Geosyntec consultants

835 Georgia Avenue, Suite 500
Chattanooga, TN 37402-2218
PH 423.385.2310
FAX 678.202.9501
www.Geosyntec.com

28 April 2023

Mr. David M. Griffin, P.E.
Program Manager
Safe Dams Program
Georgia Department of Natural Resources
2 Martin Luther King, Jr. Drive
Atlanta, Georgia 30334

Subject: Seepage Collection System Modifications Permit Application
Lake Petit Dam (Permit #112-009-00462)
Pickens County, Georgia

Dear Mr. Griffin:

On behalf of Big Canoe Property Owners Association (POA), Geosyntec Consultants, Inc. (Geosyntec) is providing this cover letter and submitting a permit application to modify the existing seepage collection system (i.e., interceptor drains) on Lake Petit Dam (Dam). The purpose of the proposed drain modifications is to improve the drainage capacity of the existing interceptor drains with a more robust drainage system. Proposed drain modifications address Maintenance Issue 1 from the Georgia Safe Dams Program (GA SDP) letter dated 20 May 2021. The proposed drain modifications require intrusive work on the Dam which led to the creation of the attached Design Report and this submittal to GA SDP for an updated permit. The proposed drain modifications do not include modification to the Low-Level Outlet (LLO) or the LLO conduit.

In addition to the drain modification design, the Design Report also includes updated stability analyses of the Dam demonstrating that the Dam meets the required factors of safety established by the State of Georgia for the applicable load conditions. Analyses cases include rapid drawdown (upstream), steady state seepage, and steady state seepage with seismic loading. Existing soils data and updated piezometric, survey, and seismic data were used for the analyses.

Rapid drawdown at the toe was not conducted, as a flood event is unlikely to inundate the downstream side of the Dam based on: (i) the Dam's spillway discharge location into Petit Creek is at approximately El. 1,514 feet (16 feet lower than the toe) and is approximately 250 feet downstream of the impact basin; and (ii) Lake Sconti Dam, the next controlled reservoir approximately one mile downstream, which has an embankment top elevation and normal pool at approximately El. 1,470.0 feet and 1,464.0 feet, respectively (60 feet lower than the toe of Lake Petit Dam). Additionally, the end of construction loading condition was not analyzed as the Dam has been constructed and in service for approximately 50 years.

The Design Report, along with construction drawings and specifications, and stability analyses are submitted herein as one package. Following receipt of this package, we will reach out to the GA SDP directly to schedule a design review meeting, if one is necessary.

If you have any further questions, feel free to contact us at 423.385.2310.

Sincerely,

Vernon James Dotson, Jr., P.E. (GA, AL, NC, TN)
Senior Principal Engineer and Engineer of Record
Geosyntec Consultants, Inc.

cc: Scott Auer, Big Canoe Property Owners Association
Wesley MacDonald, P.E., Geosyntec Consultants, Inc.

Attachments: Permit Application Form and Design Report

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Richard E. Dunn, Director

Watershed Protection Branch
2 Martin Luther King, Jr. Drive
Suite 1152, East Tower
Atlanta, Georgia 30334
404-463-1511

APPLICATION FOR PERMIT TO CONSTRUCT & OPERATE DAM

In accordance with the Safe Dams Act of Georgia, O.C.G.A. Section 12-5-376, a permit is required to construct and/or operate a Category I dam. Section 12-5-374, (1)(F) requires the owner(s) to send information to the local government for them to record the dam on the official land plat. The following information is to be completed to the fullest extent possible as part of the permit application. A complete permit application includes a completed application (from each owner/operator), a condition assessment report, design documents, an Emergency Action Plan, and an Operation & Maintenance Plan, as applicable. Additionally, a certification from the engineer stating he is responsible for the design of the dam and that the dam meets the standards of the Safe Dams Act, Rules for Dam Safety, and the Engineering Guidelines is required.

Dam Information

Name of Dam: Petit Lake Dam

Preferred Name of Dam (if different): Lake Petit Dam

Alternative Name(s) of Dam: N/A

State ID: 112-009-00462 USACOE NID #: GA00685

County: Pickens Latitude: 34.462500 Longitude: -84.290278

Other location information (e.g. subdivision, business, etc…): Big Canoe

Directions to dam (use Atlanta as origination point):

Atlanta
Georgia

Get on I-75 N/I-85 N

1 min (0.4 mi)

1. Head north on Capitol Ave SW

79 ft

2. Turn right onto M.L.K. Jr Dr SE

0.2 mi

3. Turn left to merge onto I-75 N/I-85 N

0.2 mi

Follow I-75 N and I-575 N to GA-5 N/GA-515 E in Pickens County

46 min (51.8 mi)

4. Merge onto I-75 N/I-85 N

3.1 mi

5. Keep right to continue on I-75 N

18.0 mi

6. Keep right at the fork to continue on GA-5 N/I-575 N, follow signs for Canton

30.8 mi

Take Hwy 53 E and Steve Tate Hwy to Wilderness Pkwy

28 min (17.8 mi)

7. Continue onto GA-5 N/GA-515 E

0.9 mi

8. Sharp right onto Worley Crossroads

1.7 mi

9. Turn left onto Canton Rd

0.5 mi

10. Turn right onto Hwy 53 E

8.5 mi

11. Turn left onto Steve Tate Hwy

1.0 mi

12. At the traffic circle, take the 1st exit and stay on Steve Tate Hwy

3.0 mi

13. Turn left onto Wilderness Pkwy

0.8 mi

Lake Petit Dam
Jasper, GA 30143

Primary Purpose(s) (recreation, irrigation, flood control, drinking water): Recreation

Date Built (if known): 1972

Ownership Information

Owner/Operator's Name: Big Canoe Property Owners Association

Mailing Address: 10586 Big Canoe

City, State, Zip Code: Jasper, GA 30143

Phone Number(s): 706.268.3346 Email: sauer@bigcanoepoa.org

Name and contact information of person immediately responsible for dam if different than name listed above:

Name: Scott Auer

Mailing Address: 10586 Big Canoe

City, State, Zip Code: Jasper, GA, 30143

Phone Number(s): 706.268.2400 Email: sauer@bigcanoepoa.org

Application Information

This permit application contains the following information. A response of "No" requires an explanation to justify the response.

Item	Yes	No	Explanation
Official Land Plat	☐	☒	Existing Dam
Condition Assessment Report	☐	☒	Previously submitted in April 2022
Design Report	☒	☐	
Construction Plans	☒	☐	Included as Appendix to Design Report
Technical Specifications	☒	☐	Included in Construction Plans
Operation & Maintenance Plan	☐	☒	Previously submitted in December 2022
Emergency Action Plan	☐	☒	Previously submitted in December 2022

As the Engineer of Record for this project, I certify that I have the necessary training and experience to design such a dam or modification and to the best of my knowledge, understanding, and belief the design meets the standards of the Safe Dams Act, Rules for Dam Safety and the Safe Dams Program Engineer Guidelines.

Signature of Engineer:____________________ Date: 28 April 2023

I certify that the above information is true to the best of my knowledge.

Signature of Applicant:____________________ Date: 28 April 2023

Send this completed two-page application to: Georgia Safe Dams Program, 2 Martin Luther King Jr. Drive SE, Suite 1362 East Tower, Atlanta, GA 30334.

LAKE PETIT DAM

Pickens County, Georgia

State ID No. 112-009-00462

NID No. GA00685

Seepage Collection System Modifications Design Report

Prepared for:

Big Canoe® Property Owners Association, Inc.
10586 Big Canoe
Jasper, GA 30143

Prepared by:

Geosyntec Consultants, Inc.
835 Georgia Avenue, Suite 500
Chattanooga, TN 37402

Project No: TN9418

Document No: GA230181

April 2023

REVISION LOG

Revision Number	Date	Revisions Made
0	April 2023	Original Issue for Permit Approval

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LIST OF APPENDICES

1. INTRODUCTION

This Design Report (Report) provides documentation of proposed modifications of the existing interceptor drains that are part of the seepage collection system at Lake Petit Dam (Dam or Site). In addition, this Report documents the stability analysis of the dam in its current state. The objective of this document is to provide the Georgia Safe Dams Program (GA SDP) the necessary documentation for review and approval of planned replacement of infrastructure at the Dam and to maintain the Big Canoe® Property Owners Association, Inc. (POA or Owner) of Jasper, Georgia the operating permit for the Site.

This Report was prepared by Geosyntec Consultants, Inc. (Geosyntec) of Chattanooga, Tennessee on behalf of the Owner under the direction of one of Geosyntec's Engineers of Record (EOR) in the State of Georgia approved by the GA SDP.

2. PROJECT BACKGROUND

Lake Petit Dam is owned, operated, and maintained by the POA. Lake Petit Dam is located in Pickens County, Georgia, within the Big Canoe development on Petit Creek, approximately 5.8 miles upstream of Marble Hill, Georgia. The Dam was constructed to supply water and provide recreation for the Big Canoe development and is permitted as a Category I Dam under Chapter 391-3-8 of the Georgia State Code "Rules for Dam Safety."

The dam was constructed in 1972 as a zoned earth embankment consisting of a central clayey silt core and predominantly silty sand embankment shells. There are five benches on the downstream face of the Dam, excluding the roadway bench at the downstream toe. The benches are numbered in ascending order as well as with the approximate elevation of each, with the lowermost bench being identified as Bench Number (No.) 1, or the 1544 Bench. The upper three benches (Bench Nos. 3 through 5, or the 1584, 1606, and 1626 Benches, respectively) are vegetated with grass, while the lower two, Bench No. 1 and Bench No. 2 (1562 Bench) are partially paved with concrete channels that are intended to collect and convey both surface water (Bench Nos. 1 and 2) and interceptor drain seepage (Bench No. 1) from the face of the Dam.

There are 13 interceptor drains that exit into the concrete channel on Bench No. 1. The interceptor drains are a series of corrugated plastic pipes with gravel backfill surrounding. These drains were installed on the slope upstream of Bench No.1 post-construction of the dam, in the late 1970s, in response to observed seepage and wet areas on the dam face. There are no as-built records of the installation of these drains. The interceptor drains appear to be approximately three feet (ft) below the dam surface on the slope face and extend up to approximately two-thirds the length of the slope upstream from Bench No. 1. Camera inspections conducted in 2023 observed that the drains are aligned at varying layouts with at least one drain observed to tie directly into another. These inspections provided the alignment of the drains shown in the design drawings.

Recent Quarterly Owner and Engineering inspections have noted gravel and sediment in the concrete channel at Bench No. 1. One interceptor drain has been directly observed to be collapsed near its outlet, and the 2023 camera inspection observed other sections of pipe that are partially collapsed. These observations indicate these pipes have approached the end of their usable life and need replacement.

3. GEOTECHNICAL STABILITY ANALYSES

In 1998, Geosyntec evaluated the stability of the Dam under static and seismic conditions. As part of the scope of work, Geosyntec conducted a subsurface investigation, installed dam safety instrumentation, and completed a laboratory testing program on soil samples of the Dam for strength and material characterization. Using the results of the field and laboratory investigation activities, Geosyntec developed a seepage and slope stability model of the Dam to evaluate its performance under normal and seismic loading conditions. The calculated slope stability factors of safety met the requirements of the GA SDP for the global steady-state and pseudostatic scenarios.

The 1998 report was submitted to and reviewed by the GA SDP. Additionally, Geosyntec provided Big Canoe POA and GA EPD a White Paper in 1999 and Response to Comments in 2002, which further detailed the slope stability and seismic analyses conducted. However, these documents were never formally accepted as the calculation of record. Accordingly, Geosyntec prepared updated Stability Analyses of Lake Petit Dam (Package) and attached it herein as **Appendix A** for GA SDP review and approval.

The purpose of this Package is to document an updated evaluation of the stability of the Dam under the loading conditions required by the Rules and Regulations of the State of Georgia, Rule 391-3-8-.09 for earthen embankments. Specifically, this Package documents an evaluation of the calculated factor of safety against instability for static and pseudostatic loading with steady-state seepage conditions, as well as rapid drawdown analysis. Existing soil laboratory data and subsurface investigations were reviewed and judged to be sufficient for analysis. No significant data gaps were identified which warranted additional subsurface investigations.

The GA SDP's rules also reference the rapid drawdown case for a submerged downstream toe. This analysis was not included in this Package because the toe of the Dam is not submerged nor is it expected to become submerged during the design flood. During a flood event or discharge of the reservoir through the Spillway, it is unlikely the downstream side of the Dam will become inundated due to the discharge point location and local topographic relief downstream of the Dam. The Dam's spillway discharges into an impact basin, then into Petit Creek at approximately Elevation (El.) 1,514 ft and approximately 250 ft downstream of the impact basin. The ballfields across the street from the toe of the dam are at approximately El. 1,530 ft. The next controlled level downstream is Lake Sconti Dam, which is approximately one mile downstream and has an embankment top elevation and normal pool at approximately El. 1,470 ft and 1,464 ft, respectively. The GA SDP's rules also reference the end of construction case for stability following completion of dam construction. Stability of the Dam at the end of construction was not evaluated, as this dam has been constructed and in service for approximately 50 years.

4. SEEPAGE COLLECTION SYSTEM MODIFICATIONS DESIGN

Appendix B presents the proposed interceptor drain modification layout, details, and specifications. The existing interceptor drain pipes and gravel backfill are proposed to be removed and the remaining trench then backfilled with filter compatible sand. The resulting sand trench will continue to provide a pathway for seepage relief and convey water to a new longitudinal seepage trench that will be installed along the length of Bench No. 1.

The existing concrete channel will be demolished and removed, and the seepage trench will be installed beneath the current alignment of the concrete channel on Bench No. 1. The seepage trench will consist of a perforated 12-inch (in.) diameter, corrugated, high-density polyethylene (HDPE) pipe surrounded by specified, graded gravel, which will be filtered by a specified sand. The pipe will have drop inlets near the middle of the Dam and near each abutment, which will provide entry points for stormwater and the ability to access the pipe with equipment for future inspections and maintenance.

The invert of the pipe of the new seepage trench will be installed at a maximum elevation that corresponds to the modelled piezometric surface below the existing concrete channel on Bench No. 1 (i.e., maximum pipe El. 1,540.8 ft). This will provide a means to prevent the piezometric surface near the toe and Bench No.1 from increasing above the levels modelled, as presented in the geotechnical steady state seepage model contained in **Appendix A**.

The trench excavation and pipe layout will be graded to maintain positive drainage off the bench and direct subsurface flow to both abutments. The design was selected to minimize intrusive excavation into the dam while maintaining positive flow. Maximum excavation depths will be six to seven ft below ground surface.

The graded materials, pipe, and trench construction will be conducted by using a trench box with a specialty template to segregate the graded materials and ensure the design thicknesses are maintained during construction. The Owner plans to request bids and have a qualified contractor experienced with modifications to high-hazard dams perform the installation of this design. Geosyntec's Engineer of Record will be retained during construction and have an on-site representative to observe and document construction occurs as designed.

APPENDIX A
Stability Analyses of Lake Petit Dam

LAKE PETIT DAM

Pickens County, Georgia

State ID No. 112-009-00462

NID No. GA00685

Stability Analyses of Lake Petit Dam

Prepared for:

Big Canoe® Property Owners Association, Inc.
10586 Big Canoe
Jasper, GA 30143

Prepared by:

Geosyntec Consultants, Inc.
835 Georgia Avenue, Suite 500
Chattanooga, TN 37402

Project No: TN9418

Document No: GA230035

April 2023

Geosyntec
consultants

CALCULATION PACKAGE COVER SHEET

Client:	Big Canoe Property Owners Association	**Project:**	New Seepage Collection System and Stability Analyses

Project No.: TN9418 **Task #:** 03/02

TITLE OF COMPUTATION Stability Analyses of Lake Petit Dam

COMPUTATIONS BY:
Signature ________ 04/26/2023
DATE
Printed Name Edisson Ortega Avila
and Title Senior Staff Engineer

ASSUMPTIONS AND PROCEDURES CHECKED BY:
(Peer Reviewer)
Signature ________ 04/26/2023
DATE
Printed Name Jaime A. Mercado, Ph.D., P.E.
and Title Engineer

COMPUTATIONS CHECKED BY:
Signature ________ 04/26/2023
DATE
Printed Name Jaime A. Mercado, Ph.D., P.E.
and Title Engineer

COMPUTATIONS BACKCHECKED BY:
(Originator)
Signature ________ 04/26/2023
DATE
Printed Name Edisson Ortega Avila
and Title Senior Staff Engineer

APPROVED BY:
(PM or Designate)
Signature ________ 04/26/2023
DATE
Printed Name John W. Barrett, P.E. (GA)
and Title Principal Engineer

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STABILITY ANALYSES OF LAKE PETIT DAM

1 PURPOSE AND SCOPE

This calculation package (Package) was prepared by Geosyntec Consultants, Inc. (Geosyntec) to document the stability of Lake Petit Dam (Dam) with respect to current stability criteria as defined by the Rules and Regulations of the State of Georgia, Rule 391-3-8-.09. This Package presents engineering calculations to evaluate seepage and slope stability of the Dam under the loading conditions described within the regulations described herein.

1.1 Background and Site Geometry

Lake Petit Dam is located within the Big Canoe development on Petit Creek, approximately 5.8 miles upstream of Marble Hill, Georgia (GA) and is owned and operated by Big Canoe Property Owners Association (POA). The reservoir formed by the Dam has a surface area of 107 acres (ac) at a normal pool elevation (El.) of 1,635.5 feet (ft) North American Vertical Datum of 1988 (NAVD88). Elevations reported in this Package are in relation to NAVD88 unless otherwise noted. The storage of the reservoir is approximately 4,235 ac-ft at normal pool elevation, as confirmed by the bathymetric survey conducted in March 2022 which was subsequently approved by GA Safe Dams Program (SDP) in August 2022 (Geosyntec 2022). The Dam has a maximum height of 126 ft measured vertically from the downstream toe, a crest length of approximately 908 ft, and a crest width of approximately 35 ft.

The downstream face of the Dam was designed with 2.5H:1V (horizontal to vertical) slopes, and with 10-ft wide benches at approximately 20-ft vertical intervals. The upstream face of the Dam was designed with a continuous 3.5H:1V slope.

The Dam has a trench drain system (i.e., internal drain system) under the downstream face and is located at approximate El. 1,520 ft. The internal drain system discharges into an outlet structure (i.e., impact basin) with an invert at El. 1,516.7 ft. Downstream of the Dam are the ballfields, which are estimated to be relatively free-draining downstream of the Dam.

1.2 1998 Evaluation of Stability and Rehabilitation Measures

In 1998, Geosyntec evaluated the stability of the Dam under static and seismic conditions. As part of the scope of work, Geosyntec conducted a subsurface investigation, installed dam safety instrumentation, and completed a laboratory testing program on soil samples of the Dam for strength and material characterization. Using the results of the field and laboratory investigation activities, Geosyntec developed a seepage and slope stability model of the Dam to evaluate its performance under normal and seismic loading conditions. The calculated slope stability factors of safety met the requirements of the GA SDP for the global steady-state and pseudostatic scenarios.

1.3 Objective

The 1998 report was submitted to and reviewed by the GA SDP; however, it was never formally accepted as the calculation of record. The purpose of this Package is to document an updated evaluation of the stability of the Dam under the loading conditions required by the Rules and Regulations of the State of Georgia, Rule 391-3-8-.09 for earthen embankments. Specifically, this Package documents an evaluation of the calculated factor of safety against instability for static and pseudostatic loading with steady-state seepage conditions, as well as rapid drawdown analysis.

The remainder of this Package is organized to present: (i) applicable rules and regulations; (ii) methodology; (iii) input data; (iv) analysis results; and (v) conclusions.

2 APPLICABLE RULES AND REGULATIONS

2.1 Loading Conditions

The criteria, defined on "*Rule 391-3-8-.09, Standards for the Design and Evaluation of Dams*", was considered in the slope stability calculations presented in this Package. The following minimum factors of safety can be considered as acceptable stability for the Dam:

- The calculated static factor of safety under the long-term steady-state seepage conditions (i.e., normal pool) must equal or exceed 1.5;

- The calculated pseudostatic (i.e., seismic or earthquake loading) factor of safety under the long-term steady-state seepage conditions must equal or exceed 1.1; and

- The calculated static factor of safety under the rapid drawdown conditions at the upstream side of the Dam must equal or exceed 1.3.

2.2 Normal Pool

Normal Pool is defined as the normal maximum operating range of the reservoir. For Lake Petit Dam, the Normal Pool is at El. 1635.5 ft.

2.3 Earthquake Loading

The Engineer Guidelines (2015) for the Safe Dams Program in GA states that a dam "shall be able to withstand seismic acceleration defined in the most current map for peak acceleration from a 2 percent exceedance in 50 years (i.e., 2475-year return period) earthquake." and "the minimum required seismic acceleration is 0.05g."

The methodology utilized for development of the site-specific earthquake loading, prepared in accordance with the state regulations are described in Section 3.2.2.

2.4 Rapid Drawdown

The Engineer Guidelines (2015) for the Safe Dams Program in GA states that the Dam, specifically the gated structure system, shall be designed to drain two-thirds of the reservoir volume at normal pool within 10 days, which constitutes the basis for selection of the lower reservoir level for a rapid drawdown analysis. As stated above, Normal Pool for the Dam is El. 1635.5 ft and the elevation at which one-third of the reservoir is still impounded is El. 1,602.0 ft.

The GA SDP's rules also reference the rapid drawdown case for a submerged downstream toe. This analysis was not included in this Package because the toe of the Dam is not submerged nor is it interpreted to become submerged during the design flood. During a flood event or discharge of the reservoir through the Spillway, it is unlikely to inundate the downstream side of the Dam due to the discharge point location and local topography of the ballfields and topographic relief downstream of the Dam. The Dam's spillway discharges into Petit Creek at approximately El. 1,514 ft and approximately 250 ft downstream of the impact basin. The next controlled level downstream is Lake Sconti Dam, which is approximately one mile downstream and has an embankment top elevation and normal pool at approximately El. 1,470.0 ft and 1,464.0 ft, respectively.

2.5 End of Construction

The GA SDP's rules also reference the end of construction case for stability following completion of dam construction. Stability of the Dam at the end of construction was not evaluated, as this dam has been constructed and in service for approximately 50 years.

3 METHODOLOGY

Geosyntec evaluated the stability of the tallest cross-section using limit equilibrium calculation procedures to assess the factor of safety. The pore water pressure for Normal Pool was computed with a steady-state seepage analysis. The sections below outline the methodology adopted for analysis.

3.1 Seepage Analysis

Seepage analyses were performed using the computer program SEEP/W, version 2019 (Geo-Slope, 2019a). SEEP/W uses the finite element method (FEM) for analyzing groundwater seepage problems in soil and rock. SEEP/W is capable of modeling saturated and unsaturated flow under steady-state and transient conditions.

The solution procedure for the FEM seepage model consists of defining the geometry by drawing regions that identify distinct lithologic units, assigning material parameters, and defining boundary conditions. The seepage model includes the entire embankment cross-section and underlying foundation units. A global element size of 2 ft was used for developing the FEM mesh. Low-order elements (i.e., three-node triangles and four-node quadrilaterals) were considered adequate for the FEM seepage model.

For the materials in the Dam, the hydraulic conductivities were calibrated within the range previously defined by Geosyntec (1998) until reaching a reasonable representation of the steady-state seepage condition, as interpreted from piezometers within the embankment. Piezometric readings from G-1, G-1B, G-2, P-2, P-4, P-6, and P-7 were used to compare the obtained total head from the model and the defined target value shown in Table 1. The target was selected from the mean value of the data ranging from 2020 to 2022 plus one standard deviation computed using the Three Sigma Rule (Grafarend 2006). While calibrating the seepage model, more weight was given to the piezometers close to the ground surface as they were interpreted to provide a better representation of the phreatic surface; however, this resulted in conservative estimates of the total head (i.e., increased head) deeper within the Dam.

3.1.1 Boundary Conditions

3.1.1.1 Reservoir Loading Condition

The Normal Pool reservoir was simulated with a total head boundary condition set at El. 1,635.5 ft along the upstream face and reservoir of the Dam.

3.1.1.2 Far-Field Boundary Condition

The far-field (downstream) boundary condition for the seepage analyses was set approximately 130 ft downstream of the toe of the Dam. The downstream boundary condition was assumed to be equal to El. 1,516.7 ft and defined as a total head boundary at the far downstream edge of the seepage model. This elevation corresponds to the invert of the trench drain located at the impact basin.

3.1.1.3 Internal Drain System

An internal drain system is located beneath the downstream face of the Dam and collects seepage from the embankment which is connected to the downstream toe via pipes installed during the original construction. This internal drain has been modeled as a discrete point within cross-section A-A with a total head boundary condition. The total head boundary condition allows seepage to exit the model at the location and appropriately represents the internal drain system.

The total head boundary condition assigned to the internal drain system was El. 1,535.0 ft. This boundary condition was selected based on calibration of the seepage model, in which the total head was varied until reaching a reasonable representation of the seepage model based on the target values shown in Table 1 for the piezometer readings.

3.2 Slope Stability Analysis

Limit-equilibrium slope stability analyses were performed using the computer program SLOPE/W, version 2019 (Geo-Slope, 2019b). SLOPE/W is a 2D slope stability computer program which can be used to employ both rigorous and non-rigorous limit-equilibrium analysis methods. SLOPE/W analyses uses the pore water pressures computed from the seepage analysis performed with SEEP/W.

The method described by Morgenstern-Price (1965) was used to conduct limit-equilibrium slope stability analyses. Morgenstern-Price's method utilizes interslice forces which consider both shear and normal interslice forces. Both moment and force equilibrium are satisfied for individual slices as well as the entire soil mass.

Circular failure surfaces were considered for limit-equilibrium slope stability analyses. For circular failure surfaces, ranges of entry and exit locations for potential slip surfaces were defined along the analyzed slope. The search for the critical slip surface was performed by initially selecting a large range of entry and exit locations, and then refining these ranges once the likely locations of critical entry and exit locations were identified. The entry and exit ranges were divided into 30 increments with 4 radius increments to evaluate potential failure surfaces.

The minimum sliding mass depth was set at 10 ft in order to avoid results of surficial, localized failures that are not likely to impair the overall embankment stability. These surficial failures can typically be corrected by routine maintenance activities and are not considered to pose a threat to the safety of the Dam. Because unsaturated shear strength is not assigned in these analyses, the effects of negative pore water pressures on shear strength are conservatively ignored.

3.2.1 Static Slope Stability Evaluation

Geosyntec performed static slope stability calculations for both downstream and upstream slopes, using the drained strength parameters for the defined materials and pore water pressures determined from steady-state seepage analyses described above.

3.2.2 Pseudostatic Slope Stability Evaluation

The pseudostatic analysis performed herein accounted for a horizontal seismic loading on the Dam, for both downstream and upstream slopes. The analysis was performed using the defined undrained strength parameters to account for rapid loading conditions within the cohesive soils and effective stress parameters were used for the free-draining materials. To conduct a pseudostatic analysis, a horizontal seismic coefficient (K_s) was computed. K_s was calculated using the method proposed by Bray and Travasarou (2009), an industry-accepted method for analyzing the seismic performance of embankments and slopes. This method utilizes simplified, semiempirical procedures to evaluate the performance of the Dam during earthquake loading.

Seismic coefficient calculations, presented in Attachment 1, are based on the following procedure.

Step 1: Estimate the Fundamental Period

The initial fundamental period (T_s) of the sliding mass was estimated using the following:

$$T_s=2.6H/V_s \qquad (1)$$

where H is the average height of the potential sliding mass, and V_s is the average shear wave velocity of the sliding mass. For this Package, the average height of the potential sliding mass was taken as the height of the Dam (i.e., 126 ft). V_s was calculated as 1,148 ft/s using shear wave velocity tests conducted in boring G-1B (Geosyntec 1998). This data is provided in Attachment 2. The computed T_s for the sliding mass is **0.28 sec**.

Step 2: Estimate the Pseudostatic Seismic Coefficient

The K_s was calculated using the equations and relationships provided by Bray and Travasarou (2009):

$$K_s=\exp[(-a+b^{0.5})/0.665] \qquad (2a)$$

where variables a and b are calculated using the following relationships:

$$a=2.83-0.566\ln(S_a) \qquad (2b)$$

$$b=a^2-1.33\{\ln(D)+1.10-3.04\ln(S_a)+0.244[\ln(S_a)]^2-1.5T_s-0.278(M-7)-\varepsilon\} \qquad (2c)$$

where:

- S_a is the 5 percent damped elastic spectral acceleration at the degraded period of $1.5T_s$ of the sliding mass;

- ε is the normally distributed variable to account for the probability of exceedance;
- M is the earthquake's moment magnitude; and
- D is the maximum allowable displacement in centimeters (cm) of the sliding mass.

The site's design spectra was estimated using the online National Seismic Hazard Model (NSHM) Hazard Tool made available by the United State Geological Survey (USGS), which presents a Uniform Hazard Response Spectra (UHRS) created from the National Seismic Hazard Model (USGS 2018). The UHRS analysis was performed using a Site Class D based on ASCE 7.16 (ASCE 2017) according to the V_s. Recent guidelines, such as ASCE 7.22 (ASCE 2021), provide boundary Site classes depending on the V_s. For the Dam, a Site Class C/D was estimated with the most recent guideline; however, Geosyntec conservatively adopted Site Class D in order to incorporate more conservative estimates of ground shaking at the site. The S_a at the degraded period ($1.5T_s$) of the Dam is **0.31 g** for a Site Class D. The estimated UHRS is presented in Attachment 1.

The normally distributed variable (ε) is estimated from a normal distribution function which accounts for the probability of exceedance of the selected displacement threshold (i.e., D). For example, a 50 percent probability of exceedance represents ε=0, while a 16 percent probability of exceedance represents ε=1. In this Package, a 10 percent probability of exceedance was selected (i.e., ε=1.32).

The estimated pseudostatic coefficient is modified based on the moment magnitude of the earthquake (M) selected for analysis. Selection of the magnitude is based upon regional sources of ground motions and typically ranges between 6.5 and 7.5. While the Site is in a region with relatively low seismic hazards, Geosyntec conservatively adopted an earthquake with a moment magnitude **7.0** for analysis and estimation of pseudostatic coefficients.

For embankments, the industry standard for the maximum allowable displacement of earthen dams is 60 cm (approximately 2 ft) during seismic events (FEMA, 2005). Based on the Bray and Travasarou (2009) method, the allowable displacement selected herein (i.e., D=2 ft) corresponds to a K_s of 0.054. Multiple analyses were conducted for the pseudostatic stability to evaluate the sensitivity of the model to seismic loading, specifically for the downstream slope (i.e., most critical slope under an earthquake). Initially, the allowable displacement was varied from 10 to 100 cm to compute the K_s with the Bray and Travasarou (2009) method. Additionally, the GA SDP's minimum seismic acceleration of 0.05 g was evaluated as part of the sensitivity analysis. Then, slope stability analyses were performed to determine the factor of safety for each value of K_s. The analysis was also conducted to compute the yield coefficient (K_y) for the Dam. K_y is equal to a horizontal seismic acceleration coefficient that results in a factor of safety equal to one (i.e., the acceleration above which produce deformations in a Newmark analysis).

3.2.3 Rapid Drawdown Slope Stability Evaluation

Rapid drawdown conditions occur when a reservoir level drops rapidly, not allowing for relatively impermeable soils within the embankment to drain. Rapid drawdown decreases the stabilizing effect of the reservoir on the slope, while undrained strengths still govern slow-draining soils within the embankment, resulting in an extreme loading condition on the embankment. The three-stage procedure described by Duncan et al. (1990) is used for the analysis of the rapid drawdown condition:

- Stage 1: Prior to drawdown, steady-state seepage conditions are used to calculate effective consolidation stresses on a failure surface of interest.

- Stage 2: Following drawdown, stability analysis is performed on the failure surface of interest using undrained shear strengths and total-stress analysis. Interpolation is used to estimate undrained shear strength based on effective principal stress ratios after consolidation and at failure.

- Stage 3: If drained shear strengths are less than undrained shear strengths, stability analysis is performed using drained shear strengths, assuming excess pore water pressures induced due to drawdown have dissipated.

This process may then be repeated for other failure surfaces to determine the critical slip surface for sudden drawdown. SLOPE/W automatically performs the previously described stages and reports the critical factor of safety computed for the slope.

To conduct the rapid drawdown analysis, two piezometric lines were used: one for the pre-drawdown steady-state condition (i.e., at El. 1,635.5 ft) and one for the post-drawdown steady-state condition (i.e., at El. 1,602 ft), based on the requirement of draining two-thirds of the reservoir volume and then the procedure described above was implemented.

4 INPUT DATA

4.1 Cross-Section Used for Analysis

One two-dimensional (2D) cross-section was developed for the seepage and slope stability analyses of the Dam. The cross-section A-A is located along the transverse centerline of the Dam as shown in Figure 1. Cross-section A-A is aligned with existing piezometers installed at the downstream face of the Dam (i.e., piezometers in boring locations G-1, G-1B, G-2, P-2, P-4, P-6, and P-7).

Figure 2 shows the cross-section adopted for the analysis. The surface elevations of the downstream face were developed from a survey of the Dam conducted in May 2021. The slopes of the downstream face were measured to range from 2.2H:1V to 2.5H:1V. The steeper slopes were observed close to the toe of the Dam and the crest. The surface elevation of the upstream face of the Dam was developed from a bathymetric survey of the reservoir conducted in March 2022. The overall slope of the upstream face was measured as 3.5H:1V.

The Dam consists of a shell and core with an underlying saprolite and bedrock. The ballfields are located at the downstream side of the Dam. These subsurface conditions at the Dam were established using information from the following historic sources: (i) boring logs from the 1998 field investigation conducted by Geosyntec and Piedmont Geotechnical Consultants, Inc.; (ii) boring logs from field investigations prior to the construction of the Dam.; (iii) topographic map of the area prior to the construction of the Dam; and (iv) design drawings for the Dam.

4.2 Material properties

Geosyntec estimated material parameters for analysis based upon a review of previously defined material parameters (Geosyntec 1998) and laboratory test results. As part of the 1998 field investigation, samples collected from the shell and core of the Dam were analyzed in the laboratory for index properties and strengths using isotropic consolidated undrained triaxial compression (ICU-TXC) tests. This data is provided in Attachment 2. Table 2 presents a summary of the material properties selected for the evaluations performed herein. The following subsections present the properties for the subsurface conditions at the Dam used in the seepage and slope stability analyses.

4.2.1 Hydraulic Conductivity

Dam Shell

Based on results from the grain size analyses conducted on Dam shell material, the shell is a silty sand classified as SM based on the Unified Soil Classification System (USCS). The average unit weight (γ) of the shell is 125 pounds per cubic foot (pcf). A vertical hydraulic conductivity (k_V) of 1.6 $x10^{-5}$ ft/s (4.9$x10^{-4}$ cm/s) and an anisotropy ratio (k_V/k_x) of 0.5 for the Dam shell material were used. The hydraulic conductivity was calibrated from the seepage model to reasonably match the target total heads from the piezometers presented in Table 1.

Dam Core

Based on results from the grain size analyses conducted on Dam core material collected, the core is a sandy silt classified as ML based on the USCS. A γ=130 pcf, a k_V of 3.3 $x10^{-6}$ ft/s (1.0$x10^{-4}$ cm/s), and an anisotropy ratio of 0.1 for the Dam core material were used. Similar to the shell, the hydraulic conductivity was calibrated from the seepage model to reasonably match the total heads from the piezometers.

Saprolite

The upstream saprolite was assumed to be relatively impermeable compared to the Dam shell and core. k_V = 3.3 $x10^{-9}$ ft/s (1.0$x10^{-7}$ cm/s) for the upstream saprolite material was used while the downstream saprolite was modeled with k_V = 1.6 $x10^{-6}$ ft/s (4.9$x10^{-5}$ cm/s). The anisotropy ratio assumed for the material was 1.0.

Ballfield

In the stability analyses, the ballfield soils have been modeled with γ=125 pcf, k_V = 1.6 $x10^{-3}$ ft/s (4.9$x10^{-2}$ cm/s), and an anisotropy ratio of 1.0. The hydraulic conductivity properties were calibrated based on the seepage model to properly represent a free draining material typically for ballfields.

Bedrock

In the stability analyses, the bedrock was modeled as impenetrable. The bedrock was assumed to be relatively impermeable compared to the Dam shell and core. $k_V = 3.3 \times 10^{-9}$ ft/s was used for this material. The assumed hydraulic conductivity is supported by the observation that no boils or other indications of upward seepage were observed in the tailwater creek below the Dam (Geosyntec 1998).

4.2.2 Drained and Undrained Strength Parameters

Dam Shell

Based on the dam shell ICU-TXC tests, the effective parameters at the ultimate strength condition were lower than the peak, with a range for the friction angle from 34 to 37 degrees (deg). Geosyntec selected effective friction angle (ϕ') of 34 deg and no cohesion (c') for analysis.

For the current evaluation, Geosyntec adopted the maximum effective principal stress ratio (i.e., maximum obliquity) as the failure criterion for individual laboratory tests results and re-interpreted the undrained strength characterization. Figure 3 presents failure points of individual triaxial laboratory tests based on the criterion of maximum obliquity. A linear relationship was used to define the undrained shear strengths for both the shell and core. A total stress friction angle (ϕ) of 23 deg and a cohesion (c) of 1,000 psf were selected.

Dam Core

The effective stress parameters, ϕ'=32 deg and c'=0 psf, were selected based on the evaluation of the ICU-TXC tests. The undrained parameters, ϕ=23 deg and c=1,000 psf, were obtained for the core as shown on Figure 3 and described in the previous section.

Saprolite

In the stability analyses, the saprolite has been modeled differently at the upstream and downstream of the Dam. The upstream saprolite was modeled as impenetrable, while the downstream saprolite was modeled with γ=125 pcf and drained shear strengths of ϕ'=35 deg and c'=0 psf. These parameters are considered conservative based on the high SPT blow counts measured in the material.

Ballfield

The drained shear strengths of ϕ'=32 deg and c'=0 psf were selected based on typical values of free draining materials judged to representative of fill common for roadway and ballfield construction.

Bedrock

Bedrock was assumed to be impenetrable for slope stability computations.

5 ANALYSIS RESULTS

The calculated phreatic surface and total head contours from the seepage analysis are presented in Attachment 3. For the steady-state seepage conditions analyzed, the calculated total heads were higher than the target values presented in Table 1 at several piezometer locations. The computed higher total heads represent a conservatively representative scenario of the Dam's internal seepage, and the results were considered appropriate for the stability analyses.

5.1 Static Slope Stability Evaluation Results

The calculated factor of safety for steady-state seepage slope stability analysis are summarized in Table 3 and the results are presented in Attachment 4. The calculated factor of safety, for both upstream and downstream slopes, are greater than the minimum required value for a long-term steady-state condition.

5.2 Pseudostatic Slope Stability Evaluation Results

The calculated factor of safety for steady-state seepage slope stability under seismic conditions (i.e., pseudostatic analysis) are summarized in Table 3 and the results are presented in Attachment 4.

For the allowable displacement of 60 cm (i.e., 2 ft), a K_s of 0.054 g caused a factor of safety of **1.5** and **2.4** for the downstream and upstream slopes, respectively. Based on the sensitivity analysis, a displacement equal to 100 cm (i.e., approximately 3 ft) resulted in seismic coefficients lower than the state-required seismic acceleration (i.e., 0.05g) for the design and evaluation of dams.

Geosyntec also evaluated a more conservative allowable displacement of 10 cm (i.e., 4 inches). With an allowable displacement of 4 inches, a K_s equal to 0.14 g was calculated, and on the calculated factor of safety was 1.2 for the downstream slope.

