FINAL

GAMMA WALKOVER SURVEY REPORT

Lewiston-Porter School Property
Youngstown, New York

Prepared for:

U.S. Army Corps of Engineers
Buffalo District

Prepared by:

Science Applications International Corporation
4900 Blazer Parkway
Dublin, Ohio 43017

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Survey Overview

This report describes the gamma background study performed on Lewiston-Porter School Property at 4061 Creek Road, Youngstown, NY, 14174. Background measurements were performed at the School to provide a comparative data set for background measurements obtained at the Army National Guard Weekend Training Site (WETS) on Balmer Road. Background measurements at both locations were obtained to support investigative activities at the Niagara Falls Storage Site (NFSS).

The closest normally occupied building of Lewiston-Porter School is the middle school, which is 2,045 meters due west of NFSS. WETS property is 1,350 meters due north of NFSS. The Lewiston Porter School Property was selected for comparison due to its location, and the fact that historical data indicates no Department of Defense activities occurred on this property.

Science Applications International Corporation (SAIC) conducted this study under the direction of the U.S. Army Corps of Engineers (USACE), Buffalo District, in cooperation with the New York State Department of Environmental Conservation (NYSDEC). The study was performed during the second weekend of December 2001.

The general approach was to measure gamma radiation levels using gamma radiation detectors linked to global positioning system (GPS) instruments. Radiation detection instruments made a gamma radiation measurement every two seconds, and GPS instruments provided coordinate (and time) information for each radiation measurement. The level of gamma radiation measured is directly related to the concentration of gamma emitting radionuclides (e.g., radium-226). Results were used to indicate mean gamma radiation levels in a range of surface media. Surface media considered include soil, asphalt, concrete, and gravel, all of which were encountered at NFSS.

This report includes a description of survey methodology, instrumentation, and a comparison of School and WETS background data. The procedures used for this study are described in; *Work Plan for Waste Containment Structure Characterization and Continued RI Activities: Gamma Walkover Survey and Geophysical Survey (April 19, 2001)* Addendum 1, *Lewiston-Porter School Property Gamma Walkover Survey Plan* (Work Plan).

Survey Preparation

In accordance with the Work Plan, acceptance criteria for daily check responses were calculated for each survey instrument. Each instrument was checked daily, with the response verified against the calculated value. In order to correlate instrument response with meteorological conditions, acceptance criteria were calculated from data obtained on local undisturbed soil (just east of the NFSS site flagpole). To maintain data consistency, instrument responses from the local undisturbed soil were compared, and only instruments verified to be within ten percent of the mean response of other site survey instruments were used for the survey.

An individual pack number was assigned to each GPS/survey meter combination. To maintain accountability, the pack number was placed on each component (antenna, handset, backpack, survey meter).

A file-naming convention was created to organize individual survey files, which collectively comprised the survey. Files were named in accordance with the following format; SWWXYZ, where:

S = School property data
WW= Date ("08" for December 8, "09" for December 9)
X = GPS/Survey meter pack identification (1-5)
Y = Surface type ("S" for soil, "A" for asphalt, "G" for gravel, "H" for granite, "C" for concrete)
Z = AM/PM (No character for AM, "Z" for PM)

A GPS accuracy check was performed at a monument (just south of Building 429 at NFSS) at the start and end of each workday. The positional information collected at this monument was collected to assist in making error corrections while post-processing data. Files collected at this monument were named in accordance with the following format: WWQCX, where:

WW = Date ("08" for December 8, "09" for December 9)
QC = Identifies file as a QC check
X = GPS/Survey meter pack identification (1-5)

Prior to data collection, all survey personnel were qualified on SAIC-EEMG St. Louis Health Physics Instructions HPI-001, "Performance of a GPS Gamma Walkover Survey", file naming conventions, and data transfer methods.

Survey Methods

Surveys were performed with a ratemeter (Ludlum 2221) coupled with a 2-inch by 2-inch sodium iodide (NaI 2x2) gamma detector (Ludlum 44-10), linked to a Trimble Pro XRS Asset Surveyor with a TSC 1 data collector. Each meter/detector met calibration requirements and underwent daily response check prior to and following use. The daily checks were used to verify that the instruments functioned within acceptable parameters.

