSH SERVICES, LLC



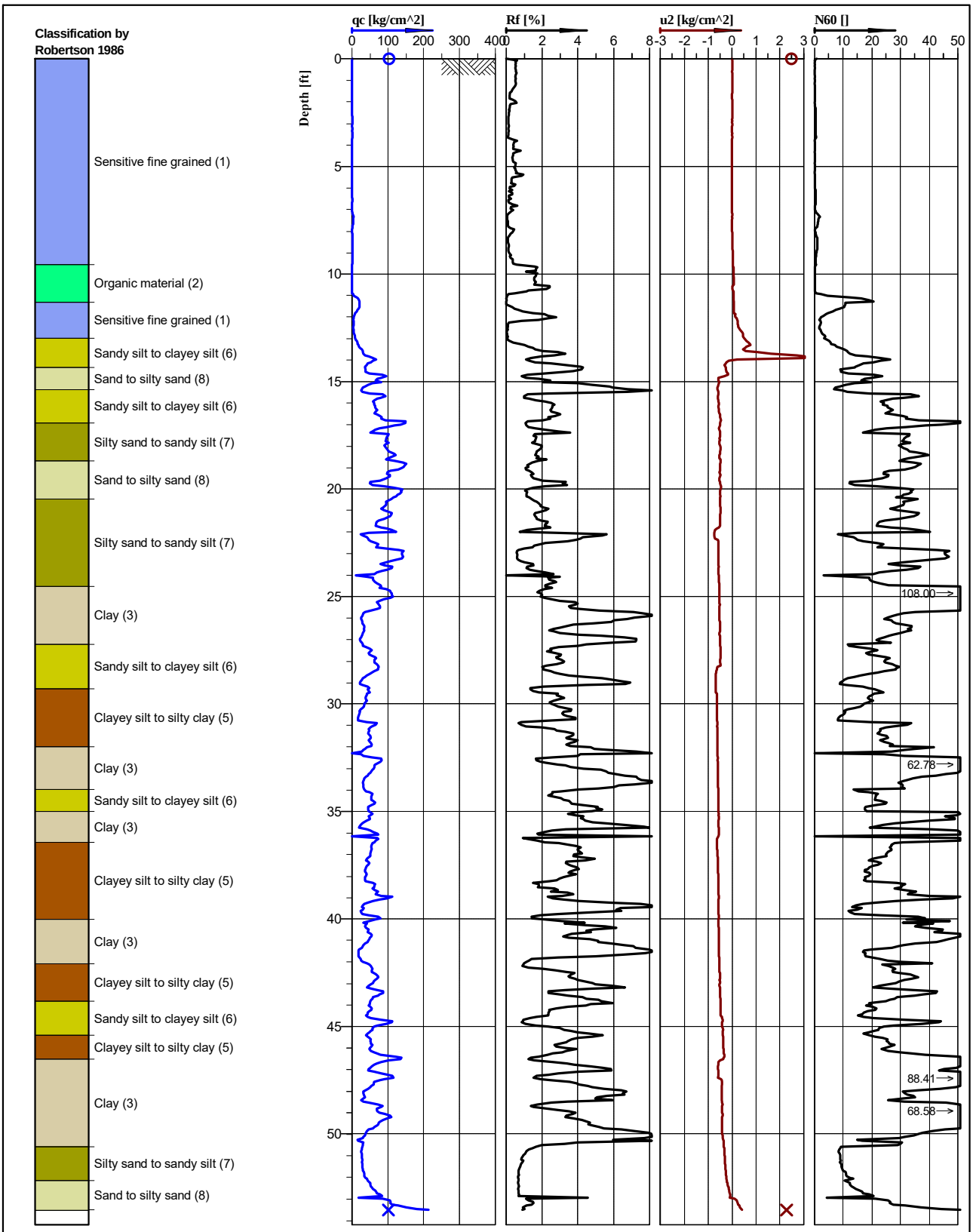
Location: 200 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 54 feet. Bored to 12 feet.		File: LMDamCPT-11.cpt	

DPS DIRECT PUSH SERVICES, LLC



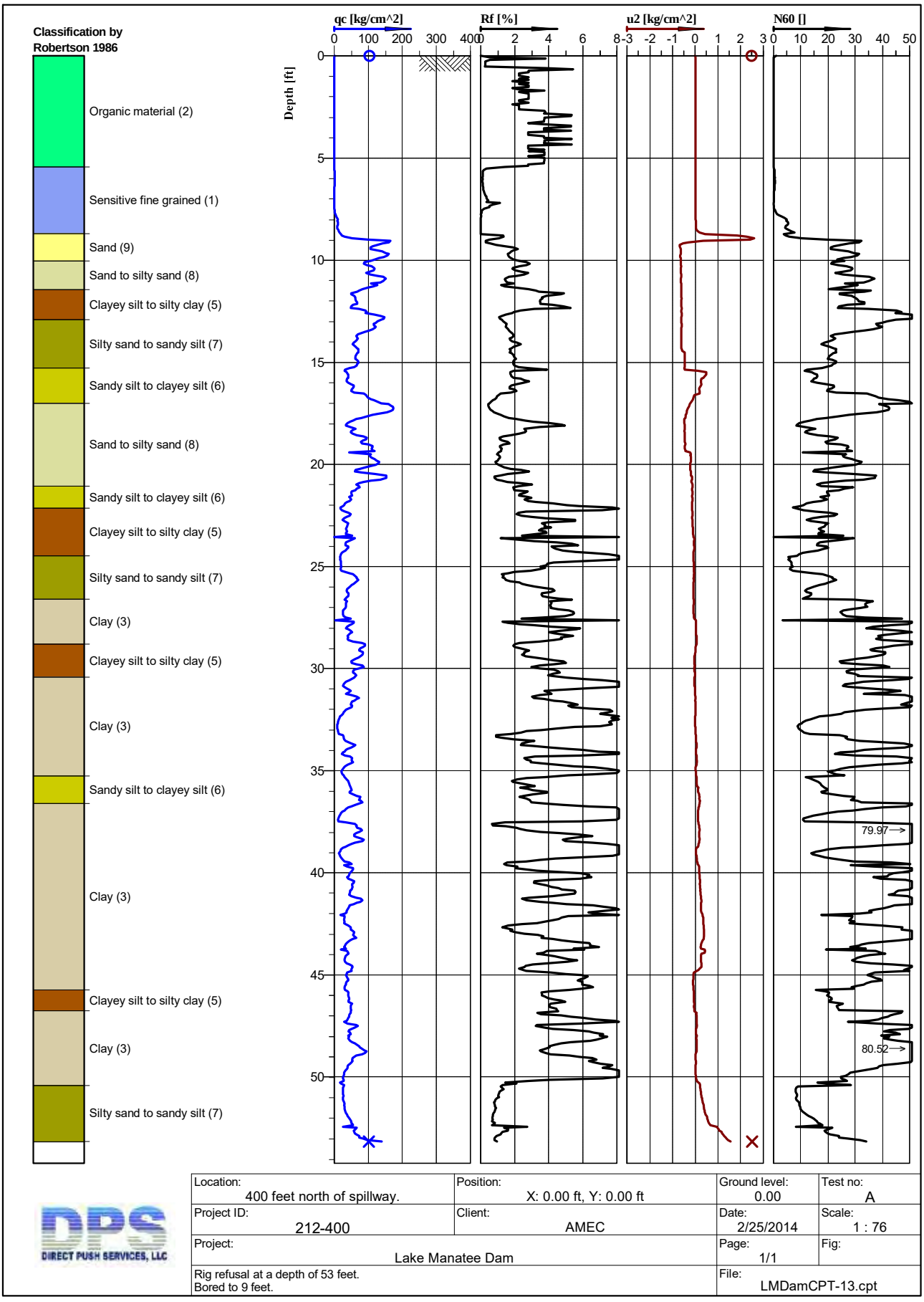
Location: 200 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 54 feet. Bored to 12 feet.		File: LMDamCPT-11.cpt	

DPS DIRECT PUSH SERVICES, LLC



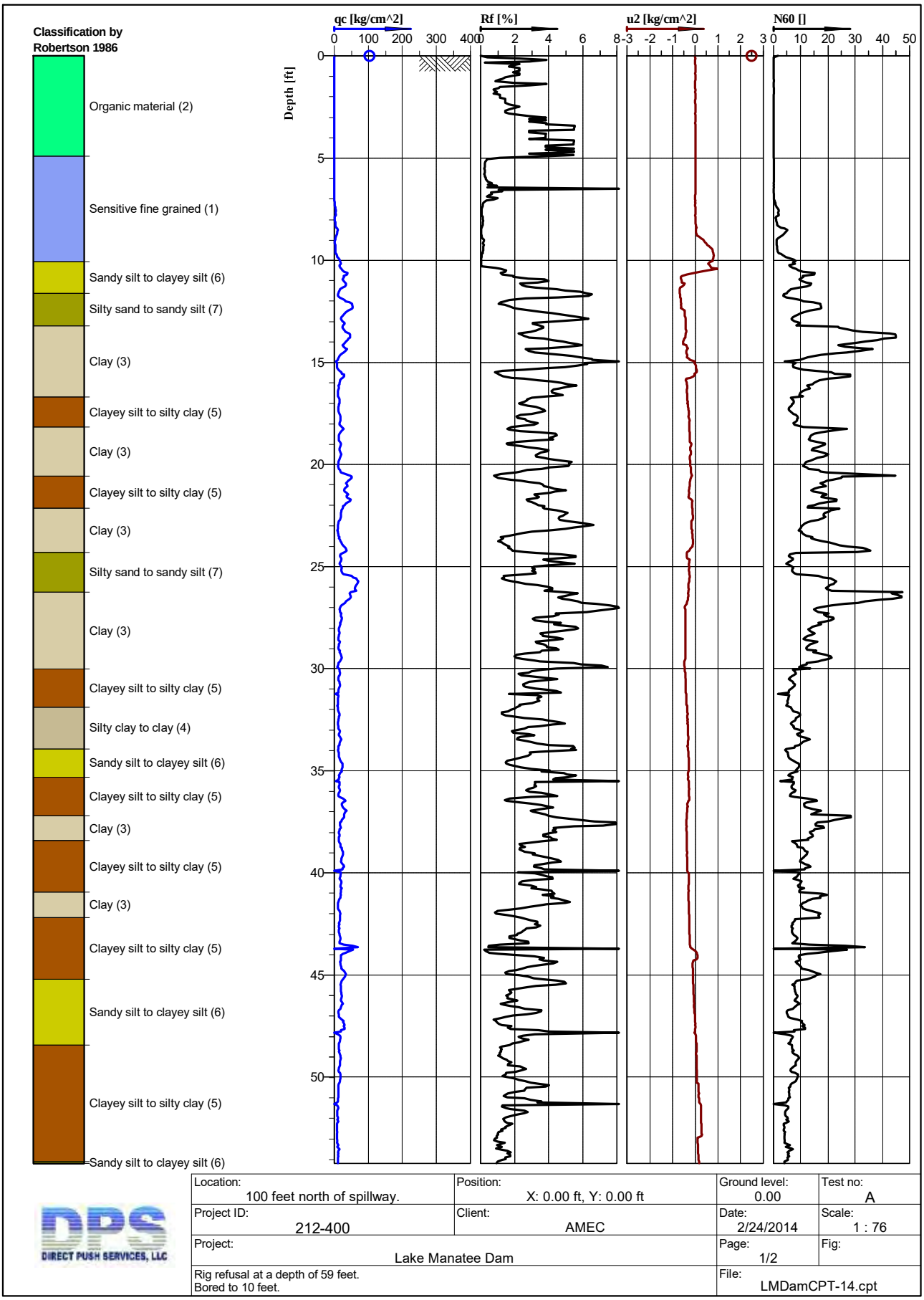
Location: 300 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 54 feet. Bored to 12 feet.		File: LMDamCPT-12.cpt	

DPS DIRECT PUSH SERVICES, LLC



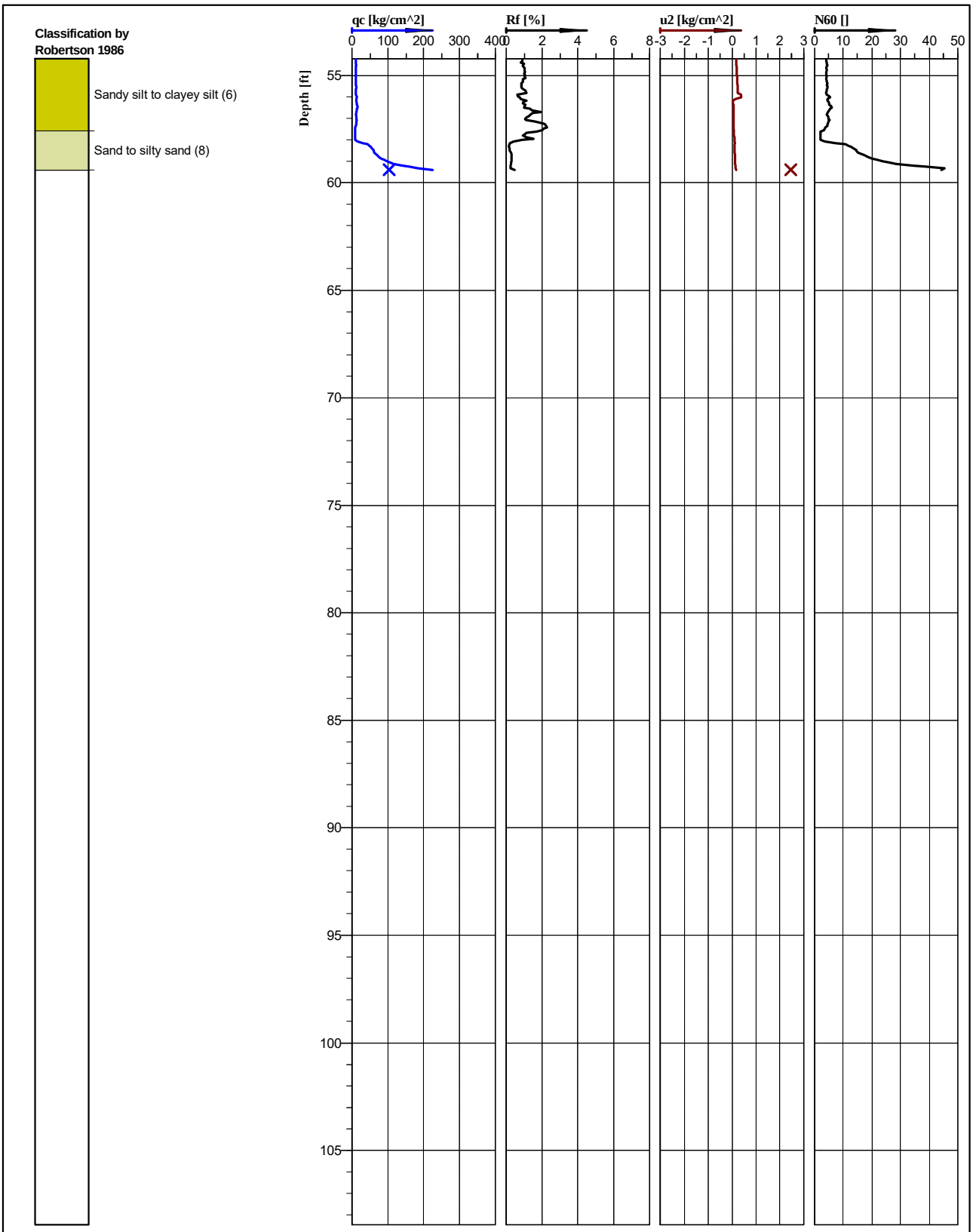
Location: 400 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 53 feet. Bored to 9 feet.		File: LMDamCPT-13.cpt	

DPS DIRECT PUSH SERVICES, LLC



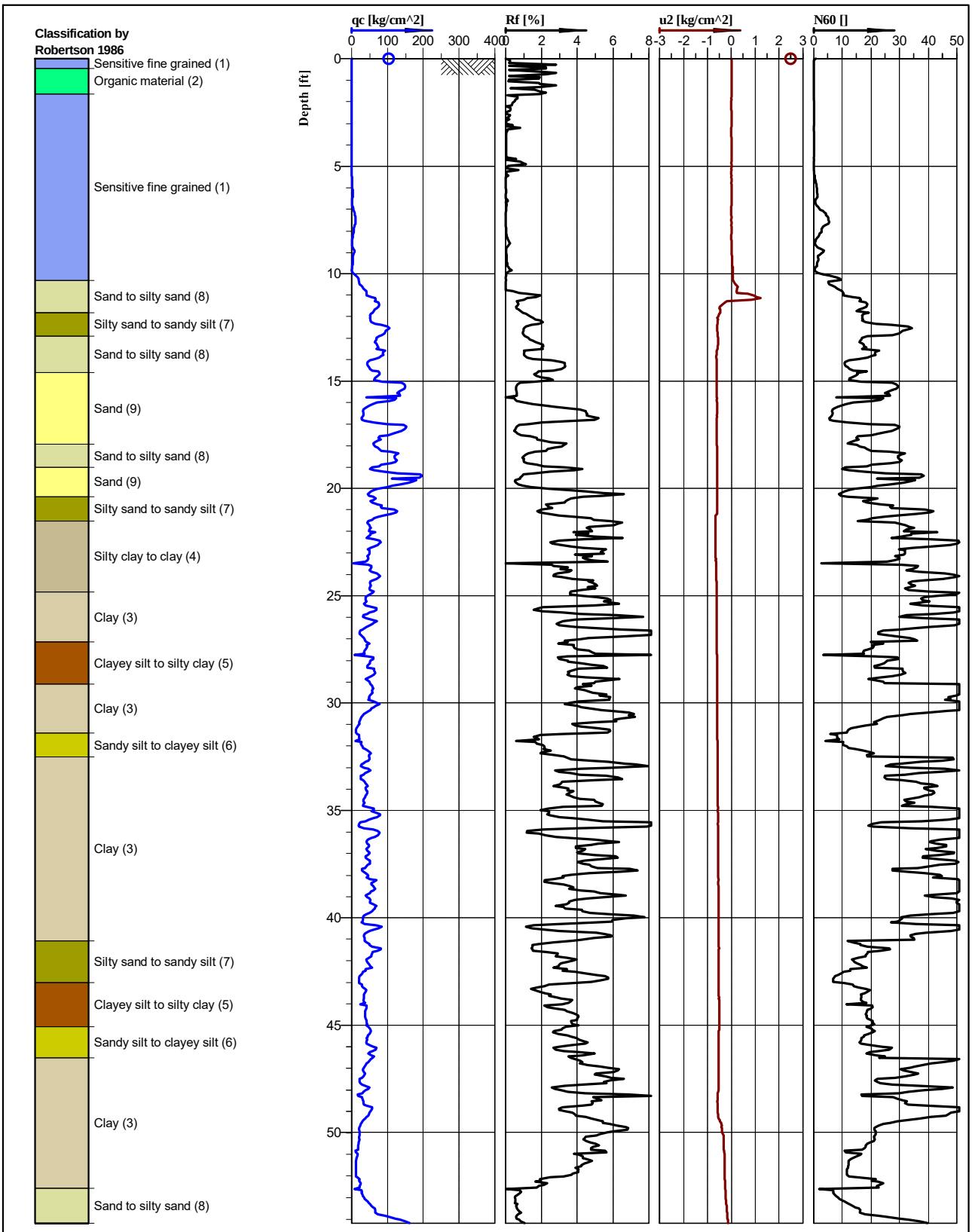
Location: 100 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 59 feet. Bored to 10 feet.		File: LMDamCPT-14.cpt	

DPS DIRECT PUSH SERVICES, LLC



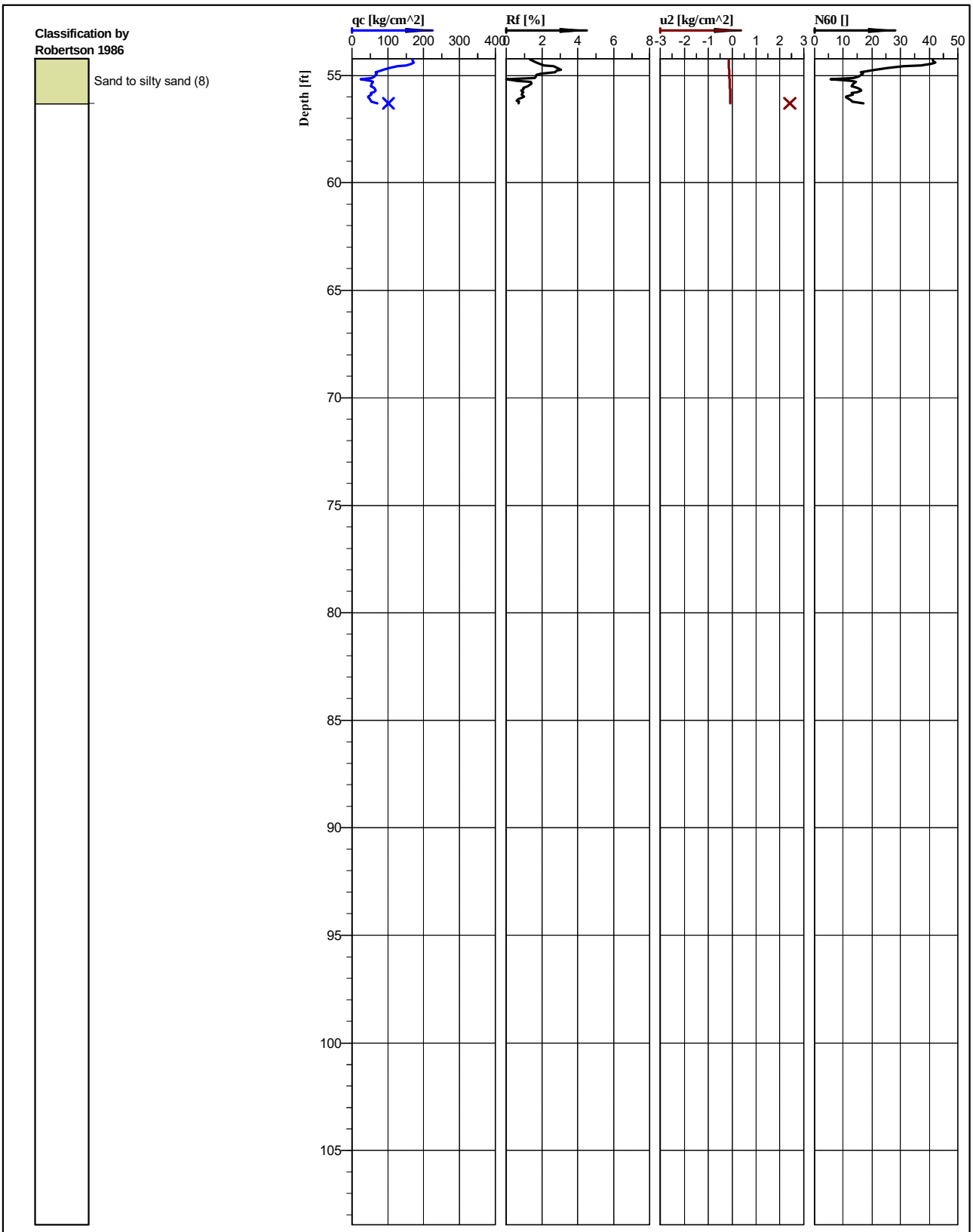
Location: 100 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 59 feet. Bored to 10 feet.		File: LMDamCPT-14.cpt	

DPS
DIRECT PUSH SERVICES, LLC



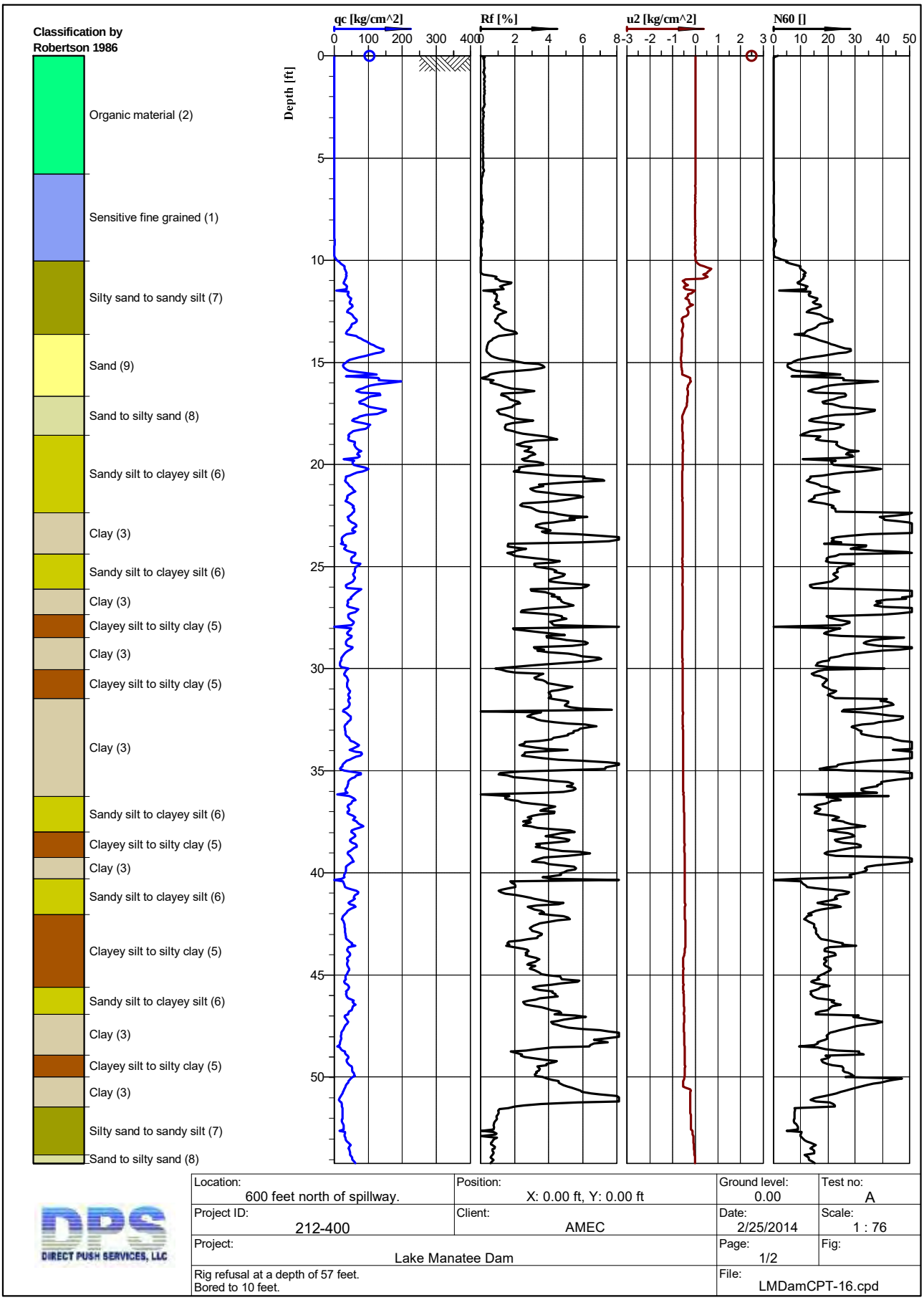
Location: 500 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 56 feet. Bored to 10 feet.		File: LMDamCPT-15.cpt	

DPS DIRECT PUSH SERVICES, LLC



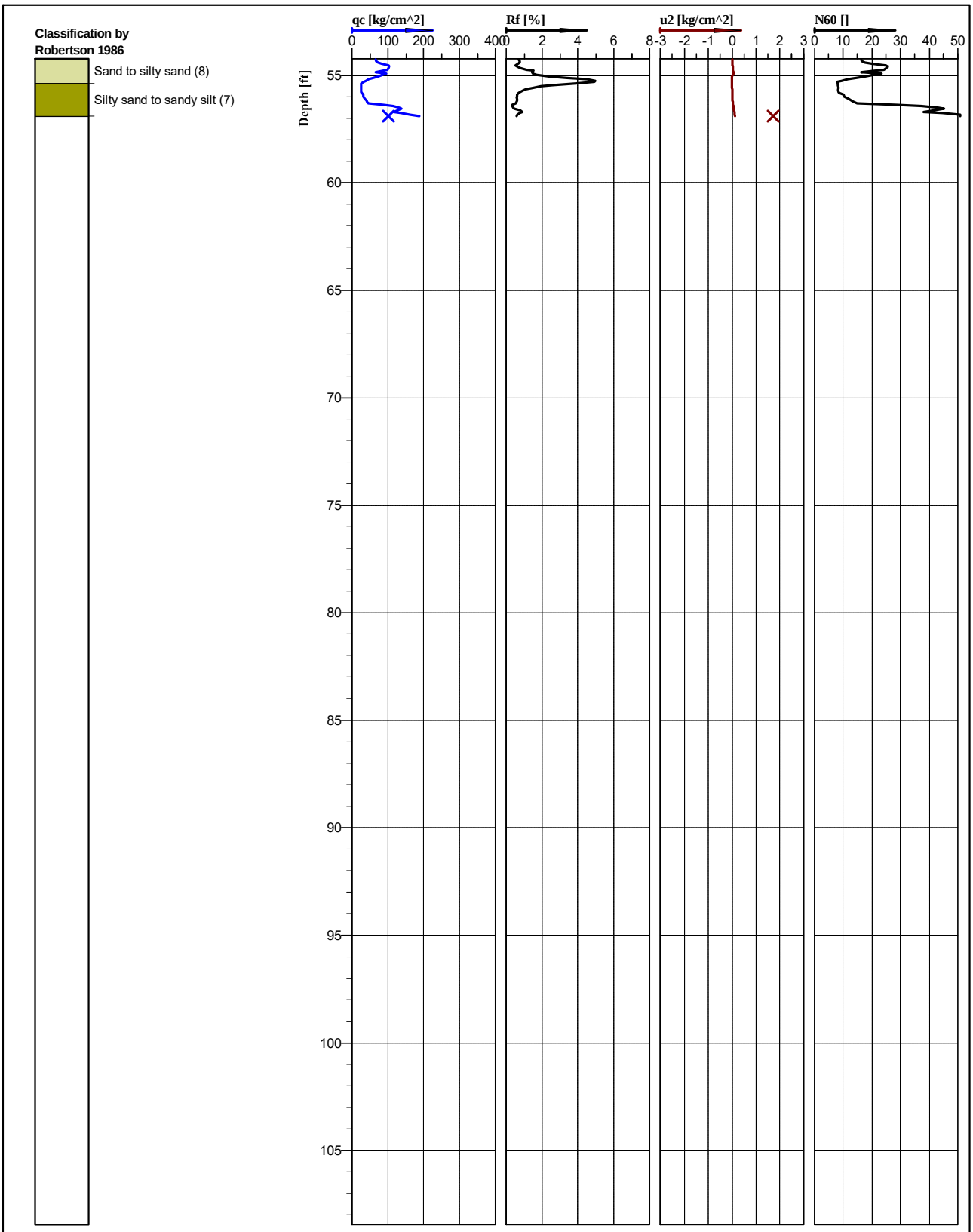
Location: 500 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 56 feet. Bored to 10 feet.		File: LMDamCPT-15.cpt	

DPS DIRECT PUSH SERVICES, LLC



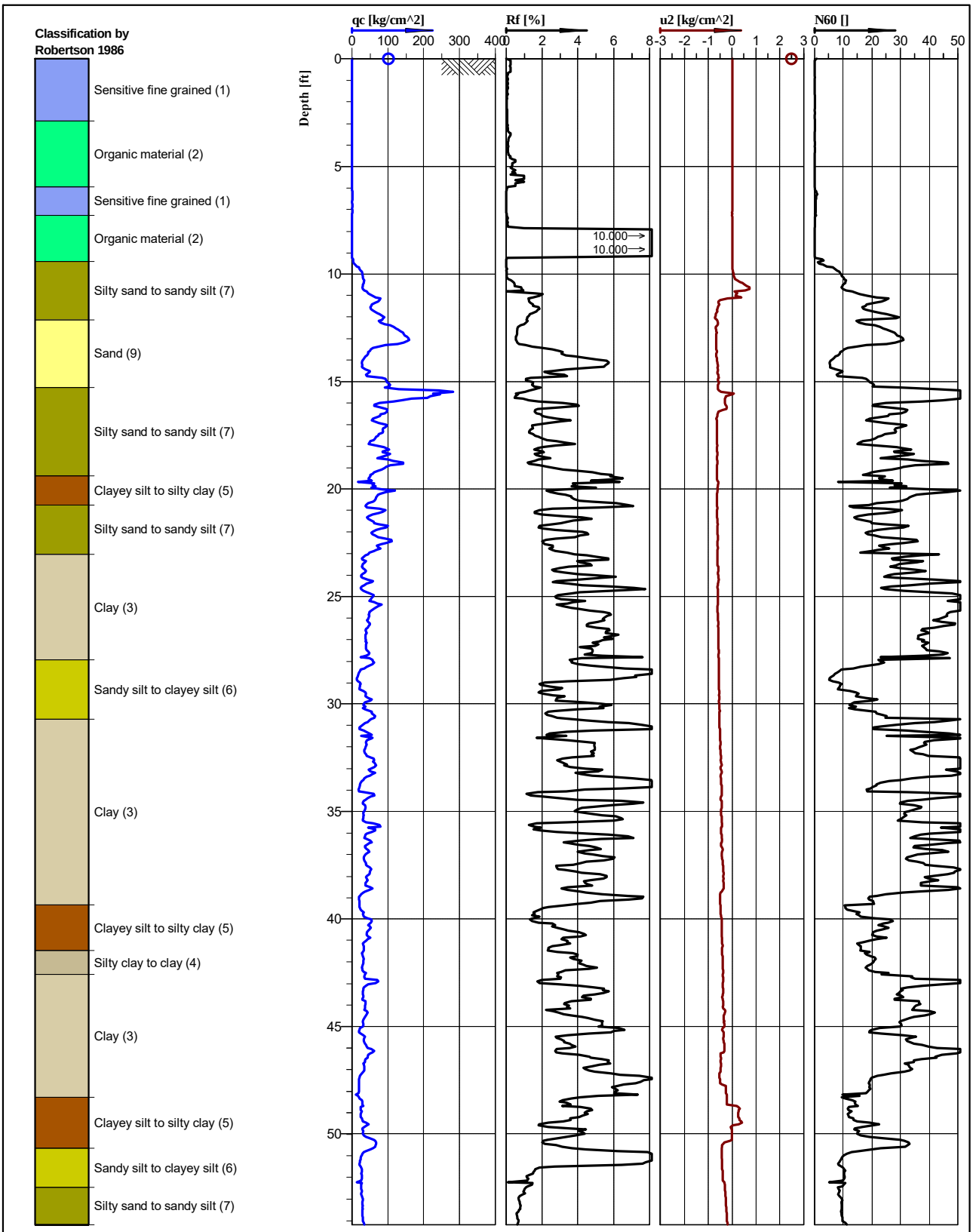
Location: 600 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 57 feet. Bored to 10 feet.		File: LMDamCPT-16.cpd	

DPS
DIRECT PUSH SERVICES, LLC



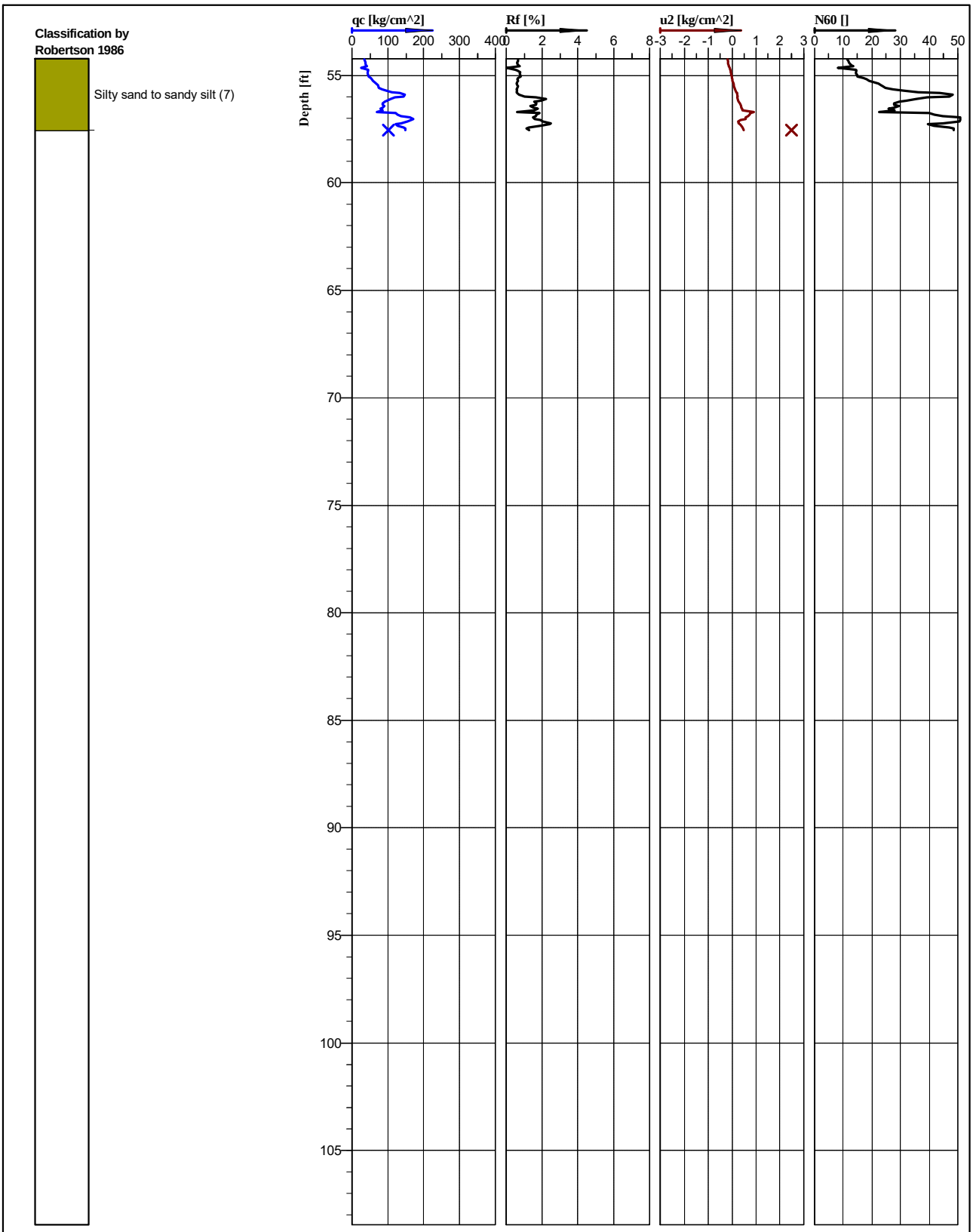
Location: 600 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 57 feet. Bored to 10 feet.		File: LMDamCPT-16.cpd	

DPS DIRECT PUSH SERVICES, LLC



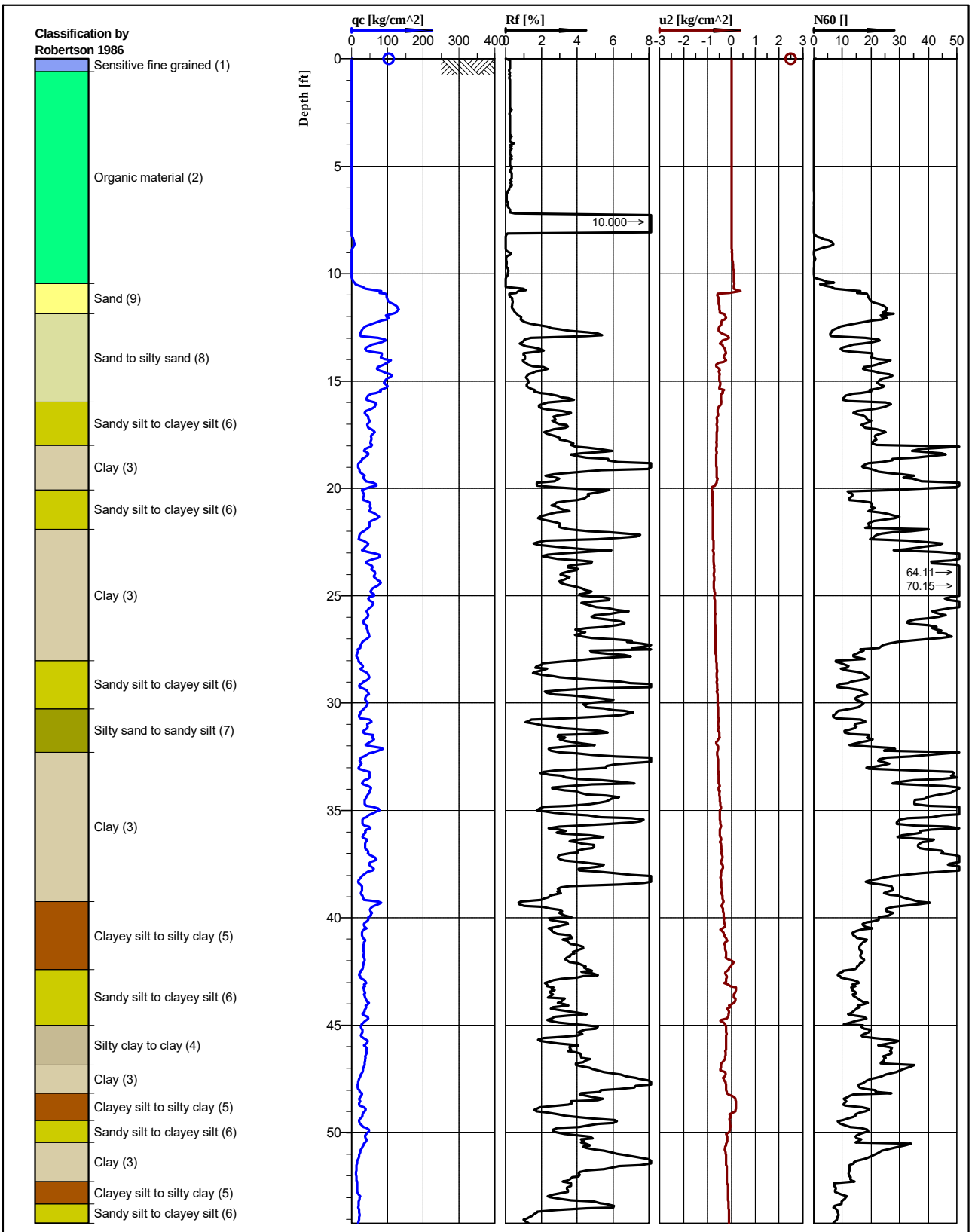
Location: 700 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 57.5 feet. Bored to 10 feet.		File: LMDamCPT-17.cpd	

DPS
DIRECT PUSH SERVICES, LLC



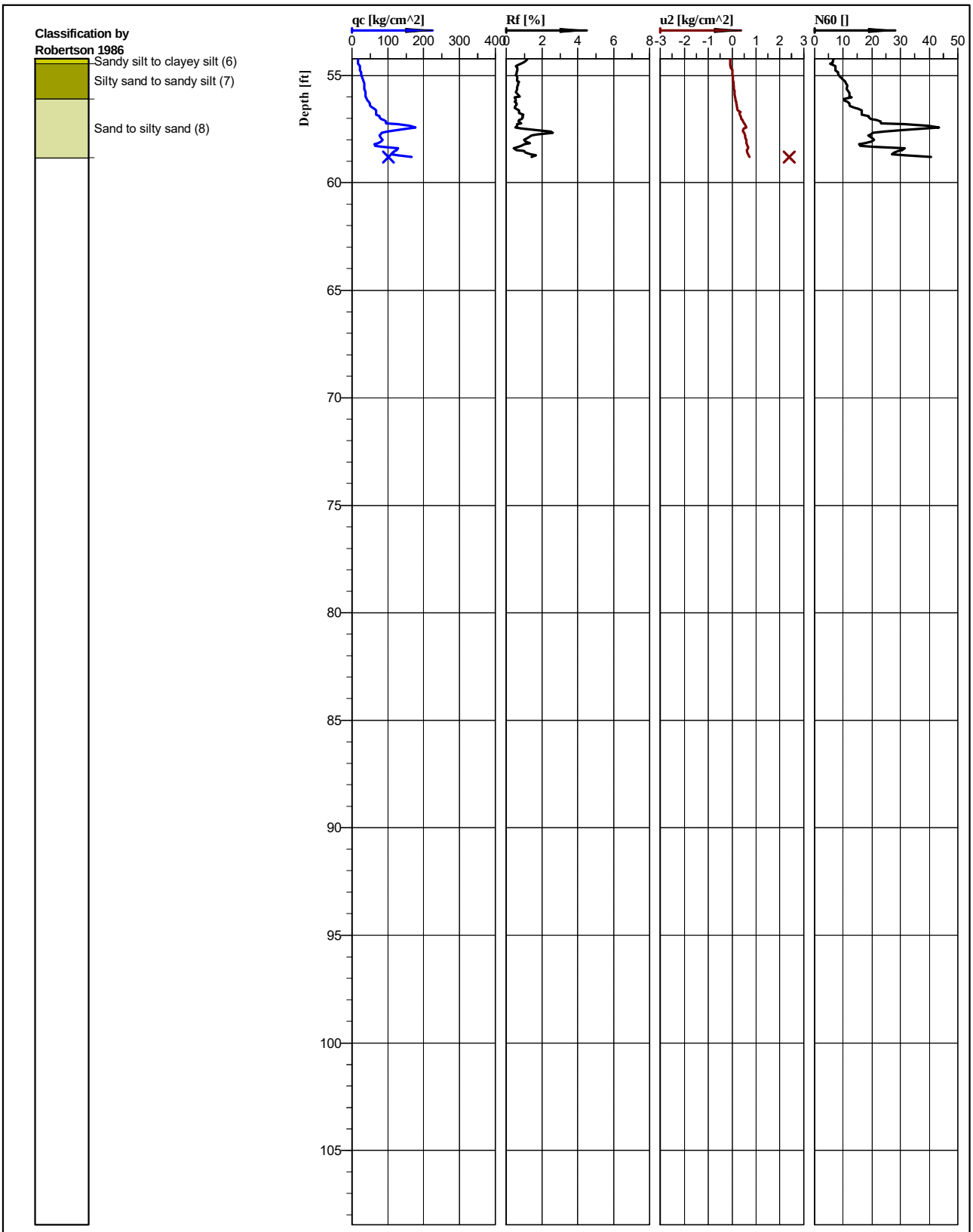
Location: 700 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 57.5 feet. Bored to 10 feet.		File: LMDamCPT-17.cpd	

DPS
DIRECT PUSH SERVICES, LLC



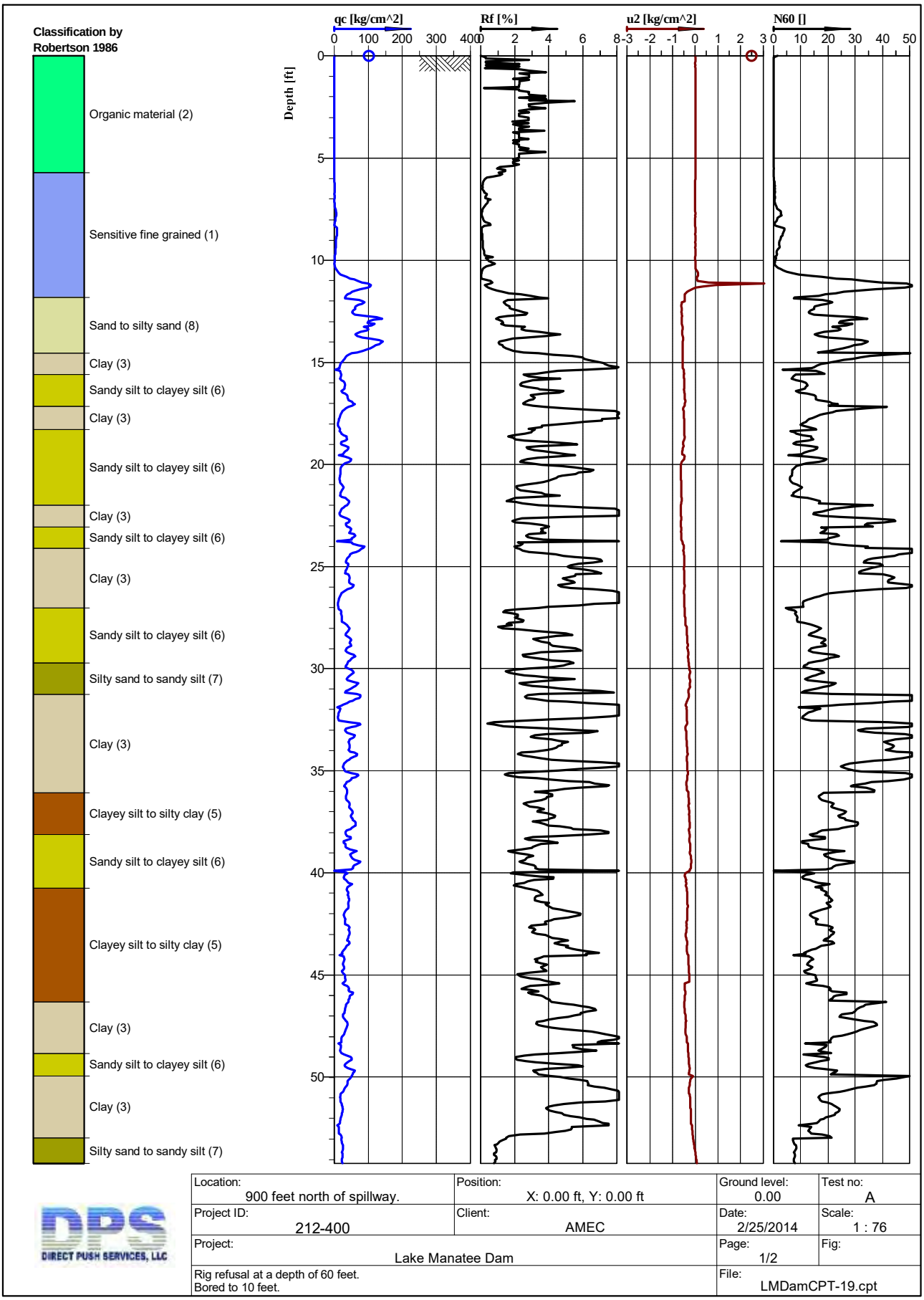
Location: 800 feet north of spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 59 feet. Bored to 10 feet.		File: LMDamCPT-18.cpd	

DPS
DIRECT PUSH SERVICES, LLC



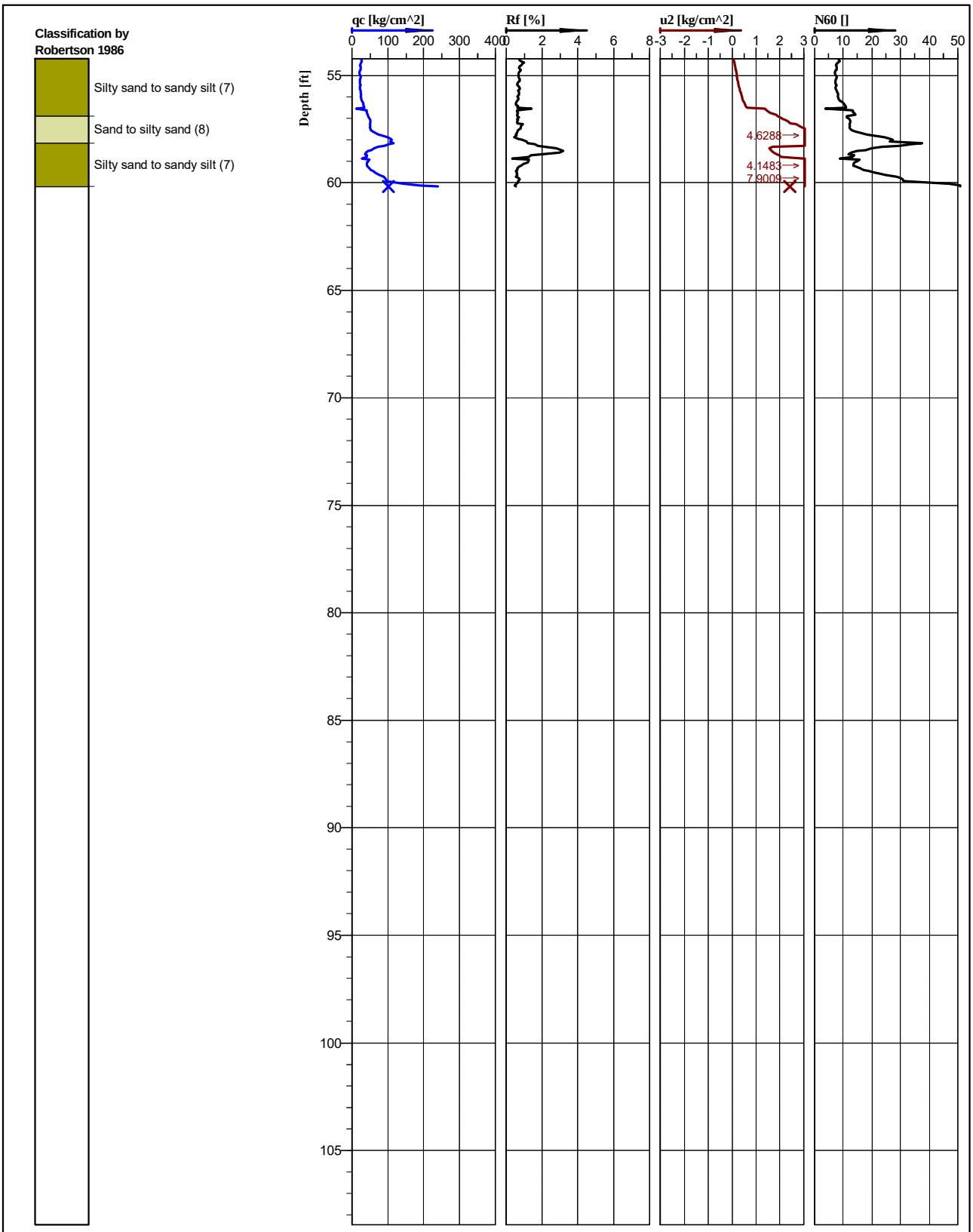
Location: 800 feet north of spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 59 feet. Bored to 10 feet.		File: LMDamCPT-18.cpd	

DPS DIRECT PUSH SERVICES, LLC



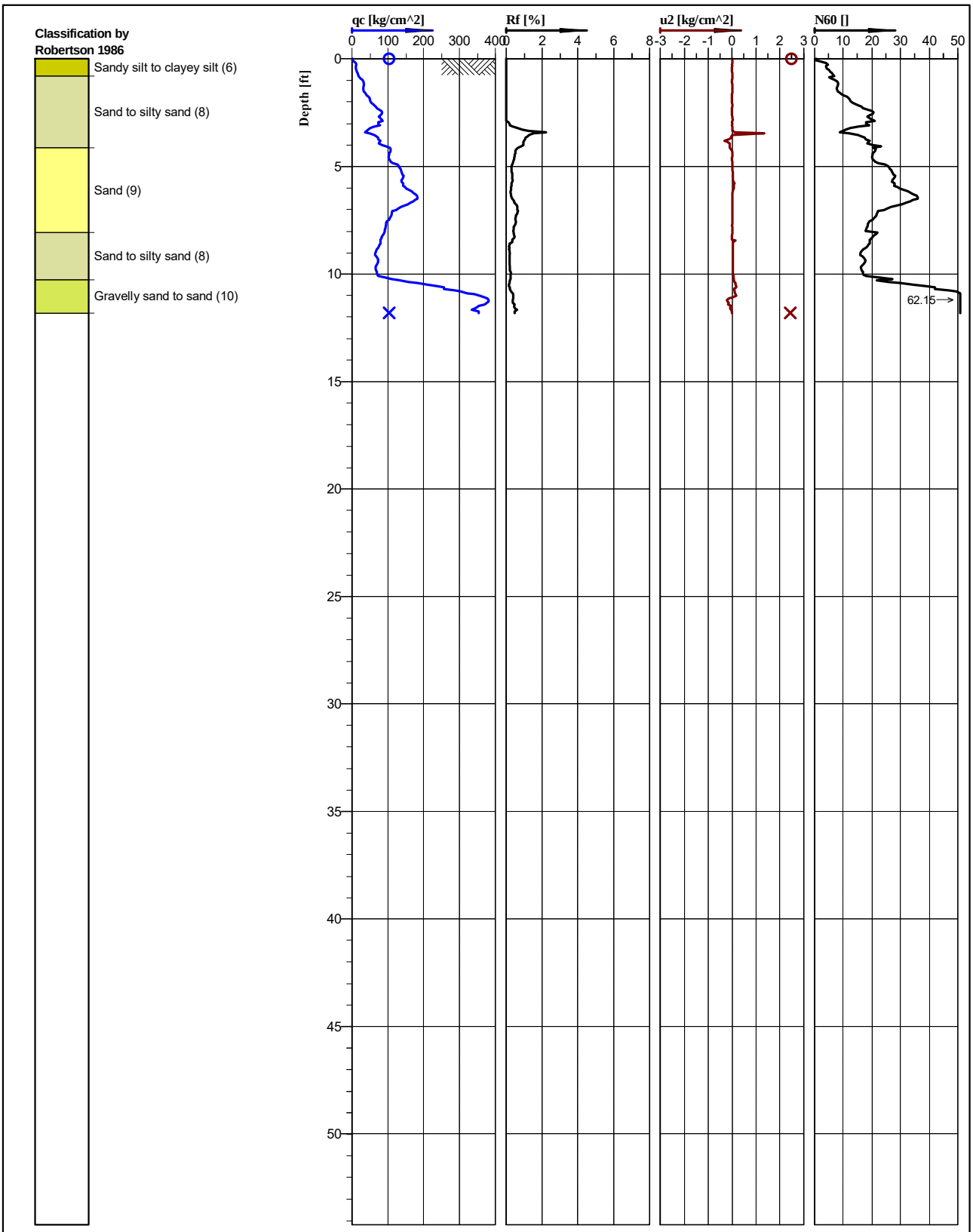
Location: 900 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 60 feet. Bored to 10 feet.		File: LMDamCPT-19.cpt	

DPS DIRECT PUSH SERVICES, LLC



Location: 900 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 60 feet. Bored to 10 feet.		File: LMDamCPT-19.cpt	

DPS DIRECT PUSH SERVICES, LLC



Location: Toe of Dam	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: CPT-20
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 12 feet.		File: LMDamCPT-20.cpd	

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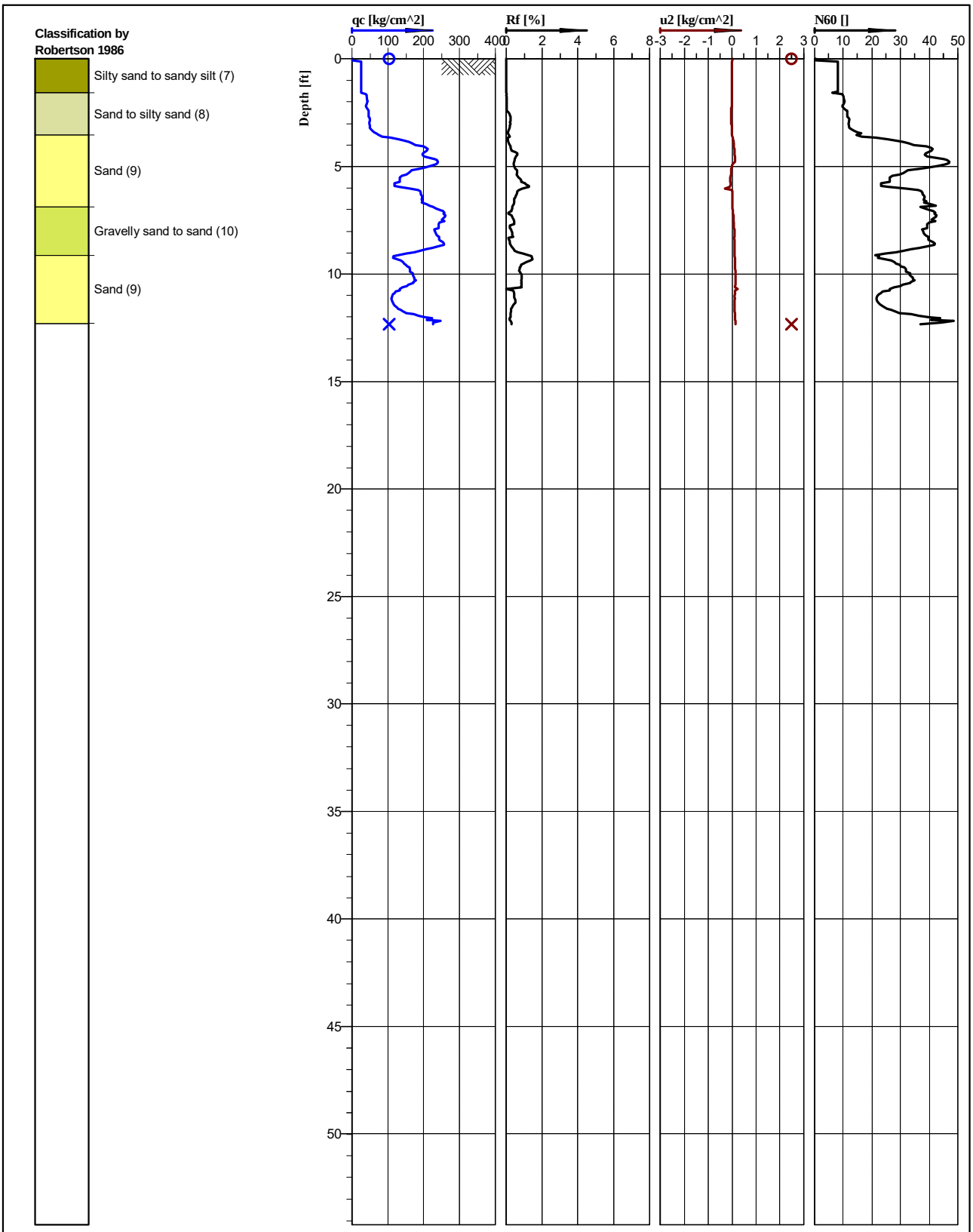
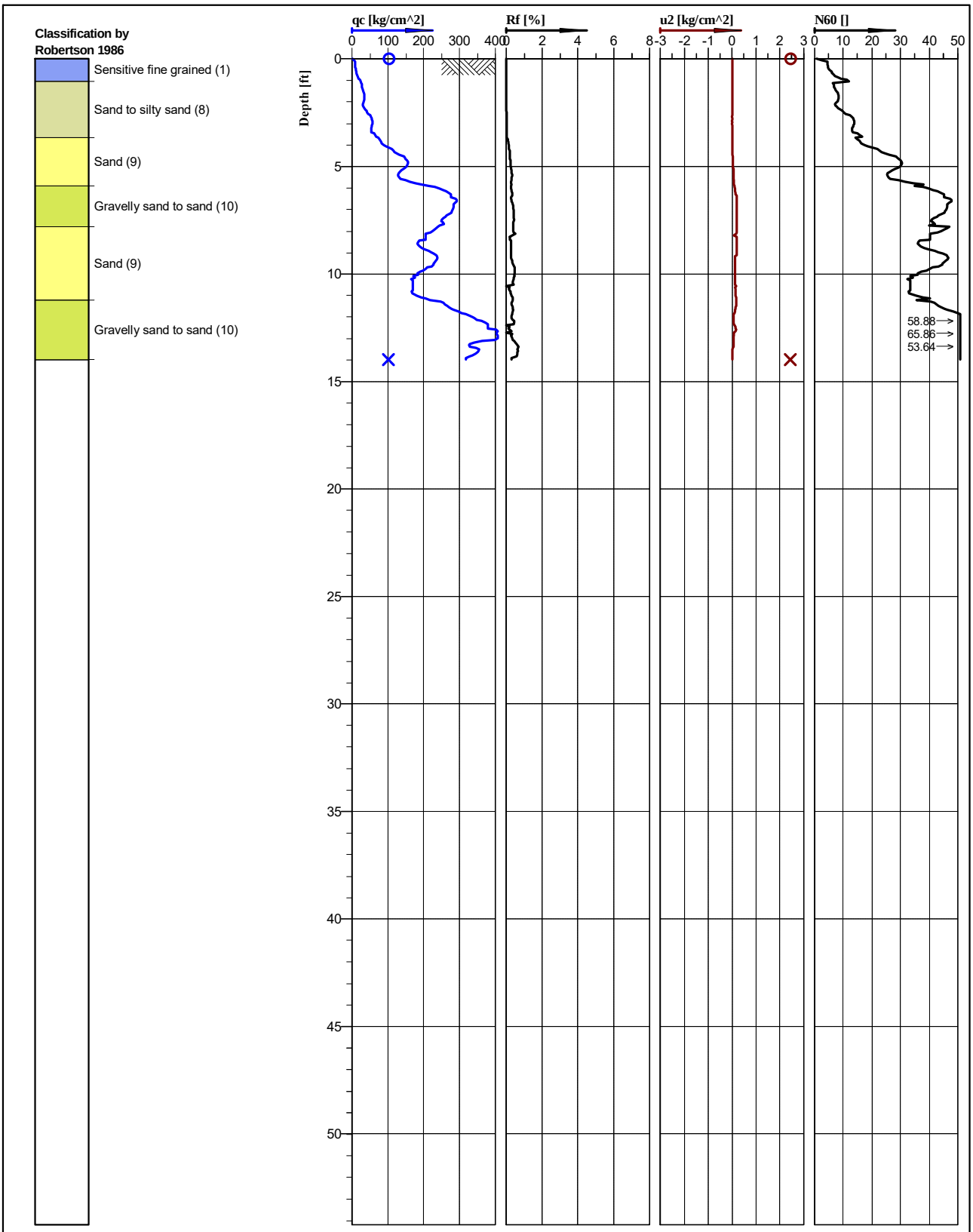
DIRECT PUSH SERVICES, LLC



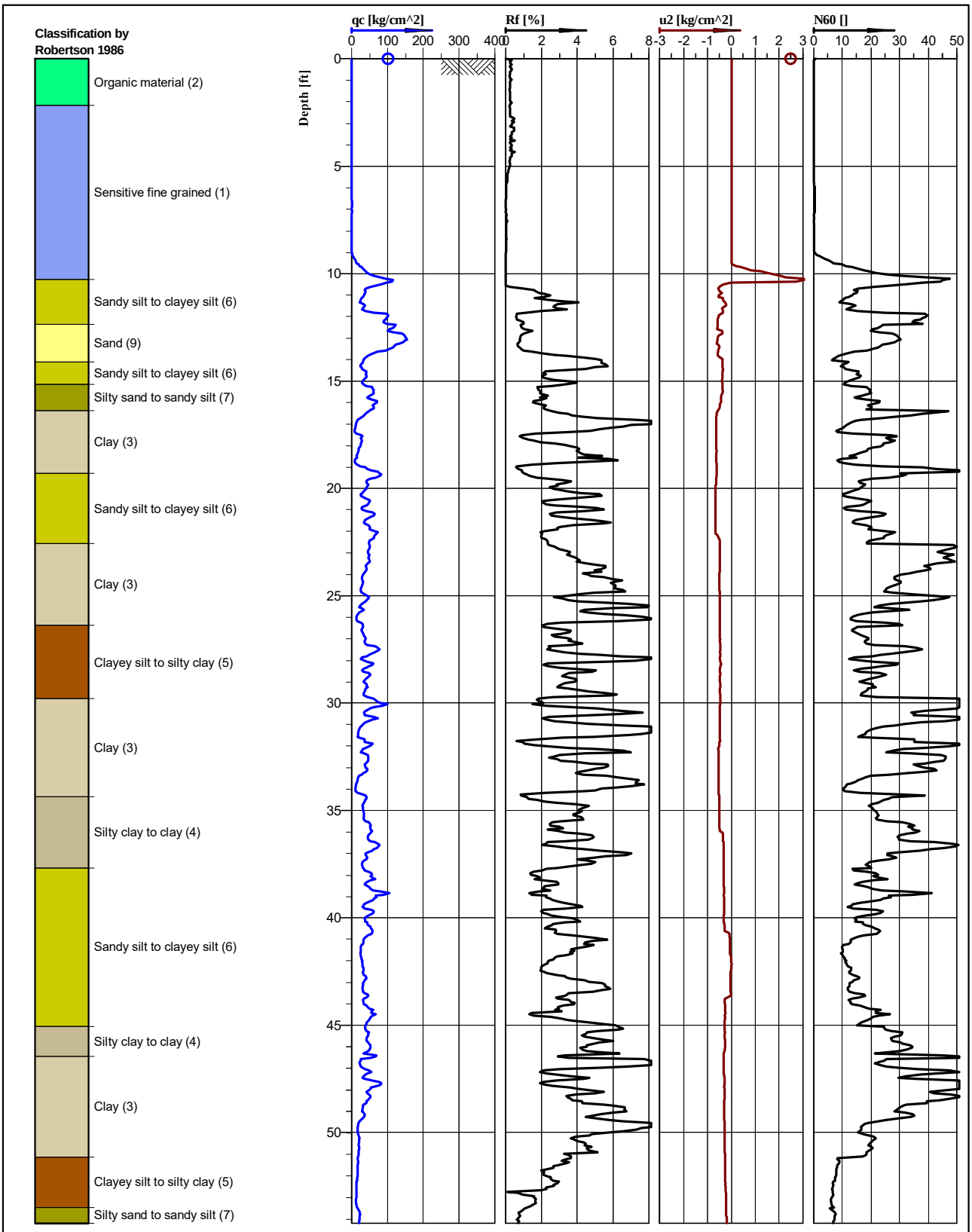
Location: Toe of Dam	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 12 feet.		File: LMDamCPT-20a.cpd	

DPS
DIRECT PUSH SERVICES, LLC



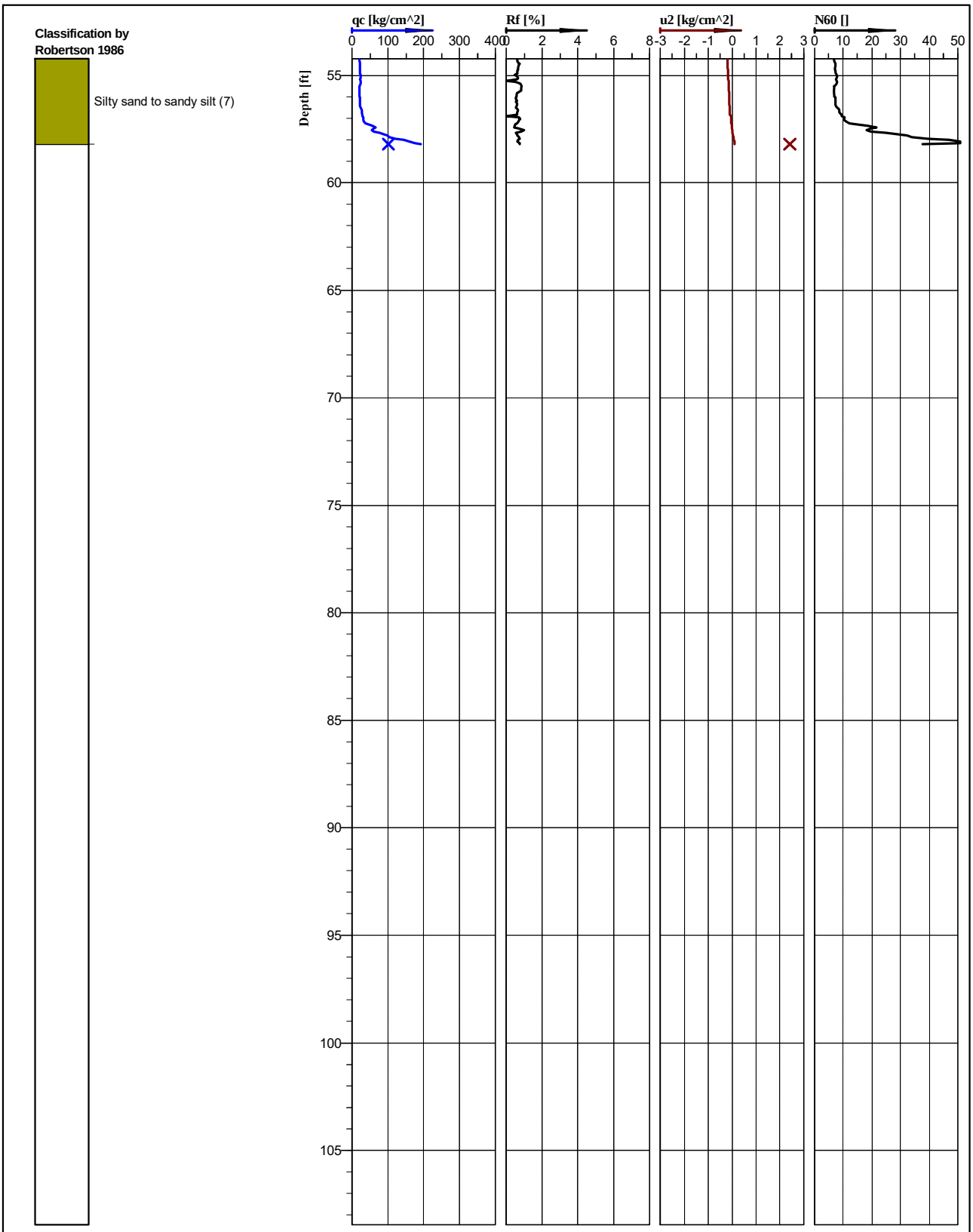
Location: Dam slope	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
rig refusal at a depth of 14 feet.		File: LMDamCPT-21.cpd	

DPS DIRECT PUSH SERVICES, LLC



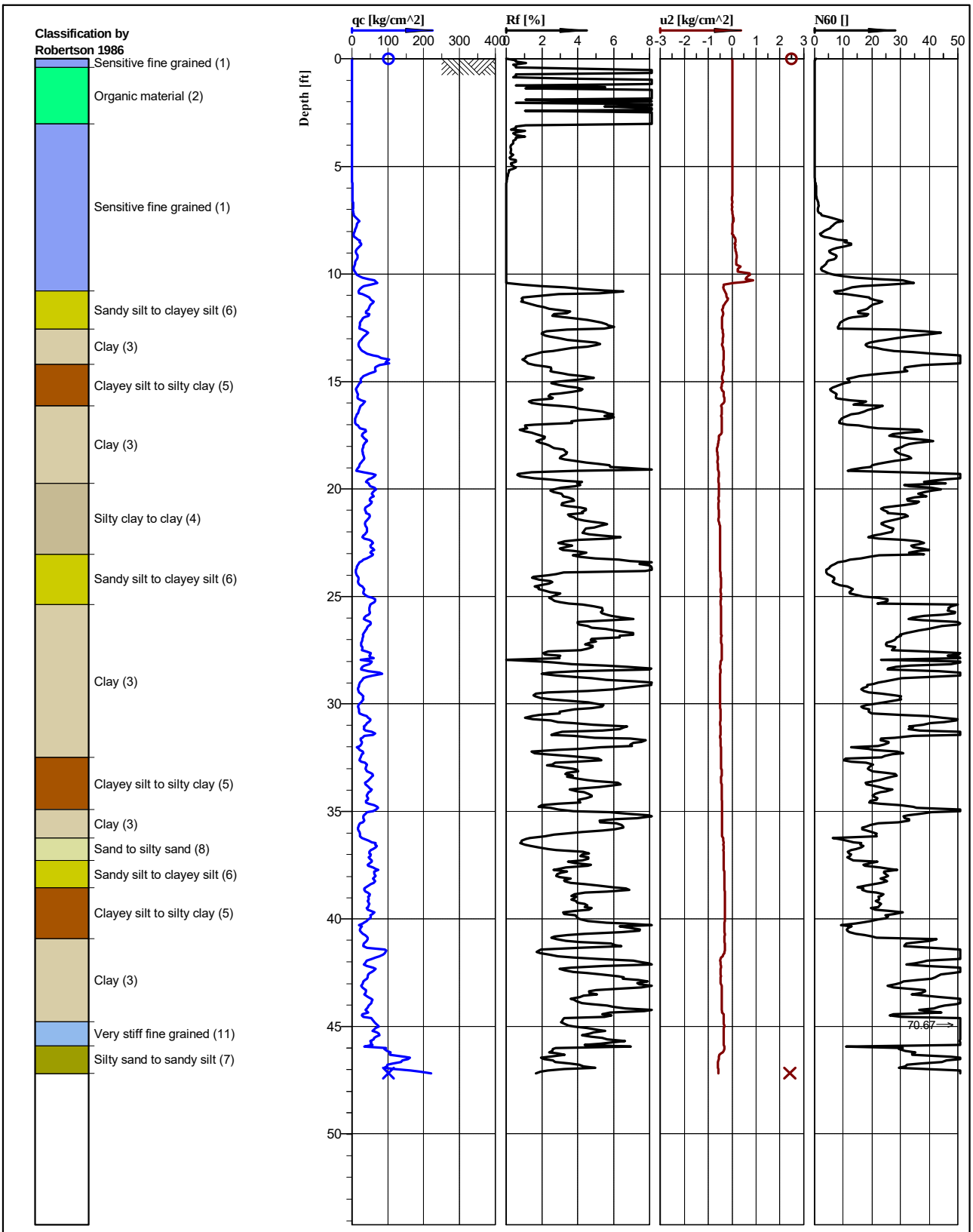
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 58 feet. Bored to 10 feet.		File: LMDamCPT-23.cpd	

DPS DIRECT PUSH SERVICES, LLC



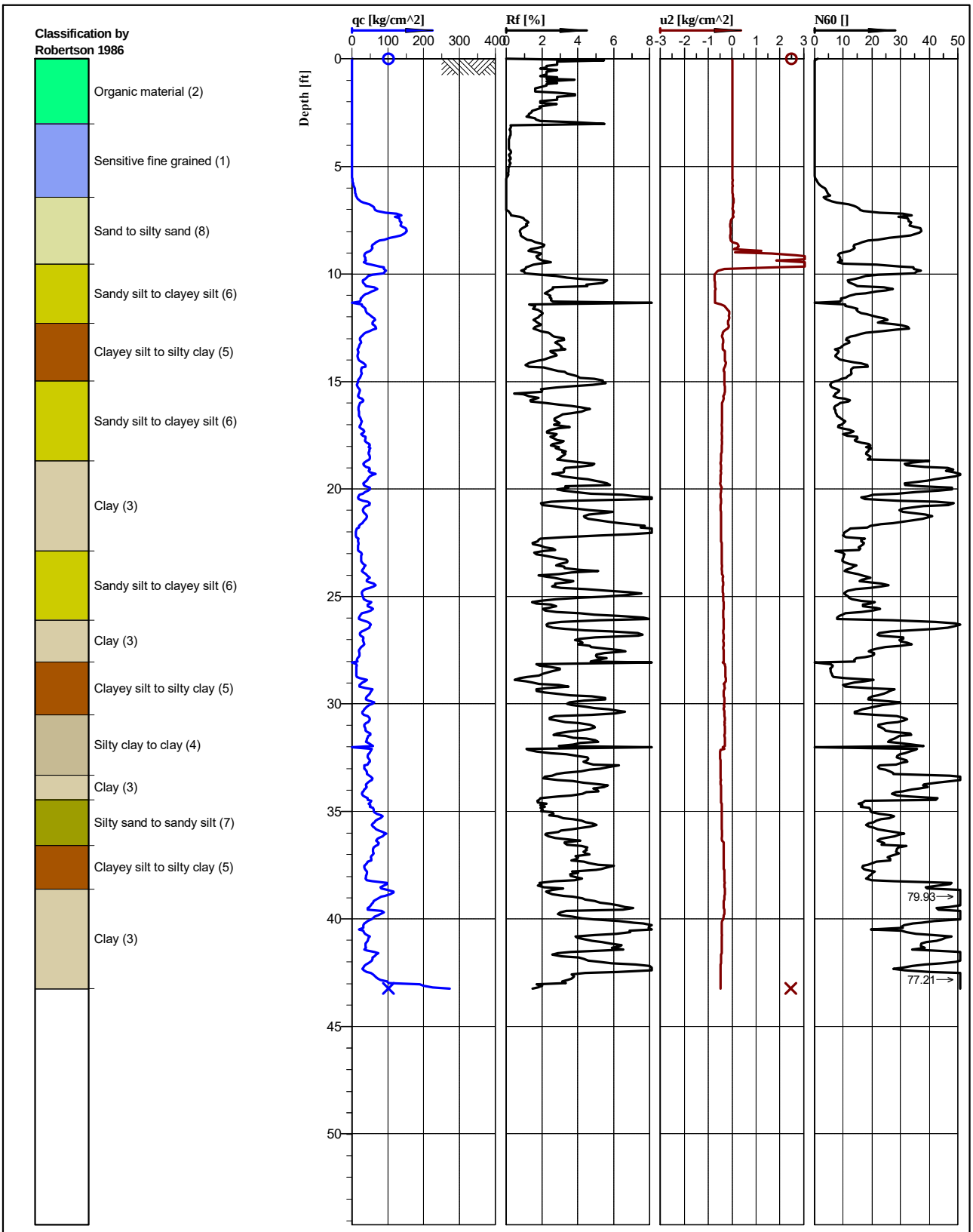
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 58 feet. Bored to 10 feet.		File: LMDamCPT-23.cpd	