When using the GA SDP's minimum seismic acceleration of 0.05 g, a pseudostatic factor of safety of 1.5 was computed for the downstream slope of the Dam. The computed K_y was 0.2 g for a factor of safety equal to one. Note that the K_y is higher than the estimated peak ground acceleration at the site (from the UHRS) of 0.18 g. Therefore, the embankment is considered stable under the seismic loading conditions evaluated herein.

5.3 Rapid Drawdown Slope Stability Analysis

The calculated factor of safety for rapid drawdown condition at cross-section A-A is summarized in Table 3 and the results are presented in Attachment 4.

Assuming a sudden release of two-thirds of the reservoir volume, the calculated factor of safety of 2.1 at the upstream slope is greater than the minimum required value of 1.3. Therefore, the embankment is considered stable under rapid drawdown loading condition considered in this evaluation.

6 CONCLUSION

Geosyntec performed seepage and slope stability analyses to evaluate and document the stability of Lake Petit Dam and predicted performance during an earthquake and following a rapid drawdown of the reservoir. Geosyntec reviewed the existing geotechnical and instrumentation data at the Site and updated the geotechnical characterization of the respective geologic and dam units. Additionally, Geosyntec developed seismic loading parameters in accordance with current guidelines for conducting pseudostatic analyses.

The calculated factors of safety exceed the minimum required values for all load cases as described herein and meets the slope stability criteria established within the GA SDP Guidelines. There are currently no known issues or concerns from a slope stability perspective.

7 REFERENCES

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TABLES

Table 1 – Piezometer Target Values for Model Calibration

Data Analysis	Mean	Std. Dev.	Target[1]
P-2A	1626.2	0.5	1626.7
P-2B	1611.1	0.9	1611.9
P-2C	1596.1	0.6	1596.7
P-4A	1588.5	2.8	1591.3
P-4B	1573.0	2.1	1575.1
P-4C	1570.6	1.4	1571.9
P-6A	1555.1	0.9	1556.0
P-6B	1538.9	0.8	1539.8
P-6C	1554.2	1.0	1555.1
P-7A	1536.1	0.5	1536.6
P-7B	1522.6	0.4	1523.0
P-7C	1527.6	0.4	1528.0
G-1A Shallow	1598.4	1.9	1600.3
G-1A Deep	1579.5	1.6	1581.0
G-1B	1585.3	1.3	1586.6
G-2 Shallow	1570.5	2.7	1573.2
G-2 Intermediate	1559.9	1.5	1561.4
G-2 Deep	1553.4	0.8	1554.2

Notes:

1. Target total head for the piezometers was selected as the Mean + 1 standard deviation of the piezometers' measured data over the last three years, which represents the upper range of 68% of the data using the Three Sigma Rule (Grafarend 2006).

Table 2 – Summary of Selected Geotechnical Parameters

Material Type	Total Unit Weight	Effective Shear Strength Parameters		Undrained Shear Strength Parameters		Hydraulic Conductivity		
	γ (pcf)	c' (psf)	ϕ' (deg)	c (psf)	ϕ (deg)	k_h (ft/s)	k_v (ft/s)	k_v / k_h
Bedrock	Impenetrable					3.3E-09	3.3E-09	1.0
Ballfield	125	0	32	-	-	1.6E-03	1.6E-03	1.0
Dam Core	130	0	32	1,000	23	3.3E-05	3.3E-06	0.1
Dam Shell	125	0	34	1,000	23	3.3E-05	1.6E-05	0.5
Saprolite D/S	125	0	35	-	-	1.6E-06	1.6E-06	1.0
Saprolite U/S	Impenetrable					3.3E-09	3.3E-09	1.0

Acronyms:
D/S: Downstream
U/S: Upstream

Table 3 – Summary of Calculated Factors of Safety for Slope Stability

Loading Condition	Required Minimum Factor of Safety[1]	Calculated Factor of Safety[2]
Steady-State Seepage Stability (Downstream)	1.5	1.6
Steady-State Seepage Stability (Upstream)	1.5	2.5
Steady-State Seepage Pseudostatic Stability (Downstream)	1.1	1.5 (D=60 cm) [3]
Steady-State Seepage Pseudostatic Stability (Upstream)	1.1	2.4 (D=60 cm) [3]
Rapid Drawdown (Upstream) Stability	1.3	2.1

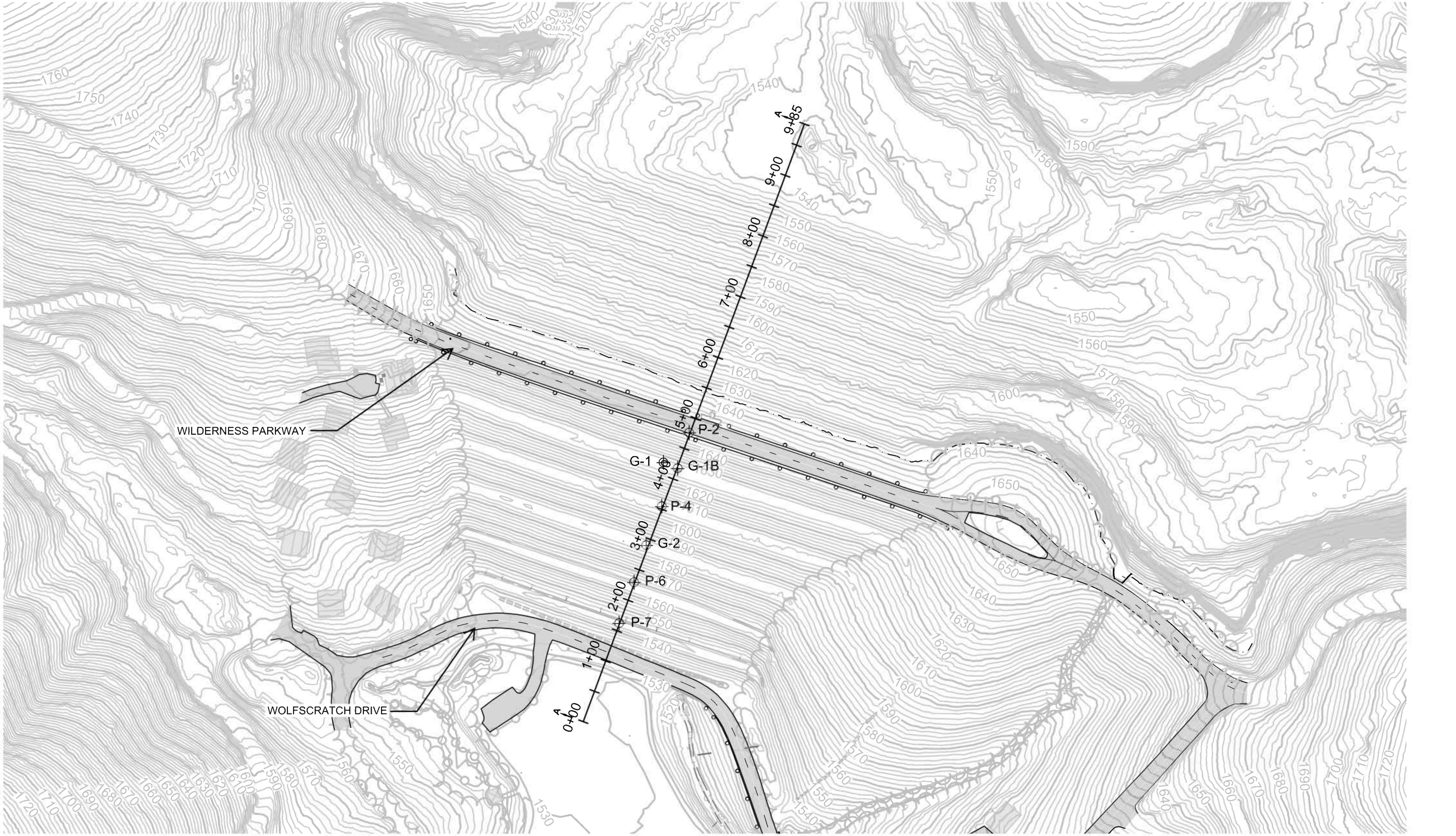
Acronyms:

None.

Notes:

1. Required minimum factor of safety are from the GA SDP Rules for Dam Safety, Rule 391-3-8-.09.
2. Results of stability analysis for the loading conditions are presented in Attachment 2.
3. The pseudostatic slope stability for the upstream slope was computed for an allowable displacement of 60 cm for a K_s equal to 0.054 g.

FIGURES



LEGEND

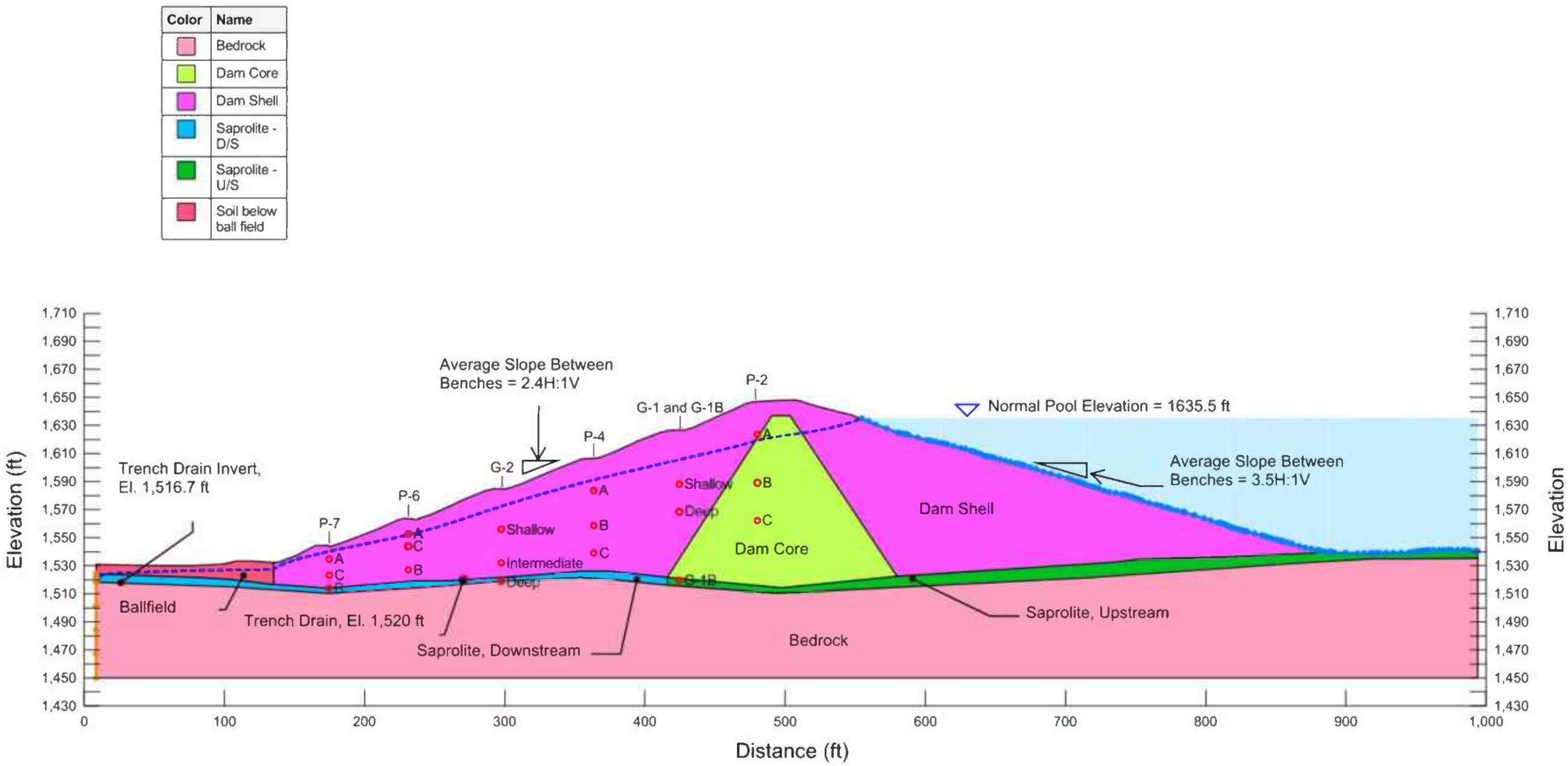
1570 — EXISTING GROUND MAJOR CONTOUR (10')

EXISTING GROUND MINOR CONTOUR (2')

⌖ APPROXIMATE BORING LOCATION OF PIEZOMETERS USED IN THIS CALCULATION PACKAGE.

0 150' 300'
SCALE IN FEET

PLAN VIEW CROSS-SECTION A-A LAKE PETIT DAM	
Geosyntec consultants	FIGURE 1
PROJECT NO: TN9418	FEBRUARY 2023



Notes:
Trench drain is located at elevation 1520 ft.; however, the trench drain is modeled with a total water head set at 1535 ft. to account for the efficiency of the trench drain.

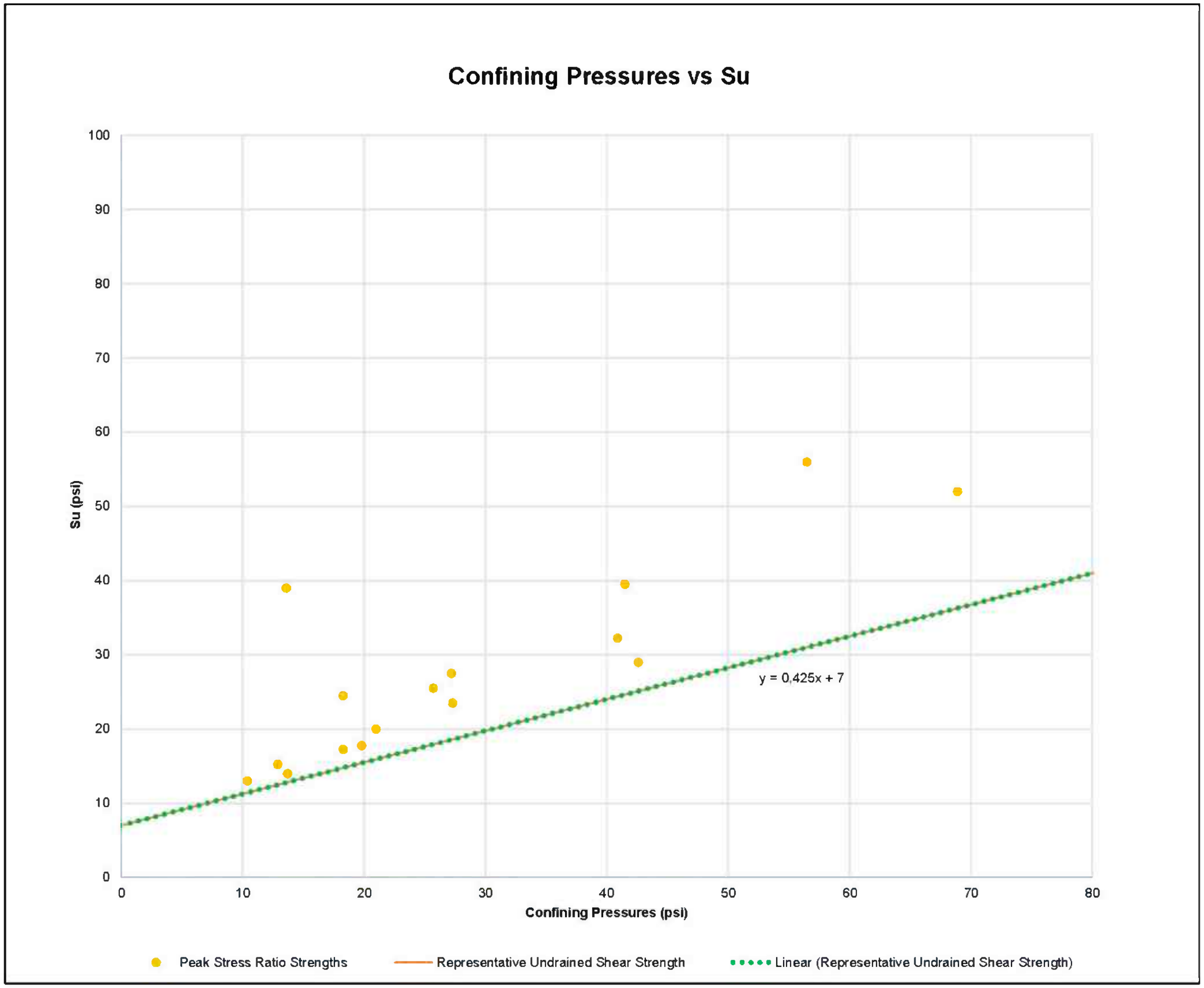
STEADY-STATE SEEPAGE ANALYSIS
LAKE PETIT DAM

Geosyntec consultants

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 2



Notes:
Representative undrained shear strength, c = 1,000 psf and φ = 23 deg.

STEADY-STATE SEEPAGE ANALYSIS
LAKE PETIT DAM

Geosyntec consultants

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 3

ATTACHMENT 1
Site Seismic Evaluation

Average Shear Wave Velocity Calculation

Shear Wave Velocity (ft/sec)	Depth (ft)	Material Description	Shear Wave Velocity by Layer (Denominator of EQ 20.4-1)*
--	0	--	--
648	2.5	SILT	0.00386
816	7.5	SILT	0.00613
957	12.5	SILT and fine to medium sand	0.00522
1333	17.5	SILT and fine to medium sand	0.00375
1074	22.5	SILT and fine to medium sand	0.00466
1105	27.5	SILT and fine to medium sand	0.00452
1466	32.5	SILT and fine to medium sand	0.00341
805	37.5	SILT and fine to medium sand	0.00621
1025	42.5	SILT and fine to medium sand	0.00488
1447	47.5	SILT and fine to medium sand	0.00346
1140	52.5	SILT, very fine sand and gravel	0.00439
1293	57.5	SILT, very fine sand and gravel	0.00387
1178	62.5	SILT, very fine sand and gravel	0.00424
1846	67.5	SILT, very fine sand and gravel	0.00271
1342	72.5	SILT, very fine sand and gravel	0.00373
882	77.5	SILT, very fine sand and gravel	0.00567
1324	82.5	SILT, very fine sand and gravel	0.00378
1501	87.5	SILT, very fine sand and gravel	0.00333
1471	92.5	SILT, very fine sand and gravel	0.00340
1305	96.5	SILT	0.00307
1422	100.5	SILT	0.00281

Low:	648	ft/sec
Max:	1846	Data Source:
Average ($\overline{v}_s$)*:	1148	ft/sec
Median:	1293	ft/sec
Depth:	100.5	ft

Notes:
*Average Shear Wave Velocity, EQ 20.4-1, page 204, ASCE 7-16.

$$\overline{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}} \qquad (20.4\text{-}1)$$

1) The values for the shear wave velocity and depth have been exported from the Law 1998 report, boring G-1B.

2) Based on the Average Shear Wave Velocity ($\overline{v}_s$) the site would be classified as Stiff Soil (Class D). Please see Table 20.3.1 (ASCE 7-16) for Site Classification based on the average shear wave velocity.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard rock	>5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50 blows/ft	>2,000 lb/ft^2
D. Stiff soil	600 to 1,200 ft/s	15 to 50 blows/ft	1,000 to 2,000 lb/ft^2
E. Soft clay soil	<600 ft/s	<15 blows/ft	<1,000 lb/ft^2
	Any profile with more than 10 ft of soil that has the following characteristics: — Plasticity index $PI > 20$, — Moisture content $w \geq 40\%$, — Undrained shear strength $\bar{s}_u < 500$ lb/ft^2		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

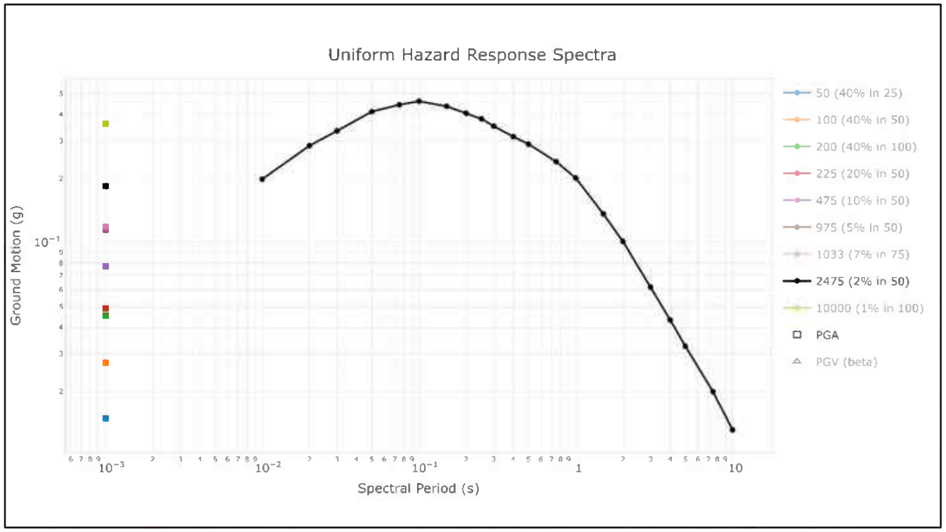
Note: For SI: 1 ft = 0.3048 m; 1 ft/s = 0.3048 m/s; 1 lb/ft^2 = 0.0479 kN/m^2.

Uniform Hazard Response Spectra Data

Intensity Measure Type (IMT): 2475 (2% in 50)
Peak Ground Acceleration (PGA): 0.184 g

Spectral Period (s)	Ground Motion (g)
0.01	0.198
0.02	0.285
0.03	0.334
0.05	0.412
0.075	0.443
0.1	0.460
0.15	0.436
0.2	0.405
0.25	0.380
0.3	0.352
0.4	0.314
0.5	0.290
0.75	0.240
1	0.201
1.5	0.136
2	0.101
3	0.062
4	0.043
5	0.033
7.5	0.020
10	0.013

Site Location



Notes:
1) Data Source: NSHM (USGS 2018).

Seismic Coefficient Calculation

Step 1:

Calculation of Initial Fundamental Period (T_s)

Pseudostatic Analysis in 1D or 2D:

1D: The case of a relatively wide potential sliding mass that is shaped like a trapezoid where:

$T_S = 4H/V_S$

$H =$	126	ft	*<- Height of Dam.*
$V_S =$	1148	ft/sec	*<- Average shear wave velocity.*
$T_S =$	0.439	s	

2D: The case of a triangular-shaped sliding mass that largely has a 2D response, where:

$T_S = 2.6H/V_S$

$H =$	126	ft	*<- Height of Dam.*
$V_S =$	1148	ft/sec	*<- Average shear wave velocity.*
$T_S =$	0.285	s	*<- Due to the geometry of the dam and 2D response expected, this T_s value is used.*

Step 2:

Calculation of the Seismic Coefficient (K_s)

$K_S = \exp[(-a + b^{0.5})/0.665]$

$a = 2.83 - 0.566 \ln(S_a)$

S_a at $1.5T_S$

$1.5T_s =$ 0.428

$S_a =$ 0.306948

Spectral Ground Motion

0.4	0.313671
0.5	0.289592
0.428	0.306948

<- Linear interpolation between 0.4 and 0.5 Spectral Periods.

$a = 3.498$

$b = a^2 - 1.33\{\ln(D) + 1.10 - 3.04\ln(S_a) + 0.244[\ln(S_a)]^2 - 1.5T_s - 0.278(M - 7) - \varepsilon\}$

$a =$	3.498		
$D =$	20	cm	*<- Maximum Allowable Displacement.*
$S_a =$	0.306948		
$T_s =$	0.285	s	
$M =$	7		*<- Magnitude (M) = 7 moderate event; M = 9 major event.*
$\varepsilon =$	1.32		*<- Normally distributed random variable with zero mean and standard deviation of 0.66 for 86th percentile, and 1.32 for 95th percentile.*
$b =$	3.889		
$K_S =$	0.101		

Notes:

[blue] Input values/data.
[orange] Output results.

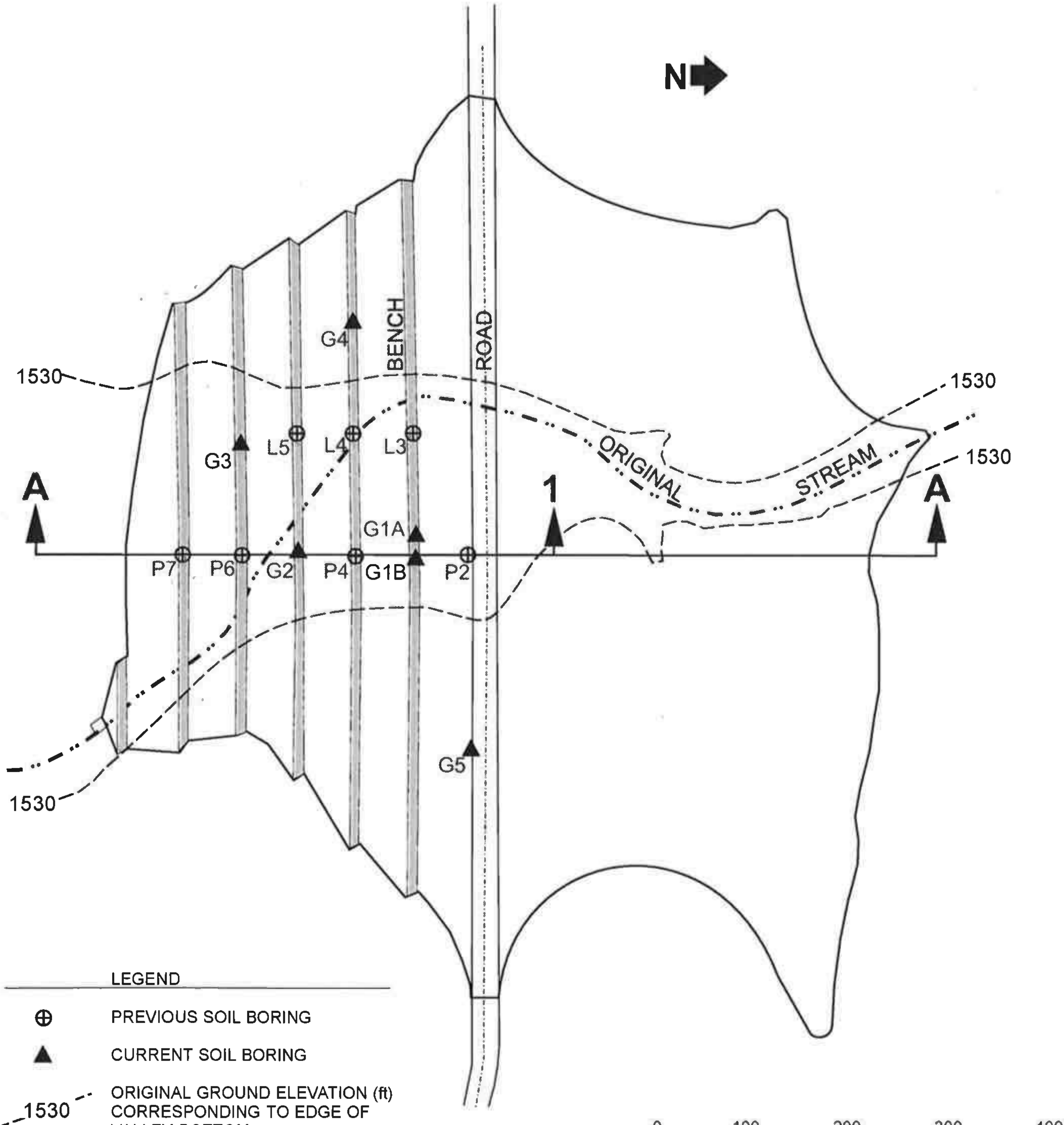
1) The seismic coefficients used in the Pseudostatic Analyses were calculated using a simplified semiempirical predictive procedure (Bray & Travasarou, 2009).
2) The example seismic coefficient calculation presented above was conducted with the assumption of a maximum allowable displacement of 20 cm (approximately 7.9 inches).
3) For the Pseudostatic Analyses, the following parameters are used when calculating the seismic coefficients: H, V_s, T_s, S_a, M, and ε.
3) S_a at a degraded $1.5T_s$ procured from the NSHM Hazard Tool (USGS, 2018).

4) A summary table with calculated seismic coefficients for D = 100, 75, 60, 30, 20, and 10 cm is presented below.

D (cm)	K_s
100	0.038
75	0.047
60	0.054
30	0.081
20	0.101
10	0.140

ATTACHMENT 2
Geotechnical Data

PETIT COVE DAM
PLAN VIEW



LEGEND

⊕ PREVIOUS SOIL BORING

▲ CURRENT SOIL BORING

1530 ORIGINAL GROUND ELEVATION (ft) CORRESPONDING TO EDGE OF VALLEY BOTTOM

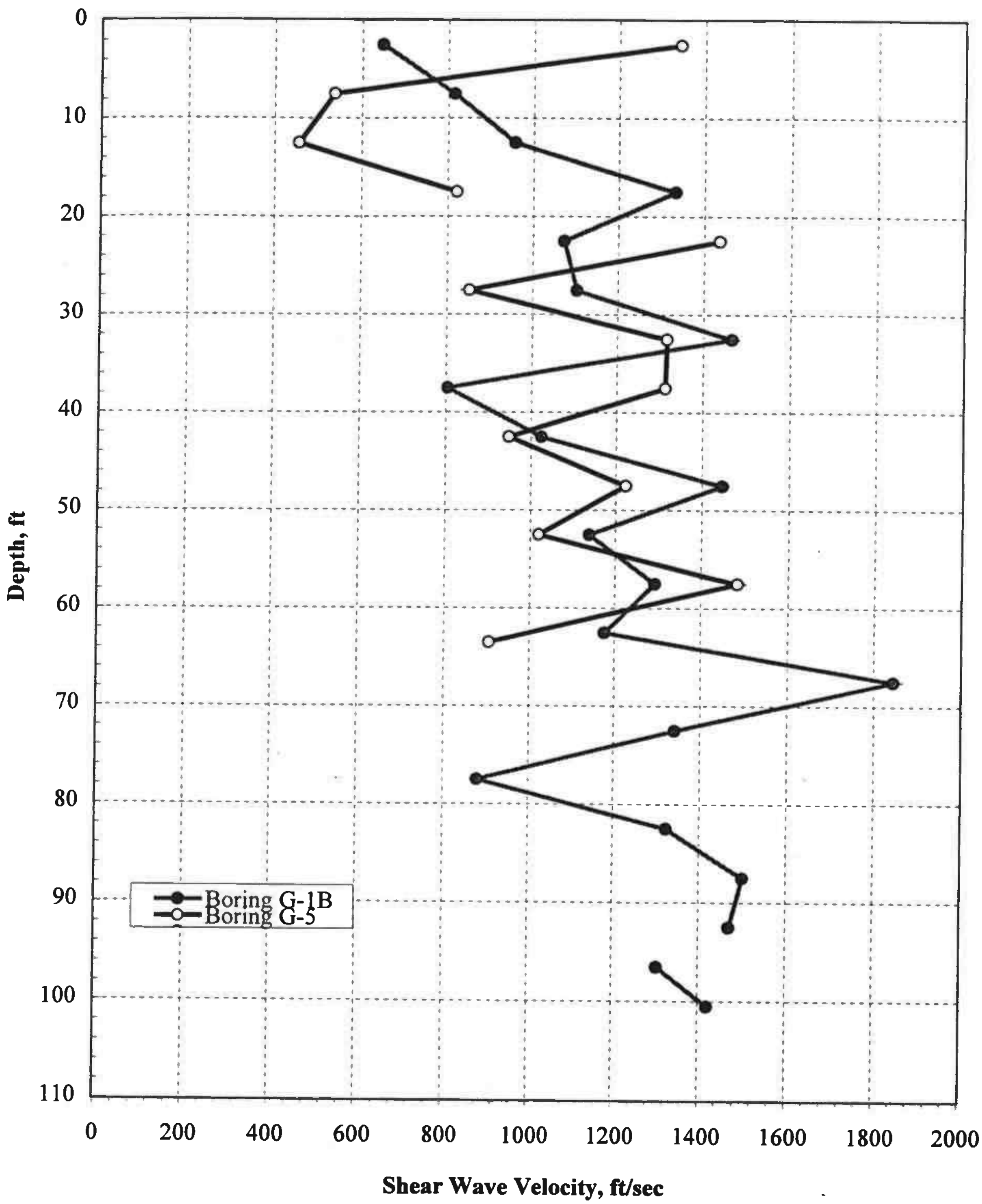
0 100 200 300 400
SCALE IN FEET

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	2-1
PROJECT NO.	GL0625-15
DOCUMENT NO.	GA981181
FILE NO.	Plan.cdr

Shear Wave Velocity Profile

SHEAR WAVE VELOCITY PROFILES



GEOSYNTEC CONSULTANTS ATLANTA, GEORGIA	FIGURE NO.	2-4
	PROJECT NO.	GL0625-15
	DOCUMENT NO.	GA981181
	FILE NO.	FIGS.cdr/df

Summary of Standard Penetration Test, Triaxial Shear Test, and Index Property Test Results

TABLE 2-1

SUMMARY OF OCTOBER 1998 GEOSYNTEC FIELD INVESTIGATION PROGRAM

Boring No.	Drilling				Sampling				Instrumentation and Additional Testing	
	Location (Figure 2-1)	Total Depth	Method	Terminate	Approximate Sequence	No. Shelby Tubes	No. Pitcher Barrel	No. SPT Tests	Piezometers	D-hole Shear Wave
G-1A	Dam centerline (offset 10 ft from G-1B)	60 ft	8" bent. mud rotary	Within dam fill	None	0	0	0	1 in. PVC casing (2 installed)	
G-1B	Dam centerline	114 ft	8" bent. mud rotary	At bedrock surface	SPT - 5' intervals Tubes - 20' intervals	4-shell	1-shell 1-core	12-shell 2-core 1-saprolite	4 in. PVC casing (1 installed)	Within 4 in PVC casing
G-2	Dam centerline	68 ft	8" rotary	At bedrock surface	SPT - 5' intervals Tubes - 20' intervals	2-shell	3-shell	4-shell 1-saprolite	1 in. PVC casing (3 installed)	
G-3	115 ft west of dam centerline, above valley bottom	47 ft	HSA - 4.25" ID	Within dam fill	SPT - 5' intervals Tubes - 15' intervals	5-shell	0	6-shell	1 in. PVC casing (1 installed)	
G-4	235 ft west of dam centerline, above right abutment	55 ft	HSA - 4.25" ID (upper 30 ft) and 4" bent. mud rotary (lower 25 ft)	Within natural soil below dam fill	SPT - 5' intervals Tubes - 15' intervals	2-shell	3-shell	6-shell		
G-5	200 ft east of dam centerline, above left abutment	67 ft	8" bent. mud rotary	Within dam fill	SPT - 5' intervals Tubes - 15' intervals	5-core	1-core	2-shell 7-core		Within 4 in PVC casing

HSA = hollow stem auger, bent. = bentonite, PVC =polyvinyl chloride

TABLE 2-2

SUMMARY OF SPT N-VALUE CORRELATION TO EFFECTIVE STRESS FRICTION ANGLE

Material Boring	ϕ' from N - Kulhaway and Mayne, 1990				ϕ' from $(N_1)_{60}$ - Hatanaka and Uchida, 1996			
	no. tests	minimum	average.	st. deviation	No. tests	minimum	average.	st. deviation
Shell								
G-1B	14	38	41	1	14	38	41	2
G-2	2	36	39	3	2	37	39	3
G-3	5	38	42	3	7	37	40	2
G-4	5	37	40	3	7	35	38	2
G-5	-	-	-	-	1	43	43	-
	total 26	weighted avg. 37.7	weighted avg. 40.8	range 1 to 3	total 31	weighted avg. 37.2	weighted avg. 40.0	range 2 to 3
Core								
G-1B	4	34	35	1	4	35	36	1
G-5	14	29	34	3	14	31	35	2
	total 18	weighted avg. 30.1	weighted avg. 34.2	range 1 to 3	total 18	weighted avg. 31.9	weighted avg. 35.2	range 1 to 2
Saprolite								
G1-B	2	44	42	0	2	44	44	0

TABLE 3-1

LABORATORY TESTING RESULTS

SPECIMEN IDENTIFICATION				TRIAXIAL SHEAR TESTING							INDEX PROPERTY TESTING						
				Specimen Initial Conditions			Peak Strength Condition		Ultimate Strength Condition		Atterberg Limits		Grain Size Analysis (percent)				USCS Class.
Test No.	Boring No.	Sample Depth (ft)	Core or Shell Material	Water Content (%)	Dry Unit Weight (pcf)	Effective Consolidation Stress[1] (psi)	Deviator Stress[2] (psi)	Pore Pressure[3] (psi)	Deviator Stress[2] (psi)	Pore Pressure[3] (psi)	Liquid Limit	Plasticity Index	gravel	sand	silt	clay	
A	G-4	47-50	shell	25.9	103.1	41.5	79.0	17.5	113.1	1.6	NP	NP	12	58	23	7	SM
B	G-4	15-16	shell	17.7	97.9	13.6	78.0[4]	-4.0	81.3[4]	-7.3							
C	G-4	30-32	shell	27.8	97.2	27.2	55.0	14.0	101.2	-8.6							
D	G-1B	20-22	shell	19.1	103.5	18.3	34.5	8.5	48.6	0.3							
E	G-1B	38-40	shell	19.8	104.8	25.7	51.0	10.5	88.3	-7.5	33	3	7	49	41	3	SM
F	G-1B	80-81.5	shell	16.5	108.1	56.5	112.0	24.5	162.6	-7.1	NP	NP	3	61	34	2	SM
G	G-1B	105-107	core	20.7	109.3	68.9	104.0	39.5	165.3	4.0	41	9	4	44	42	10	ML
H	G-5	27-30	core	17.5	114.4	21.0	40.0	10.5	84.8	-8.1	33	9	6	42	35	17	ML
I	G-5	13-15	shell	24.2	105.1	12.9	30.5	4.5	63.6	-9.0							
J	G-5	60-62	core	22.0	104.8	40.9	64.5	24.0	97.8	6.5	45	15	2	40	40	18	ML
K	G-3	15-17	shell	22.5	107.4	13.7	28.0	60.0	63.3	-7.9							
L	G-3	28-30	shell	24.1	98.5	19.8	35.5	10.5	60.7	-0.6							
M	G-2	18-20	shell	23.8	98.3	10.4	26.0	3.5	55.3	-8.1							
N	G-2	38-40	shell	18.7	106.5	27.3	47.0	15.5	81.7	-1.1							
O	G-2	58-60	shell	21.6	106.0	42.6	58.0	25.5	84.7	11.4							
P	G-1B	20-22	shell	16.9[5]	102.8[5]	18.3[6]	49.0	5.0	87.7	-12.7							

Notes:
(1) Effective consolidation stress was achieved using back pressures ranging from 49 to 79 psi.
(2) Deviator stress is equal to the vertical stress applied to the specimen during shearing.
(3) Reported pore pressure is the change in pore water pressure during shearing.
(4) During this test excess friction developed in the loading system and reported deviator stresses are believed to be larger than actual values.
(5) Test performed on recompacted material.
(6) Test specimen initially consolidated to an effective stress of 23.8 psi, then overconsolidated to an effective stress of 18.3 psi.

