Kimberly Park Pool GPR

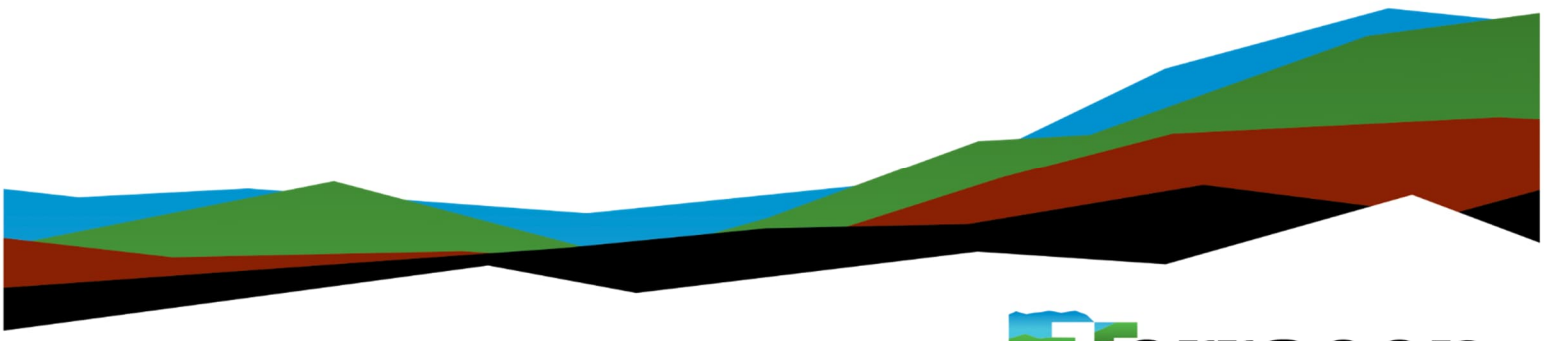
Geophysical Exploration Report

West Liberty, IA 52776

March 21, 2025 | Terracon Report No. 06251027

Prepared for:

City of West Liberty, IA
409 N Calhoun Street
West Liberty, IA 52776



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Attn: Adam Reinhardt
P: (319) 325-3180
E: areinhardt@cityofwestliberty.org

RE: Geophysical Exploration Services
Kimberly Park Pool GPR
810 North Park Street
West Liberty, IA 52776
Terracon Report No. 06251027

Dear Mr. Reinhardt:

We have completed the scope of services for the above referenced project. This report presents the findings and interpretations of the geophysical exploration for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

Kevin D. Rupp
Group Manager

Rob Kramer

Rob A. Kramer
Manager Regional Services (SME)

Thomas P. Lisi, P.E., CWI
Senior Engineer

Table of Contents

Attachments

Geophysical Exploration Plans
Geophysical Exploration Results
Exploration and Testing Procedures

Note: This report was originally delivered in a web-based format. Blue Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our geophysical exploration performed for the Kimberly Park Pool - GPR project located at 810 North Park Street in West Liberty, Iowa. The purpose of these services was to provide geophysical information services relative to:

- Identifying potential presence, location, and lateral extent of possible voids below the pool bottom and surrounding slab.

The geophysical exploration Scope of Services for this project included ground penetrating radar (GPR), geophysical interpretation, and preparation of this report.

Drawings showing the site and geophysical locations are shown on the Site Location and Geophysical Exploration Plan, respectively. More in-depth information on the methods used can be found in the Exploration and Testing Procedures.

Site Conditions

The following description of site conditions is derived from our site visit in association with the geophysical exploration.

Item	Description
Parcel Information	The project is located at 810 North Park Street, West Liberty, Iowa. See Site Location
Existing Improvements	The site is currently a public park pool.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. Our final understanding of the project conditions is as follows:

Item	Description
Project Description	Investigate pool slabs for voids and subsurface anomalies to aid the City in condition assessment.

Item	Description
Geophysical Objectives	The objective of the geophysical exploration was to determine the presence, location, and lateral extent of possible voids below the pool floor slab and surrounding paving slabs. Note GPR can detect the lateral extent of voids however, it cannot determine the height of the void.

Terracon should be notified if any of the above information is inconsistent with the planned or existing construction.

Geophysical Exploration Methodology

The surface geophysics consisted of:

- Approximately 20,000 square feet of ground penetration radar (GPR) scanning.

The geophysical exploration was conducted in the following areas as shown on the attached Geophysical Location Diagram.

Geophysical data was only collected in clear accessible areas. Any data gaps on the attached Geophysical Exploration Location Diagram were the result of obstructions such as cabinets, shelving, etc.

GPR data was collected using a cart-mounted dual frequency system consisting of 400 and 800 MHz multi-channel antenna. Both antennas are oriented in the horizontal dipole direction with data collected using transect spacings of 3-feet. Data was processed using Geolitix to yield 2D cross sections plan view of the radar data. Based on the methodology and site conditions, we estimate that the maximum approximate depth of investigation was 5-feet below the ground surface.

Geophysical Data Quality

In general, GPR data was of good quality, however, GPR is not able to determine the depth or volume of voids at the indicated locations.

Geophysical Results

Terracon representatives visited the site on March 11, 2025, with geophysical equipment to scan/explore the accessible areas of the site. A series of scans were conducted in both the pool floor area and the surrounding paving areas. The scans were then processed to

produce an amplitude map of the signal response. The data has been overlain onto plan images as shown in Exhibits 1 and 3. Anomalies consistent with potential subsurface voids and saturated areas were present at the site. On the Exhibits red areas are interpreted as potential voids or anomalous saturated soils, while blue represents typical expected slab and soil conditions. Please see the attached exhibits for further details.