DPS
DIRECT PUSH SERVICES, LLC



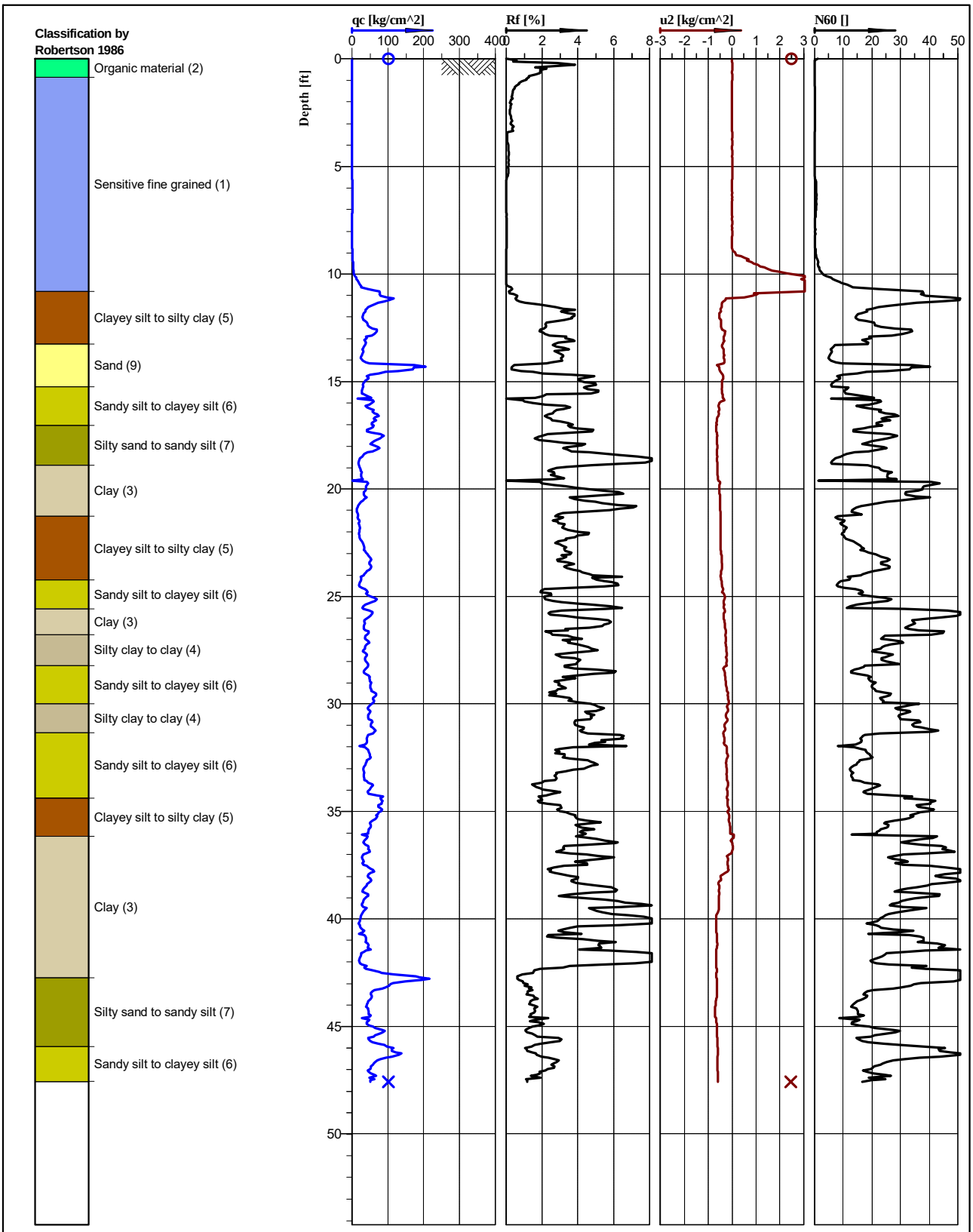
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 47 feet. Bored to 10 feet.		File: LMDamCPT-24.cpt	

DPS DIRECT PUSH SERVICES, LLC



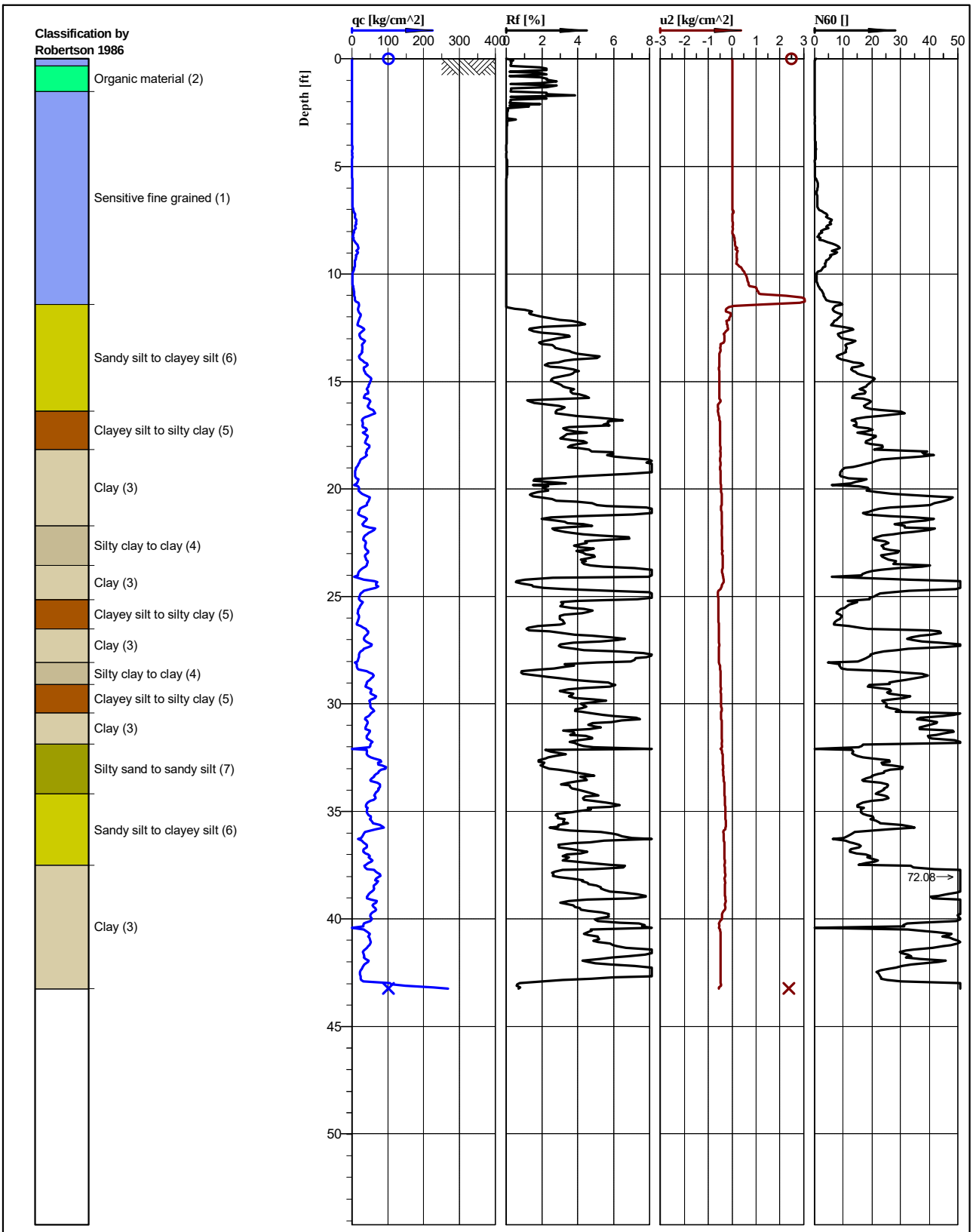
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 43 feet. Bored to 7 feet.		File: LMDamCPT-25.cpt	

DPS
DIRECT PUSH SERVICES, LLC



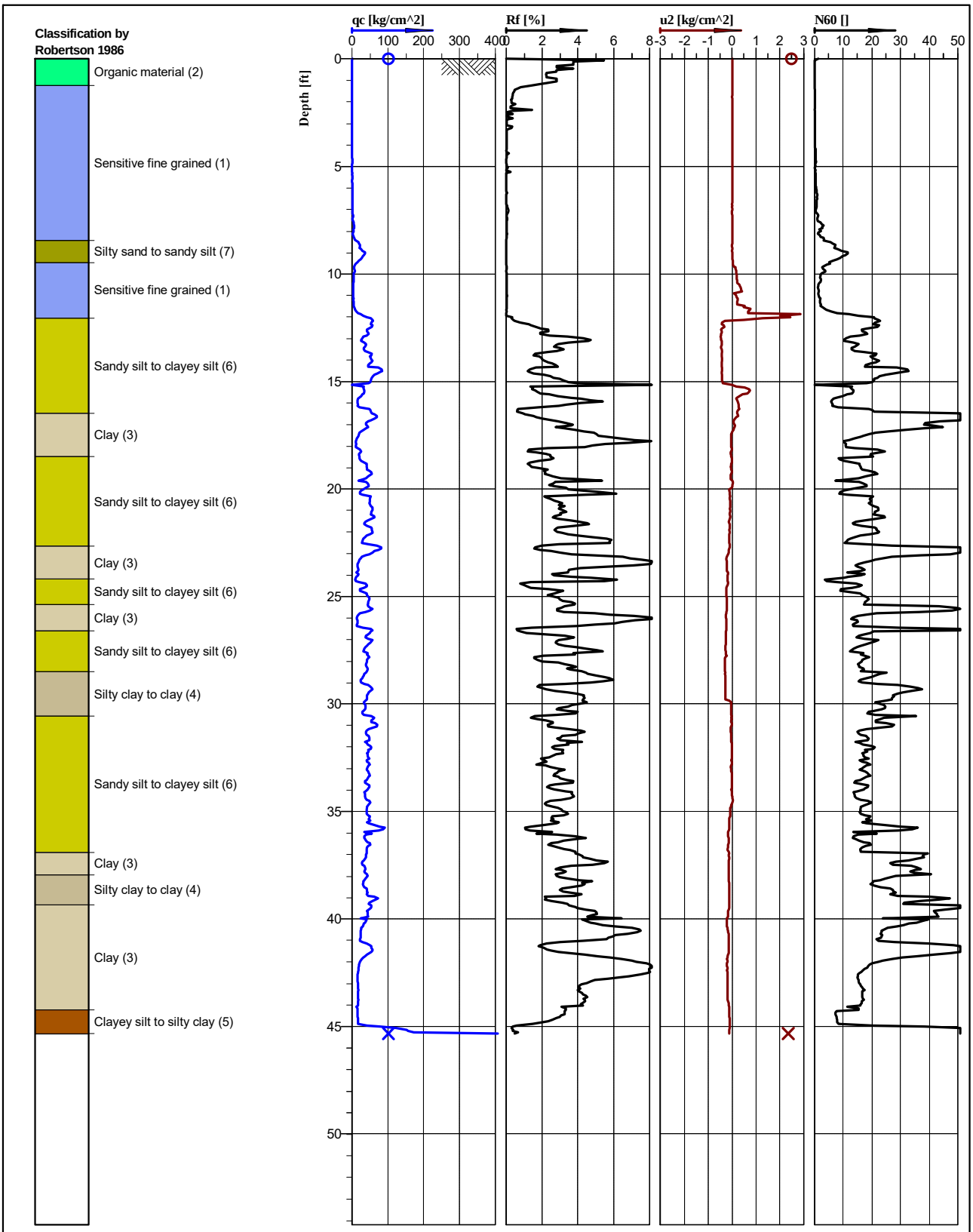
Location: Per CLient's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 47.5 feet. Bored to 10 feet.		File: LMDamCPT-26.cpt	

DPS
DIRECT PUSH SERVICES, LLC



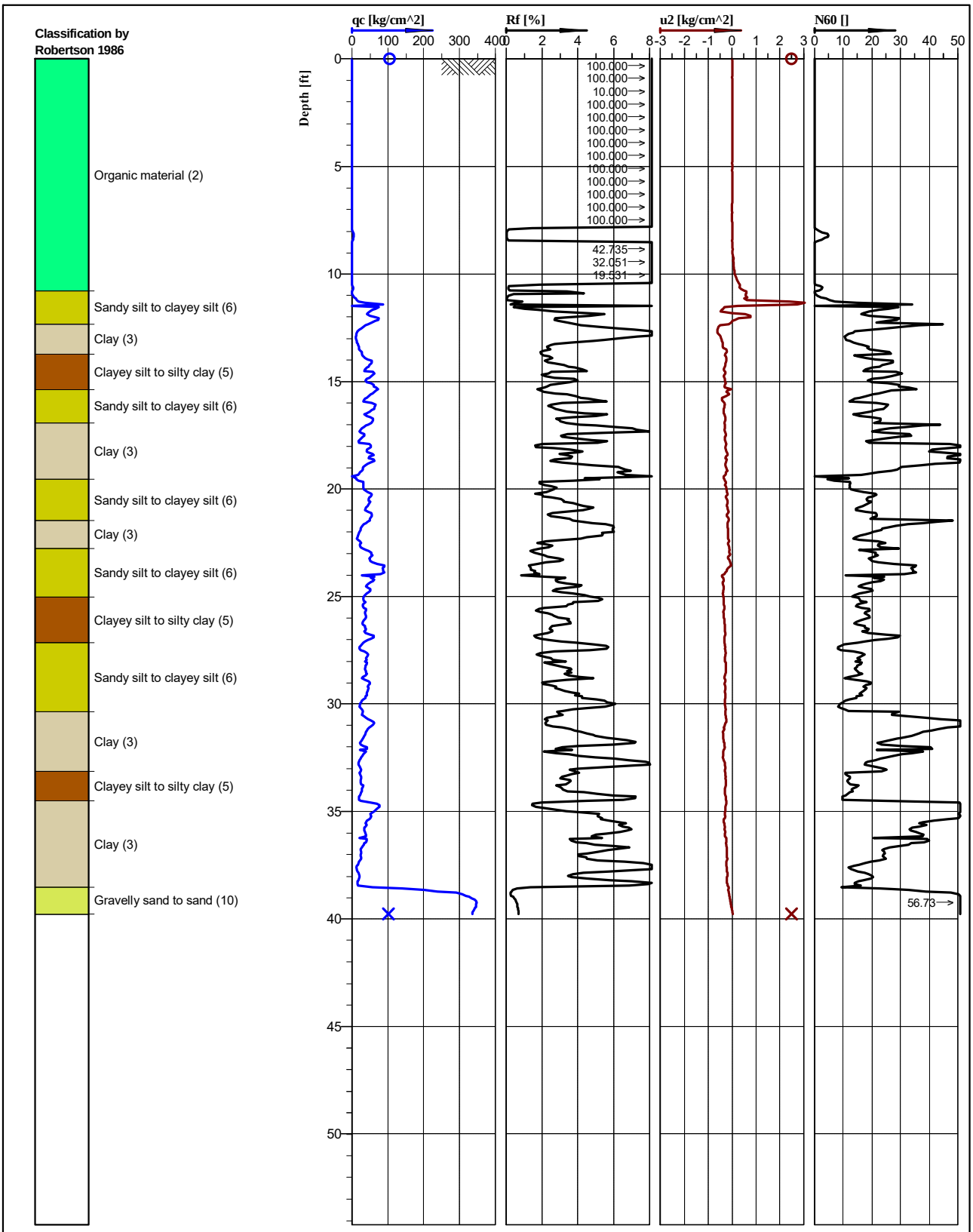
Location: Per CLient's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 43 feet. Bored to 7 feet.		File: LMDamCPT-27.cpt	

DPS
DIRECT PUSH SERVICES, LLC



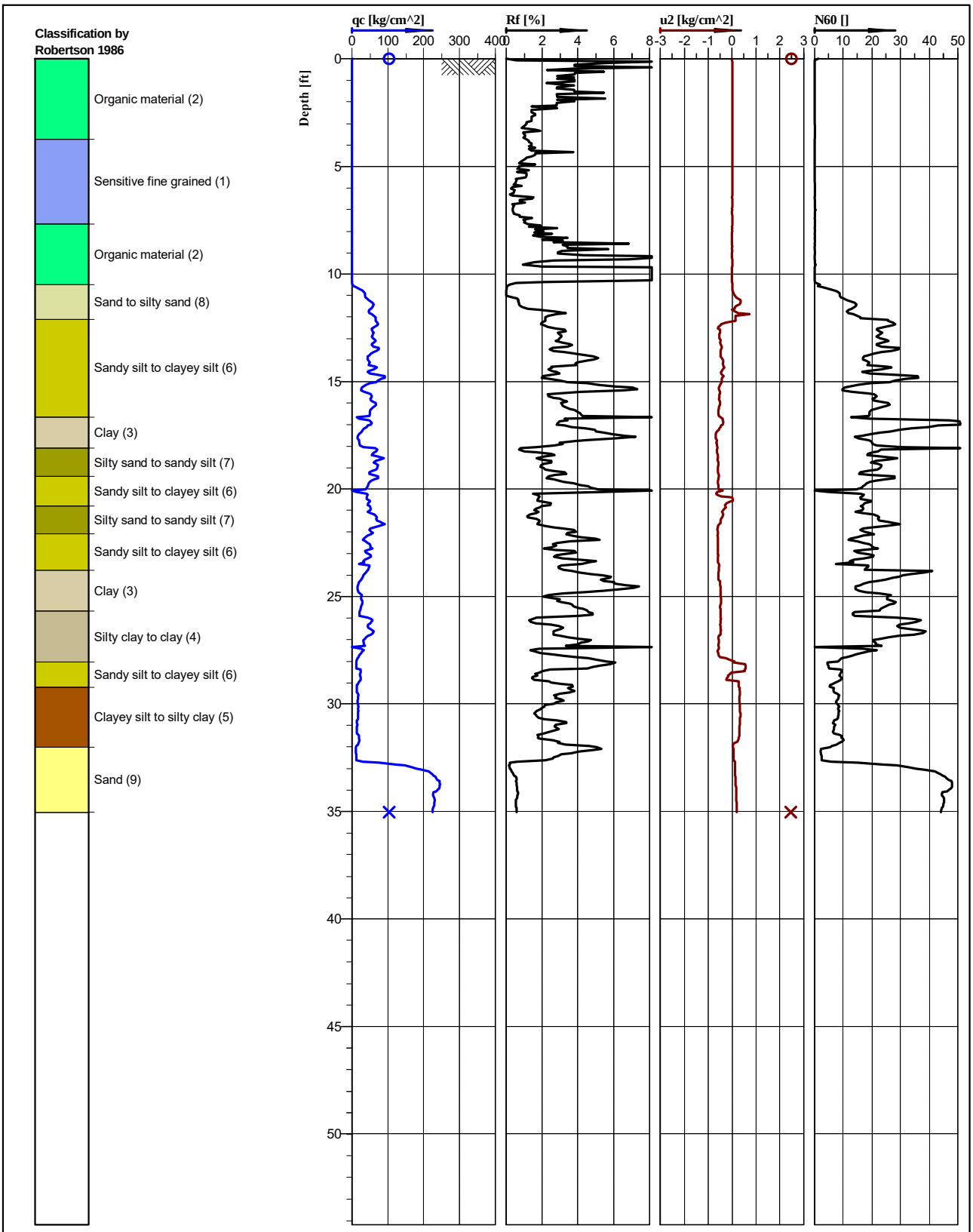
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 45 feet. Bored to 12 feet.		File: LMDamCPT-28.cpt	

DPS DIRECT PUSH SERVICES, LLC



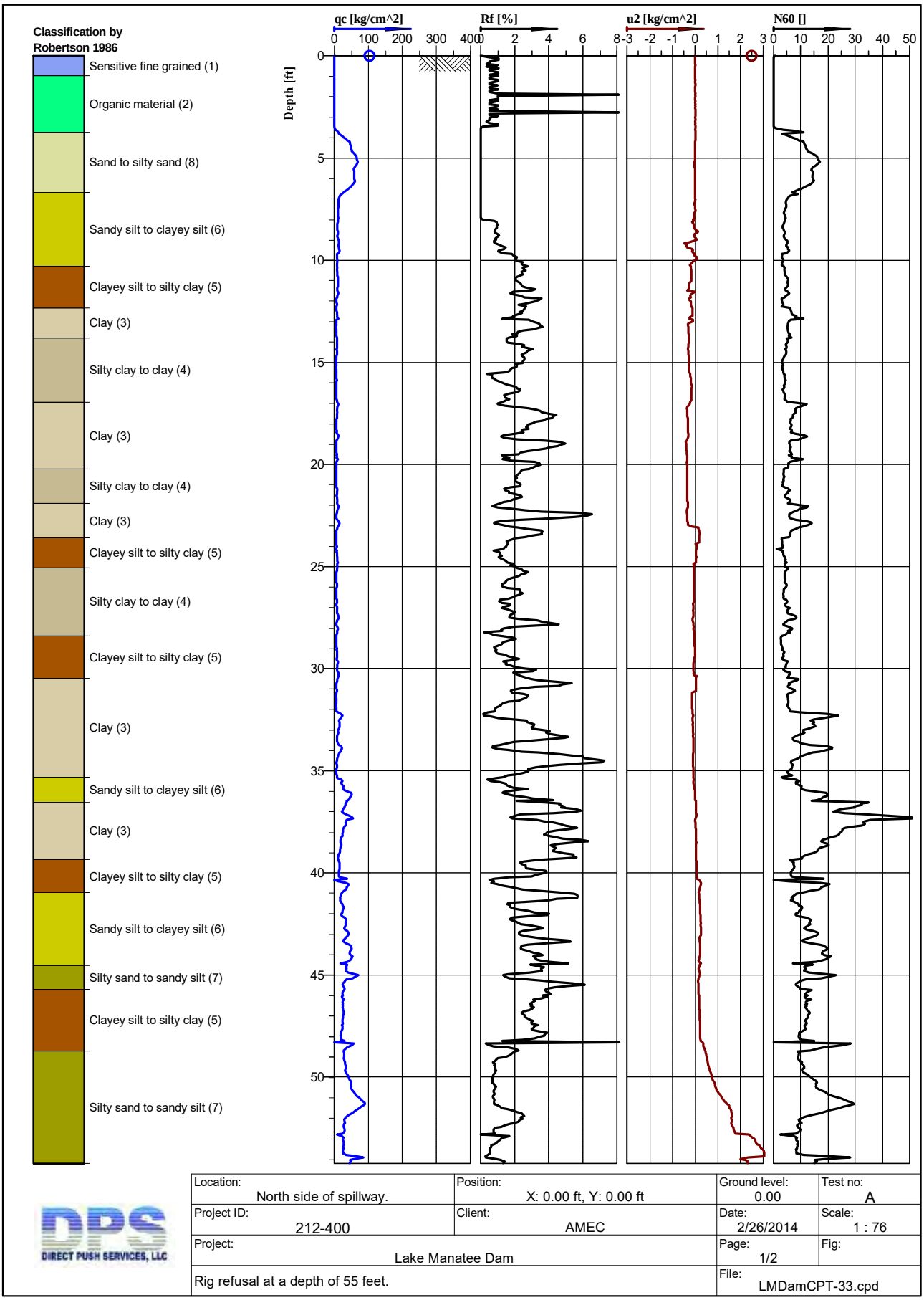
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 40 feet. Bored to 10 feet.		File: LMDamCPT-31.cpt	

DPS DIRECT PUSH SERVICES, LLC



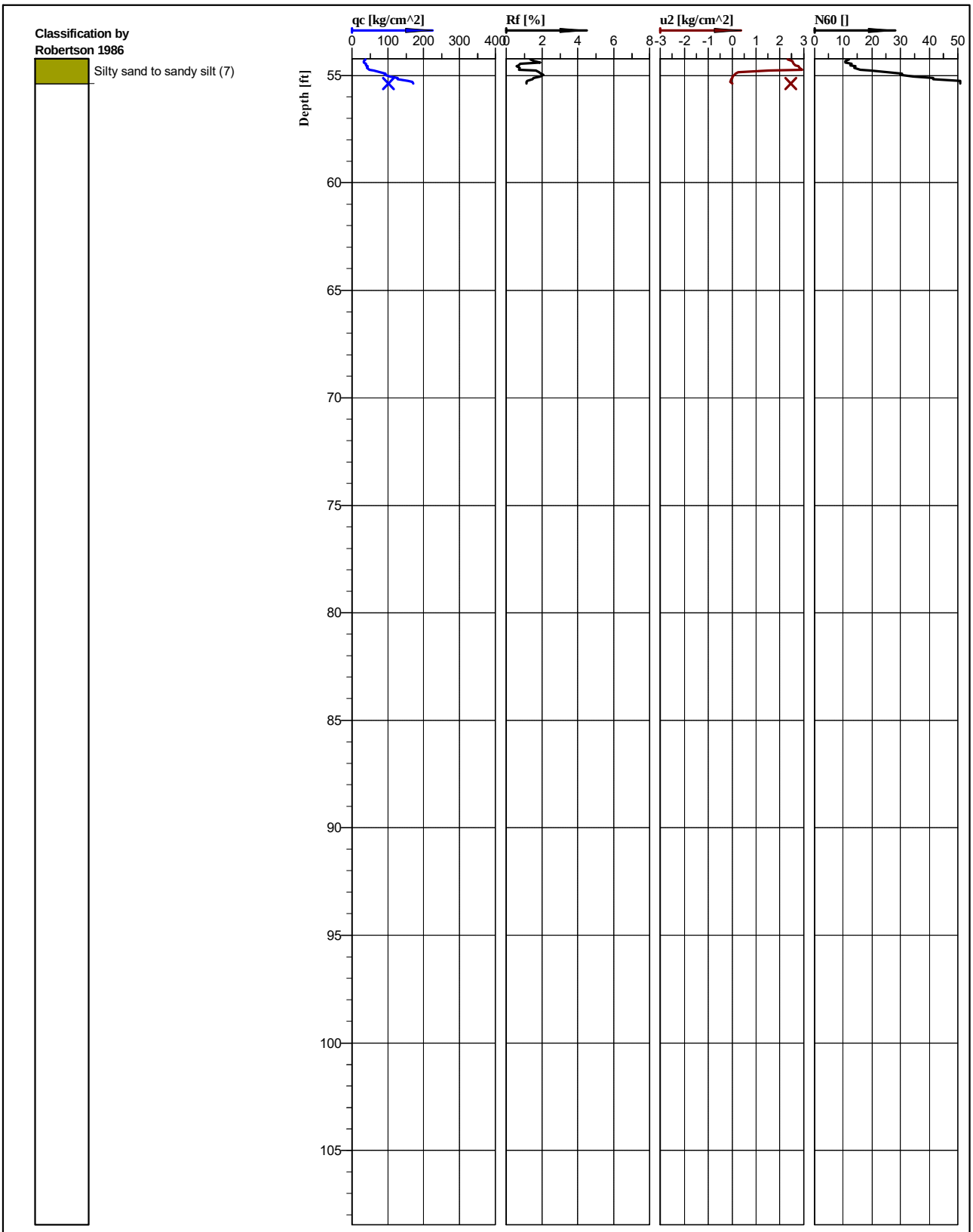
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal ata depth of 35 feet. Bored to 10 feet.		File: LMDamCPT-32.cpt	

DPS DIRECT PUSH SERVICES, LLC



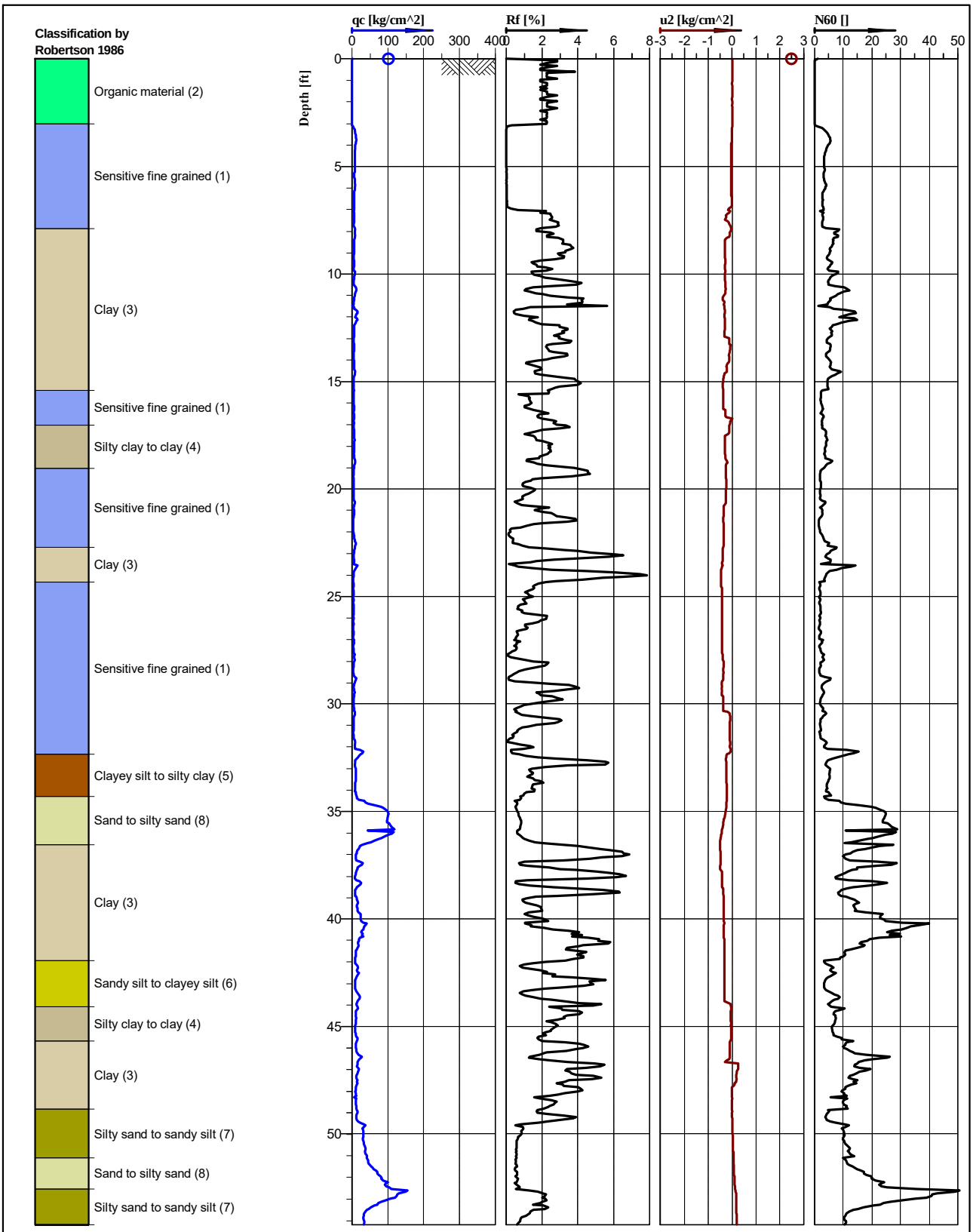
Location: North side of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-33.cpd	

DPS
DIRECT PUSH SERVICES, LLC



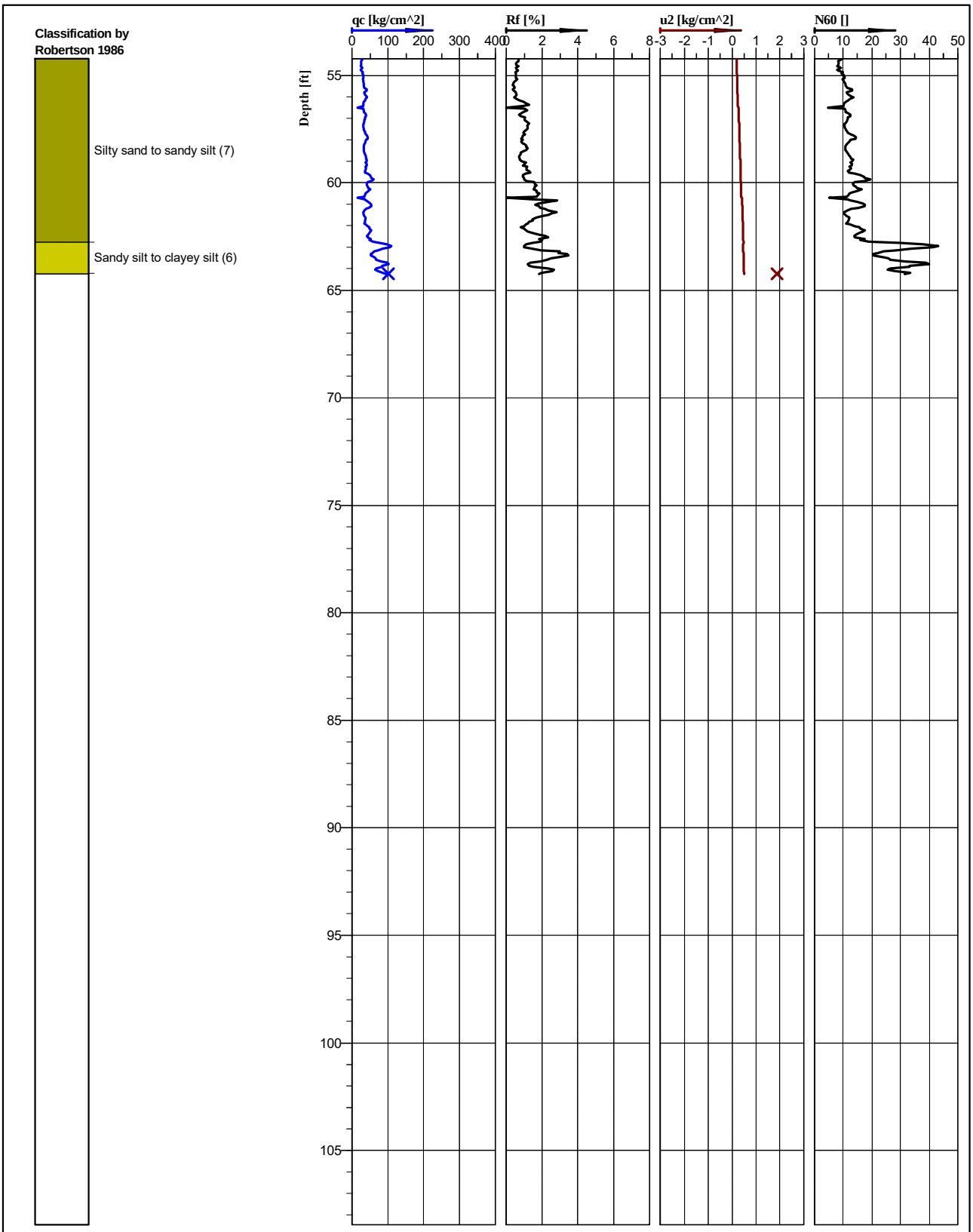
Location: North side of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-33.cpd	

DPS
DIRECT PUSH SERVICES, LLC



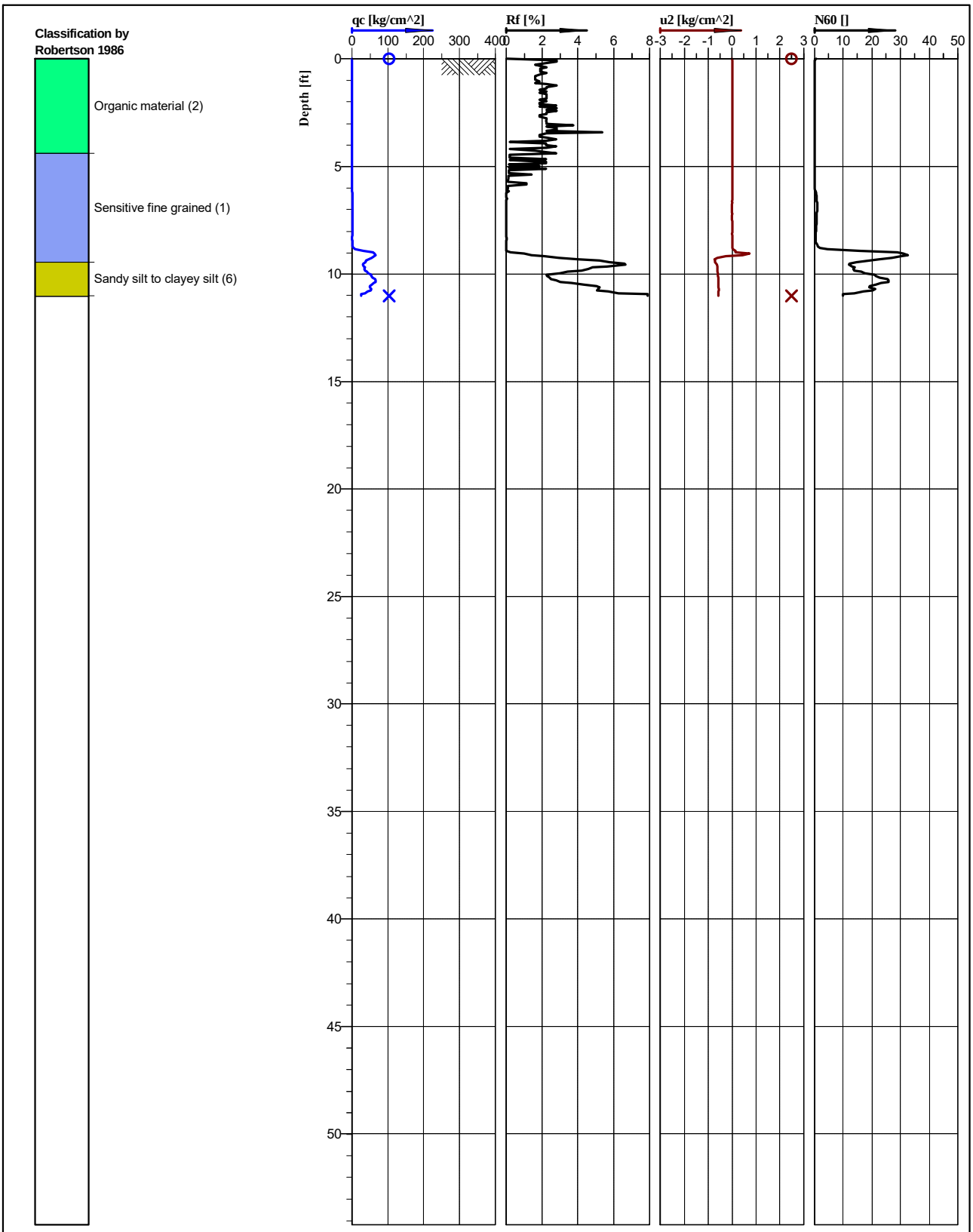
Location: South side of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 54 feet.		File: LMDamCPT-34.cpt	

DPS DIRECT PUSH SERVICES, LLC



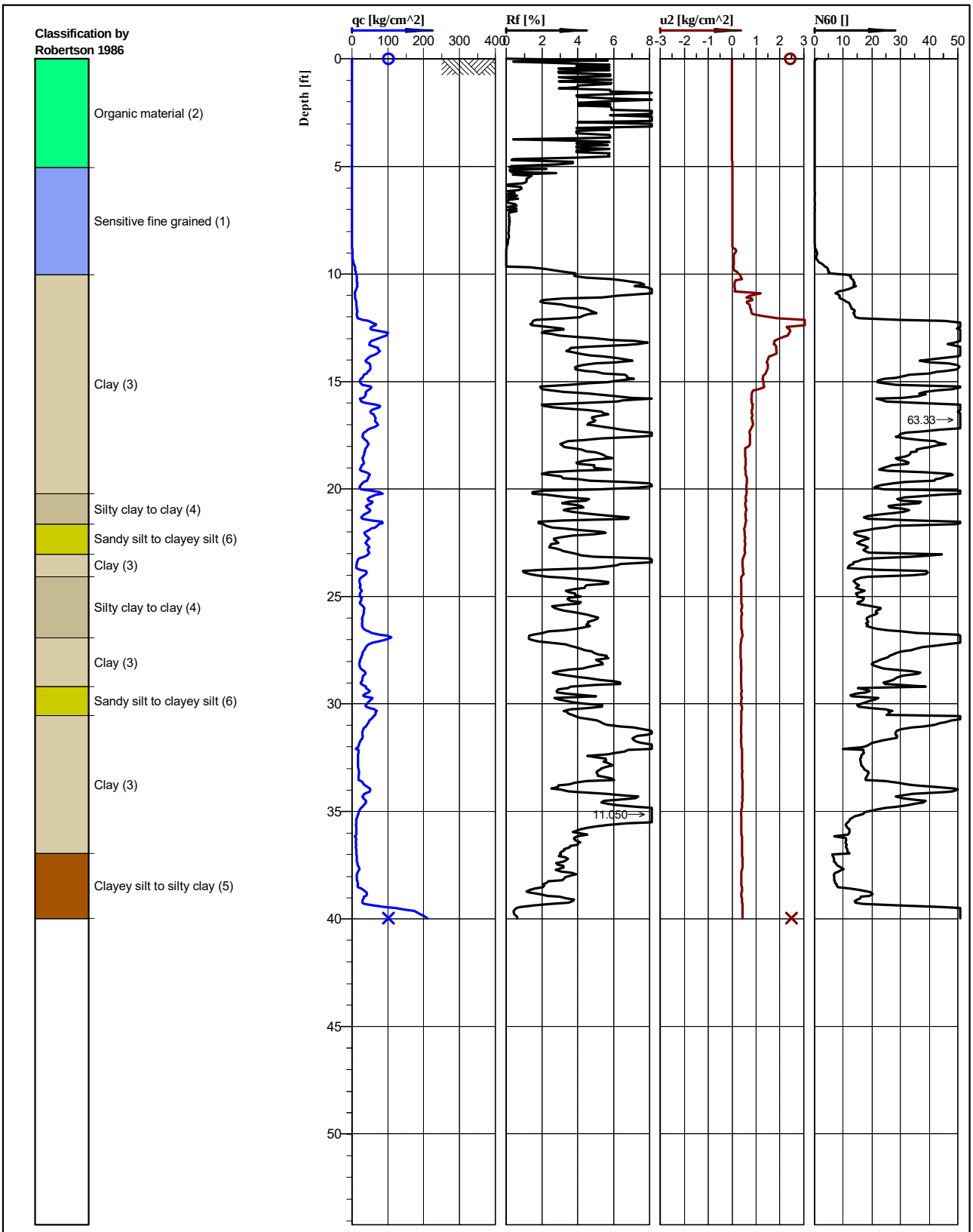
Location: South side of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 2/2	Fig:
Rig refusal at a depth of 54 feet.		File: LMDamCPT-34.cpt	

DPS
DIRECT PUSH SERVICES, LLC



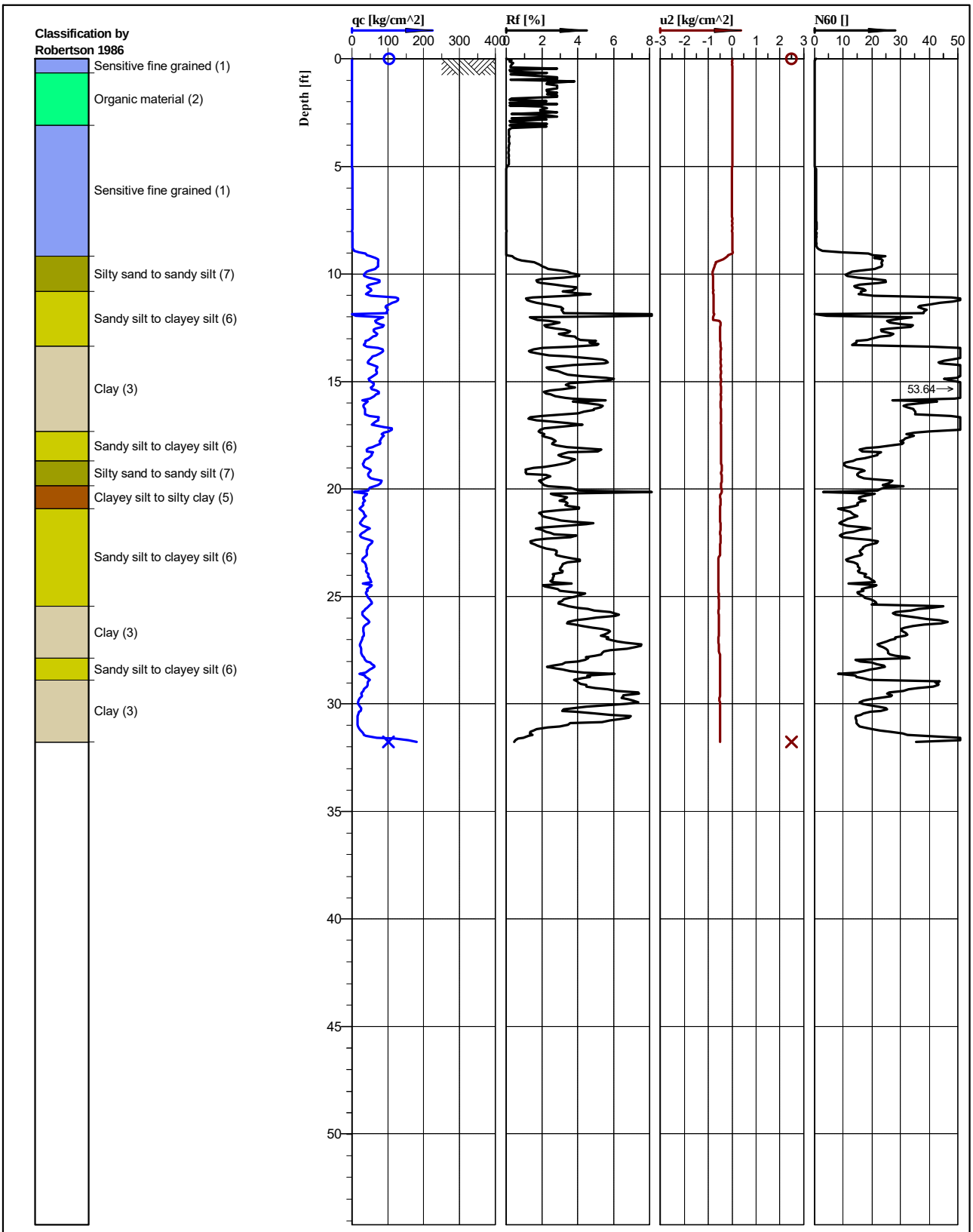
Location: 700 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 11 feet.		File: LMDamCPT-35.cpt	

DPS
DIRECT PUSH SERVICES, LLC



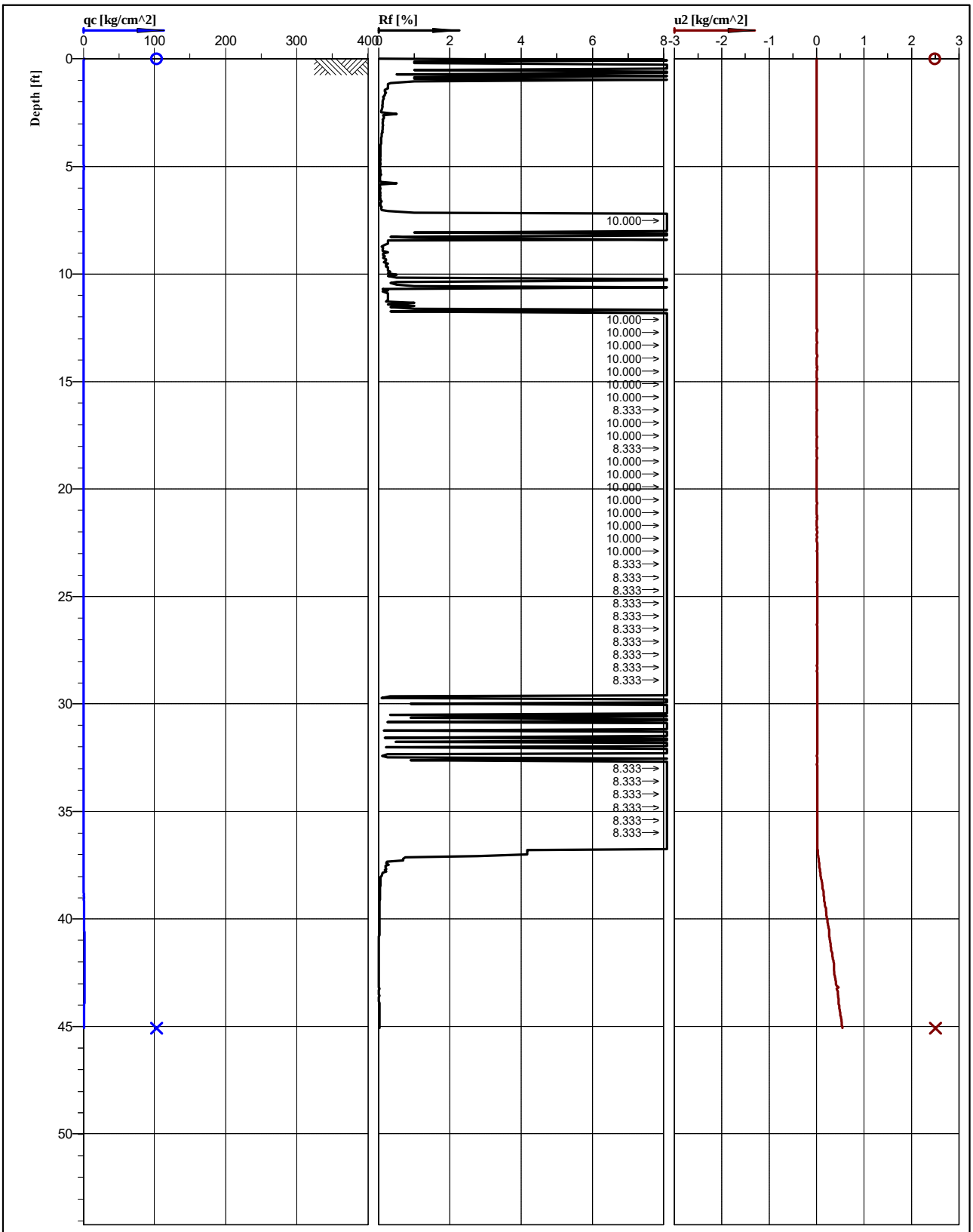
Location: 700 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Ranch		Page: 1/1	Fig:
Rig refusal at a depth of 40 feet. Bored to 12 feet.		File: LMDamCPT-35b.cpt	

DPS
DIRECT PUSH SERVICES, LLC



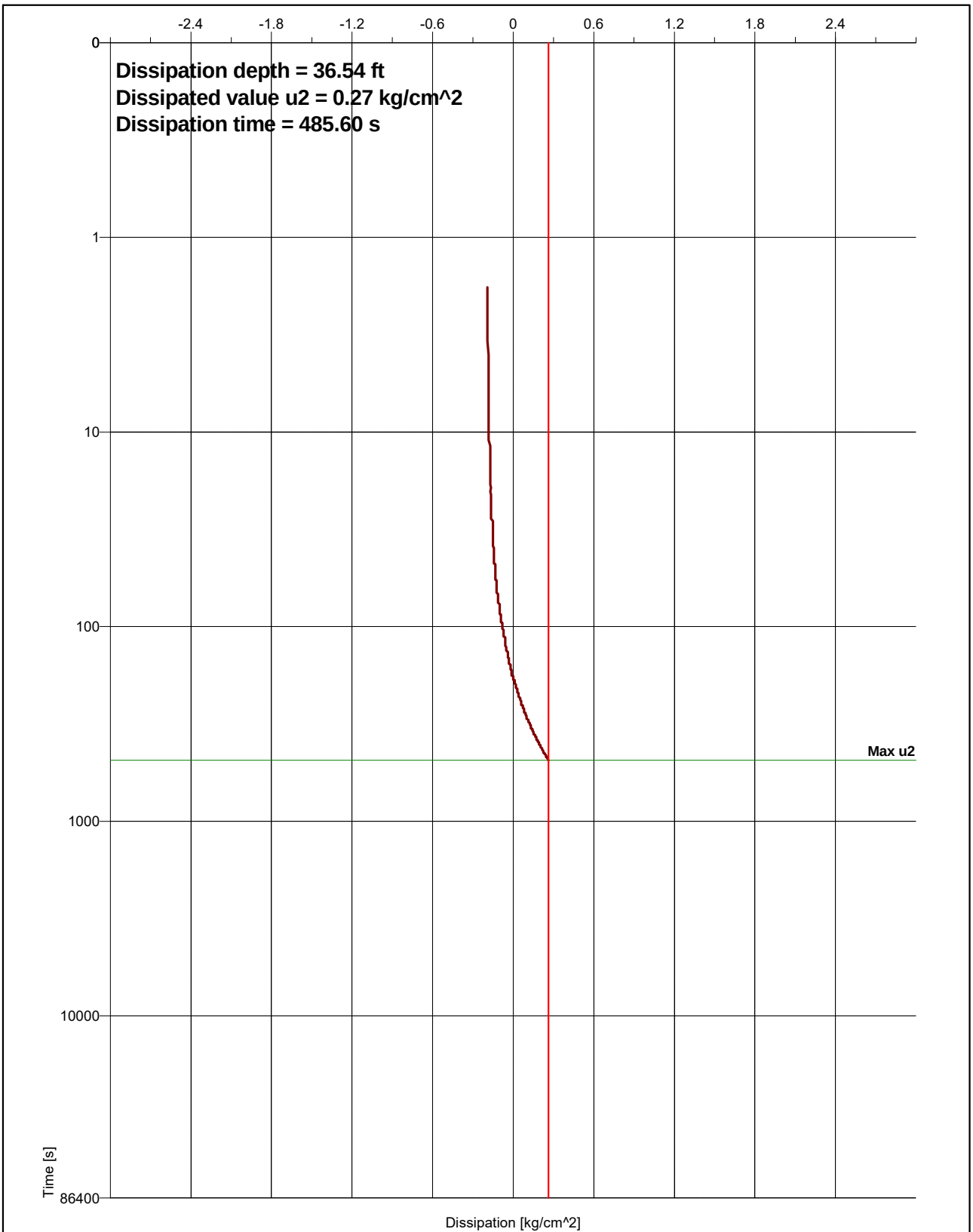
Location: 800 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/27/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 32 feet. Bored to 10 feet.		File: LMDamCPT-36.cpt	

DPS DIRECT PUSH SERVICES, LLC



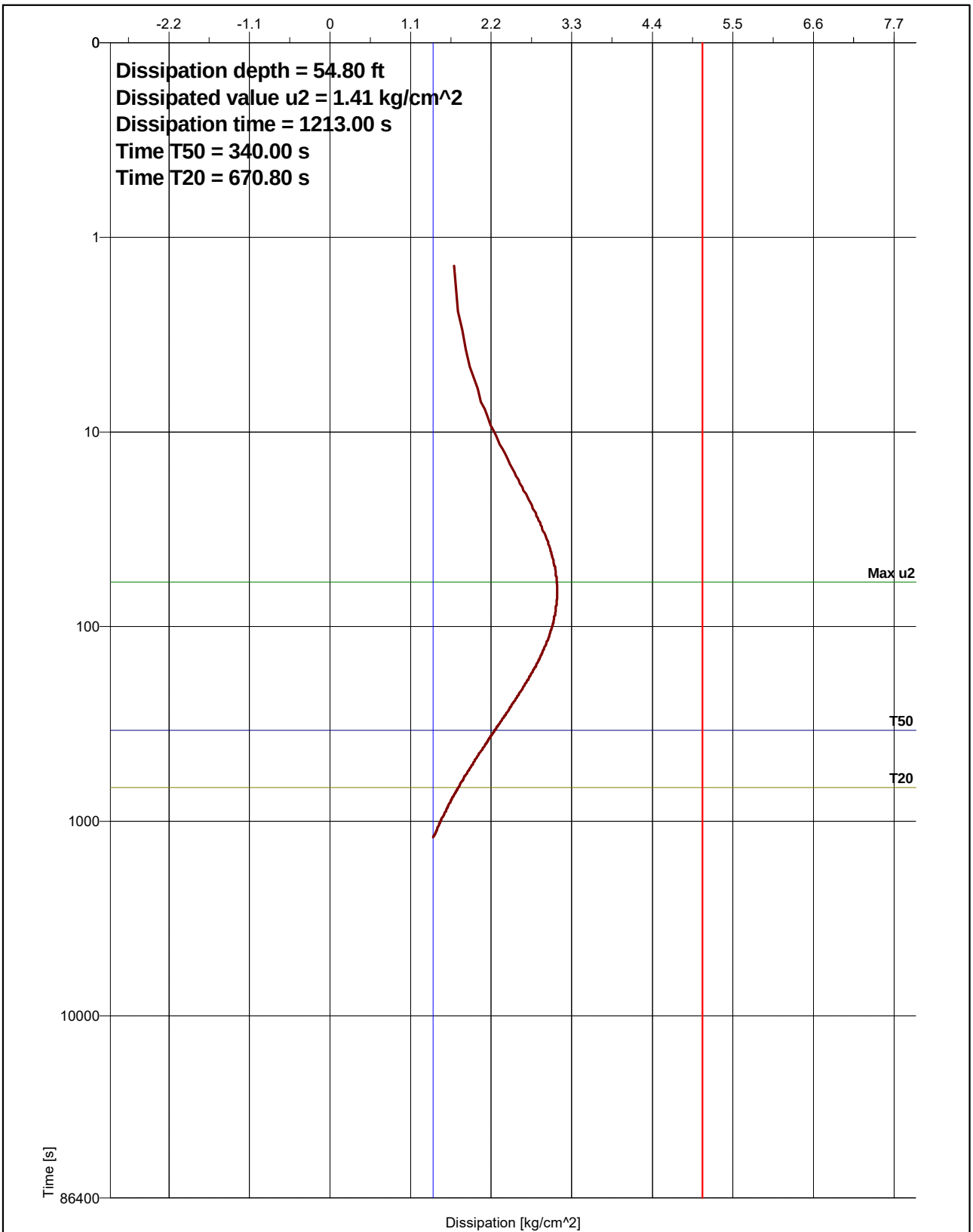
Location:	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID:	Client:	Date: 2/22/2014	Scale: 1 : 76
Project: 212-400		Page: 1/1	Fig:
		File: LMDamTest.cpd	

DPS
DIRECT PUSH SERVICES, LLC



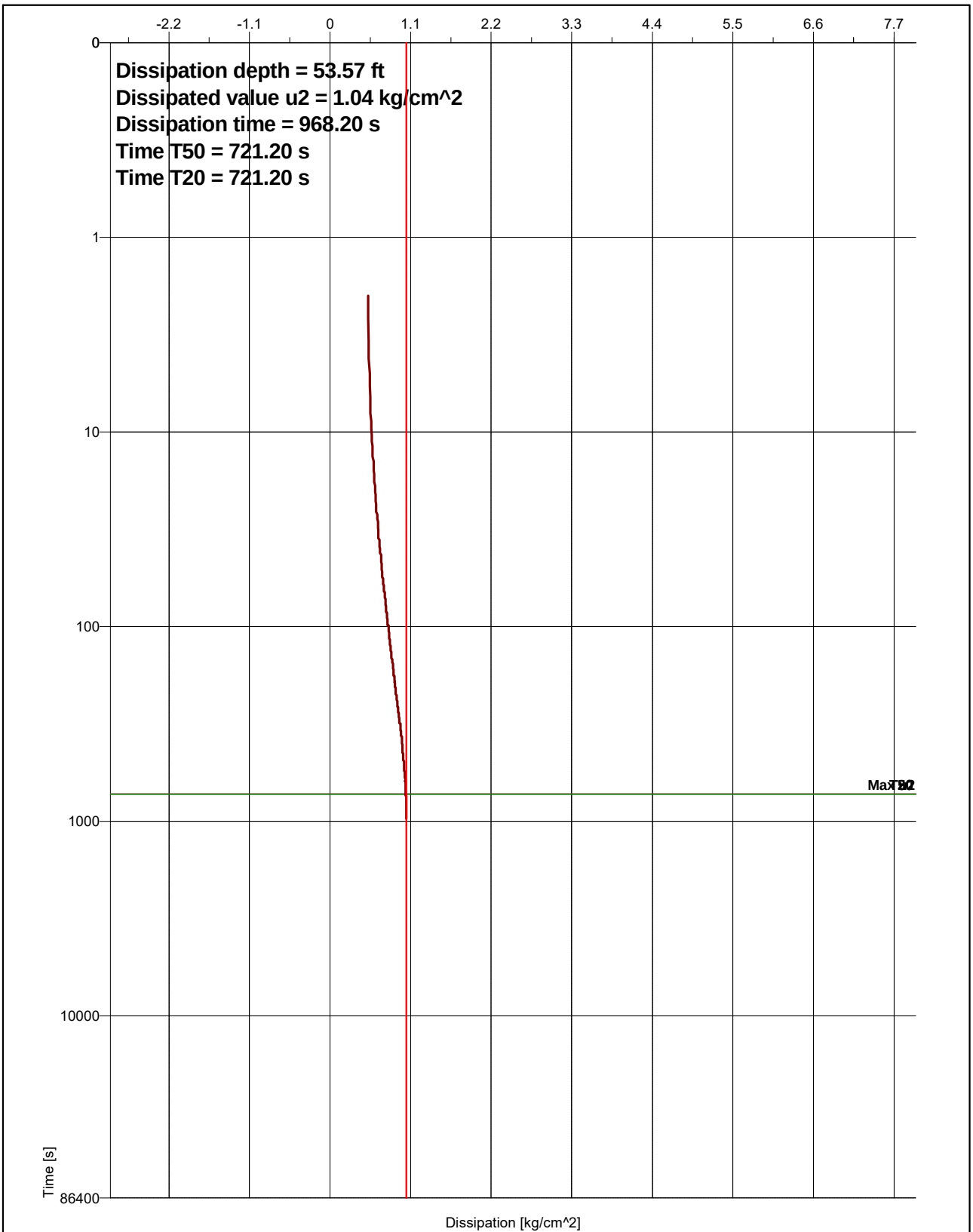
DPS DIRECT PUSH SERVICES, LLC

Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-4.cpd	



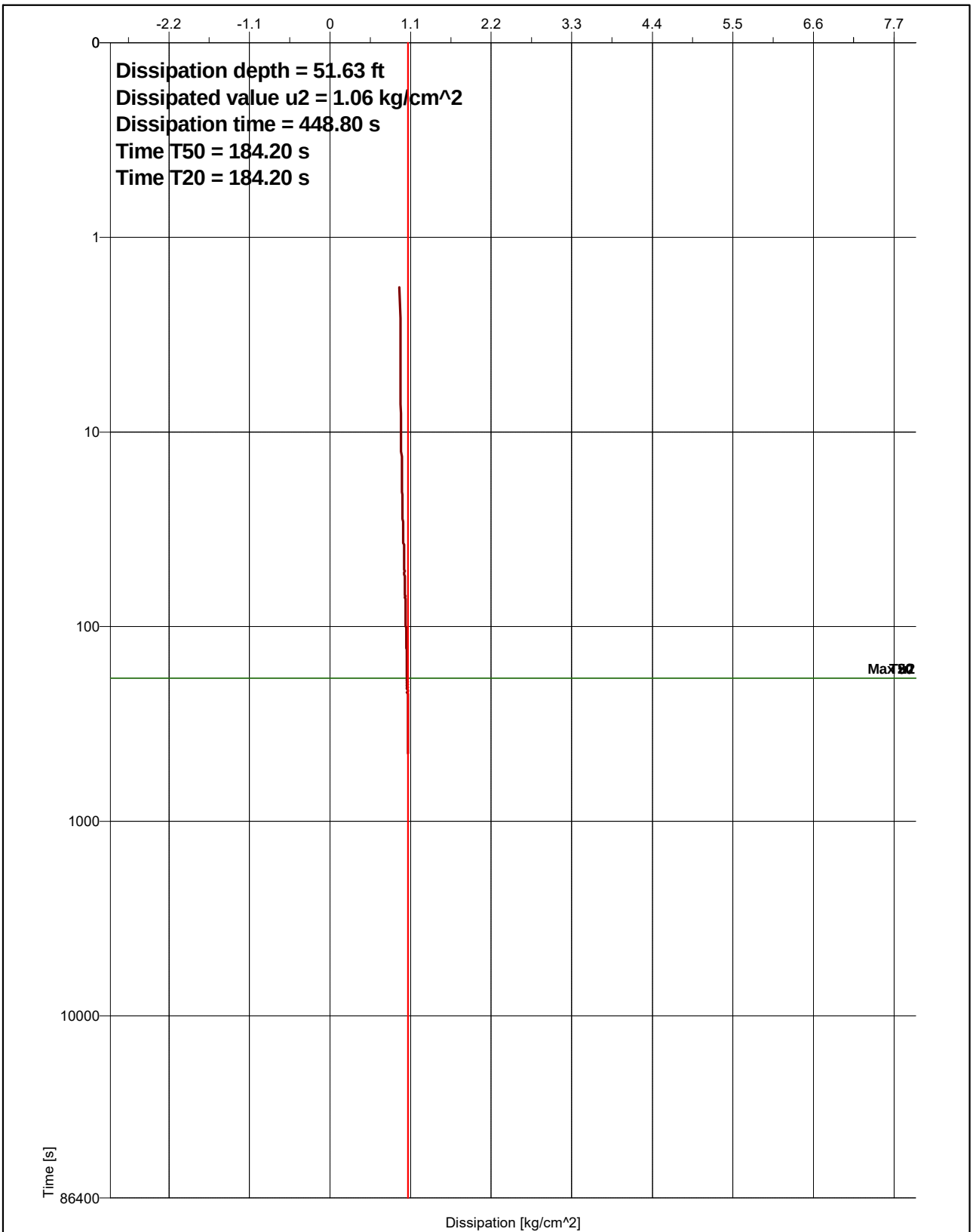
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-4.cpd	

DPS DIRECT PUSH SERVICES, LLC



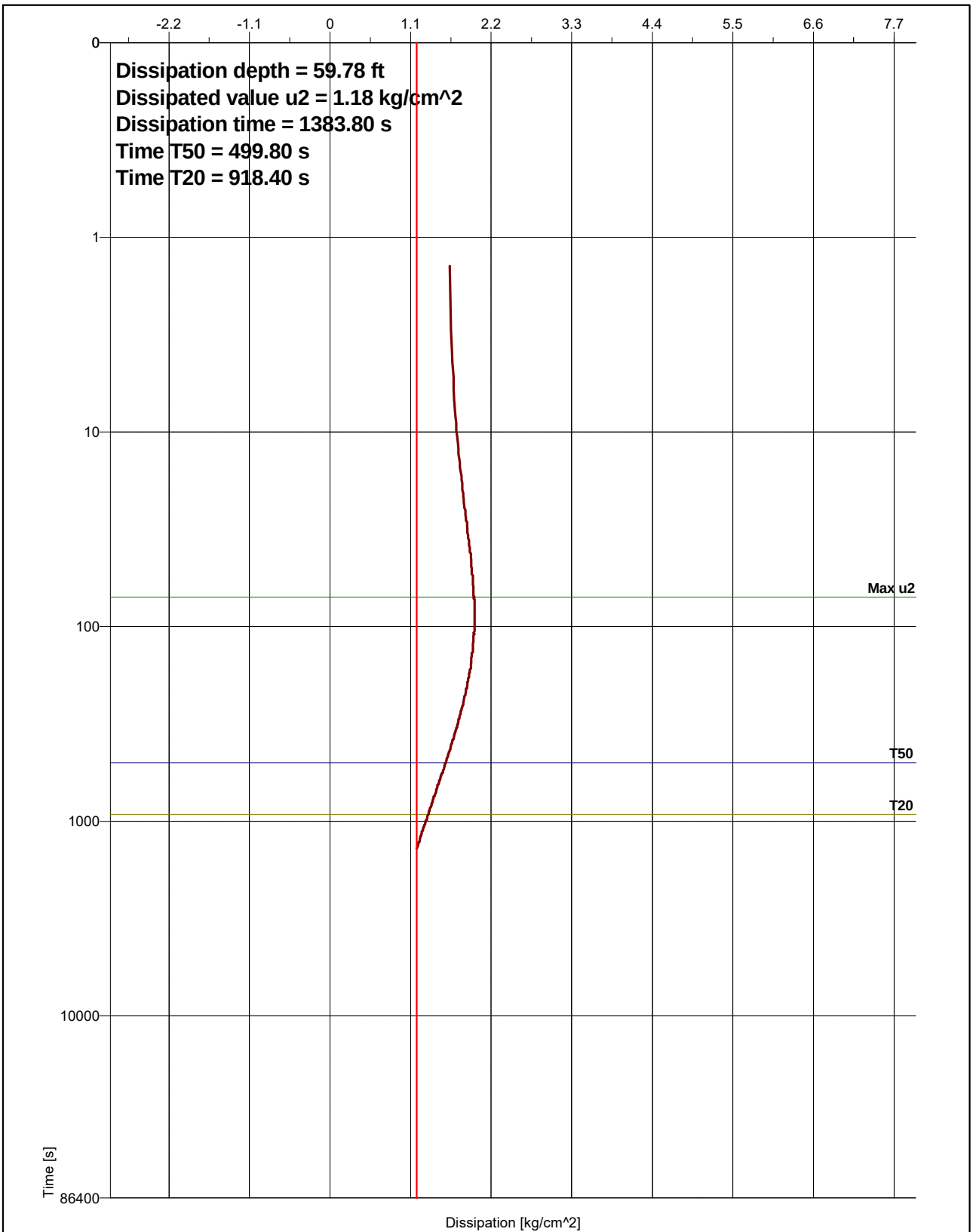
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 54 feet.		File: LMDamCPT-5.cpd	

DIRECT PUSH SERVICES, LLC



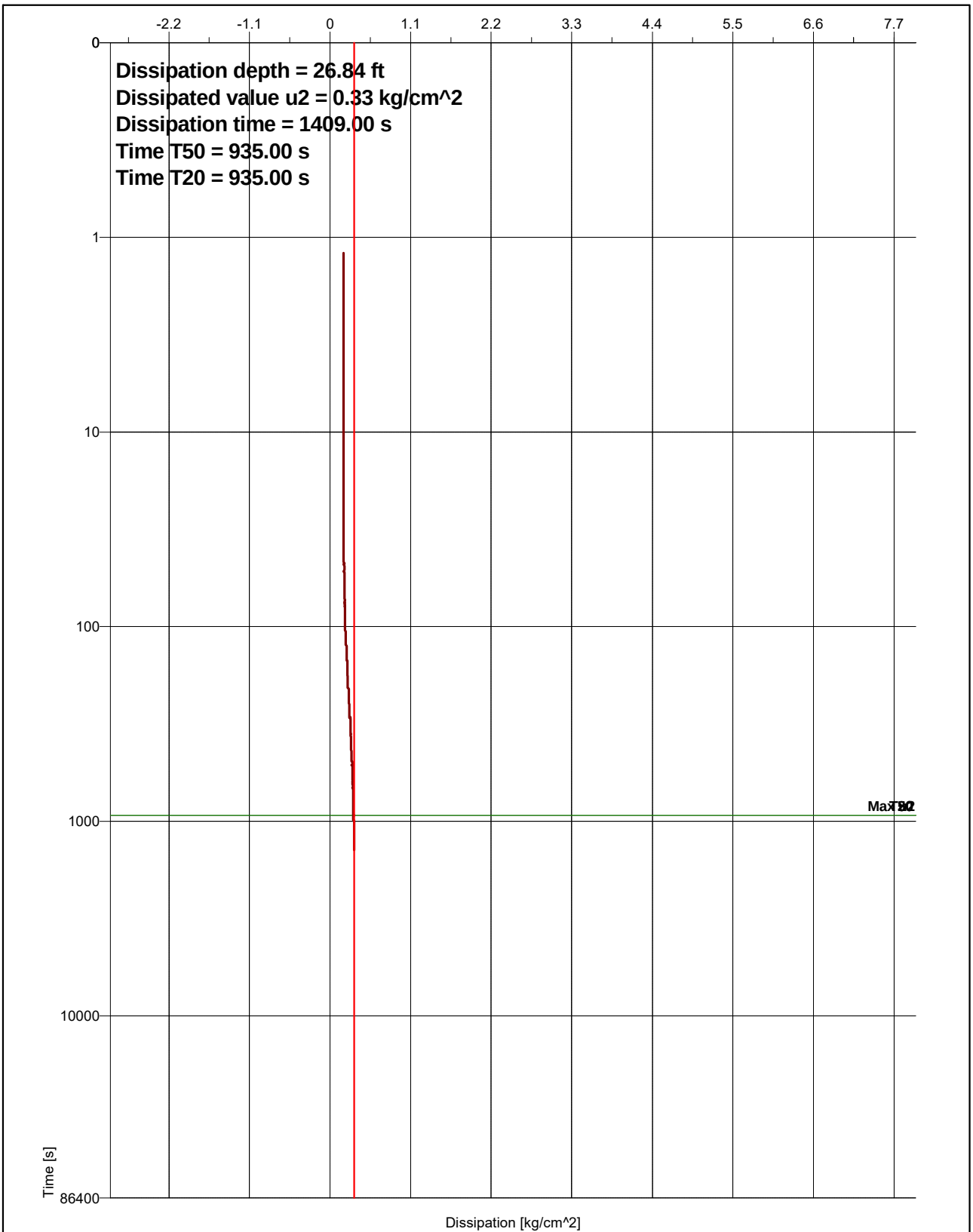
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/21/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 52 feet.		File: LMDamCPT-6.cpd	

DIRECT PUSH SERVICES, LLC



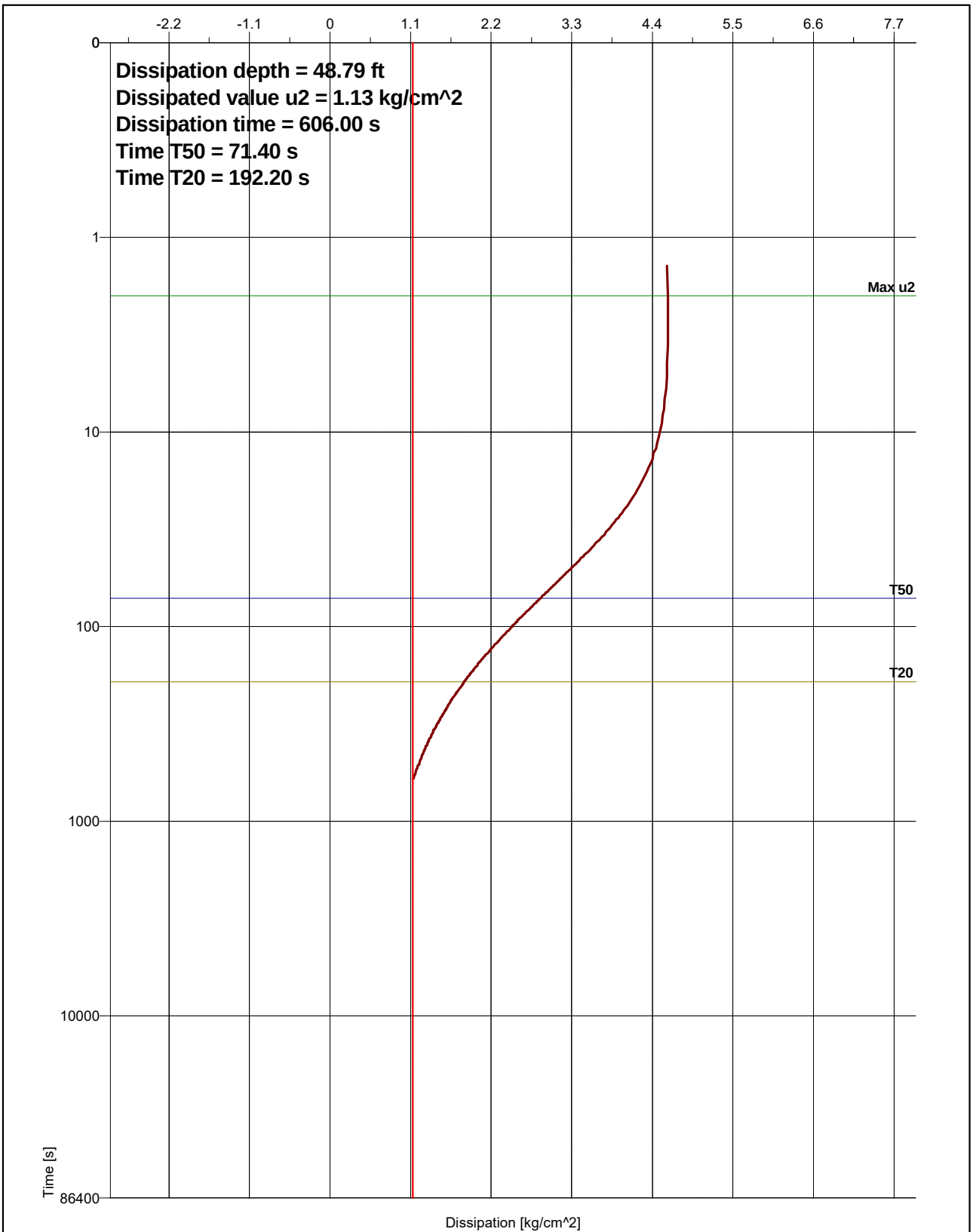
Location: Per Client's Map	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/22/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 60 feet. Pre-bored to 4 feet.		File: LMDamCPT-7.cpd	

DIRECT PUSH SERVICES, LLC



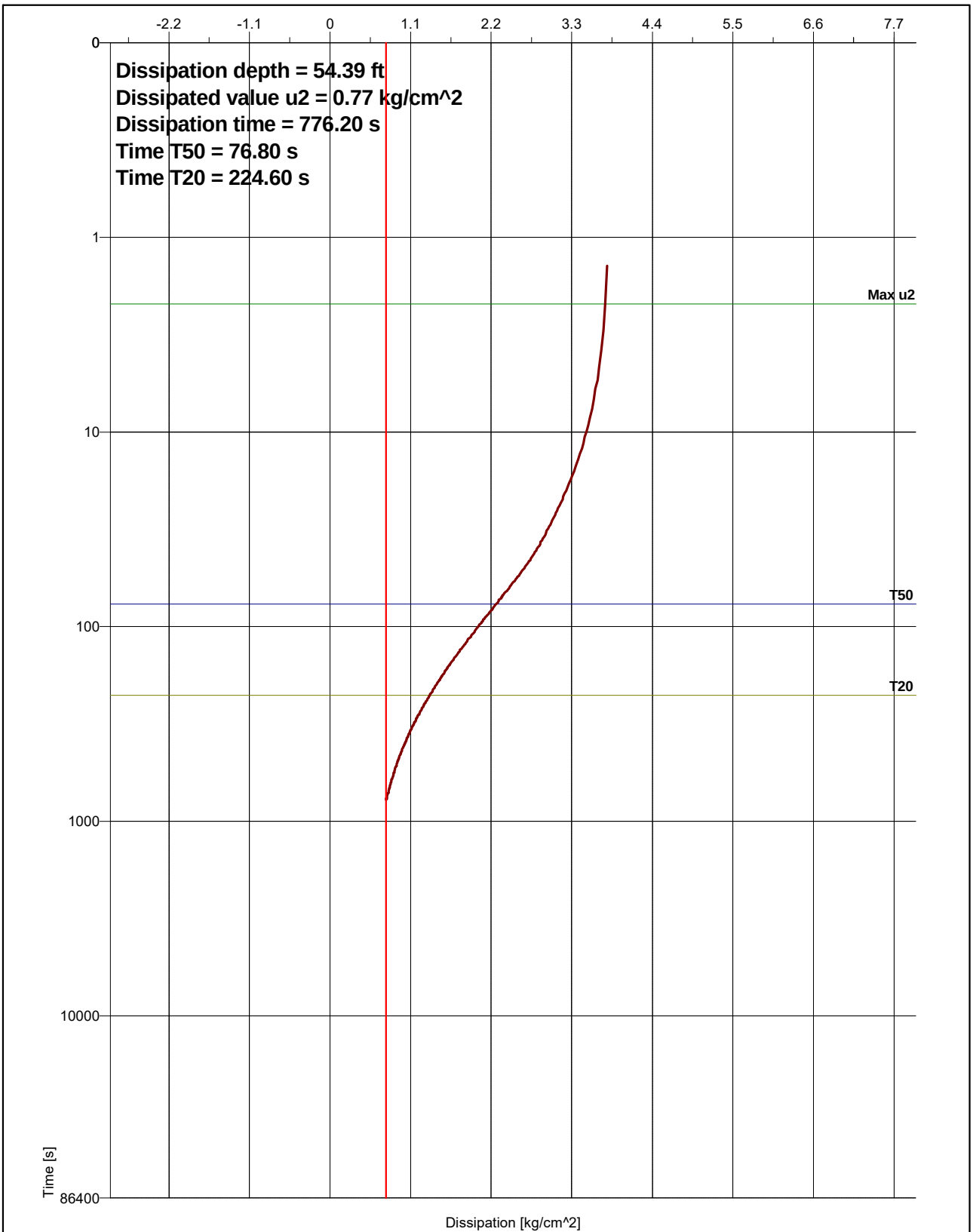
Location: 900 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 26 feet. Bored to 7.5 feet.		File: LMDamCPT-9.cpd	