Boring Logs

TEST BORING RECORD

PROJECT NAME: Lake Petit Dam	PROJECT NO.: GL0625	BORING ID: G-1B
LOCATION: G-1	N: E:	GROUND ELEV.: 1627.0
DRILLING CO.: AT&E	RIG: CME 750	DRILLER: P. Bergman
METHOD & DIAMETER: Mud Rotary (8-in.)		LOGGED BY: J.Titus
DATE: STARTED- 6 Oct 98	COMPLETED- 12 Oct 98	CHECKED BY: G. Schmertmann

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ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	SYMBOL	WELL DIAGRAM	Blows/ 6 in.	DRILLING LOG
1627	0					Begin Boring at 09:50hrs.
		SILT, micaceous, with coarse gravel, trace fine grained sand. Color: yellowish red (5YR4/6)			6, 8, 8, 21	
1622	5					
		SILT and fine to medium sand, some clay @ 9.75 -10 feet. Weathered gneiss fragments sampled as fine grained sand.			10, 16, 15, 14	
1617	10					
		SILT, micaceous, trace very fine sand. Color yellowish red (5YR5/8) Some coarse gravel (gneiss fragments) and trace organics (root) encountered @ 14-15 feet			4, 11, 11, 14	
1612	15					
						Attempt shelby tube. Would not push (rock)
1607	20					Push shelby tube, 16" recovery
1602	25					
		SILT and very fine grained sand, micaceous. Color: dark reddish brown to very dark gray.			8, 8, 14, 17	
1597	30					
		SILT, trace very fine sand, occassional lenses of weathered gneiss sampling as medium sand, trace organic material (bark/root)			8, 12, 14, 13	
1592	35					
1587	40					Push shelby tube, 16" recovery

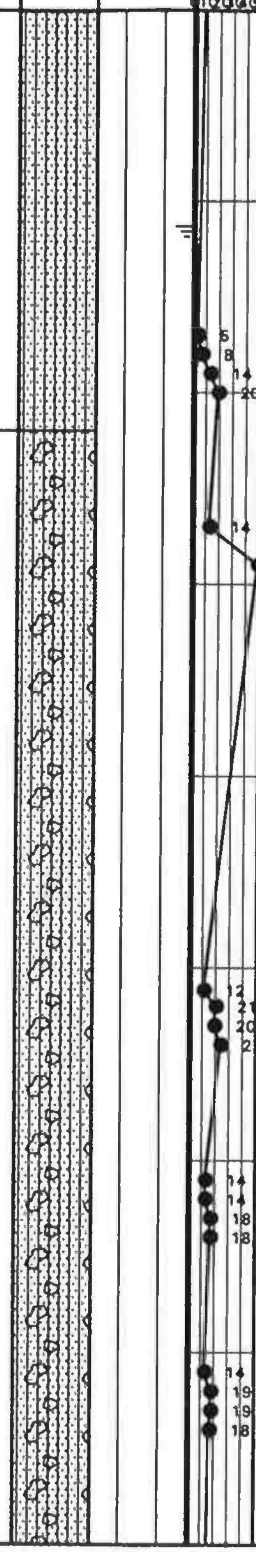
REMARKS:
3-WELL PIEZOMETER CLUSTER CONSTRUCTED AS FOLLOWS:
SHALLOW - 1-INCH PVC CASING SCREENED @ 20-40
MIDDLE - 1-INCH PVC CASING SCREENED @ 55-60
DEEP - 4-IN. PVC CASING SCREENED @ 105.5-110.5

SEE ATTACHED FIGURE FOR CONSTRUCTION DETAILS

PROJECT NAME: Lake Petit Dam	PROJECT NO.: GL0625	BORING ID: G-1B
LOCATION: G-1	N: E:	GROUND ELEV.: 1627.0
DRILLING CO.: AT&E	RIG: CME 750	DRILLER: P. Bergman
METHOD & DIAMETER: Mud Rotary (8-in.)		LOGGED BY: J.Titus
DATE: STARTED- 6 Oct 98	COMPLETED- 12 Oct 98	CHECKED BY: G. Schmertmann

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	DRILLING LOG
1587	40		Push shelby tube, 16" recovery.
1582	45		
1577	50	SILT, trace very fine sand, micaceous (muscovite). Color: red (2.5YR4/8) and very dark gray (10YR3/1)	Hard drilling @ 51-52 feet.
		SILT, some very fine sand, some medium to coarse gravel (weathered gneiss and schist fragments).	Split spoon bouncing on wood
1572	55		Hard drilling (rock) @ 57.5-58 feet
			Push shelby tube, 16" recovery
1567	60		
1562	65	SILT, some very fine sand, some medium to coarse gravel (weathered gneiss and schist). Increasing size and number with depth in the spoon.	
1557	70		
1552	75	SAND, very fine to fine grained, and silt, some fine to medium gravel (weathered gneiss and schist fragments). Silty clay in end of spoon.	
1547	80		

SYMBOL | WELL DIAGRAM | Blows/ 6 in.



REMARKS:

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TEST BORING RECORD

PROJECT NAME: **Lake Petit Dam**	PROJECT NO.: **GL0625**		BORING ID: **G-1B**
LOCATION: **G-1**	N:	E:	GROUND ELEV.: **1627.0**
DRILLING CO.: **AT&E**	RIG: **CME 750**		DRILLER: **P. Bergman**
METHOD & DIAMETER: **Mud Rotary (8-in.)**			LOGGED BY: **J.Titus**
DATE: STARTED- **6 Oct 98**	COMPLETED- **12 Oct 98**		CHECKED BY: **G. Schmertmann**

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	Blows/ 6 in.	DRILLING LOG
1547	80			Pitcher barrel sample, 16" recovery.
1542	85	SILT, some very fine sand, micaceous. Trace gneiss gravel in end of spoon.	15, 19, 28, 29	
1537	90	SILT and very fine sand, some weathered schist and gneiss fragments (1/2-1 inch. diam). Lower 5 inches of spoon has strong banding of mafics, quartz, and feldspars. Extensively weathered.	21, 23, 19, 18	
1532	95	SILT, trace clay, micaceous. Mottled slightly. Color: dark red (2.5YR3/6) and yellowish brown (10YR5/8).	0, 12, 11, 16	Drop by weight of rods Drilling becoming much harder
1527	100	SILT, some clay, micaceous. Color is very dark grayish brown (10YR3/2) @ 100-101 feet and red (2.5YR4/8) @ 101-102 feet.	10, 11, 12, 10	Hit rock while drilling past 102.5. Wood fragment came out of hole while drilling past 103 feet.
1522	105			Pitcher barrel sample, 11" recovery.
1517	110	Saprolite	12, 28, 30, 29	
1512	115	Boring terminated at 114.00 feet		
1507	120			

REMARKS:

TEST BORING RECORD

PROJECT NAME: Lake Petit Dam	PROJECT NO.: GL0625		BORING ID: G-2
LOCATION: G-2	N:	E:	GROUND ELEV.: 1584.8
DRILLING CO.: AT&E	RIG: CME 750		DRILLER: P. Bergman
METHOD & DIAMETER: Mud Rotary (8-in.)			LOGGED BY: J.Titus
DATE: STARTED- 14 Oct 98	COMPLETED- 15 Oct 98		CHECKED BY: G. Schmertmann

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ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	Blows/ 6 in.	DRILLING LOG
1585	0			Begin Drilling 14 Oct 98 16:00 hrs.
1580	5			
		SILT and fine grained sand, some coarse grained sand lenses. Color: banded red (10R4/8) and gray (2.5YR5/0). Weathered gneiss fragments in end of spoon.	10, 14, 10, 16	
1575	10			
				Hitting rock while drilling
1570	15			Hitting rock while drilling
				Pushed shelby tube, 21" recovery
1565	20			Pushed shelby tube, 8" push/recovery. Switch to pitcher barrel for sampling
1560	25			
		SILT, micaceous with fine grained sand, some coarse grained sand, some clay lenses (1 cm thick), trace coarse gravel (gneiss)	8, 10, 39, 16	
1555	30			
1550	35			
				Pitcher barrel, 18" recovery
1545	40			

REMARKS:
3-WELL PIEZOMETER CLUSTER CONSTRUCTED AS FOLLOWS:
SHALLOW - 1-IN. PVC CASING SCREENED @ 10-30
MIDDLE - 1-IN. PVC CASING SCREENED @ 50-55
DEEP - 1-IN. PVC CASING SCREENED @ 65.5-68.5

SEE ATTACHED FIGURE FOR CONSTRUCTION DETAILS

TEST BORING RECORD

PROJECT NAME: Lake Petit Dam	PROJECT NO.: GL0625		BORING ID: G-2
LOCATION: G-2	N:	E:	GROUND ELEV.: 1584.8
DRILLING CO.: AT&E	RIG: CME 750		DRILLER: P. Bergman
METHOD & DIAMETER: Mud Rotary (8-in.)			LOGGED BY: J.Titus
DATE: STARTED- 14 Oct 98	COMPLETED- 15 Oct 98		CHECKED BY: G. Schmertmann

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	SYMBOL	WELL DIAGRAM	Blows/ 6 in.	DRILLING LOG
1545	40					Pitcher barrel, 27" recovery (1.5 foot push)
1540	45					
		SILT and fine to medium sand, some coarse gravel.			30 31 50/3	
1535	50					
1530	55					
						Pitcher barrel, 20" recovery
1525	60					Pitcher barrel, no recovery
		SILT and fine to medium sand, some coarse gravel. Color: reddish brown			5 7 11 18	
1520	65	SILT and fine to medium sand. Color: olive brown				Drill bit chattering @65-68 feet Wood fragments washing up out of borehole.
		Saprolite			50/3	
1515	70	Bedrock, boring terminated at 69.50 feet				
1510	75					
1505	80					

REMARKS:

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TEST BORING RECORD

PROJECT NAME: Lake Petit Dam	PROJECT NO.: GL0625	BORING ID: G-4
LOCATION: G-4	N: E:	GROUND ELEV.: 1605.8
DRILLING CO.: AT&E	RIG: CME 750	DRILLER: P. Bergman
METHOD & DIAMETER: HSA/4" Mud Rotary		LOGGED BY: GS / JDT
DATE: STARTED- 2 Oct 98	COMPLETED- 5 Oct 98	CHECKED BY: G. Schmertmann

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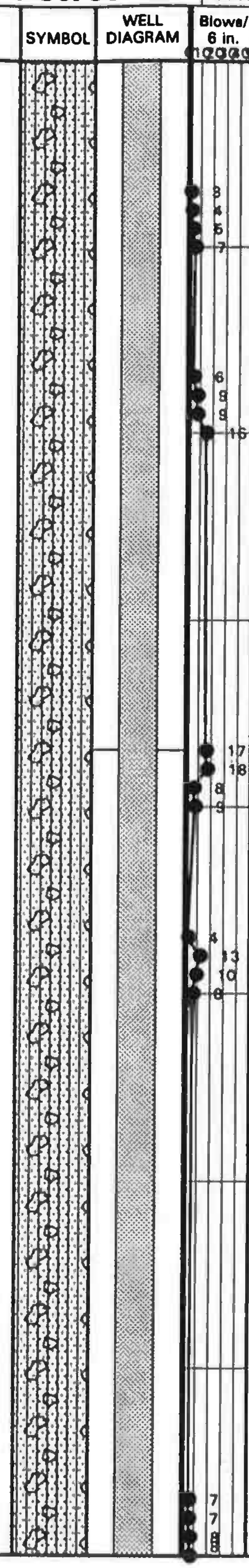

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	Blows/ 6 in.	DRILLING LOG
1606	0			2OCT98 Beging drilling using 4-1/4 ID HSA
		SILT, some sand. Color: brown	3, 4, 5, 7	
1601	5			
		SILT, some sand, some medium gravel, micaceous, dry	6, 8, 9, 16	
1596	10			
				Push shelby tube, 15" recovery
1591	15			Push shelby tube, 7" recovery
		SILT, some sand, some gravel. Medium gravel (weathered gneiss and schist) concentrated in upper 6" spoon, more silt in lower 9". dry. Color: dark brown.	17, 18, 8, 9	
1586	20			
			4, 13, 10, 8	
1581	25			
				Attempted shelby tube, would not push
1576	30			Attempted shelby tube, would not push Resume drilling on 5OCT98 at 10:45 hrs using 4-3/4 OD mud rotary. Boring has been offset by 5 feet from original location. 30-32 ft. - Pitcher barrel sample
1571	35			
		SILT, some sand. Trace gravel in upper 3" of spoon. micacoeus, dark brown.	7, 7, 8	
1566	40			

REMARKS:

TEST BORING RECORD

PROJECT NAME: **Lake Petit Dam**	PROJECT NO.: **GL0625**	BORING ID: **G-4**
LOCATION: **G-4**	N: / E:	GROUND ELEV.: **1605.8**
DRILLING CO.: **AT&E**	RIG: **CME 750**	DRILLER: **P. Bergman**
METHOD & DIAMETER: **HSA/4" Mud Rotary**		LOGGED BY: **GS / JDT**
DATE: STARTED- **2 Oct 98**	COMPLETED- **5 Oct 98**	CHECKED BY: **G. Schmertmann**

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	Blows/ 6 in.	DRILLING LOG
1566	40		8	Push shelby tube, 5" recovery.
1561	45	SILT, some sand, some fine to meduim gravel, micaceous		Push shelby tube, no recovery
				Pitcher barrel sample, 20" recovery
1556	50			Pitcher barrel sample, 8" recovery
		SILT, some sand, trace gravel (FILL)		
		Saprolite	10 16 23	
1551	55	Boring terminated at 55.00 feet	50/4	
1546	60			
1541	65			
1536	70			
1531	75			
1526	80			

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REMARKS:

TEST BORING RECORD

PROJECT NAME: **Lake Petit Dam**	PROJECT NO.: **GL0625**		BORING ID: **G-5**
LOCATION: **G-5**	N:	E:	GROUND ELEV.: **1646.72**
DRILLING CO.: **AT&E**	RIG: **CME 750**		DRILLER: **P. Bergman**
METHOD & DIAMETER: **Mud Rotary (8-in.)**			LOGGED BY: **J.Titus**
DATE: STARTED- **12 Oct 98**	COMPLETED- **14 Oct 98**		CHECKED BY: **G. Schmertmann**

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	Blows/ 6 in.	DRILLING LOG
1647	0			Begin drilling on 12OCT98: 13:50 hrs.
1642	5	SILT some fine to medium sand, some fine to medium gravel. Dry, Color: brown (7.5YR4/4)	4, 6, 7, 9	
1637	10	SILT, some very fine to fine sand, micaceous. Color: banded strong brown (7.5YR5/6) and dark gray (7.5YR4/0).	8, 9, 12, 15	Push shelby tube, 17" recovery
1632	15	SILT, trace very fine sand. Color: dark gray to very dark gray (10YR4/1 - 3/1)		Pushed shelby tube 1 foot, 24" recovery (wash out)
1627	20	SILT, trace clay, micaceous, Color: red (10R4/8) Extremely weathered schist (to silt) in end of spoon.	4, 4, 7, 9	
1622	25	SILT, some very fine sand, micaceous. Trace clay in lower 6" of spoon.	5, 5, 4, 5	Push shelby tube, 19" recovery
1617	30			Push shelby tube, no recovery
1612	35	SILT, some fine to medium quartz sand, trace clay, micaceous. Color: red (2.5YR4/8).	2, 4, 6, 10	
		SILT and sand (weathered gneiss)	5, 6, 6, 9	
1607	40	SILT, and clay. Wood fragments at 29 feet.		

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REMARKS:
Blank casing installed (no screen) for downhole geophysics applications.

PROJECT NAME: Lake Petit Dam	PROJECT NO.: GL0625		BORING ID: G-5
LOCATION: G-5	N:	E:	GROUND ELEV.: 1646.72
DRILLING CO.: AT&E	RIG: CME 750		DRILLER: P. Bergman
METHOD & DIAMETER: Mud Rotary (8-in.)			LOGGED BY: J.Titus
DATE: STARTED- 12 Oct 98	COMPLETED- 14 Oct 98		CHECKED BY: G. Schmertmann

ELEVATION (FEET)	DEPTH (FEET)	DESCRIPTION	SYMBOL	WELL DIAGRAM	Blows/ 6 in.	DRILLING LOG
1607	40				7	Wood debris washing up out of borehole
						Push shelby tube, 15" recovery
1602	45					Pushed shelby tube 6". No recovery. wood debris in end of tube
		SILT, micaceous, trace clay, trace very fine sand, trace wood/roots. Color: red (10R4/8)			2, 3, 4, 7	
1597	50					
		Increasing wood fragments up to 1" diam.			4, 8, 5, 6	
1592	55					
						Push shelby tube, 22" recovery
1587	60					Push shelby tube, 14" recovery
		SILT, some clay, trace very fine sand. Color: @ 63-64.5 - red (10R4/8) @ 64.5-65 - dark gray (5YR4/1)			4, 5, 6, 5	
1582	65					
		Boring terminated at 67.00 feet				
1577	70					
1572	75					
1567	80					

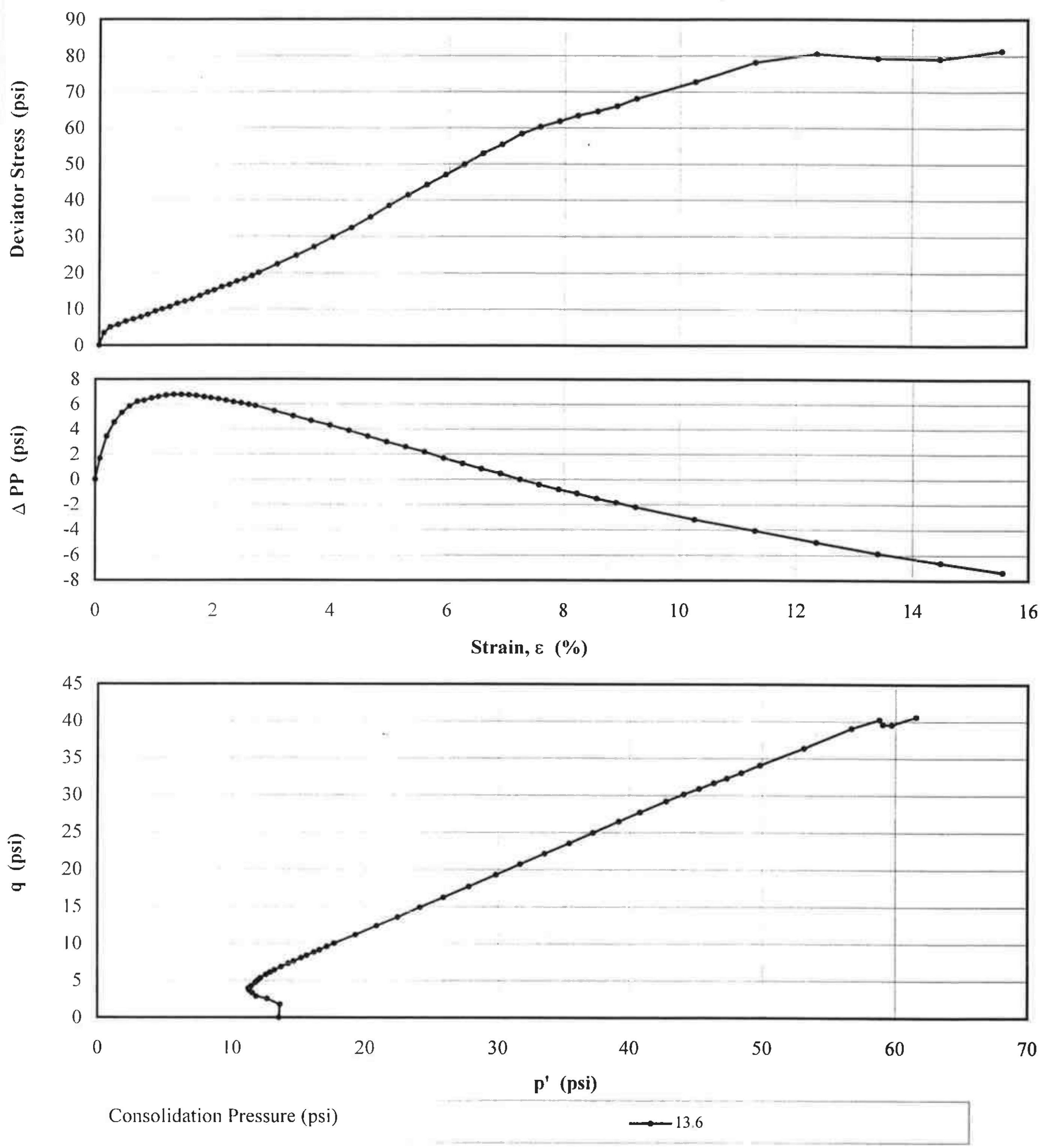
REMARKS:

Summary of Triaxial Compression Testing Results, Particle Size Distribution, and Physical Properties

GEOSYNTEC CONSULTANTS
Geomechanics and Environmental Laboratory

Sample ID: G-4 (D) (15'-16')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 1**



Note:

1. Due to equipment malfunctioning, axial load piston generated friction forces beyond the recommended standard practice resulting in very high zero load correction.

98J21

TABLE 1

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-4 (D) (15'-16')	98J21.1	6.19	2.85	17.7	97.9	56.4	13.6					81.3	102.2	15.6	49.1	1	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

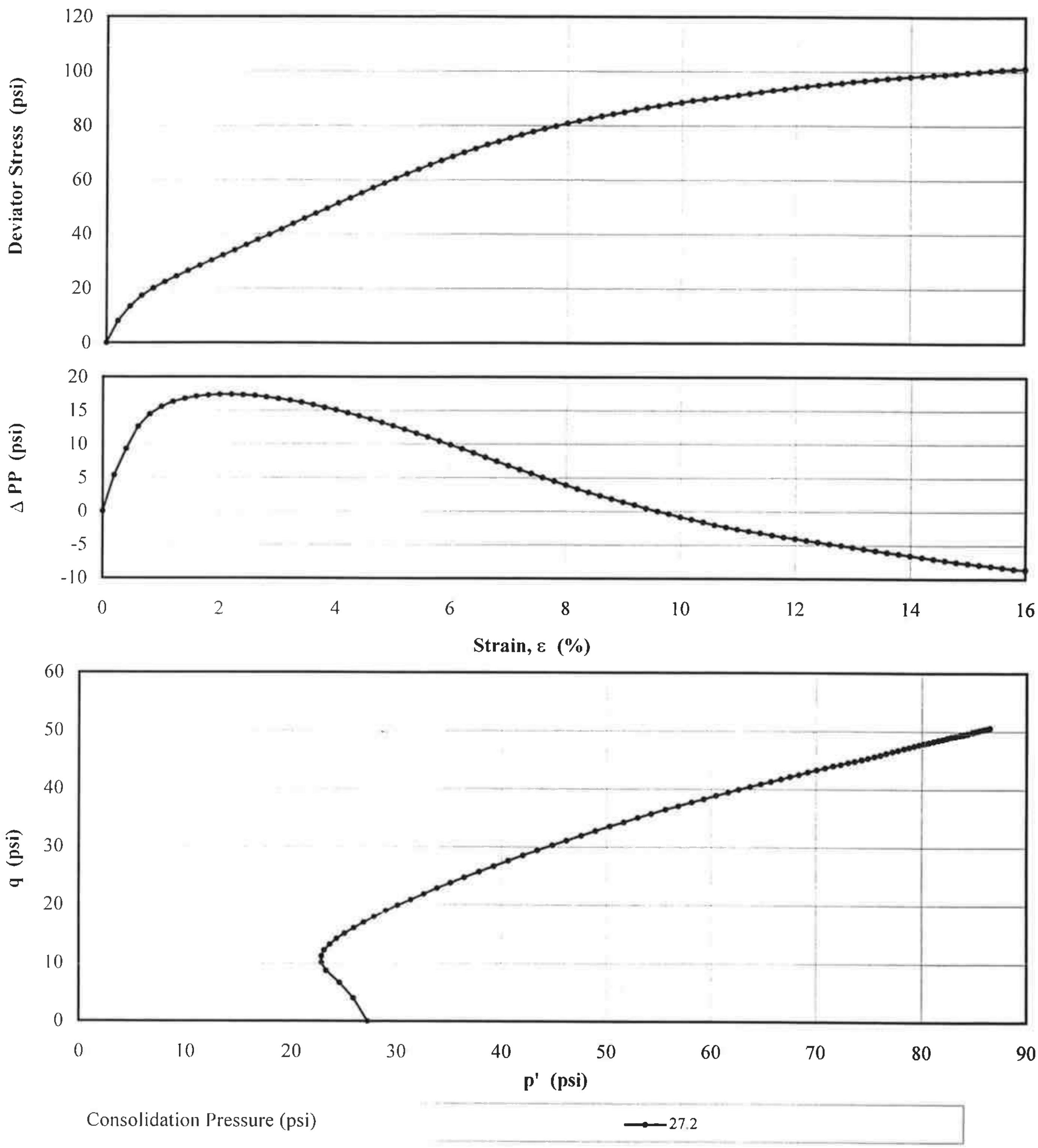
1. Due to equipment malfunctioning, axial load piston generated friction forces beyond the recommended standard practice resulting in very high zero load correction.

GEOSYNTEC CONSULTANTS
Geomechanics and Environmental Laboratory

GeoSyntec Consultants
Geomechanics and Environmental Laboratory

Sample ID: G-4 (L) (30'-32')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 2**



Note:

98J41

GL0625/4614436B.XLS

TABLE 2

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-4 (L) (30'-32')	98J41.1	6.73	2.89	27.8	97.2	51.2	27.2					101.2	137.1	16.0	42.6	2	

Notes:

- u_i = Initial pore pressure,(psi)
- u = Pore pressure,(psi)
- σ'_c= Consolidation pressure, (psi)
- σ'_1 = Effective axial stress, (psi)
- σ'_3 = Effective radial stress (confining pressure), (psi)
- ε_a = Axial strain, (%)

1.

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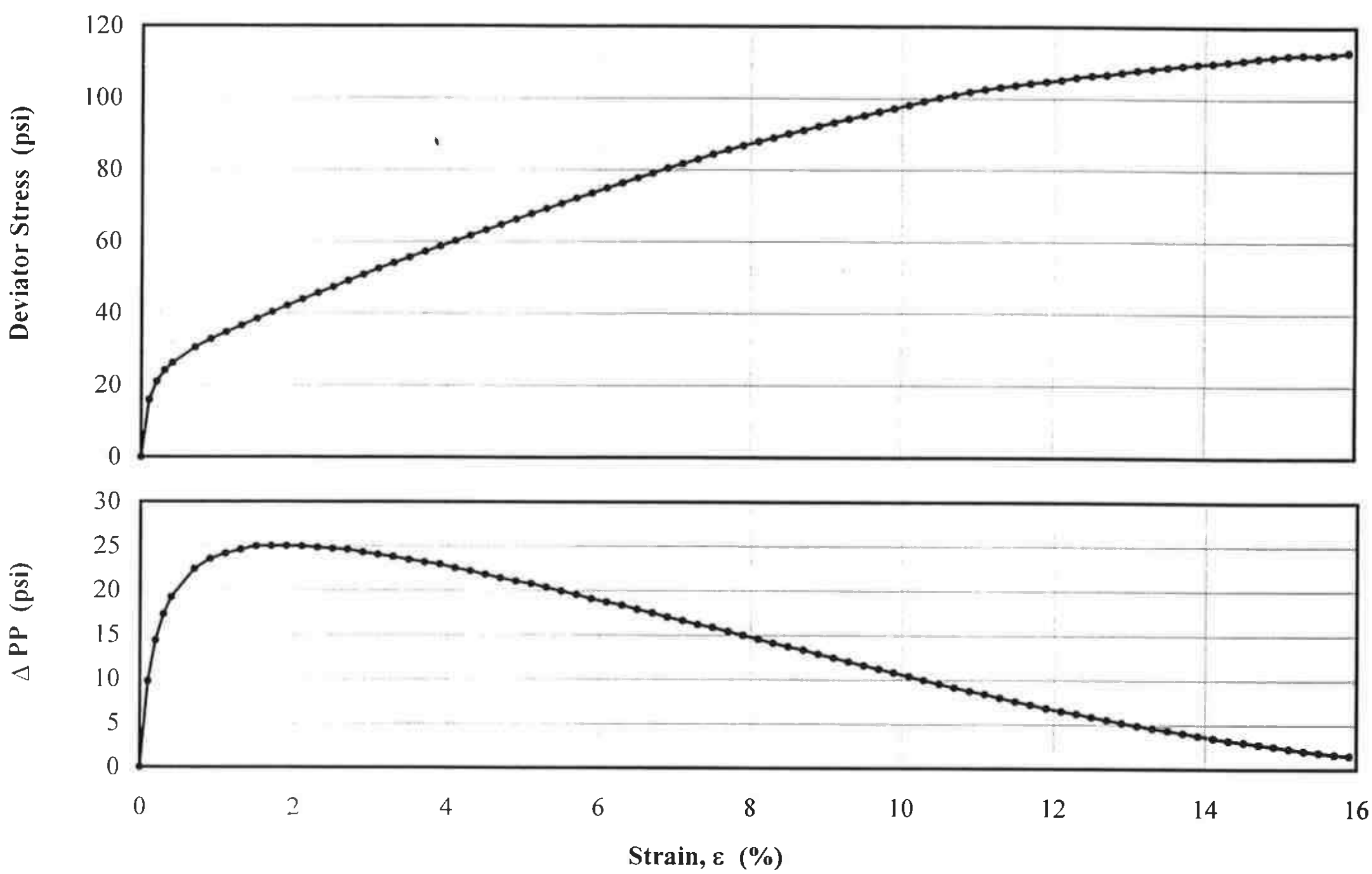
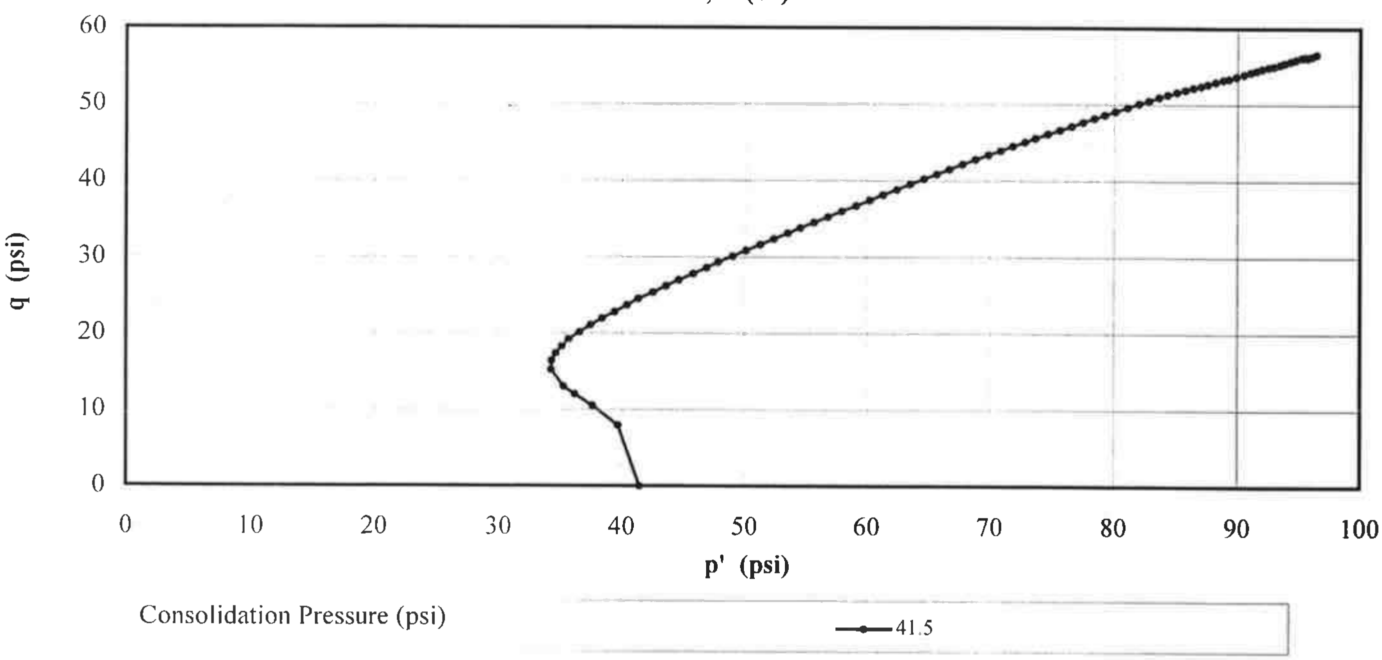
Sample ID: G-4 (H) (47'-50')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 3**





Note:

TABLE 3

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions						Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	u_i (psi)	σ'_c (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-4 (H) (47'-50')	98J42.1	6.93	2.80	25.9	103.1	49.2	41.5					113.1	153.0	15.9	50.8	3	

Notes:

- u_i = Initial pore pressure,(psi)
- u = Pore pressure,(psi)
- σ'_c= Consolidation pressure, (psi)
- σ'_1 = Effective axial stress, (psi)
- σ'_3 = Effective radial stress (confining pressure), (psi)
- ε_a = Axial strain, (%)

1.

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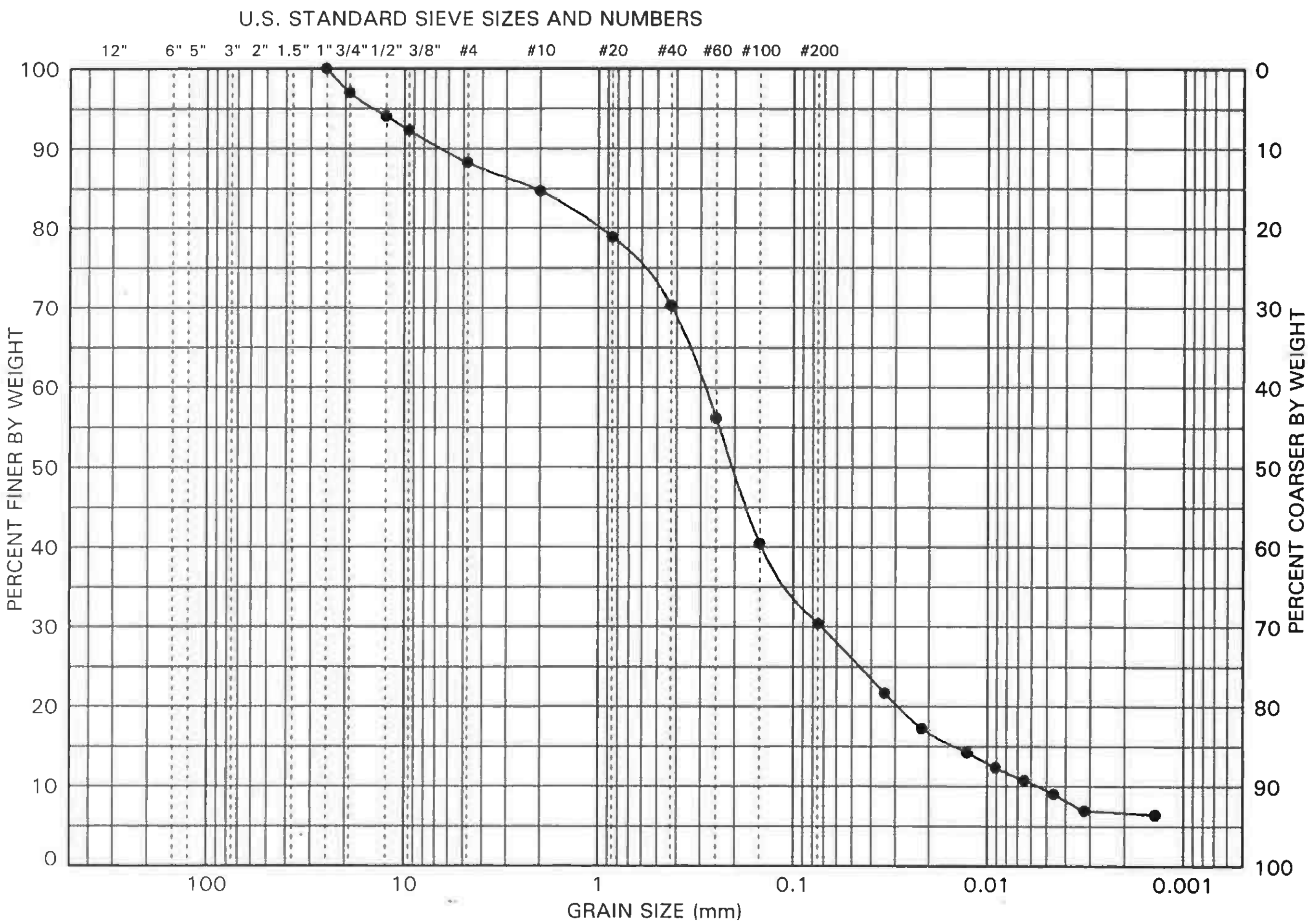
GL0625/4613692B.XLS

GEO SYNTEC CONSULTANTS Geomechanics and Environmental Laboratory Atlanta, Georgia	**FIGURE** PROJECT: Lake Petit Dam PROJECT NO.: GL0625 DOCUMENT NO.:

GS FORM: 4PS2 11/05/98	**PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES**	ASTM C 136, D 422, D 2487 D 3042 AND D 4318



BOULDERS	COBBLES	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
		GRAVEL		SAND			FINES	

SITE SAMPLE ID	*	LIQUID LIMIT (%)	NP	SOIL FRACTIONS	GRAVEL (%)	11.7
LAB. SAMPLE NO.	98J42	PLASTIC LIMIT (%)	NP		SAND (%)	57.9
SAMPLE DEPTH (ft)		PLASTICITY INDEX	NP		FINES (%)	30.4
SOIL CLASSIFICATION: SM - Silty Sand					SILT (%)	23.7
					CLAY(%)	6.7
					COEFF. UNIFORMITY (Cu)	
					COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER PARTICLE DIAMETER (mm)				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
PERCENT PASSING SIEVE SIZES (mm)																		
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	97	94	92	88	85	79	70	56	41	30	26	17	10	7	

NOTES: * G-4(H) (47-50)

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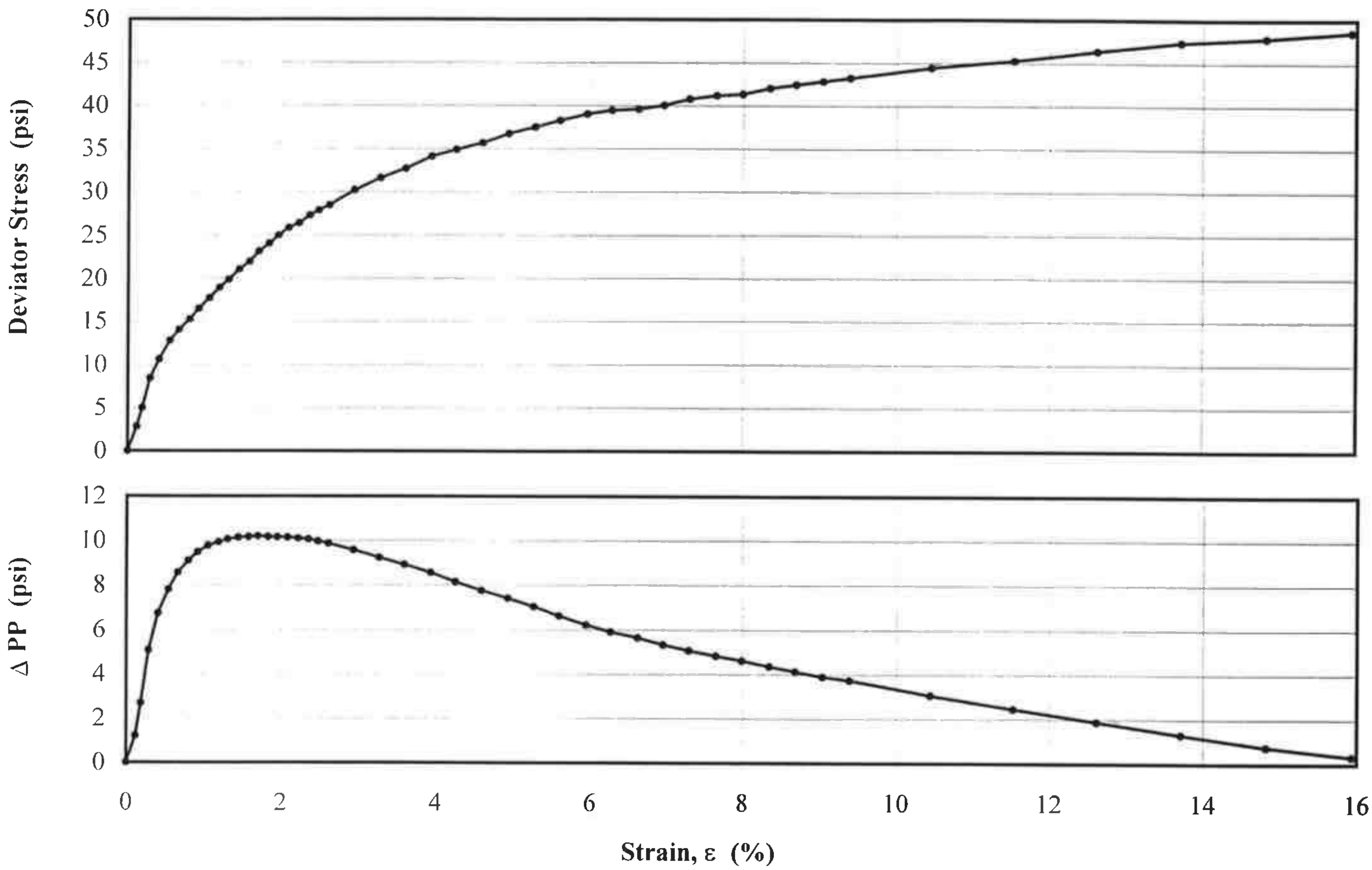
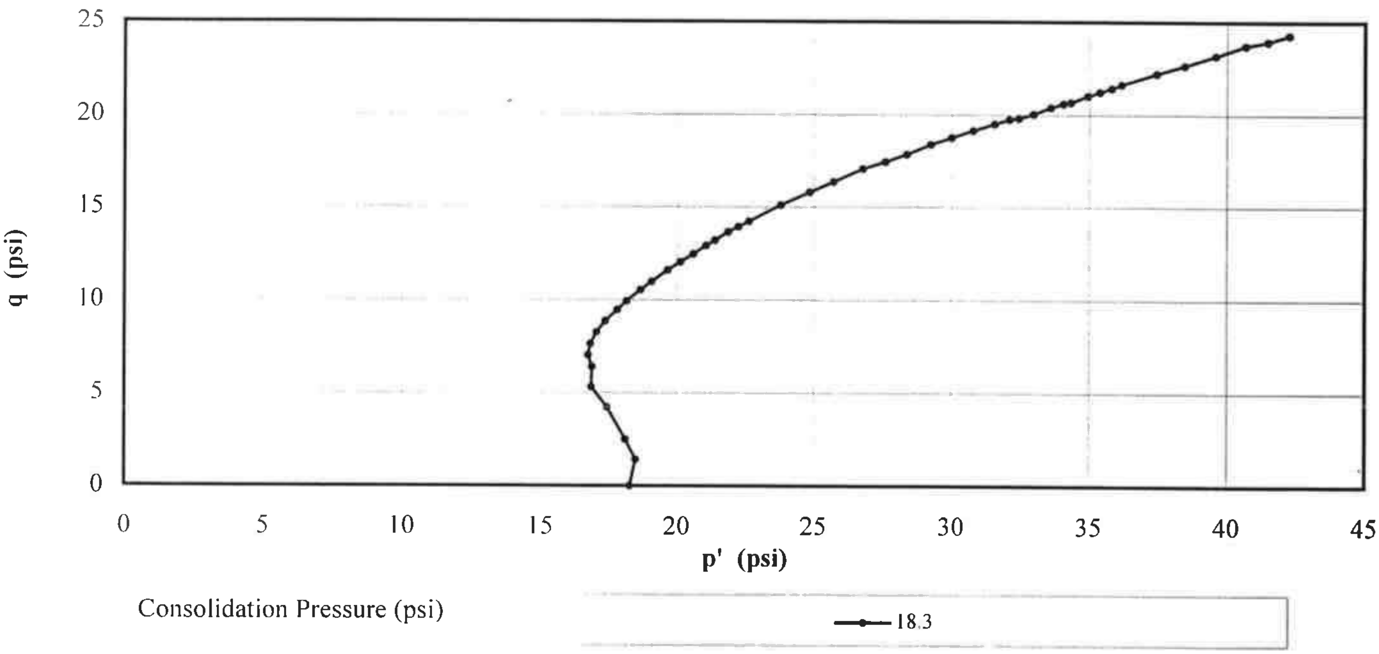
Sample ID: G-1B (E) (20'-22')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767	TRIAXIAL COMPRESSION TESTING	Figure 4





Note:

98J67

GL0625/46156388.XLS

TABLE 4

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-1B (E) (20'-22')	98J67.1	5.91	2.86	19.1	103.5	50.6	18.3					48.6	66.5	15.9	50.9	4	

Notes:

u_i = Initial pore pressure,(psi)
u = Pore pressure,(psi)
σ'_c= Consolidation pressure, (psi)
σ'_1 = Effective axial stress, (psi)
σ'_3 = Effective radial stress (confining pressure), (psi)
ε_a = Axial strain, (%)

1.