General Comments

As with any geophysical method, the processes rely on measured responses to provide indications of physical conditions in the field. Responses can be affected by on-site conditions beyond the control of the operator, such as, but not limited to, cultural features (e.g., utilities, buried metallic objects, etc.), soil/material types, soil/material moisture, and/or groundwater table depth. Interpretation is based on known factors combined with the experience of the operator and the geophysicist evaluating the results. Detailed descriptions of the limitations specific to each geophysical method are provided in the Exploration and Testing Procedures.

Sampling and testing of select areas using subsurface exploration methods is recommended to correlate the results from the geophysical surveys. As with all geophysical methods, the geophysical results provide information regarding subsurface conditions at the site but should not be considered absolute. We cannot be responsible for the interpretation of geophysical results by others.

Our analysis and opinions are based upon our understanding of the project, the geophysical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration locations or due to the modifying effects of construction (if applicable) or weather. If variations appear, we can provide further evaluation and supplemental recommendations via change order.

Our Scope of Services does not include either specifically or by implication any geotechnical, environmental, or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the client is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geophysical practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided

information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, including excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we are retained to review the changes and either verify or modify our conclusions in writing.

Exploration and Testing Procedures

Terracon utilized the following test methods in our investigation.

Ground Penetrating Radar (GPR) Surveys (ASTM D6432)

Ground penetrating radar (GPR) is a method that provides a continuous, high resolution graphical cross-section depicting variations in the electrical properties of the shallow subsurface. The method involves repeatedly radiating an electromagnetic pulse (radar signal) into the ground from a transducer (antenna) as it is moved along a traverse. Radar signals reflected by subsurface objects or horizons are detected by an antenna (often the same one used to generate the signal) and sent to a control unit for processing. The control unit then converts the varying amplitude of the reflected radar signals as a function of time into a cross-sectional image showing signal amplitude as a function of distance and depth.

GPR response is governed by two electrical properties; electrical conductivity (σ) and dielectric permittivity (ϵ), also referred to as dielectric constant. Electrical conductivity is the ability of a material to conduct a charge when an electromagnetic field is applied. Dielectric permittivity is the ability of a material to hold a charge when an electromagnetic field is applied. Electrical conductivity governs how far radar signals can propagate through the subsurface before becoming undetectable. The higher the conductivity, the faster the signal attenuates. Consequently, conductivity also affects the strength of radar signals that are reflected from subsurface boundaries. Contrasts in electrical permittivity affect how much of the radar signal is reflected at subsurface boundaries representing a change in permittivity. The greater the contrast, the more energy that is reflected.

Most earthen materials (soil and rock) and even artificial materials (e.g. concrete) have relatively low dielectric permittivity and, therefore, are relatively transparent to electromagnetic energy. This means that only a portion of the radar signal incident upon a subsurface boundary is reflected back to the surface. On the other hand, when the radar signal encounters an object composed of a material that has very high permittivity, such as buried metal, most of the incident energy is reflected.

Limitations: The ability to detect subsurface targets with GPR is based on contrasting electrical properties (dielectric) and is dependent on specific site conditions. These conditions include depth of burial, the size (or diameter), the physical condition, the surrounding soils and the surface conditions over the survey target. Typically, the depth of detection will be reduced as the clay and/or moisture content in the subsurface increases (increasing ground conductivity). The estimated depth of a given target is dependent on the assumed dielectric constant of the surrounding soils. Unless a target of known depth is available for calibration of the GPR to the site-specific conditions, the soil dielectric is typically estimated based on the soil type and moisture conditions.