DPS DIRECT PUSH SERVICES, LLC



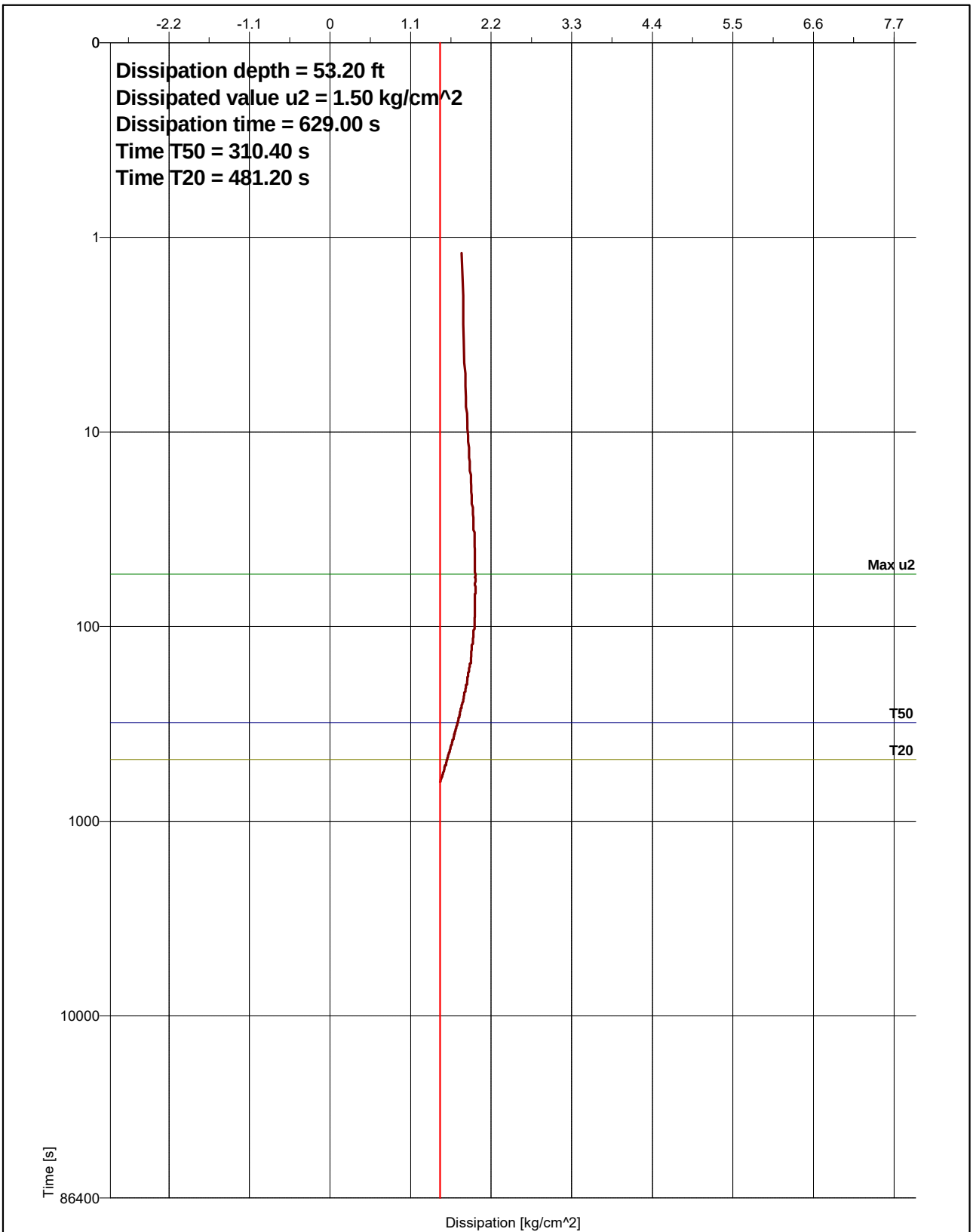
Location: 500 feet south of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 49 feet. Bored to 11 feet.		File: LMDamCPT-10.cpd	

DPS DIRECT PUSH SERVICES, LLC



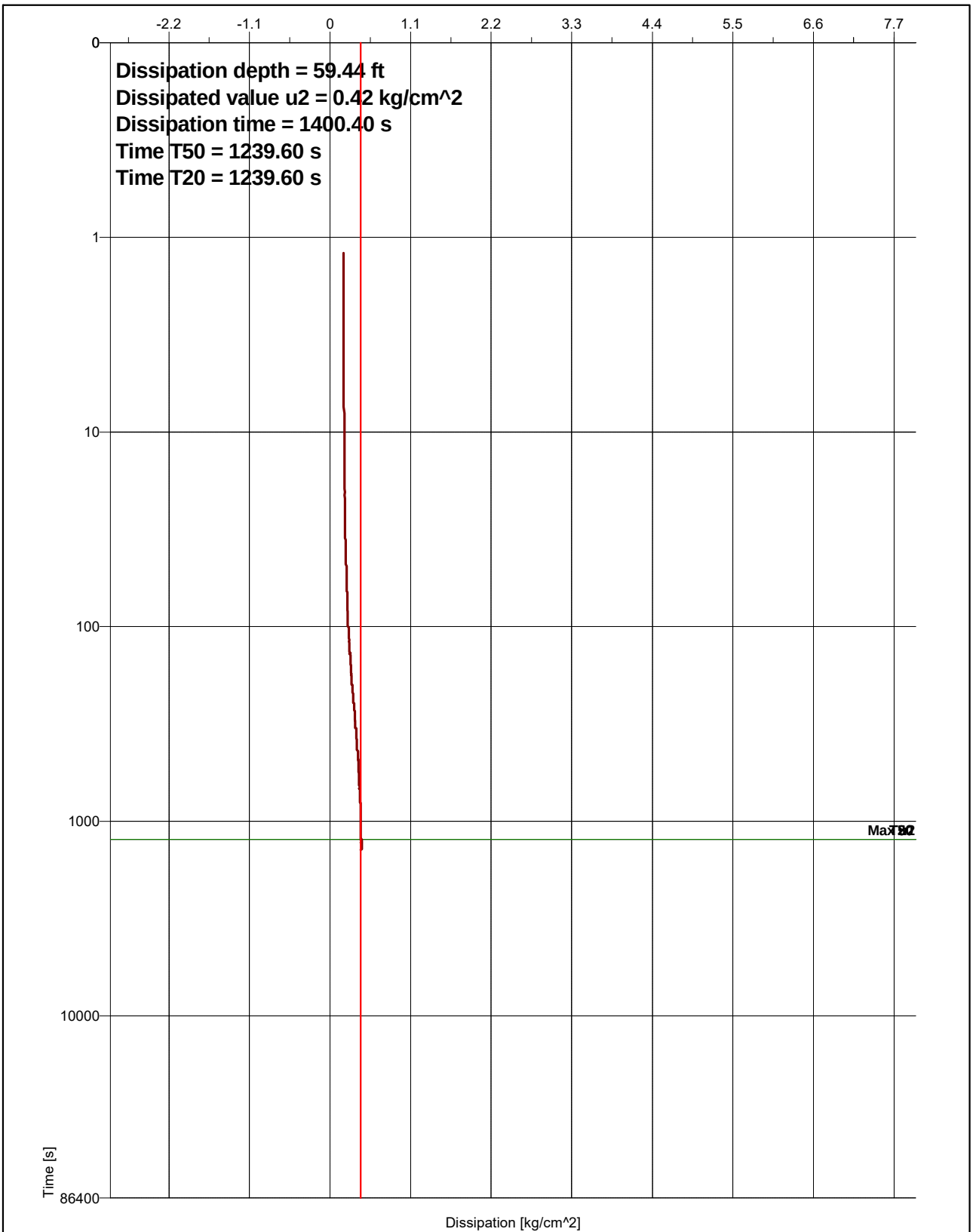
Location: 200 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 54 feet. Bored to 12 feet.		File: LMDamCPT-11.cpd	

DPS DIRECT PUSH SERVICES, LLC



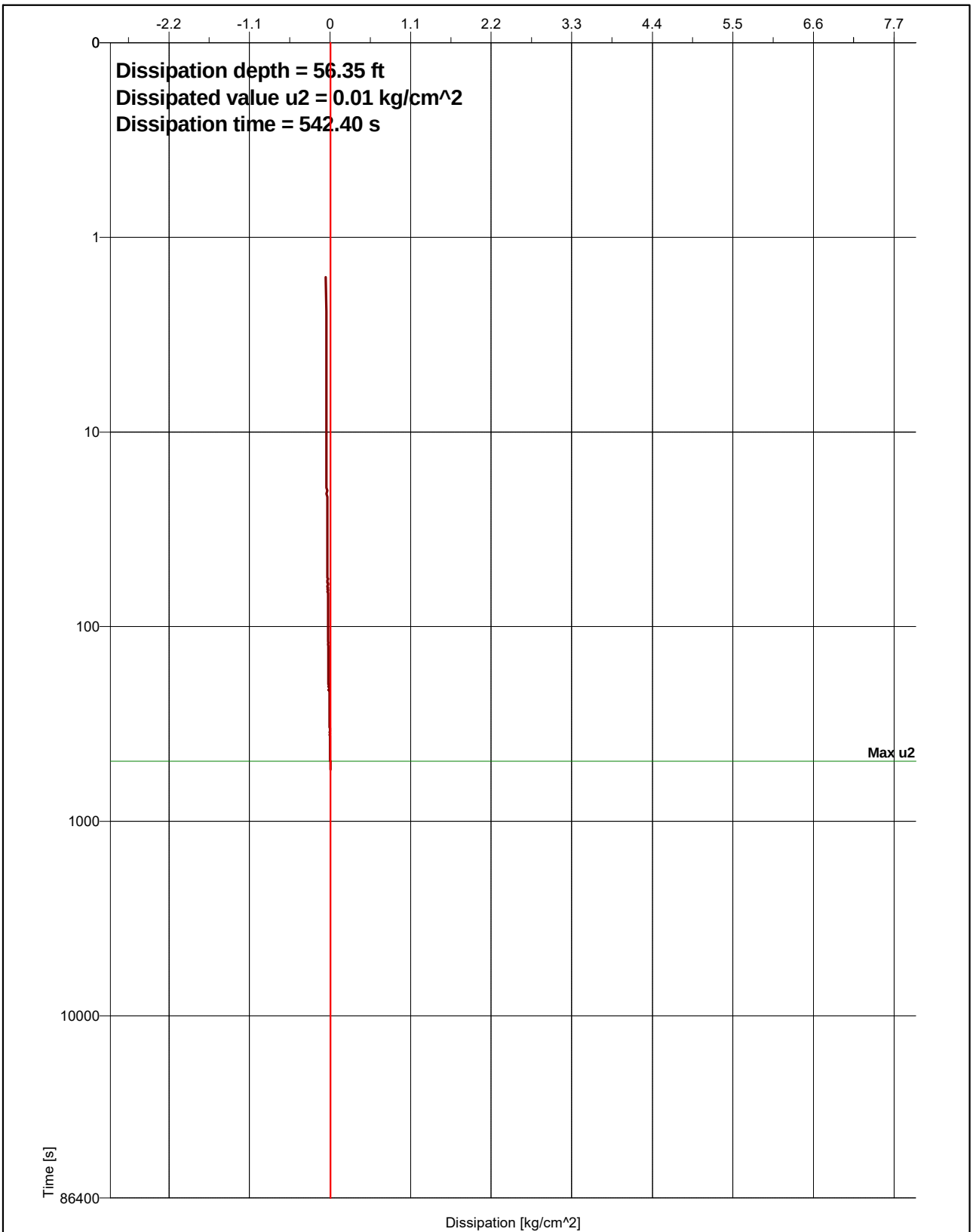
Location: 400 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/1	Fig:
Rig refusal at a depth of 53 feet. Bored to 9 feet.		File: LMDamCPT-13.cpd	

DPS
DIRECT PUSH SERVICES, LLC



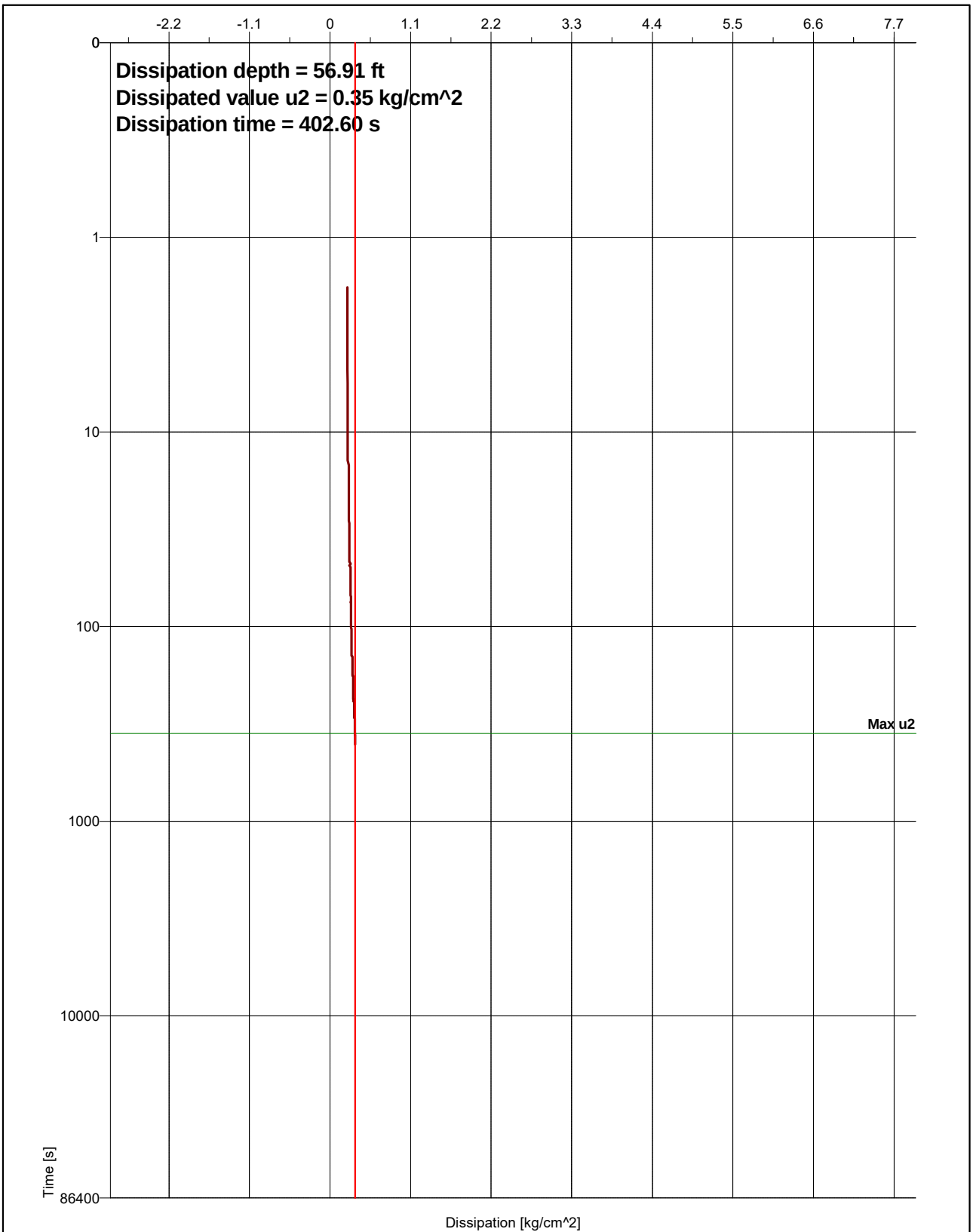
Location: 100 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/24/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 59 feet. Bored to 10 feet.		File: LMDamCPT-14.cpd	

DPS DIRECT PUSH SERVICES, LLC



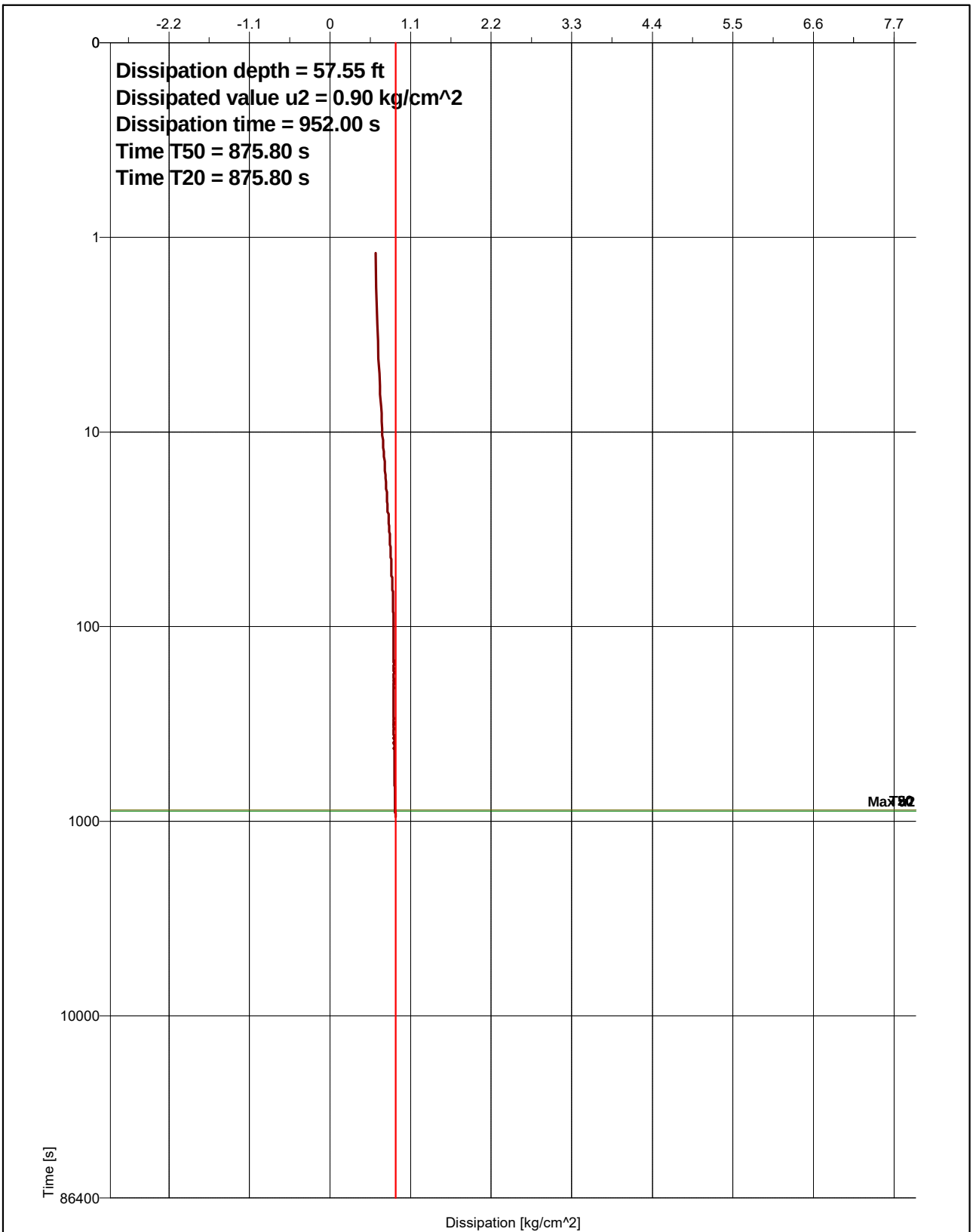
Location: 500 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 56 feet. Bored to 10 feet.		File: LMDamCPT-15.cpd	

DPS DIRECT PUSH SERVICES, LLC



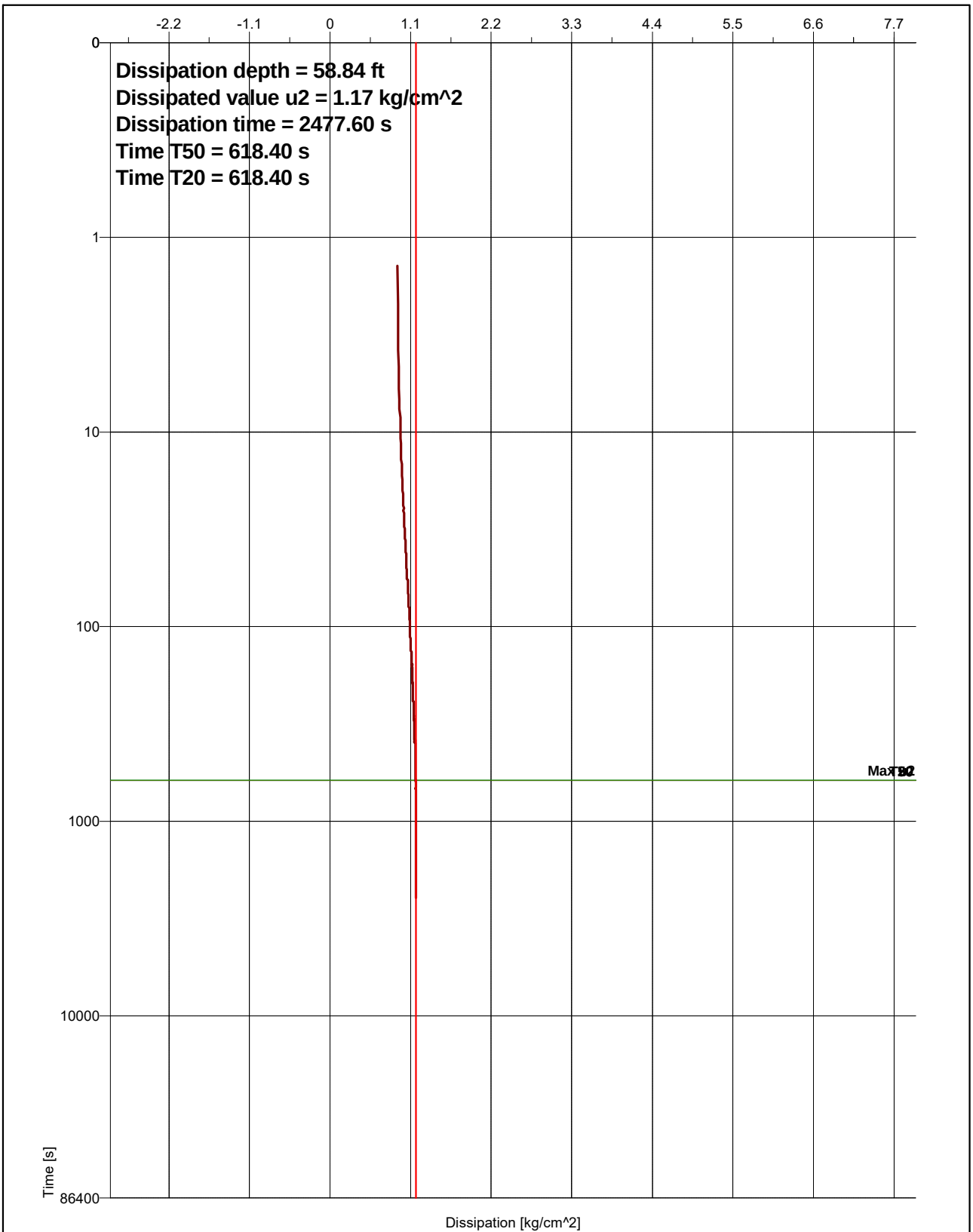
DPS
DIRECT PUSH SERVICES, LLC

Location: 600 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 57 feet. Bored to 10 feet.		File: LMDamCPT-16.cpd	



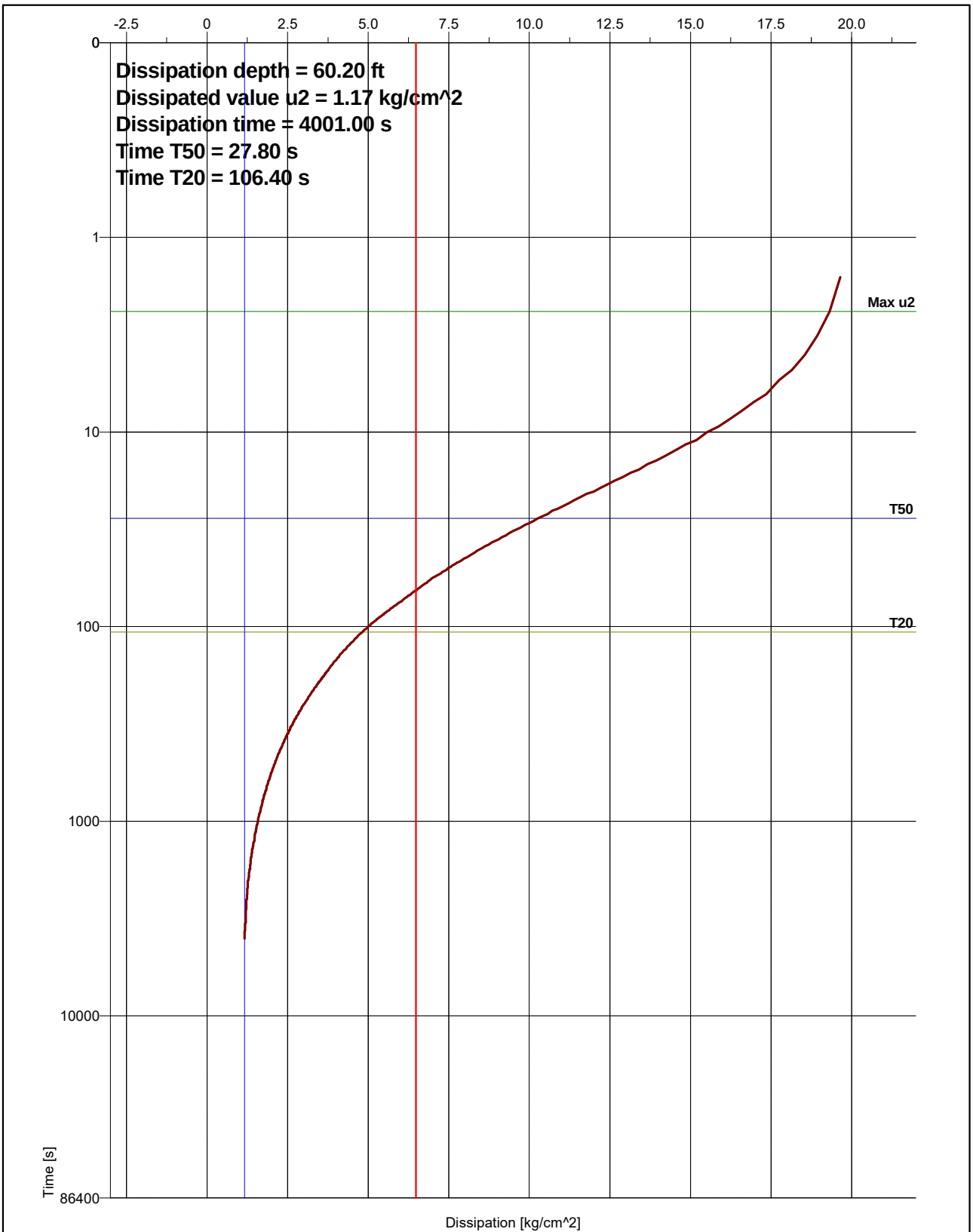
Location: 700 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 57.5 feet. Bored to 10 feet.		File: LMDamCPT-17.cpd	

DPS DIRECT PUSH SERVICES, LLC



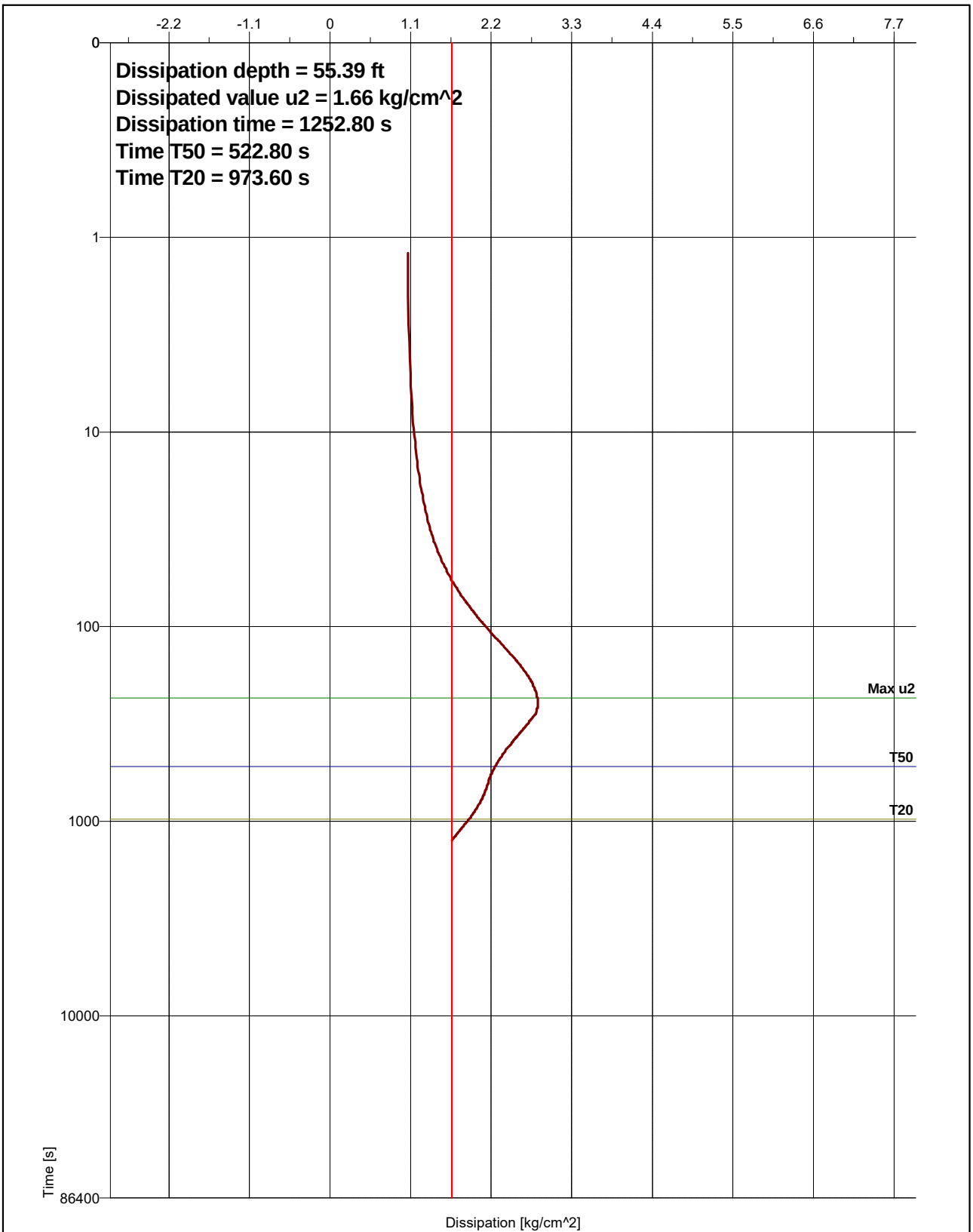
Location: 800 feet north of spillway	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 59 feet. Bored to 10 feet.		File: LMDamCPT-18.cpd	

DPS DIRECT PUSH SERVICES, LLC



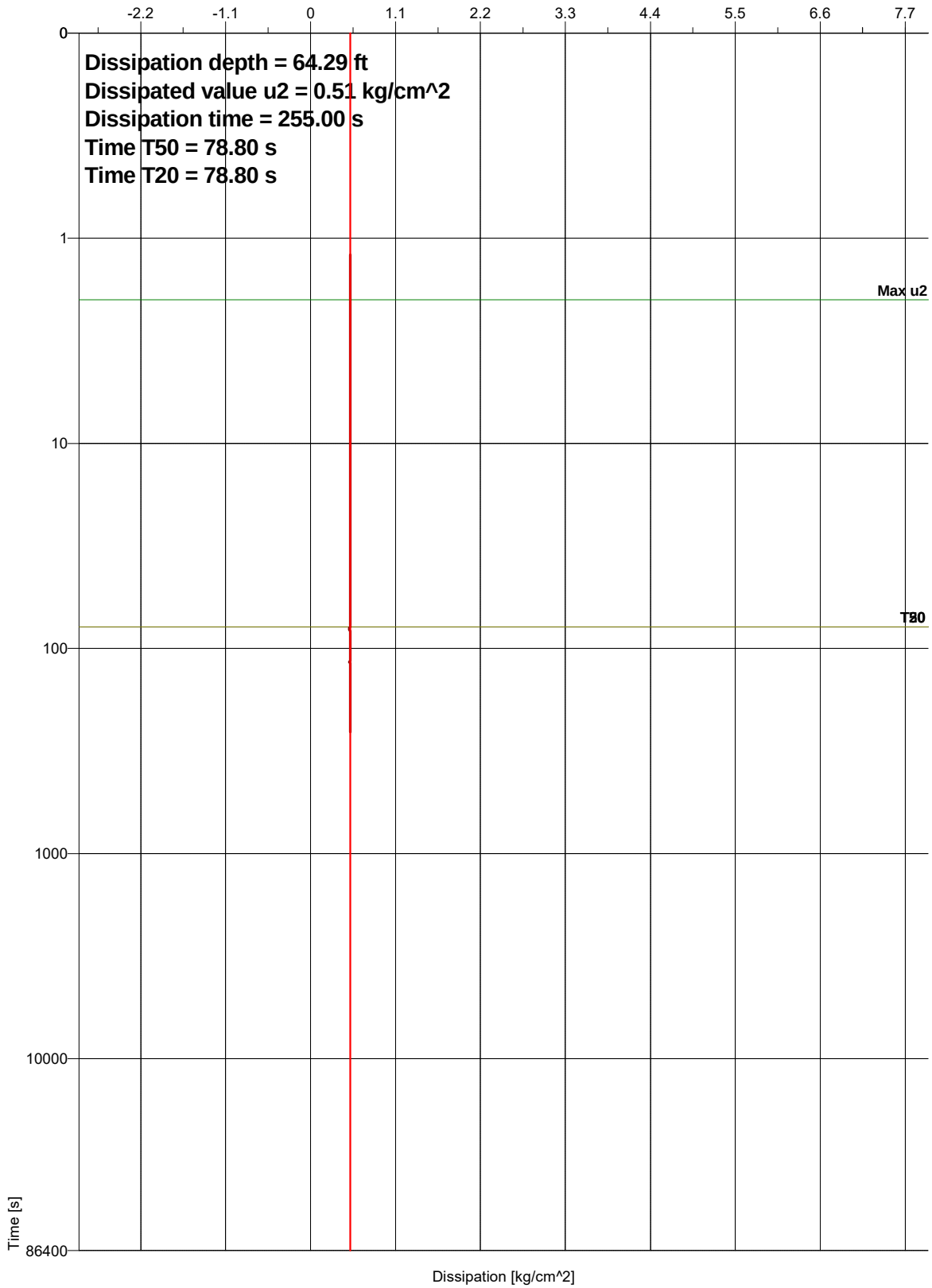
Location: 900 feet north of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/25/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 60 feet. Bored to 10 feet.		File: LMDamCPT-19.cpd	

DPS DIRECT PUSH SERVICES, LLC



Location: North side of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 55 feet.		File: LMDamCPT-33.cpd	

DPS DIRECT PUSH SERVICES, LLC



Location: South side of spillway.	Position: X: 0.00 ft, Y: 0.00 ft	Ground level: 0.00	Test no: A
Project ID: 212-400	Client: AMEC	Date: 2/26/2014	Scale: 1 : 76
Project: Lake Manatee Dam		Page: 1/2	Fig:
Rig refusal at a depth of 54 feet.		File: LMDamCPT-34.cpd	

DIRECT PUSH SERVICES, LLC

Appendix D

Amec Foster Wheeler's Emergency Sonic Core logs

BORING NUMBER Sonic-1

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/11/14 **COMPLETED** 3/11/14
GROUND ELEVATION 54.26 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Drilling
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 9+49.4; Adjacent to CPT-10
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
	SC 1				asphalt and road base	
				1.5		52.8
	SC 2		SM		(SM) very dark brown, SILTY fine grained SAND, trace cemented sand nodules, fine to medium gravel, slight organic odor (DAM SHELL MATERIAL - FILL)	
5				5.0		49.3
					- no sample recovered 5 ft to 10 ft	
10				10.0		44.3
	SC 3		SP-SM	11.0	(SP-SM) pale brown, poorly graded fine grained quartz SAND with SILT, common fine to coarse shell fragments (DAM SHELL MATERIAL - FILL)	43.3
					(SM) black, brown, variably SILTY fine grained quartz SAND (DAM SHELL MATERIAL - FILL)	
					- local clayey sand nodules at 13 ft	
15					- trace cemented sand nodules at 15 ft	
	SC 4		SM			
					- 1-inch to 3-inches clayey sand lenses	
20				20.0		34.3
	SC 5	PP = 1.5 tsf			(SC) light greenish gray, CLAYEY fine grained SAND, trace cemented clayey sand particles (DAM CORE MATERIAL - FILL)	
			SC		- 4-inch sand lense at 21.5 ft	
	SC 6	PP = 0.25, 1.25 tsf			- dolomitic, local gravel size cemented clay nodules below 22 ft	
25				25.0		29.3
					- no sample recovered 25 ft to 30 ft, loss of material due to collapse during insertion of core barrel, core advanced under weight of drill cross head without rotation or vibration	
30				30.0		24.3
	SC 7	PP = 0.25 tsf			(SC) light greenish gray CLAYEY SAND, little sand sized phosphate particles (DAM CORE MATERIAL - FILL)	
	SC 8				- lightly cemented 31 ft to 32 ft	
	SC 9	PP = 1.25, 3.0 tsf	SC		- slightly dolomitic, some sand sized phosphate particles from 32 ft to 35 ft	
35						

(Continued Next Page)

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:58 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35					(SC) light greenish gray CLAYEY SAND, little sand sized phosphate particles (DAM CORE MATERIAL - FILL) *(continued)*
	SC 10	PP = 1.25, 0.75, 1.0 tsf			- little sand sized phosphate particles, few medium to coarse sized phosphate sands below 35 ft
40					
	SC 11	PP = 0.75, 1.25, 1.75 tsf MC = 25% LL = 51 PL = 25 #200 = 35%	SC		- very pale brown, light greenish gray, slightly dolomitic between 40 ft and 45 ft
45					
	SC 12	PP = 2.0, 2.25, 2.5, 4.0 tsf			- light gray, light greenish gray, few sand sized phosphate particles between 45 ft and 50 ft
50					50.0 4.3
	SC 13	PP = 2.0, 1.75, 1.0, 1.25 tsf	SC		(SC) dark greenish gray, CLAYEY SAND, little sand sized phosphate particles, thin clay/silt lenses (NATIVE)
55					55.0 -0.7
	SC 14	PP = 2.25, 2.0 tsf	MH		(MH) dark greenish gray, variably sandy elastic SILT, local thin lenses of sand
	SC 15	PP = 2.5 tsf			- greenish gray, some clay below 58 ft
60					59.5 -5.2
	SC 16	PP = 2.25 tsf MC = 14% #200 = 5%	SP		60.0 -5.7 (SP) light gray, poorly graded fine grained quartz SAND, little sand sized phosphate particles, trace silt/clay
	SC 17	PP = 2.5, 2.75, 3.0 tsf	SC		(SC) dark greenish gray, variably CLAYEY SAND, few sand sized phosphate particles
					63.5 -9.2
65	SC 18	PP = 3.5 tsf	MH		(MH) light greenish gray, sandy elastic SILT, trace sand, dolomitic
					65.0 -10.7
	SC 19		SC		66.5 -12.2 (SC) light gray, CLAYEY SAND, dolomitic, trace sand sized phosphate particles, trace cemented sand
	SC 20		SM		67.5 -13.2 (SM) light gray, SILTY SAND, dolomitic, trace sand sized phosphate particles, trace cemented sand
	SC 21	MC = 15%	SP-SM		68.5 -14.2 (SP-SM) gray, poorly graded fine grained quartz SAND with SILT, some sand sized phosphate particles
70	SC 22		SM		

(Continued Next Page)

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:58 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - BORINGS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70						
	SC 23	PP = 0.25 tsf	SM		(SM) light gray, SILTY SAND, dolomitic, trace sand sized phosphate particles, trace cemented sand *(continued)*	
					71.5 - gray, some sand sized phosphate particles, little fine to medium gravels below 70 ft	-17.2
	SC 24	MC = 16%	SP-SM		(SP-SM) gray, poorly graded SAND with SILT, some sand sized phosphate particles, little fine to medium gravels	
					73.5	-19.2
75	SC 25		SM		(SM) gray, variably SILTY SAND, some sand sized phosphate particles, dolomitic, cemented silt/sand nodules	
					76.0 - 4-inches sand lense at 75 ft	-21.7
	SC 26		SP-SM		77.0 (SP-SM) dark gray, poorly graded fine grained quartz SAND with SILT, trace silt, some sand sized phosphate particles	-22.7
	SC 27	MC = 18% LL = 32 PL = 19	CL		(CL) light gray, variably SANDY CLAY, dolomitic silt, variably cemented	
					79.0	-24.7
80	SC 28	PP = 2.25, 3.5, 2.25 tsf	SM		(SM) light greenish gray, SILTY SAND, trace clay, few sand sized phosphate particles, slightly dolomitic, vertical sand streamers apparent	
85					- light gray, weakly cemented, dolomitic below 85 ft	
	SC 29				86.5	-32.2
	SC 30		SP-SM		(SP-SM) gray, light gray, poorly graded SAND with SILT, few sand sized phosphate particles, slightly dolomitic, trace gravel/cemented sand nodules	
90					90.0	-35.7
95					- no sample recovered 90 ft to 100 ft	
100					100.0	-45.7
	SC 31		MH		(MH) light gray, sandy elastic SILT, cemented, dolomitic, few sand sized phosphate particles	
105					105.0	-50.7

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BORING NUMBER Sonic-1

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
105					
110	SC 32	MC = 30% LL = 41 PL = 25 #200 = 78%	CL		(CL) light gray, CLAY with sand, cemented, dolomitic, few sand sized phosphate particles 110.0 -55.7 Bottom of borehole at 110.0 feet.

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BORING NUMBER Sonic-2

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DATE STARTED 3/11/14 **COMPLETED** 3/12/14 **GROUND ELEVATION** 54.25 ft **HOLE SIZE** 3 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Drilling **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** GA **AT END OF DRILLING** ---

NOTES STA 12+52.0; Adjacent to CPT-4 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SC 1				asphalt and road base (1.0) 53.3
5	SC 2		SM		(SM) very dark brown, SILTY fine grained quartz SAND, slightly organic, localized cemented sand nodules (DAM SHELL MATERIAL - FILL) (6.0) 48.3
10					- no sample recovered 6 ft to 10 ft (10.0) 44.3
15	SC 3		SM		(SM) brown, dark brown, SILTY fine grained quartz SAND, localized slightly cemented sand nodules (DAM SHELL MATERIAL - FILL)
	SC 4				- light gray, few sand sized phosphate particles, trace coarse phosphate particles, variably silty/clayey below 14 ft (17.0) 37.3
20	SC 5	PP = 3.75 tsf	SC		(SC) gray, CLAYEY SAND, silty, dolomitic, few sand sized phosphate particles, trace coarse phosphate particles (DAM CORE MATERIAL - FILL)
25	SC 6	PP = 3.25, 3.0, 2.5 tsf			- gray, greenish gray between 20 ft and 25 ft
30	SC 7	PP = 2.0 tsf			- light greenish gray, gray, minor silt between 25 ft and 30 ft
35	SC 8	PP = 3.0, 2.25, 2.0 tsf			- gray, greenish gray, slightly dolomitic between 30 ft and 37.5 ft

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	
35							
	SC 9	PP = 3.25, 3.0 tsf	SC			(SC) gray, CLAYEY SAND, silty, dolomitic, few sand sized phosphate particles, trace coarse phosphate particles (DAM CORE MATERIAL - FILL) *(continued)*	
					37.5		16.8
	SC 10	PP = 3.75 tsf	SM			(SM) light gray, SILTY fine grained quartz SAND, little sand sized phosphate particles, trace medium to coarse phosphate particles, slightly cemented, dolomitic, trace clay (DAM CORE MATERIAL - FILL)	
40					40.0		14.3
	SC 11		SC			(SC) greenish gray, gray, CLAYEY fine grained quartz SAND, little sand sized phosphate particles, wet (DAM CORE MATERIAL - FILL)	
	SC 12	PP = 1.0, 0.5 tsf				- greenish gray, minor silt, trace sand sized phosphate particles, trace fine phosphate gravel between 42 ft and 45 ft	
45					45.0		9.3
	SC 13	PP = 3.0, 3.5, 4.0 tsf	SC			(SC) greenish gray, dark greenish gray, CLAYEY fine grained quartz SAND, silty, trace sand sized phosphate particles (NATIVE)	
					49.0		5.3
50	SC 14	PP = 3.5, 3.0 tsf	SM			(SM) light greenish gray, SILTY fine grained quartz SAND, few sand sized phosphate particles, clayey, slightly dolomitic	
					52.0		2.3
	SC 15	PP = 3.5, 3.5 tsf	SC			(SC) light greenish gray, CLAYEY fine grained quartz SAND, little sand sized phosphate particles, little phosphate gravel, silty	
					54.0		0.3
55	SC 16	PP = 2.0 tsf	MH			(MH) light gray, sandy elastic SILT, dolomitic, local minor sand lenses	
					56.0		-1.8
	SC 17	PP = 3.25, 3.5 tsf	SM			(SM) greenish gray, SILTY fine grained quartz SAND, little fine to medium phosphate grains, clayey	
	SC 18	PP = 2.0, 2.25 tsf			59.0		-4.8
60			MH		60.0	(MH) greenish gray, sandy elastic SILT	-5.8
	SC 19	PP = 3.0 tsf MC = 18%	SP-SM		60.5	(SP-SM) gray, poorly graded fine grained quartz SAND with SILT, some sand sized phosphate particles	-6.3
					61.0		-6.8
	SC 20	PP = 3.5 tsf MC = 32%	MH SM			(MH) greenish gray, sandy elastic SILT	
					62.5	(SM) greenish gray, variably SILTY fine grained quartz SAND, little sand sized phosphate particles	-8.3
	SC 21	MC = 82% LL = 97 PL = 57 #200 = 63%	MH		63.5		-9.3
	SC 22					(MH) greenish gray, sandy elastic SILT	
65						(SP-SM) gray, greenish gray, poorly graded SAND with SILT, little sand sized phosphate particles, minor clay	
	SC 23	PP = 2.75 tsf MC = 30% #200 = 12%	SP-SM				
					67.5		-13.3
			MH			(MH) greenish gray, sandy elastic SILT, local thin sandy lenses	
70							

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70						
	SC 24		MH		(MH) greenish gray, sandy elastic SILT, local thin sandy lenses *(continued)*	
75					75.0	-20.8
					75.5 pale brown, DOLOSTONE, fossiliferous, micritic matrix, well indurated	-21.3
			SM		(SM) gray, SILTY SAND, some sand sized phosphate particles	
					77.0	-22.8
					77.5 pale brown, DOLOSTONE, fossiliferous, micritic matrix, well indurated	-23.3
			SM		78.0 (SM) gray, SILTY SAND, some sand sized phosphate particles	-23.8
					78.5 pale brown, DOLOSTONE, fossiliferous, micritic matrix, well indurated	-24.3
80	SC 25	PP = 3.0, 3.0, 2.25, 2.0 tsf MC = 21% #200 = 16%	SM		(SM) gray, SILTY SAND, some sand sized phosphate particles	
					83.0	-28.8
					83.5 pale brown, DOLOSTONE, fossiliferous, micritic matrix, well indurated	-29.3
85			SM		(SM) gray, SILTY SAND, some sand sized phosphate particles	
					85.0	-30.8
90	SC 26				light gray, DOLOSTONE, micritic matrix, well indurated, sandy, cemented dolomitic sandy silt	
					90.0	-35.8
	SC 27		SM		(SM) dark gray, SILTY fine grained quartz SAND, little sand sized phosphate particles	
					92.0	-37.8
	SC 28		ML		(ML) light gray, variably sandy SILT, cementation	
					93.5	-39.3
95					(MH) light greenish gray, variably sandy SILT, very fine grained quartz sand, minor clay	
	SC 29	PP = 2.0, 2.0, 2.25 tsf	MH			
100					100.0	-45.8
					Bottom of borehole at 100.0 feet.	

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BORING NUMBER Sonic-3

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/12/14 **COMPLETED** 3/12/14
GROUND ELEVATION 54.26 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Drilling
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 18+43.2; Adjacent to CPT-11
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
	SC 1				asphalt and road base	
					1.5	52.8
	SC 2				(SM) very dark brown, SILTY fine grained quartz SAND, slightly organic, local mottling iron oxide, trace cemented sand nodules (DAM SHELL MATERIAL - FILL)	
5						
			SM		- dark brown to brown, local shell fragments (5 ft to 7 ft), trace cemented sand nodules, trace clayey sand nodules, slightly organic below 5 ft	
	SC 3					
10						
					13.0	41.3
	SC 4	PP = 4.0, 3.5, 3.5 tsf			(SC) light greenish gray, light gray, CLAYEY fine grained quartz SAND, few sand sized phosphate particles, fine phosphate gravel, localized 2in silty sand lenses, slightly dolomitic (DAM SHELL MATERIAL - FILL)	
15						
20			SC			
	SC 5	PP = 3.0 tsf				
	SC 6	PP = 1.0, 0.25 tsf			- greenish gray, little sand sized phosphate particles, few fine phosphate gravel below 23 ft	
25					25.0	29.3
	SC 7				(SM) pale brown, light greenish gray, variably SILTY fine grained quartz SAND, minor clay, few sand sized phosphate particles, trace fine phosphate gravel, slightly dolomitic (DAM SHELL MATERIAL - FILL)	
30			SM			
	SC 8				- more clayey below 30 ft	
					32.0	22.3
	SC 9		SC		(SC) greenish gray, CLAYEY fine grained quartz SAND, few sand sized phosphate particles, trace fine phosphate gravel, trace silt (DAM CORE MATERIAL - FILL)	
35					35.0	19.3

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35	SC 10		SM		(SM) very pale brown, light greenish gray, SILTY SAND, few sand sized phosphate particles, trace fine phosphate gravel, slightly dolomitic (DAM CORE MATERIAL - FILL)
					37.0 17.3
	SC 11		SC		(SC) greenish gray, CLAYEY fine grained quartz SAND, minor silt, local cemented silt nodules, few sand sized phosphate particles (DAM CORE MATERIAL - FILL)
40					
	SC 12				- light gray, greenish gray, few sand sized phosphate particles, dolomitic below 41 ft
45					
	SC 13				- transition between fill and native material between 45 ft and 47 ft
					47.0 7.3
	SC 14		SM		(SM) light greenish gray, light gray, SILTY SAND, very fine grained quartz sands dolomitic silt, slightly clayey, trace sand sized phosphate particles (NATIVE)
50					50.0 4.3
	SC 15	PP = 1.75, 2.0, 2.25, 2.25, 2.25 tsf	MH		(MH) dark greenish gray, variably sandy elastic SILT, minor clay
55					
60					
	SC 16	PP = 2.25 tsf			
					62.0 -7.7
	SC 17	MC = 17%	SP		(SP) gray, poorly graded fine grained quartz SAND, some sand sized phosphate particles
					64.0 -9.7
65					
	SC 18	PP = 3.0, 3.0, 3.0, 2.0 tsf	MH		(MH) dark greenish gray, variably sandy elastic SILT, slightly dolomitic
70					

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
70			MH		(MH) dark greenish gray, variably sandy elastic SILT, slightly dolomitic *(continued)*	
				72.0		-17.7
			SM		(SM) gray, light gray, SILTY fine grained quartz SAND, dolomitic	
				73.0		-18.7
				73.5	pale brown, DOLOSTONE, locally weakly cemented to well cemented silty sand	-19.2
75			SM		(SM) gray, light gray, SILTY fine grained quartz SAND, dolomitic	
	SC 19	MC = 20%				
				79.0		-24.7
				79.5	pale brown, DOLOSTONE, locally weakly cemented to well cemented silty sand	-25.2
80			SM		(SM) gray, light gray, SILTY fine grained quartz SAND, dolomitic	
				81.0		-26.7
				82.0	pale brown, DOLOSTONE, locally weakly cemented to well cemented silty sand	-27.7
			SM		(SM) gray, light gray, SILTY fine grained quartz SAND, dolomitic	
85				85.0		-30.7
90	SC 20	PP = 2.25, 3.0 tsf	MH		(MH) greenish gray, variably sandy elastic SILT, very fine grained sands	
				92.0		-37.7
95	SC 21		ML	95.0	(ML) light gray, white, variably sandy SILT, slightly to moderately cemented, dolomitic	-40.7
100	SC 22	MC = 31% LL = 37 PL = 22 #200 = 39%	SC	100.0	(SC) light gray, light greenish gray, CLAYEY very fine grained quartz SAND, dolomitic, minor clay, locally cemented	-45.7

Bottom of borehole at 100.0 feet.

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BORING NUMBER Sonic-4

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.05
PROJECT LOCATION Manatee County
DATE STARTED 3/13/14 **COMPLETED** 3/13/14
GROUND ELEVATION 54.3 ft **HOLE SIZE** 3 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Drilling
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** GA
AT END OF DRILLING ---
NOTES STA 25+43.4; Adjacent to CPT-19
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
	SC 1				asphalt and road base
2.0					52.3
					(SM) very dark brown, SILTY fine grained quartz SAND, trace gravel size cemented sand nodules, trace clayey nodules (DAM SHELL MATERIAL - FILL)
5	SC 2		SM		
					- 6-inches clean gray sand lense at 8 ft
10					10.0 44.3
					- no sample recovered 10 ft to 20 ft, loss of material due to collapse during insertion of core barrel, core advanced under weight of drill cross head without rotation or vibration
15					
20					20.0 34.3
	SC 3	PP = 3.0, 2.25, 3.0 tsf			(SC) light gray, light greenish gray, variably CLAYEY fine grained quartz SAND, little sand sized phosphate particles, slightly dolomitic, local gravel size cemented silt nodules (DAM SHELL MATERIAL - FILL)
25					
	SC 4	PP = 1.25, 1.0 tsf	SC		- greenish gray, few sand sized phosphate particles, trace gravel sized phosphate particles between 20 ft and 30 ft
30					
					- minor silt, trace gravel size cemented nodules, little sand sized phosphate particles, trace gravel sized phosphate particles below 30 ft
					- vertical 1/2 to 1-inch sand lense and 1/16 to 1/2-inch horizontal lense 33 ft to 34 ft
35	SC	PP = 0.25, 0.25,			

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35					
	5	0.75, 1.0, 2.0, 2.0 tsf	SC		(SC) light gray, light greenish gray, variably CLAYEY fine grained quartz SAND, little sand sized phosphate particles, slightly dolomitic, local gravel size cemented silt nodules (DAM SHELL MATERIAL - FILL) *(continued)*
40					
	SC 6	PP = 2.0, 3.0, 3.5, 1.75, 2.25, 1.75 tsf			
45					
					47.5 6.8
	SC 7	PP = 2.0, 2.25, 2.25, 3.5 tsf	SC		(SC) light greenish gray, CLAYEY fine grained quartz SAND, minor silt, trace sand sized phosphate particles, slightly dolomitic (NATIVE)
50					53.0 1.3
	SC 8	PP = 3.0, 2.0, 1.25, 2.3, 4.0 tsf MC = 19% #200 = 40%	SM		(SM) light greenish gray, SILTY fine grained quartz SAND, minor clay, little fine to coarse sand sized phosphate particles, trace fine to medium gravel sized phosphate particles, slightly dolomitic
55					
60					
	SC 9	PP = 2.0 tsf MC = 20% #200 = 22%			- greenish gray, minor clay, little sand sized phosphate particles, few fine gravel sized phosphate particles below 60 ft - 4-inches sand lense at 61.5 ft
					63.0 -8.7
	SC 10	MC = 20%	SP		(SP) gray, poorly graded fine grained quartz SAND, trace silt, some sand sized phosphate particles - local 6-inches silty sand lense 65 ft to 65.5 ft
65					
					67.5 -13.2
	SC 11	MC = 32% #200 = 21%	SM		(SM) gray, greenish gray, SILTY fine grained quartz SAND - 2-inches sand lense at 69 ft
70					

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BORING NUMBER Sonic-4

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.05 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
70	SC 12	MC = 25% #200 = 17%	SM		(SM) gray, greenish gray, SILTY fine grained quartz SAND *(continued)* - variably silty and clayey, trace gravel, little sand sized phosphate particles, local minor gravel sized phosphate particles after 70 ft
75	SC 13	MC = 22% #200 = 20%			- 3-inches to 4-inches sandy silt lenses at 77 ft
80	SC 14	PP = 3.0, 3.0 tsf MC = 29% #200 = 14%			- 5-inches sand with silt lense at 79 ft
					84.0 -29.7
85	SC 15	PP = 4.0, 4.5, 4.0 tsf MC = 21% LL = 143 PL = 88	MH		(MH) dark greenish gray, greenish gray, sandy elastic SILT, trace sand, dolomitic
90	SC 16	PP = 4.0, 4.0 tsf			- 2-inches to 3-inches sand lenses 87 ft to 88 ft - 1/16 to 1/8-inch sand lenses 90 ft to 93 ft
					93.0 -38.7
95	SC 17		ML		(ML) light gray, white, sandy SILT, weak to strong cementation, dolomitic
100					100.0 -45.7
					Bottom of borehole at 100.0 feet.

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Appendix E

Amec Foster Wheeler Piezometer and Well Logs

WELL NUMBER PZ-1-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 6/19/14 **COMPLETED** 6/20/14 **GROUND ELEVATION** 51.97 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES STA 13+17 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		1.0 (SP) dark brown, poorly graded SAND, trace organic silt 51.0	
		SP-SC		2.0 (SP-SC) light gray, poorly graded SAND with CLAY, little fine gravel size limestone fragments 50.0	
	SC 1	SP-SM		(SP-SM) dark brown, brown poorly graded SAND with SILT, slightly organic staining	
10				9.0 43.0	
	SC 2	SC		(SC) light greenish gray, variably CLAYEY SAND, some phosphate particles, trace silt - few to little phosphatic sands throughout, local 2 to 3-inch clay lenses, slightly calcareous/dolomitic	
20					
	SC 3			- variably silty, trace medium grained quartz sand, local thin sandy clay lenses and nodules, few fine to medium phosphate particles, calcareous/dolomitic	
30				30.0 22.0	
	SC 4	SM		(SM) very pale brown, SILTY SAND, little to some fine to medium phosphate particle, local clayey and silty nodules, calcareous/dolomitic, 6-inch clayey sand lense at 31 ft	
				34.0 18.0	
40		SC		(SC) gray, light gray, CLAYEY SAND, variably clayey and silty, some fine to medium phosphate particle, calcareous/dolomitic, cobble size cemented clay with phosphate particle at 36 ft, local sandy clay lense at 39 ft	
	SC 5				
				47.0 5.0	
50		SM		(SM) dark greenish gray, SILTY SAND, variably silty and clayey, few fine phosphate particles, slightly calcareous/dolomitic	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:48 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50	SC 6	SM		(SM) dark greenish gray, SILTY SAND, variably silty and clayey, few fine phosphate particles, slightly calcareous/dolomitic *(continued)* - high clay content, few fine to coarse phosphate particles, trace gravel size phosphate particles, slightly calcareous/dolomitic		Grout
				56.0	-4.0	
60		MH		(MH) light greenish gray, dark greenish gray, SILT, variably sandy, trace fine phosphate particles, slightly calcareous/dolomitic, local silty sand 2 to 3-inch lenses from 59 ft to 60 ft		
				62.0	-10.0	
	SC 7	SM		(SM) greenish gray, variably SILTY SAND, local sand lenses, some fine phosphate particles		
				65.0	-13.0	
		SP		66.0 (SP) dark gray, poorly graded SAND, trace silt, some fine phosphate particles	-14.0	
70		SM		(SM) dark greenish gray, variably SILTY SAND, local silt lenses, trace phosphate particles		
				70.0	-18.0	
	SC 8	MH		(MH) greenish gray, SILT, variably sandy, little phosphate particles		
				72.0	-20.0	
		SM		73.0 (SM) gray, variably SILTY SAND, trace fine phosphate particles, desiccated, local calcareous silt lenses	-21.0	
		MH		(MH) gray, light gray, sandy elastic SILT, trace to few sand and gravel size phosphate particles, local calcareous silt and clay, 3-inch lense of desiccated silt and clay at 75 ft		
80				80.0	-28.0	
	SC 9	SP-SM		(SP-SM) gray, poorly graded SAND with SILT, fine phosphate particles, minor calcareous silt, 3-inch cemented silt lense at 81.5 ft		
				83.0	-31.0	
		ML		85.0 (ML) light gray, cemented SILT, calcareous, minor sand, trace phosphate particles	-33.0	
		SP-SM		(SP-SM) gray, poorly graded SAND with SILT, trace fine phosphate particles, moderately cemented silt nodules and lenses from 89 ft to 90 ft		
90				90.0	-38.0	
	SC 10	MH		(MH) light gray, sandy elastic SILT, calcareous/dolomitic, cemented silt with sand from 90 to 91 ft, desiccated silt with sand from 91 ft to 94 ft		
				- slightly calcareous/dolomitic, minor sand, 2-inch cemented lense at 94 ft		
100						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-1-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100		MH		(MH) light gray, sandy elastic SILT, calcareous/dolomitic, cemented silt with sand from 90 to 91 ft, desiccated silt with sand from 91 ft to 94 ft *(continued)*	Bentonite Seal
	SC 11			104.0 -52.0	Sand Pack
110		ML		(ML) gray, light gray, SILT, variably sandy, few to little fine phosphate particles, calcareous/dolomitic, common cemented nodules and lenses from 110 ft to 116 ft	Slotted Screen
	SC 12				
120				121.0 -69.0	Blank

Bottom of borehole at 121.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-1-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 6/20/14 **COMPLETED** 6/20/14 **GROUND ELEVATION** 51.95 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES STA 13+12 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		1.0 (SP) dark brown, poorly graded SAND, trace organic silt	51.0	
		SP-SC		2.0 (SP-SC) light gray, poorly graded SAND with CLAY, little fine gravel size limestone fragments	50.0	
		SP-SM		(SP-SM) dark brown, brown poorly graded SAND with SILT, slightly organic staining		
10				9.0	43.0	
		SC		(SC) light greenish gray, variably CLAYEY SAND, some phosphate particles, trace silt - few to little phosphatic sands throughout, local 2 to 3-inch clay lenses, slightly calcareous/dolomitic		
20				- variably silty, trace medium grained quartz sand, local thin sandy clay lenses and nodules, few fine to medium phosphate particles, calcareous/dolomitic		Grout
30				30.0	22.0	
		SM		(SM) very pale brown, SILTY SAND, little to some fine to medium phosphate particle, local clayey and silty nodules, calcareous/dolomitic, 6-inch clayey sand lense at 31 ft		
				34.0	18.0	
40		SC		(SC) gray, light gray, CLAYEY SAND, variably clayey and silty, some fine to medium phosphate particle, calcareous/dolomitic, cobble size cemented clay with phosphate particle at 36 ft, local sandy clay lense at 39 ft		
				47.0	5.0	
50		SM		(SM) dark greenish gray, SILTY SAND, variably silty and clayey, few fine phosphate particles, slightly calcareous/dolomitic		

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WELL NUMBER PZ-1-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SM		(SM) dark greenish gray, SILTY SAND, variably silty and clayey, few fine phosphate particles, slightly calcareous/dolomitic *(continued)* - high clay content, few fine to coarse phosphate particles, trace gravel size phosphate particles, slightly calcareous/dolomitic	-4.1	
				56.0		
		MH		(MH) light greenish gray, dark greenish gray, SILT, variably sandy, trace fine phosphate particles, slightly calcareous/dolomitic, local silty sand 2 to 3-inch lenses from 59 ft to 60 ft		Bentonite Seal
60						Sand Pack
				62.0	-10.1	
		SM		(SM) greenish gray, variably SILTY SAND, local sand lenses, some fine phosphate particles		
				65.0	-13.1	
		SP		66.0 (SP) dark gray, poorly graded SAND, trace silt, some fine phosphate particles	-14.1	
		SM		(SM) dark greenish gray, variably SILTY SAND, local silt lenses, trace phosphate particles		Slotted Screen
70						
				70.0	-18.1	
		MH		(MH) greenish gray, SILT, variably sandy, little phosphate particles		
				72.0	-20.1	
		SM		73.0 (SM) gray, variably SILTY SAND, trace fine phosphate particles, desiccated, local calcareous silt lenses	-21.1	
		MH		(MH) gray, light gray, sandy elastic SILT, trace to few sand and gravel size phosphate particles, local calcareous silt and clay, 3-inch lense of desiccated silt and clay at 75 ft		Blank
				76.0	-24.1	

Bottom of borehole at 76.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-1-S

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 6/20/14 **COMPLETED** 6/20/14
GROUND ELEVATION 51.95 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY AS **CHECKED BY** DK
AT END OF DRILLING ---
NOTES STA 13+07
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		1.0 (SP) dark brown, poorly graded SAND, trace organic silt	51.0	
		SP-SC		2.0 (SP-SC) light gray, poorly graded SAND with CLAY, little fine gravel size limestone fragments	50.0	
		SP-SM		(SP-SM) dark brown, brown poorly graded SAND with SILT, slightly organic staining		
10		SC		9.0 (SC) light greenish gray, variably CLAYEY SAND, some phosphate particles, trace silt - few to little phosphatic sands throughout, local 2 to 3-inch clay lenses, slightly calcareous/dolomitic	43.0	Grout
20				- variably silty, trace medium grained quartz sand, local thin sandy clay lenses and nodules, few fine to medium phosphate particles, calcareous/dolomitic		
30		SM		30.0 (SM) very pale brown, SILTY SAND, little to some fine to medium phosphate particle, local clayey and silty nodules, calcareous/dolomitic, 6-inch clayey sand lense at 31 ft	22.0	
40		SC		34.0 (SC) gray, light gray, CLAYEY SAND, variably clayey and silty, some fine to medium phosphate particle, calcareous/dolomitic, cobble size cemented clay with phosphate particle at 36 ft, local sandy clay lense at 39 ft	18.0	Bentonite Seal Sand Pack Slotted Screen
		SM		47.0 (SM) dark greenish gray, SILTY SAND, variably silty and clayey, few fine phosphate particles, slightly calcareous/dolomitic	5.0	
				49.0	3.0	Blank

Bottom of borehole at 49.0 feet.

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WELL NUMBER PZ-2-D

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 6/21/14 **COMPLETED** 6/21/14
GROUND ELEVATION 53.73 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY ND **CHECKED BY** DK
AT END OF DRILLING ---
NOTES STA 12+17
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SM		(SM) brown, dark brown, SILTY SAND, few gravel, slightly clayey nodules throughout	
5.0					48.7
		SC		(SC) dark brown, greenish gray, brown, light brown, CLAYEY SAND, variably silty, few gravel, stiff clayey zone at 6.5 ft	
10	SC 2			- some to few gravel, vertical sand veins throughout	
				- greenish gray, some thin sand lenses, phosphatic sands throughout, few phosphatic pebbles, trace phosphatic particles throughout	
20	SC 3				
30	SC 4				
40	SC 5			- slightly silty, few phosphate particles, trace phosphatic pebbles	
47.0					6.7
		SM		(SM) greenish gray, variably SILTY SAND, some plasticity	
50					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SM		(SM) greenish gray, variably SILTY SAND, some plasticity *(continued)*		Grout
				54.0	-0.3	
		SP-SC		55.0 (SP-SC) greenish gray, poorly graded SAND with CLAY, some phosphate particles, trace silt	-1.3	
		SC		(SC) greenish gray CLAYEY SAND, some phosphate particles, some gravel, trace silt		
				58.0	-4.3	
60		SM		(SM) greenish gray, SILTY SAND, trace phosphate particles		
	SC 7			64.0	-10.3	
		SP-SM		66.0 (SP-SM) greenish gray, poorly graded SAND with SILT, some phosphate particles to pebbles	-12.3	
		SC		(SC) greenish gray, CLAYEY SAND, little silt, some phosphate particles, thin lenses of phosphatic sand		
				69.0	-15.3	
70		SM		(SM) greenish gray, variably SILTY SAND, some phosphate particles		
	SC 8					
80						
				82.0 - cemented	-28.3	
	SC 9	SP-SM		(SP-SM) greenish gray, poorly graded SAND with SILT, little phosphate particles		
				85.0	-31.3	
		SM		(SM) light gray, gray, greenish gray, SILTY SAND, cemented - little phosphate particles, 1-inch lense of cemented silty sand at 88 ft		
90						
				93.0	-39.3	
	SC 10	SC		(SC) greenish gray, variably CLAYEY SAND, trace phosphate particles		
100						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-2-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100				(SC) greenish gray, variably CLAYEY SAND, trace phosphate particles *(continued)*	Bentonite Seal
	SC 11				Sand Pack
110		SC			
	SC 12				Slotted Screen
120					
121.0				-67.3	Blank

Bottom of borehole at 121.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-2-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 6/21/14 **COMPLETED** 6/21/14 **GROUND ELEVATION** 53.84 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES STA 12+12 **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SM		(SM) brown, dark brown, SILTY SAND, few gravel, slightly clayey nodules throughout	
5.0					48.8
		SC		(SC) dark brown, greenish gray, brown, light brown, CLAYEY SAND, variably silty, few gravel, stiff clayey zone at 6.5 ft	
10				- some to few gravel, vertical sand veins throughout	
				- greenish gray, some thin sand lenses, phosphatic sands throughout, few phosphatic pebbles, trace phosphatic particles throughout	
20					
					Grout
30					
40				- slightly silty, few phosphate particles, trace phosphatic pebbles	
47.0					6.8
		SM		(SM) greenish gray, variably SILTY SAND, some plasticity	
50					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-2-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SM		(SM) greenish gray, variably SILTY SAND, some plasticity *(continued)*		
				54.0	-0.2	
		SP-SC		55.0 (SP-SC) greenish gray, poorly graded SAND with CLAY, some phosphate particles, trace silt	-1.2	
		SC		(SC) greenish gray CLAYEY SAND, some phosphate particles, some gravel, trace silt		Bentonite Seal
				58.0	-4.2	
60		SM		(SM) greenish gray, SILTY SAND, trace phosphate particles		Sand Pack
				64.0	-10.2	
		SP-SM		66.0 (SP-SM) greenish gray, poorly graded SAND with SILT, some phosphate particles to pebbles	-12.2	
		SC		(SC) greenish gray, CLAYEY SAND, little silt, some phosphate particles, thin lenses of phosphatic sand		Slotted Screen
				69.0	-15.2	
70		SM		(SM) greenish gray, variably SILTY SAND, some phosphate particles		
				76.0	-22.2	Blank

Bottom of borehole at 76.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-2-S

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 6/23/14 **COMPLETED** 6/23/14
GROUND ELEVATION 53.86 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** DK
AT END OF DRILLING ---
NOTES STA 12+07
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		SM		(SM) brown, dark brown, SILTY SAND, few gravel, slightly clayey nodules throughout
5.0				
		SC		(SC) dark brown, greenish gray, brown, light brown, CLAYEY SAND, variably silty, few gravel, stiff clayey zone at 6.5 ft
10				- some to few gravel, vertical sand veins throughout
				- greenish gray, some thin sand lenses, phosphatic sands throughout, few phosphatic pebbles, trace phosphatic particles throughout
20				
30				
40				- slightly silty, few phosphate particles, trace phosphatic pebbles
47.0				
		SM		(SM) greenish gray, variably SILTY SAND, some plasticity
49.0				

WELL DIAGRAM: Grout (48.9 to 6.9); Bentonite Seal (6.9 to 4.9); Sand Pack (6.9 to 4.9); Slotted Screen (6.9 to 4.9); Blank (4.9 to 49.0)

Bottom of borehole at 49.0 feet.

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WELL NUMBER PZ-3-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 6/23/14 **COMPLETED** 6/23/14 **GROUND ELEVATION** 46.31 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				(SP-SM) brown, poorly graded SAND with SILT, common rock and shell fragments	
	SC 1			- dark brown, greenish gray, desiccated, trace fine phosphate particles, locally clayey, local 1 to 6-inch clayey sand lenses	
10					
	SC 2	SP-SM		- brown, dark brown, minor to trace silt, trace organic silt, common decomposing wood debris (appears to be debris from site clearing operations that included tree trunks, grass, leaves, etc.) from 10 ft to 20 ft, sonic casing advanced by its own weight from 20 ft to 25 ft	
20					
	SC 3				
				29.0 17.3	
30		SC		30.0 (SC) greenish gray, CLAYEY SAND 16.3	
	SC 4	SP-SM		(SP-SM) dark brown, brown, poorly graded SAND with SILT, trace organic silt, common 3 to 5-inch wood fragments from 36 ft to 39 ft, local clayey sand lense from 39 ft to 40 ft	
40				40.0 6.3	
	SC 5	SC		(SC) greenish gray, CLAYEY SAND, variably silty and clayey, trace fine phosphate particles, lightly calcareous/dolomitic	
50				50.0 -3.7	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	MH		(MH) greenish gray, SILT, variably sandy, few to some fine to coarse phosphate particles		Grout
				55.0	-8.7	
		SP-SM		(SP-SM) gray, poorly graded SAND with SILT, fine phosphate particles		
				57.0	-10.7	
		CH		(CH) greenish gray, sandy fat CLAY, trace silt, few fine phosphate particles		
60				60.0	-13.7	
	SC 7	MH		(MH) dark greenish gray, sandy elastic SILT, variably sandy, common 2 to 3-inch lenses with fine phosphate particles, silty sand lenses from 64 ft to 65 ft		
				66.0	-19.7	
70		SM		(SM) gray, greenish gray, variably SILTY SAND, mostly fine to coarse phosphate particles, calcareous/dolomitic, weakly cemented with local thin cemented lenses		
	SC 8					
80				- cemented SILTY SAND, variably silty and clayey, fine phosphate particles, calcareous, 1 ft limestone lense at 77 ft		
				83.0	-36.7	
	SC 9	MH		(MH) light gray, sandy elastic SILT, desiccated, trace fine phosphate particles, calcareous		
90						
				94.0	-47.7	
	SC 10	SM		(SM) greenish gray, SILTY SAND, fine phosphate particles, slightly calcareous/dolomitic		
100				100.0	-53.7	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-3-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100	SC 11	MH		(MH) light gray, sandy elastic SILT, variably sandy and clayey, desiccated, calcareous/dolomitic	Bentonite Seal; Sand Pack
				107.0 -60.7	
110	SC 12	SM		(SM) dark greenish gray, SILTY SAND, variably silty and clayey, fine phosphate particles, local silt lenses from 109 ft to 110 ft	Slotted Screen
120				120.0 -73.7	Blank

Bottom of borehole at 120.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-3-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 6/23/14 **COMPLETED** 6/23/14 **GROUND ELEVATION** 46.9 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP-SM		(SP-SM) brown, poorly graded SAND with SILT, common rock and shell fragments - dark brown, greenish gray, desiccated, trace fine phosphate particles, locally clayey, local 1 to 6-inch clayey sand lenses	
10					
	SC 2			- brown, dark brown, minor to trace silt, trace organic silt, common decomposing wood debris (appears to be debris from site clearing operations that included tree trunks, grass, leaves, etc.) from 10 ft to 20 ft, sonic casing advanced by its own weight	
20					
	SC 3				
				29.0 17.9	
30		SC		30.0 (SC) greenish gray, CLAYEY SAND 16.9	Grout
	SC 4	SP-SM		(SP-SM) dark brown, brown, poorly graded SAND with SILT, trace organic silt, common 3 to 5-inch wood fragments from 36 ft to 39 ft, local clayey sand lense from 39 ft to 40 ft	
40				40.0 6.9	
	SC 5	SC		(SC) greenish gray, CLAYEY SAND, variably silty and clayey, trace fine phosphate particles, lightly calcareous/dolomitic	
50				50.0 -3.1	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-3-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	MH		(MH) greenish gray, SILT, variably sandy, few to some fine to coarse phosphate particles	-8.1	
		SP-SM		(SP-SM) gray, poorly graded SAND with SILT, fine phosphate particles	-10.1	
60		CH		(CH) greenish gray, sandy CLAY, trace silt, few fine phosphate particles	-13.1	
	SC 7	MH		(MH) dark greenish gray, sandy elastic SILT, variably sandy, common 2 to 3-inch lenses with fine phosphate particles, silty sand lenses from 64 ft to 65 ft	-19.1	Bentonite Seal Sand Pack
70		SM		(SM) gray, greenish gray, variably SILTY SAND, mostly fine to coarse phosphate particles, calcareous/dolomitic, weakly cemented with local thin cemented lenses		Slotted Screen
	SC 8				-28.1	Blank

55.0 57.0 60.0 66.0 75.0

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-3-S

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 6/23/14 **COMPLETED** 6/23/14
GROUND ELEVATION 47.37 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY JS **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP-SM		(SP-SM) brown, poorly graded SAND with SILT, common rock and shell fragments - dark brown, greenish gray, desiccated, trace fine phosphate particles, locally clayey, local 1 to 6-inch clayey sand lenses	
10					
	SC 2			- brown, dark brown, minor to trace silt, trace organic silt, common decomposing wood debris (appears to be debris from site clearing operations that included tree trunks, grass, leaves, etc.) from 10 ft to 20 ft, sonic casing advanced by its own weight	Grout
20					
	SC 3				Bentonite Seal
				29.0 / 18.4	Sand Pack
30		SC		30.0 (SC) greenish gray, CLAYEY SAND 17.4	
	SC 4	SP-SM		(SP-SM) dark brown, brown, poorly graded SAND with SILT, trace organic silt, common 3 to 5-inch wood fragments from 36 ft to 39 ft, local clayey sand lense from 39 ft to 40 ft	Slotted Screen
40				40.0 / 7.4	Blank

Bottom of borehole at 40.0 feet.

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WELL NUMBER PZ-4-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/4/14 **COMPLETED** 8/5/14 **GROUND ELEVATION** 48.44 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
	SC 1	SP		(SP) dark grayish brown, poorly graded fine grained quartz SAND - dark gray, cemented		
				5.0	43.4	
		SM		(SM) greenish gray, cemented, SILTY SAND		
10				10.0	38.4	
	SC 2	SP		(SP) grayish-brown, light grayish-brown, brown, dark greenish brown, poorly graded fine grained quartz SAND with dark gray clay nodules - minor shell fragments at 10 ft		
20						
	SC 3			- gray clay nodules		
				- light greenish gray CLAYEY SAND lense - 3-inch		
30				- light greenish gray CLAYEY SAND lense with phosphate nodules		
	SC 4			34.0	14.4	
		CH		(CH) greenish gray, sandy fat CLAY with iron mottling		
40				40.0	8.4	
	SC 5	SP-SC		41.0 (SP-SC) greenish gray, poorly graded fine grained quartz SAND with CLAY	7.4	
		SC		42.0 (SC) light greenish gray, CLAYEY SAND, minor phosphate pebble	6.4	
		CH		(CH) dark greenish gray, SANDY CLAY, with phosphate nodules, partially cemented, minor gray sand lenses		◄ Grout
50						

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	CH		(CH) dark greenish gray, SANDY CLAY, with phosphate nodules, partially cemented, minor gray sand lenses *(continued)*		
				- abundant dark gray, poorly graded SAND lense at 52 ft		
60				- abundant thin, dark gray SAND lenses throughout		
	SC 7			63.0	-14.6	
		MH		(MH) light gray, SILT, cemented		
70				69.0	-20.6	
	SC 8	SP-SM		(SP-SM) light to dark gray, poorly graded fine grained SAND with SILT, some phosphatic grains, intermittent cemented silt and sand lenses		
				79.0	-30.6	
80		MH		80.0 (MH) light greenish gray, sandy elastic SILT with iron mottling, cemented	-31.6	
		SP		81.0 (SP) dark gray, poorly grained medium grained SAND with abundant phosphatic particles	-32.6	
	SC 9	CH		(CH) greenish gray, SANDY CLAY, with minor, calcareous fragments		
				89.0	-40.6	
90				(MH) light greenish gray, sandy elastic SILT, with minor iron mottling		
	SC 10	MH				
				98.0	-49.6	
		CH		99.0 (CH) greenish gray, sandy fat CLAY, with minor, calcareous fragments	-50.6	
100		MH		100.0 (MH) light gray, cemented, sandy elastic SILT	-51.6	

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100						
	SC 11	CH		(CH) greenish gray, sandy fat CLAY, with minor, calcareous fragments		Bentonite Seal
						Sand Pack
				108.0	-59.6	
110		MH		(MH) greenish gray, gray, sandy elastic SILT, minor iron mottling, partially cemented - partially cemented with gray sand lenses		
	SC 12					Slotted Screen
				115.0	-66.6	
		CH		(CH) greenish gray, SANDY CLAY with abundant dark gray, sand lenses, iron mottling		
				119.0	-70.6	
120		MH		120.0 (MH) light gray, cemented, sandy elastic SILT	-71.6	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-4-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/5/14 **COMPLETED** 8/5/14 **GROUND ELEVATION** 49.62 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) dark grayish brown, poorly graded fine grained quartz SAND - dark gray, cemented		
				5.0	44.6	
		SM		(SM) greenish gray, cemented, SILTY SAND		
10				10.0	39.6	
		SP		(SP) grayish-brown, light grayish-brown, brown, dark greenish brown, poorly graded fine grained quartz SAND with dark gray clay nodules - minor shell fragments at 10 ft		
20				- gray clay nodules		
				- light greenish gray CLAYEY SAND lense - 3-inch		Grout
30				- light greenish gray CLAYEY SAND lense with phosphate nodules		
				34.0	15.6	
		CH		(CH) greenish gray, sandy fat CLAY with iron mottling		
40				40.0	9.6	
		SP-SC		41.0 (SP-SC) greenish gray, poorly graded fine grained quartz SAND with CLAY	8.6	
		SC		42.0 (SC) light greenish gray, CLAYEY SAND, minor phosphate pebble	7.6	
		CH		(CH) dark greenish gray, SANDY CLAY, with phosphate nodules, partially cemented, minor gray sand lenses		
50						

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WELL NUMBER PZ-4-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		CH		(CH) dark greenish gray, SANDY CLAY, with phosphate nodules, partially cemented, minor gray sand lenses *(continued)* - abundant dark gray, poorly graded SAND lense at 52 ft - abundant thin, dark gray SAND lenses throughout	Bentonite Seal Sand Pack
60		MH		63.0 -13.4 (MH) light gray, SILT, cemented	Slotted Screen
70		SP-SM		69.0 -19.4 (SP-SM) light to dark gray, poorly graded fine grained SAND with SILT, some phosphatic grains, intermittent cemented silt and sand lenses	
				74.0 -24.4 Bottom of borehole at 74.0 feet.	