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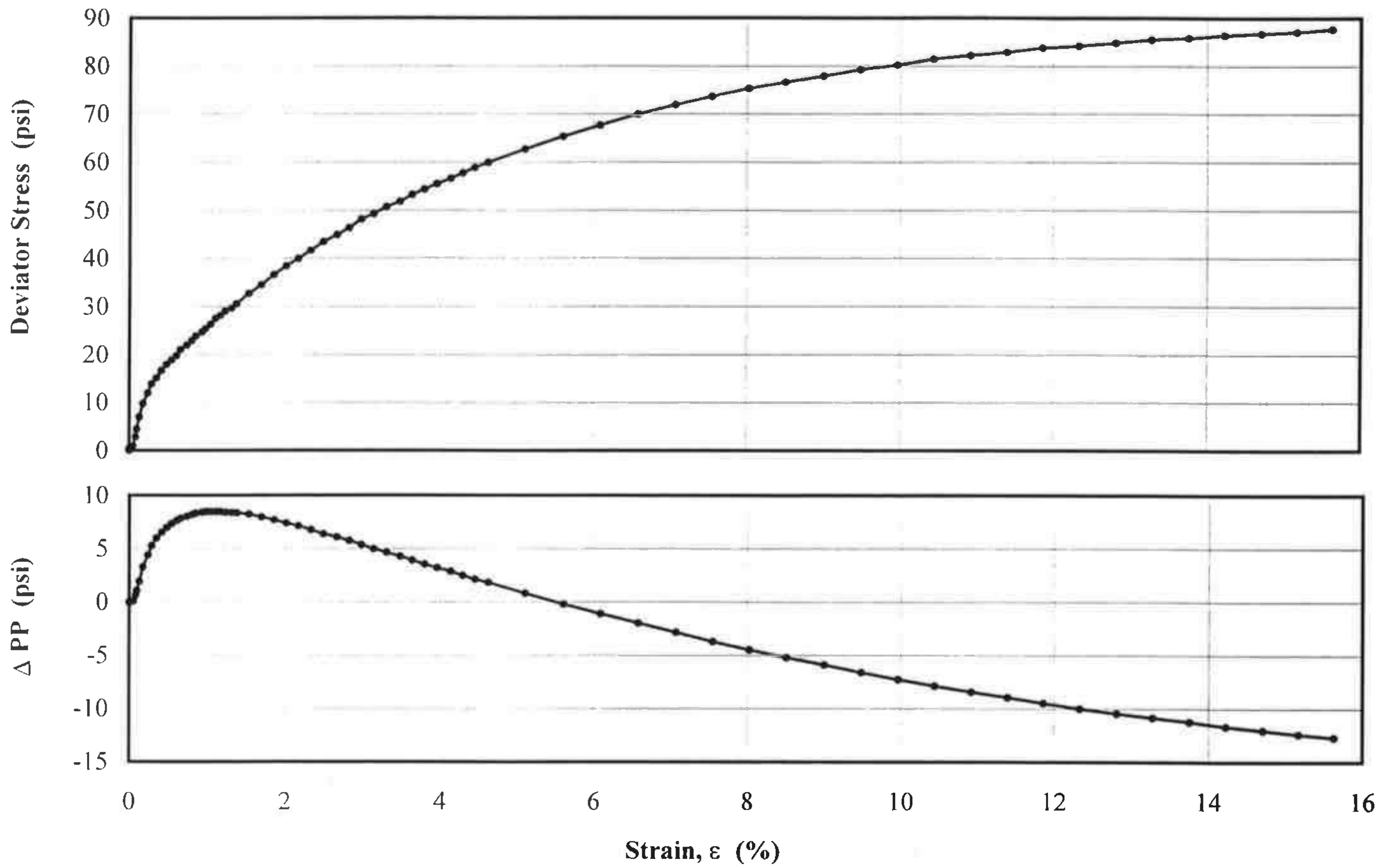
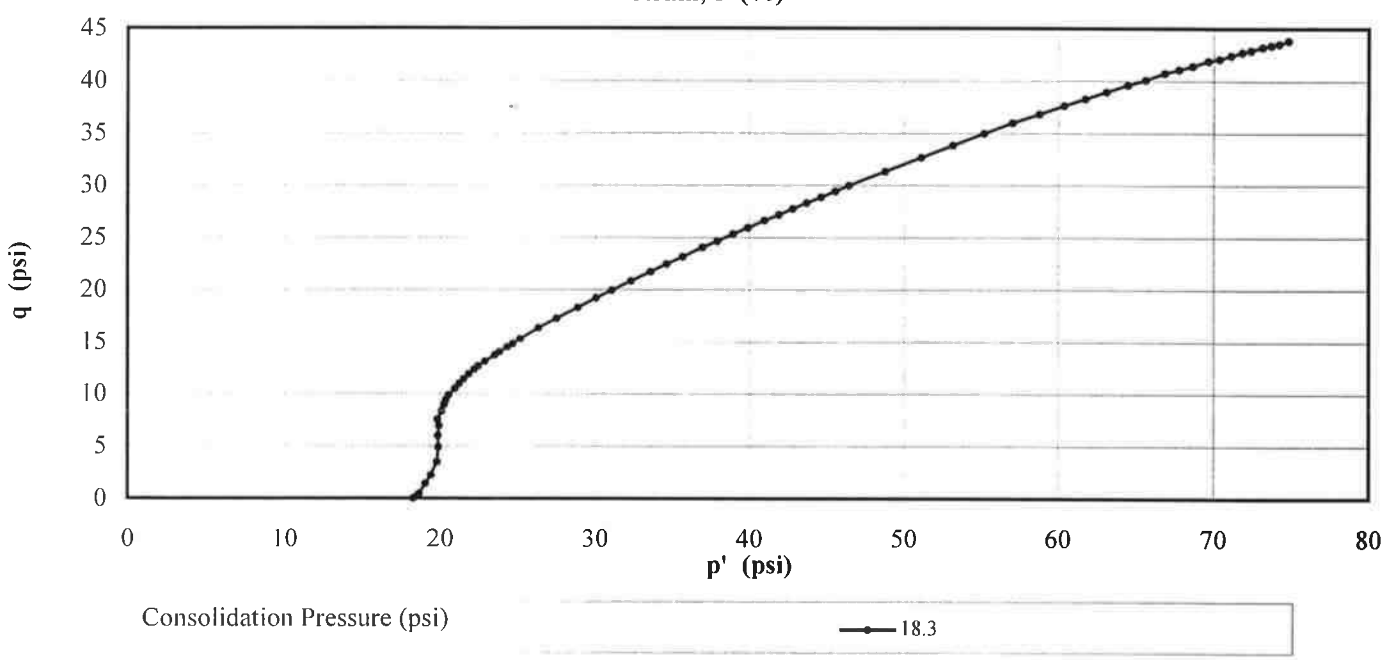
Sample ID: G-1B (E) (20'-22')-Remolded
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 5**





Note(s):
1. The test specimen was formed/remolded by recycling the tested (sheared) undisturbed Shelby tube specimen. The test material was passed through a U.S. Standard No. 3/8" sieve. The passing portion was remolded at a moisture content of 16.9% and at a dry unit weight of 102.8 pcf.
2. The test specimen was initially consolidated at 23.8 psi. and then was over-consolidated and sheared at 18.3 psi.

98J67-Remolded

TABLE 5

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-1B (E) (20'-22') Remolded	98J67-Remolded.1	6.26	2.85	16.9	102.8	78.6	18.3					87.7	118.6	15.6	65.9	5	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1. The test specimen was formed/remolded by recycling the tested (sheared) undisturbed Shelby tube specimen. The test material was passed through a U.S. Standard No. 3/8" sieve. The passing portion was remolded at a moisture content of 16.9% and at a dry unit weight of 102.8 pcf.
2. The test specimen was initially consolidated at 23.8 psi, and then was over-consolidated and sheared at 18.3 psi.

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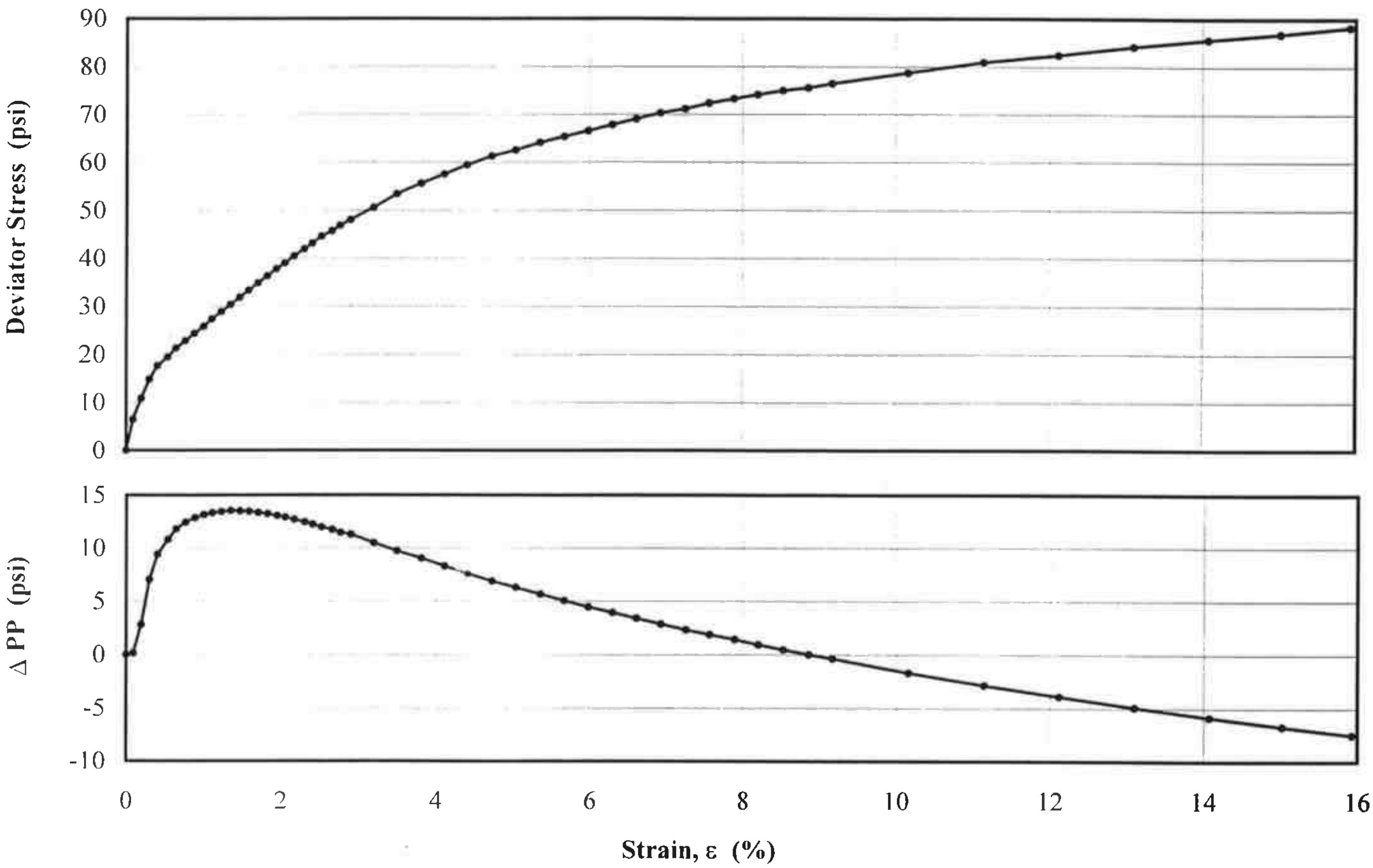
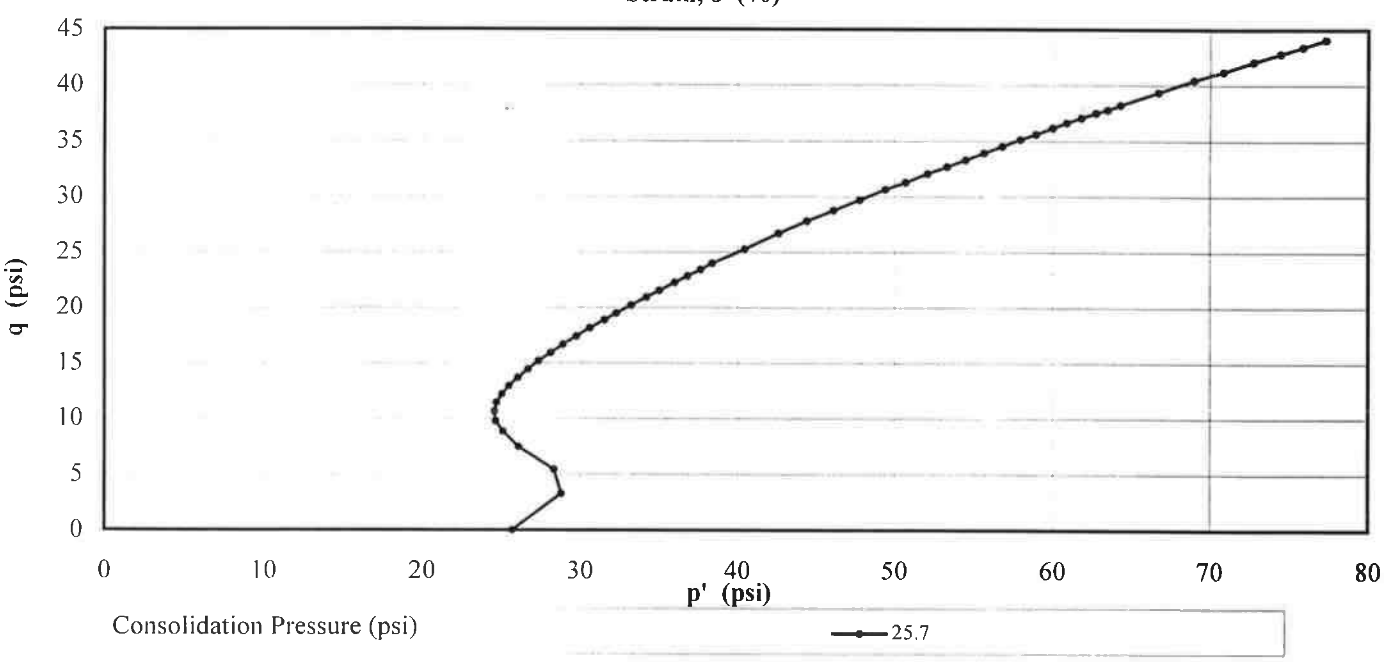
Sample ID: G-1B (H) (38'-40')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 6**





Note:

98J68

GL0625/46193926.XLS

TABLE 6

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-1B (H) (38'-40')	98J68.1	6.69	2.87	19.8	104.8	60.1	25.7					88.3	121.4	15.9	52.6	6	

Notes:

- u_i = Initial pore pressure,(psi)
- u = Pore pressure,(psi)
- σ'_c= Consolidation pressure, (psi)
- σ'_1 = Effective axial stress, (psi)
- σ'_3 = Effective radial stress (confining pressure), (psi)
- ε_a = Axial strain, (%)

1.

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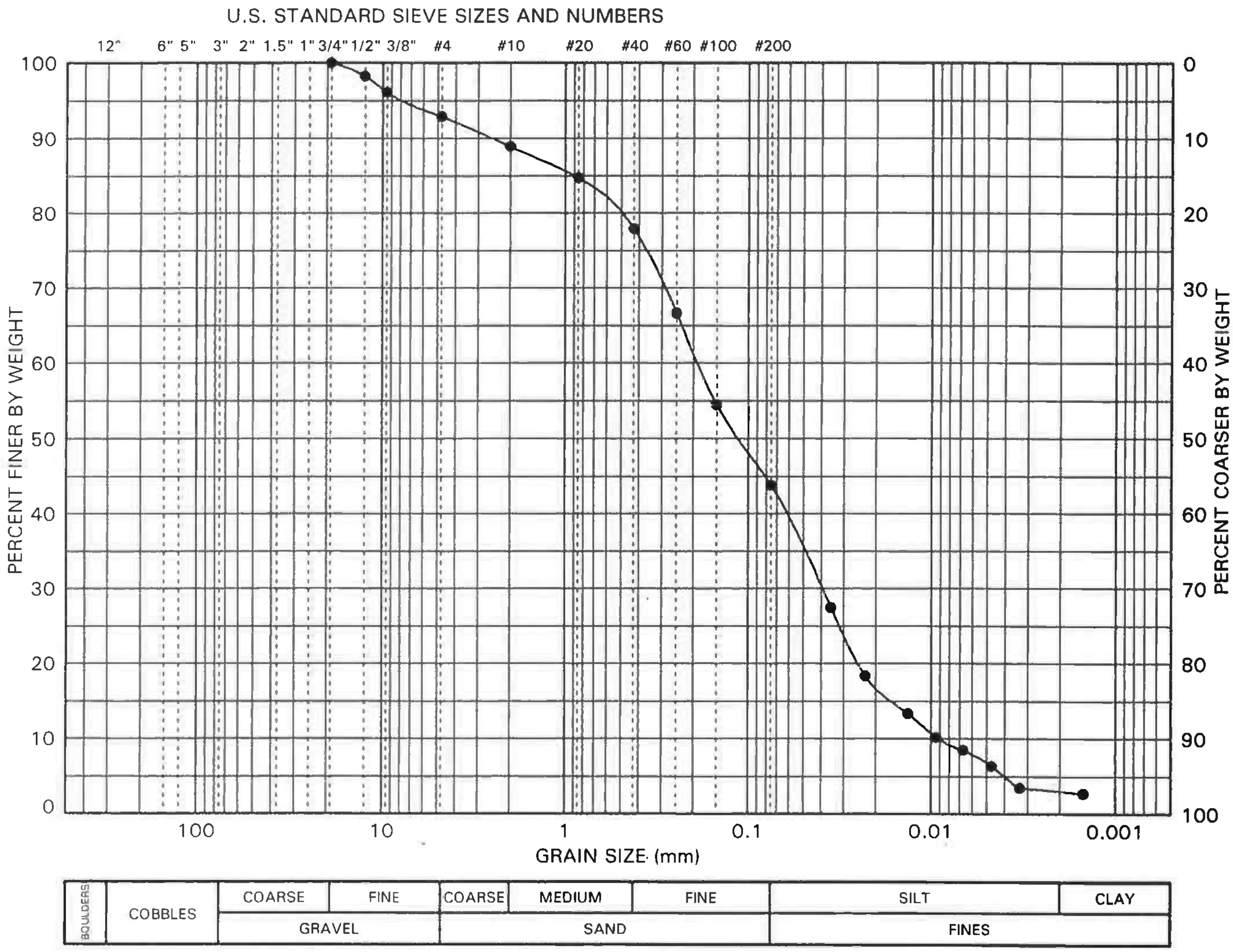
FIGURE
PROJECT: Lake Petit Dam
PROJECT NO.: GL0625
DOCUMENT NO.:

GS FORM: 4PS2 10/26/98

PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES

ASTM C 136, D 422, D 2487 D 3042 AND D 4318



SITE SAMPLE ID	*	LIQUID LIMIT (%)	33	SOIL FRACTIONS	GRAVEL (%)	7.1
LAB. SAMPLE NO.	98J68	PLASTIC LIMIT (%)	30		SAND (%)	49.1
SAMPLE DEPTH (ft)		PLASTICITY INDEX	3		FINES (%)	43.8
SOIL CLASSIFICATION: SM - Silty Sand					SILT (%)	40.7
					CLAY(%)	3.1
					COEFF. UNIFORMITY (Cu)	
					COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER PARTICLE DIAMETER (mm)				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
PERCENT PASSING SIEVE SIZES (mm)																		
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	100	98	96	93	89	85	78	67	55	44	35	17	7	3	

NOTES: * G-1B(H) (38-40)

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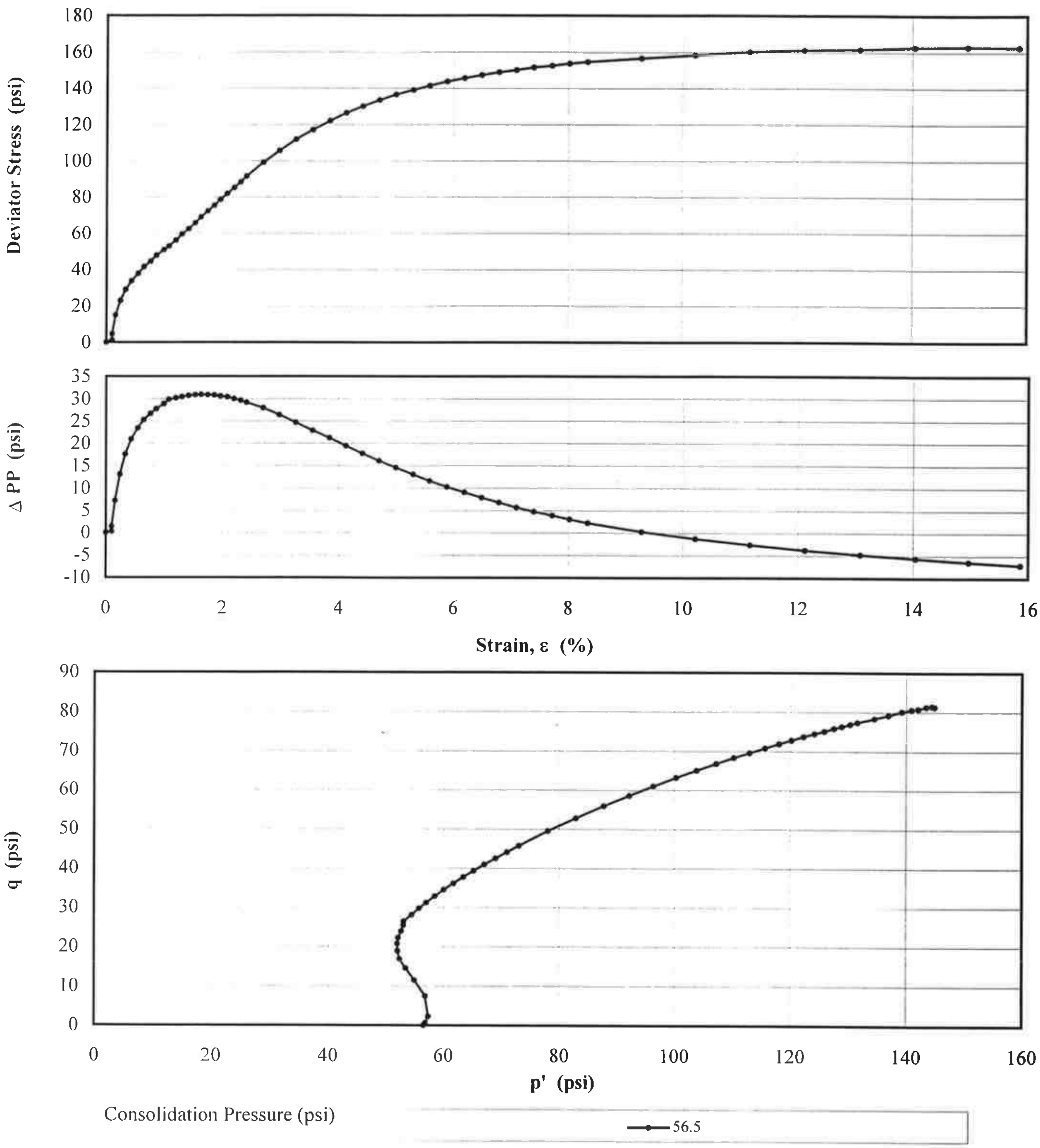
Sample ID:	**G-1B (P) (80'-81.5')**
Project Name:	LAKE PETIT DAM
Project No.:	GLG0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 7**



Note:

98J75

TABLE 7

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions						Peak				Ultimate				Figure No.	Remarks
		Height	Diameter	Moisture Content	Dry Unit Weight	u_i	σ'_c	$\sigma'_1-\sigma'_3$	σ'_1	ε_a	u	$\sigma'_1-\sigma'_3$	σ'_1	ε_a	u		
		(in.)	(in.)	(%)	(pcf)	(psi)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)		
G-1B (P) (80'-81.5')	98J75.1	6.93	2.89	16.5	108.1	48.2	56.5					162.6	226.2	15.9	41.1	7	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1.

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Atlanta, Georgia

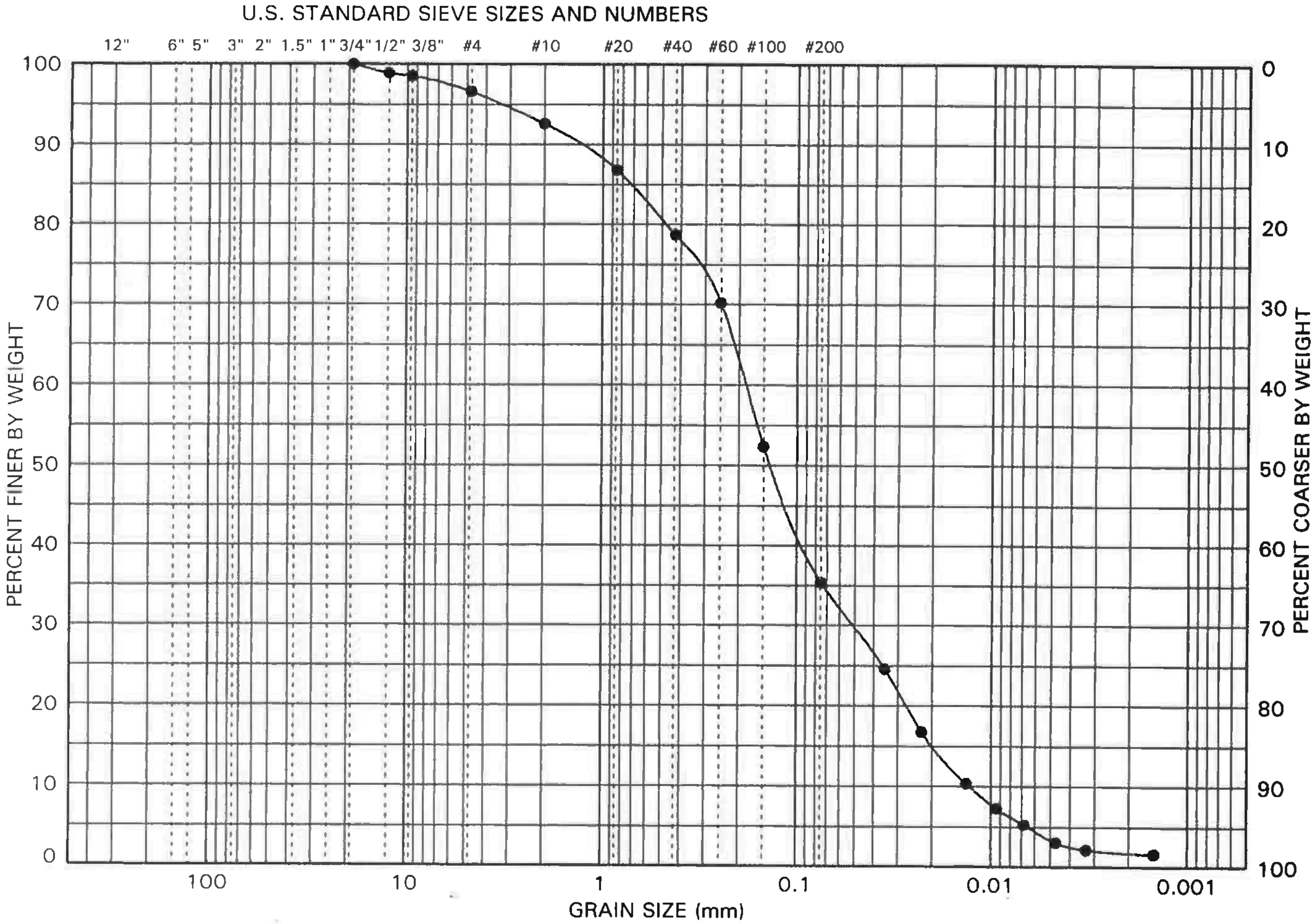
FIGURE

PROJECT: Lake Petit Dam
PROJECT NO.: GL0625
DOCUMENT NO.:

GS FORM: 4PS2 10/26/98

PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES

ASTM C 136, D 422, D 2487
D 3042 AND D 4318



BOULDERS	COBBLES	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
		GRAVEL		SAND			FINES	

SITE SAMPLE ID	*	LIQUID LIMIT (%)	NP	SOIL FRACTIONS	GRAVEL (%)	3.4
LAB. SAMPLE NO.	98J75	PLASTIC LIMIT (%)	NP		SAND (%)	61.2
SAMPLE DEPTH (ft)		PLASTICITY INDEX	NP		FINES (%)	35.4
SOIL CLASSIFICATION: SM - Silty Sand					SILT (%)	33.5
					CLAY(%)	1.9
					COEFF. UNIFORMITY (Cu)	
					COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER PARTICLE DIAMETER (mm)				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
PERCENT PASSING SIEVE SIZES (mm)																		
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	100	99	99	97	93	87	79	70	52	35	30	15	3	2	

NOTES: * G-1B(P) (80-81.5)

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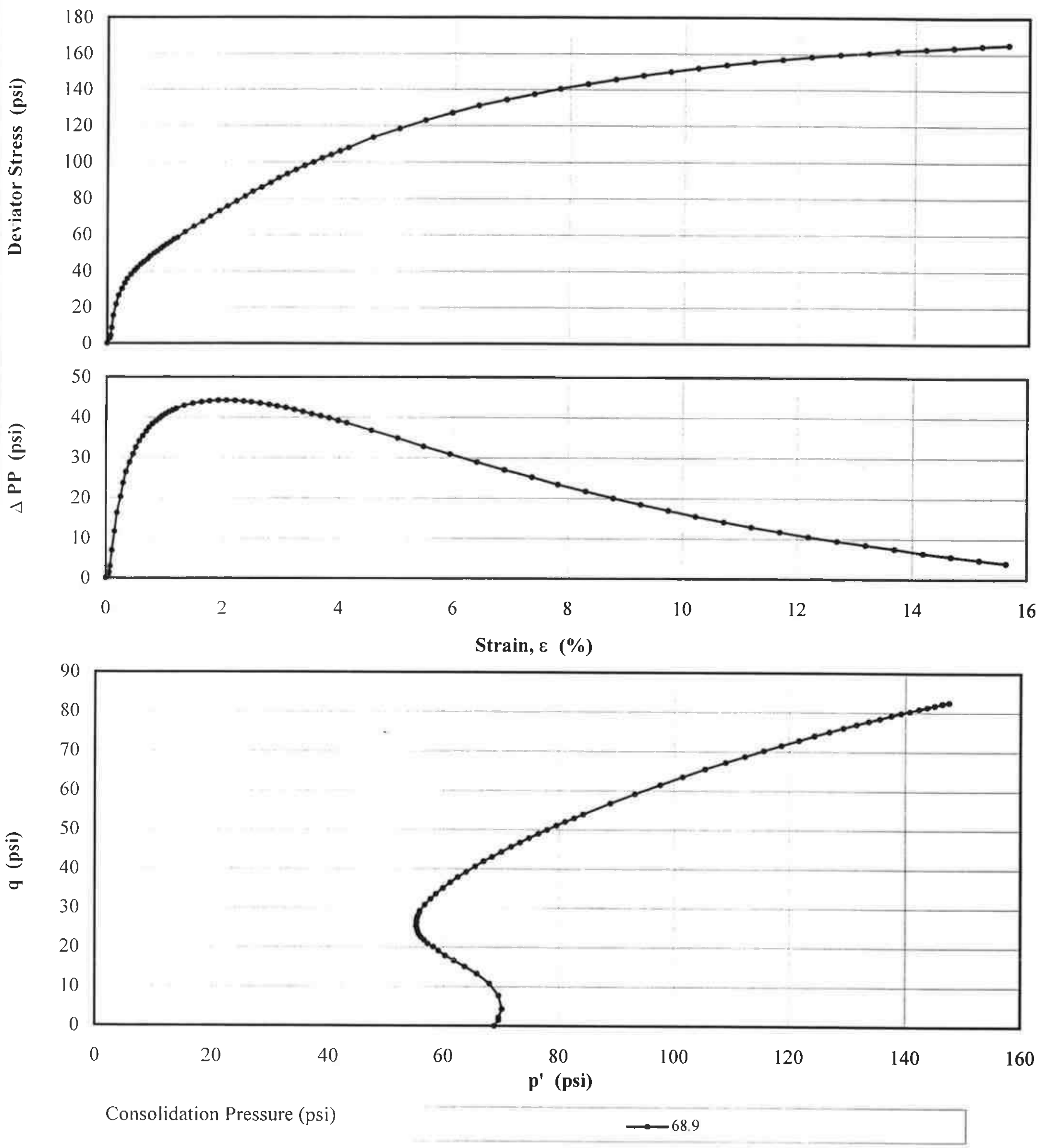
Sample ID:	**G-1B (U) (105'-107')**
Project Name:	LAKE PETIT DAM
Project No.:	GLG0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 8**



Note:

98J76

GLG0625/46196198.XLS

TABLE 8

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height	Diameter	Moisture Content	Dry Unit Weight			σ'_1-σ'_3	σ'_1	ε_a	u	σ'_1-σ'_3	σ'_1	ε_a	u		
		(in.)	(in.)	(%)	(pcf)	(psi)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)		
G-1B (U) (105'-107')	98J76.1	6.65	2.88	20.7	109.8	32.2	68.9					165.3	230.1	15.6	36.2	8	

Notes:

u_i = Initial pore pressure,(psi)
u = Pore pressure,(psi)
σ'_c= Consolidation pressure, (psi)
σ'_1 = Effective axial stress, (psi)
σ'_3 = Effective radial stress (confining pressure), (psi)
ε_a = Axial strain, (%)

1.