To collect data, technicians walked at a rate of < 0.5 m/sec while moving the NaI detector in a serpentine pattern. The detector was maintained approximately 10 cm from the surface of the surveyed medium. The GPS equipment provided time and coordinate information, which was electronically recorded with detector readings. Surveys were collected in Overdetermined 3-D mode, with a positional dilution of position (PDOP) threshold of eight. GPS data were differentially corrected from a Continuously Operating Reference Station in "real time". Data

were stored on a flash memory card within the GPS handset. Survey data were transferred to a site computer twice a day.

Although the majority of school property is free from overhead interference, some survey data were collected in the woods[1]. In these areas, an instrument response range was recorded on a field map, and then manually transferred to a survey diagram (e.g. "7-10K CPM)[2].

Post Processing

Pathfinder® software was employed to download data from memory cards to a site computer. Arcview® software was employed to generate maps depicting survey results, using New York State Plane coordinates. Only GPS data with a PDOP of eight or less was plotted.

Data was transferred to an Excel® spreadsheet to calculate surface-specific mean instrument responses. The count-rate minimum, maximum, and mean were calculated for each surface type.

Area Coverage

Measurements were collected in all accessible areas of the site. Surveys were not conducted inside buildings, or in areas considered inaccessible, for purposes of personal safety (e.g., rubble piles). General area soil was surveyed in parallel survey transects (paths) at 20-meter intervals. The survey paths on concrete (sidewalks), asphalt (parking lots, roads, track, and tennis courts), and gravel (baseball fields) varied with the configuration of the particular surface. High traffic areas and ditches/low lying areas were surveyed more extensively than other areas. Area coverage is presented in Figure 1,with results color-coded according to the range of gamma activity detected.

Survey Results

A summary of surface specific activity data is presented in Table 1. The dataset "Soil-2" was collected where a rock was removed for inspection, the activity of the rock was added to Figure 1 during post-processing. The dataset "mounds" was collected on two mounds of debris in the wooded area east of the soccer field. The mounds were each approximately 2m x 3m in area, approximately 0.5 meters at their highest point, and contained soil, rock, cloth, plastic, and metal. The dataset "brick' was collected on a 2m x 2m stack of palletized bricks. The dataset "access road" was collected on soil roads at the southeastern portion of School property. The location of the "mounds", "brick", and "access road" datasets is noted on Figure 1.

[1] The GPS signals are produced by satellites. Overhead obstructions can prevent a receiver on the ground from reading GPS signals.

[2] As used in this text, "CPM" refers to the number of counts (gamma photons) detected in one minute with a NaI 2x2 detector.

Table 1. Lewiston-Porter School Property Gamma Activity Summary

Surface Type	Mean (CPM)	Lowest (CPM)	Highest (CPM)
Soil	8,169	3,051	16,572
Gravel	7,914	4,693	11,333
Concrete	5,542	4,028	8,135
Mounds	16,877	7,127	38,222
Asphalt	4,823	2,690	17,913
Soil-2	7,805	7,105	8,561
Access Road	8,443	4,426	11,927
Bricks	10,868	10,050	12,663
Granite Curb	12,509	9,222	18,523

Figure 2 identifies sources of natural activity such as bricks, granite curbs, and rocks. A rock measuring 24,800 CPM was identified on the northwest corner of the property; a USACE geologist classified the rock as granite. The dataset "Soil-2" was collected after the rock was removed, and verifies that activity at this location was solely due to the piece of granite. Other rocks with natural activity up to 16, 572 CPM were identified in an isolated area of the ditch along Route 18. Still other rocks with natural activity up to 38,222 CPM were identified in the small mounds located in the woods east of the soccer field.

Two isolated areas up to 17,913 CPM were identified on asphalt. The activity may be attributable to underlying bricks or rocks (e.g. granite/slag). Thin patches of asphalt may also provide less shielding for underlying media containing naturally higher activity levels.

The results of the survey are typical of those found on a property such as the school, both due to natural variations found in the environment, and from man's activities in the course of construction and development. Regardless of the source of activity, none of the areas surveyed during the course of the background study demonstrated radiation levels that would present a hazard to members of the public.

Background Activity Comparison

Original surface NaI detector background levels were obtained at WETS because WETS is believed to be unimpacted by NFSS-related radiological contaminants, and the surfaces (asphalt, concrete, soil, and gravel) are similar to those at NFSS.

Lewiston-Porter School gamma background measurements were collected for comparative purposes. At WETS, surface specific data was collected in approximately 10m x 10m areas, where at Lewiston-Porter School, surface specific data was collected over large areas of property, which collectively comprise the background study. WETS and Lewiston-Porter School surface background gamma activities are presented in Table 2.