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WELL NUMBER PZ-4-S

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/5/14 **COMPLETED** 8/5/14
GROUND ELEVATION 50.46 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY SA **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) dark grayish brown, poorly graded fine grained quartz SAND - dark gray, cemented		
				5.0	45.5	
		SM		(SM) greenish gray, cemented, SILTY SAND		
10				10.0	40.5	
		SP		(SP) grayish-brown, light grayish-brown, brown, dark greenish brown, poorly graded fine grained quartz SAND with dark gray clay nodules - minor shell fragments at 10 ft		Grout
20				- gray clay nodules		
				- light greenish gray CLAYEY SAND lense - 3-inch		
30				- light greenish gray CLAYEY SAND lense with phosphate nodules		
				34.0	16.5	
		CH		(CH) greenish gray, sandy fat CLAY with iron mottling		Bentonite Seal
40				40.0	10.5	Sand Pack
		SP-SC		41.0 (SP-SC) greenish gray, poorly graded fine grained quartz SAND with CLAY	9.5	
		SC		42.0 (SC) light greenish gray, CLAYEY SAND, minor phosphate pebble	8.5	
		CH		(CH) dark greenish gray, SANDY CLAY, with phosphate nodules, partially cemented, minor gray sand lenses		Slotted Screen
50				50.0	0.5	

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-5-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/6/14 **COMPLETED** 8/6/14 **GROUND ELEVATION** 53.04 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP		(SP) dark green, dark brown, light gray, poorly graded fine grained quartz SAND, partially cemented - cemented	
10				10.0	43.0
	SC 2	SP-SC		(SP-SC) very dark brown, poorly graded SAND with CLAY	
				15.0	38.0
20		SC		(SC) greenish gray, CLAYEY SAND, partially cemented - desiccated - minor calcareous rock fragments, minor phosphate fragments, minor sand lenses	
	SC 3				
30					
	SC 4				
40					
	SC 5				
				45.0	8.0
		CH		(CH) dark greenish gray, sandy fat CLAY	
50				50.0	3.0 Grout

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		MH		(MH) greenish gray, sandy elastic SILT, with minor phosphatic particles	0.0	
				53.0		
	SC 6	CH		(CH) greenish gray, SANDY CLAY, minor phosphate pebbles		
60				- dark gray sand lenses, minor phosphatic particles		
	SC 7			- cemented, dark gray and gray sand lenses throughout		
70				- sand lense, minor iron mottling at 68 ft		
				71.0	-18.0	
		SC		72.0 (SC) dark gray, CLAYEY SAND and medium grained SAND, mottled, with shell fragments, abundant limestone fragments	-19.0	
	SC 8	SP		(SP) dark gray, poorly graded SAND, 3 to 4-inch shell and limestone fragment lense		
				75.0	-22.0	
80				white, LIMESTONE with dark gray sandy clay and silt, cemented		
				80.0	-27.0	
		SP		81.0 (SP) dark gray, poorly graded SAND, phosphatic particles	-28.0	
				82.0 light gray, sandy, LIMESTONE	-29.0	
	SC 9	SP		(SP) dark gray, SAND with phosphatic particles and limestone fragments		
				85.0	-32.0	
90		CH		(CH) dark greenish gray, sandy fat CLAY, iron mottling, dark gray, minor sand seams		
				- partially cemented, minor limestone and phosphate fragments		
				92.0	-39.0	
	SC 10	MH		(MH) greenish gray, SILT, iron mottling, cemented, desiccated, some dark gray sandy lenses		
100						

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WELL NUMBER PZ-5-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100	SC 11	MH		(MH) greenish gray, SILT, iron mottling, cemented, desiccated, some dark gray sandy lenses *(continued)*	Bentonite Seal; Sand Pack
				108.0 -55.0	
110	SC 12	CH		(CH) dark greenish gray, SANDY CLAY with abundant limestone and phosphate pebbles - hard silt lenses, partially cemented, desiccated, iron mottling	Slotted Screen
120				- limestone fragments, dark gray sand lenses at 118 ft 120.0 -67.0	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-5-M

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/7/14 **COMPLETED** 8/7/14
GROUND ELEVATION 53.51 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY SA **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) dark green, dark brown, light gray, poorly graded fine grained quartz SAND, partially cemented - cemented		
10				10.0	43.5	
		SP-SC		(SP-SC) very dark brown, poorly graded SAND with CLAY		
				15.0	38.5	
		SC		(SC) greenish gray, CLAYEY SAND, partially cemented - desiccated - minor calcareous rock fragments, minor phosphate fragments, minor sand lenses		Grout
20						
30						
40						
				45.0	8.5	
		CH		(CH) dark greenish gray, sandy fat CLAY		
50				50.0	3.5	

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WELL NUMBER PZ-5-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		MH		(MH) greenish gray, sandy elastic SILT, with minor phosphatic particles	
				53.0	0.5
		CH		(CH) greenish gray, SANDY CLAY, minor phosphate pebbles	Bentonite Seal
				- dark gray sand lenses, minor phosphatic particles	Sand Pack
60				- cemented, dark gray and gray sand lenses throughout	
				- sand lense, minor iron mottling at 68 ft	Slotted Screen
70				71.0	-17.5
		SC		72.0 (SC) dark gray, CLAYEY SAND and medium grained SAND, mottled, with shell fragments, abundant limestone fragments	-18.5
		SP		(SP) dark gray, poorly graded SAND, 3 to 4-inch shell and limestone fragment lense	
				75.0	-21.5 Blank

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-5-S

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION 52.95 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY SA **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) dark green, dark brown, light gray, poorly graded fine grained quartz SAND, partially cemented - cemented	
10.0		SP-SC		(SP-SC) very dark brown, poorly graded SAND with CLAY	
15.0		SC		(SC) greenish gray, CLAYEY SAND, partially cemented - desiccated - minor calcareous rock fragments, minor phosphate fragments, minor sand lenses	Grout
45.0		CH		(CH) dark greenish gray, sandy fat CLAY	Bentonite Seal Sand Pack Slotted Screen Blank
50.0				Bottom of borehole at 50.0 feet.	

43.0
38.0
8.0
3.0

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WELL NUMBER PZ-6-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/7/14 **COMPLETED** 8/7/14 **GROUND ELEVATION** 53.15 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) dark greenish-brown, brown to very dark brown, pale brown, poorly graded SAND - abundant shell fragments at 2 ft - minor clay nodules at 3 ft - cemented silt at 8 ft - minor clay nodules at 10 ft	
10	SC 2				
13.0					40.2
20	SC 3	SC		(SC) light greenish gray, CLAYEY SAND, phosphatic particles, minor limestone fragments - phosphate pebbles, shell fragments at 20 to 45 ft	
30	SC 4				
40	SC 5				
45.0					8.2
50		CH		(CH) dark greenish gray, sandy fat CLAY, minor iron mottling, phosphatic particles, limestone fragments	Grout
50.0					3.2

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		MH		(MH) dark greenish gray, sandy elastic SILT with phosphatic particles and pebbles	0.2	
			53.0			
		CH		(CH) dark greenish gray, sandy fat CLAY, minor phosphatic particles	-1.9	
	SC 6		55.0			
		SP	56.0	(SP) gray, poorly graded SAND, abundant phosphatic particles	-2.9	
		CH		(CH) dark greenish gray, sandy fat CLAY, minor phosphatic particles	-4.9	
			58.0			
		SP	59.0	(SP) gray, poorly graded SAND lense, abundant phosphatic particles	-5.9	
60		CH		(CH) dark greenish gray, SANDY CLAY, minor phosphatic particles - some silt, dark gray sand lenses at 60 ft	-8.9	
			62.0			
		SP		(SP) dark gray, poorly graded medium grained quartz SAND, phosphatic particles	-11.9	
	SC 7		65.0			
		CH		(CH) dark greenish gray, sandy fat CLAY, minor iron mottling, dark gray sand lenses	-16.9	
70			70.0			
		MH		(MH) dark greenish gray, sandy elastic SILT, dark gray sand lenses	-18.9	
			72.0			
		SP		(SP) dark greenish gray, poorly graded medium grained quartz SAND, shell fragments and phosphatic particles, abundant large rock fragments mottled, trace silt and clay	-22.9	
	SC 8		76.0			
		MH		(MH) light gray, sandy elastic SILT, cemented, desiccated	-26.9	
80			80.0			
		SP	82.0	(SP) dark gray, poorly graded medium grained quartz SAND, phosphatic particles, minor limestone fragments	-28.9	
	SC 9	CH		(CH) dark greenish gray, sandy fat CLAY, iron mottling, some silt, phosphatic particles	-36.9	
90			90.0			
		MH		(MH) light gray, light greenish gray, sandy elastic SILT, cemented, desiccated - some clay at 93 ft		Bentonite Seal
	SC 10					
100						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-6-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100						
	SC 11	MH		(MH) light gray, light greenish gray, sandy elastic SILT, cemented, desiccated *(continued)*		Sand Pack
110				110.0	-56.9	
	SC 12	CH		(CH) dark gray and dark greenish gray, sandy fat CLAY, very hard, partially cemented, some silt		Slotted Screen
				115.0	-61.9	
		MH		(MH) very dark gray, sandy elastic SILT, cemented, consolidated, very hard		
				117.0	-63.9	
		CH		(CH) dark greenish gray, sandy fat CLAY, minor iron mottling, minor gray sand lenses		
120				120.0	-66.9	Blank

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-6-M

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/8/14 **COMPLETED** 8/8/14
GROUND ELEVATION 53.43 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY SA **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) dark greenish-brown, brown to very dark brown, pale brown, poorly graded SAND - abundant shell fragments at 2 ft - minor clay nodules at 3 ft - cemented silt at 8 ft - minor clay nodules at 10 ft	
13.0		SC		(SC) light greenish gray, CLAYEY SAND, phosphatic particles, minor limestone fragments - phosphate pebbles, shell fragments at 20 to 45 ft	Grout
40.4					
45.0		CH		(CH) dark greenish gray, sandy fat CLAY, minor iron mottling, phosphatic particles, limestone fragments	
8.4					
50.0					
3.4					

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WELL NUMBER PZ-6-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		MH		(MH) dark greenish gray, sandy elastic SILT with phosphatic particles and pebbles	0.4	
			53.0			
		CH		(CH) dark greenish gray, sandy fat CLAY, minor phosphatic particles	-1.6	
			55.0			
		SP		(SP) gray, poorly graded SAND, abundant phosphatic particles	-2.6	Bentonite Seal
			56.0			
		CH		(CH) dark greenish gray, sandy fat CLAY, minor phosphatic particles	-4.6	
			58.0			
		SP		(SP) gray, poorly graded SAND lense, abundant phosphatic particles	-5.6	Sand Pack
			59.0			
60		CH		(CH) dark greenish gray, SANDY CLAY, minor phosphatic particles - some silt, dark gray sand lenses at 60 ft	-8.6	
			62.0			
		SP		(SP) dark gray, poorly graded medium grained quartz SAND, phosphatic particles	-11.6	
			65.0			
		CH		(CH) dark greenish gray, sandy fat CLAY, minor iron mottling, dark gray sand lenses		Slotted Screen
70			70.0		-16.6	
		MH		(MH) dark greenish gray, sandy elastic SILT, dark gray sand lenses	-18.6	
			72.0			
		SP		(SP) dark greenish gray, poorly graded medium grained quartz SAND, shell fragments and phosphatic particles, abundant large rock fragments mottled, trace silt and clay	-21.6	Blank
			75.0			

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-6-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/8/14 **COMPLETED** 8/8/14 **GROUND ELEVATION** 43.71 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) dark greenish-brown, brown to very dark brown, pale brown, poorly graded SAND - abundant shell fragments at 2 ft - minor clay nodules at 3 ft - cemented silt at 8 ft - minor clay nodules at 10 ft	
13.0		SC		(SC) light greenish gray, CLAYEY SAND, phosphatic particles, minor limestone fragments - phosphate pebbles, shell fragments at 20 to 45 ft	30.7
45.0		CH		(CH) dark greenish gray, sandy fat CLAY, minor iron mottling, phosphatic particles, limestone fragments	-1.3
50.0		MH		(MH) dark greenish gray, sandy elastic SILT with phosphatic particles and pebbles	-6.3
51.0					-7.3

Grout
Bentonite Seal
Sand Pack
Slotted Screen
Blank

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WELL NUMBER PZ-6-S

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
				Bottom of borehole at 51.0 feet.	

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WELL NUMBER PZ-6A-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 9/29/14 **COMPLETED** 9/29/14 **GROUND ELEVATION** 53.63 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SM		(SM) brown, dark brown, variably SILTY SAND, trace clayey sand nodules	
10	SC 2				
20	SC 3			21.0	32.6
		SP		22.0 (SP) light brown, poorly graded fine grained quartz SAND	31.6
		SM		(SM) light brown, brown, SILTY SAND, trace cemented clayey sand nodules throughout	
30	SC 4			30.0	23.6
		SP-SM		(SP-SM) light brown, poorly graded SAND with SILT (only half of sample wash recovered, driller stated rest must have washed out of sampler)	
40	SC 5			43.0	10.6
50		SC		(SC) greenish gray, variably CLAYEY SAND, trace cemented silt nodules, trace silts	

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SC		52.0 (SC) greenish gray, variably CLAYEY SAND, trace cemented silt nodules, trace silts *(continued)*	1.6	Grout
		SP-SC		53.5 (SP-SC) greenish gray, fine to moderate SAND with CLAY, few phosphatic particles throughout	0.1	
		SC		55.0 (SC) greenish gray, CLAYEY SAND, few to some phosphate particles to pebbles, trace silt	-1.4	
60		ML		(ML) greenish gray, variably sandy elastic SILT, light sand veins throughout, trace phosphatic particles - sand zone at 59 ft 62.0	-8.4	
	SC 7	SP		67.0 (SP) greenish gray, poorly graded fine grained quartz SAND, some phosphatic particles, 1/4-inch lense of clay throughout 65-67 ft	-13.4	
70		SC		70.0 (SC) greenish gray, variably CLAYEY SAND, phosphatic particles throughout	-16.4	
	SC 8	SP		72.0 (SP) gray, poorly graded SAND, few phosphate particles	-18.4	
		SM		74.0 (SM) greenish gray, SILTY SAND, some to few phosphatic particles	-20.4	
		SP		76.0 (SP) gray, poorly graded SAND, few phosphate particles	-22.4	
		SM		78.0 (SM) greenish gray, SILTY SAND, dolomitic, dry, cemented, silt	-24.4	
		SP		79.0 (SP) gray, poorly graded SAND, few phosphatic particles	-25.4	
80		SM		80.0 (SM) greenish gray, SILTY SAND, dolomitic silt	-26.4	
	SC 9	SP		82.0 (SP) dark gray, poorly graded medium grained quartz SAND, phosphatic particles, trace limestone fragments	-28.4	
		CH		(CH) dark greenish gray, sandy fat CLAY, iron mottling, some silt, phosphatic particles 90.0	-36.4	
90						
	SC 10	MH		(MH) light gray, light greenish gray, sandy elastic SILT, cemented, desiccated - some clay at 93 ft		
100				100.0	-46.4	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-6A-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100					
	SC 11	ML		(ML) grayish, light green, sandy SILT, trace phosphatic particles	Bentonite Seal; Sand Pack
110				110.0 -56.4	
	SC 12	SM		(SM) grayish, light green, SILTY SAND, some fine phosphatic particles	Slotted Screen
				115.0 -61.4	
		ML		(ML) grayish, light green, cemented, sandy SILT, minor sand	
120				120.0 -66.4	
				Bottom of borehole at 120.0 feet.	Blank

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-6A-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/2/14 **COMPLETED** 10/2/14 **GROUND ELEVATION** 53.88 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SM		(SM) brown, dark brown, variably SILTY SAND, trace clayey sand nodules	
21.0					32.9
		SP		22.0 (SP) light brown, poorly graded fine grained quartz SAND	31.9
		SM		(SM) light brown, brown, SILTY SAND, trace cemented clayey sand nodules throughout	
30.0					23.9
		SP-SM		(SP-SM) light brown, poorly graded SAND with SILT (only half of sample wash recovered, driller stated rest must have washed out of sampler)	
43.0					10.9
		SC		(SC) greenish gray, variably CLAYEY SAND, trace cemented silt nodules, trace silts	

Grout

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WELL NUMBER PZ-6A-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) greenish gray, variably CLAYEY SAND, trace cemented silt nodules, trace silts *(continued)*	1.9	
		SP-SC		52.0 (SP-SC) greenish gray, fine to moderate SAND with CLAY, few phosphatic particles throughout	0.4	
		SC		53.5 (SC) greenish gray, CLAYEY SAND, few to some phosphate particles to pebbles, trace silt	-1.1	
		ML		55.0 (ML) greenish gray, variably sandy elastic SILT, light sand veins throughout, trace phosphatic particles		
60				- sand zone at 59 ft		Bentonite Seal
				62.0	-8.1	
		SP		(SP) greenish gray, poorly graded fine grained quartz SAND, some phosphatic particles, 1/4-inch lense of clay throughout 65-67 ft		Sand Pack
				67.0	-13.1	
		SC		(SC) greenish gray, variably CLAYEY SAND, phosphatic particles throughout		
70				70.0	-16.1	
		SP		(SP) gray, poorly graded SAND, few phosphate particles		
				72.0	-18.1	Slotted Screen
		SM		(SM) greenish gray, SILTY SAND, some to few phosphatic particles		
				74.0	-20.1	
		SP		(SP) gray, poorly graded SAND, few phosphate particles		
				76.0	-22.1	
		SM		(SM) greenish gray, SILTY SAND, dolomitic, dry, cemented, silt		
				78.0	-24.1	
		SP		79.0 (SP) gray, poorly graded SAND, few phosphatic particles	-25.1	
80		SM		80.0 (SM) greenish gray, SILTY SAND, dolomitic silt	-26.1	Blank

Bottom of borehole at 80.0 feet.

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WELL NUMBER PZ-6A-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/2/14 **COMPLETED** 10/2/14 **GROUND ELEVATION** 53.91 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SM		(SM) brown, dark brown, variably SILTY SAND, trace clayey sand nodules		Grout
					32.9	
		SP		(SP) light brown, poorly graded fine grained quartz SAND	31.9	
		SM		(SM) light brown, brown, SILTY SAND, trace cemented clayey sand nodules throughout		
					23.9	
		SP-SM		(SP-SM) light brown, poorly graded SAND with SILT (only half of sample wash recovered, driller stated rest must have washed out of sampler)		Bentonite Seal
					10.9	Sand Pack
		SC		(SC) greenish gray, variably CLAYEY SAND, trace cemented silt nodules, trace silts		Slotted

10 20 30 40 50

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WELL NUMBER PZ-6A-S

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) greenish gray, variably CLAYEY SAND, trace cemented silt nodules, trace silts *(continued)*		Screen
				52.0	1.9	
		SP-SC		(SP-SC) greenish gray, fine to moderate SAND with CLAY, few phosphatic particles throughout		
				53.5	0.4	
		SC		(SC) greenish gray, CLAYEY SAND, few to some phosphate particles to pebbles, trace silt		Blank
				55.0	-1.1	
		ML		55.4	-1.5	
				(ML) greenish gray, variably sandy elastic SILT, light sand veins throughout, trace phosphatic particles		
				Bottom of borehole at 55.4 feet.		

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WELL NUMBER PZ-7-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/4/14 **COMPLETED** 8/4/14 **GROUND ELEVATION** 54.28 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY GK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) light brown, gray, dark brown, poorly graded fine grained quartz SAND, shell fragments	
7.0					47.3
		SP-SC		(SP-SC) very dark brown, poorly graded fine grained quartz SAND with CLAY	
10					
10.0					44.3
	SC 2	SC		(SC) greenish gray, CLAYEY SAND, minor phosphatic sands, limestone fragments	
20					
	SC 3			- increased phosphatic sands and minor clay lenses/nodules at 20 ft	
30					
	SC 4			- moderate phosphate sand and minor limestone fragments at 30 ft - minor phosphate sand and limestone fragments at 33 ft	
40					
	SC 5			- dark greenish gray below 47 ft	
50					
50.0					4.3

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SP		(SP) dark gray, poorly graded medium grained quartz SAND		Grout
				58.0	-3.7	
		SC		59.0 (SC) greenish gray, CLAYEY SAND, phosphatic sand and limestone fragments	-4.7	
60		SP		(SP) dark gray, poorly graded medium grained quartz SAND		
				62.0	-7.7	
	SC 7	SC		(SC) greenish gray, CLAYEY SAND, fine phosphatic sand and limestone fragments		
				65.0	-10.7	
		SP		66.0 (SP) greenish gray, poorly graded medium grained quartz SAND	-11.7	
		SC		(SC) greenish gray, CLAYEY SAND, fine phosphatic sand and limestone fragments		
				69.0	-14.7	
70		SP		70.0 (SP) greenish gray, poorly graded medium grained quartz SAND	-15.7	
	SC 8	SC		(SC) greenish gray, CLAYEY SAND, fine phosphate sand		
				74.0	-19.7	
		SM		(SM) light gray, SILTY SAND, desiccated		
				76.0	-21.7	
		SP		77.0 (SP) greenish gray, poorly graded medium grained quartz SAND	-22.7	
		SC		78.0 (SC) greenish gray, CLAYEY SAND, fine phosphate sand	-23.7	
		SM		79.0 (SM) light gray, SILTY SAND, desiccated with 3-inch cemented silt lense at 78.5 ft	-24.7	
80		SP				
				81.0 (SP) greenish gray, poorly graded medium grained quartz SAND	-26.7	
	SC 9	SC		(SC) greenish gray, CLAYEY SAND		
				85.0	-30.7	
		ML		(ML) greenish gray, sandy SILT, slightly clayey, moderate plasticity		
90						
				94.0	-39.7	
	SC 10	MH		94.5 (MH) gray, sandy elastic SILT	-40.2	
		CH		(CH) gray, sandy fat CLAY, trace silt, minor fine phosphate sand		
100						

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-7-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100					
	SC 11	CH		(CH) gray, sandy fat CLAY, trace silt, minor fine phosphate sand *(continued)*	Bentonite Seal; Sand Pack
				106.0 -51.7	
		MH		(MH) light gray, sandy elastic SILT, gravel sized limestone fragments	
				108.0 -53.7	
		ML		(ML) light gray, sandy SILT, desiccated	
110				110.0 -55.7	
	SC 12	CH		(CH) gray, sandy fat CLAY, fine phosphate sand and some phosphate gravel	Slotted Screen
				118.0 -63.7	
		ML		(ML) light gray, sand SILT, desiccated	
120				120.0 -65.7	

Bottom of borehole at 120.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-7-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/5/14 **COMPLETED** 8/5/14 **GROUND ELEVATION** 54.29 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY GK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) light brown, gray, dark brown, poorly graded fine grained quartz SAND, shell fragments	
7.0					47.3
		SP-SC		(SP-SC) very dark brown, poorly graded fine grained quartz SAND with CLAY	
10					
10.0					44.3
		SC		(SC) greenish gray, CLAYEY SAND, minor phosphatic sands, limestone fragments	
20				- increased phosphatic sands and minor clay lenses/nodules at 20 ft	
					Grout
30				- moderate phosphate sand and minor limestone fragments at 30 ft	
				- minor phosphate sand and limestone fragments at 33 ft	
40					
				- dark greenish gray below 47 ft	
50					
50.0					4.3

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WELL NUMBER PZ-7-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SP		(SP) dark gray, poorly graded medium grained quartz SAND		Bentonite Seal; Sand Pack
				58.0	-3.7	
		SC		59.0 (SC) greenish gray, CLAYEY SAND, phosphatic sand and limestone fragments	-4.7	
60		SP		(SP) dark gray, poorly graded medium grained quartz SAND		
				62.0	-7.7	
		SC		(SC) greenish gray, CLAYEY SAND, fine phosphatic sand and limestone fragments		
				65.0	-10.7	
		SP		66.0 (SP) greenish gray, poorly graded medium grained quartz SAND	-11.7	Slotted Screen
		SC		(SC) greenish gray, CLAYEY SAND, fine phosphatic sand and limestone fragments		
				69.0	-14.7	
70		SP		70.0 (SP) greenish gray, poorly graded medium grained quartz SAND	-15.7	
		SC		(SC) greenish gray, CLAYEY SAND, fine phosphate sand		
				74.0	-19.7	Blank
		SM		75.0 (SM) light gray, SILTY SAND, desiccated	-20.7	

Bottom of borehole at 75.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-7-S

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/5/14 **COMPLETED** 8/5/14
GROUND ELEVATION 54.19 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY GK **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		SP		(SP) light brown, gray, dark brown, poorly graded fine grained quartz SAND, shell fragments
7.0				47.2
		SP-SC		(SP-SC) very dark brown, poorly graded fine grained quartz SAND with CLAY
10				10.0 44.2
		SC		(SC) greenish gray, CLAYEY SAND, minor phosphatic sands, limestone fragments
20				- increased phosphatic sands and minor clay lenses/nodules at 20 ft
30				- moderate phosphate sand and minor limestone fragments at 30 ft
				- minor phosphate sand and limestone fragments at 33 ft
40				
				- dark greenish gray below 47 ft
50				50.0 4.2

WELL DIAGRAM: Grout; Bentonite Seal; Sand Pack; Slotted Screen; Blank

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-8-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/5/14 **COMPLETED** 8/6/14 **GROUND ELEVATION** 54.41 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY GK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) light brown and gray, very dark brown, poorly graded fine grained quartz SAND, some shell fragments	
2.0					52.4
10	SC 1			- minor clay nodules at 7 ft	
		SM		(SM) greenish gray, SILTY SAND, minor phosphate sand nodules	43.4
11.0					
		SP		(SP) very dark brown, poorly graded fine grained quartz SAND	42.4
12.0					
20	SC 2	SM		(SM) greenish gray, SILTY SAND with minor phosphatic sand/nodules	
20.0					34.4
30	SC 3	SC		(SC) greenish gray, dark greenish gray, CLAYEY SAND, moderate phosphate sand and minor limestone fragments	
40	SC 4			- limestone gravel fragments after 33 ft	
50	SC 5				Grout
50.0					4.4

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SP		(SP) dark gray, medium grained SAND		
				58.0	-3.6	
		SC		59.0 (SC) greenish gray, CLAYEY SAND, phosphatic sand and limestone fragments	-4.6	
60		SP		60.0 (SP) dark gray, poorly graded medium grained quartz SAND	-5.6	
	SC 7	SC		(SC) light greenish gray, poorly graded fine to medium grained CLAYEY SAND		
				63.0	-8.6	
		CL		(CL) light greenish gray, variably sandy CLAY		
70				70.0	-15.6	
	SC 8	SC		(SC) light gray, poorly graded fine grained quartz CLAYEY SAND		
				73.0	-18.6	
		ML		(ML) light gray, dolomitic, sandy SILT, partially consolidated, variably sandy, local gray sand lenses (6-inches)		
80				80.0	-25.6	
	SC 9			- dolomitic, variably consolidated after 80 ft		
		CL		(CL) light gray, sandy CLAY		
90				90.0	-35.6	
	SC 10	ML		(ML) light gray and white, variably sandy SILT, dolomitic, trace fine phosphatic sand, trace clay		Bentonite Seal
100				100.0	-45.6	

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WELL NUMBER PZ-8-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100	SC 11	SM		(SM) light gray, poorly graded fine grained quartz SILTY SAND, trace phosphate, slightly dolomitic,	Sand Pack
				105.0 -50.6	
		ML		(ML) light gray and white, variably sandy SILT, dolomitic, slightly calcareous, moderately consolidated	
110	SC 12			- trace phosphate, moderately consolidated at 110 ft	Slotted Screen
				112.0 -57.6	
		CL		(CL) light gray, sandy CLAY	
				118.0 -63.6	
120		SC		(SC) light gray, poorly graded fine to medium grained quartz CLAYEY SAND, minor phosphate	Blank
				120.0 -65.6	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-8-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/7/14 **COMPLETED** 8/7/14 **GROUND ELEVATION** 54.38 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY GK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		(SP) light brown and gray, very dark brown, poorly graded fine grained quartz SAND, some shell fragments		
					2.0 / 52.4	
				- minor clay nodules at 7 ft		
10		SM		(SM) greenish gray, SILTY SAND, minor phosphate sand nodules	11.0 / 43.4	
		SP		(SP) very dark brown, poorly graded fine grained quartz SAND	12.0 / 42.4	
		SM		(SM) greenish gray, SILTY SAND with minor phosphatic sand/nodules		
20					20.0 / 34.4	
		SC		(SC) greenish gray, dark greenish gray, CLAYEY SAND, moderate phosphate sand and minor limestone fragments		Grout
30				- limestone gravel fragments after 33 ft		
40						
50					50.0 / 4.4	

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WELL NUMBER PZ-8-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SP		(SP) dark gray, medium grained SAND		Bentonite Seal; Sand Pack
				58.0	-3.6	
		SC		59.0 (SC) greenish gray, CLAYEY SAND, phosphatic sand and limestone fragments	-4.6	
60		SP		60.0 (SP) dark gray, poorly graded medium grained quartz SAND	-5.6	
		SC		(SC) light greenish gray, poorly graded fine to medium grained CLAYEY SAND		
				63.0	-8.6	
		CL		(CL) light greenish gray, variably sandy CLAY		Slotted Screen
70				70.0	-15.6	
		SC		(SC) light gray, poorly graded fine grained quartz CLAYEY SAND		
				73.0	-18.6	
		ML		(ML) light gray, dolomitic, sandy SILT, partially consolidated, variably sandy, local gray sand lenses (6-inches)		Blank
				75.0	-20.6	

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-8-S

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/7/14 **COMPLETED** 8/7/14
GROUND ELEVATION 54.32 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY GK **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		(SP) light brown and gray, very dark brown, poorly graded fine grained quartz SAND, some shell fragments		
					2.0 / 52.3	
				- minor clay nodules at 7 ft		
10		SM		(SM) greenish gray, SILTY SAND, minor phosphate sand nodules	11.0 / 43.3	
		SP		(SP) very dark brown, poorly graded fine grained quartz SAND	12.0 / 42.3	
		SM		(SM) greenish gray, SILTY SAND with minor phosphatic sand/nodules		Grout
20					20.0 / 34.3	
		SC		(SC) greenish gray, dark greenish gray, CLAYEY SAND, moderate phosphate sand and minor limestone fragments		
30				- limestone gravel fragments after 33 ft		Bentonite Seal
						Sand Pack
40						Slotted Screen
50					50.0 / 4.3	Blank

Bottom of borehole at 50.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-9-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/6/14 **COMPLETED** 8/7/14 **GROUND ELEVATION** 54.33 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP		(SP) brown, poorly graded fine grained quartz SAND, trace local shell fragments	
9.0					45.3
10					
	SC 2	SM		(SM) light gray, variably silty, poorly graded fine grained quartz SILTY SAND, trace to few phosphate particles, variably clayey	
20					
	SC 3				
30					
	SC 4				
40					
	SC 5				
45.0					9.3
		SC		(SC) light gray, CLAYEY SAND, trace phosphate	
50					Grout
50.0					4.3

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SP		(SP) gray, poorly graded fine grained quartz SAND, trace clay, trace phosphate particles		
60						
	SC 7			65.0	-10.7	
		SC		(SC) light gray, CLAYEY SAND, trace phosphate particles		
70						
	SC 8			74.0	-19.7	
		SP		74.5 (SP) gray, poorly graded fine grained quartz SAND	-20.2	
		CL		(CL) olive gray, variably sandy CLAY		
				77.5	-23.2	
		SP		78.0 (SP) gray, poorly graded fine grained quartz SAND	-23.7	
80				(ML) light gray, variably sandy SILT, dolomitic, trace phosphatic sands		
		ML				
	SC 9			85.0	-30.7	
		SP-SM		85.5 (SP-SM) gray, poorly graded fine grained quartz SAND with SILT, trace clay	-31.2	
		CH		(CH) light gray, sandy fat CLAY, trace phosphate particles, variably silty		
90				90.0	-35.7	
	SC 10	ML		(ML) light gray, variably sandy SILT, slightly dolomitic, slightly consolidated		
				- less sandy, slightly dolomitic, trace phosphate particles after 93 ft		Bentonite Seal
100						

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100				(ML) light gray, variably sandy SILT, slightly dolomitic, slightly consolidated *(continued)*	Sand Pack
				fine sand from 99 to 101 ft	
	SC 11				
				coarse sand from 101 to 120 ft	
110		ML			Slotted Screen
	SC 12				
120				120.0 -65.7	Blank

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-9-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/9/14 **COMPLETED** 8/9/14 **GROUND ELEVATION** 54.01 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY PK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, poorly graded fine grained quartz SAND, trace local shell fragments	
9.0					45.0
10		SM		(SM) light gray, variably silty, poorly graded fine grained quartz SILTY SAND, trace to few phosphate particles, variably clayey	
20					
30					Grout
40					
45.0					9.0
		SC		(SC) light gray, CLAYEY SAND, trace phosphate	
50					
50.0					4.0

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WELL NUMBER PZ-9-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		SP		(SP) gray, poorly graded fine grained quartz SAND, trace clay, trace phosphate particles	Bentonite Seal; Sand Pack
60					
				65.0 -11.0	
		SC		(SC) light gray, CLAYEY SAND, trace phosphate particles	Slotted Screen
70					
				74.0 -20.0	
		SP		74.5 -20.5 (SP) gray, poorly graded fine grained quartz SAND	
		CL		75.0 -21.0 (CL) olive gray, variably sandy CLAY	

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-9-S

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/9/14 **COMPLETED** 8/9/14
GROUND ELEVATION 54.06 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY PK **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, poorly graded fine grained quartz SAND, trace local shell fragments	
9.0					45.1
10		SM		(SM) light gray, variably silty, poorly graded fine grained quartz SILTY SAND, trace to few phosphate particles, variably clayey	Grout
20					
30					Bentonite Seal
					Sand Pack
40					Slotted Screen
45.0					9.1
		SC		(SC) light gray, CLAYEY SAND, trace phosphate	
50					Blank
50.0					4.1

Bottom of borehole at 50.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-10-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/8/14 **COMPLETED** 8/9/14 **GROUND ELEVATION** 54.59 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) brown, fine grained quartz SAND, local trace silt	
10	SC 2				
13.0					
20	SC 3	SC		(SC) light gray, light greenish gray, CLAYEY SAND, trace to some phosphate particles	
30	SC 4				
40	SC 5				
41.6					
50					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) light gray, light greenish gray, CLAYEY SAND, trace to some phosphate particles *(continued)*		Grout
				52.0	2.6	
	SC 6	SM		(SM) light gray, variably clayey, SILTY SAND, trace phosphate particles		
60				60.0	-5.4	
	SC 7	SP-SM		(SP-SM) olive to gray, poorly graded SAND with SILT, some phosphatic sand nodules		
				67.0	-12.4	
		MH		68.0 (MH) olive to gray, sandy elastic SILT, desiccated	-13.4	
70		SP-SM		(SP-SM) olive to gray, poorly graded SAND with SILT, trace phosphate particles - intermittent thin lenses of silt, occasional minor cementation at 70 ft - 2-inch lense of SILTY SAND at 73 ft - 3-inch lense of SILTY SAND at 75 ft		
	SC 8					
80				80.0 - 6-inch lense of desiccated silt at 79 ft	-25.4	
	SC 9	CL		(CL) olive, sandy CLAY, some phosphate particles		
				82.0	-27.4	
		SP-SM		(SP-SM) olive to gray, SAND with SILT, few phosphate particles		
				85.0	-30.4	
90		CL		(CL) olive to gray, dark gray, sandy CLAY, some phosphate particles - 6-inch lense of sand at 89 ft		
	SC 10					
				93.0	-38.4	
100		MH		(MH) pale olive to gray, sandy elastic SILT, desiccated		

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WELL NUMBER PZ-10-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100						
	SC 11	MH		(MH) pale olive to gray, sandy elastic SILT, desiccated *(continued)*		Bentonite Seal
				103.0	-48.4	
		SM		(SM) pale brown, SILTY SAND, calcareous, cementation		Sand Pack
				105.0	-50.4	
		MH		(MH) olive to gray, sandy elastic SILT, trace phosphate particles		
				108.0	-53.4	
110		SC		(SC) olive to gray, CLAYEY SAND, some phosphate particles - cementation at 110 ft		
				112.0	-57.4	
	SC 12	MH		(MH) olive to gray, hard sandy elastic SILT, some phosphate particles, desiccated		Slotted Screen
120				120.0	-65.4	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-10-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/11/14 **COMPLETED** 8/11/14 **GROUND ELEVATION** 54.64 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, fine grained quartz SAND, local trace silt	
13.0					
		SC		(SC) light gray, light greenish gray, CLAYEY SAND, trace to some phosphate particles	
41.6					Grout

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WELL NUMBER PZ-10-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) light gray, light greenish gray, CLAYEY SAND, trace to some phosphate particles *(continued)*		
			52.0		2.6	
		SM		(SM) light gray, variably clayey, SILTY SAND, trace phosphate particles		Bentonite Seal
60						Sand Pack
			60.0		-5.4	
		SP-SM		(SP-SM) olive to gray, poorly graded SAND with SILT, some phosphatic sand nodules		
			67.0		-12.4	
		MH	68.0	(MH) olive to gray, sandy elastic SILT, desiccated	-13.4	Slotted Screen
70		SP-SM		(SP-SM) olive to gray, poorly graded SAND with SILT, trace phosphate particles - intermittent thin lenses of silt, occasional minor cementation at 70 ft - 2-inch lense of SILTY SAND at 73 ft		
			75.0		-20.4	
				- 3-inch lense of SILTY SAND at 75 ft Bottom of borehole at 75.0 feet.		

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WELL NUMBER PZ-10-S

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/11/14 **COMPLETED** 8/11/14
GROUND ELEVATION 54.61 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY JR **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, fine grained quartz SAND, local trace silt	
13.0					41.6
		SC		(SC) light gray, light greenish gray, CLAYEY SAND, trace to some phosphate particles	Grout
					Bentonite Seal
					Sand Pack
					Slotted Screen
50				50.0	4.6

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-11-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/12/14 **COMPLETED** 8/12/14 **GROUND ELEVATION** 54.35 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) brown to dark brown, gray, pale brown, poorly graded fine grained quartz SAND, few small cemented silt fragments	
10	SC 2	SM		13.0 (SM) light gray, pale brown, variably silty, fine grained quartz SILTY SAND, few fine phosphatic sand	41.4
20	SC 3	SC		18.0 (SC) light greenish gray, gray, CLAYEY SAND, few fine phosphatic sand particles	36.4
30	SC 4			- little phosphatic pebbles, dolomitic below 30 ft	
40	SC 5				
50					

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		52.0 (SC) light greenish gray, gray, CLAYEY SAND, few fine phosphatic sand particles *(continued)*	2.4	Grout
	SC 6	SM		(SM) grayish brown and gray, light gray, light greenish gray, SILTY SAND, few phosphatic fine sand, few phosphatic pebbles, dolomitic		
60				- little phosphatic gravel, dolomitic, minor cemented silt after 56 ft		
	SC 7			65.0	-10.7	
		SP		67.0 (SP) gray, poorly graded fine grained quartz SAND, some fine phosphatic sand, little phosphatic gravel	-12.7	
70		SM		(SM) gray, greenish gray, SILTY SAND, minor clay, few phosphatic fine sand, few phosphatic gravel, minor cemented silt		
	SC 8			- few phosphatic sand, few phosphatic gravel, trace cemented clay nodules after 70 ft		
				72.5	-18.2	
		SP		74.0 (SP) greenish gray, poorly graded fine grained quartz SAND, few phosphatic fine sand	-19.7	
		SM		75.5 (SM) greenish gray, SILTY SAND, few fine phosphatic sand	-21.2	
		SP		77.0 (SP) gray, poorly graded fine grained quartz SAND, some few phosphatic sand, few phosphatic gravel	-22.7	
		SC		(SC) greenish gray and gray, CLAYEY SAND, few fine phosphatic sand, few phosphatic gravel/pebbles, minor cemented, clay nodules		
80				80.0	-25.7	
		SP		81.0 (SP) gray, poorly graded fine grained quartz SAND, some fine phosphatic sand	-26.7	
	SC 9	SM		(SM) gray, SILTY SAND, few fine phosphatic sand, little phosphatic gravel		
				86.0	-31.7	
90		MH		(MH) light gray, sandy elastic SILT		
	SC 10			- minor cemented silt nodules, common clay, dolomitic after 90 ft		
				- calcareous silt at 94 ft		
100						

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100				(MH) light gray, sandy elastic SILT *(continued)* - few fine phosphatic particles after 100 ft	Bentonite Seal Sand Pack
	SC 11	MH			
				108.0 -53.7	
		SM		(SM) pale brown and light gray, SILTY SAND	
110				110.0 -55.7	
	SC 12	MH		(MH) greenish gray and gray, variably sandy elastic SILT, trace phosphatic fine particles	Slotted Screen
				- few fine phosphatic sand, common cemented silt after 115 ft	
120				120.0 -65.7	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-11-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/14/14 **COMPLETED** 8/14/14 **GROUND ELEVATION** 54.36 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown to dark brown, gray, pale brown, poorly graded fine grained quartz SAND, few small cemented silt fragments	
13.0		SM		(SM) light gray, pale brown, variably silty, fine grained quartz SILTY SAND, few fine phosphatic sand	
18.0		SC		(SC) light greenish gray, gray, CLAYEY SAND, few fine phosphatic sand particles	
41.4					
36.4				- little phosphatic pebbles, dolomitic below 30 ft	Grout

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-11-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		52.0	(SC) light greenish gray, gray, CLAYEY SAND, few fine phosphatic sand particles *(continued)*	2.4	Bentonite Seal
60		SM		65.0	(SM) grayish brown and gray, light gray, light greenish gray, SILTY SAND, few phosphatic fine sand, few phosphatic pebbles, dolomitic - little phosphatic gravel, dolomitic, minor cemented silt after 56 ft	-10.6	Sand Pack
		SP		67.0	(SP) gray, poorly graded fine grained quartz SAND, some fine phosphatic sand, little phosphatic gravel	-12.6	
70		SM		72.5	(SM) gray, greenish gray, SILTY SAND, minor clay, few phosphatic fine sand, few phosphatic gravel, minor cemented silt - few phosphatic sand, few phosphatic gravel, trace cemented clay nodules after 70 ft	-18.1	Slotted Screen
		SP		74.0	(SP) greenish gray, poorly graded fine grained quartz SAND, few phosphatic fine sand	-19.6	
		SM		75.0	(SM) greenish gray, SILTY SAND, few fine phosphatic sand	-20.6	

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-11-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/14/14 **COMPLETED** 8/14/14 **GROUND ELEVATION** 54.33 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown to dark brown, gray, pale brown, poorly graded fine grained quartz SAND, few small cemented silt fragments	
13.0		SM		(SM) light gray, pale brown, variably silty, fine grained quartz SILTY SAND, few fine phosphatic sand	
18.0		SC		(SC) light greenish gray, gray, CLAYEY SAND, few fine phosphatic sand particles	
41.3					Grout
36.3					Bentonite Seal
					Sand Pack
					Slotted Screen

10 20 30 40 50

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
		SC		(SC) light greenish gray, gray, CLAYEY SAND, few fine phosphatic sand particles *(continued)* 52.0	2.3 Blank

Bottom of borehole at 52.0 feet.

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WELL NUMBER PZ-12-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/13/14 **COMPLETED** 8/13/14 **GROUND ELEVATION** 54.47 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
	SC 1	SP		(SP) dark brown, grayish-brown, light gray, mottled, poorly graded fine grained quartz SAND, trace clay nodules		
10					44.5	
		SP-SC		(SP-SC) dark brown, SAND with CLAY		
				12.0	42.5	
	SC 2	SM		(SM) light greenish gray, SANDY SILT, partially cemented, some clay		
20				20.0	34.5	
	SC 3	SC		(SC) dark greenish gray, CLAYEY SAND, minor phosphate pebbles, limestone fragments, partially cemented		
30						
	SC 4			35.0	19.5	
		CH		(CH) dark greenish gray, SANDY CLAY, minor mottling, partially cemented		
40				- minor phosphatic particles, minor limestone and sand lenses after 40 ft		
	SC 5			- minor iron mottling at 43 ft		
				49.0	5.5	
50		SP		50.0 (SP) dark gray, poorly graded medium grained SAND, abundant phosphatic	4.5	Grout

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50				particles	
60	SC 6	MH		(MH) dark greenish gray, sandy elastic SILT, abundant phosphate pebbles, minor cemented clay	
				62.0 -7.5	
70	SC 7	SP		(SP) dark gray, poorly graded medium grained SAND, abundant phosphatic particles, minor greenish gray clay lenses, trace limestone fragments	
				71.0 -16.5	
		MH		72.0 (MH) dark greenish gray, sandy elastic SILT, abundant phosphate pebbles, minor cemented clay -17.5	
80	SC 8	SP		(SP) dark gray, medium grained SAND, abundant phosphatic particles, minor greenish gray clay lenses, minor limestone fragments	
90	SC 9	SP		- silt lense at 83 ft - minor greenish gray clay lense at 84 ft -silt lense at 86 ft - minor greenish gray clay lense at 87 ft	
				88.0 -33.5	
		CH		(CH) dark greenish gray, sandy fat CLAY, abundant phosphatic particles	
				90.0 -35.5	
		SC		(SC) dark, greenish gray, CLAYEY SAND, abundant phosphatic particles and limestone fragments	
				92.0 -37.5	
100	SC 10	MH		(MH) light greenish gray, sandy elastic SILT, partially cemented, dry, desiccated, minor iron mottling	
				97.0 -42.5	
		CH		(CH) greenish gray, sandy fat CLAY, minor iron mottling	
				100.0 -45.5	

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WELL NUMBER PZ-12-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100						
	SC 11	SC		(SC) dark gray, CLAYEY SAND, abundant phosphate pebbles, rock fragments	-47.5	Bentonite Seal
		MH		(MH) gray, greenish gray, mottled, dark gray, sandy elastic SILT, large limestone fragments, partially cemented, some clay - cemented, dry, desiccated after 104 ft		Sand Pack
		SP-SC		(SP-SC) very dark gray, SAND with CLAY	-54.5	
110		MH		(MH) dark gray, sandy elastic SILT, cemented, dry, desiccated, with limestone lense	-55.5	
	SC 12	CH		(CH) dark greenish gray, sandy fat CLAY, minor dark gray sand lenses, minor iron mottling		Slotted Screen
120		MH		(MH) light gray, sandy elastic SILT, cemented, dry, desiccated, limestone lense, calcareous	-65.5	

102.0 108.0 109.0 110.0 119.0 120.0

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-12-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/19/14 **COMPLETED** 8/19/14 **GROUND ELEVATION** 54.54 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) dark brown, grayish-brown, light gray, mottled, poorly graded fine grained quartz SAND, trace clay nodules		
10				10.0	44.5	
		SP-SC		(SP-SC) dark brown, SAND with CLAY		
				12.0	42.5	
		SM		(SM) light greenish gray, SANDY SILT, partially cemented, some clay		
20				20.0	34.5	
		SC		(SC) dark greenish gray, CLAYEY SAND, minor phosphate pebbles, limestone fragments, partially cemented		Grout
30				35.0	19.5	
		CH		(CH) dark greenish gray, SANDY CLAY, minor mottling, partially cemented		
40				- minor phosphatic particles, minor limestone and sand lenses after 40 ft		
				- minor iron mottling at 43 ft		
				49.0	5.5	
50		SP		50.0 (SP) dark gray, poorly graded medium grained SAND, abundant phosphatic	4.5	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-12-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50				particles	
		MH		(MH) dark greenish gray, sandy elastic SILT, abundant phosphate pebbles, minor cemented clay	Bentonite Seal
60					Sand Pack
				62.0 -7.5	
		SP		(SP) dark gray, poorly graded medium grained SAND, abundant phosphatic particles, minor greenish gray clay lenses, trace limestone fragments	Slotted Screen
70				71.0 -16.5	
		MH		72.0 (MH) dark greenish gray, sandy elastic SILT, abundant phosphate pebbles, minor cemented clay -17.5	
		SP		(SP) dark gray, medium grained SAND, abundant phosphatic particles, minor greenish gray clay lenses, minor limestone fragments	
				75.0 -20.5	

Bottom of borehole at 75.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-12-S

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/19/14 **COMPLETED** 8/19/14
GROUND ELEVATION 54.61 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY SA **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) dark brown, grayish-brown, light gray, mottled, poorly graded fine grained quartz SAND, trace clay nodules		
10						
10.0					44.6	
		SP-SC		(SP-SC) dark brown, SAND with CLAY		
12.0					42.6	
		SM		(SM) light greenish gray, SANDY SILT, partially cemented, some clay		Grout
20						
20.0					34.6	
		SC		(SC) dark greenish gray, CLAYEY SAND, minor phosphate pebbles, limestone fragments, partially cemented		
30						
35.0					19.6	
		CH		(CH) dark greenish gray, SANDY CLAY, minor mottling, partially cemented		Bentonite Seal
40						Sand Pack
				- minor phosphatic particles, minor limestone and sand lenses after 40 ft		
				- minor iron mottling at 43 ft		Slotted Screen
49.0					5.6	
50		SP		(SP) dark gray, poorly graded medium grained SAND, abundant phosphatic particles	4.6	
50.0						

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
				Bottom of borehole at 50.0 feet.	

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-13-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/13/14 **COMPLETED** 8/13/14 **GROUND ELEVATION** 54.45 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP		(SP) brown, poorly graded fine grained quartz SAND	
10				10.0 / 44.5	
	SC 2	SC		(SC) light gray, CLAYEY SAND	
20				- trace phosphate particles after 17 ft	
	SC 3				
30					
	SC 4				
40				40.0 / 14.5	
	SC 5	CL		(CL) olive gray, gray, variably sandy CLAY, trace phosphate particles	
				46.0 / 8.5	
50		SC		(SC) light gray, pale olive gray, CLAYEY SAND, trace phosphate particles	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SC		(SC) light gray, pale olive gray, CLAYEY SAND, trace phosphate particles *(continued)*		Grout
60				63.0	-8.6	
	SC 7	SP-SC		(SP-SC) gray, poorly graded fine to medium grained quartz SAND with CLAY		
70				74.0	-19.6	
	SC 8	SP		(SP) gray, poorly graded fine to medium grained quartz SAND - medium grained quartz, trace silt, trace phosphate particles after 77 ft		
80				81.0	-26.6	
	SC 9	SP-SM		(SP-SM) light gray, gray, poorly graded fine grained quartz SAND with SILT, trace phosphate particles		
90				86.0	-31.6	
		SM		(SM) light gray, white, SILTY SAND		
	SC 10			93.0	-38.6	
100		SP		(SP) gray, poorly graded fine to medium grained quartz SAND, trace silt, trace phosphate particles		

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WELL NUMBER PZ-13-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100		SP		102.0 (SP) gray, poorly graded fine to medium grained quartz SAND, trace silt, trace phosphate particles *(continued)*	-47.6	Bentonite Seal
	SC 11	SM		(SM) gray, SILTY SAND		Sand Pack
110				109.0	-54.6	
	SC 12	SP-SM		(SP-SM) gray, poorly graded fine to medium grained quartz SAND with SILT		Slotted Screen
				116.0	-61.6	
		SM		(SM) gray, SILTY SAND, trace phosphate particles		
120				120.0	-65.6	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-13-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/20/14 **COMPLETED** 8/20/14 **GROUND ELEVATION** 54.36 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, poorly graded fine grained quartz SAND	
10				10.0 / 44.4	
		SC		(SC) light gray, CLAYEY SAND	
20				- trace phosphate particles after 17 ft	
30					Grout
40				40.0 / 14.4	
		CL		(CL) olive gray, gray, variably sandy CLAY, trace phosphate particles	
				46.0 / 8.4	
50		SC		(SC) light gray, pale olive gray, CLAYEY SAND, trace phosphate particles	

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WELL NUMBER PZ-13-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
		SC		(SC) light gray, pale olive gray, CLAYEY SAND, trace phosphate particles *(continued)*		Bentonite Seal
60						Sand Pack
				63.0	-8.6	
		SP-SC		(SP-SC) gray, poorly graded fine to medium grained quartz SAND with CLAY		Slotted Screen
70						
				74.0	-19.6	
		SP		75.0 (SP) gray, poorly graded fine to medium grained quartz SAND	-20.6	Blank

Bottom of borehole at 75.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:49 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-13-S

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/20/14 **COMPLETED** 8/20/14
GROUND ELEVATION 54.4 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY JR **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) brown, poorly graded fine grained quartz SAND		
10				10.0	44.4	
		SC		(SC) light gray, CLAYEY SAND		Grout
				- trace phosphate particles after 17 ft		
20						
30						
						Bentonite Seal
						Sand Pack
40				40.0	14.4	
		CL		(CL) olive gray, gray, variably sandy CLAY, trace phosphate particles		Slotted Screen
				46.0	8.4	
		SC		(SC) light gray, pale olive gray, CLAYEY SAND, trace phosphate particles		
50				50.0	4.4	Blank

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-14-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/13/14 **COMPLETED** 8/14/14 **GROUND ELEVATION** 54.41 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) brown, poorly graded fine to medium grained quartz SAND	
10	SC 2				
16.0					38.4
20	SC 3	SC		(SC) light gray, variably clayey, CLAYEY SAND, trace phosphate particles	
30	SC 4				
40	SC 5				
45.0					9.4
50		SP-SM		(SP-SM) light gray, poorly graded fine grained quartz SAND with SILT, trace clay	Grout
50.0					4.4

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50	SC 6	SC		(SC) gray, CLAYEY SAND, trace phosphate particles		
				55.0	-0.6	
		SM		(SM) light gray, SILTY SAND, trace clays, trace phosphate particles		
				57.0	-2.6	
60		MH		(MH) greenish gray, sandy elastic SILT, trace limestone fragments, trace phosphate pebbles		
				62.0	-7.6	
	SC 7	CH		(CH) dark greenish gray, sandy fat CLAY, abundant phosphate fragments, trace limestone fragments		
				66.0	-11.6	
70		SP		(SP) dark gray, poorly graded medium-course grained SAND, abundant phosphatic particles, cemented silt lenses		
	SC 8					
				77.0	-22.6	
		SC		(SC) alternating lenses of light greenish gray, CLAYEY SAND, with abundant phosphate particles		
				79.0	-24.6	
80		SP		80.0 (SP) dark gray, poorly graded medium grained SAND, abundant phosphatic particles	-25.6	
		SC		82.0 (SC) alternating lenses of light greenish gray, CLAYEY SAND, with abundant phosphate particles	-27.6	
		SP		83.0	-28.6	
	SC 9	SC		85.0 (SP) dark gray, poorly graded medium grained SAND, abundant phosphatic particles	-30.6	
		SP		87.0 (SC) alternating lenses of light greenish gray, CLAYEY SAND, with abundant phosphate particles	-32.6	
90				(SP) dark gray, poorly graded medium grained SAND, abundant phosphatic particles		
		SC		(SC) alternating lenses of light greenish gray, CLAYEY SAND, with abundant phosphate		
	SC 10			95.0	-40.6	
		MH		(MH) light greenish gray, light gray, sandy elastic SILT, partially cemented, minor iron mottling		
100				- some phosphate particles, trace limestone fragments after 97 ft		Bentonite

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-14-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100	SC 11	MH		(MH) light greenish gray, light gray, sandy elastic SILT, partially cemented, minor iron mottling *(continued)*	Seal; Sand Pack
				108.0 - desiccated at 107 ft -53.6	
110	SC 12	CH		(CH) dark greenish gray, sandy fat CLAY, mottled dark gray sand lenses, partially cemented, dry, limestone fragments, some cemented silt	Slotted Screen
120				120.0 -65.6	

Bottom of borehole at 120.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-14-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/20/14 **COMPLETED** 8/20/14 **GROUND ELEVATION** 54.45 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, poorly graded fine to medium grained quartz SAND	
16.0					38.5
		SC		(SC) light gray, variably clayey, CLAYEY SAND, trace phosphate particles	Grout
45.0					9.5
		SP-SM		(SP-SM) light gray, poorly graded fine grained quartz SAND with SILT, trace clay	
50				50.0	4.5

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-14-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		SC		(SC) gray, CLAYEY SAND, trace phosphate particles 55.0 -0.5	
		SM		(SM) light gray, SILTY SAND, trace clays, trace phosphate particles 57.0 -2.6	Bentonite Seal
60		MH		(MH) greenish gray, sandy elastic SILT, trace limestone fragments, trace phosphate pebbles 62.0 -7.6	Sand Pack
		CH		(CH) dark greenish gray, sandy fat CLAY, abundant phosphate fragments, trace limestone fragments 66.0 -11.6	
70		SP		(SP) dark gray, poorly graded medium-course grained SAND, abundant phosphatic particles, cemented silt lenses 75.0 -20.6	Slotted Screen

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-14-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/20/14 **COMPLETED** 8/20/14 **GROUND ELEVATION** 54.51 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, poorly graded fine to medium grained quartz SAND	
16.0					38.5
		SC		(SC) light gray, variably clayey, CLAYEY SAND, trace phosphate particles	Grout
					Bentonite Seal
					Sand Pack
45.0					9.5
		SP-SM		(SP-SM) light gray, poorly graded fine grained quartz SAND with SILT, trace clay	Slotted Screen
50				50.0	4.5

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-15-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/16/14 **COMPLETED** 8/16/14 **GROUND ELEVATION** 54.51 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY PKK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SM		(SM) light brown, SILTY SAND, trace shell	
				2.0 / 52.5	
	SC 1	SP-SM		(SP-SM) dark brown, poorly graded fine grained quartz SAND with SILT	
10					
	SC 2				
20					
	SC 3	SC			
30				30.0 / 24.5	
		CH		(CH) olive gray, sandy fat CLAY, phosphate particles	
				32.0 / 22.5	
	SC 4	SC		(SC) olive to gray, CLAYEY SAND, phosphate particles	
				35.0 / 19.5	
				weathered, LIMESTONE/DOLOSTONE with clayey to silty sand and phosphate	
40				37.0 / 17.5	
		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles	
	SC 5			- clay lenses at 45 to 47 ft	
50					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles *(continued)*	Grout
				53.0 1.5	
	SC 6	SM		(SM) olive to gray SILTY SAND, phosphate particles	
60					
	SC 7			- gravel sized phosphate particles below 60 ft	
70					
	SC 8			74.0 -19.5	
		SP		(SP) dark gray to olive, poorly graded coarse grained quartz SAND, gravel size phosphate particles, trace silt and clay	
80				80.0 -25.5	
	SC 9	SC		(SC) olive, CLAYEY SAND, phosphatic sand nodules, calcareous, dolomitic	
				87.0 -32.5	
90		SP-SC		(SP-SC) dark gray, pale brown, olive, SAND with CLAY, gravel size phosphate particles, slightly calcareous, dolomitic	
	SC 10			- desiccated after 94 ft	
				97.0 -42.5	
100		SC		(SC) olive to gray, CLAYEY SAND, trace phosphate particles	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-15-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100					
110	SC 11	SC		(SC) olive to gray, CLAYEY SAND, trace phosphate particles *(continued)*	Bentonite Seal; Sand Pack
120	SC 12	ML		110.0 -55.5 (ML) pale brown to olive, sandy SILT, few phosphate particles, thin clayey lenses, slightly calcareous, dolomitic, desiccated	Slotted Screen
	SC 13	SC		120.0 -65.5 (SC) olive to gray, CLAYEY SAND, phosphate particles - 6-inch clay lense at 123 ft	
				125.0 -70.5	

Bottom of borehole at 125.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-15-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/18/14 **COMPLETED** 8/18/14 **GROUND ELEVATION** 54.51 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY PKK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SM		(SM) light brown, SILTY SAND, trace shell	
				2.0 / 52.5	
		SP-SM		(SP-SM) dark brown, poorly graded fine grained quartz SAND with SILT	
10				12.0 / 42.5	
		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles	
20					
					Grout
30				30.0 / 24.5	
		CH		(CH) olive gray, sandy fat CLAY, phosphate particles	
				32.0 / 22.5	
		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles	
				35.0 / 19.5	
				weathered, LIMESTONE/DOLOSTONE with clayey to silty sand and phosphate	
				37.0 / 17.5	
40		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles	
				- clay lenses at 45 to 47 ft	
50					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-15-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles *(continued)*	
				53.0	1.5
		SM		(SM) olive to gray SILTY SAND, phosphate particles	Bentonite Seal; Sand Pack
60				- gravel sized phosphate particles below 60 ft	
70					Slotted Screen
				74.0	-19.5
		SP		75.0 (SP) dark gray to olive, poorly graded coarse grained quartz SAND, gravel size phosphate particles, trace silt and clay	-20.5

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-15-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/18/14 **COMPLETED** 8/18/14 **GROUND ELEVATION** 54.51 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY PKK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SM		(SM) light brown, SILTY SAND, trace shell		
				2.0	52.5	
		SP-SM		(SP-SM) dark brown, poorly graded fine grained quartz SAND with SILT		
10						
				12.0	42.5	
		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles		Grout
20						
30				30.0	24.5	
		CH		(CH) olive gray, sandy fat CLAY, phosphate particles		
				32.0	22.5	
		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles		
				35.0	19.5	
				weathered, LIMESTONE/DOLOSTONE with clayey to silty sand and phosphate		Bentonite Seal
				37.0	17.5	
		SC		(SC) olive to gray, CLAYEY SAND, phosphate particles		Sand Pack
40						
				- clay lenses at 45 to 47 ft		Slotted Screen
50				50.0	4.5	

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-16-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/21/14 **COMPLETED** 8/21/14 **GROUND ELEVATION** 19.43 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY LG **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) white, poorly graded medium grained quartz, SAND	
				3.0	16.4
		SP-SM		4.0 (SP-SM) dark brown, poorly graded fine to medium grained quartz SAND with Silt	15.4
	SC 1	SP		(SP) light brown, white, gray, poorly graded fine to medium grained, SAND	
10				- trace phosphate particles after 8 ft	
				11.0	8.4
		ML		(ML) gray, sandy SILT, with lenses of fine grained sand	
	SC 2			15.0	4.4
		SP		(SP) white, medium, poorly graded fine grained quartz SAND, trace phosphate particles	
20				17.0	2.4
		ML		(ML) light green, gray, green, fine grained, sandy SILT	
	SC 3				
30				- medium grained, trace phosphate pebbles	Grout
	SC 4				
				37.0	-17.6
		SM		(SM) gray, SILTY SAND, trace phosphate particles	
40				40.0	-20.6
	SC 5	ML		(ML) gray, sandy SILT, gravely, partially cemented	
50					

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WELL NUMBER PZ-16-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		ML		(ML) gray, sandy SILT, gravely, partially cemented *(continued)*	
				53.0 -33.6	
	SC 6	SM		(SM) gray, medium grained, SILTY SAND, trace gravel	
60					Bentonite Seal
	SC 7				Sand Pack
				67.0 -47.6	
70		ML		(ML) light green, sandy SILT, some gravel	
	SC 8				Slotted Screen
				- partially cemented, minor iron mottling after 77 ft	
80					
	SC 9			82.0 -62.6	Blank

Bottom of borehole at 82.0 feet.

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WELL NUMBER PZ-16-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/22/14 **COMPLETED** 8/22/14 **GROUND ELEVATION** 19.43 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY LG **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		(SP) white, poorly graded medium grained quartz, SAND		
				3.0	16.4	
		SP-SM		4.0 (SP-SM) dark brown, poorly graded fine to medium grained quartz SAND with Silt	15.4	
		SP		(SP) light brown, white, gray, poorly graded fine to medium grained, SAND		
10				- trace phosphate particles after 8 ft		
				11.0	8.4	
		ML		(ML) gray, sandy SILT, with lenses of fine grained sand		
				15.0	4.4	
		SP		(SP) white, medium, poorly graded fine grained quartz SAND, trace phosphate particles		Grout
				17.0	2.4	
20		ML		(ML) light green, gray, green, fine grained, sandy SILT		
30				- medium grained, trace phosphate pebbles		
				37.0	-17.6	Bentonite Seal
		SM		(SM) gray, SILTY SAND, trace phosphate particles		Sand Pack
40				40.0	-20.6	
		ML		(ML) gray, sandy SILT, gravely, partially cemented		
50						Slotted Screen

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WELL NUMBER PZ-16-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
		ML		(ML) gray, sandy SILT, gravely, partially cemented *(continued)*		
				53.0	-33.6	
		SM		(SM) gray, medium grained, SILTY SAND, trace gravel		
				55.0	-35.6	Blank

Bottom of borehole at 55.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-17-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/21/14 **COMPLETED** 8/21/14 **GROUND ELEVATION** 19.45 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY LG **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) dark brown, poorly graded fine grained quartz SAND	
10	SC 2			14.0 / 5.5	
		ML		(ML) light green, sandy SILT, trace phosphatic sand nodules	
20	SC 3			21.0 / -1.6	
		SP-SM		(SP-SM) gray, poorly graded fine to medium grained quartz SAND with SILT, minor phosphatic pebbles	
				24.0 / -4.6	
		ML		(ML) gray, sandy SILT, trace iron mottling	
				27.0 / -7.6	
30		SP-SM		(SP-SM) gray, poorly graded medium grained quartz SAND with SILT, gravely, trace phosphatic grains	
				32.0 / -12.6	
40	SC 4	ML		(ML) light green, gray, sandy SILT, trace gravel, minor cemented clay	Grout
				- silty sand lenses at 37 ft	
	SC 5			- abundant phosphate pebbles after 44 ft	
				47.0 / -27.6	
50		SM		(SM) green, gray, SILTY SAND, medium grained sands, some phosphatic grains	

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SC 6	SM		(SM) green, gray, SILTY SAND, medium grained sands, some phosphatic grains *(continued)*	
				53.0 -33.6	
		SP-SM		(SP-SM) gray, poorly graded medium grained quartz, SAND with silt, abundant phosphatic particles	
				57.0 -37.6	
60				(ML) light green, olive, sandy SILT, partially cemented, dry, minor iron mottling	
	SC 7			- abundant phosphatic particles at 65 ft	
70				- desiccated at 69 ft	
	SC 8			- dolomitic, abundant phosphate particles after 71 ft	
80		ML			
	SC 9				Bentonite Seal Sand Pack
90					
	SC 10				Slotted Screen
				- some cementation after 94 ft	
				- gray sand lenses after 97 ft	
100				100.0 -80.6	Blank
				Bottom of borehole at 100.0 feet.	

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WELL NUMBER PZ-17-M

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/22/14 **COMPLETED** 8/22/14
GROUND ELEVATION 19.46 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY LG **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) dark brown, poorly graded fine grained quartz SAND	
14.0					5.5
		ML		(ML) light green, sandy SILT, trace phosphatic sand nodules	Grout
21.0					-1.5
		SP-SM		(SP-SM) gray, poorly graded fine to medium grained quartz SAND with SILT, minor phosphatic pebbles	
24.0					-4.5
		ML		(ML) gray, sandy SILT, trace iron mottling	
27.0					-7.5
		SP-SM		(SP-SM) gray, poorly graded medium grained quartz SAND with SILT, gravely, trace phosphatic grains	
32.0					-12.5
		ML		(ML) light green, gray, sandy SILT, trace gravel, minor cemented clay	Bentonite Seal
				- silty sand lenses at 37 ft	Sand Pack
				- abundant phosphate pebbles after 44 ft	
47.0					-27.5
		SM		(SM) green, gray, SILTY SAND, medium grained sands, some phosphatic grains	Slotted Screen
50					

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WELL NUMBER PZ-17-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
		SM		(SM) green, gray, SILTY SAND, medium grained sands, some phosphatic grains *(continued)*		
				53.0	-33.5	
		SP-SM		(SP-SM) gray, poorly graded medium grained quartz, SAND with silt, abundant phosphatic particles		Blank
				55.0	-35.5	

Bottom of borehole at 55.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-18-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/20/14 **COMPLETED** 8/20/14 **GROUND ELEVATION** 19.12 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY LG **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP		(SP) light brown to brown, poorly graded fine grained quartz SAND, trace silts	
10					
	SC 2				
17.0				2.1	
20		CL		(CL) greenish gray, sandy CLAY, phosphatic sand nodules	
	SC 3				
27.0				-7.9	
		SM		(SM) gray, SILTY SAND, lenses of light green sandy clay	
30					
30.0				-10.9	
	SC 4	SP		(SP) light greenish gray, poorly graded fine to medium grained quartz SAND	Grout
40					
40.0				-20.9	
	SC 5	CL		(CL) green, yellowish brown, sandy CLAY	
50					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-18-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		CL		51.0 -31.9	
		SP-SM		(SP-SM) gray, fine grained quartz, SAND with SILT	
				53.0 -33.9	
	SC 6			(ML) light green, sandy SILT, dolomitic, variably consolidated	
60		ML			
	SC 7			67.0 -47.9	Bentonite Seal; Sand Pack
				(CL) gray, light gray, sandy CLAY	
70				- sand lenses at 70 ft	
	SC 8	CL		- dolomitic after 75 ft	Slotted Screen
80				- some gravel after 77 ft	
	SC 9			82.0 -62.9	Blank

Bottom of borehole at 82.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-18-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/20/14 **COMPLETED** 8/20/14 **GROUND ELEVATION** 18.86 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY LG **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) light brown to brown, poorly graded fine grained quartz SAND, trace silts	Grout
17.0					1.9
		CL		(CL) greenish gray, sandy CLAY, phosphatic sand nodules	
27.0					-8.1
		SM		(SM) gray, SILTY SAND, lenses of light green sandy clay	Bentonite Seal
30.0					-11.1
		SP		(SP) light greenish gray, poorly graded fine to medium grained quartz SAND	Sand Pack
40.0					-21.1
		CL		(CL) green, yellowish brown, sandy CLAY	Slotted Screen
50					

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WELL NUMBER PZ-18-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		CL		51.0	-32.1	
		SP-SM		(SP-SM) gray, fine grained quartz, SAND with SILT		
				53.0	-34.1	
		ML		(ML) light green, sandy SILT, dolomitic, variably consolidated		
				55.0	-36.1	Blank

Bottom of borehole at 55.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-19-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/21/14 **COMPLETED** 10/21/14 **GROUND ELEVATION** 52.66 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SC 1	SP		(SP) brown, gray, SAND, trace silt, trace roots	
10				- trace clayey nodules after 5 ft	
12.0	SC 2	SP-SM		(SP-SM) gray, light greenish gray, SAND with SILT, variably clayey, trace phosphatic sand and gravel, trace cemented nodules, slightly dolomitic	
20	SC 3				
27.5					
30	SC 4	SC		(SC) greenish gray, gray, light greenish gray, CLAYEY SAND, trace cemented nodules, trace phosphatic sand - slightly dolomitic at 30 ft	
40	SC 5			- 6-inch silty sand lense at 38 ft - 1/8-inch fine sand lense at 41.5 ft - 2-inch dry dolomitic silty sand lense at 43 ft - 3-inch sand lense at 44 ft	
50				- 4-inch clay lense at 49 ft	Grout
40.7					
25.2					

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SC		(SC) greenish gray, gray, light greenish gray, CLAYEY SAND, trace cemented nodules, trace phosphatic sand *(continued)* - cemented nodules below 50 ft - 1/2-inch sand lense at 55.5 ft		
				57.5	-4.8	
		CL		58.5 (CL) gray, greenish gray, CLAY, vertical sand lens	-5.8	
60				(SM) dark greenish gray, SILTY SAND, trace phosphatic sands		
	SC 7	SM		- variably clayey and silty, trace phosphatic sand - 1.5 ft sand lense at 62.5 ft - 4-inch sand lense at 64 ft - 1-inch clay lense at 64.5 ft		
70						
	SC 8			- 2-inch sand lense at 71.5 ft		
				75.0	-22.3	
80		SP-SM		(SP-SM) light gray, light greenish gray, gray, dark gray, poorly graded fine grained quartz SAND with SILT, dolomitic, moderately cemented, desiccated, trace cemented silt and phosphatic nodules - trace phosphatic sands after 80 ft		
				84.0	-31.3	
	SC 9	MH		(MH) very pale gray, light gray, sandy elastic SILT, cemented		
				87.0	-34.3	
		SP-SM		(SP-SM) gray, poorly graded fine grained quartz SAND with SILT, dolomitic silt nodules, trace phosphatic sand		
90				90.0	-37.3	
		SM		91.5 (SM) gray, SILTY SAND, very hard, trace phosphatic sand, cemented	-38.8	
		SP-SM		93.0 (SP-SM) gray, pale brown, poorly graded fine grained quartz SAND with SILT, dolomitic, trace phosphatic sand	-40.3	
	SC 10	MH		(MH) gray, light greenish gray, sandy elastic SILT		
				95.5	-42.8	
		SP-SM		(SP-SM) light greenish gray, gray, pale brown, poorly graded fine grained quartz SAND with SILT, trace phosphatic sand		
100				100.0	-47.3	Bentonite

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-19-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100					
	SC 11	SM		(SM) greenish gray, SILTY SAND, variably silty, trace phosphatic sand	Seal; Sand Pack
				107.0 -54.3	
		MH		(MH) greenish gray, dark greenish gray, sandy elastic SILT	
110				110.0 -57.3	
	SC 12	SM		(SM) dark greenish gray, gray, light greenish gray, SILTY SAND - moderately cemented silt nodules after 113 ft	Slotted Screen
				115.0 -62.3	
		MH		(MH) gray, variably sandy, sandy elastic SILT, cemented, dolomitic, trace phosphatic sand - desiccated after 117 ft	
120				120.0 -67.3	

Bottom of borehole at 123.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-19-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/22/14 **COMPLETED** 10/22/14 **GROUND ELEVATION** 52.85 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, gray, SAND, trace silt, trace roots	
				- trace clayey nodules after 5 ft	
10					
12.0					40.9
		SP-SM		(SP-SM) gray, light greenish gray, SAND with SILT, variably clayey, trace phosphatic sand and gravel, trace cemented nodules, slightly dolomitic	
20					
27.5					25.4
		SC		(SC) greenish gray, gray, light greenish gray, CLAYEY SAND, trace cemented nodules, trace phosphatic sand	Grout
30				- slightly dolomitic at 30 ft	
				- 6-inch silty sand lense at 38 ft	
40				- 1/8-inch fine sand lense at 41.5 ft	
				- 2-inch dry dolomitic silty sand lense at 43 ft - 3-inch sand lense at 44 ft	
50				- 4-inch clay lense at 49 ft	

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WELL NUMBER PZ-19-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) greenish gray, gray, light greenish gray, CLAYEY SAND, trace cemented nodules, trace phosphatic sand *(continued)* - cemented nodules below 50 ft - 1/2-inch sand lense at 55.5 ft		
				57.5	-4.7	
		CL		58.5 (CL) gray, greenish gray, CLAY, vertical sand lens	-5.7	
60		SM		(SM) dark greenish gray, SILTY SAND, trace phosphatic sands - variably clayey and silty, trace phosphatic sand - 1.5 ft sand lense at 62.5 ft - 4-inch sand lense at 64 ft - 1-inch clay lense at 64.5 ft		Bentonite Seal Sand Pack
70				- 2-inch sand lense at 71.5 ft		Slotted Screen
				75.0	-22.2	
		SP-SM		(SP-SM) light gray, light greenish gray, gray, dark gray, poorly graded fine grained quartz SAND with SILT, dolomitic, moderately cemented, desiccated, trace cemented silt and phosphatic nodules		Blank
				79.0	-26.2	

Bottom of borehole at 79.0 feet.

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WELL NUMBER PZ-19-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/22/14 **COMPLETED** 10/22/14 **GROUND ELEVATION** 52.85 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, gray, SAND, trace silt, trace roots - trace clayey nodules after 5 ft	
12.0		SP-SM		(SP-SM) gray, light greenish gray, SAND with SILT, variably clayey, trace phosphatic sand and gravel, trace cemented nodules, slightly dolomitic	Grout
27.5		SC		(SC) greenish gray, gray, light greenish gray, CLAYEY SAND, trace cemented nodules, trace phosphatic sand - slightly dolomitic at 30 ft - 6-inch silty sand lense at 38 ft - 1/8-inch fine sand lense at 41.5 ft - 2-inch dry dolomitic silty sand lense at 43 ft - 3-inch sand lense at 44 ft - 4-inch clay lense at 49 ft	Bentonite Seal Sand Pack Slotted Screen
40.9					
25.4					

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		SC		(SC) greenish gray, gray, light greenish gray, CLAYEY SAND, trace cemented nodules, trace phosphatic sand *(continued)* - cemented nodules below 50 ft 54.0	-1.2 Blank

Bottom of borehole at 54.0 feet.

