



Memorandum

*To: Paul Holzen, PE
David Hodnett, PE*

*From: Dave Mason, PE
Zack Daniel, PE*

Date: March 26, 2018

*Subject: Scope of Work for Robinson Lake Dam – Supplemental Geotechnical Investigation
Franklin, Tennessee*

The purpose of this memorandum is to provide a scope of work and cost proposal for performing a supplemental geotechnical investigation for the Robinson Lake Dam rehabilitation measures in Franklin, Tennessee. The purpose of this work is to evaluate if dredging and deepening of the lake is feasible to allow for recreational water activities such as boating without adversely impacting the proposed dam and lake rehabilitation summarized in the *Conceptual Engineering Report, Robinson Lake Dam* (CER) dated December 8, 2017 prepared by CDM Smith Inc. (CDM Smith). In addition, the work includes a geotechnical investigation that will provide geotechnical data required for the rehabilitation design.

The geotechnical investigation is proposed to include a geophysical investigation program, a sediment sounding investigation, a geotechnical investigation consisting of land and over-water borings, a geotechnical laboratory testing program, and a technical memorandum summarizing the investigation programs and recommendations regarding the feasibility of dredging and deepening the lake. Should dredging and deepening be considered feasible, CDM Smith will submit a separate scope of work and cost proposal for the detailed rehabilitation design effort.

Background

The existing Robinson Lake Dam is an earth embankment dam with a concrete spillway in the right abutment discharging to the Harpeth River. The dam has a structural height of 22.5 feet and hydraulic height of 19 feet, with a storage capacity of 91 acre-feet at normal pool and 136 acre-feet at maximum pool.

CDM Smith was recently engaged by the City of Franklin to perform a conceptual engineering design study of Robinson Lake Dam prior to the City acquiring the property on which the dam and lake are located. The purpose of the assessment was to identify potential dam safety deficiencies and provide recommendations for a rehabilitation alternative and an Opinion of Probable Construction Costs (OPCC) as discussed in the Conceptual Engineering Report (CER). Following the

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submittal of the CER, the City purchased the property from the landowner. The City has requested that CDM Smith perform additional subsurface investigations to evaluate if it is feasible to dredge and deepen the lake to permit for recreational water activities such as boating and provide additional recommendations as to whether dredging of the lake will adversely affect the dam rehabilitation.

Scope of Services

Task 1.0 Project Kickoff Meeting

CDM Smith will conduct a project kickoff meeting within one week from receipt of a written authorization from the City. This meeting will ensure that all parties understand the scope, schedule, budget, and individual responsibilities for project completion. City staff and the CDM Smith project manager will attend this project meeting at the City's office. CDM Smith geotechnical representative(s) will participate via conference call.

CDM Smith will prepare and distribute a summary of meeting minutes to document items discussed with the parties in attendance.

Task 2.0 Supplemental Geotechnical Investigation

Task 2.1 Geophysical Field Work

CDM Smith will engage a local geophysical firm, S&ME, Inc. (S&ME), to perform geophysical surveys over the dam embankment, in the downstream areas, and across the lake to investigate subsurface conditions and identify approximate sediment and overburden thicknesses, depth to bedrock, and potential karst features. The geophysical exploration will consist of land and over-water phases. The proposed test line locations are shown on **Figure 1**.

The geophysical land phase will focus on the dam embankment and downstream area using Frequency Domain Electromagnetics (FDEM), Electrical Resistivity Tomography (ERT), and Spontaneous Potential (SP) that are summarized below. The field data acquisition is anticipated to take up to two days. The proposed methods will evaluate potential areas of seepage along the dam and downstream areas, identify potential buried structures in the embankment, and provide the overburden thickness and top of limestone bedrock. FDEM will be performed over the entirety of the dam embankment and downstream areas in a grid pattern. FDEM is capable of covering a large area in a limited period of time and permits the ERT test lines and SP to focus on select areas that exhibit subsurface anomalies. The ERT will consist of up to two test lines run along the length of the dam crest and length of the downstream slope or toe of the dam. Subsequently, the SP would be performed in the general vicinity of the ERT lines and downstream area.

The geophysical over-water phase will focus on the lake itself using FDEM and ERT. The field data acquisition is anticipated to take up to five days. FDEM will be conducted in a grid pattern and used initially to map the areas of overburden to identify the top of bedrock and potential karst conditions. Based on the FDEM results, up to three ERT test lines will be conducted at select locations across the lake to identify potential karst features.

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CDM Smith's level of effort for this task includes time for arranging the geophysical program and field coordination with the geophysical subcontractor to confirm the appropriate data are collected.