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

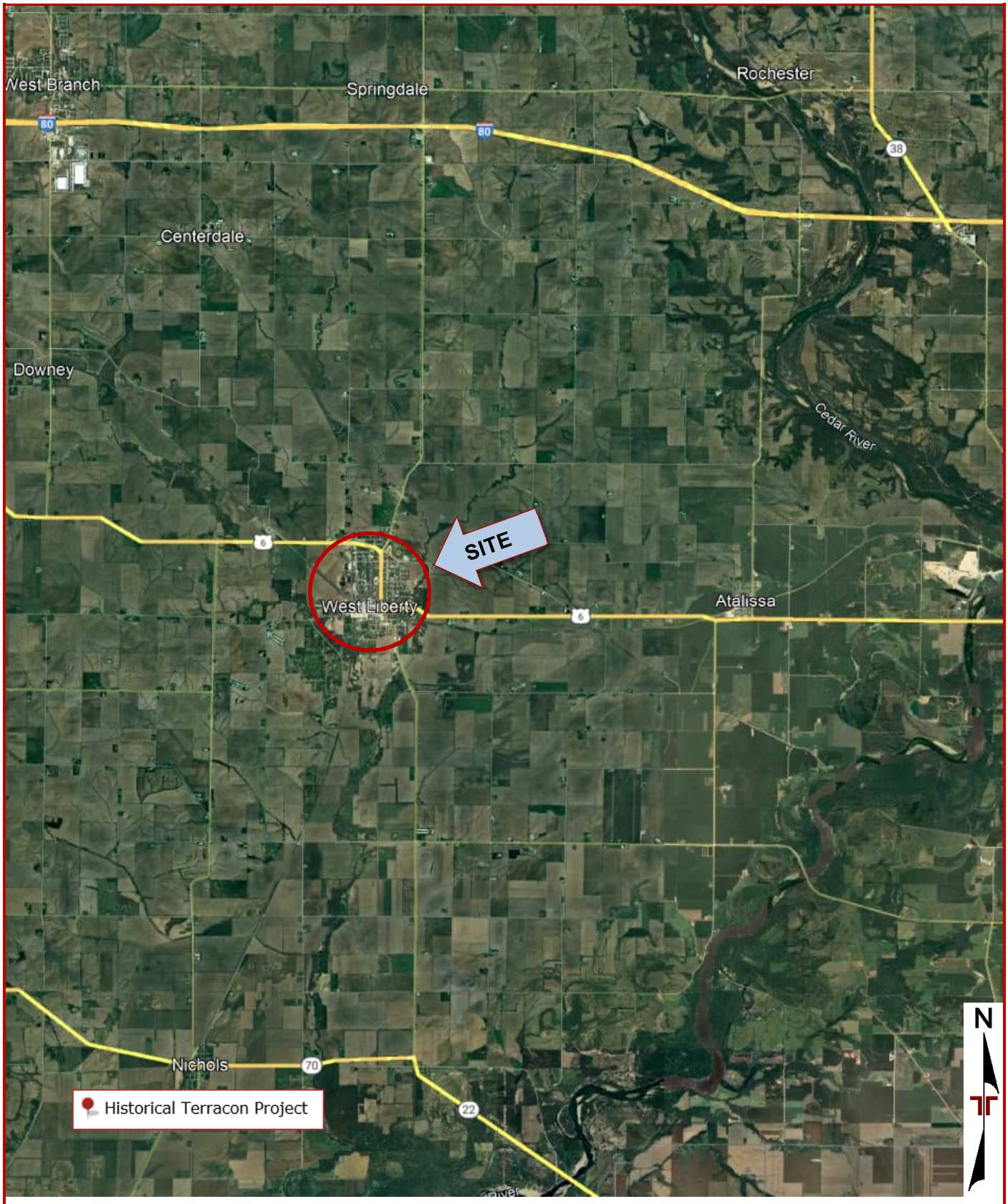


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Geophysical Exploration Plan

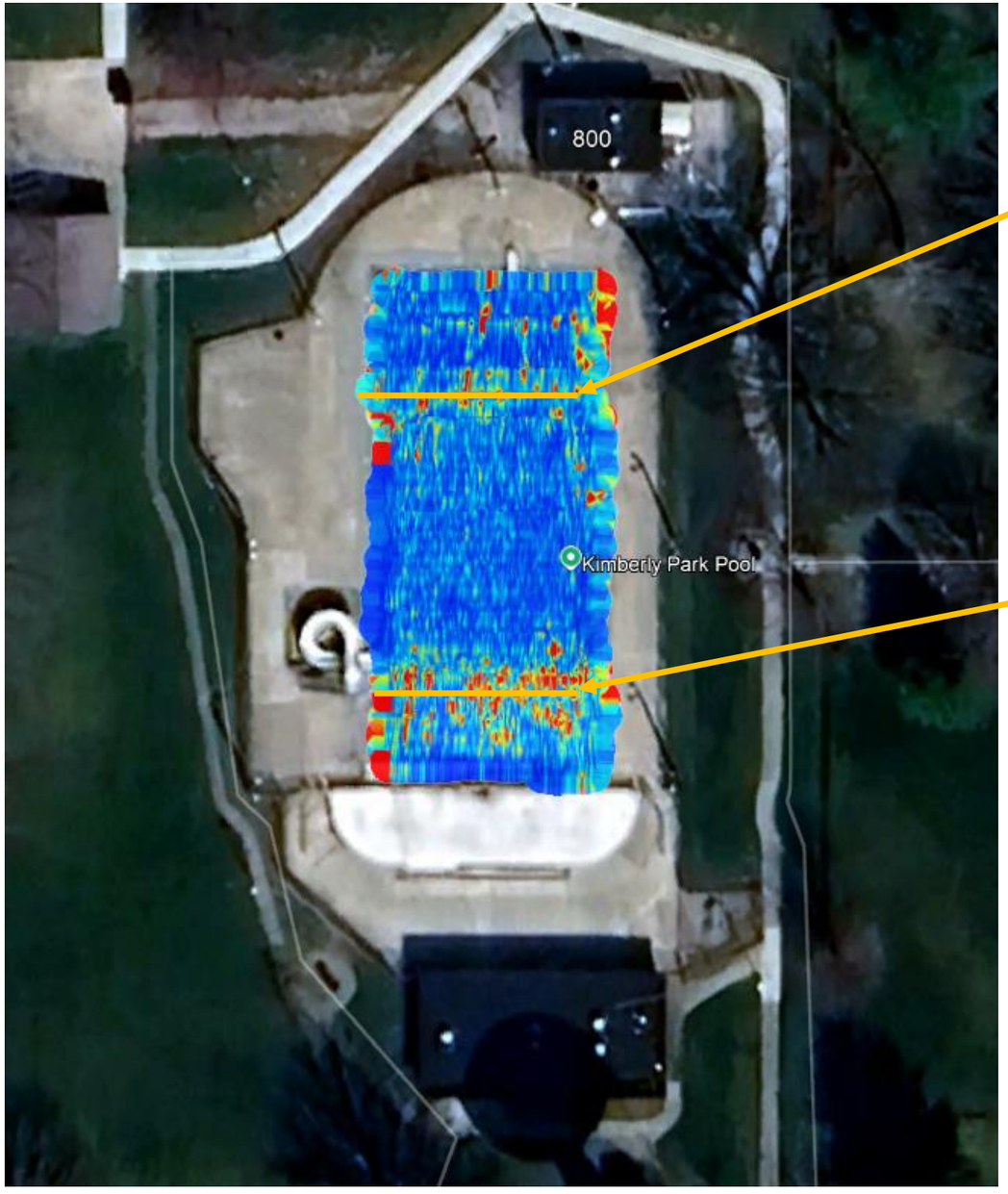
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