Two asphalt reference surveys obtained at WETS represent "original" and "paved-over" road surfaces. The "original" road surface has higher gamma activity, presumably because it is cracked and relatively thin, offering less shielding from soil. The asphalt at the School more closely resembles WETS "paved–over" asphalt. On average, gamma activity on School asphalt was 25% less than that of "paved-over" WETS asphalt. This activity difference may be a function of the following:

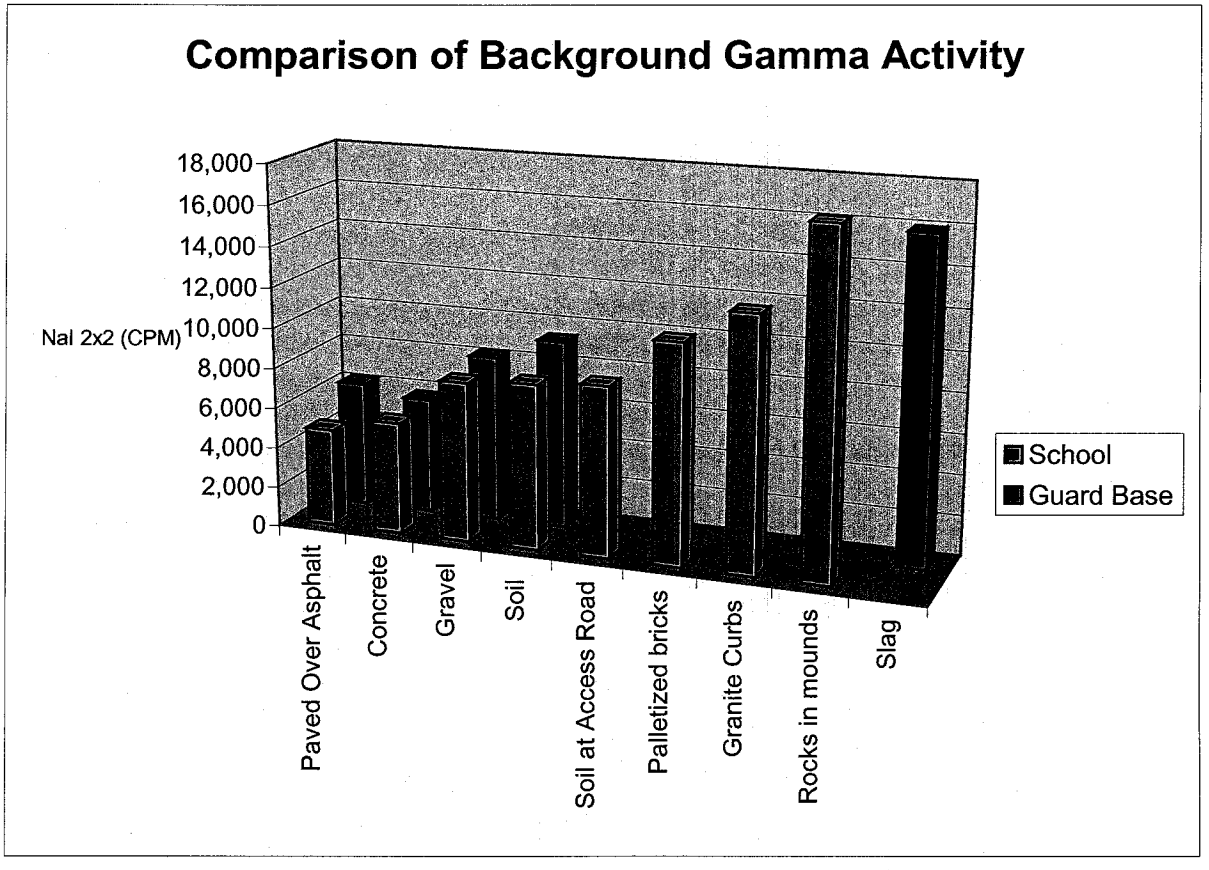
- differing pavement thickness,
- differing natural activity within the asphalt,
- differing natural activity within the asphalt subsurface, or
- differing activity (non-natural) on the asphalt surface/subsurface.