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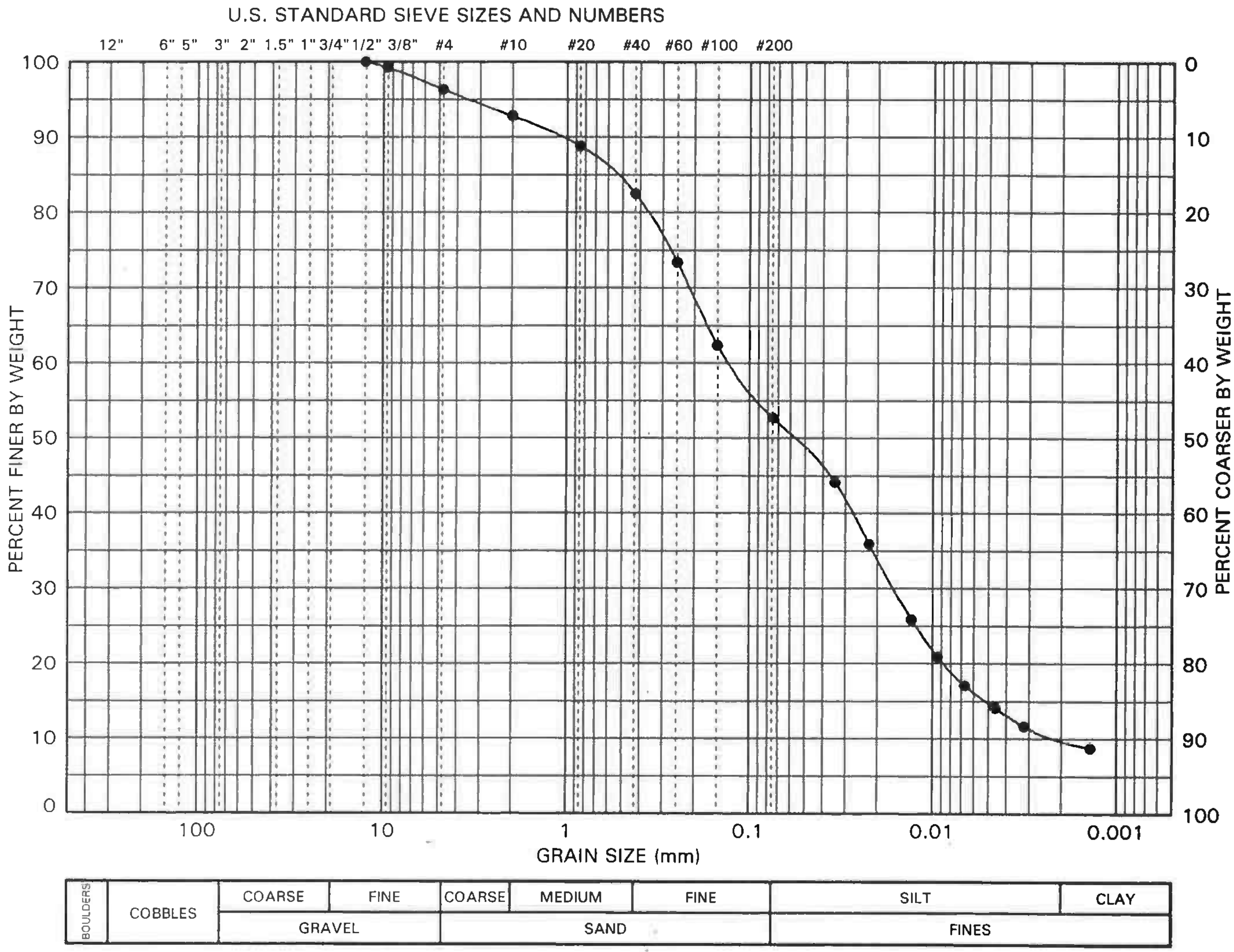
FIGURE
PROJECT: Lake Petit Dam
PROJECT NO.: GL0625
DOCUMENT NO.:

GS FORM: 4PS2 10/26/98

PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES

ASTM C 136, D 422, D 2487 D 3042 AND D 4318



SITE SAMPLE ID	*	LIQUID LIMIT (%)	41
LAB. SAMPLE NO.	98J76	PLASTIC LIMIT (%)	32
SAMPLE DEPTH (ft)		PLASTICITY INDEX	9

SOIL CLASSIFICATION:
ML - Sandy Silt

SOIL FRACTIONS	
GRAVEL (%)	3.7
SAND (%)	43.6
FINES (%)	52.7
SILT (%)	42.6
CLAY(%)	10.1
COEFF. UNIFORMITY (Cu)	
COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
PERCENT PASSING SIEVE SIZES (mm)														PARTICLE DIAMETER (mm)				
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	100	100	99	96	93	89	83	73	62	53	48	34	15	10	

NOTES: * G-1B(U) (105-107)

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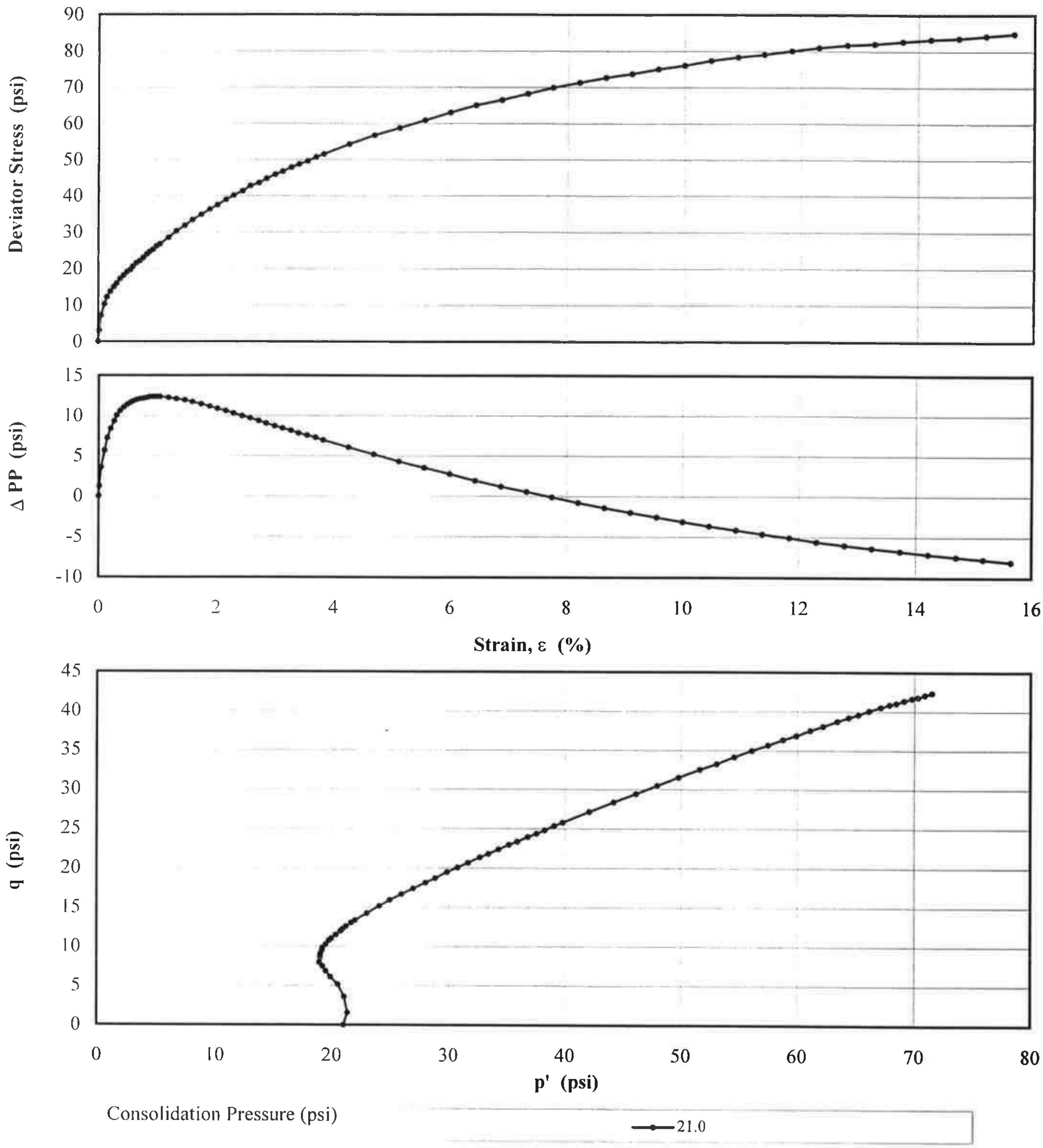
Sample ID:	**G-5 (G) (27'-30')**
Project Name:	LAKE PETIT DAM
Project No.:	GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 9**



Note:

98J111

TABLE 9

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) (1)

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-5 (G) (27'-30')	98J111.1	6.87	2.86	17.5	114.4	52.4	21.0					84.8	113.9	15.6	44.3	9	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1.

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Atlanta, Georgia

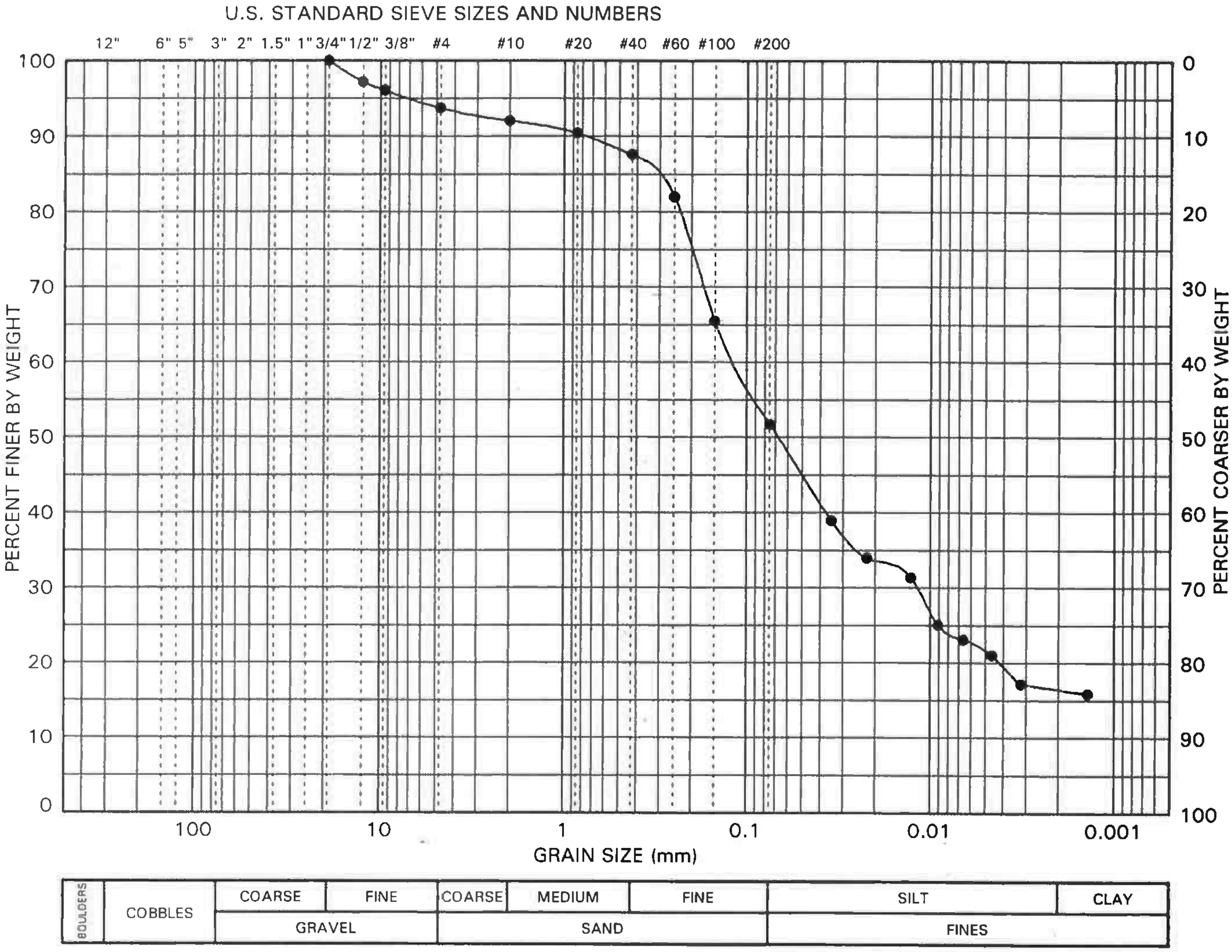
FIGURE

PROJECT: Lake Petit Dam
PROJECT NO.: GL0625
DOCUMENT NO.:

GS FORM: 4PS2 10/26/98

PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES

ASTM C 136, D 422, D 2487 D 3042 AND D 4318



SITE SAMPLE ID	*	LIQUID LIMIT (%)	33
LAB. SAMPLE NO.	98J111	PLASTIC LIMIT (%)	24
SAMPLE DEPTH (ft)		PLASTICITY INDEX	9

SOIL CLASSIFICATION:
ML - Sandy Silt

SOIL FRACTIONS	
GRAVEL (%)	6.3
SAND (%)	42.0
FINES (%)	51.7
SILT (%)	35.2
CLAY(%)	16.5
COEFF. UNIFORMITY (Cu)	
COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER PARTICLE DIAMETER (mm)				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
PERCENT PASSING SIEVE SIZES (mm)																		
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	100	97	96	94	92	90	88	82	66	52	45	33	21	16	

NOTES: * G-5(G) (27-30)

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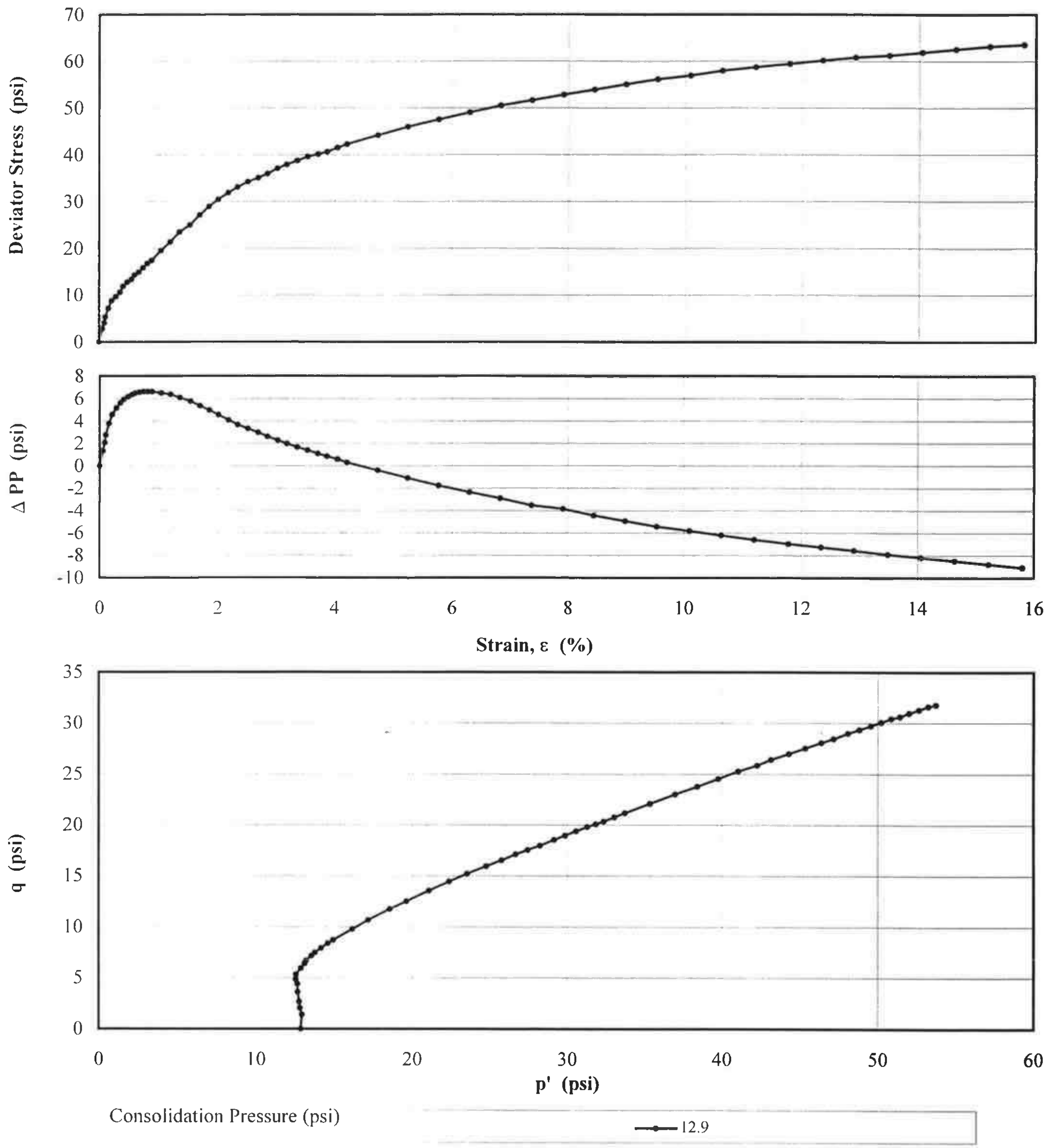
Sample ID:	G-5 (C) (13'-15')
Project Name:	LAKE PETIT DAM
Project No.:	GL0625

ASTM D 4767	TRIAXIAL COMPRESSION TESTING	Figure 10



Note:

98J112

TABLE 10

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	$\sigma'_1-\sigma'_3$ (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	$\sigma'_1-\sigma'_3$ (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-5 (C) (13'-15')	98J112.1	5.69	2.86	24.2	105.1	50.6	12.9					63.6	85.5	15.8	41.6	10	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1.

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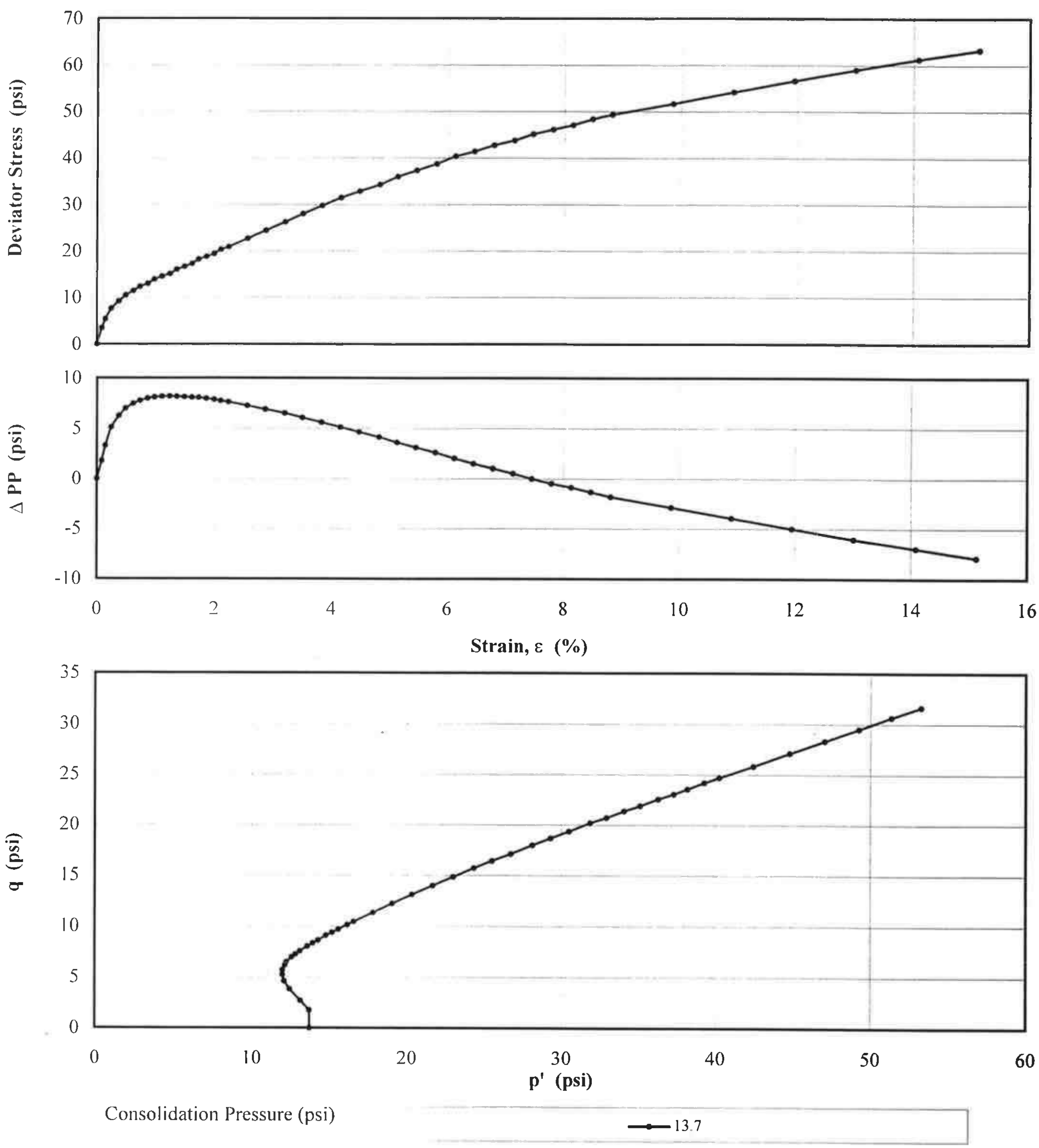
Sample ID: G-3 (D) (15'-17')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 11**



Note:

TABLE 11

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-3 (D) (15'-17')	98J141.1	6.14	2.84	22.5	107.4	51.1	13.7					63.3	84.9	15.1	43.2	11	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1.

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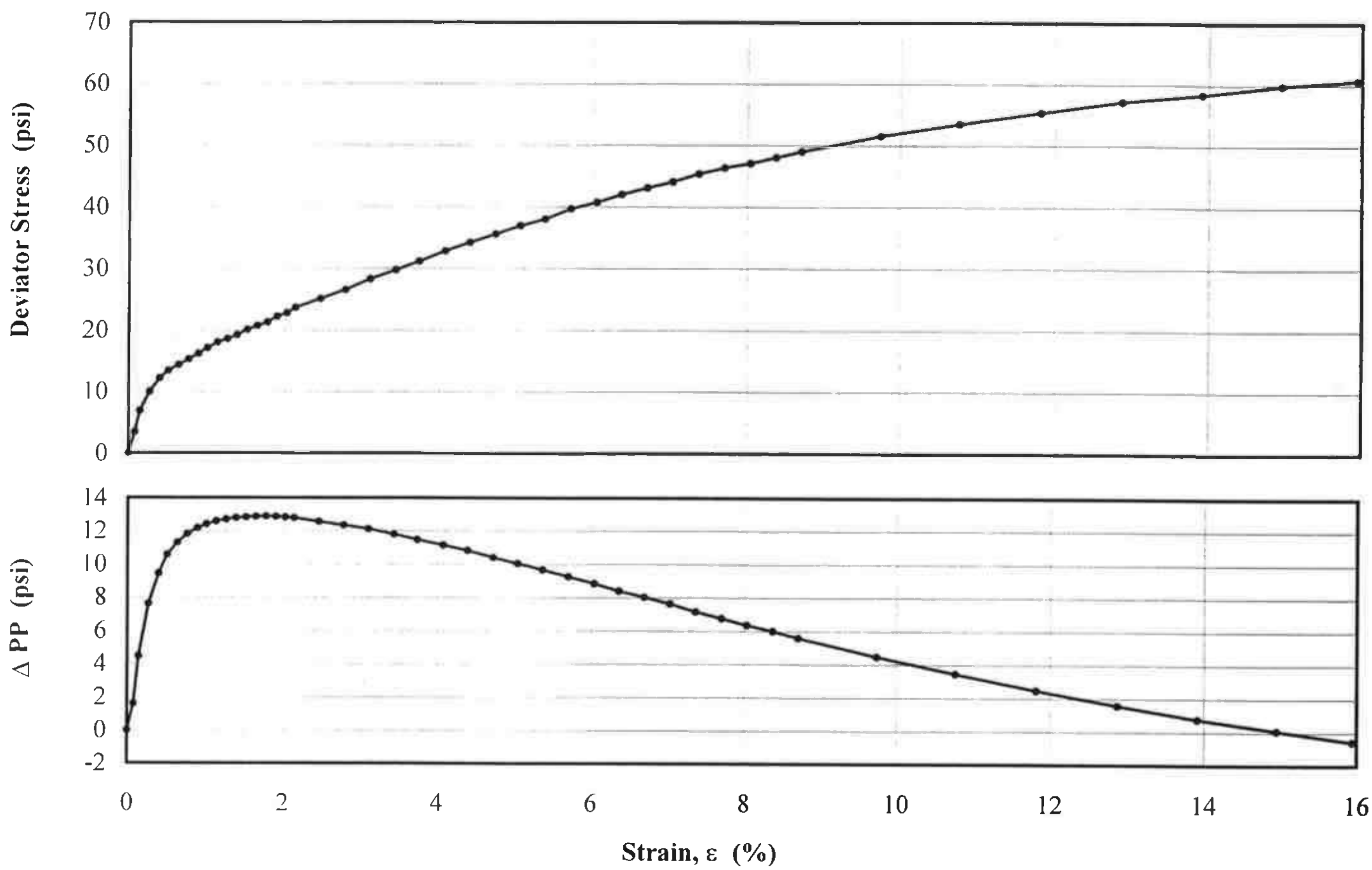
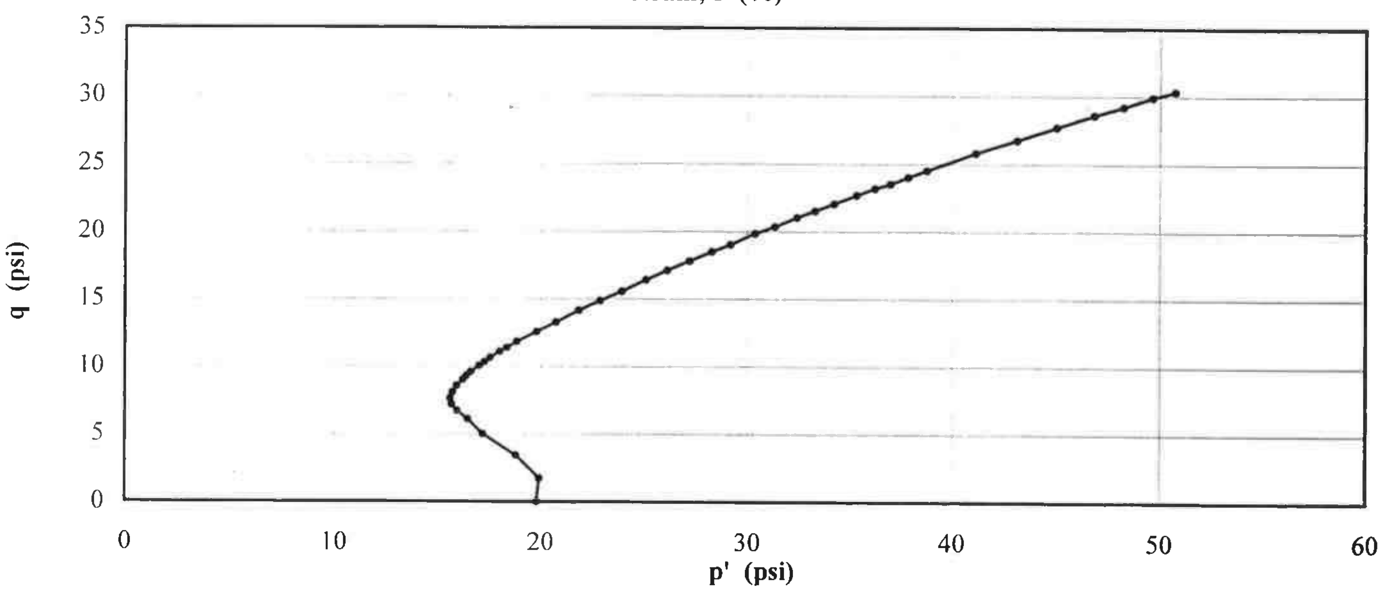
Sample ID:	G-3 (G) (28'-30')
Project Name:	LAKE PETIT DAM
Project No.:	GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 12**





Note:

98J142

TABLE 12

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-3 (G) (28'-30')	98J142.1	6.26	2.86	24.1	98.5	51.3	19.8					60.7	81.1	15.9	50.7	12	

Notes:

- u_i = Initial pore pressure,(psi)
- u = Pore pressure,(psi)
- σ'_c= Consolidation pressure, (psi)
- σ'_1 = Effective axial stress, (psi)
- σ'_3 = Effective radial stress (confining pressure), (psi)
- ε_a = Axial strain, (%)

1.

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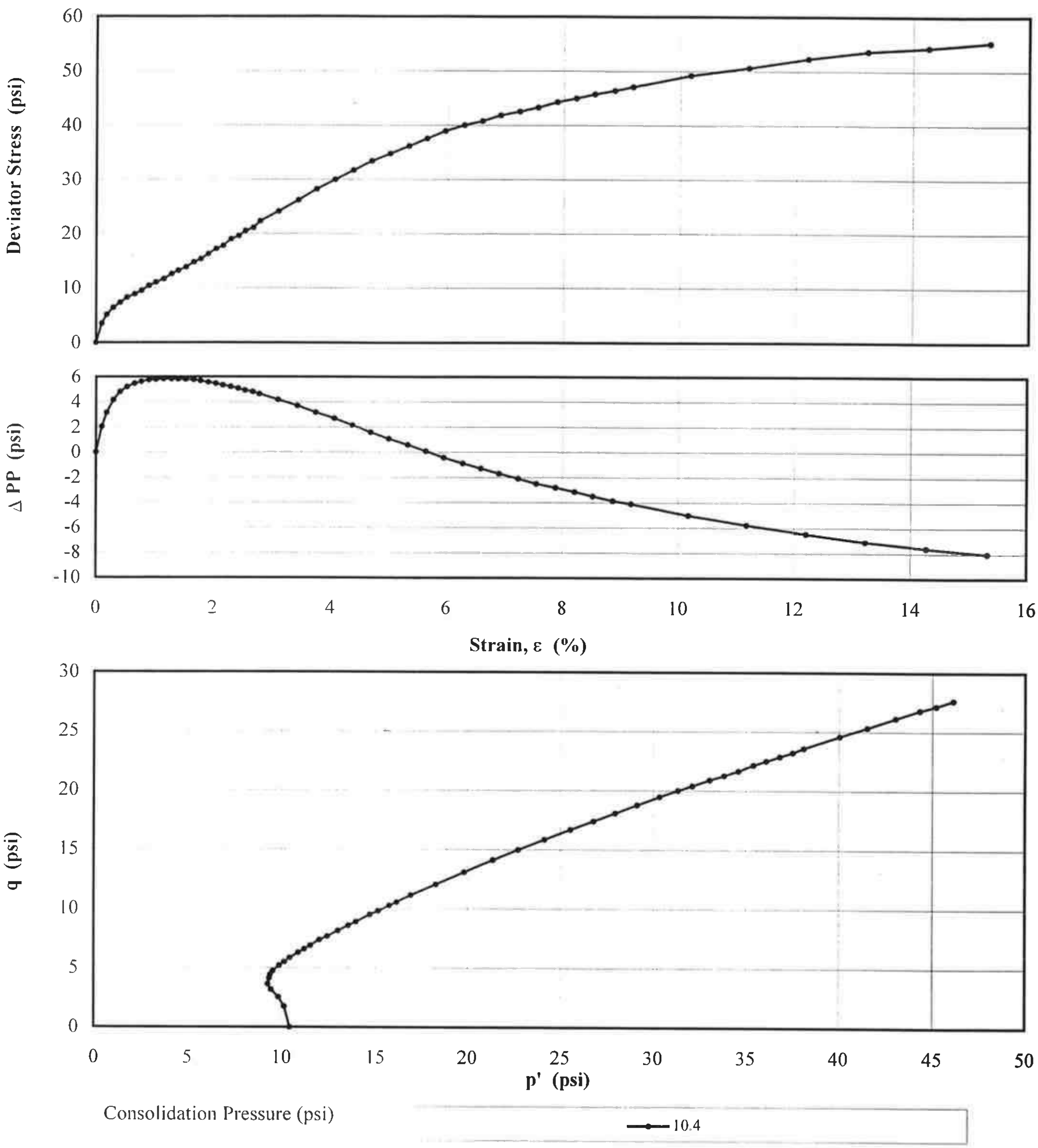
Sample ID: G-2 (B) (18'-20')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 13**



Note:

98J156

TABLE 13

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-2 (B) (18'-20')	98J156.1	6.06	2.84	23.8	98.3	49.2	10.4					55.3	73.8	15.3	41.1	13	

Notes:

- u_i = Initial pore pressure,(psi)
- u = Pore pressure,(psi)
- σ'_c= Consolidation pressure, (psi)
- σ'_1 = Effective axial stress, (psi)
- σ'_3 = Effective radial stress (confining pressure), (psi)
- ε_a = Axial strain, (%)

1.

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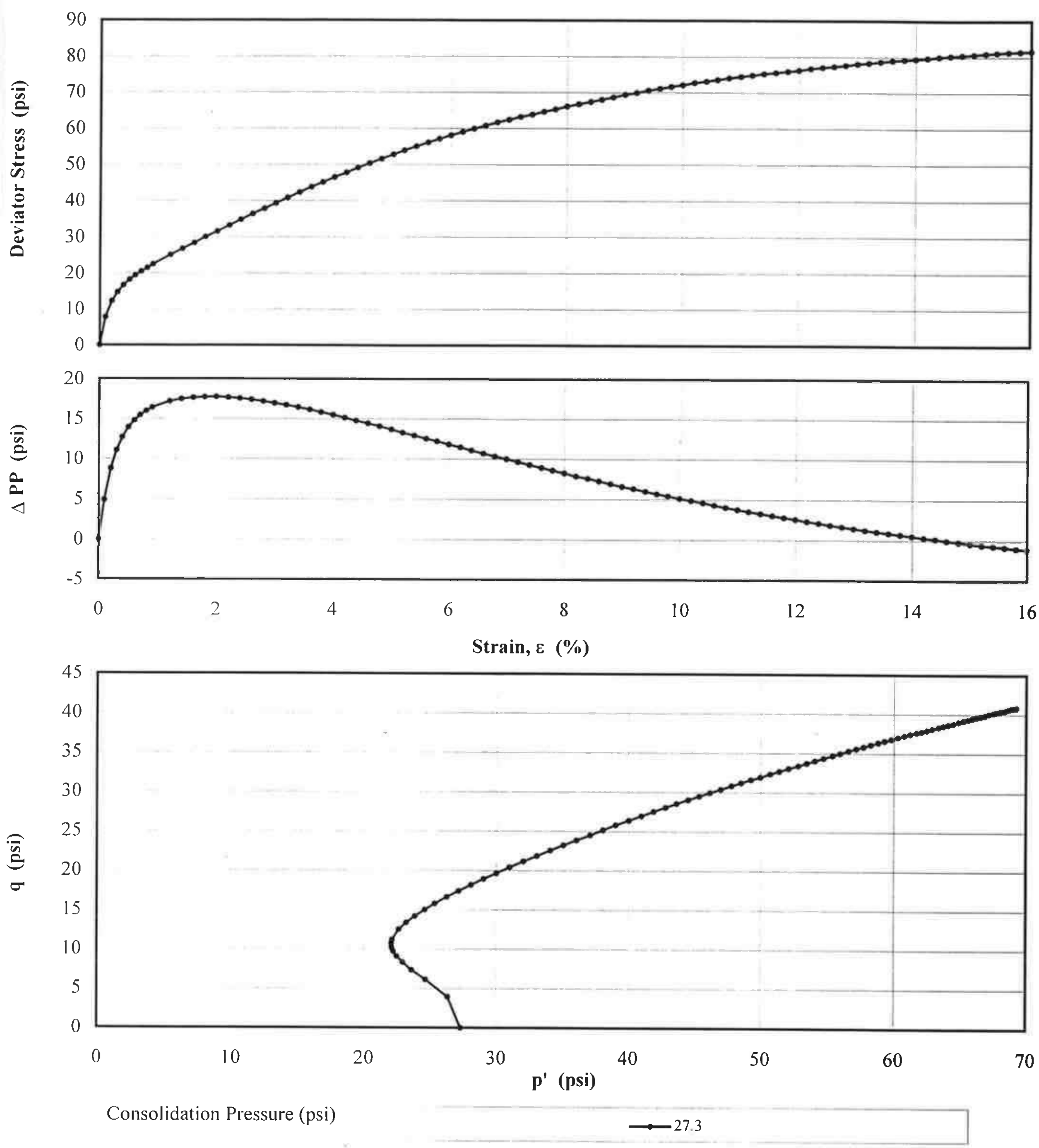
Sample ID: G-2 (E) (38'-40')
Project Name: LAKE PETIT DAM
Project No.: GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 14**



Note:

98J157

GL0625/4628796B.XLS

TABLE 14

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	σ'_1-σ'_3 (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-2 (E) (38'-40')	98J157.1	5.83	2.87	18.7	106.5	49.7	27.3					81.7	110.1	16.0	48.6	14	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1.

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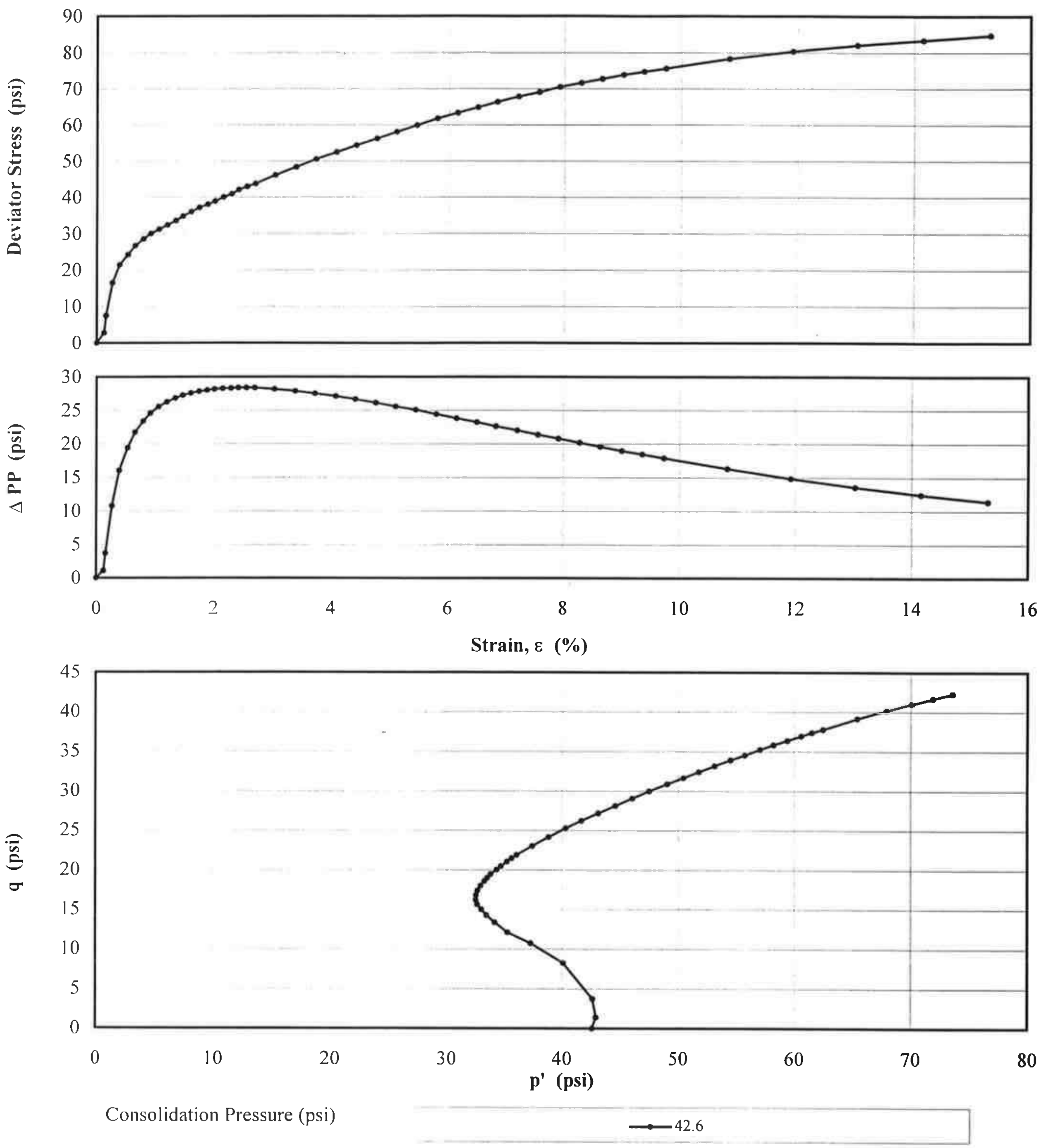
Sample ID:	**G-2 (H) (58'-60')**
Project Name:	LAKE PETIT DAM
Project No.:	GL0625

ASTM D 4767 | **TRIAXIAL COMPRESSION TESTING** | **Figure 15**



Note:

TABLE 15

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	$\sigma'_1-\sigma'_3$ (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	$\sigma'_1-\sigma'_3$ (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-2 (H) (58'-60')	98J159.1	5.67	2.87	21.6	106.0	50.5	42.6					84.7	115.9	15.3	61.9	15	

Notes:

u_i = Initial pore pressure,(psi)
u = Pore pressure,(psi)
σ'_c= Consolidation pressure, (psi)
σ'_1 = Effective axial stress, (psi)
σ'_3 = Effective radial stress (confining pressure), (psi)
ε_a = Axial strain, (%)

1.