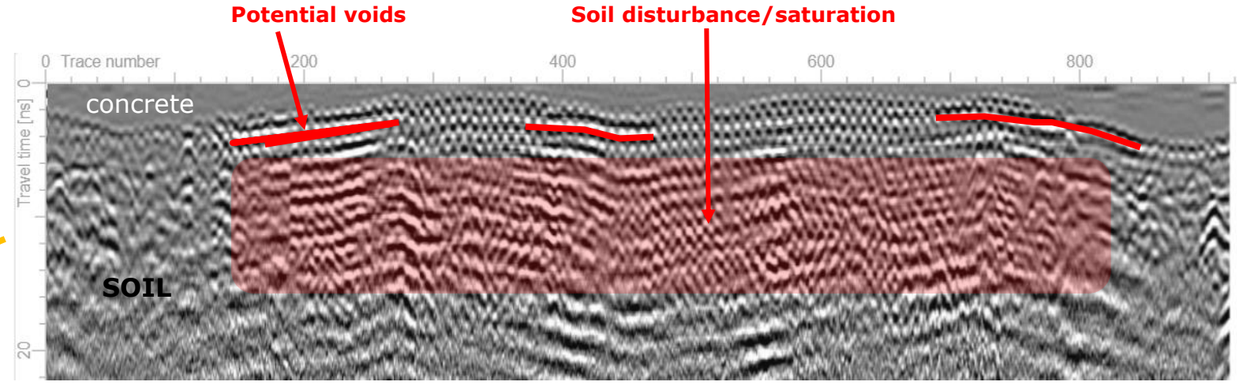
Geophysical Exploration Results

Contents:

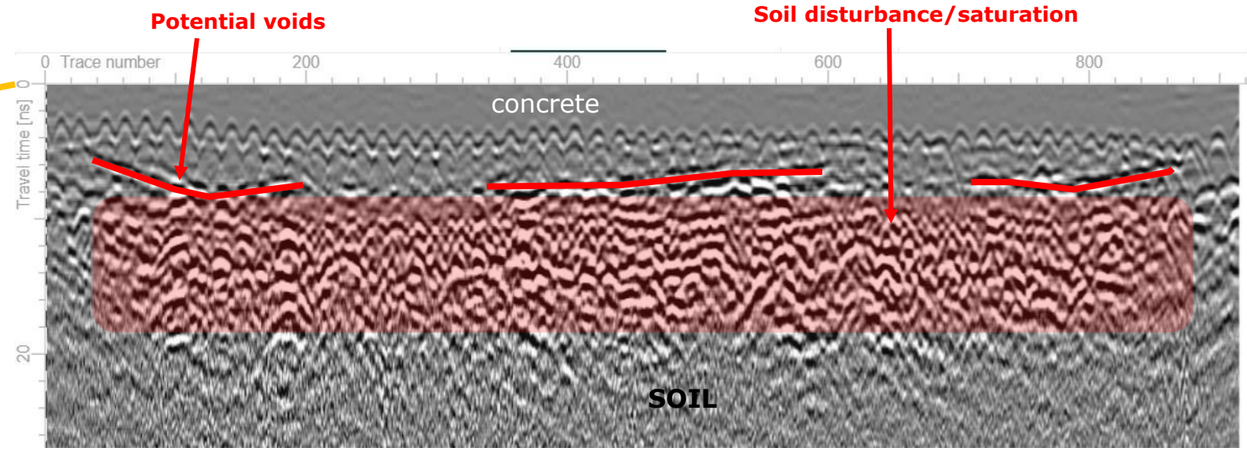
GPR Results - Pool



GPR results from inside the pool. Areas of red indicate potential voids, potential water infiltration areas and potential subsurface moisture or saturation.