Task 2.2 *Sediment Sounding Field Work*

CDM Smith will engage a local commercial diving firm, Mainstream Commercial Divers, Inc. (MCD), to perform sediment depth readings across the lake using a probe rod and plate. A plate will be attached to the probe rod to measure the depth to the top of the sediment, and the probe rod will be pushed to the approximate bottom of sediment. The readings will be taken on a grid spacing of 20 feet within 100 feet of the dam crest and on a grid spacing of 50 feet over the remainder of the lake. The readings will be taken from a small jon boat or by wading, and each reading will be surveyed using a GPS device.

CDM Smith's level of effort for this task includes time for arranging the sediment sounding program and field oversight for the first day of work to verify that appropriate methods are used. The CDM Smith representative will also collect up to three sediment samples for environmental analysis to be conducted in general accordance with United States Environmental Protection Agency (USEPA) analysis methods for sediment.

Task 2.3 *Geotechnical Investigation Program*

CDM Smith will engage a local geotechnical drilling firm, S&ME, to perform field explorations on the dam embankment, in the downstream and abutment areas and in the lake to investigate subsurface conditions and identify potential karst features. The geotechnical exploration will consist of up to twelve Standard Penetration Test (SPT) borings including the following:

- Ten land borings: two borings along the dam crest, two borings along the existing auxiliary spillway, four borings along the proposed emergency spillway and associated crest, one boring at the proposed outlet structure, and one boring near the right abutment
- Two over-water borings: one boring at the proposed inlet structure and one boring upstream of the proposed inlet structure.

The boring locations are shown on **Figure 2**.

The borings will include continuous sampling through the overburden, and NQ-size rock coring in ten of the twelve boreholes. It is assumed that packer testing will be conducted in up to five of the borings for evaluation of bedrock permeability.

CDM Smith's level of effort for this task includes field oversight by a qualified geotechnical engineer to direct the work, log the borings, and verify that appropriate methods are used. This oversight is typical for CDM Smith projects where dam safety investigations are performed.

Geotechnical laboratory tests will be performed on selected samples from the borings. The tests will include grain size tests, moisture content, Atterberg limits, triaxial tests, and laboratory mini-vane tests.

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Task 2.4 *Geotechnical Analyses*

CDM Smith will perform preliminary geotechnical design analyses for the proposed lake dredging to support the dam rehabilitation design. The analyses will include seepage evaluations to supplement the previously completed analyses.

Task 2.5 *Supplemental Geotechnical Investigation Technical Memorandum Deliverable*

CDM Smith will prepare a technical memorandum summarizing the geophysical, sediment soundings, subsurface exploration, and laboratory testing data collection. This memorandum will present CDM Smith's recommendations regarding whether dredging and deepening of the lake is feasible and will provide a recommendation as to whether the City should elect to continue with rehabilitation of the dam and lake.

Three hard copies and one digital copy of the draft technical memorandum will be provided to the City for review. Comments will be incorporated, and three hard copies and one digital copy of the Phase 1 final technical memorandum will be provided to the City.

Task 2.6 *Progress Meeting No. 1*

A progress meeting will be conducted near the end of Task 2.5 to present the findings for Task 2.0 and decide whether to proceed with the rehabilitation of the dam and lake. Prior to Progress Meeting No. 1, CDM Smith will provide the City the draft technical memorandum that will be finalized following the conclusion of the meeting. City staff and the CDM Smith project manager will attend this progress meeting that will be held at the City's office. CDM Smith geotechnical representative(s) will attend via conference call.

CDM Smith will prepare and distribute a summary of meeting minutes to document items discussed with all parties in attendance.

Final design, permitting, bidding, and construction services are not included in this scope of work.

General

Project management and administration costs associated with this scope of work are included within each task.

Schedule

CDM Smith will begin work on this project within one week from receipt of a written authorization from the City. Due to the time-sensitive nature of this work, this authorization may simply be an email from staff asking us to proceed. It is anticipated that the work will be completed within 120 calendar days of written authorization.

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Compensation

CDM Smith will perform Tasks 1.0 through 2.0, billed hourly, for a not-to-exceed upper limit of \$188,700, which includes CDM Smith labor, outside professionals (including 10% markup for administration), and other direct costs (see attached budget sheet). Invoices will be submitted to the City monthly based on hours completed and charges incurred within the billing period. A project status report will accompany each invoice. A table of billing rates and a summary of costs by task is provided below:

**City of Franklin, Tennessee
 Robinson Lake Dam Supplemental Geotechnical Investigation
 March 2018**

Task	Description	Task Hours	Labor Cost	Other Direct Costs and Outside Professionals	Total Cost
1	Project Kick-off Meeting	11	\$ 1,980	\$ 100	\$ 2,080
2	Supplemental Geotechnical Investigation	466	\$ 62,900	\$ 123,708	\$ 186,608
	Geophysical Field Work	22	\$ 3,225	\$ 37,425	\$ 40,650
	Sediment Sounding Field Work	37	\$ 5,335	\$ 13,849	\$ 19,184
	Geotechnical Field Work and Lab Testing	214	\$ 27,675	\$ 72,434	\$ 100,109
	Supplemental Geotechnical Investigation Technical Memorandum Deliverable	181	\$ 24,490		\$ 24,490
	Progress Meeting No. 1	12	\$ 2,175		\$ 2,175
TOTAL BASIC SERVICES =		477	64,880	\$ 123,808	\$ 188,700