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WELL NUMBER PZ-20-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/2/14 **COMPLETED** 10/2/14 **GROUND ELEVATION** 54.4 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP-SM		(SP-SM) light brown, poorly graded fine grained quartz SAND with SILT, trace cemented nodules, trace shell fragments	52.4	
				2.0		
	SC 1	SM		(SM) brown, dark brown, light greenish gray, gray, SILTY SAND		
10				- trace phosphatic sand and pebbles, trace cemented nodules at 9 ft - trace clay nodules, trace shell fragments after 10 ft		
	SC 2			- dolosilt after 13 ft		
				18.0	36.4	
20		SP-SC		(SP-SC) greenish gray, SAND with CLAY, phosphatic sand, gravel size cemented silt nodules		
				21.0	33.4	
		SP-SM		22.0 (SP-SM) light brown, light gray, SAND with SILT, trace shell fragments, trace clayey and silty nodules, trace phosphatic sand	32.4	
	SC 3	SM		(SM) light greenish gray, SILTY SAND, cemented silt nodules, trace phosphatic sand		
				27.0	27.4	
30		SC		(SC) greenish gray, CLAYEY SAND, trace cemented gravel size nodules		
				33.0	21.4	
	SC 4	SM		(SM) light greenish gray, SILTY SAND, variable dolosilt lenses		
				36.0	18.4	
40		SC		(SC) dark green, CLAYEY SAND, trace cemented sand, phosphatic nodules, trace phosphatic sand		
				43.0	11.4	
		SM		44.0 (SM) light greenish gray, SILTY SAND, variable cemented nodules, trace phosphatic sand	10.4	
	SC 5	SC		(SC) dark greenish gray, CLAYEY SAND, variably clayey and silty		
50				50.0	4.4	Grout

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SM		(SM) light greenish gray, dark greenish gray, SILTY SAND, few phosphatic sand and pebbles, trace cemented nodules, trace clay, gravel size cemented clay		
				- local variable sand lenses after 56 ft		
60				- variably clayey after 60 ft		
	SC 7			62.5 - 6-inch fine to medium sand lens at 61.5 ft	-8.1	
		ML		64.0 (ML) greenish gray, SANDY SILT, trace phosphatic sand	-9.6	
		SM		(SM) dark greenish gray, SILTY SAND, variably clayey and silty, trace phosphatic sand		
				67.0 - 2-inch sand lense at 65 ft - 1-inch sand lense at 66 ft	-12.6	
		SP		68.0	-13.6	
		SC		(SP) gray, dark gray, poorly graded fine-medium grained quartz SAND, trace phosphatic sand, trace silts and clays		
70				70.0 (SC) greenish gray, CLAY, variable thin sand veins	-15.6	
	SC 8	SP-SM		71.5 (SP-SM) gray, dark gray, greenish gray, poorly graded fine grained quartz Sand with SILT, slightly dolomitic, cemented sand and silt nodules, trace phosphatic sands	-17.1	
		SM		74.5 (SM) dark greenish gray, SILTY SAND, vertical thin sand veins, variably silty	-20.1	
				- NO SAMPLE RECOVERY		
80				80.0	-25.6	
	SC 9	SP-SM		81.5 (SP-SM) light gray, gray, SAND with SILT, trace phosphatic sand, trace cemented silt nodules	-27.1	
		SP		82.5 (SP) gray, dark gray, poorly graded fine grained quartz SAND, little phosphatic sand, trace cemented sand and silt nodules	-28.1	
		MH		(MH) light gray, sandy elastic SILT, minor sand, dolomitic, trace phosphatic sand - 1.5 ft desiccated SILTY SAND at 83 ft		
				87.0	-32.6	
90		SP-SM		(SP-SM) gray, dark gray, SAND with SILT, trace phosphatic silt, trace cemented silty sand nodules, minor cementation, trace silt		
				94.0 - 1 ft moderately cemented silt lense	-39.6	
	SC 10	MH		(MH) light gray, light greenish gray, SILT, trace cemented Silt with sand nodules, minor sand		
100				100.0	-45.6	Bentonite

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WELL NUMBER PZ-20-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100	SC 11	SM		(SM) light greenish gray, greenish gray, gray, light gray, SILTY SAND, trace weakly cemented nodules, variably clayey, trace fine phosphate particles	Seal; Sand Pack
110	SC 12	SM		- trace cemented silt nodules after 110 ft	Slotted Screen
				115.5 -61.1	
		SP-SM		(SP-SM) gray, poorly graded fine grained quartz SAND with SILT	
				117.0 -62.6	
		SM		(SM) light gray, light greenish gray, SILTY SAND	
120				120.0 -65.6	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-20-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/2/14 **COMPLETED** 10/2/14 **GROUND ELEVATION** 54.42 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP-SM		(SP-SM) light brown, poorly graded fine grained quartz SAND with SILT, trace cemented nodules, trace shell fragments	52.4	
				2.0		
		SM		(SM) brown, dark brown, light greenish gray, gray, SILTY SAND		
10				- trace phosphatic sand and pebbles, trace cemented nodules at 9 ft		
				- trace clay nodules, trace shell fragments after 10 ft		
				- dolosilt after 13 ft		
				18.0	36.4	
20		SP-SC		(SP-SC) greenish gray, SAND with CLAY, phosphatic sand, gravel size cemented silt nodules		
				21.0	33.4	
		SP-SM		22.0 (SP-SM) light brown, light gray, SAND with SILT, trace shell fragments, trace clayey and silty nodules, trace phosphatic sand	32.4	
		SM		(SM) light greenish gray, SILTY SAND, cemented silt nodules, trace phosphatic sand		
				27.0	27.4	
30		SC		(SC) greenish gray, CLAYEY SAND, trace cemented gravel size nodules		◄Grout
				33.0	21.4	
		SM		(SM) light greenish gray, SILTY SAND, variable dolosilt lenses		
				36.0	18.4	
		SC		(SC) dark green, CLAYEY SAND, trace cemented sand, phosphatic nodules, trace phosphatic sand		
40				43.0	11.4	
		SM		44.0 (SM) light greenish gray, SILTY SAND, variable cemented nodules, trace phosphatic sand	10.4	
		SC		(SC) dark greenish gray, CLAYEY SAND, variably clayey and silty		
50				50.0	4.4	

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WELL NUMBER PZ-20-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
		SM		(SM) light greenish gray, dark greenish gray, SILTY SAND, few phosphatic sand and pebbles, trace cemented nodules, trace clay, gravel size cemented clay		
				- local variable sand lenses after 56 ft		Bentonite Seal
60						Sand Pack
				- variably clayey after 60 ft		
				62.5 - 6-inch fine to medium sand lens at 61.5 ft	-8.1	
		ML		64.0 (ML) greenish gray, SANDY SILT, trace phosphatic sand	-9.6	
		SM		(SM) dark greenish gray, SILTY SAND, variably clayey and silty, trace phosphatic sand		
				67.0 - 2-inch sand lense at 65 ft - 1-inch sand lense at 66 ft	-12.6	
		SP		68.0	-13.6	Slotted Screen
		SC		(SP) gray, dark gray, poorly graded fine-medium grained quartz SAND, trace phosphatic sand, trace silts and clays		
70				70.0 (SC) greenish gray, CLAY, variable thin sand veins	-15.6	
		SP-SM		71.5 (SP-SM) gray, dark gray, greenish gray, poorly graded fine grained quartz Sand with SILT, slightly dolomitic, cemented sand and silt nodules, trace phosphatic sands	-17.1	
		SM		(SM) dark greenish gray, SILTY SAND, vertical thin sand veins, variably silty		
				74.5	-20.1	
				75.6 - NO SAMPLE RECOVERY	-21.2	Blank

Bottom of borehole at 75.6 feet.

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WELL NUMBER PZ-20-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/22/14 **COMPLETED** 10/22/14 **GROUND ELEVATION** 54.35 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP-SM		(SP-SM) light brown, poorly graded fine grained quartz SAND with SILT, trace cemented nodules, trace shell fragments	52.4	
				2.0		
		SM		(SM) brown, dark brown, light greenish gray, gray, SILTY SAND		
10		SM		- trace phosphatic sand and pebbles, trace cemented nodules at 9 ft - trace clay nodules, trace shell fragments after 10 ft		
		SM		- dolosilt after 13 ft		
				18.0	36.4	Grout
20		SP-SC		(SP-SC) greenish gray, SAND with CLAY, phosphatic sand, gravel size cemented silt nodules		
				21.0	33.4	
		SP-SM		22.0 (SP-SM) light brown, light gray, SAND with SILT, trace shell fragments, trace clayey and silty nodules, trace phosphatic sand	32.4	
		SM		(SM) light greenish gray, SILTY SAND, cemented silt nodules, trace phosphatic sand		
				27.0	27.4	
30		SC		(SC) greenish gray, CLAYEY SAND, trace cemented gravel size nodules		
				33.0	21.4	
		SM		(SM) light greenish gray, SILTY SAND, variable dolosilt lenses		
				36.0	18.4	Bentonite Seal
		SC		(SC) dark green, CLAYEY SAND, trace cemented sand, phosphatic nodules, trace phosphatic sand		Sand Pack
40		SC				
				43.0	11.4	
		SM		44.0 (SM) light greenish gray, SILTY SAND, variable cemented nodules, trace phosphatic sand	10.4	Slotted Screen
		SC		(SC) dark greenish gray, CLAYEY SAND, variably clayey and silty		
50				50.0	4.4	Blank

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-21-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/6/14 **COMPLETED** 10/6/14 **GROUND ELEVATION** 53.95 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				- NO SAMPLE RECOVERED	
	SC 1			5.0 — 49.0	
		SP		6.0 (SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt — 48.0	
		SP-SM		(SP-SM) greenish gray, light gray, light greenish gray, SILTY SAND, trace phosphatic sand, variably silty, trace cemented silt nodules, gravel	
10					
	SC 2			- trace phosphatic sand to pebbles, slightly desiccated and dolomitic after 11.5 ft	
				13.5 — 40.5	
		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt, trace roots	
20				- 6-inch lense of light yellow, very pale brown, dolomitic silt, slightly desiccated, dolostone at 18.5 ft	
				20.0 — 34.0	
	SC 3	SP-SM		(SP-SM) greenish gray, gray, SILTY SAND, variably clayey, trace cemented nodules and gravel size cemented silt nodule, trace phosphatic sand	
30				- trace desiccated dolostone nodules after 30 ft	
				34.0 — 20.0	
	SC 4	SP-SC		(SP-SC) dark greenish gray, poorly graded fine grained quartz SAND with CLAY	
				37.0 — 17.0	
40		SP-SM		(SP-SM) greenish gray, gray, light greenish gray, light gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands, cemented nodules	
	SC 5			- damp, slightly cemented after 41 ft	
				45.5 — 8.5	
		CL		46.5 (CL) dark greenish gray, sandy CLAY, variable fine thin sand lenses — 7.5	
50		SC		(SC) greenish gray, CLAYEY SAND, trace phosphate sand to pebbles	

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) greenish gray, CLAYEY SAND, trace phosphate sand to pebbles *(continued)*		Grout
				52.0	2.0	
	SC 6	SP-SM		(SP-SM) light gray, light greenish gray, gray, variably silty and clayey, SAND, trace gravel size cemented silt, trace phosphate sand to gravel - vertical sand veins after 54 ft		
60				- moderate cementation after 59 ft		
				61.0	-7.1	
	SC 7	CL		(CL) very dark greenish gray, variably sandy CLAY, variable thin fine sand lenses throughout - 1/8-inch sand lense at 63.3 ft		
				66.0	-12.1	
		SP		(SP) gray, very dark gray, black, poorly graded fine grained quartz SAND, trace silts and clays, little phosphatic sand - trace cemented dolosilt nodules at 68 ft		
70				70.0	-16.1	
	SC 8	SM		71.0 (SM) pale gray, SILTY SAND, moderately cemented	-17.1	
		SP-SM		(SP-SM) light gray, gray, poorly graded fine grained quartz SAND with SILT, trace cemented nodules		
				74.0	-20.1	
		SP		(SP) gray, dark gray, poorly graded fine grained quartz SAND, little phosphate sand, trace silts and clays - very pale brown cemented dolosilt nodules at 75 ft		
80				79.0	-25.1	
	SC 9	SP-SM		(SP-SM) greenish gray, poorly graded fine grained quartz SAND with SILT, trace cemented nodules - trace phosphate sands after 80 ft		
				85.0 - 6-inch cemented silty sand nodules at 84.5 ft	-31.1	
		SP		(SP) gray, dark gray, poorly graded fine grained quartz SAND, trace silt, little phosphatic sands		
90				89.5	-35.6	
	SC 10	SP-SM		(SP-SM) light gray, gray, poorly graded fine grained quartz SAND with SILT, cemented nodules, trace phosphatic sand		
				94.0 - desiccated at 93 ft - vertical sand veins at 94 ft	-40.1	
		SP-SC		(SP-SC) light greenish gray, variably clayey and silty, SAND with CLAY, trace phosphatic sand		
				97.0 - desiccated at 95 ft	-43.1	
		SP-SM		(SP-SM) light gray, light greenish gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands		
100				100.0	-46.1	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-21-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100					
110	SC 11	SM		(SM) greenish gray, SILTY SAND, trace phosphatic sands 2 ft trace cemented nodules 110.0 -56.1	Bentonite Seal Sand Pack
120	SC 12	SP-SM		(SP-SM) light greenish gray, gray, greenish gray, SILTY SAND, trace phosphatic sands - moderately cemented, slightly dolomitic after 112.5 ft 120.8 -66.9	Slotted Screen Blank

Bottom of borehole at 120.8 feet.

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WELL NUMBER PZ-21-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/22/14 **COMPLETED** 10/22/14 **GROUND ELEVATION** 54.05 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0				- NO SAMPLE RECOVERED		
				5.0	49.1	
		SP		6.0 (SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt	48.1	
10		SP-SM		(SP-SM) greenish gray, light gray, light greenish gray, SILTY SAND, trace phosphatic sand, variably silty, trace cemented silt nodules, gravel		
				- trace phosphatic sand to pebbles, slightly desiccated and dolomitic after 11.5 ft		
				13.5	40.6	
20		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt, trace roots		
				- 6-inch lense of light yellow, very pale brown, dolomitic silt, slightly desiccated, dolostone at 18.5 ft		
				20.0	34.1	
30		SP-SM		(SP-SM) greenish gray, gray, SILTY SAND, variably clayey, trace cemented nodules and gravel size cemented silt nodule, trace phosphatic sand		Grout
				- trace desiccated dolostone nodules after 30 ft		
				34.0	20.1	
		SP-SC		(SP-SC) dark greenish gray, poorly graded fine grained quartz SAND with CLAY		
				37.0	17.1	
40		SP-SM		(SP-SM) greenish gray, gray, light greenish gray, light gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands, cemented nodules		
				- damp, slightly cemented after 41 ft		
				45.5	8.6	
		CL		46.5 (CL) dark greenish gray, sandy CLAY, variable fine thin sand lenses	7.6	
50		SC		(SC) greenish gray, CLAYEY SAND, trace phosphate sand to pebbles		

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WELL NUMBER PZ-21-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SC		(SC) greenish gray, CLAYEY SAND, trace phosphate sand to pebbles *(continued)*	2.1	
				52.0		
		SP-SM		(SP-SM) light gray, light greenish gray, gray, variably silty and clayey, SAND, trace gravel size cemented silt, trace phosphate sand to gravel - vertical sand veins after 54 ft		Bentonite Seal
60				- moderate cementation after 59 ft		Sand Pack
				61.0	-7.0	
		CL		(CL) very dark greenish gray, variably sandy CLAY, variable thin fine sand lenses throughout - 1/8-inch sand lense at 63.3 ft		
				66.0	-12.0	
		SP		(SP) gray, very dark gray, black, poorly graded fine grained quartz SAND, trace silts and clays, little phosphatic sand - trace cemented dolosilt nodules at 68 ft		Slotted Screen
70				70.0	-16.0	
		SM		71.0 (SM) pale gray, SILTY SAND, moderately cemented	-17.0	
		SP-SM		(SP-SM) light gray, gray, poorly graded fine grained quartz SAND with SILT, trace cemented nodules		
				74.0	-20.0	
		SP		75.0 (SP) gray, dark gray, poorly graded fine grained quartz SAND, little phosphate sand, trace silts and clays	-21.0	

Bottom of borehole at 75.0 feet.

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WELL NUMBER PZ-21-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/24/14 **COMPLETED** 10/24/14 **GROUND ELEVATION** 54.02 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY HI **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0				- NO SAMPLE RECOVERED		
				5.0	49.0	
		SP		6.0 (SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt	48.0	
		SP-SM		(SP-SM) greenish gray, light gray, light greenish gray, SILTY SAND, trace phosphatic sand, variably silty, trace cemented silt nodules, gravel		
10				- trace phosphatic sand to pebbles, slightly desiccated and dolomitic after 11.5 ft		
				13.5	40.5	
		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt, trace roots		Grout
20				- 6-inch lense of light yellow, very pale brown, dolomitic silt, slightly desiccated, dolostone at 18.5 ft		
				20.0	34.0	
		SP-SM		(SP-SM) greenish gray, gray, SILTY SAND, variably clayey, trace cemented nodules and gravel size cemented silt nodule, trace phosphatic sand		
30				- trace desiccated dolostone nodules after 30 ft		
				34.0	20.0	
		SP-SC		(SP-SC) dark greenish gray, poorly graded fine grained quartz SAND with CLAY		Bentonite Seal
				37.0	17.0	
		SP-SM		(SP-SM) greenish gray, gray, light greenish gray, light gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands, cemented nodules		Sand Pack
40				- damp, slightly cemented after 41 ft		
				45.5	8.5	Slotted Screen
		CL		46.5 (CL) dark greenish gray, sandy CLAY, variable fine thin sand lenses	7.5	
		SC		(SC) greenish gray, CLAYEY SAND, trace phosphate sand to pebbles		
50						

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WELL NUMBER PZ-21-S

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50		SC		51.0	3.0 ◄Blank

Bottom of borehole at 51.0 feet.

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WELL NUMBER PZ-22-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/23/14 **COMPLETED** 10/23/14 **GROUND ELEVATION** 54.06 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP		(SP) brown, dark brown, SAND, trace silt, trace roots, trace clayey nodules	
10				dry, weakly cemented, SAND with Silt, trace phosphatic sand	
	SC 2			12.5 — 41.6	
20		SP-SM		(SP-SM) gray, light greenish gray, variably clayey and silty, SAND with SILT, moderate cementation, trace phosphatic sands, trace cemented silt nodules	
	SC 3				
30					
	SC 4			33.0 — 21.1	
40		SP-SC		(SP-SC) light greenish gray, brown, poorly graded fine grained quartz SAND with CLAY, trace phosphatic sand, trace cemented nodules, slightly dolomitic	
				- 2-inch light gray, sand with silt lense at 36 ft	
				42.5 — 11.6	
	SC 5	SP-SM		(SP-SM) light gray, pale brown, SAND with Silt, trace phosphatic sands - 1/8 to 1/2-inch orangish-red silt inclusion at 43 ft	
50				- slightly dolomitic, weakly cemented, trace cemented silt nodules at 47 ft	
				50.0 — 4.1	

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
	SC 6	SM		(SM) dark greenish gray, SILTY SAND, high clay content, variably clayey and silty, thin fine vertical sand veining throughout, trace phosphatic sand	Grout
60				60.0 -5.9	
	SC 7	MH		(MH) light greenish gray, light gray, pale greenish gray, sandy elastic SILT - moderately cemented, desiccated & slightly dolomitic after 66 ft	
70				70.0 -15.9	
	SC 8	SP		(SP) gray, dark gray, poorly graded fine grained quartz SAND, few phosphatic sands, trace silts - strongly cemented silty sand with phosphatic lense at 72.5 ft - 7-inch lense of desiccated, dolomitic, silty sand with phosphate particles at 73 ft	
				74.0 -19.9	
		SM		(SM) light gray, SILTY SAND, trace phosphatic sands, moderately cemented, dolomitic	
				76.0 -21.9	
80		SP-SM		(SP-SM) gray, greenish gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sand, variably silty and clayey - 4-inch silt lense at 77.5 ft - 5-inch sand lense at 78.5 ft	
				83.0 -28.9	
	SC 9	SP		- 1-inch strongly cemented dolosilt lense at 83 ft (SP) gray, poorly graded fine grained quartz SAND, trace silts and clays, trace to few phosphatic sands - 4 foot few cemented dolosilt lens - 4-inch strongly cemented silt lense at 87 ft - 2-inch strongly cemented silt lense at 88 ft	
90				90.0 -35.9	
				- 2-inch strongly cemented silt lense at 90 ft	
	SC 10	SM		(SM) gray, light gray, SILTY SAND, strongly cemented, trace phosphate sands - desiccated at 91.5 ft - few cemented silt nodules, gravel at 93 ft - 1 ft desiccated, moderate cementation at 96.5 ft	
100					

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WELL NUMBER PZ-22-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100		SM		101.5 -47.4 - 6-inch desiccated, moderate cementation lense at 99.5 ft (SM) gray, light gray, SILTY SAND, strongly cemented, trace phosphate sands *(continued)*	Bentonite Seal
	SC 11			(SP-SM) gray, greenish gray, light gray, pale greenish gray, poorly graded fine grained quartz SAND with SILT, slightly clayey, trace phosphatic sands 10" silt lense	Sand Pack
110		SP-SM		light gray, pale greenish gray, SAND with Silt, trace phosphatic sand-pebbles - 12-inch silty sand lense, moderate to strong cementation at 112 ft	Slotted Screen
	SC 12				
120				121.0 -66.9	Blank

Bottom of borehole at 121.0 feet.

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WELL NUMBER PZ-22-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/25/14 **COMPLETED** 10/25/14 **GROUND ELEVATION** 54.07 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, dark brown, SAND, trace silt, trace roots, trace clayey nodules	
10				dry, weakly cemented, SAND with Silt, trace phosphatic sand	
12.5					41.6
		SP-SM		(SP-SM) gray, light greenish gray, variably clayey and silty, SAND with SILT, moderate cementation, trace phosphatic sands, trace cemented silt nodules	
20					
30					Grout
33.0					21.1
		SP-SC		(SP-SC) light greenish gray, brown, poorly graded fine grained quartz SAND with CLAY, trace phosphatic sand, trace cemented nodules, slightly dolomitic	
40				- 2-inch light gray, sand with silt lense at 36 ft	
42.5					11.6
		SP-SM		(SP-SM) light gray, pale brown, SAND with Silt, trace phosphatic sands - 1/8 to 1/2-inch orangish-red silt inclusion at 43 ft	
50				- slightly dolomitic, weakly cemented, trace cemented silt nodules at 47 ft	
50.0					4.1

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WELL NUMBER PZ-22-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
		SM		(SM) dark greenish gray, SILTY SAND, high clay content, variably clayey and silty, thin fine vertical sand veining throughout, trace phosphatic sand	Bentonite Seal; Sand Pack
60				60.0 / -5.9	
		MH		(MH) light greenish gray, light gray, pale greenish gray, sandy elastic SILT - moderately cemented, desiccated & slightly dolomitic after 66 ft	Slotted Screen
70				70.0 / -15.9	
		SP		(SP) gray, dark gray, poorly graded fine grained quartz SAND, few phosphatic sands, trace silts - strongly cemented silty sand with phosphatic lense at 72.5 ft - 7-inch lense of desiccated, dolomitic, silty sand with phosphate particles at 73 ft	
				74.0 / -19.9	
		SM		(SM) light gray, SILTY SAND, trace phosphatic sands, moderately cemented, dolomitic	Blank
				76.0 / -21.9	

Bottom of borehole at 76.0 feet.

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WELL NUMBER PZ-22-S

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 10/24/14 **COMPLETED** 10/24/14
GROUND ELEVATION 54.04 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY H.I **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, dark brown, SAND, trace silt, trace roots, trace clayey nodules	
10				dry, weakly cemented, SAND with Silt, trace phosphatic sand	
12.5					41.5
		SP-SM		(SP-SM) gray, light greenish gray, variably clayey and silty, SAND with SILT, moderate cementation, trace phosphatic sands, trace cemented silt nodules	Grout
20					
30					
33.0					21.0
		SP-SC		(SP-SC) light greenish gray, brown, poorly graded fine grained quartz SAND with CLAY, trace phosphatic sand, trace cemented nodules, slightly dolomitic	Bentonite Seal
40				- 2-inch light gray, sand with silt lense at 36 ft	Sand Pack
42.5					11.5
		SP-SM		(SP-SM) light gray, pale brown, SAND with Silt, trace phosphatic sands - 1/8 to 1/2-inch orangish-red silt inclusion at 43 ft	Slotted Screen
50				- slightly dolomitic, weakly cemented, trace cemented silt nodules at 47 ft	
50.0					4.0

Bottom of borehole at 50.0 feet.

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WELL NUMBER PZ-23-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/27/14 **COMPLETED** 10/27/14 **GROUND ELEVATION** 54.5 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
10	SC 1	SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace roots, trace gravel, trace silt	
12.5					42.0
20	SC 2	SP-SM		(SP-SM) gray, greenish gray, poorly graded fine grained quartz SAND with SILT, hard, trace cemented silt nodules, gravel, trace phosphatic sands, trace clays	
22.5					32.0
30	SC 3	SP		(SP) brown, dark brown, poorly graded fine to medium grained-quartz SAND, trace silt	
30.0					24.5
				NO RECOVERY - ALL WATER	
34.0					20.5
40	SC 4	SP		(SP) light brown, brown, gray, poorly graded fine to medium grained-quartz SAND, trace silt, trace phosphatic sand, gravely - trace silts and clays	
40.0					14.5
	SC 5	SP-SM		(SP-SM) gray, poorly graded fine grained-quartz SAND with SILT, trace cemented silt nodules, gravely - 2 ft slightly dolomitic and desiccated lense	
48.5					6.0
50		SM		(SM) dark greenish gray, SILTY SAND, few clays, trace phosphatic sand	Grout

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50	SC 6	SM		(SM) dark greenish gray, SILTY SAND, few clays, trace phosphatic sand *(continued)*		
				55.0	-0.5	
		SP-SM		56.0 (SP-SM) light gray, gray, poorly graded fine grained-quartz SAND with SILT, slightly dolomitic, trace phosphatic sand, desiccated, weakly cemented	-1.5	
				57.0	-2.5	
		SP		58.0 (SP) gray, poorly graded fine grained-quartz SAND, few phosphatic particles, trace silt	-3.5	
		SP-SM				
60		MH		60.0 (SP-SM) light gray, gray, SAND with Silt, slightly dolomitic, trace phosphatic sand, desiccated, weakly cemented	-5.5	
	SC 7	SP		(MH) light greenish gray, gray, sandy elastic SILT, thin sandy lenses		
				63.0 (SP) gray, dark gray, poorly graded fine grained-quartz SAND, trace silt, trace phosphatic sand	-8.5	
		SP-SM		(SP-SM) light gray, gray, light greenish gray, poorly graded fine grained-quartz SAND with SILT, weakly cemented silty sand nodules, trace phosphatic sand		
				67.5	-13.0	
		SM		(SM) greenish gray, SILTY SAND		
70				70.0	-15.5	
	SC 8	MH		71.5 (MH) dark greenish gray, SILT, high clay content, variable thin fine sand lense	-17.0	
		SP-SM		(SP-SM) greenish gray, gray, poorly graded fine grained-quartz SAND with SILT, trace phosphatic sands, trace silt nodules		
80				- trace to few moderately cemented nodules, trace phosphatic sands		
				82.0	-27.5	
	SC 9	SP		(SP) gray, dark gray, poorly graded fine grained-quartz SAND, trace silt, few phosphatic sands		
				84.5	-30.0	
		SP-SM		85.5 (SP-SM) gray, poorly graded fine grained-quartz SAND with SILT, trace to few moderately cemented nodules, trace phosphatic sands	-31.0	
		SM		87.5 (SM) light gray, gray, SILTY SAND, very hard, strongly cemented, desiccated, trace phosphatic sands	-33.0	
90				(SP-SM) gray, light greenish gray, greenish gray, light gray, poorly graded fine grained-quartz SAND with SILT, weakly cemented nodules, trace phosphatic sands		
	SC 10	SP-SM				
100						Bentonite

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-23-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100				(SP-SM) gray, light greenish gray, greenish gray, light gray, poorly graded fine grained-quartz SAND with SILT, weakly cemented nodules, trace phosphatic sands *(continued)*	Seal
	SC 11	SP-SM			Sand Pack
110				- weakly to moderately cemented at 108.5 ft - slightly dolomitic, desiccated at 110 to 112 ft	
	SC 12				Slotted Screen
				116.5 -62.0	
		SP		(SP) dark gray, black, poorly graded fine grained-quartz SAND, little phosphatic sands, trace silt 118.0 -63.5	
120		SP-SM		(SP-SM) greenish gray, poorly graded fine grained-quartz SAND with SILT, trace phosphatic sands, moderately cemented 118 to 119 ft 120.0 -65.5	

Bottom of borehole at 120.0 feet.

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WELL NUMBER PZ-23-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/8/14 **COMPLETED** 10/8/14 **GROUND ELEVATION** 54.46 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace roots, trace gravel, trace silt	
12.5					42.0
		SP-SM		(SP-SM) gray, greenish gray, poorly graded fine grained quartz SAND with SILT, hard, trace cemented silt nodules, gravel, trace phosphatic sands, trace clays	
22.5					32.0
		SP		(SP) brown, dark brown, poorly graded fine to medium grained-quartz SAND, trace silt	Grout
30.0					24.5
				NO RECOVERY - ALL WATER	
34.0					20.5
		SP		(SP) light brown, brown, gray, poorly graded fine to medium grained-quartz SAND, trace silt, trace phosphatic sand, gravely - trace silts and clays	
40.0					14.5
		SP-SM		(SP-SM) gray, poorly graded fine grained-quartz SAND with SILT, trace cemented silt nodules, gravely - 2 ft slightly dolomitic and desiccated lense	
48.5					6.0
50		SM		(SM) dark greenish gray, SILTY SAND, few clays, trace phosphatic sand	

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WELL NUMBER PZ-23-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SM		(SM) dark greenish gray, SILTY SAND, few clays, trace phosphatic sand *(continued)*		
				55.0	-0.5	
		SP-SM		56.0 (SP-SM) light gray, gray, poorly graded fine grained-quartz SAND with SILT, slightly dolomitic, trace phosphatic sand, desiccated, weakly cemented	-1.5	
		SP		57.0	-2.5	Bentonite Seal
		SP-SM		58.0 (SP) gray, poorly graded fine grained-quartz SAND, few phosphatic particles, trace silt	-3.5	Sand Pack
60		MH		60.0 (SP-SM) light gray, gray, SAND with Silt, slightly dolomitic, trace phosphatic sand, desiccated, weakly cemented	-5.5	
		SP		(MH) light greenish gray, gray, sandy elastic SILT, thin sandy lenses		
				63.0 (SP) gray, dark gray, poorly graded fine grained-quartz SAND, trace silt, trace phosphatic sand	-8.5	
		SP-SM		(SP-SM) light gray, gray, light greenish gray, poorly graded fine grained-quartz SAND with SILT, weakly cemented silty sand nodules, trace phosphatic sand		
				67.5	-13.0	Slotted Screen
		SM		(SM) greenish gray, SILTY SAND		
70				70.0	-15.5	
		MH		71.5 (MH) dark greenish gray, SILT, high clay content, variable thin fine sand lense	-17.0	
		SP-SM		(SP-SM) greenish gray, gray, poorly graded fine grained-quartz SAND with SILT, trace phosphatic sands, trace silt nodules		
				75.8	-21.3	Blank

Bottom of borehole at 75.8 feet.

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WELL NUMBER PZ-23-S

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/8/14 **COMPLETED** 10/9/14 **GROUND ELEVATION** 54.46 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace roots, trace gravel, trace silt	Grout
12.5		SP-SM		(SP-SM) gray, greenish gray, poorly graded fine grained quartz SAND with SILT, hard, trace cemented silt nodules, gravel, trace phosphatic sands, trace clays	Bentonite Seal
22.5		SP		(SP) brown, dark brown, poorly graded fine to medium grained-quartz SAND, trace silt	
30.0				NO RECOVERY - ALL WATER	
34.0		SP		(SP) light brown, brown, gray, poorly graded fine to medium grained-quartz SAND, trace silt, trace phosphatic sand, gravely - trace silts and clays	
40.0		SP-SM		(SP-SM) gray, poorly graded fine grained-quartz SAND with SILT, trace cemented silt nodules, gravely - 2 ft slightly dolomitic and desiccated lense	Sand Pack
48.5		SM		(SM) dark greenish gray, SILTY SAND, few clays, trace phosphatic sand	Slotted
50					

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WELL NUMBER PZ-23-S

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
		SM		(SM) dark greenish gray, SILTY SAND, few clays, trace phosphatic sand *(continued)*	Screen
				55.0 -0.5	Blank
		SP-SM		55.4 -0.9 (SP-SM) light gray, gray, poorly graded fine grained-quartz SAND with SILT, slightly dolomitic, trace phosphatic sand, desiccated, weakly cemented	
				Bottom of borehole at 55.4 feet.	

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WELL NUMBER PZ-24-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/21/14 **COMPLETED** 8/21/14 **GROUND ELEVATION** 38.28 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY GK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
	SC 1	SP		(SP) dark brown, brown, poorly grained fine grained quartz SAND, organic		
10						
	SC 2					
20				20.0	18.3	
	SC 3	SM		(SM) dark greenish gray, SILTY SAND, abundant phosphate sands		
				24.0	14.3	
		CL-ML		(CL-ML) light greenish gray, CLAYEY SILT, fine to medium grained phosphatic sands		
30				30.0	8.3	
	SC 4	SM		(SM) dark greenish gray, variably SILTY SAND with high clay content, trace fine grained phosphatic sand		
				- 2 to 3-inch sand lenses, trace fine grained phosphate sand at 37 ft		
40				40.0	-1.7	Grout
	SC 5	CL-ML		(CL-ML) gray, CLAYEY SILT, cemented clay nodules		
				42.0	-3.7	
		ML		43.0 (ML) gray, sandy SILT, phosphatic sand, desiccated	-4.7	
		SP		(SP) gray, poorly graded fine to medium grained quartz SAND, abundant phosphatic sands		
				48.0	-9.7	
		SM		49.0 (SM) light gray, SILTY SAND	-10.7	
50		SP		(SP) gray, poorly graded fine to medium grained quartz SAND, abundant phosphatic sands		

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
		SP		52.0	-13.7	
		SM		(SM) gray, SILTY SAND, cobble-sized cemented clay nodules		
	SC 6			54.0	-15.7	
		CL-ML		55.0 (CL-ML) gray, CLAYEY SILT, cobble-sized cemented clay nodules	-16.7	
				(ML) gray, sandy SILT		
60		ML		- 2 to 3-inch sand lense at 57 ft		
	SC 7			65.0	-26.7	
		SP		(SP) dark gray, fine to medium grained SAND, phosphatic		
70				69.0	-30.7	
		SM		(SM) gray, SILTY SAND with gravel-sized well cemented clay nodules		
	SC 8			71.0	-32.7	
		ML		(ML) light gray, sandy SILT, desiccated		
				73.0	-34.7	
		CL-ML		74.0 (CL-ML) gray, CLAYEY SILT	-35.7	
		ML		(ML) light gray, SILT, desiccated		
				76.0	-37.7	
		CL-ML		(CL-ML) dark gray, CLAYEY SILT		
				79.0	-40.7	
80		ML		79.5 (ML) light gray, sandy SILT, desiccated, little well-cemented clay nodules	-41.2	
	SC 9			(CL-ML) dark gray, gray, light gray, CLAYEY SILT		Bentonite Seal
						Sand Pack
90		CL-ML		- desiccated at 91 ft		
	SC 10					Slotted Screen
				- abundant phosphate nodules at 97 ft		
100				100.0	-61.7	Blank
				Bottom of borehole at 100.0 feet.		

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WELL NUMBER PZ-24-D

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SC 11				
	SC 12				

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WELL NUMBER PZ-24-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/21/14 **COMPLETED** 8/21/14 **GROUND ELEVATION** 38.75 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY GK **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
		SP		(SP) dark brown, brown, poorly grained fine grained quartz SAND, organic		Grout
20					18.8	
		SM		(SM) dark greenish gray, SILTY SAND, abundant phosphate sands		
					14.8	
		CL-ML		(CL-ML) light greenish gray, CLAYEY SILT, fine to medium grained phosphatic sands		
30					8.8	
		SM		(SM) dark greenish gray, variably SILTY SAND with high clay content, trace fine grained phosphatic sand		Bentonite Seal
				- 2 to 3-inch sand lenses, trace fine grained phosphate sand at 37 ft		Sand Pack
40					-1.3	
		CL-ML		(CL-ML) gray, CLAYEY SILT, cemented clay nodules	-3.3	
		ML		(ML) gray, sandy SILT, phosphatic sand, desiccated	-4.3	
		SP		(SP) gray, poorly graded fine to medium grained quartz SAND, abundant phosphatic sands		Slotted Screen
					-9.3	
		SM		(SM) light gray, SILTY SAND	-10.3	
50		SP				

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WELL NUMBER PZ-24-M

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50		SP		(SP) gray, poorly graded fine to medium grained quartz SAND, abundant phosphatic sands *(continued)*	-13.3	
				52.0		
		SM		(SM) gray, SILTY SAND, cobble-sized cemented clay nodules	-15.3	
				54.0		
		CL-ML		(CL-ML) gray, CLAYEY SILT, cobble-sized cemented clay nodules	-16.3	Blank
				55.0		
				Bottom of borehole at 55.0 feet.		

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WELL NUMBER PZ-25-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 10/15/14 **COMPLETED** 10/15/14 **GROUND ELEVATION** 25.15 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AB **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1			NO RECOVERY	
10				10.0 15.2	
	SC 2	SP-SM		(SP-SM) greenish gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands	
				16.5 8.7	
		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt	
20				20.0 5.2	
	SC 3	SP-SC		(SP-SC) brown, poorly graded fine grained quartz SAND with CLAY, trace sand to pebble sized phosphate	
				22.0 3.2 - 1/4-inch clay lense at 20.5 ft	
		SP-SM		(SP-SM) gray, greenish gray, brown, poorly graded fine grained quartz SAND with SILT, trace cemented silt nodules, trace sand to pebble sized phosphate - 2-inch cemented silt and phosphatic sand lense at 23 ft	
30				30.0 -4.9	
	SC 4	SM		(SM) greenish gray, variably clayey and silty, SILTY SAND, trace phosphatic sands	
				35.0 -9.9	Grout
		SC		(SC) greenish gray, CLAYEY SAND	
				38.0 - 1-inch sand lense at 37 ft -12.9	
40		SM		(SM) gray, greenish gray, light gray, SILTY SAND, trace phosphatic sands, trace cemented nodules, gravel	
	SC 5			- 6-inch sand lense at 40.5 ft	
				43.0 - 2-inch cemented silt lense at 42 ft -17.9	
		SP		(SP) gray, dark gray, poorly graded fine grained quartz SAND, trace to little phosphatic sands, trace cemented silt nodules	
50					

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6	SP		52.0 (SP) gray, dark gray, poorly graded fine grained quartz SAND, trace to little phosphatic sands, trace cemented silt nodules *(continued)*	-26.9	
		SM		(SM) gray, light gray, variably clayey and silty, SILTY SAND, variable fine sand lenses throughout, trace cemented silt nodules, gravel throughout - 3-inch dry cemented silt lense at 55 ft - 5-inch dry cemented silt and dolostone lense at 56 ft		
60				- moderately cemented, dolomitic after 60 ft		
	SC 7	ML		62.0 (ML) greenish gray, dark greenish gray, sandy SILT	-36.9	
		SP-SM		64.0 (SP-SM) light gray, poorly graded fine grained quartz SAND with SILT, moderately cemented, desiccated, dolomitic, trace phosphatic sands	-38.9	
				66.5 (SM) light greenish gray, greenish gray, SILTY SAND, trace cemented nodules	-41.4	
70				- trace phosphatic sands after 70 ft		Bentonite Seal
	SC 8	SM				Sand Pack
80				80.0	-54.9	
		SP-SC		81.5 (SP-SC) dark greenish gray, SAND with CLAY, trace phosphatic sand, trace cemented nodules	-56.4	
	SC 9	SM		(SM) light gray, dark greenish gray, SILTY SAND, trace cemented silt nodules, moderately cemented, desiccated, dolomitic - trace phosphatic sand after 84 ft		Slotted Screen
90				90.0	-64.9	
		SP-SM		91.0 (SP-SM) gray, greenish gray, poorly graded fine grained quartz SAND with SILT, desiccated, dolomitic silt nodules	-65.9	Blank
	SC 10			Bottom of borehole at 91.0 feet.		

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WELL NUMBER PZ-25-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-25-M

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 10/16/14 **COMPLETED** 10/16/14
GROUND ELEVATION 25.44 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY AB **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0				NO RECOVERY		
10					15.4	
		SP-SM		(SP-SM) greenish gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands		Grout
					8.9	
		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt		
20					5.4	
		SP-SC		(SP-SC) brown, poorly graded fine grained quartz SAND with CLAY, trace sand to pebble sized phosphate	3.4	
				- 1/4-inch clay lense at 20.5 ft		
		SP-SM		(SP-SM) gray, greenish gray, brown, poorly graded fine grained quartz SAND with SILT, trace cemented silt nodules, trace sand to pebble sized phosphate - 2-inch cemented silt and phosphatic sand lense at 23 ft		Bentonite Seal
30					-4.6	
		SM		(SM) greenish gray, variably clayey and silty, SILTY SAND, trace phosphatic sands		Sand Pack
					-9.6	
		SC		(SC) greenish gray, CLAYEY SAND		
				- 1-inch sand lense at 37 ft	-12.6	
40		SM		(SM) gray, greenish gray, light gray, SILTY SAND, trace phosphatic sands, trace cemented nodules, gravel		Slotted Screen
				- 6-inch sand lense at 40.5 ft		
				- 2-inch cemented silt lense at 42 ft	-17.6	
		SP		(SP) gray, dark gray, poorly graded fine grained quartz SAND, trace to little phosphatic sands, trace cemented silt nodules		
					-22.6	Blank

Bottom of borehole at 48.0 feet.

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WELL NUMBER PZ-26-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/13/14 **COMPLETED** 8/13/14 **GROUND ELEVATION** 20.74 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0				1.0 SAMPLES WERE BAGGED AND NOT CLASSIFIED TO CONDUCT LABOROTORY TESTING, LITHOLOGY WAS AVERAGED FROM PZ-25 AND PZ-27	19.7	
10	SC 1	SP-SM		(SP-SM) greenish gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands		
20	SC 2	SP		14.0 (SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt	6.7	
30	SC 3	SP-SC		20.0 (SP-SC) brown, poorly graded fine grained quartz SAND with CLAY, trace sand to pebble sized phosphate	0.7	
		MH		23.0 (MH) light gray, sandy elastic SILT, cemented, common calcareous clayey sand, few fine phosphatic sands	-2.3	
40	SC 4	SM		31.0 (SM) greenish gray, variably clayey and silty, SILTY SAND, trace phosphatic sands	-10.3	Grout
		SP		33.0 (SP) dark gray, fine grained quartz SAND, some fine phosphatic sand, trace silt	-12.3	
		MH		34.0 (MH) light gray and gray, variably sandy, SANDY SILT, cemented	-13.3	
		SP		35.0 (SP) gray, fine grained quartz SAND, few phosphatic fine sand, minor cemented silt fragments	-14.3	
50	SC 5	MH		38.0 (MH) greenish gray, light gray, pale brown, sandy elastic SILT, trace clay, few fine phosphatic sands	-17.3	
				50.0	-29.3	

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GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

WELL NUMBER PZ-26-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
60	SC 6	SM		(SM) gray, pale brown, grayish brown, SILTY SAND	
	SC 7			64.0 -43.3 (MH) dark gray, gray, greenish gray, sandy elastic SILT, slight cementation	Bentonite Seal
70					Sand Pack
	SC 8	MH			
80				80.0 -59.3	Slotted Screen
	SC 9	SM		(SM) light gray, dark greenish gray, SILTY SAND, trace cemented silt nodules, moderately cemented, desiccated, dolomitic	
				86.0 -65.3	

Bottom of borehole at 86.0 feet.

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WELL NUMBER PZ-26-M

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/13/14 **COMPLETED** 8/13/14 **GROUND ELEVATION** 20.85 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY SA **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0				1.0 SAMPLES WERE BAGGED AND NOT CLASSIFIED TO CONDUCT LABOROTORY TESTING, LITHOLOGY WAS AVERAGED FROM PZ-25 AND PZ-27	19.9	
10		SP-SM		(SP-SM) greenish gray, poorly graded fine grained quartz SAND with SILT, trace phosphatic sands		Grout
				14.0	6.9	
		SP		(SP) brown, dark brown, poorly graded fine grained quartz SAND, trace silt		
20				20.0	0.9	
		SP-SC		(SP-SC) brown, poorly graded fine grained quartz SAND with CLAY, trace sand to pebble sized phosphate		
				23.0	-2.2	
		MH		(MH) light gray, sandy elastic SILT, cemented, common calcareous clayey sand, few fine phosphatic sands		Bentonite Seal
30						Sand Pack
				31.0	-10.2	
		SM		(SM) greenish gray, variably clayey and silty, SILTY SAND, trace phosphatic sands		
				33.0	-12.2	
		SP		34.0 (SP) dark gray, fine grained quartz SAND, some fine phosphatic sand, trace silt	-13.2	
		MH		35.0 (MH) light gray and gray, variably sandy, SANDY SILT, cemented	-14.2	
		SP		(SP) gray, fine grained quartz SAND, few phosphatic fine sand, minor cemented silt fragments		Slotted Screen
				38.0	-17.2	
40		MH		(MH) greenish gray, light gray, pale brown, sandy elastic SILT, trace clay, few fine phosphatic sands		
				45.0	-24.2	

Bottom of borehole at 45.0 feet.

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WELL NUMBER PZ-27-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/11/14 **COMPLETED** 8/11/14 **GROUND ELEVATION** 16.13 ft **HOLE SIZE** 6.625 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY AS **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		1.0 (SP) brown, poorly graded fine grained quartz SAND, trace silt	15.1	
		SP-SC		2.0 (SP-SC) dark gray, brown, poorly graded fine grained quartz SAND with CLAY, trace clayey nodules	14.1	
	SC 1	SP		(SP) dark brown and gray, poorly graded fine grained quartz SAND, minor silt		
10				10.0	6.1	
		SP-SC		12.0 (SP-SC) brown to dark brown, poorly graded fine grained quartz SAND, trace silts with clays, local greenish gray clay nodules	4.1	
	SC 2	SC		(SC) greenish gray, variably clayey, fine grained quartz, CLAYEY SAND, few fine phosphatic particles, slightly dolomitic, few phosphate gravel		
				17.0	-0.9	
		ML		18.0 (ML) pale brown, sandy SILT	-1.9	
20		SM		(SM) dark greenish gray, SILTY SAND, slight clay content, few phosphatic sands		
				21.0	-4.9	
		MH		22.0 (MH) light gray, sandy elastic SILT, cemented, common calcareous clayey sand, few fine phosphatic sands	-5.9	
	SC 3	SP		24.0 (SP) dark gray, trace silt, poorly graded fine grained quartz SAND, some fine phosphoric particles	-7.9	
		MH		(MH) light gray to gray, sandy elastic SILT, dolomitic, few phosphatic sands		Grout
30				31.0	-14.9	
		SP		32.0 (SP) dark gray, poorly graded fine grained quartz SAND, some fine phosphatic sand, trace silt	-15.9	
		MH		33.0 (MH) light gray to gray, variably sandy, SANDY SILT, cemented, dolomitic	-16.9	
		SP		34.0 (SP) dark gray, fine grained quartz SAND, some fine phosphatic sand, trace silt	-17.9	
	SC 4	MH		35.5 (MH) light gray and gray, variably sandy, SANDY SILT, cemented	-19.4	
		SP		37.0 (SP) gray, fine grained quartz SAND, few phosphatic fine sand, minor cemented silt fragments	-20.9	
40				(MH) greenish gray, light gray, pale brown, sandy elastic SILT, trace clay, few fine phosphatic sands		
		MH				
	SC 5					
50				50.0	-33.9	

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WELL NUMBER PZ-27-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
	SC 6	SM		(SM) gray, pale brown, grayish brown, SILTY SAND	
				- cemented silt fragments at 57 ft	
60				- few phosphatic sands below 60 ft	Bentonite Seal
				- cemented sand at 62.5 ft	Sand Pack
	SC 7			64.0 -47.9 (MH) dark gray, gray, greenish gray, sandy elastic SILT, slight cementation	
				- clayey nodules at 67ft	
70					
	SC 8	MH		- cemented silt, fine phosphatic particles at 72 ft	Slotted Screen
80				80.5 -64.4	
	SC 9			Bottom of borehole at 80.5 feet.	

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WELL NUMBER PZ-27-M

amec foster wheeler

CLIENT Carollo Engineers, Inc.
PROJECT NAME Lake Manatee Dam Evaluation
PROJECT NUMBER 300472x2.11
PROJECT LOCATION Manatee County
DATE STARTED 8/11/14 **COMPLETED** 8/11/14
GROUND ELEVATION 15.99 ft **HOLE SIZE** 6.625 inches
DRILLING CONTRACTOR Terra Sonic Drilling Services
GROUND WATER LEVELS:
DRILLING METHOD Sonic Core
AT TIME OF DRILLING ---
LOGGED BY AS **CHECKED BY** DK
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
0		SP		1.0	(SP) brown, poorly graded fine grained quartz SAND, trace silt	15.0	
		SP-SC		2.0	(SP-SC) dark gray, brown, poorly graded fine grained quartz SAND with CLAY, trace clayey nodules	14.0	
		SP			(SP) dark brown and gray, poorly graded fine grained quartz SAND, minor silt		
10				10.0		6.0	Grout
		SP-SC		12.0	(SP-SC) brown to dark brown, poorly graded fine grained quartz SAND, trace silts with clays, local greenish gray clay nodules	4.0	
		SC			(SC) greenish gray, variably clayey, fine grained quartz, CLAYEY SAND, few fine phosphatic particles, slightly dolomitic, few phosphate gravel		
				17.0		-1.0	
		ML		18.0	(ML) pale brown, sandy SILT	-2.0	
20		SM		21.0	(SM) dark greenish gray, SILTY SAND, slight clay content, few phosphatic sands	-5.0	Bentonite Seal
		MH		22.0	(MH) light gray, sandy elastic SILT, cemented, common calcareous clayey sand, few fine phosphatic sands	-6.0	
		SP		24.0	(SP) dark gray, trace silt, poorly graded fine grained quartz SAND, some fine phosphoric particles	-8.0	Sand Pack
		MH			(MH) light gray to gray, sandy elastic SILT, dolomitic, few phosphatic sands		
30				31.0		-15.0	
		SP		32.0	(SP) dark gray, poorly graded fine grained quartz SAND, some fine phosphatic sand, trace silt	-16.0	
		MH		33.0		-17.0	
		SP		34.0	(MH) light gray to gray, variably sandy, SANDY SILT, cemented, dolomitic	-18.0	Slotted Screen
		MH		35.5	(SP) dark gray, fine grained quartz SAND, some fine phosphatic sand, trace silt	-19.5	
		SP		37.0	(MH) light gray and gray, variably sandy, SANDY SILT, cemented	-21.0	
		MH			(SP) gray, fine grained quartz SAND, few phosphatic fine sand, minor cemented silt fragments		
40				40.5	(MH) greenish gray, light gray, pale brown, sandy elastic SILT, trace clay, few fine phosphatic sands	-24.5	

Bottom of borehole at 40.5 feet.

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WELL NUMBER Well-1-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/18/14 **COMPLETED** 10/14/14 **GROUND ELEVATION** 28.1 ft **HOLE SIZE** 10 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY JR **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					
	SC 1	SP-SM		(SP-SM) brown, dark brown, poorly graded fine grained quartz SAND with SILT - trace clayey nodules from 6 to 8 ft	
10					
	SC 2				
15.0					13.1
		SP-SC		(SP-SC) brown, greenish gray, SAND with CLAY, trace to few clayey nodules, slightly cemented	Grout
20					
22.0					6.1
	SC 3	SC		(SC) greenish gray, variably clayey, CLAYEY SAND, trace silt, trace phosphate particles	
30					
30.0					-1.9
	SC 4	CL		(CL) greenish gray, variably sandy CLAY, few to some silt - sand lense at 32 ft - sand lense at 35 ft - sand lense at 37 ft - sand lense at 39 ft	
40					
41.0					-12.9
		SC		(SC) greenish gray, CLAYEY SAND, few to some silt	Bentonite Seal Sand Pack
	SC 5				
45.0					-16.9
		SP-SM		(SP-SM) greenish gray, gray, poorly graded fine grained quartz SAND with SILT, trace cemented silt nodules	
50					

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WELL NUMBER Well-1-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50						
	SC 6			51.5	-23.4	
		ML		52.0 (ML) light greenish gray, variably sandy SILT, cemented, dolomitic	-23.9	
		SP		53.0 (SP) gray poorly graded fine grained quartz SAND, phosphatic sands	-24.9	Slotted Screen
		SP-SM		54.5 (SP-SM) greenish gray, gray, poorly graded fine grained quartz SAND with SILT, trace cemented silt, phosphatic particles	-26.4	
		SP		(SP) gray, poorly graded fine grained quartz SAND, trace silt, trace cemented sand and silt nodules		
				58.0	-29.9	
		SP-SM		59.5 (SP-SM) greenish gray, gray, fine grained quartz SAND with SILT, trace phosphatic particles, slightly desiccated	-31.4	
60		ML		61.0 (ML) gray, variably sandy SILT, cemented, dolomitic, trace phosphatic particles, sandy veins	-32.9	Blank
	SC 7			Bottom of borehole at 61.0 feet.		

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WELL NUMBER Well-2-D

amec foster wheeler

CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DATE STARTED 8/19/14 **COMPLETED** 8/19/14 **GROUND ELEVATION** 35.79 ft **HOLE SIZE** 10 inches

DRILLING CONTRACTOR Terra Sonic Drilling Services **GROUND WATER LEVELS:**

DRILLING METHOD Sonic Core **AT TIME OF DRILLING** ---

LOGGED BY ND **CHECKED BY** DK **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0						
	SC 1	SP-SM		(SP-SM) dark brown, brown, poorly graded fine grained quartz SAND with SILT, trace cemented sand fragments throughout		
10						
	SC 2	SC		(SC) gray, greenish gray, CLAYEY SAND		
				2-inch sand lense		
		SP-SM		(SP-SM) light brown, brown, poorly graded fine grained quartz SAND with SILT, trace silty sand nodules		Grout
20						
	SC 3	SC		(SC) greenish gray, variably clayey, CLAYEY SAND, trace silt, small sandy pockets throughout, trace phosphate particles throughout		
30						
	SC 4	ML		(ML) greenish gray, sandy SILT, sand lenses throughout, sandy pockets throughout, phosphate particles throughout sandy zones		Bentonite Seal
		SC		(SC) greenish gray, CLAYEY SAND, sandy lenses throughout, phosphate particles throughout		Sand Pack
40						
	SC 5	ML		(ML) greenish gray, variably sandy SILT, trace phosphate particles throughout, trace sand veins throughout - 2-inch thick sand lense		
		SC		(SC) greenish gray, CLAYEY SAND, few phosphate particles throughout		
		SP-SC		(SP-SC) greenish gray, SAND with CLAY, few phosphate particles throughout, slightly silty, some cemented clayey nodules		Slotted Screen
50						

12.0 / 23.8 — 16.0 / 19.8 — 22.0 / 13.8 — 32.0 / 3.8 — 37.0 / -1.2 — 40.0 / -4.2 — 44.0 / -8.2 — 46.0 / -10.2 — 50.0 / -14.2

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CLIENT Carollo Engineers, Inc. **PROJECT NAME** Lake Manatee Dam Evaluation

PROJECT NUMBER 300472x2.11 **PROJECT LOCATION** Manatee County

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50					
	SC 6	SP-SM		(SP-SM) greenish gray, SAND with SILT, some phosphate particles throughout, some cemented silt fragments throughout	
53.5					-17.7
		SC		(SC) greenish gray, CLAYEY SAND, trace phosphate particles	Blank
55.0					-19.2

Bottom of borehole at 55.0 feet.

GENERAL BH / TP / WELL - C-44 GINT STD US LABS.GDT - 4/29/15 14:50 - T:\300472X2 CAROLLO-LK MANATEE DAM-EVAL\REPORT\GEOTECHNICAL REPORT\APPENDIX\300472X2 - MANAEE COUNTY DAM - PIEZOMETERS.GPJ

Appendix F

Amec Foster Wheeler Laboratory Testing Results

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-05	1	0.0 - 2.0	13.4				
	2	2.0 - 4.0	18.0				
	3	4.0 - 6.0	10.1				
	4	6.0 - 8.0	15.4				
	7	13.5 - 15.0	30.1				
	8	16.0 - 17.5	36.1	18.9	35	17	18
	9	18.5 - 20.0	54.1				
B-06	1	0.0 - 2.0	11.1				
	2	2.0 - 4.0	11.6				
	3	4.0 - 6.0	19.4				
	4	6.0 - 8.0	12.4				
	5	8.0 - 10.0	13.4				
	6A	11.0 - 12.5	22.9				
	7	13.5 - 15.0	19.8				
	8	16.0 - 17.5	25.9				
	9	21.0 - 22.5	34.1	31.0			
B-07	1	0.0 - 2.0	5.5				
	2	2.0 - 4.0	4.1				
	3	4.0 - 6.0	11.1				
	4	6.0 - 8.0	5.6				
	5	8.0 - 10.0	22.0				
	6	11.0 - 12.5	42.9				
	7	13.5 - 15.0	28.0	32.6	41	23	18
	8	18.5 - 20.0	42.7				
B-08	1	0.0 - 2.0	4.9				
	2	2.0 - 4.0	7.0				
	3	4.0 - 6.0	7.2				
	4	6.0 - 8.0	8.5				
	5	8.0 - 10.0	15.4				
	6	11.0 - 12.5	21.3				
	7	13.5 - 15.0	35.4	28.3	40	20	20
	8	18.5 - 20.0	43.3				
B-09	1	0.0 - 2.0	5.5				
	2	2.0 - 4.0	9.4				
	3	4.0 - 6.0	10.3				
	4	6.0 - 8.0	9.4				
	5	8.0 - 10.0	16.8				
	6	11.0 - 12.5	21.6				
	7	13.5 - 15.0	33.7	21.1	33	20	13
	8	18.5 - 20.0	59.7				
B-10	1	0.0 - 2.0	10.0				
	2	2.0 - 4.0	12.7				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-10	3	4.0 - 6.0	10.5				
	4	6.0 - 8.0	10.0				
	5	8.0 - 10.0	12.0				
	6	11.0 - 12.5	26.7				
	7	13.5 - 15.0	38.0				
	8	18.5 - 20.0	82.2				
B-11	1	0.0 - 2.0	10.8				
	2	2.0 - 4.0	4.3				
	3	4.0 - 6.0	11.0				
	4	6.0 - 8.0	4.7				
	5	8.0 - 10.0	3.6				
	6	11.0 - 12.5	24.7				
	7	13.5 - 15.0	26.7				
	8	16.0 - 17.5	24.7				
	9	18.5 - 20.0	32.6				
	10	21.0 - 22.5	93.4				
	11	23.5 - 25.0	81.7	61.4	134	68	66
	12	26.0 - 27.5	99.5				
B-12	1	0.0 - 2.0	9.1				
	2	2.0 - 4.0	11.4				
	3	4.0 - 6.0	7.8				
	4	6.0 - 8.0	9.1				
	5	8.0 - 10.0	19.8				
	6	11.0 - 12.5	23.7				
	7	13.5 - 15.0	31.5				
	8	16.0 - 17.5	52.6				
	9	18.5 - 20.0	83.0				
	10	21.0 - 22.5	109.2				
	11	23.5 - 25.0	106.0				
	13	28.5 - 30.0	39.6	90.9	55	26	29
B-13	1	0.0 - 2.0	7.0				
	2	2.0 - 4.0	8.7				
	3	4.0 - 6.0	8.1				
	4	6.0 - 8.0	7.8				
	5	8.0 - 10.0	11.1				
	6	11.0 - 12.5	16.4				
	7	13.5 - 15.0	17.9				
	8	16.0 - 17.5	20.2				
	9	18.5 - 20.0	20.1				
	10	21.0 - 22.5	92.9				
	11	23.5 - 25.0	50.5				
	12	26.0 - 27.5	25.9				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-13	13	28.5 - 30.0	46.8				
	14	31.0 - 32.5	25.1				
	15	33.5 - 35.0	30.6				
B-14	1	0.0 - 2.0	64.6				
	2	2.0 - 4.0	12.3				
	3	4.0 - 6.0	9.2				
	4	6.0 - 8.0	10.8				
	5	8.0 - 10.0	12.2				
	6	11.0 - 12.5	19.2				
	7	13.5 - 15.0	20.7				
	8	16.0 - 17.5	22.0				
	9	18.5 - 20.0	28.5				
	10	21.0 - 22.5	35.0				
	11A	23.5 - 24.5	22.3				
	11B	24.5 - 25.0	54.7				
	12	26.0 - 27.5	79.2				
	13A	28.5 - 29.0	69.2	65.4	71	32	39
	13B	29.0 - 30.0	25.9				
B-15	1	0.0 - 2.0	8.9				
	2	2.0 - 4.0	7.7				
	3	4.0 - 6.0	10.2				
	4	6.0 - 8.0	12.0				
	5	8.0 - 10.0	38.5				
	6	11.0 - 12.5	31.5				
	7	13.5 - 15.0	42.8				
	8	16.0 - 17.5	67.9				
	9	18.5 - 20.0	79.6	21.9		NP	
	10	21.0 - 22.5	75.8				
	11	23.5 - 25.0	103.8				
B-16	1	0.0 - 2.0	7.2				
	2	2.0 - 4.0	10.4				
	3	4.0 - 6.0	10.0				
	4	6.0 - 8.0	10.8				
	5	8.0 - 10.0	10.9				
	6	11.0 - 12.5	26.3				
	7	13.5 - 15.0	25.4	1.7			
	8	16.0 - 17.5	22.3				
	9	18.5 - 20.0	24.0				
	10	21.0 - 22.5	26.3				
	11	23.5 - 25.0	84.7				
	12	26.0 - 27.5	34.6				
	13	28.5 - 30.0	29.3				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-16	14	31.0 - 32.5	36.0				
B-17	1	0.0 - 2.0	6.3				
	2	2.0 - 4.0	8.7				
	3	4.0 - 6.0	11.5				
	4	6.0 - 8.0	15.0				
	5	8.0 - 10.0	18.8				
	6	11.0 - 12.5	17.6				
	7	13.5 - 15.0	15.4				
	8	16.0 - 17.5	16.4				
	9	18.5 - 20.0	17.2				
	10	21.0 - 22.5	18.0				
	11	23.5 - 25.0	43.0	32.0	48	20	28
	12	26.0 - 27.5	43.9				
	13	28.5 - 30.0	23.8				
	14	31.0 - 32.5	31.5				
	15	33.5 - 35.0	38.7	49.3	47	32	15
B-18	1	0.0 - 2.0	10.0				
	2	2.0 - 4.0	10.2				
	3	4.0 - 6.0	11.6				
	4	6.0 - 8.0	11.3				
	5	8.0 - 10.0	10.9				
	6	11.0 - 12.5	19.8				
	7	13.5 - 15.0	16.3				
	8	16.0 - 17.5	21.3				
	9	18.5 - 20.0	46.1				
	10	21.0 - 22.5	31.6				
	11	23.5 - 25.0	24.0				
	12	26.0 - 27.5	24.4				
	13	28.5 - 30.0	61.6	71.6	92	43	49
B-19	1	0.0 - 2.0	6.4				
	2	2.0 - 4.0	7.9				
	3	4.0 - 6.0	8.8				
	4	6.0 - 8.0	12.5				
	5	8.0 - 10.0	23.4				
	6	11.0 - 12.5	28.3				
	7	13.5 - 15.0	20.1				
	8	16.0 - 17.5	38.7				
	9	18.5 - 20.0	38.1				
	10	21.0 - 22.5	21.7				
	11	23.5 - 25.0	32.2				
	12	26.0 - 27.5	22.8	24.4	30	16	14
	13	28.5 - 30.0	64.8				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-20	1	0.0 - 2.0	7.3				
	2	2.0 - 4.0	12.9				
	3	4.0 - 6.0	16.1				
	4	6.0 - 8.0	20.6				
	5	8.0 - 10.0	34.0				
	6	11.0 - 12.5	59.9				
	7	13.5 - 15.0	42.3				
	8	16.0 - 17.5	38.4				
	9	18.5 - 20.0	33.7				
	10	21.0 - 22.5	21.4				
	11	23.5 - 25.0	30.8				
	12	26.0 - 27.5	57.8				
	13	28.5 - 30.0	74.1	72.8	100	41	59
B-21	1	0.0 - 2.0	10.7				
	2	2.0 - 4.0	9.8	8.0			
	3	4.0 - 6.0	16.9				
	4	6.0 - 8.0	16.6	31.4	34	20	14
	5	8.0 - 10.0	14.6				
	6	11.0 - 12.5	19.3				
	7	13.5 - 15.0	21.1	35.5	51	18	33
	8	16.0 - 17.5	21.1				
	9	18.5 - 20.0	20.2				
	10	21.0 - 22.5	23.0	33.4	44	17	27
	11	23.5 - 25.0	19.6				
	12	26.0 - 27.5	21.8				
	13	28.5 - 30.0	21.3	36.3	48	17	31
	14	31.0 - 32.5	24.4				
	15	33.5 - 35.0	22.1				
	16	36.0 - 37.5	22.5				
	17	38.5 - 40.0	22.1				
	18	41.0 - 42.5	20.0	25.9	31	15	16
	19	43.5 - 45.0	34.2	30.6	51	26	25
	20	46.0 - 47.5	23.7	46.7	34	20	14
	21	48.5 - 50.0	33.2	24.6	42	20	22
	22	51.0 - 52.5	40.6	20.4	39	21	18
	22A	51.0 - 52.5	101.6	83.4	155	58	97
	23	53.5 - 55.0	72.5	89.7	97	50	47
	23A	53.5 - 55.0	52.8	44.9	38	22	16
	24	56.0 - 57.5	49.7	41.0	51	31	20
	25	58.5 - 60.0	41.5	27.7	52	22	30
	26	61.0 - 62.5	55.5	60.6	79	37	42
	27	63.5 - 65.0	43.8	43.3	39	33	6
	28	66.0 - 67.5	33.5	26.6		NP	

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-21	30A	73.5 - 75.0	20.9	12.6			
	31	78.5 - 80.0	23.7	43.9			
	33	88.5 - 90.0	68.2	75.3	105	56	49
	34	93.5 - 95.0	19.8	56.3			
	35	98.5 - 100.0	38.3	22.1			
B-22	1	0.0 - 2.0	10.4				
	2	2.0 - 4.0	11.1				
	3	4.0 - 6.0	16.6	6.4			
	4	6.0 - 8.0	15.2				
	5	8.0 - 10.0	14.6	28.3	42	21	21
	6	13.5 - 15.0	17.7				
	7	18.5 - 20.0	20.8				
	8	23.5 - 25.0	21.9	32.4	43	17	26
	9	28.5 - 30.0	19.3				
	10	33.5 - 35.0	25.8				
	11	38.5 - 40.0	20.7	31.1	39	16	23
	12	43.5 - 45.0	24.7				
	13	48.5 - 50.0	15.0	38.8	43	25	18
	14	53.5 - 55.0	25.9				
	15	58.5 - 60.0	17.1	59.2	154	74	80
	16	68.5 - 70.0	52.5	82.4			
	17	78.5 - 80.0	21.1	19.3			
	18	88.5 - 90.0	18.0				
	19	93.5 - 95.0	46.1	39.3	49	32	17
	20	96.0 - 97.5	38.0				
	21	98.5 - 100.0	36.5	64.1			
	23	103.5 - 105.0	24.4	41.4	44	24	20
	24	106.0 - 107.5	36.1				
	25	108.5 - 110.0	38.0	19.9			
B-23	1	43.0 - 45.0	16.9	41.6			
	2	48.0 - 50.0	22.3	41.6	33	19	14
	3	53.0 - 55.0	69.0	91.5	101	51	50
	4	58.0 - 60.0	58.4	63.6			
	5	63.0 - 65.0	50.1		68	32	36
	6	68.0 - 70.0	70.5	64.5			
	10	88.0 - 90.0	49.2		91	45	46
	12	93.5 - 95.0	26.5	46.9			
	13	96.0 - 98.0	35.9	21.5			
	14	98.5 - 100.5	25.9				
	15	101.0 - 103.0	29.5				
B-24	1	43.0 - 45.0	24.2	37.1			
	2	48.0 - 50.0	26.1				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-24	3	53.0 - 55.0	40.0		47	23	24
	4	58.0 - 60.0	50.4				
	5	63.0 - 65.0	68.9				
	6	68.0 - 70.0	41.8				
	7	73.0 - 75.0	22.6				
	8	78.0 - 80.0	27.2				
	9	83.0 - 85.0	32.9	13.4			
	10	88.0 - 90.0	68.7	63.6	132	71	61
	11	91.0 - 92.5	62.2				
	12	93.0 - 95.0	61.1	47.9	61	31	30
	13	96.0 - 98.0	36.0	66.7			
	14	98.5 - 100.0	29.2				
B-25	3	18.0 - 20.0	18.0	4.2			
	7	43.0 - 45.0	20.2	30.0			
	8	48.0 - 50.0	20.4	33.3			
	11	63.0 - 65.0	26.8				
	12	68.0 - 70.0	32.5				
	16	88.0 - 90.0	71.2				
	17	91.0 - 92.5	94.3	31.1			
	19	96.0 - 98.0	32.4	25.6			
	20	98.0 - 100.0	33.5				
B-26	1	0.0 - 2.0	15.1	22.4			
	2	3.0 - 5.0	16.6				
	3	8.0 - 10.0	20.0	30.0			
	4	13.0 - 15.0	24.0				
	5	18.0 - 20.0	19.8	27.5			
	6	23.0 - 25.0	23.5	3.9			
	7	28.0 - 30.0	20.3	3.4			
	8	33.0 - 35.0	31.8	11.2			
	9	38.0 - 40.0	57.0				
	10	43.0 - 45.0	24.1				
	11	48.0 - 50.0	68.3	67.8	96	35	61
	12	53.0 - 55.0	52.1	51.9			
	13	58.0 - 60.0	46.3	62.2			
	14	63.0 - 65.0	24.4				
	15	68.0 - 70.0	61.2				
	16	73.0 - 75.0	22.5	16.7			
	17	78.0 - 80.0	28.4				
	18	83.0 - 85.0	15.7	6.6			
	19	88.0 - 90.0	26.2	60.3			
	20	90.5 - 92.5	36.2	67.6	46	26	20
	21	93.0 - 95.0	29.1	58.7			
	22	96.5 - 98.5	40.8				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-27	1	8.0 - 10.0	14.8				
	2	18.0 - 20.0	21.7				
	3	23.0 - 25.0	25.6				
	4	28.0 - 30.0	20.9				
	5	33.0 - 35.0	22.3				
	6	38.0 - 40.0	20.0				
	7	43.0 - 45.0	19.8				
	8	48.0 - 50.0	38.9	11.6	46	24	22
	10A	58.0 - 59.0	45.4				
	10B	59.0 - 60.0	27.1				
	11A	63.0 - 64.0	32.4				
	11B	64.0 - 65.0	46.9				
	12	68.0 - 70.0	98.2				
	14	78.0 - 80.0	18.0				
	17	93.0 - 95.0	30.8				
	18	96.0 - 97.5	40.3				
	19	98.5 - 100.0	36.4	24.1	58	29	29
B-28	1	8.0 - 10.0	17.3				
	3	28.0 - 30.0	35.3				
	4	33.0 - 35.0	30.9				
	5	35.0 - 37.0	29.8				
	6	38.0 - 40.0	25.7				
	7	43.0 - 45.0	22.4				
	8	48.0 - 50.0	21.6				
	9	53.0 - 55.0	24.8				
	10A	58.0 - 60.0	39.9				
	10B	58.0 - 60.0	32.9	9.2			
	11	63.0 - 65.0	56.8				
	12	68.0 - 70.0	22.6				
	17	93.0 - 95.0	32.8		52	36	16
	18	96.0 - 97.5	32.7	75.8			
	19	98.5 - 100.0	28.7				
B-29	1	0.0 - 2.0	18.2				
	2	8.0 - 10.0	17.0				
	3	18.0 - 20.0	22.2				
	4	28.0 - 30.0	18.4				
	5	38.0 - 40.0	18.7				
	6	43.0 - 45.0	28.2				
	7	48.0 - 50.0	30.8				
	8	53.0 - 55.0	25.6				
	9A	58.0 - 60.0	32.4	18.5			
	9B	58.0 - 60.0	66.6	80.2	104	46	58
	10	63.0 - 65.0	44.8				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-29	11A&B	68.0 - 70.0	34.9				
	13	78.0 - 80.0	20.0	12.7			
	14	83.0 - 85.0	45.2				
	15	88.0 - 90.0	56.4				
	16	90.0 - 92.0	30.3				
	17	93.0 - 95.0	31.8				
	18	95.0 - 97.0	34.0				
	19	97.5 - 99.5	25.2				
B-30	1	0.0 - 2.0	13.4				
	2	8.0 - 10.0	16.8				
	3	18.0 - 20.0	20.1				
	4	28.0 - 30.0	25.7				
	5	33.0 - 35.0	20.3				
	6	38.0 - 40.0	23.0				
	7	43.0 - 45.0	23.9				
	8	48.0 - 50.0	35.4				
	9	53.0 - 55.0	28.7				
	10	58.0 - 60.0	54.2				
	11A	63.0 - 64.0	16.3				
	11B	64.0 - 65.0	67.2				
	13A	73.0 - 74.0	26.4	16.1			
	13B	74.0 - 75.0	27.3				
	15A	83.0 - 84.0	29.0				
	15B	84.0 - 85.0	61.2				
	16	88.0 - 90.0	71.3				
	17	90.0 - 91.5	26.5				
	18	93.5 - 95.0	29.0				
	19	96.0 - 98.0	25.4				
	20	98.0 - 100.0	33.7	45.8	44	25	19
B-31	1	0.0 - 2.0	9.9				
	2A	8.0 - 9.0	15.5				
	2B	9.0 - 10.0	16.6				
	3	18.0 - 20.0	30.1				
	4	23.0 - 25.0	21.9				
	6	33.0 - 35.0	22.7				
	7	38.0 - 40.0	51.3				
	8	43.0 - 45.0	22.7				
	9	48.0 - 50.0	64.9	73.3	80	33	47
	10	53.0 - 55.0	68.9				
	11	58.0 - 60.0	87.4				
	12	63.0 - 65.0	28.1				
	13	68.0 - 70.0	23.5				
	15	78.0 - 80.0	28.9				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-31	16	83.0 - 85.0	19.9				
	19	93.0 - 95.0	32.6				
	20	96.0 - 98.0	38.1	52.4	51	28	23
	21	98.0 - 100.0	40.8	68.3	82	28	54
B-32	1A	0.0 - 1.0	16.8	22.5			
	1B	1.0 - 2.0	96.2				
	2A	8.0 - 9.0	20.5	19.6			
	2B	9.0 - 10.0	19.1				
	3	18.0 - 20.0	24.8	32.4			
	4	23.0 - 25.0	33.3	30.6			
	5	28.0 - 30.0	21.5	37.3	44	18	26
	7	38.0 - 40.0	33.4	41.8			
	8	43.0 - 45.0	31.2				
	9	48.0 - 50.0	38.0	37.4			
	10	53.0 - 55.0	67.8	59.4			
	11A	58.0 - 59.0	35.2	56.5			
	11B	59.0 - 60.0	25.0				
	12	63.0 - 65.0	43.5	94.4			
	13	68.0 - 70.0	27.8	21.7			
	14	73.0 - 75.0	43.1	85.6	101	51	50
	15	78.0 - 80.0	27.4	22.3			
	17	88.0 - 90.0	16.8	15.3			
	19	93.0 - 95.0	27.5	71.7	42	26	16
	20	98.0 - 100.0	39.1	73.5			
	22	100.5 - 102.5	43.7	49.7	52	27	25
B-33	1A	8.0 - 9.0	18.3				
	1B	9.0 - 10.0	16.0				
	3	28.0 - 30.0	27.6				
	4	33.0 - 35.0	26.7				
	5	38.0 - 40.0	22.5				
	6	43.0 - 45.0	29.3				
	7	48.0 - 50.0	28.7				
	8A	53.0 - 54.0	62.2				
	8B	54.0 - 55.0	31.1				
	9A	58.0 - 59.0	62.1				
	9B	59.0 - 60.0	32.1				
	11	68.0 - 70.0	45.9				
	16	93.0 - 95.0	37.3	71.6	64	34	30
	17	96.0 - 97.5	37.4				
	18	97.5 - 99.0	25.9				
	19	101.0 - 102.5	33.3				
B-34	1	0.0 - 2.0	6.8				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-34	2	8.0 - 10.0	16.6				
	3	18.0 - 20.0	20.4				
	4	28.0 - 30.0	23.8				
	5B	33.0 - 35.0	28.6				
	6	38.0 - 40.0	26.9				
	7	43.0 - 45.0	21.0				
	8	48.0 - 50.0	31.4				
	9A	53.0 - 54.0	23.0				
	9B	54.0 - 55.0	30.2	21.0	32	19	13
	10	58.0 - 60.0	21.2				
	11	63.0 - 65.0	21.1				
	12	68.0 - 70.0	31.5				
	13A	73.0 - 74.0	30.8				
	13B	74.0 - 75.0	32.7				
	15	83.0 - 85.0	30.4				
	18	92.5 - 94.5	29.4				
	19	95.0 - 96.5	47.1				
	20	97.5 - 99.0	20.4	55.8			
	21	100.0 - 102.0	37.8	54.2	48	28	20
B-35	1	0.0 - 2.0	12.9				
	2	8.0 - 10.0	18.9				
	3	18.0 - 20.0	17.2				
	4	28.0 - 30.0	18.1				
	5	33.0 - 35.0	24.0				
	6	38.0 - 40.0	31.8				
	7	43.0 - 45.0	25.0				
	8	48.0 - 50.0	37.1				
	9	53.0 - 55.0	23.8	24.3			
	10	58.0 - 60.0	22.5			NP	
	11	63.0 - 65.0	20.9				
	12A	68.0 - 69.0	87.6				
	12B	69.0 - 70.0	29.1	13.8			
	13A	73.0 - 74.0	31.8				
	13B	74.0 - 75.0	31.6				
	16	88.0 - 90.0	65.2	84.1			
B-36	1B	8.0 - 10.0	16.6	41.4			
	2	18.0 - 20.0	22.1		28	13	15
	3	28.0 - 30.0	27.1				
	4	33.0 - 35.0	33.0		45	21	24
	6	43.0 - 45.0	25.6				
	7	48.0 - 50.0	37.6				
	8	53.0 - 55.0	22.4				
	9A	58.0 - 59.0	28.0				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-36	9B	59.0 - 60.0	21.6				
	10	63.0 - 65.0	22.5	11.9			
	11B	68.0 - 70.0	56.6		46	21	25
	14	78.0 - 80.0	34.2				
	15	88.0 - 90.0	79.3				
	16	90.0 - 92.0	84.1				
	19	97.0 - 99.0	42.5	71.3	48	26	22
B-37	1	8.0 - 10.0	16.4	38.6	27	15	12
	3	20.0 - 22.0	21.5				
	4	28.0 - 30.0	22.9				
	5	38.0 - 40.0	30.9	44.0			
	6	43.0 - 45.0	26.8				
	7	48.0 - 50.0	38.6				
	8	53.0 - 55.0	34.5		33	23	10
	12	73.0 - 75.0	42.1				
	13A	78.0 - 79.0	46.3				
	13B	79.0 - 80.0	40.3				
	15B	88.0 - 90.0	23.3	12.4			
	16	90.0 - 92.0	84.0				
	17	92.5 - 94.5	89.5				
	18	95.0 - 97.5	73.3	59.4			
	19	97.5 - 100.0	31.2		40	28	12
B-38	1	8.0 - 10.0	18.1				
	2	13.0 - 15.0	20.9	13.6			
	3	18.0 - 20.0	27.4	27.8			
	4	23.0 - 25.0	38.4				
	5A	28.0 - 29.5	22.6	4.6			
	5B	29.5 - 30.0	38.6				
	6	33.0 - 35.0	22.9				
	7	38.0 - 40.0	26.2				
	8	43.0 - 45.0	27.4				
	9	48.0 - 50.0	29.0	24.7	32	18	14
	15	78.0 - 80.0	23.3				
B-39	1	8.0 - 10.0	16.6				
	2	13.0 - 15.0	24.4				
	3	18.0 - 20.0	30.1	28.8			
	4	23.0 - 25.0	33.0				
	5A	28.0 - 30.0	27.7				
	6	33.0 - 35.0	25.9				
	7	38.0 - 40.0	22.7				
	8	43.0 - 45.0	36.2				
	9	48.0 - 50.0	26.4				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-39	10	53.0 - 55.0	44.2				
	11A	58.0 - 59.0	87.8				
	11B	59.0 - 60.0	42.8	12.5			
	12	63.0 - 65.0	43.8				
	13	68.0 - 70.0	22.0	15.2			
	15	78.0 - 80.0	19.7				
	16	83.0 - 85.0	19.7	23.2			
	17	88.0 - 90.0	18.5				
	18	93.0 - 95.0	47.0				
	19	96.0 - 97.5	35.7				
	21	101.0 - 102.5	47.2		59	30	29
	22	103.5 - 105.0	23.0	6.2			
B-40	1	0.0 - 2.0	11.8				
	2	8.0 - 10.0	16.4	26.8			
	3	18.0 - 20.0	24.2				
	4	23.0 - 25.0	27.1		43	22	21
	5	28.0 - 30.0	25.5				
	6	33.0 - 35.0	23.0				
	7	38.0 - 40.0	21.5				
	8	43.0 - 45.0	20.8				
	9	48.0 - 50.0	31.7		45	27	18
	10	53.0 - 55.0	29.3				
	11	58.0 - 60.0	31.7	9.9			
	12	63.0 - 65.0	66.1		43	24	19
	13	68.0 - 70.0	87.3				
	14	73.0 - 75.0	22.1	17.1			
	15	78.0 - 80.0	23.9		33	20	13
	16	83.0 - 85.0	19.3	14.1			
	17	88.0 - 90.0	21.8				
	18	90.5 - 92.0	16.9				
	19	93.0 - 95.0	22.6	17.2			
	20	95.5 - 97.0	29.8				
	21	98.0 - 100.0	35.8				
	22	100.5 - 103.0	25.3				
B-41	1	0.0 - 2.0	11.6				
	2	8.0 - 10.0	15.9	28.1	31	15	16
	3	18.0 - 20.0	26.9				
	4	23.0 - 25.0	26.3				
	5	28.0 - 30.0	23.0				
	6	33.0 - 35.0	22.6				
	7	38.0 - 40.0	17.0				
	8	43.0 - 45.0	33.2	44.8			
	9	48.0 - 50.0	67.4				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-41	10	53.0 - 55.0	35.2				
	11	58.0 - 60.0	29.8				
	12	63.0 - 65.0	61.1				
	13	68.0 - 70.0	26.6		28	20	8
	14	73.0 - 75.0	19.4				
	15	78.0 - 80.0	21.3				
	16	83.0 - 85.0	22.5	15.8			
	17	88.0 - 90.0	21.2				
	18	90.5 - 92.5	18.0	8.7			
	19	93.0 - 95.0	25.1				
	21	98.0 - 100.0	30.9				
	22	100.5 - 102.5	51.1				
	23	103.0 - 105.0	66.2	68.0			
B-42	1	8.0 - 10.0	18.4	35.2			
	2	18.0 - 20.0	24.0				
	3	23.0 - 25.0	26.6		40	18	22
	4	28.0 - 30.0	21.0				
	5	33.0 - 35.0	21.0				
	6	38.0 - 40.0	24.5				
	7A	43.0 - 45.0	23.7				
	7B	48.0 - 50.0	17.5	55.9			
	8	48.0 - 50.0	46.7				
	9A	53.0 - 55.0	65.7				
	9B	58.0 - 60.0	49.0				
	10	58.0 - 60.0	28.3				
	11	63.0 - 65.0	24.6	42.6	37	19	18
	12A	68.0 - 70.0	21.0	24.7			
	13	73.0 - 75.0	21.8				
	14	78.0 - 80.0	19.4				
	15	83.0 - 85.0	20.2				
	16A	88.0 - 90.0	21.4	9.5	26	17	9
	17A	93.0 - 95.0	24.5	28.2			
	18	93.0 - 97.5	28.1				
	19	98.5 - 100.0	32.3		54	31	23
	20	101.0 - 102.5	22.7				
B-43	1	0.0 - 2.0	13.3				
	2	8.0 - 10.0	14.6	29.7			
	3	18.0 - 20.0	19.6				
	4	23.0 - 25.0	23.5				
	5	28.0 - 30.0	25.3				
	6	33.0 - 35.0	20.5				
	7	38.0 - 40.0	19.1				
	8	43.0 - 45.0	17.1				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-43	9A	48.0 - 49.0	57.7				
	9B	49.0 - 50.0	27.6	80.5			
	10	53.0 - 55.0	82.1				
	11	58.0 - 60.0	38.7				
	12	63.0 - 65.0	22.6		28	20	8
	13	68.0 - 70.0	21.4	8.7			
	14	73.0 - 75.0	19.3				
	15	78.0 - 80.0	16.8				
	16A	83.0 - 84.0	24.0				
	16B	84.0 - 85.0	30.0	9.0			
	17	88.0 - 90.0	23.9				
	18	93.0 - 95.0	23.8				
	19	96.0 - 97.5	23.4				
	20	98.5 - 100.0	33.4	61.1			
B-44	1	8.0 - 10.0	16.6				
	2	18.0 - 20.0	25.8				
	4	38.0 - 40.0	30.1	38.2	35	19	16
	5	43.0 - 45.0	23.6				
	6	48.0 - 50.0	21.5				
	7	53.0 - 55.0	26.3	28.5			
	8	58.0 - 60.0	20.3				
	9	63.0 - 65.0	24.8	14.2			
	10	68.0 - 70.0	22.8				
	11B	73.0 - 75.0	24.3				
	12	78.0 - 80.0	19.7				
	13	83.0 - 85.0	32.1	11.8			
	14	88.0 - 90.0	39.4		69	31	38
	15	90.0 - 92.0	87.3				
	16	92.5 - 94.5	98.0				
	17	95.0 - 97.0	41.6		46	30	16
	18	97.5 - 99.5	25.8	31.3			
B-45	1	8.0 - 10.0	18.1	31.1			
	3	20.0 - 22.0	29.1				
	4B	28.0 - 30.0	19.2	5.7			
	5	38.0 - 40.0	31.8	26.3	32	18	14
	6	43.0 - 45.0	24.9				
	8B	50.0 - 52.0	21.9				
	9	53.0 - 55.0	21.5		29	18	11
	10	58.0 - 60.0	22.2				
	11A	63.0 - 64.0	18.1				
	11B	64.0 - 65.0	19.2				
	13	73.0 - 75.0	23.3	22.9			
	14	78.0 - 80.0	29.2				

Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-45	15	83.0 - 85.0	28.3		31	21	10
	16	88.0 - 90.0	59.6		105	49	56
	17	90.0 - 92.0	69.9				
	18	92.5 - 94.5	88.7				
	19	95.0 - 96.5	32.8		42	26	16
	20	97.5 - 99.0	30.7				
B-46	1	0.0 - 2.0	8.8				
	2B	8.0 - 10.0	16.2	46.3			
	3	13.0 - 15.0	16.4	29.5			
	4	18.0 - 20.0	21.0				
	5	23.0 - 25.0	22.3				
	6	28.0 - 30.0	26.0				
	7	33.0 - 35.0	24.4				
	8	38.0 - 40.0	24.7				
	8	48.0 - 50.0			46	24	22
	9	43.0 - 45.0	23.5		39	20	19
	11	53.0 - 55.0	44.1				
	12	58.0 - 60.0	24.1				
	13	63.0 - 65.0	25.4	10.0			
	14	68.0 - 70.0	20.9			NP	
	15	73.0 - 75.0	21.7				
	16	78.0 - 80.0	22.3				
	19	98.5 - 100.0	28.9	14.6	58	29	29
B-47	1	0.0 - 2.0	12.2				
	2	8.0 - 10.0	15.5	38.3			
	3	13.0 - 15.0	17.2				
	4	18.0 - 20.0	21.2				
	5	23.0 - 25.0	19.7				
	6	28.0 - 30.0	23.9				
	7	33.0 - 35.0	20.9				
	8	38.0 - 40.0	20.6				
	9	43.0 - 45.0	15.5				
	10	48.0 - 50.0	27.2	31.5			
	11	53.0 - 55.0	49.9				
	12	58.0 - 60.0	29.0				
	13	63.0 - 65.0	24.2				
	14	68.0 - 70.0	18.9	7.0			
	15	73.0 - 75.0	19.3				
	16	78.0 - 80.0	16.7	5.4			
	17	83.0 - 85.0	18.5	27.7			
	18	88.0 - 90.0	21.5				
	20	93.5 - 95.0	27.2				
	21	96.0 - 97.5	33.3		70	40	30

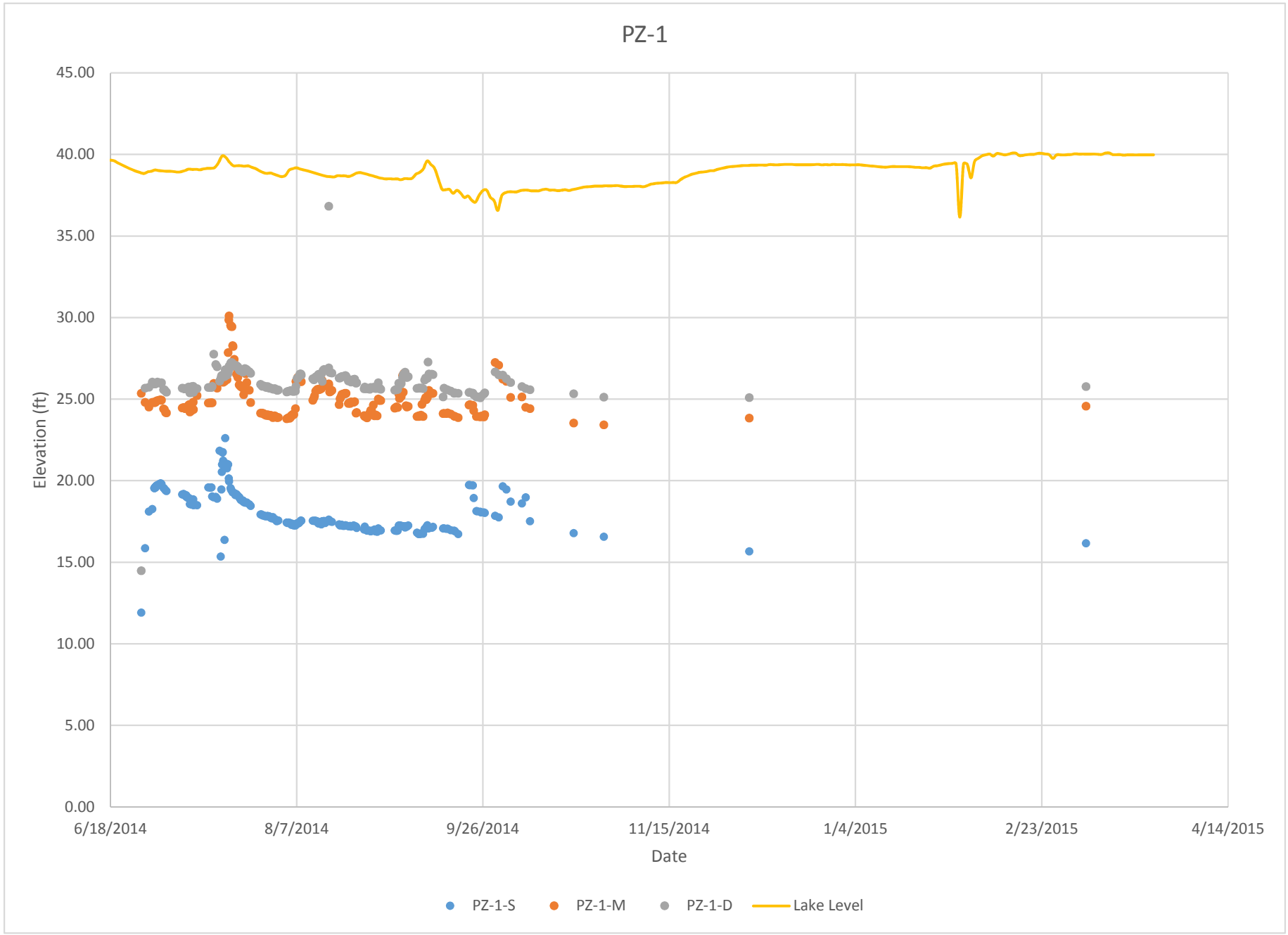
Laboratory Testing Results

Bore Hole #	Sample ID	Depth (ft)	Moisture Content (%)	% Finer #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-47	22	98.5 - 100.0	30.8				
B-48	1	0.0 - 2.0	10.8	5.6			
	2	3.0 - 5.0	11.9				
	3	8.0 - 10.0	16.9	7.5			
	4	13.0 - 15.0	26.4	32.1			
	5	18.0 - 20.0	26.1				
	6	23.0 - 25.0	23.0				
	7	28.0 - 30.0	27.5		43	20	23
	8	33.0 - 35.0	26.5	3.5			
	9	38.0 - 40.0	28.5	17.6			
	10	43.0 - 45.0	21.7				
	11	48.0 - 50.0	31.4	7.3			
	12	53.0 - 55.0	4.7	34.7	25	19	6
	13	58.0 - 60.0	26.7				
	14	63.0 - 65.0	36.0				
Sonic-1	11	40.0 - 45.0	24.9	35.1	51	25	26
	16	59.5 - 60.0	14.3	4.5			
	21	67.5 - 68.5	15.2				
	24	71.5 - 73.5	15.7				
	27	77.0 - 79.0	18.2		32	19	13
	32	105.0 - 110.0	30.3	78.1	41	25	16
Sonic-2	19	60.0 - 60.5	17.8				
	21	61.0 - 62.5	31.9				
	22	62.5 - 63.5	81.8	63.3	97	57	40
	23	63.5 - 67.5	30.0	11.6			
	25B	75.0 - 85.0	20.8	16.4			
Sonic-3	17	62.0 - 64.0	16.9				
	19B	72.0 - 85.0	19.8				
	22	95.0 - 100.0	31.3	38.8	37	22	15
Sonic-4	8	53.0 - 60.0	18.6	39.7			
	9	60.0 - 63.0	19.6	21.8			
	10	63.0 - 67.5	20.4				
	11	67.5 - 70.0	32.3	20.5			
	12	70.0 - 72.5	25.1	17.5			
	13	72.5 - 80.0	21.9	20.0			
	14	80.0 - 84.0	29.4	14.0			
	15	84.0 - 90.0	20.8		143	88	55

Appendix G

Amec Foster Wheeler Piezometer Readings

PIEZOMETER READINGS



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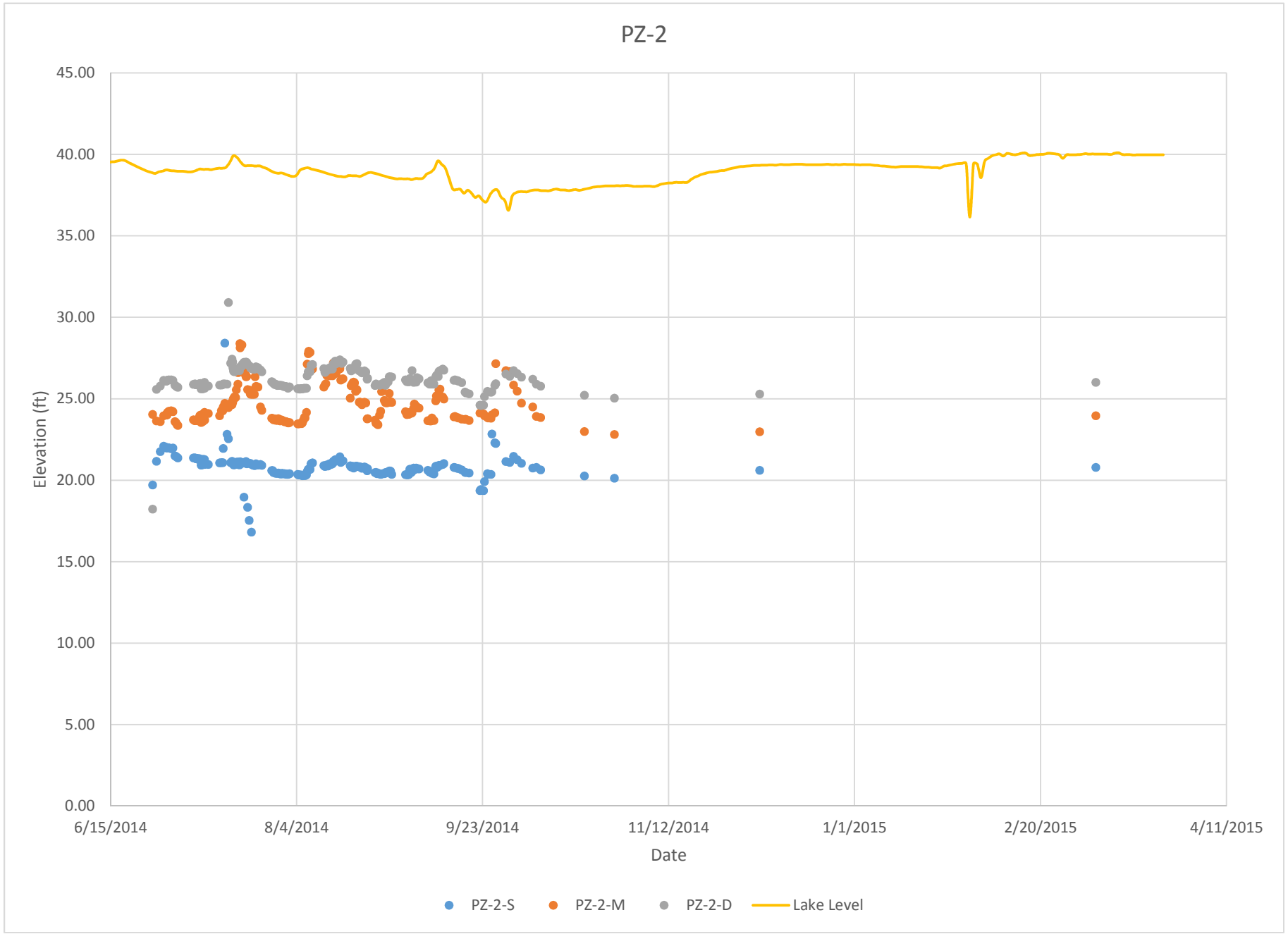

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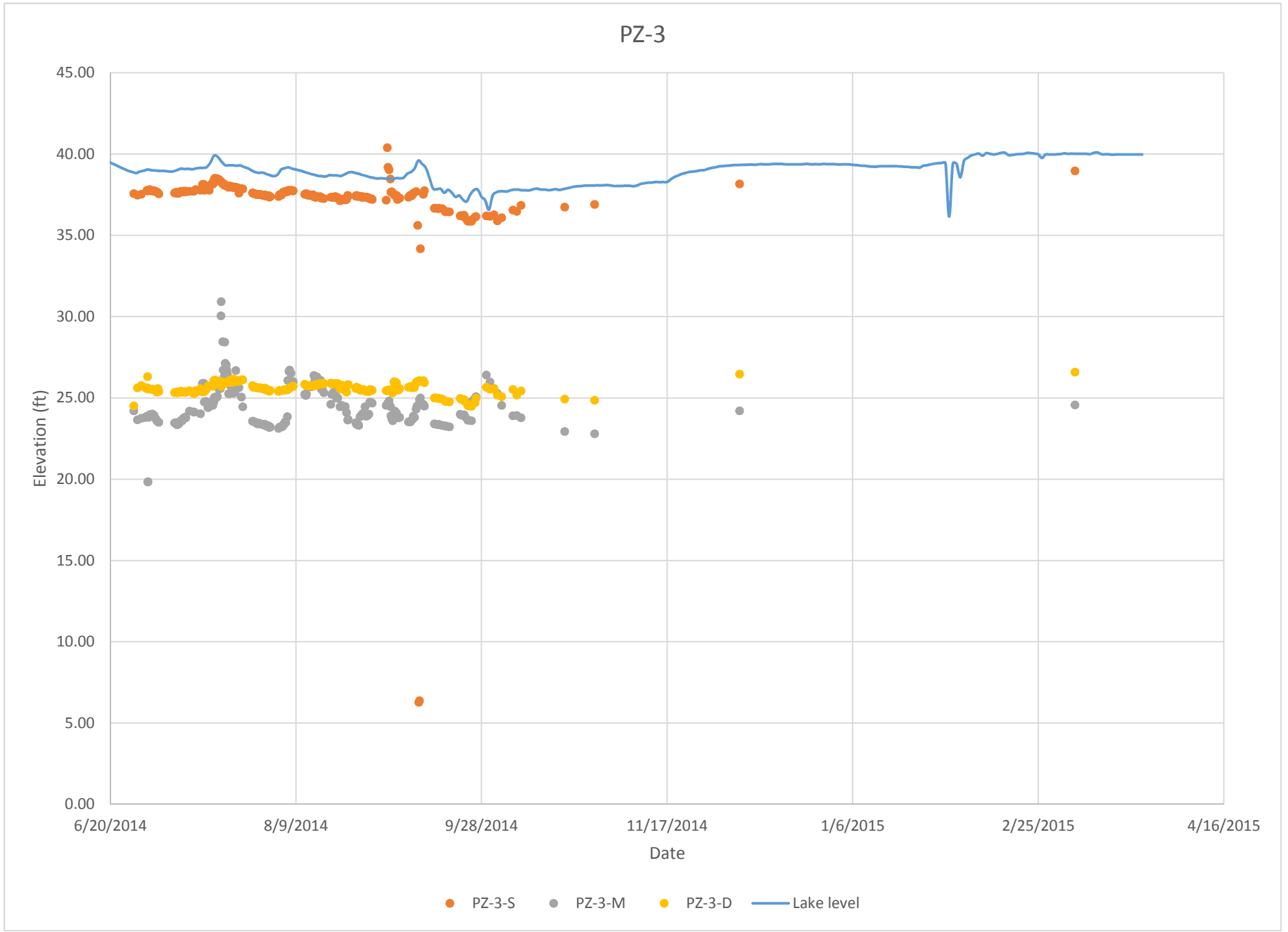

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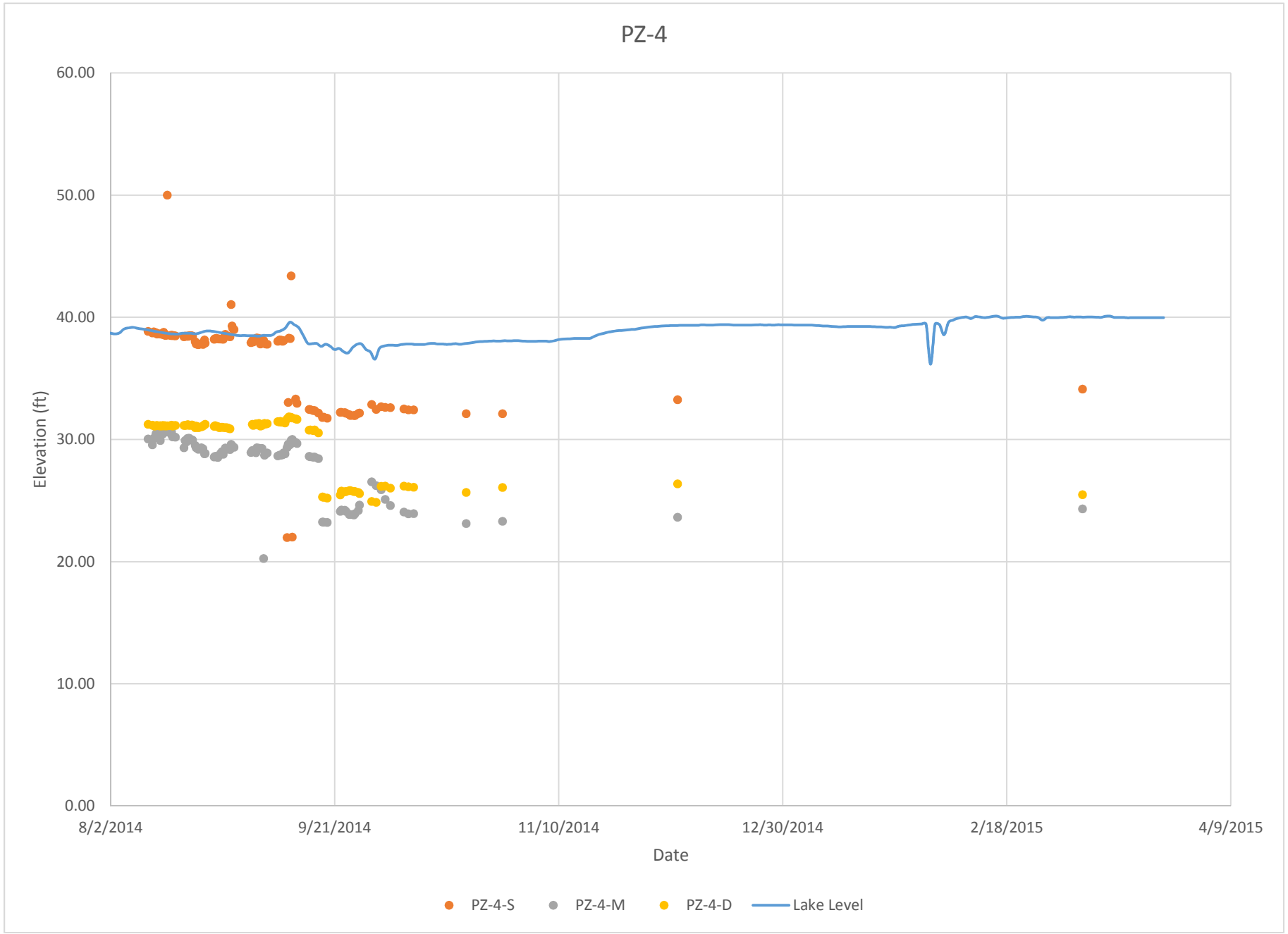

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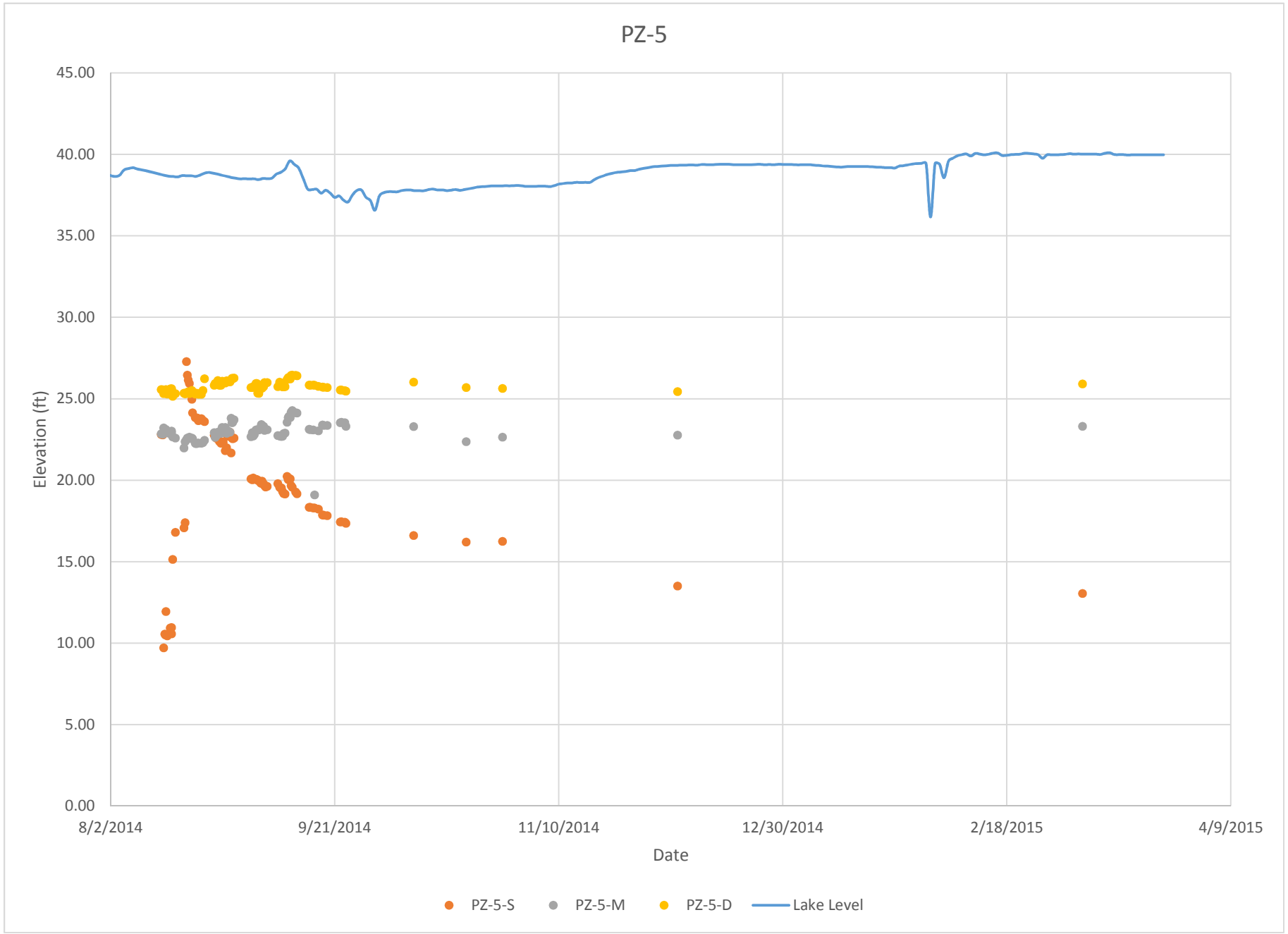

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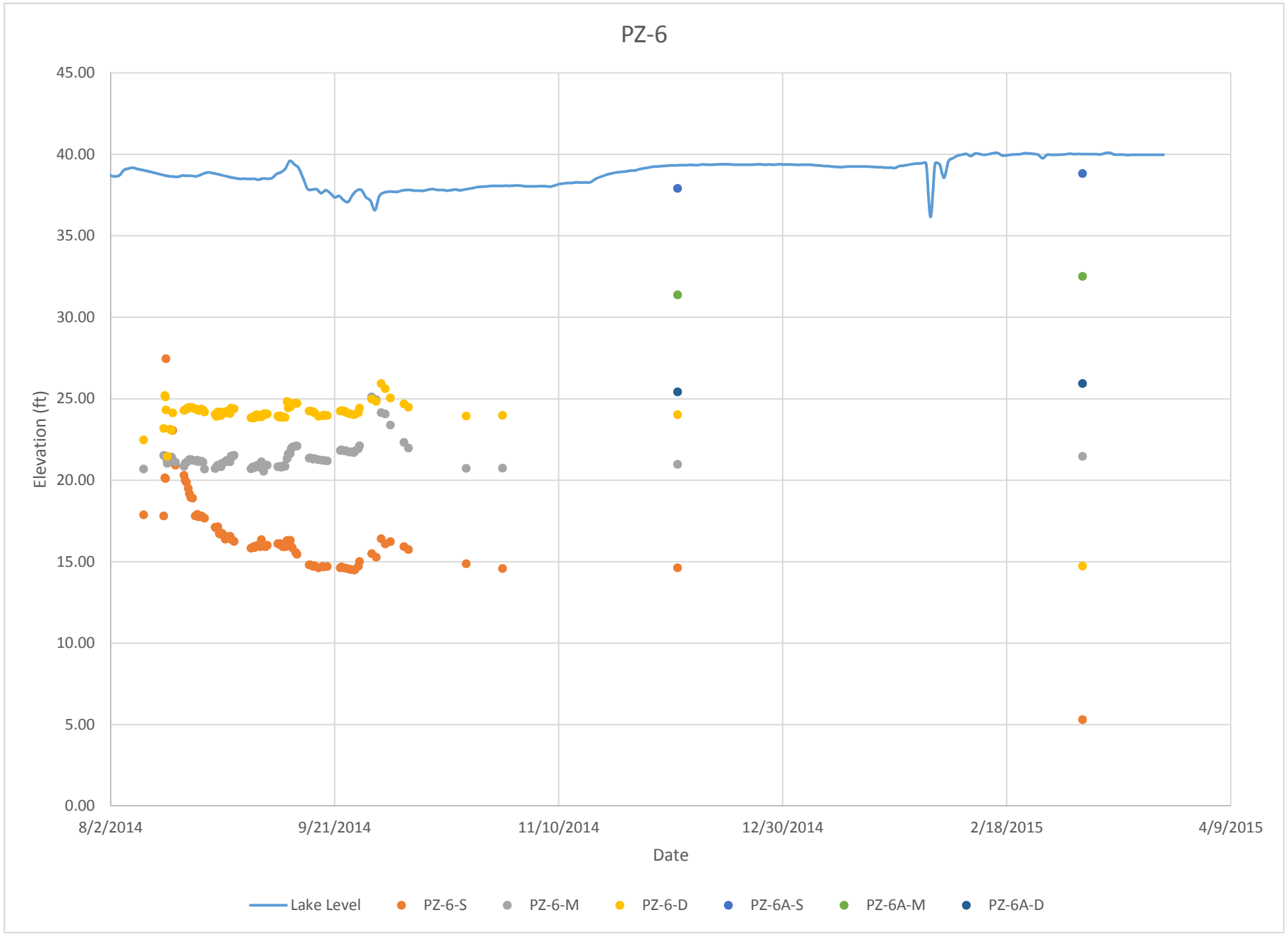

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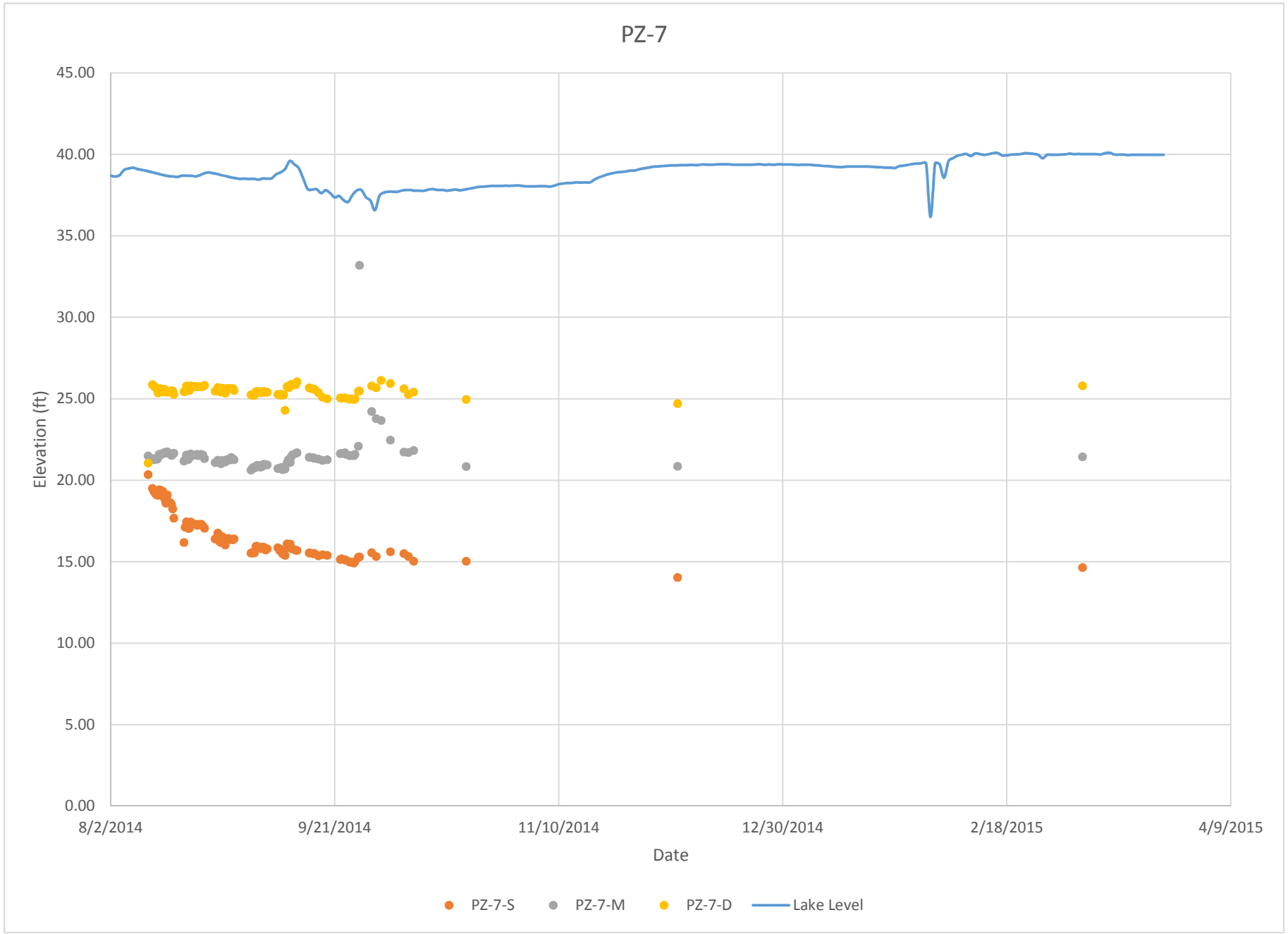

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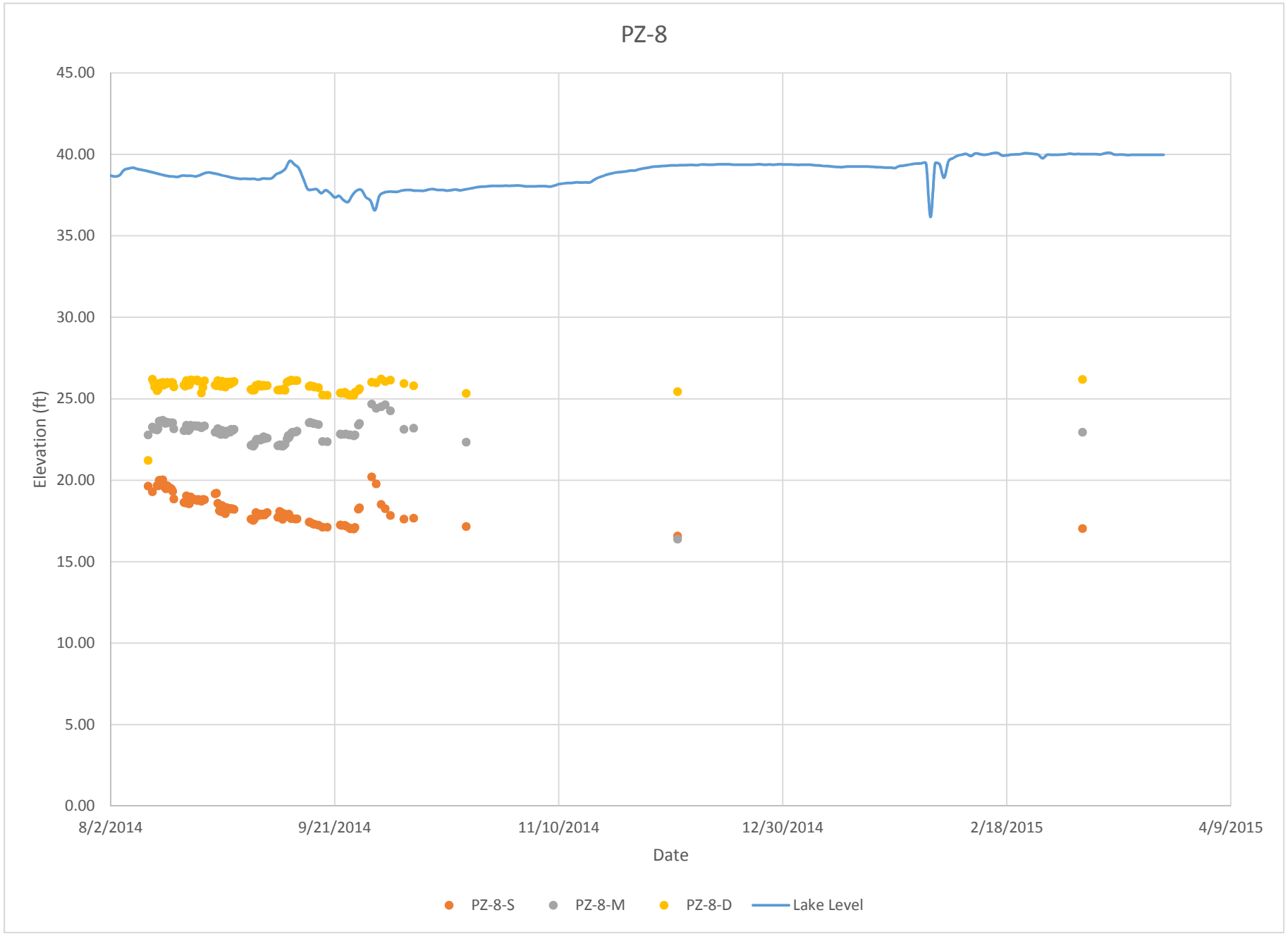

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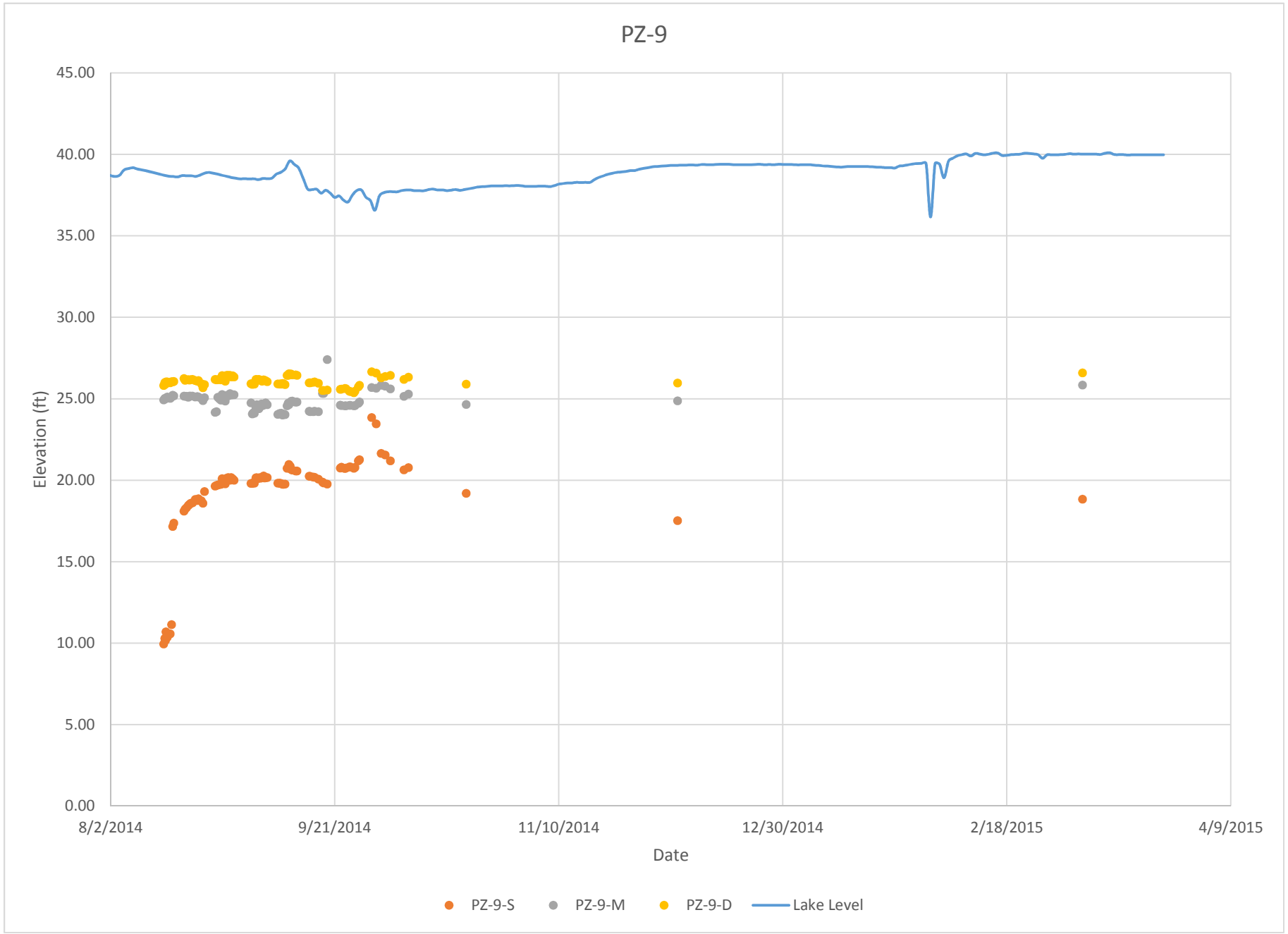

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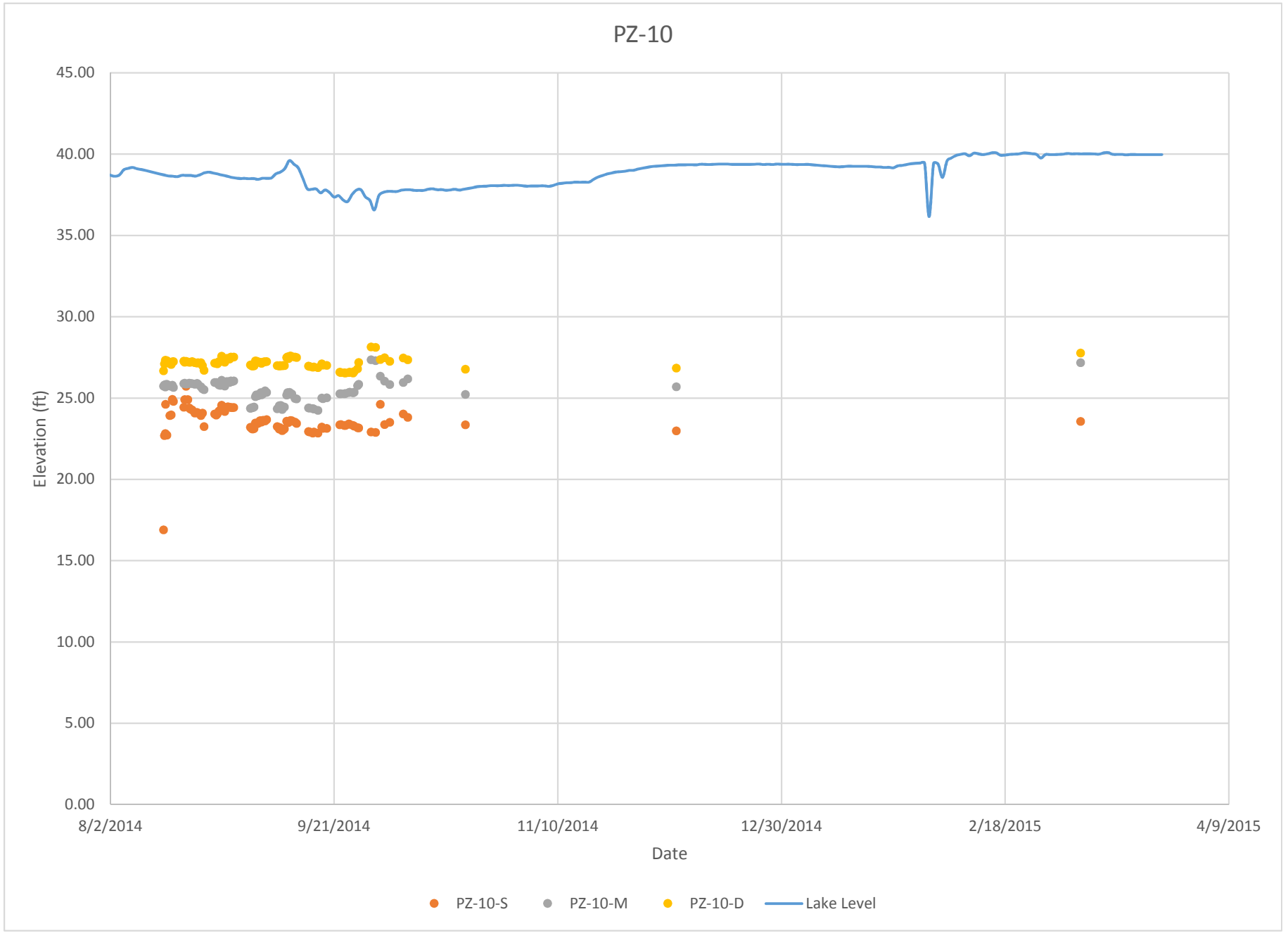

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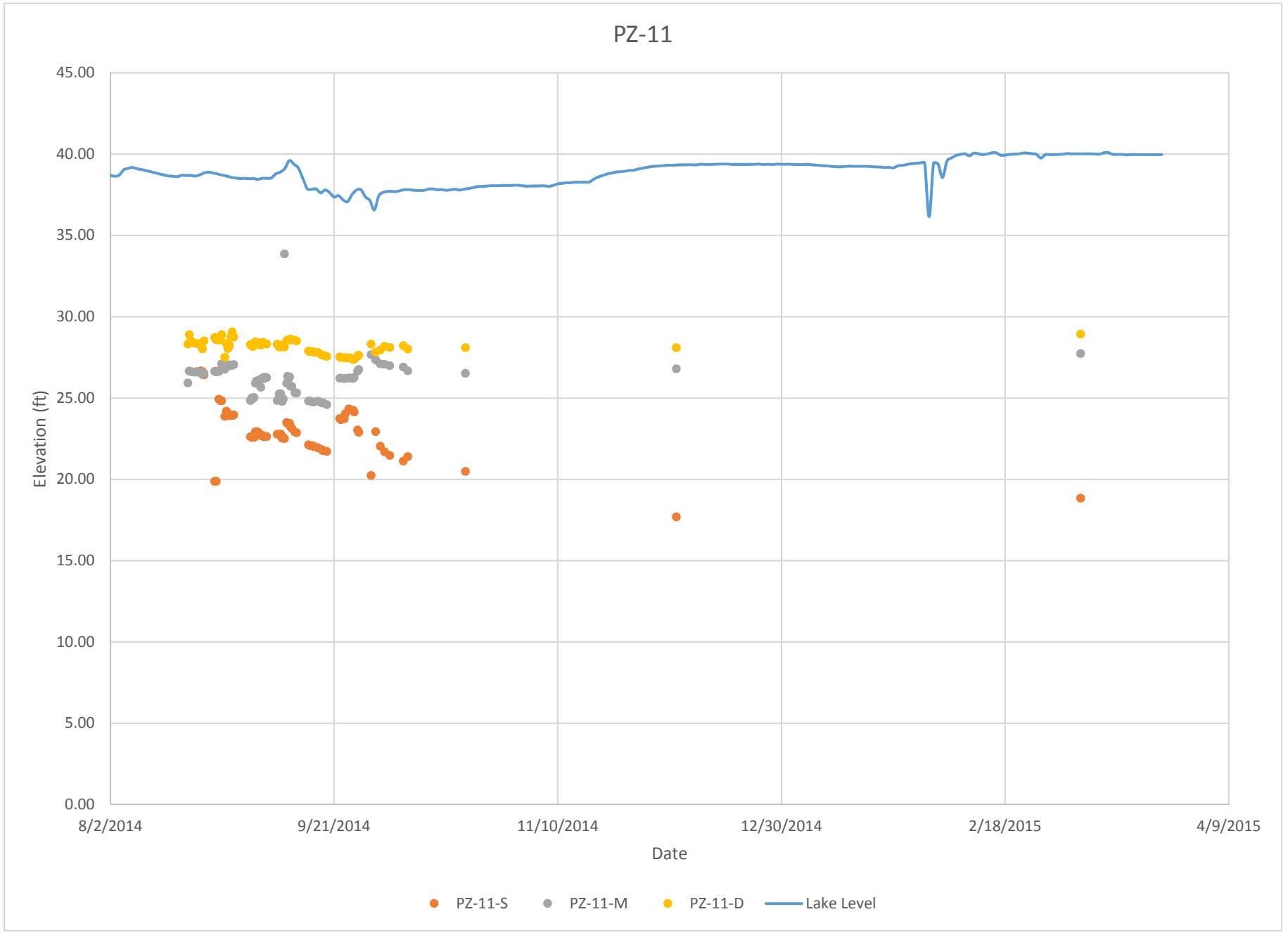

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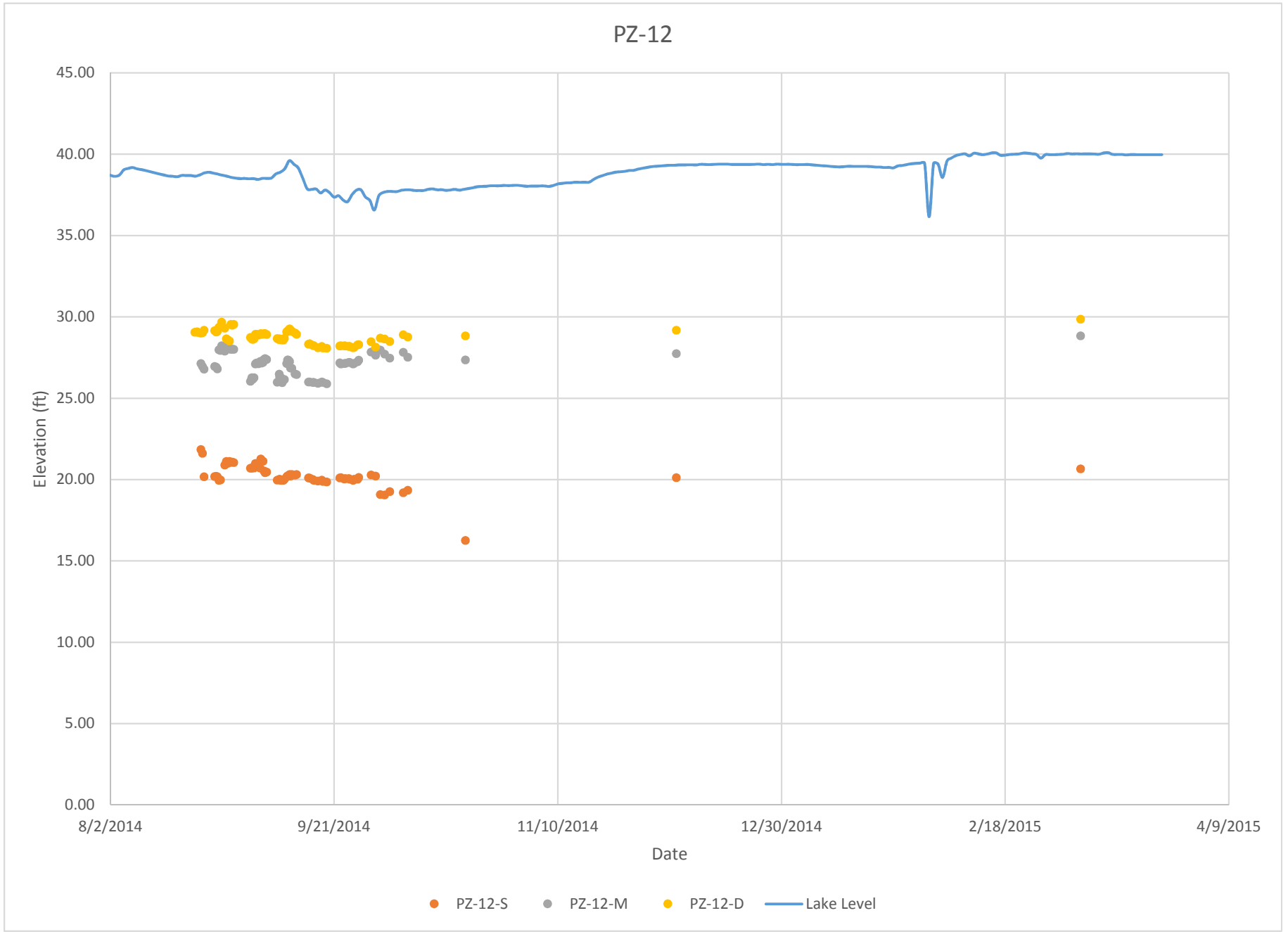

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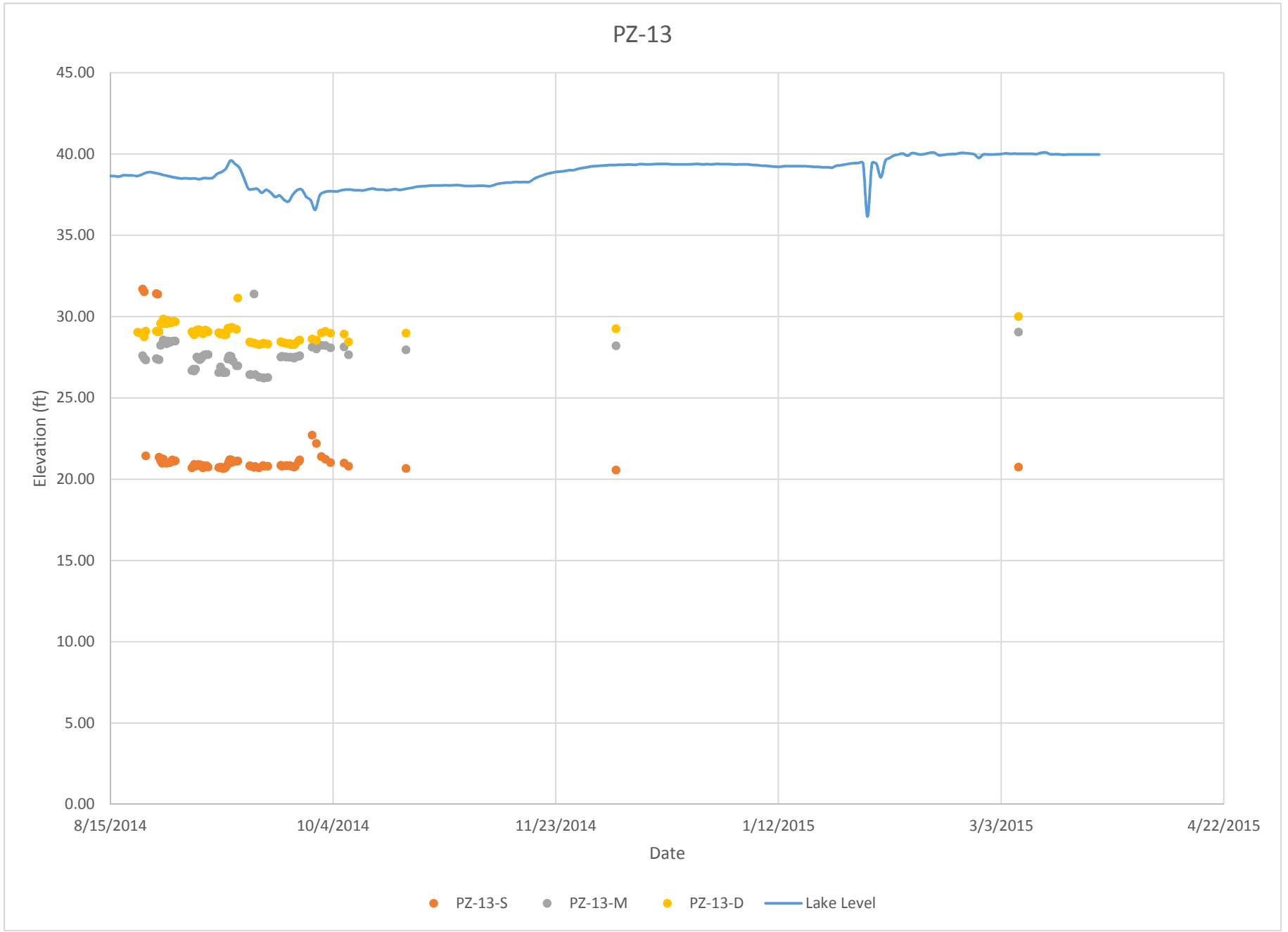

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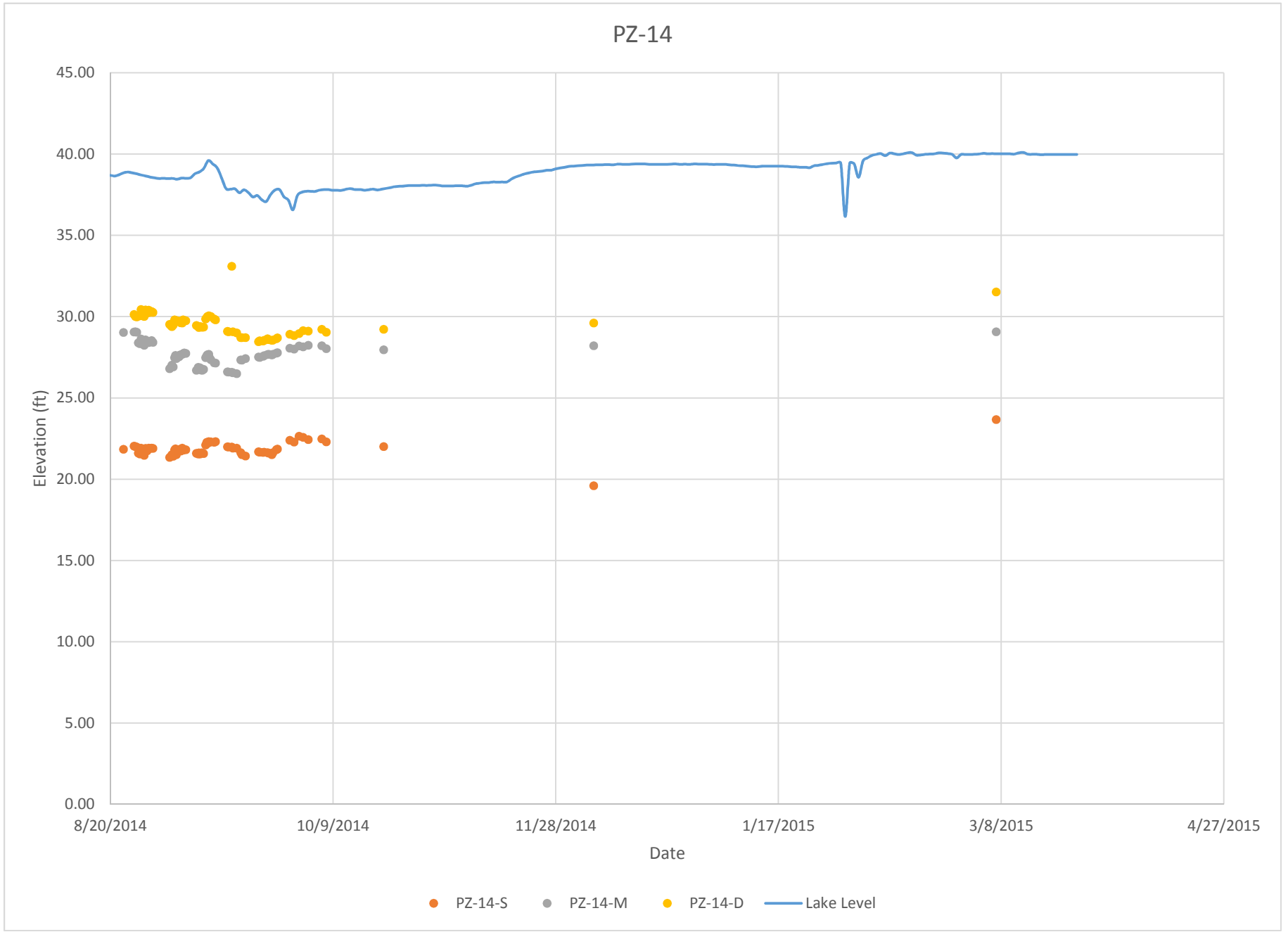

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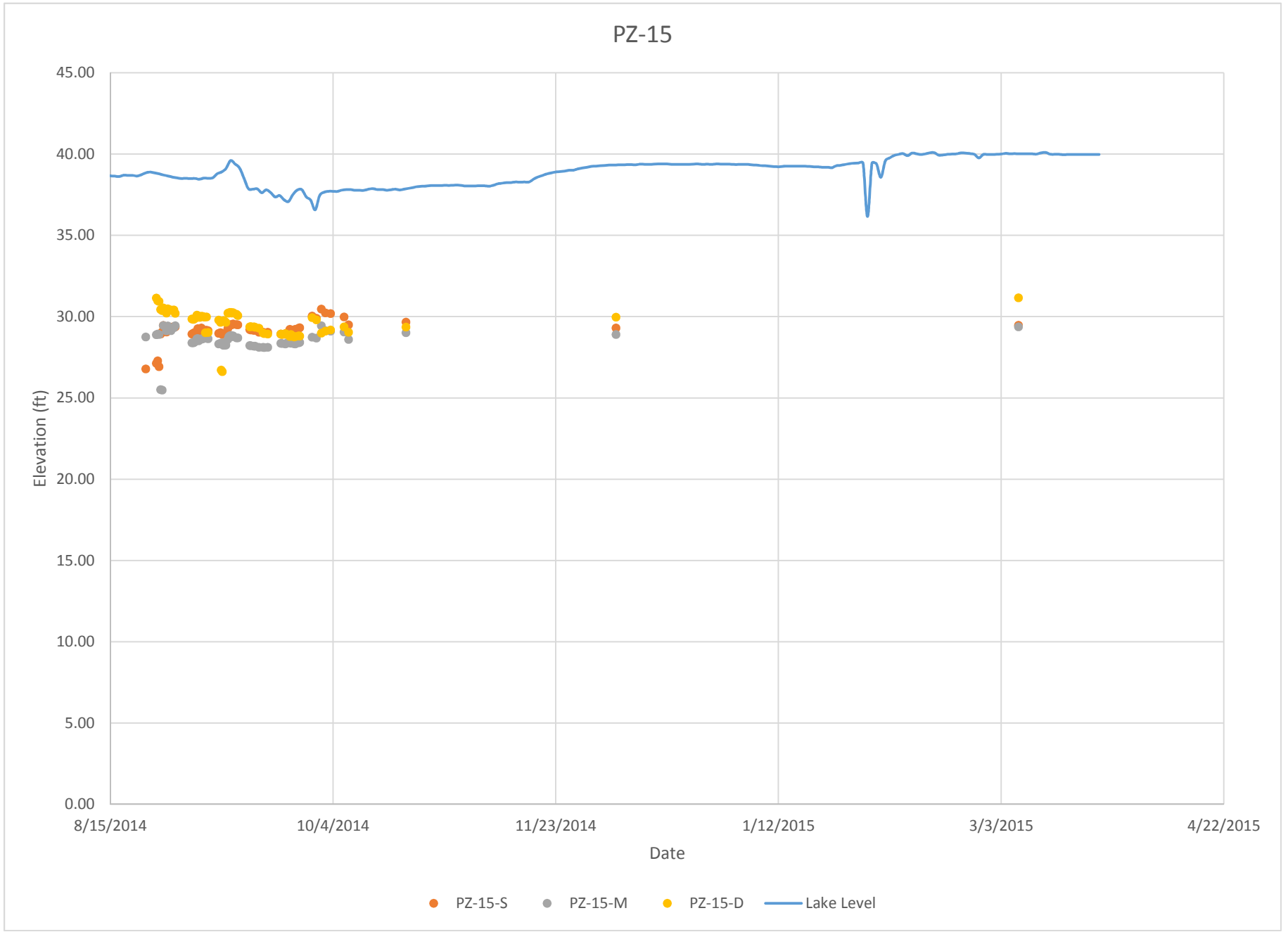

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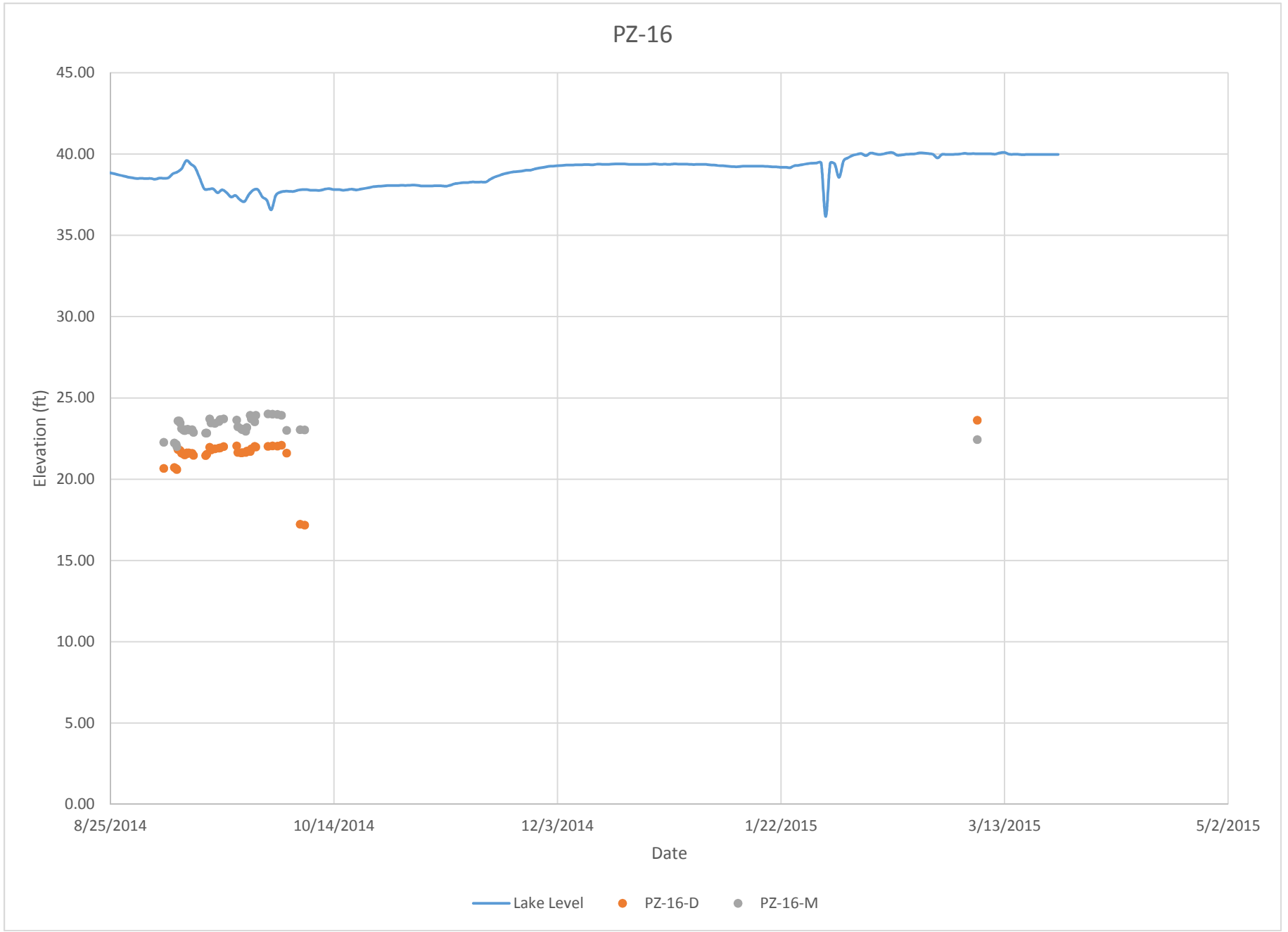

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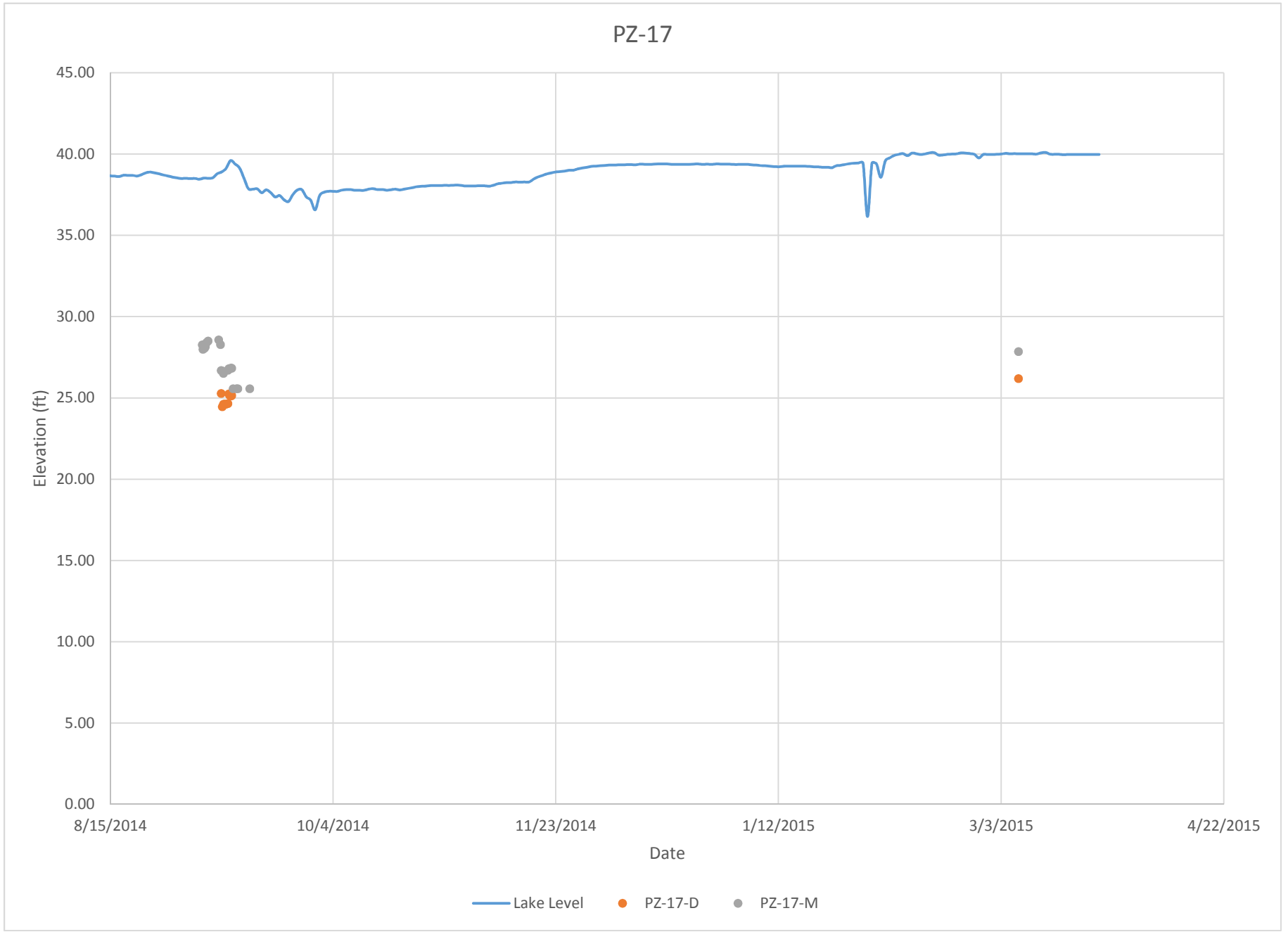

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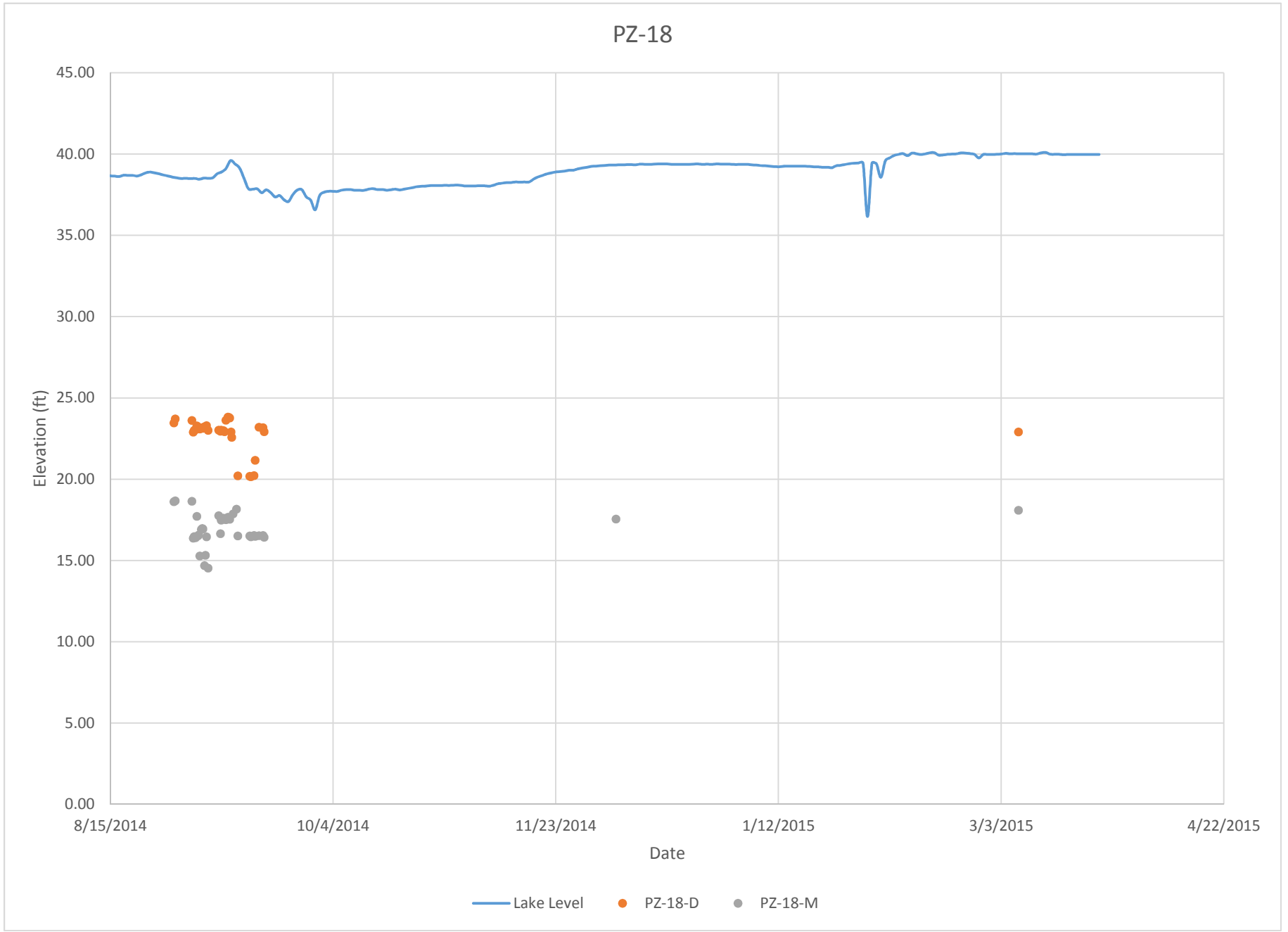

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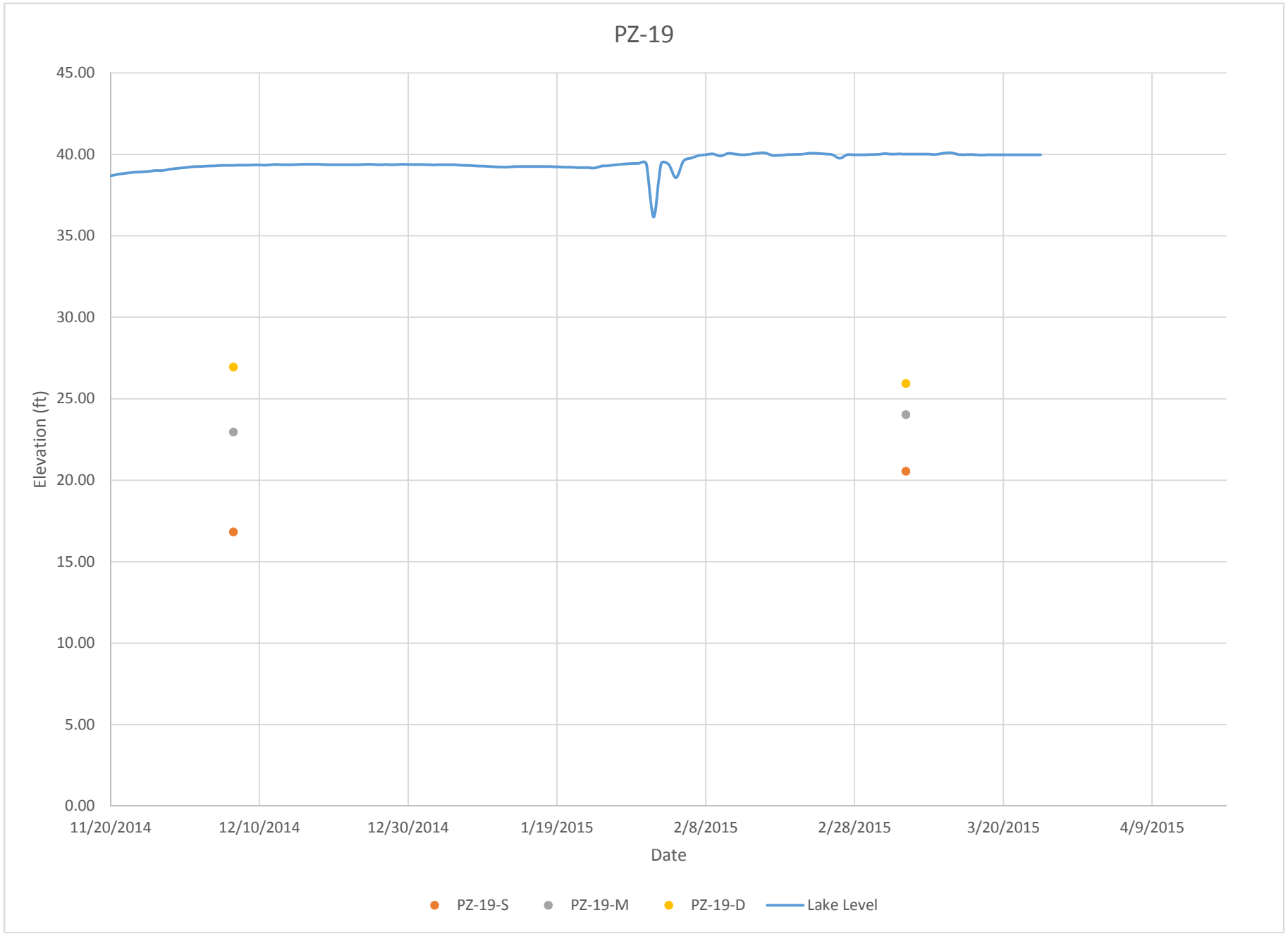