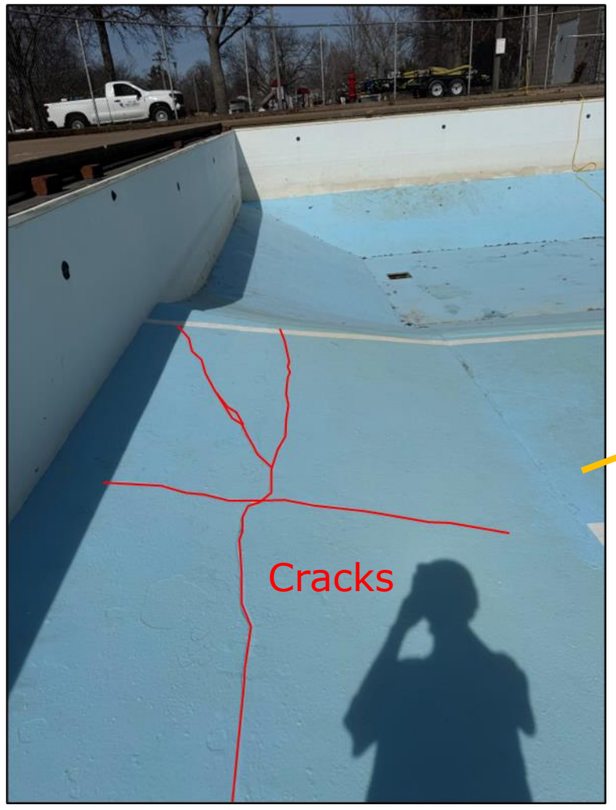


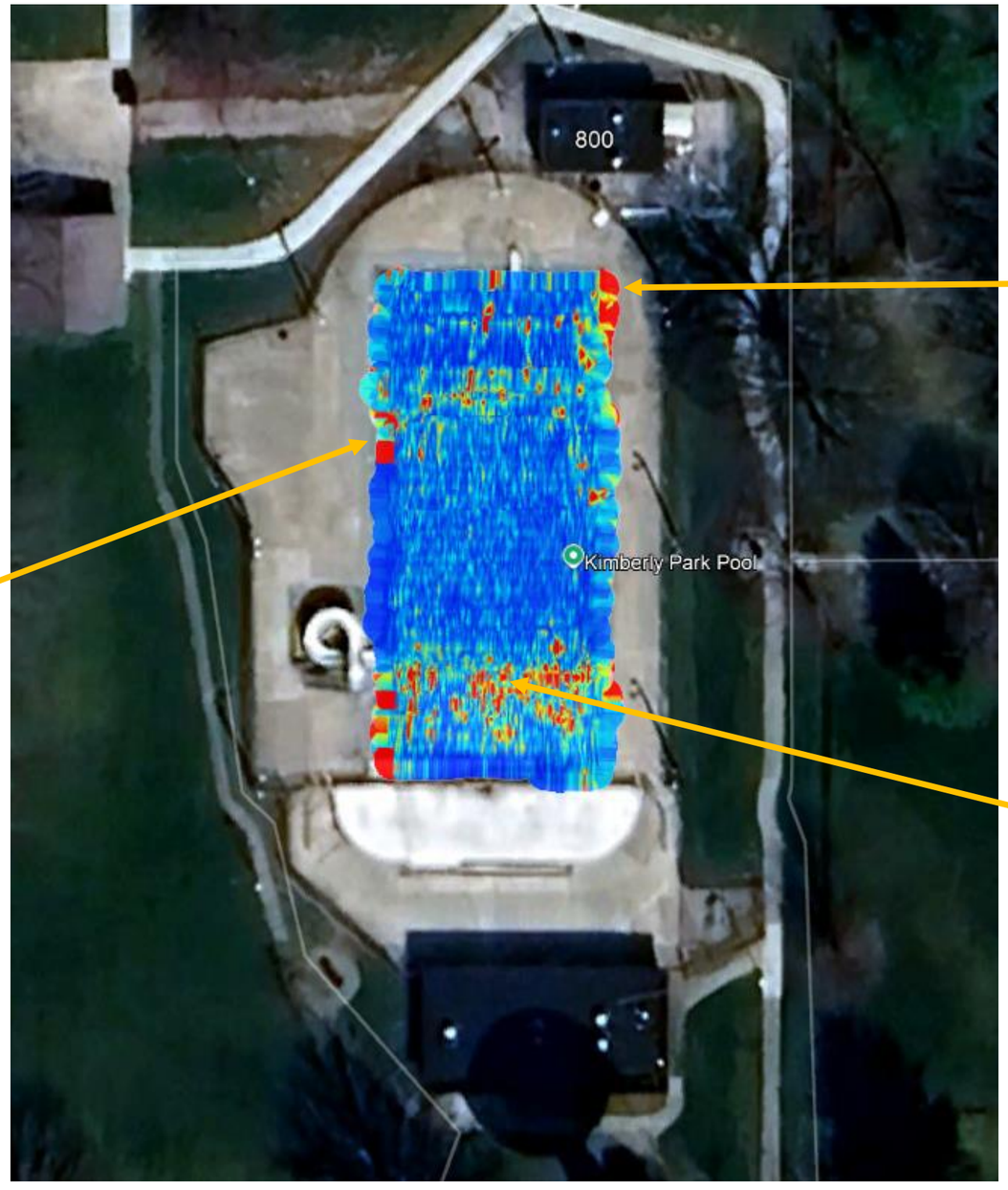
Transition to deep end of pool showed tighter reinforcement spacing somewhat blocking the GPR signal penetration but increased amplitude can indicate voids or saturation in the subsurface.



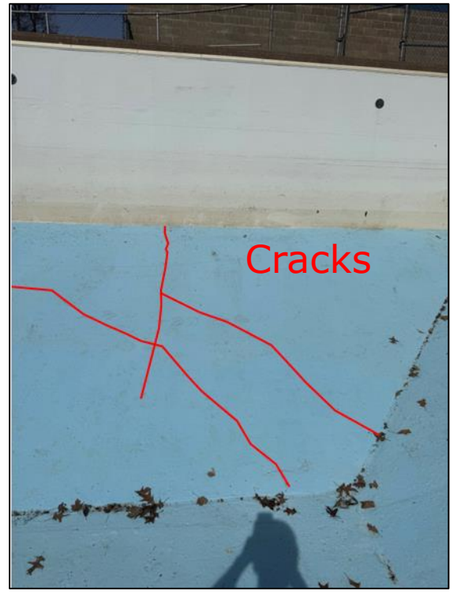
Shallow end of pool exhibited both potential voids at bottom of slab and increased potential for soil saturation underneath.