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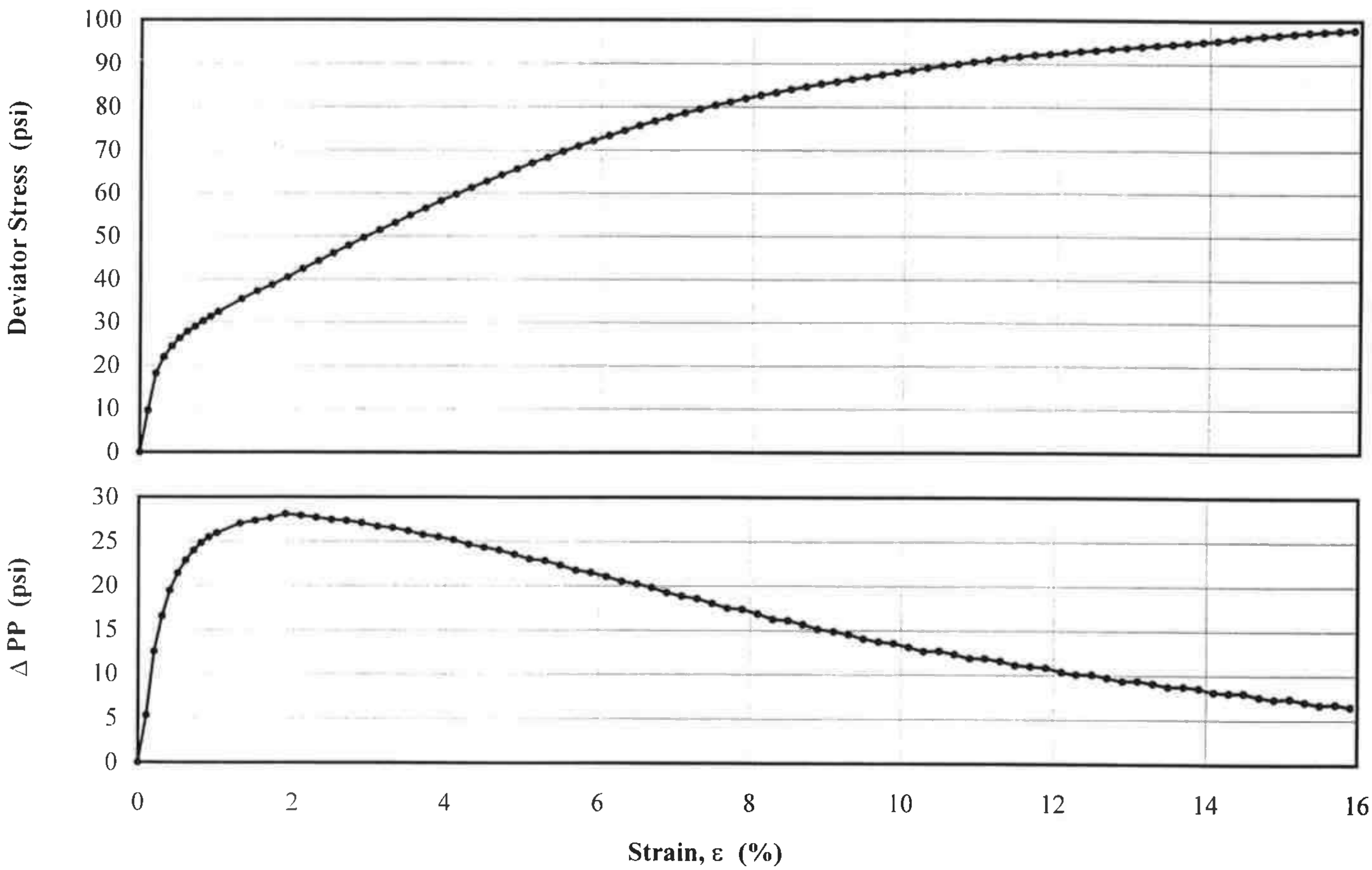
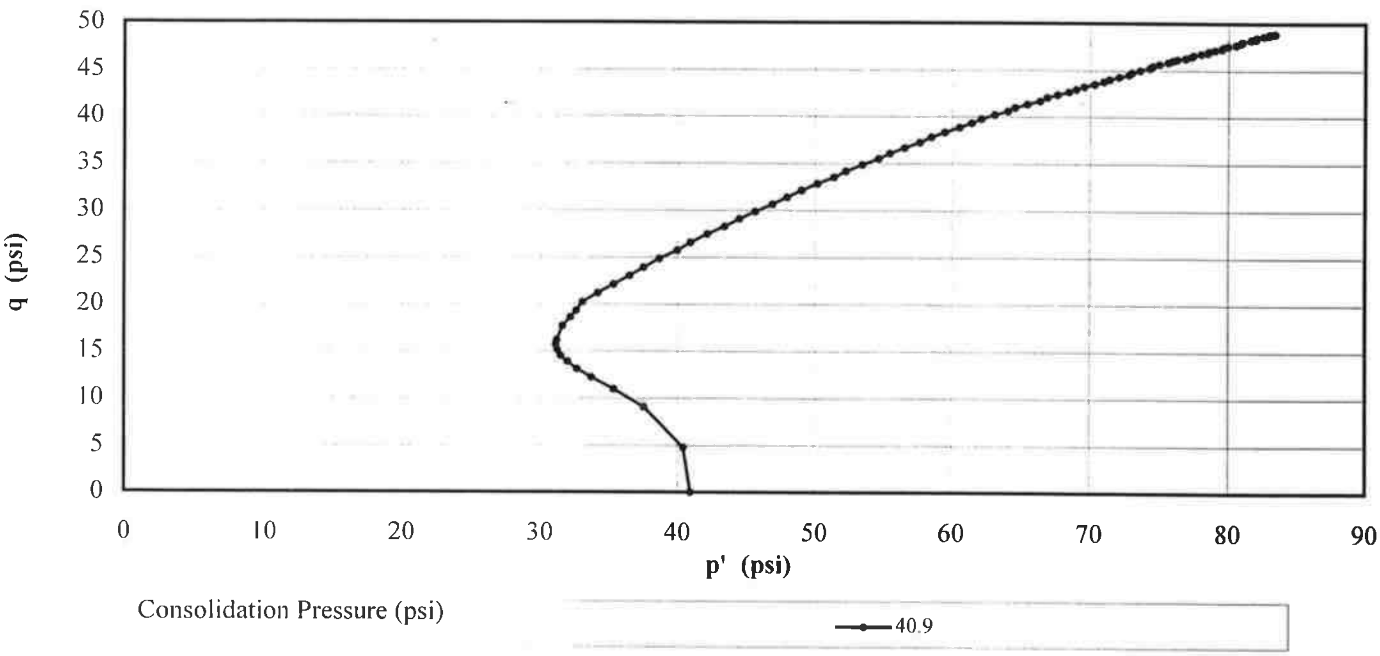
Sample ID:	**G-5 (P) (60'-62')**
Project Name:	LAKE PETIT DAM
Project No.:	GL0625

ASTM D 4767	**TRIAXIAL COMPRESSION TESTING**	**Figure 16**





Note:

98J162

GL0625/46285930.XLS

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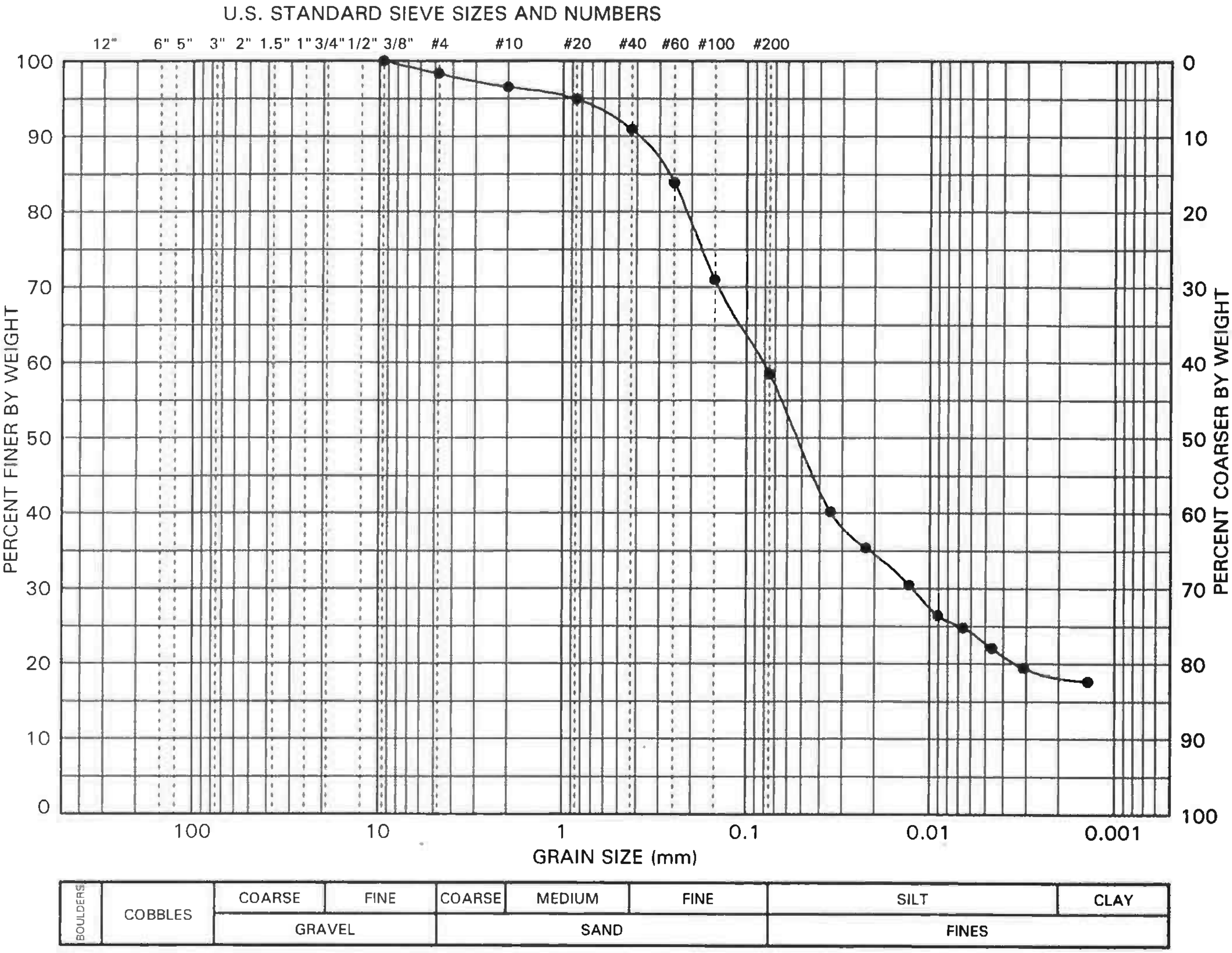
Geomechanics and Environmental Laboratory
Atlanta, Georgia

FIGURE
PROJECT: Lake Petit Dam
PROJECT NO.: GL0625
DOCUMENT NO.:

GS FORM: 4PS2 10/26/98

PARTICLE SIZE DISTRIBUTION AND PHYSICAL PROPERTIES

ASTM C 136, D 422, D 2487 D 3042 AND D 4318



SITE SAMPLE ID	*	LIQUID LIMIT (%)	45	GRAVEL (%)	1.7
LAB. SAMPLE NO.	98J162	PLASTIC LIMIT (%)	30	SAND (%)	39.8
SAMPLE DEPTH (ft)		PLASTICITY INDEX	15	FINES (%)	58.5
SOIL CLASSIFICATION: ML - Sandy Silt				SILT (%)	40.0
				CLAY(%)	18.5
				COEFF. UNIFORMITY (Cu)	
				COEFF. CURVATURE (Cc)	

PERCENT PASSING U.S. STANDARD SIEVE SIZES AND NUMBERS														PERCENT FINER THAN HYDROMETER PARTICLE DIAMETER (mm)				
3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#100	#200					
75	50	37.5	25	19	12.5	9.5	4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.050	0.020	0.005	0.002	0.001
100	100	100	100	100	100	100	98	97	95	91	84	71	59	49	34	23	19	

NOTES: * G-5(P) (60-62)

TABLE 16

CONSOLIDATED UNDRAINED (ICU) TRIAXIAL COMPRESSION TESTS

SUMMARY OF TEST RESULTS (ASTM D 4767) [1]

Site Sample ID	Lab Sample No.	Specimen Initial Conditions				u_i	σ'_c	Peak				Ultimate				Figure No.	Remarks
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	(psi)	(psi)	$\sigma'_1-\sigma'_3$ (psi)	σ'_1 (psi)	ε_a (%)	u (psi)	$\sigma'_1-\sigma'_3$ (psi)	σ'_1 (psi)	ε_a (%)	u (psi)		
G-5 (P) (60'-62')	98J162.1	6.10	2.85	22.0	104.8	50.0	40.9					97.8	132.3	15.9	56.5	16	

Notes:

u_i = Initial pore pressure,(psi)

u = Pore pressure,(psi)

σ'_c= Consolidation pressure, (psi)

σ'_1 = Effective axial stress, (psi)

σ'_3 = Effective radial stress (confining pressure), (psi)

ε_a = Axial strain, (%)

1.

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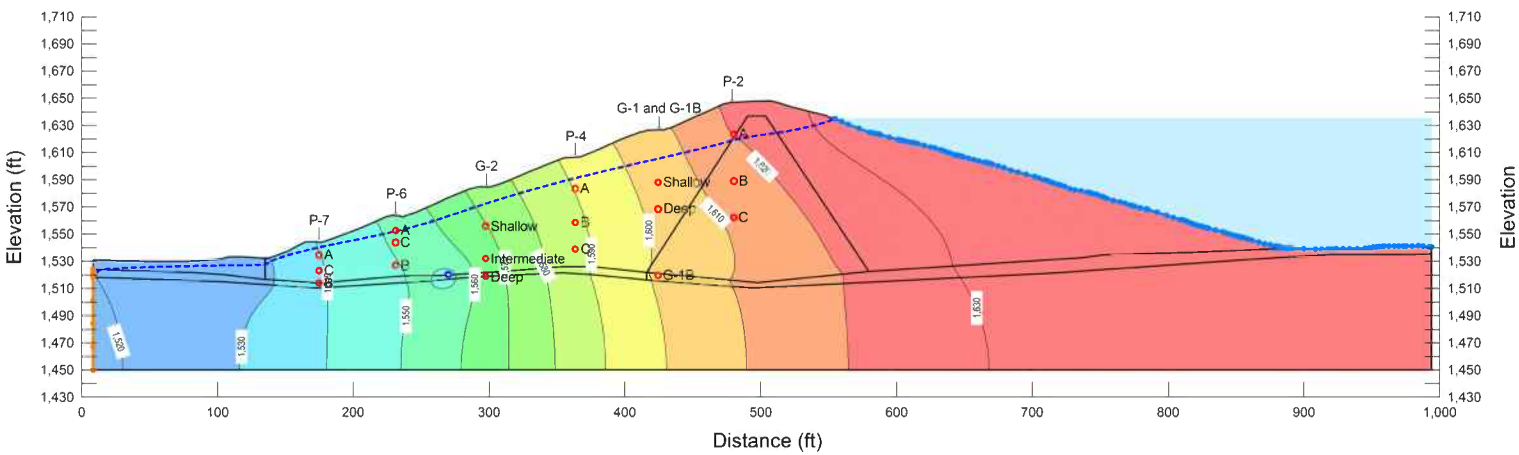
ATTACHMENT 3
Seepage Analysis Results

Color	Name	K-Function	Sat Kx (ft/sec)
	Bedrock		3.3e-09
	Dam Core	Kx = 3.3e-5 ft/s (Dam Core)	
	Dam Shell	Kx = 3.3e-5 ft/s (Dam Shell)	
	Saprolite - D/S	Kx = 1.6e-6 ft/s (D/S Saprolite)	
	Saprolite - U/S		3.3e-09
	Soil below ball field	Kx = 1.6e-3 ft/s (Ball Field Soils)	

Color	Name
	Normal Reservoir, EL 1635.5
	Trench Drain Exit, 1516.7 ft
	Trench Drain, 1,535 ft

Water Total Head

- ≤ 1,520 - 1,530 ft
- 1,530 - 1,540 ft
- 1,540 - 1,550 ft
- 1,550 - 1,560 ft
- 1,560 - 1,570 ft
- 1,570 - 1,580 ft
- 1,580 - 1,590 ft
- 1,590 - 1,600 ft
- 1,600 - 1,610 ft
- 1,610 - 1,620 ft
- ≥ 1,620 ft



Notes:
Cross-Section A-A
Steady-State Seepage Analysis
Normal Pool Reservoir
Headwater El. = 1,635.5 ft

STEADY-STATE SEEPAGE ANALYSIS
LAKE PETIT DAM

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PROJECT NO. TN9418

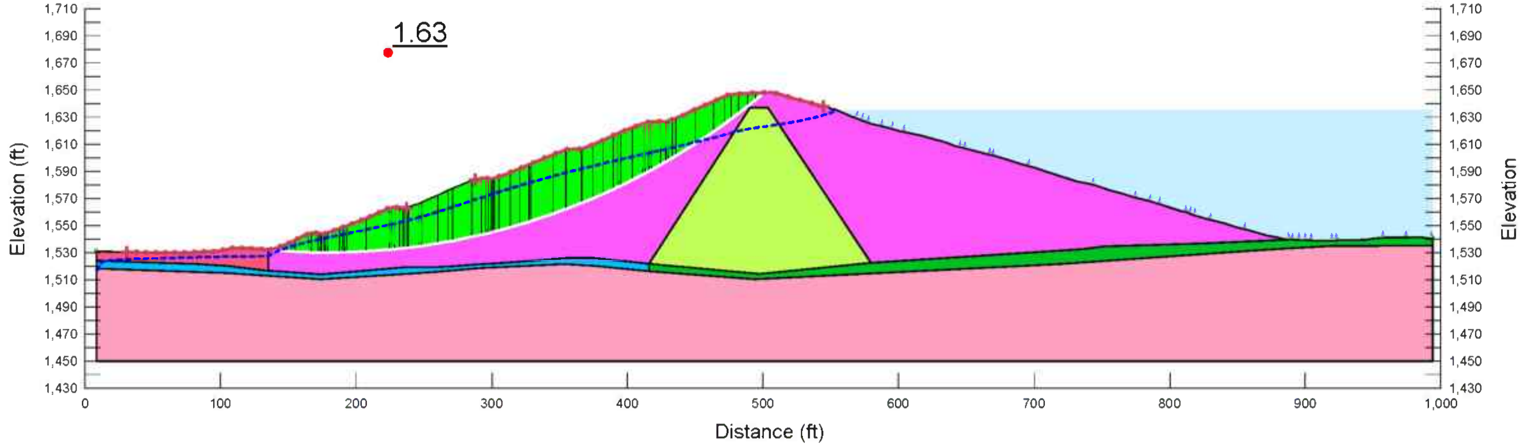
DATE: FEBRUARY 2023

Figure 2-1

ATTACHMENT 4
Slope Stability Analysis Results

Steady-State Seepage Stability Results

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core	Mohr-Coulomb	130	0	32
	Dam Shell	Mohr-Coulomb	125	0	34
	Saprolite - D/S	Mohr-Coulomb	125	0	35
	Saprolite - U/S	Bedrock (Impenetrable)			
	Soil below ball field	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Steady-State Seepage Stability Analysis of Downstream Slope
Normal Pool Elevation
Headwater Elev. = 1,635.5 ft

STEADY-STATE SEEPAGE STABILITY ANALYSIS OF DOWNSTREAM SLOPE
LAKE PETIT DAM

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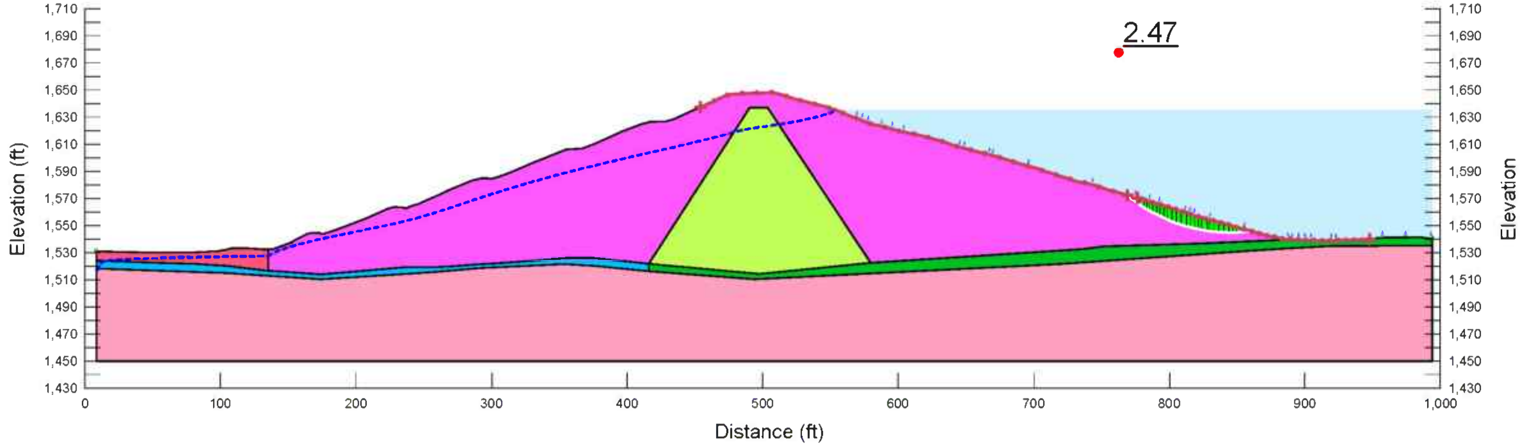
Figure 3-1

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core	Mohr-Coulomb	130	0	32
	Dam Shell	Mohr-Coulomb	125	0	34
	Saprolite - D/S	Mohr-Coulomb	125	0	35
	Saprolite - U/S	Bedrock (Impenetrable)			
	Soil below ball field	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Steady-State Seepage Stability Analysis of Upstream Slope
Normal Pool Elevation
Headwater Elev. = 1,635.5 ft

STEADY-STATE SEEPAGE STABILITY ANALYSIS OF UPSTREAM SLOPE
LAKE PETIT DAM

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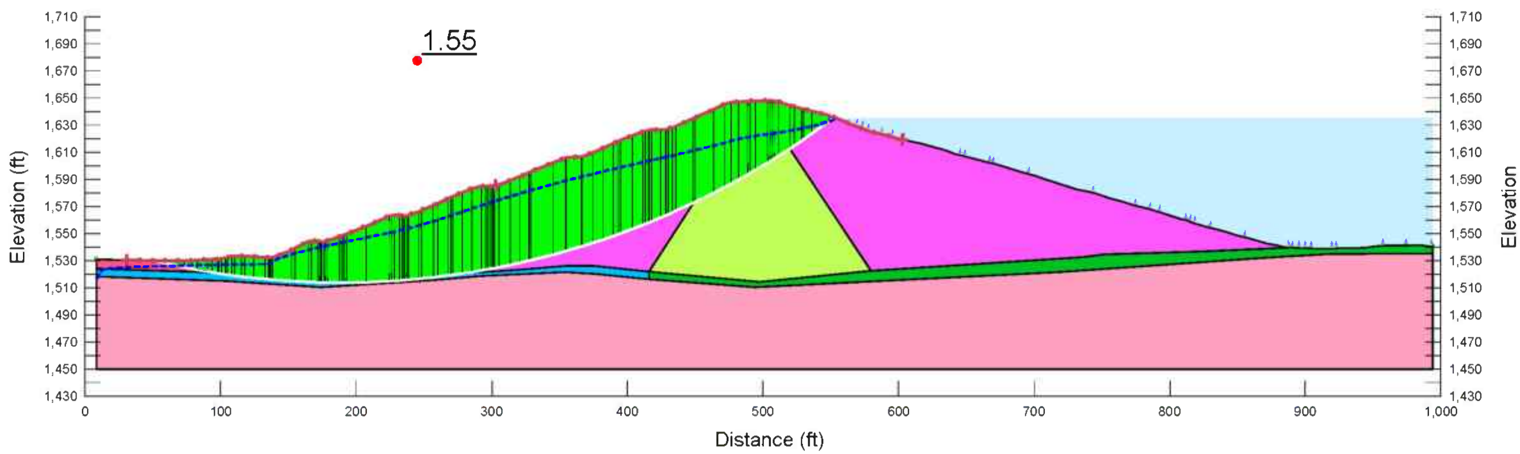
Figure 3-2

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Steady-State Seepage Pseudostatic Stability Results

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.038 g for an allowable displacement of 100 cm.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.038 g)

LAKE PETIT DAM

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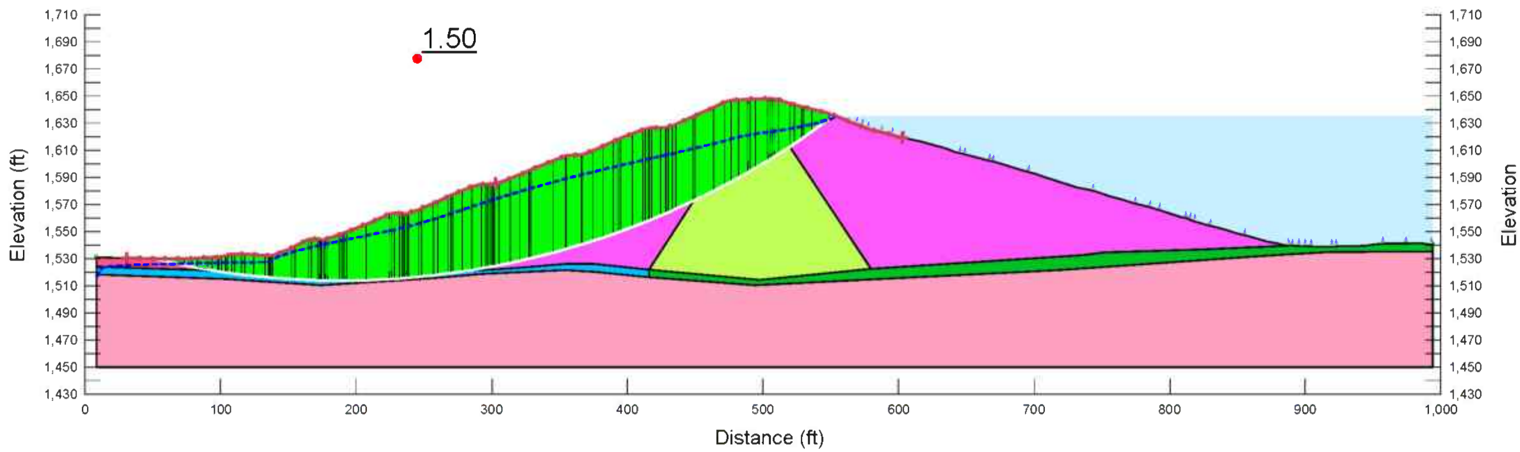
Figure 3-3

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.047 g)

LAKE PETIT DAM

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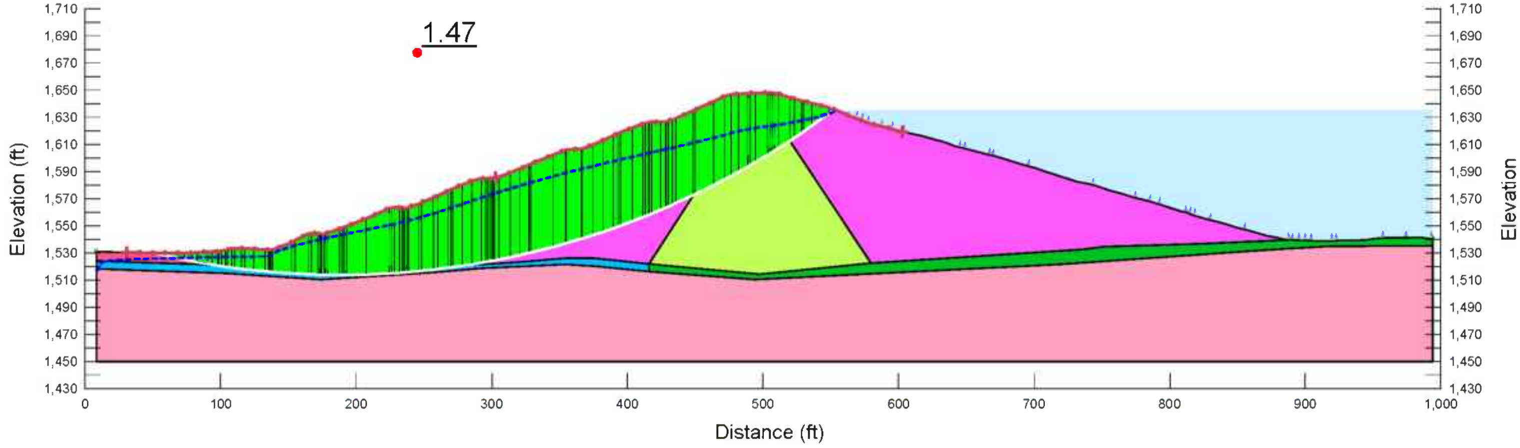
PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 3-4

Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.047 g for an allowable displacement of 70 cm.

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.050 g, which is GS SDP minimum required seismic acceleration.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.050 g)
LAKE PETIT DAM

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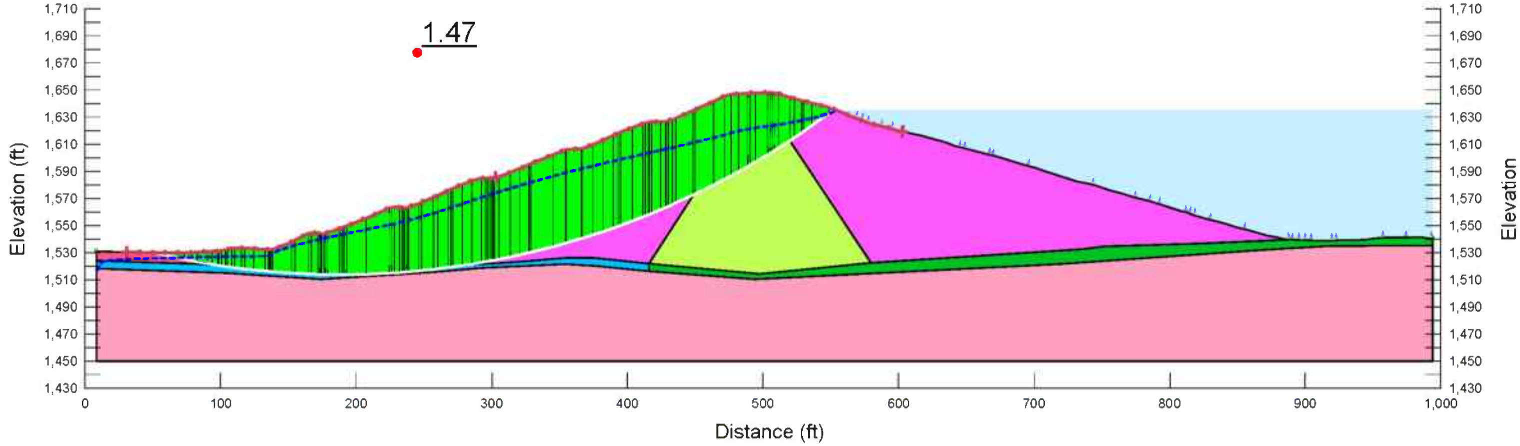
Figure 3-5

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.047 g for an allowable displacement of 60 cm.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.054 g)
LAKE PETIT DAM

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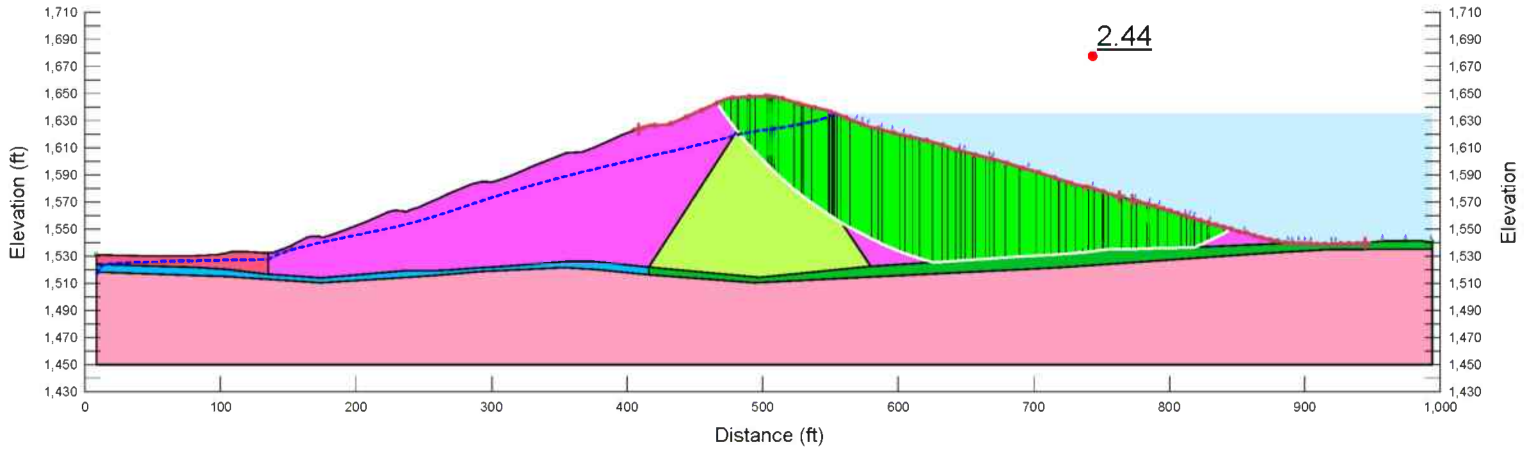
Figure 3-6

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.047 g for an allowable displacement of 60 cm.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.054 g)
LAKE PETIT DAM

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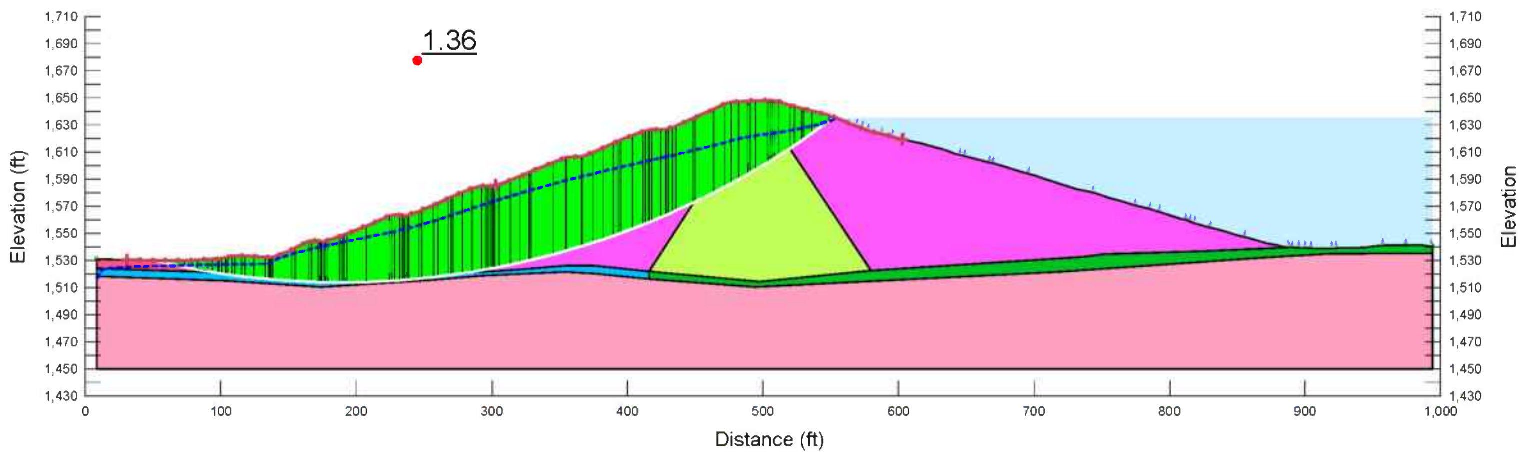
PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 3-7

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.081 g)

LAKE PETIT DAM

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Figure 3-8

PROJECT NO. TN9418

DATE: FEBRUARY 2023

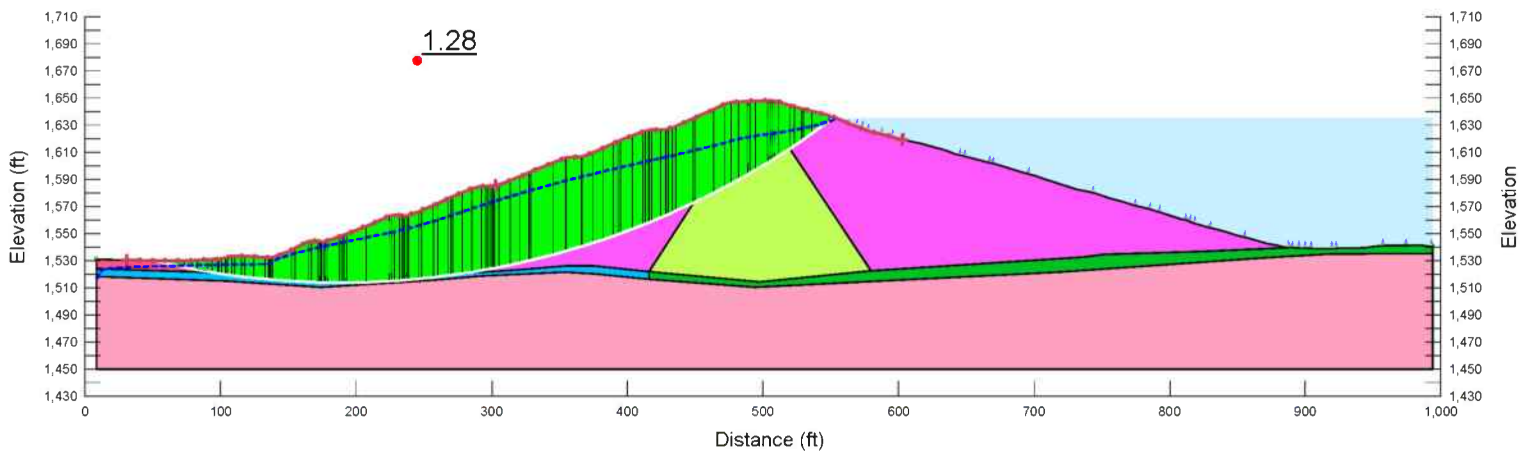
Notes:

Cross-Section A-A

Pseudostatic Analysis of Downstream Slope

The pseudostatic analysis was performed with a seismic coefficient K_s of 0.081 g for an allowable displacement of 30 cm.

