FINAL REPORT

GROUND PENETRATING RADAR INVESTIGATION

ST. THOMAS ESSO GAS STATION SITE
ST. THOMAS, U.S. VIRGIN ISLANDS

Prepared For

JOHN K. DEMA, P.C.

ST. CROIX, U.S. VIRGIN ISLANDS

MAY 1992

SDII
SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED

May 8, 1992

Law Offices of John K. Dema, P.C.
1236 Strand Street, Suite 103
Christiansted, St. Croix
U.S. Virgin Islands 00820

Attention: Mr. Richard Smith

Subject: Final Report - Ground Penetrating Radar Investigation
St. Thomas Esso Gas Station Site, U.S. Virgin Islands
SDII Project No. 92616

Dear Mr. Smith:

The purpose of this letter is to transmit the final report for the above referenced project. The project was completed in general accordance with our proposal dated January 17, 1992. The primary purpose of the investigation was to help determine the possible existence of buried underground storage tanks, pipelines, or other subsurface features at the project site. The secondary purpose was to help characterize geologic conditions underlying the site.

Subsurface Detection Investigations, Inc. (SDII), appreciates the opportunity to have assisted your firm on this project. If you have any questions or comments about the report, please do not hesitate to call. We look forward to hearing from you soon.

Sincerely,

SUBSURFACE DETECTION INVESTIGATIONS, INC.

Robert J. Windschauer, P.G.
Principal Geologist

92616

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1.0 INTRODUCTION

1.1 Background

Subsurface Detection Investigations, Inc. (SDII) was authorized by the Law Offices of John K. Dema, P.C., to perform a geophysical survey at a site in St. Thomas, U.S. Virgin Islands. An environmental investigation is currently being conducted by Hydrologic Associates, Inc. (HAI) at the site.

1.2 Purpose and Scope

The purpose of this investigation, as we understand it, was to utilize geophysical techniques to help determine the possible existence of buried underground storage tanks (UST's), pipelines, or other subsurface features at the project site. Ground Penetrating Radar (GPR) was selected as the most appropriate geophysical technique to help determine the possible existence of these subsurface features at the project site. The GPR survey was conducted across all accessible areas of the project site. SDII implemented the following scope of work to perform this investigation:

- Perform a preliminary GPR survey to determine the effectiveness of the GPR technique on the project site.
- Perform a GPR survey over the specified areas of the site.
- Prepare a final report that summarizes GPR methodology, field procedures, and the results of the GPR survey.

1.3 Site Description

The project site is located near the southwest corner of the Four-Winds Shopping Center on Highway 38 in St. Thomas, Virgin Islands (Figure 1). An Esso gasoline station was operating at the project site at the time of the investigation. The area of the site surveyed during this investigation was approximately 22,000 ft^2 (0.5 acres). The entire project site is covered with asphalt paving. There are two structures on the site; a station office and a detached structure which appeared to be used for automobile repair, storage, and covered parking (Figure 2).

Several soil borings have been completed on properties immediately adjacent to the project site. The borings were completed in conjunction with the environmental assessment of the project site. Lithologic logs from the soil borings indicate that the site is underlain by clayey, silty sands and cobbles. Soil borings also indicate that depth to the water table is greater than 6 feet (ft) below land surface (bls).

2.0 METHODOLOGY

2.1 Equipment and Principles

Ground penetrating radar (GPR) is an electromagnetic sounding method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of: an antenna, which houses the transmitter and receiver; a profiling recorder, which processes the received signal and produces a graphic display of the data; and optionally, a video display unit, which processes and transmits the output signal to a color video display and tape recorder.

The transmitter radiates repetitive short-duration electromagnetic (EM) pulses into the earth from an antenna placed close to, and electromagnetically coupled with the ground surface. Electromagnetic waves are reflected back to the receiver at ground surface by interfaces between materials with differing dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials. Subsurface features which commonly cause such reflections are: 1) natural geologic conditions such as changes in sediment composition, bedding and cementation horizons, voids, and moisture content; or 2) man-introduced materials or changes to the subsurface such as disturbed soils, buried debris, tanks, pipelines, and utilities. The profiling recorder processes the signal from the receiver and produces a continuous cross section of the subsurface interface reflections, referred to as reflectors.

Depth of investigation of the GPR signal is highly site-specific, and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively-high electrical conductivities such as clays and brackish groundwater, and lowest in relatively-low conductivity materials such as dry sand or rock. Depth of investigation is also dependant on antenna transmitting frequency. Depth of investigation generally increases as transmitting frequency decreases, however, the ability to resolve smaller subsurface features is diminished.

The GPR antenna is internally shielded from above-ground interference sources. Accordingly, the GPR signal is not affected by overhead power lines or nearby above ground conductive objects; e.g., metal fences, automobiles, or debris piles.

2.2 Field Procedures

A GPR survey is performed by towing the antenna across the ground along predetermined transect lines. The antenna is either pulled by a person or towed behind a vehicle. The configuration of the transect lines is designed based on the geometry and size of the target, and the dimensions of the site.

Underground storage tank (UST), pipeline, and utility investigations are generally performed along a bi-directional grid system of perpendicular transect lines. A grid system is used to increase the survey coverage of a site, and also to increase the probability of crossing the short axis of a target, which provides