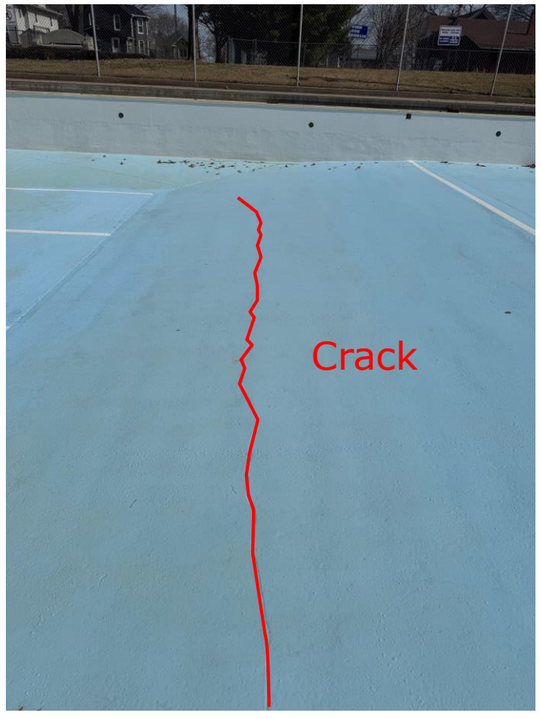
GPR Photos - Pool



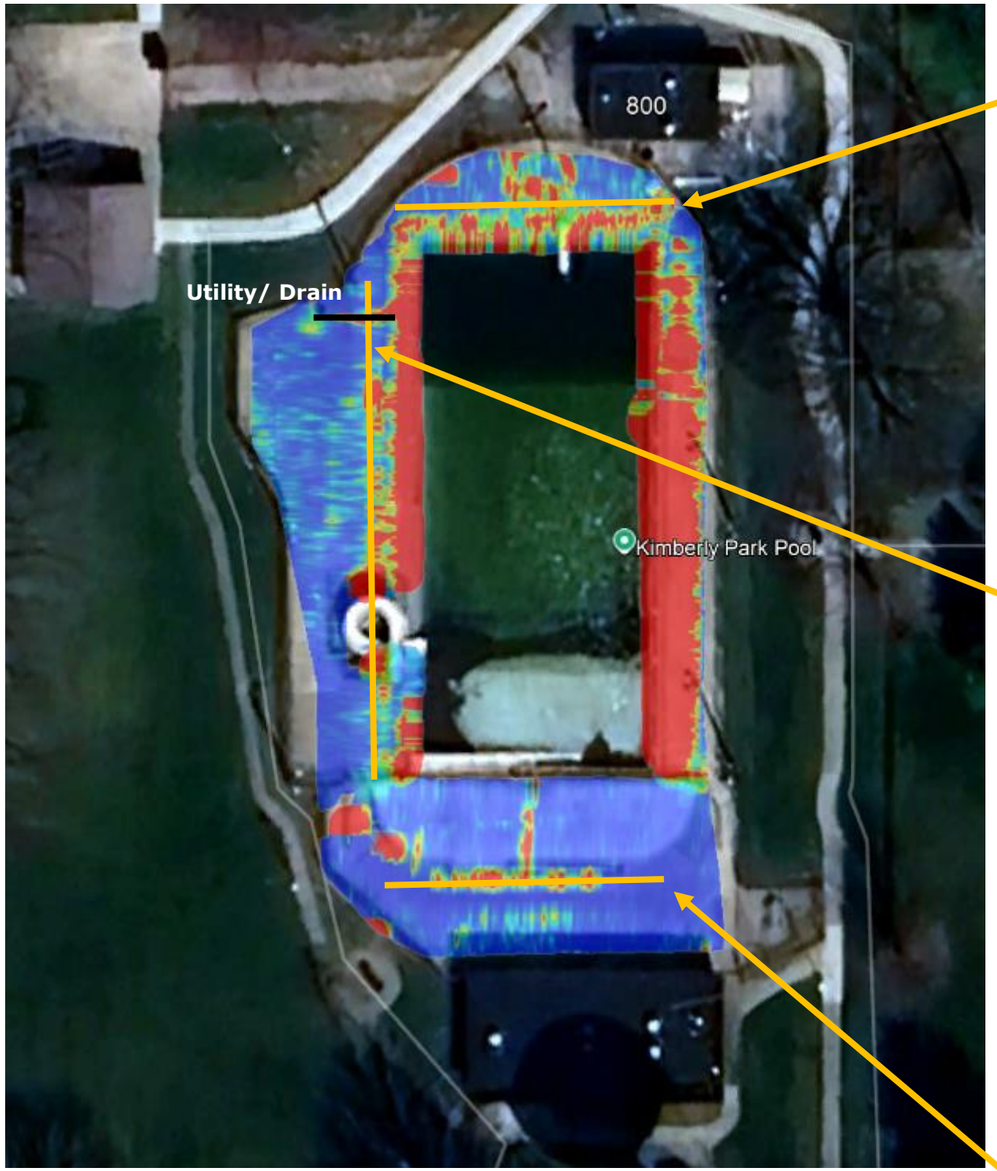


GPR results from inside the pool. Areas of red indicate potential voids, potential water infiltration areas and potential subsurface moisture or saturation.