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.101 g for an allowable displacement of 20 cm.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.101 g)
LAKE PETIT DAM

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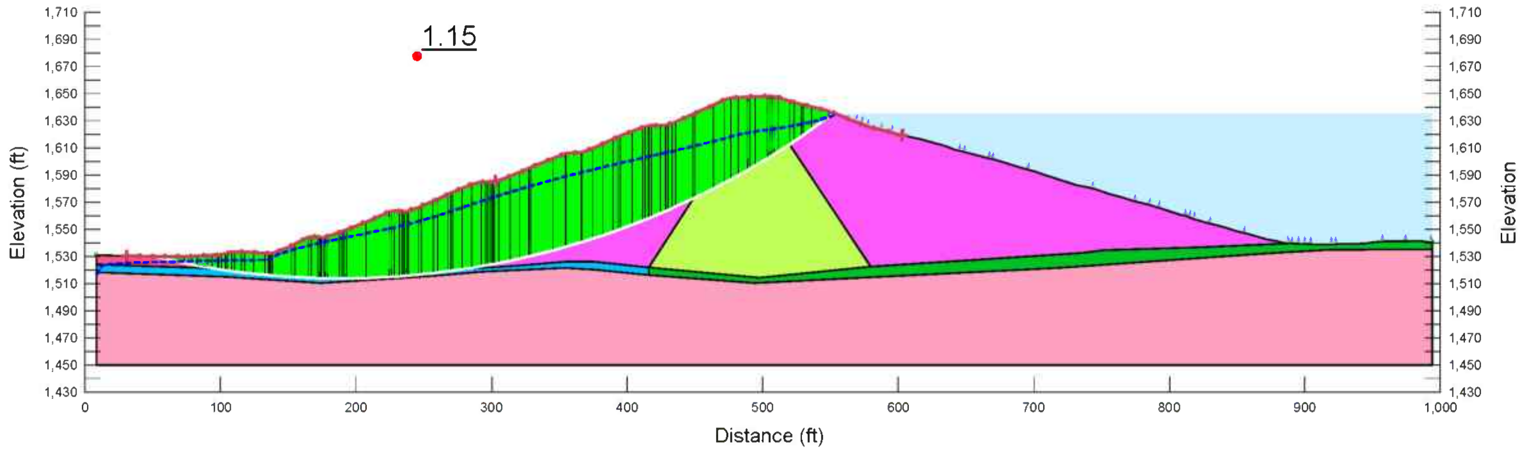
Figure 3-9

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.140 g for an allowable displacement of 10 cm.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.140 g)
LAKE PETIT DAM

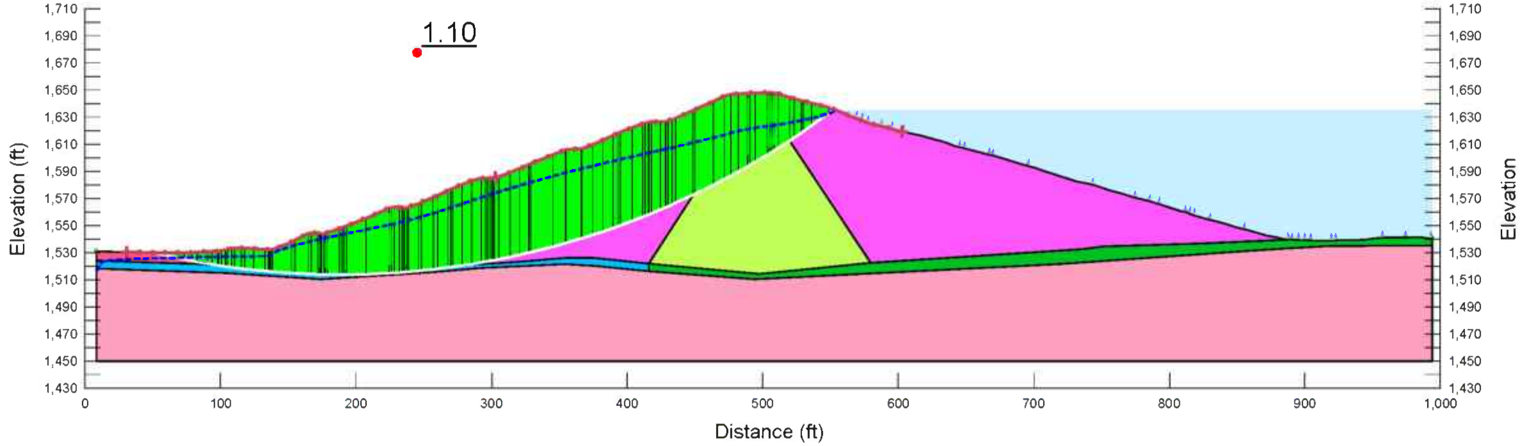
Geosyntec consultants

Figure 3-10

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.160 g, which is GS SDP minimum required factor of safety of 1.1.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.160 g)
LAKE PETIT DAM

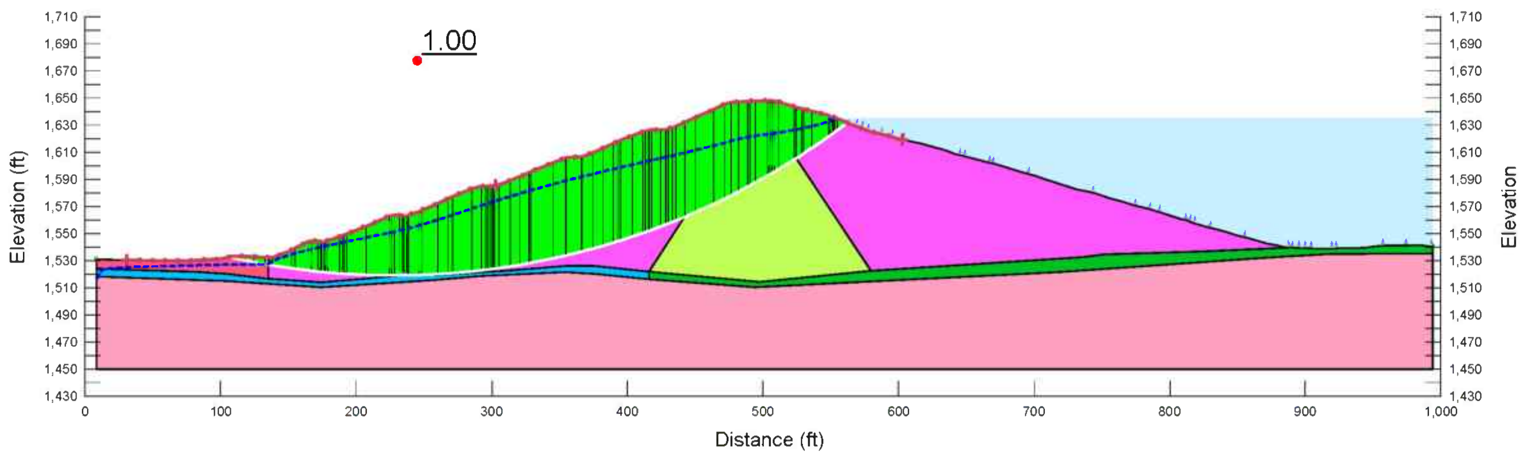
Geosyntec consultants

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 3-11

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Dam Core (Undrained)	Mohr-Coulomb	130	1,000	23
	Dam Shell (Undrained)	Mohr-Coulomb	125	1,000	23
	Saprolite - D/S (Undrained)	Mohr-Coulomb	125	0	35
	Saprolite - U/S (Undrained)	Bedrock (Impenetrable)			
	Soil below ball field (Undrained)	Mohr-Coulomb	125	0	32



Notes:
Cross-Section A-A
Pseudostatic Analysis of Downstream Slope
The pseudostatic analysis was performed with a seismic coefficient K_s of 0.200 g, which was performed to identify the yield coefficient K_y.

PSEUDOSTATIC SLOPE STABILITY ANALYSIS OF DOWNSTREAM SLOPE (K_s=0.200 g)
LAKE PETIT DAM

Geosyntec consultants

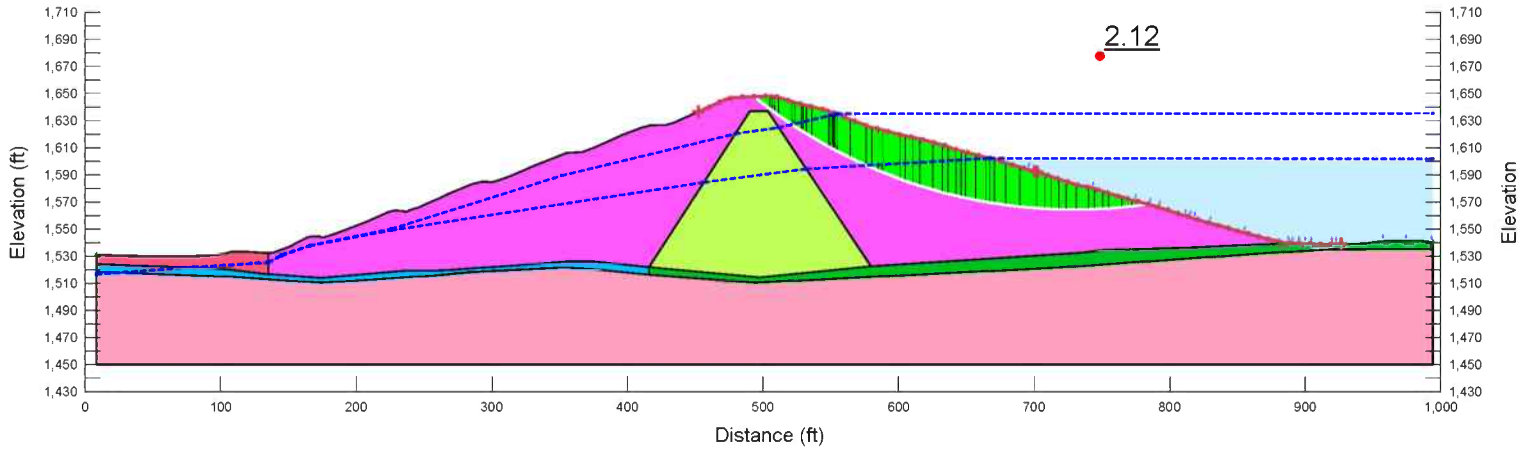
PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 3-12

Rapid Drawdown Stability Results

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Cohesion R (psf)	Phi R (°)	Piezometric Line	Piezometric Line After Drawdown
	Bedrock (Duncan)	Bedrock (Impenetrable)						1	2
	Dam Core (Duncan)	Mohr-Coulomb	130	0	32	1,000	23	1	2
	Dam Shell (Duncan)	Mohr-Coulomb	125	0	34	1,000	23	1	2
	Saprolite - D/S (Duncan)	Mohr-Coulomb	125	0	35	0	35	1	2
	Saprolite - U/S (Duncan)	Bedrock (Impenetrable)						1	2
	Soil below ball field (Duncan)	Mohr-Coulomb	125	0	32	0	32	1	2



Notes:
Cross-Section A-A
Rapid Drawdown Analysis of Upstream Slope
Analysis assumes a sudden release of two-thirds of the reservoir volume, from El. 1,635.5 to 1,602 ft.

RAPID DRAWDOWN SLOPE STABILITY ANALYSIS OF UPSTREAM SLOPE
LAKE PETIT DAM

Geosyntec consultants

PROJECT NO. TN9418

DATE: FEBRUARY 2023

Figure 3-13

APPENDIX B
Seepage Collection System Modifications Design Drawings and Specifications

SEEPAGE COLLECTION SYSTEM MODIFICATIONS

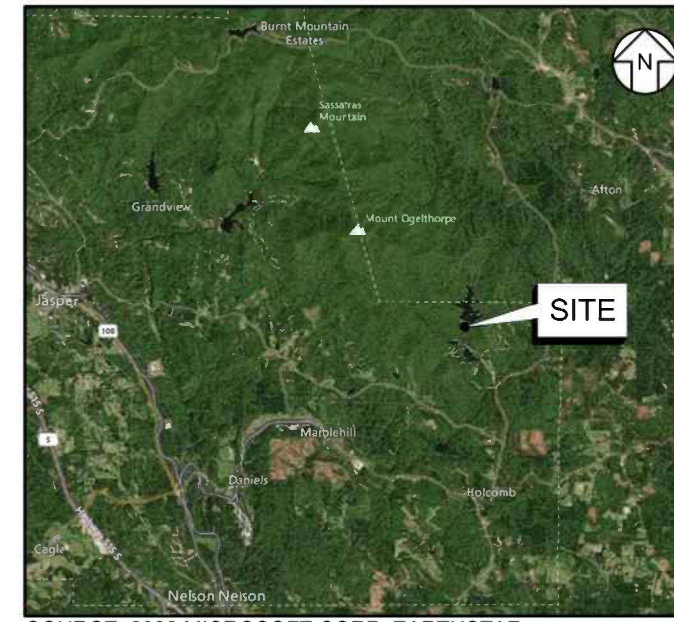
LAKE PETIT DAM
JASPER, GEORGIA
APRIL 2023

SOURCE: GOOGLE MAPS 2023

LOCATION MAP

0 10 MILES 20 MILES
SCALE IN FEET

SHEET LIST TABLE



SOURCE: 2023 MICROSOFT CORP. EARTHSTAR

VICINITY MAP

0 10,000' 20,000'
SCALE IN FEET

Big Canoe POA

PREPARED FOR:
BIG CANOE PROPERTY OWNERS ASSOCIATION
10586 BIG CANOE
JASPER, GA 30143

Geosyntec consultants

PREPARED BY:
GEOSYNTEC CONSULTANTS, INC.
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402
TELEPHONE: 423.385.2310

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0	4/28/2023	PERMIT DRAWINGS	J.X.C.	V.J.D.

DESIGN BY: E.O.A.
DRAWN BY: J.X.C.
CHECKED BY: W.M.M.
REVIEWED BY: C.H.G.
APPROVED BY: V.J.D.

TITLE: COVER SHEET
PROJECT: LAKE PETIT DAM - BIG CANOE
SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA
Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE: APRIL 2023
PROJECT NO.: TN9418
FILE: TN9418.05-C01
SHEET NO.: 01 OF 08

SCALE IN FEET: 0, 60', 120'

LEGEND

- EXISTING GROUND 10 FT INTERVALS
- EXISTING SHORELINE
- EXISTING TREELINE
- EXISTING PIEZOMETER
- EXISTING UNDERGROUND POWER LINE
- EXISTING UNDERGROUND TELEPHONE LINE
- EXISTING WATER LINE
- EXISTING FENCE LINE
- EXISTING STORM PIPE
- EXISTING 8" DUCTILE IRON
- EXISTING GUARD RAIL
- EXISTING GRATE INLET
- EXISTING STORM PIPE

GENERAL MAPPING NOTES

1. HORIZONTAL COORDINATE SYSTEM CORRESPONDS TO NORTH AMERICAN DATUM OF 1983 (NAD83), GEORGIA STATE PLANE, WEST ZONE IN US SURVEY FEET. ELEVATIONS CORRESPOND TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) IN US SURVEY FEET. CONTRACTOR SHALL NOTIFY THE ENGINEER IN THE EVENT OF A DISCREPANCY.
2. EXISTING GROUND SURFACE CONTOURS SHOWN ON THIS DRAWING SET, EXCEPT THOSE NOTED BELOW, WERE OBTAINED FROM A LIDAR SURVEY PERFORMED BY JORDAN ENGINEERING ON APRIL 2021. ELEVATIONS OF INVERTS OF EXISTING DRAINGAGE FEATURES, AND INSTRUMENT LOCATIONS WERE OBTAINED BY JORDAN ENGINEERING ON APRIL 2021.
3. CONTOURS WITHIN THE LAKE PETIT RESERVOIR WERE OBTAINED FROM A BATHYMETRIC SURVEY PERFORMED BY SEASIDE ENGINEERING AND SURVEYING, LLC IN MARCH 2022.
4. ALL EXISTING UTILITY TYPES AND LOCATIONS AND SUBSURFACE PIPING SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. CONTRACTOR IS RESPONSIBLE TO CONFIRM AND FIELD-LOCATE ALL UTILITIES IN THE WORK AREA PRIOR TO EXCAVATION.

GENERAL WORK NOTES

1. CONTRACTOR SHALL MAINTAIN AND PROTECT EXISTING PIEZOMETERS, DRAIN LINES, AND STORMWATER PIPES THROUGHOUT CONSTRUCTION. PIEZOMETERS SHALL REMAIN ACCESSIBLE THROUGH CONSTRUCTION. LOCATIONS OF EXISTING PIEZOMETERS ARE APPROXIMATE.
2. THE REGULATIONS OF ALL LOCAL, STATE, OR FEDERAL GOVERNMENTAL BODIES HAVING JURISDICTION OVER THE WORKING AREAS SHALL BE OBSERVED AT ALL TIMES.
3. ALL "WORK" SHALL BE PERFORMED IN A MANNER CONSISTENT WITH BEST PRACTICES.

SUMMARY OF SCOPE OF WORK/CONSTRUCTION SEQUENCE

CONTRACTOR SHALL PERFORM WORK AND SHALL COORDINATE THE CONSTRUCTION SCHEDULE AND OPERATIONS WITH THE OWNER. THE CONTRACTOR IS RESPONSIBLE FOR SCHEDULING THE ACTIVITIES LISTED BELOW IN A MANNER SUCH THAT ALL ACTIVITIES ARE COMPLETED EFFICIENTLY IN ACCORDANCE WITH PROJECT REQUIREMENTS, INCLUDING THE PROJECT COMPLETION DATE. THE FOLLOWING LIST IS INCLUDED ONLY TO IDENTIFY THE MAIN ELEMENTS OF THE WORK TO ASSIST THE CONTRACTOR IN UNDERSTANDING THE GENERAL REQUIREMENTS OF THE PROJECT AND IS NOT INTENDED TO DESCRIBE ALL THE WORK REQUIRED, NOR DESIGNATE A REQUIRED SEQUENCE OF CONSTRUCTION ACTIVITIES. THE GENERAL CATEGORIES OF WORK THAT ARE TO BE PERFORMED UNDER THIS PROJECT INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

A. FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND INCIDENTALS REQUIRED.
B. MOBILIZE CONSTRUCTION EQUIPMENT AND PERSONNEL.
C. ESTABLISH SURVEY CONTROL OF SITE AND UPDATE AS NECESSARY DURING CONSTRUCTION.
D. ESTABLISH PERIMETER EROSION AND SEDIMENT CONTROLS (ESC) USING BEST MANAGEMENT PRACTICES (BMP) AND PROVIDE TEMPORARY ACCESS TO THE WORK AREA.
E. LOCATE LOCATE AND VISIBLY MARK LOCATION OF EXISTING CULVERTS DRAINS, STORMWATER PIPES, UTILITIES, AND DAM INSTRUMENTATION TO MITIGATE DAMAGE DURING EXCAVATION.
F. REMOVE 13 EXISTING 4-INCH DIAMETER HDPE DRAINS AND GRAVEL BACKFILL, THEN BACKFILL WITH GRADED SAND. PLACE TOPSOIL AND VEGETATE EXCAVATED AREA TO RESTORE TO EXISTING GRADE AND CONDITION.
G. REMOVE EXISTING TWO-STAGE FILTER, DRAIN PIPE AND EXISTING INTERCEPTOR DRAINS ON LEFT ABUTMENT BETWEEN THE 1544 BENCH AND 1562 BENCH (BENCH NOS.1 AND 2, RESPECTIVELY). BACKFILL TRENCH AND RESTORE SURFACE AREA WITH LOCALIZED GRADING, SAND AND TOPSOIL, AND REVEGETATE.
H. REMOVE EXISTING CONCRETE DITCH AT LOCATIONS SHOWN.
I. DISPOSE OF PIPE, GRAVEL BACKFILL, AND CONCRETE OFFSITE, IN ACCORDANCE WITH LOCAL REGULATIONS.
J. INSTALL LONGITUDINAL TRENCH, PIPE, BACKFILL, FOUR CATCH BASINS, AND ONE HEADWALL ALONG THE 1544 BENCH (BENCH NO. 1) AT THE LOCATIONS AND ELEVATIONS SHOWN.
K. PLACE FILL AND COMPACT LOCALLY OVER SECTION OF PIPE JUST ABOVE HEADWALL WHERE PORTION OF PIPE WILL BE EXPOSED ABOVE GROUND. PLACE RIPRAP ALONG SLOPE AND DOWNSTREAM OF HEADWALL.
L. CONNECT CATCH BASIN 4 TO EXISTING 24-INCH CMP PIPE NETWORK ON DOWNSTREAM SIDE OF RIGHT ABUTMENT.
M. UPON COMPLETION OF WORK, RESTORE DISTURBED AREAS INCLUDING TEMPORARY ACCESS ROADS TO EXISTING GRADES, VEGETATE BARE AREAS TO RESTORE SOIL COVER, AND REMOVE PERIMETER EROSION AND SEDIMENT CONTROLS.

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GEORGIA REGISTERED PROFESSIONAL ENGINEER VERNON JAMES DOTSON, JR.

DESIGN BY:	E.O.A.
DRAWN BY:	J.X.C.
CHECKED BY:	W.M.M.
REVIEWED BY:	C.H.G.
APPROVED BY:	V.J.D.

TITLE: EXISTING CONDITIONS

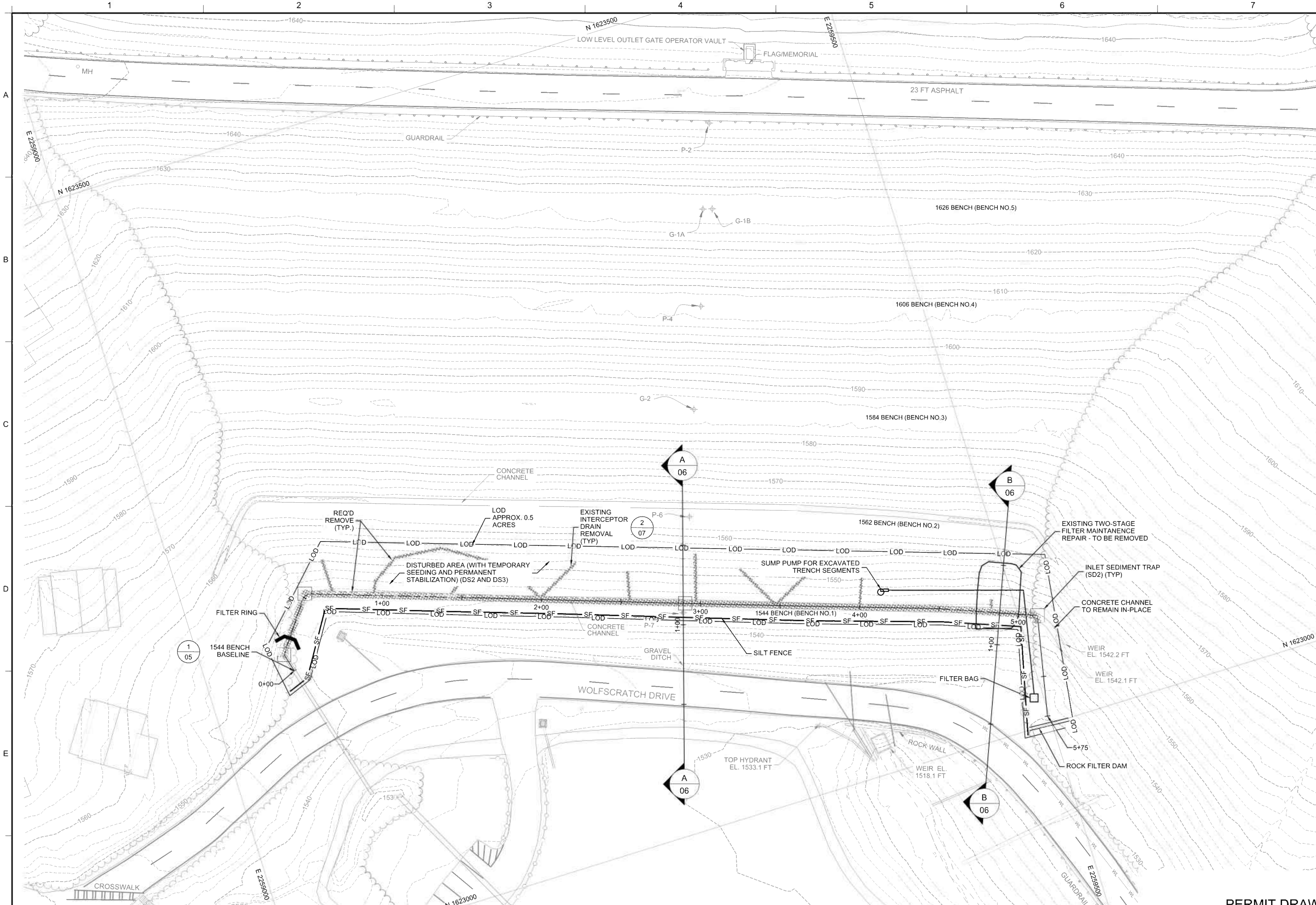
PROJECT: LAKE PETIT DAM - BIG CANOE

SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE:	APRIL 2023
PROJECT NO.:	TN9418
FILE:	TN9418.05-C02
SHEET NO.:	02 OF 08



LEGEND

1600	EXISTING GROUND MAJOR CONTOUR (10')
	EXISTING GROUND MINOR CONTOUR (2')
1540	PROPOSED GRADING MAJOR CONTOURS (10')
1542	PROPOSED GRADING MINOR CONTOURS (2')
	PROPOSED EXCAVATION GRADING LIMIT
LOD	LIMIT OF DISTURBANCE
SF	SILT FENCE
	SHORELINE
	TREELINE
	PIEZOMETER
P	UNDERGROUND POWER LINE
T	UNDERGROUND TELEPHONE LINE
WL	WATER LINE
	FENCE LINE
STM	STORM PIPE
8"DI	8" DUCTILE IRON
	EXISTING GUARD RAIL
	DEMOLITION/REMOVE
	INLET SEDIMENT TRAP
	FILTER RING
	ROCK FILTER DAM

NOTES:

1. FOR GENERAL NOTES SEE SHEET 02.
2. INSTALL EROSION AND SEDIMENT CONTROLS SHOWN IN ACCORDANCE WITH GEORGIA SOIL & WATER CONSERVATION COMMISSION FIELD MANUAL FOR EROSION & SEDIMENT CONTROL IN GEORGIA, 2016 EDITION.

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DRAWN BY:	J.X.C.
CHECKED BY:	W.M.M.
REVIEWED BY:	C.H.G.
APPROVED BY:	V.J.D.

TITLE: PLAN VIEW - DEMO AND EROSION & SEDIMENT CONTROL

PROJECT: LAKE PETIT DAM - BIG CANOE

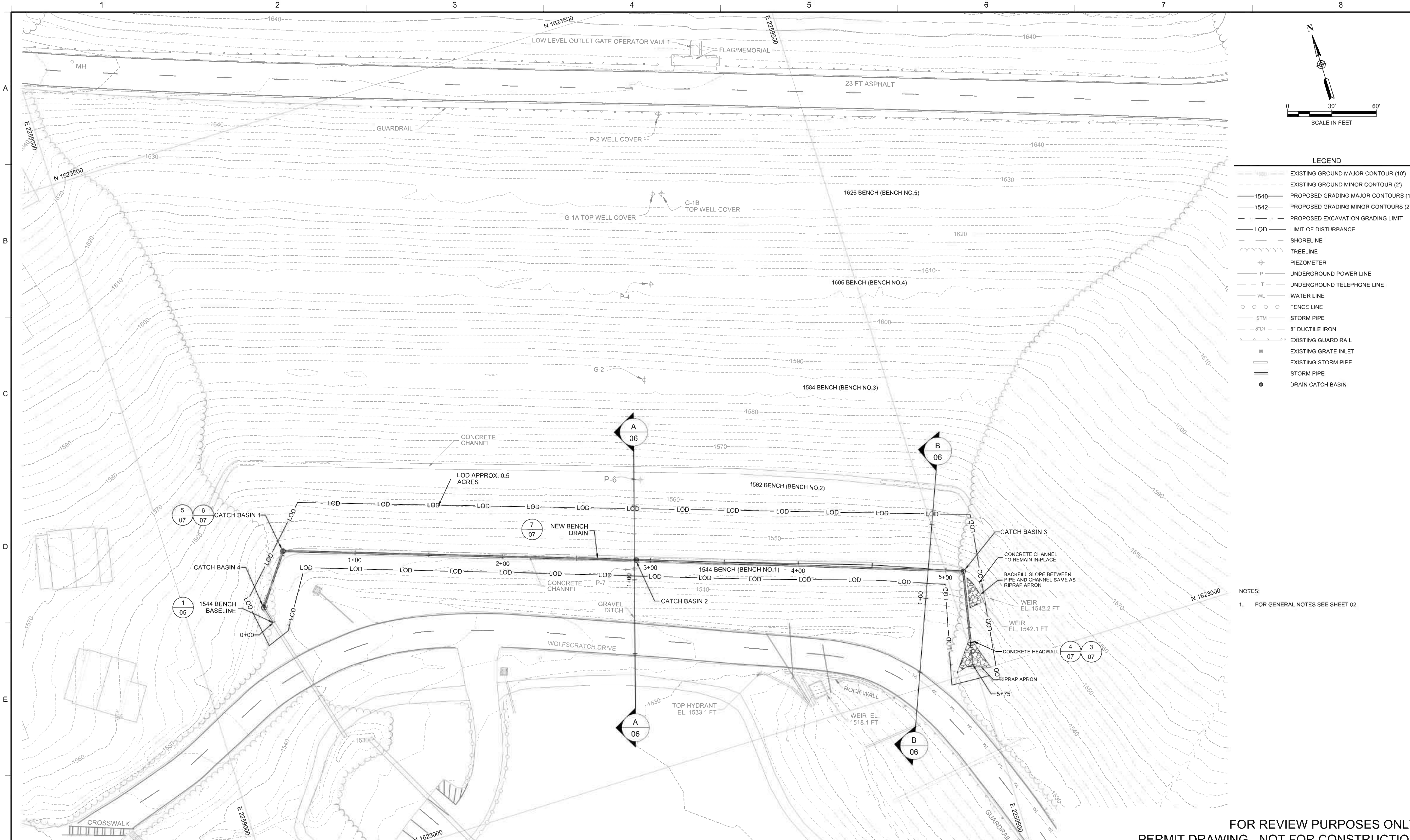
SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE:	APRIL 2023
PROJECT NO.:	TN9418
FILE:	TN9418.05-C03
SHEET NO.:	03 OF 08

C:_GEOPW\DSO1\DMS14752\TN9418.05-C03
PW:\CLIENTS\BIG CANOE\TN9244 - LAKE PETIT DAM ANALYSIS\05 - GEOTECH STABILITY ANALYSIS AND PIPE DESIGN (TN94)



NOTES:

1. FOR GENERAL NOTES SEE SHEET 02

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0	4/28/2023	PERMIT DRAWINGS	J.X.C.	V.J.D.

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DRAWN BY: J.X.C.
CHECKED BY: W.M.M.
REVIEWED BY: C.H.G.
APPROVED BY: V.J.D.

TITLE: PLAN VIEW - PROPOSED CONDITIONS

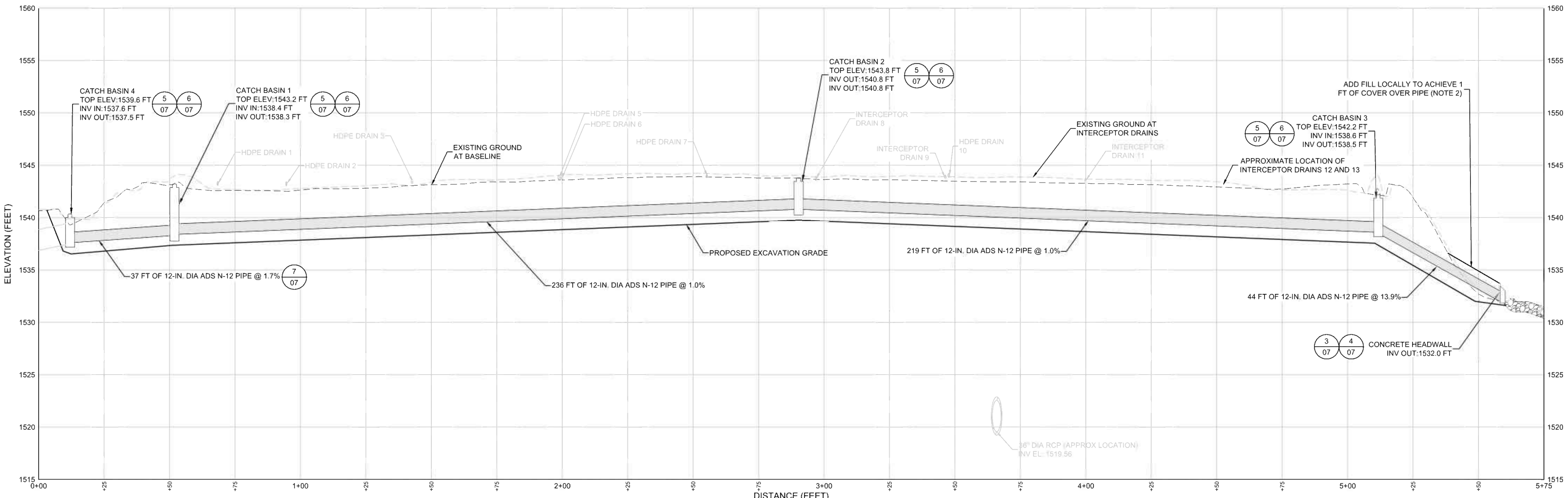
PROJECT: LAKE PETIT DAM - BIG CANOE

SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE: APRIL 2023
PROJECT NO.: TN9418
FILE: TN9418.05-C04
SHEET NO.: 04 OF 08



1 / 03 PROFILE
1544 BENCH BASELINE
SCALE: 1" = 20' (HORIZONTAL)
SCALE: 1" = 5' (VERTICAL)

NOTES:

1. FOR GENERAL NOTES SEE SHEET 02.
2. PLACE FILL AND COMPACT LOCALLY OVER SECTION OF PIPE JUST ABOVE HEADWALL WHERE PORTION OF PIPE IS PROPOSED ABOVE GROUND. PLACE RIPRAP ALONG SLOPE AND DOWNSTREAM OF HEADWALL AS SHOWN FOR EROSION PROTECTION. FILL MAY BE SOIL EXCAVATED FROM THE TRENCH ON THE 1544 BENCH (BENCH NO. 1), PROVIDED IT IS MOISTURE CONDITIONED TO BE FREE OF EXCESS WATER AND ABLE TO BE COMPACTED.

SCALE IN FEET (HORIZONTAL): 0, 20', 40'
SCALE IN FEET (VERTICAL): 0, 10', 20'

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GEORGIA REGISTERED PROFESSIONAL ENGINEER VERNON JAMES DOTSON, JR.

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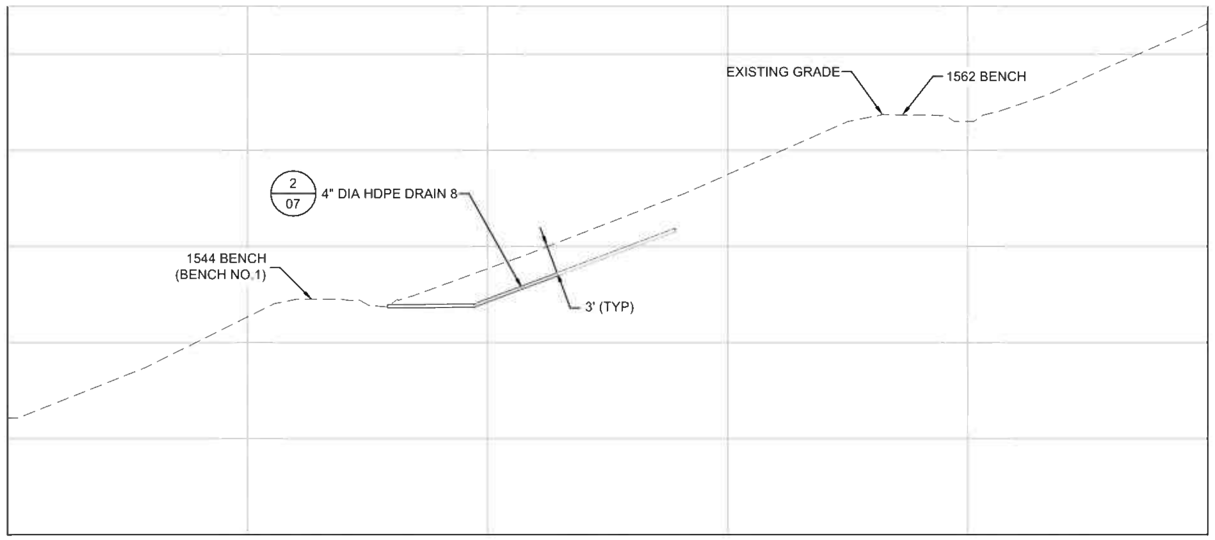
DRAWN BY:	J.X.C.
CHECKED BY:	W.M.M.
REVIEWED BY:	C.H.G.
APPROVED BY:	V.J.D.