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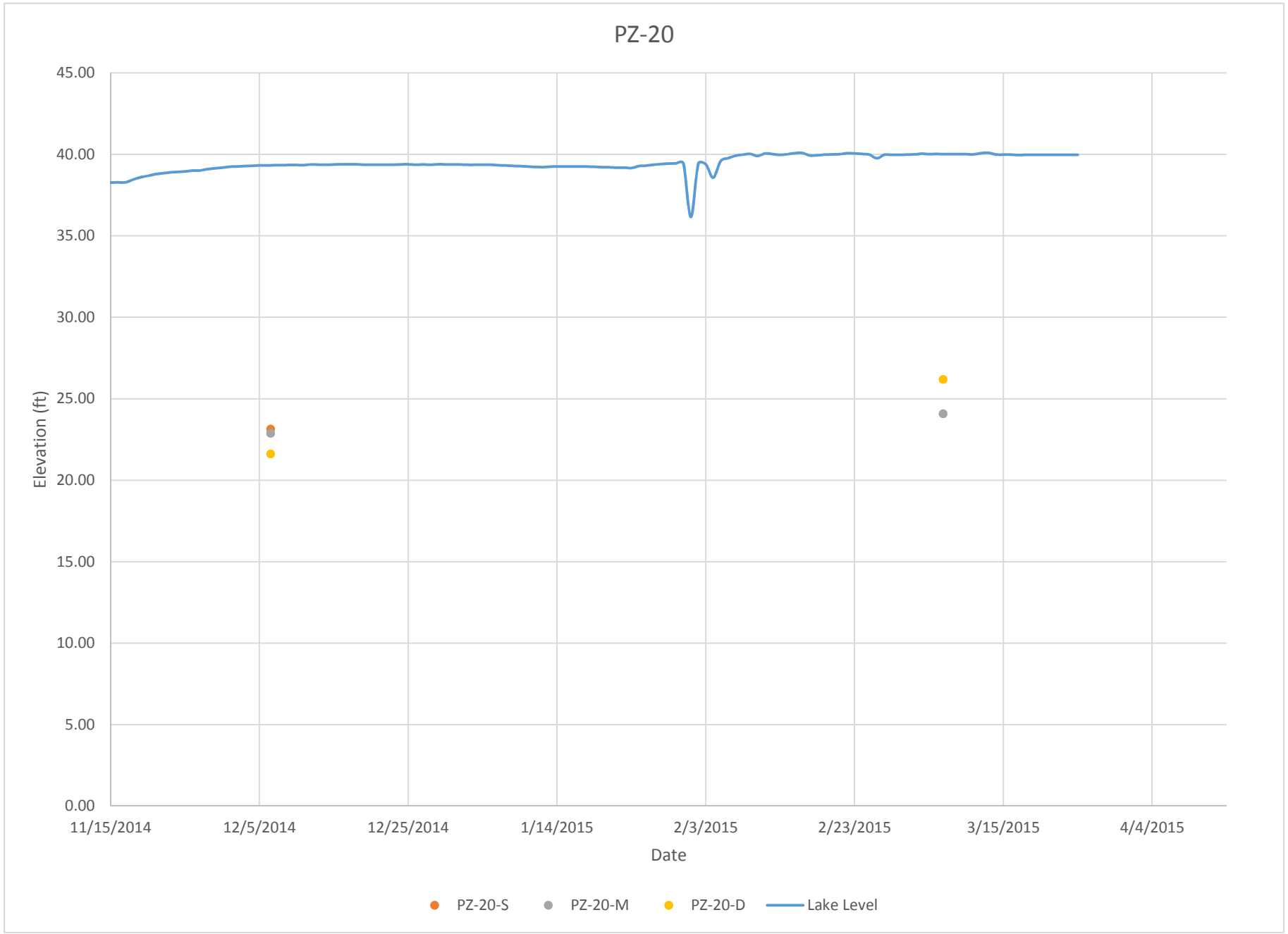

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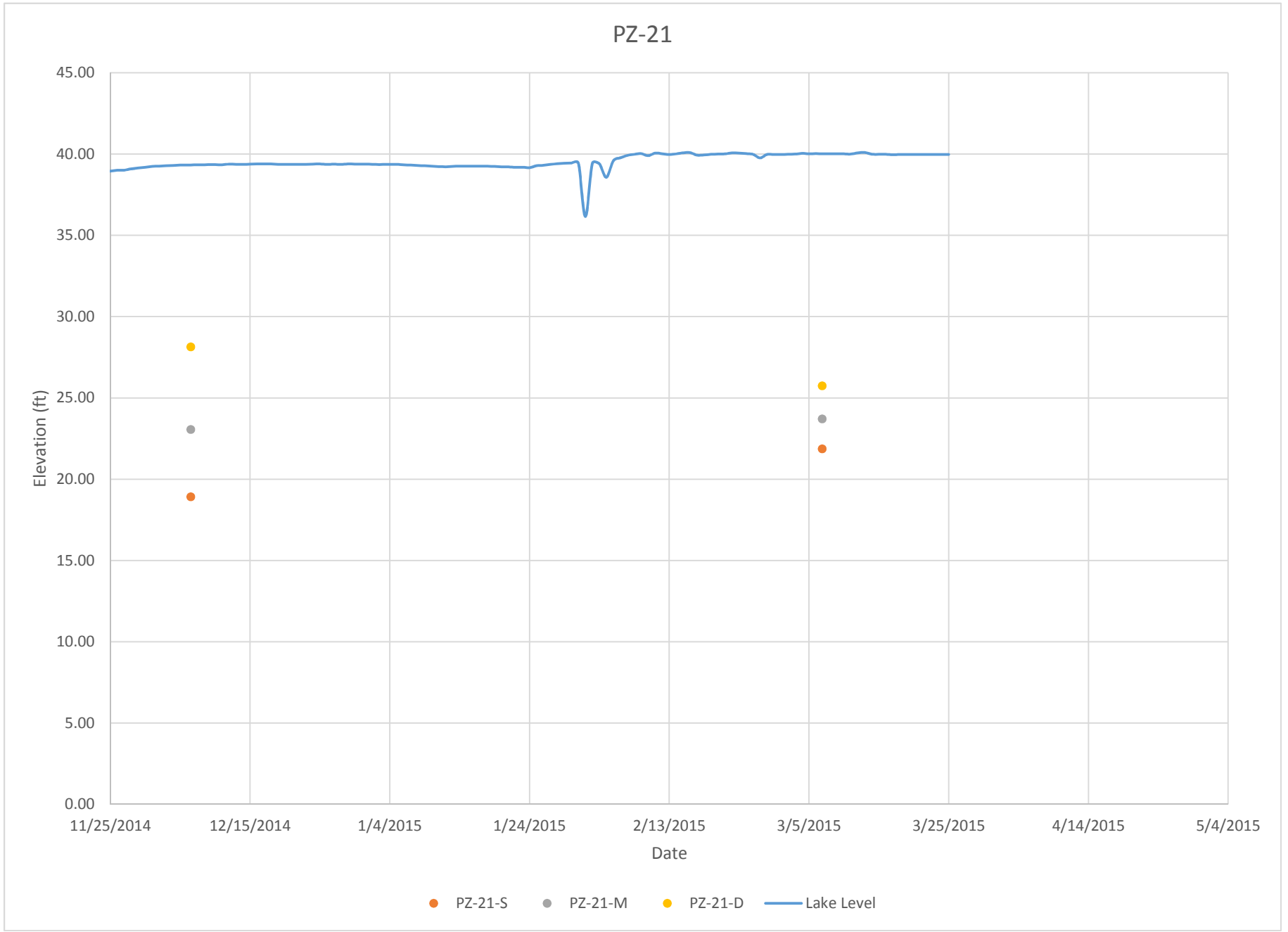
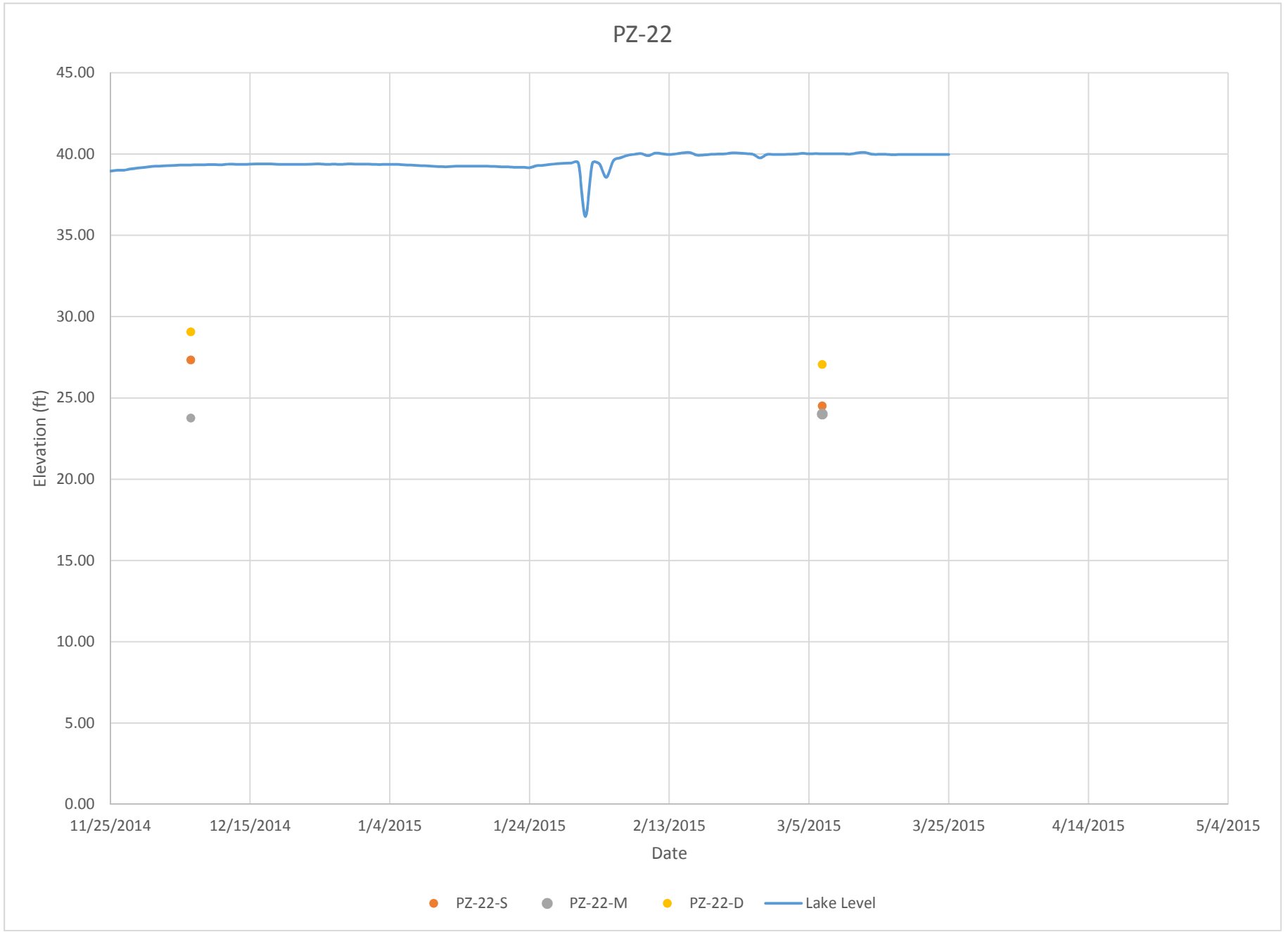


PIEZOMETER READINGS



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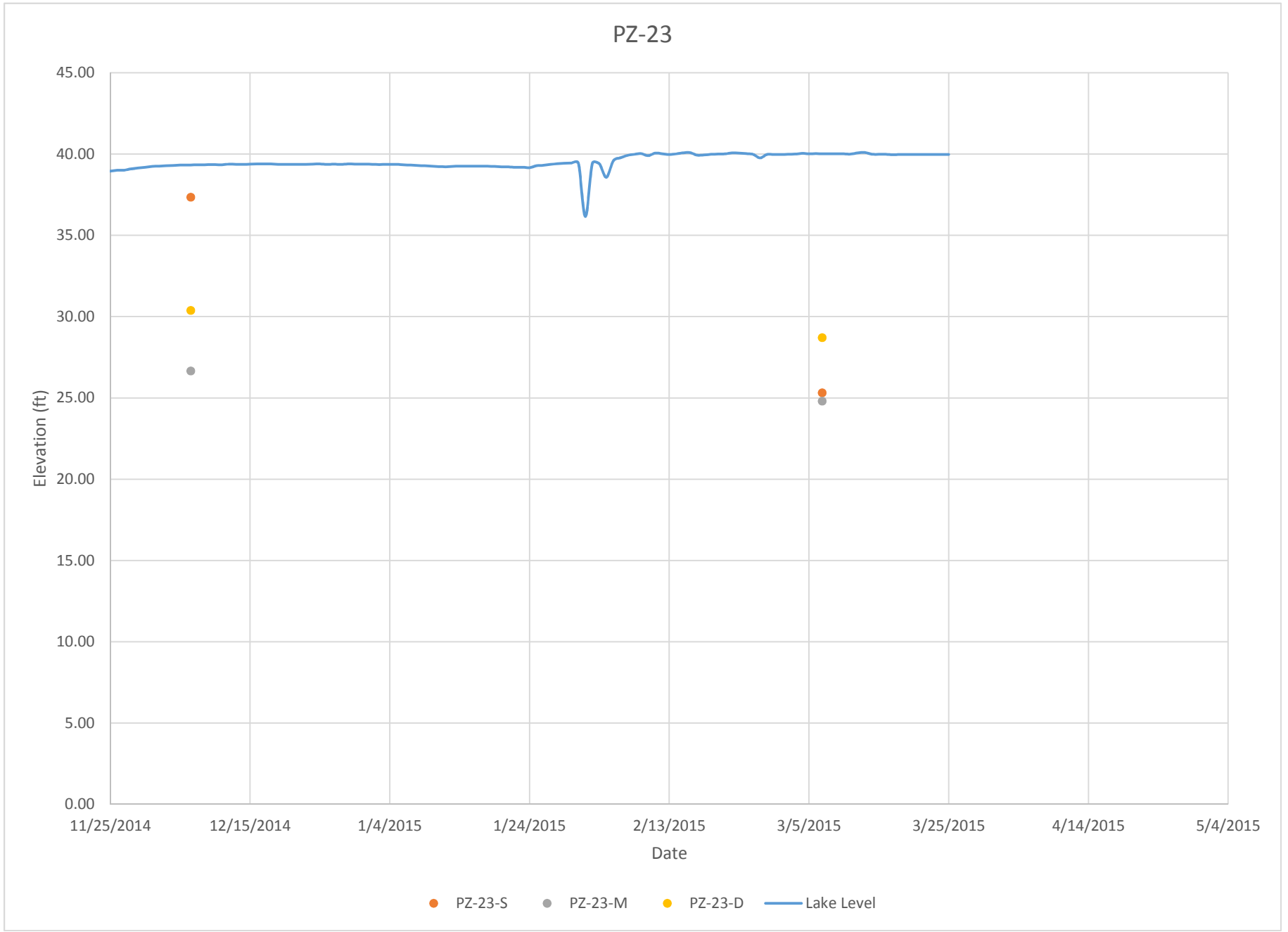

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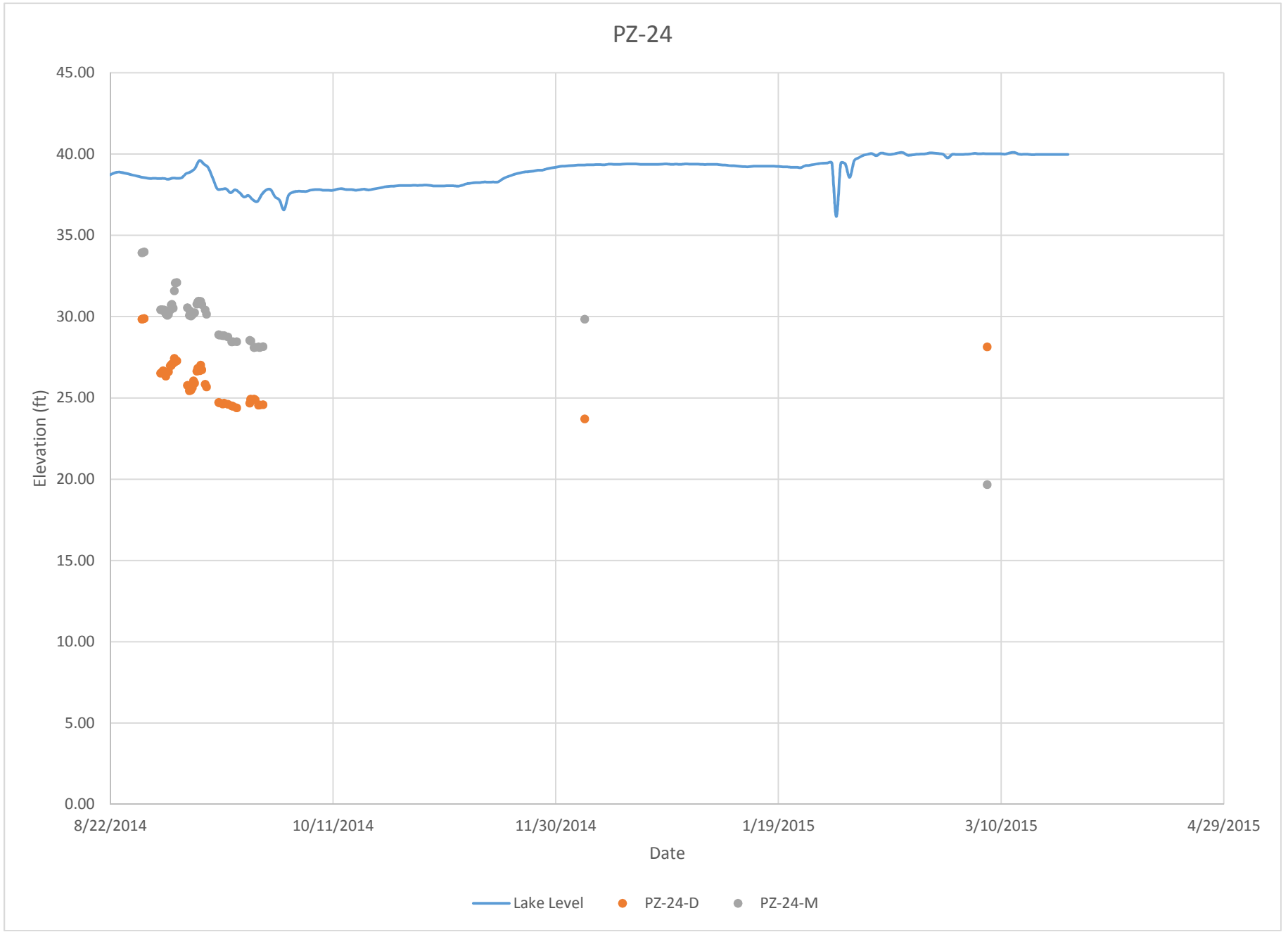

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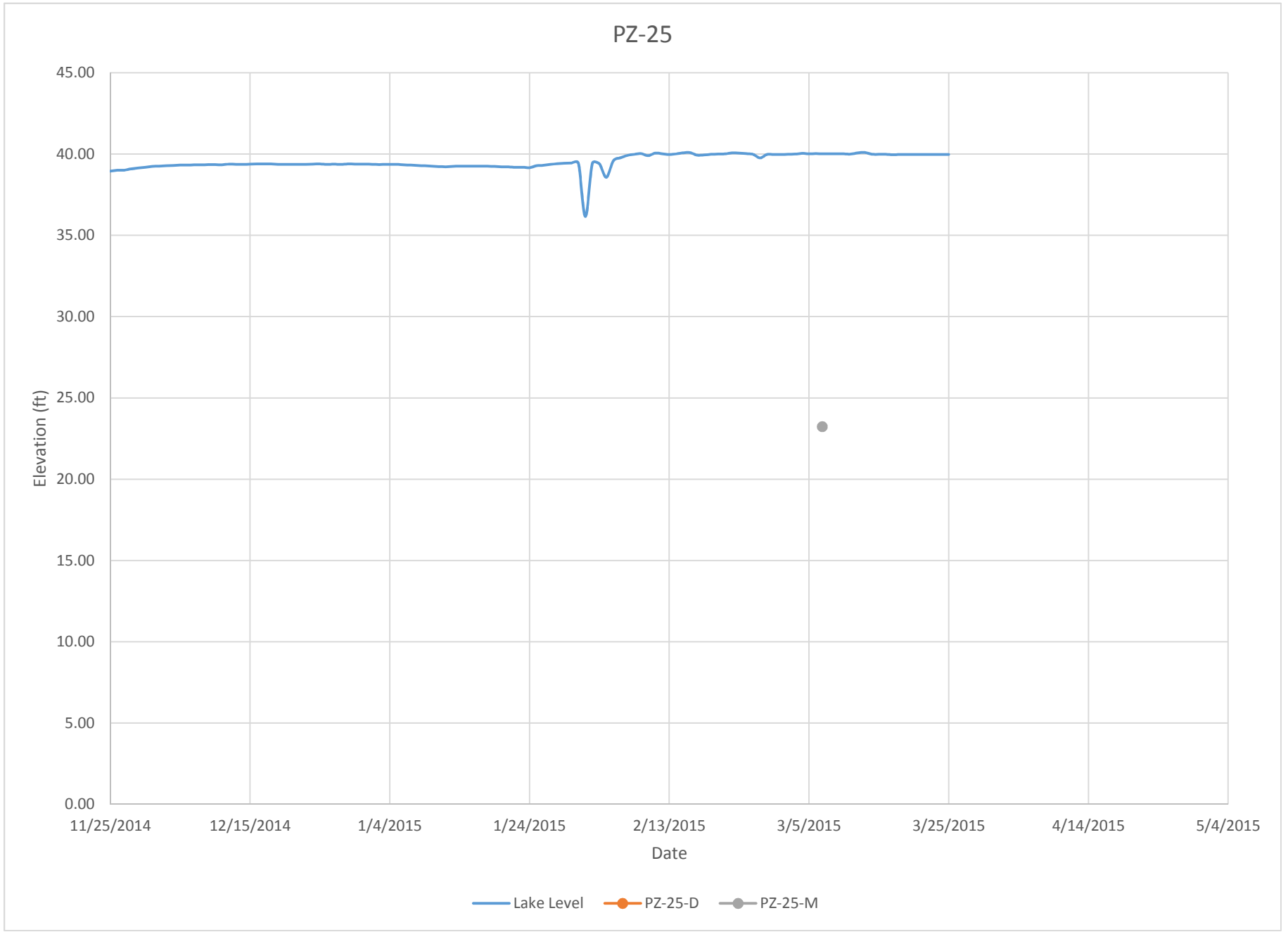

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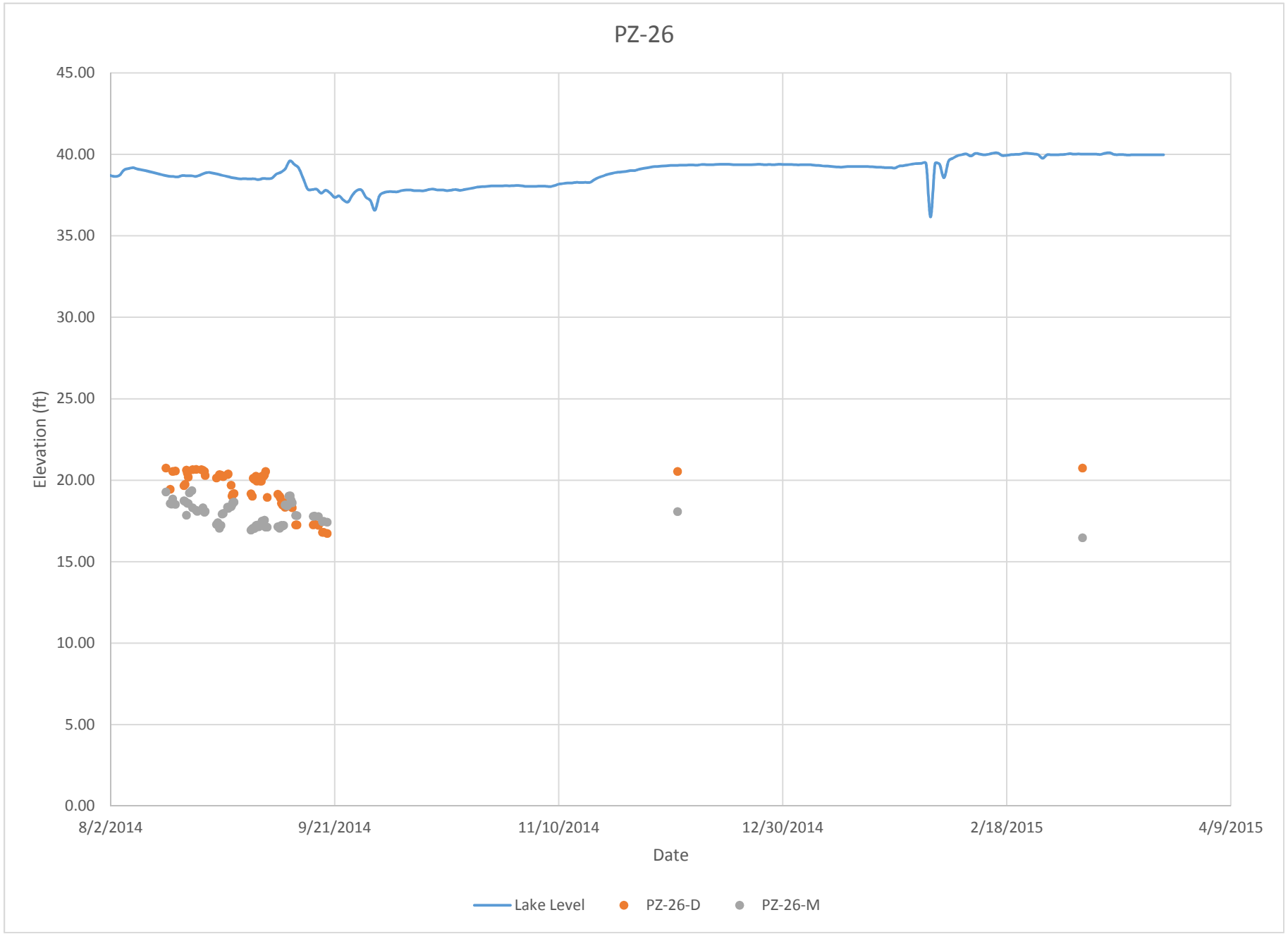

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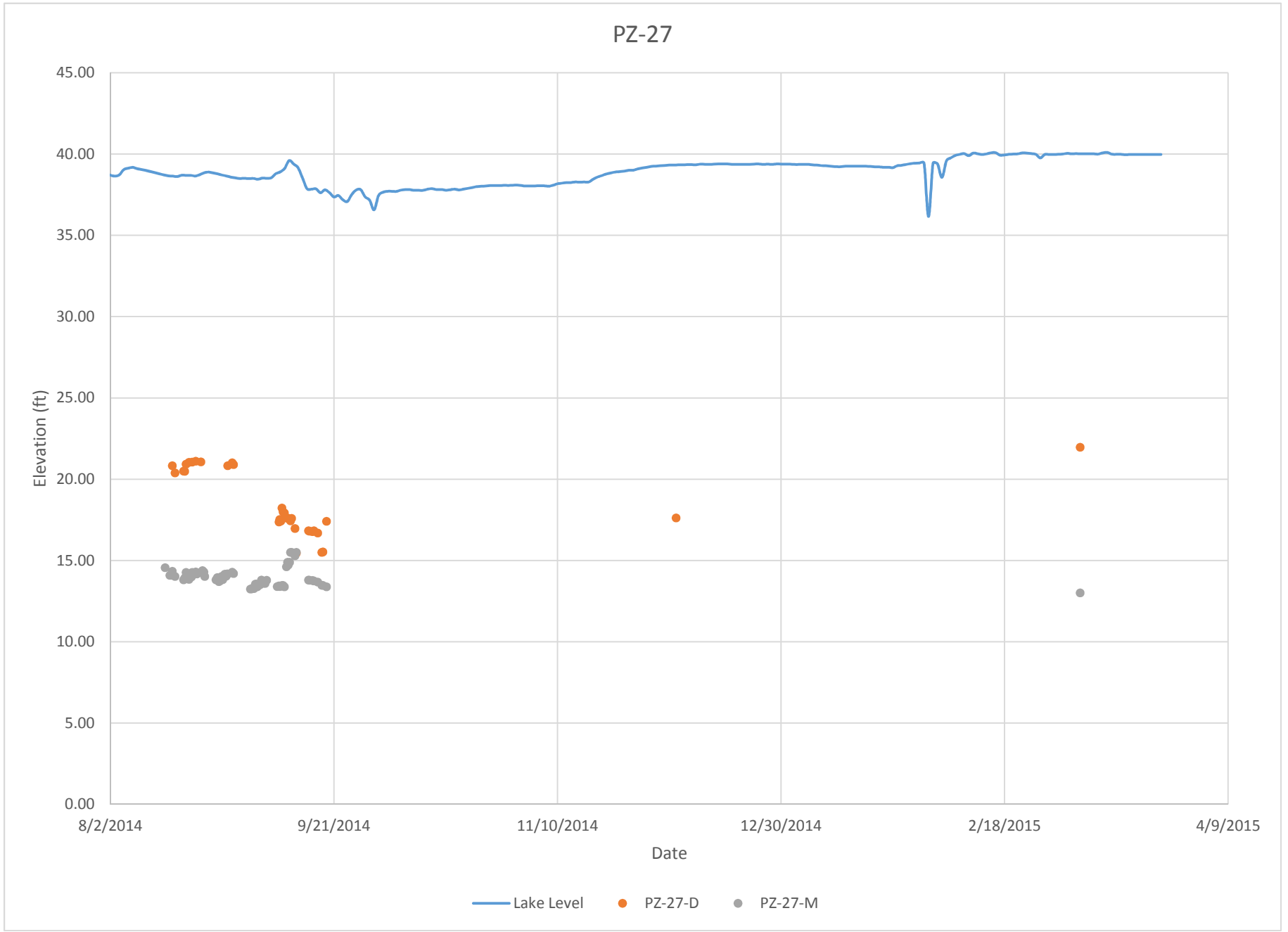

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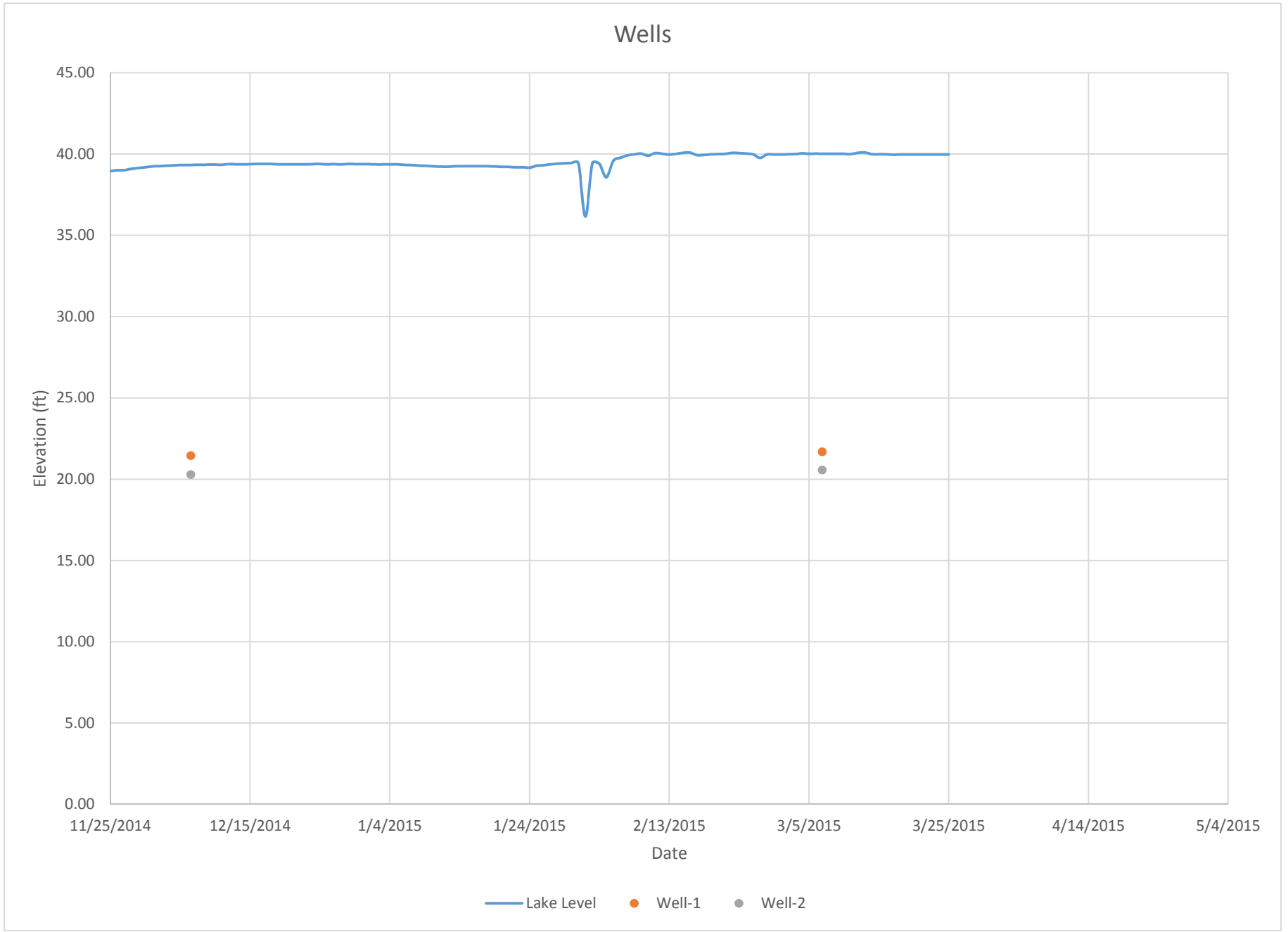

BID ATTACHMENT 7, PAINT CHIP COATINGS REPORT

Report of
XRay-Fluoresence (XRF) and Paint Chip Coatings Testing for Lead

Lake Manatee Dam

Bradenton, Florida

Prepared For:

Prepared By:
Wood Environment & Infrastructure Solutions, Inc.
Jacksonville, Florida

WOOD PROJECT NO.

JULY 7, 2021

wood.

July 7, 2021

Mr. David Butcher

Wood Environment & Infrastructure Solutions, Inc.
6256 Greenland Road
Jacksonville, Florida 32258
Phone: 904.396.5173 ● Fax: 904.396.5703
www.woodplc.com

SUBJECT: **Report of XRF Testing and Paint Chip Sampling for Leaded Coatings**
Lake Manatee Dam
Bippy Road
Bradenton, Florida
Wood Project No. 3004472X4.C06.TSK86

Dear Mr. Butcher :

Wood Environment & Infrastructure Solutions, Inc. (Wood) is pleased to provide you with the results of the XRF testing and piant chip sampling performed for the presence of leaded coatings on accessible paint components of the Lake Manatee Dam located on Bippy Road in Bradenton, Florida.

The XRF lead testing and paint chip sampling was performed on June 30, 2021, by Mr. James Marsh of Wood, a U.S. Environmental Protection Agency (EPA) accredited Lead Risk Assessor. This report presents the XRF and paint chip test results. Test results, accreditations of Wood personnel and photographic documentation are attached

Background Information

Based on information provided to Wood, it is our understanding that repairs are being made to the Manatee Dam that in some areas will involve disturbance of the existing paint coatings. As part of planning for those repairs testing for the presence of leaded coatings was performed on accessible paint coatings. You requested a proposal from Wood to perform the testing for leaded coatings.

Testing for Lead Coatings

The purpose of the testing was to evaluate the presence of leaded coatings on paint Dam comnponents. Wood is reporting all detectable concentrations of lead in this report to better meet OSHA criteria.

Twenty-three (23) XRF tests and 10 paint chip samples were performed on June 30, 2021 at the project site. Testing was performed in general compliance with XRF equipment manufacturer's guidelines as they applied to the testing being performed.

Lead XRF Testing Procedures

Wood performed the testing for leaded coatings using the *Lead Paint Analyzer (LPA-1),* manufactured by the *Radiation Monitoring Devices (RMD)*. The LPA-1 is a portable, in-situ test and measurement instrument that operates on the principal of X-Ray Fluorescence. The instrument contains a small, radioactive sealed source of Cobalt 57. LPA-1 is a hand-held scanner that contains the radioactive source and is held to the surface to be tested. The device provides an almost instantaneous measurement of K Shell atomic structure values of the material being tested in milligrams per square

centimeter (mg/cm^2). The lead electrons in the K (inner electron shell) are excited by the Cobalt 57 and release identifying energies that are recognized by the microprocessor by their respective spectrums, thus identifying the presence of lead and its quantity.

Testing Criteria and Results

Eleven (11) of the 23 XRF tests performed revealed detectable lead concentrations as noted in the following table:

Date	Location	XRF Reading*
6/30/21	Road Handrail Northwest	0.4
6/30/21	North Gate Shaft	0.5
6/30/21	Central Gate Shaft	0.8
6/30/21	Spill Gate Arm: N. Central	0.2
6/30/21	Spill Gate Arm Anchor-Central	0.2
6/30/21	Spill Gate Arm-North	0.6
6/30/21	Road Bed Support Beam	0.1
6/30/21	Water Pipe NWest	2.6
6/30/21	North Sheet Piling	7.5
6/30/21	South Sheet Piling	4.6
6/30/21	Water Pipe-South	1.2

*= Readings in milligrams per square centimeter (mg/cm^2)
Red = High Lead Concentartion
Brown = Moderate Lead Concentration
Black = Low Lead Concentration

Conclusions

Based on the analysis results lead is present in most all existing Dam coatings. The majority of the lead concentrations are very low with only four componnets with moderate to high concentrations.

Recommendations

The components with moderate to high detectable leaded coatings, should be removed by licensed lead professionals prior to performing renovations that would disturb those coatings. Air testing should also be perform during initial disturbance of coatings with low lead concentrations to ascertain airborne lead generated by the removal methodology being used. Even low concentrations can become airborne when extensively disturbed, such as sanding, grinding or torch cutting.

Qualifications

Wood has endeavored to observe the existing conditions with respect to lead on the Lake Manatee Dam using generally accepted procedures as outlined in the the XRF manufacturers guidelines as applicable to the evaluation being performed.

Our conclusions and recommendations are based upon the background information furnished to us, the test data obtained from previous building surveys, and the test data from the currently limited sampling. If the background information is incorrect or if other test data becomes available, please contact us so that our conclusions and recommendations can be reviewed.

This report is intended for the exclusive use of Manatee County under the terms and conditions of our agreement. Use of this report or reliance upon information contained in this report by any other party implies an agreement by that party to the same terms and conditions under which our services were provided. Furthermore, the use of this report by a party for purposes beyond those intended by Wood will be at their sole risk. These findings are relevant to the dates of our services and should not be relied upon to represent conditions at substantially earlier or later dates.

Wood appreciates the opportunity to be of service on this phase of your project. If we can be of further assistance or answer any questions about the report content or our services, please contact us.

Sincerely,

Wood Environment & Infrastructure Solutions, Inc.

James E. Marsh
EPA Lead Risk Assessor

John M. Stump, P.G.
Qualifying Agent

Attachment A: Certifications
Attachment B: XRF Unit Calibration Results
Attachment C: Photographic Documentation

Distribution: Client 1 – email
File (1)

ATTACHMENT A
CERTIFICATIONS

ATTACHMENT B

XRF UNIT CALIBRATION RESULTS

Calibration Record

XRF Unit No.:	1198	**Last Source Change**	Nov 2017
XRF Type:	Lead Paint Analyzer LPA-1	**Screening Reading Time:**	Quick Mode
Field Calibration Date	February 13/27, 2020		

Initial 6/30/21 Calibration	**NIST Level**	**Quick Mode**	**Within Limits**
	II	1.8	Yes
	Manufacturer Standard	1.9	Yes
	Blank	-0.0	Yes
End of Day 6/30/21 Calibration	II	1.8	Yes
	Manufacturer Standard	1.8	Yes
	Blank	-0.1	Yes

Checked by: JEM

ATTACHMENT C

PHOTOGRAPHIC DOCUMENTATION

PHOTO 1: Dam Roadway View.

PHOTO 2: Dam View: Lakeside.

PHOTO 3: Dam View: Spillway Side.

PHOTO 4: Dam View: Spillway Gates Shafts/Motors.

PHOTO 5: Handrail: XRF Test 1

PHOTO 6: Motor Casing: XRF Test 2.

PHOTO 7: Spillway Gate South Shaft: XRF Test 3 (Paint Chip 4)

PHOTO 8: Dam Shaft Housing: XRF Test 4.

PHOTO 9: Dam Spillway Gate Central Shaft: XRF Test 5.

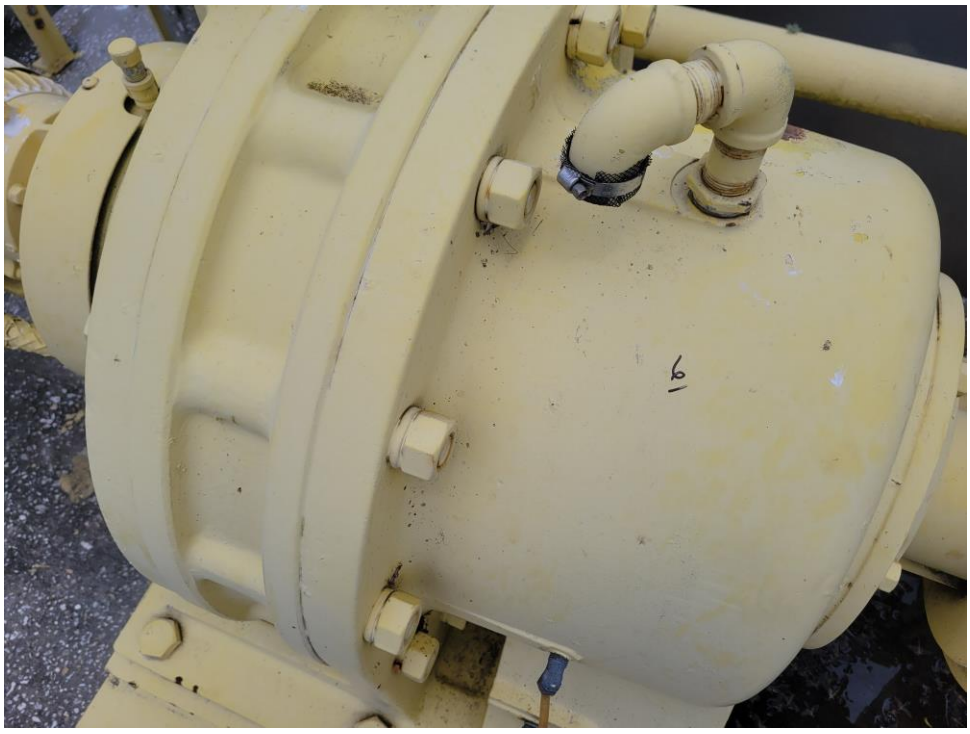

PHOTO 10: Gate Motor: XRF Test 6.

PHOTO 11: Motor Support: XRF Test 7.

PHOTO 12: South Central Ladder: XRF Test 8.

PHOTO 13: South Central Ladder Cage: XRF Test 9.

PHOTO 14: East Central Railing: XRF Test 10.

PHOTO 15: Roadbed Metal Channel Lid: XRF Test 11 (Paint Chip 10).

PHOTO 16: South Central Gate Arm: XRF Test 12.

PHOTO 17: North Central Gate Arm: XRF Test 13 (Paint Chip 2).

PHOTO 18: Dan gate Arm Anchor South Central: XRF Test 14 (Paint Chip 1).

PHOTO 19: North Gate Arm Anchor: XRF Test 15 (Paint Chip 5).

PHOTO 20: Roadbed Support Beam North: XRF Test 16 (Paint Chip 7).

PHOTO 21: Water Pipe North: XRF Test 17 (Paint Chip 6).

PHOTO 22: Spill Gate View.

PHOTO 23: North Sheet Piling: XRF 18 (Paint Chip 8).

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order: 202105200
CustomerID: AMECN25
CustomerPO:
ProjectID:

Attn: **James Marsh**
Wood Env. & Infrastructure Solutions
6256 Greenland Road
Jacksonville, FL 32258

Phone: (904) 396-5173
Fax: (904) 399-3176
Received: 07/02/21 10:30 AM
Collected: 7/30/2021

Project: **30042X4.C06.TSK86 / Lake Manatte Dam**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
PC-1	*202105200-0001*	7/30/2021	7/6/2021	0.2578 g	<80 ppm
	Site: spill gate grm mount - central				
PC-2	*202105200-0002*	7/30/2021	7/6/2021	0.2525 g	<80 ppm
	Site: central				
PC-3	*202105200-0003*	7/30/2021	7/6/2021	0.2543 g	210 ppm
	Site: Dam gate shaft - center				
PC-4	*202105200-0004*	7/30/2021	7/6/2021	0.1614 g	<120 ppm
	Site: dam gate shaft - north				
PC-5	*202105200-0005*	7/30/2021	7/6/2021	0.2565 g	<80 ppm
	Site: spill gate mount - north				
PC-6	*202105200-0006*	7/30/2021	7/6/2021	0.2529 g	11000 ppm
	Site: waste pipe - north side				
PC-7	*202105200-0007*	7/30/2021	7/6/2021	0.2540 g	<80 ppm
	Site: road supp beam plunge				
PC-8	*202105200-0008*	7/30/2021	7/6/2021	0.2549 g	86000 ppm
	Site: sheet piling - north				
PC-9	*202105200-0009*	7/30/2021	7/6/2021	0.2516 g	11000 ppm
	Site: road bed riley - west				
PC-10	*202105200-0010*	7/30/2021	7/6/2021	0.2524 g	<80 ppm
	Site: road bed metal channel lid - central				

Phillip Worby, Lead Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.
Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.
Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 07/06/2021 18:02:37

BID ATTACHMENT 8, BORING LOCATIONS AND BORING LOGS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 9, VOIDS UNDER BASIN AND DOWNSTREAM APRON

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 10, DOWNSTREAM APRON CONCRETE THICKNESS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 11, ORIGINAL DESGIN DRAWINGS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

SECTION D, SAMPLE CONSTRUCTION AGREEMENT WITH GENERAL CONDITIONS OF THE CONSTRUCTION AGREEMENT AND AGREEMENT EXHIBITS

CONSTRUCTION AGREEMENT

for

STIPULATED SUM

between

MANATEE COUNTY (AS OWNER)

and

_____ (AS CONTRACTOR)

AGREEMENT NO.

SAMPLE

CONSTRUCTION AGREEMENT FOR
STIPULATED SUM
[PROJECT NAME]

THIS AGREEMENT ("Agreement") is made and entered into by and between Manatee County, a political subdivision of the State of Florida, referred to herein as "Owner", and the firm of _____, incorporated in the State of _____ and registered and licensed to do business in the State of Florida (license #_____), referred to herein as "Contractor."

WHEREAS, the Owner intends to construct **[PROJECT DESCRIPTION]**, the aforementioned improvements being hereinafter referred to and defined as the "Project"; and

WHEREAS, in response to Owner's Invitation for Bid Construction No. _____ (the "IFBC"), Contractor has submitted its Bid (the "Contractor's Bid") to provide the aforementioned construction services.

NOW THEREFORE, the Owner and the Contractor, in consideration of the mutual covenants hereinafter set forth, the sufficiency of which is hereby acknowledged, agree as follows:

1. Contract Documents. The Contract Documents consist of this Agreement and attached Exhibits, the attached General Conditions of the Construction Agreement, Supplementary Conditions (if any), Special Conditions (if any), Drawings (the titles of which are attached hereto as Exhibit A), Specifications (the titles of which are attached hereto as Exhibit B), Addenda issued prior to execution of this Agreement, the Invitation for Bid (including any Instructions to Bidders, Scope of Work, Bid Summary, Supplements, and Technical Specifications), any interpretations issued pursuant to the Invitation for Bid, the Contractor's Bid, permits, notice of intent to award, Notice to Proceed, purchase order(s), any other documents listed in this Agreement, and Modifications [to include written Amendment(s), Change Order(s), Work Directive Change(s) and Field Directive(s)] issued after execution of this Agreement. These form the Agreement, and are as fully a part of the Agreement as if attached or repeated herein. This Agreement represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. No other documents shall be considered Contract Documents.

2. Work. The Contractor shall fully execute the Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

3. Date of Commencement and Substantial Completion.

A. Date of Commencement. The date of commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner.

B. Contract Time. The Contract Time shall be measured from the date of commencement.

SAMPLE

C. Substantial Completion. The Contractor shall achieve Substantial Completion of the entire Work not later than ___ days from the date of commencement, or as follows:

Portion of Work **Substantial Completion Date**

subject to adjustments of this Contract Time as provided in the Contract Documents.

Time is of the essence in the Contract Documents and all obligations thereunder. If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents (to include not only the entire Work but any portion of the Work as set forth above), the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of $_____ per calendar day, commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable estimate of damages the Owner will incur because of delayed completion of the Work. The Owner may deduct liquidated damages as described in this paragraph from any unpaid amounts then or thereafter due the Contractor under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at the maximum allowable rate.

4. Contract Sum.

A. Payment. The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be _____ Dollars and Zero Cents ($_____), subject to additions and deductions as provided in the Contract Documents.

B. Alternates. The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner. *(State the numbers or other identification of accepted alternates. If decisions on other alternates are to be made by the Owner subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)*

C. Unit Prices. Unit prices, if any, are reflected in the Contractor's Bid.

5. Payments.

A. Progress Payments.

(1) Based upon Applications for Payment submitted to the Architect/Engineer by the Contractor and Certificates for Payment issued by the Architect/Engineer, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

(2) The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

SAMPLE

(3) Payments shall be made by Owner in accordance with the requirements of Section 218.735, Florida Statutes.

(4) Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect/Engineer may require. This schedule, unless objected to by the Owner or Architect/Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

(5) Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

(6) Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

i. Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of five percent (5.00%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 3.3.B. of the General Conditions;

ii. Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), supported by paid receipts, less retainage of five percent (5.00%);

iii. Subtract the aggregate of previous payments made by the Owner; and

iv. Subtract amounts, if any, for which the Architect/Engineer has withheld or nullified an Application for Payment, in whole or in part as provided in Section 3.3.C. of the General Conditions.

(7) The progress payment amount determined in accordance with Section 5.A(6) shall be further modified under the following circumstances:

i. Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect/Engineer shall determine for

SAMPLE

incomplete Work, retainage applicable to such work and unsettled claims.

ii. Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 3.2.B. of the General Conditions.

(8) Reduction or limitation of retainage, if any, shall be as follows:

Notwithstanding the foregoing, upon completion of at least 50% of the Work, as determined by the Architect/Engineer and Owner, the Owner may, with the concurrence of the Architect/Engineer, reduce to two and one-half percent (2.5%) the amount of retainage withheld from each subsequent progress payment.

(9) Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

B. Final Payment. Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when:

(1) The Contractor has fully performed the Work except for the Contractor's responsibility to correct Work as provided in Section 2.4.C. of the General Conditions, and to satisfy other requirements, if any, which extend beyond final payment; and

(2) A final Application for Payment has been approved by the Architect/Engineer.

6. Termination or Suspension.

A. Termination. The Agreement may be terminated by the Owner or the Contractor as provided in Article XIV of the General Conditions.

B. Suspension by Owner. The Work may be suspended by the Owner as provided in Article XIV of the General Conditions.

7. Other Provisions.

A. Substantial Completion Defined. Substantial Completion shall be defined as provided in Article I of the General Conditions. In the event a temporary certificate of occupancy or completion is issued establishing Substantial Completion, the Contractor shall diligently pursue the issuance of a permanent certificate of occupancy or completion.

B. Project Meetings. There shall be a project meeting, at the jobsite or other location acceptable to the parties, on a regularly scheduled basis. The meeting will be attended by a representative of the Contractor, Architect/Engineer and Owner. These representatives shall be authorized to make decisions that are not otherwise contrary to the requirements of this Agreement.

SAMPLE

C. Weather. Any rainfall, temperatures below 32 degrees Fahrenheit or winds greater than 25 m.p.h. which actually prevents Work on a given day, shall be considered lost time and an additional day added to the Contract Time, provided no work could be done on site, and provided written notice has been submitted to the Owner by the Contractor documenting same.

D. Shop Drawings; Critical Submittals. In consideration of the impact of timely review of submittals and shop drawings on the overall progress of the Work, it is hereby agreed that the Owner shall cause his agents and design professionals to accomplish the review of any particular "critical" submittals and/or shop drawings and return same to the Contractor within fourteen (14) days.

E. Applications for Payment. Applications for Payment shall be submitted once monthly at regular intervals and shall include detailed documentation of all costs incurred.

F. Punch List. Within 30 days after obtainment of Substantial Completion, the Owner shall generate a "punch list" of all work items requiring remedial attention by the Contractor. Within 5 days thereafter the Architect/Engineer shall assign a fair value to the punch list items, which sum shall be deducted from the next scheduled progress payment to the Contractor. Upon satisfactory completion of the punch list items, as certified by the Architect/Engineer, the previously deducted sum shall be paid to the Contractor.

G. Closeout documentation. Within 30 days after obtainment of Substantial Completion and before final payment, Contractor shall gather and deliver to Owner all warranty documentation, all manufacturer's product and warranty literature, all manuals (including parts and technical manuals), all schematics and handbooks, and all as-built drawings.

H. Governing Provisions; Conflicts. In the event of a conflict between this Agreement and the Specifications, or as between the General Conditions and the Specifications, the Specifications shall govern.

I. E-Verify. The Contractor's employment of unauthorized aliens is a violation of Section 274(e) of the Federal Immigration and Employment Act. The Contractor shall utilize the U.S. Department of Homeland Security E-Verify system to verify the employment eligibility of all new employees hired during the term of this Agreement, and shall require the same verification procedure of all Subcontractors.

8. Insurance and Bonding. If and to the extent required by the Invitation for Bid documents, the Contractor shall furnish insurance coverage for (but not necessarily limited to) workers' compensation, commercial general liability, auto liability, excess liability, and builder's risk. The Contractor shall furnish to the Owner all appropriate policies and Certificate(s) of Insurance. The Contractor shall also post a Payment and Performance Bond for the Contract Sum, within ten (10) days following notification of intent to award, and otherwise in accordance with the Invitation for Bid documents.

9. Independent Contractor. The Contractor acknowledges that it is functioning as an independent contractor in performing under the terms of this Agreement, and it is not acting as an employee of the Owner.

SAMPLE

10. Entire Agreement. This Agreement (inclusive of the Contract Documents incorporated herein by reference) represents the full agreement of the parties.

11. Amendments; Waivers; Assignment.

A. Amendments. This Agreement may be amended only pursuant to an instrument in writing that has been jointly executed by authorized representatives of the parties hereto.

B. Waivers. Neither this Agreement nor any portion of it may be modified or waived orally. However, each party (through its governing body or properly authorized officer) shall have the right, but not the obligation, to waive, on a case-by-case basis, any right or condition herein reserved or intended for the benefit or protection of such party without being deemed or considered to have waived such right or condition for any other case, situation, or circumstance and without being deemed or considered to have waived any other right or condition. No such waiver shall be effective unless made in writing with an express and specific statement of the intent of such governing body or officer to provide such waiver.

C. Assignment. The rights and obligations of either party to this Agreement may be assigned to a third party only pursuant to a written amendment hereto.

12. Validity. Each of the Owner and Contractor represents and warrants to the other its respective authority to enter into this Agreement.

13. Covenant to Defend. Neither the validity of this Agreement nor the validity of any portion hereof may be challenged by any party hereto, and each party hereto hereby waives any right to initiate any such challenge. Furthermore, if this Agreement or any portion hereof is challenged by a third party in any judicial, administrative, or appellate proceeding (each party hereby covenanting with the other party not to initiate, encourage, foster, promote, cooperate with, or acquiesce to such challenge), the parties hereto collectively and individually agree, at their individual sole cost and expense, to defend in good faith its validity through a final judicial determination or other resolution, unless all parties mutually agree in writing not to defend such challenge or not to appeal any decision invalidating this Agreement or any portion thereof.

14. Disclaimer of Third-Party Beneficiaries; Successors and Assigns. This Agreement is solely for the benefit of the parties hereto, and no right, privilege, or cause of action shall by reason hereof accrue upon, to, or for the benefit of any third party. Nothing in this Agreement is intended or shall be construed to confer upon or give any person, corporation, partnership, trust, private entity, agency, or other governmental entity any right, privilege, remedy, or claim under or by reason of this Agreement or any provisions or conditions hereof. This Agreement shall be binding upon, and its benefits and advantages shall inure to, the successors and assigns of the parties hereto.

15. Construction.

A. Headings and Captions. The headings and captions of articles, sections, and paragraphs used in this Agreement are for convenience of reference only and are not intended to define or limit their contents, nor are they to affect the construction of or be taken into consideration in interpreting this Agreement.

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B. Legal References. All references to statutory sections or chapters shall be construed to include subsequent amendments to such provisions, and to refer to the successor provision of any such provision. References to "applicable law" and "general law" shall be construed to include provisions of local, state and federal law, whether established by legislative action, administrative rule or regulation, or judicial decision.

16. Severability. The provisions of this Agreement are declared by the parties hereto to be severable. In the event any term or provision of this Agreement shall be held invalid by a court of competent jurisdiction, such invalid term or provision should not affect the validity of any other term or provision hereof; and all such terms and provisions hereof shall be enforceable to the fullest extent permitted by law as if such invalid term or provision had never been part of this Agreement; provided, however, if any term or provision of this Agreement is held to be invalid due to the scope or extent thereof, then, to the extent permitted by law, such term or provision shall be automatically deemed modified in order that it may be enforced to the maximum scope and extent permitted by law.

17. Governing Law; Venue. This Agreement shall be governed by the laws of the State of Florida. Venue for any petition for writ of certiorari or other court action allowed by this Agreement shall be in the Circuit Court of the Twelfth Judicial Circuit in and for Manatee County, Florida.

18. Attorney's Fees and Costs. In any claim dispute procedure or litigation arising from this Agreement, each party hereto shall be solely responsible for paying its attorney's fees and costs.

19. Notices. All notices, comments, consents, objections, approvals, waivers, and elections under this Agreement shall be in writing and shall be given only by hand delivery for which a receipt is obtained, or certified mail, prepaid with confirmation of delivery requested, or by electronic mail with delivery confirmation. All such communications shall be addressed to the applicable addressees set forth below or as any party may otherwise designate in the manner prescribed herein.

To the Owner: _____
_____
_____
_____
Email: _____

To the Contractor:

_____
_____
_____
_____
Email: _____

SAMPLE

Notices, comments, consents, objections, approvals, waivers, and elections shall be deemed given when received by the party for whom such communication is intended at such party's address herein specified, or such other physical address or email address as such party may have substituted by notice to the other.

20. Public Records Law. The Contractor shall comply with the Florida Public Records Act (Chapter 119, Florida Statutes), and shall:

A. Keep and maintain public records required by the Owner to perform the services called for in this Agreement.
B. Upon request from the Owner's custodian of public records, provide the Owner with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes or as otherwise provided by law.
C. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of this Agreement and following completion of this Agreement if the Contractor does not transfer the records to the Owner.
D. Upon completion of this Agreement, transfer, at no cost, to the Owner all public records in possession of the Contractor or keep and maintain such public records. If the Contractor transfers all public records to the Owner upon completion of the Agreement, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of the Agreement, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the Owner, upon request from the Owner's custodian of public records, in a format that is compatible with the information technology systems of the Owner.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE OWNER'S CUSTODIAN OF PUBLIC RECORDS AT 941-748-4501, EXT. 5845; DEBBIE.SCACCIANOCE@MYMANATEE.ORG; POST OFFICE BOX 1000, BRADENTON, FLORIDA 34206.

21. Exhibits. Exhibits to this Agreement are as follows:

Exhibit A—Title(s) of Drawings

Exhibit B—Title(s) of Specifications

Exhibit C—Affidavit of No Conflict

Exhibit D—Certificate(s) of Insurance

Exhibit E—Payment and Performance Bond

SAMPLE

Exhibit F—Standard Forms

1—Application for Payment
2—Certificate of Substantial Completion
3—Final Reconciliation / Warranty / Affidavit
4—Change Order

(*Remainder of this page intentionally left blank*)

SAMPLE

WHEREFORE, the parties hereto have executed this Agreement as of the date last executed below.

_____
Name of Contractor

By: _____

Printed Name: _____

Title: _____

Date: _____

MANATEE COUNTY, a political subdivision of the State of Florida

By: _____

Printed Name: _____

Title: _____

Date: _____

SAMPLE

GENERAL CONDITIONS

of the

CONSTRUCTION AGREEMENT

SAMPLE

TABLE OF CONTENTS FOR GENERAL CONDITIONS

Page

Article I -- Definitions GC-1

1.1 Definitions GC-1
A. Acceptance GC-1
B. Application for Payment GC-1
C. Architect/Engineer GC-1
D. Change Order GC-1
E. Construction Services GC-1
F. Construction Team GC-1
G. Contract Sum GC-1
H. Contract Time GC-1
I. Contractor's Personnel GC-1
J. Days GC-1
K. Defective GC-2
L. Field Directive GC-2
M. Final Completion Date GC-2
N. Float Time GC-2
O. Force Majeure GC-2
P. Notice to Proceed GC-2
Q. Owner GC-2
R. Owner's Project Representative GC-2
S. Payment and Performance Bond GC-2
T. Permitting Authority GC-2
U. Procurement Ordinance GC-2
V. Progress Report GC-2
W. Project GC-2
X. Project Costs GC-3
Y. Project Manager GC-3
Z. Project Plans and Specifications GC-3
AA Project Schedule GC-3
BB. Project Site GC-3
CC. Subcontractor GC-3
DD. Substantial Completion and Substantially Complete GC-3
EE. Substantial Completion Date GC-3
FF. Substitute GC-3
GG. Unit Price Work GC-4
HH. Work GC-4
II. Work Directive Change GC-4

Article II -- Relationship and Responsibilities GC-4

2.1 Relationship between Contractor and Owner GC-4
A. Purpose GC-4
B. Construction Team GC-4
C. Owner's Reliance on Bid (or GMP) GC-4

SAMPLE

2.2 General Contractor Responsibilities GC-5
A. Personnel GC-5
B. Cooperation with Architect/Engineer GC-5
C. Timely Performance GC-5
D. Duty to Defend Work GC-5
E. Trade and Industry Terminology GC-5
2.3 Project Schedule GC-6
2.4 Construction Services GC-7
A. Construction of Project GC-7
B. Notice to Proceed GC-7
C. Quality of Work GC-7
D. Materials GC-7
E. Accountability for Work GC-7
F. Contract Sum GC-8
G. Governing Specifications GC-8
H. Adherence to Project Schedule GC-8
I. Superintendent *GC-8*
J. Work Hours GC-8
K. Overtime-Related Costs GC-8
L. Insurance, Overhead and Utilities GC-9
M. Cleanliness GC-9
N. Loading GC-9
O. Safety and Protection GC-9
P. Emergencies GC-10
Q. Substitutes GC-10
R. Surveys and Stakes GC-10
S. Suitability of Project Site GC-11
T. Project Specification Errors GC-11
U. Remediation of Contamination GC-11
V. Interfacing GC-12
W. Job Site Facilities GC-13
X. Weather Protection GC-13
Y. Performance and Payment Bond GC-13
Z. Construction Phase; Building Permit; Code Inspections GC-13
(1) Building Permit GC-13
(2) Code Inspections GC-14
(3) Contractor's Personnel GC-14
(4) Lines of Authority GC-14
AA. Quality Control GC-14
BB. Management of Subcontractors GC-15
CC. Job Requirements GC-15
DD. As-Built Drawings GC-17
EE. Progress Reports GC-17
FF. Contractor's Warranty GC-17
GG. Apprentices GC-18
HH. Schedule of Values GC-18
II. Other Contracts GC-18

Article III -- Compensation GC-18

3.1 Compensation GC-18

SAMPLE

A. Adjustments GC-18
B. Valuation GC-18
C. Unit Price Work GC-19
3.2 Schedule of Compensation GC-19
A. Periodic Payments for Services GC-19
B. *Payment for Materials and Equipment* GC-19
C. Credit toward Contract Sum GC-19
3.3 Invoice and Payment GC-20
A. Invoices GC-20
B. Additional Information; Processing of Invoices GC-20
C. Architect/Engineer's Approval GC-20
D. Warrants of Contractor with Respect to Payments GC-20
E. All Compensation Included GC-20

Article IV -- Subcontractors GC-21

4.1 Subcontracts GC-21
A. Subcontracts Generally GC-21
B. No Damages for Delay GC-21
C. Subcontractual Relations GC-21
D. Insurance; Acts & Omissions GC-22
4.2 Relationship and Responsibilities GC-22
4.3 Payments to Subcontractors; Monthly Statements GC-22
A. Payment GC-22
B. Final Payment of Subcontractors GC-22
4.4 Responsibility for Subcontractors GC-22
4.5 Contingent Assignment of Subcontracts GC-23

Article V -- Changes in Work GC-23

5.1 General GC-23
5.2 Minor Changes in the Work GC-23
5.3 Emergencies GC-24
5.4 Concealed Conditions GC-24
5.5 Hazardous Materials GC-24
5.6 Change Orders; Adjustments to Contract Sum GC-25
A. Change Orders Generally GC-25
5.7 Owner-Initiated Changes GC-25
5.8 Unauthorized Work GC-25
5.9 Defective Work GC-25
5.10 Estimates for Changes GC-26
5.11 Form of Proposed Changes GC-26
5.12 Changes to Contract Time GC-26

Article VI -- Role of Architect/Engineer GC-26

6.1 General GC-26
A. Retaining GC-26
B. Duties GC-26
C. Termination GC-26
6.2 Administration GC-27

SAMPLE

A. Site Visits GC-27
B. Reporting GC-27
6.3 Interpretation of Project Plans and Specifications GC-27
6.4 Rejection of Non-Conforming Work GC-27
6.5 Correction of Work GC-27
6.6 Timely Performance of Architect/Engineer GC-28

Article VII -- Owner's Rights and Responsibilities GC-28

7.1 Project Site; Title GC-28
7.2 Project Plans and Specifications; Architect/Engineer GC-28
7.3 Surveys; Soil Tests and Other Project Site Information GC-28
7.4 Information; Communication; Coordination GC-29
7.5 Governmental Body GC-29
7.6 Pre-Completion Acceptance GC-29
7.7 Ownership and Use of Drawings, Specifications and Other Instruments of Service GC-29
7.8 Owner's Project Representative GC-30
A. Responsibilities GC-30
B. Limitations GC-31

Article VIII -- Resolution of Disagreements; Claims for Compensation GC-31

8.1 Owner to Decide Disputes GC-31
8.2 Finality GC-31
8.3 No Damages for Delay GC-31
8.4 Permitted Claims Procedure GC-32
8.5 Contract Claims and Disputes GC-32
8.6 Claims for Consequential Damages GC-33

Article IX -- Indemnity GC-33

9.1 Indemnity GC-33
A. Indemnification Generally GC-33
B. Indemnification; Enforcement Actions GC-33
C. Claims by Employees GC-33
9.2 Duty to Defend GC-33

Article X-- Accounting Records; Ownership of Documents GC-33

10.1 Accounting Records GC-34
10.2 Inspection and Audit GC-34
10.3 Access GC-34
10.4 Ownership of Documents GC-34

Article XI -- Public Contract Laws GC-35

11.1 Equal Opportunity Employment GC-35
A. Employment GC-35
B. Participation GC-35
11.2 Immigration Reform and Control Act of 1986 ..... GC-35
11.3 No Conflict of Interest GC-35

SAMPLE

A. No Interest in Business Activity GC-35
B. No Appearance of Conflict GC-36
11.4 Truth in Negotiations GC-36
11.5 Public Entity Crimes GC-36

Article XII-- Force Majeure, Fire or Other Casualty GC-36

12.1 Force Majeure GC-36
A. Unavoidable Delays GC-36
B. Concurrent Contractor Delays GC-36
C. Notice; Mitigation GC-36
12.2 Casualty; Actions by Owner and Contractor GC-37
12.3 Approval of Plans and Specifications GC-37
12.4 Notice of Loss or Damage GC-37

Article XIII -- Representations, Warranties and Covenants GC-38

13.1 Representations and Warranties of Contractor GC-38
13.2 Representations of the Owner GC-40

Article XIV -- Termination and Suspension GC-41

14.1 Termination for Cause by Owner GC-41
A. Nonperformance GC-41
B. Insolvency GC-42
C. Illegality GC-42
D. Rights of Owner GC-42
14.2 Termination without Cause by Owner GC-42
A. Release of Contractor GC-43
B. Waiver of Protest GC-43
14.3 Suspension without Cause GC-43
14.4 Termination Based Upon Abandonment, Casualty or Force Majeure GC-43
14.5 Vacation of Project Site; Delivery of Documents GC-43
14.6 Termination by the Contractor GC-44

SAMPLE

GENERAL CONDITIONS
ARTICLE I
DEFINITIONS

1.1 Definitions. For purposes of the Contract Documents, the following terms shall have the following meanings.

A. Acceptance: The acceptance of the Project into the Owner's operating public infrastructure.

B. Application for Payment: The form approved and accepted by the Owner, which is to be used by Contractor in requesting progress payments or final payment and which is to include such supporting documentation as is required by the Contract Documents.

C. Architect/Engineer: _____, a _____ corporation or limited liability company, registered and licensed to do business in the State of Florida, OR _____, an employee of Owner.

D. Change Order: A written order signed by the Owner, the Architect/Engineer and the Contractor authorizing a change in the Project Plans and/or Specifications and, if necessary, a corresponding adjustment in the Contract Sum and/or Contract Time, pursuant to Article V.

E. Construction Services: The Construction Services to be provided by Contractor pursuant to Section 2.4, in accordance with the terms and provisions of the Contract Documents.

F. Construction Team: The working team established pursuant to Section 2.1.B.

G. Contract Sum: The total compensation to be paid to the Contractor for Construction Services rendered pursuant to the Contract Documents, as set forth in Contractor's Bid (or Guaranteed Maximum Price Addendum), unless adjusted in accordance with the terms of the Contract Documents

H. Contract Time: The time period during which all Construction Services are to be completed pursuant to the Contract Documents, to be set forth in the Project Schedule.

I. Contractor's Personnel: The Contractor's key personnel designated by Contractor.

J. Days: Calendar days except when specified differently. When time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or legal holiday, such day will be omitted from the computation.

SAMPLE

K. Defective: When modifying the term "Work", referring to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or that does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or that has been damaged prior to Owner's approval of final payment (unless responsibility for the protection thereof has been assumed by Owner).

L. Field Directive: A written order issued by Owner which orders minor changes in the Work not involving a change in Contract Time, to be paid from the Owner's contingency funds.

M. Final Completion Date: The date upon which the Project is fully constructed and all Work required on the Project and Project Site is fully performed as verified in writing by the Owner.

N. Float Time: The time available in the Project Schedule during which an unexpected activity can be completed without delaying Substantial Completion of the Work.

O. Force Majeure: Those conditions constituting excuse from performance as described in and subject to the conditions described in Article XII.

P. Notice to Proceed: Written notice by Owner (after execution of Contract) to Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform the Work.

Q. Owner: Manatee County, a political subdivision of the State of Florida.

R. Owner's Project Representative: The individual designated by Owner to perform those functions set forth in Section 7.8.

S. Payment and Performance Bond: The Payment and Performance Bond security posted pursuant to Section 2.4.Y to guarantee payment and performance by the Contractor of its obligations hereunder.

T. Permitting Authority: Any applicable governmental authority acting in its governmental and regulatory capacity which is required to issue or grant any permit, certificate, license or other approval which is required as a condition precedent to the commencement or approved of the Work, or any part thereof, including the building permit.

U. Procurement Ordinance: The Manatee County Procurement Code, Chapter 2-26 of the Manatee County Code of Laws, as amended from time to time.

V. Progress Report: A report to Owner that includes all information required pursuant to the Contract Documents and submitted in accordance with Section 2.4.EE, hereof.

W. Project: The total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by Owner and by separate contractors. For the purposes of the Contract Documents, the term Project shall

SAMPLE

include all areas of proposed improvements and all areas which may reasonably be judged to have an impact on the Project.

X. Project Costs: The costs incurred by the Contractor to plan, construct and equip the Project and included within, and paid as a component of, the Contract Sum.

Y. Project Manager: Subject to the prior written consent of Owner, the individual designated to receive notices on behalf of the Contractor, or such other individual designated by the Contractor, from time to time, pursuant to written notice in accordance with the Contract Documents.

Z. Project Plans and Specifications: The one hundred percent (100%) construction drawings and specifications prepared by the Architect/Engineer, and any changes, supplements, amendments or additions thereto approved by the Owner, which shall also include any construction drawings and final specifications required for the repair or construction of the Project, as provided herein.

AA. Project Schedule: The schedule and sequence of events for the commencement, progression and completion of the Project, developed pursuant to Section 2.3., as such schedule may be amended as provided herein.

BB. Project Site: The site depicted in the Project Plans and Specifications, inclusive of all rights of way, temporary construction easements or licensed or leased sovereign lands.

CC. Subcontractor: Any individual (other than a direct employee of the Contractor) or organization retained by Contractor to plan, construct or equip the Project pursuant to Article IV.

DD. Substantial Completion and Substantially Complete: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use; provided, however, that as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy or completion and other permits, approvals, licenses, and other documents from any governmental authority which are necessary for the beneficial occupancy of the Project or any designated portion thereof.

EE. Substantial Completion Date: The date on which the Project or designated portion thereof is deemed to be Substantially Complete, as evidenced by receipt of (i) the Architect/Engineer's certificate of Substantial Completion, (ii) written Acceptance of the Project by the Owner, and (iii) approvals of any other authority as may be necessary or otherwise required.

FF. Substitute: Materials or equipment offered by the Contractor as an alternative to that set forth in the Project Plans and Specifications, where (i) the Project Plans and Specifications do not authorize an "approved equal", or (ii) the Owner, in its reasonable discretion, determines that a pre-authorized "approved equal" will result in a substantial change to the Work because of cost, quality or other difference in comparison to the materials or equipment specified.

GG. Unit Price Work: Work to be paid for on the basis of unit prices.

SAMPLE

HH. Work: The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

II. Work Directive Change: A written directive to Contractor, issued on or after the effective date of the Agreement pursuant to Section 5.8 and signed by Owner's Project Representative, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed or responding to emergencies.

ARTICLE II
RELATIONSHIP AND RESPONSIBILITIES

2.1 Relationship between Contractor and Owner. The Contractor accepts the relationship of trust and confidence established with Owner pursuant to the Contract Documents. The Contractor shall furnish its best skill and judgment and cooperate with Owner and Owner's Project Representative in furthering the interests of the Owner. The Contractor agrees to provide the professional services required to complete the Project consistent with the Owner's direction and the terms of the Contract Documents. All services provided hereunder by Contractor, either directly or through Subcontractors, shall be provided in accordance with sound construction practices and applicable professional construction standards.

A. Purpose. The purpose of the Contract Documents is to provide for the provision of construction services for the Project on the Project Site by the Contractor, and construction of the Project by the Contractor in accordance with the Project Plans and Specifications. The further purpose of the Contract Documents is to define and delineate the responsibilities and obligations of the parties to the Contract Documents and to express the desire of all such parties to cooperate to accomplish the purposes and expectations of the Contract Documents.

B. Construction Team. The Contractor, Owner and Architect/Engineer shall be called the "Construction Team" and shall work together as a team commencing upon full execution of the Contract Documents through Substantial Completion. As provided in Section 2.2, the Contractor and Architect/Engineer shall work jointly through completion and shall be available thereafter should additional services be required. The Contractor shall provide leadership to the Construction Team on all matters relating to construction. The Contractor understands, acknowledges and agrees that the Architect/Engineer shall provide leadership to the Construction Team on all matters relating to design.

C. Owner's Reliance on Bid (or Guaranteed Maximum Price Addendum). The Contractor acknowledges that the representations, statements, information and pricing contained in its Bid (or Guaranteed Maximum Price Addendum) have been relied upon by the Owner and have resulted in the award of this Project to the Contractor.

SAMPLE

2.2 General Contractor Responsibilities. In addition to the other responsibilities set forth herein, the Contractor shall have the following responsibilities pursuant to the Contract Documents:

A. Personnel. The Contractor represents that it has secured, or shall secure, all personnel necessary to perform the Work, none of whom shall be employees of the Owner. Primary liaison between the Contractor and the Owner shall be through the Owner's Project Representative and Contractor's Project Manager. All of the services required herein shall be performed by the Contractor or under the Contractor's supervision, and all personnel engaged in the Work shall be fully qualified and shall be authorized or permitted under law to perform such services.

B. Cooperation with Architect/Engineer. The Contractor's services shall be provided in conjunction with the services of the Architect/Engineer. In the performance of professional services, the Contractor acknowledges that time is critical for Project delivery. The Contractor acknowledges that timely construction utilizing the services of an Architect/Engineer and a Contractor requires maximum cooperation between all parties.

C. Timely Performance. The Contractor shall perform all services as expeditiously as is consistent with professional skill and care and the orderly progress of the Work, in accordance with the Project Schedule. Verification of estimated Project Schedule goals will be made as requested by the Owner.

D. Duty to Defend Work. In the event of any dispute between the Owner and any Permitting Authority that relates to the quality, completeness or professional workmanship of the Contractor's services or Work, the Contractor shall, at its sole cost and expense, cooperate with the Owner to defend the quality and workmanship of the Contractor's services and Work.

E. Trade and Industry Terminology. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials, or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or laws or regulations in effect at the time of opening of Bids (or at the time of execution of the Guaranteed Maximum Price Addendum), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of Owner or Contractor, or any of their agents or employees from those set forth in the Contract Documents. Computed dimensions shall govern over scaled dimensions.

2.3 Project Schedule. The Contractor, within ten (10) days after being awarded the Agreement, shall prepare and submit for the Owner's and Architect/Engineer's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the

SAMPLE

extent required by the Contract Documents, and shall provide for expeditious and practicable execution of Work.

A. The Project Schedule shall show a breakdown of all tasks to be performed, and their relationship in achieving the completion of each phase of Work, subject to review of Owner and Architect/Engineer and approval or rejection by Owner. The Project Schedule shall show, at a minimum, the approximate dates on which each segment of the Work is expected to be started and finished, the proposed traffic flows during each month, the anticipated earnings by the Contractor for each month and the approximate number of crews and equipment to be used. The Project Schedule shall include all phases of procurement, approval of shop drawings, proposed Change Orders in progress, schedules for Change Orders, and performance testing requirements. The Project Schedule shall include a construction commencement date and Project Substantial Completion Date, which dates shall accommodate known or reasonably anticipated geographic, atmospheric and weather conditions.

B. The Project Schedule shall serve as the framework for the subsequent development of all detailed schedules. The Project Schedule shall be used to verify Contractor performance and to allow the Owner's Project Representative to monitor the Contractor's efforts.

C. The Project Schedule may be adjusted by the Contractor pursuant to Article V. The Owner shall have the right to reschedule Work provided such rescheduling is in accord with the remainder of terms of the Contract Documents.

D. The Contractor shall prepare a submittal schedule, promptly after being awarded the Agreement and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect/Engineer's approval. The Architect/Engineer's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect/Engineer reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

E. The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect/Engineer.

2.4 Construction Services. The Contractor shall provide the following Construction Services:

A. Construction of Project. The Contractor shall work from the receipt of a Notice to Proceed through the Substantial Completion of the Project in accordance with the terms of the Contract Documents to manage the construction of the Project. The Construction Services provided by the Contractor to construct the Project shall include without limitation (1) all services

SAMPLE

necessary and commensurate with established construction standards, and (2) all services described in the Invitation for Bid (or Request for Proposal) and the Bid (or Guaranteed Maximum Price Addendum).

B. Notice to Proceed. A Notice to Proceed may be given at any time within thirty (30) days after the effective date of the Agreement. Contractor shall start to perform the Work on the date specified in the Notice to Proceed, but no Work shall be done at the site prior to the issuance of the Notice to Proceed.

C. Quality of Work. If at any time the labor used or to be used appears to the Owner as insufficient or improper for securing the quality of Work required or the required rate of progress, the Owner may order the Contractor to increase its efficiency or to improve the character of its Work, and the Contractor shall conform to such an order. Any such order shall not entitle Contractor to any additional compensation or any increase in Contract Time. The failure of the Owner to demand any increase of such efficiency or any improvement shall not release the Contractor from its obligation to secure the quality of Work or the rate of progress necessary to complete the Work within the limits imposed by the Contract Documents. The Owner may require the Contractor to remove such personnel as the Owner deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the Project is deemed to be contrary to the Owner's interest. The Contractor shall provide good quality workmanship and shall promptly correct construction defects without additional compensation. Acceptance of the Work by the Owner shall not relieve the Contractor of the responsibility for subsequent correction of any construction defects.

D. Materials. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Architect/Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instruction of the applicable supplier except as otherwise provided in the Contract Documents.

E. Accountability for Work. The Contractor shall be solely accountable for its Work, including plans review and complete submittals. The Contractor shall be solely responsible for means, methods, techniques, sequences and procedures of construction. If a specific means, method, technique, sequence or procedure of construction is required by the Contract Documents, the Contractor may utilize an alternative means, method, technique, sequence or procedure acceptable to the Architect/Engineer if the Contractor submits sufficient information to allow the Architect/Engineer to determine that the alternative is equivalent to that required by the Contract Documents.