Table 2. School/WETS Mean Background Activity with a NaI 2x2

Surface Type	WETS[1] (CPM)	Lewiston-Porter School[1] (CPM)	Relative Percent Difference[2]
Soil	9,356	8,169	-14%
Slag	15,976	NA	NA
Gravel	8,240	7,914	-4.0%
Concrete	5,754	5,542	-4.0%
Mounds (Rocks)	NA	16,877	NA
Original asphalt	11,083	NA	NA
Paved over asphalt	6,206	4,843	-25%
Soil-2	9,356	7,805	-18%
Access Road	NA	8,445	NA
Bricks	NA	10,868	NA
Granite Curb	NA	12,509	NA

1) Mean counts/minute detected with a NaI 2x2.
2) Relative percent difference between School and WETS measurements, respectively.
NA = not present/applicable

Table 3. Comparison of School/WETS Mean Background Activity



Conclusion

Gamma activity from soil, concrete, and gravel surfaces were within a relative percent difference of 18%, and may be considered equal. Activity levels at the School were lower than those observed at WETS for all comparable media. There was a 25% difference on asphalt, presumably because of the additional variables encountered when surveying asphalt surfaces. Gamma activity data collected at the School compared favorably with WETS background data, validating the use of WETS data for investigation activities at NFSS.

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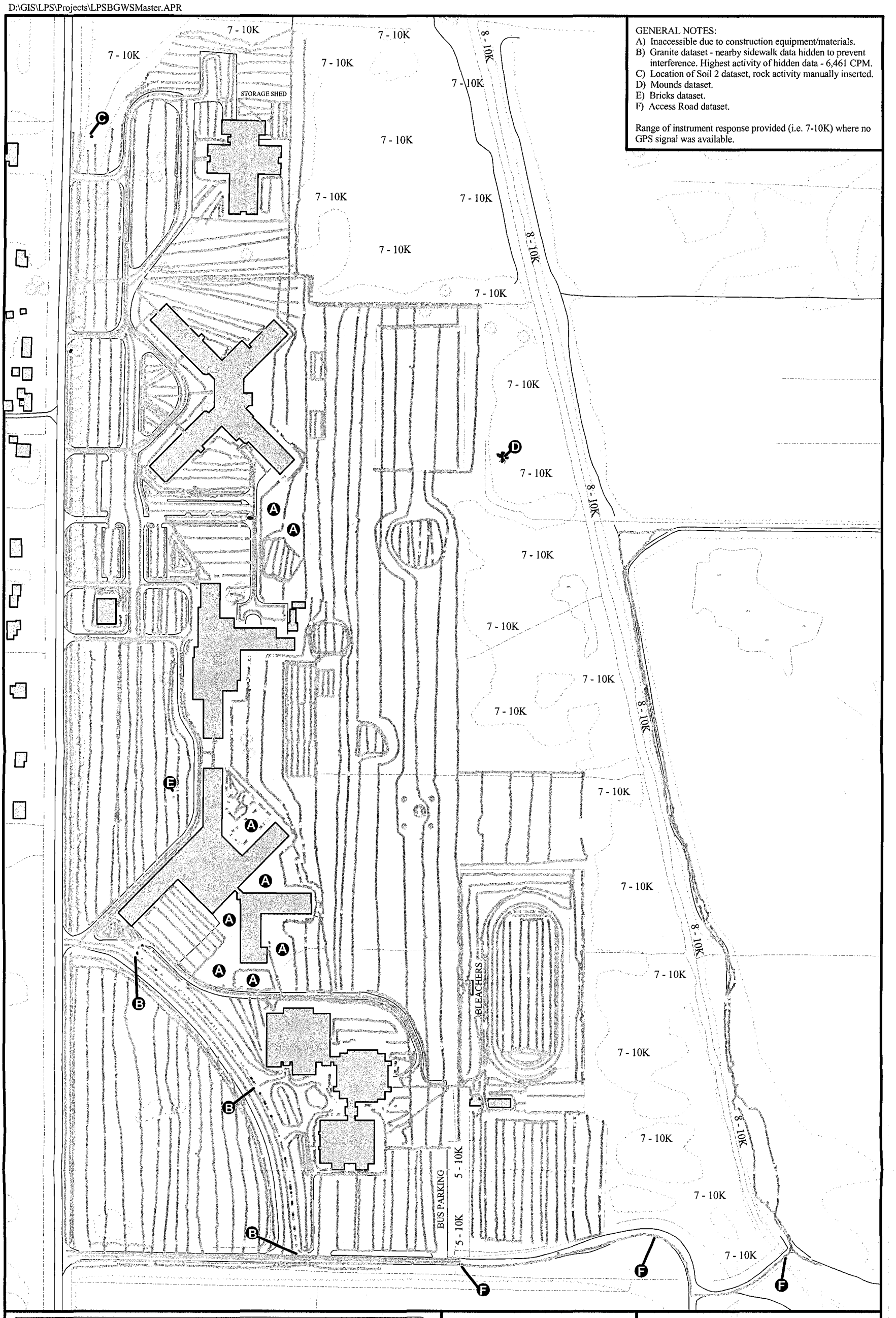