TITLE: PROFILE
PROJECT: LAKE PETIT DAM - BIG CANOE
SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE:	APRIL 2023
PROJECT NO.:	TN9418
FILE:	TN9418.05-C06
SHEET NO.:	05 OF 08



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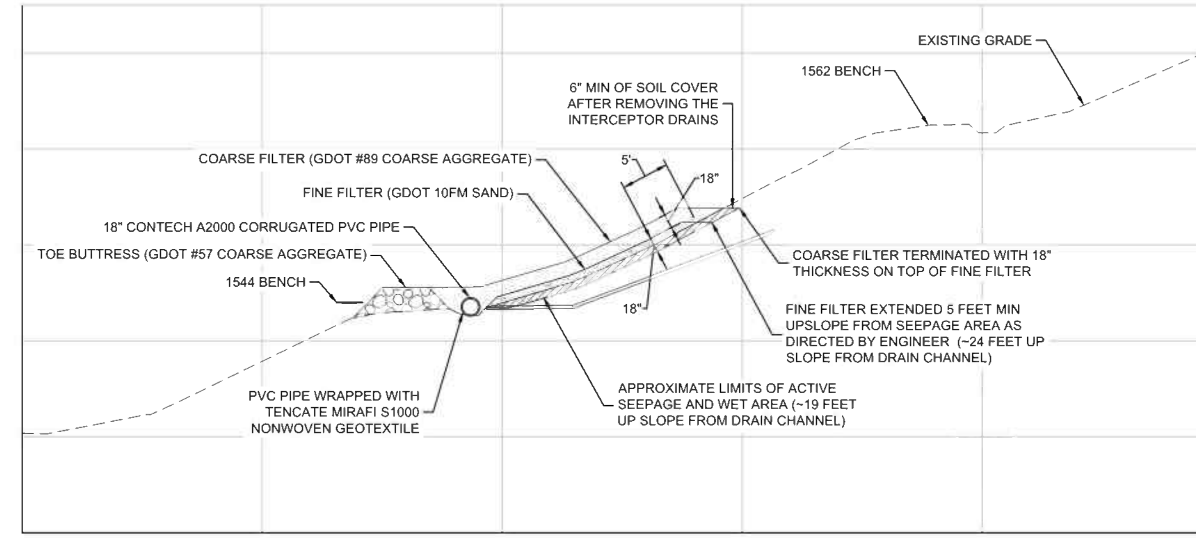

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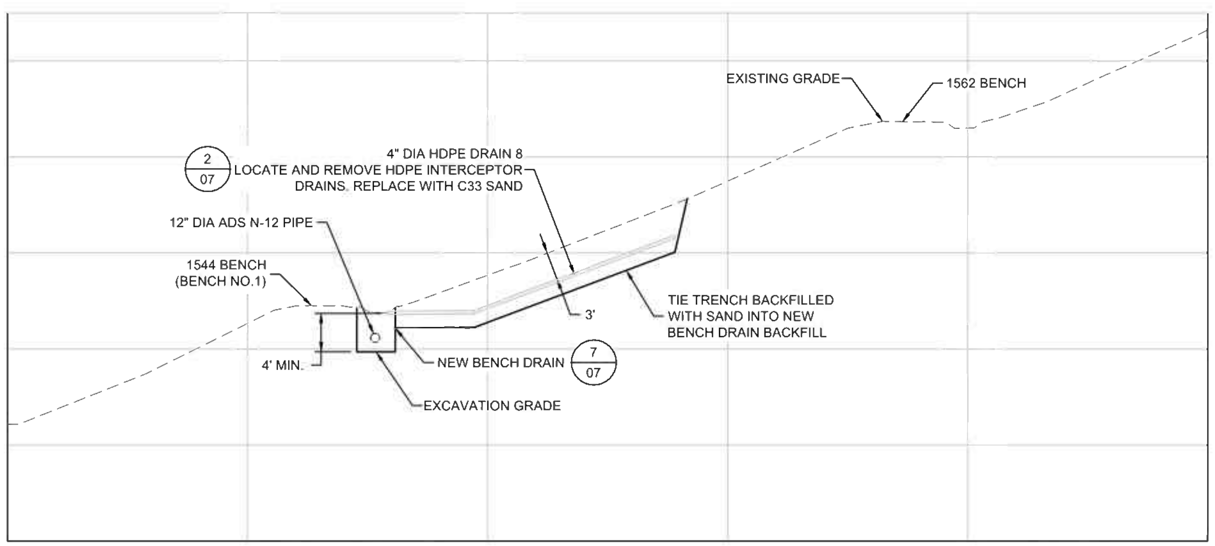

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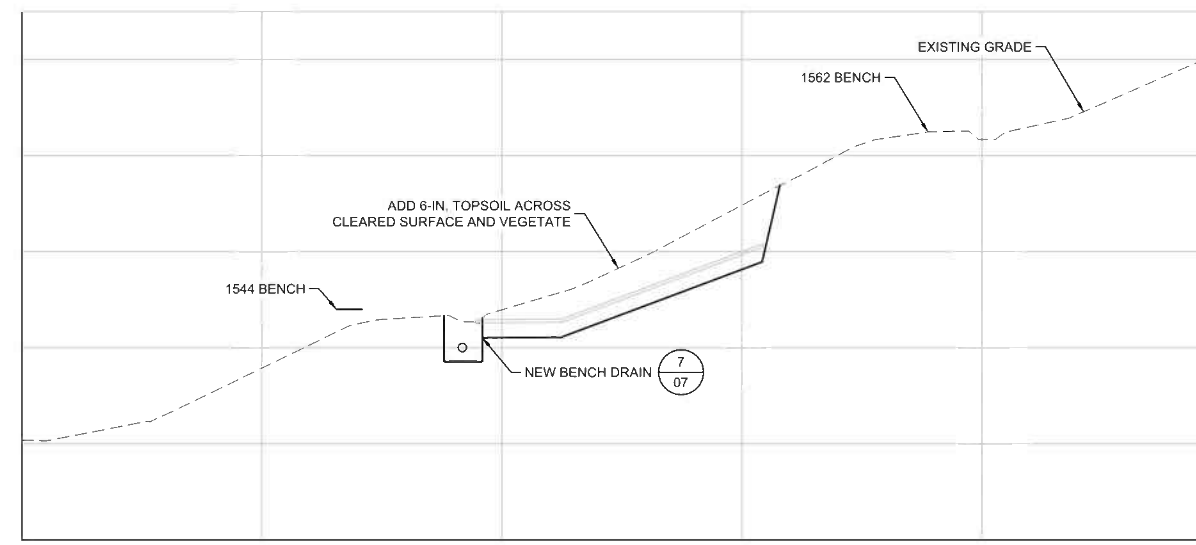

PROPOSED

NOTES:

1. FOR GENERAL NOTES SEE SHEET 02
2. PROFILE OF EXISTING 4" DIA. HDPE INTERCEPTOR DRAIN IS FOR REFERENCE ONLY AND MAY NOT REPRESENT FULL EXTENT AT THE SECTION SHOWN. EXCAVATION AND BACKFILL FOR THE DRAIN SHOULD ONLY BE AT THE LOCATION OF THE PIPE AND FOR THE WIDTH OF THE AGGREGATE BACKFILL (ESTIMATED TO BE 1.5 FT WIDE). BOTTOM OF EXCAVATION SHALL BE GRADED TO POSITIVELY DRAIN INTO THE TRENCH OF THE NEW BENCH DRAIN.

A / 02 SECTION
TYPICAL SECTION
SCALE: 1" = 10' (HORIZONTAL)
SCALE: 1" = 10' (VERTICAL)

B / 02 SECTION
TYPICAL SECTION
SCALE: 1" = 10' (HORIZONTAL)
SCALE: 1" = 10' (VERTICAL)

0 20' 40'
SCALE IN FEET (HORIZONTAL)

0 10' 20'
SCALE IN FEET (VERTICAL)

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REV	DATE	DESCRIPTION	DRN	APP
0	4/28/2023	PERMIT DRAWINGS	J.X.C.	V.J.D.

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DESIGN BY:	E.O.A.
DRAWN BY:	J.X.C.
CHECKED BY:	W.M.M.
REVIEWED BY:	C.H.G.
APPROVED BY:	V.J.D.

TITLE: TYPICAL SECTIONS

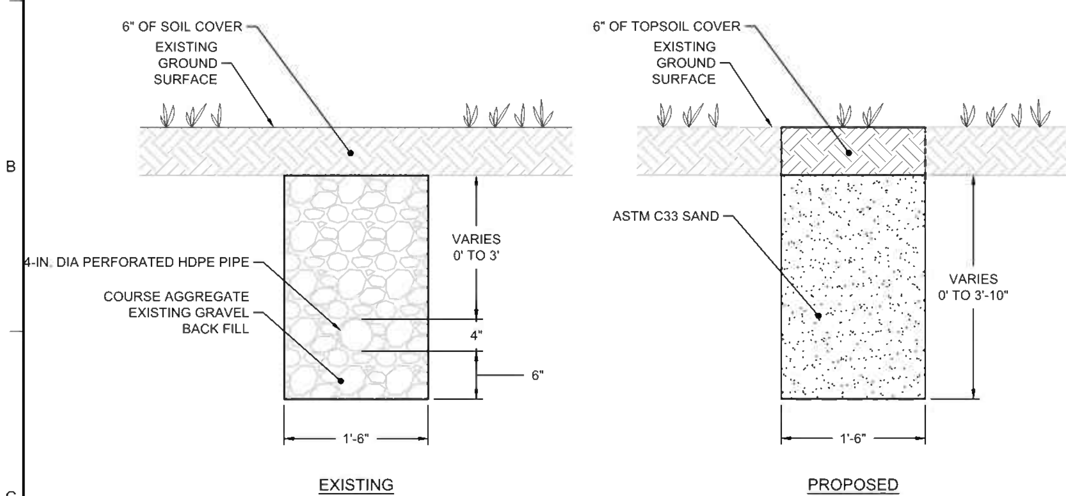
PROJECT: LAKE PETIT DAM - BIG CANOE

SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

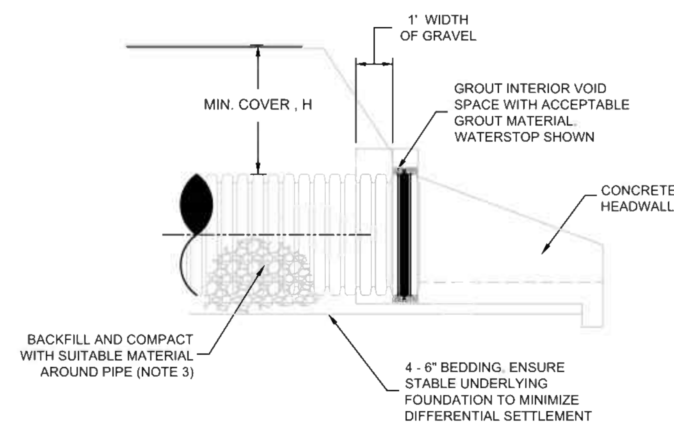
Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE:	APRIL 2023
PROJECT NO.:	TN9418
FILE:	TN9418.05-C07
SHEET NO.:	06 OF 08

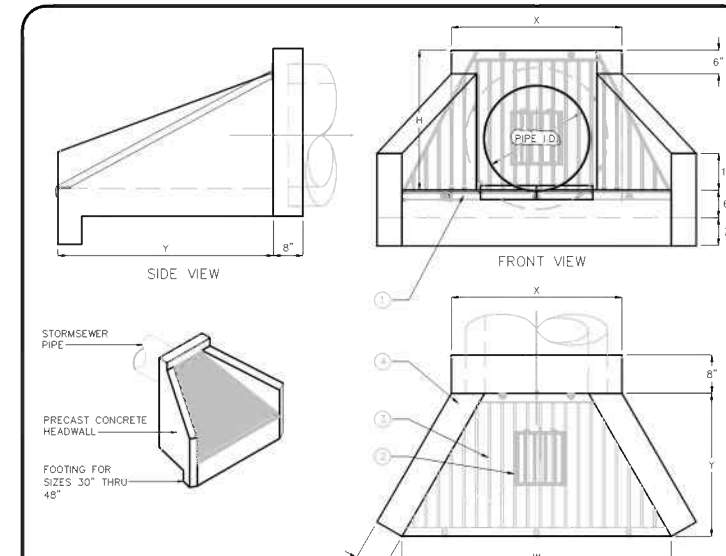


2 / 03 DETAIL
REMOVAL OF EXISTING INTERCEPTOR DRAINS
SCALE: NTS



NOTES:
1. INSERT PIPE INTO HEADWALL, WITH PIPE RESTING ON BEDDING. THE PIPE SHOULD BE IN THE APPROXIMATE CENTER OF THE OPENING.
2. GROUT PIPE INTO CONCRETE STRUCTURE WITH NON-SHRINK GROUT. SOLID MASONRY UNITS, FULLY GROUTED IN PLACE, MAY BE USED TO HELP FILL LARGE VOIDS. SEE STANDARD DETAILS STD-203 AND 206A FOR ADDITIONAL INFORMATION ON THE APPLICATION OF WATERSTOP.
3. PIPE AT AND AROUND STRUCTURE CONNECTION TO BE INSTALLED PER ASTM D2321, LATEST EDITION. SEE STANDARD DETAIL 100 SERIES FOR PIPE INSTALLATION DETAILS AND TECHNICAL NOTE: 5.04 CONNECTIONS TO MANHOLES AND STRUCTURES FOR ADDITIONAL INFORMATION.
4. MINIMUM COVER: MINIMUM COVER, H, IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" (300mm) FROM THE TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOTATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER, H, IS 12" (300mm) UP TO 48" (1200mm) DIAMETER PIPE AND 24" (600mm) OF COVER FOR 60" (1500mm) DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT.

3 / 04 DETAIL
HDPE-PP HEADWALL CONNECTION INSTALLATION
SCALE: NTS
SOURCE: ADVANCED DRAINAGE SYSTEMS, INC. STD-113



(Rows DSA-15 through DSA-48 crossed out on the drawing.)

MODEL	PIPE DIA	H	W	X	Y	Z	WEIGHT (LBS)
		DIMENSIONS					
DSA-12	12"	2'-6"	4'-3"	3'-0"	2'-0"	–	2,700
DSA-15	15"	2'-6"	4'-3"	3'-0"	2'-0"	–	2,700
DSA-18	18"	2'-6"	4'-3"	3'-0"	2'-0"	–	2,600
DSA-21	21"	3'-0"	5'-10"	3'-2"	3'-0"	–	4,300
DSA-24	24"	3'-0"	5'-10"	3'-2"	3'-0"	–	4,200
DSA-30	30"	3'-6'	7'-6"	4'-1"	4'-0"	9"	6,200
DSA-36	36"	4'-1"	9'-3"	4'-8"	5'-0"	9"	8,100
DSA-42	42"	4'-11"	12'-6"	5'-10"	6'-0"	12"	11,000
DSA-48	48"	4'-11"	12'-6"	5'-10"	6'-0"	12"	11,000

KEYED NOTES		
MARK	QTY	DESCRIPTION
1	1	1-1/2" X 1/4" GALVANIZED ANGLE BOLTED TO CONCRETE WITH 1/2" ANCHOR BOLTS
2	1	12"x12" HINGED CLEAN OUT GRATE
3	1	GALVANIZED STEEL DEBRIS GRATE, 1-1/2" X 3/16" BARS @ 2" O.C. 1" CLEAR OPENING
4	1	DRAINAGE EXIT STRUCTURE MFG: PARK USA 888-611-PARK WWW.PARKUSA.COM MODEL: DSA-1 DATE MANUFACTURED:

SPECIFICATIONS

CONCRETE : Class I/II concrete with of design strength of 4500 PSI at 28 days. Unit is of monolithic construction including walls and floor.

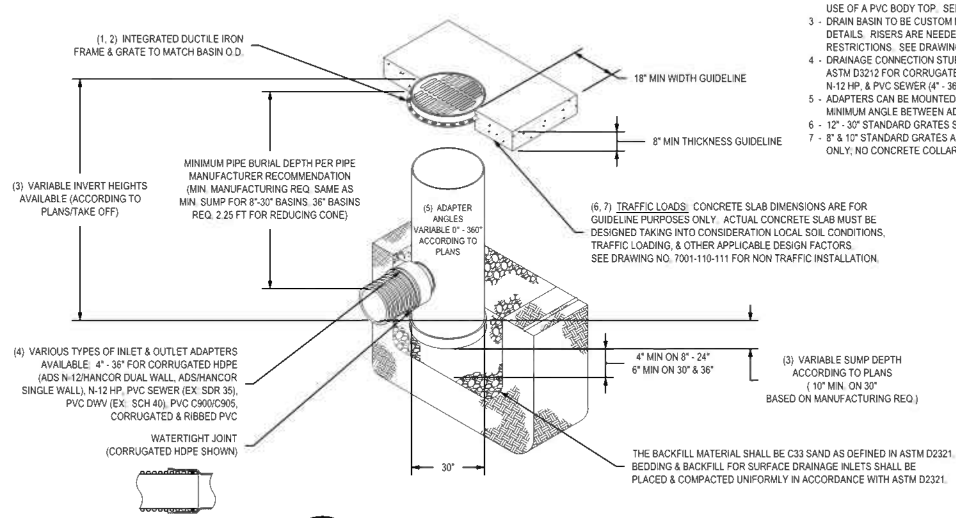
REINFORCEMENT: Grade 60 reinforced. No. 4 steel rebar to conform to ASTM A615 on required centers or equal. Bar bending and placement shall with the latest ACI standards.

GRATING: All steel fabrication shall be in accordance to AWA D1.1. Steel shall be ASTM A36 carbon steel, and hot-dipped galvanized after fabrication in accordance to ASTM A123

PARK
www.parkusa.com 888-611-PARK
DRAINAGE EXIT STRUCTURE
MODEL DSA 12" THRU 48"
01/2019 TN9418.05-C08

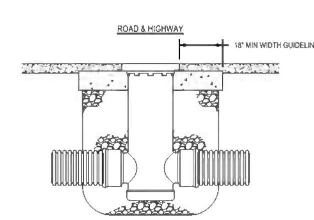
4 / 04 DETAIL
CONCRETE HEADWALL
SCALE: NTS
SOURCE: PARK USA

NYLOPLAST DRAIN BASIN WITH STANDARD GRATE



1 - 8" - 30" STANDARD GRATES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
2 - 12" - 30" FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05. 8" & 10" STANDARD GRATES FIT DIRECTLY ONTO DRAIN BASINS WITH THE USE OF A PVC BODY TOP. SEE DRAWING NO. 7001-110-045.
3 - DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065.
4 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER (4" - 36").
5 - ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.
6 - 12" - 30" STANDARD GRATES SHALL MEET H-20 LOAD RATING.
7 - 8" & 10" STANDARD GRATES ARE RATED FOR LIGHT DUTY APPLICATIONS ONLY; NO CONCRETE COLLAR NEEDED FOR LIGHT DUTY RATING.

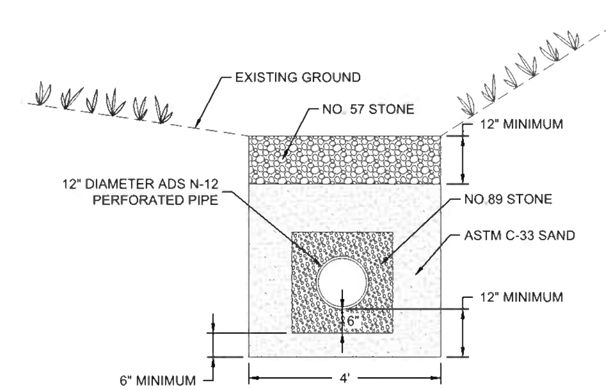
5 / 05 DETAIL
NYLOPLAST DRAIN BASIN
SCALE: NTS
SOURCE: ADS NYLOPLAST



STRUCTURE SIZE	H-20 GRATE OPTIONS				
30"	PEDESTRIAN	STANDARD	SOLID	2X2 R&H	2X3 R&H

1 - THE BACKFILL MATERIAL SHALL BE C33 SAND & BACKFILL FOR SURFACE DRAINAGE INLETS SHALL BE PLACED & COMPACTED UNIFORMLY IN ACCORDANCE WITH ASTM D2321.
2 - TRAFFIC LOADS: CONCRETE SLAB DIMENSIONS ARE FOR GUIDELINE PURPOSES ONLY. ACTUAL CONCRETE SLAB MUST BE DESIGNED TAKING INTO CONSIDERATION LOCAL SOIL CONDITIONS, TRAFFIC LOADING, & OTHER APPLICABLE DESIGN FACTORS.
3 - 36" DRAIN BASIN REQUIRES 36"X30" REDUCING CONE. REDUCING CONE REQUIRES MINIMUM 2.25FT FROM GRADE TO TOP OF PIPE.

6 / 05 DETAIL
DRAIN BASIN - INLINE DRAIN
SCALE: NTS
SOURCE: ADS NYLOPLAST



7 / 04 DETAIL
NEW BENCH DRAIN
SCALE: NTS

FOR REVIEW PURPOSES ONLY
PERMIT DRAWING - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
0	4/28/2023	PERMIT DRAWINGS	J.X.C.	V.J.D.

DESIGN BY:	E.O.A.
DRAWN BY:	J.X.C.
CHECKED BY:	W.M.M.
REVIEWED BY:	C.H.G.
APPROVED BY:	V.J.D.

TITLE: DETAILS
PROJECT: LAKE PETIT DAM - BIG CANOE
SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE:	APRIL 2023
PROJECT NO.:	TN9418
FILE:	TN9418.05-C08
SHEET NO.:	07 OF 08

PROJECT SPECIFICATIONS - SITE PREPARATION

CLEARING AND GRUBBING

1. LIMITS FOR CLEARING AND/OR GRUBBING SHALL BE AS DEFINED ON THE DRAWINGS. CLEARING AND GRUBBING SHALL ONLY BE PERFORMED TO THE EXTENT NECESSARY TO COMPLETE THE WORK.
2. CLEARING SHALL CONSIST OF REMOVAL AND DISPOSAL OF BRUSH, DOWNED TIMBER, LOGS, STANDING TREES AND SNAGS, OTHER GROWTH AND ANY ITEMS THAT WOULD INTERFERE WITH CONSTRUCTION OPERATIONS. MATERIAL DISPOSAL SHALL BE OFFSITE, IN ACCORDANCE WITH LOCAL REGULATIONS.
3. GRUBBING SHALL CONSIST OF REMOVAL AND DISPOSAL OF STUMPS, BURIED LOGS, ROOTS GREATER THAN 1-IN. DIAMETER, AND ANY OTHER ORGANIC MATERIAL BELOW THE GROUND SURFACE. ALL CLEARED AREAS WILL BE GRUBBED UNLESS OTHERWISE NOTED. MATERIAL DISPOSAL SHALL BE OFFSITE, IN ACCORDANCE WITH LOCAL REGULATIONS.
4. ALERT THE ENGINEER IF CLEARING AND GRUBBING REQUIRES REMOVAL OF TREES LARGER THAN 8-IN. IN DIAMETER.

TOPSOIL

1. ALL TOPSOIL AND SURFACE SOILS CONTAINING ORGANIC MATERIAL SHALL BE REMOVED FROM AREAS TO BE GRUBBED. TOPSOIL SHALL BE STOCKPILED FOR FUTURE USE IN APPROVED LOCATIONS UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
2. TOPSOIL SHALL NOT BE USED AS, OR MIXED WITH, FILL MATERIAL IN THE CONSTRUCTION OF EARTH EMBANKMENTS.
3. TOPSOIL MATERIAL USED AS A SURFACE DRESSING SHALL BE REASONABLY FREE OF CINDERS, DEBRIS, AND STONES. UNSUITABLE AND EXCESS TOPSOIL MATERIAL SHALL BE DISPOSED OFFSITE.

EARTHWORK

SITE PREPARATION:

1. IF EARTHWORK OPERATIONS ARE PERFORMED DURING WET SEASONS, CONTRACTOR SHALL AVOID OPERATING EQUIPMENT ON SATURATED SOILS. ANY WET SUBGRADE AREAS WHICH RECEIVE COMPACTED FILL SHALL BE DRAINED AND ALLOWED TO DRY PRIOR TO FILL PLACEMENT.
2. TEMPORARY STORAGE OF EXCAVATED MATERIALS OR EQUIPMENT IS NOT ALLOWED ON THE FACE OR BENCHES OF THE DAM.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR MANAGEMENT OF SEEPAGE AND STORMWATER DURING CONSTRUCTION. WATER SHALL NOT BE ALLOWED TO POOL IN EXCAVATIONS.

EXCAVATION:

1. EXCAVATION SHALL BE ACCOMPLISHED BY CUTTING ACCURATELY TO THE CROSS SECTIONS, GRADES, AND ELEVATIONS SHOWN ON THE DRAWINGS.
2. SOFT, UNSTABLE, OR OTHERWISE UNSATISFACTORY MATERIALS ENCOUNTERED BELOW THE REQUIRED GRADES SHALL BE REMOVED AS DIRECTED AND REPLACED WITH APPROVED, PROPERLY COMPACTED MATERIAL.
3. COMMON EXCAVATION SHALL INCLUDE ALL MATERIAL WHICH CAN BE REMOVED BY COMMON EARTH EXCAVATION EQUIPMENT.
4. EXCAVATION SHOULD RESULT IN A BOTTOM OF TRENCH THAT IS GRADED TO POSITIVELY DRAIN PRIOR TO BEING BACKFILLED.
5. CONTRACTOR IS RESPONSIBLE FOR SAFETY RELATED TO SHORING OF TEMPORARY EXCAVATIONS AND PREVENTING MOVEMENT OF EMBANKMENT MATERIAL DUE TO COLLAPSE. A TIGHT-FITTING TRENCH BOX IS RECOMMENDED.
6. HEAVY EQUIPMENT LOADING ON THE BENCH SHOULD BE LIMITED TO PRESSURES LESS THAN 7 PSI ACROSS THE WIDTH OF THE BENCH. HEAVY EQUIPMENT SHOULD NOT BE LEFT ON THE BENCH OVERNIGHT.

COMPACTED FILL:

1. COMPACTED FILL SHALL CONSIST OF THE PLACEMENT AND VIBRATORY COMPACTION OF FILL MATERIAL ABOVE THE NATURAL GROUND OR OTHER SURFACE IN CONFORMANCE WITH THE DRAWINGS.
2. CONTRACTOR SHALL SUBMIT SUPPLIER'S CERTIFICATION AND GRAIN SIZE DISTRIBUTION OF A REPRESENTATIVE SAMPLE OF COMPACTED FILL PRIOR TO INSTALLATION.
3. SAMPLING AND ACCEPTANCE FOR COMPACTED SOIL: PRIOR TO CONSTRUCTION A MINIMUM OF ONE BULK SAMPLE SHALL BE TAKEN FROM THE ONSITE STOCKPILE FOR CONFORMANCE TESTING AND TO ESTABLISH COMPACTION STANDARDS. THE SAMPLE SHALL BE TESTED FOR PARTICLE SIZE (ASTM D-422 AND ASTM D-1140), ATTERBERG LIMITS (ASTM D-4318), MAXIMUM DRY DENSITY (ASTM D-698). THE PORTION OF THE COMPACTED FILL MATERIAL PASSING THE NO. 40 SIEVE SHALL HAVE A PLASTICITY INDEX OF ZERO.

   TESTING SHALL BE PERFORMED BY A QUALIFIED, INDEPENDENT COMMERCIAL TESTING LABORATORY. TEST RESULTS SHALL BE SUBMITTED TO THE ENGINEER WITHIN 48 HOURS OF COMPLETION OF TESTING.
4. FILL MATERIAL SHALL BE PLACED IN HORIZONTAL LIFTS NO GREATER THAN 6-IN. IN THICKNESS. EACH SUCCESSIVE LIFT WILL BE PLACED ON FIRM APPROVED SUBGRADE OR COMPACTED FILL. WHERE PREVIOUS LIFTS ARE FOUND TO BE UNACCEPTABLE, THE AREA WILL BE SCARIFIED, AERATED OR MOISTENED, RECOMPACTED OR REMOVED, AND REPLACED AS REQUIRED. COMPACT EACH LIFT TO A FIRM AND UNYIELDING CONDITION AS VERIFIED BY THE ENGINEER.
5. PREVENT CONTAMINATION OF THE FILL MATERIAL FROM: (I) RUNOFF CONTAINING SEDIMENT; (II) CONSTRUCTION TRAFFIC; (III) EROSION DUE TO STORMWATER RUNOFF OR PUMPING; AND (IV) MIXING WITH FINE-GRAINED MATERIALS.
6. PREVENT SEGREGATION OF PARTICLES DURING HANDLING AND PLACEMENT.

DRAINAGE:

1. THE FILL SURFACE SHALL BE ADEQUATELY MAINTAINED DURING CONSTRUCTION. THE SURFACE SHALL BE SLOPED TO ACHIEVE SUFFICIENT DRAINAGE, AND TO PREVENT WATER FROM PONDING ON THE FILL. IF PRECIPITATION IS EXPECTED WHILE FILL CONSTRUCTION IS TEMPORARILY HALTED, THE SURFACE SHALL BE ROLLED OR COVERED TO IMPROVE SURFACE RUNOFF.
2. WET OR FROZEN MATERIAL SHALL BE REMOVED.

   PLACEMENT OF FROZEN MATERIALS SHALL NOT BE ALLOWED.

BENCH DRAIN

1. COORDINATE INSTALLATION OF DRAIN AND OTHER OPERATIONS ON THE PROJECT IN A MANNER THAT WILL PREVENT DAMAGE TO COMPLETED WORK AND PREVENT CONTAMINATION OF DRAIN MATERIALS.
2. MAINTAIN POSITIVE DRAINAGE DURING AND FOLLOWING EXCAVATION OF TRENCH. EXCAVATE TO THE LINES AND GRADES SHOWN ON THE PLANS. THE BOTTOM OF THE TRENCH EXCAVATION SHOULD BE AT A CONTINUOUS, POSITIVELY DRAINING SLOPE.
3. PERFORATED PIPE SHALL BE ADS DUAL-WALL PERFORATED HDPE PIPES (N-12) OR APPROVED EQUIVALENT.
4. PIPES SHALL UTILIZE AASHTO CLASS II PERFORATIONS AS SPECIFIED IN ADS TECHNICAL NOTE TN 1.01.
5. CONTRACTOR SHALL CONFORM TO MANUFACTURER'S INSTALLATION GUIDELINES FOR DRAIN BASIN, PIPE, AND FITTINGS.
6. AFTER PIPE INSTALLATION, PLACE DRAINAGE AGGREGATES IN 6-IN. LAYERS. COMPACT EACH LAYER THOROUGHLY UNTIL FIRM AND STABLE UNTIL REACHING THE TOTAL PLAN DEPTH, WHILE NOT DISTURBING THE PIPE ALIGNMENT. ENSURE ADEQUATE COMPACTION OF DRAINAGE MATERIALS UNDER HAUNCHES OF DRAIN PIPE.
7. PROTECT ALL MATERIALS FROM CONTAMINATION BY FOREIGN MATTER. IN THE EVENT THAT THE DRAINAGE AGGREGATES BECOME CONTAMINATED, REMOVE THE CONTAMINATED PORTION AND REPLACE WITH CLEAN MATERIAL AT NO ADDITIONAL COST TO OWNER.
8. CONTRACTOR IS ENCOURAGED TO USE PLACEMENT TEMPLATES OR OTHER DEVICES TO ASSIST WITH INSTALLING THE GRADED SAND AND AGGREGATE MATERIALS AROUND THE PIPE TO THE SPECIFIED DIMENSIONS.

CATCH BASIN (DRAIN BASIN)

1. CONTRACTOR SHALL FURNISH AND INSTALL MANHOLE, RISER, FRAME, AND COVER AS SHOWN ON DRAWINGS. CATCH BASIN SHALL BE NYLOPLAST DRAIN BASIN WITH A 30-IN. DUCTILE IRON DRAIN GRATE OR APPROVED EQUIVALENT.
2. DRAIN BASINS SHALL BE PROVIDED WITH GASKETS COMPATIBLE FOR DUAL WALL PIPE.
3. CATCH BASIN 4 SHALL HAVE BE COMPATIBLE WITH EXISTING 24 IN. CORRUGATED METAL PIPE ON THE DOWNSTREAM END OF SYSTEM.
4. PRIOR TO DELIVERY TO SITE, CONTRACTOR SHALL SUBMIT MANUFACTURER SHOP DRAWINGS FOR EACH COMPONENT OF THE SYSTEM FOR ENGINEER APPROVAL.

HEADWALL

1. CONTRACTOR SHALL FURNISH AND INSTALL PRECAST HEADWALL AS SHOWN ON DRAWINGS. HEADWALL SHALL BE REINFORCED CONCRETE PARK DRAINAGE EXIT STRUCTURE, OR ENGINEER-APPROVED EQUIVALENT.
2. HEADWALL SHALL HAVE BARS OR OTHER MEANS TO PREVENT ACCESS INTO THE PIPE WHILE PROVIDING FOR FLOW TO PASS AND MAINTAIN THE ABILITY TO ACCESS TEMPORARILY FOR CLEANING, INSPECTION, ETC.
3. PRIOR TO INSTALLATION, CONTRACTOR SHALL SUBMIT MANUFACTURER SHOP DRAWINGS FOR EACH COMPONENT OF THE SYSTEM FOR ENGINEER APPROVAL.
4. THE WORK SHALL INCLUDE FURNISHING AND INSTALLING CEMENT MORTAR TO CREATE A BOTTOM THAT IS FLUSH WITH ALL INLET AND OUTLET INVERTS AND THE FACE OF THE HEADWALL.
5. ALL OPENINGS SHALL BE SEALED WITH NON-SHRINK GROUT AND WATERSTOPS TO FORM WATERTIGHT SEAL.

DRAINAGE AGGREGATE

1. SAND SHALL MEET THE REQUIREMENTS OF GDOT 801 AND MEET THE GRADATION OF ASTM C-33.
2. NO. 89 STONE SHALL MEET THE REQUIREMENTS OF GDOT 800 FOR COARSE AGGREGATE SIZE NO. 89.
3. NO. 57 STONE SHALL MEET THE REQUIREMENTS OF GDOT 800 FOR COARSE AGGREGATE SIZE NO.57.
4. CONTRACTOR SHALL SUBMIT SAMPLE OF EACH DRAINAGE AGGREGATE MATERIAL AND SUPPLIER'S CERTIFICATION OF DRAINAGE AGGREGATE CONFORMANCE FOR ENGINEER APPROVAL PRIOR TO INSTALLATION.

VEGETATION

1. CONTRACTOR SHALL REVEGETATE DISTURBED AREAS AS SHOWN ON THE DRAWINGS DEPENDING ON THE SEASON WITH SUGGESTIONS AS FOLLOWS: SUMMER - BERMUDA GRASS; SPRING AND FALL - 30% KENTUCKY BLUEGRASS, 60% KENTUCKY 31 FESCUE, AND 10% PERENNIAL RYEGRASS; WINTER - TALL FESCUE.
2. PRIOR TO PURCHASE AND INSTALLATION, CONTRACTOR SHALL SUBMIT PROPOSED PRODUCT FOR OWNER APPROVAL, ALONG WITH PRODUCT EXPIRATION DATE AND WRITTEN INSTRUCTIONS TO ENSURE PROPER MAINTENANCE OF RESTORED VEGETATION.

RIPRAP

1. RIPRAP SHALL BE HARD, DURABLE, ANGULAR IN SHAPE, RESISTANT TO WEATHERING, AND MAY BE NATURALLY OCCURRING PARTICLES OR FRAGMENTS OF NATURAL STONE. CONTROL OF GRADATION SHALL BE BY VISIBLE INSPECTION. ROUNDED STONES, BOULDERS, SANDSTONE, OR SIMILAR SOFT STONE OR RELATIVELY THIN OR ELONGATED SLABS WILL NOT BE ACCEPTABLE.
2. CONCRETE RUBBLE, MASONRY, SHALE, OR OTHER MATERIALS SHALL NOT BE USED FOR RIPRAP.
3. GRADATION REQUIREMENTS FOR RIPRAP SHALL BE GDOT TYPE 3 AS SHOWN ON THE FOLLOWING TABLE:

SIZE BY VOLUME	APPROX. WEIGHT (LBS)	PERCENT SMALLER THAN
1.0 CUBIC FEET	165	100%
0.1 CUBIC FEET	15	10% - 65%

4. NEITHER THE BREADTH NOR THICKNESS OF A SINGLE ROCK SHALL BE LESS THAN 1/3 OF ITS LENGTH. ROUNDED STONE SHALL BE AVOIDED.
5. CONTRACTOR SHALL PREPARE AREAS TO RECEIVE RIPRAP. IF UNSUITABLE MATERIALS ARE ENCOUNTERED, THEY SHALL BE REMOVED AND REPLACED. AFTER AN ACCEPTABLE SUBGRADE FOR GRANULAR BEDDING MATERIAL IS ESTABLISHED, BEDDING MATERIAL SHALL BE IMMEDIATELY PLACED AND LEVELED TO THE SUBGRADE ELEVATION. IMMEDIATELY FOLLOWING THIS, THE RIPRAP SHALL BE PLACED. IF BEDDING MATERIAL IS DISTURBED FOR ANY REASON, IT SHALL BE REPLACED AND GRADED. IN-PLACE BEDDING MATERIALS SHALL NOT BE CONTAMINATED WITH SOILS, DEBRIS, OR VEGETATION BEFORE THE RIPRAP IS PLACED.
6. AGGREGATE BEDDING/BASE SHALL BE PLACED AND GRADED TO OBTAIN A CONTINUOUS UNINTERRUPTED BASE OF THE REQUIRED THICKNESS.
7. FOLLOWING ACCEPTABLE PLACEMENT OF AGGREGATE BEDDING/BASE, RIPRAP PLACEMENT SHALL IMMEDIATELY COMMENCE.
8. RIPRAP SHALL BE PLACED AND GRADED IN A MANNER TO ENSURE THAT THE LARGER ROCK FRAGMENTS ARE UNIFORMLY DISTRIBUTED AND THAT THE SMALLER ROCK FRAGMENTS SERVE TO FILL THE SPACES BETWEEN THE LARGER ROCK FRAGMENTS IN A MANNER THAT WILL RESULT IN A COMPACT MASS OF STONE OF THE SPECIFIED THICKNESS. HAND PLACING MAY BE REQUIRED TO PROVIDE THE RESULTS SPECIFIED ABOVE.
9. RIPRAP SHALL HAVE A MINIMUM THICKNESS AS INDICATED ON THE CONSTRUCTION DRAWINGS WITH INDIVIDUAL PIECES AT THE SURFACE HAVING A MAXIMUM DEVIATION OF HALF THE DIAMETER OF THE LARGEST PARTICLE SIZE.
10. PLACING OF RIPRAP IN LAYERS OR BY DUMPING INTO CHUTES OR BY SIMILAR METHODS RESULTING IN SEGREGATION WILL NOT BE PERMITTED.
11. CONTRACTOR SHALL SUBMIT SUPPLIER'S CERTIFICATION OF RIPRAP CONFORMANCE FOR ENGINEER APPROVAL PRIOR TO INSTALLATION.

AGGREGATE BEDDING/BASE

1. AGGREGATE BEDDING/BASE FOR RIPRAP CHANNEL LINING SHALL COMPLY WITH GDOT STANDARD SPECIFICATION SECTION 800.1 FOR NO. 89 AND NO. 57, AS REQUIRED ON THE PLANS.
2. CONTRACTOR SHALL SUBMIT SUPPLIER'S CERTIFICATION OF AGGREGATE BEDDING/BASE CONFORMANCE FOR ENGINEER APPROVAL PRIOR TO INSTALLATION.

FOR REVIEW PURPOSES ONLY
PERMIT DRAWING - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
0	4/28/2023	PERMIT DRAWINGS	J.X.C.	V.J.D.

GEORGIA REGISTERED PROFESSIONAL ENGINEER No. PE028302 VERNON JAMES DOTSON, JR. 4/28/23

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DESIGN BY:	E.O.A.
DRAWN BY:	J.X.C.
CHECKED BY:	W.M.M.
REVIEWED BY:	C.H.G.
APPROVED BY:	V.J.D.

TITLE: NOTES AND SPECIFICATIONS

PROJECT: LAKE PETIT DAM - BIG CANOE

SITE: SEEPAGE COLLECTION SYSTEM MODIFICATIONS

Big Canoe POA

Geosyntec consultants
835 GEORGIA AVENUE, SUITE 500
CHATTANOOGA, TN 37402

DATE:	APRIL 2023
PROJECT NO.:	TN9418
FILE:	TN9418.05-C09
SHEET NO.:	08 OF 08

C:_GEOPW\DS01\DMS14752\TN9418.05-C09
PW:\CLIENTS\BIG CANOE\TN9244 - LAKE PETIT DAM ANALYSIS\05 - GEOTECH STABILITY ANALYSIS AND PIPE DESIGN (TN94)