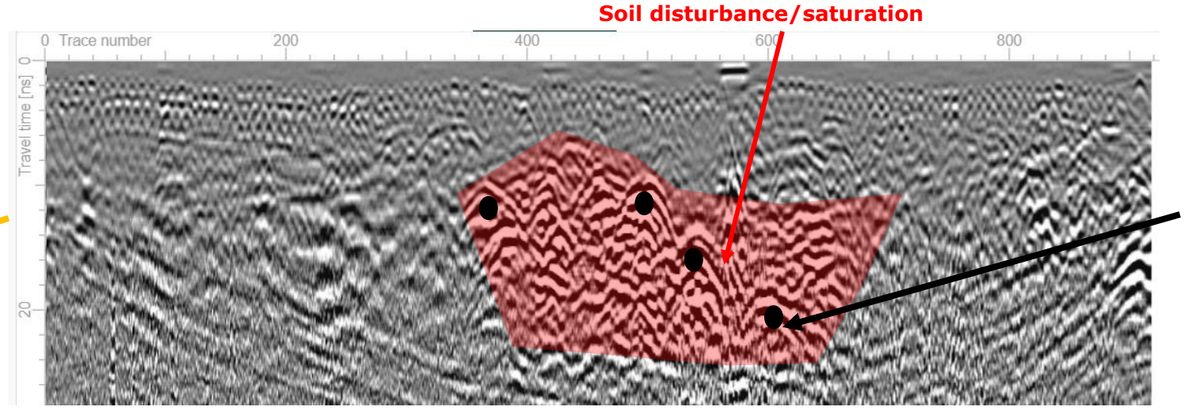




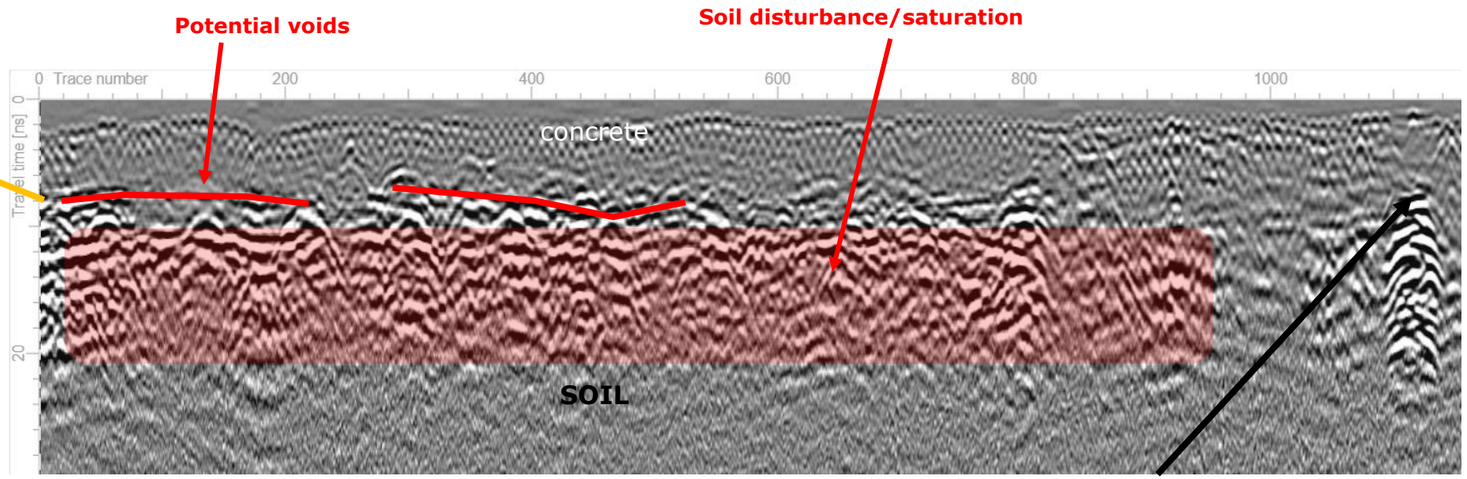
GPR Results - Paving



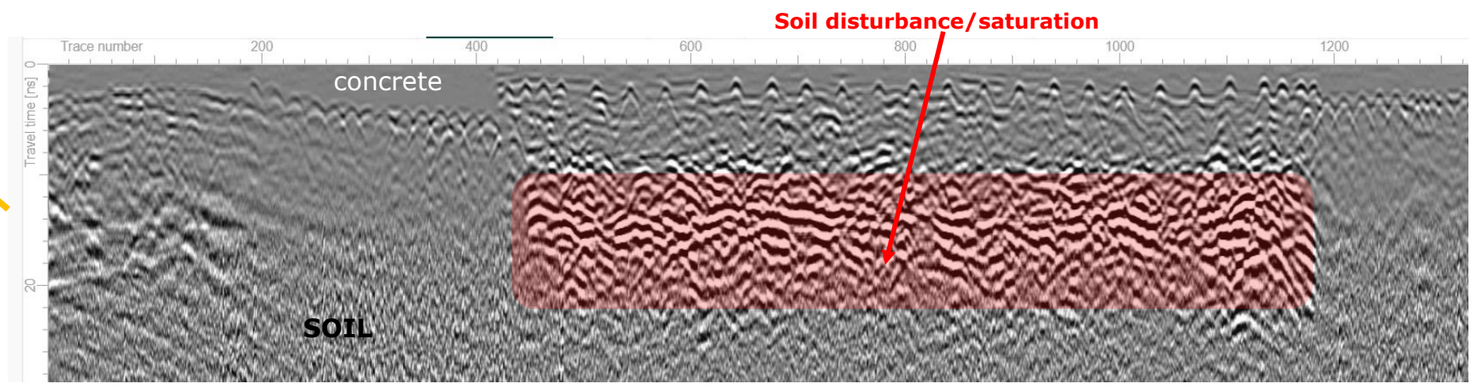
GPR results from outside the pool. Areas of red indicate potential voids, potential water infiltration areas, and potential subsurface moisture or saturation.