F. Contract Sum. The Contractor shall construct the Project so that the Project can be built for a cost not to exceed the Contract Sum.

G. Governing Specifications. In the absence of specified Owner design standards or guidelines, the Architect/Engineer shall use, and the Contractor shall comply with, the most recent version of the applicable FDOT or AASHTO design standards. In general, the Project shall be constructed by the Contractor in accordance with applicable industry standards. The Contractor shall be responsible for utilizing and maintaining current knowledge of any laws,

SAMPLE

ordinances, codes, rules, regulations, standards, guidelines, special conditions, specifications or other mandates relevant to the Project or the services to be performed.

H. Adherence to Project Schedule. The development and equipping of the Project shall be undertaken and completed in accordance with the Project Schedule, and within the Contract Time described therein.

I. Superintendent. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project Site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

(1) The Contractor, as soon as practicable after award of the Agreement, shall furnish in writing to the Owner through the Architect/Engineer the name and qualifications of the proposed superintendent. The Architect/Engineer may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect/Engineer has reasonable objection to the proposed superintendent or (2) that the Architect/Engineer requires additional time to review. Failure of the Architect/Engineer to reply within 14 days shall constitute notice of no reasonable objection.

(2) The Contractor shall not employ a proposed superintendent to whom the Owner or Architect/Engineer has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not be unreasonably withheld or delayed.

J. Work Hours. Contractor shall provide competent, suitable qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and Contractor shall not permit overtime work or the performance of Work on Saturday, Sunday or legal holiday without Owner's written consent given after prior notice to Architect/Engineer (at least seventy-two (72) hours in advance).

K. Overtime-Related Costs. Contractor shall pay for all additional Architect/Engineer charges, inspection costs and Owner staff time for any overtime work which may be authorized. Such additional charges shall be an obligation of Contractor and no extra payment shall be made by Owner because such overtime work. At Owner's option, such overtime costs may be deducted from Contractor's monthly payment request or Contractor's retainage prior to release of final payment. Contractor's obligation to pay all overtime-related costs shall not apply if Contractor is directed by Owner to work overtime solely for Owner's convenience.

L. Insurance, Overhead and Utilities. Unless otherwise specified, Contractor shall furnish and assume full responsibility for all bonds, insurance, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

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M. Cleanliness. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project Site. Contractor shall restore to original conditions all property not designated for alteration by the Contract Documents If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from Contractor.

N. Loading. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

O. Safety and Protection. Contractor shall comply with all applicable federal, state and local safety regulations. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

(1) All employees on the Work and other persons and organizations who may be affected thereby;

(2) All the Work and materials and equipment to be incorporated therein, whether in storage on or off the Project Site; and

(3) Other property at the Project Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement during construction.

Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss, and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for the protection required by public authority or local conditions. Contractor shall provide reasonable maintenance of traffic for the public and preservation of the Owner's business, taking into full consideration all local conditions. Contractor's duties and responsibilities for safety and protection with regard to the Work shall continue until such time as all the Work is completed.

P. Emergencies. In emergencies affecting the safety or protection of persons or the Work or property at the Project Site or adjacent thereto, Contractor, without special instruction or authorization from Architect/Engineer or Owner, shall act to prevent threatened damage, injury or loss. Contractor shall give Owner prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner determines that a change in the Project is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variation.

Q. Substitutes. For Substitutes not included with the Bid (or Guaranteed Maximum Price Addendum), but submitted after the effective date of the Agreement (or

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Guaranteed Maximum Price Addendum), Contractor shall make written application to Architect/Engineer for acceptance thereof, certifying that the proposed Substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will also contain an itemized estimate of all costs and delays or schedule impacts that will result directly or indirectly from review, acceptance and provision of such Substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by the Architect/Engineer in evaluating the proposed Substitute. Architect/Engineer may require Contractor to furnish at Contractor's expense, additional data about the proposed Substitute. In rendering a decision, Owner, Architect/Engineer and Contractor shall have access to any available Float Time in the Project Schedule. If Substitute materials or equipment not included as part of the Bid (or Guaranteed Maximum Price Addendum), but proposed after the effective date of the Agreement, are accepted and are less costly than the originally specified materials or equipment, then the net difference in cost shall be credited to the Owner and an appropriate Change Order executed to adjust the Contract Sum.

(1) Architect/Engineer will be allowed a reasonable time within which to evaluate each proposed Substitute. Architect/Engineer will be the sole judge of acceptability and no Substitute will be ordered, installed or utilized without Architect/Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved shop drawing. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any Substitute.

(2) Contractor shall reimburse Owner for the charges of Architect/Engineer and Architect/Engineer's Consultants for evaluating each proposed Substitute submitted after the effective date of the Agreement and all costs resulting from any delays in the Work while the Substitute was undergoing review.

R. Surveys and Stakes. The Contractor shall furnish, as part of the Contract Sum, all labor, stakes, surveys, batter boards for structures, grade lines and other materials and supplies and shall set construction stakes and batter boards for establishing lines, position of structures, slopes and other controlling points necessary for the proper prosecution of the Work. Where rights-of-way, easements, property lines or any other conditions which make the lay-out of the Project or parts of the Project critical are involved, the Contractor shall employ a competent surveyor who is registered in the State of Florida for lay-out and staking. These stakes and marks shall constitute the field control by and in accord with which the Contractor shall govern and execute the Work. The Contractor shall be held responsible for the preservation of all stakes and marks and if for any reason any of the stakes or marks or batter boards become destroyed or disturbed, they shall be immediately and accurately replaced by the Contractor.

S. Suitability of Project Site. The Contractor has, by careful examination, satisfied itself as to the nature and location of the Work and all other matters which can in any way affect the Work, including, but not limited to details pertaining to borings, as shown on the drawings. Such boring information is not guaranteed to be more than a general indication of the materials likely to be found adjacent to holes bored at the Project Site, approximately at the locations indicated. The Contractor has examined boring data, where available, made its own interpretation of the subsurface conditions and other preliminary data, and has based its Bid (or Guaranteed Maximum Price Addendum) on its own opinion of the conditions likely to be

SAMPLE

encountered. Except as specifically provided in Sections 2.4.U., 5.4 and 5.5, no extra compensation or extension of time will be considered for any Project Site conditions that existed at the time of bidding (or at the time of execution of the Guaranteed Maximum Price Addendum). No verbal agreement or conversation with any officer, agent or employee of the Owner, before or after the execution of the Agreement, shall affect or modify any of the terms or obligations herein contained.

T. Project Specification Errors. If the Contractor, during the Work, finds that the drawings, specifications or other Contract Documents cannot be followed, the Contractor shall immediately inform the Owner in writing, and the Owner shall promptly check the accuracy of the information. Any Work done after such discovery, until any necessary changes are authorized, will be done at the Contractor's sole risk of non-payment and delay.

U. Remediation of Contamination. Owner and Contractor recognize that remediation of subsurface conditions may be necessary due to potential hazardous materials contamination. Because the presence or extent of any contamination is not known, Contractor shall include no cost in the Contract Sum, and no time in the Project Schedule, for cost or delays that might result from any necessary remediation. The Project Schedule will provide a period of time between demolition activities and the start of the next activity to commence any remediation if needed. Contractor shall use all reasonable efforts in scheduling the Project to minimize the likelihood that remediation delays construction. All hazardous materials remediation Work which Contractor agrees to perform shall be done pursuant to a Change Order or amendment consistent with the following:

(1) The dates of Substantial Completion shall be equitably adjusted based on delays, if any, incurred in connection with remediation efforts.

(2) Contractor and any Subcontractors which have mobilized on the Project Site, shall be paid for demonstrated costs of overhead operations at the Project Site during any period of delay of more than seven (7) days, except to the extent that Work proceeds concurrently with remediation. The categories of costs to be reimbursed are limited to those reasonably incurred at the jobsite during the delay period (such as trailers or offices, telephones, faxes, and the like); equipment dedicated to the Project and located at the Project Site; salaries and associated costs of personnel dedicated to the Project to the extent that they do not perform work on other projects; and other jobsite costs that are reasonable and which are incurred during the delay period. Subcontractors and suppliers which have not mobilized are limited to the costs set forth in Section 2.4.U(3).

(3) Contractor and any Subcontractor or supplier on the Project who is eligible for compensation shall be paid any demonstrated costs of escalation in materials or labor, and reasonable costs of off-site storage of materials identified to the Project, arising because of any delay of more than seven (7) days. Such Contractor, Subcontractors and suppliers are obligated to take all reasonable steps to mitigate escalation costs, such as through early purchase of materials.

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(4) Contractor, for itself and all Subcontractors and suppliers on the Project, hereby agrees that the extension of time for delays under Section 2.4.U(1), and payment of the costs identified in Sections 2.4.U(2) and/or Section 2.4.U(3), are the sole remedies for costs and delays described in this Section, and waives all claims and demands for extended home office overhead (including, but not limited to, "Eichleay" claims), lost profit or lost opportunities, and any special, indirect, or consequential damages arising as a result of delays described in this Section. The Contract Sum shall be adjusted to reflect payment of allowable costs.

(5) If any delay described in this section causes the time or cost for the Project to exceed the Contract Time or the Contact Sum, then the Owner may terminate the Agreement pursuant to Section 14.2.

(6) Contractor and any Subcontractor or supplier seeking additional costs under this Section 2.4.U. shall promptly submit estimates or any costs as requested by Owner, and detailed back-up for all costs when payment is sought or whenever reasonably requested by Owner. All costs are auditable, at Owner's discretion. Bid, estimate and pricing information reasonably related to any request for additional compensation will be provided promptly upon request.

(7) Contractor shall include provisions in its subcontracts and purchase orders consistent with this Section.

V. Interfacing.

(1) The Contractor shall take such measures as are necessary to ensure proper construction and delivery of the Project, including but not limited to providing for all procurement of long-lead items, the separate construction subcontracts, and the general conditions items are performed without duplication or overlap to maintain completion of all Work on schedule. Particular attention shall be given to provide that each Subcontractor bid package clearly identifies the Work included in that particular separate subcontract, its scheduling for start and completion, and its relationship to other separate contractors.

(2) Without assuming any design responsibilities of the Architect/Engineer, the Contractor shall include in the Progress Reports required under this Section 2.4 comments on overlap with any other separate subcontracts, omissions, lack of correlation between drawings, and any other deficiencies noted, in order that the Architect/Engineer may arrange for necessary corrections.

W. Job Site Facilities. The Contractor shall arrange for all job site facilities required and necessary to enable the Contractor and Architect/Engineer to perform their respective duties and to accommodate any representatives of the Owner which the Owner may choose to have present on the Project Site.

SAMPLE

X. Weather Protection. The Contractor shall provide temporary enclosures of building areas to assure orderly progress of the Work during periods when extreme weather conditions are likely to be experienced. The Contractor shall also be responsible for providing weather protection for Work in progress and for materials stored on the Project Site. A contingency plan shall be prepared upon request of the Owner for weather conditions that may affect the construction.

Y. Payment and Performance Bond. Prior to the construction commencement date, the Contractor shall obtain, for the benefit of and directed to the Owner, a Payment and Performance Bond satisfying the requirements of Section 255.05, Florida Statutes, covering the faithful performance by the Contractor of its obligations under the Contract Documents, including but not limited to the construction of the Project on the Project Site and the payment of all obligations arising thereunder, including all payments to Subcontractors, laborers, and materialmen. The surety selected by the Contractor to provide the Payment and Performance Bond shall be approved by the Owner prior to the issuance of such Bond, which approval shall not be unreasonably withheld or delayed provided that the surety is rated A or better by Best's Key Guide, latest edition. For Changes in the Work that result in an increase in the Contract Sum, Owner reserves the right to require the Contractor to secure and deliver additive riders to the Payment and Performance Bond.

Z. Construction Phase; Building Permits; Code Inspections. Unless otherwise provided, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work.

(1) Building Permit. The Owner and Architect/Engineer shall provide such information to any Permitting Authority as is necessary to obtain approval from the Permitting Authority to commence construction prior to beginning construction. The Contractor shall pull any required building permit, and shall be responsible for delivering and posting the building permit at the Project Site prior to the commencement of construction. The cost of the building permit is included in the Contract Sum. The Owner and Architect/Engineer shall fully cooperate with the Contractor when and where necessary.

(2) Code Inspections. The Project requires detailed code compliance inspection during construction in disciplines determined by any Permitting Authority. These disciplines normally include, but are not necessarily limited to, structural, mechanical, electrical, plumbing, general building and fire. The Contractor shall notify the appropriate inspector(s) and the Architect/Engineer, no less than 24 hours in advance, when the Work is ready for inspection and before the Work is covered up. All inspections shall be made for conformance with the applicable ordinances and building codes. Costs for all re-inspections of Work found defective and subsequently repaired shall not be included as Project Costs and shall be borne by the Contractor or as provided in the contract between Contractor and Subcontractor.

SAMPLE

(3) Contractor's Personnel. The Contractor shall maintain sufficient off-site support staff and competent full-time staff at the Project Site authorized to act on behalf of the Contractor to coordinate, inspect, and provide general direction of the Work and progress of the Subcontractors. At all times during the performance of the Work, the Owner shall have the right to demand replacement of Contractor Personnel to whom the Owner has reasonable objection, without liability to the Contractor.

(4) Lines of Authority. To provide general direction of the Work, the Contractor shall establish and maintain lines of authority for its personnel and shall provide this information to the Owner and all other affected parties, such as the code inspectors of any Permitting Authority, the Subcontractors, and the Architect/Engineer. The Owner and Architect/Engineer may attend meetings between the Contractor and his Subcontractors; however, such attendance is optional and shall not diminish either the authority or responsibility of the Contractor to administer the subcontracts.

AA. Quality Control. The Contractor shall develop and maintain a program, acceptable to the Owner and Architect/Engineer, to assure quality control of the construction. The Contractor shall be responsible for and supervise the Work of all Subcontractors, providing instructions to each when their Work does not conform to the requirements of the Project Plans and Specifications, and the Contractor shall continue to coordinate the Work of each Subcontractor to ensure that corrections are made in a timely manner so as to not affect the efficient progress of the Work. Should a disagreement occur between the Contractor and the Architect/Engineer over the acceptability of the Work, the Owner, at its sole discretion and in addition to any other remedies provided herein, shall have the right to determine the acceptability, provided that such determination is consistent with standards for construction projects of this type and generally accepted industry standards for workmanship in the State of Florida.

BB. Management of Subcontractors. All Subcontractors shall be compensated in accordance with Article IV. The Contractor shall solely control the Subcontractors. The Contractor shall negotiate all Change Orders and Field Orders with all affected Subcontractors and shall review the costs and advise the Owner and Architect/Engineer of their validity and reasonableness, acting in the Owner's best interest. When there is an imminent threat to health and safety, and Owner's Project Representative concurrence is impractical, the Contractor shall act immediately to remove the threats to health and safety and shall subsequently fully inform Owner of all such action taken. The Contractor shall also carefully review all shop drawings and then forward the same to the Architect/Engineer for review and actions. The Architect/Engineer will transmit them back to the Contractor, who will then issue the shop drawings to the affected Subcontractor for fabrication or revision. The Contractor shall maintain a suspense control system to promote expeditious handling. The Contractor shall request the Architect/Engineer to make interpretations of the drawings or specifications requested of him by the Subcontractors and shall maintain a business system to promote timely response. The Contractor shall inform the Architect/Engineer which shop drawings or requests for clarification have the greatest urgency, to enable the Architect/Engineer to prioritize requests coming from the Contractor. The Contractor shall advise the Owner and Architect/Engineer when timely response is not occurring on any of the above.

SAMPLE

CC. Job Requirements.

(1) The Contractor shall provide each of the following as a part of its services hereunder:

(a) Maintain a log of daily activities, including manpower records, equipment on site, weather, delays, major decisions, etc;

(b) Maintain a roster of companies on the Project with names and telephone numbers of key personnel;

(c) Establish and enforce job rules governing parking, clean-up, use of facilities, and worker discipline;

(d) Provide labor relations management and equal opportunity employment for a harmonious, productive Project;

(e) Provide and administer a safety program for the Project and monitor for subcontractor compliance without relieving them of responsibilities to perform Work in accordance with best acceptable practice;

(f) Provide a quality control program as provided under Section 2.4.C above;

(g) Provide miscellaneous office supplies that support the construction efforts which are consumed by its own forces;

(h) Provide local travel to and from its home office to the Project Site and to those other places within Manatee County as required by the Project;

(i) Verify that tests, equipment, and system start-ups and operating and maintenance instructions are conducted as required and in the presence of the required personnel and provide adequate records of same to the Architect/Engineer;

(j) Maintain at the job site orderly files for correspondence, reports of job conferences, shop drawings and sample submissions, reproductions of original Contract Documents including all addenda, change orders, field orders, additional drawings issued after execution of the Agreement, Owner/Architect/Engineer's clarifications and interpretations of the Contract Documents, Progress Reports, as-built drawings, and other project related documents;

(k) Keep a diary or log book, recording hours on the job site, weather conditions, data relative to questions of extras or deductions; list of visiting officials and representatives or manufacturers, fabricators,

SAMPLE

suppliers and distributors; daily activities, decisions, observations in general and specific observations in more detail as in the case of observing test procedures, and provide copies of same to Owner/Architect/Engineer;

(l) Record names, addresses and telephone numbers of all Contractors, Subcontractors and major suppliers of materials and equipment;

(m) Furnish Owner/Architect/Engineer periodic reports, as required, of progress of the Work and Contractor's compliance with the approved progress schedule and schedule of shop drawing submissions;

(n) Consult with Owner/Architect/Engineer in advance of scheduling major tests, inspections or start of important phases of the Work;

(o) Verify, during the course of the Work, that certificates, maintenance and operations manuals and other data required to be assembled and furnished are applicable to the items actually installed, and deliver same to Owner/Architect/Engineer for review prior to final Acceptance of the Work; and

(p) Cooperate with Owner in the administration of grants.

(2) The Contractor shall provide personnel and equipment, or shall arrange for separate Subcontractors to provide each of the following as a Project Cost:

(a) Services of independent testing laboratories, and provide the necessary testing of materials to ensure conformance to contract requirements; and

(b) Printing and distribution of all required bidding documents and shop drawings, including the sets required by Permitting Authority inspectors.

DD. As-Built Drawings. The Contractor shall continuously review as-built drawings and mark up progress prints to provide as much accuracy as possible. Prior to, and as a requirement for authorizing final payment to the Contractor due hereunder, the Contractor shall provide to the Owner an original set of marked-up, as-built Project Plans and Specifications and an electronic format of those records showing the location and dimensions of the Project as constructed, which documents shall be certified as being correct by the Contractor and the Architect/Engineer. Final as-built drawings shall be signed and sealed by a registered Florida surveyor.

EE. Progress Reports. The Contractor shall forward to the Owner, as soon as practicable after the first day of each month, a summary report of the progress of the various parts of the Work, to include those parts of the Work in fabrication and in the field, stating the existing status, estimated time of completion and cause of delay, if any. Together with the summary report, the Contractor shall submit any necessary revisions to the original schedule for the Owner's review

SAMPLE

and approval. In addition, more detailed schedules may be required by the Owner for daily traffic control.

FF. Contractor's Warranty. The Contractor warrants to the Owner and Architect/Engineer that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements will be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect/Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

(1) Contractor shall use its best efforts and due diligence to ensure that during the warranty period, those entities or individuals who have provided direct warranties to the Owner as required by the Contract Documents perform all required warranty Work in a timely manner and at the sole cost and expense of such warranty providers. Any such cost or expense not paid by the warranty providers shall be paid by the Contractor, to include any costs and attorney's fees incurred in warranty-related litigation between Contractor and any Subcontractors.

(2) The Contractor shall secure guarantees and warranties of Subcontractors, equipment suppliers and materialmen, and assemble and deliver same to the Owner in a manner that will facilitate their maximum enforcement and assure their meaningful implementation. The Contractor shall collect and deliver to the Owner any specific written guaranties or warranties given by others as required by subcontracts.

(3) At the Owner's request, the Contractor shall conduct, jointly with the Owner and the Architect/Engineer, no more than two (2) warranty inspections within three (3) years after the Substantial Completion Date.

GG. Apprentices. If Contractor employs apprentices, their performance of Work shall be governed by and shall comply with the provisions of Chapter 446, Florida Statutes.

HH. Schedule of Values. Unit prices shall be established for this Agreement by the submission of a schedule of values within ten (10) days of receipt of the Notice to Proceed. The schedule shall include quantities and prices of items equaling the Contract Sum and will subdivide the Work into components in sufficient detail to serve as the basis for progress payments during construction. Such prices shall include an appropriate amount of overhead and profit applicable to each item of Work. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

II. Other Contracts. The Owner reserves the right to let other contracts in connection with this Work. The Contractor shall afford other contractors reasonable

SAMPLE

opportunity for the introduction and storage of their materials and execution of their work, and promptly connect and coordinate the Work with theirs.

ARTICLE III
COMPENSATION

3.1 Compensation. The Contract Sum constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Sum.

A. Adjustments. The Contract Sum may only be changed by Change Order or by a written amendment. Any claim for an increase or decrease in the Contract Sum shall be based on written notice delivered by the party making the claim to the other party. Notice of the amount of the claim with supporting data shall be delivered within fifteen (15) days from the beginning of such occurrence and shall be accompanied by claimant's written statement that the amount claimed covers all amounts to which the claimant is entitled as a result of the occurrence of said event. Failure to deliver a claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

B. Valuation. The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Sum shall be determined in one of the following ways (at Owner's discretion):

(1) In the case of Unit Price Work, in accordance with Section 3.1.C, below; or

(2) By mutual acceptance of a lump sum; or

(3) On the basis of the cost of the Work, plus a negotiated Contractor's fee for overhead and profit. Contractor shall submit an itemized cost breakdown together with supporting data.

C. Unit Price Work. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment pursuant to a requested Change Order under the following conditions:

(1) If the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Sum and the variation in the quantity of the particular item of Unit Price Work performed by Contractor differs by more than 15% from the estimated quantity of such item indicated in the Agreement; and

(2) If there is no corresponding adjustment with respect to any other item of Work; and

(i) If Contractor believes that it has incurred additional expense as a result thereof; or

(ii) If Owner believes that the quantity variation entitles it to an

SAMPLE

adjustment in the unit price; or

(iii) If the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

3.2 Schedule of Compensation. All payments for services and material under the Contract Documents shall be made in accordance with the following provisions.

A. Periodic Payments for Services. The Contractor shall be entitled to receive payment for Construction Services rendered pursuant to Section 2.4 in periodic payments which shall reflect a fair apportionment of cost and schedule of values of services furnished prior to payment, subject to the provisions of this Section.

B. Payment for Materials and Equipment. In addition to the periodic payments authorized hereunder, payments may be made for material and equipment not incorporated in the Work but delivered and suitably stored at the Project Site, or at other location, subject to prior approval and acceptance by the Owner on each occasion.

C. Credit toward Contract Sum. All payments for Construction Services made hereunder shall be credited toward the payment of the Contract Sum as Contractor's sole compensation for the construction of the Project.

3.3 Invoice and Payment. All payments for services and materials under the Contract Documents shall be invoiced and paid in accordance with the following provisions.

A. Invoices. The Contractor shall submit to the Owner periodic invoices for payment, in a form acceptable to the Owner, which shall include a sworn statement certifying that, to the best of the Contractor's knowledge, information and belief, the construction has progressed to the point indicated, the quality and quantity of Work covered by the invoice is in accord with the Project Plans and Specifications, and the Contractor is entitled to payment in the amount requested, along with the cost reports required pursuant to Article II, showing in detail all monies paid out, Project Costs accumulated, or Project Cost incurred during the previous period. This data shall be attached to the invoice.

B. Additional Information; Processing of Invoices. Should an invoiced amount appear to exceed the Work effort believed to be completed, the Owner may, prior to processing of the invoice for payment, require the Contractor to submit satisfactory evidence to support the invoice. All Progress Reports and invoices shall be delivered to the attention of the Owner's Project Representative. Invoices not properly prepared (mathematical errors, billing not reflecting actual Work done, no signature, etc.) shall be returned to the Contractor for correction.

C. Architect/Engineer's Approval. Payment for Work completed shall be subject to the Architect/Engineer approving the payment requested by the Contractor and certifying the amount thereof that has been properly incurred and is then due and payable to the Contractor, and identifying with specificity any amount that has not been properly incurred and that should not be paid.

D. Warrants of Contractor with Respect to Payments. The Contractor warrants that (1) upon payment of any retainage, materials and equipment covered by a partial payment

SAMPLE

request will pass to Owner either by incorporation in construction or upon receipt of payment by the Contractor, whichever occurs first; (2) Work, materials and equipment covered by previous partial payment requests shall be free and clear of liens, claims, security interests, or encumbrances; and (3) no Work, materials or equipment covered by a partial payment request which has been acquired by the Contractor or any other person performing Work at the Project Site, or furnishing materials or equipment for the Project, shall be subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or any other person.

E. All Compensation Included. Contractor's compensation includes full payment for services set forth in the Contract Documents, including but not limited to overhead, profit, salaries or other compensation of Contractor's officers, partners and/or employees, general operating expenses incurred by Contractor and relating to this Project, including the cost of management, supervision and data processing staff, job office equipment and supplies, and other similar items.

ARTICLE IV
SUBCONTRACTORS

4.1 Subcontracts. At the Owner's request, the Contractor shall provide Owner's Project Representative with copies of all proposed and final subcontracts, including the general and supplementary conditions thereof.

A. Subcontracts General. All subcontracts shall: (1) require each Subcontractor to be bound to Contractor to the same extent Contractor is bound to Owner by the terms of the Contract Documents, and those terms may apply to the portion of the Work to be performed by the Subcontractor, (2) provide for the assignment of the subcontracts from Contractor to Owner at the election of Owner, upon termination of Contractor, (3) provide that Owner will be an additional indemnified party of the subcontract, (4) provide that Owner will be an additional insured on all insurance policies required to be provided by the Subcontractor, except workers' compensation, (5) assign all warranties directly to Owner, and (6) identify Owner as an intended third-party beneficiary of the subcontract.

(1) A Subcontractor is a person or entity who has a direct contract with Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

(2) A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

B. No Damages for Delay. Except when otherwise expressly agreed to by Owner in writing, all subcontracts shall provide:

> "LIMITATION OF REMEDIES – NO DAMAGES FOR DELAY. The Subcontractor's exclusive remedy for delays in the performance of the

SAMPLE

contract caused by events beyond its control, including delays claimed to be caused by the Owner or Architect/Engineer or attributable to the Owner or Architect/Engineer and including claims based on breach of contract or negligence, shall be an extension of its contract time and shall in no way involve any monetary claim."

Each subcontract shall require that any claims by the Subcontractor for delay must be submitted to the Contractor within the time and in the manner in which the Contractor must submit such claims to the Owner, and that failure to comply with the conditions for giving notice and submitting claims shall result in the waiver of such claims.

C. Subcontractual Relations. The Contractor shall require each Subcontractor to assume all the obligations and responsibilities which the Contractor owes the Owner pursuant to the Contract Documents, by the parties to the extent of the Work to be performed by the Subcontractor. Said obligations shall be made in writing and shall preserve and protect the rights of the Owner and Architect/Engineer, with respect to the Work to be performed by the Subcontractor, so that the subcontracting thereof will not prejudice such rights. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with its sub-subcontractors.

D. Insurance; Acts and Omissions. Insurance requirements for Subcontractors shall be no more stringent than those requirements imposed on the Contractor by the Owner. The Contractor shall be responsible to the Owner for the acts and omissions of its employees, agents, Subcontractors, their agents and employees, and all other persons performing any of the Work or supplying materials under a contract to the Contractor.

4.2 Relationship and Responsibilities. Except as specifically set forth herein with respect to direct materials acquisitions by Owner, nothing contained in the Contract Documents or in any Contract Document does or shall create any contractual relation between the Owner or Architect/Engineer and any Subcontractor. Specifically, the Contractor is not acting as an agent of the Owner with respect to any Subcontractor. The utilization of any Subcontractor shall not relieve Contractor from any liability or responsibility to Owner, or obligate Owner to the payment of any compensation to the Subcontractor or additional compensation to the Contractor.

4.3 Payments to Subcontractors; Monthly Statements. The Contractor shall be responsible for paying all Subcontractors from the payments made by the Owner to Contractor pursuant to Article III, subject to the following provisions:

A. Payment. The Contractor shall, no later than ten (10) days after receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, pay to each Subcontractor the amount to which the Subcontractor is entitled in accordance with the terms of the Contractor's contract with such Subcontractor. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-Subcontractors in a similar manner. After receipt of payment from Owner, if the need should arise to withhold payments to Subcontractors for any reason, as solely determined by Contractor, the Contractor shall promptly restore such monies to the Owner, adjusting subsequent pay requests and Project bookkeeping as required.

SAMPLE

B. Final Payment of Subcontractors. The final payment of retainage to Subcontractors shall not be made until the Project has been inspected by the Architect/Engineer or other person designated by the Owner for that purpose, and until both the Architect/Engineer and the Contractor have issued a written certificate that the Project has been constructed in accordance with the Project Plans and Specifications and approved Change Orders. Before issuance of final payment to any Subcontractor without any retainage, the Subcontractor shall submit satisfactory evidence that all payrolls, material bills, and other indebtedness connected with the Project have been paid or otherwise satisfied, warranty information is complete, as-built markups have been submitted, and instruction for the Owner's operating and maintenance personnel is complete. Final payment may be made to certain select Subcontractors whose Work is satisfactorily completed prior to the completion of the Project, but only upon approval of the Owner's Project Representative.

4.4 Responsibility for Subcontractors. As provided in Section 2.4.BB, Contractor shall be fully responsible to Owner for all acts and omissions of the Subcontractors, suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect Contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions.

4.5 Contingent Assignment of Subcontracts. Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that:

(1) assignment is effective only after termination of the Contract by the Owner for cause pursuant to Article XIV and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

(2) assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Agreement.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract. Upon such assignment, if the Work has been suspended for more than thirty (30) days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension. Upon such assignment to the Owner, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE V
CHANGES IN WORK

5.1 General. Changes in the Work may be accomplished after execution of the Agreement, and without invalidating the Agreement, by Change Order, Work Directive Change or order for a minor change in the Work, subject to the limitations stated in this Article V and elsewhere in the Contract Documents. A Change Order shall be based upon agreement among the Owner, Contractor and Architect/Engineer; a Work Directive Change requires agreement by the Owner and Architect/Engineer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect/Engineer alone. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor

SAMPLE

shall proceed promptly, unless otherwise provided in the Change Order, Work Directive Change or order for a minor change in the Work.

5.2 Minor Changes in the Work. The Owner or Architect/Engineer shall have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such change will be effected by written order signed by the Architect/Engineer and shall be binding on the Owner and Contractor. The Contractor shall abide by and perform such minor changes. Such changes shall be effected by a Field Directive or a Work Directive Change. Documentation of changes shall be determined by the Construction Team, and displayed monthly in the Progress Reports. Because such changes shall not affect the Contract Sum to be paid to the Contractor, they shall not require a Change Order pursuant to Section 5.6.

5.3 Emergencies. In any emergency affecting the safety of persons or property, the Contractor shall act at its discretion to prevent threatened damage, injury, or loss. Any increase in the Contract Sum or extension of time claimed by the Contractor because of emergency Work shall be determined as provided in Section 5.6. However, whenever practicable, the Contractor shall obtain verbal concurrence of the Owner's Project Representative and Architect/Engineer where the act will or may affect the Contract Sum or Contract Time.

5.4 Concealed Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect/Engineer before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Architect/Engineer will promptly investigate such conditions and, if the Architect/Engineer determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect/Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect/Engineer shall promptly notify the Owner and Contractor in writing, stating the reasons. If the Contractor disputes the Architect/Engineer's determination or recommendation, the Contractor may proceed as provided in Article VIII. If the Owner disputes the Architect/Engineer's determination or recommendation, the Owner may appeal directly to the Purchasing Official and shall thereafter follow the process set forth in Section 8.5.

5.5 Hazardous Materials. In the event the Contractor encounters on the Project Site material reasonably believed to be hazardous, petroleum or petroleum related products, or other hazardous or toxic substances, except as provided in Section 2.4.U, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and the Architect/Engineer in writing. The Work in the affected area shall not thereafter be resumed except by Change Order or written amendment, if in fact the material or substance has not been rendered harmless. The Work in the affected area shall be resumed when the Project Site has been rendered harmless, in accordance with the final determination by the Architect/Engineer or other appropriate professional employed by Owner. The Contractor shall not be required to perform without its consent any Work relating to hazardous materials, petroleum or petroleum related products, or

SAMPLE

other hazardous or toxic substances. In the event the Contractor encounters on the Project Site materials believed in good faith to be hazardous or contaminated material, and the presence of such hazardous or contaminated material was not known and planned for at the time the Contractor submitted its Bid (or Guaranteed Maximum Price proposal), and it is necessary for the Contractor to stop Work in the area affected and delays Work for more than a seven (7) day period, adjustments to the Contract Sum and/or Contract Time shall be made in accordance with this Article V.

5.6 Change Orders; Adjustments to Contract Sum.

A. Change Orders Generally. The increase or decrease in the Contract Sum resulting from a change authorized pursuant to the Contract Documents shall be determined:

(1) By mutual acceptance of a lump sum amount properly itemized and supported by sufficient substantiating data to permit evaluation by the Architect/Engineer and Owner; or

(2) By unit prices stated in the Agreement or subsequently agreed upon; or

(3) By any other method mutually agreeable to Owner and Contractor.

If Owner and Contractor are unable to agree upon increases or decreases in the Contract Sum and the Architect/Engineer certifies that the work needs to be commenced prior to any such agreement, the Contractor, provided it receives a written Change Order signed by or on behalf of the Owner, shall promptly proceed with the Work involved. The cost of such Work shall then be determined on the basis of the reasonable expenditures of those performing the Work attributed to the change. However, in the event a Change Order is issued under these conditions, the Owner, through the Architect/Engineer, will establish an estimated cost of the Work and the Contractor shall not perform any Work whose cost exceeds that estimated without prior written approval by the Owner. In such case, the Contractor shall keep and present in such form as the Owner may prescribe an itemized accounting, together with appropriate supporting data of the increase in overall costs of the Project. The amount of any decrease in the Contract Sum to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in costs will be the amount of the actual net decrease.

SAMPLE

5.7 Owner-Initiated Changes. Without invalidating the Agreement and without notice to any Surety, Owner may, at any time, order additions, deletions or revisions in the Work. These will be authorized by a written amendment, a Field Directive, a Change Order, or a Work Directive Change, as the case may be. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided). A Work Directive Change may not change the Contract Sum or the Contract Time; but is evidence that the parties expect that the change directed or documented by a Work Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Sum or Contract Time.

5.8 Unauthorized Work. Contractor shall not be entitled to an increase in the Contract Sum or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents.

5.9 Defective Work. Owner and Contractor shall execute appropriate Change Orders (or written amendments) covering changes in the Work which are ordered by Owner, or which may be required because of acceptance of defective Work, without adjustment to the Contract Sum.

5.10 Estimates for Changes. At any time Architect/Engineer may request a quotation from Contractor for a proposed change in the Work. Within twenty-one (21) calendar days after receipt, Contractor shall submit a written and detailed proposal for an increase or decrease in the Contract Sum or Contract Time for the proposed change. Architect/Engineer shall have twenty-one (21) calendar days after receipt of the detailed proposal to respond in writing. The proposal shall include an itemized estimate of all costs and time for performance that will result directly or indirectly from the proposed change. Unless otherwise directed, itemized estimates shall be in sufficient detail to reasonably permit an analysis by Architect/Engineer of all material, labor, equipment, subcontracts, overhead costs and fees, and shall cover all Work involved in the change, whether such Work was deleted, added, changed or impacted. Notwithstanding the request for quotation, Contractor shall carry on the Work and maintain the progress schedule. Delays in the submittal of the written and detailed proposal will be considered non-prejudicial.

5.11 Form of Proposed Changes. The form of all submittals, notices, Change Orders and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Owner. Standard Owner forms shall be utilized.

5.12 Changes to Contract Time. The Contract Time may only be changed pursuant to a Change Order or a written amendment to the Contract Documents. Any claim for an extension or shortening of the Contract Time shall be based on written notice delivered by the party making the claim to the other party. Notice of the event of the claim with supporting data shall be delivered within fifteen (15) days from detection or beginning of such occurrence and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled to because of the occurrence of said event. The Contract time will be extended in an amount equal to time lost due to delays beyond the control of Contractor. Such delays shall include, but not be limited to, acts or neglect by Owner or others performing additional Work; or to fires, floods, epidemics, abnormal weather conditions or acts of God. Failure to deliver a written notice of claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

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ARTICLE VI
ROLE OF ARCHITECT/ENGINEER

6.1 General.

A. Retaining. The Owner shall retain an Architect/Engineer (whether an individual or an entity) lawfully licensed to practice in Florida. That person or entity is identified as the Architect/Engineer in the Agreement and is referred to throughout the Contract Documents as if singular in number.

B. Duties. Duties, responsibilities and limitations of authority of the Architect/Engineer as set forth in the Contract Documents shall not be restricted, modified or

extended without written consent of the Owner and Architect/Engineer. Consent shall not be unreasonably withheld.

C. Termination. If the employment of the Architect/Engineer is terminated, the Owner shall employ a successor Architect/Engineer as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect/Engineer.

6.2 Administration. The Architect/Engineer will provide administration of the Agreement as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect/Engineer approves the final Application for Payment. The Architect/Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

A. Site Visits. The Architect/Engineer will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. Unless specifically instructed by Owner, the Architect/Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect/Engineer will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

B. Reporting. Based on the site visits, the Architect/Engineer will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect/Engineer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect/Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

SAMPLE

6.3 Interpretation of Project Plans and Specifications. The Architect/Engineer will be the interpreter of the requirements of the Project Plans and Specifications. Upon receipt of comments or objections by Contractor or Owner, the Architect/Engineer will make decisions on all claims, disputes, or other matters pertaining to the interpretation of the Project Plans and Specifications.

6.4 Rejection of Non-Conforming Work. Upon consultation with Owner, the Architect/Engineer shall have the authority to reject Work which does not conform to the Project Plans and Specifications.

6.5 Correction of Work. The Contractor shall promptly correct all Work rejected by the Architect/Engineer for being defective or as failing to conform to the Project Plans and Specifications, whether observed before or after the Substantial Completion Date and whether or not fabricated, installed, or completed. The Contractor shall bear all costs of correcting such

rejected Work, including compensation for Architect/Engineer's additional services made necessary thereby.

6.6 Timely Performance of Architect/Engineer. The Contractor shall identify which requests for information or response from the Architect/Engineer have the greatest urgency and those items which require prioritizing in response by the Architect/Engineer. The Contractor shall also identify the preferred time period for response and shall request a response time which is reasonably and demonstrably related to the needs of the Project and Contractor. If Architect/Engineer claims that Contractor's expectations for a response are unreasonable, Owner shall require Architect/Engineer to communicate such claim to Contractor in writing together with the specific time necessary to respond and the date upon which such response will be made. If Contractor believes that Architect/Engineer is not providing timely services or responses, Contractor shall notify Owner of same in writing not less than two (2) weeks before Contractor believes performance or response time from Architect/Engineer is required without risk of delaying the Project.

ARTICLE VII
OWNER'S RIGHTS AND RESPONSIBILITIES

7.1 Project Site; Title. The Owner shall provide the lands upon which the Work under the Contract Documents is to be done, except that the Contractor shall provide all necessary additional land required for the erection of temporary construction facilities and storage of his materials, together with right of access to same. The Owner hereby represents to the Contractor that it currently has and will maintain up through and including the Substantial Completion Date, good title to all of the real property constituting the Project Site. Owner agrees to resolve, at its expense, any disputes relating to the ownership and use of the Project Site which might arise during construction.

7.2 Project Plans and Specifications; Architect/Engineer. The parties hereto acknowledge and agree that Owner has previously entered into an agreement with Architect/Engineer. Pursuant to the terms of such agreement, the Architect/Engineer, as an agent and representative of Owner, is responsible for the preparation of Project Plans and Specifications which consist of drawings, specifications, and other documents setting forth in detail the requirements for the construction of the Project. All such Project Plans and Specifications shall be provided either by Owner or the Architect/Engineer, and Contractor shall be under no obligation to provide same and shall be entitled to rely upon the accuracy and completeness of the Project Plans and Specifications provided by the Architect/Engineer and all preliminary drawings prepared in connection therewith. The Contractor will be furnished a reproducible set of all drawings and specifications reasonably necessary for the performance of Contractor's services hereunder and otherwise ready for printing. The Contractor shall be notified of any written modification in the agreement between Owner and Architect/Engineer.

7.3 Surveys; Soil Tests and Other Project Site Information. Owner shall be responsible for providing a legal description and certified land survey of the Project Site in a form and content and with such specificity as may be required by the Architect/Engineer and Contractor to perform their services. To the extent deemed necessary by Owner and Architect/Engineer, and solely at Owner's expense, Owner may engage the services of a geotechnical consultant to perform test borings and other underground soils testing as may be deemed necessary by the Architect/Engineer or the Contractor. Contractor shall not be obligated to provide such surveys or

SAMPLE

soil tests and shall be entitled to rely upon the accuracy and completeness of the information provided; subject, however, to the provisions of Section 2.4.S hereof. Owner shall provide Contractor, as soon as reasonably possible following the execution of the Contract Documents, all surveys or other survey information in its possession describing the physical characteristics of the Project Site, together with soils reports, subsurface investigations, utility locations, deed restrictions, easements, and legal descriptions then in its possession or control. Upon receipt of all surveys, soils tests, and other Project Site information, Contractor shall promptly advise Owner of any inadequacies in such information and of the need for any additional surveys, soils or subsoil tests. In performing this Work, Contractor shall use the standard of care of experienced contractors and will use its best efforts timely to identify all problems or omissions. Owner shall not be responsible for any delay or damages to the Contractor for any visible or disclosed site conditions or disclosed deficiencies in the Project Site which should have been identified by Contractor and corrected by Owner prior to the execution of the Contract Documents.

7.4 Information; Communication; Coordination. The Owner's Project Representative shall examine any documents or requests for information submitted by the Contractor and shall advise Contractor of Owner's decisions pertaining thereto within a reasonable period of time to avoid unreasonable delay in the progress of the Contractor's services. Contractor shall indicate if any such documents or requests warrant priority consideration. However, decisions pertaining to approval of the Project Schedule as it relates to the date of Substantial Completion, the Project Cost, Contractor's compensation, approving or changing the Contract Sum shall only be effective when approved by Owner in the form of a written Change Order or amendment to the Contract Documents. Owner reserves the right to designate a different Owner's Project Representative provided Contractor is notified in writing of any such change. Owner and Architect/Engineer may communicate with subcontractors, materialmen, laborers, or suppliers engaged to perform services on the Project, but only for informational purposes. Neither the Owner nor the Architect/Engineer shall attempt to direct the Work of or otherwise interfere with any Subcontractor, materialman, laborer, or supplier, or otherwise interfere with the Work of the Contractor. Owner shall furnish the data required of Owner under the Contract Documents promptly.

7.5 Governmental Body. The Contractor recognizes that the Owner is a governmental body with certain procedural requirements to be satisfied. The Contractor has and will make reasonable allowance in its performance of services for such additional time as may be required for approvals and decisions by the Owner and any other necessary government agency.

7.6 Pre-Completion Acceptance. The Owner shall have the right to take possession of and use any completed portions of the Work, although the time for completing the entire Work or such portions may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

7.7 Ownership and Use of Drawings, Specifications and Other Instruments of Service.

(1) The Architect/Engineer and the Architect/Engineer's consultants shall be deemed the authors and owners of their respective instruments of service, including the Project Plans and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The

SAMPLE

Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the instruments of service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be constructed as publication in derogation of the Architect/Engineer's or Architect/Engineer's consultants' reserved rights.

(2) The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the drawings and specifications provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Project Plans and Specifications or other instruments of service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the drawings or specifications on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect/Engineer and the Architect/Engineer's consultants.

7.8 Owner's Project Representative. Owner's Project Representative is Owner's Agent, who will act as directed by and under the supervision of the Owner, and who will confer with Owner/Architect/Engineer regarding his actions. The Owner's Project Representative's dealings in matters pertaining to the on-site Work shall, in general, be only with the Owner/Architect/Engineer and Contractor and dealings with Subcontractors shall only be through or with the full knowledge of Contractor.

A. Responsibilities. Except as otherwise instructed in writing by Owner, the Owner's Project Representative will:

(1) Attend preconstruction conferences; arrange a schedule of progress meetings and other job conferences as required in consultation with Owner/Architect/Engineer and notify those expected to attend in advance; and attend meetings and maintain and circulate copies of minutes thereof;

(2) Serve as Owner/Architect/Engineer's liaison with Contractor, working principally through Contractor's superintendent, to assist in understanding the intent of the Contract Documents. As requested by Owner/Architect/Engineer, assist in obtaining additional details or information when required at the job site for proper execution of the Work;

(3) Report to Owner/Architect/Engineer whenever he believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents;

(4) Accompany visiting inspectors representing public or other agencies having jurisdiction over the project; record the outcome of these inspections and report to Owner/Architect/Engineer;

SAMPLE

(5) Review applications for payment with Contractor for compliance with the established procedure for their submission and forward them with recommendations to Owner/Architect/Engineer; and

(6) Perform those duties as set forth elsewhere within the Contract Documents.

B. Limitations. Except upon written instructions of Owner, Owner's Project Representative shall not:

(1) Authorize any deviation from the Contract Documents or approve any substitute materials or equipment;

(2) Exceed limitations on Owner/Architect/Engineer's authority as set forth in the Contract Documents;

(3) Undertake any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent, or expedite the Work;

(4) Advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents;

(5) Advise on or issue directions as to safety precautions and programs in connection with the Work;

(6) Authorize Owner to occupy the project in whole or in part; or

(7) Participate in specialized field or laboratory tests.

SAMPLE

ARTICLE VIII
RESOLUTION OF DISAGREEMENTS; CLAIMS FOR COMPENSATION

8.1 Owner to Decide Disputes. The Owner shall reasonably decide all questions and disputes (with the exception of matters pertaining to the interpretation of the Project Plans and Specifications which shall be resolved by the Architect/Engineer pursuant to Section 6.3) that may arise in the execution and fulfillment of the services provided for under the Contract Documents, in accordance with the Procurement Ordinance.

8.2 Finality. The decision of the Owner upon all claims, questions, disputes and conflicts shall be final and conclusive, and shall be binding upon all parties to the Contract Documents, subject to judicial review as provided in Section 8.5 below.

8.3 No Damages for Delay. If at any time Contractor is delayed in the performance of Contractor's responsibilities under the Contract Documents as the result of a default or failure to perform in a timely manner by Owner or Owner's agents or employees, Contractor shall not be entitled to any damages except for compensation specifically authorized in Article III. Contractor's sole remedy will be a right to extend the time for performance. Nothing herein shall preclude Contractor from any available remedy against any responsible party other than Owner.

Contractor shall be responsible for liquidated damages for delay if otherwise provided for in the Contract Documents.

8.4 Permitted Claims Procedure. Where authorized or permitted under the Contract Documents, all claims for additional compensation by Contractor, extensions of time affecting the Substantial Completion Date, for payment by the Owner of costs, damages or losses due to casualty, Force Majeure, Project Site conditions or otherwise, shall be governed by the following:

(1) All claims must be submitted as a request for Change Order in the manner as provided in Article V.

(2) The Contractor must submit a notice of claim to Owner's Project Representative and to the Architect/Engineer within fifteen (15) days of the beginning of such occurrence. Failure to submit a claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

(3) Within twenty (20) days of submitting its notice of claim, the Contractor shall submit to the Owner's Project Representative its request for Change Order, which shall include a written statement of all details of the claim, including a description of the Work affected.

(4) After receipt of a request for Change Order, the Owner's Project Representative, in consultation with the Architect/Engineer, shall deliver to the Contractor, within twenty (20) days after receipt of request, its written response to the claim.

(5) In the event the Owner and Contractor are unable to agree on the terms of a Change Order, the Owner shall have the option to instruct the Contractor to proceed with the Work. In that event, the Owner shall pay for those parts of the Work the scope and price of which are not in dispute. The balance of the disputed items in the order to proceed will be resolved after completion of the Work, based upon completed actual cost.

(6) The rendering of a decision by Owner with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment) will be a condition precedent to any exercise by Owner or Contractor of such right or remedies as either may otherwise have under the Contract Documents or by laws or regulations in respect of any such claim, dispute or other matter.

8.5 Contract Claims and Disputes. After completion of the process set forth in Section 8.4 above, any unresolved dispute under this Agreement shall be decided by the Purchasing Official in accordance with Section 2-26-63 of the Manatee County Code of Laws, subject to an administrative hearing process as provided in Section 2-26-64. The decision of the hearing officer in accordance with Section 2-26-64 of the Manatee County Code of Laws shall be the final and conclusive decision subject to exclusive judicial review in circuit court by a petition for certiorari.

SAMPLE

8.6 Claims for Consequential Damages. The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Agreement. This mutual waiver includes:

(1) damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons, unless any of such damages or losses are covered by insurance placed by the Contractor; and

(2) damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article XIV. Nothing contained in this Section 8.6 shall be deemed to preclude assessment of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

ARTICLE XV
INDEMNITY

9.1 Indemnity.

A. Indemnification Generally. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect/Engineer, Architect/Engineer's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.1.

B. Indemnification; Enforcement Actions. The Contractor's duty to indemnify and hold harmless the Owner in Section 9.1 above shall extend to fines, penalties and costs incurred by the Owner as related to any enforcement action taken by local, state, regional or federal regulatory entities. The Owner may deduct any of such fines, penalties and costs as described in this Section from any unpaid amounts then or thereafter due the Contractor under the Contract Documents. Any of such fines, penalties and costs not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at the maximum allowable rate.

C. Claims by Employees. In claims against any person or entity indemnified under this Section 9.1 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly

SAMPLE

employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 9.1.A. shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

9.2 Duty to Defend. The Contractor shall defend the Owner in any action, lawsuit, mediation or arbitration arising from the alleged negligence, recklessness or intentionally wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of the Work. Notwithstanding any other provisions within this Article IX, so long as Contractor, through its own counsel, performs its obligation to defend the Owner pursuant to this Section, Contractor shall not be required to pay the Owner's costs associated with the Owner's participation in the defense.

ARTICLE X
ACCOUNTING RECORDS; OWNERSHIP OF DOCUMENTS

10.1 Accounting Records. Records of expenses pertaining to all services performed shall be kept in accordance with generally accepted accounting principles and procedures.

10.2 Inspection and Audit. The Contractor's records shall be open to inspection and subject to examination, audit, and/or reproduction during normal working hours by the Owner's agent or authorized representative to the extent necessary to adequately permit evaluation and verification of any invoices, payments or claims submitted by the Contractor or any of its payees during the performance of the Work. These records shall include, but not be limited to, accounting records, written policies and procedures, Subcontractor files (including proposals of successful and unsuccessful bidders), original estimates, estimating worksheets, correspondence, Change Order files (including documentation covering negotiated settlements), and any other supporting evidence necessary to substantiate charges related to the Contract Documents. They shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs (including overhead allocations) as they may apply to costs associated with the Contract Documents. For such audits, inspections, examinations and evaluations, the Owner's agent or authorized representative shall have access to said records from the effective date of the Contract Documents, for the duration of Work, and until three (3) years after the date of final payment by the Owner to the Contractor pursuant to the Contract Documents.

10.3 Access. The Owner's agent or authorized representative shall have access to the Contractor's facilities and all necessary records to conduct audits in compliance with this Article. The Owner's agent or authorized representative shall give the Contractor reasonable advance notice of intended inspections, examinations, and/or audits.

10.4 Ownership of Documents. Upon obtainment of Substantial Completion or termination of the Agreement, all records, documents, tracings, plans, specifications, maps, evaluations, reports, transcripts and other technical data, other than working papers, prepared or developed by the Contractor shall be delivered to and become the property of the Owner. The Contractor at its own expense may retain copies for its files and internal use.

SAMPLE

ARTICLE XI
PUBLIC CONTRACT LAWS

11.1 Equal Opportunity Employment.

A. Employment. The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, sex, color, national origin, disability or age, and will take affirmative action to ensure that all employees and applicants are afforded equal employment opportunities without discrimination because of race, creed, sex, color, national origin, disability or age. Such action will be taken with reference to, but shall not be limited to, recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff or termination, rates of training or retraining, including apprenticeship and on-the-job training.

B. Participation. No person shall, on the grounds of race, creed, sex, color, national origin, disability or age, be excluded from participation in, be denied the proceeds of, or be subject to discrimination in the performance of the Agreement.

11.2 Immigration Reform and Control Act of 1986. Contractor acknowledges that it is responsible for complying with the provisions of the Immigration Reform and Control Act of 1986, located at 8 U.S.C. Section 1324, et seq., and regulations relating thereto. Failure to comply with the above statutory provisions shall be considered a material breach and shall be grounds for immediate termination of this Agreement.

11.3 No Conflict of Interest. The Contractor warrants that it has not employed or retained any company or person, other than a bona fide employee working solely for the Contractor to solicit or secure this Agreement, and that it has not paid or agreed to pay any person, company, corporation, individual, or firm other than a bona fide employee working solely for the Contractor, any fee, commission, percentage, gift or any other consideration, contingent upon or resulting from the award or making of this Agreement.

A. No Interest in Business Activity. By accepting award of this Agreement, the Contractor, which shall include its directors, officers and employees, represents that it presently has no interest in and shall acquire no interest in any business or activity which would conflict in any manner with the performance of services required hereunder, including without limitation as described in the Contractor's own professional ethical requirements. An interest in a business or activity which shall be deemed a conflict includes but is not limited to direct financial interest in any of the material and equipment manufacturers, suppliers, distributors, or contractors who will be eligible to supply material and equipment for the Project for which the Contractor is furnishing its services required hereunder.

B. No Appearance of Conflict. The Contractor shall not knowingly engage in any contractual or professional obligations that create an appearance of a conflict of interest with respect to the services provided pursuant to the Agreement. The Contractor has provided the Affidavit of No Conflict, incorporated into the Contract Documents as Exhibit "C", as a material inducement for Owner entering the Agreement. If, in the sole discretion of the County Administrator or designee, a conflict of interest is deemed to exist or arise during the term of this Agreement, the County Administrator or designee may cancel this Agreement, effective upon the date so stated in a written notice of cancellation, without penalty to the Owner.

SAMPLE

11.4 Truth in Negotiations. By execution of the Contract Documents, the Contractor certifies to truth-in-negotiations and that wage rates and other factual unit costs supporting the compensation are accurate, complete and current at the time of contracting. Further, the original Contract Sum and any additions thereto shall be adjusted to exclude any significant sums where the Owner determines the Contract Sum was increased due to inaccurate, incomplete or non-current wage rates and other factual unit costs. Such adjustments must be made within one (1) year after final payment to the Contractor.

11.5 Public Entity Crimes. The Contractor is directed to the Florida Public Entity Crimes Act, Section 287.133, Florida Statutes, specifically section 2(a), and the Owner's requirement that the Contractor comply with it in all respects prior to and during the term of the Agreement.

ARTICLE XII
FORCE MAJEURE, FIRE OR OTHER CASUALTY

12.1 Force Majeure.

A. Unavoidable Delays. Delays in any performance by any party contemplated or required hereunder due to fire, flood, sinkhole, earthquake or hurricane, acts of God, unavailability of materials, equipment or fuel, war, declaration of hostilities, revolt, civil strife, altercation or commotion, strike, labor dispute, epidemic, archaeological excavation, lack of or failure of transportation facilities, or any law, order, proclamation, regulation, or ordinance of any government or any subdivision thereof, or for any other similar cause to those enumerated, beyond the reasonable control and which with due diligence could not have been reasonably anticipated, shall be deemed to be events of Force Majeure and any such delays shall be excused. In the event such party is delayed in the performance of any Work or obligation pursuant to the Contract Documents for any of the events of Force Majeure stated in this Section 12.1, the date for performance required or contemplated by the Contract Documents shall be extended by the number of calendar days such party is actually delayed.

B. Concurrent Contractor Delays. If a delay is caused for any reason provided in Section 12.1.A.and during the same time period a delay is caused by Contractor, the date for performance shall be extended as provided in 12.1.A. but only to the extent the time is or was concurrent.

C. Notice; Mitigation. The party seeking excuse for nonperformance based on Force Majeure shall give written notice to the Owner, if with respect to the Contractor, or to the Contractor if with respect to the Owner, specifying its actual or anticipated duration. Each party seeking excuse from nonperformance based on Force Majeure shall use its best efforts to rectify any condition causing a delay and will cooperate with the other party, except that neither party shall be obligated to incur any unreasonable additional costs and expenses to overcome any loss of time that has resulted.

12.2 Casualty; Actions by Owner and Contractor. During the construction period, if the Project or any part thereof shall have been damaged or destroyed, in whole or in part, the Contractor shall promptly make proof of loss; and Owner and Contractor shall proceed promptly to collect, or cause to be collected, all valid claims which may have arisen against insurers or others based upon such damage or destruction. The Contractor shall diligently assess the damages or

SAMPLE

destruction and shall prepare an estimate of the cost, expenses, and other charges, including normal and ordinary compensation to the Contractor, necessary for reconstruction of the Project substantially in accordance with the Project Plans and Specifications. Within fifteen (15) days following satisfaction of the express conditions described in subsections (1), (2) and (3) below, the Contractor covenants and agrees diligently to commence reconstruction and to complete the reconstruction or repair of any loss or damage by fire or other casualty to the Project to substantially the same size, floor area, cubic content, and general appearance as prior to such loss or damage:

(1) Receipt by the Owner or the trustee of the proceeds derived from collection of all valid claims against insurers or others based upon such damage or destruction, and receipt of other sums from any source such that the funds necessary to pay the Project Cost and any additions to the Project Cost necessitated for repair or reconstruction are available;

(2) Written agreement executed by the Contractor and the Owner, by amendment to the Contract Documents or otherwise, authorizing and approving the repair or reconstruction and any additions to the Project Cost necessitated thereby, including any required adjustment to the Contract Sum; and

(3) Final approval by the Owner of the Project Plans and Specifications for such repair or reconstruction and issuance of any required building permit.

12.3 Approval of Plans and Specifications. The Owner agrees to approve the plans and specifications for such reconstruction or repair if the reconstruction or repair contemplated by such plans and specifications is economically feasible, and will restore the Project, or the damaged portion thereof, to substantially the same condition as prior to such loss or damage, and such plans and specifications conform to the applicable laws, ordinances, codes, and regulations. The Owner agrees that all proceeds of any applicable insurance or other proceeds received by the Owner or the Contractor as a result of such loss or damage shall be used for payment of the costs, expenses, and other charges of the reconstruction or repair of the Project.

12.4 Notice of Loss or Damage. The Contractor shall promptly give the Owner written notice of any significant damage or destruction to the Project, defined as loss or damage which it is contemplated by Contractor will increase the Contract Sum or extend the Substantial Completion Date, stating the date on which such damage or destruction occurred, the then expectations of Contractor as to the effect of such damage or destruction on the use of the Project, and the then proposed schedule, if any, for repair or reconstruction of the Project. Loss or damage which the Contractor determines will not affect the Contract Sum or Substantial Completion Date will be reported to Owner and Architect/Engineer immediately, and associated corrective actions will be undertaken without delay.

ARTICLE XIII
REPRESENTATIONS, WARRANTIES AND COVENANTS

13.1 Representations and Warranties of Contractor. The Contractor represents and warrants to the Owner each of the following.

SAMPLE

A. The Contractor is a construction company, organized under the laws of the State of _____, authorized to transact business in the State of Florida, with _____ as the primary qualifying agent. Contractor has all requisite power and authority to carry on its business as now conducted, to own or hold its properties, and to enter into and perform its obligations hereunder and under each instrument to which it is or will be a party, and is in good standing in the State of Florida.

B. Each Contract Document to which the Contractor is or will be a party constitutes, or when entered into will constitute, a legal, valid, and binding obligation of the Contractor enforceable against the Contractor in accordance with the terms thereof, except as such enforceability may be limited by applicable bankruptcy, insolvency, or similar laws from time to time in effect which affect creditors' rights generally and subject to usual equitable principles in the event that equitable remedies are involved.

C. There are no pending or, to the knowledge of the Contractor, threatened actions or proceedings before any court or administrative agency within or without the State of Florida, against the Contractor or any partner, officer, or agent of the Contractor which question the validity of any document contemplated hereunder, or which are likely in any case, or in the aggregate, to materially adversely affect the consummation of the transactions contemplated hereunder, or materially adversely affect the financial condition of the Contractor.

D. The Contractor has filed or caused to be filed all federal, state, local, or foreign tax returns, if any, which were required to be filed by the Contractor, and has paid, or caused to be paid, all taxes shown to be due and payable on such returns or on any assessments levied against the Contractor.

E. Neither Contractor nor any agent or person employed or retained by Contractor has acted fraudulently or in bad faith or in violation of any statute or law in the procurement of this Agreement.

F. The Contractor shall timely fulfill or cause to be fulfilled all of the terms and conditions expressed herein which are within the control of the Contractor or which are the responsibility of the Contractor to fulfill. The Contractor shall be solely responsible for the means and methods of construction.

G. It is recognized that neither the Architect/Engineer, the Contractor, nor the Owner has control over the cost of labor, materials, or equipment, over a Subcontractor's methods of determining bid prices, or over competitive bidding, market, or negotiating conditions.

H. During the term of the Contract Documents, and the period of time that the obligations of the Contractor under the Contract Documents shall be in effect, the Contractor shall cause to occur and to continue to be in effect those instruments, documents, certificates, and events contemplated by the Contract Documents that are applicable to, and the responsibility of, the Contractor.

I. The Contractor shall assist and cooperate with the Owner and shall accomplish the construction of the Project in accordance with the Contract Documents and the Project Plans and Specifications, and will not knowingly violate any laws, ordinances, rules, regulations, or orders that are or will be applicable thereto.

SAMPLE

J. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective, and that Owner, representatives of Owner, and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall give Architect/Engineer timely notice of readiness of the Work for all required approvals and shall assume full responsibility, including costs, in obtaining required tests, inspections, and approval certifications and/or acceptance, unless otherwise stated by Owner.

K. If any Work (including Work of others) that is to be inspected, tested, or approved is covered without written concurrence of Architect/Engineer, it must, if requested by Architect/Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Architect/Engineer timely notice of Contractor's intention to cover the same and Architect/Engineer has not acted with reasonable promptness in response to such notice. Neither observations by Architect/Engineer nor inspections, tests, or approvals by others shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

L. If the Work is defective, or Contractor fails to supply sufficient skilled workers, or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof and terminate payment to the Contractor until the cause for such order has been eliminated. Contractor shall bear all direct, indirect and consequential costs for satisfactory reconstruction or removal and replacement with non-defective Work, including, but not limited to fees and charges of Architect/Engineers, attorneys and other professionals and any additional expenses experienced by Owner due to delays to other Contractors performing additional Work and an appropriate deductive change order shall be issued. Contractor shall further bear the responsibility for maintaining the schedule and shall not be entitled to an extension of the Contract Time or the recovery of delay damages due to correcting or removing defective Work.

M. If Contractor fails within seven (7) days after written notice to correct defective Work, or fails to perform the Work in accordance with the Contract Documents, or fails to comply with any other provision of the Contract Documents, Owner may correct and remedy any such deficiency to the extent necessary to complete corrective and remedial action. Owner may temporarily exclude Contractor from all or part of the site, temporarily take possession of all or part of the Work, Contractor's tools, construction equipment and machinery at the site or for which Owner has paid Contractor but which are stored elsewhere, all for such duration as is reasonably necessary to correct the deficiency. All direct and indirect costs of Owner in exercising such rights and remedies will be charged against Contractor in an amount approved as to reasonableness by Architect/Engineer and a Change Order will be issued incorporating the necessary revisions.

N. If within three (3) years after the Substantial Completion Date or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions, either correct such defective Work or if it has been rejected by Owner, remove it from the site and replace it with non-defective Work. If Contractor does not promptly comply with the

SAMPLE

terms of such instruction, Owner may have the defective Work corrected/removed and all direct, indirect and consequential costs of such removal and replacement will be paid by Contractor. Failing payment by the Contractor and notwithstanding any other provisions of the Contract Documents to the contrary, Owner shall have the right to bring a direct action in the Circuit Court to recover such costs.

13.2 Representations of the Owner. To the extent permitted by law, the Owner represents to the Contractor that each of the following statements is presently true and accurate:

A. The Owner is a validly existing political subdivision of the State of Florida.

B. The Owner has all requisite corporate or governmental power and authority to carry on its business as now conducted and to perform its obligations under the Contract Documents and each Contract Document contemplated hereunder to which it is or will be a party.

C. The Contract Documents and each Contract Document contemplated hereby to which the Owner is or will be a party has been duly authorized by all necessary action on the part of, and has been or will be duly executed and delivered by, the Owner, and neither the execution and delivery thereof nor compliance with the terms and provisions thereof or hereof: (a) requires the approval and consent of any other person or party, except such as have been duly obtained or as are specifically noted herein; (b) contravenes any existing law, judgment, governmental rule, regulation or order applicable to or binding on the Owner; or (c) contravenes or results in any breach of, default under, or result in the creation of any lien or encumbrance upon the Owner under any indenture, mortgage, deed of trust, bank loan, or credit agreement, the charter, ordinances, resolutions, or any other agreement or instrument to which the Owner is a party, specifically including any covenants of any bonds, notes, or other forms of indebtedness of the Owner outstanding on the date of the Contract Documents.

D. The Contract Documents and each document contemplated hereby to which the Owner is or will be a party constitutes, or when entered into will constitute, a legal, valid, and binding obligation of the Owner enforceable against the Owner in accordance with the terms thereof, except as such enforceability may be limited by applicable bankruptcy, insolvency, or similar laws from time to time in effect which affect creditors' rights generally, and subject to usual equitable principles in the event that equitable remedies are involved.

E. There are no pending or, to the knowledge of the Owner, threatened actions or proceedings before any court or administrative agency against the Owner which question the validity of the Contract Documents or any document contemplated hereunder, or which are likely in any case or in the aggregate to materially adversely affect the consummation of the transactions contemplated hereunder or the financial or corporate condition of the Owner.

F. The Owner shall use due diligence to timely fulfill or cause to be fulfilled all of the conditions expressed in the Contract Documents which are within the control of the Owner or which are the responsibility of the Owner to fulfill.

G. During the pendency of the Work and while the obligations of the Owner under the Contract Documents shall be in effect, the Owner shall cause to occur and to continue to be in effect and take such action as may be necessary to enforce those instruments, documents,

SAMPLE

certificates and events contemplated by the Contract Documents that are applicable to and the responsibility of the Owner.

H. The Owner shall assist and cooperate with the Contractor in accomplishing the construction of the Project in accordance with the Contract Documents and the Project Plans and Specifications, and will not knowingly violate any laws, ordinances, rules, regulations, orders, contracts, or agreements that are or will be applicable thereto or, to the extent permitted by law, enact or adopt any resolution, rule, regulation, or order, or approve or enter into any contract or agreement, including issuing any bonds, notes, or other forms of indebtedness, that will result in the Contract Documents or any part thereof, or any other instrument contemplated by and material to the timely and effective performance of a party's obligations hereunder, to be in violation thereof.

ARTICLE XIV
TERMINATION AND SUSPENSION

14.1 Termination for Cause by Owner. This Agreement may be terminated by Owner upon written notice to the Contractor should Contractor fail substantially to perform a material obligation in accordance with the terms of the Contract Documents through no fault of the Owner. In the event Owner terminates for cause and it is later determined by a court of competent jurisdiction that such termination for cause was not justified, then in such event such termination for cause shall automatically be converted to a termination without cause pursuant to Section 14.2.

A. Nonperformance. If the Contractor fails to timely perform any of its obligations under the Contract Documents, including any obligation the Contractor assumes to perform Work with its own forces, or if it persistently or repeatedly refuses or fails, except in case for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or fails, without being excused, to maintain an established schedule (failure to maintain schedule shall be defined as any activity that falls thirty (30) days or more behind schedule) which has been adopted by the Construction Team, or it fails to make prompt payment to Subcontractors for materials or labor, or disregards laws, rules, ordinances, regulations, or orders of any public authority having jurisdiction, or otherwise is guilty of substantial violations of the Agreement the Owner may, after seven (7) days written notice, during which period the Contractor fails to perform such obligation, make good such deficiencies and perform such actions. The Contract Sum shall be reduced by the cost to the Owner of making good such deficiencies, and the Contractor's compensation shall be reduced by an amount required to manage the making good of such deficiencies. Provided, however, nothing contained herein shall limit or preclude Owner from pursuing additional damages from Contractor because of its breach.

B. Insolvency. If the Contractor is adjudged bankrupt, or if it makes a general assignment for the benefit of its creditors, or if a receiver is appointed because its insolvency, then the Owner may, without prejudice to any other right or remedy, and after giving the Contractor and its surety, if any, fourteen (14) days written notice, and during which period the Contractor fails to cure the violation, terminate the Agreement. In such case, the Contractor shall not be entitled to receive any further payment. Owner shall be entitled to recover all costs and damages arising because of failure of Contractor to perform as provided in the Contract Documents, as well as reasonable termination expenses, and costs and damages incurred by the Owner may be deducted from any payments left owing the Contractor.

SAMPLE

C. Illegality. Owner may terminate the Agreement if Contractor disregards laws or regulations of any public body having jurisdiction.

D. Rights of Owner. The Owner may, after giving Contractor (and the surety, if there is one) seven (7) days written notice, terminate the services of Contractor for cause; exclude Contractor from the Project Site and take possession of the Work and of all Contractor's tools, construction equipment and machinery at the Project Site and use the same to the full extent they could be used (without liability to Contractor for trespass or conversion); incorporate in the Work all materials and equipment stored at the Project Site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case, Contractor shall not be entitled to receive any further payment beyond an amount equal to the value of material and equipment not incorporated in the Work, but delivered and suitably stored, less the aggregate of payments previously made. If the direct and indirect costs of completing the Work exceed the unpaid balance of the Contract Sum, Contractor shall pay the difference to Owner. Such costs incurred by Owner shall be verified by Owner in writing; but in finishing the Work, Owner shall not be required to obtain the lowest quote for the Work performed. Contractor's obligations to pay the difference between such costs and such unpaid balance shall survive termination of the Agreement. In such event and notwithstanding any other provisions of the Contract Documents to the contrary, Owner shall be entitled to bring a direct action in the Circuit Court to recover such costs.

14.2 Termination without Cause by Owner. The Owner, through its County Administrator or designee, shall have the right to terminate the Agreement, in whole or in part, without cause upon sixty (60) calendar days' written notice to the Contractor. In the event of such termination for convenience, the Owner shall compensate Contractor for payments due through the date of termination, and on any subsequent payment to cover costs of Work performed through the date of termination subject to the terms and conditions of Section 3.1. The Contractor shall not be entitled to any other further recovery against the Owner, including, but not limited to, anticipated fees or profit on Work not required to be performed, or consequential damages or costs resulting from such termination.

A. Release of Contractor. As a condition of Owner's termination rights provided for in this subsection, Contractor shall be released and discharged from all obligations arising by, through, or under the terms of the Contract Documents, and the Payment and Performance Bond shall be released. Owner shall assume and become responsible for the reasonable value of Work performed by Subcontractors prior to termination plus reasonable direct close-out costs, but in no event shall Subcontractors be entitled to unabsorbed overhead, anticipatory profits, or damages for early termination.

B. Waiver of Protest. Contractor hereby waives any right to protest the exercise by Owner of its rights under this Section that may apply under the Procurement Ordinance.

14.3 Suspension without Cause. Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety (90) days by written notice to Contractor, which will fix the date on which Work will be resumed. Contractor shall be allowed an increase in the Contract Sum or an extension of the Contract Time, or both, directly attributable to any suspension if Contractor makes an approved claim therefor.

SAMPLE

14.4 Termination Based Upon Abandonment, Casualty or Force Majeure. If, after the construction commencement date (i) Contractor abandons the Project (which for purposes of this paragraph shall mean the cessation of all construction and other activities relating to the Project, excluding those which are necessary to wind down or otherwise terminate all outstanding obligations with respect to the Project, and no recommencement of same within one hundred twenty (120) days following the date of cessation), or (ii) the Project is stopped for a period of thirty (30) consecutive days due to an instance of Force Majeure or the result of a casualty resulting in a loss that cannot be corrected or restored within one hundred twenty (120) days (excluding the time required to assess the damage and complete the steps contemplated under Section 12.2), the Owner shall have the right to terminate the Agreement and pay the Contractor its compensation earned or accrued to date.

14.5 Vacation of Project Site; Delivery of Documents. Upon termination by Owner pursuant to Section 14.2 or 14.4, Contractor shall withdraw its employees and its equipment, if any, from the Project Site on the effective date of the termination as specified in the notice of termination (which effective date shall not be less than two (2) working days after the date of delivery of the notice), regardless of any claim the Contractor has or may not have against the Owner. Upon termination, the Contractor shall deliver to the Owner all original papers, records, documents, drawings, models and other material set forth and described in the Contract Documents.

14.6 Termination by the Contractor. If through no act or fault of Contractor, the Work is suspended for a period of more than ninety (90) consecutive days by Owner or under an order of court or other public authority, or Owner fails to act on any Application for Payment or fails to pay Contractor any sum finally determined to be due; then Contractor may, upon fourteen (14) days written notice to Owner terminate the Agreement and recover from Owner payment for all Work executed, any expenses sustained, plus reasonable termination expenses. In lieu of terminating the Agreement, if Owner has failed to act on any Application for Payment or Owner has failed to make any payment as aforesaid, Contractor may upon fourteen (14) days written notice to Owner stop the Work until payment of all amounts then due.

(Remainder of this page intentionally left blank)

SAMPLE

Exhibit A
Title(s) of Drawings

SAMPLE

Exhibit B
Title(s) of Specifications

SAMPLE

Exhibit C
Affidavit of No Conflict

SAMPLE

Exhibit D
Contractor's Certificate(s) of Insurance

SAMPLE

Exhibit E
Contractor's Payment and Performance Bond

SAMPLE

Exhibit F
Standard Forms

SAMPLE

APPLICATION FOR PAYMENT

Request No.: ____ Project No.: _____
Purchase Order No.: _____
County Bid No.: _____
Consultant: _____

Project: _____
From: _____ To: _____

CONTRACT PAYMENT SUMMARY

Original Contract Amount:				$ -
Change Order(s):				$ -
Change order summary:				
Number	Date Approved	Additive	Deductive	
SUBTOTALS:		$ -	$ -	
Net change order subtotal (Additive less Deductive):				$ -
Current Contract Amount (CCA): (Original Amount + Change Order(s))				$ -
		Previous Status	Total WIP	
Value of the Work in Place (WIP)		$ -	$ -	
Value of Stored Materials		$ -	$ -	
Total Earned ($ and % of CCA)		$ -	$ -	
Retainage ($ and % of CCA)		$ -	$ -	
Net Earned (Total earned minus retainage)				$ -
TOTAL PREVIOUS PAYMENTS				$ -
AMOUNT DUE THIS PAYMENT (Net Earned minus Previous Payments)				$ -

CONTRACTOR'S AFFIDAVIT OF NOTICE

CERTIFICATE: The undersigned CONTRACTOR certifies that all items and amounts shown on this Application for Payment are on account of work performed, materials supplied and/or materials stored on site and paid for by Contractor in accordance with the Contract Documents with due consideration for previous Payment(s), if any, received by the Contractor from the County, and that the Amount Due this Payment shown is now due.

NOTARY:

State of Florida, County of _____

Sworn to (or affirmed) and subscribed before me
this _____ day of _____ by _____

(Name of person giving notice)

_____
(Signature of Notary Public - State of Florida)
Print, Type or Stamp Commissioned Name of
Notary Public:

Personally Known ____ or Produced Identification ____
Type of Identification Produced: _____

CONTRACTOR:

_____
Name of person authorized to sign Affidavit of Notice

_____
TITLE

Contractor name, address and telephone no.:

_____
_____
_____
_____
_____

SAMPLE

VERIFICATION, RECOMMENDATION, CONCURRENCES AND APPROVALS

	(Signatures)	(Date)
Quantities verified by:	_____	_____
Consultant/Engineer:	_____	_____
Project Management:	_____	_____
Department Head:	_____	_____
Payment approved by the Board of County Commissioners:	_____	_____
Attested to by the Clerk of Circuit Court:	_____	_____

CERTIFICATE OF SUBSTANTIAL COMPLETION (S.C.)	CHECK ONE:	
	Partial	Total
Project Title:	Date Submitted:	
Contractor Data: Name: Address: City/State/Zip:	Project No: S. C. Date (Proposed)	

If the "Partial" completion box above is checked, the following description applies to the work for which substantial completion is being sought. Otherwise, the work described in the Contract including approved changes, if any, is certified to be substantially complete:
(Description of the portion of work substantially completed):

SAMPLE

(USE CONTINUATION SHEETS IF NECESSARY)

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item does not alter the Contractor's responsibility to complete all of the contract work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by the Contractor within _____ days of substantial completion. The approved substantial completion date is: _____

Contractor Signature	Date	Engineer's Approval	Date
Printed Name and Title		Printed Name and Title	

The Contractor shall be responsible for security, operation, safety, maintenance, HVAC, insurance and warranties in accordance with the Contract. The County will assume the responsibility for paying the cost of electrical power from midnight of the date of Engineer's approval as indicated above.

ATTACH THE INSPECTOR'S FINAL WALKTHROUGH LIST OF DEFICIENCIES.

FINAL RECONCILIATION, WARRANTY PERIOD DECLARATION AND CONTRACTOR'S AFFIDAVIT

Project Title:	Date Submitted:
Contractor Data: Name: Address: City/State/Zip:	Project No: Warranty (months):

This Final Reconciliation is for the work performed for Manatee County by the above named contractor, hereinafter called CONTRACTOR, pursuant to the contract dated _____ as amended, and acts as an addendum thereto.

It is agreed that all quantities and prices in the attached Final Pay Estimate No. _____ are correct and that the amount of $_____ including retainage is due to the CONTRACTOR, that no claims are outstanding as between the parties, and that the above stated sum represents the entirety of monies owed the CONTRACTOR.

It is further agreed that the warranty period for CONTRACTOR'S work pursuant to the Contract is from _____ to _____

As (title) _____ for CONTRACTOR, I have authority to bind said CONTRACTOR, and as such make this final reconciliation, declaration and affidavit for the purpose of inducing Manatee County to make final payment to CONTRACTOR for work done at/upon _____ under said contract:

CONTRACTOR has paid all social security and withholding taxes accrued in connection with the construction project.

CONTRACTOR has paid all workers' compensation and other insurance premiums incurred in connection with this construction project.

CONTRACTOR has paid for all required permits in connection with this construction project.

All laborers, materialmen, suppliers, subcontractors and service professionals who worked for and/or supplied materials, equipment and/or services to the CONTRACTOR under this construction contract have been paid in full.

SAMPLE

_____
(Affiant Signature)

NOTARY:
State of Florida, County of _____ , Sworn to (or affirmed) and subscribed before me this _____ day of _____ , ____, by _____ (person giving notice).

Signature of Notary Public - State of Florida: _____
Print, Type or Stamp Commissioned Name of Notary Public:

Personally Known ☐ or Produced Identification ☐
Type of Identification Produced _____

CONTRACT CHANGE ORDER

(for Total Contract Adjusted Amount Greater than $1,000,000)

PROJECT:

Change Order No.:

Contract Amount (Present Value)

Project Number:

NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	BY EXECUTION OF THIS CHANGE ORDER THE CONTRACTOR AGREES THAT ALL CLAIMS FOR ADDITIONAL CONTRACT TIME AND COSTS FOR THE ITEMS IN THIS CHANGE ORDER HAVE BEEN SATISFIED.		
		TOTAL DECREASE:	**TOTAL INCREASE:**

Contractor: _____
Address: _____
City / State: _____

Contractor Signature: _____ Date: _____

THE NET CHANGE OF

ADJUSTS THE CURRENT CONTRACT AMOUNT FROM

TO

____ CALENDAR DAYS ARE ADDED TO THE SCHEDULE WHICH CHANGES THE FINAL COMPLETION DATE TO MONTH DAY, YEAR

SAMPLE

RECOMMENDATION, CONCURRENCES AND APPROVALS

	SIGNATURES	DATE
Consultant / Engineer:		
Project Manager:		
Division Manager:		
	Project Management Division Manager	
Manatee County Purchasing:		
	Purchasing Official	

Authority to execute this contract per Manatee County Code, Chapter 2-26, and per the delegation by the County Administrator effective 1/26/2009

JUSTIFICATION FOR CHANGE	Change Order No : Project Number:

1. NECESSITY FOR CHANGE:

SAMPLE

2. Is change an alternate bid? (If yes, explain)

3. Does change substantially alter the physical size of the project? (If yes, explain)

4 Effect of this change on other "Prime" contractors?

5 Has the Surety and insurance company been notified, if applicable? CONTRACTOR RESPONSIBILITY