Project Billing Rates	
Category	Rate
Officer	225
Project Manager	195
Senior Technical Specialist	210
Technical Specialist	185
Senior Engineer/Scientist	165
Engineer/Scientist III	135
Engineer/Scientist II	120
Junior Engineer/Scientist	110
Senior Designer	125
Designer/Drafter/Technician	105
Project Accounting	115
Administrative	85

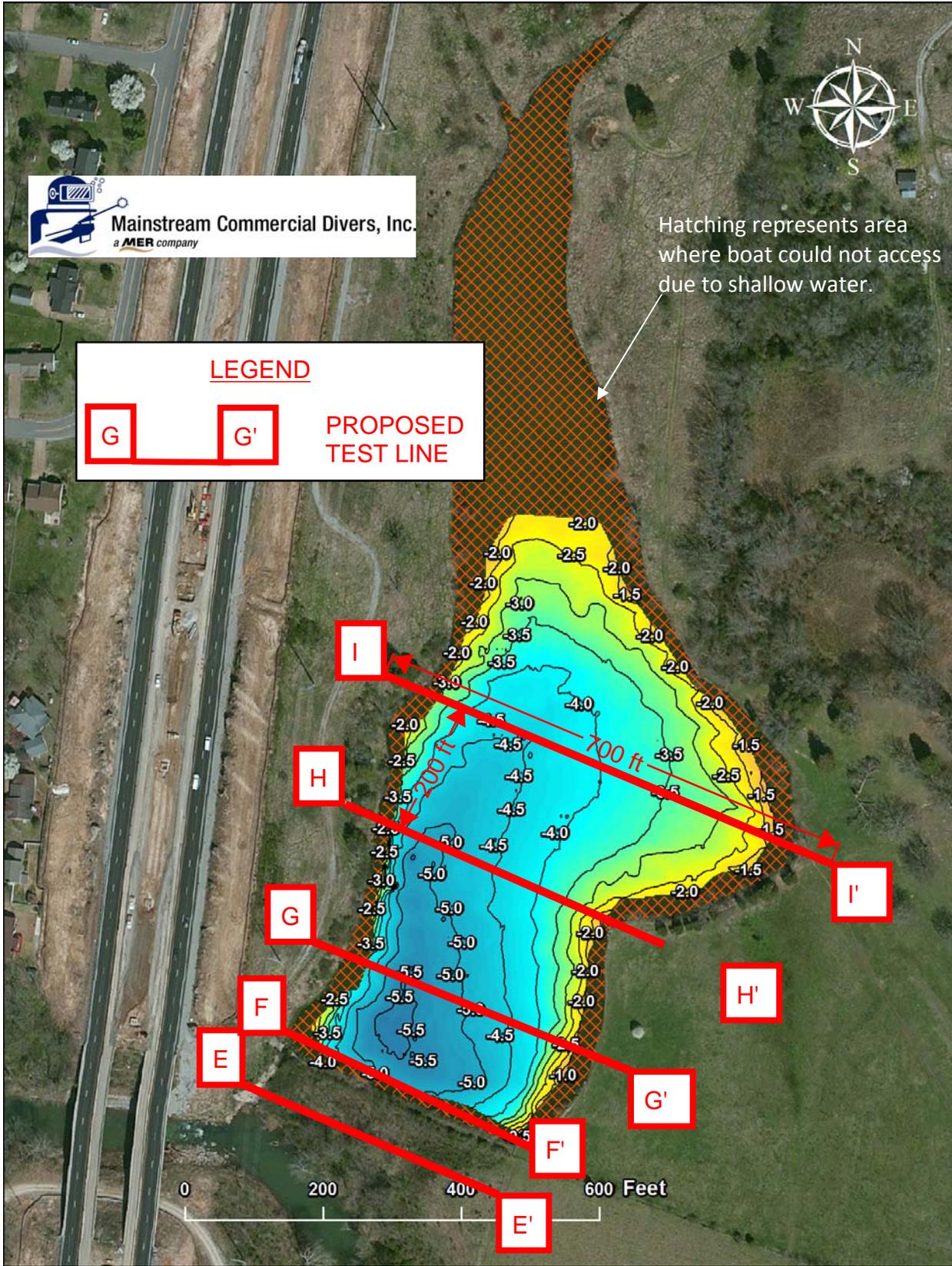


FIGURE 1 -
PROPOSED GEOPHYSICAL ERT
TEST LINE LOCATION PLAN