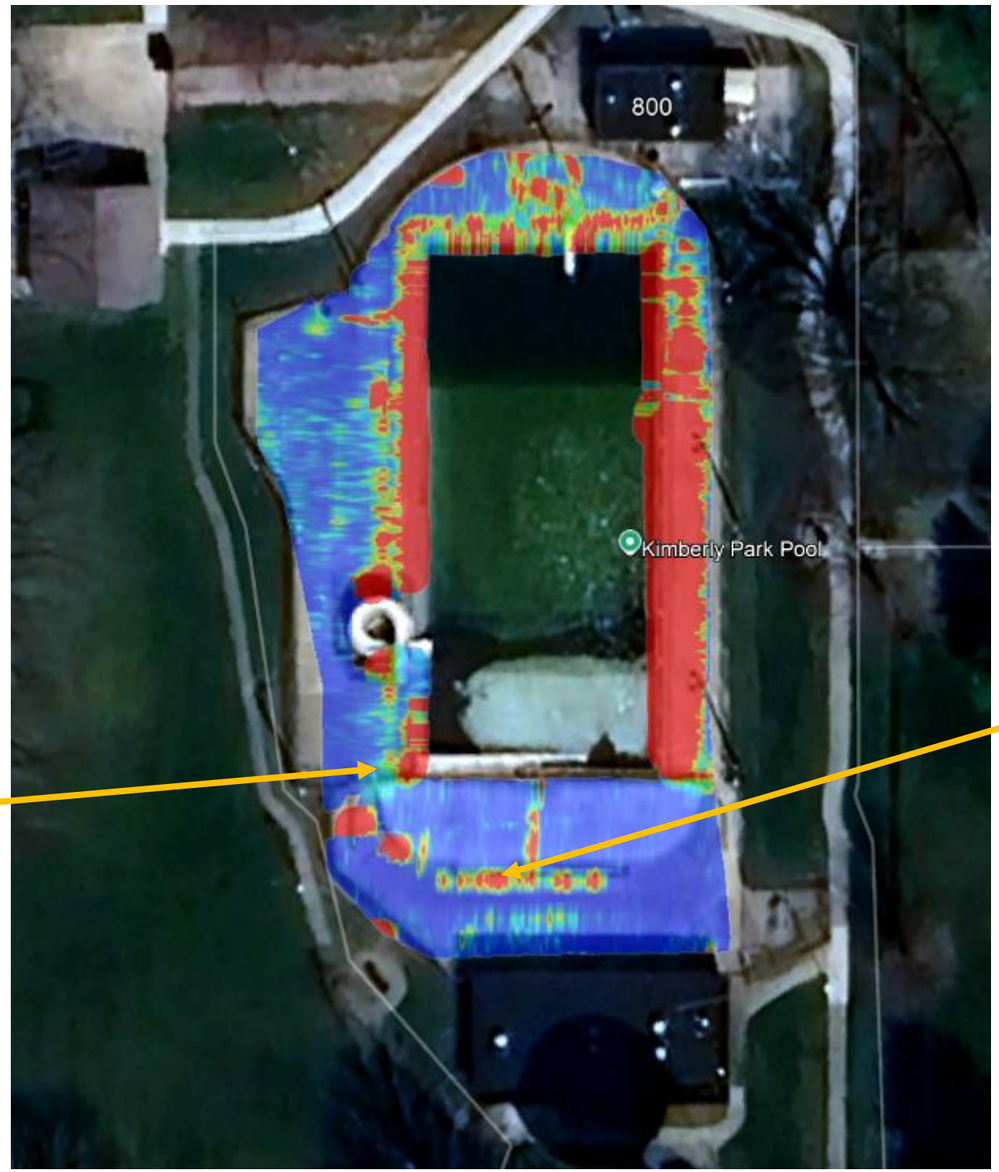
North end of the area exhibited potential utilities; the high amplitude of the return could indicate moisture, voids or other disturbances around the utilities.1

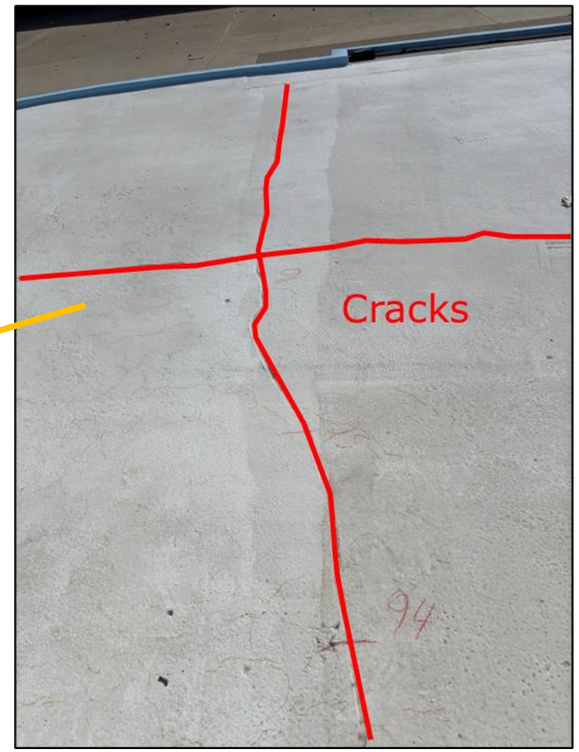


The paving areas around the sides of the pool indicated some potential voids and soil moisture.



This area may exhibit the area around a utility or drain, however soil around the utility appears with increased amplitude indicating potential moisture, disturbance, or saturation.





GPR results from outside the pool. Areas of red indicate potential voids, potential water infiltration areas, and potential subsurface moisture or saturation.