Figure 1. Lewiston Porter School Background Gamma Walkover Survey Coverage

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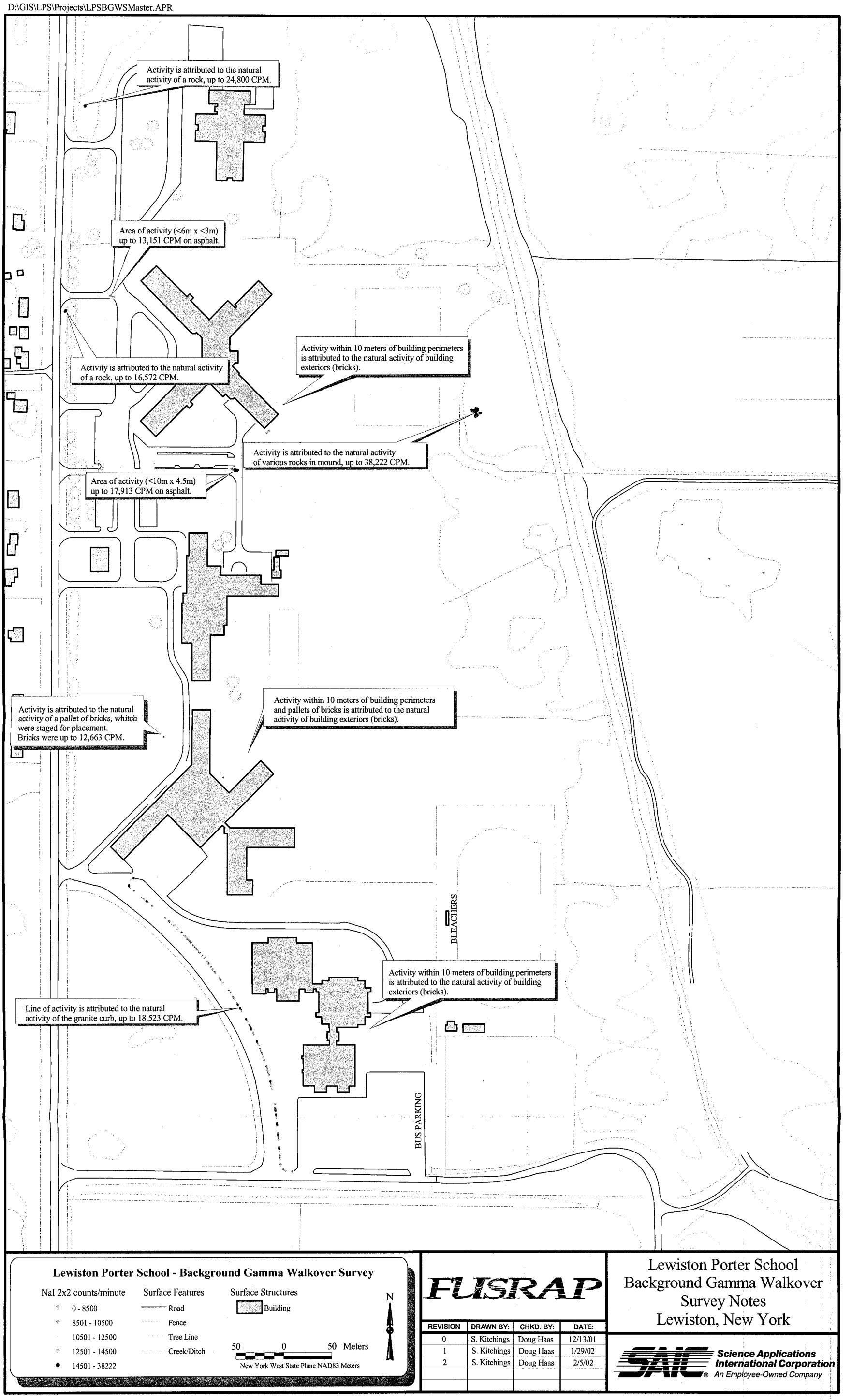

Figure 2. Lewiston Porter School Background Gamma Walkover Survey Notes